

IACHEC Contamination WG

Eric D. Miller (MIT)

IACHEC 2016 – IUCAA

Contamination WG Agenda

- summary by Eric (~ 5 min)
- presentations (~ 60 min)
 - Paul (for Doug Swartz and Steve O'Dell):
“Modeling contamination migration on the Chandra X-ray Observatory: III”
 - Herman:
“Update on Chandra ACIS contamination modeling”
 - Eric:
“Suzaku XIS Contamination Update”
 - Steve:
“XMM EPIC-MOS Contamination Update”
 - anyone else?
- organization of contamination white paper (~ 20 min)

Membership

Eric Miller (chair, Suzaku, Astro-H)

Andy Beardmore (Swift)

Vadim Burwitz (eROSITA)

Larry David (Chandra)

Tadayasu Dotani (Astro-H)

Megan Eckart (Astro-H SXS)

Michael Freyberg (eROSITA)

Terry Gaetz (Chandra)

Catherine Grant (Chandra)

Kenji Hamaguchi (Suzaku)

Maurice Leutenegger (Astro-H SXS)

Herman Marshall (Chandra)

Kallol Mukerjee (ASTROSAT SXT)

Steve O'Dell (Chandra)

Paul Plucinsky (Chandra)

Steve Sembay (XMM-Newton EPIC)

Doug Swartz (Chandra)

Masahiro Tsujimoto (Suzaku, Astro-H)

Cor de Vries (XMM-Newton RGS)

Qazuya Wada (Suzaku)

2014: 12 out of 19 members present

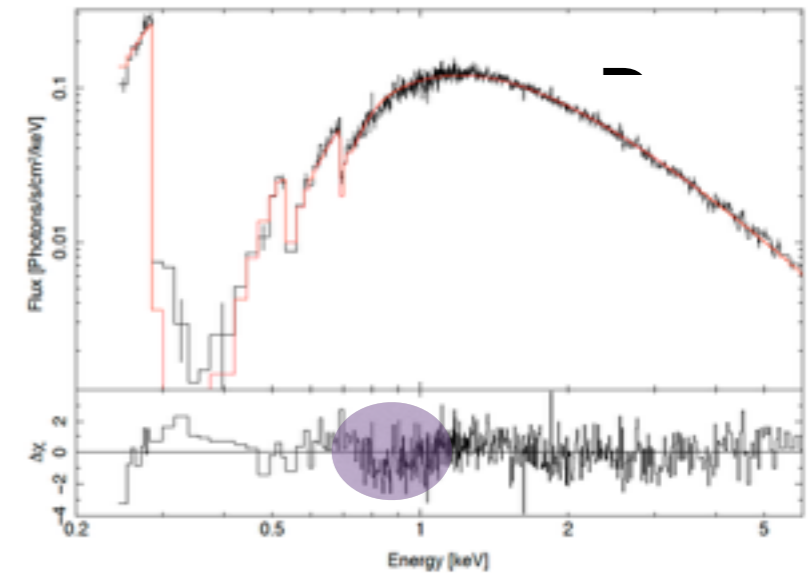
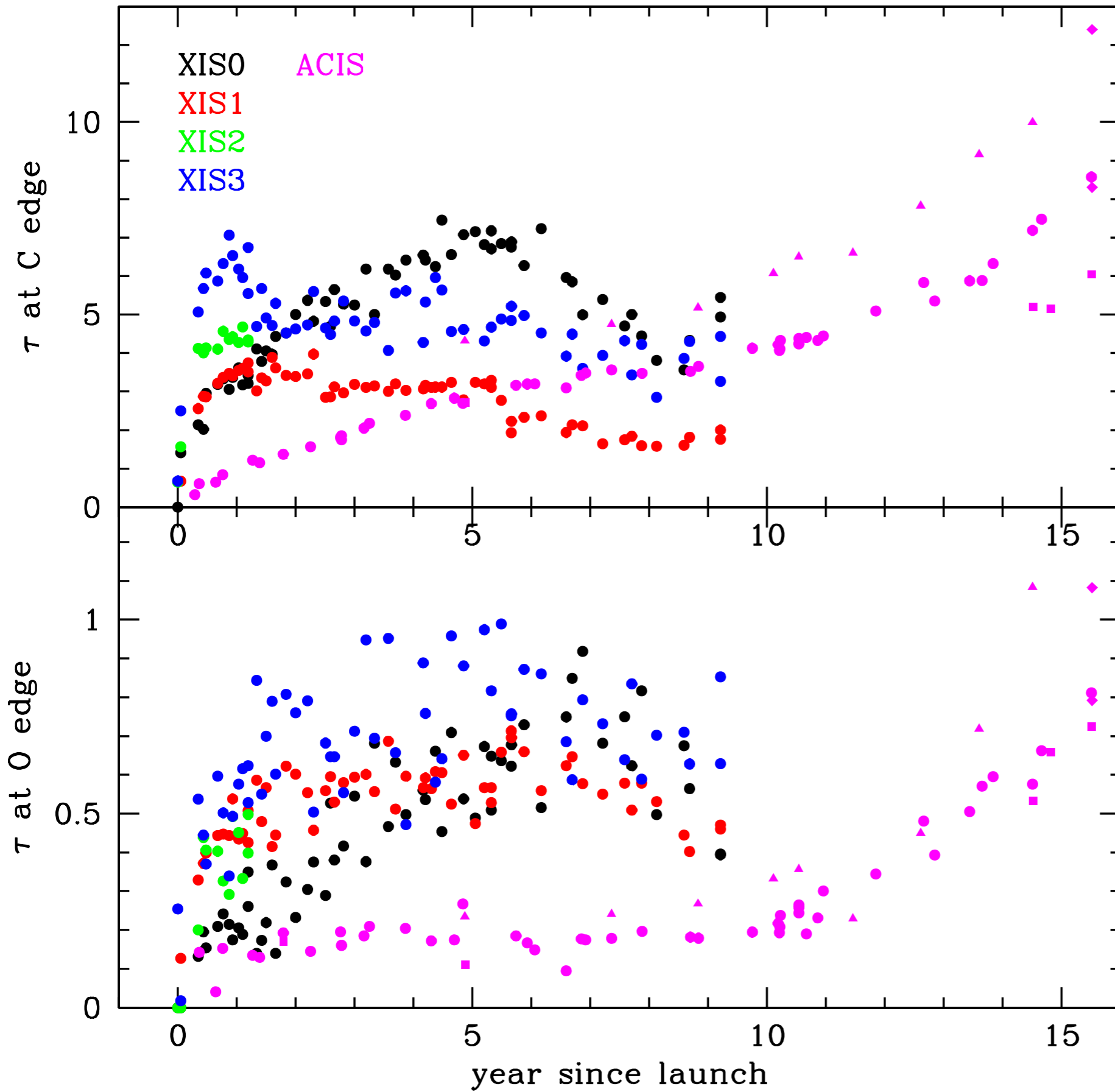
2015: 6 out of 20 members present



