

Amira-Avizo Software version 2023.1

Release notes

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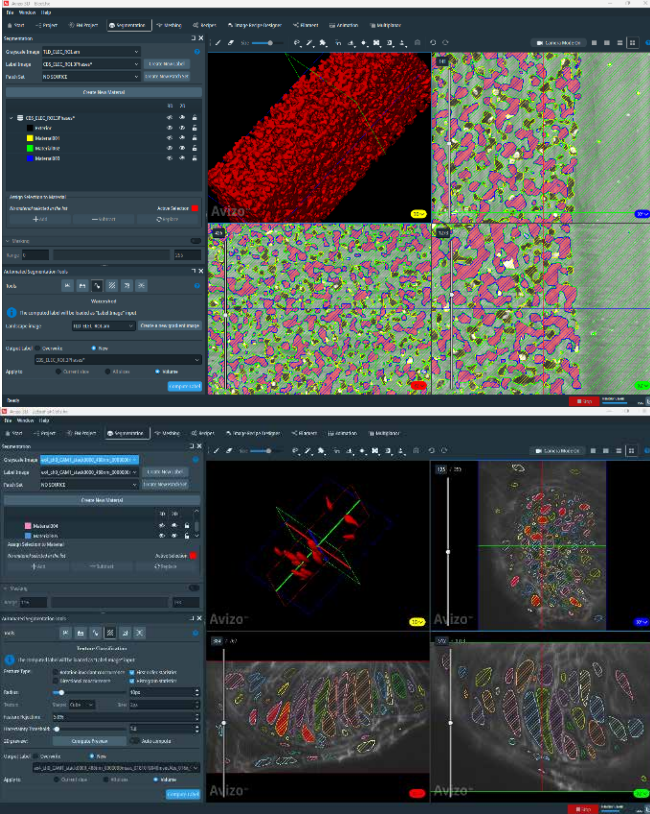
Introduction

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](#).

Segmentation+ Workroom

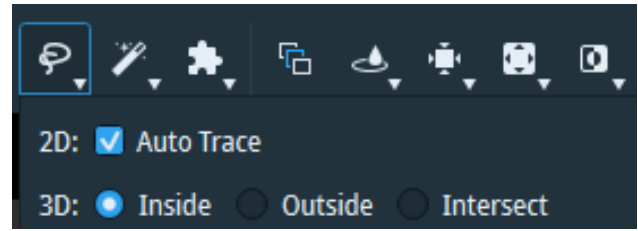
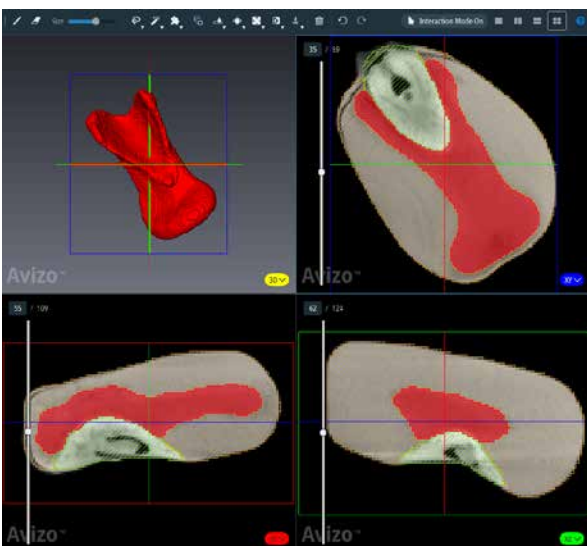
We continue to enrich the Segmentation+ workroom introduced with the 2021.2 release. The overall purpose is to take the interactive segmentation workroom to a new level by addressing previous limitations with respect to larger datasets and prepare the workroom for more innovation. Our efforts focus on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



Interactive Segmentation Tools

- Material Selection:**

In interaction mode, you can now select materials in the 2D viewer using a voxel selection. Using options in the contextual menu of the 2D viewer, you can select in 2D or 3D either an entire material or each connected component independently.



- Lasso:**

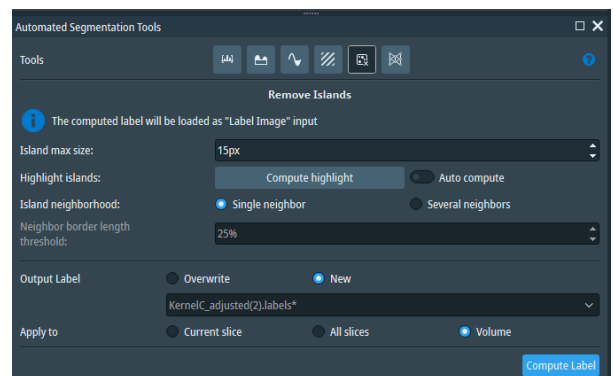
The Lasso lets you define an area by generating a closed contour curve in 2D or 3D.

- 2D viewers:** By default, the 2D lasso is polygonal. You can place control points to trace the lasso using the left mouse button. You can also click and hold the left mouse button and then move your mouse to automatically add points at regular intervals along your defined path. Zooming in reduces the space between the control points, allowing for greater precision. Once you are done tracing, you can switch to editing mode by pressing the Enter key to move control points. Pressing enter a second time creates a selection of pixels.
- 2D viewer:** The 3D lasso is not editable and the selection of voxels is made freehand. Three modes are available:
- Lasso:** The Lasso lets you define an area by generating a closed contour curve in

Automated Segmentation Tools

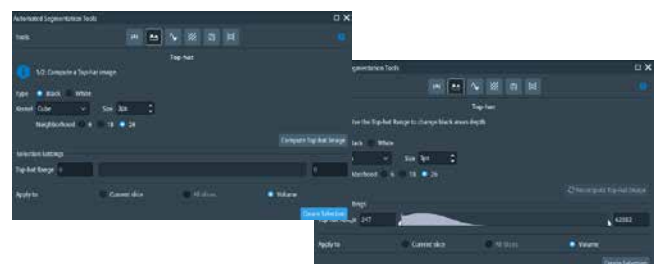
- Remove Island:**

This tool allows you to use the corresponding module to filter small, connected components (please refer to the section *New Module: Remove Island*).



