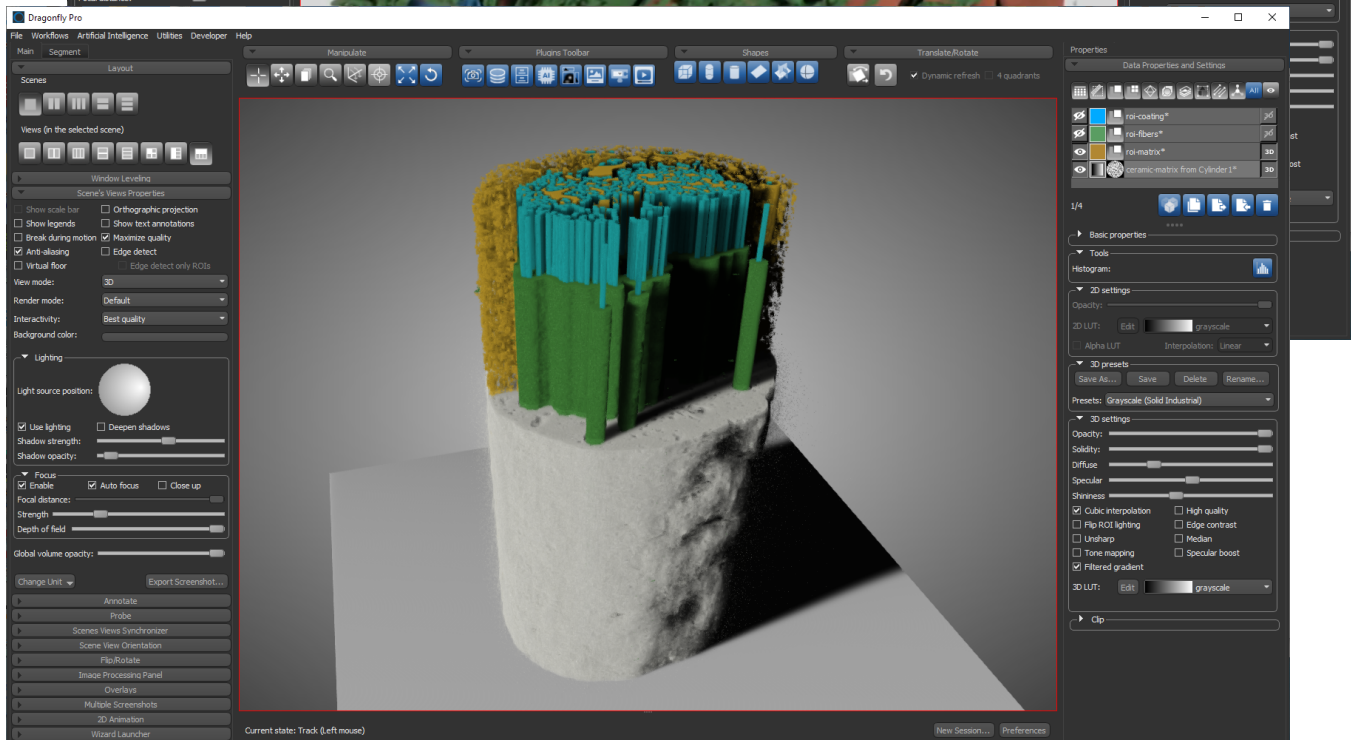
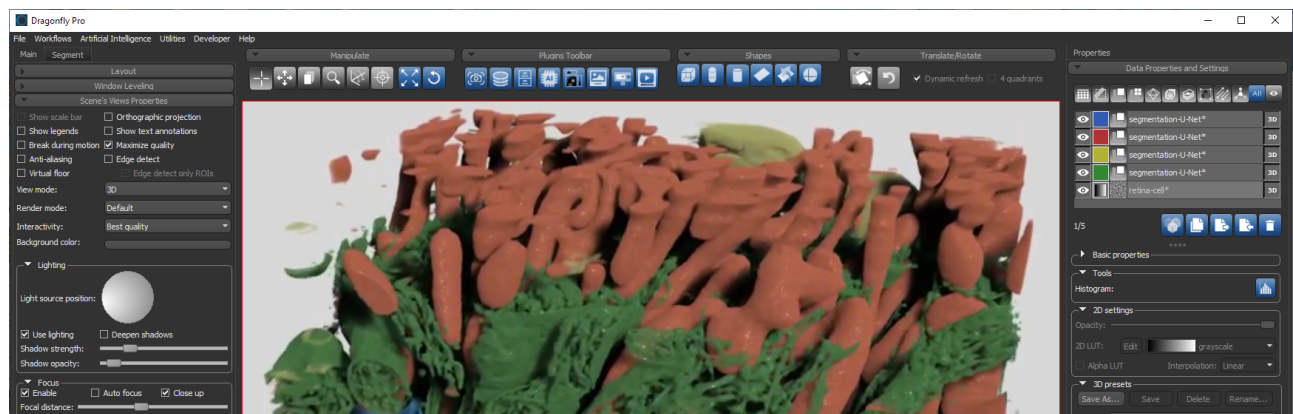




DRAGONFLY 2020.1 RELEASE NOTES



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Title Dragonfly Release Notes
Release date 2020-05-20
Reference number TM021-A-07

Contents

This document describes the new features, product enhancements, and other improvements implemented in the Dragonfly and Dragonfly Pro 2020.1 software release. You should read these release notes before you install this new version.

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New Features

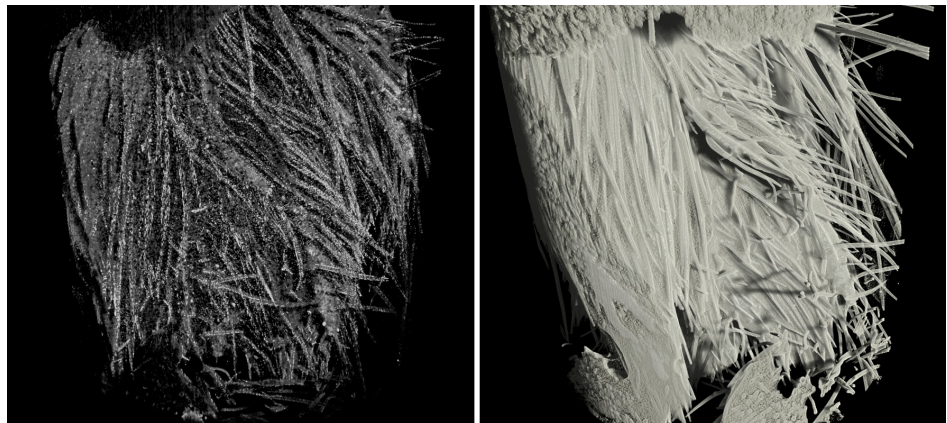
The 2020.1 software release for **Dragonfly** and **Dragonfly Pro** provides the following new features. See [Product Enhancements](#) on page 47 for information about all the enhancements for Deep Learning, Machine Learning, and automated segmentation, as well as improvements for managing user data and projects.

Next Generation Rendering Engine

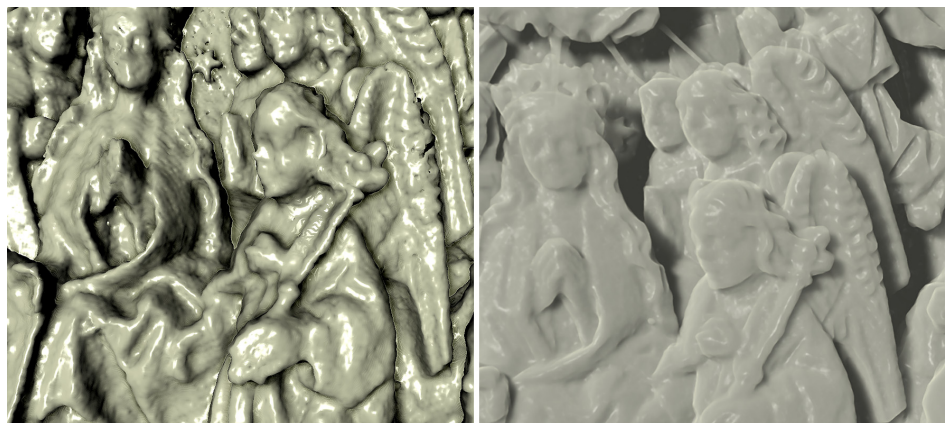
Bring your real-world materials to life and produce stunning renderings for animated sequences and publication-quality images. The 2020.1 Dragonfly software release introduces the next generation of 3D rendering for the high-definition visualization of scientific and industrial data. More powerful than ever, Dragonfly's new rendering engine delivers faster ray tracing, cleaner sampling, and more accurate lighting and shadowing — all within automated steps that save you valuable time.

In addition, the new engine's interactivity controls for balancing performance and speed for different quality graphic cards let you quickly amend scenes, adjust lighting and focus, and change material properties. Below are just a couple of examples of the rendering results you can expect in the Dragonfly 2020.1 software release.

Previous results (on left) and with Dragonfly's new rendering engine (on right)



Soybean sample. Data courtesy of Keith Duncan (Donald Danforth Plant Science Center).

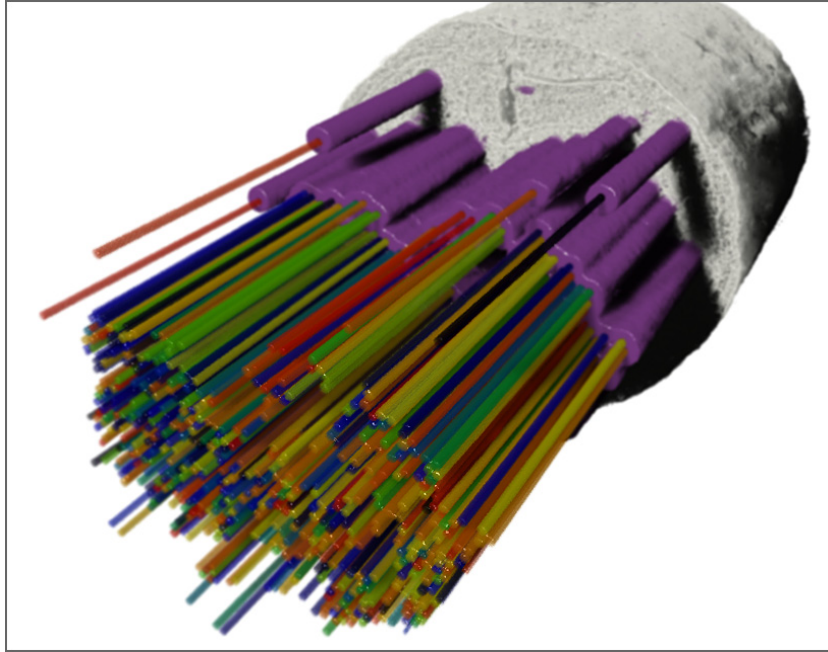


Detail of wooden gothic prayer bead. Data courtesy of the University of Western Ontario.

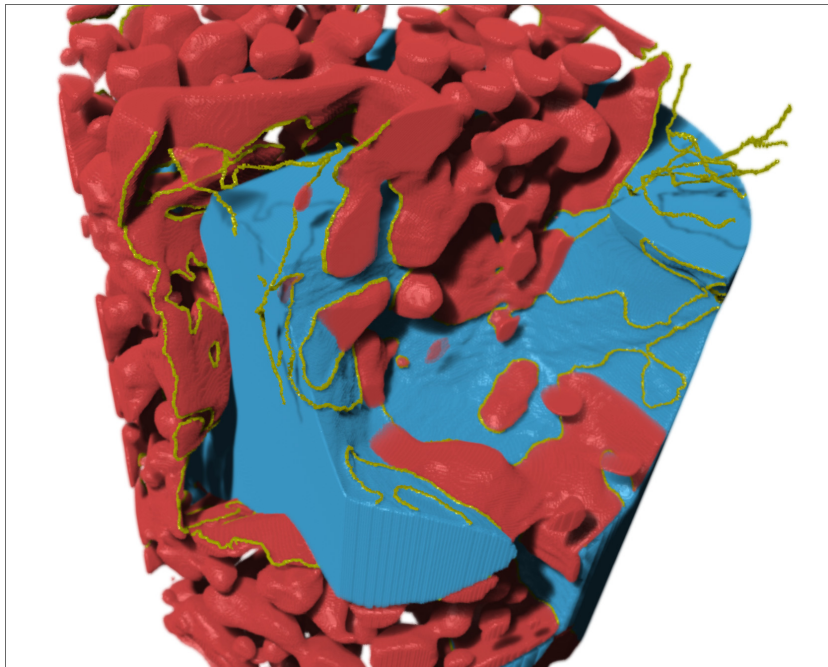
New Rendering Capabilities

Below are some examples of the new capabilities for visualizing regions of interest and for combining regions of interest with graphs. You should note that this rendering engine does not require image data to show an ROI in a 3D view.

New rendering capabilities for regions of interest and other objects



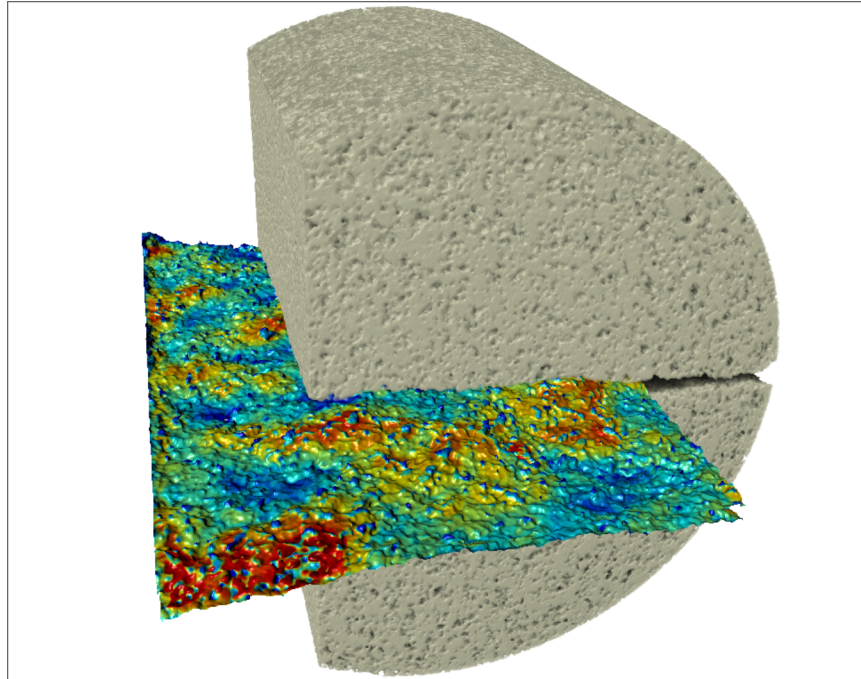
Segmented ceramic matrix composite. Courtesy of Aly Badran (University of Colorado).



Segmented solid oxide fuel cell with three-phase boundary graph. Courtesy of Aaron Stebner (Colorado School of Mines).

Below is an additional example of the capabilities of the new rendering engine for combining multiple objects in a single 3D view.

Thickness mesh



Thickness mesh of an induced fracture in Berea sandstone core. Courtesy of Zuleima Karpyn, Penn State University. Dataset available on the Digital Rocks portal (<https://www.digitalrocksporal.org/>).

Correlative Workflows

User who apply several microscopy techniques to single samples should notice that correlative workflows with the new rendering are greatly improved. Challenges for rendering low and high resolution datasets with large size differences at acceptable speeds have been addressed and resolved. Instead of having to render all datasets at the setting of the high-resolution dataset, the new rendering engine can render then at a constant rate of 10 to 15 frames per second (FPS). With Dragonfly's legacy rendering engine, rendering a single frame could take up to 30 seconds whenever the size difference in the correlative datasets was more than an order of magnitude.

NOTE Correlative workflows allow microscopists to study samples at much greater ranges of magnification than with a single technique. Conducting an initial low-magnification inspection of a sample to identify specific regions of interest can also generate much greater ranges of information about the samples at different scales.

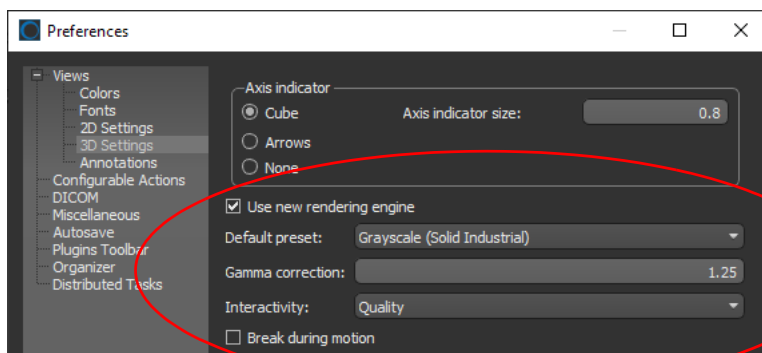
NOTE Examining multiple overlapping datasets in 3D can still affect rendering performance with the new engine. You should choose your interactivity settings appropriately (see [Scene's Views Properties](#) on page 11) when working with multiple volumes and objects in the same 3D view.

Enabling the New Engine and Setting Defaults

A number of new items, circled below, are available in the 3D Settings preferences to enable the new rendering engine and to set its defaults.

Click the **Preferences** button on the Status bar or choose **File > Preferences** on the menu bar to open the Preferences dialog. Then choose **Views | 3D Settings** in the Preferences dialog to view the 3D Settings preferences.

New rendering engine preferences



Use new rendering engine... Lets you toggle between the new rendering engine and the legacy version. You should note that a restart will be required after changing the rendering engine.

Default preset... Lets you select the 3D preset that will be applied by default (see [3D Presets](#) on page 13).

Gamma correction... Lets you select the gamma correction setting that will be applied automatically.

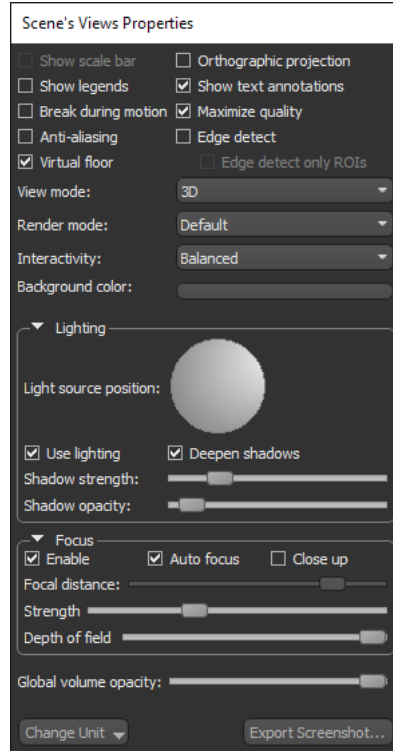
Interactivity... Lets you choose an *Interactivity* option, which lets you balance quality and speed for different grade graphic cards at every stage of the visualization workflow (see [Scene's Views Properties](#) on page 11).

Break during motion... If checked, the quality of visualizations will be decreased during manipulations, but will then return to the set quality when at rest (see [Scene's Views Properties](#) on page 11).

Scene's Views Properties

A number of new options for adjusting interactivity and focus, as well as for adding virtual floors, are available in the updated **Scene's Views Properties** panel, shown below, for the new rendering engine.

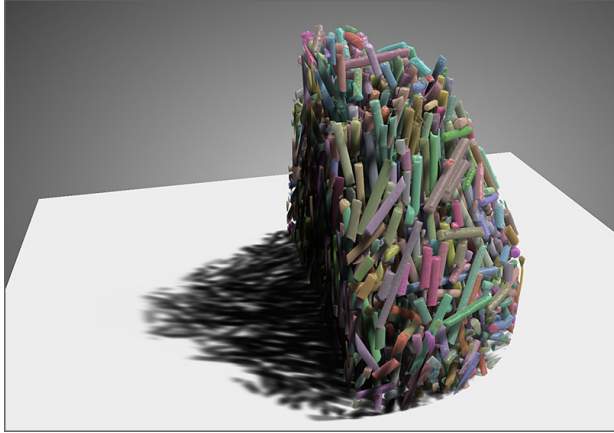
Scene's Views Properties panel




New items in the Scene's Views Properties panel for the next generation rendering engine are described below. Changes to previous items, which are marked with *, are also summarized.

Changes to the Scene's Views Properties panel

	Description
Orthographic projection*	Lighting and shadowing controls are available for orthographic projections with the new rendering engine.
Break during motion*	If checked, the quality of visualizations will be decreased during manipulations by increasing the size of the raycasting steps. For example, when panning, rotating, or adjusting window leveling. Visualizations will return to the set quality when at rest. In general, selecting this option may help reduce delays when working with large datasets. NOTE Was previously available as Lower quality in motion .
Edge detect only ROIs	If checked, a delineated edge will be applied to the labeled voxels of visible regions of interest. This setting can help visualizations in which object boundaries are indistinct.

