Avizo Inspect 9.1
Software for Industrial Inspection and Materials Research & Development

Dear Avizo Inspect User,

With this document we would like to inform you about Avizo Inspect 9.1, new software for Industrial Inspection and Materials R&D. Based on FEI's flagship Avizo software application integrating over 10 years of expertise, Avizo Inspect provides a comprehensive set of tools addressing the whole research-to-production cycle: from materials research in off-line labs to automated quality control in production environments.

This document will also inform you about the most important new features, improvements, and changes introduced by Avizo 9.1. For major changes introduced in Avizo 9.0, please refer to the *Avizo 9.0 Release Notes* document.

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 fei-sw-support@fei.com.
We would like to thank you in advance for your efforts.

March 2016, the Avizo team

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Avizo Inspect 9.1 release notes – FEI© 2016

AVIZO INSPECT – NEW EDITION

Avizo Inspect is the new application for industrial inspection and materials R&D. It streamlines the process of industrial inspection and materials design, off-line, near-line, and in-line, including dimensional metrology with advanced measurements, and an extensive set of inspection workflows, called "recipes", for quantification of indications, porosity, inclusions, and defects.
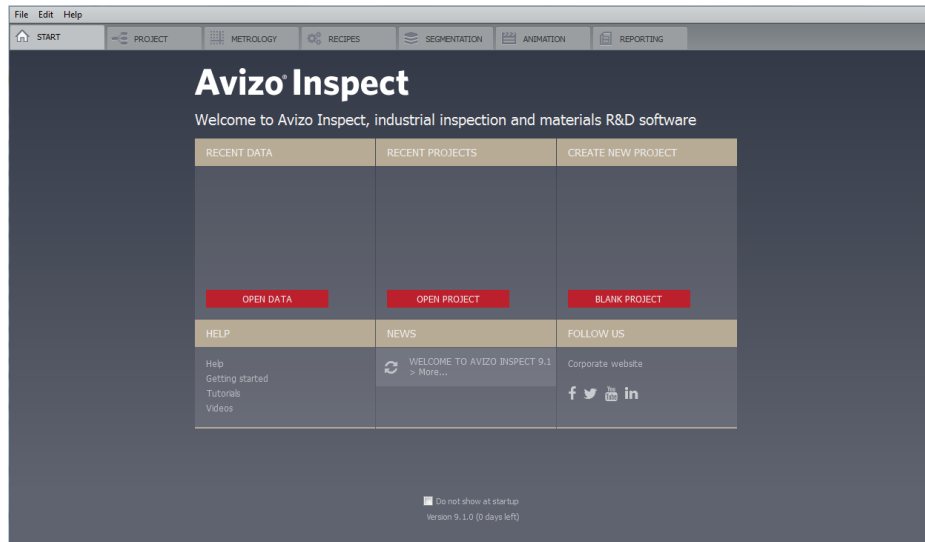
Avizo Inspect includes all Avizo features as well as the following extensions: **Avizo XMetrology Extension**, **Avizo XRecipe Extension**, **Avizo XReporting Extension**, and **Avizo XLVolume Extension**.

NEW XMETROLOGY EXTENSION

The Avizo **XMetrology** extension allows creation of test plans consisting of a set of measures on the part. Once a test plan has been created and saved on a reference part, it can then be re-applied to any similar part and used to validate or reject the part.
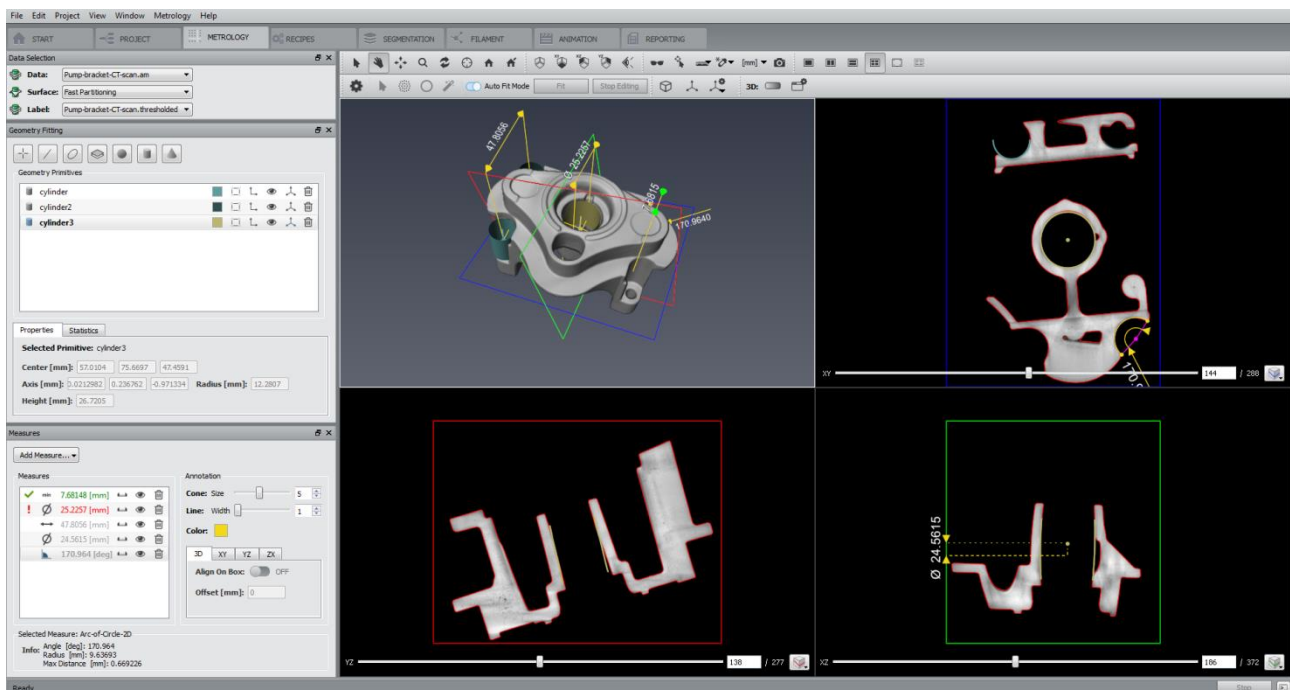
DATA SELECTION PANEL

