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The JEM-EUSO global light system laser station prototype

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We describe the design and fabrication of a prototype Global Light System (GLS) laser ground station for the JEM-EUSO project. The GLS will be a network of ground-based UV LEDs and steered lasers to monitor and calibrate the JEM-EUSO cosmic ray detector planned for the International Space Station. The GLS units will generate optical signatures in the atmosphere that are comparable to tracks from cosmic ray extensive air showers (EASs). Unlike the EASs, the number, time, energy, location and direction (for lasers) of GLS events can be specified as JEM-EUSO passes 400 km overhead.

Laser tracks from the GLS prototype will be recorded by prototype detectors in ground-to-ground tests. Distant tracks with low angular speed are of particular interest because these are the types of EAS tracks that will be measured by JEM-EUSO. To do this ground-to-ground tests, the prototype detectors will need to measure the laser through the atmosphere at low elevation viewing angles. The beam energy can be adjusted from 1 to 90 mJ to compensate for this additional atmospheric attenuation. The frequency tripled YAG laser produces 355nm (7 ns pulse) light. This wavelength is near the center of the UV EAS fluorescence spectrum. The system is housed in a utility trailer that can be pulled by a small truck for domestic campaigns or rolled into an industry standard 20 foot container for global deployment. In operation mode, the laser platform inside the trailer is isolated mechanically to maintain beam pointing accuracy. A retractable two stage steering head can point in any direction above the horizon. A slip ring eliminates cable wrap problems. The GLS prototype will be used to test the EUSO-TA detector and will also be used in preflight tests of the EUSO-balloon payload planned for a super pressure balloon mission.

Collaboration

JEM-EUSO

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