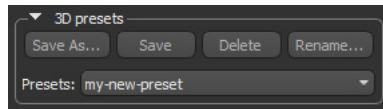
	Description
Virtual floor	<p>If checked, a <i>virtual floor</i> computed from the “Up” position of the camera will be automatically added to the view. As shown in the screen capture below, objects can cast realistic shadows on the 'virtual floor'.</p>  <p>NOTE The color of the virtual floor can be selected as a preference (see Views Preferences on page 71).</p> <p>NOTE Computing virtual floors can be expensive as it is not a hardware accelerated feature and interactivity performance will likely decrease. You should apply this feature only when you need to take a series of screenshots or to record an animated sequence.</p>
Interactivity	<p>Each <i>Interactivity</i> option for Dragonfly's new rendering engine offers the optimum balance of quality and speed for different grade graphic cards and for different stages of visualization workflows.</p> <p>Best quality... Retains the best quality visualizations during manipulations before returning to the set quality.</p> <p>Quality... Retains good quality visualizations for more limited graphic cards. You can also use this mode when you're nearing the final stages of your visualization process to quickly change and amend your scene, enhance lighting, and change material properties.</p> <p>Balanced... Provides a good balance between quality and speed.</p> <p>Speed... This mode is ideal when working with lower quality graphic cards.</p> <p>Fastest with lighting... Lets you quickly make manipulations without any discernible delay, while still retaining current lighting.</p> <p>Fastest without lighting... Lets you quickly make manipulations without any discernible delay, without the current lighting applied. Use this mode to speed up your visualization workflow from the beginning with almost instant feedback.</p> <p>NOTE Interactive rendering automatically updates rendered images in real time as you make changes in your scene. It is a great aid in modifying and transforming objects, tweaking material properties, adjusting lighting and the camera, and virtually any part of the rendered scene.</p> <p>You should also note that some settings, such as maximized quality, cubic interpolation, gradient filtering, and virtual floors, can lead to rendering delays. For more speed, you can turn off some of these GPU-intensive features until your visualization workflow is complete.</p>
Lighting settings*	<p>You should note the following changes for the Lighting settings:</p> <ul style="list-style-type: none"> • The new Deepen shadows setting lets you choose to apply deep shadows, or if not selected, to apply less harsh shadows. • The lighting items 'Shadow precision' and 'Spotlight' are deprecated for the new rendering engine. • The material properties item 'Shininess' is deprecated for the new rendering engine. • The material property items 'Specular' and 'Diffuse' have been moved to the 3D settings panel and are configurable for each object in the view (see 3D Settings Panel on page 13).

	Description
Focus settings	<p>You should note the following new items for adjusting the Focus settings:</p> <p>Close up... If selected, reduces the minimum focusing distance of the camera. This lets you focus more closely to your subject, which gives you greater magnification.</p> <p>Strength... Lets you adjust the amount of blur applied to the foreground and background areas that are outside of the center of focus. You should note that unfocusing image areas can help make a feature of interest stand out.</p>
Global volume opacity	<p>Lets you adjust the opacity of all image data in a 3D view that does not correspond to the labeled voxels of visible regions of interest and visible multi-ROI classes.</p> <p>NOTE The opacity of the highlight applied to selected regions of interest and multi-ROIs, as well as the image data that corresponds to labeled voxels, are adjustable in the 3D opacity panel on the Data Properties and Settings panel, as shown below.</p> 

3D Presets

A new set of 3D presets are available for Dragonfly’s new rendering engine that let you quickly create optimized renderings of different materials and samples with a minimum of manipulations. These options are available in **Presets** drop-down menu on the 3D presets panel, shown below.

3D presets panel

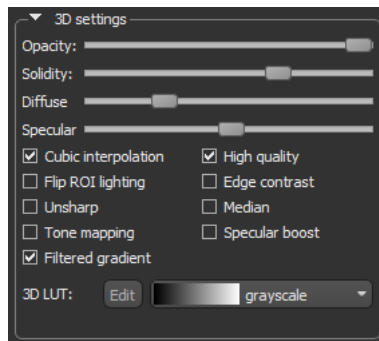


3D presets are groups of lighting and material settings that are optimized for particular data types or materials, such as organic tissue, bone, and solids. For the best performance with Dragonfly 2020.1, you should select the 3D preset that is the most suitable for your typical data as the default setting (see [Enabling the New Engine and Setting Defaults](#) on page 10 and [Views Preferences](#) on page 71). In addition to the pre-installed 3D presets, you can also create your own presets.

3D Settings Panel

A number of new options for adjusting the material properties of selected objects and for filtering image data are available in the 3D settings panel, which is available on the right sidebar and is shown below.

3D settings panel



New items in the 3D settings panel for the next generation rendering engine are described below. Changes to previous items, which are marked with *, are also summarized.

3D settings panel changes

	Description
Solidity	Lets you vary the solidity, or opaqueness, of the voxels of the selected object. You should note that this non-linear function is applied at every step of the raycasting process in contrast to opacity, which is a linear function that determines the transparency of an object. NOTE In most cases, you should adjust either Opacity or Solidity with their respective sliders.
Diffuse*	Determines the strength of diffuse light reflected from the surfaces of objects and is a characteristic of light absorbed by surfaces. Increasing this property with the Diffuse slider will result in object surfaces being more defined. NOTE Was previously part of the Scene View's Properties. And is now selectable for each object within a 3D view.
Specular*	Determines the strength of specular reflections originating from the surfaces of an object and is a characteristic of light reflected from shiny surfaces. Increasing this property with the Specular slider will result in increased reflections. You should note that specular effects will be affected by the Specular boost setting, if this settings is selected. NOTE Was previously part of the Scene View's Properties. And is now selectable for each object within a 3D view.
Shininess*	Determines how much the smooth surfaces of an object reflect light. Increasing shininess will result in surfaces that reflect more light and is usually adjusted in conjunction with Specular. NOTE Was previously part of the Scene View's Properties. And is now selectable for each object within a 3D view.
Unsharp	If checked, objects in the view will be sharpened by increasing contrast along edges and other high frequency components. NOTE The term <i>Unsharp</i> comes from a darkroom technique used in traditional film-based photography in which an unsharp or smoothed version of an image is subtracted from the original one.
Tone mapping	Tone mapping maps one set of colors to another to approximate the appearance of high-dynamic-range images in a medium that has a more limited dynamic range. In Dragonfly, it can be applied to brighten datasets that appear too dark.
Filtered gradient	If checked, this option will smooth the gradient calculated for lighting. Very similar to tricubic filtering, but applied to the gradient with the effect of smoothing areas with abrupt intensity changes. NOTE An image gradient is a directional change in the intensity or color in an image.
Median	If checked, objects will be smoothed by median filtering. When applied, pixel values are replaced with the median of itself and their neighbors. This can help remove noise while still preserving boundaries.
Specular boost	If checked, adjustments to the Specular setting will be greater.
3D LUT*	You should notice that LUTs, which determine how regions within specific arrays of intensity are highlighted and how color is applied, are more accurately mapped to the selected window leveling range when using the new rendering engine. In comparison to the previous rendering engine, 3D LUTs are applied to the whole data range while leveling is applied as a pass-through. NOTE Applied LUTs can be edited interactively to optimize visualizations.

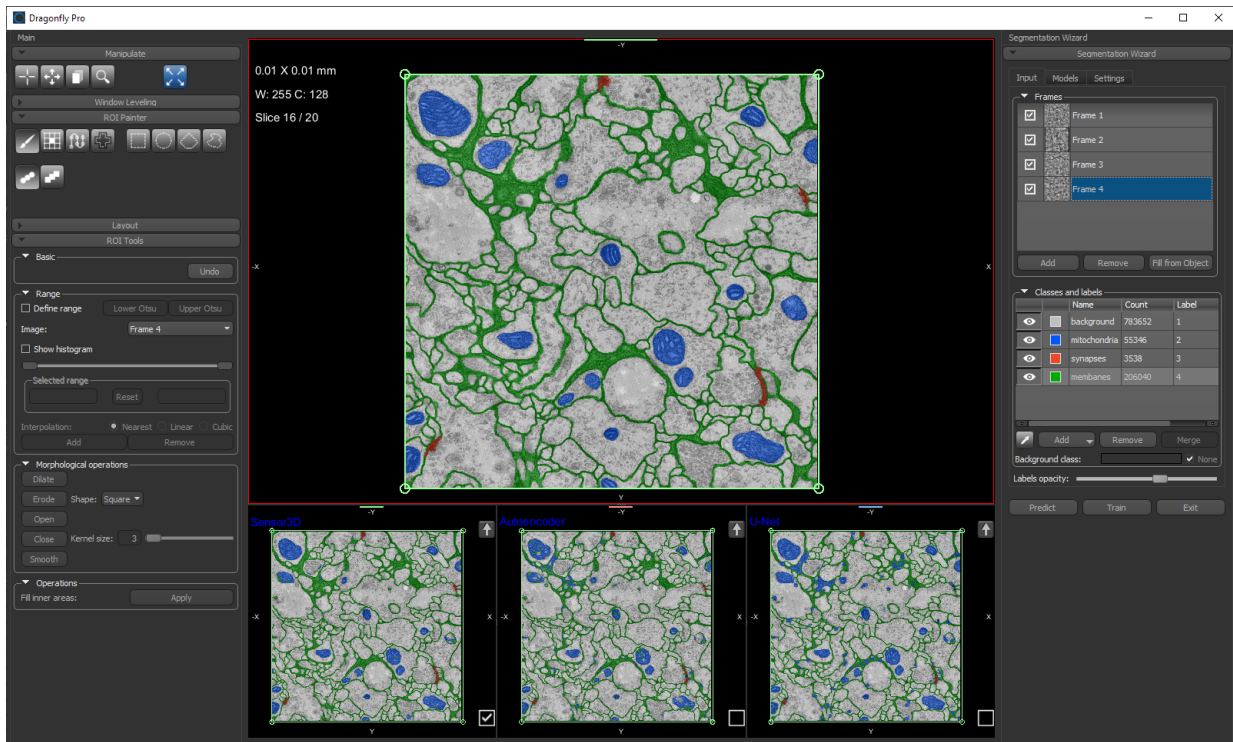
NOTE Some 3D settings, such as cubic interpolation, gradient filtering, and high quality, can lead to rendering delays. For more speed, you can turn off some of these GPU-intensive features until your visualization workflow is complete.

Segmentation Wizard

Dragonfly's new Segmentation Wizard provides an easy-to-use, guided workflow for implementing powerful deep learning and classical machine learning segmentation of multi-dimensional images. With the Segmentation Wizard, you simply paint the different features of interest within a limited subset of your image data and then train models to identify objects according to a predefined set of rules. The most promising model can then be fine-tuned and exported for repeated segmentation tasks. This empowers any user to achieve robust and reproducible segmentation results that are not influenced by user bias.

Right-click the image data you need to segment in the Data Properties and Settings panel and then choose **Segmentation Wizard** in the pop-up menu to open the Segmentation Wizard context, shown below. The workspace includes a large views area in which you can label the voxels within a frame and preview model predictions, as well as panels on the right side that include the Input, Models, and Settings tabs.

Segmentation Wizard



NOTE The Segmentation Wizard requires a Deep Learning license. Refer to the topic [Licensing for Optional Features](#) on page 60 for information about the availability of the optional features for Dragonfly 2020.1.

Key Features and Benefits

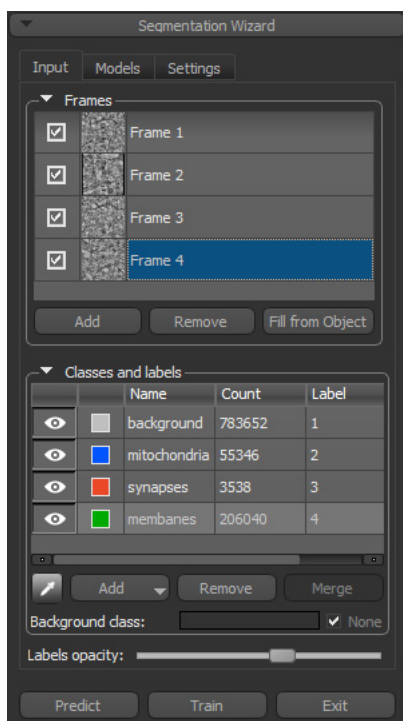
Just some of the many key features and benefits of the Segmentation Wizard are listed below.

- Automatically splits available data into Training, Evaluation, and Test sets.
- Works on frames that are created automatically on the visible part of the data.
- Users apply their specific knowledge to identify features of interest by labeling a limited subset of the image data that is defined by frames. Advanced knowledge of machine learning and deep learning algorithms is not required.
- Direct and quick feedback with previews of model predictions. New frames can be filled automatically with the best model prediction, based on the highest-ranked prediction.
- Models can be fine-tuned by correcting the most-promising prediction.

Input Tab

The **Input** tab on the Segmentation Wizard panel, shown below, provides the opportunity to add frames on the image data and to define classes. Labeling features of interest within frames can be accomplished with the ROI Painter tools. Frames can also be filled from previously segmented multi-ROIs.

Input tab about

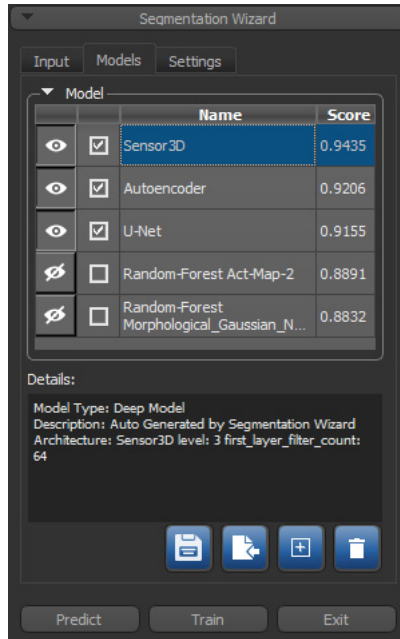


NOTE Refer to the topic [New Options for Multi-ROIs](#) on page 27 for information about the new options for working with multi-ROIs in Dragonfly 2020.1.

Models Tab

The options on the **Models** tab let you enable or disable models, import trained models, as well as to save models for use with the **Segment with AI** feature (see [Automated Segmentations](#) on page 55).

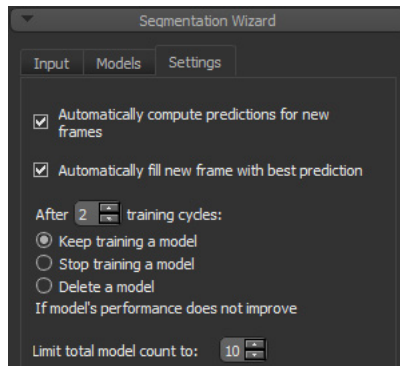
Models tab



Settings Tab

The options on the **Settings** tab, shown below, let you set your training preferences.

Settings tab



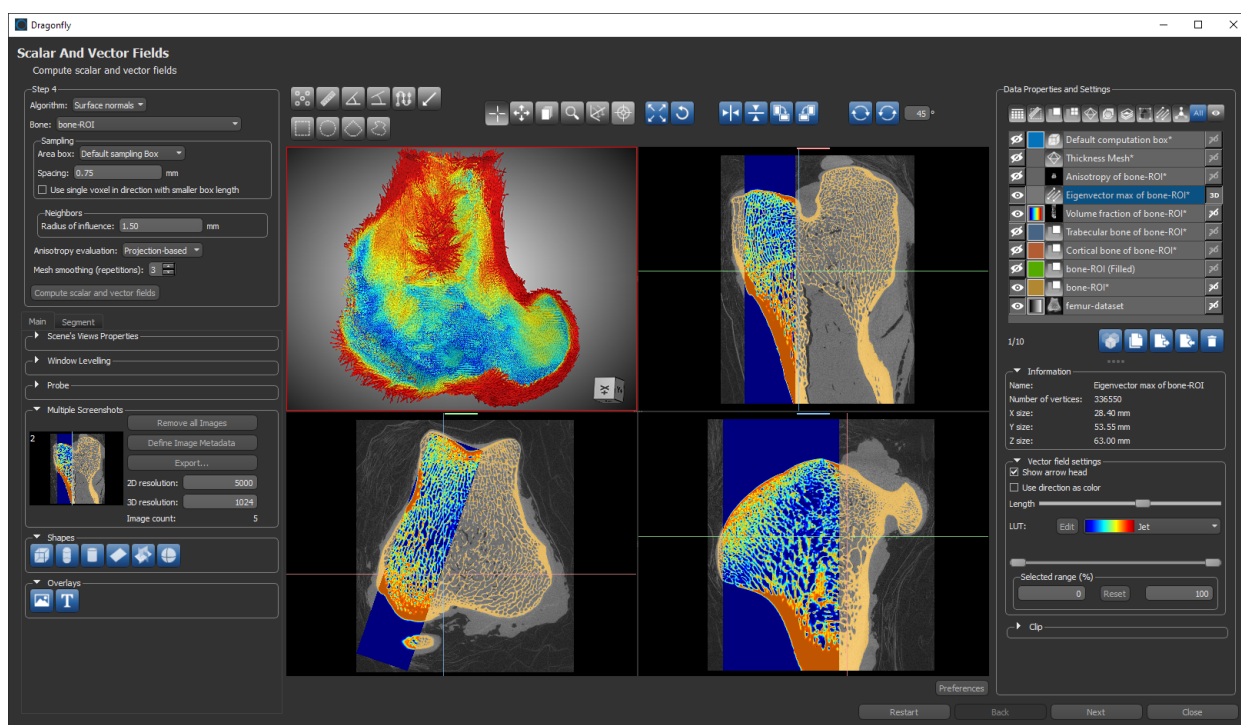
You can choose to have new frames filled automatically with the best model prediction, as well as determine when model training will be stopped.

Bone Analysis Wizard

Designed for the evaluation of high-resolution micro-CT samples of bone specimens, Dragonfly's new Bone Analysis Wizard provides 3D vector-based mappings of anisotropy magnitude and directionality and 3D scalar-based mappings of bone volume fraction. In addition, an automated separation of cortical and trabecular bone drives the calculation of common morphometric indices that provide researchers with quantitative descriptions of bone micro-architecture.

Right-click the image data from a bone study in the Data Properties and Settings panel and then choose **Bone Analysis Wizard** in the pop-up to open the Bone Analysis Wizard, shown below.

Bone Analysis wizard

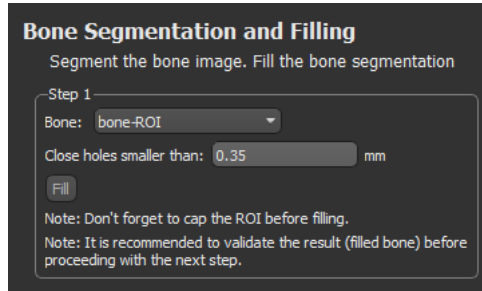


NOTE Bone Analysis is a separately licensed feature for Dragonfly 2020.1. Refer to the topic [Licensing for Optional Features](#) on page 60 for information about the availability of all the optional features for Dragonfly.

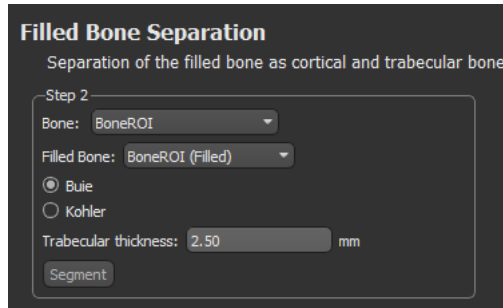
Bone Analysis Workflow

A series of self-guided segmentation steps let you close cortical pores and vascular inlets and fill an initial bone segmentation before proceeding to the separation of the cortical and trabecular bone, computing morphometric measurements, and generating 3D vector-based mappings of anisotropy magnitude and directionality and 3D scalar-based mappings of bone volume fraction. Observations and measurements are appended automatically to detailed reports.

Bone segmentation and filling... The first step in the workflow lets you segment the selected bone image and fill the initial segmentation.



