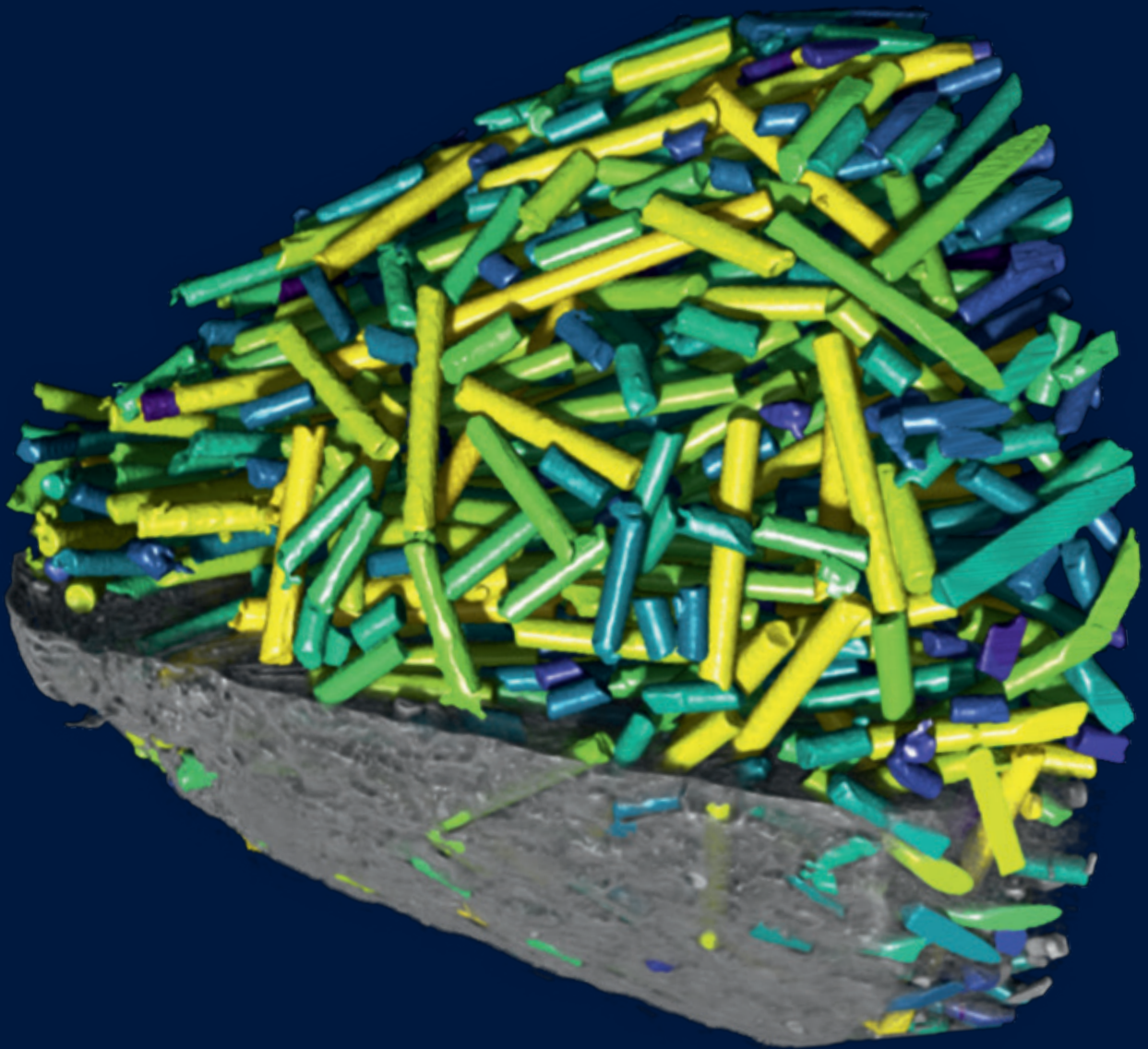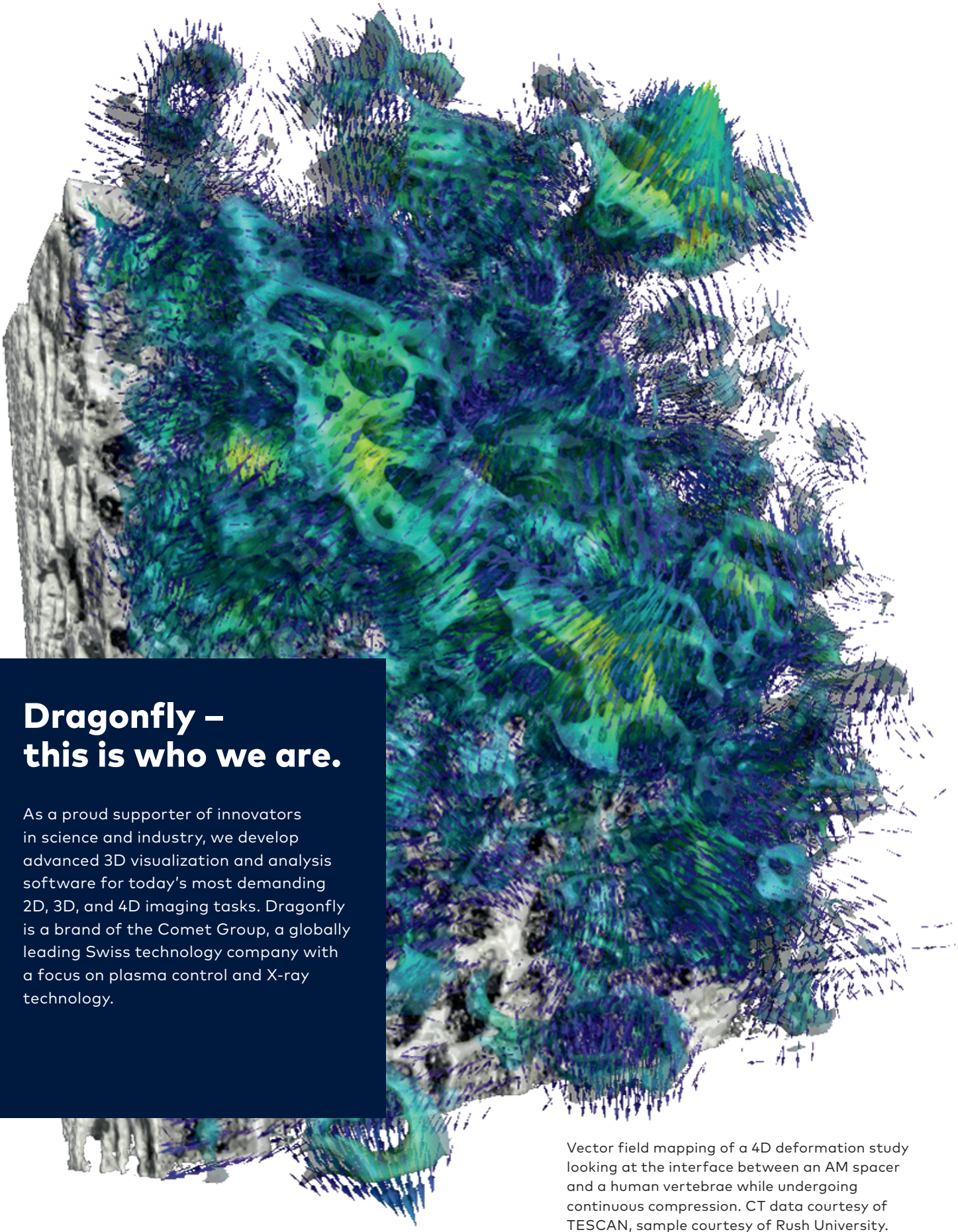# Dragonfly 3D World.

The powerful, flexible, and user-friendly solution for 3D visualization and analysis.

dragonfly

Dragonfly –
this is who we are.

As a proud supporter of innovators in science and industry, we develop advanced 3D visualization and analysis software for today's most demanding 2D, 3D, and 4D imaging tasks. Dragonfly is a brand of the Comet Group, a globally leading Swiss technology company with a focus on plasma control and X-ray technology.
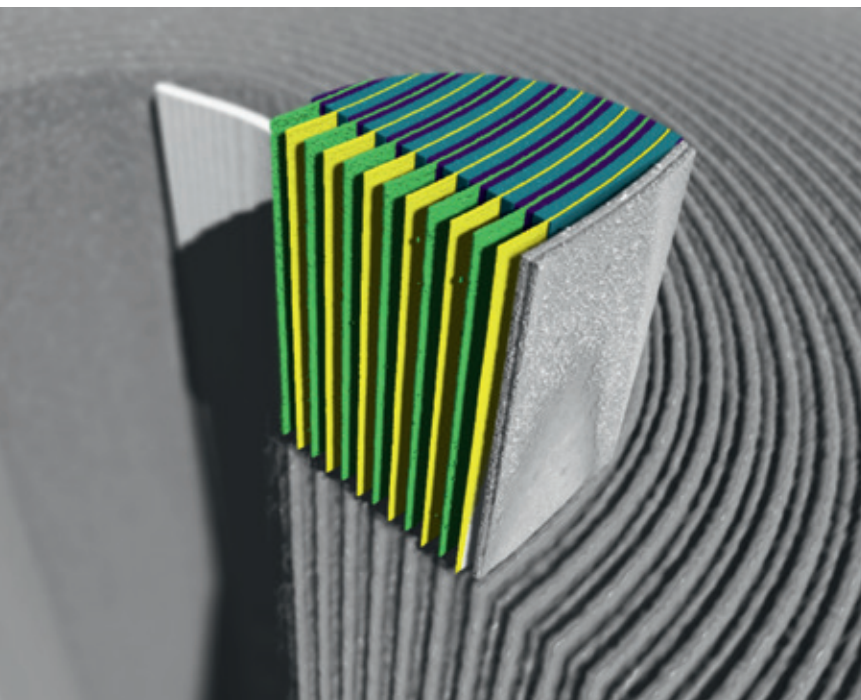
Vector field mapping of a 4D deformation study looking at the interface between an AM spacer and a human vertebrae while undergoing continuous compression. CT data courtesy of TESCAN, sample courtesy of Rush University.