Topics

- comparison among instruments and missions
 - chemical composition
 - time dependence
 - spatial dependence (micron to cm scales)
 - temperature dependence (where is the coldest surface?)
 - environmental dependence (orbit)
- mitigation for current instruments
 - celestial monitoring targets
 - effects on calibration and science results
 - "bake-out" procedures
- mitigation for future instruments
 - design (cold traps, contamination blocking filters)
 - procurement
 - ground procedures
 - ground testing and calibration
 - on-orbit monitoring

ACIS vs. XIS Comparison



Contamination WG Plan (from 2015)

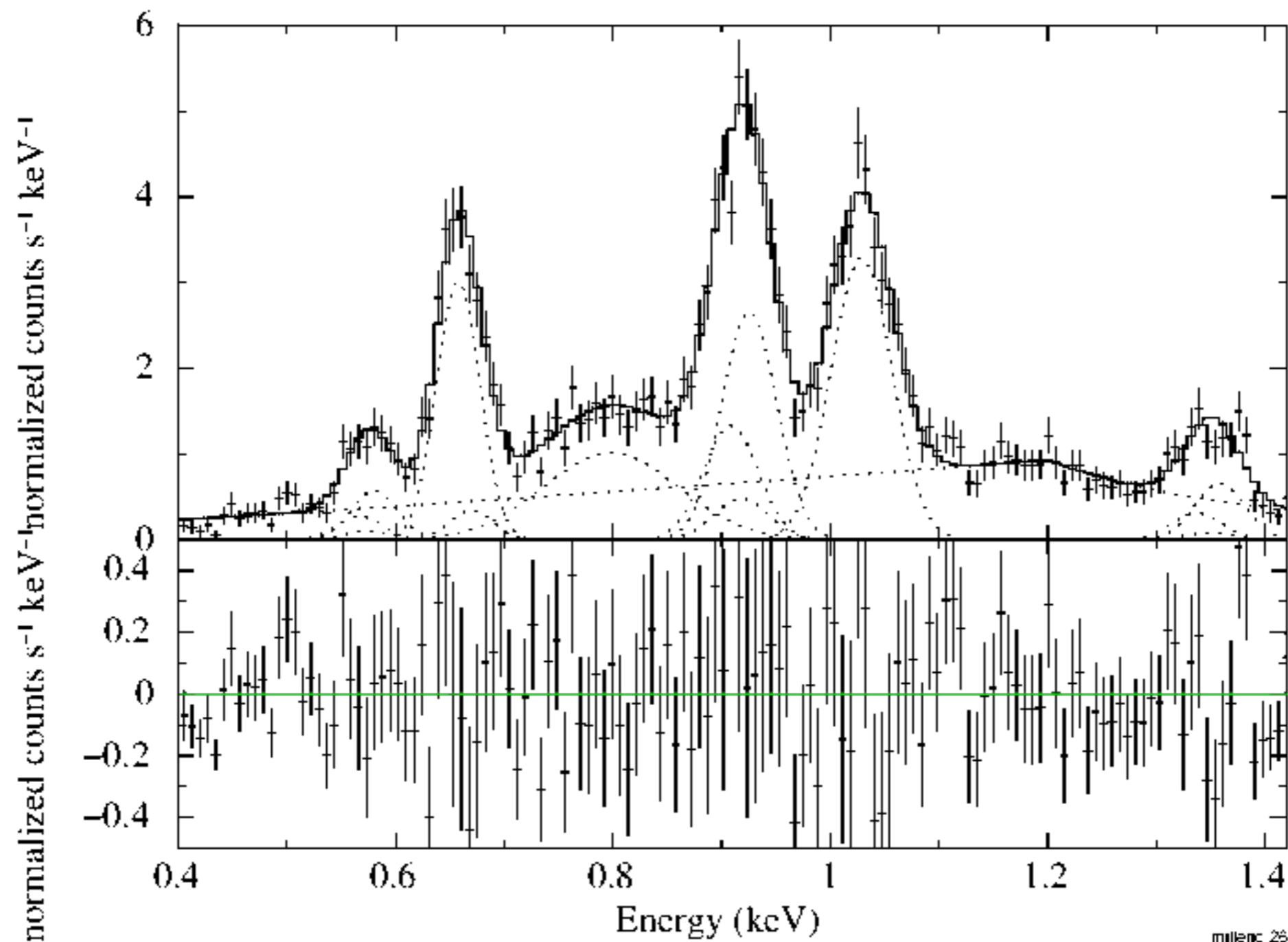
- legacy/heritage WG white paper
- lessons learned for design and ground mitigation
- lessons learned for first light targets, “zero-contamination” baseline
- targets and observing strategies to detect and monitor contamination
- primary role of this working group!
- Eric & Herman will discuss this at MIT, prepare a skeleton manuscript with example text for *Suzaku* XIS (A/I Eric due 2015 August 30)

Suzaku XIS
Contamination Update

Eric D. Miller (MIT)

