

RELEASE NOTES - AVIZO 9.0 BETA, SEPTEMBER 2014

Avizo 9.0 Beta

3D Analysis Software for Scientific and Industrial Data

Dear Avizo User,

With this document we would like to inform you about the most important new features, improvements, and changes in this version. Please read these Release Notes carefully. We would appreciate your feedback regarding this version. If you encounter problems, but also if you have suggestions for improvement, please report them to vsghotline@fei.com. We would like to thank you in advance for your efforts.

September 2014, the Avizo and Amira team

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OVERVIEW

Avizo 9.0 is a major evolution of the Avizo product family including new extensions, enhancements of the user interface for ease of use and simplified workflows, new and enhanced features, and performance improvements.

Important note: the Avizo product family evolves!

The Avizo product family is aimed primarily at providing software tools to scientists for characterizing material structures and properties. Thus, the previously named Avizo Fire edition has become the more widely used version, and more especially its image processing, analysis and quantification module, which is an essential part of Avizo's feature-set for materials characterization.

In order to present more clearly Avizo as the reference software for visualization, analysis, and quantification in Materials Science and Industrial Inspection, **Avizo Fire edition will be just named Avizo.**

Avizo Standard edition will be called Avizo Lite as it does not include the quantification module, and hence offers more limited capabilities.

The previous Avizo editions targeting secondary applications will become Avizo extensions, providing specialized features for CAE post-processing, and environmental and geophysics data visualization and analysis.

Avizo Wind edition becomes the XWind extension, available for Avizo Lite and Avizo.

The XWind extension includes dedicated visualization and computation modules, readers and writers for advanced FEA/CFD data processing, analysis and export.

Avizo Earth edition becomes the XEarth extension, available for Avizo Lite and Avizo.

The XEarth extension includes dedicated visualization and computation modules and workflows, as well as a SEG-Y reader, for the exploration and analysis of geophysics data.

Avizo Green edition becomes the XGreen extension, available for Avizo Lite and Avizo.

The XGreen extension includes visualization and computation modules, a set of geographical projections and a NetCDF reader, dedicated to the analysis of climate, oceanography, environmental, and earth-mapped data.

About Avizo and Amira

Avizo is 3D data visualization and analysis software dedicated to materials science and industrial inspection. Avizo originates from the Amira software that was initially created for scientific visualization and life sciences imaging applications. Amira and Avizo share the same platform and have many common features. However Amira remains focused on medical and biology fields, while Avizo addresses materials and physical science and industrial inspection.

NEW XFIBER EXTENSION

Avizo **XFiber** is a new extension that provides specific support for analyzing fibers, filaments, tunnels, and other networks or tree-like structures. This option assists segmentation and analysis with automatic, semi-automatic, and interactive tools.

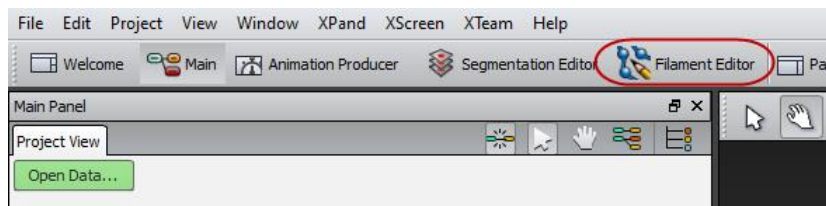
NEW FILAMENT EDITOR

The Avizo **XFiber** extension introduces the *Filament Editor* workroom (see Avizo Lite dedicated paragraph below to learn more about the *workroom* concept).

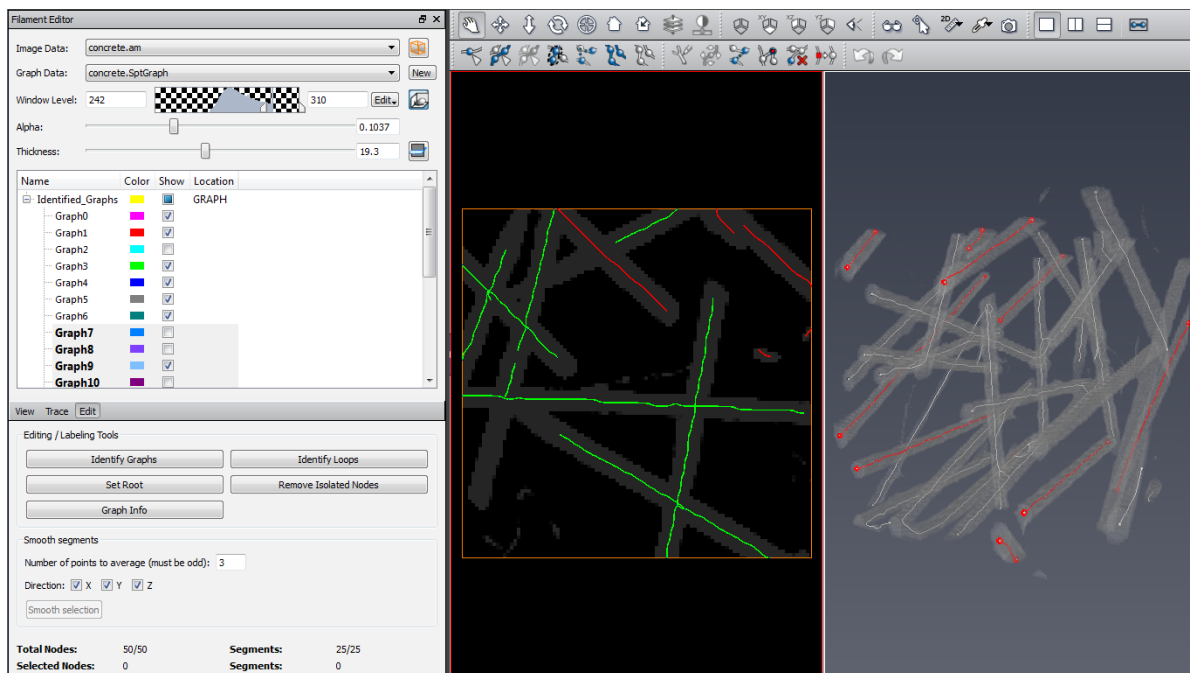
The *Filament Editor* is a well proven feature of Amira that was initially designed to analyze and quantify 3D images of filamentous structures such as neurons and blood vessel networks. The Avizo **XFiber** extension now brings to Avizo users the benefits of the *Filament Editor* for the study of fiber structures in materials such as reinforced concrete, composite materials, paper, and so on.

