Enhanced Presentation of Tomographic Data

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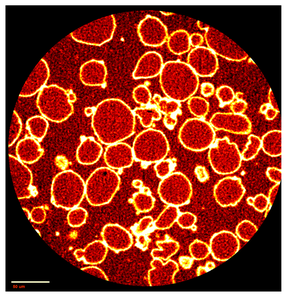
Abstract

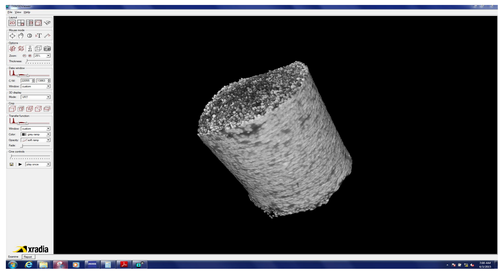
X-ray tomography yields a very large amount of data in three dimensions. Effectively displaying this data to a broad audience is a challenge. Techniques are discussed to improve the presentation of movies of both 2D and 3D tomographic data using commercially available software.

Background

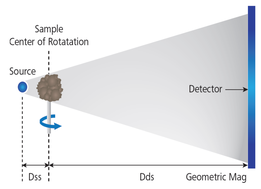
Solid materials can now be viewed non-destructively with x-rays by tomography, a technique for reconstructing 2D images of an object taken at many angles (usually covering 360 degrees) into a 3D data cube. The data can then be rendered into 2D or 3D still images or movies.



Images from same metal-loaded O-Ring sample. Right: 2D slice; 1 of 1000. Below: 3D image of 3D still of movie rendering of object exterior.



Because of the wealth of data created with this technique, we are looking for effective ways to present the results to audiences. We would like simultaneously to present two or more movies of, for example, an entire sample and an area-of-in The 3D movies present an aspect of the object by manipulating the data (e.g., threshhold) and rotating of the image to permit viewing from various angles.



Conventional Micro-CT Architecture

XCT: Visual representation of x-ray tomographic process

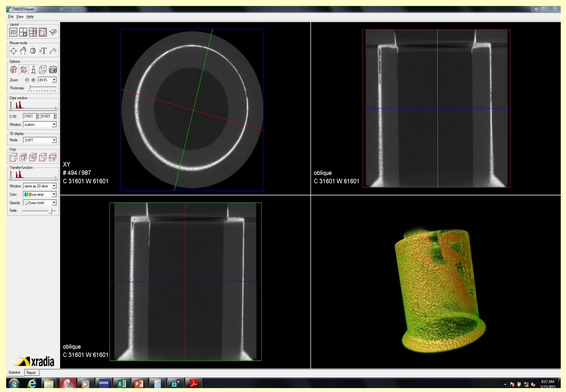
Objectives

Optimize ways to present the wealth of visual data created with tomographic x-rays.

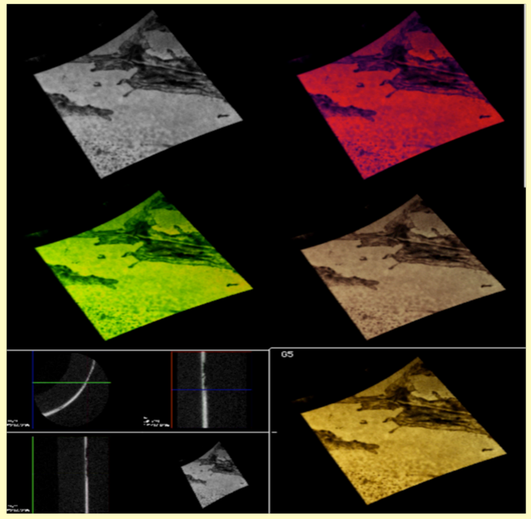
Simultaneously present full-view pictures of a sample with an area-of-interest in 2D stills and 3D movies.

Combine multiple movies to run simultaneously.

