## Avizo Inspect 9.3.0

Software for Industrial Inspection and Materials Research & Development

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

November 2016, the Avizo Inspect team

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## NEW FITTING METHODS

### CHEBYSHEV MINIMUM ZONE (MZ)

The Minimum Zone method is based on CHEBYSHEV algorithm. This method can be used to fit the same primitives as Least Square Method (LS).

- LINE: The line that is the axis of the minimum-circumscribed cylinder of the points.
- PLANE: The plane halfway between two parallel planes of minimal separation that contains all the points between them.
- CIRCLE: The circle halfway between the two concentric circles of minimal separation that contains all the points between them.
- SPHERE: The sphere halfway between two concentric spheres of minimal separation that contains all the points between them.
- CYLINDER: The cylinder halfway between two coaxial cylinders of minimal separation that contains all the points between them.
- CONE: The cone halfway between two coaxial cones, having the same apex angle, of minimal separation that contains all the points between them.

### CHEBYSHEV MINIMUM INNER ZONE (MZI)

The Minimum Zone Inner method is based on CHEBYSHEV algorithm. This method can be used to fit the same primitives as Least Square Method (LS).

It follows the same algorithm as Minimum Zone Method (MZ), the only difference is that instead of taking the mean geometry, we take the minimum one.
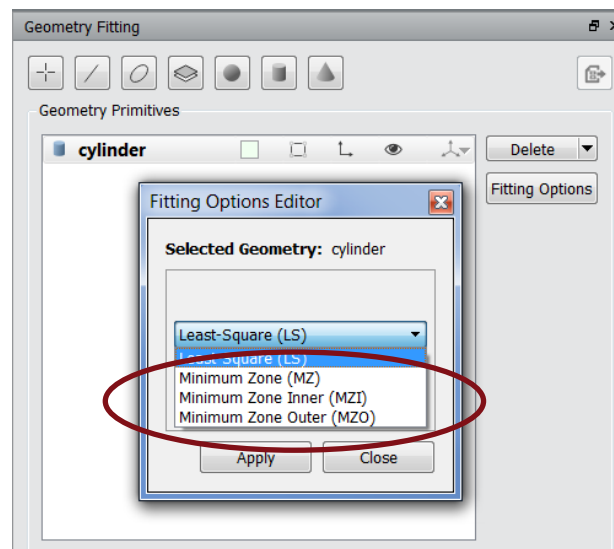
### CHEBYSHEV MINIMUM OUTER ZONE (MZO)

The Minimum Zone Outer method is based on CHEBYSHEV algorithm. This method can be used to fit the same primitives as Least Square Method (LS).

It follows the same algorithm as Minimum Zone Method (MZ), the only difference is that instead of taking the mean geometry, we take the maximum one.

## NEW FAST SURFACE EXTRACTION METHODS

### FAST PARTITIONING ISO 50

A new fast surface extraction algorithm is based on ISO 50 threshold value.

### FAST PARTITIONING OTSU

A new fast surface extraction algorithm is based on Otsu threshold value.

**WARNING**: Otsu partitioning does not support float data for now. Current workaround is to use Normalize module and then Convert to byte before entering Metrology workroom.
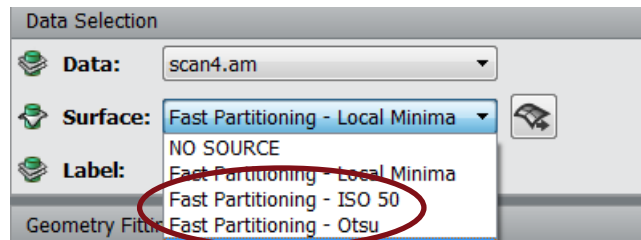


