



# XRT - Swift Workshop

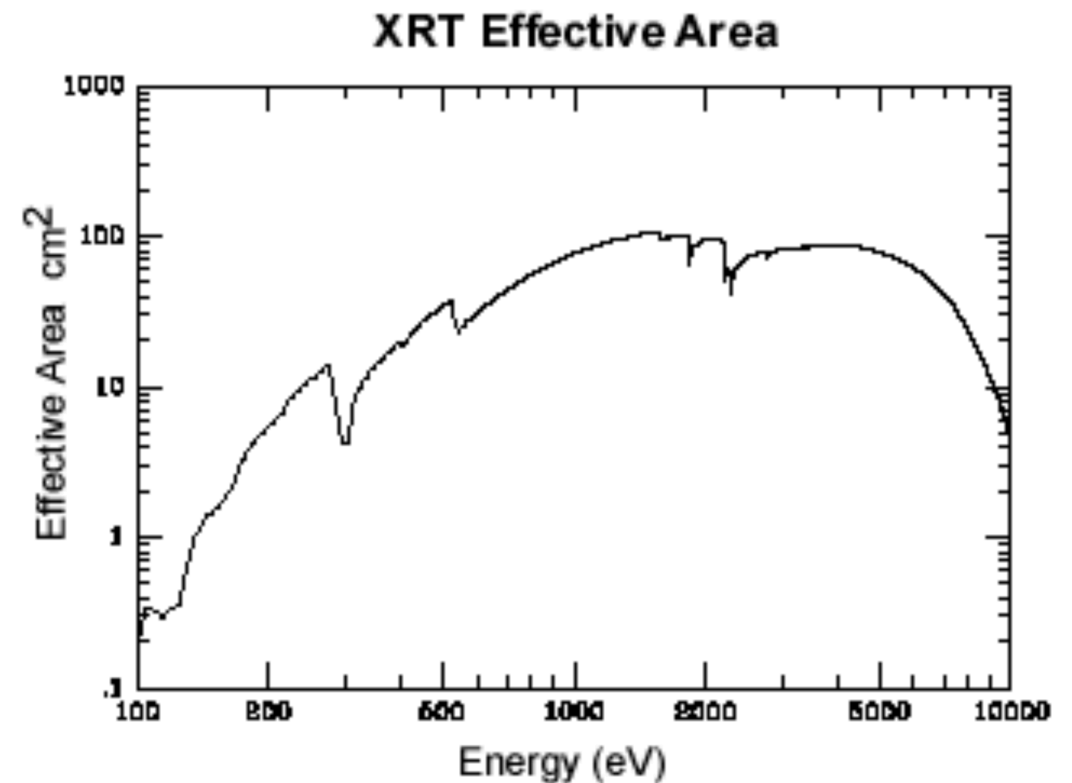
**Simone Dichiaro (Penn State)  
on behalf of the XRT Team**





