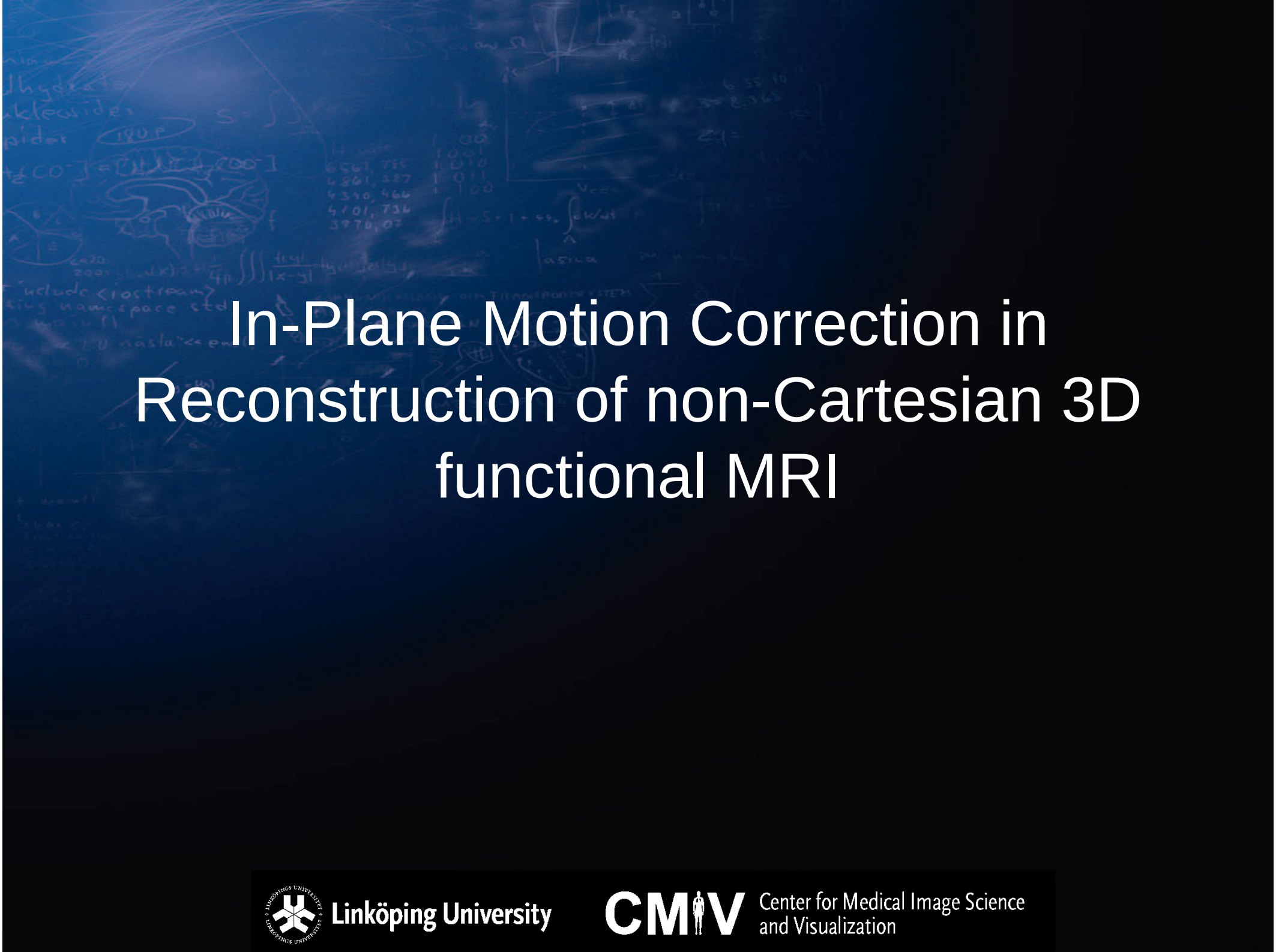


In-Plane Motion Correction in Reconstruction of non-Cartesian 3D functional MRI

Linköping University

CMIV Center for Medical Image Science and Visualization

Outline

Purpose

Background to my work

My thesis work

Conclusion

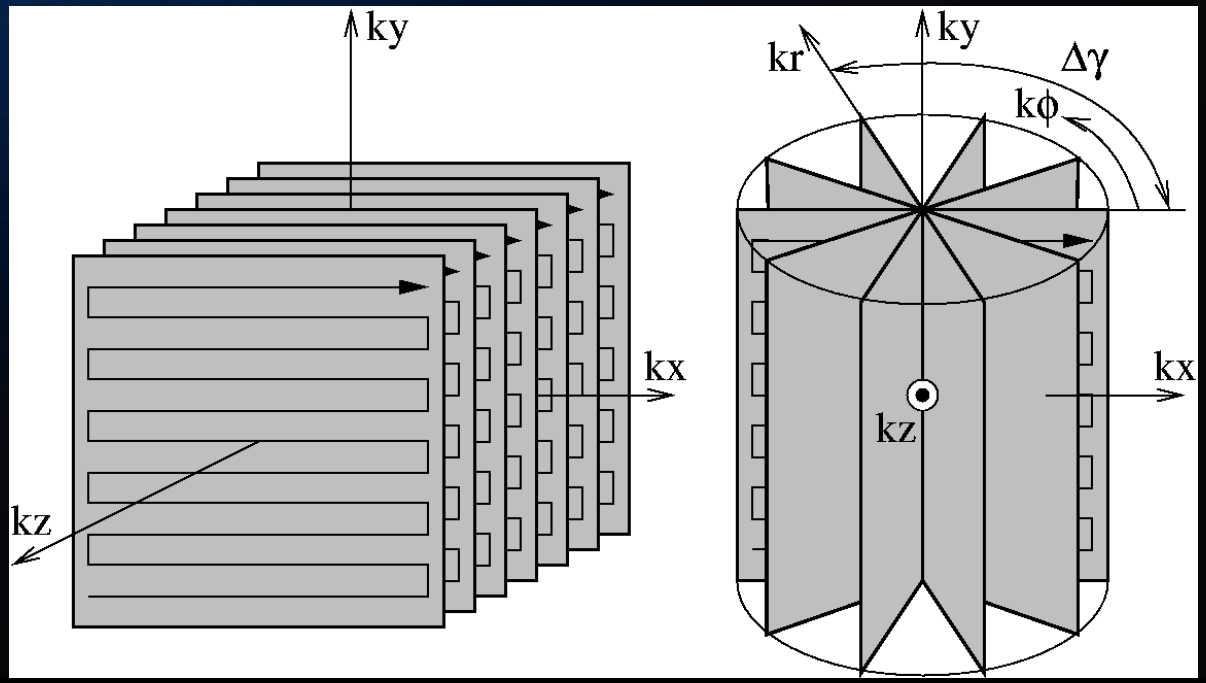
Purpose

Magnetic Resonance in Resonance

Sampling with PRESTO-CAN (1)

