

## RELEASE NOTES - AVIZO FOR FEI SYSTEMS 9.3.0, DECEMBER 2016

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### **Avizo for FEI Systems 9.3.0**

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 [fei-sw-support@fei.com](mailto:fei-sw-support@fei.com). We would like to thank you in advance for your efforts.

December 2016, the Avizo team

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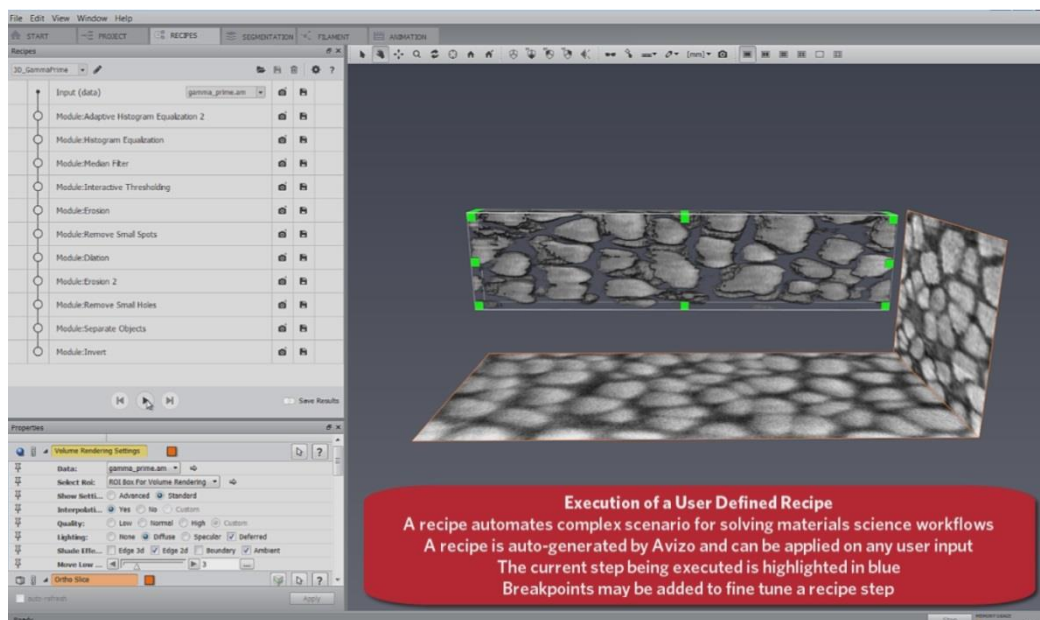
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## OVERVIEW

The Avizo for FEI Systems 9.3 release includes important new features, enhancements, performance improvements, and issue fixes.

### 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 extension is available by default in the FEI Systems edition.



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.

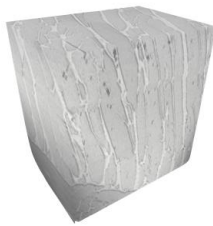
At each step, a snapshot of the result of the step is created and optionally saved (when the *Save Results* option is on). By default, the default display module defined in the *Preferences Auto Display* is used. But this can be changed by adding a snapshot for a particular step, setting a breakpoint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

### RECIPE EXAMPLES LIBRARY

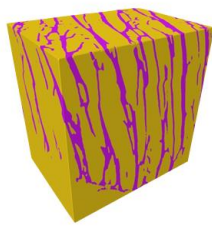
Avizo for FEI Systems 9.3 adds a set of recipe examples for segmenting various types of materials. Each recipe is documented with a dedicated tutorial.

