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ORIGINAL ARTICLE

Design optimization and background modeling of the HEX experiment on Chandrayaan-I

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Abstract Spacecraft and their subsystem components are subject to a very hazardous radiation environment in both near-Earth and deep space orbits. Knowledge of the effects of this high energy particle and electromagnetic radiation is essential in designing sensors, electronic circuits and living habitats for humans in near Earth orbit, en route to and on the Moon and Mars. This paper discusses the use of Monte Carlo simulations to optimize system design, radiation source modeling, and determination of background in sensors due to galactic cosmic rays and radiation from the Moon. The results demonstrate the use of Monte Carlo particle transport toolkits to predict secondary production, determine dose rates in space and design required shielding geometry.

Keywords Detector design optimization · Background modeling

1 Introduction

Space-borne low energy γ-ray detectors which operate in the energy range of tens of keV to hundreds of MeV, experience an intense radiation environment of energetic charged particles and electromagnetic radiation. These interact with the detector and its surrounding materials to produce a background emission against which weak astrophysical or planetary signals have to be detected. This is the instrumental background and it is sensitive to the choice

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