Coordination with Suzaku

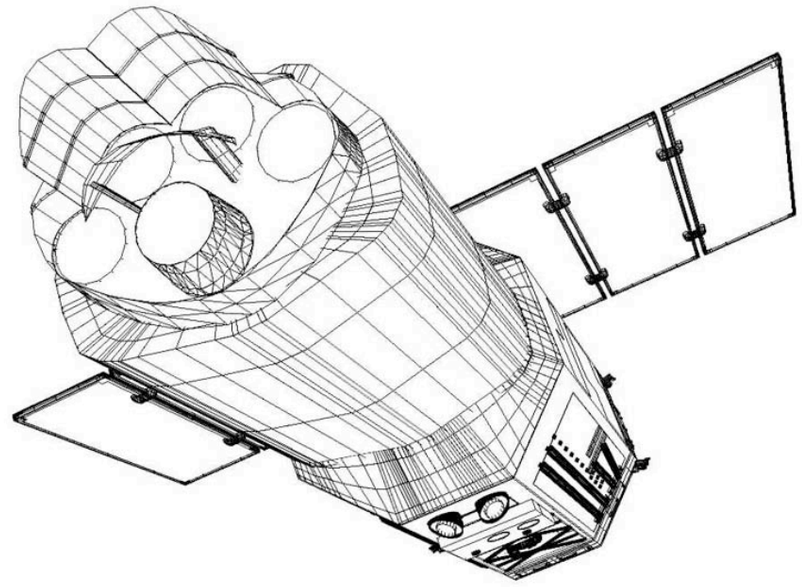
Five typical cases

Tad Takahashi
ISAS/JAXA

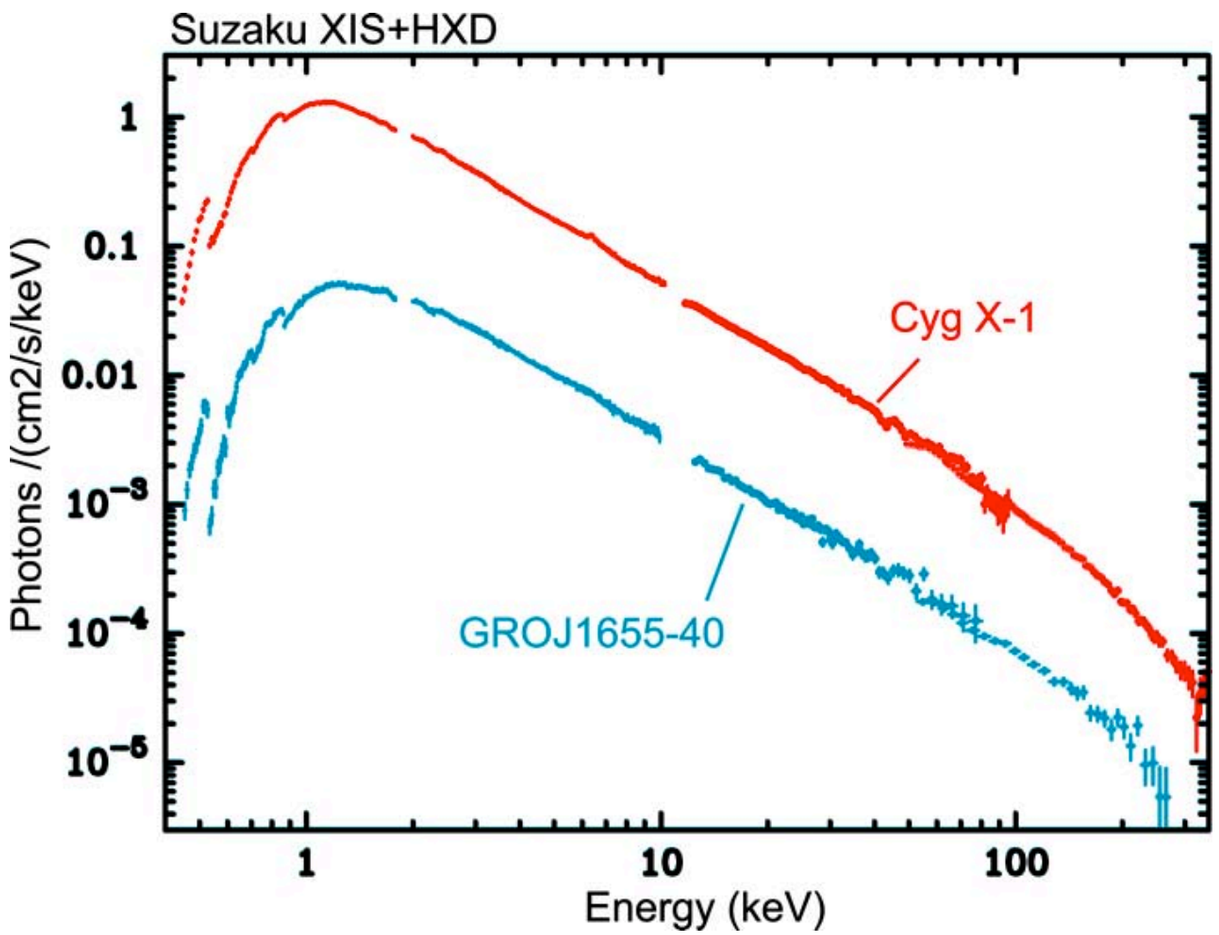
Makoto Tashiro
Saitama U.

Suzaku

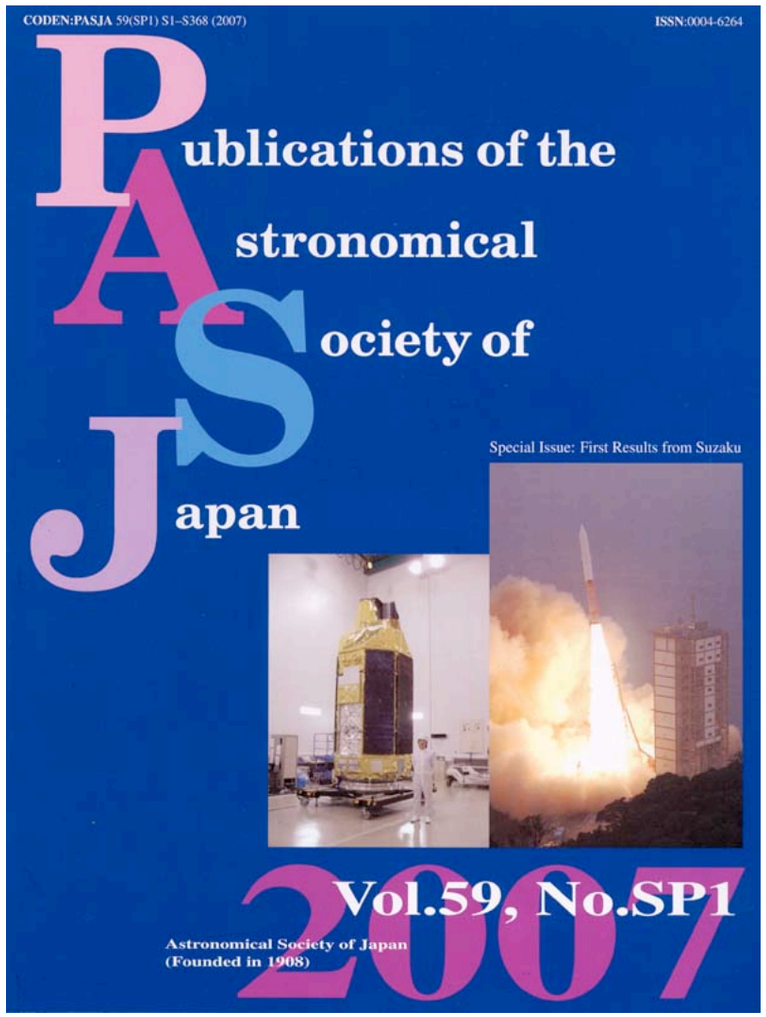
Wide band X-ray spectroscopy from 0.3 keV to 600 keV



~1000 cm^2 effective area 1-6 keV
Low background X-ray
Low background Hard X-ray observation (especially upto 50 keV)



