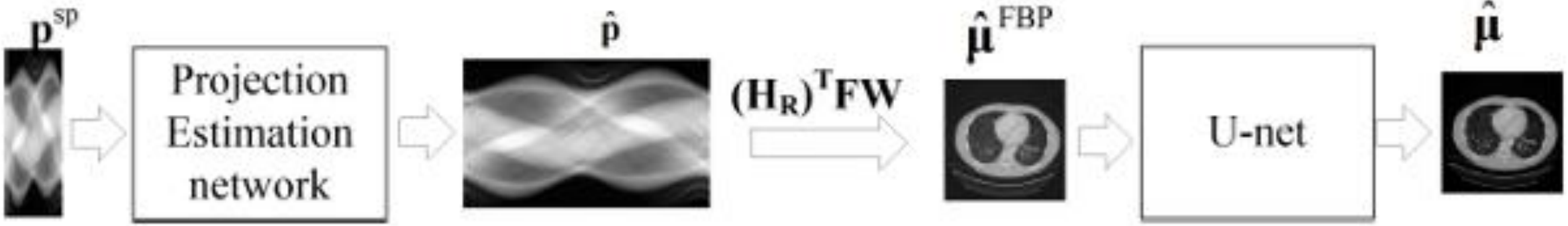
Derenzo Random Phantom Projection Tensors for Learned Reconstructions

