Feb 20, 2019 Version 2

Protocol for microCT inspection of Gallium particle accelerator targets V.2

DOI
dx.doi.org/10.17504/protocols.io.ybefsje

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DOI: dx.doi.org/10.17504/protocols.io.ybefsje

Protocol Citation: Muofhe Tshibalanganda, Anton Du Plessis, Stephan Le Roux, Paul Papka 2019. Protocol for microCT inspection of Gallium particle accelerator targets. **protocols.io https://dx.doi.org/10.17504/protocols.io.ybefsje**

Manuscript citation:

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Protocol status: Working
We use this protocol and it's working

Created: February 19, 2019

Last Modified: February 20, 2019

Protocol Integer ID: 20550

Abstract

This protocol described the steps used to inspect the Gallium targets used in particle accelerators. These targets are metal disks filled with Gallium, and laser welded on the edges. Various production quality issues may be present - the microCT process needs to be a standard, routine methodology for direct comparison among all such data sets. This protocol sets out the exact steps used for this analysis type.

Guidelines

Each target is scanned twice: rotated 90 degrees after the first scan.

Safety warnings

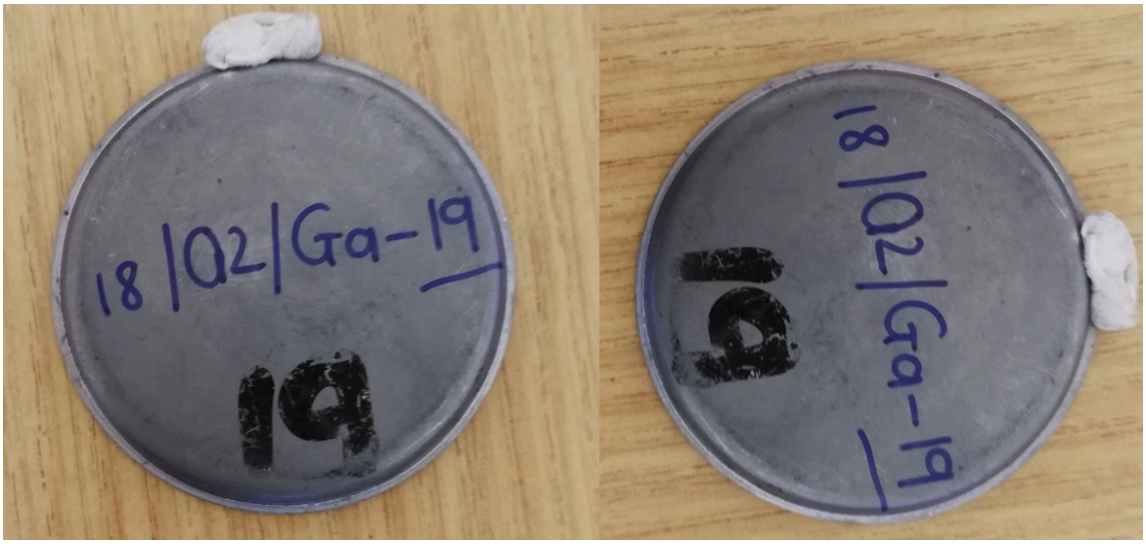
Never apply procedure to used targets.
Use safety gloves when handling targets.

Before start

Make sure the targets are unused. Used targets are very radioactive - life threatening.

Sample loading

1 Mark the top of the disk with a small ball of prestik, this is the reference for orientation to check second scan rotation by 90 degrees (eg. in data set after scanning, to ensure the disk was rotated).



Sample Mounting

2 Load the sample on a foam (e.g. florist oasis) with prestik at top, but angled towards the flat side by up to 10 degrees. This is to reduce penetration artefacts - perfect vertical is not suggested.


