CCD & Backgrounds Working Groups

Activities at IACHEC 2014

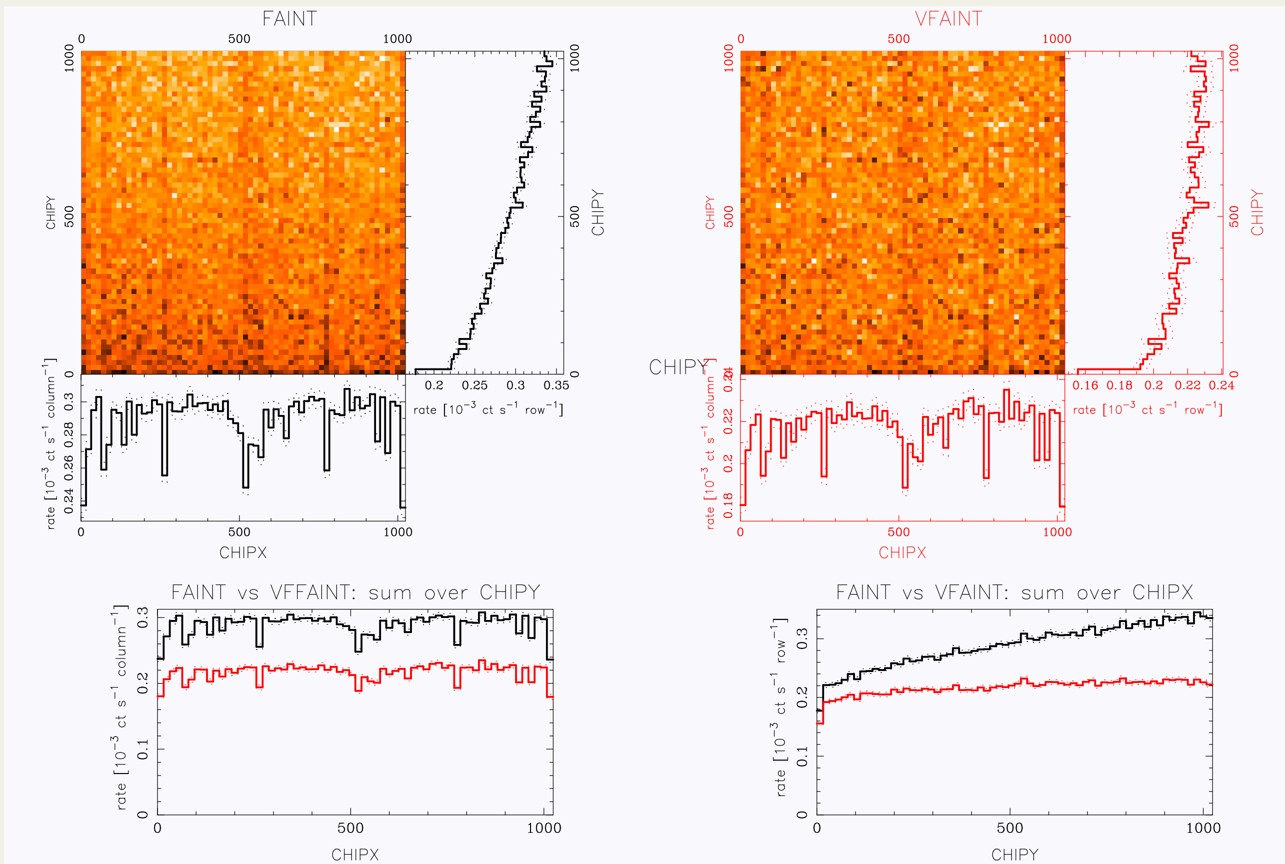
Particle background characterization

- Chandra ACIS background non-uniformity (Gaetz)
- Why are soft proton flares such a problem for XMM, not a (significant) problem for Chandra, and is there anything to be done about them? (Kuntz)
- The particle background of the X-IFU instrument onboard of ATHENA (Natalucci)

ACIS spatial non-uniformity

Terry Gaetz

- Energy-dependent, structures due to CTI and ?
- Applying very faint (VF) mode filter reduces background level and non-uniformity



