

# Foam Characterization at LANL using Computed Tomography

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## Introduction

Foam characterization is constantly requested at Los Alamos National Laboratory (LANL). X-ray Computed Tomography (CT) is used to check for foam consistency, voids, placement, volume fraction, and particle size. Foams are CT imaged and then rendered with 3D software. The process of 3D rendering is a multi-step process that can be labor intensive depending on the information requested. The resultant images are fed into modeling codes to ultimately, give the Principal Investigator a clearer understanding of end performance.

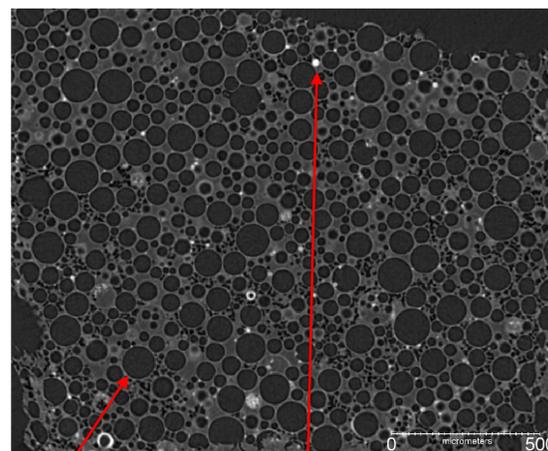
## Instrumentation

A Carl Zeiss Xradia 520 Versa X-ray Microscope is used to take CT scans. We can select between a 0.4X, 4X, 10X, 20X, or flat panel objective based on the size or specific feature of a sample. A voxel size as small as 0.5  $\mu\text{m}$  is possible depending on the objective selected and the size of the sample. The CT process is non-destructive, so samples remain intact.

## Software/Analysis

ThermoFisher Scientific Avizo software is used to render CT scans with a multitude of analysis options. Some of the most common requested data in our analysis of foams are XY and XZ slice through movies, void porosity, void volume, void sizes, and particle distribution.

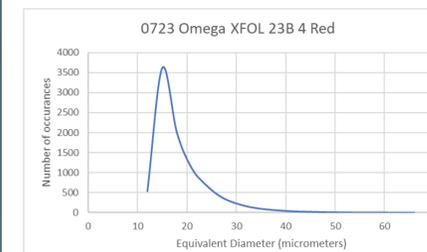
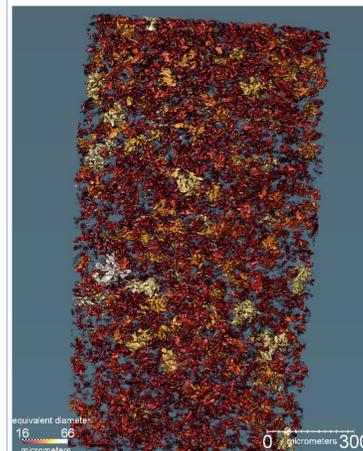
### Void Porosity



Void High Density Particle

**Imaging Conditions:**  
60 kVp, 5 W, 4X objective,  
3001 images, 1 s exposure,  
2.6  $\mu\text{m}$  voxel size

### Particle Size Distribution



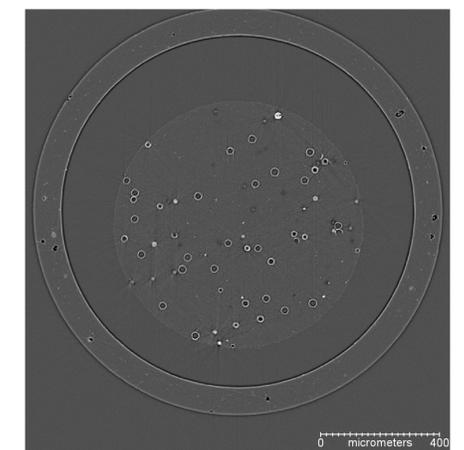
8,939 total particles identified

**Imaging Conditions:**  
80 kVp, 7 W, 4X objective,  
1601 images, 13.5 s exposure,  
0.9  $\mu\text{m}$  voxel size

### Foam Placement



Focus is on any gap between foam and hohlraum.



Focus is to confirm center placement of foam within cylinder.

**Imaging Conditions:**  
80 kVp, 7 W, 4X objective,  
1601 images, 13.5 s exposure,  
0.9  $\mu\text{m}$  voxel size

## Conclusion

CT rendering and radiographs are highly relied upon for sample characterization due the high resolution it provides. Techniques highly valued for foam analysis are void porosity, void volume, void sizes, and particle distribution. It can also give machinists and chemists feedback on any issues identified. The CT analysis is compiled into a PowerPoint presentation and provided to the physicist.

We are working to archive our CT data and results in the National Secure Data Service (NSDS).