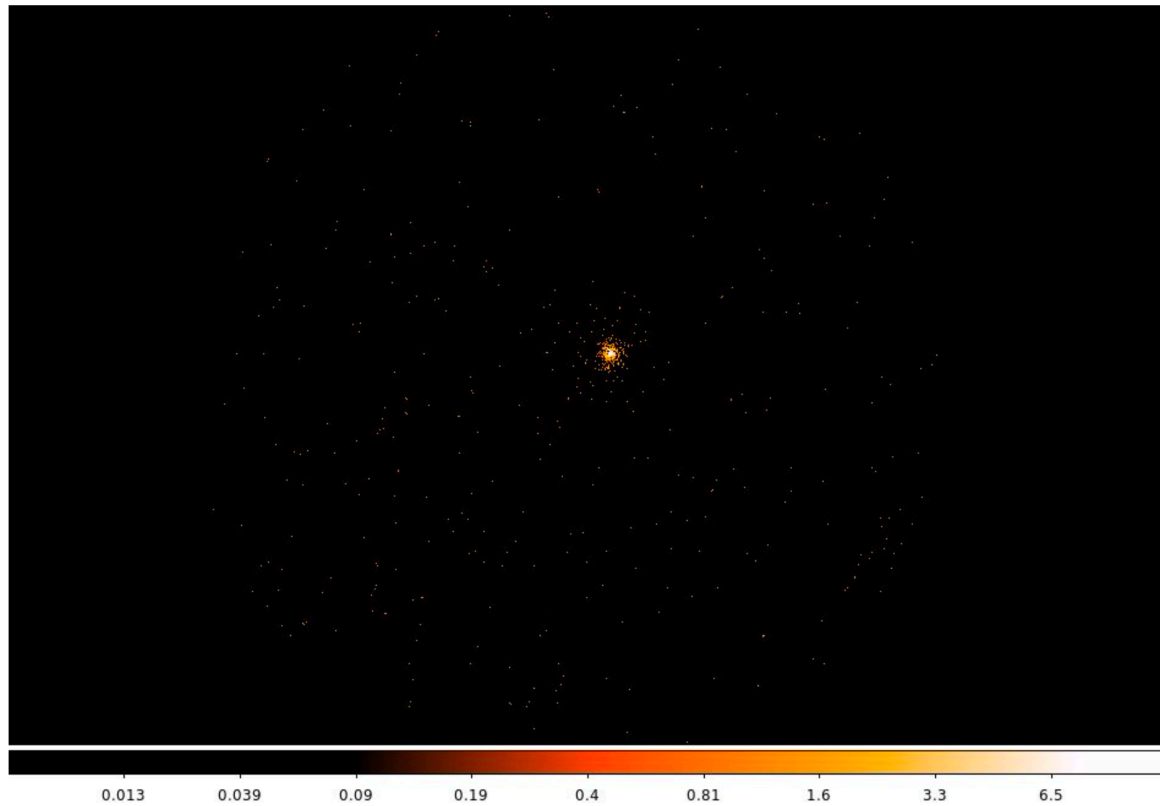
# XRT Features

- **Detector:** MAT CCD-22, 600 x 602 pixels
  - **Field of View (Detector Format) :** 23.6 x 23.6
  - **Pixel Size:** 40  $\mu\text{m}$  x 40  $\mu\text{m}$
  - **Pixel Scale:** 2.36 arcseconds/pixel
  - **PSF:** 18 arcsec HPD @ 1.5 keV  
22 arcsec HPD @ 8.1 keV
  - **Position accuracy:** 3-6 arcsec
  - **Energy Range:** 0.2-10 keV
- 
- **Available Readout Modes:** Windowed Timing (WT) and Photon-Counting (PC)
  - **Energy Resolution:** 140 eV @ 5.9 keV (at launch)
  - **Sensitivity:**  $2 \times 10^{-14}$  erg  $\text{cm}^{-2}$   $\text{s}^{-1}$  (depends on the spectrum, bkg, etc)





# XRT modes

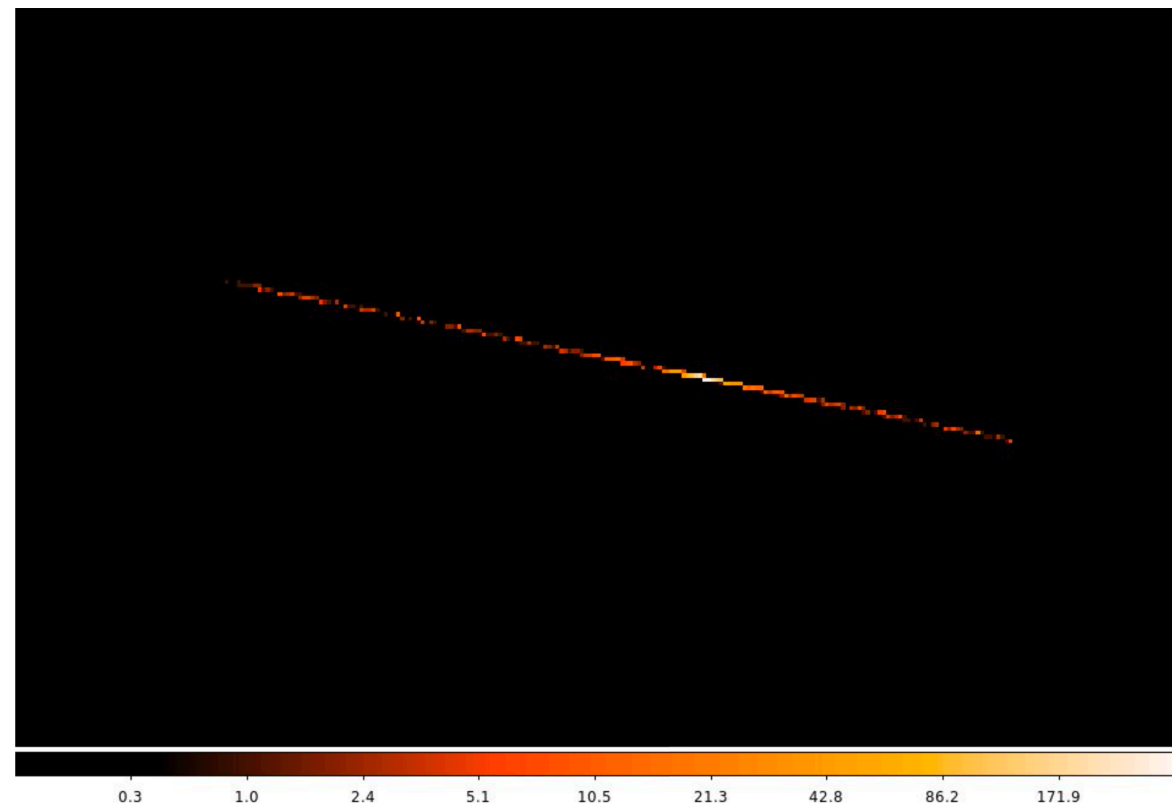


**Photon Counting:** retains full imaging and spectroscopic resolution  
 2-D images  
 2.5 s time resolution  
 Used for fluxes below 1 mCrab

**Windowed Timing:** It's obtained compressing 10 rows into a single row, and then reading out only the central 200 columns (~8 arcmin) of the CCD  
 1-D images oriented at the spacecraft roll angle

