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Integrating an annulus-shaped transmission imaging source into the body coil of a PET/MRI system: influence on MR imaging

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Accurate correction for photon attenuation is essential for quantitative simultaneous positron emission tomography/magnetic resonance imaging (PET/MRI). Several methods have been developed to derive attenuation maps based on MRI or emission data, but they all have limitations affecting their robustness and general applicability, especially in whole-body PET/MRI. As an alternative, a transmission imaging system based on an annulus-shaped source was proposed earlier. For this system, a prototype was implemented as a removable insert and it was successfully used to generate attenuation maps. In this study, we aimed to test the feasibility of integrating an annulus-shaped transmission source into the body coil of a simultaneous PET/MRI system. We showed that installing a liquid-filled hose between the RF shield and the rungs of the body coil does not significantly affect the MRI signal-to-noise ratio, and that it does not generate signals disturbing the MRI process when excited by its RF pulses (no fold-in artifacts were observed). We conclude that an annulus-shaped transmission source can be integrated into the body coil of a whole-body simultaneous PET/MRI system without compromising MRI performance. Installing the annulus at this location has a big advantage: it allows a robust method of obtaining accurate attenuation maps without sacrificing space in the patient bore. This will be of great benefit in particular for the development of wide-bore systems, which is necessary to enable simultaneous PET/MRI for a wider range of patients and applications such as radiotherapy planning.

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