

# **Update in the Swift XRT calibration: background characterization**

*(with a measurement of the CXRB spectrum  
in the 2-7 keV band )*

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## OUTLINE

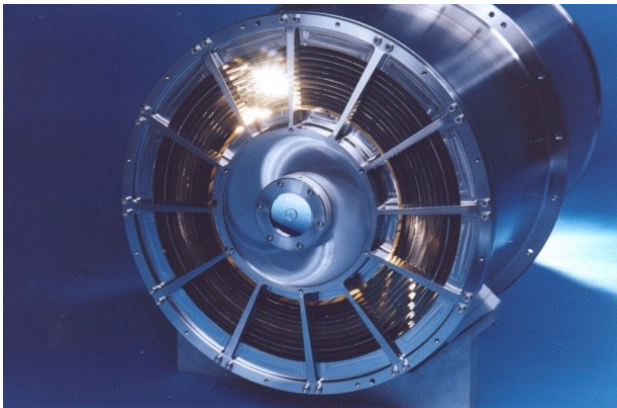
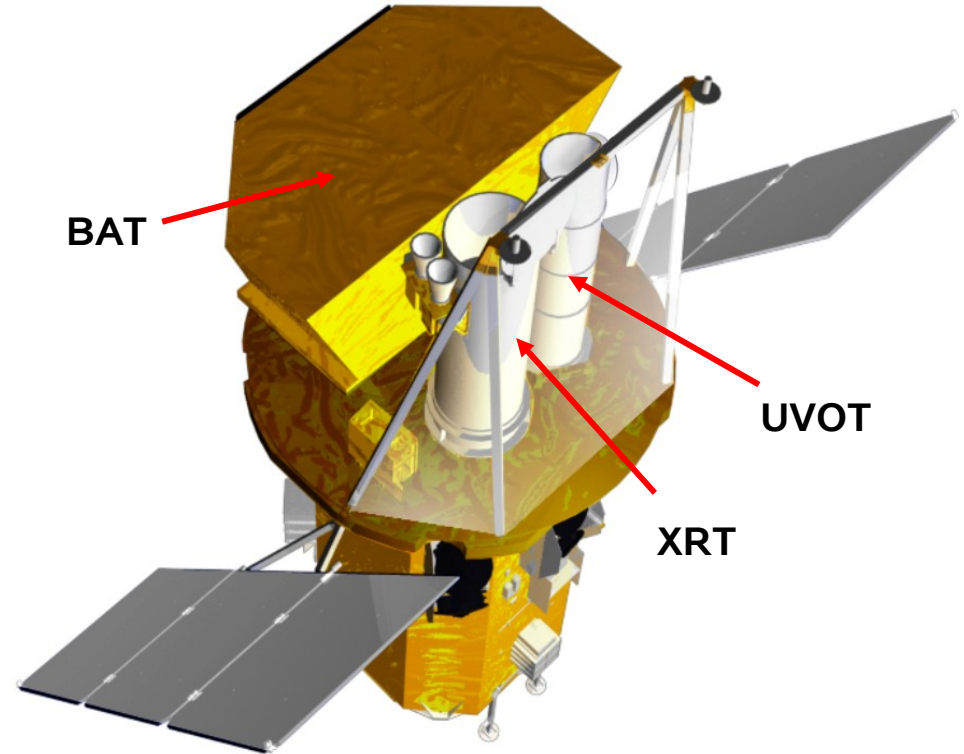
The total observed background

The instrumental background and the shutter-closed observation

The stray light contamination

The cosmic X-ray background spectrum

# The instrument (I)

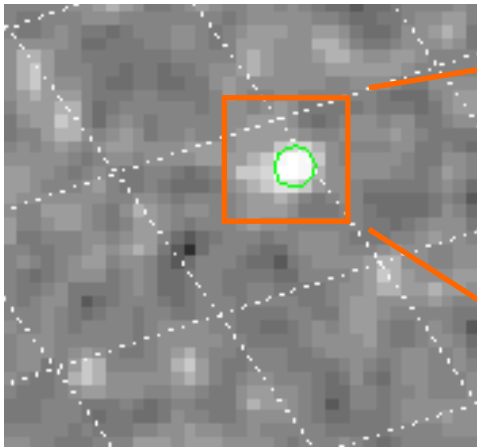


## The Swift X-ray Telescope :

- **0.2-10.0 keV**
- **FOV: 23.6' x 23.6'**
- **Energy resolution 140 eV @ 5.9 keV**
- **HPD: 17" @ 1.5 keV**

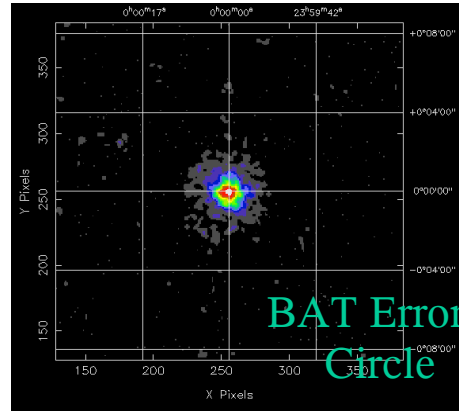
# The instrument (II)