Unlock a world of answers from your 3D images.

From effortless visualization to AI-based segmentation and quantification – Dragonfly 3D World delivers the features you need for quick and meaningful results.

Equipped with an advanced machine learning based segmentation engine, the Dragonfly 3D World user-friendly interface enables scientists and engineers to extract powerful qualitative and quantitative findings from images with ease.

Get quantitative answers for your most demanding 2D, 3D, and 4D imaging studies – including data from correlative and hyperspectral imaging systems, X-ray, SEM, FIB-SEM, confocal microscopy, and many more!

Your benefits with Dragonfly 3D World:

- Easy-to-use, intuitive, and customizable interface
- Import of 2D/3D/4D images, volumetric data, and proprietary data types from multiple sources
- Post-processing functions for data restructuring, filtering, volume and slice registration, image stitching etc.
- Deep-learning based image enhancement and segmentation
- Automation of 3D analysis workflows with macros

Battery anode cathode segmentation.
Data courtesy of ZEISS.

Cover image:
Fiber dataset. Data courtesy of ZEISS.

Driving innovation – for every application.

At Dragonfly, we are scientists at heart. Led by experience and driven by curiosity, our team develops tailored software solutions in close collaboration with the academic community. It's our aim to drive innovation and efficiency across various applications – in research as well as in production environments.

Retina cell segmented with deep learning.
Data courtesy of National Institutes of Health (NIH).

Geoscience.

Industrial mining, oil and gas industry, earth and planetary science.

Extracting meaningful characteristics of rock texture – both fine-grain and macroscopic – is one of the main imaging challenges in geoscience. Dragonfly 3D World is a gamechanger in the field. Its advanced multi-scale, multi-modality segmentation and analysis tools impact both academic research and high-value industry applications. With its user-friendly interface, it is perfectly suited for operators, service labs, and consult-ants in E&P alike.
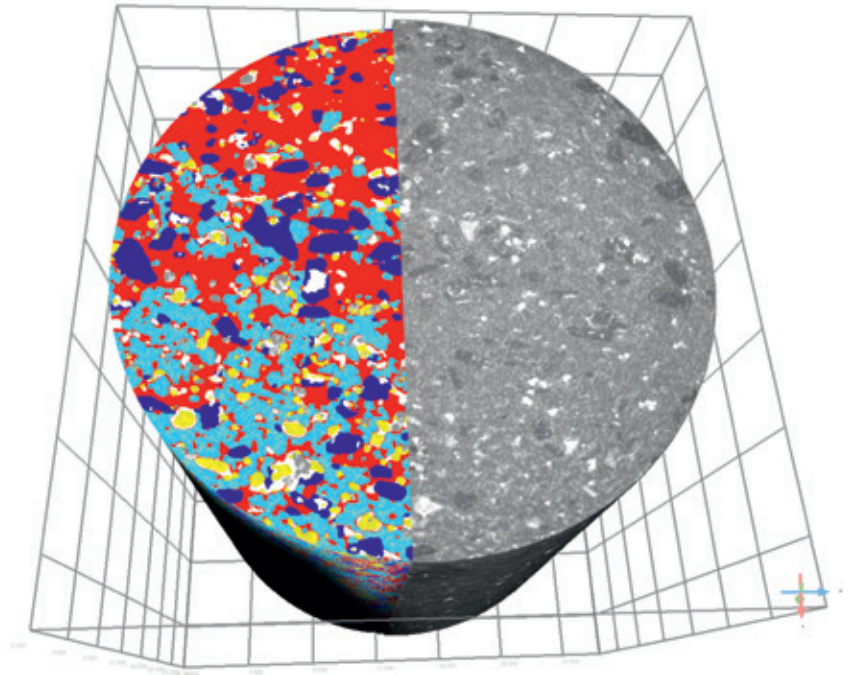
Basaltic andesite core plug segmented with deep learning.
Data courtesy of Tyree X-Ray Facility.
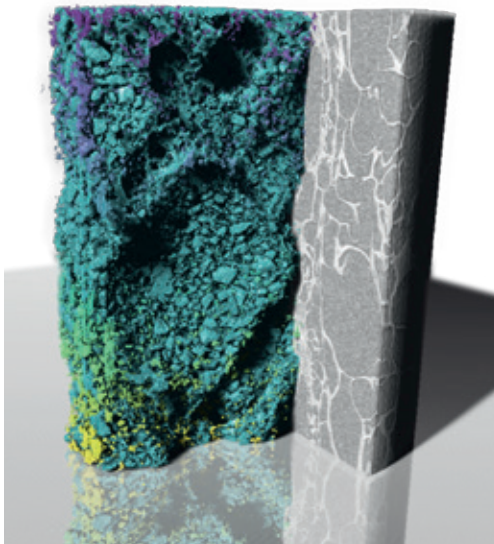
KitKat chocolate bar imaged by laboratory micro-CT.

Food science.

Manufactured foods, agriculture, and produce.

The microstructure of foods significantly affects the consumption experience. Dragonfly 3D World's quantitative and analytical tools enable researchers to link ingredient ratios and distributions along with nuanced textures to key performance indicators such as taste and mouth-feel.

Materials science.

Composites, ceramics, foams, powders, metals, batteries.

