

Amira-Avizo Software version 2022.2

Release notes

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Introduction

This document covers the most important new features, improvements, and changes in this version of Thermo Scientific™ Amira™ Software and Avizo™ Software. In addition, you will find a list of new Xtras including video tutorials, recipes, and workflows which have been published on [amira-avizo.com](https://www.thermo.com/amira-avizo.com) since the previous release.

We value your feedback. If you encounter any problems or have any suggestions for improvement, do not hesitate to [contact us](#).

Supported platforms and packages

OS Requirements

While we have a list of supported operating systems (OS) for our software, some functionalities may only work on certain dedicated operating systems. For each functionality, we will indicate whether it works with all supported OS, or if it only works on a dedicated OS.

Licensing

Amira and Avizo Software are available as packages or editions, which can be complemented by extensions geared to specific tasks or industries. The packages and editions are summarized in the list to the right:

- **Base Packages:**
 - Amira Software 3D
 - Avizo Software 3D
- **3D Pro Packages:**
 - Amira Software 3D Pro
 - Avizo Software 3D Pro
- **Editions:**
 - Amira Software 3D for Cell Biology
 - Amira Software for EM Systems
 - Avizo Software 3D for Industrial Inspection
 - Avizo Software for EM Systems

Image Stack/Volume Processing to Image Recipe

Image Recipe Designer Workroom and Image Recipe Player module

“Packaging” image processing steps into a reusable recipe is key for accelerating microscopy image-based research. In Amira-Avizo creating such recipes was possible until now via the “Image Stack Processing” (ISP) and “Image Volume Processing” (IVP) features and associated workrooms.

To facilitate user’s experience with those two critical features, ISP and IVP are now merged into one feature: Image Recipe. It has been revamped as an easily-accessible single workroom with better visibility for the user, and a new player that can support of Large Multichannel time series data (Xplore5D Extension and SMS file format).

Changes:

- The new workroom is now called “Image Recipe Designer” (previously ISP or IVP workrooms).
- The new module for executing a recipe on a dataset in the Project View is called “Image Recipe Player” (previously Image Stack Processing or Image Volume Processing).
- The Image Recipe Designer Workroom is now always accessible by default in the main workrooms toolbar.
- Creating and editing an image processing recipe requires a dataset to work on. The selection of the dataset is now done within the workroom.

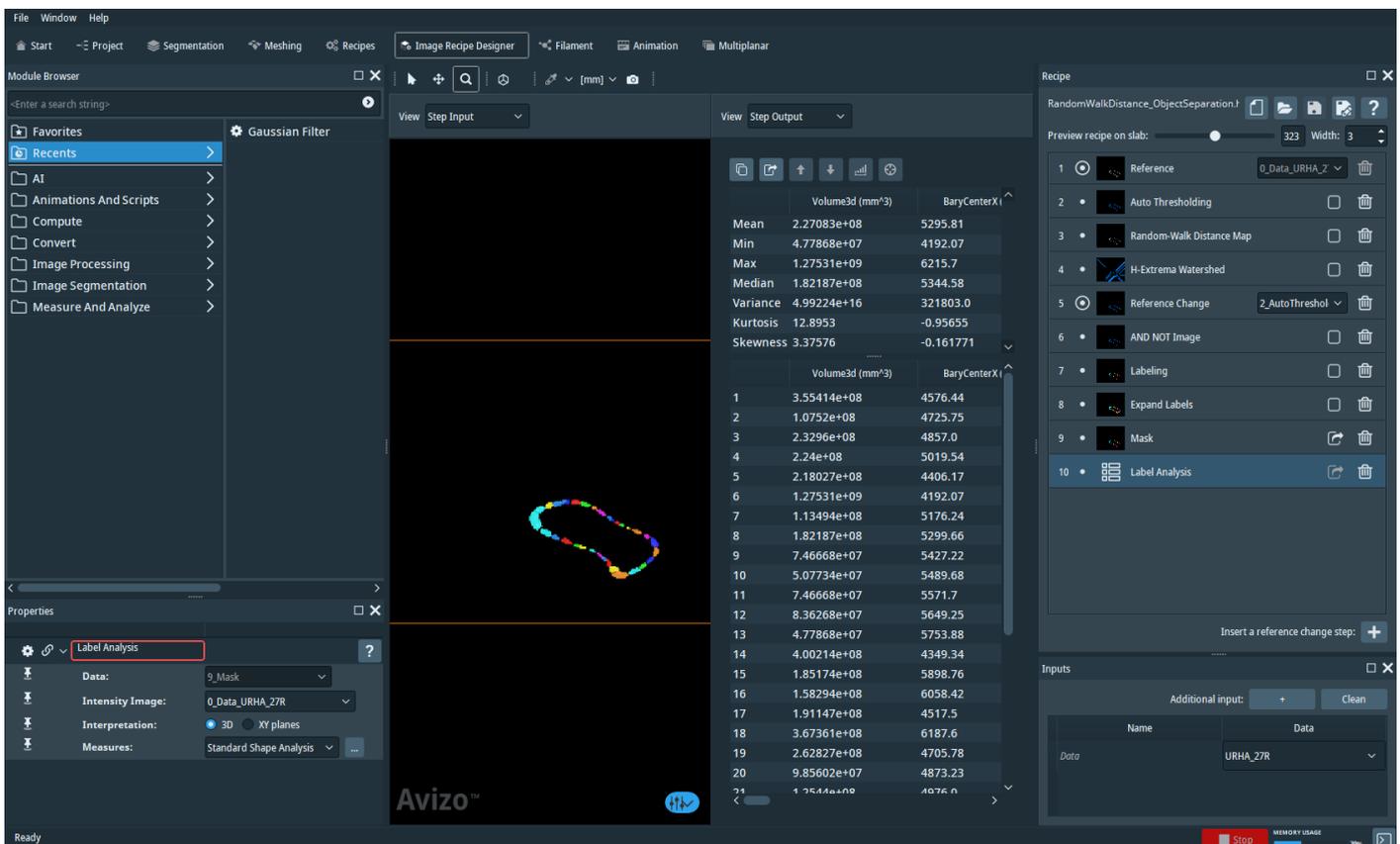


Figure 1. The Image Recipe Designer Workroom.