- Top Hat (Advanced Packages):**

This tool detects dark or light areas in the image corresponding to the valleys or the narrow peaks of a *function f* using morphological operators. The enhanced image is then thresholded to create a selection.



- **Texture Classification (Advanced Packages):**
The texture supervised classification tool performs image segmentation based on local textural features. This is achieved by training a classifier to discriminate between different materials. The training is based on the materials defined in the current **Label Image**. The segmentation result is generated as a new label image, which indicates the most likely material for any pixel. The **Uncertainty Threshold** can be used to avoid labeling pixels for which the classifier has a low confidence, which often happens around the interfaces. When this is problematic, it is advised to lower this threshold to finalize segmentation using the *Watershed Tool*.

Automated Segmentation Tools

Following feedback gathered from our perception tests, the user interface has been modified to improve the user experience:

- The navigation and slice browsing in the 2D viewer is now faster and more fluid for larger datasets
- Visual feedback now shows the current mode of the display panels, i.e. interaction or navigation mode
- A newly added notification area clearly states the requirements for each automated tool
- The “Add Patch” tool (Advanced Packages) can now be activated from the patch set navigation area
- The masking area is now always expanded

OS requirements: All supported platforms

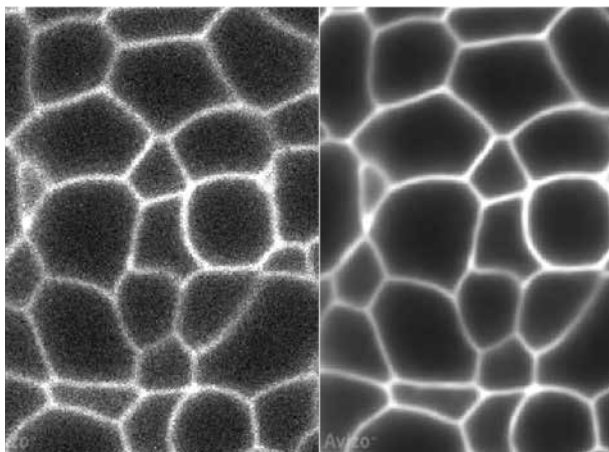
Licensing: Standard Packages.

Deep Learning Denoising

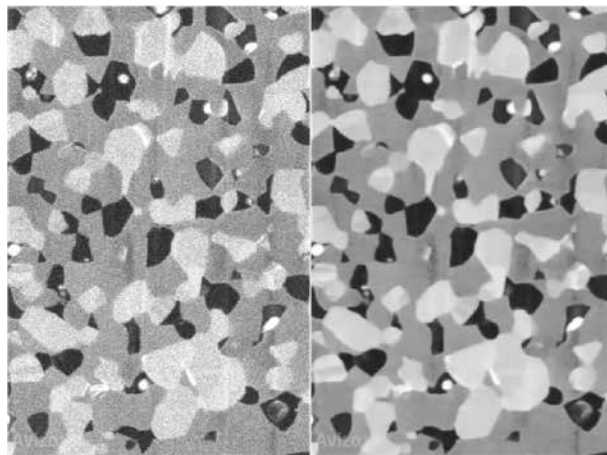
Noise2Void

Denoising modules help you run faster acquisitions and digitally compensate for missing information.

The Noise2Void approach is an unsupervised denoising method that does not require noisy image pairs or clean target images. Therefore, a model can be directly trained with this method using the images you need to denoise without a ground truth. A new deep learning module named *DL Training - Noise to Void 2D* is



Noise2Void Deep Learning denoising applied to EM image of a zebrafish embryo.

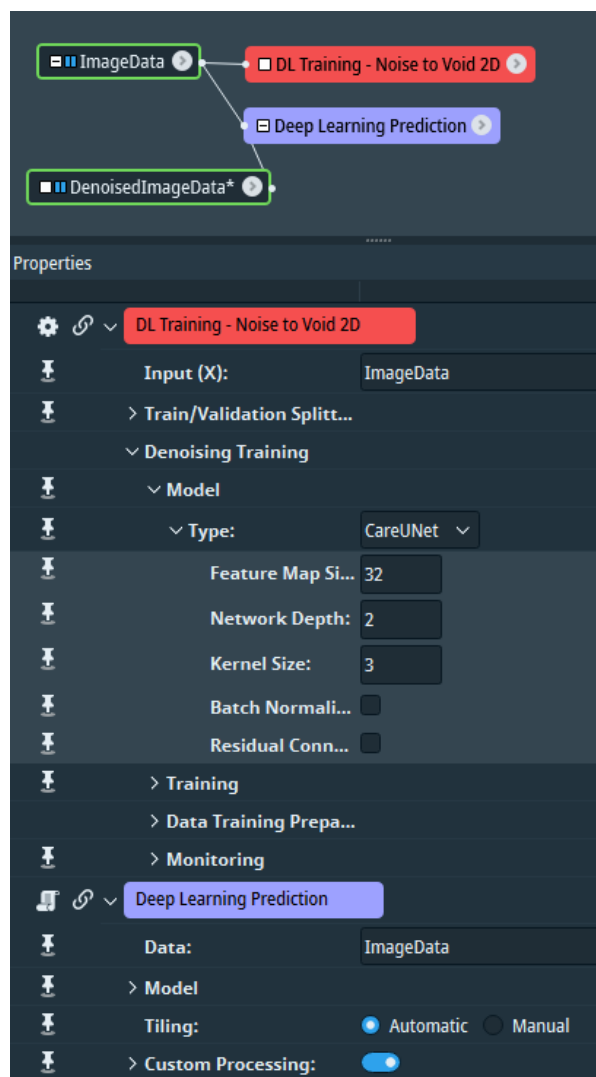


Noise2Void Deep Learning denoising applied to EM image of a SOFC sample.

now available to train a model using this pipeline. Once trained, the denoising model can be used with the existing module of inference named *Deep Learning Prediction*.

