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Presentation of Digital 3D reconstruction of historical textile fragment

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The 89th Textile Institute World Conference Wuhan- China

Digital 3D Reconstruction of Historical Textile Fragment

Sophie Calvert, Dr. Jess Power,
Dr. Paul Bills, Dr. Helen Ryall

Presented by Dr.Jess Power



Project Overview Aims

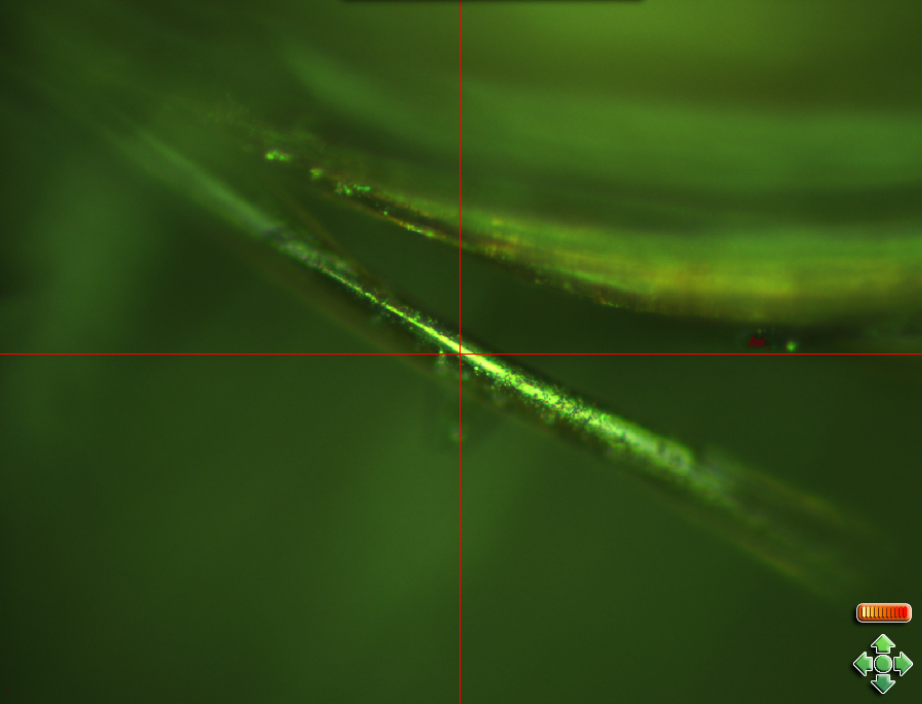
- To use photography and 3D scanning techniques to analyze a historic textile fragment
- To accurately record data and explore a methodology suitable for handling and testing historic textiles
- To discuss possibilities for future research

Digital 3D Reconstruction of
Historical Textile Fragment

Project Overview

The Fragment

- Analyzing textile fragments from the English National Trust Archive
- Fragments examined in this study loaned from Claydon House archive, Buckinghamshire
- Textiles date back to 1625c
- Fragments examined are part of a decorative mens recticella lace collar
- Iron Mordant is causing the rapid deterioration of the textile



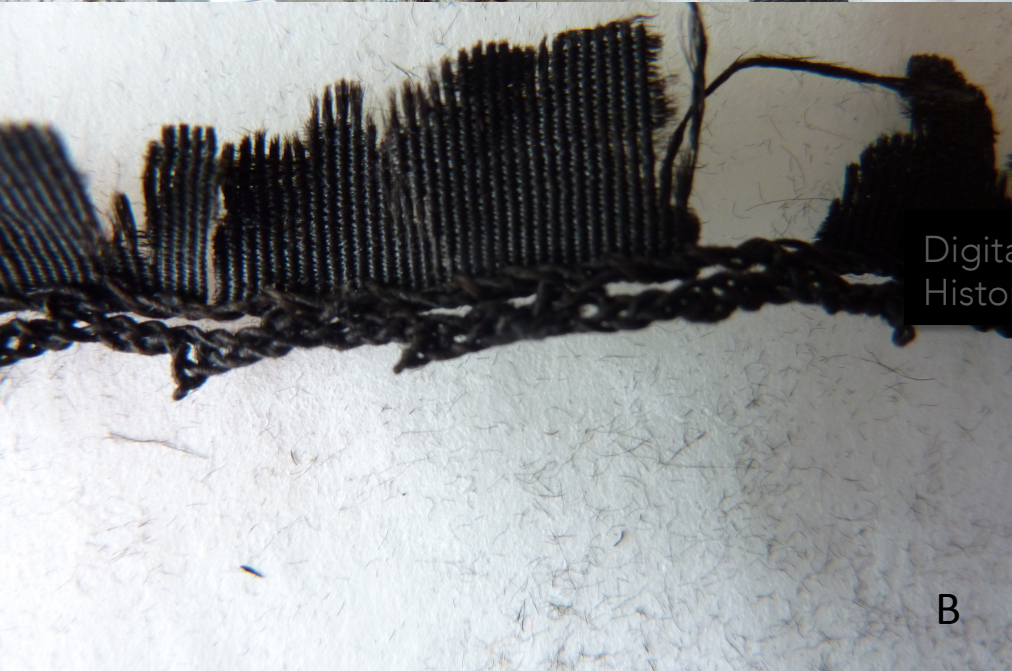
Digital 3D Reconstruction of
Historical Textile Fragment



A

Project Overview The Fragment

- A- Detail of the lace decorative collar
- B- Detail of the silk trim (seen at the base of the collar)



B

Digital 3D Reconstruction of
Historical Textile Fragment

Computerized Tomography Scan (CT)

- Used to determine 3D yarn architecture
- Instrument used in this study- Nikon Metrology 225 Micro CT Scanner
- Each Scan contained 1583 frames which were constructed using Nikon Metrology Software



