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NEW SIMULATIONS FOR RADIATION SHIELDING MATERIALS IN LUNAR HABITATS

Abstract

Regolith utilisation in habitat construction is at the heart of this paper. This work aims to study the shielding properties of lunar regolith in the Moon radiation environment. The simulations are done with RayXpert® software developed at TRAD Tests Radiations. The software is a Monte Carlo based user-friendly tool. It allows for selective generation of primary radiation sources, detailed 3D visualisations and energy deposition calculations based on GEANT-4 physics. The results are compared to a simplified scenario simulated with Geant4. Geant4 has been extensively used for studies of radiation protection of astronauts in space, which is the reason why these simulations and results are adopted as the ground truth. The radiation protection potential is evaluated from the secondary emissions produced behind a regolith wall of a hemispheric dome and their relative significance both in terms of energy deposition and quality factors. This study allows evaluating the capability of RayXpert® to perform this kind of calculations. The results are also used to identify the range of the habitat wall thickness that favours radiation dose reduction according to As Low As Reasonably Achievable principle. Regolith compactness and wall thickness will directly affect the architectural freedom in habitat construction. The results will be discussed to design the final habitat wall composition and thickness. The outlook section of this paper suggests a list of supplementary materials which can be put into a multilayer structure to enhance radiation protection.