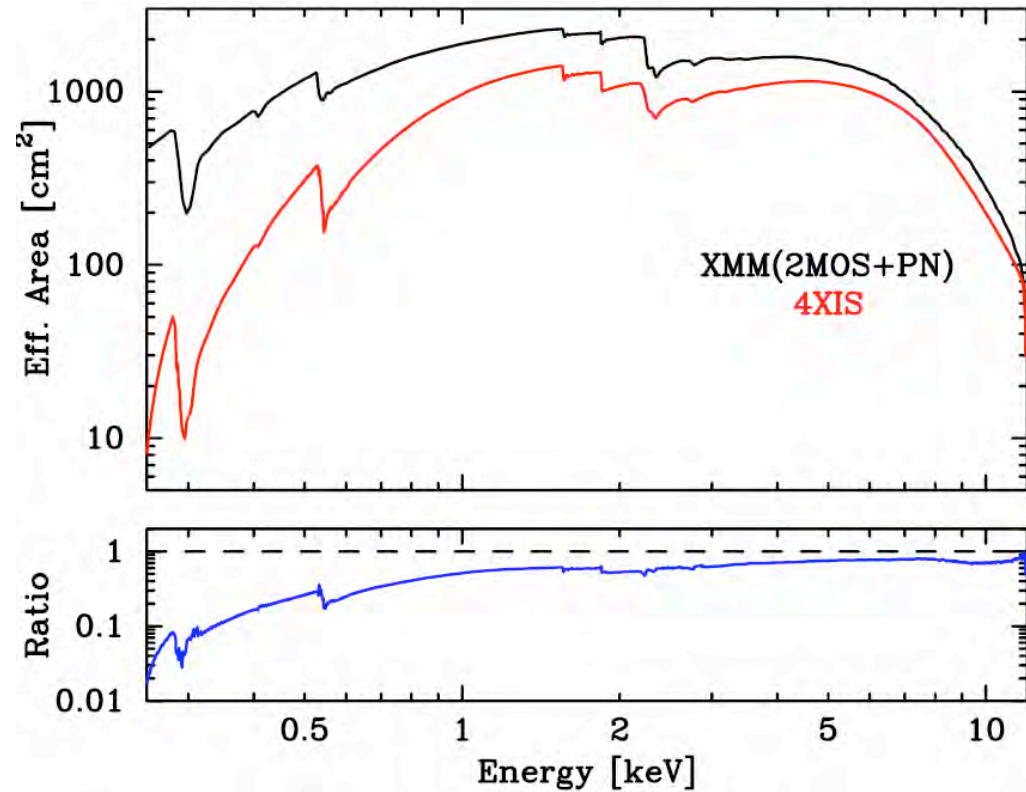


Calibration Status of the Suzaku X-ray Telescope

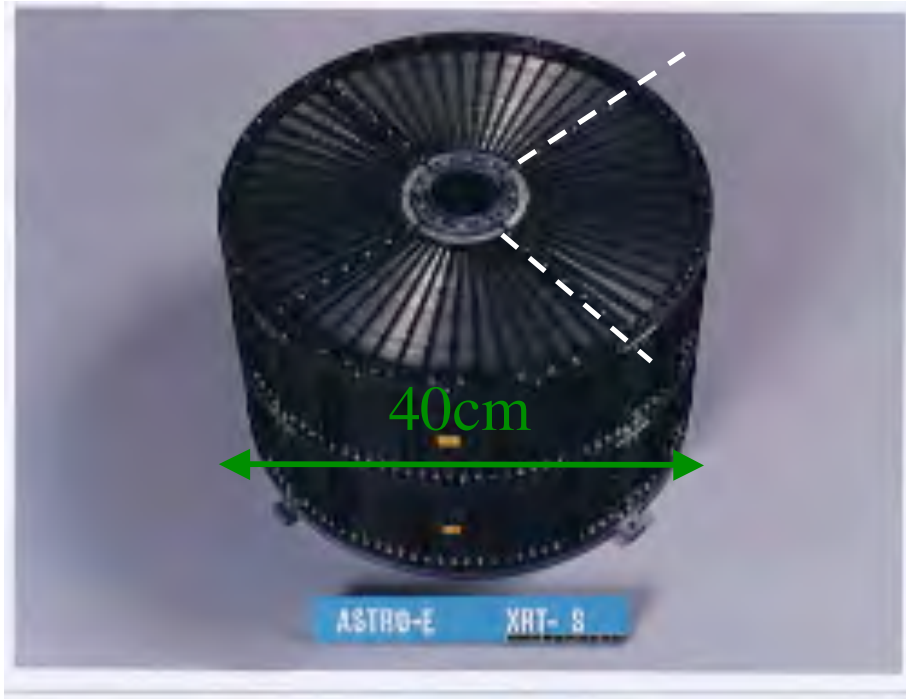
Manabu ISHIDA
(Tokyo Metropolitan University)

