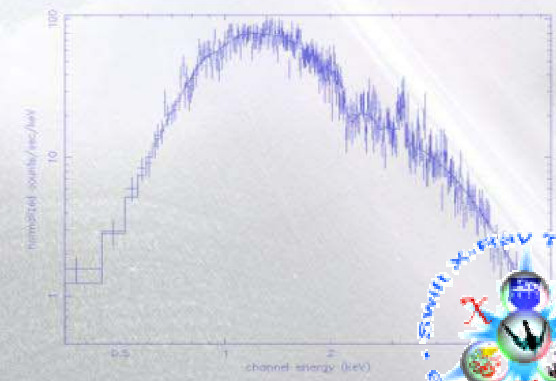
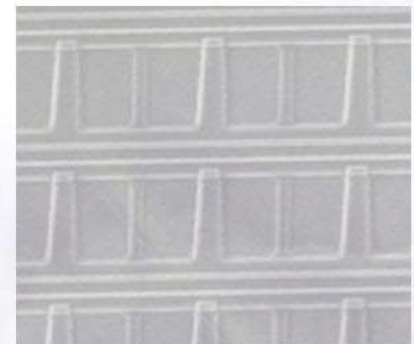
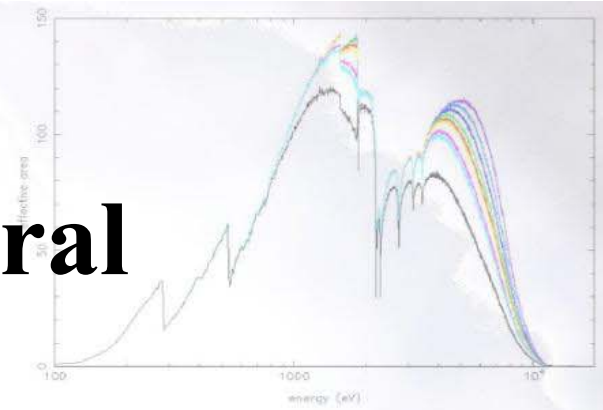


