

IBIS/Integral off-axis GRB's spectral analysis

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Outline:

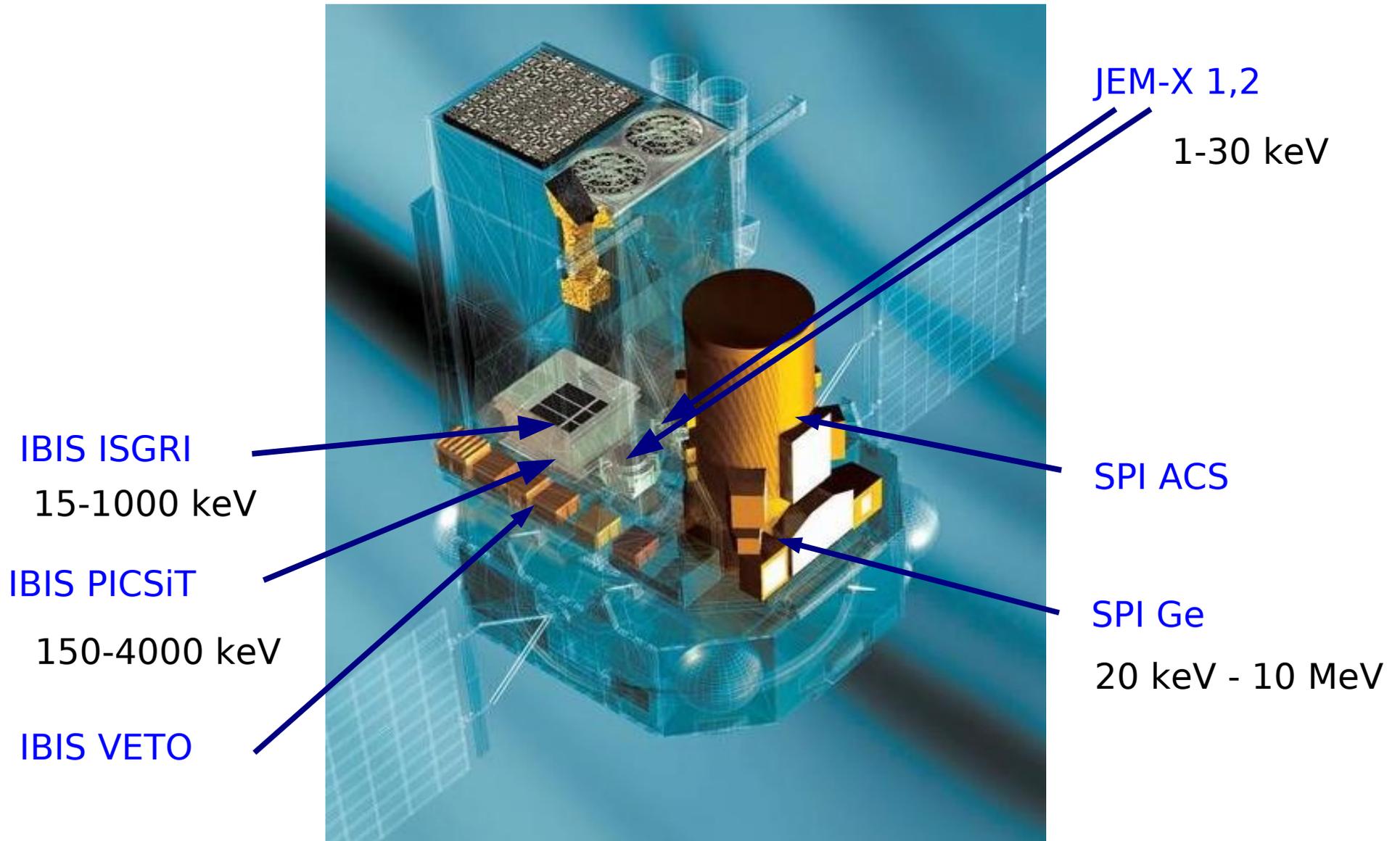
Satellite INTEGRAL and its Mass Model

IBIS spectral response

GRB spectral analysis

Summary

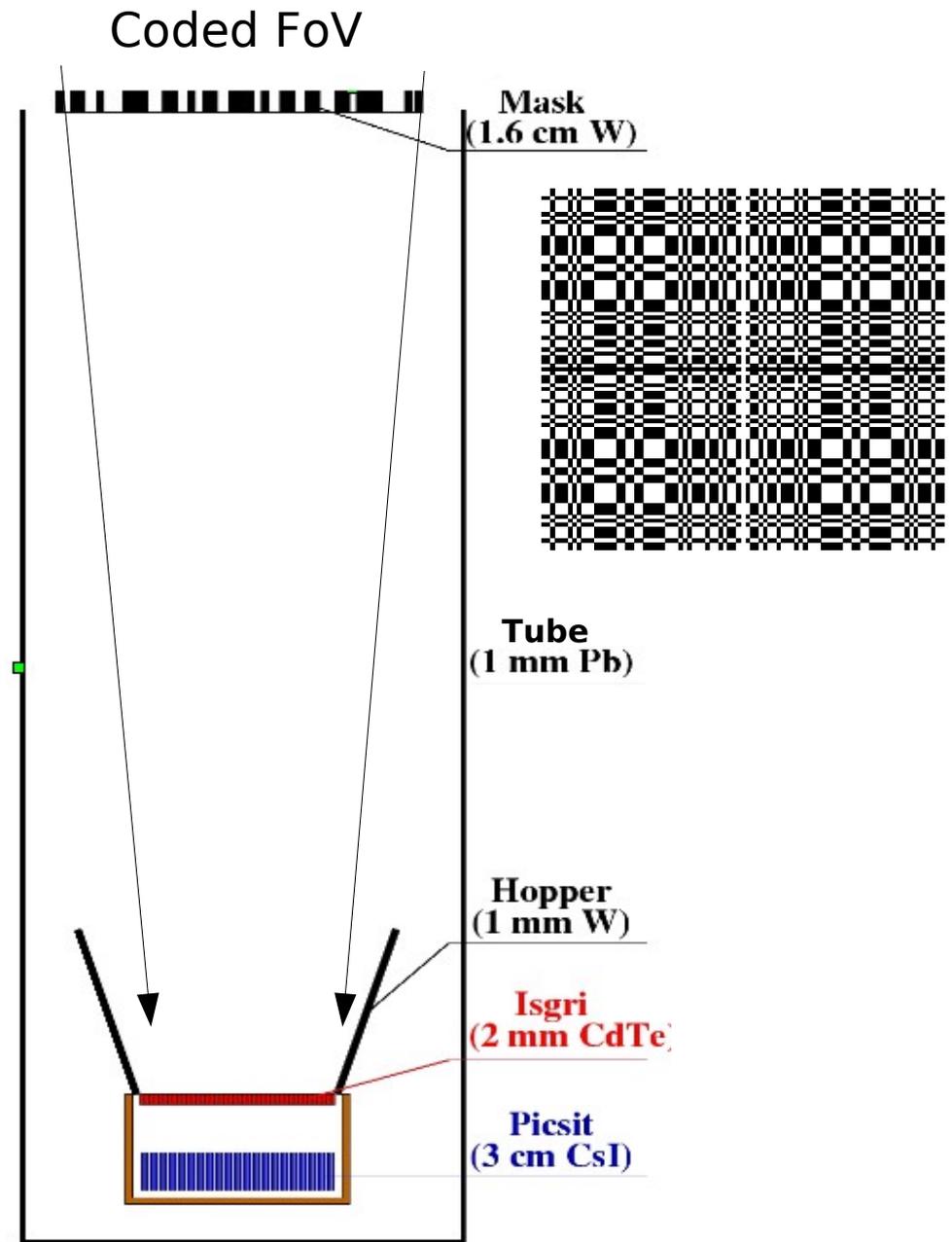
Satellite INTEGRAL



Telescope IBIS

IBIS Coded FoV - 30°