OS requirements: Windows only

Licensing: Advanced Packages.



User interface of Deep Learning Noise2Void denoising as well as Prediction module.

Image Recipe

In version 2022.2, we added the Image Recipe Designer workroom to help you design reusable recipes that streamline and reproduce image processing workflows. This version introduces new options to better document Image Recipes and to facilitate their use.

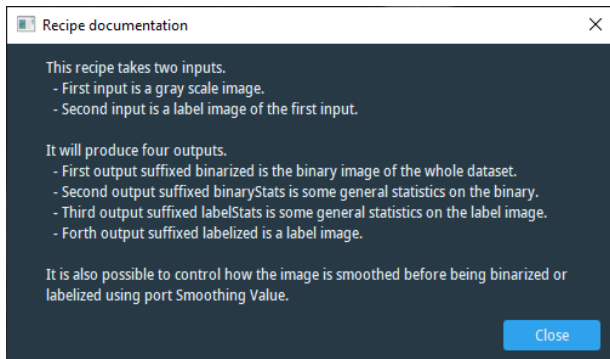
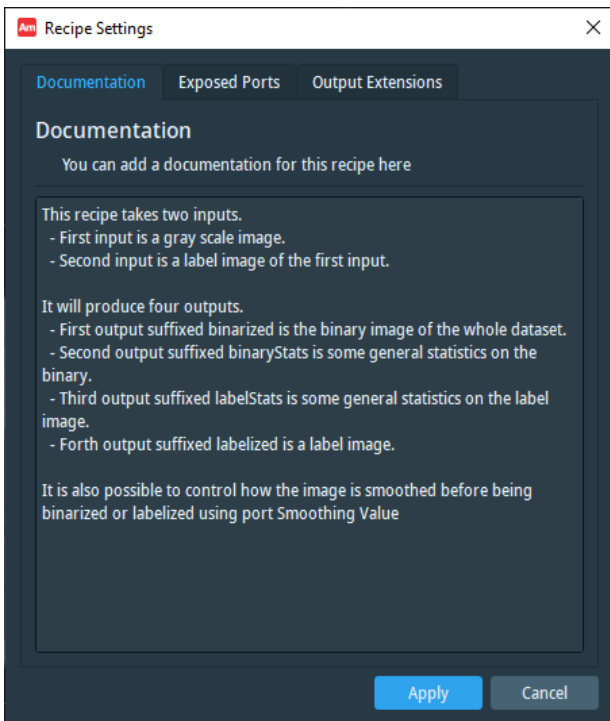
Documenting Image Recipes

The Image Recipe Designer workroom now contains a *Recipe Settings* dialog to help you document your recipes and make them easier to use.

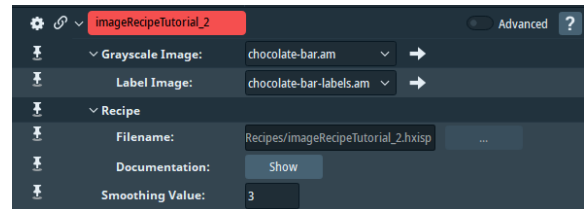
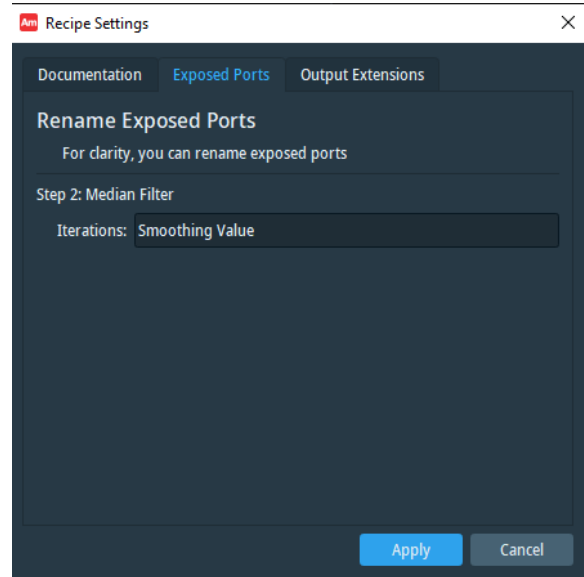


The recipe settings will let you:

- Add general documentation



- Adjust the names of exposed ports



- Choose the suffix for each output

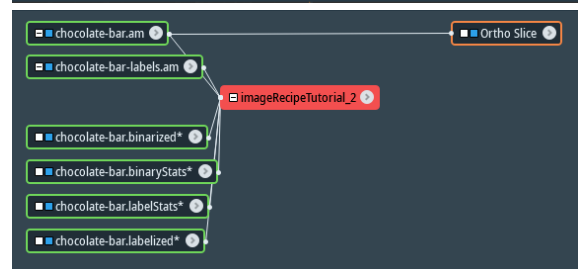
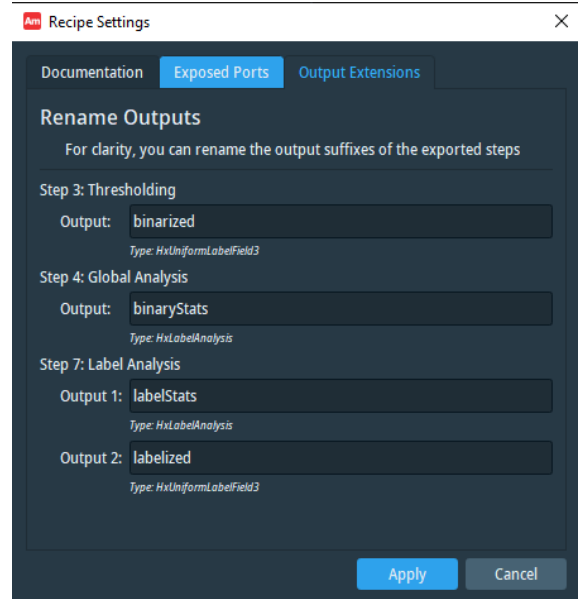
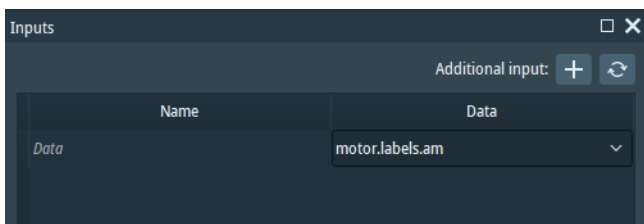
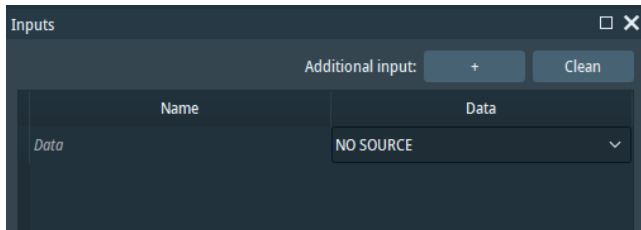


