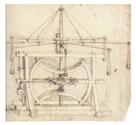
Alcator C-Mod Tokamak - Virtual Reality Vizualization

R.T. Mumgaard, J.A. Stillerman, J.T. Stillerman

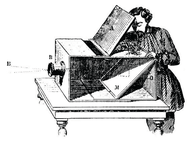
Plasma Science and Fusion Center, MIT, Cambridge, MA, USA

Accelerating Evolution in Science Imagery

- Public expectations for imagery are changing rapidly.


1500s


1700s


1800s


1960s


2010s

- Immersive Environments are getting better and less expensive.


Stereoscope


Cave virtual environment

Oculus Rift


Google Cardboard

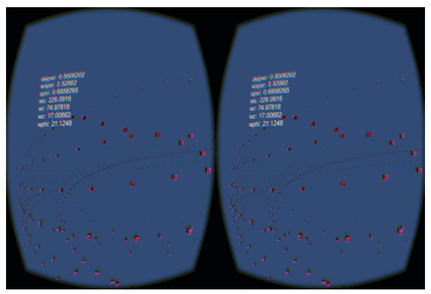
Applications

Education and Outreach

- Compelling images
- Create a variety of content
- Construct audience targeted narrative
  - The research
  - The engineering
  - The scientific results
- Hold audience attention using innovative technology

Science and Engineering

- Render 3D Engineering models
- Explore inter campaign survey pictures.
- Understand spatial relationships between components.
- Visualize data from modeling codes



Learn More or Collaborate

- Visit PSFC website to access the final products and the virtual tour:

Contact us:
Josh Stillerman
jas@psfc.mt.edu
Bob Mumgaard
mumgaard@psfc.mit.edu

www.psfc.mit.edu/outreach/3d-tours

Future Work

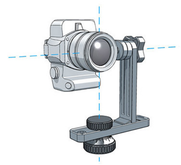
- Utilize new images of machine interior
  - 20 GB of new images have been taken with GoPro Hero camera
  - Structure from motion
  - More detailed 3D tours
  - Construct true 3D models from images
- Overlay magnetic fields, plasma and diagnostic results
- Tours of other PSFC facilities
- Visualize output of modeling codes
- Create shared 3D environments
- Visualize 3D CAD models

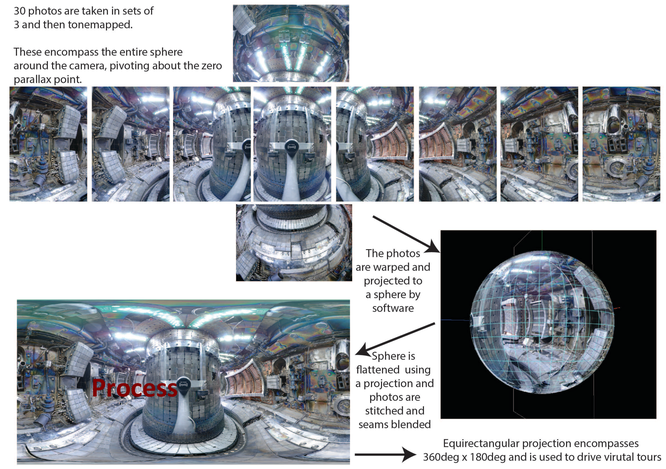
Acquiring Imagery

- Use techniques and software now common in real estate industry
  - Tripod head on car allows the camera to be pivoted about its entrance pupil eliminating parallax
  - Take enough photos to cover sphere surrounding camera
  - Photos stitched around sphere and projected flat

- Projections used to drive virtual reality using Java/HTML5
- Allows user to navigate on their own or be guided through view
- Multiple sets of photos from different points (14 on C-Mod) linked together into virtual tours
- Can be accessed on the web or tablets/smartphones

Specialized tripod head used to pivot camera on rail





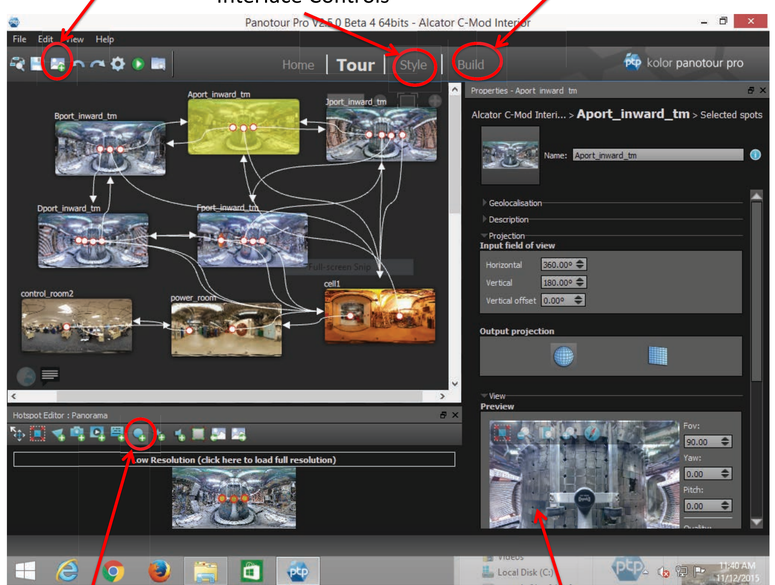
Constructing the tour

Pantour Pro (by krpaono) was used to construct a 3D tour of the experiment.

1 - Load Panoramas

4 – Add User Interface Controls

5 - Build the Tour

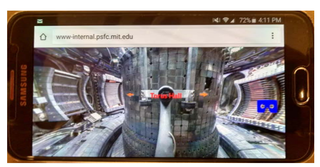


2 - Add Navigation Hot Spots

3 – Set Destination and View

- Software for constructing 3D tours is now inexpensive and easy to use.
- Pantour Pro (krpano.com) generates both HTML5 and flash based tours.
- Includes support for gyroscopic orientation inputs from tablets and mobile devices.
- Beta version supports stereoscopic viewers. Oculus Rift, Google Cardboard, etc..

6 – View on Mobile Device



7 – Explore with Cardboard viewer