The *Filament Editor* offers automatic and interactive tracing tools for segmenting the centerline of the fibers and measuring their thickness in fiber networks and other filamentous structures, and editing spatial graphs obtained by skeletonization. Automatic tools can be conveniently used for images with good object-to-background contrast and will quickly arrive at the desired analysis. Usually, however, images suffer from degradations such as noise and blur so that an automatically traced image will be left with false connectivity and/or missing segments. Interactive tracing tools as well as a full-featured line editor can then be used to correct possible tracing errors.

The *Filament Editor* is activated by pressing the *Filament Editor* button in the workroom toolbar.



This will change the layout of the main and viewer windows.



The main components of this layout are the following:

- *Data Selector*: In the upper part of the main window two drop-down menus allow you to select the image and the *Spatial Graph* data object to be edited.
- *2D Viewer Settings*: Controls for window level and thickness settings in 2D slice and 2D segment viewer. It also provides buttons to turn on/off volume rendering and/or slicing in the 3D viewer.
- *Label Window*: The major part of the main control panel is occupied by the label window presenting a tree-like representation of the graph. Here the user may define and edit an arbitrary number of labels on different hierarchical levels of the graph data.
- *Tool Box*: Below the label window a tool box provides access for the tracing tools and the graph display and edition options.
- *Info Area*: At the bottom of the control panel a box informs the user about the graph being edited.
- *Viewers*: The *Filament Editor* typically offers three viewers for editing and viewing the data. The 2D slice viewer displays the image data as an arbitrarily oriented slice with variable thickness. In contrast the 2D segment viewer displays the image data along the currently selected segment as a curved slice also with variable thickness. The 3D viewer is the familiar Avizo viewer for 3D visualization of the graph data with optional 3D slice and volume rendering display.

To learn more about the *Filament Editor*, please refer to *Avizo User's Guide*.

NEW FIBER TRACING FEATURES

The Avizo **XFiber** extension introduces two new modules for tube-like structure detection and tracing in various modality acquisitions such as X-ray microtomography. These modules can be very powerful in a number of cases to enhance fibers or tube-like structures in noisy or low resolution images. The new modules *Cylinder Correlation* and *Trace Correlation Lines* are part of the new *Fiber Tracing* category.

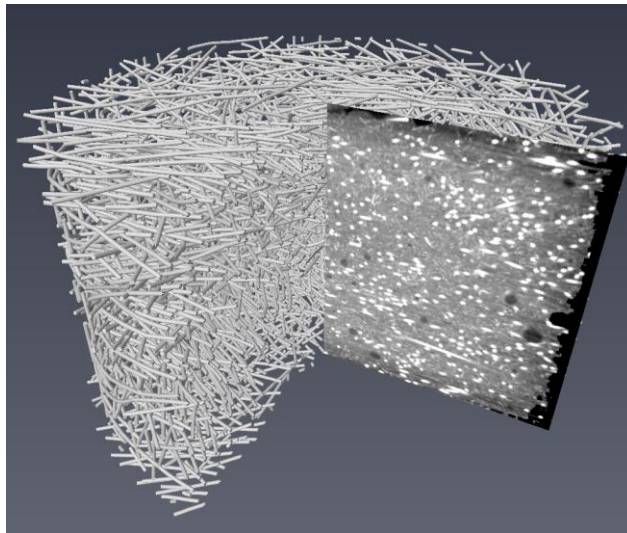
A dedicated tutorial describes the detection workflow for the example of steel fibers in reinforced concrete.

NEW CYLINDER CORRELATION MODULE

This module calculates the cross correlation of an input scalar field with a parametric hollow or solid cylinder with optional correction for missing wedge artifacts. It can be used to enhance tube-like structures in an image, for example cellulose fibers in paper. The module is the first step before tracing the centerlines of these structures with the *Trace Correlation Lines* module.

NEW TRACE CORRELATION LINES MODULE

This module traces lines based on a correlation field and an orientation field as computed by the *Cylinder Correlation* module. The output is a *Spatial Graph* object containing the traced centerlines. To get basic statistics for the generated lines, you can use the *Spatial Graph Statistics* module that has been enhanced to compute also the orientation of each centerline.



Steel fiber centerlines extracted from an X-ray microtomography scan of reinforced concrete

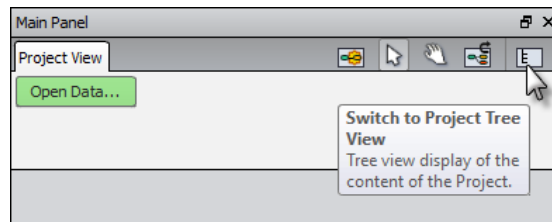
NEW XWIND EXTENSION – ADVANCED CFD/FEA DATA EXTENSION

Avizo Wind edition becomes the **XWind** extension, available for Avizo Lite and Avizo.

The XWind extension includes all features previously available in Avizo Wind edition: dedicated visualization and computation modules, readers and writers for advanced FEA/CFD data processing, analysis and export.

Like Avizo Wind edition previously, the XWind extension requires a specific license. When installing Avizo, a specific action is no longer required for installing the XWind extension. You simply have to enter the appropriate activation code to activate and be able to use the extension features.

XWind tree view is available from the Main panel shortcuts menu:



The standard behavior of the tree view in Avizo Wind that consists of organizing display, compute, and data objects in separate folders, can be restored by enabling the Project View option *Group by display/compute/data in tree view* in the Layout panel of the Preferences. The *Models* directory has been renamed to *Data*.