Improvements to the user's experience:

- It is now possible to load images or recipes from within the Image Recipe Designer workroom instead of doing some back and forth between ISP and the Project workroom.
- The name of a recipe undergoing the editing process is now visible, with a symbol indicating that this recipe is currently being modified.
- Image Recipe Player is now listed as a “favorite” module for all image data types by default, which means it is more easily accessible in the Module Browser.
- Users can make an “image recipe within image recipe,” or split a large recipe into smaller useful recipes. The Image Recipe Player is now a module available in the Image Recipe Designer workroom. You might have a big recipe with a lot of steps that could be split into pre-processing, segmentation, labeling and analysis sections. Just create a recipe for the pre-processing, another for the segmentation, one for the labeling and finally one for the analysis. Then on top of that, create a recipe that will call on those four recipes. Your recipes will be easier to understand, reusable, and better adapted to your workflows.
- The maximum size supported in Image Recipe Designer extends from 4k images to very large data (tested with 100k*100k; computation steps can be slow but the workroom remains usable). However, it is usually advised to design a recipe on a representative subvolume.
- A new module is now available in the Image Recipe Designer : “Label to Attribute.” Previously this module was only available in the Project workroom. With the addition of spreadsheet analysis in 2022.1 we continue to increase the number of modules available.
- The default directory when searching for a recipe in Image Recipe Player is now the same directory as the one used for saving the recipes. These are the advances in support of processing large multichannel timeseries datasets, using SMS file format (XPIore 5D extension) as shown on the following page:
- The Image Recipe Player now supports SMS datasets as inputs.
- You may have a large dataset, a multichannel data, a timeseries, or a combination of all of them; sometimes this data may not fit within available PC memory yet you still want to process it, to create statistical analysis. With this version, it is now possible to apply a recipe on each timestep of your dataset, and the results will then be combined at the end.
- You can select how to apply your recipe on your large dataset: for single-channel recipes, you may choose to apply the recipe to a given channel of the datasets or to all channels. For intrinsically multichannel recipes, you may select which channel connects to which recipe input.

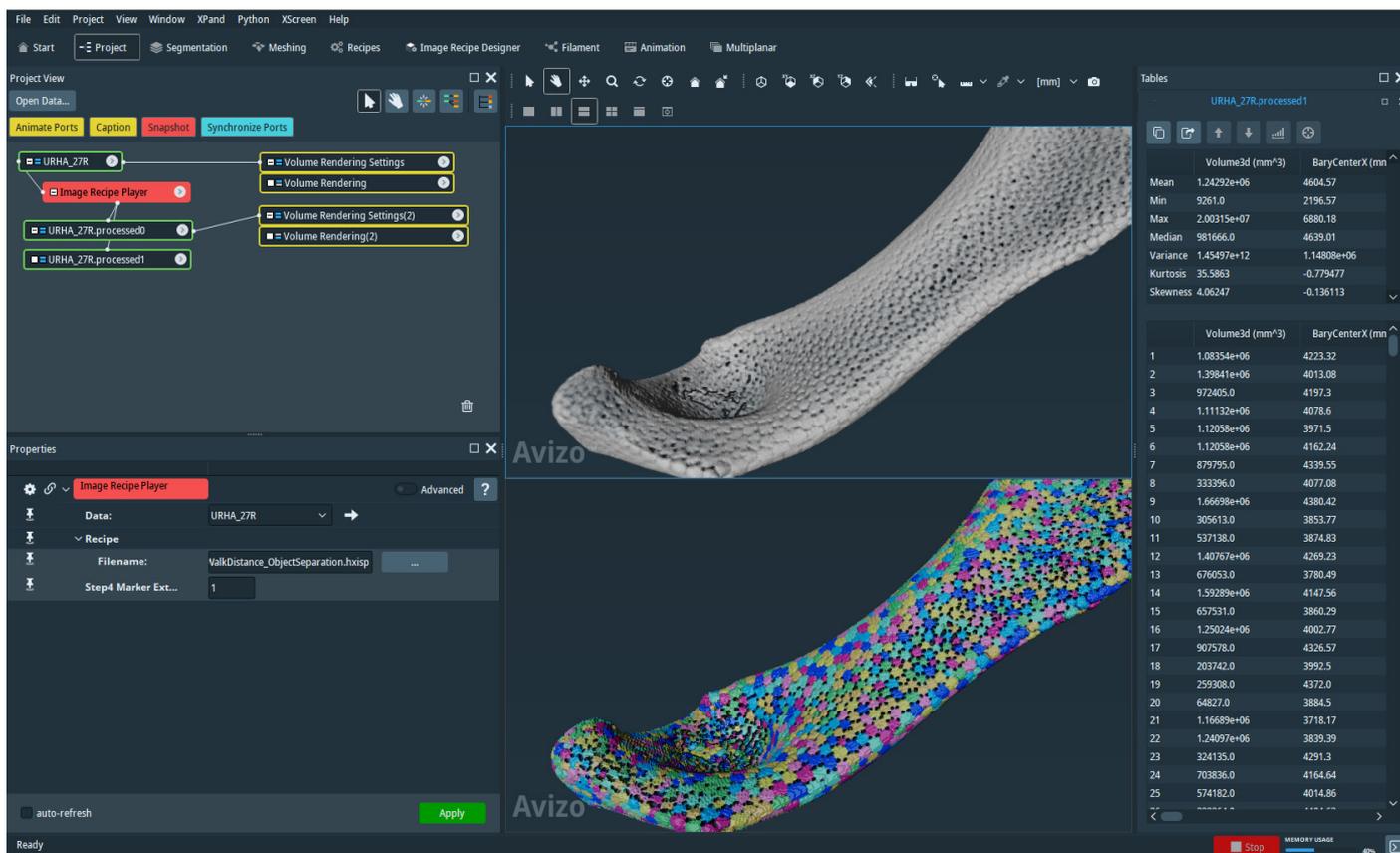


Figure 2. The Image Recipe Player Module.

Limitations:

When the spatial dimension of a single time step of a SMS dataset is very large and does not fit within available memory, it is possible that applying a recipe will fail (i.e., result in extremely long processing times (e.g. days) due to swapping, error messages, or even crashes). In this case the Image Recipe Player allows you to use an advanced, experimental feature called “Low Memory Setting.” Using this feature implies that the recipe will be applied in a block processing manner, if possible, or perhaps by working directly from the disk. This will guarantee that the required RAM is lower, though at the cost of the time required to process the recipe. In this case, expect processing

time to be extended by a factor of 2 to 5 at least, compared to a situation where the ‘in memory’ setting can work. Warning: Only a subset of the modules available in the Image Recipes are compatible with this feature. Applying a recipe that contains one or more unsupported modules in low memory mode will fail. For the complete list of modules compatible with the low memory mode, please refer to the documentation.

