boujou 4

Reference Guide

Revision 2.2

boujou 4.1

The first choice for professional matchmovers

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2d3's sister company, Vicon, builds cameras with custom high-resolution, high-speed sensors and embedded multiprocessing.

2d3 Ltd (www.2d3.com) & Vicon (www.vicon.com) are subsidiaries of OMG plc (www.omg3d.com).

Contents

Preface

This *Reference Guide* describes the features and functionality available in boujou 4.1 and explains their general operation.

Audience

This book is intended for users who are using boujou for camera tracking, including tracking moving objects or generating detailed 3D structures from shots. Refer to this book as often as necessary.

boujou camera tracking and calibration data is used by professional matchmovers in the following types of applications:

- **Post Production** for film and TV visual effects solutions.
- **Industrial Design** for architecture, manufacturing, prototyping, forensic, and other industrial applications.
- **Education** for training and research programs.

This book does not assume any previous experience with boujou. If you have used a previous release, you will notice some differences in the user interface and some functionality. All boujou concepts, features, and functionality are described fully in this book.

Structure

This section describes how the information in this book is organized.

The first chapter provides an overview of this boujou:

Chapter 1 **Introduction** describes the role of boujou in camera-tracking applications, summarizes its key features and functionality, and explains its workflow.

Each of the following chapters describe the features and operation of boujou:

Chapter 2 **User Interface** describes the layout of the boujou interface and its operation.

Chapter 3 **Basic Functions** describes the basic tracking process and the tools used to track the majority of shots in boujou.

Chapter 4 **Advanced Functions** describes the advanced tools used for complex or difficult camera moves, as well as keyboard shortcuts, user preferences, and batch processing in boujou.

Chapter 5 **Export to an Animation Package** describes how to export data from boujou for use in supported third-party animation packages.

Each of the appendices provide additional information that can help you make the most of using boujou:

Appendix A **boujou 4.1 Keyboard Shortcuts** lists all the keyboard shortcuts available in boujou.

Appendix B **boujou 4.1 Preferences** lists and describes the interface and tool settings you can customize in the **Preferences** dialog box.

Appendix C **Lens Squeeze Ratio** shows how to determine the appropriate value to set in the **Lens Squeeze Ratio** option in the **Cameras** dialog box to correct for an anamorphic shot.

Appendix D **boujou_script File Commands** lists and describes the available boujou script commands and provides an example boujou_script file.

Appendix E **Using Survey Points without a 3D Model** describes how to use survey points to improve the 3D structure of your solve if you have coordinates rather than a 3D model.

Appendix F **Support Resources** describes the support resources available to boujou users.

Appendix G **Documentation Feedback** describes how to supply feedback on the boujou documentation.

Appendix H **Customer Satisfaction Survey** requests your feedback on our products and services to help us improve future offerings.

Conventions

This table illustrates the typographical conventions used in this book.

Convention	Description
This type	Menus, commands, buttons, and options displayed in the GUI. Terms in a definition list or emphasis for important introductory words in a paragraph.
`This type`	Text displayed by the system or extracts of program code.
This type	Path names, file names, and extensions. Commands or text you are to enter in files or dialog boxes.
This type	Cross-references to related information in another section or document.
This type	A URL for a site on the World Wide Web.
Caution	A caution alerting you to actions that could result in the loss of data.

Convention	Description
Important	A note giving information that emphasizes or supplements important points in the text or information that may apply only in special cases.
Tip	A tip helping you to apply the techniques and procedures in the text to your specific use or to suggest an alternative method.

Related Documentation

This *Reference Guide* book is designed to be used in conjunction with the additional documentation for this release of boujou shown in the following table.

Document	Description
Books	All of the boujou books are installed in PDF format (requires Adobe Reader version 5.0 or later, which you can download free from the Adobe Web site at *www.adobe.com*).
Quick Start Guide	This book provides details on installing and getting started with the current software release. This book is also provided in printed form in your boujou product box.
Tutorials	This book provides step-by-step instructions on the intended way of performing specific tasks in boujou.
2d3 Web site	The 2d3 online support system (*www.2d3.com/php/support/faqs.php*) provides a library of information that you can use to help answer your questions.

Introduction 1

boujou 4.1 provides fully automated 3D camera tracking and calibration from film and video material. In most cases no prior information about the camera or material is required, and no skilled user intervention is needed to derive the 3D information.

Camera tracking with boujou

boujou 4.1 enables you to add 3D objects to live camera footage in your 3D animation package by creating a virtual camera that matches the physical one that took the shot. It does this by automatically identifying features in the scene over the entire length of the shot. These features are then automatically linked together into a large number of tracks. boujou 4.1 then uses state-of-the-art techniques to solve the highly complex 3D mathematics in order to work out the camera parameters for each frame of the shot. 3D consistency between tracked features ensures that small moving objects are excluded from the shot.

boujou 4.1 tracks features in the scene automatically, so its processing engine can quickly analyze and choose the maximum number of qualifying features. boujou 4.1 uses statistical analysis to detect tracks that are producing inconsistent results and eliminate them. By repeating this process of analysis and elimination throughout the sequence, boujou 4.1 ends up with a large number of tracks that are consistent and a highly accurate calibration.

boujou 4.1 also supports imported geometry to help define 3D space. This means that difficult shots are easier to track, and an extended range of tracking options are available.

Supported Import Image File Formats

Table 1-1 lists the types of image file formats that can be imported for camera tracking in boujou 4.1. For details on importing image files into boujou 4.1, see *Chapter 4 Advanced Functions*.

Table 1-1: Supported import image file formats

File Format	Extension	Support
Windows AVI	*.avi*	Appropriate codec must be installed on your machine. Not supported on Linux or OS X.
Cineon/DPX	*.cin* *.dpx*	30- or 40-bits per pixel. DPX: 3 or 4 channel 16 bit log encoded data, 10 and 16 bits per component.
Open EXR	*.exr*	Full EXR support (read only).
Maya IFF	*.iff*	Full IFF support.
JPEG	*.jpg*	Full JPEG support.
Quicktime	*.mov*	Full Quicktime support (read only). Not supported on Linux.
PGM	*.pgm*	Full PGM image support.
Softimage	*.pic*	24- or 32-bits per pixel, with or without encoding.
PNG	*.png*	Full PNG support.
PPM	*.ppm*	Full PPM support.
SGI	*.rgb* *.sgi*	Silicon Graphics Bitmap RGB or RGBA, with or without encoding, 8- or 16-bits per component.
TGA	*.tga*	24- or 32-bits per pixel, with or without encoding (read only).
TIFF	*.tiff*	Grayscale, RGB or RGBA, with or without encoding, 8- or 16-bits per component.

Supported Export Image File Formats

Table 1-2 lists the types of image file formats that can be exported from boujou 4.1 for camera tracking in third-party animation packages. For details on exporting image files from V, see *Chapter 4 Advanced Functions*.

Table 1-2: Supported image export file formats

File Format	Extension	Support
Windows AVI	*.avi*	Appropriate codec must be installed on your machine. Not supported on Linux or OS X.
Cineon	*.cin*	30- or 40-bits per pixel.
Maya IFF	*.iff*	Full IFF support.
JPEG	*.jpg*	Full JPEG support.
PGM	*.pgm*	Full PGM image support.
Softimage	*.pic*	24- or 32-bits per pixel, with or without encoding.
PNG	*.png*	Full PNG support.
PPM	*.ppm*	Full PPM support.
SGI	*.rgb* *.sgi*	Silicon Graphics Bitmap RGB or RGBA, with or without encoding, 8- or 16-bits per component.
TIFF	*.tiff*	Grayscale, RGB or RGBA, with or without encoding, 8- or 16-bits per component.

Supported Camera Export File Formats

Table 1-3 lists the types of camera file formats that can be exported from boujou 4.1 for camera tracking in third-party animations packages. For details on exporting a scene file created in boujou 4.1, see *Chapter 5 Export to an Animation Package*.

Table 1-3: Supported camera export file formats

File Format	Extension
3D Studio Max	*.ms
After Effects (Maya)	*.ma
boujou Animation	*.ban
Cinema 4D	*.c4d
Cineon	*.jdf
Combustion	*.cws
Filmbox (Windows and Linux only)	*.fbx
Flair	*.mrmc
Flame v5.0, v7.0, or v9.0	*.action
Fusion 5.0	*.comp
Houdini 4.1	*.hip
Lightwave	*.lws
Maya pre version3, Maya 3, or Maya 4+	*.ma
Mistika DVE	*.fx
Shake	*.shk
Smoke	*.dve
SoftImage (3.8, 3.9.1, and 3.9.2)	*.xsi
XSI (1.5 and 2.0+)	*.xsi
Text	*.txt

boujou Camera Tracking Workflow

This section summarizes the basic workflow for camera tracking in boujou 4.1. The workflow is highly non-linear, and there are many additional stages that can be added. However, the following basic stages always need to be carried out, and in the order specified:

1. Import an image sequence.

   You load film or video material from live camera footage into boujou 4.1.

2. Track 2D features.

   You create feature tracks in which boujou 4.1 identifies parts of the imported image sequence that are different from the surrounding area and then matches them with similar features found in subsequent frames.

3. Solve the camera.

   You solve the camera using the 2D feature tracks. During this stage boujou 4.1 calculates the motion of the camera (position, orientation, and focal length) and the three dimensional position of most feature points detected in the scene.

4. Export the results.

   You export the scene file created by the camera solve for use in a third-party 3D animation package.

For details on these basic stages, see *Chapter 3 Basic Functions*. To learn more about additional boujou 4.1 functionality, see *Chapter 4 Advanced Functions*.

User Interface 2

This chapter covers the various elements of the boujou 4.1 interface:

Important

If you are new to boujou 4.1, or if you have been using an earlier version of the product, you should read this chapter first.

boujou 4.1 User Interface Enhancements

The boujou 4.1 interface has been redesigned and includes the following significant differences from previous versions of boujou:

- The windows and panels surrounding the main Image window can be undocked and floated anywhere in the screen area or docked in other areas of the interface. This enables you to customize the layout of boujou 4.1 to suit your way of working and is ideal for multi-monitor setups.
- The image display contrast and brightness in the **Zoom Tool** pane can be adjusted, using new controls.
- The progress bar now contains a new **Lasso** selection tool button.
- On the menu bar, the **Import/Export**, **Artifacts**, **Actions**, and **Play** menu items have been removed, and new **Setup**, **2D Tasks**, **3D Tasks**, **Scripts**, and **Export** menu items have been added.
- The boujou 4.1 toolbar has additional buttons for **Orthogonal** views, stepping through solved frames, and the **Fly Align** and **Vertex Align** tools. The layout of the **Play** controls on the toolbar has been slightly changed.
- Access to the **Toolbox**, **Taskview** (formerly **Artifacts Tree**), **History**, **Help**, **Overlays**, **Zoom**, and **Model** panes is now tab-based.
- The boujou 4.1 menu bar has been redesigned. The **Import/Export**, **Artifacts**, **Actions**, and **Play** menu items, which were present in boujou 3, have been removed and new **Setup**, **2D Tasks**, **3D Tasks**, **Scripts**, and **Export** menu items have been added.

boujou 4.1 Window

The boujou 4.1 window, shown in Figure 2-1, is clearly laid out to enable you to easily work with your image data.

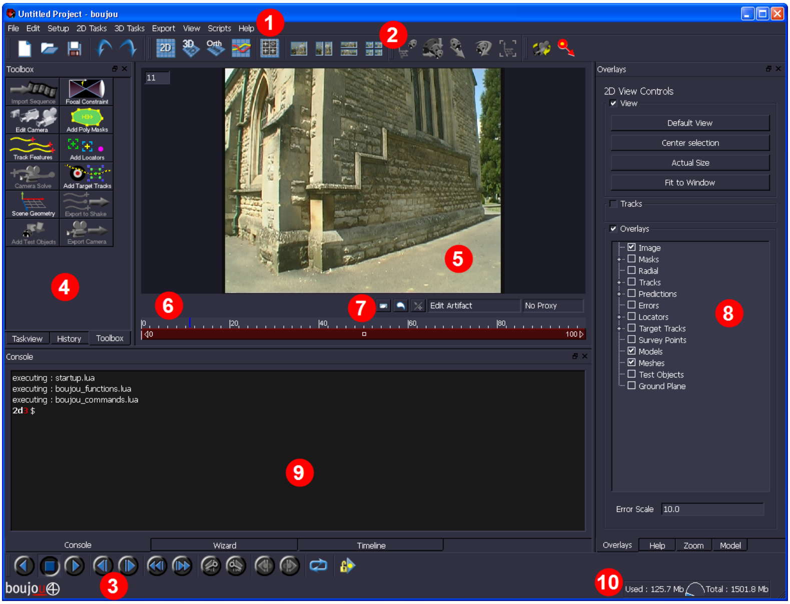


Figure 2-1: boujou 4.1 user interface

As you work with boujou 4.1, you will use the following key areas of the user interface:

1. Menu Bar

Contains commands for managing the appearance and operation of boujou 4.1. For details, see *Menu Bar* on page 2-7.

2. Toolbars

Contain tools for managing project files, configuring views, and manipulating camera angles. For details, see *Toolbars* on page 2-16.

3. **Play Controls Toolbar**

   Contains controls for playing and stepping through image sequences and camera movements. For details, see *Play Controls Toolbar* on page 2-21.

4. **Left Sidebar**

   Contains tool and function panes in a customizable layout. It can also remain empty. For details, see *Left Sidebar* on page 2-23.

5. **Image Window**

   Displays image sequences, and 2D and 3D graphical tracking data in various configurable views. For details, see *Image Window* on page 2-32.

6. **Timebar**

   Enables you to navigate through an image sequence, specify frame ranges, and display the **Go to frame** dialog box in which you can type the required frame number. For details, see *Timebar* on page 2-43.

7. **Status Bar**

   Provides status information on system activity and contains tools for selecting and manipulating data in the Image window. Status information is also displayed in the Wizard. For details, see *Status Bar* on page 2-43.

8. **Right Sidebar**

   Contains tool and function panes in a customizable layout. It can also remain empty. For details, see *Right Sidebar* on page 2-46.

9. **Basebar**

   Contains tool and function panes in a customizable layout. It can also remain empty. For details, see *Basebar* on page 2-63.

10. **Cache Bar**

    Displays information about the memory used to cache an image sequence while it is being loaded. For details, see *Cache Bar* on page 2-69.

Each of the boujou 4.1 window elements is described in more detail on page 2-7 to page 2-69. Sections appear in the order they are listed above.

Managing Panes

The right sidebar, left sidebar, and basebar areas are containers for the panes that contain the tools you use to work within boujou 4.1. They are configurable areas that can contain one or more panes.

For information on the default layout of the panes in each area, see *Left Sidebar* on page 2-23, *Right Sidebar* on page 2-46, and *Basebar* on page 2-63.

Within the right sidebar, left sidebar, and basebar areas, you can lay out the panes in the following ways:

- **Tabbed** In the tabbed layout, the panes lay on top of one another and are accessible using the tabs at the bottom of the area.
- **Stacked** In the stacked layout, the panes are positioned one above the next within the sidebar areas, and side by side in the basebar.
- **Combined tabbed and stacked layouts** In a combined layout, some of the panes are stacked and some are tabbed.

You can also undock and float the panes in any area of the screen space or across a multi-monitor setup.

To display or hide a pane:

1. From the **View** menu, point to **Panes**.
   OR
   right-click any toolbar or the title bar of any pane.
2. Click the name of the pane that you want to display or hide.

Tip

You can also hide a pane by clicking the **Hide** button in the top right corner of the pane.

To undock or dock a pane:

- Click the **Undock** button in the top right corner 
  OR
  double-click the title bar of a docked pane to undock it and make it a floating pane.
- Double-click anywhere on the title bar at the top of a floating pane to dock it in the last location at which it was docked.

To move a pane:

- Drag the pane by its title bar to its new location. You can leave the pane floating or you can dock it in the same or another location.

  When you drag a pane over an area into which it can be docked in the left sidebar, the right sidebar, or the basebar, a dotted outline shows where the pane will dock when you release it.

Tip

Not all panes can be docked in all areas. Sidebar panes (except the Toolbox pane) can be docked in either sidebar but not in the basebar area. The Toolbox, however, can be docked in either sidebar or the basebar.
The basebar panes, except for the **Console** pane, can also be docked in the area between the toolbars and the **Image** window at the top of the boujou 4.1 window. For more details of the panes that can be docked in each area, see *Left Sidebar* on page 2-23, *Right Sidebar* on page 2-46, and *Basebar* on page 2-63.

Menu Bar

The menu bar, shown in Figure 2-2, contains commands for managing the appearance and operation of boujou 4.1.

Figure 2-2: boujou 4.1 menu bar

The commands available from the boujou 4.1 menu bar are described in the following sections:

- *File Menu* on page 2-8
- *Edit Menu* on page 2-9
- *Setup Menu* on page 2-10
- *2D Tasks Menu* on page 2-11
- *3D Tasks Menu* on page 2-12
- *Export Menu* on page 2-13
- *View Menu* on page 2-14
- *Scripts Menu* on page 2-15
- *Help Menu* on page 2-15

File Menu

The commands in the **File** menu, shown in Figure 2-3, enable you to manage project files in boujou 4.1.

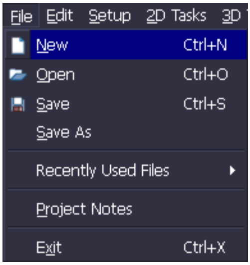


Figure 2-3: File menu

Tip

Some menu commands have corresponding keyboard shortcuts; for details on these, see *Appendix A boujou 4.1 Keyboard Shortcuts*.

Edit Menu

The commands in the **Edit** menu, shown in Figure 2-4, enable you to manage recent actions, editing operations, the Setup Wizard, the image sequence cache, data playback, and user preferences.

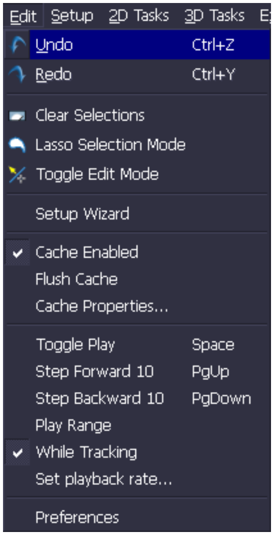


Figure 2-4: Edit menu

Tip

Some Edit commands also can be accessed from elsewhere in the boujou 4.1 window. Some menu commands have corresponding keyboard shortcuts; for details on these, see *Appendix A boujou 4.1 Keyboard Shortcuts*.

Setup Menu

The commands in the **Setup** menu, shown in Figure 2-5, enable you to manage image sequences, camera settings, and proxy sequences.

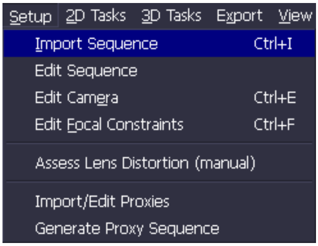


Figure 2-5: Setup menu

Tip

Some Setup commands also can be accessed from Toolbox shortcut buttons; for details, see *Toolbox Pane* on page 2-28. Some menu commands have corresponding keyboard shortcuts; for details on these, see *Appendix A boujou 4.1 Keyboard Shortcuts*.

2D Tasks Menu

The commands in the **2D Tasks** menu, shown in Figure 2-6, enable you to manage feature tracking, masks, and target tracking on 2D image data.

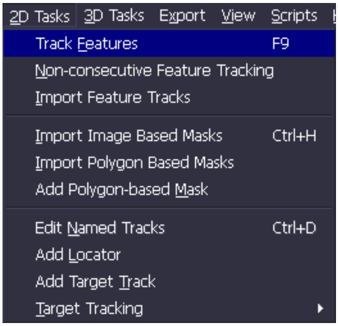


Figure 2-6: 2D Tasks menu

Tip

Some 2D Task commands also can be accessed from Toolbox shortcut buttons; for details, see *Toolbox Pane* on page 2-28. Some menu commands have corresponding keyboard shortcuts; for details on these, see *Appendix A boujou 4.1 Keyboard Shortcuts*.

3D Tasks Menu

The commands in the **3D Tasks** menu, shown in Figure 2-7, enable you to manage camera solving, scene geometry, test objects, transformation, modeling, and mesh generation.

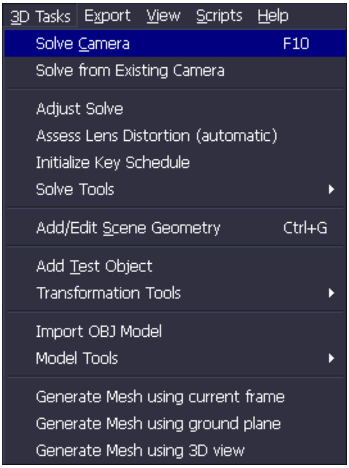


Figure 2-7: 3D Tasks menu

Tip

Some 3D Task commands also can be accessed from elsewhere in the boujou 4.1 window. Some menu commands have corresponding keyboard shortcuts; for details on these, see *Appendix A boujou 4.1 Keyboard Shortcuts*.

Export Menu

The commands in the **Export** menu, shown in Figure 2-8, enable you to export image data from boujou 4.1.

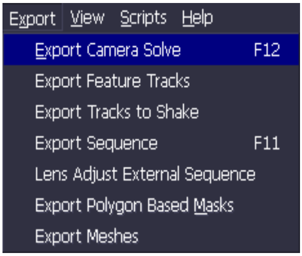


Figure 2-8: Export menu

Tip

Some Export commands also can be accessed from Toolbox shortcut buttons; for details, see *Toolbox Pane* on page 2-28. Some menu commands have corresponding keyboard shortcuts; for details on these, see *Appendix A boujou 4.1 Keyboard Shortcuts*.

View Menu

The commands in the **View** menu, shown in Figure 2-9, enable you to manage the appearance and layout of the boujou 4.1 window.

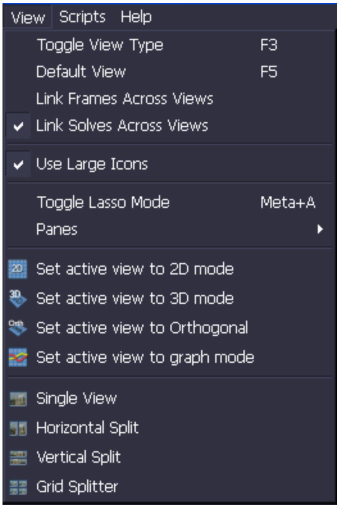


Figure 2-9: View menu

Tip

Some View commands also can be accessed from toolbar buttons; for details, see *Active View Controls Toolbar* on page 2-18. Some menu commands have corresponding keyboard shortcuts; for details on these, see *Appendix A boujou 4.1 Keyboard Shortcuts*.

Scripts Menu

The commands in the **Scripts** menu, shown in Figure 2-10, enable you to manage the boujou 4.1 scripts. For details on using boujou scripts for customizing processing, see *Chapter 4 Advanced Functions*.

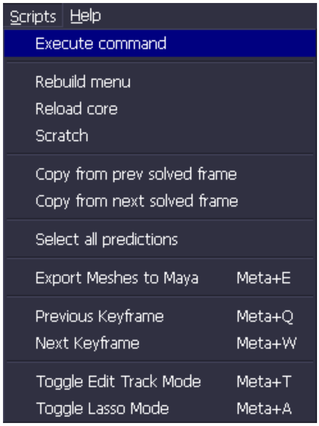


Figure 2-10: Scripts menu

Tip

Some menu commands have corresponding keyboard shortcuts; for details on these, see *Appendix A boujou 4.1 Keyboard Shortcuts*.

Help Menu

The commands in the **Help** menu, shown in Figure 2-11, enable you to display the **About boujou** dialog box in which you can view version and licensing information about the installed release of boujou 4.1.

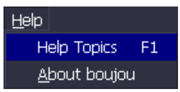


Figure 2-11: Help menu

Toolbars

The **Toolbars**, shown in Figure 2-12, contain buttons for some of the frequently used functions within boujou 4.1.

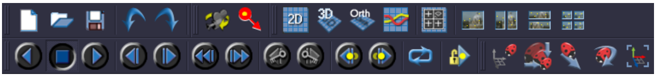


Figure 2-12: boujou 4.1 Toolbars

By default, the buttons are arranged in groups in the main toolbar area at the top of the boujou 4.1 window.

The buttons available from the five tool groups are described in the following sections:

- *Standard Toolbar* on page 2-17
- *Active View Controls Toolbar* on page 2-18
- *Transformations Toolbar* on page 2-19
- *Model Toolbar* on page 2-20
- *Play Controls Toolbar* on page 2-21

You can customize the appearance and location of the boujou 4.1 toolbars to suit your preferences. The toolbars can be positioned at the top (default), bottom, left, or right of the main window.

To display or hide a toolbar:

1. From the menu bar, click **View** and point to **Panes**
   OR
   right-click any toolbar or the title bar of any pane.

   Panes that are currently displayed are indicated by a check mark in the menu.

2. Click the name of the toolbar you want to display or hide.

boujou 4.1 maintains these settings until you adjust them again.

To position a toolbar elsewhere in the boujou 4.1 window:

1. Click the split bar on the left side of the desired toolbar and drag it to the desired location in boujou 4.1 window.

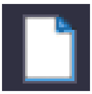
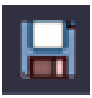
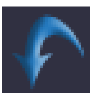
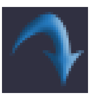
   The toolbar changes to an outline shape so you can visualize where it will be positioned.

2. Drop the toolbar at the far right, left, top, or bottom areas of the main window. You may need to increase your screen resolution.

Standard Toolbar

Table 2-1 describes the buttons in the Standard toolbar.

Table 2-1: Standard Toolbar Buttons

Button	Function	Description
	**New**	Displays a dialog box that gives you the options of closing the current project, leaving it open, or canceling your request. If you choose to close the current project, you are prompted to save any unsaved changes. It then opens a new boujou 4.1 project.
	**Open**	Displays the **Open Project** dialog box, in which you can browse for a previously saved boujou 4.1 project.
	**Save**	Saves the current project.
	**Undo**	Undoes the last command.
	**Redo**	Cancels the last undo.

Active View Controls Toolbar

Table 2-2 describes the buttons in the Active View Controls toolbar, which you use to manage the visualization of data in the Image window (for details, see *Image Window* on page 2-32)

Table 2-2: Active View Controls Toolbar Buttons

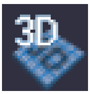
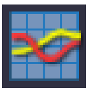
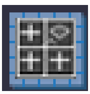
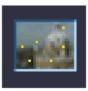
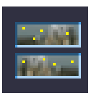
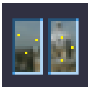
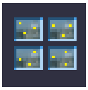
Button	Function	Description
View modes		
	**2D Mode**	Sets the active view to 2D mode.
	**3D Mode**	Sets the active view to 3D mode.
	**Orthogonal Mode**	Sets the active view to single Orthogonal mode.
	**Graph Mode**	Sets the active view to Graph mode.
Split Views		
	**Orthogonal Views**	Splits the Image window into four views in a 2x2 grid: Top, Side, Front, or 3D view.
	**Single View**	Reverts the Image window to a single view.
	**Horizontal Split**	Splits the Image window into two views, side by side.

Table 2-2: Active View Controls Toolbar Buttons

Button	Function	Description
	**Vertical Split**	Splits the Image window into two views, one on top of the other.
	**Grid Splitter**	Splits the Image window into four views arranged in a 2x2 grid.

Transformations Toolbar

Table 2-3 describes the buttons in the Transformations toolbar.

Table 2-3: Transformations Toolbar Buttons

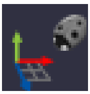
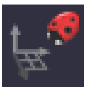
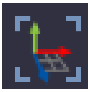
Button	Function	Description
	**Edit the coordinate frame**	Applies transformations edits to the coordinate frame when the button is in this setting.
	**Edit the test objects**	Applies transformations edits to the selected test object when the button is in this setting.
	**Scale**	Displays or hides the scale manipulator for the selected 3D test object (if **Edit the test objects** button pressed).
	**Translate**	Displays or hides the translate manipulator for the selected 3D test object or the coordinate frame (depending on whether the **Edit the coordinate frame** or the **Edit the test objects** button is pressed).

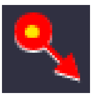
Table 2-3: Transformations Toolbar Buttons

Button	Function	Description
	**Rotate**	Displays or hides the Rotate manipulator for the selected 3D test object or the coordinate frame (depending on whether the **Edit the coordinate frame** or the **Edit the test objects** button is pressed).
	**Reset coordinate frame transformations**	Undoes all transformations that have been applied to the coordinate frame.

Model Toolbar

Table 2-4 describes the buttons in the Model toolbar.

Table 2-4: Model Toolbar Buttons

Button	Function	Description
	**Fly Align**	Moves the camera while in the 2D View using mouse navigation in conjunction with an imported model. A Camera icon is displayed in the top right of the Image window to indicate when this mode has been invoked.
	**Vertex Align**	Moves the camera while in the 2D View by selecting and manipulating points on an imported model.

Play Controls Toolbar

Table 2-5 describes the buttons in the Play Controls toolbar, which you use to play back data in the Image window (for details, see *Image Window* on page 2-32).

Table 2-5: Play Controls Toolbar Buttons

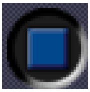
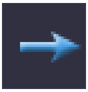
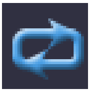
Button	Function	Description
	**Play Backward**	Play the image sequence backward.
	**Stop Playback**	Stop playing the image sequence.
	**Play Forward**	Play the image sequence forward.
	**Step Backward**	Step backward by one frame.
	**Step Forward**	Step forward by one frame.
	**Go to Start**	Go to the first frame of the image sequence.
	**Go to End**	Go to the last frame of the image sequence.
	**Previous Key**	Jump to the previous keyframe of the currently selected artifact (polygon mask, target track, or locator).

Table 2-5: Play Controls Toolbar Buttons

Button	Function	Description
	**Next Key**	Jump to the next keyframe of the currently selected artifact (polygon mask, target track, or locator).
	**Play Once**	Play forward to the end frame, then stop.
	**Cycle**	Repeat playback from the start when the last frame is reached.
	**Auto Reverse (ping pong)**	Play forward to the end frame, then backward to the start frame.
	**Locked to Point**	Lock the view to a single selected point during playback. The background image moves, but the selected point is static. This allows you to see how much the surrounding pixels move relative to the point.

Left Sidebar

By default, the **Left Sidebar** contains the following panes, described on the pages indicated, in a tabbed layout:

- *Taskview Pane* on page 2-24
- *History Pane* on page 2-26
- *Toolbox Pane* on page 2-28

It can also contain the following panes or be empty:

- *Overlays Pane* on page 2-48
- *Help Pane* on page 2-56
- *Zoom Tool Pane* on page 2-57
- *Model Tools Pane* on page 2-60

Figure 2-13 shows an example of a customized layout, with both tabbed and vertically stacked panes. For more information on managing the panes within the left sidebar, see *Managing Panes* on page 2-5.

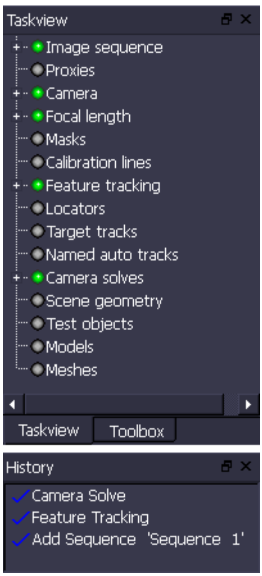


Figure 2-13: Left sidebar with tabbed and stacked panes

Taskview Pane

The **Taskview** pane, shown in Figure 2-14, shows the tracking tasks that need to be completed and indicates your progress.

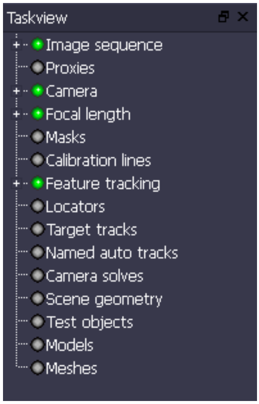


Figure 2-14: Taskview pane

The **Taskview** pane is displayed when you click the **Taskview** tab at the bottom of the left sidebar in the default layout, as shown in Figure 2-15.

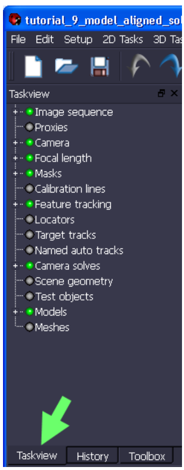


Figure 2-15: Taskview tab

The green lights show which tasks have been completed. You can expand a branch by clicking the **+**; this reveals the artifact associated with that action. Double-click the artifact to view or edit the properties for that action.

Informationals

Informationals are a context-sensitive advice system offering prompts, guidance, and warnings throughout the camera solving process. For example, if you camera solve a sequence and then add a locator, an Informational is created suggesting that you camera solve again, as shown in Figure 2-16.

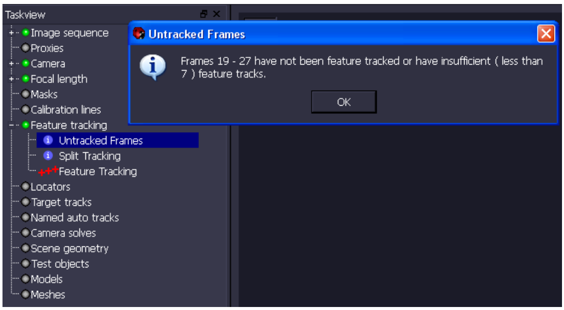


Figure 2-16: Sample Informational

Informationals are displayed when you double-click the artifact in the same branch as the task to which they relate in the **Taskview** pane.

History Pane

The **History** pane, shown in Figure 2-17, displays the actions that you have carried out since opening the current project file. The actions are listed with the most recent displayed at the top.

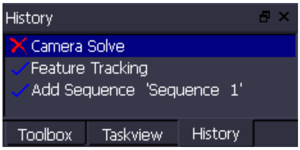


Figure 2-17: History pane

The **History** pane is displayed when you click the **History** tab at the bottom of the left sidebar in the default layout, as shown in Figure 2-18.

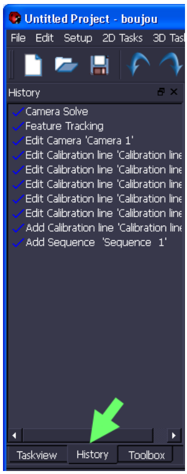


Figure 2-18: History tab

To undo an action:

- Use any of the following methods:

  History pane: Double-click the action. The blue check mark turns into a red cross to show that the item has been undone. All items above the selected one are also undone.

  Standard toolbar: Undo button 

  Keyboard shortcut: CTRL+Y

To redo an action:

- Use any of the following methods:

  History pane: Double-click a previously undone action. The red cross turns into a blue check mark to show that the item has been redone. All items above the selected one are also redone.

  Standard toolbar: Redo button 

  Keyboard shortcut: CTRL+Y

Toolbox Pane

The **Toolbox** pane, shown in Figure 2-19, contains buttons to carry out all actions for workflow tasks in boujou 4.1.

Figure 2-19: Toolbox pane

The **Toolbox** pane is displayed when you click the **Toolbox** tab at the bottom of the left sidebar in the default layout, as shown in Figure 2-20.

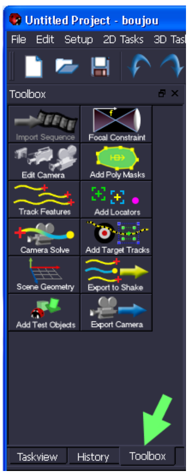


Figure 2-20: Toolbox tab

By default, a basic set of buttons appears in the **Toolbox**. You can add to or rearrange the default shortcut buttons to suit the way you work. Table 2-6 shows all of the available shortcut buttons, identifying their category and whether or not they are displayed in the Toolbox by default.

Table 2-6: Available Shortcut Buttons

Category	Button	Default
Miscellaneous		
Preferences		Yes
Setup		
Import Sequence		Yes
Edit Sequence		No
Edit Camera		Yes
Edit Focal Length Constraints		Yes
Assess Lens Distortion		No
Import Proxy		No
Generate Proxy		Yes

Table 2-6: Available Shortcut Buttons

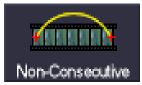
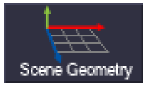
Category	Button	Default
2D Tasks		
Track Features		Yes
Non-consecutive Feature Tracking		No
Import Tracks		No
Import Image-based Masks		No
Import Polygon-based Masks		No
Add Polygon-based Mask		Yes
Edit Named Tracks		No
Add Locator		Yes
Add Target Tracks		Yes

Table 2-6: Available Shortcut Buttons

Category	Button	Default
3D Tasks		
Camera Solve		Yes
Add Scene Geometry		Yes
Add Test Object		Yes
Export		
Export Camera Solve		Yes
Export Tracks		No
Export Tracks to Shake		Yes
Export Sequence		No
Lens Adjust External Sequence		No
Export Polygon-based Masks		No

To add a shortcut button to the Toolbox:

- Right-click in an empty area of the Toolbox, and then in the displayed menu point to the desired category (Miscellaneous, Setup, 2D Tasks, 3D Tasks, Setup), and then click the desired shortcut button.

To replace an existing shortcut button:

- Right-click the shortcut button, and then in the displayed menu point to the desired category, and then click the desired shortcut button.

To remove a shortcut button:

- Right-click the shortcut button, and then in the displayed menu select **Remove button**.

To move a shortcut button:

- Drag it to the desired location (the pointer looks like an I-beam to guide you in placing the button).

Image Window

The **Image window**, shown in Figure 2-21, enables you to configure the visualization of image data. The Image window is always displayed in the center of the boujou 4.1 window.

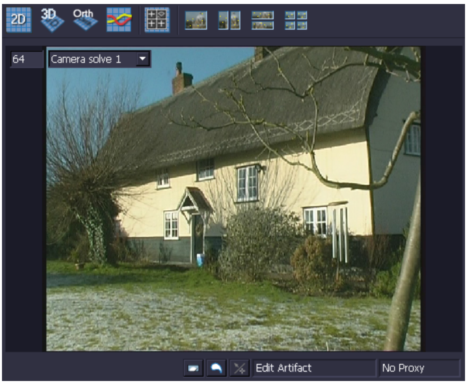


Figure 2-21: Image Window

You can use the Active View Controls toolbar, shown in Figure 2-22, to select an available view mode or split the Image window (for details, see *Active View Controls Toolbar* on page 2-18).

Figure 2-22: Active View Controls toolbar

You can configure the overlays for each window either from the **Overlays** pane (for details, see *Overlays Pane* on page 2-48) or the right-click menu in the Image window.

The current frame number is displayed in the top left of the Image window. You can navigate to a specific frame in the sequence by entering the required frame number in this box.

