Status of the XIS Orbital Calibration and Softwares

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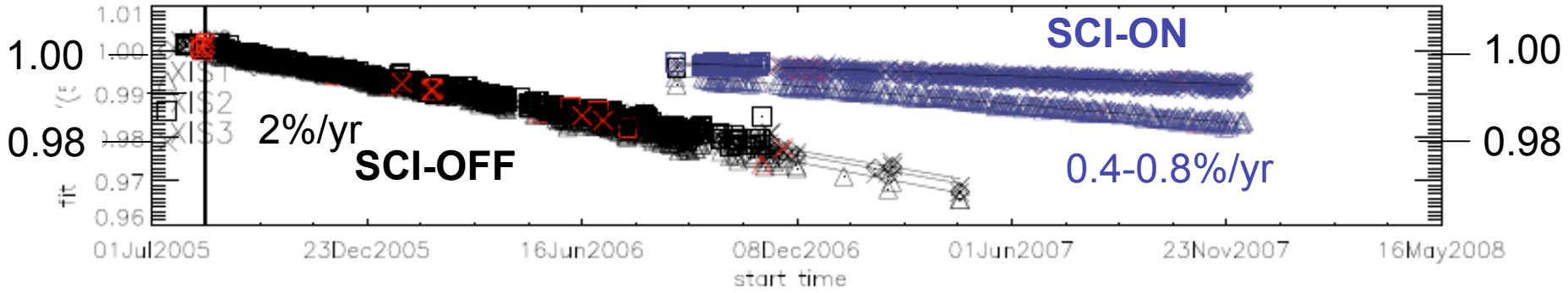
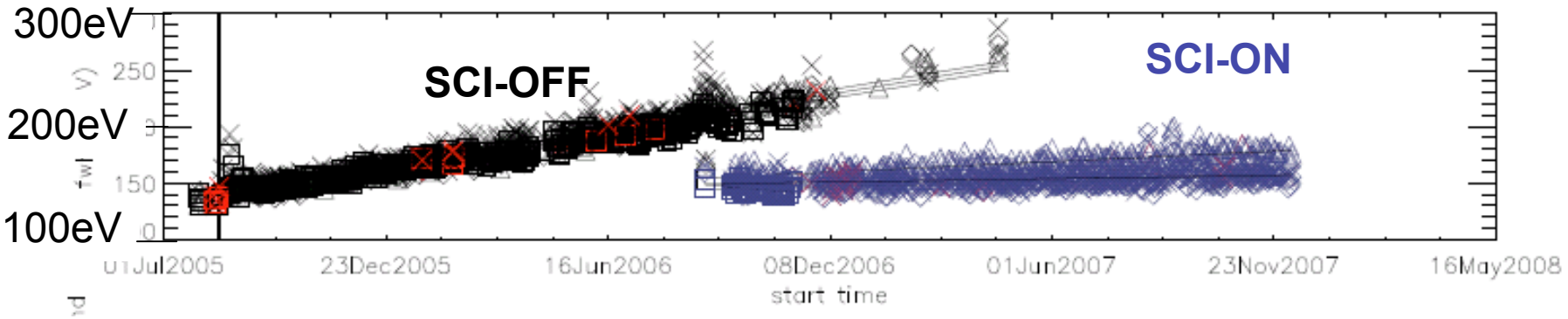
Current Status of the XIS

- No significant change in the XIS hardware since the last Users' Meeting 2007May
- SCI-ON for all the observations

Peak ch of Mn Kα from ^{55}Fe calibration sources / that at the lauch



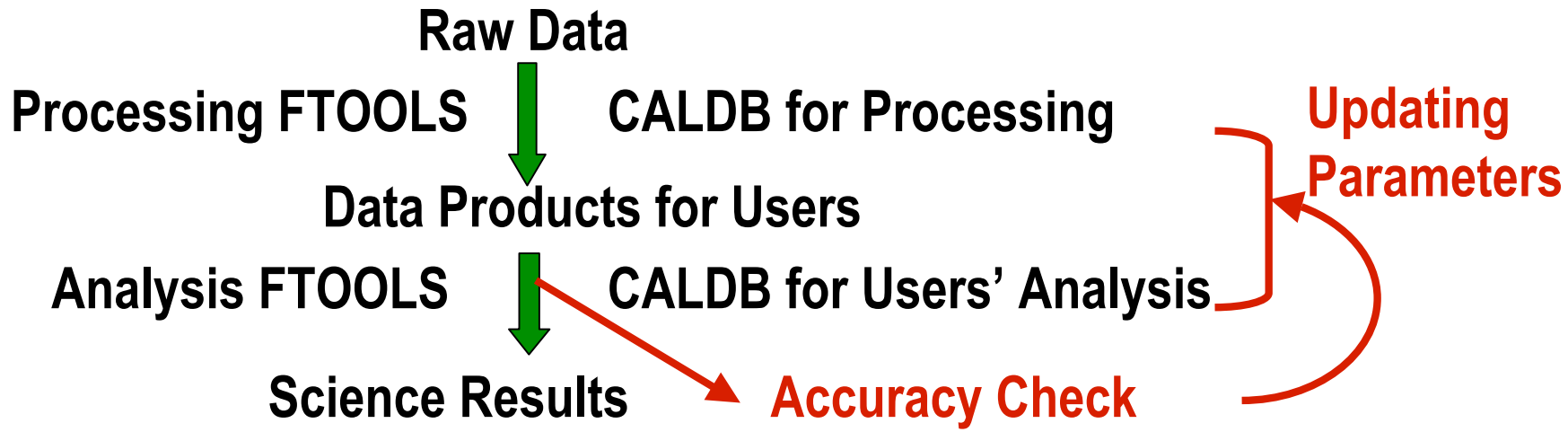
FWHM of Mn Kα from ^{55}Fe calibration sources