OS requirements: All supported platforms

Licensing: 3D Pro Packages, Edition Packages. Applying an Image Processing Recipe to SMS dataset requires the XPIore5D extension.

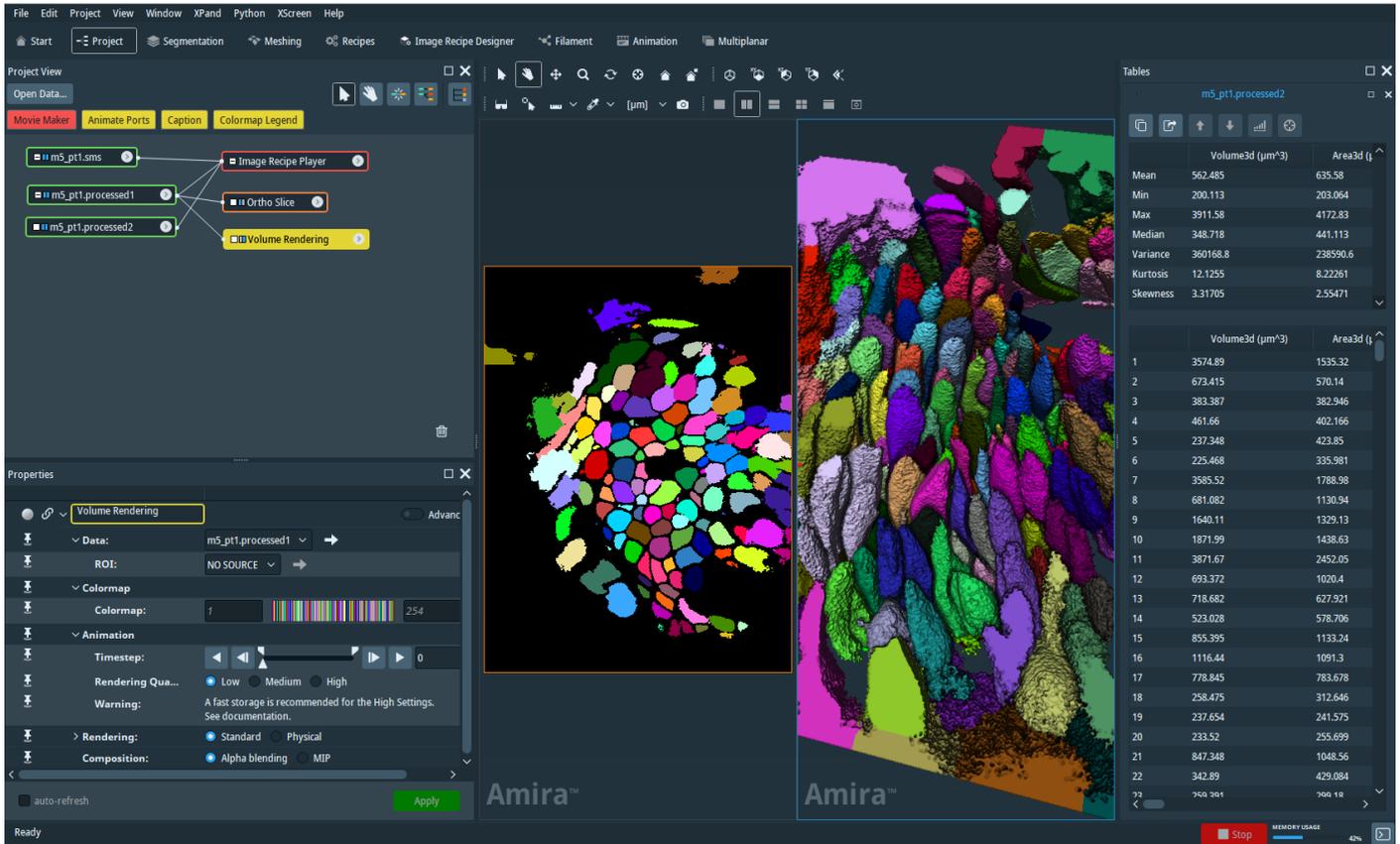


Figure 3. Recipe Designer processing out-of-core SMS data.

Segmentation+ Workroom

We continue to enrich the Segmentation+ workroom introduced with the 2021.2 release. The overall purpose is to take the interactive segmentation workroom to a new level by addressing known limitations and prepare the workroom for more innovation. Our efforts focus on both porting existing tools from the classic segmentation editor to the new segmentation+ workroom, and also adding new tools and workflows to enhance the overall user experience in interactive segmentation.

New AI-Assisted Segmentation Tool

The AI-Assisted Segmentation tool helps users produce segmentation on complex images with minimal effort or knowledge in image processing. This interactive approach uses a shallow neural network to provide results in the fastest possible way, with the AI Assisted Segmentation tool doing most of the work segmenting the image. It is particularly well suited for speeding up the processing of electron microscopy images but can also be used with any 3D data-set.

Patch Sets:

Using the AI-Assisted Segmentation tool, the strategy with patch sets is to annotate a tiny part of the image to allow a shallow neural network to quickly obtain a segmentation. For this purpose, the user can create a new patch set and use the “Add patch” tool to define patches (square regions of interest) inside the image and in the XY direction. When creating a patch set, the user can choose

the patch size. A patch set navigation panel has been added in the new segeditor to allow the user to easily navigate between patches. To select a patch, either use the patch set navigation panel or click directly on the patch in the XY display panel. Once selected, a patch can be deleted using the Delete key.

Description of the tool:

The AI-Assisted Segmentation tool was added into the automated segmentation tool panel of the new Segmentation Editor. The user can set some parameters, such as the number of epochs, and then select a material in a label image where the areas to segment have been annotated. The neural network will be trained from the contents of the image patches, and predict for the entire image a segmentation of the material of interest. The tool generates a selection, allowing you to apply any selection modifier before adding it to the label field and material of your choice.

Limitations:

An NVIDIA GPU supporting CUDA Compute Capability 5.2 or higher is required, with up-to-date drivers. Your CPU must support the AVX2 extensions. The Python environment for deep learning has been upgraded; please remember to install it prior to using this tool.

