STIX IDL GSW update

Ewan Dickson

On behalf of the STIX Software Team

STIX Team Meeting Autumn 2023, Wroclaw

Release Version History

- Version 0.1.0 was released on 31st March 2022
  - First public release, basic functionality for file reading, spectroscopy and imaging.
- Version 0.2.0 was released on 10th July 2022
  - Advancements in all areas particularly the demo scripts, aspect handling added.
- Version 0.3.0 was released on 3rd Nov 2022
  - Improved imaging capabilities and supports the draft version of the official level 1 data products.
- Version is 0.4.0 - 12th Apr 2023
  - First official release compatible with the release versions of our L0, and L1 FITS files.
- **Version is 0.5.0 – 4th Nov 2023**
  - Latest release uploaded last weekend. General improvements to spectroscopy, imaging and aspect

Current Release v0.5 (General & Spectroscopy)

- Changelog at https://github.com/i4Ds/STIX-GSW/releases/tag/v0.5.0
- General
  - Update calibration data
  - Current best livetime parameters
  - Easier dowload of data files
  - Software version now included in output FITS files
  - Flexiblity of output directory
- Spectroscopy
  - Semi-transparent grids
  - keyword to shift time bins by time step
  - corrected ELUT formula
  - update transmission

Current Release v0.5 (Imaging & Aspect)

- Imaging
  - stx_map2fits
  - stx_imaging_pipeline accepts 'method' keyword
  - Grid and detector separation values updated
  - Implemented new definition of (u,v) points
  - Corrected ELUT formula
- Aspect
  - SAS_OK flag used to indicate reliablity of solution
  - Error codes incuded with data when solution
  - More info in talks from Frederic Schuller

Update Calibration Data

- `IDL> stx_check_config_files`
- `STIX Configuration files are already up to date v0.1.2`
- Currently Updates
  - ELUT
  - Science Channels
- Accessed through mirror of STIX-CONF at http://dataarchive.stix.i4ds.net/STIX-CONF
- Additional data products straightforward to add
- ELUTs changed on 19th June (update of calibration) 3rd July (Icomp= 2), 31st July (Fine thermal bins) and 5th November (return to nominal bins)

Dowload Of Data Files

- IDL> ephemeris_file = stx_get_ephemeris_file('09-May-23 06:14:37.094', '09-May-23 06:36:12.194')

- IDL> ephemeris_file

- User/stix/solo_L2_stix-aux-ephemeris_20230509_V01.fits

- data_file = stx_get_science_fits_file('1178428688')

- IDL> data_file

- User/stix/solo_L1_stix-sci-xray-cpd_20200607T213709-20200607T215208_V01_1178428688-49155.fits

Flare Location (i)
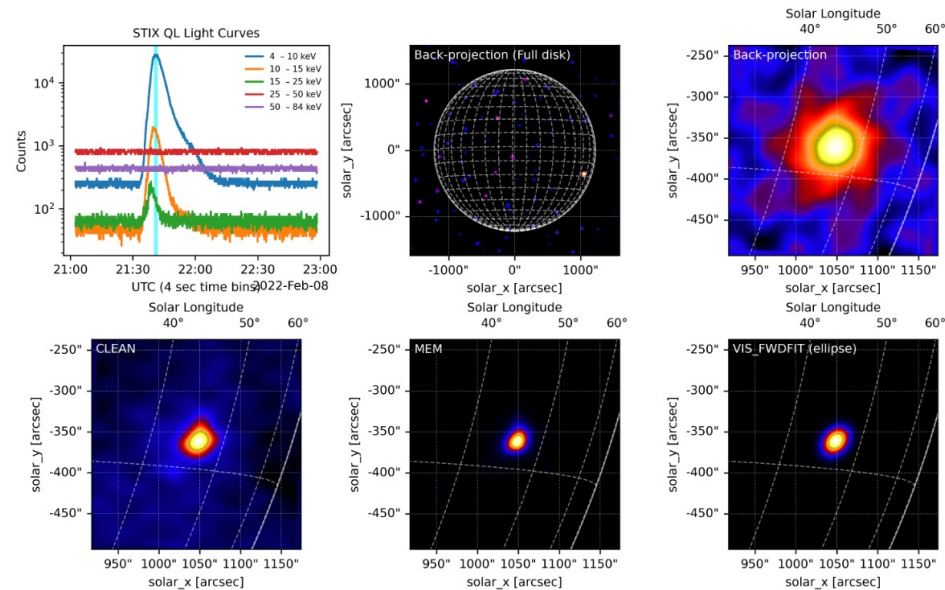
- flare_location_hpc = [1050., -375.]
- time_range = ['8-Feb-2022 21:00:00.00', '8-Feb-2022 21:40:00.437']
- aux_fits_file = stx_get_ephemeris_file(time_range[0], time_range[1])
- aux_data = stx_create_auxiliary_data(aux_fits_file, time_range)
- flare_location_stx = stx_hpc2stx_coord(flare_location_hpc, aux_data)
- stx_convert_spectrogram, fits_path_data = fits_path_data, flare_location_stx = flare_location_stx