Bill Worstell

PicoRad->MGH

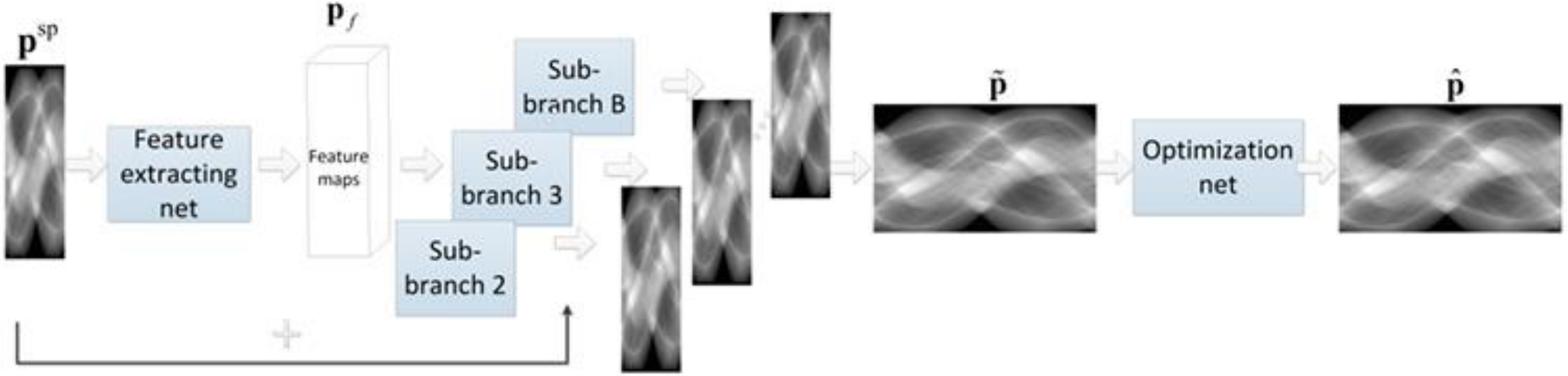
1/23/2024

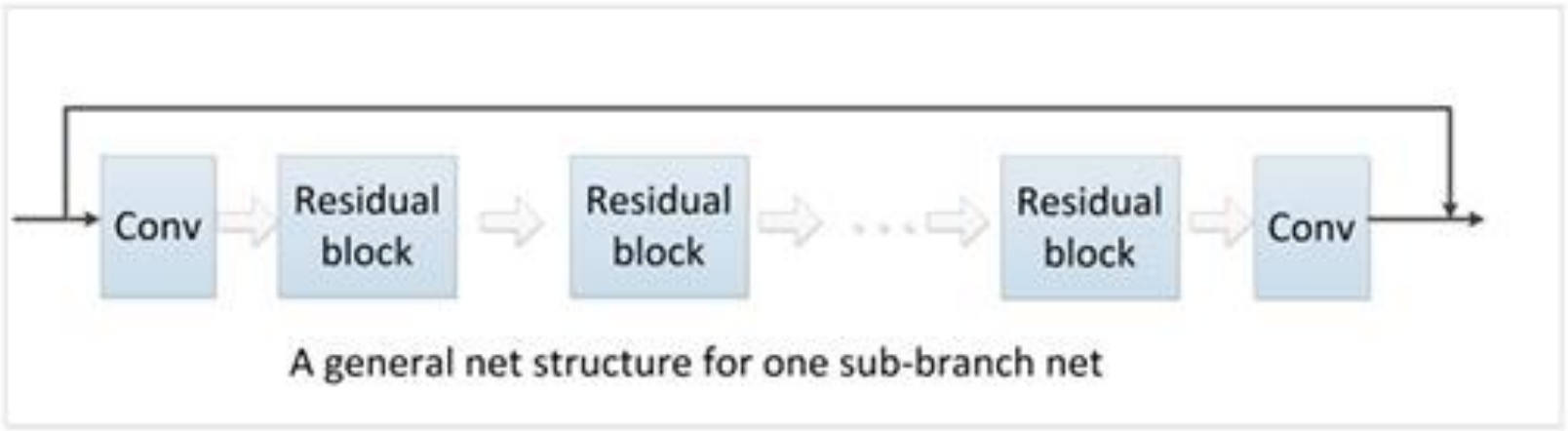
DiffDRR

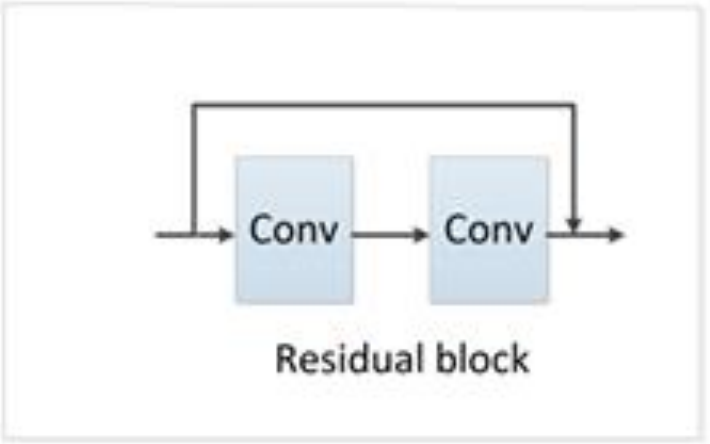


Liang, K., Yang, H. and Xing, Y., 2018. Comparison of projection domain, image domain, and comprehensive deep learning for sparse-view X-ray CT image reconstruction. *arXiv preprint arXiv:1804.04289*.

Method for learned reconstruction of high-resolution sparse-view X-ray CT which we can adapt to our multiple pinhole SPECT case

