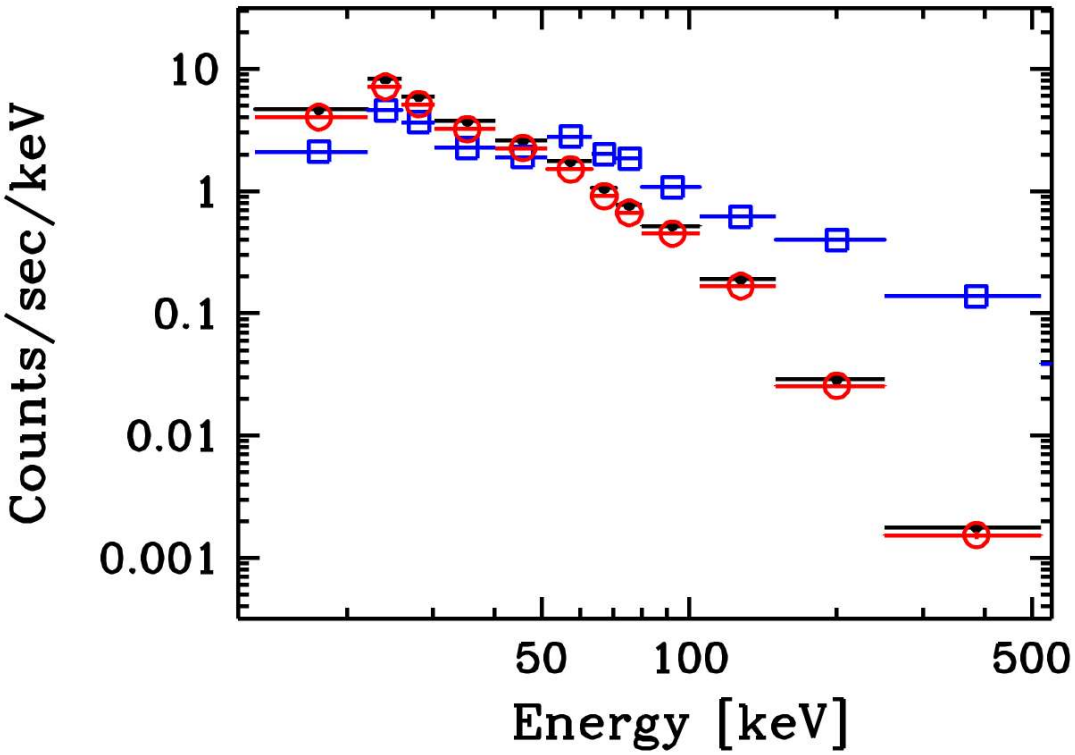
Methods for extraction ISGRI spectra – review

P. Lubi?ski (CAMK, Warsaw & ISDC), M. Chernyakova (ISDC),
P. Kretschmar (MPI, Garching & ESAC), N. Produit (ISDC),
J. Rodriguez (CEA, Saclay & ISDC), S. Soldi (ISDC), R. Walter (ISDC)



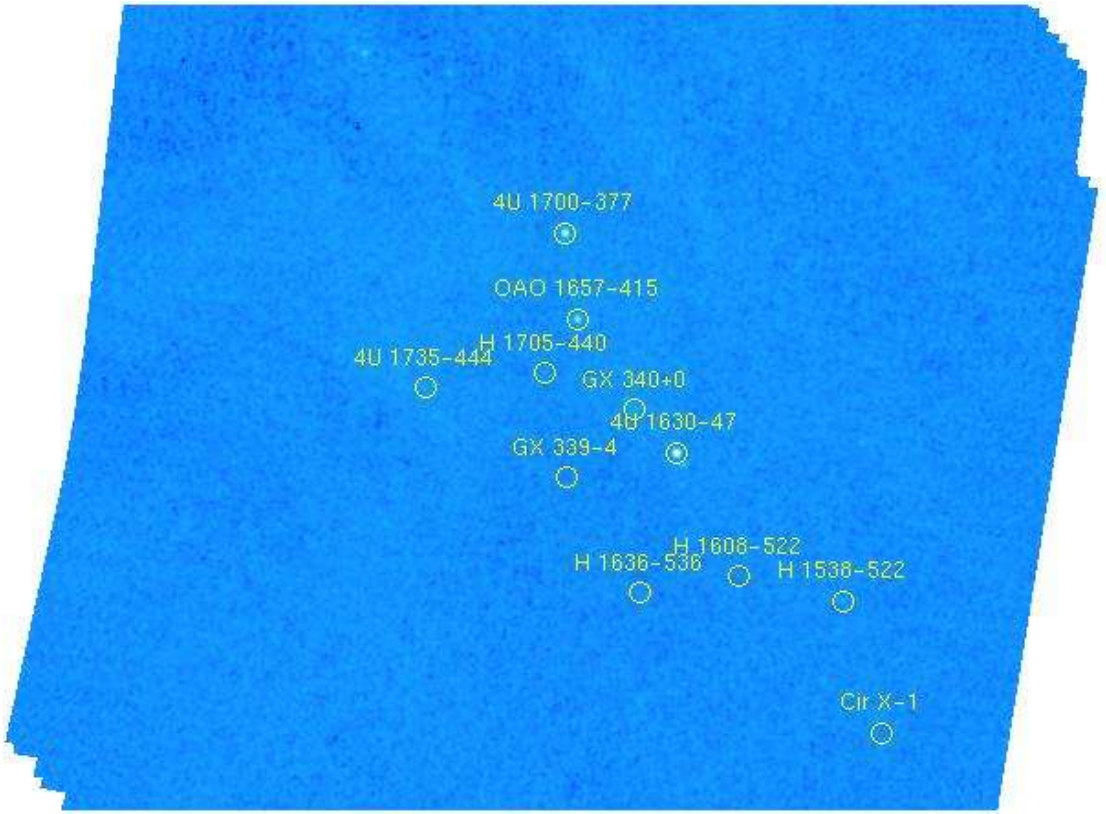
Spectral extraction at extreme conditions

Goal:

Spectra for H 1538-522 (~30 mCrab) and Cir X-1 (~20 mCrab) from GPS observation in Rev. 0100