Flare Location (ii)

- `time_range = ['8-Feb-2022 21:00:00.00', '8-Feb-2022 21:40:00.437']`

- `aux_fits_file = stx_get_ephemeris_file( time_range[0], time_range[1])`

- `aux_data = stx_create_auxiliary_data(aux_fits_file, time_range)`

- `stx_estimate_flare_location, fits_path_data, time_range , aux_data, flare_loc = flare_location_hpc`

- `flare_location_stx = stx_hpc2stx_coord(flare_location_hpc, aux_data)`

- `stx_convert_spectrogram,  fits_path_data = fits_path_data, flare_location_stx = flare_location_stx`

Flare Location (iii)

- stx_convert_spectrogram, $
-    fits_path_data = fits_path_data, $
-    flare_location_hpc = flare_location_hpc,
aux_fits_file = aux_fits_file
- stx_convert_pixel_data, $
-    fits_path_data = fits_path_data,$
-    flare_location_hpc = flare_location_hpc, $

Semi-transparent Grids

- Previous STIX GSW assumed fully opaque grids when calculating the response.
- This causes a notable divergence in the 63- 70 keV energy bin
- Updated version uses correct tungsten transmission for each grid
- Bridge factor included
- The corner cutting and shadowing depending on source location is also calculated
- Simplified version is still used in imaging pipeline
- Effects included: slit/pitch ratio, grid thickness, internal shadowing, corner cutting, grid transparency, and bridges.