Suzaku Special Issue



Coordination with Swift #1

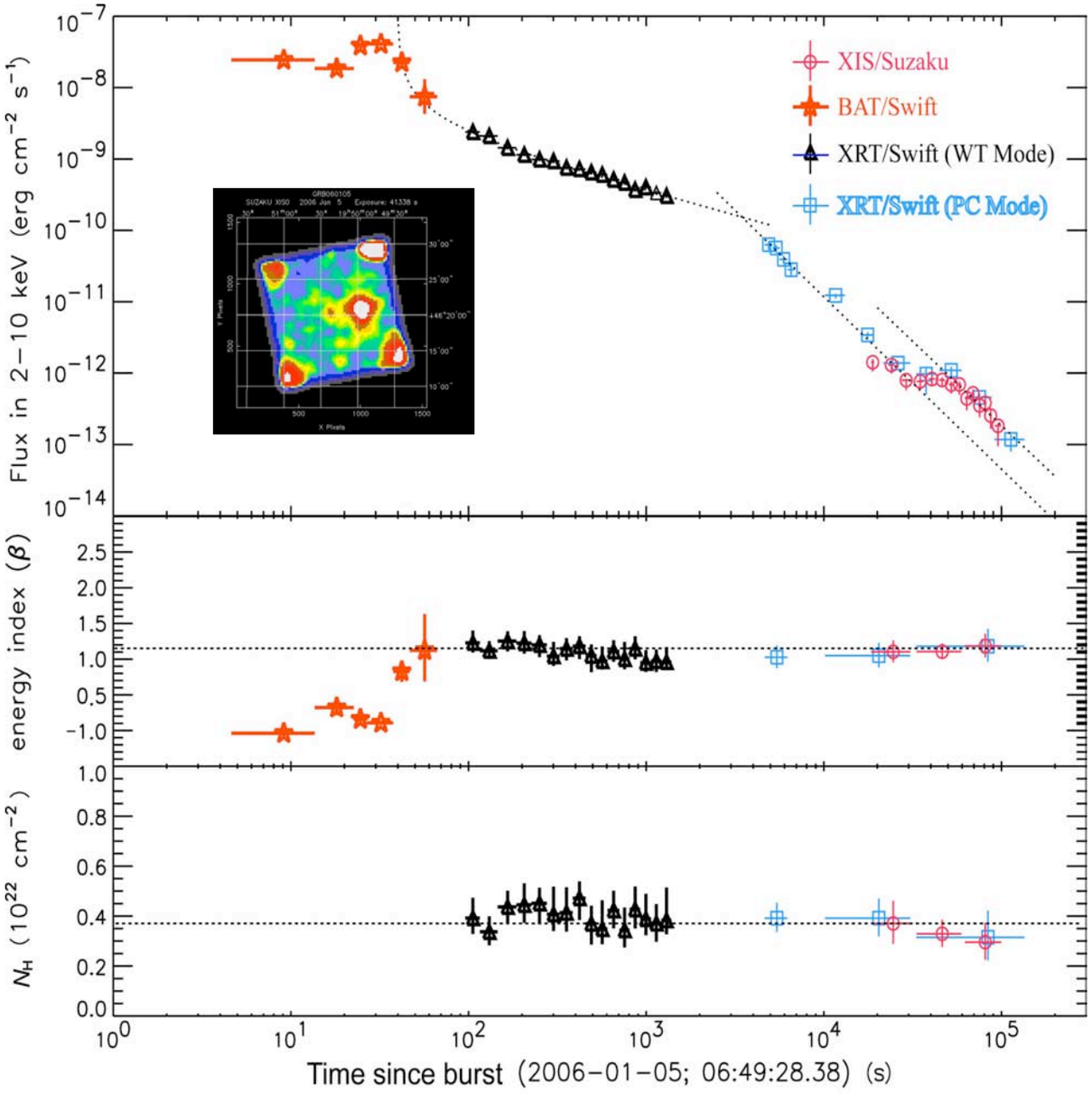
Suzaku TOO observation for Bright GRBs

Suzaku follow-up observations *to detect hard X-ray emission in afterglow*

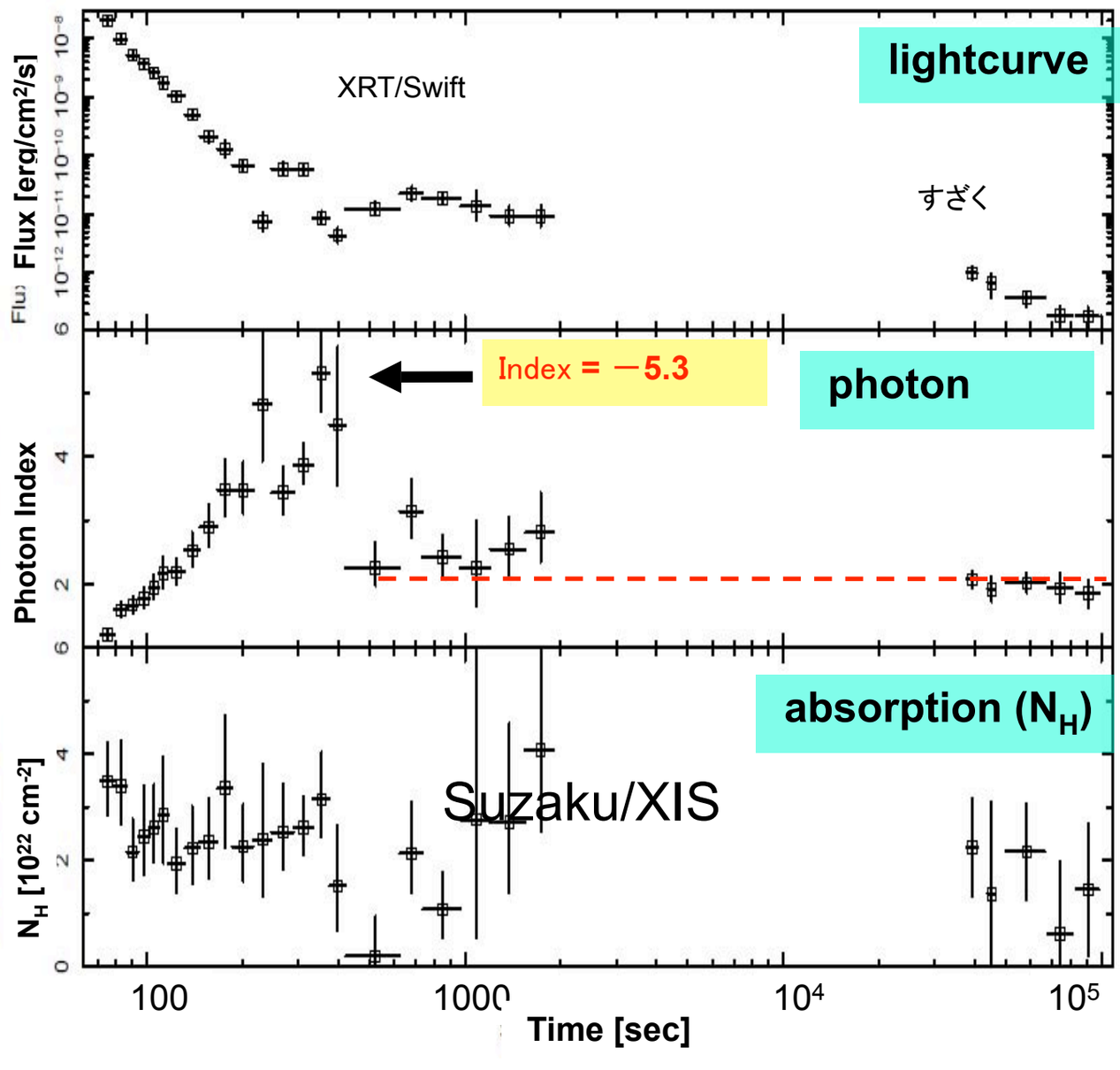
GRB	BAT	Start time (T0+)	WAM	ToO
060105	06:49:28	12:10:00 (+5.4hr)	detected	Tashiro+ 07
060904A	02:31:04	10:30:00 (+8.0hr)	GCN5543	Yonetoku+ (in prep)
070328	03:53:53	07:20:00 **(+3.4hr)**	GCN6240	under analysis

We still do not know a good TOO criteria to detect bright afterglow in hard X-ray band above 10 keV.

GRB060105



GRB060904A



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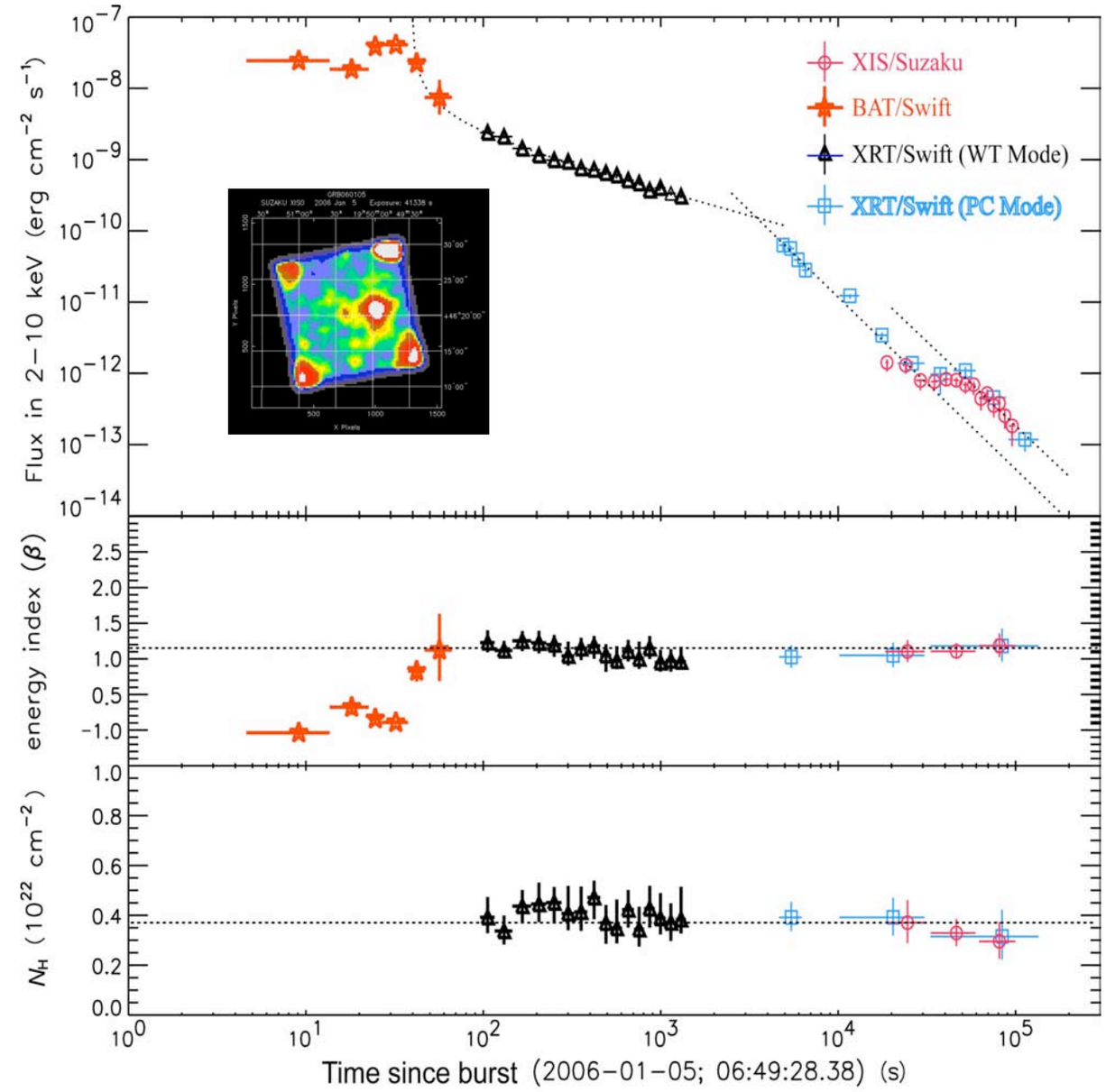

