Cross calibration of Suzaku/Chandra/XMM-Newton with PKS2155-304

M. Ishida (ISAS/JAXA)

M. Tsujimoto (PSU)

T. Kohmura (Kogakuin Univ.)

Observation log

Suzaku/XIS

No.	ObsID	Date	t_exp (ks)	Sensor	Window	Mode	Charge Inj.	Processing ver.
SX1	700012010	2005/12/02	64	0,1,2,3	1/8	3x3, 5x5	off	2.0.6.13
SX2	101006010	2006/05/02	39	0,1,2,3	1/4	3x3, 5x5	off	2.0.6.13
SX3	102020010	2007/04/22	12	0,1,3	1/4	3x3	on	2.0.6.13
SX4		2008/05/12		0,1,3	1/4			

CXO/HRC/LETGS

No.	ObsID	Date	t_exp (ks)	Processing ver.
CH1	N/A			
CH2	6923	2006/05/01	30	7.6.7.2
CH3	8379	2007/04/22	30	7.6.11

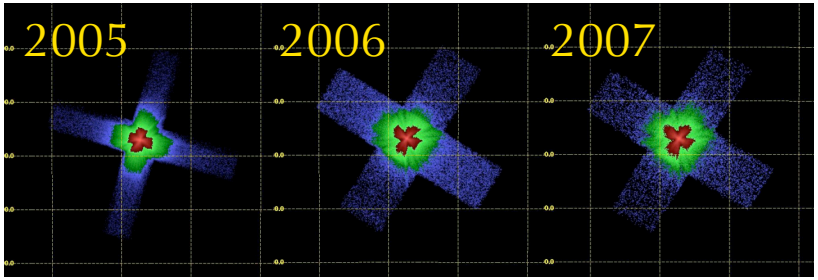
XMM-Newton/EPIC/MOS

No.	ObsID	Date	t_exp (ks)	Window	Filter	Position	Processing ver.
XM1	0158961301	2005/11/30	50	PrimePartialW2	Medium	Filter_C	CCF@2008/04/15
XM2	0158961401	2006/05/01	60	PrimePartialW2	Medium	Filter_C	CCF@2008/04/15
XM3	0411780201	2007/04/22	44	PrimePartialW2	Medium	Filter_C	CCF@2008/04/15

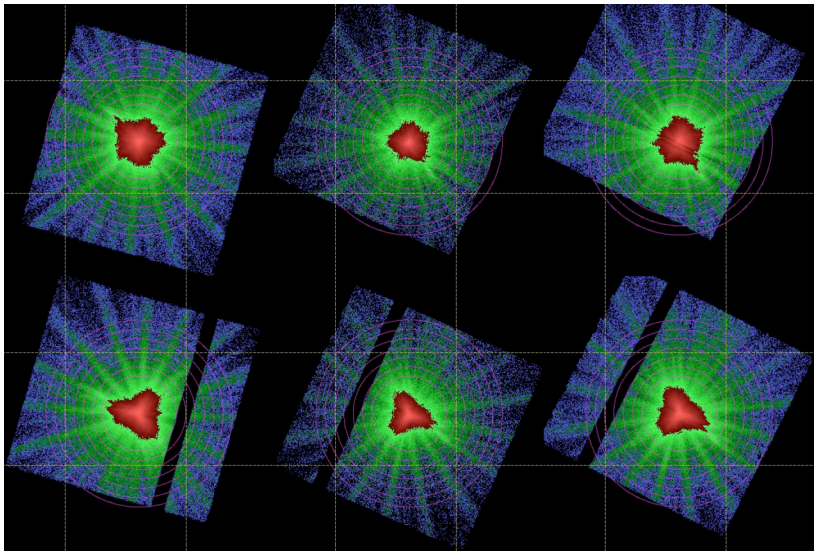
XMM-Newton/EPIC/pn

No.	ObsID	Date	t_exp (ks)	Window	Filter	Processing ver.
XP1	0158961301	2005/11/30	48	PrimeSmallWin	Medium	CCF@2008/04/15
XP2	0158961401	2006/05/01	52	PrimeSmallWin	Medium	CCF@2008/04/15
XP3	0411780201	2007/04/22	31	PrimeSmallWin	Medium	CCF@2008/04/15