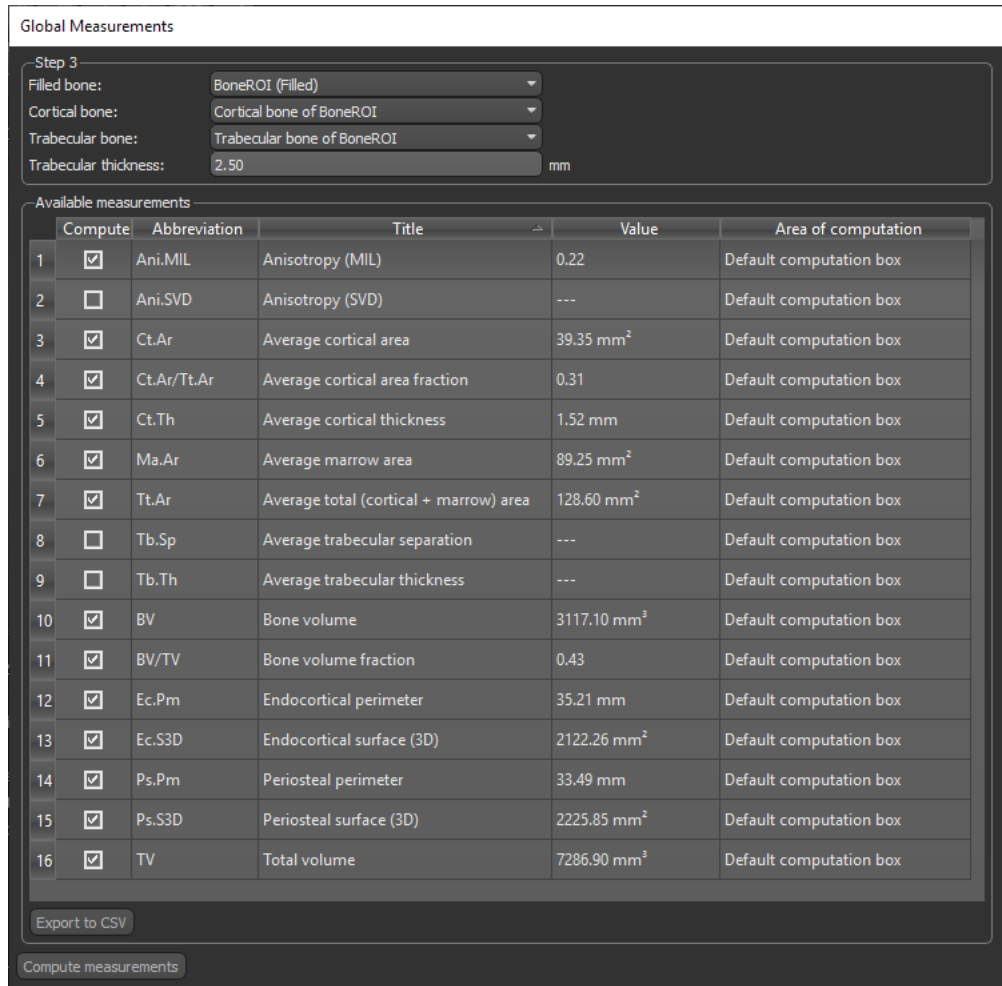
Filled bone separation... The second step of the guided segmentation, shown below, lets you choose a segmentation method — Buie or Kohler — for separating filled bone into cortical and trabecular components.



Compute global measurements... The inputs for computing global measurements, as described by Bouxsein *et al.**, are shown in the following screen capture. These measurements rely on input cortical bone and trabecular bone segmentations, which offers the opportunity to edit automated bone segmentations, as well as to input any region of interest that satisfies the requirements.

* Bouxsein, M.L. et al. Guidelines for assessment of bone microstructure in rodents using micro-computed tomography. *J Bone Miner Res* **25**, 2010.

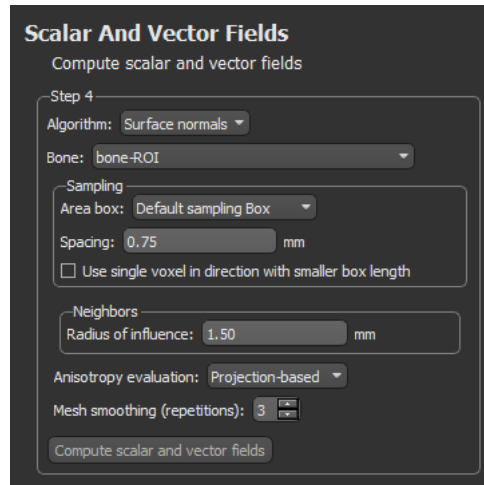
Global Measurements dialog



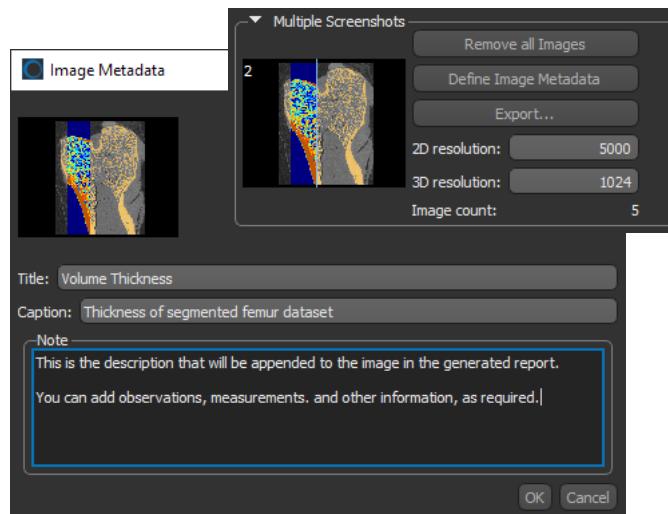
NOTE You can apply a mask to limit the area in which the selected global measurements will be computed.

Compute scalar and vector fields... The parameters to compute scalar values of volume thickness and vector fields of anisotropy are available as the next step in a bone analysis workflow.

Compute scalar and vector fields



Prepare Screenshots and Notes... A multiple screenshots panel is available on the left sidebar to collect screen captures that can be included in generated reports. Metadata can be easily integrated in reports by clicking the **Define Image Metadata** button on the Multiple Screenshots panel. The Multiple Screenshots panel (on top) and Image Metadata dialog are shown below.

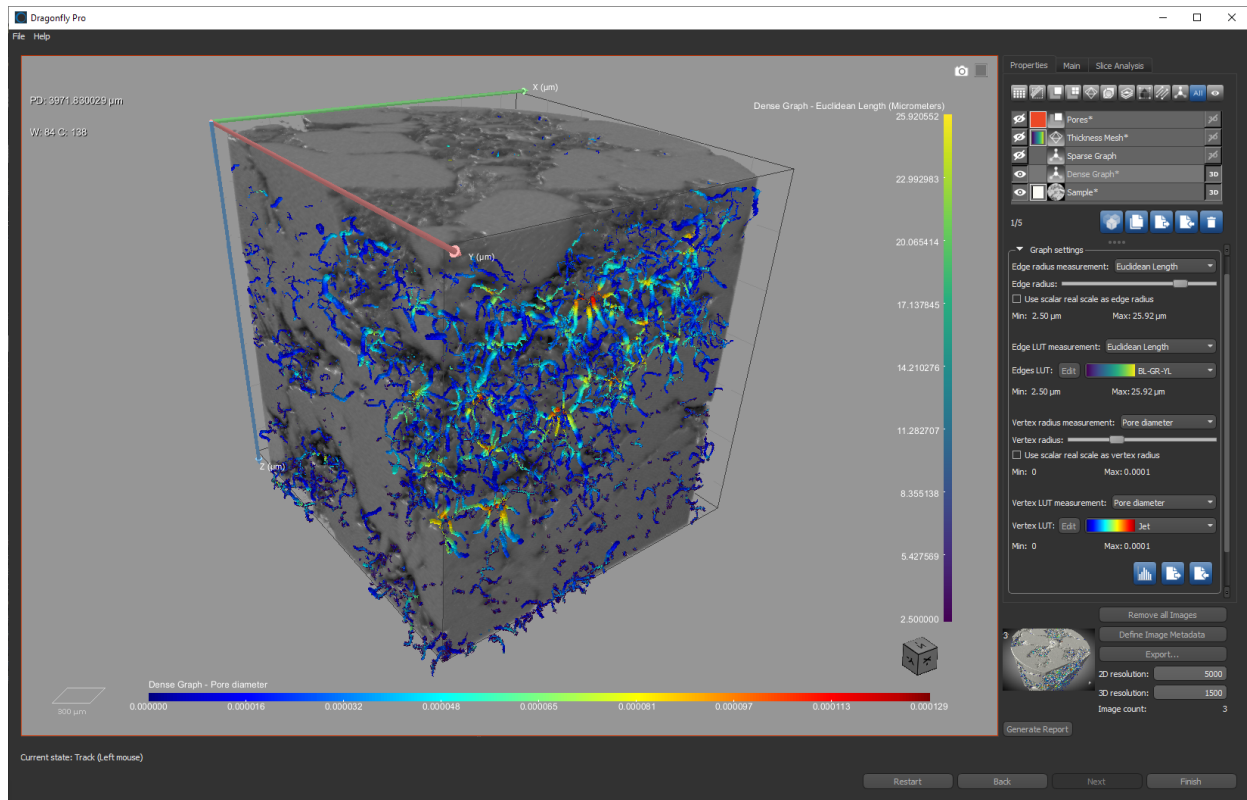


Generate Report... Lets you generate a report in the PDF file format, which is automatically formatted with a header that includes the project title, job ID, author(s), contact information, and creation date. You can also add your institution's logo. Computed global measurements and screen captures taken during the current session will also be included in the report. You should note that reports use a LaTeX template that can be easily modified for specific requirements.

Plug Analysis Wizard

Dragonfly's new wizard for Plug Analysis provides a dedicated workflow for analyzing core plugs acquired from rock samples and other porous media. It includes powerful algorithms that support segmentation with Deep Learning and built-in automation for quantitatively extracting computations that add weight to observations from core material. Analysis results can be quickly appended to detailed reports that can include screen captures, graphs, and other supporting material. Choose **Workflows > Plug Analysis** on the menu bar to open the Plug Analyzer, shown below. You can also open the Plug Analysis Wizard from the dataset pop-up menu.

Plug Analysis module



NOTE Plug Analysis is a separately licensed feature for Dragonfly 2020.1 and is not bundled with non-commercial licenses. Refer to the topic [Licensing for Optional Features](#) on page 60 for information about the availability of all the optional features for Dragonfly.

Plug Analysis Workflow

The Plug Analysis workflow includes the pre-processing, segmentation, editing, and computation steps described below.

Pre-processing... The first step in the workflow lets you perform the basic pre-processing tasks of beam hardening correction and cropping with a cylinder on axial and longitudinal views of the loaded image data.

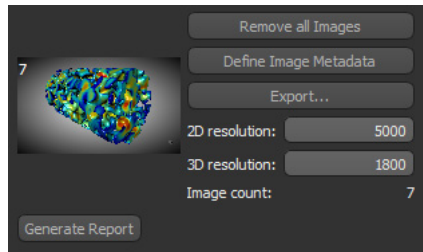
Segmentation... Lets you choose an Otsu threshold, Deep Learning model, or to apply a manual range to perform the basic segmentation of the plug components.

Correct segmentation... The opportunity to correct the automated segmentation by applying morphological operators, filling inner areas, or with Dragonfly’s ROI Painter tools is then available at this next step of the workflow.

Box editing... The Box Editing step lets you adjust the input and output boxes for computing tortuosity and throat-weighted tortuosity from the graph of plug porosity.

Calculations... Lets you choose the measurements and computations you need to add fully analyze your core sample (see [Plug Measurements](#) on page 23).

Prepare screenshots and notes... A multiple screenshots panel, shown below, is available on the right sidebar to collect screen captures for generated reports. Notes can be easily integrated in a report by clicking the **Define Image Metadata** button.



Reporting... Lets you generate reports in the PDF file format, which are automatically formatted with a header that includes the project title, job ID, author(s), contact information, and creation date. Screen captures taken during the current session, thickness mesh measurements, distributions of pore sizes and tortuosity, as well as plug porosity measurements can also be included in reports. You should note that reports use a LaTeX template that can be easily modified for specific requirements.

Plug Measurements

The analysis capabilities of the dedicated Plug Analysis module are listed below.

Plug Analysis measurements

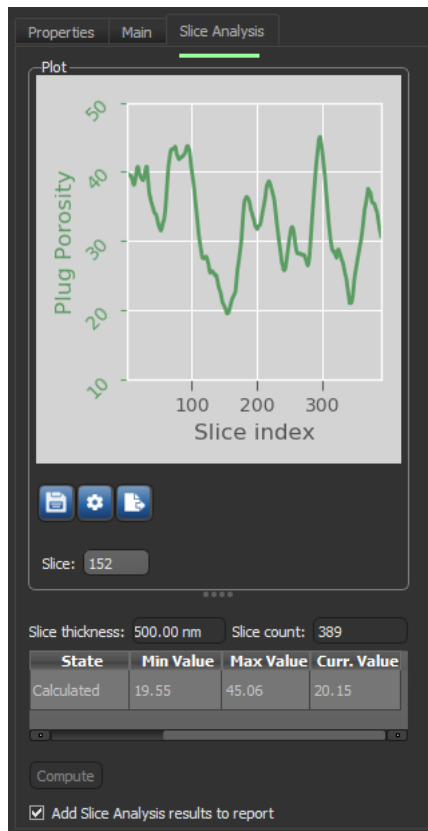
	Description
Plug porosity	You can compute plug porosity for each XY slice within the segmented image data on the Slice Analysis tab (see Plug Porosity Slice Analysis on page 24).
Thickness mesh	Computes color-coded meshes that show referential values of the local thickness. Thickness is calculated as the diameter of a hypothetical sphere that fits within each boundary point and is the same as computing the volume thickness on the ROI and sampling it on the vertices of the mesh.
Volume thickness	Computes and generates scalar-based maps of volume thickness.
Shortest path distance map	Computes and generates scalar-based maps of the shortest path distance from the input box to the output box defined at the Box editing step of the workflow.
Sparse Graph	Computes and generates sparse graphs that include edge scalar measurements of Euclidean length and vertex scalar measurements of pore diameter.
Dense Graph	<p>Computes and generates dense graphs that include edge scalar measurements of Euclidean length and vertex scalar measurements of segment tortuosity, segment length, segment index, segment Euclidean length, pore diameter, Dijkstra Euclidean, Dijkstra Throat Weighted.</p> <p>The following distributions are also available for reporting as follows:</p> <p>Pore size distribution... Plots pore size distribution within the dense graph.</p> <p>Tortuosity... Plots tortuosity within the dense graph (see Tortuosity Distributions for Graphs on page 32).</p> <p>Throat-weighted tortuosity... Plots the distribution of throat-weighted tortuosity within the dense graph (see Tortuosity Distributions for Graphs on page 32).</p>

Plug Porosity Slice Analysis

This parameter for slice-by-slice analysis lets you compute plug porosity for each XY slice within the volumetric data. The plug porosity percentage of the region of interest is computed as: $[(\text{total labeled voxels})/(\text{total all voxels})]*100$.

Click the **Slice Analysis** tab on the right sidebar to open the **Slice Analysis** panel. You can then choose the **Plug Porosity** measurement and click the **Compute** button to generate the results and plotted graph shown below. Select the **Add Slice Analysis results to report** option if want to include this analysis in your generated report.

Slice Analysis panel



If required, you can customize and save the figure, as well as export the results to a CSV file for further processing. Plug Porosity measurements are also available in the main application for detailed slice analyses of any reformatted view.

Pore Network Modeling

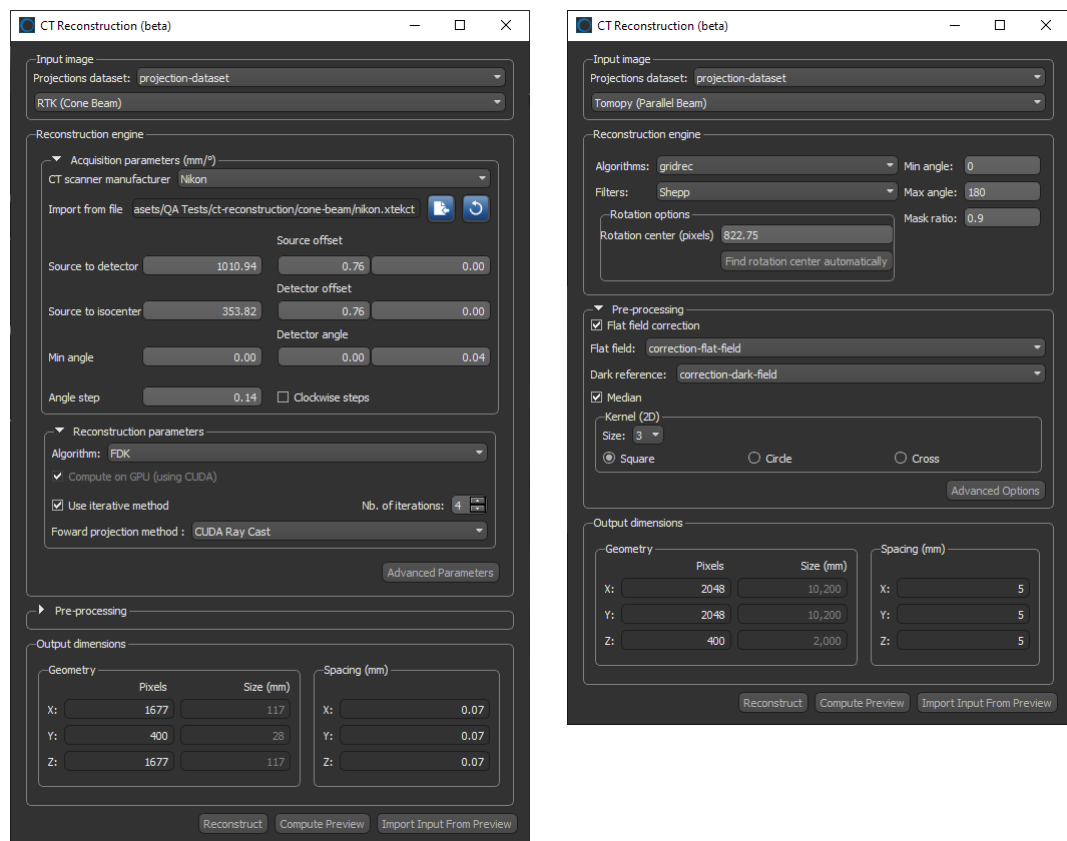
Go further with other unique Dragonfly capabilities, such as pore network modeling, to generate and extract pore network models based on 3D image data. The previously released **Pore Network Modeling** module for Dragonfly provides valuable insights into pore and throat size distributions as a natural outcome of producing a network model.

CT Reconstruction Module

The **CT Reconstruction** module for Dragonfly 2020.1 provides for the tomographic reconstruction of cone-beam projections with RTK, an open-source software based on the Insight Toolkit (ITK), and parallel-beam projections using TomoPy, an open-source Python package for tomographic data processing and image reconstruction. CT Reconstruction provides benchmarked reconstruction algorithms, selectable reconstruction parameters, iterative methods, and previews for verifying selected settings. Extensive knowledge about the integrated image reconstruction algorithms is not required to obtain optimal results with CT Reconstruction.

Choose **Workflows > CT Reconstruction** on the menu bar to open the CT Reconstruction dialogs, shown below.

CT Reconstruction options for cone beam and parallel beam acquisitions



NOTE The CT Reconstruction module is only available as Beta in this software release.

Reconstruction Algorithms

CT Reconstruction includes the benchmarked Feldkamp-David-Kress (FDK) algorithm for cone-beam acquisitions, and Fourier grid reconstruction ('gridrec') and algebraic reconstruction techniques ('art') for parallel-beam. Geometry readers are provided for commercial scanners from Nikon, KA Imaging, and North Star Imaging.

Pre and Post-Processing

Basic operators for reconstruction include flat and dark-field correction and median filtering, while GPU acceleration provides fast processing of large data sizes. Downstream, Dragonfly's extensive image processing toolbox includes beam-hardening correction, ring artifact removal, noise reduction, and image stack alignment. Batch processing allows reconstruction jobs to be run sequentially without operator input.