Digital 3D Reconstruction of
Historical Textile Fragment

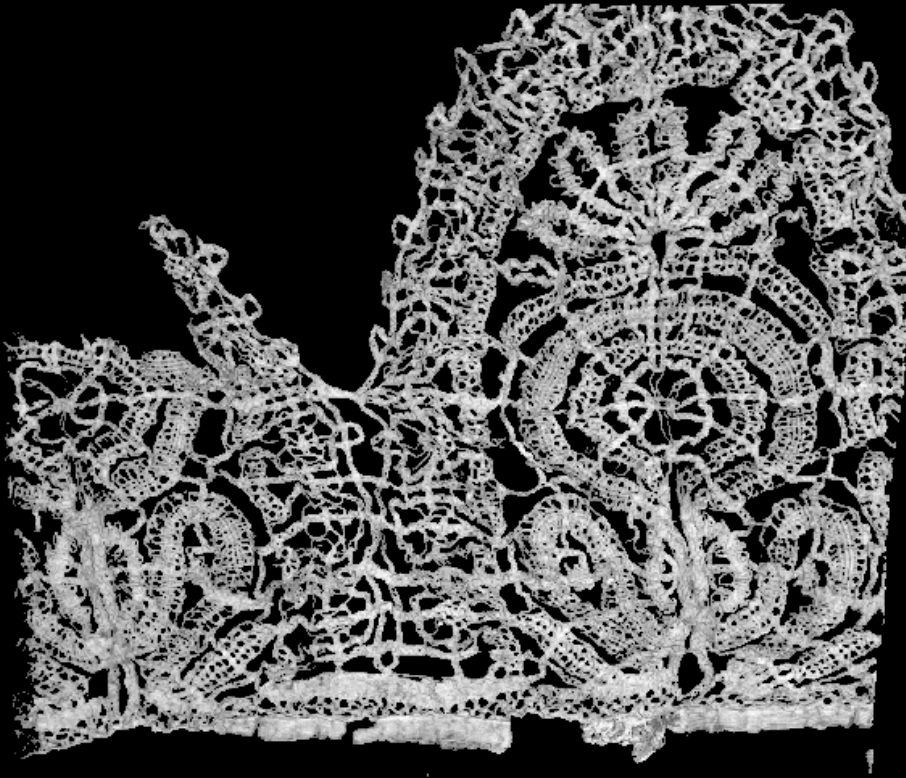
Computerized Tomography Scan (CT)





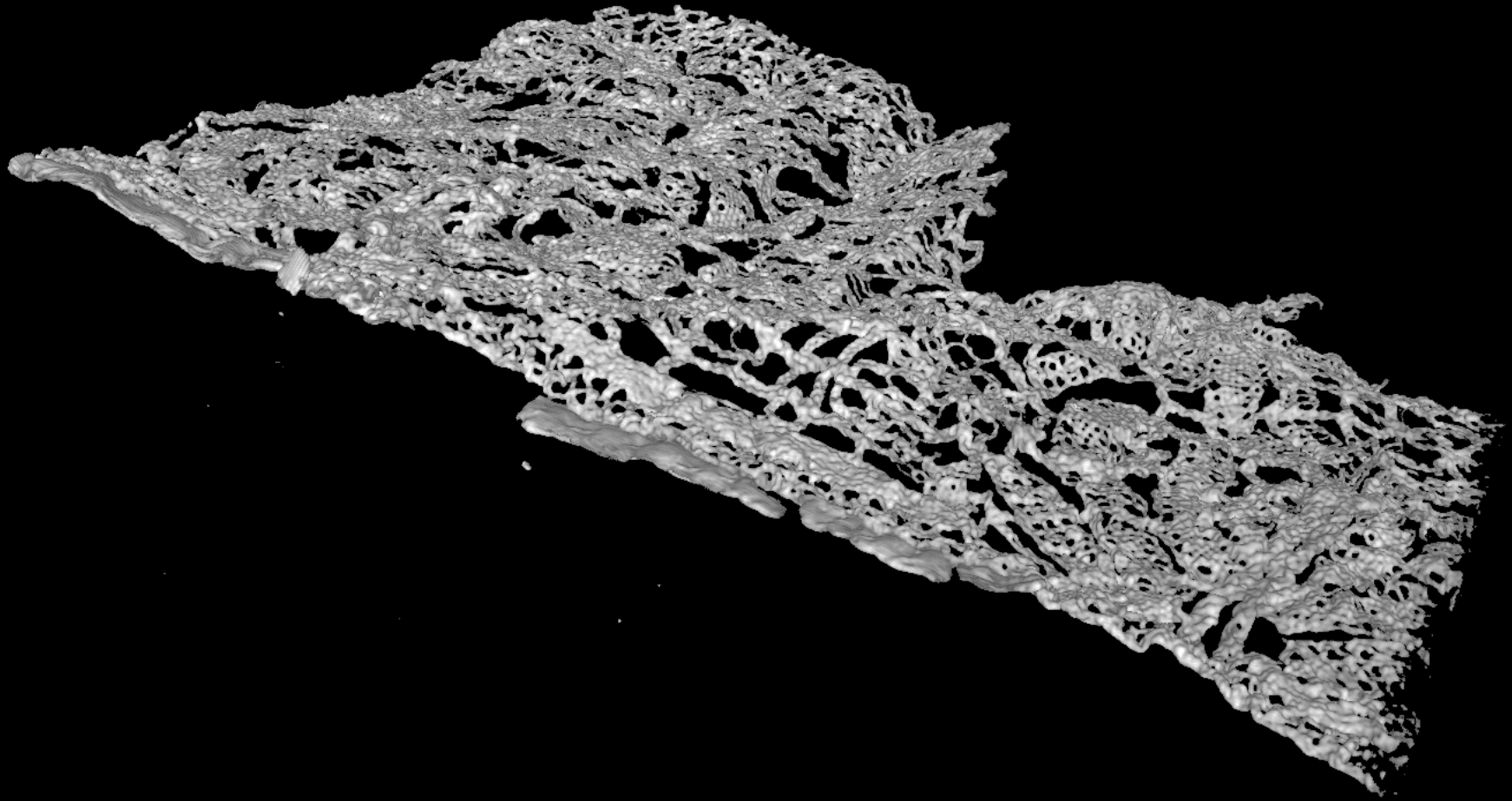
Video File

Computerized Tomography
Scan (CT)



