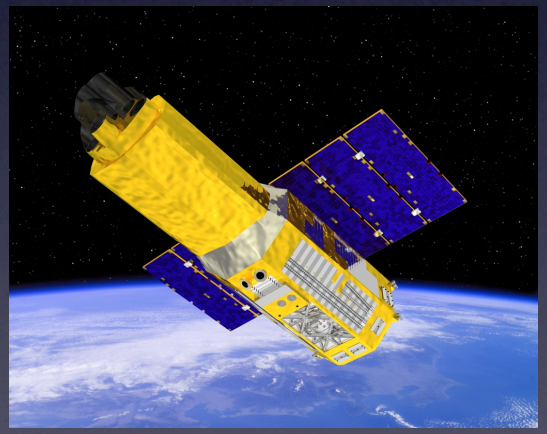
The *Suzaku*/XIS: Status Report

Eric Miller
MIT Kavli Institute

for the *Suzaku*/XIS Team

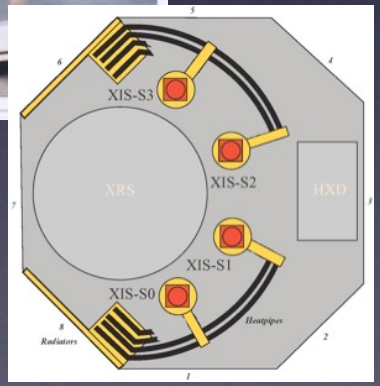


Outline

- instrument health and status
  - spacecraft and instrument anomalies
  - gain and effective area tracking
  - changes in background
  - changes in charge injection
- calibration status
  - CTI and RMF fine-tuning
  - open issues

Suzaku/XIS - Overview

- 4 CCDs with independent X-ray telescopes (XRTs)
- 3 front-illuminated (FI) XIS0 XIS2 XIS3
  1 back-illuminated (BI) XIS1



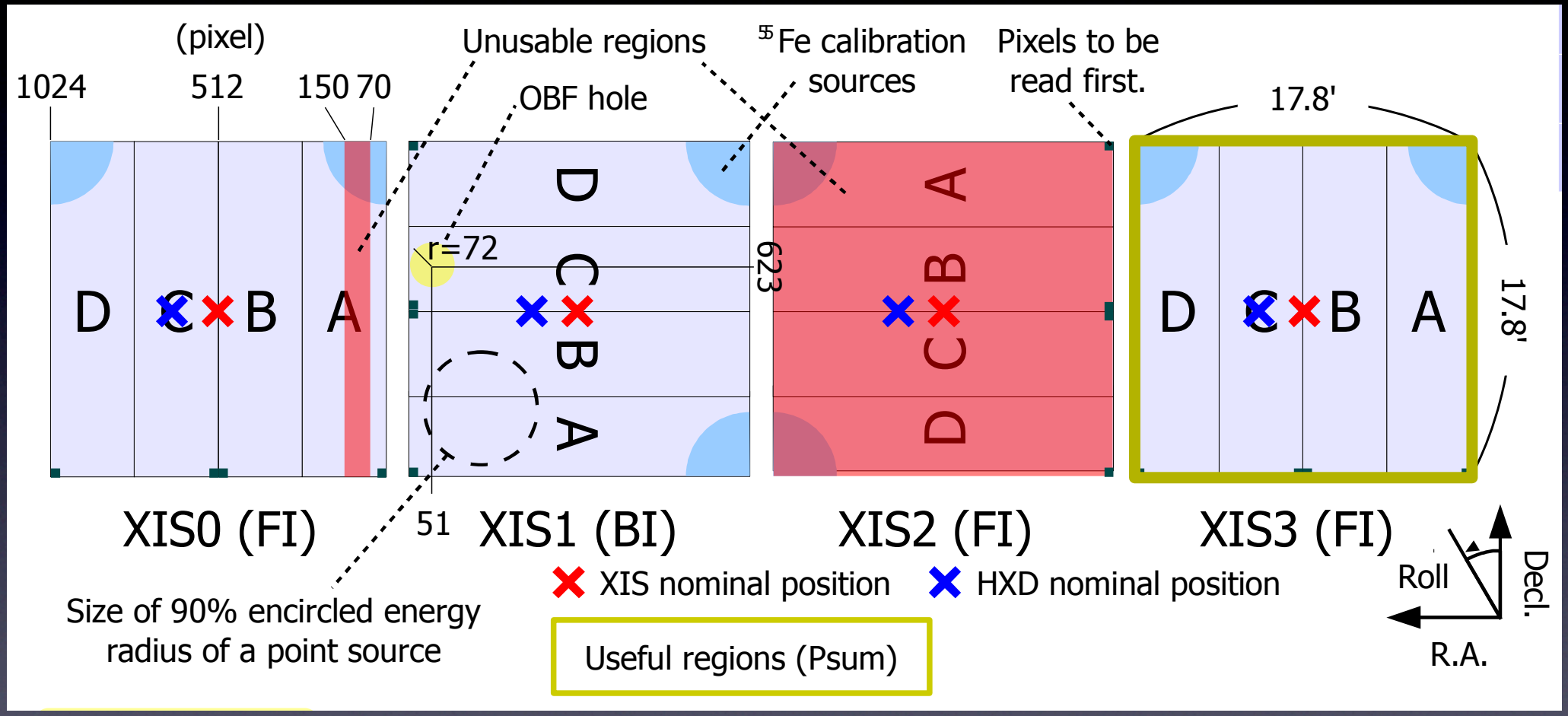
Field of view	17.8' x 17.8'
Energy range	0.2-12 keV
Energy resolution	~180 eV @6keV
Effective area	340 (FI)/390 (BI) cm^2 @1.5keV
Time resolution	8 s (Normal) - 7.8 ms (Psum)

from Tsujimoto's "pocket guide"

Major XIS Events

July 10, 2005	launch of *Suzaku*
August 13, 2005	XIS doors open, start of observations
November 9, 2006	anomaly (μ-meteorite?) in XIS2; 2/3 of chip affected, XIS2 switched off
January 30, 2008	CPU board malfunction in MPU; switch to redundant board
June 23, 2009	anomaly (μ-meteorite?) in XIS0; 1/8 of chip affected, XIS0 safe for normal ops
December 18, 2009	anomaly (μ-meteorite?) in XIS1; no CCD damage, likely hole in XIS1 OBF

XIS Status



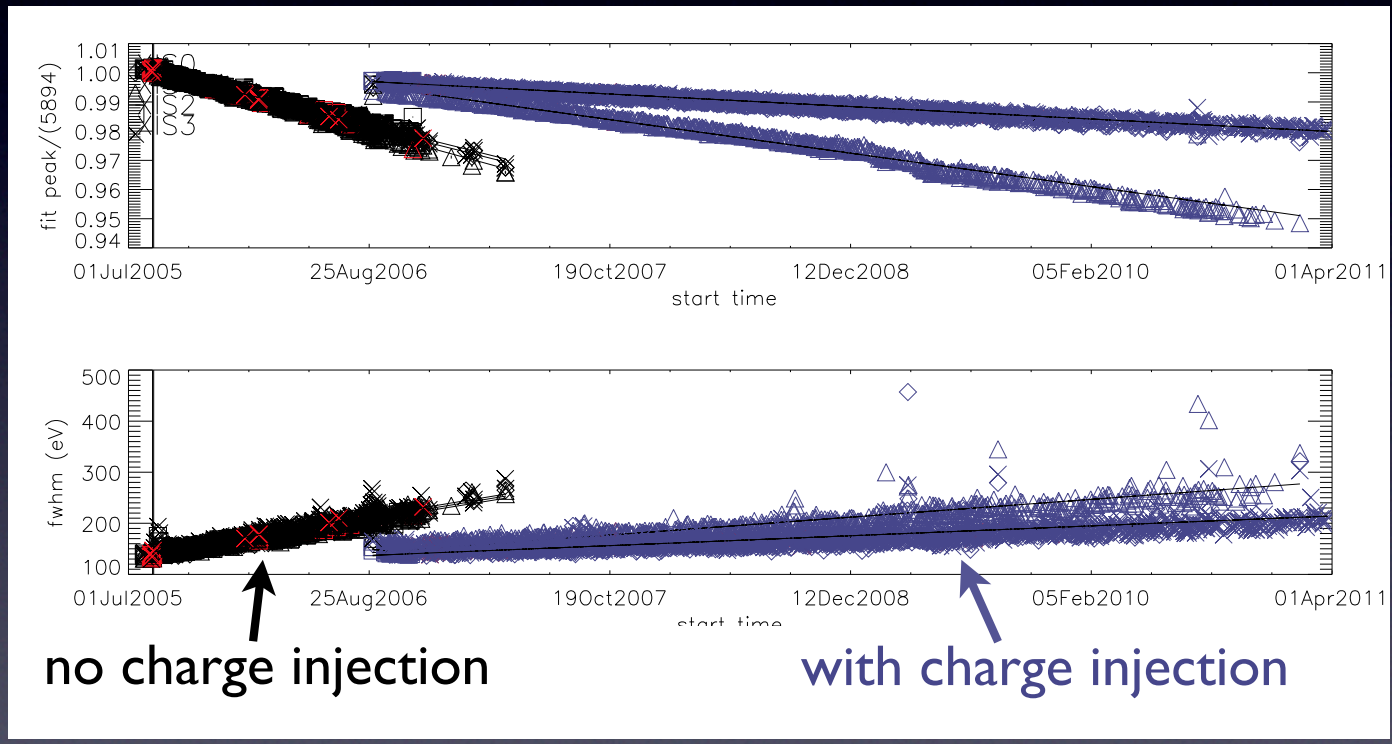
from Tsujimoto's "pocket guide"