Image Recipe Designer User Interface

We have also added the following improvements:

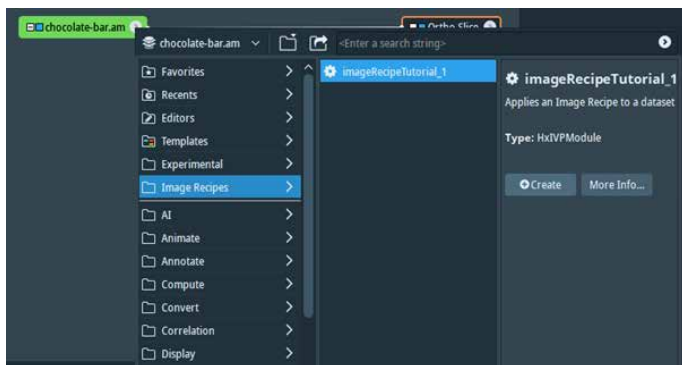
- You can now remove a step by pressing the *Delete* key, which displays a confirmation dialog
- The interface for adding or removing additional inputs to an image processing recipe has been improved
- The name of the recipe in the **Image Recipe Designer** is now the filename without the file extension



Use your image recipes directly from the Module Browser

We have added a new **Image Recipes** section in the module browser of the **Project** workroom. This section contains all recipes that are stored in the *Image Recipe Path*. This directory can be configured from a new preference, *Recipe > Image Recipe > Path*. Subdirectories are supported and will appear as subsections in the module browser.

You can now simply select the image recipe you want directly from the module browser. This will insert a pre-configured **Image Recipe Player** connected to your data.



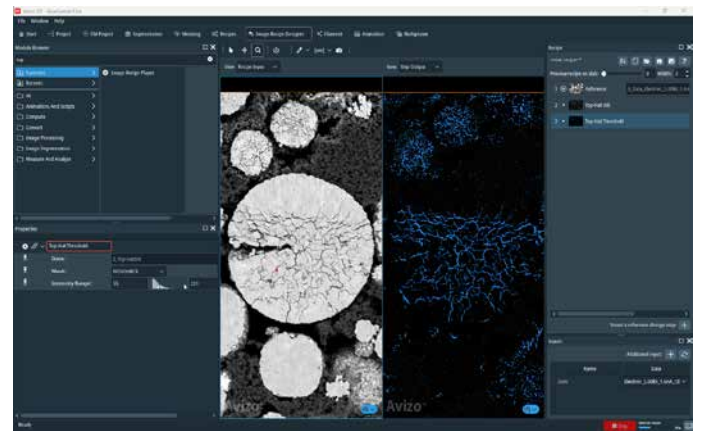
Note: Saving an image recipe from the **Image Recipe Designer** makes it directly visible in the **Module Browser**. However, external modifications on the *Image Recipe Path* requires a restart of the application to be visible. For instance, if you copy an existing image recipe in this path, it will not be visible in the module browser until you have restarted the application.

New modules in Image Recipe Designer

With each release, we are expanding the number of modules supported by **Image Recipe Designer**. This release includes three new modules:

- Closing by reconstruction
- Opening by reconstruction
- Remove Island
(please refer to the *New Module: Remove Island* section)

We have also modified the **Top-Hat** module within **Image Recipe Designer** to make it easier to use. Now, creating a **Top-Hat** module will add two steps to the image recipe: initialization of the **Top-Hat** and thresholding. Please refer to the *Compatibility notes* section if you previously created recipes using **Top-Hat**.