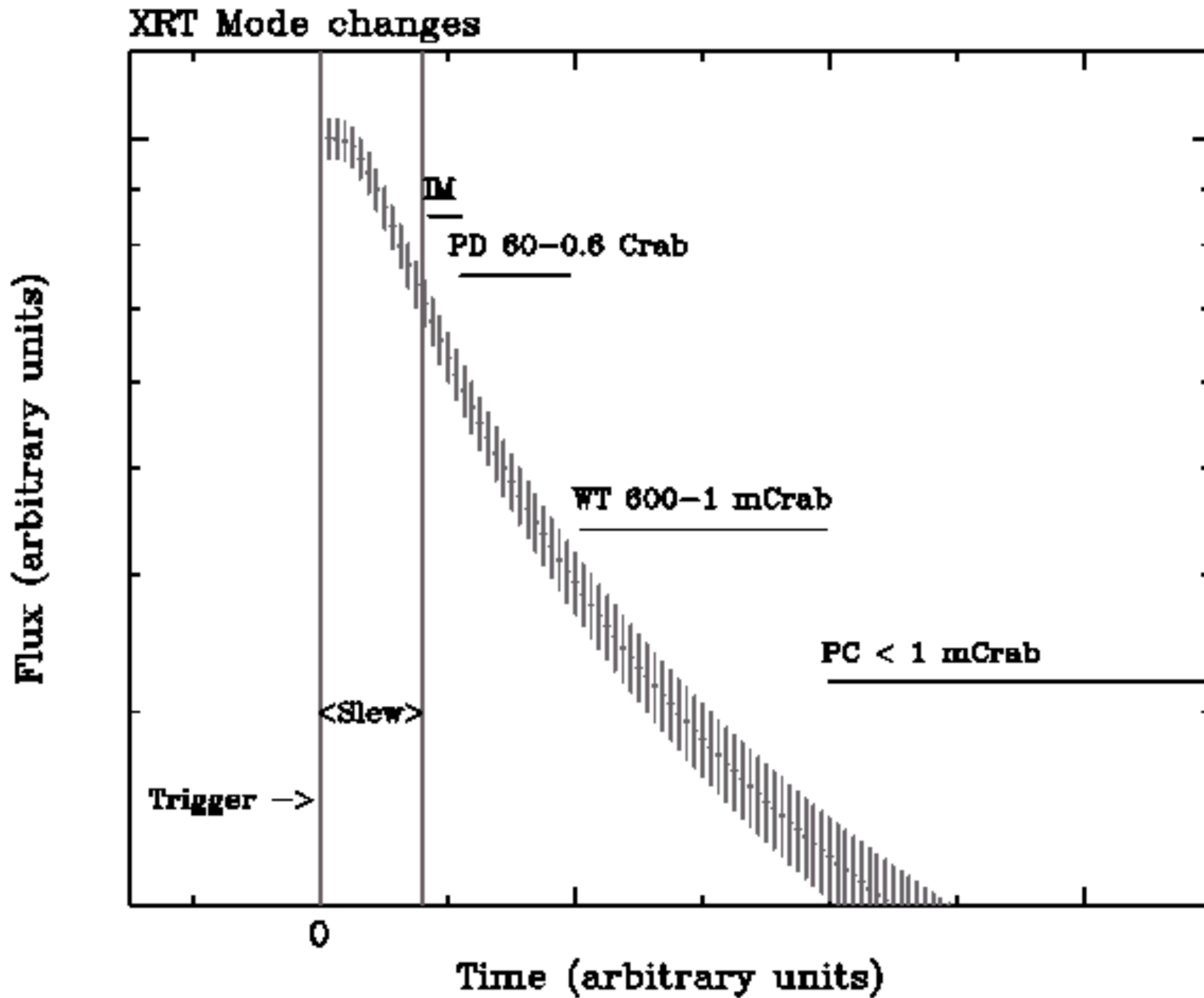
1.7 ms time resolution

Used for bright sources (>1 mCrab)





# XRT modes







# Software

**NASA's HEASARC: Software**

Navigation menu: FITSIO, FTOOLS, FV, HEASoft, Hera, Maki, PIMMS, PROFIT, Xanadu, Xselect, XSTAR, ASTRO-Update, FITS

## Download the HEASOFT Software

Current version [6.33.2 Release Notes](#)

### STEP 2 - Download the desired packages:

Selecting an individual mission package will automatically select a set of recommended general-use tools.

- All
- Mission-Specific Tools
- [ASCA](#)  
  [Einstein](#)  
  [EXOSAT](#)  
  [CGRO](#)  
  [HEAO-1](#)  
  [Hitomi](#)  
  [INTEGRAL](#)  
  [IXPE](#)  
  [MAXI](#)
- [NICER](#)  
  [NuSTAR](#)  
  [OSO-8](#)  
  [ROSAT](#)  
  [Suzaku](#)  
 [Swift](#)  
 [Vela](#)  
 [XTE](#)

**HEASoft:** <https://heasarc.gsfc.nasa.gov/docs/software/heasoft/download.html>

**Swift calibration files:** <https://heasarc.gsfc.nasa.gov/docs/heasarc/caldb/swift>





# Data

## Quick Look Site (hours after the obs)

### Swift quick look data

Tue, 13 Aug 2024 22:34:30 UTC

Older data are available in the [Swift archive \(full listing here\)](#), also supplied by [HEASARC](#) (US) and the [ASDC](#) (Italy).

[About quick-look data.](#)

#### Instructions:

- Click on a sequence number to access data for that sequence.
- Click on a column header to sort the table by that column.
- After about a week the data are moved to the [archive](#) (also available from [HEASARC](#) and the [ASDC](#) and removed from this list.
- The columns are described at the bottom of the table.

ObsID	Ver	Object	Observed	Processed	C
<a href="#">00010085006</a>	8	DLT17aw	2024-08-04T11:39:56	2024-08-05	<a href="#">new data moc2024</a>
<a href="#">00010085007</a>	12	AT2024pxl	2024-08-07T04:31:56	2024-08-08	<a href="#">new data moc2024</a>
<a href="#">00010085008</a>	9	AT2024pxl	2024-08-10T16:00:55	2024-08-12	<a href="#">new data moc2024</a>
<a href="#">00010375123</a>	14	IC3599	2024-08-07T10:22:56	2024-08-08	<a href="#">new data moc2024</a>
<a href="#">00010450046</a>	5	GSN069	2024-08-08T14:09:57	2024-08-09	<a href="#">new data moc2024</a>
<a href="#">00010450047</a>	4	GSN069	2024-08-12T11:13:44	2024-08-12	<a href="#">new data moc2024</a>
<a href="#">00010695036</a>	3	XMMSL2J194402.0+284451	2024-08-12T17:01:56	2024-08-13	<a href="#">new data moc2024</a>
<a href="#">00011565027</a>	8	AT2018cdp	2024-08-02T21:44:57	2024-08-12	<a href="#">FINAL FOR ARCHIV</a>
<a href="#">00011601270</a>	1	TOO (280.025	2024-04-02T23:58:55	2024-04-03	<a href="#">new data moc2024</a>
<a href="#">00013509215</a>	8	SwiftJ164449.3+573451	2024-08-02T07:37:56	2024-08-12	<a href="#">FINAL FOR ARCHIV</a>
<a href="#">00013509216</a>	13	SwiftJ164449.3+573451	2024-08-09T05:21:57	2024-08-11	<a href="#">new data moc2024</a>
<a href="#">00013544251</a>	5	Mrk335	2024-08-06T16:18:56	2024-08-07	<a href="#">new data moc2024</a>
<a href="#">00013544252</a>	3	Mrk335	2024-08-10T22:56:18	2024-08-12	<a href="#">new data moc2024</a>
<a href="#">00013598259</a>	4	ZTFJ1406+1222	2021-04-29T12:46:35	2021-04-29	<a href="#">new data moc2021</a>
<a href="#">00013906123</a>	2	1ES1959+650	2024-08-04T23:07:57	2024-08-05	<a href="#">new data moc2024</a>
<a href="#">00013906124</a>	5	1ES1959+650	2024-08-08T23:15:57	2024-08-09	<a href="#">new data moc2024</a>
<a href="#">00013942003</a>	13	ZTFJ0546+3843	2024-08-05T16:57:55	2024-08-06	<a href="#">new data moc2024</a>

