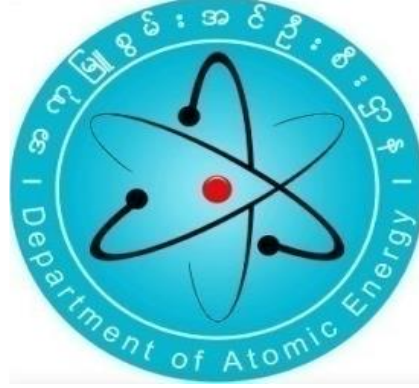




COMPARISON OF IMAGE RECONSTRUCTIONS FOR GAMMA TRANSMISSION COMPUTED TOMOGRAPHY SYSTEM BY USING MATLAB AND i-GORBIT SOFTWARE

By

Khaing Nyunt Myaing

khaing.nm@gmail.com

Myo Zaw Htut, Myo Min Thein

Atomic Energy Division, Ministry of Education

MYANMAR

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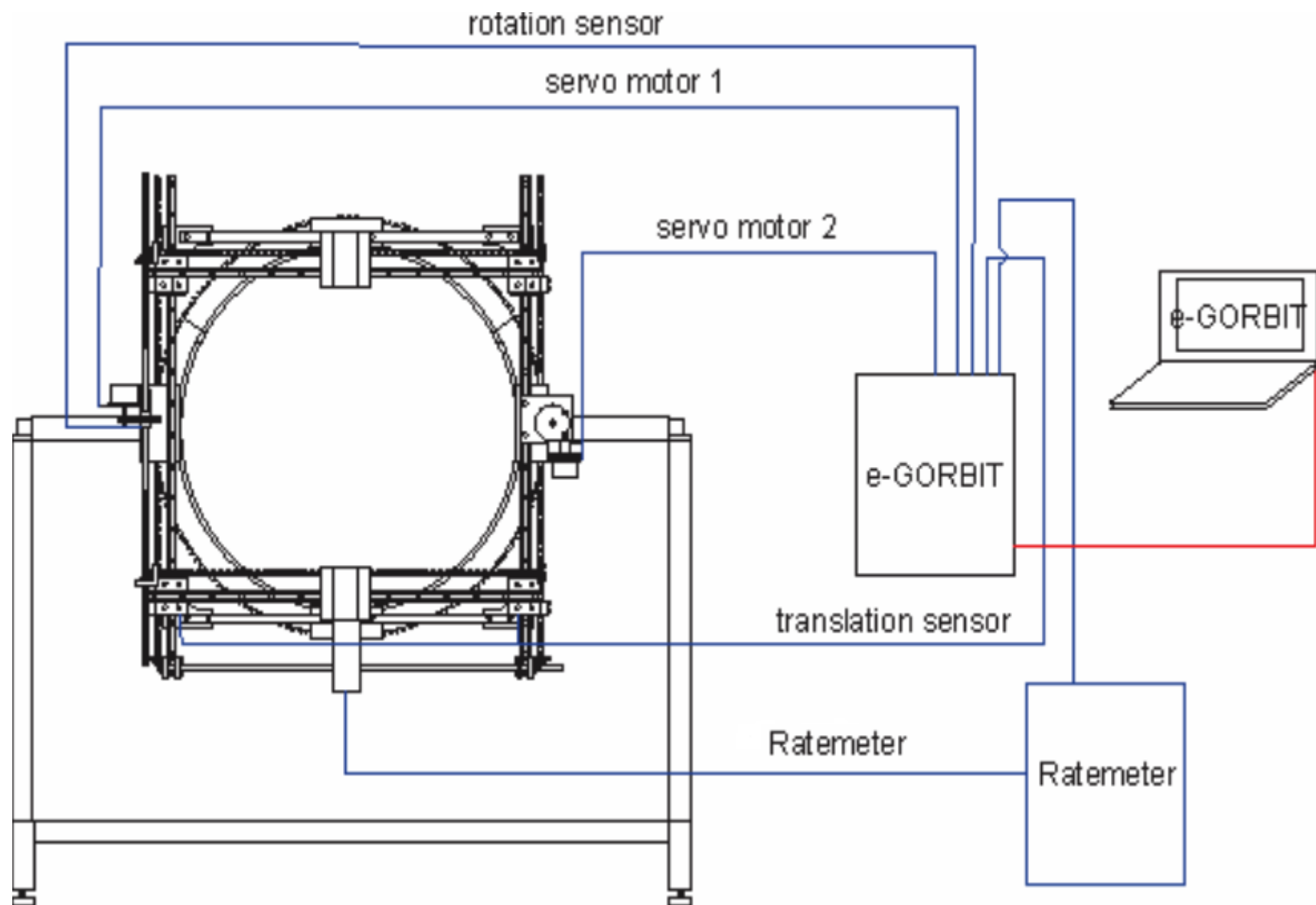
Introduction

- CT is a rapidly developing technique that is especially useful for imaging and measuring multi-component and multi-phase processes.
- Obtain internal structure of the object nondestructively, produces extremely accurate internal dimensions, compatible with all shapes and sizes and it gives excellent resolution.
- The goal of industrial gamma-ray CT is to produce internal images of object with sufficient detail to detect important features.

Aim and Objectives

- To create the image reconstruction program by MATLAB GUI package for the improvement in resolution of images.
- To perform tomographic scans with different density materials in pipe vessel for the investigation of the internal structure and density changes.
- To compare the images obtained by i-GORBIT and MATLAB image reconstructions for analysis of the results.

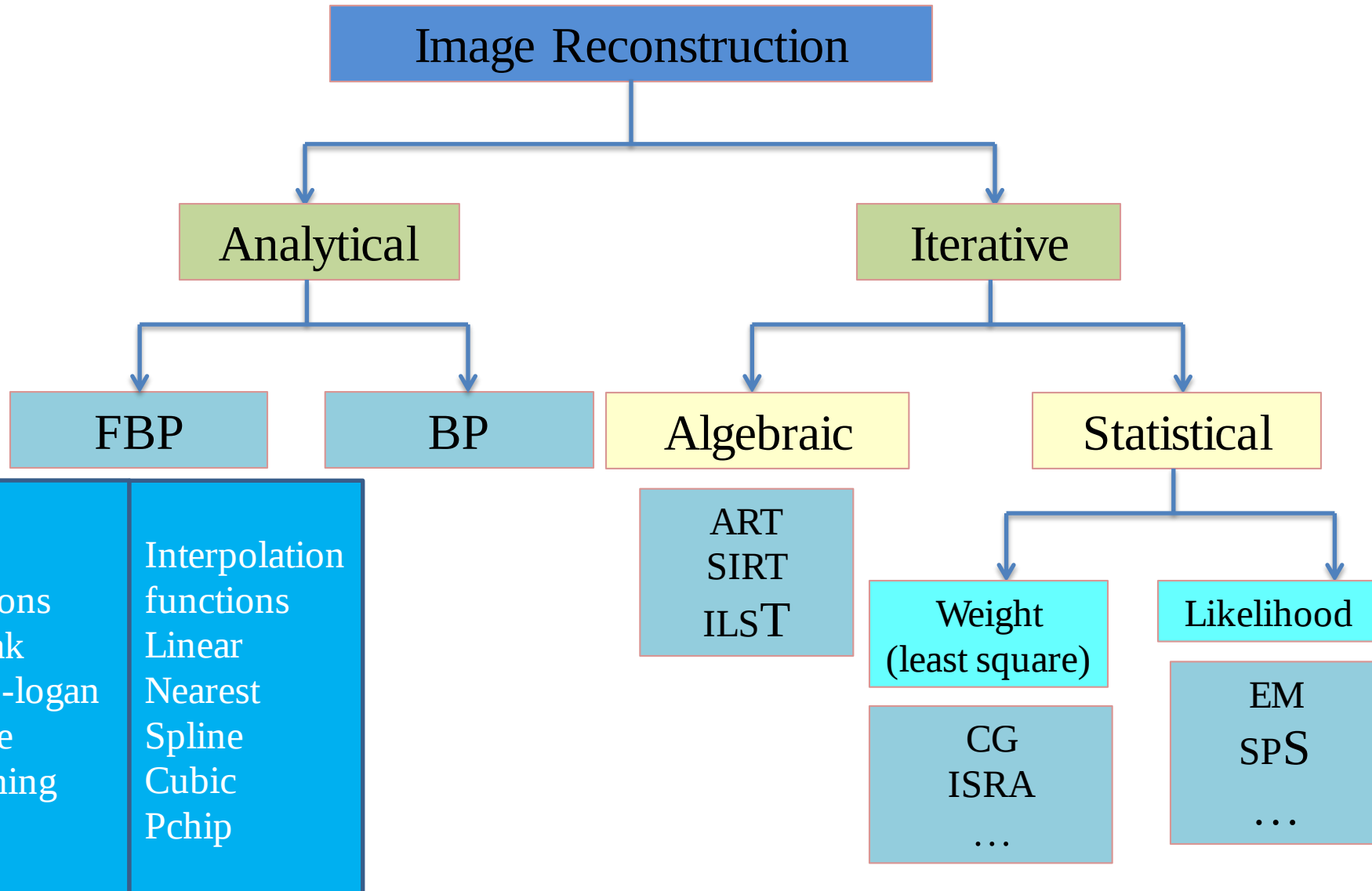
Experimental Work



Sample		Material	Thickness (cm)	Width (cm)	Length (cm)
1		Lead	3	5	10
		Plexiglas	4	5	10
		Iron	3	5	10
2		Lead block	3.5	9.1	9.8
		Air void	-	6.2	4.9
3		Brick	10.7	4.7	7.4
		Air void	-	1	7.4
		Polymer vessel	1	20(diameter)	19



Image Reconstruction Methods



Implementation Steps of Image Reconstruction Program By MATLAB

- Based on GUI MATLAB (Graphical User Interface)
- In this program load the initial data in *.mat file type, which is acquired in the form of intensity measurements which must be converted to projection data.
- The reconstruction algorithms used was the back projection (BP) and filtered back projection technique(FBP)
- BP used simple Radon transform functions
- FBP used simple Radon and Inverse Radon transform functions with different filters and interpolations