## NEW SURFACE EXPORT

For each surface computation method, the computed surface can be exported in project view using the export button.
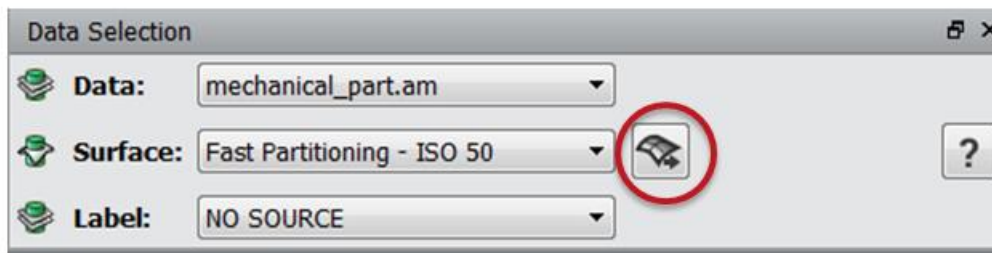


## NEW 3-2-1 REGISTRATION WIZARD

The wizard allows for selecting fitted geometries to define a new LCS, using a plane, a line and a point:
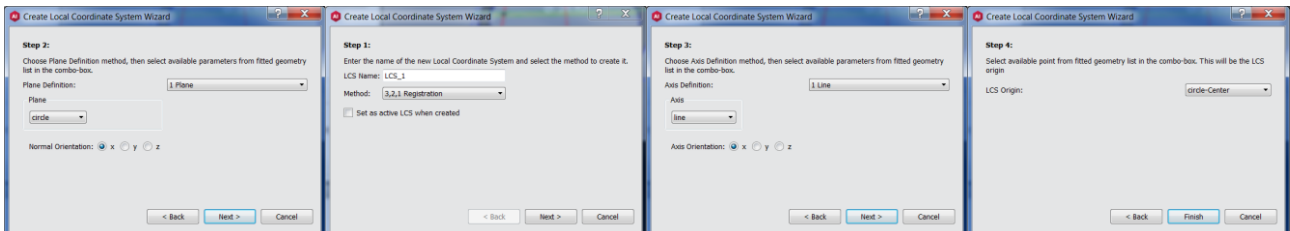


## NEW IGES AND STEP READERS FOR CAD MODEL IMPORT

### IGES READER

Reader for IGES (Initial Graphics Exchange Specification) files is now part of Avizo Inspect without the need of additional license. The IGES format serves as a neutral exchange format for 2D or 3D CAD product models, drawings, and graphics.

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## STEP READER

Reader for STEP (Standard for the Exchange of Product Data) files is now part of Avizo Inspect without the need of additional license. STEP is an ISO standard industrial automation systems product data representation and exchange format. For this reader and other CAD readers some additional package might be required, please contact our support lines for more information.
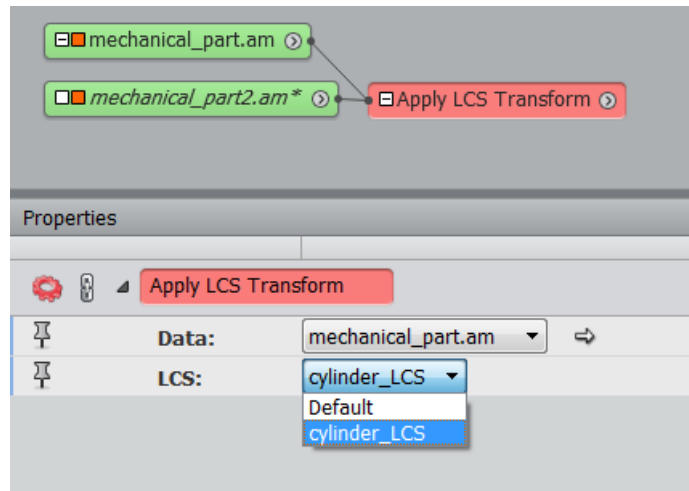
## NEW MODULES

## APPLY LCS TRANSFORM

This module creates of a new data which is transformed according to the selected Local Coordinate System (LCS).



## APPLY LCS TRANSFORM FROM

This module allows to modify input data by application of a reference data Local Coordinate System (LCS) transformation.

If a large data needs to be transformed, a sub-sample version of the data can be used in the Metrology Workroom to create different LCS. Once LCS are created, the original full resolution data can then be transformed using one of the LCS created on the sub-sample version.

