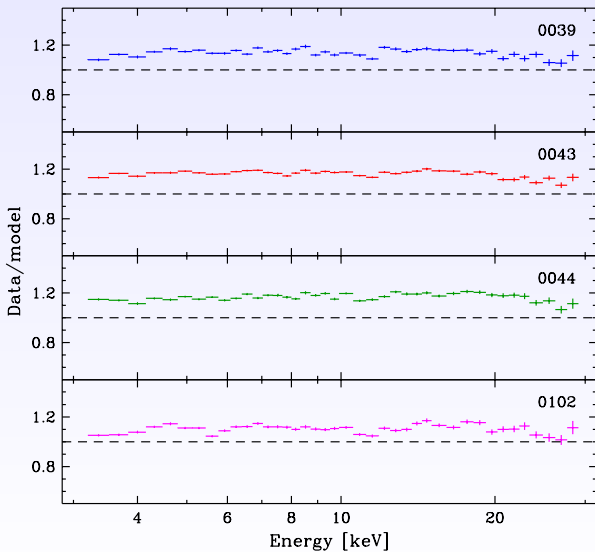


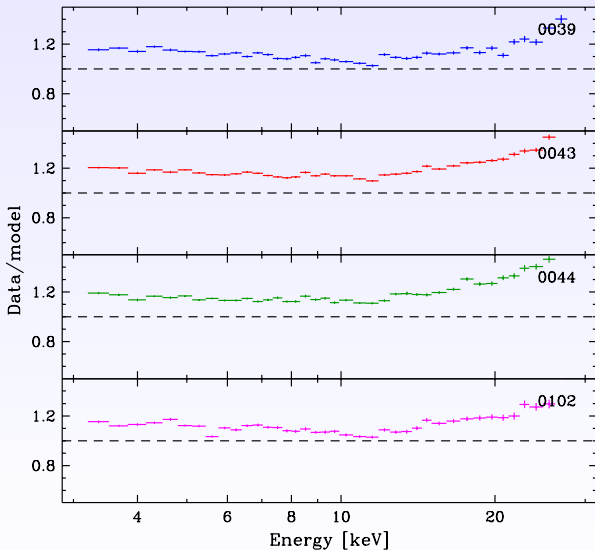
INTEGRAL calibration status

Piotr Lubiński

The 3rd INTEGRAL Data Analysis Workshop
18-20 October 2006

JEM-X 2, OSA 5.1 ($\Gamma=2.1$, $A=9.7$)