Hybrid sampling pattern

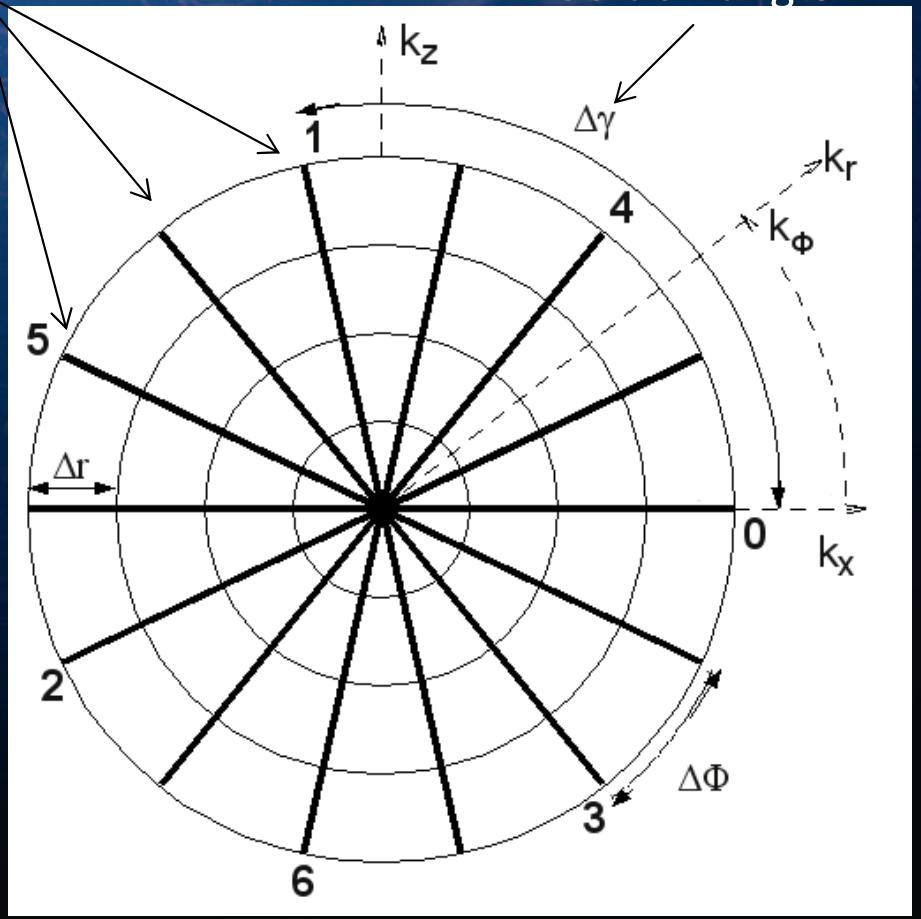
- Radial in (kx,kz)-direction
- Cartesian in ky-direction



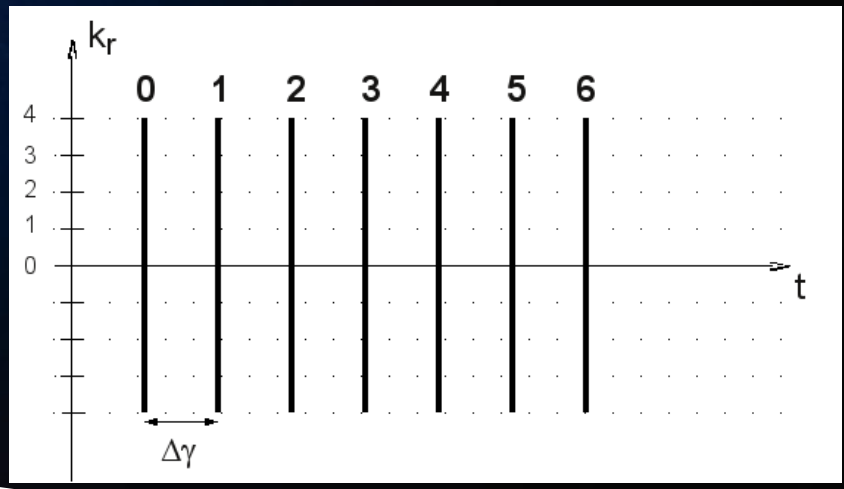
Sampling with PRESTO-CAN (2)