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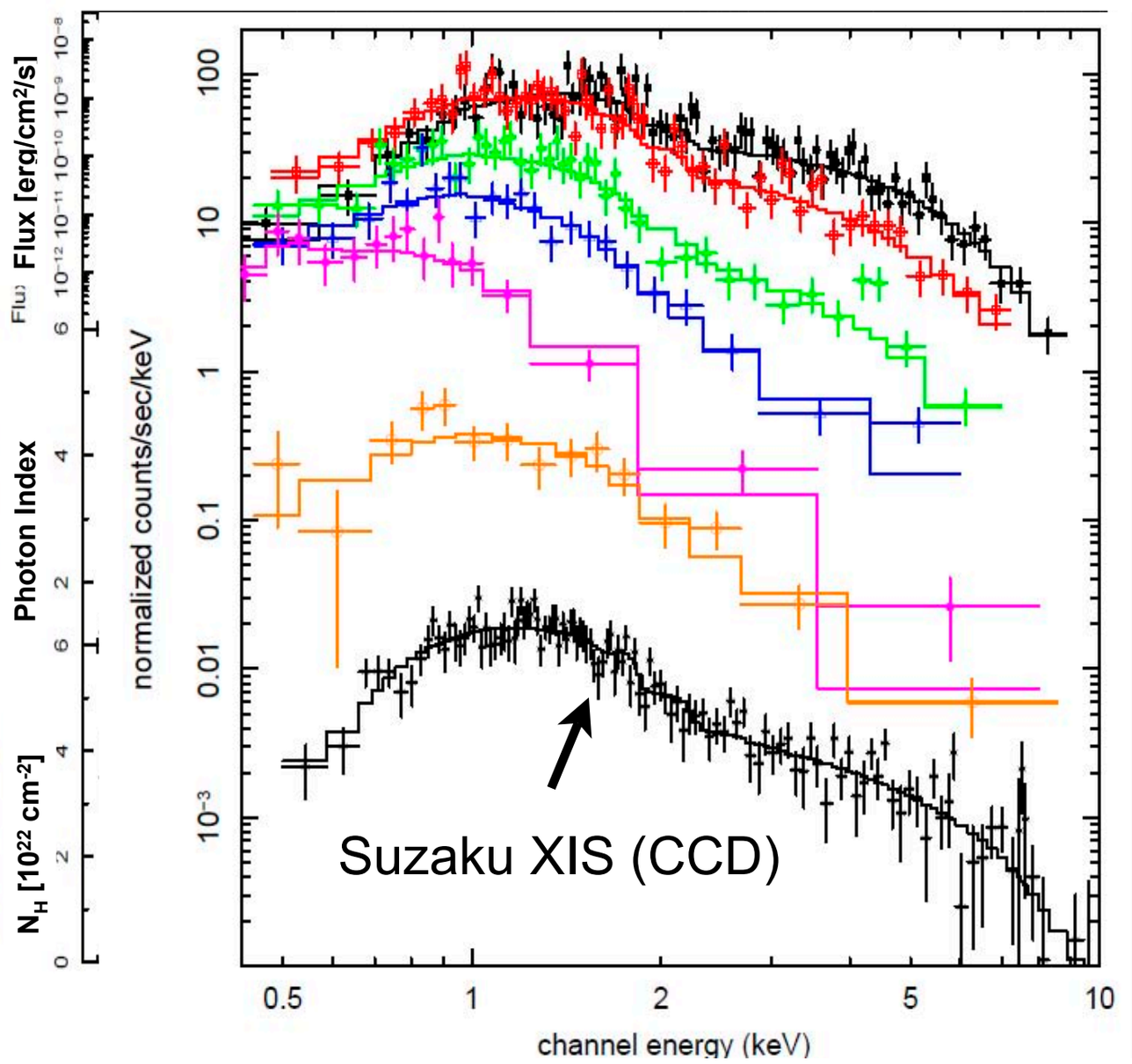


GRB Trigger Table (2007)

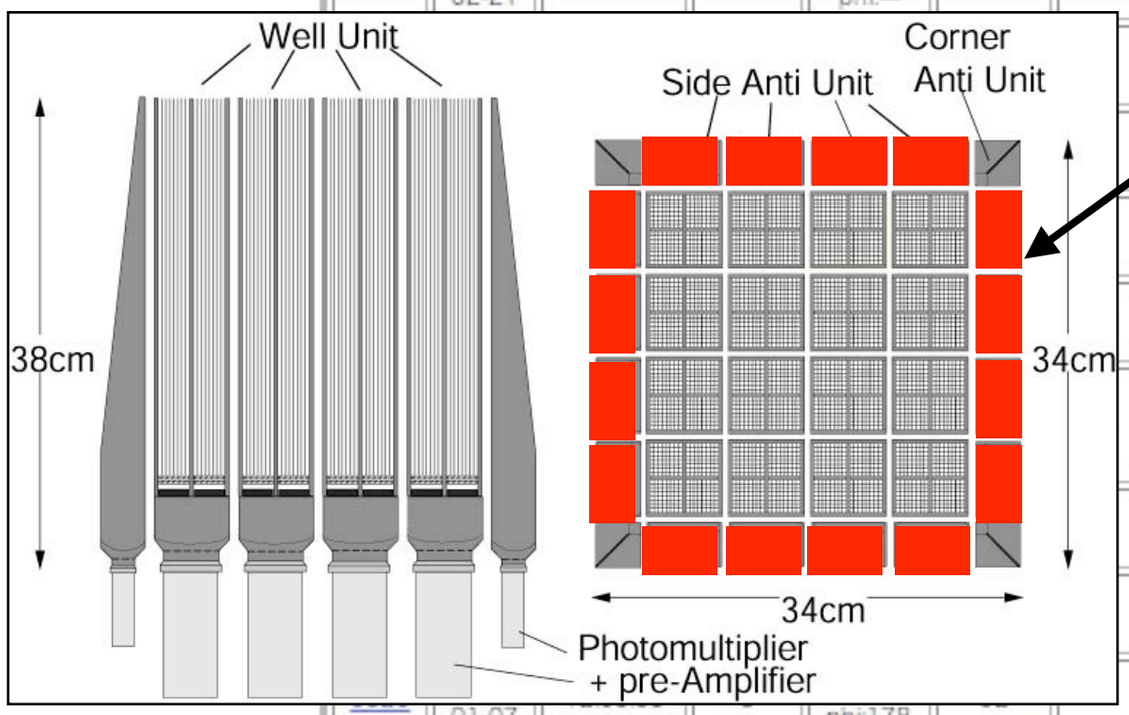
Trigger No.	Date [yyyy-mm-dd]	Trigger Time UTC [hh:mm:ss]	Detector	Incident angle [degree]	Duration T90	Fluence	Light Curves	Spectra	Download Data	GCN Circulars	Other Detections	Comment
0590	2007-04-02	15:48:35	0,1,2,3	theta:123 phi:61	17	—	Click	—	Click	6241	Konus-Wind SPI-ACS Mars Odyssey	—
0588	2007-03-29	14:59:20	0,2,3	theta:— phi:—	48	—	Click	—	Click	—	Konus-Wind SPI-ACS	—
0585	2007-03-28	03:53:46	0,1,2	theta:92 phi:7	37	—	Click	—	Click	—	Swift Konus-Wind	—
0584	2007-03-26	00:45:24	0,2,3	theta:— phi:—	65	—	Click	—	Click	—	SPI-ACS	—
0582	2007-03-24	23:26:21	2	theta:— phi:—	9.5	—	Click	—	Click	—	Konus-Wind	—
0580	2007-03-21	18:52:15	2	theta:—	0.34	—	Click	—	Click	—	Konus-Wind	—
0578	2007-03-18	07:28:56	0,1	theta:101 phi:47	47	—	Click	—	Click	—	Swift	—
0571	2007-03-05	00:11:32	0,3	theta:— phi:—	5.5	—	Click	—	Click	—	SPI-ACS	—
0566	2007-02-27	21:09:49	2	theta:— phi:—	20	—	Click	—	Click	—	SPI-ACS	—
0562	2007-02-21	21:06:45	2	theta:— phi:—	9.2	—	Click	—	Click	—	Konus-Wind SPI-ACS	—
							Click	—	Click	—	Konus-Wind	—
							Click	—	Click	—	Konus-Wind	—
							Click	—	Click	—	SPI-ACS	—
							Click	—	Click	—	Konus-Wind SPI-ACS	—
							Click	—	Click	6024	Konus-Wind SPI-ACS Swift, Mars Odyssey	—
							Click	—	Click	6022	Konus-Wind Mars Odyssey	—
							Click	—	Click	—	Konus-Wind SPI-ACS	—
	01-07			phi:178			Click	—	Click	6016	Swift	—

