

Project technical report 1

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1 Previous works

See literature file.

2 Data Characteristics

Parameters defining the projection file format

- number of projections: 2000
- image dimensions: 2048×2048
- vertical and horizontal pixel size: 0.119865 microns

Parameters defining experiment

- angle between projections: 0.09 degree
- Vertical rotation axis position: 1024.006591 pixel
- energy: 33.6

Parameters defining reconstruction

- start voxel: (1,1,1) end voxel (2048, 2048, 256) of reconstruction volume
- Optic used: 0.119865
- Pad method: reflect
- number of planes: 4
- number of angles: 645
- Rotation axis
- ...

3 Reading The Data

3.1 Projections

show 4 different projection out of 100

3.2 Sinogram

From the projections by taking one row in each projection we were able to reconstruct a sinogram as in Figure 1

Individual images are displayed in the index section 6.1

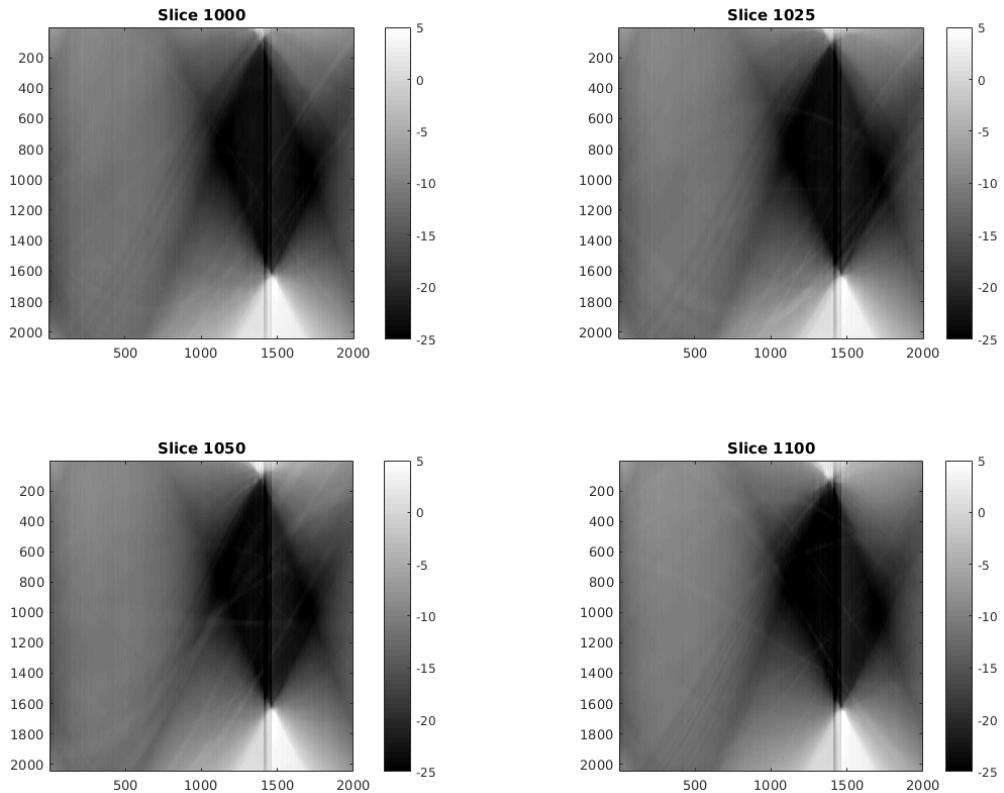


Figure 1: Sinogram of slice 1000, 1025, 1050, 1100

4 FBP Reconstruction

In this section we try multiple FBP parameters in order to understand their influence on the reconstruction. We took as input the sinograms displayed previously.

4.1 Reconstruction without zero-padding default filter

We first performed the MatLab default iradon function for the reconstruction without trying to correct the center of rotation of the object.

The resulting images (Figure 2) are subjected to artefacts particularly on corner details.

