

Software

# Release notes

Amira Software and Avizo Software  
version 2022.1

This document covers the most important new features, improvements, and changes in version 2022.1 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 <https://xtras.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 at [frbor.3d\\_info@thermofisher.com](mailto:frbor.3d_info@thermofisher.com).

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# Definitions and glossary

## 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 OSs, 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 as follows:

- 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

# New features

## Segmentation+ workroom

We continue to enhance the Segmentation+ workroom introduced with the 2021.2 release. Below is a summary of the highlights of the 2022.1 release:

### Superpixel tool

A new superpixel tool allows you to brush and quickly select meaningful groups of pixels.

When the superpixel tool is activated, the image in the current 2D viewer is partitioned into groups of pixels. Thanks to the waterpixel algorithm used, these groups have homogeneous dimensions, and their boundaries follow the contours of structures shown in the image. You can select or deselect these groups of pixels by brushing over the image. This tool is compatible with other selection tools such as the classic brush.

The new superpixel tool will dramatically increase the speed and accuracy of your selection. Compared with the brush tool, the superpixel brush lets you “paint” much faster without having to precisely follow the contours of your selection.

The new superpixel tool is only available in the Segmentation+ workroom (not available in the Classic Segmentation workroom).

**OS requirements:** Windows

**Licensing:** 3D Pro Packages, Edition Packages

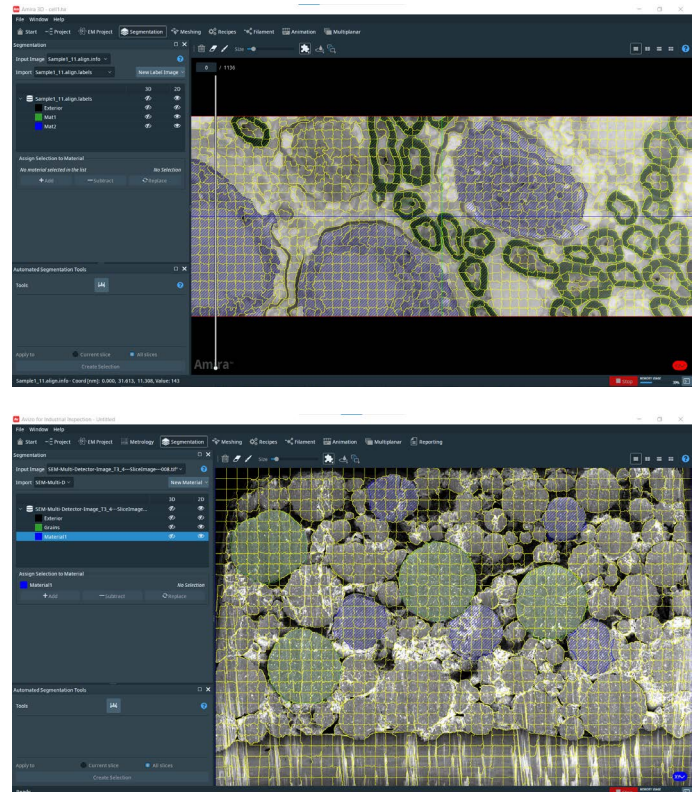


Figure 1: Superpixel grid for interactive brushing

## Threshold tool

The Threshold tool allows you to select voxels with an intensity value within the specified threshold range, either in the whole 3D volume or within the current slice.

Compared with the same tool in the Classic Segmentation workroom, this tool provides a visual indication of the current slice to be processed. However, it does not currently offer the option “Select only current material.”

**OS requirements:** all supported platforms

**Licensing:** no restriction

## Interpolate tool

The Interpolate tool allows you to interpolate the selection between parallel slices. You can segment only a fraction of the slices within your dataset. It is the same algorithm as used in the Classic Segmentation workroom, which performs a shape-based interpolation. Therefore, the number of slices that can be interpolated directly depends on the variation of the shape of the structure in the direction of the interpolation.

The algorithm has been accelerated and performs 3 to 4 times faster on a 12-core CPU. Both the Classic and Segmentation+ workrooms benefit from this acceleration.