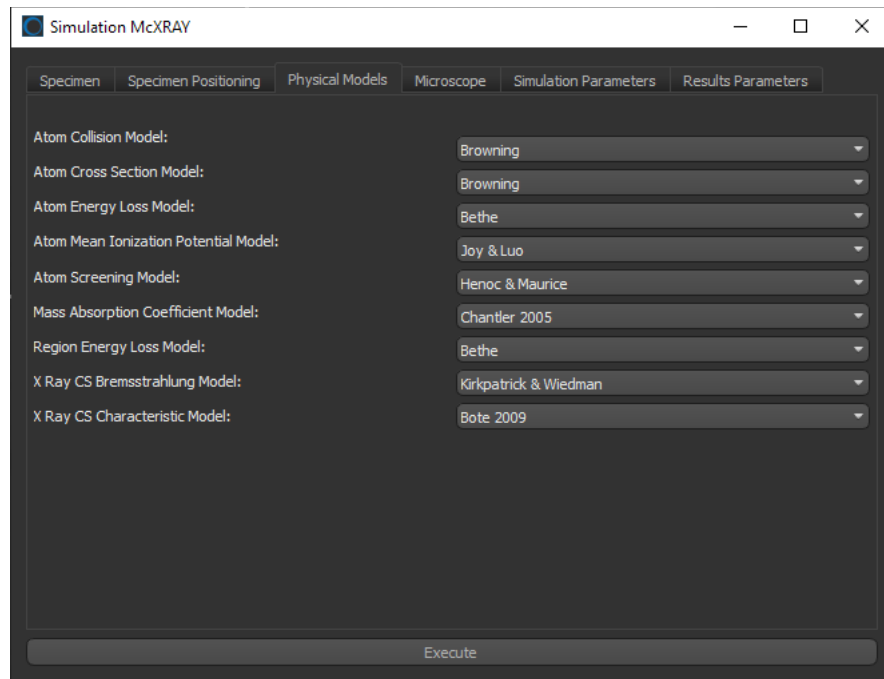
MC X-Ray

MC X-Ray simulates electron scattering in materials in order to correlate X-Ray emission to composition in quantitative X-ray microanalysis. By simulating X-ray spectra, it is possible to establish the optimum conditions to perform a specific analysis, as well as to establish detection limits or to explore possible peak overlaps.

MC X-Ray can compute the complete X-ray spectra from the simulation of electron scattering in solids of various types of geometries and allows for up to 256 different regions in the materials having the shape of spheres, cylinders, and combinations of horizontal and vertical planes. All of these regions can have a different composition.

Choose **Workflows > MC X-Ray Simulator** to open the MC X-Ray dialog, shown below.

Physical Models tab on the MC X-Ray dialog



NOTE The MC X-Ray module is only available as Beta in this software release.

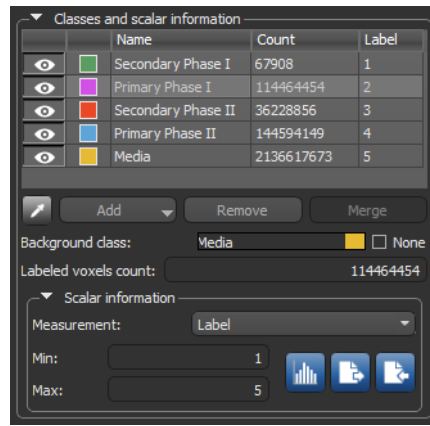
Additional features of MC X-Ray include bright-field, dark-field, and high angle annular dark-field detectors, as well as the display of electron trajectories, electron and energy distribution at the specimen surfaces, transmitted electrons distribution, and energy loss distribution.

New Options for Multi-ROIs

The 2020.1 software release introduces the concept of editable multi-ROIs. This means that you can create and label classes directly on a multi-ROI instead of working on multiple regions of interest and then creating the multi-ROI.

As shown in the following screen capture, the new **Classes and scalar information** box on the Data Properties and Settings panel for selected multi-ROIs indicates the name of each class in the multi-ROI, the number of labeled voxels, and the color assigned to each class. If available, you can also view scalar information related to each class. In addition, you can show or hide any class by toggling the visibility control.

Classes and scalar information for multi-ROIs



NOTE The Pick tool lets you visually select a class within a view.

Background Class

If this option is enabled, labeled voxels that are removed from any class, as well as unlabeled voxels that are painted, will be added automatically to the set background class.

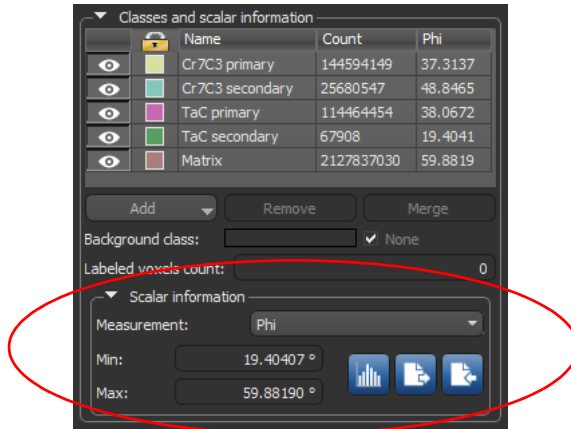
Do the following to set a class as the background for a multi-ROI:

- Name the class that you intend to set as the background, recommended.
- Drag the class to the **Background class** box and drop it when the "+" appears with your cursor.
- To remove the background class, check the **None** option.

Scalar Information

Scalar information related to each class in a multi-ROI, whether it was generated or imported, appears in the Classes and scalar information list and is selectable in the **Scalar information** box that is circled below.

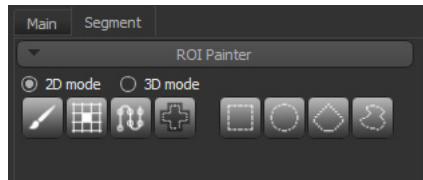
Scalar information box



Labeling Multi-ROIs with the Painter Tools

You can use the tools available on the ROI Painter panel, shown below, to manually label the voxels of each class in a multi-ROI.

ROI Painter panel



NOTE The labeled voxels of the classes in a multi-ROI cannot intersect. For example, if you are labeling voxels as 'Class 1' and paint over the labeled voxels of another class, then those voxels will be automatically labeled as 'Class 1'.

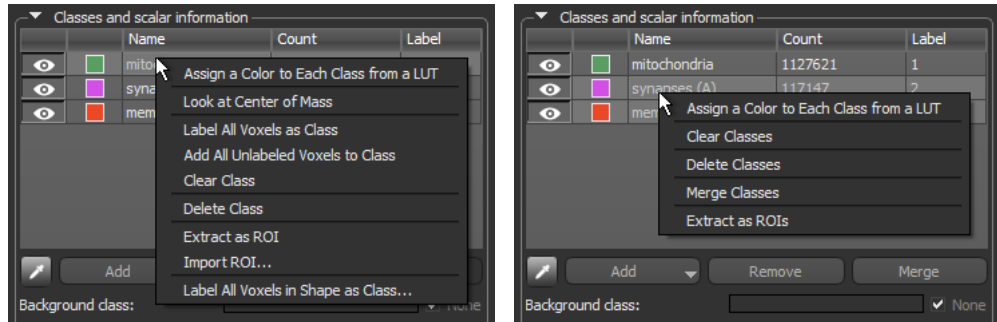
In cases in which a feature of interest was misidentified as belonging to another class, for example by the Segmentation Wizard during model training, you can edit labels in 'Exclusive' mode. In this mode, only labeled voxels within the selected classes will be affected by painting. For example, if you select classes A and B and then add to class A, only voxels labeled as class B will be automatically relabeled as class A.

You can also edit the labels of each class within a multi-ROI by applying morphological operators and other operations, such as filling inner areas and adding clipped regions. Additional options are available in the Classes and scalar information pop-up menu to label all non-intersected voxels, clear classes, and import the labels of a region of interest (see [Options for Selected Classes](#) on page 29).

Options for Selected Classes

Contextual menu items for single selections and multiple-class selections let you fully segment the multi-ROI, as well as clear, delete, and merge classes. You can also extract classes as ROIs for other purposes.

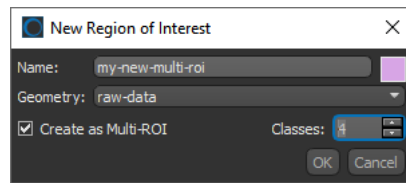
Single selection (on left) and multiple (on right) options



Creating New Multi-ROIs

The options to create a new multi-ROI with a selectable number of classes is available from the ROI Tools panel. Click the **New** button in the Basics box to open the **New Region of Interest** dialog, shown below.

New Region of Interest dialog

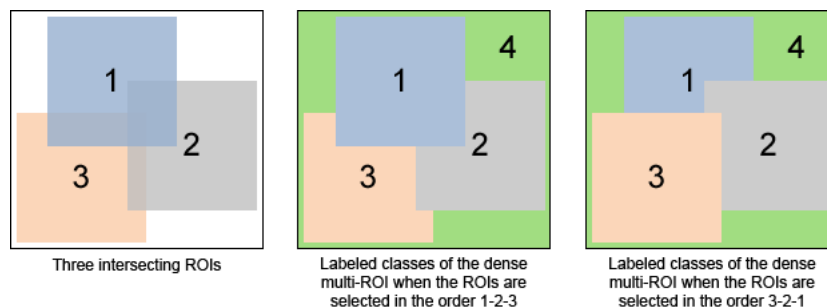


Creating Dense Multi-ROIs from ROIs

The option to create new multi-ROIs, in which the labeled voxels of each selected ROI is assigned to a class and all unlabeled or 'complementary' voxels are labeled as an additional class, is available from the pop-up menu for selected regions of interest. For example, if you create a multi-ROI from five regions of interest, then the dense multi-ROI will contain six classes and will be fully segmented.

As shown in the following illustration, in which the labeled voxels of three regions of interest intersect, the selection order determines how labeled voxels are distributed in the resulting classes of the multi-ROI. Unlabeled voxels are assigned to an additional class.

Intersecting ROIs and resulting dense multi-ROIs



You should note that dense multi-ROIs are often selected as the output for training deep learning models.

Creating Dense Multi-ROIs from Multi-ROIs

The option to create new multi-ROIs, in which all unlabeled or 'complementary' voxels are labeled and assigned to a new class, is now available from the pop-up menu for selected multi-ROIs. For example, if you create a dense multi-ROI from a multi-ROI that contains five classes, then the dense multi-ROI will contain six classes and will be fully segmented.

2D Watershed

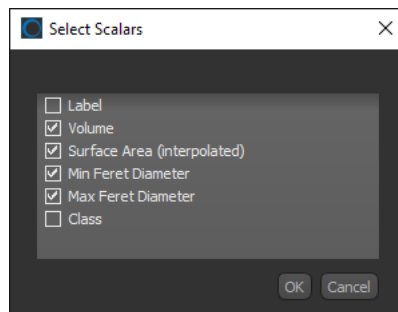
In cases in which you need to prepare training data for Deep Learning, you can perform a watershed segmentation on a single slice of a labeled multi-ROI.

Right-click the required multi-ROI in the Data Properties and Settings panel and then choose **2D Watershed** in the pop-up menu. You will then need to choose a region of interest for computing a distance map, as well as a landscape for computing the watershed. The result will be a fully segmented, single-slice multi-ROI.

Creating Images from Selected Scalars

This new option for multi-ROIs automatically creates an image for each scalar value checked in the **Select Desired Scalars** dialog, shown below

Select Scalars dialog.



The result is series of new images in which data values correspond to the scalar values of labeled voxels.

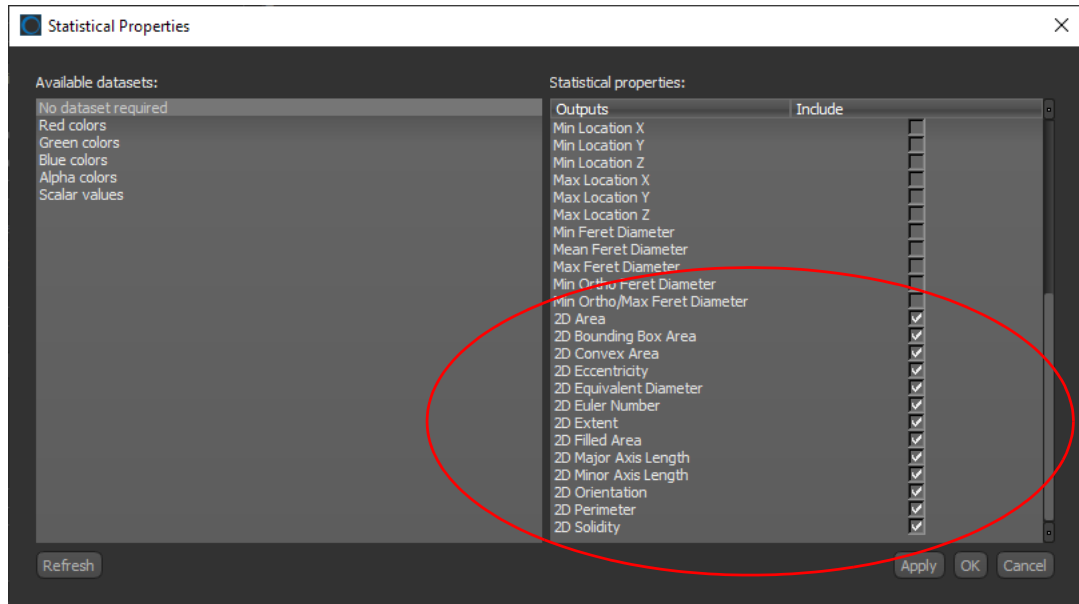
NOTE Images are generated in the FLOAT data type, which stores double-precision floating-point numbers with up to 17 significant digits.

Measurements for 2D Multi-ROIs

A number of new options are available in this software release for measuring the properties of the labeled regions, or connected components, on 2D multi-ROIs.

Right-click a multi-ROI in the Data Properties and Settings panel and then choose **Connected Components > Analysis** in the pop-up menu to start your analysis. The following properties can then be selected in the **Statistical Properties** dialog in the Object Analysis module.

Statistical Properties for 2D multi-ROIs



Descriptions of the selectable statistical properties for 2D multi-ROIs are available in the following table.

Selectable statistical properties for 2D multi-ROIs

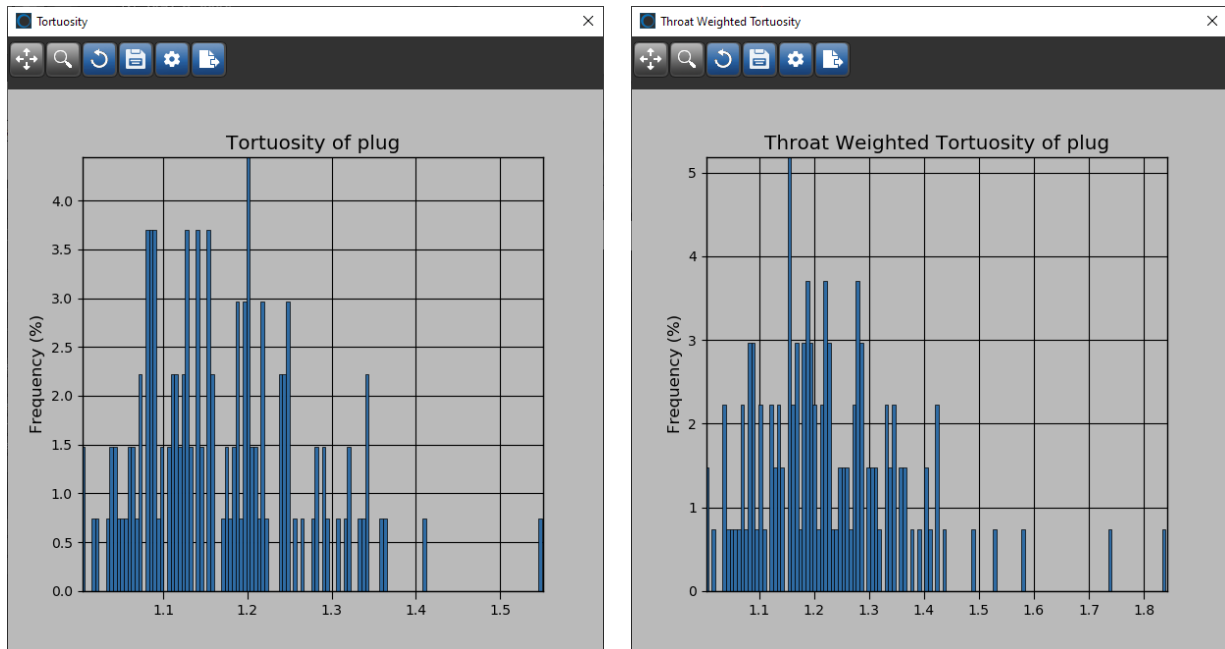
	Description
2D Area	The area of the labeled pixels in the region, reported in (default units) ² .
2D Bounding Box Area	The area of the bounding box that encloses the labeled pixels in the region, reported as (default units) ² .
2D Convex Area	The area of the convex hull image, which is the smallest convex polygon that encloses the region. Reported in (default units) ² .
2D Eccentricity	Eccentricity of the ellipse that has the same second-moments as the region. The eccentricity is the ratio of the focal distance (distance between focal points) over the major axis length. The value is in the interval [0, 1]. When it is 0, the ellipse becomes a circle.
2D Equivalent Diameter	The diameter of a circle with the same area as the region, reported in default units.
2D Euler Number	Euler characteristic of the region.
2D Extent	Ratio of pixels in the region to pixels in the total bounding box. Computed as: 2D Area / 2D Bounding Box Area.
2D Filled Area	The area of all pixels — both labeled and unlabeled — in the region which describes the area of the filled region. Reported in (default units) ² .
2D Major Axis Length	The length of the major axis of the ellipse that has the same normalized second central moments as the region. Reported in default units.

	Description
2D Minor Axis Length	The length of the minor axis of the ellipse that has the same normalized second central moments as the region. Reported in default units.
2D Orientation	Angle between the 0th axis (rows) and the major axis of the ellipse that has the same second moments as the region, ranging from $-\pi/2$ to $\pi/2$ counter-clockwise. Reported in degrees or radians.
2D Perimeter	Perimeter of object which approximates the contour as a line through the centers of border pixels using a 4-connectivity. Reported in default units.
2D Solidity	Ratio of pixels in the region to pixels of the convex hull image.

Tortuosity Distributions for Graphs

As a new feature for computed graphs, you can plot the distribution of graph tortuosity and throat-weighted tortuosity between input and output boxes. You should note that the tortuosity factor is a measure of the departure of a porous medium from the ideal system made of straight and parallel capillaries.

Histograms of tortuosity and throat-weighted tortuosity

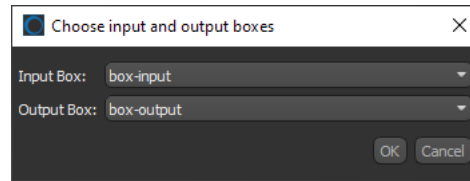


Plotting Tortuosity

Do the following to plot the distribution of tortuosity within a graph of porous media:

- Add box shapes to define the input and output of the segment of the graph that you want to plot.
- Right-click the graph in the Data Properties and Settings panel and then choose **Plot Graph Tortuosity** in the pop-up menu.

- Choose the input and output boxes, as shown below.

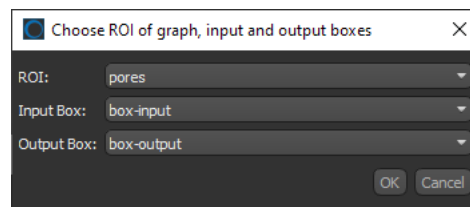


- Click **OK** to plot the tortuosity within the selected segment of the graph.

Plotting Throat-Weighted Tortuosity

Do the following to plot the distribution of throat-weighted tortuosity within a graph of porous media:

- Add box shapes to define the input and output of the segment of the graph that you want to plot.
- Right-click the graph in the Data Properties and Settings panel and then choose **Plot Graph Throat-Weighted Tortuosity** in the pop-up menu.
- Choose the graph region of interest, as well as the input and output boxes, as shown below.

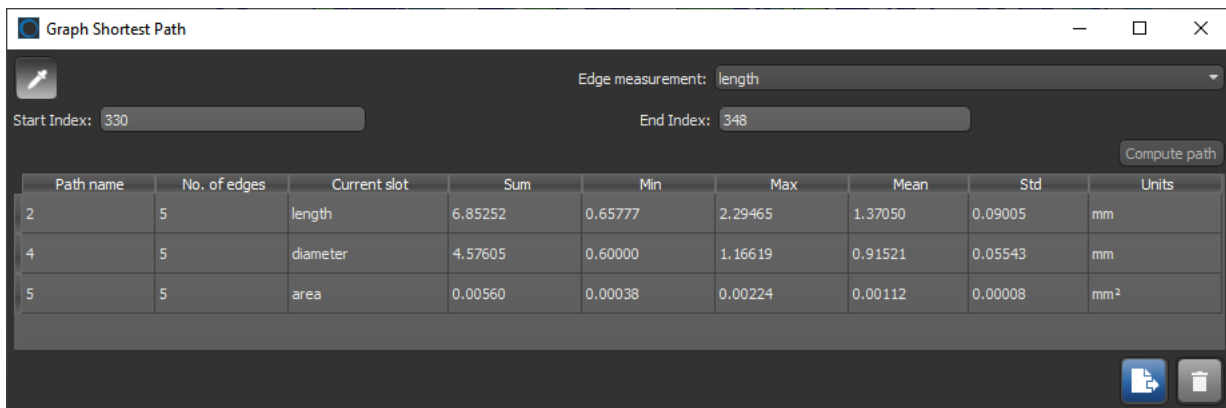


- Click **OK** to plot the throat-weighted tortuosity within the selected segment of the graph.