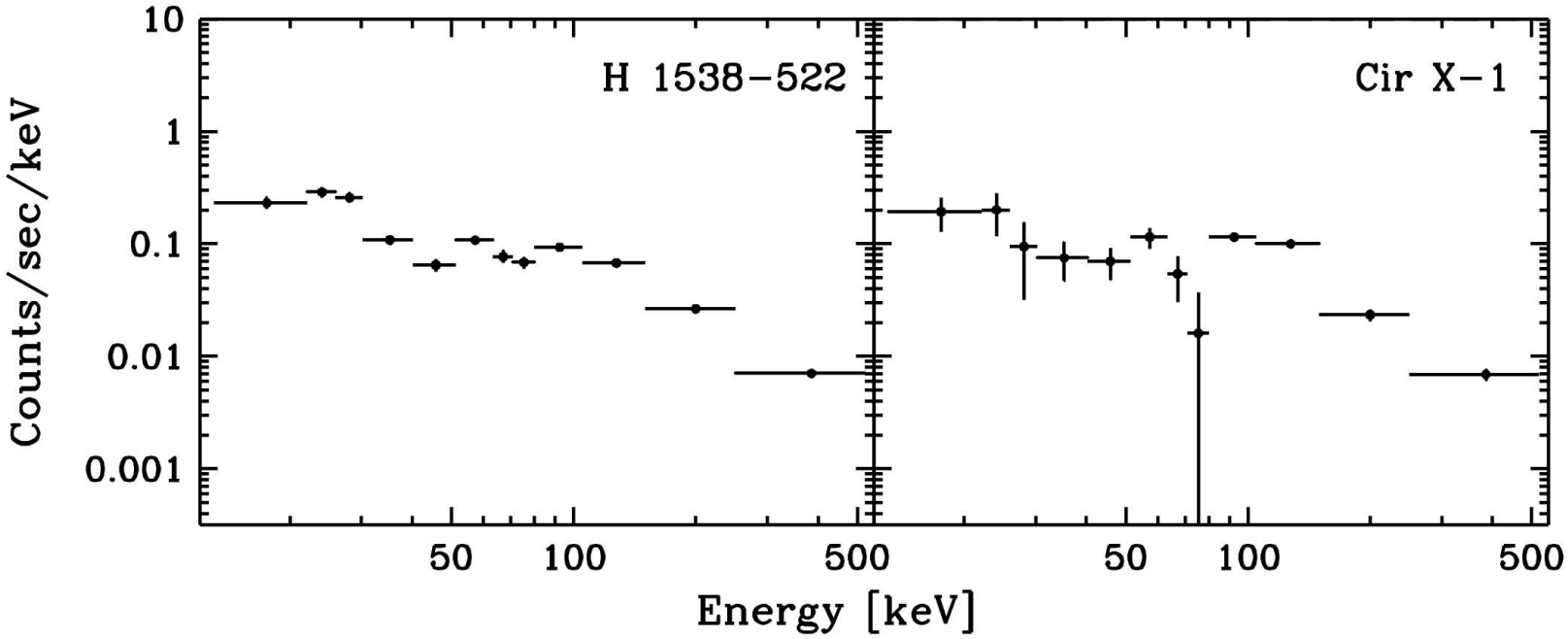
Conditions:

crowded field (11 objects, including 5 stronger than 50 mCrab)
very large offset angles (11-22 and 17-24 degrees)

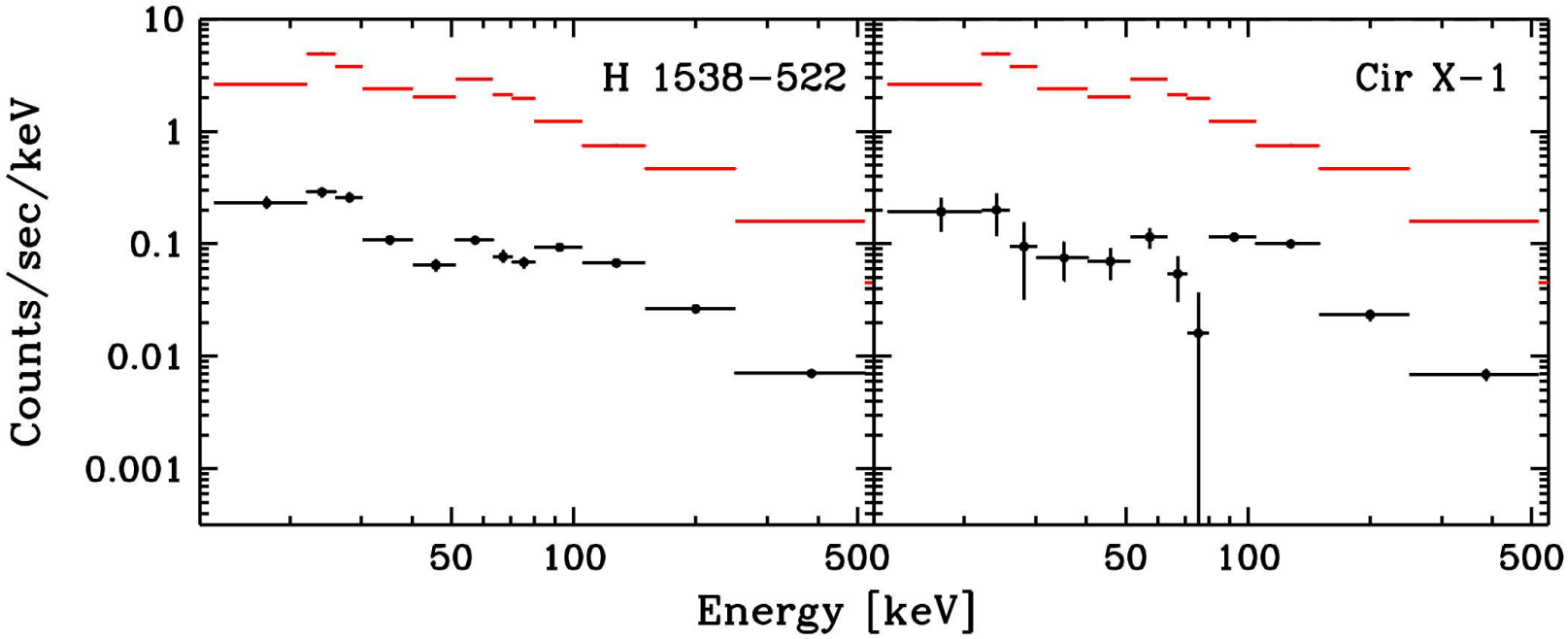


Result:

Very hard (spectral index < 1), obviously false spectra



Check the background...



