

# Cross-Calibration between Chandra and XMM-Newton

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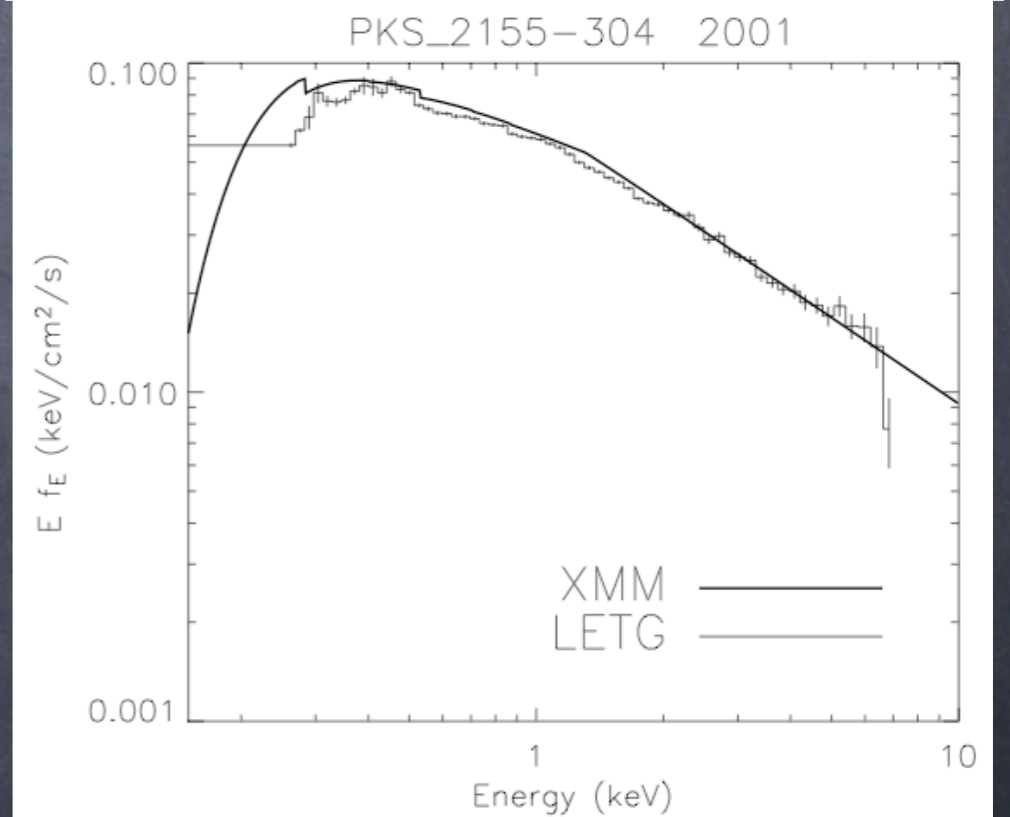
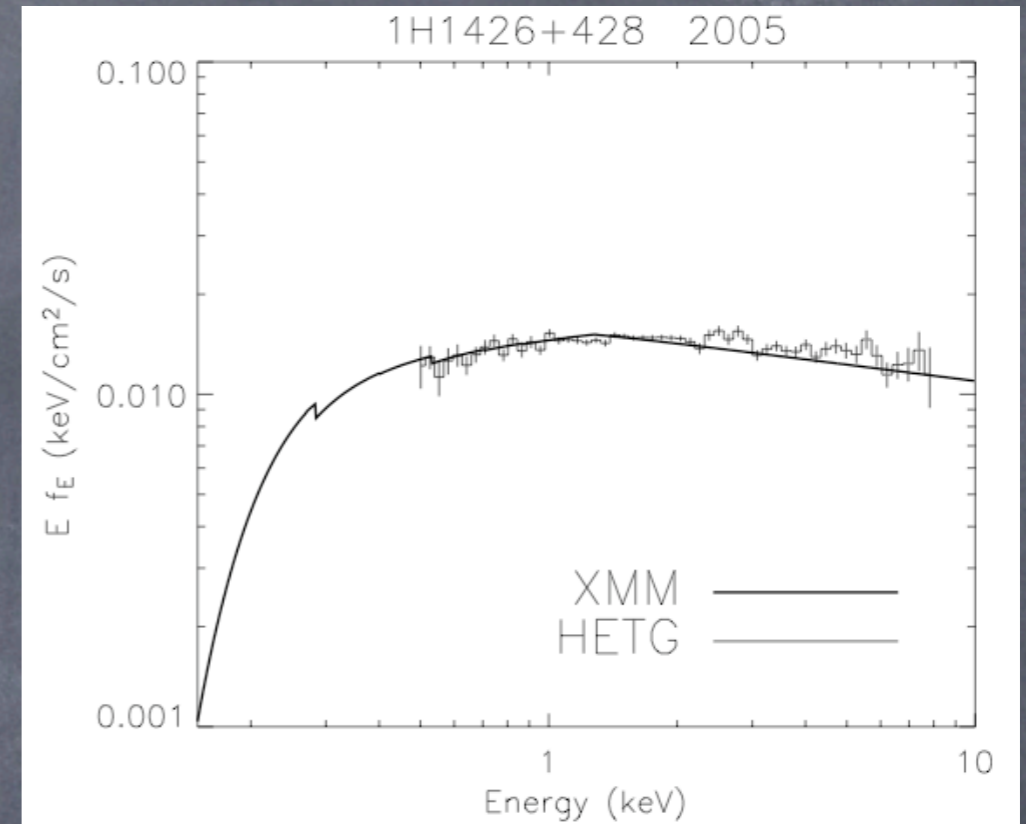
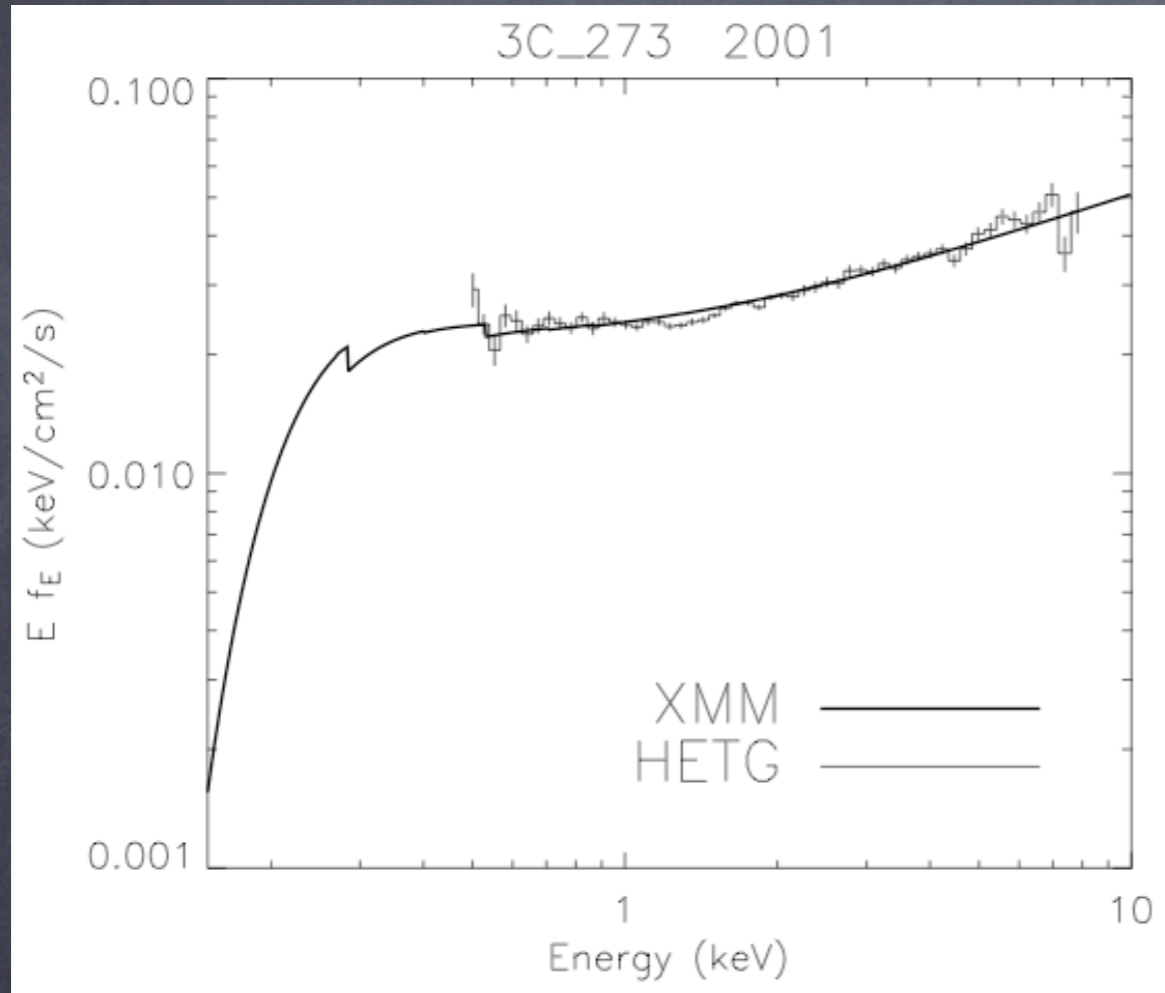
# Overview