Compton scattering between
ISGRI and PICSIT – half of the sky
Compton instrument

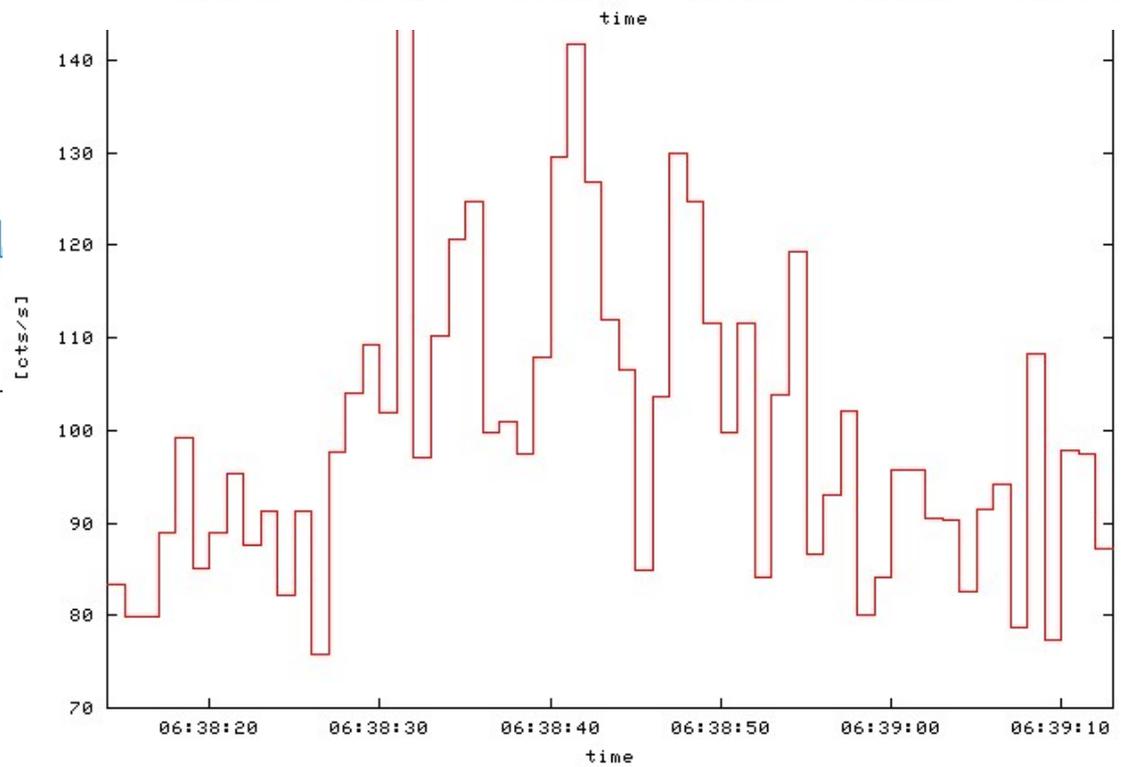
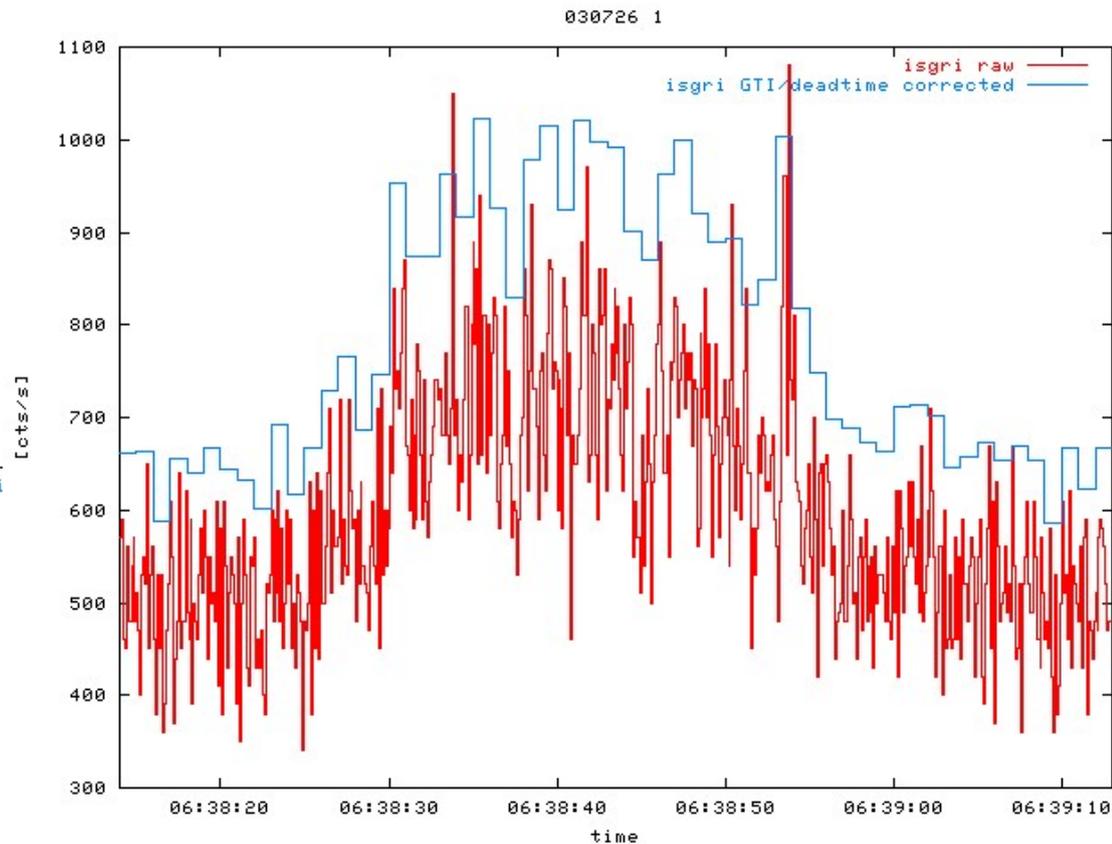
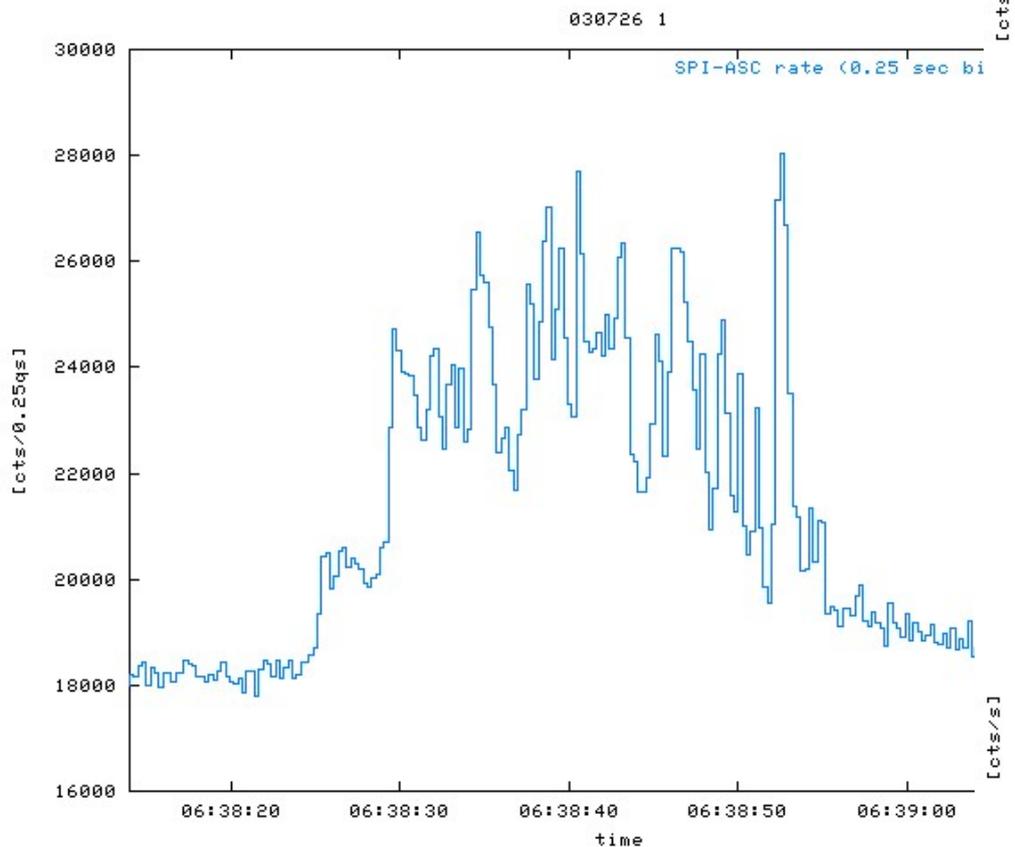


Off-axis GRB 030726 - 82°

SPI/ACS

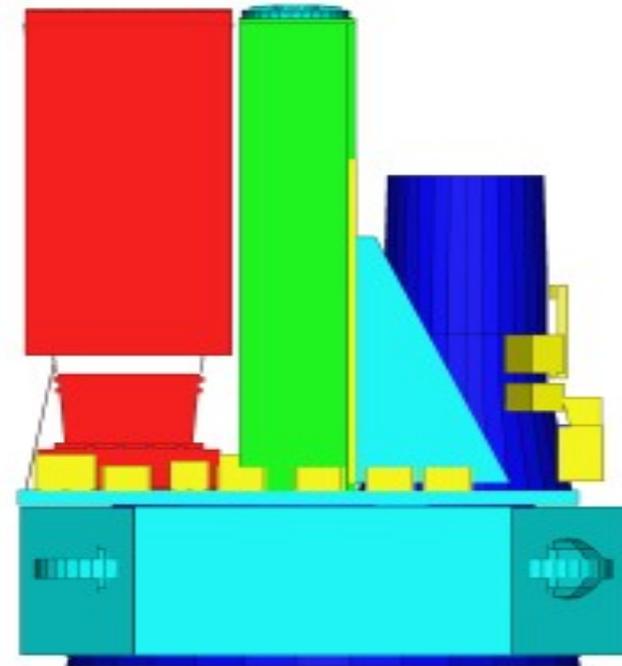
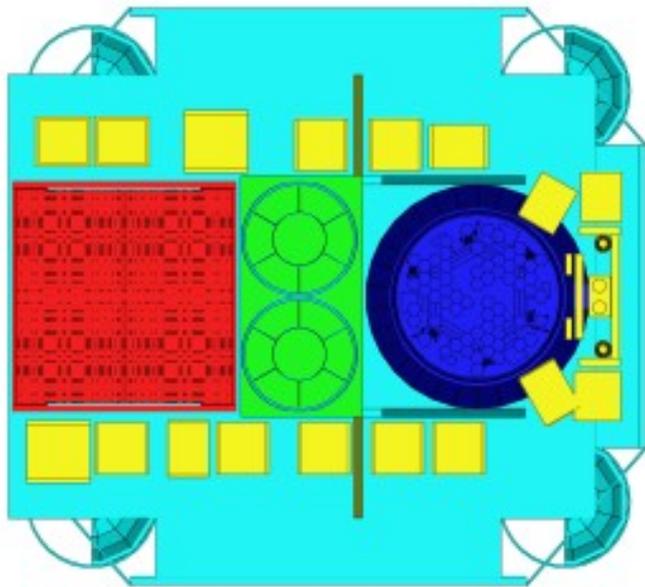
IBIS/ISGRI