Swift XRT spectral calibration

Andy Beardmore
and the
Swift XRT calibration team



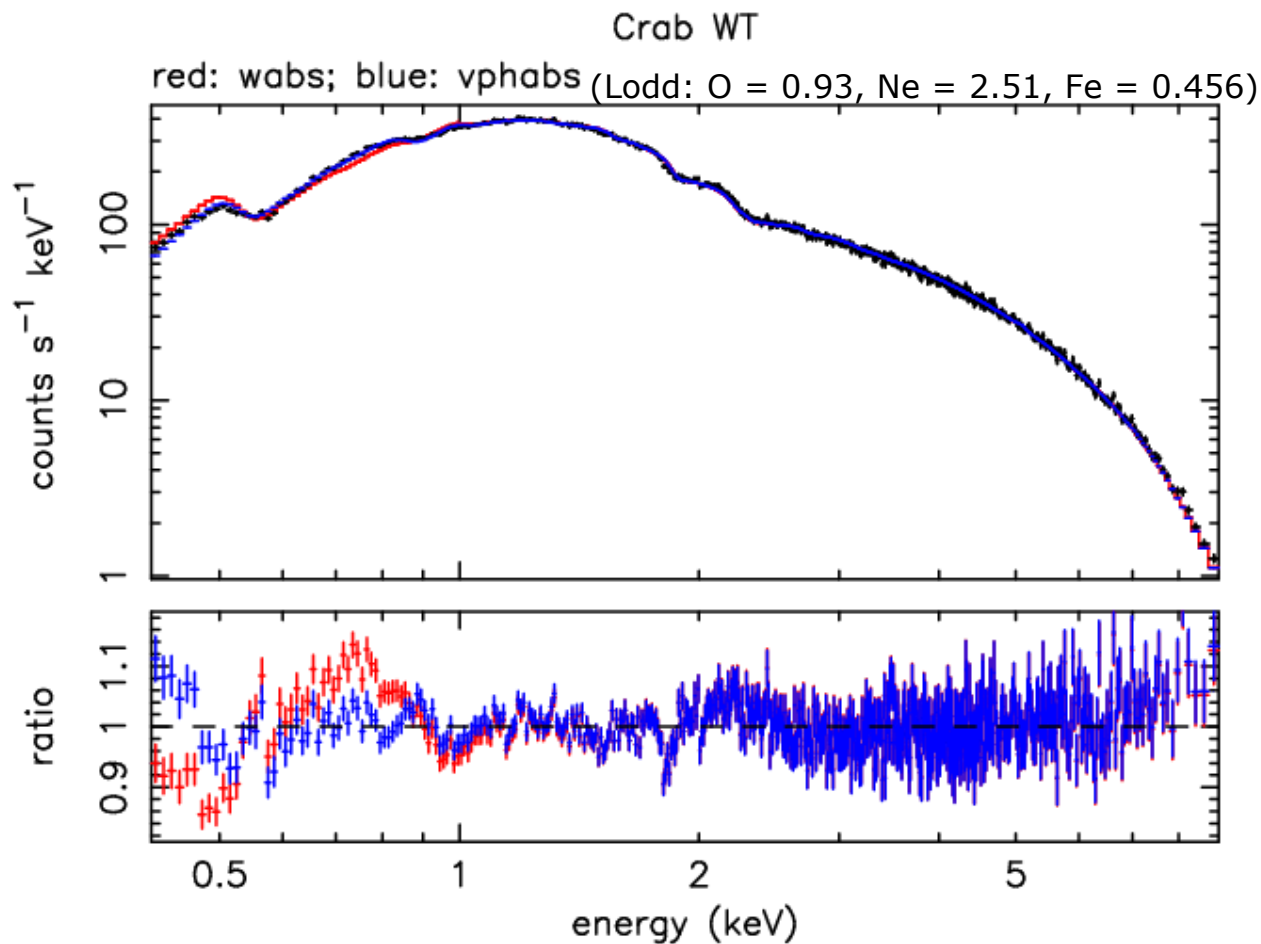
Breaking news: GRB060614 – the XCWG burst? -
brightest Swift burst to date

Swift XRT in-orbit calibration highlights

- Crab
- 3C273 (simultaneous with XRT/XMM/XTE)
- PSR0540-69
- E0102
- RXJ1856



Off-pulse Crab spectrum (to minimise pile-up)



wabs:

$$N_{\text{H}} = 0.320$$

$$\Gamma = 2.065$$

$$N = 9.08$$

vphabs:

$$N_{\text{H}} = 0.448$$

$$\Gamma = 2.074$$

$$N = 9.25$$

BeppoSax :

$$N_{\text{H}} = 0.497$$

$$\Gamma = 2.131$$

$$N = 9.35$$

(Energy scale offset $\sim 0.020 \text{ keV}$ applied to fits)

