KARL-FRANZENS-UNIVERSITÄT GRAZ
UNIVERSITY OF GRAZ

STIX Software

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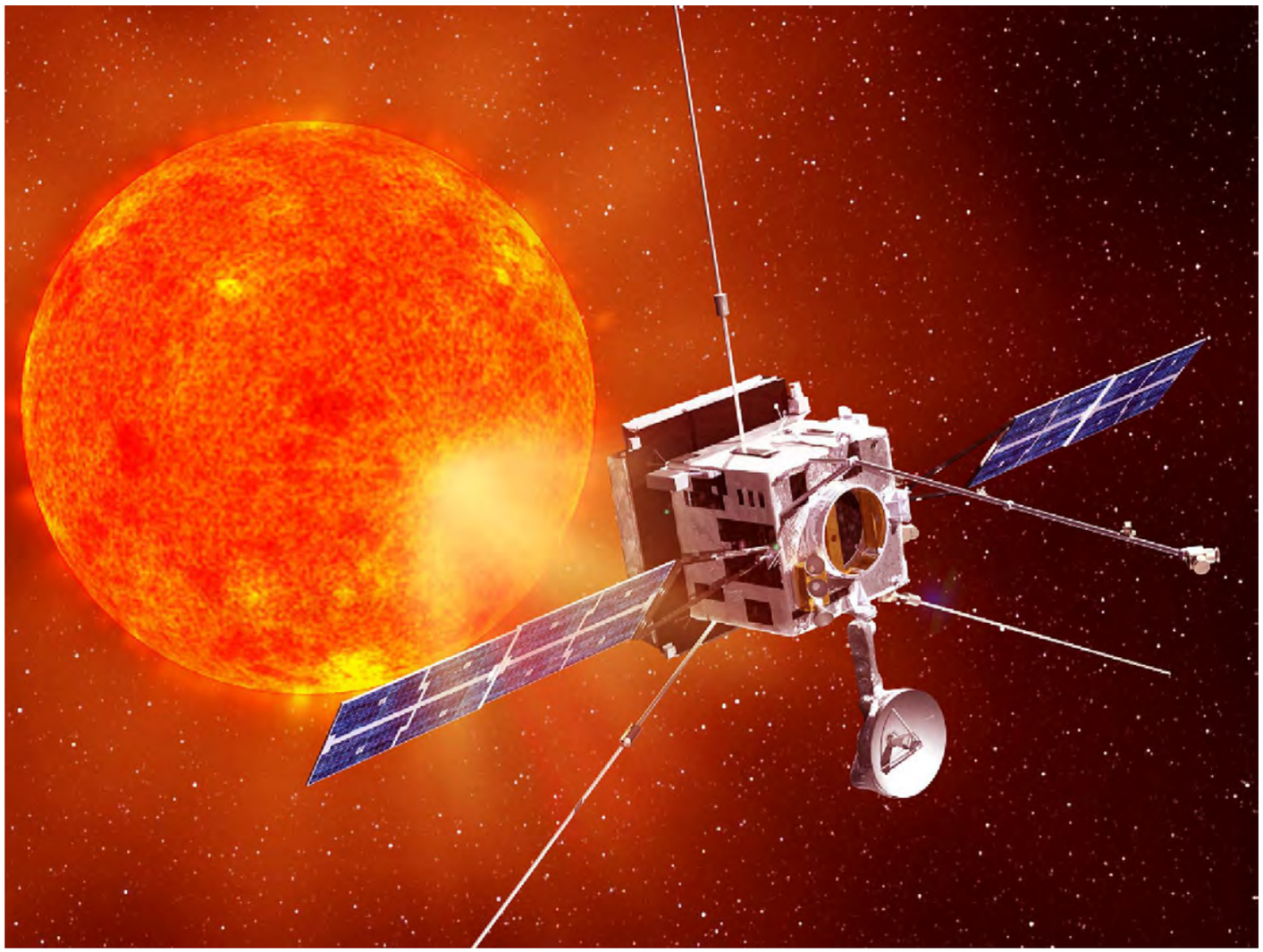
Solar Orbiter



(Image: ESA)

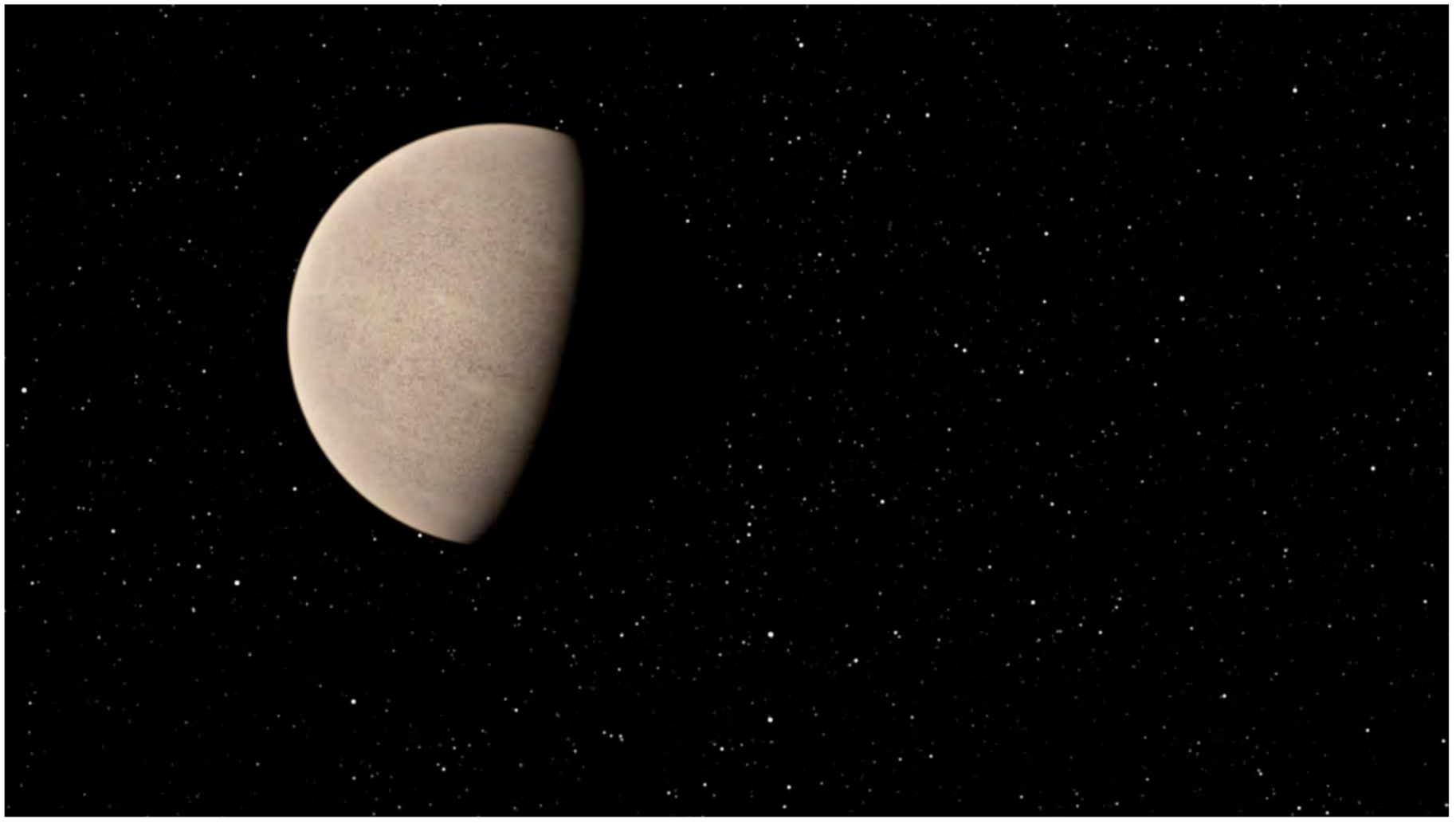
Solar orbiter will fly in a highly elliptical orbit reaching a perihelion of 0.28 AU

10 instruments (6 remote sensing 4 in-situ)

High inclination (24° nominal 34° extended)

Aims to improve our understanding of the inner heliosphere

Solar Orbiter



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10 instruments (6 remote sensing 4 in-situ)