If you are working with multiple solves or survey data, you can select which of these is displayed in the Image window. To do this, click the required option from the drop-down list at the top left of the Image window.

The following sections describe the components and operation of the Image window:

- *2D Mode View* on page 2-34
- *3D Mode View* on page 2-35
- *Ortho Mode View* on page 2-36
- *Graph Mode View* on page 2-37
- *Splitting the Image Window into Multiple Views* on page 2-38
- *Playing Back Data in the Image Window* on page 2-40
- *Navigating Data in the Image Window* on page 2-41

2D Mode View

The **2D Mode** view, shown in Figure 2-23, enables you to view the image sequence through the camera which captured it. You can move forward and backward through time, and you can scale and drag the image in the plane of the lens.

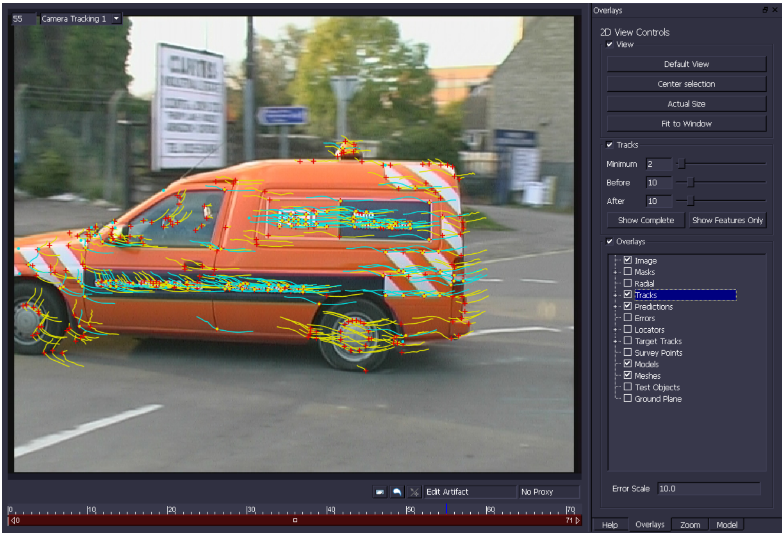


Figure 2-23: Sample 2D Mode view

The **2D Mode** view is displayed when you click the **Set active view to 2D mode** button on the Active View Controls toolbar.

3D Mode View

The **3D Mode** view, shown in Figure 2-24, enables you to view your scene though a camera other than the one that captured the shot. This new camera can move completely independently of the scene. You can only use the 3D view after you have solved the shot and created a 3D structure.

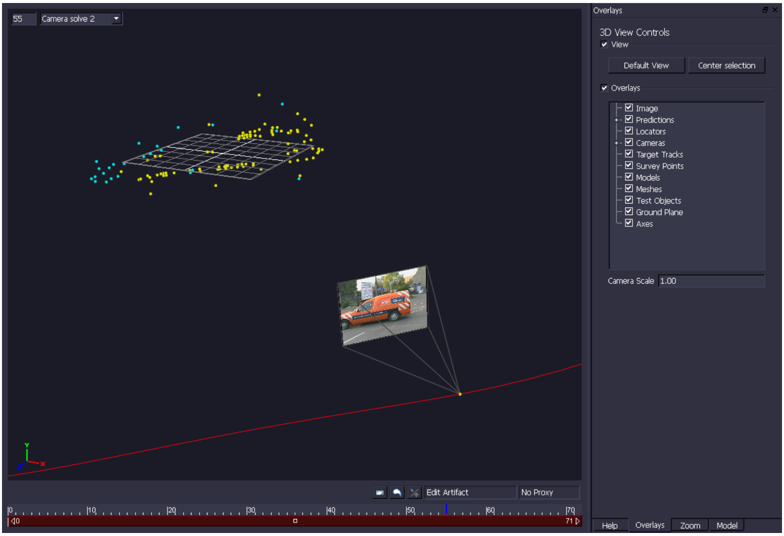
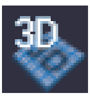


Figure 2-24: Sample 3D Mode view

The **3D Mode** view is displayed when you click the **Set active view to 3D mode** button on the Active View Controls toolbar.



Ortho Mode View

The **Ortho Mode** view, shown in Figure 2-25, enables you to view the 3D scene from preset directions without any foreshortening or perspective.

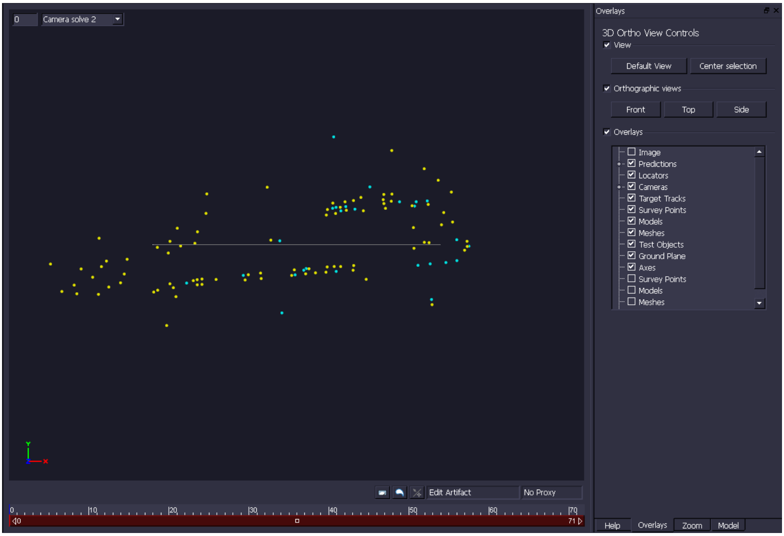


Figure 2-25: Sample Ortho Mode view—Front

The standard 3D orthogonal views are available:

- Front (looking down –Z axis when working with Y-up, Z-back)
- Side (looking down –X axis when working with Y-up, Z-back)
- Top (looking down –Y axis when working with Y-up, Z-back)

The **Ortho Mode Front** view is displayed when you click the **Set active view to Orthogonal** button on the Active View Controls toolbar.

Graph Mode View

The **Graph Mode** view, shown in Figure 2-26, enables you to view the camera rotations and translations split into X,Y,Z components, as well as the focal length once camera solving is complete.

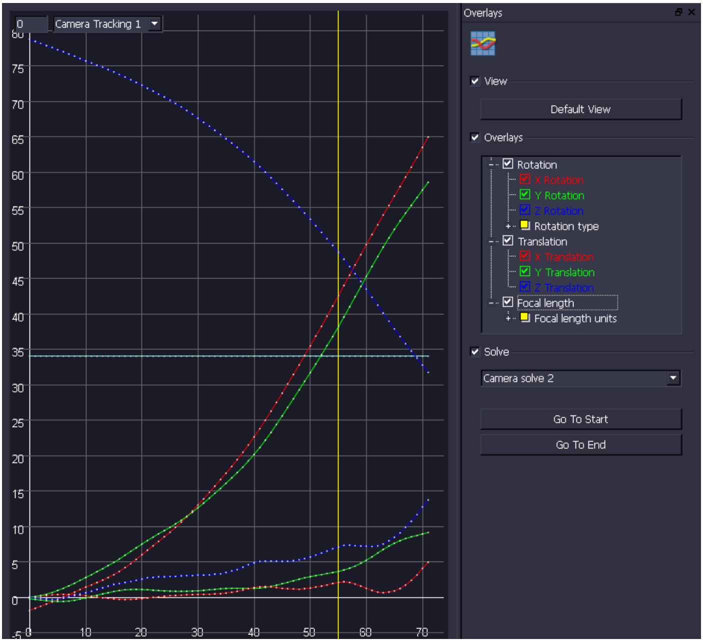


Figure 2-26: Sample Graph Mode view

The **Graph Mode** view is displayed when you click the **Set active view to graph mode** button on the Active View Controls toolbar.

You cannot edit the graph points. The overlays can be managed from the **Overlays** pane.

Table 2-7 describes the main options for navigating in the **Graph Mode** view.

Table 2-7: Graph Mode view navigation options

Option	Controls
Pan view	SHIFT+LMB+RMB or SHIFT+MMB (if **Middle Mouse button for navigation** is set in **Preferences**; see *Appendix B boujou 4.1 Preferences*)
Zoom all	SHIFT+RMB
Zoom vertical	SHIFT+ALT+RMB+drag vertically
Zoom horizontal	SHIFT+ALT+RMB+drag horizontally

Splitting the Image Window into Multiple Views

You can split the Image window into a 2x2 grid view, two horizontal views, or two vertical views. This is useful when aligning objects or structure, joining tracks, and working with locators.

Once you have split the Image window, you can set each view to the desired mode and configure its overlays independently. You can resize the views by moving the vertical splitter left and right, and the horizontal splitter up and down. In a 2x2 grid view, the vertical splitter resizes all views together.

Click the desired view to make it active. In the 2D Mode view, you can then hold the SHIFT key and left-click and drag the mouse to shuttle to the desired frame. You can revert the Image window to a single view at any time.

For example, the **Orthogonal Views** split view, shown in Figure 2-27, splits the Image window into four views: top, side, front, and 3D.

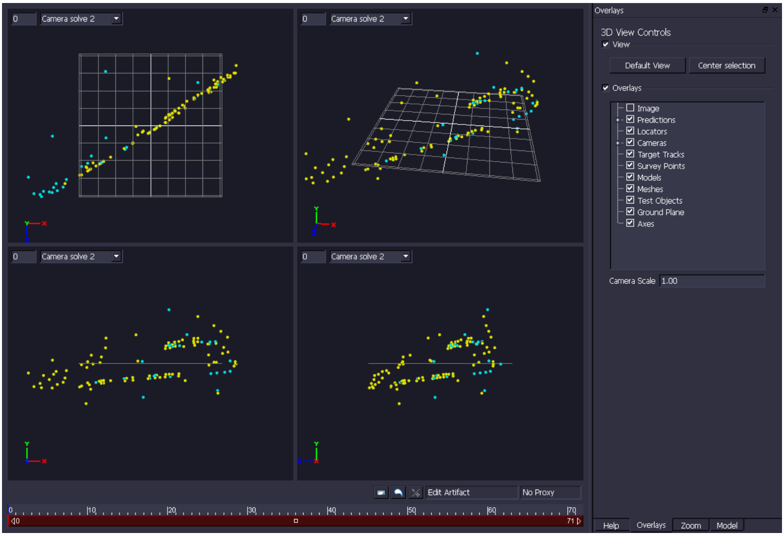
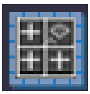


Figure 2-27: Sample Orthogonal Views Mode view

The Image window is split into this 2x2 grid when you click the **Orthogonal Views** button on the Active View Controls toolbar.



When you are using split views, you can link the views so that they are all synchronized to the same timeline. This is useful when you have split the Image window into a 2D mode view and a 3D mode view and you want to see both views at the same point in time (as if you were using a 3D animation package). To use this feature, from the **View** menu, click **Link Frames Across Views**.

When you are working with multiple solves or survey data, you can link the solve or survey data that is displayed in each of the split views so that they are synchronized. To use this feature, from the **View** menu, click **Link Solves Across Views**.

Playing Back Data in the Image Window

You use the buttons in the Play Controls toolbar to manage the play back of data in the Image window.

Figure 2-28: Play Controls toolbar

For further details on the Play Controls toolbar, see *Play Controls Toolbar* on page 2-21.

The following additional play controls are available from the **Edit** menu:

Toggle Play	Start or stop playback.
Step Forward 10	Move 10 frames forward.
Step Backward 10	Move 10 frames backward.
Play Range	Play the frame range specified by the Zoom Bar.
While Tracking	Step through the image sequence during feature tracking. This option is on by default.
Set playback rate	Set the required playback rate. This value does not affect the value of frame rate in the **Cameras** dialog or scene export.

Navigating Data in the Image Window

Table 2-8 describes the main options for navigating in the Image window.

Table 2-8: Image window navigation controls

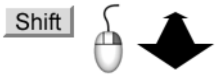
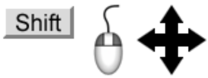
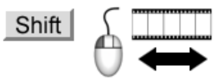
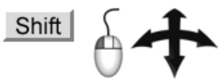
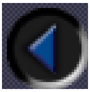
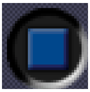
Mouse	Keyboard	Function
	—	**Zoom / Dolly** the view in 2D mode or 3D mode
 or if **Middle Mouse button** is set in **Preferences** (see *Appendix B boujou 4.1 Preferences*): 	—	**Translate / Truck / Pan** the view in 2D mode or 3D mode
 or click and drag on the Timebar.	—	**Shuttle / Scrub** through the timeline in 2D mode
	—	**Orbit** the view in 3D mode
	—	**Roll** the view in 3D mode

Table 2-8: Image window navigation controls

Mouse	Keyboard	Function
Play Controls toolbar		
	ALT+LEFT ARROW	**Play Backward**
	SPACEBAR	**Start/Stop**
	ALT+RIGHT ARROW	**Play Forward**
	LEFT ARROW	**Step Backward**
	RIGHT ARROW	**Step Forward**
Go to frame dialog box (for details, see *Timebar* below).	—	**Move to a specific frame**

Tip

You can restrict the play range to the zoom range. To do this, from the menu bar, click **Edit** and then click **Play Range**.

Timebar

The **Timebar**, shown in Figure 2-29, enables you to navigate through an image sequence, specify frame ranges, and display information about the length of a sequence and the current frame position.

Figure 2-29: Timebar

The Timebar shows the frame range for the entire sequence. The red Zoom bar in the bottom half of the Timebar controls the range of frames displayed in the top half; to resize the Zoom bar, click and drag the arrow at either end of it.

When you first import an image sequence, the size of the Zoom bar defaults to the full length of the sequence. To restrict playback to the range specified by the Zoom bar, from the menu bar, click **Edit** and then click **Play Range**. Double-click the Zoom bar to expand it to the full length of the sequence.

To jump to a particular frame number, right-click anywhere on the Timebar, then click **Go to frame...** and in the **Go to frame** dialog box, enter the required frame number and click **OK**.

Status Bar

The **Status bar** provides status information on system activity and contains tools for selecting and manipulating data in the Image window.

The Status bar is directly below the Image window. The contents of the bar depend on the current state of system activity:

- *Processing Status* on page 2-44
- *Editing Status* on page 2-44

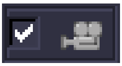
Processing Status

The Status bar displays processing information during tracking and saving operations, as shown in Figure 2-30.

Figure 2-30: Status bar—processing

During processing, the status bar contains the following controls:

- **Progress bar**
  Displays progress of processing operations.
- **Camera Solve on Completion check box**
  Determines whether or not to automatically start a camera solve process when the current processing operation completes.

- **Cancel**
  Enables you to cancel the current operation.

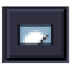
Editing Status

The Status bar contains tools for editing the current image data when tracking and saving operations are not being run, as shown in Figure 2-31.

Figure 2-31: Status Bar—editing

The right side of the Status bar contains the following editing and proxy controls and information:

- **Clear All Selections button**
  Clears all objects currently selected.

- **Lasso Selection Mode button**

  Enters or exits Lasso Selection mode.

  When this button appears to be pressed, Lasso Selection mode is on and you can define a selection area from the path of the mouse cursor. When Lasso Selection mode is off, you return to rectangular selection mode. You can add and subtract from the selection set by using the CTRL key in the usual way.

- **Toggle Edit Mode button**

  Enters or exits Edit mode.

  When the button appears to be pressed, Edit mode is on.

- **Artifact**

  Displays the name of the artifact that you are currently adding or editing.

- **Proxy**

  Indicates whether or not you are using a proxy image sequence. If Using Proxy is displayed, you can right-click the Proxy box to display a menu with commands to turn proxies on or off, or to switch between proxies.

Right Sidebar

By default, the **Right Sidebar** contains the following panes, described on the pages indicated, in a tabbed layout:

- *Overlays Pane* on page 2-48
- *Help Pane* on page 2-56
- *Zoom Tool Pane* on page 2-57
- *Model Tools Pane* on page 2-60

It can also contain the following panes or be empty:

- *Taskview Pane* on page 2-24
- *History Pane* on page 2-26
- *Toolbox Pane* on page 2-28

Figure 2-32 shows an example of a customized layout, with both tabbed and vertically stacked panes. For more information on managing the panes within the right sidebar, see *Managing Panes* on page 2-5.

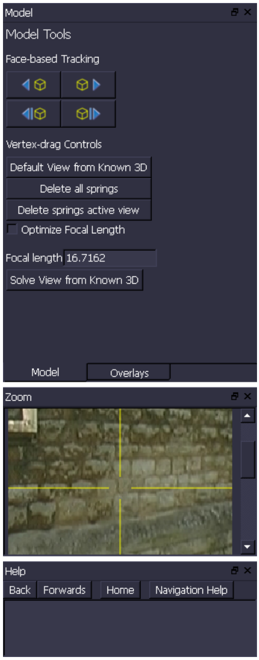


Figure 2-32: Right sidebar with tabbed and stacked panes

Overlays Pane

The **Overlays** pane controls which overlays are displayed in the Image window. All of the controls in the **Overlays** section of an **Overlays** pane are also available from the menu displayed when you right-click anywhere in the Image window.

The contents of the **Overlays** pane depend upon the current view mode (for details, see *Active View Controls Toolbar* on page 2-18).

Figure 2-33 shows the **Overlays** pane for 2D mode. 

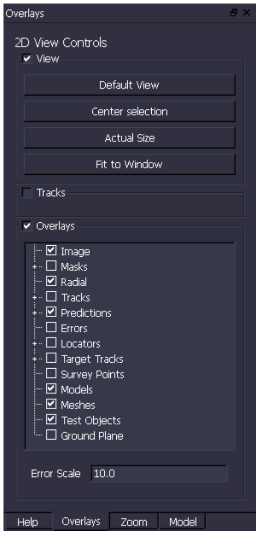


Figure 2-33: Overlays pane—2D mode

Figure 2-34 shows the **Overlays** pane for 3D mode. 

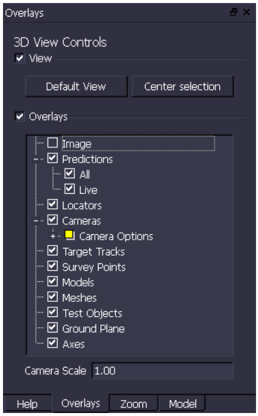


Figure 2-34: Overlays pane—3D mode

Figure 2-35 shows the **Overlays** pane for Orthogonal mode.  or 

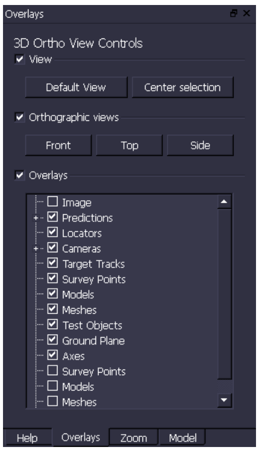


Figure 2-35: Overlays pane—Orthogonal mode

Figure 2-34 shows the **Overlays** pane for Graph mode. 

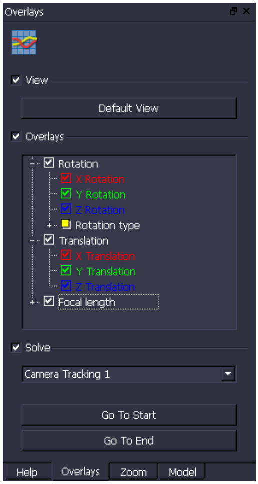


Figure 2-36: Overlays pane—Graph mode

The **Overlays** pane is displayed when you click the **Overlays** tab at the bottom of the right sidebar in the default layout, as shown in Figure 2-37.

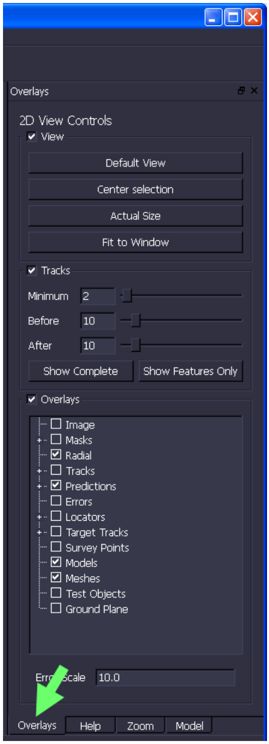


Figure 2-37: Overlays tab

Table 2-9 describes the **Overlays** pane controls.

Table 2-9: Overlays pane controls

Function	View Mode	Description
View		Displays the View options.
Default View		Re-centers the view and restores the default view settings.
Center on Selection	2D and 3D	Centers the view on the selected object or group of objects.
Actual Size	2D only	Displays the image at actual size, dependent on the resolution of the screen.
Fit to Window	2D only	Scales the image to fit the size of the current boujou 4.1 Image window.
Tracks		Display the track length display options.
Minimum	2D only	Sets the minimum visible track length. Default: 2
Before	2D only	Sets the number of frames visible before the current frame. Default: 10
After	2D only	Sets the number of frames visible after the current frame. Default: 10
Show Complete	2D only	Shows the entire track, including the current feature position.
Show Feature Only	2D only	Shows just the current tracked feature position.

Table 2-9: Overlays pane controls

Function	View Mode	Description
Overlays		Displays the overlay options.
Image	2D and 3D	Displays the background image.
Masks	2D only	**Mask Display Options > Polygons** Displays only the Polygon outline of the mask. **Mask Display Options > Filled Regions** Displays only the fill region of the mask. **Mask Display Options > Both** Displays the Polygon outline and the fill region (default). **Show Nearest Keyframes** Displays lines linking each vertex of the polygon outline to their position at the nearest keyframe.
Radial	2D only	Displays the distorted/undistorted image (if lens correction has been applied).
Tracks	2D only	**All** Displays all types of feature track (default). **Inlying** Displays only the inlying feature tracks (the ones used to calculate the camera). **Gold** Displays only the feature tracks that have been given gold status by the user.
Predictions	2D and 3D	**All** Displays all predictions (default). **Live** Displays only the predictions that are associated with features visible in the current frame (the yellow ones).
Errors	2D only	Displays the error difference between the original feature and the reprojected predictions at 10 times its actual length.

Table 2-9: Overlays pane controls

Function	View Mode	Description
Locators	2D only	**Locator Options > Tracks Only** Displays only the keyframes set by the user.
	2D and 3D	**Locator Options > Predictions Only** Displays only the 3D prediction calculated from the locator (2D view option, 3D view default).
	2D only	**Locator Options > Both** Displays both the keyframes and the 3D prediction (default).
Cameras	3D only	**Camera Options > Show Camera Path** Displays the camera path as a continuous red line.
		Camera Options > Show Individual Cameras Displays the position of the camera in each frame as a red dot with a line to show the direction of view. The length of the line is proportional to the camera's focal length.
Target Tracks	2D only	**Target Track Options > Tracks Only** Displays only the 2D track.
	2D and 3D	**Target Track Options > Predictions Only** Displays only the 3D prediction calculated from the Target Track (2D view option, 3D view default).
	2D only	**Target Track Options > Both** Displays both the 2D track and the 3D prediction (default).
	2D only	**Show All Features** Displays the position of the 2D feature found by the target tracker in each frame as a black dot.
Survey Points	2D and 3D	Displays any survey points that have been used to improve the 3D structure of the solve.
Models	2D and 3D	Displays any imported models.
Meshes	2D and 3D	Displays meshes generated from predictions.
Test Objects	2D and 3D	Displays any 3D test objects that have been created after camera solving.
Ground Plane	2D and 3D	Displays the ground plane.
Axes	3D only	Displays the axis tripod in the bottom left of the 3D view.

Table 2-9: Overlays pane controls

Function	View Mode	Description
Rotation	Graph only	**X Rotation** Displays the X rotations as a red line. **Y Rotation** Displays the Y rotations as a green line. **Z Rotation** Displays the Z rotations as a blue line. **Rotation type > Static Euler** Expresses rotations as Euler rotations about static axes. **Rotation type > Moving Euler** Expresses rotations as Euler rotations about moving axes.
Translation	Graph only	**X Translation** Displays the X translations as a red line. **Y Translation** Displays the Y translations as a green line. **Z Translation** Displays the Z translations as a blue line.
Focal Length	Graph only	**Focal length units > mm** Displays the focal length in millimeters. **Focal length units > inches** Displays the focal length in inches. **Focal length units > pixels** Displays the focal length in pixels.
Camera Scale	3D only	Sets the scale factor by which the camera display is multiplied in the 3D view. Default: 4
Error Scale	2D only	Sets the scale factor by which reprojection errors are multiplied in the 2D display. Default: 10

Help Pane

The **Help** pane, shown in Figure 2-38, shows context-sensitive help pages which describe the tools and actions in greater detail.

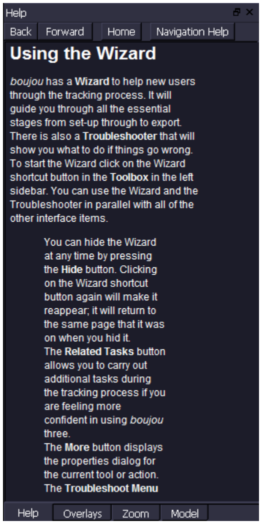


Figure 2-38: Help pane

The **Help** pane is displayed when you click the **Help** tab at the bottom of the right sidebar in the default layout.

You can navigate through previously viewed help pages by using the **Back**, **Forward**, and **Home** buttons at the bottom of the **Help** pane. The **Navigation Help** button displays the Workspace Navigation help topic, which describes the keyboard and mouse controls to use for navigating in the boujou 4.1 Image window.

Zoom Tool Pane

The **Zoom Tool** pane, shown in Figure 2-39, displays a zoomed-in area of the main image which makes working with locators and target tracks easier and more accurate.

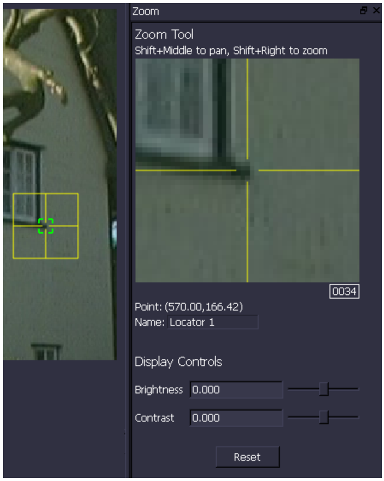


Figure 2-39: Zoom Tool pane

The **Zoom Tool** is displayed when you click the **Zoom** tab at the bottom of the right sidebar in the default layout, as shown in Figure 2-40.

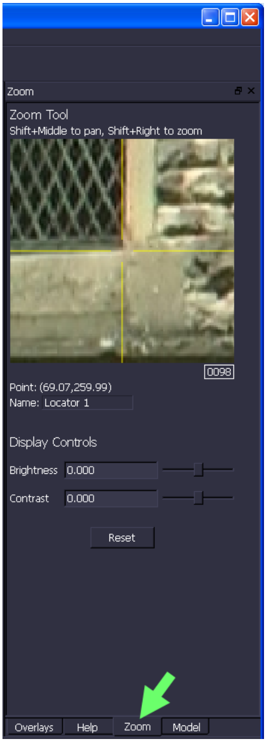
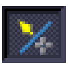


Figure 2-40: Zoom tab

If the **Zoom Tool** pane is not hidden, it will also be displayed automatically when you add a new locator or target track, or when you turn on the edit mode using the **Toggle Edit Mode** button in the Status bar.



The position of a locator or target track keyframe can be edited in the **Zoom Tool** pane using the truck/pan navigation control (for details, see Table 2-8 on page 2-41), which shows the position using a cross hair. The X and Y values of the **Point** at the center of the locator or target track are given below the zoomed region.

The zoomed region is shown in the main window as a yellow box, quartered by a cross hair. You can change the amount of zoom by using the zoom navigation control (for details, see Table 2-8 on page 2-41) in the **Zoom Tool** pane. Zooming in and out in the **Zoom Tool** pane makes the yellow box in the main window get smaller and larger. The X and Y positions (in pixels) of the center of the cross hairs is given below the zoomed region. The **Name** of the artifact that you are editing is also given below the zoomed region.

If you are editing a locator prior to camera solving, or a target track that has not yet been tracked, an image will appear in the **Zoom Tool** pane only when you are on a keyframe.

If you are editing a locator after camera solving, or a tracked target track, an image is displayed in the **Zoom Tool** pane even when you are not on a keyframe. Any adjustments that you make in the **Zoom Tool** pane will create a keyframe at the current frame.

The **Display Controls** adjust the brightness and contrast of the image display in both the main Image window in 2D Mode view and the **Zoom Tool** pane. These **Brightness** and **Contrast** controls can be used to make features clearer and easier to work with when adding locators or target tracks. Adjustments made here are to the display only and do not affect boujou 4.1's tracking or solving engine in any way. The **Reset** button returns these values to their default of 0 (zero).

When high dynamic range images are loaded, these controls are replaced with the **Black Point** (default is 0), **Display Gamma** (default is 2.2), and **Exposure Adjust** (default is 0) parameters which apply to EXR, Cineon, and DPX formats.

Model Tools Pane

The **Model Tools** pane, shown in Figure 2-41, provides a set of tools to help with face-based tracking. This tracking method, introduced in boujou 4.1, is described in *Chapter 4 Advanced Functions*.

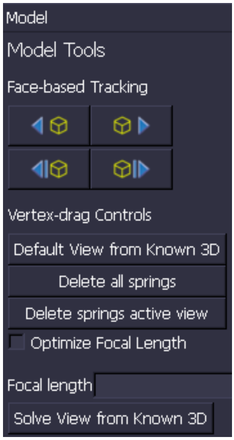


Figure 2-41: Model Tools pane

The **Model Tools** pane is displayed when you click the **Model** tab at the bottom of the right sidebar in the default layout, as shown in Figure 2-42.

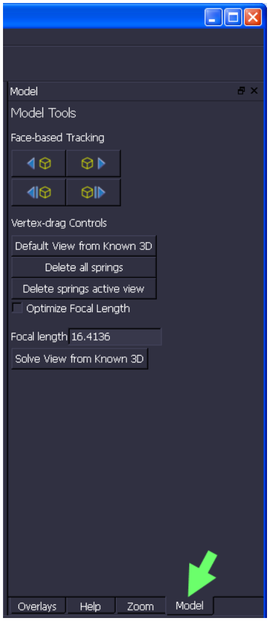


Figure 2-42: Model tab

Table 2-10 describes the **Model Tools** pane controls.

Table 2-10: Model Tools pane controls

Function	Description
Face-Based Tracking	
Track Forward	Track the faces of the model forward.
Track Backward	Track the faces of the model backward.
Track Forward One Frame	Track the faces of the model forward by one frame.
Track Backward One Frame	Track the faces of the model backward by one frame.
Vertex-drag Controls	
Default View from Known 3D	Creates a camera view based on the default model position. Frames with default views are displayed in yellow on the Timeline.
Delete all springs	Deletes all vertex align springs in every view.
Delete springs active view	Deletes all vertex align springs in the current view.
Optimize Focal Length	Optimizes focal length based on vertex alignment.
Focal Length	Enables you to manually enter the focal length of the current view.
Solve View from Known 3D	Creates a camera view based on connected survey points.

Basebar

By default, the **Basebar** contains the following panes, described on the pages indicated, in a tabbed layout:

- *Console Pane* on page 2-64
- *Wizard and Troubleshooter Pane* on page 2-65
- *Timeline Pane* on page 2-66

It can also contain the following pane or be empty:

- *Toolbox Pane* on page 2-28

Figure 2-43 shows an example of a customized layout, with both tabbed and stacked panes. For more information on managing the panes within the basebar, see *Managing Panes* on page 2-5.

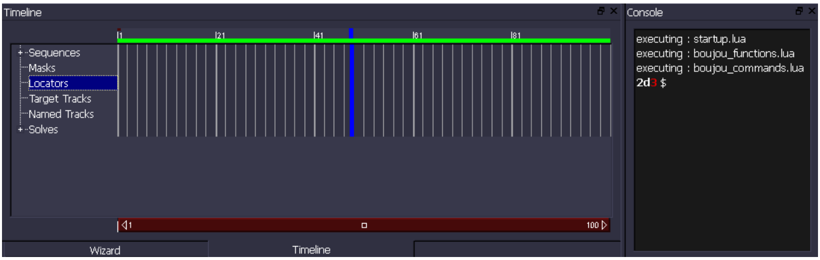


Figure 2-43: Basebar with tabbed and stacked panes

Console Pane

The **Console Pane**, shown in Figure 2-44, has two functions:

- Displays summary information about system activity such as the speed of feature tracking or the location of autosaved files.
- Acts as the embedded scripting command entry window, where you can type commands for the embedded scripting engine. Embedded scripting in boujou is still in extended beta phase. For more information about the embedded scripting functionality, contact 2d3 Support (for contact details, see *Appendix F Support Resources*).

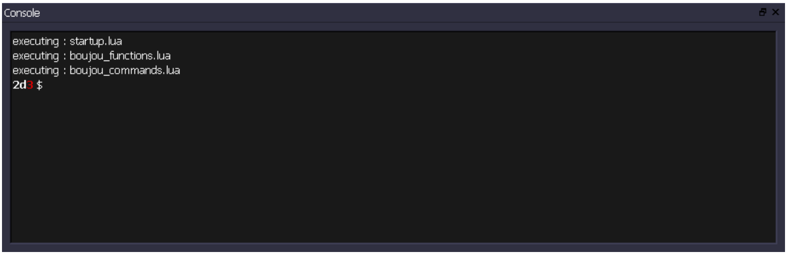


Figure 2-44: Console pane

The **Console** pane is displayed when you click the **Console** tab at the bottom of the basebar in the default layout, as shown in Figure 2-45.

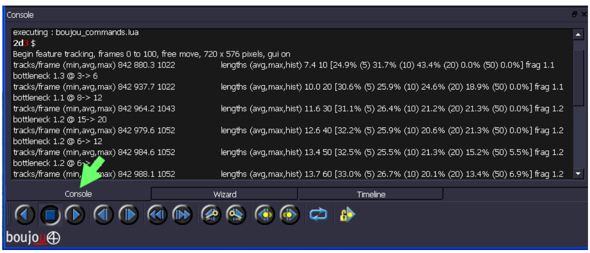


Figure 2-45: Console tab

Wizard and Troubleshooter Pane

The **Wizard**, shown in Figure 2-46, is designed to help new users through the tracking process in boujou 4.1. It guides you through every stage from setup through to export. You can use the Wizard and the Troubleshooter in parallel with all of the other interface items.

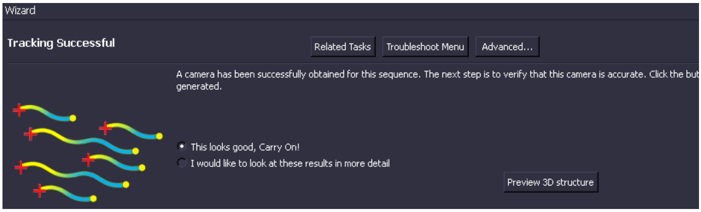


Figure 2-46: Wizard

The **Wizard** is displayed when you click the **Wizard** tab at the bottom of the basebar in the default layout, as shown in Figure 2-47.

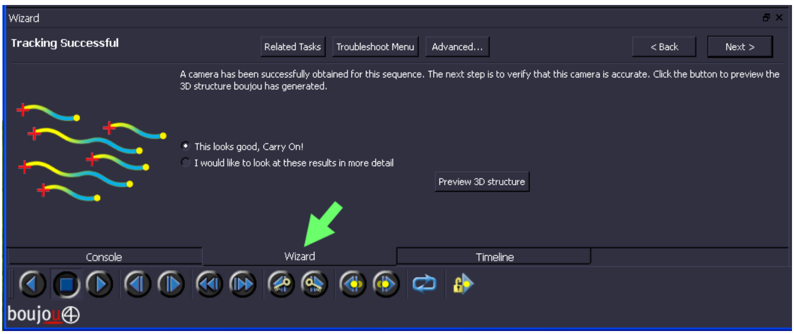


Figure 2-47: Wizard tab

The **Wizard** contains the following buttons:

- **Related Tasks**
  This button at the top of the Wizard displays a list of additional tasks you can choose to carry out during the tracking process if you are feeling more confident in using boujou 4.1.
- **Troubleshoot Menu**
  This button at the top of the Wizard displays troubleshooting tips, which show you what to do if things go wrong at any time during the tracking process.
- **More**
  This button at the bottom of the Wizard opens the original boujou 4.1 dialog box for a particular tool. For example, if you know that a specific tool setting will allow you to track your shot without having to go through the Troubleshooter, use this button.
- **Back**
  This button at the bottom of the Wizard displays the previous **Wizard**, **Related Task**, or **Troubleshooting** page.
- **Next**
  This button at the bottom of the Wizard displays the next **Wizard**, **Related Task**, or **Troubleshooting** page.

Timeline Pane

The **Timeline**, shown in Figure 2-48, displays the keyframes for masks, locators, and target tracks, and also the target tracking quality.

Figure 2-48: Timeline pane

The **Timeline** pane is displayed when you click the **Timeline** tab at the bottom of the basebar in the default layout, as shown in Figure 2-49.

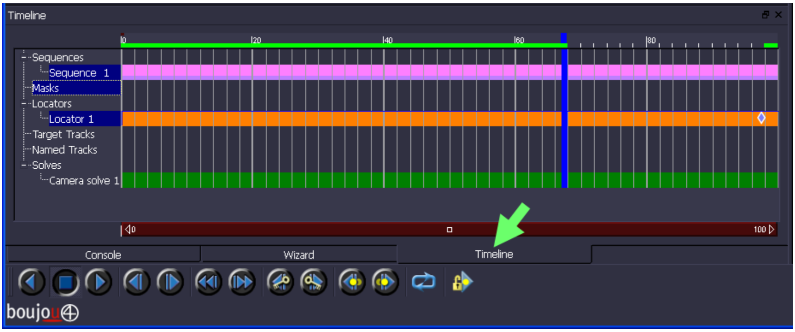


Figure 2-49: Timeline tab

The left side of the Timeline contains a list of project artifacts you can select to navigate through in the image sequence.

The right side of the Timeline displays the keyframes for masks, locators and target tracks, and also the target tracking quality. Gold tracks and named tracks are also displayed, making it easier for you to check that your gold tracks are evenly distributed throughout the sequence. It can be useful to see how the locator keyframes are distributed when you are working with survey points. Frames that contain default camera views, such as those created when key schedules are generated, are displayed in yellow on the Timeline.

Table 2-11 describes the Timeline submenu functions, which you can access by right-clicking any of the colored bars in the Timeline.

Table 2-11: Timeline submenu options

Artifact	Menu Item	Description
Sequence	**Properties**	Opens the Import Sequence dialog to display the image sequence properties.