IBIS/Compton

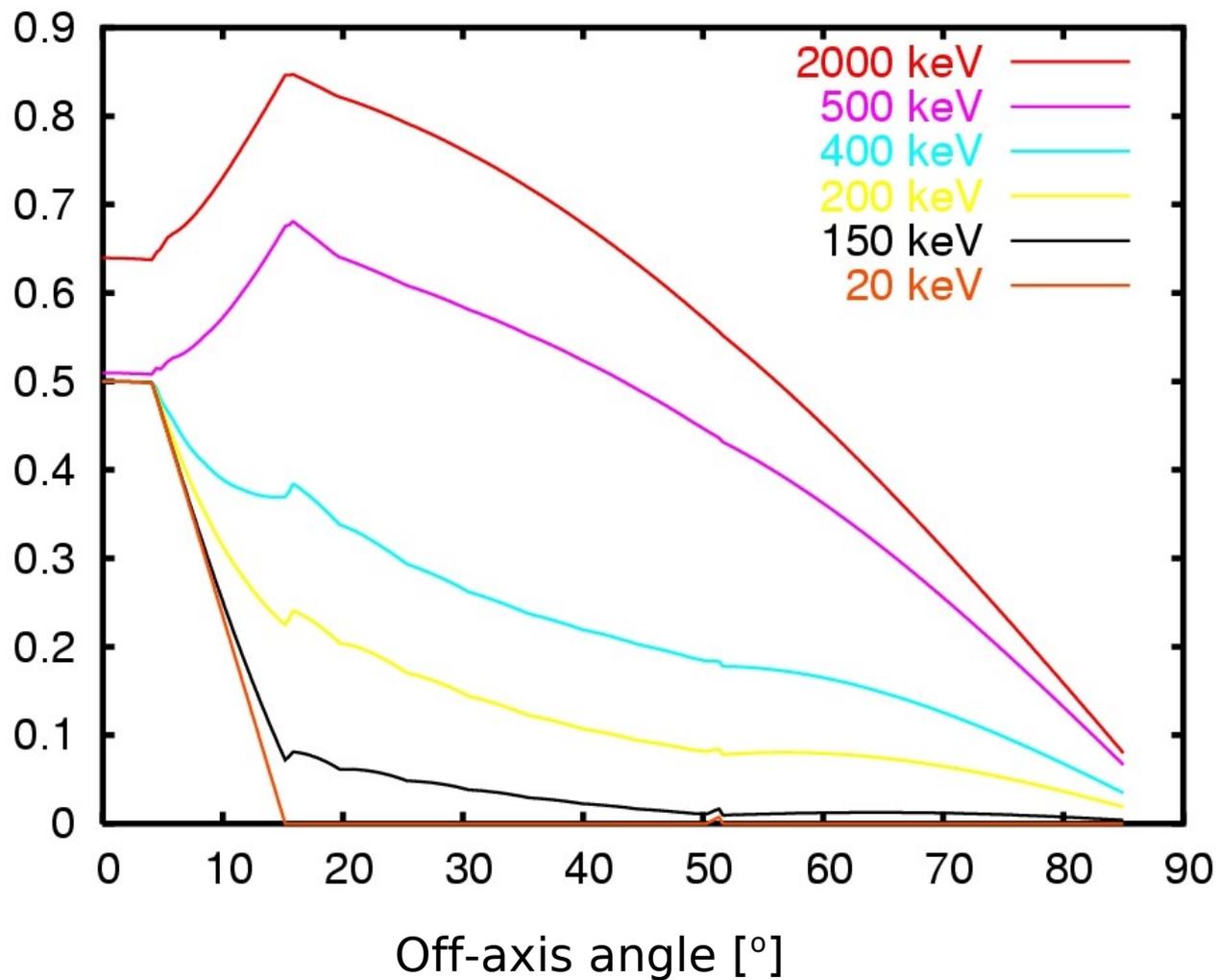


Integral Mass Model

CERN geant3 simulation tool

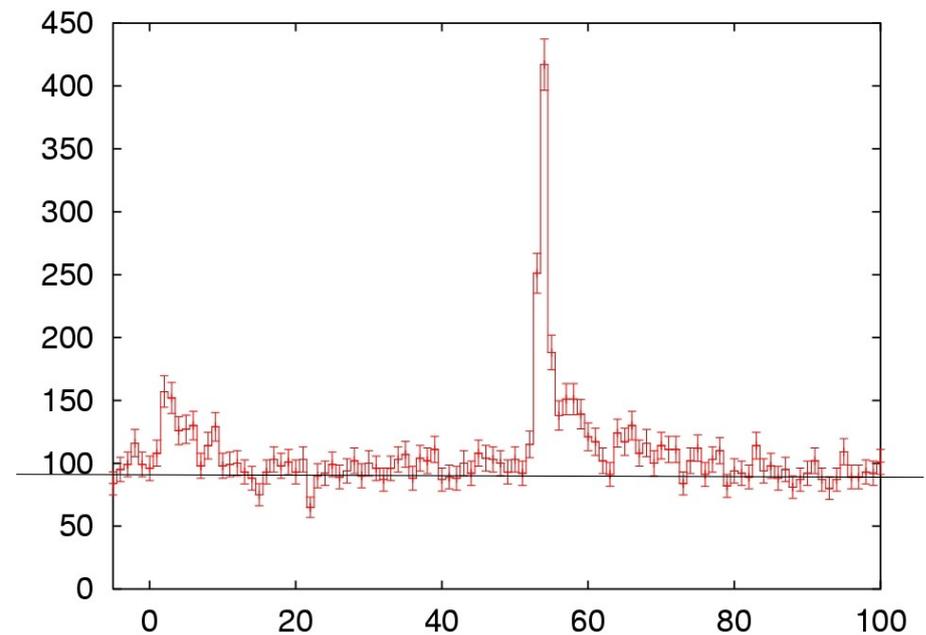


IBIS tube transparency



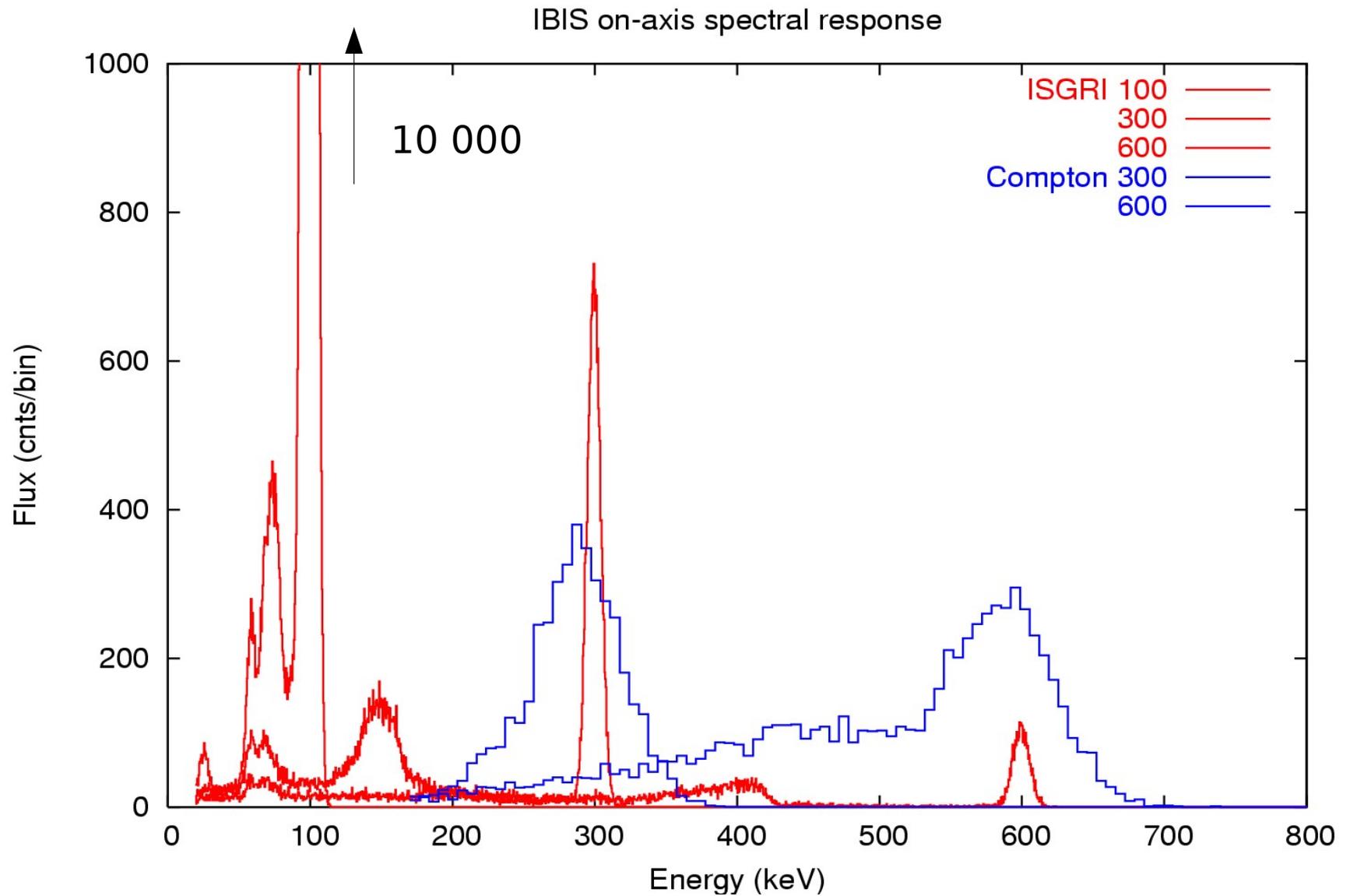
IBIS off-axis spectral analysis

- Background subtraction
- Response modeling
(direction dependent, GRB position must be known!)
- Model fitting (xspec tool)



