Cyg X-1: The 2008 April 18ff. Campaign

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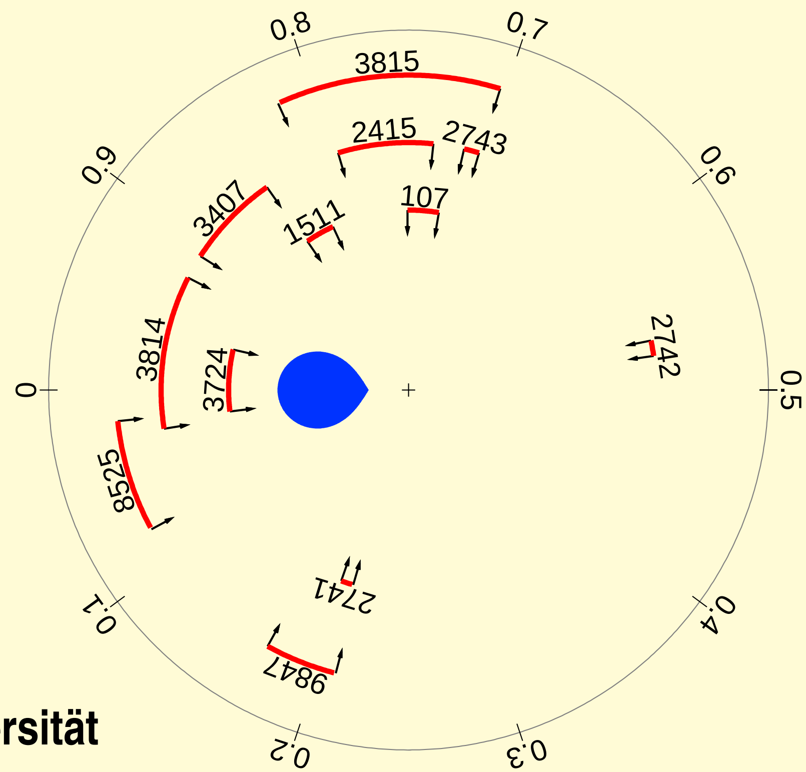

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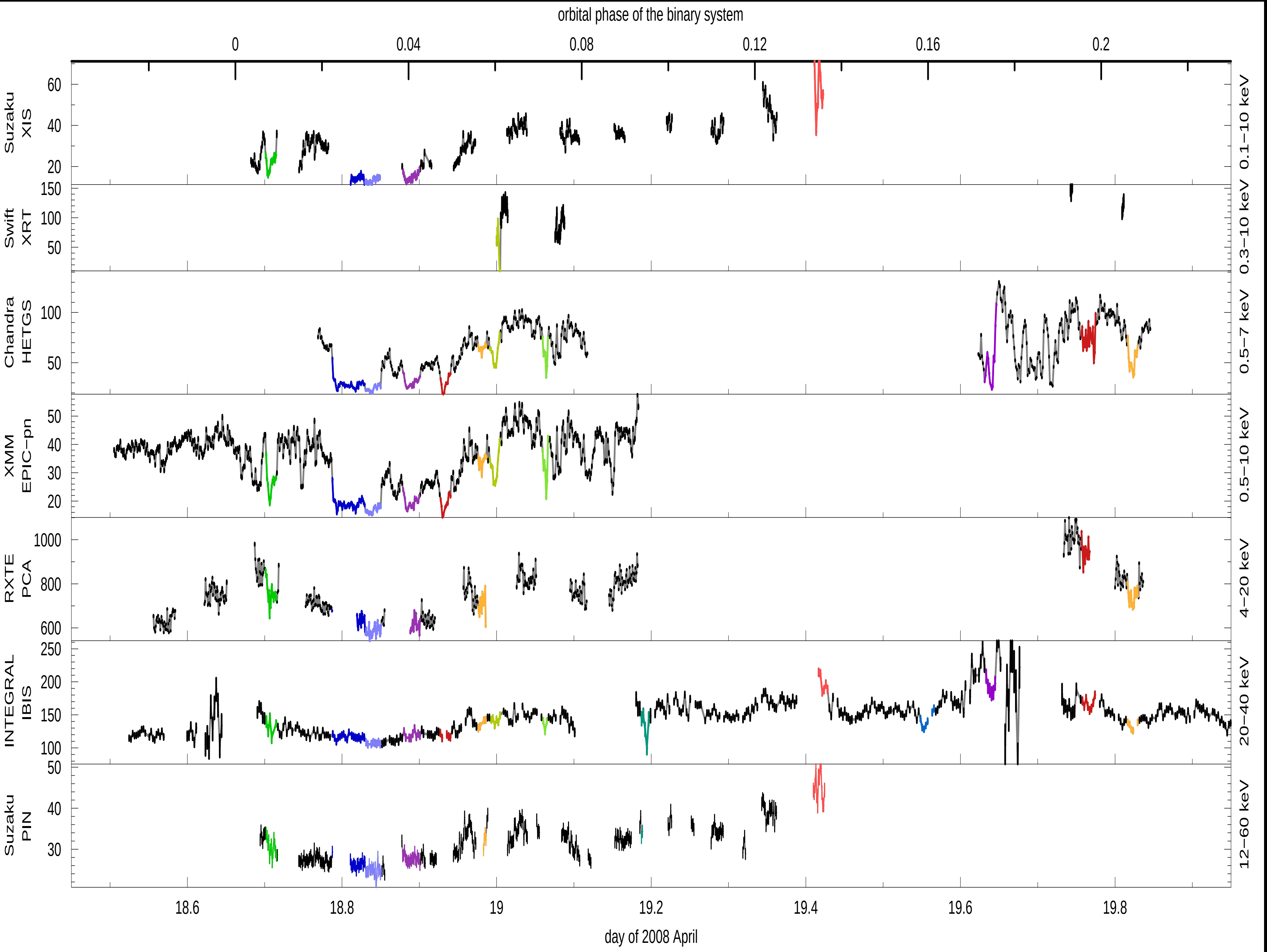
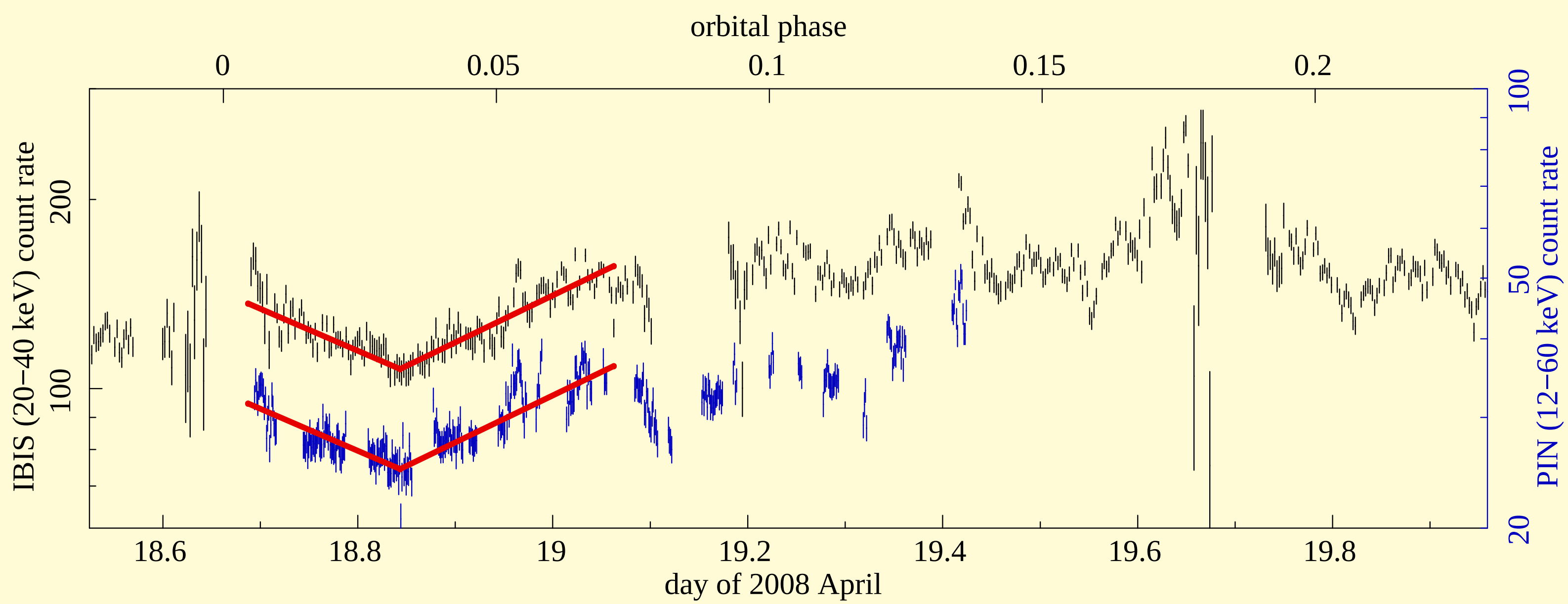
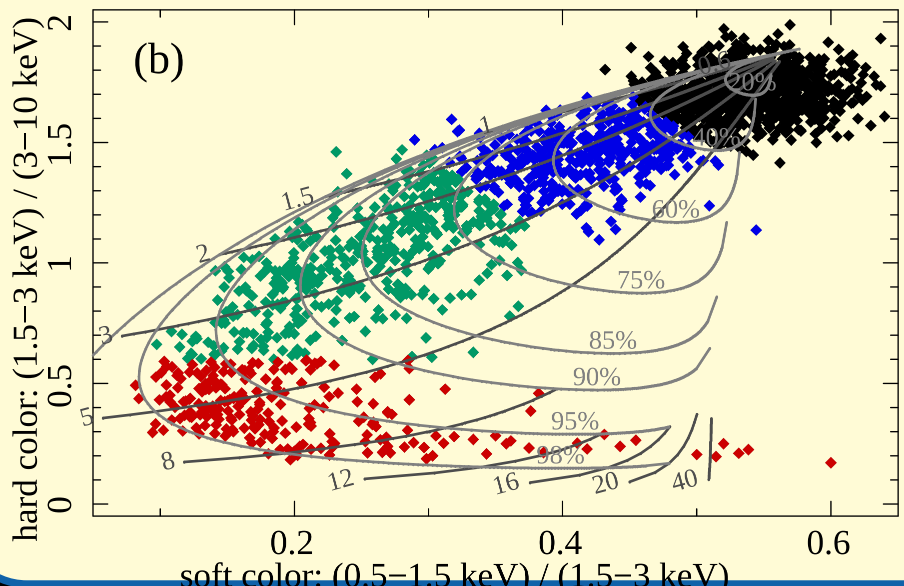
PHYSICS



