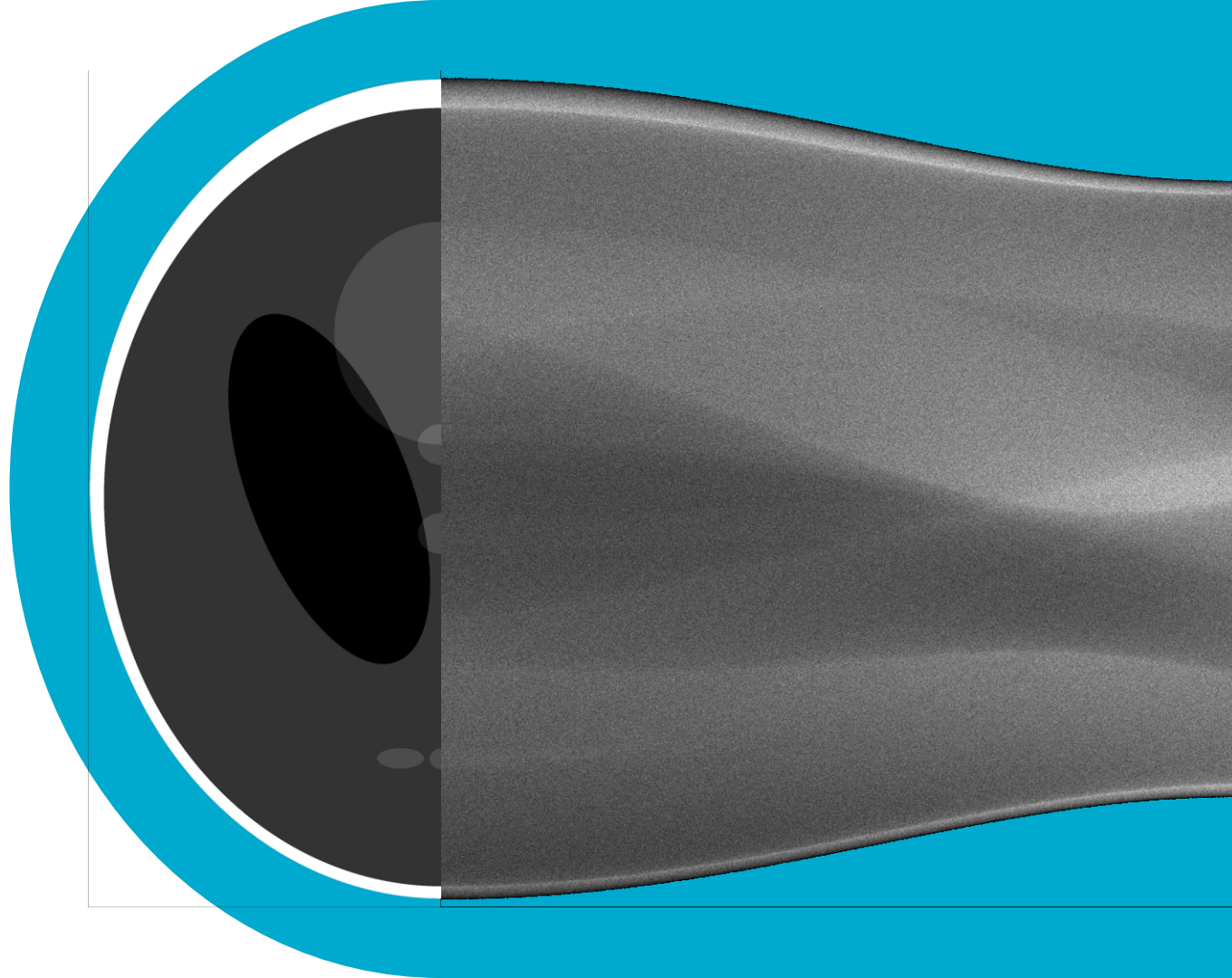




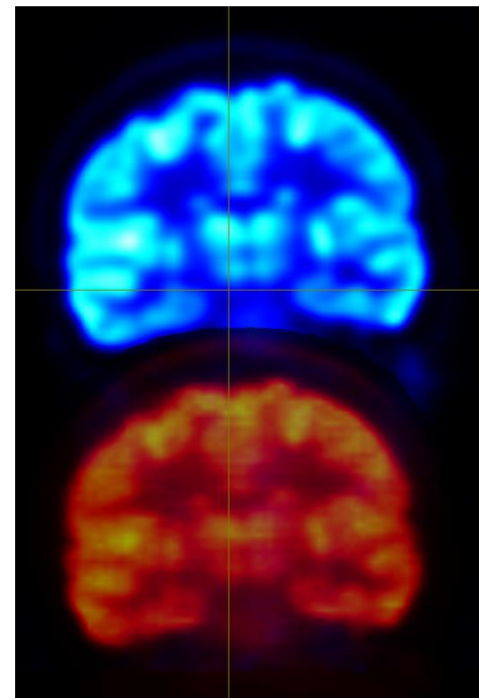
Vendor-consistent orientation systems in STIR

Ashley Gillman | 6th July 2020



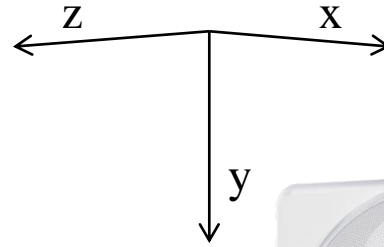
Motivation

- Currently, SIRF's output images aren't aligned with vendor reconstructions.
- This can make it difficult to align vendor images, e.g. for:
 - Attenuation correction using CT or MRAC.
 - Comparing STIR reconstructions with vendor reconstructions.
 - Using anatomical prior images.
 - Simplifies use of STIR in clinical research.