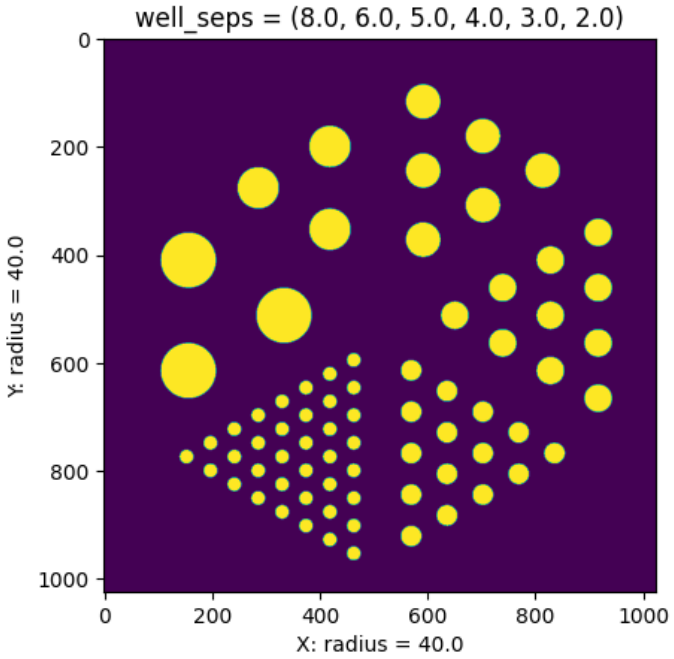


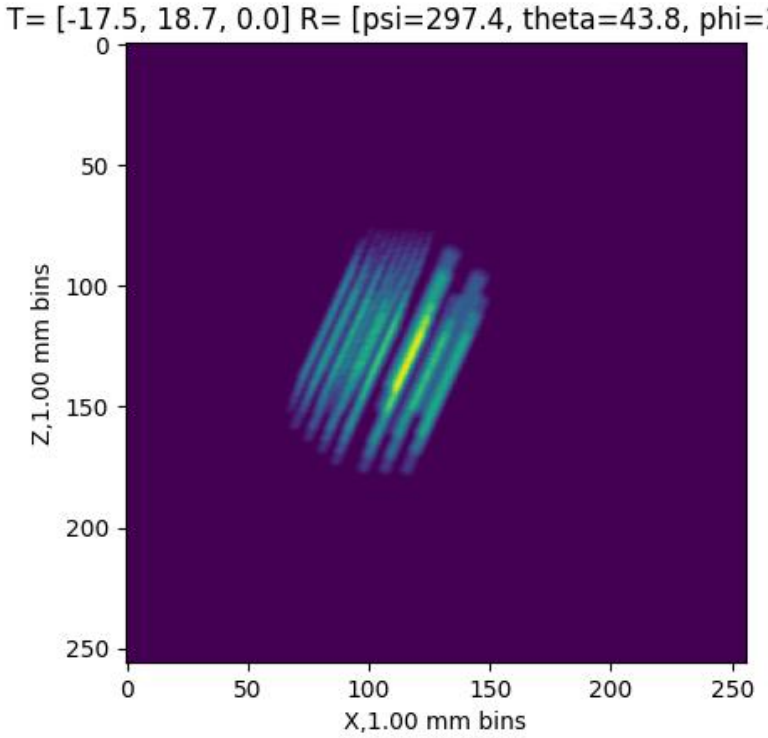


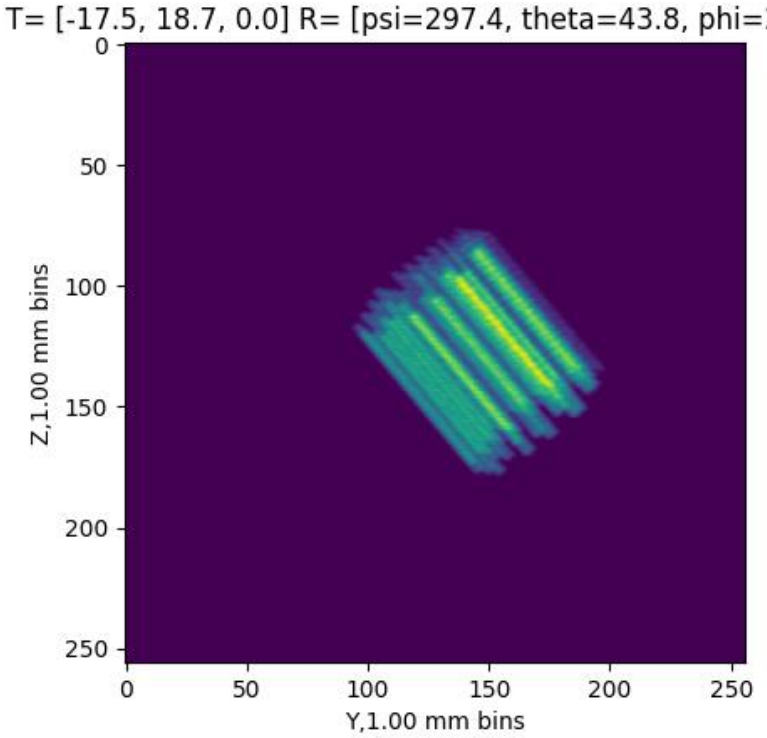


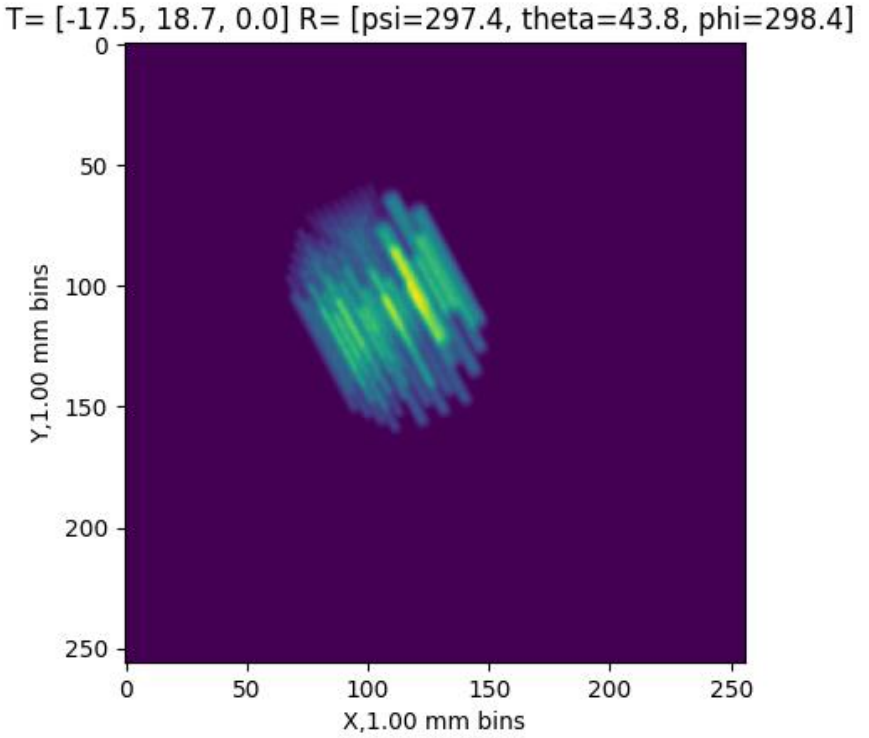
https://github.com/BillWorstell/derenzo_phantom/blob/master/iDerenzoRandomPytomograph.ipynb