orbital phase of the binary system
0
0.04
0.08
0.12
0.16
0.2
Suzaku XIS
0.1−10 keV
Swift XRT
0.3−10 keV
Chandra HETGS
0.5−7 keV
XMM EPIC−pn
0.5−10 keV
RXTE PCA
4−20 keV
INTEGRAL IBIS
20−40 keV
Suzaku PIN
12−60 keV
18.6
18.8
19
19.2
19.4
19.6
19.8
day of 2008 April

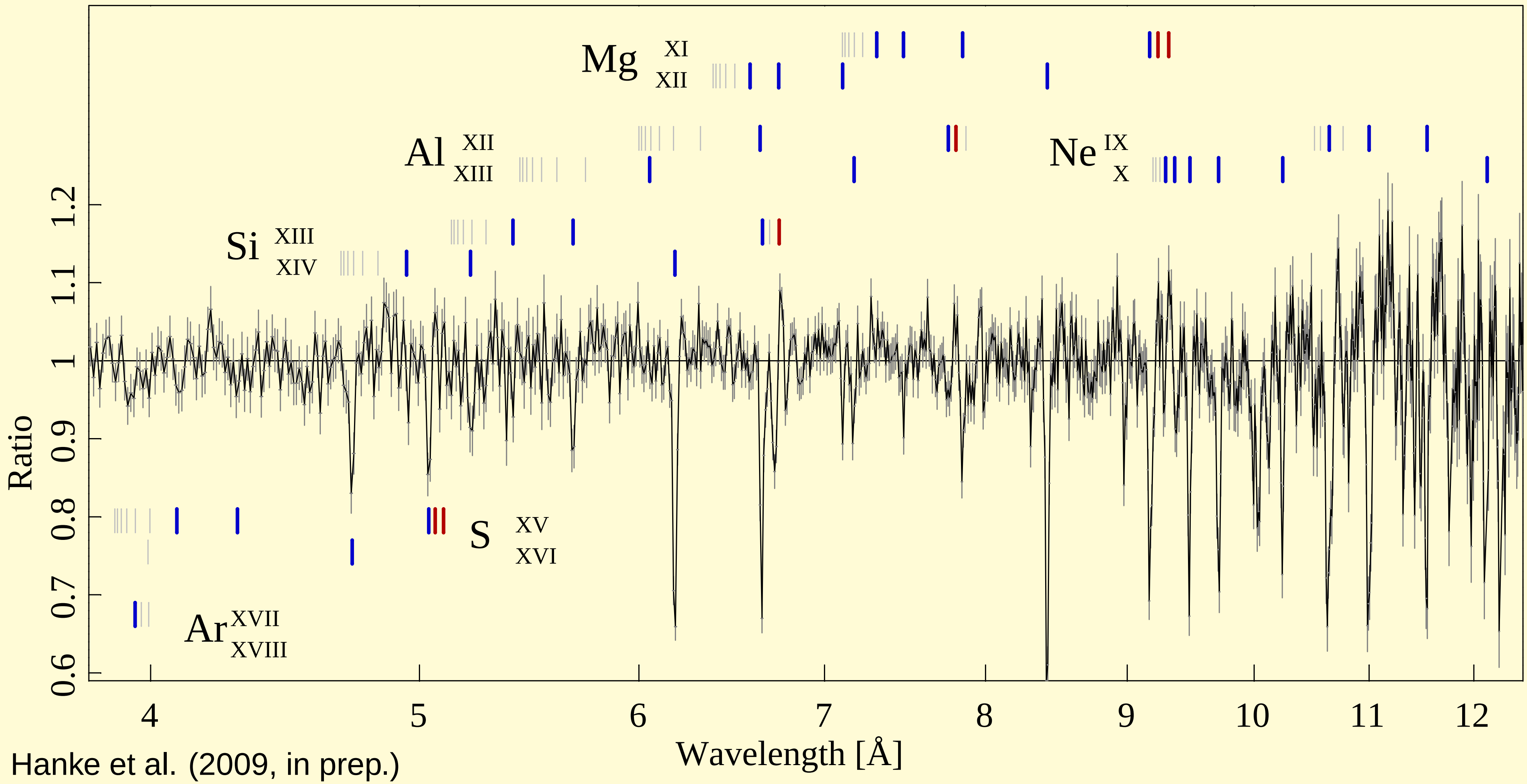
Soft Spectrum





As expected, low energy behavior dominated by strong dipping, low energy behavior can be explained with partial covering.