Probing the microstructure of advanced and innovative materials is indispensable to next-generation materials. Dragonfly's tools for quantitative measurements and descriptions of key microstructure features help advance scientist's research and production goals. From fiber orientation, porosity dimensions, and electrode thickness to grain size distribution – Dragonfly delivers powerful insights into a wide range of materials.
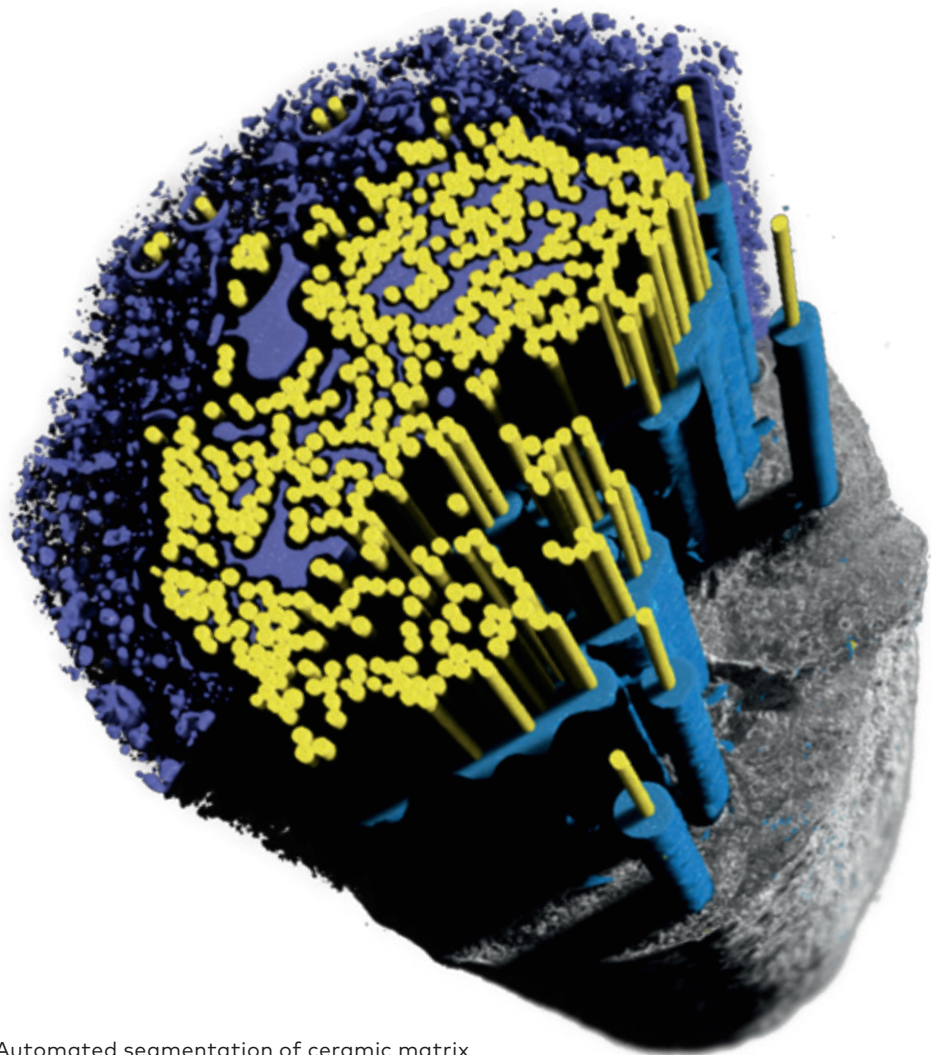
Automated segmentation of ceramic matrix composite with deep learning.
Data courtesy of University of Colorado.
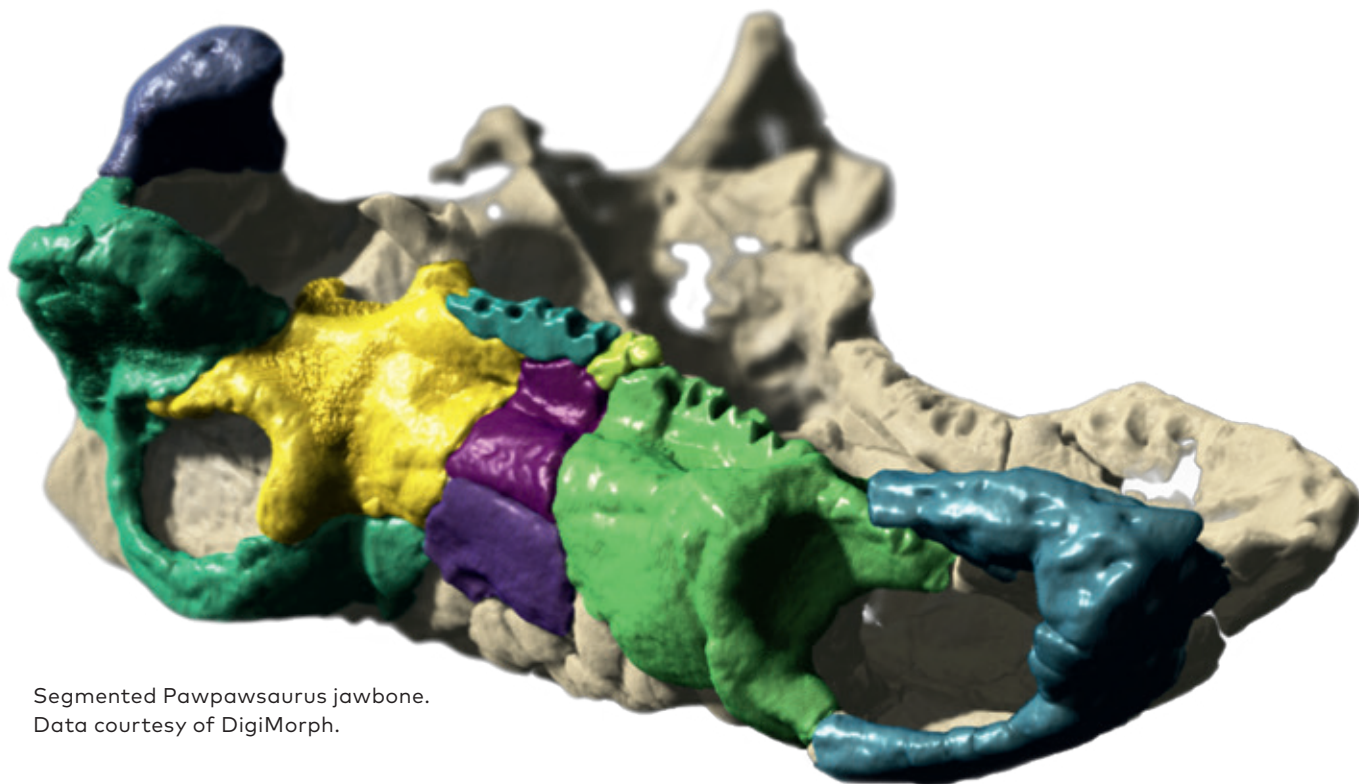
Segmented Pawpawsaurus jawbone.
Data courtesy of DigiMorph.

Museum collections.

Paleontology and natural history, anthropology, and cultural heritage.

Revealing the ins and outs of precious collection samples makes non-contact/non-destructive examinations of paramount importance to museum imaging programs. Dragonfly 3D World's user-friendly and powerful tools produce stunning visual and quantitative takeaways from studied specimens. The AI-based image processing of X-ray CT images is especially effective in highlighting the nuanced textures in highly delicate or poorly preserved objects.

Gothic prayer bead.
Data courtesy of
University of Western Ontario.
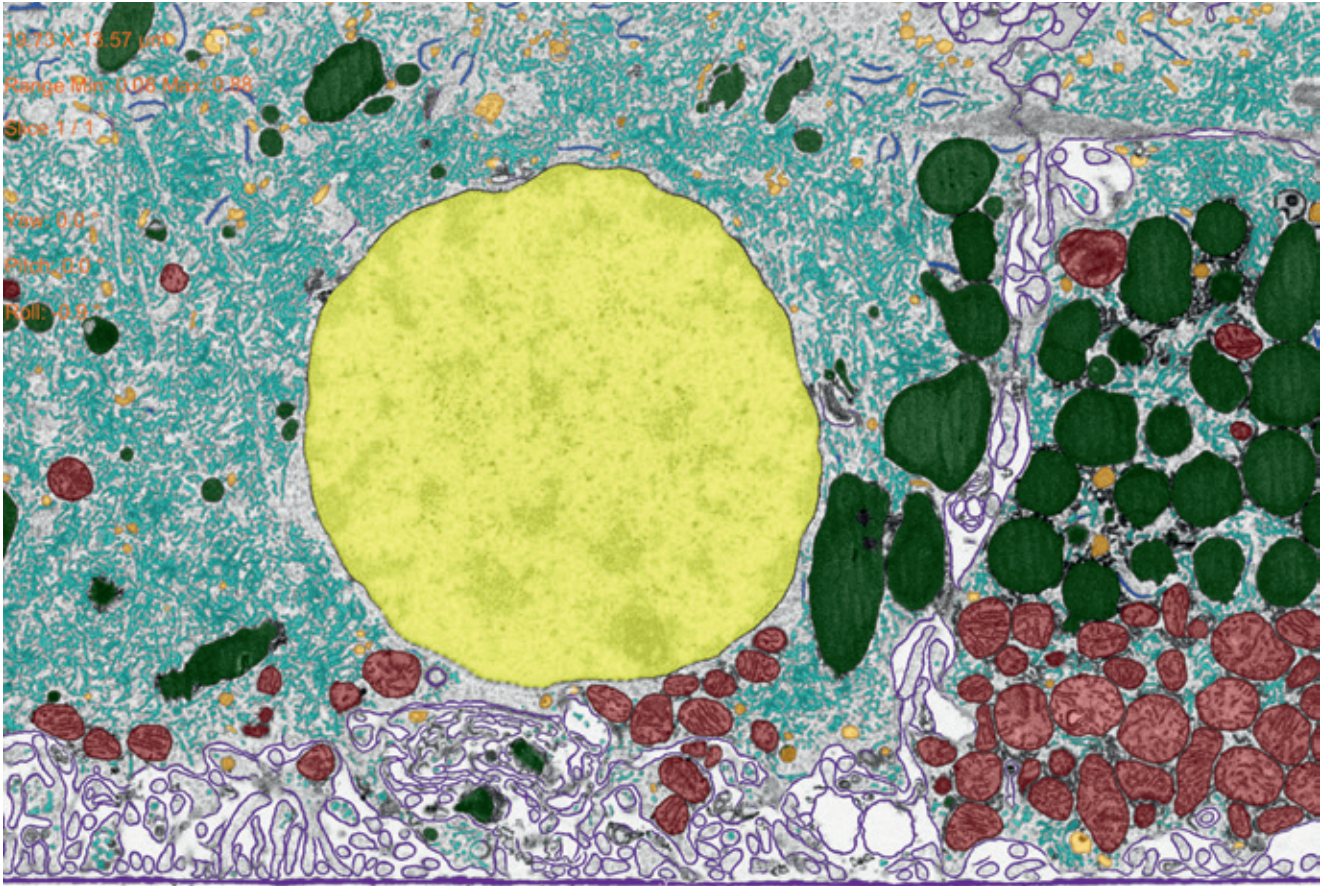
Segmented human retinal pigment epithelium cells (Pollreisz et al. 2022. Inv Opth & Vis Sci, 2022(63), 871).

Life science.

Cellular and subcellular imaging, bone organization, plant and animal anatomy, paleontology, pharma R&D.

From organelle to organism: Dragonfly 3D World simplifies analyses and extends findings from scientific imaging to all relevant length scales of the life sciences.

Cellular and subcellular imaging

Dragonfly automates the labeling process of cellular ultrastructure from EM images and couples it with rich analytics of organelle size and spatial distributions.

Flower. Data courtesy of Nees-Institute for the Biodiversity of Plants, University of Bonn.

Bone organization

With Dragonfly 3D World, users can measure key cortical and trabecular bone attributes of experimental and naturally observed bone samples. For therapeutic implant studies, Dragonfly allows the visual and numerical assessment of bone regrowth interdigitation.

Plant anatomy

Dragonfly3D World analysis tools for measuring and visualizing grain and other feature size distributions add quantitative descriptions to the abundant qualitative observations in imaging studies.

Animal anatomy

Non-invasive imaging of laboratory and field-collected animals reveals the structural organization of animal life. Dragonfly 3D World's visualization and inspection tools yield insightful answers and impactful visuals.

