Status of the ROSSINI project at GSI*

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Overview

Since the end of the Apollo missions, human spaceflight concentrated on missions in Low Earth Orbit thus reducing one of the major risk for man in space - radiation. Due to Earth's magnetic field, astronauts are largely protected from cosmic radiation originating from the sun or outside our galaxy. This situation will change significantly when the final destination is beyond this protection and deeper into the solar system. The feasibility of missions into deep space is strongly connected to the capability of protecting astronauts from the harsh radiation environment in interplanetary space [1]. Passive shielding, a well known technique in radiation protection, shows great promises in reducing the health risk induced by the space radiation environment.

The ROSSINI project

The ROSSINI(RadiatiOn Shielding by ISRU and/or INnovative MaterIals for EVA, Vehicle and Habitat) project is funded by ESA and started in 2012. The goal of the experiment is to select innovative shielding materials and provide recommendations and guidelines for space radioprotection in different mission scenarios. These include the protection of spaceships, which require light and durable shielding materials, as well as the shielding of possible permanent bases on Mars or Moon, where available material like regolith can offer the needed protection.
The project is a common effort of Thales Alenia Space, GSI, SpaceIT and ESA.

Experiments

The shielding effectivness of all candidate materials is assessed through dose reduction curves and/or Bragg-Peak measurments similar to the experimental setup in [2].
For the most promising materials a characterization of the mixed radiation field produced by heavy ions impinging on the targets is perfomed. Particle identification is achieved with a BaF_2 telescope and kinetic energy with the time-of-flight technique [3].
First experiments were performed in June 2012 at NSRL/Brookehaven National Laboratory (USA), and in August and October 2012 at Cave A/GSI using high energy heavy ion beams.

Status and outlook

Experimental data taken during the measurment campaign in 2012 at GSI is currently being analysed [Fig 1]. Based on the gained experience, optimizations of the detectors and electronics are currently in progress, as well as changes of the experimental site Cave A. Further experiments are expected to be performed at the end of 2013.

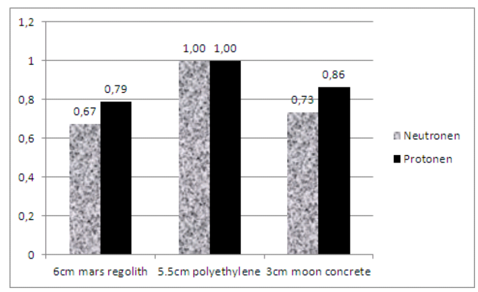

Figure 1: Preliminary relative proton and neutron production rate for 1 GeV/u Ti beam impinging on different shielding materials of 5 g/cm^2 thickness. All results are scaled to Polyethelene, which is a widely used radiation shielding material.

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