Computing Shortest Distances on Graphs

This software release provides the option to compute the shortest distance between two selected nodes on a graph and to then extract additional scalar values within that interval. Choose **Utilities > Start Graph Shortest Path** on the menu bar to open the Graph Shortest Path dialog, shown below.

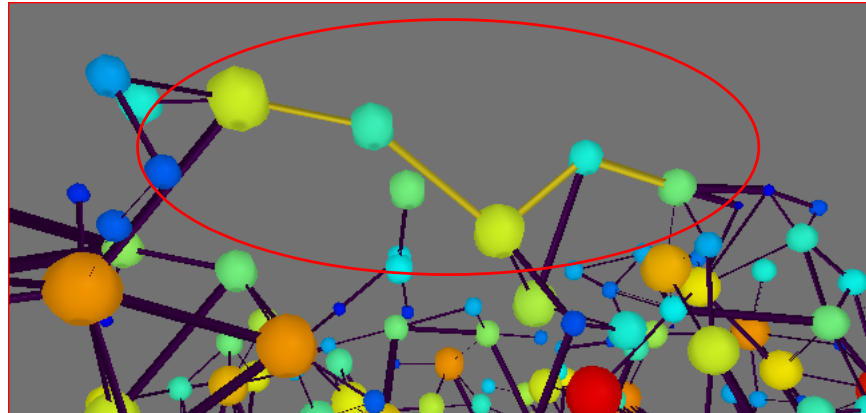
Graph Shortest Path dialog



Do the following to compute the shortest distance between two selected nodes:

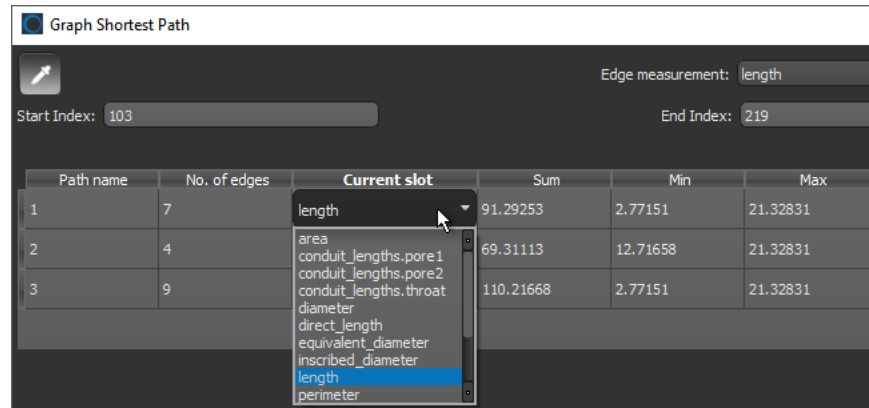
- Pick a path-starting vertex and a path-ending vertex with the **Pick** tool.
- Choose a measurement in the **Edge measurement** drop-down menu.
- Click the **Compute path** button.

The shortest path between the selected vertices is computed automatically and the Edge LUT measurement is updated to highlight the computed path, as shown below.



In addition, specific measurements extracted from the edges within the path appear in the Graph Shortest Path dialog. These include the total of the selected measurements, the minimum, maximum, and mean values, as well as the variance.

- If available, you can choose other edge measurements to examine in the **Current slot** drop-down menu, as shown below.



Configured Actions for Computing Shortest Distances

The following configured actions are available for picking vertices with the **Pick** tool.

Configured actions for computing distances

	Description
Pick path ending vertex	Configured action for picking the path-ending vertex.
Pick path starting vertex	Configured action for picking the path-starting vertex.
Pick vertices	Configured action for entering vertex-picking mode.
Switch to pick end vertex	Configured action for switching to pick path-ending vertex mode.
Switch to pick start vertex	Configured action for switching to pick path-starting vertex mode.

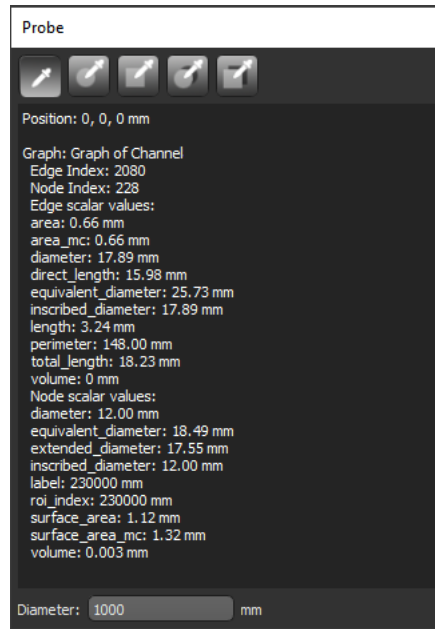
Import Graph from CSV

This new option, which is available on the **File** menu, lets you import a graph saved in the comma-separated values (*.csv extension) file format.

Probing Graph Scalar Values

You can now view the scalar values of graph edges and/or nodes, as well as assigned index numbers, in 3D views with the **Probe** tool. Results are displayed on the Probe panel, as shown below.

Probe panel



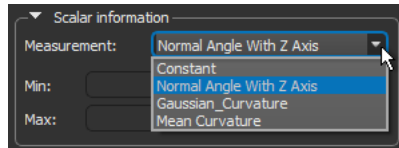
NOTE The Probe panel is available by default on the left sidebar on the Main tab.

Scalar Values for Meshes

This software release includes the option to add additional scalar values, such as curvature, normal angles with the Z-axis, or a constant, to meshes.

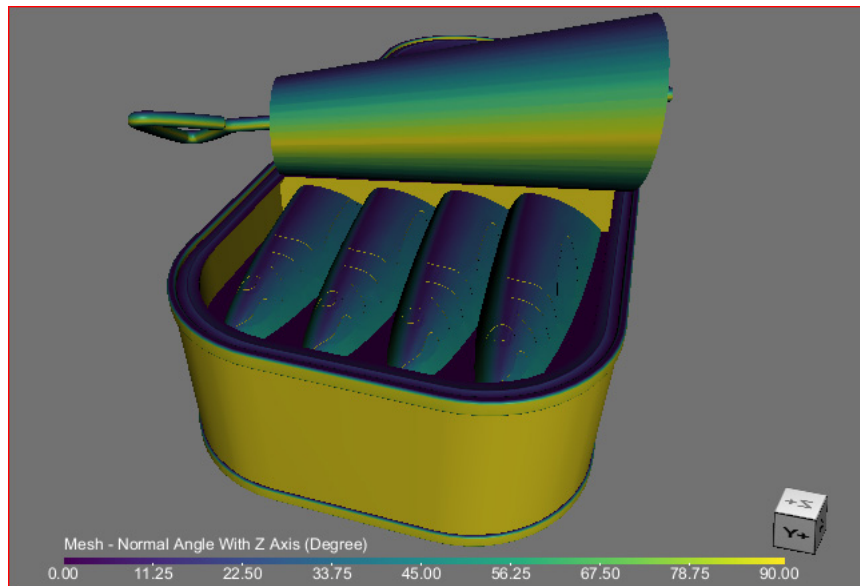
Right-click a mesh in the Data Properties and Settings panel and then choose the required option in the pop-up menu. The computed scalar value will appear in the **Scalar information** group box, as shown below, and will be displayed on the legend.

Scalar information



You should note that you can map values to any LUT. In the following example, the default blue-green-yellow LUT was selected for mapping normal angles with the Z axis.

Normal angles with Z axis



Translation for Scalar Values

If required, you can apply a linear transformation, with or without an offset, to selected mesh scalar data. Right-click the mesh in the Data Properties and Settings panel and then choose **Apply Translation to Scalar Values** in the pop-up menu. You can then choose the scalar values slot that you need to modify in the **Choose a Scalar Values Slot** dialog, as well as the slope value and offset in the following dialogs.

Image Filtering

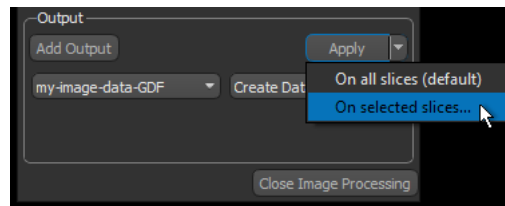
A number of new options, as well as additional filters, are available in this software release for processing and filtering image data.

Apply to Selected Slices Only

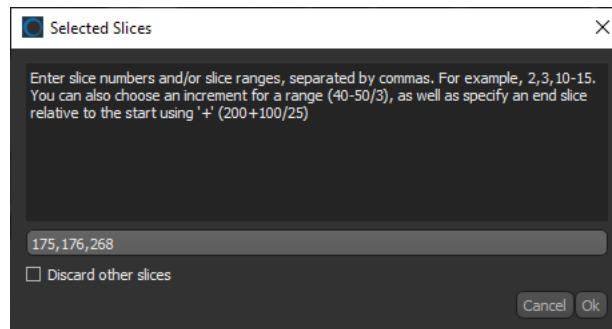
As an update for image processing, you can now restrict the application of a filter or arithmetic operation to selected image slices. For example, to correct an anomaly that only appears a limited number of slices on a 3D image.

Do the following to apply filtering to selected slices only:

- Mark the image slices to which you want to restrict processing.
NOTE Right-click inside the view of the original data and then choose **Show Marked Slices Indicator** in the pop-up menu to view the options for marking image slices.
- Choose **Apply > On selected slices** in the Output box on the Image Processing panel, as shown below.



- Choose the slices, or a range of slices, on which the selected operation should be applied in the **Selected Slices** dialog, as shown below.

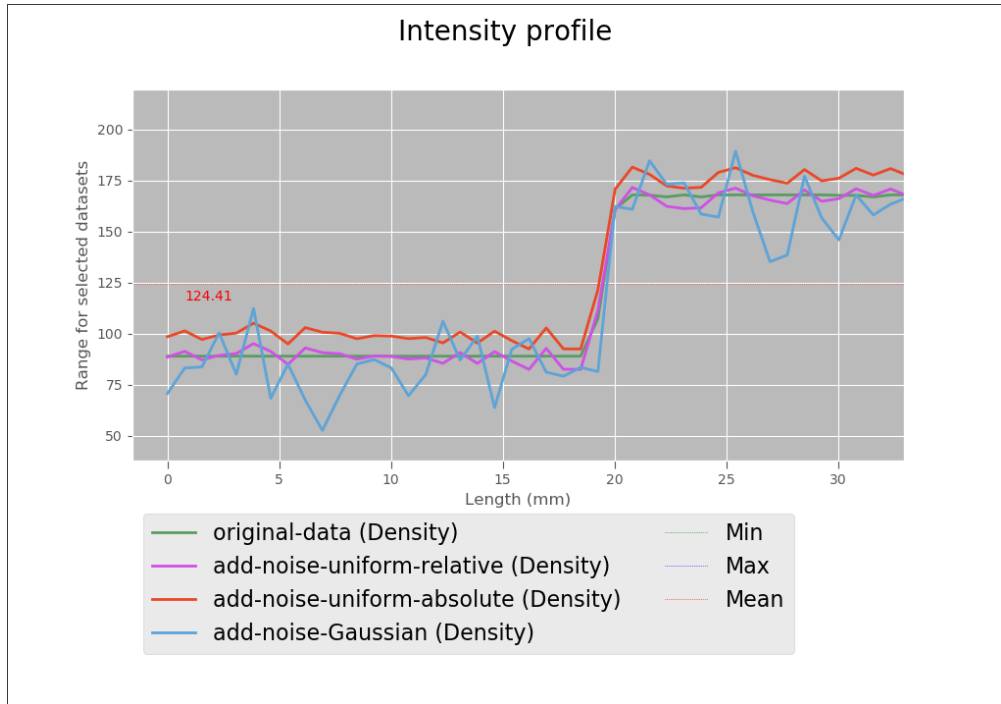


NOTE You can also extract a dataset of selected slices only by checking the **Discard other slices** option.

Additive Noise Filter

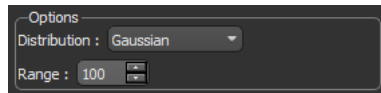
The new **Additive Noise** filter lets you artificially add noise to an image. Deliberately corrupting an image with noise lets you test the resistance of an image processing operator to noise and assess the performance of various noise reduction filters and denoising models.

The result of adding noise to a grayscale image is show below on an intensity profile.



The following options are available for the Additive noise filter in the Image Processing panel.

Options for additive noise



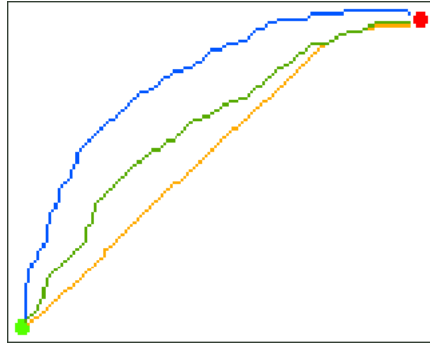
Distribution... Lets you choose a distribution for the added noise — Uniform absolute, Uniform relative, and Gaussian.

Range... Lets you choose the range of data within which noise will be added. For example, at a range of 100 with a 'Uniform relative' distribution, noise will be added within ± 50 of the original data.

Find Path Between ROIs

This new option for Dragonfly 2020.1 lets you define the connectivity of the strongest path between two regions of interest.

Path ROIs computed with varying geometrical biases



Do the following to compute a path ROI between two ROIs:

- Define the start and end nodes as regions of interest and then create a mask ROI to contain the path, recommended.
- Right-click the image data on which you want to compute the path and then choose **Find Path ROI Between ROIs** in the pop-up menu.
- Choose the starting point ROI and end point ROI in the **Choose an ROI** dialog.
- Choose an ROI as the mask, recommended, and then click **OK**.
- Select a geometrical bias and then click **OK** to compute the path.

The new path ROI appears in the Data Properties and Settings panel.

Euler Characteristic Number

Euler Characteristic numbers provide topological characteristics of various classes of geometric figures based only on a relationship between the numbers of vertices (V), edges (E), and faces (F) of the figure. This number, given by $V - E + F$, is the same for all figures whose boundaries are composed of the same number of connected pieces.

To compute the Euler characteristic number, right-click a region of interest or graph in the Data Properties and Settings panel and then choose **Get Euler Characteristic Number** in the pop-up menu. The result appears in an **Information** dialog.

Structured Grids Comparator

The new Structured Grids Comparator for Dragonfly 2020.1 lets you evaluate the quality of processed image data and segmentations with a number of metrics.

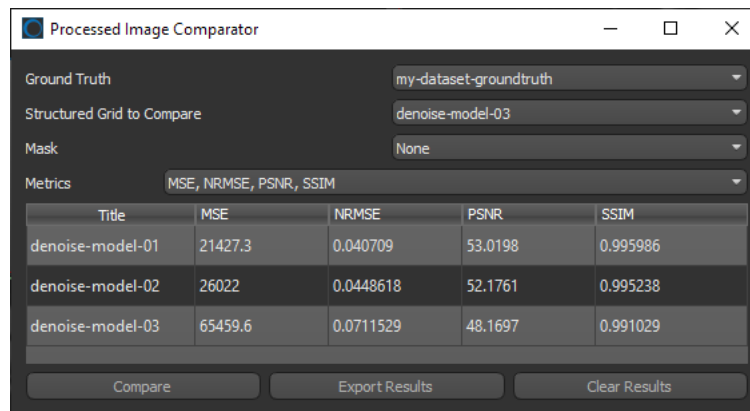
Choose **Structured Grids Comparator** in the **Utilities** menu to open the Structured Grids Comparator dialog. You can then select a ground truth, mask, and the required metrics to evaluate your data. You should note that results are cumulative and can be exported in the comma-separated values (*.csv extension) file format for further analysis or archiving.

NOTE The structured grids that you choose to compare must have the same size and shape, as well as the same resolution.

Processed Image Comparator

For processed image data, you can select metrics such as Mean Squared Error (MSE), Normalized Root Mean Square Error (NRMSE), Peak Signal-to-Noise Ratio (PSNR), and Structural Similarity Index (SSIM), to evaluate the quality of images generated by denoising deep learning models or that were processed by filtering or any other operation.

Structured Grids Comparator results for processed image data



NOTE You can open the Processed Image Comparator from the Data Properties and Settings panel by multi-selecting the ground truth and processed image data, right-clicking, and then choosing **Open Processed Image Comparator** in the pop-up menu.

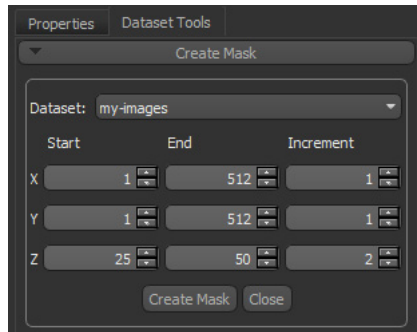
Segmentation Comparator

For regions of interest and multi-ROIs, you can select metrics such as Accuracy, Dice Similarity Coefficient (DICE), False Negatives (FN), False Positives (FP), and others to evaluate the quality of machine learning and deep learning segmentation models.

Creating Image Masks

This new option for Dragonfly 2020.1 lets you quickly create an ROI mask for processing image data. Right-click the required image data in the Data Properties and Settings panel and then choose **Create Mask** in the pop-up to open the Create Mask panel, shown below.

Create Mask panel



The resulting mask will be a new region of interest with the same shape as the selected image data and that is fully labeled within the selected dimension and increment.

Auto Synchronization Between 2D and 3D Views

With the **Auto Synchronization** option for Dragonfly 2020.1, you can automatically update the slice position of all the MPR views in the current scene to wherever you clicked in the 3D view.

NOTE The configured action for this option is “Center MPR 2D views from 3D pick” (see [Configurable Actions](#) on page 71).

Import Images from Hitachi SEM

Support for importing images acquired with Hitachi scanning electron microscopes is available in this software release. Simply add the required TIFF file to Dragonfly's Image Loader and the application will apply the information available in the accompanying “image_file_name.txt” file to correctly import your Hitachi SEM acquisitions.

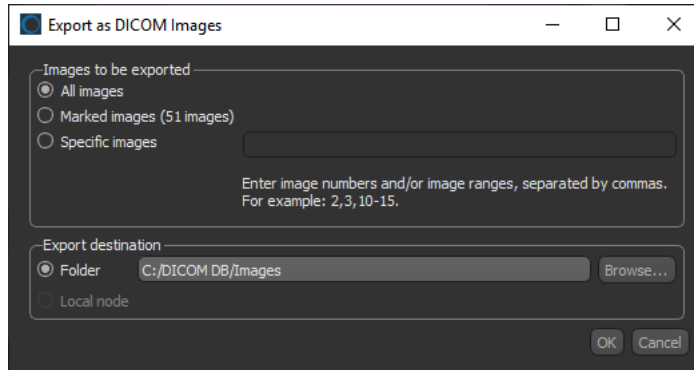
NOTE See [Measurements for 2D Multi-ROIs](#) on page 31 for information about the new options are available in this software release for measuring the properties of the labeled regions on 2D multi-ROIs.

Export Images as DICOM

This software release provides the option to export images in the DICOM format. Whenever you export images in the DICOM format, you can choose the images to be exported and an export destination.

Choose **Export > As DICOM** in the Data Properties and Settings panel to open the **Export as DICOM Images** dialog, shown below.

Export as DICOM Images dialog



NOTE Digital Imaging and Communications in Medicine (DICOM) is a standard for handling, storing, printing, and transmitting information in medical imaging. It includes a file format definition and a network communications protocol that uses TCP/IP to communicate between systems. DICOM files (*.dcm extension) can be exchanged between two entities that are capable of receiving images and data in DICOM format.

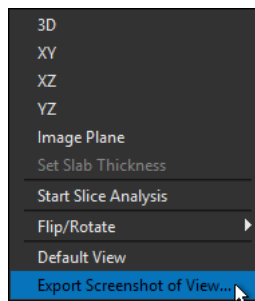
Exporting Screenshots

A number of additional options are available for exporting screenshots of 2D and 3D views. These new options are described below.

Export Screenshots from Views

The option to export screenshots is now available from the contextual menus for 2D and 3D views, as shown below.

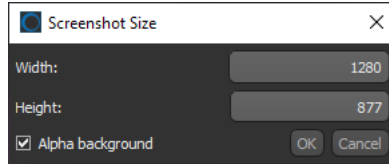
View contextual menu



Export Screenshots with Transparent Backgrounds

The option to export screenshots from 3D views with a transparent background is available in this software release. Select **Alpha background** in the Screenshot Size dialog, shown below, to export the image in the PNG and TIFF file formats with a transparent background.

Screenshot Size dialog



Export Meshes with Color

The option to export scalar meshes with colors preserved is now available for the VRML (*.wrl extension) file format. Right-click the mesh you need to export and then choose **Export > Mesh to File with Colors** in the pop-up menu.