Standard spectral extraction method

Count rates fitted to shadowgrams with the use of Pixel Illumination Function, OSA level SPE

Alternative methods

Spectra based on count rates obtained from sky images (single pointings or mosaic), level IMA

Single pointings:

1. fitted count rates (isgri_sky_res), source must be detected
2. count rates from pixel having catalog position of the source in its area (isgri_sky_ima)

Mosaic image:

3. fitted count rates (isgri_mosa_res), detection needed
4. count rates from 'source' pixel (isgri_mosa_ima)

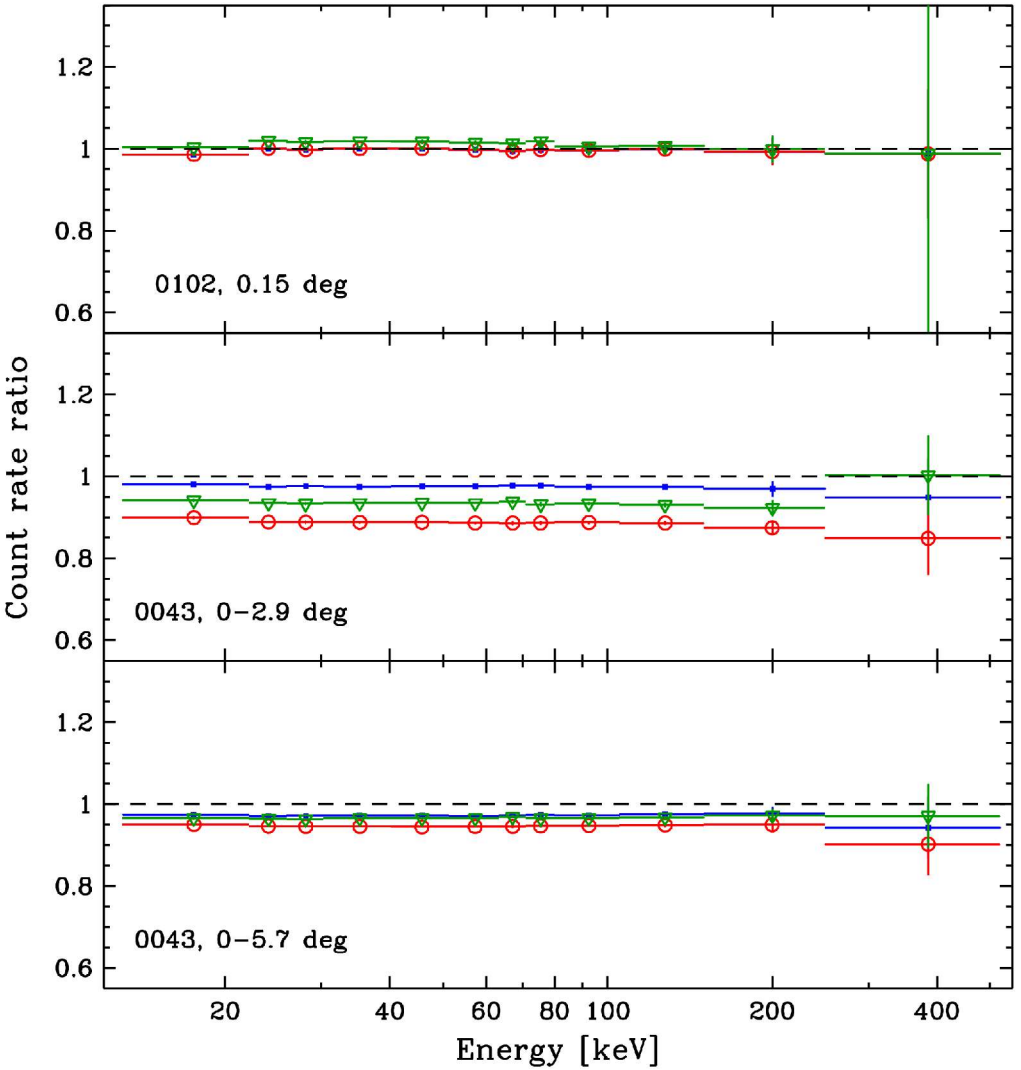
Systematic comparison between various methods – Crab