Scene

Computerized Tomography Scan (CT)







Scene

Computerized Tomography Scan (CT)

Infinite Focus Microscopy (IFM)

- Used to determine surface and yarn measurement and structure
- Objective Lense provides small depth of focus to combine with vertical scanning to capture point height and true colour surface data

Digital 3D Reconstruction of
Historical Textile Fragment

Expert    

M G4 50x Overlay: Cross

Position Control

-139.0000 μm Set 0
238.0000 μm Set 0
58.3850 μm Set 0
39684.8558 μm Set 0
-0 $^\circ$ Set 0

Go 0 Clear Move Over Axis

Up
Down

Simple Change Reset Measurement Settings

Advanced Settings >>

Control

(Brightness): 3.28 ms

1.02

Advanced Settings >>

Imaging: off Polarizer: DEACTIVATED

Element Control

Real3D

Element type: 3D Dataset
Viewer
Field type: No ImageField

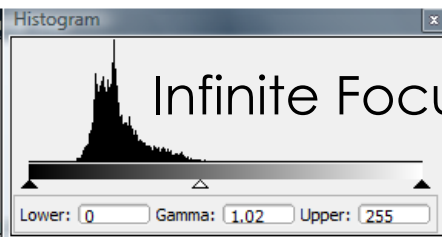
StartFlash Autofocus

61.5000 μm
23.6000 μm
(AF): 37.9000 μm
Res.: 0.20 μm
2.13 μm

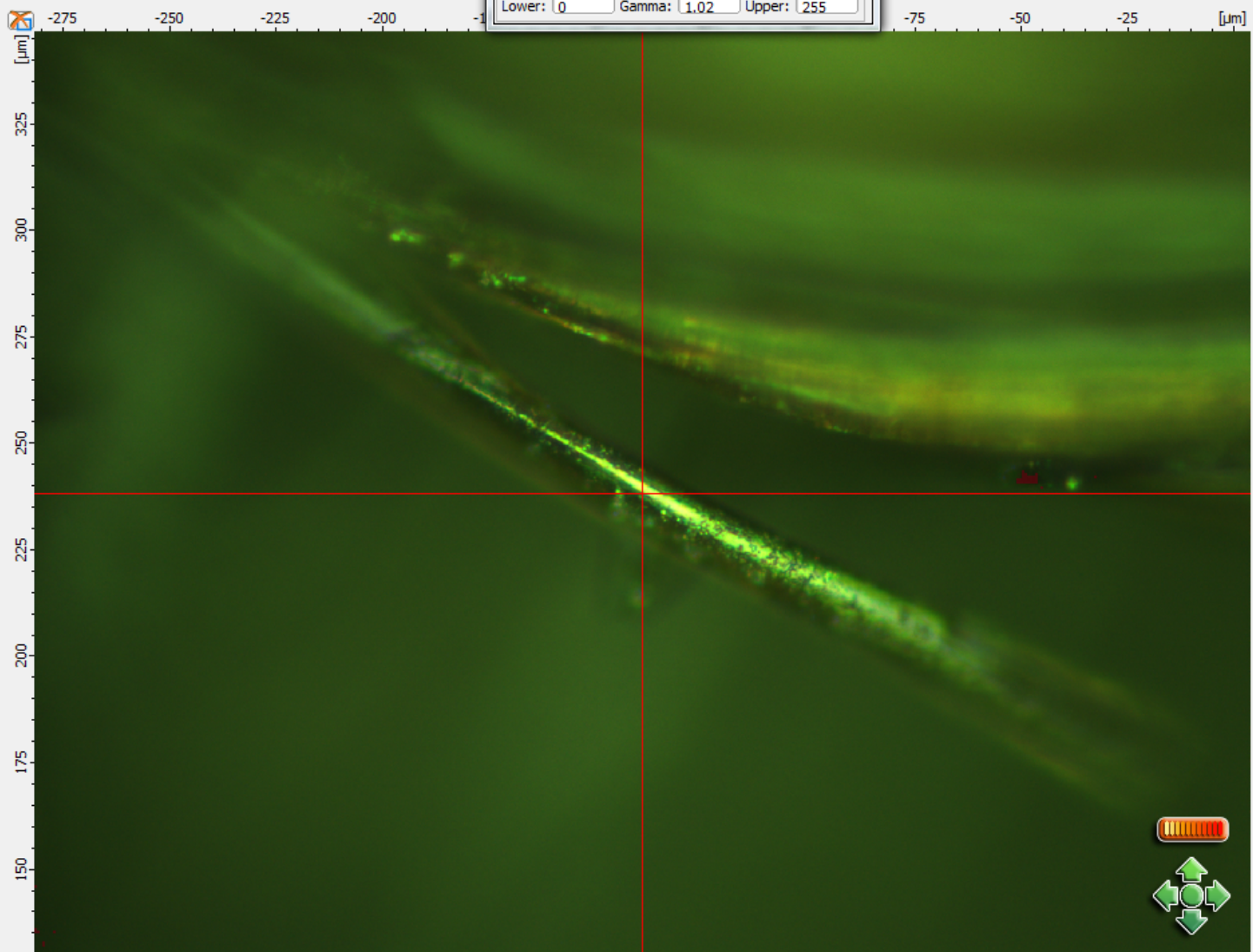
Advanced Settings >>

Duration
d time: 7.1 - 12 s
Size: 0.0000 μm x 0.0000 μm x 37.9000 μm

Start Measurement

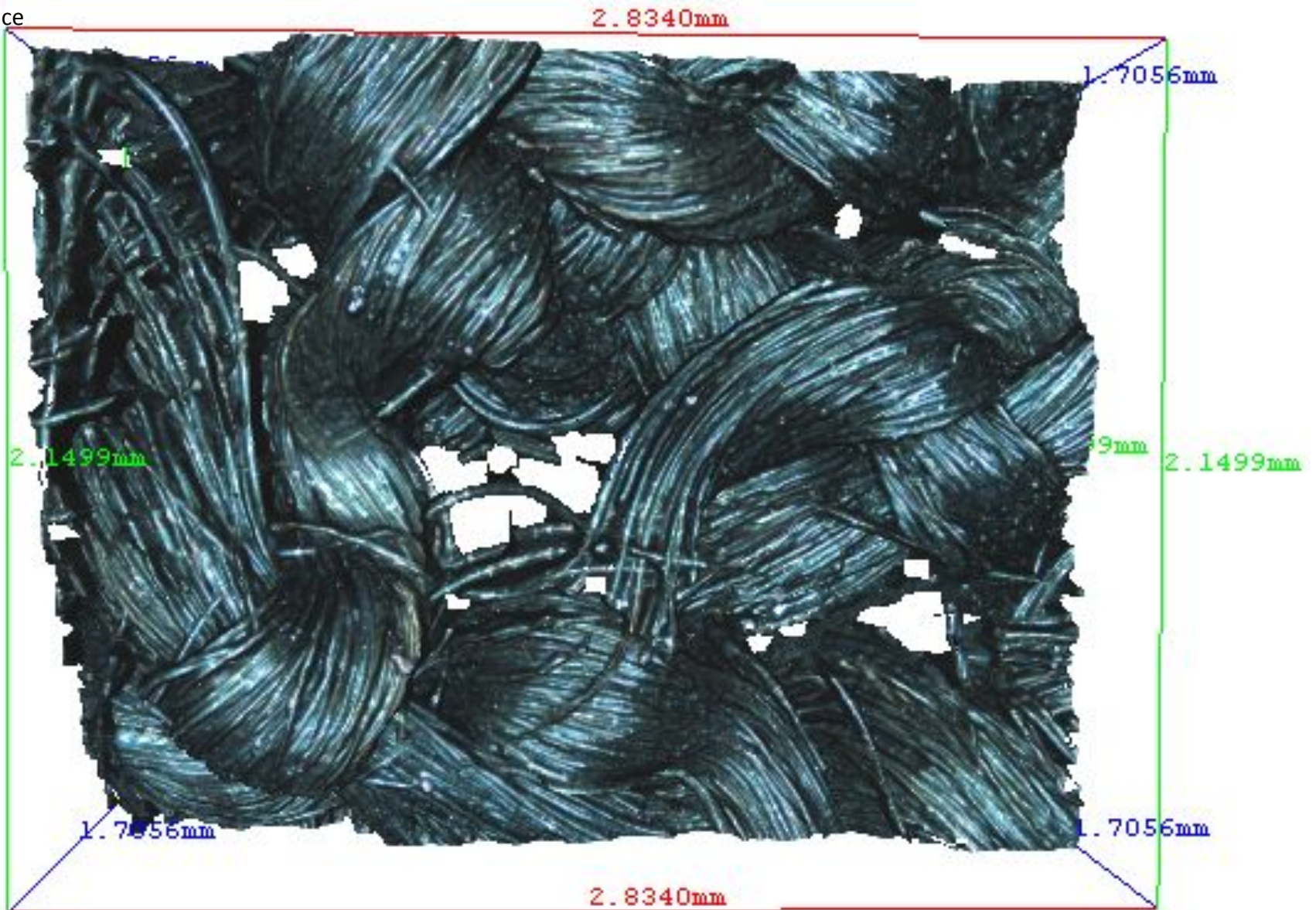


Infinite Focus Microscopy (IFM)