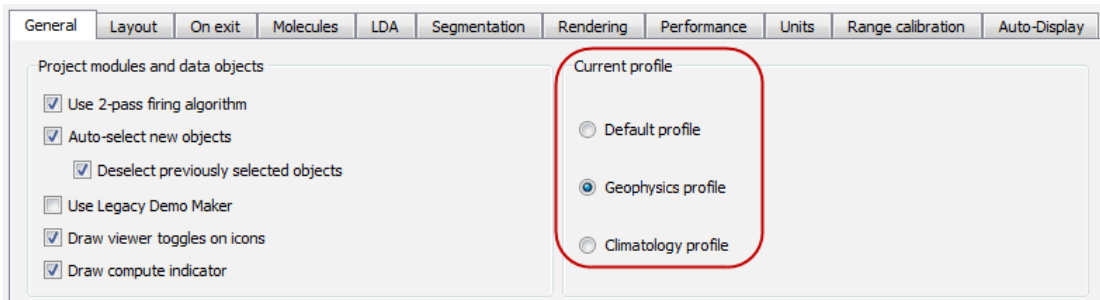
NEW XEARTH EXTENSION – GEOPHYSICS EXTENSION

Avizo Earth edition becomes the **XEarth** extension, available for Avizo Lite and Avizo.

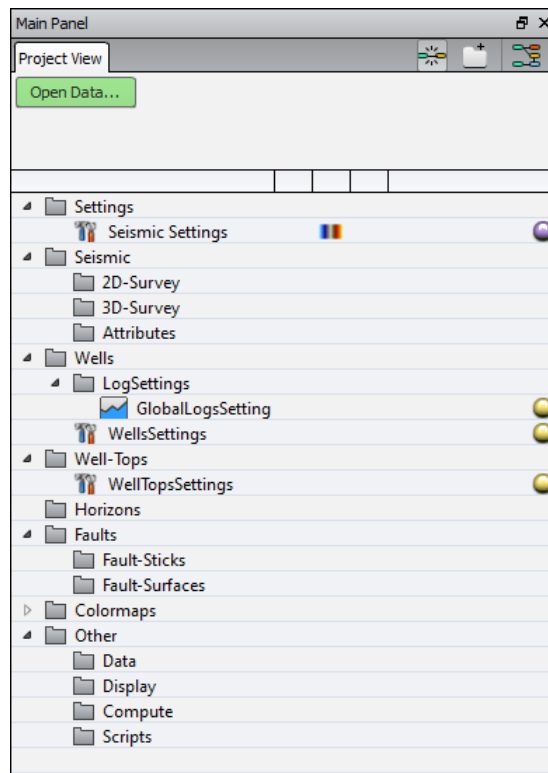
The XEarth extension includes dedicated visualization and computation modules and workflows, as well as a SEG-Y reader, for the exploration and analysis of geosciences data.

Like Avizo Earth edition previously, the XEarth extension requires a specific license. When installing Avizo, a specific action is no longer required for installing the XEarth extension. You simply have to enter the appropriate activation code in the License Manager dialog.

A *Geophysics profile* has been defined to enable all XEarth extension features, which are not available in the default profile. To switch to the Geophysics profile, open the General panel of the Preferences and check the corresponding checkbox in the *Current profile* section.



You will then be notified that Avizo must be restarted. After restart you will notice changes in the user interface, especially with the dedicated tree view. The profile name is shown in the Avizo title bar. SEG-Y import is now available, as well as dedicated modules, colormaps, etc.



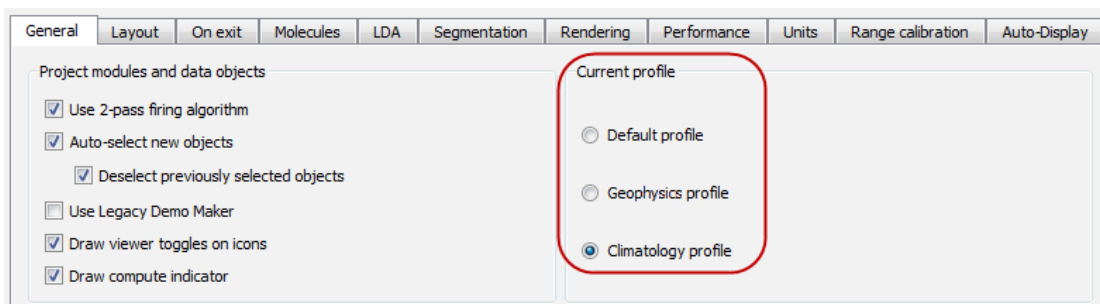
NEW XGREEN EXTENSION – CLIMATOLOGY EXTENSION

Avizo Green edition becomes the **XGreen** extension, available for Avizo Lite and Avizo.

The XGreen extension encompasses visualization and computation modules, a set of geographical projections and a NetCDF reader, dedicated to the analysis of climate, oceanography, environmental, and earth-mapped data.

Like Avizo Green edition previously, the XGreen extension requires a specific license. When installing Avizo, a specific action is no longer required for installing the XGreen extension. You simply have to enter the appropriate activation code in the License Manager dialog.

A *Climatology profile* has been defined to enable all XGreen extension features, which are not available in the default profile. To switch to the Climatology profile, open the General panel of the Preferences and check the corresponding checkbox in the *Current profile* section.



You will then be notified that Avizo must be restarted. After restart the profile name will be shown in the Avizo title bar. NetCDF import will be available, as well as dedicated modules, colormapaps, etc.

AVIZO LITE AND AVIZO – ENHANCEMENTS AND NEW FEATURES

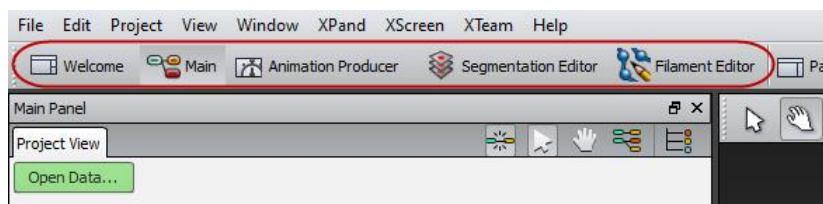
USER INTERFACE ENHANCEMENTS

WORKROOM CONCEPT

The Avizo 9.0 user interface provides an easier and faster way to switch between application areas. With the user-friendly *workroom* concept, several dedicated components are accessible as independent applications assembled together into the general Avizo platform. Each component provides its own specific interface, dedicated tools, and visualization options. Since switching between different components is possible through a simple toolbar, the user can explore and approach complex data sets using dedicated tools in the workrooms, and keep a clear overview in the general-purpose framework.

