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Modeling the space environment and its effects on spacecraft and astronauts using SPENVIS

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Modeling the Space Environment: Being on earth, we are well shielded from the space weather environment by our planet's atmosphere and its magnetic field. However, satellites and astronauts are directly exposed to its hazardous effects. The danger becomes increasingly more substantial when moving away from Earth's protection e.g. a spacecraft mission through the harsh radiation environment of Jupiter and its Moons or future manned missions to Mars. SPENVIS (<https://www.spennis.oma.be>) is a web application that allows someone to model the space environment (i.e. cosmic rays, radiation belts, solar energetic particles, plasmas, outgassing and micro-particles) around Mercury, Earth, Mars and Jupiter but also in the interplanetary medium. In addition, it enables to calculate the potential effects of these environments on spacecraft components and astronauts.

SPENVIS - A Long and Acclaimed History: Since its first development by the Royal Belgian Institute for Space Aeronomy (BIRA-IASB) in 1996, it has been successful ESA operational software for more than 15 years. In the recent years, SPENVIS has also been integrated in ESA's Space Situational Awareness (SSA http://www.esa.int/Our_Activities/Operations/Space_Situational_Awareness) Space Weather Service Network. As a result, SPENVIS has established a mature user community from all over the globe that is using the system for various purposes including mission analysis and planning, education and scientific research. Lately, a new system known as SPENVIS Next Generation (<http://www.spennis-ng.eu/>) has been developed under ESA's GSTP-5 programme by an international consortium led by the space weather section of BIRA-IASB. The new system has a distributed architecture, uses standards to integrate models and supports the integration to other software by offering a web interface as well as an application programmer's interface (API).

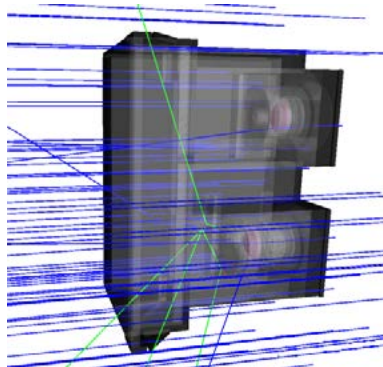


Figure 1: SPENVIS Geant4 simulation of trapped energetic proton interactions with the SREM instrument onboard PROBA-1 spacecraft.

Biography

Stijn Calders is a Project Manager with a strong expertise in IT engineering and Space Physics. He is employed at Royal Belgian Institute for Space Aeronomy to work on space weather services. Space weather is the influence of solar electromagnetic and particle radiation, galactic cosmic rays and the radiation belts on satellites, technology and human health on Earth and in space (e.g. GPS navigation, communication and astronauts). His main duty today is the technical project management of ESA's "SPENVIS Next Generation" (SPENVIS-NG) project. The key objective of the project is to upgrade the current SPENVIS system into a new web-based, service-oriented & distributed framework supporting plug-in of models related to the hazardous space environment, and including both a user friendly interface for rapid analysis and a machine-to-machine interface for interoperability with other software tools (e.g., SEISOP).

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