

Nikon

Confocal Microscope C1 <EZ-C1 Software>

3D Deconvolution / 3D Viewer

Ver.1.00

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Introduction

EZ-C1 is the operation software for the Nikon Confocal Microscope C1.

EZ-C1 can easily display not only simple 2D images, but also 3D images, time series 2D images, and time series 3D images. These data can be acquired with one-click or two-clicks on a PC.

Chapter1, "Getting Started," describes installation procedures and setup procedures for the software. Read this chapter to install the software on a PC.

Chapter 2, "3D Deconvolution," describes 3D Deconvolution functions.

Chapter 3, "3D Viewer," describes 3D Viewer functions.

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Although every effort has been made to ensure the accuracy of this manual, errors or inconsistencies may remain. If you note any points that are unclear or incorrect, please contact your nearest Nikon representative. Be sure to read the manuals for the microscope, PC, and EZ-C1 too.

- Required knowledge

This manual was prepared for users having entry-level knowledge of Windows. If you encounter terms or tasks you do not understand, refer to your Windows instruction manuals for more information.

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Media Cybernetics has copyrights on dlls and ocxs of 3D Deconvolution and 3D Viewer.

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Getting Started

This chapter describes installation procedures and setup procedures for the software. When the software has been installed and set up already, you can skip this chapter. Read this chapter to install the software on a PC.

1.1 Accessories

The following accessories come with the EZ-C1 3D option software.

- EZ-C1 3D Deconvolution / 3D Viewer CD-ROM
- EZ-C1 3D Deconvolution / 3D Viewer instructions manual

1.2 Requirements

The following specifications are required for a PC to run the EZ-C1 software.

- OS: Microsoft Windows 2000 Professional (with service pack 4 or later) or Microsoft Windows XP Professional (with service pack 2 or later)
- CPU: Pentium IV 3.4 GHz or higher, with Hyper Threading technology
- RAM: 2 GB or larger, (4 GB recommended)
- HDD: SATA II (SATA150) ,7200rpm,8MB Cache
At least 350 MB of available disk space is required for installation.
Sufficient large and fast hard disk is required to save images. (larger than 10 GB)
Example) One Z slice image (50 frames) of 4-ch image (512 x 512 pixels) requires 100 MB.
One Z slice image (50 frames) of 32-ch image (512 x 512 pixels) requires 800 MB.
- Video card: To construct 3D images on 3D Viewer with a video card, the card must be compatible with OpenGL standards. Nikon recommends ATI Radeon 9600 series or higher-grade cards. The following are examples for cards. But Nikon has not checked their performance.
ATI Radeon 8500,9000, 9700
nVidia GeForce 256, GeForce 2, GeForce 2 MX, GeForce 3, GeForce4, Quadro series
Diamond Fire GL1
3D Labs Oxygen GVX1, Wildcat series
Matrox Parhelia
- Monitor: 1600 x 1200 pixels (UXGA) with True Color mode (24 bits) monitor, and video adapter (with 256 MB memory or larger for 3D display)

Note

- Some PCs might not work even in this environment. If this happens, please consult your nearest Nikon representative.

1.3 Licensing for 3D Deconvolution and 3D Viewer

The EZ-C1 3D Deconvolution and 3D Viewer software is provided with a CD-ROM. Install the software to a PC referring to the following procedures. When the software has been installed and set up already, you can skip this section.

1.3.1 Installing the License Setup Software

- (1) Log in as an administrator. Insert the EZ-C1 3D Deconvolution/3D Viewer CD-ROM to the PC. The installer starts up automatically.
- (2) Click the EZ-C1 license option utility button.
- (3) Follow the instructions given by each installer wizard after the installer starts up.

Note

- If the installer does not start up automatically, run the setup.exe program in the EZ-C1 CD-ROM.

1.3.2 Licensing Procedure for 3D Deconvolution and 3D Viewer

First, insert the HASP key into the USB port of the computer.

And then, start up the "EZ-C1 license option utility."

To start the "EZ-C1 license option utility," select "Program" - "Nikon" - "EZ-C1 3.50" - "EZ-C1 license option utility" menu entry from the Windows "Start" button.

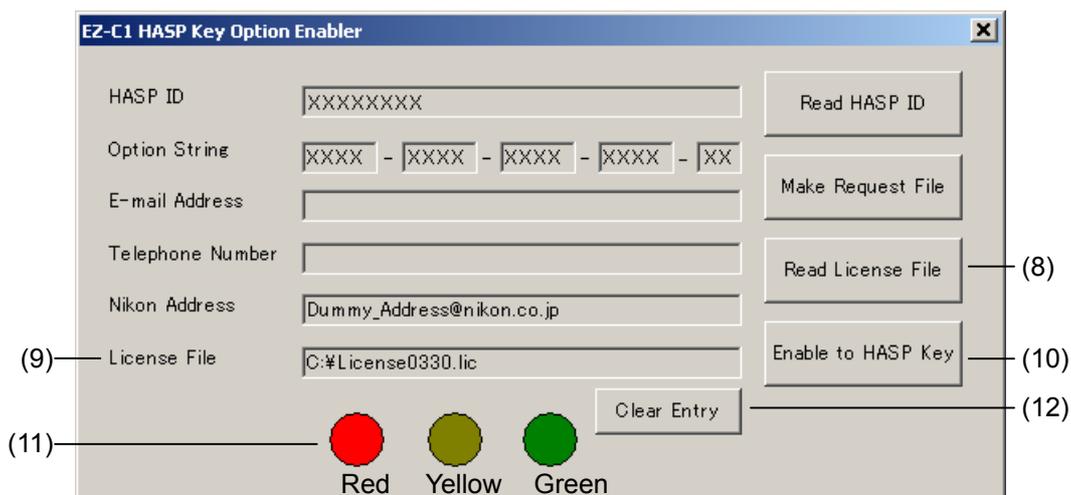
The window shown below appears.

- (1) HASP ID: The HASP ID appears here.
- (2) [Read HASP ID]: If the HASP ID does not appear in Step (1) or if the HASP key is inserted after the startup of the software, press the Read HASP ID button to read the ID again.
- (3) Option String: Enter the character string (18 digits) printed on the license card.
- (4) E-mail Address: Enter your e-mail address.
- (5) Telephone Number: Enter your phone number.
- (6) Nikon Address: The Nikon e-mail address appears here to send a license request file.
- (7) [Make Request File]: Press this button to open the "Save File" dialog box to create a license request file into the specified folder.

Send the license request file created in the specified folder to the e-mail address shown in Step (6). (For information on how to attach a file to a mail message, refer to the user guide of your e-mail software.)

When the file is accepted by Nikon, an e-mail with a license file will be returned. (For information on where an attachment file is stored, refer to user guide of your e-mail software.)

Start up the "EZ-C1 license option utility" again.



- (8) [Read License File]: Press this button to open the "Save File" dialog box. And then, select the license file attached to the e-mail message from the folder storing attached files.
- (9) License File: The specified license file name appears here.
- (10) [Enable to HASP Key]: Press this button to enable option functions of the HASP key.
- (11) Status Indicators: These indicators, the red, yellow, and green indicators from left to right, display the HASP key information status. The red indicator is lit when no option function is enabled. The yellow indicator is lit during the HASP key processing. The green indicator is lit when the processing is complete and the HASP key information is overwritten.
- (12) [Clear Entry]: Press this button to clear all data. (It is used to reset all entries.)

This is the end of the licensing procedure of the HASP key. Use the HASP key and start up EZ-C1 to enable the option functions, 3D Deconvolution and 3D Viewer.

1.3.3 Uninstalling the licensing software

To remove "EZ-C1 license option utility," click the Start button of the Windows OS. Select "Settings"->"Control Panel"->"Add/Remove Programs." Select "EZ-C1 license option utility" on the "Add/Remove Programs" dialog box and click the Change/Remove button.

1.4 Installing the software

Log in to the PC as an administrator. Insert the EZ-C1 CD-ROM to the CD drive of the PC. The installer starts up automatically.

- (1) Log in as an administrator. Insert the EZ-C1 3D Deconvolution/3D Viewer CD-ROM to the PC. The installer starts up automatically.
- (2) Click the "EZ-C1 3D Deconvolution / 3D Viewer" button.
- (3) Follow the instructions given by each installer wizard after the installer starts up.

Note

- If the installer does not start up automatically, run the setup.exe program in the EZ-C1 CD-ROM.

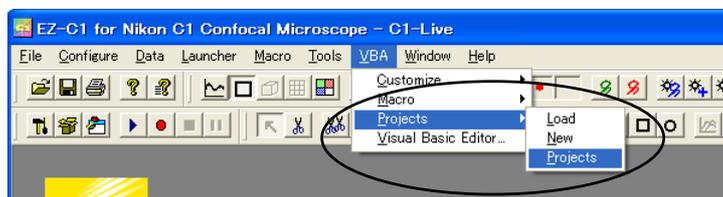
1.5 Uninstalling the software

To remove the EZ-C1 software, click the Start button of the Windows OS. Select "Settings"->"Control Panel"->"Add/Remove Programs." Select "EZ-C1" on the "Add/Remove Programs" dialog box and click the Change/Remove button.

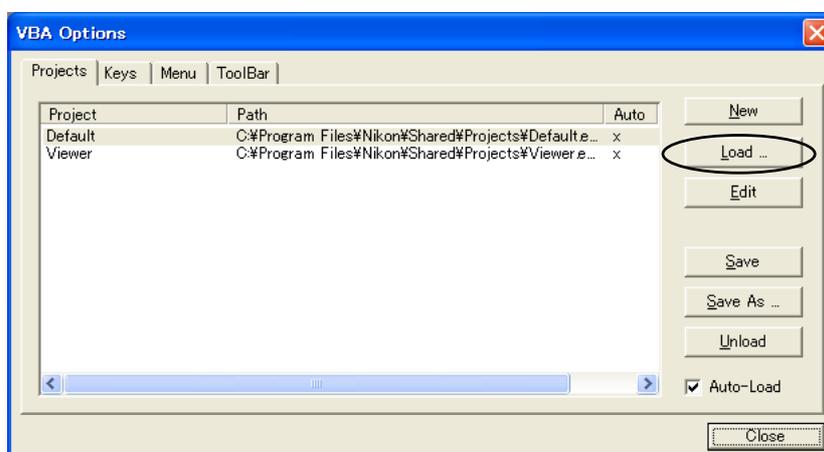
1.6 Registering macro programs to EZ-C1

Start up EZ-C1.