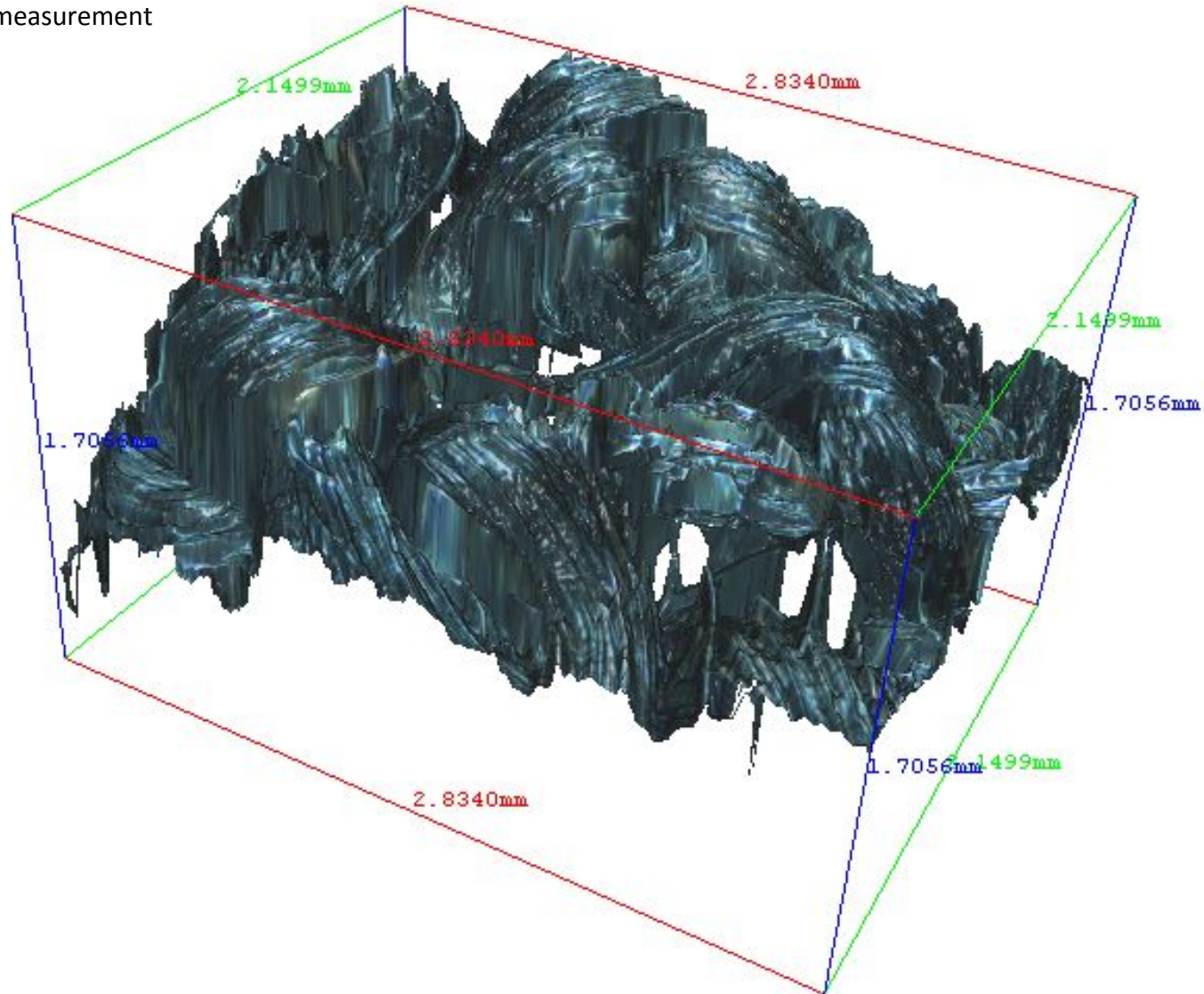
Linen Lace structure
10.00x Magnification
Exposure Time 167.5
Ms. Contast 0.76
IFM G4g measurement
Device

Infinite Focus Microscopy (IFM)



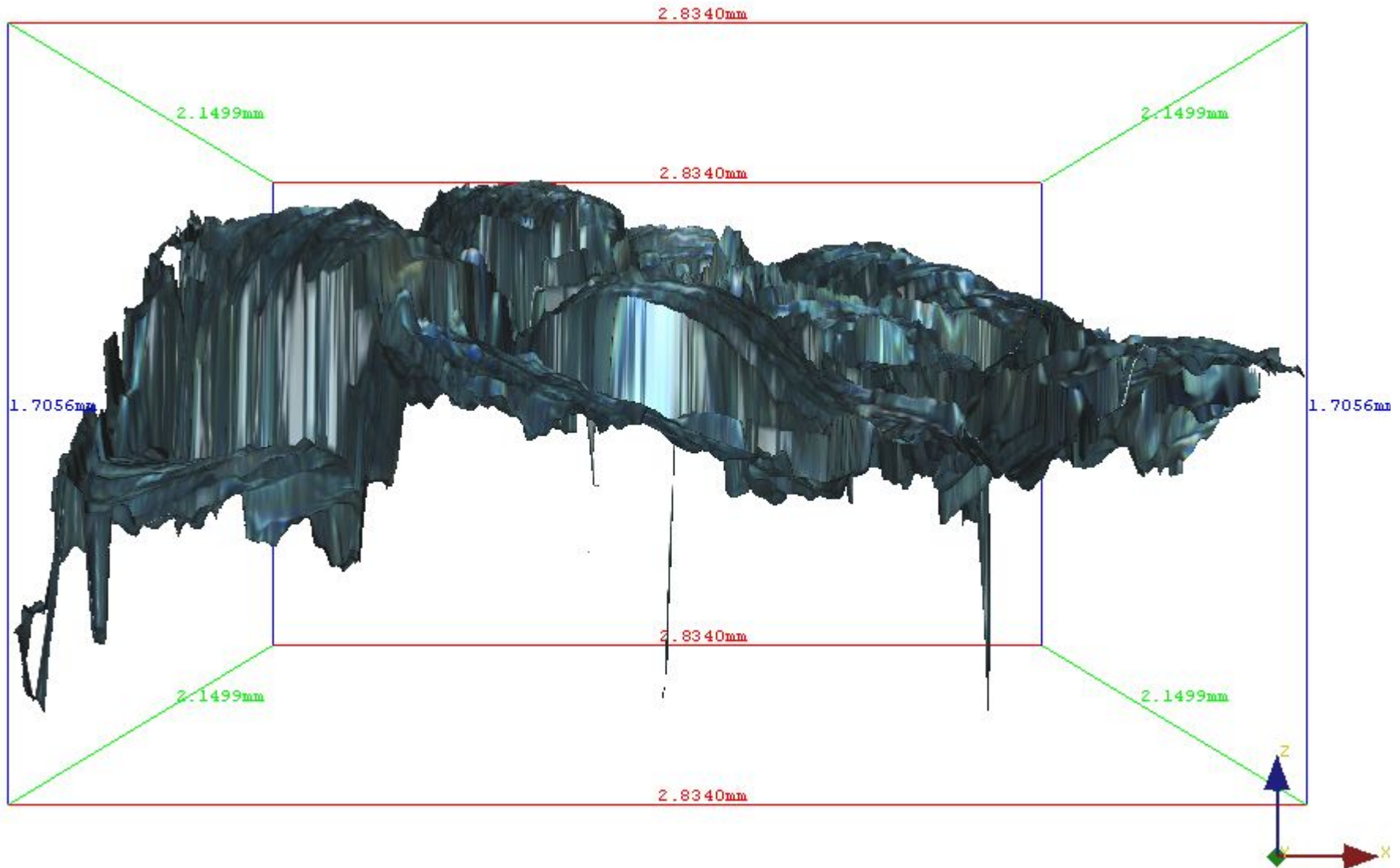
Linen Lace structure
10.00x Magnification
Exposure Time 167.5
Ms. Contast 0.76
IFM G4g measurement
Device