18/02

Scanning settings

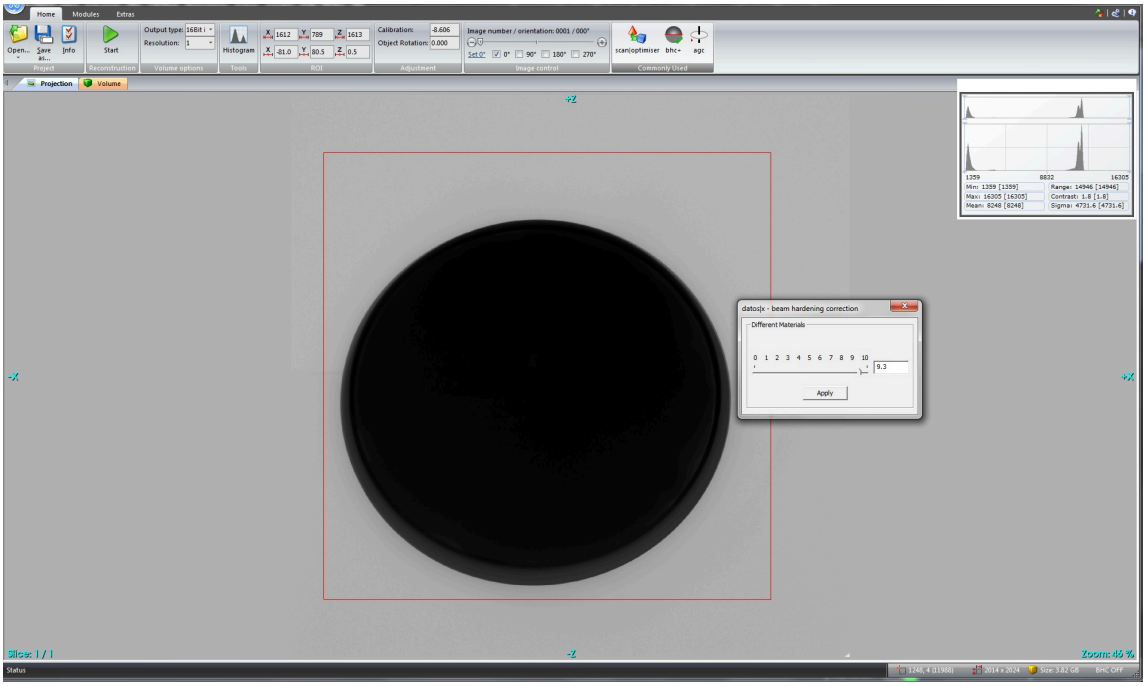
3 This is using a General Electric VTomex L240 system, but most microCT systems would work with similar settings.

Voltage	200 kV
Current	150 µA
X-ray Sensitivity	4
Beam Filter	0.5 mm copper
Detector filter	0.5 mm copper plate
Voxel size	30 µm
Timing	333 m/s