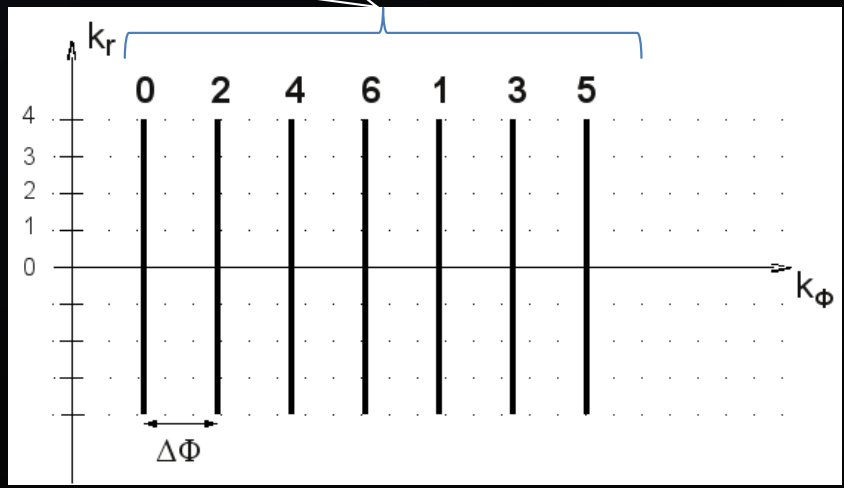
Profile

Golden angle

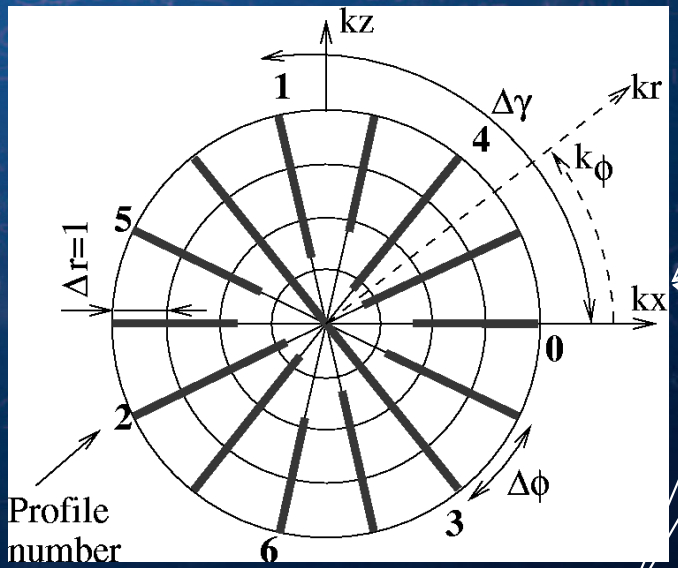


Image



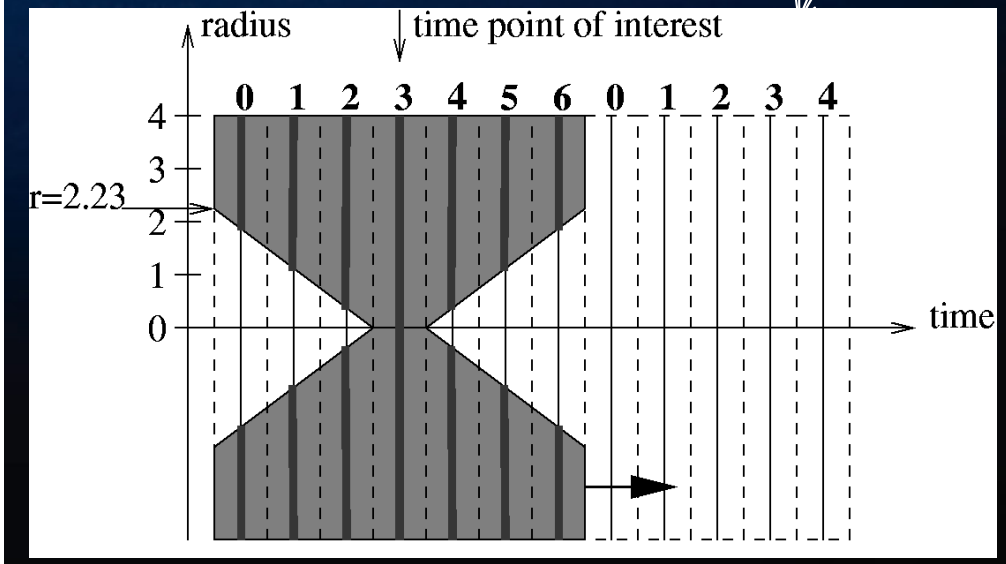


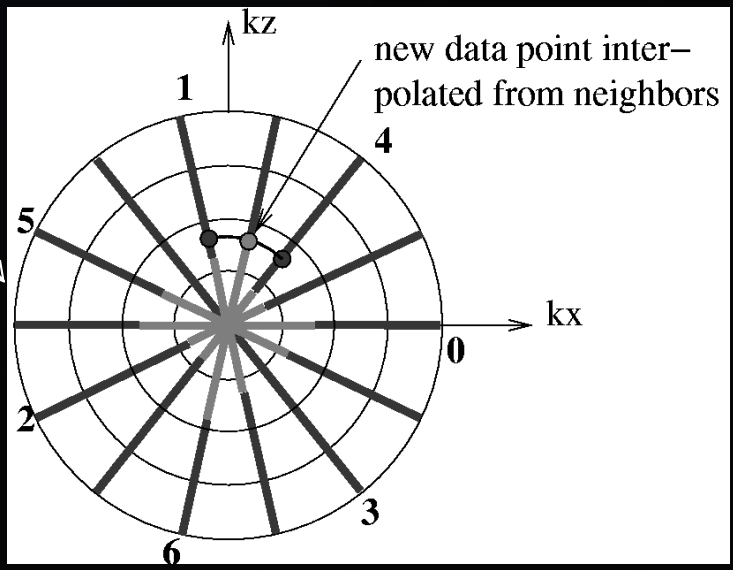
Sampling with PRESTO-CAN (3)



Increasing the temporal resolution by:

1. Starting with the profiles furthest away from the time point of interest.
2. Removing data points when Nyquist is fulfilled.
3. Interpolating new sample points in angular direction.



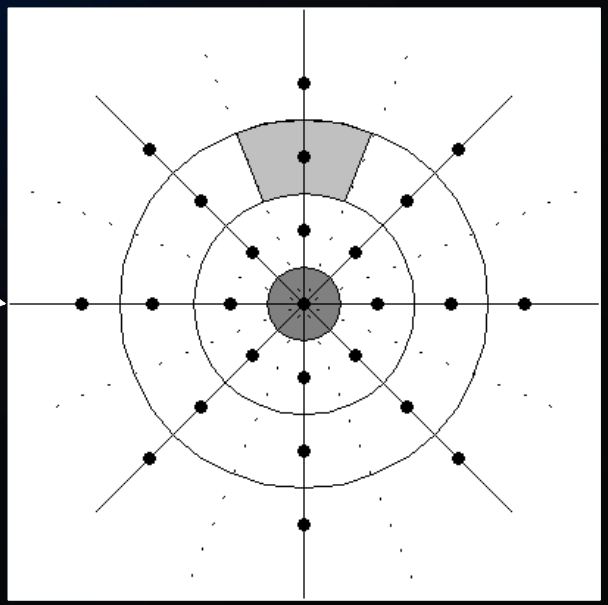


Sampling with PRESTO-CAN (4)

Needs a Cartesian Grid to reconstruct to spatial domain

Four steps:

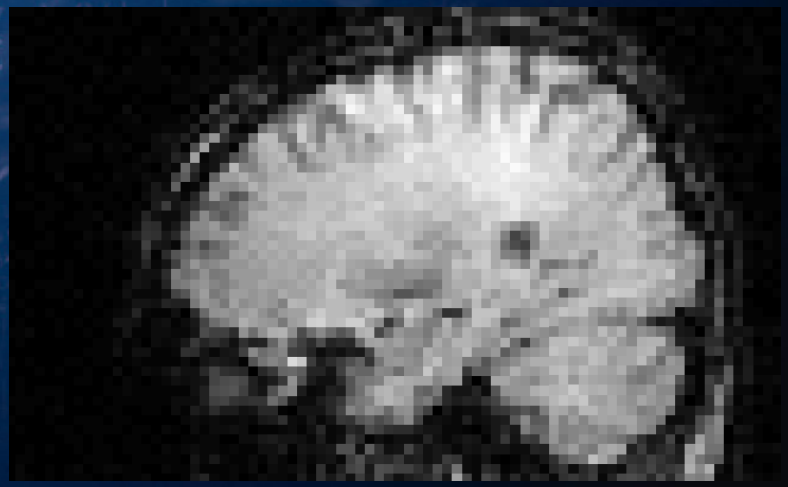
1. Pre-Weighting
2. Interpolation with Kaiser Bessel Filter to a Cartesian Grid
3. Post-Weighting
4. Compensating for Filter Kernel