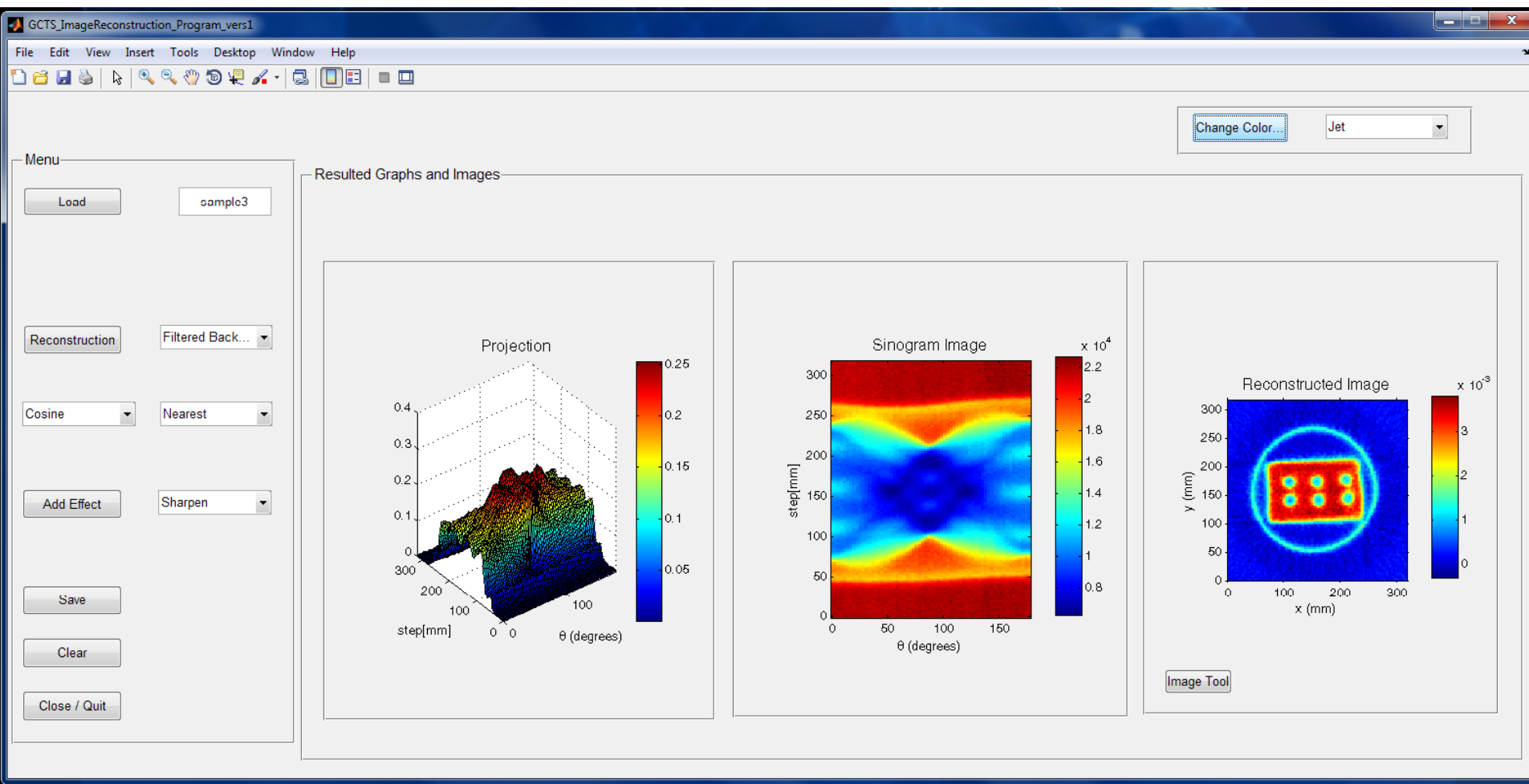
Image Reconstructions by MATLAB

- Image Processing Toolbox

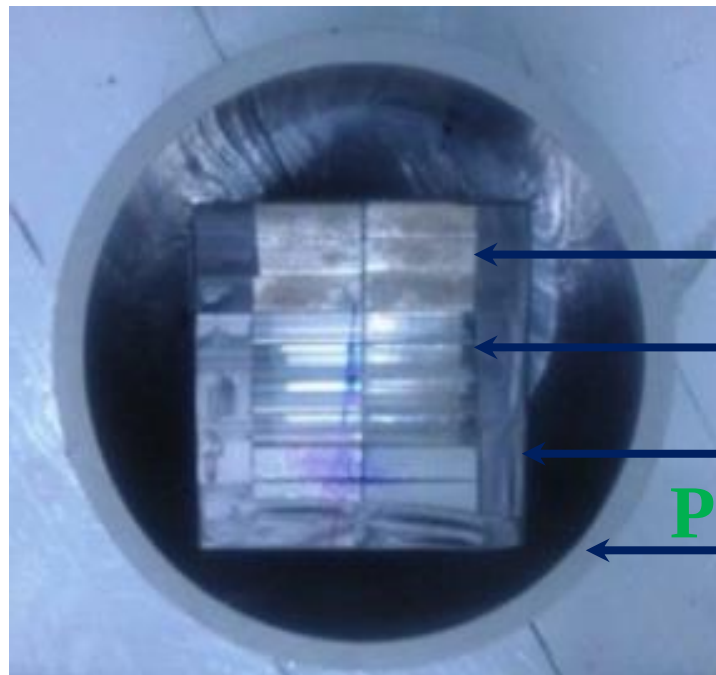
Main window includes with

- Load Button (load intensity profile, projection, sinogram)
- Reconstruction Button (BP and FBP algorithms)
 - FBP use different filter functions: Ramlak, Sheeplagan, Cosine, Hamming, Hann
 - Different interpolation functions: nearest, linear, spline, pchip, cubic
- Image Effect “Emboss, Sharpen, Edge”
- The input data, projection and reconstructed image data can also be enhanced in *.mat file type

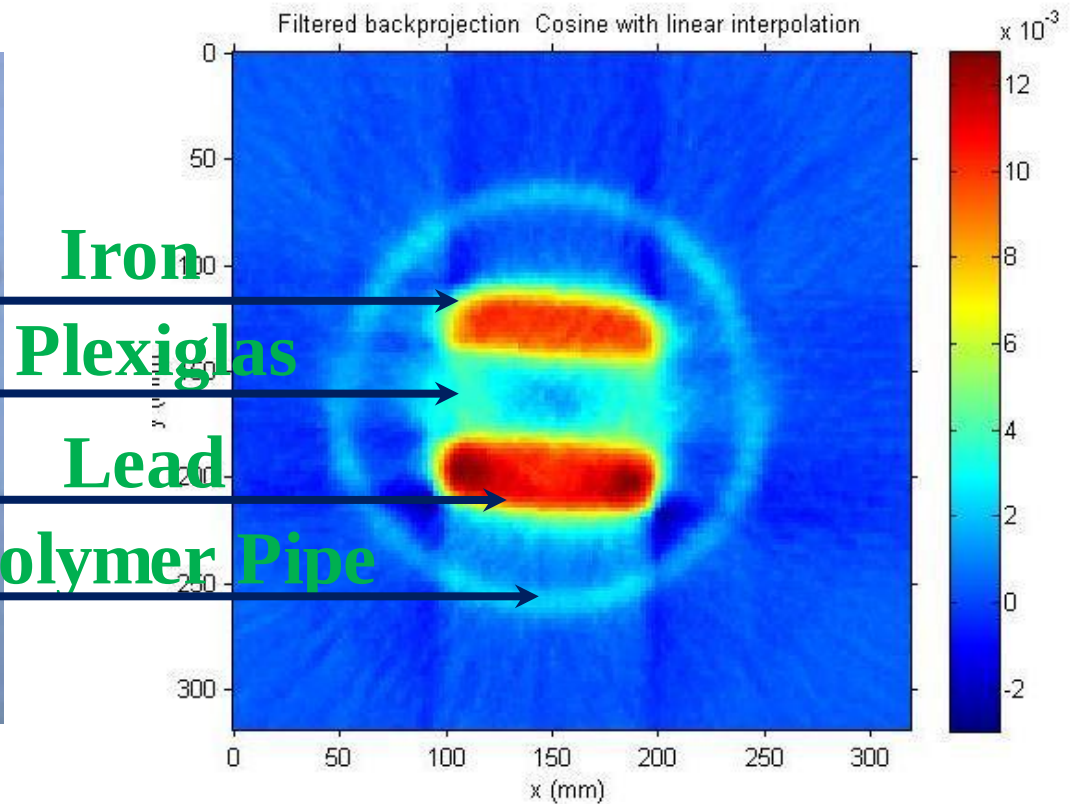
Working Interfaces of Image Reconstruction Program by GUI MATLAB package



Comparison of CT image and Optical Camera Image

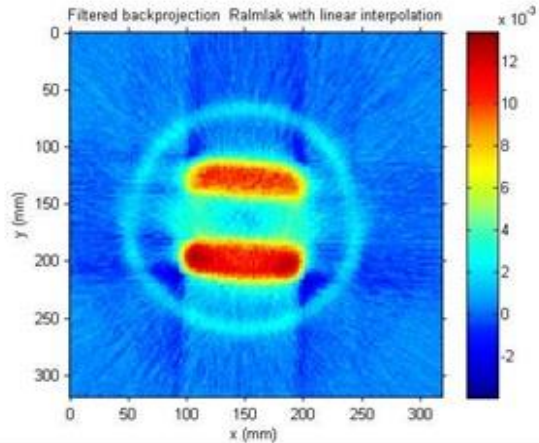


Real Optical camera image

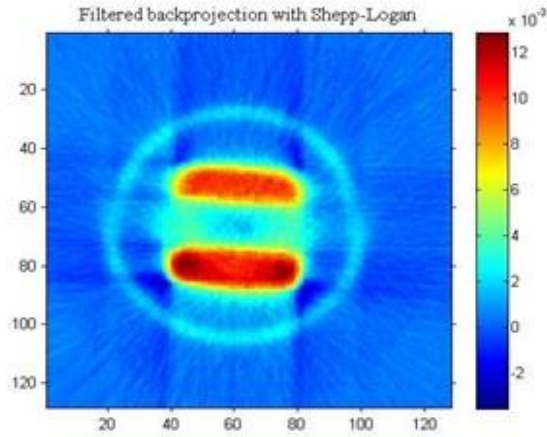


FBP with Cosine Filter and Linear Interpolation

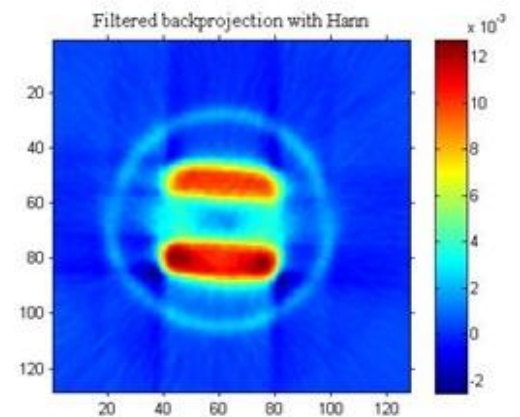
Image Reconstructions for Sample 1 by MATLAB