**BAT Burst Image**

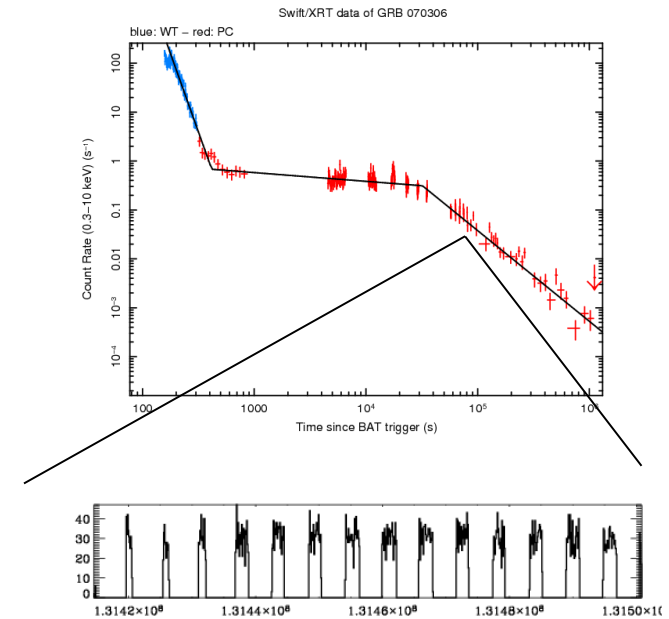


**T~30 sec**

**XRT Image**



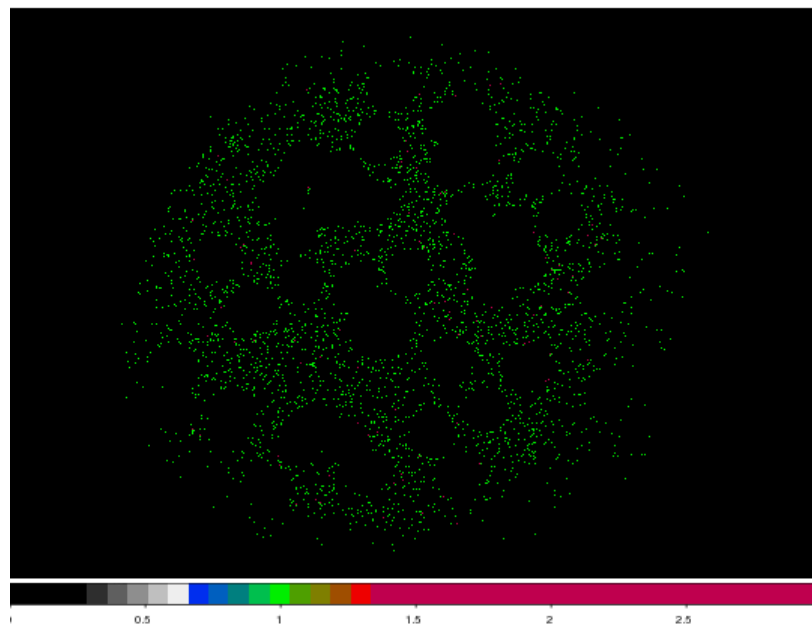
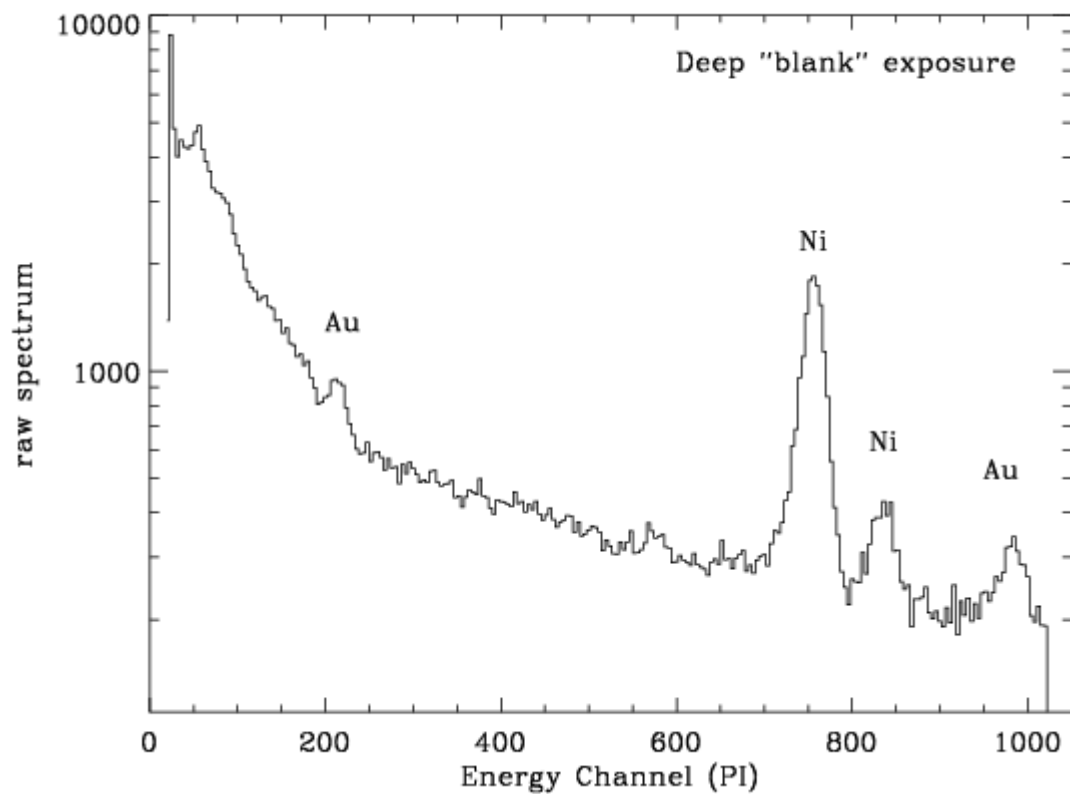
**T~70 sec**