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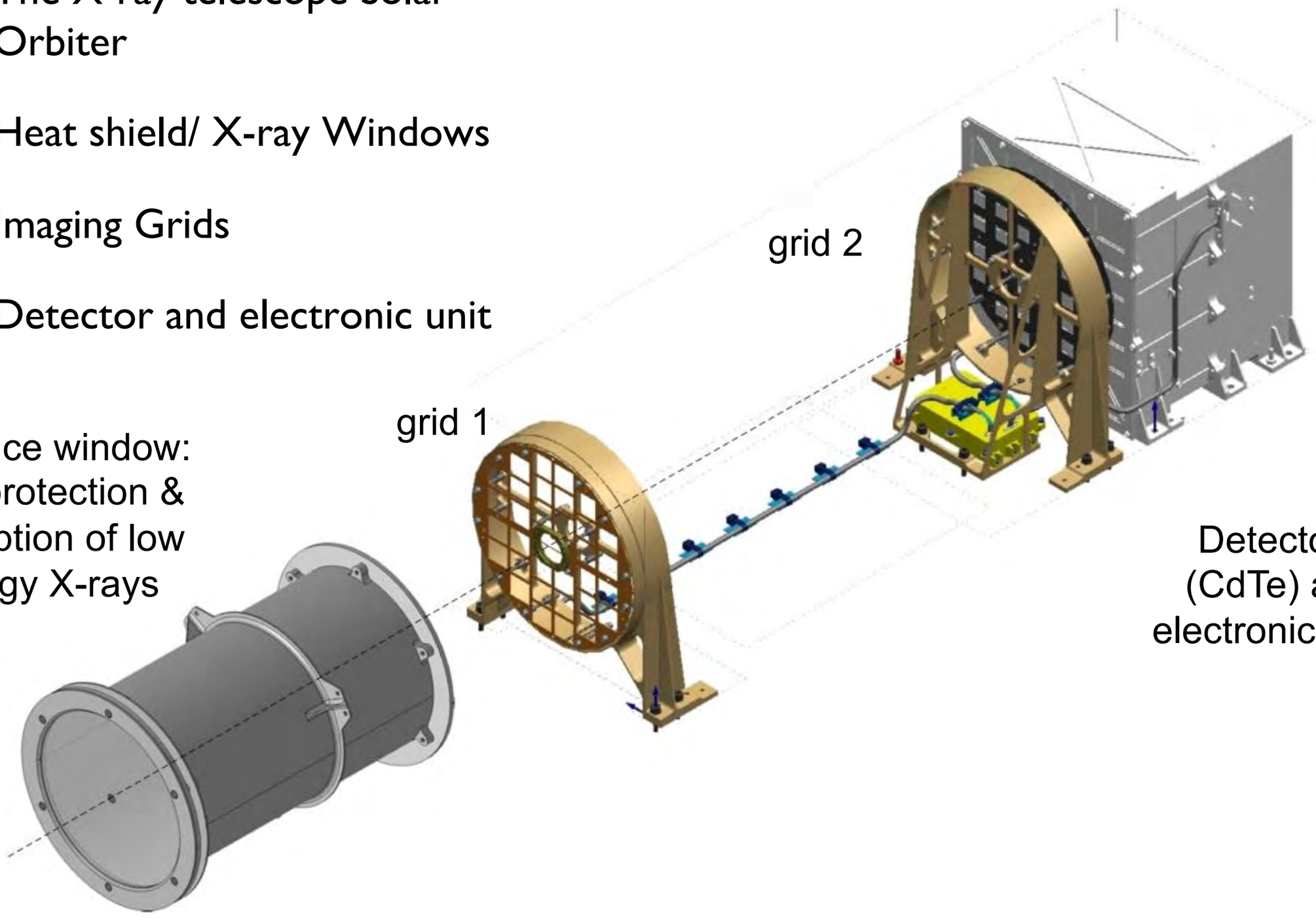
STIX (Spectrometer Telescope for Imaging X-rays)

- The X-ray telescope Solar Orbiter
- Heat shield/ X-ray Windows
- Imaging Grids
- Detector and electronic unit



Entrance window: heat protection & absorption of low energy X-rays

Detectors (CdTe) and electronics box

The STIX team

Ireland:
Software

TRINITY COLLEGE DUBLIN
COLÁISTE NA TRÍONÓIDE

Germany:
Aspect
system

AIP

Poland: IDPU, thermal
simulations,
EGSE, software

CBK PAN

France: ASIC,
detectors, software

cea

l'Observatoire de Paris – LESIA
Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique

Cz: Power supply,
flight software

CH: PI, spectrometer, grids,
sensors, software lead

Fachhochschule Nordwestschweiz
Hochschule für Technik

PAUL SCHERRER INSTITUT
PSI

almaTech
SPACE & NAVAL ENGINEERING

Art of Technology

SYDERAL
ELECTRONICS AND SOFTWARE

Austria:
Software

UNI GRAZ

Italy:
Software

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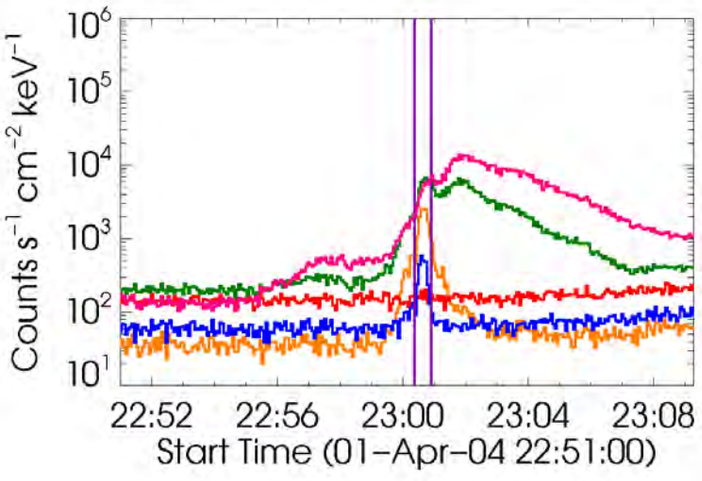
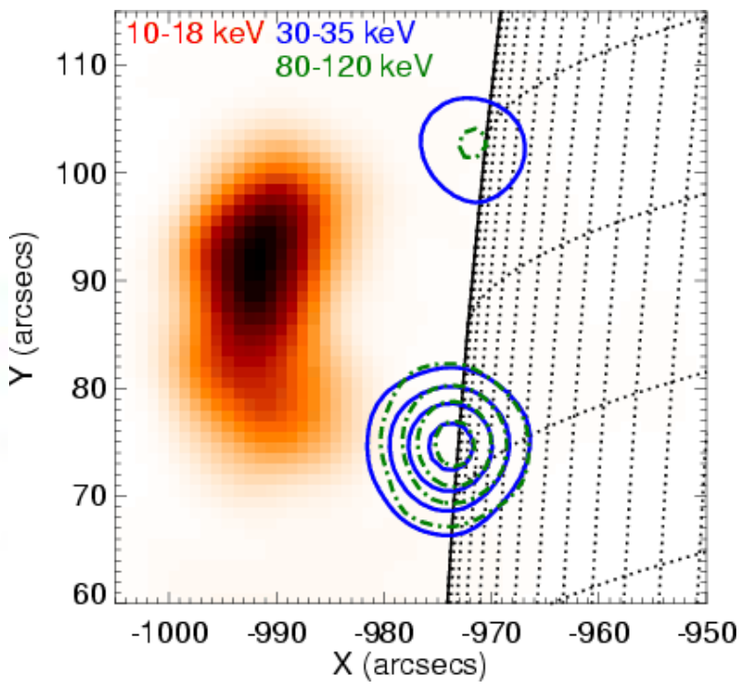
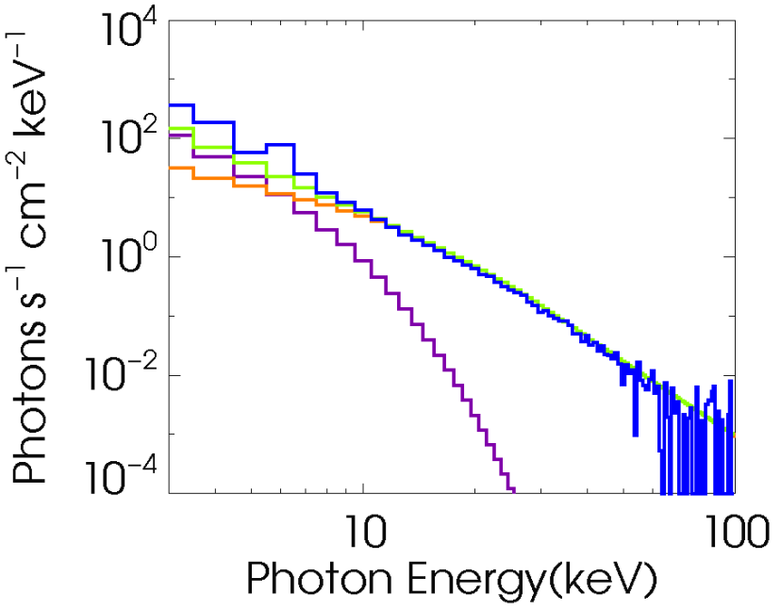
Solar Hard X-Rays

- High energy accelerated elections emit x-rays via bremsstrahlung
- Emission is prompt optically thin
- Allowing us to infer timing, location and energy characteristics of solar flares
- Important context for origin of detected electrons
- Useful for alerting other imagers of presence and positioning of flares