JEM-X 2, OSA 6.0



JEM-X 1, OSA 5.1

JEM-X

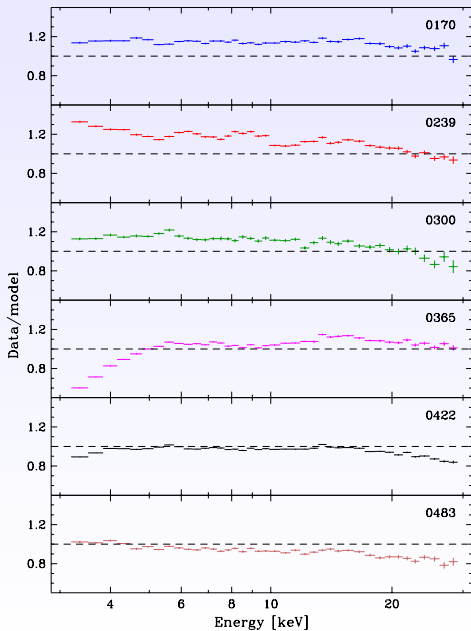
ISGRI

SPI

PICsIT

Cross-calibration

Conclusions



JEM-X 1, OSA 6.0

JEM-X

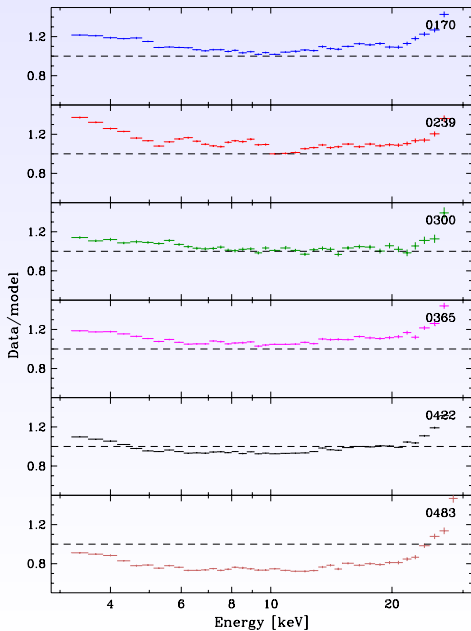
ISGRI

SPI

PICsIT

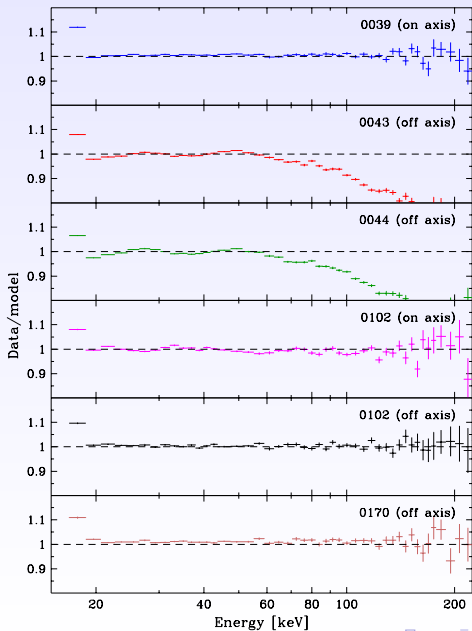
Cross-calibration

Conclusions



JEM-X 2 and JEM-X 1, OSA 5.1 and OSA 6.0, 3-20 keV

Rev.	Γ	A	χ^2	Γ	A	χ^2
0039	2.10	11.0	5.8	2.11	11.0	26.4
0043	2.10	11.3	6.4	2.07	10.7	56.7
0044	2.08	10.8	4.5	2.05	10.2	31.6
0102	2.09	10.4	6.4	2.10	10.7	21.6
0170	2.11	11.4	4.8	2.14	11.6	39.0
0239	2.20	13.9	13.6	2.20	13.3	43.0
0300	2.16	12.4	3.7	2.15	11.4	7.1
0365	1.91	6.5	187	2.13	11.2	33.4
0422	2.10	9.4	60.5	2.13	9.9	206
0483	2.18	10.8	4.1	2.15	8.3	44.2

ISGRI, OSA 5.1 ($\Gamma=2.225$, $A=14.9$)

