# Visualization and Analysis of X-ray Tomography Data

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Pacific Northwest NATIONAL LABORATORY
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Thrust Area 3; October 2010 – September 2013

## Purpose

- Image analysis characterizes signals of interest, distinguishes them from imaging artifacts
- Identifying features is a key aspect of interpreting image signals by associating particular signals with their function regions
- Seek to establish at PNNL a set of signature capabilities for rapid image analysis and feature recognition by developing a portable, expandable, parallelized software toolkit for interpreting multi-dimensional images

## Key Successes

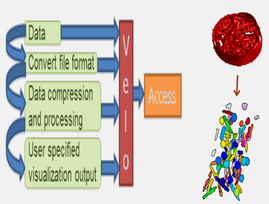
- Developed toolkit providing image analysis and feature recognition capabilities based on identified needs of data collection instruments and applications
- Established, tested toolkit links into the chemical imaging data analysis framework
- Feature recognition feeds back to other steps in the pipeline, enhancing capabilities
- Developed algorithms to generate quick views that can influence decision making during image acquisition

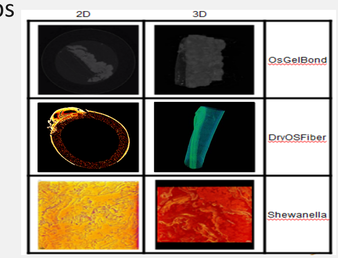
## Research Accomplishments

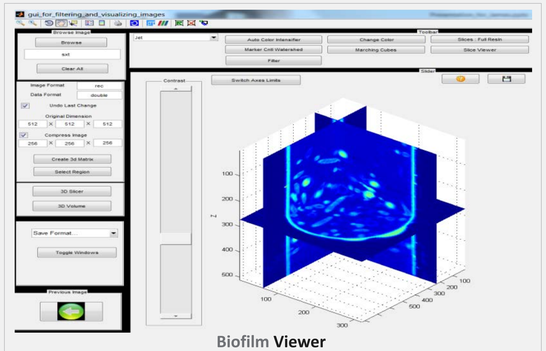
### Structure and Biogeochemical Function of Microbial Biofilms (Synchrotron Micro-Tomography, Advanced Photon Source, APS)

In support of ***Marshall Project (CII 1.1)***,

- A toolkit to visualize, process 3D data
- Near-real-time visualization support during beamline trips



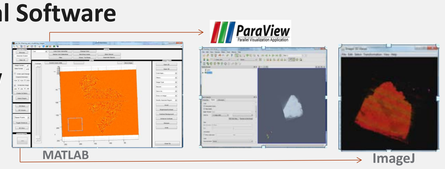



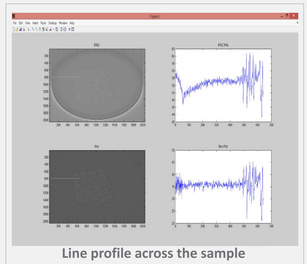



Biofilm Viewer

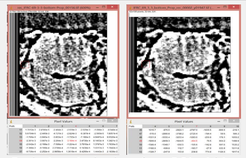
#### Integrating BioFilmViewer and Commercial Software

- ImageJ, Chimera, MATLAB, Cell Profiler
- Drishti, Vaa3D, Icy, BioImageXD, Paraview

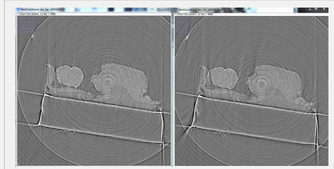


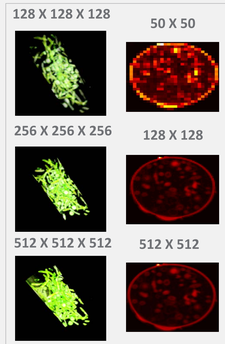
Line profile across the sample



Exploring pixel values for a ROI within the sample for two reconstruction methods



Re-alignment of samples with stage motion artifacts to improve reconstruction results

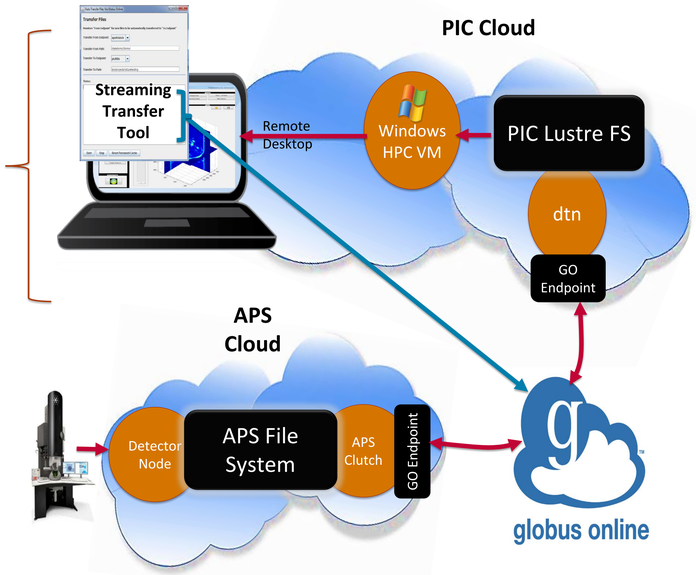



Comparison of 2D and 3D Images at different resolutions

#### Visualization Support During Beamtime (APS)

Few of the samples collected and visualized

### Near-Real-Time Remote Analysis from APS




- Tested initial prototype with Erin Miller's APS beamtime (March 13-16, 2013)
- 1.6 TB of data (71 data sets) transferred over 3 days
- Analysis for each sample completed within 25 minutes.

## Next Steps

This work is extensible to additional applications within chemical imaging and beyond. The toolkit now can be licensed, and it is a part of applications for future funding from clients. including DOE, the National Institutes of Health, and Department of Homeland Security.

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