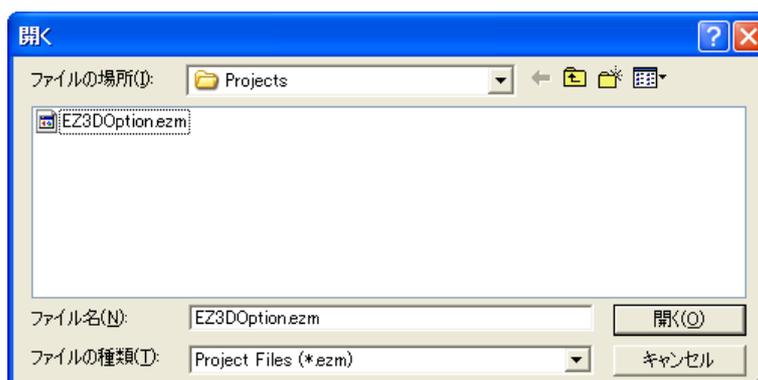
On the "VBA" menu, point to "Projects," and then click "Projects."



The "VBA Options" dialog box appears. Press the "Load" button in the box.



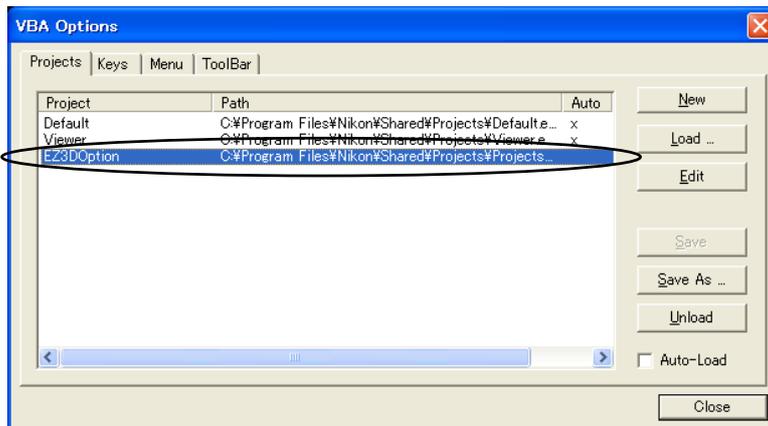
Select the EZ3DOption.ezm file.



Note

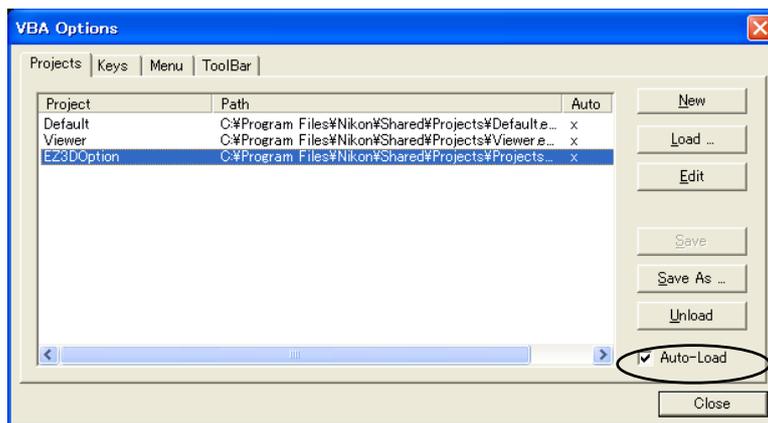
- The EZ3DOption.ezm file is installed with the 3D Deconvolution / 3D Viewer installer. In the installation, a new folder, Projects, will be created in the "Program Files¥Nikon¥Shared" folder. And then data will be installed into the new folder.

Specify the setting to read the EZ3DOption.ezm macro file.



Select the EZ3DOption.ezm macro file. Check the "Auto-Load" check box.

When the "Auto-Load" check box is checked, the EZ3DOption.ezm macro file will be read at the start-up of the EZ-C1 from this time forward.



The "Data | Volume Option" menu appears in the EZ-C1 menu.



2

3D Deconvolution

This chapter describes the 3D deconvolution function.

When an image of a focal plane is captured, not only focused light comes from the focal plane to the image capturing device but also defocused light comes from various directions of the microscope optical system. The 3D deconvolution function can reduce the defocused light using calculations to acquire focused images.

In the 3D deconvolution calculation, an image of the point spread function (PSF) is generally used. The PSF shows a 3 dimensional spread of a point source of light.

This software includes 3D Blind Deconvolution and 3D Non-Blind Deconvolution developed by Media Cybernetics Inc.

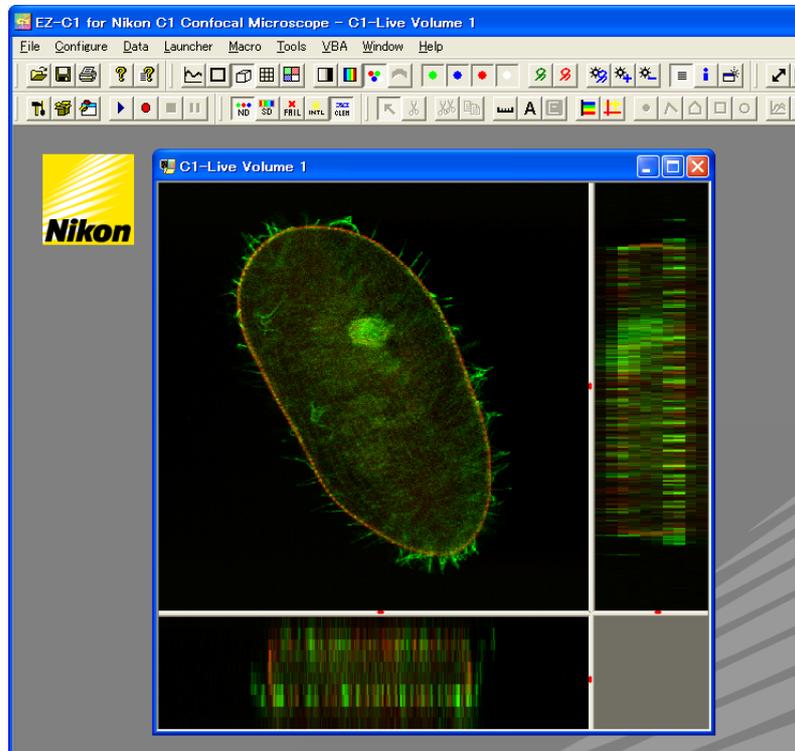
3D Blind Deconvolution is a computational algorithm, which can perform calculations without the PSF. The algorithm calculates the focal plane image repeatedly and predicts the PSF image from an original blurred image, information of the specimen such as the refractive index of the medium and the wavelength of fluorescence light, and information of the optical system such as the microscope specifications and the numerical aperture of the objective.

3D Non-Blind Deconvolution is a computation algorithm with the PSF. The algorithm also calculates the focal plane image repeatedly, but it does not any predict PSF image.

Nikon recommends 3D Blind Deconvolution for general usage. In a case when a PSF image is acquired correctly, use 3D Non-Blind Deconvolution.

2.1 Starting Up 3D Deconvolution

At first, acquire a Z-slice image with EZ-C1. Or, open a Z-slice image acquired before. (For the image acquisition method, refer to the EZ-C1 manual.)



Select the image. And then, point to Data, and Volume Option, and select AQI Deconvolution on the tool bar.

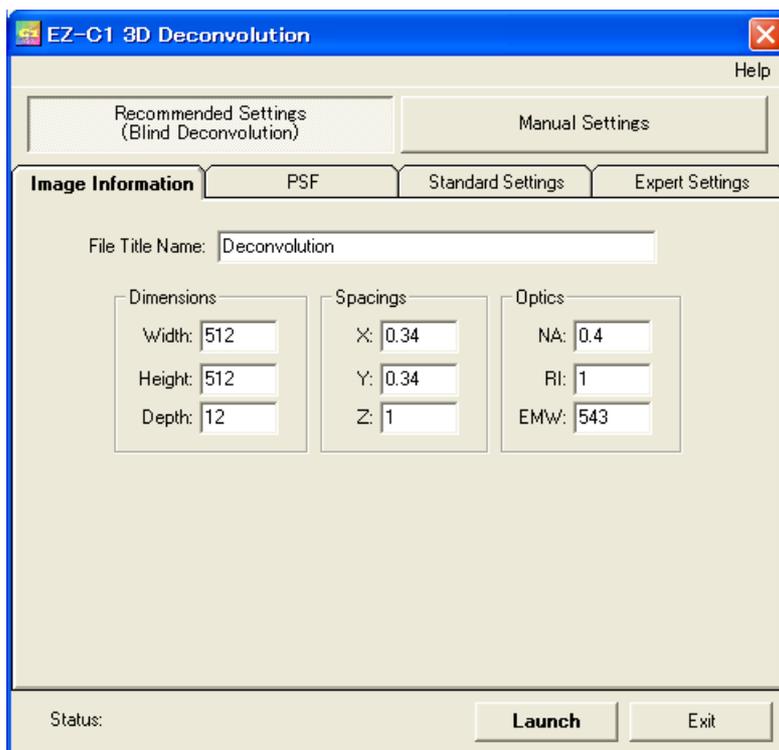


The EZ-C1 Deconvolution dialog box appears.

2.2 Running 3D Deconvolution

The Image Information tab is selected in default and the selected image name and information are displayed.

When information about the microscope or the specimen is included in the image data, they are displayed too.



Press the Recommended Settings button or the Manual Settings button.

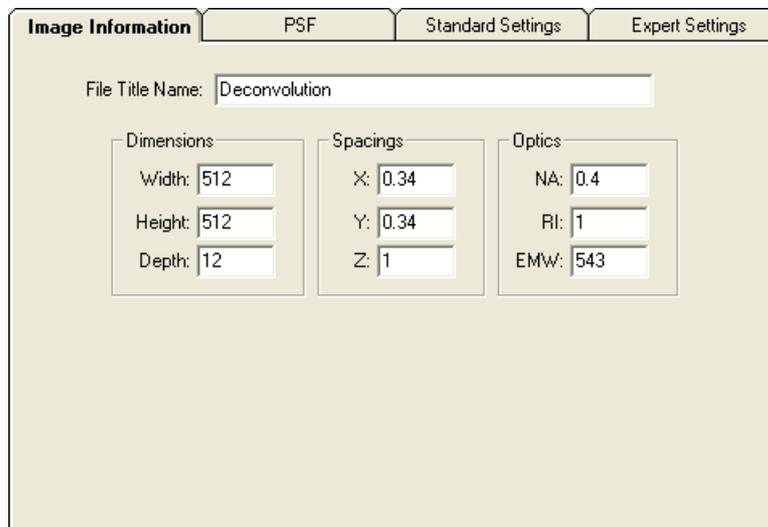
When the Recommended Settings button is selected, only the Optics data on the Image Information can be modified. Other data on the PSF tab, the Standard Settings tab, and the Expert Settings tab cannot be modified. Default values are used.

When the Manual settings button is selected, all data can be set up by operators except the Title, the Dimensions, and the Spacings on the Image Information tab. With the Help menu, a dialog box appears indicating software information.

When all settings are set up, press the Launch button. A Deconvolution calculation starts. (It takes several seconds to several minutes depending on the PC specifications.) A result image appears on another window on the EZ-C1 screen.