Suzaku XRT

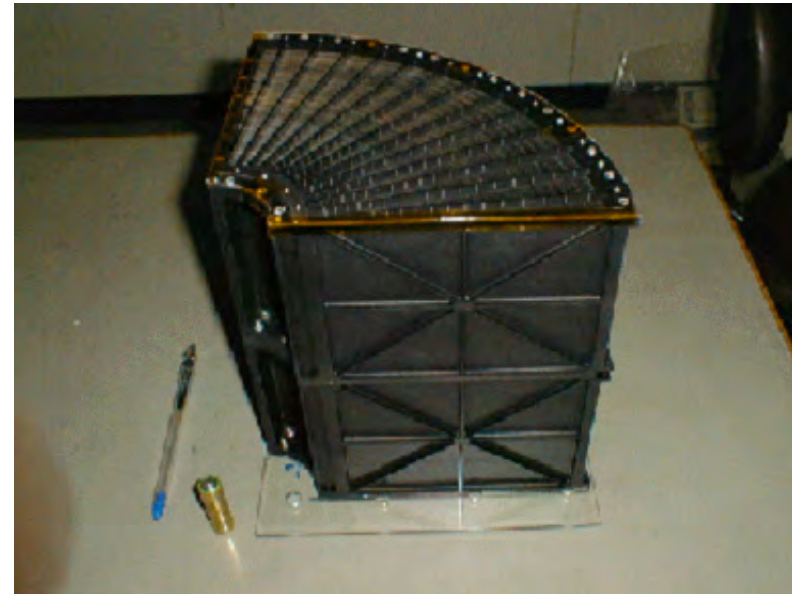


- Wolter I type optics:
 - Focal length = 4.75m, grazing angle = 0.18~0.60 deg
- **Aiming to achieve large EA with small weight.**
 - 178 μ m thick reflector, 175 shell nested as tight as possible.
 - **80kg** (Suzaku) cf. 1100 kg (Chandra), 1320 kg (XMM).
 - paraboloid / hyperboloid is approximated by cones.

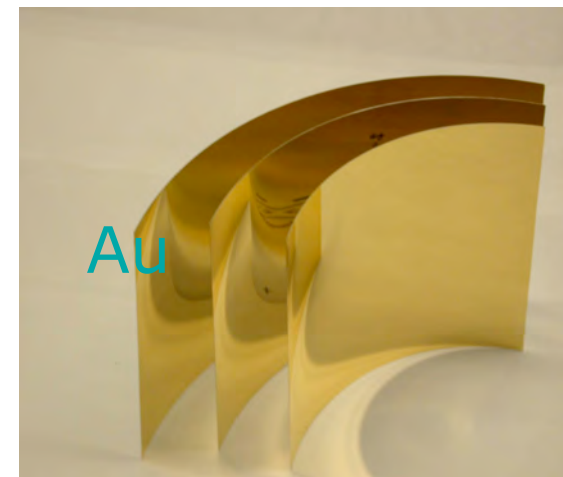
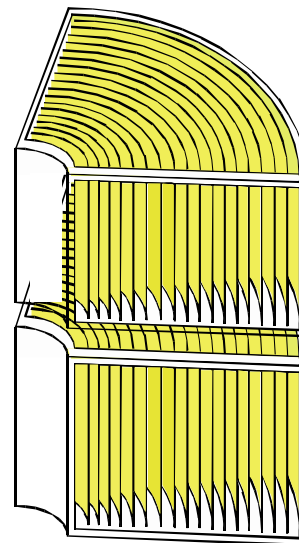
Suzaku XRT