Generates Pytorch 256x256x256 volume tensor at [1.,1.,1.] mm spacing with random position and orientation after 3D translations and rotations



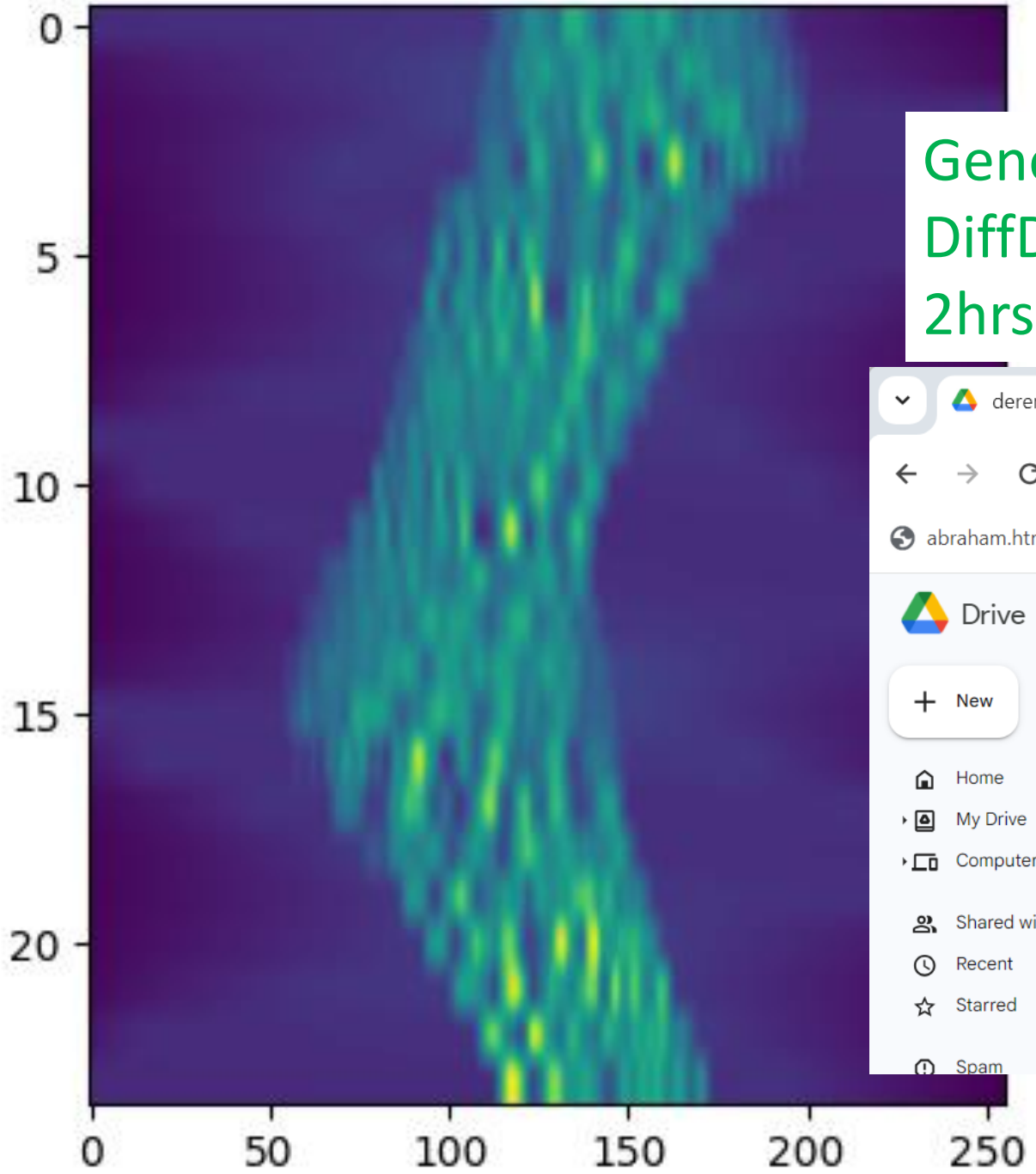


