

## RELEASE NOTES - AMIRA 6.3.0, DECEMBER 2016

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### **Amira 6.3.0**

3D Data Visualization and Analysis Software for Life Sciences

Dear Amira User,

With this document we would like to inform you about the most important new features, improvements, and changes in this version of Amira. 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 Amira team

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## OVERVIEW

The Amira 6.3 release includes important new features, enhancements, performance improvements, and issue fixes.

## AMIRA - ENHANCEMENTS AND NEW FEATURES

### NEW READER

Amira provides a new reader for importing data in the VGL file format typically used by CT manufacturers such as Nikon. This format uses a XML header and references one or several associated data files with extensions such as .vol, .raw, .gz, .tiff, .jpg, or .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 enter the standard deviation:

- *Image*: The standard deviation is interpreted in voxels
- *Physical*: The standard deviation is interpreted 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)

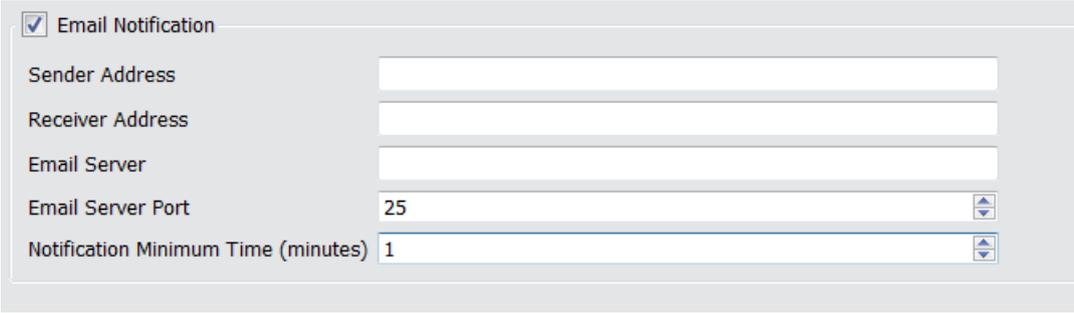
- Standard mode = 28 mn
- Separable Mode = 37 sec
- Recursive mode = 18 sec

### 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, Amira will send an email to the user at the end of the computation.

Amira will summarize the computation time of the concerned module.

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



The screenshot shows a preferences window for 'Email Notification'. 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). The 'Email Server Port' and 'Notification Minimum Time' fields have up and down arrow buttons.

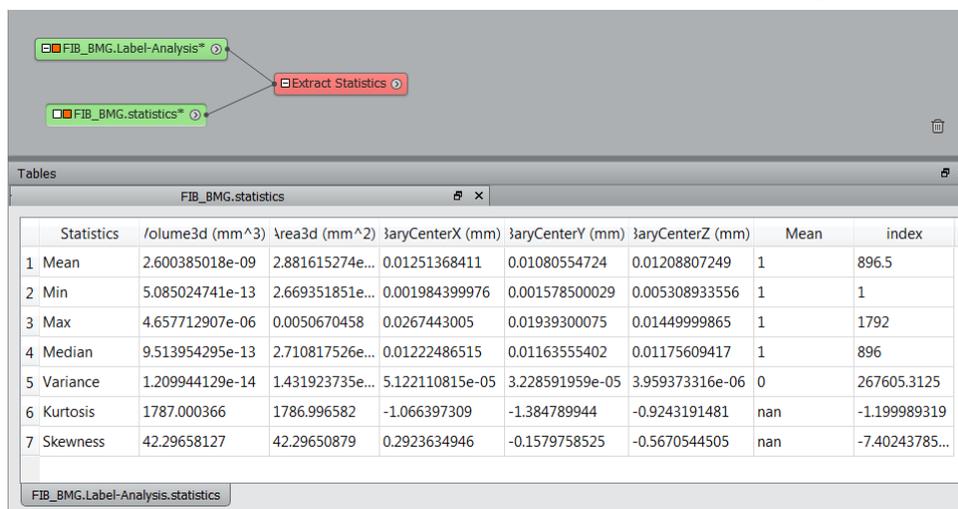
Limitation: This notification is only available on server which do not require an authentication.

## 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 Amira software interface. At the top, there are three nodes: 'FIB\_BMG.Label-Analysis\*', 'FIB\_BMG.statistics\*', and 'Extract Statistics'. The 'Extract Statistics' node is connected to the other two. Below this, a window titled 'Tables' displays a spreadsheet for 'FIB\_BMG.statistics'. The spreadsheet has 8 columns: 'Statistics', '/olume3d (mm^3)', '\area3d (mm^2)', '\aryCenterX (mm)', '\aryCenterY (mm)', '\aryCenterZ (mm)', 'Mean', and 'index'. The data is as follows:

	Statistics	/olume3d (mm^3)	\area3d (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

### DOCUMENTATION

#### Python Tutorial

This **tutorial** demonstrates how to expand Amira using existing tools from the Python eco-system. This tutorial builds an entire *Python Script Object* integrating the Fast Fourier Transform from the *scipy* package into Amira's graphical user interface as an alternative to Amira's own FFT.

## PROCESSING OF TIME SERIES DATA

**Process Time Series** enables the processing of time series data. 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.