Gain and FWHM Tracking

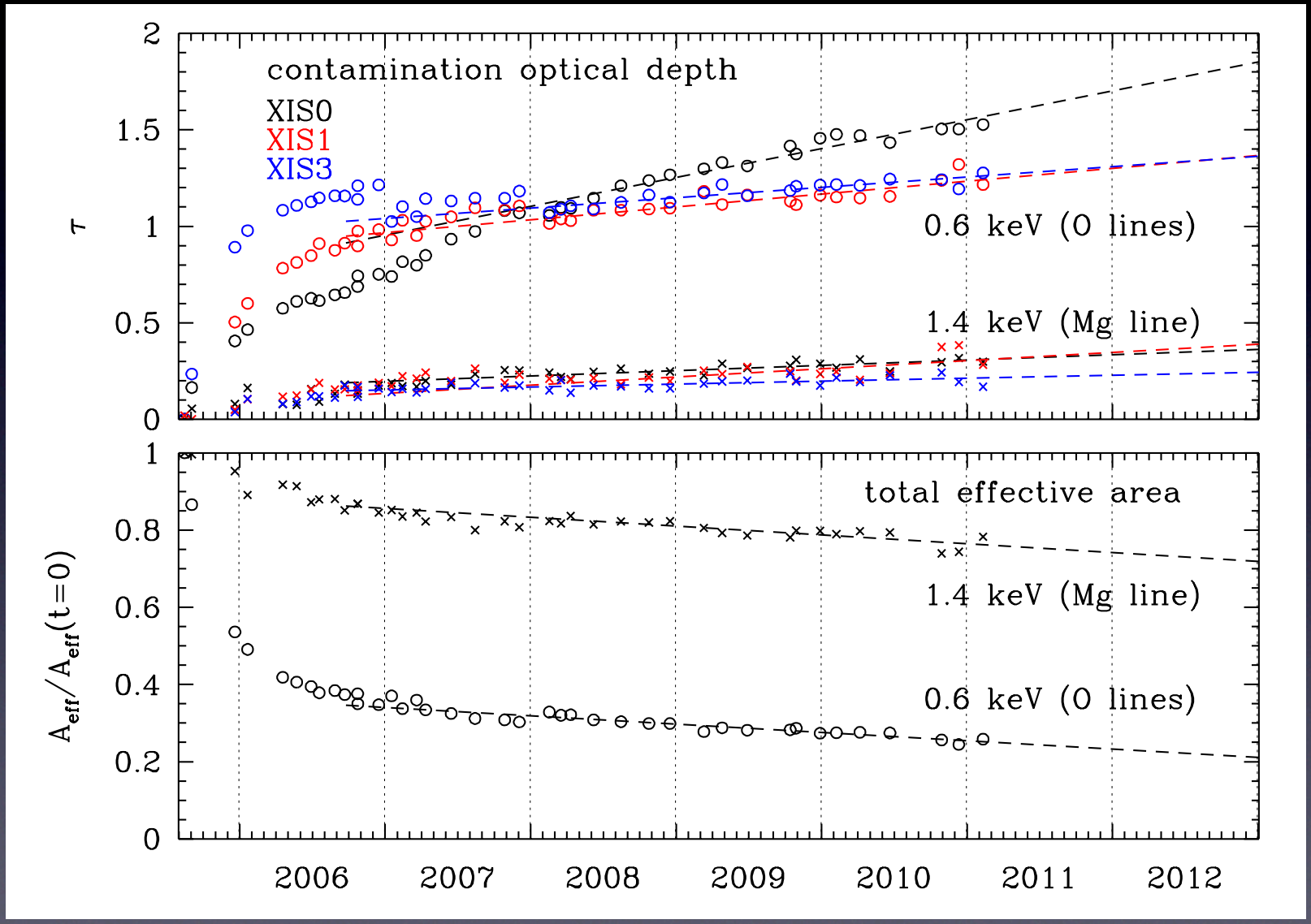
- ^{55}Fe cal sources ➙ Mn Kα at 5.9 keV
  raw data, no CTI correction

- gain change
  with SCI on
  (% per yr)
  XIS0 -0.399 ±0.001
  XIS3 -0.372 ±0.001
  XIS1 -0.997 ±0.001

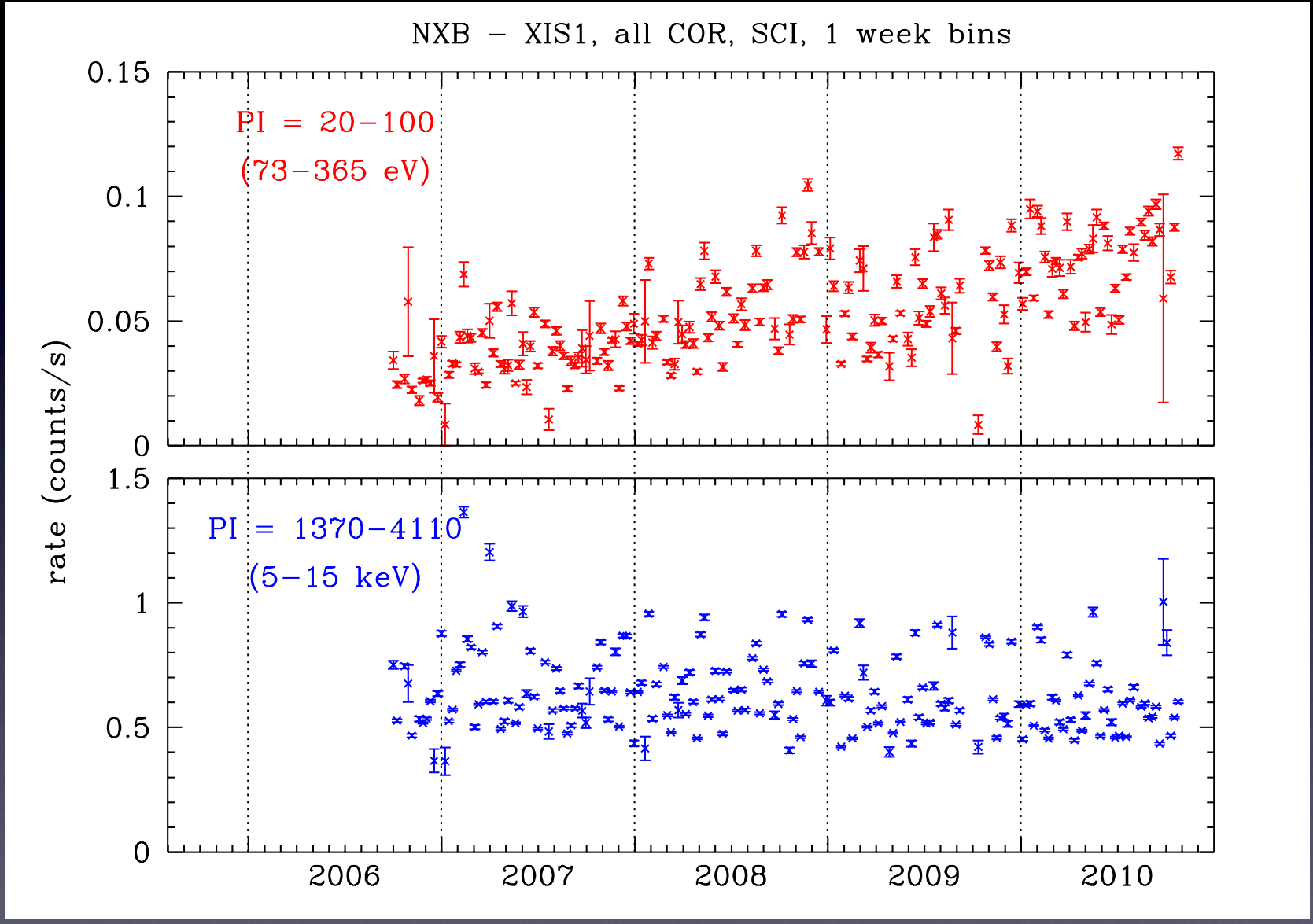
- FWHM change
  with SCI on
  (eV per yr)
  XIS0 16.1 ±0.8
  XIS3 16.8 ±1.4
  XIS1 30.4 ±1.2