**OS requirements:** all supported platforms

**Licensing:** no restriction

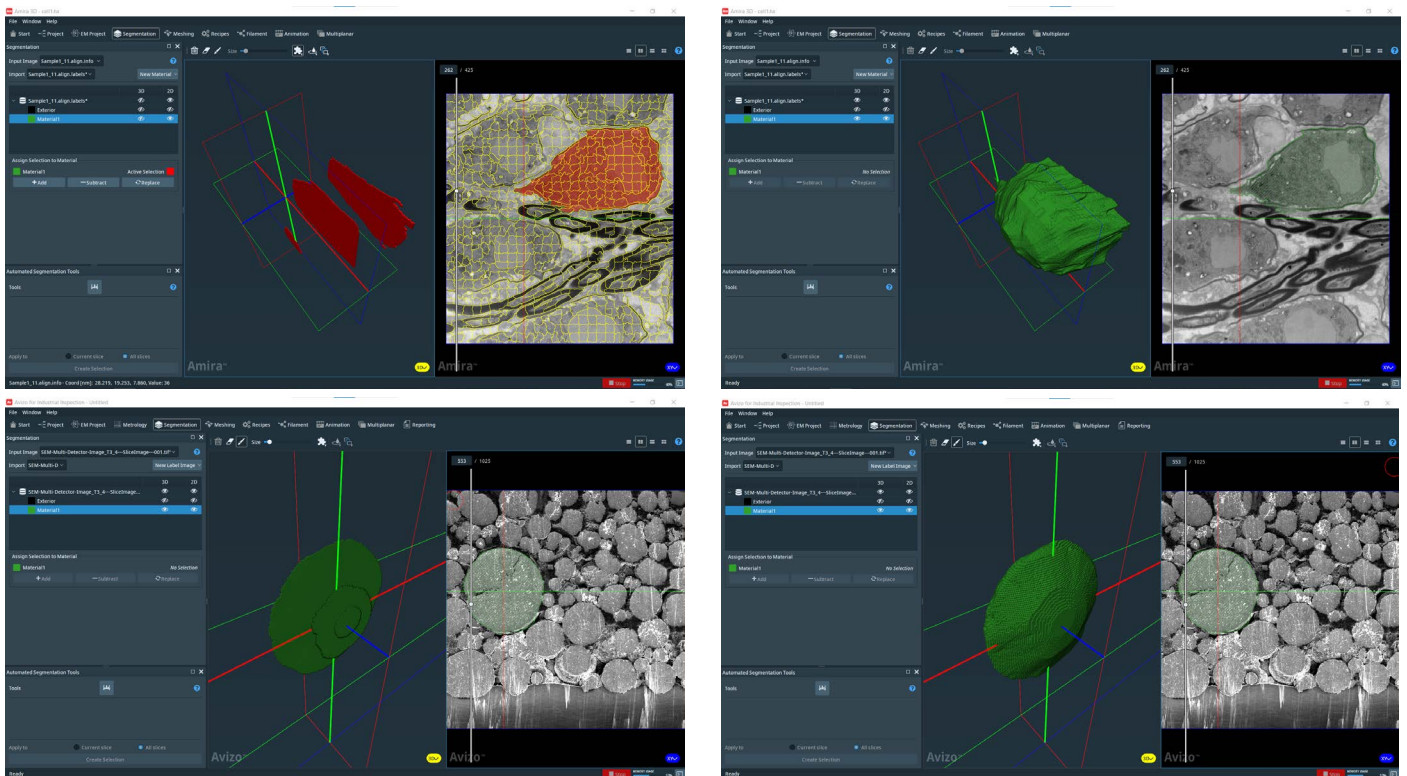


Figure 2: The interpolation tool fills the selection between parallel slices

## 3D Display of selection and material

We have added the ability to display the selection and materials in 3D in the Segmentation+ Workroom. The 3D rendering is based on the Voxelized Rendering module. Compared with the Classic Segmentation workroom, it is much faster on large data. However, it will not show the data at full resolution when the GPU memory is insufficient, which may cause single slices or thin structures not to be visible.

**OS requirements:** all supported platforms

**Licensing:** no restriction



# New Deep learning modules for segmentation in 2D and 3D

## Deep learning model training for segmentation in 2D

A new module called “**DL Training - Segmentation 2D**” is now available for 2D image-based deep learning model training. This module replaces the previous “Deep Learning Training” module, which has been deprecated.

Please refer to the compatibility notes.

With the “DL Training – Segmentation 2D” module, tiling of the input dataset is now possible. The tiling functionality allows you to automatically split a single large 2D data slice (input data) into tiles (multiple sub-slices of the same size). Each tile is considered as an independent training sample. In addition, it is now possible to randomize the order of the training samples before assigning them to training and validation sets. A new option allows you to plot the metrics for all classes in TensorBoard logs, in the case of multi-class segmentation.

**OS requirements:** Windows

**Other requirements:** An NVIDIA GPU supporting CUDA Compute Capability 3.5 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 the new modules.

