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Digitale Denkmaltechnologien
Vorlesung: Nahbereich - Digitalisate

Institut für Archäologische Wissenschaften, Denkmalwissenschaften und Kunstgeschichte

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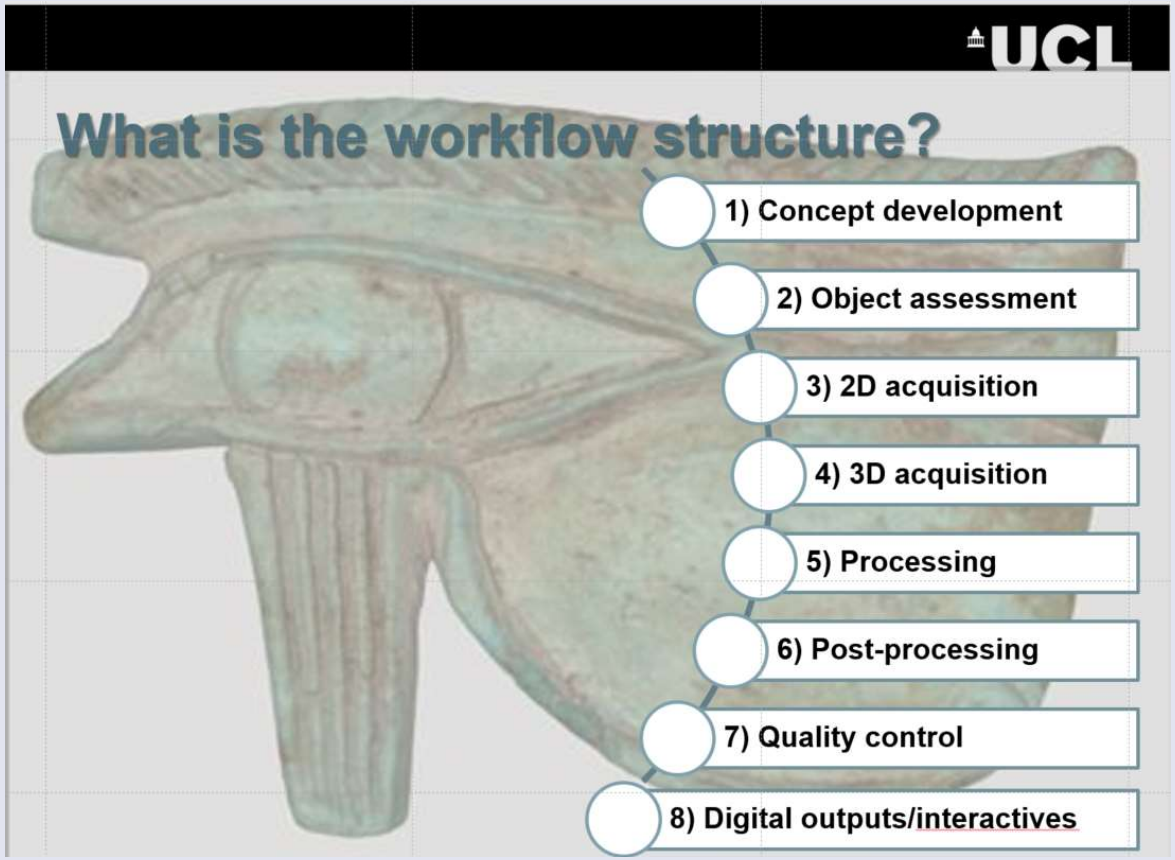
KDWT

Inhalt der Vorlesung: **Digitalisate für Museen, Digitales Surrogat und Digitaler Zwilling?**

- Mona Hess 1200-1300
  - Fallbeispiele für Digitale Denkmaltechnologien, Anwendung im Nahbereich (Objekte)
    - 3DPetrie Projekt UCL
    - Physikalische Reproduktion: Neue Museumsakquise - Re-engineering James Watt
- John Hindmarch 1400-1600 mit Pause
  - Digitalisate/ Digitale Surrogate/ Aura
  - Rendering und Herausforderungen der Digitalisierung von Objekten

Fallbeispiel 3DPetrie



Definition of 'visual surrogate' 3D models

- A model which captures the geometry and visible properties of the object to a level where the model is credible as the object within a variety of standard display options. In other words, a model that would be a believable representation whether in a web app, an exhibition, or a giant screen, etc.
- The model can be rotated in any direction as opposed to photographic techniques where an object rotates on a single axis.
- 3D is not a lighting effect (2.5D).

Concept development

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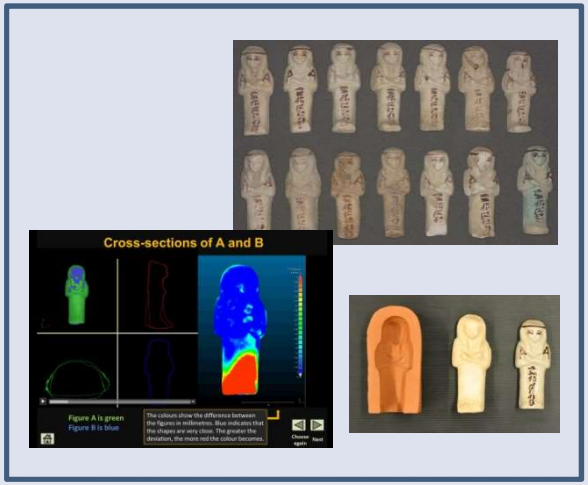
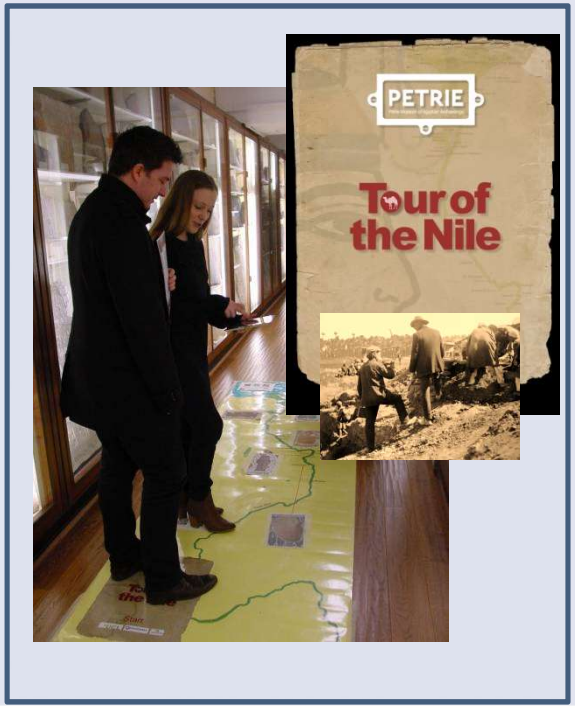
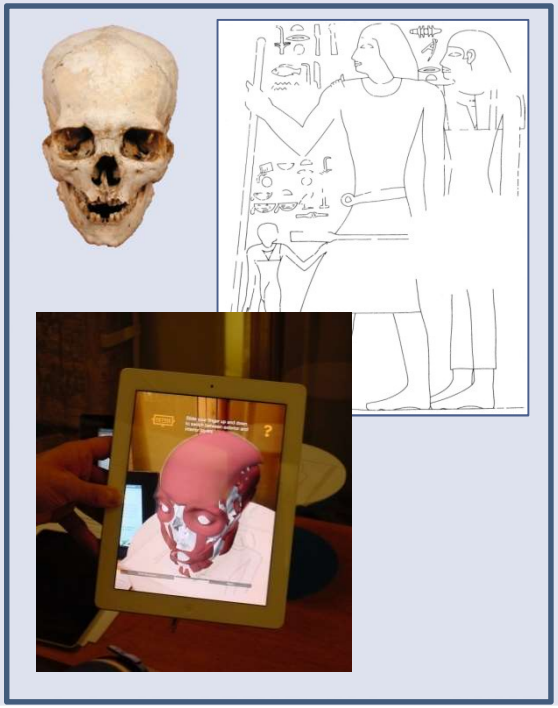
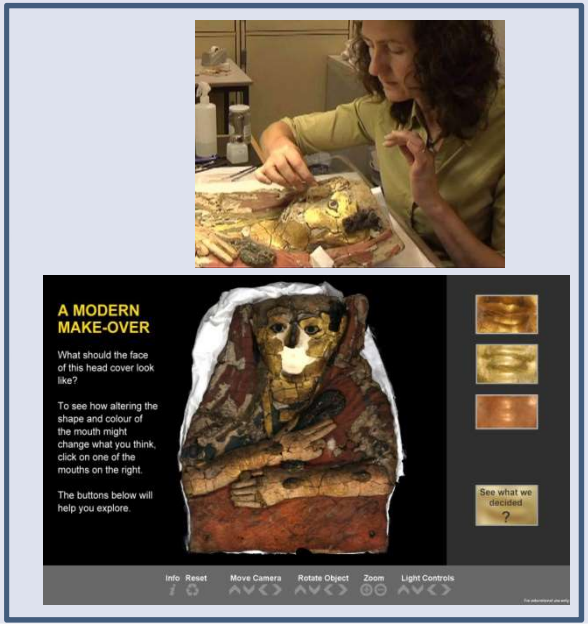
- What are you trying to tell visitors?
- How do you want to deliver your story?
- How will 3D help?









Object assessment

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Object ID: please fill in object ID here

1 & 2. Selection & Assessment

1.1 UCL Petrie **Object Assessment Document** (completed by Curator, Conservator and Scanning Technician)		
Photograph	ID (UC number):	Post Date:
	Location:	Batch No.:
	Purpose of Capture:	
	Key Object for purpose? Related objects in this batch?	
	Material(s):	
	Dimensions:	
Description and condition:		
Modern marks on object (list):		
Key features on object to capture:		
Conservation treatment to be undertaken before imaging? ( ) Required, ( ) Desirable, ( ) NO If treatment is required or desirable, why?		
Treatment approved? ( ) Yes ( ) NO Treatment plan agreed? ( ) Yes ( ) NO Past conservation treatment recorded on file? ( ) Yes ( ) NO		
Accessibility concerns:		
Transport and packing requirements:		
Handling requirements:		
Tick any other work-flow issues: ( ) 2D/3D capture combined when object out ( ) Non-repeatable 3D capture ( ) All 2D/ 3D capture in a single session ( ) Conservation treatment complete	( ) Notify project curator before starting capture ( ) Notify project conservator before starting capture ( ) Notify Petrie curator before starting capture ( ) Notify Petrie curator before starting capture	
Any known current/ future uses for object?		
List any integrated activities relating to object:		
Surface characteristics relevant for 3D capture:		
Potential problems for 3D capture or modelling:		
Additional comments:		
Recommended imaging methods: Location: Estimated number of images/ scans per device: Estimated scanning time/ time per process:		
Rate the suitability of the proposed method (add comments): (more text) ( ) 1 - Highly suitable for this type of object: ( ) 2 - Reasonably well suited for this type of object: ( ) 3 - Mixed suitability for this object (specify reasons): ( ) 4 - Not well suited for this type of object but recommended (specify reasons):		
( ) Approved for capture Signed:	( ) Not Approved for capture: Signed:	

1 & 2. Selection & Assessment — Process_Log v.4 simple, page 1

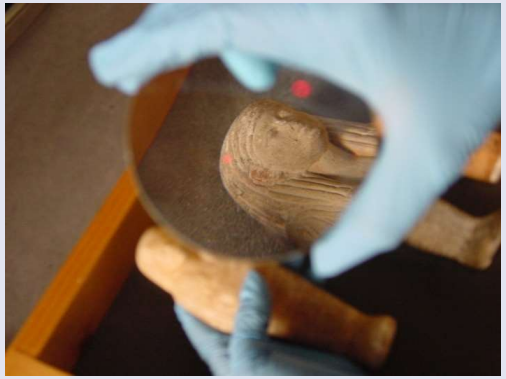
An Object Assessment Document is prepared for each object by:

- The Digital Curator
- The Conservator
- The Scanning Technician

Is the object safe for imaging?