<https://www.swift.ac.uk/archive/ql.php>

## Archive (~ a week after the obs)

### HEASARC Archive Search

### [Data Caveat](#)

**Target id:**  (e.g. 100001)

**Observation id:**  (e.g. 00010000001)

**Object Name or Coordinates:**  J2000

**Observation Dates:**

Search Type  **Radius:**  Default

**BAT FOV** beta test, Master Log only

**Master Log** [parameter search form](#)

**BAT Log** [parameter search form](#)

**UVOT Log** [parameter search form](#)

**XRT Log** [parameter search form](#)

**TDRSS Log** [parameter search form](#)

#### Observation Logs:

Query the HEASARC Swift tables using the parameters set above

<https://heasarc.gsfc.nasa.gov/cgi-bin/W3Browse/swift.pl>





# XRT analysis

Analysis step-by-step:

<https://www.swift.ac.uk/analysis/xrt/>

Swift: Catching Gamma-Ray Bursts on the Fly

U.S. site  
Italian site  
U.K. site

UNIVERSITY OF LEICESTER  
School of Physics & Astronomy

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## XRT Data Analysis

### Ready-made products

[Swift-XRT data products for GRBs](#)  
[Build Swift-XRT products for any object](#)  
[Information about available XRT Positions for GRBs](#)

### XRT analysis threads

- General introduction
  - [Obtaining and setting up the Swift software](#)
  - [Files and directory structure](#)
- General processing
  - [Producing cleaned XRT event-files](#)
  - [Source detection and position determination](#)
- Analysis
  - [General introduction to XSELECT](#)
    - [How to extract an image](#)
    - [How to extract a spectrum](#)
      - [Pile-up walk-through](#)
      - [ARFs](#)
      - [Position-dependent WT RMFs](#)
    - [How to extract a light-curve](#)
      - [Light-curve exposure correction](#)
      - [Barycentric correction](#)
  - [Exposure Maps](#)

### Calibration information

[Information about XRT's operating modes](#)

TACHEC Cross-calibration of Chandra, NuSTAR, Swift, Suzaku, XMM-Newton with 3C 273 and

#### Instrument guides

- [BAT data analysis guide](#)
- [XRT data analysis guide](#)
- [UVOT data analysis guide](#)

#### XRT help threads

General introduction

- [Obtaining and setting up the Swift software](#)
- [Files and directory structure](#)

General processing

- [Producing cleaned XRT event-files](#)
- [Source detection and position determination](#)

Analysis

- [General introduction to XSELECT](#)
- [How to extract an image](#)
- [How to extract a spectrum](#)
- [Pile-up walk-through](#)
- [ARFs](#)
- [How to extract a light-curve](#)
- [Light-curve exposure correction](#)
- [Exposure Maps](#)

#### XRT pages

- [Leicester XRT Known Issues](#)
- [Calibration](#)
- [Science Analysis](#)
- [XRT Modes](#)
- [XRT SPIE papers](#)

#### XRT documents

- [XRT Software Guide](#)
- [XRT instrument paper](#)
- [Gain and RMF release table.](#)

## Basic commands:

- xrtpipeline**: It runs the XRT data processing, creating the Level 2 cleaned event file which has been calibrated and screened through a standard screening process
- ximage**, **xrtcentroid**: to detect the source and to determine the position
- xselect**: used to extract higher level products such as images, light curves and spectra

## Output file:

sw[obsid]x<mode><window><type>\_cl.evt

The <type> includes “sl” for slew and “st” for settling data, but these can be ignored. The useful files are “po” for pointing.