- The typical XRT observation starts ~100 s from the burst and lasts 15 days , with ~ 10 ks effective exposure each day
- 1 orbit is 5800 s ; ~ 4 targets per orbit for each source: ~1500s of observation and ~ 4000s of occultation
- 300 bursts observed since the beginning of the mission (November 2004)

# Total integrated background

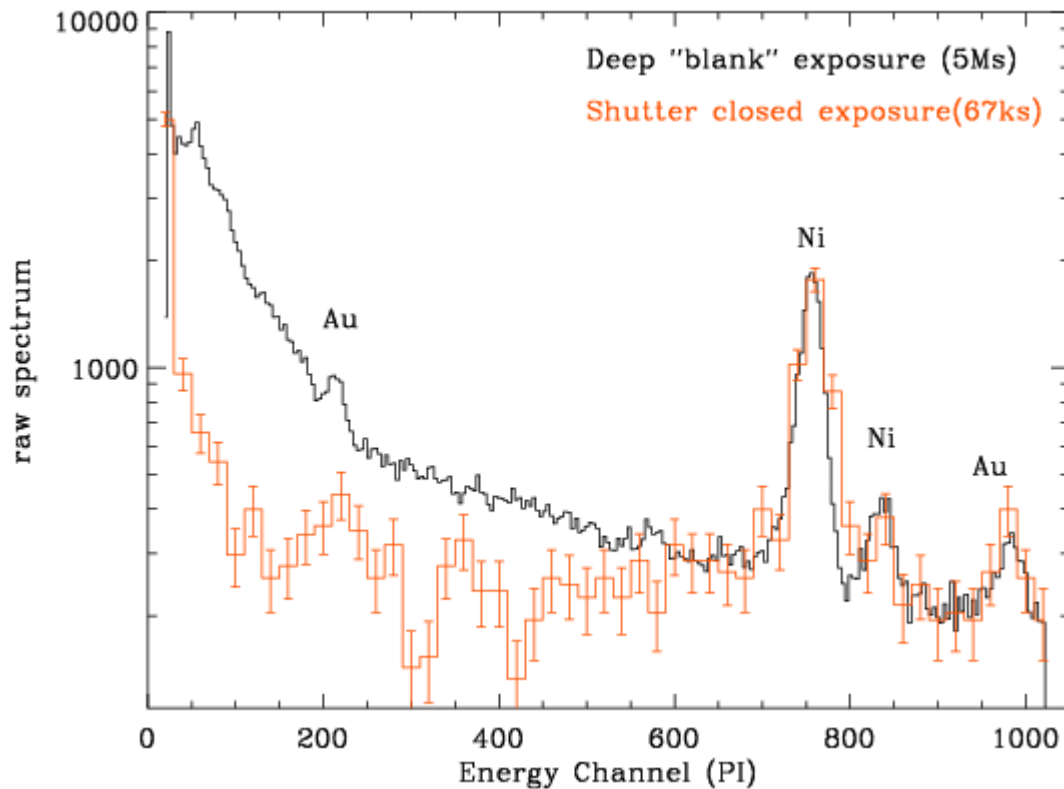
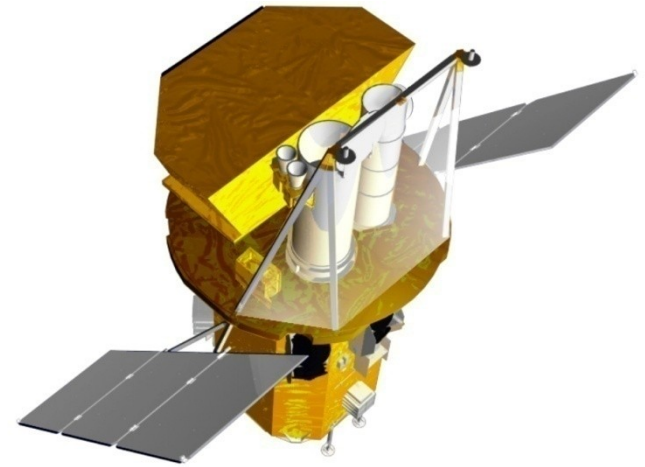
Deep stacked exposure (~ 5 Ms) of source-free regions



- Everything included:
- particle induced
  - electronic
  - stray-light
  - cosmic