- Published analyses to web
- Continued effort to cross-cal formally
- Attended meetings for joint cal discussions
- Started cross-cal work with Suzaku
  
- Continuing XMM-Chandra cross-cal analysis
- Attending cross-cal meetings
- Completing first Chandra-Suzaku cross-cal
- Completing Chandra grating internal checks

# Web Page Publishing

- CXC web page live: <http://space.mit.edu/ASC/calib/crosscal/>
- XMM web page is live: [http://xmm.esac.esa.int/external/xmm\\_sw\\_cal/calib/cross\\_cal/index.php](http://xmm.esac.esa.int/external/xmm_sw_cal/calib/cross_cal/index.php)
  - Cross-linked with CXC cross-cal page
  - Three cases shown, using public data
- International Astronomical Consortium for High Energy Calibration: <http://www.iachec.org/>

# Additions to web pages

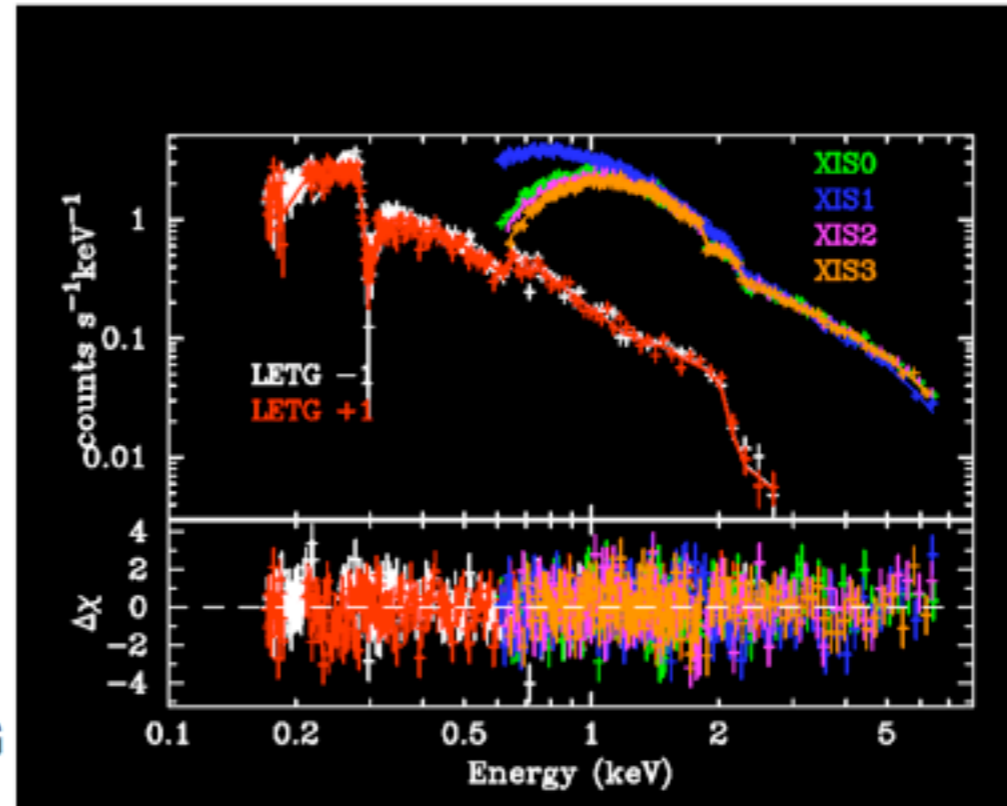


From <http://space.mit.edu/ASC/calib/crosscal/>  
(H. Marshall, EPIC calibration meeting)