**Licensing:** no restriction

## Deep learning model training for segmentation in 3D

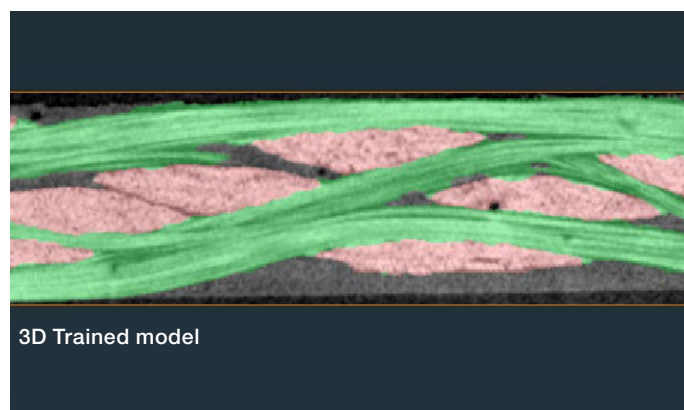
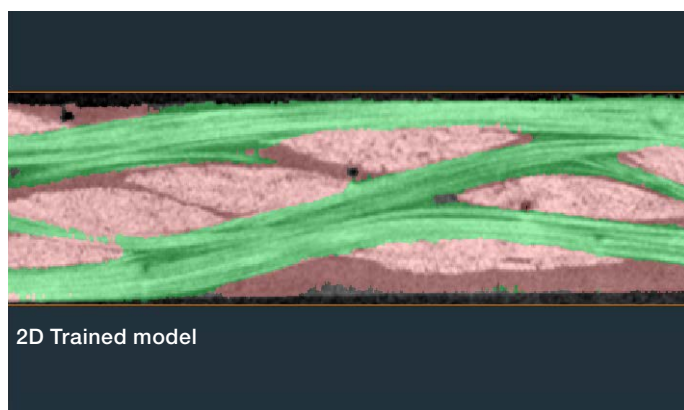
A new module called “**DL Training - Segmentation 3D**” is now available for 3D image-based deep learning model training. This module is similar to the “DL Training - Segmentation 2D” but relies on 3D convolution layers for all proposed network architectures: ResNet and VGG-backed U-Nets, and generic U-Nets. The tiling functionality splits the input volume into independent training samples. In addition, it is possible to randomize the training samples before assigning samples in training and validation sets.

Compared with 2D, 3D models will better capture the nature of the structures to be segmented. Better prediction results quality can be expected. However, the GPU hardware requirement and computation time for training 3D models are increased.

**OS requirements:** Windows

**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 the new modules.

**Licensing:** 3D Pro Packages, Edition Packages



Comparison of segmentation using 2D and 3D deep learning models, trained with the same training data. Dataset: micro-CT of woven composite, courtesy of Henry Moseley X-ray Imaging Facility, School of Materials, University of Manchester.

## Other new modules

### Data module: Camera Bookmark

The “**Camera Bookmark**” module allows you to save the camera settings of a viewer and to reapply it to any viewer at any time, including within animations. Multiple camera positions can be stored within the module, and the module can be saved on a disk.

Thanks to the versatility of this new functionality, you will be able easily design your visual inspection scenarios, and with the ability to use them in animations, you will maximize the impact of the features you want to highlight through visual exploration of your data.

**OS requirements:** all supported platforms

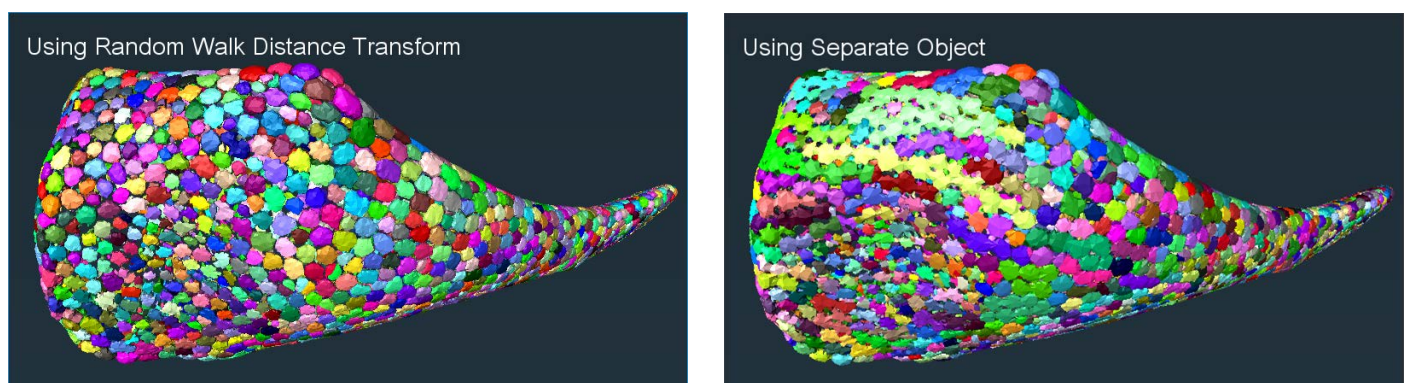
**Licensing:** no restriction

### Compute modules: Random-Walk Distance Map, Random-Walk Averaged Distance Map

Two new modules, “**Random-Walk Distance Map**” and “**Random-Walk Averaged Distance Map**” are now available to help improve the segmentation of 3D non-spherical objects.