## NEW SURFACE/VOLUME VISUALIZATION TOGGLE

This new toggle option allows for switching between Volume visualization and surface visualization in the 3D View of the metrology workroom.
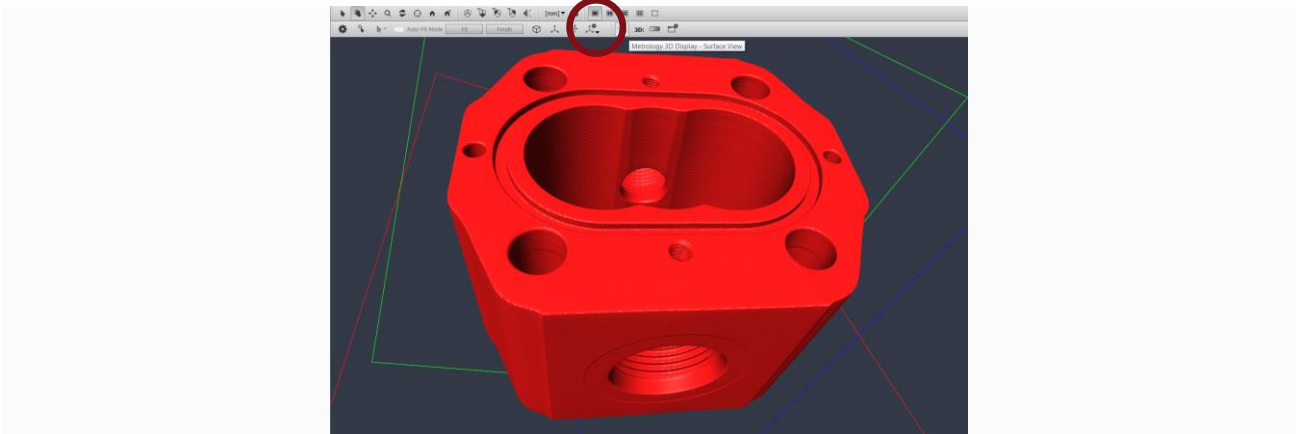
## NEW LCS ORIGIN GLYPH

This new toggle option allows for displaying the axis system at the origin of the currently selected Local Coordinate System (LCS).
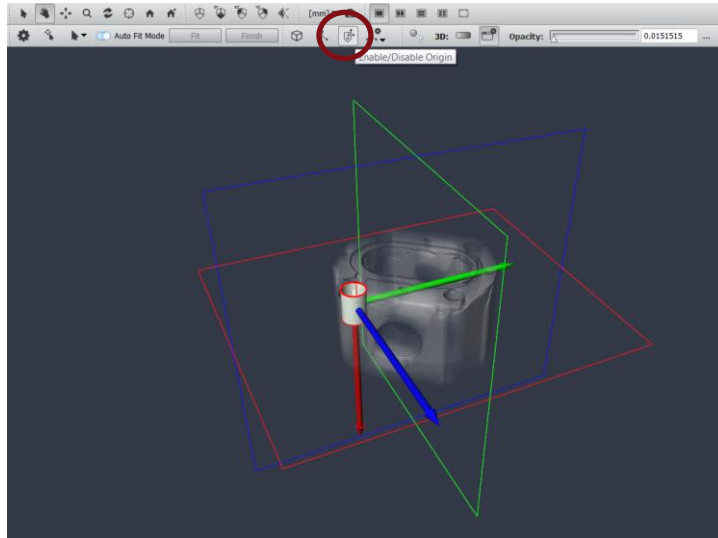


## NEW GEOMETRY FITTING PERFORMANCE OPTIMIZATION

Dramatic speed up of Least Square fitting when large number of support points are selected, leading to huge performance improvement when fitting geometries.

# AVIZO LITE AND AVIZO - ENHANCEMENTS AND NEW FEATURES

## NEW READER

Avizo provides a new reader for Windows plateform, to read the **VGL** file extension from CT manufacturers such as NIKON. This format wraps an xml description of the 3D scene and references one or several associated data files with extension .vol,.raw,.gz,.tiff,.jpg, and .jpeg.