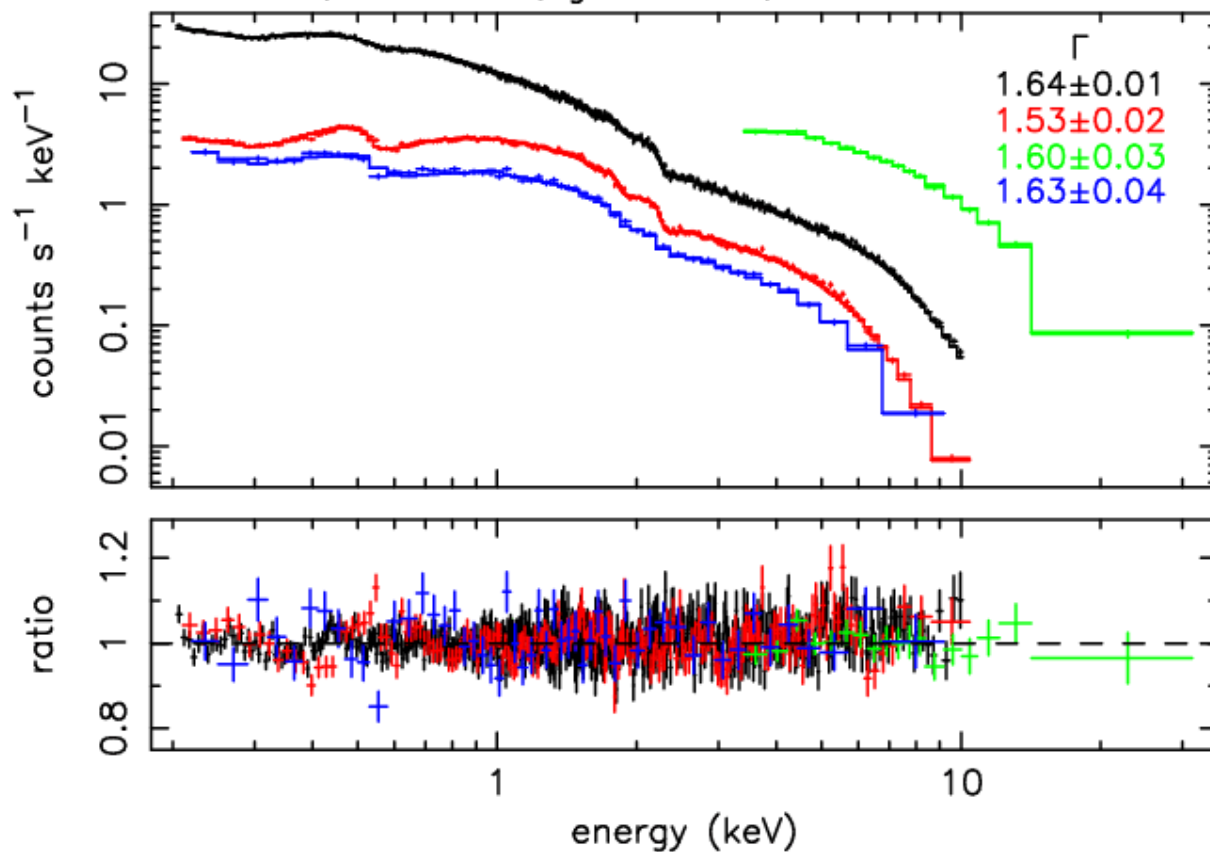


Simultaneous observing campaign (2005-07-10)

model: wabs (bbody + bbody + power)

3C273

black: PN, red: MOS2, green: PCA, blue: XRT WT



model: wabs (bbody + bbody + power)