The “Random-Walk Distance Map” module computes a distance map from a binary segmentation. This map indicates, for each foreground voxel, the average time it takes for a random walk starting from this voxel to reach a background voxel. Compared with Euclidean or Chamfer distance maps, this module is less affected by noise in the segmentation or objects of anisotropic shapes.

This new module is particularly well-suited for object separation workflows in the case of non-spherical objects and/or noisy segmentation data, as can be seen in the new Xtra [Object Separation using Random-Walk Distance Map](#).



Comparison of results of an Object Separation workflow using either the Random Walk Distance Map or the classic Separate Object module. Data courtesy of Mason Dean and Ronald Seidel (MPI Potsdam-Golm), David Knoetel (Zuse Institute Berlin). Image data: micro-CT image of a hyomandibula of a stingray (*Urobatis halleri*).

The “**Random-Walk Average Distance Map**” module allows you to compute an averaged distance map directly from a grayscale image, through averaging the results obtained on a range of binary thresholds. This module can help you achieve even more robust 3D segmentation results than simply using a single thresholding value.

**Limitations:** Compared with a classic distance map, the peak memory and computation time are increased with these modules.

**OS requirements:** all supported platforms

**Licensing:** 3D Pro Packages, Edition Packages

## Compute module: Waterpixels

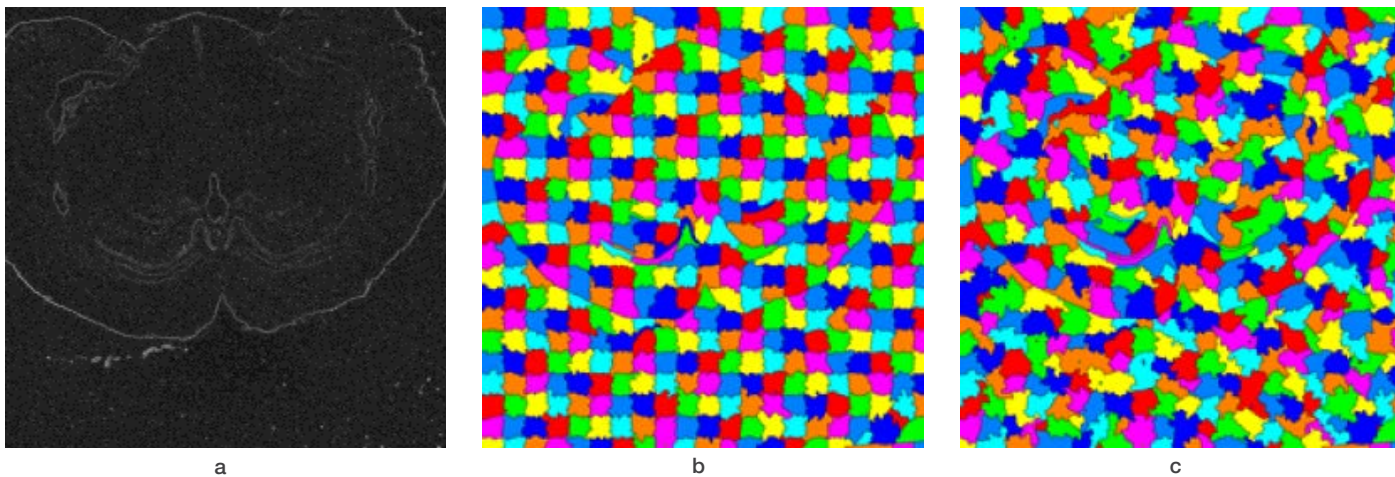
The new module “**Waterpixels**” is a particular implementation of superpixels, which partitions the input image into regions of homogeneous sizes and which follows the image’s contour. The implementation is inspired by the following publication:

V. Machairas, E. Decenciere, T. Walter. “Waterpixels: Superpixels based on the watershed transformation,” *IEEE International Conference On Image Processing, Paris, France, Oct. 2014*. <https://doi.org/10.1109/ICIP.2014.7025882>

The module can accept grayscale or RGB images. It computes 2D waterpixels for a 2D image and 3D waterpixels for a 3D image. An option allows you to automatically compute the gradient magnitude – on the luminance in the case of RGB input data.

**OS requirements:** Windows

**Licensing:** 3D Pro Packages, Edition Packages



Superpixel generation with the waterpixel algorithm: (a) Input image given by a morphological gradient, (b) waterpixels emphasizing the regular grid (high regularization factor), (c) waterpixels emphasizing the input image (low regularization factor).



# Xplore5D extension enhancements

## Large data conversion to SMS format user experience

Based on your feedback, we have significantly enhanced the general user experience of our SMS Converter. The SMS Converter is a tool embedded in the Xplore5D extension, designed to convert customer datasets easily and rapidly into the Thermo Fisher Scientific custom Out Of Core file format: SMS. The conversion step of your data is now guided and interactive; step by step you will be able to easily:

Select the data files you want to convert. Note it is now possible to select files rather than directories as well as to select files from different directories. At this stage, an additional option button allows you to check the consistency of the list of files prior to the conversion itself, aiming to avoid inconsistencies (e.g., in file dimensions, formats, etc.) that would otherwise slow down data conversion.