**Recipe Name:** AR-01\_Ti-62222  
**Dataset:** FIB Serial Section of Ti-62222  
**Layers Output:** Alpha, Beta  
**Recipe Steps:** 11  
**Custom Python Scripts:** None

**Recipe Name:** AR-02\_GammaPrime  
**Dataset:** FIB Serial Section of Particles in Nickel-Base Superalloy  
**Layers Output:** Particles, Matrix  
**Recipe Steps:** 11  
**Custom Python Scripts:** None

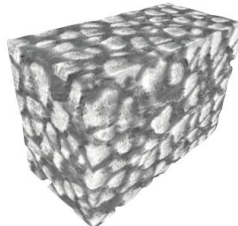


Raw Dataset

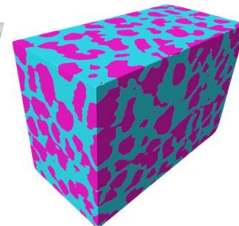


Segmentation

(Alpha = Yellow, Beta = Purple)



Raw Dataset



Segmentation

(Particles = Pink, Matrix = Blue)

## NEW SCRIPT FOR EXPORTING SITES TO MAPS

A script has been added as part of the MAPS/Avizo bridge in order to export sites to MAPS.

## AVIZO LITE AND AVIZO - ENHANCEMENTS AND NEW FEATURES

### NEW READER

Avizo provides a new reader for Windows platform, 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

Smooths 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)

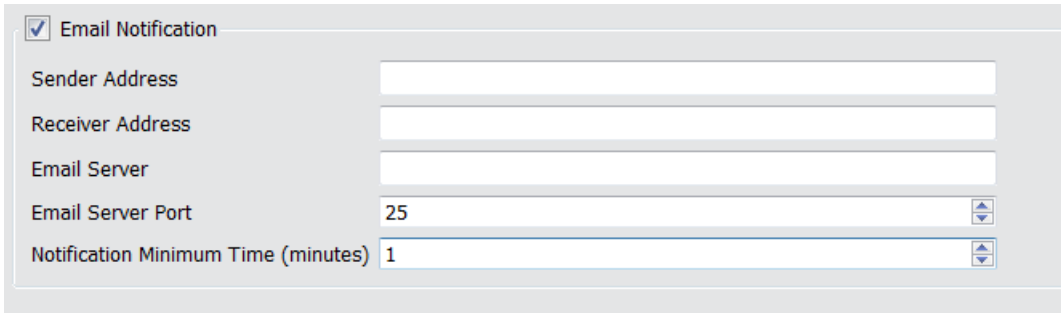
- Standard mode = 28 mn
- Separable Mode = 37 sec
- Recursive mode = 18 sec

## 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.



The screenshot shows a dialog box for configuring email notifications. It includes a checked checkbox for "Email Notification" and several input fields: "Sender Address", "Receiver Address", "Email Server", "Email Server Port" (set to 25), and "Notification Minimum Time (minutes)" (set to 1).

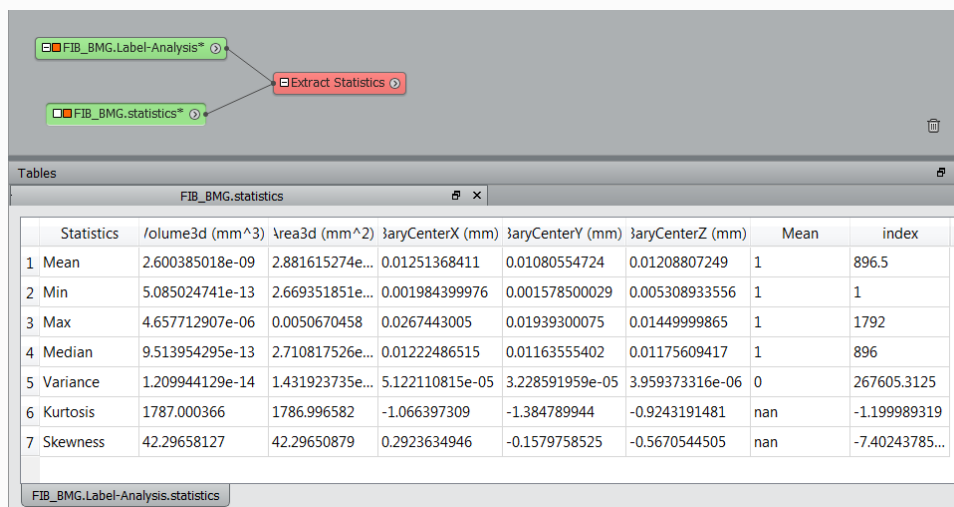
Limitation: This notification is only available on server which do not require an authentication.