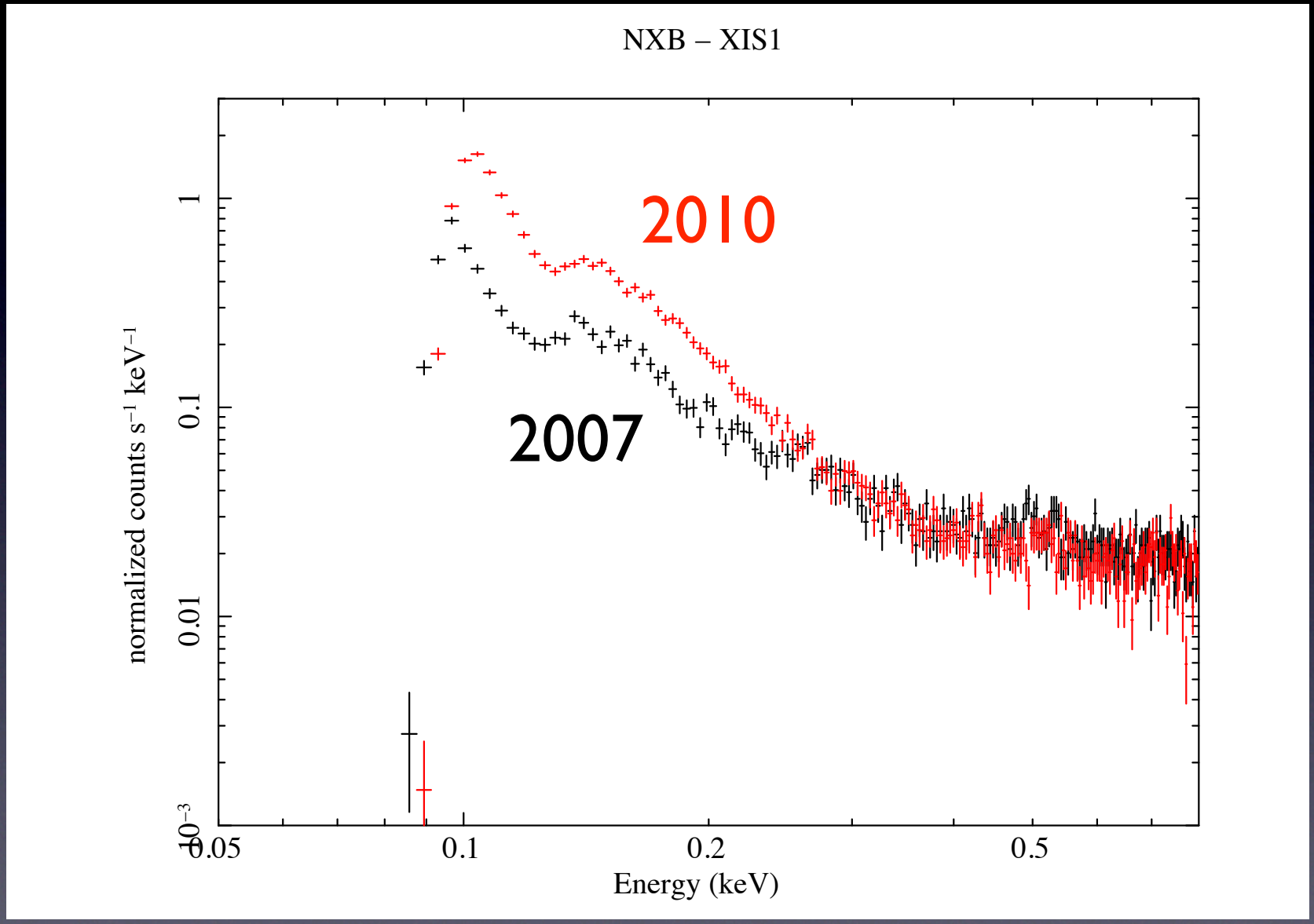
Effective Area Tracking



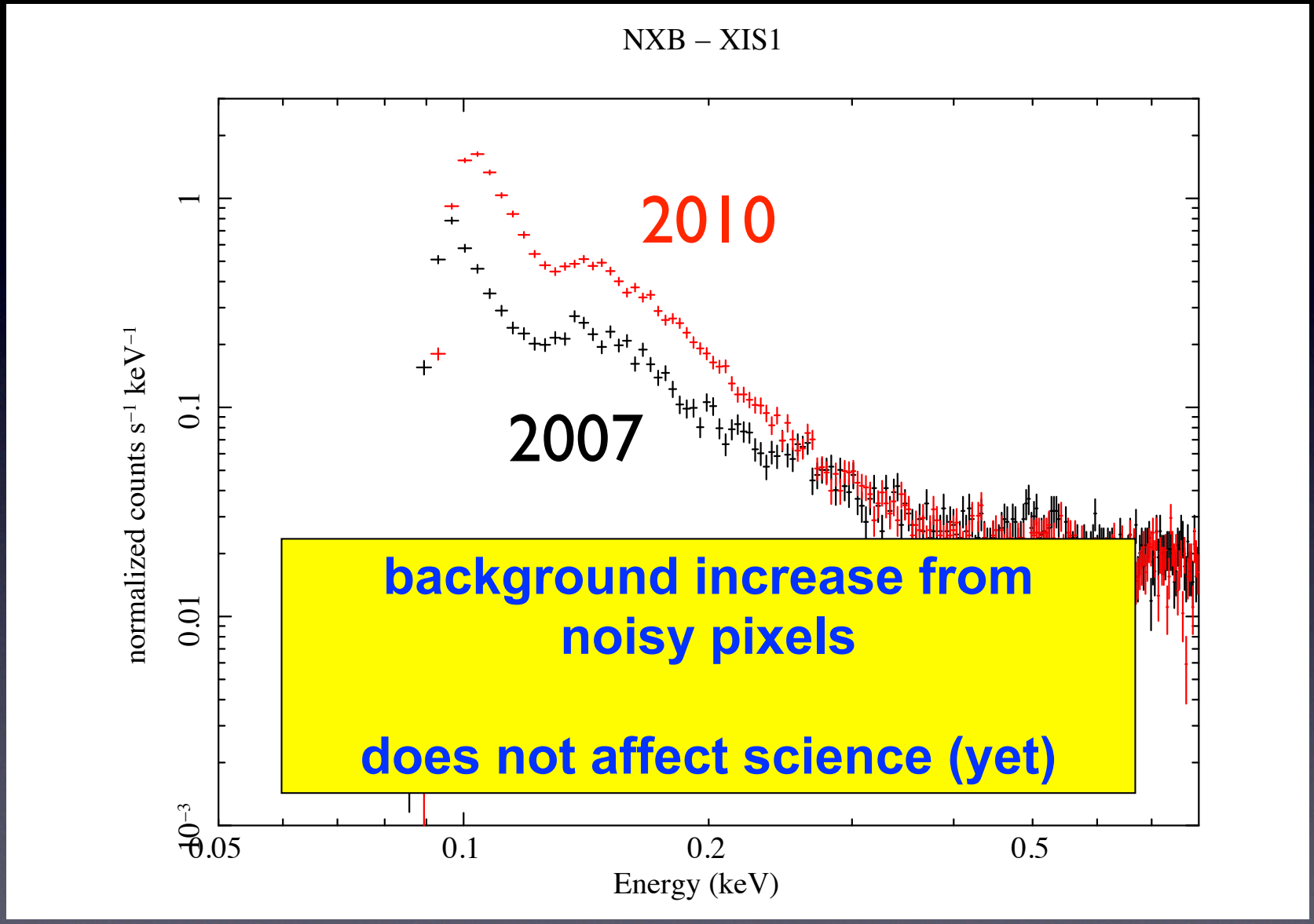
Background Tracking



Background Tracking

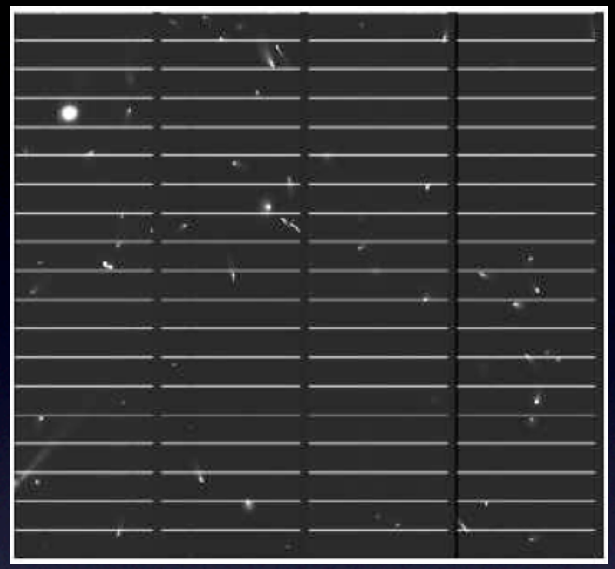


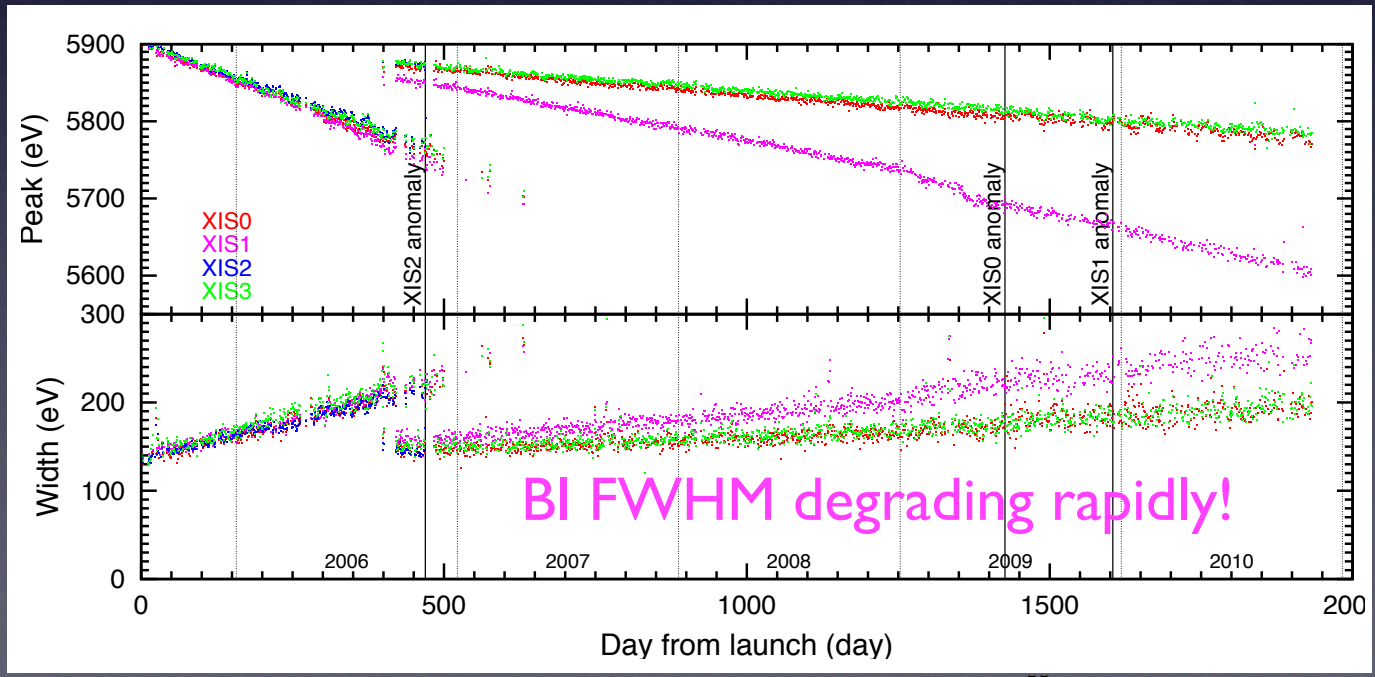