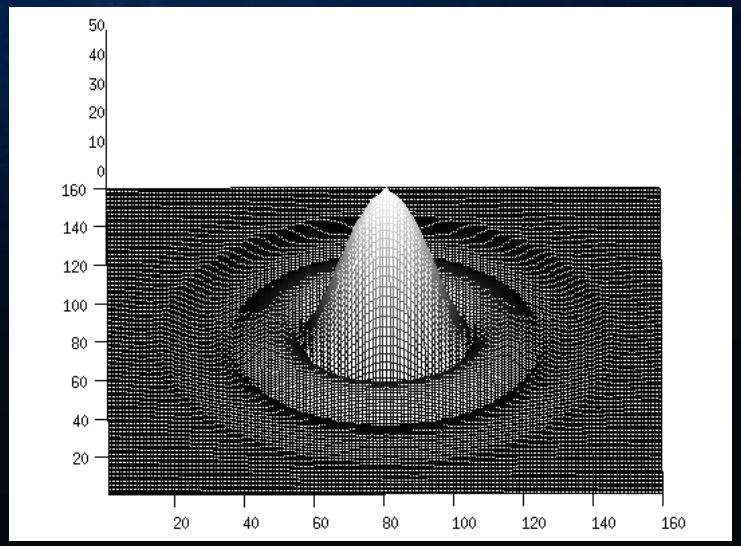
Thesis Work - Overview

1. Create Phantom
2. Estimate the movement
3. Correct for the motion
4. Investigate if the Hourglass Filter improves the result
5. See if other pre-proccessing is possible for improving the result
6. Change gridding reconstruction

Computer Simulated Phantom



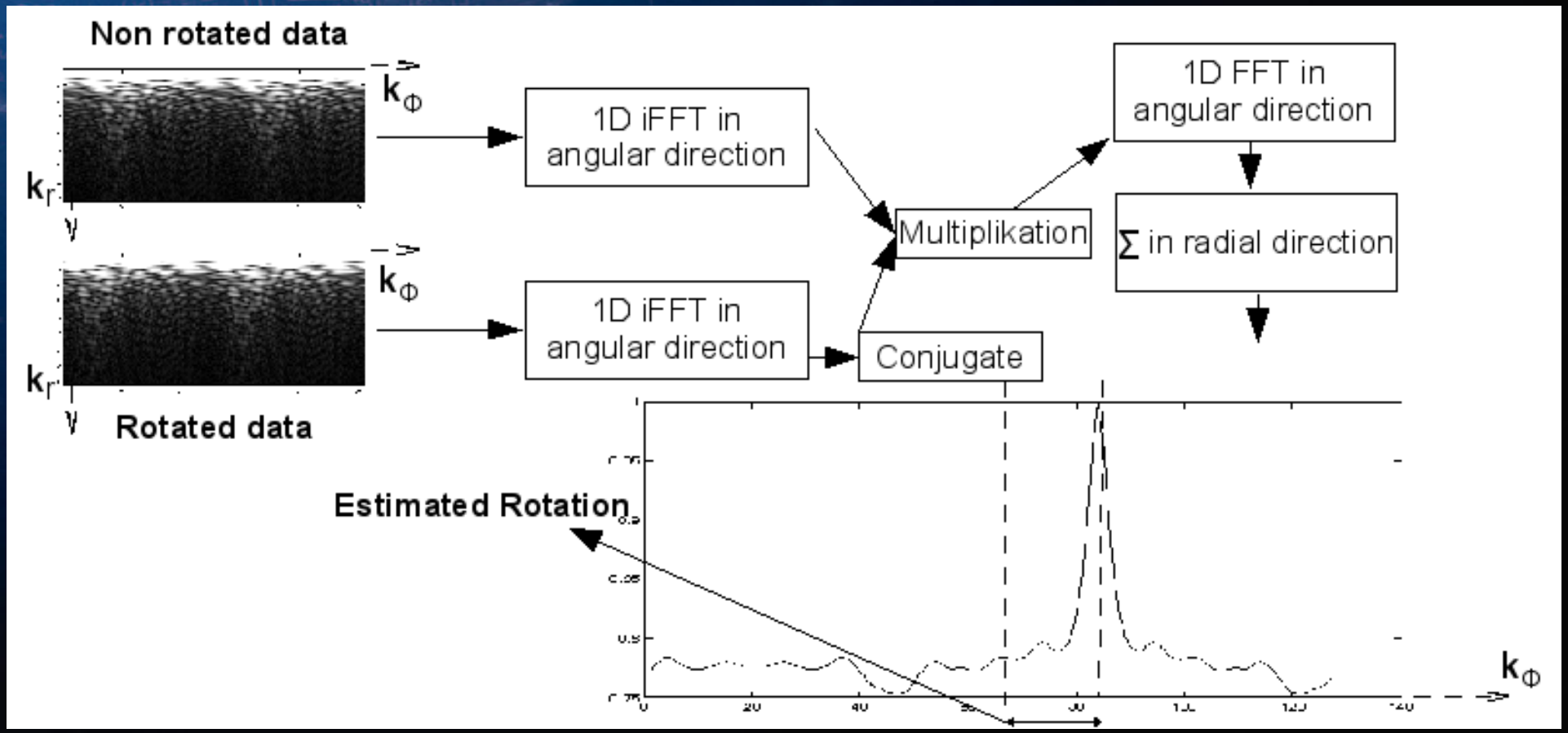
A slice of a real brain - The ”model”