# Chandra-Suzaku

## 2006 May: Spectral Fit

- Independent Fit
  - ★  $\Gamma$ : 2.49-2.53 (XIS0,2,3:FI)  
2.49 (LETG)
  - ★ Const: 0.97-1.0 (FI)  
1.0 (LETG:fix)
- Constrained Fit (but  $N_H$ )
  - ★  $\Gamma = 2.523 \pm 0.011$
  - ★ Normalization =  
1.006/0.950/1.003/1.001 for  
XIS0/1/2/3 with respect to LETG



	Normalization	$N_H (10^{20} \text{cm}^{-2})$	$\Gamma$
XIS0	0.967(0.025)	< 7.8	2.487(0.022)
XIS1	0.961(0.024)	< 3.4	2.557(0.022)
XIS2	0.976(0.026)	< 8.1	2.504(0.023)
XIS3	0.996(0.027)	< 8.8	2.533(0.024)
LETG	1.000	1.314(0.089)	2.485(0.035)

(M. Ishida, international calibration working group meeting)

# Flux Comparisons

- Analysis of 17 AGN over XMM mission
- Defined 4 bandpasses, fluxes from fits
- Suggests: MOS QE drop at low E & +5-7% global MOS QE change or global PN QE drop

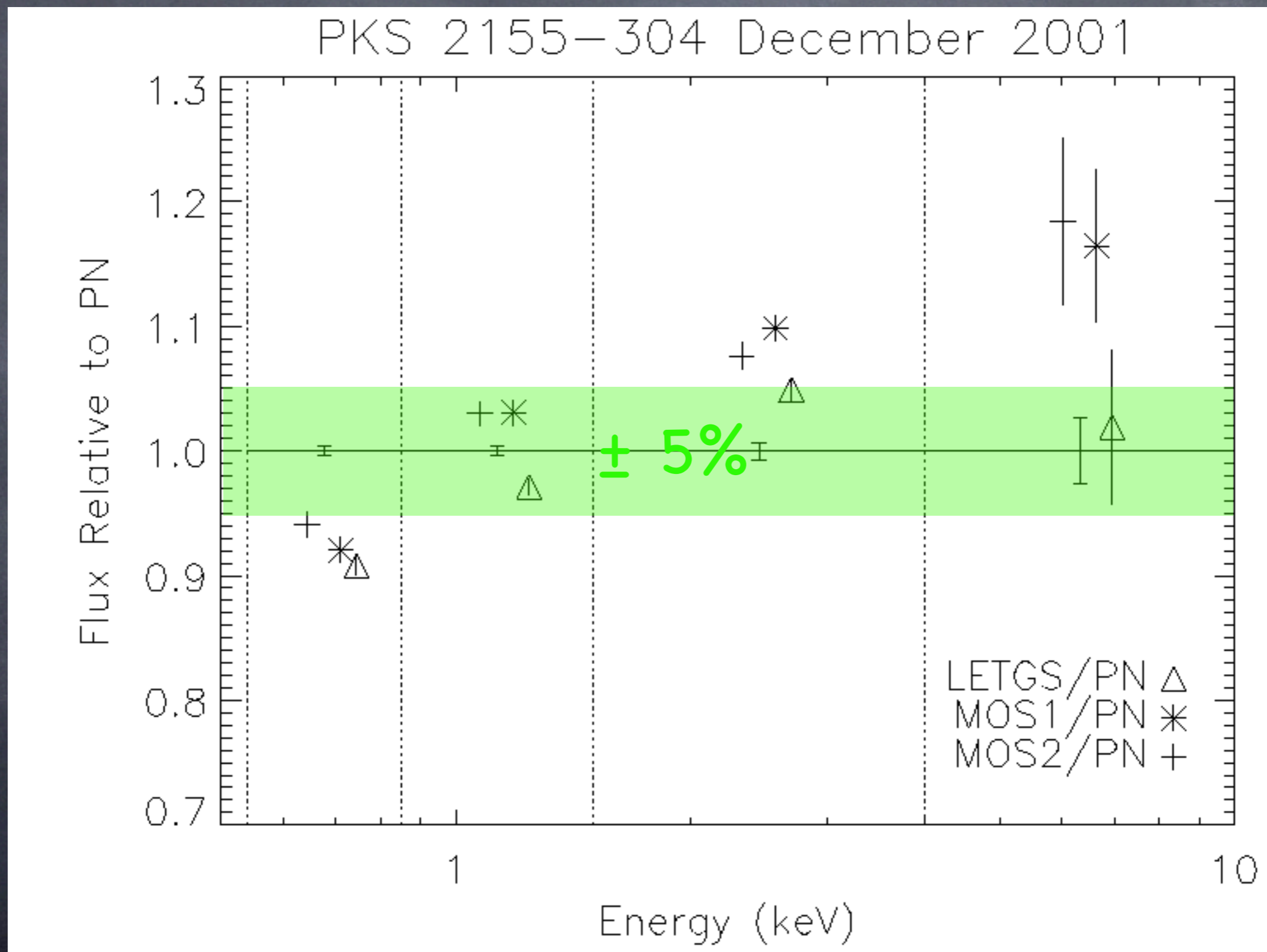
Band (keV)	(MOS1-PN)/PN	(MOS2-PN)/PN
0.54-0.85	-5.4%	-1.6%
0.85-1.50	+2.4%	+4.1%
1.50-4.0	+6.8%	+7.3%
4.0-10.0	+11.4%	+7.4%