Infinite Focus Microscopy (IFM)



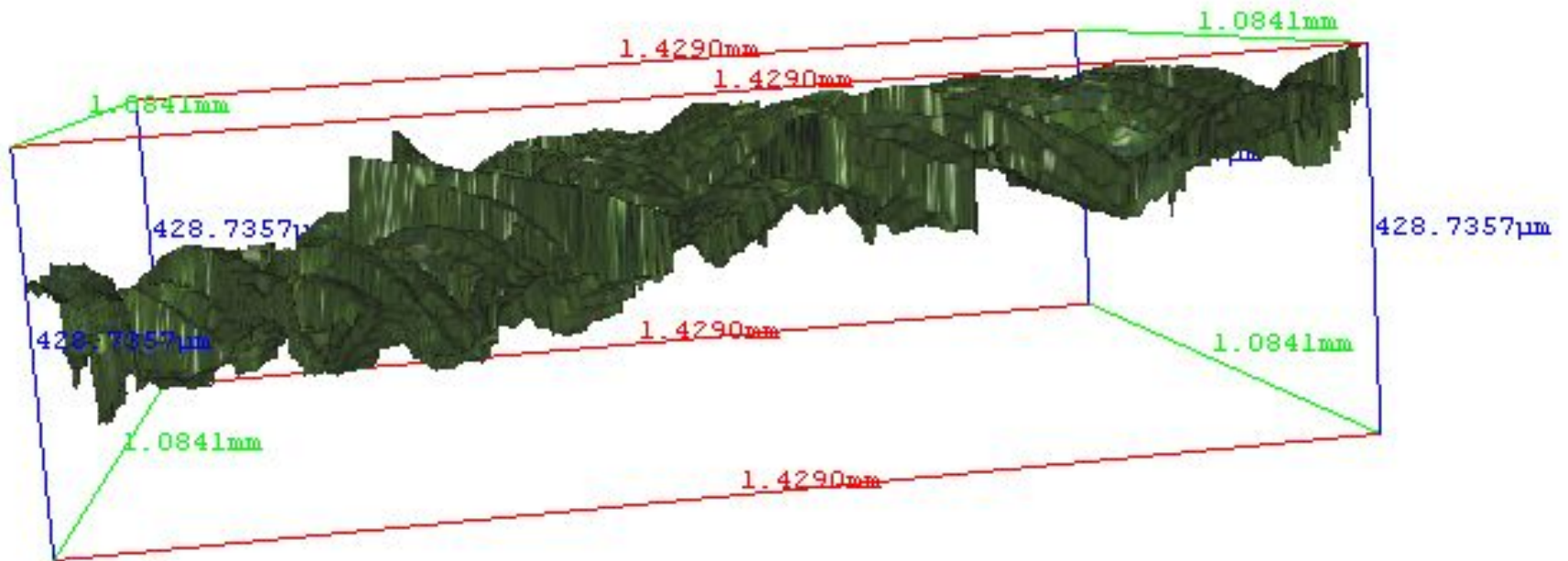
Linen Lace structure
10.00x Magnification
Exposure Time 167.5
Ms. Contast 0.76
IFM G4g measurement
Device

Infinite Focus Microscopy (IFM)



Silk structure
10.00x Magnification
Exposure Time 1.165ms
Contrast 0.94
IFM G4g measurement
Device

Infinite Focus Microscopy (IFM)