Full images refer to Index 6.2

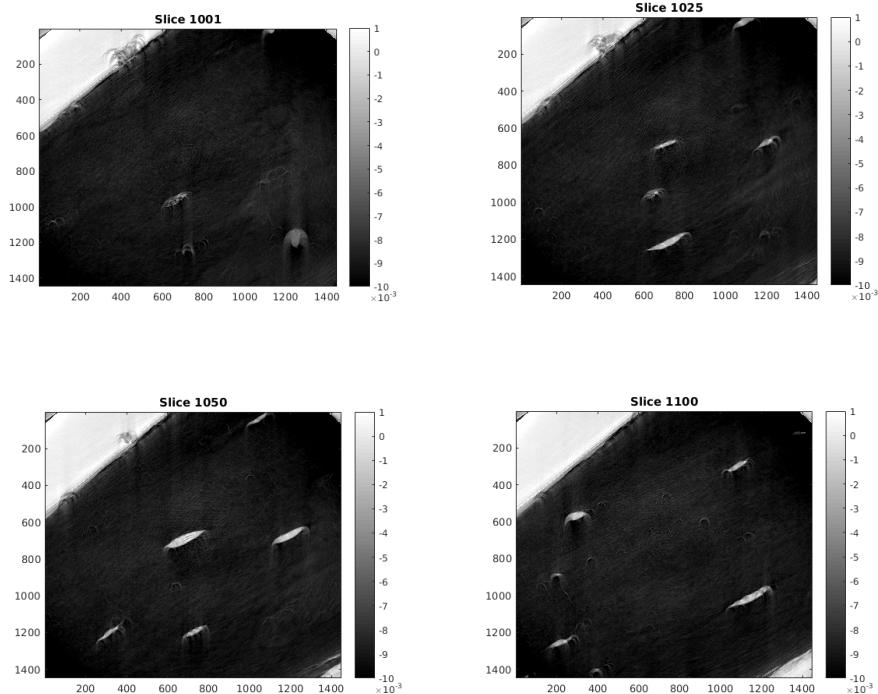


Figure 2: FBP without zero-padding

4.2 Reconstruction with zero-padding

4.3 Zero-padding on 4 slices

In order to get better images we had to correct the center of rotation. To do so we used the actual rotation axis od 1043.5 end defined a new output size of $\text{round}(2 * \text{rotAxis})$. The resulting new sized projections were used to build the new images. The results were non blurry images as is Figure 3.

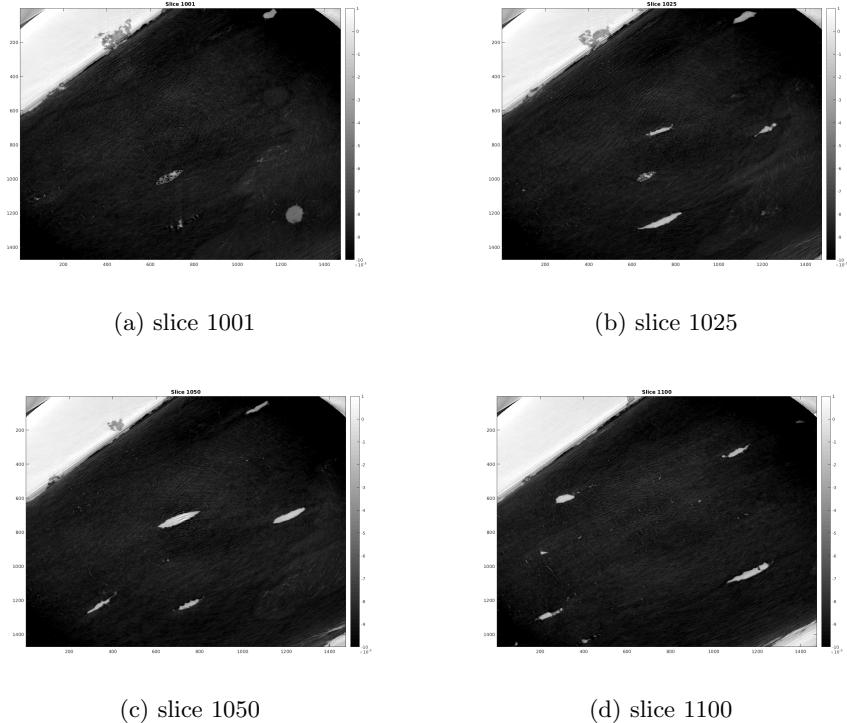


Figure 3: Back-projection with zero-padding with 2000 projections

4.3.1 Comparing frequency scaling one slice

In this section the fastest filter was used (Ram-Lak) and multiple frequencies were displayed. Low frequencies were affected by a strong ring artifact effect as shown Figure 4. Frequencies from 0.7 to 1 were less affected by ring artifact. A frequency of 0.7 was use for the next experiments.

