

The design of a wide-bore 1.5T MR body coil with integrated PET detectors

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We envision a clinical workflow for the PET/MRI, in which PET/MRI is used for treatment planning and diagnostic workup for personalized cancer treatments using image-guided therapies (e.g. MR-guided radiotherapy, MR-LINAC). However, commercially available PET/MRIs have a small bore that is not suitable for scanning of patients in radiotherapy position (arms up). The aim of this study was to show the feasibility of a wide-bore body coil with integrated PET detectors that can be retrofitted into a Philips Ingenia 1.5T MR scanner, replacing the commercially available body coil.

We built and simulated a wide-bore 42-rung high-pass quadrature birdcage coil (~64 MHz). The PET detector covers were designed to minimize mirror currents and to fit within the confined space between the body coil and RF shield. Simulations were done to evaluate performance with and without PET detector covers. Additionally, we studied the effect of gradient switching on coincidence resolving time (CRT).

Simulations with and without the presence of PET detector covers indicate that PET covers are responsible for an attenuation of <2 dB (B1+ of 80%) and similar values were found experimentally. The PET energy resolution of the current setup was 11.57% and measurements of the CRT (333ps) showed no degrading effect of timing related to gradient switching.

In conclusion, we designed a body coil with integrated PET detectors that can be fitted into a Philips Ingenia 1.5T MR scanner, replacing the commercially available body coil.

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