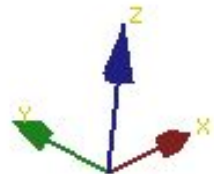
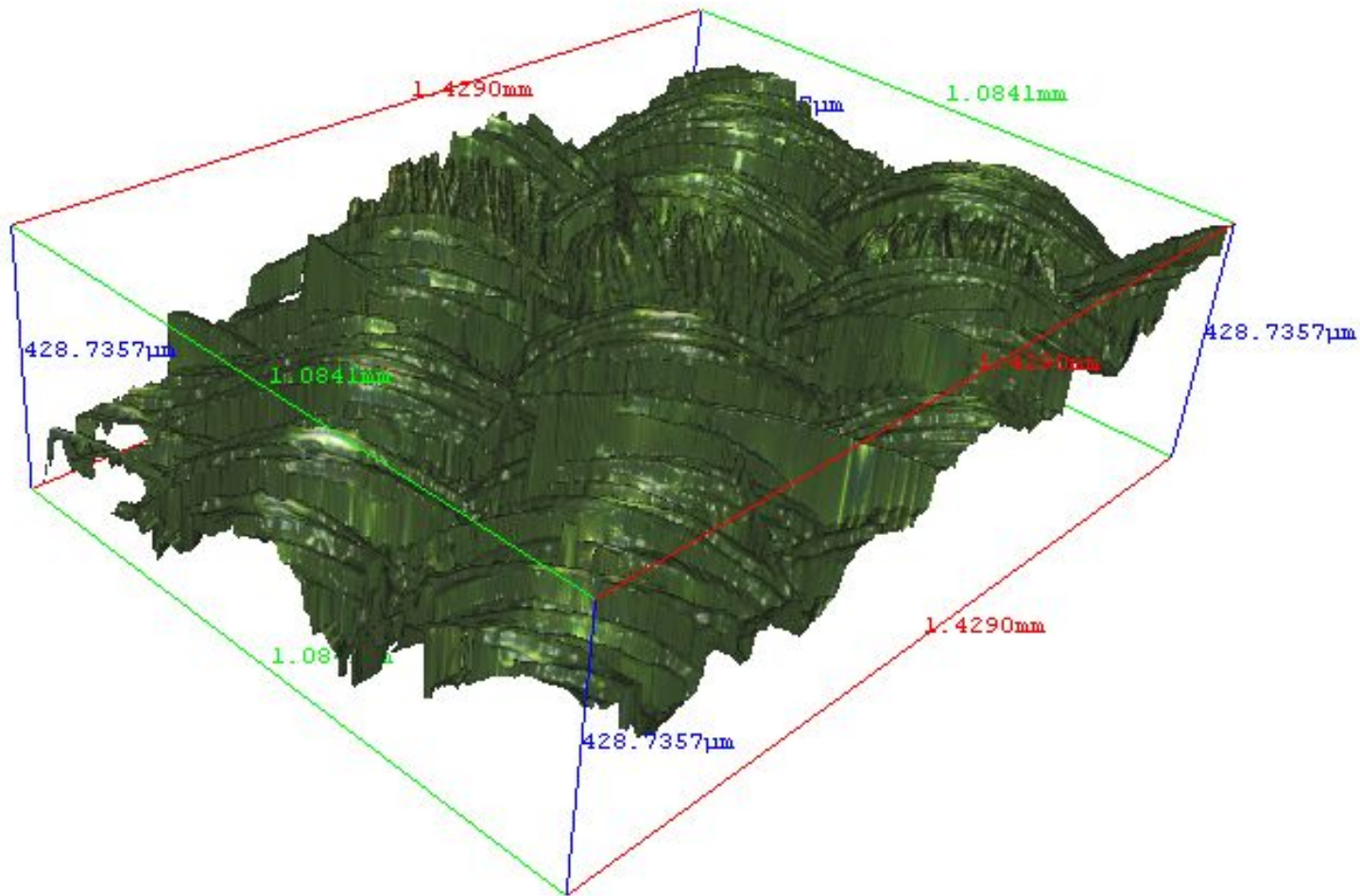
Silk structure
10.00x Magnification
Exposure Time 1.165ms
Contrast 0.94
IFM G4g measurement
Device

Infinite Focus Microscopy (IFM)



Silk structure
10.00x Magnification
Exposure Time 1.165ms
Contrast 0.94
IFM G4g measurement
Device

Infinite Focus Microscopy (IFM)



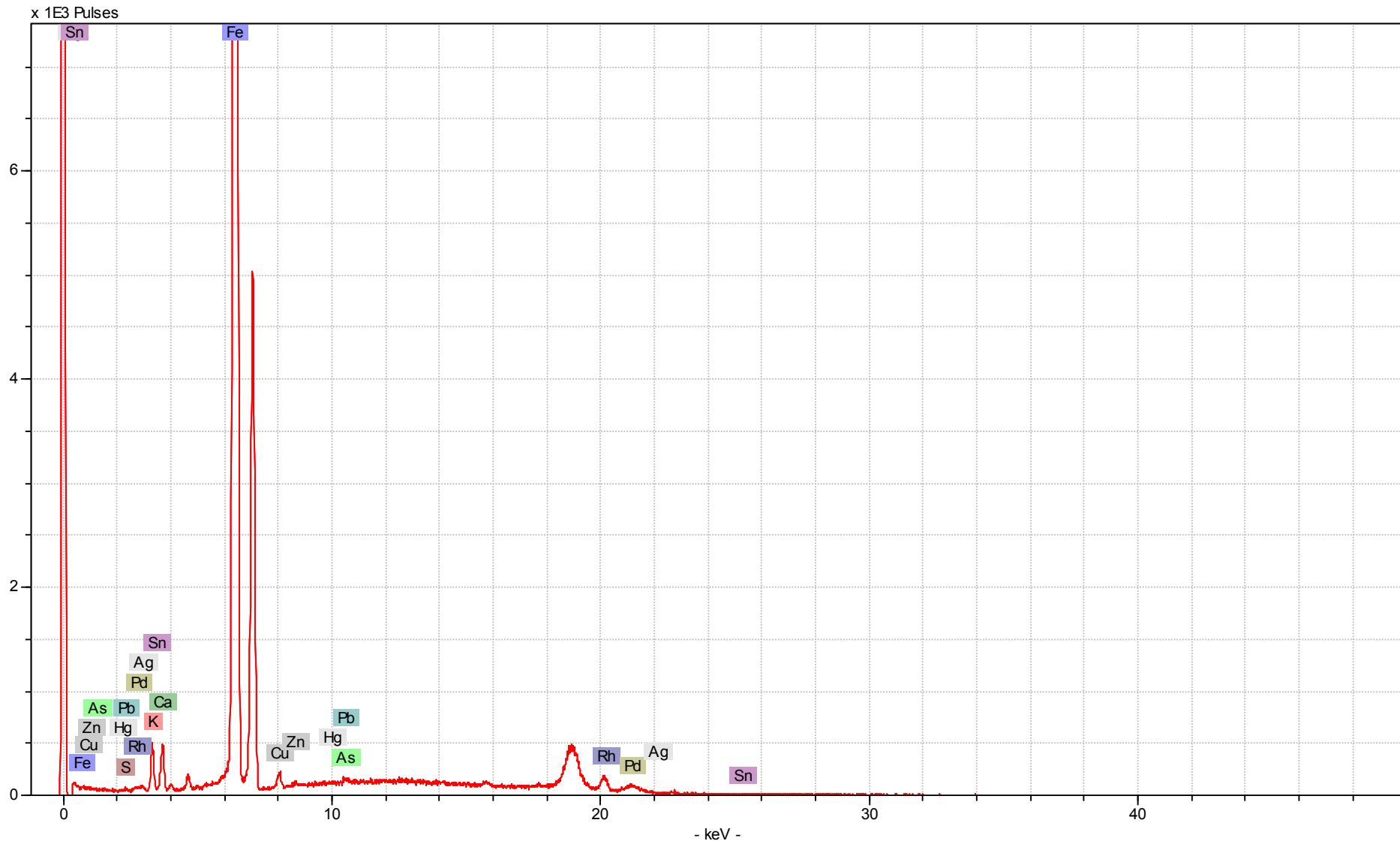
X-Ray Florescence (XRF)

