Implementation of Block Detector Geometry in STIR

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Block vs Cylindrical

- Scanner model
- Projection data bins
- System matrix

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ϕ
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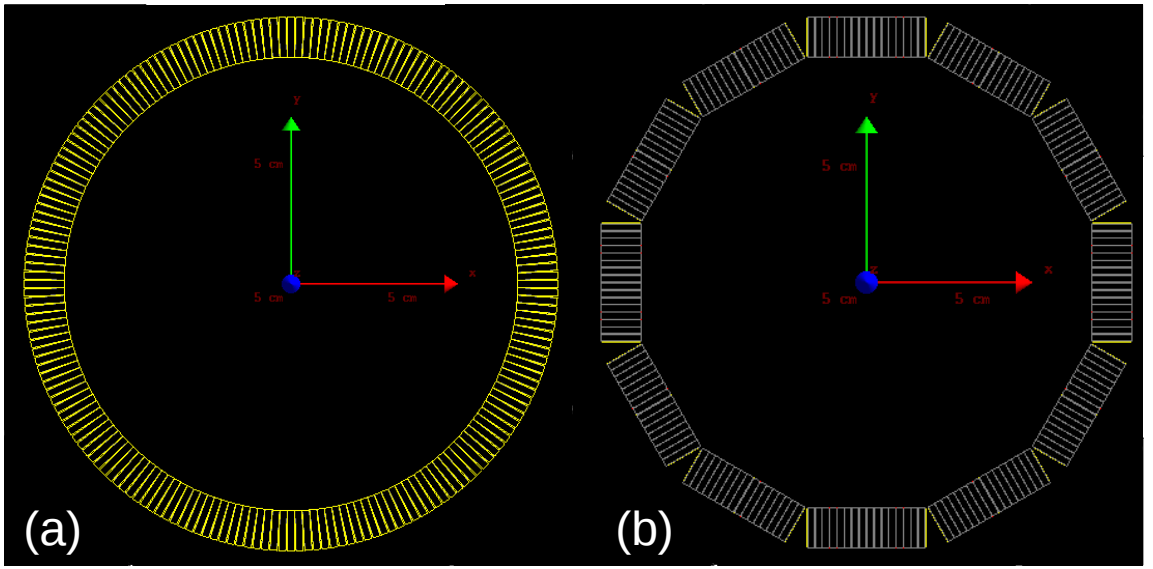
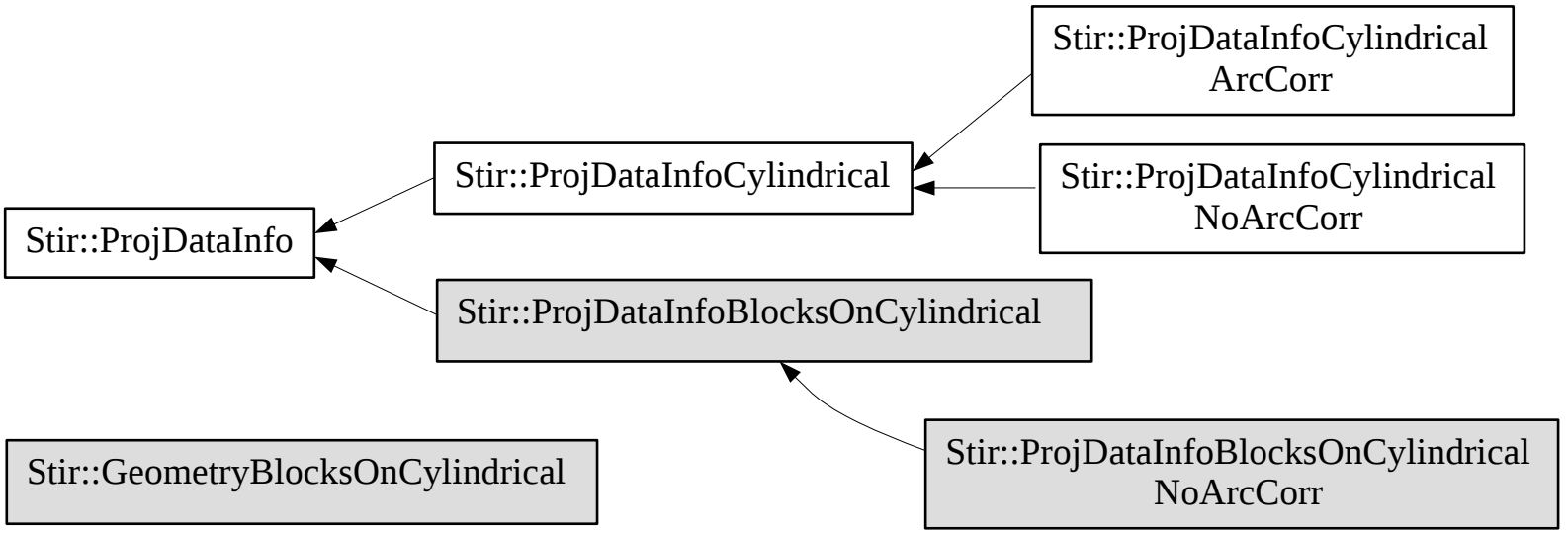
s