Paleontology

Dragonfly 3D Worlds AI-based processing routines are uniquely suited to handling often low-contrast textures – such as fossilized biomatter against surrounding rock matrix.

Pharma research & development

In this health-critical field, Dragonfly's advanced tools let R&D engineers extract cracks and other defects and make precise measurements on the variance of particle shape and size.

Quality assurance.

Industrial inspection of electronics, castings, plastic injection and additive manufacturing parts.
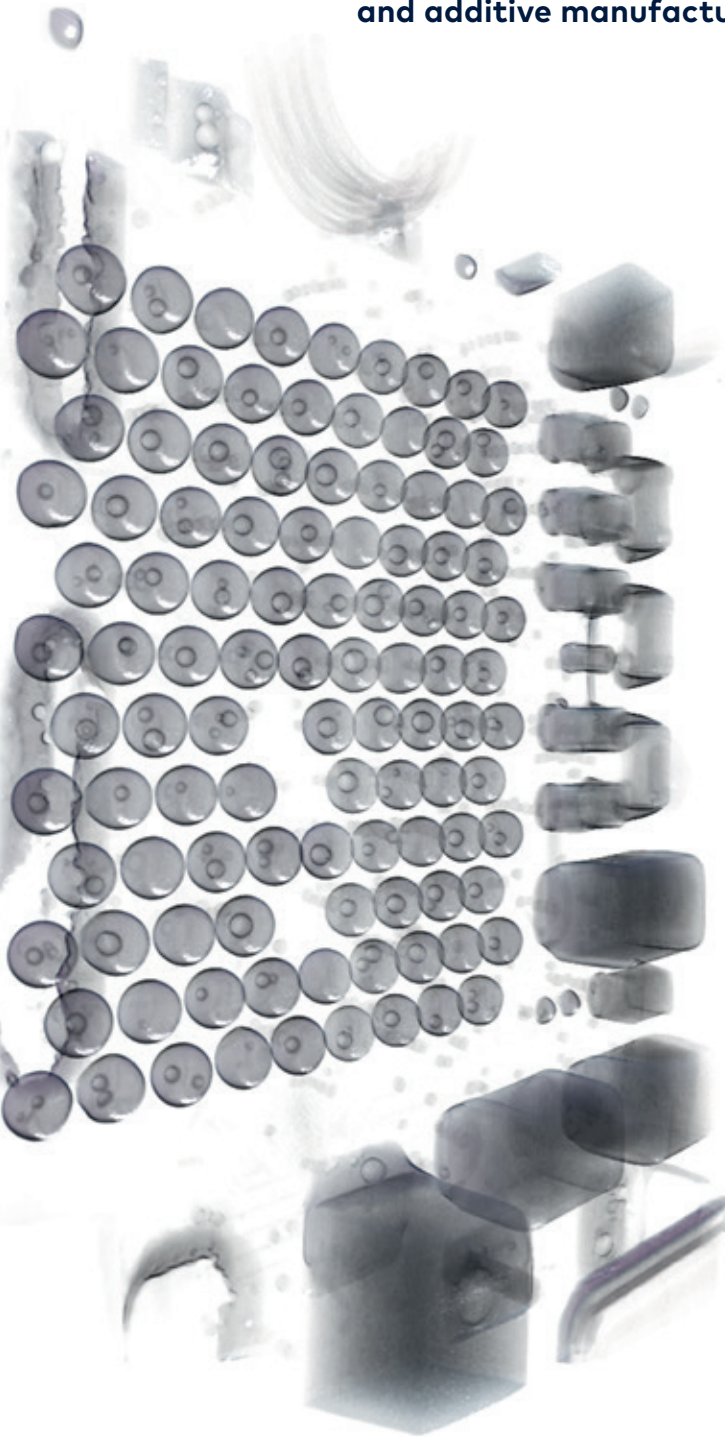
Non-destructive testing (NDT) with X-ray computed tomography helps manufacturers monitor and optimize both their product and process quality. With Dragonfly 3D World, industrial users can unleash the true potential of scientific image processing for their inspections – and gain unique insights into the critical areas of parts and components.

Electronics

Finding cracks, open solder joints, delaminations, or voids in electronic components like semiconductor packages and surface-mounted technology (SMT) assemblies, is a task best performed with automated processes. Dragonfly 3D World provides the tools for error-free X-ray inspections without the need for human intervention.
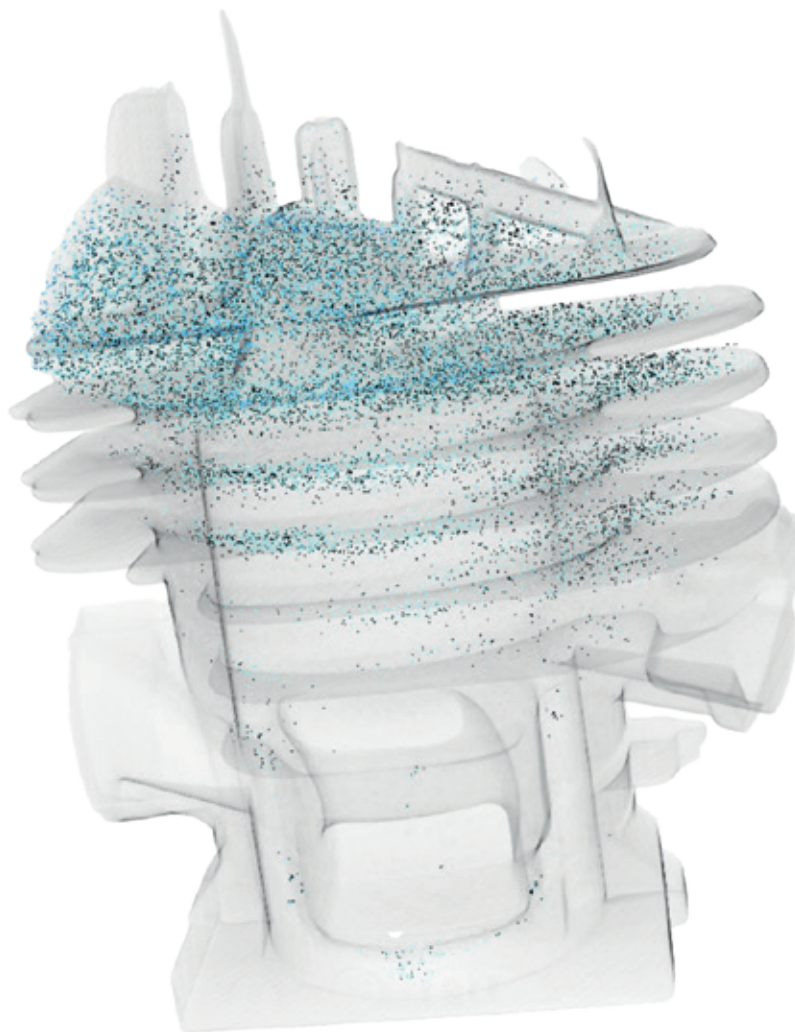
Battery cells

Battery cells undergo testing against the highest quality assurance criteria in the automotive and other industries due to the importance of flawless long-term reliability. Dragonfly 3D World offers the tools for the inspection of battery cells based on X-ray images, for example for the automatic segmentation and measurement of the overhang between anode and cathode components.

3D visualization of a printed circuit board with voids in BGA solder bumps. Data courtesy of Comet Yxlon.

Fast porosity analysis of a cast part using modified Otsu thresholding.
Data courtesy of Comet Yxlon.

Additive manufacturing

Additive manufacturing (AM) is a game-changer in various industries, including aerospace and medical. With new technologies come new inspection challenges: AM in any material and any process may produce deviations from the intended design or flaws like irregular pore sizes, particle contamination or trapped powders. Dragonfly 3D World takes the quantification of these typical defects to a new level – from color-coded wall thickness evaluation to sphericity analyses.

Metal castings

Typical foundry casting flaws can occur in all casting techniques that involve materials such as iron, aluminum, magnesium, or zinc – with a major impact on product quality. Cracks in structural components can lead to system failures, downtime, high repair costs, and even loss of life. Dragonfly 3D World provides a wide range of smart tools to visualize and quantify cracks in CT images of metal castings.

Plastic injection

The presence of cracks or planar flaws, such as delaminations leading to the fracture of parts into layers, are a major problem for the continued performance of injection-molded plastic components. Dragonfly supports reliable and efficient crack detection that allows full characterization of crack location and extent in samples, providing spatial context and quantitative information.
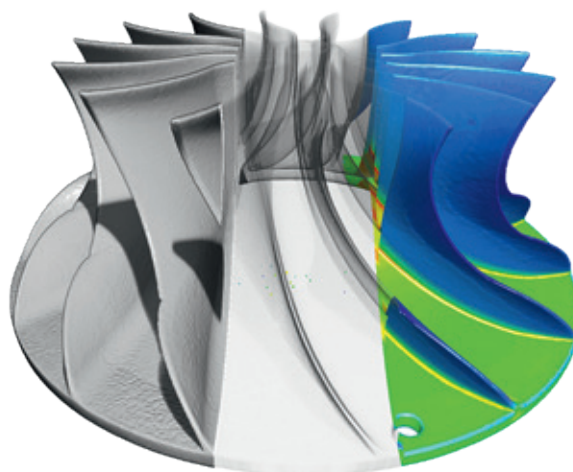
Exemplary visualization capabilities of Dragonfly 3D World based on a CT scan of an additively manufactured impeller.
Data courtesy of Comet Yxlon.