Suzaku XIS Contamination Observations

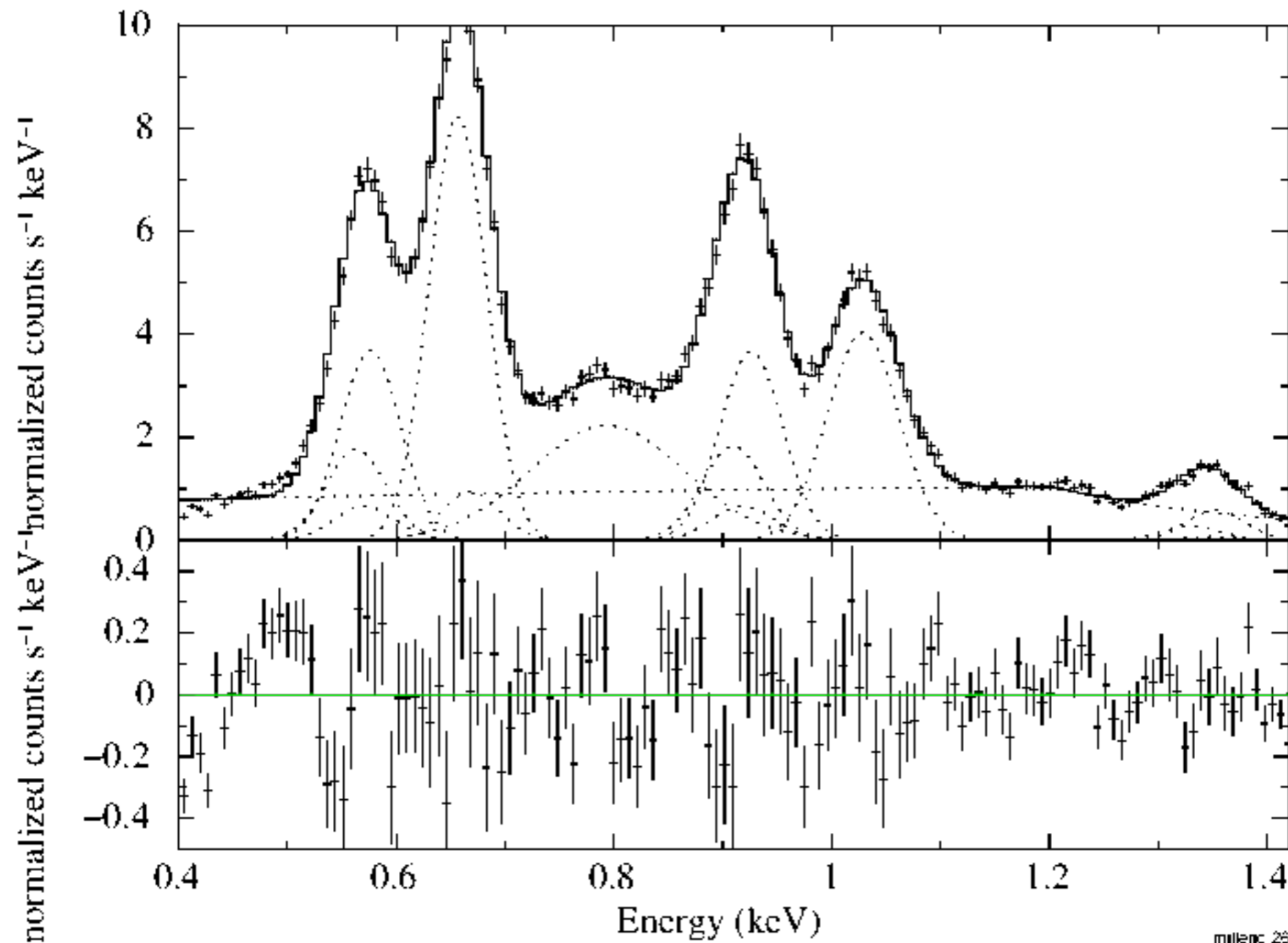
1 E0102-72.3 - XIS3, 20050813, Gaussian fits