Background Tracking



Charge Injection Changes

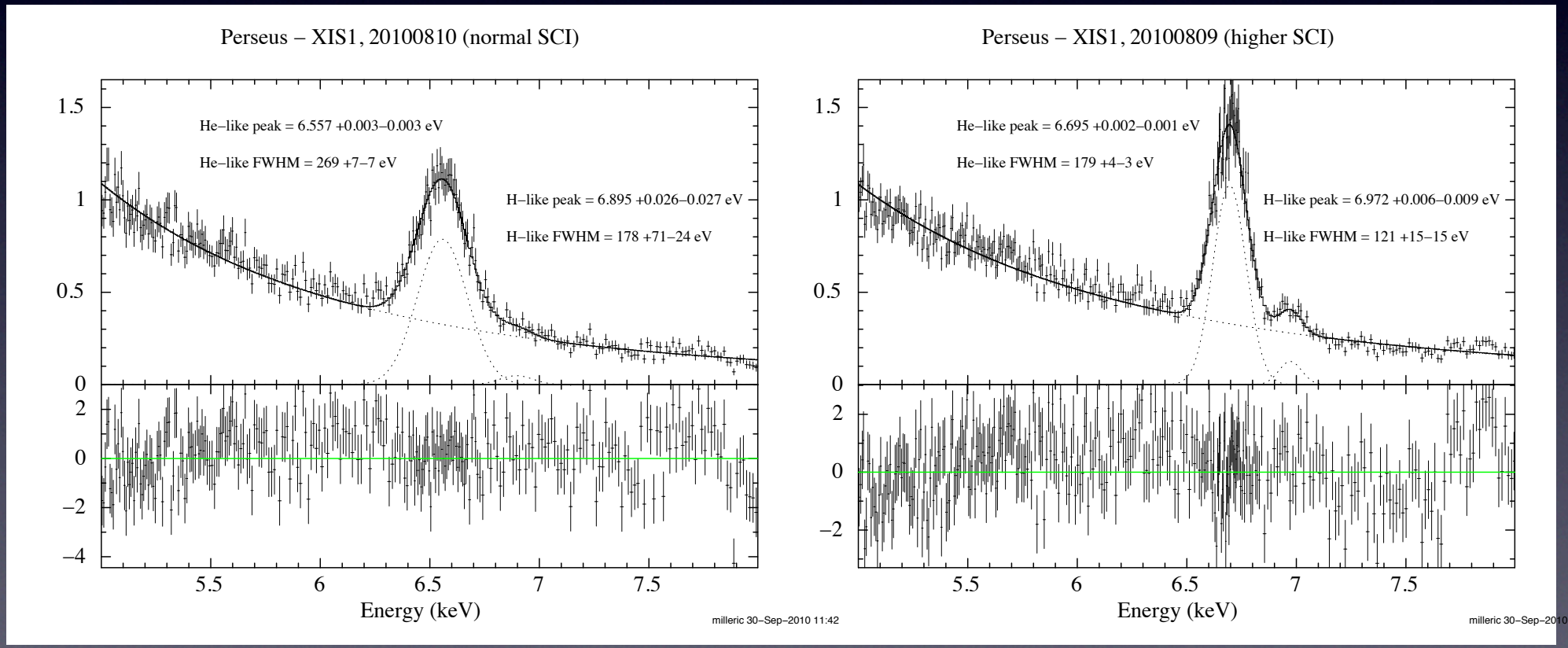
- row of charge injected every 54 rows "spaced-row" (SCI)
- fills traps, reduces CTI
- FI: 6 keV
  BI: 2 keV (to reduce noise < 0.4 keV)





