

# Investigating the Influence of TOF and DOI on Spatial Resolution in Flat-Panel and Cylindrical Total-Body PET

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**Background:** As a cost-efficient alternative to cylindrical total-body PET systems, our group is developing a dual panel system based on monolithic BGO detectors with intrinsic DOI-decoding capabilities (2 mm FWHM) and good TOF resolution (327 ps).

**Objective:** Comparing the spatial resolution of a monolithic dual panel system and a pixelated cylindrical system throughout the full FOV, with an emphasis on the impact of varying TOF and DOI resolutions.

**Methods:** Point sources in a 2 cm radius warm background were simulated in GATE every centimeter along the main axes of both scanners, and images were reconstructed iteratively using MLEM. Slices and line profiles were plotted and analyzed visually.

**Results:** No clear differences were observed between reconstructions without TOF and those with a very high TOF resolution. In both systems, not measuring DOI information resulted in blurring of the point sources and mispositioning of the peaks. The WT-PET outperformed the Quadra-like device, even when it would be able to measure DOI information.

**Conclusion:** Increasing the TOF resolution may improve overall image quality but has no effect on the spatial resolution. DOI measurements are indispensable to achieve high and homogeneous spatial resolution over the full FOV, as parallax effects deteriorate the spatial resolution when the DOI is unknown. The WT-PET offers better spatial resolution than the cylindrical device thanks to the high intrinsic resolution of its monolithic detectors.

## Field

Systems and applications

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