Is the object suitable for imaging?

Which imaging technique is best?



2D Acquisition

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Reference photography for modelling and quality checking

Post- Processing

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In post-processing the model geometry and colour is cleaned. - 1 Mio points.

Rough build , processed Post –processed Reference photograph

Quality Control: Curatorial criteria

- Both processed and post-processed models reviewed by project curator
- Reviewed with reference photographs and actual object

Assessment of the technical issues :

- *Colour* – general and specific, variations
- *Specularity* - general and specific, variations
- *Resolution* - general and specific, variations
- *Fills* (size and accuracy)
- *Layer blending*
- *Occluded areas*

Reaching the ‘visual surrogate’ quality level?

Digital Outputs/ Interactives

Keep in mind limitation of your target platform

3D meshes produced by laser scanning and/or other approaches can be very memory consuming. Unity3D is optimized for meshes patches 65K triangle big. So the problem is to downsize high-resolution meshes to 65K meshes keeping details on.

800K triangles

65K triangles

65K triangles + Normal map to add back some details

Interactives

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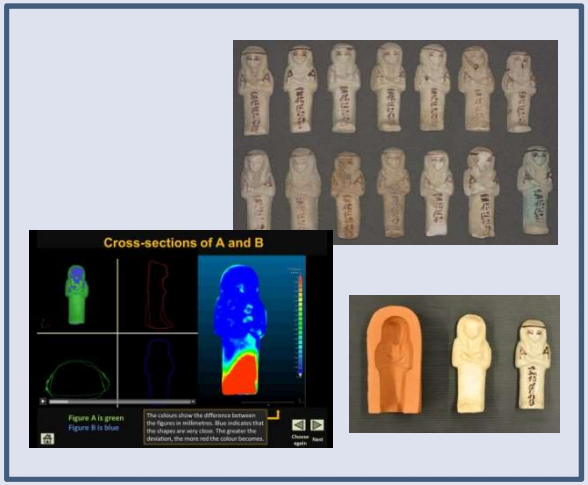
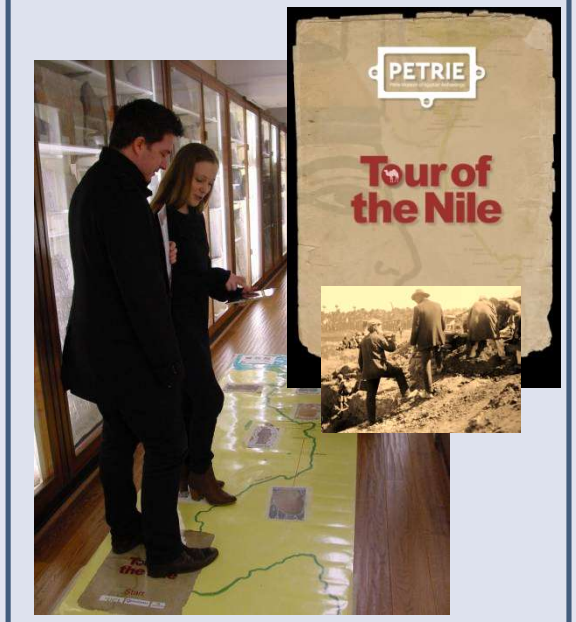
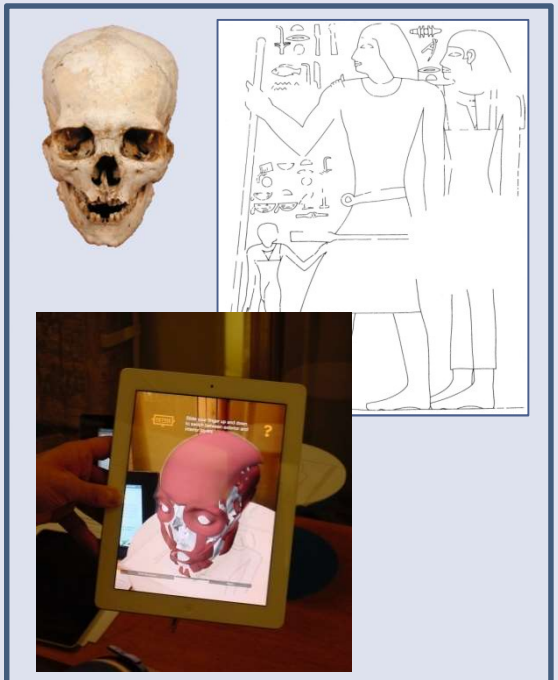
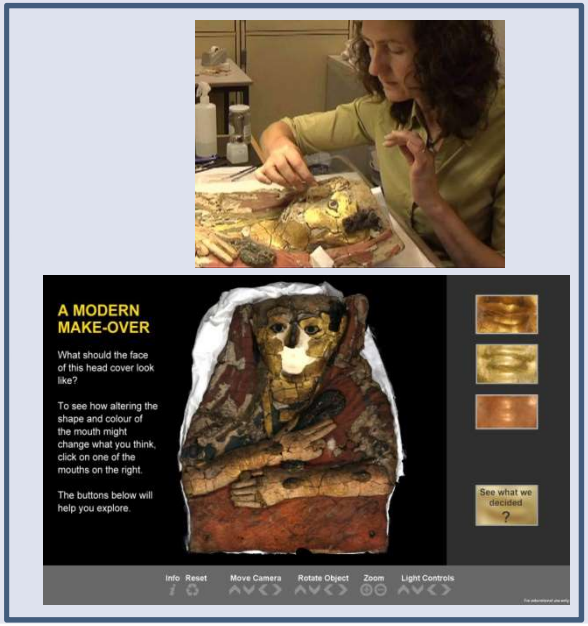
- Archivierte Webseite:
- http://www.lifestudy.ac.uk/museums/petrie/research/research-projects/3dpetrie/3d-interactives









Interactive applications

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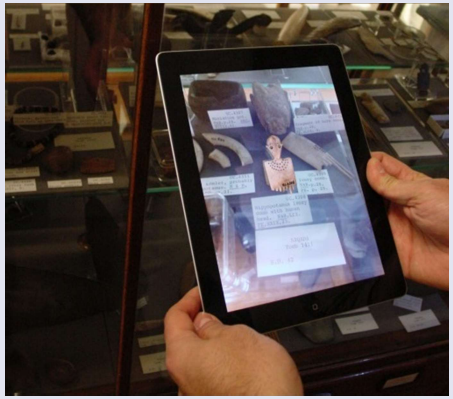
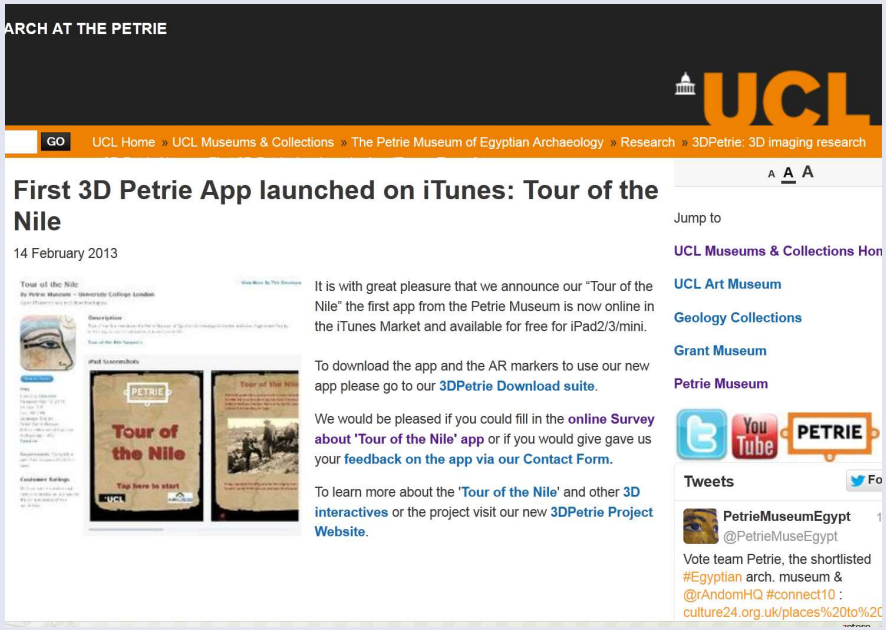
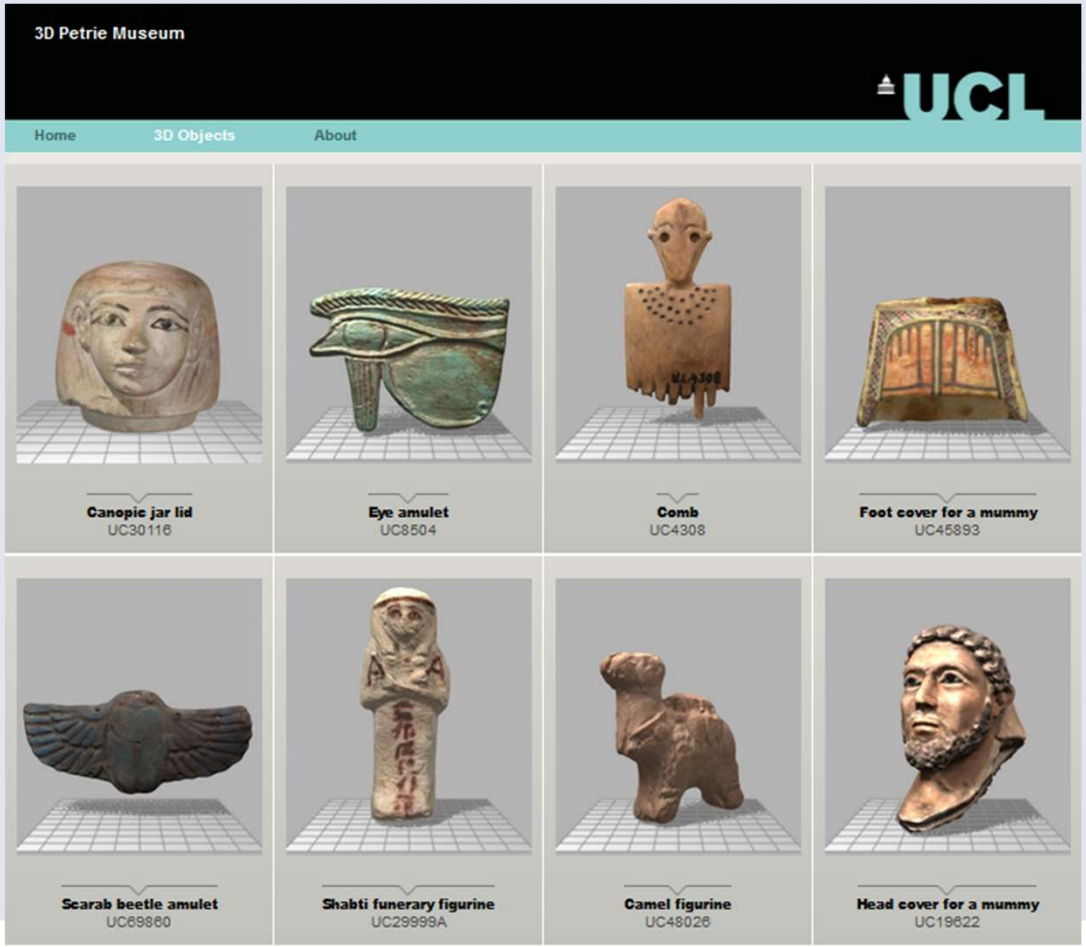