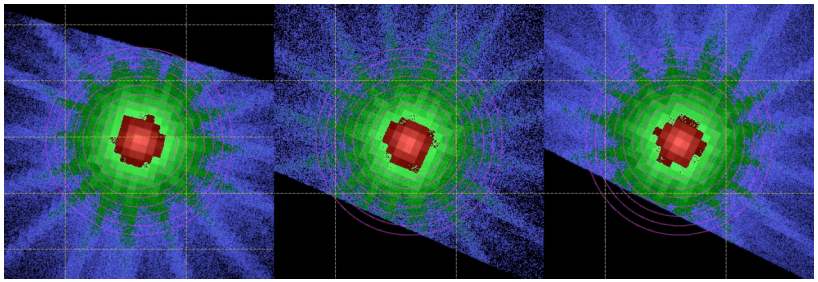
Images



Suzaku XIS
2005: we do not use XIS1(BI) and XIS2 (FI) because significant part of their data suffer accidental light leak.

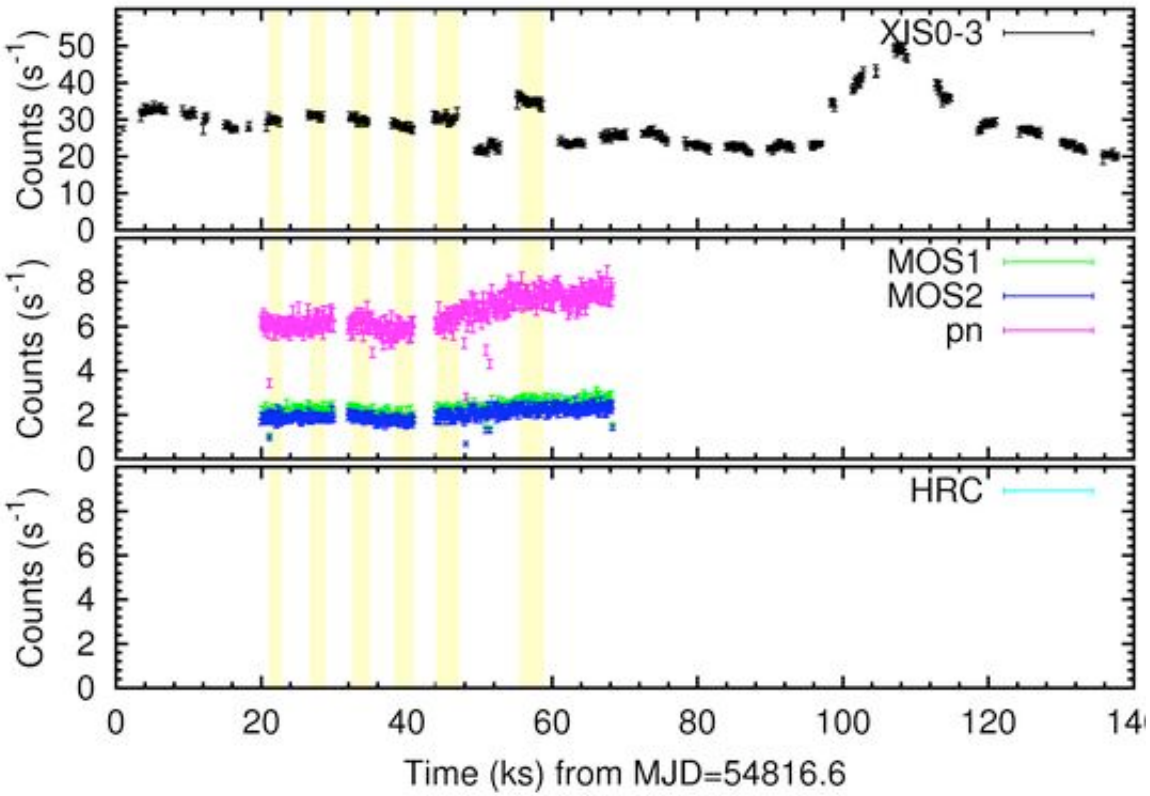


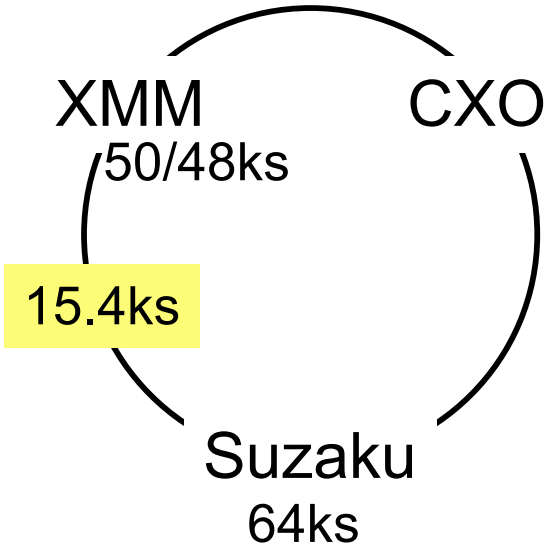