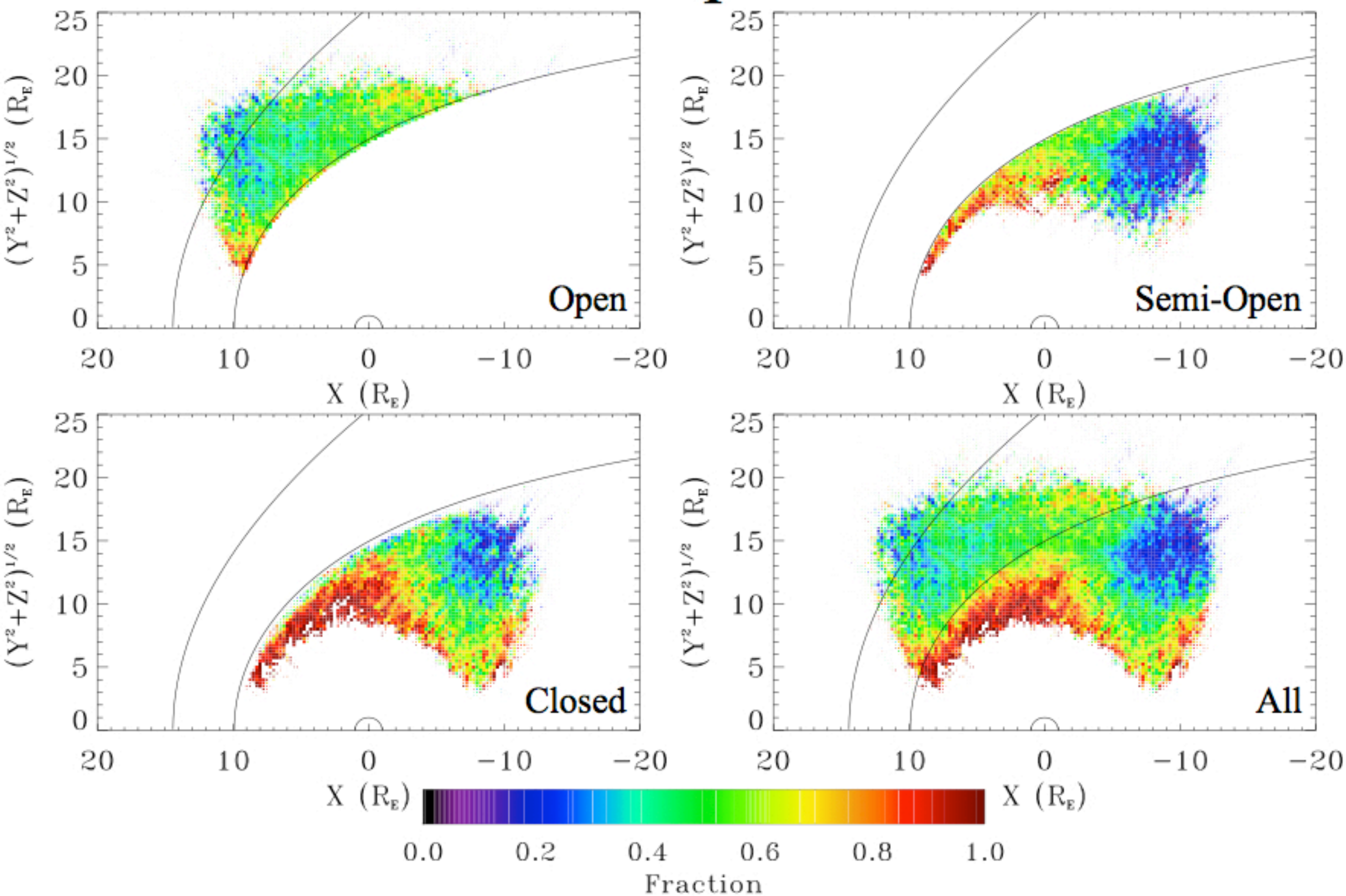
ACIS-I
G02346
5-8 keV

Soft Proton Flares in XMM & Chandra

K.D. Kuntz

- 51% of XMM EPIC-pn time is flared, only 8% for Chandra ACIS-S3
- Maximum flare strength Chandra ~ 1/10 XMM
- Differences in orbit? Optics? Detectors?
- Chandra observes less just inside the magnetosheath ("hot zone" for XMM)
- Overall response to flares is lower for Chandra

Where are the proton flares?