Smooth workflows for cutting-edge results.

Our intuitive, easy-to-learn interface guides users through their project.

From flexible file import options to an extensive array of image visualization and manipulation tools, as well as specialized extensions, Dragonfly 3D World delivers the features you need to accomplish meaningful results quickly and reliably.

Flexible image import

Your Dragonfly 3D World experience begins with file readers for an array of file formats from leading instrument manufacturers – from TIFF, PNG or BMP to microscopy and medical file formats like MRC or DICOM.

Advanced image processing

Overcome the limitations of imaging artifacts with Dragonfly 3D World's rich tool chain, spanning from traditional image filtering and post-processing algorithms to the latest AI models trained by Dragonfly experts, or customized by end-users.
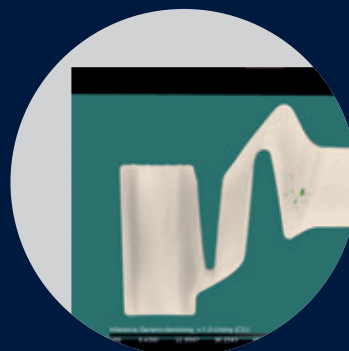
Segmentation/Quantification

Dragonfly 3D World simplifies the task of labeling image features for analysis with pre-trained and ready-to-use deep learning models for semantic segmentation. Powerful options for computing measurements and classifying objects are then available to enable you to fully assess material properties and structures.
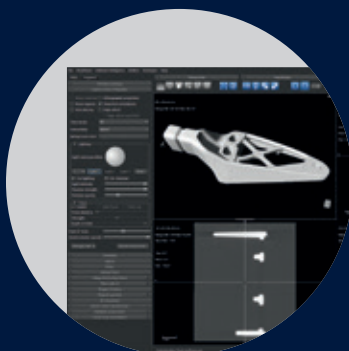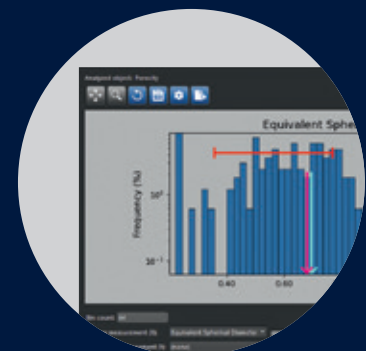
Image import
File readers for many formats from TIFF to PNG, MRC or DICOM

Image processing
Highest image quality with Dragonfly 3D World's rich tool chain

Segmentation/ Quantification
Full access to material properties and structures

Impactful visualizations

See every detail from every angle and make dramatic impressions of your volume data. Manage multiple screenshots of arbitrary size for impactful 2D and 3D storytelling in up to 4K, or prepare sensational scroll-through animations with our easy-to-use movie makers. Apply powerful features like arbitrary clipping, focal spotlighting, or dewarped planes.

Actionable reporting

Share your findings with impressive presentations: Dragonfly 3D World lets you export every measurement and every image without effort. Generate the input you need and fuel your statistical analyses or process improvement with reliable, quantitative data.
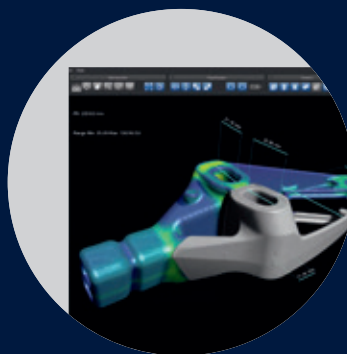
Customization

From workflow automation to new feature development, Dragonfly 3D World can be tailored exactly to your team's needs. Record macros to automate repetitive tasks, combine multiple macros for batching, or access the Python console to take advantage of the powerful image processing algorithms freely available in the Python ecosystem.
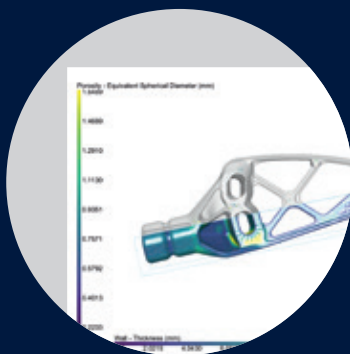
Visualization
Make dramatic impressions of your volume data

Reporting
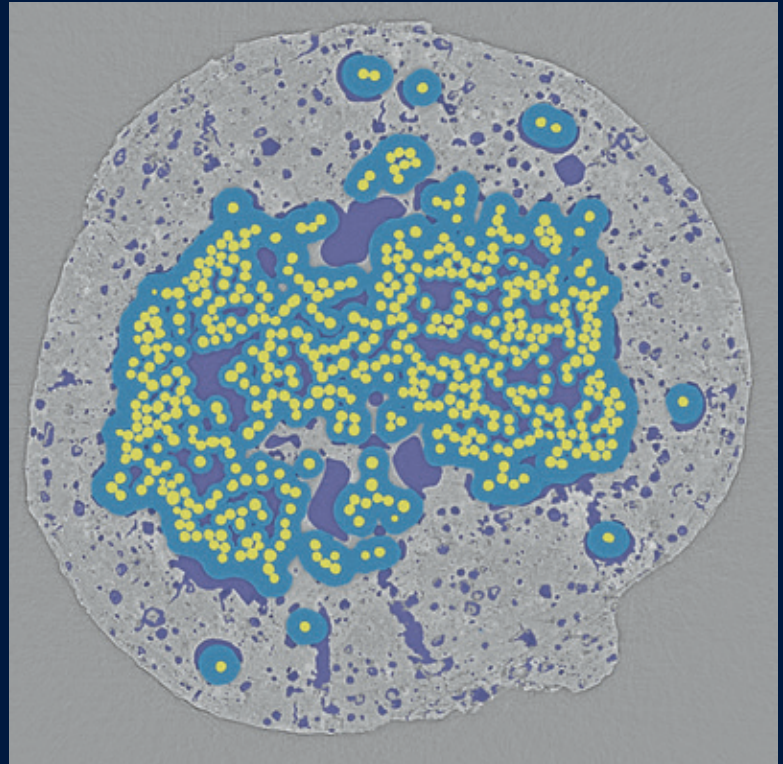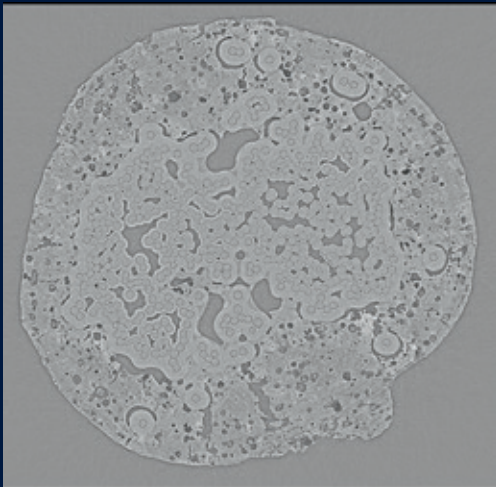Export and share your findings and turn them into great presentations

Customization
Dragonfly 3D World can be tailored exactly to your team's needs

The new era of image processing. Powered by AI.

Dragonfly 3D World combines the power of deep learning with intuitive workflows.

Ceramic matrix composite before (above) and after automated segmentation with deep learning (right).
Data courtesy of University of Colorado.

C. elegans before (above)
and after denoising (below).
Data courtesy of National Institute
of Standards and Technology.

Experience image processing on a completely new level: Dragonfly 3D World is based on the world's leading commercially supported deep learning engine that lets you train and execute convolutional neural networks to meet your own unique image enhancement and image segmentation challenges.
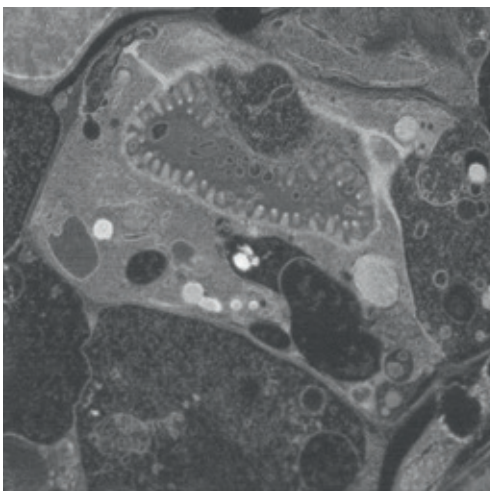
Watch models learn.

