Piloting Photogrammetry in Digital Libraries

Marcia McIntosh
Digital Production Librarian

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Shannon Willis
Digital Projects Lab Manager

Who are we?

- University of North Texas
- Digital Projects Unit - Digitization Lab
- Two main repositories: The Portal to Texas History and the UNT Digital Library

UNIVERSITY OF NORTH TEXAS
Digital Library

We typically do 2D digitization of flat materials

Photographs

Magazines

Books

FERMILAB-PUB-12-108-A SLAC-PUB-15262

Dark Matter in 3D

Daniele S. M. Alves,[1] Sonia El Hedri,[2,3] and Jay G. Wacker[2,3]

[1]Fermi National Accelerator Laboratory, Batavia, IL 60510

[2]SLAC National Accelerator Laboratory, Menlo Park, CA 94025

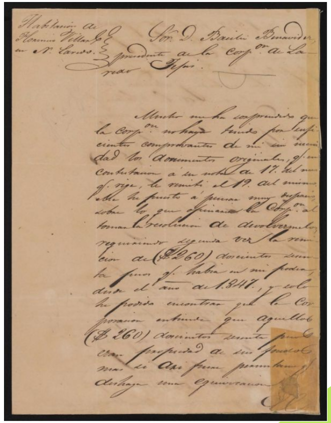
[3]Stanford Institute for Theoretical Physics, Stanford University, Stanford, CA 94305

(Dated: April 26, 2012)

We discuss the relevance of directional detection experiments in the post-discovery era and propose a method to extract the local dark matter phase space distribution from directional data. The first feature of this method is a parameterization of the dark matter distribution function in terms of integrals of motion, which can be analytically extended to infer properties of the global distribution if certain equilibrium conditions hold. The second feature of our method is a decomposition of the distribution function in moments of a model independent basis, with minimal reliance on the ansatz for its functional form. We illustrate our method using the Via Lactea II N-body simulation as well as an analytical model for the dark matter halo. We conclude that $\mathcal{O}(1000)$ events are necessary to measure deviations from the Standard Halo Model and constrain or measure the presence of anisotropies.

Work supported by US Department of Energy contract DE-AC02-76SF00515.

Reports

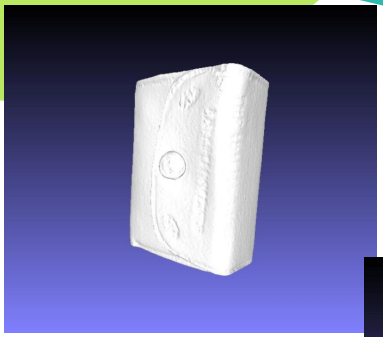


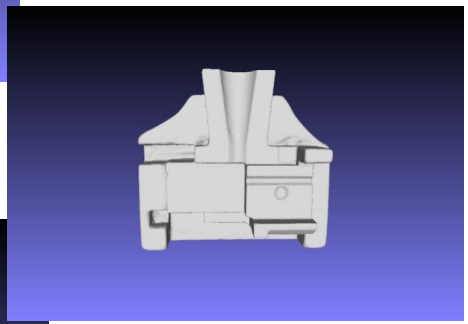
Documents

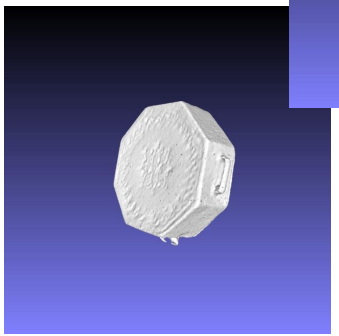
Past 3D Work

- 3D Laser Scanning
- Lacked texture for laser scanned models
- Explore possibility of creating photorealistic 3D models with color and texture