XMM/EPIC/MOS
Pileup at the image core.
2005: r = 25″-45″
2006: r = 25″-40″
2007: r = 25″-35″



XMM/EPIC/pn
Pileup at the image core.
2005: r = 25″-45″
2006: r = 25″-40″
2007: r = 25″-35″

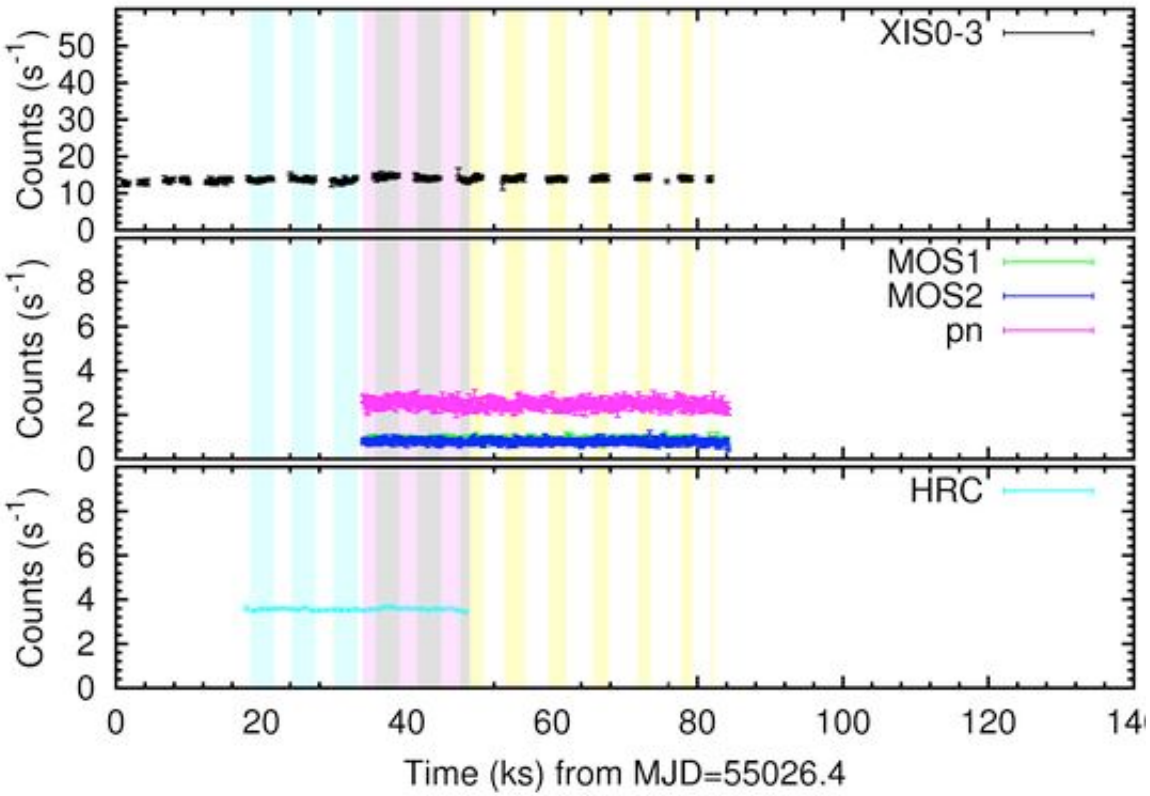
Data overlap (2005)