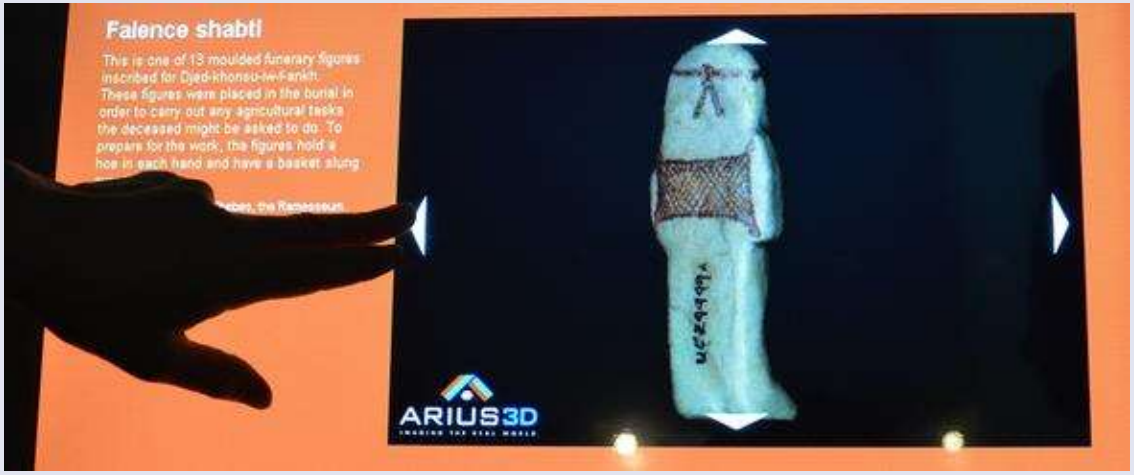


Online resources

- 3DPetrie: 3D imaging research, digital applications and use of new technologies in the museum
- Follow @3DPetrie
- www.ucl.ac.uk/3dpetriemuseum
- www.ucl.ac.uk/museums/petrie/research/research-projects/3dpetrie



3DPetrie: 3D imaging research, digital applications and use of new technologies in the museum



Hess, M., Serpico, M., Amati, G., Pridden, I., Nelson, T., & Robson, S. (2015). **Developing 3D imaging programmes – workflow and quality control**. *AMC JOCCH , Journal of Computing in Cultural Heritage, 9 (1)*, 1:1-1:11. doi:10.1145/2786760

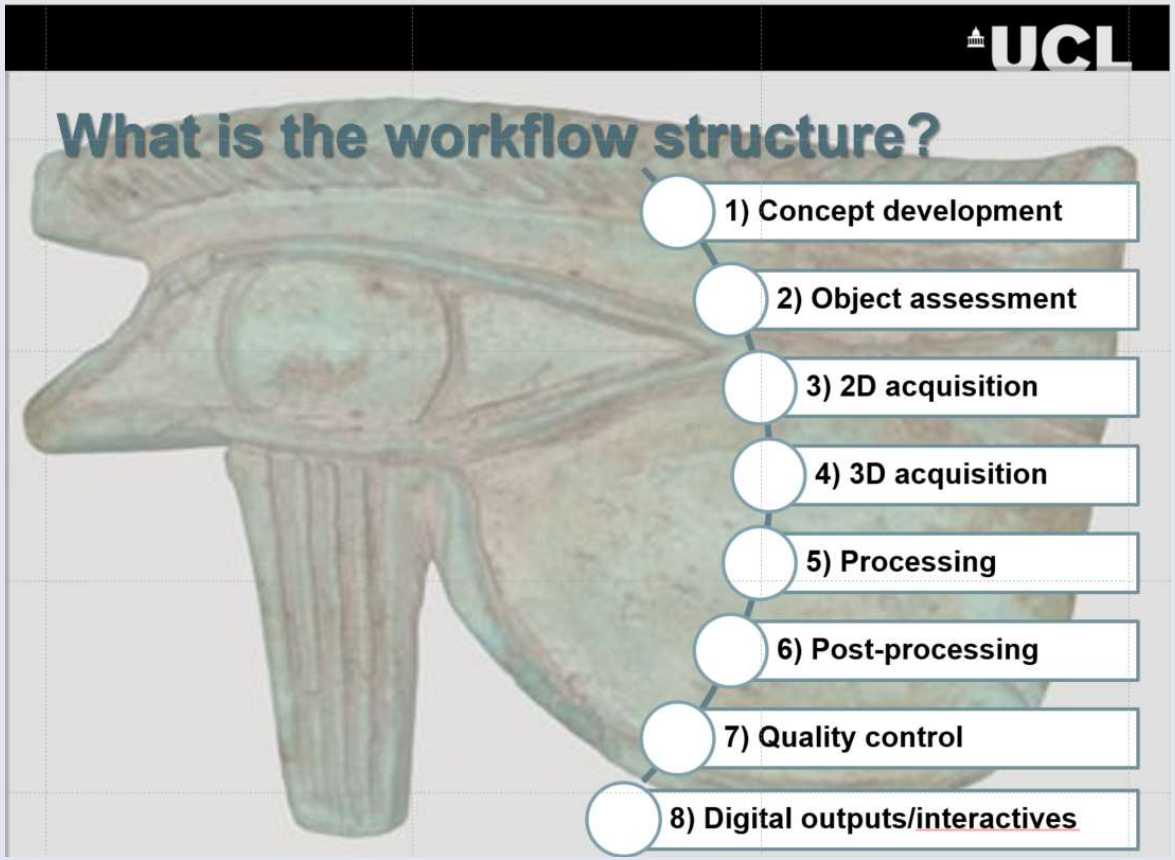
www.ucl.ac.uk/3dpetriemuseum

UCL Qatar, Exhibition with interactives and 3D Prints

Physical Surrogate/ Replica

Photograph/Scan: Ivor Pridden - UCL Petrie Museum)
3D print: DMC (Digital Manufacturing Centre) – UCL Bartlett

Fallbeispiel 3DPetrie



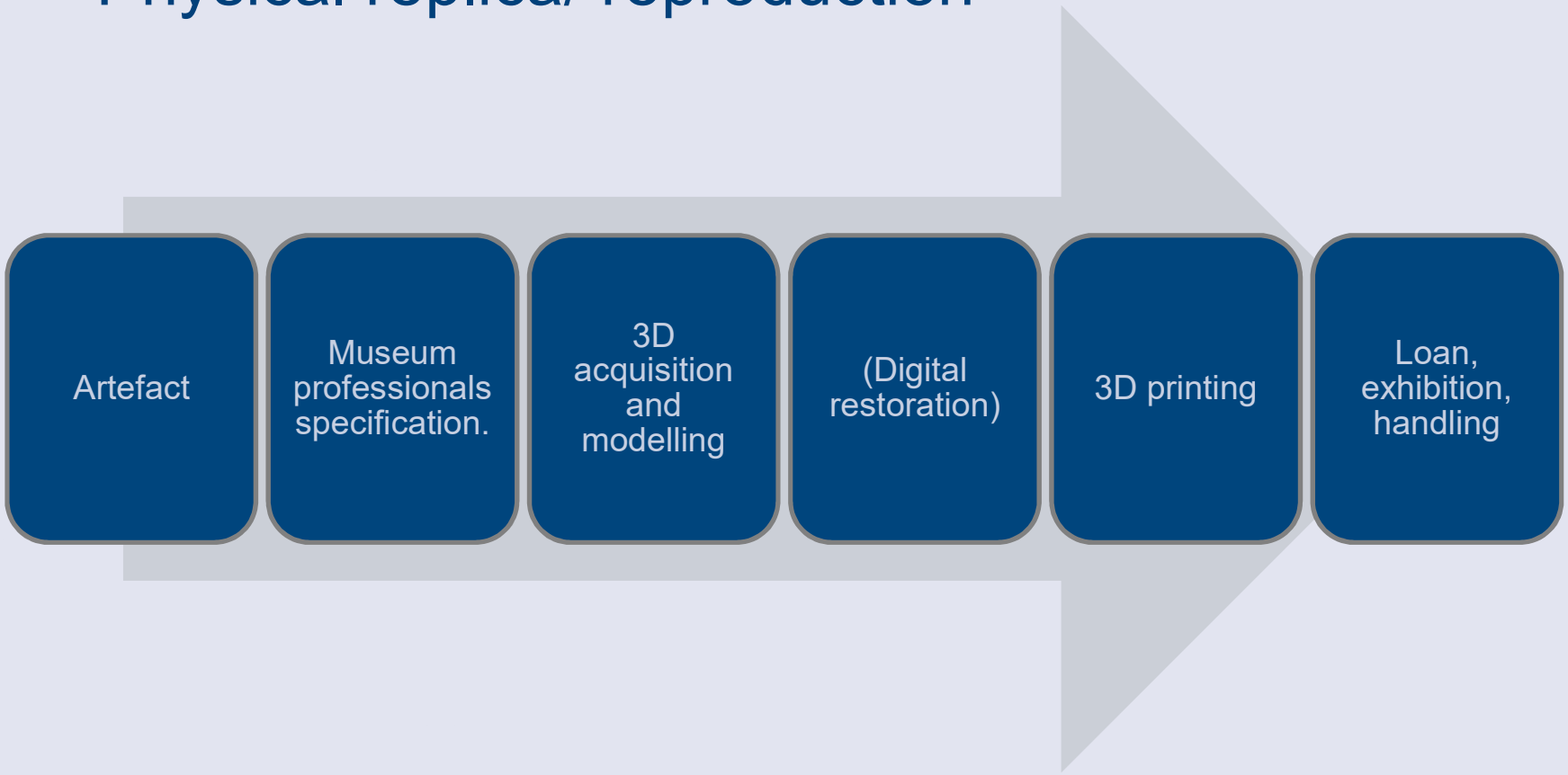
Hess, M. and Robson, S. (2013) 'Re-engineering Watt: A case study and best practice recommendations for 3D colour laser scans and 3D printing in museum artefact documentation', in Saunders, D. et al. (eds) *Lasers in the Conservation of Artworks IX*. British Museum, London: Archetype, pp. 154–162. Available at: http://discovery.ucl.ac.uk/1411525/ (Accessed: 17 February 2017).