Inform the converter of the number of Channels (C), Time-steps (T) and Z stacks (Z) your data contains, as well as the order in which your list of files must be browsed. Note that with this new version single files containing multichannel data will allow for automatic filling of the C, T and Z sections (e.g., this is the case for single file multichannel data).

Inform the converter of your metadata. The voxel size and the spatial origin information from the metadata of the inputs are automatically set if they can be read from the files. However, you will be able to check them and set these values manually if necessary. Finally, you can now import the metadata into your SMS file.

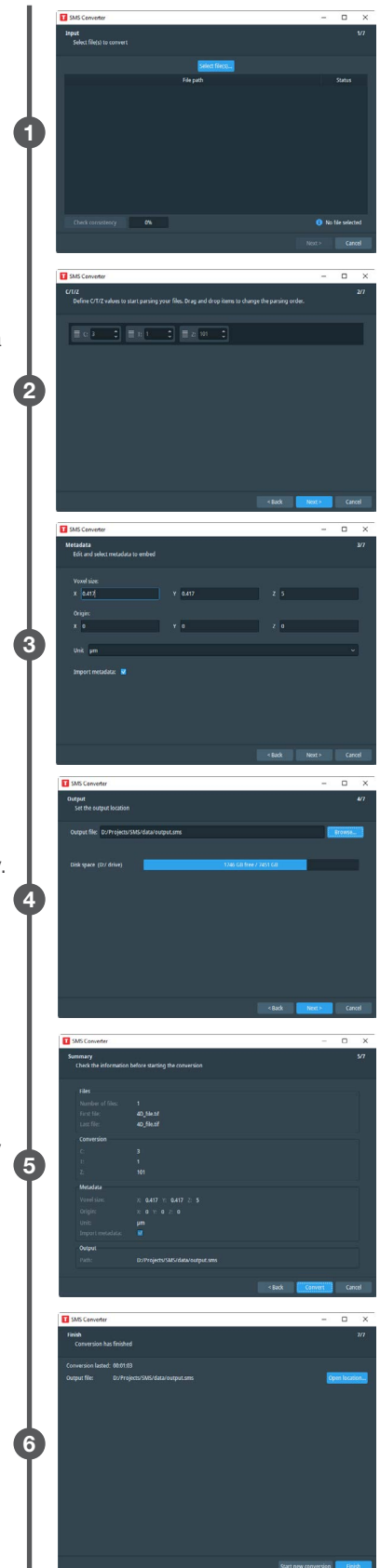
Select the desired output file. There is now a default output file provided in the input directory. To help avoid delay in the conversion step, at this stage you will be able to check the disk space available on the storage drive selected.

Summary view. Before proceeding to the conversion step, you are presented with a summary view allowing you to verify all previous inputs and go back to correct if needed.

Open output directory. Once data conversion is finished, the final step lets you open the output directory. At this stage you can also decide to start a new conversion.

**OS requirements:** all supported platforms

**Licensing:** Xplore5D extension, Amira Software 3D for Cell Biology



## Support of new file formats through XBioFormats extension

The Xplore5D SMS Converter now supports a wide variety of file format such as .tif, .tiff, .lif, .czi, .cif and many others through Glencoe's Bio-Formats readers. You can find the list of file format supported here: <https://docs.openmicroscopy.org/bio-formats/6.6.0/supported-formats.html> .

To benefit from this support, you will need the XBioFormats extension in addition to XPlore5D. This new support is included in Amira Software 3D for Cell Biology. Using Bio-Formats, the SMS converter supports single file multichannel datasets, single file time-series datasets and single multichannel time-series datasets.

### Limitations:

- A single file that contains multiple images is not fully supported. The conversion will consider this file as a single dataset.
- Some file formats are not fully supported by Bio-Formats and may result in inconsistency in the conversion process. Please refer to the Bio-Formats documentation for a complete status for each file format.
- File formats that require a manual intervention prior to the conversion step are not supported (e.g., Raw, HDF5, Dicom).
- Single 2D data are not supported.
- Color (RGB) images are not supported.
- Datasets including more than five channels are not fully supported: it is only possible to display the first five channels.

**OS requirements:** all supported platforms

**Licensing:** Xplore5D + XBioFormats extension, Amira Software 3D for Cell Biology

## Module enhancements

### Deep Learning Prediction

The module “**Deep Learning Prediction**” can now also be used with 3D deep learning models, in addition to 2D models.