Table 2-11: Timeline submenu options

Artifact	Menu Item	Description
Sequence (cont.)	**Define tracking region**	Specifies a frame range to be tracked. When the cursor has changed to an I-beam, click and drag the image sequence bar to highlight the required frame range. The selected area changes color.
	Delete tracking region	Clears a previously defined tracking range (the feature tracks are not deleted).
	Feature track region	Feature tracks the specified range of frames.
Masks	**Add keyframe**	Adds a mask keyframe.
	Delete keyframe	Deletes a mask keyframe.
	Toggle visibility	Makes the mask visible or invisible, depending on its current state, and sets a visibility keyframe.
	Properties	Opens the Polygon-based Mask dialog to display the properties for the selected mask.
Locators	**Delete keyframe**	Deletes a locator keyframe.
	Properties	Opens the Locators dialog to display the properties for the selected locator.
Target Tracks	**Add keyframe**	Adds a target track keyframe.
	Delete keyframe	Deletes a target track keyframe.
	Properties	Opens the Target Tracks dialog to display the properties for the selected target track.
	Track	Tracks between the first and last keyframes.
	Track range	Tracks between the two nearest keyframes.

Table 2-11: Timeline submenu options

Artifact	Menu Item	Description
Target Tracks (cont.)	**Clear range tracking**	Clears the range between the two nearest keyframes.
	Set range occluded	Defines the range between the two nearest frames as occluded. The range changes color to black.
	Clear range occluded	Changes an occluded range to untracked.
Named Tracks	**Properties**	Opens the Named Tracks dialog box to display the properties for the selected track.
	Gold	Makes the selected track gold.
	Flagged	Flags the selected track for export.
Solves	**Properties**	Displays the camera solve information for the selected solve.

When you first import an image sequence, the size of the Zoom bar defaults to the full length of the sequence. To restrict playback to the range specified by the Zoom bar, from the menu bar, click **Edit** and then click **Play Range**. Double-click the Zoom bar to expand it to the full length of the sequence.

Cache Bar

The **Cache bar**, shown in Figure 2-50, displays information about the memory used to cache an image sequence.

Figure 2-50: Cache bar

The Cache bar is located at the bottom right of the boujou 4.1 window.

It shows the amount (in Mb) the image sequence occupies in the cache and the total amount of memory that has been allocated to the cache. The cache is the amount of physical memory boujou 4.1 uses to store image files for faster playback. When you launch boujou 4.1, it sets a cache size equal to approximately 70% of the total available system RAM.

You can view and change these settings in the **Cache Properties** dialog box (for details on caching images, see *Chapter 3 Basic Functions*).

Basic Functions 3

This chapter describes the basic tracking process and the tools that you need to track the majority of shots as well as the advanced functions of the feature tracker and camera solver:

Importing an Image Sequence

The first thing you need to do when you launch boujou 4.1 is to import the image sequence that you want to track. boujou 4.1 can track a wide range of formats including 16-bit and HDR images, and any resolution. The image sequence contains all of the information that boujou 4.1 needs to calculate the motion of the camera that filmed the sequence.

You use the **Import Sequence** dialog box, shown in Figure 3-1, to load an image sequence in boujou 4.1.

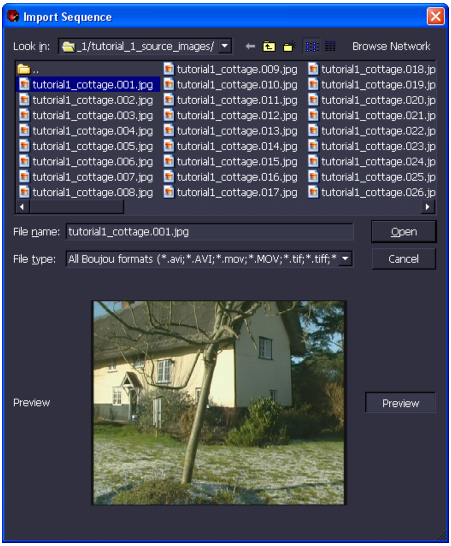


Figure 3-1: Import Sequence dialog box

Important
For details of the available image formats you can import into boujou 4.1, see *Chapter 1 Introduction*.

To import an image sequence:

1. Open the **Import Sequence** dialog box in any of the following ways:

   Toolbox: Import Sequence 

   Menu bar: Setup > Import Sequence

   Keyboard shortcut: CTRL+I

2. Use the navigation controls to browse for the image sequence.

Tip

Browse Network If you don't know your drive mapping letters, use the **Browse Network** button at the top right of the dialog box to display an Explorer-style dialog box.

A preview of the image sequence is shown in the bottom half of Figure 3-2. This can be toggled on and off using the **Preview** button. Once you have selected an image, click **Open**.

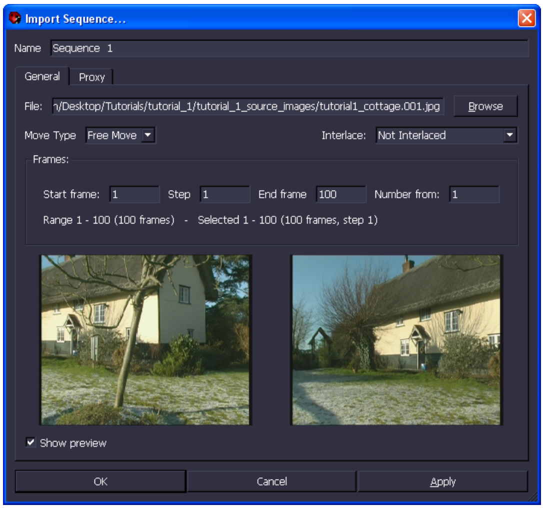


Figure 3-2: Import Sequence preview image sequence

3. In the **Name** field, either leave the default name, *Sequence 1*, or overtype it with the name you want to use for the sequence you have just loaded.

4. The **File** field shows the full path name of the first frame of the image sequence. You can edit this field to select a different image sequence, but it is easier to click the **Browse** button and return to the previous dialog box.

5. Specify the type of camera move from the **Move Type** drop-down list:
   - **Free Move**
     The camera is free to translate and rotate.
   - **Nodal Pan**
     The camera is fixed in 3D space and can only move in an angular sense (pan, tilt, and roll). An example of this would be a camera mounted on a tripod. Nodally panning moves provide no depth information about objects in the scene, so boujou 4.1 calculates its prediction points as though they were projected onto a sphere.
6. Specify the appropriate interlace setting from the **Interlace** drop-down list, as described in Table 3-1.

Table 3-1: Interlace drop-down menu options

Interlace Setting	Description
Not Interlaced	Treat the frames as progressive and ignore fields.
Use Upper Fields Only	Keep the upper fields, discard the lower fields and interpolate to maintain the image pixel height.
Use Lower Fields Only	Keep the lower fields, discard the upper fields and interpolate to maintain the image pixel height.
Use Fields, Lower Field First	Use both fields, starting with the lower field, without interpolation. This doubles the length of the sequence in the boujou 4.1 Image window.
Use Fields, Upper Field First	Use both fields, starting with the upper field, without interpolation. This doubles the length of the sequence in the boujou 4.1 Image window.

7. Enter the **Start frame**, **Step**, and **End frame**. By default the first frame and last frame that can be found in the specified directory are displayed. Step defaults to 1, but you may wish to step frames if you are working with a smooth, slow shot and

only choose to work on a few frames. In this case, your 3D animation package interpolates between them.

8. The **Number from** value controls the start frame index. It defaults to the frame number of the first frame of the sequence.
9. Select **OK** to confirm your selections.

If you want to make any changes to the camera or focal length settings, go to the **Taskview**. If not, you are ready to start feature tracking.

Specifying a Camera

The **Cameras** dialog box contains the settings for the camera type that was used to capture your footage. boujou 4.1 automatically chooses the appropriate camera settings based on the resolution of the image. For example, if your footage has a pixel resolution of 720x576, boujou 4.1 creates a PAL camera. If the resolution does not match any in the list, a custom camera with a pixel aspect ratio of 1 is created. You can create your own camera presets by editing a copy of the *preset_cameras.bpc* file from the *\Extras* folder on the installation disc. This file is not used by default; to make it active, from the **Edit menu**, click **Preferences**, expand **Import** and then click **Preset Camera File Location** to set the location (for details, see *Appendix B boujou 4.1 Preferences*).

A camera with the appropriate settings is created automatically as soon as the image sequence is imported when you click the **OK** button in the **Import Sequence** dialog box. At this point, you are ready to track. If you want, you can check or change any of your camera or focal length settings in the **Cameras** dialog box, shown in Figure 3-3.

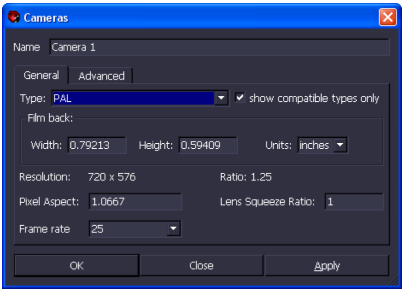


Figure 3-3: Cameras dialog box—Basic tab

To specify a camera:

1. Open the **Cameras** dialog in either of the following ways:

   Taskview: Double-click **Camera** and then double-click the desired Camera artifact.

   Menu bar: From the **Setup** menu, click **Edit Camera**.

2. In the **Name** field, either leave the default, *Camera 1*, or overtype it with the name you want to use to identify the camera.

   Caution

   If you are using Maya, don't rename your camera to something beginning with a number. Maya doesn't recognize object names starting with a number and will fail to load any animation data.

3. If you want to change the type of camera, choose a different preset from the **Type** drop-down list. If your camera settings are not covered by the presets, choose **Custom**.

4. If you clear the **Show Compatible Cameras** option, all of the preset camera types are displayed. If you choose a camera that isn't compatible with the image size, boujou 4.1 issues a warning.

5. Enter the **width** and **height** of the **Film Back** (this is the area of the film that is exposed to light, or the size of the CCD in the case of digital cameras). The default **Units** can be set to either inches or millimeters from the drop-down list.

6. Adjust the **pixel aspect ratio** if necessary. If you edit the default value, press the TAB key and boujou 4.1 will calculate the appropriate **Film Back** height. boujou 4.1 relies on a correct value of pixel aspect ratio; if the value is wrong, the solution quality may be poor.

   Important

   The pixel aspect ratio of an image is the area of a picture described by one pixel. For example, the pixel aspect ratio for a NTSC image on a 4:3 screen is: 486/720x4/3=0.9 (i.e. the pixels are 10% taller than they are wide).

7. Adjust the **Lens Squeeze Ratio** if required, for example, if the incorrect vertical field of view makes CG objects look wrong when using film resolution footage. For details and examples of this option, see *Appendix C Lens Squeeze Ratio*.

   Caution

   Not all 3D animation packages support lens squeeze. Please check before you decide to use the lens squeeze ratio.

8. Choose the **Advanced** tab, shown in Figure 3-4, if you wish to adjust the **Principal Point** position or apply a **Radial distortion** factor:

   - The position of the **principal point** of the image is given as a percentage of the image size in x and y. The origin is assumed to be at the top left of the image. The values are percentages, but you can change the units from the **Units** drop-down list.

- Use the up and down arrows to specify the amount of **Radial distortion** to be applied to the image sequence.

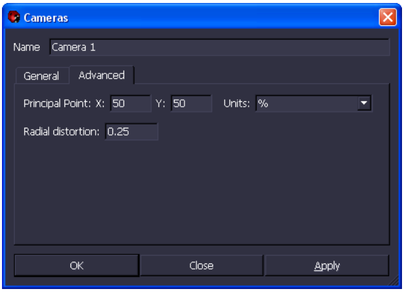


Figure 3-4: Advanced tab in Cameras dialog box

9. Click **OK**. If you have any default camera views or an existing solve in the project, a warning message is displayed to alert you to the fact that the camera views or solve are no longer valid for the undistorted image. For more details, see section *Assessing lens distortion* in *Chapter 4 Advanced Functions*.

Important

Radial distortion can be assessed automatically or by using calibration lines. If you don't know the radial correction factor for your camera/lens, leave the value as zero and use automatic assessment or the calibration lines to assess the level of distortion in the image. For more details, see section *Assessing lens distortion* in *Chapter 4 Advanced Functions*.

Saving a Project

Save your work regularly to avoid losing it in the event of system failure.

By default, boujou 4.1 automatically saves your project when it finishes feature tracking or camera solving. The autosaved file is written to a temporary directory:

Windows: *C:\Documents and Settings\<Username>\Local Settings\Temp*

OS X: */private/tmp*

Linux: */tmp*

If you have not previously saved the current project, the file saved after feature tracking is called *Untitled Project_T_autosave.bpj* and the file saved after camera solving is called *Untitled Project_C_autosave.bpj*.

You can change this default location, or configure boujou 4.1 not to save automatically after tracking. To do this, from menu bar, click **Edit**, then click **Preferences**, expand **Directories** and then click **Auto-save Files** (for details, see *Appendix B boujou 4.1 Preferences*). You can also manually save your project.

To save your current boujou 4.1 project:

1. Open the **Save Project As** dialog box in any of the following ways:

   Toolbar: Save 

   Menu bar: File > Save

   Keyboard shortcut: CTRL+S.

2. Specify the location and the name of the boujou project file (*.bpj*) in which your project settings are to be saved

3. Click **Save** to save the file and close the dialog box.

Tracking Features

The feature tracking process identifies parts of the image that are different from the surrounding area and then matches them with similar features found in subsequent frames. boujou 4.1 finds features and matches them automatically; it then decides which tracks are moving consistently and passes them on to the solver. The quality of the final camera solve depends entirely on the quality of the feature tracks. Any feature tracks that start or end outside the selected range are also kept in their entirety, preventing any discontinuities in the 2D tracking data.

It is possible to feature track with different settings over different sections of the shot. The different sections of tracks are then merged together. boujou 4.1 allows multiple solves to be stored in a single project but allows only one set of feature tracks. If you feature track the same section twice, boujou 4.1 throws away the first set of tracks for that section (except for any that were made gold) and replaces them with the new ones.

When a solve is created from a given set of feature tracks, a very close, one-to-one correspondence is created between each prediction and the feature track from which it was created. To boujou 4.1, they are inseparable. Therefore, if you feature track the same section again, the first set of feature tracks in that section only will be thrown away, but the predictions associated with the discarded tracks will be removed for the entire project.

This means that if a project already contains a solve and you feature track the entire project again, all of the predictions in that solve will be discarded. If you feature track only a subsection of the project again, the predictions associated with any feature tracks that cross this subsection will be removed for the entire project. The camera patch and any predictions for tracks that do not cross these sections will be kept.

When you complete a feature track in a project that has any existing feature tracks and solves, a message is displayed to alert you to this fact.

You use the **Feature Tracking Properties** dialog box, as shown in Figure 3-5 to manage the feature tracking process.

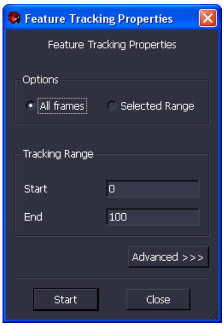


Figure 3-5: Feature Tracking Properties dialog box

To track features:

1. Open the **Feature Tracking Properties** dialog box, as shown in Figure 3-5 on page 3-10, in any of the following ways:

   Toolbox: Track Features 

Menu bar: 2D Tasks > Track Features

Keyboard shortcut: F9

2. You can track the entire sequence by selecting the **All Frames** option (default). If you only want to track part of the sequence, choose **Selected Range** and enter the **Start** and **End** frames in the **Tracking Range** section.
3. A set of **Advanced Properties**, as shown in Figure 3-6, can be accessed by clicking the **Advanced** button.

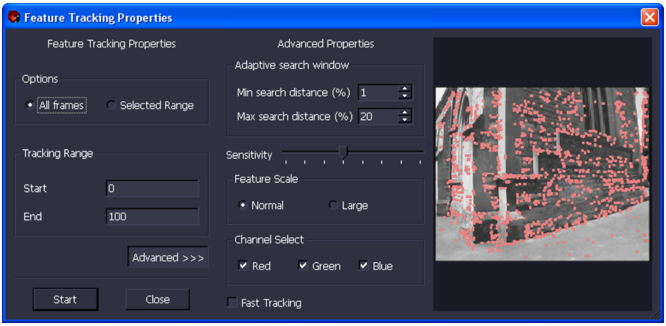


Figure 3-6: Feature Tracking properties dialog box—Advanced

Table 3-2 describes the **Advanced Properties** you can set in the **Feature Tracking Properties** dialog box.

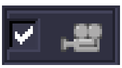
Table 3-2: Advanced Properties

Property	Description
Search Distance (%)	Specifies how far ahead in the image boujou 4.1 looks when building feature tracks. The value is a percentage of the total image size from edge to edge in any given direction. Fast moving shots need a larger search distance than slow moving shots because the features move a greater number of pixels from frame to frame. However, the greater the search distance the longer it takes to feature track a shot. The search distance in the boujou 4.1 feature tracker is adaptive. This means that it automatically increases if it cannot find a feature in the next frame. The **Min** and **Max** settings define the range of values of search distance that the feature tracker uses. This helps you to optimize the speed of feature tracking for a particular shot.
Sensitivity	Determines the number of features found in a frame. Click and drag the slider arrow to change the value of sensitivity. Increasing the sensitivity increases the number of features found. The effects appear in the image preview as soon as you release the mouse button. Not all of the features shown in the preview become feature tracks. Only features that are successfully matched with features in subsequent frames become tracks. Increasing the sensitivity can sometimes have a detrimental effect because features will be found in the noise in the image, and this will make it less likely that boujou 4.1 will be able to find good matches. For example, you may get better results for a greenscreen shot or a shot with a lot of blur, if you reduce the sensitivity.

Table 3-2: Advanced Properties

Property	Description
Feature Scale	Controls the type of features that are detected. For example, for a wooden tabletop, the **Normal** scale setting finds features mainly in the texture of the wood grain, but the **Large** scale setting finds features at the corners of the tabletop. The advantage of using the Large setting is that the feature tracker ignores smaller, noisier features. The image preview shows you the effect each option has on the feature detection (not all features become tracks). Large scale features should work well for the markers in greenscreen or bluescreen shots.
Channel Select	Enables you to choose which color channels are used for tracking. The image preview shows you the features that will be detected using the current selection. Not all features will become tracks.
Fast Tracking	Makes the feature tracker run even faster, but with reduced accuracy. It is only available for Free Move shots and not Nodal Pans.

4. Click the **Start** button to begin feature tracking.
5. The Status bar shows the feature tracking progress and an estimated finish time. If you click the **Camera Solve on Completion check box** check box next to the camera icon, boujou 4.1 starts camera solving as soon as feature tracking is finished.



6. Tracking statistics are displayed in the **Console** pane during feature tracking.
7. You can make boujou 4.1 automatically save the current project after feature tracking and camera solving in **Preferences** (for details, see *Appendix B boujou 4.1 Preferences*).

Checking Feature Tracking Quality

You can examine the quality of your feature tracks in the **Feature Tracking Info** dialog box, shown in Figure 3-7.

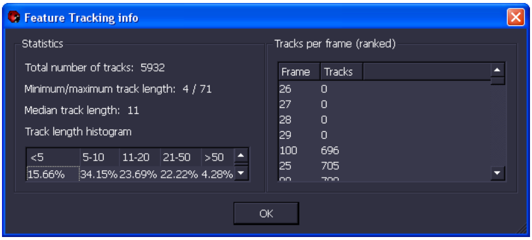


Figure 3-7: Feature Tracking Info dialog box

For a camera solve to be successful, the feature tracking process must achieve the following:

- Several long tracks should be produced.
- At any one time there should be at least 10–15 evenly distributed tracks present.
- The features being tracked need to be distributed in 3D space and should not be constrained to a single plane.

To check the quality of feature tracking:

1. Open the **Feature Tracking Info** dialog box. In the **Taskview**, expand **Feature Tracking** and then double-click the desired **Feature Tracking** artifact.
2. Examine the details in the **Feature Tracking Info** dialog box:
    - The total number of tracks.
    - The maximum and minimum track length.
    - The median track length.
    - A track length histogram showing the percentage of tracks that are in a particular length range.
    - A list of the number of tracks in each frame. The values can be sorted by clicking the column heading.

When you are satisfied with the quality of your feature tracks, you can move on to camera solving.

Solving the Camera

Camera solving calculates the motion of the camera (position, orientation, and focal length) and the three dimensional position of most feature points detected in the scene.

You can manage the basic camera solving process in two stages, which are described in the following sections:

1. *Performing a Complete Camera Solve* on page 3-16
2. *Performing an Adjust Camera Solve* on page 3-18

Tip

For details on additional methods that provide you with additional control over the camera solving process, see *Chapter 4 Advanced Functions*.

Performing a Complete Camera Solve

Performing a **Solve Complete** process automatically initializes the camera, generates 3D structure, and then optimizes the camera parameters. It is also possible to automatically correct for lens distortion and smooth the camera path as part of this process.

You use the **Advanced Camera Solve Properties** dialog box, shown in Figure 3-8, to manage the process.

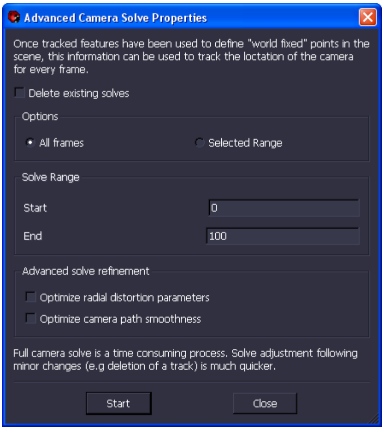


Figure 3-8: Advanced Camera Solve Properties dialog box

To perform a complete camera solve:

1. Open the **Advanced Camera Solve Properties** dialog box in any of the following ways:

   Toolbox: Camera Solve 

   Menu bar: 3D Tasks > Solve Camera

   Keyboard shortcut: F10

   Important
   In boujou 4.1, this **Advanced Camera Solve Properties** dialog box only covers **Complete** camera solving (where a new solve is created).

2. Select or clear the **Delete existing solves** option to choose whether or not to keep existing solves in your project for reference or backup before beginning a new camera solve. If

you chose to keep existing camera solves, they can be accessed from the **Taskview** pane.

3. From the **Options** section, select whether you want to create a complete camera solve or one in sections based on frame ranges:
   - **All frames**

     Solves the camera for the entire duration of the image sequence.
   - **Selected Range**

     Solves the camera for the specified range of frames.
4. From the **Solve Range** section, specify the frame range if you specified **Selected Range** in the **Solve Range** section:
   - **Start**

     The first frame in the range.
   - **End**

     The last frame in the range.
5. In the **Advanced solve refinement** section, you can specify the following options if required:
   - **Optimize radial distortion parameters**

     Select this option if you want boujou 4.1 to automatically calculate the amount of lens distortion in your shot.
   - **Optimize Camera Path Smoothness**

     Select this option if your camera path is noisy. When the camera path has been smoothed, boujou 4.1 recalculates the 3D structure to make sure that it matches the new camera motion.
6. Click the **Start** button to begin camera solving.

   The Status bar shows tracking progress, giving the estimated time of completion and the percentage completed.

When boujou 4.1 solves a camera, it creates 3D predictions. If boujou 4.1 cannot calculate a camera for the entire sequence, it does as much as it can. For very difficult shots this can mean that it calculates several track fragments for the sequence. These fragments cannot be joined together in boujou 4.1, but they can show you where the problem areas are and can be joined together in a 3D animation package.

Tip

Tim Dobbert's book, *Matchmoving: the Invisible Art of Camera Tracking* (Sybex, 2005, ISBN 0-7821-4403-9) contains a very useful chapter on how to connect two partial camera tracks in a 3D animation package.

Performing an Adjust Camera Solve

The **Solve Adjust** process can only be performed once you have got a camera solve. It carries out just the structure generation and optimization stages of the solving process. It is a very useful way of improving the camera solve after making small changes such as adding a locator or making some feature tracks gold.

You use the **Solve Adjust** dialog box, shown in Figure 3-9, to manage the process.

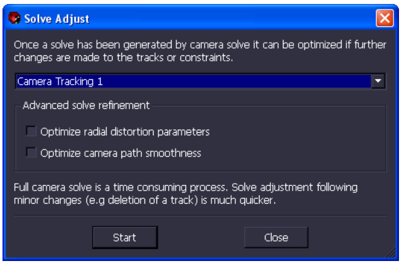


Figure 3-9: Solve Adjust dialog box

To perform an adjust camera solve:

1. Open the **Solve Adjust** dialog box by selecting **Adjust Solve** from the **3D Tasks** menu.
2. From the **User Solve** drop-down list, select the camera solve that you want to adjust (multiple solves can exist in the same project).
3. In the **Advanced solve refinement** section, you can specify the following options if required:
   - **Optimize radial distortion parameters**
     Select this option if you want boujou 4.1 to automatically evaluate the value of lens distortion in your shot.

- **Optimize camera path smoothness**
  Select this option if your camera path is noisy. When the camera path has been smoothed, boujou 4.1 recalculates the 3D structure to make sure that it matches the new camera motion.

4. Click the **Start** button to begin solve adjust.

Checking Camera Solve Quality

You can examine the quality of your camera solve in the **Camera solve information** dialog box, shown in Figure 3-10.

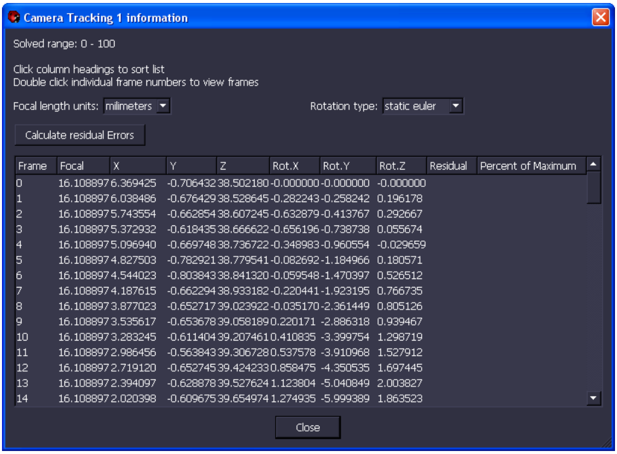


Figure 3-10: Camera solve information dialog box

To display the **Camera solve information** dialog box, in the **Taskview**, expand **Camera solves** and then double-click the desired **Camera solve** artifact.

The **Camera solve information** window shows the calculated focal length, camera X,Y,Z position, camera X,Y,Z rotation and residual for each frame. The values can be sorted in ascending or descending order by clicking the column headings. **Focal length units** can be selected from the drop-down list (the default is millimeters). The rotations can be expressed as either static Euler angles or moving Euler angles from the **Rotation type** drop-down list. The residual values do not appear when you first open the

Camera solve information dialog box. This makes the dialog box open much faster. Click the **Calculate Residual Errors** button to display the residuals for each frame.

Residual is a measure of the accuracy of the calculated camera track. It is the difference (in pixels) between the predicted position of a feature and its measured position in the image. The values shown in the **Camera Tracking Information** window are the average of all the residuals in a particular frame. You should look out for any residuals that are significantly higher than the ones around them as these sudden spikes show that there is a problem. Individual residuals can be displayed by turning on the **Errors** overlay. The **Percent of Maximum** values show the residual values for that frame as a percentage of the maximum residual.

Using 3D Test Objects

Test objects provide a quick and easy way of assessing the quality of the camera solve before you export to your animation package. It is good practice to check that the test object does not appear to slip or jump in the 2D view when you play through the sequence before you export the camera track.

The following sections describe how to work with 3D test objects:

- *Inserting a 3D Test Object* on page 3-21
- *Manipulating 3D Test Objects* on page 3-24

Inserting a 3D Test Object

You use the **Test Objects** dialog box, shown in Figure 3-11, to insert a 3D test object.

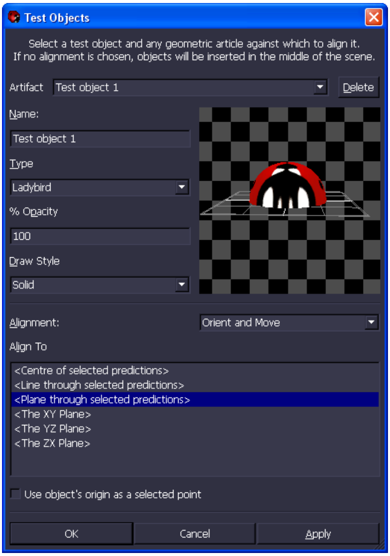


Figure 3-11: Test Objects dialog box

To insert a 3D test object:

1. Open the **Test Objects** dialog box in any of the following ways:

   Toolbox: Add Test Object 

   Menu bar: Actions > Add Test Object

   Keyboard shortcut: CTRL+T

2. A new test object is created as soon as the dialog box opens. By default this is a Ladybird named *Test Object 1*. It appears at the center of the floor grid.

3. To edit an existing test object, select it from the **Artifact** drop-down list. To create another test object, choose **<New Test Object>** from the list. To delete a test object from the **Artifact** list, click the **Delete** button.

4. Choose the **Type** of test object from the drop-down list: Arrow, Cube, Cylinder, Disk, Ladybird (default), Plane, Pyramid or Sphere, as shown in Figure 3-12.

Figure 3-12: Test object types

The **Preview window** shows what the selected test object type looks like before you insert it into your project. You can navigate in this window by using the standard controls.

5. The **% Opacity** controls the transparency of the test object. The default is 100% opacity.

6. Select the **Draw Style** of the test object: either wireframe or solid.

7. Choose the method of alignment from the **Alignment** drop-down list:

   - **None (default)**

     The test object is created at the origin, sitting on the floor grid.

   - **Move**

     Acts like a positional constraint. It translates the test object to the selected predictions or geometric feature without changing its orientation.

   - **Orient**

     Acts like a rotational constraint. If only one prediction is selected, it changes the orientation of the object so that it faces the prediction. If two predictions are selected, it aligns the object with the line between the predictions. If three or more predictions are selected, it aligns the object with the resulting best-fit plane. The position of the object does not change.

   - **Move and Orient**

     Acts like a positional constraint and a rotational constraint. It moves and orients the test object to the selected predictions or geometric features.

8. Select the alignment target from the **Align To** list box. This box contains the XY plane, the YZ plane and the ZX plane by default, and also any locators, geometric features or currently selected predictions that are in the project. Only the alignment targets valid for the selected Alignment method are available—the rest remain dimmed. For example, if you have selected one prediction, only the **<Center of selected predictions>** option is available. **<Line though selected predictions>** and **<Plane through selected predictions>** are both grayed. You can select more predictions from the 2D or 3D view with the **Test Objects** dialog still open.
9. The **Use object's origin as a selected point** check box allows you to use the test object as one of the selected alignment targets.
10. Click **Apply** to apply the changes.

You can make further adjustments to the size and position of the test object by using the **Scale**, **Translate** and **Rotate** manipulators (for details, see *Manipulating 3D Test Objects* on page 3-24). You can also import models as *.obj* files and use these as objects by placing them appropriately in the scene; however, these do not appear in the **Test Objects** dialog box.

Manipulating 3D Test Objects

The **Scale**, **Translate**, and **Rotate** tools, shown in Figure 3-13, enable you to manipulate 3D test objects in 3D space.

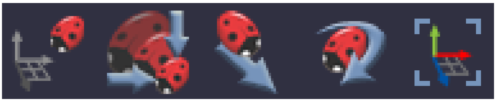


Figure 3-13: Scale, translate, and rotate tools

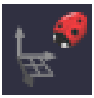
Tip

You can also use **Translate** or **Rotate** tools to manipulate the coordinate frame. For details, see *Chapter 4 Advanced Functions*.

These tools provide a fast and interactive way of manipulating the size or position of a test object.

To scale, translate, or rotate a 3D test object:

1. From the **Transformations** toolbar, ensure that the **Select whether to edit the coordinate system or the test object** button has the test object selected (the ladybird is highlighted on the button).

2. Display the desired manipulator in either of the following ways:

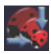
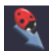
   Transformations toolbar: Scale , Translate , or Rotate 

   Image window right-click menu: Scale, Translate, or Rotate

3. Use the manipulator that surrounds the object to apply your transformations as described in Table 3-3 on page 3-25.

   Tip

   If you want to accurately align your test object to a point or orient it to a specific plane, use the **Test Objects** dialog box.

Table 3-3 describes how to use each of the **Scale**, **Translate**, and **Rotate** tools.

Table 3-3: Scale, Translate, and Rotate tools

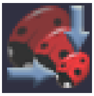
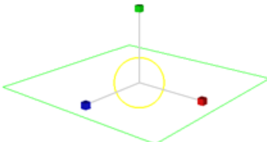
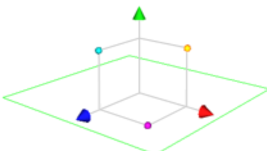
Tool	Manipulator	Function
 **Scale**		To scale 3D test objects: • Drag the **red** cube to scale in the local **X** direction. • Drag the **green** cube to scale in the local **Y** direction. • Drag the **blue** cube to scale in the local **Z** direction. • Drag the **yellow** circle to scale in local **X,Y,Z** simultaneously (proportional scaling).
 **Translate**		To translate 3D test objects or the coordinate frame: • Drag the **red** arrow to translate along the local **X** axis. • Drag the **green** arrow to translate along the local **Y** axis. • Drag the **blue** arrow to translate along the local **Z** axis. • Drag the **yellow** cube to translate in the local **XY** plane (green plus red). • Drag the **cyan** cube to translate in the local **YZ** plane (blue plus green). • Drag the **magenta** cube to translate in the local **ZX** plane (blue plus red).

Table 3-3: Scale, Translate, and Rotate tools

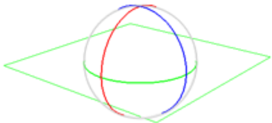
Tool	Manipulator	Function
 **Rotate**		To rotate 3D test objects or the coordinate frame: • Drag the **red** circle to rotate about the local **X** axis (tilt/ pitch). • Drag the **green** circle to rotate about the local **Y** axis (pan/ yaw). • Drag the **blue** circle to rotate about the local **Z** axis (roll/ bank).

Table 3-4 describes the commands you can select from the **Test Objects** right-click menu to work with 3D test objects.

Table 3-4: Test Objects commands

Property	Description
Scale	Displays the scale manipulator allowing you to scale the object.
Translate	Displays the translate manipulator allowing you to translate the object.
Rotate	Displays the rotate manipulator allowing you to rotate the object.
Center view on selection	Places the test object you have selected in the center of the camera view.
Rename	Enables you to rename the test object.
Delete	Deletes the test object.
Properties	Opens the **Test Objects** dialog box.

Caching Images

The cache is the amount of physical memory boujou 4.1 used to store image files for faster playback. When you first play through the image sequence, the playback rate is slow as the images are loaded into the cache. Once the complete sequence is cached, it plays at the frame rate you specify. To do this, from the menu bar, click **Edit** and then click **Set playback rate**.

You can view the default cache settings in the Cache bar (for details, see *Chapter 2 User Interface*). You can change the values in the **Cache Properties** dialog box, shown in Figure 3-14.

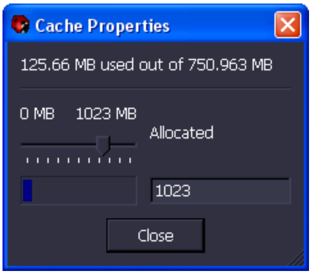


Figure 3-14: Cache Properties dialog box

The **Cache Properties** dialog box tells you how much RAM memory boujou 4.1 has used caching the current sequence, how much RAM is allocated to the boujou 4.1 image cache, and what the total amount of system RAM available is. When you first open the **Cache Properties** dialog box, the number field displays the total available RAM, and the slider is at the 70% position.

To set the cache size:

1. Open the **Cache Properties** dialog box in either of the following ways:

   Menu bar: From the **Edit** menu, click **Cache Properties**.

   Cache bar: Double-click anywhere in this area.

2. Change the amount of memory allocated to the cache by moving the **Allocated** slider or entering a value in the number field.

Important
If the total amount of RAM available in the image cache is shown as a negative value, you should set the amount manually. To do this, from the menu bar, click **Edit** and then click **Preferences.** Double-click **Miscellaneous** and then click **Total physical memory (MB)** (for details, see *Appendix B boujou 4.1 Preferences*).

3. Click **Close** to close the dialog box and save your changes.

To flush the cache:

- Use either of the following methods:

  Cache bar right-click menu: Flush Cache

  Menu bar: From the **Edit** menu, click **Flush Cache**.

  The cache is automatically flushed before the start of feature tracking or camera solving. This helps to reduce the chances of boujou 4.1 running out of memory before tracking is finished. You can change this behavior in the **Preferences** (for details, see *Appendix B boujou 4.1 Preferences*).

To disable the cache:

- Use either of the following methods:

  Cache bar right-click menu: Cache Enabled (clear the option)

  Menu bar: From the **Edit** menu, click **Cache Enabled**.

  If your image sequence is too long to fit in cache, you can either restrict the playback range or use a lower resolution image proxy.

Adding Project Notes

You can add notes to your project file to describe how you tracked it using the **Project Notes** dialog box, shown in Figure 3-15.

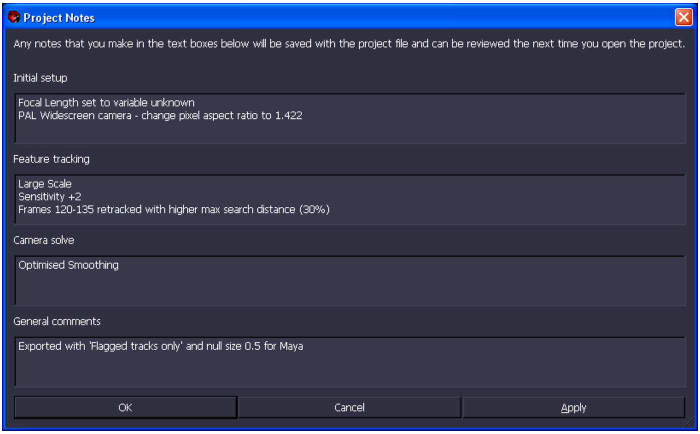


Figure 3-15: Project Notes dialog box

These notes are saved with the project and can be referred to whenever the project is opened.

The **Project Notes** dialog box can be opened from the menu bar. To do this, click **File** and then click **Project Notes**.

Advanced Functions 4

This chapter covers the advanced tools required for complex or difficult camera moves, setting user preferences, and batch processing:

Using Image Proxy Sequences

If your image sequence is too long to fit into the image cache, you can use lower resolution proxy images for playback. Tracking is still done on the original frames. You can import several proxy image sequences of different resolutions into your project and swap between them or turn them off as required.