2.3 Detailed Settings for 3D Deconvolution

Image Information tab



The screenshot shows a software window with four tabs: 'Image Information', 'PSF', 'Standard Settings', and 'Expert Settings'. The 'Image Information' tab is active. It contains a text field for 'File Title Name' with the value 'Deconvolution'. Below this are three columns of input fields:

- Dimensions:** Width: 512, Height: 512, Depth: 12
- Spacings:** X: 0.34, Y: 0.34, Z: 1
- Optics:** NA: 0.4, RI: 1, EMW: 543

- **File Title Name:** The name of the selected Z-slice image appears.
- **Dimensions Width:** Width of the image (pixels)
- **Dimensions Height:** Height of the image (pixels)
- **Dimensions Depth:** Frame number included the Z-slice image
- **Spacings X:** One pixel length in the X-direction (μm)
- **Spacings Y:** One pixel length in the Y-direction (μm)
- **Spacings Z:** One frame height of the Z-slice image (μm)
- **Optics NA:** Numerical aperture of the objective used to acquire the image
- **RI:** Refractive index. It is the coefficient value from immersion of the objective.
- **EMW:** Wavelength for image acquisition (nm). If two or more wavelengths are used, enter 488 nm or the center value of all wavelengths.

[Recommened Settings]

- **EMW:** 488 (nm)

PSF tab

- **Input PSF Use an Input PSF:** Check here to perform 3D Non-Blind Deconvolution.
- **Input PSF Input PSF File Name:** Specify the PSF file name to be used in 3D Non-Blind Deconvolution.
- **Input PSF Dimensions Width:** Width of the PSF image (pixels)
- **Input PSF Dimensions Height:** Height of the PSF image (pixels)
- **Input PSF Dimensions Depth:** Frame number included the Z-slice PSF image
- **Input PSF Spacings X:** One pixel length in the X-direction of the PSF image (μm)
- **Input PSF Spacings Y:** One pixel length in the Y-direction of the PSF image (μm)
- **Input PSF Spacings Z:** One frame height of the Z-slice PSF image (μm)
- **Input PSF PSF Source:** Select the PSF image type, Calculate for the image acquired with Blind Deconvolution and Measurement for the image acquired in a microscopic observation.
- **Output PSF Save an output PSF:** Check here to output the calculated PSF image in 3D Blind Deconvolution. It is meaningless for 3D Non-Blind Deconvolution because no PSF image calculation will be performed but the input PSF image will be output.
- **Output PSF Output PSF File Name:** Specify the file name to save the calculated PSF image.

[Recommened Settings]

- **Input PSF Use an Input PSF:** [OFF]
- **Output PSF Save an output PSF:** [OFF]

Standard Settings tab

Image Information	PSF	Standard Settings	Expert Settings
Deconvolution Method: <input type="text" value="Expectation Maximization"/>			
DarkCurrent Calculation: <input type="text" value="Automatic Calculation"/>		DarkCurrent Value: <input type="text" value="0"/>	
Number of Iterations: <input type="text" value="10"/>		Bin Factor XY: <input type="text" value="1"/>	
Save Interval: <input type="text" value="1"/>		Bin Factor Z: <input type="text" value="1"/>	

- **Deconvolution Method:** Select a calculation method used for Deconvolution.
 - Expectation Maximization:** It requires larger iteration count but provides better result.
 - Power Acceleration:** It can get a result faster than other methods. But the result has lower definition.
 - Extrapolation Acceleration:** It can get a faster result than Expectation Maximization and has higher definition than Power Acceleration. It is suitable for 3D Non-Blind Deconvolution.
 - Gold's Method:** It is suitable for high S/N images with 3D Non-Blind Deconvolution. It uses Gaussian calculation in the iteration calculation.
- **Dark Current Calculation:** Select a calculation method used for brightness of background images.
 - Automatic Calculation:** The background images are calculated automatically in Deconvolution calculations.
 - Manual Input:** A background image brightness value is entered manually.
- **Dark Current Value:** Enter a background image brightness value when the Manual Input option is selected for Dark Current Calculation.
- **Number of Iteration:** Enter a calculation iteration number.
- **Save Interval:** Enter an interval number to save temporal values in the Deconvolution calculation iteration. Calculations in progress are saved several times before the completion (before the Number of Iteration). This value must be a divisor of the value specified in the Number of Iteration.
- **Bin Factor XY:** Enter an XY binning number for the Deconvolution calculation. This is used to resize images for speeding up the calculations.
- **Bin Factor Z:** Enter a Z binning number for the Deconvolution calculation. This is used to resampling the image slices for speeding up the calculations.

[Recommened Settings]

- **Deconvolution Method:** [Expectation Maximization]
- **Dark CurrentCalculation:** [Automatic Calculation]
- **Number of Iteration:** 10
- **Save Interval:** 10
- **Bin Factor XY:** 1
- **Bin Factor Z:** 1

Expert Settings tab

Image Information	PSF	Standard Settings	Expert Settings
Image First Guess:	<input type="text" value="Original Data"/>	<input checked="" type="checkbox"/> Subvolume in XY	<input type="checkbox"/> Subvolume in Z
PSF First Guess:	<input type="text" value="Theoretical Estimate"/>	<input checked="" type="checkbox"/> Perform Intensity Correction	<input type="checkbox"/> Enable PSF Constraints
Frequency Constraint:	<input type="text" value="Automatic"/>		
Subvolume Calculation:	<input type="text" value="Static"/>		
Guardband XY:	<input type="text" value="10"/>	PSF Waist Radius:	<input type="text" value="1"/>
Guardband Z:	<input type="text" value="6"/>	PSF Stretch Factor:	<input type="text" value="3"/>
Subvolume Overlap:	<input type="text" value="10"/>	Noise Smoothing Factor:	<input type="text" value="2"/>
Gold's Gauss Interval:	<input type="text" value="3"/>	Gold's Gauss FWHM:	<input type="text" value="1"/>

- **Image First Guess:**

Select an option for the first image of the Deconvolution calculation.

Original Data: The input image is used for the first image to make predictions.

Filtered Original Data: A filtered image with a noise reduction filter (linear) is used for the first image to make predictions.

Flat Sheet: An image with a uniform brightness is used for the first image to make predictions.

User-Input First Guess: A user image is used for the first image to make predictions. When this option is selected, a dialog box appears to select an image.

- **PSF First Guess:**

Select an option for the first image of the Deconvolution PSF calculation.

Theoretical Estimate: A theoretically calculated PSF image is used. Cone-shaped.

Flat Sheet: An image with a uniform brightness is used for the first image to make predictions.

AutoCorrelation: An auto correlation function is used.

User-Input First Guess: A user image is used for the first image to make predictions. When this option is selected, a dialog box appears to select an image.

- **Frequency Constraint:**

Select an option to limit the range effected by the PSF. For a wide field image or a diasopic image, only the theoretical limit is available. But for a confocal image, not only the theoretical limit but also a measured value is available.

Automatic: The range is determined automatically.

Theoretical Limit: The range is determined by theoretical calculations.

Detected Limit: The range is determined by a measured value. It can be used only for confocal images.

- **Subvolume Calculation:**
For a Deconvolution calculation, the size of a whole image is too big to read it to physical memory for the calculation. Therefore, a whole image is divided into several areas called Subvolumes. A Z-stack image is calculated on a subvolume basis. At last, all subvolumes are combined into one image. Select an option to use memory for the subvolume calculation.
 - Static:** A static value of memory is assigned for the calculation.
 - Dynamic:** A dynamic value of memory is assigned for the calculation at the beginning. Other calculations are also considered in the memory assignment calculation.
- **Guardband XY:**
This value is used in the calculation to merge subvolume images in the X- and Y- directions. This is necessary to create a smooth and continuous image. It is set to 10 in default. To improve the image smoothness and continuousness, raise the value up to 25.
- **Guardbandr Z:**
This value is used in the calculation in the vertical continuousness in the Z-directions for the Deconvolution calculation. It is set to 6 in default.
- **Subvolume Overlap:**
This is an overlap width to merge subvolume images. If the overlap width is too small for adjacent subvolumes, an error can occur in the overlap positioning.
- **Subvolume in XY:**
Check this checkbox to use all pixels in the XY plane for the Deconvolution calculation.
- **Subvolume in Z:**
Check this checkbox to use all z slice data for the Deconvolution calculation.
- **Perform Intensity Correction:**
Check this checkbox to correct the brightness for the Deconvolution calculation.
- **Enable PSF Constraints:**
Check this checkbox to calculate the PSF over theoretical constraints. Do not check here in the wide field image or diasopic image calculation. This function is disabled for 3D Non-Blind Deconvolution.
- **PSF Waist Radius:**
Enter an ignored radius value at the center of the PSF image in the Deconvolution calculation. This setting is disabled for 3D Non-Blind Deconvolution.
- **PSF Streach Factor:**
Enter a value for stretching the theoretical PSF image in the optical axis direction. For the Wide field image or diasopic image calculation, enter 1.0. For the Confocal image calculation, enter 3.0.
- **Noise Smoothing Factor:**
Enter a value for noise reduction calculations. This factor effects exponentially on noise reduction calculations. Normally, enter 2.0. For images with terrible noise, use 20.0 or 200.0.
- **Gold's Gauss Interval:**
This value is used when the Doconvolution Method on the Standard Settings tab is set to Gold's Method. Enter a value of rate for the Deconvolution calculation iteration count per Gaussian calculation processing. The Gold's Method is used only for 3D Non-Blind Deconvolution.
- **Gold's Gauss FWHM:**
This value is used when the Doconvolution Method on the Standard Settings tab is set to Gold's Method. Enter the full width at half maximum for Gaussian distribution. The Gold's Method is used only for 3D Non-Blind Deconvolution. The recommended value is calculated as following: $1 + \text{Log}_{10}([\text{Noise Smoothing Factor Value}]^2)$

[Reccomended Settings]

- **Image First Guess:** [Original Data]
- **PSF First Guess:** [Theoretical Estimate]
- **Frequency Constraint:** [Automatic]
- **Subvolume Calculation:** [Static]
- **Guardband XY:** 10
- **Guardbandr Z:** 6
- **Subvolume Overlap:** 10
- **Subvolume in XY:** Check
- **Subvolume in Z:** Uncheck
- **Perform Intensity Correction:** Check
- **Enable PSF Constraints:** Uncheck
- **PSF Waist Radius:** 1.0
- **PSF Streach Factor:** 3.0(Confocal)
- **Noise Smoothing Factor:** 2.0
- **Gold's Gauss Interval:** 3 (It is not used in the Recommended Settings.)
- **Gold's Gauss FWHM:** 1.0 (It is not used in the Recommended Settings.)

3

3D Viewer

This chapter describes the 3D Viewer function.

