3D Surface Models in Paleontology and Archaeology

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Digital Data in Biodiversity Conference
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Buesching mastodon site Fort Wayne, Indiana, 1998

- *Mammut americanum*
- Adult male
- Victim of musth-combat
- Scavenged by humans, butchered, cached in pond, preserved in marl
- Ca. 85% complete

- Provides osteological data for refined taphonomic and comparative study

Buesching mastodon site UMORF release May, 2014

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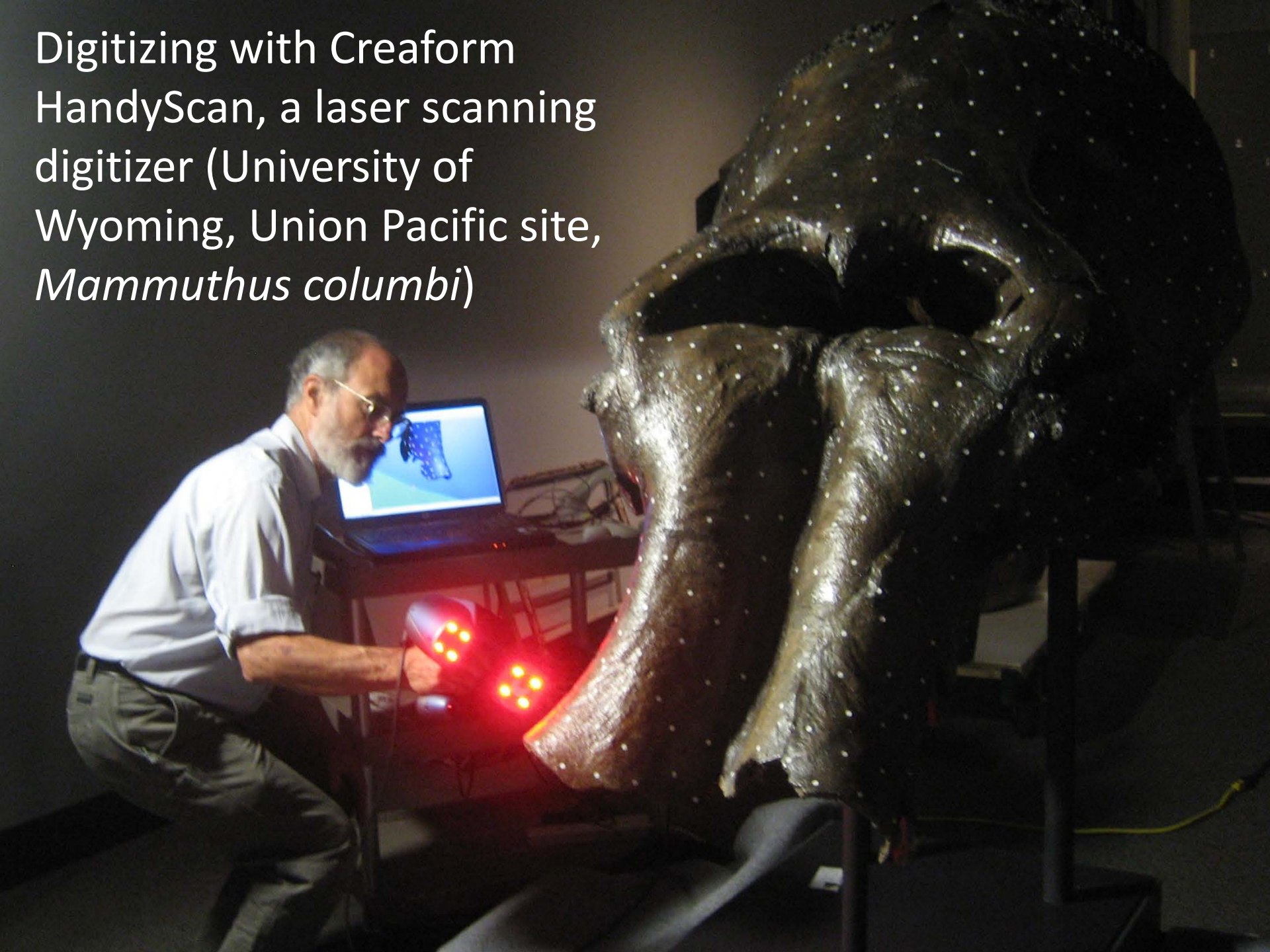
Buesching mastodon skeletal mount, University of Michigan

