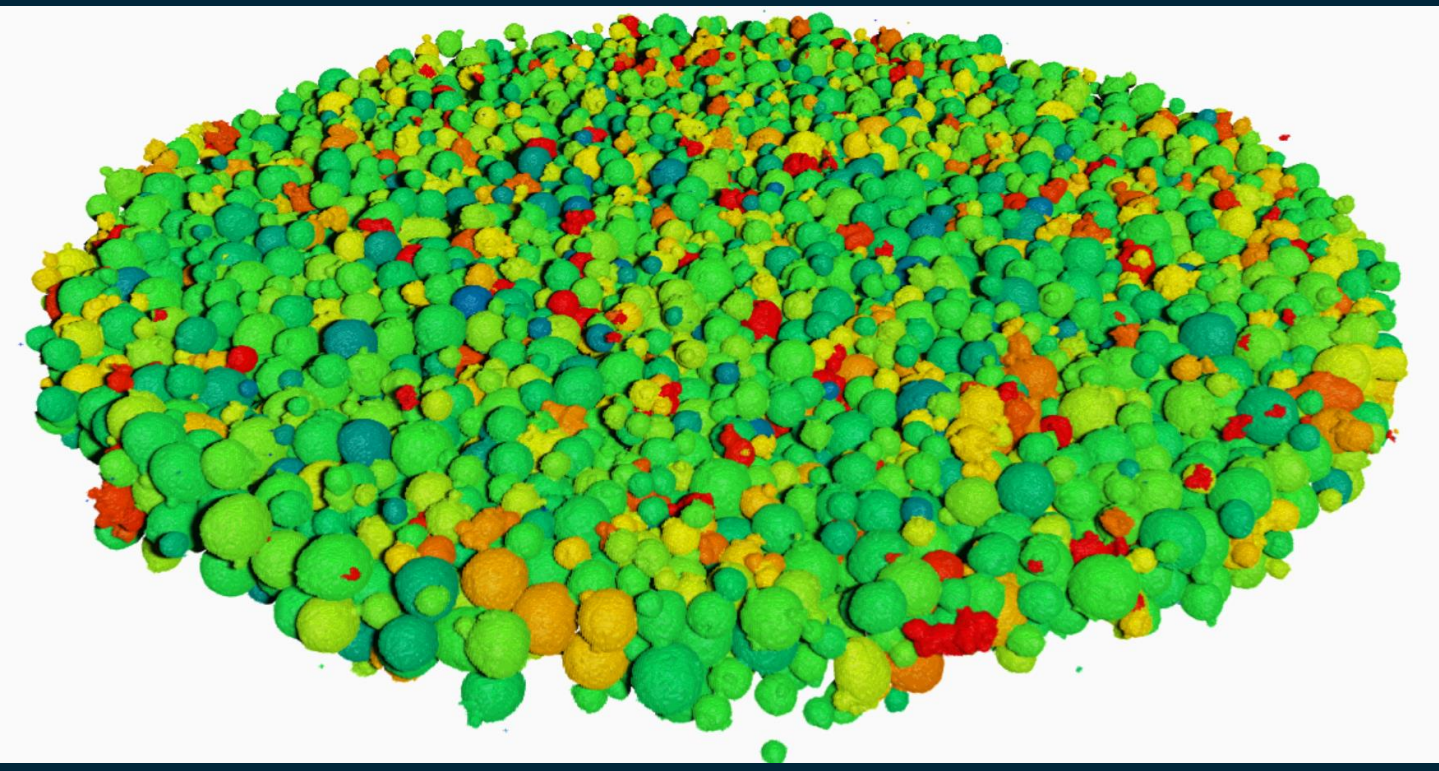
Application Note



Quality control of an additively manufacturing powders

Additive manufacturing using metal powder feedstock is the most widely used AM method in industry, and it is now widely recognized that the powder quality is key to high quality manufacturing. There are many ways to test and characterize powders – all with some limits and assumptions. X-ray computed tomography is increasingly used due to its ability to provide full 3D morphological information in addition to simple identification of contamination or excessive irregularities that may be missed in other methods. This application note shows some of the capabilities of Dragonfly 3D World for this sample type.