The *Data Selection* panel allows the selection of the data on which measurements need to be performed: the volume itself that needs to be measured, the type of surface defining the interface between the part and the "outside", and finally, a mask for additional types of measures.

The first option of the *Surface* selection pull-down menu allows for selection of an interface based on a fast partitioning algorithm. The second one, *Adaptive Sub-Voxel*, relies on a much more advanced and CPU/RAM intensive algorithm that provides a more accurate interface computation.

GEOMETRY FITTING PANEL

The workroom includes a dockable *Geometry Fitting* panel where geometry can be fitted. Geometry fitting relies on selecting points supporting the geometry lying on the interface between the part and the "outside" of the part. These points are selected by picking in one of the four viewers provided in the layout. When a point is "picked", it is projected to the surface selected in the *Surface* pull-down menu of the *Data Selection* panel.
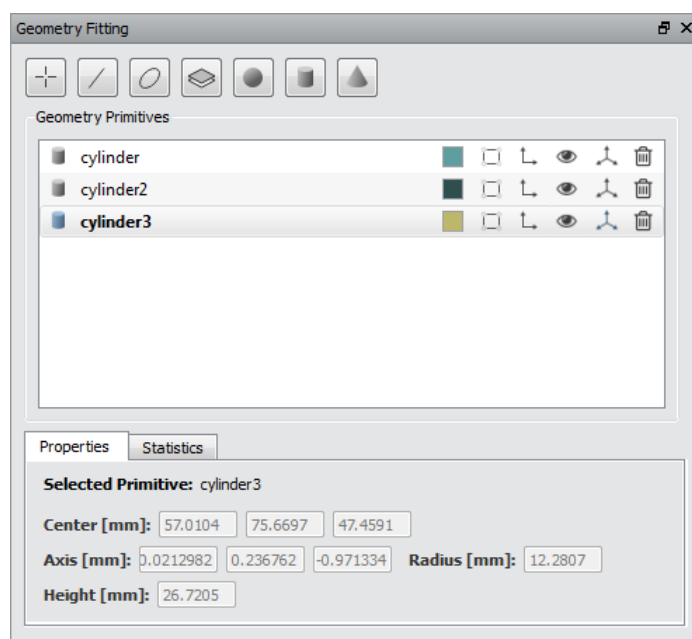
Different selection tools are provided in the toolbar at the top of the viewers.

## LOCAL COORDINATE SYSTEMS SETTING

The part may need to be realigned according to a specific orientation, as it may be tilted during CT acquisition to optimize the beam path and minimize acquisition artifacts. The fitted geometries are used to define the directions of *Local Coordinate Systems* (or LCS). Different tools are provided to create these LCS and multiple LCS can be created.

Visualization can switch from one LCS to another in order to create other measures that are aligned with the axes of a particular LCS.

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MEASUREMENT CREATION

Two main categories of measures are provided: one based on fitted geometry that has been fitted on the interface of the part with the "outside" of the part; and one based on the optional mask provided in the *Data Selection* panel. The fitted-geometry-based measurement gives a sub-resolution precision measure while the mask-based measurement gives a measure with resolution precision. The *Measures* panel gives access to all of the measurement tools.
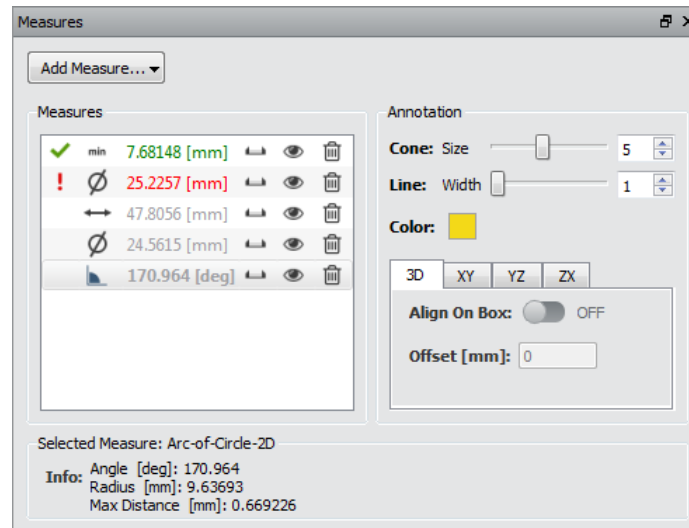

Once a measure type has been selected, possible geometries that can be used to support the measure are shown in the measure creation wizard.