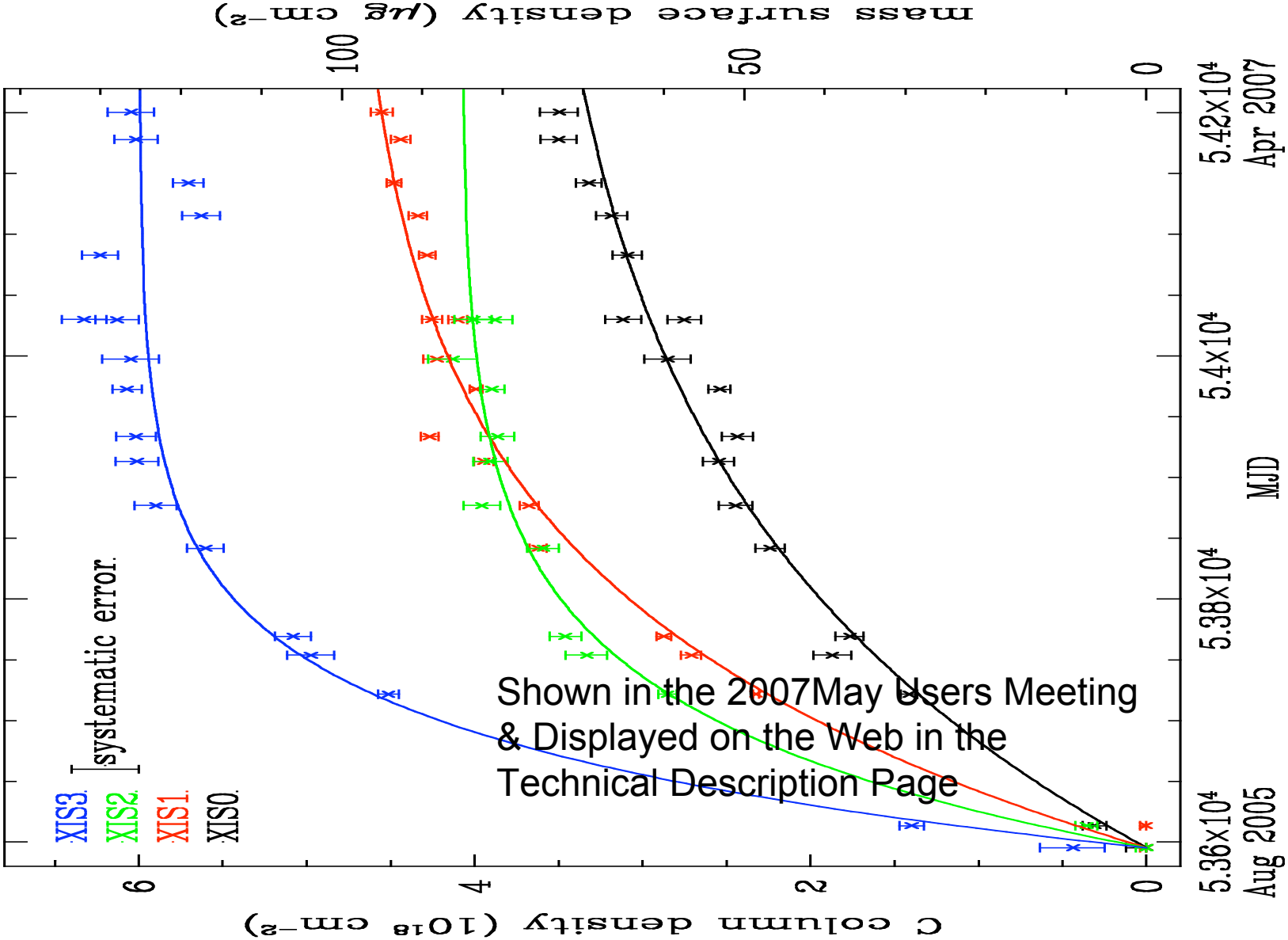
Ver. 2 Processing & HEASOFT6.4

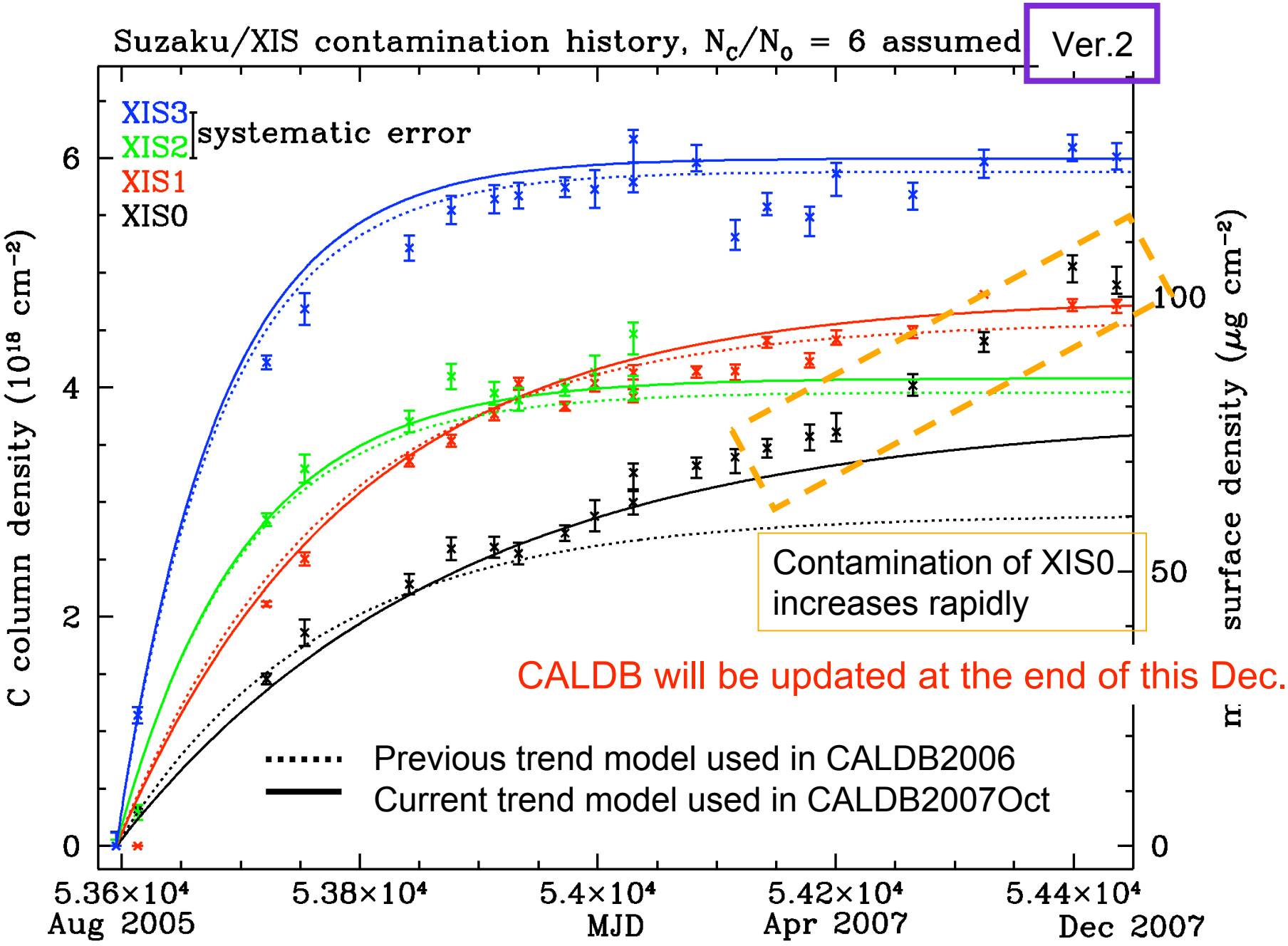
- Ver. 2 processing started.
  - Full processing of the SCI-ON data
- HEASOFT v6.4
  - Updates + New software xisnxbgen is introudced
- CALDB updated (as always)

Quality of the CCD Data (accuracy of the energy scale etc) is significantly affected by the processing