Steve Sembay (sfs5@star.le.ac.uk)  
MPE 04/05/06

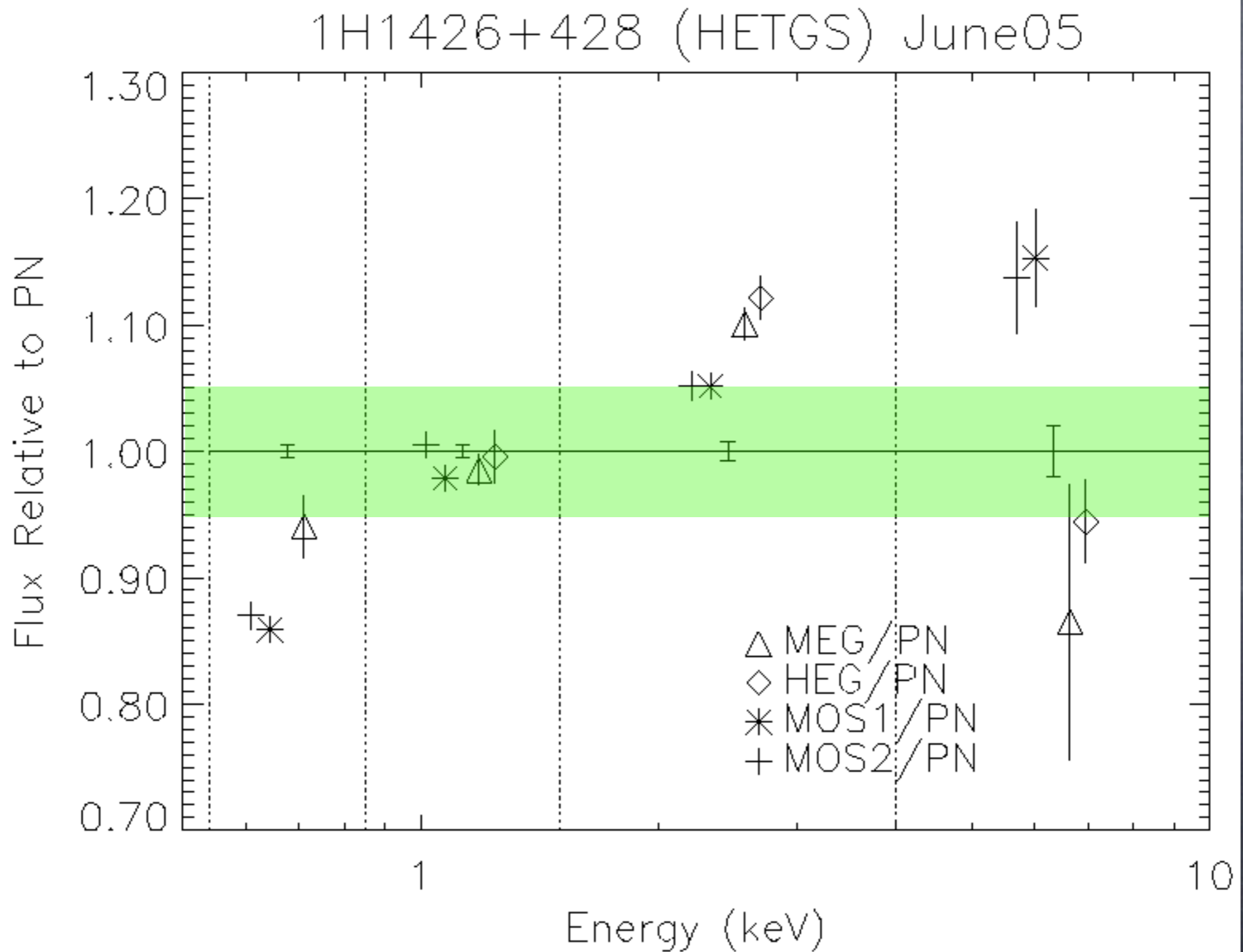


from EPIC calibration meeting

# Flux Comparisons



# Flux Comparisons





# XMM/Chandra Blazar Observations to Date

XMM-Chandra Cross-Calibration Observations of AGN												
Target	XMM						Chandra					
	Rev	Seq #	Start Date	exp (ks)	A	$\Gamma$	Config	ObsID	Start Date	exp (ks)	A	$\Gamma$
PKS 2155-304	87	124930101	2000-05-30:0530	61			HETGS	1705	2000-05-31:1740	30	4e-2	2.507
		124930201	2000-05-31:0030	72			LETG/ACIS	1703	2000-05-31:0220	30	0.051	2.66
											1e-1	1.72
3C 273	94	126700301	2000-06-13:2340	73			LETG/HRC	1704	2000-05-31:0950	30		
	96	126700801	2000-06-17:2320	73	0.0024	3.17	ACIS-S	1711	2000-06-14:0550	30		
					0.0176	1.63	ACIS-S	1712	2000-06-14:1420	30		
	277	136550101	2001-06-13:0710	90	6.48e-3	3	HETG	2463	2001-06-13:0700	30	2e-2	1.74
					0.0187	1.57	LETG/ACIS	2464	2001-06-13:1610	30	7e-3	2.577
											1e-2	1.47
PKS 2155-304	362	89210101	2001-12-01:0600	15	0.063	2.5	LETG/HRC	2462	2001-06-14:1250	30		
					0.068	2.86	LETG/ACIS	2471	2001-06-15:2030	30	8e-3	2.72
					Eb=1.22						1e-2	2.72
							HETGS	3167	2001-11-30:2010	30	6e-2	2.738
							LETG/ACIS	3168	2001-11-30:1120	30	9e-2	2.995
											0.171	1.71
PKS 2155-304	545	124930601	2002-11-29:2330	115	0.0272	2.28	LETG/HRC	3166	2001-11-30:0230	30		
					0.0269	2.81	HETGS	3706	2002-11-29:2230	30	0.02	2.72
					Eb = 0.98		LETG/ACIS	3707	2002-11-30:0700	30	2e-2	2.91
											0.052	1.67
							HETGS	3708	2002-11-29:1430	30	3e-2	2.759