	Images	2800
	Averaging	1

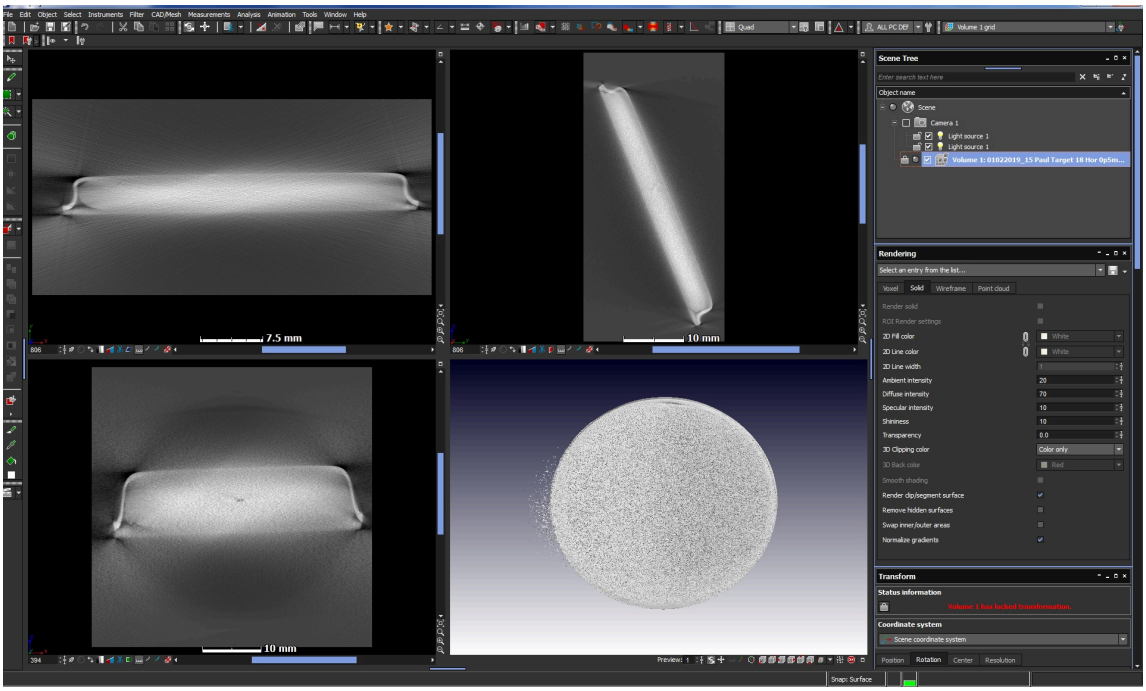
Reconstruction

4 Reconstruction of the 3D data is done using General Electric Datos 2.2, using specifically beam hardening correction value of 9.3 - this reduces beam hardening artefacts significantly.