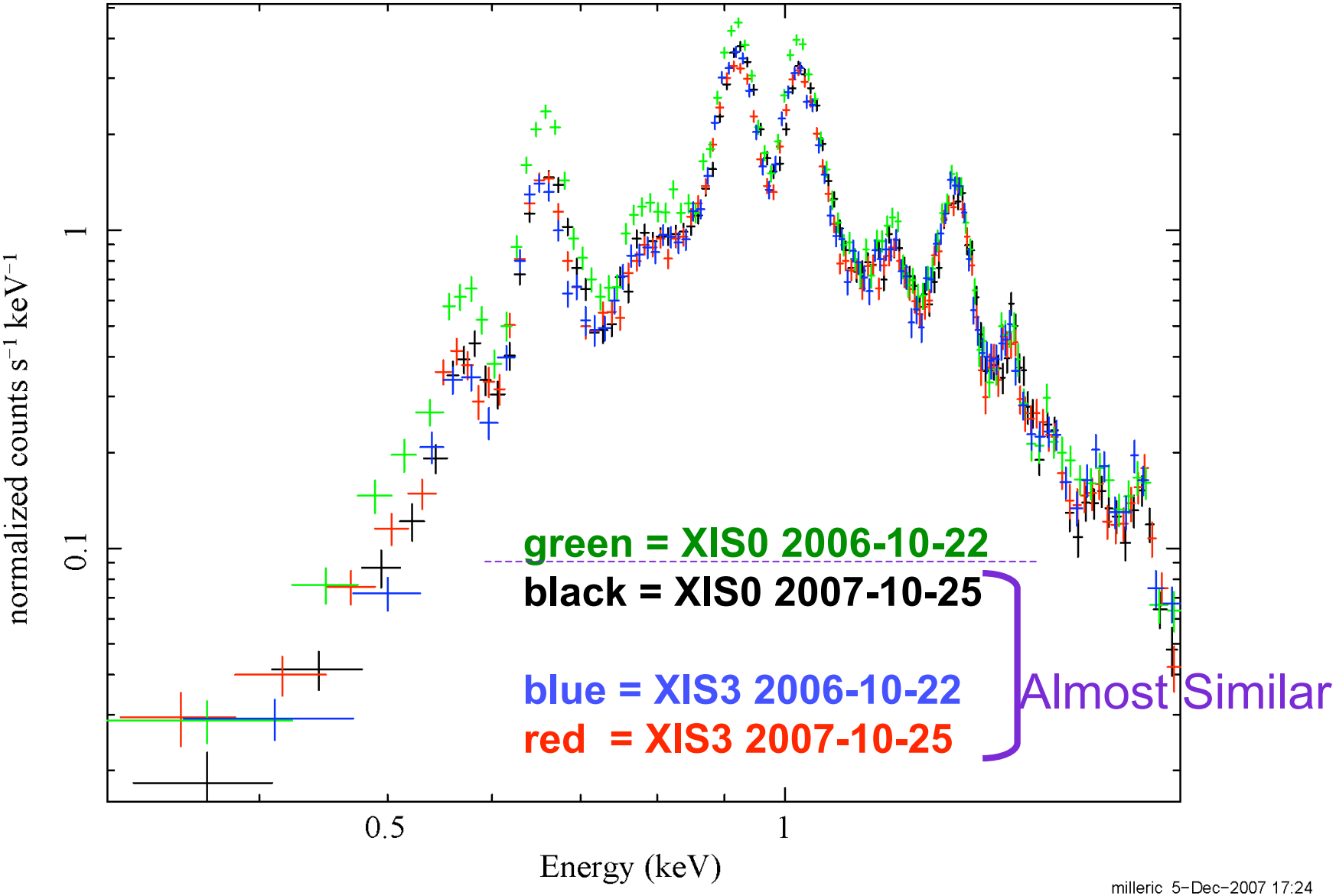


Contamination on the XIS OBF until 2007Apr evaluated from E0102 obs. (ver.1.x products)

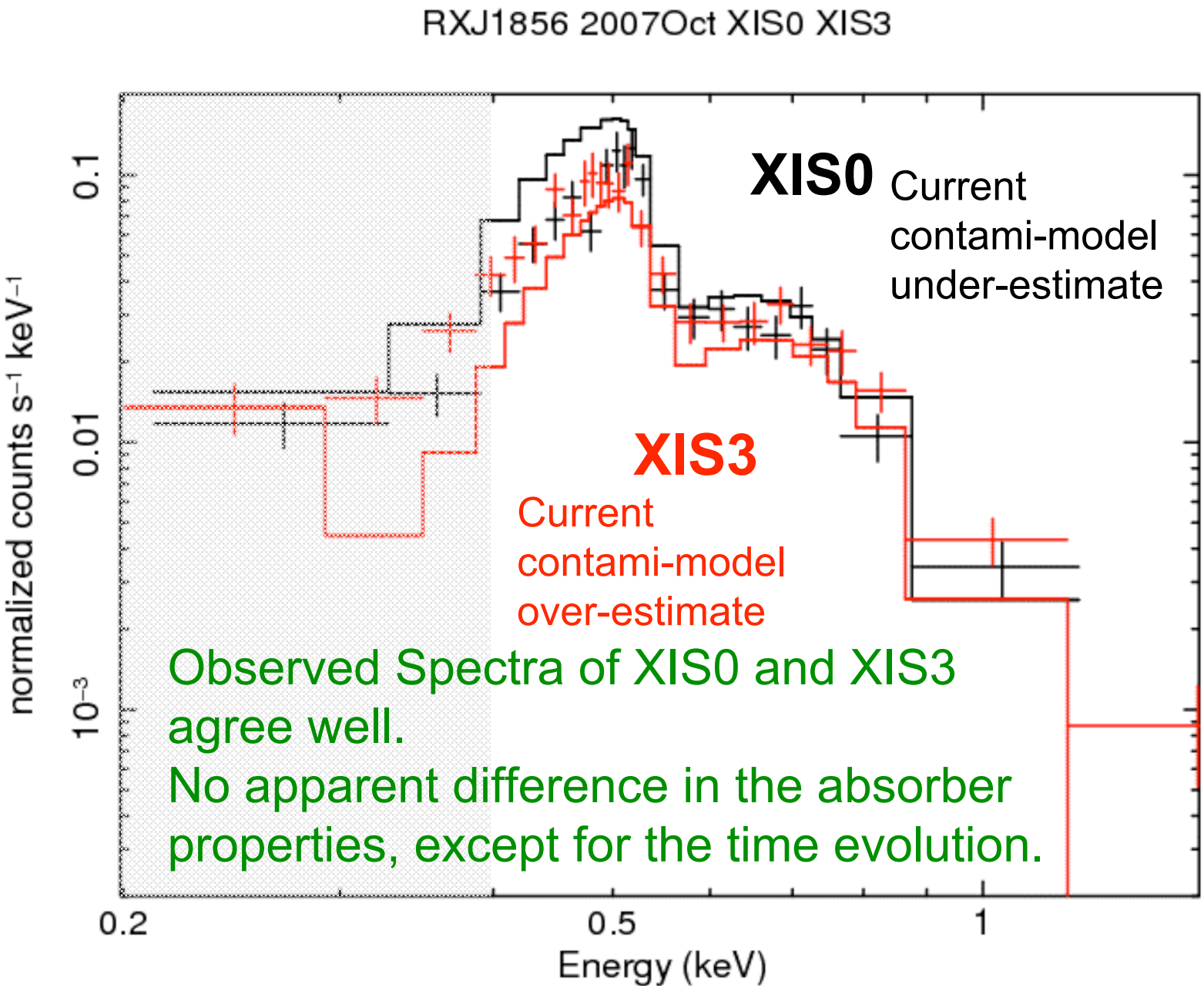



Suzaku/XIS contamination history, N_C/N_O = 6 assumed
Ver.2
XIS3
XIS2
XIS1
XIS0
systematic error
C column density (10^{18} cm^{-2})
surface density (μg cm^{-2})
0
2
4
6
0
50
100
5.36×10⁴
Aug 2005
5.38×10⁴
5.4×10⁴
MJD
5.42×10⁴
Apr 2007
5.44×10⁴
Dec 2007
Contamination of XIS0 increases rapidly
CALDB will be updated at the end of this Dec.
Previous trend model used in CALDB2006
Current trend model used in CALDB2007Oct