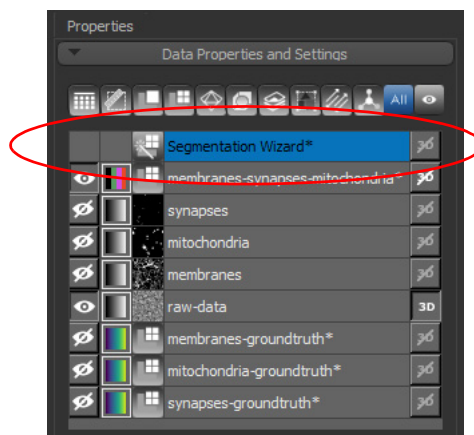
NOTE Importing meshes exported with color in the VRML file format is not yet supported by Dragonfly.

Context Groups

This software release provides the option to save and load 'context groups', which define the workspace of contexts — such as the Segmentation, Plug Analyzer, or Bone Analysis Wizards — and include all objects associated with the context. This lets you resume working within a specialized workflow after exiting the context or Dragonfly without having to import the required objects or to repeat computational steps.

Context groups appear on the Data Properties and Settings panel in the main context, as shown below.

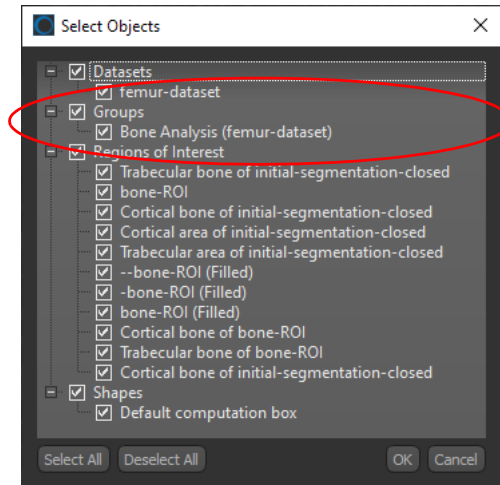
Context group in the Data Properties and Settings panel (circled)



To load a context from the main application window, right-click the required group in the Data Properties and Settings panel and then choose **Reopen** in the pop-up menu.

You can also import a context group from a saved session. Choose **File > Import Object(s)** on the menu bar and then select the ORSSession (*.ORSSession extension) file with the required session group. You can then select the group that you want to import in the Select Objects dialog.

Select Objects dialog

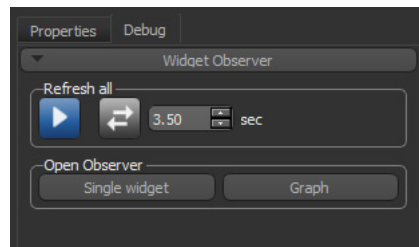


Widget Observer

This new software developer tool helps you to troubleshoot issues, such as unequal panel sizes, misaligned icons, and missing styles, by letting you examine the properties of the parents and childs of a selected widget.

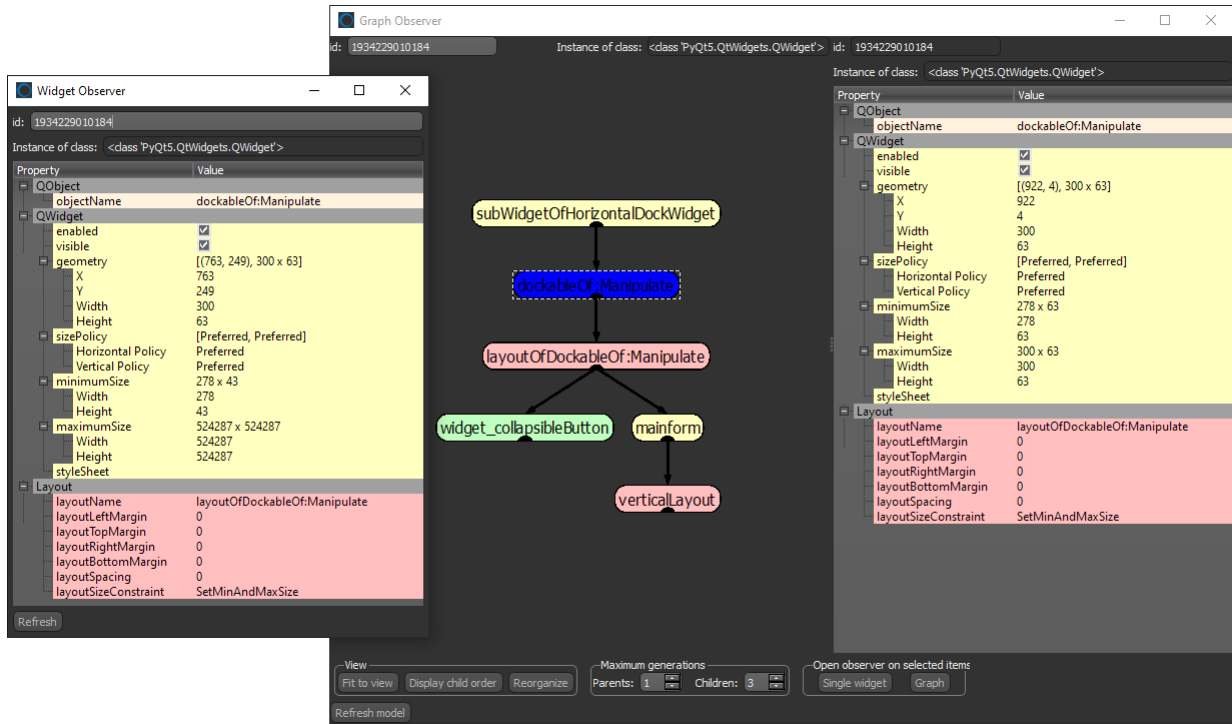
Choose **Developer > Widget Observer** on the menu bar to open the Widget Observer panel, shown below.

Widget Observer panel



You can then open a single Widget Observer or Graph Observer, as shown in the following screen captures. To view the properties of a widget you can enter the object ID or use a configured action to show the properties of the selected instance of class (see [Configured Actions for the Widget Observer](#) on page 46).

Widget Observer and Graph Observer dialogs



Configured Actions for the Widget Observer

The following configured actions are available for opening the Widget Observer panel and associated dialogs.

Configured actions for the Widget Observer

	Description
Open the Widget Observer	Opens the Widget Observer panel on the right sidebar.
Start Widget Observer (graph) on widget at cursor	Opens the Graph Observer and displays the properties of the selected instance of a class. For example, 'OrsPythonPlugins.OrsBasicManipulate.mainform.mainform'.
Start Widget Observer (single widget) on widget at cursor	Opens the Widget Observer and displays the properties of the selected instance of a class. For example, 'OrsPythonPlugins.OrsBasicManipulate.mainform.mainform'.

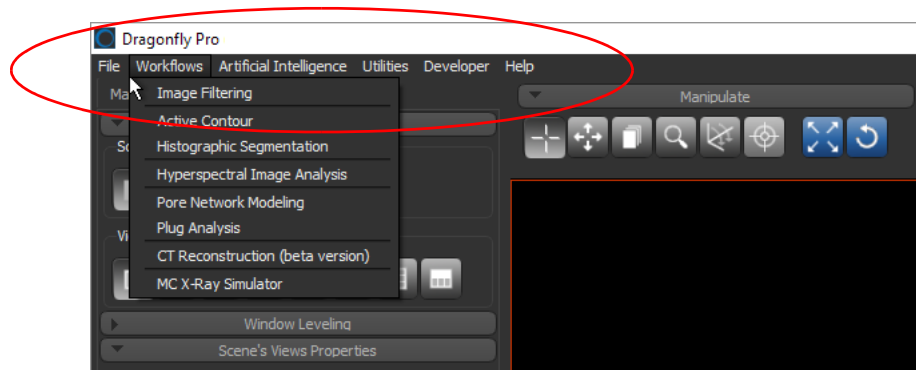
Product Enhancements

This release provides the following product enhancements for Dragonfly 2020.1. Information about new features, such as the Segmentation Wizard, Plug Analysis, and the CT Reconstruction, as well as newly implemented options for multi-ROIs and graphs, is available in the topic [New Features](#) on page 7.

Refactored Menu Bar

One of the first changes you should notice in Dragonfly 2020.1 is the refactored menu bar, shown below.

Menu bar



Refactoring was implemented to help make finding the items that you need for your workflows easier and quicker. For details about the items available on the menu bar, see [Menu Bar Changes](#) on page 63.

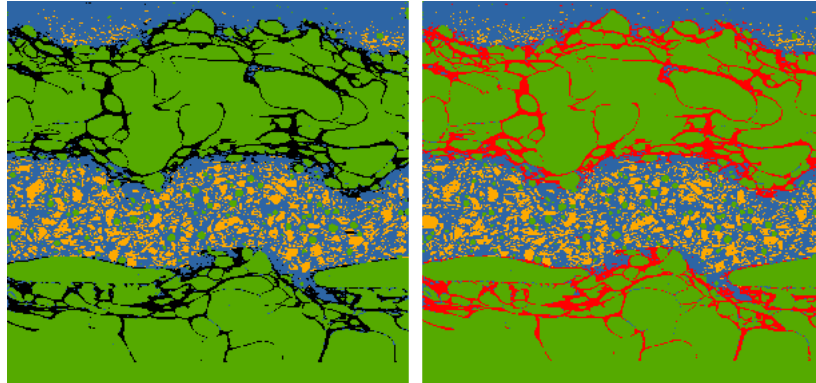
Deep Learning Improvements

This software release features a number of enhancements and other changes for Deep Learning. These modifications are summarized below.

New Class Pattern

- Deep models are now divided into two types — Regression and Segmentation. There are no longer separate categories for binary and multi-class segmentations. The Model Generator was updated to support only two model types.
- Segmentation deep models now only accept multi-ROIs as the target output and produce multi-ROIs as previews and segmentations.
NOTE Refer to the topic [New Options for Multi-ROIs](#) on page 27 for information about creating and labeling classes directly in multi-ROIs and other options.
- Segmentation class settings — visibility, name, and color — are now part of the deep model. Default settings are created to be consistent with old versions.
- The number of classes — Class count — selected for a segmentation model in the Model Generator dialog and the number of classes in the output target multi-ROI must be the same. In previous versions, the model assumed that output multi-ROIs contained an additional unspecified background class. For example, the output multi-

ROI for a segmentation model with a Class count of four previously needed to contain only three classes.



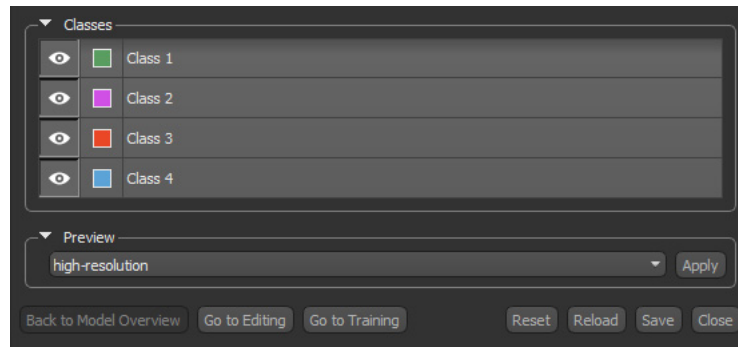
Class models that previously required multi-ROIs with three classes (left), now need multi-ROIs with four classes (right), as shown above.

- Masks are auto generated from labeled voxels.
- Training patches have to be 100% labeled to be included in training, not 50% as previously.
- The method by which data is sampled for training has been changed — from generated patches sampling to grid sampling.

Class Settings

Class settings are now displayed in a table on **Model Overview** screen, as shown below, even if model is not loaded. If required, class names and assigned colors can be edited here.

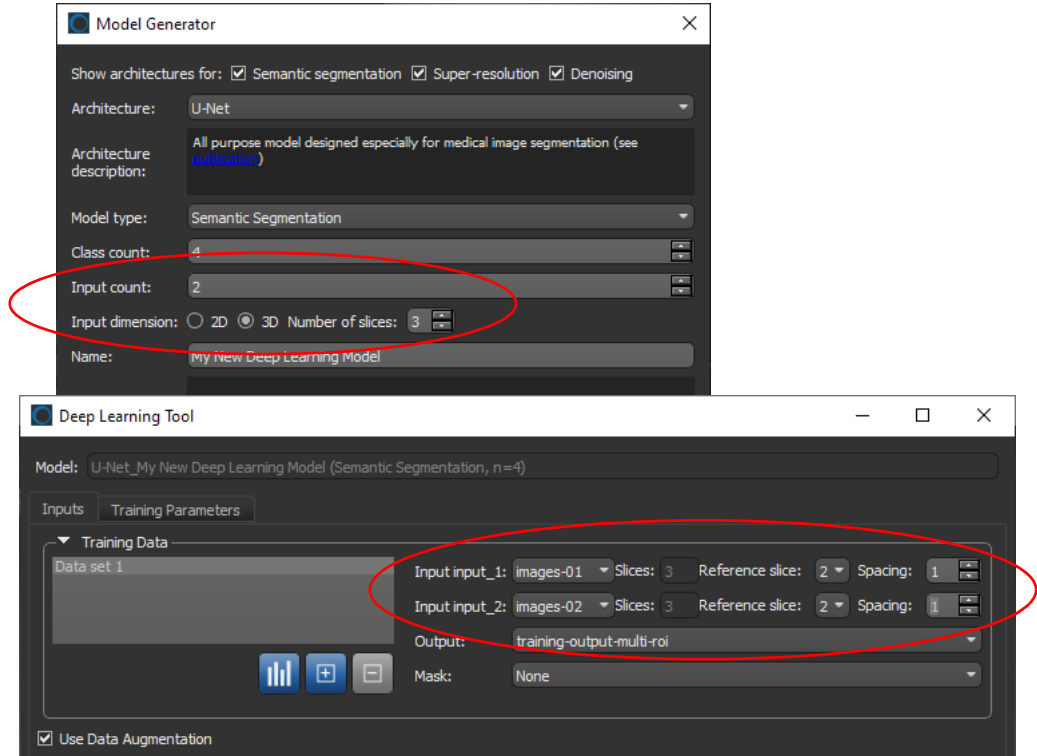
Class settings



Multi-Input and Multi-Slice Models

Dragonfly's Deep Learning tool now supports multiple inputs, as well as multi-slice models. These options can be selected in the Model Generator dialog as the **Input count** and **Input dimension** options and then configured on the **Model Training** panel.

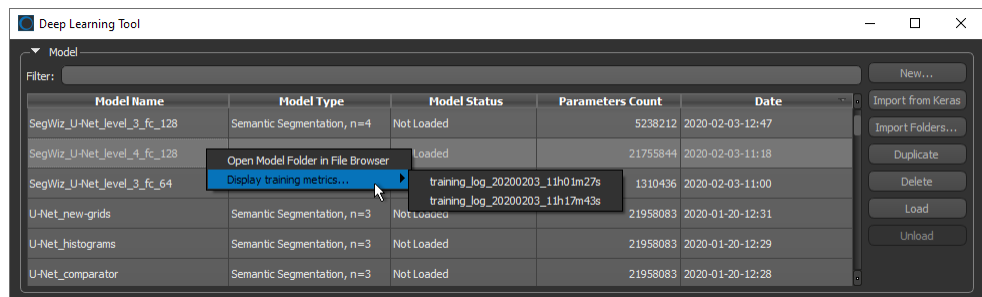
Model Generator dialog (above) and Model Training panel (below)



Training

The following changes are implemented for training deep models:

- The default training parameters are now selected more carefully.
- No more global shared parameters, such as data augmentation, validation, and so on. All training parameters are saved as a file in the model folder each time that a model is trained.
- Training log history can be displayed from the Model contextual menu, as shown below.



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- The TensorBoard callback is now always used and was removed from the UI. This callback writes a log for TensorBoard, which lets you to visualize dynamic graphs of your training and test metrics, as well as activation histograms for the different layers in your model. TensorBoard is a visualization tool provided with TensorFlow.
- The Training Progress bar, shown below, was updated to provide more detailed feedback about the real-time status of training.



You can also view training progress and the results of each epoch in a list view, as shown below.

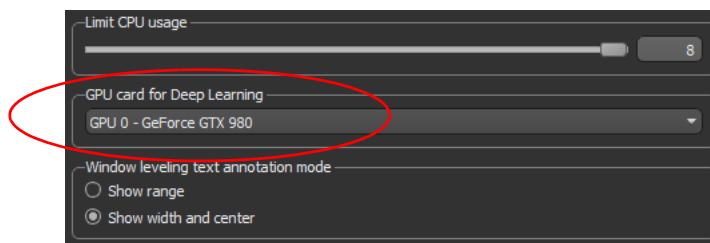
Epoch	loss	mean_absolute_error	timestamp	val_loss	val_mean_absolute_error
001	0.25412258671389687	0.1772356480360031	03/25/2020 09:39:01	0.36202672123908997	0.28528067469596863
002	0.20073963867293465	0.12410962581634521	03/25/2020 09:39:02	0.35469067096710205	0.27821657061576843
003	0.20386454628573525	0.12750476998739624	03/25/2020 09:39:04	0.32946231961250305	0.2532467544078827
004	0.1897835350698895	0.11368750035762787	03/25/2020 09:39:05	0.3026472330093384	0.22669334709644318
005	0.18871570958031547	0.1128859892487526	03/25/2020 09:39:07	0.29945647716522217	0.22377115488052368
006	0.18784248497751024	0.11227644979953766	03/25/2020 09:39:08	0.30920907855033875	0.2338002324104309
007	0.19211218920018938	0.116813063621521	03/25/2020 09:39:09	0.31313860416412354	0.23800444602966309
008	0.1903063886695438	0.11527787148952484	03/25/2020 09:39:11	0.2936217188835144	0.21874496340751648
009	0.1812697168853548	0.10650049895048141	03/25/2020 09:39:13	0.29061180353164673	0.21600107848644257
010	0.1846433033545812	0.11013993620872498	03/25/2020 09:39:14	0.25836077332496643	0.18400025367736816
011	0.17945332494046953	0.1052129864692688	03/25/2020 09:39:15	0.2754684090614319	0.2013811469078064
012	0.1806683341662089	0.10669358819723129	03/25/2020 09:39:17	0.255496084690094	0.18166202306747437
013	0.1791854037178887	0.1054733544588089	03/25/2020 09:39:18	0.25737908482551575	0.1838117092847824
014	0.17664249572488996	0.10319219529628754	03/25/2020 09:39:20	0.2674299478530884	0.19413474202156067
015	0.17863543993896908	0.10545075684785843	03/25/2020 09:39:21	0.25866469740867615	0.1856268048286438
016	0.18086524307727814	0.10794077068567276	03/25/2020 09:39:23	0.25717422366142273	0.18439900875091553
017	0.17550920943419138	0.10284705460071564	03/25/2020 09:39:24	0.2502965263170471	0.17777886986732483

- Models can be unloaded to release GPU memory.
- Model status was expanded with additional descriptors — Not loaded — and color-coding for easy identification.

Selectable GPU for Deep Learning

A new preference for selecting a specific GPU device to use for Deep Learning is now available in cases in which you have multiple GPUs and need to set one of them for Deep Learning.

Go to **Preferences > Miscellaneous** to open the preferences for the available GPU cards, circled below.