Scan Mounted Skeleton

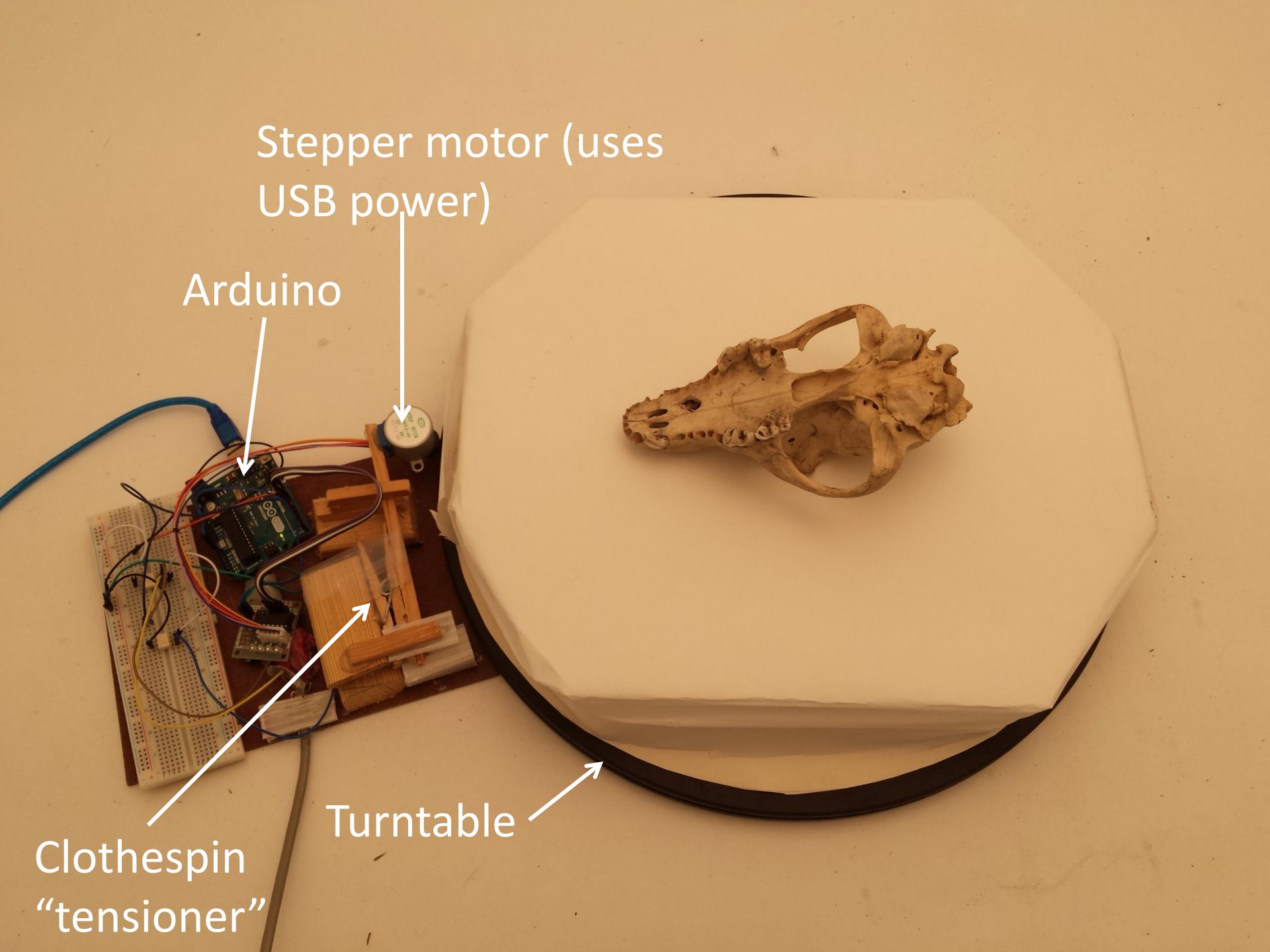
- Leica Color Scanner
- Time-of-flight
- Sub-centimeter precision
- Nine scans stitched together
- Multiple targets for alignment
- Missed extreme dorsal regions
- Point cloud used as template for aligning bone models
- Full dataset includes photos for texture-mapping