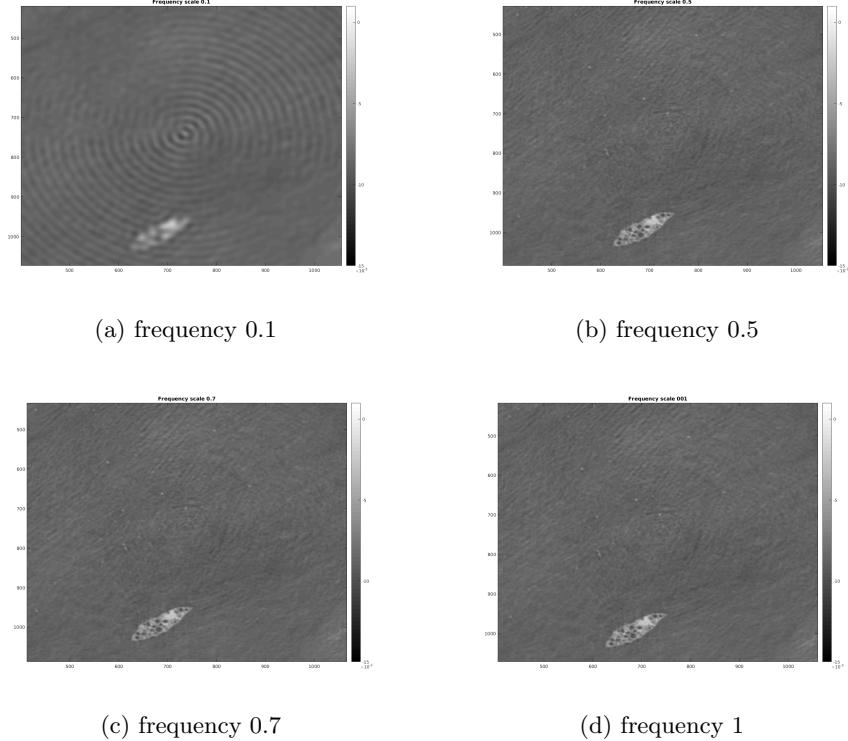


Figure 4: Multiple frequencies for FBP with 2000 projections Slice 1001

4.3.2 Using MatLab implemented filters

Now that we have a correct reconstruction we reconstructed using different filters available on MatLab. As expected FBP without filtering results in a very blurry image with no details Figure 5a. Figures 5b, 5c, 5d, 5e and 5f Represent a zoomed reconstruction using different filters. We observed similar results. Only computation time was significantly different between each Filter.