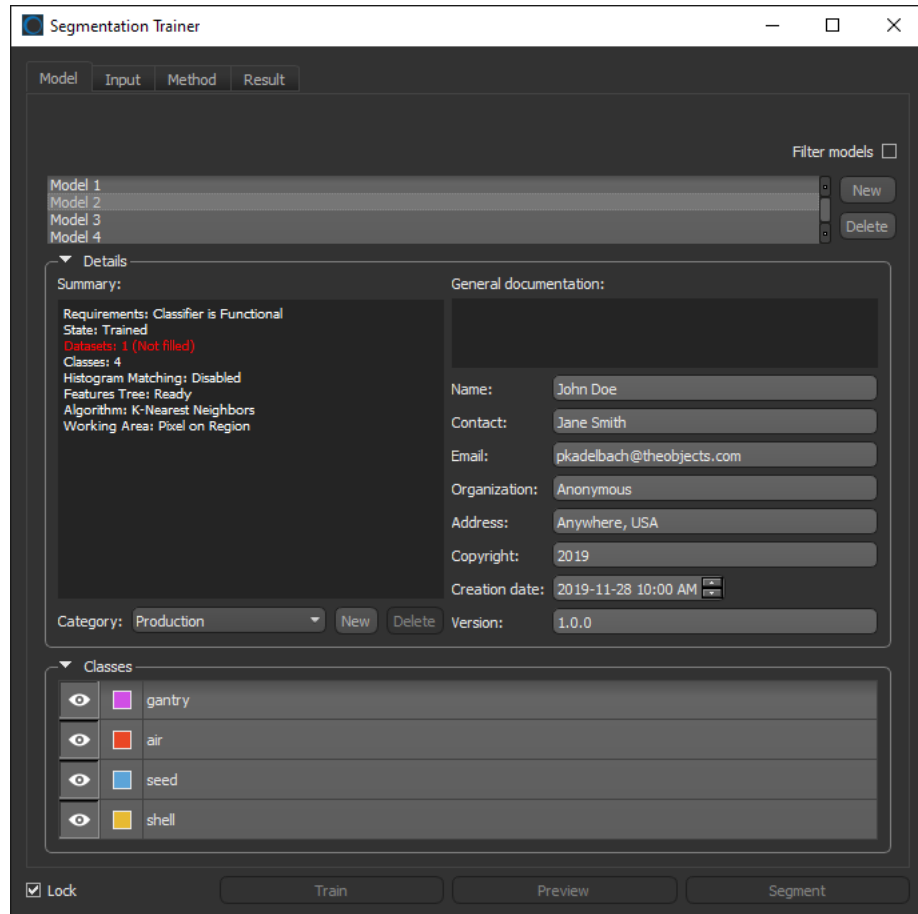


Improvements for Machine Learning Segmentation

The Machine Learning Segmentation Tool, which provides classical machine learning segmentation of multi-dimensional images and was previously referred to as the Segmentation Trainer, was reformatted for this software release to mirror the look and feel of Dragonfly's Deep Learning Tool.

Choose **Artificial Intelligence > Machine Learning Segmentation** on the menu bar to open the Machine Learning Segmentation dialog, shown below.

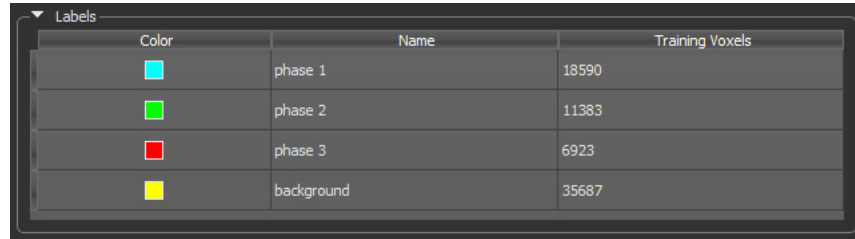
Machine Learning Segmentation dialog



Changes implemented for machine learning segmentation include the following:

- Some items were re-distributed on the Model, Input, Method, and Results tabs.
- Class definitions, including name, color, and visibility, are available on the Model Overview panel.

- The number of training voxels that intersect with the applied mask is indicated on the **Input** panel, as shown below.



Color	Name	Training Voxels
■	phase 1	18590
■	phase 2	11383
■	phase 3	6923
■	background	35687

- Output targets are now multi-ROIs, not ROIs.



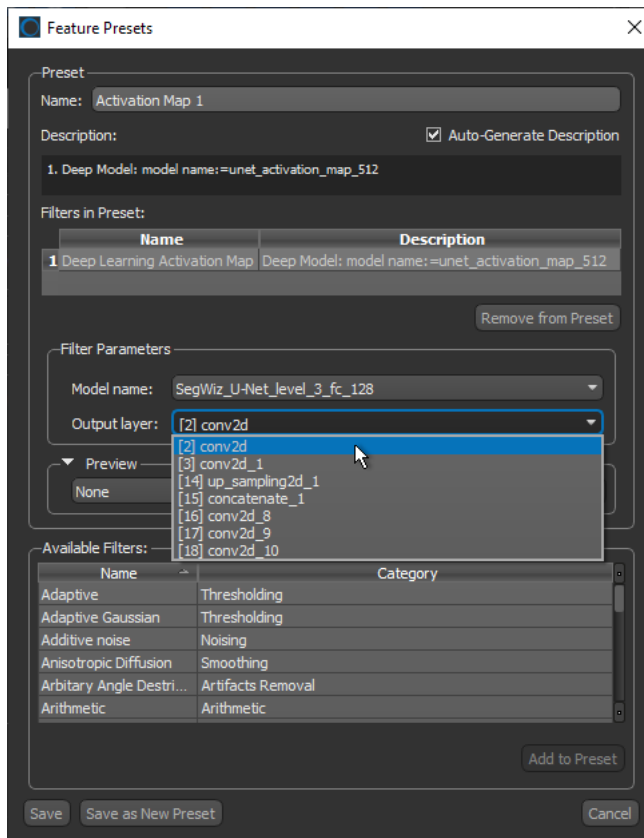
NOTE Refer to the topic [New Options for Multi-ROIs](#) on page 27 for information about creating and labeling classes directly in multi-ROIs and other options.

Edit Deep Model Filters

Additional changes to the Machine Learning Segmentation Tool include the option to edit deep model filters, such as activation maps.

Right-click a Deep Model filter in the Features tree on the **Method** tab and then choose **Edit** in the pop-up menu to open the Feature Preset dialog, shown on the following page. You can then edit the filter parameters.

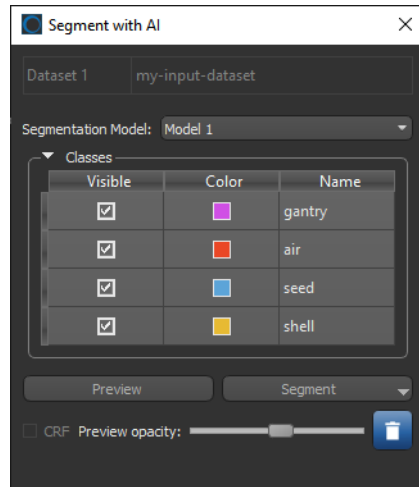
Feature Presets dialog



Automated Segmentations

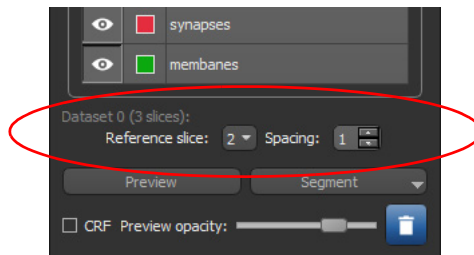
A number of updates for automated segmentations are available in this software release in the **Segment with AI** feature. The updated panel, which replaces the one previously available as Segment with Classifier, is available on the **Segment** tab on the left sidebar by default.

Segment with AI panel

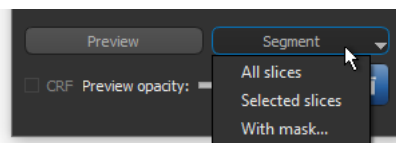


The changes implemented for segmenting image data with the Segment with AI feature are summarized below.

- Models are sorted by class count and are no longer separated between deep models and machine learning classifiers.
- You can view the name and associated color of each class in a selected model, as well as set visibility for previews, in the **Classes** box.
- Regression models have been removed. You should note that these models are available in the Comprehensive filters for image processing.
- For 3D models, you can choose the reference slice and spacing for applying previews and segmenting the selected data. These options are available as shown below.



- The option to segment all slices or selected slices, as well as to apply the model within a mask are now available, as shown below.

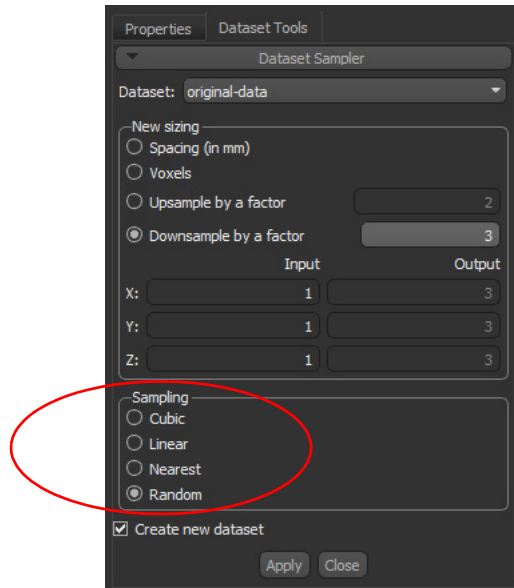


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Dataset Sampler

As an added option for modifying data, you can now downsample and upsample by a random factor. Right-click the data you need to modify and then choose **Modify and Transform > Sample** in the pop-up menu to open the Dataset Sampler panel.

Dataset Sampler panel



Export Histogram Data in CSV

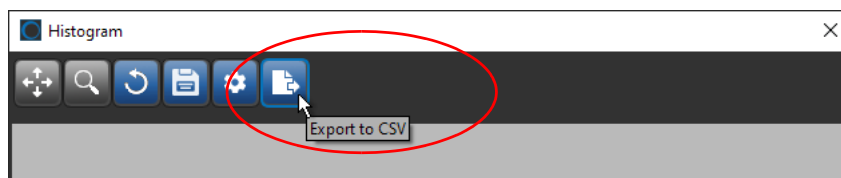
This software release provides the opportunity to export histogram data in the comma-separated values (*.csv extension) file format for further analysis or archiving.

This option is available for histograms computed from:

- Image data and regions of interest and in the Compare Histograms dialog.
- The Object Analysis dialog, when in histogram view. For example, the histogram of Phi versus Theta.
- The Histogrammic Segmentation dialog. For example, image data versus the Sobel 3D of the image data.
- The Slice Analysis panel.

Click the **Export to CSV** button, as shown below, from any of the above to export histogram data in the CSV file format.

Export to CSV option for histograms



Changes for Annotations

The changes described below are available for annotations, such as rulers, angles, and regions, in the Dragonfly 2020.1 software release.

Constrain Ellipse Tool

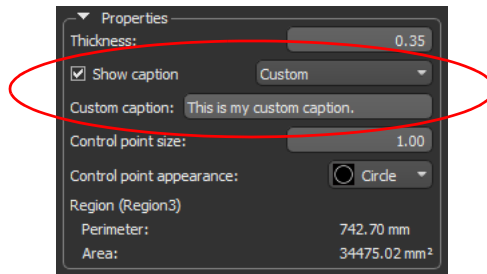
You can now constrain the **Ellipse** tool to a circle by configuring a keyboard shortcut for the action '**Constrain ellipse to be round**'.

Custom Captions

In this software version, you can add custom captions to rulers, angles, and other annotations. Custom captions are available in the Properties box on the Data Properties and Settings panel for selected annotations.

To create a custom caption, choose **Custom** in the Caption drop-down menu and then enter a caption in the **Custom caption** edit box.

Annotation properties



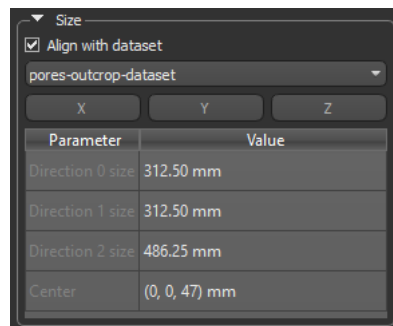
Additional Options for Shapes

The following options are now available for Shapes in this software release.

Selectable Sizes and Orientation

The software release adds the options to automatically align boxes, capsules, cylinders, and spheres with a selected dataset, as well as to set the dimensions of a shape. These options are available on the Data Properties and Settings panel for selected shapes, as shown below.

Size panel

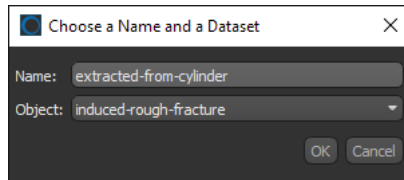


Extract Structured Grids

The option to extracted structured grids from a dataset is now available for capsules, cylinders, and spheres. This feature was previously limited to boxes.

Right-click the required shape in the Data Properties and Settings panel and then choose **Extract Structured Grid** in the pop-up menu to open the **Choose a Name and a Dataset** dialog, shown below. You can then enter a name for the extracted structured grid and the object from which the intersecting data values will be extracted.

Choose a Name and a Dataset dialog

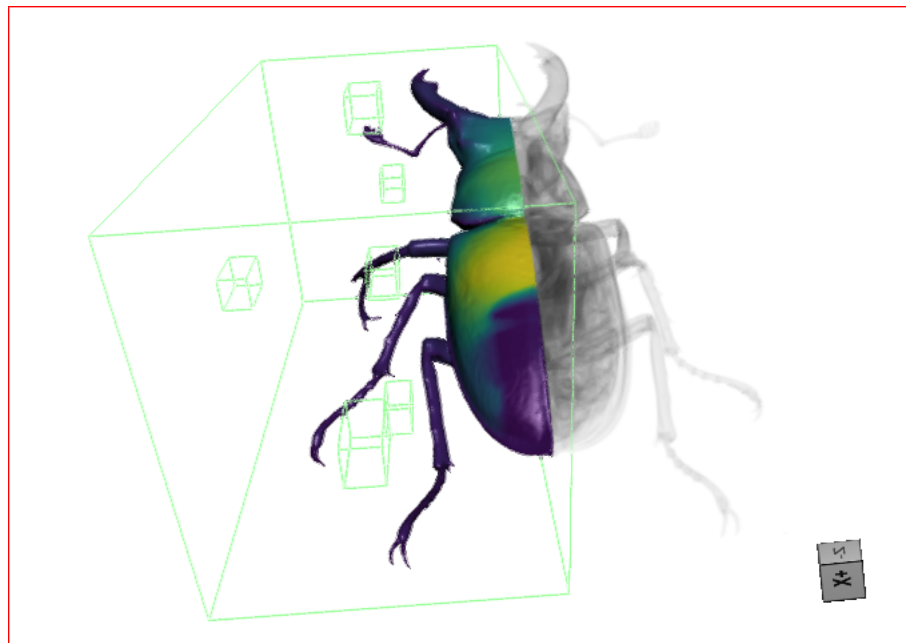


Application of 3D Visual Effects

For single shapes, such as a box or visual plane, you can now set applied 3D visual effects to the inside or outside of different objects. This can be particularly useful when creating animated sequences with Dragonfly's Movie Maker.

In the example below, clipping was applied to the inside of a box for a thickness mesh and to the outside of the same box for the corresponding image data.

Clip applied inside and outside of multiple objects



Scene's Views Properties Panel

A number of new items and additional changes were implemented for the Scene's Views Properties panel to accommodate the advanced capabilities of the new rendering engine for Dragonfly 2020.1. These changes are itemized in the topic [Scene's Views Properties](#) on page 11.

3D Settings

A number of new options are available for adjusting the visualization of image data and other objects in the 3D settings box on the Data Properties and Settings panel when using the new rendering engine for Dragonfly 2020.1. These changes are itemized in the topic [3D Settings Panel](#) on page 13.

Updates for the Organizer

A set of new preferences and pop-up menu items are available for the Organizer in this software release. In addition, an updated progress bar now shows the progress of file downloads.

Organizer Preferences

The following preferences are available for the Organizer.

Start the Organizer automatically... If selected, the Organizer will appear automatically onscreen whenever you start Dragonfly.

Synchronize object names with Properties list... If selected, object names will be synchronized between the Organizer and the Properties list.

Pop-Up Menu Items

The following contextual menu item is available for objects selected in the Organizer:

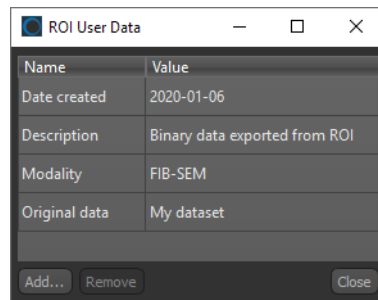
Show File in New File Browser... Opens your file browser at that location of the selected item.

Managing User Data

Previous Dragonfly releases offered the option to add descriptions to selected objects, such as image data, regions of interest, meshes, and so on. This software release provides the additional option to add any number of field names and associated values to an object description.

Right-click an item in the Data Properties and Settings panel and then choose **Manage User Data** in the pop-up menu to open the **User Data** dialog, shown below.

User Data dialog



NOTE Object descriptions entered in previous Dragonfly versions will be migrated automatically to the new dialog. The 'Manage User Data' item was previously named 'Edit Object Description'.

Licensing for Optional Features

You should note that commercial users will require a separate license for each optional feature that is available for Dragonfly 2020.1. These features include the following:

- **Deep Learning...** Includes the **Deep Learning Tool**, with which you can train deep models for image segmentation and regression tasks. Also included with this feature is the **Segmentation Wizard**, which provides an easy-to-use, guided workflow for implementing deep learning and classical machine learning segmentation of multi-dimensional images (see [Segmentation Wizard](#) on page 15).

You should note that additional features, such as **Segment with AI**, will be limited to classical machine learning models without a license for Deep Learning.

- **Auto Process...** Enables real-time processing of serial section 2D stack experiments. You should note that Auto Process is now a standard feature for **Dragonfly Pro**.
- **Bone Analysis...** This feature is designed for the evaluation of high-resolution micro-CT image data of bone specimens (see [Bone Analysis Wizard](#) on page 18).
- **Hyperspectral Image Analysis...** Facilitates the interactive visualization, manipulation, and analysis of hyperspectral images.
- **Image Stitcher...** Lets you precisely combine, or *stitch*, overlapping 2D or 3D image tiles to create a single high-resolution image that is beyond the normal resolution of a microscope's field of view.
- **Organizer...** Provides an easy way to organize, manage, and share data and analysis results.

- **Plug Analysis...** This new feature for Dragonfly provides a dedicated workflow for analyzing core plugs acquired from rock samples and other porous media (see [Plug Analysis Wizard](#) on page 22).

NOTE The optional features listed above for Dragonfly 2020.1, except for **Plug Analysis**, are bundled with non-commercial licenses and do not require any additional activation keys.

Academic Licensing Requests

You should note that starting with version 2020.1, academic licensing requests can be made directly from Dragonfly.

Choose **Help > Request Non-Commercial License** on the menu bar to open the Request Non-Commercial License dialog, shown below.

Request Non-Commercial License dialog

NOTE You must provide your credentials and a photo of the ID issued by your institution, as well as complete the online survey, to request a non-commercial license.

Proxy Server Settings for License Activations

In most cases, systems must be connected to the Internet to activate a Dragonfly license. If the Internet connection at your facility runs through a proxy, you can now configure a proxy server in the **Proxy Configuration** dialog, shown below, whenever you activate a Dragonfly license.

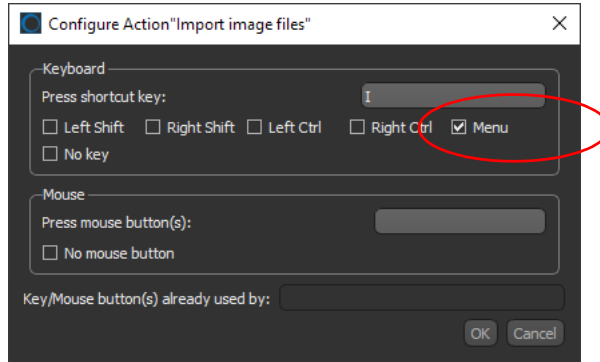
To open the Proxy Configuration dialog, click the **Configure Proxy** button, shown below, in the **Activate Product** dialog.

Proxy Configuration dialog

Mapping for Configured Actions

You can now include the **Menu** key when you configure a shortcut for a configured action. This new option is circled on the screen capture of the **Configure Action** dialog and is shown below.

Configure Action dialog



Developer Documentation

The developer documentation for Dragonfly has been updated for version 2020.1. Choose **Developer > Developer Documentation** on the menu bar to open the documentation system.

Menu Bar Changes

The following changes and new items for the refactored menu bar are implemented for Dragonfly 2020.1.

File Menu

The new items listed below are available for the **File** menu. Other changes are also noted.

File menu changes

	Description
Import Graph from CSV*	Lets you import a graph that was saved in the comma-separated values (*.csv extension) file format.
User Profile	Opens the User Profile dialog, in which you can enter your name and contact information, as well as add a copyright notice. NOTE Was originally available in the Help menu.

* New for version 2020.1.

Workflows Menu

This new menu contains items originally available in the Tools menu, as well as a number of new items.

Workflows menu

	Description
Image Filtering	Opens the Image Filtering module, in which you can process images using standard image filters, deep learning models, and arithmetic operations.
Active Contour	Opens the Active Contour module, in which you can quickly and efficiently perform segmentation tasks using the active contour model.
Histogrammic Segmentation	Open the Histogrammic Segmentation module, in which you can quickly segment image data by selecting clustered data values.
Hyperspectral Image Analysis	Opens the HyperChannels panel on the left sidebar. This module facilitates the interactive visualization, manipulation, and analysis of hyperspectral images.
Pore Network Modeling	Opens the Pore Network Modeling module, which provides a ready-made framework for performing a wide range of pore network simulations.
Plug Analysis*	Opens the Plug Analysis wizard, which provides a dedicated workflow for analyzing core plugs acquired from rock samples and other porous media (see Plug Analysis Wizard on page 22).
CT Reconstruction*	Opens the CT Reconstruction module, which provides tomographic reconstruction of cone-beam and parallel-beam acquisitions (see CT Reconstruction Module on page 25).
MC X-Ray Simulator*	Opens the MC X-Ray module, which can simulate electron scattering in materials in order to correlate X-Ray emission to composition in quantitative X-ray microanalysis (see MC X-Ray on page 26).