## NEW RECURSIVE GAUSSIAN FILTER 2D AND RECURSIVE GAUSSIAN FILTER 3D MODULES

Smoothes an image using a kernel based on a Gaussian distribution. Offers improved performances for large Standard Deviation input values. With the recursive implementation the computation time is independent of the Standard Deviation.

The new *Coordinate Type* port offers two options to express the standard deviation:

- *Image*: each standard deviation component is interpreted in number of voxels
- *Physical*: each standard deviation component is interpreted as a value in the current spatial unit

On a 1024x1024x256 volume with isotropic voxels the following performance can be achieved:

With Standard Deviation = (2, 2, 2)

- Standard mode = 49 sec
- Separable Mode = 5 sec
- Recursive mode = 18 sec

With Standard Deviation = (9, 9, 9)
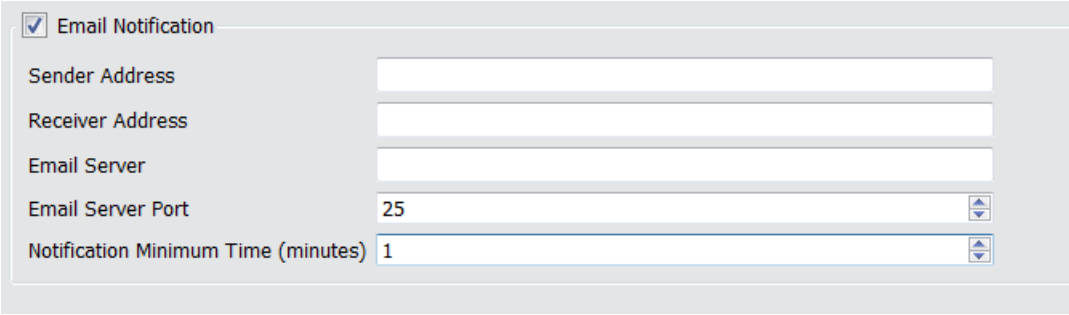
- Standard mode = 28 mn
- Separable Mode = 37 sec
- Recursive mode = 18 sec

## NEW COMPUTE END NOTIFICATION MECHANISM

This new feature allows the user to be notified when a computation is over. When a given computation takes over a specified amount of time, Avizo will send an email to the user at the end of the computation.

Avizo will summarize the computation time of the concerned module.

The settings are available from the preferences in the Notification tab.

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Limitation: This notification is only available on server which do not require an authentication.

## NEW EXTRACT STATISTICS

This module computes statistics on a Spreadsheet, Label Analysis or Image Analysis input and generates a Spreadsheet result containing these statistics. Computed statistics are the following:

- Mean
- Min
- Max
- Median
- Variance
- Kurtosis
- Skewness

The result Spreadsheet will contain one statistics table per table in the input spreadsheet. No statistics will be computed on columns of type "string": these columns will contain "0" values in the result Spreadsheet.