A small cast for a bust. Who is the man?

Aim of project: Physical replica for an exhibition at the Science Museum.

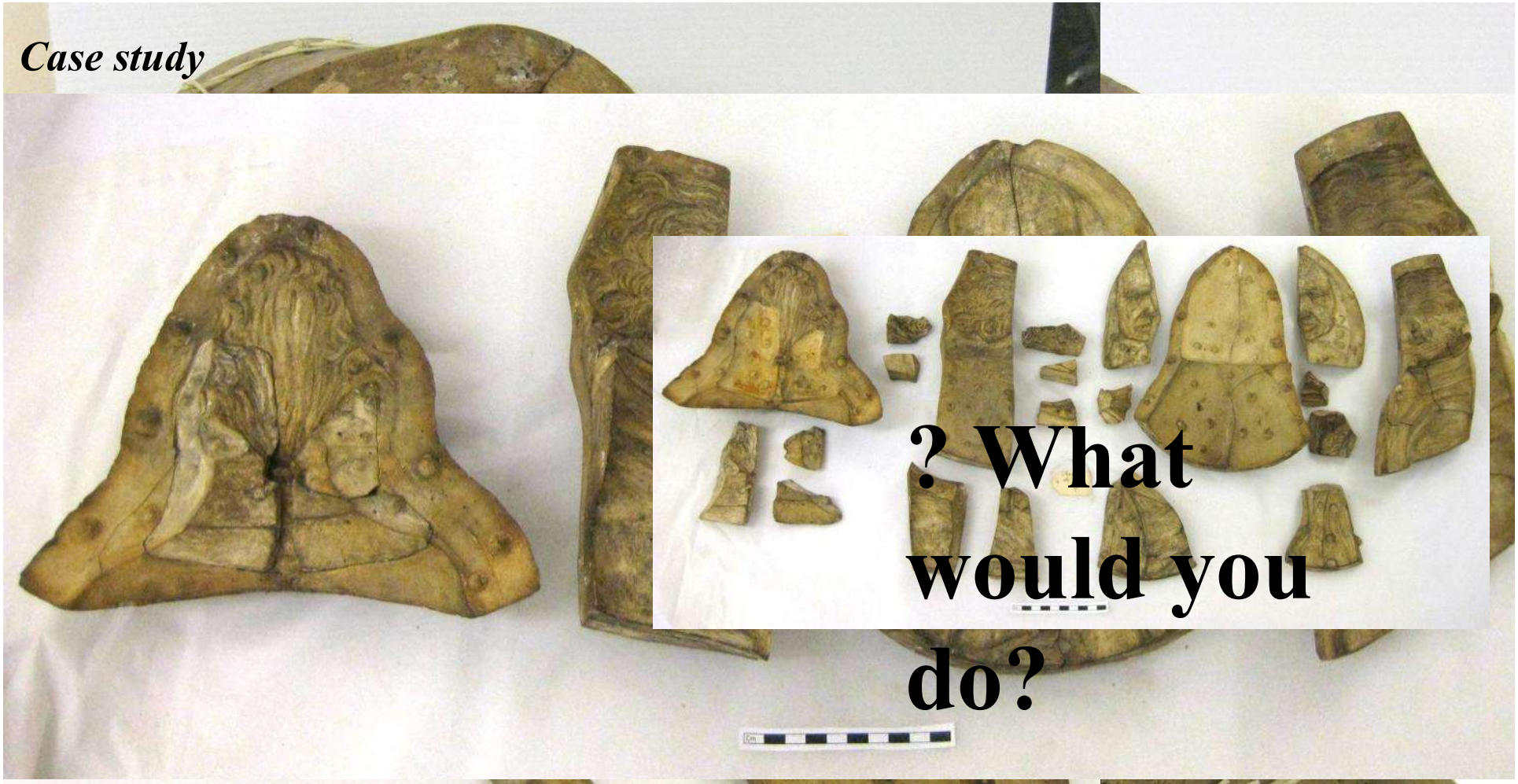
RE-ENGINEERING JAMES WATT

Fallbeispiel James Watt/ Re-Engineering Watt Physical replica/ reproduction



Watt and our world – Reinstallation of Watt's workshop at the Science Museum

- http://www.sciencemuseum.org.uk/watt



? What would you do?

- Photographs Copyright of the Science Museum London

Technical background : Arius 3D laser scanning

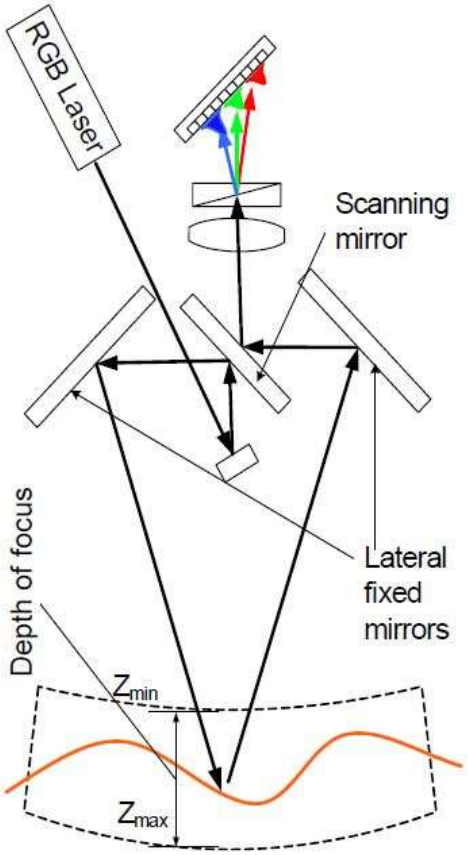


Fig. 3: The auto-synchronized principle, using a scanning mirror and the Schleimpflug condition, increases range accuracy without sacrificing volume of measurement.

Sky Laser Source (solid state):

Wavelengths 473 532 635, laser spot diameter 80 □m

Arius Foundation Model 150 scanner:

designed to deliver a 100□m laser spot over a width and depth of field of ~50mm

Resolution: point spacing 100 x 100□m with geometric and colour information (XYZ RGB IJK)

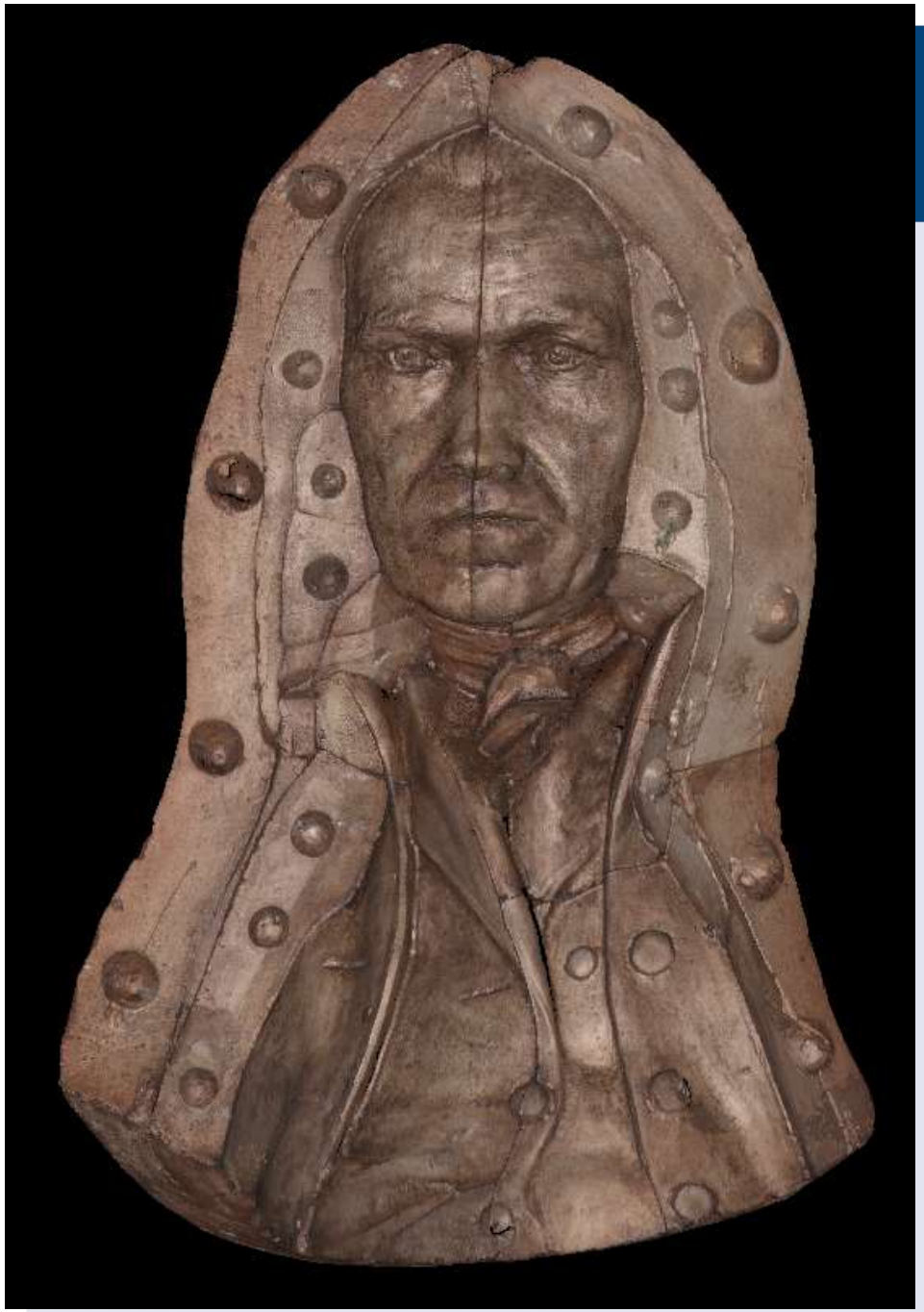
Accuracy: single point accuracy better than 25 □m