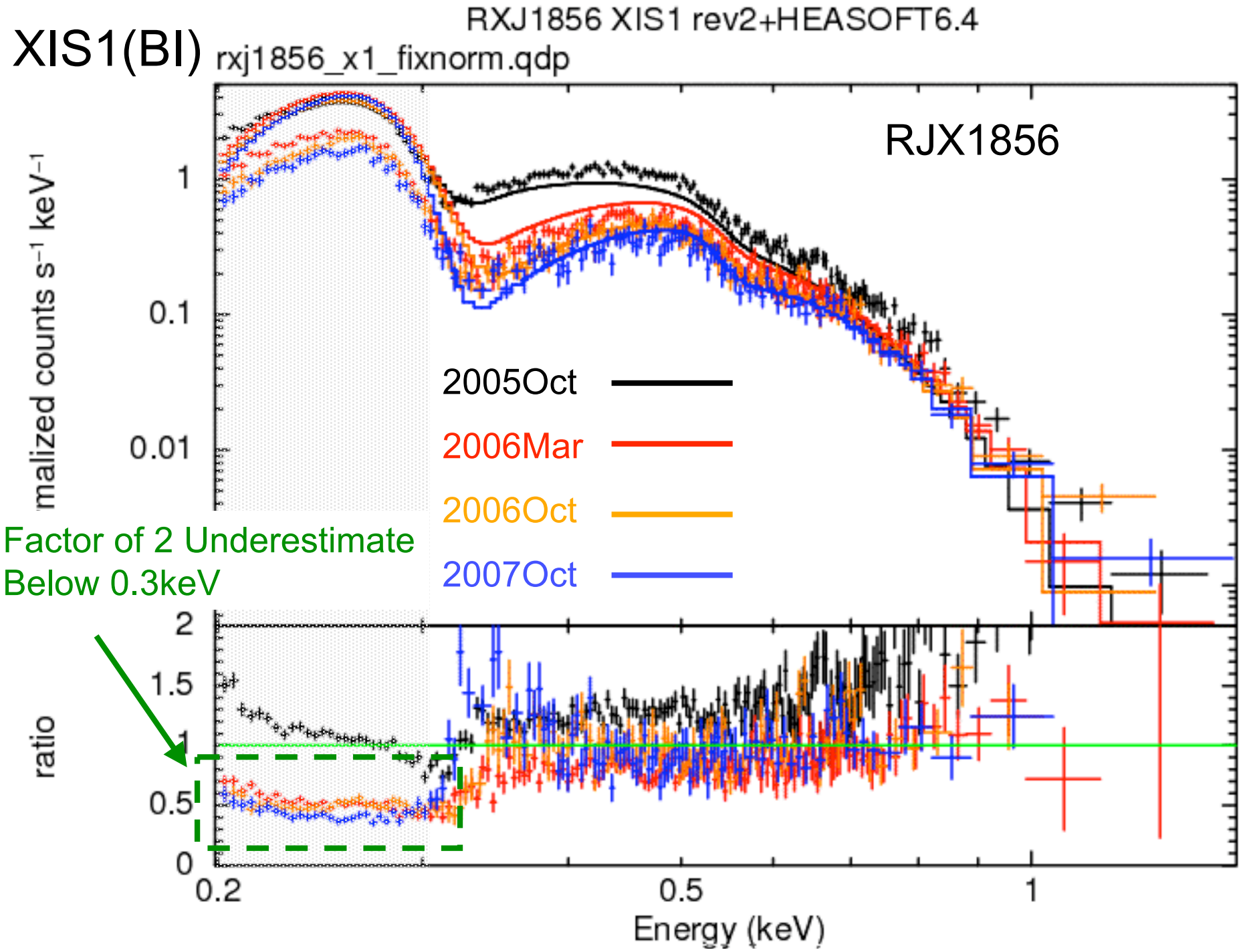
XIS0,XIS3 spectra of E0102



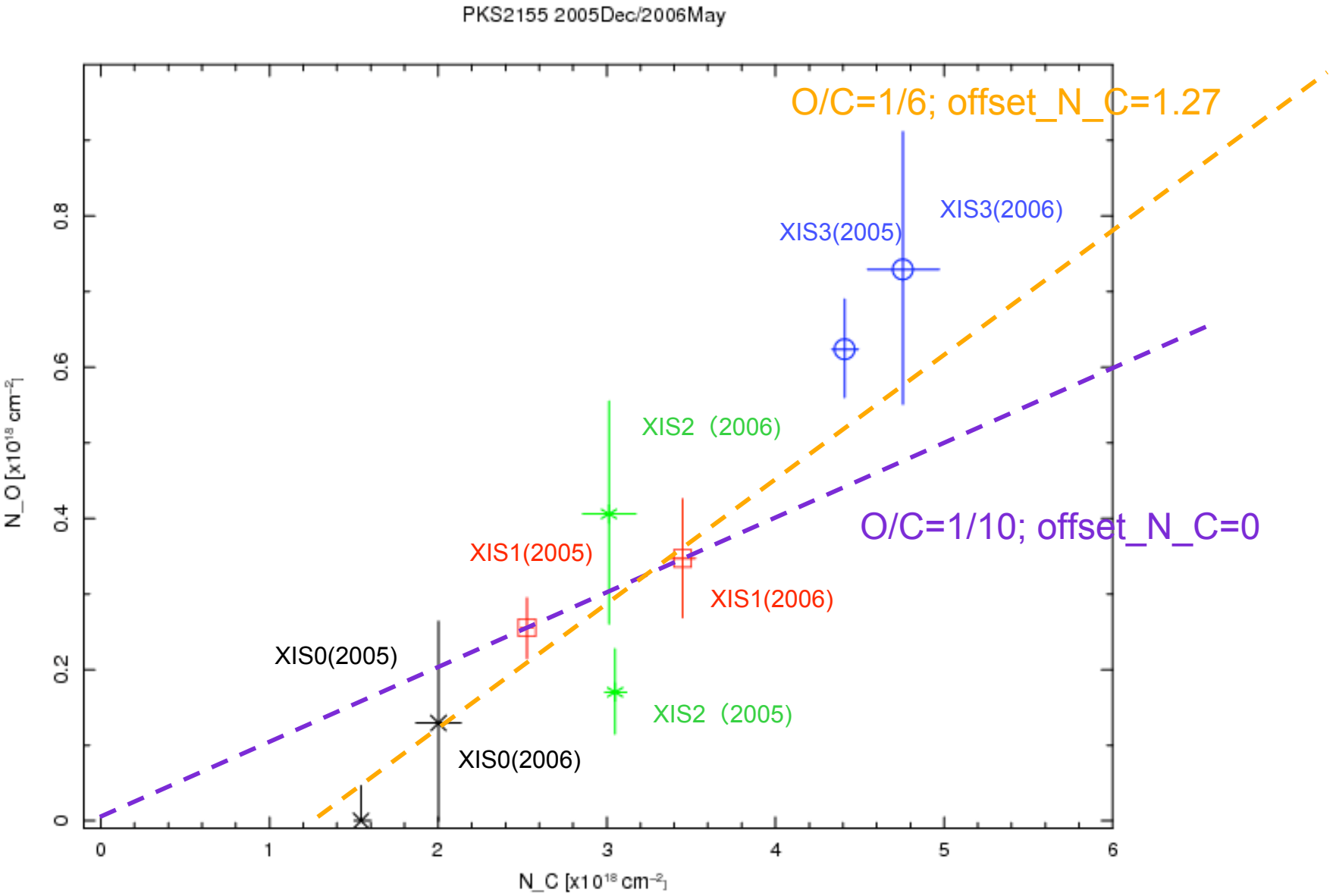
RXJ1856 observed on 2007Oct



XIS1(BI)


RXJ1856 XIS1 rev2+HEASOFT6.4
rxj1856_x1_fixnorm.qdp
RJX1856
malized counts s⁻¹ keV⁻¹
1
0.1
0.01
2005Oct
2006Mar
2006Oct
2007Oct
Factor of 2 Underestimate
Below 0.3keV
ratio
2
1.5
1
0.5
0
0.2
0.5
1
Energy (keV)

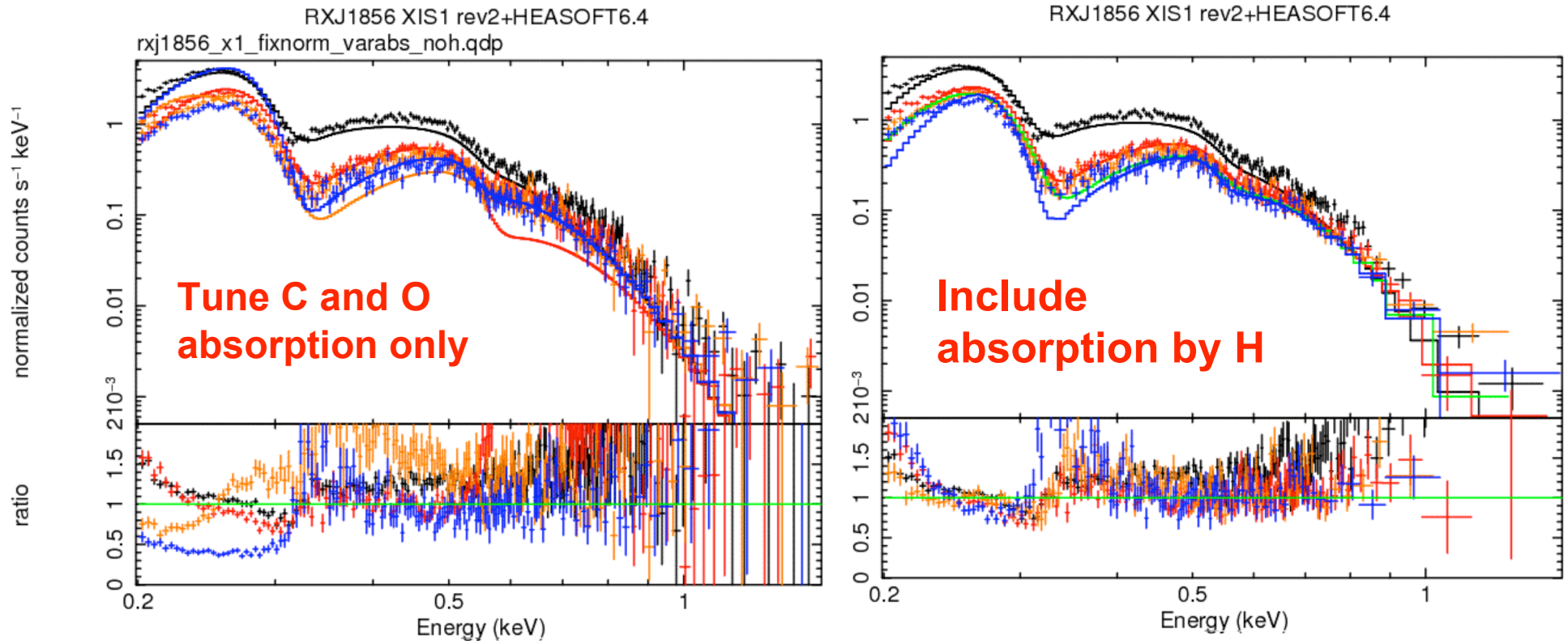
Contamination N_O vs N_C



*)Error bars are 90% error for 2parameters confidence,i.e., delta χ2=4.61

Factor of 2 underestimate below 0.3keV

- Unable to improve the fit only with C & O
- Absorption by Heavier Element No apparent edge found
- Absorption by H (or He) but too much ~10^{21}cm^2
- Constant Factor (Grading Problem at low energy?)