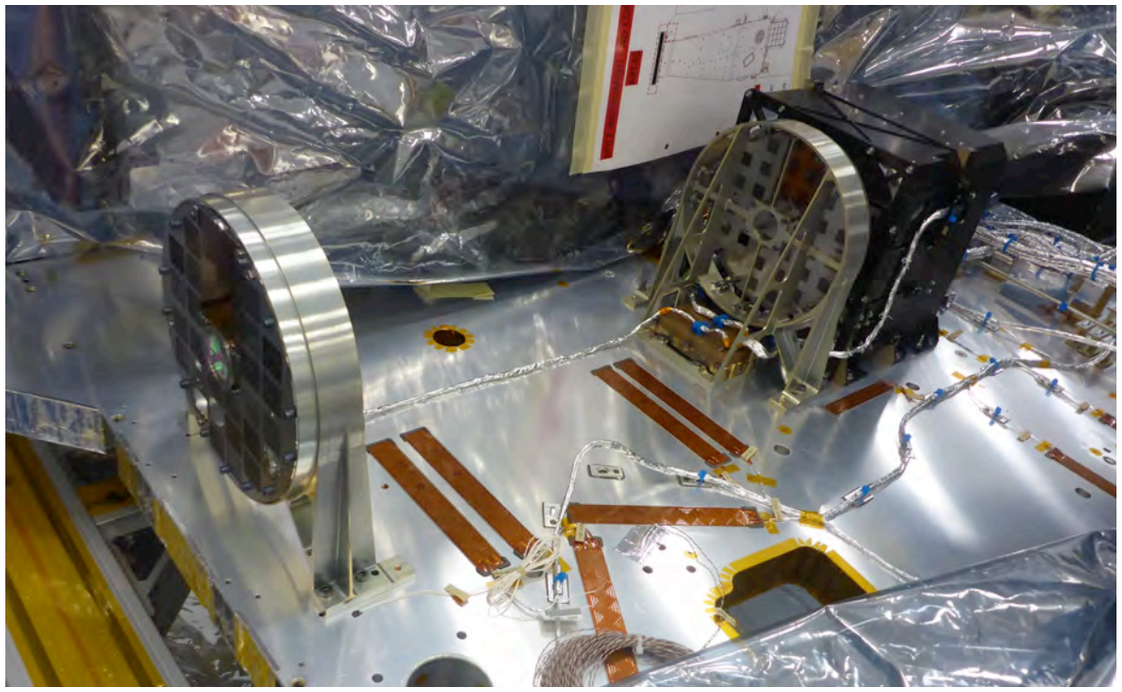


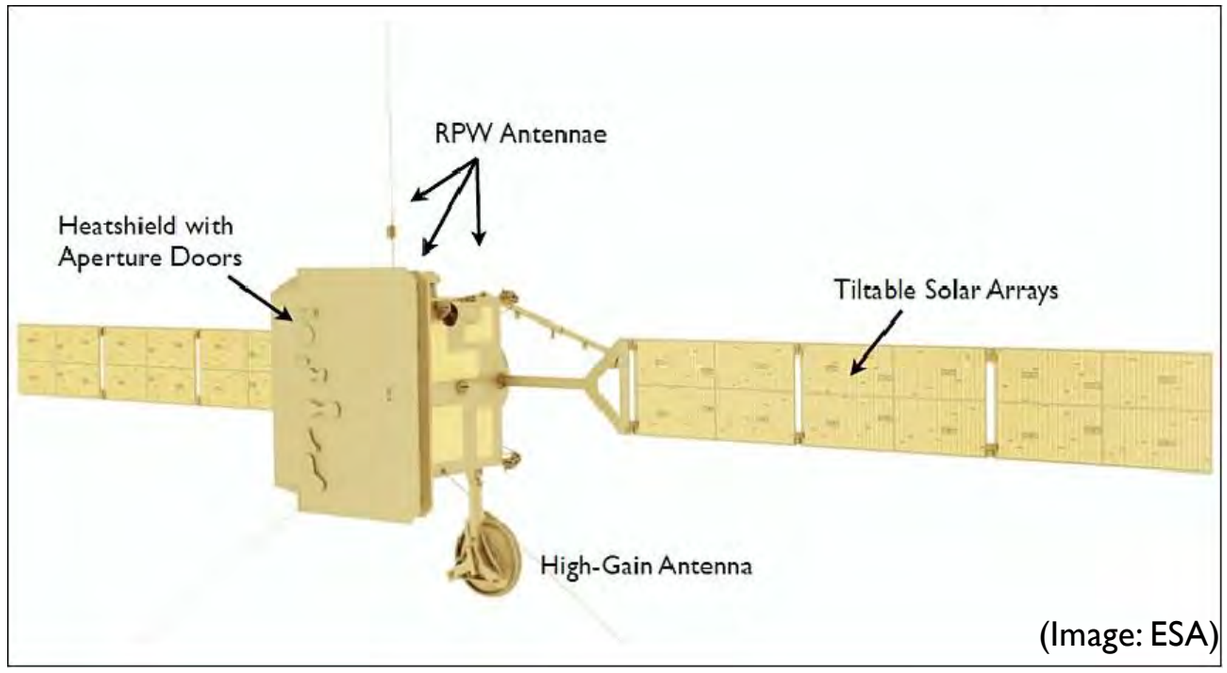




(Hurford, 2002)

Constraints on STIX





Light – 7.2 kg total mass
Low power – 8W

Experiences high temperatures

Telemetry from STIX will be low

700 bits per second
(out of 1 x 10^5 bits per second for total for Solar Orbiter)

Compared with
~2.3 x 10^4 bits per second for RHESSI
~1.5 x 10^8 bits per second for all SDO