Suzaku GRB Web

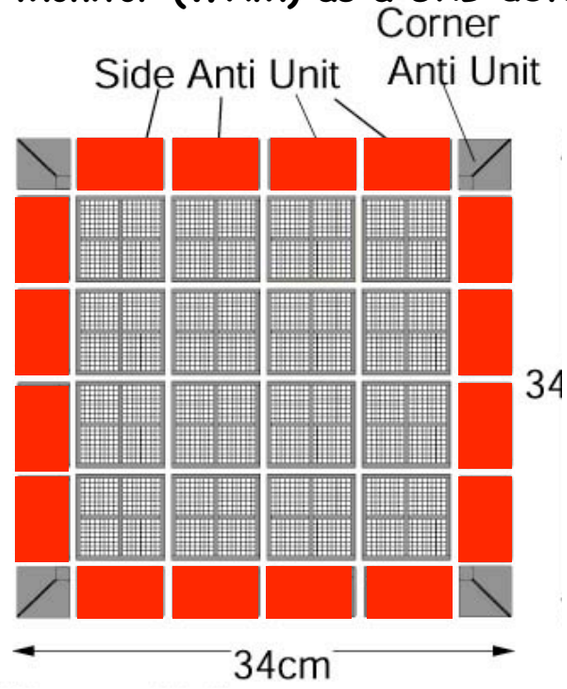
Coordination with Swift #2

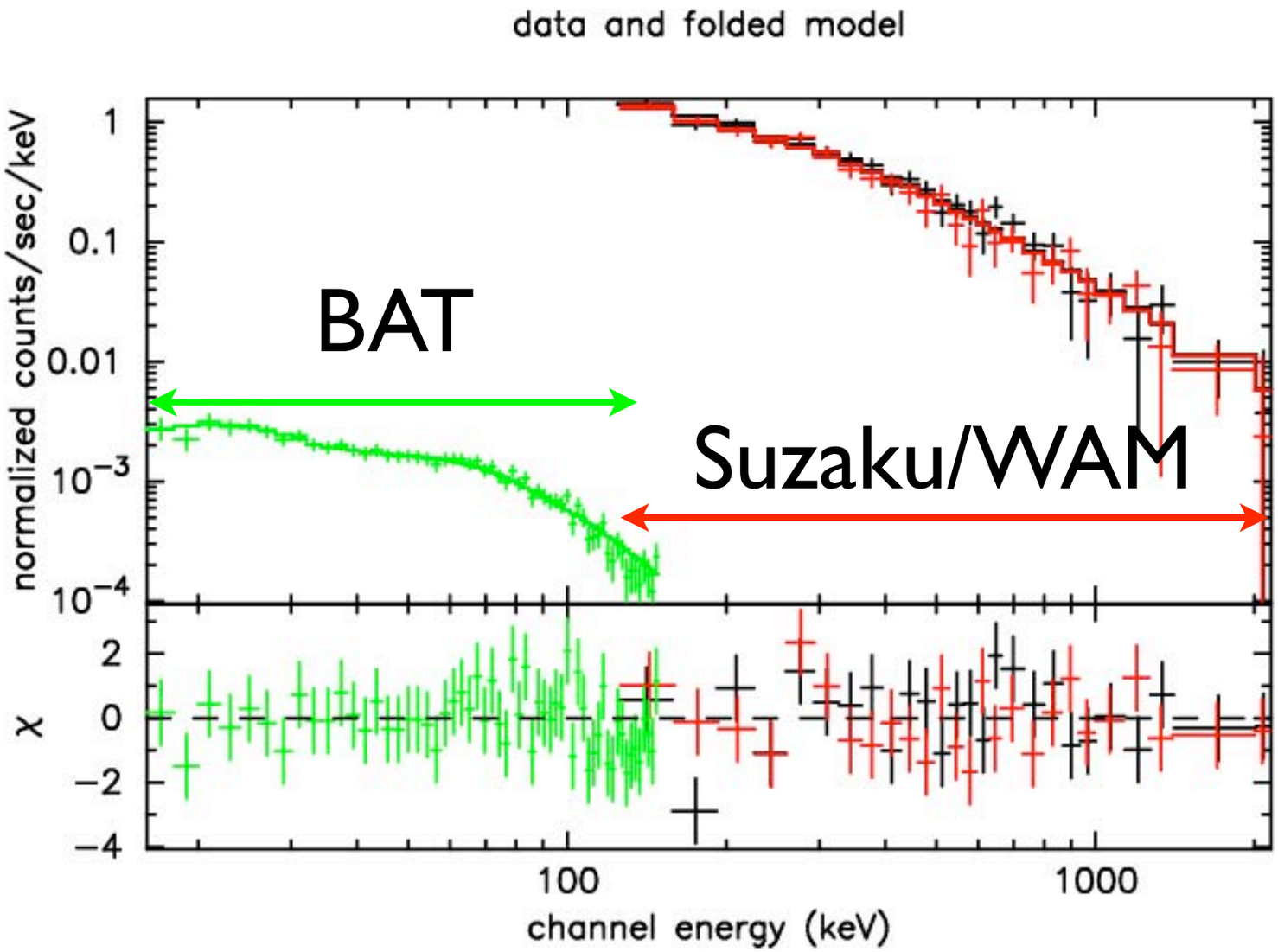
Wide-band GRB Spectrum

BAT+WAM/HXD



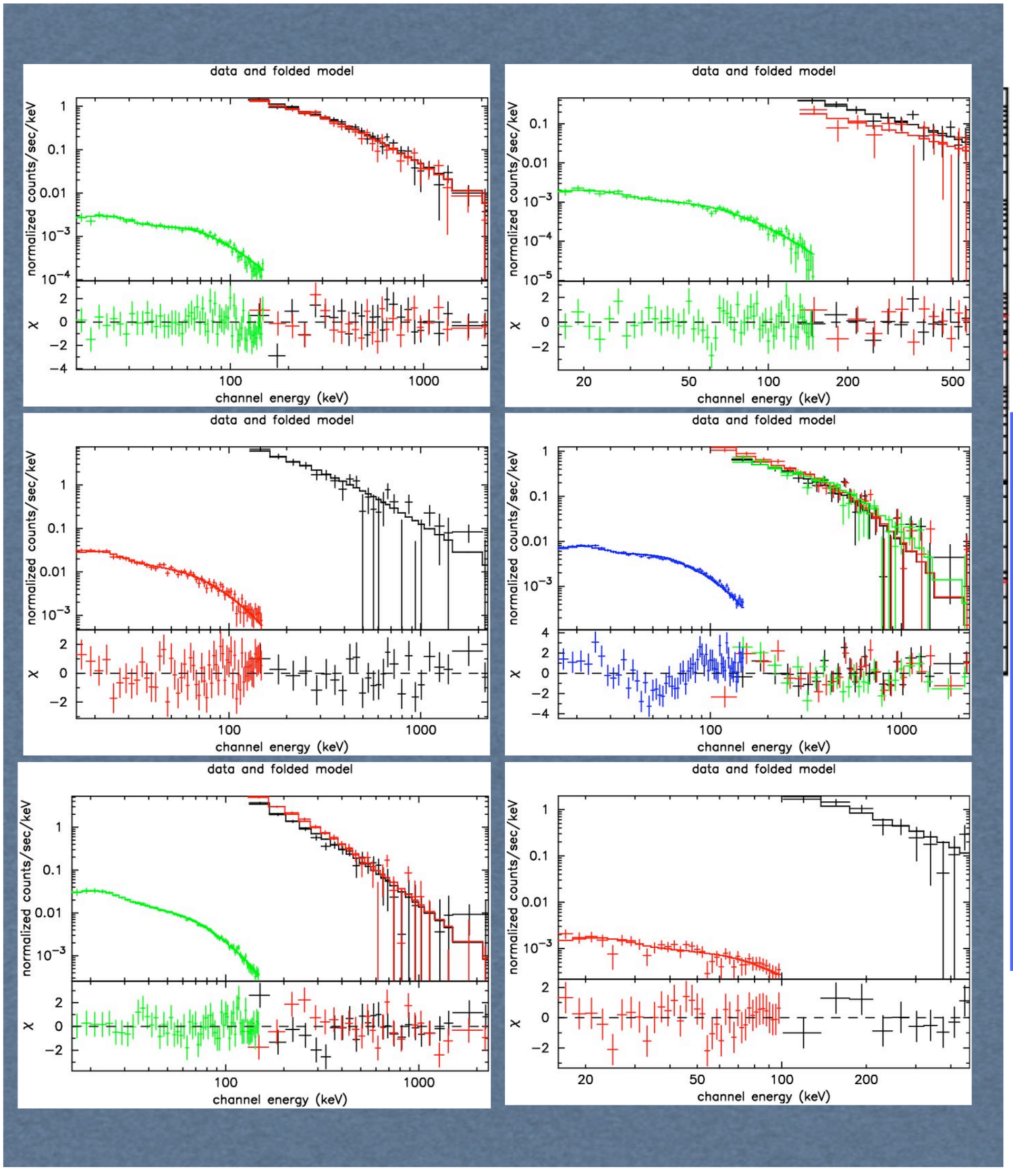
Wide-band All-sky Monitor (WAM) as a GRB detector

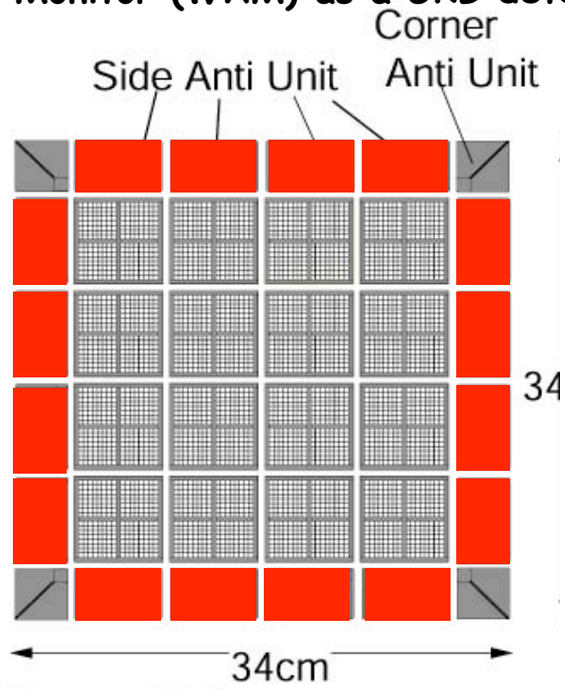




Suzaku/WAM +Swift/BAT
+Konus-Wind
© Ohno and cross cal. collab.