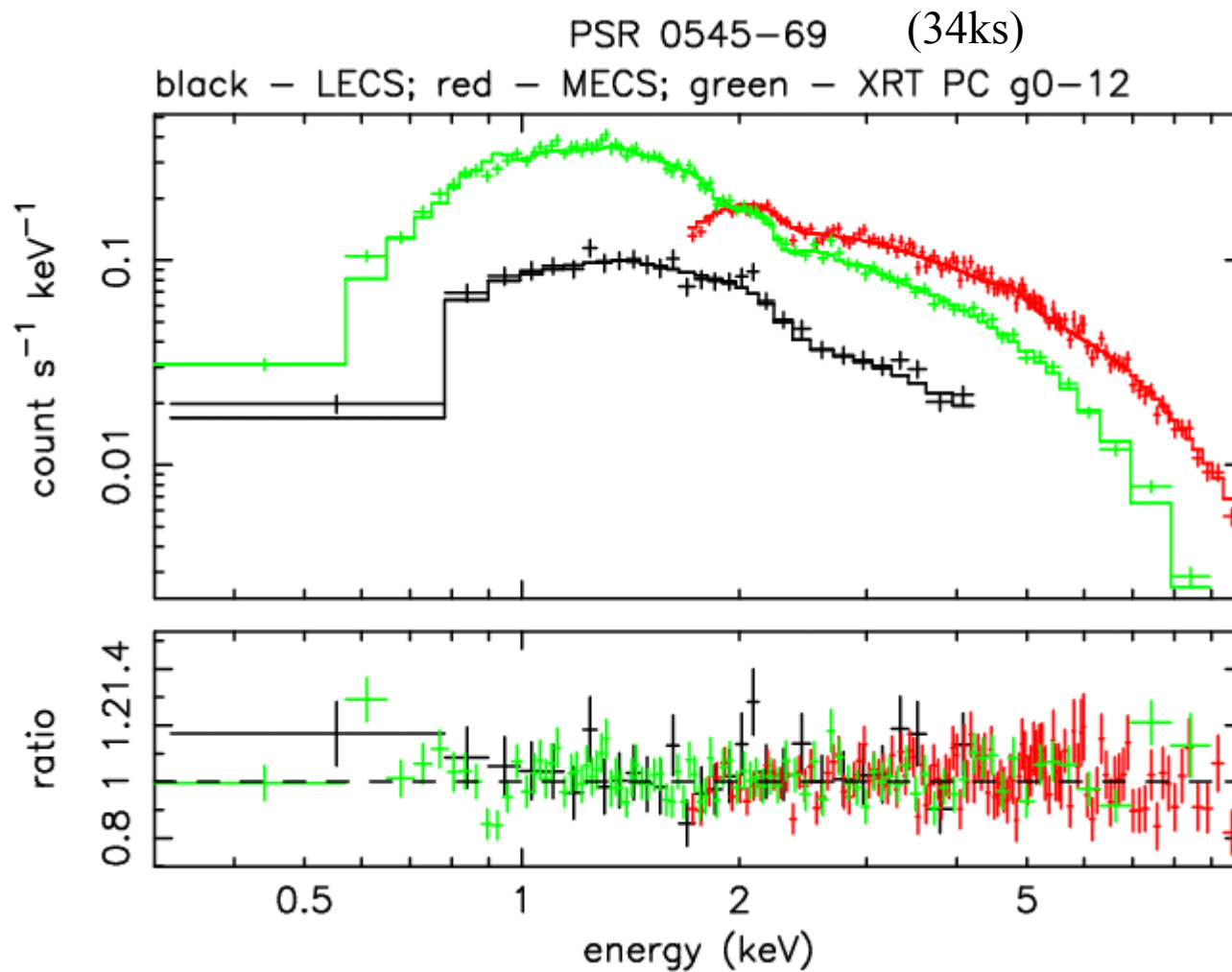
	PN	M2	XTE PCU02	XRT WT
Γ	1.645(0.010)	1.536(0.025)	1.598(0.032)	1.632(0.042)
kTbb1 (keV)	0.074(0.003)	0.072(0.004)		0.060(0.008)
kTbb2 (keV)	0.186(0.010)	0.265(0.014)		0.214(0.070)
F _x (0.2-10)	1.53e-10	1.59e-10		1.60e-10
F _x (2.0-10)	8.53e-11	9.27e-11	9.98e-11	9.44e-11