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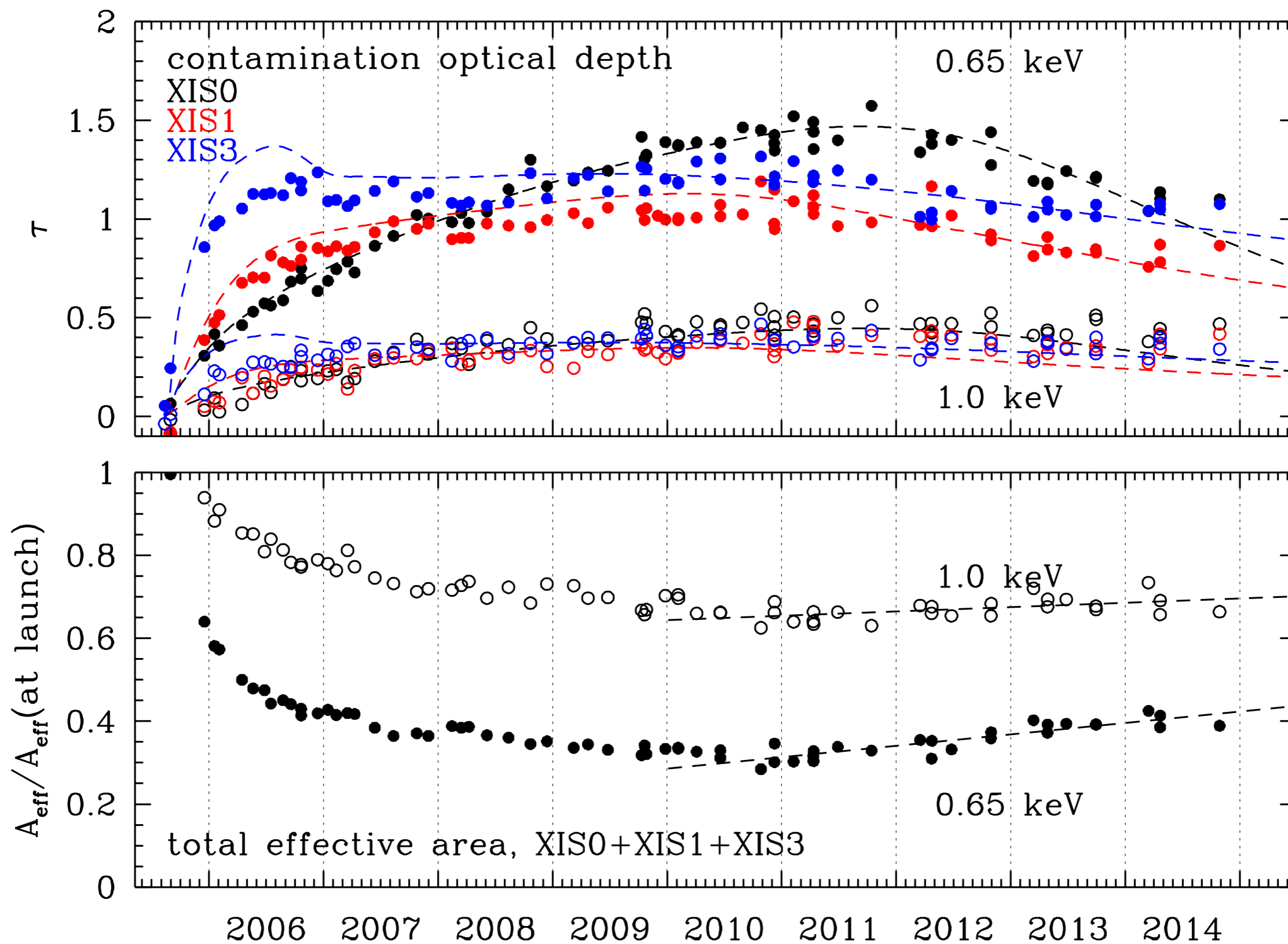
Suzaku XIS Contamination Observations