The proxy tool functions are described in the following sections:

- *Generating an Image Proxy Sequence*
- *Importing an Image Proxy Sequence* on page 4-3
- *Managing a Proxy Image Sequence* on page 4-5

Generating an Image Proxy Sequence

You can generate a lower resolution proxy sequence using the **Generate Image Proxy** dialog box, shown in Figure 4-1.

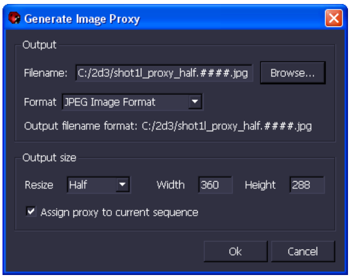


Figure 4-1: Generate Image Proxy dialog box

The generated sequence is automatically linked to the current image sequence.

To generate an image proxy sequence:

1. Open the **Generate Image Proxy** dialog box in either of the following ways:

   Toolbox: Generate Proxy 

   Menu bar: Setup > Generate Proxy Sequence

2. Under the **Output** section of the dialog box, select the **Filename** and **Format**. Use the **Browse** button to change the

folder that the proxy images are written to. The **Output** file name format section gives a preview of how the files are named based on the current settings. For details of supported image file formats, see Table 1-1 on page 1-2.

3. Under the **Output size** section, specify the size of the proxy images. Either leave the default, **Half** size, or select one of the other options from the drop-down list: **No resize**, **Custom**, **Quarter**, or **Eighth**. If you choose the **Custom** option, you can specify the image **Height** and **Width** in pixels.
4. Select the **Assign proxy to current sequence** check box to start using the image proxy straight away.
5. Click the **OK** button to start creating the images. Progress can be monitored in the Status bar.

Importing an Image Proxy Sequence

If you have created a lower resolution sequence from a third-party animation package, or if you have already generated one for the current image sequence, you can import it into your current boujou 4.1 project and use it as a proxy. You use the **Import/**

Modify Proxy dialog box, shown in Figure 4-2, to import an image proxy sequence.

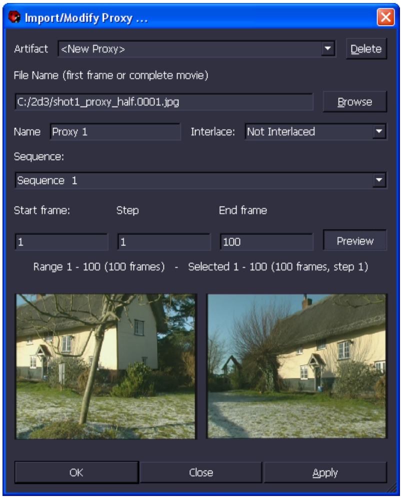
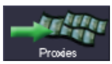


Figure 4-2: Import/Modify Proxy dialog box

To import an image proxy sequence:

1. Open the **Import / Modify Proxy** dialog box in either of the following ways:

   Toolbox: Proxy 

   Menu bar: Setup > Import/Edit Proxies

2. If you want to import a new proxy sequence, leave the **Artifact** field set to *<New Proxy>*. If you want to edit the settings of an existing proxy, select it from the drop-down list.

3. Click the **Browse** button to select the sequence that you want to use as a proxy, or type the full path in the **File Name** field.

4. In the **Name** field, either leave the default name, *Proxy 1*, or overtype it with the name you want to use for the current proxy.

5. Specify the appropriate interlace setting from the **Interlace** drop-down list. The settings are the same as in the **Import Sequence** dialog box.

6. Choose the sequence that you want to associate the proxy from the **Sequence** drop-down list. The current version of boujou 4.1 does not support multiple image sequences so the drop-down list only contains *Sequence 1*.
7. The **Start frame**, **Step**, and **End frame** are set automatically from the available frames on disk. You can make any changes by editing the values in the text boxes. If the **Preview** button is activated, the start frame and end frame are displayed at the bottom of the dialog box.
8. Click the **OK** button to apply your changes and close the dialog box.

Managing a Proxy Image Sequence

When an image proxy is being used, the details are displayed in the right of the Status bar, as shown in Figure 4-3.

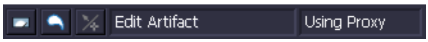


Figure 4-3: Proxy image details in Status bar

Right-click the **Using Proxy** text to display a different proxy or to switch the proxy off.

The proxy is a property of the image sequence and so all the available proxies are listed in the **Import Sequence** dialog box. To open this dialog box, in the **Taskview**, expand the **Image Sequence** and then double-click the **Sequence1** artifact. When the **Import Sequence** dialog box appears, click the **Proxy** tab, as shown in Figure 4-4.

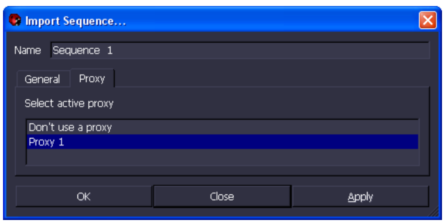


Figure 4-4: Import Sequence dialog box—Proxy tab

Setting Focal Length Constraints

When you import a sequence into a new project, boujou 4.1 assumes that your camera has a constant focal length of unknown value. If you have any additional information about the focal length of the camera, you can give it to boujou 4.1 using the **Focal Length properties** dialog box, shown in Figure 4-5.

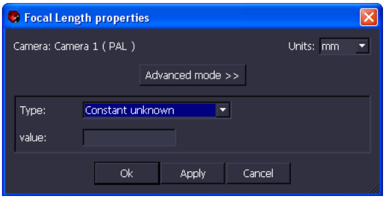


Figure 4-5: Focal Length properties dialog box

To edit the focal length:

1. Open the **Focal Length properties** dialog box in any of the following ways:

   Toolbox: Focal Length Constraints 

   Menu bar: Setup > Edit Focal Constraints

   Taskview: Focal Length branch > Focal Length 1 artifact (the artifact is created as soon as you have imported an image sequence into the project).

2. The name of the current **Camera** is displayed at the top of the dialog box.

3. You can change the working units from the **Units** drop-down list. The options are **millimeters** (default), **inches**, or **pixels**.

4. Choose the focal length **Type** that applies to the whole sequence. Either leave the default, **Constant unknown**, or

select another focal length type from the drop-down list, as described in Table 4-1.

Table 4-1: Focal Length Types

Focal Length Type	Description
Variable unknown	There is zoom in the shot, but you do not know how much.
Variable initialized	There is zoom in the shot, and you've got a rough idea of the starting focal length. Giving boujou 4.1 an approximate value of focal length (+/- 25%) can reduce solve times significantly.
Constant unknown	There is no zoom and you do not know the focal length.
Constant initialized	There is no zoom and you have a rough idea of what the focal length was. Giving boujou 4.1 an approximate value of focal length (+/- 25%) can reduce solve times significantly.
User Fixed	There is no zoom and you know exactly what the focal length is.

The **User Fixed** or **Initialized** focal length value can be typed in the **Value** field. The default value is 35 mm.

Using the Advanced Mode

The default constraint is a keyframe on the first frame and another one on the last frame. If you did not change any of the settings when you first opened the **Focal Length properties** dialog box, both keyframes are set to unknown focal length and the range between them is set to **Constant**.

You can set more complex focal length constraints in the **Advanced** mode in the dialog box, shown in Figure 4-6, in which you can add keyframes to describe shots that are part zoom and part constant focal length.

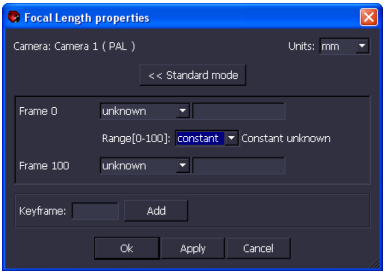


Figure 4-6: Focal Length properties—Advanced Mode

To set advanced focal length constraints:

1. Open the **Focal Length properties** dialog box and click the **Advanced mode** button (for details on opening the **Focal Length properties** dialog box, see *Setting Focal Length Constraints* on page 4-6).

2. To add a new keyframe, enter a frame number into the **Keyframe** box at the bottom of the dialog box and then click the **Add** button. A new frame appears in the frames list and there are now two ranges with constant unknown focal length.

3. Select the focal length type for a **Frame** from the drop-down list. The focal length at a **Frame** can either be **unknown** (default), **approximate** or **exact**. If you choose **approximate** or **exact**, you can enter the value in the field to the right (a value of 35 mm appears in here by default if you choose either of these two types). The approximate type is equivalent to initialized in the **Basic** mode.

4. The **Range** between keyframes can either be **Constant** or **Variable**, as shown in Table 4-2 on page 4-9. You can only set a range to **Constant** if the keyframes at either end have the same value. If one keyframe has **Unknown** focal length and the other has **Approximate** focal length, you can only choose the **Variable** option (see Table 4-2).

Both keyframes need to have the same focal length type for the **Constant** range option to be available.

Table 4-2: Range between keyframes

1st End Condition	2nd End Condition	Range - Constant	Range - Variable
Exact	**Exact**	User Fixed	Variable Initialized
Approximate	**Approximate**	User Initialized	Variable Initialized
Unknown	**Unknown**	Constant Unknown	Variable Unknown
Exact	**Approximate**	-	Variable Initialized
Exact	**Unknown**	-	Variable Unknown
Approximate	**Unknown**	-	Variable Unknown

Caution

If you add more than two focal length keyframes, as shown in Figure 4-7, you need to use the scroll bar on the right of the dialog box to see them all. This may seem obvious but it can be very easy not to notice and start editing the wrong range, or to forget to change a range back from **Variable** to **Constant**.

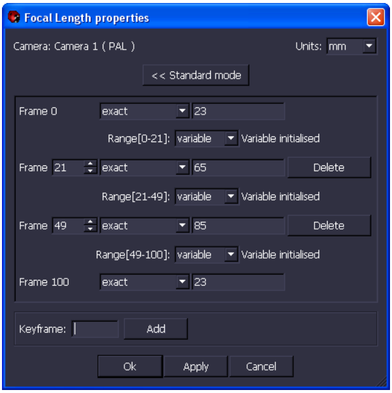


Figure 4-7: Multiple focal length keyframes

5. Click **OK** to apply your changes and close the dialog box.

Using Polygon Masks

You can use masks to hide elements of the image or to concentrate on an area of particular interest. You can mask out features that may cause confusing tracks such as water, fire, or smoke, or you can mask out the background and just track a foreground object. The polygon mask tool allows you to quickly create a mask and keyframe it during the sequence. Multiple masks can also be created and be combined with imported masks. In boujou 4.1, areas within masks can be specified and subtracted from the mask to create masks with holes.

The following sections describe the polygon mask tools:

- *Creating a Polygon Mask*
- *Editing a Polygon Mask* on page 4-12
- *Creating a Polygon Mask with a Hole* on page 4-13
- *Editing Polygon Mask Properties* on page 4-15
- *Importing and Exporting Polygon Masks* on page 4-17
- *Manipulating Polygon-based Masks* on page 4-19

Creating a Polygon Mask

The outline of a polygon mask can be drawn by clicking in the Image window to create the vertices of the polygon. Do not add too many vertices as this makes the mask more time-consuming to edit, and you do not need the mask to precisely match the outline of this shape that you want to hide.

To create a polygon mask:

1. Enter polygon mask creation mode in either of the following ways:

   Toolbox: Add Polygon Masks 

   Menu bar: 2D Tasks > Add Polygon-based Mask

2. Move the cursor over the image and click to create the first point of the mask outline. A magenta dot appears.
3. Move the cursor again and a yellow line is drawn between the first point and the cursor arrow. Click again to create a second point and the first line segment changes color to magenta. Continue to create points until you have created the required mask shape. You must have a minimum of three points to create a mask.
4. To close the mask outline, click the first point to close the outline (the cursor changes to a hand to show that you are about to complete the mask). A polygon mask is immediately created and appears in the Image window. A keyframe is also created at the current frame.
5. The mask can be animated by adding additional keyframes throughout the image sequence. Editing the mask creates a new keyframe.

Editing a Polygon Mask

To ensure that the polygon mask covers the image object from frame to frame, edit it at certain points along the Timeline to add keyframes. boujou 4.1 interpolates between the keyframes you create.

To edit a polygon mask:

1. Select the polygon mask to be edited by clicking the outline.

   When a mask is selected for editing, the outline is drawn in yellow, the polygon vertices are visible, and the mask manipulator tool appears in the center of the mask.

2. Edit the mask using the following controls:

   - **To move a point**, click a yellow dot and drag. When selected for editing, points appear red.
   - **To add a new point**, hold down CTRL+SHIFT and click the outline where you wish to add a point. The newly created point is added to the selection, and can be immediately moved with CTRL+drag.
   - **To move multiple points**, CTRL+click points or lines. When you select the last point, keep the mouse button held down and then drag.
   - **To move a line**, click the line and drag—this moves two points. When selected for editing, lines appear red.
   - **To shuttle frames**, SHIFT+drag.

3. When the mask is selected, the **mask manipulation tool**, shown in Figure 4-8, appears in the center.

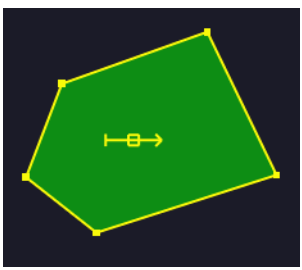


Figure 4-8: Mask manipulation tool

4. Use the following tools to manipulate the mask in the Image window:
   - **To translate the mask**, click and drag the center of the tool.
   - **To rotate the mask**, click and drag the arrow on the right.
   - **To scale the mask**, click and drag the T-bar on the left.
   - **To move the pivot of the mask tool** , CTRL+LMB - drag (the pivot is the center of rotation/ scaling).
   - **To re-center the pivot**, CTRL+SHIFT+LMB - click.
   - **To invert the mask**, right-click the mask and select **Invert Mask** from the displayed window. The area defined outside the mask borders is masked. Hiding the background in this way can be useful for isolating and tracking moving objects.
5. Once you have finished editing the polygon mask, deselect it in any of the following ways:

   Image window: Click away from it

   Menu bar: Edit > Clear Selections

   Status bar: Clear All Selections button 
6. Mask keyframes are displayed in the Timeline. You can move keyframes by clicking them and dragging, and you can add or delete keyframes by right-clicking and selecting the appropriate option from the menu.

Creating a Polygon Mask with a Hole

In some complex shots with multiple moving elements, it can be necessary to make doughnut-shaped masks. boujou 4.1 enables you to perform simple boolean operations on two or more masks. This can make building complex polygon shapes much easier.

To create a polygon mask with a hole:

1. Create the first mask, as shown in Figure 4-9. For details on doing this, see *Creating a Polygon Mask* on page 4-11.

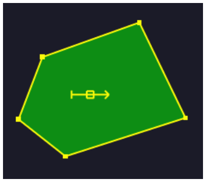


Figure 4-9: First mask

2. Create a second mask inside the first mask, as shown in Figure 4-10. This will be the hole.

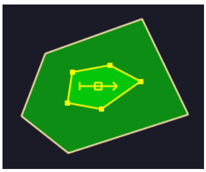


Figure 4-10: Second mask (hole)

3. Select the first mask and choose **Manage Holes** from the right-click menu. The **Subtract a mask** dialog box, shown in Figure 4-11, is displayed.

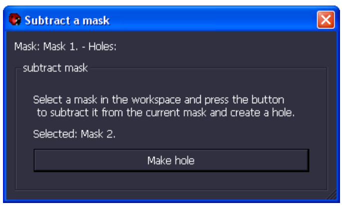


Figure 4-11: Subtract a mask dialog box

4. Select the second mask then click the **Make a Hole** button. The second mask is extracted from the first, as shown in Figure 4-12.

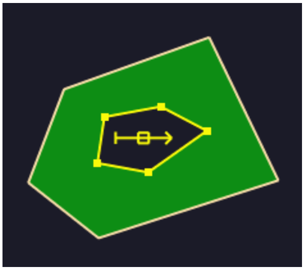


Figure 4-12: Hole in mask

The hole moves with the first mask, but you can also keyframe it separately.

Editing Polygon Mask Properties

Once you have created or imported a polygon mask, you can edit its properties using the **Polygon-based Masks** dialog box, shown in Figure 4-13.

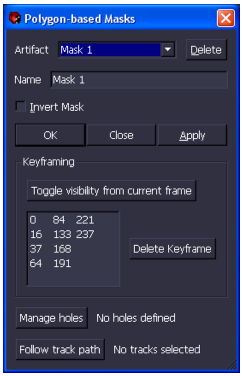


Figure 4-13: Polygon-based Masks dialog box

To edit polygon mask properties:

1. Open the **Polygon-based Masks** dialog box in any of the following ways:

   Taskview: Masks branch > Mask artifact

   Timeline right-click menu: Mask > Properties

   Image window 2D Mode view right-click menu: Properties

   Image window: select the mask and then use the keyboard shortcut CTRL+ENTER

   Keyboard shortcut: CTRL+M

2. Edit any of the following properties in the **Polygon-based Masks** dialog box:

   - **Artifact:** Select which mask you want view or edit the properties for from the drop-down list.
   - **Delete:** Deletes the currently selected mask.
   - **Name:** Either leave the default name, *Mask 1*, or overtype it with the name you want to use for the mask.
   - **Invert Mask:** Hide either the area inside or outside the outline of the polygon-based mask. Select this check box to hide the area outside the mask.
   - **OK:** Click this button to apply the changes and close the dialog box.
   - **Keyframing:** Lists the keyframes that were set for that particular mask.
     - **Toggle visibility from current frame**

       Make the mask visible or invisible, depending on its current state, and set a visibility keyframe.
     - **Delete Keyframe**

       Delete individual keyframes.
   - **Manage holes:** Displays the **Subtract a mask** dialog box, shown in Figure 4-14, in which you can use the

selected mask to cut a hole in another mask. The number of holes in a mask is listed to the right of this button.

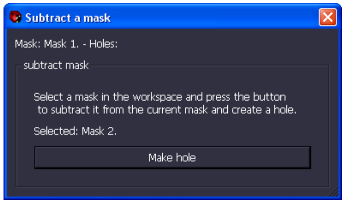


Figure 4-14: Subtract a mask dialog box

- **Follow track path:** Attaches a mask to a selected 2D track (feature track or target track) in order to animate it. The mask now follows the path of the 2D feature.

Important

Once a mask has been attached to a track, no further keyframing is possible.

Importing and Exporting Polygon Masks

Polygon-based masks can be imported or exported between boujou 4.1 projects. The mask is scaled to fit the image size of the new sequence.

You export masks using the **Export Polygon Based Masks** dialog box, shown in Figure 4-15.

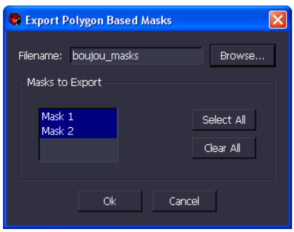


Figure 4-15: Export Polygon Based Masks dialog box

To export a polygon mask:

1. Open the **Export Polygon Based Masks** dialog box in either of the following ways:

Toolbox: Export Poly Mask 

Menu bar: Export > Export Polygon Based Masks

2. Enter a name for the mask file that you are exporting in the **Filename** field. Click the **Browse** button to change the directory that the file is written to. The mask file has the extension *.bmk*.
3. You can choose which mask you want to export from the **Masks to Export** box. Several masks can be written to the same *.bmk* file.
4. Click **OK** to export the **.bmk* file and close the dialog box.

You import masks using the **Import Masks** dialog box, shown in Figure 4-16.

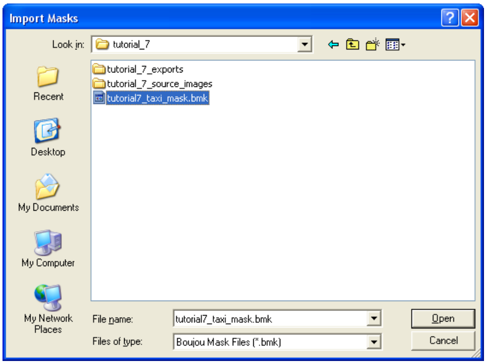


Figure 4-16: Import Masks dialog box

To import a polygon mask:

1. Open the **Import Masks** dialog box in either of the following ways:

   Toolbox: Import Poly Mask 

   Menu bar: 2D Tasks > Import Polygon Based Masks

2. Browse for the mask file (**.bmk*) that you want to import from the **Import Masks** dialog box.

If the image sequence in the new project contains a different number of frames to the project the mask was exported from, the warning window, shown in Figure 4-17, is displayed.

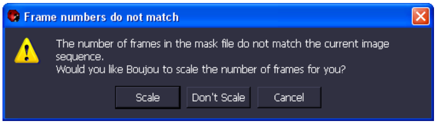


Figure 4-17: Frame numbers do not match warning message

3. In the warning window, select one of the following options:
   - **Scale:** Scale the mask keyframes to fit the new sequence length.
   - **Don’t Scale:** Import the mask keyframes with the same frame spacing that they had when they were created.
4. The mask is automatically scaled to fit the size of the new image sequence.

Manipulating Polygon-based Masks

Table 4-3 describes the commands you can select from the **Polygon-based masks** right-click menu.

Table 4-3: Polygon-based masks commands

Menu item	Description
Add Keyframe	Adds a new mask keyframe at the current frame. Also available by right-clicking the Timeline.
Delete selected keypoints	Deletes the currently selected points on the mask outline. The number of points which form the mask outline cannot be keyframed, so the selected points are permanently deleted.
Add keypoint	Adds a point to the mask outline at the current cursor position. The number of points which form the mask outline can not be keyframed, so the new point is added for the entire sequence.

Table 4-3: Polygon-based masks commands

Menu item	Description
Invert Mask	Changes the masking from mask inside the outline (default) to mask outside the outline and vice versa.
Toggle visibility	Makes the mask visible or invisible, depending on its current state, and sets a visibility keyframe. Also available by right-clicking the Timeline.
Manage Holes	Opens the **Subtract a mask** dialog box.
Rename	Opens the **Rename Artifact** dialog box.
Delete	Deletes the currently selected mask.
Follow Track	Creates a translation key frame based on a selected mask and a single 2D track, which causes the mask to follow the path of the 2D track.
Delete Keyframe	Deletes the current mask keyframe. Also available by right-clicking the Timeline.
Properties	Displays the **Polygon-based Masks** properties dialog box. Also available by right-clicking the Timeline.

Importing an Image-based Mask

You can import any number of image-based masks within a project, using the **Import Image-Based Mask** dialog box, shown in Figure 4-18. These image-based masks can be used in conjunction with any polygon-based masks you have created in boujou 4.1.

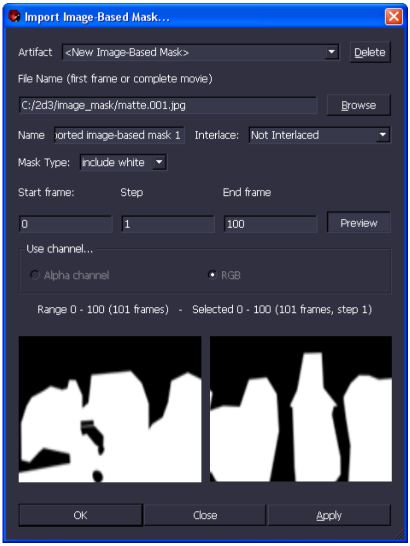


Figure 4-18: Import Image-Based Mask dialog box

To import an image-based mask:

1. Open **Import Image-Based Mask** dialog box in any of the following ways:

   Toolbox: Image Based Mask 

   Menu bar: 2D Tasks > Import image-based masks

   Keyboard shortcut: CTRL +H

2. The **Artifact** drop-down list displays all of the image-based masks that are in the current project. If you are importing a new mask, make sure that **<New Image-Based Mask>** is selected.

3. The **File Name** field contains the full path and name of the first frame of the mask sequence or the complete movie file. If you want to use a different sequence, either type the new path into this field or select the **Browse** button to display the **Import Sequence** browse dialog box.
4. In the **Name** field, either leave default name, *Imported image-based mask 1*, or overtype it with the name you want to use for the Image-based mask.
5. Specify the required **Interlace** option from the drop-down list.
6. Select the **Mask Type** from the drop-down list. The options in this list relate to the image object imported as a mask, as shown in Table 4-4.

Table 4-4: Mask Type options

Mask Type	Description
Include white	Track the white areas only.
Include black	Track the black areas only.
Exclude white	Do not track the white areas but track everything else.
Exclude black	Do not track the black areas but track everything else.

7. Specify the **Start Frame**, **Step**, and **End Frame** for the mask sequence. If you use a single frame as your mask, keep the default values and the frame will be used throughout the whole image sequence. If you use a sequence of frames as your mask, they are scaled to fit the current timeline. The size of the mask images is also scaled automatically to fit the current sequence.
8. The **Preview** button turns the preview of the first and last frames of the mask sequence on and off.
9. Click **OK** to apply the changes and close the dialog box.

Using Locators

The main uses of Locators are:

- **Adding extra 3D points**

  Sometimes boujou 4.1 fails to track an important feature in your shot and you do not get a 3D reference point for this feature when you export the camera. To pick out additional 3D points you can add a locator after camera solving and boujou 4.1 will use the current camera solution to predict where the feature will be in 3D space. You only need to add a minimum of two keyframes and boujou 4.1 fills in the gaps.

- **Improving the camera solve**

  Adding locators can improve your camera solve solution and 3D structure. Do an **Adjust Solve** after adding locators and you can get better 3D structure and camera path. This is a very useful technique for fixing problem tracks and the **Adjust Solve** means that you get very fast feedback on any editing you do. Sometimes this technique can also be used to join multiple camera solve fragments (partial solves). Make sure that the keyframes are evenly spaced along the Timeline, and a minimum of 3-5 keyframes is recommended.

- **Manual tracking**

  You can use the locator tool before feature tracking to create a manual feature track. The track is positioned by eye, one frame at a time. These locator tracks are set as gold by default, and so guide the automatic feature tracking and help create more tracks in problem areas. This is useful when boujou 4.1 has difficulty in finding enough feature tracks on its own (due to motion blur or other effects). 2D Locator tracks created in this way only exist on the keyframes that you create them on, so the more keyframes the better.

- **Non-consecutive feature tracking**

  Add a locator with a keyframe on each of the frames that you want to match between to help guide the non-consecutive feature tracker.

- **Survey points**
  Locators can be connected to and disconnected from survey points, enabling you to improve the quality of the 3D structure using survey data measured on set.

The following sections describe the locator tools:

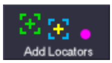
- *Adding Locators*
- *Editing Locator Positions* on page 4-27
- *Editing Locator Properties* on page 4-28
- *Manipulating Locators* on page 4-29

Adding Locators

To add a locator, you need to manually identify its position with two or more keyframes. Each locator keyframe that you specify adds another key to the solve key schedule. Adding too many keyframes or adding keyframes too close together can slow down camera solving significantly.

To add a locator:

1. Enter Edit mode in either of the following ways:

   Toolbox: Add Locators 

   Menu bar: 2D Tasks > Add Locator

   The cursor changes to a cross hair.

2. Click the image to create the first keyframe. A small, green box appears at the cursor position and the **Zoom Tool** pane

is displayed (unless the **Zoom Tool** pane has been hidden), as shown in Figure 4-19.

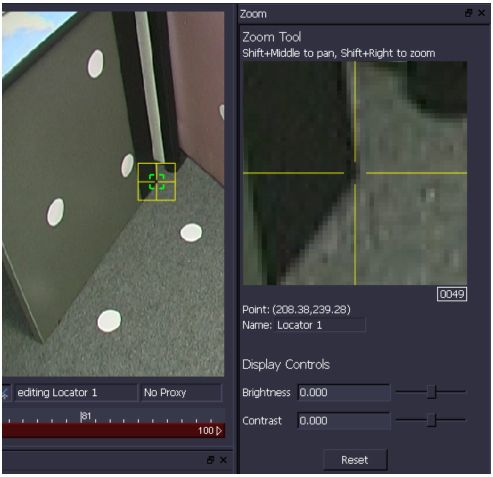


Figure 4-19: Zoom tool pane

3. In the Status bar below the main window the **Toggle Edit Mode** button is shown as pressed, indicating that Edit mode is now on, and the new locator is identified in the Artifact area of the status bar as shown in Figure 4-20.

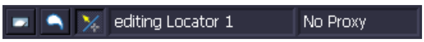


Figure 4-20: Toggle Edit Mode on and Locator artifact

4. Hold the mouse button down and drag to roughly adjust the position of the locator in the main window. For fine adjustment use the **Zoom Tool**. The adjustment is done using the standard navigation tools: SHIFT+RMB controls the amount of zoom and SHIFT+LMB+RMB (or SHIFT+MMB if you have that Preference set) controls the position of the locator as shown by the crosshairs.

5. Move to another frame and add a second keyframe. You cannot shuttle through the sequence in the **Zoom Tool** pane, but SHIFT+LMB in the main window or clicking and dragging in the Timeline both work as normal. If you have already

tracked the camera, boujou 4.1 starts working out where the 3D point will be as soon as you create the second keyframe. In the main window a small plus (+) appears near the center of the square to show where boujou 4.1 thinks your 3D point should be, based on the current camera solution. The **Zoom Tool** is always centered on the predicted position of the locator unless you are on a keyframe.

6. If the predicted position of the locator seems to drift as you play through the sequence, add more keyframes. Normally 3 or 4 keyframes are enough if you just want to add an extra 3D point to a good camera solution.
7. If you are adding locators to try and improve the camera solution, adding more keyframes is a good idea. After you have added the locators, do an **Adjust Solve** to refine the camera solve solution.
8. If you are adding locators as manual feature tracks prior to camera solving, you should try to add as many keyframes as possible, especially in the areas where the automatic feature tracker may have difficulties (blurred frames, for example). Locators are 'gold' tracks; if you run the automatic feature tracker after adding a gold track, it is guided by the gold tracks and tries to find more automatic tracks that move in a similar way. The **Zoom Tool** is blank on all non-keyframe frames if the camera has not yet been tracked.
9. The locators overlay is switched on as soon as you start adding a locator. In the 3D view locator predictions are displayed as purple dots.
10. When you have finished adding keyframes to the locator click the **Toggle Edit Mode** button again to leave Edit mode and then de-select the locator.

Editing Locator Positions

You may decide to change the position of a locator in one or more keyframes. This may be because you want to refine the accuracy, you made a mistake when you first created it, or you want to put it elsewhere in the scene.

To edit a locator's position:

1. In the main boujou 4.1 window select the locator that you want to edit in either of the following ways:

   Image window: Click the locator or drag a box around it

   Locator properties dialog box: Artifact drop-down list (for details, see *Adding Locators* on page 4-24)

2. Switch on Edit mode in any of the following ways:

   Status bar: Toggle Edit Mode 

   Menu bar: Edit > Toggle Edit Mode

   Image window right-click menu: Toggle edit mode

3. The zoom box appears around the locator and the **Zoom Tool** is displayed (unless the **Zoom Tool** pane has been hidden). The zoomed-in area of the image only appears in the **Zoom Tool** if the camera has been tracked or if the current frame is a locator keyframe.

   Important

   You can see where the locator keyframes are by expanding the Timeline. You can navigate between the keyframes of the currently selected locator by using the **Next Keyframe** and **Previous Keyframe** buttons in the Play Controls toolbar.

4. You can edit the locator position as before by making rough adjustments in the main window by clicking and dragging, and making fine adjustments in the **Zoom Tool**.

5. You can only edit the currently selected locator when you are in Edit mode. If you want to edit a different locator, you must toggle Edit mode off, select the locator, then toggle Edit mode back on.

6. If you are in Edit mode and the camera has been tracked, editing the position of a locator on a non-keyframe frame

automatically adds a new keyframe.

7. If you need to edit lots of locators quickly, you can do so without toggling Edit mode on and off each time. Select a locator and either drag it to a new position in the main window, or open the **Zoom Tool** pane and make more precise adjustments with the **Zoom Tool**. You are only in Edit mode for as long as you have the mouse button pressed. This means that you can immediately select another locator in the main window and start editing it in the **Zoom Tool** pane.

8. If you click the **Add Locator** button when you are editing a locator in Edit mode, you immediately start editing the new locator.

Editing Locator Properties

Once you have created a locator, you can edit its properties in the **Locators** dialog box, shown in Figure 4-21.

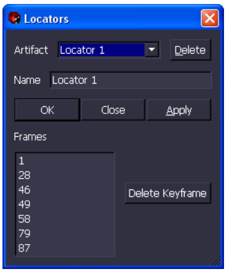


Figure 4-21: Locators dialog box

To edit location properties:

1. Open the **Locators** dialog box in any of the following ways:

   Taskview: Locators branch > Locator artifact

   Timeline right-click menu: Properties

   Image window 2D Mode view right-click menu: Properties

   Image window 2D Mode view: Select the locator and use the keyboard shortcut CTRL+ENTER

   Keyboard shortcut: CTRL+L

2. Edit any of the following properties in the **Locators properties** dialog box:

   - **Artifact:** Select which locator you want view or edit the properties for from the drop-down list
   - **Delete:** Deletes the currently selected locator.
   - **Name:** Either leave the default name, *Locator 1*, or overtype it with the name you want to use for the locator.
   - **Delete Keyframe:** Delete individual keyframes from the list of keyframes that were set for that particular locator in the area at the bottom of the dialog box. Click a keyframe to jump to that frame in the main boujou 4.1 window.
   - **OK:** Click this button to apply the changes and close the dialog box.

Manipulating Locators

Table 4-5 describes the commands you can select from the **Locators** right-click menu to manipulate locators.

Table 4-5: Locators commands

Menu Item	Description
Toggle edit mode	Turns Edit mode on or off.
Delete keyframe	Deletes the current keyframe.
Add keyframe	Adds a keyframe at the current frame.
Gold	Toggles the gold status of the locator. Locators are gold by default.
Flag for export	Toggles the export flag status of the locator. Locators are flagged for export by default.
Connect Survey Point	Connects a selected locator to a selected survey point. Select the survey point using a model vertex and then CTRL+select the locator in one of the other views.

Table 4-5: Locators commands

Menu Item	Description
Center view on selection	Changes the camera view so that the currently selected object is in the center of the Image window.
Disconnect Survey Point(s)	Disconnects selected locators from survey points to which they are connected.
Rename	Enables you to rename the locator.
Delete	Deletes the selected locator.
Properties	Displays the **Locators properties** dialog box.

Using Target Tracks

The target tracking process uses pattern matching to calculate its tracks. This makes it useful for tracking things that would cause problems for the automatic feature tracker, such as circular bluescreen or greenscreen markers. The automatic tracker finds false tracks around the edges of circular markers which do not move consistently with the camera motion. The target tracker tracks the center of the marker, as shown in Figure 4-22, resulting in an accurate and consistent track.

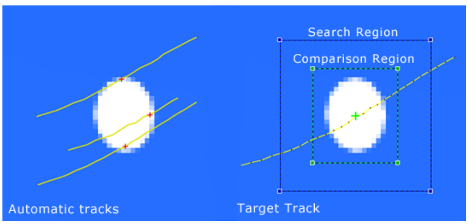


Figure 4-22: Target tracker

Target tracking is done as a separate process to automatic feature tracking. Add your target track keyframes (you need a minimum of two) and then track between them. The target tracker uses a weighted average of the pattern at each keyframe, which enables you to track features that change in shape due to perspective effects (a circular marker becomes more elliptical as the camera moves around it).

If you select a target track and go to one of its keyframes, it is displayed as two concentric boxes and a small plus (+). The plus marks the position of the center of the feature that you are trying to track. The inner, green square is the **comparison region** and the outer, blue square is the **search region**.

The comparison region is the pattern that you are trying to match. If your pattern is a circle, the comparison region should be slightly larger than the diameter of the circle. If the comparison region is too large, there is lots of spurious information that confuses the pattern matching. If the region is too small, the outline of the circle is hard to distinguish against the background.

The search region works in the same way as the search distance in the **Advanced Feature Tracking** properties dialog box. It is the region that the target tracker looks at in the next frame to find the pattern that is being tracked. Increase the search region size for fast-moving shots and reduce it for slow-moving ones.

The sizes of the comparison and search regions can be keyframed, so can be set interactively by clicking and dragging on the corners of the boxes. To set the default sizes, from the menu bar click **Edit**, then click **Preferences** and expand **Target Tracking** (for details, see *Appendix B boujou 4.1 Preferences*).

The following sections describe target tracking tools:

- *Adding Target Tracks* on page 4-32
- *Editing Target Tracks* on page 4-35
- *Checking Target Tracks Quality* on page 4-37
- *Editing Target Tracks Properties* on page 4-38
- *Manipulating Target Tracks* on page 4-41

Adding Target Tracks

You add target tracks to define the region that you want to track. You must specify two or more frames; each frame in the defined tracking region creates a target track keyframe.

To add a target track:

1. Enter Edit mode in either of the following ways:

   Toolbox: Add Target Track 

   Menu bar: 2D Tasks > Add Target Track

   The cursor changes to a cross hair.

2. Click the image to create the first keyframe. A green plus (+) appears at the center of the region that you want to track, surrounded by the comparison region and the search region. The **Zoom Tool** is displayed (unless the **Zoom Tool** pane has been hidden), and the green box surrounding the target region in the main window shows the area that appears in the **Zoom Tool**, as shown in Figure 4-23.

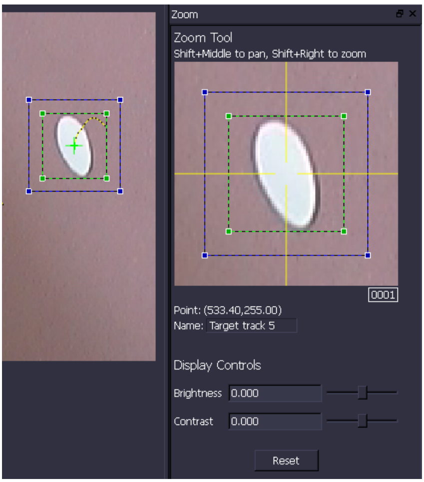


Figure 4-23: Zoom Tool view of target track

3. In the Status bar below the main window the **Toggle Edit Mode** button is shown as pressed, indicating that Edit mode is now on, and the new target track is identified in the Artifact area of the status bar as shown in Figure 4-24.

Figure 4-24: Toggle Edit Mode button pressed

4. Hold the mouse button down and drag to roughly adjust the position of the target track in the main window. For fine adjustment, use the **Zoom Tool**. The adjustment is done using the standard navigation tools: SHIFT+RMB controls the amount of zoom and SHIFT+LMB+RMB (or SHIFT+MMB if you have the MMB Preference set) controls the position of the locator as shown by the crosshairs.
5. Adjust the size of the comparison region and the search region by clicking and dragging the corners of the squares. When you are in Edit mode this can only be done with the **Zoom Tool**.
6. Go to another frame where this feature is visible and click it to set another keyframe. If the feature changes shape by a significant amount, you may need to add more keyframes.
7. If the feature is hidden and then comes back into view, add a keyframe just before it disappears and another when it reappears. You can set the range between these two frames to be **Occluded**. The target tracker skips over this range during tracking, but the tracking data either side of the occlusion is considered part of the same track.

