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TARANIS XGRE and IDEE Detection Capability of Terrestrial Gamma-Ray Flashes and Associated Electron Beams

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With a launch expected in 2018, the TARANIS micro-satellite is dedicated to the study of transient phenomena observed in association with thunderstorms. On-board the spacecraft, XGRE and IDEE are two instruments dedicated to study Terrestrial Gamma-ray Flashes (TGFs) and associated electron beams (TEBs). XGRE can detect electrons (energy range: 1 MeV to 10 MeV) and X/gamma-rays (energy range: 20 keV to 10 MeV), with a very low instrumental dead time, and the ability to discriminate one type of particle from the other. The IDEE instrument is focused on electrons in the 80 keV to 4 MeV energy range, with the ability to estimate their pitch angles.

Monte-Carlo simulations of the TARANIS instruments, using a preliminary model of the spacecraft, allow sensitive area estimates for both instruments. It leads to an averaged effective area of 425 cm^2 for XGRE to detect X/gamma rays from TGFs, and the combination of XGRE and IDEE gives an average effective area of 255 cm^2 to detect electrons/positrons from TEBs. We then compare these performances to RHESSI, AGILE, and Fermi GBM, using performances extracted from literature for the TGF case, and with the help of Monte-Carlo simulations of their mass models for the TEB case.

Combining this data with with the help of the MC-PEPTITA Monte-Carlo simulations of TGF propagation in the atmosphere, we build a self-consistent model of the TGF and TEB detection rates of RHESSI, AGILE, and Fermi. It can then be used to estimate that TARANIS should detect about 225 TGFs/year and 25 TEBs/year.