The flare fraction is the highest on closed field lines.
The "hot zone" is just inside the magnetopause.

Simulating ATHENA background

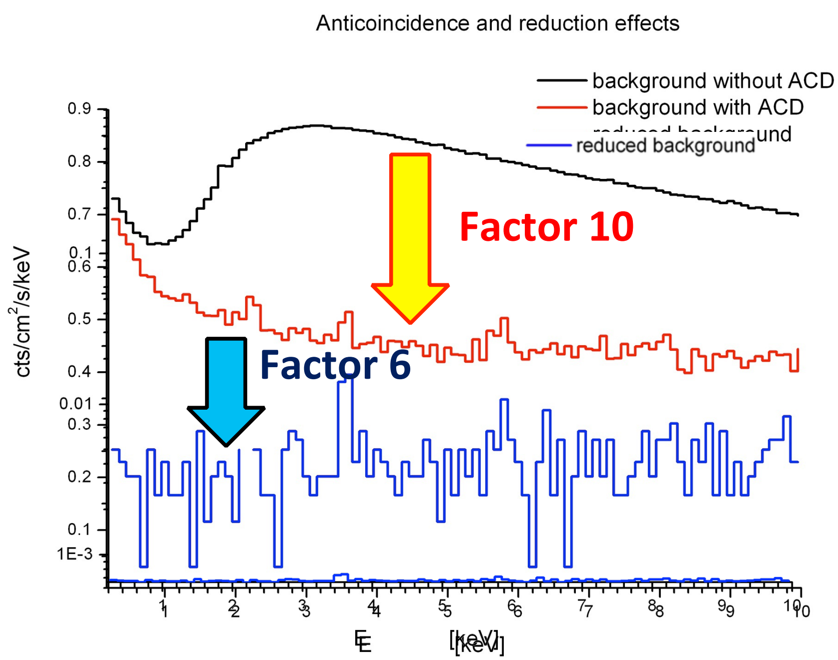
Lorenzo Natalucci

- GEANT2 simulations for X-ray microcalorimeter at L2

Background reduction

The bkg main components are secondary electrons and primary protons due to the ACD low efficiency in the outer zones. We then improve the geometrical efficiency of the ACD and exploit materials with low electron production yield

- Reduce the distance between the TES array and the ACD from 2 mm to 1 mm:
  19% reduction
- Kapton layer inside the Nb shield:
  70% reduction
- Kapton filter very close to the detector:
  17% reduction



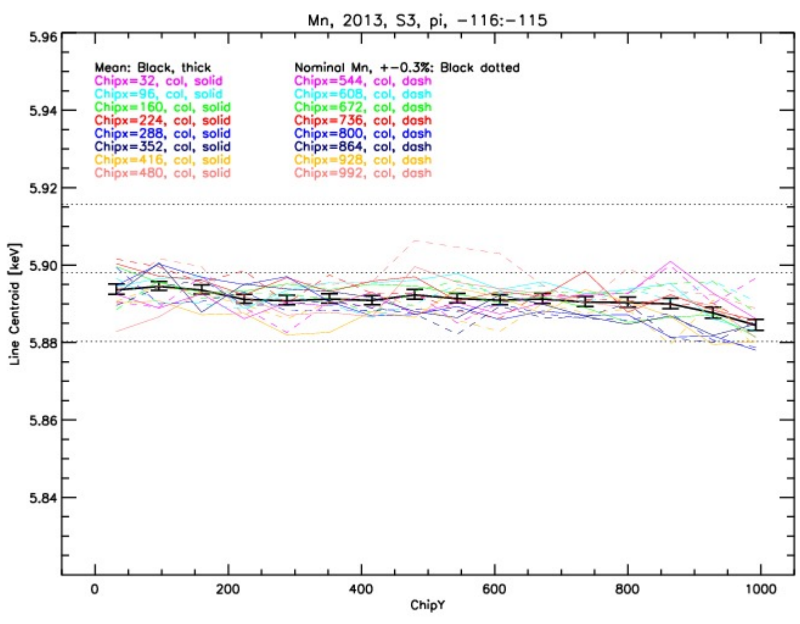
CCD calibration issues

- Evaluating the ACIS temperature-dependent CTI correction (Durham)
- Chandra ACIS BI Low Energy Gain (Gaetz)
- The evolution of deep traps in MOS CCDs (Sembay)
- Chandra HETG observations at high X-ray fluxes (Schultz)

