Performance of the HEPD-02 LYSO calorimeter and expected sensitivity to GRBs detection

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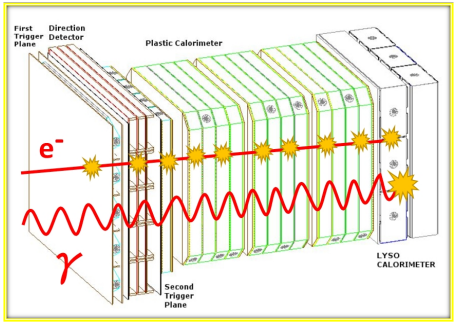
HEPD-02 spectrometer and GRBs detection



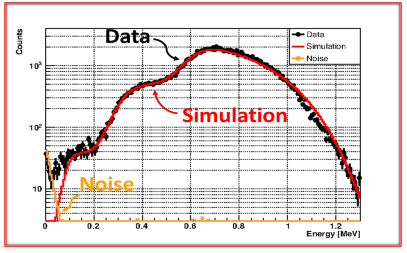
HEPD-02 is composed by two planes of segmented plastic scintillators that acts as triggers, a silicon MAPS tracker placed between the two trigger layers and a calorimeter. The calorimeter is divided in twelve plastic scintillators, each read by two PMTs and two final layers, each made of three LYSO bars. All the detector is surrounded by a veto system.

HEPD-02 could identify γ-ray converting in the LYSO scintillator by requiring the other detectors to act as veto. This instrument could be used to study the nature of Gamma Ray Bursts, the most powerful astrophysical γ-ray sources.

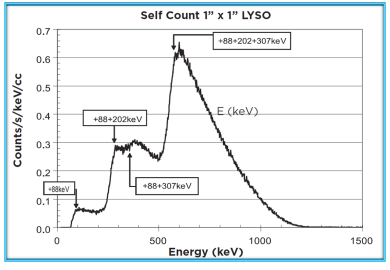
Experimental set-up and measured spectrum

LYSO radioactivity constitues an **important limitation to the HEPD sensitivity to low energy γ-ray**, therefore, it is necessary to proper address the background spectrum in order to evaluate the minimum detectable energy with a sufficient sensitivity.

The spectrum presents all three ^{176}Lu features each one corresponding to the capture of a combination of photons of 308 keV, 201 keV, 88 keV. It is possible to obtain a residual rate below 1 Hz for energy superior than 1.5 MeV, this implies that the **GRBs measurements are feasable for energy greater than 2 MeV.**



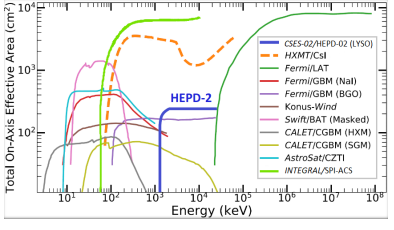
LYSO background spectrum



The main weak point in using LYSO as scintillating crystal is its high radioactive background due to the presence of the natural occurring **^{176}Lu** that decays **β⁻** producing Hafnium which relaxate by emitting **three γs** respectevelly of **306.8 keV, 201.8 keV** and **88.3 keV**, with minor probability also a fouth X-ray is emitted.

$$^{176}\mathrm{Lu} \longrightarrow {}^{176}\mathrm{Hf}^{*} + e^{-} + \bar{\nu}_e$$

Effective Area and GRBs detection



HEPD-02 will be able to **detect γ-ray photons above 2 MeV up to 20 MeV**. In this energy range the sky is observed just by INTEGRAL, HXMT and Fermi-BGO (and also CALET with a minor acceptance). HEPD-02 could join the GRBs campaign helping potentiate the sky coverage and better understand these phenomena, in particular in conjunction with GW detections.