JEM-X

ISGRI

SPI

PICsIT

Cross-calibration

Conclusions

ISGRI, OSA 5.1

JEM-X

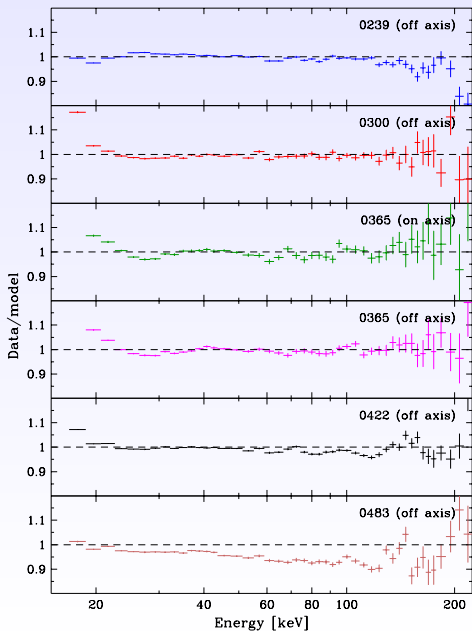
ISGRI

SPI

PICsIT

Cross-calibration

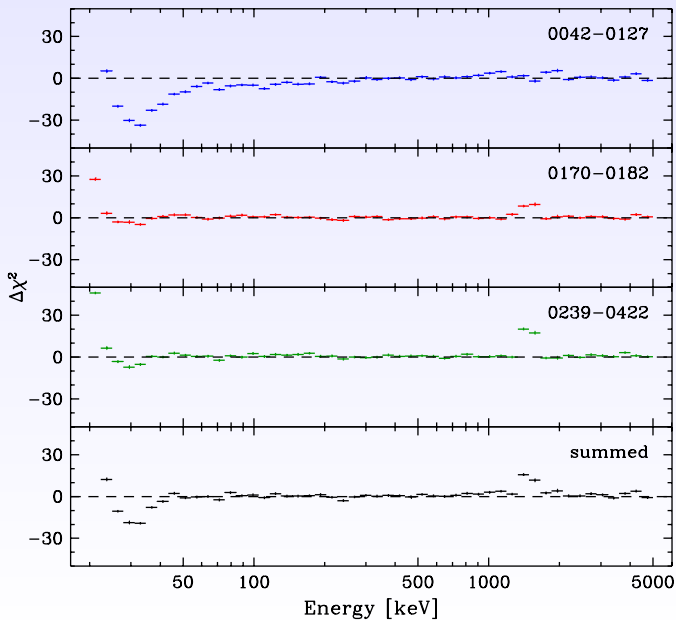
Conclusions



ISGRI, OSA 5.1, 20-500 keV

Rev.	Γ	A	20-200 keV flux	χ^2/NDF
0039 (S)	2.23	15.0	0.293	1.74
0043 (D)	2.23	14.8	0.288	87.2
0044 (D)	2.23	15.0	0.287	105
0102 (S)	2.23	15.2	0.291	3.31
0102 (D)	2.23	15.2	0.292	1.10
0170 (D)	2.23	15.3	0.294	1.48
0239 (D)	2.23	15.2	0.292	18.3
0300 (D)	2.23	15.2	0.290	5.41
0365 (S)	2.23	15.2	0.291	9.82
0365 (D)	2.23	15.3	0.291	16.9
0422 (D)	2.24	15.5	0.290	8.27
0483 (D)	2.25	15.9	0.281	3.77