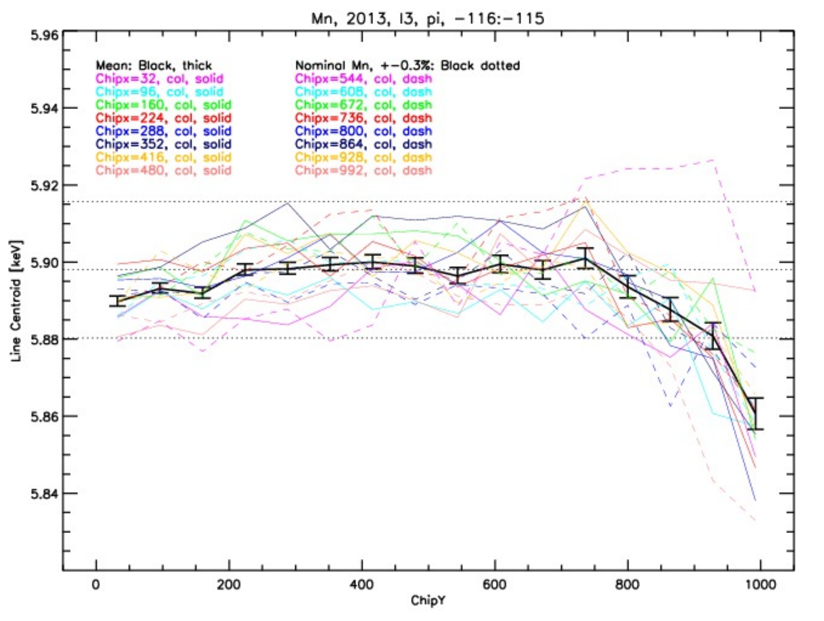
ACIS T-dependent CTI correction

Nick Durham

- How well does the temperature-dependent calibration do at higher temperatures?



S3 Mn Warm (-116 : -115C)



I3 Mn Warm (-116 : -115C)

ACIS-S1 low-energy gain

Terry Gaetz

Summary

Summary:

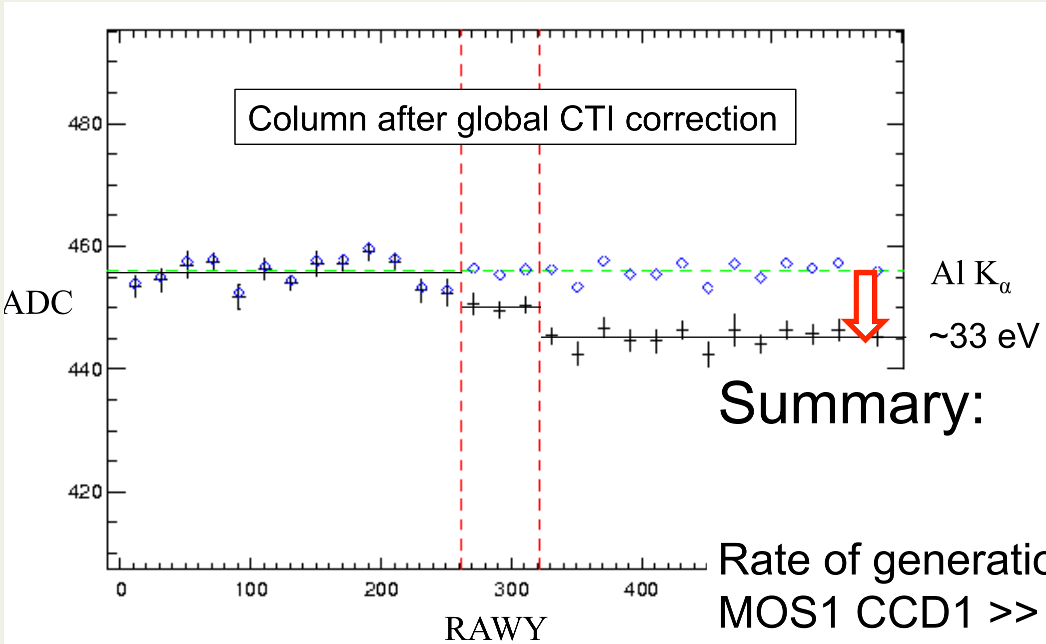
- S1: narrowed ratio and residuals ($\sim \pm 2 - 3\%$) down to ~ 400 eV
  - a significant improvement, but gain error still large compared to other ACIS chips
- below ~ 400 eV more complex