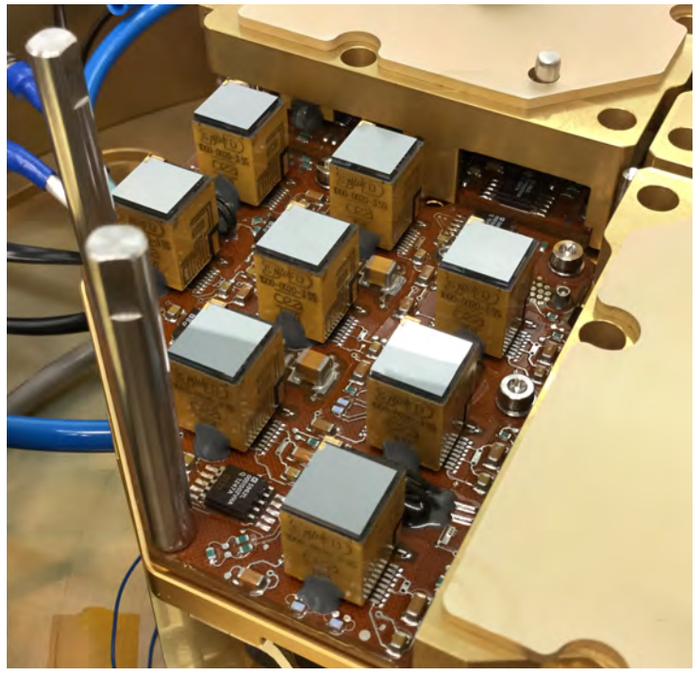
Detectors

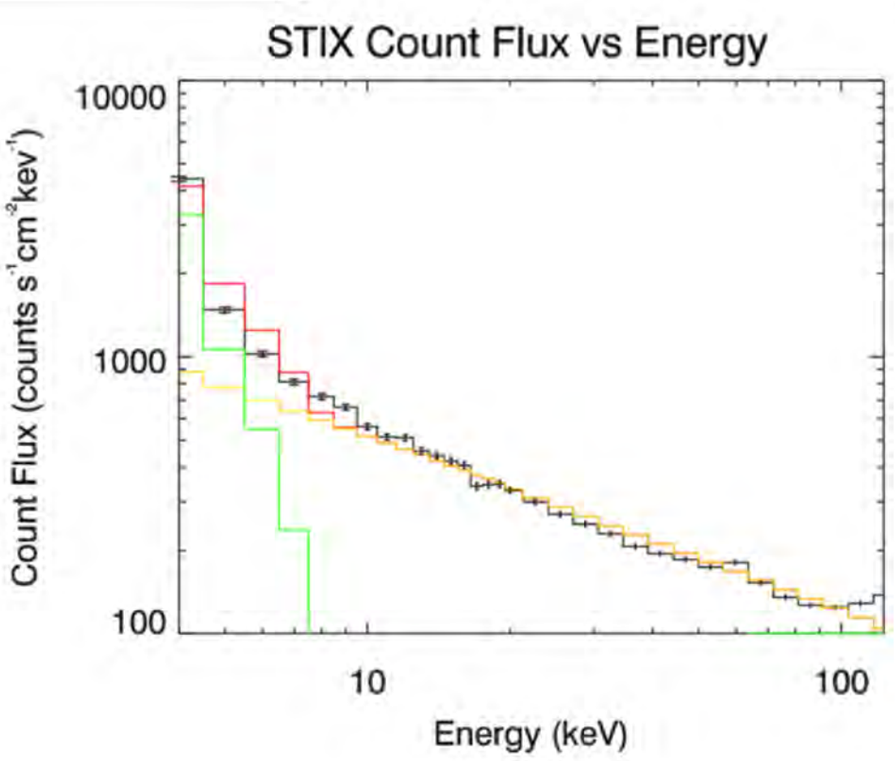
32 Cadmium Telluride detectors

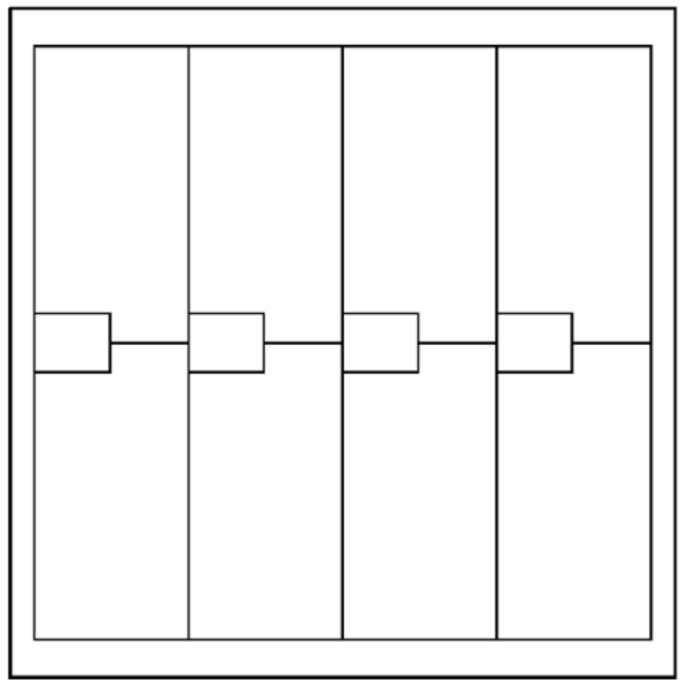
12 pixels (8 large 4 small)

Sensitive in energy range 4 -150 keV

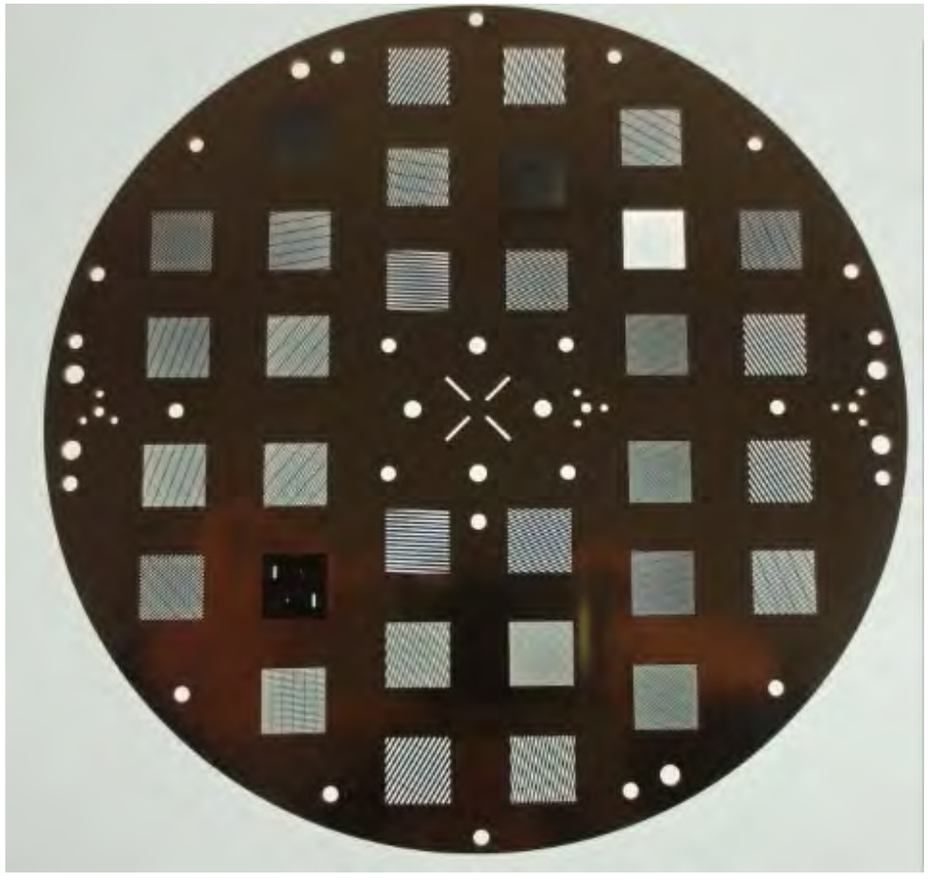
32 energy channels







Grids



32 Subcollimators one per detector

Each has 2 Tungsten grids front and rear

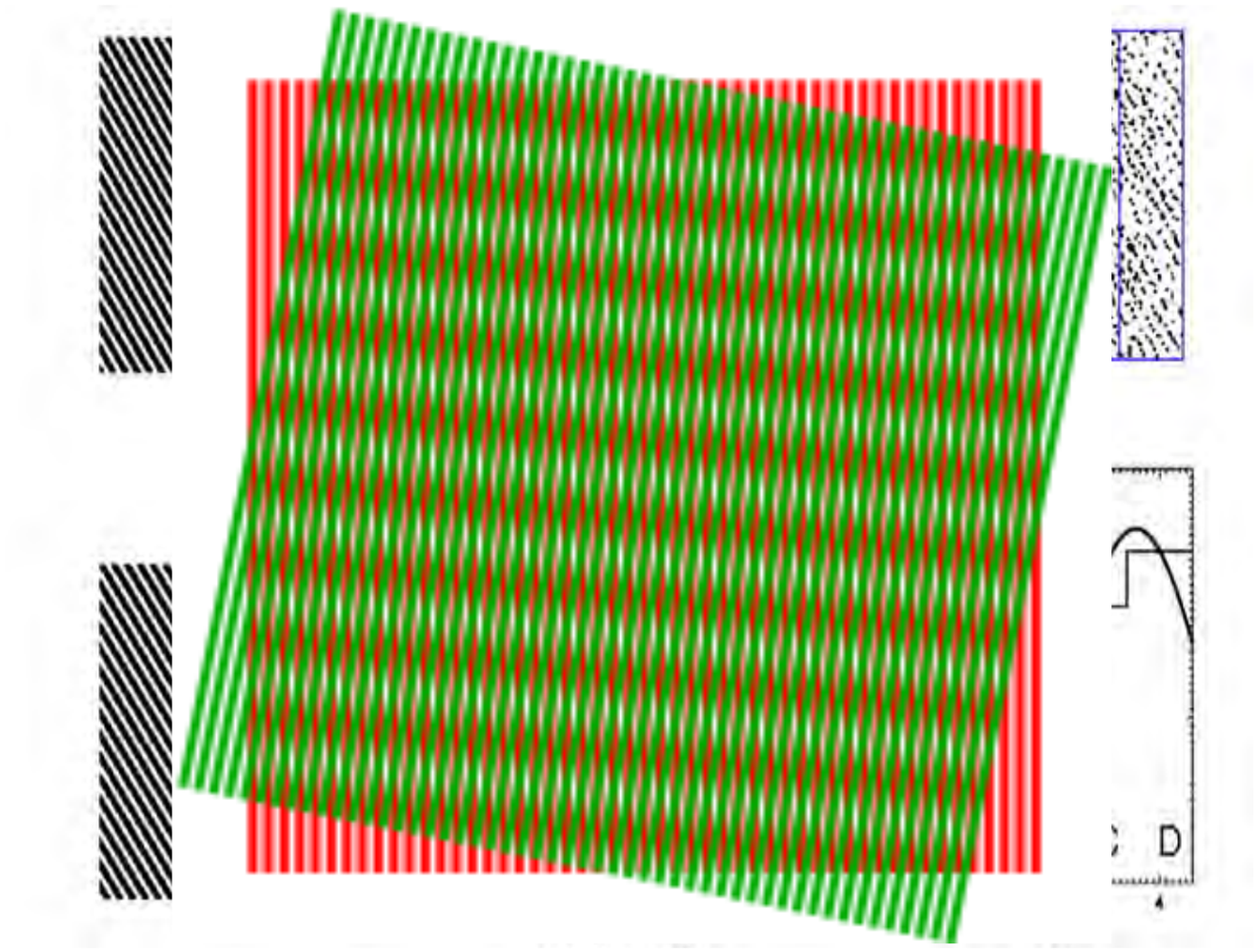
Slits go varying size an pitch– similar to RHESSI and Yohkoh

