thermo scientific

Release notes PerGeos Software Version 2019.2

Digital rock visualization, analysis and simulation

The aim of this document is to inform you about the most important new features, improvements and changes in this version of Thermo Scientific™ PerGeos Software.

Please read these Release Notes carefully.

We would appreciate your feedback regarding this version. If you encounter any problems or have any suggestions for improvement, please do not hesitate to contact us at FRBOR.3d_hotline@thermofisher.com.

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New Physically Based Rendering Mode for Volume Rendering

A new Physically Based Lighting mode has been added to the Volume Rendering tool. The former standard rendering mode remains as the default mode. This Physically Based Lighting effect provides lighting using an advanced BRDF (Bidirectional Reflectance Distribution Function) model that provides more realistic rendering with better depth.

A set of predefined materials, including a Rock material, which is optimized for visualization of rock samples, is available for selection with this new lighting mode.

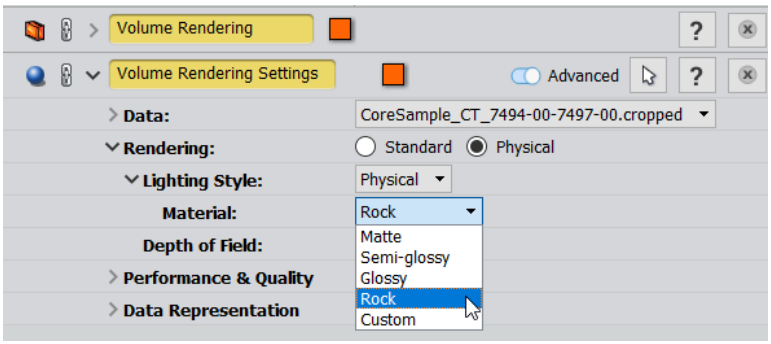

Figure 1. Different material types are available with the Physical rendering mode.

