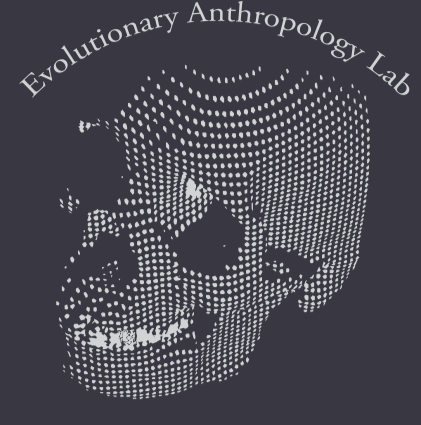
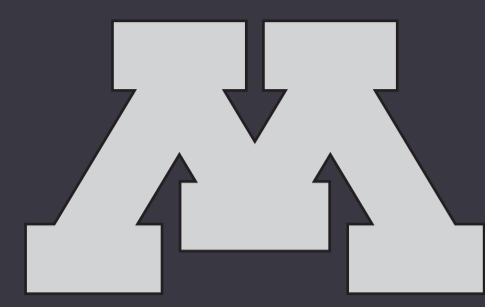


A Portable, Low-Cost, Open-Design Rig for Reflectance Transformation Imaging

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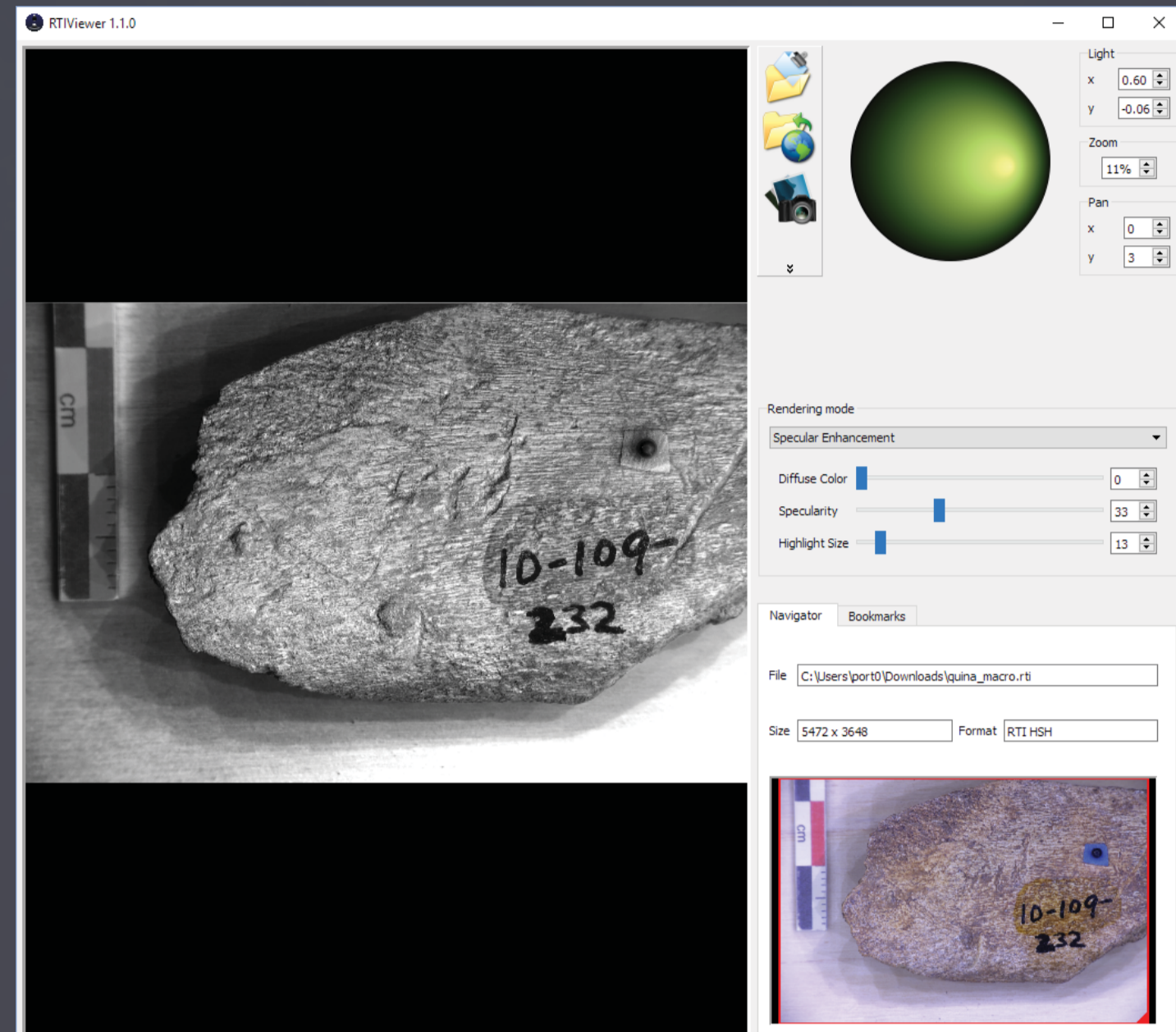