The following components are currently available as workrooms:

- Start page (called “Welcome”)
- Project View workroom (called “Main”)
- Animation Producer
- Segmentation Editor
- Filament Editor (requires XFiber extension)



START PAGE

When launching Avizo, a Start page now opens, giving you access to shortcuts to improve your user experience:

- Recent data, recent projects, and template lists
- Open Data, Open Project, and New Project shortcuts
- Easy access to help pages, tutorials, webcasts...

- Latest news regarding Avizo product family and FEI events
- Community links

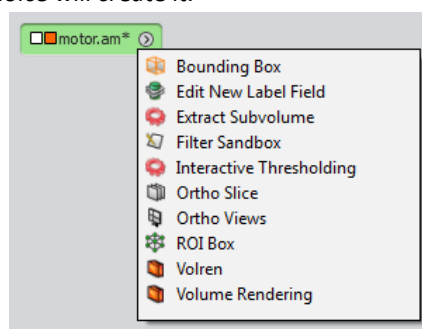


The Start page can be disabled but remains available at any time from the Workroom toolbar.

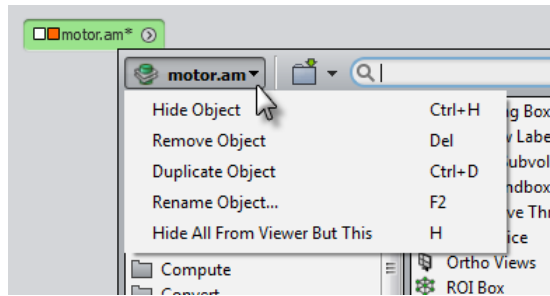
PROJECT VIEW ENHANCEMENTS

Avizo 9.0 Project View has undergone several enhancements to improve your user experience:

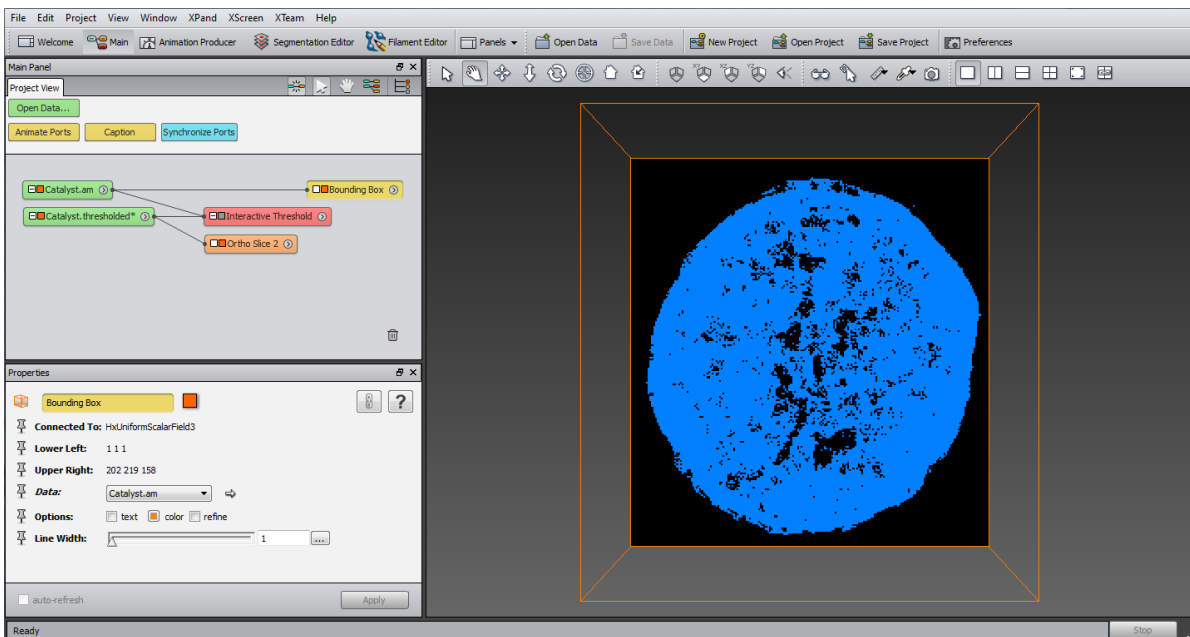
- Scrolling is now automatic when dragging icons out of the view.
- Switching to pan mode is now possible with the [ESC] key or by keeping the middle mouse button pressed.
- Pressing [H] while a data or a display module is selected will hide all from the 3D viewer except for this data or display module. This can also be done from the Project menu or the object pop-up option menu.
- Pressing [CTRL] while right-clicking on an object will display the list of favorite items of the object pop-up. A simple click on the item of your choice will create it.



- In the object pop-up, the option menu related to a selected object is now more visible and accessible.