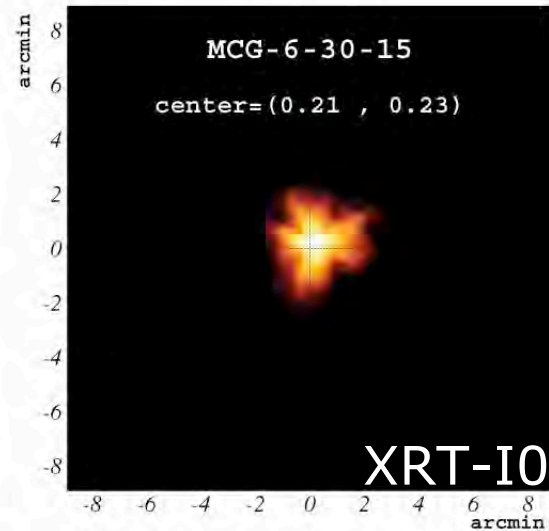
Quadrant



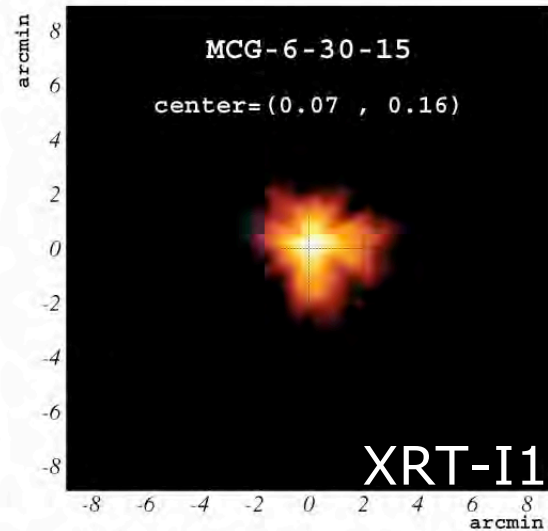
Made in a unit of quadrant,
not in full shell.



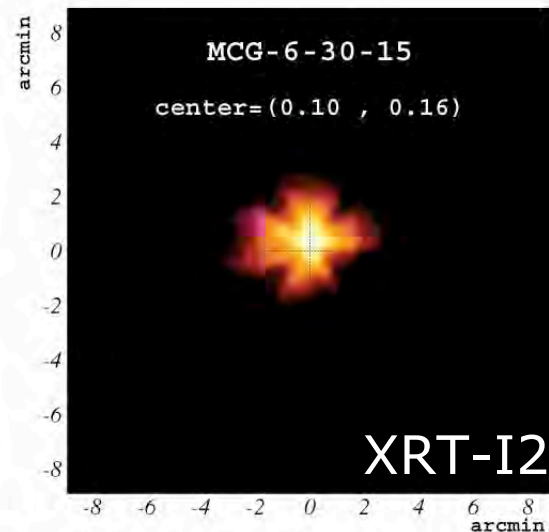
Images on the focal plane



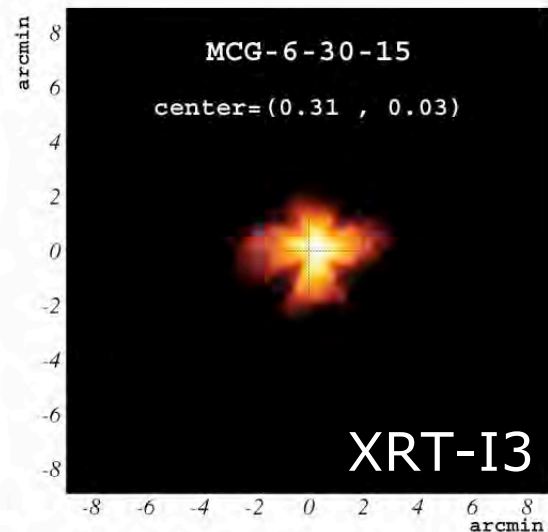
Suzaku XRT-I0 image (contactpass STT selected)



Suzaku XRT-I1 image (contactpass STT selected)



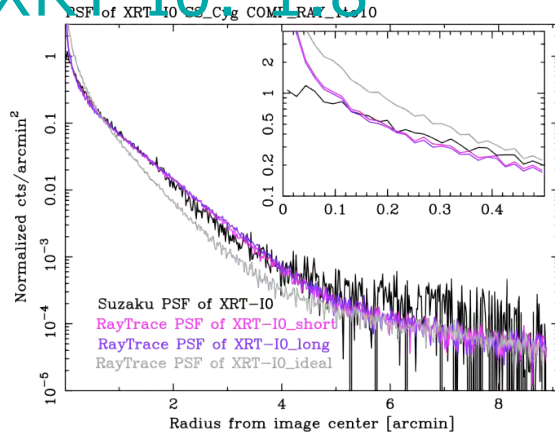
Suzaku XRT-I2 image (contactpass STT selected)