In the manual tiling mode, which may be required in situations where the available GPU memory and requirements are not accurately estimated, it is now also possible to adjust the number of pixels of overlap between adjacent tiles. Reducing this overlap will reduce the GPU memory requirements and the computation time. However, artefacts at the boundaries between tiles may appear, especially when the model is not able to generalize accurately. Nevertheless, the automatic tiling mode will be sufficient in most cases.

**OS requirements:** Windows

**Licensing:** 3D Pro Packages, Edition Packages

## Image Stack Processing and Image Volume Processing enhancements

### Quantitative analysis in ISP and IVP recipes

The following modules can now be used within the ISP and IVP workrooms and recipes:

- Label Analysis
- Sieve Analysis
- Global Analysis
- Analysis Filter

When you select a spreadsheet associated with one of these modules, the viewer will display the contents of the spreadsheet.

Thanks to the addition of analysis modules directly in your recipes, you will be able to further automate your analysis and create more comprehensive recipes. You are now able to create recipes that embed all steps from image processing to quantification of individual objects and export the resulting spreadsheet.

**OS requirements:** all supported platforms

**Licensing:** 3D Pro Packages, Edition Packages

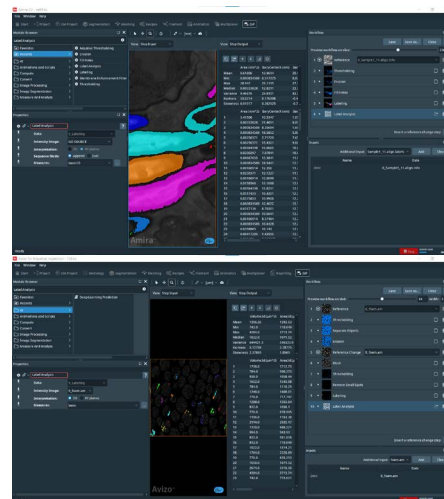


Image Volume Processing workroom showing quantitative analysis on individual particles

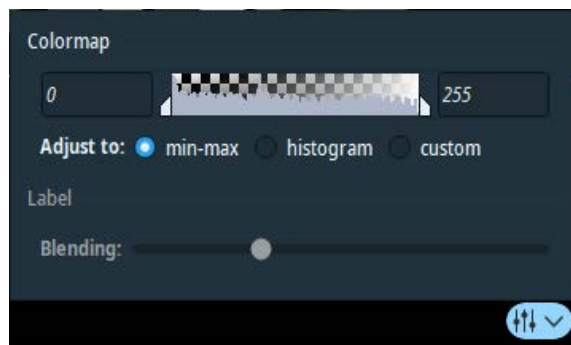
## Control widget added to both viewers of the ISP and IVP workrooms.

With this new widget, you can now select how the colormap is auto-adjusted for the viewer: min-max of the dataset or histogram. You can select a custom range too. The label blending slider has also been moved to this new control widget.

Thanks to the new widget, you now have faster and more granular control over some important parameters from one single dedicated area, boosting your productivity.

**OS requirements:** all supported platforms

**Licensing:** 3D Pro Packages, Edition Packages



New widget allowing colormap adjustments in ISP and IVP workroom viewers

## Miscellaneous module enhancements

The algorithms behind the following modules have been enhanced:

- Beam Hardening Correction
- Radial Auto-correlation – quantification of grayscale image
- Ring Artefact Removal
- Cylindrical Intensity Profile

These modules were restricted to the processing of 16-bit data and a total size of 2GB. These limitations are now removed. The previous modules are deprecated, (see compatibility notes for more details).

**OS requirements:** all supported platforms

**Licensing:** 3D Pro Packages, Edition Packages

## Python interpreter - Multithreading and Multiprocessing support

This 2022.1 version adds support for multithreading and multiprocessing for Python scripts, allowing developers of custom modules to greatly accelerate the execution of their scripts. Refer to the user's guide Multiprocessing/Multithreading section for details and code snippets.

**OS requirements:** all supported platforms

**Licensing:** no restriction

## Licensing

### ToGo Viewer no longer requires a dedicated license

Since 2021.2, all 3D Pro Packages and Edition Packages have included access to our ToGo Publisher for Amira and Avizo Software. This publisher gives you the ability to encapsulate your analyzed datasets in a specific file format which can then be distributed to anyone (collaborators, management, customers, partners) for use with our free ToGo Viewer.

Now, the ToGo Viewer for Amira and Avizo Software no longer requires any license activation. Your customers, partners, and collaborators will just have to fill the [To Go viewer request form](#) to download the ToGo viewer for Amira and Avizo Software and be able to view and interact with the results of your analyzed dataset.

**OS requirements:** all supported platforms

**Limitations:** The ToGo Viewer can only open ToGo datasets generated with the ToGo Publisher.

**Licensing:** The ToGo Viewer does not require any license. Note that the ToGo Publisher, necessary to create ToGo files, is included with our 3D Pro and Edition Packages.