$$\phi = 0.0^\circ, \quad \psi = 0.0^\circ$$

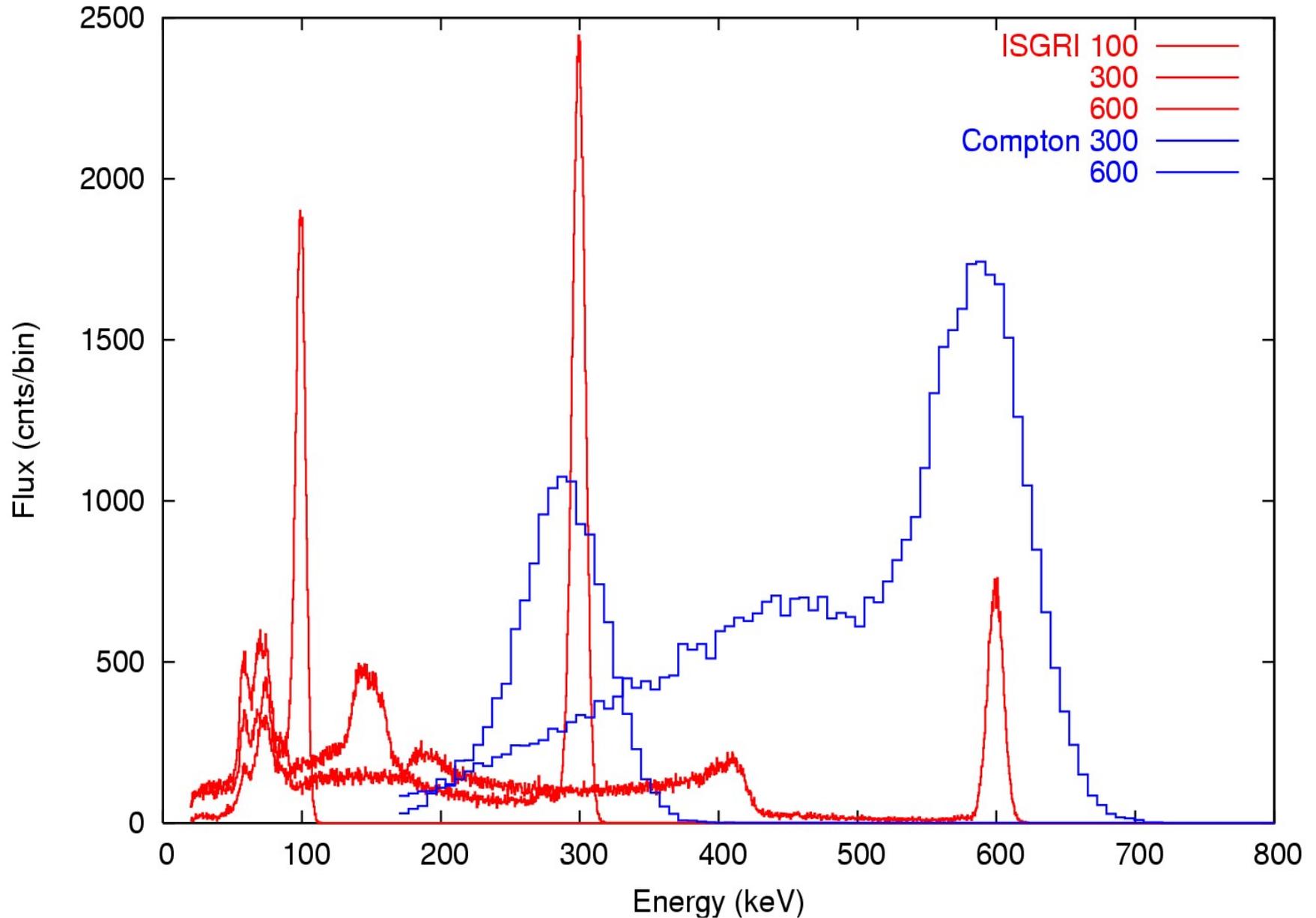
IBIS response



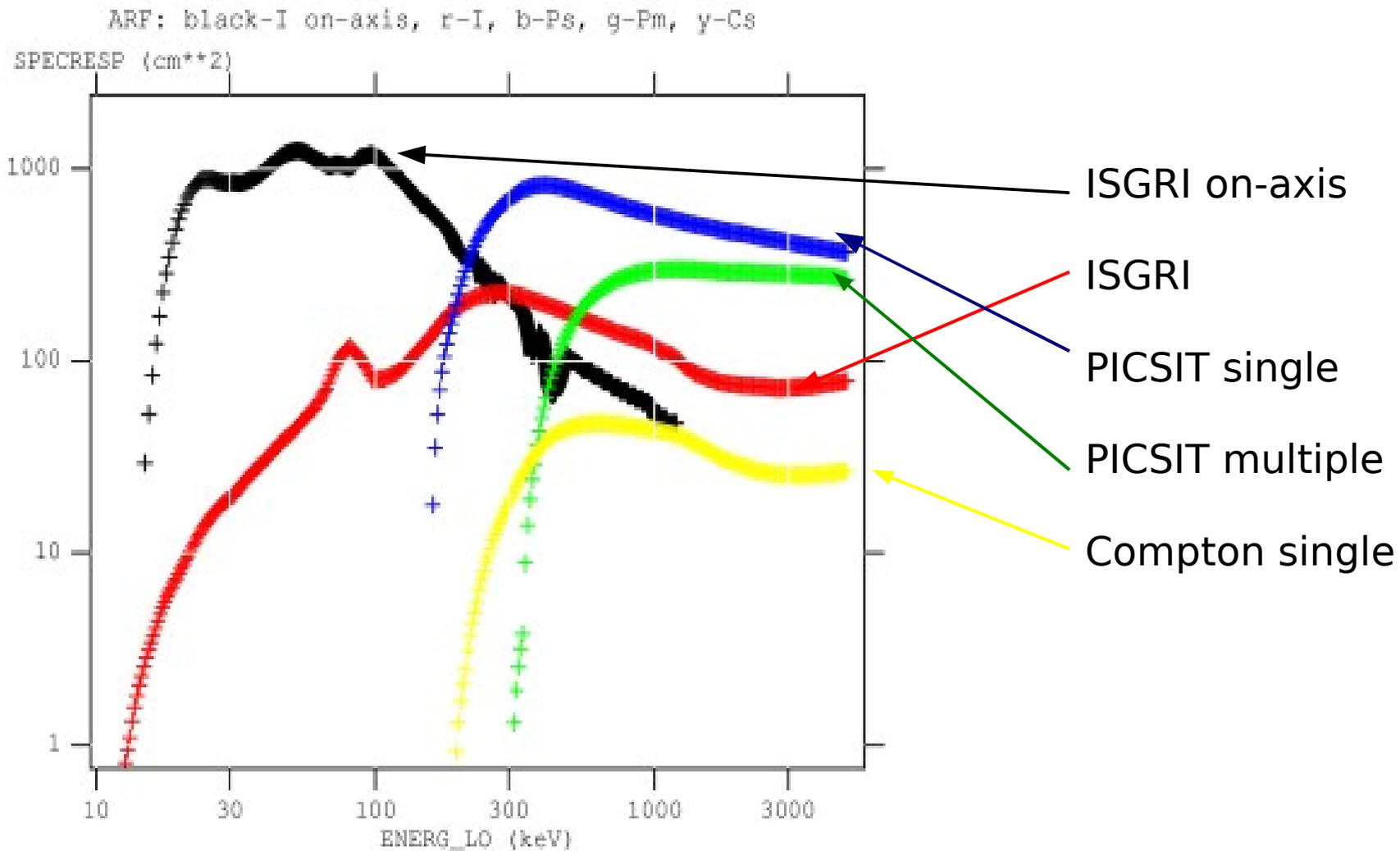
$$\phi = 281.036^\circ, \quad \psi = 36.827^\circ$$

IBIS response

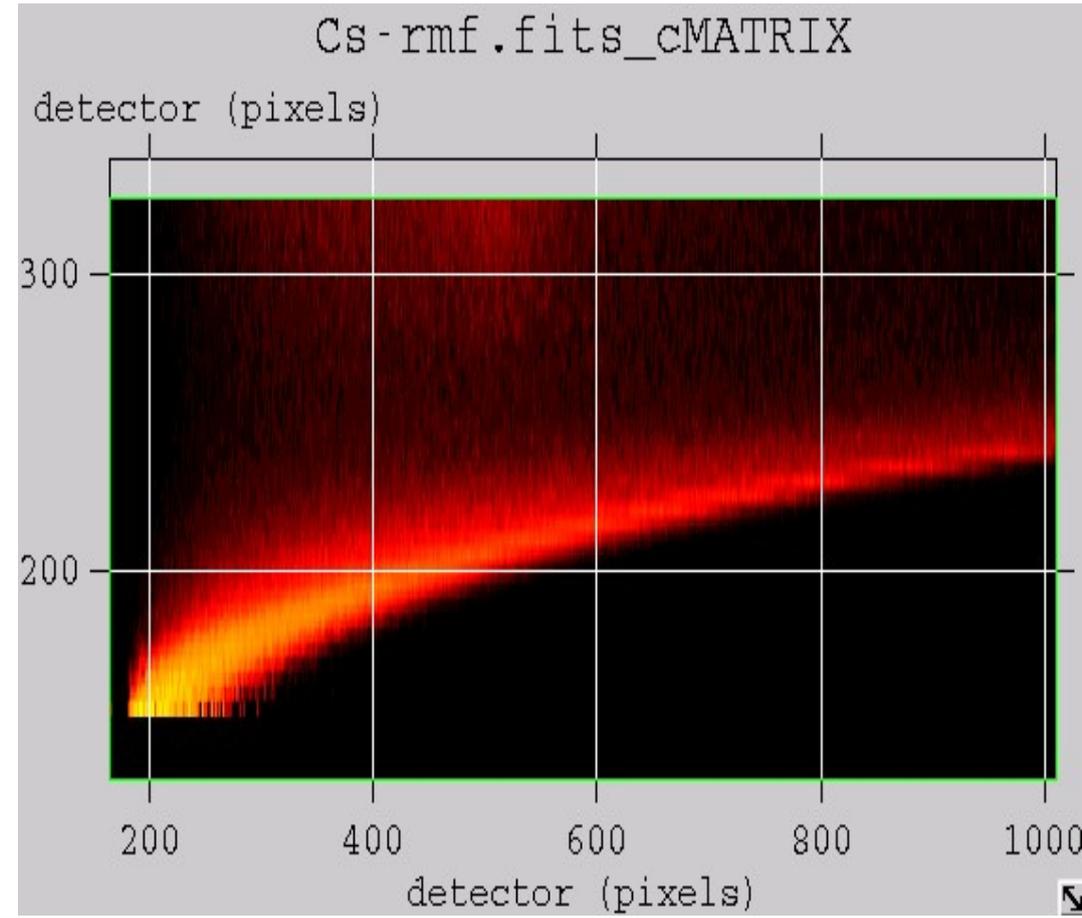
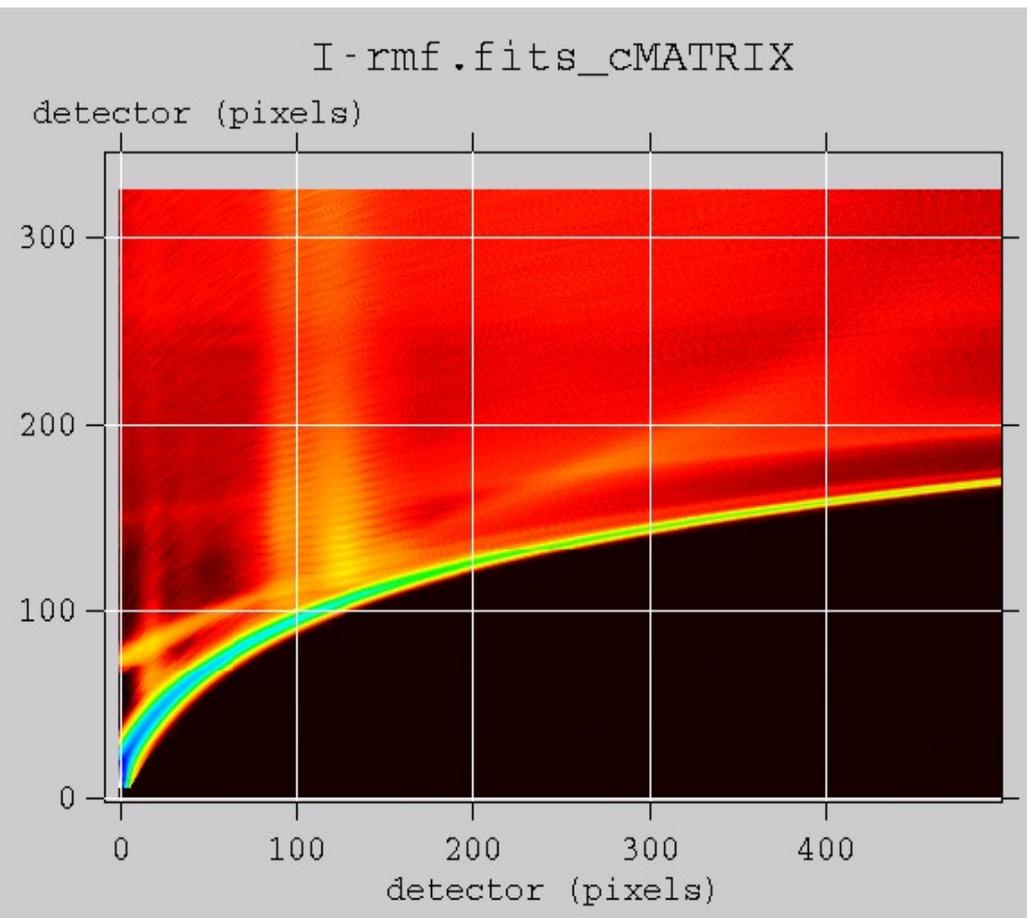
IBIS off-axis spectral response