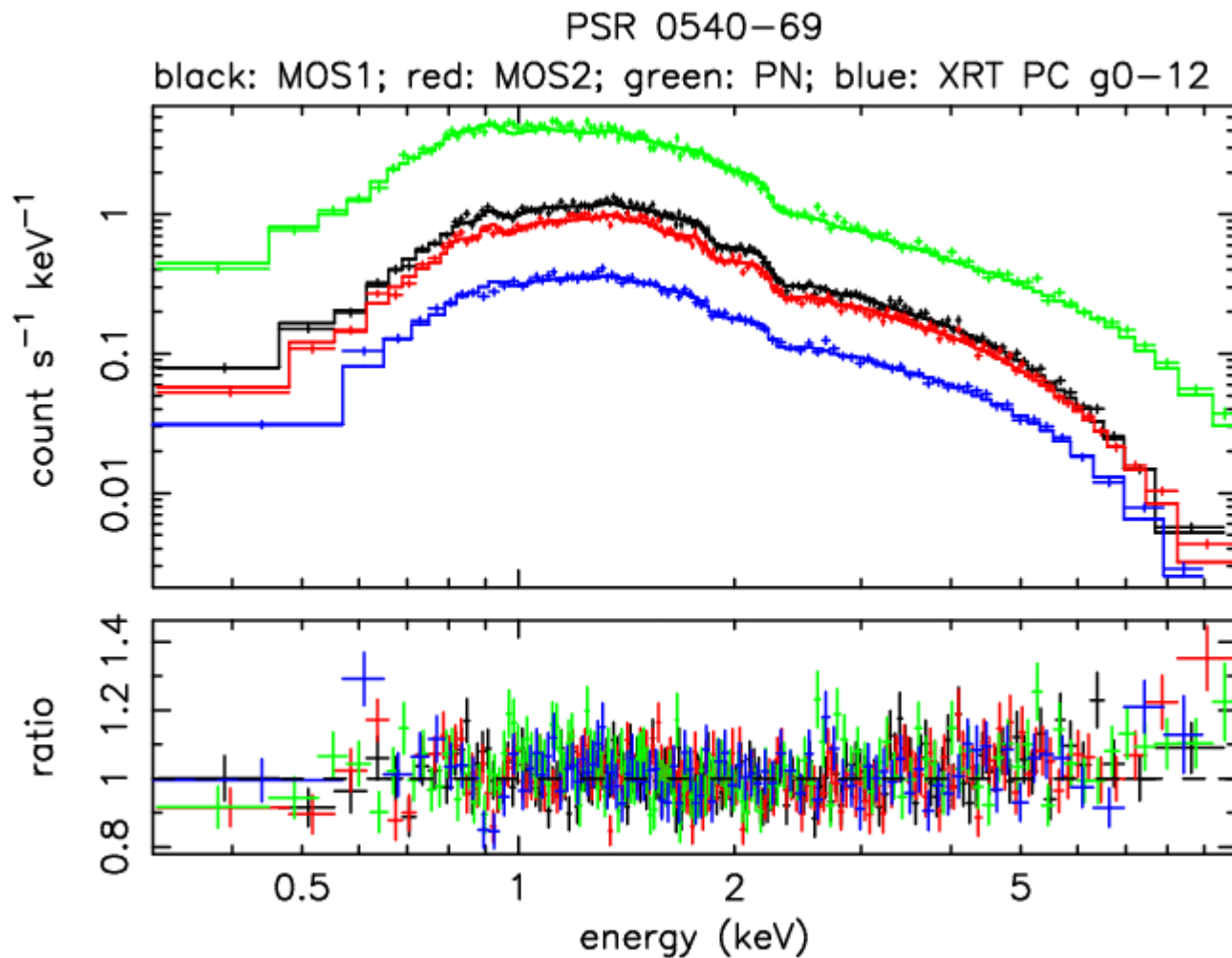
XRT flux cal :

