

Screen 13 - TOF MLEM for Total-Body J-PET with Analytical System Response and Resolution Modelling

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We report the reconstructed results of the simulated NEMA IEC and static XCAT phantoms, obtained using the original time-of-flight maximum likelihood expectation maximisation (TOF MLEM) algorithm, designed for total-body modular Jagiellonian PET (J-PET) scanners. The continuous J-PET detectors allow the system response matrix (SRM) to be defined as a set of log-polynomial models, derived from fitting the Monte Carlo simulated emissions of annihilation photons on 2D planes with differing obliqueness. The new TOF MLEM accounts for the resolution modelling in detector space, parallax effect and smearing in J-PET scintillator strips. Compared to the algorithm with no resolution model, a considerable improvement in image quality and other metrics was observed. We also explore a simplified attenuation correction using on-the-fly weighting for each measurement, which proved to be less sensitive to boundary effects and produced similar or better results than the traditional integration over bins. The proposed analytical SRM model for the total-body J-PET can be further upgraded to account for the non-collinearity, positron range and other factors.

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