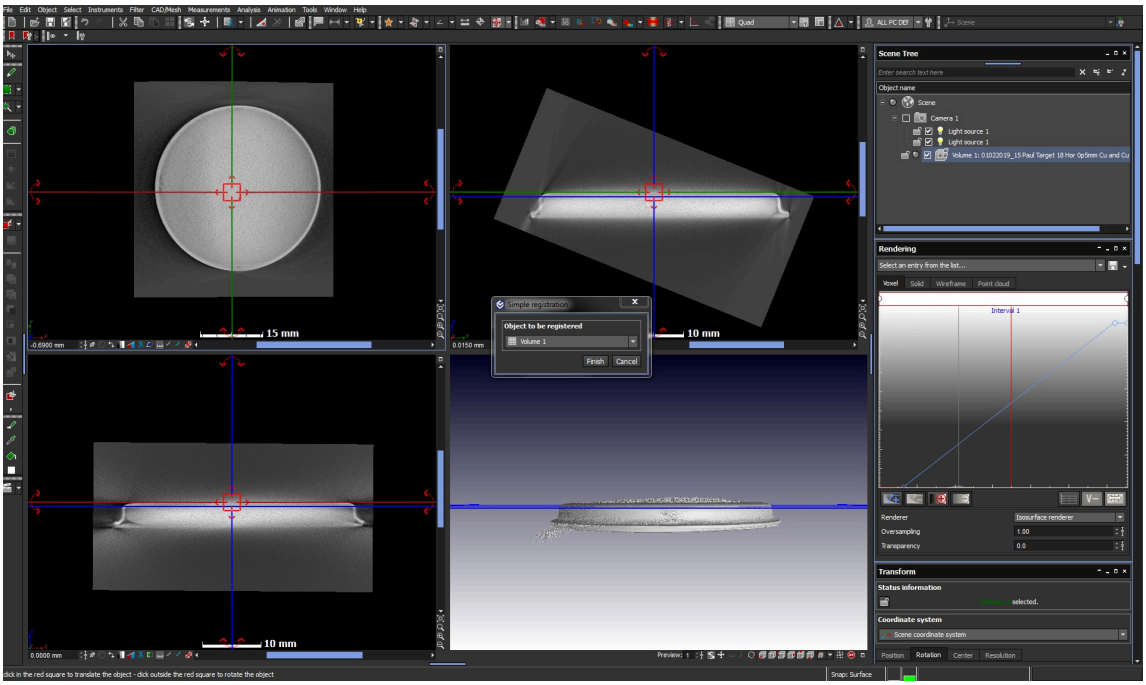


Analysis

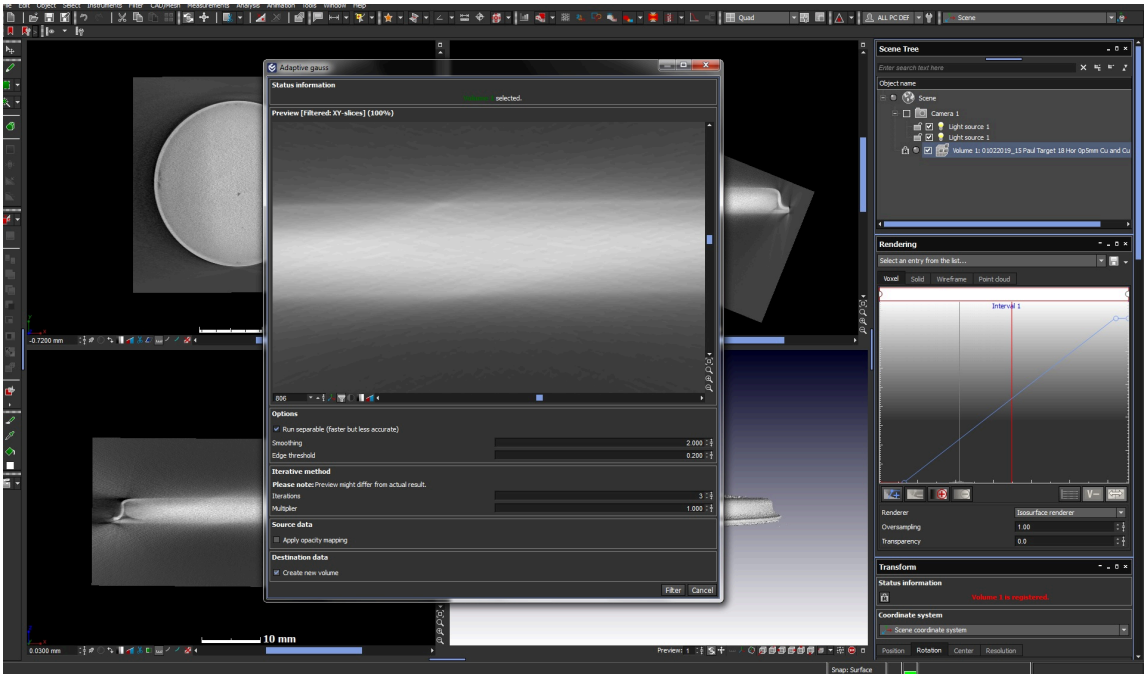
5 1. Analysis of 3D data is described here using Volume Graphics VGSTUDIO MAX 3.2 .

