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TOWARDS A MULTI-SCALE PLATFORM TO INVESTIGATE MULTI- CONSTRAINTS AND  
EFFECTS INDUCED BY SPACE RADIATION ENVIRONMENTS ON SYSTEM BOARDS

**Abstract**

Space radiation environments induce critical problematic in satellites as charging, dose and Single Event Effect (SEE) induced by plasmas environment and particle, respectively. Otherwise, other constraints such as thermal condition or reliability can induce synergies impacting disturbance mechanisms. Thus, these last ten years, multi-scales modeling and physics-based Monte-Carlo or analytical approaches have been developed to address risk assessments in operational conditions and system qualifications. However, the developments of these methods were conducted in industrial and academic communities partitioned by type of effect. This work aims to propose an investigation towards a multi-scale platform integrating multi-constraints and effect, particularly the internal charge and the SEE. This approach is based a sequential modeling of physical mechanisms, distinguishing the common and specific physical layers. Thus, the first layer concern the physics related to the radiation environment and transport of particles in matter, while the second step concern the effect modeling thanks to specific modules issued from SPIS and MUSCA SEP3 tools. Investigations are proposed on the shielding impacts to charging and SEE problematic, particularly for nanoscale technologies and SpaceWire cables. Results demonstrate the interest to consider finely the shielding in the effect assessments for modern system boards, and the contribution of developing the multi-constraints platform.