→ **Photogrammetry!**







Materials: Texas Fashion Collection

Chinese Lotus shoe

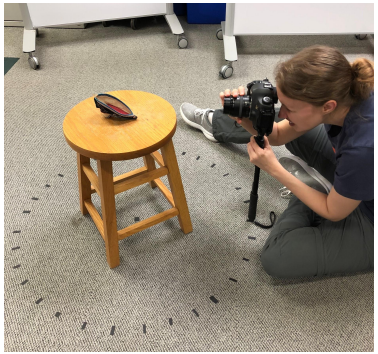
Yves Saint Laurent Black Pump

Judith Lieber Handbag

2 tutorials + 2 shooting methods + 2 software programs

Agisoft

lynda.com



RECAP 360

Supplies

Stuff we had:

- Canon 5Ds SLR camera
  - 50 mm lens, batteries, battery charger, memory card, card reader
- 2 North Light 900w HID copy lights
- 2 small Fotodiox small lights
- Really Right Stuff tripod
- Gray paper
- Large 360 degree circle (printed)
- Miscellaneous: gaffer's tape, foam wedges, etc.
- Agisoft (free 30 day trial of pro version)

Stuff we didn't have:

- Lazy susan (Bed Bath and Beyond bamboo, covered in gray paper)
- One month subscription to Recap 360

Two tutorials

Cultural Heritage Imaging (CHI)

Photogrammetry Examples and 3D Information

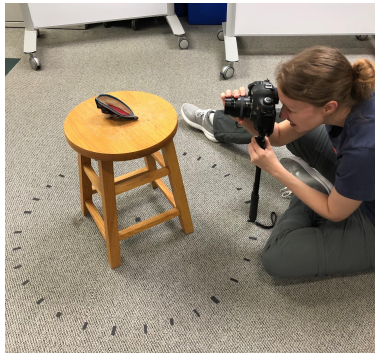
Lynda.com

3D Scanning with a Camera - Kacie Hultgren

First Shooting Method: Walk Around

Pros

- Good for stationary objects
- Theoretically helps software match images better



Cons

- Harder on the photographer
- Not able to use HID lights, so had to change aperture, ISO, and shutter speed from the ideal to compensate for low ambient light

Second Shooting Method: Lazy Susan

Pros

- Easier on the photographer
- Standard background is theoretically easier to mask out
- Able to use our copy lights (at our Phase One setup)
- Opportunity for tethering

Cons

- Required us to buy a lazy susan and mark with 10 degree intervals

Shooting: Lessons Learned

- Tripods are essential
- In addition to the three recommended heights, need to get good shots of top and bottom of object
- Consistent background is important. Everything that is not the object should be the same color
- Consider multiple lights (we wanted more than two heavy duty lights)
- Consider tethering
- Preferred Lazy Susan method

First Software: Autodesk Recap 360

Pros

- All automated
- Uses cloud computing so it doesn't tie up your computer

Cons

- Subscription service, not a one time purchase
- No free trial will let you make a photogrammetry model
- Have to use/purchase cloud credits each time it processes images into a model
- Less control over processing of images and model creation
- Liked our Recap model less

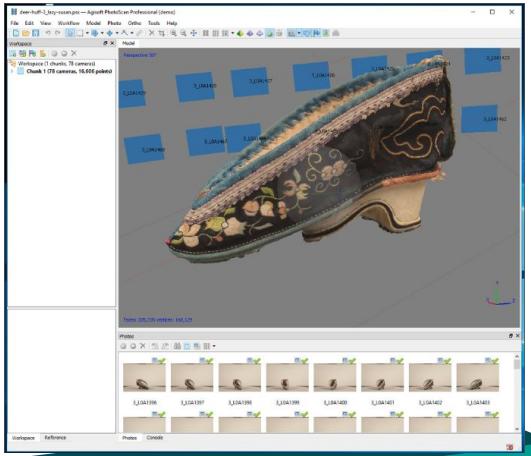
Second Software: Agisoft

Pros

- Free 30 day trial of Pro version
- One time purchase
- More control over processing decisions
- We liked our Agisoft models better