							LETG/HRC	4406	2002-11-30:0210	15		
3C 273	655	159960101	2003-07-07:1740	58	2.15e-3	3.14	LETG/HRC	3709	2002-11-30:1450	15		
					0.0278	1.81	HETGS	4430	2003-07-07:1230	30	3e-2	1.837
							LETG/ACIS	4431	2003-07-07:2050	30	7e-3	2.16
PKS 2155-304	835	136550801	2004-06-30:1300	63	7.6e-4	3.91					0.021	1.675
					0.0178	1.77	HETGS	5169	2004-06-30:1300	30	2e-2	1.737
							LETG/ACIS	5170	2004-06-30:2150	30	7e-3	2.18
PKS 2155-304	908	158960901	2004-11-22:2130	29							9e-3	1.47
		158961001	2004-11-23:1950	40			LETG/HRC	5172	2004-11-22:2330	30		
1H1426+428	1015	310190201	2005-06-25:0603	45	0.015	1.9	HETGS	5173	2004-11-23:2330	30	2e-2	2.8
					0.0153	2.16						
	1035	310190501	2005-08-04:0452	47			LETG/ACIS	6088	2005-06-25:0555	45	2e-2	2.03
							LETG/ACIS	6089	2005-08-04:0436	45	2e-2	2.266
											0.112	0.427

From <http://space.mit.edu/ASC/calib/crosscal/>

# Cross-cal Plans

- Complete flux measurements for 8 more cases of exact temporal overlap
  - similar to MOS-PN differences so far
  - need more GTI sets and XMM fluxes
- Start supporting comparisons using 1E0102
  - effort led by Paul Plucinsky as part of RMF tests
  - use some existing and new HETGS data
  - help Andy Pollock refine model using RGS
- Fit joint observations
  - complete and use formal methods
  - update ACIS contamination model
  - evaluate possible PN and MOS changes with XMM team

# Contamination Monitoring

- Contaminate deposition rate continues
- A new spectral-temporal model is needed

