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A highly multiplexed detector readout scheme for Total-Body PET

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Nowadays, the technology associated to Time-of-Flight (TOF) Positron Emission Tomography (PET) detectors is reaching the technological limit imposed by the scintillator crystal and photosensors available. Improving the TOF resolution is key to further increase the effective sensitivity of the system. As an alternative, this effective boost in sensitivity can be accomplished by increasing the solid angle coverage of the PET scanner building large axial length systems. This are the so-called Total Body PET (TB-PET) scanners.

TB-PET systems are commercially available, and the first clinical studies have been reported. These systems are the so-called Biograph Vision from Siemens with remarkable TOF capabilities of 217 ps, and the uExplorer from United Imaging. Nevertheless, from the technical perspective, there is still room for further improving these systems by including depth of interaction (DOI) information to provide homogeneous spatial resolution in the entire Field of View (FOV), and/or readout channel reduction since the large number of signals to be handle is a major concern to develop these long axial scanners.

In this work, we show the design and preliminary results of a detector geometry that allows one to mitigate these major concerns on TB-PET systems: the reduction of readout channels as well as the DOI, while providing <300 ps CTR and sub-3mm spatial resolution.

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