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Combining Endoscopic Ultrasound with Time-Of-Flight PET: the EndoTOFPET-US Project

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Prostate cancer is the second most frequently diagnosed cancer in males. Pancreas cancer, on the other hand, is among the deadliest cancers. Both require advanced imaging techniques for their diagnosis and staging. The endoTOFPET-US collaboration develops a multimodal imaging technique for endoscopic exams. It combines the benefits of high resolution metabolic imaging with Time-Of-Flight Positron Emission Tomography (PET) and anatomical imaging with ultrasound (US).

EndoTOFPET-US consists in an PET head extension for a commercial US endoscope and a PET plate outside the body in coincidence with the head. This paper presents the functionality and development of this novel instrument. The high level of miniaturization and integration creates challenges in fields such as scintillating crystals, ultra-fast photo-detection, highly integrated electronics, system integration and image reconstruction.

Amongst the developments, we highlight the use of fast scintillators coupled to optical elements that concentrate the light on the active area of the photodetector as well as fast and compact digital SiPMs with single SPAD readout to obtain the best coincidence time resolution (CTR). In view of the targeted resolution of ˜1 mm in the reconstructed image, we present a prototype detector system with a CTR of better than 240ps FWHM. We discuss the challenges in simulating such a system and introduce reconstruction algorithms based on graphics processing units (GPU).

quote your primary experiment

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