   The size of the comparison region and the search region is keyed on each keyframe. This makes it much easier to track features that get bigger or smaller in the frame due to changes in focal length or the motion of the camera.

   Important
   You can see where the target track keyframes are by expanding the Timeline. You can navigate between the keyframes of the currently selected target track by using the **Next Keyframe** and **Previous Keyframe** buttons in the Play Controls toolbar.

8. When you are ready to start tracking, you must leave Edit mode. Click the **Toggle Edit Mode** button on the Status bar;

or from the menu bar, click **Edit** and then click **Toggle Edit Mode**; or when you are on a keyframe, right-click the target track in the main window and select **Toggle Edit Mode** from the submenu.

9. When you have left Edit mode, start tracking in any of the following ways:

   Image window right-click menu: Track

   Menu bar: 2D Tasks > Target Tracking Tools > Track

   Timeline: see *Checking Target Tracks Quality* on page 4-37 for details

   The Status bar displays target tracking progress, as shown in Figure 4-25.

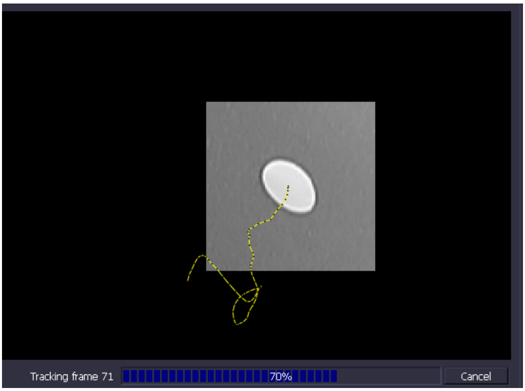


Figure 4-25: Target tracking process in status bar

   The patch that is being tracked is shown in the main window and a zoomed-in view is shown in the **Zoom Tool**. This allows you to monitor the accuracy of the target track as it works through the shot.

10. Once the tracking is complete, you can check the quality by either looking at the Timeline or the **Target Track** properties dialog box.

Editing Target Tracks

Once you have added target tracks, you can edit them to change the defined tracking region.

To edit target tracks:

1. In the main boujou 4.1 window select the target track that you want to edit in any of the following ways (depending on whether the defined target track has already been tracked):

   Target track previously tracked:

   Taskview: Target tracks branch > target track artifact

   Image window: Click the target track,
   or
   Drag a box around the target track path (only after tracking),
   or
   Drag a box around the target track feature (a cyan +). If the target track is untracked, the feature (+) is only visible on keyframes.

   Timeline: Target Tracks

   Target Track dialog box: Artifact drop-down list (for details, see *Adding Target Tracks* on page 4-32)

   Target track not yet tracked:

   - Switch Edit mode on in any of the following ways:

   Status bar: Toggle Edit Mode 

   Menu bar: Edit > Toggle Edit Mode

   Image window right-click menu: Toggle edit mode

   Important
   When you are in Edit mode, you cannot select a different target track. You must leave Edit mode, change the selection, then re-enter Edit mode.

2. Once you have selected the target track, add or delete keyframes by using the right-click menu in the Image window or the right-click menu in the Timeline (for details, see *Adding*

Target Tracks on page 4-32). If you are editing a tracked target track, you can add a keyframe by making a change with the **Zoom Tool**.

Caution

If you add a new keyframe in the middle of a tracked range, the tracking information is thrown away by default. To stop this happening, from the menu bar, click **Edit**, then click **Preferences**, expand **Target Tracking**, click **Auto Clear** and set it to **No** (for details, see *Appendix B boujou 4.1 Preferences*).

3. You can also edit target tracks without toggling Edit mode on and off each time:
   - Select a target track and click and drag to modify its position or change the size of the search region or comparison region.
   - To make more precise adjustments, use the **Zoom Tool**. You are only in Edit mode for as long as you have the mouse button pressed. This means that you can immediately select another target track in the Image window and start editing it with the **Zoom Tool**. If you select an untracked target track, you can only use this method on keyframes.

Checking Target Tracks Quality

The Timeline, shown in Figure 4-26, displays the keyframes, tracking status, and quality of the target tracks that you have added.

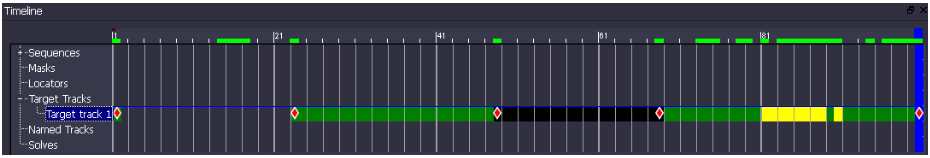


Figure 4-26: Target Tracks in Timeline

Tracked regions are shown in the following colors to indicate the accuracy of the tracking:

- Black: Range has been set to occluded.
- Background color: Untracked frames.
- Green: Tracking quality is above the **Good track threshold**.
- Yellow: Tracking quality is above the **OK track threshold**.

These thresholds are set in the **Preferences** dialog box (for details, see *Appendix B boujou 4.1 Preferences*). By default, the **Good track threshold** is 0.9, and the **OK track threshold** is 0.7. The maximum possible is 1.0. You should add extra keyframes in any red areas and then track the ranges again.

Table 4-6 describes the commands you can select from the right-click menu displayed when you right-click between two keyframes in the Timeline.

Table 4-6: Target Track keyframes commands

Menu Item	Description
Add Keyframe	Adds a keyframe at the current frame.
Delete Keyframe	Deletes the current keyframe.
Properties	Opens the **Target Tracks properties** dialog box.
Track	Tracks between all keyframes.

Table 4-6: Target Track keyframes commands

Menu Item	Description
Track Range	Tracks between the two neighboring keyframes.
Clear Range Tracking	Clears the range between the two neighboring keyframes.
Set Range Occluded	Changes the status of a range to occluded.
Clear Range Occlusion	Changes the status of a range from occluded to untracked.

Editing Target Tracks Properties

Once you have created target tracks, you can edit their properties in the **Target Tracks** dialog box. The **Target Tracks** dialog box gives you a high level of additional control over how the target tracker works. You can rename target tracks, assess their quality frame by frame, and specify particular frame ranges over which a feature is occluded.

You can edit information about the individual tracked frames in the **Frames** tab, as shown in Figure 4-27.

Figure 4-27: Target Tracks dialog box—Frames tab

To edit target track frame properties:

1. Open the **Target Tracks** dialog box in any of the following ways:

   Taskview: Target tracks branch > target track artifact

   Timeline right-click menu: Properties

   Image window 2D Mode view right-click menu: Target track > Properties

   Image window 2D Mode view: Select target track and use the keyboard shortcut CTRL+ENTER

   Keyboard shortcut: CTRL+A

2. Click the **Frames** tab to display information about the individual frames (untracked frames are not listed).

3. Edit any of the following properties:

   - **Artifact:** Select which target track you want to work with from the drop-down list. Selecting a track here also enables you to edit it in the main window.
   - **Name:** View or change the name of your target track.
   - **Frame:** The frame numbers of any tracked frames or keyframes between the first and last keyframe of the selected target track.
   - **Type:** If a frame is a keyframe, the type is **key**.
   - **Score:** A normalized measure of tracking quality. A keyframe always has a value of 1.0 and has a small key icon next to it. Tracked frames have a colored **score light** next to them. This light appears green if the score is above 0.9 (Good track threshold), yellow if it is above 0.7 (OK track threshold), and red if it is below 0.7. You can set these threshold values in the **Preferences** dialog box (for details, see *Appendix B boujou 4.1 Preferences*).

You can edit information about the frames between each pair of adjacent keyframes in the **Ranges** tab, as shown in Figure 4-28.

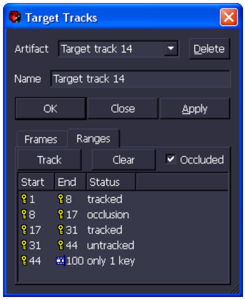


Figure 4-28: Target Tracks dialog box—Ranges tab

To edit target track range properties:

1. Open the **Target Tracks** dialog box in any of the following ways:

   Taskview: Target tracks branch > target track artifact

   Timeline right-click menu: Properties

   Image window 2D Mode view right-click menu: Properties

   Image window 2D Mode view: Select target track and use the keyboard shortcut CTRL+ENTER

   Keyboard shortcut: CTRL+A

2. Click the **Ranges** tab to displays status of the frames between each pair of neighboring keyframes.

3. Edit any of the following properties:

   - **Artifact:** Select which target track you want to work with from the drop-down list. Selecting a track here also enables you to edit it in the main window.
   - **Name:** View or change the name of your target track.
   - **Start / End:** The start and end frames for a range specified by two adjacent keyframes.
   - **Status:** One of **tracked**, **untracked**, **occlusion**, or **only one key**. A frame range can be set to occlusion by clicking

the frame number in the **Start** column and then selecting the **Occluded** check box at the bottom of the dialog box. Frame ranges can be tracked using the **Track** button or untracked using the **Clear** button. The **only one key** icon is displayed if there is no entry or exit key for the range.

Manipulating Target Tracks

Table 4-7 describes the commands you can select from the **Target Tracks** right-click menu displayed when you right-click a target track in the Image window.

Table 4-7: Target Tracks commands

Menu Item	Description
Toggle edit mode	Turns Edit mode on or off.
Track	Tracks between all keyframes.
Clear Tracked Points	Clears tracked points between all keyframes.
Delete Keyframe	Deletes the current keyframe.
Add Keyframe	Adds a keyframe at the current frame.
Gold	Toggles the gold status of the target track. target tracks are gold by default.
Flag for Export	Toggles the export status of the target track. Target tracks are flagged for export by default.
Connect Survey Point	Connects a selected target track to a selected survey point. Select the survey point using a model vertex and then CTRL+select the target track in one of the other views.
Center View on Selection	Changes the camera view so that the currently selected object is in the center of the Image window.
Disconnect Survey Point(s)	Disconnects selected target tracks from survey points to which they are connected.

Table 4-7: Target Tracks commands

Menu Item	Description
Rename	Allows you to rename the target track.
Delete	Deletes the selected target track.
Properties	Displays the **Target Tracks** properties dialog box.

Describing Scene Geometry

The **Scene Geometry** dialog box, shown in Figure 4-29, contains tools for manipulating the 3D coordinate frame and modifying the calculated 3D structure. The 3D structure calculated by boujou 4.1 can be aligned to the coordinate frame using soft constraints or adjusted to fit the coordinate frame using hard constraints.

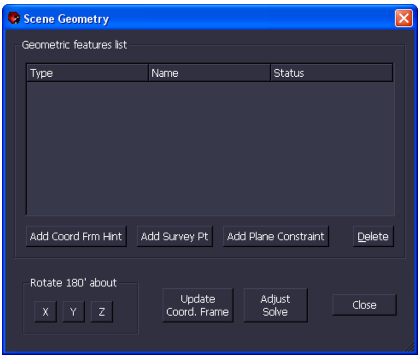


Figure 4-29: Scene Geometry dialog box

Aligning the 3D scene to the coordinate frame makes the tracking data easier to work with when you export it to an animation package. Using hard constraints can improve the quality of your solution, but only if the existing solve is already quite good. Hard constraints cannot fix a solve that is very bad, broken, or fragmented.

The predictions that you select to connect to one Geometric feature are still selected when you add another geometric feature.

This means that you can add a Planar Constraint and then define it as the ZX plane without having to reselect the predictions.

The following sections describe the ways you can describe the scene geometry in boujou 4.1:

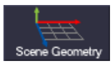
- *Adding a Coordinate Frame Hint*
- *Adding a Survey Point* on page 4-46
- *Adding a Planar Constraint* on page 4-48
- *Editing Geometric Features* on page 4-50

Adding a Coordinate Frame Hint

A coordinate frame hint is a soft constraint which fits the coordinate frame to the 3D predictions. The relative positions of the predictions do not change. If you create conflicting coordinate frame hints, boujou 4.1 does a 'best fit' to try to fit the coordinate frame to them. The hints that you have set up are applied as soon as you click the **Update Coord Frame** button. Coordinate frame hints can only be added after camera solving. Any changes that you have made to the coordinate frame using the manipulators are overwritten.

To add a coordinate frame hint:

1. Open the **Scene Geometry** dialog box in any of the following ways:

   Toolbox: Scene Geometry 

   Menu bar: 3D Tasks > Add/Edit Scene Geometry

   Keyboard shortcut: CTRL+G

2. From the **Geometric features list**, click the **Add Coord Frm Hint** button. An entry named **Origin (hint)** is added to the list, as shown in Figure 4-30 below.

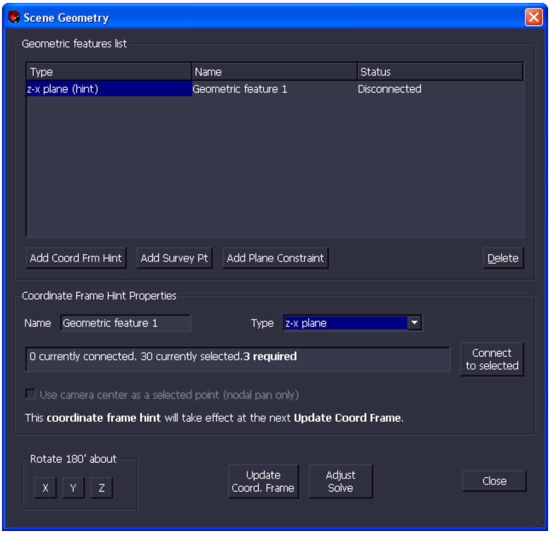


Figure 4-30: Scene Geometry dialog box—Coordinate Frame Hint

3. From the **Type** drop-down list, leave the geometric feature type set to **Origin** (the default) or select another type of coordinate frame hint, as described in Table 4-8.

Table 4-8: Coordinate Frame Hint Type

Hint Type	Minimum 3D Points	Description
Origin	1	The center of the 3D coordinate frame where X=0, Y=0 and Z=0. This point is in the middle of the workspace in your animation software.
X axis	2	A line passing through the origin in the X direction.
Y axis	2	A line passing through the origin in the Y direction. Y is the 'up' axis for Maya, XSI, combustion, LightWave, etc.

Table 4-8: Coordinate Frame Hint Type

Hint Type	Minimum 3D Points	Description
Z axis	2	A line passing through the origin in the Z direction. Z is the 'up' axis for 3ds Max.
XY plane	3	The plane represented by the ground plane overlay if you are working Z-up.
YZ plane	3	The plane defined by the Y axis and the Z axis, passing though the origin.
ZX plane	3	The plane represented by the ground plane overlay if you are working Y-up.
Line parallel to X axis	2	A line in the same direction as the X axis, but not going through the origin.
Line parallel to Y axis	2	A line in the same direction as the Y axis, but not going through the origin.
Line parallel to Z axis	2	A line in the same direction as the Z axis, but not going through the origin.
Plane parallel to XY plane	3	A plane that is parallel to the XY plane but does not go through the origin.
Plane parallel to YZ plane	3	A plane that is parallel to the YZ plane but does not go through the origin.
Plane parallel to ZX plane	3	A plane that is parallel to the ZX plane but does not go through the origin.
Known length	2	The value you assign to the distance between two selected 3D points, enabling you to scale the 3D structure. Enter the value in the **Length** field.

Tip

Each subsequent Coordinate Frame Hint that you add defaults to the previously selected type. You can change the type from the drop-down list.

4. Under the **Coordinate Frame Hint Properties** section, in the **Name** field, either leave the default name, *Geometric feature x*, or overtype it with another name and press TAB to apply the new name.
5. Select the 3D predictions (including locator and target track predictions) that you want to constrain in the 2D or 3D views of the Image window.The selected points are identified in the text box near the bottom of the dialog box.

   Tip

   You can select points without having to close the **Scene Geometry** dialog box.

6. Click the **Connect to selected** button to connect the geometric feature to the points.

   The **Status** of the Geometric feature immediately changes from **Disconnected** to **## Tracks Connected**.
7. Click the **Update Coord Frame** button at the bottom of the dialog box to apply the soft constraint to the boujou 4.1 coordinate frame.
8. If your coordinate frame appears to be the wrong way up after applying a hint, use one of the **Rotate 180° about** buttons to flip it around the X, Y, or Z axis.
9. Click the **Close** button to exit the dialog box.

Adding a Survey Point

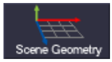
Survey points can be used as a hard constraint to fit the 3D points to a set of 3D coordinates measured on set. You need a minimum of four survey points, visible for the entire shot, and well spaced in the frame, to create this type of constraint effectively.

Tip

Survey points are usually created by importing a 3D model (for details, see *Using a 3D Model as Survey Data* on page 4-60 and in the *boujou 4.1 Tutorials* book). If you do not have a 3D model, you can input the survey points manually as X, Y, Z coordinates (for details, see *Appendix E Using Survey Points without a 3D Model*).

To add a survey point:

1. Open the **Scene Geometry** dialog box in any of the following ways:

   Toolbox: Scene Geometry 

   Menu bar: 3D Tasks > Add/Edit Scene Geometry

   Keyboard shortcut: CTRL+G

2. From the **Geometric features list**, click the **Add Survey Pt** button. An entry named **Survey Point (hard)** is added to the list, as shown in Figure 4-31.

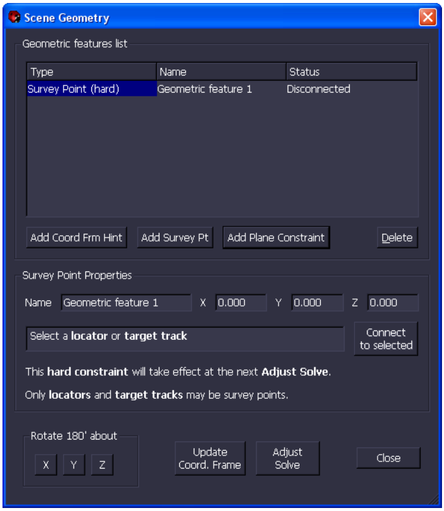


Figure 4-31: Scene Geometry dialog box—Survey Point

3. Under the **Survey Point Properties** section, in the **Name** field, either leave the default name, *Geometric feature x*, or overtype it with another name and press the TAB key to apply the new name.

4. In the **X**, **Y** and **Z** fields, enter the coordinates to which you want to constrain the 3D prediction.

5. From a 2D or 3D view in the Image window, select the 3D predictions that you want to constrain. The selected points are identified in the **Select a locator or target track** field.
6. Click the **Connect to selected** button to connect the Survey Point to the selected 3D predictions.

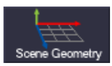
   The **Status** column of the Survey Point entry in the **Geometric features list** immediately changes from **Disconnected** to **## Tracks Connected**.
7. Click the **Update Coord Frame** button at the bottom of the dialog box to apply the hard constraint to the boujou 4.1 coordinate frame.
8. Click the **Adjust Solve** button to perform an Adjust Only camera solve without leaving the **Scene Geometry** dialog box. Because the new Survey Point is a hard constraint, you must recalculate the camera to match the modified 3D structure.
9. Click the **Close** button to exit the dialog box.

Adding a Planar Constraint

This is a hard constraint which fits the selected 3D points to a plane. You need to do an adjust solve to apply this constraint and recalculate the camera path. To do this without leaving the **Scene Geometry** dialog box, click the **Adjust Solve** button at the bottom of the dialog box. You cannot force two planar constraints to be perpendicular to each other.

To add a planar constraint:

1. Open the **Scene Geometry** dialog box in any of the following ways:

   Toolbox: Scene Geometry 

   Menu bar: 3D Tasks > Add/Edit Scene Geometry

   Keyboard shortcut: CTRL+G

2. From the **Geometric features list**, click the **Add Plane Constraint** button. An entry named **Planar Constraint (hard)** is added to the list, as shown in Figure 4-32.

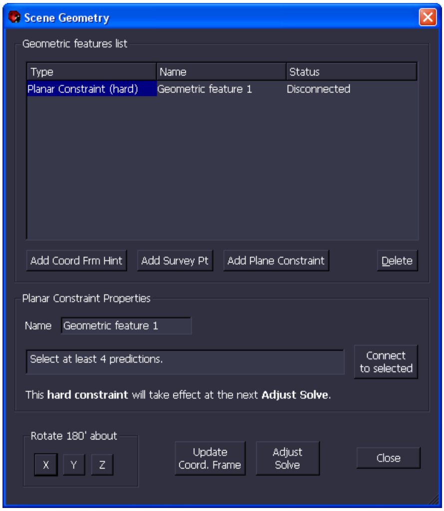


Figure 4-32: Scene Geometry dialog box—Planar Constraint

3. Under the **Planar Constraint Properties** section, in the **Name** field, either leave the default name, *Geometric feature x*, or overtype it with another name and press TAB to apply the new name.
4. Select the 3D predictions (including locator and target track predictions) that you want to constrain in the 2D or 3D views of the Image window. The selected points are identified in the text box near the bottom of the dialog box.

Tip
You can select points without having to close the **Scene Geometry** dialog box.

5. Click the **Connect to selected** button to connect the Planar Constraint to the selected 3D predictions.

The **Status** column of the Planar Constraint entry in the **Geometric features list** immediately changes from **Disconnected** to **## Tracks Connected**.

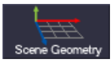
6. Click the **Adjust Solve** button to perform an Adjust Only camera solve without leaving the **Scene Geometry** dialog box. Because the new Planar Constraint is a hard constraint, you must recalculate the camera to match the modified 3D structure.
7. Click the **Close** button to exit the dialog box.

Editing Geometric Features

Once you have created a Coordinate Frame Hint, Survey Point, or Planar Constraint, you can edit it.

To edit a geometric feature:

1. Open the **Scene Geometry** dialog box in any of the following ways:

   Toolbox: Scene Geometry 

   Menu bar: 3D Tasks > Add/Edit Scene Geometry

   Keyboard shortcut: CTRL+G

   Taskview: Scene Geometry branch > geometric feature artifact

2. In the **Scene Geometry** dialog box, ensure that the geometric feature that you want to edit is selected. The properties displayed depend on the selected geometric feature.
3. Edit any of the properties (for details, see *Adding a Coordinate Frame Hint* on page 4-43, *Adding a Survey Point* on page 4-46, or *Adding a Planar Constraint* on page 4-48).

Manipulating the Coordinate Frame

The **Rotate** and **Translate** tools, shown in Figure 4-33, enable you to move the ground plane relative to the 3D structure

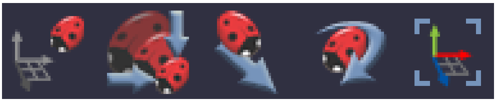


Figure 4-33: Rotate and Translate tools

Tip

You can also use **Scale**, **Rotate**, or **Translate** tools to manipulate the 3D test objects. For details, see *Chapter 3 Basic Functions*.

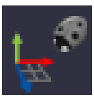
These tools provide a quick and easy way of manipulating the coordinate frame, enabling you to orientate your 3D structure the right way up and parallel to the floor prior to export. You can access these tools from the Transformations toolbar. If this toolbar is not visible, show it by right-clicking one of the other Tool groups and selecting **Transformations** from the list.

Tip

Use the Orthogonal views to make orienting your 3D structure even easier (for details, see *Chapter 2 User Interface*). To adjust the coordinate frame more precisely, use the soft constraints in the **Scene Geometry** dialog box (for details, see *Adding a Coordinate Frame Hint* on page 4-43).

To translate or rotate the coordinate frame:

1. From the **Transformations** toolbar, ensure that the **Select whether to edit the coordinate system or the test object** button has the coordinate system selected (the axis tripod is highlighted on the button).

2. Display the desired manipulator in either of the following ways:

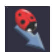
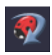
   Transformations toolbar: Translate  or Rotate 

   Image window right-click menu: Translate or Rotate

3. Use the manipulator at the center of the ground plane to apply your transformations as described in Table 3-3 on page 3-25. The manipulator remains static at the center of the ground plane and the 3D predictions move.

Solving the Camera with Advanced Tools

In previous versions of boujou, camera initialization was only ever performed using **Solve Complete**, while structure generation and optimization could be performed separately using **Solve Adjust**.

boujou 4.1 has an improved camera solver which provides more feedback and an extended and enhanced toolset enabling more data to be extracted from the shot.

In boujou 4.1, the camera solving process takes place in three main stages:

1. **Initializing the Camera**

   The first stage of the camera solving process is to initialize the camera. This involves obtaining an initial estimate of the parameters of the camera, that it, its position and orientation at each frame and its focal length. This is most difficult stage and the most likely to fail for problem shots where the feature tracking information is low quality or there is not enough parallax.

2. **Generating 3D Structure**

   In the second stage of the camera solving process, you examine the generated structure and configure boujou 4.1 to discard all points where the projection error is above a specified threshold.

3. **Optimizing Camera Parameters**

   In the third stage of the camera solving process, you optimize the 3D positions of the points and the position, orientation, and focal length camera parameters.

All three stages are automatically performed in a **Solve Complete**. A **Solve Adjust** performs only the structure generation and camera optimization stages. boujou 4.1 makes these internal camera solving tools accessible to the user to provide direct control for solving problem shots.

The following sections describe advanced camera solving:

- *Using Advanced Camera Solve Tools* on page 4-55

  boujou 4.1 provides many methods for the user to initialize the camera as well as tools for fine-grained control over structure generation and optimization These tools are in addition to the basic camera solving methods, described in *Chapter 3 Basic Functions*.

- *Visualizing Reprojection Errors* on page 4-56

  After repairing the camera for any reprojection errors identified in the camera solving process, you can manually optimize the camera by minimizing reprojection errors.

- *Working with Partial Solves and Fragmented Solves* on page 4-57

  You can visually identify any remaining problems with the camera solving process.

To make full use of the underlying functionality of the boujou 4.1 camera solve tools, it is important to be precise in the use of camera solver terminology. Table 4-9 defines terms that were only loosely applied in previous versions of boujou, but which now refer to specific features or functions relating to the camera solver:

Table 4-9: Glossary of Camera Solve Terms

Term	Definition
View	The camera's position, orientation, and focal length in a single frame.
Solve	A series of camera views, plus the corresponding 3D structure.

Table 4-9: Glossary of Camera Solve Terms

Term	Definition
Key Schedule	The distribution of solve keyframes. Before boujou 4.1 does any camera solving, it examines the feature tracks and breaks up the shot into sections which are linked by a certain number of tracks. These breaks are called solve keyframes. Shots with plenty of long, consistent tracks may just have a solve keyframe at the start and the end. Shorter, more sporadic tracks may result in many keyframes. When boujou 4.1 calculates a camera solution it creates views at the keyframes and then fills in the gaps. Feature tracks that span less than three keyframes are discarded. If the key schedule is very sparse, certain sections of the shot may have very few 3D predictions, even though they seem to have lots of feature tracks. You can add extra solve keyframes by adding a locator (each locator keyframe creates a new solve keyframe). At each frame of the key schedule, a default view is created. Frames with default views are displayed in yellow in the Timeline. You can also see these frames in the **Graph** view, where they are displayed as keys on each curve. Also, the frame numbers of those frames selected for the key schedule are displayed in the **Console** view.
Structure	The cloud of 3D points calculated by boujou 4.1 after camera solving.

Using Advanced Camera Solve Tools

In boujou 4.1, cameras can be generated in a large variety of ways including:

- Solving a sub range
- Copying solved views from other parts of the sequence
- Importing from external sources (e.g. motion control data)
- Manually editing ('eyeballing')
- Interpolating between existing views
- Solving using survey points/model vertices tied to tracks

The design of the some of the interface relating to camera solving and the locations of the tools has changed from previous versions of boujou.

In boujou 4.1, the **Solve Tools** menu provides additional tools for managing the camera solve process. To access these commands, from the menu bar, click **3D tasks** and point to **Solve Tools**.

- **Regenerate Structure**

  Generates 3D points for all possible tracks.

- **Filter Structure**

  Removes the least accurate predictions based on their covariance.

- **Interpolate Views**

  Enables you to delete a range of camera views and replace them using a straight line interpolation.

- **Copy Solve**

  Creates a copy of the current active solve. Several solves can coexist in a project file, and copying a solve is a good way of creating a backup of your solve before you start editing it.

- **Create User Solve**

  Creates a solve that contains no camera views or structure. This is the starting point for creating your own camera views.

- **Default View from Known 3D**

  Creates a new camera view based on the coordinate frame of the imported model. The camera is positioned so that the model is in the center of its field of view, pointing down one of the axes. Frames with default views are displayed in yellow on the Timeline.

- **Delete View**
  Deletes a single frame from the current solve.
- **Copy View**
  Copies a view from a specified frame to the current frame.
- **Optimize View**
  Optimizes the camera position and orientation in the current frame by minimizing the error between the measured features and the 3D predictions.
- **Regenerate View**
  Recreate the view on the current frame using the existing 3D structure.

Caution
Make sure that you have got the correct solve selected when you use the Image window views. You can switch between solves using the **Solve** drop-down list in the top left corner of the Image window.

Visualizing Reprojection Errors

The 3D predictions of features tracked in the image sequence that boujou 4.1 creates in the first stage of the camera solving process are displayed in a 2D view window as a cloud of yellow and cyan dots on top of the image. A yellow dot indicates a prediction for a feature that was visible in that frame; a cyan dot indicates a prediction for a feature was not visible in that frame.

These predictions represent where the tracked 2D features are in 3D space based on the calculated camera motion. There are always some differences between the measured feature and the 3D prediction—these differences are called reprojection errors. The reprojection error for a point in a frame is the distance between the position of the track in that frame and the position of the tracks 3D point projected into the frame using the cameras parameters on that frame. The smaller the reprojection errors are, the more accurate the camera solve will be.

To visualize the reprojection error:

1. Open a camera solved project and display a 2D view window.
2. Display the **Overlays** pane to show the **2D View Controls** view.
3. In the **Overlays** section, select the following options and expand them to set any specified sub options:
   - **Track**: Clear the **All** sub option
   - **Predictions:** Clear the **All** sub option
   - **Errors**
4. In the **Error Scale** field, set the value to 1.0.
5. In the **Tracks** section, click **Show Features Only**.
6. In the Model toolbar, click the **Fly Align** button and use SHIFT + mouse buttons to "fly" the camera around.

   As you fly the camera away from its starting position, you should see the reprojection errors increase in the 2D view. These appear a purple lines linking the feature (represented by a red cross) and the prediction (represented by a yellow dot).
7. To repair the camera, from the menu bar, click **3D Tasks**, point to **Solve Tools** and then click **Optimize View**. This changes the camera parameters in order to minimize these reprojection errors.

Working with Partial Solves and Fragmented Solves

If boujou 4.1 cannot calculate a camera for the entire sequence, it does as much as it can. For very difficult shots this can mean that it calculates several track fragments. These fragments cannot be joined together in boujou 4.1, but they can show you where the problem areas are.

To fix the breaks and obtain a single camera track for the entire sequence, try feature tracking with different settings over the broken sections, adding locators and target tracks, or correcting for lens distortion.

You can tell if boujou 4.1 has only calculated a partial solve or multiple solve fragments when the predictions disappear during playback in the 2D view, or if one set of predictions is suddenly replaced by another set. The Timeline displays each camera track fragment, as shown in Figure 4-34.

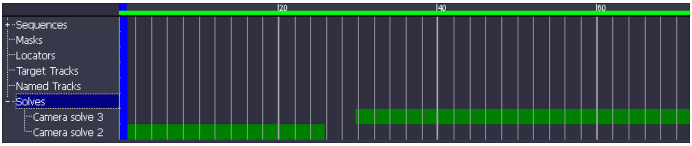


Figure 4-34: Camera track fragments in Timeline

The **Camera solve** branch of the **Taskview** also shows each of the tracking fragments, as shown in Figure 4-35.

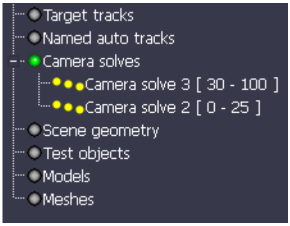


Figure 4-35: Tracking fragments in Camera solve branch

You can navigate between the camera tracking fragments by using the **Solve** drop-down list at the top left of the Image window, as shown in Figure 4-36

Figure 4-36: Solve drop-down list

Important

Tim Dobbert's book, *Matchmoving: the Invisible Art of Camera Tracking*

(Sybex, 2005, ISBN 0-7821-4403-9) contains a very useful chapter on how to connect two partial camera tracks in a 3D animation package.

Using Model-based Tracking

boujou 4.1 allows you to import a 3D model in OBJ format. You import the model using the **Import OBJ Model** command on the **3D Tasks** menu.

A 3D model is useful for sparse solves. Objects can only help the camera solving if there are enough feature tracks to link the object to the image. If you have used the survey points tool in boujou three, you will be familiar with the idea of locator keyframes having to be linked by feature tracks. The locators are connected to the survey points and each frame of the sequence that has sufficient locator keyframes defines a camera view. These views represent a sparse solve—boujou 4.1 needs enough feature tracks connecting these views to fill in the gaps in the camera path.

A 3D model is also helpful for determining the appropriate model-based tracking methods to use. If the vertices of your 3D model correspond to 2D features in the image, use survey points to solve from known 3D. If your model vertices do not correspond to vertices in the image, you can use face-based tracking. However, face-based tracking is less likely to give you a usable solution; the most robust method is 'eyeballing' approximate camera positions.

The following sections describe these model-based tracking methods:

- *Using a 3D Model as Survey Data* on page 4-60

  An imported OBJ model can be used to represent the survey data and to automatically determine where on the Timeline locator or target track keyframes should be placed.

- *Using a 3D model to Create Approximate Camera Positions* on page 4-63

  Vertex alignment is a method of approximating the position of the camera. You can align the model using the **Fly Align** method (using the navigation tools), or the object manipulators, or the **Vertex Drag** method.

- *Using a 3D Model for Face-based Object Tracking* on page 4-65

  Face-based tracking links the feature tracks and the polygon faces in the model to calculate the camera motion. If you have too few features tracks or if they are poor quality, the accuracy of the tracking is low and the model appears to drift.

Using a 3D Model as Survey Data

boujou 4.1 allows you to use an imported OBJ model to represent the survey data and to automatically determine where on the Timeline locator or target track keyframes should be placed.

To use a model as survey data, you need to have locators or target tracks in your scene to identify the features that you have survey data for, and you need to have feature tracks linking the keyframes. This is exactly the same as the survey data tool in boujou three. However, you can now link the locators to the model vertices, which makes setting up your scene far more straightforward. As before, you need at least seven locator keyframes on a frame and at least 10 feature tracks joining this frame to the next set of locator keyframes.

Tip

If you do not have a 3D model, you can manually input survey points as X,Y,Z coordinates (for details, see *Appendix E Using Survey Points without a 3D Model*).

To use a 3D model as survey data:

1. Feature track your shot.
2. Go to the first frame of the sequence and from the menu bar click **3D Tasks** and then click **Import OBJ Model**.
3. Select the **Create User Solve** check box. This creates a solve that contains no camera view or structure. This is the starting point for creating camera views by connecting model vertices to locators or target tracks. Click **OK** and the **Input Focal Length** dialog box is displayed.
4. In the **Input Focal Length** dialog box, enter a focal length for the camera created by the user solve in the previous step.

5. To initialize the solve key schedule, from the menu bar click **3D Tasks** and then click **Initialize Key Schedule**. For an explanations of the solve key schedule, see Table 4-9 on page 4-53.

   At each frame of the key schedule, a default view is created. Frames with default views are displayed in yellow in the Timeline. You can also see these frames in the **Graph** view, where they are displayed as keys on each curve. Also, the frame numbers of those frames selected for the key schedule are displayed in the **Console** view. This gives you the best set of frames for adding locators or target track keys based on the number of feature tracks connecting them.

6. Add locators or target tracks to features which correspond to vertices of the model. Make sure that locator/target track key frames are on the same frames as the solve key frames. The easiest way to do this is to use the **Next/Previous Solved Frame** buttons on the Play Controls toolbar.

   Tip

   Hiding the model while adding locators/target tracks makes the Image window less cluttered. When the locators/target tracks have been added, you can display the model again.

7. Connect the locators to the model vertices:

   a. Select model vertices and locator/target tracks together in the 2D view, which you can do using either of the following methods:

      - Align the model approximately with the image using one or both of the **Fly Align** and **Vertex Align** tools. When using these tools, bear in mind that you are actually moving the camera and effectively setting up an initial view.

      - Split the main Image window into two views displaying the locators/target tracks, one set to a 2D view and the other to a 3D view. In the 3D view, select **Survey Data** from the **Solve** drop-down list in the top left corner of the Image window. This displays the model that represents the survey data with connected vertices displayed in orange.

b. Click a vertex which you want to connect to a locator/target track. The entire model mesh turns green.

c. CTRL + click the corresponding locator/target track. It also turns green.

d. Right-click and select **Connect Survey Point** from the menu. The model vertex and the locator/target track turns orange when it is connected and deselected.

   You can disconnect survey points using the **Disconnect Survey Point(s)** command from the same menu. This can be useful if a point has been connected in error.

e. Repeat this process for all the vertex locator/target track connections you wish to make.

8. Click the **Next Solved Frame** button to move to the next solved keyframe.
9. Click the **Solve View from Known 3D** button in the **Model Tools** pane. This aligns the camera, based on the survey point connections you made in step 7.
10. Connect any unconnected vertices to their corresponding locators/target tracks in the current frame. You only need to connect each vertex once.
11. Repeat steps 8–10 for each solved keyframe to the end of the sequence.
12. You now have a sparse solve with camera positions on each of the solve keyframes. To fill in the gaps between the keyframes and improve the result, from the menu bar, click **3D Tasks** and then click **Solve from Existing Cameras**. When boujou 4.1 calculated the key schedule it made sure that there would be enough feature tracks linking each pair of keyframes to allow it to work out how the camera moved between them.

    Important

    It is not possible to generate a solve from existing cameras if there is a default camera view on any frame in a solve. If you miss any frames during the process of survey data camera alignment, it is possible that default views will remain. Therefore, a warning message is displayed if you attempt to use **Solve from Existing Camera** while there is a default camera present. The frames on which the default views lie are listed in the warning message.

Notice that the text under the frame counter in the main Image window says **User Solve [Aligned]** and the model still appears to be in the right position. This is because you connected the vertices of the model to the locators and the model is now always linked to the 3D predictions by the locators.

Using a 3D model to Create Approximate Camera Positions

When you manipulate the model in the 2D view prior to camera solving you are actually moving the camera. This means that you can create an approximate camera view by lining up the 3D model with the appropriate part of the scene in the image sequence. These approximate views should be added on the solve keyframes after feature tracking. This gives you a sparse solve. The gaps in this solve can be filled using **Solve from Existing Cameras** function.