OS requirements: All supported platforms

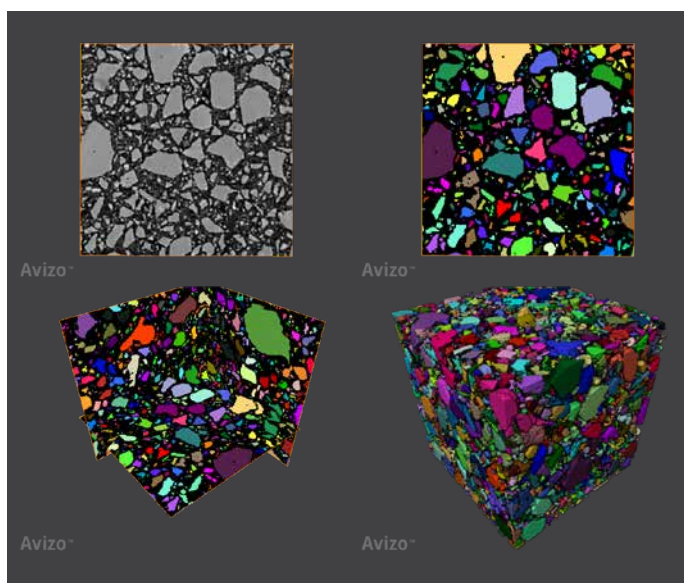
Licensing: Advanced Packages

New Modules

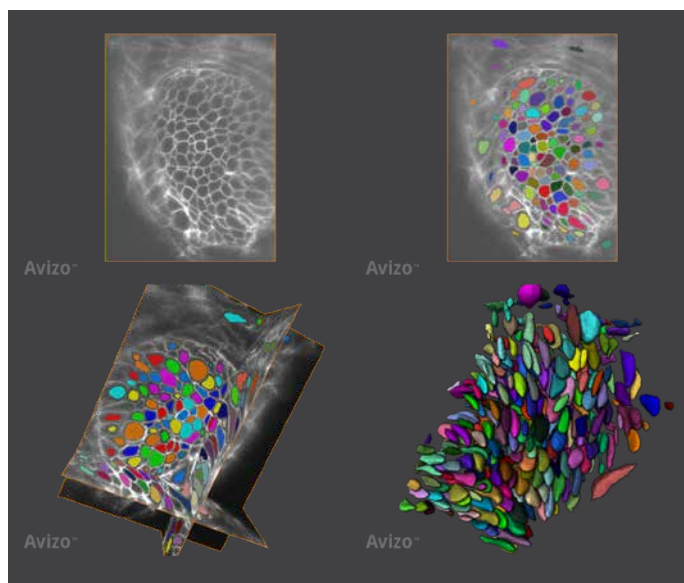
Hierarchical Watershed Segmentation

This module implements the watershed algorithm, enabling segmentation of images into meaningful regions. The traditional challenge with watershed segmentation is the adjustment of the parameter controlling the fusion of adjacent regions. Starting from either the local minima or maxima of the input image, the first execution of this module computes a hierarchy of catchment basins simulating water flooding in the landscape and stores it in a tree structure. Once this structure is computed, you can quickly adjust the threshold criterion that controls how adjacent regions are being merged and interactively identify the optimal trade-off.

This module replaces a previous implementation from the Hierarchical Watershed module, which is now discontinued.



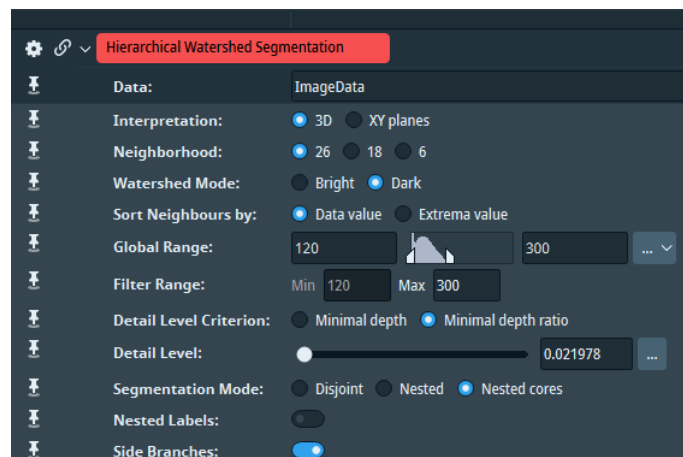
Hierarchical watershed segmentation applied to a 3D microCT volume of a rock sample.



Hierarchical watershed segmentation applied to 3D EM image of a zebrafish embryo.

As with the previous module, it has two main use cases:

- Implement more control on object separation by applying this module on a distance map from a binary image of structures that are in contact (e.g., densely packed particles or cells, pore space)
- Segmentation of structures separated by relatively salient boundaries, such as membrane-marked samples in fluorescence imaging, boundaries revealed by a filter such as gradient magnitude, or membrane enhancement



User interface of the Hierarchical Watershed Segmentation module.

OS requirements: All supported platforms

Licensing: Advanced Packages

Remove Islands

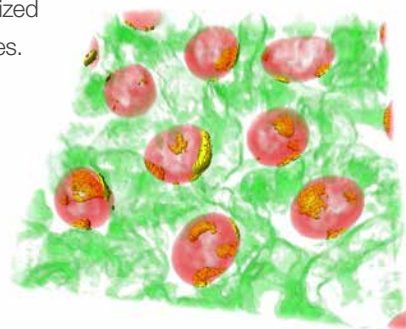
This module supports post processing of label images by removing small regions, or “islands.” An island is defined as a connected component containing a number of voxels less than or equal to a specified value. Islands can be relabeled to the predominant neighboring label, depending on the number of neighboring labels and the fraction of surface of interface shared with these neighbors.

OS requirements: All supported platforms

Licensing: No restrictions

Colocalization

This module detects colocalized particles of two binary images. The result is a binary image containing the union of overlapping particles.



OS requirements: All supported platforms

Licensing: No restrictions

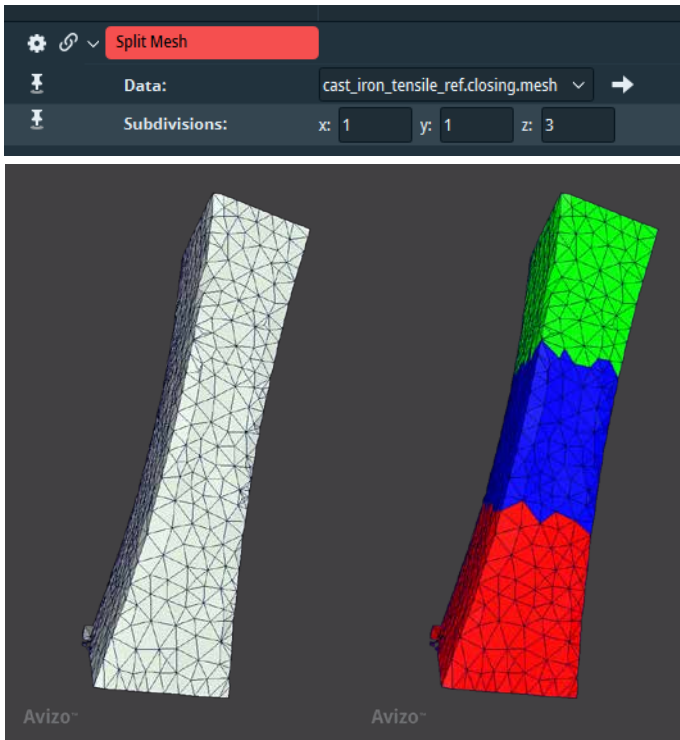
Digital Volume Correlation

In this version, we are addressing the computational demand related to processing of large datasets with the Digital Volume Correlation module.