USING TEST PLANS

Once geometries have been fitted, and LCS and measures created, all of them can be saved as a test plan. A collection of test plans can be created and re-applied on other parts that need to be validated against a reference model. This is done through the *Metrology* menu, where test plans can be saved or opened.

NEW XRECIPE EXTENSION

The Avizo **XRecipe** extension allows creation of user-defined "recipes" for automation of a complex scenario, making use of multiple tools and workspaces. They define high-level workflows, such as extracting user-defined statistics from an image.
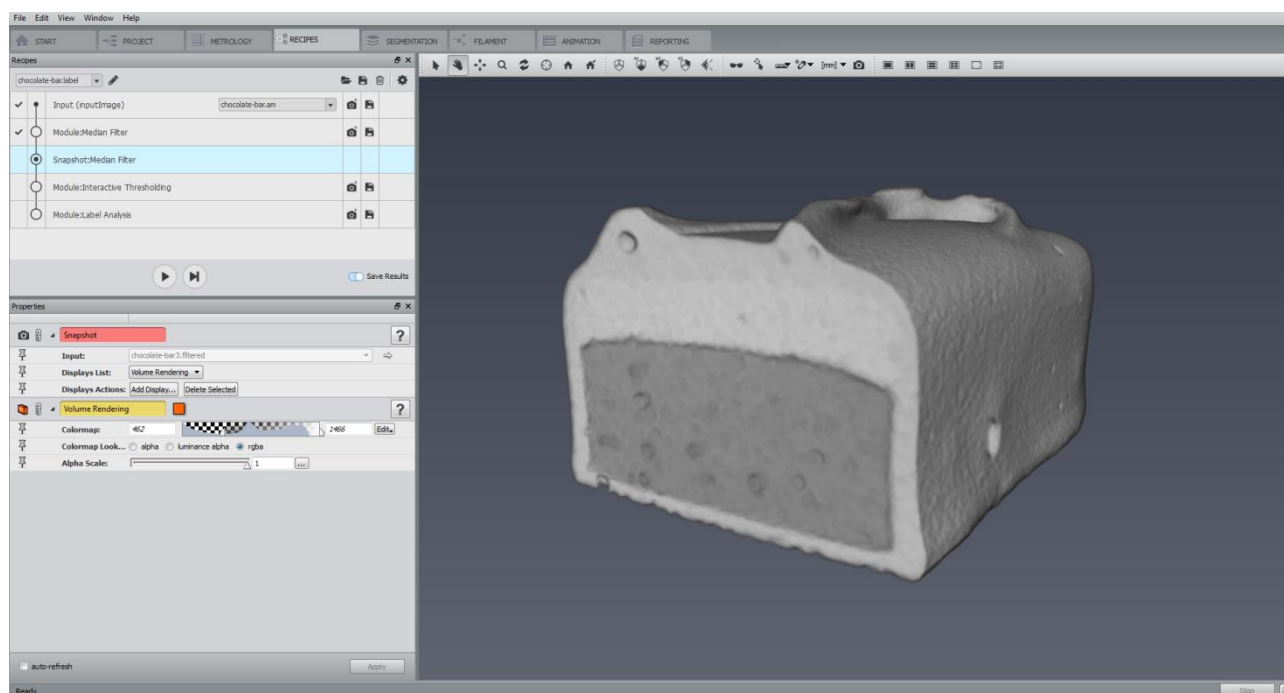

The *Recipes* panel allows the execution of user-defined recipes. Once a recipe is loaded into the panel, it can be played and edited. Multiple recipes can be loaded, and they can be saved on disk using a dedicated file format (hxrecipe).

When a recipe is played, the user has control over the execution: it can either be executed all at once, or paused using breakpoints. A breakpoint allows changing the properties of a tool used in the recipe.

At each step, a snapshot of the result of the step is created and optionally saved (when the *Save Results* option is on). By default, the default display module defined in the *Preferences Auto Display* is used. But this can be changed by adding a snapshot for a particular step, setting a breakpoint on the snapshot step, then running the recipe. When the recipe reaches the snapshot breakpoint, the recipe will stop and the snapshot can be customized in the *Properties* panel.

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NEW XREPORTING EXTENSION

The Avizo **XReporting** extension allows creation of reports, including snapshots and analysis results, in an HTML template or PDF file. This can be done automatically by assigning a particular snapshot or table generated when running a recipe to a specific frame, or by dragging and dropping a snapshot generated through the Avizo snapshot tool or a table resulting from an analysis.

