DAN/MSL INSTRUMENT: FIRST FIELD TESTS. M.L Litvak[1], I.G. Mitrofanov[1] , V. N. Shvecov[2], G.N. Timoshenko[2], A.S. Kozyrev[1], A.V. Malakhov, M.I. Mokrousov[1], A.B. Sanin[1], V. Tretyakov[1], A. Vostrukhin, D. Golovin[1], A. Varenikov[1] , [1]Space Research Institute, RAS, Moscow, 117997, Russia, litvak@mx.iki.rssi.ru , [2]Joint Institute for Nuclear Research, 141980, Dubna, Russia

Introduction: The Dynamic Albedo of Neutrons instrument is designed especially for Mars Science Laboratory mission to 1) Estimate average content of hydrogen (possible as part of hydrated minerals) along the path of MSL rover; 2) To deconvolve vertical distribution of Hydrogen under the rover as a function of depth [1-3].

The DAN instrument operates like a "neutron radar" and uses principles of neutron activation analysis taken from Earth based geological applications and adopted for space implementation. DAN is composed of two separated units: DAN Pulsing Neutron Generator (DAN/PNG) and DAN Detectors/Electronics (DAN/DE). First unit is a pulse emitter of high energy neutrons to irradiate the subsurface, second one is a detector of thermal and epithermal neutrons thermalized in the subsurface after irradiation.

Calibrations & Field Tests: In 2009 second flight model of DAN has been assembled, tested and passed through series of physical calibrations and field tests. All tests have been divided into two groups: indoor and outdoor measurements. Here we would like to focus on outdoor activity (field tests) which took place in the vicinity of Moscow (Russia) at the special geological test area used by Moscow State University to teach future geologists. Several soil targets have been prepared to test DAN sensitivity to the different distribution of water in the subsurface. First set of targets was related with homogeneous soil model : 1 m diameter x 1 m depth of sand SiO2 with homogeneously distributed naturally adsorbed water, (see figure 1, upper graph). Second set of targets was prepared artificially trying to simulate layering structure of martian regolith. On the top we still have sand with naturally absorbed water but at the bottom (depth is varied from 10 up to 40 cm) we have so called "water lens" with enhanced content of water. Usually it was 3-4% higher in comparison with the natural distribution (see an example on figure 1, bottom graph). For all soil targets DAN measurements have been performed to get time profiles of thermal neutrons (die away curves) generated in the subsurface within ~ 1000 ms time window right after the DAN/PNG neutron pulse. The results of comparison between such measurements for different soil targets are shown on the figure 2. It is seen that even small increase of water content at depth 15-30 cm can be detected by DAN instrument.

All results have been modeled using MCNPX code and used to calibrate and adjust DAN numerical model.

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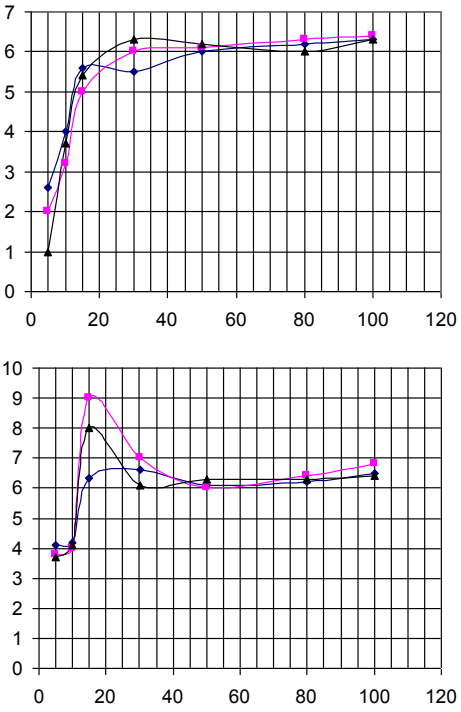

Fig.1. Soil targets with different depth distribution of water: Homogeneous model (upper graph) and layered model (bottom graph). X axis corresponds to depth in cm, Y axis corresponds to Humidity in %

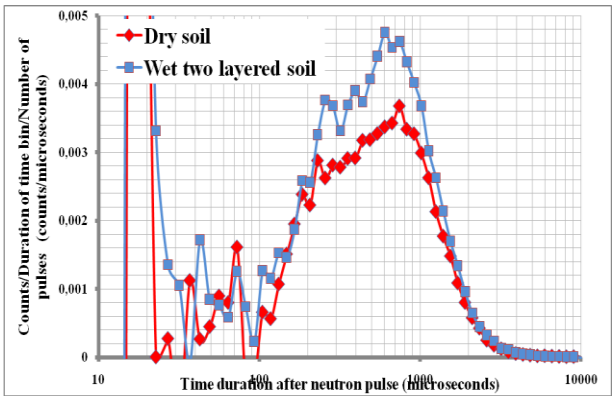

Fig.2. The DAN measurements (thermal neutron die away curves as a time profiles measured right after neutron pulse) are presented for different types of soil mod-

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References:
[1] Litvak M.L. et al. (2007) *38th LPSC*, abstract # 1554. [2] Litvak M.L. et al. (2008) *39th LPSC*, abstract # 1549 [3] Litvak M.L. et al. (2008), *Astrobiology*, 8,3, 605-612.