OS requirements: Windows only

Licensing: 3D Pro Packages, Edition Packages

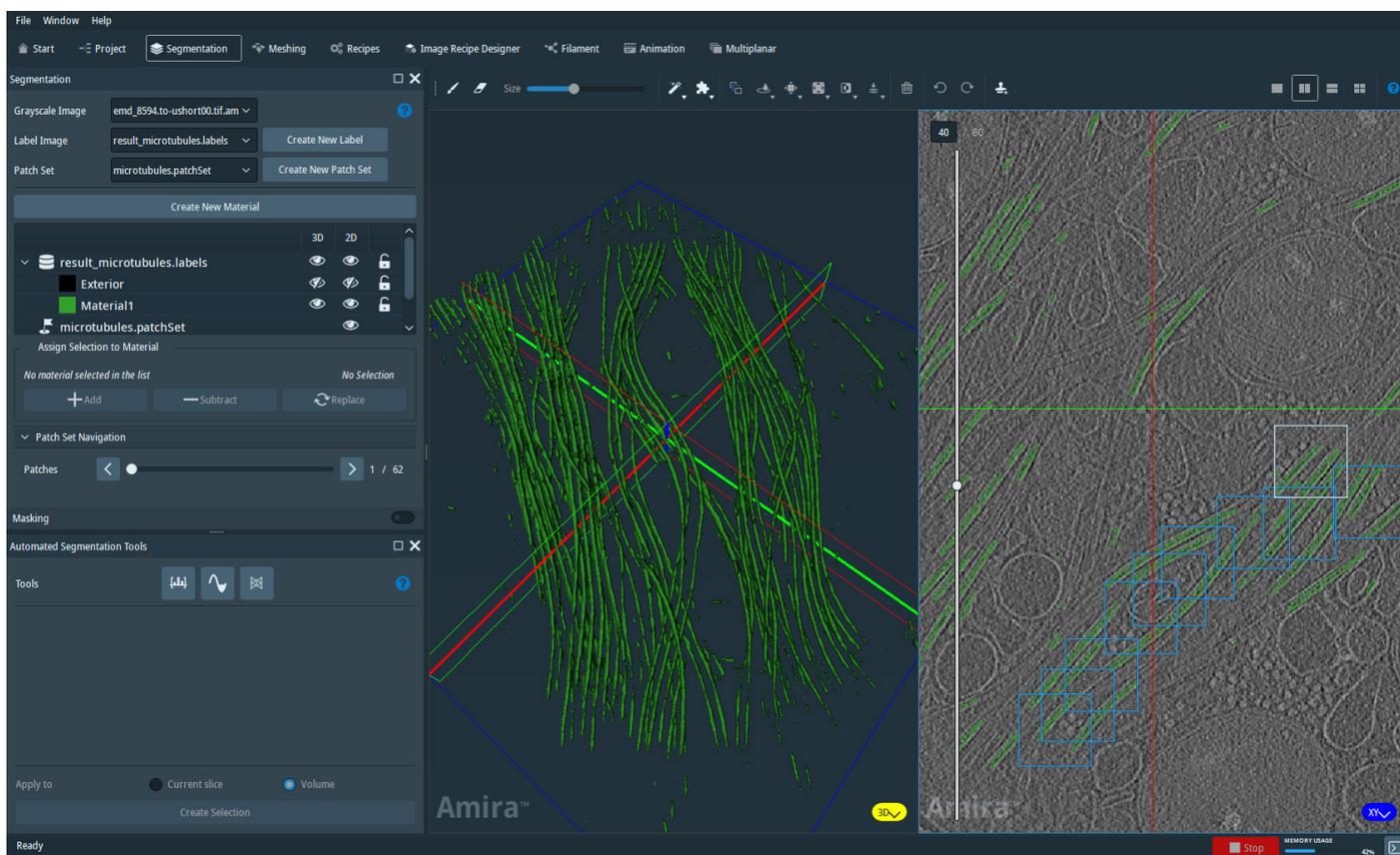


Figure 4. AI-assisted segmentation in the Segmentation+ workroom.