- Symmetries to speed up the calculation



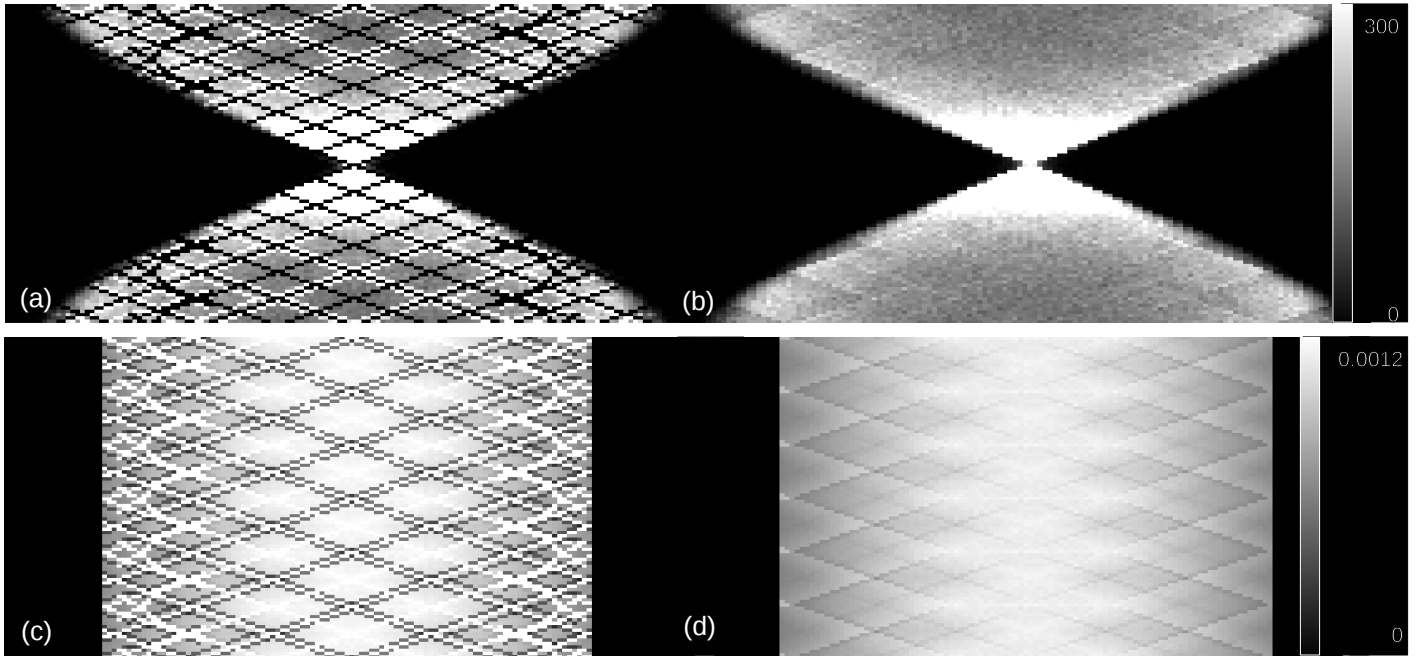
Schematics of scanner models. (a) Cylindrical geometry, (b) block geometry.

