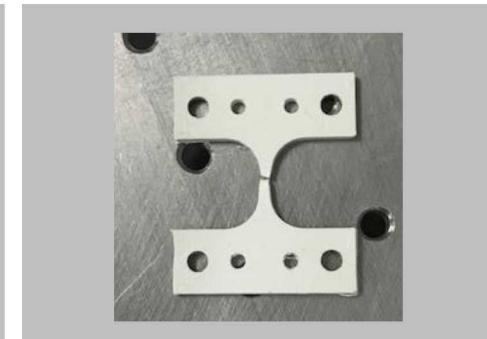
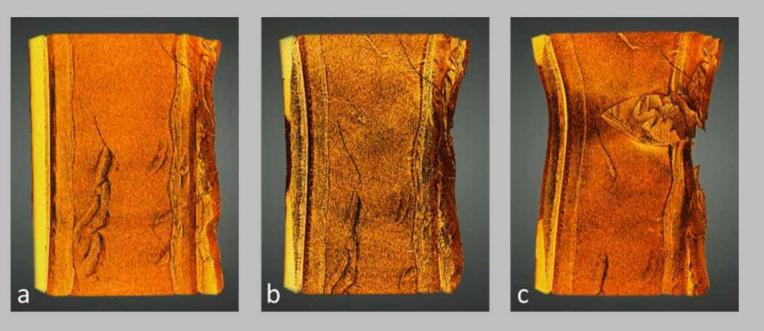


Exceptional service in the national interest

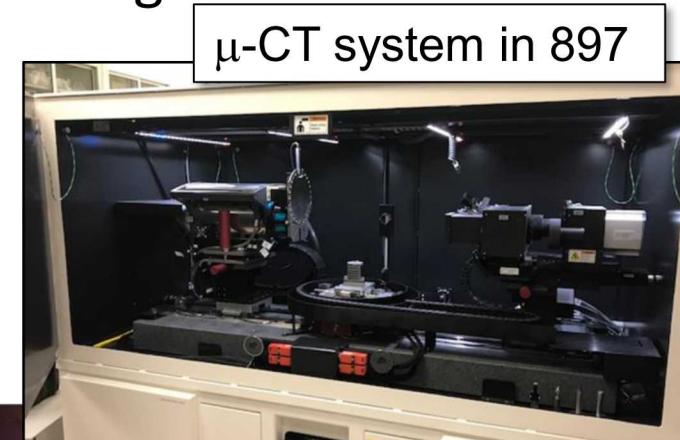


VISUALIZATION OF MICRO-COMPUTED TOMOGRAPHY AND XRD TEXTURE DATASETS USING VIRTUAL REALITY TOOLS

Mark A. Rodriguez, Tod T. Amon, James J. Griego, and
Harlan J. Brown-Shaklee

Outline

- There are **two overarching themes** that embody datasets from newly developed instrumentation such as micro-computed tomography (μ -CT) and X-ray Diffraction (XRD) data collected with area detectors:
 - 1) file sizes are becoming **massive** and un-wielding
 - μ -CT data can approach 100 GB
 - 2) datasets are **multidimensional** in nature
 - μ -CT data (x, y, z) + time
 - texture analysis ($2\theta, \chi, \phi$)