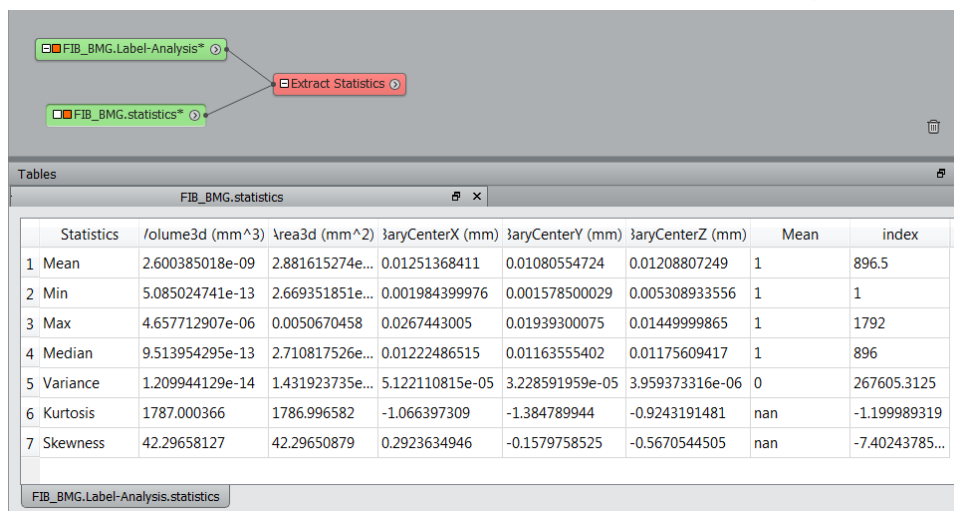| | Statistics | Volume3d (mm^3) | Area3d (mm^2) | BaryCenterX (mm) | BaryCenterY (mm) | BaryCenterZ (mm) | Mean | index |
|---|---|---|---|---|---|---|---|---|
| 1 | Mean | 2.600385018e-09 | 2.881615274e... | 0.01251368411 | 0.01080554724 | 0.01208807249 | 1 | 896.5 |
| 2 | Min | 5.085024741e-13 | 2.669351851e... | 0.001984399976 | 0.001578500029 | 0.005308933556 | 1 | 1 |
| 3 | Max | 4.657712907e-06 | 0.0050670458 | 0.0267443005 | 0.01939300075 | 0.01449999865 | 1 | 1792 |
| 4 | Median | 9.513954295e-13 | 2.710817526e... | 0.01222486515 | 0.01163555402 | 0.01175609417 | 1 | 896 |
| 5 | Variance | 1.209944129e-14 | 1.431923735e... | 5.122110815e-05 | 3.228591959e-05 | 3.959373316e-06 | 0 | 267605.3125 |
| 6 | Kurtosis | 1787.000366 | 1786.996582 | -1.066397309 | -1.384789944 | -0.9243191481 | nan | -1.199989319 |
| 7 | Skewness | 42.29658127 | 42.29650879 | 0.2923634946 | -0.1579758525 | -0.5670544505 | nan | -7.40243785... |

FIB_BMG.Label-Analysis.statistics

## PYTHON

### DOCUMENTATION

Extending Avizo functionality with Python Tools Tutorial demonstrates how to expand Avizo using Python tools. This tutorial builds an entire *Python Script Object* integrating the Fast Fourier Transform from the scipy package into Avizo's graphical user interface as an alternative to Avizo's own FFT.

### PROCESSING OF TIME SERIES DATA

Process Time Series enables the processing of time series data has been greatly enhanced. It is now possible to apply an entire segmentation workflow created in the *Project View* to an entire time series using the new *Process Time Series* module. The result is then presented as a time series in the *Project View*. To better indicate that a time series is a data object consisting of multiple 3D volumes, the color of the *Time Series Control* module has been adjusted to match the color of all other multi-volume data objects, e.g. *Multi-Channel Field*.

## ENHANCED FEATURES

### SPATIAL GRAPH STATISTICS

The Spatial Graph Statistics adds the **Tensor** measure, the orientation tensor per segment.

The **Orientation Theta** and **Orientation Phi** measures were previously based on the segment's orientation going from start to end point which was erroneous for curved segment. The measures are now based on the new **Tensor** measure.

### UNIT MANAGEMENT

The *Units Editor* can now be called on Spatial Graph and the spreadsheet extracted from this graph manages units.

### UNSHARP MASKING

Performance has been improved. It now uses the Recursive Gaussian filter.

### VOLUME RENDERING AND ISOSURFACE

Volume Rendering and Isosurface now align with Avizo's voxel centered bounding box.

In the image below, left is Avizo 9.2 displaying Orthoslice in blue and Volume Rendering in purple. Right is same display with Avizo 9.3.
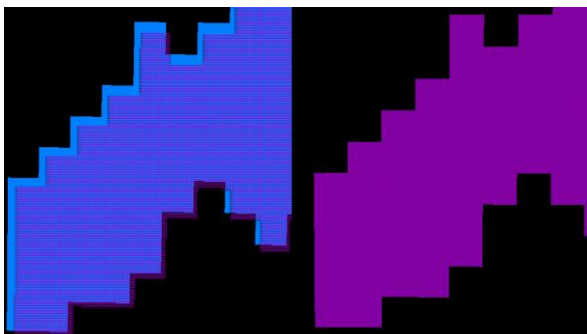


### MRC 2014

The MRC file format reader has been updated to support MRC 2014.