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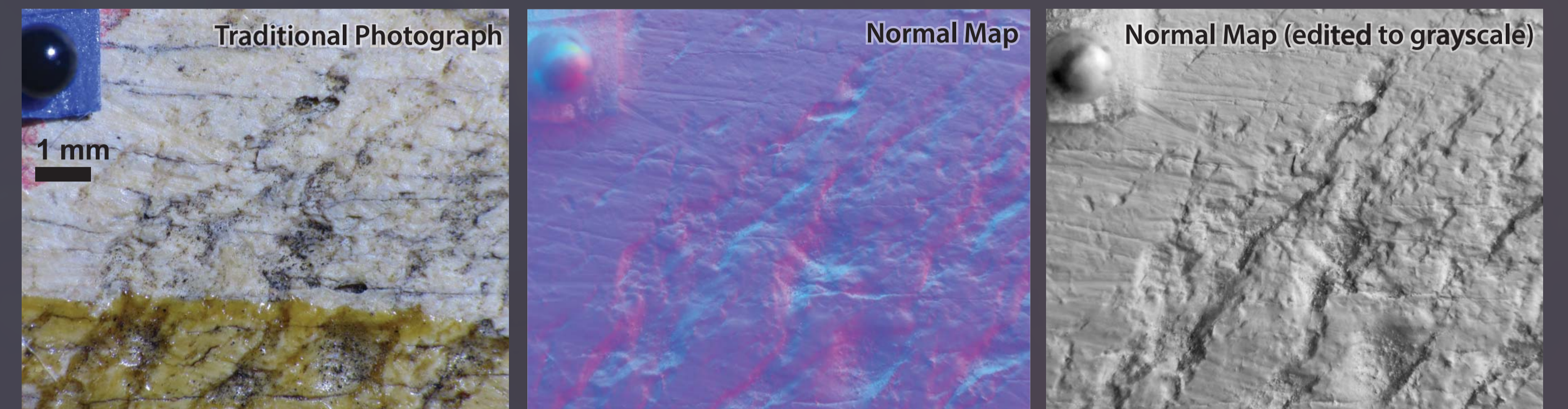
What is RTI?

Reflectance transformation imaging (RTI) is an image enhancement technique. Digital photographs of an object are taken from a stable camera position with lighting from different directions and angles. The program RTIBuilder¹ calculates surface normals for each pixel. These data can be used by programs such as RTIViewer² to digitally re-light an object, or create different visualizations revealing details that are not apparent in traditional photographs.