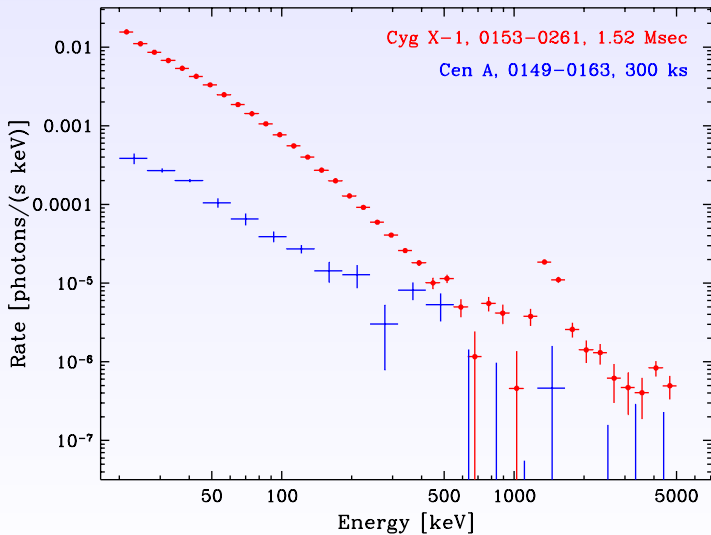
SPI, OSA 6.0



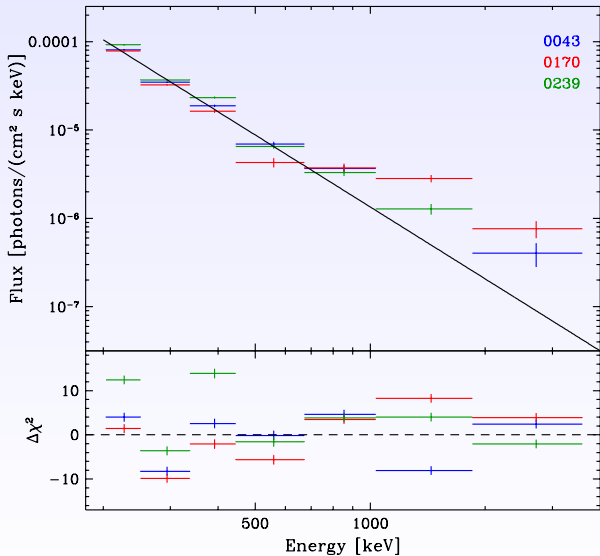
SPI, OSA 6.0, 25-1000 keV

Revs.	exp.	Γ_1	E_b	Γ_2	20-200 keV	χ^2/NDF
0042-0127	0.93	2.08	64	2.18	0.261	4.40
0170-0182	0.19	2.10	98	2.24	0.271	1.32
0239-0422	0.38	2.08	47	2.15	0.270	1.82
summed	1.50	2.13	106	2.20	0.270	1.77