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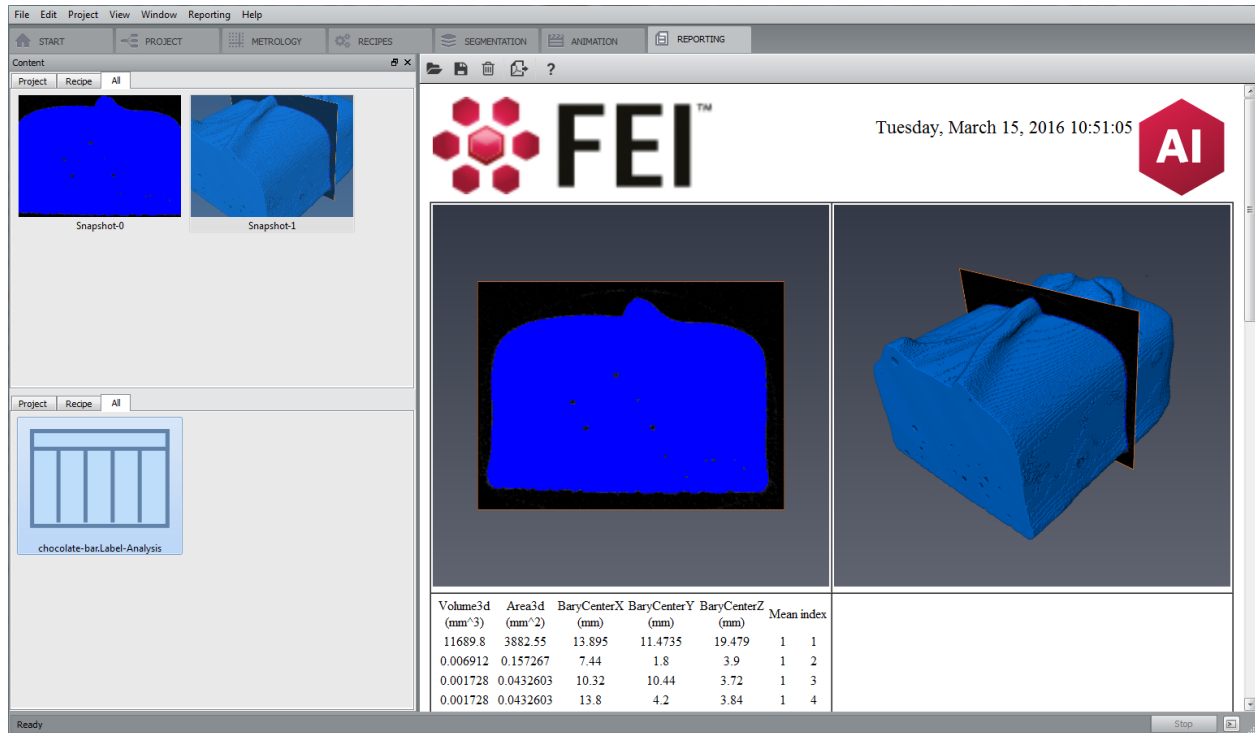
AVIZO LITE AND AVIZO – ENHANCEMENTS AND NEW FEATURES

USER-INTERFACE ENHANCEMENTS

Some components of the GUI, such as buttons or combo boxes, have been reworked (size, look and feel, color, margins, etc.), in order to have a more homogeneous interface on all platforms.

SEGMENTATION WORKROOM ENHANCEMENTS

Avizo 9.1 comes with an improved segmentation editor. The user interface was redesigned with a focus on ergonomics and intuitiveness. In addition to the improvements of the user interface, new tools were introduced and other enhancements made.
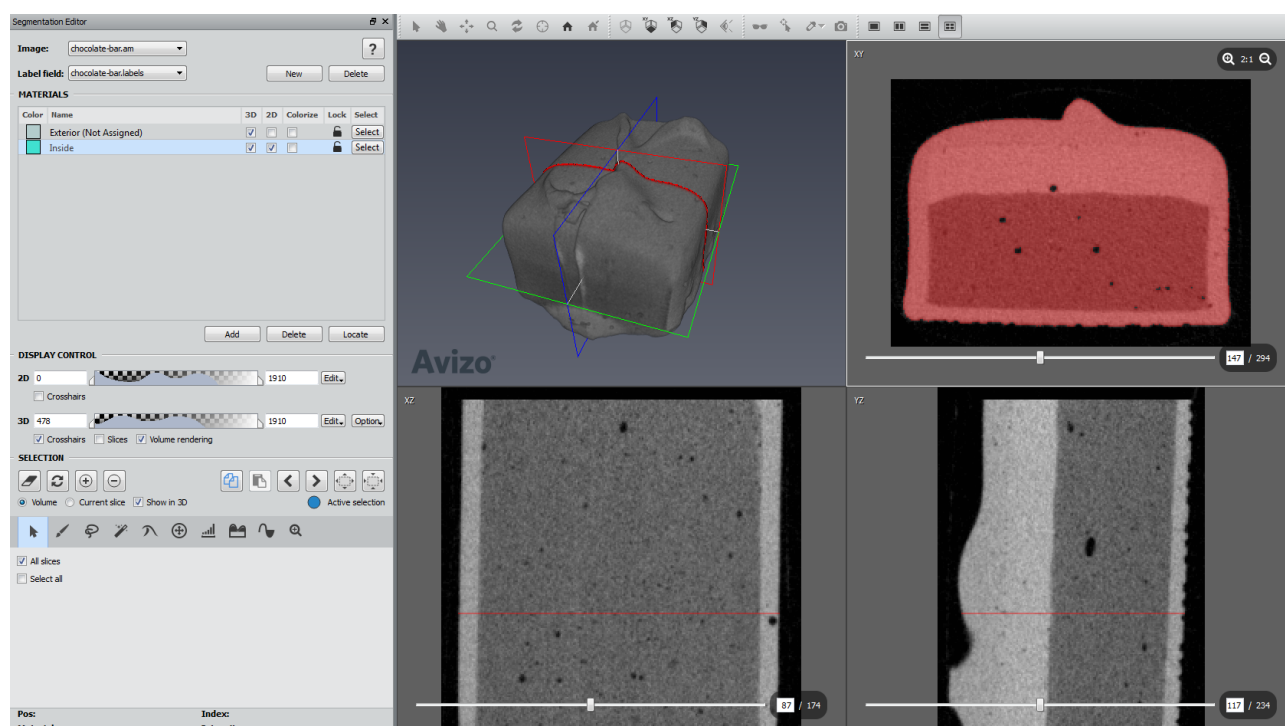

NEW DISPLAY CONTROL AREA

2D DISPLAY CONTROL

2D crosshairs can now be activated using the associated checkbox in the 2D display control area.

