

## Summary

### Performance Evaluation of Continuous Blood Sampling System for PET Study: Comparison of Three Detector-Systems

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**[Objectives]** To measure cerebral blood flow with  $^{15}\text{O}$  PET, it is necessary to measure the time course of arterial blood radioactivity. We examined the performance of three different types of continuous blood sampling system. **[Methods]** Three kinds of continuous blood sampling system were used: a plastic scintillator-based beta detector (conventional beta detector (BETA)), a bismuth germanate (BGO)-based coincidence gamma detector (Pico-count flow-through detector (COINC)) and a Phoswich detector (PD) composed by a combination of plastic scintillator and BGO scintillator. Performance of these systems was evaluated for absolute sensitivity, count rate characteristic, sensitivity to background gamma photons, and reproducibility for nylon tube geometry. **[Results]** The absolute sensitivity of the PD was 0.21 cps/Bq for  $^{68}\text{Ga}$  positrons at the center of the detector. This was

approximately three times higher than BETA, two times higher than COINC. The value measured with BETA was stable, even when background radioactivity was increased. The count rate characteristic of the PD and COINC was linear up to 8 kcps. The reproducibility of sensitivity for nylon tube geometry of COINC was the smallest (C.V. = 1.00%) among the three. PD was the weights the least (3.5 kg) among the three, which is convenient for clinical use. **[Conclusions]** Each detector has unique characteristics derived from its own structure. Although the performance of all three detectors meets clinical requirement, PD had the highest physical performance.

**Key words:** Positron-emission tomography, Continuous blood sampling system, Phoswich detector, Beta detector, Pico-count flow-through detector.