Dragonfly 3D World's deep learning solution is bundled with pre-built and pre-trained neural networks, making it easy and fast to apply even for novices. Revolutionize your workflows: Powered by Google's TensorFlow and Keras, Dragonfly 3D World gives you the power to train, reuse, and repurpose existing models for advanced applications, and also develop new neural networks.
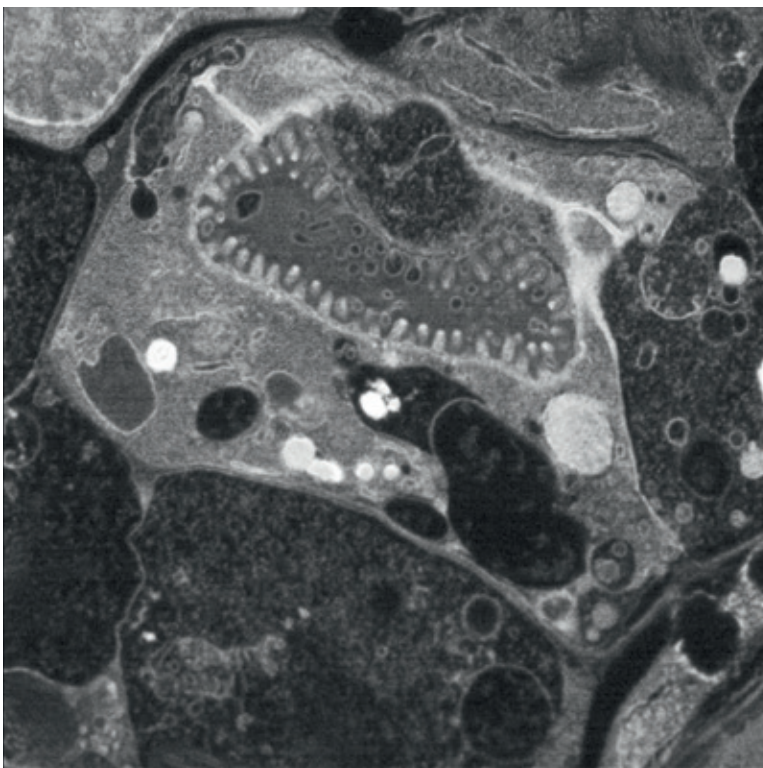
Enhance your image quality.

Our deep learning based models can vastly improve the quality of your images. From denoising to super resolution, you will see your images in clearer detail than ever before.

Use automated segmentation.

Well-trained AI models ensure efficient and reliable segmentations for complex materials without user bias. Training can be accomplished by simply painting the different features of interest within a subset of your image data. The model will then learn how to segment the whole dataset or other similar datasets. Segmentation results that can then be combined with any Dragonfly analysis or modeling workflow.
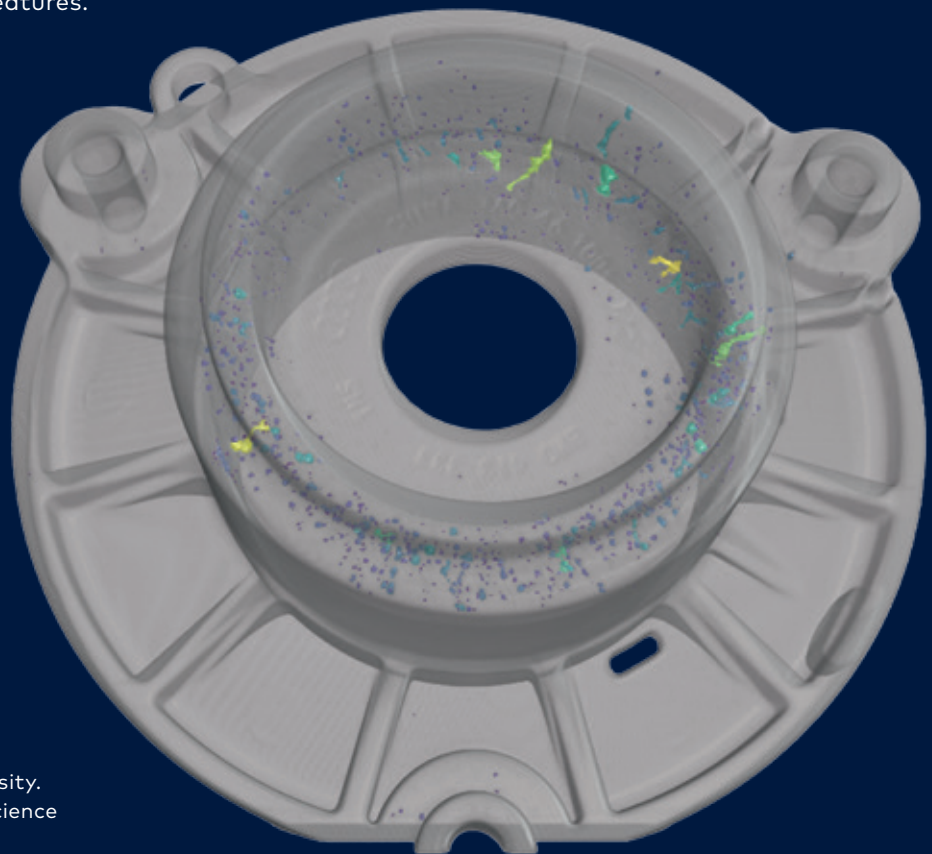
Quantitative analysis: Count, measure, excel.

## Examine porosity, fibers, size, shape, or wall thickness efficiently.

Whether you are analyzing pores, fibers, grains or phases, Dragonfly 3D World's quantification and analysis tools give you powerful options for counting, measuring, and characterizing image features.

Cast metal part evaluated for porosity. Data courtesy of Dandong Huari Science Electric Co., Ltd.
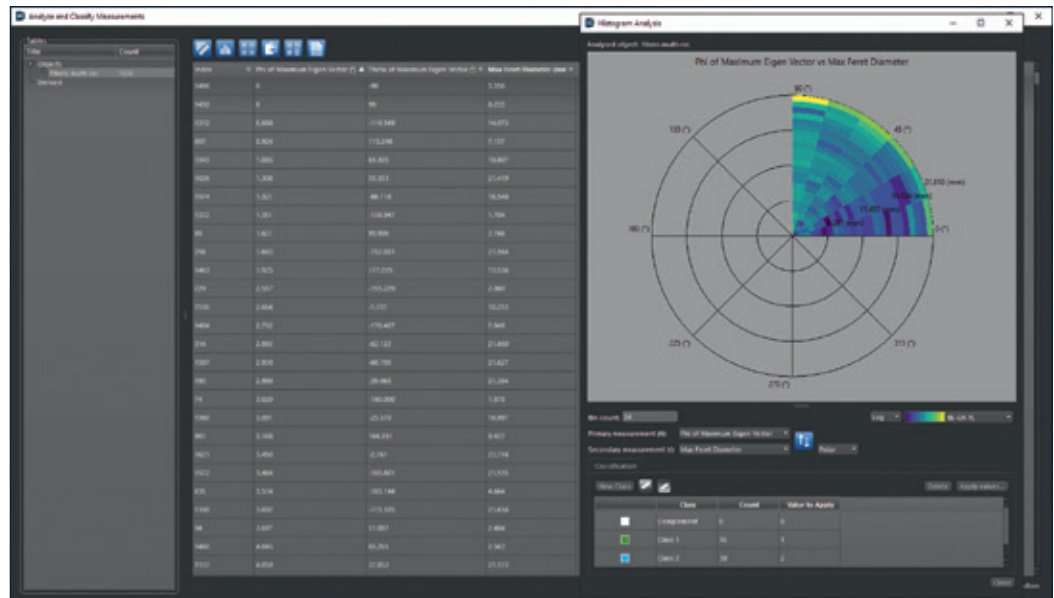
Polar plot for fiber analysis.

Size, shape, and spatial properties

Make measurements on hundreds to millions of individual grains, pores, organelles, etc. Select from volume, surface area, Ferret diameter, aspect ratio, roughness, sphericity, and scores of additional measurements.

- Cross-index measurements to answer nuanced research questions
- Plot histograms to gain insights into the distribution and characteristics of your data
- Categorize and classify objects according to specific criteria
- Probe depth maps to understand biases in spatial distributions

Porosity and void analysis

Dragonfly 3D World's automated thresholding tools enable a fast and efficient segmentation of casting or electronics parts. Porosity and voids can be calculated, visualized, and analyzed by size or volume using color coding.

- Reconstruct porous, dentritic, and fracture networks from 3D image data or simulations
- Compute size and shape of pores, total porosity, surface-connected porosity, tortuosity, velocity and pressure for permeability, temperature and flux for thermal conductivity, and more
- Dedicated pore network modeling module for performing a wide range of pore network simulations (OpenPNM).
- NASA's Porous Microstructure Analysis (PuMA) plug-in for computing effective material response simulations on microstructures of porous media

Local Wall-Thickness (mm)

