Initial MR Compatibility Characterization of a preclinical PET/MRI insert

[1]Aaron Selfridge, [1]Qian Wang, [2]Felipe Godinez, [1,2]Ramsey Badawi

[1]Department of Biomedical Engineering, UC Davis, [2]Department of Radiology, UC Davis

Simultaneous preclinical PET/MRI is well suited to applications which require a dynamic process to be imaged both with PET and MRI. Parametric measurements from PET and functional parameters from MRI can then be used together to gain a better understanding of biological processes. We have designed and built a preclinical PET/MRI insert with sufficiently high sensitivity to image such dynamic processes in mice and rat brains. In this work we assess the impact of the PET insert components on image quality of a preclinical 7T MRI system.

Two opposing PET modules, containing a complete detector stack (Figure 1), were placed in the FOV during an MR acquisition, as they would sit in the completed system. A 3 cm diameter water filled tube was imaged with gradient (GE) and spin echo (SE) sequences in three configurations: No PET components, PET electronics only, and PET detector and electronics. MR images did not present any artifacts indicative of major compatibility issues or changes to magnetic field homogeneity. In the case of the SE sequence, SNR degraded from a factor of 57 at baseline to a factor of 41 in the presence of the PET electronics and detector. Uniformity similarly degrades from 90% to 88%. For the GE sequence the impact on SNR is reversed, increasing from 92 at baseline to 102 when the PET components are used. Uniformity similarly increases from 83 to 85%.

Future work will provide a comprehensive evaluation of both the PET system performance and MRI compatibility of the full detector ring during operation. Additionally, we will evaluate the impact of MRI sequences on PET performance and image quality. These evaluations will help us to make this instrument a core component of our preclinical imaging capabilities.

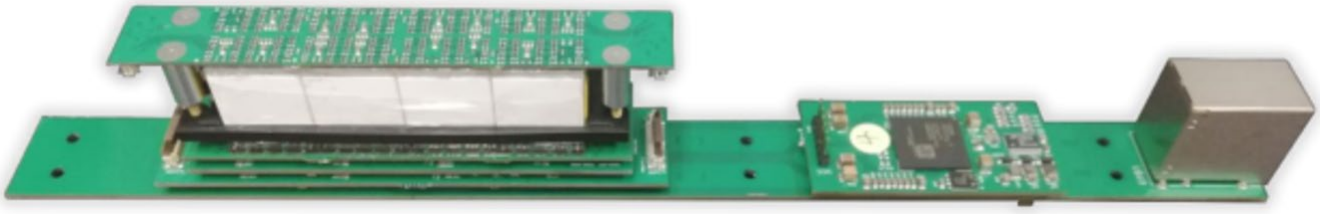

Figure 1. A single PET modules with scintillation crystal, photodetector, and preamplifiers on the left. The FPGA, power components, and connector are on the right. Two opposing modules were used to evaluate MRI compatibility.