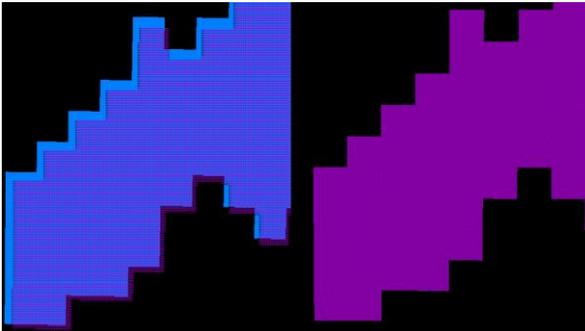
### UNSHARP MASKING

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

### VOLUME RENDERING AND ISOSURFACE

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

In the image below, left is Amira 6.2 displaying **Orthoslice** in blue and **Volume Rendering** in purple. Right is same display with Amira 6.3.



### 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 when the size of the extracted data 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.

## AMIRA XIMAGEPAQ EXTENSION – ENHANCEMENTS

### ENHANCED FEATURES

#### NORMALIZE IMAGE FILTER

This module has now 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.

Understanding living cells and their processes requires analysis of data from various imaging systems and modalities all using different file formats. Each experimental setup can represent a very unique challenge for the researcher to process the data. Multi-scale dynamic processes require tracking of various sized objects, from diffraction-limited particles to entire cells. There can be a few dozens to tens of thousands objects in each data set. In addition, intracellular processes are supported by sub-cellular structures that also need to be identified and quantified. To better support the needs for cell biologist a new edition is being offered that combines:

- The flexibility for data import of the XBioFormats extension
- The segmentation and analysis capabilities of Amira's XImagePAQ extension
- The detection accuracy of Amira's XTracing extension
- New time series processing, object tracking and analysis tools

### NEW MODULES

#### OBJECT TRACKING

Amira has been enhanced with a series of modules designed to perform a flexible object tracking\* on any type of data. In cell biology, these are typically cells or particles. Nevertheless, any type of object can be tracked using Amira's modular approach.

**Localize Objects** creates a specific point cloud that can be used as an input to compute tracks. The module requires a time series of label images and the corresponding time series of intensity images as inputs. The resulting point cloud can be visualized using standard point cloud display modules, such as *Point Cloud View*.

**Generate Tracks** uses the *Point Cloud* generated by *Localize Objects* as an input. It computes the tracks from this *Point Cloud* automatically choosing the appropriate motion model. The track computation is performed in two stages:

- Frame-to-frame linking
- Gap closing

For each stage, several parameters exist to customize the tracking process including but not limited to:

- Maximum & Minimum radii for linking and closing
- Limiting the available motion models
- Enabling splitting & merging events

The tracks are then presented as a temporal spatial graph.

**Temporal Spatial Graph** is a new data type and has been derived from Amira's spatial graph. It stores each location of an object over time as *Steps*. The nodes of the graph represent the *Events*, e.g. appearance, disappearance, merge, and split. A collection of *Steps* between nodes are called *Segments* and a series of concatenated *Segments* are called *Tracks*, where a *Track* can have 1 to N *Segments*. *Temporal Spatial Graphs* or *Tracks* can be visualized with the new *Track View* display module and quantified with the new *Analyze Tracks* compute module.

**Track View** is a new display module to visualize *Tracks*. Similarly to *Spatial Graph View* it allows separately adjusting the rendering and coloring of the different components of the tracks, and using various measures for value mapping. In addition, *Track View* provides control over the time period to be visualized.

\*Object Tracking is currently only available for 3D time series data, 2D time series support without prior conversion to 3D time series will be available with Amira 6.4 in the second half of 2017.

**Analyze Tracks** calculates different values on the tracks. It requires a *Temporal Spatial Graph* as input data and automatically computes all available measures. The result is a *Temporal Spatial Graph* with additional data columns attached to the different components. These tracks can also be visualized with *Track View*.

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## DOCUMENTATION

**Processing of Time Series Data Tutorial** demonstrates how to apply a segmentation workflow to an entire time series based on a TLS-SPIM data set provided by Dr. Liang Gao's lab, Stony Brook University.

**Object Tracking Tutorial** demonstrates how to use the tracking, display and analysis tools to track objects and compute quantitative results from the resulting tracks based on the segmentation results from the *Processing of Time Series Data Tutorial*.

## OPERATING SYSTEMS

Amira 6.3 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.
- Mac OS X El Capitan (10.11) and macOS Sierra (10.12).

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

- Microsoft Visual Studio 2013 (VC12) Update 4 on Windows.
- gcc 4.4.x on Red Hat Enterprise Linux 6.
- Currently, Amira 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

Amira 6.3 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.
<b>Extract Subvolume</b>	45654	Port Units is now disabled and set to global when a ROI Box is connected.
<b>Filament Editor</b>	44929	Computation for setting root on a large spatial graph has been improved.
<b>Label Field</b>	46556	The relabel Tcl method has been fixed and no longer corrupts the label field and its materials.
<b>Multi Planar Viewer</b>	43512	Performance when using Registration tool with VRT Render Mode has been improved
	54237	The Register button now works correctly.
<b>Plot 3D Orientation</b>	46149	When changing the module's parameters between two exports to lattice, the lattice output was not updated. This has been fixed.
<b>Python</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>Resample</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>ROI Box</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>Script Module</b>	45425	It is no longer possible to load .tcl files as Script Object. Only .scro files can now be selected.
<b>Segmentation Editor</b>	44930	Contrast threshold slider associated to Magic Wand tool is now enabled in Amira/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.
<b>Spatial Graph Statistics</b>	46664	The definition and calculation of tortuosity are now correctly set to the ratio Curve Length on Chord Length.
	57755	
	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	Selecting Tubes display style no longer resets the segments coloring.
	37825	
<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).