Main classes to add



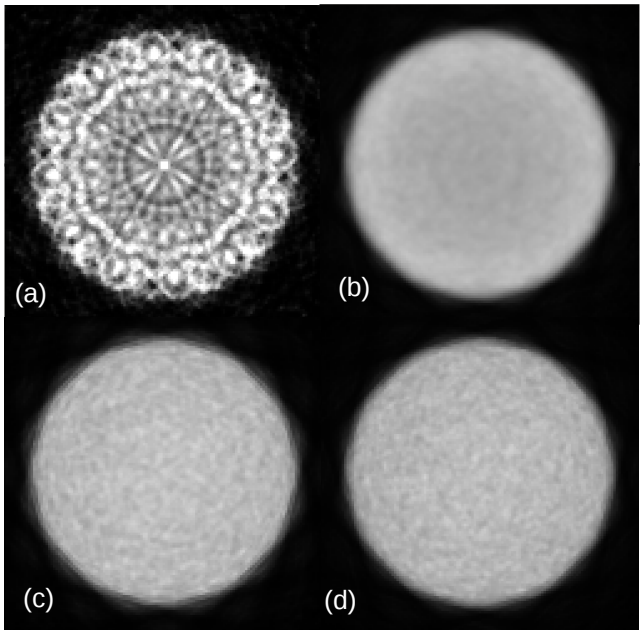
Class hierarchy classes related to sinogram data. Arrows indicate the parent class. Grey boxes show the new classes added to the library.
The classes ProjDataInfoBlocksOnCylindrical and ProjDataInfoBlocksOnCylindricalNoArcCorr store and calculate the sinogram LORs and bin information for the block geometry. The class GeometryBlocksOnCylindrical builds a map of Cartesian coordinates of detectors according to the scanner geometry.

Simulation Results (sinograms)

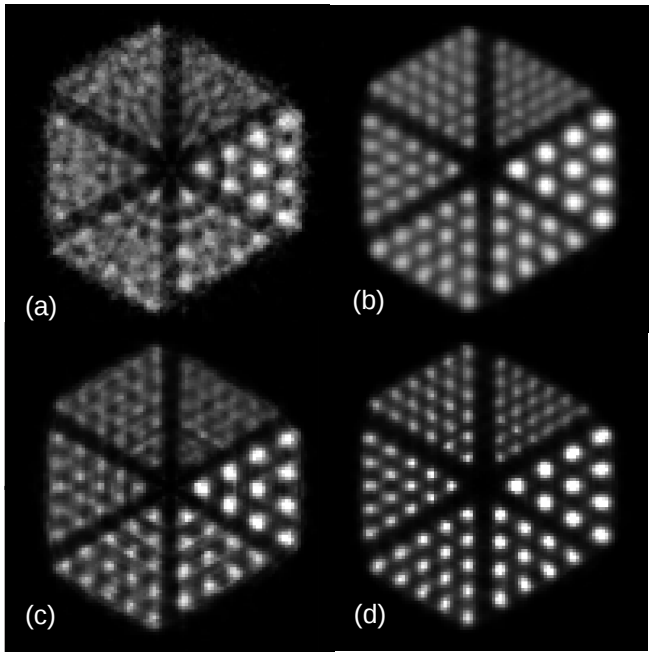


Direct sinograms in the center of scanner. (a) Sinogram of the plane source located perpendicular to y axis in cylindrical geometry, (b) Sinogram of the plane source located perpendicular to y axis in block geometry, (c) normalization factors' sinogram in cylindrical geometry, (d) normalization factors' sinogram in block geometry. The color bar in each row is common to both sinograms. However, for the cylindrical geometry, there are values which are more than the maximum value in the color bar. These values are depicted in white. Therefore in the sinogram (a), bins greater than or equal to 300, and in the singoram (c), bins greater than or equal to 0.0012 are white.

Simulation Results (images)



Reconstructed images of the uniform cylinder phantom using OSEM algorithm. (a) Cylindrical geometry without normalization, (b) block geometry without normalization, (c) cylindrical geometry with normalization, (d) block geometry with normalization.



Reconstructed images of the Derenzo phantom using OSEM algorithm. (a) Cylindrical geometry without normalization, (b) block geometry without normalization, (c) cylindrical geometry with normalization, (d) block geometry with normalization. A circular artifact is observed in image (c).