* New for version 2020.1.

Artificial Intelligence Menu

This new menu contains items originally available in the Tools menu, as well as a number of new items.

Artificial Intelligence menu

	Description
Machine Learning Segmentation	Opens the Machine Learning Segmentation Tool , which is an advanced machine learning plug-in for image segmentation. NOTE Was previously named 'Segmentation Trainer'.
Deep Learning Model Evaluation Tool	Opens the Model Evaluation dialog, in which you can compare the results of different deep models with selected metrics.
Deep Learning Tool	Opens the Deep Learning Tool , with which you can train deep models for image segmentation and regression tasks.

Utilities Menu

This new menu contains items originally available in the Tools menu, as well as a number of new items.

Utilities menu

	Description
Auto Process Stack	Opens the Auto Process Stack panel on the right sidebar, which enables real-time automatic processing of serial section 2D stack experiments.
Macro Builder	Opens the Macro Builder , which provides an intuitive, visual way to build and edit complex macros or to combine multiple macros for batching.
Macro Player	Opens the Macro Player , in which you can record and play macros.
Screen Recorder	Opens the Screen Recorder dialog, which lets you start recording your full screen while working with Dragonfly.
Camera Position Bookmarker	Opens the Camera Position Bookmarker , in which you can bookmark and apply camera positions.
Opacity Console	Opens the Opacity Setting dialog, in which you adjust the opacity of multiple objects.
Action Log Viewer	Opens the Action Log Viewer console, in which you view all the actions that were performed during the current session.
Python Console	Opens the Python console, which provides a quick way to execute commands and explore possibilities that can be pasted into larger scripts.
Report Generator*	Opens the Report Generator panel on the left sidebar, in which you can generate a report from saved XML data.
Execute DOS Command	Opens the Command dialog, in which you can enter common DOS commands.
Start Command Prompt	Opens the Command Prompt window, which lets you access the Python environment from Dragonfly.
Start Command Prompt (as Administrator)	Opens the Command Prompt window in Administrator mode.
Open All Users Folder in File Browser	Automatically opens the Dragonfly directory with the Python All Users Extensions folder in your installed file manager.
Open Current Users Folder in File Browser	Automatically opens the Dragonfly directory with the Python Users Extensions folder in your installed file manager.
Infinite Toolbox	Opens Dragonfly's Infinite Toolbox , in which you can submit, browse, and download extensions that implement new features and workflows.
Open Plugins	Lets you directly access plug-ins from a drop-down menu.

	Description
Structured Grids Comparator*	Opens the Structured Grids Comparator dialog, in which you can evaluate the quality of processed image data, regions of interest, or multi-ROIs (see Structured Grids Comparator on page 40).
Graph Shortest Path*	Opens the Graph Shortest Path dialog, in which you can compute the shortest distance between two selected nodes on a graph and then extract additional scalar values within that interval (see Computing Shortest Distances on Graphs on page 33).

* New for version 2020.1.

Developer Menu

The new items listed below are available for the **Developer** menu. Other changes are also noted.

Developer menu changes

	Description
Developer Documentation	Opens the Dragonfly technical documentation package for developers. NOTE Was moved from the Help menu.
Widget Observer	Opens the Widget Observer panel, from which you can examine the properties of the parents and childs of a selected widget (see Widget Observer on page 45).
Deep Model Architecture Generator	Opens the Deep Model Architecture Generator dialog, in which you can create the architecture for a new deep model.
File Loader Generator	Opens the File Loader Generator dialog, with which you can create a new file load option.

Help Menu

The new items listed below are available for the **Help** menu.

Help menu additions

	Description
Request Non-Commercial License	Opens the Request a Non-Commercial License dialog, in which you can request a non-commercial license (see Academic Licensing Requests on page 61).

Changes to Contextual Menus

The following changes and new items for the contextual menus are implemented for Dragonfly 2020.1.

Data Properties and Settings Panel

The following contextual menu items are now available for selected image data, annotations, regions of interest, multi-ROIs, meshes, shapes, vector fields, and graphs on the Data Properties and Settings panel.

Dataset Pop-Up Menu

A number of new items, listed below, are available for the **Dataset** pop-up menu. Other changes, such as deprecated items, are also listed.

Dataset pop-up menu changes

	Description
Edit Object Description	Item deprecated. Replaced with 'Manage User Data'.
Export as DICOM	Provides the option to export images in the DICOM format (see Export Images as DICOM on page 43).
Segment with AI	Replaces the item 'Segment with Classifier' (see Automated Segmentations on page 55).
Manage User Data	Opens the User Data dialog, in which you can add metadata to the selected item (see Managing User Data on page 60).
Create Mask	Lets you quickly create an ROI mask with the same shape as the selected image data and that is fully labeled within the selected dimension and increment. (see Creating Image Masks on page 42).
Find Path ROI Between ROIs	Automatically computes the path linking two regions of interest (see Find Path Between ROIs on page 39).
Bone Analysis Wizard	Opens the Bone Analysis Wizard , which is designed for the evaluation of high-resolution micro-CT image data of bone specimens (see Bone Analysis Wizard on page 18).
Plug Analysis Wizard	Opens the Plug Analysis Wizard , which provides a dedicated workflow for analyzing core plugs acquired from rock samples and other porous media (see Plug Analysis Wizard on page 22).
Segmentation Wizard	Opens the Segmentation Wizard , which provides an easy-to-use, guided workflow for implementing powerful deep learning and classical machine learning segmentation of multi-dimensional images (see Segmentation Wizard on page 15).
Open Processed Image Comparator	Opens the Processing Image Comparator dialog, in which you can compare processed images with a ground truth using selected metrics (see Structured Grids Comparator on page 40). NOTE This option is available for multiple selections only.

Annotation Pop-Up Menu

A number of new items, listed below, are available for the **Annotation** pop-up menu. Other changes are also noted.

Annotation pop-up menu changes

	Description
Edit Object Description	Item deprecated. Replaced with 'Manage User Data'.
Manage User Data	Opens the User Data dialog, in which you can add metadata to the selected item (see Managing User Data on page 60).
Align Current View Normal*	Automatically aligns the normal of the current view with the selected ruler.

* Available only for rulers.

ROI Pop-Up Menu

A number of new items, listed below, are available for the **Region of Interest** pop-up menu. Other changes are also noted.

ROI pop-up menu changes

	Description
Edit Object Description	Item deprecated. Replaced with 'Manage User Data'.
Create Dense Multi-ROI from ROIs	Creates a new multi-ROI, in which the labeled voxels of each selected ROI is assigned to a class and all unlabeled, or 'complementary' voxels, are labeled as an additional class (see Creating Dense Multi-ROIs from ROIs on page 29).
Manage User Data	Opens the User Data dialog, in which you can add metadata to the selected item (see Managing User Data on page 60).
Get Euler Characteristic Number	Automatically computes the Euler Characteristic number of the selected ROI (see Euler Characteristic Number on page 39).
Open Segmentation Comparator	Opens the Segmentation Comparator dialog, in which you can compare regions of interest with a ground truth using selected metrics (see Structured Grids Comparator on page 40). NOTE This option is available for multiple selections only.

Multi-ROI Pop-Up Menu

A number of new items, listed below, are available for the **Multi-ROI** pop-up menu. Other changes are also noted.

Multi-ROI pop-up menu changes

	Description
Edit Object Description	Item deprecated. Replaced with 'Manage User Data'.
Create Dense Multi-ROI	Creates a new multi-ROI, in which all unlabeled, or 'complementary' voxels, are labeled and assigned to a new class (see Creating Dense Multi-ROIs from Multi-ROIs on page 30).
Compute Watershed 2D	Lets you perform a Watershed segmentation on a single slice of a multi-ROI (see 2D Watershed on page 30).
Manage User Data	Opens the User Data dialog, in which you can add metadata to the selected item (see Managing User Data on page 60).
Create Images from Scalars	Automatically creates an image for each scalar value checked in the Select Desired Scalars dialog (see Creating Images from Selected Scalars on page 30).
Fill Multi-ROI with New Class	Adds a new class to the multi-ROI in which all unlabeled voxels are labeled.
Create Cubic Mesh	Item deprecated. Options to create meshes from multi-ROIs are available on the Segment tab on the left sidebar.
Open Segmentation Comparator	Opens the Segmentation Comparator dialog, in which you can compare multi-ROIs with a ground truth using selected metrics (see Structured Grids Comparator on page 40). NOTE This option is available for multiple selections only.

Mesh Pop-Up Menu

A number of new contextual items, listed below, are available for meshes. Other changes are also noted.

Mesh pop-up menu changes

	Description
Export Mesh to File with Colors	Lets you export scalar meshes in the VRML (*.wrl extension) file format with vertex colors preserved.
Edit Object Description	Item deprecated. Replaced with 'Manage User Data'.
Manage User Data	Opens the User Data dialog, in which you can add metadata to the selected item (see Managing User Data on page 60).
Align Axis of Inertia	Lets you automatically align the axis of inertia of the current mesh with the axis of inertia of another mesh.
Add Vertex Normal Angle from Z Axis Scalar Value	Automatically computes and adds normal angles from the Z-axis (see Scalar Values for Meshes on page 36).
Apply Translation to Scalar Values	Lets you apply a linear transformation, with or without an offset, to the values of the selected scalar type.
Compute Gaussian Curvature	Automatically computes and adds scalar values of curvature calculated with the Gaussian method (see Scalar Values for Meshes on page 36).
Compute Mean Curvature	Automatically computes and adds scalar values of curvature calculated with the Mean method (see Scalar Values for Meshes on page 36).
Create Vertex Scalar Distance from Mean Points	Automatically computes and adds scalar values of distances calculated from the mean position of a series of points. NOTE You must first create a points series with the Point tool to enable this item.

Shape Pop-Up Menu

A number of new items, listed below, are available for the **Shape** pop-up menu. Other changes are also noted.

Pop-up menu changes for shapes

	Description
Edit Object Description	Item deprecated. Replaced with 'Manage User Data'.
Manage User Data	Opens the User Data dialog, in which you can add metadata to the selected item (see Managing User Data on page 60).
Remove from Structured Grid	This item does one of the following: <ul style="list-style-type: none"> Removes all labeled voxels in the selected region of interest or multi-ROI that intersect with the voxels contained in the subvolume defined by the current shape(s). Overwrites all voxels in the selected image data that intersect with the voxels contained in the subvolume defined by the current shape(s). New values will be '0'. NOTE This item was previously available only for regions of interest.

Vector Field Pop-Up Menu

A number of new items, listed below, are available for the **Vector Field** pop-up menu. Other changes are also noted.

Pop-up menu changes for vector fields

	Description
Edit Object Description	Item deprecated. Replaced with 'Manage User Data'.
Manage User Data	Opens the User Data dialog, in which you can add multiple attributes to the selected data (see Managing User Data on page 60).
Delete Selected Scalar Values	Lets you delete selected measurements. You can select multiple scalar value slots when deleting scalar information.
Import Scalar Values from CSV File	Lets you import scalar values contained in a comma-separated values (*.csv extension) file. Scalar values can imported from either an ORS-formatted CSV file, in which case all slots will be imported, or you can import scalar slots one-by-one from a generic CSV file that contains the required IDs and corresponding values.
Map Scalar Values From	Lets you map vertex scalar values contained within another object to the selected vector field.
Add a Constant Vertex Measurement	Lets you add a constant vertex measurement to the selected vector field.
Apply Translation to Scalar Values	Lets you apply a linear transformation, with or without an offset, to the values of the selected scalar type.
Export Data to CSV File	Lets you export vector fields in the selected comma-separated values (*.csv extension) file format.

Graph Pop-Up Menu

A number of new items, listed below, are available for the **Graph** pop-up menu. Other changes are also noted.

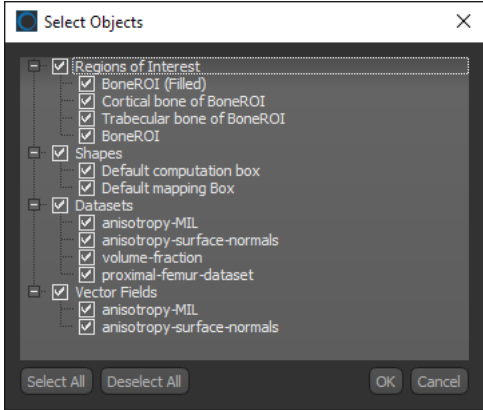
Pop-up menu changes for graphs

	Description
Edit Object Description	Item deprecated. Replaced with 'Manage User Data'.
Manage User Data	Opens the User Data dialog, in which you can add multiple attributes to the selected data (see Managing User Data on page 60).
Plot Graph Tortuosity	Lets you plot the tortuosity within a graph of porous media (see Plotting Tortuosity on page 32).
Plot Graph Throat Weighted Tortuosity	Lets you plot the throat-weighted tortuosity within a graph of porous media (see Plotting Throat-Weighted Tortuosity on page 33).
Copy in an ROI as Sphere and Cylinder	Lets you copy a graph into a region of interest as labeled spheres and cylinders, with either a fixed radius or radii computed from a selected scalar slot.
Apply Translation to Scalar Values	Lets you apply a linear transformation, with or without an offset, to the values of the selected scalar type.
Create Vertex Scalar Distance from Mean Points	Automatically computes and adds scalar values of distances calculated from the mean position of a series of points. NOTE You must first create a points series with the Point tool to enable this item.
Get Euler Characteristic Number	Automatically computes the Euler Characteristic number of the selected graph (see Euler Characteristic Number on page 39).
Create Euclidean Length Scalar Values	Automatically adds measurements of Euclidean length to the edge scalar values.

Context Group Pop-Up Menu

This new contextual menu is available for the context groups created when working with the Segmentation, Bone Analysis, and Plug Analysis wizards.

Pop-up menu for context groups

	Description
Export	Lets you export the selected context group in the ORS Object file format (*.ORSObject extension).
Extract Objects from Context Group	Lets you extract selected objects from the context group. The objects included in the context group can be selected in the Select Objects dialog, shown below. 
Execute Macro	Provides a shortcut for selecting macros that can be executed for the context.
Manage User Data	Opens the User Data dialog, in which you can add multiple attributes to the selected context (see Managing User Data on page 60).
Reopen...	Lets you reopen the selected context and continue your workflow.

Views Pop-Up Menus

A number of new options are available for the 2D and 3D views pop-up menus.

Views pop-up menu changes

	Description
Orthogonalize Other 2D Views*	Automatically resets all other 2D views in the current scene to be orthogonal to the current scene view. For example, after you have created an oblique or double-oblique view.
Export Screenshot of View	Lets you export a screenshot of the current view — including its scale bar, legend, annotations, overlays, and other objects that are visible onscreen — to a number of standard image file formats. NOTE A no background option is available for exporting screenshots of 3D views (see Export Screenshots with Transparent Backgrounds on page 44).

* Available for 2D views only.

Preferences Changes

A number of new items, listed below, and other changes have been implemented for the setting the application preferences. You should note that a new set of preferences for the Organizer have also been added to the Preferences dialog.

Click **Preferences** on the Status bar or choose **File > Preferences** on the Menu bar to open the Preferences dialog.

Views Preferences

Changes for the **Views** preferences are indicated in the following table.

Views preferences changes

	Description
Colors	
Virtual floor	Lets you choose a color for the virtual floor option for 3D views (see Scene's Views Properties on page 11).
Fonts	
User interface font size	Lets you choose a font size, in points, for interface elements such as panels, dialogs, and other controls.
3D Settings	
Use new rendering engine	Lets you enable Dragonfly's new rendering engine (see Enabling the New Engine and Setting Defaults on page 10).
Default preset	Lets you set a default preset for 3D views whenever the new rendering engine is enabled.
Gamma correction	Lets you set a default Gamma correction for 3D views whenever the new rendering engine is enabled.
Interactivity	Lets you set a default Interactivity setting for 3D views whenever the new rendering engine is enabled.
Break during motion	Lets you set a short delay or interval before the requested quality is applied. This can avoid unnecessary delays when making multiple changes to 3D views, such as rotation, pans, window leveling, and so on.

Configurable Actions

New items for the **Configurable Actions** preferences are indicated in the following table.

Configurable Actions changes

	Description
Center MPR 2D views from 3D pick	Lets you automatically update the slice position of all MPR views in the scene to where you clicked in the 3D view.
Constrain ellipse to be round	Constrain the Ellipse tool to a circle.
Open the Widget Observer	Opens the Widget Observer panel on the right sidebar (see Widget Observer on page 45).
Start Widget Observer (graph) on widget at cursor	Opens the Graph Observer and displays the properties of the selected instance of class. For example, 'OrsPythonPlugins.OrsBasicManipulate.mainform.mainform'.
Start Widget Observer (single widget) on widget at cursor	Opens the Widget Observer and displays the properties of the selected instance of class. For example, 'OrsPythonPlugins.OrsBasicManipulate.mainform.mainform'.

Miscellaneous

Changes for the **Miscellaneous** preferences are indicated in the following table.

Miscellaneous preferences changes

	Description
GPU card for Deep Learning	Lets you designate a specific GPU for deep learning (see Selectable GPU for Deep Learning on page 51).

Organizer

The new set of preferences for the **Organizer** is available in the 2020.1 software release.

Organizer preferences

	Description
Start the Organizer automatically	If selected, the Organizer will appear automatically onscreen whenever you start Dragonfly.
Synchronize object names with Properties list	If selected, object names edited in the Data Properties and Settings panel will be updated automatically in the Organizer and vice-versa.

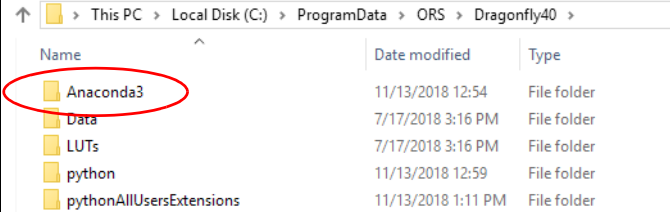
System Requirements

This release supports the base system requirements.

Changes to the System Requirements

Changes to the base system requirements are noted below.

System requirements changes

Version	Changes to system requirements
3.0.0	None.
3.1.0	None. NOTE Dragonfly 3.1 includes a new Anaconda distribution for Python. You should note that the current version of Python accessed by Dragonfly will be updated automatically to version 3.6 when you install this new release.
3.5.0	None.
3.6.0	None.
4.0.0	None. NOTE The Anaconda distribution was changed to version 5.2.0 for this software release. You should also note that the current version of Python accessed by Dragonfly will be updated automatically to version 3.6.5 when you install this new release. In addition, the Anaconda distribution will be installed in the ProgramData folder, as shown below, instead of the Program Files directory.  This change was implemented to allow users to update Dragonfly without running in Administrator mode. If you are updating a previous installation, the current Anaconda distribution will be deleted from the Program Files folder.
4.1.0	None.
2020.1	None. NOTE The current version of Python accessed by Dragonfly will be updated automatically to version 3.7.3 when you install this new release.

Extending Dragonfly

Dragonfly's Infinite Toolbox, an open exchange platform for the Dragonfly user community, lets you submit, browse, and download extensions that implement new features and workflows for all of your image processing or analysis needs.

Choose **Utilities > Infinite Toolbox** on the menu bar to open Dragonfly's Infinite Toolbox.

Requesting New Features

Let us know if you have a suggestion for a new feature, or an idea for an improvement to an existing workflow.

Getting Help

Learning Dragonfly

Just by taking a quick look around www.theobjects.com/dragonfly, you'll find some great free resources, such as our latest instructional videos, recorded webinars, and user forums.

Dragonfly Workshops

Our hands-on training workshops are a great way to get up and running quickly. Combining in-depth instruction with class exercises, our product specialists will quickly teach you how to use key Dragonfly features and functions to optimize your image visualization and analysis tasks.

Check for upcoming workshops on our website at:
<http://www.theobjects.com/dragonfly/workshops.html>.

Reporting Issues

Dragonfly includes an integrated reporting module that lets you include comments and other information along with generated DMP and log files whenever you encounter an issue that results in a crash or application freeze.

Send Report to ORS dialog

Please provide as much information as possible to help ORS understand the circumstances under which the problem occurred.

Name:

Email:

Reference (optional):

Details:

OK Cancel

You should note that you can also report an issue at any time by choosing **Help > Report an Issue** on the menu bar.

