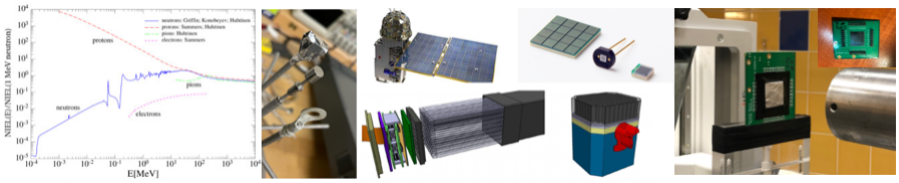

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The GALI-ISS Mission - a Gamma-ray Burst Localizing Instrument

Thursday 28 April 2022 13:00 (25 minutes)

The Gamma-ray Burst Localizing Instrument (GALI) is a new concept for localizing γ-ray bursts (GRBs), by utilizing the mutual occultation between numerous small scintillators. In a sense, the method is similar to the coded mask aperture, only that the mask itself is composed of detecting scintillators, so that most of the photons are being detected. The large number of scintillators compensates for the low count rates in each individual scintillator.

We built a laboratory prototype with 90 SiO2-coated CsI(Tl) scintillators of (9mm)ˆ3 wrapped in Vikuiti film and coupled to Si photomultipliers (SiPMs). To test the direction reconstruction capabilities of GALI, we exposed it to a 10 mCi 241Am source placed ˜3.5 m away to simulate a distant source, so that the flux of the 59.6 keV line is ˜50 ph cm-2 s-1 .Subsequently, we scan the entire hemisphere by rotating the detector system varying θ between 0 and 90° and ϕ between 0 and 360° with 5° intervals. For each angle we acquire two kinds of measurements: a 60 s long exposure (corresponding to up to ˜ 3000 counts on each scintillator), and a series of 100 bursts 0.5 s long. The obtained measurements are analyzed offline.

To quantify the advantages of the instrument, we compared the performance of the GALI prototype with a large 4-scintillator detector system connected to traditional PM Tubes. We found that GALI reconstructs burst directions with an accuracy between 1.3° and 2.8°, compared to between 3° and 21° for the 4-scintillator detector. It can be concluded that GALI performs strictly better in all measured directions.

We are currently building, integrating, and testing a larger version of GALI for the International Space Station (ISS), composed of 362 scintillators We will describe the experiments for lowering the photon-energy threshold and optimizing the electronics (ASIC, FPGA, and CPU) parameters. Namely, we examine the influence of the ASIC bias voltage, threshold voltage and its different calibration modes on spectra of laboratory γ-ray sources We will also present the status of the new GALI-ISS mission and the state of the hardware.

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