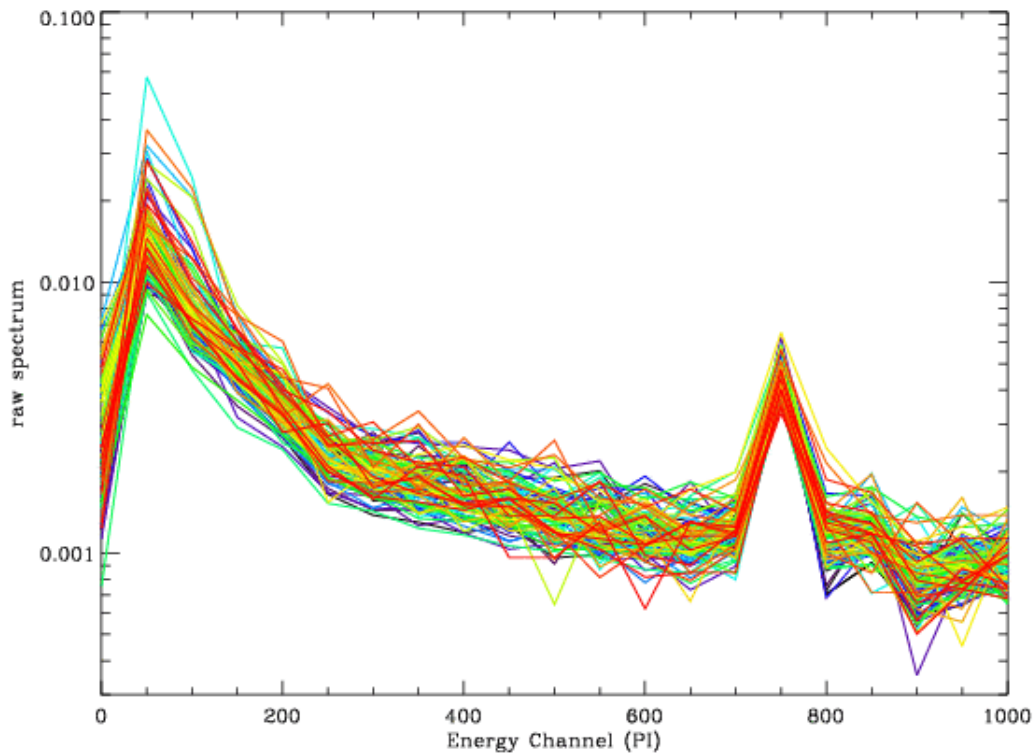
# The “instrumental” background

In September 2007 due to an incorrect (manual) input coordinate the satellite pointed close to the Sun. This triggered the detector sun-shutter and XRT performed 2 days observation with shutter close



Instrumental:= particle+warm pixels can be estimated by means of the observations with detector shutter closed

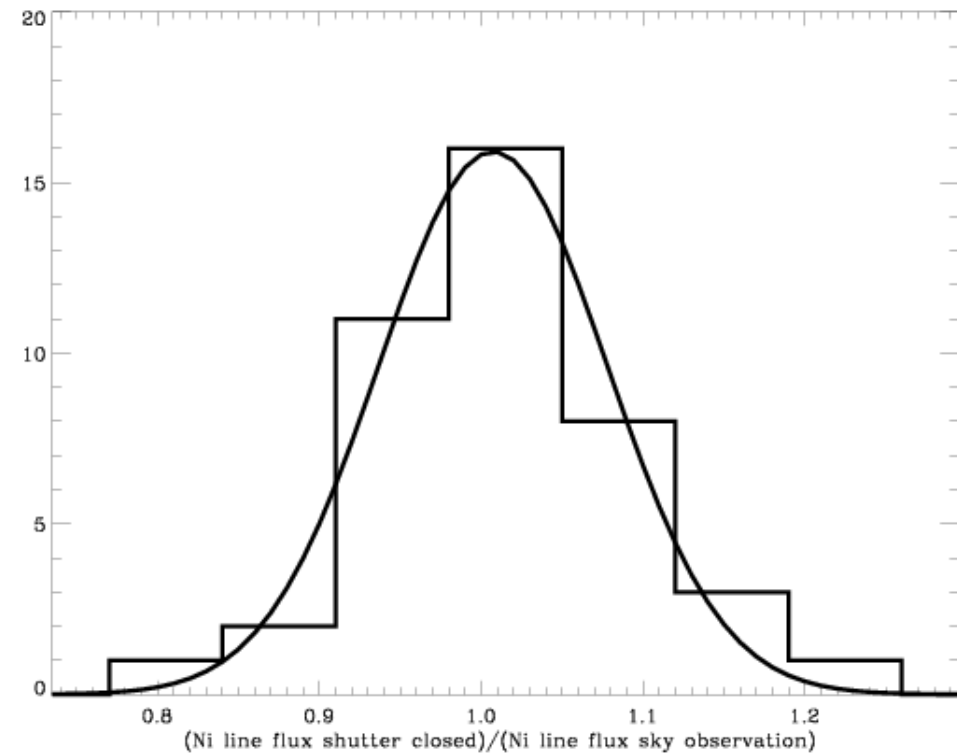
# The “instrumental” background



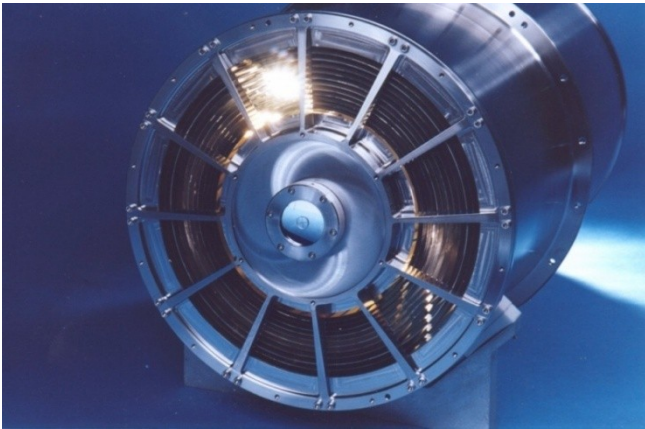
The Nickel line integrated flux varies is highly predictable: the distribution of the ratios of the expected value (from the shutter-closed observation) with the  $\sim 70$  observed peaks at 0.99 with  $\sigma = 0.07$ .