XRD instrument in 897

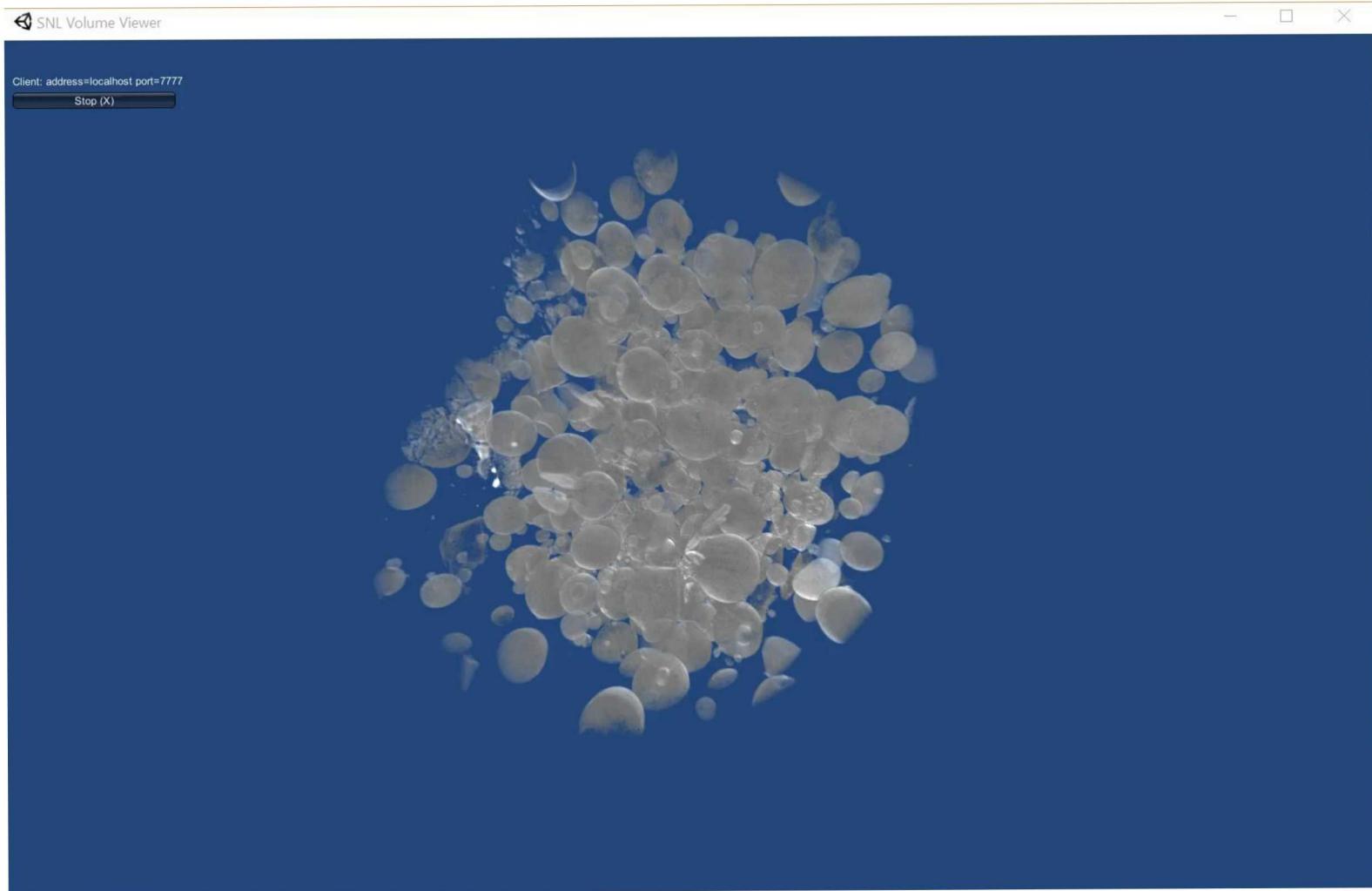
Our Enhanced Surveillance Project Goal



Develop an **Intuitive and Immersive Diagnostic** for μ -CT and other 3D datasets to improve the speed and efficiency by which these massive files are explored and evaluated.

We employ **Virtual Reality** to realize this goal

Glass beads in Epoxy: fly-through video of μ -CT data with contrast level adjustment

