

Color-coded local wall thickness map. Data courtesy of Dr Elena Lopez, Fraunhofer IWS (Dresden).

## CAD Deviation of an additively manufactured bracket

Additive manufacturing (AM) allows unique complex geometries to be produced, but sometimes these do not perfectly follow the design intent. These deviations could be due to warping because of the high temperatures and residual stresses induced in the material, or they could be due to dimensional errors in the AM toolpath/scanning hardware, or due to slicing errors of the CAD model. Other unexpected errors may also occur which necessitate geometry evaluation compared to the design intent – commonly referred to as CAD deviation, nominal-actual comparison, or 3D deviation maps.

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# Publication

This application note shows such an application using Dragonfly 3D World's "signed deviation map" function. The data is from a study originally reported in:

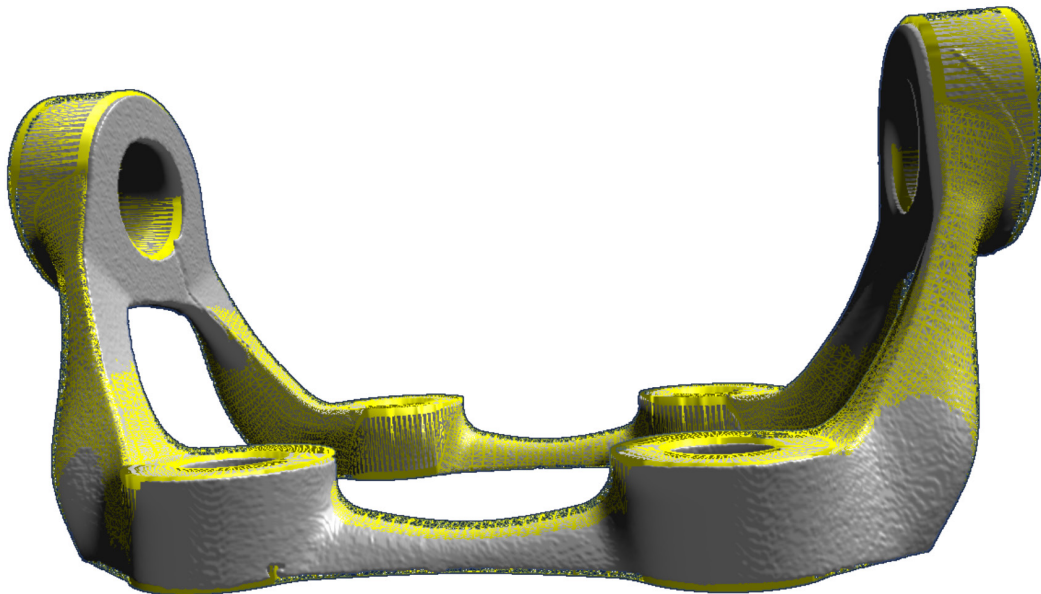
Anton du Plessis and Stephan G. le Roux, Standardized X-ray tomography testing of additively manufactured parts: A round robin test. Additive Manufacturing, Volume 24, December 2018, Pages 125-136 (<https://doi.org/10.1016/j.addma.2018.09.014>).

# Requirements

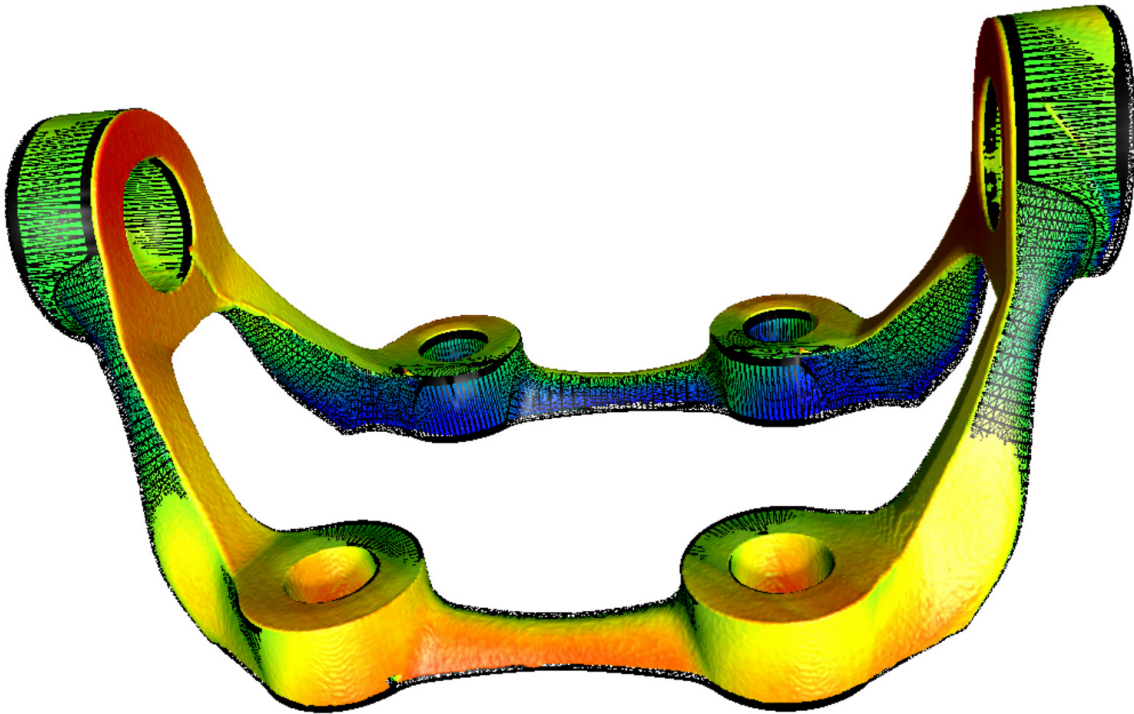
A high-quality CT scan of the part, typically using a laboratory X-ray micro-CT instrument. Image analysis is fully digital, and the actual part is not needed. A computer with Dragonfly 3D World is needed, the data can be any format, provided the voxel size is known (typical is a stack of 16-bit tiff images representing the full volume). Design file in STL format is needed.