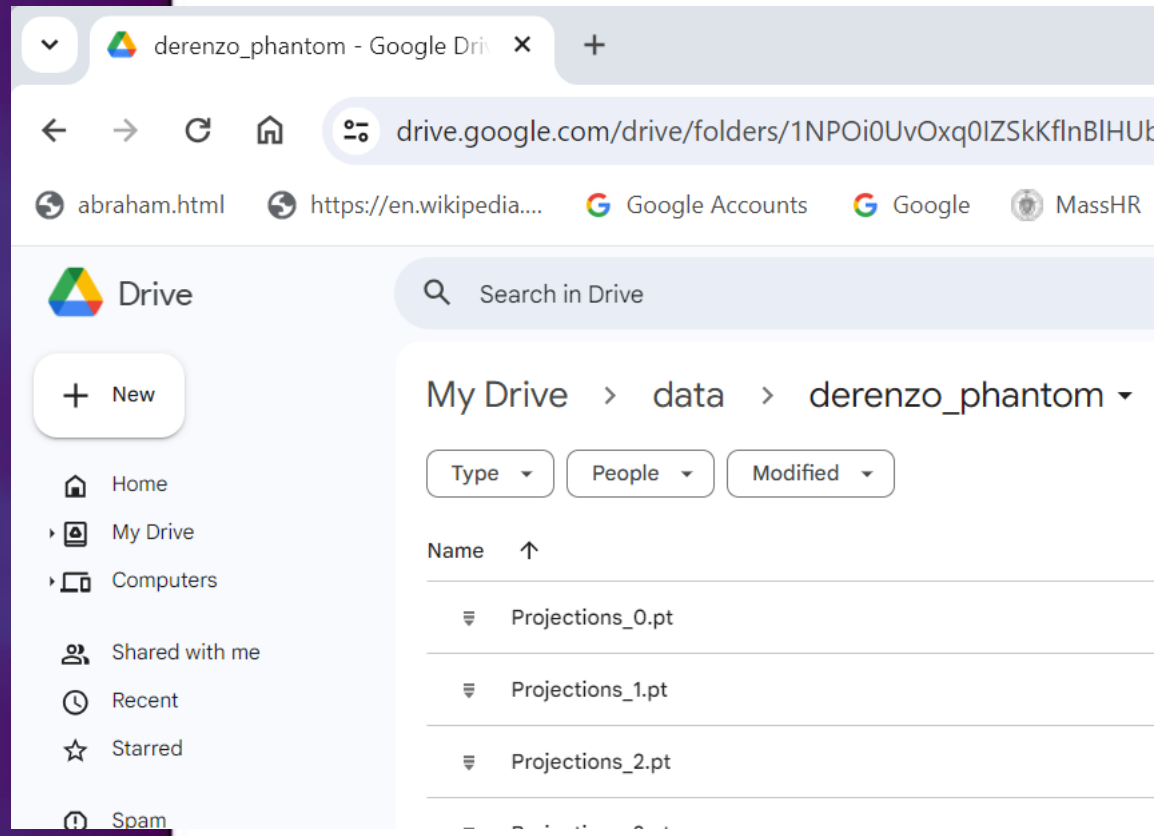


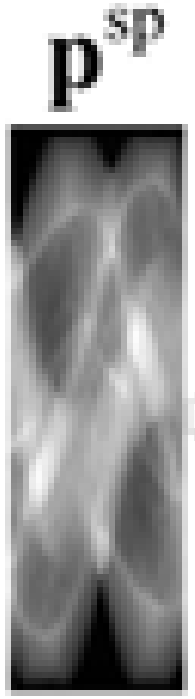


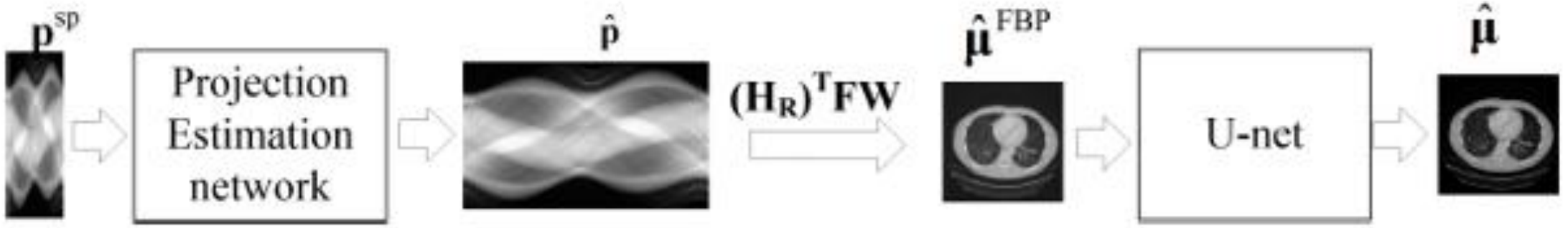
https://github.com/BillWorstell/derenzo_phantom/blob/master/iDerenzoRandomPytomograph.ipynb