IBIS response – effective area



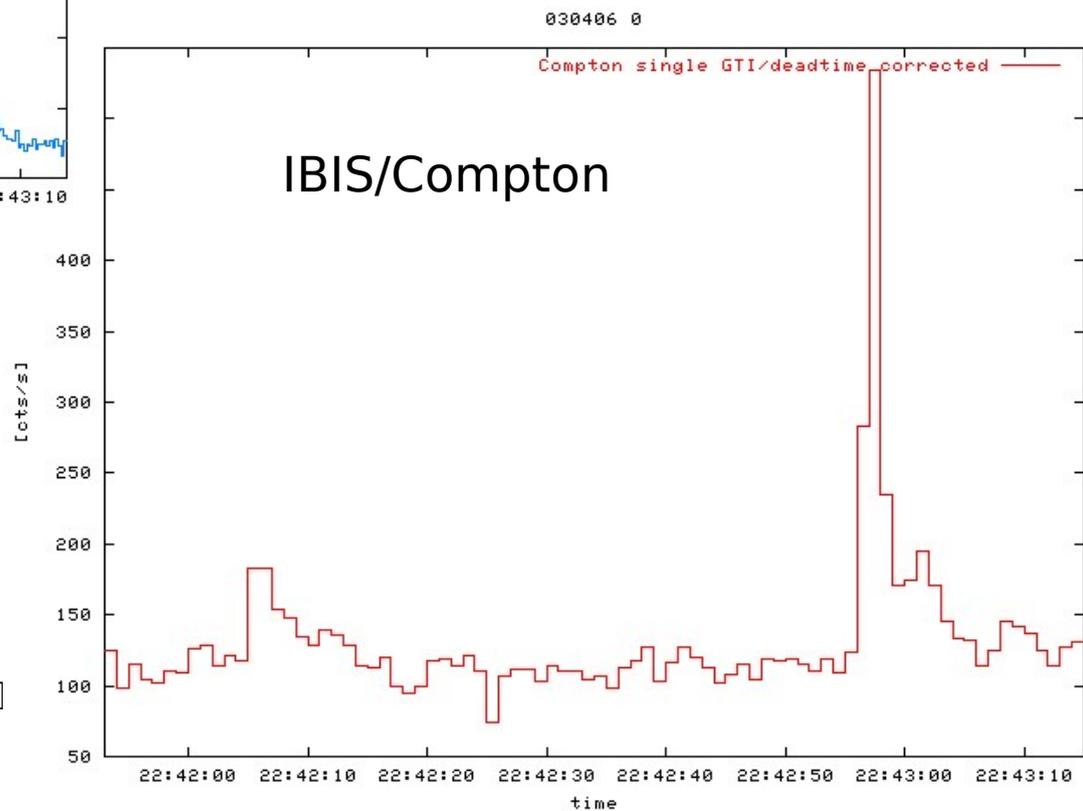
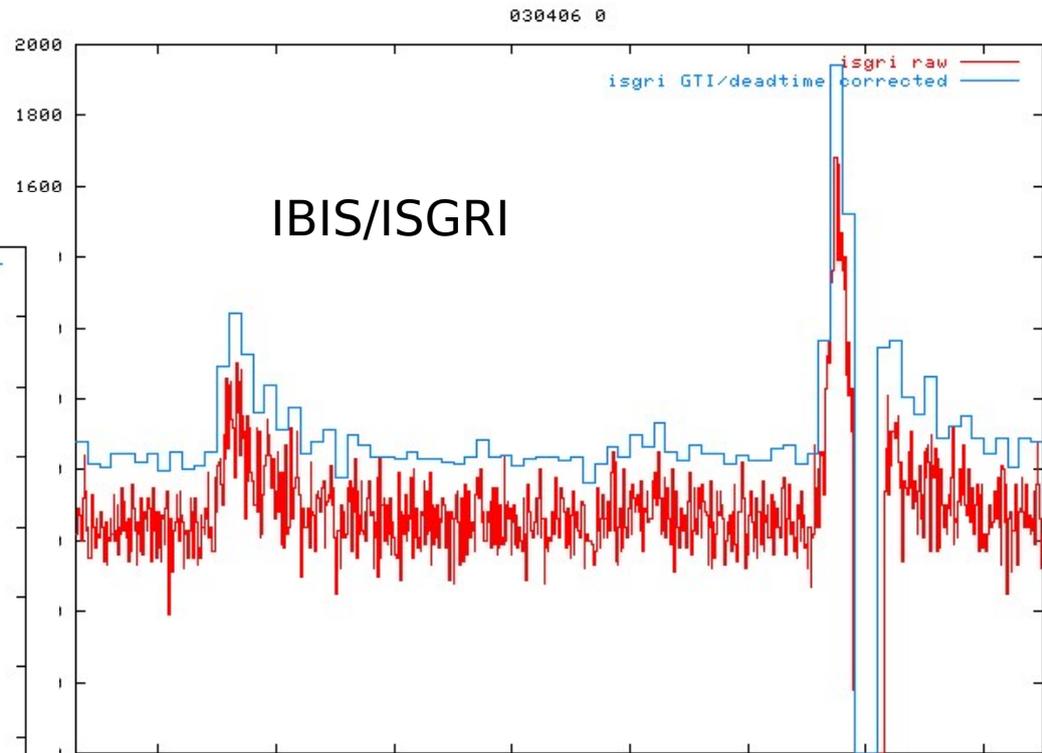
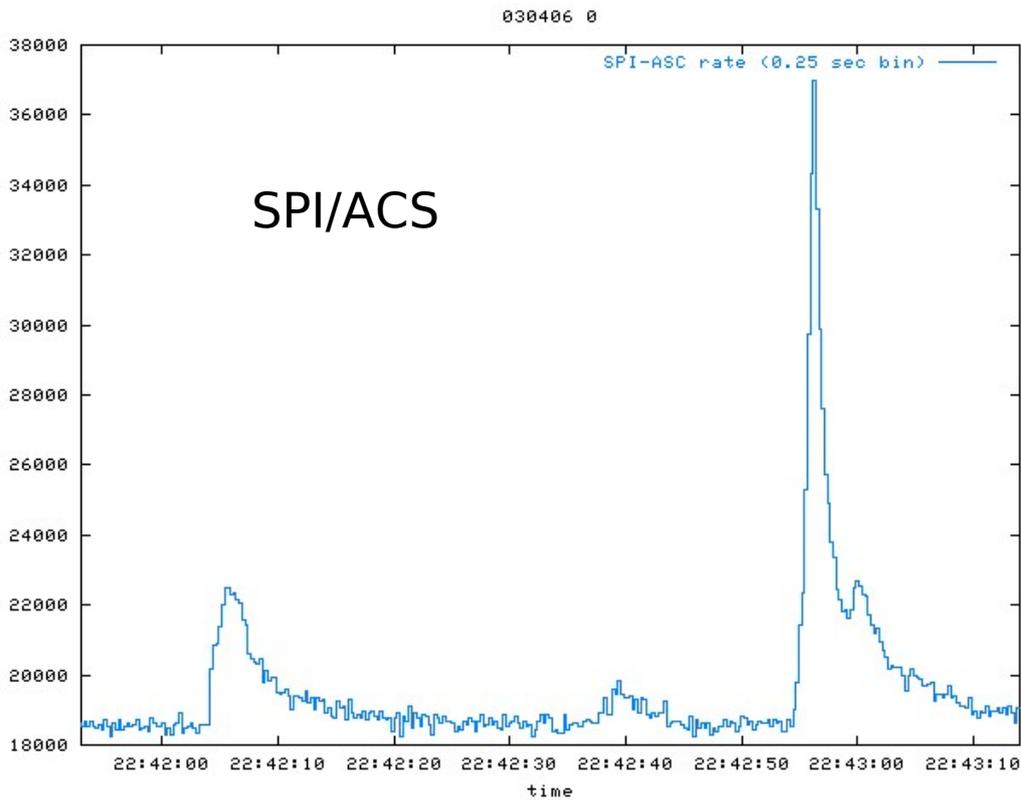
IBIS response matrices: ISGRI, Compton



