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Walk-Through Flat Panel Total Body PET design for efficient patient throughput

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Abstract text

The combination of longer axial field-of-view PET systems, advancements in detector technology and the use of deep learning for signal processing have enabled sub-one minute scan times at reasonable dose levels and scan quality. At this point, the patient throughput is mostly limited by patient preparation and positioning on the bed. We therefore propose a novel total-body PET scanner design consisting of two flat detector panels (each 70x106 cm^2) that adapt to patient height, placed vertically and spaced 50 cm apart (see figure 1). An additional advantage of this design is the small footprint (about 2 m^2) compared to the large installation space required for conventional scanners (30-40 m^2). After radiotracer administration, the patient can simply walk into the scanner and stand still in an upright position for a scan of 30 seconds. The scanner design offers simultaneous head and torso imaging at a high sensitivity while having an estimated cost only slightly higher than a standard (e.g. 25 cm axial field of view) PET/CT system. This is achieved by a lower number of detectors due to the proximity of the flat panels to the patient and the use of low-cost but high-resolution monolithic BGO detectors. Simulation study results show a sensitivity only 33% lower than the (roughly 3-4 x more expensive) Siemens Quadra total-body scanner. Reconstructed images of point sources show an excellent spatial resolution <2mm. A mock-up based on the patient sizes was also built to track patient motion in a standing position with optical tracking, comparing both normal-breathing and breath-hold motion. In volunteers we observed that 30 second breath-hold is feasible and that motion is reduced significantly in breath-hold mode.

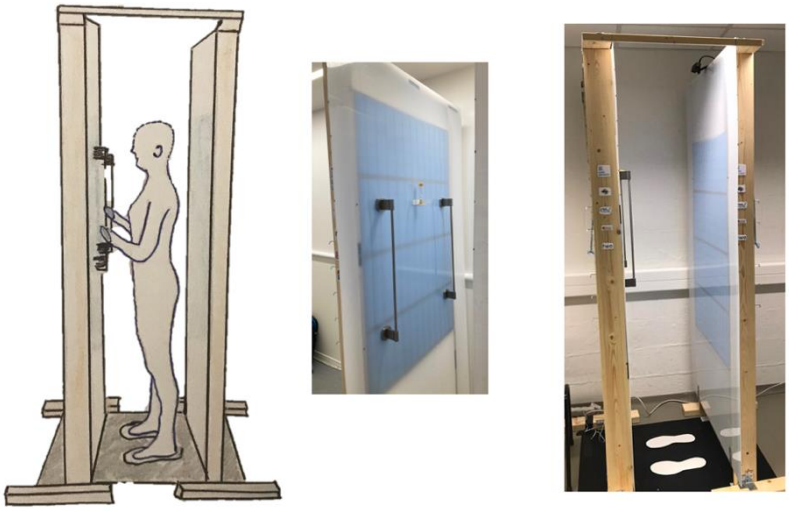

Figure 1: Artist view of the proposed scanner design (a) and mock-up used in the patient motion study (b-c).