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dragonfly

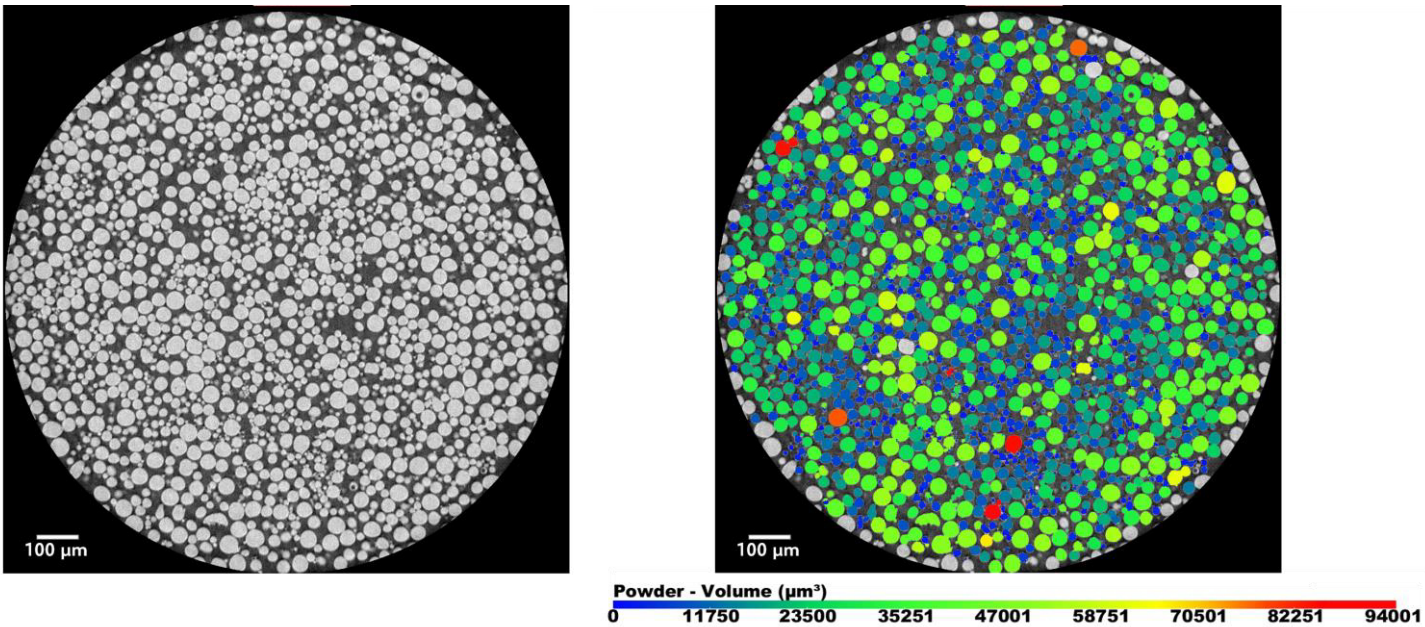
Requirements

A high-quality CT scan of the part, typically using a laboratory X-ray micro-CT instrument. Image analysis is fully digital and the actual part is not needed. A computer with Dragonfly 3D World is needed, the data can be any format, provided the voxel size is known (typical is a stack of 16-bit tiff images representing the full volume). In this app note, one good dataset is shown with segmentation based on a watershed transform, while a second noisy dataset is segmented using deep learning. The data for the first example was acquired using a ZEISS Versa X-ray microscope, thanks to William Harris (ZEISS USA).