Porting Classic tools to Segmentation+

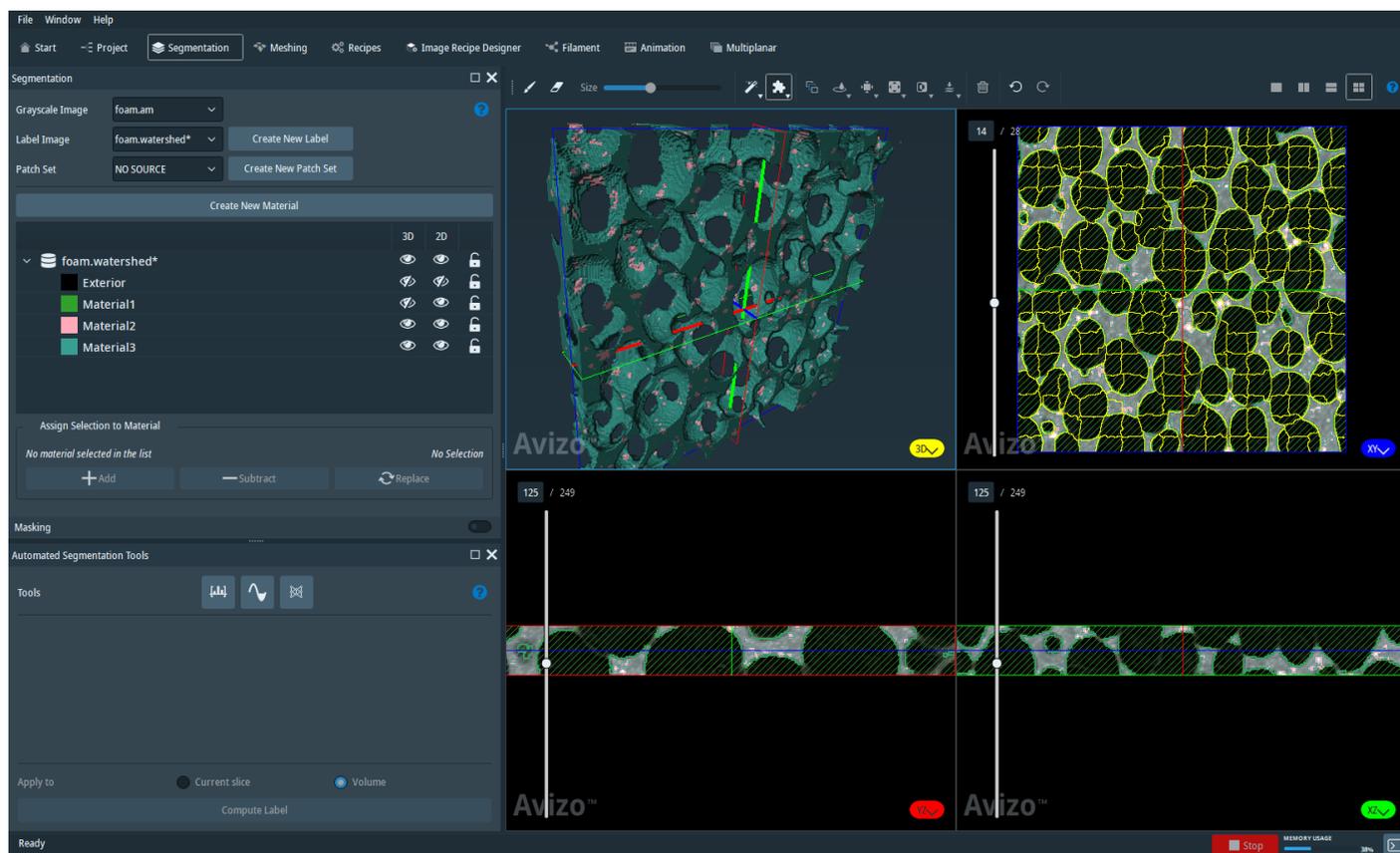


Figure 5. The new Segmentation+ workroom.

The transition from the Classic Segmentation workroom towards Segmentation+ continues with the porting of the following segmentation tools:



Brush tool with histogram selection:

By enabling Masking, the brush will select only voxels whose intensity values are within the range set by the Masking range slider.

Magic Wand:

This tool performs a region growing operation, from the selected seed point into all adjacent voxels with intensity values within the specified range. Region growing is performed either in 2D or 3D space, depending on whether the Current Slice or Volume option is active.

Watershed (License 3D Pro):

This combines the powerful Watershed algorithm with interactive techniques to provide a highly effective strategy for segmenting complex 3D structures. This tool is based on a marker-based watershed algorithm which segments a gray level image based on:

- A landscape image extracted from the image data.
- A set of markers which identifies a subset of the regions of interest (called tags or markers) inside the data set.

Shrink:

Perform a morphological erosion of the current selection. The selection is made smaller by one voxel in the selected directions.

Grow:

Perform a morphological dilation of the current selection. The selection is made bigger by one voxel in the selected directions.

Smooth:

Smooth the current selection. Smoothing works by applying a Gaussian filter to the binary selection image and then reselecting all pixels with an intensity higher than 0.5.

Invert:

Invert the current selection. The selected voxels are deselected, while non-selected voxels become selected.

Undo/Redo:

Cancel/Redo the last action applied to a selection or a patch set.

OS requirements: All supported platforms

Licensing: No restrictions, except for the Watershed tool which is restricted to 3D Pro and Edition Packages

Improvements to Segmentation+ workroom

Following the feedback gathered from our perception tests, the Graphical User Interface (GUI) has been modified to improve the user experience:

- Selecting an existing label field to edit or creating a new label field is now separated from the creation of a new material in the current label field.
- It is now easier to tune the size of the brush and eraser tool.
- Lock/Unlock feature: It is now possible to lock a Label or a Material to prevent any modification.
- Interpolate tool: The tool has been improved so that the user does not need to choose the interpolation direction.

OS requirements: All supported platforms

Licensing: No restrictions

Patch Extractor module

Using the new Patch Set data structure related to the AI-assisted segmentation tool, the new “Patch Extractor” module lets the user extract the patches that have been defined from the Add Patch tool of the segmentation editor inside a grayscale and/or a label image.

This is useful for storing the annotated training patches and accumulating information from multiple datasets, in order to train a deeper neural network with better generalization ability than the shallow model described above.