30 Fourier grids

1 background detector

1 course flare location

Moiré fringes



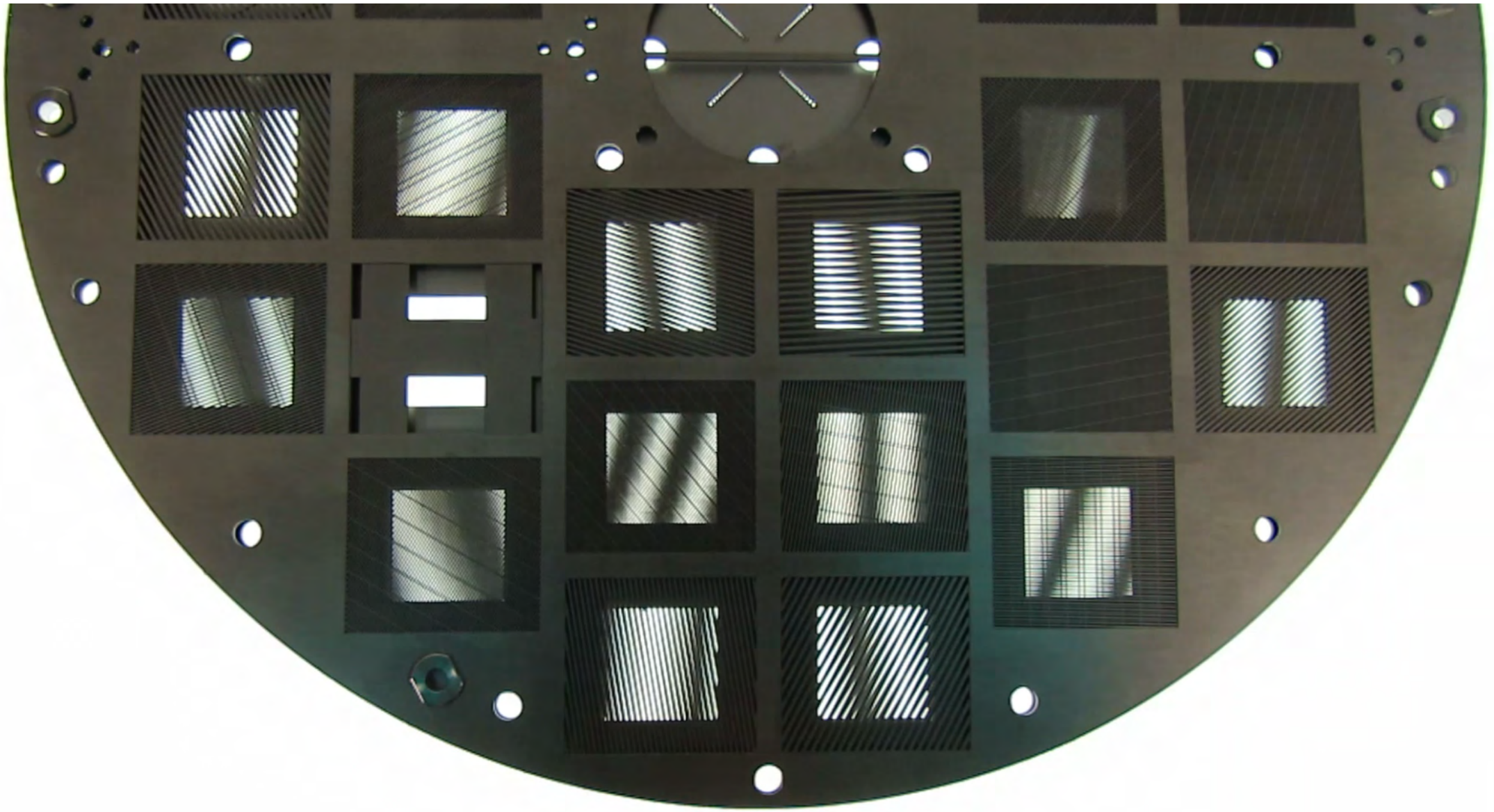
(Hurford, 2012)

Varying grids cause moiré fringes based on direction of incoming photons

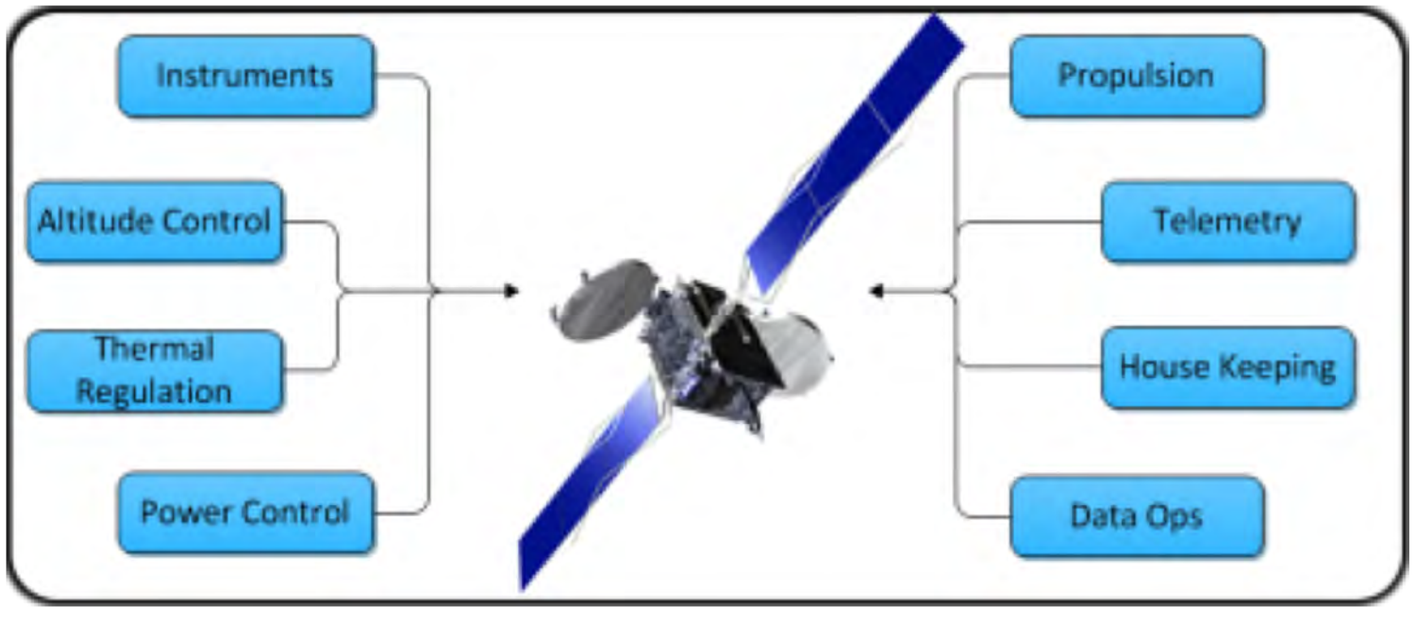
These manifest as differences in pixel counts in the various detectors

Similar to design used in RHESSI and Yohkoh/HXT

Images can then be reconstructed using Fourier techniques



The Flight Software



(Image: ESC)