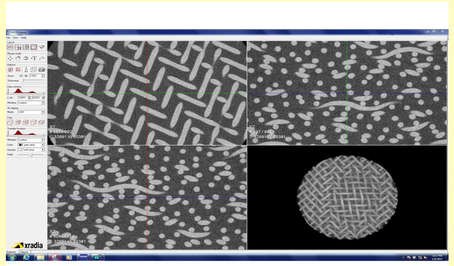
Apply accurate, readable scales to 2D images.



Above: 3 orthogonal views and 1 3D false-colorized view of braze connecting inner tube with outer cylinder in O-Ring braze sample.



Above: Higher resolution scan of same O-Ring sample showing multi- colorized options and orthogonal views.



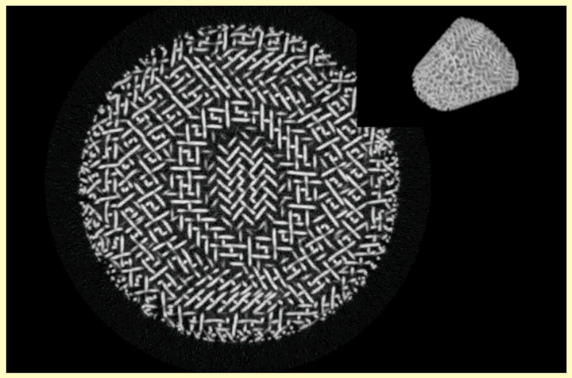
Above: 3 orthogonal views and 1 3D view of same sample.

S.T.A.R. Fellow C. Watts Clayton with Zeiss/ Xradia 5200 Versa x-ray computer tomography instrument.

Methods

Three kinds of software are used during this project:

- Programs that come with the tomographic equipment are required to reconstruct the 2D images taken at a number of angles into 3D data cubes. They are also used to produce both still images and movies from the data cubes.
- IGOR can used to manipulate large files such as movies. To most efficiently process multiple images automatically, user programming is required.
- iMovie is a user-friendly presentation tool which includes Picture-In-Picture movie viewing, slide shows, and visual enhancements such as scales. It requires QuickTime reader or conversion for some presentation formats.



Above: iMovie rendering of Picture in Picture dual view of 2D and 3D movies of mesh sample at left.

This material is based upon work supported by the Sandia National Laboratories, and S.D. Bechtel, Jr. Foundation. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funders.
The STAR program is administered by the Cal Poly Center for Excellence in STEM Education (CESAME) on behalf of the California State University.

Conclusions

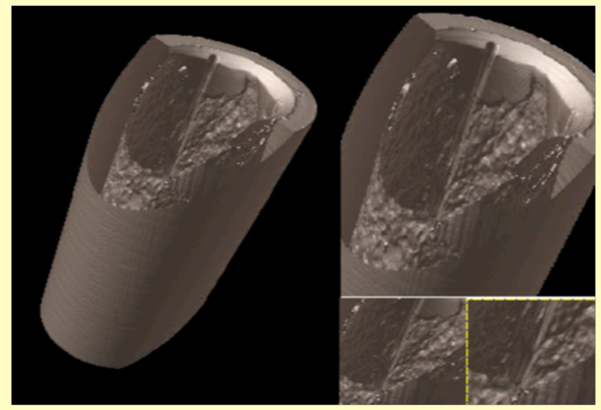
Research identified pros and cons within each application.
Attention must be paid to readability, scales, distortion, and file types when converting across platforms.

iMovie
- User-friend features; intuitive interface
- Handles all file types; requires QuickTime reader or conversion app
- Operates in iOS or Windows
- Easy 'Picture-In-Picture' feature for dual 3D views

IGOR
- Data-friendly functions; requires user programming skills to optimize
- Handles most file types
- Operates in iOS or Windows

Zeiss/Xradia
- App accompanies X-ray spectroscopy instrument
- Handles limited file types; interfaces with instrumentation; can generate false-color images.
- Operates in Windows

Future Directions:
- Exhibit more than two movies together on one slide.
- Create accurate post-production scales on 2D slides.



Above: 3D still image cropped and displayed for area of interest.

ACKNOWLEDGEMENTS
The work acquired throughout the 9-week period was funded in part by STAR to support Science Teachers and Researchers. An appreciation is given to Dr. Bernice Mills for her encouragement, advice, and support throughout the project.