

Demonstration of an Axial PET concept for brain and small animal imaging

Saturday, 20 February 2010 09:25 (25 minutes)

We present the experimental demonstration of a new geometrical concept for high resolution PET imaging, immune from parallax error and magnetic field. We aim to overcome the main performance limitations of standard PET cameras (with radially arranged crystals), whose lack of Depth Of Interaction of the 511 keV gamma-ray and incapability of recognizing Compton events inside the crystals cause a non-uniform spatial resolution.

Our concept consists of long scintillation LYSO crystals, axially arranged around the Field Of View, and Wave Length Shifter (WLS) strips, orthogonal to the crystals. The energy measurement and the transverse coordinates (x, y) are provided by the crystals, while the axial coordinate is obtained from the strips. The photons from crystals and WLSs are individually read out by G-APDs. The spatial resolution only depends on the cross section of the crystals and on the WLS strip width, while the sensitivity can be enhanced increasing the number of crystal layers. Simulations show that about 60% of Compton events in the crystal matrix can be reconstructed.

Two AX-PET modules –each with 48 crystals and 156 WLS strips –have been built and fully characterized. Specific simulation and reconstruction software has been developed. We found very good energy resolution of 11.5% (FWHM) at 511 keV and spatial resolution of better than 2 mm (FWHM) in all 3 coordinates. Coincidence measurements with point-like sources and with PET phantoms are in preparation.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

<https://twiki.cern.ch/twiki/pub/MCPAD/PaoloBeltrame/ViennaSummary.pdf>

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Session Classification: Applications 1