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The AX-PET Experiment: A Demonstrator for an Axial Positron Emission Tomography

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The AX-PET (AXial Positron Emission Tomography) experiment proposes a novel geometrical approach for a PET scanner, in which long LYSO scintillator crystals are placed axially in the tomograph. Arrays of WLS strips, placed behind each layer of crystals, provide the measurement of the axial coordinate. Both the crystals and the WLS strips are individually read out by G-APDs (Geiger-mode Avalanche Photo Diodes). Such a matrix of LYSO crystals and WLS strips allows for a 3D localization of the photons interactions (both photoelectric absorption and Compton scattering), with good spatial resolution and without compromising on the sensitivity of the detector.

Two AX-PET modules have been built at CERN and fully characterized with point-like Na-22 sources, demonstrating competitive performance in terms of spatial and energy resolutions. Operated in coincidence, the two modules represent the demonstrator for a PET prototype, which has been successfully used for the reconstruction of images of several phantoms filled with F-18 in aqueous solution.

The AX-PET detector concept, its performance, the reconstructed images of different phantoms will be described. We will also report about experimental studies of the digital Silicon Photomultipliers (dSiPM) from Philips as alternative photodetectors for the AX-PET. With their highly integrated read-out electronics and excellent intrinsic time resolution, dSiPMs may allow for compact detector modules with Time of Flight capability (TOF-PET).

Primary author: CASELLA, Chiara (ETH Zurich)

Presenter: CASELLA, Chiara (ETH Zurich)

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