

Executive Summary

Response functions of semi-leaded neutron monitor count rates and leader rates from latitude surveys during 2019-2020

P. Yakum,^{a,*} S. Khamphakdee,^a W. Nuntiyakul,^a D. Ruffolo,^b P. Evenson,^c
P.-S. Mangeard,^c A. Sáiz,^b C. Banglieng,^d A. Seripienlert,^e P. Jiang,^f
P. Chuanraksasat,^e K. Munakata,^g J. Madsen,^h B. Soonthornthum^e and
S. Komonjinda^a

^aDepartment of Physics and Materials Science, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand

^bDepartment of Physics, Faculty of Science, Mahidol University, Bangkok 10400, Thailand

^cDepartment of Physics and Astronomy, University of Delaware, Newark, DE 19716, USA

^dDepartment of Physics, Faculty of Science and Technology, Rajamangala University of Technology Thanyaburi, Pathum Thani 12110, Thailand

^eNational Astronomical Research Institute of Thailand (NARIT), Chiang Mai 50180, Thailand

^fPolar Research Institute of China, Pudong, Shanghai 200136, China

^gPhysics Department, Shinshu University, Matsumoto, Nagano 390-8621, Japan

^hWisconsin IceCube Particle Astrophysics Center, University of Wisconsin-Madison, WI 53703, USA

We have developed a portable neutron monitor (“Changvan”) with three sections to investigate cosmic ray spectral variations via latitude surveys. The Changvan uses the NM64 design for two sections, but the third lacks the lead producer, so we call this a “semi-leaded” neutron monitor. The Changvan was operated on two voyages on the Chinese icebreaker *Xuelong* between Shanghai and Antarctica during 2019 and 2020. Repeated measurements with the same detector over different phases of the solar cycle provide precise information about cosmic ray spectral variation. In addition, we tested two techniques to track spectral variations, which can be implemented at fixed stations. The count rate ratio of unleaded vs. leaded counters varies with geomagnetic cutoff rigidity, indicating sensitivity to the cosmic ray spectrum. Histograms of the time delay between successive neutron counts determine the leader fraction, also used to monitor short-term and solar-cycle spectral variations. We report measurements of the response functions of the count rates and leader rates of the unleaded and leaded counters during these two latitude surveys. We found in this work that the count rate and leader rate ratio of unleaded vs. leaded counters varies linear trend with geomagnetic cutoff rigidity, indicating sensitivity to the cosmic ray spectrum.

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*Presenter