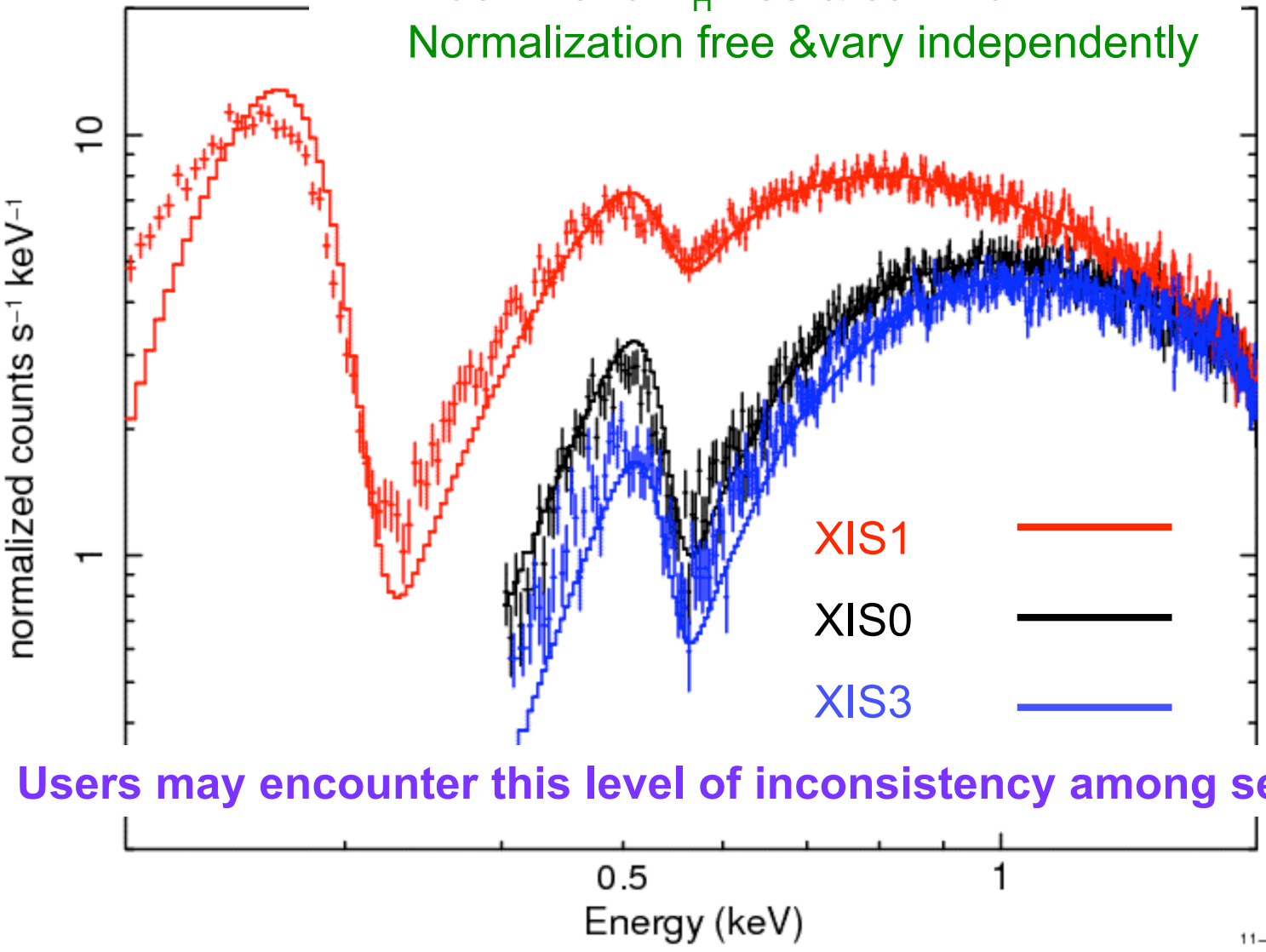


PKS2155 2007Apr

Power * Abs

Index Γ and N_H free & common

Normalization free &vary independently



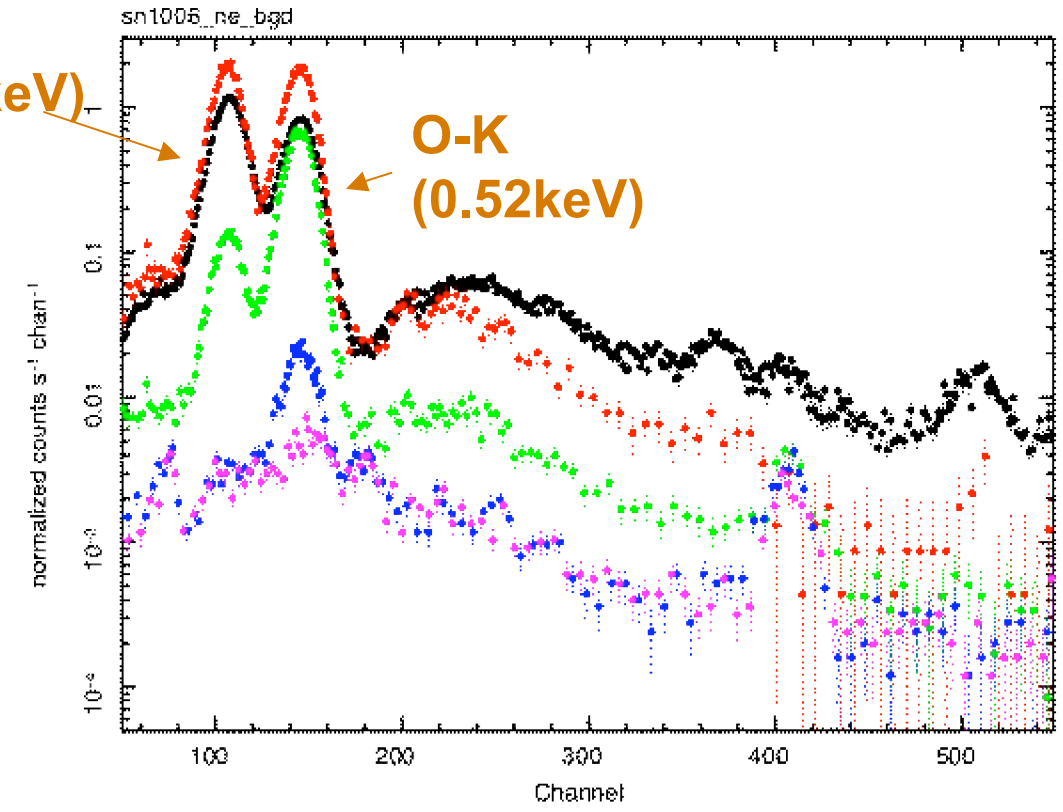
Users may encounter this level of inconsistency among sensors

Atmospheric Fluorescence Line

- When the telescope is looking at the shining Earth or its atmosphere, fluorescence lines of the Earth atmosphere (N-K, O-K) by Solar X-rays are contaminated in the observed spectra.
- Intensity and line ratio depends on the elevation angle from the Earth rim and the Solar activity.

