Matter RADiation interactions SIMulator for Space Applications (MRADSIM-Space)

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Background:
The idea rises from the necessity of having a user-friendly single graphical interface simulation tool to convert large CAD files of satellites into GDML and analyze the radiation effects on electronics parts present inside the satellite. This work has been carried out in two phases. The first phase is to provide to the community a free converter from CAD (.STP) files to GDML for further analysis. The second phase is a commercial product that includes all detailed analysis of the effects.

Material and Methods:
The MRADSIM Software has cross-platform structure using CMake and the source code in C++, the simulation engine is based on Geant4 and the format conversion, geometry editing and graphics display are based on OpenCascade [1] and Qt5 [2].
To run MRADSIM-Space the user should provide mission parameters (epoch, duration, orbit etc.), STP file of the geometry of either a part or entire satellite and target components/parts on which desires to analyze the radiation effects. The program intuitively suggests to user other essential parameters that user may control, does a final check of input information and runs. The output is a set of results including energy deposition, fluence on target surface, 3D dose analysis, LET (Linear Energy Transfer) flux, NIEL (Non Ionizing Energy Loss)m and Charging.

Preliminary results:
The MRADSIM-Converter have been downloaded and under use by many research institutions (see www.mradsim.com for full list). The beta version of MRADSIM-Space is being distributed in INFN Sections for free and unlimited use. Fully debugged commercial version will follow soon. The next coming version of MRADSIM will cover also Earth based applications such as radioprotection and screening optimizations in health, nuclear, high density electronics applications.

[1] https://dev.opencascade.org/project/mradsim
[2] https://www.qt.io/
[3] Ali Behcet Alpat et al., « MRADSIM-Converter: A new software for STEP to GDML conversion », Submitted to Computer Physics Communications, COMPHY-D-22-00474