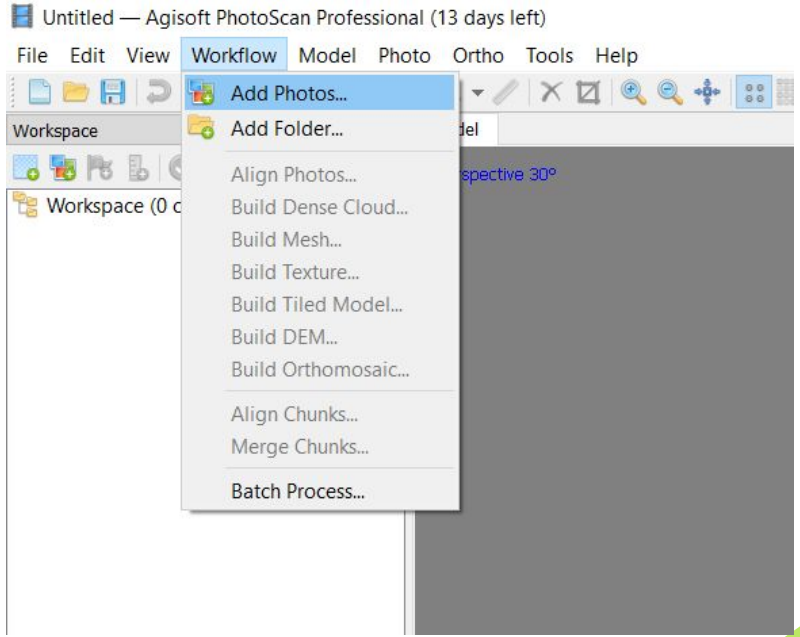
Cons

- Uses computer's memory and storage (can be taxing)
- Steep learning curve

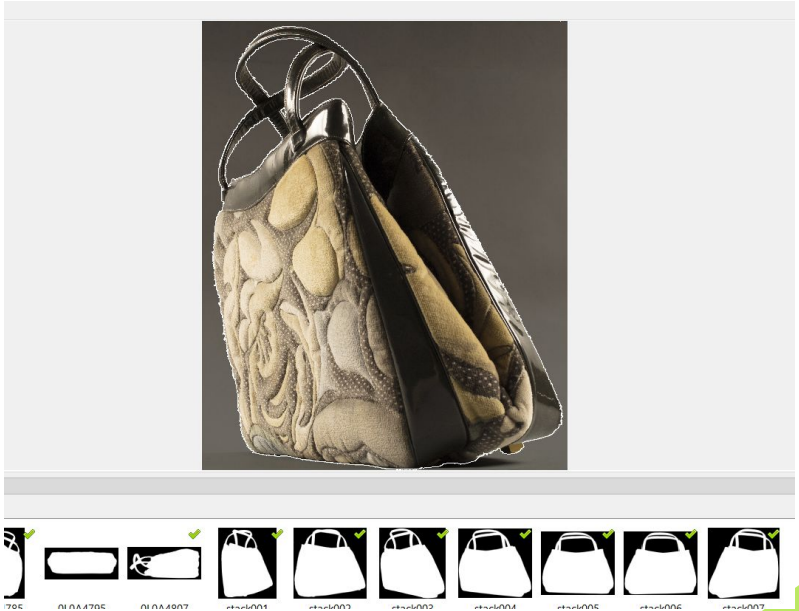


Agisoft Processing - Convert and Add

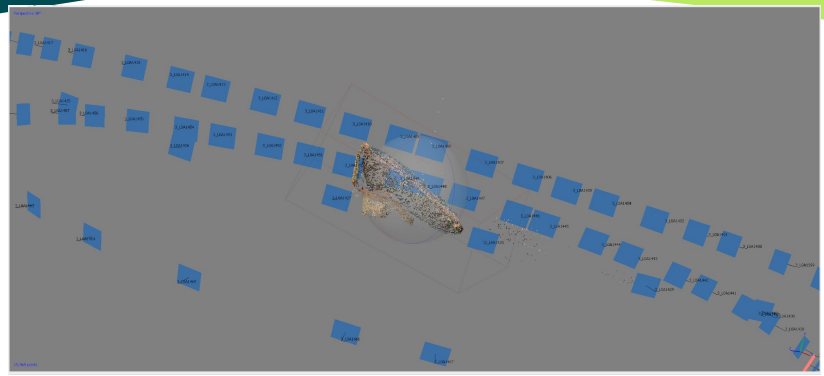
- Convert images if shoot in RAW
- We often cropped to take out unwanted background elements
- Add Photos to Agisoft project