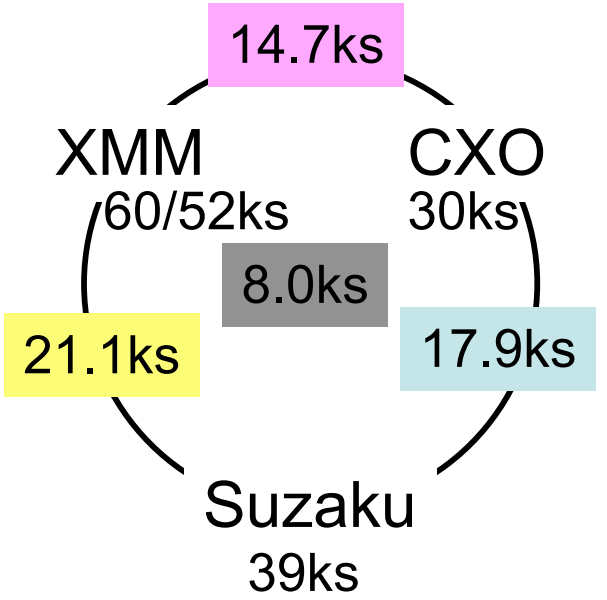




- The source was most intense among the three observations.
- No CXO coverage.
- Light leak of XIS1 and XIS2.

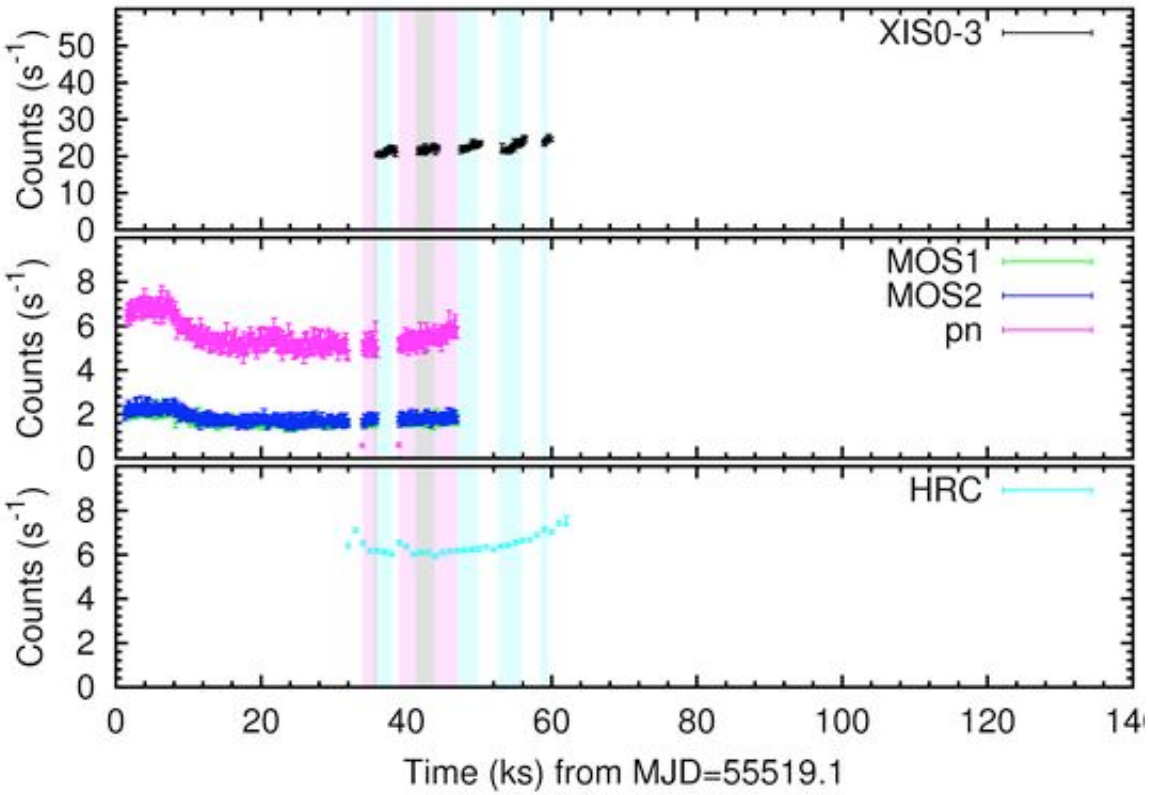
Data overlap (2006)