Background - Coordinate Systems

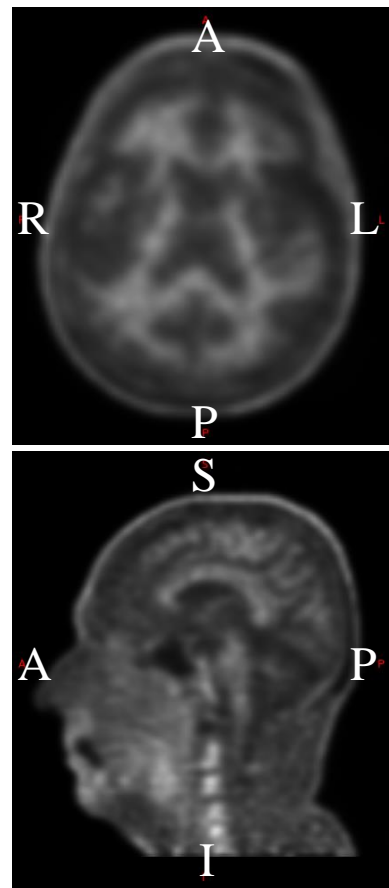
- STIR Uses a gantry-based coordinate system.
- From the STIR Developers' overview:
 - X-axis : horizontal axis, pointing right when looking from the bed into the gantry
 - Y-axis : vertical axis, pointing downwards
 - Z-axis : the scanner axis, pointing from the gantry towards the bed



Demonstration of STIR axes conventions

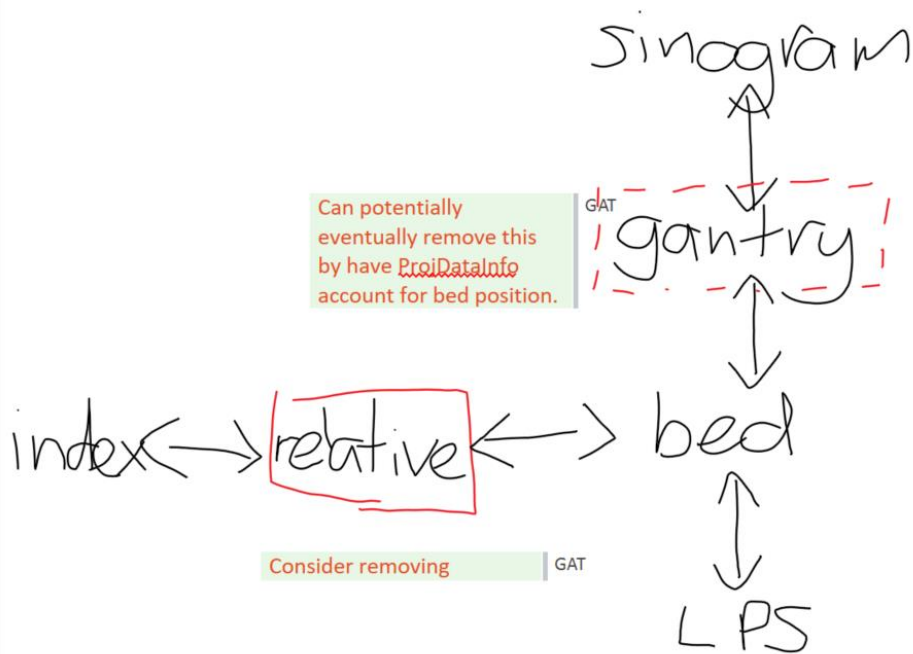
Background - Coordinate Systems

- Many common medical technologies (e.g., DICOM, NifTI) use a patient-based coordinate system, which is defined w.r.t. patient anatomy.
 - In DICOM, axes directions are defined with respect to patient's Left, Posterior, Supine (LPS).
 - NifTI orientation is defined by an affine transform of axes with respect to Right, Anterior, Supine (RAS).
- This system is useful in analysis as it allows rapid approximate alignment of anatomy.



Demonstration of Patient-based axes conventions

Background - Coordinate Systems



Sinogram Coordinates

- s, r, theta, phi, m
- Owned by ProjDataInfo

- ProjDataInfo responsible for sinogram-to-image-space (gantry) mapping

Gantry Coordinates

- In mm
- FoR is centre of first ring (move to centre of gantry?)
- z, y, x is always defined by below Figure (sampling must be axes-aligned, no rotations or permutations of axes)
- Owned by DiscretisedDensity

- DiscretisedDensity is responsible for gantry-to-bed mapping.

Bed Coordinates

- In mm
- Like Gantry Coordinates, but FoR moves with the bed.

DiscretisedDensity is responsible for bed-to-LPS mapping

LPS Coordinates

- Patient-based system (changes with patient orientation)
- FoR is vendor-defined (required a calibrated transform per scanner)
- Owned by DiscretisedDensity

Progress

- Have given DiscretisedDensity a “get_LPS-coordinates_for_indices()”
- Have given ProjDataInfo a “bed_position_horizontal” and “bed_position_vertical”

- Don't actually use this yet!

Next steps

- Need to refactor so that translation between sinogram and image space is all done in one file.
- Needs to “know” a lot about DiscretisedDensity (including bed position), ProjDataInfo (basic scanner geometry) and potentially the Scanner (different vendors could have different FoRs)