Staring and dithering, small offset angles

Mean from sky images

mosaic PSF fit results

mosaic pixel count rate



Systematic comparison between various methods – Crab

Staring, large offset angles

Mean from sky images

mosaic PSF fit results

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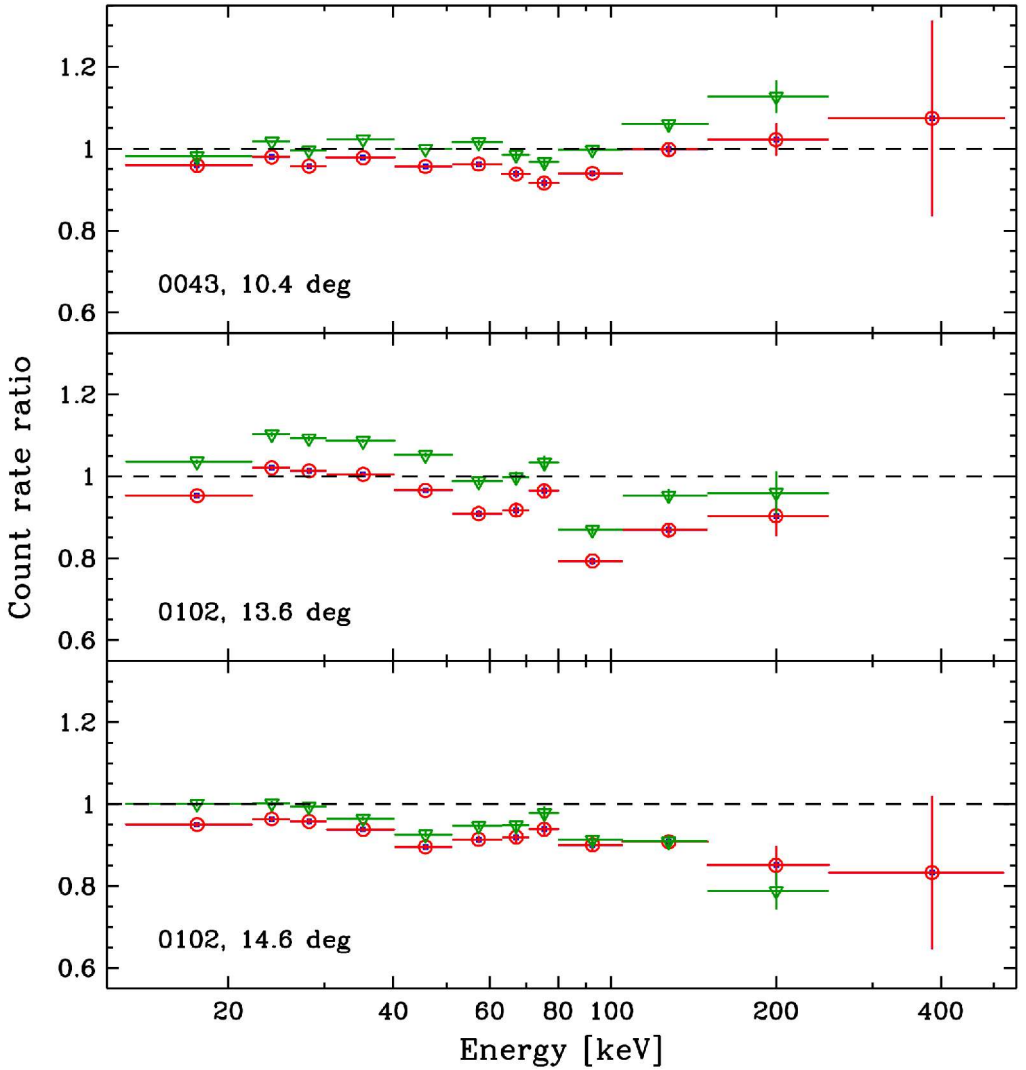
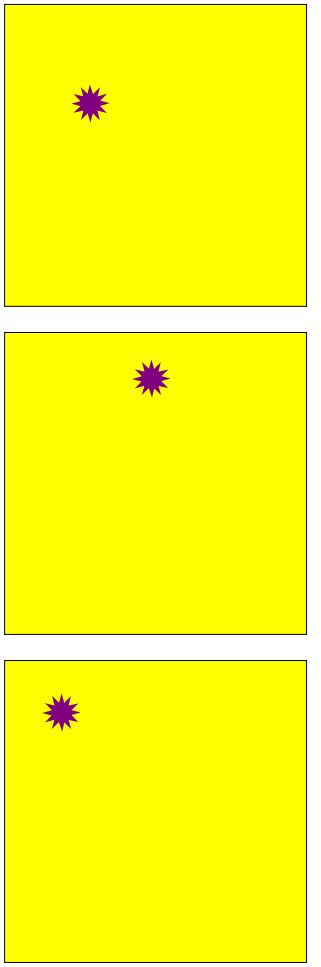


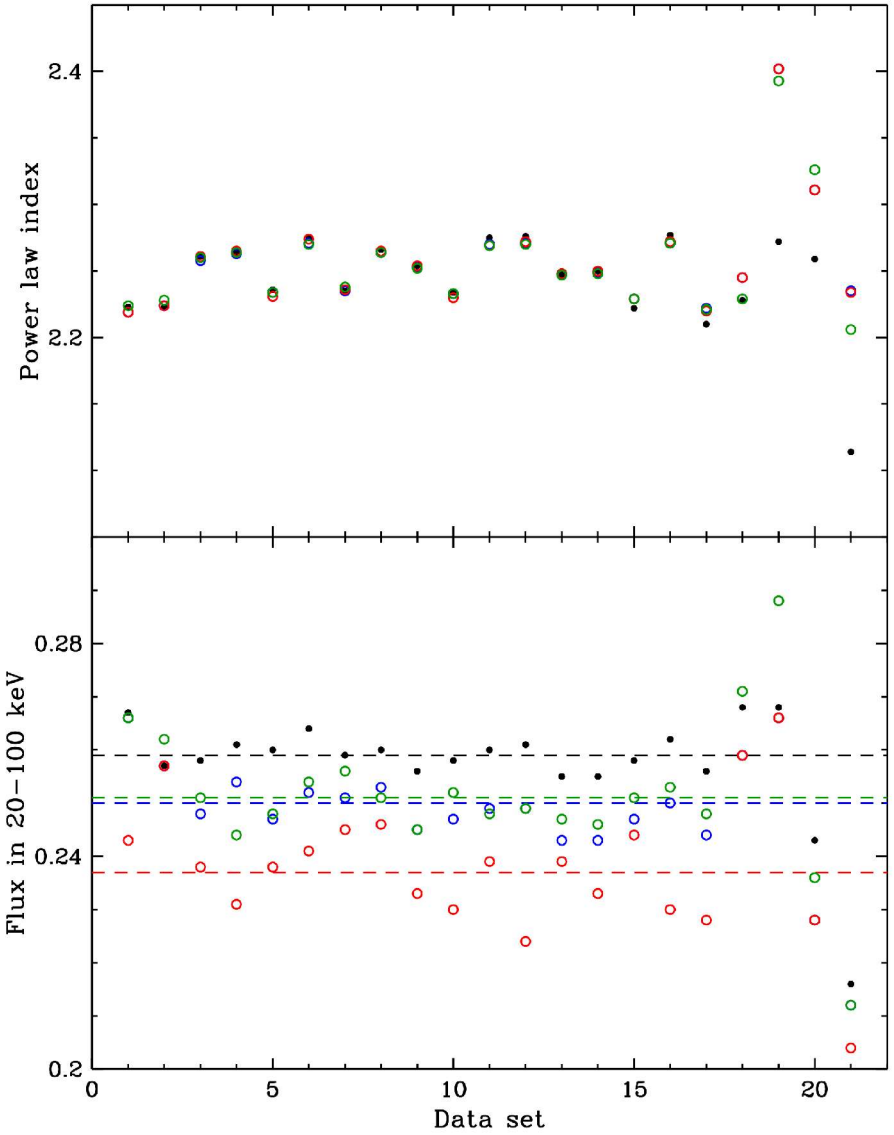


Power law fitted to Crab spectra

Power law index – all methods in agreement

Flux in 20-100 keV compared to the standard method flux:

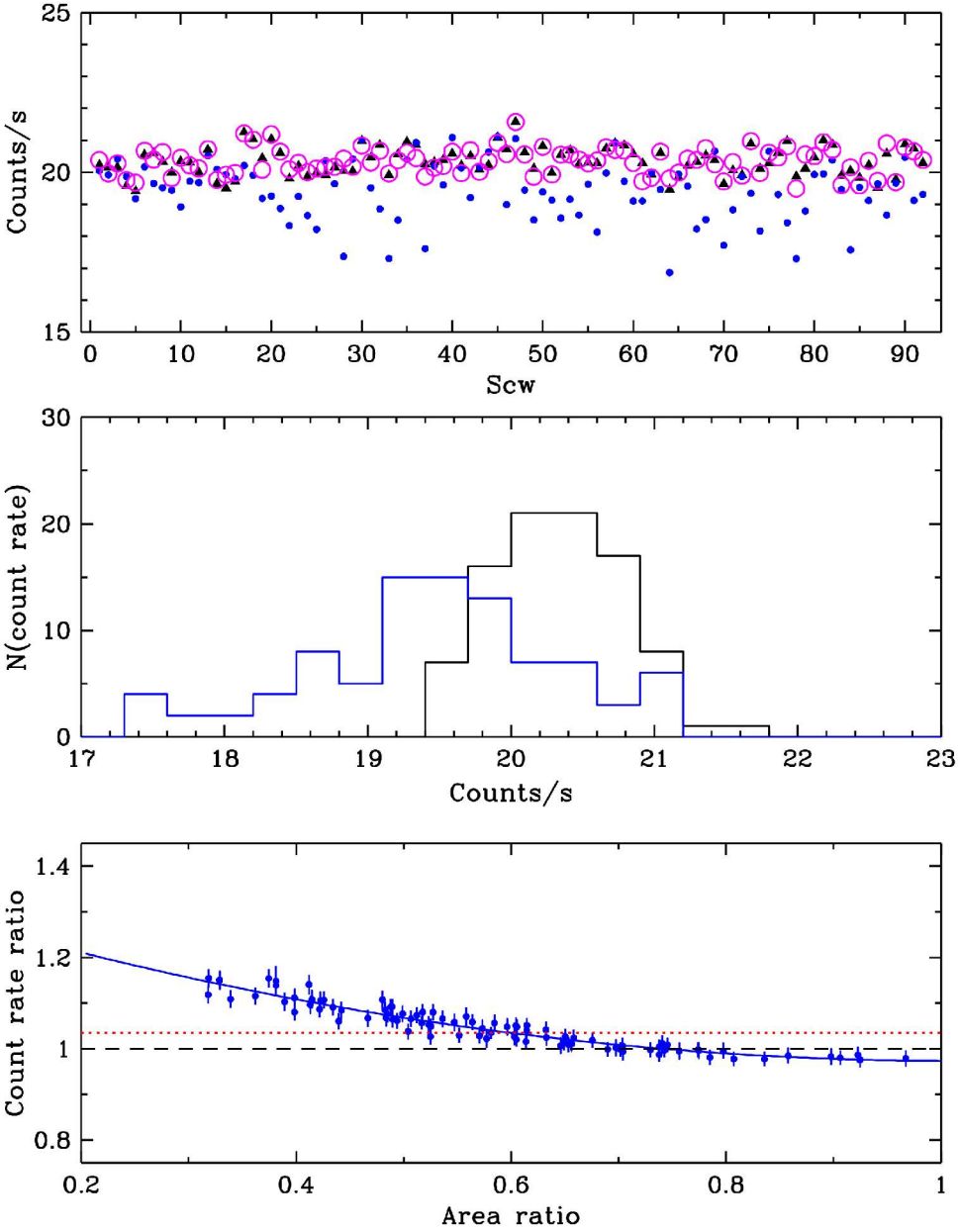
mean from sky images	**-3.5 %**
mosaic PSF fit results	**-3.1 %**
mosaic pixel count rate	**-8.5 %**



Method based on the mean from sky images – correction

Crab, Rev. 0239, 30-40 keV

Standard method
PSF fit result
Mean from sky image pixels

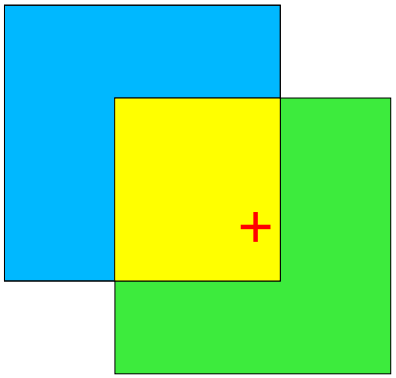


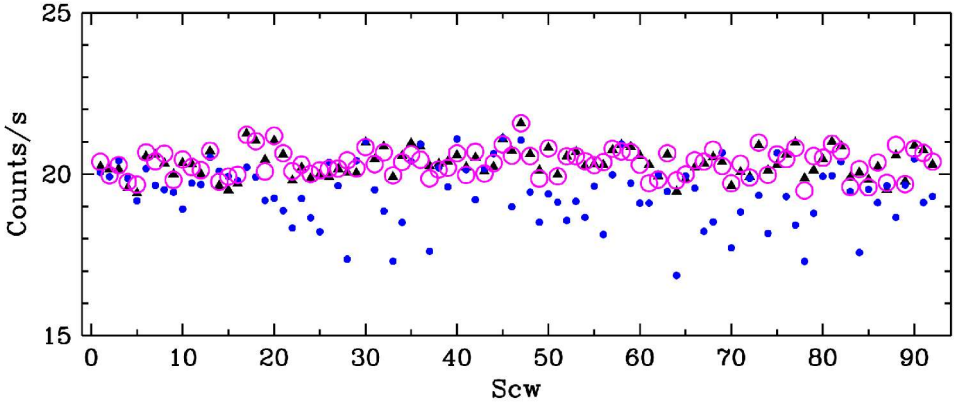
Method based on the mean from sky images – correction