### MISC ENHANCEMENTS

- Python Script-Object files can be opened or drag-and-dropped directly in the application.

- Extract subvolume displays warning about the size of the extracted data when this size is greater than the available memory.

## DEPRECATIONS

- Option Preferences - Rendering - Legacy Surface has been removed from the GUI

- Option View - Background - checkerboard has been removed.

- VolumePro supports has been discontinued.

## AVIZO – ENHANCEMENTS

## ENHANCED FEATURES

### NORMALIZE IMAGE FILTER

Now has a Percentile mode. This mode automatically selects the input range between two given percentiles of the input image histogram.

### LIST OF MEASURES IN LABEL ANALYSIS STORED BY CATEGORY

The documentation related to measures has been enhanced for increased readability. Measures are now categorized based on the measure groups presented in the Label Analysis module.

### LABEL ANALYSIS

The former Excel XML export file format only writes the data array in the output file. A new format named *Microsoft XML Spreadsheet 2003 – including statistics (*.xml)* is created with the addition of a new tab in the exported Excel XML file with data of analysis statistics.
As the data array, statistics values are expressed in display units.

## NEW MODULE

Extract Orientation Tensor allows extracting the tensor orientation from an attributed spatial graph (output of Spatial Graph Statistics) and converting it to a cluster data. The cluster can then be visualized using tensor glyph (using a Tensor View display module) to represent the individual fiber orientation (ellipsoids rotated into coordinate system defined by eigen vectors of tensor, and axis scaled by eigen values).

A straight fiber will be represented by a line (large major eigen value) while a curved fiber will be represented with an ellipsoid (flattened if curved only within a plane as shown in the example below).
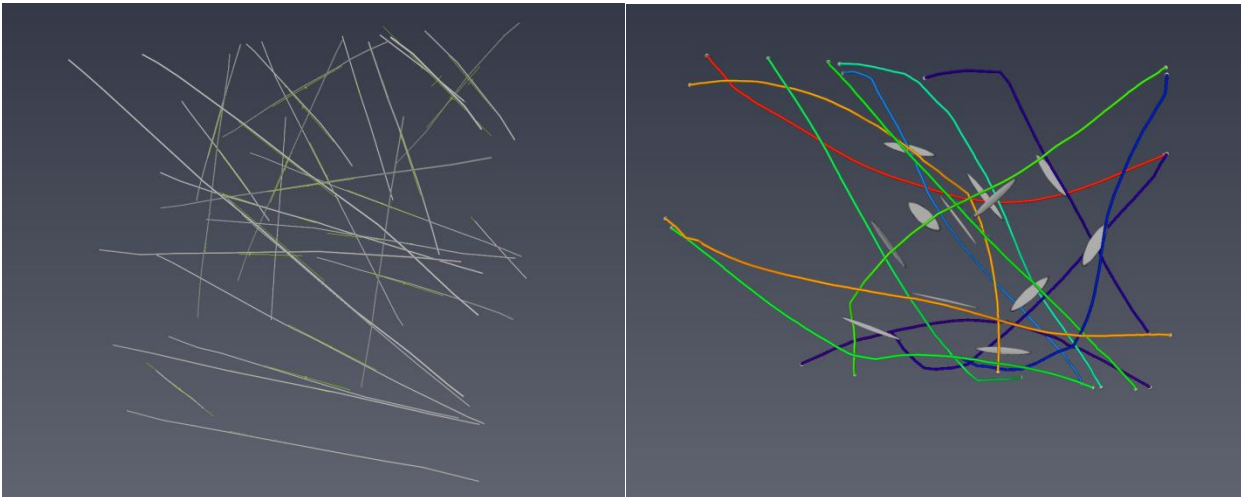
## XPORENETWORKMODELING EXTENSION – NEW FEATURE

### NEW WRITER

Pore Network Models can now be exported in *Pore Network Node-Link* format. The Pore Network Node-Link network data format is composed of four ASCII files, regrouping information on the throats and pores composing a Pore Network Model.