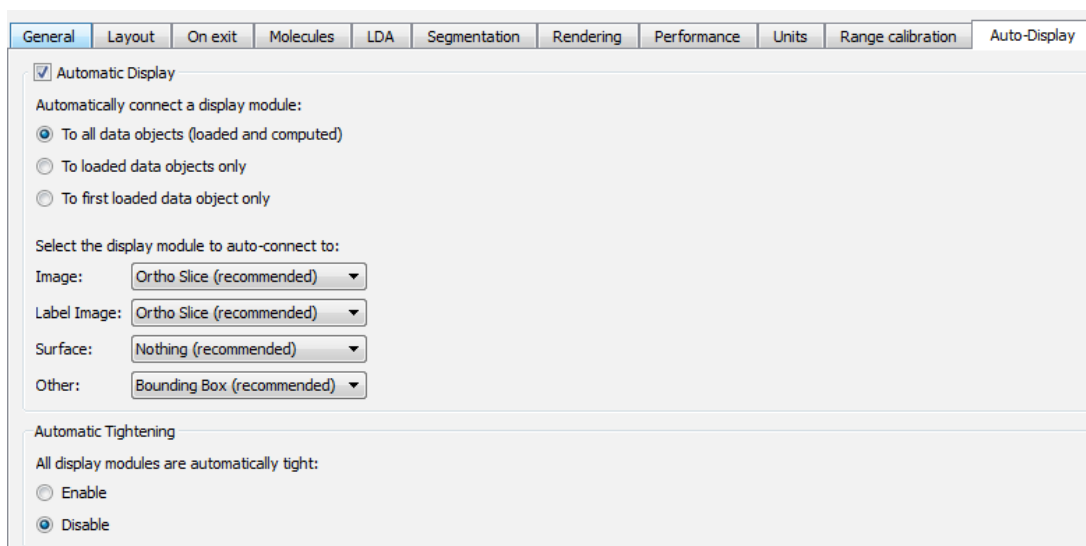
- The Project View, Properties area, and Workroom menu are now displayed on the left side of the 3D Viewer to improve accessibility and ergonomics. It is possible to switch back to the previous layout by checking *Show panels on right-hand side* from the Layout panel of the Preferences.
- The Project View icons have been redesigned to improve readability.



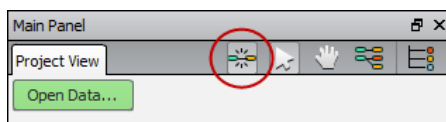
AUTOMATIC DISPLAY

When adding a new data object in Avizo Project View, a basic display module is now automatically connected to it to offer a first preview.

This feature can be enabled, tuned and disabled from the Auto-Display panel in the Preferences. You can choose to connect a display module to every data objects (including results of compute modules), or only to newly loaded data objects, or only to the first loaded data object. For each data type a display module is recommended by default. You can change it as you wish. Finally you can decide to tighten all display modules to the data they are connected to, which can save room in the Project View and increase its readability.



The automatic display feature can also be easily enabled and disabled from the Project View toolbar dedicated button.

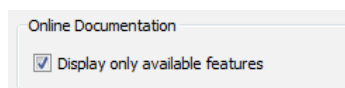


DOCUMENTATION IMPROVEMENTS

A navigation bar on top of help pages makes navigation through the Avizo online documentation easier.

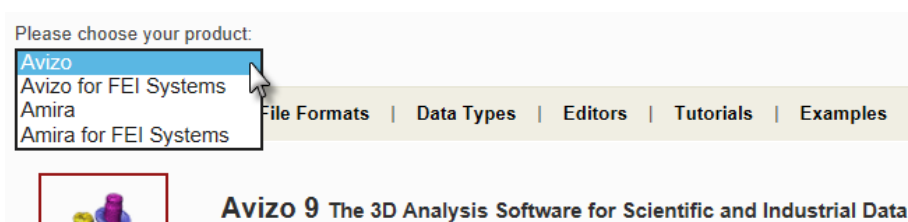


The online documentation now only displays by default the contents relative to the licenses installed. For users who would like to browse all the features of the product including those locked by missing licenses, this setting can be changed in the General panel of the Preferences.

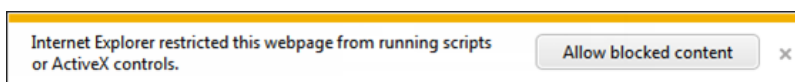


The index generated during the first use of the documentation search tool is now kept on disk, so that it does not need to be rebuilt on each restart of the application, making research faster.

In a web browser, all Avizo and Amira product family documentation can be accessed by selecting the product of your choice in the top left combo box.



This requires a compatible web browser (Internet Explorer or FireFox) with cookies enabled. The web browser may ask for a user confirmation about script execution.



NEW IMAGE FORMATS SUPPORTED

ENHANCED SUPPORT FOR TIFF-BASED FORMATS

The range of TIFF-based formats supported in Avizo has been increased.

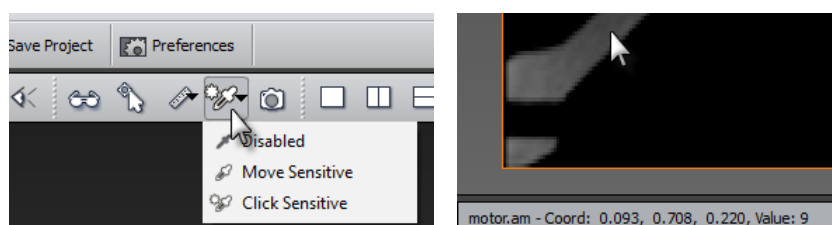
Image type/option	Avizo 8.1	Avizo 9.0
Tiff - multiple pages	x	x
Tiff – strips	x	x
Tiff – tiles		x
Tiff – grayscale	x	x
Tiff – RGB	x	x
Tiff - color model YCbCr		x
Tiff - compression LZW	x	x
Tiff - compression jpeg		x
Tiff - compression deflate		x
Tiff - images size > 4GB		x
Zeiss LSM	x	x
Metamorph STK	x	x
Olympus Fluoview	x	x