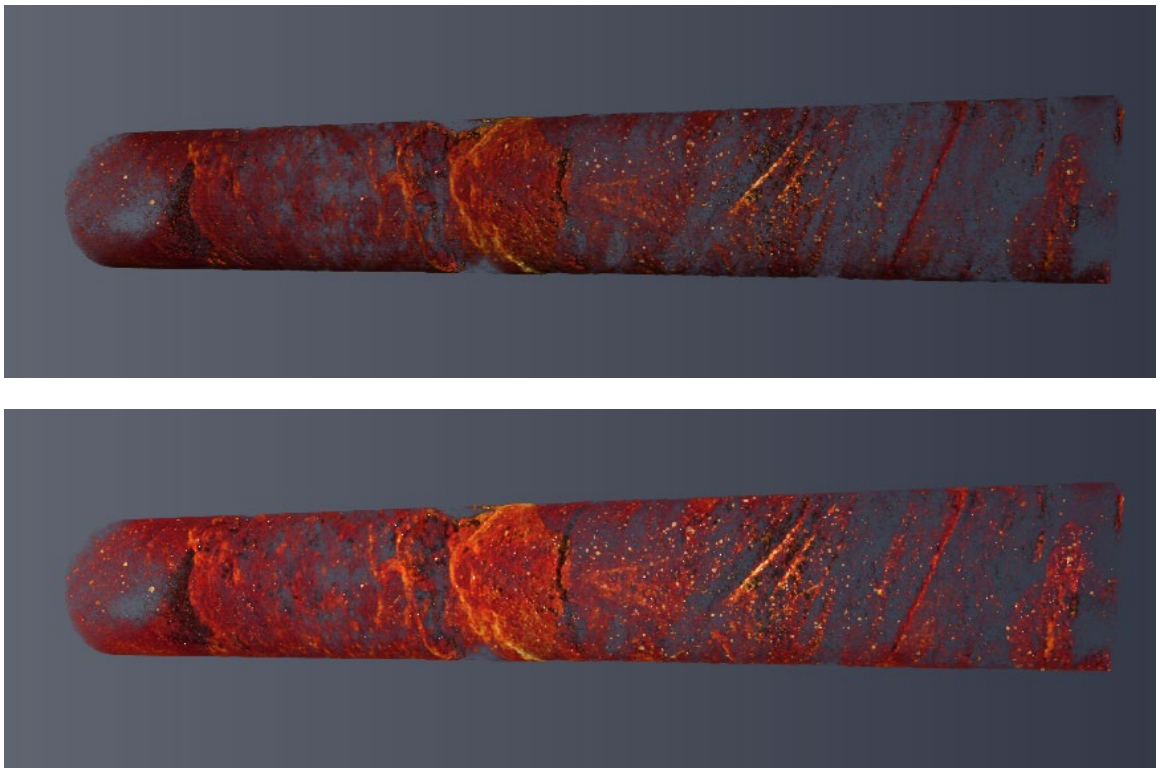

Figure 2. Volume Rendering results of high-density minerals in a core sample using standard (top) and physical (bottom) rendering modes.

The introduction of this new mode was also an opportunity to simplify the user interface of the Volume Rendering Settings by introducing a gradual complexity and removing the deprecated parameters. The least frequently used parameters are collapsed by default.

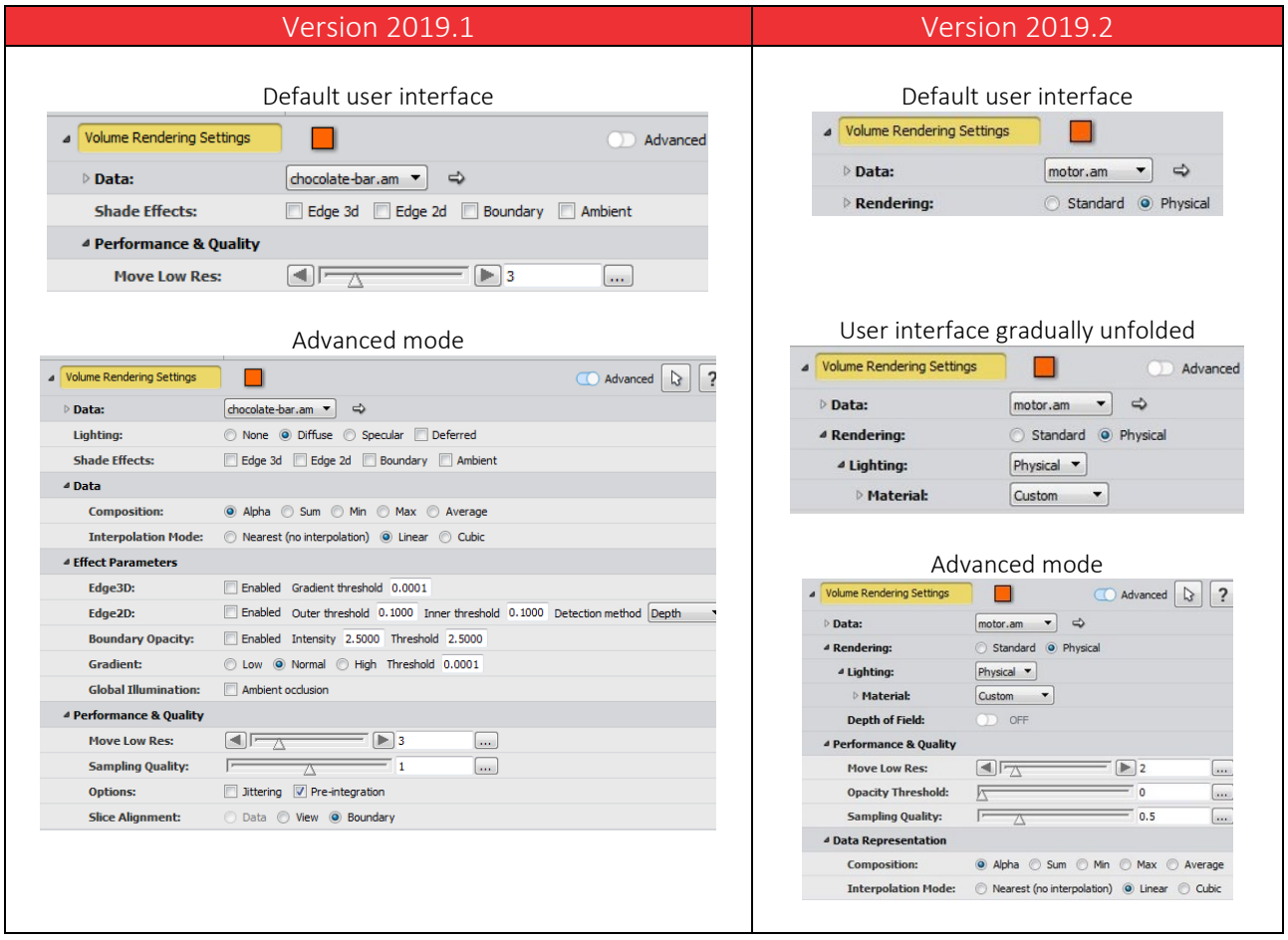

Figure 3. Changes in properties area of Volume Rendering between PerGeos Software version 2019.1 and version 2019.2