3D DISPLAY CONTROL

Two new checkboxes are available in the 3D display control area to activate 3D crosshairs and slices. The *Slices* checkbox is enabled only if *Crosshairs* is checked. When *Crosshairs* is selected, crosshairs and a frame appear in the 3D viewer. When *Slices* is checked, slices also appear.

A *Volume rendering* checkbox is available to activate a volume rendering visualization in the 3D viewer. A colormap allows the user to update its state. Volume rendering settings are now available in a dedicated menu *Option*.
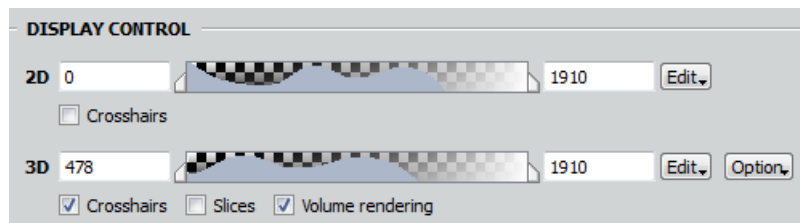
MATERIALS LIST ENHANCEMENT

The visibility of each material color of the 3D volume rendering can be now be set directly from the *Materials* list, using the corresponding checkboxes from the *Colorize* column. This column is enabled only if volume rendering is activated.
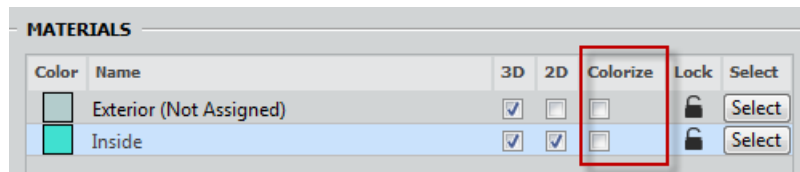

SELECTION AREA ENHANCEMENTS

SELECTION STATE

The state of the current selection is now displayed using a label in the *Selection* area. This label can display three different messages: *No selection*, *Active selection*, *Hidden selection*. The last two states indicate whether an in-plane selection is shown in one of the 2D viewers or located in a different slide.
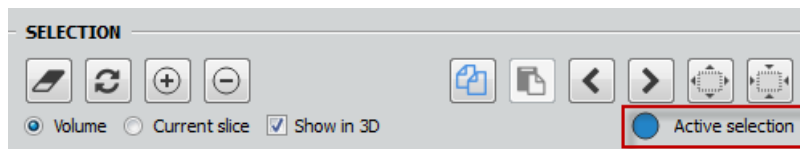
NEW MASKING FEATURE

The masking feature allows the user to control the masking by setting its range, and its visibility in 2D/3D viewers, and to enable/disable it in some tools. This masking feature is optional for the *Brush* and *Lasso* tools. It is used in the workflows for the *Magic Wand*, *Threshold*, and *TopHat* tools.
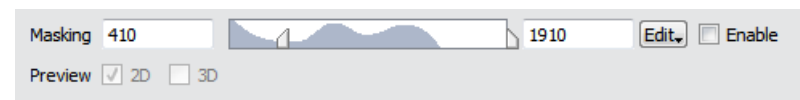
TOOL ENHANCEMENTS

The Brush tool icon now uses stipple circles and rectangles in 2D viewers.

The Lasso tool can now interact in the 3D viewer. Three modes are available: *Inside*, *Outside*, and *Intersect*.

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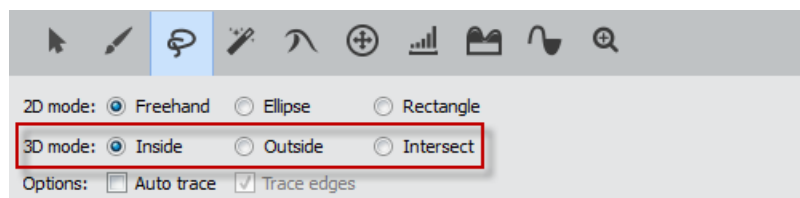
The performance of the Magic Wand tool has been improved when *All slices* is activated. The option *Absolute values* is now named *Relative range*, and when it is selected, the masking slider takes a relative policy.
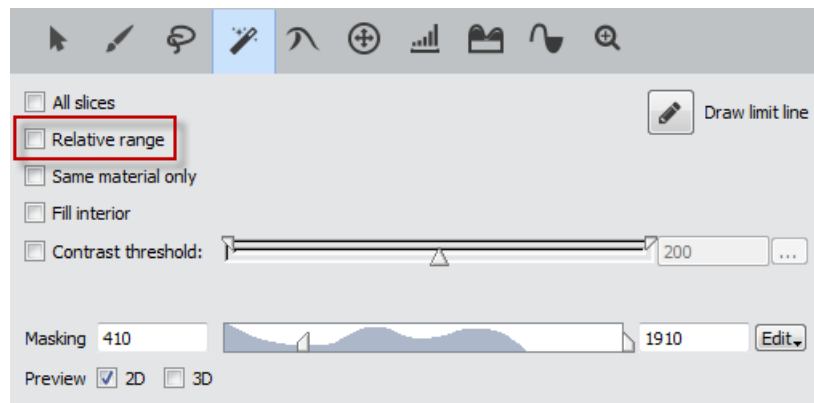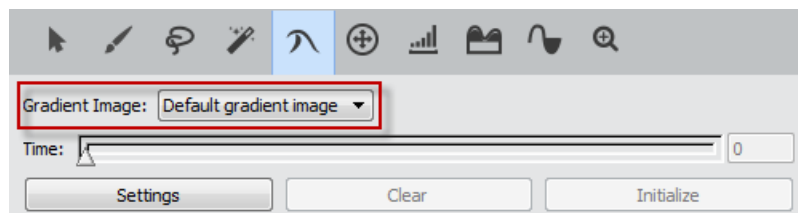