To check the stability of the instrumental background we consider  $\sim 70$  deep source-free observations.

The largest variations are registered below 1 keV



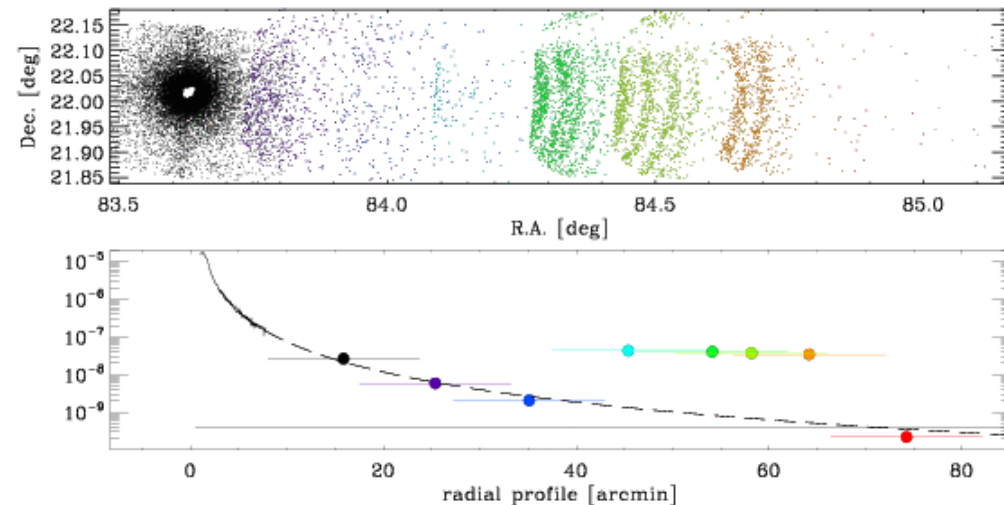
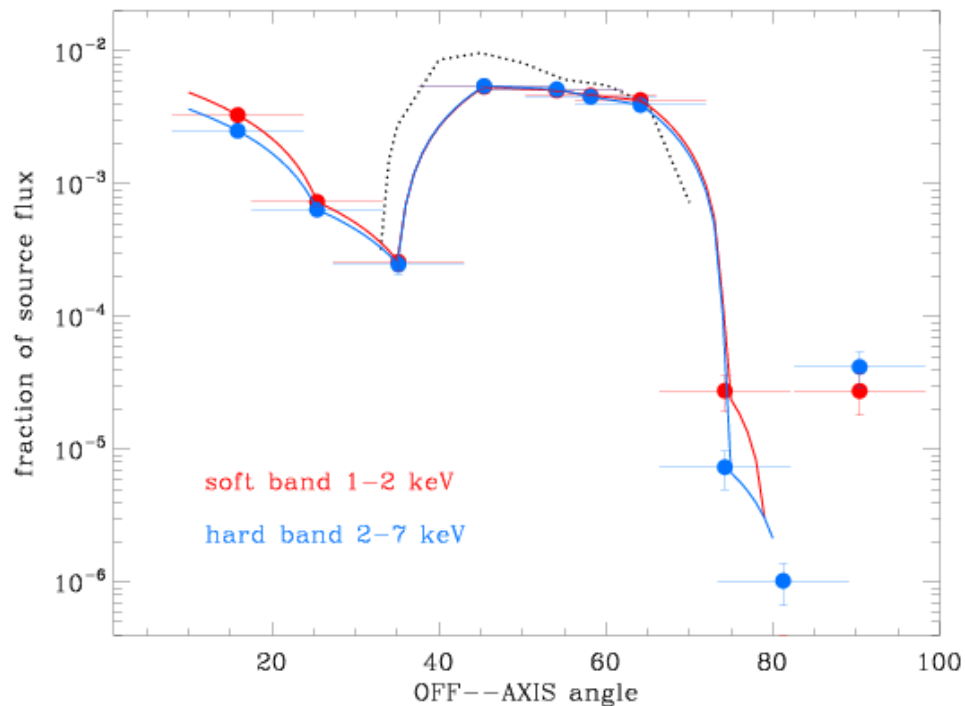
# Stray-light contamination