# Typical outputs

- 3D colormap images of deviations (also video).
- Aligned design and actual part in 3D data.



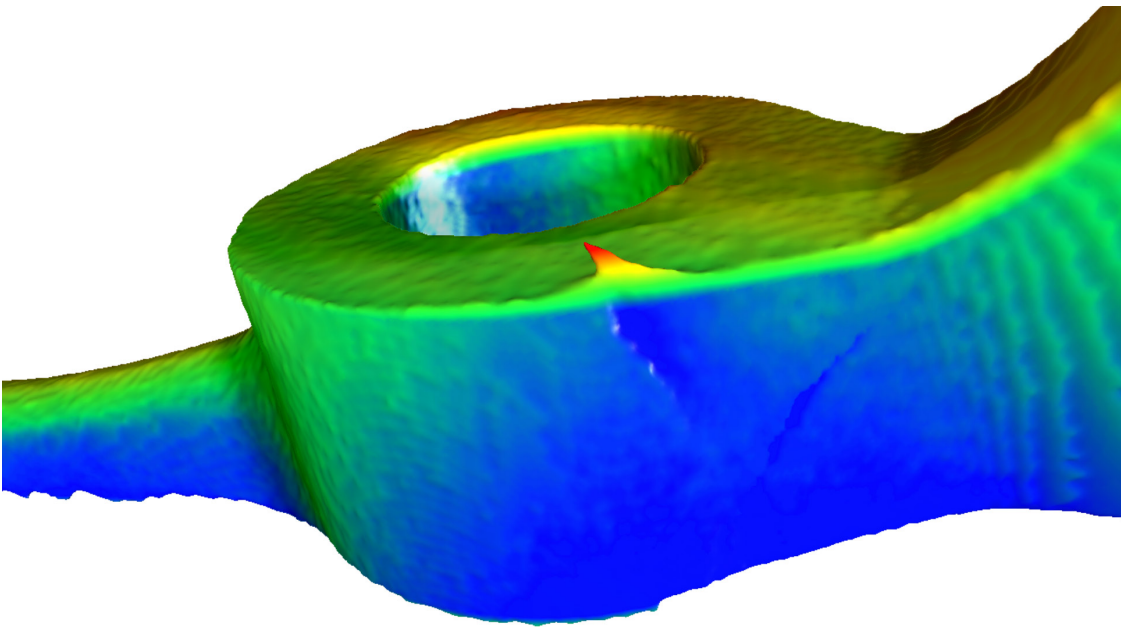
*Step 1: Align actual data to design file, overlap shown here for design file in yellow wireframe.*




**Actual Mesh - Signed Distance Map to Stub Axle Support (Registered) (mm)** 

-0.5    -0.4    -0.2    -0.1    0.0    0.1    0.2    0.4    0.5

Step 2: Perform signed distance map to color-code local deviations – red is positive and blue is negative deviation compared to design (wireframe).



**Actual Mesh - Signed Distance Map to Stub Axle Support (Registered) (mm)** 

-0.5    -0.4    -0.2    -0.1    0.0    0.1    0.2    0.4    0.5

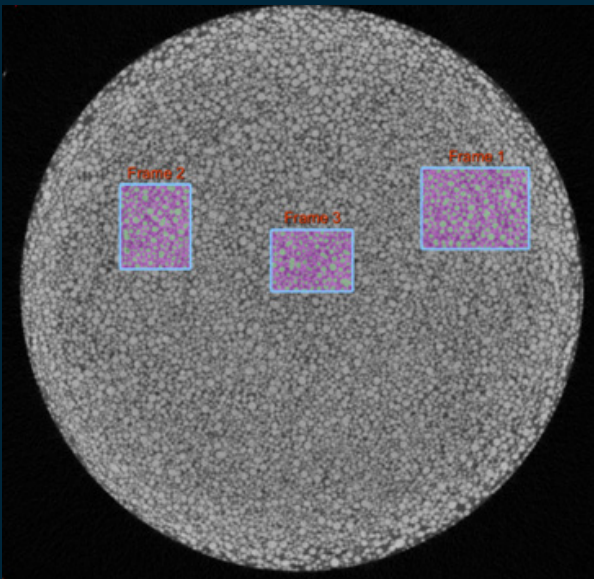
Example of high positive deviation of a sharp protrusion indicated by red color.

# Advanced

This application note demonstrates a typical case of 3D deviation analysis for a metal additively manufactured bracket, using Dragonfly 3D World software. Dragonfly has a wide range of visualization, segmentation and analysis capabilities not shown here with almost any 2D or 3D measures possible.

## The benefits

The benefits of this for your process is knowledge of the quality of your parts, 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 to be made 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!



For a video workflow demonstration of the above case:  
<https://www.youtube.com/watch?v=PPvPB7cdyKE>



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