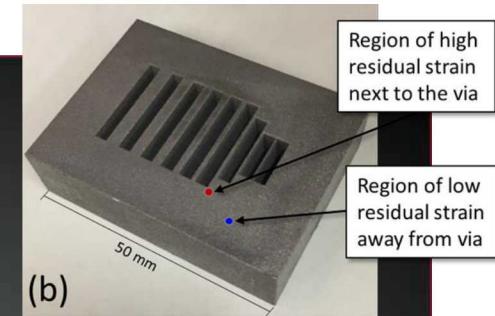
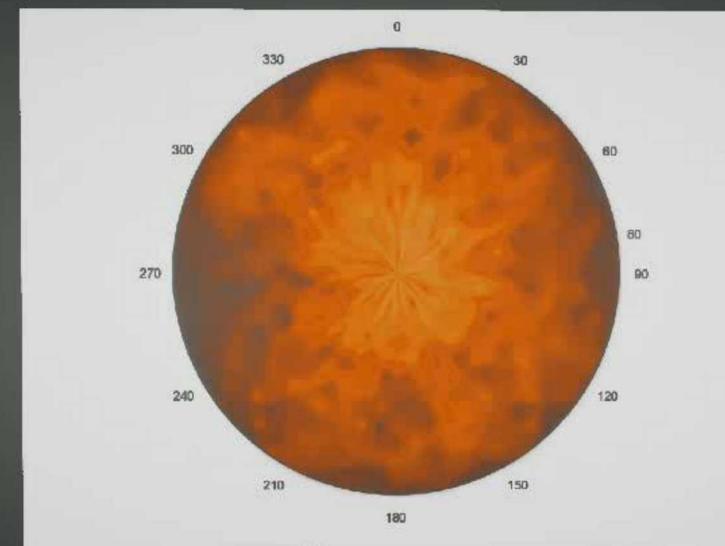


In-situ failure of Additive Manufactured part: sequential 3D μ -CT datasets showing deformation



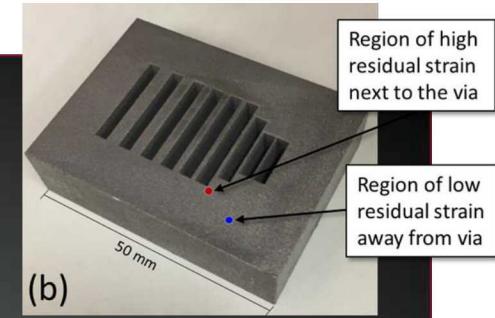
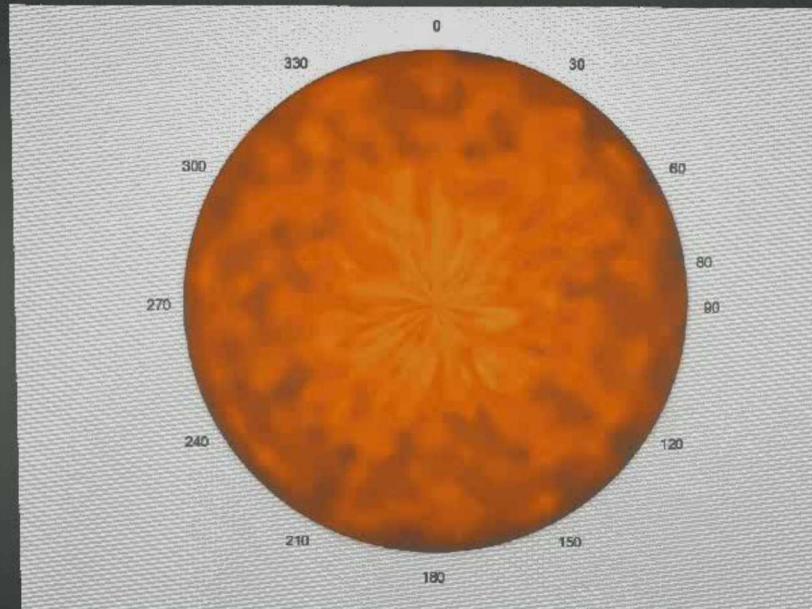
We have diagnosed residual strain in XRD datasets via distortion of intensity distribution in pole figures