There are three methods of manipulating the model in order to create an approximate camera view:

- **Fly Align**

  When you are in Fly Align mode, you can move the camera using the navigation tools. A large circle with a horizontal line through it appears in the Image window to indicate that you are moving the camera rather than moving an object, and a camera icon appears in the top right of the Image window. It also warns you that the navigation tools will not behave in the usual way (e.g.: Shift+LMB moves the camera position and does not shuttle through the image sequence). You enter Fly Align mode by clicking the **Fly align** button on the Model toolbar (for details, see *Model Toolbar* on page 2-20).

- **Object Manipulators**

  The test object manipulators can also be used to manipulate the model. Click the model to select it (the mesh turns green) and then click one of the **Rotate**, **Scale**, or **Translate** manipulator buttons in the Transformations toolbar (for details, see *Transformations Toolbar* on page 2-19). The selected manipulator appears centered at the model's pivot point.

- **Vertex Drag**

  This method is the quickest if the object's vertices correspond to features in the image (greenscreen markers, for example). Every time you drag a vertex to a feature in the image, you add a 'spring'. Adding subsequent springs changes the camera position until the model appears to be aligned with the image. If you have the **optimize focal length** option switched on in the **Model Tools** pane, the focal length is also adjusted to match the model alignment. You enter Vertex Drag mode by clicking **Vertex Drag** button on the Model toolbar (for details, see *Model Toolbar* on page 2-20).

Once you have set up approximate camera positions on solve keyframes, you can use the **Solve from Existing Cameras** function from the **3D Tasks** menu. This fills in the gaps in the 'sparse solve' using the 2D feature tracks, and optimizes the camera.

To use a 3D model to create approximate camera positions:

1. Import an image sequence.
2. Import a set of feature tracks.
3. To import the OBJ model, from the menu bar click **3D Tasks** and then click **Import OBJ Model**.
4. Click the **Create User Solve** check box.
5. In the **Input Focal Length** dialog box, set the focal length to an appropriate value (the default is 30 mm) and click **OK**. The model appears in the default position in the middle of the image.
6. From the menu bar, click **3D Tasks** and then click **Initialize Key Schedule**. This calculates the solve key schedule. Camera views are initialized on the solve keyframes, giving a guide to the most effective frames to align the camera on. You can see where these keys have been put by looking at the **Graph** view or the **Console** pane.

7. Use the **Next Solved Frame** and **Previous Solved Frame** buttons to navigate between the views. Go to the first solved frame (this should be on the first frame of the sequence).
8. Align the model so that it matches the object in the sequence as closely as possible.
9. Jump to next solve keyframe by clicking the **Next Solved Frame** button.
10. To get a better starting point for aligning the model you can copy the previous camera position (remember that you are actually moving the camera around the stationary model). From the menu bar, click **Scripts** and then click **Copy from prev solved frame**. Fine-tune the alignment as before.
11. Repeat until you have determined an approximate camera position (view) on all of the frames of the key schedule.
12. From the menu bar, click **3D Tasks** and then click **Solve from Existing Cameras**. This fills in the gaps between the views and optimizes the solve. Note that the model is no longer aligned to the solution and can now be used as a test object. The model only remains aligned if it has been linked to the solve using survey points.

Important

It is not possible to generate a solve from existing cameras if there is a default camera view on any frame in a solve. If you miss any frames during the process of survey data camera alignment, it is possible that default views will remain. Therefore, a warning message is displayed if you attempt to use **Solve from Existing Camera** while there is a default camera present. The frames on which the default views lie are listed in the warning message.

Using a 3D Model for Face-based Object Tracking

Face-based tracking works by linking 2D features and the faces of a polygon mesh in the model to calculate the camera motion in the shot. If you have too few features tracks, or if they are poor quality, the accuracy of the tracking is low and the model appears to drift. Since drift is often a problem with this tracking method, you should look on it as a way of getting an approximate camera path that you can subsequently optimize.

To use a 3D model for face-based object tracking:

1. Import an image sequence.
2. Track features.
3. Go to a frame where there are the most feature tracks visible on the object that you want to track. This gives you the best lock between the model faces and the 2D tracks.
4. To import the object model, from the menu bar, click **3D Tasks** and then click **Import OBJ Model**. Even a very simple model can be used for face-based tracking. boujou 4.1 is linking the features found in the image with the polygon faces of the model and so the number and shape of the faces does not matter.
5. Click the **Create User Solve** check box.
6. In the **Input Focal Length** dialog box set the focal length to an appropriate value (the default is 30 mm) and click **OK**. The model should appear in the default position in the middle of the image.
7. Align the model to the object in the image by using the **Fly Align** mode or by clicking one of the vertices of the model and then using the Translate and Rotate manipulators from the Transformations toolbar.
8. In the **Model Tools** pane, click the **Track Forward** button. You should be able to see the object tracking all the way to the end of the shot. Watch the model during the tracking to check for drift. If the model starts to drift, stop the tracking by clicking the **Cancel** button in the Status bar below the main Image window. Correct the alignment of the model and then continue the tracking.
9. Go back to the frame where you first aligned the model. The easiest way to do this is to go to the last frame and then click the **Next Solved Frame** button on the right of the **Play** controls tool group.
10. Click the **Track Backward** button. This tracks the object all the way to the start.

11. If you play through the shot now, you should see the model moving as though it is locked to the object in the image sequence.
12. If you go to the 3D view, you'll see the model and the camera path, but no 3D predictions. If you export the camera at this stage, it will line up with the OBJ in your 3D animation software.

    The camera path produced from face-based tracking may not be perfect, but it can be used as a starting point.

Using Mesh Generation

You can generate polygonal meshes from the 3D predictions created by boujou 4.1 and export them as *.obj* files (Maya ASCII (**.ma*) export is also available via a script). The mesh is generated by projecting selected 3D points into 2D and then creating connectivity information in 2D, which is then used to mesh the 3D structure.

When generating meshes, it may be useful to:

- View only the active 3D points (those whose track has a feature in the currently selected frame).

  This is so that points arising from non-continuous surfaces are not connected together. The 3D points used can either be from manual tracks (locators and target tracks) or from those automatic tracks that have had 3D points generated.
- Generate more 3D points than are produced by a default camera solve.

  To turn all tracks with low reprojection error into 3D points, from the menu bar click **3D Tasks**, point to **Solve Tools** and then click **Regenerate Structure**.
- Filter out those tracks whose 3D position is poorly constrained (e.g. 3D points arising from very short 3D tracks).

  To do this, from the menu bar click **3D Tasks**, point to **Solve Tools** and then click **Filter Structure**.

To generate meshes:

1. Import an image sequence (for details on doing this, see *Importing an Image Sequence* on page 3-1).
2. Feature track the image sequence (for details, see *Tracking Features* on page 3-9).
3. Perform a camera solve (for details, see *Solving the Camera* on page 3-15).
4. Select the 3D predictions to be used to generate the mesh.
5. From the **3D Tasks** menu, select the desired projection method:
   - **Generate Mesh using Current Frame**
     Project the mesh from the direction of the current camera position, as shown in Figure 4-37.

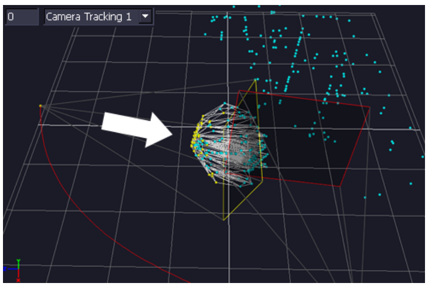


Figure 4-37: Mesh from current frame

- **Generate Mesh using Ground Plane**
  Project the mesh perpendicular to the ground plane, as shown in Figure 4-38.

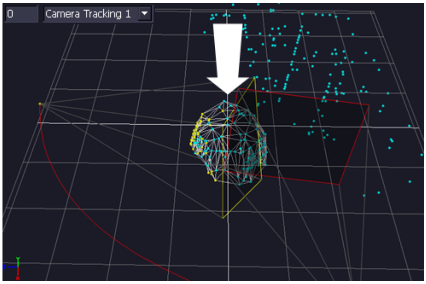


Figure 4-38: Mesh using ground plane

- **Generate Mesh using 3D View**
  Project the mesh in a user-specified direction using current 3D view (you must be in 3D viewing mode), as shown in Figure 4-39.

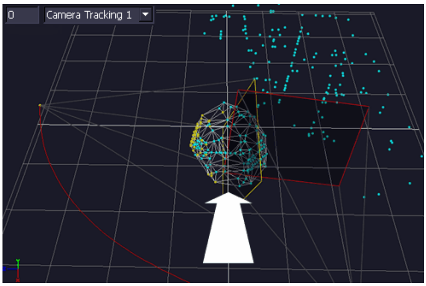


Figure 4-39: Mesh using 3D view

Once you have created your mesh, you can export it as an *.obj* file. To do this, from the menu bar click **Export** and then click **Export Meshes**. The **Export Meshes** dialog box is displayed. Multiple meshes can be exported.

You can export the mesh as a Maya ASCII (**.ma*) file using a script. From the **Scripts** menu, select **Export Meshes to Maya**.

Using Feature Tracks

The automatic feature tracks calculated by boujou 4.1 cannot be edited directly. However, tracks can be transferred between projects and other software packages, inaccurate tracks can be deleted, fragmented tracks can be joined, and good tracks can be given gold status to improve the solve. A feature track is just a series of X and Y coordinates, so exported tracks can be viewed in any text editor.

The following sections described advanced methods for using feature tracks:

- *Editing Automatically Generated Feature Tracks* on page 4-70
- *Creating Gold Tracks* on page 4-72
- *Exporting 2D Feature Tracks* on page 4-73
- *Importing 2D Feature Tracks* on page 4-77
- *Using Non-Consecutive Feature Tracking* on page 4-78

Editing Automatically Generated Feature Tracks

Table 4-10 describes the function of each command shortcut menu that is displayed when you right-click a feature track or prediction in the Image window.

Table 4-10: Feature Tracks commands

Menu Item	Description
Gold	Makes the selected track gold. This gives it greater priority in the solver and allows you to influence which tracks get used and which get rejected. This is very useful when fixing problem shots.
Flag for export	Enables you to export only the tracks or predictions that you're interested in. This helps to reduce the amount of data that you export and makes the scene more manageable in your animation software.

Table 4-10: Feature Tracks commands

Menu Item	Description
Join	Joins selected track fragments. If a foreground object moves in front of a feature that is being tracked, the track is broken and a new one is created when the feature comes back into view. boujou 4.1 does not know that these two tracks belong to the same feature and produces two 3D predictions for that feature instead of one. This can mean that your 3D solution is less accurate. If you join the track fragments, the solver has more information about the position of that feature in 3D space and produces a more accurate result. Select the tracks fragments with the CTRL key held down and then choose **Join** from the right-click menu. Alternatively use the keyboard shortcut CTRL+J. Joined tracks automatically become gold. If you have a lot of broken tracks, it is quicker and easier to use the Non-Consecutive Feature Tracking tool.
Connect Survey Point	Connects a selected track to a selected survey point. This option is only available when working with locators and target tracks. Select the survey point using a model vertex and then CTRL+select the locator/target track in one of the other views.
Disconnect Survey Point(s)	Disconnects selected tracks from survey points to which they are connected. This option is only available when working with locators and target tracks.
Center view on selection	Places the track you have selected in the center of the camera view.

Table 4-10: Feature Tracks commands

Menu Item	Description
Rename	Displays the **Rename Track** dialog box, in which you can give the selected track a more meaningful name. Default: *Named Track 1*
Delete	Deletes the selected track.
Properties	Displays the **Named Tracks** dialog box, in which you can view and configure the properties of a named track. A named track is a track which has been either made gold or flagged for export. You can do most of the right-click menu operations from this dialog box. The **Artifact** drop-down list lets you choose any named track in the current project. If you want to change the properties of several named tracks, make sure you click the **Apply** button before you select the next track from the **Artifact** drop-down list.

Creating Gold Tracks

Gold tracks help the tracking process in the following ways:

- **Feature Tracking**
  The automatic feature tracker attempts to generate sets of tracks that are consistent with gold tracks, generally resulting in better automatic tracking.
- **Camera Solving**
  Solutions for the camera solve are forced to include the gold tracks. This means that these tracks can never be rejected, which is useful if the tracks are in a part of the scene which has few other tracks.

You can create gold tracks to give priority to the following types of track:

- Feature tracks generated by the automatic tracking engine
- Manual locator tracks (always gold)

- Target tracks (always gold)
- Tracks imported from other projects or packages

Tip

If you are making more than one track gold, make sure that the tracks are spread out in time and that a new track starts before the previous one finishes. The easiest way to do this is from the Timeline.

To create a gold track:

- In the Timeline, right-click the desired track and select **gold** from the displayed menu as shown in Figure 4-40 below.

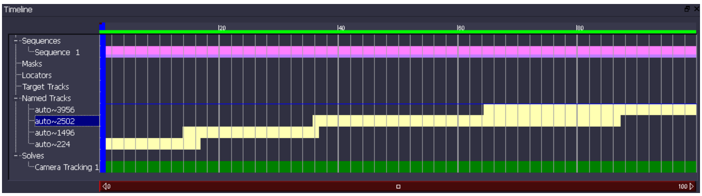


Figure 4-40: Check track spread in Timeline

Exporting 2D Feature Tracks

You can export the 2D tracks created by boujou 4.1 to other boujou 4.1 projects or to 2D compositing packages such as Shake or Inferno.

You configure how boujou 4.1 is to export its 2D feature tracks in the **Export Feature Tracks** dialog box, shown in Figure 4-41.

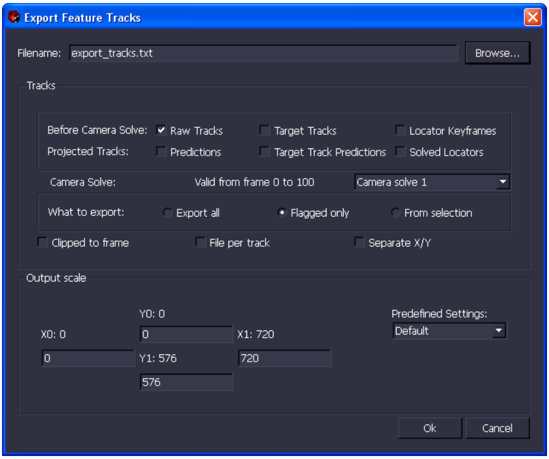


Figure 4-41: Export Feature Tracks dialog box

Raw feature tracks and 3D predictions can all be exported as 2D tracks. Exporting 3D predictions as 2D tracks has the added benefit of providing you with tracks that last for the entire length of the sequence. There are several format options to allow you to export the 2D tracks to suit your compositor. The tracks can be scaled so that you can transfer the tracks between projects of different resolutions.

To export 2d feature tracks:

1. Open the **Export Feature Tracks** dialog box in either of the following ways:

   Toolbox: Export Tracks 

   Menu bar: Export > Export Feature Tracks

2. In the **Tracks** section, in the **Filename** field, enter a name for the exported file.

3. In the **Before Camera Solve** section, specify any raw 2D tracks that you wish to export:
   - **Raw Tracks:** 2D Feature Tracks as found by the automatic feature tracker.
   - **Target Tracks:** Target tracks as 2D tracks.
   - **Locator Keyframes:** Locators on keyframes (manual tracks).
4. In the **Projected Tracks** section, specify any projected tracks (those that are the result of camera tracking and last for the entire sequence) that you wish to include in the export:
   - **Predictions:** The 2D positions of 3D predictions on all frames.
   - **Target Track Predictions:** The 2D positions of 3D predictions calculated from target tracks on all frames.
   - **Solved Locators:** The 2D positions of locators on all frames.
5. In the **Camera Solve** section, if your project contains several camera solve fragments, specify which fragment to export projected tracks for using the drop-down list. Text to the left of the drop down list indicates the frame range over which each camera track fragment is valid.
6. In the **What to export** section, specify the tracks that you want to export:
   - **Export all:** All tracks of the selected type.
   - **Flagged only:** Only the tracks that have been flagged for export.
   - **From selection:** Only the tracks in the current selection set.
7. Specify any additional formatting requirements:
   - **Clipped to frame:** All tracks (including predictions) end when they leave the frame.
   - **File per track:** Creates a separate file for each track.
   - **Separate X/Y:** Creates separate files for the X and Y values of each track.

8. In the **Output scale** section, you can resize the tracks and change the coordinate system to meet your requirements:
   - **Predefined Settings:** Select the desired preset:
     - **Default:** Linear dimensions in pixels, origin top left.
     - **x2:** Linear dimensions in pixels, scaled by a factor of 2, origin top left.
     - **x4:** Linear dimensions in pixels, scaled by a factor of 4, origin top left.
     - **Half Size:** Linear dimensions in pixels, scaled by half, origin top left.
     - **Quarter Size:** Linear dimensions in pixels, scaled by quarter, origin top left.
     - **Top-Left:** Linear dimensions in pixels, origin top left.
     - **Bottom-Left:** Linear dimensions in pixels, origin bottom left.
     - **Normalized [0,1]:** Linear dimensions normalized to fit in the range 0 to 1, origin top left.
     - **Center Origin [-1, 1]:** Linear dimensions normalized to fit in the range -1 to 1, origin in the center.

     The selected preset automatically populates the other fields in this section, which you can accept or over type to meet your requirements:

     - X0
     - Y0
     - X1
     - Y1
9. Click **OK** to start the export.

The text file created consists of the feature track ID, frame number, and point coordinates.

Importing 2D Feature Tracks

You can import a text file containing 2D track data into boujou 4.1. You can either import all the feature tracks that you need, or just import a small number of good ones and then feature track again. You can import feature tracks at any time.

You configure the way boujou 4.1 is to import 2D track data in the **Import Tracks** dialog box, shown in Figure 4-42.

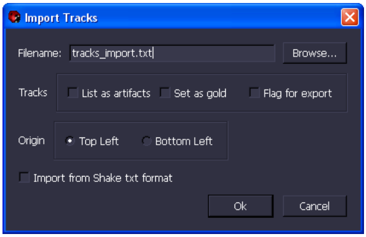


Figure 4-42: Import Tracks dialog box

To import 2D feature tracks:

1. Open the **Import Tracks** dialog box in either of the following ways:

   Toolbox: Import Tracks 

   Menu bar: 2D Tasks > Import Tracks

2. In the **Filename** section, select the text file you wish to import using the **Browse** button.

3. In the **Tracks** section, set any or all of the following import options:

   - **List as artifacts:** Create artifacts for all of the imported tracks in the **Named Tracks** branch of the **Taskview**.
   - **Set as Gold:** Automatically flag all imported tracks as **gold** (see *Creating Gold Tracks* on page 4-72).
   - **Flag for export:** Automatically flag all imported tracks for export (see *Editing Automatically Generated Feature Tracks* on page 4-70.)

4. In the **Origin** section, select the option for interpreting the imported track coordinates as having their origin either at the **Top Left** or the **Bottom Left** of the image.
5. Select the **Import from Shake txt format** option to create feature tracks in boujou 4.1 from 2D tracks exported from Shake as *.txt* files.
6. Click **OK**.

Using Non-Consecutive Feature Tracking

The non-consecutive feature tracker is a very useful tool for creating tracking matches between frames that are more than one frame apart on the Timeline. If an object in your shot goes out of frame and then comes back in again, or if a large foreground object moves across the scene and cuts the background tracks, the non-consecutive feature tracker can join the fragments and improve the 3D solution.

You configure the way boujou 4.1 handles such features in the **Non-consecutive Feature Tracking Properties** dialog box, shown in Figure 4-43.

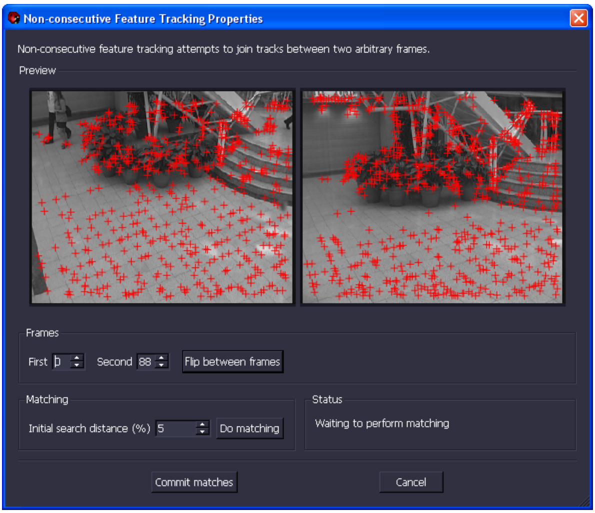


Figure 4-43: Non-consecutive Feature Tracking Properties

To use non-consecutive feature tracking:

1. Feature track your shot.
2. Open the **Non-consecutive Feature Tracking Properties** dialog box in either of the following ways:

   Toolbox: Non-Consecutive Feature Tracking 

   Menu bar: 2D Tasks > Non-Consecutive Feature Tracking
3. The **Preview** shows the two frames that you want to track between. By default the first and last frames of the sequence are displayed. If there was a break in the feature tracking, the frames either side of the break are displayed. You can use the usual boujou 4.1 navigation shortcuts to pan and zoom in the preview windows.
4. The **Frames** fields enable you to specify the two frames to be tracked.
5. The **Flip between frames** button swaps over the frames being displayed in the Preview for as long as the button is pressed. This is very useful for checking that the tracker has found good matches.
6. Set the **Initial search distance (%)** to an appropriate value for the frames that you are trying to match. If a particular feature in the scene has moved a large distance between the two frames, increase the value of **Initial search distance**. The higher the value, the greater the chance of incorrect matches being made.
7. When you have specified which two frames to match, click the **Do matching** button. The **Status** field shows how many matches have been made. If no matches were made, the message ‘matching failed’ is displayed.
8. If matching fails, try either adjusting the **Initial search distance (%)** value, or add a locator in the main boujou 4.1 Image window (not in the Preview). The locator should have a keyframe on each of the two frames that you want to match between.

9. When you are happy with the matches that have been made, click the **Commit matches** button and then start camera solving.

Assessing Lens Distortion

Lens distortion can have a serious effect on the quality of tracking and, if left uncorrected, can make it impossible to get a usable camera track from your footage. Distortion makes objects appear to change shape depending on where they are in the frame: a cube in the center of the frame looks different from a cube at the edge of the frame because the distortion increases as you move further from the center. This can make things very difficult for boujou 4.1 because it cannot work out the 3D structure of non-rigid objects.

boujou 4.1 has tools that allow you to estimate how much distortion there is in your shot and correct for it. These tools work by unwarping the image until features that you know should be straight line up with a calibration line that is always straight (as described in *Understanding the Lens Distortion Pipeline* on page 4-81). This task is made much easier if you shoot a lens grid, as shown in Figure 4-44, with your camera at the time of the shoot.

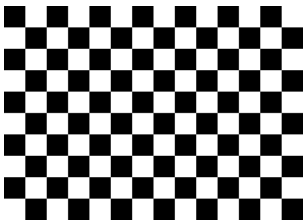


Figure 4-44: Camera lens grid

Important

If you apply a correction for radial distortion after you have initialized any cameras or there is an existing solve in a project, the existing cameras or solve will no longer be valid for the undistorted images.
This can affect the behavior of the Vertex drag tool.
Any solves with existing predictions can be corrected by performing an Adjust solve after radial correction has been applied.
If you are aligning a model and using default camera views, such as those

created when initializing the key schedule, these views should be regenerated before using the Vertex align tool.
If you apply a value of R in the **Advanced** tab of the **Cameras** dialog box and there is an existing solve or any initialized cameras, a warning message is displayed alerting you to this fact.

The following sections describe the tools boujou 4.1 provides to assess lens distortion:

- *Manually Assessing Lens Distortion*
- *Automatically Assessing Lens Distortion* on page 4-87
- *Exporting a Corrected Image Sequence* on page 4-90
- *Lens-adjusting an External Sequence* on page 4-92

Understanding the Lens Distortion Pipeline

Before assessing lens distortion, it is important to understand the process pipeline, which is described in Table 4-11.

Table 4-11: Lens Distortion Pipeline

No.	Example	Setting	Description
1		D1 PAL 720x576	In this example the original images are D1 PAL resolution (720x576). Correcting for lens distortion involves warping the original image until all straight lines stop looking curved. This process results in a new set of images that are of a different size to the originals—they are larger if the value of R is positive and smaller if the value is negative. Because of this the camera that you export from boujou 4.1 is a custom type.

Table 4-11: Lens Distortion Pipeline

No.	Example	Setting	Description
2		Custom 810x648	A radial distortion value of 0.25 gives a custom camera with an image size of 810x648. You need to export the undistorted images from boujou 4.1 using the **Export Sequence** tool to act as the background image sequence in your animation software. The 3D structure that boujou 4.1 calculates is undistorted, and so you need to have undistorted images in the background for the 3D points to line up with features in the image.
3		Custom 810x648	Render the augmenting objects in your animation software with an alpha channel at the same resolution as the undistorted images exported from boujou 4.1 (in this example 810x648). Do not render the background image.
4		D1 PAL 720x576	Use boujou 4.1 to redistort the rendered sequence so that it matches the original footage. This can be done using the **Lens-Adjust External Sequence** tool. After the rendered images have been redistorted they should be in the same resolution as the original footage.
5		D1 PAL 720x576	Composite the distorted CG frames on top of the original background plates.

Understanding boujou Lens Distortion Assessment

If you are an advanced user, you may also need to understand boujou 4.1's lens distortion model, for example, to write a program to remove the lens distortion from your images before importing them into boujou 4.1. Otherwise, the information in this section is not necessary for the basic use of the boujou 4.1 lens distortion assessment tools.

boujou 4.1 uses the following single-parameter model to calculate lens distortion:

$$(x_d - x_c)(1 + kr_u^{\,2}) = (x_u - x_c)$$

$$(y_d - y_c)(1 + kr_u^{\,2}) = (y_u - y_c)$$

$$r_u^{\,2} = \frac{1}{w_p^{\,2}}(x_u - x_c)^2 + \frac{h_f^{\,2}}{w_f^{\,2} h_p^{\,2}}(y_u - y_c)^2$$

where:

k	is the lens distortion value in the boujou 4.1 **Cameras** dialog box *(R)*.
(x_d, y_d)	is the pixel position in an image (the image contains distortion).
(x_u, y_u)	is the new pixel position when lens distortion is removed.
(x_c, y_c)	is the principal point position in pixels (the center of the image).
w_p	is the width of the image in pixels.
h_p	is the height of the image in pixels.
w_f	is the film back width.
h_f	is the film back height.

Manually Assessing Lens Distortion

If your scene contains straight lines, you can use calibration lines to manually assess the amount of lens distortion in your shot using the **Assess Lens Distortion** dialog box, shown in Figure 4-45.

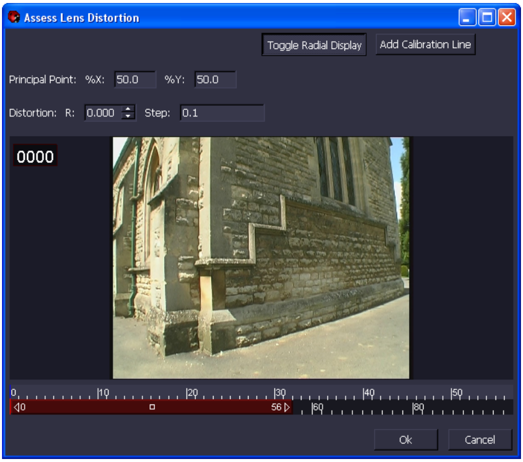


Figure 4-45: Assess Lens Distortion dialog box

To manually assess lens distortion:

1. Open the **Assess Lens Distortion** dialog box, shown in Figure 4-45, in either of the following ways:

   Toolbox: Assess Distortion 

   Menu bar: Setup > Assess Lens Distortion (manual)

2. The navigation controls in the **Assess Lens Distortion** window are exactly the same as in the main 2D view. To jump to a specific frame number, right-click the Timebar and the **Go to frame** button appears. Click it and the **Go to frame** dialog box is displayed. Enter the frame number that you want to go to and then click **OK**.

3. If your camera has a non-centered principal point, enter the correct position in the **Principal Point %X** and **%Y** fields. These values are the percentage distances of the principal

point from the **top left** corner of the image. X is the horizontal distance and Y is the vertical distance.

4. If you know the value of the distortion parameter, **R**, for the shot you are working on, enter it in the **R** field. Click the **Toggle Radial Display** to preview the results.
5. If you do not know how much distortion there is in your shot, you can estimate it by adding a **calibration line**. A calibration line is a line that is always straight regardless of how much you warp the background. The end points of the calibration line should both be on a feature in the image that you know is straight, for example, the corner of a building, a door frame, or the edge of a table. Change the value of **R** to undistort the image until the feature that you know should be straight is parallel to the calibration line. Try to avoid features that go through the center of the image as these are not distorted; lines are more distorted the further away they are from the center of the image. To add a calibration line click the **Add Calibration Line** button.
6. Click and drag in the image to draw a calibration line. Release the mouse button to stop drawing. When you click away from the line it changes color from yellow to cyan.
7. Click the line to edit it. It turns green and white boxes appear at each end. Click and drag these boxes to adjust the position of the calibration line.
8. Change the value of **R** using the up and down arrows next to the number field. Adjust the **Step value** if required (this controls by how much the value of **R** changes when you click the arrows). When the feature in the image is parallel with the

calibration line, as shown in Figure 4-46, click the **OK** button to apply the distortion correction and close the window.

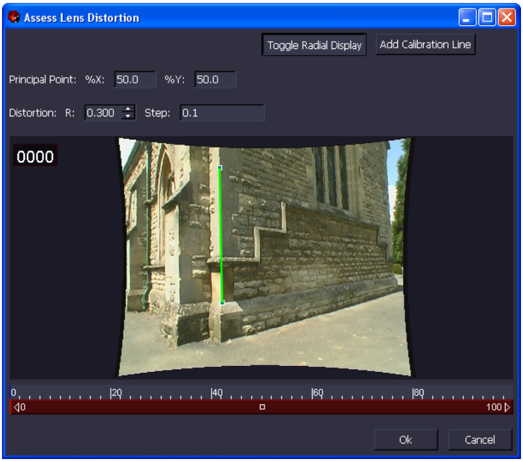


Figure 4-46: Adjust feature to match calibration line

9. A **Calibration line 1** artifact is added to the **Taskview**. If you double-click the artifact, the **Calibration Lines** dialog box is displayed, as shown in Figure 4-47, allowing you to delete or rename any of the calibration lines in the current project. If you click the **Adjust Radial** button, the **Assess Lens Distortion** window is displayed.

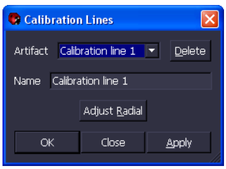


Figure 4-47: Calibration Lines dialog box

10. You can now feature track and camera solve your shot as usual.
11. Once you have determined the radial distortion for your lens, you can type it into boujou 4.1's **Cameras** dialog box for every shot using that lens. The distortion and principal point

settings are under the **Advanced** tab, as shown in Figure 4-48.

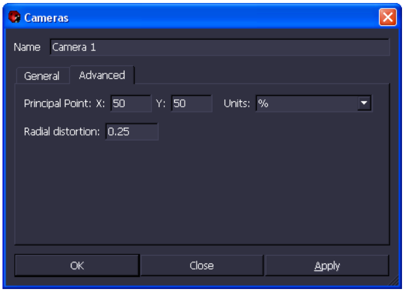


Figure 4-48: Cameras dialog box—Advanced tab

Automatically Assessing Lens Distortion

It is not always possible to use calibration lines to assess the amount of lens distortion in your shot. Some scenes contain no straight lines, and if you didn't shoot a lens grid before you started filming, you have no way of telling if you have removed all of the distortion. You can use the **Auto-assess radial lens distortion** dialog box, shown in Figure 4-49, to automatically calculate the optimum value of **R** for an existing camera solve. No calibration lines are needed and so scenes without straight lines are no longer a problem.

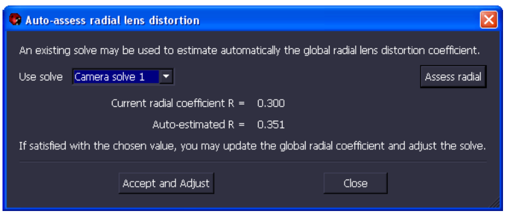


Figure 4-49: Auto-assess radial lens distortion dialog box

To automatically assess lens distortion:

1. Camera solve an image sequence.
2. Open the **Auto-assess radial lens distortion** dialog box in

any of the following ways:

Menu bar: 3D Tasks > Assess Lens Distortion (automatic)

Advanced Camera Solve Properties dialog box: Optimize radial distortion parameters option

Solve Adjust dialog box: Optimize radial distortion parameters option

3. Choose the camera solve that you want to assess from the **Use solve** drop-down list.
4. If you corrected for lens distortion before you tracked the camera, the value of **R** that you used appears in the **Current radial coefficient** field.
5. Click the **Assess radial** button to make boujou 4.1 automatically calculate the optimum value of lens distortion for the current camera track. The calculated value of **R** appears in the **Auto-estimated R** field. It is also shown in the **Console** pane.
6. If this value looks appropriate, click the **Accept and Adjust** button. An **Adjust Solve** camera solve is done, using the new value of **R**, which is written in the **Advanced** tab of the **Cameras** dialog box.

You can also find the optimum value of **R** from the **Advanced Camera Solve Properties** dialog box, shown in Figure 4-50 on page 4-89.

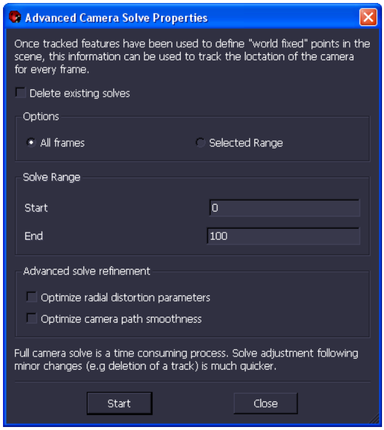


Figure 4-50: Advanced Camera Solve Properties dialog box

In the **Advanced solve refinement** section. select the **Optimize radial distortion parameters** check box to automatically calculate the value of **R**, either as part of a **Complete** camera solve or an **Adjust Solve**. The calculated value of **R** is written in the **Advanced tab** of the **Cameras** dialog box, overwriting any existing value.

Exporting a Corrected Image Sequence

Once you have corrected your image sequence for lens distortion you may want to export the undistorted images. These corrected images are then used as the background sequence in your 3D animation package.

You export image sequences using the **Export Sequence** dialog box, shown in Figure 4-51.

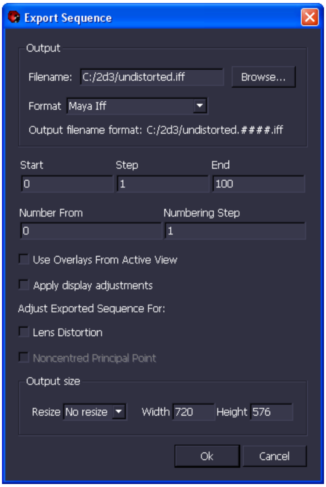
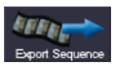


Figure 4-51: Export Sequence dialog box

To export an image sequence:

1. Open the **Export Sequence** dialog box in any of the following ways:

   Toolbox: Export Sequence 

   Menu bar: Export > Export Sequence

   Keyboard shortcut: F11

2. Using **Browse** button choose the location where you wish to save the exported image sequence and enter a name in the **Filename** field.

3. Specify the image file **Format** that you'd like to export. For details of supported export image formats file formats, see Table 1-2 on page 1-3.
4. Specify the **Output filename format**. This is the template that is used for writing each image file in the sequence. The default is *name.###.extension*.
5. Set the **Start** frame, **Step** size, and **End** frame.
6. Set the **Number From** and **Number Step** options if required. If you want to export boujou 4.1 frames 0, 1, 2, 3, and 4 as 1, 3, 5, 7, and 9, set **Number From** to 1 and **Number Step** to 2.
7. To save the images with the current overlays on (feature tracks, locators, predictions etc.) check the **Use overlays from active view** box. You can't change the active overlays if the **Export Image Sequence** dialog box is open.
8. To save images with brightness and contrast display adjustments made in the display controls of the **Zoom Tool** pane, select the **Apply Display Adjustments** check box.
9. If you want to save out images with the lens distortion removed or images with a non-centered principal point, check the required boxes under the **Adjust Exported Sequence For** heading. These boxes only become active if you have corrected for lens distortion or non-centered principal point within the current project:
   - **Lens Distortion:** Export the image sequence with the lens distortion correction applied.
   - **Non-centered principal point:** Export the image sequence with the principal point correction applied.
10. You can scale the exported images using the **Output size** option. Select the required option from the **Resize** drop-down list:
    - **No Resize:** Export at the original image resolution.
    - **Custom:** Export at the resolution specified in the **Width** and **Height** options, which become active when this option is selected.

- **Half:** Export at one-half of the original image resolution.
- **Quarter:** Export at one-quarter of the original image resolution.
- **Eighth:** Export at one-eighth of the original image resolution.

11. Click **OK** to start exporting the sequence.

Lens-adjusting an External Sequence

If you have corrected for lens distortion in your boujou 4.1 project, you need to redistort your CG material to match the original distorted images using the **Lens Adjust External Sequence** dialog box, shown in Figure 4-52.

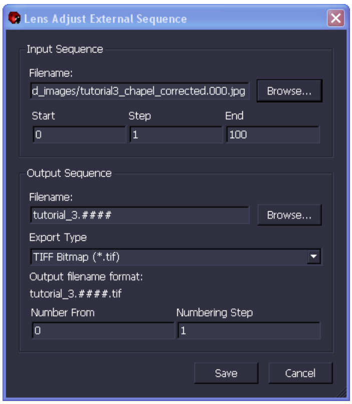


Figure 4-52: Lens Adjust External Sequence dialog box

To adjust lens distortion for an external sequence:

1. Open the boujou 4.1 project file for the shot that you have tracked and exported to your animation software. This project file contains the appropriate camera settings, radial distortion value (R), and principal point values. These values are required to make sure that the CG images that you have just rendered get redistorted by the correct amount to match the original images.

2. Open the **Lens Adjust External Sequence** dialog box in either of the following ways:

   Toolbox: Lens Adjust External Sequence 

   Menu bar: Export > Lens Adjust External Sequence

3. Click the **Browse** button to browse for the CG image sequence that you want to redistort. The file name and path of the first frame of the sequence are displayed in the **Filename** field.