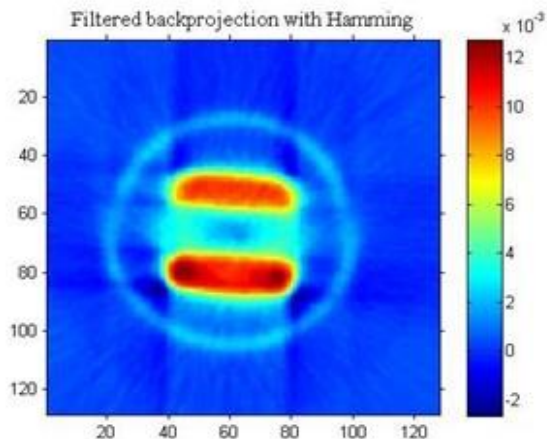
FBP with Ramlak



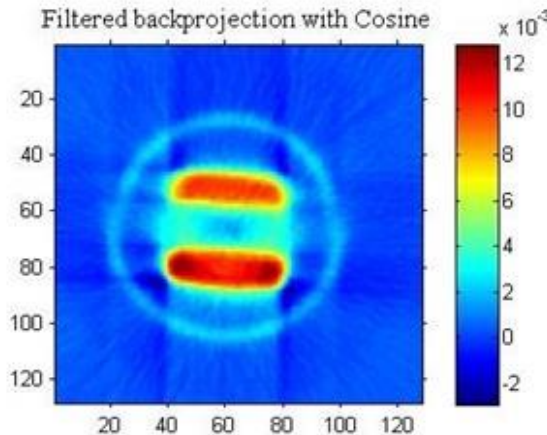
FBP with Sheeplogan



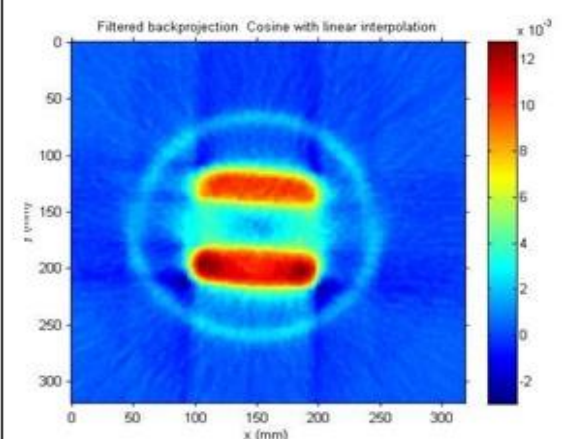
FBP with Hann



FBP with Hamming

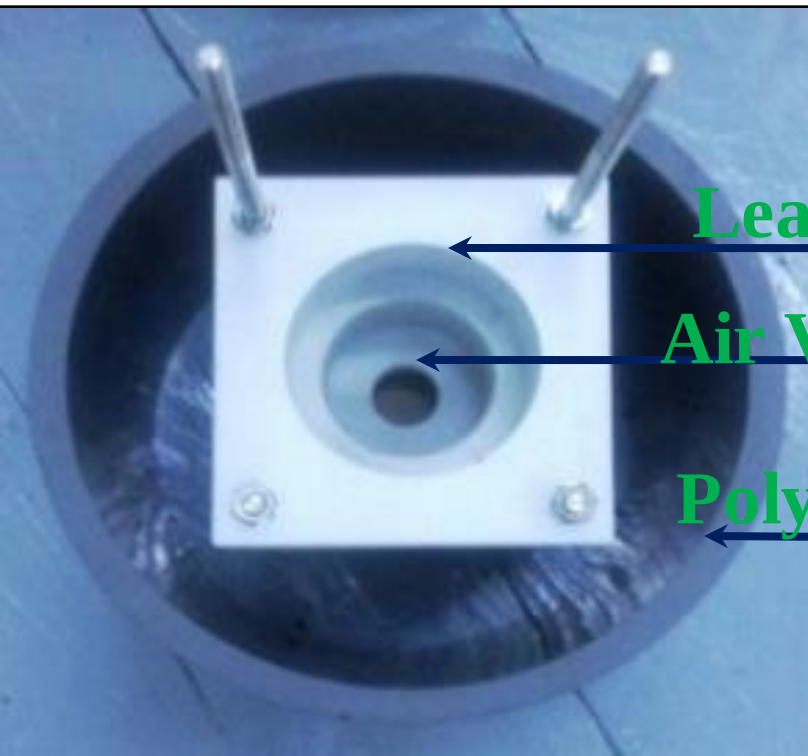


FBP with Cosine

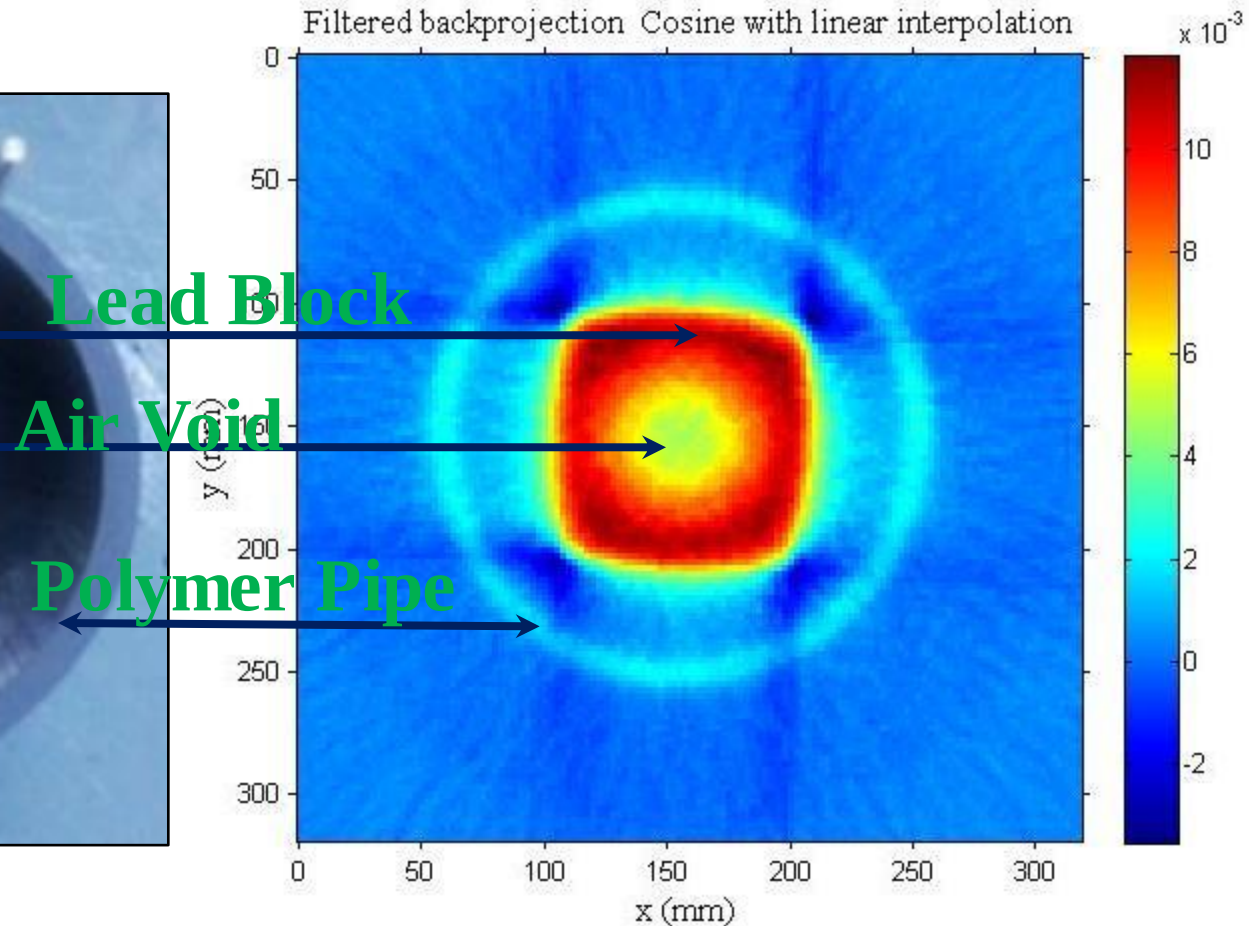


**Cosine with linear
interpolation**

Comparison of CT image and Optical Camera Image

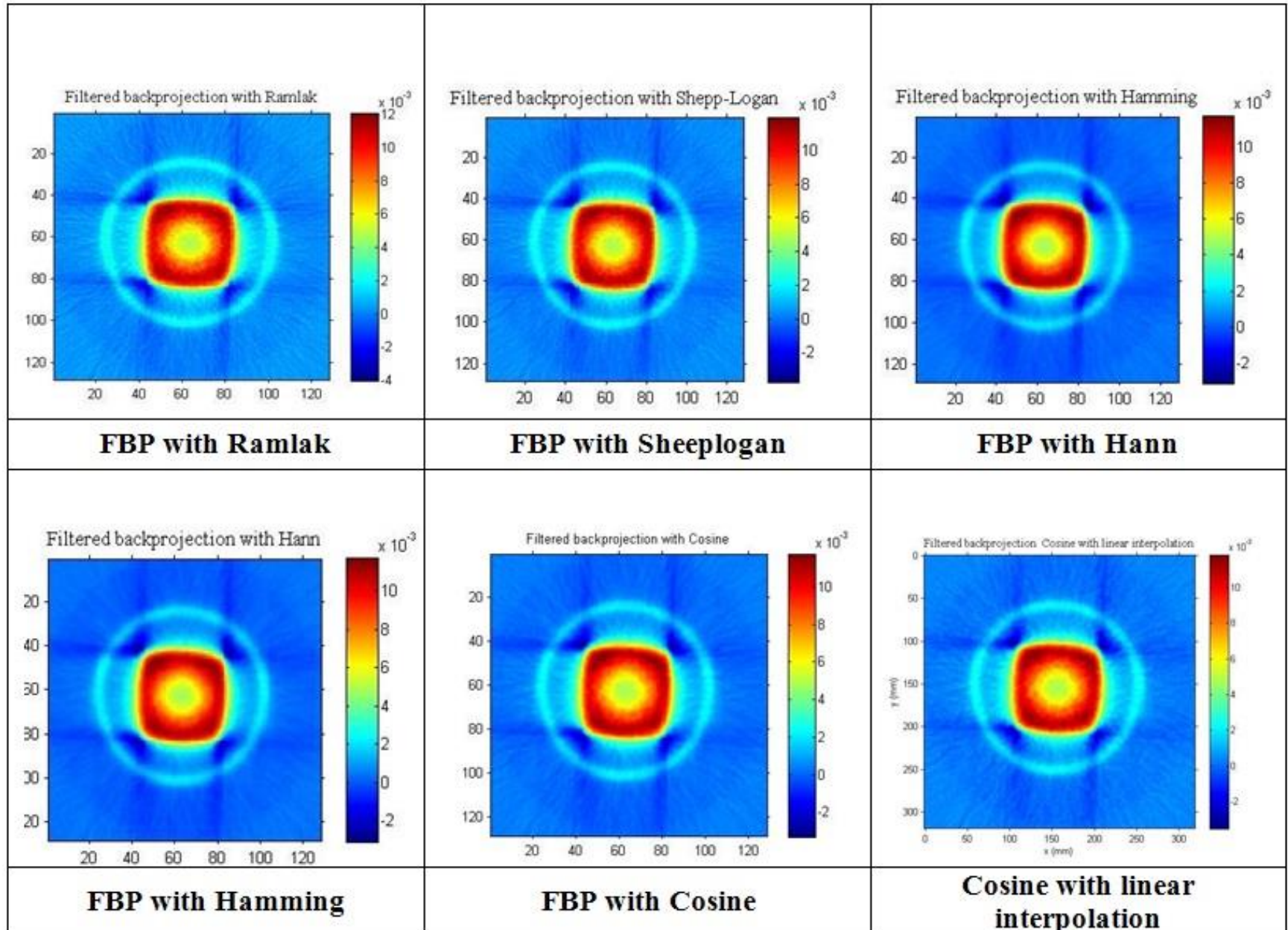


Real Optical Image

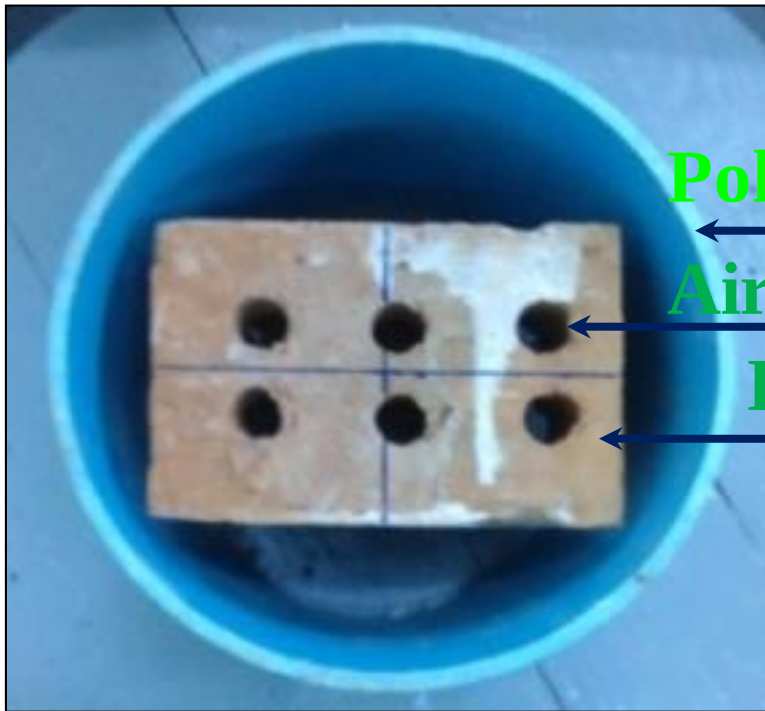


