

# STIX L2 and L3 Data Products

*Preliminary and Partial*

Gordon Hurford  
for the STIX Team

11-July-2018

SOWG-12

# Some Relevant STIX Factoids

- **Imaging spectroscopy of flare X-rays**
  - 30 energy channels from 4 to 150 keV
  - Energy range includes both thermal ( $\sim 5\text{-}40$  MK) and non-thermal bremsstrahlung emission
- **Detectors and data**
  - 32 Cd-Te coarsely-pixelated (12) detectors
  - Fundamental data are counts as a function of time, energy, detector, pixel
- **Indirect Imaging**
  - Uses ratio of count rates among pixels to measure 30 Fourier-components (visibilities) of the source angular distribution
  - Images (7 arcsec resolution) are reconstructed by Fourier inversion of visibilities (as in radio interferometry)
  - Imaging data available only for ground-selected flares
  - Time- and energy-resolution are ground-selected on a flare-by-flare basis
- **Light curves and Spectra**
  - Spatially-integrated light curves are continuous.
  - Spectroscopy (for ground-selected flares only) can be spatially integrated or feature-based
  - Spectral time- and energy-resolution are ground-selected on a flare-by-flare basis.
  - Derived data products are plasma (T, EM), non-thermal electron parameters and movies (vs time or energy).

# STIX Data Products - General

- **Potential users:**

- Those just wanting overview of flare timing, intensity and location
  - Can rely on provided L2 and L3 data products as-is.
- Non-specialists wanting x-ray products adapted to their study.
  - Optimize X-ray time-resolution, energy-intervals, image parameters to support their unique objectives
  - Apply STIX-provided (IDL) tools to L2 data.
- Advanced users wanting to use x-ray data in non-standard ways
  - Optimize algorithms, calibrations, corrections for their unique objectives
  - Use their custom software with L1 and L2 data and calibration data.

- **Linearity**

- **Flux and visibilities are linearly related to source and so can be combined across time and/or energy by the user.**

- **Analysis software**

- Development is at an early stage but IDL software, browsing and archive will be based on RHESSI heritage.

- **Programmatic Issue**

- Funding for this work not secured.
- Currently no opportunities for funding instrument operations in Switzerland.

# STIX Low-Latency L2 Data Bases

Item	Coverage	Time resolution	Energy resolution	Spatial	Calibration	Units	FORMAT
Light Curves*	Continuous*	4s	5 broad bands, 4-150 keV	integrated	Yes**, except for off/diagonal energy response	Ph/cm <sup>2</sup> /s	FITS, PNG 1 hour plots
Background	Continuous*	16s	Same 5 bands, 4-150 keV	n/a	Live time only	Counts/cm <sup>2</sup> /s	FITS, PNG 6-hour plots
Calibration Spectra from Ba-133 source	as acquired, Solar quiet time ~1/day	~1 day	>=0.2 keV in selected energy bands	Detector/pixel-specific	Live time only	Counts	FITS. PNG plots
Aspect solution STIX offset from s/c ref.	Occasional	~days	n/a	<3 arcsec	Based on time series of corrected photodiode outputs	Arcsec offset from s/c reference	FITS PNG plot of trends
Flare List	Continuous*	Start, End, Peak times	Estimated peak spectral parameters	Approximate location (~2 arcmin)	Various Flags:		FITS. Printable text

\* When STIX is observing

\*\* Better calibrated than LL pipeline version

# STIX Science-Related L2 Data Bases

Item	Coverage	Time resolution	Energy resolution	Spatial	Calibration	Units	FORMAT
Spectrograms	Ground-selected flares only*	Ground-selected, uniform, ~1 to ~100 s	Ground-selected, up to 30 channels	integrated	Fitted E gain, offset, resolution for each pixel	(2-D plots, flux vs t, E)	FITS PNG color-coded 2-D display
Spectra	Ground-selected flares only*	Match to spectrogram columns	Match to spectrogram rows	Integrated	Similar to spectrograms with diagonal elements removed	Photons/cm <sup>2</sup> /s	FITS, PNG plots
Light curves	Ground-selected flares only*	Match to spectrogram rows	Match to spectrogram columns	Integrated	Similar to spectrograms	Ph/cm <sup>2</sup> /s	FITS,, PNG plots
Visibilities	Ground-selected flares only*	Ground-selected, nonuniform ~1 to ~1000s	Ground-selected, up to 30 channels	30 visibilities,	Corrected for live time, diagonal energy response, grid response, metrology	Ph/cm <sup>2</sup> /s	FITS, TBD PNG displays
Images	Ground-selected flares only*	Single or combined visibilities ~1 to ~1000 s	Single or combined visibilities	Full disk coverage, 7 arcsec resolution	Corrected for live time, diagonal energy response, gri response, metrology	Ph/cm <sup>2</sup> /arcsec <sup>2</sup> /s	FITS, PNG color-coded maps

\* Subject to T/M limitations, can be selected up to several weeks after-the fact

# STIX Science-Related L3 Data Bases

Item	Coverage	Time resolution	Energy resolution	Spatial	Units	FORMAT
Spatial Movies Flux(x,y) vs time	Selected flares	Match available L2 images (~1 to 100 s)	Match available images	~5 arcsec pixels	Ph/arcsec <sup>2</sup> /cm <sup>2</sup> /s	FITS, MPEG movies
Movies Spectral movies (Flux vs energy)	Selected flares & flare features	Match available L2 images (~1to~1000s)	Match available spectra	Spatially- integrated or feature-based	Ph/arcsec <sup>2</sup> /cm <sup>2</sup> /s Or Ph/cm <sup>2</sup> /s	FITS, MPEG movies
Nonthermal electron spectra	Selected flares	Single or combined flare spectra (~1 to ~1000s)	Match available spectra	Integrated	Electrons/keV/s	FITS, PNG plots