The data for the throats are read from the LINK files (XXXX_LINK1.DAT, XXXX_LINK2.DAT). The data for the pores are read from the NODE files (XXXX_NODE1.DAT, XXXX_NODE2.DAT). Their structures are detailed in the APPENDIX I of the PhD thesis PORE-SCALE MODELING OF NON-NEWTONIAN FLOW IN POROUS MEDIA by TAHA SOCHI, which can be found here http://www3.imperial.ac.uk/pls/portallive/docs/1/39459696.PDF .

## FUTURE DEPRECATION

This is the last version to support *XGreen* extension on **Mac OS X**.

This is the last version to support *XTeam* extension. The extension will then be removed in the future version.

## XPAND

- For Windows users only the Qt version moves from Qt 4 to Qt 5. Some changes of your code must be needed if you use Qt classes. To update your code to Qt 5 read the porting guide provided by Qt http://doc.qt.io/qt-5/portingguide.html and by the XPand Porting Guide (accessible from `$AVIZO_ROOT/share/devrefAvizo/Avizo.chm`)

- The new XPand version introduces few incompatible source changes. Please read carefully the XPand Porting Guide which lists all those changes (accessible from `$AVIZO_ROOT/share/devrefAvizo/Avizo.chm`)


## OPERATING SYSTEMS

Avizo 9.3 runs on:

- Microsoft Windows 7/8/10 (64-bit). 32-bit is no longer supported.
- Linux x86 64 (64-bit). Supported 64-bit architecture is Intel64/AMD64 architecture. Supported Linux distribution is Red Hat Enterprise Linux 6 and Red Hat Enterprise Linux 7.
- Mac OS X Capitan (10.11) and Sierra (10.12)

In order to add custom extensions to Avizo with Avizo **XPand**, you will need:

- Microsoft Visual Studio 2013 (VC12) Update 4 on Windows.
- gcc 4.4.x on Red Hat Enterprise Linux 6 and Red Hat Enterprise Linux 7.
- Currently, Avizo XPand support is not available for Mac OS X El Capitan (10.11) nor macOS Sierra (10.12). It will become available again once Clang support has been completed.

Avizo 9.3 provides many enhancements and solutions to known problems, including the following:

| | | |
|---|---|---|
| **Align Slices** | 45814 | An error occurred when saving and reloading a project containing this module. This has been fixed. |
| **Analysis Filter** | 46562 | When applying an Analysis Filter a second time with different settings resulting in an empty result, the previous label field result was kept. Thus, as the spreadsheet was updated with the empty filter result, it did not match the label field result. This has been fixed. |
| **Arithmetic** | 23253 44019 | Arithmetic module now reuses and updates its result when applied several times. |
| **Colormap Legend** | 51869 | The use of this module at the same time as Surface View module no longer causes an error. |
| **Cylinder Correlation** | 45516 | Results produced by the module could be null depending on CUDA memory defined in port CUDA Memory. This has been fixed. |
| | 52258 | The units of measurement are now shown in the ports when the units are activated |
| | 52456 | The Missing Wedge Correction port is no longer hidden with the advanced ports of the module. It is visible in the module's Properties Area but it is set to OFF by default. |
| **DICOM Import** | 43807 24062 | When a precision loss or an overflow is detected, a warning dialog is now displayed to define how the data should be processed. The slope/intercept corrections are taken into account. Please refer to the Precision Loss/Overflow management chapter in DICOM import documentation. |
| **Extract Subvolume** | 45654 | Port Units is now disabled and set to global when a ROI Box is connected. |
| **Filament Editor** | 44929 | Computation for setting root on a large spatial graph has been improved. |
| **Label Field** | 46556 | The relabel Tcl method has been fixed and no longer corrupts the label field and its materials. |
| **Marker Based Watershed Inside Mask** | 46250 | The module now updates the output result at each computation, instead of creating a new one each time. |
| | 54597 | The landscape port has been removed because the landscape image is computed internally. |
| **Plot 3D Orientation** | 46149 | When changing the module's parameters between two exports to lattice, the lattice output was not updated. This has been fixed. |
| **Python** | 46570 | After creating a new object HxPythonScriptObject, it is now possible to save and reload a project. |
| | 46357 | Enpkg now works when the installation directory contains blank characters. |
| **Resample** | 53075 | An error occurring when setting Resample module's resolution in X, Y or Z dimension to the same value as the input data dimension has been fixed. |
| **ROI Box** | 45405 | When reconnecting a ROI box to a new input data, the minimum and maximum corners of the ROI box are no longer reset if they are inside the bounding box of the connected data. |
| **Script Module** | 45425 | It is no longer possible to load .tcl files as Script Object. Only .scro files can now be selected. |
| **Segmentation Editor** | 44930 | Contrast threshold slider associated to Magic Wand tool is now enabled in Avizo Lite. |
| | 45476 | The Masking port for segmentation tools was sometimes disabled while it shouldn't have been. This has been fixed. |