N-K (0.39keV)

O-K (0.52keV)



DAY EARTH

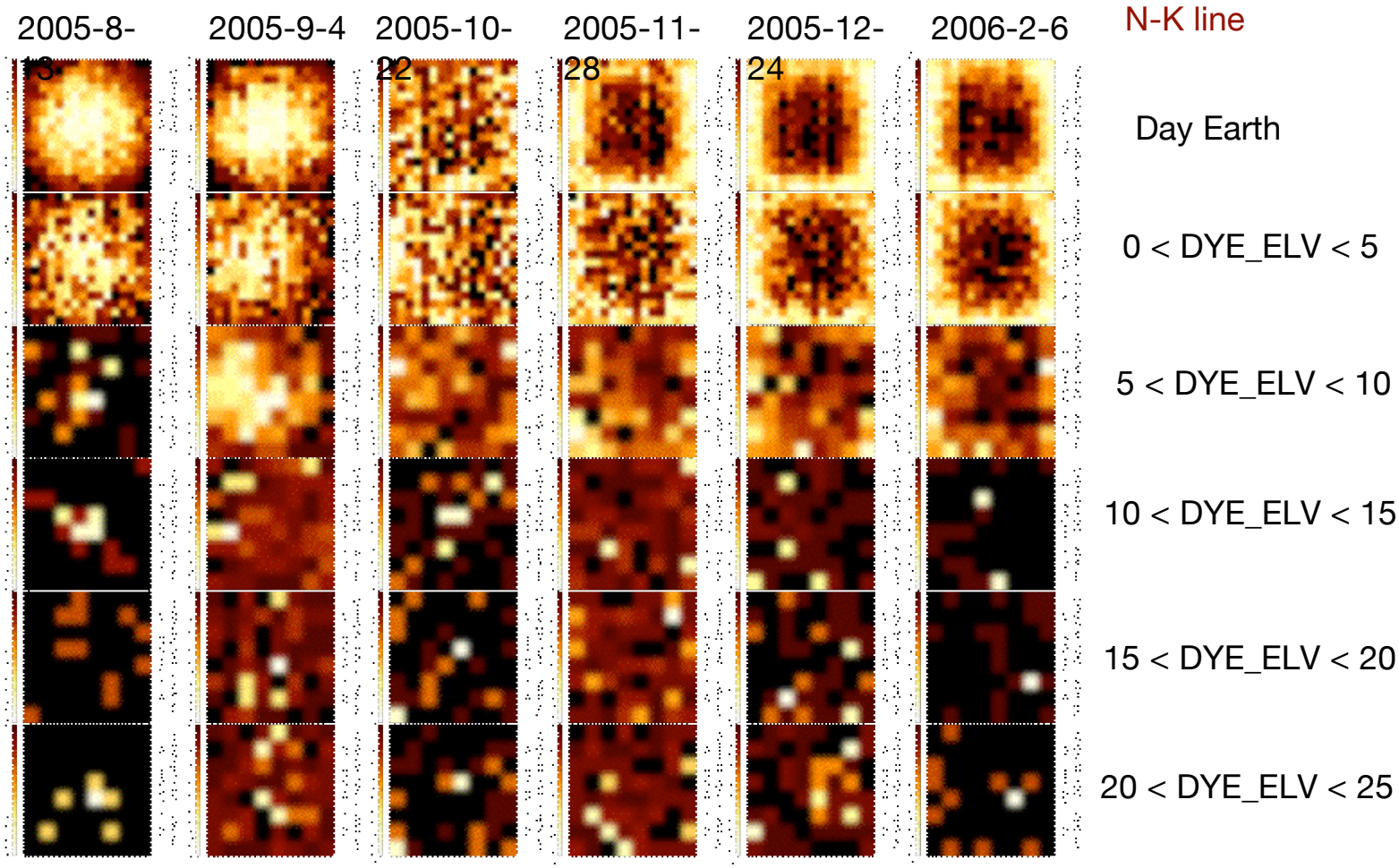
0 < DYE_ELV < 5

5 < DYE_ELV < 10

10 < DYE_ELV < 20

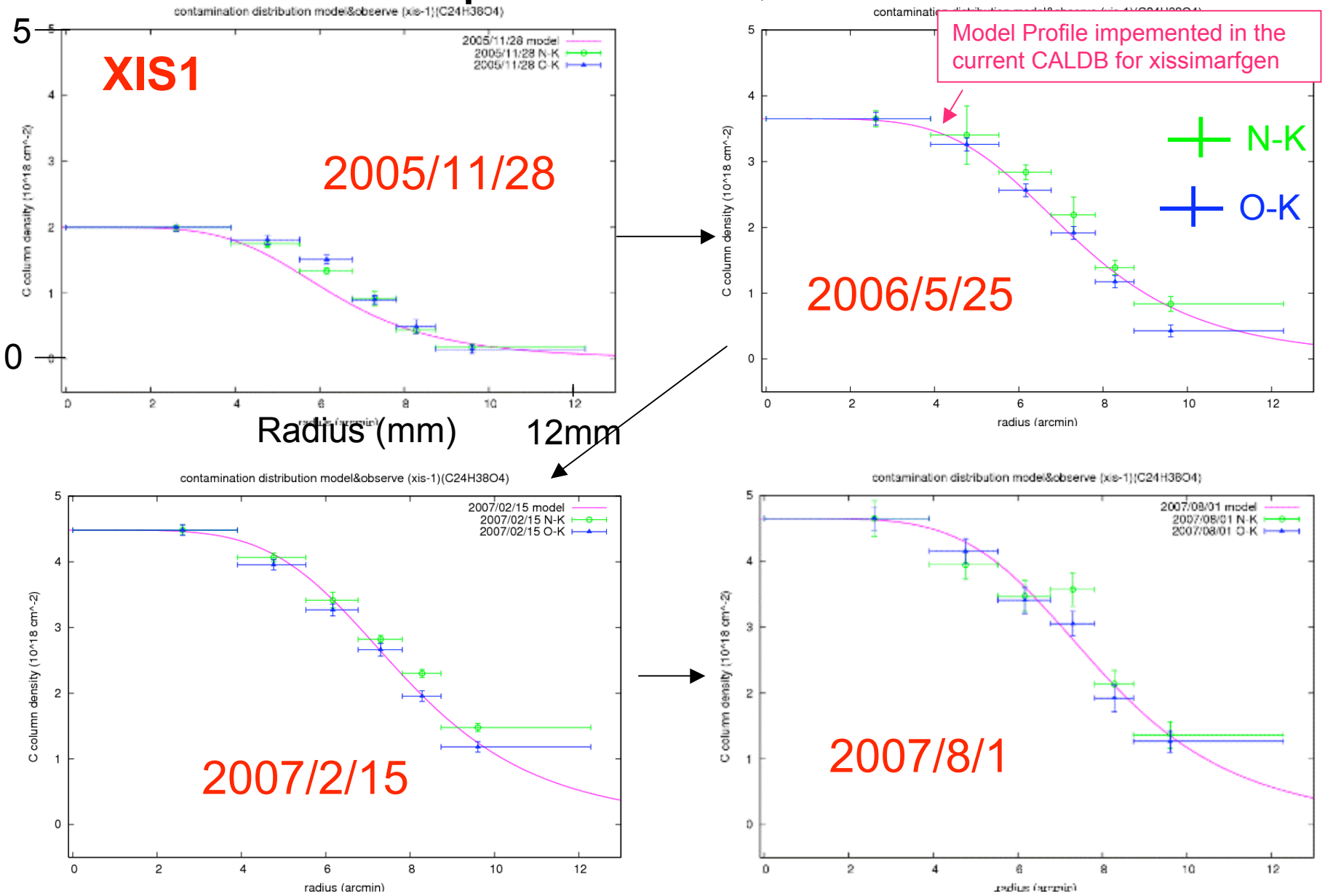
20 < DYE_ELV < 30

Detected Intensity of N-K line
can be used to measure the contamination thickness