OS requirements: Windows only

Licensing: 3D Pro Package, Edition Packages

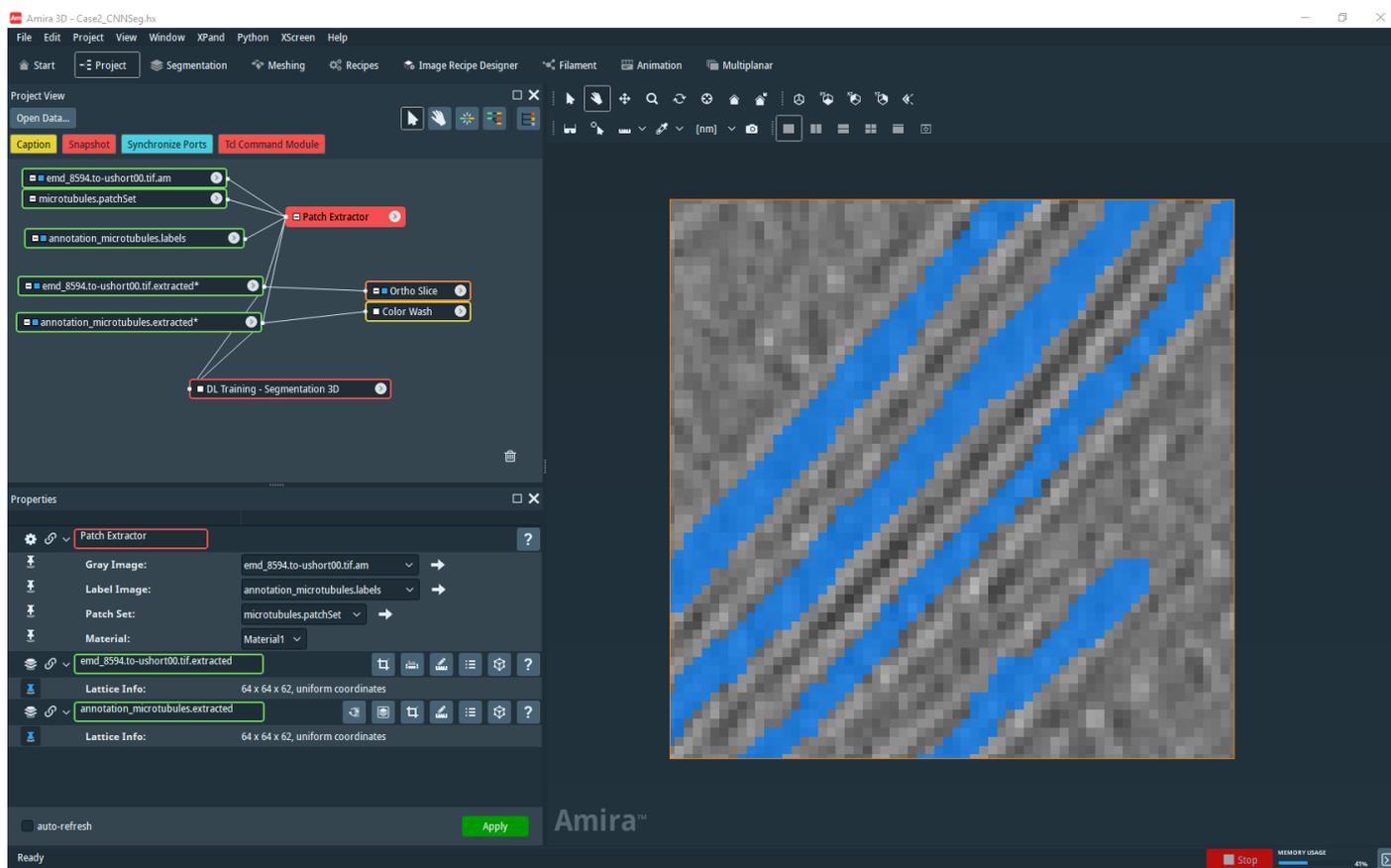


Figure 6. The AI Patch extraction module.

Enhancements

Meshing

Run-time performance of the meshing algorithm from the Meshing workroom, and from the Generate Tetra Mesh module, has been significantly increased, with a computation time cut nearly in half. The generated meshes have, so far as they have been tested, better quality and tend to contain slightly more tetrahedra. Memory requirements remain similar.

Avizo XWind mesh file formats supported for CAE/CFD/FEA interoperability have been updated. Among others, the file formats ABAQUS until 2022, ANSYS until 2022 and COMSOL 5.6 are supported.

OS requirements: Windows only

Licensing: XWind extension

User Interface improvements

The following modules have been greatly improved in term of performance in the 2022.1 version:

- Beam Hardening Correction
- Ring Artefact Removal
- Cylindrical Intensity Profile

The user experience of these tools have been enhanced in this 2022.2 version; for example, by incorporating a threshold range displaying the data histogram and an interactive component to define the centerpoint.

OS requirements: All supported platforms

Licensing: 3D Pro Packages, Edition Packages

Xplore5D improvement

The SMS Converter is now supporting 32-bits integer images.

Projects containing SMS datasets can now be saved as any other projects, with different policies: minimum size, minimum computation, or Pack&Go. Pay attention to your choices, however, and recognize that SMS datasets can be very large.

OS requirements: All supported platforms

Licensing: XPlore5D extension, Amira Software 3D Cell Biology

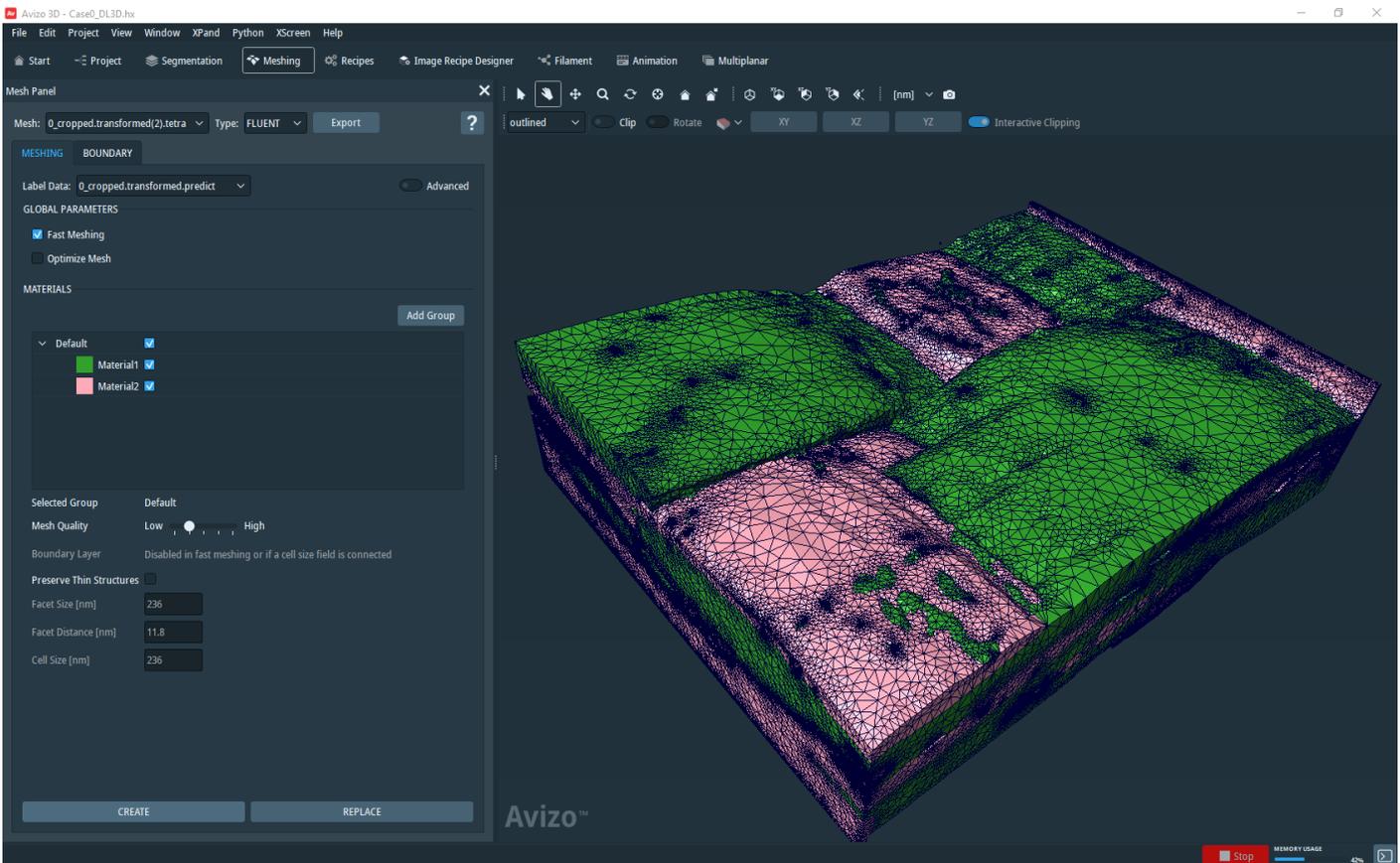


Figure 7. The enhanced Meshing Workroom.