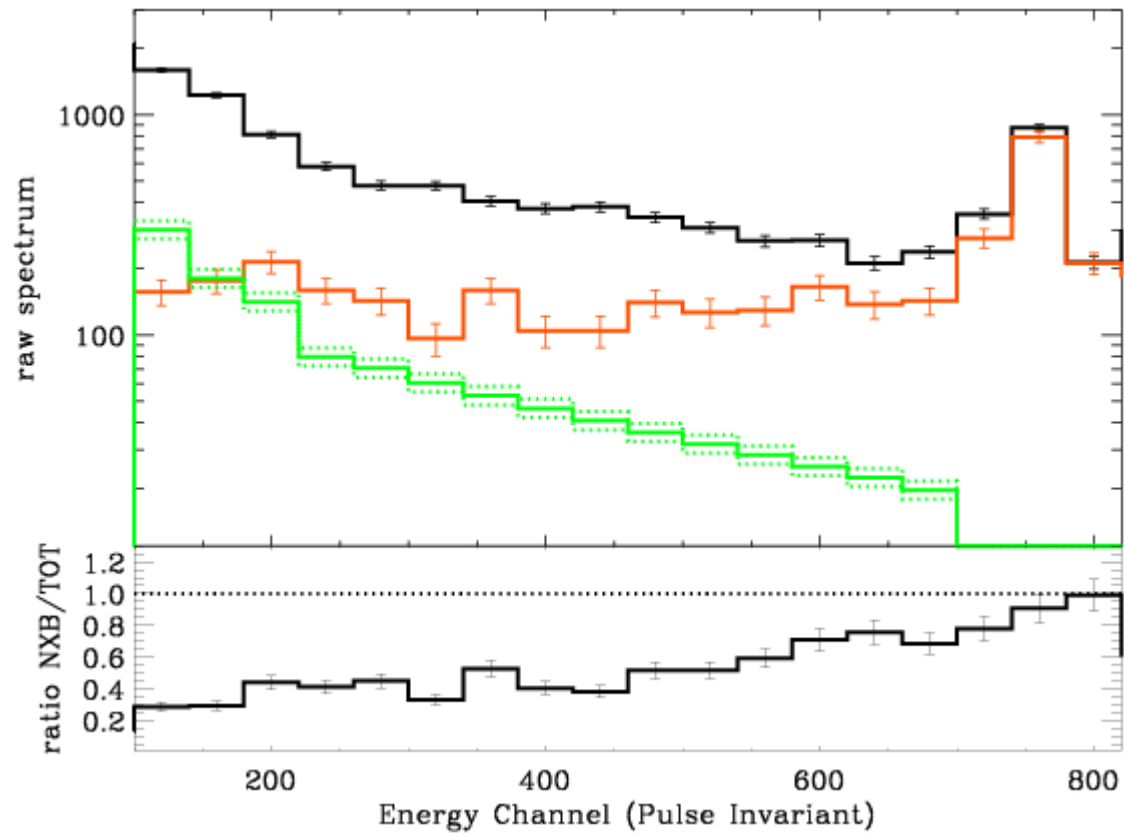


XRT does not have any baffle to avoid stray- -light contamination

Stray light contamination is expected to be a not negligible part of the diffuse background

A number of off-axis observation of the Crab has been performed in order to estimate the stray-light contamination



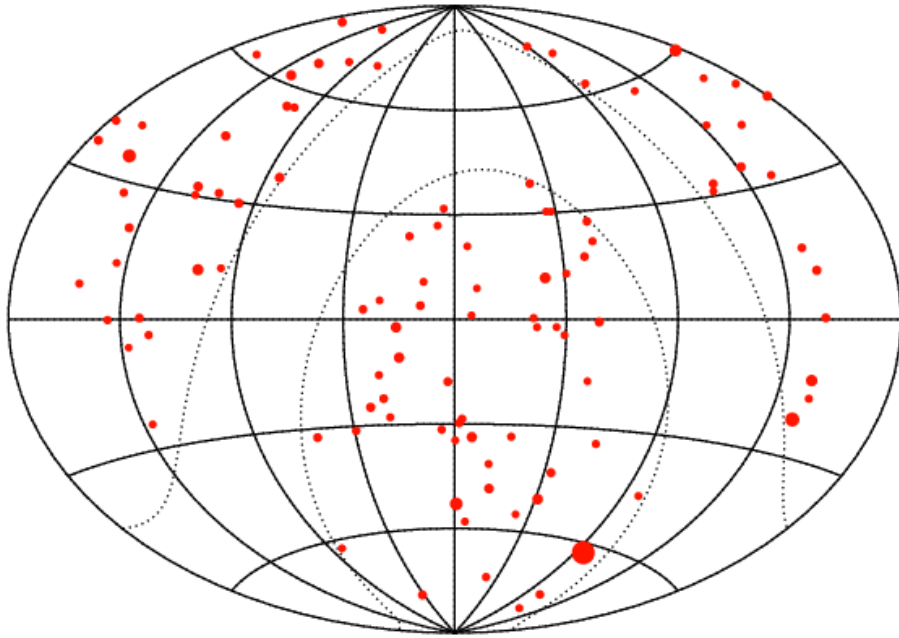


A typical observation:

70 ks observation with no bright sources

NXB is 30-50% of the total

# Cosmic XRB spectral measurement



104 deep GRB follow – up observations

Typical exposure : 80 ks

Field of view : 0.054 square degrees

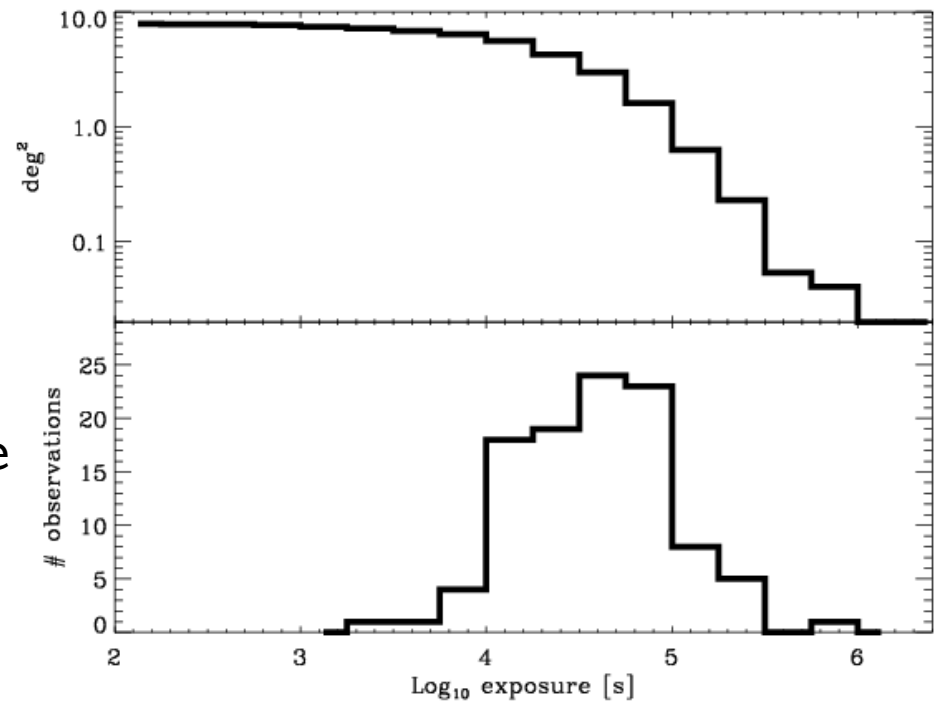
Total surveyed area : ~6square degrees

Spectral analysis of the integrated emission

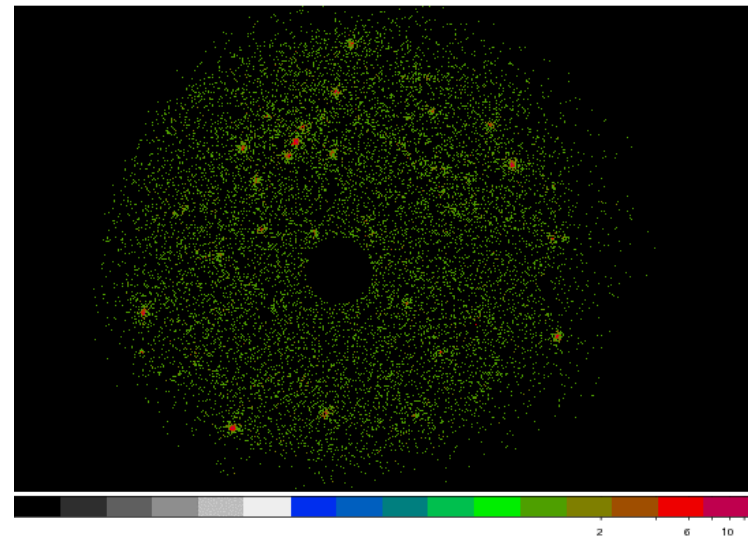
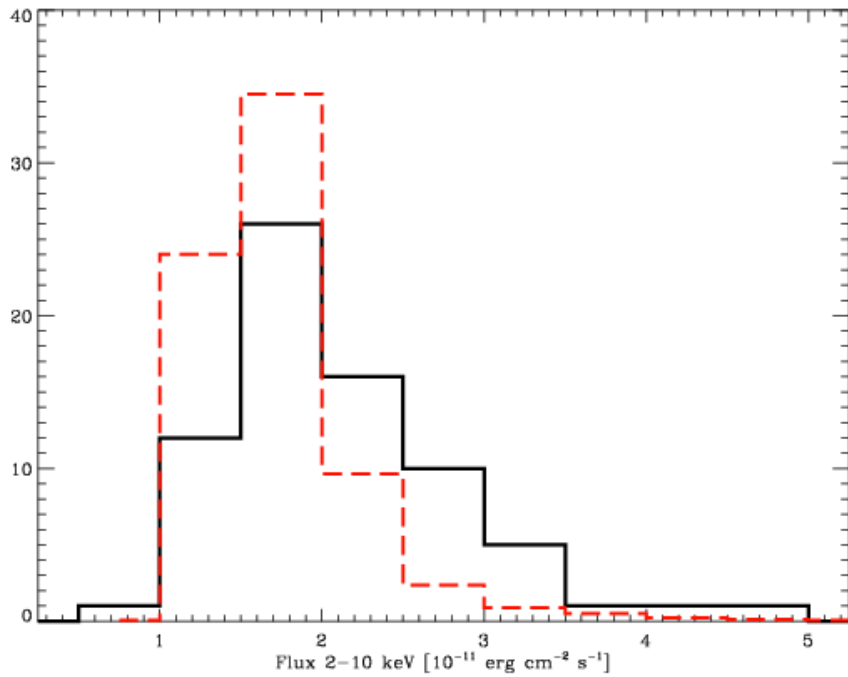
Stacked and field to field