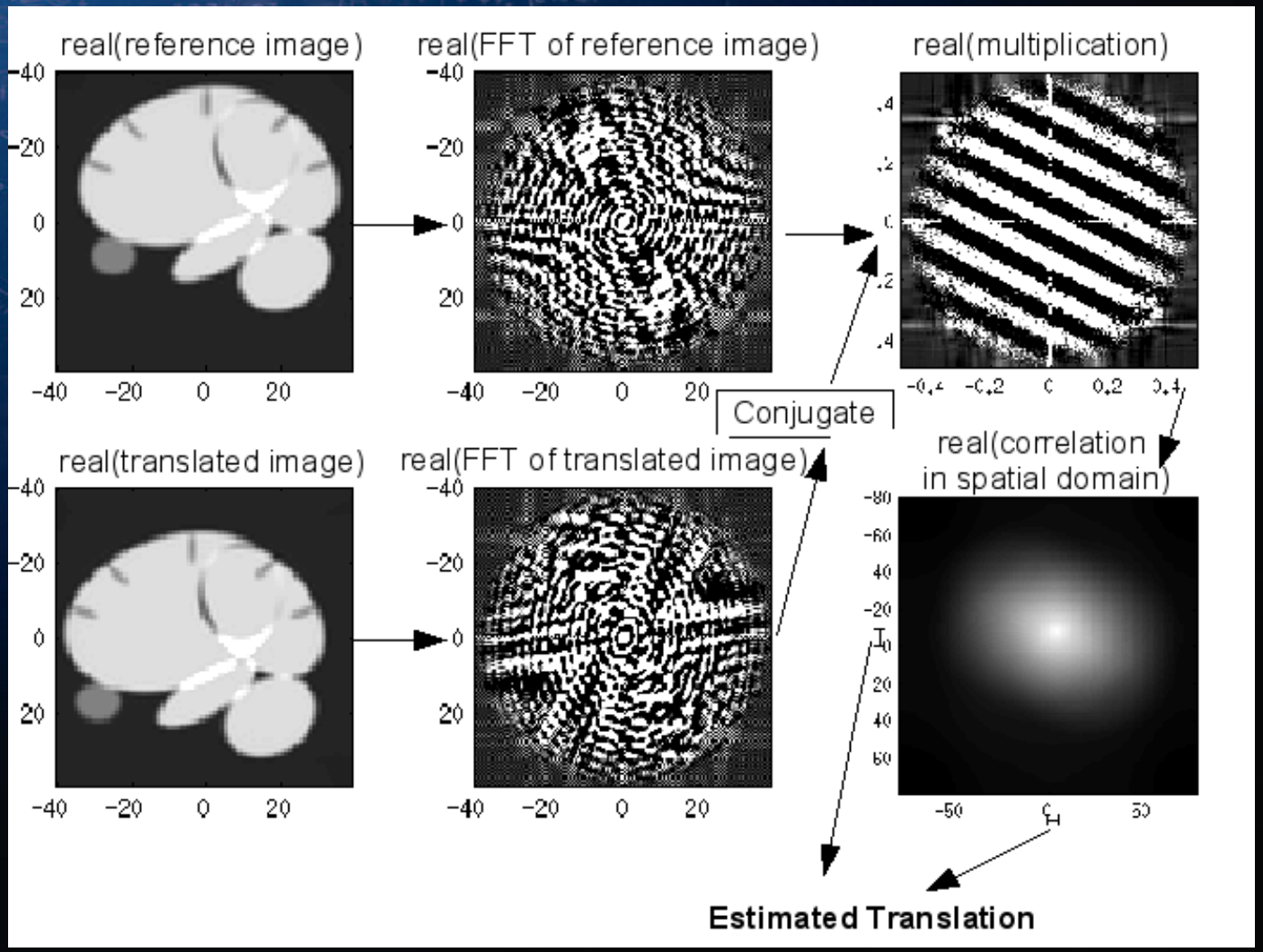
The jinc-function

The Phantom – Mr Brain

Rotation Estimation

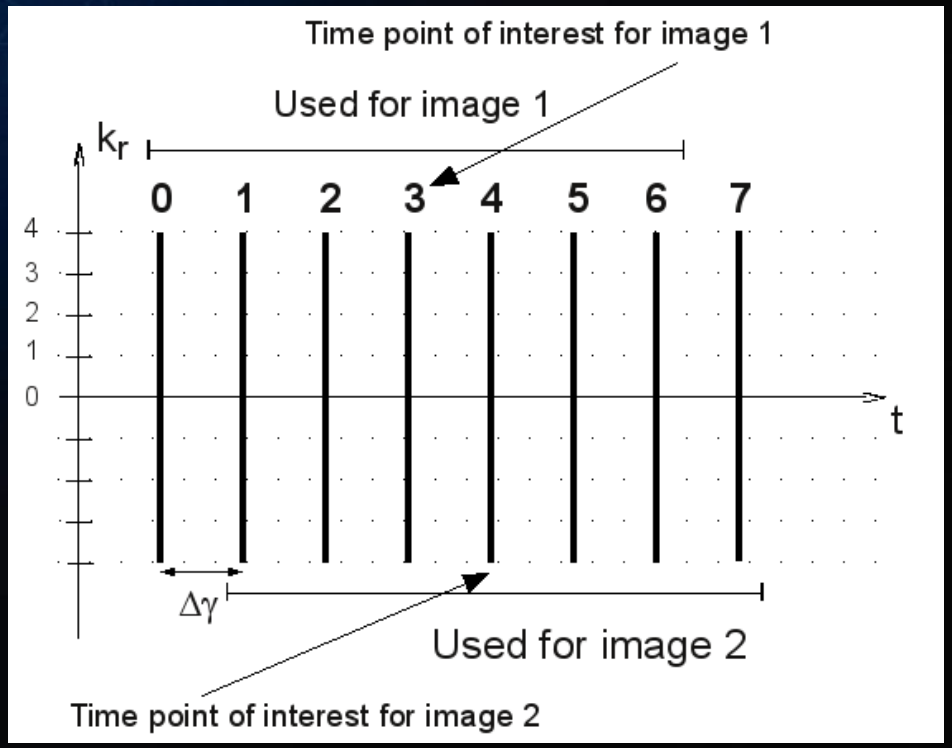


Translation Estimation



Rotation Correction

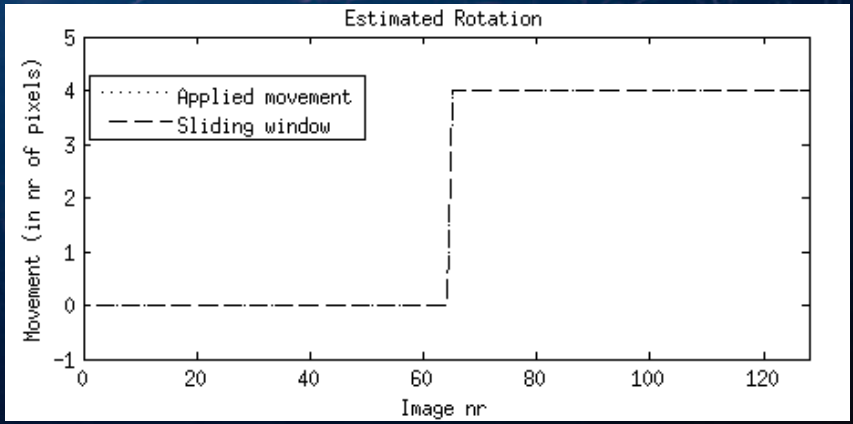
1. Find the time point of interest for every image
2. Reorder the profiles to correct angle position
3. Reconstruct the images