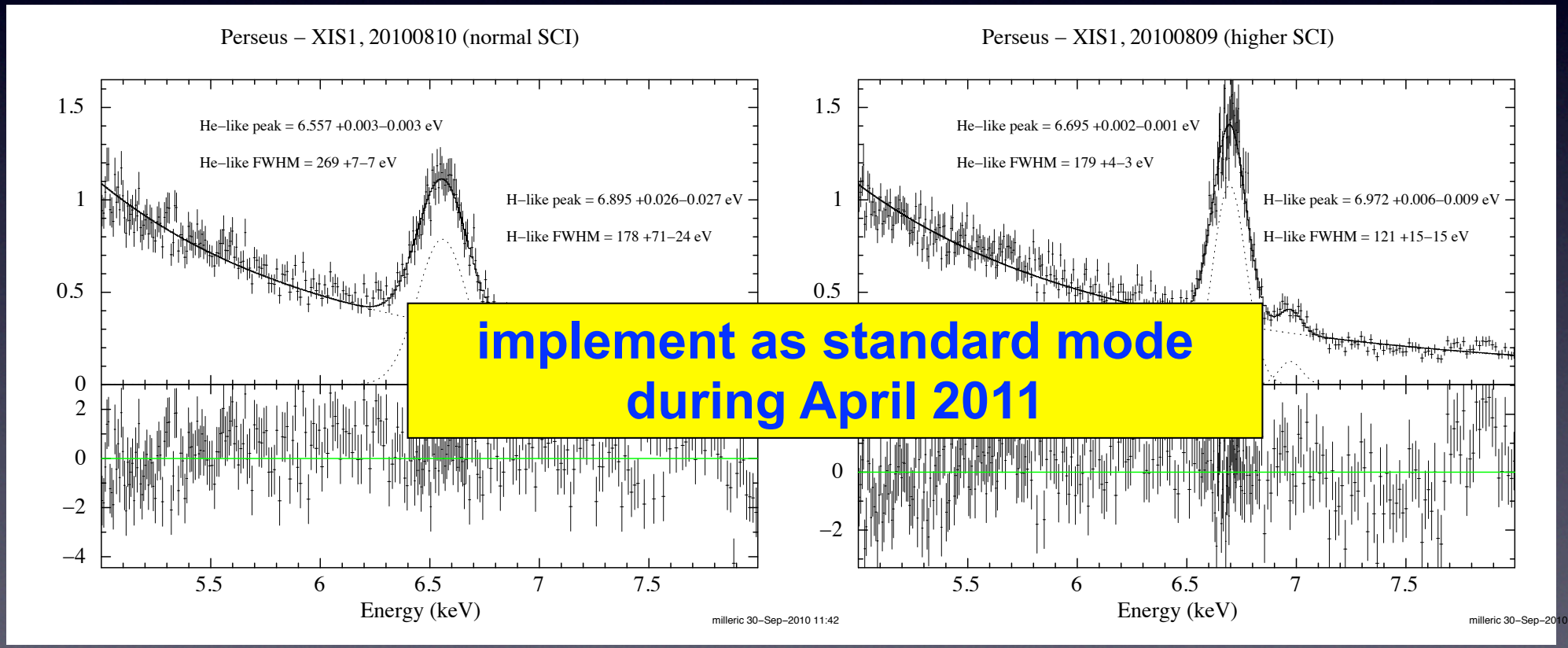
Charge Injection Changes

- August 2010 start experiment w/ increased BI SCI
- FWHM improves; 180 ➔ 120 km/s at 6.5 keV (Fano limit??)
- telemetry saturation from trailing row (mask onboard)



Charge Injection Changes

- August 2010 start experiment w/ increased BI SCI
- FWHM improves; 180 ➔ 120 km/s at 6.5 keV (Fano limit??)
- telemetry saturation from trailing row (mask onboard)

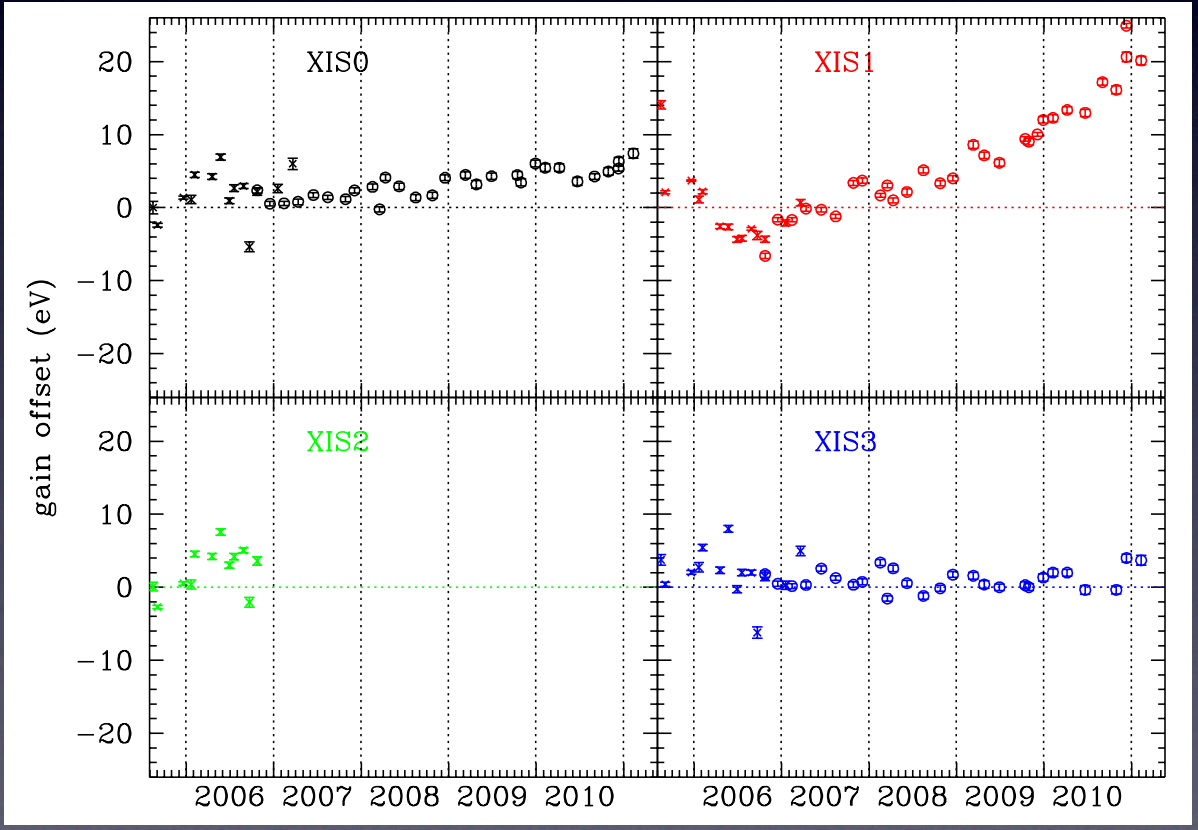


Outline

- instrument health and status
  - spacecraft and instrument anomalies
  - gain and effective area tracking
  - changes in background
  - changes in charge injection
- calibration status
  - CTI and RMF fine-tuning
  - open issues