4. Set the **Start**, **Step**, and **End** frames as appropriate.

5. In the **Output Sequence** section of the dialog box, **Browse** for the directory where you want to write the images and give the file name root (typing *name.###.extension* makes sure you keep any leading zeroes in the frame numbers).

6. From the **Export Type** drop down list, select the required export format as shown in Table 4-12. Not all of these formats support alpha channels.

Table 4-12: Lens-adjusted export file formats

File Format	Extension	Support
Cineon	*.cin*	30- or 40-bits per pixel.
Maya IFF	*.iff*	Full IFF support.
JPEG	*.jpg*	Full JPEG support.
Softimage	*.pic*	24- or 32-bits per pixel, with or without encoding.
PNG	*.png*	Full PNG support.
PPM	*.ppm*	Full PPM support.
SGI	*.rgb*	Silicon Graphics Bitmap RGB or RGBA, with or without encoding, 8- or 16-bits per component.
TIFF	*.tiff*	Grayscale, RGB or RGBA, with or without encoding, 8- or 16-bits per component.

A preview of how the file name will be formatted appears in the **Output filename format** area.

7. Set the **Number From** and **Numbering Step** options if required. For example, if you want to export frames 0, 1, 2, 3 as 1, 3, 5, 7, set **Number From** to 1 and **Numbering Step** to 2.
8. The **Save** button becomes active. Click it to start exporting the redistorted images.

Setting User Preferences

You can change the appearance of the boujou 4.1 interface and the tool settings in the **Preferences** dialog box, shown in Figure 4-53. You can save your preferences and transfer them from one computer to another.

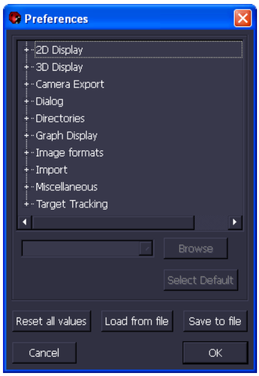


Figure 4-53: Preferences dialog box

To set up user preferences:

1. Open the **Preferences** dialog box in either of the following ways:

   Toolbox: Preferences 

   Menu bar: Edit > Preferences (Windows) or boujou > Preferences (OS X)

2. The **Preferences** dialog box contains the following sections:
   - **2D Display**
   - **3D Display**

- **Camera Export**
- **Dialog**
- **Directories**
- **Graph Display**
- **Image Formats**
- **Import**
- **Miscellaneous**
- **Target Tracking**

Click the + to expand each branch and display the settings you can set. For details of the preferences you can set within each of these sections, see *Appendix B boujou 4.1 Preferences*.

3. Use the controls at the bottom section of the **Preferences** dialog box to make your changes. For options that set colors, the **Browse** button opens a color palette from which to select.

4. Click the **Reset all values** button to change the preferences back to the default settings.

Caution
This action cannot be undone.

5. You can save your preferences to a **.bpf* file by clicking the **Save to file** button. You can import a **.bpf* file by clicking the **Load from file** button.

6. Click **OK** to apply the changes and close the dialog box. Some preferences require you to close down boujou 4.1 and start it up again before they take effect.

Using boujou 4.1_script for Command-line Processing

boujou_script is a command-line version of boujou that enables you to create, track, and solve project files. You can process multiple project files using a batch file if desired. For example, for each image sequence that you want to track, you would run the normal version of boujou, set up the image sequence and the camera, and then save the project. You would then create a boujou_script file and run it from the command line to track and solve them all, one after the other.

Tip
If boujou_script encounters an error during processing, it terminates. This can be very inconvenient if it happens at the beginning of a long series of

shots. Therefore, it is a good idea to write a separate boujou_script file for each project and then run them consecutively using a batch file.

To write a boujou_script file:

1. Open a standard text editor.
2. Type the desired commands, using the following syntax:

   ```
   BoujouScriptFile{}
   command { argument1 value1 argument2 value2 argument3
   "value with spaces" }
   ```

   where:

`BoujouScriptFile {}`	is the required first line.
`command`	is one of the available boujou_script functions.
`argument`	is a characteristic of the specified function.
`value`	is the data that the script is to process. A space is considered a separator, so you must enclose any value containing spaces (for example, a directory path name) in quotation marks.

   For an example boujou_script file and details of the commands, arguments, and values you can specify, see *Appendix D boujou_script File Commands*.

3. Save your boujou_script file with a *.bsc* file extension.

To run a boujou_script file:

1. Open a command session.
2. Change to the boujou 4.1 directory, which contains the *boujou_script.exe* file, by default:
   - *C:\Program Files\2d3\boujou 4* (Windows)
   - *usr/local/ boujou 4_0_1* (Linux)
   - *applications/boujou4* (OS X)

3. Enter the following command:

    ```
    boujou_script -name filename.bsc
    ```

    where `filename.bsc` is the full path and file name of your boujou_script file.

Export to an Animation Package 5

This chapter describes how to export data from boujou 4.1 for use in 3D animation package. It gives general guidance as well as information specific to supported export formats:

- *Exporting a boujou 4.1 Scene for an Animation Package*
- *Importing a boujou 4.1 Scene into an Animation Package* on page 5-4
- *Exporting boujou 4.1 Data into Other Formats* on page 5-17

Exporting a boujou 4.1 Scene for an Animation Package

This section describes how you can export the scene file created in boujou 4.1 for use in the 3D animation package that you are using. boujou 4.1 uses a Y-up, right-handed coordinate system by default, but it can be set to Z-up in the **Preferences** (for details, see *Appendix B boujou 4.1 Preferences*).

Caution

Only try to augment a part of the scene where there is a good coverage of predictions. If you place an augmenting object in an area where there are no predictions, it may appear to slip. The 3D predictions show you where the virtual camera is likely to give you good augmentation results.

You configure the way boujou exports a scene file in the **Export Camera** dialog box, shown in Figure 5-1.

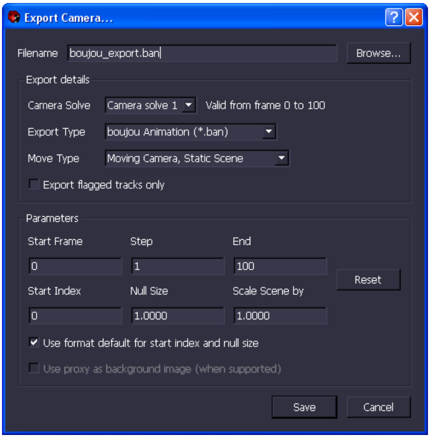


Figure 5-1: Export Camera dialog box

To export a boujou 4.1 scene file for a 3D animation package:

1. Open the **Export Camera** dialog box in any of the following ways:

   Toolbox: Export Camera Solve 

   Menu bar: Export > Export Camera Solve

   Keyboard shortcut: F12

2. In the **Filename** field, enter the name of the file. Alternatively, if you want to overwrite an existing file use the **Browse** button.

3. In the **Export details** section, specify the following options:

   - Use the **Camera Solve - Valid from** option if you are exporting broken solves. If you have several solve fragments, your camera export is not going to be valid for the entire length of the sequence. The **Valid from** field tells you the duration of the current solve fragment.

- In **Export Type**, select the appropriate file format from the drop-down list. For details of available export file formats, see *Chapter 1 Supported Camera Export File Formats*.
- Choose the appropriate **Move Type:**
    - **Moving camera, static scene:** 3D points stationary, camera rotates and translates. (default).
    - **Panning camera, Translating Scene:** Camera rotates only, 3D points translate.
    - **Static camera, Moving Scene:** Camera static, 3D points rotate and translate.

  Most export formats allow you to export a static camera and moving points, or a panning camera and translating points, in addition to the default moving camera and static points.
- Select the **Export flagged tracks only** check box if you want to export only the tracks that were flagged for export in the **Named Tracks** dialog box.

4. In the **Parameters** section, specify the following options:
    - You can export a subsection of the camera track by specifying **Start Frame**, **Step**, and **End**.
    - The **Start Index** allows you to export with a non-zero first frame; **Null Size** changes the size of the 3D features within the animation package; **Scale Scene by** changes the global scale of the exported scene.

Tip

You can set the default value of **Scene Scale in** the **Preferences** dialog box. From the menu bar, click **Edit** then click **Preferences**. Expand **Camera Export** and then **General**. Select **Default Scale** and change the value. For details, see *Appendix B boujou 4.1 Preferences*.

The **Start Index** and **Null Size** fields become available and you can enter the required value for the first frame.

- If you want to export with a different first frame index, clear the **Use format default for start index and null size** check box. boujou 4.1 defaults to using the **Number From** value from the **Image Sequence** dialog box when it exports.

5. Click **Save**.

Warning
Only export the scene points for the features that you’re interested in. This makes the scene far more manageable when the points have been imported. Use the **Flag Tracks for Export** feature from the right-click menu in the main boujou 4.1 workspace.

Importing a boujou 4.1 Scene into an Animation Package

Once you have exported a scene file created in boujou 4.1, as described in *Exporting a boujou 4.1 Scene for an Animation Package* on page 5-1, you can import it into a supported third-party animation package:

- *Importing a Scene into 3D Studio Max* on page 5-5
- *Importing a Scene into After Effects* on page 5-6
- *Importing a scene into Cinema 4D* on page 5-6
- *Importing a scene into Cineon* on page 5-8
- *Importing a Scene into Combustion* on page 5-9
- *Importing a Scene into Flame, Inferno, or Smoke* on page 5-9
- *Importing a Scene into Fusion* on page 5-10
- *Importing a Scene into Houdini* on page 5-11
- *Importing a Scene into LightWave* on page 5-11
- *Importing a Scene into Maya* on page 5-12
- *Importing a Scene into Softimage XSI* on page 5-12

Important
Not every third-party animation package works in the same way, and not every export format supports the same parameters. It is important to understand the limitations of your chosen animation package before you start working with camera tracking data exported from boujou 4.1.

Importing a Scene into 3D Studio Max

boujou 4.1 creates a Max script file for importing into Max 3 and above.

Important

Max uses a Z-up, right-handed coordinate system.

To import a boujou 4.1 scene into 3D Studio Max:

1. From the menu bar, select on **MAXScripts > Run Script**.
2. Browse for the **.ms* script created by boujou 4.1 and run it; a camera and a series of scene points appear in the workspace.

   On export of the *.ms* file from boujou 4.1, an image index file (*.ifl*) is saved into the same directory as the original tracked image sequence. This file is referenced in the exported Max Script file and is used to load the image sequence into 3DS Max when the script is run.

   The image sequence is loaded as a viewport background image for the active viewport in 3DS Max. After import, ensure that the active 3DS Max viewport is set to the boujou 4.1 camera and then ensure that the Viewport Background for this viewport is set to display the image sequence. This can be done from the View menu > Viewport Background in 3DS Max. The viewport can be set to update with the animated images from the Customize > Preferences > Viewports Update Background when playing.

   When boujou 4.1 writes the Max script file it converts the value of focal length it has calculated into a field of view using the film back settings. When you come to render your scene in Max, the field of view is converted to a focal length using the value of render aperture width given in the **Render Scene** dialog box. This value should be set appropriately to the correct film back setting by the exported Max script but should be checked if Max performs final renders with the wrong value for focal length. Unless you set this value to the correct film back setting, Max will use the wrong value of focal length for your final render.

Important

Only export the scene points for the features that you're interested in. This makes the Max workspace far more manageable when the points have been loaded. Use the **Flagged for Export** feature in the **Taskview > Named Tracks** dialog box.

Importing a Scene into After Effects

boujou 4.1 exports Maya (*.ma*) files for import into Adobe After Effects When the *.ma* file is imported into After Effects, it creates two compositions: one with the same name as the boujou 4.1 project and the other with the prefix *square*. The latter is required to correct for non-square pixels in the original sequence.

In the composition window you will see a number of small red squares. These squares represent the position of the 3D predictions exported from boujou 4.1. You need to use these points as reference to place your additional layers at the correct distance from the camera.

Important

After Effects uses a Y-up coordinate system.

Importing a scene into Cinema 4D

When exporting for Cinema 4D, boujou 4.1 creates a *.c4d* file which can be loaded directly into Cinema 4D. An animated camera and a hierarchy of points are automatically created.

You can also use the plug-in available on the **Resource** disc to import into Cinema 4D. A different plug-in is required depending on which version of Cinema 4D you are using:

- The plug-in for release 8 works on both the Windows and Macintosh versions (release 8 and above).
- The plug-in for release 7 works on Windows. It reads the boujou 4.1 **ASCII text** export.

Cinema 4D can also read the LightWave *(*.lws)* and FBX exports.

To import a boujou 4.1 scene into Cinema 4D Release 8:

1. Open boujou 4.1 and click **Edit > Preferences > Camera > Export > boujou 4.1 Animation > Camera Format** and set to **Both Formats for each Key** (for details, see *Appendix B boujou 4.1 Preferences*).
2. Export your camera solving results as a boujou 4.1 Animation file *(*.ban)*.
3. Create a folder called *ban* in your Cinema4D plugins directory (e.g. *CINEMA_4D_R8\Plugins\ban*).
4. Copy the boujou 4.1 plug-in (*filter_ban.cob* and *plugin_ban.cob*) into the ban folder you have just created
5. Start Cinema4D and go to **File > Open**
6. Ensure you have set **File of type** to **All files** and select the *.ban* file you exported from boujou 4.1.
7. In the **View** window go to **Cameras > Scene Cameras > "Camera_1"** to look through the boujou 4.1 camera.

To import a boujou 4.1 scene into Cinema 4D Release 7:

1. Track your shot with boujou 4.1 and export the results as an **ASCII text** file. Put the image sequence in the *Cinema4D\CINEMA 4D XL Release 7* directory.
2. Copy the plug-in (*boujou.cof* or *boujou.cob*) into the Cinema 4D plugins directory. Launch Cinema 4D.
3. Go to **Plugins > boujou 4.1 import**.
4. In the **Viewing** window, select **Cameras > Scene Camera > boujou 4.1 Camera.**
5. In the **Materials** window, select **File > New Material**.
6. Right-click **Material > Edit**. In the dialog box, select **Image** and browse for the image sequence in the *Cinema4D\CINEMA 4D XL Release 7* directory. Select **Edit**, then **Calculat**e, then **OK**.
7. Right-click **Camera** in **Object List > Edit**. Enter the correct value of **Focal Length** and enter the filmback width value in the **Aperture Width** field - these values are not set by the plug-in. These values are written in the **.txt* file exported

from boujou 4.1, and can also be found from the **Camera Solves Summary** artifact in boujou 4.1's **Taskview**.

Importing a scene into Cineon

The export to Cineon is done via a **.jdf* file. The layout contained in the file has a 3D Space node holding the camera and point data, and some nodes to set up a simple image patch for display of the point positions. The **null size** option in boujou 4.1 sets the size of this image patch in pixels. If the **three planes per point** user preference is set in boujou 4.1, each point is displayed as a set of three perpendicular patches, which can make the point's position easier to see.

Important

Cineon uses a Y-up, right-handed coordinate system.

To import a boujou 4.1 scene into Cineon:

1. To view the basic output, create an input node holding the background footage and attach it as an input to the 3D space node.
2. Attach an output node to the 3D space node.

   A render of the output should show the points from boujou 4.1 moving correctly in relation to the background sequence.
3. It may be necessary to set the **scale scene by** option to something like 10 or 100 when exporting from boujou 4.1, for the scene to appear at a sensible size in Cineon.

   If a low resolution proxy was used for tracking in boujou 4.1, set the flow graph base size to the full render size and multiply the value in **3dSpaceNode / Camera / Format / Scan Resolution** by the ratio of the sizes. For example, if tracking was on a half resolution proxy, change the value from 20.82 to 41.64.

Importing a Scene into Combustion

boujou 4.1 creates a **.cws* workspace file that can be loaded directly into Combustion.

Important

Combustion uses a Y-up, left-handed coordinate system.

Only export the scene points for the features that you're interested in. This makes the workspace file far more manageable when loaded into Combustion. Use the **Flag Tracks for Export** feature from the right-click menu in the main boujou 4.1 workspace.

To import a boujou 4.1 scene into Combustion:

- Double-click the **.cws* file exported from boujou 4.1. This launches Combustion and sets up the camera, background image, and scene points (nulls).

Importing a Scene into Flame, Inferno, or Smoke

boujou 4.1 creates a **.action* file that had be loaded directly into flame, inferno, or smoke.

Important

flame, inferno, and smoke use a Y-up, right-handed coordinate system.

Only export the scene points for the features that you're interested in. This makes the scene far more manageable when loaded into flame or inferno. Use the **Flagged for Export** feature from the right-click menu in the main boujou 4.1 workspace.

To import a boujou 4.1 scene into flame, inferno, or smoke:

1. Enter the action module using arbitrary clips. These clips are ignored once the setup has loaded.
2. Select load and navigate to the directory where the **.action* file is stored.
3. Select **All** and load the setup.
4. Select the background layer, press **Add**, and choose the clip which was tracked in boujou 4.1 from the desktop.

Importing a Scene into Fusion

boujou 4.1 creates a Fusion 5.0 (*.comp*) file that can be loaded directly into Fusion. This file contains the image sequence which is used for tracking, a 3D animated camera, a 3D point cloud and a merge node. The network created on import into Fusion is shown in Figure 5-2.

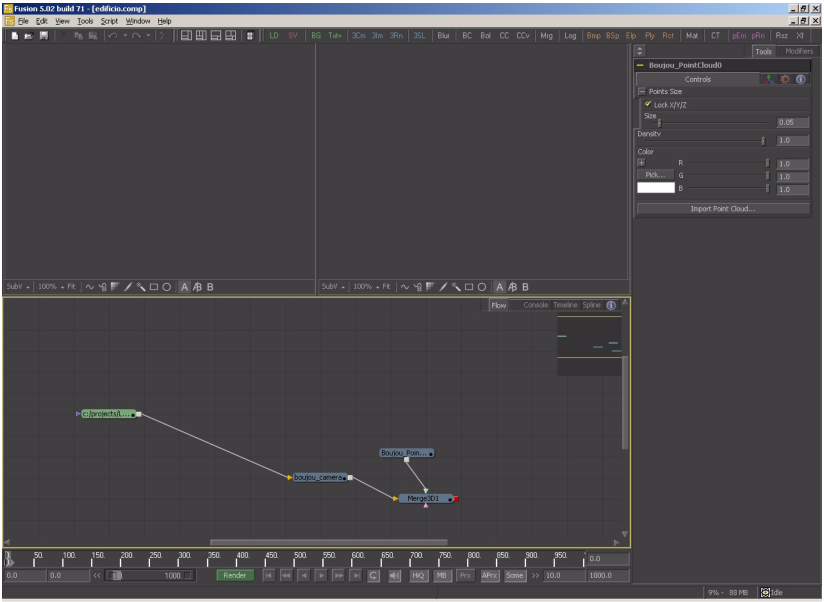


Figure 5-2: Fusion network created on import

Important

Fusion uses a Y-up, left-handed coordinate system.

Importing a Scene into Houdini

boujou 4.1 creates a Houdini 4.1 (*.hip*) project file that can be loaded directly into Side Effects Software's Houdini.

Important

Houdini uses a Y-up, right-handed coordinate system.

To import a boujou 4.1 scene into Houdini:

- Go to **File > Load** and browse for the **.hip* file exported from boujou 4.1.

  Warning

  Houdini 4 does not support Windows AVI files as background images.

  An animated camera, the 3D scene points, and the background image are all created in the workspace. To group the 3D points as a single object set the **Houdini Compound Points** option in **Edit > Preferences > Camera Export > Houdini** (for details, see *Appendix B boujou 4.1 Preferences*).

Importing a Scene into LightWave

boujou 4.1 creates a LightWave 6.5 (*.lws*) scene file that can be loaded directly into the layout module of NewTek's LightWave. This export has been successfully tested in LightWave 8.

Important

LightWave uses a Y-up, left-handed coordinate system.

To import a boujou 4.1 scene into LightWave:

- Go to **File > Load Scene** and browse for the **.lws* scene exported from boujou 4.1.

  A camera and a series of scene points appear in the workspace. You have to load the tracked image sequence as the background image separately. There is a limit to the number of 3D points that can be loaded into LightWave. The default value of 1000 can often prove inadequate for complex scenes. To increase this value you must edit the *lw3.cfg* file (in Windows NT4 this is held in the *WINNT\Profiles\userName* directory). Search for the line `MaxObjects 1000` and set it to 2000.

Importing a Scene into Maya

boujou 4.1 creates a Maya ASCII (*.ma*) file that can be loaded directly into Maya 2 and above. An animated camera, image plane, and a hierarchy of scene points are automatically generated. It uses Maya's default units of centimeters and degrees.

Important

Maya uses a Y-up, right-handed coordinate system

To import a boujou 4.1 scene into Maya:

- In Maya go to **File > Open Scene** and select **Files of type: Maya scene (*.mb, *.ma)** and browse for the *.ma* exported file from boujou 4.1.

  If you use **File > Import** to load the **.ma* file, Maya does not change the default values of units and frame rate. This can result in the boujou 4.1 camera keyframes not lining up with the background images.

  Warning

  Do not change the name of your camera within boujou 4.1 to something starting with a number. Maya does not like object names that begin with a number and will fail to load the animation data onto the boujou 4.1 camera.

Importing a Scene into Softimage XSI

boujou 4.1 exports to Softimage and XSI using the dotXSI format. This format is interpreted differently by the various versions of Softimage products, and so boujou 4.1 must export its data using several variations of the dotXSI format.

Important

Softimage 3D & XSI use a Y-up, right-handed coordinate system.

Warning

Softimage 3D only supports its own image format *(*.pic*). Make sure that your *.pic files have the same pixel aspect ratio as the boujou 4.1 camera. If the pixel aspect ratio is wrong, the 3D points won't line up with the background image.

To import a boujou 4.1 scene into Softimage 3.8 (dotXSI version 1.3):

1. Set the playback speed to the appropriate value before importing the scene or the data will be fitted to a 30fps Timeline. Playback speed is set in **Motion Module > Play Control**.
2. Import the dotXSI file using **Tools Module > Import > Objects > ASCII Import**.

   Constraints are not supported in this version of the dotXSI format, so the camera is animated directly. The camera and the boujou 4.1 reference cannot be grouped together, which makes applying global transformations to the scene very difficult.

To import a boujou 4.1 scene into Softimage 3.9.1 (dot-XSI version 2.0):

1. Set the playback speed to the appropriate value before importing the scene or the data will be fitted to a 30fps Timeline. Playback speed is set in **Motion Module > Play Control**.
2. Import the dotXSI file using **Tools Module > Import > Objects > XSI Import**.

The camera is constrained to a set of nulls that are grouped with the boujou 4.1 reference points. Roll is controlled by an up-vector constraint. Global transformations can now be applied to the points and the camera simultaneously by selecting the top node of the hierarchy of nulls imported from boujou 4.1.

To import a boujou 4.1 scene into Softimage 3.9.2 (dot-XSI version 3.0):

1. Set the playback speed to the appropriate value before importing the scene or the data will be fitted to a 30fps Timeline. Playback speed is set in **Motion Module > Play Control**.

   Warning

   Softimage 3.9.2 defaults to a vertical field of view.

2. Import the dotXSI file using **Tools Module > Import > Objects > XSI Import**.

The camera is constrained to a set of nulls that are grouped with the boujou 4.1 reference points. Roll is controlled by an up-vector constraint. Global transformations can now be applied to the points and the camera simultaneously by selecting the top node of the hierarchy of nulls imported from boujou 4.1.

To import a boujou 4.1 scene into XSI 1.5 (dotXSI version 3.0):

1. Import the dotXSI file using **File > Import > Import xsi**.

   Warning
   XSI 1.5 defaults to a horizontal field of view.

   On some systems XSI gives you the error `The file does not exist` on import, or the *.xsi* file that you exported from boujou 4.1 does not appear in the file browser. To get around this problem drag and drop the file into the XSI workspace.

2. Make sure that the Timeline frame rate and the camera format are set to the appropriate values (XSI defaults to a NTSC camera with a frame rate of 29.97 fps).

   The camera and camera interest are animated directly. The camera gets its pan and tilt rotations from the translation of the camera interest, and the camera roll is animated separately. All of the scene elements (camera, interest and reference points) are grouped under a parent null named **TopNull**.

XSI does not refer the camera roll values to the orientation of the parent null. Instead it uses the global orientation. This means that if you try to apply a rotation to the entire hierarchy the camera roll values stay constant relative to the global axis system and your 3D points are not in the correct position relative to the background image.

To get around this problem you should use the Softimage 3.9.2 export. Because of the incompatibilities between Softimage and XSI some manual set-up is required to make the reference points line up with the background image.

XSI 1.5 defaults to a horizontal field of view for the camera imported from boujou 4.1, whereas Softimage 3D defaults to a vertical field of view. You need to bring up the **bou_cam** properties dialog box to set the field of view to the correct orientation (vertical).

The Softimage 3.9.2 export uses an up-vector constraint to control camera roll, but XSI only supports up-vector constraints for IK chains. Without this constraint the camera will not roll and the nulls will not line up with the features in the background image.

To correct the camera roll in XSI 1.5 (dotXSI version 3.0):

1. Load the *.xsi* file from boujou 4.1 into XSI.
2. In a schematic view select **bou_cam**.
3. In the menu bar select **constrain > direction**.
4. When it prompts you for a target reference, click **camera_1_up_vector** in the schematic view.
5. A properties window is displayed for the new direction constraint (with the title **scene_root:bou_cam: direction cns**). Change the **Align Axis** section to: X=0, Y=1, Z=0 and make sure the **Active** check box is selected. Ignore the **Up Vector** tab.

The camera should now roll correctly.

To import a boujou 4.1 scene into XSI 2.0 and above (dot-XSI version 3.0):

1. Import the dotXSI file using **File > Import > Import dotXSI**.

   Warning
   XSI 2.0 and above defaults to a vertical field of view.

   On some systems XSI gives you the error `The file does not exist` on import, or the *.xsi* file that you exported from boujou 4.1 does not appear in the file browser. To get around this problem drag and drop the file into the XSI workspace.

2. Make sure that the camera frame rate, rotoscope image sequence frame rate, and playback frame rate are all set to the appropriate value (XSI defaults to a NTSC camera with a frame rate of 29.97 fps).

3. In the **Camera Rotoscopy > Time Control > Source Clipping** section make sure all of the frames of the image sequence are being used. XSI usually defaults to an out frame that is less than the last frame of the sequence. For a 25 frame sequence, starting at frame 1, the **In** value should be set to 0 and the **Out** value should be set to 25.

The camera and camera interest are animated directly. The camera gets its pan and tilt rotations from the translation of the camera interest, and the camera roll is animated separately. All of the scene elements (camera, interest and reference points) are grouped under a parent null named **TopNull**.

XSI does not refer the camera roll values to the orientation of the parent null - instead it uses the global orientation. This means that if you try to apply a rotation to the entire hierarchy the camera roll values will stay constant relative to the global axis system and your 3D points will not be in the correct position relative to the background image.

To get around this problem you should use the Softimage 3.9.2 export. Because of the incompatibilities between Softimage and XSI some manual set-up is required to make the reference points line up with the background image.

The Softimage 3.9.2 export uses an up-vector constraint to control camera roll, but XSI only supports up-vector constraints for IK chains. Without this constraint the camera does not roll and the nulls do not line up with the features in the background image.

To correct the camera roll in XSI 2.0 and above (dotXSI version 3.0):

1. Load the *.xsi* file from boujou 4.1 into XSI.
2. In a schematic view, select **bou_cam**.
3. In the menu bar, select **constrain>direction**.
4. When it prompts you for a target reference, click **camera_1_up_vector** in the schematic view.
5. A properties window is displayed for the new direction constraint (with the title **scene_root:bou_cam: direction cns**). Change the **Align Axis** section to: X=0, Y=1, Z=0 and

make sure the **Active** check box is selected. Ignore the **Up Vector** tab.

The camera should now roll correctly.

Exporting boujou 4.1 Data into Other Formats

boujou 4.1's camera animation data and 2D track data can be exported in several other formats. Camera animation can be exported in the widely used FBX format, and can also be used to drive motion control rigs. The raw 2D tracks and the 3D predictions can be exported as 2D tracking data to compositing packages or as a simple text file:

- *Exporting boujou 4.1 Camera-tracking Data in FBX Format*
- *Exporting boujou 4.1 Tracks in Shake Format* on page 5-17
- *Exporting boujou 4.1 Tracks in ASCII or boujou Animation File Format* on page 5-20
- *Exporting the Camera to Mark Roberts Motion Control Rig* on page 5-20
- *Exporting boujou 4.1 Tracks to Mistika DVE* on page 5-21

Exporting boujou 4.1 Camera-tracking Data in FBX Format

boujou 4.1 can export its camera tracking data in the Autodesk FBX format. The FBX format can read by Maya, LightWave, 3DS Max, XSI and Cinema4D.

Warning

The FBX export is currently only available for Windows and Linux.

Exporting boujou 4.1 Tracks in Shake Format

boujou 4.1 can export its raw feature tracks and its 3D predictions as 2D tracks in a format that Shake can understand. Exporting 3D predictions as 2D tracks has the benefit of giving you tracks that last for the entire length of the sequence, even if the original feature is hidden behind another object or goes out of shot.

You configure the way boujou exports its tracks to Shake in the **Export Tracks to Shake** dialog box, shown in Figure 5-3.

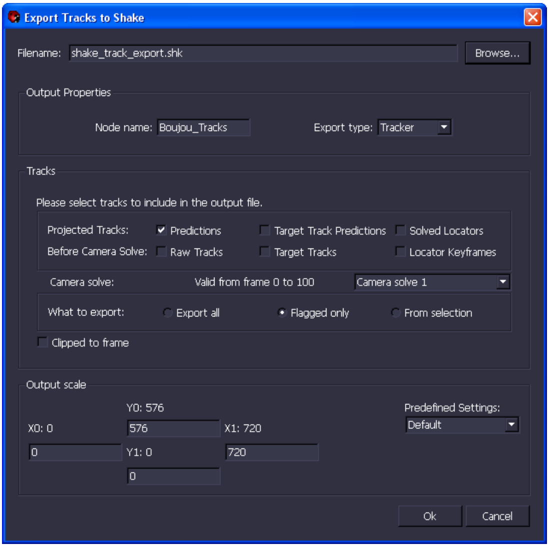


Figure 5-3: Export Tracks to Shake dialog box

To export boujou 4.1 tracks in the Shake format:

1. Open the **Export Tracks to Shake** dialog box in either of the following ways:

   - **Toolbox:** Export to Shake shortcut button 

   - **Menu bar:** Export > Export Tracks to Shake

2. In the **Filename** field enter a name for the exported file.

3. In the **Output Properties** section edit the name of the node in the **Node name** field if required (default is *boujou 4.1_Tracks*).

4. Choose the type of node that you want to export from the **Export type** drop down list. You can export as a **Tracker** node, a **MatchMove** node, a **Stabilize** node, a **Corner Pin** node, or as **raw data**. If you choose **MatchMove**, **Stabilize**,

or **Corner Pin**, you need to select the required number of tracks to create these nodes.

If you choose raw data, the tracks are exported as a file per track with the X and Y values also in separate files. The files are named:

name_auto_###_x.txt

name_auto_###_y.txt

Each file contains a column of frame numbers and a column of X or Y values.

5. In the **Tracks** section choose the sort of track that you want to export. **Projected tracks** are created after camera solving and exist on every frame of the sequence. Before camera solving you can only export tracks for visible features.
6. If your camera track has resulted in multiple camera solutions, you can choose which solution you want to export projected for by using the **Camera Track** drop down list.
7. The **What to Export** options allow you to either **export all** the tracks of the chosen type in the scene, just the tracks that you have **flagged** for export, or just the tracks from the current **selection**. Because boujou 4.1 can create thousands of feature tracks and 3D prediction points it is a good idea to only export the tracks that you really need using on the last two options.
8. Checking the **Clipped to Frame** box cuts each track as it leaves the frame.
9. **Output scale** allows you to set the origin, change the units or scale the exported tracks. This is useful if, for example, you have tracked half-resolution images in boujou 4.1 and want to use them with the full-resolution image sequence. There are several presets available from the drop down list: **Default**, **x2**, **x4**, **Half Size**, **Quarter Size**, **Top-Left**, **Bottom-Left**, **Normalized [0,1]**, or **Center Origin [-1,1]**.

If you have chosen to export the tracks as **raw data**, they can be loaded into any Shake text field as a raw expression.

To load boujou 4.1 tracks into Shake:

1. Right-click a **Parameter** (over the text box and not the parameter name).
2. Select **Load Expression**.
3. Set **exprFormat** to **Raw**.
4. Select the boujou 4.1 track file and select **OK**.

Exporting boujou 4.1 Tracks in ASCII or boujou Animation File Format

boujou 4.1 can also export its tracking data as an ASCII text file (**.txt*) and a boujou animation file (**.ban*). These formats contain the camera motion and the 3D scene points. The **.txt* file uses a camera rotation matrix and the **.ban* file uses a camera projection matrix. There are a number of options that can be set for these exports under **Edit > Preferences > Camera Export** (for details, see *Appendix B boujou 4.1 Preferences*).

Important

boujou 4.1's **.txt* and **.ban* formats use a Y-up, right-handed coordinate system

Please refer to the comments within the files themselves for further information, or contact 2d3 directly at *2d3support@2d3.com*.

The **.txt* format can be used for exporting to Cinema 4D and the **.ban* format can be used for exporting to After Effects.

Exporting the Camera to Mark Roberts Motion Control Rig

boujou 4.1 creates a Flair file *(*.mrmc)* that can be used to drive Mark Roberts motion control rigs. Use the Z-up, X-forward user preference when exporting Flair files.

Important

The Flair format uses a Z-up, right-handed coordinate system.

Warning

The data exported to the Flair format by boujou 4.1 has not been validated in any way. It is the user's responsibility to satisfy themselves that it is safe to use this data to drive a motion control rig.

Exporting boujou 4.1 Tracks to Mistika DVE

boujou 4.1 can export its camera tracking data to SGO's Mistika compositing system using the **.fx* format. Only the **Moving camera, static scene** Move Type is supported.

A boujou 4.1 Keyboard Shortcuts

The following sections in this appendix describe the keyboard keys, keyboard shortcuts, and keyboard and mouse combinations you use to perform the specified action within the given functional area of boujou 4.1:

- *2D Tasks Keyboard Shortcuts* on page A-2
- *3D Tasks Keyboard Shortcuts* on page A-3
- *Edit Keyboard Shortcuts* on page A-3
- *Export Keyboard Shortcuts* on page A-4
- *File Keyboard Shortcuts* on page A-4
- *Image Window Keyboard Shortcuts* on page A-5
- *Play Controls Keyboard Shortcuts* on page A-7
- *Scripts Keyboard Shortcuts* on page A-8
- *Setup Keyboard Shortcuts* on page A-8

To use a keyboard shortcut, hold down the first key and then press the second and any subsequent keys. To use a keyboard and mouse combination, hold down the key while performing the mouse action, then release the key and the mouse button.

Tip

Middle wheel button on mouse: Where this appendix lists a keyboard shortcut using MIDDLE, you can use the middle wheel button if your mouse has this button and you have set the **Middle mouse button for navigation** option in the **Preferences** dialog box (for details, see *Appendix B boujou 4.1 Preferences*). If your mouse does not have this button or you choose not to set the option, hold down both the left and right mouse buttons.

Apple users: Where this appendix lists a keyboard shortcut using a function key (F1–F12), if you are using an Apple Mac keyboard, hold down the Command (or Apple) key ⌘ and then press the specified function key.

2D Tasks Keyboard Shortcuts

Table A-1 describes the keyboard keys, keyboard shortcuts, and keyboard and mouse combinations you use to perform tasks with 2D data in boujou 4.1.

Table A-1: Keyboard shortcuts—2D Tasks

Shortcut	Function	Notes
F8	Track Features and Solve Camera	See Apple users' Tip on page A-1.
F9	Track Features	See Apple users' Tip on page A-1.
CTRL + A	Target Tracks dialog box	
CTRL + D	Edit Named Tracks	
CTRL + H	Import Image-Based Mask	
CTRL + J	Join Tracks	
CTRL + L	Edit Locators	
CTRL + M	Edit Polygon-based Masks	
CTRL +RETURN	Show Properties Dialog Box for Selected Artifact	
CTRL + LEFT	Move mask pivot	When in Edit Mask mode
CTRL + SHIFT + LEFT	Add point to mask	
CTRL + SHIFT + LEFT	Reset mask pivot	When in Edit Mask mode

3D Tasks Keyboard Shortcuts

Table A-2 describes the keyboard key and keyboard shortcuts you use to perform tasks with 3D data in boujou 4.1.

Table A-2: Keyboard shortcuts—3D Tasks

Shortcut	Function	Notes
F10	Solve Camera	See Apple users' Tip on page A-1.
CTRL + G	Add/Edit Scene Geometry	
CTRL + T	Add/Edit Test Objects	
CTRL + SHIFT + M	Move to Point	Select test object and point first.
CTRL + SHIFT + O	Orient to Plane	Select test object and points first.
CTRL + SHIFT + R	Rotate Manipulator	Toggle on/off
CTRL + SHIFT + S	Scale Manipulator	Toggle on/off
CTRL + SHIFT + T	Translate Manipulator	Toggle on/off

Edit Keyboard Shortcuts

Table A-3 describes the keyboard key and keyboard shortcuts you use to edit data in boujou 4.1.

Table A-3: Keyboard shortcuts—Edit

Shortcut	Function	Notes
CTRL + C	Edit Copy	
CTRL + V	Edit Paste	
CTRL + X	Edit Cut Exit	
CTRL + Y	Redo	
CTRL + Z	Undo	
DELETE	Delete	

Export Keyboard Shortcuts

Table A-4 describes the keyboard keys you use to export data from boujou 4.1.

Table A-4: Keyboard shortcuts—Export

Shortcut	Function	Notes
F11	Export Image Sequence	See Apple users' Tip on page A-1.
F12	Export Camera Solve	See Apple users' Tip on page A-1.

File Keyboard Shortcuts

Table A-5 describes the keyboard shortcuts you use to manage image and project files in boujou 4.1.

Table A-5: Keyboard shortcuts—File

Shortcut	Function	Notes
CTRL + N	File New	
CTRL + O	File Open	
CTRL + S	File Save	

Image Window Keyboard Shortcuts

Table A-6 describes the keyboard keys, keyboard shortcuts, and keyboard and mouse combinations you use to manipulate data in the boujou 4.1 Image window.