| | 53183 | An issue occurring when using selection with lasso 3D on huge data has been fixed. |
|---|---|---|
| | 43558 | Inconsistencies related to the display in the 3d viewer of transformed image have been fixed. In the Segmentation Editor, the image is displayed untransformed. To avoid other display inconsistencies, it is not possible to display other objects in the 3d viewer. To this end, the Object visibility option of the viewer context menu is disabled. |
| | 46162 | Some artifacts could appear when using Fill holes command on large slices with a lot of regions. This has been fixed. |
| | 33538 | When using the Interpolate command, the 2d viewers now correctly display the interpolated selection. |
| **Spatial Graph Local Statistics** | 45424 | The default resolution is now set to 5% of the size of the input Spatial Graph. |
| **Spatial Graph Statistics** | 46664 57755 | The definition and calculation of tortuosity are now correctly set to the ratio Curve Length on Chord Length. |
| | 53578 | The use of this module on a Spatial Graph with loops previously removed in the Filament editor no longer causes an error. |
| **Spatial Graph View** | 42482 37825 | Selecting Tubes display style no longer resets the segments coloring. |
| **Surface Editor** | 37456 | Closedness test has been restored. |
| **Surface View** | 52068 | An issue when displaying more than one surface using Intel graphics board has been fixed. |
| **TCL** | 46705 | The command load -avizo was no longer recognized. This has been fixed. |
| **Time Series** | 45456 | No extra image is created when reloading a project containing a time series data. |
| | 45071 | The memory was not properly cleared after deletion of the Time Series Control module. This has been fixed. |
| | 44428 | The synchronization between the Time ports of Time Series Control modules is now correctly managed by the Connection Editor. |
| | 44927 | Using the Animation Director with Time Series data no longer causes an error. |
| **Trace Correlation Lines** | 52258 | The units of measurement are now shown in the ports when the units are activated |
| **Vector To RGB** | 46158 | Magnitude was taken into account even when the option Ignore Magnitude was checked. This has been fixed. |
| **Voltex** | 45397 | In case of multiple Voltex renderings, toggling one Voltex on/off no longer disrupts the display of the other ones. |
| **Voxelized Rendering** | 44799 | When a label field is connected to the module, the Gamma port is now hidden and the Colormap port is now displayed. |
| **XPand** | 52959 | XPand Extension Porting Guide has been updated with details to fix a compilation error about an inclusion of taglib/internal/version-impl.h. The version.cpp, winversion.rc and internal/winversion.h files should be removed from your Avizo local directory. Please refer to XPand Extension Porting Guide for more details. |
| | 52925 | A compilation issue when calling the "FaceOctree::lineIntersectsTriangle" method has been fixed. |
| | 54386 | DLL dependencies were not resolved properly at runtime, this has been fixed. |
| | 52926 | Performance has been improved on McDArray. |

Our team is continually focused on solving as many issues as possible to make your experience of Avizo as satisfactory as possible. To this purpose, we would 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.