source plus diffuse emission as extended source

Instrumental and stray-light as the background



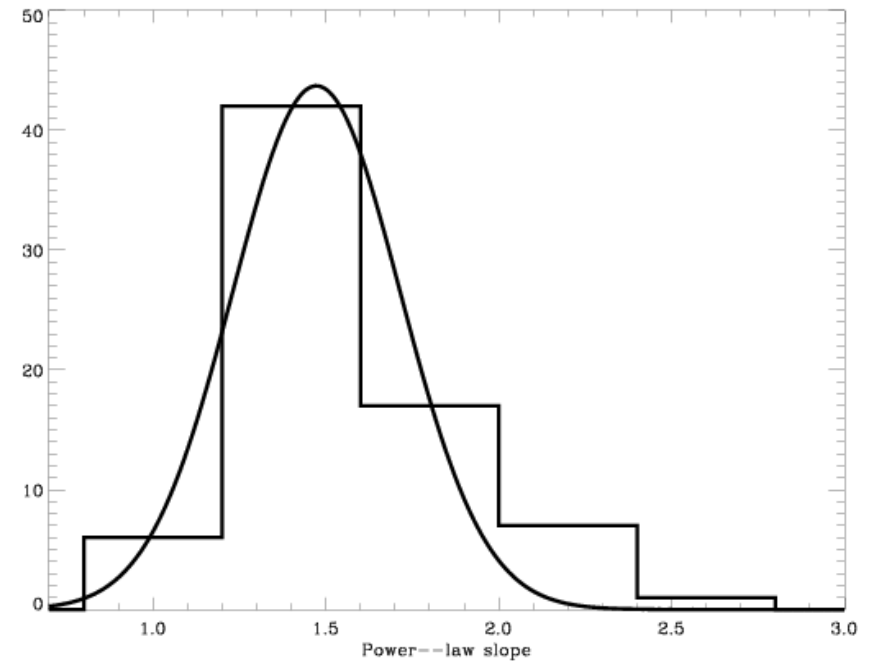
# Field to field CXRB spectral analysis: the cosmic variance



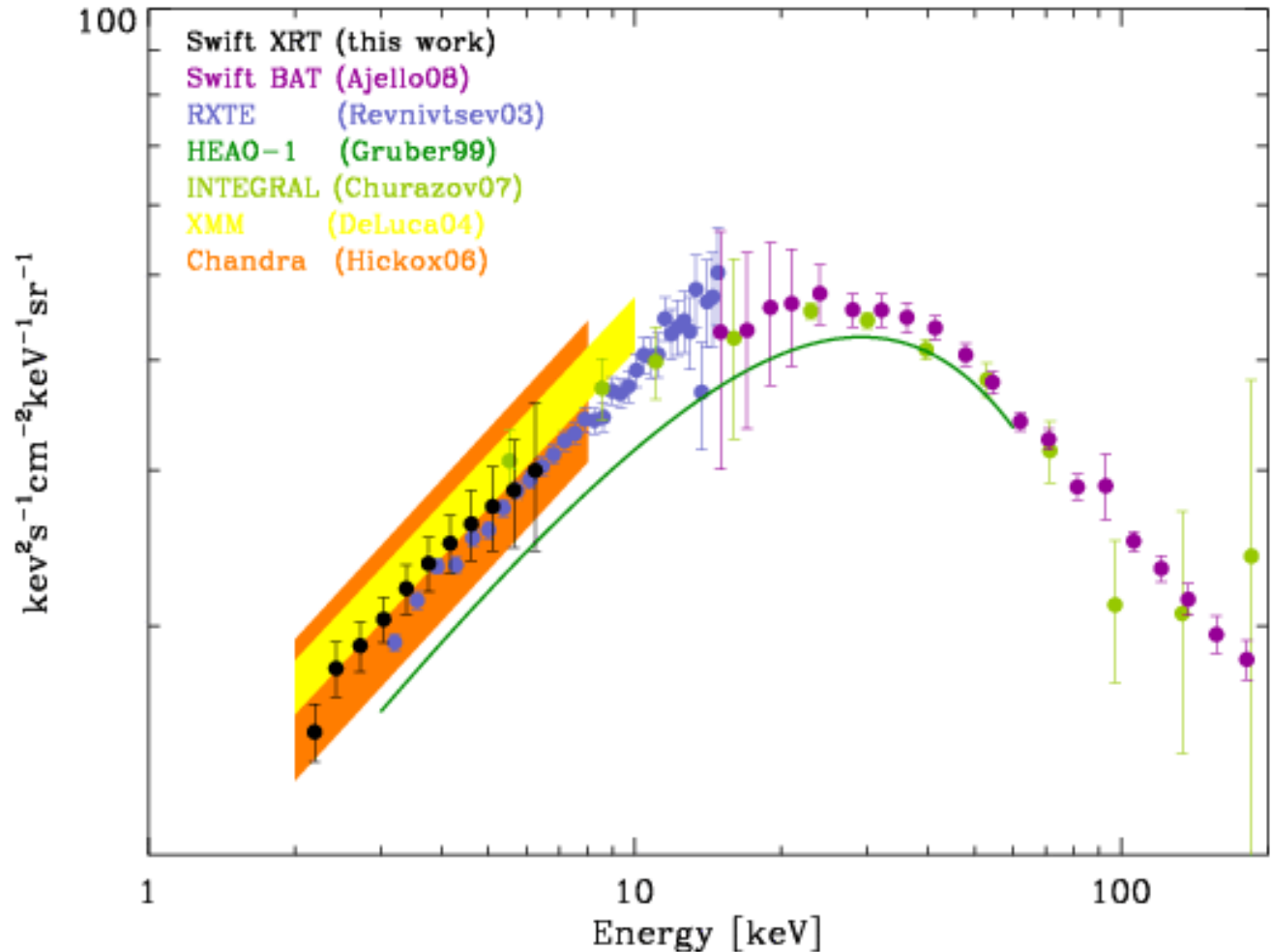
73 exposure longer than 20 ks

Mean Flux 2-10keV:  $2.1 \pm 0.4 \text{E-}11$  [cgs]

Photon index :  $1.47 \pm 0.21$



# The CXRB Spectrum



- total exposure: 6.5 Ms
- slope: 1.45 +/- 0.20
- flux 2-10. : 2.1 +/- 0.2 E-11 cgs