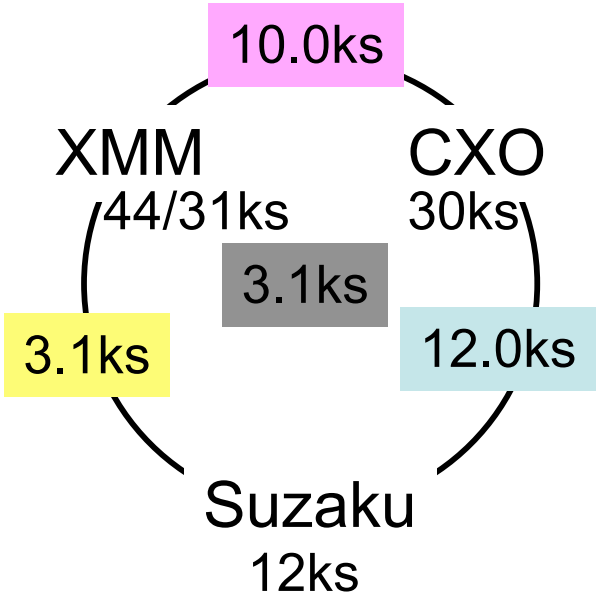




- The source was faintest among the three observations.
- Simultaneous coverage of any pair is moderate.
- Overlap of all instruments is limited.

Data overlap (2007)

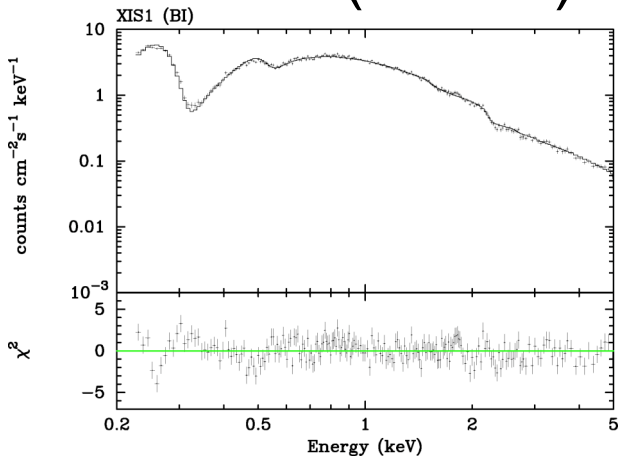




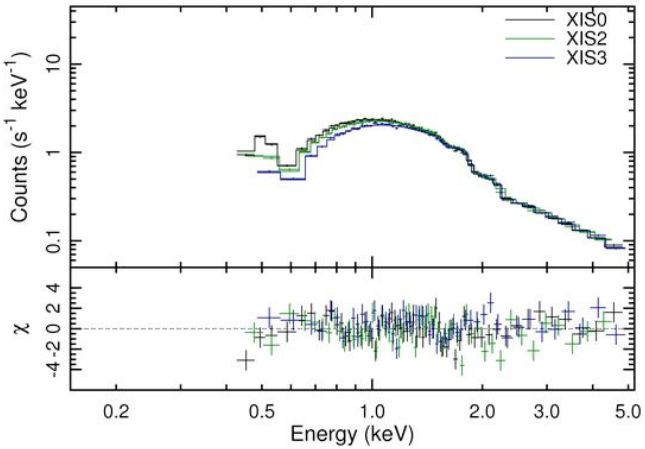
- The source intensity was intermediate among the three observations.
- Suzaku observations were too short.

Quality of Spectra (2006)

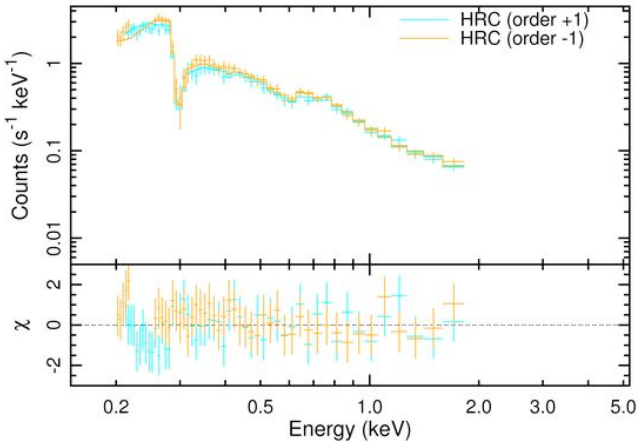
XIS-BI (21.1ks)