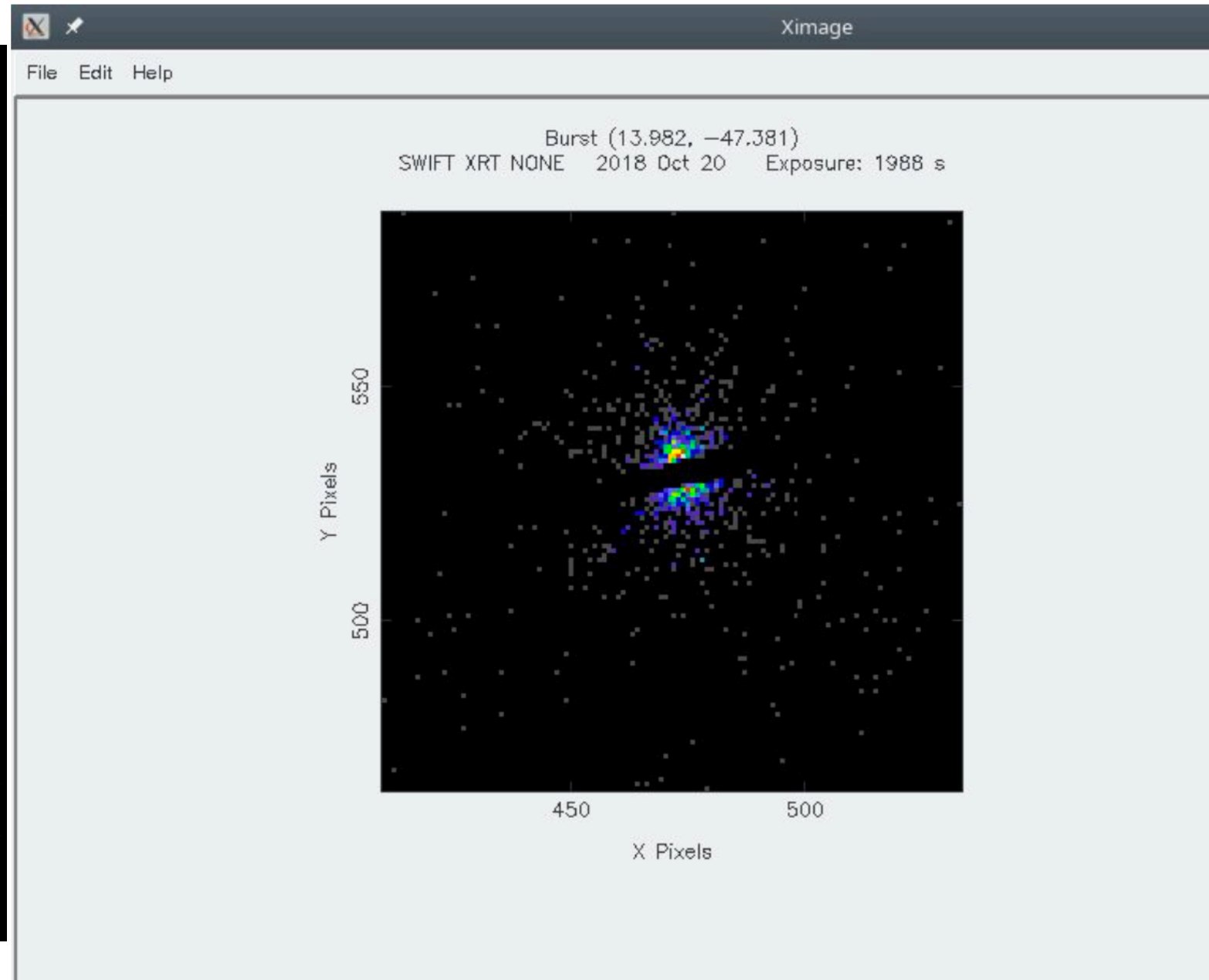
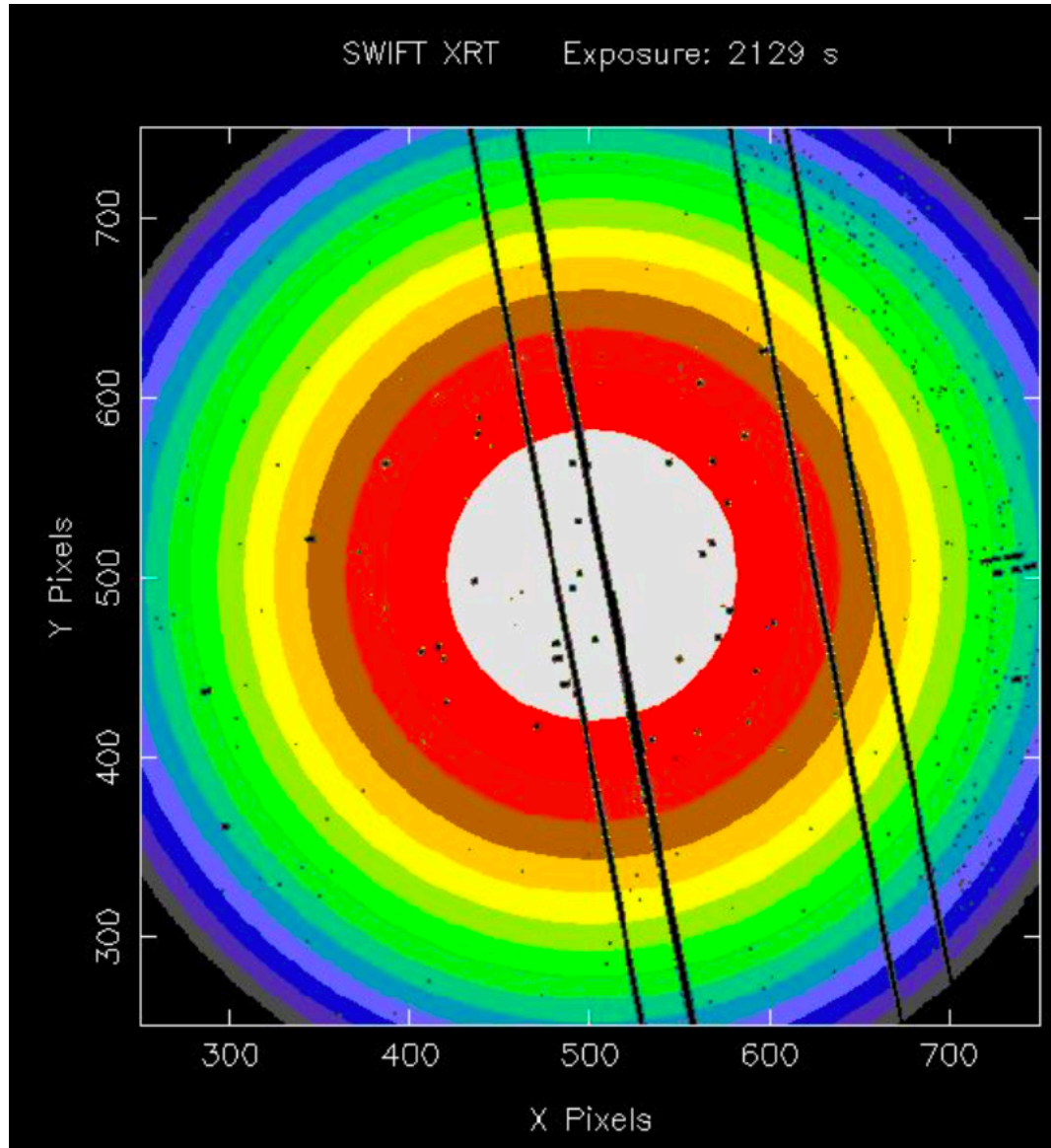
**UKSSDC Help Desk:** [swifthelp@le.ac.uk](mailto:swifthelp@le.ac.uk)



