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Monte-Carlo simulation of a biochip irradiation during a Mars mission

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Detecting life in the Solar System is one of the great challenges of new upcoming space missions. One way to detect organic matter on extra-terrestrial objects could be the use of biochips.

A biochip is composed of biological sensitive systems called ligands (like antibodies) fixed on a slide, which allow the detection of specific organic molecules, called biomarkers. In the case of measurements on site (from samples extracted from the planetary soil) the main concern is to ensure the survival of the biochip during the full mission. Space radiation seems to be a critical parameter, requiring a detailed investigation of the biochip behaviour under such conditions. In particular, the survival ability of the ligands must be studied, as well as slide's alterations.

In this abstract, we present first simulation results of the radiation environment encountered during a Mars mission. For this purpose, two tools based on the Geant4[1,2] Monte Carlo toolkit have been used: GRAS[3] (Geant4 Radiation Analysis for Space) and PLANETOCOSMICS[4]. Simulations are divided into two distinct phases: the

Earth-Mars travel and the stay on Mars. Earth-Mars travel and doses calculations in the biochip have been studied with the GRAS tool. Thanks to PLANETOCOSMICS we simulate the interaction of GCR (Galactic Cosmic Rays) and SPE (Solar Protons Events) spectra with Mars atmosphere and soil in order to better quantify the radiation environment at soil level. During these two phases, particles and energies involved are different.

These first results allow the preparation of irradiation experiments on a French beam facility (AIFIRA, in Bordeaux) for autumn 2007.

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