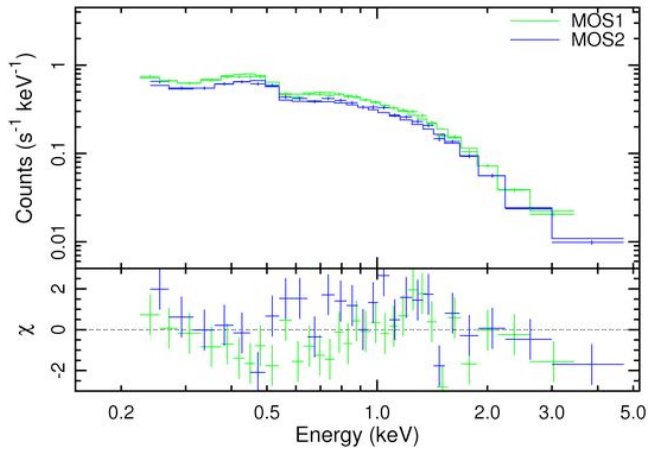


XIS-FI (21.1ks)

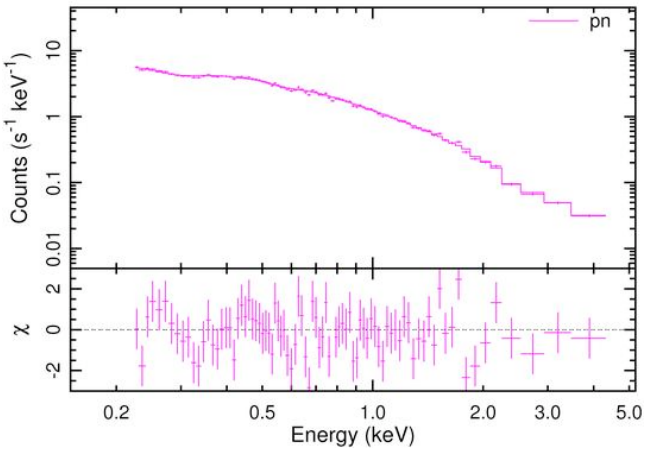


LETGS (17.9ks)



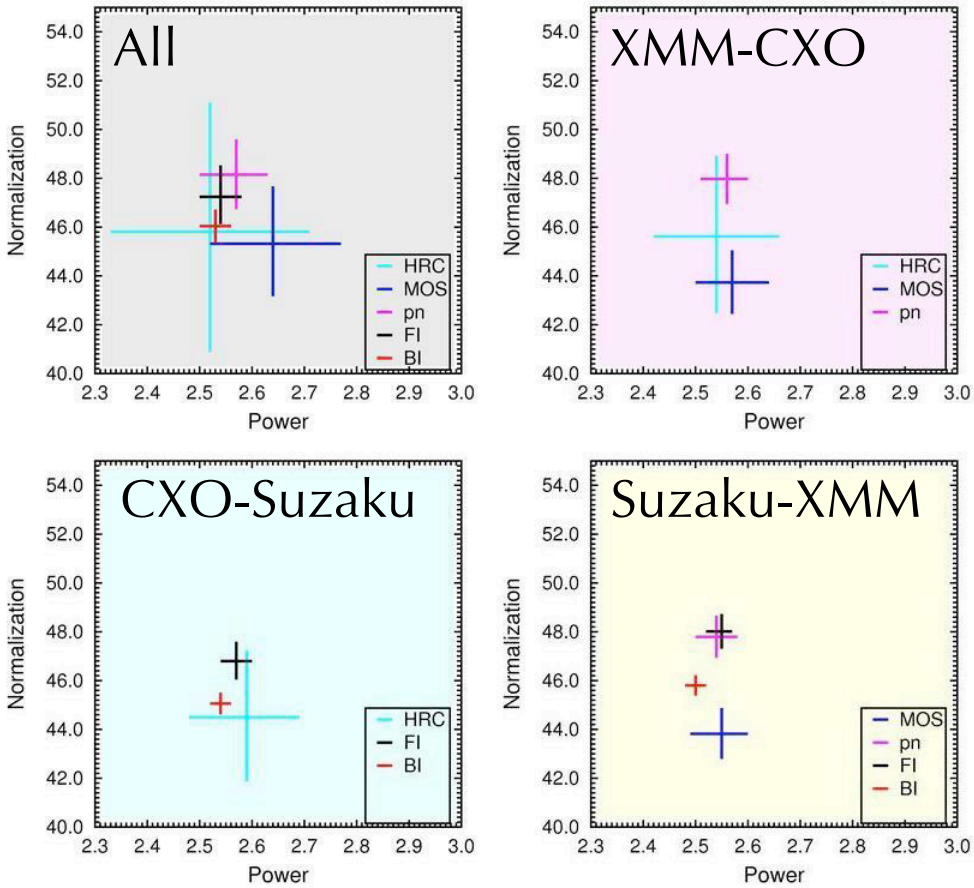


XMM-MOS (21.1ks)