Colorize by Measure

Colorize by Measure is a new tool that generates a colormap based on a measure. It takes as input the spreadsheet of measurements that is generated by the Label Analysis tool. You select the measure based on which colormap is to be generated.

The generated colormap is available for selection in the colormap port of the Display and Compare Properties panels. In addition, this colormap can be used with most display tools, such as Ortho Slice, Colorwash and Voxelized Rendering. Known limitation: Voxelized Rendering does not support a colormap when too many objects are present, which is typically in the order of 32,000 objects. A warning message will appear when the limit is reached.

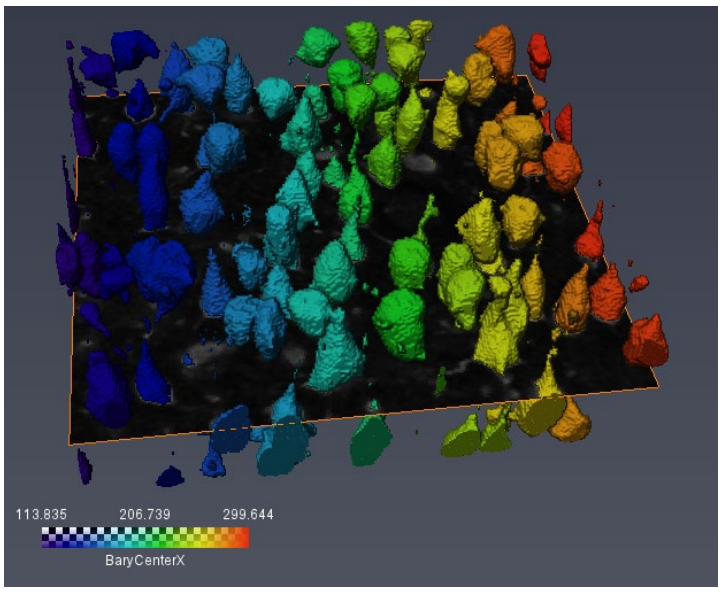

Figure 4. The colormap generated by the Colorize by Measure tool is used in the Voxelized Rendering tool.

Petrography Features: Large Data Handling

This version of PerGeos Software includes a group of petrography features that enable you to visualize, interact with, segment and analyze large-area optical and SEM images of thin sections. Color image support is added for segmentation and large data handling. In addition, out-of-core processing is now available through the UI for 2D images.

Convert to LDA: JPEG 2000, CZI and Big Tiff

The Convert to Large Data Format tool is now available in the tools browser in Explore. Using this tool, you can convert color images from various formats, including JPEG 2000, CZI and Big Tiff, to LDA. The reader for these formats is out of core; thus, it consumes less memory than the actual file size during the conversion process.

For color input images with 8-bit channels, a single 32-bit LDA file is created. If the input color image has 16-bit channels, the output will be three LDA files, one for each channel. You can convert and merge these files into a single color LDA file with 8-bit channels using the tools and the recipe described in the following subsections.

Export Color Images in LDA format

Another option for converting a color image to LDA is opening it and then using the Export Data As option. The VolumeViz LDA type is now available for color images.

16-bit to 8-bit Color Conversion Recipe

Only 8-bit color images are supported for visualization and segmentation in PerGeos Software. Therefore, 16-bit color images must be converted to 8-bit color data before starting the analysis.

A new recipe is now available for converting 16-bit color channels into 8-bit and combining them into a single dataset. This recipe is packaged as one of the default recipes accessible through the Recipes panel. It takes as input three 16-bit grayscale images representing the red, green and blue channels. It produces an 8-bit color image.