Xtra recipe library

The following Xtras have been published or updated since the previous release notes. Pay particular attention to the product, license and OS requirements, as well as the installation instructions. Your feedback is welcome.

[Divide Full Data Volume into Defined Sub-Volume Blocks](#)

for Label Analysis: This Xtra demonstrates how to use the Arithmetic module to divide a whole volume data into defined sub-volume blocks and then perform label analysis on the blocks.

[Efficient Graph-based 2D Image Segmentation](#) (Update):

This Xtra implements efficient graph-based image segmentation by Felzenszwalb and Huttenlocher.

[Split and Merge Segments](#) (Update):

This module merges the two most representative segments at the intersection points of a graph structure and detaches the others.

[Interactive Top-Hat by Reconstruction](#) (Update):

This module provides an interactive Top-Hat segmentation that prevents the segmentation of “false positive” porosity on the edges.

Recipe Sequencer (Update): Module for sequencing a recipe on each individual isolated label from a label field.

Cylinder Slice with Native Resolution in Z (Update): This Xtra module is a version of the Cylinder Slice module that sets the resolution, in the Z direction, of the extracted image to the native resolution of the input data.

Refine Surface (Update): This module refines a surface.

Slice by Slice Thinning (Update): This module performs the thinning of a binary image slice-by-slice.

Object Separation using Random-Walk Distance Map:

Realizes an object separation workflow relying on Random-Walk Distance Map. It is more robust for noisy segmentation or non-spherical shapes, compared to Separate Object.

Scale Axes: The coordinate-axes displayed using the “Axes” module cannot be scaled easily. Using this Xtra, you can easily change the lengths of the axes and the location of the displayed origin.

BSE SEM denoiser (Update): U-Net model for denoising back-scattered SEM images.

Getting Started with Deep Learning Training for Image

Segmentation (Update): Model and companion project for the Deep Learning tutorial.

Create Material Ids: Using this module, the “Materials” parameter-bundle of a label-field is created and filled with an ID and name for each label-value.

Image Stack Builder: This module merges together a set of several 2D/3D images into one single volume. It is very helpful for building a 2D image stack from a set of 2D images for ground truth definition.

High Content Screening Plate Manager (Update): Load, visualize, and process multi-channel fields from Thermo Scientific CellInsight CX5, CX7 LED, and CX7 LZR HCA instruments and HCS Studio software.

Scientific Scalebar: This Xtra automatically sets the scalebar parameters to comply with the requirements for scientific papers.

Plane Tools - Surface and Volume Distance to Plane and

Spatial Graph Projection onto Plane: This Xtra provides a set of three modules to compute distance and projection to a user-defined plane.

Extract Objects: The Xtra module extracts single objects based on labels’ information listed in a Label Analysis.

Reconstruct Spatial Graph from Markers: This Xtra filters a Spatial Graph to keep only segments that have at least one point in each of the labels of an input Label Field.

How to Calculate Surface Area: Three approaches are shown for extracting a surface and measuring the surface area of its geometry.

How to Install the Deep Learning Python Environment

(Update): Two videos explain how to install the dependencies needed to use Deep Learning within Amira 3D, Avizo 3D, or Pergeos. One video covers the standard install and the other is for users without an Internet connection.

How to Calculate Surface Area of a Custom ROI: This tutorial elaborates how to draw a region of interest on a surface. With this ROI, you can calculate its surface area.

Volume Operations: Flip, Swap, Auto-Crop and Enlarge: This Xtra is a set of modules allowing to perform and automate volume operations on your data.

Eval on Spatial Graph: This Xtra evaluates a scalar field at each point of a Spatial Graph and stores the result as thickness attribute of the resulting Spatial Graph.

Compatibility notes

DICOM Export/Import of dicomseg: Amira-Avizo is now able to read DICOM files using Transfer Syntax UID : 1.2.840.10008.1.2.5 (RLE Lossless). An update of the DCMTK 3rd party library (to version 3.6.3) fixed a bug occurring when writing DICOM files of “Segmentation Storage SOP” class (dicomseg). These files, despite being readable with previous versions of Amira-Avizo, were not respecting the DICOM standard. This upgrade and fix causes a compatibility break in Amira-Avizo: dicomseg files written with previous versions of Amira-Avizo will be no longer be read properly with 2022.2 version. To work around this issue, you must load the old dicomseg file in a previous version of Amira-Avizo (e.g. 2022.1), and save it in .am file format. Then, please load this .am file with version 2022.2, and export it as a DICOM file to obtain a dicomseg file conforming with DICOM standard.

XPand developers: Compilers required to build Amira/Avizo applications’ extensions based on XPand API are:

- Microsoft Visual Studio 2019 on Windows
- gcc 9 on Linux OS

Amira/Avizo Pro users who have developed custom extensions based on XPand API must rebuild their extensions using the new supported compilers.

Avizo for Industrial Inspection Metrology workroom: Eigen library update to version 3.4.0 introduces a different behaviour in the determination of the fitted geometries in the Metrology workroom. Fitted cones and cylinders can have axes with inverted extremes. The new results will be stable and

repeatable once the file containing dimensions and fitted geometries is saved with 2022.2. These changes can induce inversion of the position of dimensions and can result in dimensional changes if dimensions or inherited geometries are referring axes extrema.

Import of 16-bit PNG files: In previous versions, loading a 16-bit PNG was resulting in an 8-bit dataset in Amira/Avizo, with intensity values remapped from their initial dynamic to the [0, 255] range. Following an upgrading of our 3rd party Qt, to version 5.13.0, native support for 16-bit grayscale images is now possible. As a result, 16-bit PNG files are now read as 16-bit images in Amira/Avizo without any intensity remapping anymore. Users who wish to maintain compatibility can use the tool “Convert Image Type” to perform the intensity remapping explicitly. Images which use a significant range of gray values are mostly unaffected, but images which only had a few of them will see changes in the way that colors are interpolated during the conversion process. See **Figure 8** for the same 4 images loaded with this change.

Documentation and distant executable: Running Amira/Avizo on a local PC via an executable stored on a remote PC accessible via LAN requires that the environment variable QTWEBENGINE_DISABLE_SANDBOX be set to 1 in order to access the product documentation.

