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Implementation and Performance of FORE-FBP for Brain Imaging on the GE SIGNA PET/MR

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Fourier rebinning combined with 2D filtered backprojection (FORE-FBP) was implemented for the GE SIGNA PET/MR. The algorithm was designed and tested for brain imaging. Spatial resolution, image uniformity and signal-to-noise ratio (SNR) were assessed for a range of maximum ring differences (ΔZ). Results were compared to those for ordered subsets expectation maximum (OSEM) and time-of-flight OSEM (TOF-OSEM). Nearest neighbor axial interpolation provided the highest FORE-FBP NEMA spatial resolution (4.4 × 4.0 × 4.0 mm at 1 cm radius for maximum ΔZ=44), which was inferior to that for OSEM/TOF-OSEM (3.4 × 2.1 × 1.5 mm). Axial resolution for FORE-FBP degraded by < 0.4 mm for ΔZ=44 compared to ΔZ=27 for radii < 10 cm. Two cylindrical phantoms of disparate internal diameters (2.2 and 19.7 cm) indicated that FORE-FBP image uniformity in the axial direction in the central axial 15 cm reached optimal levels for ΔZ=27. Image SNR for FORE-FBP improved with increasing ΔZ, with linear interpolation providing the lowest image variability. Image uniformity and SNR within the central axial 15 cm for the NEMA NU 2-1994 phantom were superior for OSEM/TOF-OSEM compared to FORE-FBP by 30% and 10-25%, respectively.

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