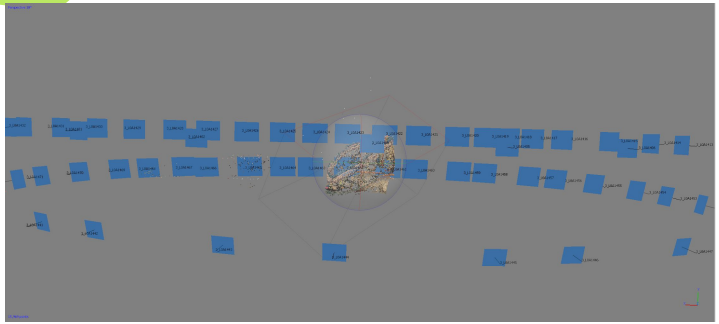


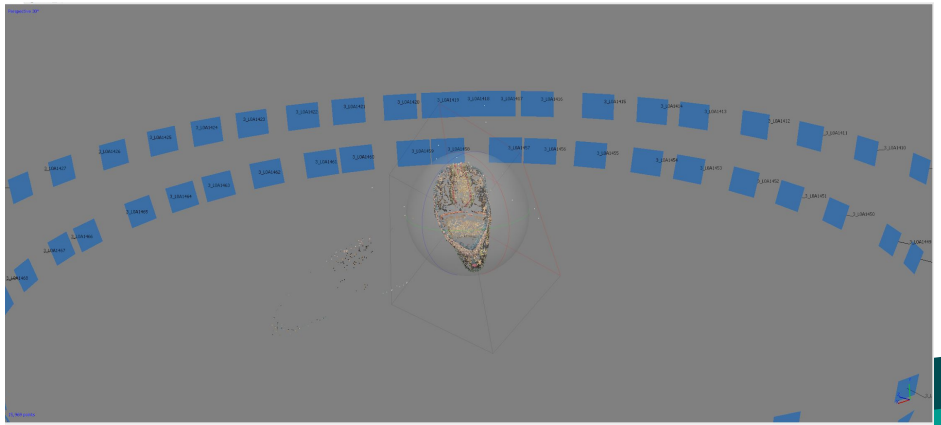
Agisoft Processing - Masking Images



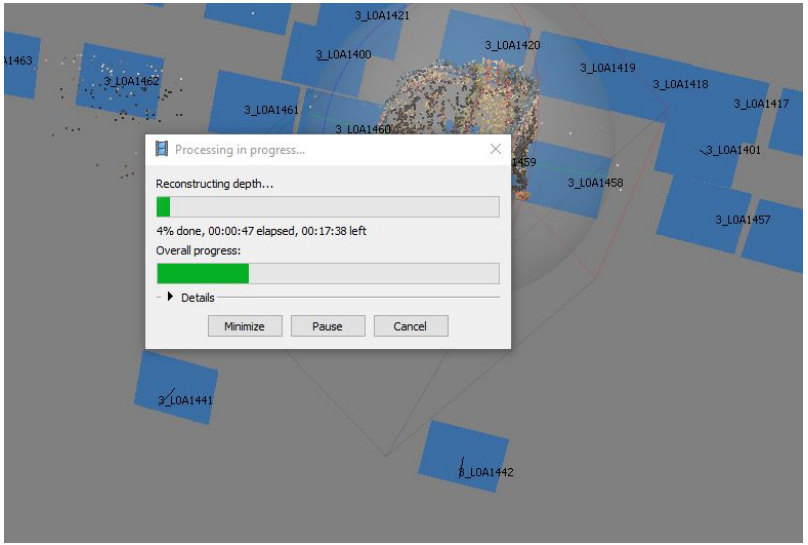
Agisoft Processing - Align Photos

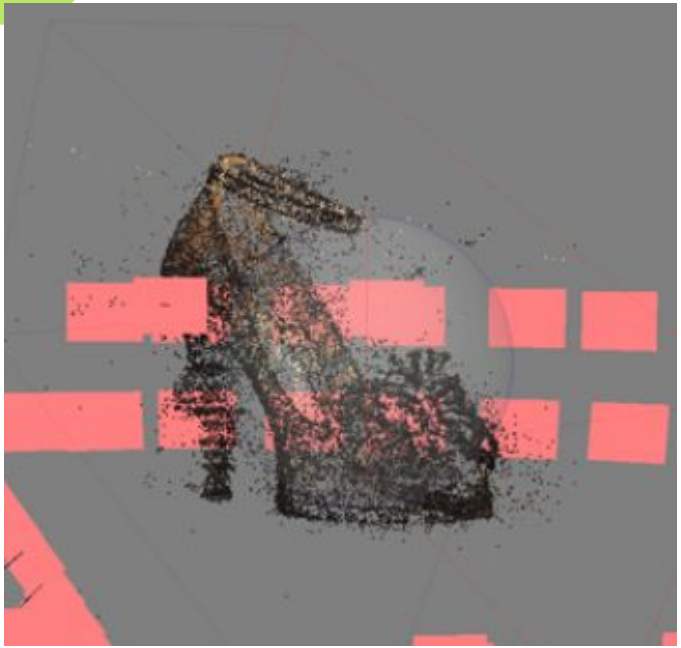




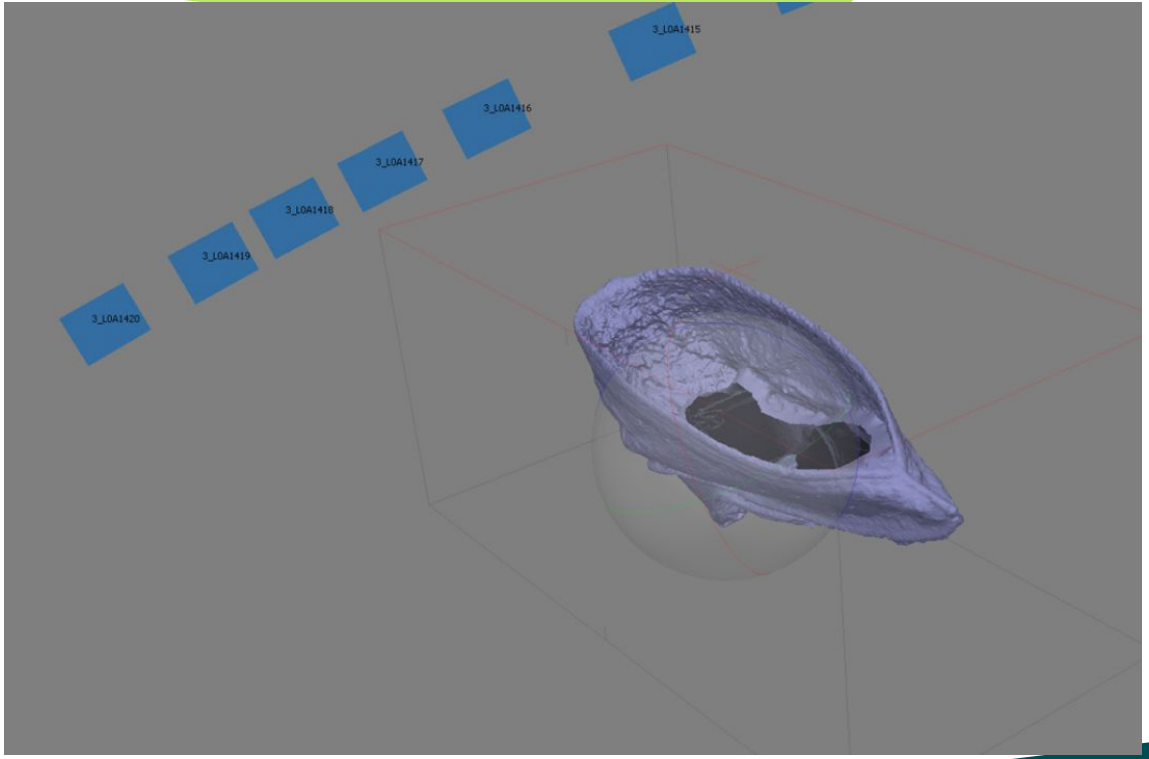