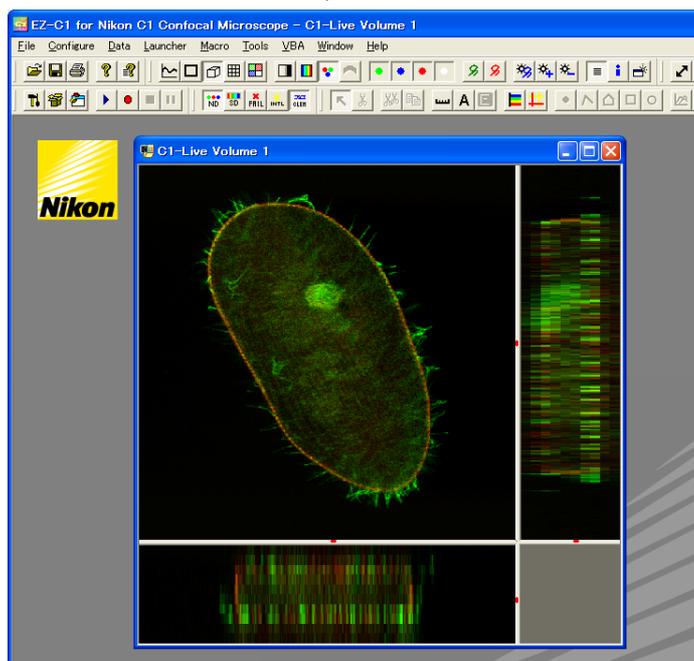
3D Viewer displays images captured in EZ-C1 as three-dimensional images using volume rendering processing.

The brightness and the angle of a three-dimensional image can be modified on screen.

EZ-C1 has a similar function of volume rendering on the "Data | Volume | Volume Render" menu. However, the 3D Viewer function has more advanced features for processing three-dimensional image.

3.1 Starting Up 3D Viewer

At first, acquire a Z-slice image with EZ-C1. Or, open a Z-slice image acquired before. (For the image acquisition method, refer to the EZ-C1 manual.)

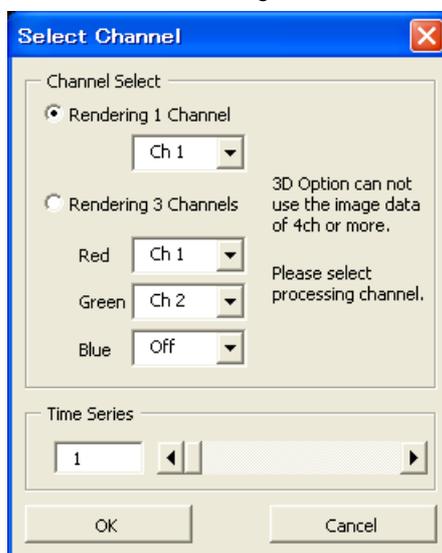


Select the image. And then, point to Data, and Volume Option, and select AQI Volume Render on the tool bar.



The 3D Viewer function can be used for an image that is composed of 3 channels or less and XYZ slice image.

On the other hand, EZ-C1 can handle a 32-channel image such as a spectral image or a time lapse XYZ slice image. Therefore, if such an image is selected, the following dialog box appears to select channels and time frame data to create a three-dimensional image.



- **Channel Select Rendering 1 Channel:** Select a channel to create a three-dimensional image.
- **Channel Select Rendering 3 Channel:** Up to three channels can be selected to create a three-dimensional image.
 - Red:** Select a channel for red. This channel is mandatory.
 - Green:** Select a channel for green. It can be turned off.
 - Blue:** Select a channel for blue. It can be turned off.

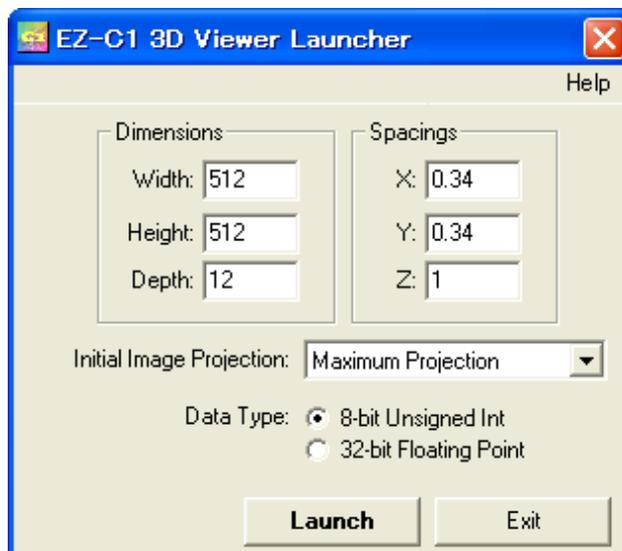
NOTE: When one channel is used in 3D Viewer, any color can be used for display. But when two or three channels are used, only RGB colors can be used.

- **Time Series:** When an XYZ slice image is acquired in a time lapse observation, select the time frame for a three-dimensional image.
- **OK:** To accept the setting, click OK. The "EZ-C1 3D Viewer Launcher" dialog box appears.
- **Cancel:** Clear the settings and finishes 3D Viewer.

The EZ-C1 3D Viewer Launcher dialog box appears.

3.2 Running 3D Viewer

The information for the selected image appears.

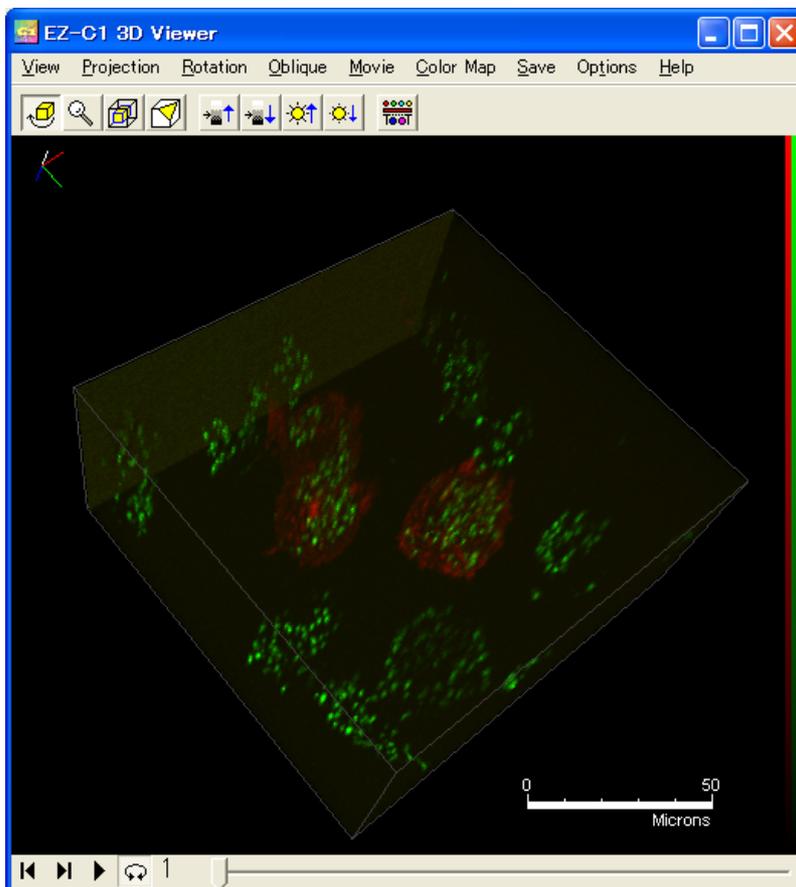


- **Dimensions Width:** Width of the image (pixels)
- **Dimensions Height:** Height of the image (pixels)
- **Dimensions Depth:** Frame number included the Z-slice image
- **Spacings X:** One pixel length in the X-direction (μm)
- **Spacings Y:** One pixel length in the Y-direction (μm)
- **Spacings Z:** One frame height of the Z-slice image (μm)
- **Initial Image Projection:** Select an option for projection method in volume rendering.
 - Maximum Projection:** A three-dimensional image is created based on the maximum value of the brightness. This option functions same as "Maximum Projection" on EZ-C1 original function.
 - Minimum Projection:** A three-dimensional image is created based on the minimum value of the brightness.
 - Sum Projection:** Data for a three-dimensional image is summed in the ray axis direction. This option functions same as "Accumulate Projection" on EZ-C1 original function.
 - Alpha Blend:** Transmittance data (alpha) is set for each pixel. A three-dimensional image with surface processing (shading) is created.
 - Surface Slice:** The topmost slice image is used for each divided range to create a three-dimensional image.
- **Data Type:** Select the output data type of the Volume Rendering image.
- **Help Menu:** A dialog box appears indicating software information.

When all settings are set up, press the Launch button. The Z slice image is calculated to get a three-dimensional image in accordance with the Projection method. A new window opens showing the Volume Rendering result.

3.3 Detailed settings for 3D Viewer

Press the Launch button on the EZ-C1 3D Viewer Launcher dialog box to show the following EZ-C1 3D Viewer window. The displayed three-dimensional image on the window can be rotated, cut, and zoomed with mouse operations. Besides, Movie function can be used for moving pictures such as angle change or 3D settings change.



3.3.1 Mouse operations for 3D Viewer

[Mouse operation]

- **Rotation:** While holding down the left button on the image, move the mouse position to rotate it. If necessary, the right button can be assigned for this function with the tool bar settings.
- **Zoom:** While holding down the right button, move the mouse position to the upper left or to the lower right to change the zoom ratio. If necessary, the left button can be assigned for this function with the tool bar settings.
- **Slice:** While holding down the Ctrl key, left click the slice plane on the image and move the mouse position. Two slice patterns are selectable, orthogonal plane and free (oblique) plane.
- **Rotation of the slice plane:** While holding down the Shift key, left click the slice plane on the image and move the mouse position. It can be used for a free slice plane only.

- **Orthogonal Slices Mode:** Left click the slice orthogonal plane on the image and move the mouse position.

3.3.2 3D Viewer Menu

The EZ-C1 3D Viewer window has its own menu to set up 3D settings.

3.3.2.1 View Menu

This menu is used for image viewing settings for 3D images.

Volume Projection (Software or Hardware)

This menu is used to show a 2D image of the created 3D image viewed in a specified direction. Three options are available. The Software option is used to calculate a 3D image and a 2D image on the PC. It takes a longer time than other two options but can create a high resolution 2D image. The Hardware 2D Texture option and the Hardware 3D Texture option are used to create a 3D image and a 2D image on the videocard. These options take shorter time than the Software option. An image can be rotated smoothly. But, a higher performance video card is necessary. For details about the video card, refer to Section 1.2, "Operation Conditions."

Orthogonal Slices

This menu is used to show orthogonal planes of XY, XZ, and YZ. Under this mode, left click the slice orthogonal plane on the image and move the mouse position to move the plane.

Cube Surface

This menu is used to show a cube. Each surface of the cube has each 3D image viewed in their directions. On each surface, hidden pixels are also projected and displayed.

Isosurface

This menu is used to show solid data in three-dimensional image. Solid data is created such that same brightness pixels are combined and surfaces and edges are determined. This mode is useful for clear outline when viewed in an orthogonal slice plane or a free slice plane. When this menu is selected, the Adjust Minimum Threshold dialog box appears.