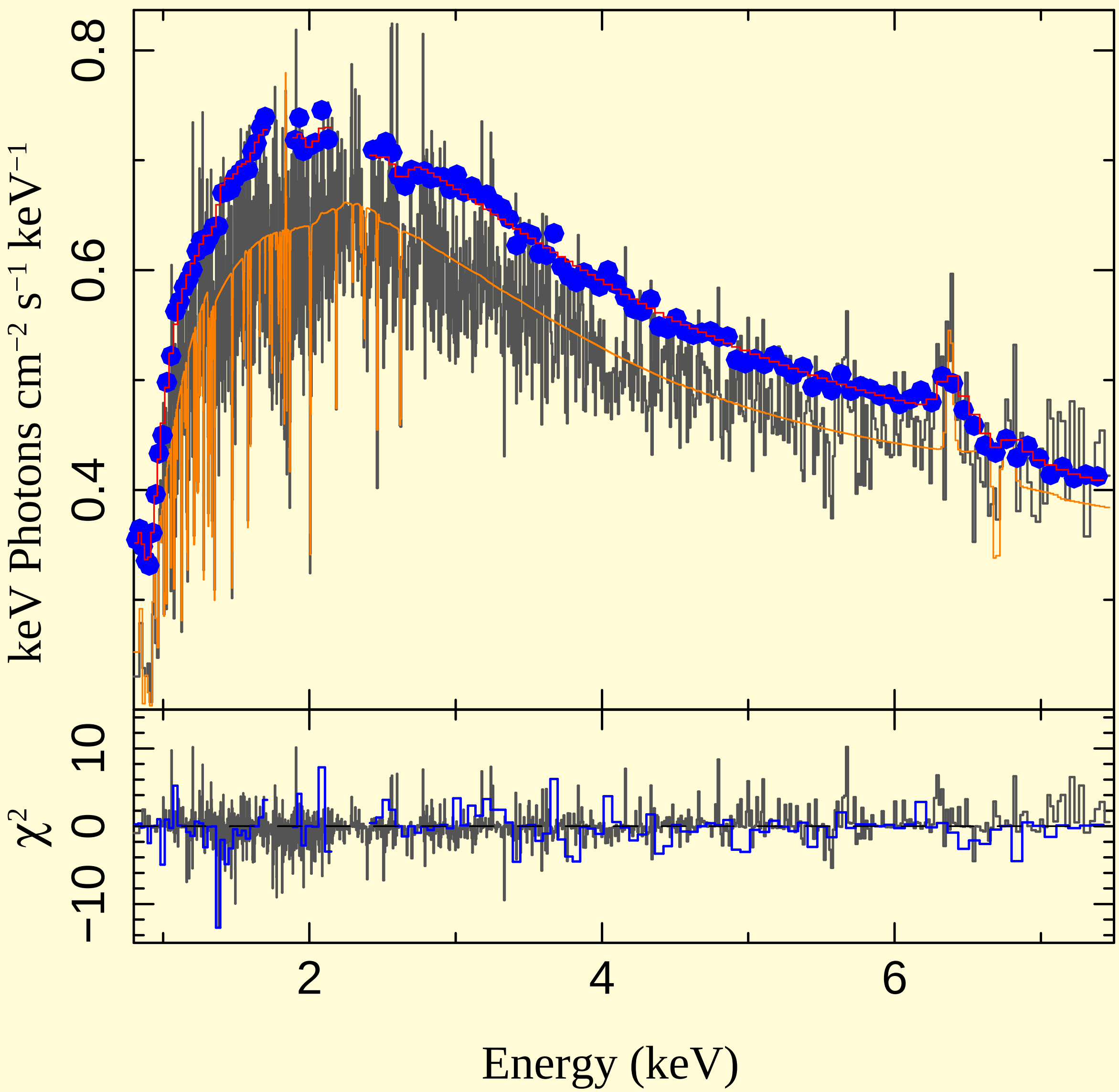
Soft Spectrum



Hanke et al. (2009, in prep.)

Non-dip spectrum shows significant line absorption features from all relevant H- and He-like ions (spectrum during dips more complicated).

Soft Spectrum

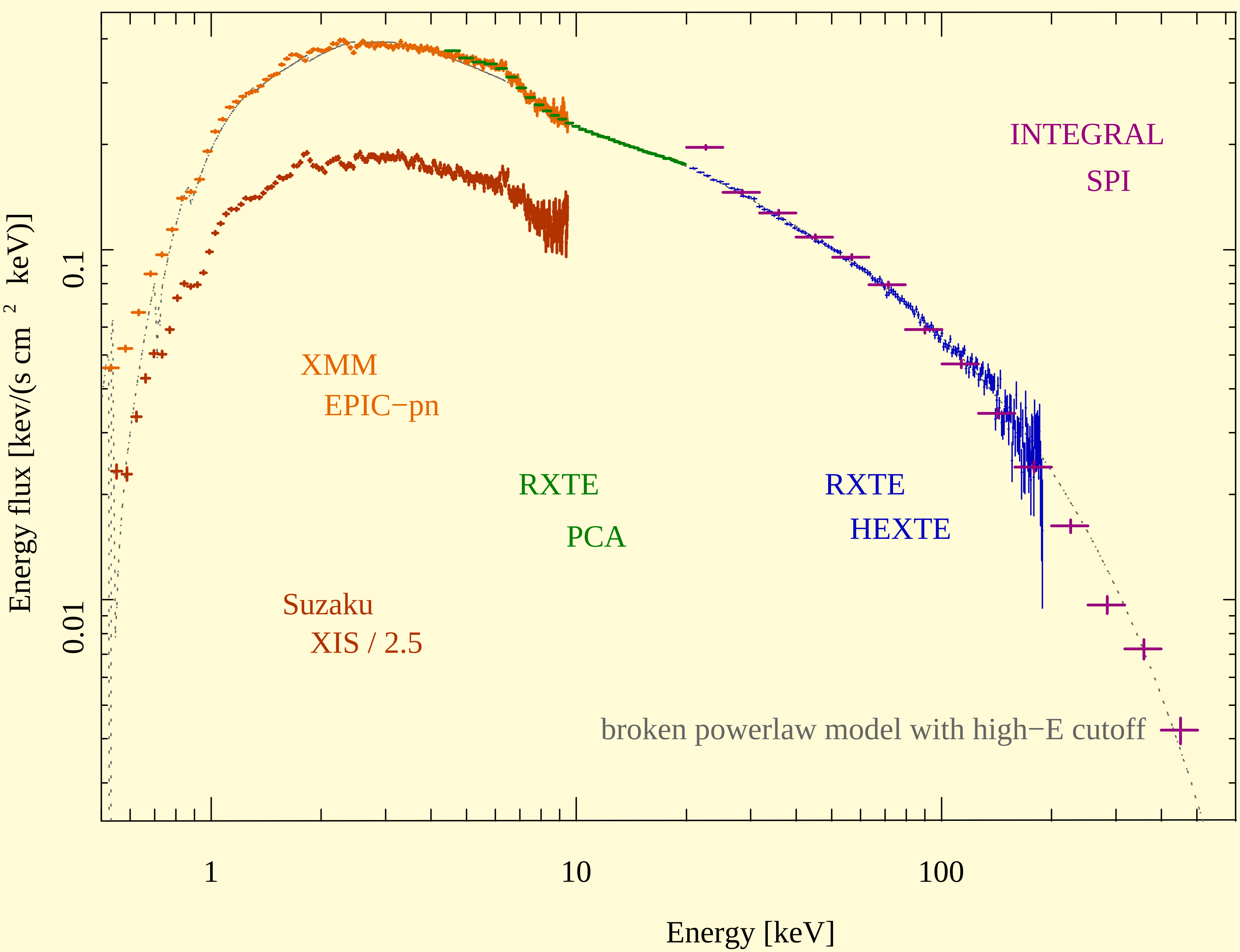


Analysis of soft spectrum complicated by

- Line absorption also present in X-ray CCDs $\Longrightarrow$ can influence N_H and soft excess!
- Scattering halo not resolved in *Suzaku* $\Longrightarrow$ mimics soft excess.