New module: Split Mesh

The new **Split Mesh** module allows you to process larger datasets with limited hardware requirements. This is achieved by fragmenting the total volume in smaller sub-domains, which are processed individually with the correct boundary conditions applied at the interfaces. The result for each sub-domain is used for the final calculation of the global deformation.

The sub-domains are processed sequentially, which limits the system memory needed to process the entire volume.



Products: Amira-Avizo 3D

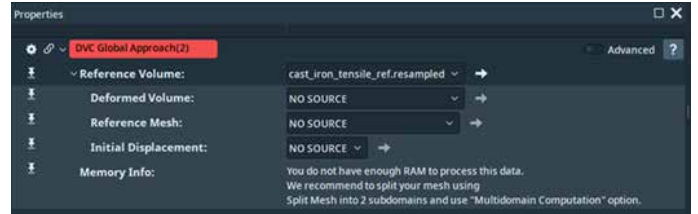
OS requirements: All supported platforms

Licensing: No restrictions

Multidomain DVC Global Approach

The DVC Global Approach module requires a certain amount of Available RAM system memory to run. The module now includes a new port indicating the required free system memory, which is the minimum RAM memory required to run the algorithm.

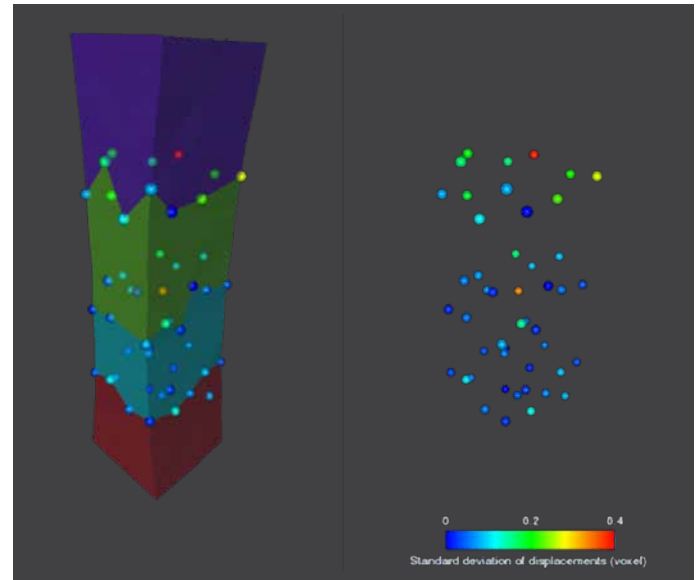
The calculation is based on the size of the reference volume and on the assumption that 80% of the total system memory should be available when applying the module.



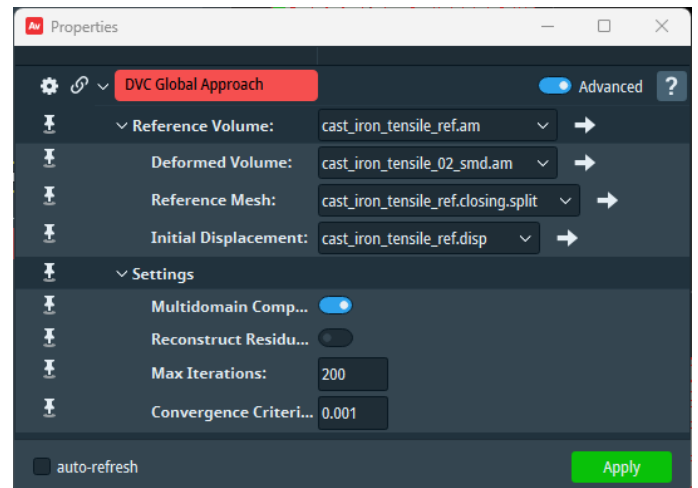
If available system memory is smaller than the required free system memory, a low-memory warning message will appear in the **DVC Global Approach** module with a recommendation of the number of subdomains required based on the available system memory.

We recommend splitting the mesh in the minimum possible number of sub-volumes and never apply them where fracture or important phenomena need to be carefully studied, as the boundary conditions applied at the interfaces may impact the accuracy of the results.

The interfaces can be investigated in detail at the end of the calculation using the displacement components of the interface nodes.



By connecting a split Reference Mesh to the DVC Global Approach, the new Multidomain computation option becomes available. The residual is by default not computed to reduce the memory required for the approach to complete.



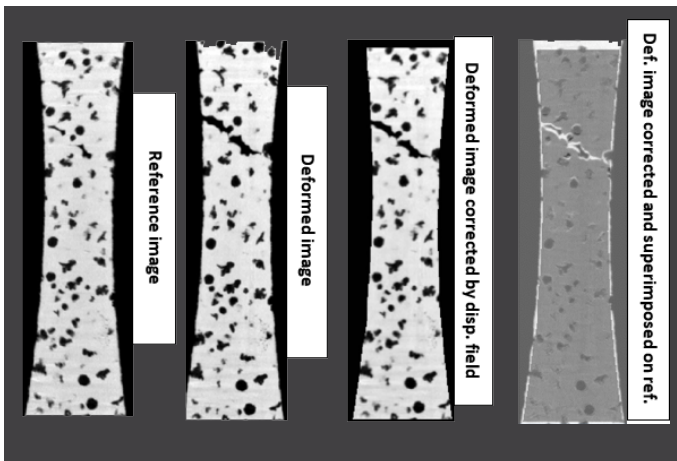
OS requirements: All supported platforms

Licensing: No restrictions

New module: DVC Correct Deformed Volume

Following a successful DVC Global Approach (from reference to deformed), the correlation residuals image can be used to correct the *in-situ* motion of the corresponding deformed volume. The residual fields are very useful to check the consistency of a DVC analysis but can also be used to correct the deformed volume via the displacement field.