x: supported format

NEW AND ENHANCED FEATURES

NEW MOVE-SENSITIVE EASY PROBE

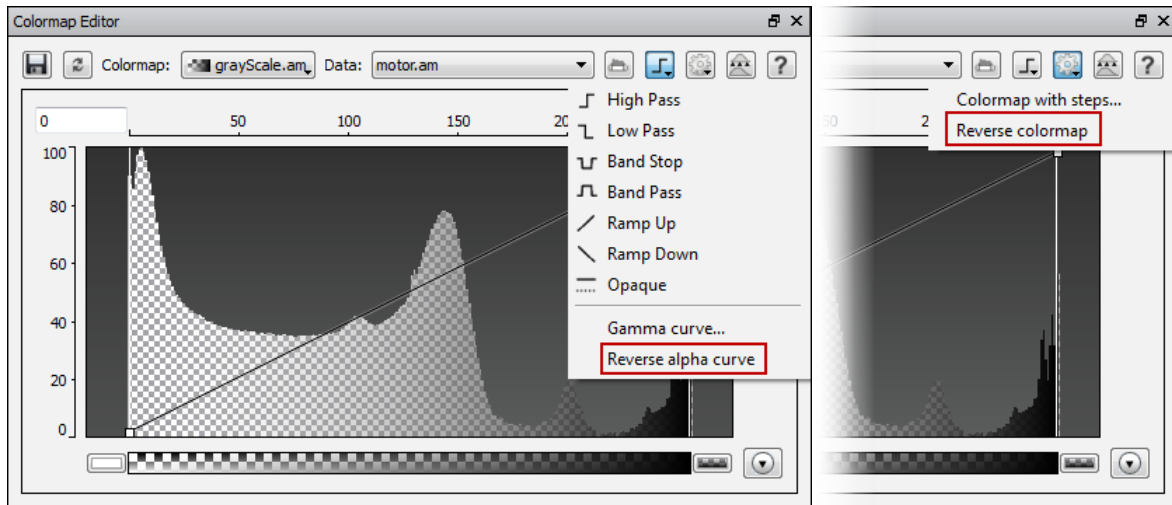
A *Quick Probe* feature, accessible from the viewer toolbar, allows displaying the value and coordinates of a voxel using the mouse. The Quick Probe button supports three modes: move-sensitive, click sensitive, and disabled.



By default, the Quick Probe is move-sensitive i.e., the voxel value and coordinates under the mouse cursor are displayed in the progress bar. In click-sensitive mode, the value and coordinates are displayed if the [SHIFT] key is pressed and visualization in the viewer is clicked on with the left mouse button.

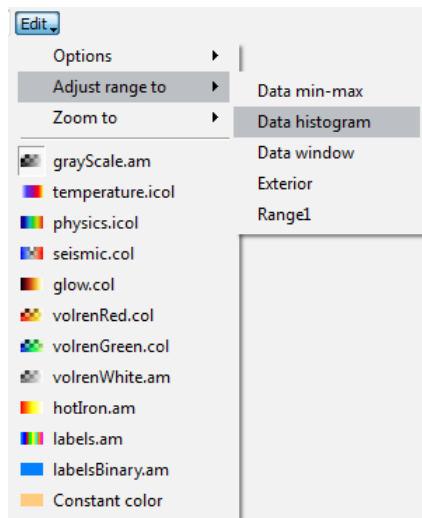
NEW REVERSE COLORMAP AND ALPHA CURVE OPTION

It is now possible to easily reverse the colormap and the alpha curve in the *Colormap Editor* by selecting the dedicated option.



COLORMAP PORT ENHANCEMENTS

The Edit menu of colormap ports has been slightly reworked. Adjust range options and zoom options are gathered in the same submenus. The possibility to adjust the range to data histogram has been added.



When the mouse hovers over the colorbar:

- the mouse wheel can be used to zoom on the colorbar,
- pressing on the space bar allows zooming to range and zooming to data min-max alternately.

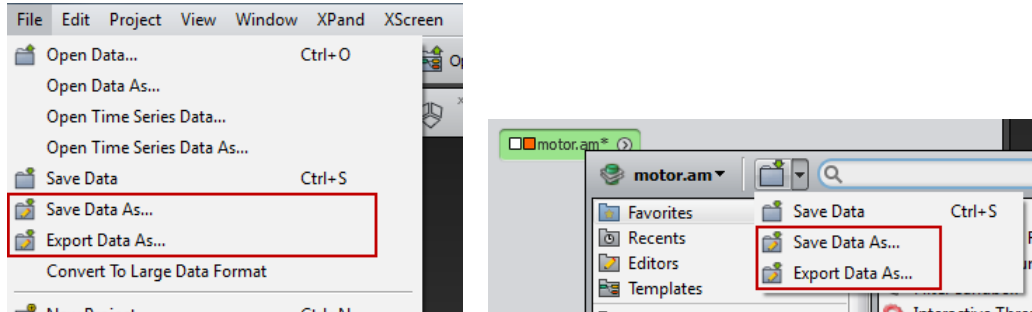
Left and right thumbs of the colorbar are snapped when brought close to each other. This is convenient when you wish to observe a single label in a label field.

SNAPSHOT TOOL ENHANCEMENT

An antialiasing option has been added in the snapshot tool dialog.

NEW “SAVE DATA AS” AND “EXPORT DATA AS” POLICY

The *Save Data As* command now allows you to save data only in native file formats. A native file format is a file format that can save all of the data properties in Avizo. If you want to save your data in a non-native file format, you must now use the new dedicated item *Export Data As*. The file dialog will present a list of all file formats suitable for saving that data object, native or not.



Save Data As now renames the data object in the Project View according to the saved file name. As a project keeps track of the new file associated with the data object, a subsequent *Save* [Ctrl + S] will update that file and the project will refer to that file when saved and reloaded.

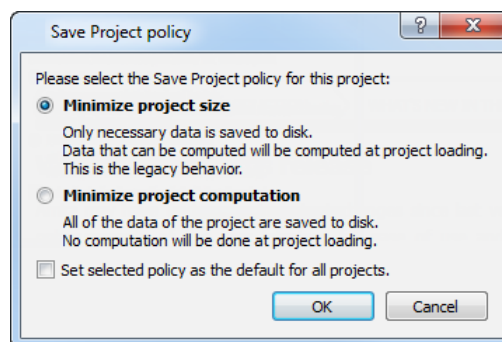
On the other hand, *Export Data As* keeps the data object name and the project unchanged.