Generated and saved Pytorch 96x256x256 DiffDRR projection tensors for 100 events in 2hrs on a T4 GPU on Google Colab onto Drive



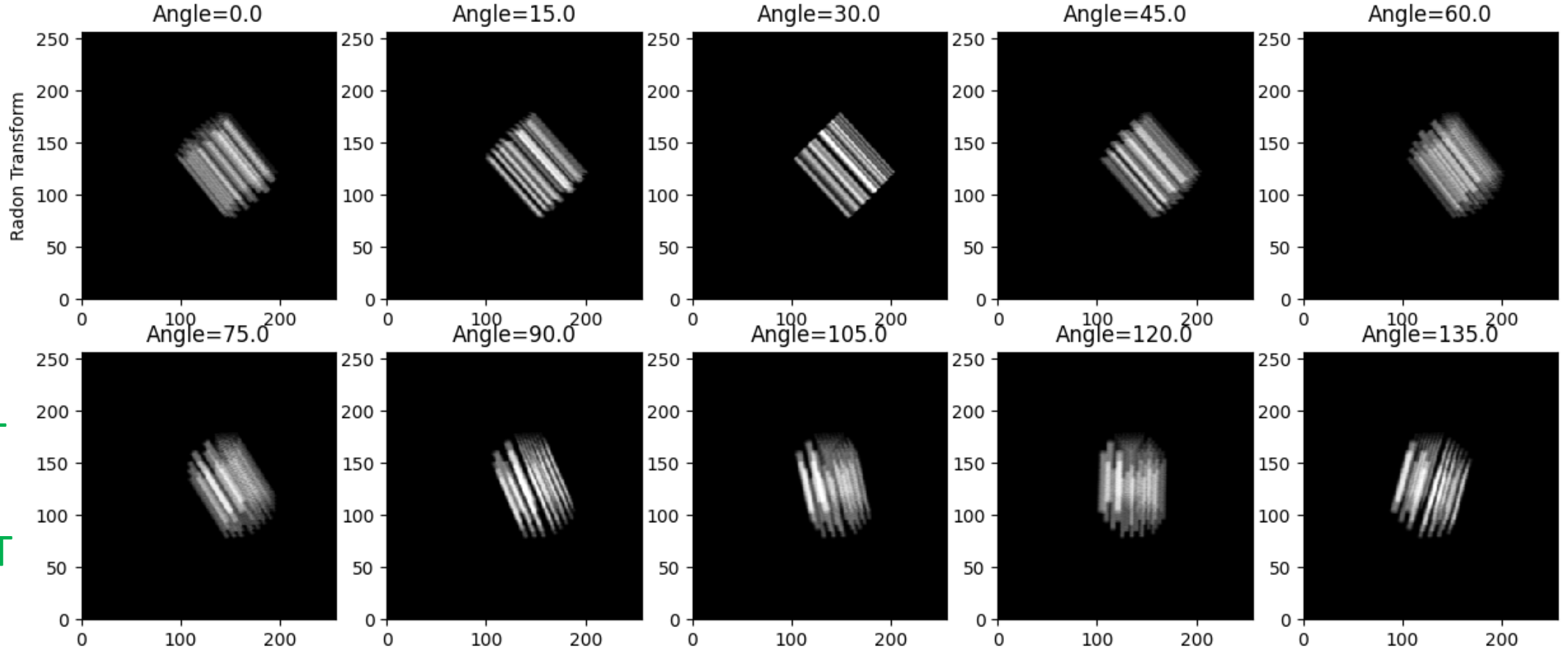




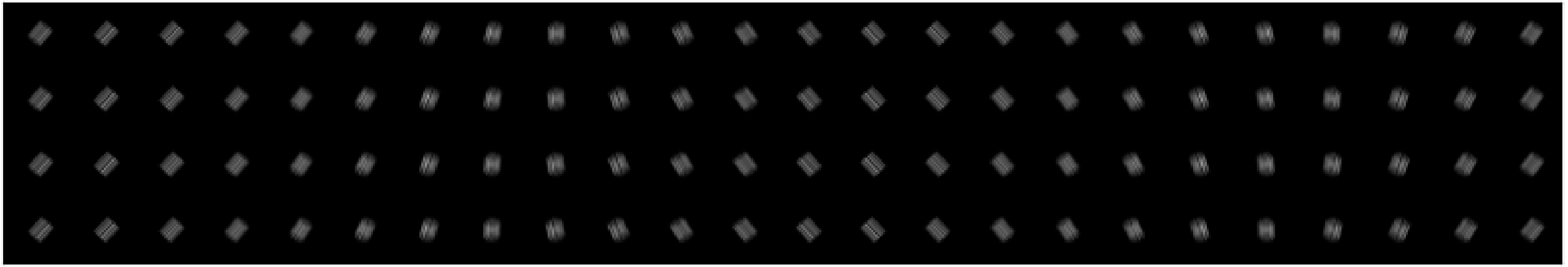


Used Pytomography GPU radon transforms to generate ideal CT projections

https://github.com/BillWorstell/derenzo_phantom/blob/master/iDerenzoRandomPytomograph.ipynb

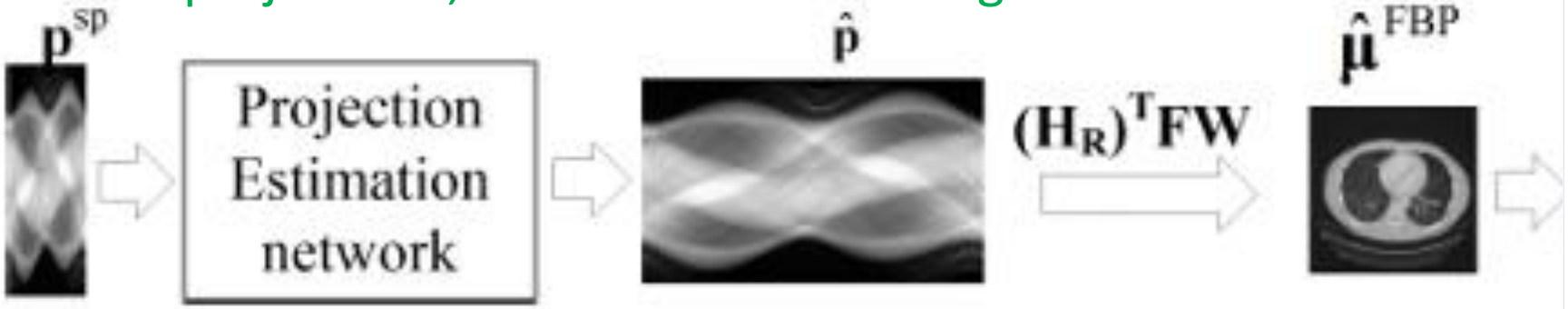