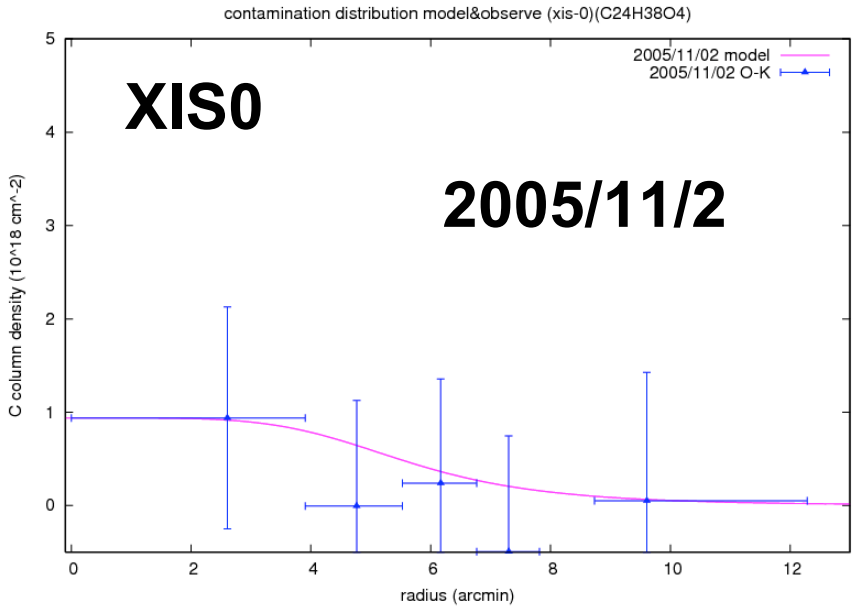


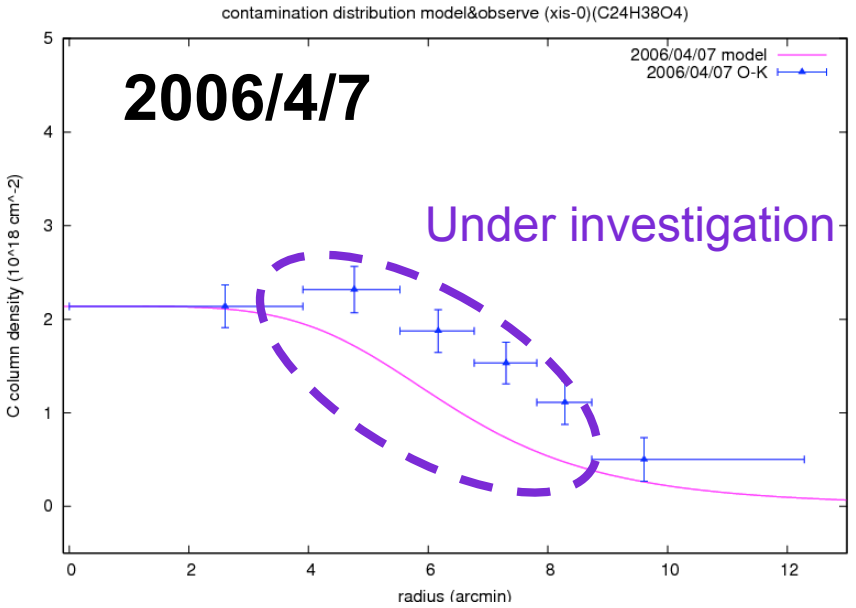
Radial Profile of Contamination from Atmospheric N-K, O-K

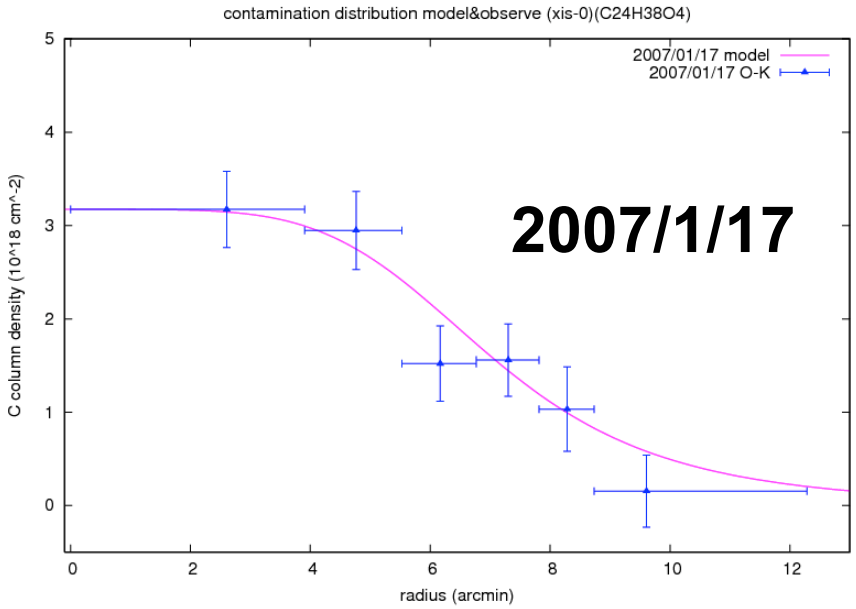
N_C(10^{18}cm^{-2})