Wide-band All-sky Monitor (WAM) as a GRB detector





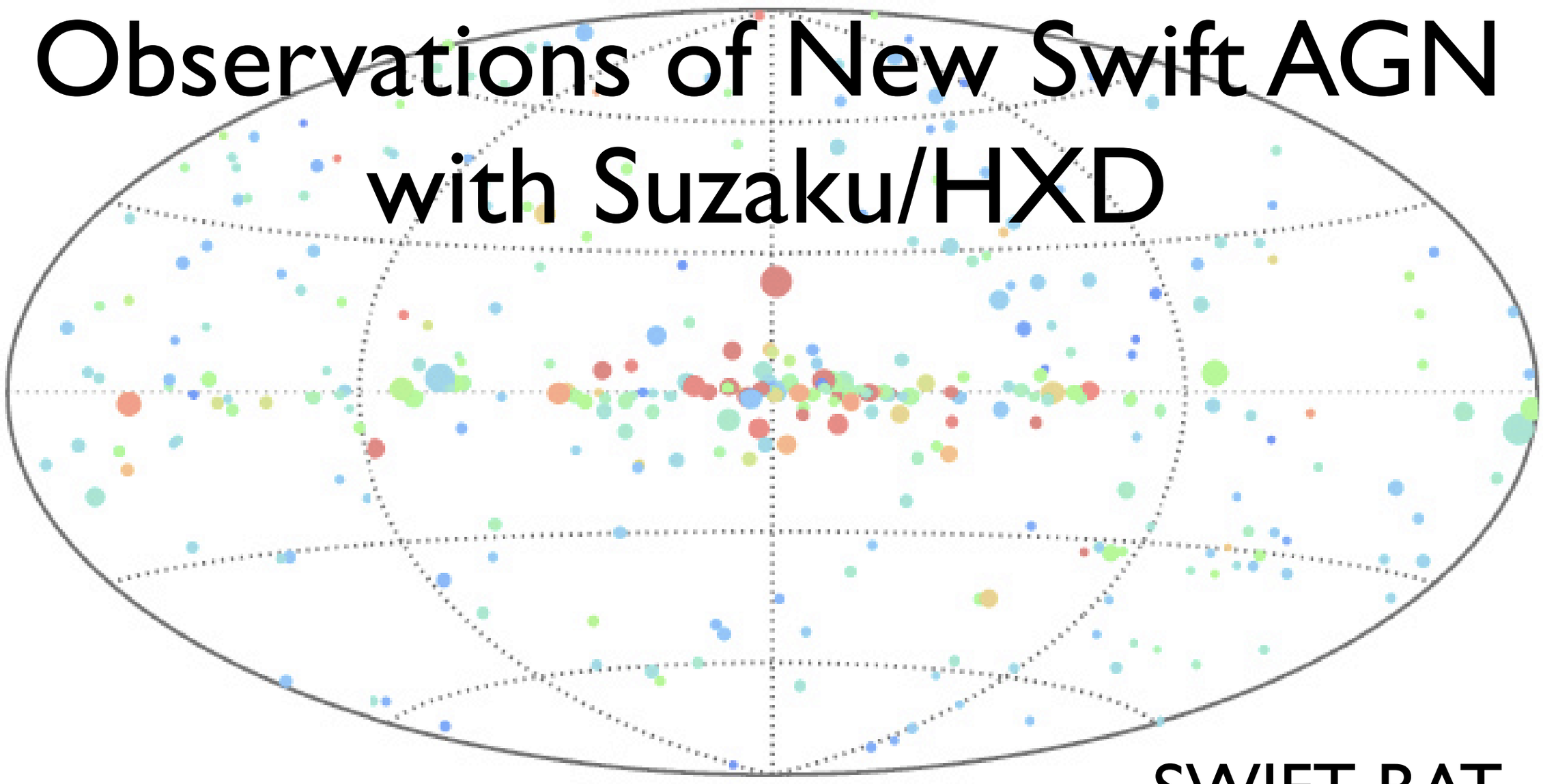
	Z	Epeak (keV)
050904	6.29	1180
051111	1.55	670
051221A	0.54	333
060124	2.30	992
060502A	1.51	376
061007	1.26	1350

Suzaku/WAM +Swift/BAT +Konus-Wind

© Ohno and cross cal. collab.

Coordination with Swift #3

Observations of New Swift AGN with Suzaku/HXD



New type of AGN

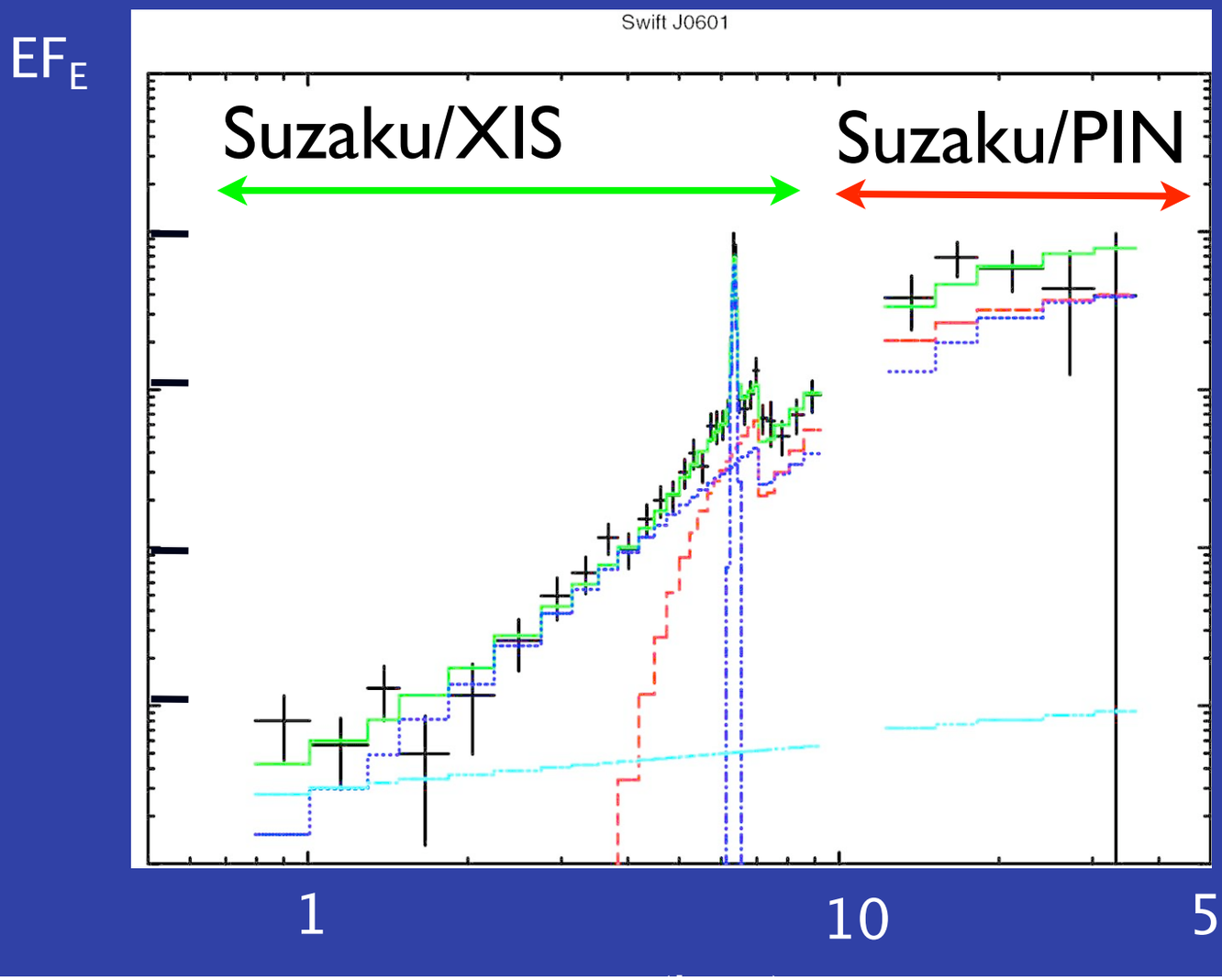
Swift/BAT survey + Suzaku has started to unveil previously unknown AGNs in the very local universe. (Difficult to find in optical survey)

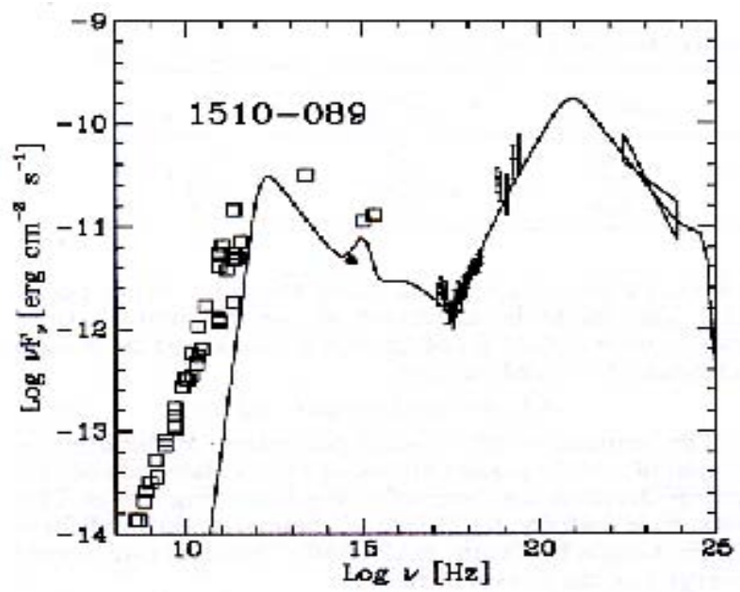
Suzaku spectra : Compton-thick AGN (N_H~$10^{24}cm^{-2}$) without scattering component (previously not known)