Adjust Minimum Threshold dialog box



- **Use the current Threshold:** If the Threshold function has been used, the previous value is used as the threshold value.
- **Auto Threshold:** The threshold value is calculated automatically from the image data.
- **Adjust Threshold:** The threshold value is set manually. Enter a value into the entry.
- **With Binning Factor:** In the Isosurface calculation, some pixels can be merged (binning). When this factor is specified, operations such as rotation and zooming become faster but resolution becomes poorer.
- **Use smoothed data:** Check here to reduce noise in the calculation.
- **Display sides:** Check here to display a boundary surface of the Isosurface image as a side.

Height Map

This menu is used to display contour lines on the 3D image.

3.3.2.2 Projection Menu

This menu is used to select an option for projection method in volume rendering.

Seven methods can be selected for the projection method: Maximum projection, Sum projection, Minimum projection, Voxel Gradient, Alpha Blending, Best Focus, and Surface Slice. For each calculation method, refer to Section 3.2, "Running 3D Viewer."

Note: In the initial condition, all projection methods can be selectable. But, if the Orthogonal slices or Surface Slice is selected for the View mode, some methods are disabled.

3.3.2.3 Rotation Menu

This menu is used to rotate the image.

Free

Use this mode to rotate the 3D image freely with mouse operations.

Object

Use this mode to fix the rotation axis to X, Y, or Z (optical axis direction) of the 3D image. The rotation axis is specified in the Best Axis or X, Y, Z-axis below.

Screen

Use this mode to fix the rotation axis to the horizontal axis, vertical axis, or depth axis of the screen. The rotation axis is specified in the Best Axis or X, Y, Z-axis below.

Best Axis

This mode can be used with the Object option or the Screen option for the Rotation mode. The rotation axis is determined from the mouse operation automatically.

X, Y, Z Axis

This mode can be used with the Object option or the Screen option for the Rotation mode. The rotation axis is specified manually. The image does not rotate in other direction.

Note: The Object option and the Screen option have different rotation axes depending on the axis setting between the image and the screen.

Go to View | XY, XZ, ZY

This menu is used to reset the rotated image to the selected position.

Rotate 90 | X Axis, Y Axis, Z Axis

This menu is used to rotate the image 90 degrees around the X-, Y-, or Z- axis.

3.3.2.4 Oblique Menu

This menu is used to set up the free slice plane. (oblique plane)

Display Slice

This mode is a toggle switch. Pressing it once displays the slice plane. Pressing it again clears the slice plane. When this mode is turned on, the following menus are enabled.

Note: This menu cannot be used on the following cases: Volume Projection - Software, Volume Projection - Hardware | 3D Texture, and Height Map.

Go to Origin

This menu is used to reset the settings to the initial conditions. The initial condition is overwritten when the image intersects the orthogonal slice plane.

Fix Pane

This menu is used to fix the free slice plane. When the free slice plane is fixed and the 3D image is rotated, the free slice plane does not move.

Flip Pane

This menu is used to display the hidden side of the 3D image. The hidden side and the display side are changed along with the free slice plane. After flipping images, use the Control Panel functions and the Rotate functions to see an appropriate direction of the image. (For the Control Panel, refer to Section 5.3, "3D Viewer Control Panel.")

XY, XZ, ZY

This menu is used to slice the XY, XZ, or ZX plane of the 3D image.

Parallel

This menu is used to move the free slice plane parallel to the screen.

3.3.2.5 Movie Menu

This menu is used to set up the Movie settings for the 3D image.

Play / Stop Movie

Start/stop the moving image.

Quick Movies

Use this menu to select a predetermined setting for the Movie settings. A fast moving image can be seen.

Rotate Y Axis

The image rotates around the Y-axis, +/- 30 degrees, +/- 45 degrees, +/- 60 degrees, +/- 90 degrees, or +/- 180 degrees.

Rotate X Axis

The image rotates around the X-axis, +/- 30 degrees, +/- 45 degrees, +/- 60 degrees, +/- 90 degrees, or +/- 180 degrees.

Original View

Restore the image to its original position before the Movie function.

Set Start Point

This menu is used to set up the start point of the moving image.

Set Mid Point

This menu is used to set up the middle point of the moving image. When set, the Mid Point Active option is turned on automatically.

Mid Point Active

This menu is used to make the moving image pass the middle point. If not set, the moving image moves from the Start Point to the End Point but the Mid Point is ignored.

Set End Point

This menu is used to set up the end point of the moving image.

Set Step Angle

This menu is used to set up the step size of angle for the Movie function. 5 degrees, 10 degrees, and 15 degrees are selectable. The nearest angle from these three angles is used when a moving image is created.

Go to Point

This menu is used to move the image viewing to the Start, Mid, or End position.

Loop Mode

This menu is used to repeat the moving image. When the image is moved to the End point, it returns to the Start point and repeat the function.

Rock Mode

This menu is used to repeat the moving image. When the image is moved from the Start point to the End point, it moves from the End point to the start point. After that, the function repeats again and again.

Opposite Path

In some cases, two ways can be set for the rotation from the Start point to the End point. Normally, the shortest way is selected. But when this option is set to on, the longer way is selected. (For an example case from 10 degrees to 120 degrees, the image rotates from 10 degrees, 20 degrees, and so on. But when this option is on, it rotates from 10 degrees, 0 degree, -10 degrees, and so on.)

Create Movie

The created Movie data is displayed on the Main Window of EZ-C1.

3.3.2.6 Color Map Menu

This menu is used to set up the color settings for the 3D image. The color settings, the look up table settings, wavelength, and fluorescence colors are selectable on this menu. Besides, a background color can be set and a color can be inverted.

Color

This menu can be used only when one channel data is used. A color can be assigned for the channel from gray, red, green, blue, cyan, yellow, magenta, and orange.

Look Up Table

This menu can be used only when one channel data is used. A color can be assigned for the channel from the look up table data. A color can be assigned for the channel from red fire, green fire, blue fire, black body, copper, cool, jet, and spectrum.

Wavelength

This menu can be used only when one channel data is used. A wavelength color can be assigned for the channel. Selectable colors are 400 nm, 450 nm, 500 nm, 550 nm, 600 nm, 650 nm, 700 nm, and 750 nm.

Probe

This menu can be used only when one channel data is used. A fluorescence color can be assigned for the channel. Selectable colors are Dapi (456nm), Cy2 (506), Fluorescein (519nm), Fitc (520nm), Lucifer Yellow (528nm), GFP (540nm), Cy3 (570nm), DsRed (583nm), Rhodamine (590nm), Cy3.5 (596nm), Propidium Iodide (617nm), Texas Red (620nm), Cy5 (670nm), Cy5.5 (694nm), and Cy7 (767nm).

Background

This menu is used to set up a background color. Selectable colors are white, 75% gray, 50% gray, 25% gray, black, black to white, and white to black. The black to white and the white to black are gradation patterns in the vertical direction. On the Control Panel, further detailed settings are provided. (For the Control Panel, refer to Section 5.3, "3D Viewer Control Panel.")

Reverse

This menu is used to inverse the color of the 3D image.

Change Colors

This menu appears when the Color tab on the Control Panel is activated.
(For the Control Panel, refer to Section 5.3, "3D Viewer Control Panel.")

3.3.2.7 Save Menu

This menu is used to save a 3D image or a 2D image.

Current View

This menu is used to send the image on the 3D Viewer to a window of EZ-C1. The file save function starts automatically.

Rotated Volume

This menu is used to send the rotated image on the 3D Viewer to a window of EZ-C1. The file save function starts automatically.

To Clipboard

This menu is used to send the image on the 3D Viewer to the clipboard. The image can be pasted to various application software such as Photoshop and image editors.

Save Default View

This menu is used to save the settings for 3D Viewer. Next time, the application runs under the saved conditions. To clear the settings, refer to the Reset Default View menu.

Reset Default View

This menu is used to restore the settings for 3D Viewer to the factory default conditions.

Save Setting

This menu is used to save the settings for 3D Viewer.

Load Setting

This menu is used to load the settings of 3D Viewer.

3.3.2.8 Options Menu

This menu is used to set up the Option settings for 3D Viewer.

Control Panel

This menu is used to display the Control Panel.
(For the Control Panel, refer to Section 5.3, "3D Viewer Control Panel.")

Whole Volume

This menu is used to reset the dimensions of subvolume images to that of the original 3D image.

Full Res View

This menu is used to create 2D image same as the original 3D image resolution on 3D Viewer. This menu can be used only when the Volume Projection is selected. Note that when the 3D image is rotated, the resolution becomes normal and is lower than that of the original image.

Correct Aspect

This menu is used to create a 3D image with correct aspect ratio. The Voxell option shows a cube in normal settings. But when the correct aspect is turned on, a correct interpolation image is created and its dimensions are the same as the original view.

Auto Rotate

When this option is checked, the image keeps rotating with the mouse operation. You need not move the mouse position. When this option is not checked, the image rotates only when the mouse is being moved.

Display Floor

When this option is checked, a checker pattern appears below the image.

Display Axes

When this option is checked, the X-, Y-, and Z-axes appear on the screen. The X-axis is red, the Y-axis is green, and the Z-axis is blue. Each axis can be named and displayed with the Control Panel.

(For the Control Panel, refer to Section 5.3, "3D Viewer Control Panel.")

Display Grid

When this option is checked, a grid pattern appears on each surface of the 3D image. The grid size can be changed with the Control Panel.

(For the Control Panel, refer to Section 5.3, "3D Viewer Control Panel.")

Display Scale Bar

When this option is checked, a scale bar appears at the lower right of the screen. The size of the scale bar changes automatically in accordance with the object size.

Logo**Display**

When this option is checked, a logo appears at the lower left of the screen. The logo image is specified in the Logo | Bitmap menu.

Bitmap

Select this menu to open a dialog box for registering a logo image. Select the logo image bitmap file on the dialog box. Note that the file must be 24-bit RGB image and 256 x 256 or smaller. If a larger image is selected, a part (256 x 256) of the image will be displayed.

Perspective View

When this option is checked, the 3D image is drawn in perspective. Therefore, a near object becomes larger than a farther object even when they are the same size in original.

Stereo Mode**Off**

When this option is selected, the stereo mode is disabled.

Anaglyph

When this option is selected, the image is drawn in anaglyph stereo mode.

This option can be used only for 1-channel images.

LCD Glasses

This option is provided to use special LCD glasses and a special graphic card for stereo viewing. But, this function is not supported on EZ-C1.

Anaglyph Colors

This option is used for anaglyph stereo mode settings. The colors for the right eye and the left eye are selected for the anaglyph stereo image. Normally the colors are Red-Blue, Red-Cyan, Red-Blue, Red-Green, Cyan-Red, Blue-Red, Green-Red, Left Only, and Right Only are selectable.

Auto Threshold

When this option is selected, the lower threshold is calculated automatically and pixels lower than the value are not displayed.

3.3.2.9 Help Menu

Press here to open the help window.