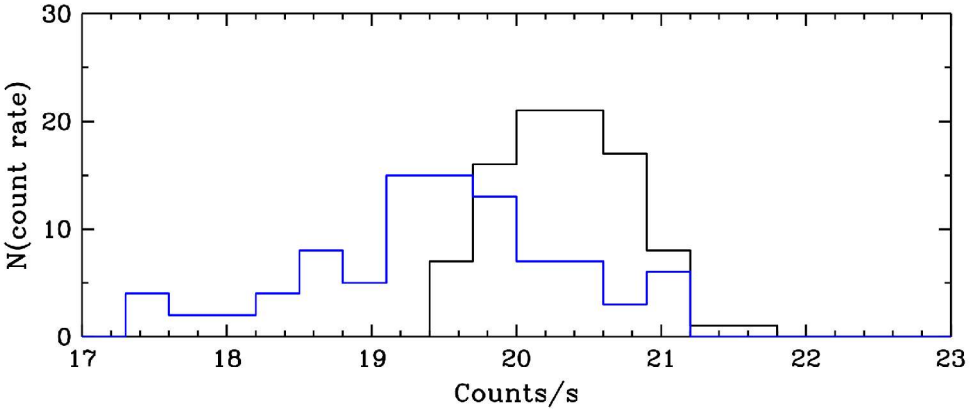
Crab, Rev. 0239, 30-40 keV

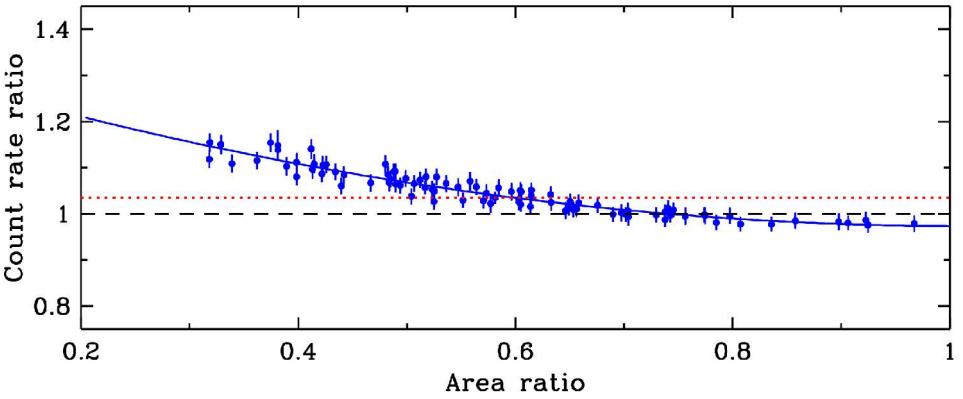
Standard method
PSF fit result
Mean from sky image pixels

Ratio between areas of sky image pixel and partial area of pixel of the same size centered at the catalog source position