Energy Scale Calibration

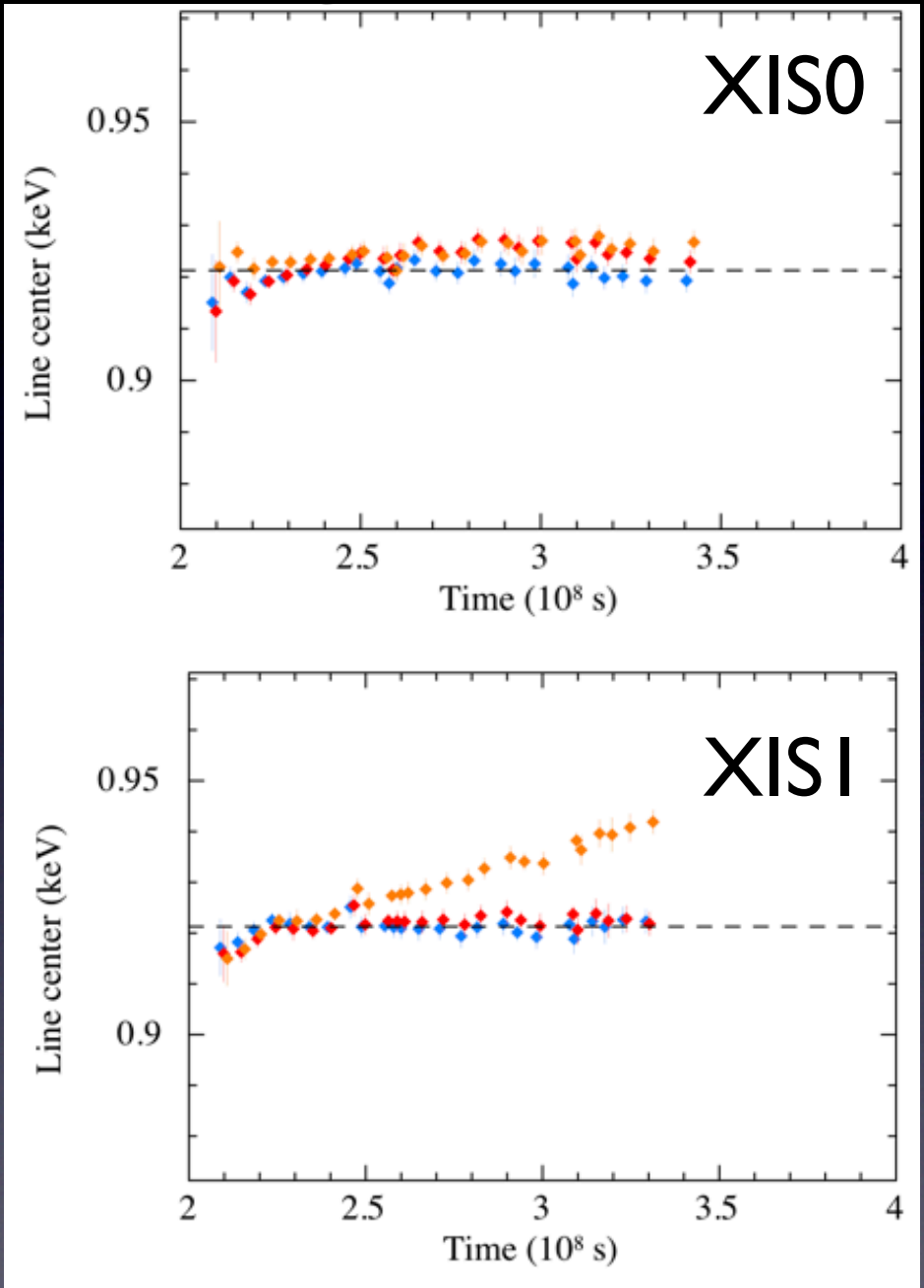
- at 1 keV, energy scale over-corrected at recent times
- fine tune CTI parameters to make low/high energy agree



gain shift 0.5-1 keV from E0102 (data-model)

Results for Ne Heα

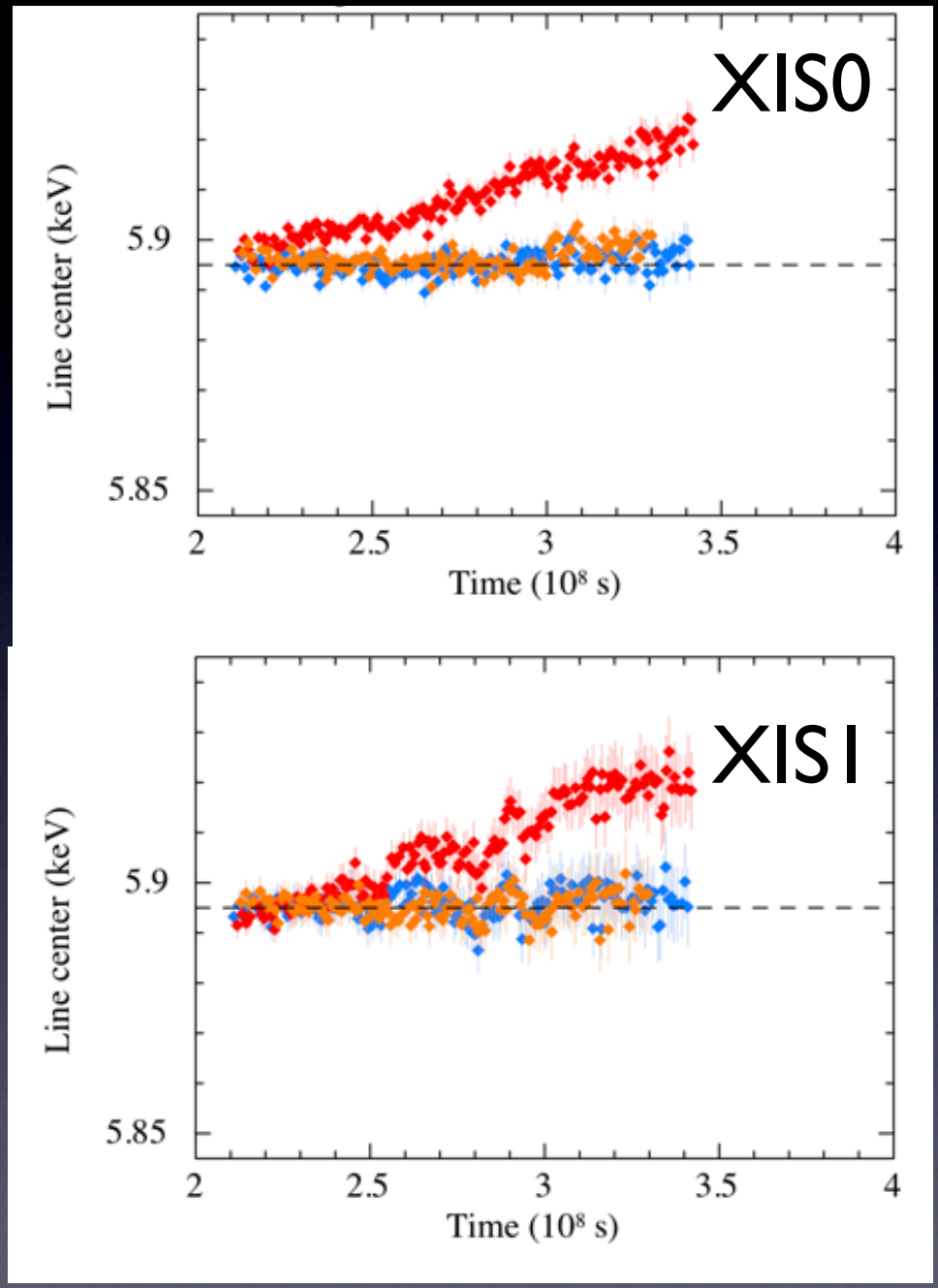
- current release, ver.14, ID=20100929
- new makepi before fine tuning, ID=20110123
- new makepi after fine tuning, ID=20110219



Sawada-san

Results for Mn Kα

- current release, ver.14, ID=20100929
- new makepi before fine tuning, ID=20110123
- new makepi after fine tuning, ID=20110219