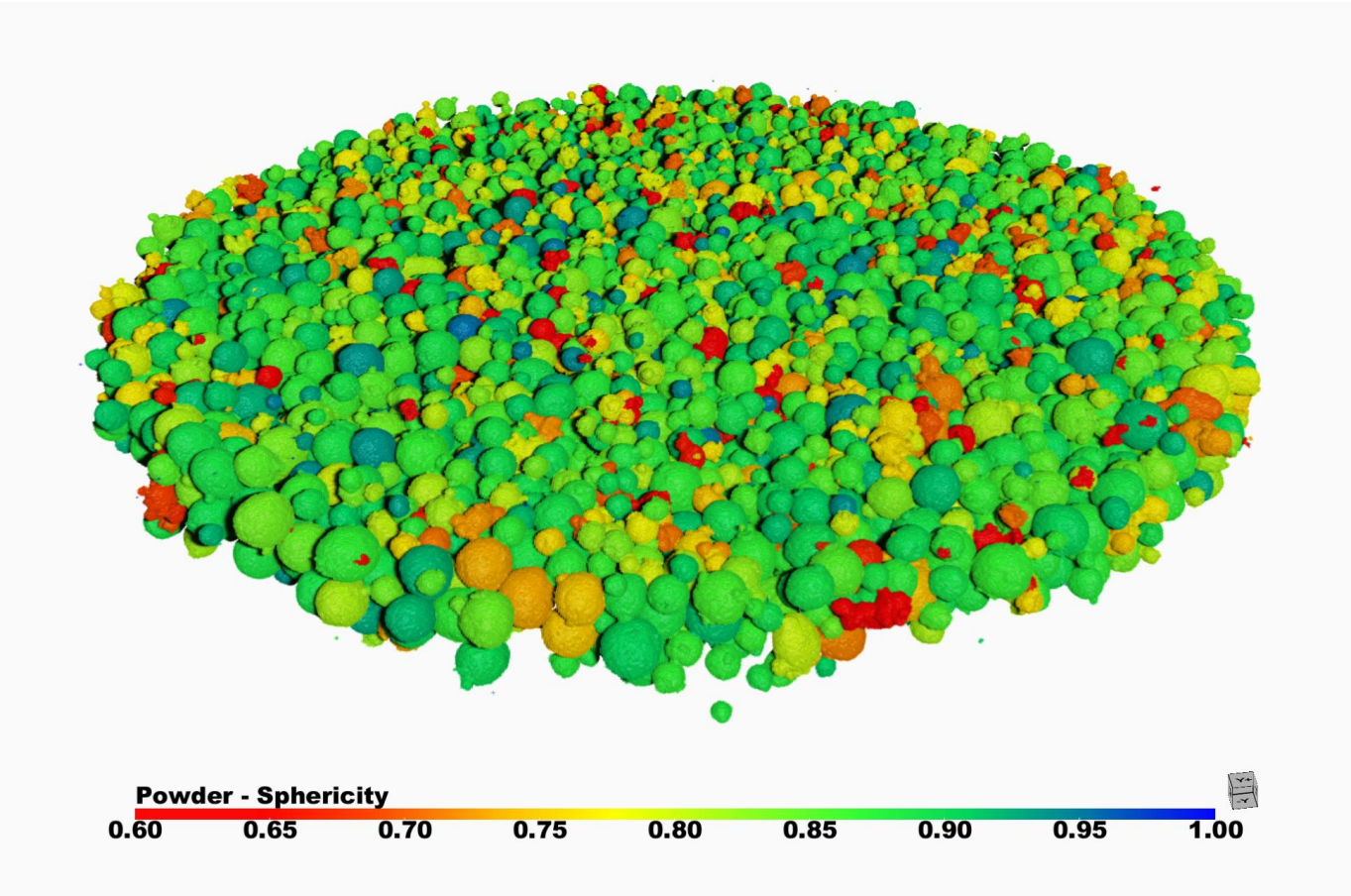
Typical outputs

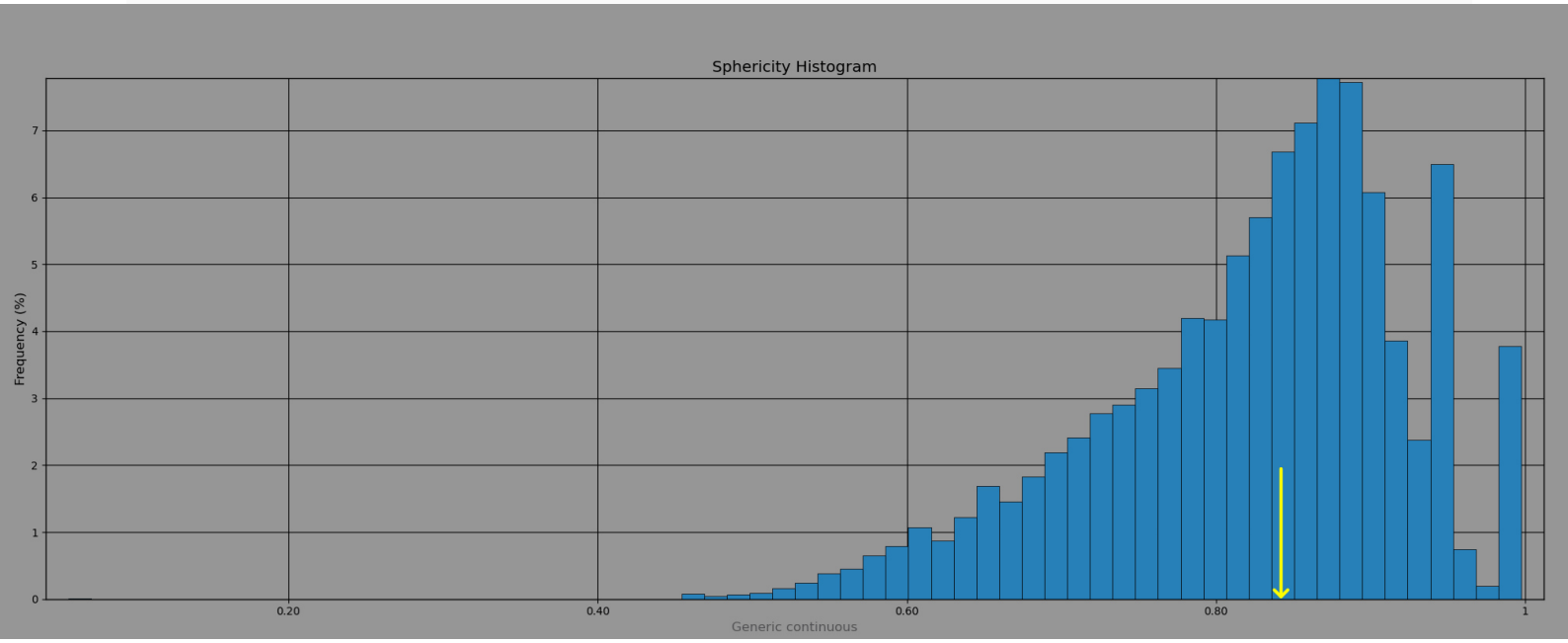
- Cross sectional images and video showing the presence of contamination, pores inside particles, or excessively irregular shaped particles.
- Particle analysis including particle size distribution and sphericity analysis, amongst others

X-ray tomography data acquired at high quality and sufficient resolution often looks like below images, with image processing needed to separate the particles from each other digitally and then analyzing their sizes and other features such as sphericity



Cross-sectional image of metal powder (left) and its volume color coded result (right) after watershed segmentation.