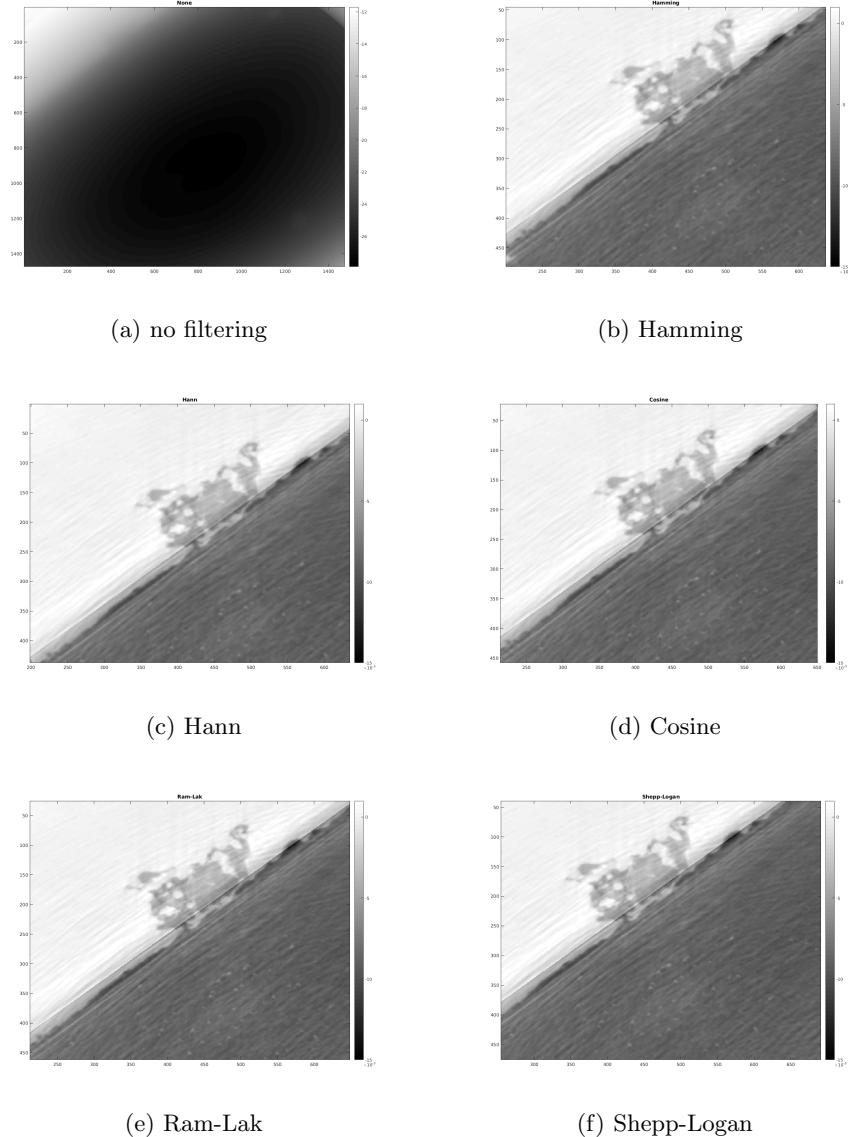


Figure 5: Multiple filters for FBP with 2000 projections Slice 1001

4.3.3 Comparing matlab implemented interpolation methods

All of the interpolation methods proposed by irandon MatLab function were used and compared. Once again all reconstructions resulted in the same results. Only the computation time changed.

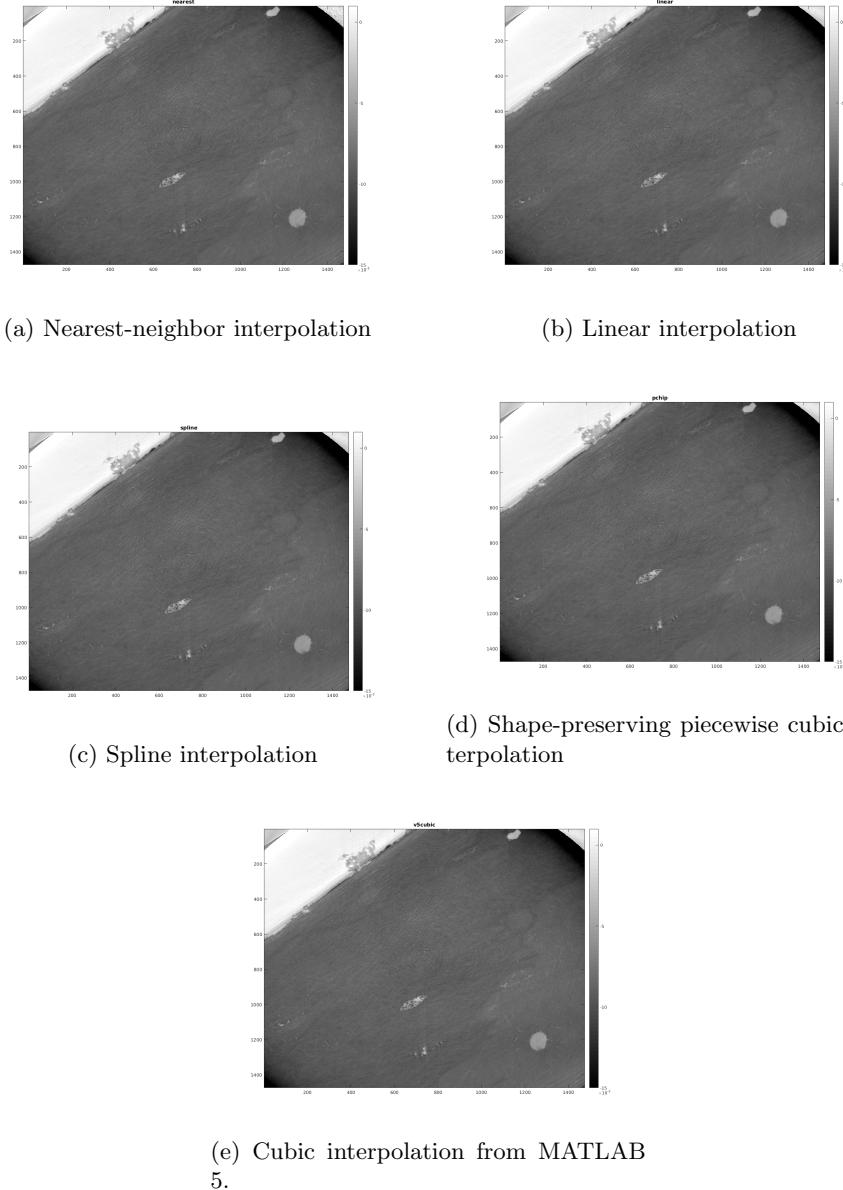


Figure 6: Multiple interpolation methods for FBP with 2000 projections Slice 1001