0.800   2.820   4.839   6.859   8.878   10.898   12.917   14.937   16.956
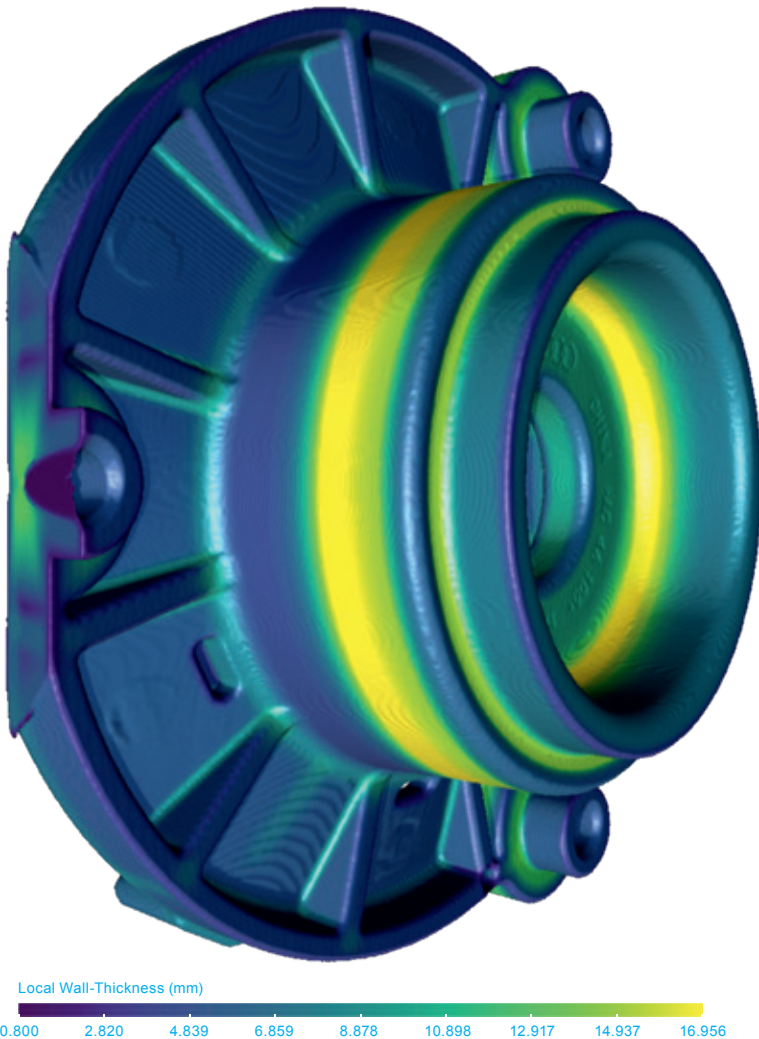
Inspection of wall thickness.
Data courtesy of Dandong Huari Science
Electric Co., Ltd.

Meshes and models

Compute high-quality surface mesh models directly from images or from segmentations.

- Visualize scalar quantities with color-coding and filtering with opacity
- Extract interfacial meshes from segmented phases
- Graph three-phase boundaries and compute throat thickness
- Generate 3D tetrahedral meshes for solving fluid mechanics and heat equations
- Set boundary conditions for heat equations and other simulations with the 3D Mesh Painter
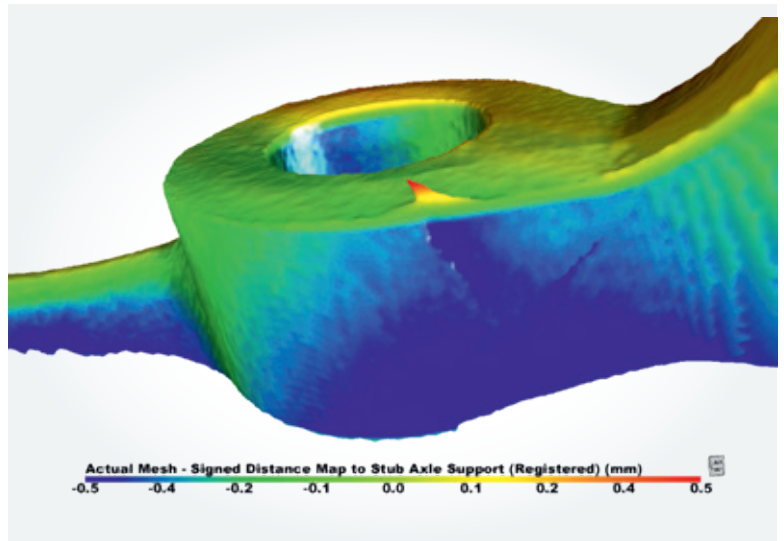
Wall thickness analysis

Create images that highlight different thicknesses and their distribution within inspection parts – with color-coding or complete statistical analysis.

- Thickness meshes can be examined in 2D and 3D views
- Filter displayed ranges in the Measurement Inspector
- Methods include sphere fitting and ray tracing

Example of high positive deviation of a sharp protrusion indicated by red color. (A. du Plessis and S. G. le Roux, Standardized X-ray tomography testing of additively manufactured parts: A round robin test. Additive Manufacturing, Volume 24)

Deviation from design

Does the final manufactured part conform to its original design? By importing the design mesh file (STL) Dragonfly 3D World allows the comparison of this file with the actual part. Color coding can be used to highlight the largest deviations or warping.

Fiber analysis

Calculating the physical properties of composites, polymers, and fibrous materials with Dragonfly 3D World provides researchers and product developers with the comprehensive understanding of material behavior that is essential for improving and developing new products.

- Automated extraction of individual fibers from reinforced composites
- Computation of microstructural characteristics, such as fiber length and tortuosity, orientation, thickness
- Examination of the interface between fibers and matrix material in composites

Automate your analyses

With Dragonfly 3D World, many inspection tasks can be automated. Just one example: the segmentation and measurement of battery overhang distances. Deep learning based analysis tools boost the speed and efficiency of the inspection processes.
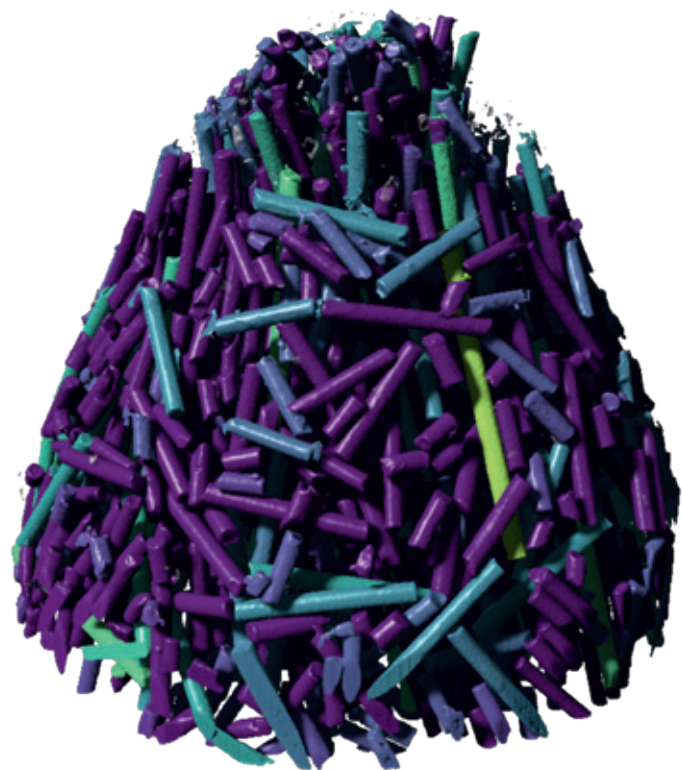
Fiber dataset.
Data courtesy of ZEISS.

Additional modules and extensions.

Power up your Dragonfly 3D World experience with special tools for special tasks.
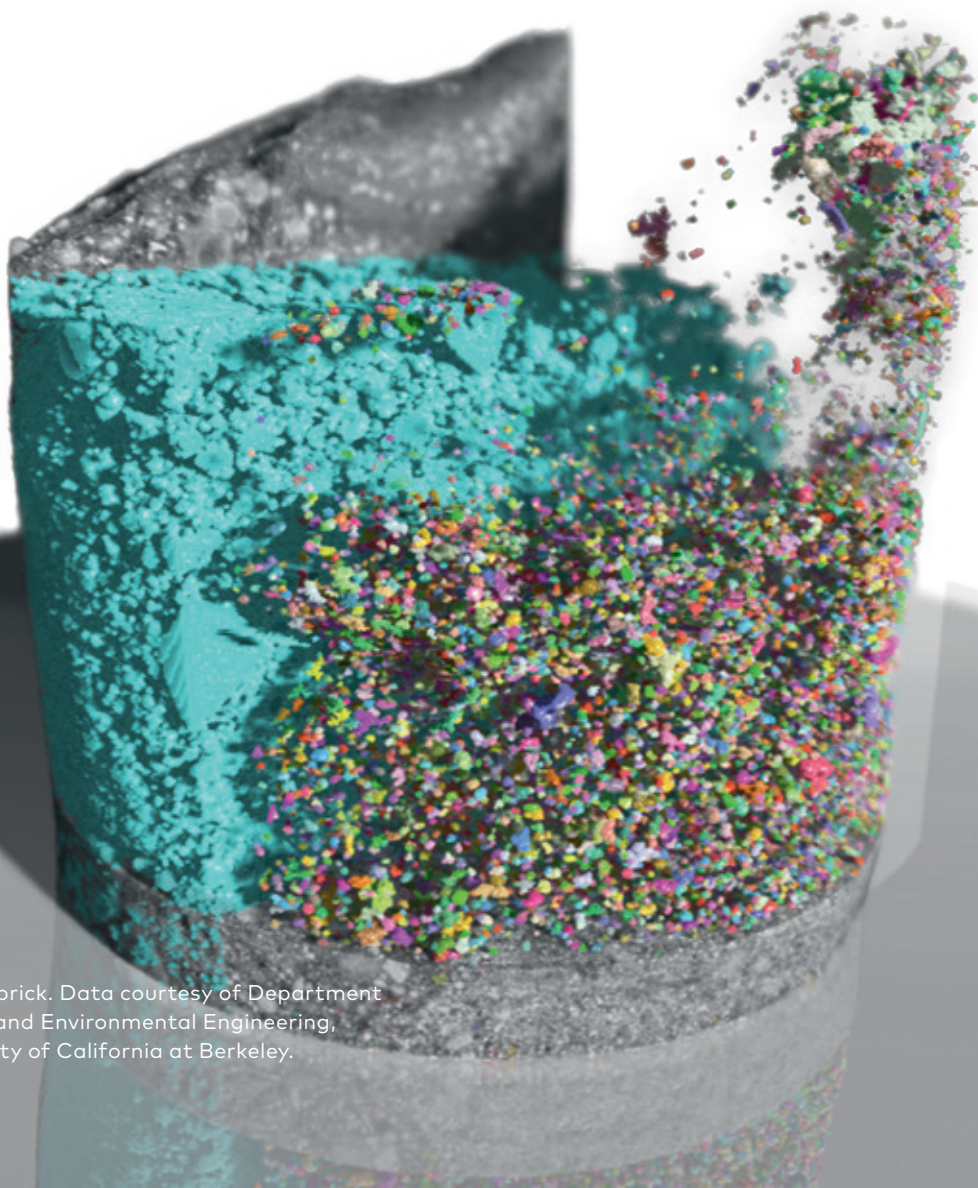
Roman brick. Data courtesy of Department of Civil and Environmental Engineering, University of California at Berkeley.