0.2-10keV: PN ~ 5%; M2 ~ 1%

2-10keV: PN ~ 10%; M2 ~ 2%; RXTE ~ 5%





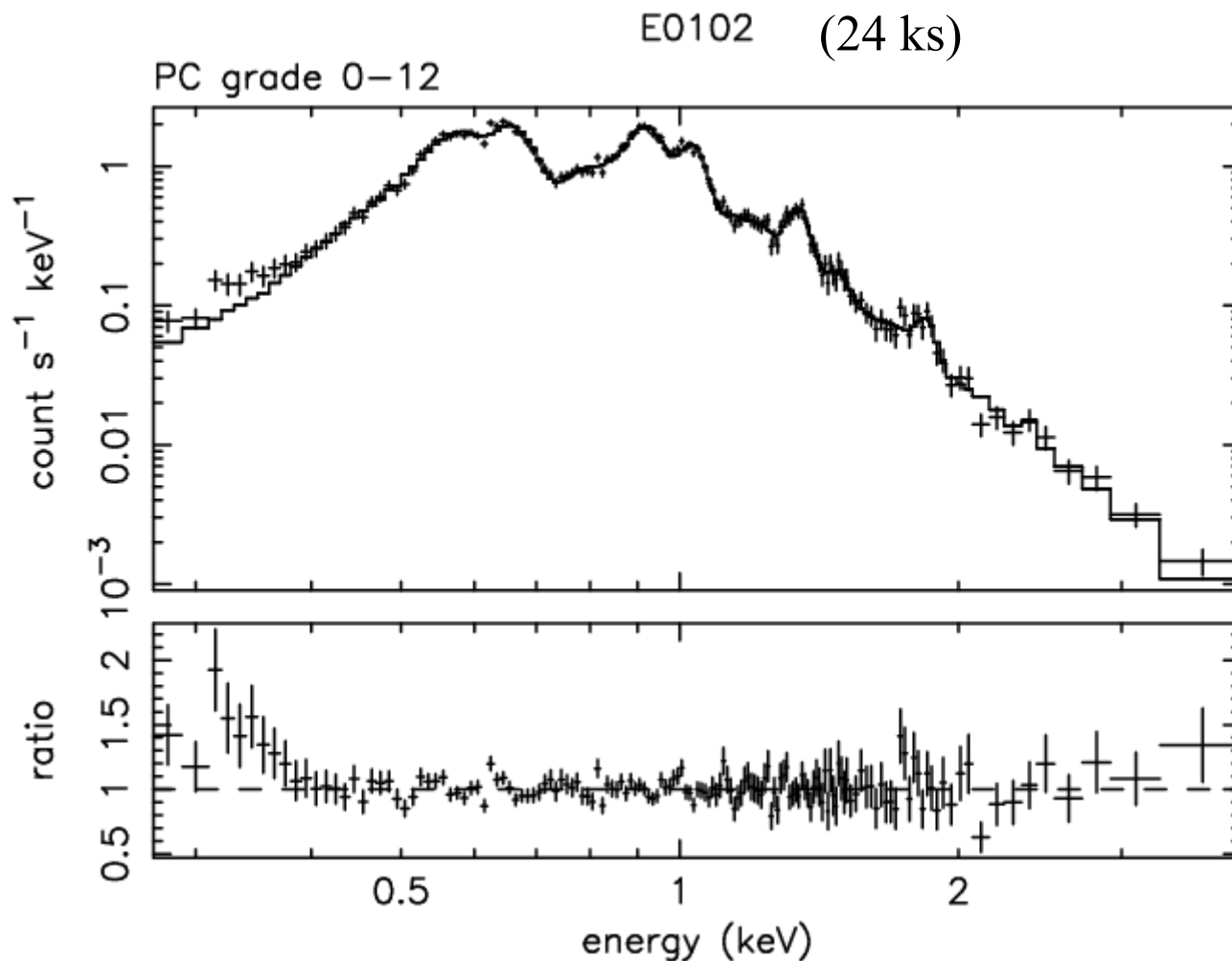


model tbabs (vnei + power) vnei: van der Heyden et al., 2001, $kT=0.6\text{keV}$,
 $O=0.33$, $Ne=3*O$, $Fe=2.1*O$ $\tau = 2e10\text{s cm}^{-3}$

	LECS/ MECS	MOS1	MOS2	PN	XRT PC
N_H	0.57(0.04)	0.62(0.03)	0.61(0.03)	0.63(0.02)	0.60(0.03)
Γ	1.91(0.02)	1.96(0.02)	1.97(0.02)	1.93(0.02)	1.89(0.03)
$F_x(0.3-10)$	4.1e-11	4.0e-11	3.8e-11	3.3e-11	3.9e-11