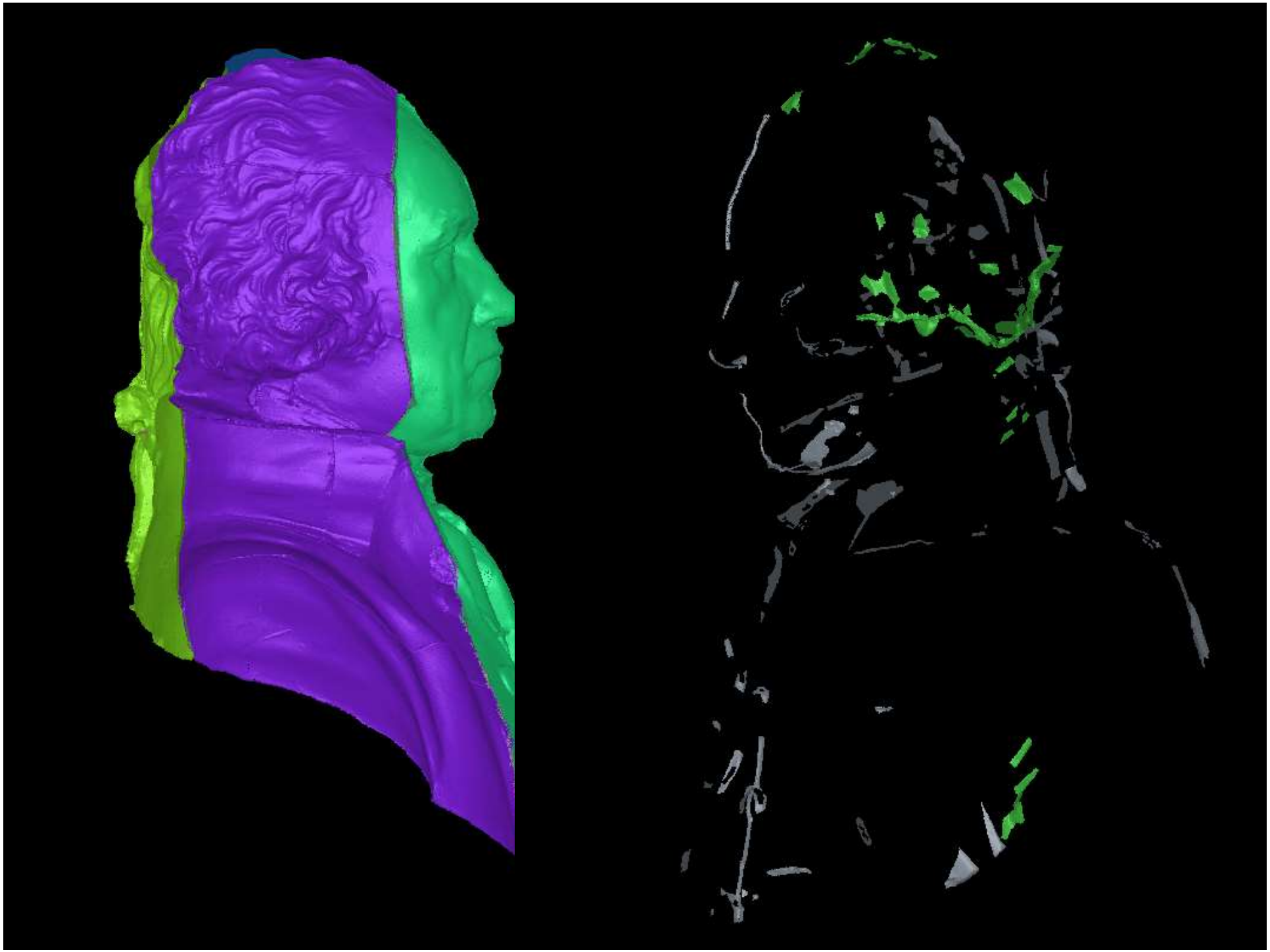
Object dimension: x=890, y=762, z=508

Speed/area of scanning: 25 mm /minute at 100 x 100 □m

Depth of field : 60 x 60 mm > programming of profile path for the laser head

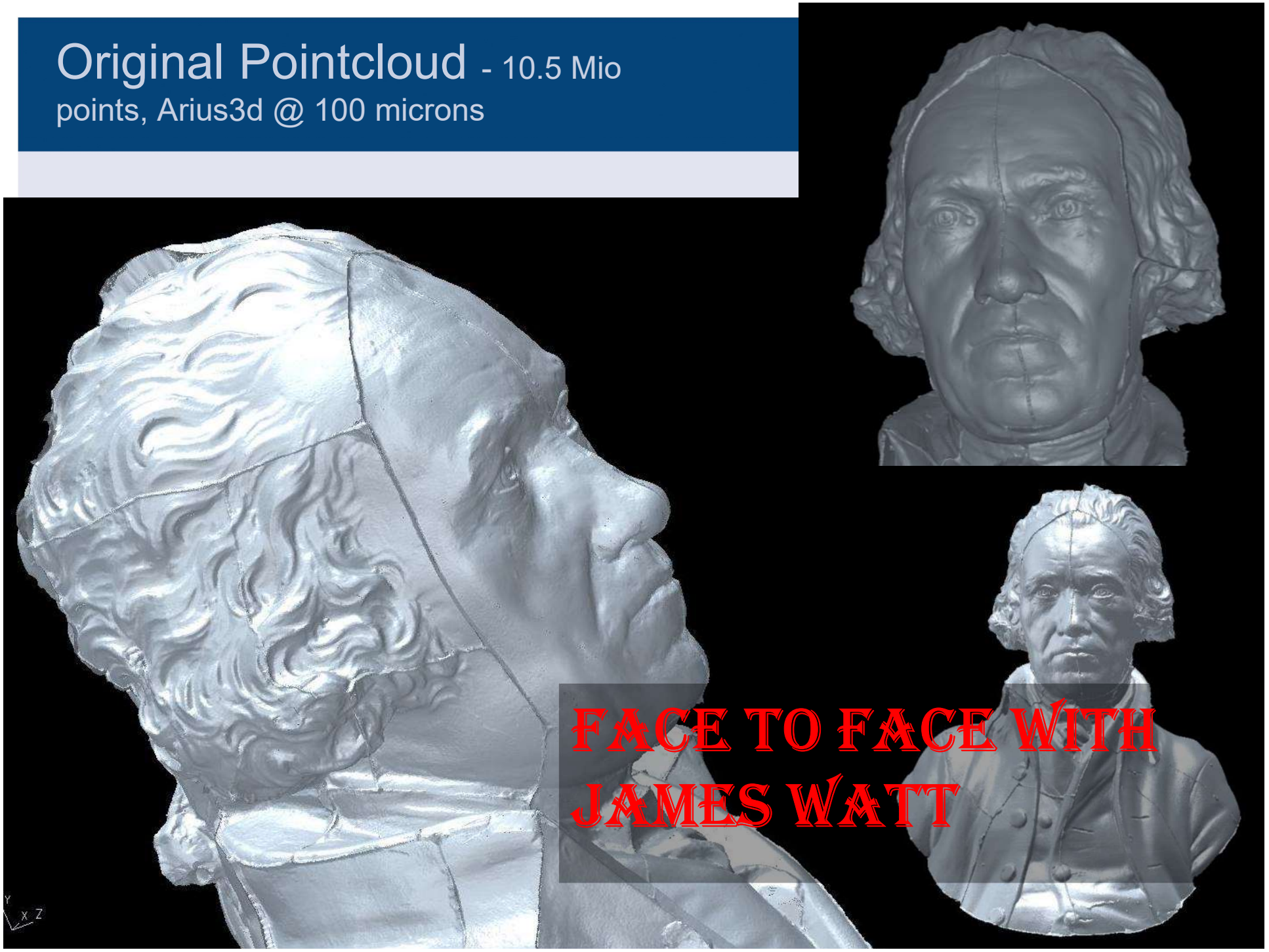
Technical background : Arius 3D laser scanning