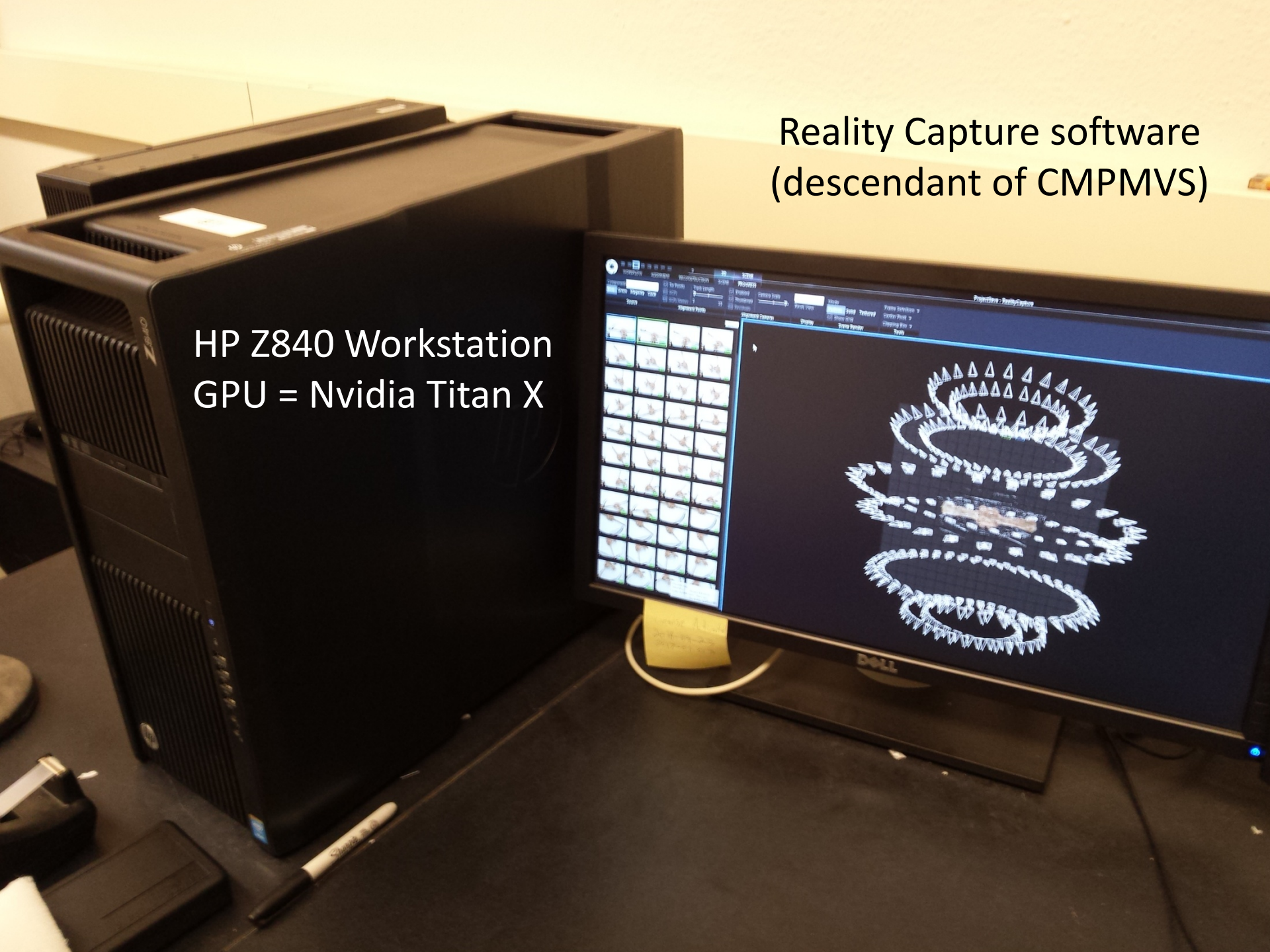
Point cloud produced by Leica scanner …

Digitizing with Microscribe, a mechanical-arm, point-digitizer (left calcaneum of the Buesching mastodon)


Digitizing with Creaform HandyScan, a laser scanning digitizer (University of Wyoming, Union Pacific site, *Mammuthus columbi*)