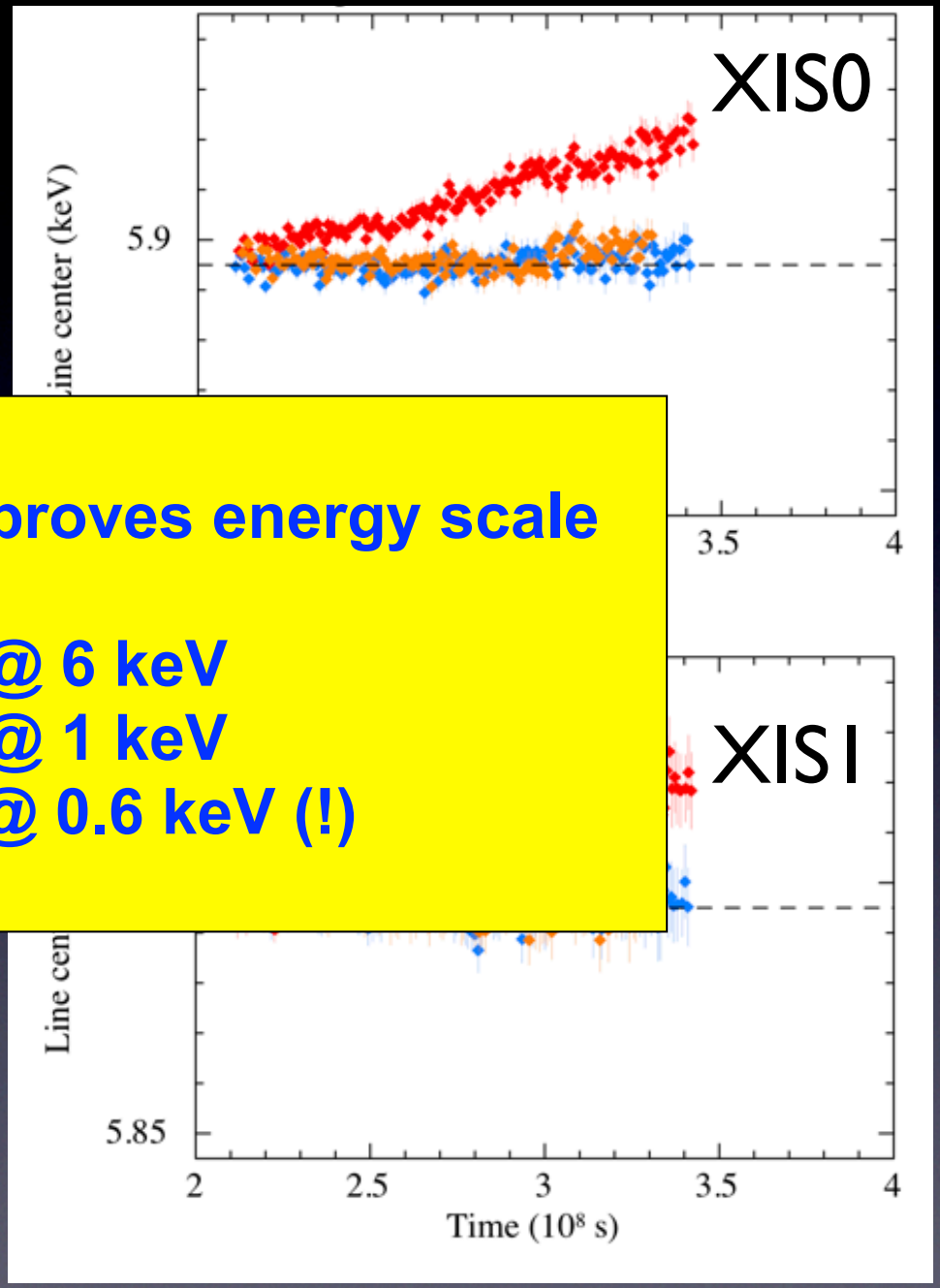


Results for Mn Kα

- current release, ver.14, ID=20100929
- new mak
  tuning, ID
- new mak
  tuning, ID

fine tuning CTI improves energy scale

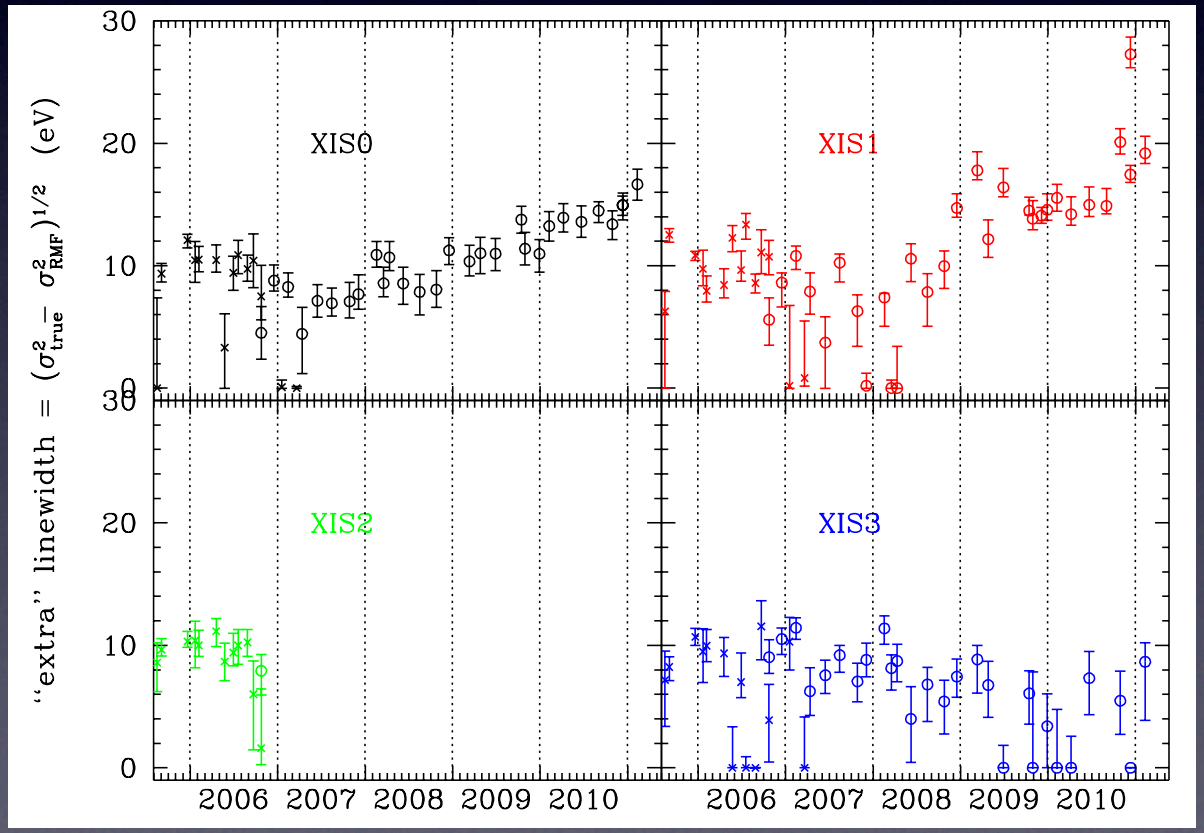
0.1% @ 6 keV
0.5% @ 1 keV
1.0% @ 0.6 keV (!)



Sawada-san

Response Calibration

- low-energy FWHM underestimated for XIS0, XIS1
- discrepancy increasing since 2008