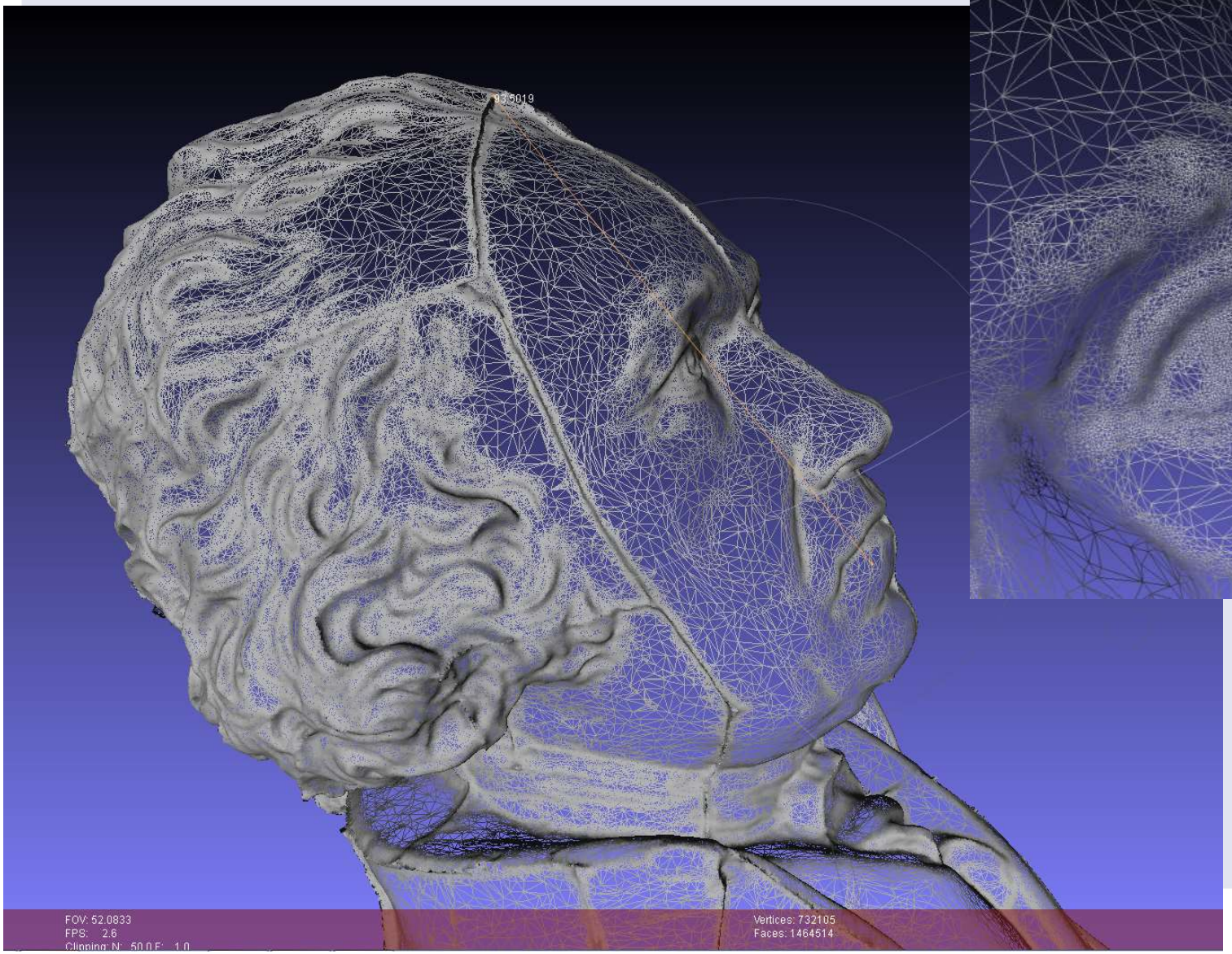


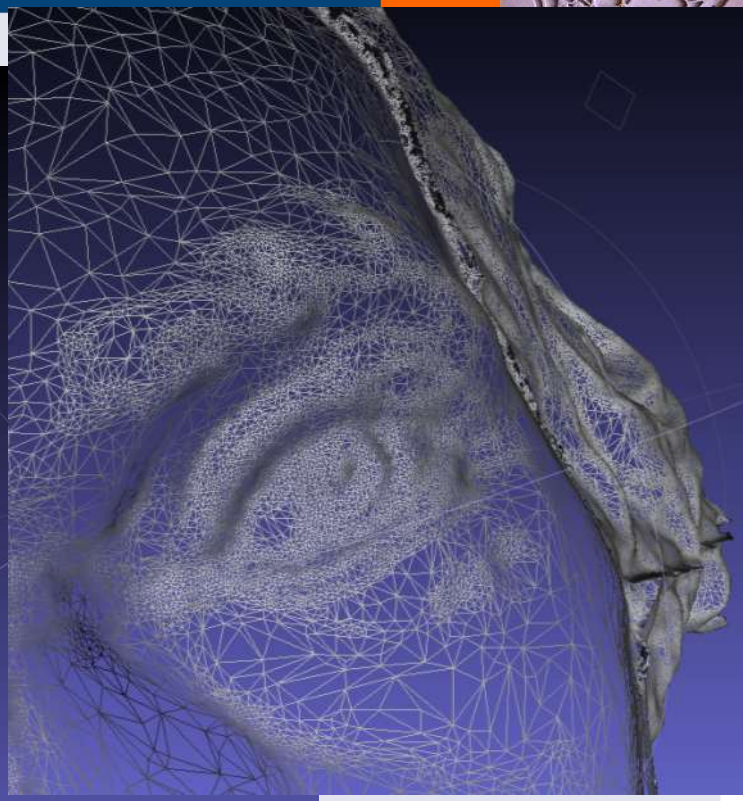
Original Pointcloud - 10.5 Mio

points, Arius3d @ 100 microns



3D Mesh for Prototyping - 1.5 Mio triangles





3D Mesh for Prototyping - 1.5 Mio triangles

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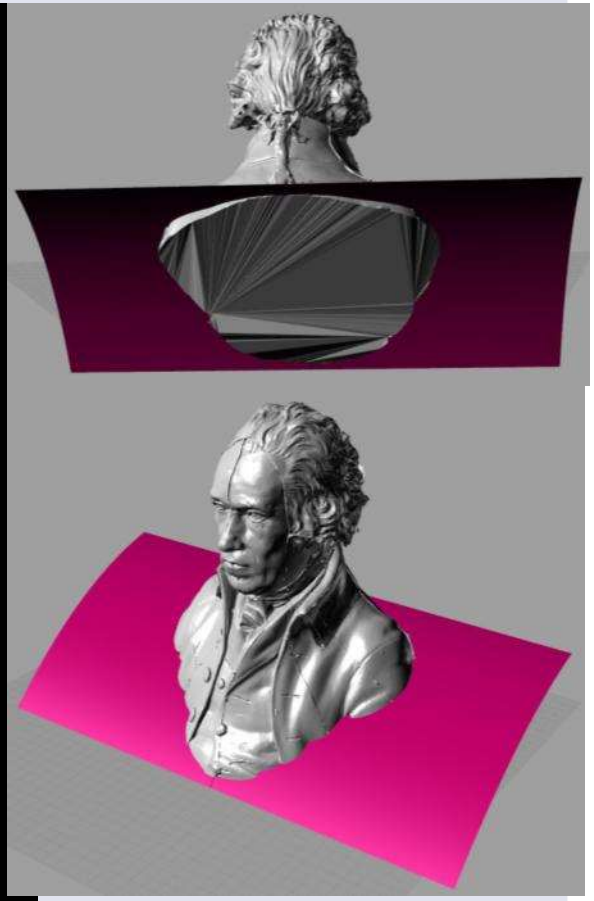
DMC



DMC UCL Bartlett

Quality Control 3D scan from Replica

recorded with Arius3D, @ 100 microns

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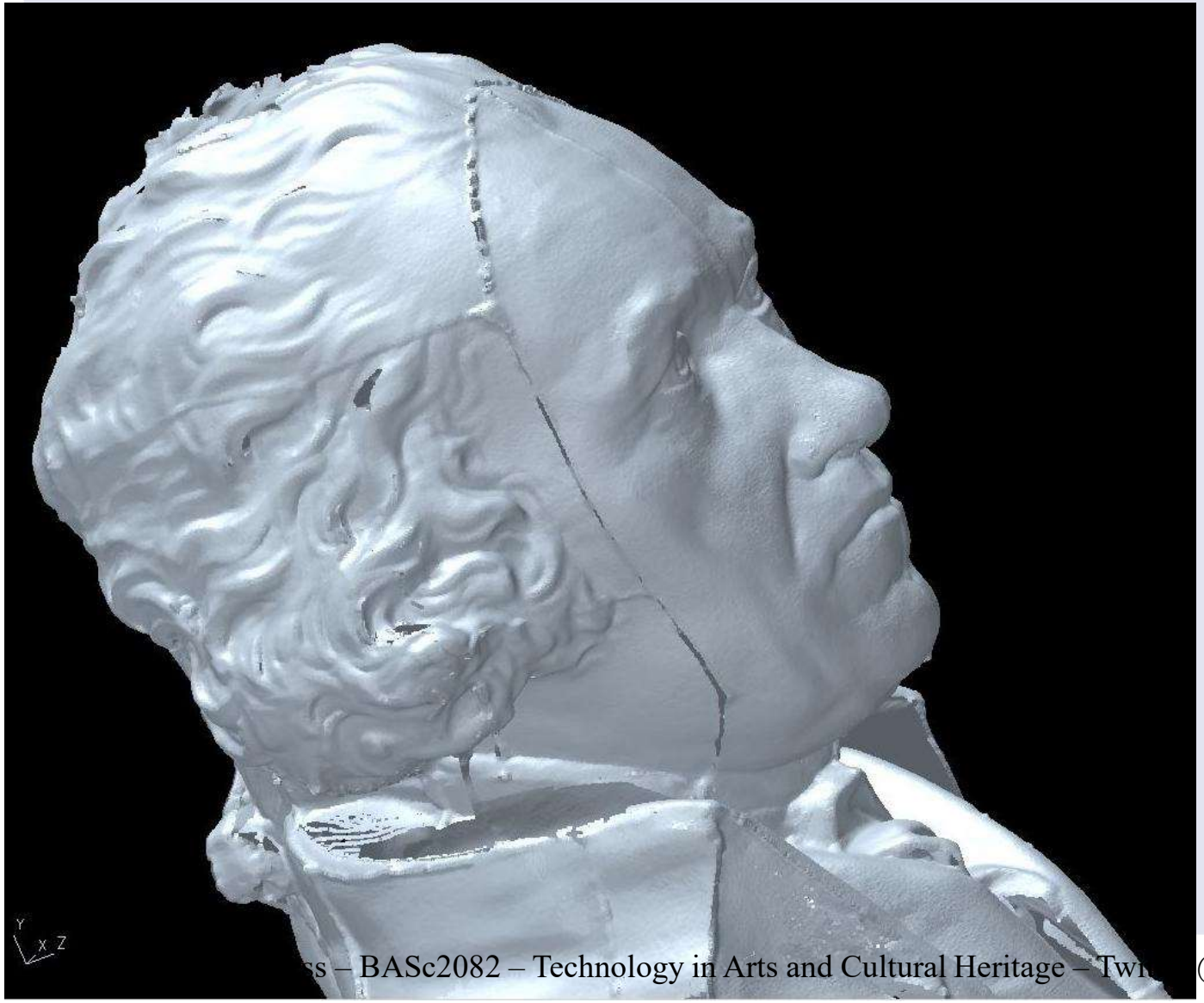

