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The Spectrometer/Telescope for Imaging X-ray (STIX) on Solar Orbiter: flight design, challenges and trade-offs

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Solar Orbiter is a Sun-observing mission of the European Space Agency, addressing the interaction between the Sun and the heliosphere, with launch planned for 2018. The Spectrometer/Telescope for Imaging X-rays (STIX), one of ten instruments on-board the spacecraft, will determine the intensity, spectrum, timing, and location of thermal and accelerated electrons near the Sun through their Bremsstrahlung X-ray emission, addressing in particular the emission from flaring regions on the Sun.

STIX uses indirect Fourier imaging. The Sun is observed through pairs of fine tungsten grids, separated by 55 cm, that cast a Moire transmission pattern on pixelized CdTe detectors. The source location and morphology will be reconstructed on the ground using the transmitted pixel count rates. The construction of flight-hardware has recently started.

This contribution focuses on the instrument and detector challenges, performance limitations, and how they were addressed. The main design constraints comprise a) the limited electrical power (7 W), b) the thermal environment (CdTe passively cooled to -20 deg Celsius embedded in a +50 deg Celsius spacecraft), c) the radiation environment (degradation of CdTe from displacement damage by energetic protons), d) the required long-term reliability (space mission duration of ten years), e) the requirement for autonomous operation over periods of up to 80 days, and f) the low telemetry rates (700 bits per second).

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