Nowak et al. (2009; in prep, this is an older simultaneous *Suzaku*/*RXTE* observation)

Broad-Band Spectrum



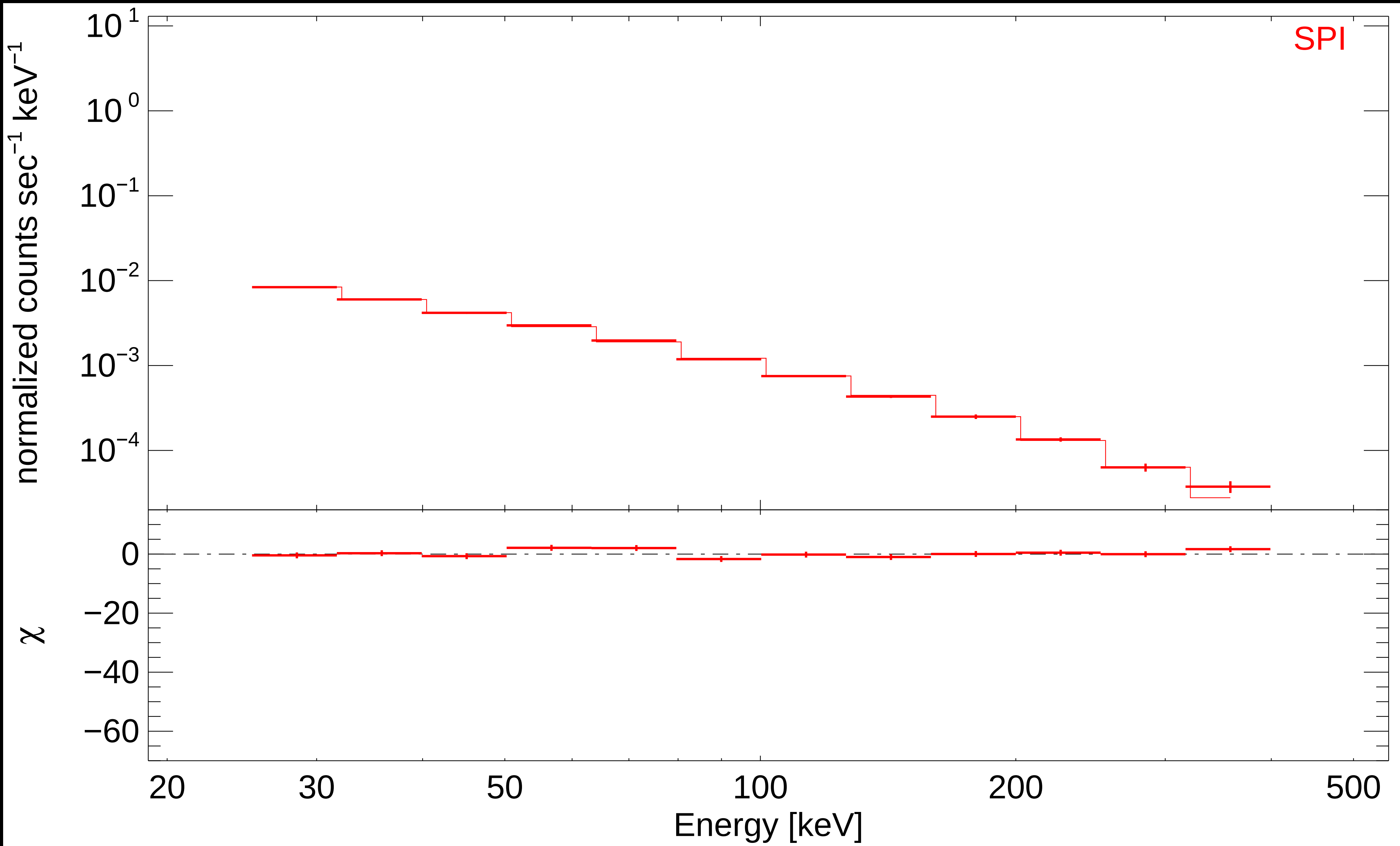
Broad-band spectrum can be well described by broken power-law with exponential cutoff and fairly standard spectral parameters typical for a harder "hard state" (e.g., Wilms et al., 2006)

Analysis

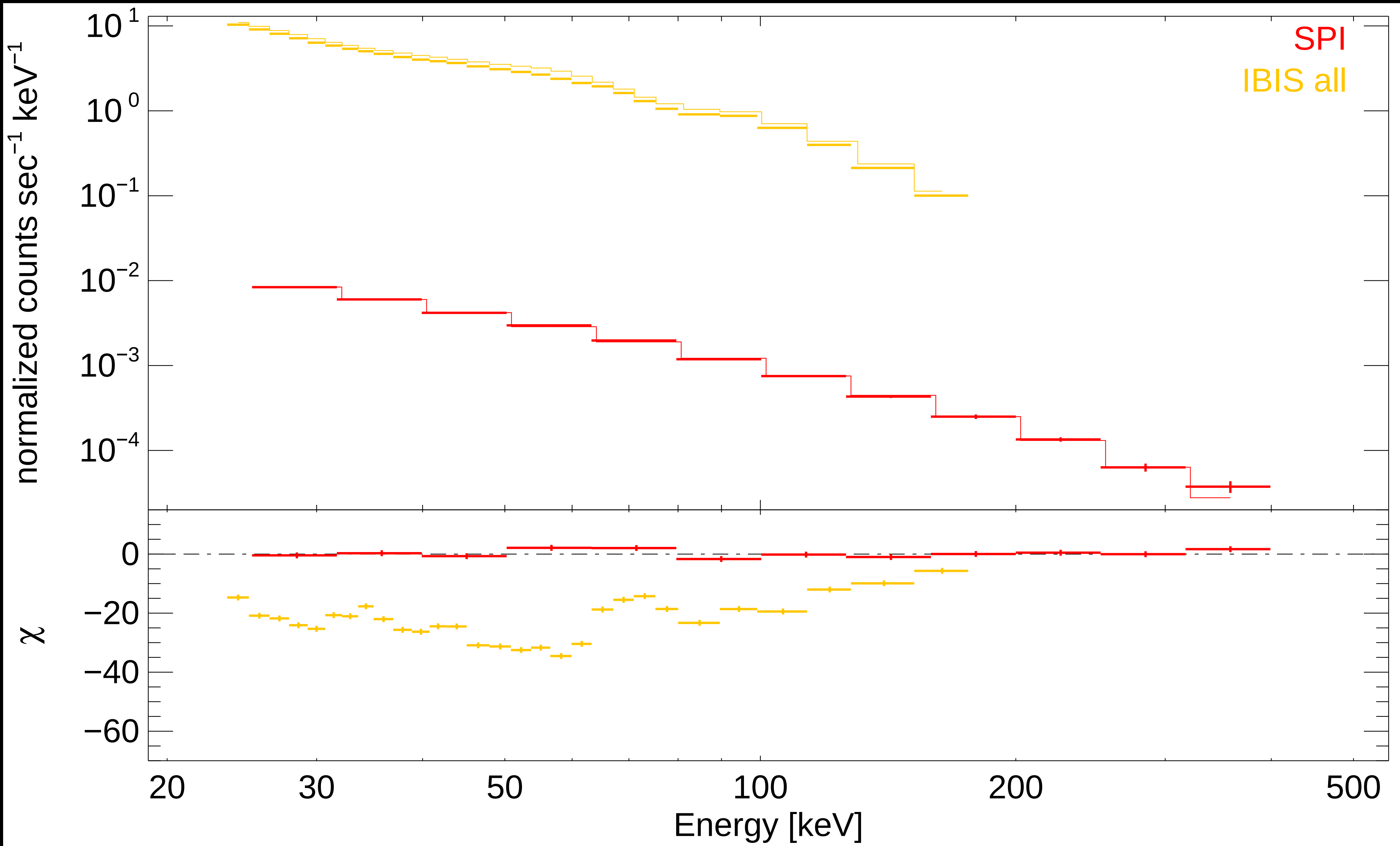
Analysis to compare cross calibration for $>$20 keV:

- time averaged data (high SNR, but only quasi-simultaneous)
- Newest officially available calibrations
- Newest officially available data reduction software
- Instruments included:
  - *INTEGRAL*-IBIS: all data (65 ksec) and FCOV only (11 ksec)
  - *INTEGRAL*-SPI: with MCM filtered bg model (82 ksec)
  - *RXTE*-HEXTE A and B (7 ksec each)
  - *Suzaku*-PIN (10 ksec)
  - *Suzaku*-GSO (with Crab fudged ARF; 10 ksec)