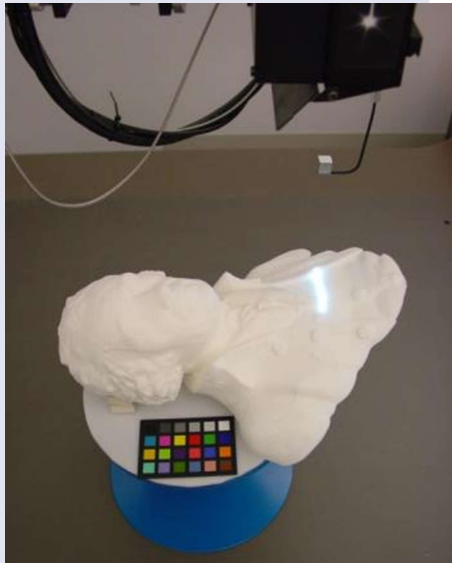

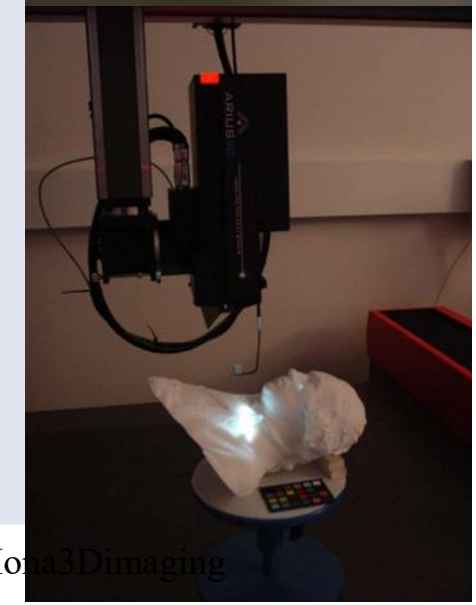

Case study: quality control through cloud comparison

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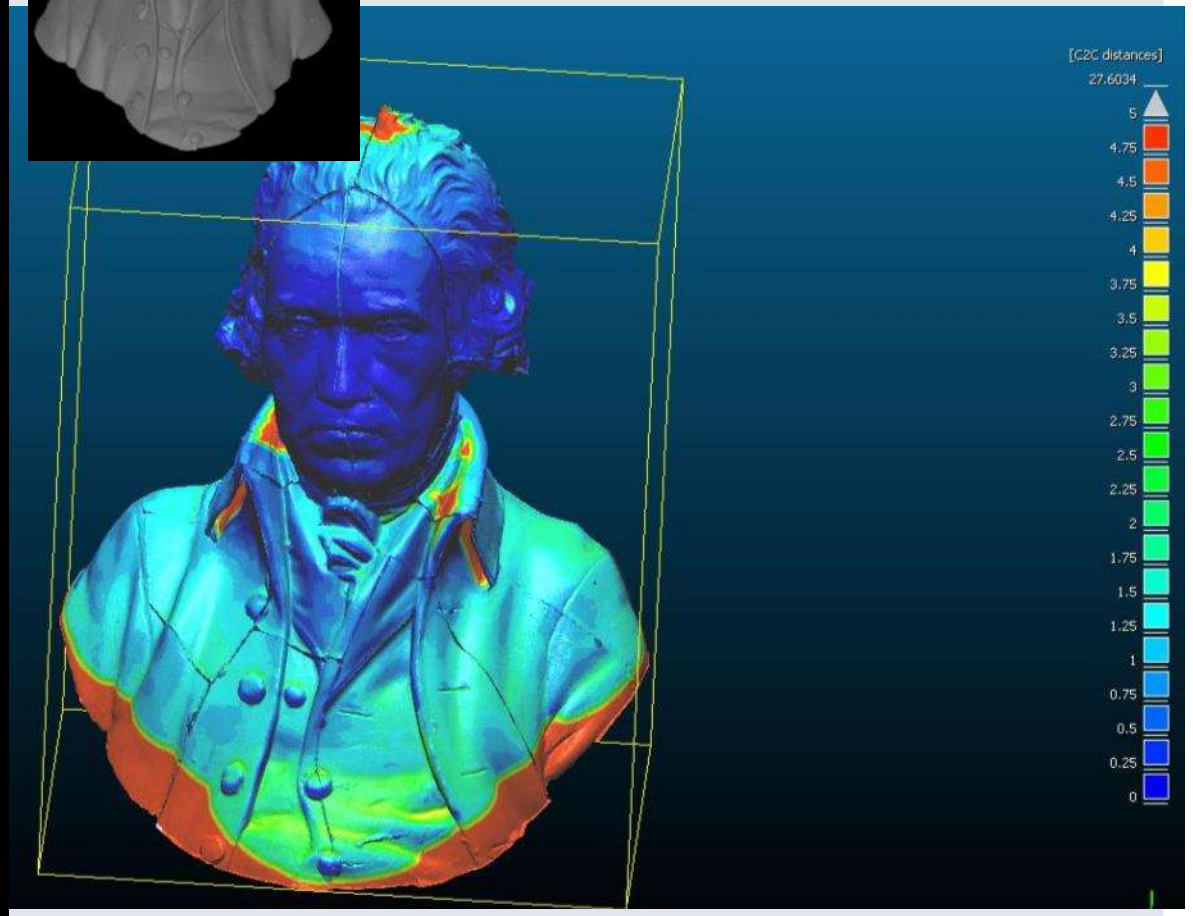

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Scientists create sculpture of Industrial Revolution engineer James Watt using 3D technology

By DAILY MAIL REPORTER
Last updated at 12:41 PM on 21st February 2011

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A previously unseen sculpture of James Watt, one of the Industrial Revolution's greatest engineers, has been created using 3D technology.

The bust comes from a mould, dating back to 1807, which was discovered in Watt's workshop during preparations for an exhibition on his life.

Best known for his pioneering work on the steam engine, Watt helped turn Britain from cottage and craft production into an industrial powerhouse.

New from old: Scientists created this bust of James Watt by applying 3D technology to a mould of the Industrial Revolution engineer's head from 1807

The complex plaster mould used for the bust is one of 26 which fill the shelves of Watt's preserved workshop, many still tied up in their original string.

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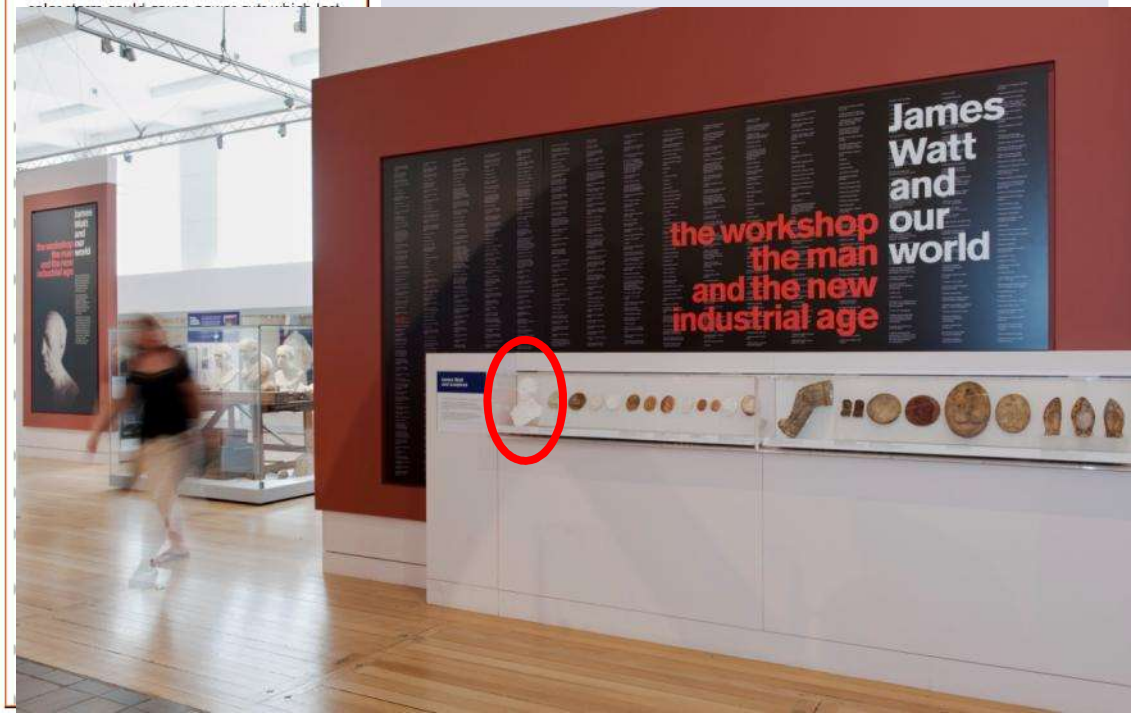
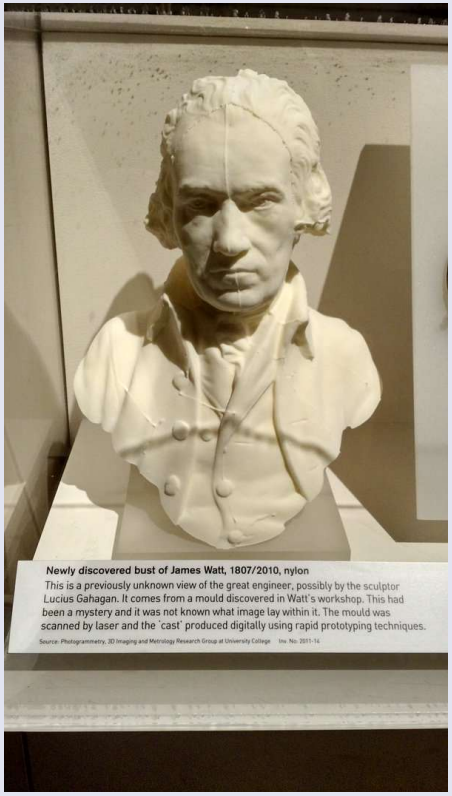
Press: ‘embargoed unseen bust release’