The output of this new module corresponds to the deformed volume corrected via the measured displacement field. As a result, the microstructural changes induced by a dynamic process (compression, heating, drying, etc.) can be directly aligned and visualized against the reference configuration. For example, this module has been used to pinpoint the interaction between the microstructure and cracks during a tensile test of a nodular cast iron specimen. After correction of the internal deformation, the cracks can now be visualized in the



configuration of the reference image, which clearly indicates that decohesion (white region in the above image) between the dark nodules (graphite) and the bright matrix (ferritic) is responsible for the damage.

Care must be taken to ensure that the DVC Global Approach has correctly converged before applying this module. The correlation residuals need also to be examined in detail even if the DVC analysis has converged as other sources of uncertainties can in turn bias the DVC results (small local decorrelation due to large deformation, spurious motion of the sample during scanning, CT artifacts, etc.).

OS requirements: All supported platforms

Licensing: XDigitalVolumeCorrelation Extension

Meshing

We have improved the meshing workroom, as well as the **Generate Tetra Mesh** module, by providing granular control in the mesh making and by using more self-explanatory language for existing functionalities. The speed and robustness of the meshing process have been improved. Further, the **XWind** extension is now available on Linux as well as Windows.

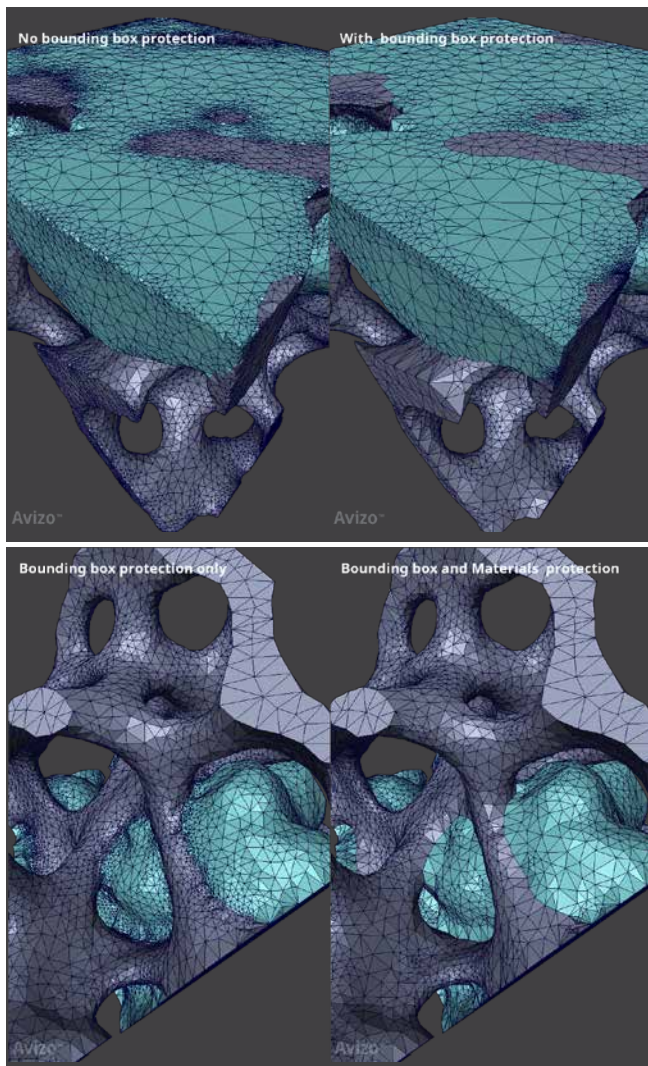
The **Direct Approach** generates the tetrahedral mesh directly from a label image and corresponds to what was previously called *Fast Meshing*.

The newly introduced **Polygonal Approach** uses a surface (triangle) mesh as an intermediate step for generating the tetrahedral mesh. It was previously available when the *Fast Meshing* option was not activated.

Direct Approach uses weight information to avoid staircase effects originating from the discrete voxel representation and to produce smoother meshes. When this option is selected, the algorithm will either use pre-existing weights, if any, or compute its own.

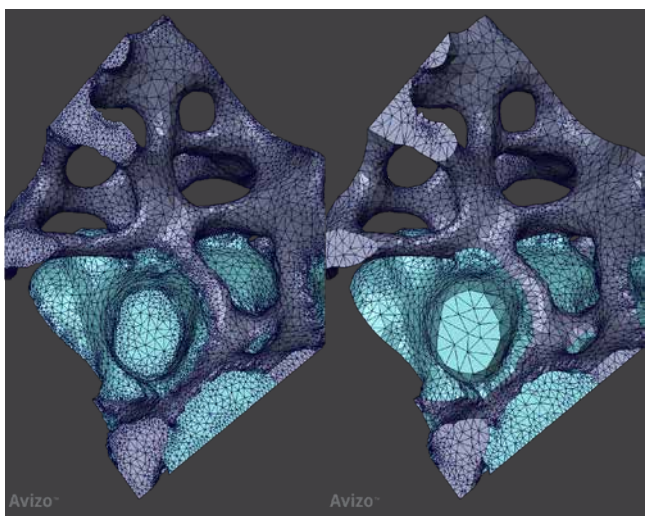


When using **Direct Approach**, you can apply different options for feature protection. The Bounding Box option corresponds to the default approach used in the previous implementation. In addition, it is now also possible to activate protection of the interfaces between materials to improve the accuracy of the boundaries. These different protections lead to increased computation time and may result in oversampling on some edges and sometimes produce non-orientable faces that can be problematic for some solver applications. It is therefore possible to select the type of protection desired.