NetCDF file format support: Some metadata stored in .nc files and that were available in the Parametric bundle after loading an .nc file in the previous version are no longer available. However, the main geometric information and image data are unchanged.

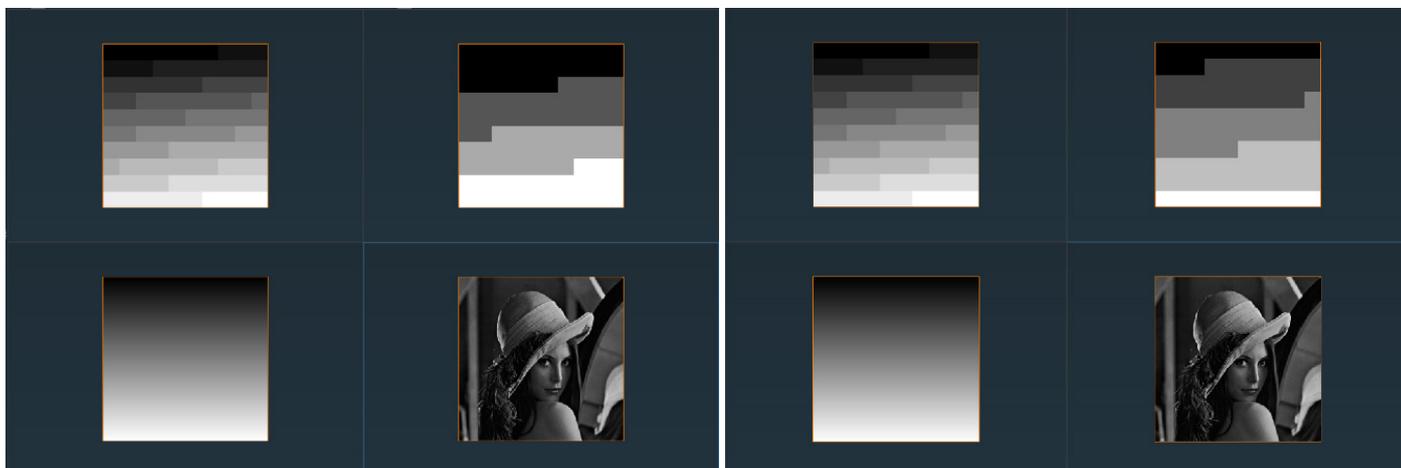


Figure 8. On the left are 16-bit images loaded with Amira/Avizo 2022.1; on the right are the same images loaded by Amira/Avizo 2022.2.

XPand extension requirements

To add custom extensions with Amira/Avizo XPand extension, you will need:

- Microsoft Visual Studio 2019 version 16.2 (v142) on Windows
- gcc 9.x on Linux Ubuntu 20.04

As of this release the Eigen library is no longer distributed with Amira/Avizo and it is therefore necessary to explicitly install it to compile any XPand tools that make use of it.

Amira/Avizo Pro users who have developed custom extensions based on XPand API must rebuild their extensions using the new supported compilers.

End of support

CentOS7, replaced by Ubuntu 20.04 as official Linux distribution

CentOS7 is discontinued starting from this release. It is replaced by Ubuntu 20.04 as the officially supported Linux platform. Amira/Avizo 2022.1 was the last officially maintained release on CentOS7 platform. There will be no new product development nor update on CentOS7 after that version. We encourage you to transition to the Linux-supported platform to benefit from our full support.

Resolved issues

Name	ID	Description
Linux platform	AA-11419	The SELinux environment does not cause startup error anymore
LDA	AA-12356	It is now possible to open LDA files issued from big stack of jpeg2000 files without error
DICOM	AA-23716	When exporting a dicom file, the pixel spacing tag is now saved with the correct unit
VGL Reader	AA-25349	TIFF stack data is now imported with the correct size and voxel size
VGL Writer	AA-26631	Projects containing VGL files which reference a great number of images can now be correctly saved and exported in both hx and togo formats
Correlation Histogram	AA-27099	Multiple rectangular regions can now be drawn inside an histogram from the Correlation Histogram module using Tcl Command Module
Colormap Editor	AA-27104	Colormap conversion has been fixed to avoid incoherence in color value
Link Camera	AA-27182	Link(s) between viewers does not impact anymore the new segmentation editor workroom when switching on it
Align Mosaic Blocks	AA-27210	The aligning algorithm has been fixed to avoid failure when processing huge blocks
Membrane Enhancement Filter	AA-27284	The module has been corrected for 2D images. Following Outputs are now available: Partial Planeness Tensor Voting, Planeness

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CUDA on Windows 7 / Windows 8

As already announced, MS Windows 7, MS Windows 8 and MS Windows 8.1 operating systems support has been discontinued (since release 2020.3). Anyway Amira/Avizo can be used on those OSs without major issues. Starting from this release a third party update causes all CUDA based functionalities (Deep learning tools, Ambient occlusion, Anisotropic diffusion and Non-Local means filter - GPU Adaptive Manifold) to not be functional anymore on these platforms. We encourage you to update your Operating system to a Windows-supported platform in order to benefit from our full functionalities.

Operating systems

Amira/Avizo Software version 2022.2 runs on:

- Microsoft Windows 10 (64-bit).
- Linux x86 64 (64-bit). Supported 64-bit architecture is Intel64/AMD64 architecture.
Supported Linux distribution is Ubuntu 20.04 (desktop).

Resolved issues (*continued*)

Name	ID	Description
Label Analysis	AA-27394	Computing a label image containing negative values does not raise an error anymore
TIFF reader	AA-27462	RGB TIFF file with slice greater than 30.000x30.000 are now loaded without error
Deep Learning Prediction	AA-27475	Large Data are now successfully processed by deep learning prediction
Segmentation Editor+	AA-27489	Transformed data in project view are now properly displayed in the new segmentation Editor
Generate Surface	AA-27528	The Smoothing Extent port is now limited to 3 (limitation of the algorithm)
Random Walk Distance Map	AA-27551	The transformation of the input data is now applied to the output data
Time Series	AA-27683	Saving time series project as Pack&Go has been fixed to avoid overwriting data which have similar names
Avizo ToGo	AA-27751	Avizo ToGo is now correctly installed on a machine where no prior Avizo installation has been done
Intensity Auto Classification	AA-27790	Using the module on large datasets with a high Pre-Computing (%) value now works as expected

Learn more at thermofisher.com/amira-avizo