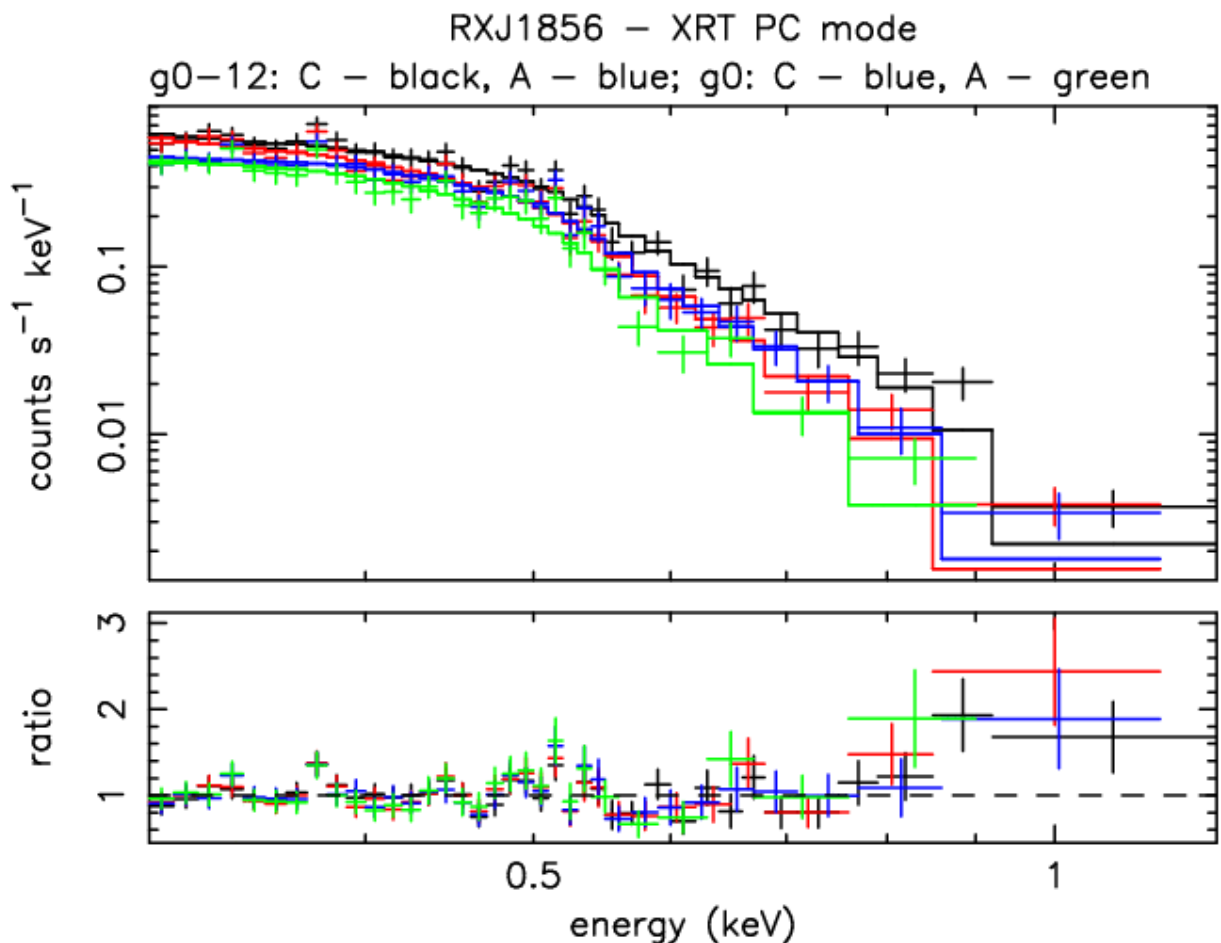
Absolute flux: $\sim 10\%$ (PN)
 5% (others)





0.4-2.5 keV flux = $2.5e-11 \text{ erg cm}^{-2} \text{ s}^{-1}$
 $\sim 5\%$ Chandra





(exposure: 15.5ks)

$$kT = 0.065 \pm 0.005 \text{ keV}$$

$$N_H < 3.8 \times 10^{20} \text{ cm}^{-2}$$

$$F_{X(0.2-2)} = 8.5 \times 10^{-12} \text{ ergs s}^{-1} \text{ cm}^{-2}$$

$$kT = 0.058 \pm 0.005 \text{ keV}$$

$$N_H = 2.9 \pm 2.5 \times 10^{20} \text{ cm}^{-2}$$

$$F_{X(0.2-2)} = 8.0 \times 10^{-12} \text{ ergs s}^{-1} \text{ cm}^{-2}$$

LETGS/RGS:

$$kT = 0.0635 \text{ keV}$$

$$N_H = 0.9 \times 10^{20} \text{ cm}^{-2}$$



Observed a variety of in-orbit calibration sources

- Systematic errors $\sim 5\%$ evident in spectra of bright sources.

- potential energy scale offsets can cause larger residuals, and are under investigation

- Absolute flux calibration good to $\sim 10\%$

Let us know when your (cal) observations are!



