

The Focal Surface of the JEM-EUSO Instrument

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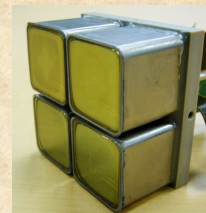
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Abstract

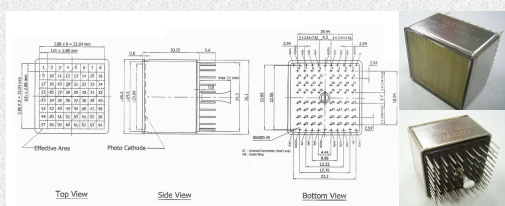
The Extreme Universe Space Observatory on JEM/EF (JEM-EUSO) is a space mission to study extremely high-energy cosmic rays. The JEM-EUSO instrument is a wide-angle refractive telescope in near-ultraviolet wavelength region to observe timeresolved atmospheric fluorescence images of the extensive air showers from the International Space Station. In this paper we describe in details the main features and technological aspects of the focal surface of the instrument. The JEM-EUSO focal surface is a spherical curved surface, with an area of about 4.5m². The focal surface detector is made of more than 5,000 multi-anode photomultipliers (MAPMTs). Current baseline is Hamamatsu R11265-03-M64. The approach to the focal surface detector is highly modular. Photo-Detector-Modules (PDM) are the basic units that drive the mechanical structure and data acquisition. Each PDM consists of 9 Elementary Cells (ECs). The EC, which is the basic unit of the MAPMT support structure and of the front-end electronics, contains 4 units of MAPMTs. In total, about 1,300 ECs or about 150 PDMs are arranged on the whole of the focal surface of JEM-EUSO.

MAPMT Support Board



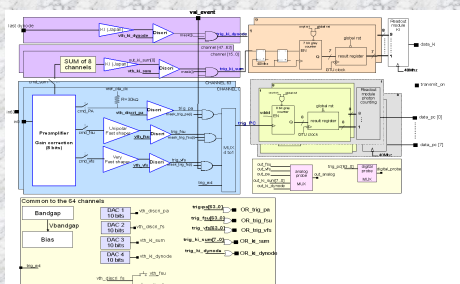
The base board is made with PEEK and bonds PMTs with HYSOL. It doesn't destroy the MAPMT when the PDM is vibrated with 20 Grms.

64ch Multi-Anode PMT with Ultra Bi-Alkali Photo Cathode

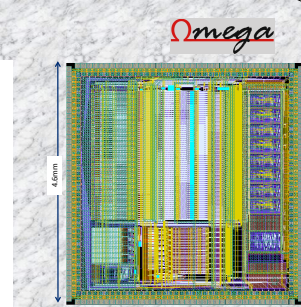


Mechanical drawing of the 64ch MAPMT and its photograph.

64ch Front-End ASIC

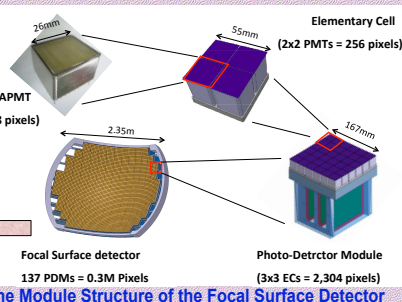


Schematic of the ASIC. This has 64 channel photon counting circuits and 9 channel charge counting circuits. This works with 0.66W/ch.

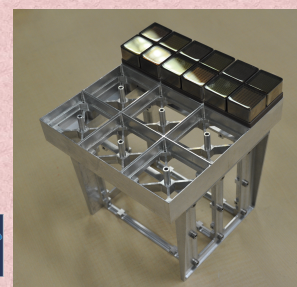


Layout of the ASIC. The ASIC chip is mounted on the ASIC board put on the back of the PMT Support Board.

JEM-EUSO Focal Surface

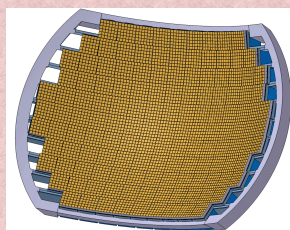


PDM Structure

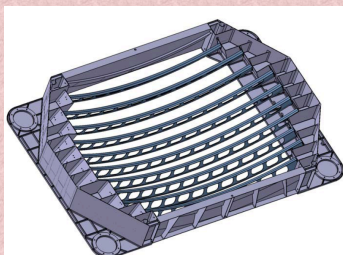


The prototype of the PDM structure with 3 ECs.

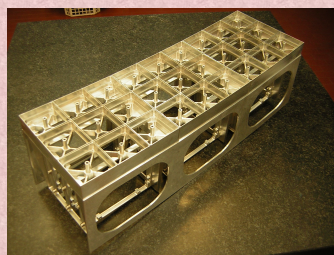
Focal Surface Layout and Support Structure



The shape of the focal surface is a spherical surface with about 2,500 mm radius. The PDMs should have a layout which minimizes the gaps on that surface. This is the PDM layout in case of 137 PDMs.



The FS Frame has the rib structure. This is made by an aluminum alloy type 7075 T4.



The prototype of the rib structure and 3 PDM structures.