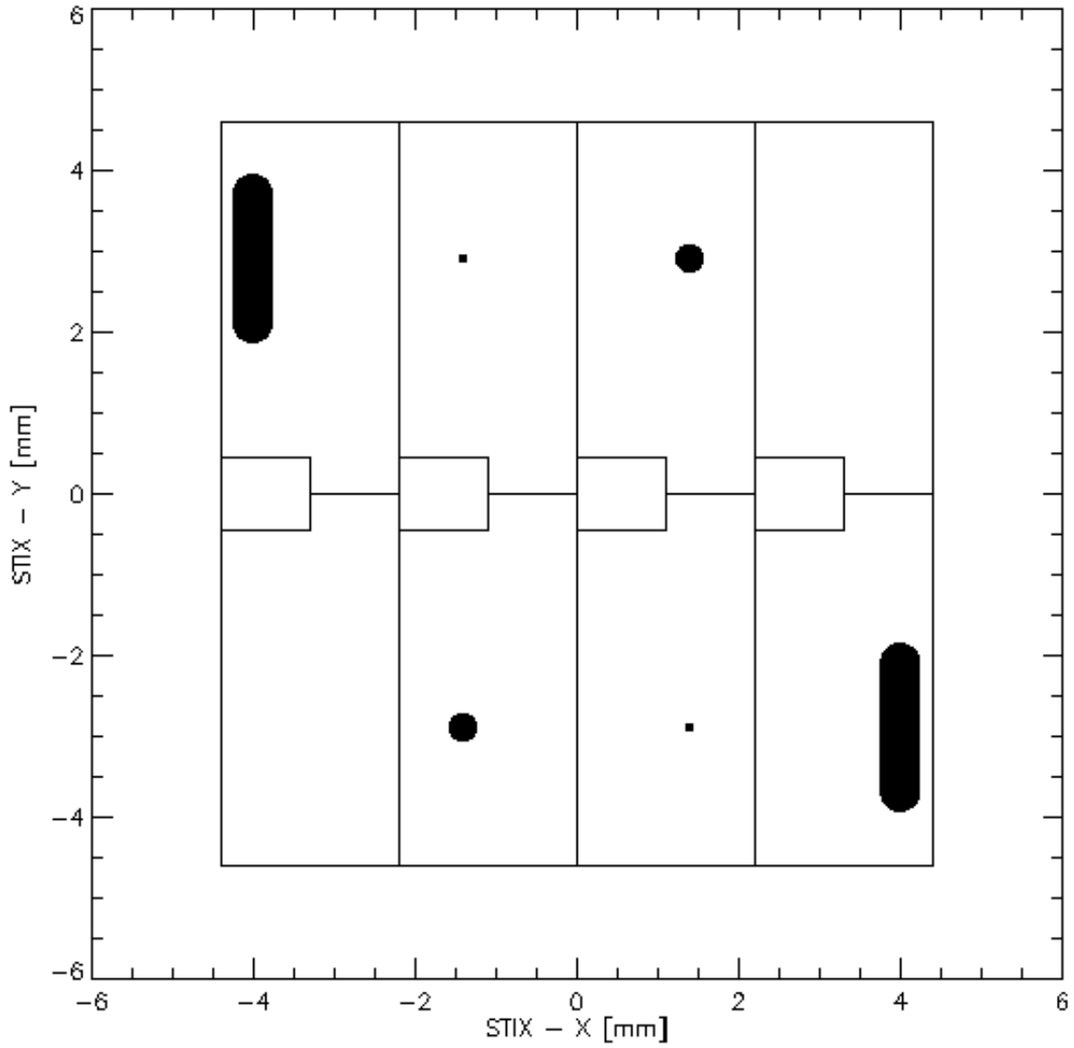
Onboard spacecraft operations

Controls all operations of instrument in flight

Includes necessary processing

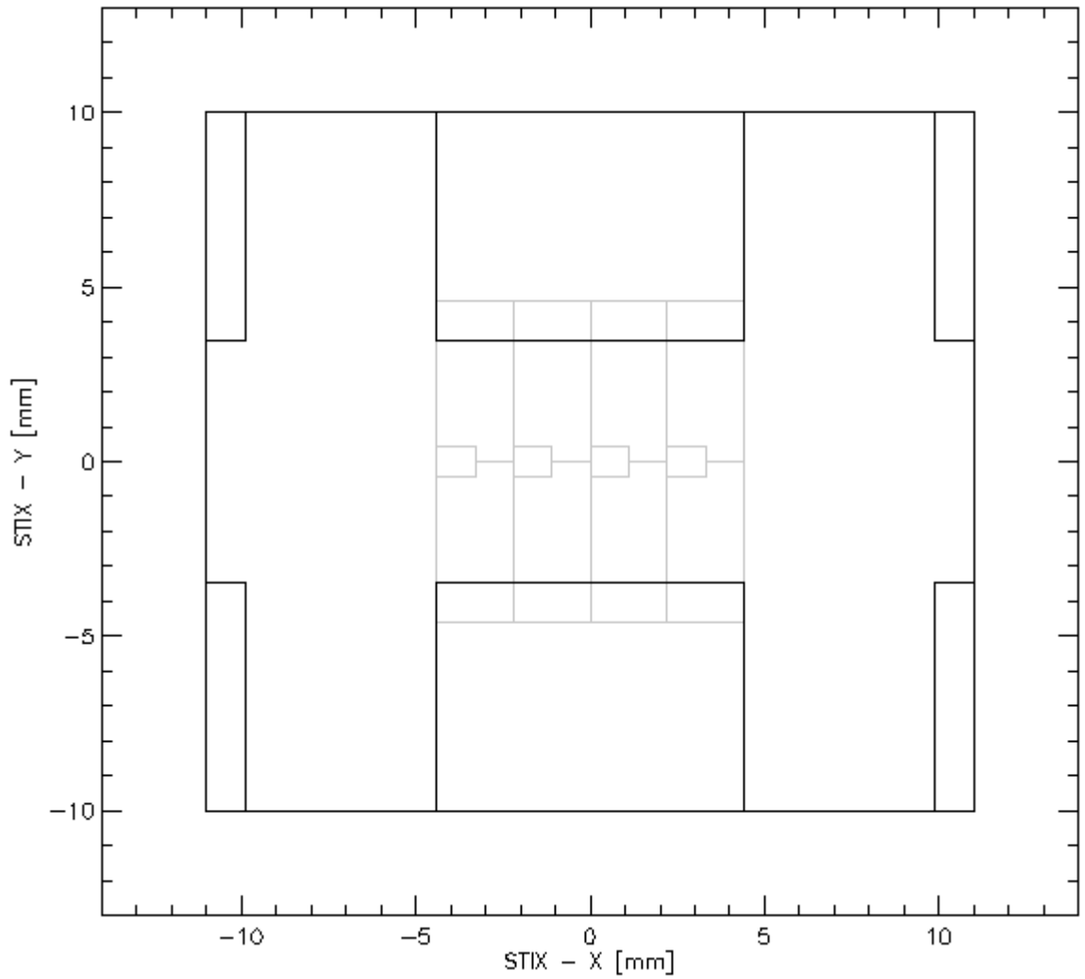
Some parameter adjusted by telecommand

Background Monitor

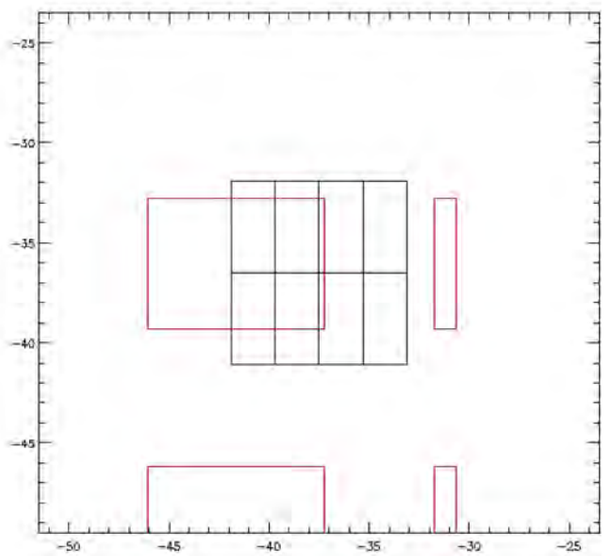


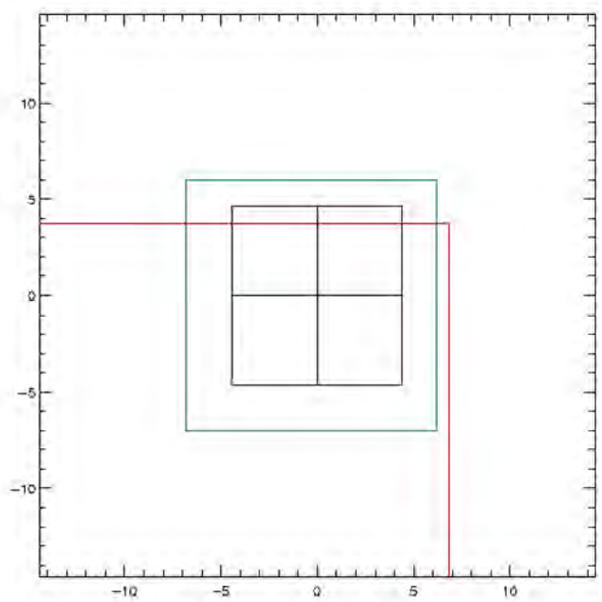
- Single detector dedicated to measuring current background
- Rate in a covered pixels used as a proxy for instrument background
- Pixels with small apetures allow determination of true flux at high rates

The Coarse Flare Locator



- Dedicated detector for real time measurement of source location
- Relative rates in each pixel combined with measurements from imaging detectors provides estimate