4.4 Reduced number of projections

A decreasing number of projections were used to perform FBP. Results were displayed in Figure 7 and zoomed in Figure 7. From this figure we can notice the increase of artifact and loss of details with lower number of projections. This motivates the study of iterative reconstruction.

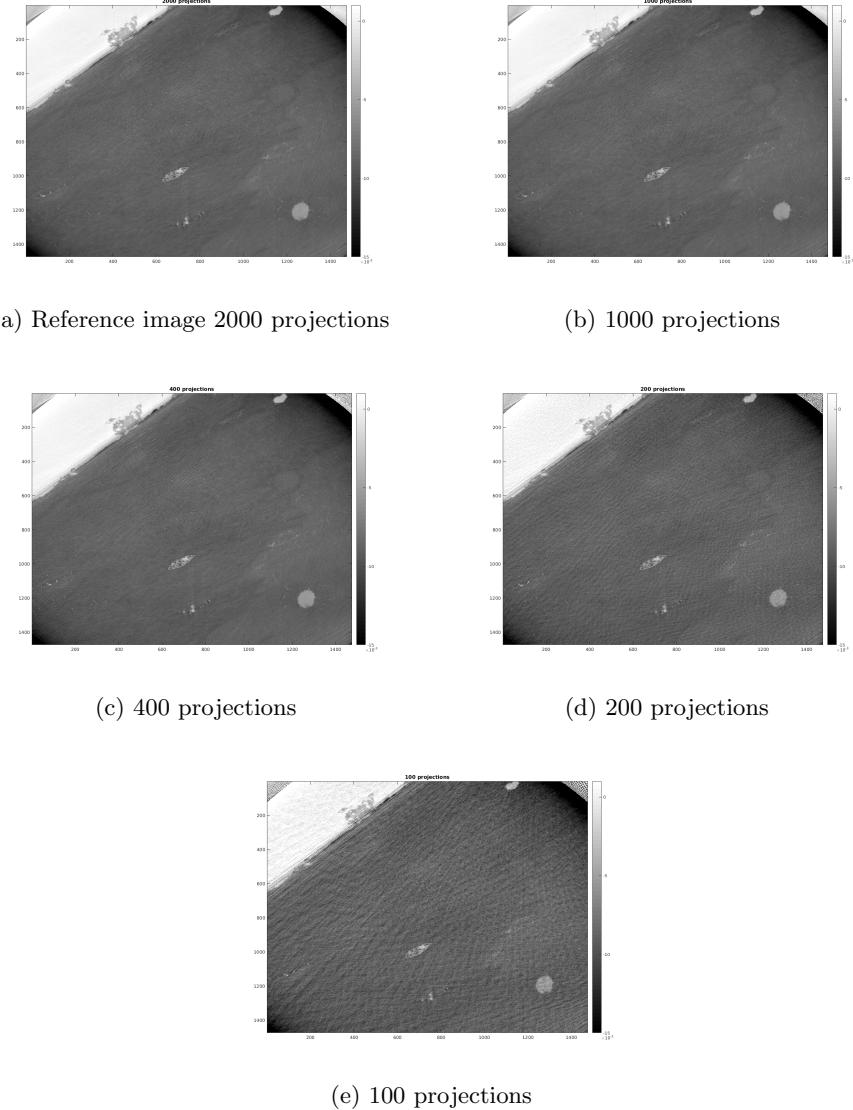


Figure 7: Multiple number of projection for FBP on Slice 1001

