# 3D Electron Tomography in GPGPU

**G.Scavello[1],** P.L. Galindo[1], F.J. Maestre-Deusto[1], J. Pizarro[1], J. Hernandez[2], M. Herrera[2], S. Molina[2]

***[1]Dept. Lenguajes y Sist. Informáticos,***

***[2]Dept. Ciencia de los Materiales e I.M. y Q.I., Facultad de Ciencias***

***CASEM, Campus Río San Pedro, Universidad de Cádiz, Puerto Real-11510, Cádiz, Spain***

gioscavello@yahoo.it

3D Electron Tomography (ET) is concerned with the reconstruction of 3D volumes using a set 2D images obtained in the electron microscope. ET images suffer geometrical distortions introduced by the electrical and mechanical noise of real devices. Moreover, the effect of the scattering affect the quality of the reconstructed volume. The reconstruction process include the alignment of the series, that is the correction, of the geometrical distortions. These kind of correction can be based on image processing and features extracting techniques. Due to the huge dimension of the tomography data, parallel computing is a necessary tool in order to obtain good reconstruction in short times.

A tomography software prototype capable of performing a whole reconstruction process (alignment and volume recovering) of a full resolution volume (1024 x 1024 x 1024 voxels ) starting from experimental images obtained in STEM mode has been developed. The prototype implements a semi – automatic alignment method designed for needle – shaped specimens for which classical alignment methods doesn't work in an optimal way. The tomography series supplied to the system is filtered in order to put in evidence those regions of the images in which the object of study lies, thus allowing the selection of these region that can be used as markers to align the series. The reconstructed volume of a needle – shaped specimen containing quantum dots (QDs) is shown as a result of the reconstruction process.

In our method, we consider single axis mode, thus allowing a per – slice approach to reconstruct the volume. Indeed, the aligned series has been considered a stack of 2D tomographies having the same 2D weight matrix. Simultaneous Iterative Reconstruction Technique (SIRT) has been chosen as reconstruction method because of its robustness to noise. The software has been deployed using MATLAB R2009A for the alignment and Compute Unified Device Architecture (CUDA) for the reconstruction. CUDA is the General Purpose Graphic Processing Unit (GPGPU) framework developed by NVIDIA that supplies high – level programming environment to use GPGPU capabilities. The implementation of SIRT on GPGPU allows a drastic reduction of the time needed to process a slice. Therefore, the entire volume can be reconstructed at its full resolution in less than 2.5 hours.

## References

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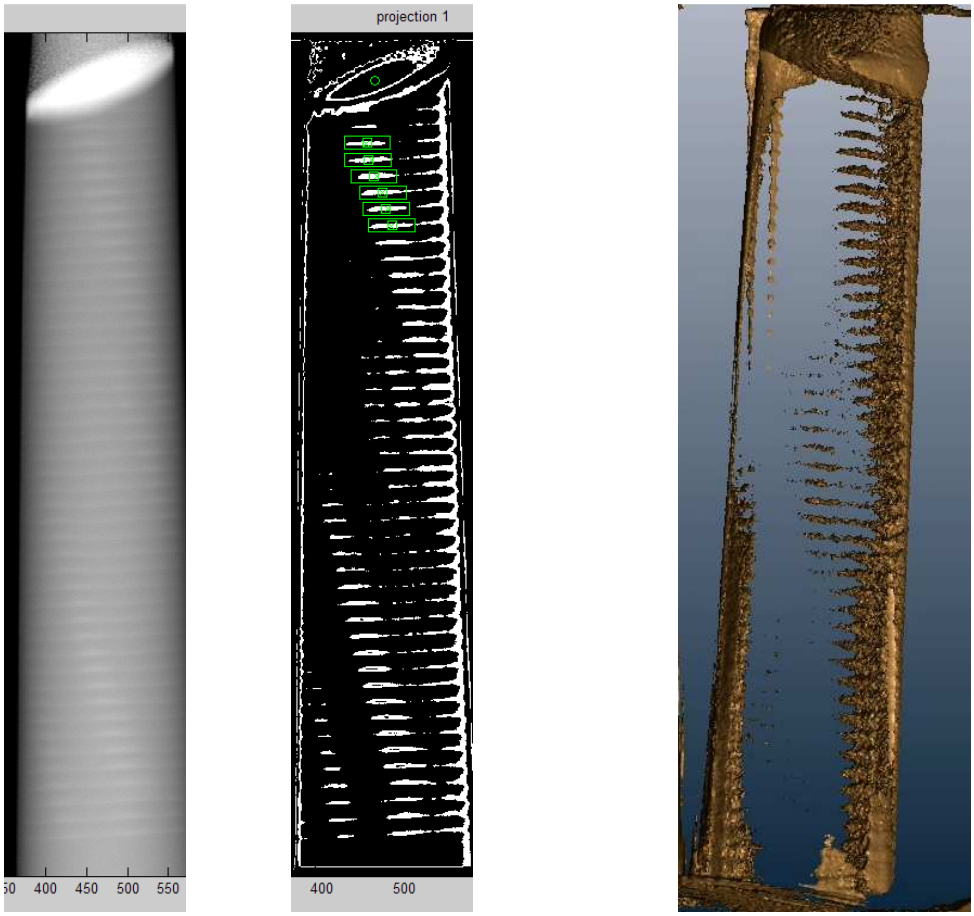
## Figures




(a) (b) (c)

*Figure 1: (a) Needle – shaped specimen, (b) segmentation and markers selection, (c) reconstructed volume.*