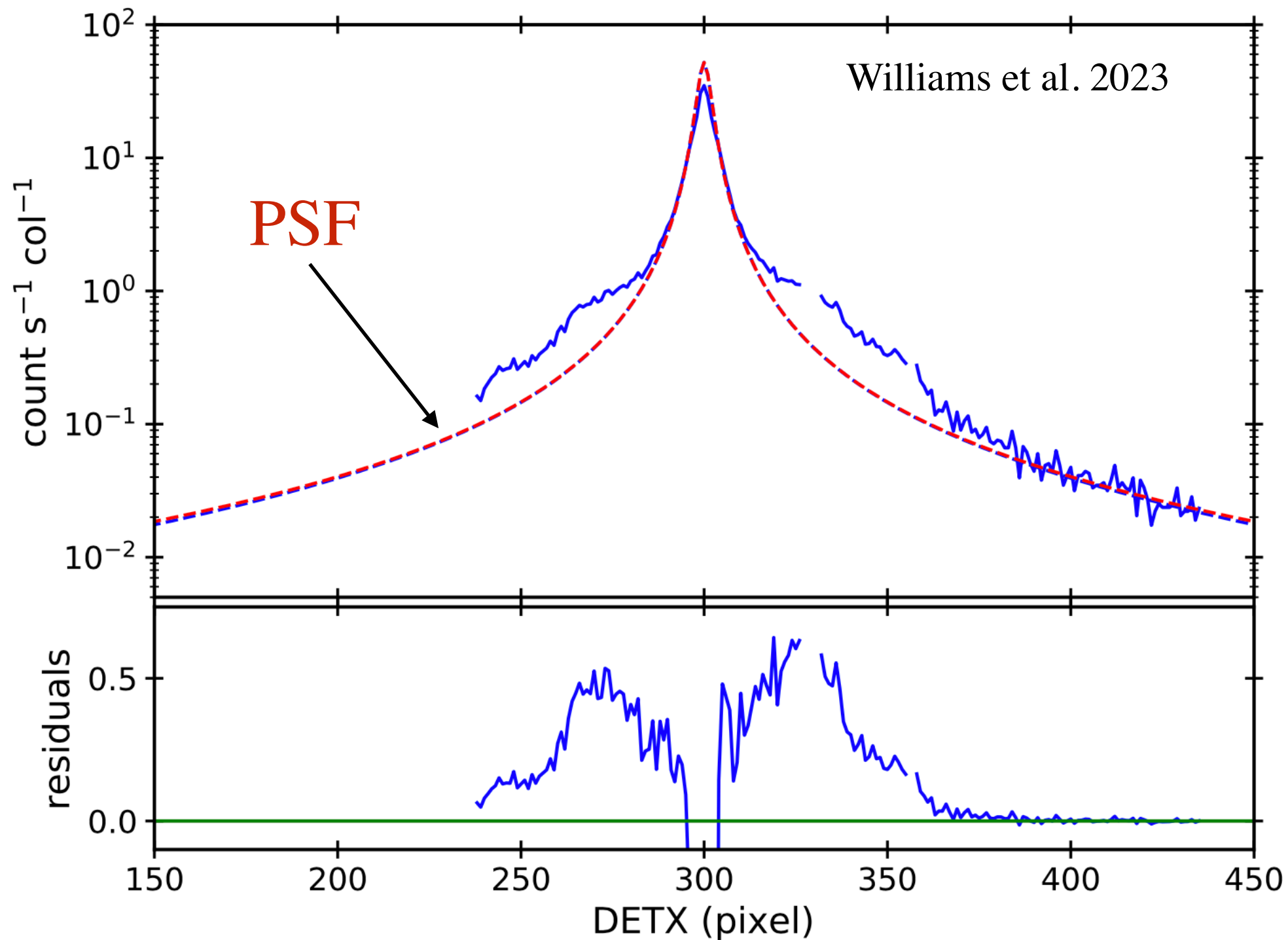




# Exposure map



# Pile-up effect

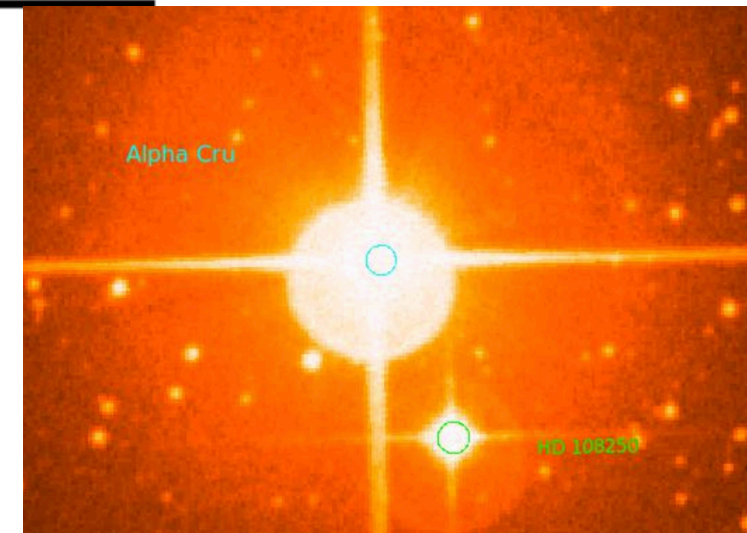
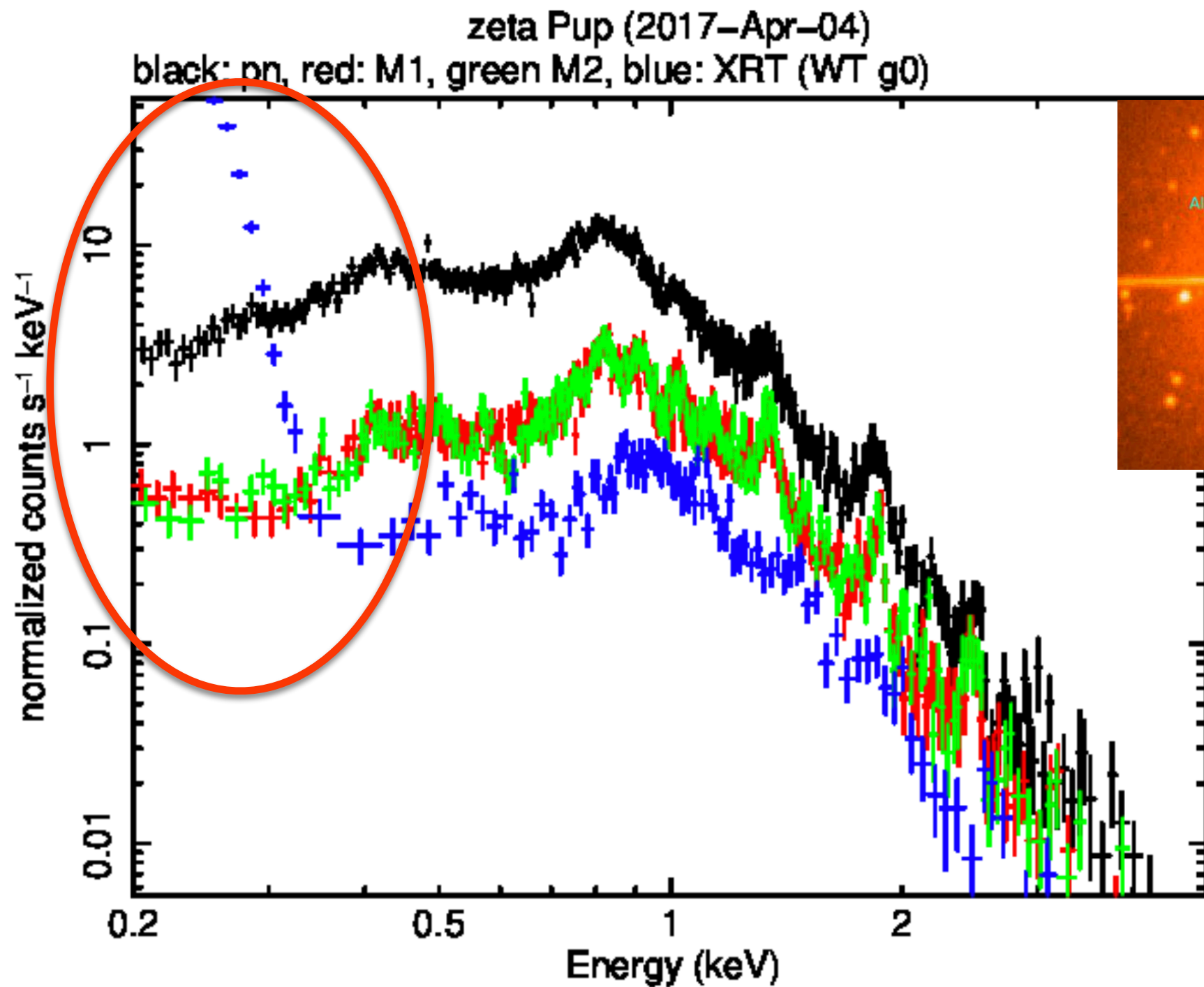


**Pile-up details:** <https://www.swift.ac.uk/analysis/xrt/pileup.php>





# Optical Loading



**Optical loading tool:** [https://www.swift.ac.uk/analysis/xrt/optical\\_tool.php](https://www.swift.ac.uk/analysis/xrt/optical_tool.php)







# User online tool



Home About Support Data Access Data Analysis GRB Products Publications Links

site map | Search:  ?

Home > Data Analysis > Build Swift-XRT products

## Build Swift-XRT products.

**Version 1.10 of the Python API has been released as part of [swifttools v3.0](#).** Users are advised to update, and see the [Release notes](#).

On 2022 August 5 we added some [new options for spectral fitting](#) to this service.

This web-form is not designed for bulk processing of large numbers of datasets. If you have a large project you wish to perform, please use the [API](#); the documentation includes [an example of how to submit a large number of jobs piecemeal](#), so as not to overload our servers.

Using this form you can build an XRT light curve, spectrum or enhanced position of any *point source* observed by Swift. Full documentation for this process is given in the [online documentation](#). **You need to be [registered](#) to use this service. [[Why?](#)].**

*There are still open issues related to the analysis of Swift-XRT data. Please read the [XRT digest pages](#) before drawing conclusions from the products you generate here.*

You currently have 0 jobs in the queue or running.