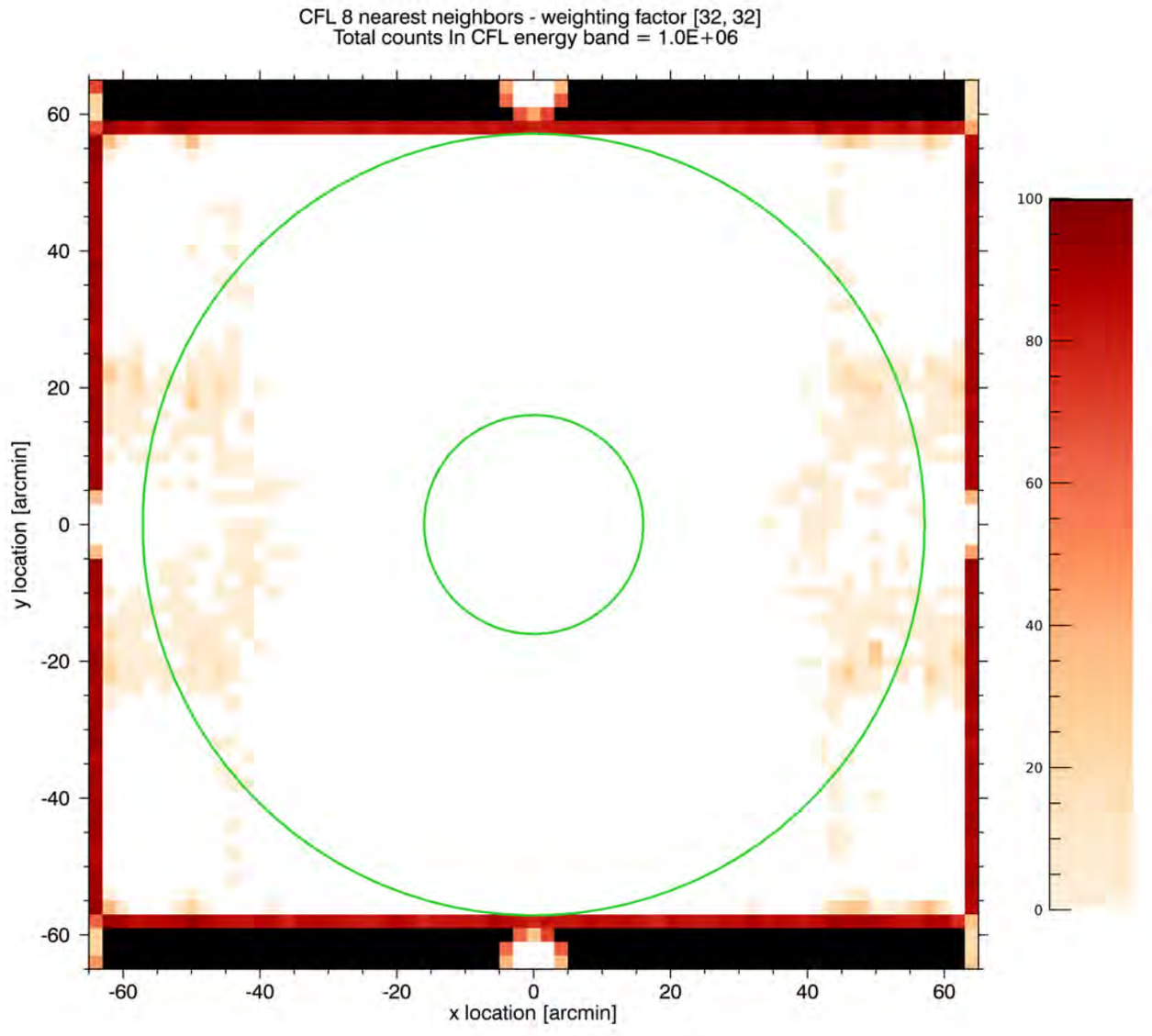
Testing The Coarse Flare Locator

Extensive simulation of CFL response for numerous points in STIX field of vision

- Refine routine

- Estimate accuracy

- Determine optimum parameters

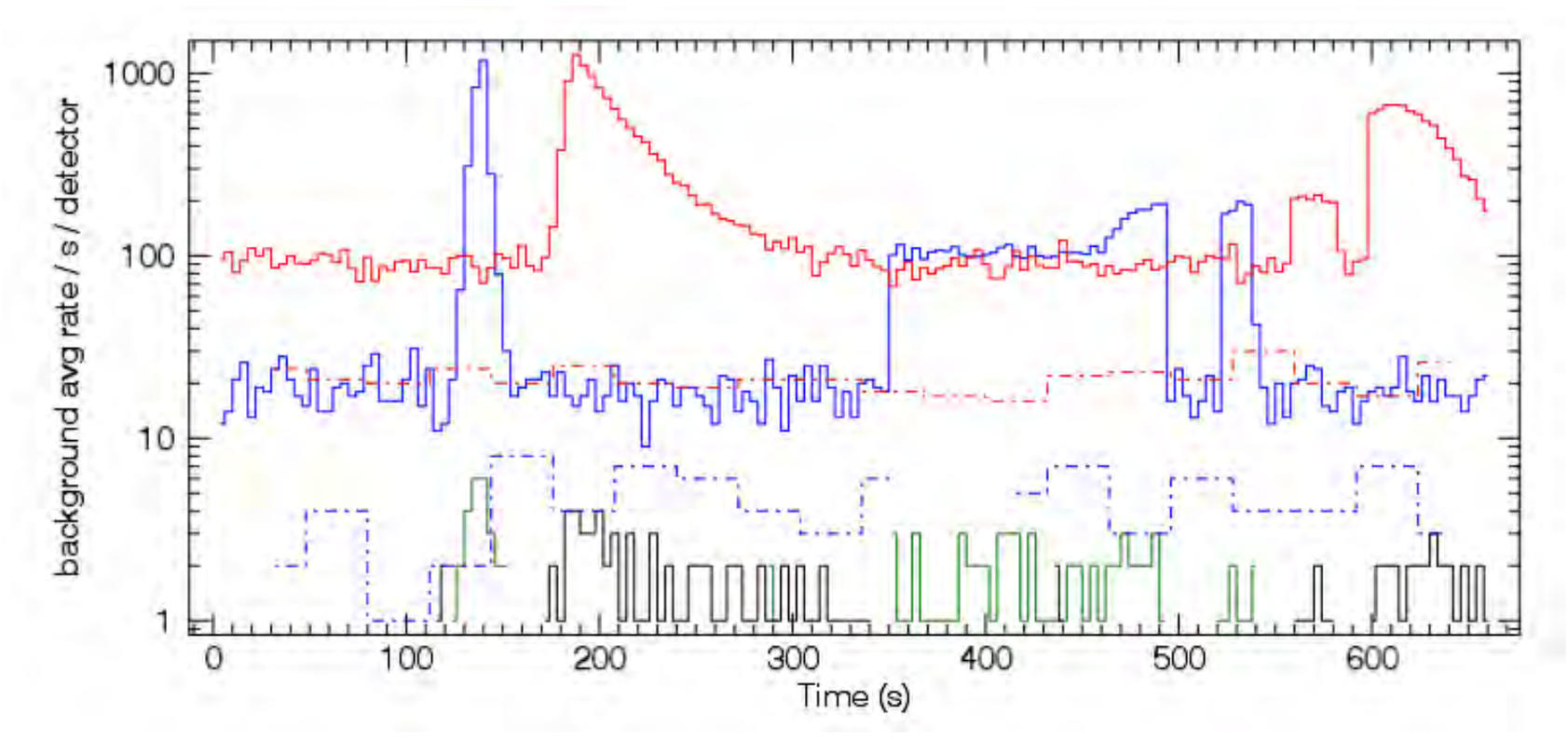


Flare Detection Module

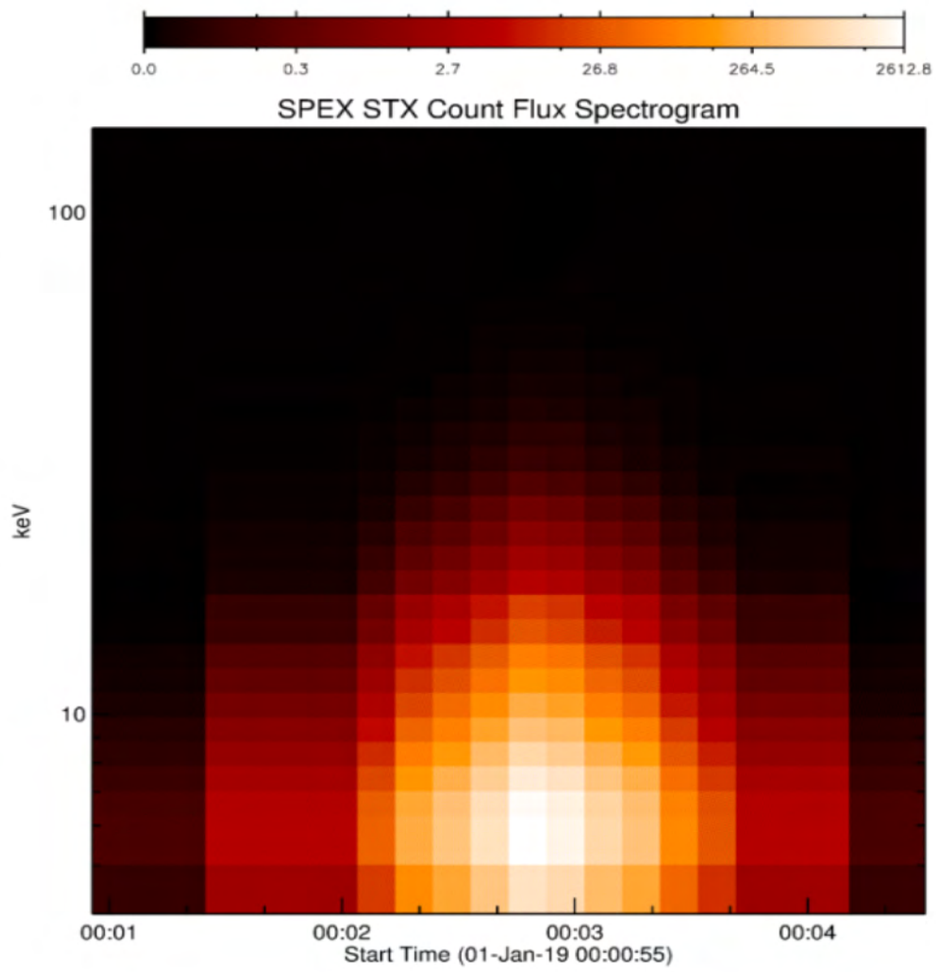
Real-time identification of time intervals corresponding to flaring activity