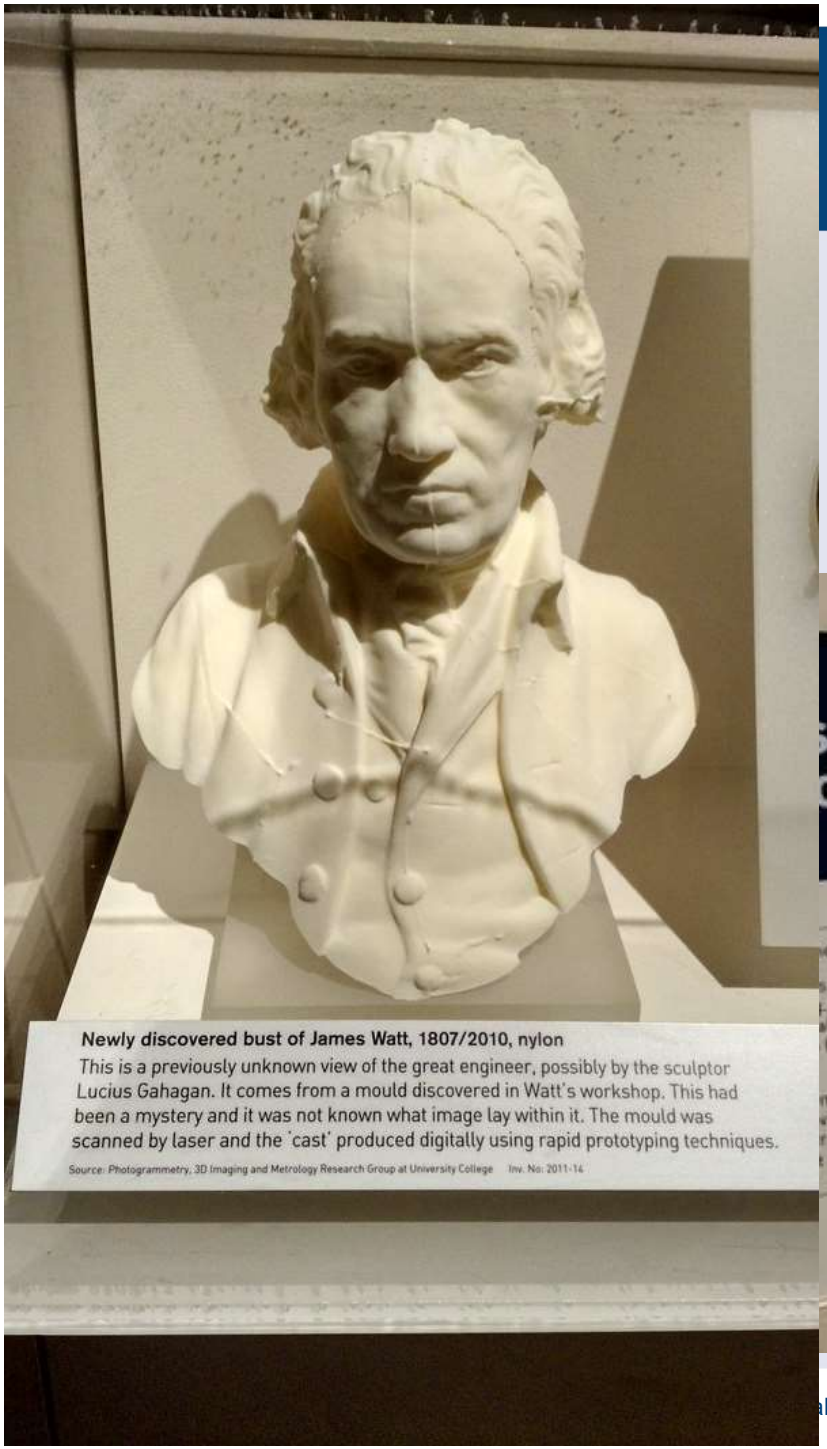


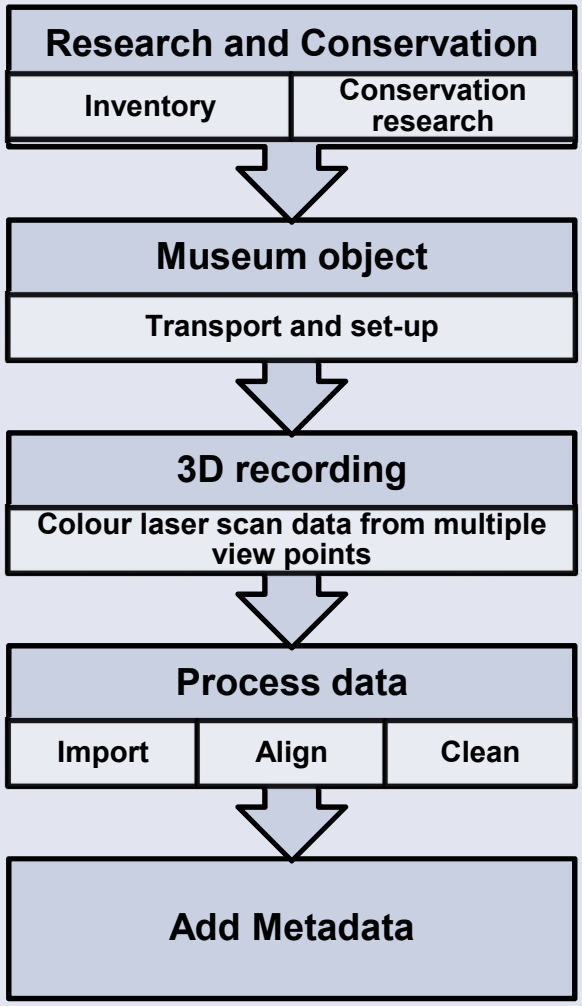
In January 2016: Yellowing of 3D printed Nylon
Who could propose a solution?
Rapid Prototype photo-stability case - study and course attendance.
Ongoing PhD – Carolien Coon, SEAHA CDT

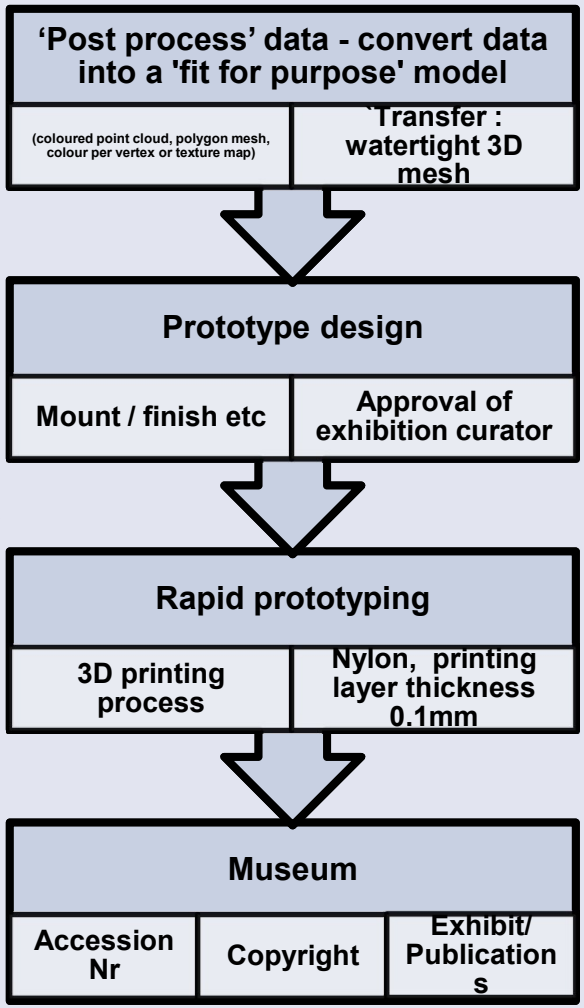


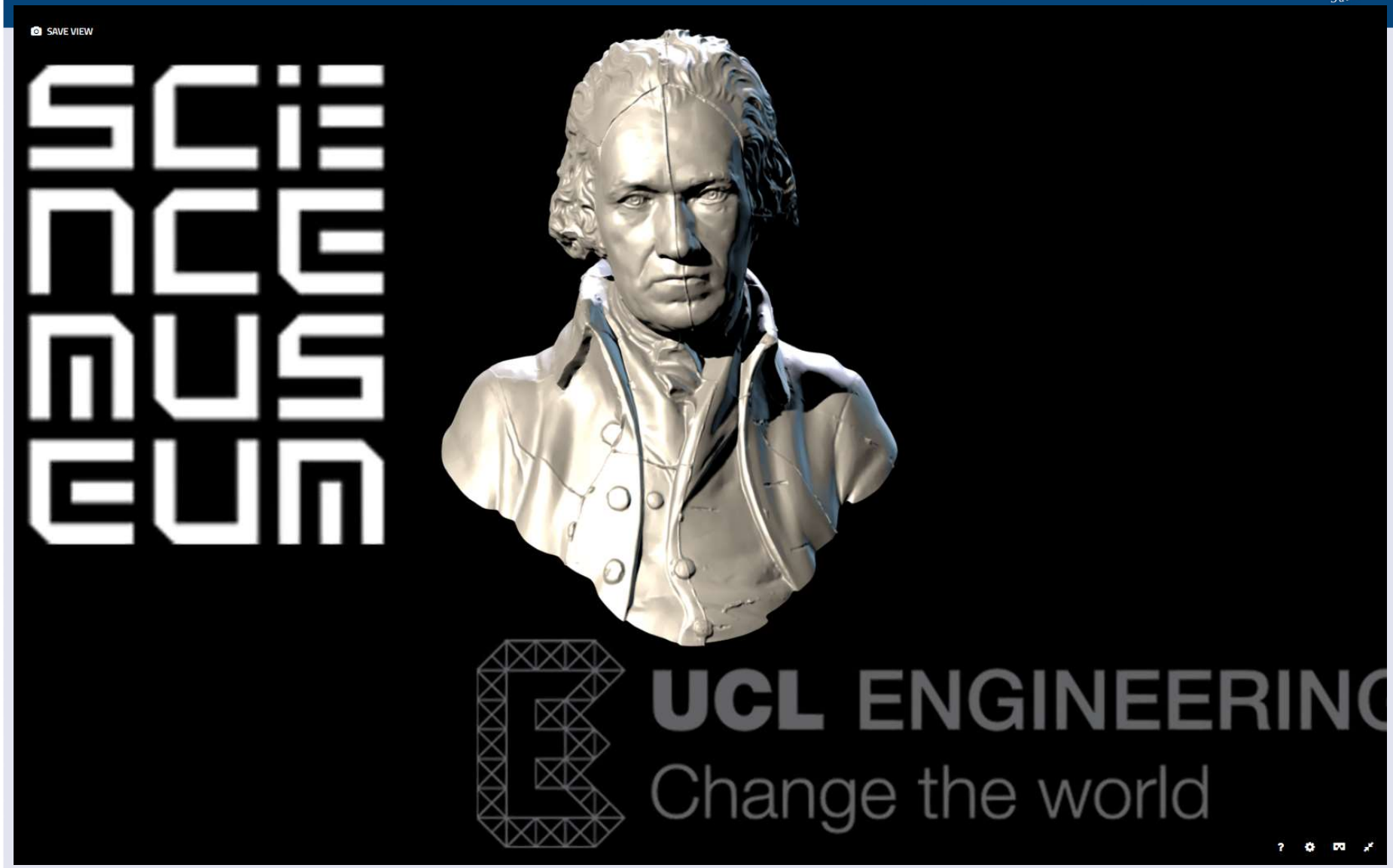
In January 2016: Yellowing of SD printed 'Nylon'
Who could propose a solution?

Rapid Prototype photo-stability case - study and course attendance. Ongoing PhD – Carolien Coon, SEAHA CDT




Research and Conservation
Inventory
Conservation research
Museum object
Transport and set-up
3D recording
Colour laser scan data from multiple view points
Process data
Import
Align
Clean
Add Metadata


'Post process' data - convert data into a 'fit for purpose' model
(coloured point cloud, polygon mesh, colour per vertex or texture map)
'Transfer : watertight 3D mesh
Prototype design
Mount / finish etc
Approval of exhibition curator
Rapid prototyping
3D printing process
Nylon, printing layer thickness 0.1mm
Museum
Accession Nr
Copyright
Exhibit/ Publications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Literatur

- Hess, M. (2018) 'Digitalisierung für Kultur', in Epple, P. (ed.) *Digitalisierung*. 1st edn. Göttingen Germany: Cuvillier (Zwischen den Welten. Coburger Schriftenreihe (wissenschaftliche Schriftenreihe der Hochschule Coburg)), pp. 53–74. Available at: https://cuvillier.de/de/shop/publications/7762-digitalisierung (Accessed: 25 April 2018).
- https://www.ucl.ac.uk/museums-static/science-of-3d/digital-museum/
- Hess, M. and Robson, S. (2013) 'Re-engineering Watt: A case study and best practice recommendations for 3D colour laser scans and 3D printing in museum artefact documentation', in Saunders, D. et al. (eds) *Lasers in the Conservation of Artworks IX*. British Museum, London: Archetype, pp. 154–162. Available at: http://discovery.ucl.ac.uk/1411525/ (Accessed: 17 February 2017).
- Hess, M. *et al.* (2015) 'Developing 3D Imaging Programmes–Workflow and Quality Control', *J. Comput. Cult. Herit.*, 9(1), pp. 1:1–1:11. doi: 10.1145/2786760.