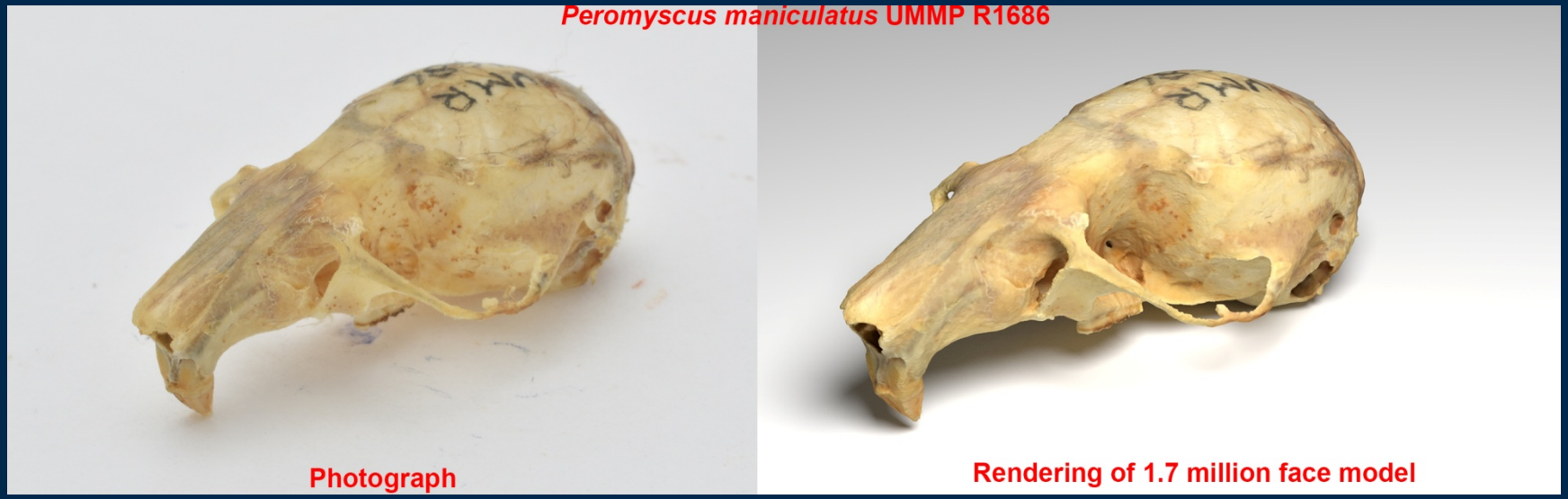

2x 500W Halogen lights
Keep it cool …
Coroplast and disposable tablecloth tent
Nikon D810 w/
60mm macro lens
DigiCamControl
(open source)


Stepper motor (uses USB power)
Arduino
Clothespin "tensioner"
Turntable


Reality Capture software
(descendant of CMPMVS)
HP Z840 Workstation
GPU = Nvidia Titan X