The Polygonal Approach uses a surface mesh as an intermediate step. This surface is produced by the Generate Surface module or provided explicitly as an advanced parameter.

A new edge size parameter is now accessible in the advanced settings. This parameter can be used, for instance, to correct artifacts such as an umbrella effect, as in this example:



OS requirements:

All supported platforms (previously only on Windows)

Licensing: XWind Extension

Xlab

All modules from the Xlab extension, which used to be only available on Windows, are now also available on Linux.

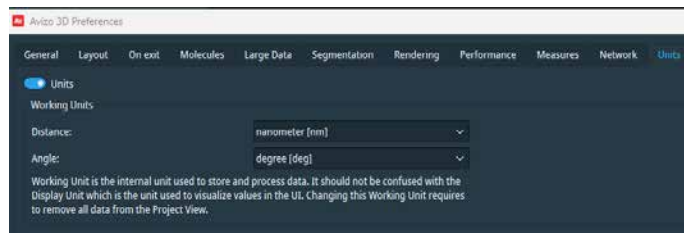
OS requirements:

All supported platforms (previously only on Windows)

Licensing: XLab extension

Units

Unit Management has been simplified:



- Unit preferences are now limited to working unit selection; you can now change the display unit directly from the UI in the viewers toolbar
- When loading a dataset, the proposed unit that will be used to interpret the data is now by default the working unit
- A warning now displays when loading a dataset with a unit that would lead to a possible precision issue (for instance, when loading a dataset with kilometric voxel size while the working unit is in nanometers)
- It is now possible to change the working unit even when a dataset has been loaded; this requires cleaning of all datasets and prompts a warning dialog
- We have removed the following features:
 - Automatically determine working units
 - Lock display units on working units
 - Auto select units for dataset without units

OS requirements: All supported platforms

Licensing: Advanced packages

Xtra Recipe Library

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

Iterate Recipe:

Allows you to run a given recipe while varying a chosen parameter value of any of the modules making up the recipe.

Surface Material Grid View:

Arranges all materials of a surface in a grid view.

AI Assisted Tool for CryoEM Segmentation:

Provides a tutorial for interactively segmenting a cellular cryo-electron tomography image using the AI-assisted segmentation tool in the Segmentation+ workspace.

Xtras Installer:

Install resources from the Xtra Library onto your local machine.

Python Command Module:

Enters and executes Python code from the Amira-Avizo Software interface.

Hough Circle Fitting (Update):

Uses the Generalized Hough-transform to detect circles in an image.

Compatibility Notes

Hierarchical Watershed

This module will be discontinued in version 2023.1 and replaced by the Hierarchical Watershed Segmentation module. Previous projects using the deprecated module will still be usable, but a warning will be issued. We strongly suggest updating them with the new module.

Top-Hat Module

The previous Top-Hat module in Image Recipe Designer has been discontinued and is now replaced by initialization and thresholding steps. While existing image recipes using the old module will still work, we strongly suggest updating them with the new module.

End of Support

Previous Token Yearly Subscription License will be discontinued from version 2023.2

In June 2021, Thermo Fisher Scientific introduced its new yearly subscription license model for academic and government organizations using version 2021.1. This important change has streamlined the use of image processing and data analysis technologies to allow more users to work simultaneously with the advanced features of Amira and Avizo Software.

The old token yearly subscription license will be discontinued from version 2023.2 and will not be renewed.

If you are still using the old token yearly subscription license, we recommend that you migrate to the new structure to continue to benefit from the improvements and new capabilities of Amira and Avizo Software.

The new yearly subscription license provides:

- Full access to the whole Amira and Avizo Software portfolio
- Predefined number of primary user licenses ensuring that there is always a pool of concurrent users
- Predefined number of extension licenses providing the entire breadth of Amira and Avizo Software technology
- Optional extension licenses for research organizations using the most advanced capabilities of the software
- All the latest innovations and features

Amira Software XObjectTracking Extension discontinued

Amira Software XObjectTracking extension is discontinued starting from version 2023.1.

CentOS7 discontinued

As previously announced, Amira and Avizo Software 2022.1 were the last officially maintained releases on CentOS7. While you can still use Amira and Avizo Software 2022.1 on CentOS7, support and bug fixes will no longer be provided.

Ubuntu 20.04 is now the officially supported Linux platform. We encourage you to transition to Ubuntu 20.04 to receive full support.

Operating Systems

Amira and Avizo Software version 2023.1 runs on:

- Microsoft Windows 10 (64-bit).
- Microsoft Windows 11 (64-bit)
- Linux x86 64 (64-bit) running on Intel64/AMD64 architecture and Ubuntu 20.04 (desktop)

Our products are tested on the following configurations:

Platform	GPU	Driver number
Windows 10	NVidia Tesla M60	512.78
Windows 11	NVidia RTX A4500	528.02
Ubuntu-20.04	NVidia T1000	525.105.17

Resolved Issues

Name	ID	Description
2D-Histogram Segmentation	AA-24893	2D-Histogram Segmentation module is now handling well 2D input data when 3D interpretation is selected.
Convert Image Type	AA-27809	32-bit data with negative values has been managed to avoid failure when converting it to 8-bit or 16-bit label.
Generate Tetra Grid	AA-28042	The number of materials is now limited to 256 for tetra grid generation.
Image Recipe Designer	AA-28191	When switching from label to grayscale with the Convert Image Type module in the Image Recipe Designer, the colormap of the data was mishandled and could lead to a bad display of the result. This is not the case anymore.
Nd2 reader	AA-26898	Nd2 reader is now able to handle special characters for metadata parameter name.
Ortho Slice (LDA)	AA-28333	When the adjust view option is checked ON and the input data is a Multi-Channel Field or SMS, there is no longer View All when changing channels selector.
Parameter Editor	AA-28137	Parameters are now correctly handled when Remove All is requested.
Tiff reader	AA-27919	2D Tiff file size is now well handled.
System Requirements	AA-28538	The CUDA version is now described in the System Requirements.

Learn more at thermofisher.com/amira-avizo

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