Table A-6: Keyboard shortcuts—Image window

Shortcut	Function	Notes
F	Center View on Selection	
F3	Toggle 3D Mode	See Apple users' Tip on page A-1
F5	Default View	See Apple users' Tip on page A-1
DOWN ARROW	Zoom Out	
UP ARROW	Zoom In	
CTRL + 0	Toggle Ground Plane Overlay	
CTRL + 1	Toggle Image Overlay	
CTRL + 2	Toggle Mask Overlay	2D view only
CTRL + 3	Toggle Radial Overlay	2D view only
CTRL + 4	Toggle Tracks Overlay	2D view only
CTRL + 5	Toggle Predictions Overlay	
CTRL + 6	Toggle Errors Overlay	2D view only
CTRL + 7	Toggle Locators Overlay	
CTRL + 8	Toggle Target Tracks Overlay	
CTRL + 9	Toggle Test Objects Overlay	
CTRL + SHIFT + LEFT or SHIFT + ⌘ + LEFT	Roll View	3D mode view

Table A-6: Keyboard shortcuts—Image window

Shortcut	Function	Notes
SHIFT + LEFT	Shuttle View	2D mode view
	Rotate View	3D mode view
SHIFT + MIDDLE	Translate View	2D mode view
	Translate View	3D mode view
		See Middle mouse button Tip on page A-1.
SHIFT + MIDDLE	Translate view	2D mode view
	Translate view	3D mode view
		See Middle mouse button Tip on page A-1.
SHIFT + RIGHT	Zoom View	2D mode view
	Dolly View	3D mode view

Play Controls Keyboard Shortcuts

Table A-7 describes the keyboard keys and keyboard shortcuts you use to play back data in boujou 4.1.

Table A-7: Keyboard shortcuts—Play Controls

Shortcut	Function	Notes
F1	Help	
F6	Lock Play to Single Selected Point	See Apple users Tip on page A-1.
END	Go to End	
HOME	Go to Start	
LEFT ARROW	Step backward	
RIGHT ARROW	Step forward	
ALT + LEFT ARROW	Play backward	
ALT + RIGHT ARROW	Play forward	
CTRL + LEFT ARROW	Previous Solved Frame	
CTRL + RIGHT ARROW	Next Solved Frame	
SHIFT + LEFT ARROW	Previous Key	
SHIFT + RIGHT ARROW	Next Key	
PAGE DOWN	Jump backward (10 frames)	
PAGE UP	Jump forward (10 frames)	
SPACE BAR	Toggle Play	

Scripts Keyboard Shortcuts

Table A-8 describes the keyboard shortcuts you use to work with embedded scripting in boujou 4.1. The META key is defined in the embedded script. For details, see *Chapter 4 Advanced Functions*.

Table A-8: Keyboard shortcuts—Scripts

Shortcut	Function	Notes
META + A	Toggle Lasso Mode	
META + E	Export meshes to Maya	
META + Q	Previous Keyframe	
META + T	Toggle Edit Track Mode	
META + W	Next Keyframe	

Setup Keyboard Shortcuts

Table A-9 describes the keyboard shortcuts you use to set up cameras in boujou 4.1.

Table A-9: Keyboard shortcuts—Setup

Shortcut	Function	Notes
CTRL + I	Import Image Sequence	
CTRL + E	Edit Camera	
CTRL + F	Edit Focal Constraints	
CTRL + R	Edit Calibration Lines	

boujou 4.1 Preferences B

This appendix lists and describes the interface and tool settings you can customize in the **Preferences** dialog box. For details on setting user preferences, see *Chapter 4 Advanced Functions*.

The following sections describe the settings you can configure in the specified section of the **Preferences** dialog box:

2D Display Preferences

Table B-1 describes the preferences you can set to control the appearance of the 2D Mode view in the Image window.

Table B-1: 2D Display Preferences

Preference	Function
Background Color	Sets the background color. Default: charcoal gray
Calibration Line Color	Sets the color of the calibration lines. Default: cyan
Circle tessellation for predictions	Sets the number of sides for the 2D polygon shape when the **Predictions as circles** option is set to **Yes**. Default: 5
Default Image Viewsize	**Fit to Window** Scales the image viewsize to fit the workspace window. **Actual Size** Displays the images at actual size, regardless of the size of the workspace window.
Error Color	Sets the color of the error vectors. Default: magenta
Feature Color	Sets the feature color. Default: red
Grid Major Color	Sets the color for major grid divisions. Default: white
Grid Minor Color	Sets the color for minor group divisions. Default: gray
Inlying Feature Color	Sets the color of the inlying features. Default: red
Inlying Track Color	Sets the color of the inlying tracks. Default: cyan
Locator Feature Color	Sets the color for locator/feature cross display. Default: cyan

Table B-1: 2D Display Preferences

Preference	Function
Locator Feature Connected Color	Sets the color for locators which have been connected to survey points. Default: orange
Locator Feature Connected Selected Color	Sets the color for selected locators when connected to survey points. Default: green
Locator Feature Selected Color	Sets the color for selected locator cross display. Default: green
Mask Color	Sets the fill color of polygon and image-based masks. Default: green
Mask Opacity	Sets the opacity of the mask Default: 50%
Polygon Color	Sets the color of the polygon mask outline. Default: light yellow
Prediction OFF Color	Sets the color of the non-live predictions. Default: cyan
Prediction ON Color	Sets the color of the live predictions. Default: yellow
Prediction Size	Sets the size of the prediction dot. Default: 5.0 units
Predictions as circles	Whether or not to draw predictions as 2D polygon shapes Default: No
Track Anti-aliasing	Whether or not to have tracks displayed with anti-aliasing for a smoother appearance. This can help in determining the steadiness of a given track. Default: Yes
Track Color	Sets the color of the feature tracks. Default: yellow

3D Display Preferences

Table B-2 describes the preferences you can set to control the appearance of the 3D Mode view in the Image window.

Table B-2: 3D Display Preferences

Preference	Function
Active camera color	Sets the color of the camera frustum on the current frame. Default: yellow
Background Color	Sets the background color. Default: charcoal gray
Camera color	Sets the color of the camera position and path display. Default: red
Grid Extent	The size of the grid displayed in the 3D view and the ground plane in the 2D view. Defined as the number of divisions in one quarter of the grid when **Grid Subdivision Size** is set to 1.
Grid Major Color	Sets the color for major grid divisions. Default: white
Grid Minor Color	Sets the color for minor group divisions. Default: gray
Grid Subdivision Size	The size of each subdivision of the grid displayed in the 3D view and the ground plane in the 2D view.
Prediction OFF Color	Sets the color of the predictions which fall outside the camera frustum on the current frame. Default: cyan
Prediction ON Color	Sets the color of the predictions which fall inside the camera frustum on the current frame. Default: yellow
Prediction Size	Sets the size of the prediction dot. Default: 5.0 units

Table B-2: 3D Display Preferences

Preference	Function
Predictions as spheres	Draws the predictions as 3D polygonal spheres. Default: No
Preferred Camera Orientation	**Y-Up Z-back** Camera orientation for Y-up coordinate systems, e.g. Maya, LightWave, XSI. **Z-up Y-forward** Camera orientation for Z-up coordinate systems, e.g. 3D Studio Max. **Z-up X-forward** Camera orientation for Mark Roberts Motion Control Rig. Default: Y-Up Z-back
Show color axes	Display the coordinate system axes on the floor grid (X red, Y green, Z blue). Default: No
Sphere tessellation for predictions	Sets the polygon tessellation when the **Predictions as Spheres** option is used. Default: 5
Wireframe Color	Sets the unselected color of the test object when the **Draw Style** is set to **Wireframe**. Default: gray

Camera Export Preferences

Table B-3 describes the preferences you can set to control the export of camera data from boujou 4.1 for use in third-party animation packages.

Table B-3: Camera Export Preferences

Preference	Function
3DS Max	Sets options for exporting cameras to 3D Studio Max: **Export points as spheres** Predictions are created as spheres in 3D Studio Max. Default: No
boujou 4.1 Animation	**Camera format** Writes the camera animation in the **.ban* file in one of three formats: • 3x4 Projection Matrices • Calibration, Rotation, Translation • Both Formats for Each Key Default: 3x4 Projection Matrices
Cineon	Sets options for exporting cameras to Cineon: **Three planes per point** Displays points as three perpendicular patches. Default: No
General	**Default Start Frame Index:** • **Use sequence 'number from' value** boujou 4.1 uses the Number From value in the Import Seq**uence** dialog box as the first frame index number. This is the default. Sets general options for exporting cameras: **Default Format** Sets the default format when exporting to a 3D

Table B-3: Camera Export Preferences

Preference	Function
General (cont.)	animation package. Default: boujou 4.1 Animation **Default Scale** Sets the default scene scale when exporting to a 3D animation package. Default: 1.0 • **Use first frame number of image sequence** boujou 4.1 uses the frame number of the first frame of the image sequence as the first frame index number. • **Use default for export format** This is always zero (unless a built-in value). **Show Camera Export Reminders** Displays reminders relating to the export format that you have selected, such as setting the correct timeline frame rate or aperture width. Default: Yes
Houdini	Sets options for exporting cameras to Houdini: **Compound Points** Creates the 3D scene points as individual nulls or as a single object in Houdini. Default: Yes
Lightwave	Sets options for exporting cameras to Lightwave: **Export points as spheres** Creates predictions as spheres in Lightwave. Default: No
Maya	Sets options for exporting cameras to Maya: **Units of Length** Choose the preferred measurement units from mm, cm, m, ins, yds.

Table B-3: Camera Export Preferences

Preference	Function
Text	Sets options for exporting cameras to txt: **Camera Rotation Format** Sets the format of the camera rotations in the **.txt* export: • 3x3 rotation matrix • Static Axis Euler Angles • Moving Axis Euler Angles Default: 3x3 rotation matrix

Dialog Preferences

Table B-4 describes the preferences you can set to control how some boujou 4.1 information and warning messages are displayed.

Table B-4: Dialog Preferences

Preference	Function
Show Radial Change Warning	Whether or not to display the warning message alerting users that changing radial distortion values after solving or initializing cameras will affect existing solves. Default: Yes
Show Re-feature Track Warning	Whether or not to display the warning message alerting users that feature tracking more than once with an existing solve will remove predictions associated with deleted tracks. For details, see *Tracking Features* section in *Chapter 3 Basic Functions*. Default: Yes

Directories Preferences

Table B-5 describes the preferences you can set to control where boujou 4.1 stores data on your computer.

Table B-5: Directories Preferences

Preference	Function
Auto-save Files	Sets the default directory for saving autosaved projects. Default: A temporary directory for the operating system: • Windows: *C:\Documents and Settings\<Username>\Local Settings\Temp* • OS X: */private/tmp* • Linux: */tmp*
Equivalent Directories 1, 2, 3	Enables you to set up groups of directory paths. If boujou 4.1 cannot find the files that it is looking for in the original directory path, it searches through all of the directory paths in the Equivalent Directories group. You can set up three groups of Equivalent Directories and there is no limit to the number of directory paths that you can include in each group. Spaces are used as delimiters and the directory paths are case sensitive.
Help Directory	Sets the default directory for the boujou 4.1 help files. Default: The documentation installation directory for the operating system: • Windows: *<installation_directory>/docs/pdf* • OS X: */Library/Documentation* • Linux: *<installation_directory>/doc/pdf*
Images	Sets the default directory for loading and saving images. Default: The last used directory
Masks	Sets the default directory for loading image-based masks. Default: The last used directory

Table B-5: Directories Preferences

Preference	Function
Project Files	Sets the default directory for loading and saving project files. Default: The last used directory
Scripts Directory	Sets the default directory in which boujou 4.1 looks for lua scripts. Default: ./scripts

Display Preferences

Table B-6 describes the preferences you can set to control the appearance of the 3D object models and survey points in the Image window.

Table B-6: Display Preferences

Preference	Function
Model Vertex Size	Adjusts the display size for vertices of imported models Default: 0.5.
Model Wireframe Selected Color	Sets the color for the wireframe display of imported models when selected. Default: green
Survey Point Color	Sets the color of survey points (model vertices). Default: yellow
Survey Point Connected Color	Sets the color of survey points (model vertices) when connected to locators/target tracks Default: orange
Survey Point Connected Selected Color	Sets the color of selected survey points (model vertices) when connected to locators/target tracks. Default: orange

Table B-6: Display Preferences

Preference	Function
Survey Point Selected Color	Sets the color of selected survey points (model vertices). Default: green

Graph Display Preferences

Table B-7 describes the preferences you can set to control the appearance of the Graph Mode view in the Image window.

Table B-7: Graph Display Preferences

Preference	Function
Background Color	Sets the background color for the graph display. Default: charcoal gray

Image Formats Preferences

Table B-8 describes the preferences you can set to control how 16-bit images are converted by boujou 4.1 on import.

Important

These settings can affect feature tracking.

Table B-8: Image Formats Preferences

Preference	Function
Cineon Parameters	Sets options for Cineon and DPX formats: • **Density delta** - Default 0.002 • **Density delta (16 bits)** - Default 0.00003 • **Film gamma** - Default 0.6 • **Mid-gray code** - Default 445 • **Mid-gray code (16bits)** - Default 28480

Import Preferences

Table B-9 describes the preferences you can set to control the way third-party image data is imported into boujou 4.1.

Table B-9: Import Preferences

Preference	Function
Detect alpha channel to use as mask	Enables or disables alpha channel detection in imported image sequences. Default: Yes
Image Preview	Enables or disables the image preview in the **Import Sequence** dialog box (you may want to disable the preview if you are loading large images over a network). Default: Yes
Preset Camera File Location	Sets the default directory for the *preset_cameras.bpc* file. If no location is specified, boujou 4.1 uses its internal presets (default).

Miscellaneous Preferences

Table B-10 describes the preferences you can set to control the general appearance and operation of the boujou 4.1 user interface.

Table B-10: Miscellaneous Preferences

Preference	Function
Auto save period (minutes)	Specifies the number of minutes before the project is automatically saved. Setting this to a value of 0 (zero) turns the auto save feature off. Default: 215

Table B-10: Miscellaneous Preferences

Preference	Function
boujou GUI style	Specifies the look and feel of the boujou 4.1 user interface (UI): • **None:** Plain gray UI scheme. • **boujou3:** Dark gray UI scheme used in boujou 3. • **boujou4:** Charcoal gray UI scheme used in boujou 4. • **bulletSD:** UI scheme used in boujou bullet SD. • **SilverBullet:** UI scheme used in boujou silver bullet • **Nexus:** UI scheme used in Vicon Nexus. Default: boujou4
Console Prompt	Specifies the font for the text in the Console pane prompt using basic HTML tagging. Default: <B>2d</ font>3</B> $ that is, 
Font size	Sets the default font size for text that appears on the screen. Default: 9 point
Help Reader	Sets the location of the preferred PDF reader for viewing the documentation PDF files. If nothing is specified, the default PDF reader is used.
Middle mouse button for navigation	Enables you to use the middle mouse button for some of the workspace navigation controls. Default: No
MRU Items	Sets the number of most recently used items shown in **File > Open**. Default: 4

Table B-10: Miscellaneous Preferences

Preference	Function
Script separate history items	Creates a separate entry in the history list for each command within an embedded lua script. Default: No
Total physical memory (MB)	Specifies the amount of RAM available on your computer if it is not correctly determined by boujou 4.1 (sometimes a problem on Macs with 2GB or more). Default: 0 (boujou 4.1 uses the value that it has found from the operating system)
Use Hardware OpenGL	Controls whether the hardware OpenGL is used. If you have a graphics card that supports OpenGL, you can set this option to make the boujou 4.1 interface more responsive. Default: Yes. You need to close boujou 4.1 and restart it for the hardware OpenGL to be used.
Use Version 1.0 bpj File Format	Save projects using the old *.bpj* format. Default: Yes

Target Tracking Preferences

Table B-11 describes the preferences you can set to control the target tracking process.

Table B-11: Target Tracking Preferences

Preference	Function
Auto clear	Sets whether adding a keyframe to a tracked range deletes the tracking for that range. If you want to keep the tracking, set this option to No. Default: Yes
Comparison region size	Sets the size of the comparison region used for target tracking. Default: 11

Table B-11: Target Tracking Preferences

Preference	Function
Good track threshold	Sets the tracking score above which a tracked frame is considered good. Default: 0.9
OK track threshold	Sets the tracking score above which a tracked frame is considered OK. Default: 0.7
Search window size	Sets the size of the search window used for target tracking. Default: 21

Tracking Preferences

Table B-12 describes the preferences you can set to control the camera solve and feature tracking processes.

Table B-12: Tracking Preferences

Preference	Function
Auto-save project after camera solve	Enables or disables the autosave after camera solving. Default: Yes
Auto-save project after feature tracking	Enables or disables the autosave after feature tracking. Default: Yes
Auto-track camera after feature tracking	Enables or disables auto-track camera after feature tracking. Default: No
Clear Cache before camera solve	Clears the cache before camera solving. Default: Yes
Clear Cache before feature tracking	Clears the cache before feature tracking. Default: Yes

Table B-12: Tracking Preferences

Preference	Function
Feature tracking default parameters	Sets the defaults for the feature tracking parameters found in the **Advanced Properties** section of the **Feature Tracking** dialog box: • **Large feature scale** Sets the feature scale parameter to large features. Default: No • **Maximum search distance (%)** Sets the size of the maximum tracking search distance as a percentage. Default: 20 • **Minimum search distance (%)** Sets the size of the minimum tracking search distance as a percentage. Default: 1 • **Sensitivity** Sets the default tracking sensitivity level. Default: 3 • **Use blue channel** Enables or disables the use of the image sequence blue channel for feature tracking. Default: Yes • **Use fast tracker** Enables or disables the Fast Tracking feature. Default: No • **Use green channel** Enables or disables the use of the image sequence green channel for feature tracking. Default: Yes • **Use red channel** Enables or disables the use of the image sequence red channel for feature tracking. Default: Yes

Lens Squeeze Ratio

boujou 4.1 automatically creates a camera with the appropriate settings when you import an image sequence. You configure the way boujou 4.1 does this by specifying the camera type that was used to capture your footage in the **Cameras** dialog box (for details see *Chapter 3 Basic Functions*).

boujou 4.1 usually handles anamorphic footage by reducing the film back height to compensate for the increased pixel aspect ratio. This is adequate in a majority of cases, especially for DV cameras that achieve widescreen aspect ratio by masking the top and bottom of the CCD array. However, the incorrect vertical field of view can sometimes make CG objects look wrong when using film resolution footage. You can corrects for this by setting an appropriate value in the **Lens Squeeze Ratio** option in the **Cameras** dialog box. This option separates the anamorphic squeeze from the pixel aspect ratio, allowing you to keep the correct vertical field of view in your effects shot.

Caution

Not all 3D animation packages support lens squeeze. Please check before you decide to use the lens squeeze ratio.

The following examples show how you determine the appropriate value to set in the **Lens Squeeze Ratio** option in the **Cameras** dialog box to correct for an anamorphic shot:

- *Lens Squeeze Ratio Example 1* on page C-2
- *Lens Squeeze Ratio Example 2* on page C-3

Lens Squeeze Ratio Example 1

If you import a 2048x1556 image sequence, boujou 4.1 suggests a **35mm Full Aperture** camera type. The settings for this type are:

```
Film Back Width = 0.98"; Film Back Height = 0.7446"
Pixel Aspect Ratio = 1; Lens Squeeze = 1.0
```

However, if this were an **anamorphic** shot with a **lens squeeze** of 2, we would change the pixel aspect ratio to 2. This results in film back values of:

```
Film Back Width = 0.98"; Film Back Height = 0.3722"
```

The height value has been reduced to give the required pixel aspect ratio value (filmback and pixel aspect ratio are linked in the **Cameras** dialog), and that's not what happens in real life. If the **Lens Squeeze Ratio** is set to 2 and the pixel aspect ratio to 2, the filmback values stay unchanged (0.98" x 0.7446"). This represents the effect of attaching an anamorphic lens onto a normal 35mm camera—the size of the gate doesn't change, just the lens.

As far as boujou 4.1 is concerned, it is the value of pixel aspect ratio that is important for an accurate solve. The lens squeeze value makes sure that the filmback size stays how it should.

Once you've decided what the values of film back, lens squeeze, and pixel aspect ratio should be, you can add a line to your *preset_cameras.bpc* file (for details on specifying the location for this image formats file, see Table B-8 on page B-11). For example:

```
NewPresetCamera { Name “35mm Full Aperture Anamorphic
(2048)” Width 2048 Height 1556 FilmWidthMM 24.892
FilmHeightMM 18.9121 LensSqueeze 2 PixelAspect 2
FocalMM 50 LensDistortion 0 Principal_X 50
Principal_Y 50 TypeFocal Constant }
```

Lens Squeeze Ratio Example 2

If you import a 720x576 image sequence, boujou 4.1 suggests a **D1 PAL** camera type. The setting for D1 PAL (4:3 image aspect ratio) are:

```
Film Back Width = 20.12mm; Film Back Height = 15.09mm
Pixel Aspect Ratio = 1.0667; ; Lens Squeeze = 1.0
```

However, 720x576 images could also be **PAL Widescreen** (16:9 image aspect ratio). If you select this preset, you get the following settings:

```
Film Back Width = 20.12mm; Film Back Height = 11.318mm
Pixel Aspect Ratio = 1.4222; Lens Squeeze = 1.0
```

If your camera masks the top and bottom of the sensor to get a 16:9 aspect ratio, these settings will be correct. However, if an additional lens has been added in order to provide a horizontal squeeze, the vertical field of view will be wrong. If this is the case, you will need to use the following settings:

```
Film Back Width = 20.12mm; Film Back Height = 11.318mm
Pixel Aspect Ratio = 1.4222; Lens Squeeze = 1.3333
```

boujou_script File Commands D

This appendix illustrated how to write a boujou_script file and lists and describes the available boujou_script commands. For details on writing and running boujou_script files, see
Chapter 4 Advanced Functions.

Example boujou_script File

```
#
# boujou script file for loading image sequences, feature
tracking and camera solving
#
BoujouScriptFile    { }
SetLog          { File "F:\2d3\Training\boujou_script\log.htm" }
AddCamera           { PreSet "D1 NTSC" Name camera-0 }
AddImset            { Name imset-0
                      Camera camera-0
                      File
"F:\2d3\Training\boujou_script\fish_interlaced\fish_interlaced
.###.sgi"
                      Start   001
                      Step    001
                      End     030
                      FrameRate  29.97
                      Offset 001
                      Interlace InterlaceFieldsEvenFirst }
Save                { File
"F:\2d3\Training\boujou_script\fish_interlaced-0.bpj" }
Ftrack              { }
Save                { File
"F:\2d3\Training\boujou_script\fish_interlaced-f.bpj" }
Ctrack              { }
Save                { File
"F:\2d3\Training\boujou_script\fish_interlaced-c.bpj" }
SetExportOptions    { FlaggedOnly       False
                      NullSize          2
                      FirstFrame        001
                      LastFrame         030
```

```
                      FrameStep         001
                      FirstFrameIndex   1
                      ExportScale       5
                      Type              Moving
                      UseFormatDefault  False  }
ExportCameraTrack   { Format "Maya 4"
                      File
"F:\2d3\Training\boujou_script\fish_interlaced.ma" }
#
# start a new job
#
Clear               { }
#
AddCamera           { PreSet "PAL" Name camera-0 }
EditCamera          { Name camera-0  TypeFocal Variable }
AddImset            { Name imset-0
                      Camera camera-0
                      File
"F:\2d3\Training\boujou_script\manor_pan_zoom\manor_pan_zoom.#
##.tif"
                      Move MoveNodal
                      Start  000
                      Step   001
                      End    050
                      FrameRate 25
                      Interlace InterlaceNone }
Save                { File
"F:\2d3\Training\boujou_script\manor_pan_zoom-0.bpj" }
Ftrack              { }
Save                { File
"F:\2d3\Training\boujou_script\manor_pan_zoom-f.bpj" }
Ctrack              { }
Save                { File
"F:\2d3\Training\boujou_script\manor_pan_zoom-c.bpj" }
ExportCameraTrack   { Format "Flame (v7.0)"   File
"F:\2d3\Training\boujou_script\manor_pan_zoom.action"  }
#
Clear               { }
#
# load a pre-saved project, track it and export the results to
3DS Max
```

```
#
Load          { File "F:\2d3\Training\boujou_script\market.bpj"
}
Ftrack                { }
Save              { File "F:\2d3\Training\boujou_script\market-
f.bpj" }
Ctrack                { }
Save              { File "F:\2d3\Training\boujou_script\market-
c.bpj" }
ExportCameraTrack   { Format "3D Studio Max"   File
"F:\2d3\Training\boujou_script\market.ms" }
#
# preferences
#
ExportPreferences { File
"F:\2d3\Training\boujou_script\prefs.bpf" }
```

boujou_script Commands

Table D-1 lists and describes the commands you can specify in a boujou_script command line.

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
AddCamera { }					
				Add a camera to the project	
	Name	Yes		Name of camera (camera-0 for default)	
	Preset			Set Camera values from the preset values	see elsewhere
	Type	If no preset		The camera type	see elsewhere
	Width	If no preset		Width of image in pixels, must agree with images	
	Height	If no preset		Height of image in pixels, must agree with images	
	FilmWidthMM	If no preset		Width of film back in mm	
	FilmHeightMM	If no preset		Height of film back in mm	
	PixelAspect	If no preset		Pixel aspect Ratio	
	FocalMM	If no preset		Focal length in MM	
	TypeFocal	Constant			
	LensDistortion		0	Lens Distortion	

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
	Principal_X		50	X coordinate of principal point	
	Principal_Y		50	Y coordinate of principal point	
AddFocalLength{}					
				Add focal length data to the sequence	
	Name	Yes		Name of the focal length artifact	
	Keyframes	Yes		List of focal length keyframes	0 - nframes
	KeyframeTypes	Yes		Type of focal length in each of the keyframes	APPROXIMATE EXACT
	KeyframeValues	Yes		Value of focal length in each keyframe in mm.	
	Ranges	Yes		Data type of the focal length in each range	CONSTANT VARIABLE
AddImset { }					
				Add an image sequence to the project	
	Name	Yes		Set name of image sequence	

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
	Camera	Yes		The name of the camera associated with sequence	
	File	Yes		Path and name of sequence files	
	Start		From File	Start frame deduced from file if not supplied	
	Step		1	Frame Step	
	End		From File	End frame deduced from file if not supplied	
	Interlace			Interlace options	InterlaceNone InterlaceInterpolate Replace Odd InterlaceInterpolate Replace Even InterlaceFieldsOdd First InterlaceFieldsEven First
	Move		MoveFree	Free move or Nodal Pan	MoveFree MoveNodal
	FrameRate		25		
	Offset		0		

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
AddMatte { }					
				Apply an image mask to the image sequence	
	Name	Yes		Name of mask	
	MaskType	Yes		Type of mask	Include White Include Black Exclude White Exclude Black
	File	Yes		Path and name of sequence files	
	Start		From File	Start frame, deduced from file if not supplied	
	Step		1	Frame step	
	End		From File	End frame, deduced from file if not supplied	

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
	Interlace			Interlace options	InterlaceNone InterlaceInterpolate Replace Odd InterlaceInterpolate Replace Even InterlaceFieldsOdd First InterlaceFieldsEven First
BoujouScriptFile{ }					
		Yes		File must begin with this command	
Clear {}					
				Clear the project space in order to start a new job	
Ctrack {}					
				Solve camera	
	Camera TrackingMode		Complete	Camera solving mode	Complete Reuse Adjust

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
	AdjustLevel			Adjust-only camera solving	Typical Thorough Exhaustive
EditCamera { }					
	TypeFocal			Set focal length to a type other than constant	Variable UserFixed
ExportCameraTrack { }					
				Export a camera file	
	File			Enter path and file name of exported file	
	Format			Enter name of format type	See elsewhere
ExportFeatureTracks { }					
				Export 2d tracks to file	
	File			Path and file name for exported file	
	OriginBottomLeft		TRUE	Origin position	TRUE/FALSE
	SeparateXYFiles		FALSE	Write X and Y ordinates in separate files	TRUE/FALSE
	SeparateTrackFiles		FALSE	Write one file per track	TRUE/FALSE
	ClipToFrame		FALSE	Ignore tracks once they have left the current frame	TRUE/FALSE

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
	FlaggedOnly		FALSE	Export flagged tracks only	TRUE/FALSE
	IncludeFeatures		TRUE	Include feature tracks	TRUE/FALSE
	IncludeLocatorInput		FALSE	Include locators on their keyframes only	TRUE/FALSE
	IncludeLocatorPredictions		FALSE	Include solved locators	TRUE/FALSE
	IncludeTargetTracks		FALSE	Include target tracks on keyframes only	TRUE/FALSE
	IncludeTTPredictions		FALSE	Include solved target tracks	TRUE/FALSE
	IncludePredictions		FALSE	Include 3D predictions as 2D tracks	TRUE/FALSE
ExportPreferences { }					
				Export the user preferences to a file	
				Enter path and file name of .bpf to be saved	
Ftrack { }					
	File			Track features (or load from file). Enter path and file name of 2d track file to be loaded	

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
	Deflicker		FALSE	Compensate for lighting variations during tracking	TRUE/FALSE
	Rolling		FALSE	Use this tracker if the camera rolls about its Z-axis	TRUE/FALSE
	SearchWindow		0.06	Value of search window	
	Method		Standard	Type of feature tracking	Standard Thorough
ImportPreferences { }					
				Import the user preferences from a file	
	File path			Enter path and file name of .bpf file to be loaded	
Load { }					
				Load a project file	
	File			Enter path and file name of project file to be loaded	
RedistortedMovie { }					
	Input	Yes		Enter the path and file name of the image sequence to re redistorted	

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
	Output	Yes		Enter the path and file name of the image sequence to which the redistorted sequence will be saved	
	Interlace		InterlaceNone	Specify the interlacing setting for the input sequence	InterlaceNone InterlaceInterpolate Replace Odd InterlaceInterpolate Replace Even InterlaceFieldsOdd First InterlaceFieldsEven First
	Start		1	First frame of the input sequence to redistort and export	
	Step		1	Frame step for the input sequence	
	End		Same as input sequence	Last frame of the input sequence to redistort and export	
	NumberStart		1	Number to assign to the first frame of the exported sequence	

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
	NumberStep		1	Frame step for the output sequence numbering	
	MovieType		Same as input sequence	Format of export sequence	AVI, MOV, JPEG, TIFF, PNG, PNM, SGI, SOFTIMAGE, CINEON, DPX, DPX16, TARGA, NULL
Save { }					
				Save a project file	
	File			Path and file name for saved project file	
SaveMovie { }					
	File			Enter path and file name of image sequence to export. Image format deduced from file extension.	
	Distortion			Add or remove lens distortion	Add Remove
	NumberStart			Start frame	
	NumberStop			End frame	

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
SavePresetCameras { }					
	File			Enter path and file name of .bpc to be saved	
SetExportOptions { }					
				Set some options relating to exporting camera solves	
	Flagged Only		FALSE		TRUE/FALSE
	NullSize		1	Override the default null size for that format	
	FirstFrame			First frame to export	
	LastFrame			Last frame to export	
	FrameStep			Frame step	
	FirstFrameIndex			First frame index, 0 vs 1	
	ExportScale		1	Scale factor applied to exported scene	
	Type		Moving	Export as moving camera static scene; static camera moving scene; panning camera translating scene	Moving Static Panning
	UseFormatDefault		TRUE		TRUE/FALSE

Table D-1: boujou_script Commands

Command	Arguments	Compulsory	Default	Description	Permitted Values
SetLog { }					
	File	Recommend-ed		Specify the log file, use as first command Name of script log file	

Using Survey Points without a 3D Model

E

boujou 4.1 allows you to use an imported OBJ model to represent survey data and to automatically determine where on the timeline locator or target track keyframes should be placed. Using a 3D model as survey data is the recommended method for using survey points (for details, see *Chapter 4 Advanced Functions*). However, if you only have a list of X,Y,Z values and no 3D model, then you can use survey points to improve the 3D structure of your solve by incorporating on-set measurements into the camera solve.

Important

You must feature track your shot before you start adding survey points.

Using Survey Points

Each survey point needs to be connected to a locator or a target track. The positions of the locator and target track keyframes are essential to getting a good result from the survey points feature. Each locator must have at least 2 keyframes and you should add the keyframes on the same image frames as other locator keyframes to create groups. Each group of keyframes must be connected to the next group by at least 10 automatic feature tracks. The minimum number of locators with keyframes in a group is either 4 or 7, depending on the camera tracking mode that you want to use (see below). All camera tracking modes need to have a keyframe group on the first and last frames of the sequence.

Important

If you only have survey data for a small area of the scene that you are trying to track, it is unlikely that you will get a good result using the survey points tool. Try to get measurements for points over a wide area of the scene.

Figure E-1 illustrates the layout of locator keyframes for a shot with known focal length where only three of the locators were in shot for the entire length of the sequence:

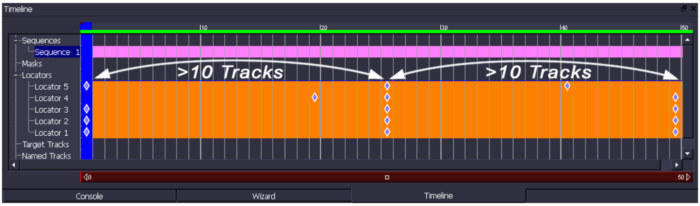


Figure E-1: Locator keyframes layout

You use the **Scene Geometry** dialog box, shown in Figure E-2, to add a survey point.

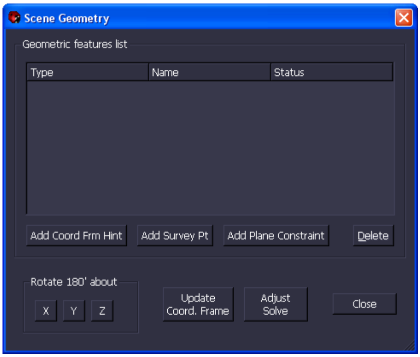
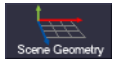


Figure E-2: Scene Geometry dialog box

You must first feature track your shot and add locators or target tracks to the features in the image that you have survey data for. Make sure that you have grouped the locator and target track keyframes as described above.

To add a survey point:

1. Open the **Scene Geometry** dialog box in any of the following ways:

   Toolbox: Scene Geometry shortcut button 

   Menu bar: Artifacts > Scene Geometry

   Keyboard shortcut: CTRL+G

2. Click the **Add Survey Point** button to create the first point. A new survey point appears in the **Geometric features list** at the top of the dialog box.

3. By default this survey point is named *Geometric feature 1*. You can rename it in the **Name** field in the **Survey Point Properties** section of the dialog box. After you finish typing press the TAB key to apply the new name and leave the field.

4. Enter the coordinates of the survey point in the **X**, **Y**, and **Z** fields.

5. Select the locator or target track that you want connect the survey point to and then click the **Connect to selected** button. In the **Geometric features list** the **Status** of the survey points changes from **Disconnected** to the point's coordinates and which locator it is connected to. For example: *(14.50, 100.50, 2.00) Locator 10*.

6. Keep adding survey points until you have entered all of your survey data. Any survey points that are not connected to locators are not discarded when you close the **Survey Points** dialog box. They are saved with the project and their status is displayed as disconnected whenever you open the **Scene Geometry** dialog box. Disconnected survey points have no effect on the camera track.

7. Once you have added all of the survey points that you need you can check that you have not incorrectly entered any of the measurements by going to the 3D view and selecting **Survey Data** from the **Solve** drop-down list in the top left corner of the Image window (this view appears by default in the 3D view if you don't already have a camera solve). Survey points that have been connected to locators are displayed in blue and

those that are unconnected are displayed in gray, as shown in Figure E-3.

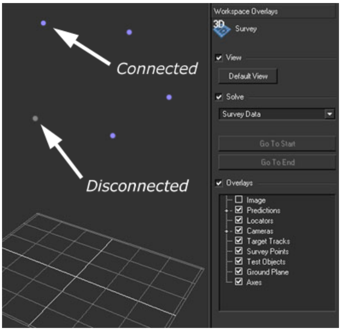


Figure E-3: Survey Data

When you have added and connected all of your survey points, you can solve the camera as usual. The hard constraints that you have set up are incorporated into the 3D structure.

Support Resources F

This appendix describes the resources available to you to obtain support for your use of boujou 4.1.

If you have a technical support query, go to the **Support** page on the 2d3 Web site:

www.2d3.com/php/support/login.php

In the **Find Solution** section, you can search through an extensive list of FAQs, or you can go to the **Log a Case** section to submit support requests to our team based in the UK. All users with an up-to-date support contract will have a log-in name and password for full access to the Web site. If you have not yet received your log-in details, please contact us at *2d3support@2d3.com*.

When reporting a bug, please try to supply as much of the following information as possible:

- Company name
- HASP licensing dongle number
- A description of the bug with steps to reproduce the problem
- boujou software version number
- Operating system
- Image size, format, and number of frames
- Example images or screen grabs

If you need help with a difficult shot, contact 2d3 Support, who can provide you with a link to our FTP site, where you can upload the files.

Documentation Feedback G

At 2d3, we are working to develop comprehensive and easy-to-use documentation to support your use of our products. We welcome your comments or suggestions on how we can continue to improve our product documentation.

Please provide your documentation feedback using our 2d3 Online Support System, at *http://www.2d3.com/php/support/login.php*. For details, see *Appendix F Support Resources*.

Please include “Documentation Feedback” in the Summary line and provide the following details in the body of your message:

- **Product details**
  - Product name, version number, and build number
- **Document details**
  - Document title and revision number or copyright date
  - Document type and content location:

Book	Chapter title, section title, and page number
Help	Topic title and section title

- **Problem description**
  - Brief description of current content, identifying your concerns (e.g. specify any factual inaccuracies, errors, or omissions; grammatical errors; navigation or information location problems)
- **Feedback details**
  - Your suggestions for correcting or improving the documentation

Customer Satisfaction Survey H

Please help us to improve our services by printing this page and sending your completed survey by fax or post to the 2d3 office. See the inside cover of this book for our contact details.

We value your honest opinion on the service you have received so far. We take your feedback into consideration when providing products and services in the future. If you have any questions or comments about this survey, please contact our Sales and Support Manager.

Contact Name	____________________	**Title**	____________
Organization	____________________	**Date**	____________

For each question, check the box that most closely describes your opinion. Leave any that are not applicable blank.

How satisfied are you with the quality of your boujou 4.1 software? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with the purchase experience of your boujou 4.1 software? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with the value of your boujou 4.1 software? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with the installation or your first usage of your boujou 4.1 software? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How often do you use your boujou 4.1 software? (1=Every day, 2= Every week, 3=Every 2-3 weeks, 4=Every month, 5=Every 2-3 months)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with your continuing usage of your boujou 4.1 software? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How likely are you to buy another 2d3 software application in the future? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How likely are you to recommend boujou to others? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How completely were any problems you contacted 2d3 customer services about resolved? (1=Fully, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

Please provide any additional information or comments

Index

C

D

E

F

P

T