Average Top24 Transmission
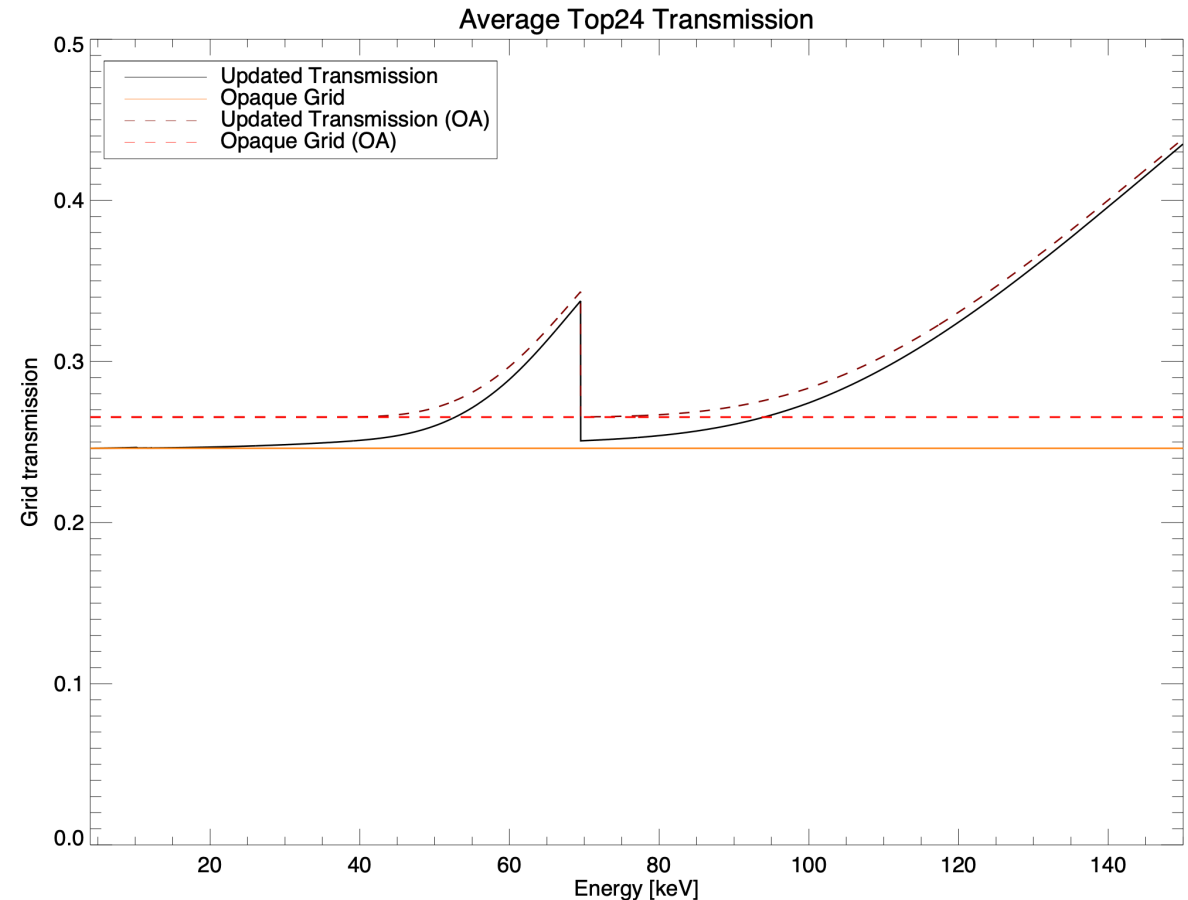
Shift Time Bins

- For events prior to 9th December 2021 incorrect time reporting on board meant the duration had to be shifted for a single bin
- This is only possible for full time resolution data
- For the vast majority of observations this has been fixed in the FITS file
- For some events although not automatically detected it is still possible to shift
- HISTORY: 'Time and count arrays were shifted to fix offset'
- COMMENT: 'Time and count arrays offset not fixed as possibly summed on board'
- stx_convert_spectrogram, ..., /shift_duration
- stx_convert_pixel_data , ..., /shift_duration

Next Update

- Planned in the coming months
- Summing finest bins in current ELUT (fine bins) in stx_convert
- Light curve tool: do ELUT correction after summing in energy
- Option to skip ELUT correction
- Fuzzy grid parameters (Anna Volpara)