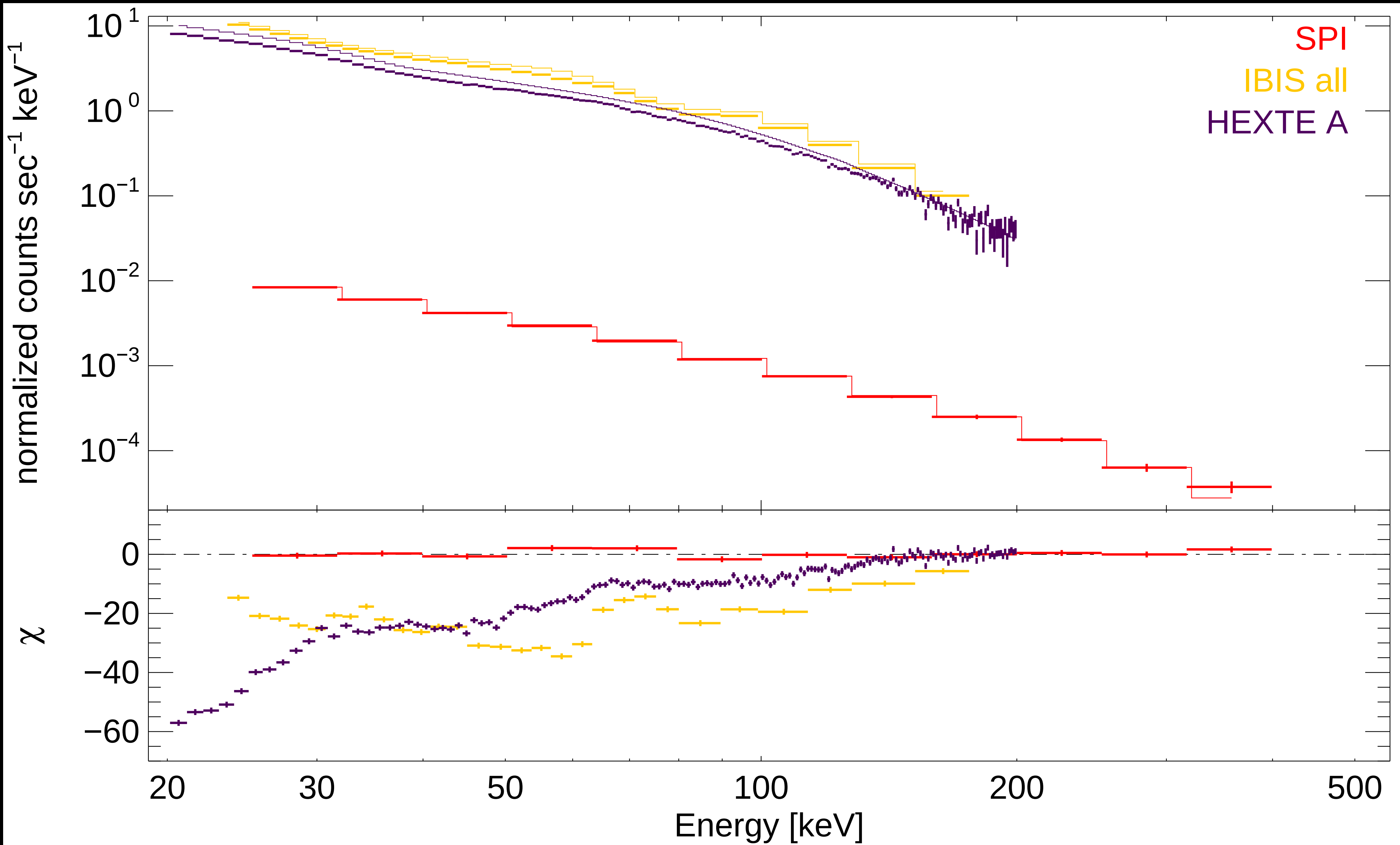
Since we're comparing instruments wrt each other, comparison to a simple spectral model is sufficient.



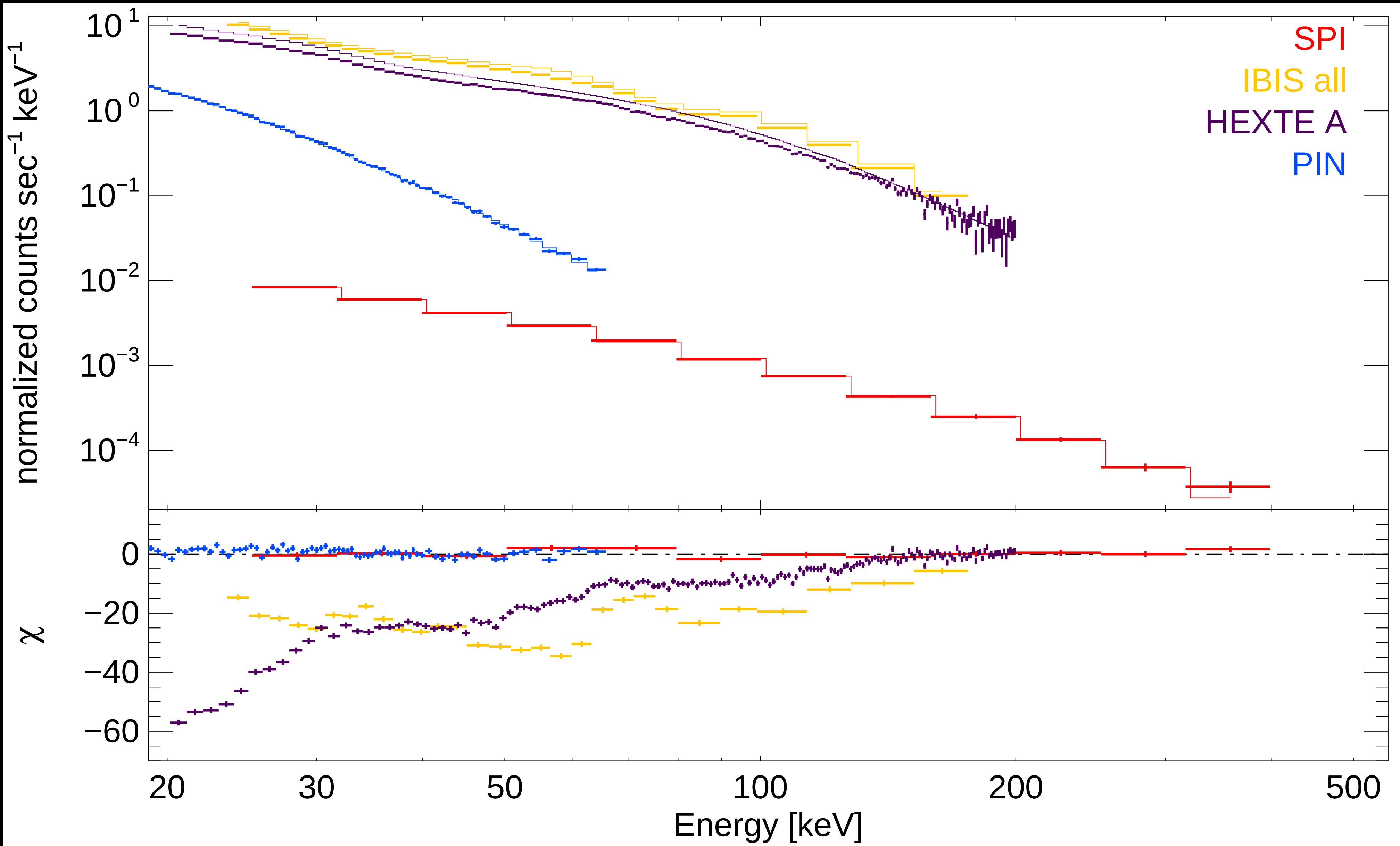
Comparison with respect to best fit SPI cutoffpl