GRB spectral analysis

GRB	Polar angle (°)	Duration (s)
030406	36.9	70
030722	76.6	15
031111	53.6	10

GRB 030406 – light curve

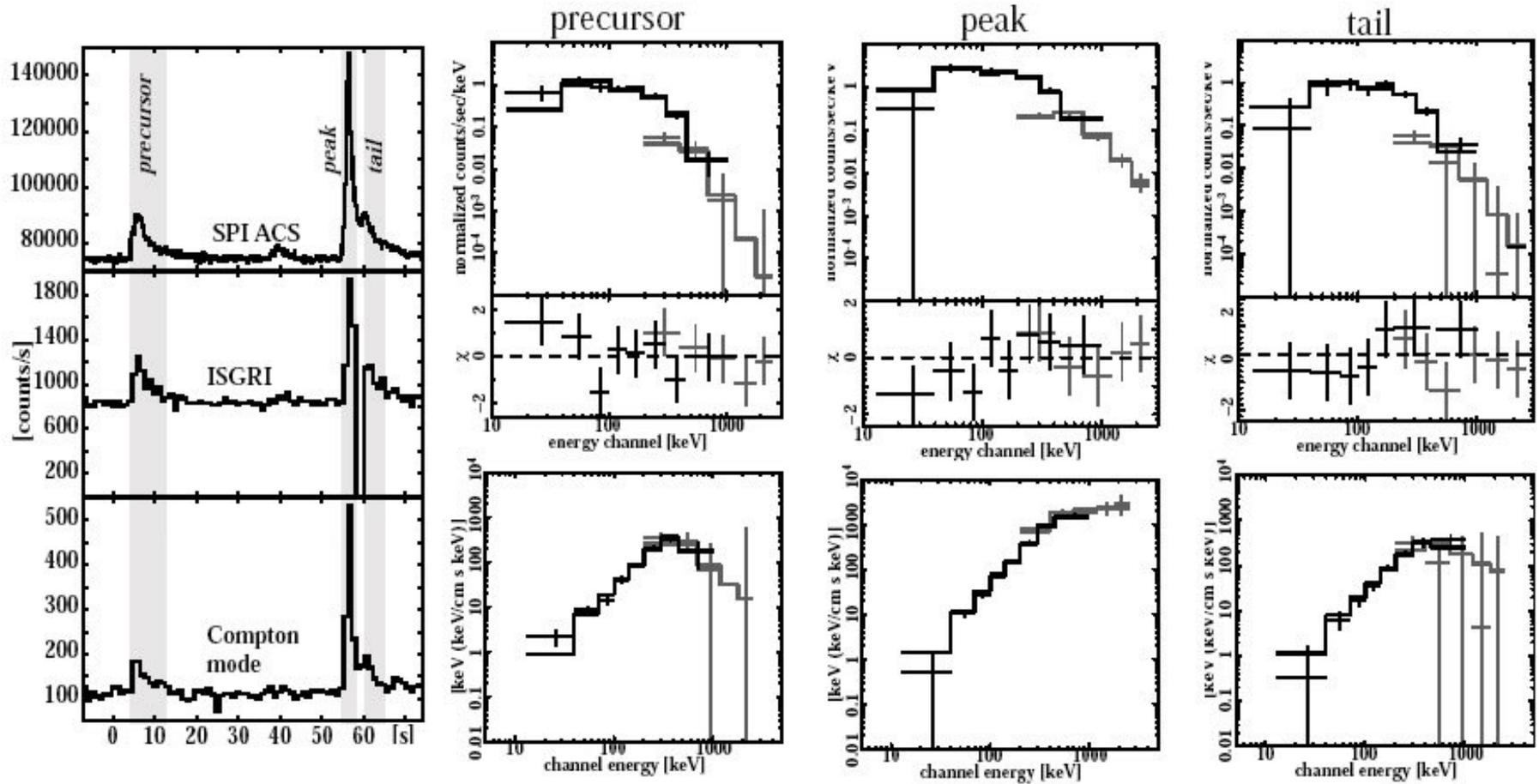


Position: IPN triangulation
and Compton imaging
duration = 70 s
off-axis = 36.9°

4.10.2006

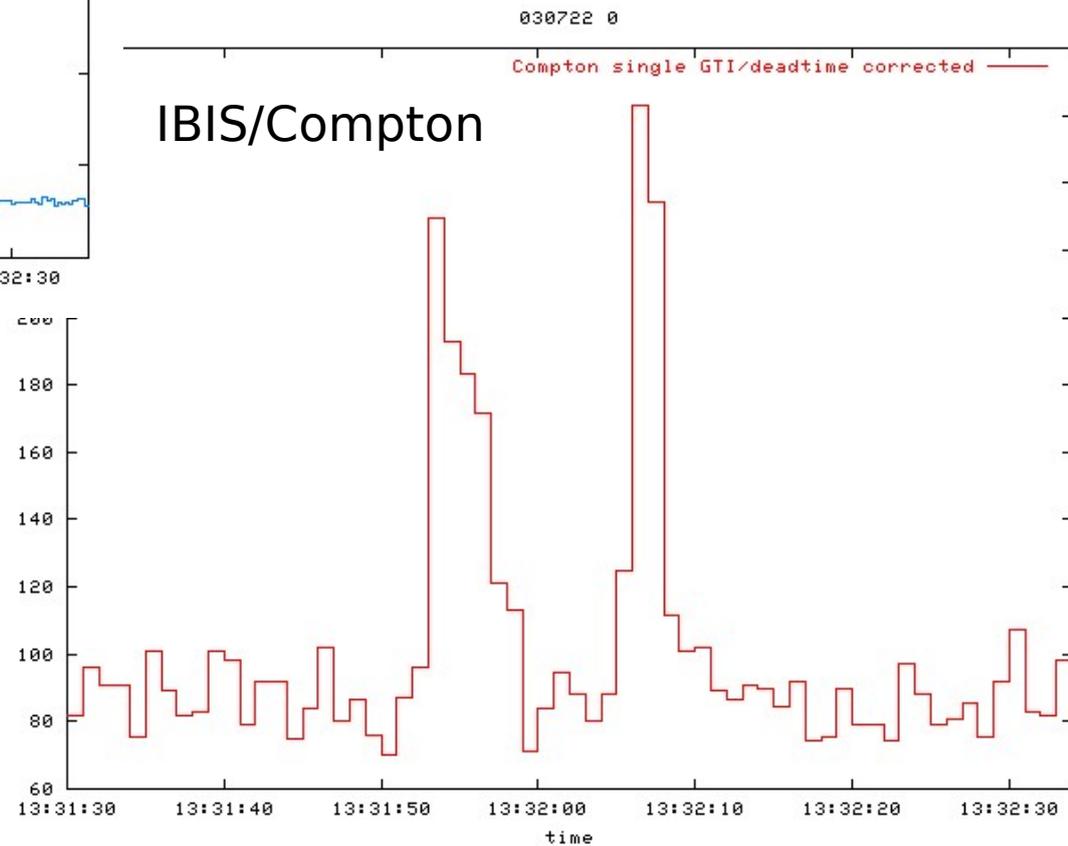
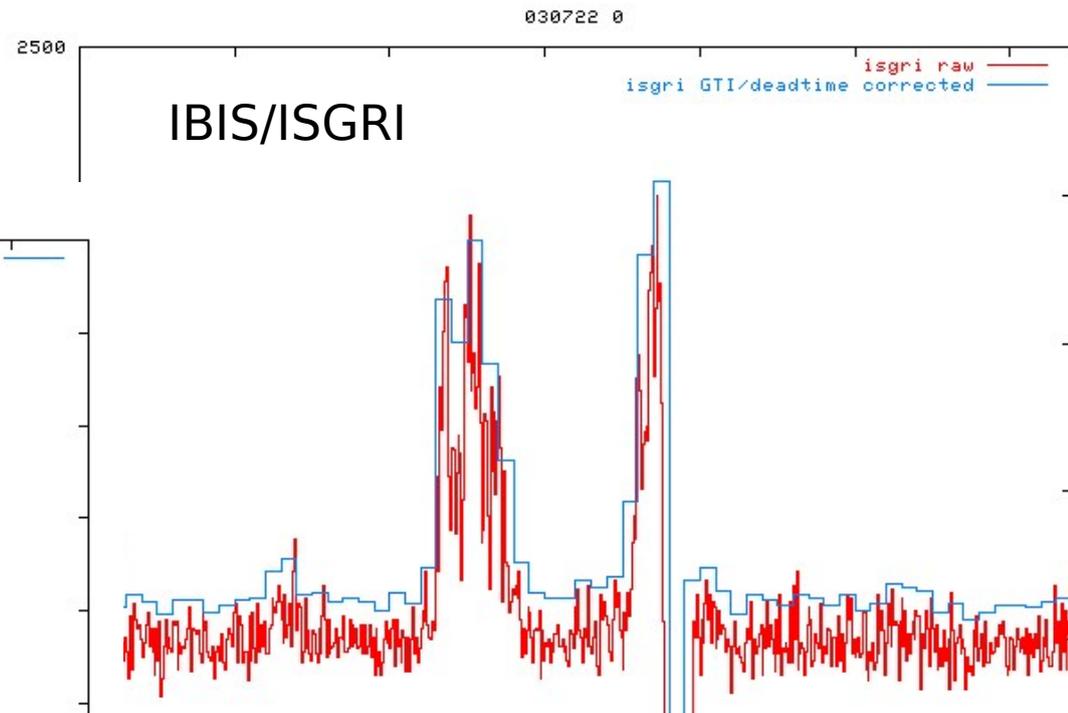
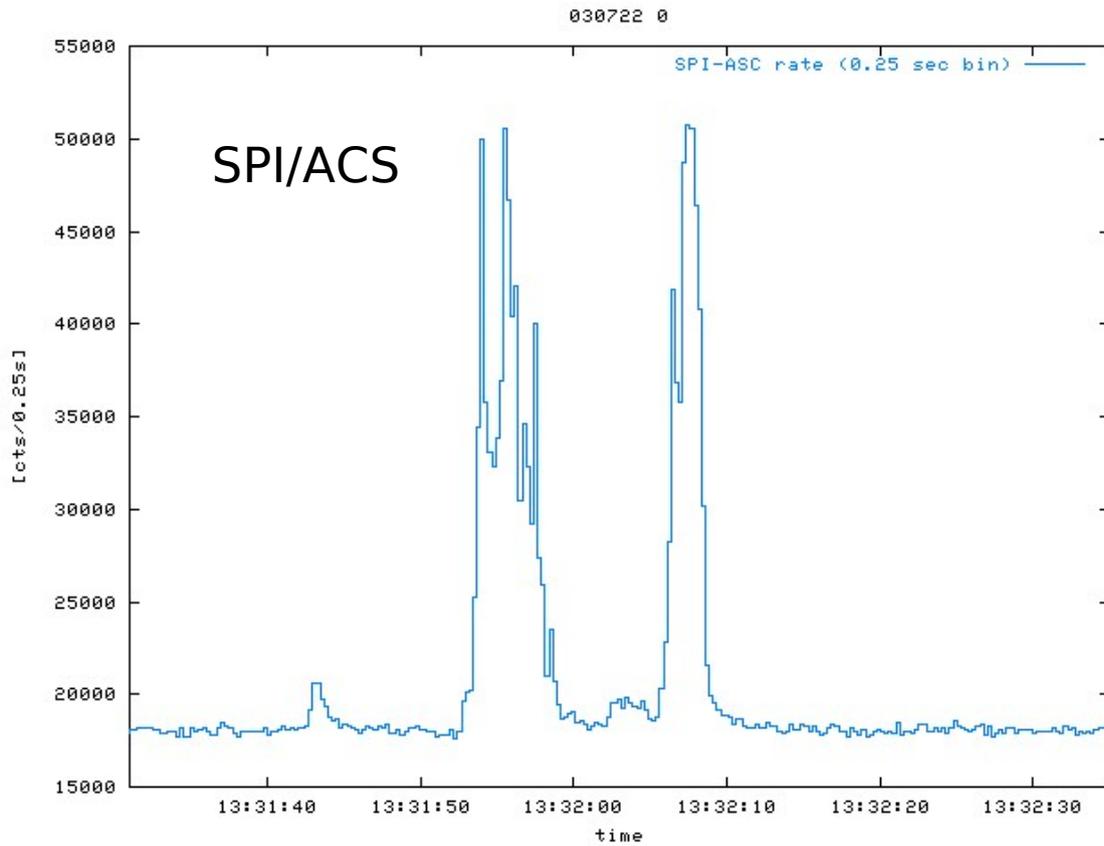
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GRB 030406 – spectrum