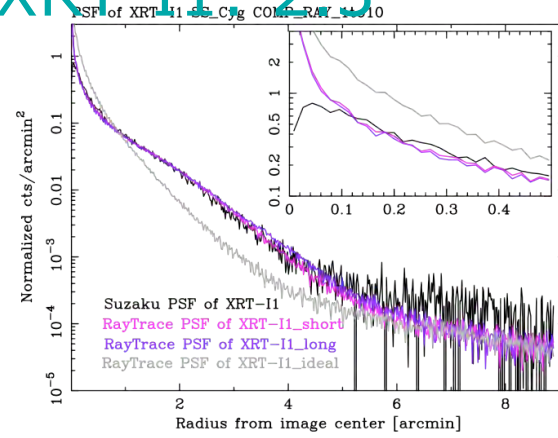
Suzaku XRT-I3 image (contactpass STT selected)

Point-Spread Function

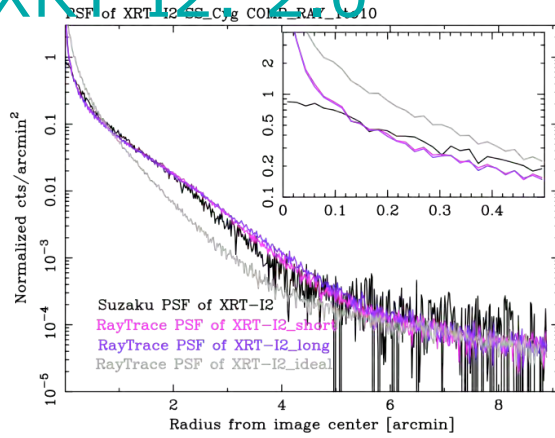
XRT-I0: 1.8'



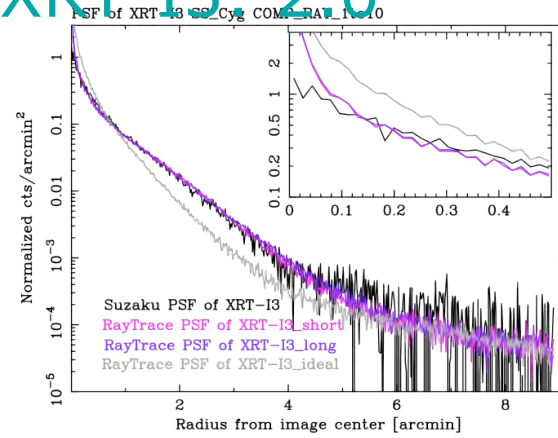
XRT-I1: 2.3'



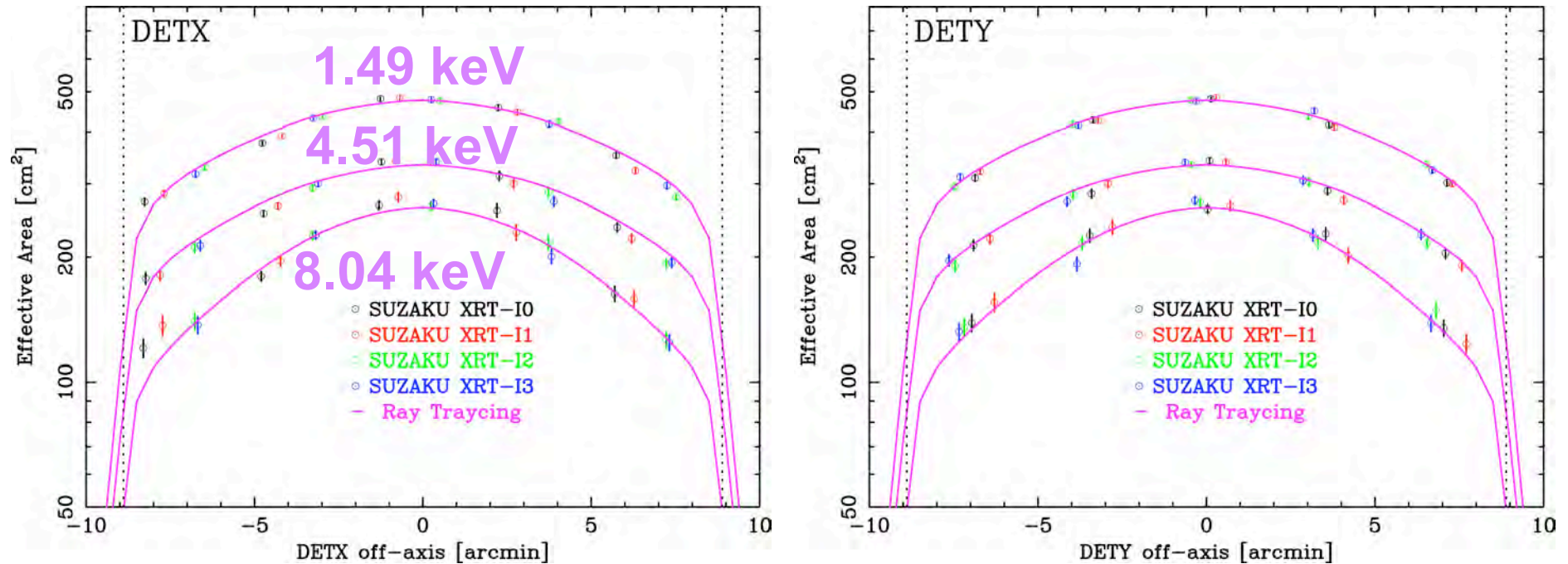
XRT-I2: 2.0'



