EXPERIMENTAL SIMULATION OF MARTIAN NEUTRON LEAKAGE SPECTRUM; D.M. Drake, S. Wender, R. Nelson, and E. R. Shunk, Los Alamos National Laboratory, Los Alamos, NM 87545; Winfried Amian, UFA, Julich, FRG; Peter Englert, San Jose State University, San Jose, CA; Johannes Bruckner, Max-Planck Institut fur Chemie, Mainz, FRG; Manfred Drosg, University of Vienna, Vienna, Austria

The boron loaded plastic scintillator that partially surrounds the Gamma Ray Spectrometer (GRS) of the Mars Observer satellite has two functions. First, via anticoincidence, it allows pulses that are caused by energetic cosmic rays to be eliminated from the gamma-ray spectrum, and second, it counts cosmic ray created neutrons that leak from the martian surface. Due to the fact that the plastic shield is divided into four parts similar to the sides of a pyramid, the neutron leakage spectrum can be parameterized by the four counting rates. Because the space craft velocity is larger than that of thermal neutrons, the front face of the counter counts faster than the back face.[1]

In a previous paper[2], we modeled the neutron leakage spectrum using a neutron transport code for various martian surface conditions (dry and wet regolith, layers, and carbon dioxide overlay). These spectra were parameterized into epithermal and thermal parts in order to facilitate identification regolith features.

Although we have a high degree of confidence in the codes used, we thought some experimental verification of the trends predicted would be appropriate.

To this end we filled a large container with pseudo "martian sand" whose composition was similar to that found at Chryse and bombarded it with pseudo cosmic rays, i.e., 800 MeV protons from the Los Alamos LAMPF accelerator.

The LAMPF beam was delivered in pulses whose time duration was less than a nano-second, about twenty time per second. The leakage neutrons were detected by ^{6}Li glass detectors located at the end of a 30 meter evacuated flight path. The time of flight neutron spectra were converted to energy spectra and corrected for detector efficiency so that they could be compared directly to the calculated spectra.

Preliminary results of this experiment show the neutron spectrum to be considerably harder than calculations using infinite plane geometry. We attribute this difference in part to the finite size of the containers.

References

1) William C. Feldman and Darrell M. Drake, Nuclear Instruments and Methods A245 (1986) 182.
2) D. M. Drake, W. C. Feldman, and B. M. Jakosky, Journal of Geophysical Res. 93 (1988) 6353.