$\mathbf{10} \quad \mathcal{U} \quad \text{Fachhochschule}_{\text{Nordwestschweiz}} \text{ Exploring the Impact of Solar Energetic Particles on STIX Hard}_{X-ray Observations}$

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The Spectrometer Telescope for Imaging X-rays (STIX) is one of the ten instruments onboard Solar Orbiter. It measures X-rays emitted during solar flares in the energy range of 4 – 150 keV, and takes X-ray images by using an indirect imaging technique, based on the Moiré effect. Thirty-two pixelated CdTe detectors with a total effective area of 6 cm² are used by STIX to measure X-rays. Apart from X-rays, solar energetic particles and their secondaries can also be recorded by STIX detectors, which can contaminate hard X-ray observations. Due to the grids and X-ray windows in front of the detectors, as well as the enclosure, only particles of above certain energies can reach STIX detectors. In this study, we present STIX measurements of two SEP events and simulations of the STIX response to solar energetic particles using Geant4 simulations.

The Spectrometer/Telescope for Imaging X-rays (STIX)



Preliminary Monte Carlo simulations of SEPs

 Monte Carlo simulations can help to understand how STIX responds to SEP events

- STIX measures intensity, spectrum, timing, and takes images of hard X-rays caused by Bremsstrahlung emission of thermal and non-thermal electrons accelerated in the corona.
- Imaging principle based on indirect bigrid Fourier imaging technique
- 32 coarsely pixelated CdTe detectors are used to measure X-rays

STIX measurements of SEP events compared to EPD particle measurements



- Simulation package
 - Based on Geant4
- Complex geometries converted from CAD files, simple geometries described using CSG models
- Spacecraft shielding assumed to be 1 mm thick aluminum alloy
- Physical model using *EmLivermorePhysics* (Bremsstrahlung, ionizing, multiplescattering, Compton, photo-electric, pair production and fluorescence emission included)
- Preliminary simulation runs performed for both electrons and protons in two cases: incident angle of 45 degrees w.r.t. the axis of STIX and particles passing the X-ray window (the front)



28-Oct-2021 M7.9 GOES class flare and associated SEP event. Electrons with energies above 1 MeV contaminated

09-Oct-2021 M1.6 GOES class flare and associated SEP

View of STIX and trajectories of electrons with energies of 5 MeV in Geant4. Electrons are incident obliquely at 45 degrees from above