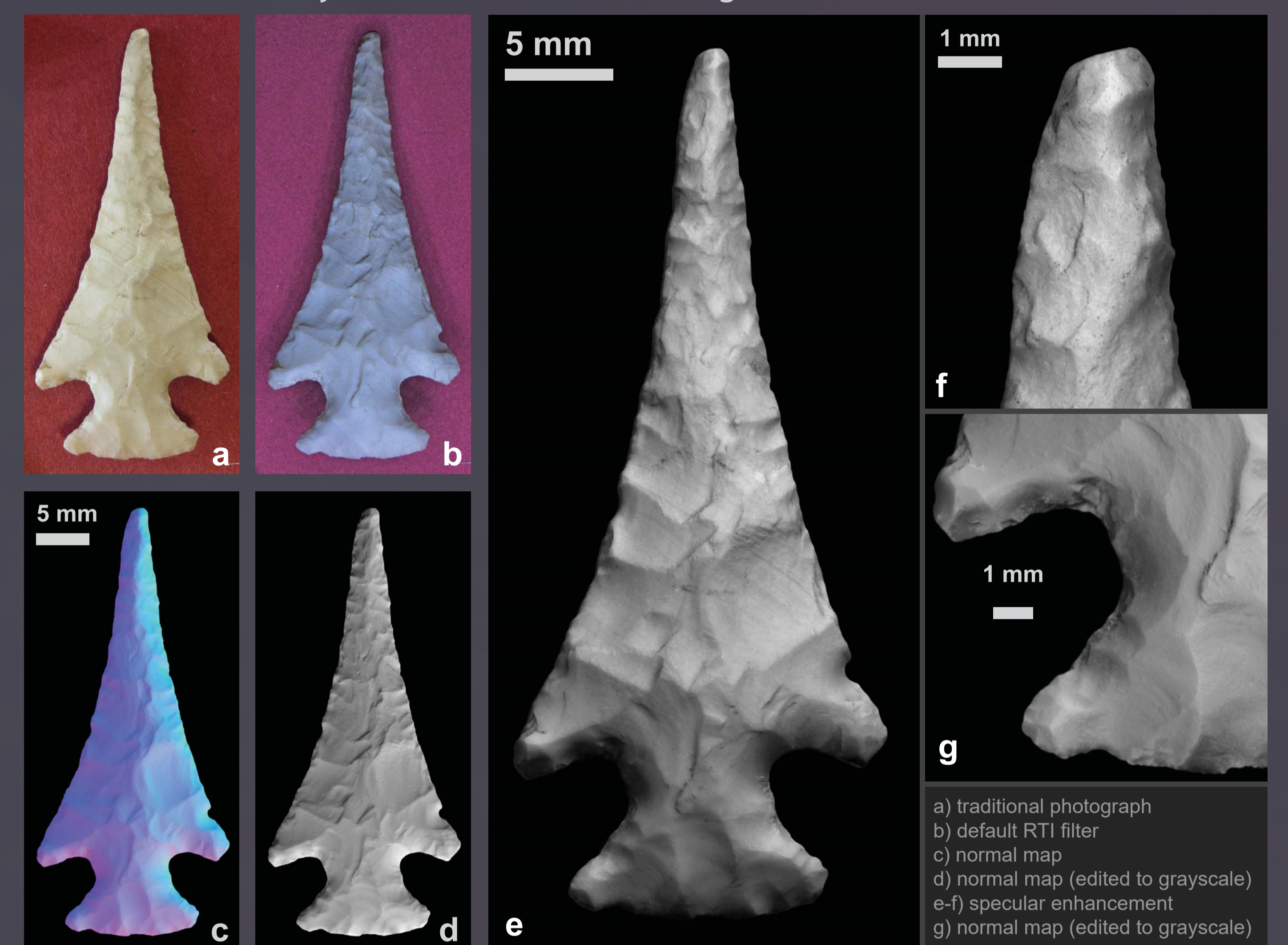


Sample Results

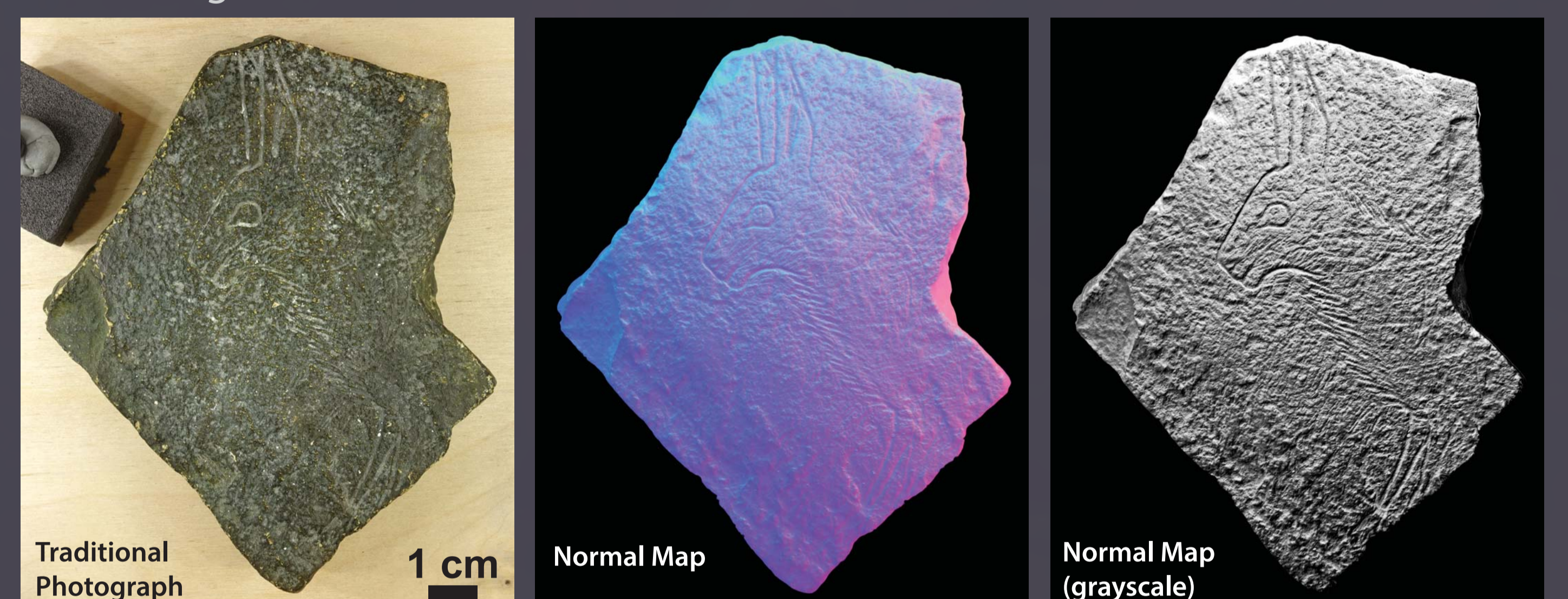
Knapping Marks (long bone fragment from La Quina)



North American Projectile Point (unknown origin)