Keys

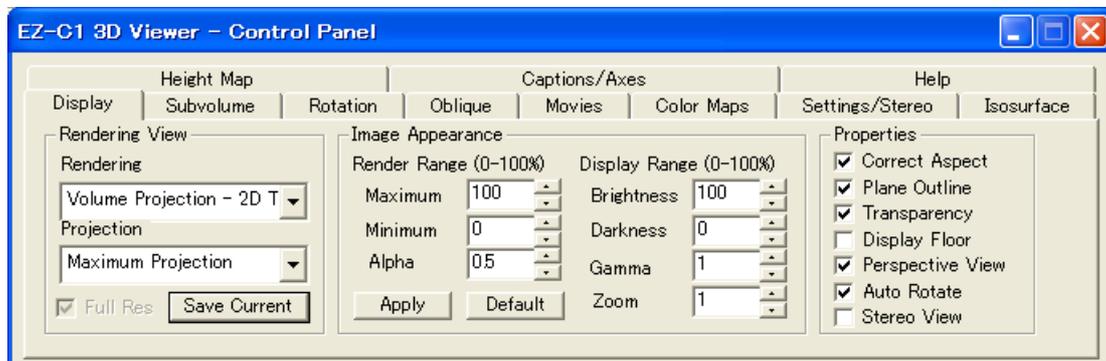
Help information appears for mouse operations.

3.3.3 3D Viewer Control Panel

With the Control Panel, detailed settings can be set up for 3D Viewer.

3.3.3.1 Display Tab

On the Display tab, 2D display methods after 3D image creation are controlled.



[Rendering View]

- **Rendering:** This item is used for image viewing settings for 3D images. For detailed information, refer to Section 3.3.2.1, "View Menu."
- **Projection:** This item is the projection method selection. For detailed information, refer to Section 3.2, "Running 3D Viewer."
- **Full Res:** This item is the same as Option | Full Res View menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Save Current:** This item is the same as the Save | Current View menu. For detailed information, refer to Section 3.3.2.7, "Save Menu."

[Image Appearance]

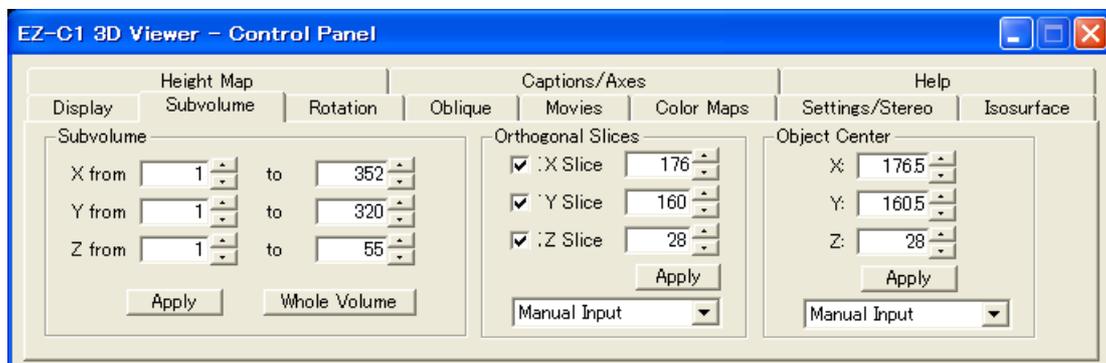
- **Render Range:** This item is used to set up the lower limit and the higher limit for creating 3D images. (0 to 100%) Values lower than or higher than these limits will be ignored in 3D image calculations.
- **Alpha:** This item is used when the Projection is set as Alpha Blend. Transmittance data (alpha) is set for each brightness.
- **Brightness:** This item determines the brightness for pixels of the higher limit. (0 to 100%)
- **Darkness:** This item determines the brightness for pixels of the lower limit. (0 to 100%)
- **Gamma:** This item is the Gamma curve coefficient to display the image. (0.1 to 4)
- **Zoom:** This is the zoom coefficient for the image.
- **Apply:** To accept the settings, press this button.
- **Default:** To restore the settings to the default conditions, press this button.

[Properties]

- **Correct Aspect:** This item is the same as the Options | Correct Aspect menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Plane Outline:** Check this item to display outlines of 3D images, orthogonal planes, and subvolumes.
- **Transparency:** Check this item to display pixels darker than the Darkness value transparently.
- **Display Floor:** This item is the same as the Options | Display Floor menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Perspective View:** This item is the same as the Options | Perspective View menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Auto Rotate:** This item is the same as the Options | Auto Rotate menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Stereo View:** This item is the same as the Options | Stereo Mode | Anaglyph menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."

3.3.3.2 Subvolume Tab

On the Subvolume tab, subvolume settings and orthogonal plane settings are set up. The subvolume is a part of an image. If the original image is large, the subvolume provides faster calculations. Set up the subvolume settings. And calculate subvolumes for all image range. It enables smooth viewings.



[Subvolume]

- **X, Y, Z:** These items are the start points and the end points of a subvolume in the X-, Y-, and Z-axes.
- **Apply:** To accept the settings, press this button.
- **Whole Volume:** This item is the same as the Options | Whole Volume menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."

[Orthogonal Slices]

- **X, Y, Z Slice:** These items can be used when the Orthogonal Slices option is selected for the View mode. The positions of the orthogonal planes are set up here. Check the check box to display an orthogonal plane.
- **Apply:** To accept the settings, press this button.
- **Rotation Center:** Select the rotation center settings here.
 - Manual Input:** A position is entered manually.
 - Whole Volume:** The center of the whole data is set as the rotation center.
 - Subvolume:** The center of the created subvolume is set as the rotation center.
 - Center of Mass:** The center of mass (brightness) of all 3D images is set as the rotation center.
 - Object Center:** The center of mass (brightness) of the created 3D image is set as the rotation center.

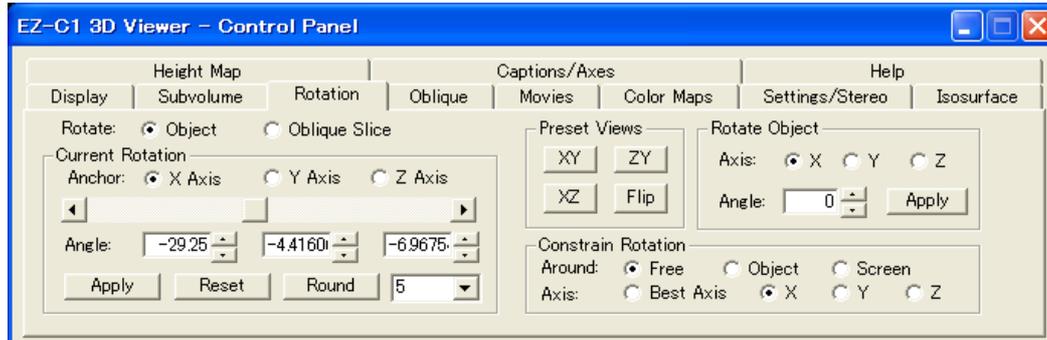
[Object Center]

- **X, Y, Z:** These items are the rotation center of the created 3D image for manual setup. If the Rotation Center setting has not been set as the Manual Input option, it will change to the Manual Input option automatically.
- **Apply:** To accept the settings, press this button.
- **Rotation Center:** Select the rotation center settings here.
 - Manual Input:** A position is entered manually.
 - Whole Volume:** The center of the whole data is set as the rotation center.
 - Subvolume:** The center of the created subvolume is set as the rotation center.
 - Center of Mass:** The center of mass (brightness) of all 3D images is set as the rotation center.
 - Ortho Slices:** The center of the Orthogonal Slices data is set as the rotation center.

3.3.3.3 Rotation Tab

On the Rotation tab, the rotation settings for created 3D images are set up. Usually, a created 3D image is rotated with mouse operations. But, it can be rotated with numeric values here, too.

Besides, a rotated image can be restored to its original position with a preset button, to which preset settings can be registered.



- **Rotate Object, Oblique Slice:** Select the Object or the Oblique Slice option to be rotated. If the free slice plane is not selected, the Oblique Slice option is disabled.

[Current Rotation]

- **Anchor X Axis, Y Axis, Z Axis:** Select the rotation axis here.
- **Angle X, Y, Z:** These items are rotation angles for the manual setup.
- **Apply:** To accept the settings, press this button.
- **Reset:** To restore the image position to the original position.
- **Round:** When the image is rotated to an arbitrary position and the Round button is pressed, the image moves to a position which angle is an integral multiple of the value in the combo box. (When an image is rotated to a position of 14 degrees and the value in the combo box is 5, the image will be rotated to a position of 15 degrees automatically.)

[Preset Views]

- **XY, ZY, XZ, Flip:** To move the image to a preset position, press the button. XY, ZY, XZ, and Flip are available. The Flip button inverses the rotation direction vertically.

[Rotated Object]

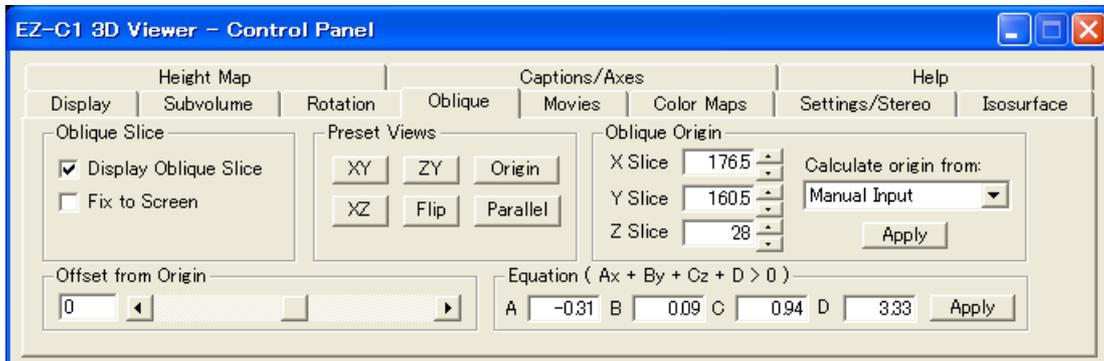
- **Axis X, Y, Z:** Select the rotation axis here.
- **Angles:** To rotate the object manually, enter the rotation angle here.
- **Apply:** To accept the settings, press this button.

[Constrain Rotation]

- **Around Free, Object, Screen:** These options are the same functions as the Rotate | Free option, the Rotate | Object option, and the Rotate | Screen option. For detailed information, refer to Section 3.3.2.3, "Rotation Menu."
- **Axis Best Axis, X, Y, Z:** These options are the same functions as the Rotate | Best Axis option, the Rotate | X option, the Rotate | Y option, and the Rotate | Z option. For detailed information, refer to Section 3.3.2.3, "Rotation Menu."

3.3.3.4 Oblique Tab

On the Oblique tab, the free slice plane (oblique plane) settings are set up.