1 E0102-72.3 - XIS1, 20050831, Gaussian fits



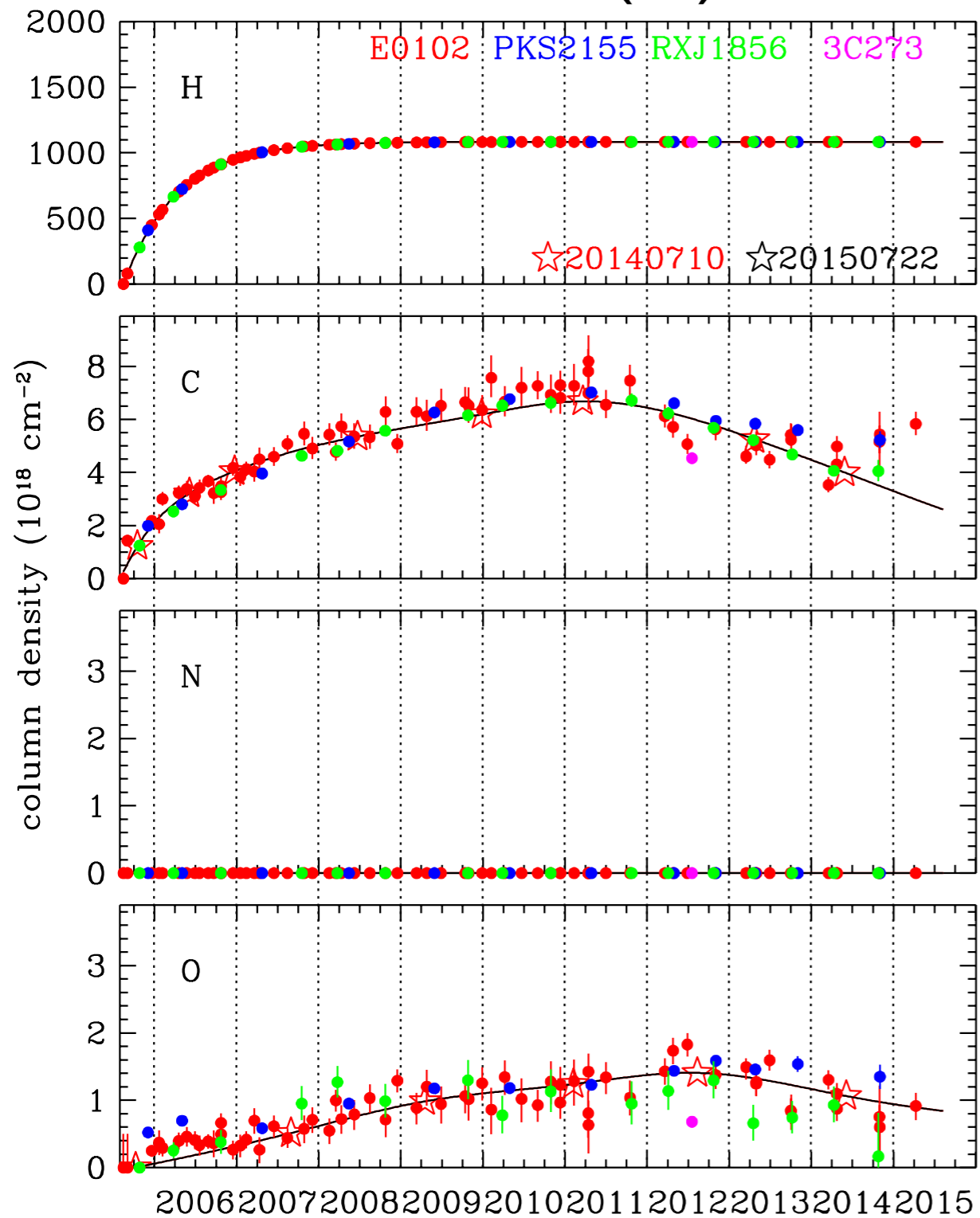
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Suzaku XIS Contamination Trend