Processing - Build Dense Point Cloud

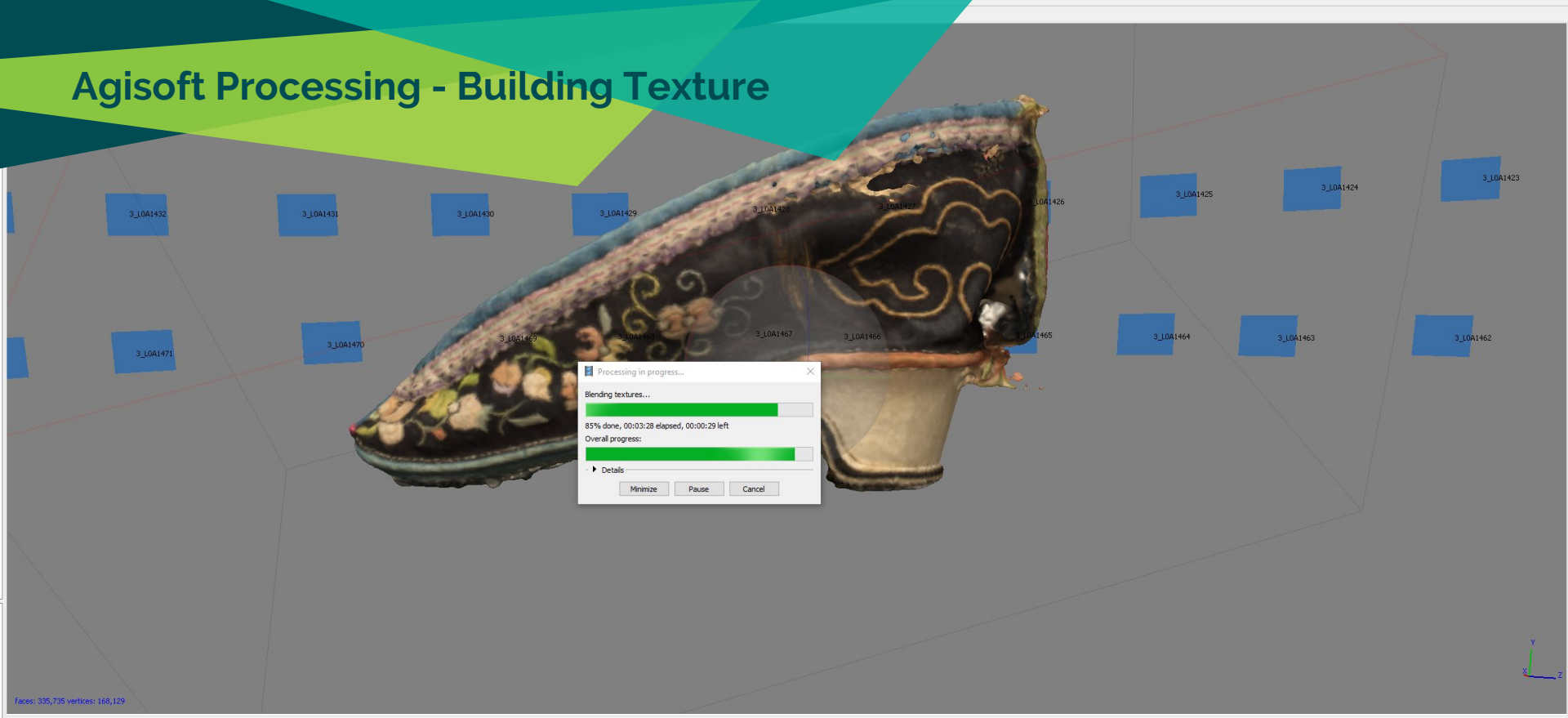




Agisoft Processing - Build Mesh

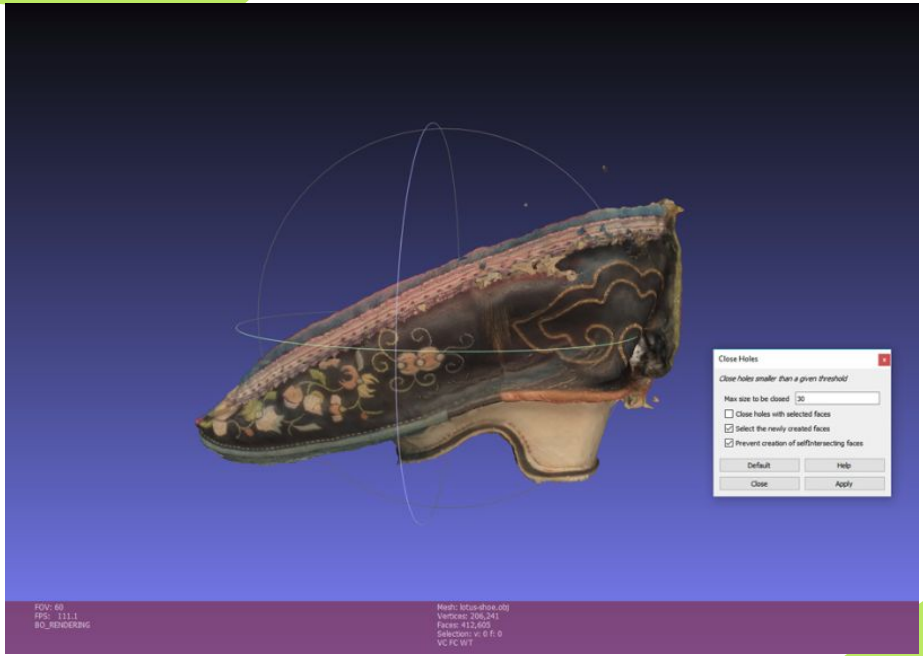


Agisoft Processing - Building Texture



Processing - Output and Clean Up

- Export as OBJ
- Any remaining holes or texture problems can be edited in MeshLab or Meshmixer



Processing Tips

Chunking

Working in small batches can help get more accurate models.

Background

For ease in masking later, use a simple background. Masking is the most time consuming part.

Image Alignment

If the images are not aligned correctly, you will not get a good model at the end.

Image Organization

Don’t reorganize images on your computer after you start a job. The program will lose the path to the image.

Computing Time

Expect to spend time waiting for jobs to process. Dense Point Cloud seems to take the longest.