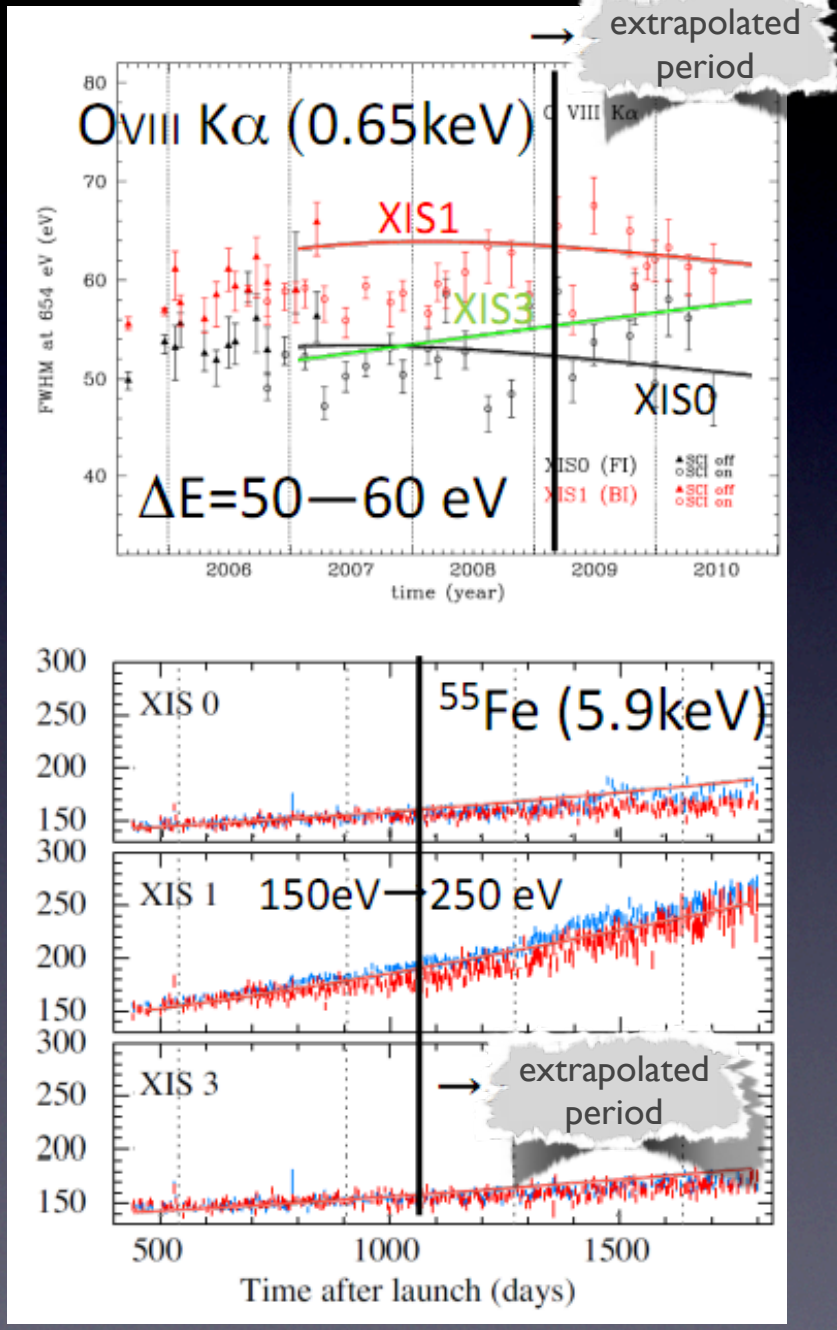


residual σ 0.5-1 keV from E0102

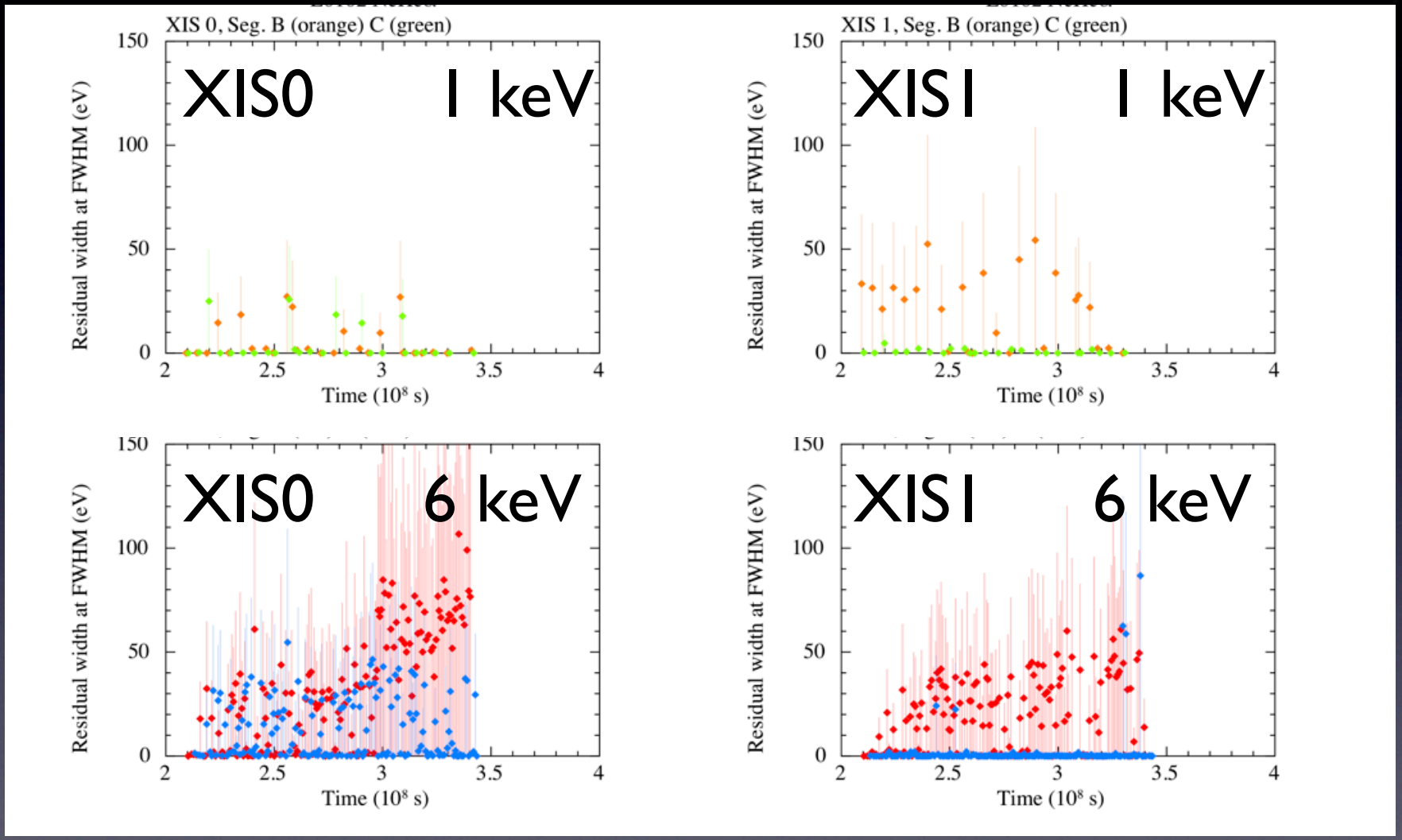
Problems with Response

- indirect modeling
  - implicit boundary condition:
    $FWHM_a$=0 @ E=0
    FWHM slope is too steep at low E
- unexpected behavior of the model
  - FWHM at OVIII for XIS0 and XIS1 is decreasing with time!

taken from Nobukawa report on 20110210



New RMF Params (In Progress)

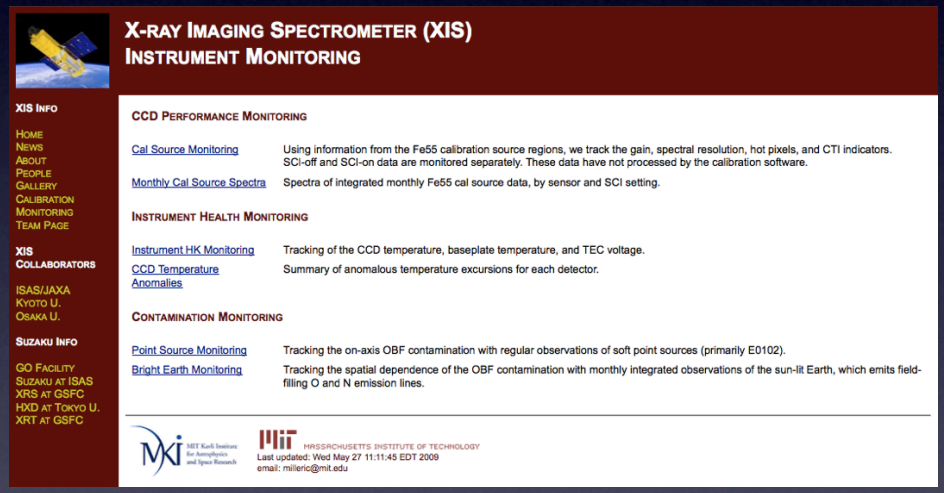


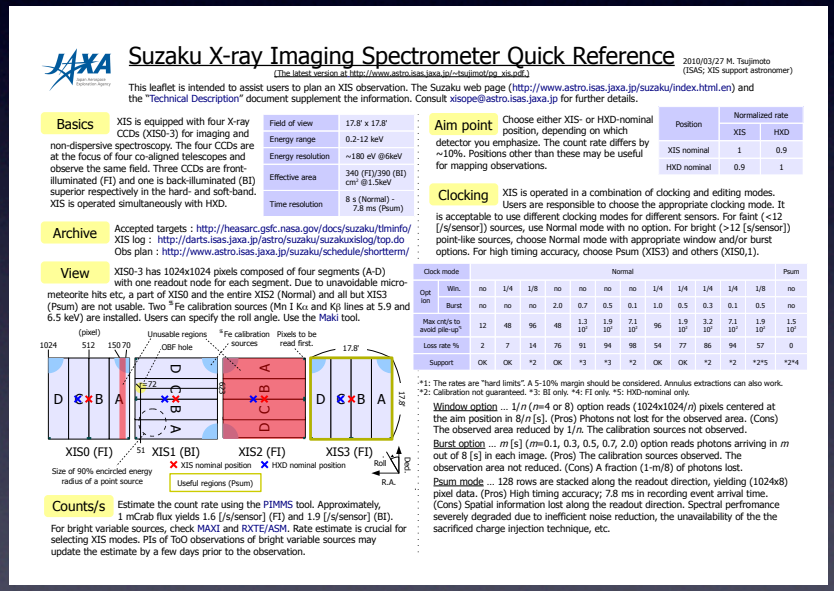
Open Calibration Issues

- P-Sum (timing) mode
  - only XIS3; response files soon to appear in CALDB
- OBF contamination
  - new composition/evolution model
  - rolled out in Jan 2011, broke FTOOLS, rolled back in
  - new CALDB and FTOOLS update ASAP
- Si edge
  - still working on it

XIS Status - Summary

- XIS0 has lost ~ 10% of area but is operating safely
- XIS1,3 are operating normally





http://space.mit.edu/XIS/monitor

http://www.astro.isas.jaxa.jp/~tsujimot/pg_xis.pdf