FBP cosine with linear interpolation

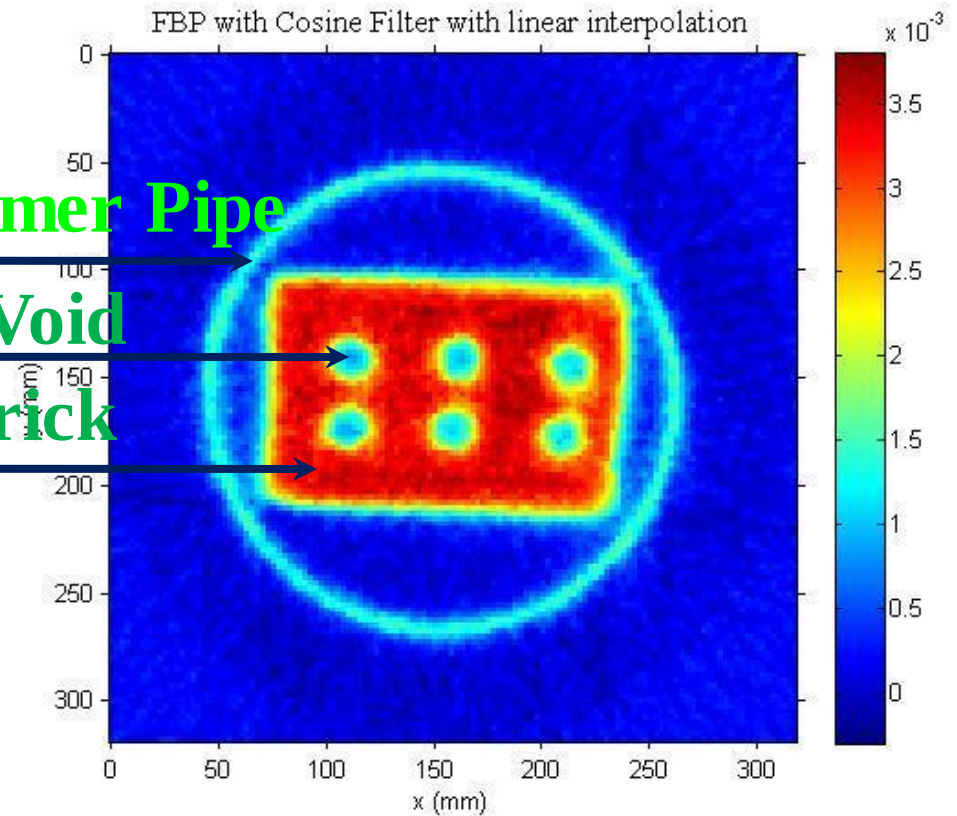
Image Reconstructions for Sample 2 by MATLAB



Comparison of CT image and Optical Camera Image



Real Optical Image



FBP Cosine filter with
Linear Interpolation

Image Reconstructions for Sample 3 by MATLAB

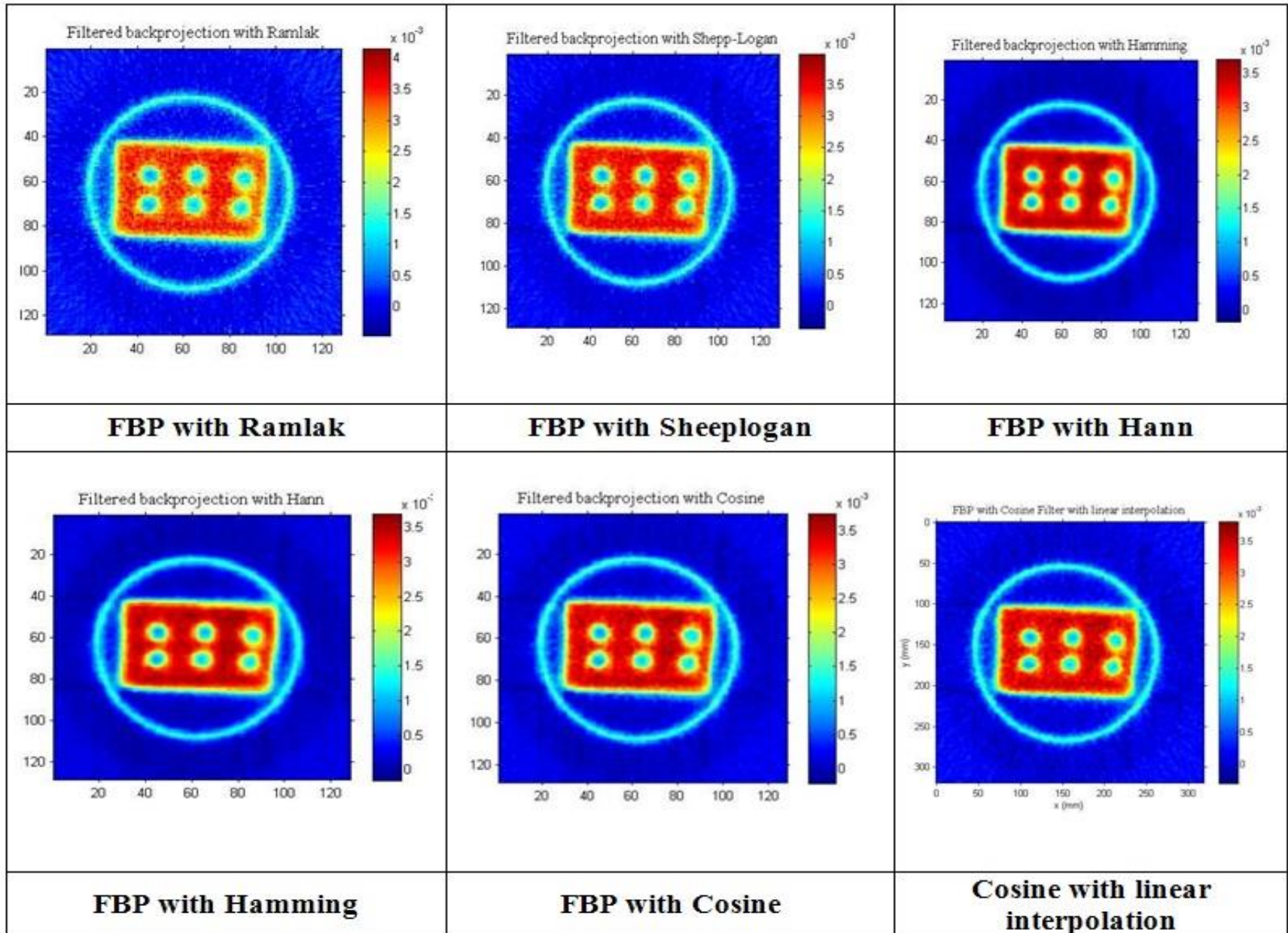
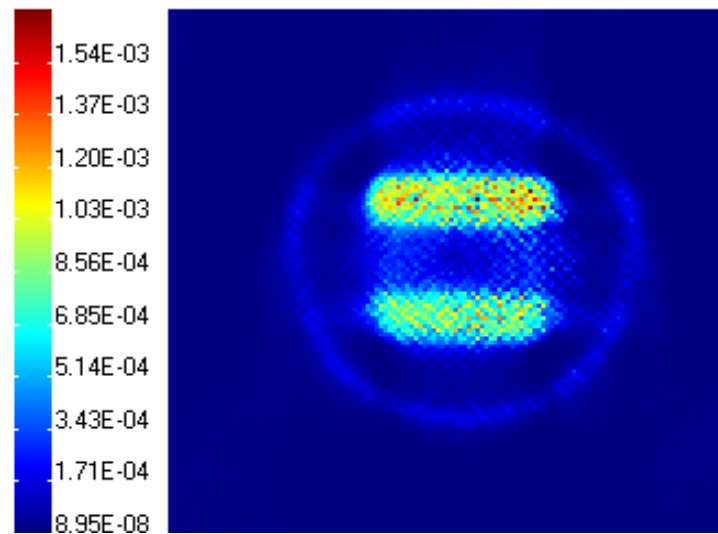
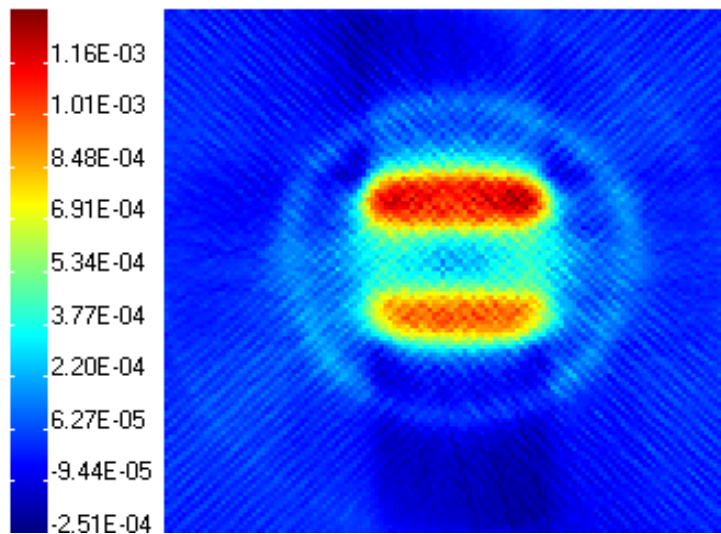
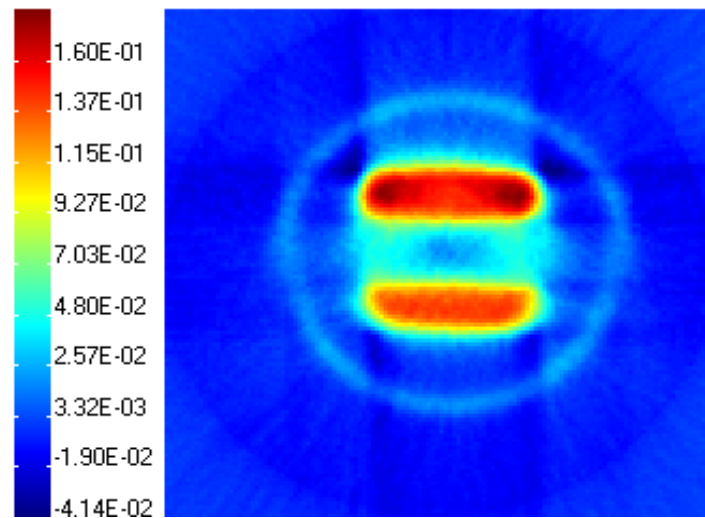
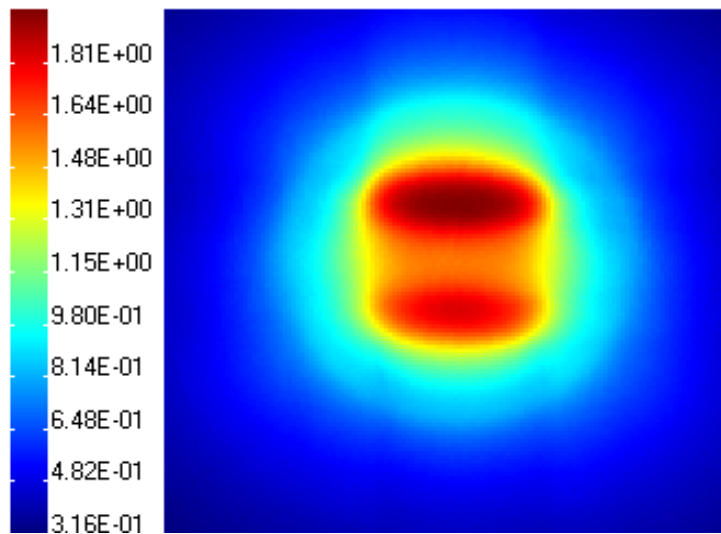


