Initial total-body rat imaging results with TBS PET using 4-layer DOI information

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Last year, we developed a total-body small animal (TBS) positron emission tomography (PET) with 4-layer depth-of-interaction (DOI) detector for high-sensitivity molecular imaging. In this study, we present the initial total-body rat imaging results of the TBS PET. The TBS PET had an inner diameter of 155 mm and an axial length of 325.6 mm which can cover a rat whole-body (Fig. 1). Each DOI PET detector consisted of 4-layered 16×16 GSOZ crystals (2.8×2.8×7.5 mm^3) and an 8×8 array multi-anode PMT. The peak sensitivity of 16.7% was obtained at the center of the FOV. The total-body rat images with FDG and NaF radiopharmaceuticals were obtained for 15 min, respectively. The list-mode PET data were reconstructed by using OSEM algorithm with 8 subset and 6 iterations. The voxel size was 1.5×1.5×1.5 mm^3. The NaF imaging shows a clear identification of skeletal structures such as skull, rib, and (Fig. 2). The FDG imaging shows a high glucose metabolism on the rat brain. The rat brain structures such as cerebellum, cortex, thalamus and olfactory bulb were well identified in the multiple slice images (Fig. 3). In conclusion, we successfully demonstrated the total-body rat imaging with various radiopharmaceuticals using the TBS PET. In the future, we plan to use the TBS PET for ultra-low activity imaging applications such as single-cell tracking and in-beam PET imaging.

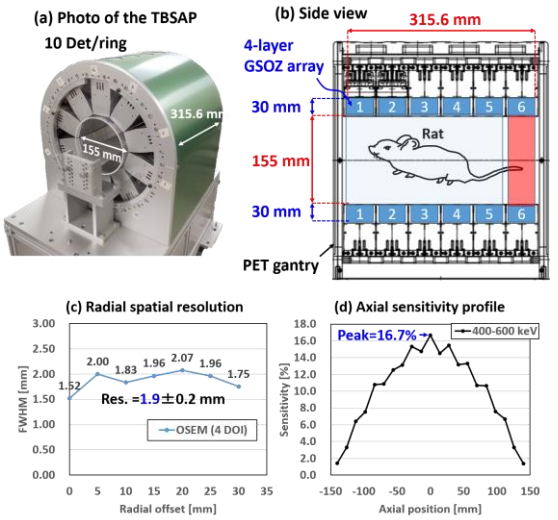

Fig. 1. (a) Photo of the TBS PET scanner, (b) side view, (c) radial spatial resolution, and (d) axial sensitivity profile.

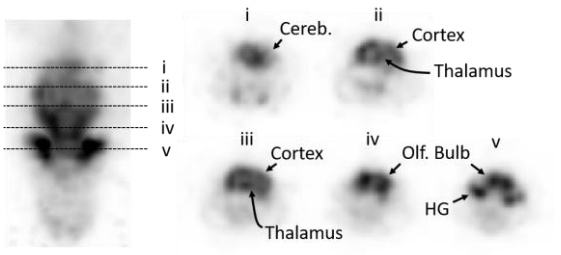

Fig. 3. Rat mouse FDG multi-slice images with different slice levels: (i) cerebellum (cerb.), (ii-iii) cortex and thalamus, (iii) olfactory bulb, (v) olfactory bulb and harderian gland (HG).

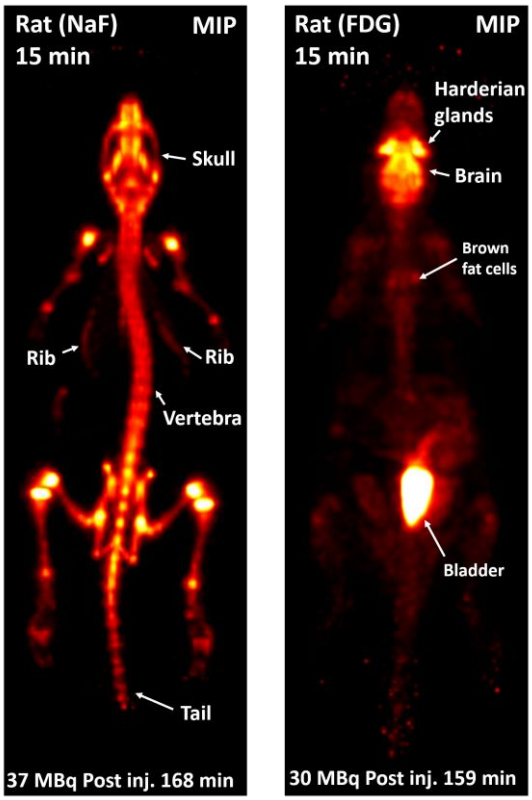

Fig. 2. The total-body rat imaging results: (left) bone imaging with NaF, (right) glucose metabolism imaging with FDG.