A new combo box is added to the Propagating Contour tool for selecting the gradient image used in this tool. The *Menu* button is now named *Settings*, and the *DoIt* button is now named *Initialize*.

A new button *Select Masked Voxels* is added to the Threshold tool in order to compute the selection only when it's needed, not interactively.
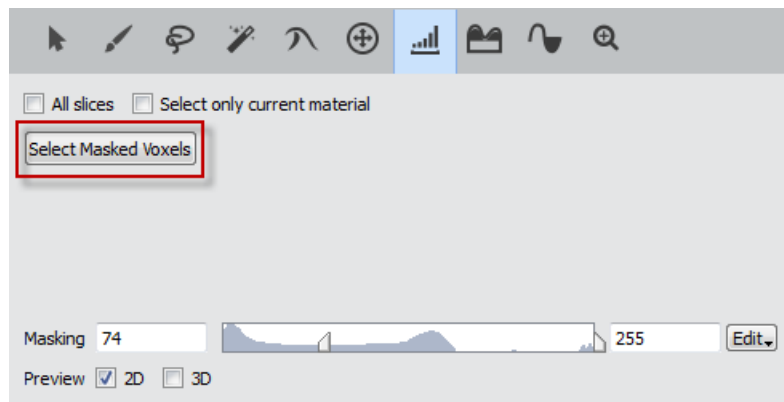
In the TopHat tool, a new port *Kernel shape* now allows the selection and configuration of the kernel shape similarly to the erode/dilate group modules. A new button *Select Masked Voxels* is also available when the masking is available, and works as in the Threshold tool.
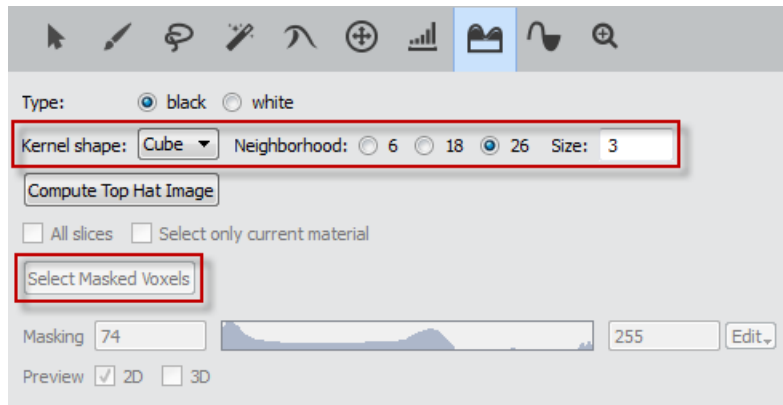
A Zoom tool is now available to manage the zoom factor on all and individual 2D viewers. A shortcut for the zoom tool has been added to the individual 2D Viewers.

VIEWER ENHANCEMENTS

The viewer layout is now stored and restored each session. The default is still 4-viewer mode.

Panning is now enabled in 2D viewers using the middle mouse button, and the scrollbars are only visible in the active 2D viewer.

The frames of the crosshairs in 2D and 3D viewers are now colored according to their orientation: **red** for XY plane, **green** for XZ plane, and **blue** for YZ plane.
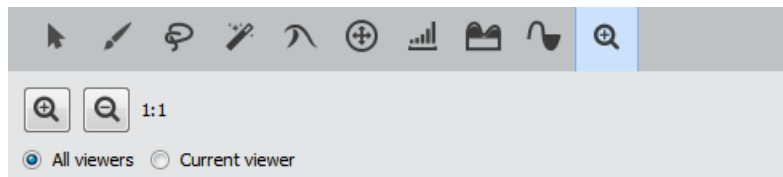
When a 2D viewer is active, the **XY**, **XZ**, and **YZ** buttons of the viewer toolbar are enabled. Pressing one of these buttons, causes the 2D viewer with the specified orientation to become the current viewer. These buttons are grayed out when the 3D viewer is active.

Slices in the 3D viewer are pickable and can be moved in *Interact* mode. The crosshair can also be moved to a picked location by pressing and holding down the **Ctrl** key.

In the 3D viewer context menu, a new sub-menu *Visible objects* was added to the *Object visibility in viewer N* entry. It allows the user to show or hide a particular display module in the project directly from the viewer.

Zoom buttons are now available in each 2D viewer, allowing the user to specify the zoom factor for each viewer independently.

SEGMENTATION AND SELECTION MENU ENHANCEMENTS

The *Undo* action in the *Segmentation* menu is now moved to the *Edit* menu.