- high residual strain



Unstrained region in AM part shows uniform intensity distribution in pole figure

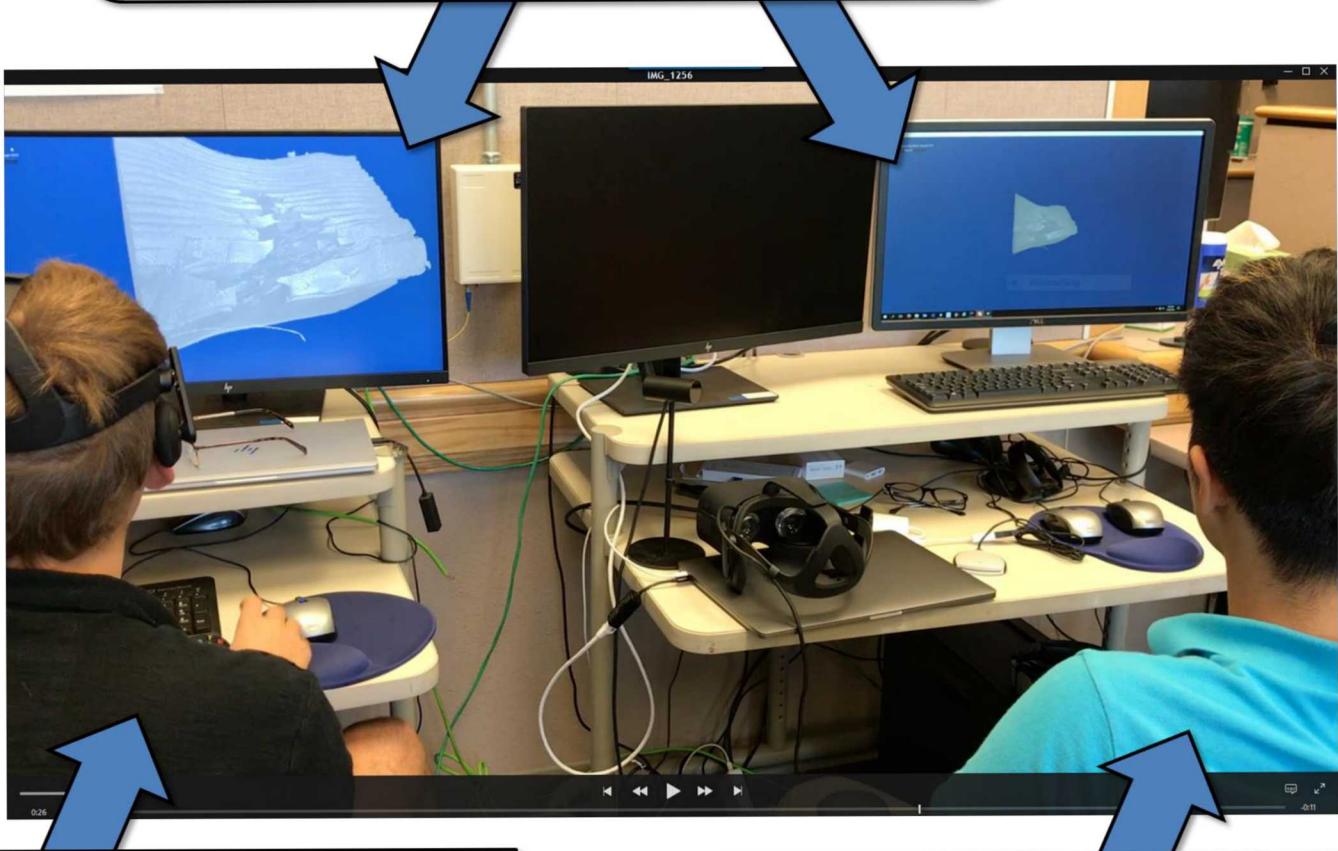
- Low residual strain



Σ^-

Collaborative Viewing

Simultaneous visualization of 3D data on multiple computers with on-screen and VR viewing options



Devon on his PC viewing 3D data in Virtual Reality on Oculus Rift headset

Bao-Loc viewing the same 3D data on his monitor and moving in 3D space using his Xbox controller

Summary

- Virtual Reality visualization allows for fast and flexible diagnosis in a 3D environment.
- Visualization can be performed on-screen or with VR headset.
- VR tools and options are available for data manipulation, marking, and measurement.
- VR has been extended to XRD analysis for evaluating multidimensional $(2\theta, \chi, \phi)$ data such as pole figure images with embedded macrostrain.
- Software is network capable for collaborative and interactive viewing via the internet.
- Generic TIFF stack format translates easily for viewing 3D data from additional diagnostics.