Future Plans

- Finest grids
- Imaging Spectroscopy (Andrea Battaglia)
- Fine energy binning DRM
- Simulated DRM using GEANT (Hualin Xiao)
  - DRM for each detector/pixel
- Spectral dependent ELUT correction
- Flare search and selection
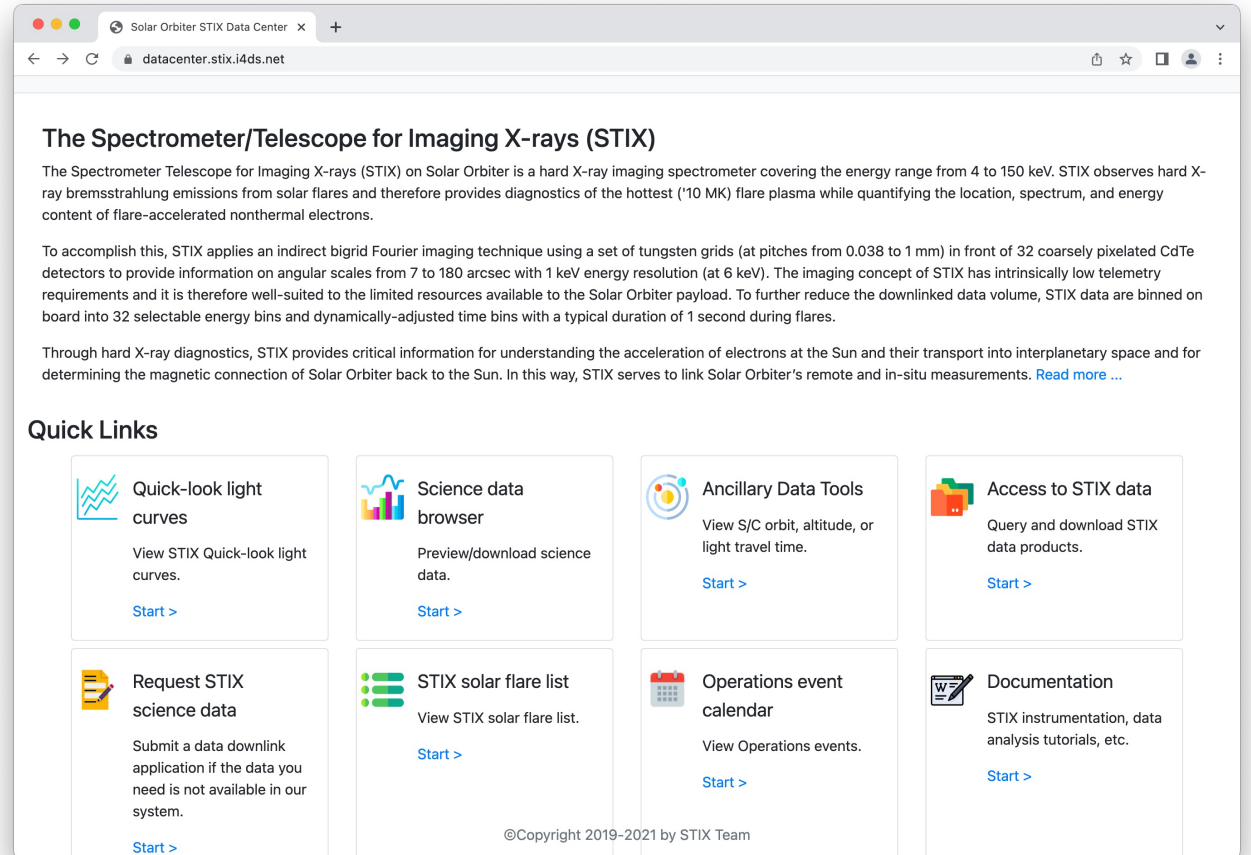
Data Access

Official L1 FITS file are available at

https://datacenter.stix.i4ds.net/view/list/fits

http://dataarchive.stix.i4ds.net/fits/

https://soar.esac.esa.int/soar/

STIX GitHub

- The development of the STIX Ground software occurs on GitHub

- https://github.com/i4Ds/STIX-GSW

- Users are encouraged to make issues for features they would like to see and bugs that they find