- Used to determine constituent elements including possible links to dye process
- Qualative and semi quantitative Xray Florescence measurments were performed on different areas of the textile fragments
- Instrument used in this study- A commercially available Bruker Artax 400 XRF

Digital 3D Reconstruction of
Historical Textile Fragment

Silk 40kV for 90s
Bruker ARTAX 400 XRF
Rh Tube and a 650µm collimator

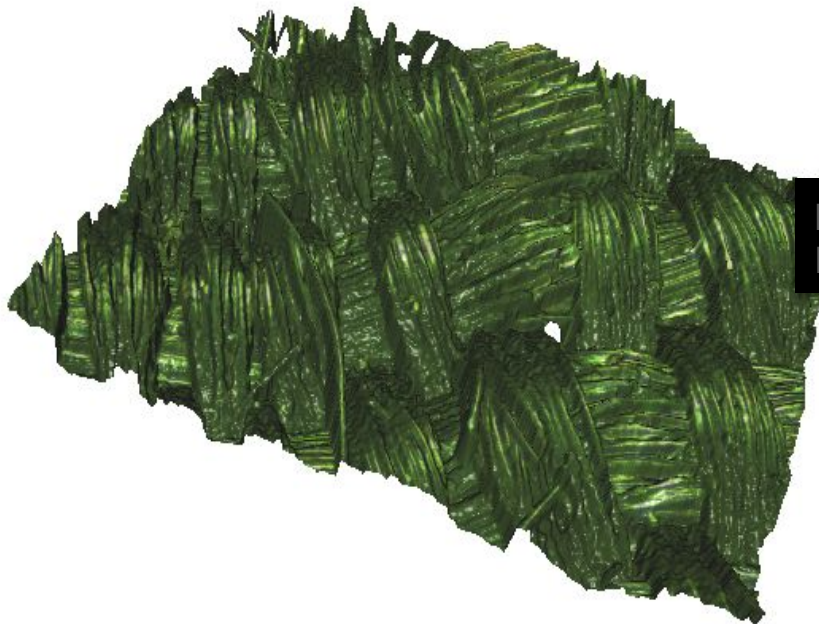
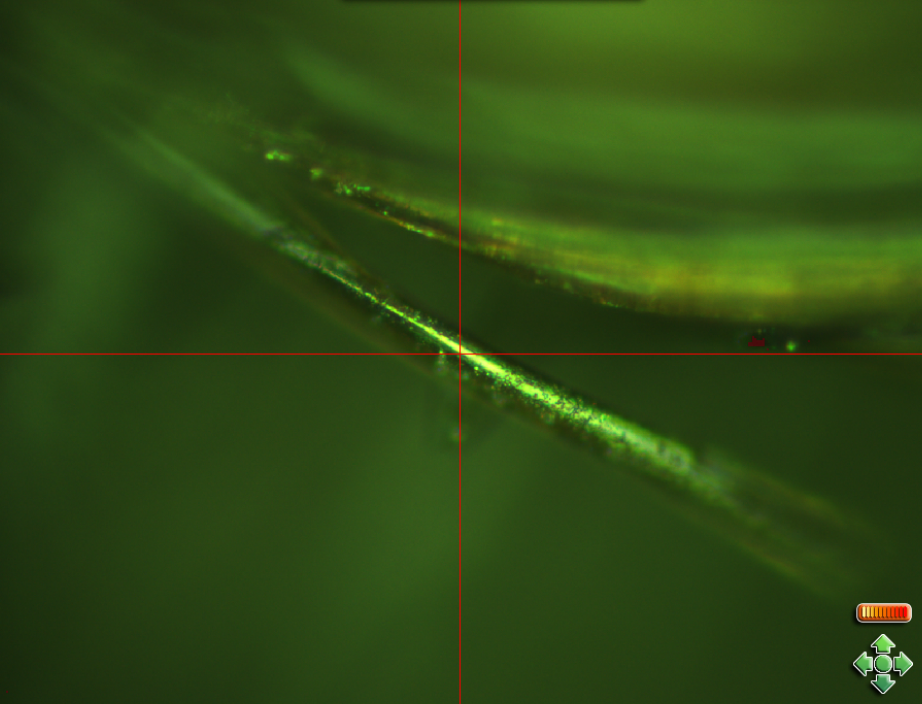
X-Ray Fluorescence (XRF)



Credits: Working the XRF for this project Professor Sue
Kilcoyne

Conclusions

- Research has demonstrated the potential of (CT), (IFM) and (XRF) 3D scanning technique to examine both structure and fibre of historic textile fragment
- These methods non destructively unlock the data and detail which in time would fully disintegrate with the textile
- Data collected will be used within 3D software packages for advanced textile simulation modelling purposes



Digital 3D Reconstruction of
Historical Textile Fragment

Further Research

- A range of software currently exists which takes 3D scan imagery such as the CT data within this study into reconstruction including; MATALAB, Rhinoceros, ANSYS.
- Reverse engineering software has the capability to convert 3D image dataset into high quality meshes for image modeling which is an exciting opportunity for the textile designer
- Current 3D textile software work with a range of assumed fabric properties unsuitable for historic textile modeling, often without areas of degradation, rot or dye variability

Digital 3D Reconstruction of
Historical Textile Fragment