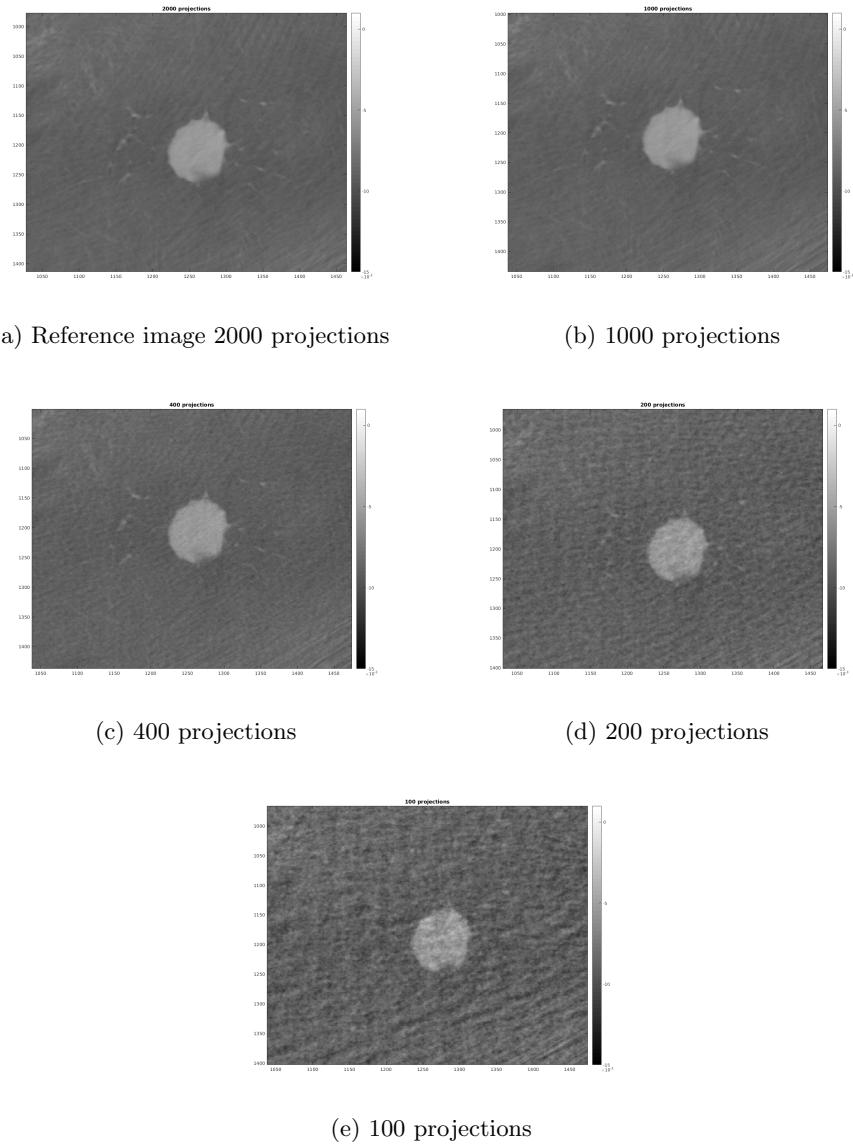


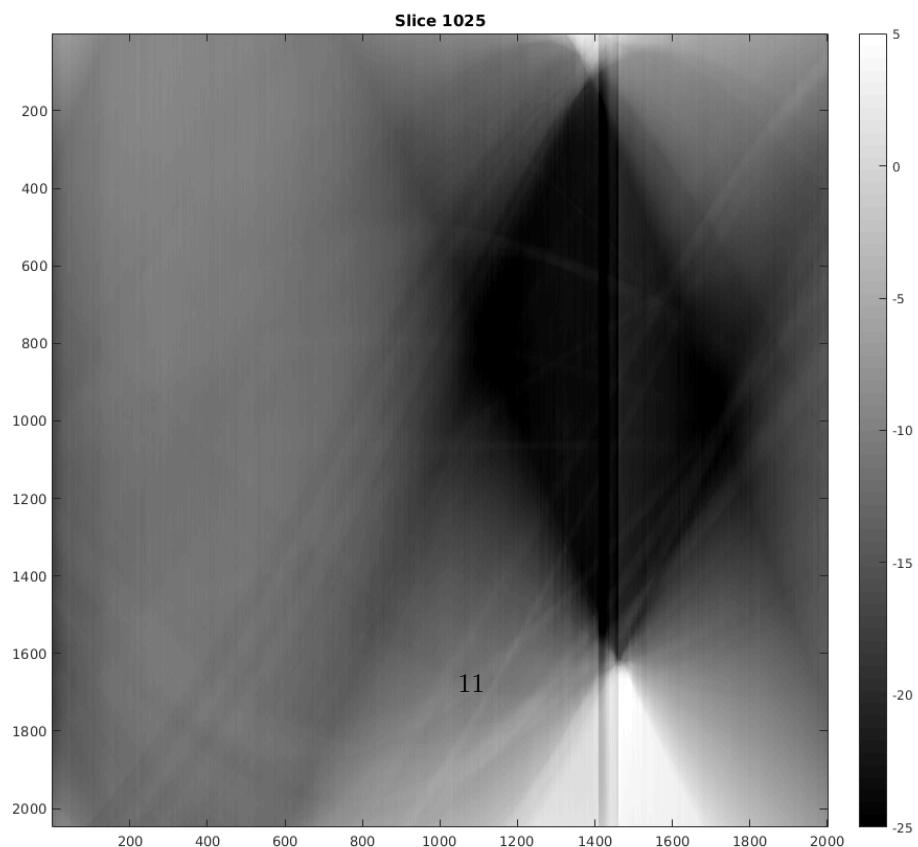
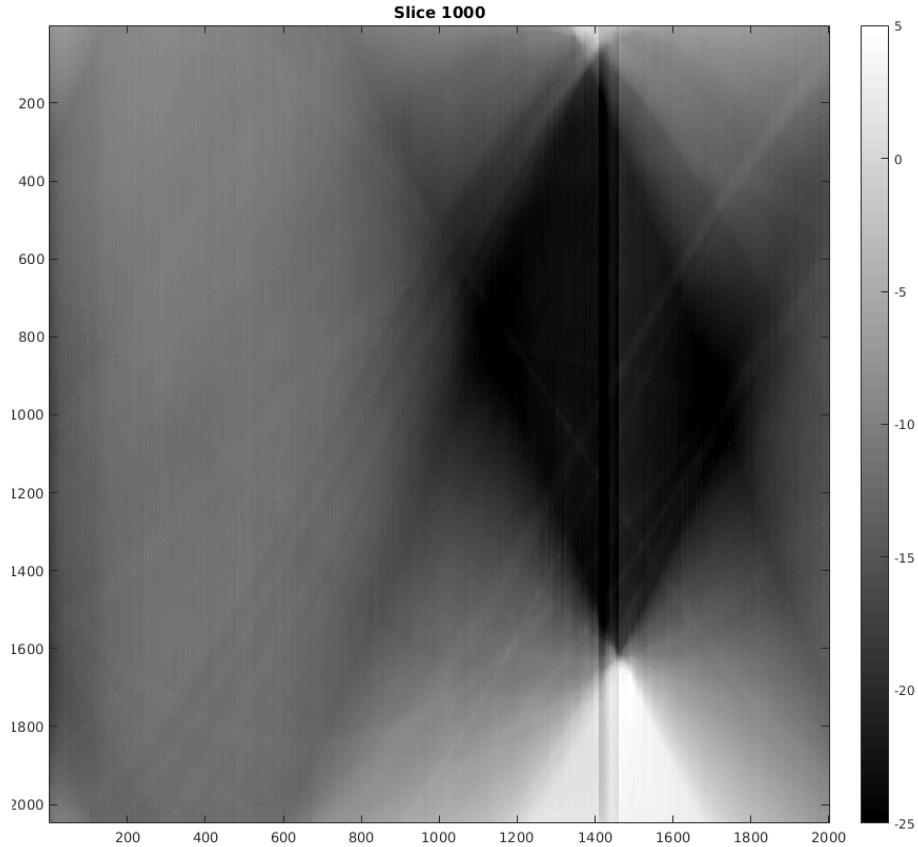
Figure 8: Multiple number of projection for FBP on Slice 1001 zoomed