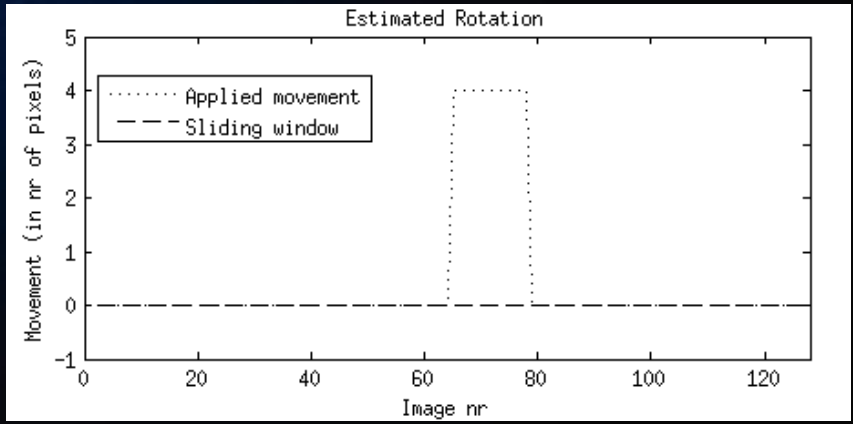


Translation Correction

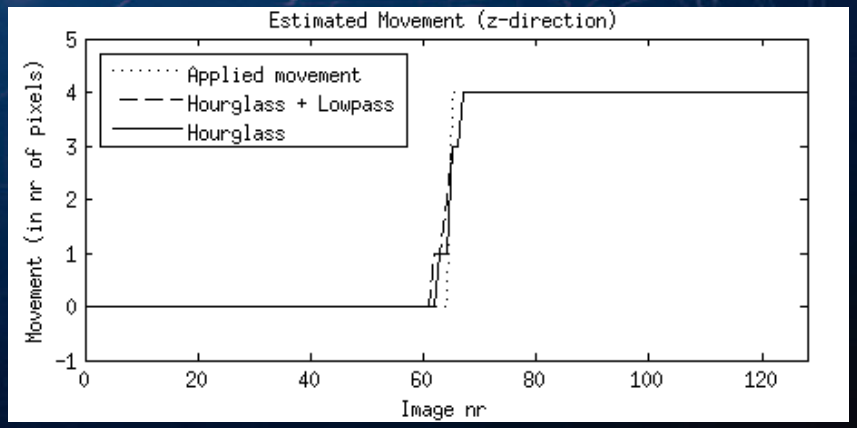
1. Find the time point of interest for every image.
2. Correct translation on input data before correcting for rotation in two steps
    1. Recalculate translation estimation vectors.
    2. Apply a phase to the profiles when ordered by time.

