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DEVELOPMENT OF A LOW-COST AND OPEN-SOURCE CUBESAT PAYLOAD TO MEASURE RADIATION IN LOW EARTH ORBIT

Abstract

When it comes to space, particularly regarding space weather, we realize that there is still a gap related to sensors to be embedded in Cubesats to perform measurements in Low Earth Orbit (LEO). When the causes of catastrophic failures in small satellites and microsatellite missions are analyzed,it has shown that a significant number of these failures occur in electronic components, many of which are caused by radiation concentrated in LEO. Another major challenge faced in the space industry is the South Atlantic Anomaly (SAA), located over South America. It affects satellites with orbital inclinations between 35 and 60, which are periodically exposed to the mentioned anomaly.

This paper aims to present a low-cost, low-energy consumption, and open source radiation measurement payload to be embedded on a Cubesat for education purposes.The studies will be in the LEO orbits,with focus on measurements in the region of South Atlantic Anomaly(SAA). The payload is capable of measuring Alpha (α), Beta (β) and Gamma(γ) particles with an energy range of 33 keV to 8 MeV. In addition to the measurement instruments, a Global Navigation Satellite System (GNSS) module is also onboard, which will be used to generate radiation maps that will be distributed to the entire community for conducting studies related to space weather.

As this is an open source project, this work will cover all the methodology used in the development of this payload. This includes the process of studying for the development of the particle meter prototype, calibration process, engineering model development, energy consumption analysis, electromagnetic compatibility, environmental tests, as well as the results obtained in each stage of the development process. In addition, the next steps in the development of this payload will be discussed.