



Contribution ID: 1356

Type: Poster

In-service Calibration of EUSO Detectors Using Stellar Signals with Atmospheric Transmission Modeling

The JEM-EUSO program focuses on developing UV-sensitive detectors for observing ultra-high energy cosmic rays (UHECR) and astrophysical neutrinos from ground-based, balloon-borne, and space-borne platforms. Stars, as point-like objects with well-known UV emission, are ideal candidates for in-service calibration. In this work, we analyze data from EUSO-TA, EUSO-TA2, and EUSO-SPB2 experiments to measure the intensity of stellar signals. Using satellite data on cloud cover and aerosols, we account for atmospheric effects by modeling atmospheric transmission with the libRadtran software, thereby improving calibration accuracy. The analysis pipeline presented here enables calibration of the detectors through the determination of their point spread functions and stellar signal amplitudes. This method is applicable to future UHECR and astrophysical neutrino observations based on the EUSO experience, particularly in scenarios where near-the-limb observations require precise atmospheric corrections as stars appear above the limb. Discussed approach may also find application in other atmospheric observations and be extended to detectors outside the EUSO family.

Collaboration(s)

The JEM-EUSO Collaboration

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Session Classification: PO-1

Track Classification: Cosmic-Ray Indirect