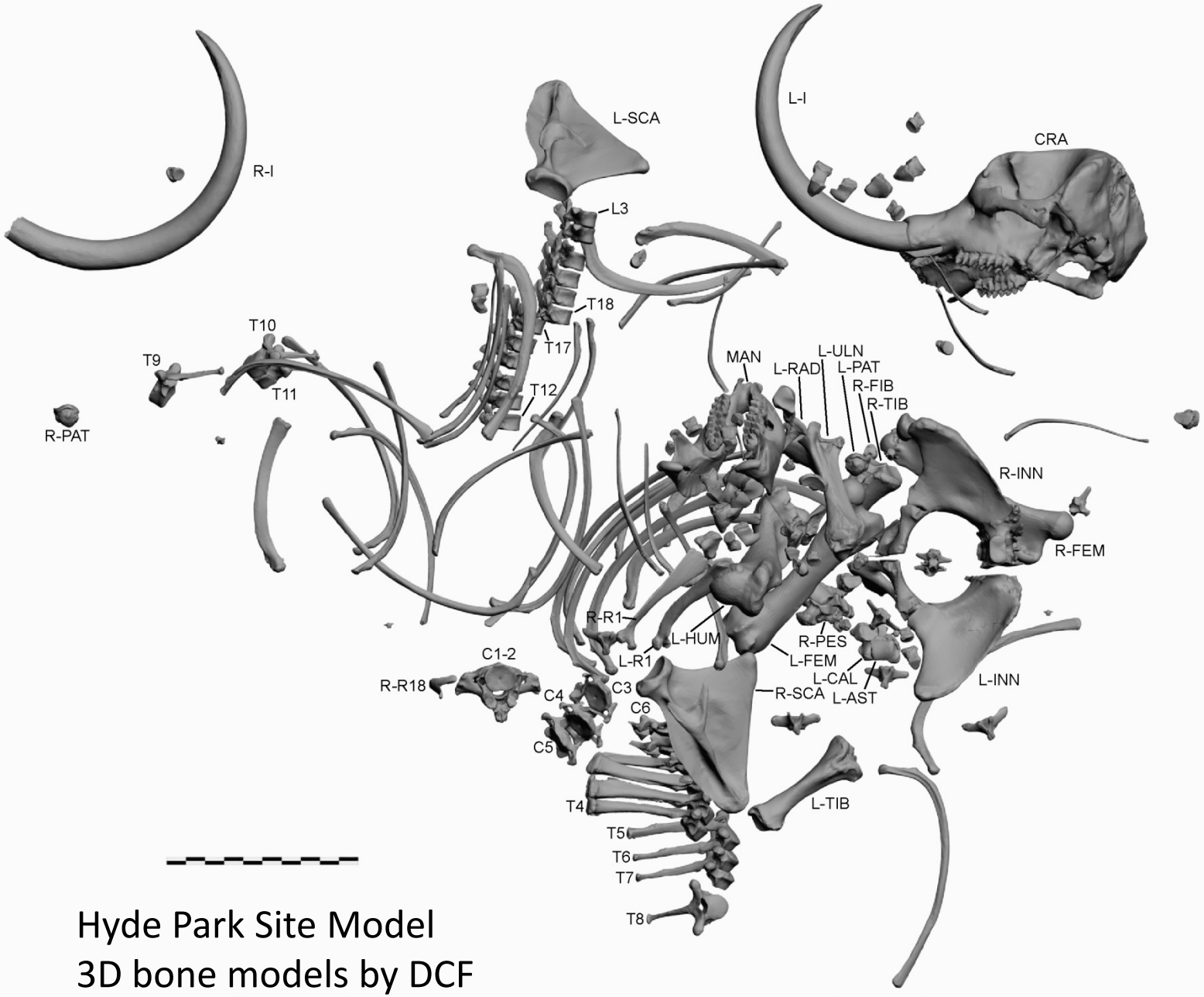
Typical process/results for a ~15-cm object