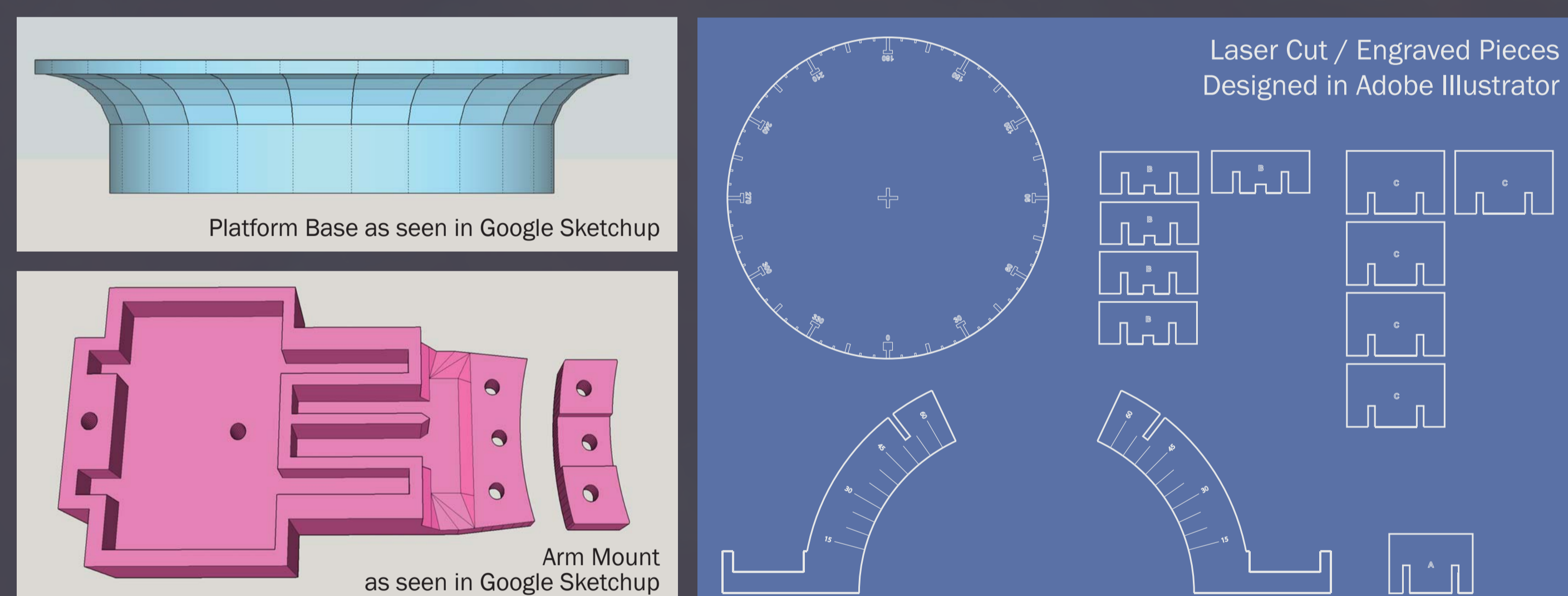
Cast of Engraved Hare (Grotte d'Isturitz)



Rig Design and Construction

The goal of this project was to create a RTI capture rig that would be inexpensive, portable, and easy to reproduce. This rig is based on a basic design originally developed by a team at the University of Tübingen³. It consists of a stationary platform with a rotating arm that supports a small flashlight. A camera or USB microscope is mounted above the rig using a tripod or copy stand.

Unlike 'dome style' RTI capture systems, this rig is not automated and requires the use of reflective spheres. On the other hand, because it does not contain wired LEDs or any circuits it is arguably easier for others researchers to replicate and has fewer components that could be damaged in adverse field conditions. Custom parts can be 3D print or laser cut. All other components can be acquired in a hardware store or online. 3D printed parts were designed in Google Sketchup. Laser cut parts were designed in Adobe Illustrator. Other users will be able to alter these files to create custom rigs to fit their own needs.