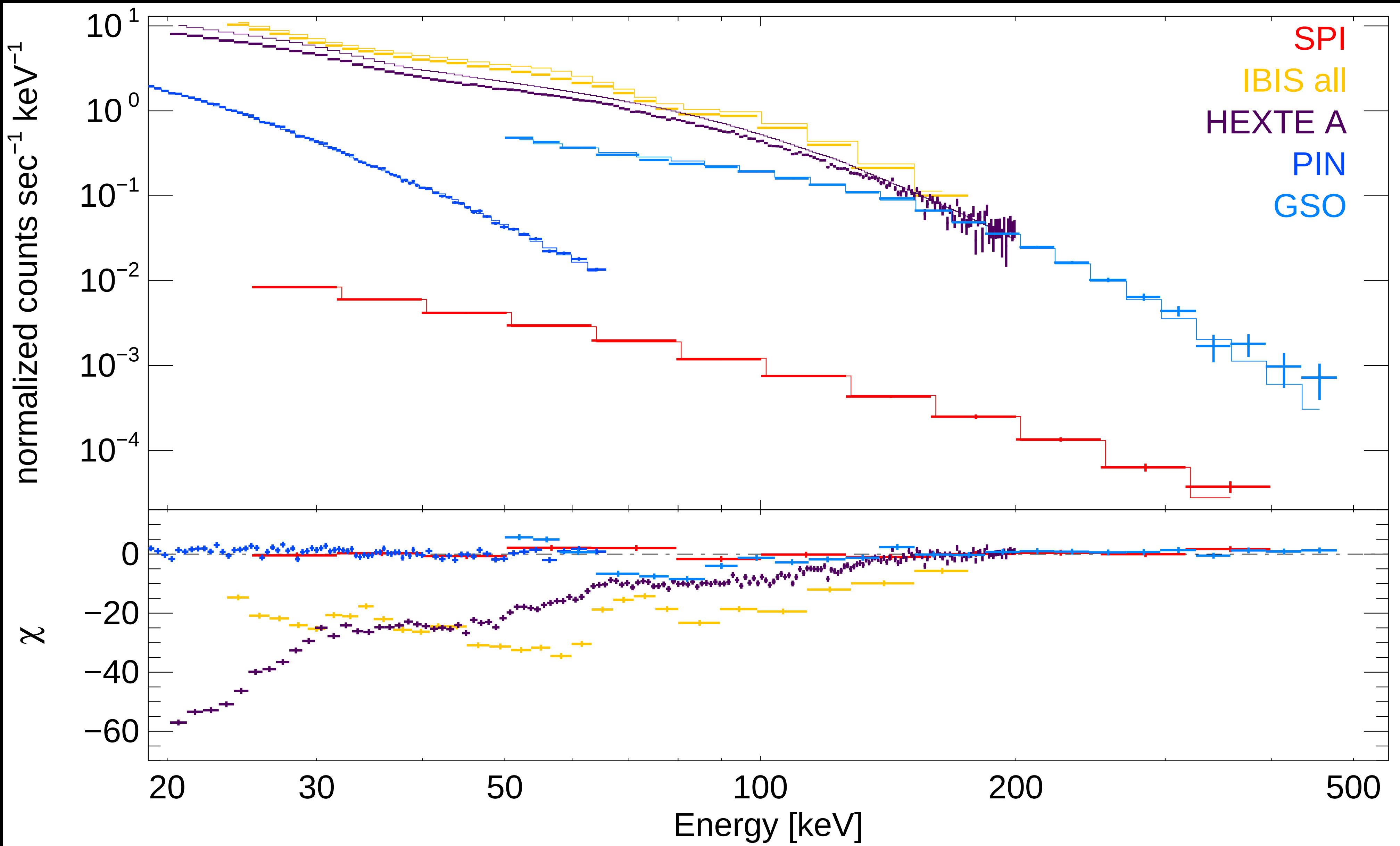
Comparison with respect to best fit SPI cutoffpl



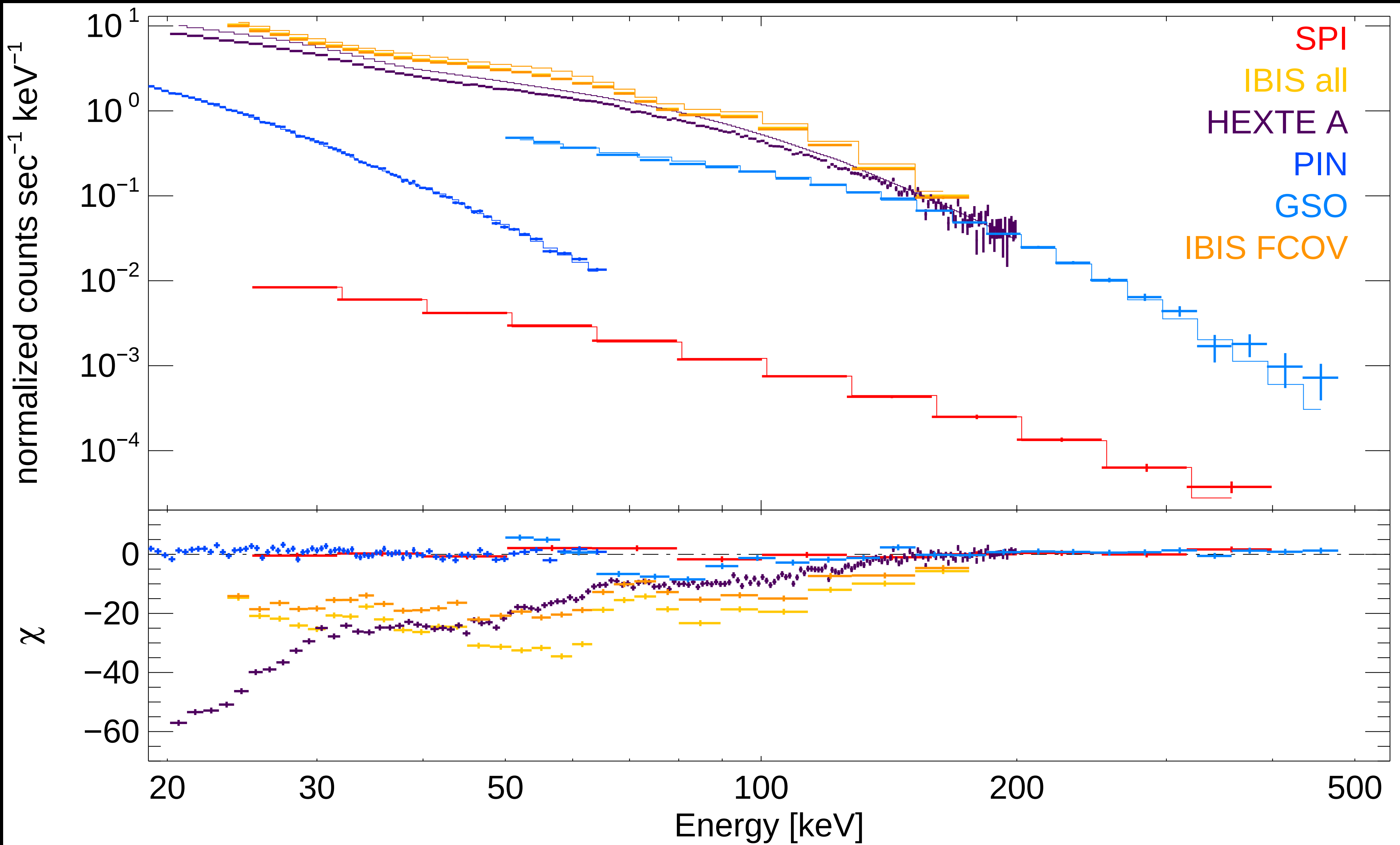
Comparison with respect to best fit SPI cutoffpl



