Flexible 3D and 4D X-ray tomography with the ASTRA Toolbox

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Computed Tomography workflow
What is the ASTRA Toolbox?

- All Scales
- Tomographic Reconstruction
- Antwerp

- Powerful
- Easy to use
- Broad support
- Flexible

• Developed at Universiteit Antwerpen and CWI
• Open source
Basic usage

**projection data**

**volume data**

### 2D geometries:
- Parallel Beam
- Fan Beam
- Arbitrary system matrix

### 3D geometries:
- Parallel Beam
- Cone Beam

### Algorithms:

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```plaintext
sinogram_data = loadSino();
vol_geom = astra_create_vol_geom(729, 729, 10);
proj_geom = astra_create_proj_geom('cone', 5.8, 5.8, 658, 656, linspace2(0, 2*pi, ... 700),1825,8800);
sinogram_id = astra_mex_data3d('create', '-sino', proj_geom, sinogram_data);
rec_id = astra_mex_data3d('create', '-vol', vol_geom);
configuration = astra_struct('FBP3D_CUDA');
configuration.ProjectionDataId = sinogram_id;
configuration.ReconstructionDataId = rec_id;
alg_id = astra_mex_algorithm('create', configuration);
astra_mex_algorithm('run', alg_id);
rec = astra_mex_data2d('get', rec_id);
```
ASTRA Toolbox - Distributed

GPU 1  Back Projection 1
GPU 2  Back Projection 2
GPU 3  Back Projection 3

Only with circular trajectory - yet.

(7 GPUs per PC)

Applications
Circular cone beam CT

Missing wedge - Electron tomography

before correction
after correction

Conveyor belt geometry

Adaptive zooming

Reconstruction with Circular Trajectory

Reconstruction with Variable Distance

Tomosynthesis, laminography

J. Cant, G.Behiels, J. Sijbers "Continuous Digital Laminography",
6th Conference on Industrial Computed Tomography, Wels, Austria, 2016
4D CT – Foam compression

V. Van Nieuwenhove et al., “Registration Based SIRT: A reconstruction algorithm for 4D CT”, 7th Conference on Industrial Computed Tomography, Leuven, Belgium, 2017
4D neutron tomography – fluid dynamics

Thank you

http://www.astra-toolbox.com
  • Download (incl. samples)
  • Documentation
  • Source code

ASTRA toolbox training on April 5-7, 2017 (Antwerp): http://extrema.uaantwerpen.be

W. Van Aarle et al. “Fast and Flexible X-ray Tomography using the ASTRA Toolbox”, Optics Express, 24(22), 2016