Next will try using 3D U-net to infer ideal CT projections from mphSPECT projections



Next will try using 3D U-net to infer ideal CT projections from mphSPECT projections, then reconstruct using FBP for all slices

https://github.com/wolny/pytorch-3dunet



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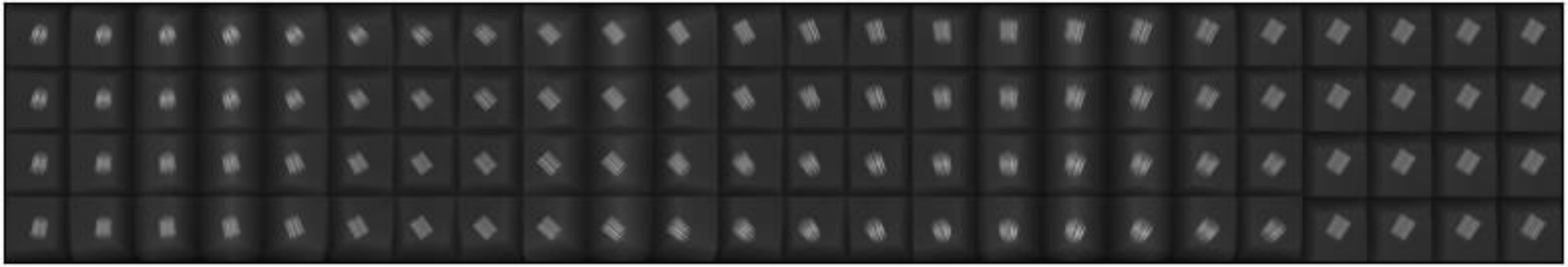
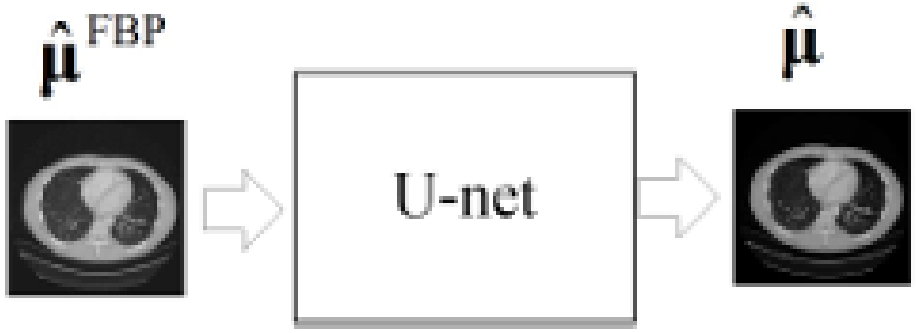
DOI 10.5281/zenodo.10456011 | Conda Build passing | Last updated 03 Jan 2024 | license MIT