## 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**.



The screenshot shows the Avizo interface with the "Extract Statistics" module. Below it, a spreadsheet window titled "FIB\_BMG.statistics" displays the following data:

Statistics	/olume3d (mm^3)	\rea3d (mm^2)	\aryCenterX (mm)	\aryCenterY (mm)	\aryCenterZ (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...

## PYTHON

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## 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

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### 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.

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### UNIT MANAGEMENT

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

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### UNSHARP MASKING

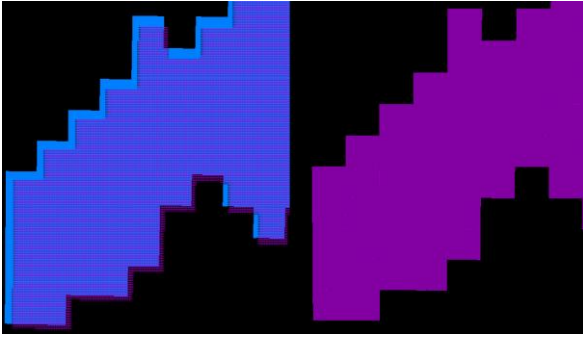
Performance has been improved. It now uses the [Recursive Gaussian](#) filter.

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### 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.



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## MRC 2014

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

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## 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

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#### NORMALIZE IMAGE FILTER

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

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#### 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.

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#### 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.

## 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.

## SOLVED ISSUES

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

<b>Align Slices</b>	45814	An error occurred when saving and reloading a project containing this module. This has been fixed.
<b>Analysis Filter</b>	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.
<b>Arithmetic</b>	23253 44019	Arithmetic module now reuses and updates its result when applied several times.
<b>Colormap Legend</b>	51869	The use of this module at the same time as Surface View module no longer causes an error.
<b>Cylinder Correlation</b>	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.
<b>DICOM Import</b>	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.
	45654	Port Units is now disabled and set to global when a ROI Box is connected.
<b>Extract Subvolume</b>	44929	Computation for setting root on a large spatial graph has been improved.
<b>Filament Editor</b>	46556	The relabel Tcl method has been fixed and no longer corrupts the label field and its materials.
<b>Label Field</b>	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.
<b>Marker Based Watershed Inside Mask</b>	46149	When changing the module's parameters between two exports to lattice, the lattice output was not updated. This has been fixed.
<b>Plot 3D Orientation</b>	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.
<b>Python</b>	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.
<b>Resample</b>	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.
<b>ROI Box</b>	45425	It is no longer possible to load .tcl files as Script Object. Only .scro files can now be selected.
<b>Script Module</b>	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.
<b>Segmentation Editor</b>		

	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.
<b>Spatial Graph Local Statistics</b>	45424	The default resolution is now set to 5% of the size of the input Spatial Graph.
<b>Spatial Graph Statistics</b>	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.
<b>Spatial Graph View</b>	42482 37825	Selecting Tubes display style no longer resets the segments coloring.
<b>Surface Editor</b>	37456	Closedness test has been restored.
<b>Surface View</b>	52068	An issue when displaying more than one surface using Intel graphics board has been fixed.
<b>TCL</b>	46705	The command load -avizo was no longer recognized. This has been fixed.
<b>Time Series</b>	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.
<b>Trace Correlation Lines</b>	52258	The units of measurement are now shown in the ports when the units are activated
<b>Vector To RGB</b>	46158	Magnitude was taken into account even when the option Ignore Magnitude was checked. This has been fixed.
<b>Voltex</b>	45397	In case of multiple Voltex renderings, toggling one Voltex on/off no longer disrupts the display of the other ones.
<b>Voxelized Rendering</b>	44799	When a label field is connected to the module, the Gamma port is now hidden and the Colormap port is now displayed.
<b>XPand</b>	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](mailto:fei-sw-support@fei.com).