Next steps:

- generate tweaks for S3 (much smaller effects...)
- generate and test CALDB-compatible gain and resp files
- test against other datasets (*e.g.*, E0102)
- if ok, include in CALDB release

Evolution of deep traps in MOS

Steve Sembay



Summary:

Rate of generation of traps on central CCDs very different. MOS1 CCD1 >> MOS2 CCD1

Currently around ~10% of columns of MOS1, CCD1 affected by a deep trap

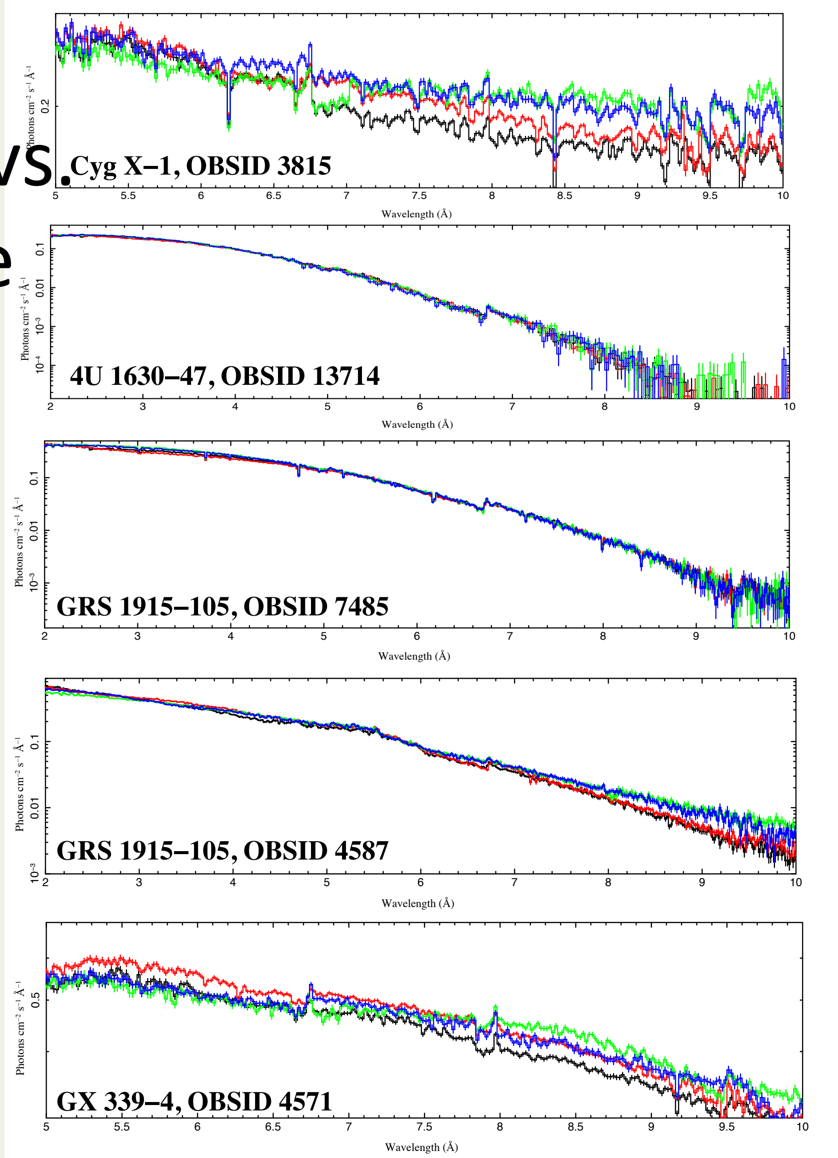
Good news: no strong energy dependence between Al and Mn. Need to check at low energies

But "single pixel energy trap model" breaks down for multi-pixel events…what to do about this??