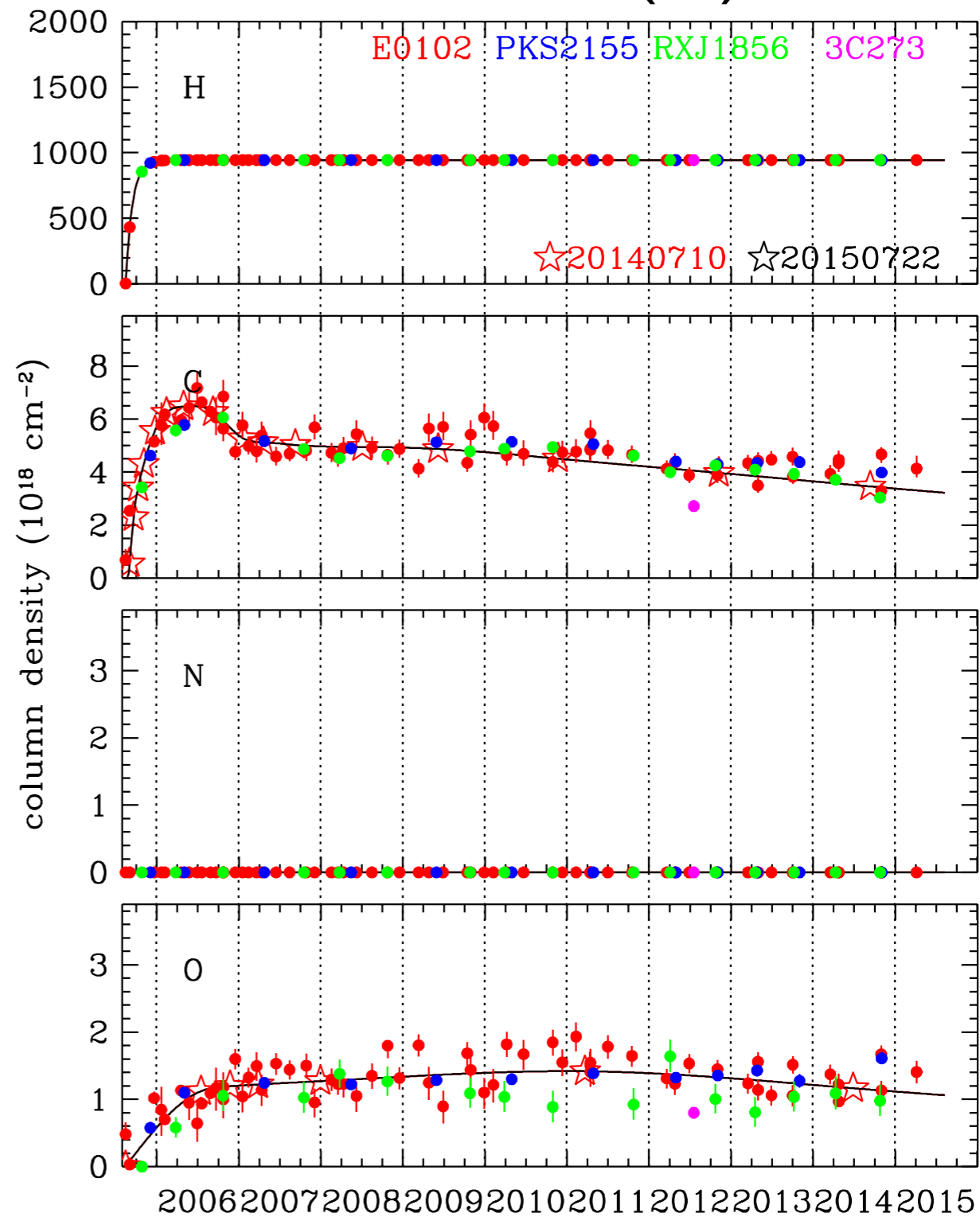


Suzaku XIS Contamination Composition

XIS0 (FI)



