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## The PETITION project – Image reconstruction software using only emission data for full and open ring PET scanners

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The PETITION (PET for InTensive Care units and Innovative protON therapy) collaboration is currently developing two compact brain Positron Emission Tomography (PET) scanners with a focus on new clinical applications. The first device (ICU device) is a mobile scanner intended to scan deeply sedated, critically-ill patients with sepsis directly in the Intensive Care Units (ICU). The second device (PBT device) is designed for proton beam therapy (PBT) for the purpose of online in vivo dosimetry and hypoxia tracking studies.

The PET scanners are built with custom-made mechanics to match the different requirements of the two applications. While the ICU device is a conventional full ring scanner, the PBT system features an opening which allows for proton irradiation during image acquisition. The detector readout electronics are identical for both system. Lutetium-yttrium oxyorthosilicate scintillators arranged in blocks of crystals are combined with Silicon Photomultipliers as active detector elements.

The image reconstruction software is based on the well-known ordered subset expectation maximisation (OSEM) algorithm. For quantitative PET, image corrections are imperative and commonly external information is used for scatter and attenuation estimates. However the PETITION devices have neither radionuclide transmission sources nor X-ray computed tomography available, and emission only data correction has to be used. While the transmission-less method is already used with full ring PET scanners, it is usually not used with open ring devices.

This document gives a quick overview of the PETITION scanners before presenting preliminary results of image reconstruction and correction based on emission data only for both PETITION scanners geometries.

### Topic Selection

Brain Imaging

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