

# VALIDATION OF TOF-PET RECONSTRUCTION FOR GE SIGNA PET/MR SCANNER WITH STIR

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- Validate the reading and histogramming of ToF LM data
- Demonstrate LM-ToF-OSEM and ToF-OSEM reconstructions for phantom and patient dataset.

## Listmode File

- Listmode events are stored for a particular detector pair and timing difference in HDF5 files.
- CListRecordGESIGNA.cxx class modified to handle the time of flight information accurately.

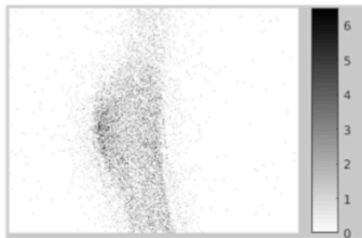
Uncompressed listmode file extracted from scanner  $\xrightarrow{\text{lm\_to\_projdata}}$   
TOF STIR Sinogram

# LISTMODE FILE READING AND UNLISTING: RESULTS

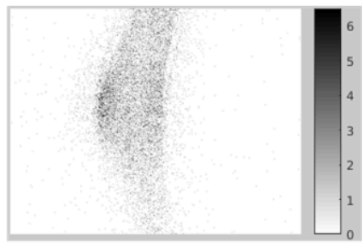
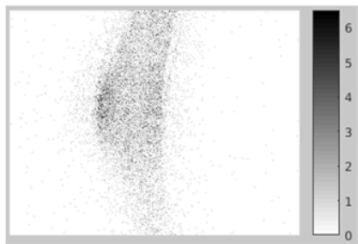
VENDOR'S RECONSTRUCTION  
TOOLBOX



STIR



TOF bin 2

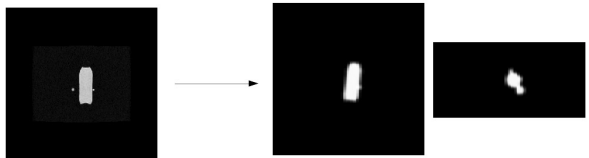
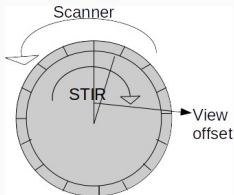


TOF bin 0

# DATA CORRECTIONS IN STIR

## Data Corrections

- Norm File<sub>HDF5</sub>  $\xrightarrow{\text{correct\_projdata}}$  Norm Sinogram
- Norm File, RDF sino<sub>HDF5</sub>  $\xrightarrow{\text{read\_geo\_factors}}$  Geo Sinogram
- NormGeo = Norm\*Geo (`stir_math -s -mult normgeo norm.hs geo.hs`)
- Rotated MRAC Image  $\xrightarrow{\text{calculate\_attenuation\_coefficients}}$  Attenuation Sinogram



## Experimental Setup:

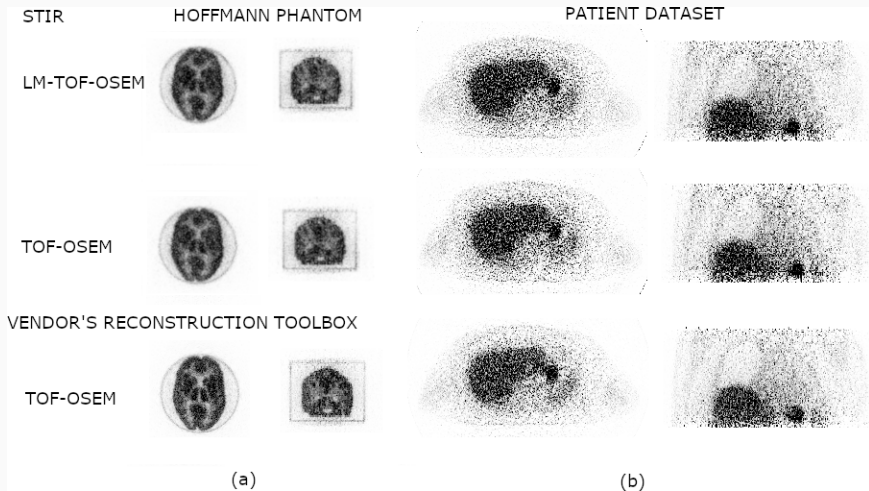
- Acquisition Datasets:
  - Hoffmann Phantom
  - Patient Dataset: Patient with lung fibrosis injected with 40.62 MBq of experimental  $^{18}\text{F}$  radiotracer.

## Reconstruction Setup

- TOF-OSEM and LM-TOF-OSEM reconstructions with 28 subsets over 3 iters with STIR and only TOF-OSEM with GE PET/MR Toolbox<sup>7</sup>.
- No randoms and scatter corrections applied currently. No post-filtering applied.
- Reconstructed Image STIR: 305x305x89 with voxel size = 2x2x2.8 mm<sup>3</sup>.
- Reconstructed Image Toolbox: 192x192x89 with voxel size = 3.1x3.1x2.8 mm<sup>3</sup>.

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<sup>7</sup>GE Proprietary software for offline reconstruction





# CONCLUSION

- We validated histogrammed LM data from GE SIGNA PET/MR in STIR and demonstrated LM-TOF-OSEM and TOF-OSEM reconstructions with the recent TOF developments.
- Residual differences reported probably because of decay and deadtime correction which have not been implemented yet.
- There are also residual VQC offsets.
- Future work will allow ToF scatter and randoms correction.

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GE TOOLBOX SUPPORT:

Kristen Wangerin and Michel Tohme, PET/MR Scientist, GE Healthcare, University of California, Davis, USA

DATA SUPPORT:

Nicholas Keat, Invicro, London, UK

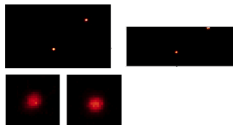
Gaspar Delso, PET/MR Scientist, GE Healthcare, University of Cambridge, Cambridge, UK

STIR LISTMODE FILE Reading Development:

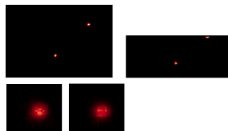
Ottavia Bertolli and Kris Thielemans, Institute of Nuclear Medicine, University College London, London, UK

# IMAGE RECONSTRUCTION WITH OSEM: STIR AND TOOLBOX

STIR



GE-TOOLBOX



VQC (top row) and VQC point source zoomed with matrix size  $59.4 \times 59.4 \times 59.4 \text{ mm}^3$  (bottom row)



BOTTLE



HOFFMANN



PATIENT

TRANSVERSE

CORONAL

TRANSVERSE

CORONAL