- It is also possible to download the "development" version that is currently being worked on before the official release to SSW
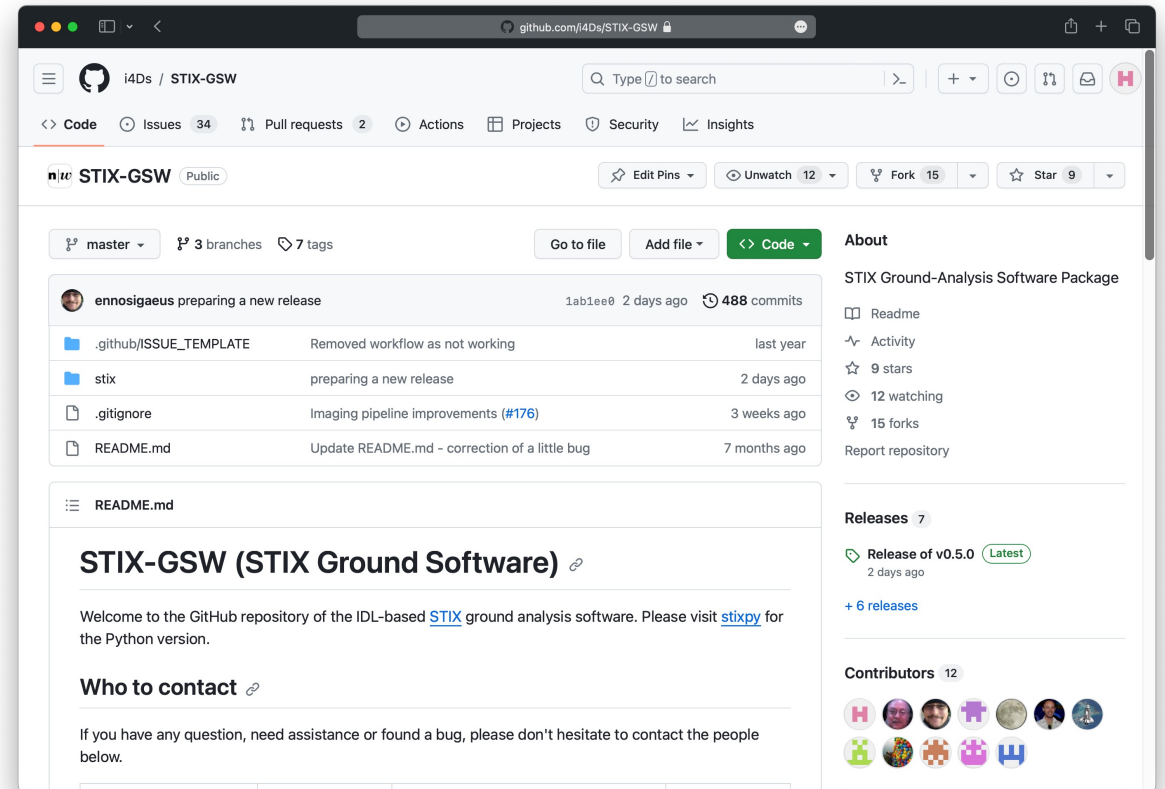
Who to contact

If you have any question, need assistance or found a bug, please don't hesitate to contact the people below.

Topic	Contact	E-Mail	GitHub Account
Aspect and pointing	Frédéric Schuller	fschuller [at] aip [dot] de	@FredSchuller
Spectroscopy and OSPEX	Ewan Dickson	ewan [dot] dickson [at] uni-graz [dot] at	@grazwegian
Imaging	Paolo Massa	massa [dot] p [at] dima [dot] unige [dot] it	@paolomassa
Imaging-spectroscopy	Andrea F. Battaglia	andrea [dot] battaglia [at] fhnw [dot] ch	@afbattaglia
Website	Hualin Xiao	hualin [dot] xiao [at] fhnw [dot] ch	@drhlxiao
IDL tools	Ewan Dickson	ewan [dot] dickson [at] uni-graz [dot] at	@grazwegian
Python tools	Shane Maloney	shane [dot] maloney [at] dias [dot] ie	@samaloney
Data requests	Säm Krucker	krucker [at] berkeley [dot] edu	
General issues	Säm Krucker	krucker [at] berkeley [dot] edu	
SolarSoftware	Säm Freeland	freeland [at] lmsal [dot] com	

https://github.com/i4Ds/STIX-GSW#who-to-contact