XRT-I3: 2.0'



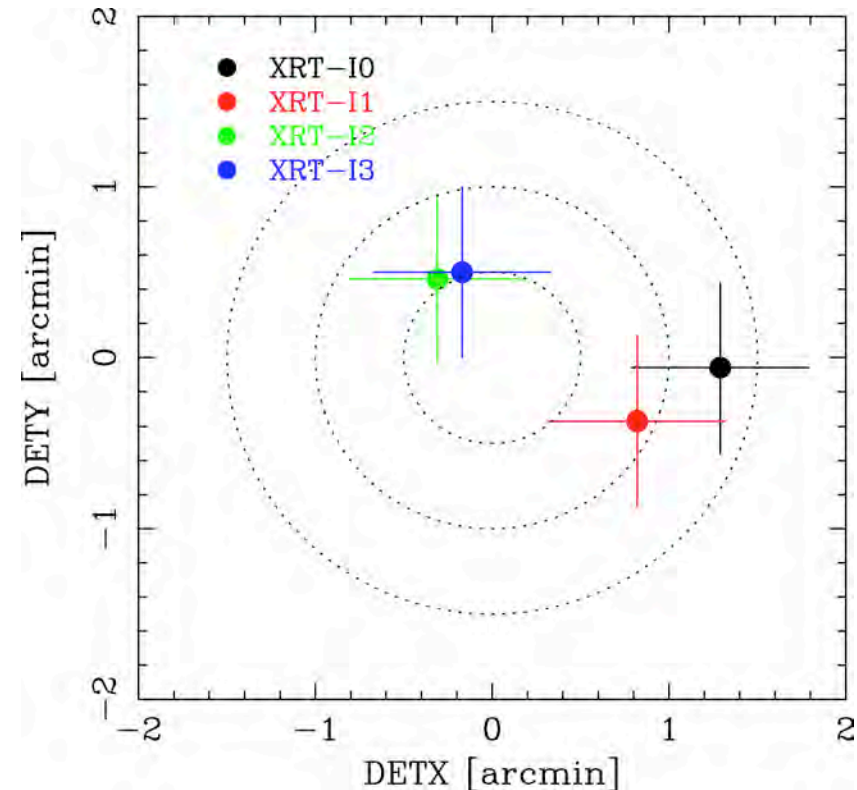
Vignetting



- Crab at five off-axis angles: 0', ±3.5', ±7.0'
- Crab: $\Gamma=2.10$, $A=9.7$ ph/cm²/s/keV at 1keV (Toor & Seward 1974), $N_H = 3 \times 10^{21}$ cm⁻²
- Ray-Tracing simulator reproduces the data within 8%.
- EA at the detector edge is 40~50% of the center.