NEW SAVE PROJECT POLICY

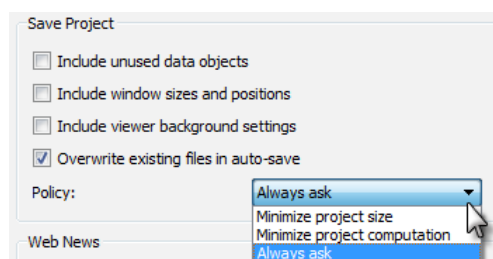
When saving a project, it is now possible to choose between two options:

- Minimize the project size: only necessary data objects are saved to disk ; the ones that can be recomputed will be recomputed at project loading. This is the legacy behavior.
- Minimize the project loading time: all the data of the project are saved to disk. This way no computation at project loading is necessary.

The first time you save a project in Avizo 9.0, the *Save Project* policy dialog will be displayed, allowing you to choose the mode you prefer and to make it the default mode for subsequent projects.



You can modify the default setting at any time from the *Save Project* section in the General panel of the Preferences.



With the new option *Include viewer background settings* you can decide to save or not the background color and mode in projects. This is disabled by default.

SCRIPTING ENHANCEMENTS

A *CamelCase* label is now registered for all modules, lights, and tree view items. CamelCase labels do not contain spaces (words are only separated by capital letters) and may be preferred for convenience when scripting. For example, the CamelCase label for Ortho Slice is OrthoSlice.

For the objects mentioned above, both the GUI labels and the CamelCase labels can be used in the Console (see below for auto-completion) and in scripts (GUI labels are saved in saved networks but manually created scripts can use both labels).

The auto-completion in the Console works like this:

- From an empty console line, if you press the [TAB] key, the label of the selected module in the Project View is suggested. It will suggest the shorter of its GUI label and CamelCase label (which is often the CamelCase one). If you press the [TAB] key twice or more, it will add quotation marks around the CamelCase label.
- From few letters:
 - If there is only one possible completion, or if all the suggestions lead to the same object in the Project View, the shorter of its GUI label and CamelCase label is enclosed in quotation marks and displayed.
 - If there are several possible completions, they are all displayed, mixing GUI labels and CamelCase labels.

NEW LICENSING SYSTEM IMPROVEMENTS

The reactivation of licenses is now suggested when expired licenses are found and the process automatically reactivates all expired licenses.

It is now possible to use the activation system on a computer with no internet connection. The procedure to follow is detailed on our website and accessible from Avizo online documentation.

Note: Avizo 8.1 introduced a new licensing system, based on on-line activation. Please refer to *Avizo 8.1 Release Notes* for all details (<http://www.fei.com/software/avizo-release-notes/>).

OPEN INVENTOR UPGRADE

Avizo now uses Open Inventor 9.4 as its graphics engine. This upgrade includes bug fixes and improvements such as better performance with *Delayed* transparencies, a new high-performance high quality algorithm for the *Sorted Layers* transparencies, and enhanced *Volume Rendering* performance for texture generation (non-LDM and compressed volumes).

NEW MODULE VOLREN AND COMPARISON WITH VOLUME RENDERING MODULE

The new *Volren* module displays a direct full-resolution volume rendering of 3D images with shading effects. *Volren* enables you to render segmented regions at the same time with different colormaps. The *Volume Rendering* module has been developed to take advantage of modern graphics hardware, *Volren* may provide better performance than the *Volume Rendering* module on old generation graphics hardware.

Differences between modules *Volren* and *Volume Rendering*

Feature	<i>Volren</i> module	<i>Volume Rendering</i> module
Mouse picking	No	Yes
Isosurface Rendering	No	Yes Separate module
Voxelized Rendering	No	Yes Separate module
DRR rendering (simulated Digitally Reconstructed Radiograph)	Yes	No
MIP rendering (Maximum Intensity Projection)	Yes	Yes
Lighting and shade effects	Yes Diffuse, specular	Yes Diffuse, specular, enhanced edge, boundary, ambient, deferred, high quality
User defined light coefficients	Yes	No
Light angle control	Yes <i>Port Shading: User-defined</i>	Yes Use top menu View>Light to Create custom light and deactivate Headlight
Cast shadows	No	Yes
Multi-Channel Field input	No	Yes
Color Field input (RGBA)	Yes	Yes
Label field secondary input and per-label colormap	Yes	No
Label colormap support (cycling, no interpolation)	No	Yes
Multi-Volume support	Yes	Yes
Support for data larger than graphics memory	Yes Full resolution when still, low resolution during interaction	Yes Progressive adaptive resolution, limited by memory threshold
Support for data larger than the main memory (RAM)	No	Yes With converting data into LDA format
LDA format support (Large Data Access for progressive loading, instant preview, quick extract from out-of-core data)	No	Yes
ROI Box (Region of Interest)	Yes	Yes
Custom ROI	Yes Corner Cut exclusion corner	Yes ROI Box for Volume Rendering: exclusion box, fence, cross, subvolume
Hardware support	Modern graphics boards with updated driver e.g. NVidia Quadro	Modern graphics boards with updated driver e.g. NVidia Quadro Requires support for advanced shaders

NEW MODULES

POINT CLOUD FILTER filters a connected *Point Cloud* by an expression built from the coordinates and data values of each *Point Cloud* (new name for *Cluster* objects).

CORNER CUT defines a cutting region with the shape of an axis-aligned 3D box originating from a corner of the bounding box. The cutting box can be used to clip the volume displayed by the *Volren* module.

EIGENVECTOR TO COLOR, when connected to the first eigenvector of a tensor field and to a vector field representing the eigenvalues (both produced by *Extract Eigenvalues*), generates a color representation which describes by a color code the directions of the first principal direction of the tensor field.

ENHANCED MODULES AND EDITORS

The **SIMPLIFICATION EDITOR** algorithm has been improved in order to dramatically reduce the occurrence of intersections in the computed simplified surface. Topological problems such as flat triangles, flat solid angles (two triangles overlapping), extremely close vertices, and flat edges (two triangles sharing an edge and overlapping) are now handled in a better way. Normal flipping problems should be avoided in most cases.

GENERATE SURFACE now supports 32-bit input label fields.

ILLUMINATED STREAMLINES offers a new coloring mode DEC (Directionally Encoded Colors) that uses red, green, and blue primaries to encode the direction of the line segment at a given point where red, green, and blue denote the x, y, and z directions respectively.