Comparison with respect to best fit SPI cutoffpl

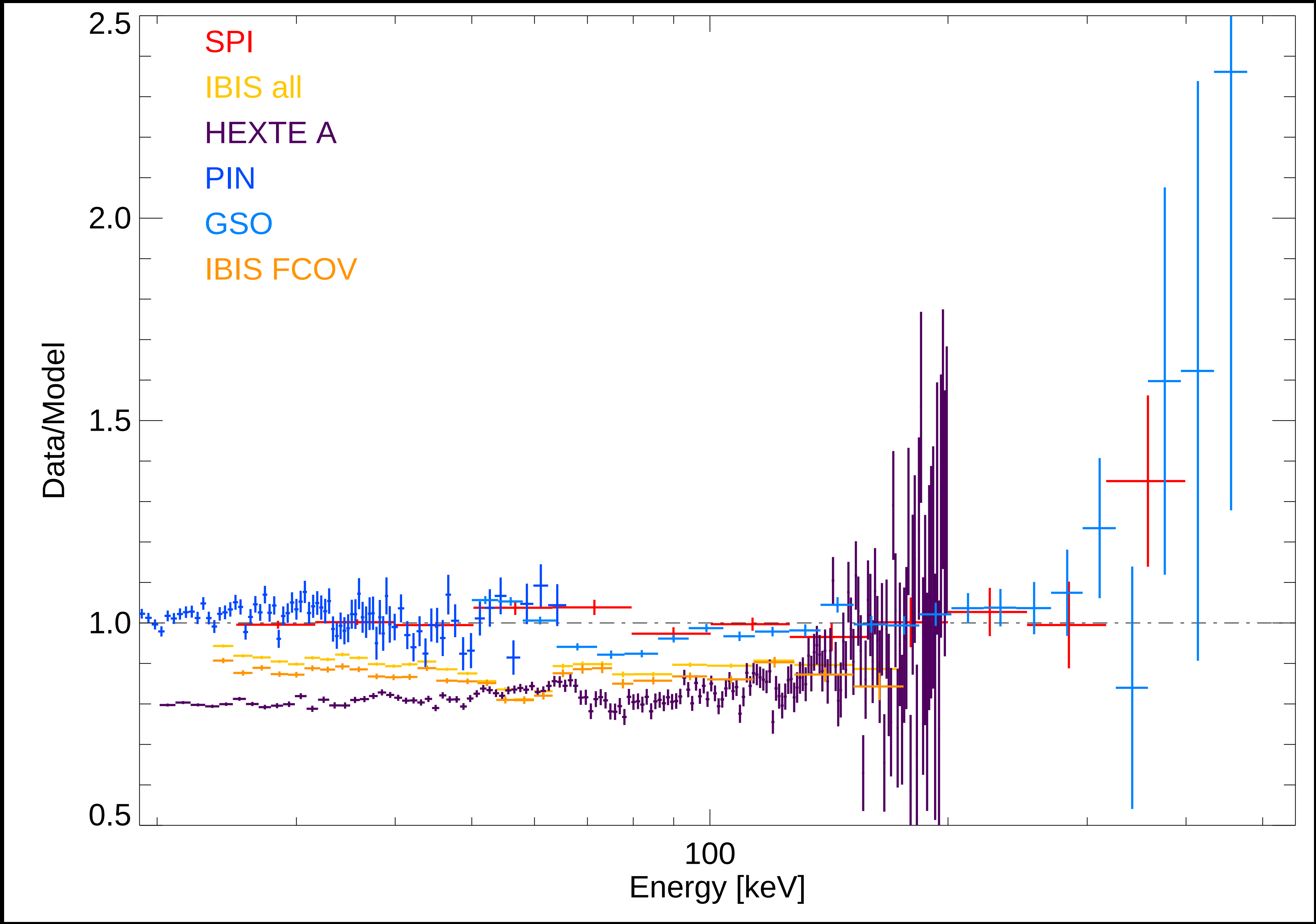


Comparison with respect to best fit SPI cutoffpl

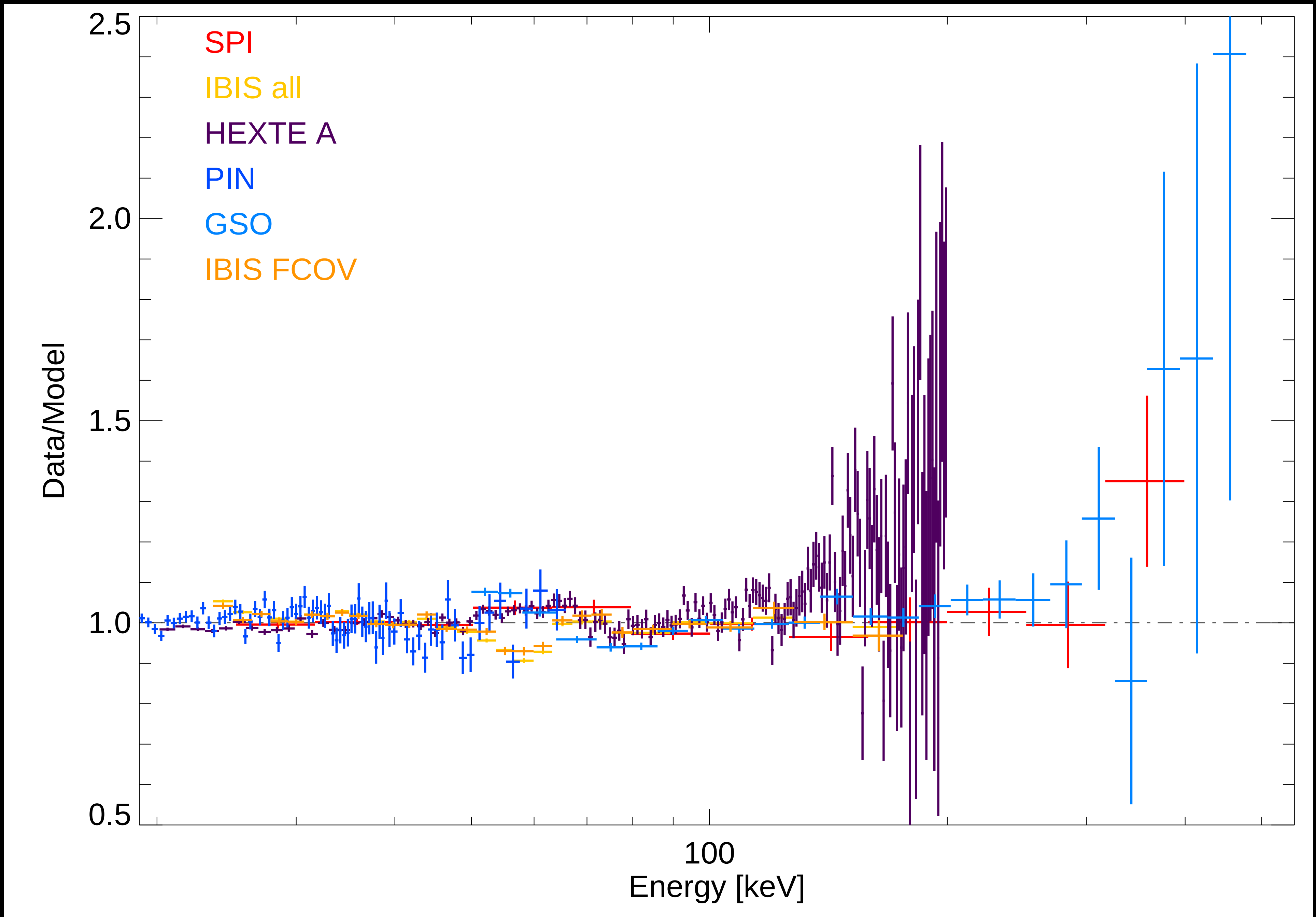


Comparison with respect to best fit SPI cutoffpl

But in reality this is unfair ("χ punishes high SNR instruments") $\Longrightarrow$ look at ratio