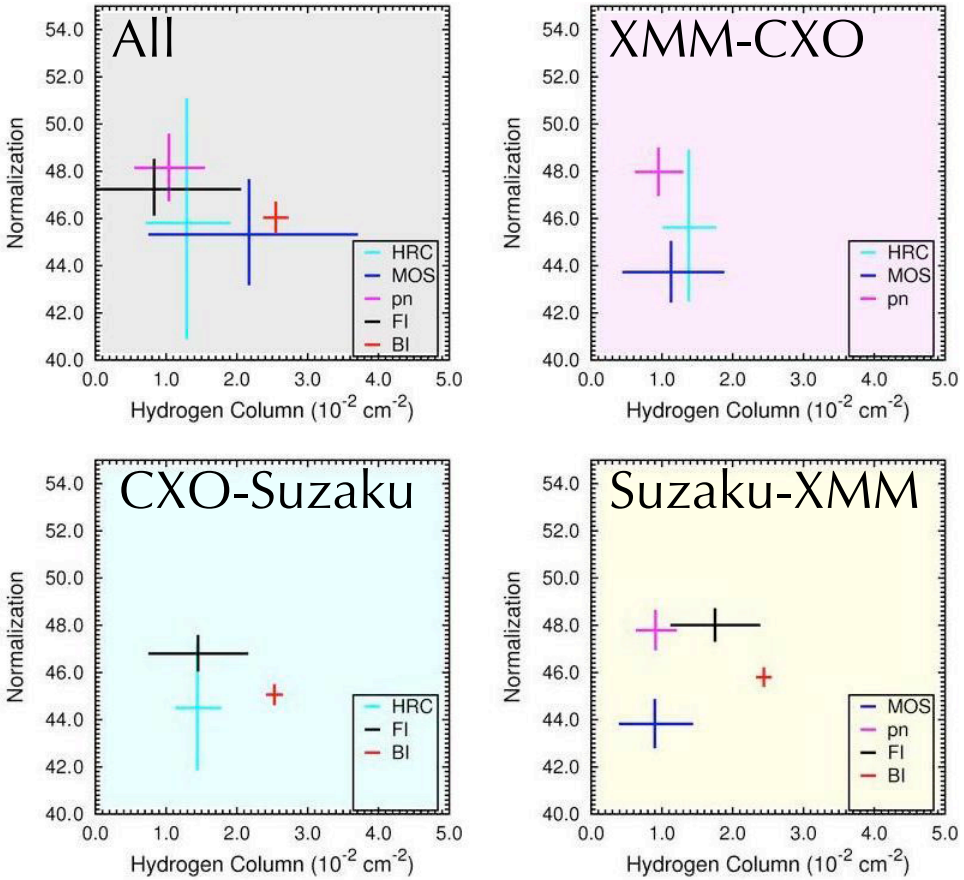
XMM-pn (21.1ks)

Comparison of photon index (2006)



- Photon index = 2.55±0.03 for all pairs (ignoring errors).
- Normalization: flux in unit of 10^{-12}erg cm^{-2} s^{-1} in the 0.5-5keV band = $4.6\pm0.2\times10^{-11}$erg cm^{-2} s^{-1} for all pairs (ignoring errors).

Comparison of N_H



- N_H to PKS2155-304 = (1.5-1.7)×10^{20}cm^{-2}
- Uncertainty ≈ 1×10^{20}cm^{-2}

Summary

- We carried out Suzaku/CXO/XMM coordinated observations of PKS2155-304 for cross calibration ~once per year.
- From the 2006 observations:
  - Flux in the 0.5-5keV agrees within ±4% ($4.6\pm0.2\times10^{-11}$ erg cm^{-2} s^{-1}).
  - Photon index becomes within 2.55 ± 0.03
  - N_H distributes within $\approx 1\times10^{20}cm^{-2}$ from the true value $(1.5\text{-}1.7)\times10^{20}cm^{-2}$.
- For better calibration (overlap time > 40ks),
  - CXO and XMM should expose >40ks, with maximum effort to overlap between the two.
  - Suzaku should cover both CXO and XMM observing windows (>20ks overlap with XMM).