# Xtra Recipe Library

The following Xtras have been published or updated since the previous release notes. Make sure that you consider the product, license, or OS requirements as well as the installation instructions. We will continue to enrich this library of add-ons and how-tos, and we welcome your feedback as always (use the “Contact Us” button).

**[Bone segmentation workflow for murine hindpaw:](#)** Semi-automatic workflow and recipe for high-throughput bone segmentation of murine hindpaw  $\mu$ CT datasets.

**[Object Separation using Random-Walk Distance Map:](#)**

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

**[Getting Started with Deep Learning Training \(Update\):](#)** This is a model and companion project for the Deep Learning tutorial.

**[BSE SEM denoiser – Deep Learning Model \(Update\):](#)** U-Net model for denoising back-scattered SEM images.

**[Patch Extraction Tools for Deep Learning data preparation \(Update\):](#)** A set of tools dedicated to the preparation of data for training deep learning models and reducing annotation time.

**[Slab View:](#)** The “Slab View” display module allows you to display only a slab from any kind of 3D visualization.

**[How to Use the Surface View Module and Create Elaborate Surface Renderings:](#)** This short video demonstrates the basic use of the “Surface View” module and how to combine several Surface View modules to create elaborate renderings.

**[How to Customize Amira-Avizo with moduleExtender:](#)** Are there module settings you always need to change during your daily work? This Xtra describes how you can permanently change default settings of modules in Amira and Avizo Software.

**[Masking Map by Molecule:](#)** The module “Mask Map By Molecule” allows you to mask an electron microscopy (EM) map of a macro molecule by an atomic model of the entire or partial molecule. This can be useful when validating EM maps from SPA (Single Particle Analysis) with published models from the Protein Data Bank.

**[kMeans Clustering on Label Analysis \(Python\):](#)** This Xtra implements kMeans clustering on a label analysis spreadsheet. Separated objects can be clustered based on any measure group that is inbuilt or user customized.

**[Differential Interference Contrast \(DIC\) Image Segmentation and Quantification using Deep Learning:](#)** This workflow uses deep learning to segment images obtained by differential interference contrast (DIC) microscopy. Nuclei and mitochondria are segmented and counted cell by cell.

**[Porosity Volume Fraction Analysis:](#)** This tutorial demonstrates the steps to quantify porosity volume fraction and distribution.

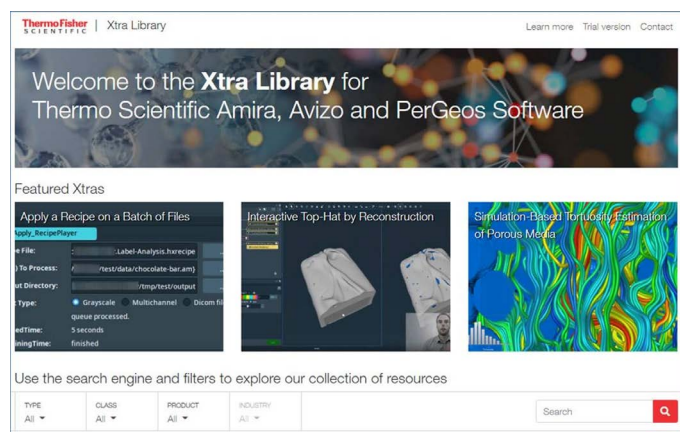
**[Bookmarks Manager:](#)** Add bookmarks to your project, including status and camera, so you can easily retrieve a given visualization. You can then navigate through the bookmarks.

**[Landmark based Data Alignment:](#)** This tutorial demonstrates how the “Landmark Based Data Alignment” module can be used to facilitate the alignment of datasets using pairs of landmarks.

**[Inter Time Steps Recipe Player:](#)** The “Inter Time Steps Recipe Player” module executes a two-input recipe to a specific pair of two successive time steps of a time series dataset or to all its pairs of two successive time steps.

**[CMake Usage to Create XPand C++ API Modules:](#)** Starting with version 2021.2, the use of CMake is required to create solutions that implement the Amira Avizo 3D Pro extension modules with the XPand C ++ API. This video demonstrates what needs to be done to create a solution for Microsoft Visual Studio.

**[How to Set the Colormap for Ortho Slice and Volume Rendering:](#)** This tutorial is an introduction to the basic principle and use of colormaps.





## Compatibility notes

Deep Learning Training: The previous version of the “Deep Learning Training” module is now deprecated. You can still load projects created from versions 2021.1 or 2021.2, but it is highly recommended that you switch to the new module DL Training - Segmentation 2D. All features from the previous module can be found in the new module. Trained models can still be used, either as initialization of new trainings or for prediction, without any modifications.

Projects involving the “Deep Learning Training” module from version 2019.3 through 2020.3 will now generate errors, as this module, which was deprecated in 2021.1, is no longer supported. Models trained with versions 2019.3 through 2020.3 require modifications of the associated .py file to behave correctly with respect to Prediction. Please refer to the 2021.1 release note and product documentation for more information.