pytorch-3dunet

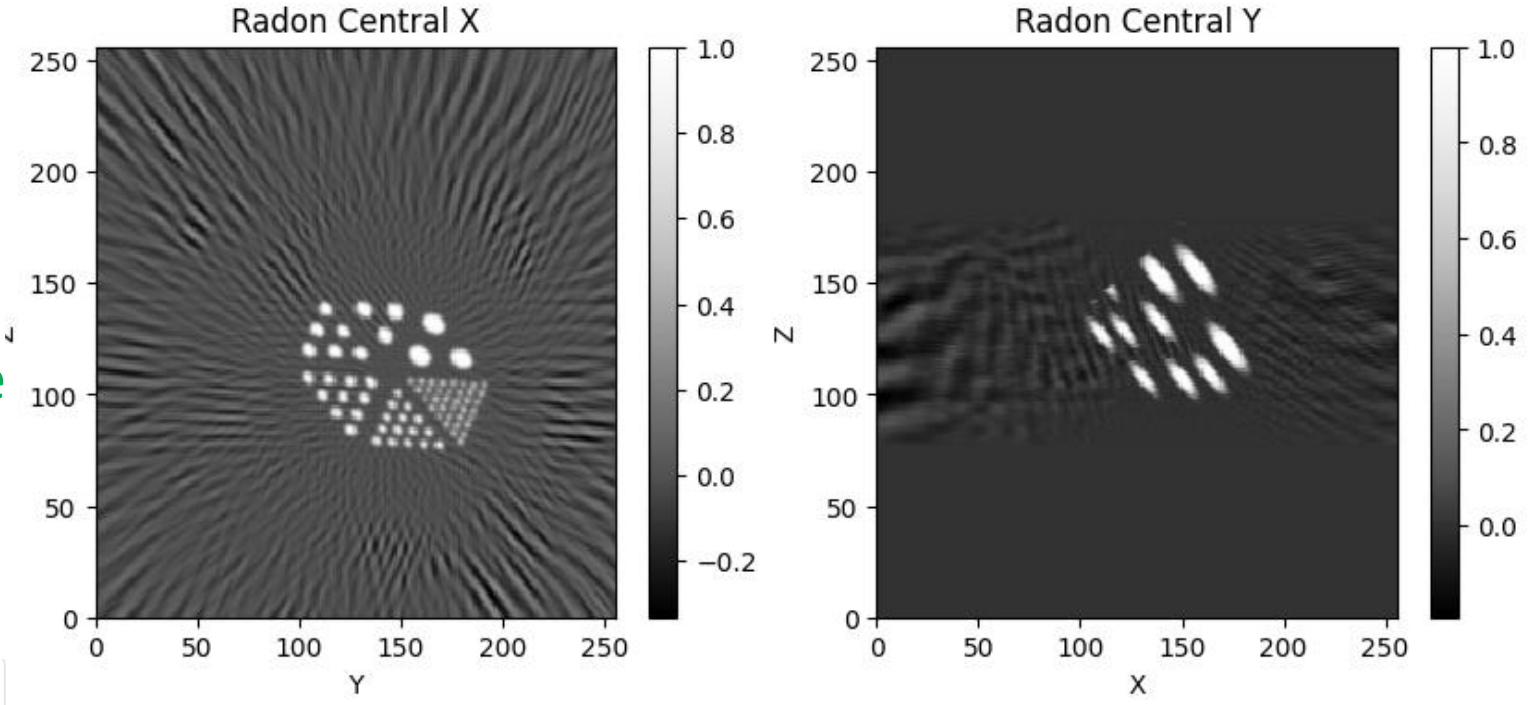
PyTorch implementation of 3D U-Net and its variants:

- `UNet3D` Standard 3D U-Net based on 3D U-Net: Learning Dense Volumetric Segmentation from Sparse Annotation
- `ResidualUNet3D` Residual 3D U-Net based on Superhuman Accuracy on the SNEMI3D Connectomics Challenge





256-angle radon projection tensors are also saved for the same events, for possible future end-to-end learned reconstruction as in the source paper



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