ALIGN SURFACES has a new *Weights* port to assign different importance to vertices of the surface to be transformed.

ISOCONTOUR ANNOTATED SLICE is deprecated and replaced with an *annotate* option in *Isocontour Slice* display module.

EMBOSSSED SLICE is deprecated and replaced with an *embossing* option in the *Slice* display module.

VOLUME EDIT now supports RGBA image inputs. It has a new *Padding Value* port that specifies by which data value(s) voxels in selected regions are replaced when cutting. For color fields a specific value can be set for each channel. If a color field is attached to the module this port allows the user to select if changes should affect only the alpha channel or all channels.

CAPTION module, if connected to a data object, will display its name.

PERFORMANCE IMPROVEMENTS

Several compute modules and image filters have been parallelized, resulting in dramatic performance improvements when using multi-core processing (how many cores are used can be controlled in the *Performance* panel of the Preferences dialog):

- *Arithmetic*
- *Register Images*
- *Resample*
- *Laplacian Zero-Crossing*
- *Sobel Filter*

- *Adaptive Histogram Equalization* in 2D only (i.e., XY planes)
- *Lanczos Filter*
- *Sigmoid Intensity Remapping*
- *Brightness-Contrast*
- *Moments Filter*
- *Gamma Correction*

Spatial Graph View tube rendering has been improved in speed and responsiveness. Changing the *Tube scale factor* is now instantaneous even for large *Spatial Graph* objects.

LINUX SUPPORTED DISTRIBUTION

The official Linux distribution for Avizo is Red Hat Enterprise Linux 6 64-bit. Nevertheless, Avizo is likely to work on other 64-bit Linux distributions if the required versions of the system libraries can be found. Technical support for those platforms will be limited.

In order to add custom extensions to Avizo with Avizo XPand, you will need gcc 4.4.x on RHEL 6.

AVIZO - ENHANCEMENTS AND NEW FEATURES

Avizo Fire now becomes Avizo.

LABEL ANALYSIS ENHANCEMENTS

NEW STANDARD SHAPE ANALYSIS MEASURE GROUP

A new measure group, called *Standard Shape Analysis*, is available from the *Measures* drop-down list. This group can be used to characterize the shape parameters of labels (such as volume, barycenter, anisotropy, covariance matrix, voxel face area...).

NEW MEASURES

New XY/3D measures have been added:

- *Majority* (most represented gray level intensity inside a particle)
- *Median* (median gray level intensity within a particle)
- *GreyBaryCenterZ* (Z coordinate of the weighted center of gravity)
- *IntegralMeanCurvature* (integral of mean curvature)
- *Anisotropy* (region's deviation from a spherical shape)
- *BorderVoxelCount* (sum of voxels that are at the intersection of the image volume with its bounding box)
- *EigenVal1, EigenVal2* (largest and medium eigenvalues of the covariance matrix)
- *EigenVec1X, EigenVec1Y, EigenVec2X, EigenVec2Y* (X and Y coordinates of the eigenvectors of the covariance matrix)
- *Elongation* (ratio of the medium and the largest eigenvalue of the covariance matrix)
- *ExtentMin1, ExtentMin2, ExtentMax1, ExtentMax2* (extent of the data in the direction of the eigenvectors of the covariance matrix)

New 3D-only measures have been added:

- *EigenVal3* (smallest eigenvalues of the covariance matrix)
- *EigenVec3X*, *EigenVec3Y*, *EigenVec3Z*, *EigenVec1Z*, *EigenVec2Z* (X, Y, Z coordinates of the smallest eigenvector of the covariance matrix and Z coordinates of the other eigenvectors)
- *Flatness* (ratio of the smallest and medium eigenvalues of the covariance matrix)
- *VoxelFaceArea* (sum of voxel surfaces that are on the outside of each connected component)

NEW MODULES

LOCAL THRESHOLDING provides algorithms to perform a binary segmentation of an image stack into foreground and background objects. The output of the module is a label field. The algorithms work best if multiple small objects need to be segmented before a slowly varying background. *Local* methods adapt the threshold value on each pixel to the local image characteristics, as opposed to *global* (histogram-based) methods (e.g., in *Auto Thresholding* and *Interactive Threshold* modules).

BLOCK FACE CORRECTION can be used to correct inter-slice intensity variations that are typically found in block face scanning stacks. Using the *Segmentation Editor*, the user defines regions of foreground and (optionally) background voxels on each slice. *Block Face Correction* generates corrected slices that have been calculated using the mean voxel intensity in the labeled regions.

FILTER BY SPREADSHEET creates a new a label field object from an existing label field, filtered by a spreadsheet. This feature is useful, for example, when the spreadsheet output of *Shape Analysis* is being filtered or as a complement for the *Analysis Filter*.

AVERAGE VOLUME computes the per-voxel average of an arbitrary number of 3D image data sets or label fields.

HIERARCHICAL WATERSHED uses a variant of the watershed transform to segment gray value images into meaningful regions. *Hierarchical Watershed* can also be used to separate objects in a binary segmented image. Rather than producing a single segmentation, the algorithm creates a hierarchy of catchment basins so that the user can control the level of granularity of the labeled image. However, unlike *Marker-Based Watershed*, the markers are set to local minima and cannot be specified.

SPREADSHEET TO POINT CLOUD converts a spreadsheet with x, y, z coordinate columns into a *Point Cloud* object (new name for *Cluster* objects).

POINT CLOUD DENSITY computes the local density of a *Point Cloud*. The density value is stored as a new data column on the result *Point Cloud* (new name for *Cluster* objects). The density is defined as the number of points per volume of a sphere centered at the point's location. Several algorithms for computing the density are available.

SOLVED ISSUES

Avizo 9.0 Beta already provides various enhancements and solutions to known problems. During this Beta phase, our team will focus on solving as many issues as possible to make your experience of Avizo 9.0 as satisfactory as possible. In this purpose, we would appreciate your feedback regarding this Beta version. If you encounter problems, or also if you have suggestions for improvement, please report them to vsghotline@fei.com.