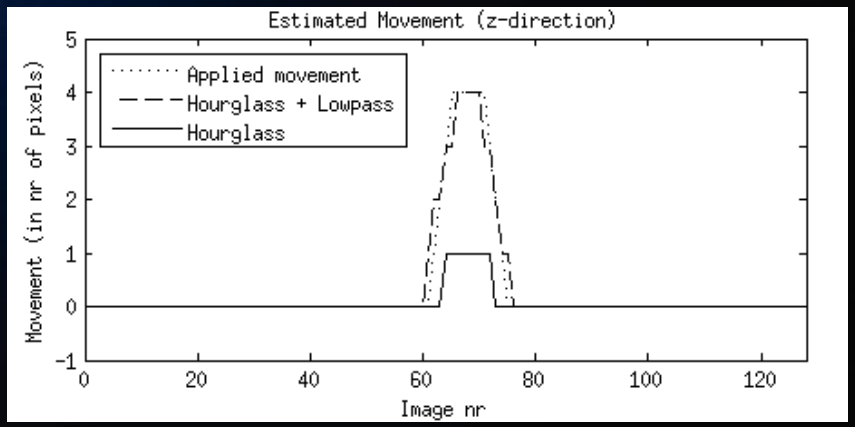
Result – Rotation Estimation





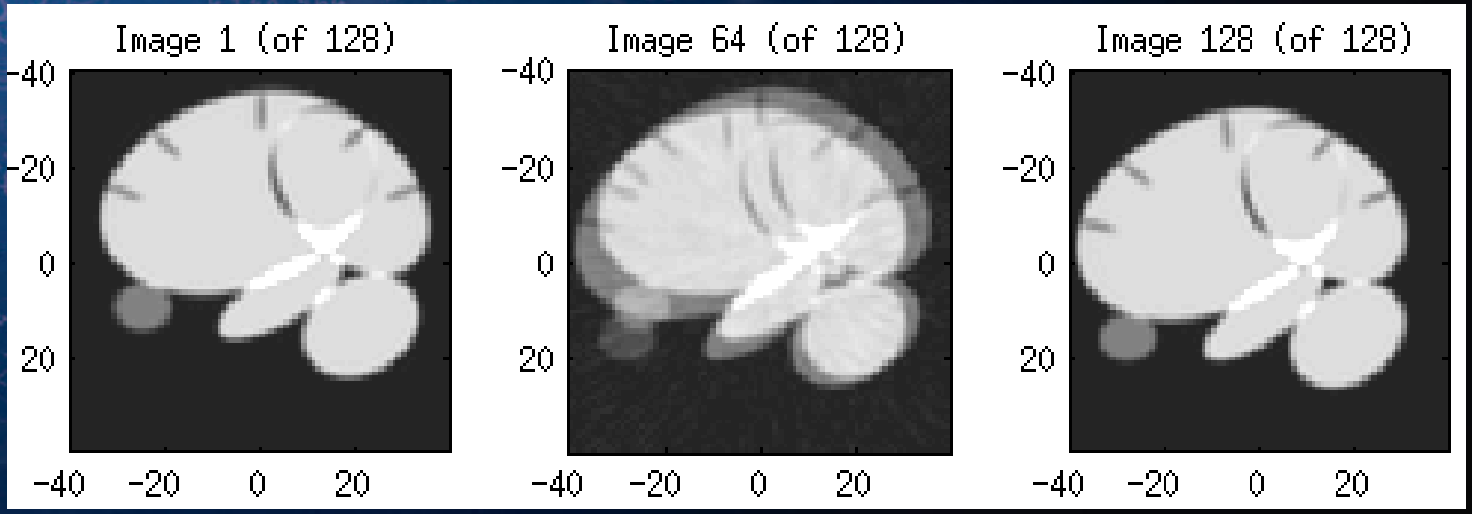
Result – Translation Rotation



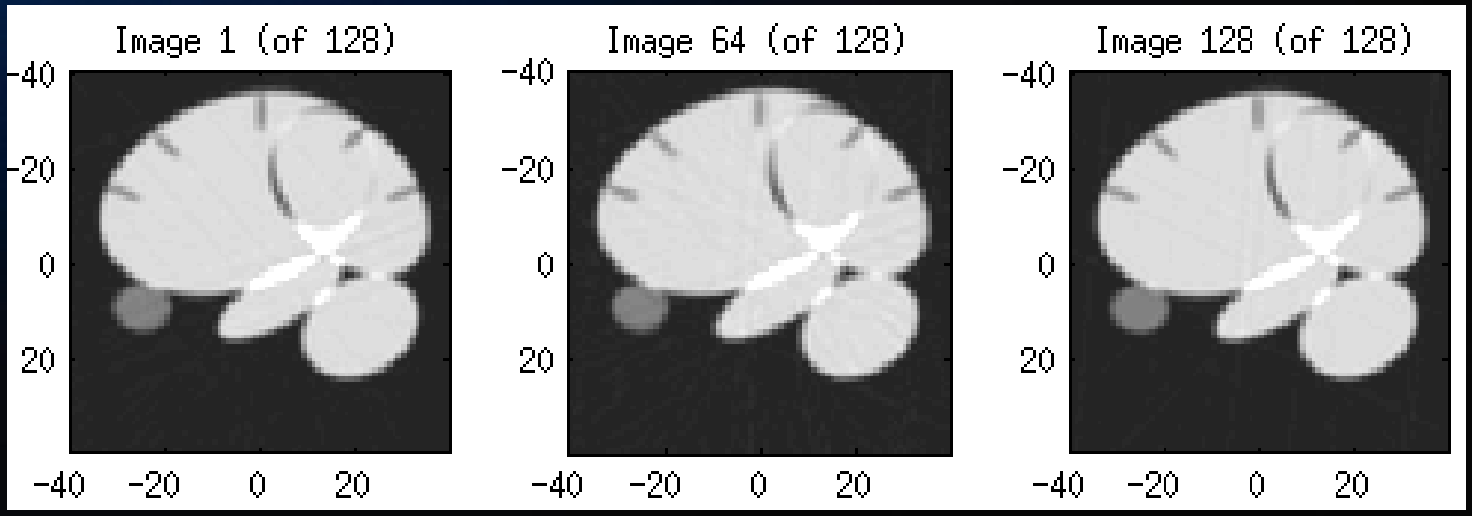


Result - Step Movement

Not Corrected

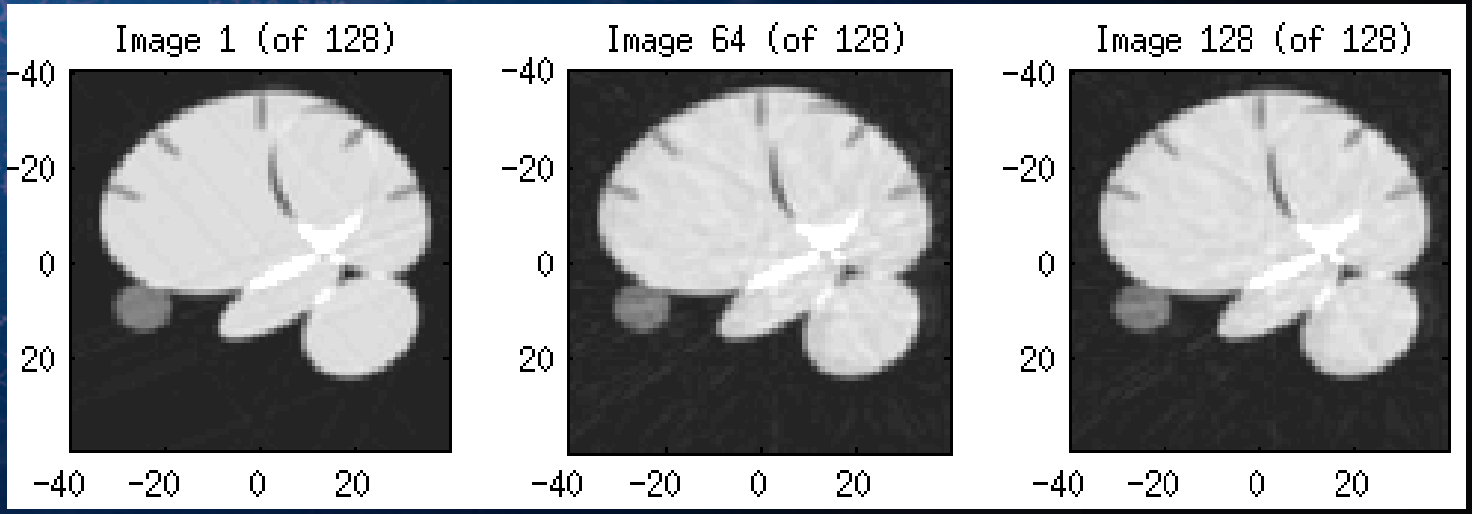


Corrected

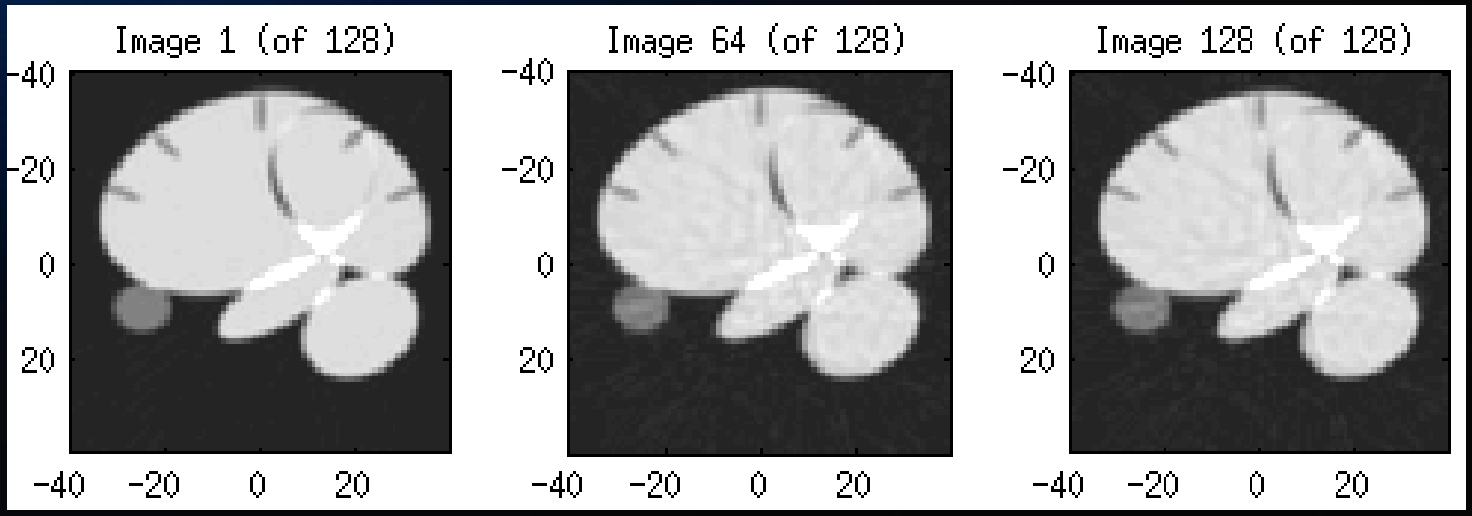


Result – Pulse Movement

Not Corrected