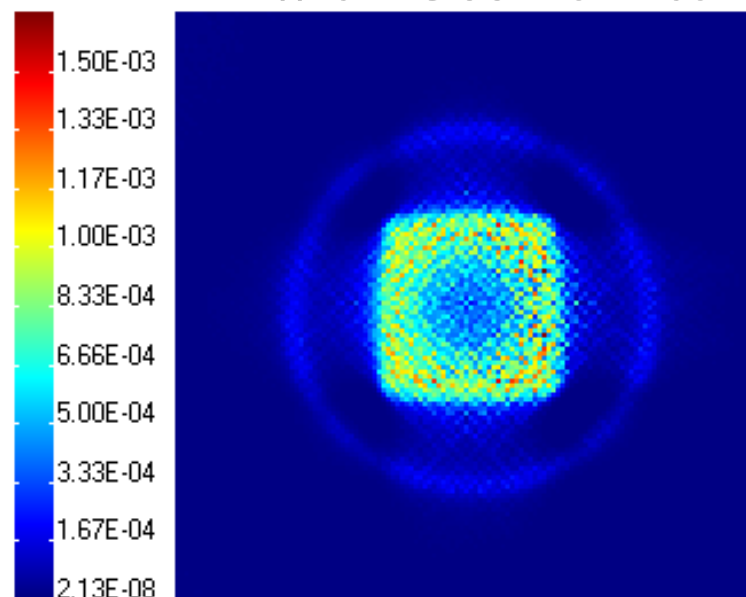
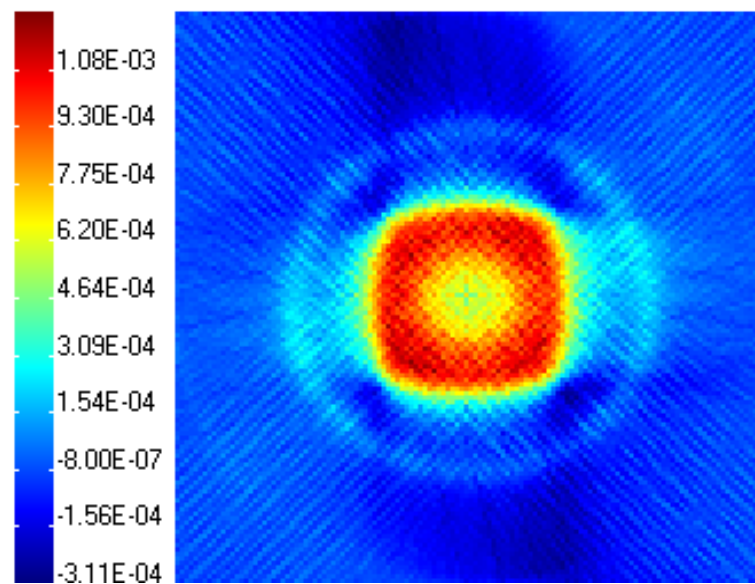
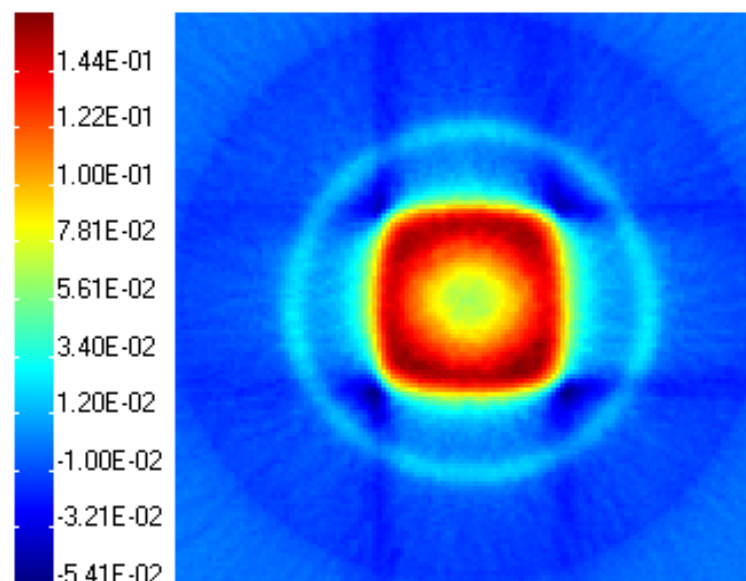
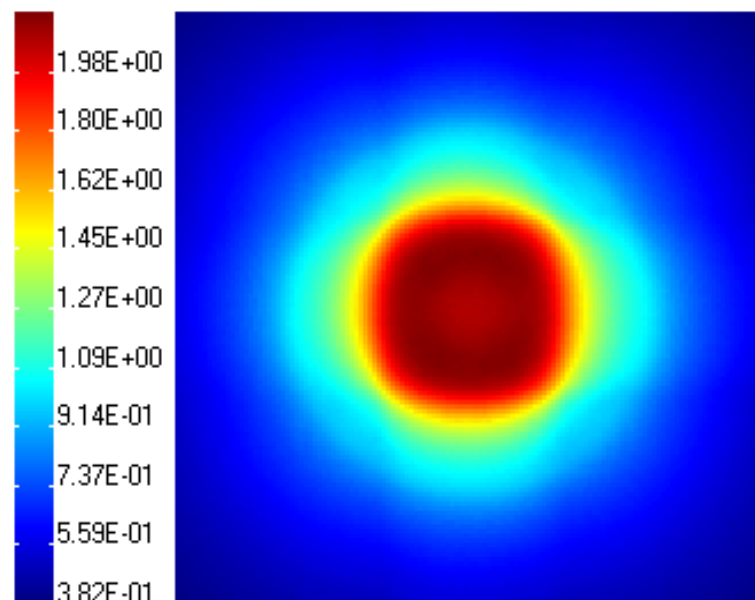
Image Reconstructions for Sample 1 By i- GORBIT