No hint of AGN in optical image

ESO 005-G 004

Ueda+ 2007





Coordination with Swift #4

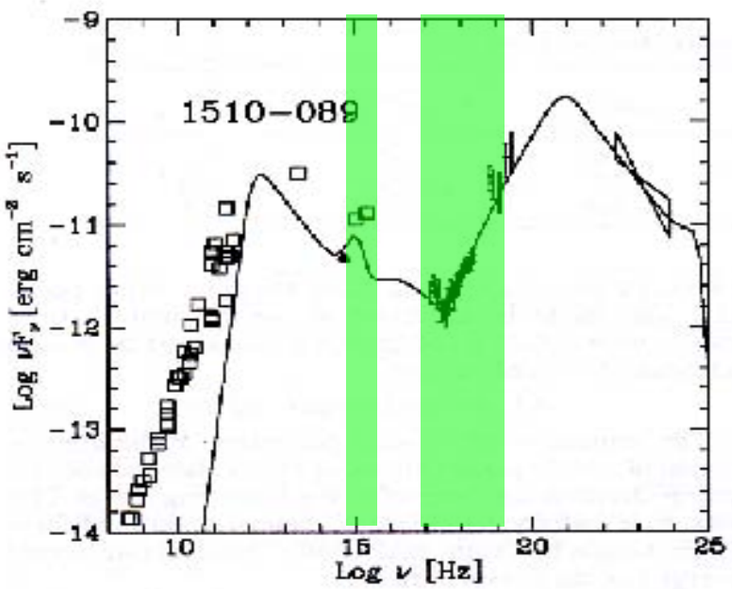
Multi-wavelength observation UVOT/XRT+Suzaku (Fill-in proposal)

a powerful Gamma-ray blazar PKS 1510-089

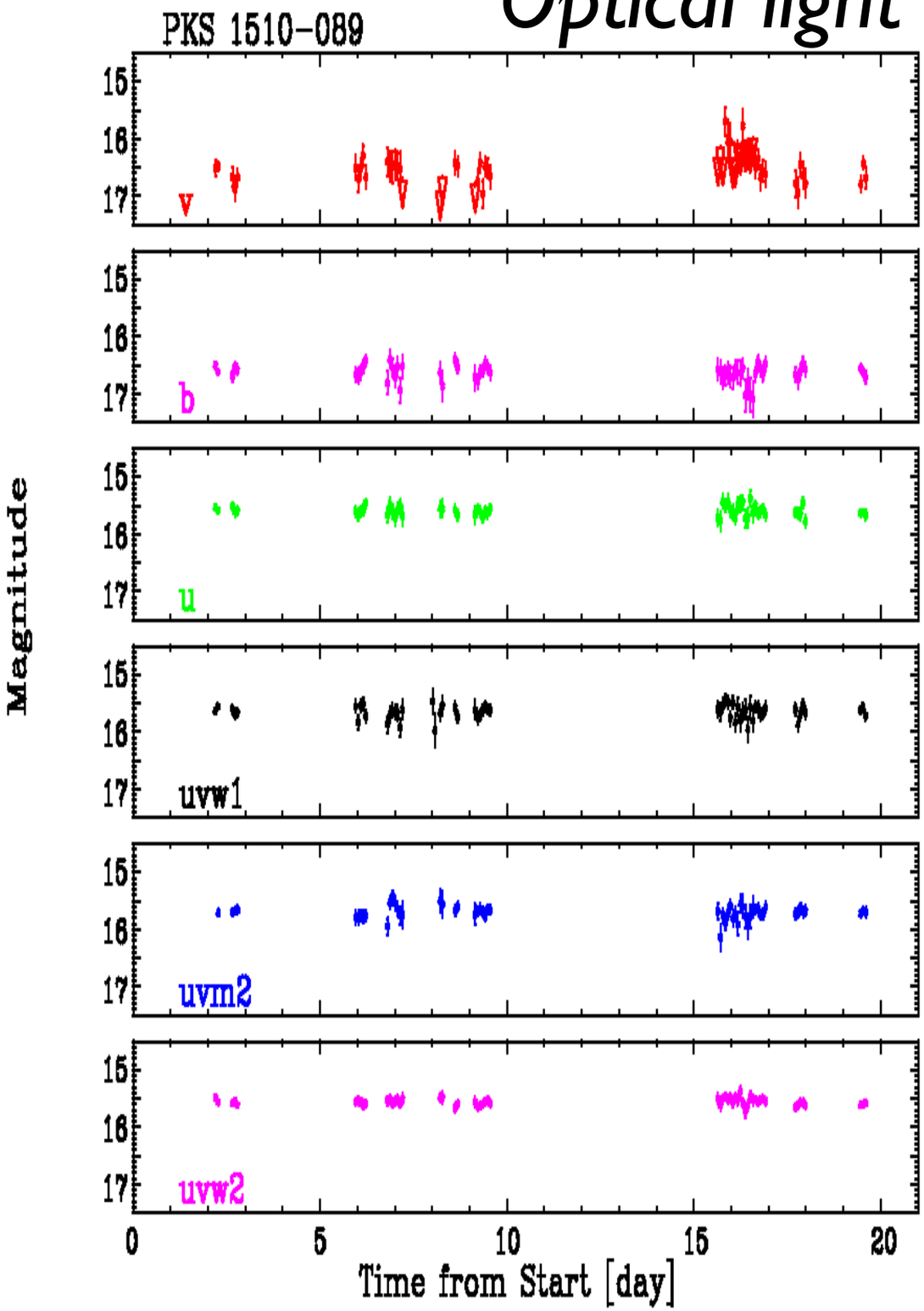
Suzaku : 120 ks/three days
Swift :24.3 ks/18 days