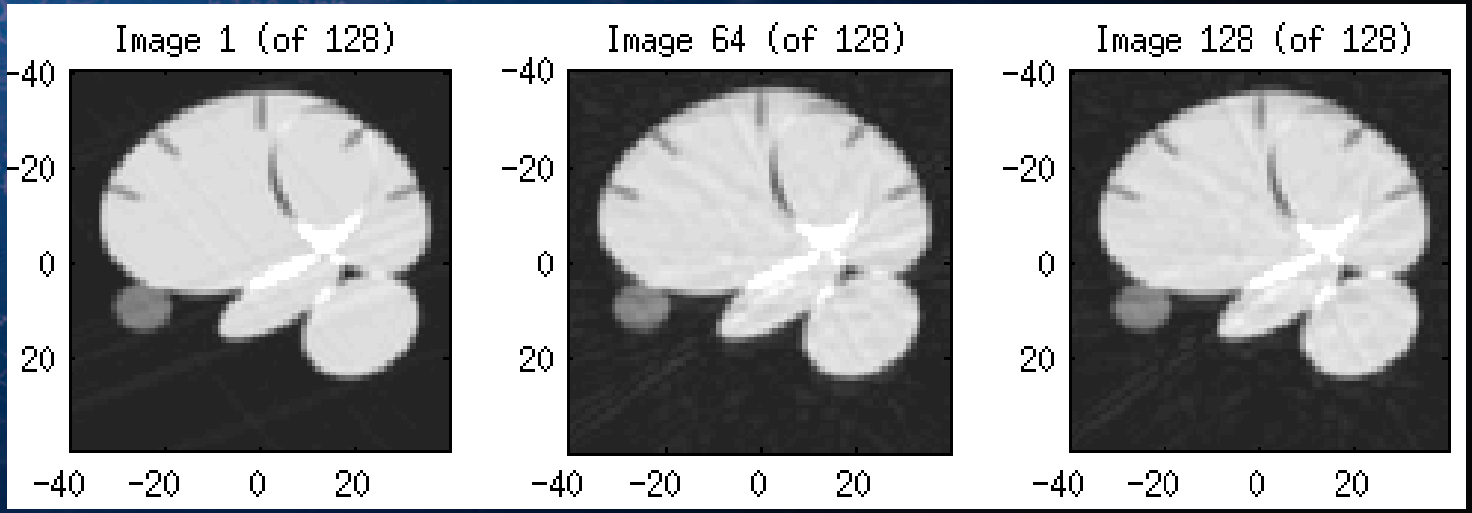


Corrected

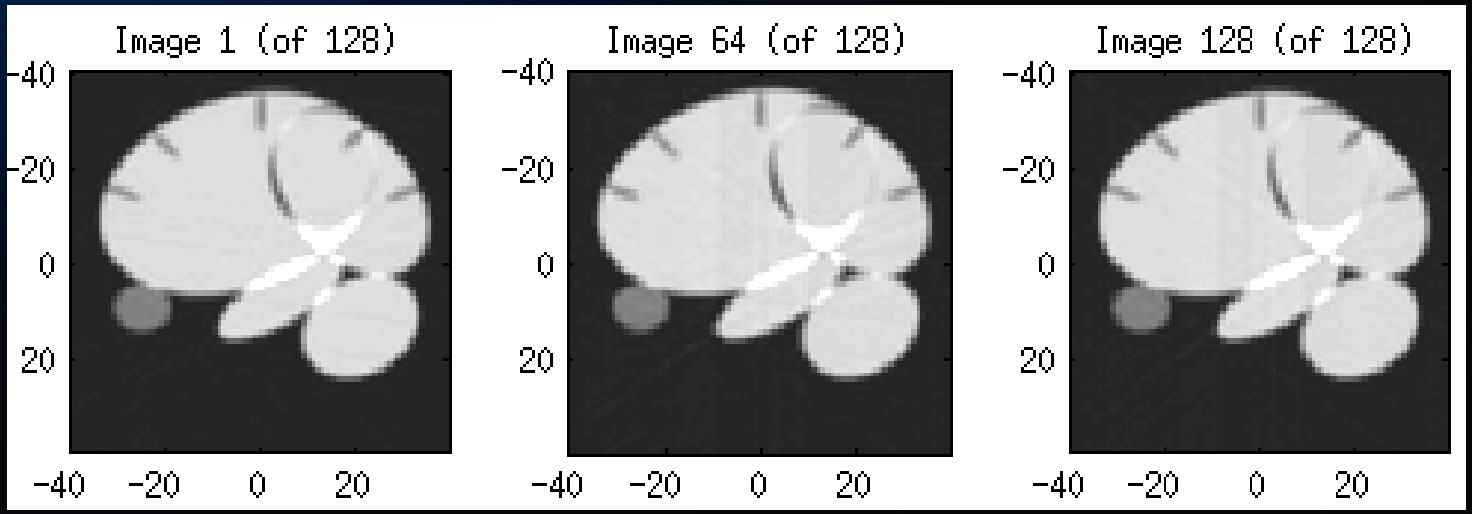


Result – Pulse Only Translation

Not Corrected



Corrected



Conclusion

The motion correction algorithm implemented can successfully reconstruct computer simulated images with much less motion artifacts!

Thank you for listening!

Linköping University

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