Recipe by Slab – Color

A new Recipe by Slab tool is now available for workflows that generate a color image as output. Using this tool, you can run recipes that result in a color image in an out-of-core fashion. The input data can be in-memory or LDA (out-of-core). The input must be compatible with the chosen recipe. The output is written out at a user-specified location as a color LDA file.

Using the "Recipe by Slab – Color" tool and the "Convert 16-bit to 8-bit Color Image" recipe, you can convert and combine the 16-bit LDA files that are generated as a result of applying the "Convert to Large Data Format" tool on color images with 16-bit channels.

Recipe by Slab – 2D Images

All the Recipe by Slab tools now support 2D image processing. You can use grayscale and color 2D images as input for these tools. This enables you to run workflows on large-area SEM and optical microscopy datasets without running out of memory.

Petrography Features: Image Segmentation

This version of PerGeos Software introduces a set of features for enabling segmentation of optical microscopy data.

Color Images in Segmentation Workspace

A color image can now be selected as the image to be segmented in the Segmentation workspace. In the Segmentation panel, you can pick a color image in the image field. A label image with the same dimensions as the color image is generated.

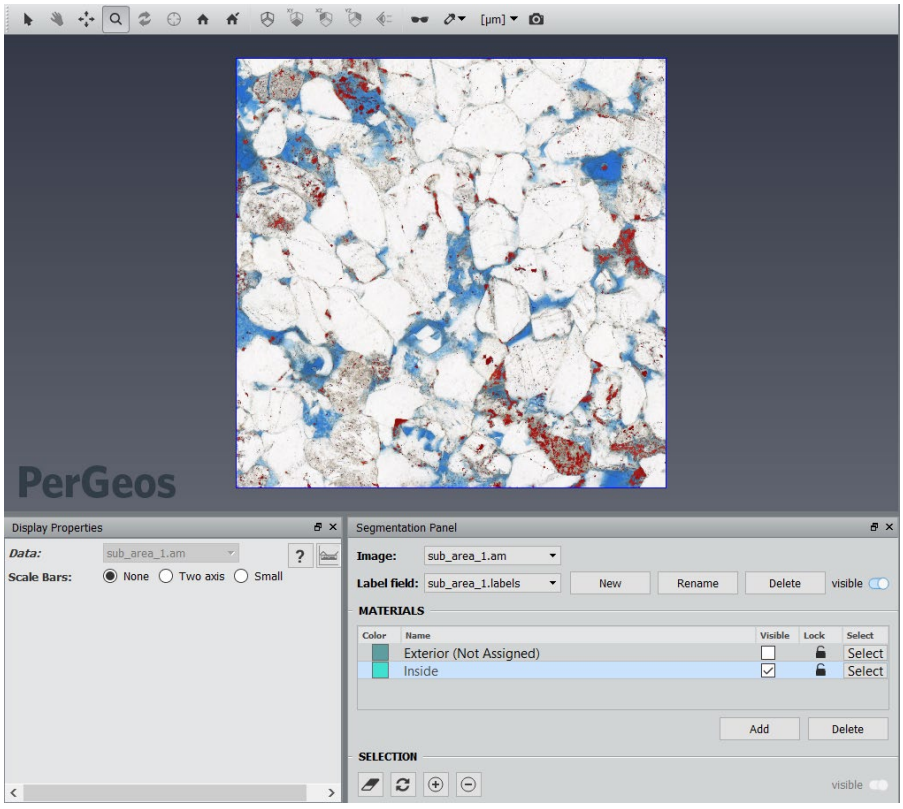

Figure 5. Color image support in Segmentation workspace. Image courtesy of Stratum Reservoir.

Histogram for Color Images

The image histogram is now calculated for color images upon loading. This is the same behavior as for grayscale images. The histogram information is shown in the preview panel.

