DTU Training School: Scientific Computing for X-Ray CT

ASTRA Exercises – Part 3

11. Getting started with 3D
Run and look at the 3D samples `s005_3d_geometry`, `s006_3d_data` and `s007_3d_reconstruction`.

12. Cone beam reconstruction
Run the script `reconstructApple` (from `ExampleDatasets.zip`). This performs a reconstruction on a cone beam data set of an apple. It already contains the correct cone beam parameters.
Experiment with the types of artifacts you get when setting these parameters wrong. In particular: a wrong detector pixel size, a wrong source-origin distance, a wrong angular range, the wrong rotation direction, if the projection images are transposed
(`projections = permute(projections, [3 2 1]);`).

13. Helical reconstruction
Perform a reconstruction of the helical dataset (from `Exercises.zip`). The necessary geometric parameters are in the `helical.log` file. The `helical.mat` also contains a regular circular cone beam data set to optionally try first.
Helical acquisitions are common in the medical world: the patient is moved through the scanner while the scanner rotates around the patient.
NB: `helical.log` accidentally omits the information that the detector pixel size is 1mm.

14. High resolution phantom
The pixel size of the detector and the object are independent in ASTRA. Use this to create a low resolution sinogram from a high resolution phantom image, with the 2D CPU `strip` projector. This can be used to create more realistic simulation data by avoiding the "inverse crime" of assuming your phantom can be represented perfectly on your pixel grid, and using the same system matrix for producing simulation data and the reconstruction.
For example: use a 512x512 phantom to create a 64x64 sinogram, and reconstruct this on a 64x64 grid. How does the reconstruction compare to starting from a 64x64 phantom?

15. Misalignment
Open the fan beam `misalignment` data set (from `Exercises.zip`). Every projection in this data set has been shifted by a random offset. Try to (somehow) fix this misalignment.