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An Instrument to Measure Atmospheric Neutron Intensities

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We report progress in the development of a fast-neutron telescope, operating in the range from 10-150 MeV, capable of measuring the atmospheric neutron intensity as a function of direction and energy. We also report new measurements of ground level cosmic-ray atmospheric neutrons. The SONTRAC instrument was conceived at Case Western Reserve University [1]. The original intent of the instrument was to measure solar flare neutrons from balloons or low Earth orbit, where the background is a combination of gammas and neutrons from the platform and the Earth's atmosphere. To reject this background while measuring the neutrons, the instrument measures the location, path and energy of the recoil protons from (n,p) scatters in plastic scintillator. The kinematics of (n,p) scattering allow one to determine the direction and energy of each triggered event.

The active cubic volume is a stack of scintillating fiber sheets. The sheets are comprised of parallel scintillating fibers, nominally 300 µm on-center, and are then stacked with their fiber orientations alternating and mutually orthogonal. The cube faces are viewed by opto-electronic devices to record the luminous path of recoil protons. The prototype was calibrated with proton beams showing that heavily ionizing protons are easily recognized and measured [2].

A 20 cm version of SONTRAC is capable of making rapid measurements of the neutron intensity at various flight altitudes. Smaller versions could be developed to perform long flight-path integrations of the differential neutron intensity. Future development of the instrument includes lower channel-count opto-electronic readout devices and algorithms for processing and analyzing data.

A $(5\ \mathrm{cm})^3$ prototype is making measurements of the ground-level neutron intensity in the lab. Preliminary measurements will be presented.

References

[1] *19th Intern. Cosmic Ray Conf.*, **5**, Pp. 498-501 (SEE N85-34991 23-93).

[2] *Innovative Telescopes and Instrumentation for Solar Astrophysics*, Ed. Stephen L. Keil,Sergey V. Avakyan. Proceedings of the SPIE, **4853**, pp. 399-410 (2003)