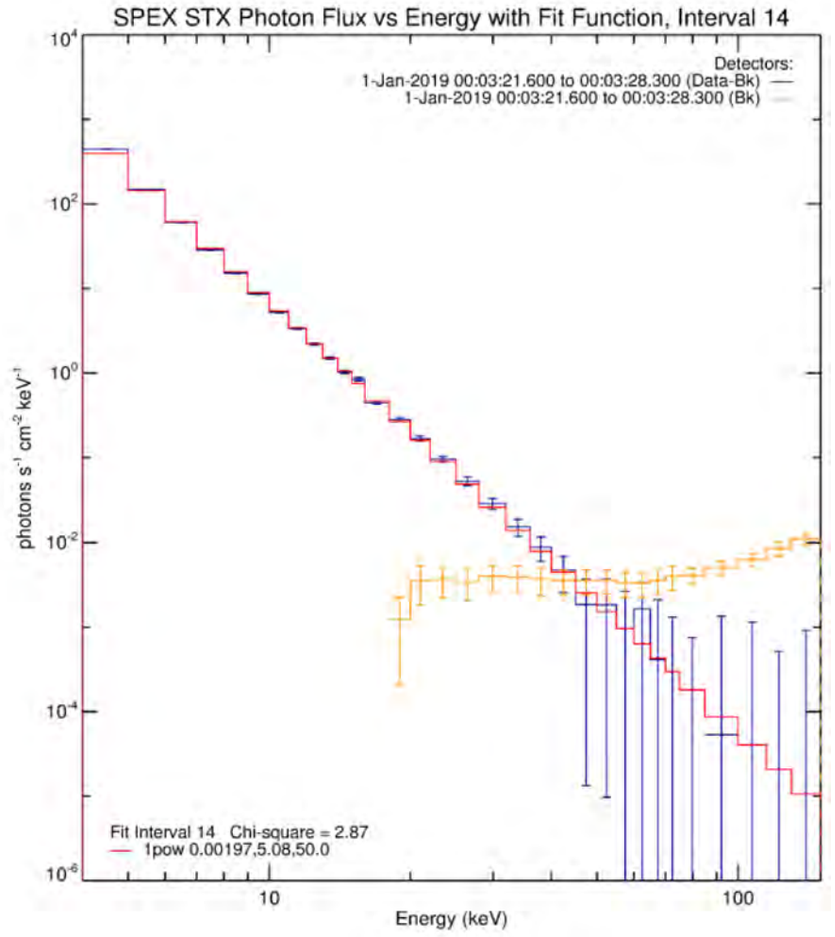
change in total count rates in a quick-look time interval in two energy bands corresponding to thermal and non-thermal emission.

Tested with simple profiles and modified RHESSI Lightcurves



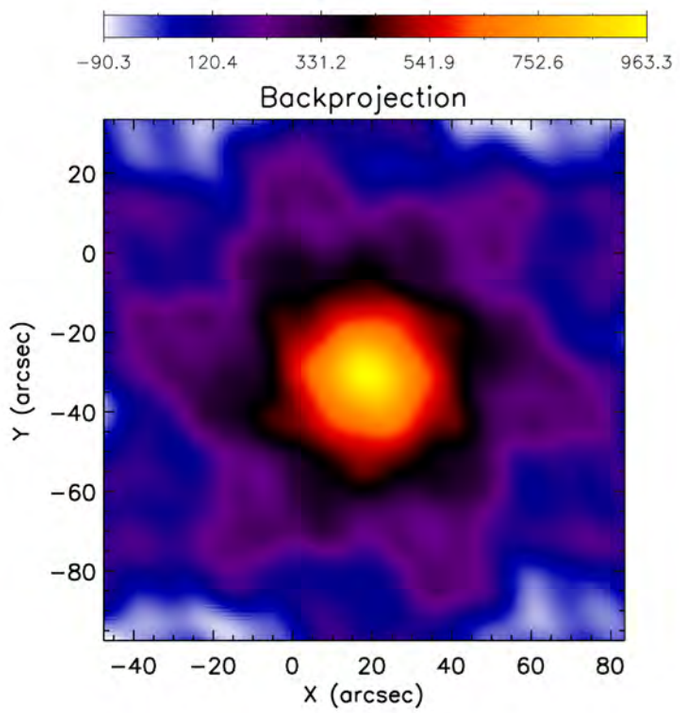
Data analysis (spectroscopy)

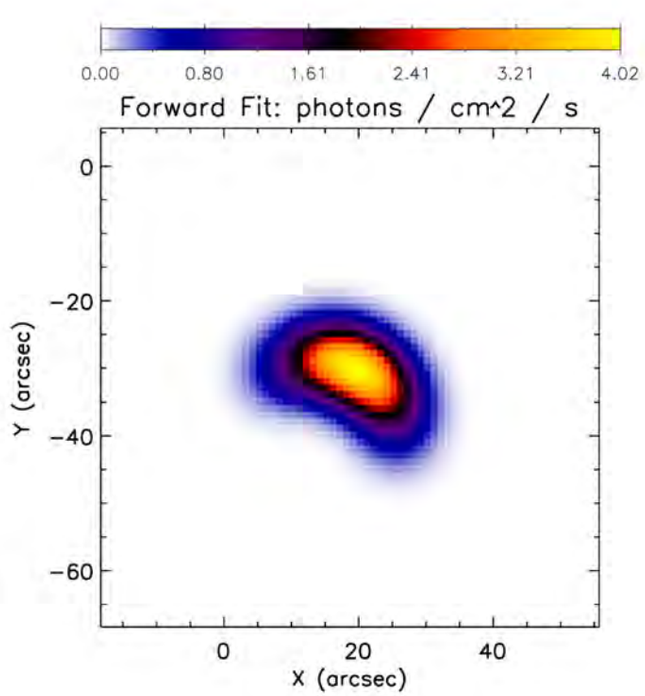


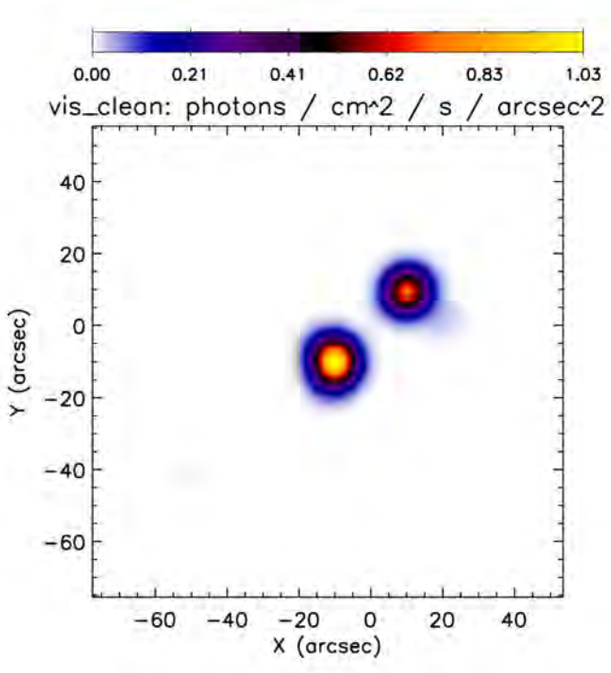


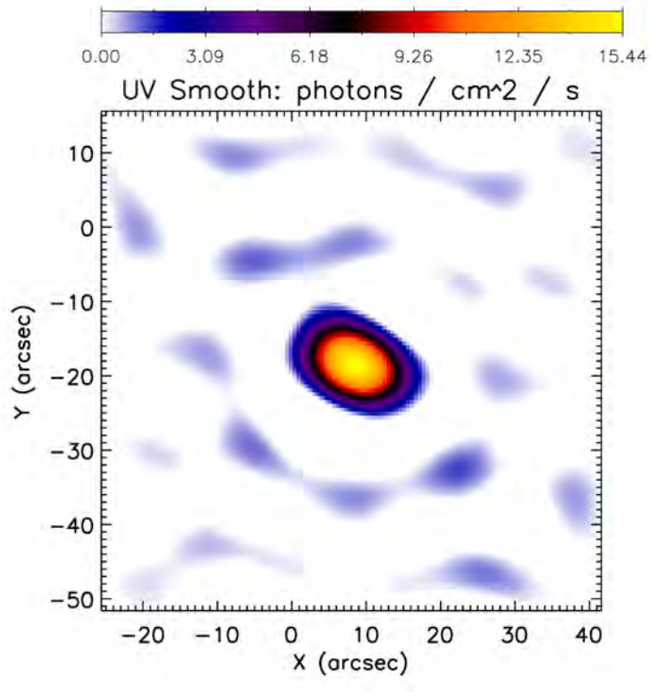
- STIX spectroscopy data can be read and processed by OSPEX

Data analysis (Imaging)









- Any visibility based algorithm can be fed STIX visibilities for imaging.

Thank you!