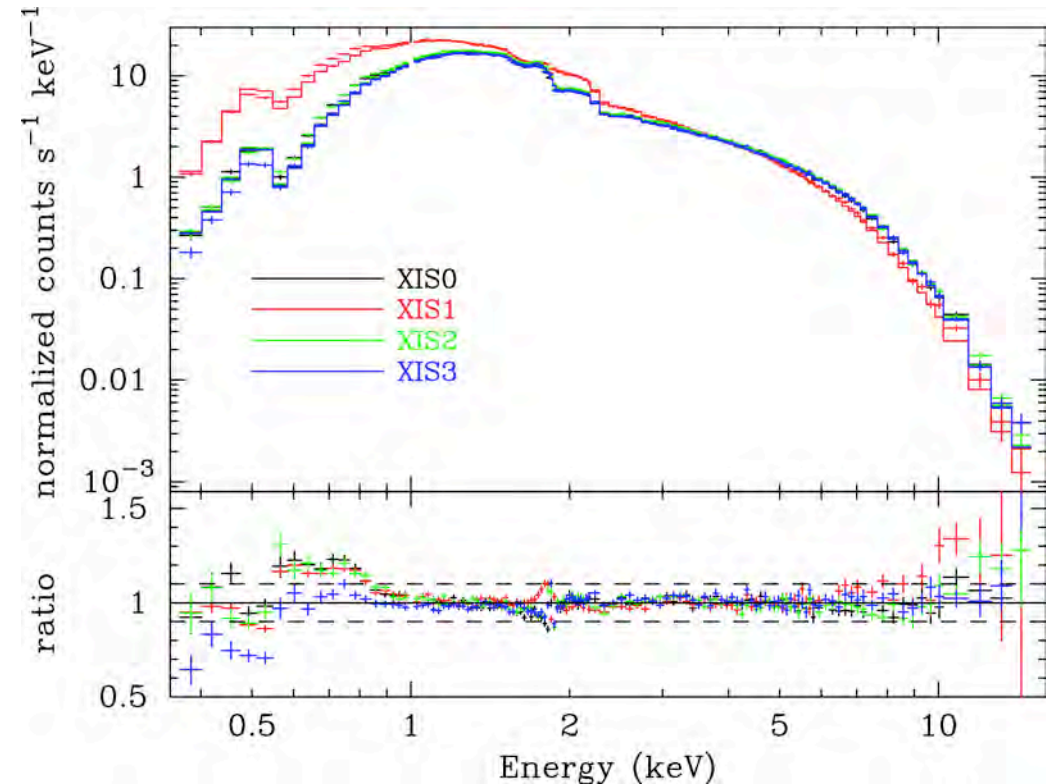
Optical axis in the focal plan

- Optical axis is defined as the axis providing the maximum transmission.
- Obtained from the vignetting measurement.
- Within a radius of 1.3 arcmin from the detector center.
- More than 97% efficiency for all XRTs.



On-axis energy response with Crab

- Fit is carried out in the 1.0-1.5keV, 2.0-10.0keV band.
- Power law is fitted to the data.
- Agreement $<3\%$ below 6keV, $<8\%$ below 10keV.



Crab parameters

Rev0.6	$N_H(10^{22}\text{cm}^{-2})$	Γ	Flux (2-10)	
XIS0	0.31 ± 0.01	2.14 ± 0.01	$2.06\text{E-}8$	1.10(204)
XIS1	0.25 ± 0.01	2.06 ± 0.01	$2.08\text{E-}8$	1.08(239)
XIS2	0.30 ± 0.01	2.13 ± 0.01	$2.10\text{E-}8$	1.35(207)
XIS3	0.32 ± 0.01	2.12 ± 0.01	$2.04\text{E-}8$	1.13(201)

Rev0.6	$N_H(10^{22}\text{cm}^{-2})$	Γ	Flux (2-10)	
XIS0	0.29 ± 0.01	2.11 ± 0.01	$2.13\text{E-}8$	1.32(857)
XIS1			$2.10\text{E-}8$	
XIS2			$2.15\text{E-}8$	
XIS3			$2.04\text{E-}8$	

- Crab standard: $\Gamma = 2.10\pm 0.03$, $A = 9.7\text{ph/cm}^2/\text{s/keV}$ at 1keV (Toor & Seward 1974).
- $N_H = 3\times 10^{21}\text{cm}^{-2}$
 $\Rightarrow F(2-10) = 2.094\times 10^{-8}\text{ erg cm}^{-2}\text{ s}^{-1}$.

In-flight calibration summary

- PSF/EEF
 - HPD: 1.8 – 2.3 arcmin
 - Well reproduced by the ray-tracing simulator
- Optical axis:
 - Scattering of 4XRTs are <1.3 arcmin from the detector center.
 - More than 97% for all XRTs.
- Vignetting:
 - Reproduced with the Ray-tracing simulator within 8%.
 - EA~50% at the detector edge.
- EA
 - Crab flux is consistent with the conventional value (Toor, Seward 1974) within 2.5%.