The Bone Analysis wizard, shown above, provides guided steps for segmenting cortical and trabecular bone, computation of global measurements, generation of vector fields, slice-by-slice measurements, and report generation.
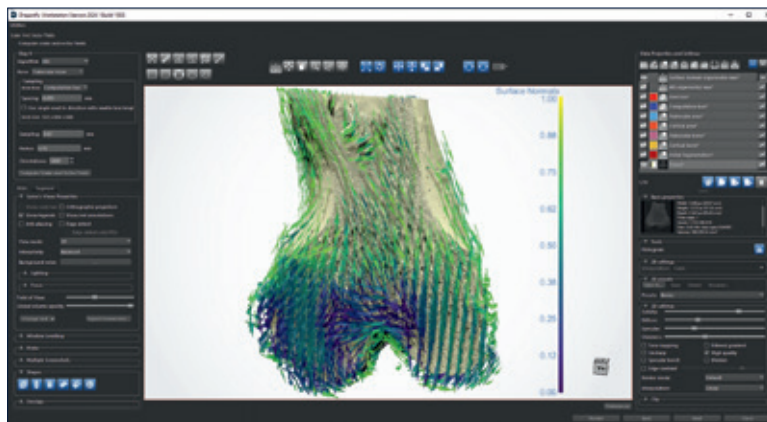
Dragonfly's flexible products cover a wide range of analyses, disciplines, and industries. Yet for certain applications, more focused requirements need to be met. Our developers work together with subject matter experts to create additional functions or modules to enhance your Dragonfly experience and address these specialized areas of study.
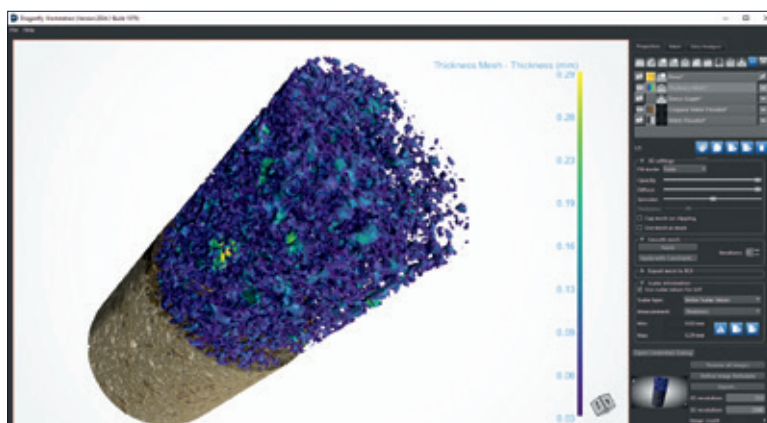
Bone Analysis add-in

Bone Analysis provides 3D vector-based mappings of anisotropy magnitude and directionality and 3D scalar-based mappings of bone volume fraction. These can be used as a proxy for bone strength. The add-in also includes the automated separation of cortical and trabecular bone and volume-thickness mapping and export of histograms of local morphometrics.

Plug Analysis add-in

Plug Analysis provides a dedicated workflow for pre-processing and analyzing core plug images acquired from rock samples and other porous media. It includes segmentation with deep learning and computations of length, tortuosity, pore diameter, porosity, and other parameters that add weight to observations.

The Plug Analysis wizard, shown above, includes guided pre-processing, segmentation, computation, and reporting steps.

Remote Access add-in

Enjoy the flexbility to work anywhere, at any time – at the microscope, in the office, in meetings, or even in the coffee shop. The remote access add-in allows you to access your advanced 3D visualizations and analyses throughout your company network. Practically any device with a mouse – laptop or desktop (Windows/Linux/MacOS/ChromeOS) – becomes a virtual workstation.
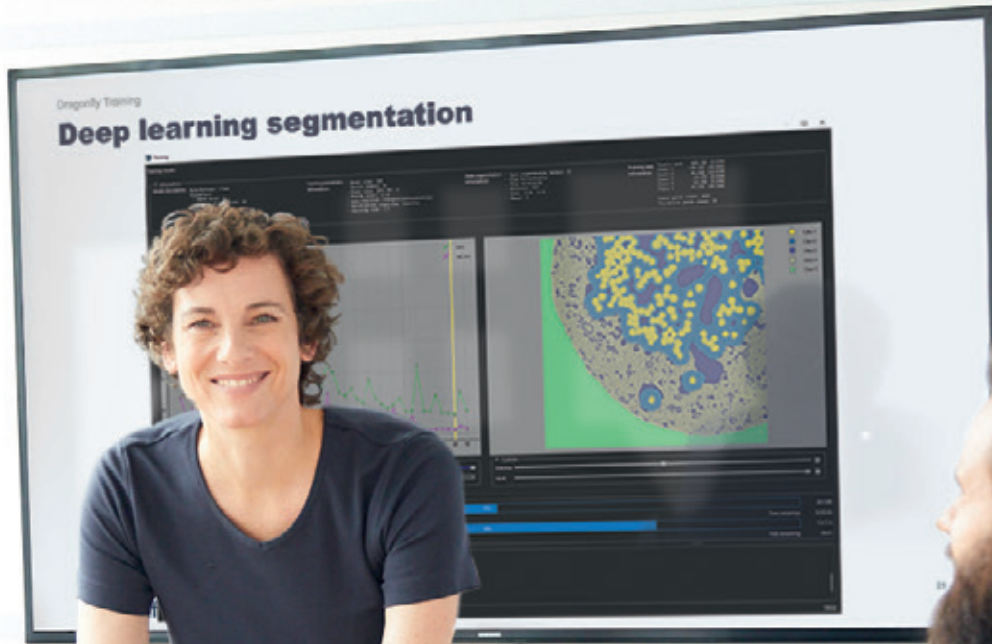
Support and training.

Good support is just as important as our products themselves.

How can we help? Dragonfly offers a range of professional and community resources to give you the answers you need – from online help to tutorials to personalized assistance on our Dragonfly Social platform.

Maintenance & support plan

The available annual maintenance and support plan includes a recurring budget support hours by our experts to make sure you achieve your goals when using Dragonfly 3D World.

Online documentation

The extensive online help section on the Dragonfly website is the place to find information, instructions, tips, and more. You can choose from basic topics like "Getting started" to in-depth explanations concerning tasks like segmentation or 3D modeling.

Online trainings

Follow along with a Dragonfly product specialist as they demonstrate the features and benefits of Dragonfly 3D World and walk you through specialized modules. Our interactive web-based training allows you to practice new techniques on numerous case studies and can be adapted to your individual needs and interests.

On-site trainings

Combining in-depth instruction with class exercises, our product specialists will quickly teach you how to use key Dragonfly 3D World features and functions to optimize your image visualization and analysis tasks. A Dragonfly training expert will work with you to create a course outline that meets your specific needs.

Dragonfly Social

Dragonfly Social is a new online community platform that lets Dragonfly users start discussions, chat, post, access material, as well as upload and download extensions and deep models for the application.

Information.

System requirements

- Windows 10/11 (64-bit) or Linux (64-bit), starting from Ubuntu 18.04
- AVX compliant CPU
- GPU with 1+ GB of VRAM (NVIDIA or AMD) or Intel integrated graphics processor (IGP) with UHD Graphics*
- Support for Open GL 4.3 or higher
- 8 GB of RAM
- 10+ GB of local hard disk space for download and installation

* Performance will likely not be comparable to running Dragonfly 3D World on a system with a dedicated GPU.

License information

Dragonfly 3D World is available with the license option that fits your needs

- Perpetual license
- Annual subscription license
- Non-commercial license
- Floating license
- Trial license

Find more information at https://dragonfly.comet.tech/gettingstarted

Eager to see for yourself?

Download a free trial version of Dragonfly 3D World at https://dragonfly.comet.tech

Contact us

Comet Technologies Canada Inc.
460 Sainte-Catherine W, Suite 600
Montreal (Québec) H3B 1A7
Canada
T +1 514 843-3861
sales.dragonfly@comet.tech

https://dragonfly.comet.tech

dragonfly