The *Orientation* sub-menu in the *Segmentation* menu is now grayed out when the 3D viewer is active.

Some sub-menus were removed from the *Segmentation* and *Selection* menus (*Current viewer*, *Image*, *Data window*, *Gradient*, and *Color*).

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NEW SEGMENTATION PREFERENCES

A new *Color* preference is now available in the *Selection Draw Style* area of the *Segmentation* preferences.

A new *3D Viewer Position* preference is now available in the *Viewers Layout* area of the *Segmentation* preferences. By default, it is set to **Upper Left**.
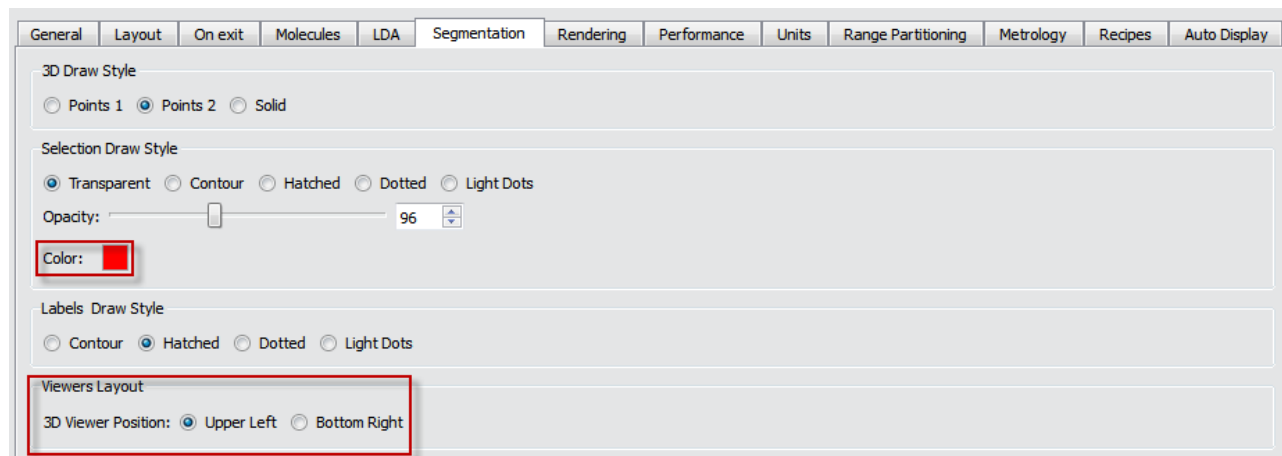
ENHANCED FEATURES

SCRIPTING ENHANCEMENTS

A new command **getState** is available for all modules and objects from the *Project View*. In the Console, type the name of the object followed by **getState**. It gives a view of the object's state, as done when saving the project.

A new command **isOfType** is also available for all the modules and objects from the *Project View*. In the Console, type the name of the object followed by **isOfType <type>**, where *type* is the object type you want to check. It returns 1 if it's correct, 0 otherwise.

OPEN INVENTOR UPGRADE

Avizo now uses Open Inventor 9.6 as its graphic engine. This upgrade includes bug fixes and improvements such as enhanced *Delayed* and *Sorted* transparency algorithms, and enhanced *JPEG 2000* and *3D TIFF* readers.

XPAND UPDATE

The new version of Avizo XPand is a major evolution bringing many enhancements to improve your programming experience. The new version introduces a more homogeneous API, is better documented and will guarantee fewer compatibility breaks in the future. To reach this goal, the new version of Avizo XPand introduces some incompatible source changes. A porting guide included with the Avizo XPand distribution lists those changes. Please refer to this document for more information.

Custom extensions to Avizo can no longer be developed using Microsoft Visual 2010, as it is no longer supported by Avizo XPand. Microsoft Visual Studio 2013 should now be used on Windows operating systems.

NEW MODULES

Line Set Cross Contour shows the intersection of a line set and a cutting plane.

Point Cloud Cross Contour shows the intersection of a point cloud and a cutting plane.

Copy Parameters copies parameter bundles from one data set to another.

Tcl Command Module allows execution of Tcl code.

Thickness Map computes the local thickness for each voxel in a binary image, defined as the diameter of the largest ball containing the voxel and entirely inscribed in the object.

Convert Geometry To Label generates a binary or label map that provides a voxel-based representation of a continuous geometry input, which can be an opened or closed surface, a set of lines or spatial graph, or a set of points.

ENHANCED MODULE AND EDITOR

A new option is added to the Register Images module to disable rotation. If this option is checked, the transform used will have no rotation component. It can be used with any transform settings.

The Simplification Editor algorithm has been improved to dramatically reduce the occurrence of intersections in the computed simplified surface.

ENHANCED READERS

The JPEG 2000 reader now supports large JP2 images, accessing only the part of the images that is needed. This avoids loading unnecessary data and reducing peak memory usage.

Tessellation options can now be set for CATIA5, IGES, and STEP readers, such as the linear tolerance, the angular tolerance, and the maximum triangle edge ratio. IGES and STEP readers now also allow loading of edge data, like the CATIA5 reader.

ENHANCED WRITER

The DICOM Export now allows exporting 3D DICOM by selecting *Enhanced CT* from the existing dialog which pops up when saving as DICOM.