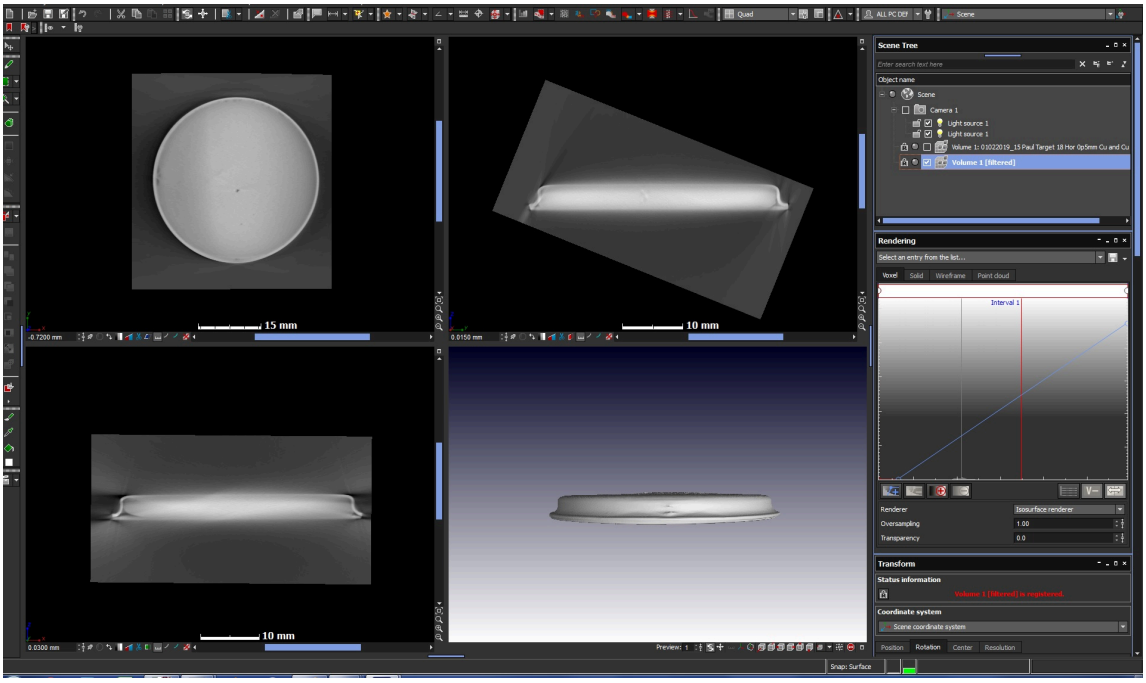


2. Register the sample - use simple registration to turn the sample upright in the software windows.



3. De-noising is done using the filters Adaptive Gauss with smoothing factor 2, edge threshold=0.2, iteration=3.

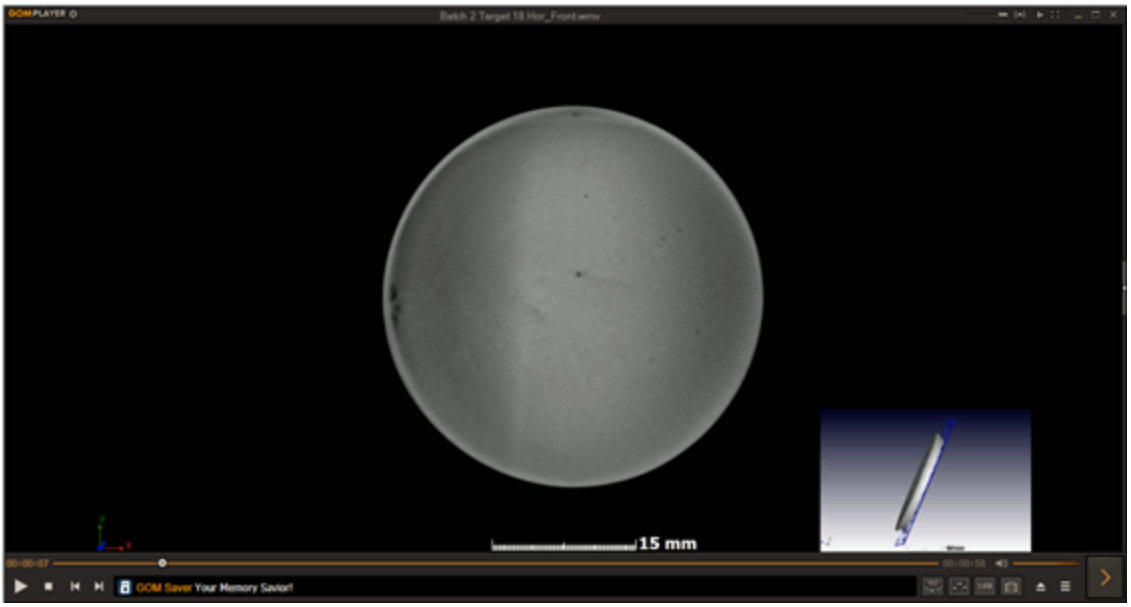

Adaptive gauss
Status information
Preview [Filtered: XY-slices] (100%)
Options
Run separable (faster but less accurate)
Smoothing
Edge threshold
Iterative method
Please note: Preview might differ from actual result.
Iterations
Multiplier
Source data
Apply opacity mapping
Destination data
Create new volume
Filter
Cancel
10 mm
Scene Tree
Object name
Scene
Camera 1
Light source 1
Light source 1
Rendering
Select an entry from the list...
Voxel
Solid
Wireframe
Point cloud
Interval 1
Renderer
Isosurface renderer
Oversampling
Transparency
Transform
Status information
Coordinate system
Scene coordinate system
Position
Rotation
Center
Resolution
Snap: Surface


15 mm
10 mm
10 mm
Scene Tree
Object name
Scene
Camera 1
Light source 1