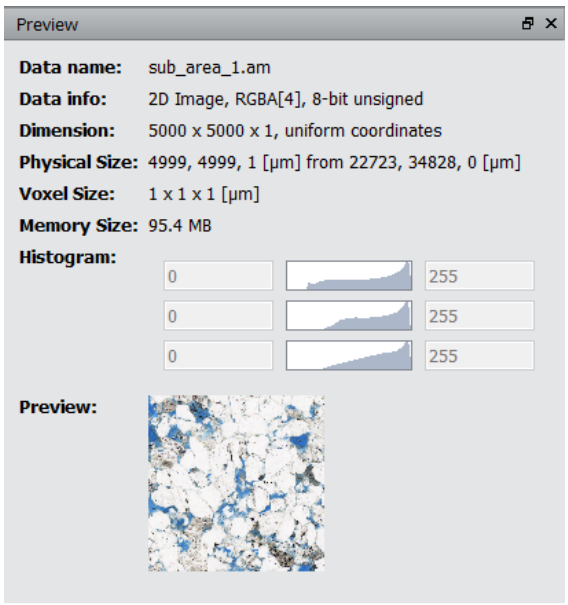

Figure 6. Preview panel for a color image.

Interactive Overlay Threshold: Color Image Support

The Interactive Overlay Threshold tool now supports color images as input. You can specify a range for each channel and create a selection. The red mask for the selection is updated interactively. The histogram for each channel is displayed in its threshold port.

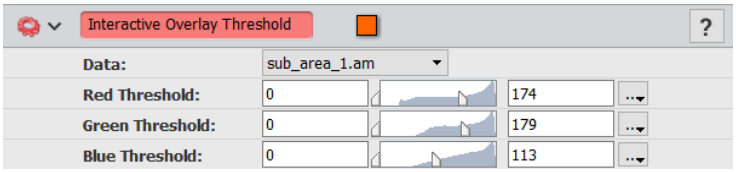

Figure 7. The Interactive Overlay Threshold tool supports color images.

Color Auto Classification

The Color Auto Classification tool is introduced in this version of PerGeos Software. This is a tool based on machine learning that automatically segments a color image into labels. A supervised random forest method is used. A pre-trained model is used to segment the input color image into eight labels, corresponding to the following colors: black, white, blue, brown, grey, pink, yellow and red.

Three outputs are generated:

- Label image of the segmented labels: *.autoclass
- Grayscale image of the confidence of classification in percentages: *.conf
- Grayscale image of spectral intensity: *.spectral

A new colormap named autoColorLabels.am is added to the product. This colormap maps the output labels from the Color Auto Classification tool to their respective colors.

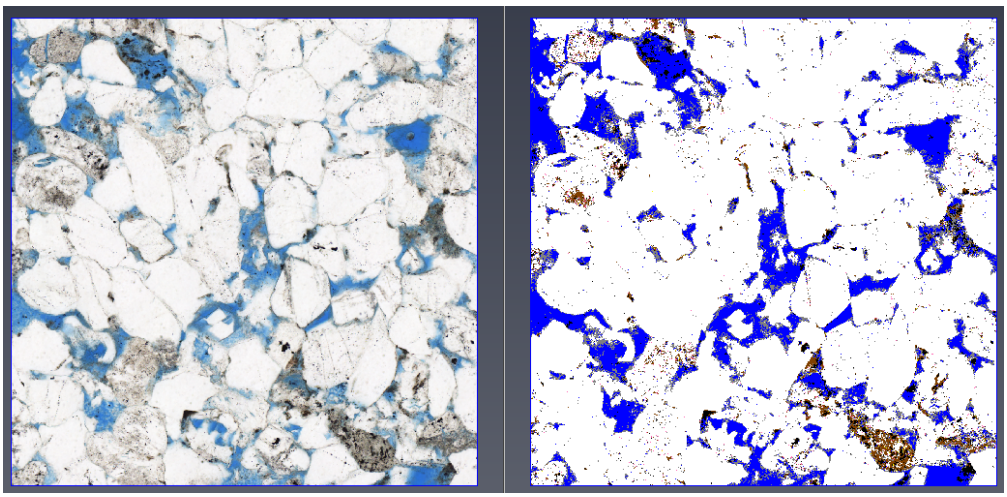

Figure 8. Automatic segmentation of an optical image of a thin section using Color Auto Classification. Image courtesy of Stratum Reservoir.

Core Profile Enhancements

Optional Registration in Assembly Wizard

The registration of core segments in the assembly wizard is optional now. The registration is activated by default. However, for cases where registration is not needed, it can be turned off. This will reduce the processing time, as most of the time is spent registering the core segments during assembly.

