

Reaching new horizons in pre-clinical imaging: trimodal PET-FUS-MR technology

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Combining PET with other imaging techniques such as MR or US devices has gained interest to, for example, provide anatomical information or to improve drug administration, respectively.

Recently, special interest has arisen in the use of Focal US (FUS) to open the Brain Blood Barrier (BBB) to allow drugs pass through the brain. However, since the FUS lacks of visual information it is difficult to ensure that the US are being delivered accurately and, therefore, its combination with imaging techniques such as PET or MR would represent a great advance.

To improve this area of medical imaging, we have designed and validated a pre-clinical PET device that can be used as a part of a trimodal system that combines PET-MR-FUS.

We report in this contribution the preliminary performance evaluation of the PET system as well as its compatibility to simultaneously work with our home-made low-field MR and FUS devices.

In particular, we show the preliminary NEMA results obtained with our custom PET insert, as well as the first reconstructed images (PET and MR) acquired with the trimodal system. For the trimodal study we designed a phantom that contains a layer of melting gelatin and a mixture of Cooper Sulfate and ¹⁸F. PET and MR data were simultaneously acquired while the phantom was being heated-up using FUS. The reconstructed images showed the mixing process of the elements inside the phantom when the gelatin was melting which is comparable to the process of opening the BBB.

Field

Systems and applications

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