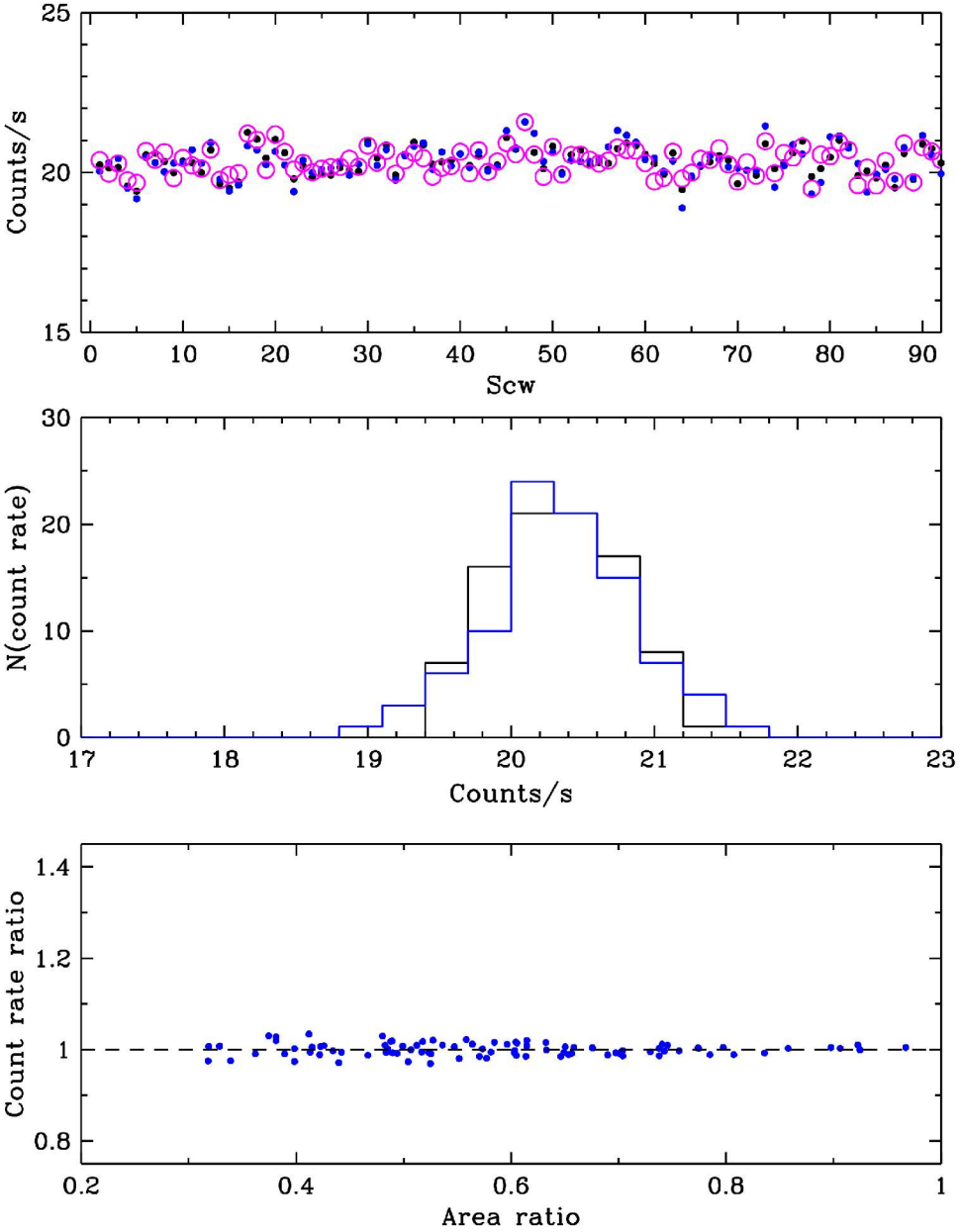






Method based on the mean from sky images – correction

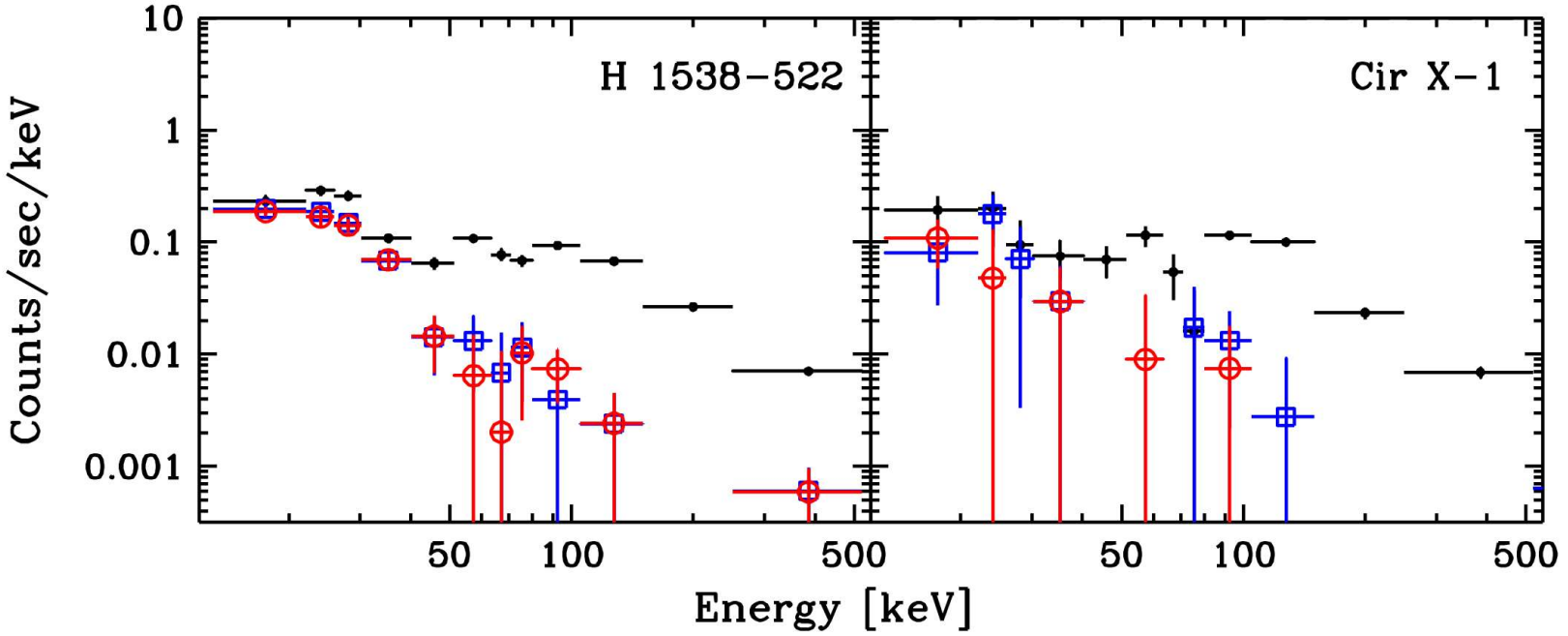
After phenomenological correction with a second order polynomial



Weaker sources

Dithering:

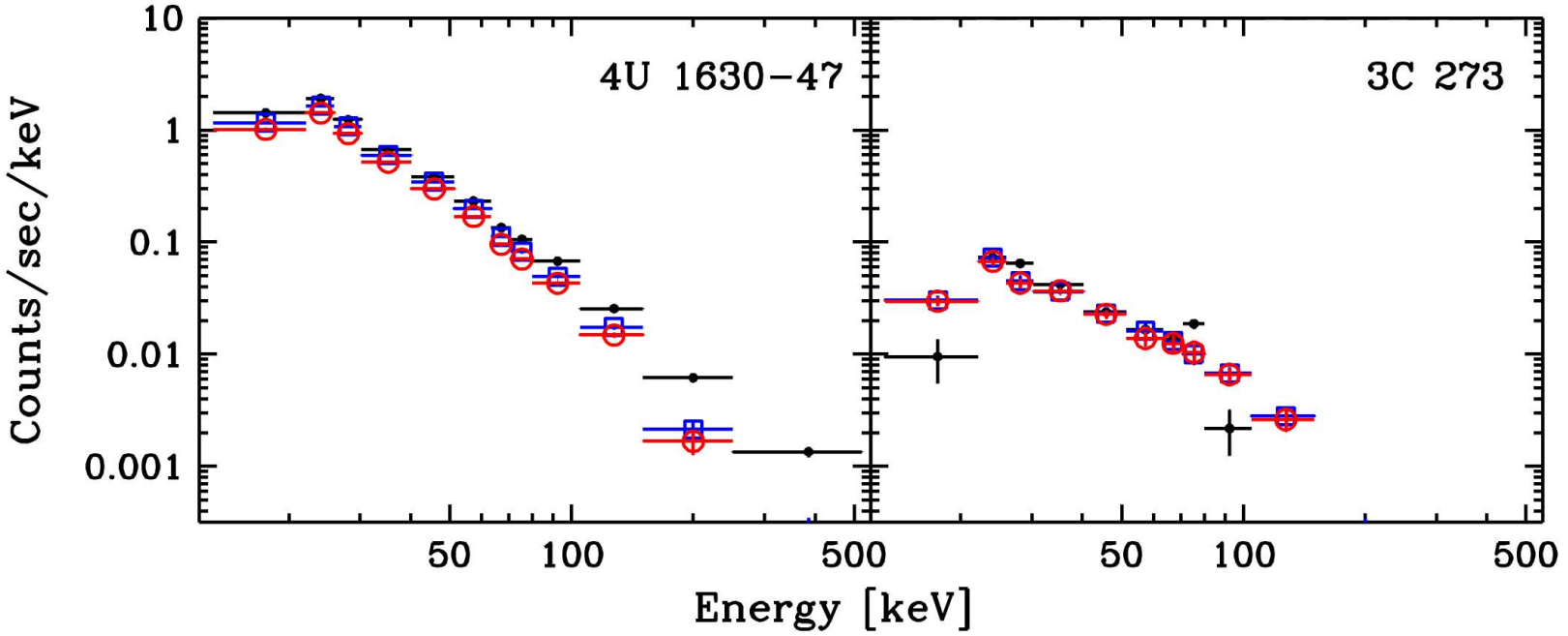
H 1538-522 (0100)	11-22 deg	49 ks	29 mCrab
Cir X-1 (0100)	17-24 deg	16 ks	19 mCrab



Weaker sources

Dithering:

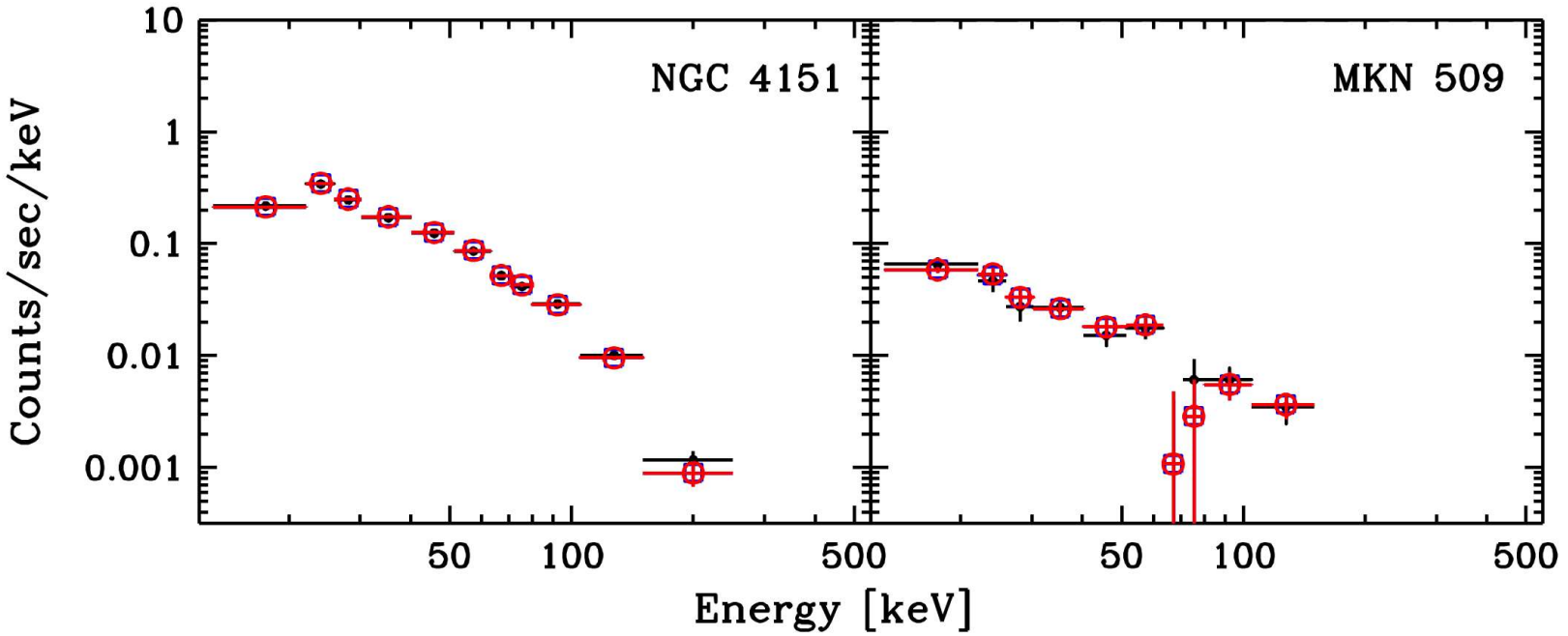
4U 1630-47 (0100)	1-17deg	101 ks	176 mCrab
3C 273 (0089, 0090)	1-8 deg	173 ks	11 mCrab



Weaker sources

Staring, 0 deg:

NGC 4151 (0074, 0075)	259 ks	45 mCrab
MKN 509 (0070)	53 ks	7 mCrab (~ ISGRI limit)



CONCLUSIONS

Standard spectral extraction

- staring, 0 deg
- dithering up to 10 degrees offset (50% PCFOV)

Alternatives for sources not weaker than 50 mCrab

Mean of count rates fitted in sky images

- source must be detected in a single pointing

Mean of count rates from sky image pixels at the source position

- flux can be underestimated by at most ~20%

usually, on average, by 3-4%

Count rate fitted in mosaic sky image

- flux can be underestimated usually by 3-4%
- source must be detected in mosaic image

Count rate for mosaic pixel at the source position

- flux can be underestimated by more than 20%

usually, on average, by 7-10%