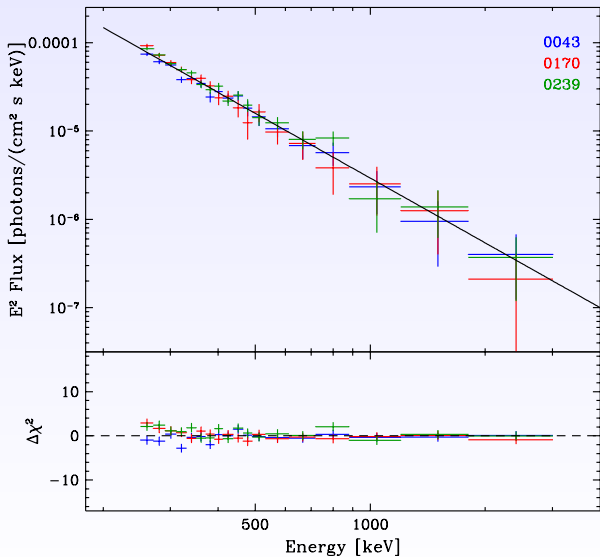
SPI, OSA 6.0, weaker sources



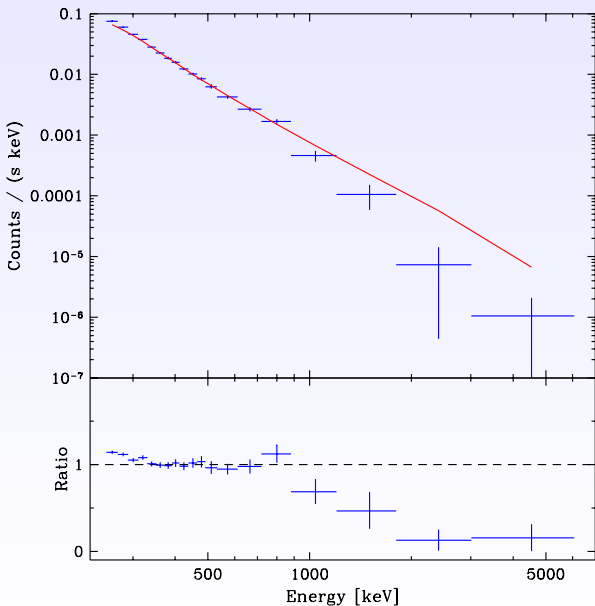
PICsIT, Crab spectra, standard software

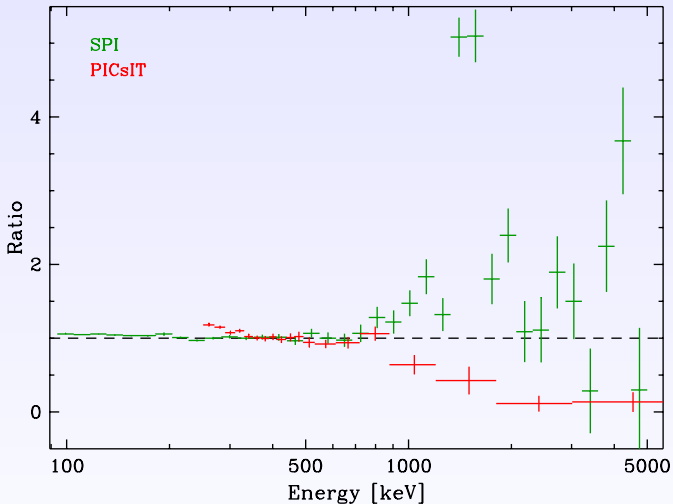


PICsIT, Crab spectra, advanced method



PICsIT, Crab summed spectrum, 330-880 keV

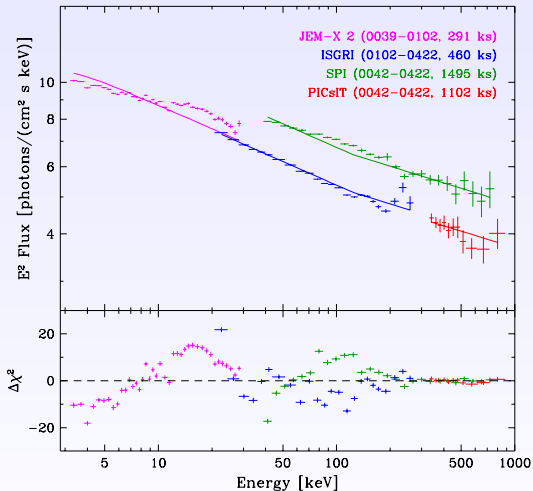




Data set	Γ	300-800 keV flux	χ^2/NDF
PICsIT	2.22 ± 0.07	8.6	0.38
SPI	2.21 ± 0.16	10.9	1.31

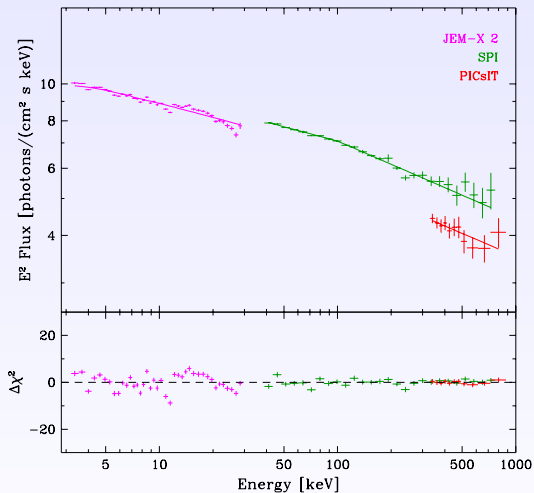
PICsIT normalization factor = 0.78

INTEGRAL, OSA 5.1 (SPI, OSA 6.0), 3-880 keV



Data	Γ_1	E_b	Γ_2	C_J	C_I	C_P	χ^2/NDF
J,I,S,P	2.21	120	2.14	0.80	0.80	0.76	47.3

INTEGRAL, OSA 5.1 (SPI, OSA 6.0), 3-880 keV



Data	Γ_1	E_b	Γ_2	C_J	C_I	C_P	χ^2/NDF
J,I,S,P	2.21	120	2.14	0.80	0.80	0.76	47.3
J,S,P	2.13	100	2.20	0.94	—	0.79	7.15