ART with 0.5 relaxation parameter

EM

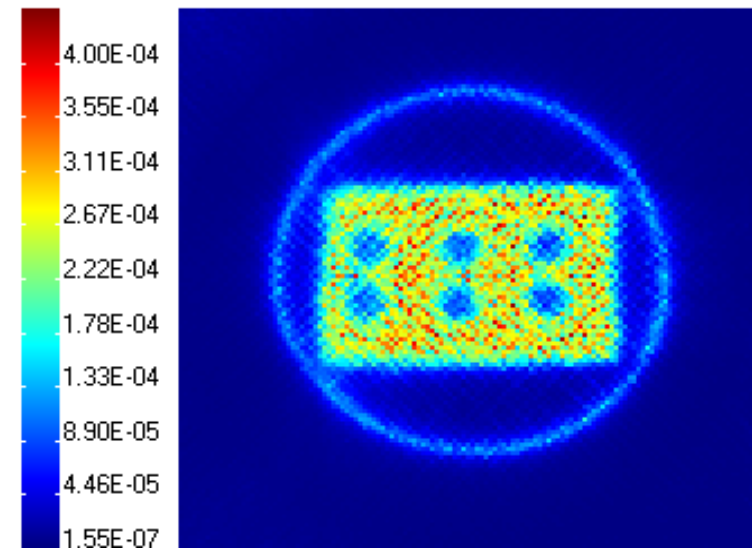
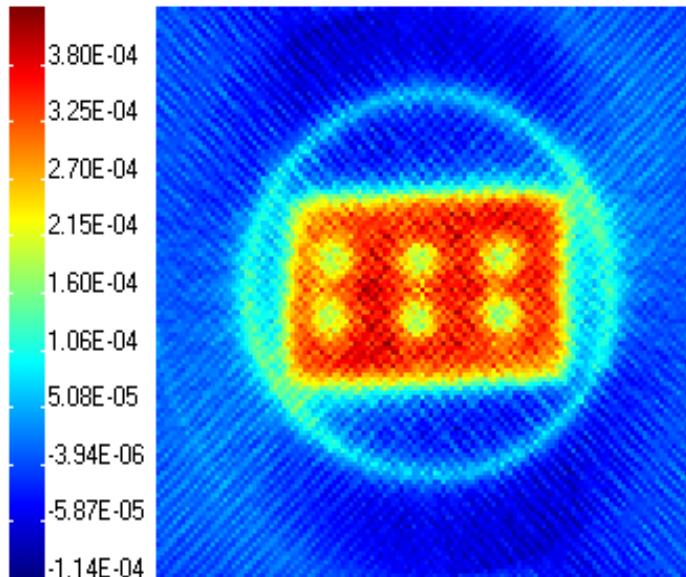
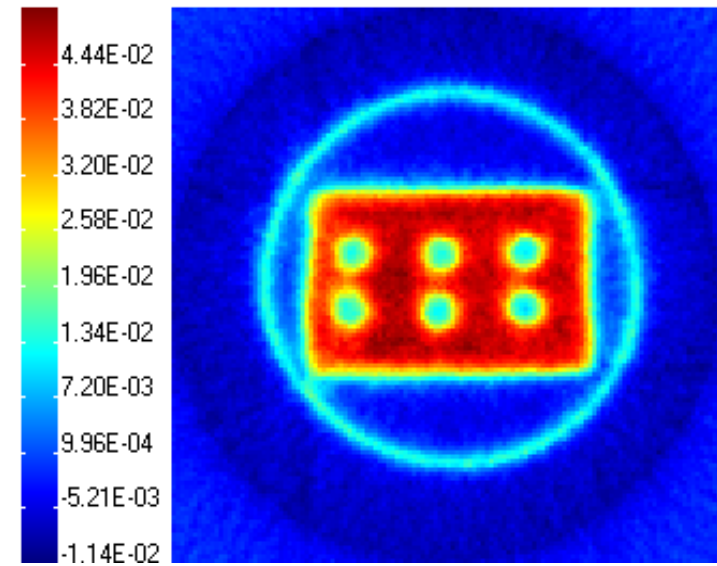
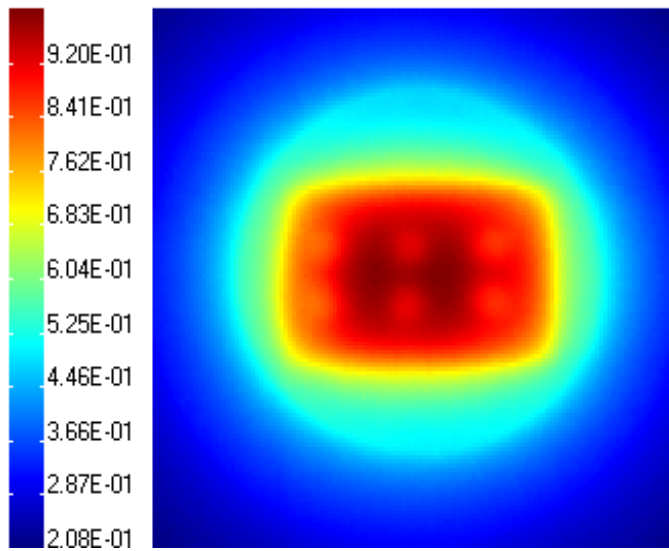
Image Reconstructions for Sample 2 By i- GORBIT



ART with 0.5 relaxation parameter

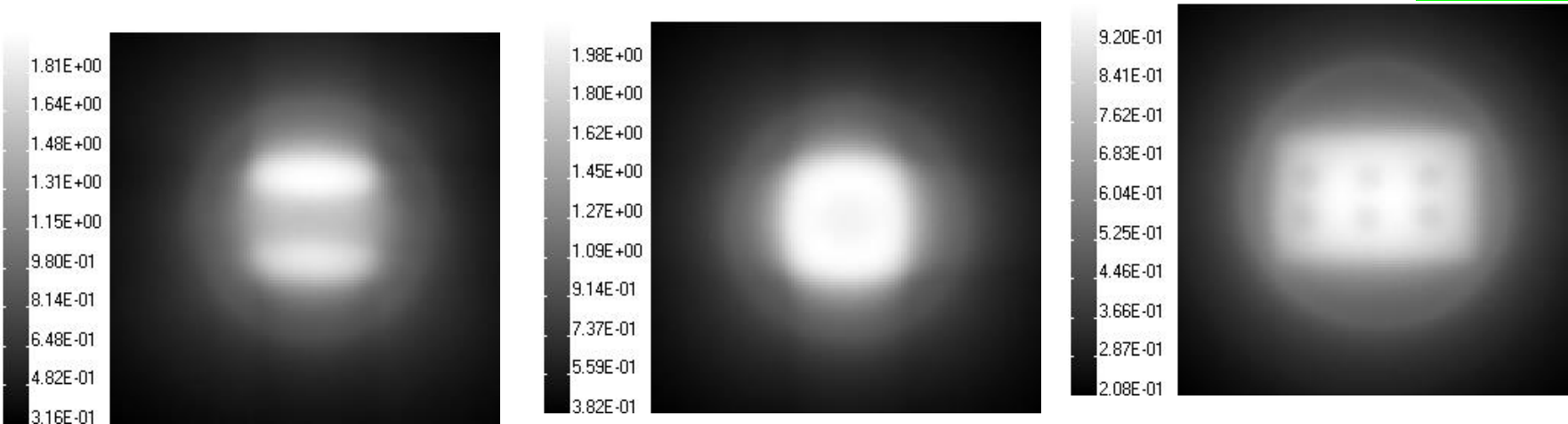
EM

Image Reconstructions for Sample 3 By i-GORBIT

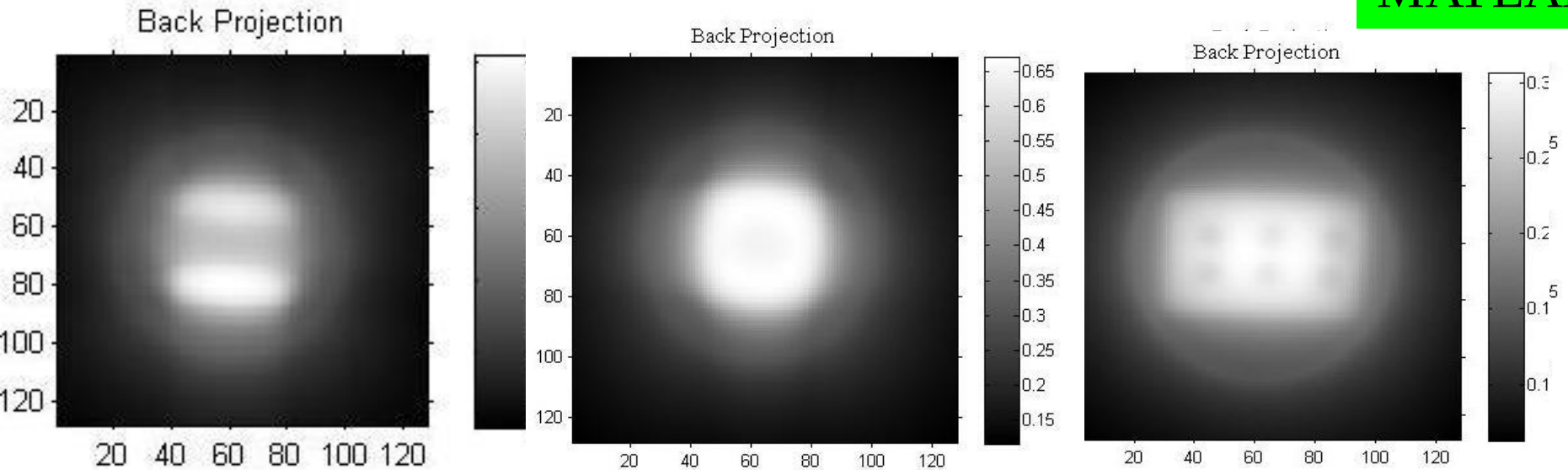


Comparison of Image Reconstructions by i-GORBIT and MATLAB with Back Projection method

i-GORBIT



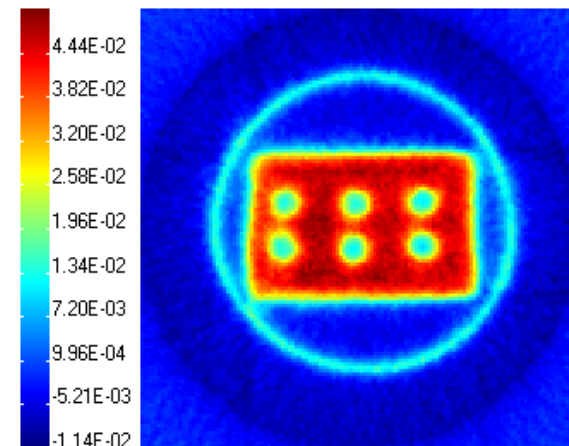
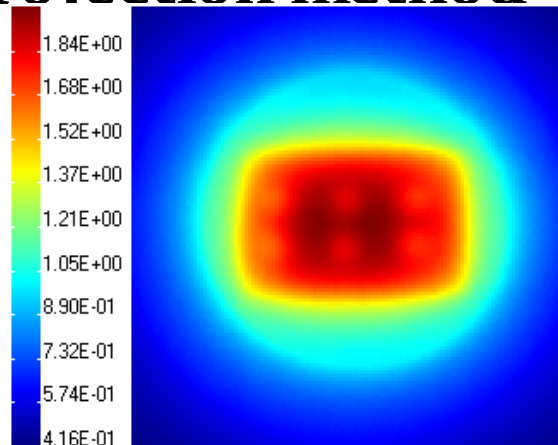
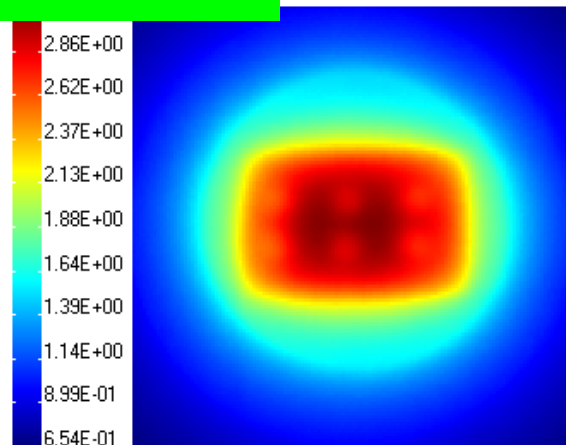
MATLAB