[Oblique Slices]

- **Display Oblique Slice:** This item is the same as the Options | Display Slice menu. For detailed information, refer to Section 3.3.2.4, "Oblique Menu."
- **Fix To Screen:** This item is the same as the Options | Fix menu. For detailed information, refer to Section 3.3.2.4, "Oblique Menu."

[Offset from Origin]

- **Offset from Origin:** To move the selected plane parallel to itself, move the slider bar.

[Preset Views]

- **XY, ZY, XZ:** This item is the same as the Options | XY, XZ, ZY menu. For detailed information, refer to Section 3.3.2.4, "Oblique Menu."
- **Flip:** This item is the same as the Options | Flip Pane menu. For detailed information, refer to Section 3.3.2.4, "Oblique Menu."
- **Origin:** This item is the same as the Options | Go to Origin menu. For detailed information, refer to Section 3.3.2.4, "Oblique Menu."
- **Parallel:** This item is the same as the Options | Parallel menu. For detailed information, refer to Section 3.3.2.4, "Oblique Menu."

[Oblique Origin]

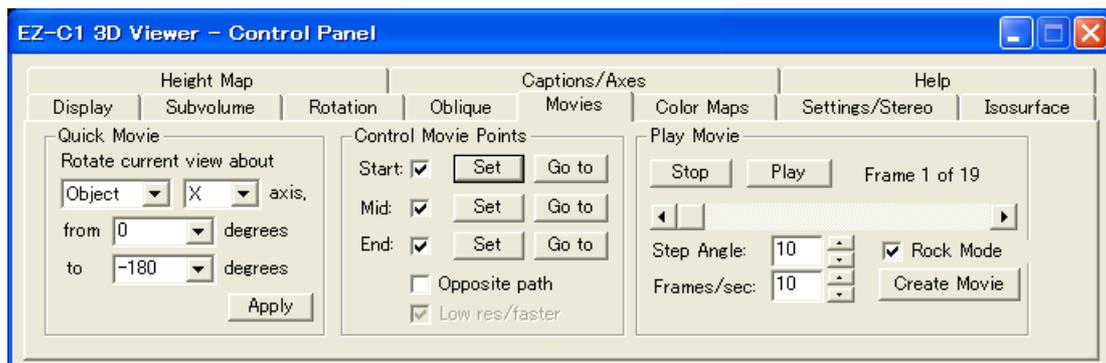
- **X, Y, Z Slice:** To set up the origin (X, Y, Z) of the free slice plane, enter the coordinate values. If the Calculate origin from setting has not been set to the Manual Input option, it will change to the Manual Input option automatically.
- **Calculate origin from:** Select the origin setting for free slice planes here.
- **Manual Input:** A position is entered manually.
 - **Whole Volume:** The center of the whole data is set as the rotation center.
 - **Subvolume:** The center of the created subvolume is set as the rotation center.
 - **Center of Mass:** The center of mass (brightness) of all 3D images is set as the rotation center.
 - **Ortho Slices:** The center of the Orthogonal Slices data is set as the rotation center.
 - **Object Center:** The center of mass (brightness) of the created 3D image is set as the rotation center.
- **Apply:** To accept the settings, press this button.

[Equation]

- **$Ax + By + Cz + D > 0$:** To specify the free slice plane using parameters in the expression of the plane formula, enter each parameter values.
(This function is provided only for Advanced Users.)

3.3.3.5 Movies Tab

On the Movies tab, the Movie settings for the 3D image are set up.

**[Quick Movie]**

- **Rotate current view about:** To set up the rotation method and the rotation axis, select an option here.
 - Object:** The image is rotated around the axis of the created 3D image.
 - Screen:** The image is rotated around the axis of the screen.
 - X, Y, Z Axis:** Select the rotation center axis.
- **From, To:** Enter the angle range to rotate the image. 0 degree, +/- 15 degrees, +/- 30 degrees, +/- 45 degrees, +/- 60 degrees, +/- 90 degrees, +/- 180 degrees, +/- 270 degrees, and +/- 360 degrees are selectable.
- **Apply:** To accept the settings, press this button.

[Control Movie Points]

- **Start:** To activate the start position of the Movie function, check this option. This setting cannot be changed once activated.
 - Set:** This item is the same as the Movie | Set Start Point menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
 - Go To:** This item is the same as the Movie | Go to | Start menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
- **Mid:** This item is the same as the Movie | Mid Point Active menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
 - Set:** This item is the same as the Movie | Set Mid Point menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
 - Go To:** This item is the same as the Movie | Go to | Mid menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."

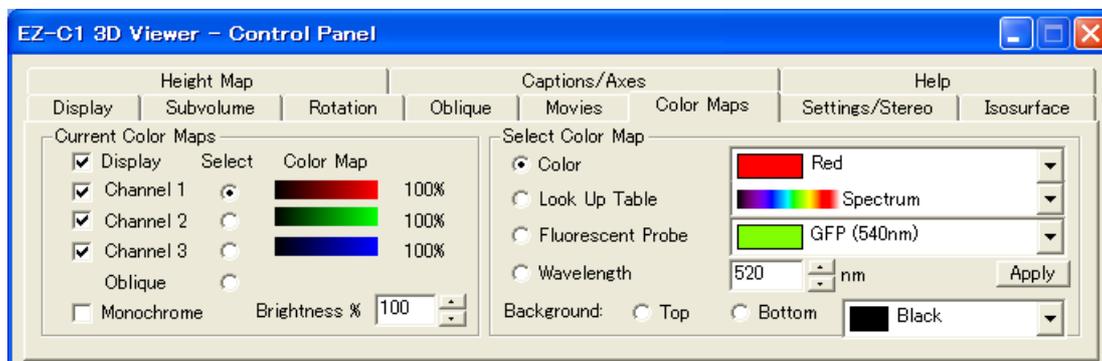
- **End:** To activate the End position of the Movie function, check this option. This setting cannot be changed once activated.
 - Set:** This item is the same as the Movie | Set End Point menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
 - Go To:** This item is the same as the Movie | Go to | End menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
- **Opposite path:** This item is the same as the Movie | Opposite Path menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
- **Low Res / faster:** This option is used to lower the resolution and to move the image faster. This option is checked and cannot be changed.

[Play Movie]

- **Stop, Start:** This item is the same as the Movie | Start, Stop menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
- **Position:** This is the frame number of the Movie.
- **Step Angle:** This option is used to set up the step size of angle for the Movie function.
- **Frame/sec:** This option is used to set up the speed of the moving image.
- **Rock Mode:** This item is the same as the Movie | Rock Mode menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
- **Create Movie:** This item is the same as the Movie | Create Movie menu. For detailed information, refer to Section 3.3.2.5, "Movie Menu."

3.3.3.6 Color Maps Tab

On the Color Maps tab, the color settings for the 3D image are set up. The color settings, the look up table settings, wavelength, and fluorescence colors are selectable on this menu. Besides, a background color can be set and a color can be inverted.



[Current Color Maps]

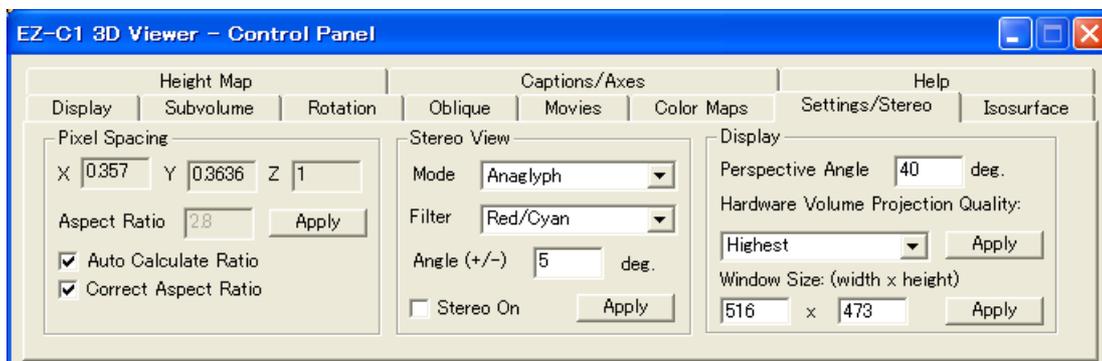
- **Display:** Check this option to display a color bar.
- **Channel 1, 2, 3:** Check these options to display channel images.
 - Select:** Select a channel to set up the brightness in the Brightness area.
 - Color Map:** The selected color map is displayed here.
- **Oblique:** When the free slice plane is displayed, this option becomes active.
 - Select:** Check this option to adjust the brightness of the free slice plane.
 - Color Map:** The color map for the free slice plane appears here.
- **Monochrome:** Check this option to display the monochrome image.
- **Brightness:** To set a brightness for each channel or for the free slice plane, enter a value here.

[Select Color Map]

- **Color:** This item is the same as the Color Map| Color menu. For detailed information, refer to Section 3.3.2.6, "Color Map Menu."
- **Look Up Table:** This item is the same as the Color Map| Look Up Table menu. For detailed information, refer to Section 3.3.2.6, "Color Map Menu."
- **Fluorescent Probe:** This item is the same as the Color Map| Probe menu. For detailed information, refer to Section 3.3.2.6, "Color Map Menu."
- **Wavelength:** This menu can be used only when one channel data is used. A wavelength color can be assigned for the channel. Enter the wavelength color into the entry.
- **Apply:** To accept the settings, press this button.
- **Background:** A background color can be set up. The background color has a gradation pattern from top to bottom.
 - Top:** Specify the color for the upper part. Select a color in the combo box.
 - Bottom:** Specify the color for the lower part. Select a color in the combo box.

3.3.3.7 Settings / Stereo Tab

On the Settings / Stereo tab, the stereo image settings and other settings are set up.



[Pixel Spacing]

- **X, Y, Z:** The X, Y, and Z dimensions for one pixel appear here. Refer to Section 3.2, "Running 3D Viewer" for setting the values.
- **Aspect Ratio:** Enter the aspect ratio between the X direction and the Z direction.
- **Apply:** To accept the settings, press this button.
- **Auto Calculate Ratio:** Check the checkbox to calculate the aspect ratio automatically. When this option is selected, the aspect ratio cannot be entered manually.
- **Correct Ratio:** This item is the same as the Options | Correct Aspect menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."