Light source 1
Volume 1 [filtered]
Rendering
Select an entry from the list...
Voxel
Solid
Wireframe
Point cloud
Interval 1
Renderer
Isosurface renderer
Oversampling
Transparency
Transform
Status information
Coordinate system
Scene coordinate system
Position
Rotation
Center
Resolution
Snap: Surface

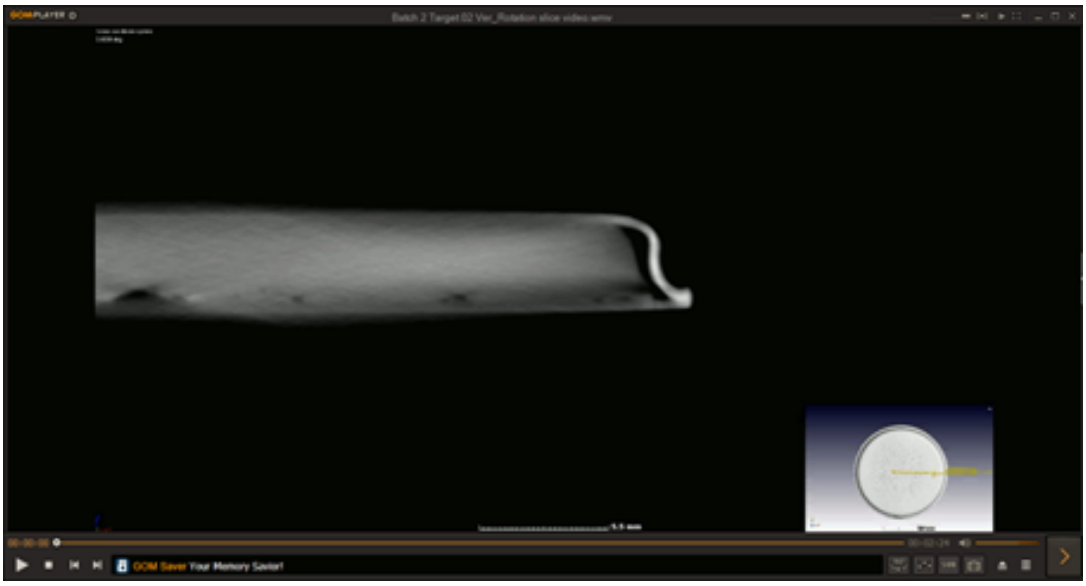
Animation

6 Create Vvdeos of only front and rotation slice with 5mm per front slice and 0.1 degree per rotational slice.
Video format: .wmv with naming:
Batch # Target # Front slice
Batch # Target # Front slice 90 degree rotation
Batch # Target # Rotation
Batch # Target # Rotation 90 degree roration
- Rotation video are started from west (artefacts at North and South) and rotated anticlockise. Capsule is facing up, welded plate is facing down

Front slice video



Rotation video



Saving

7 The data is saved including the filtered data set, as a image stack (tiff). These can be viewed manually without special software. The analyzed volume can be opened in free myVGL software.