Compton Gamma Ray Observatory

JEM-X

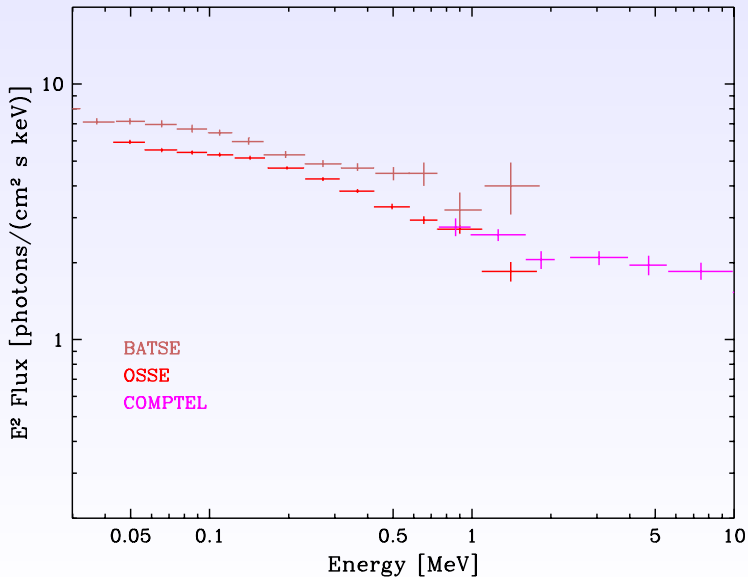
ISGRI

SPI

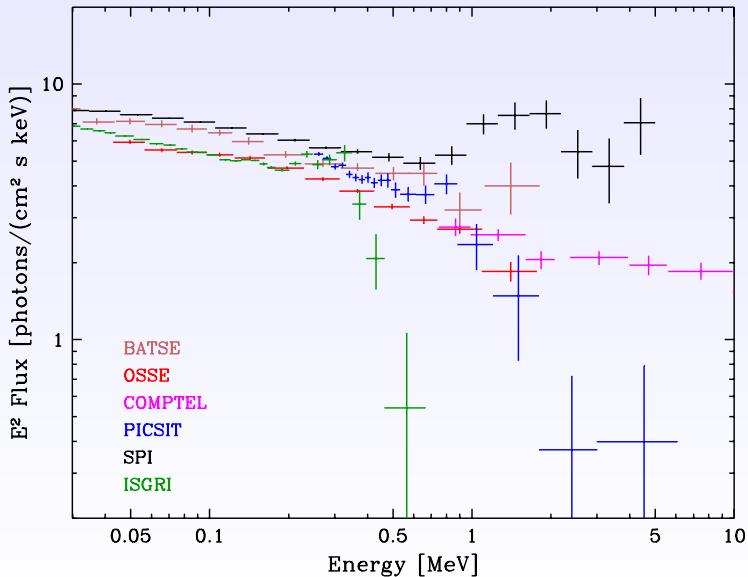
PICsIT

Cross-calibration

Conclusions



INTEGRAL and Compton Gamma Ray Observatory



CONCLUSIONS

- JEM-X
 - JEM-X 2 well calibrated in OSA 5.1
 - JEM-X 1 needs response files for Revs. > 300
 - wrong spectral shape in OSA 6.0, under investigation

CONCLUSIONS

- ISGRI
 - relatively well calibrated in OSA 5.1 (2-3%)
 - important changes in OSA 6.0 (energy calibration, LUT 2 table, Nomex correction)
 - new set of response files needed for OSA 6.0
 - too large spectral slope assumed for ARF modeling

CONCLUSIONS

- SPI
 - very good calibration made on ground
 - residuals observed below 35 keV (3%)
 - spectral hardening and bumps at high energy (electronic noise, background modeling)

CONCLUSIONS

- PICsIT
 - very good calibration up to ~ 1 MeV
 - standard software produces spectra of rather low quality
 - better instrument model (PIF) needed above 1 MeV

CONCLUSIONS

- Cross-calibration
 - Too steep spectra from ISGRI
 - JEM-X, ISGRI and PICsIT absolute normalization about 5%, 20% and 20% below SPI
 - very good agreement between SPI and PICsIT spectral slope up to ~ 900 keV
 - overall agreement with CGRO Crab results up to 1 MeV