[Stereo View]

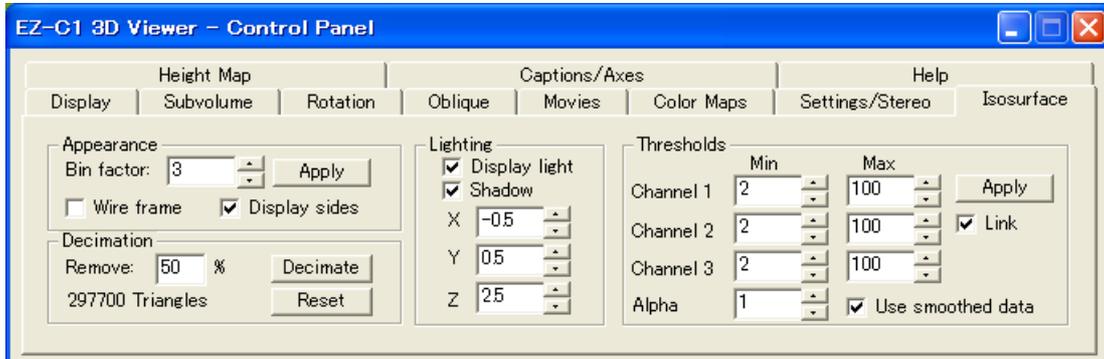
- **Mode:** Set up an option for the stereo mode here. Only Anaglyph option is available here.
- **Filter:** This item is the same as the Options | Anaglyph Colors menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Angle:** Enter the angle for stereo images here.
- **Stereo On:** Check this option to enable the stereo mode.
- **Apply:** To accept the settings, press this button.

[Display]

- **Perspective Angle:** Enter the angle for the perspective view.
- **Hardware Volume Projection Quality:** Select an option for image quality to create 3D images using hardware. The Fastest, Medium, and Highest options are available.
- **Apply:** To accept the settings, press this button.
- **Window Size X, Y:** Enter the window size here.
- **Apply:** To accept the settings, press this button.

3.3.3.8 Isosurface Tab

On the Isosurface tab, detailed settings for the Isosurface function are set up when the Isosurface option is selected for the View mode.



[Appearance Frame]

- **Bin Factor:** In the Isosurface calculation, some pixels can be merged (binning). When this factor is specified, operations such as rotation and zooming become faster but resolution becomes poorer.
- **Apply:** To accept the settings, press this button.
- **Wire frame:** Check this checkbox to display wire-frame images for Isosurface images.
- **Display sides:** Check here to display a boundary surface of the Isosurface image as a side.

[Decimation]

- **Remove:** To reduce the face number for the Isosurface image, use this function. Enter a value (%) into the entry and press the Decimate button. The removed faces are determined automatically in a lower-priority order. To display 100% faces, press the Reset button.

[Lightng]

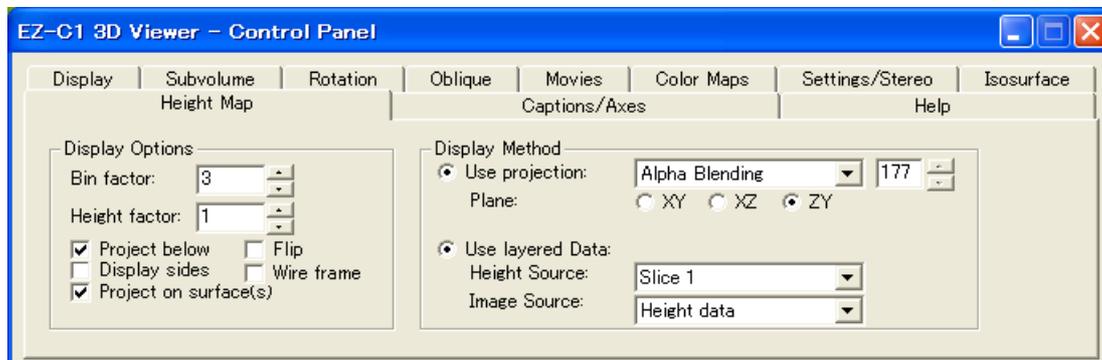
- **Display Light:** To show the light source for shading the Isosurface image, check the checkbox here.
- **Shadow:** To apply shading effect to the Isosurface image, check the checkbox here.
- **X, Y, Z:** To specify the light source position for shading the Isosurface image, enter the coordinates here. Zero is a position on each plane. The value can be specified from between -10 to 10.

[Thresholds]

- **Channel Min, Max:** To specify the lower limit and the higher limit for creating Isosurface image, enter values for each channel. Pixels of lower value or higher value than the limits will be ignored to calculate the Isosurface image.
- **Link:** To change thresholds for all channels together, check the checkbox here.
- **Apply:** To accept the settings, press this button.
- **Alpha:** To set up transmittance data for the Isosurface image, enter a value here. A value between 0 to 1 can be specified for it.
- **Use smoothed data:** Check here to reduce noise in the calculation.

3.3.3.9 Height Map Tab

On the Height Map tab, detailed settings for the Isosurface function are set up when the Height Map option is selected for the View mode.



[Display Options]

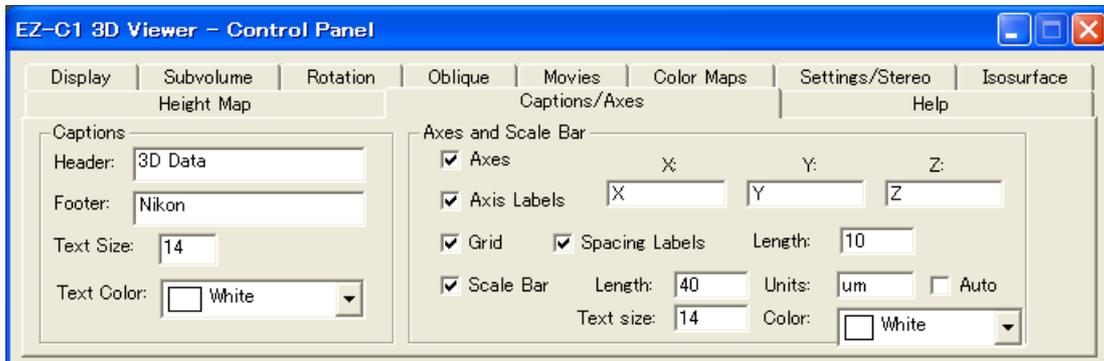
- **Bin Factor:** In the Height Map calculation, some pixels can be merged (binning). When this factor is specified, operations such as rotation and zooming become faster but resolution becomes poorer.
- **Height Factor:** To change the height factor for the Height Map calculation, change the value. When the value is large, the height effect becomes significant.
- **Project Below:** To project the calculated Height Map image to the bottom, check the checkbox here.
- **Display sides:** Check here to display a boundary surface of the Height Map image as a side.
- **Project on surface(s):** Check here to project surface textures similar to the Isosurface image onto the surfaces of the Height Map images.
- **Flip:** When this checkbox is checked, the height direction is reversed from the normal settings in the Height Map calculations.
- **Wire Frame:** Check this checkbox to display wire-frame images for Height Map images.

[Display Method]

- **Use Projection:** Select a projection method for the Height Map calculations. For details about projection methods, refer to Section 3.2, "Running 3D Viewer." When the Surface Slice mode is selected, the slice plane number can be set.
- **Plane:** Select planes from among the XY, XZ, and ZY options to create Height Map images.
- **Use layered Data:** When this check box is checked, a sliced plane is overlaid on the Height Map image. To use this function, sliced image data must be created beforehand. And, the data must have the same size as the image data. Two types data can be used for each of the Height Map data and the slice plane data.
- **Height Source:** Select the Height Map image overlaid with the User Layered Data function. The Slice 1, Slice 2, and Slice 1 & 2 options are selectable.
- **Image Source:** Select the slice plane data overlaid with the User Layered Data function. When the Slice 1 option is selected for the Height Source item, the Height Source option and the Slice 2 option are selectable. When the Slice 2 option or the Slice 1 & 2 option is selected, the Height Source option, the Slice 3 option, and the Slice 3 & 4 option are selectable.

3.3.3.10 Captions / Axis Tab

On the Captions / Axis tab, the screen title, the axes settings, and the scale bar settings can be set up.



[Captions]

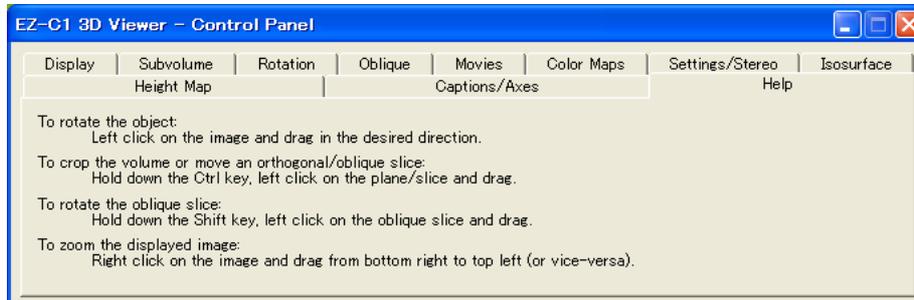
- **Header:** Enter the strings displayed above the screen.
- **Footer:** Enter the strings displayed below the screen.
- **Text Size:** Enter the text size.
- **Text Color:** Select the text color.

[Axis and Scale Bar]

- **Axis:** This item is the same as the Options | Display Axes menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Axis Labels:** Check the checkbox to display axis names.
X, Y, Z: Enter the axis name for each axis.
- **Grid:** This item is the same as the Options | Display Grid menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Spacing Labels:** Check the checkbox to display the grid position value.
- **Length:** Enter the interval for grid position values. When the Auto option is checked, the interval is calculated automatically.
- **Scale Bar:** This item is the same as the Options | Display Scale Bar menu. For detailed information, refer to Section 3.3.2.8, "Options Menu."
- **Length:** Enter the length of the scale bar. When the Auto option is checked, the length is calculated automatically.
- **Units:** Enter the unit for the scale bar.
- **Text Size:** Enter the text size for the scale bar.
- **Text Color:** Enter the text color for the scale bar.

3.3.3.11 Help Tab

On the Help tab, mouse operations are shown. No item can be set on the tab.



3.3.4 3D Viewer Toolbar



- **Rotate:** Press the icon to enable the rotation mode of the mouse control. Click the left button to rotate the image. Click the right button to zoom in/out.
- **Zoom:** Press the icon to enable the zoom mode of the mouse control. Click the right button to rotate the image. Click the left button to zoom in/out.
- **Subvolume:** Press the icon to enable the subvolume setting mode. Select a face and move it to create a subvolume.
- **Oblique Rotate:** Click the icon to enable the free slice plane mode. Select a plane to be cut and move it.
- **Increase Threshold:** Click the icon to increase the lower limit to display pixels. Pixels under the limit are not displayed.
- **Decrease Threshold:** Click the icon to decrease the lower limit to display pixels. Pixels under the limit are not displayed.
- **Increase Brightness:** Click the icon to increase the brightness of the image. The maximum value is 100%.
- **Decrease Brightness:** Click the icon to decrease the brightness of the image. The minimum value is 0%.
- **Control Panel:** Click the icon to display the Control Panel. For detailed information about the Control Panel, refer to Section 3.3.3.3, "3D Viewer Control Panel."



- **Back one Frame:** Return the Movie frame to the previous frame.
- **Forward one Frame:** Forward the Movie frame to the next frame.
- **Play / Stop Movie:** Start/stop the moving image.
- **Loop or Rock:** Toggles the Movie | Loop mode and the Movie | Rock mode. For detailed information, refer to Section 3.3.2.5, "Movie Menu."
- **Position Slider Bar:** Change the Movie frame to be displayed.