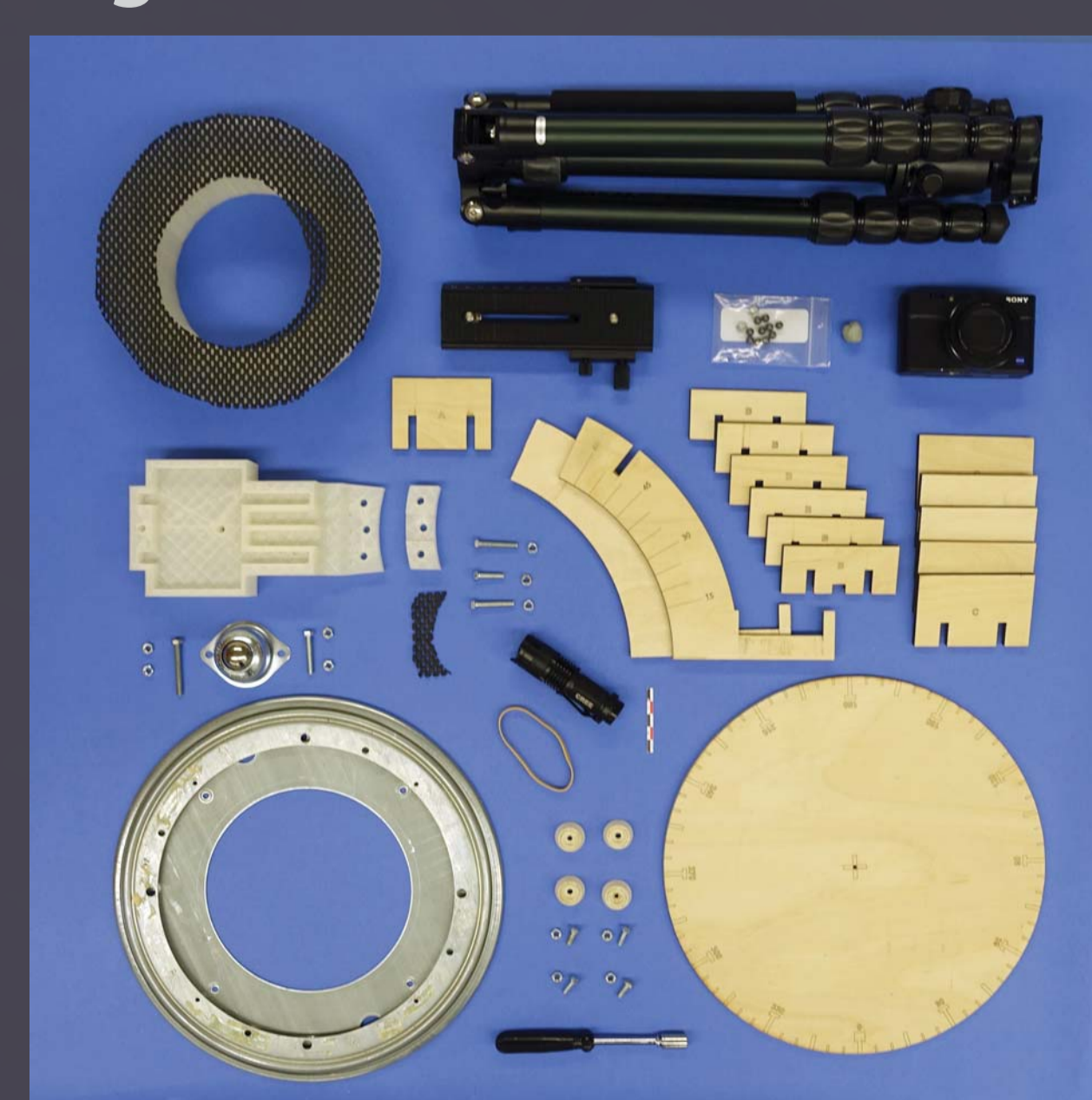


Summary parts list:

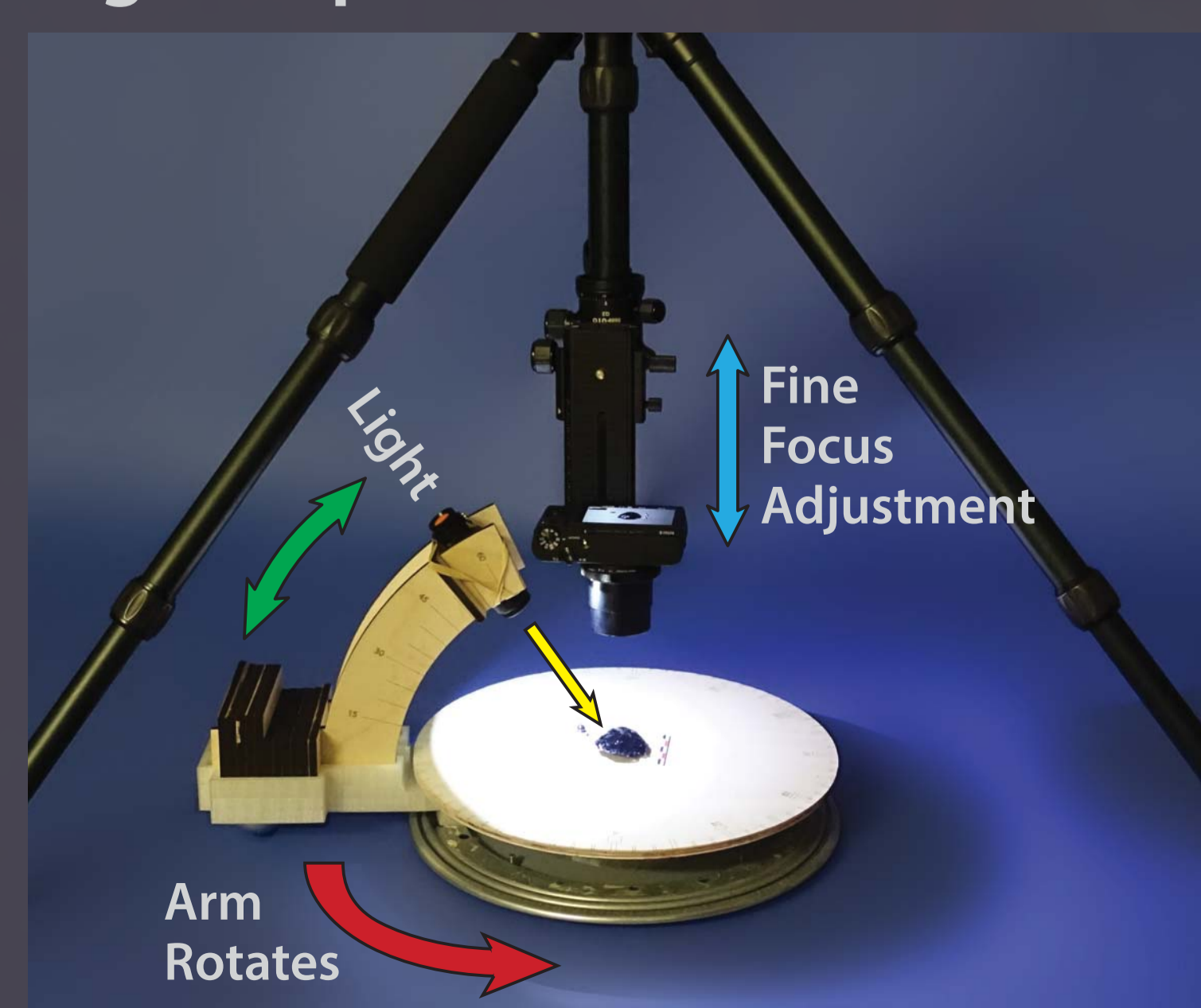
- 12 inch lazy susan bearing
- Shelf liner (anti-slip)
- One or more small LED flashlights
- Nuts and bolts
- Digital camera or USB microscope
- Macro focus rail
- 10mm rubber feet
- 1 inch roller ball transfer bearing
- Reflective ceramic ball bearings
- Scale bar(s)
- Tripod or copy stand (camera must face straight down)

A more detailed parts list, files for 3D printing and laser cutting, and a written tutorial on rig assembly and use are freely available for download on the Data Repository for the University of Minnesota⁴.

Rig Materials



Rig Setup



Summary and Conclusions

- RTI has a wide range of applications across disciplines related to the study of human evolution. These include but are not limited to taphonomy, lithic analysis, and the study of art objects.
- The rig presented here allows users to efficiently and consistently produce high quality RTI results.
- Systems such as this one advance the broader goals of proliferating affordable and open tools for scientific research.

References

- 1) RTIbuilder [software application] http://culturalheritageimaging.org/What_We_Offer/Downloads/Process
- 2) RTIViewer [software application] http://culturalheritageimaging.org/What_We_Offer/Downloads/View
- 3) Porter et al. (in press). Portable and Low-cost Solutions to the Imaging of Paleolithic Art Objects. JAS Reports.
- 4) Supplemental Poster Materials. Data Repository for the University of Minnesota. <http://doi.org/10.13020/D66C7Q>

Acknowledgments

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