part	[s]	α	β	E_{break}
precursor	7.3	$0.0^{+0.3}_{-0.3}$	9.0^{+1}_{-6}	490^{+40}_{-180}
peak	2.81	$-1.5^{+0.7}_{-1.0}$	$1.7^{+0.4}_{-0.3}$	390^{+60}_{-50}
tail	4.3	$-0.8^{+0.7}_{-2.2}$	$2.8^{+1.2}_{-0.6}$	270^{+70}_{-50}

GRB 030722 – light curve

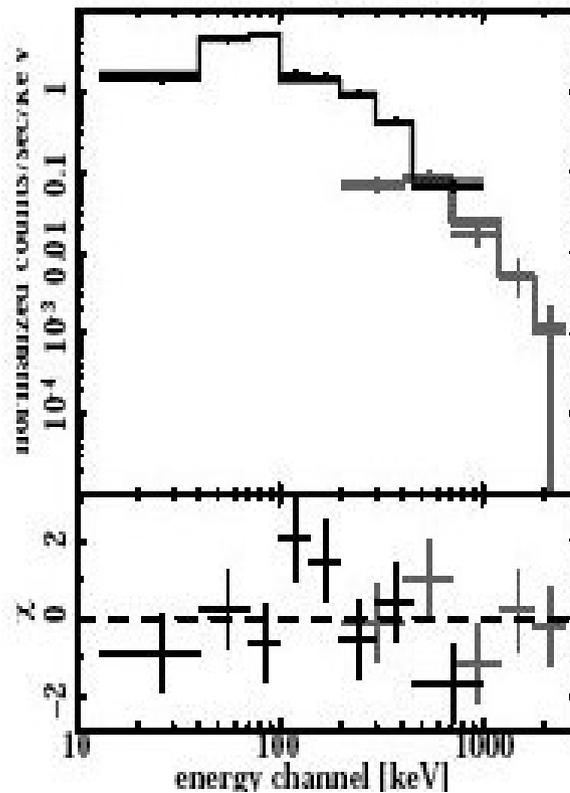
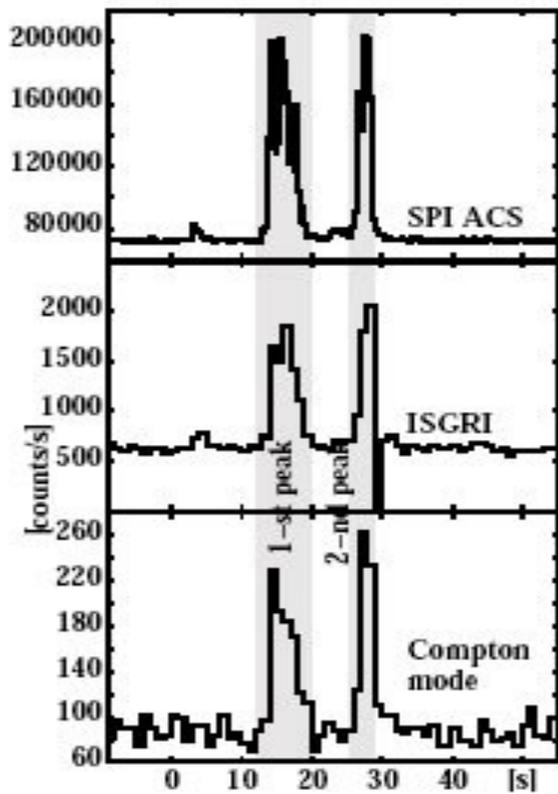


Position: IPN triangulation - annulus
and Compton imaging
duration = 15 s
off-axis = 76.6°