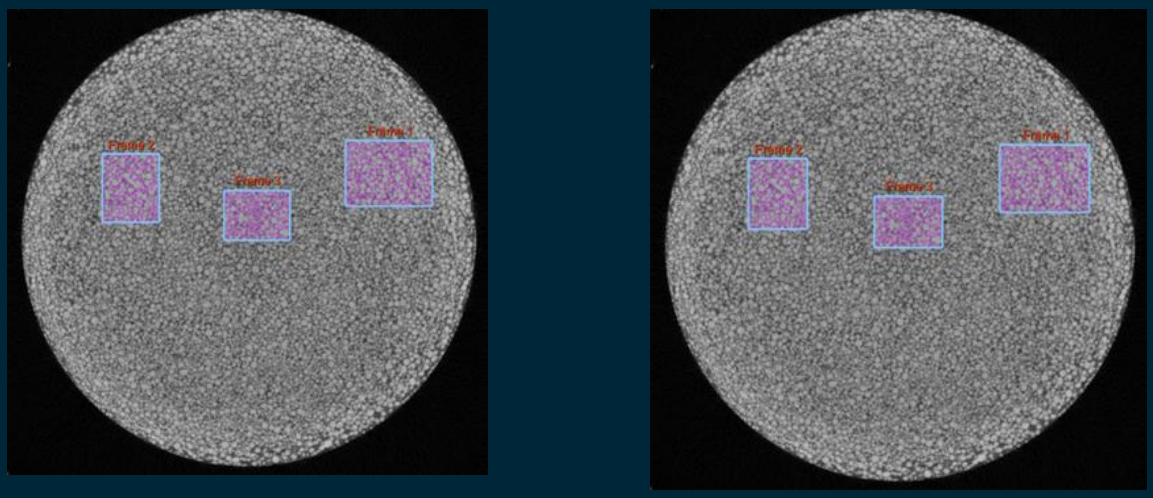




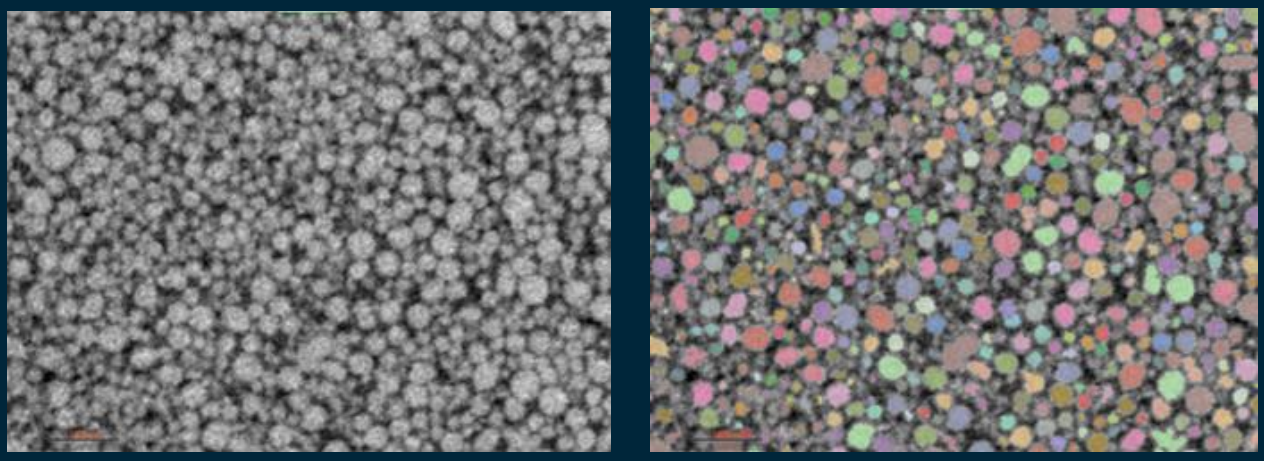
A sphericity analysis of AM powder particles shown in 3D and statistical distribution.

Advanced

Sometimes image quality or resolution is not good enough for the above workflow, in these cases deep learning can be a good solution for image segmentation as shown in the example below for noisy data.



A noisy dataset of metal powder is shown, with three frames used as deep learning training inputs using manual segmentation of particle and background pixels in a single slice image.



The power of deep learning image segmentation shown here for a noisy powder dataset: this allows detailed analysis despite noisy data or insufficient resolution, with limited training inputs making the method time and cost efficient.

The benefits

The benefits of this are knowledge of powder quality, using a reliable software for data analysis. The workflows in Dragonfly 3D World are fully customizable and open to the user, there are no hidden algorithms or question marks surrounding data analysis. Customization and reporting tools allow faster and better decisions for improving manufacturing processes and in quality control and qualification efforts. Unlock a new world of quality control in your additive manufacturing processes using Dragonfly 3D World!

For a video workflow demonstration of the above case:
https://www.youtube.com/watch?v=ocdHsUop5yE

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