AVIZO – ENHANCEMENTS AND NEW FEATURES

NEW MODULE

Variance operates on the first-order statistics of an image. It creates a result image where pixel values are functions of values of this pixel in the initial image and its neighborhood of a specified size. In order to calculate this value, a local histogram is calculated.

ENHANCED MODULE

Ortho Views now offers several clipping types:

- No clipping is applied.

- The clipping direction is either the direction of the normal to the plane or its inverse, depending on which one forms the largest angle with the camera direction.

- The clipping direction is the direction of the normal to the plane.

- The clipping direction is the opposite direction of the normal to the plane.

When attached to a 2D data, the module displays it in a single viewer.

ENHANCED READER

The ANU Netcdf reader now adds the support for stacks of simple 3D volume tomography data.

OPERATING SYSTEMS

Avizo Inspect 9.1 runs on Microsoft Windows 7/8/10 64-bit.

In order to add custom extensions to Avizo Inspect with Avizo **XPand**, you will need Microsoft Visual Studio 2013 (VC12) Update 4 on Windows.

SOLVED ISSUES

Avizo Inspect 9.1 provides many enhancements and solutions to known problems, including the following:

Align Surfaces	42587	The computation now works correctly when an ROI is attached to the module.
Analysis Filter	37869	Running multiple Label Analysis Filters could result in incorrect label fields. This has been fixed.
Animation Director	41711	When side-by-side stereo mode is selected in the Movie Maker video export, the produced video now has the expected size.
	37632	A Tcl interface has been added to the embedded Movie Maker module of the Animation Director.
	36253	Deleting a selected event now works properly.
	34867	A pack & go project using the Animation Director is now correctly loaded and played.
DICOM Reader	41956	Slice spacing (0018;0088) and slice thickness (0018;0050) tags are now taken into account to define z voxel size when a single slice is loaded.
Extract Subvolume	30646	Applying this module to a 2D data set works correctly now.
	38165	In some cases, the dragger was not correctly positioned. This has been fixed.
Filament Editor	40312	Creation of an inconsistent Spatial Graph is now impossible.
Generate Surface	40459 37835	The module no longer modifies its input label field by changing some of its parameter bundles.
	37770	The Tcl command showMaterialList allowing to select a single material to generate a surface from has been restored.
Installer	37625	Avizo Lite is now used for file associations.
Jobs Dialog	37404	An error occurred when opening this dialog. This has been fixed.
JPEG 2000 Reader	23235 (5557)	Large JP2 files can now be read.
Label Analysis	41306	When the Seek Label tool is activated, the cross-hairs and slice are now positioned correctly on the material currently selected in the list.
Labeling	38085	The documentation has been improved to provide information about important usage requirements.
License Activation System	36472	The Test button now checks not only the existence of the FNP license server but the connection too.
	35601	Highlights are now used to indicate whether the activation code syntax is correct or not.
LS-DYNA Reader	40212	Deleted cells in time series data could cause errors in the rendering. This has been fixed.
Mask	30277	Material bundles are now copied to the modules result.
Material Statistics	39037	Units are now correctly exported when exporting the result spreadsheet to CSV format.
Pack & Go Export	36280	When saving a project as pack & go, data objects were saved in Avizo native format but retained their original file extension. The .am extension is now appended to the data original format.
Relabel	37868	16-bit label input no longer causes an error.
Remesh Surface	37822	Density contrast and Density range ports visibility has been restored when a surface curvature is used instead of a density field.
Save / Export	35783	Files can now be saved into folders containing non-ASCII characters in their name.
	37752	Data objects over 4GB saved in Avizo ZIP format are now correctly read.
Scalebars	39989	The measure was not correct when the module was in fixed size mode. This has been fixed.
Segmentation Editor	40262	The pointer of the Lasso tool cursor for setting control points has been restored for more accuracy.

	43234	A specific combination of Ortho Views display and use of Watershed tool could cause errors. This has been fixed.
	37974	Material lock statuses are no longer lost in the Segmentation Editor when a Generate Surface module is attached to the label field.
	34507	Using the Pick tool on large data no longer causes an error.
	28505	Sometimes parts of the selected material were not replaced when using the Replace selection tool. This has been fixed.
	43351	When the Segmentation Editor preference selection draw style was not set to the default value (transparent), operations on the label field in the project view could fail. This has been fixed.
Slice	38081	2D data sets are now displayed correctly.
Snapshot Tool	41814	Export to PDF format has been fixed.
Surface Area Volume	38999	Even when the surface is not close to the origin, the volume results are now correct.
Surface Editor	37696	The draw tool to highlight triangles now works when "visible triangles only" is checked.
	35331	The Fix Intersections option now displays the correct number of intersections fixed.
Surface View	40124	An Avizo license was abnormally required when using the module. This has been fixed.
Template Projects	38153	A saved Template project could not be loaded again as the path was not correct. This has been fixed.
TIFF Reader	37800	Data sets over 4GB saved in Avizo 3D TIFF format are now correctly read.
Volren	36760	Performance issues when using spin animation are now fixed.
Volume Rendering	34322	Initializing the module with Tcl commands and then displaying its properties no longer causes an error.
XScreen	36687	Limitations are now described in documentation.

Our team is dedicated to solving as many issues as possible to make your experience with Avizo as satisfactory as possible. For this purpose, we would greatly appreciate your feedback regarding this version. If you encounter problems, or if you have suggestions for improvement, please report them to fei-sw-support@fei.com.