- Photography time – 20 to 25 min
- Compute time < 2 hours
- 10 – 40 million faces
- RGB color (we use vertex color)
- Resolvable detail < 100 microns



Bristle mammoth model rendered with Blender (open source)

Overhead view of Hyde Park mastodon excavation

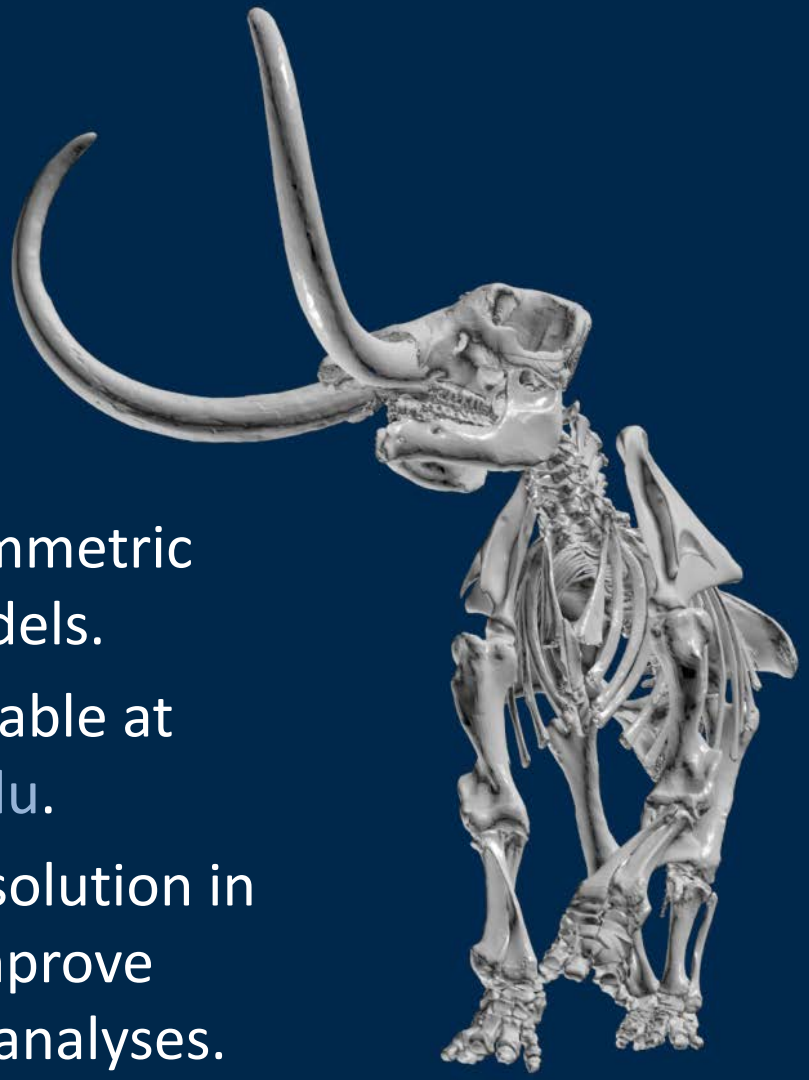


Hyde Park Site Model
3D bone models by DCF
Site assembly by P. Nester

Hyde Park site model – animation by Adam Rountrey

http://umorf.ummp.lsa.umich.edu

Conclusions



- Mechanical, laser, and photogrammetric methods yield photorealistic models.
- Internet access to models is available at http://umorf.ummp.lsa.umich.edu.
- Online resources will improve resolution in osteological identification and improve taphonomic and paleobiological analyses.
- 3D models will also facilitate site mapping and educational applications.

Acknowledgments

- Buesching family and Indiana State Museum for access to specimen
- Generations of University of Michigan undergraduates for help with modeling mastodon and mammoth osteology
- Linda Garcia and Peter Knoop, for help with web development
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