Chandra HETG at high X-ray fluxes

Norbert Schultz

- Continuous clocking mode vs. standard timed event mode
- Effects of dispersed secondary images



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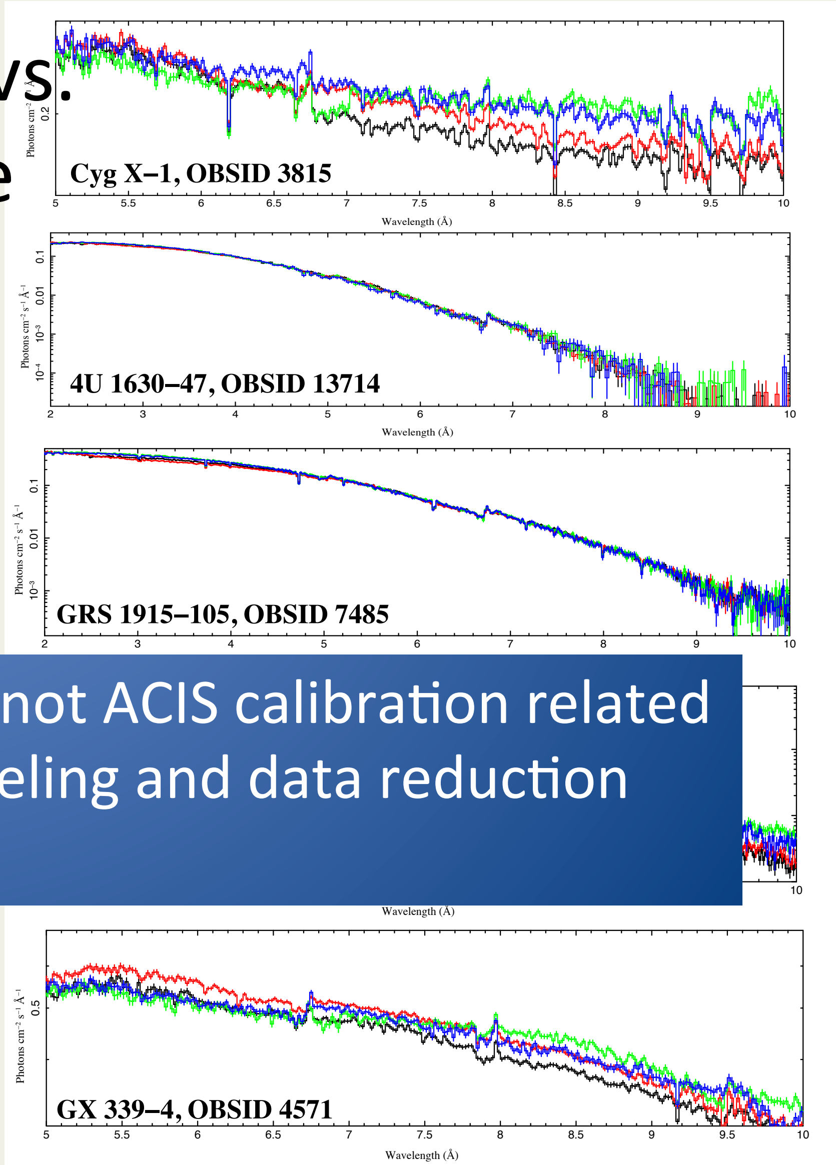

Problems in bright HETG spectra are not ACIS calibration related but require intensive additional modeling and data reduction depending on chosen configurations

CCD & background WG

- Talks are on-line on the CCD WG wiki page
- https://wikis.mit.edu/confluence/display/iachec/CCD