Patience

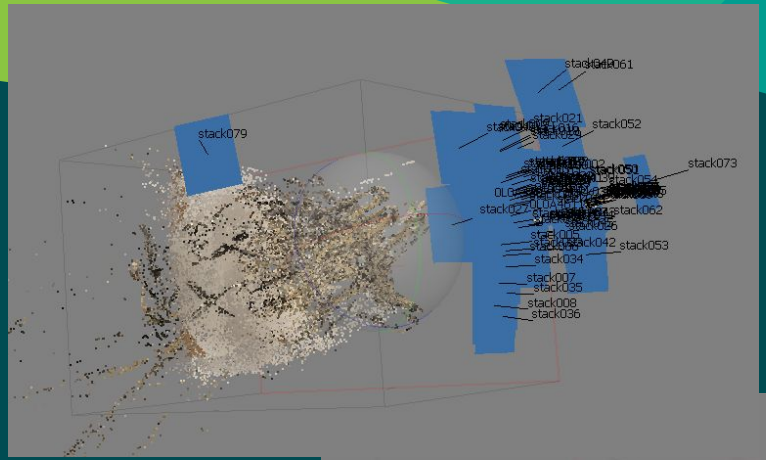
Be prepared to do a lot of trial and error.

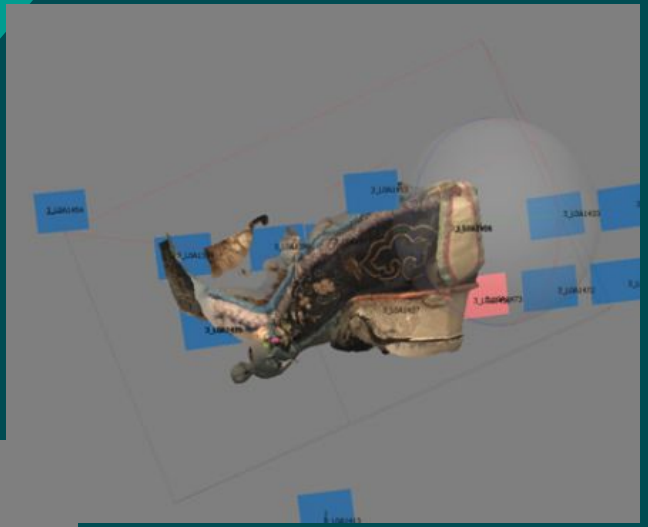
Our Method of Metadata, Upload, and View

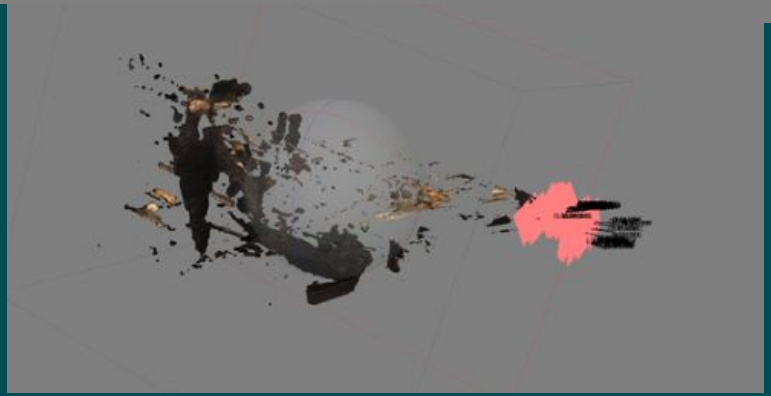
- Metadata describes the 3D Model instead of the object
- PNGs of model for use with the current viewer in our systems (cannot manipulate 3D model)
- GIF of the model
- Model files available for download in RAW and finished forms
- Readme file of the process

Lessons Learned

- The objects we thought would be easy were not so easy (lots of depth and glare)
- Photogrammetry is a time consuming process, which makes it costly.
- To make it a regular piece of digitization work we would need: more lights, a real backdrop, automated turntable, Agisoft license, and dedicated space and equipment.
- Given time, cost, and equipment needs, it is important to consider if a 3D model adds significantly more value for researchers than 2D photos for a given object or collection.







Thank You/Credits

-CHI Cultural Heritage Imaging for Photogrammetry Tutorial Videos
-Lynda.com
-Annette Baker at Texas Fashion Collection for materials loaning
-SlidesCarnival for presentation theme “Escalus”
-Bloopers provided by the presenters