Comparison of Image Reconstructions by i-GORBIT and MATLAB with Filter Back

i-GORBIT

Projection method



Ram lak

Sheeplogan

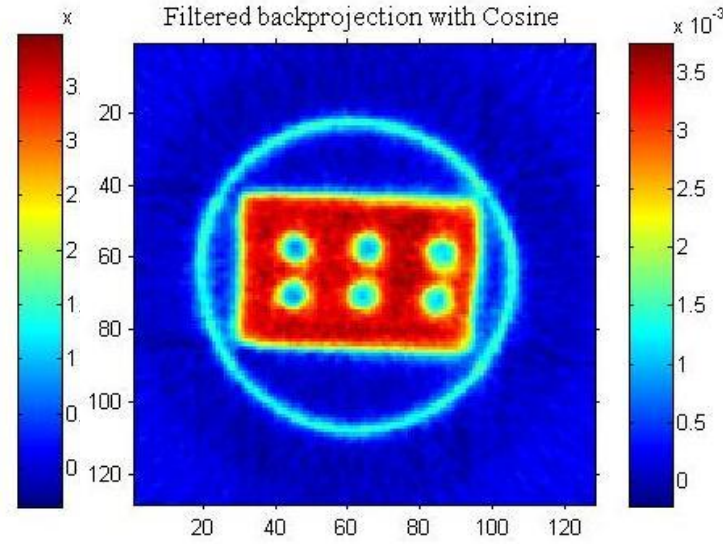
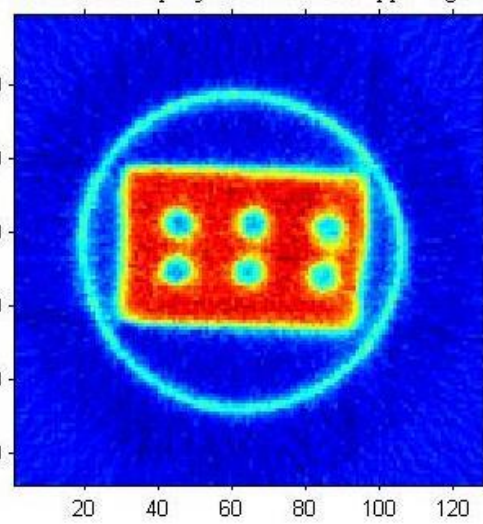
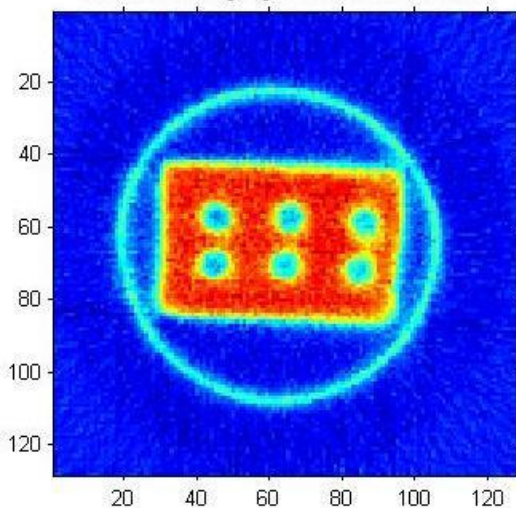
Cosine

MATLAB

Reconstruction with Ramlak

Filtered backprojection with Shepp-Logan

Filtered backprojection with Cosine



Ram lak

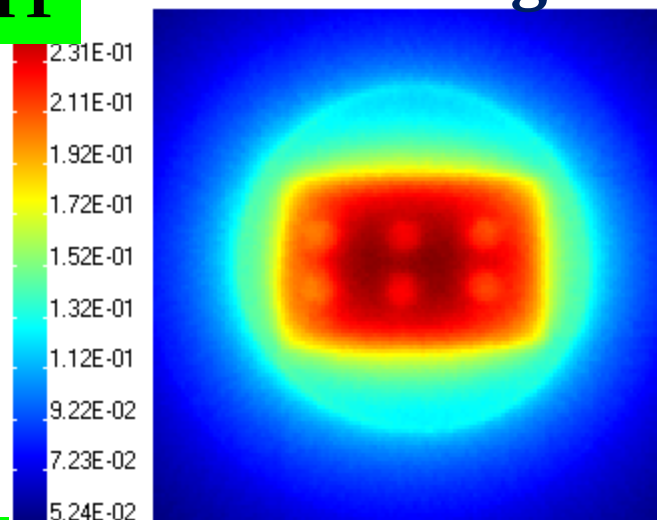
Sheeplogan

Cosine

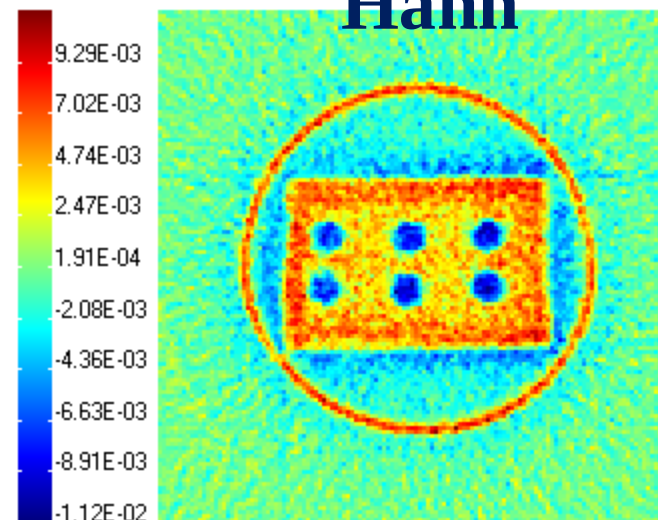
Comparison of Image Reconstructions by MATLAB and i-GORBIT with Filtered Back Projection method

i-GORBIT

Hamming

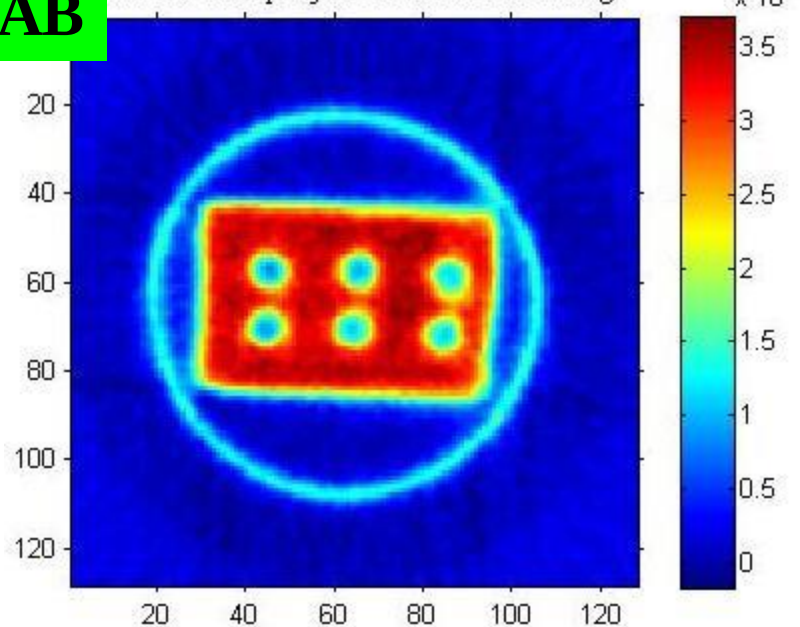


Hann

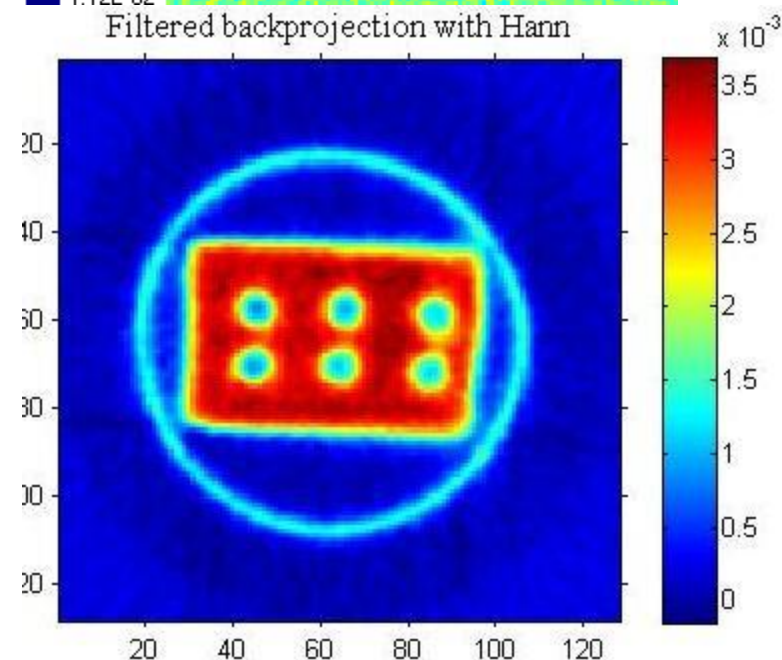


MATLAB

Filtered backprojection with Hamming



Filtered backprojection with Hann



Discussion of the Results

- The linear attenuation coefficients values (μ) as shown in color index increases approximately proportionally to the density of the sample materials.
- The pixels with highest intensity color values are directly related to the highest density region and lowest intensity color value area shows the lower density materials of pipe vessel.
- The image reconstruction by MATLAB improve the resolutions of images that distinguish clearly high and low density materials inside the pipe vessel.
- The physical parameters of the object can be determined by using with image tool and image can be analysed by special functions of image processing toolbox.

