THE ANGLE DETECTING INCLINED SENSORS (ADIS) SYSTEM: MEASURING PARTICLE ANGLES OF INCIDENCE WITHOUT POSITION SENSING DETECTORS

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We report on a novel system, the Angle Detecting Inclined Sensors (ADIS), for determining the angles of incidence of Solar Energetic Particles, Galactic Cosmic Rays and Anomalous Cosmic Rays. This system would be especially applicable to compact high resolution energetic particle telescopes. The response of charged particle detectors varies with particle pathlength, which depends on angle of incidence. Achieving good elemental and isotopic resolution requires correcting for this effect. ADIS consists of three detectors, two of which are inclined at an angle to the telescope axis, forming the first detectors in a multi-element telescope. By comparing the signals from the ADIS detectors, and using the computable angle dependent pathlengths through the detectors, the angle of incidence may be determined. The ADIS system thus can replace hodoscopes using conventional position sensing detectors (PSD's). PSD's add significant complexity and require additional electronics, thus increasing instrument mass, power usage and, in many cases, telemetry requirements. With a power law approximation for the range-energy relation for ions stopping in a detector using ADIS, we derive simple equations for the incident particle charge and trajectory. These calculations are well within the capabilities of even the slowest on-board processors. We present Monte-Carlo modeling of such an instrument to demonstrate the system's capabilities. ADIS may also have applications for other charged particle measurements, such as in cosmic ray air shower arrays or accelerator experiments.