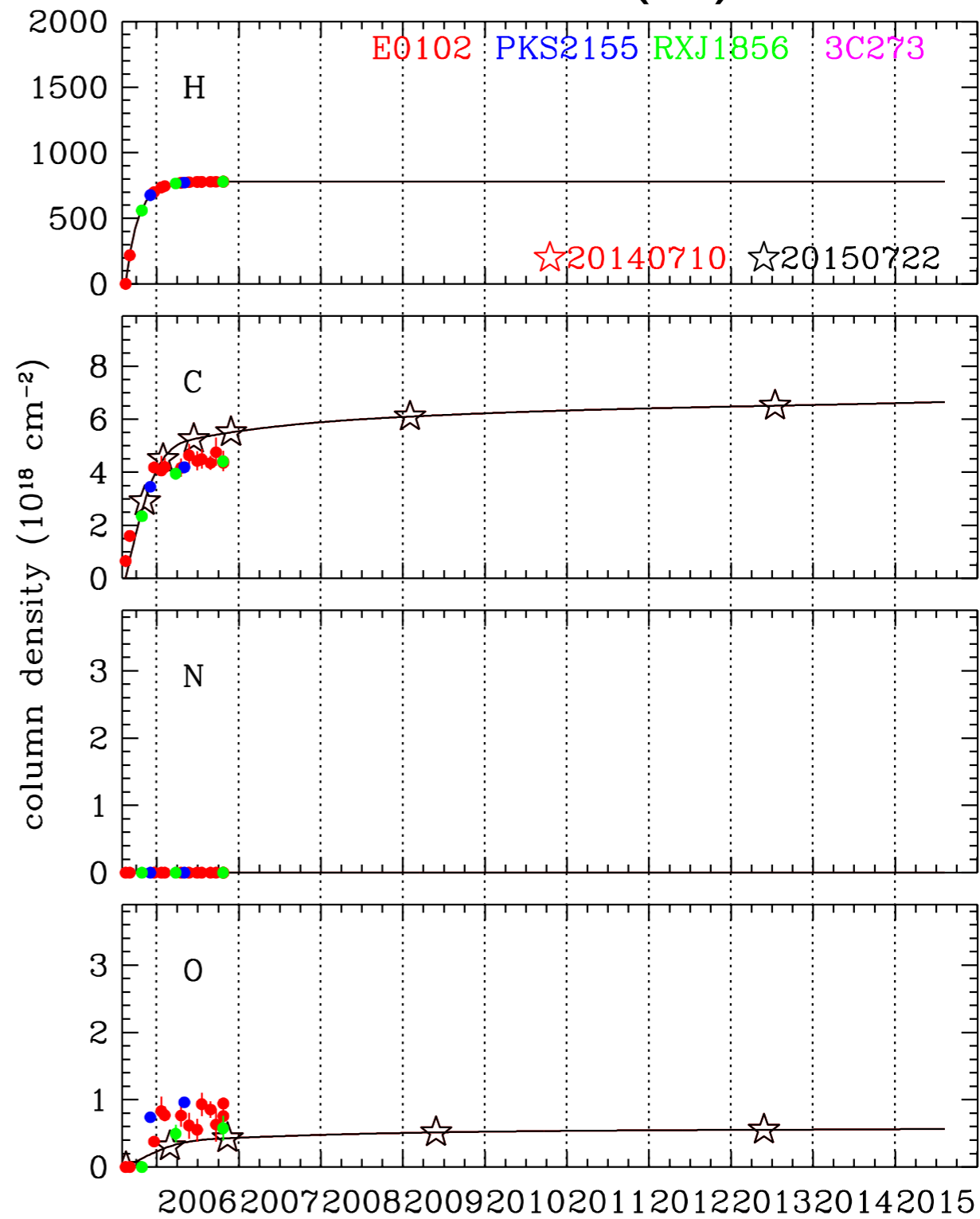