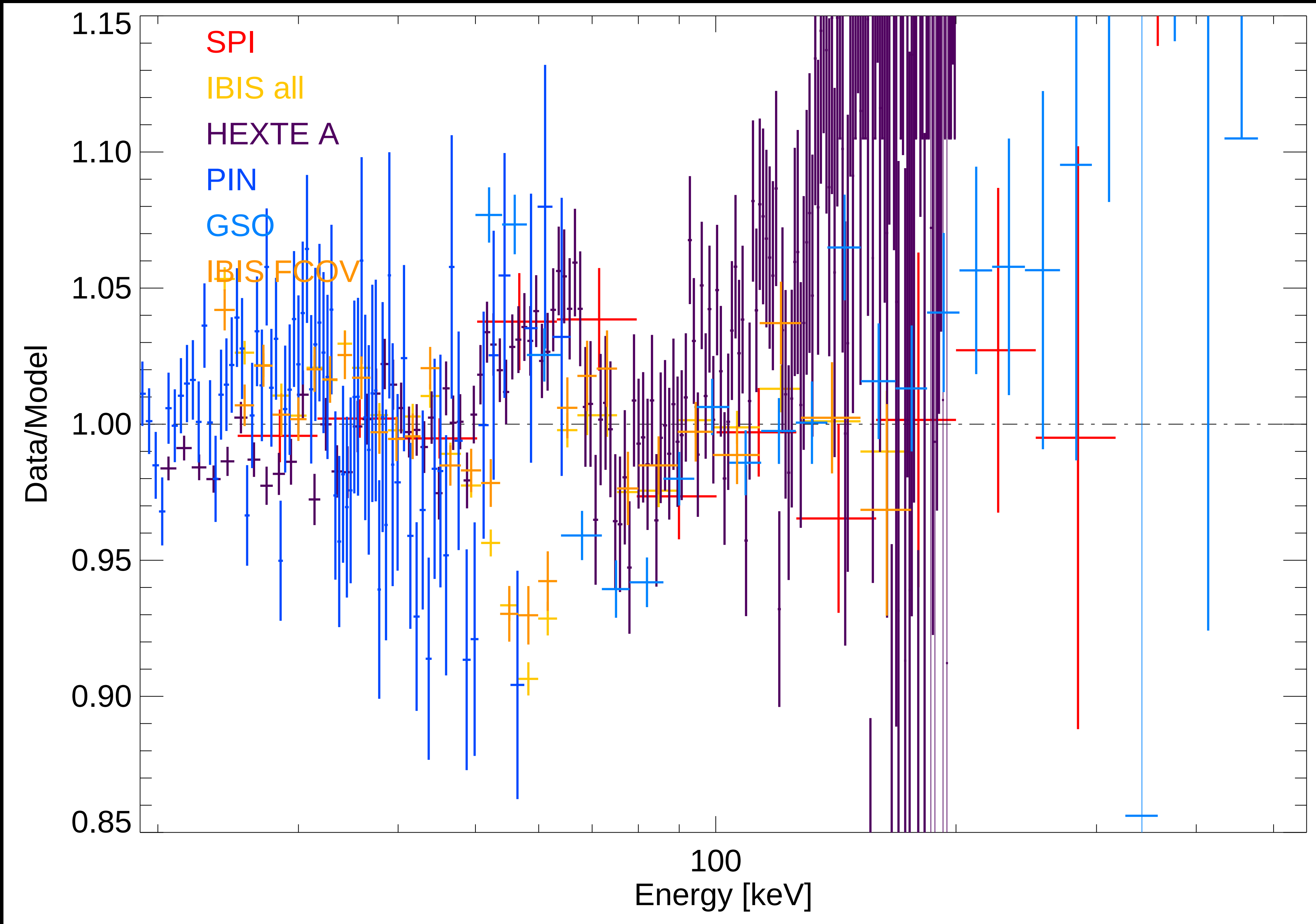


As expected, the major difference between the instruments is in the flux normalization



Same continuum as before, but with multiplicative constant (SPI=1).

IBIS: 0.90, IBIS FCOV: 0.87, HEXTE: 0.81, HXD: 1.01, GSO: 0.98



IBIS: 0.90, IBIS FCOV: 0.87, HEXTE: 0.81, HXD: 1.01, GSO: 0.98

Deviations $<$200 keV are at the $\pm 5\%$ level

Remarks & Outlook

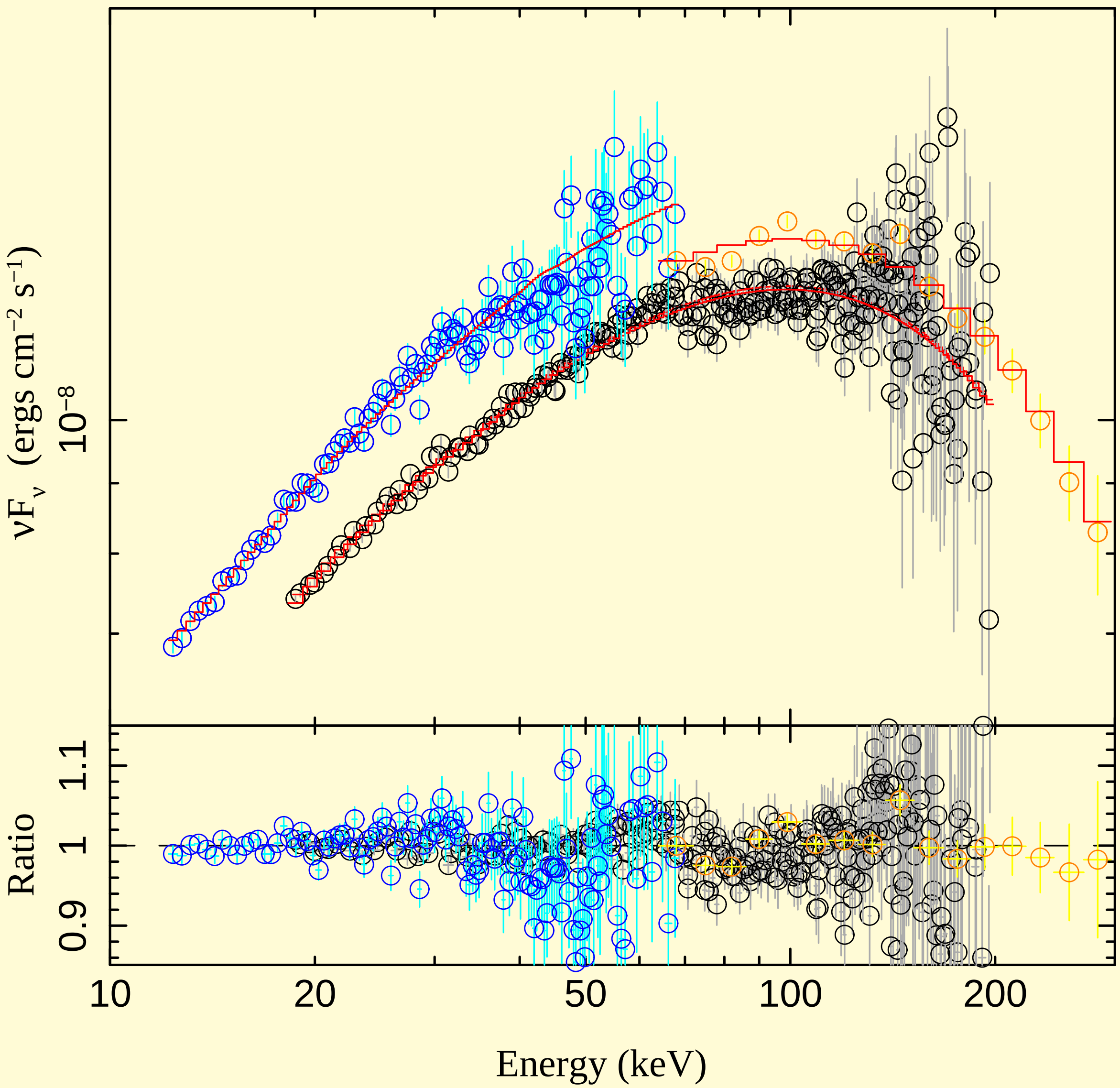
Remarks:

- agreement better than expected (except for flux!)
- further slight improvement possible when allowing different slopes, but quantification difficult (correlation E_{cut} and Γ)
- minimizing χ^2 by varying background in PIN/GSO *and* fitting results in 10% difference of PIN and GSO, for *INTEGRAL*

Outlook:

- we will be using better time cuts (spectral variability!)
- include soft data (*RXTE*-PCA, *Suzaku*-PIN, *Swift*-XRT, *Chandra*, *XMM-Newton*)
- add *Swift*-BAT

Remarks & Outlook



Caveat: νf_ν with “corrfile” gives

SPI:PIN:GSO 1:0.84:0.91