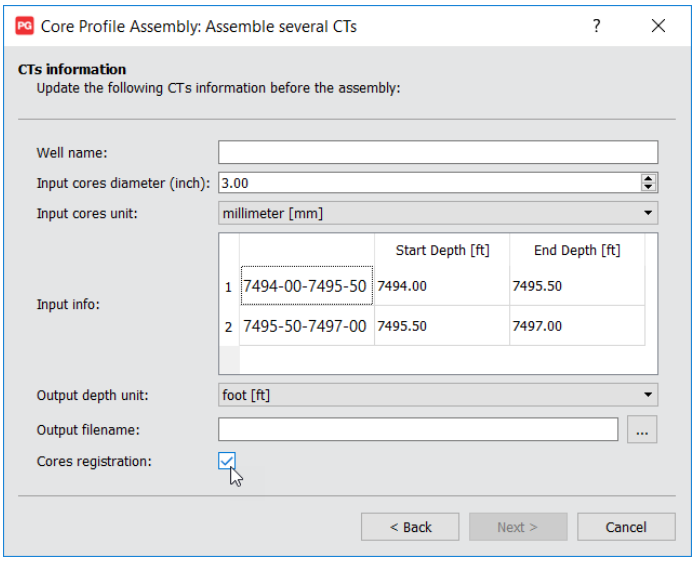

Figure 9. Core registration is now optional during assembly.

Compatibility Notes

Non-Local Mean Filter parametrization changes

The Non-Local Mean Filter has been improved with a new mode (GPU Adaptive Manifold mode) in PerGeos Software 2019.2 version. All modes have been grouped in the new module **Non-Local Means Filter**. In this new module, the parameters have been refactored to have the same behavior for all modes. In PerGeos Software 2019.2 version, to achieve the same results as in previous versions, for the former GPU mode, the following parameters must be converted:

Parameter Name	Before PerGeos Software 2019.1	After PerGeos Software 2019.1
Search Window	X*	$X \in 2\mathbb{N} \Rightarrow (X-1)/2$ $X \in 2\mathbb{N}+1 \Rightarrow X/2$
Local Neighborhood	Y	$Y \in 2\mathbb{N} \Rightarrow (Y-1)/2$ $Y \in 2\mathbb{N}+1 \Rightarrow Y/2$
Similarity Value	Z	$\sqrt{Z}$

*If the Search Window was set to *X* in a version prior to PerGeos Software 2019.2, it should be set to *X* / 2 if *X* was odd, in order to get the same results in PerGeos Software 2019.2 or newer versions.

Operating Systems

PerGeos Software 2019.2 runs on:

- Microsoft Windows 7/8/10 (64-bit)
- Linux x86 64 (64-bit). Supported 64-bit architecture is Intel64/AMD64 architecture. Supported Linux distribution is Red Hat Enterprise Linux 7.

To add custom extensions with PerGeos XPand, you will need:

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

Solved Issues

PerGeos Software 2019.2 release provides various enhancements and solutions to known problems, including:

Absolute Permeability Lattice Boltzmann	AA-20848	Label Mapping Pores port is now correctly displayed when trying to map binary files.
Arithmetic	AA-17900	Arithmetic tool now takes into account the transformation applied to the input.
DICOM loader	AA-20586	The scaling option of the DICOM loader is now correctly restored when reloading a saved project that includes some DICOM data.
Licensing	AA-12987	The documentation has been improved to explain how to mix floating and node-locked licenses.
MRC	AA-9986	Convert to LDA option would generate erroneous data when loading some large MRC files. This has been fixed.
	AA-9979	Read As External Data option is now supported to read large MRC files.
Non-Local Means Filter	AA-19985	On machines with multiple GPUs, the Non-Local Means Filters module would list all available CUDA devices, but the computation would always run on the first listed GPU, no matter the device

		selected. The selected CUDA device is now correctly taken into account.
	AA-20713	The Non-Local Means Filter parameters interpretation has been modified from 2019.1 version. See Compatibility notes for parameters conversion.
Pore Network Model View	AA-14663	When trying to display a small Pore Network Model's data, visualization issues could occur when moving the camera. This has been fixed.
REK	AA-20853	REK reader has been fixed to support 32-bit REK files.

We are focused on solving as many issues as possible to make your experience using PerGeos Software as satisfactory as possible. We would appreciate your feedback regarding this version. If you encounter problems or have suggestions for improvements, please report them to FRBOR.3d_hotline@thermofisher.com.