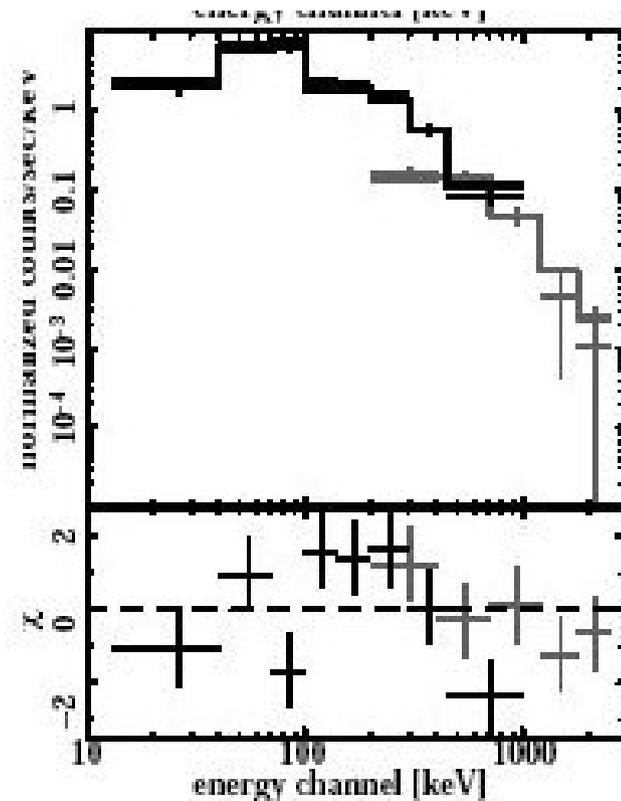
4.10.2006

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GRB 030722 – spectrum

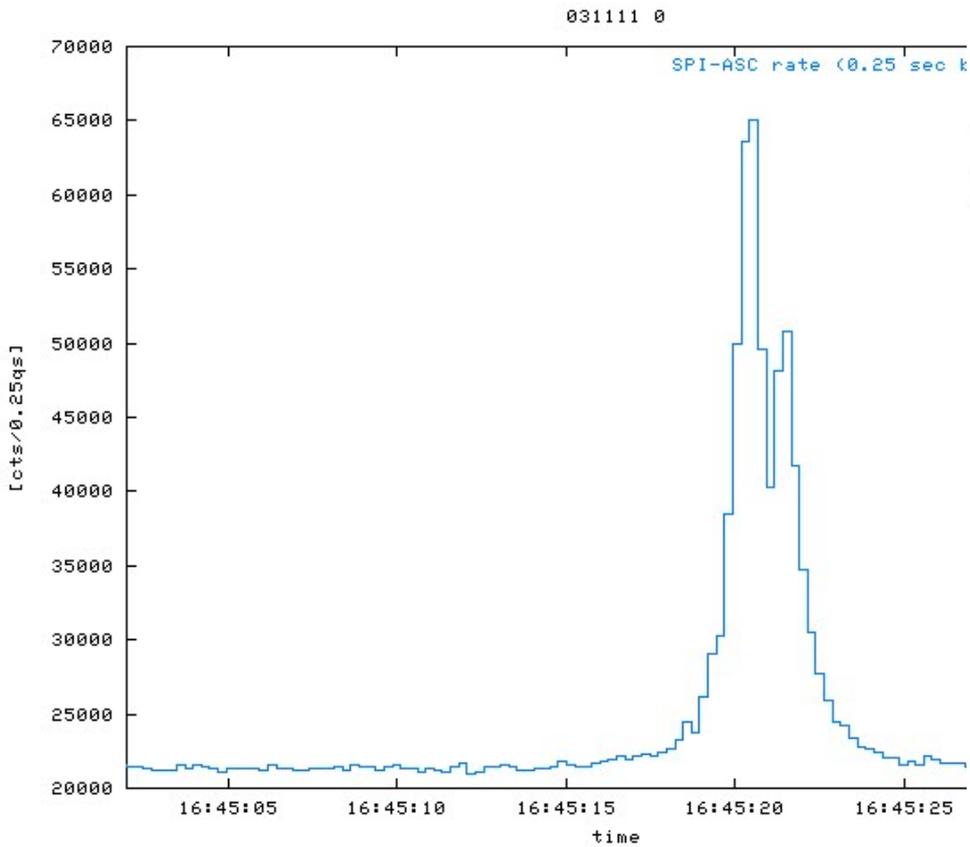


$\Gamma=2.07 \pm 0.05$
 $\chi^2/\text{dof}=1.23$

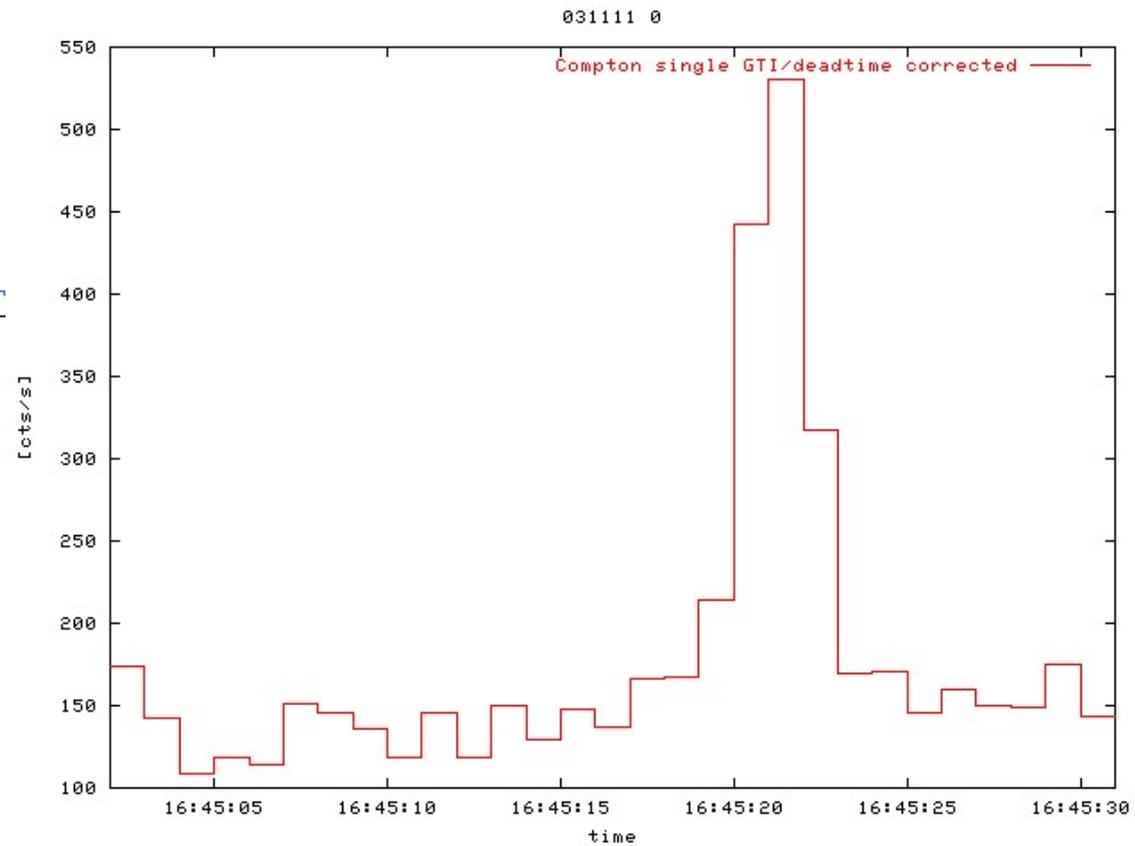
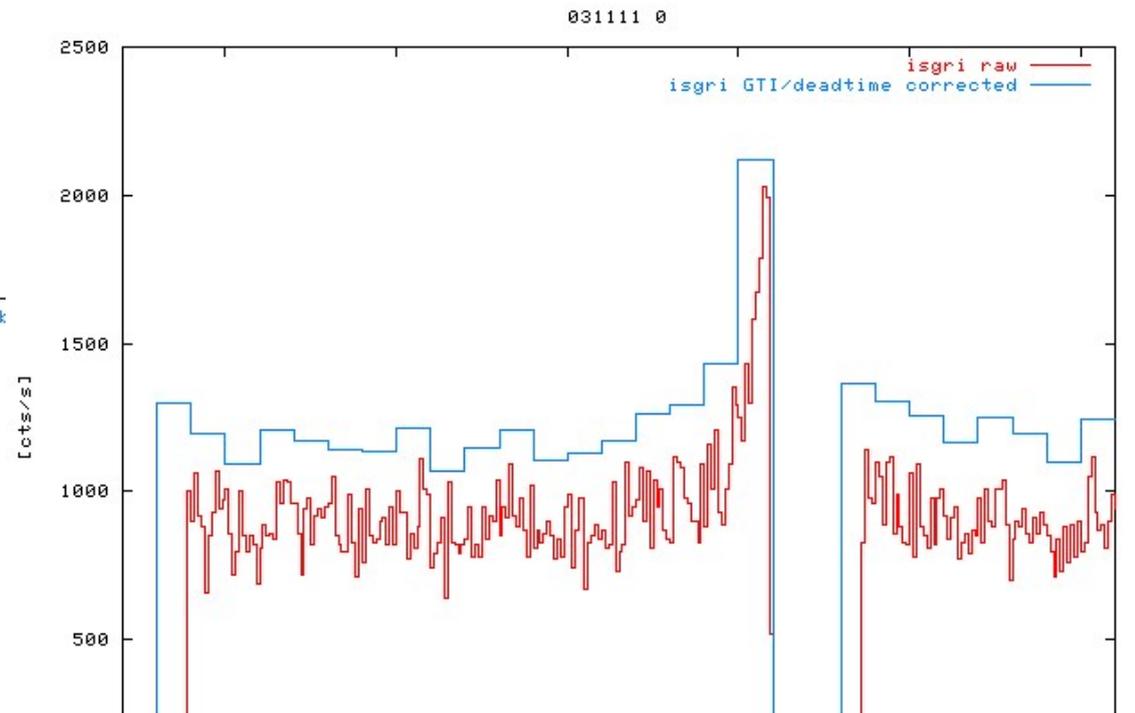


$\Gamma=2.05 \pm 0.06$
 $\chi^2/\text{dof}=1.9$

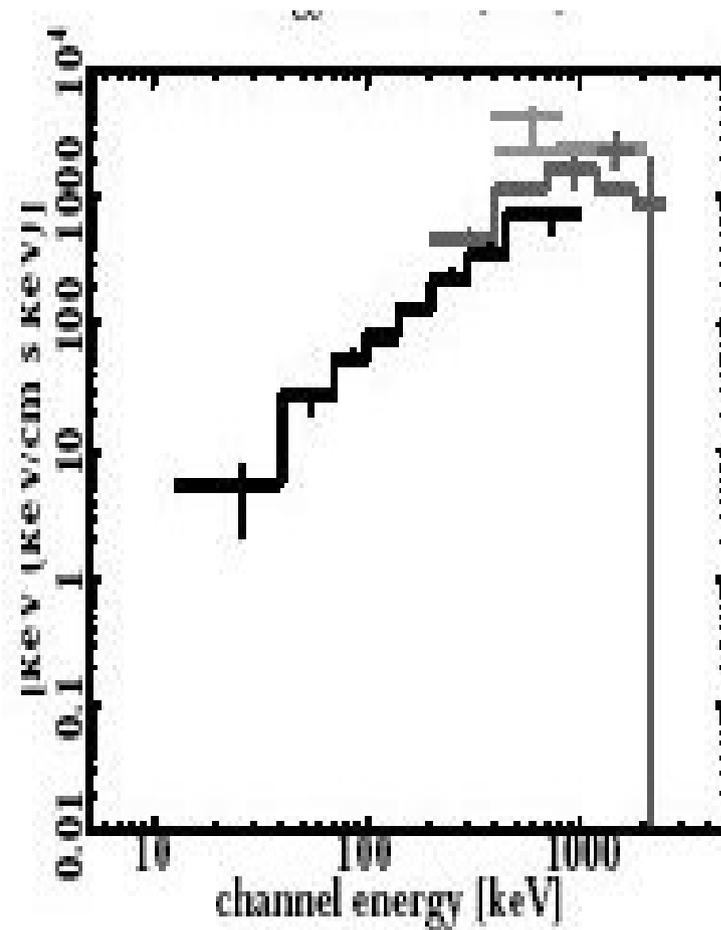
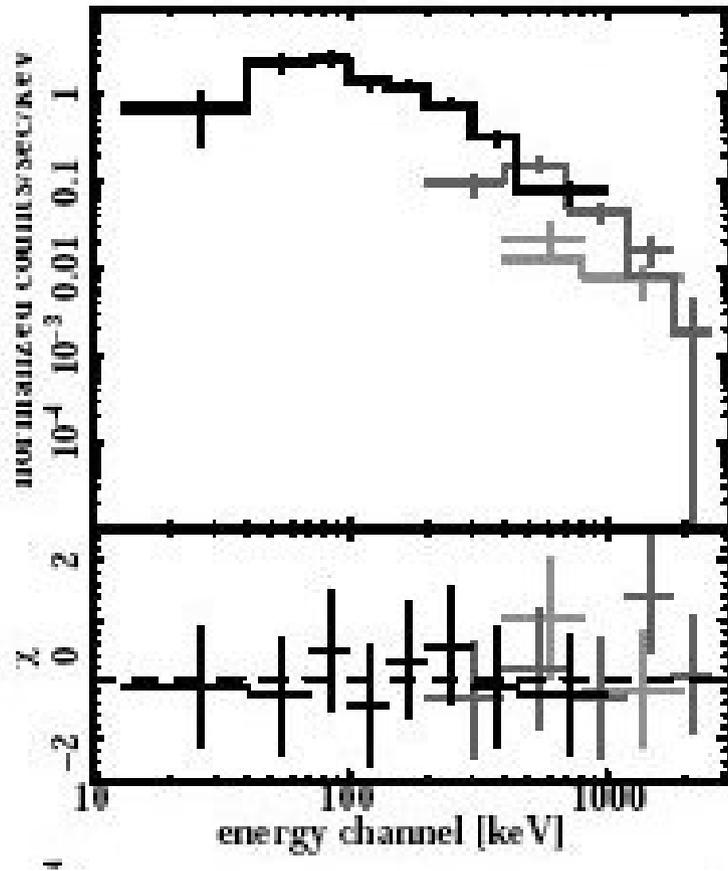
GRB 031111 – light curve



Position: IPN annulus,
Hete2 localization
duration = 10 s
off-axis = 53.5°



GRB 031111 – spectrum



$i_1 = 0.6 \pm 0.2$
 $i_2 = 2.8 \pm 0.7$
 $E_{\text{break}} = 770 \text{ keV}$

Summary:

1. 60 off-axis GRBs detected per year
2. Spectral analysis possible for ~ 20 per year
strong or/and long and localized
3. Special class of GRB: strong, hard, long, $E_{\text{peak}} \sim \text{MeV}$
4. Is there any limit for E_{peak} ?