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Prediction, Testing, Measurement and Effects of space environment on space missions (3)

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FRAUNHOFER SATELLITE RADIATION SENSING SYSTEMS

Abstract

Fraunhofer INT develops systems for onboard radiation sensing. Onboard in this context means inside electronic boxes on printed circuit boards (PCB) in close proximity to radiation sensitive electronic devices. The goals of these radiation sensor systems are:

- be simple, robust, cheap and easy to integrate,
- measure total ionizing dose (TID) locally on the PCB,
- detect solar particle events (SPE),
- enable adaptive radiation mitigation techniques and
- support anomaly investigation.

This ability to measure dose and/or particle fluxes on the PCB is particularly of interest as this is where radiation hurts the most. In case of intense solar particle events the sudden increase of the measured particle fluxes can be used as an input for adaptive radiation mitigation techniques to protect important electronic parts and systems. Furthermore it can help to reduce radiation design margins for successive missions because you get a better knowledge of the received dose inside your electronic box in a given radiation environment. In addition in the case of in orbit verification or validation (IOV) missions it is of major importance to verify the reliability of your design against the actual dose received.

Our approach is to add as little as possible devices and make use of already installed hardware e.g. microprocessors to operate them. And the output of those sensor devices should already be digital. So we propose to integrate extra memory devices on the PCB: non-volatile UV-EPROMs to measure dose and/or SRAMs to detect high energy (solar) particles. The radiation-induced change of their digital content is a measure for the radiation exposure after calibration in a known radiation field. Fraunhofer Onboard Radiation Sensors (FORS) are already accepted to fly on the German geostationary Heinrich Hertz communication satellite as part of the Fraunhofer On-Board Processor (FOBP) and is foreseen to be implemented onboard of a CubeSat.