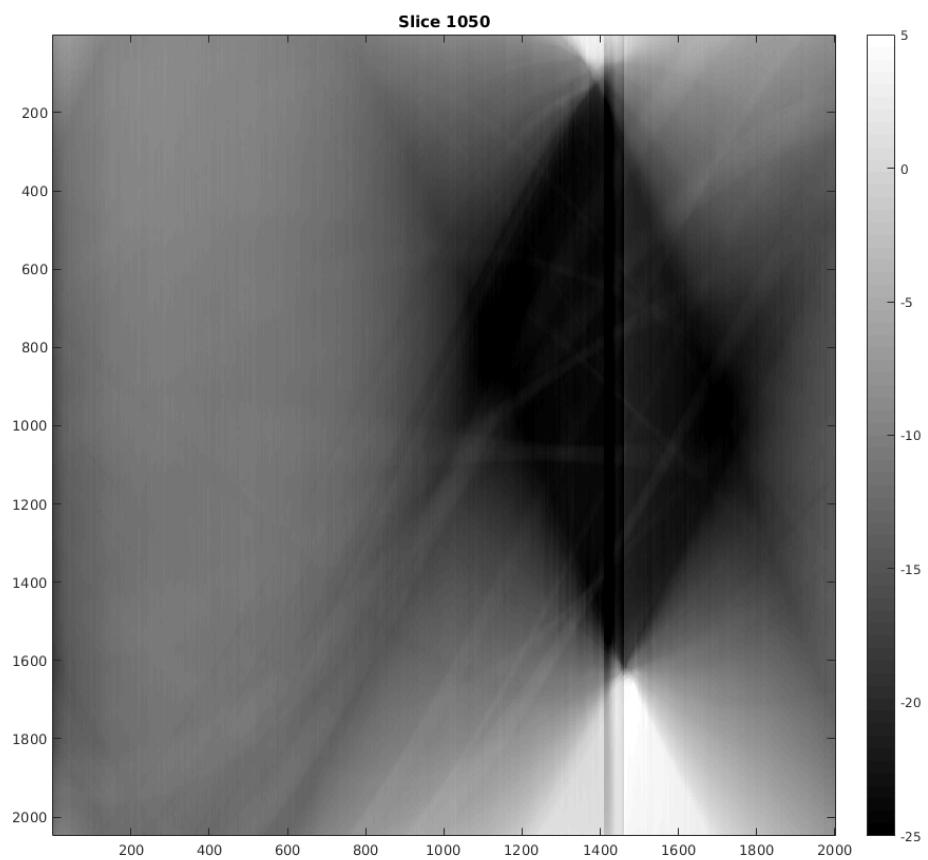
5 iterative reconstruction

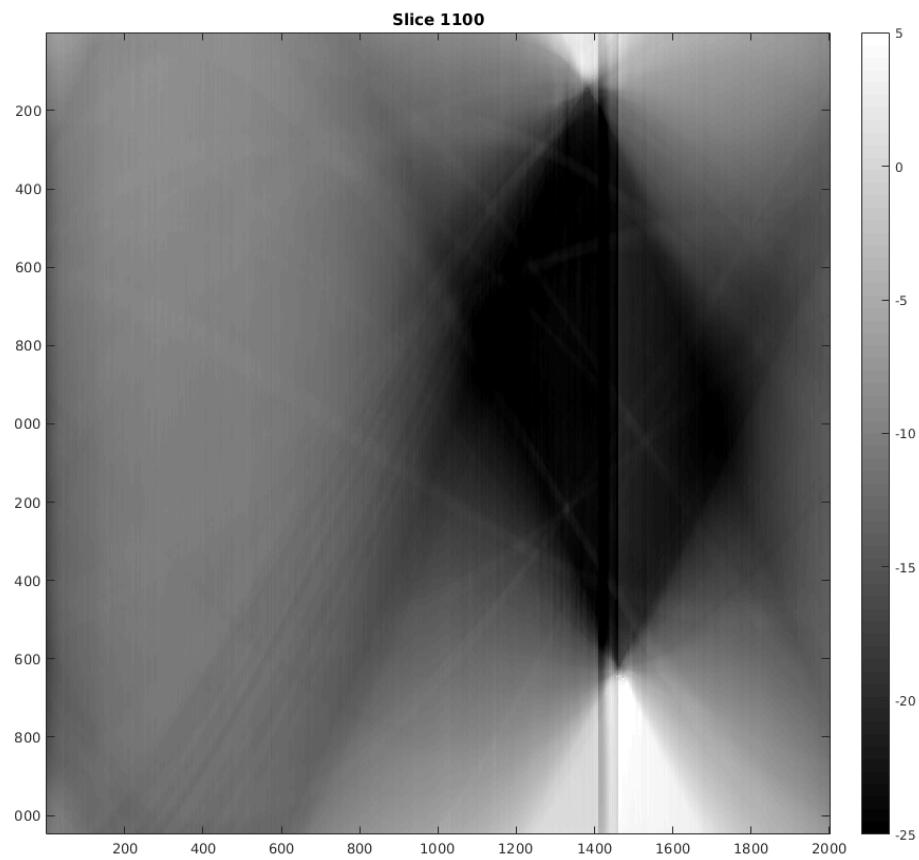
currently working on Split-Bregman method.

6 Index

6.1 Sinogram







6.2 Without zero padding