Some modules have been replaced by new versions. Projects from previous versions of the software can be opened, but the new versions of the modules will be instantiated. These new versions have a different interface and may generate slightly different results. However, these differences are negligible for any practical applications. The impacted modules are:

- Beam Hardening Correction
- Ring Artefact Removal
- Radial Auto-correlation – quantification of grayscale image
- Cylindrical Intensity Profile

For the 2022.2 release, the following changes are anticipated:

The officially supported Linux distribution will be Ubuntu 20.04. The compilers' versions required to use the XPand extension will be upgraded to:

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

## End of support

### CentOS 7 – Linux distributions

CentOS 7 will be discontinued and replaced by Ubuntu 20.04 as the officially supported Linux platform. Amira and Avizo Software 2022.1 will be the last officially maintained release on the CentOS 7 platform. There will be no new product development nor updates of CentOS 7 after this version. You can still use the CentOS 7 versions of our products, and we will continue to provide bug fixes for 12 months. However, as new versions are released, we encourage you to transition to the supported Linux platform to benefit from our full support.

### Windows 7 and Windows 8

As already announced, support for Windows 7, Windows 8, and Windows 8.1 operating systems has been discontinued since release 2020.3, although no major issues are known so far. However, a CUDA update planned for the next 2022.2 version will make many CUDA-based functionalities no longer work on these platforms. The impacted modules will be Deep learning modules, Ambient occlusion, Anisotropic diffusion and Non-Local means filter - GPU Adaptive Manifold. We encourage you to update your OS to a Windows-supported platform to benefit from our full functionalities.

### Support ending for MacOS (discontinued since 2020.3)

As previously announced, Amira and Avizo Software 2020.3 is the last supported release on the MacOS platform. You can still use the Mac OS versions of our software products. However, no support or bug fixes will be proposed any longer.

# Operating systems

Amira and Avizo Software version 2022.1 runs on:

- Microsoft® Windows™ 10 (64-bit).
- Linux x86 64 (64-bit). Supported 64-bit architecture is Intel64/AMD64 architecture. The supported Linux distribution is CentOS 7.

Avizo Software 2022.1 for Industrial Inspection runs on:

- Microsoft Windows 10 (64-bit).

To add custom extensions with the XPand extension, you will need:

- Microsoft Visual Studio 2013 (VC12) Update 4 on Windows
- gcc 4.8.x on Linux CentOS 7

## Solved issues

Name	ID	Description
Process Time Series	AA-27105	The module can now be computed on Amira when the Workflow Result is connected to a SpatialGraph data.
Avizo ToGo	AA-25975	ToGo Viewer is now able to read data which contain Unicode characters in their name or file path.
Beam Hardening Correction	AA-26645	Beam Shield Correction is now working correctly with intensity values greater than the maximum range.
Bio-Formats	AA-26554	Bio-formats reader is now able to read large nd2 files (max heap size of 64GB).
Filament Editor	AA-26614	Clicking lines in the Filament Editor has been fixed to avoid an error when connecting an RGB data.
Fractal Dimension	AA-24978	When the images contained few information, the Fractal Dimension could return some inconsistent results, this is not the case anymore. Documentation has also been improved.
Generate Molecular Surface	AA-25575	The maximum number of recalculation iterations has been increased to allow the module to work correctly with large molecules.
Remesh Surface	AA-26628	Desired Size vertices and triangles ports are now correctly reloaded when reopening a project.
Spreadsheet	AA-25979	Median value is now properly computed for both cases of odd and even number of objects.
DVC Local Approach	AA-26774, AA-26681	Special characters ("(", "+", "-") are now allowed for the Unstructured Model input name.
Volume Edit	AA-26584	Mouse Cursor has been fixed and replaced by an arrow to make it easier to see where the line is being drawn.

Thermo Scientific License Manager has been updated to improve offline operations, make sure you don't skip Thermo Scientific License Manager 1.6.7 installation at the end of Amira-Avizo Software installation to benefit from those fixes.

Name	ID	Description
Thermo Scientific License Manager	LM-191	Offline upgrade only supported upgrading from x to x+1 version. Offline upgrade now supports upgrading to any version.
Thermo Scientific License Manager	LM-116	Offline activation would fail when activating more than 5 licenses at a time. This has been fixed.
Thermo Scientific License Manager	LM-174	Licenses upgrade could fail on machines connected to the internet via a Proxy server. TLM can now be configured with proxy settings and the documentation has been updated consequently.
Thermo Scientific License Manager	LM-173	When trying to activate, upgrade, deactivate or reactivate a license, an error could occur if the firewall was not configured to allow the connection to TLM portal server. TLM documentation has been updated to document how to configure your firewall.

 Learn more at [thermofisher.com/amira-avizo](https://thermofisher.com/amira-avizo)