Swift & Suzaku observation

BeppoSAX

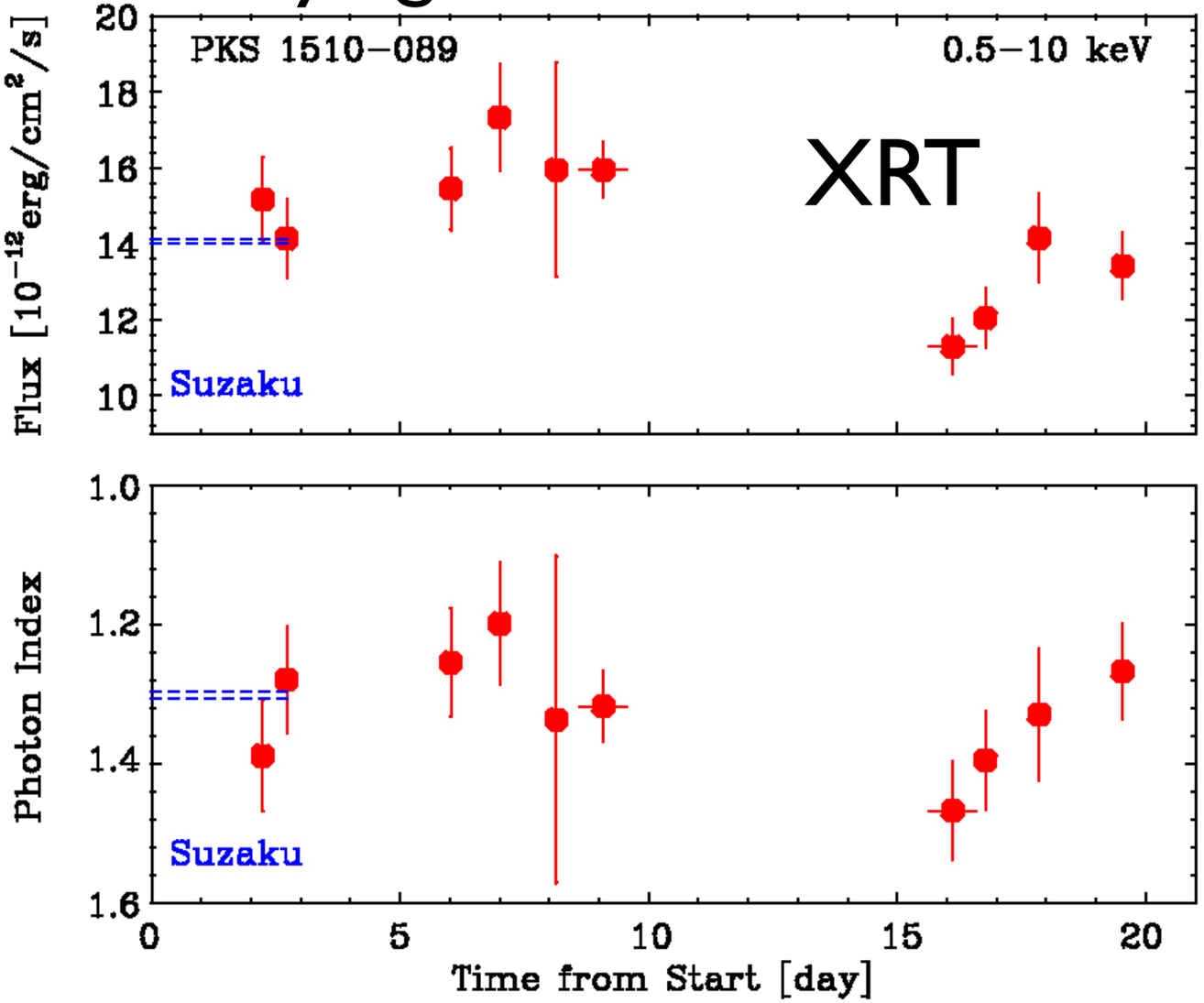


Optical light curve



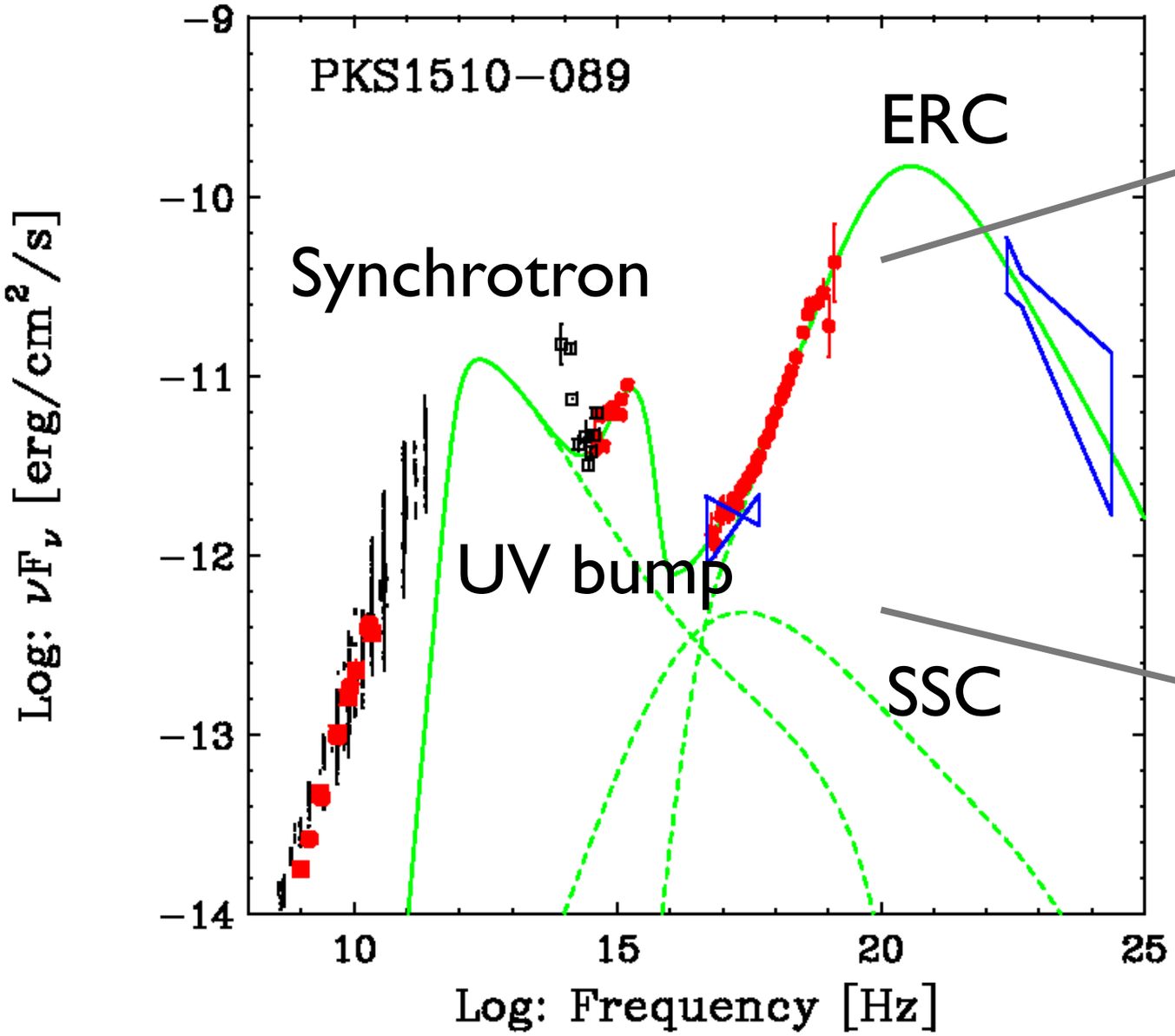
X-ray light curve

Kataoka+ 2007



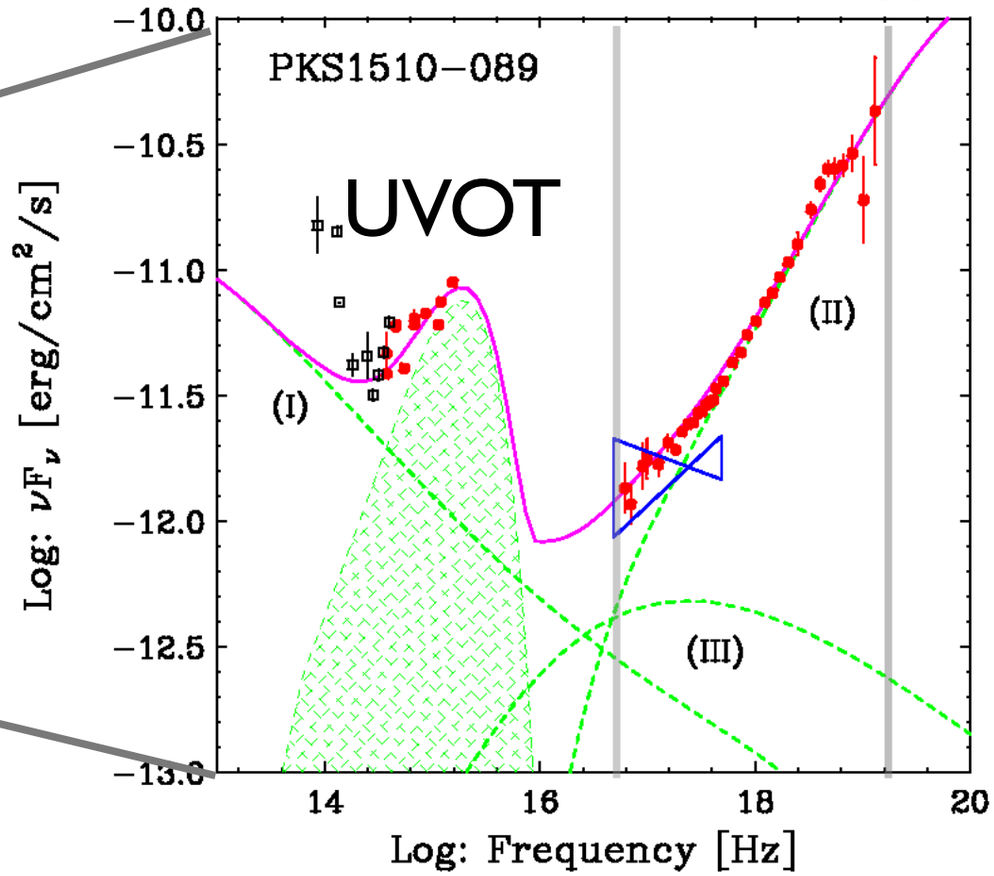
Multi wavelength spectrum

Kataoka+ 2007



Suzaku

0.3 keV 50 keV



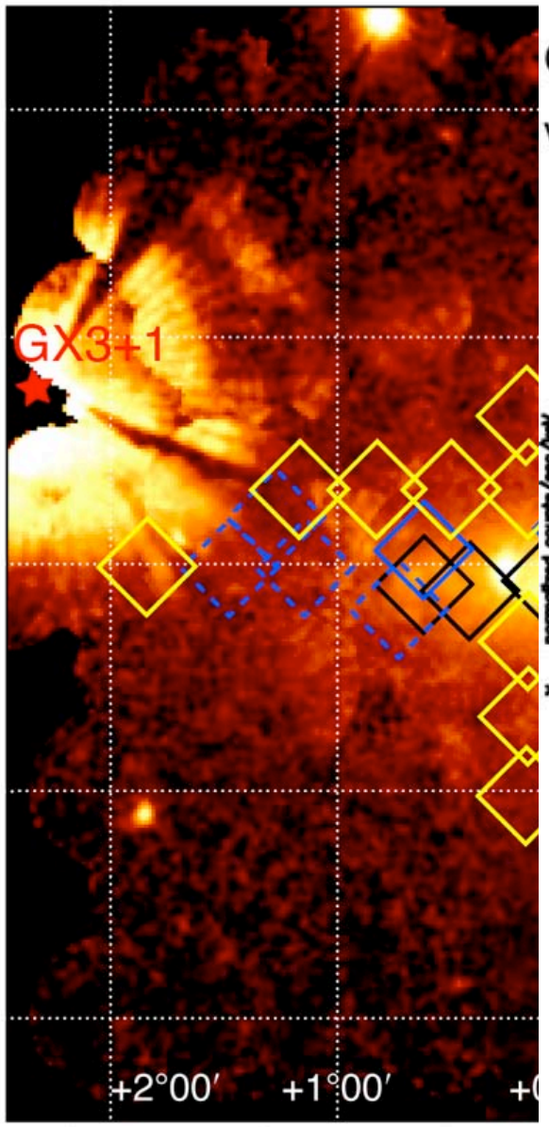
Clearly shows
the importance of UVOT
in this kind of study