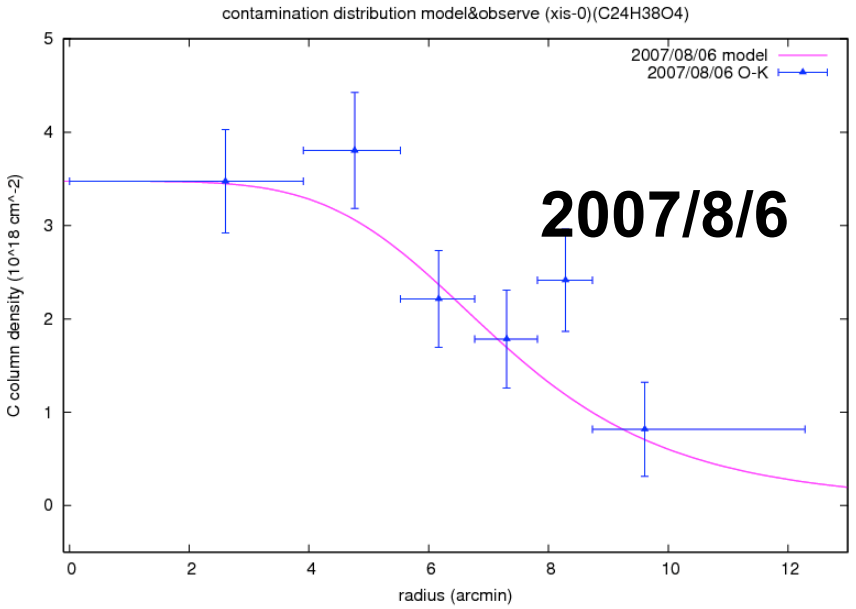


Radial Profile of Contamination from Atmospheric O-K for **FI-CCD**

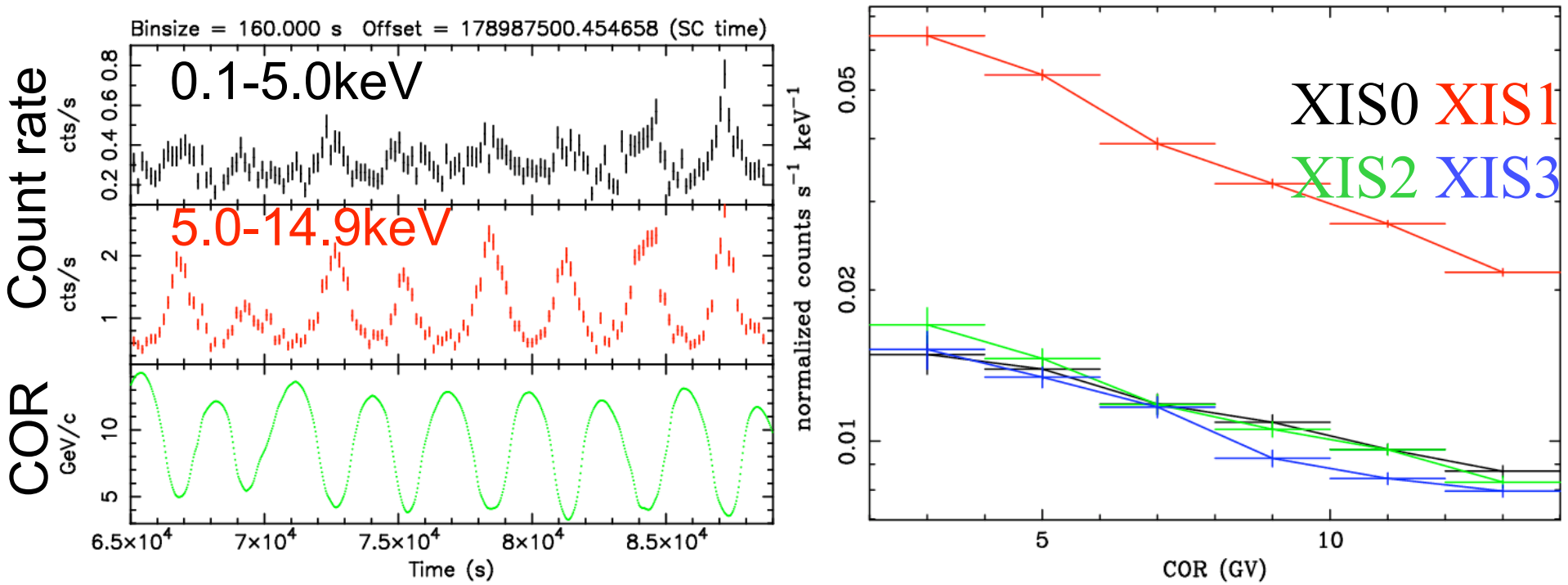








Cut-Off-Rigidity Dependence of the XIS NXB



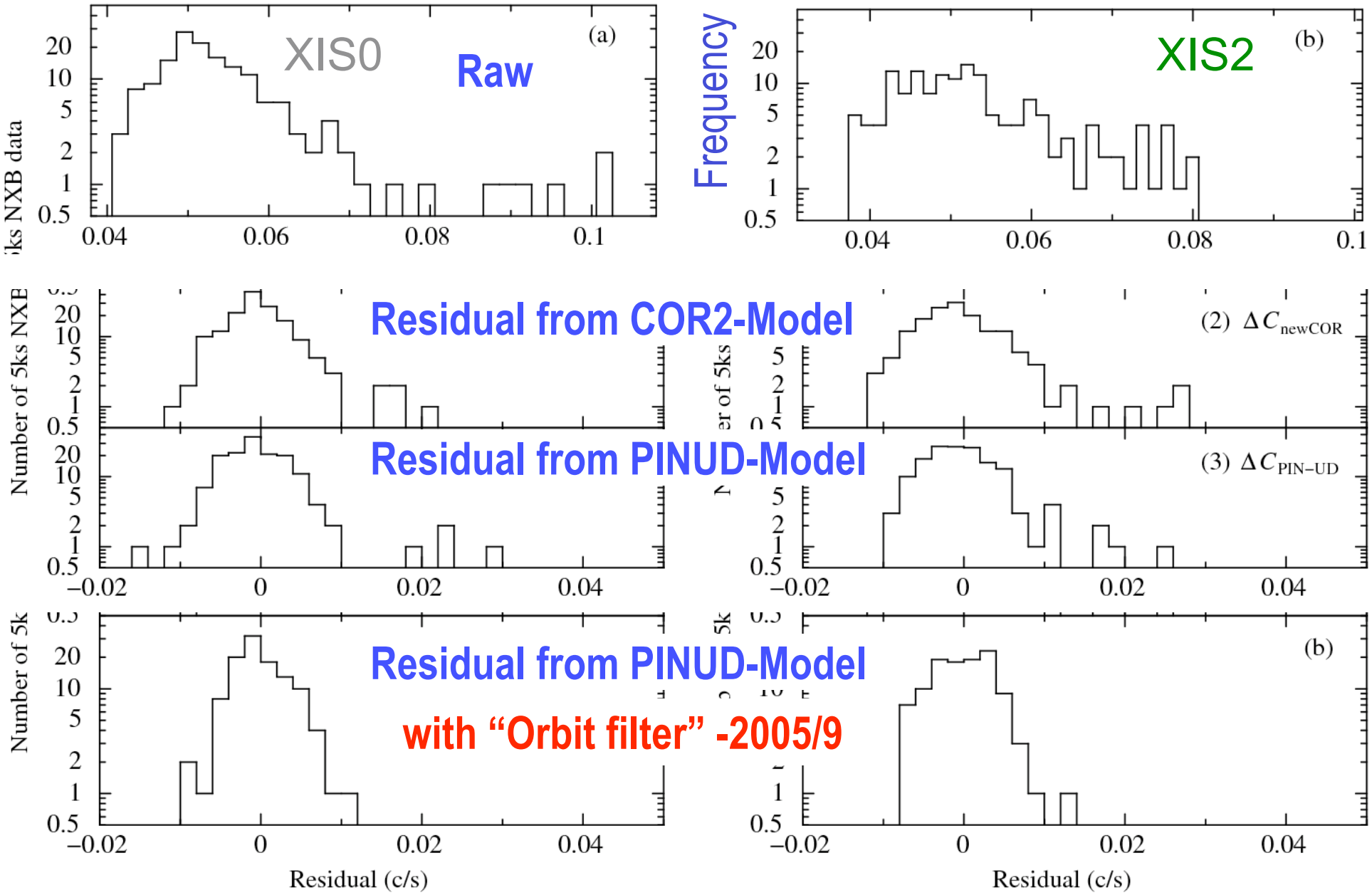
The COR dependence of the NXB can be used to model the XIS NXB.

1) Sort the NXB spectra from the Night Earth Database into each COR bin.
2) Calculate the appropriate weights of each COR bin for a given source observation.
3) Make the NXB spectrum for the given source observation by summing the sorted spectra with appropriate weights.

Other parameters, such as PINUD of the HXD, can be used instead of the COR.

5-12keV NXB (integrated for 5ks)

Tawa et al., 2008
PASJ in press



Tawa et al., 2008

Reproducibility 5-12keV XIS NXB

- 2005Oct-2006Jun (Cut 2005Sep)
- Applying “Orbit Filter”
- 5ks integration
  - Duration>>5ks

We introduced a new COR database

Parameter	COR	COR2	PINUD
XIS0	4.4±0.5%	3.5±0.7%	2.8±0.9%
XIS1	6.6±0.1%	6.9±0.1%	4.4±0.1%
XIS2	5.7±0.4%	5.7±0.4%	4.0±0.6%
XIS3	3.3±0.9%	2.4±1.2%	3.8±0.8%

% of the NXB

Case Study

Tawa et al., 2008
PASJ in press

- Target is (excess) diffuse emission over XIS FOV with comparable surface density as the average CXB
- Exposure 100ks
- For 5-12keV band integrated counts for the whole area of an FI-CCD
  - CXB: 9.7×10^{-3} c/s
  - Target Diffuse Emission: 9.7×10^{-3} c/s (assumed)
  - NXB: 52×10^{-3} c/s

- Statistical Error $\Delta I_{stat} = 0.84 \times 10^{-3}$ c/s
- Fluctuation of the CXB (estimated) $\Delta I_{CXB} = 1.5 \times 10^{-3}$ c/s
- NXB reproducibility (PINUD) $\Delta I_{NXB} = 1.8 \times 10^{-3}$ c/s

Comparable

*) CXB fluctuation dominates when we take 1-7keV band.

xisnxbgen is introduced HEASOFT6.4

to make an appropriate NXB spectra for a given source observation

We (XIS team) had been providing perl scripts and the NXB database independent to the HEASOFT/CALDB.
The new ftool xisnxbgen is simper to use, and the NXB data base is now included in the CALDB.

We have to update every half a year at least

1. Create an estimated NXB file 'xis1_nxb.pi'
   in the DET coordinates region 'ds9.reg ‘

   See Detail by fhelp

   % xisnxbgen xis1_nxb.pi xis1_src.pi DETREG ds9.reg suzaku.orb none
2. Create an estimated NXB file 'xis1_nxb.pi ‘
   in the SKY coordinates region 'ds9.reg'
   including the calibration source area,
   and an image in the energy range of 274 <= PI <= 548 (1-2 keV).

   % xisnxbgen xis1_nxb.pi xis1_src.pi SKYREG ds9.reg
   suzaku.orb suzaku.att pixq_and=0 pi_min=274 pi_max=548