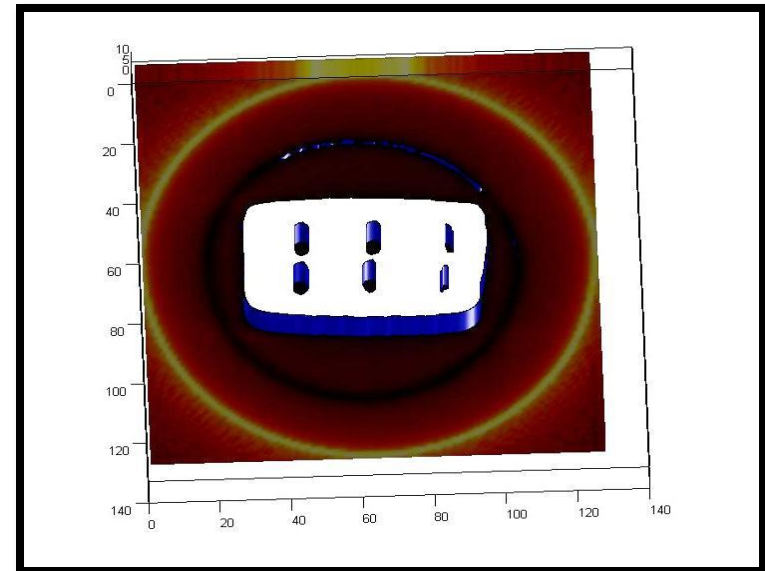
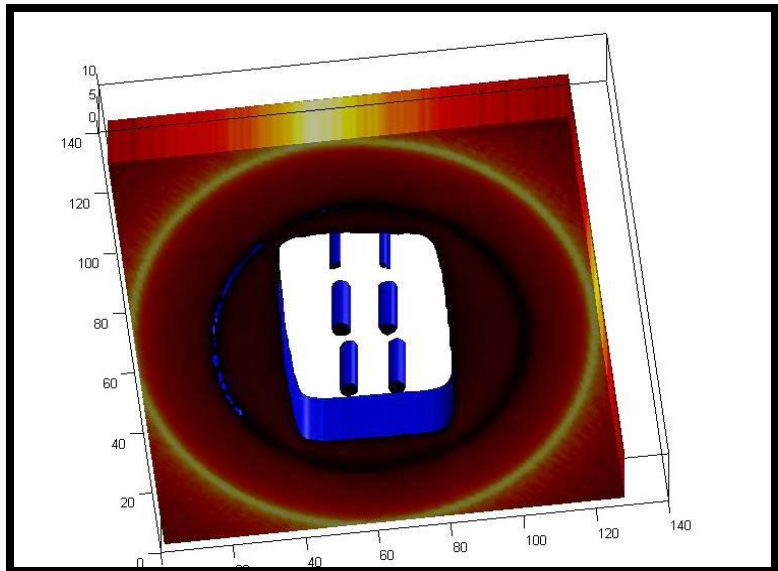
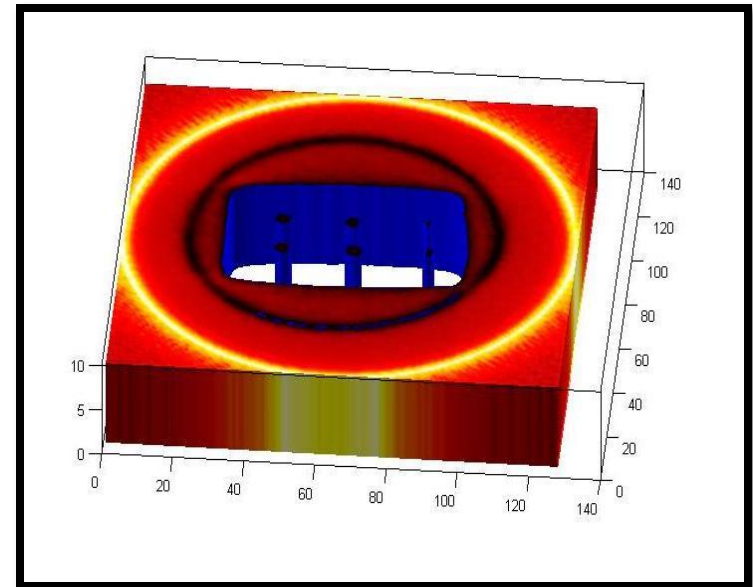
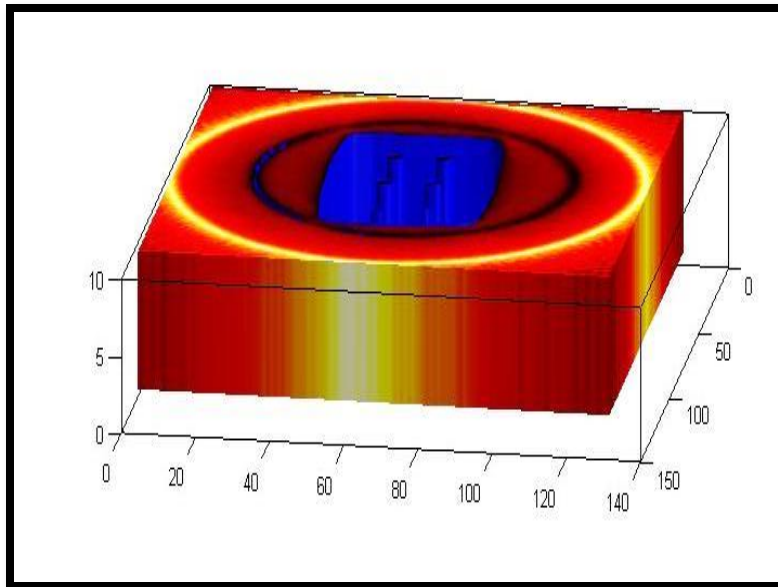
CONCLUSION

- The gamma ray tomography technique provided a clear graphical representation of the different density distributions that occurred in cross sections of the polymer pipe vessel column.
- Image reconstructions by MATLAB based on GUI package improved the resolution of images by FBP methods with different filter functions and interpolations.
- CT images obtained by MATLAB distinguish clearly high and low density materials which contained in a polymer pipe vessel.
- MATLAB based on GUI is used for both image reconstructions and measurement of gamma CT system.
- Future plan of research work will be dedicated to the development of the image reconstruction from 2D to 3D image by using MATLAB GUI package.

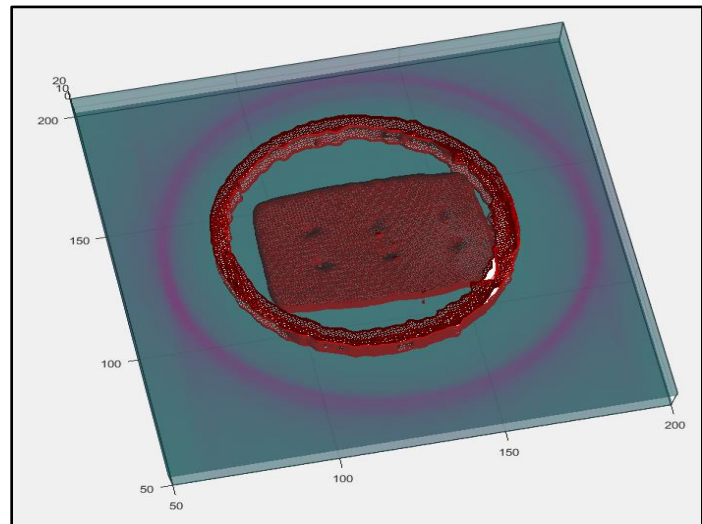
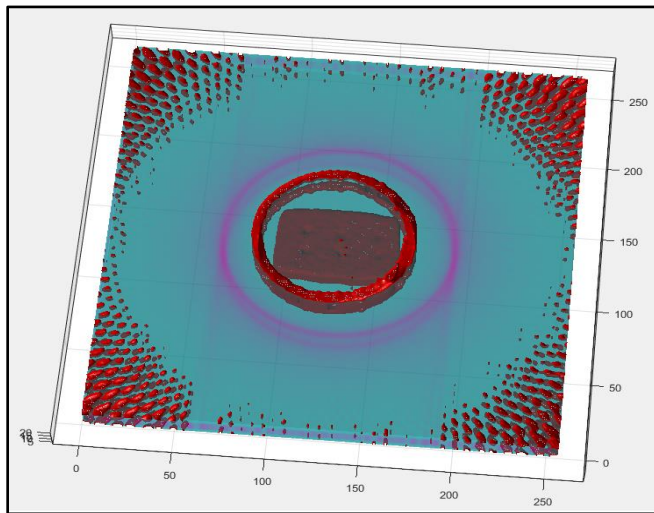
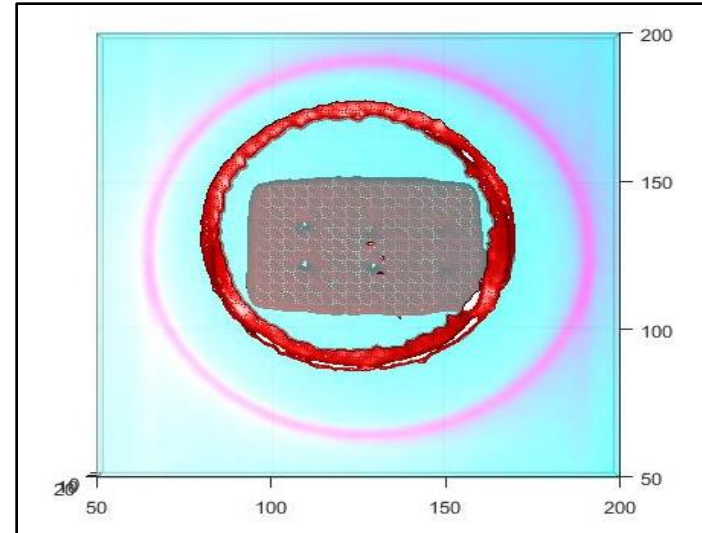
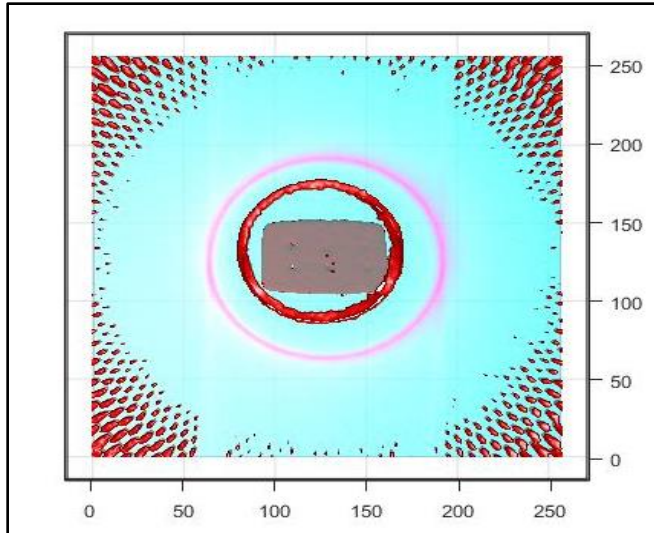


Thank You for Your Attention !

3D visualization for images obtained by program “GCTS” for sample -3(six holes brick)



3D volumetric visualization with different views and directions in output voxel range



3D volumetric visualization with different views and directions in ROI