Coordination with Swift #5

Galactic Center Survey to study diffuse emission

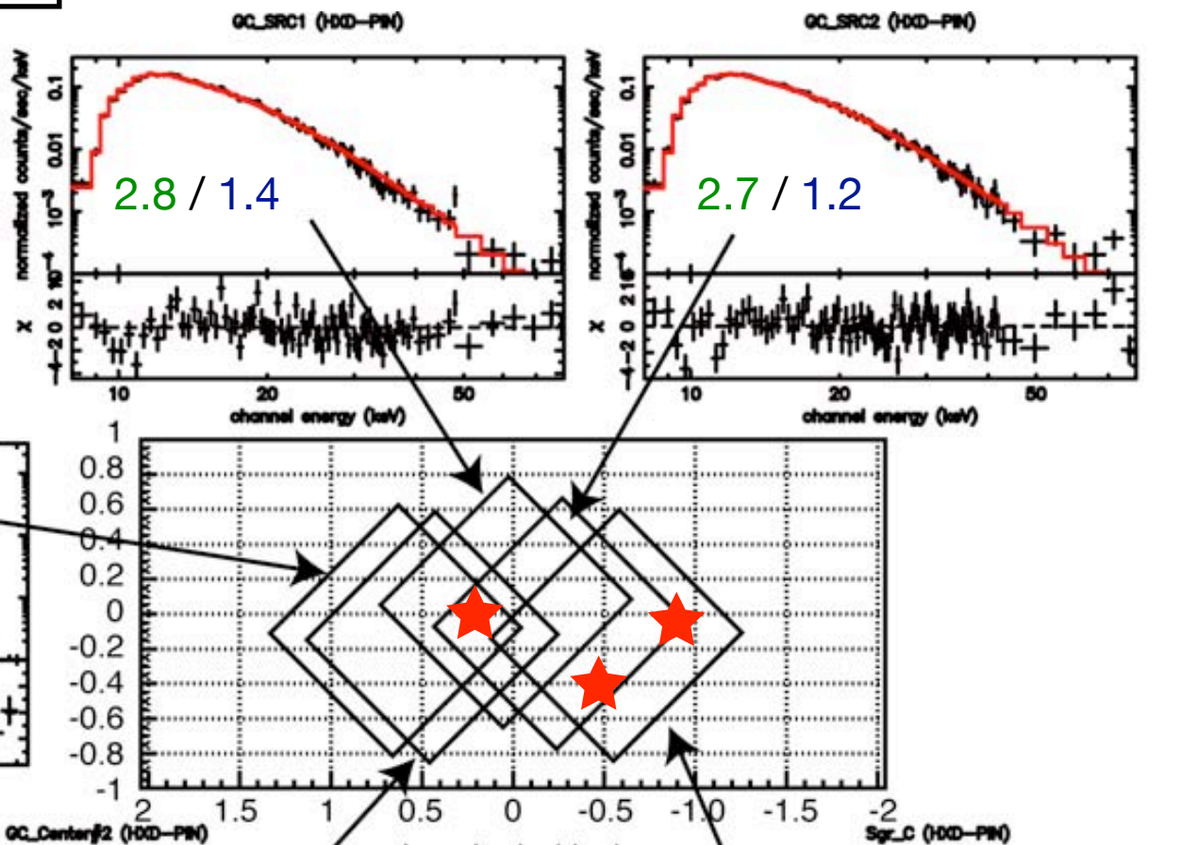
GC survey with Suzaku

SWG | AO-1 (pointing) | AO-1 (mapping) | AO-2



Galactic Center
with *Suzaku* HXD-PIN

Photon index
/ Norm



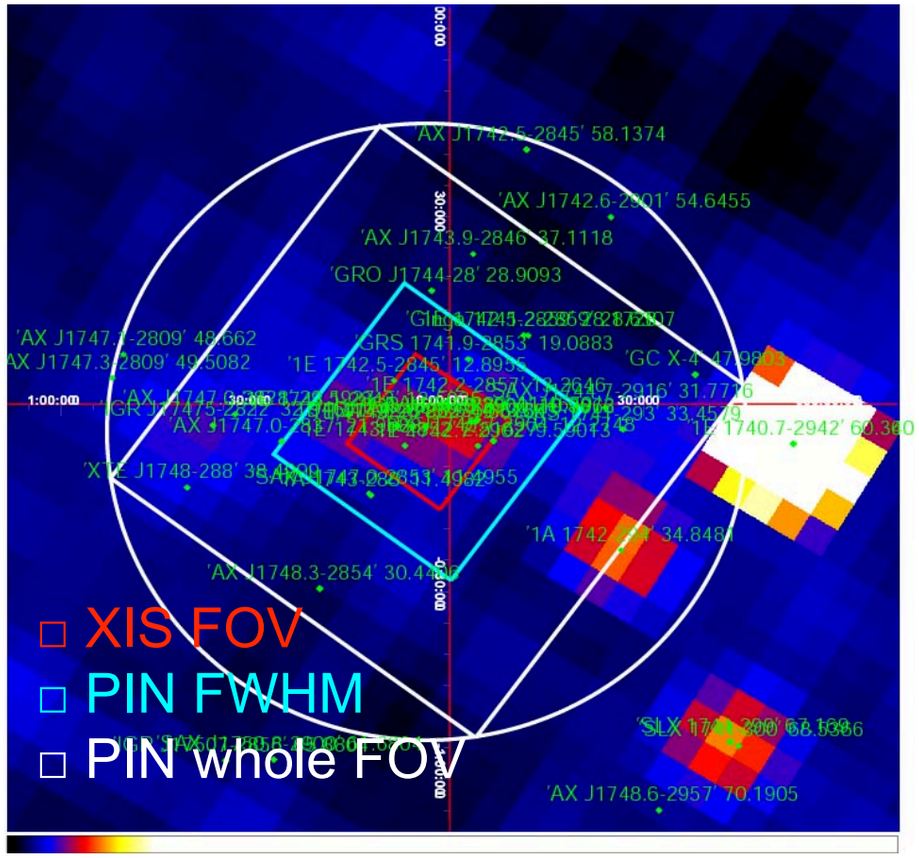
3-10keV (Log)

Point source confusion

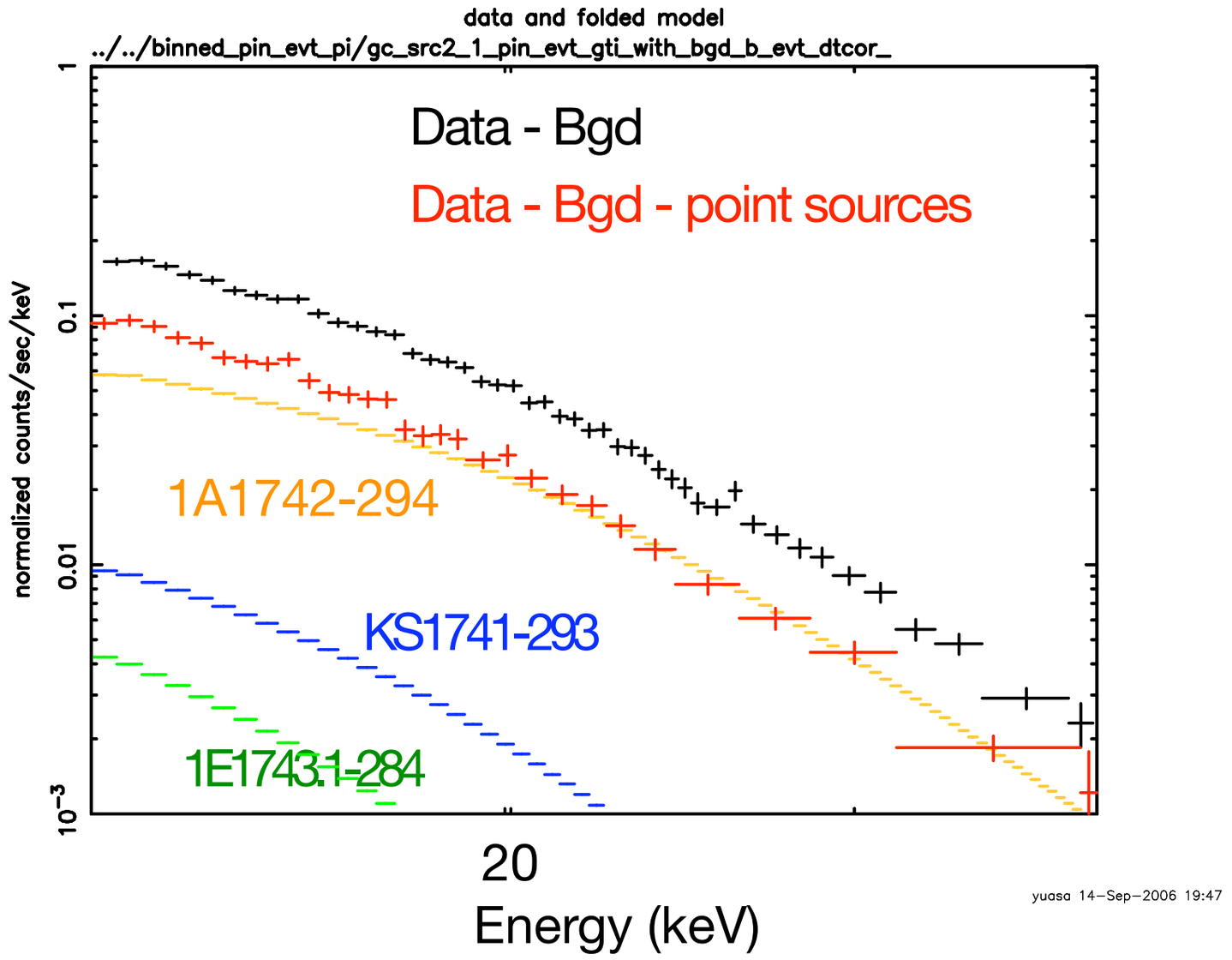
Simultaneous observation with Swift is crucial !

We have some

INTEGRAL IBIS/ISGRI 22-63 keV



Contributions from three bright sources were estimated utilizing the monitoring short observations.



Bright point sources can explain only half of the observed flux.

- unknown bright source outside the XIS-FOV : No detection with Swift/INTEGRAL
- dim sources below the XIS detection limit

Summary

- So far, we have experienced very nice cooperation between Suzaku & Swift.
  - Suzaku TOO (bright GRBs): Record 3.4 hrs after Swift trig.
  - Wideband GRB spectra (BAT+WAM): up to a few MeV
  - New Compton thick AGN from BAT survey
  - Multi-wavelength observation
    from UVOT/Swift to HXD/Suzaku as a fill-in proposal
  - Galactic Center Survey to study diffuse emission
    Swift is crucial to remove contribution from transient point sources. More simultaneous exposure by Swift is helpful.
- We hope we could extend this, more in next years.