**User objects tool:** [https://www.swift.ac.uk/user\\_objects/](https://www.swift.ac.uk/user_objects/)

See Evans et al. (2009, MNRAS, 397, 1177), Evans et al. (2007, A&A, 469, 379) and Evans et al. (2010, A&A, 519, A102) for details





# API

**Install the last version of swifttools:** <https://pypi.org/project/swifttools/>

## The xrt\_prods Python module

This documentation is for **xrt\_prods v1.10**, in **swifttools v3.0** ([Release notes](#))

The **swifttools.ukssdc/xrt\_prods** Python module provides an interface to the [tools to build Swift-XRT data products for point sources](#).

**Important note** Our servers have a finite capacity, so please do not submit large numbers of jobs en masse; instead you can use the API to submit all of your jobs, but a few at a time, waiting until the requested jobs have completed before submitting the next tranche. We have provided [an example of how to do this](#).

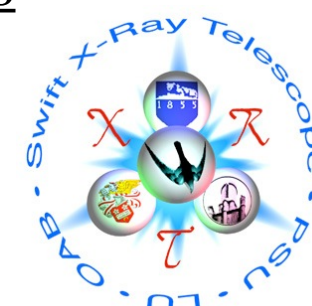
### Documentation contents

The documentation is organised as follows.

- [Introduction / quickstart](#)
- [How to request products](#).
- [Examining your submitted job](#).
- [How to cancel requested jobs](#).
- [How to query the status of a job](#).
- [How to retrieve the completed products](#).
- [A simple end-to-end tutorial](#).
- [Miscellaneous methods and advanced usage](#).

**xrt\_prods documentation:** [https://www.swift.ac.uk/xrt\\_products/](https://www.swift.ac.uk/xrt_products/)

**!!!NOTE!!!:** API can also be used for several other tasks: to check the targets visibility, to submit ToOs, to check the status of the required observations, to download the data, etc <https://github.com/Swift-SOT/swifttools>





# Thanks





# Back-up







# GRB analysis products

## Swift-XRT products for GRBs

**Index pages:** [XRT Catalogue](#) | [Light curves](#) | [Spectra](#) | [Positions](#) | [Burst Analyser](#) | [Build XRT products](#)

The table below lists all GRBs observed by Swift to date. Each GRB name links to the main XRT results page for that GRB. Direct links to the enhanced position, light curve, spectrum, SPER results and the actual data are also provided.

Show bursts for: [2004](#) | [2005](#) | [2006](#) | [2007](#) | [2008](#) | [2009](#) | [2010](#) | [2011](#) | [2012](#) | [2013](#) | [2014](#) | [2015](#) | [2016](#) | [2017](#) | [2018](#) | [2019](#) | [2020](#) | [2021](#) | [2022](#) | [2023](#) | **2024** | [All](#)

[Show all thumbnails.](#)

GRB	Catalogue Entry	Enhanced Position	Light curve	Spectrum	Burst Analyser	Image	SPER	Data
<a href="#">GRB 240811A</a>	<a href="#">XRT cat</a>	<a href="#">Position</a>	<a href="#">Curve</a>	<a href="#">Spectrum</a>	<a href="#">BAT+XRT</a>	<a href="#">Image</a>	<a href="#">SPER</a>	<a href="#">Obs data</a>
<a href="#">GRB 240809A</a>	<a href="#">XRT cat</a>	<a href="#">Position</a>	<a href="#">Curve</a>	<a href="#">Spectrum</a>	<a href="#">BAT+XRT</a>	<a href="#">Image</a>		<a href="#">Obs data</a>
<a href="#">GRB 240805B</a>	<a href="#">XRT cat</a>	<a href="#">Position</a>	<a href="#">Curve</a>	<a href="#">Spectrum</a>	<a href="#">BAT+XRT</a>	<a href="#">Image</a>		<a href="#">Obs data</a>
<a href="#">GRB 240805A</a>	<a href="#">XRT cat</a>	<a href="#">Position</a>	<a href="#">Curve</a>	<a href="#">Spectrum</a>	<a href="#">BAT+XRT</a>	<a href="#">Image</a>		<a href="#">Obs data</a>
<a href="#">GRB 240730A</a>	<a href="#">XRT cat</a>	<a href="#">Position</a>	<a href="#">Curve</a>	<a href="#">Spectrum</a>	<a href="#">BAT+XRT</a>	<a href="#">Image</a>	<a href="#">SPER</a>	<a href="#">Obs data</a>
<a href="#">GRB 240727A</a>	<a href="#">XRT cat</a>	<a href="#">Position</a>	<a href="#">Curve</a>	<a href="#">Spectrum</a>	<a href="#">BAT+XRT</a>	<a href="#">Image</a>	<a href="#">SPER</a>	<a href="#">Obs data</a>
<a href="#">GRB 240715A</a>	<a href="#">XRT cat</a>	<a href="#">Position</a>	<a href="#">Curve</a>	<a href="#">Spectrum</a>	<a href="#">BAT+XRT</a>	<a href="#">Image</a>		<a href="#">Obs data</a>

### GRBs without confirmed afterglows

[GRB 240727B](#)

[GRB 240713A](#)

[GRB 240615A](#)

[GRB 240415B](#)

[GRB 240128A](#)

[GRB 240109A](#)

[CD-56 1032 - field 7](#)

**GRB products:** [https://www.swift.ac.uk/xrt\\_products/](https://www.swift.ac.uk/xrt_products/)

See Evans et al. (2010, A&A, 519, 102), Evans et al. (2009, MNRAS, 397, 1177) and Evans et al. (2007, A&A, 469, 379) for details