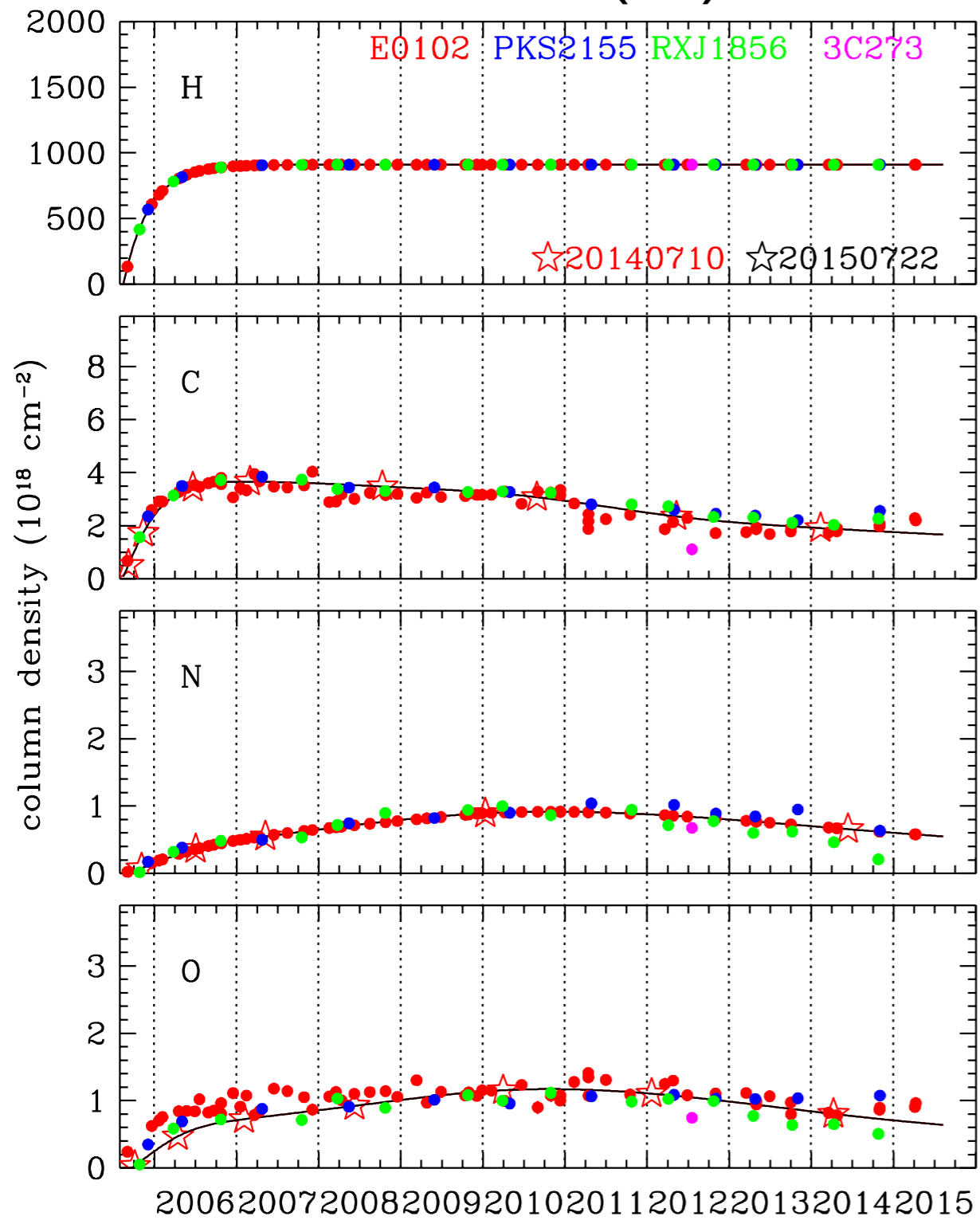
XIS3 (FI)



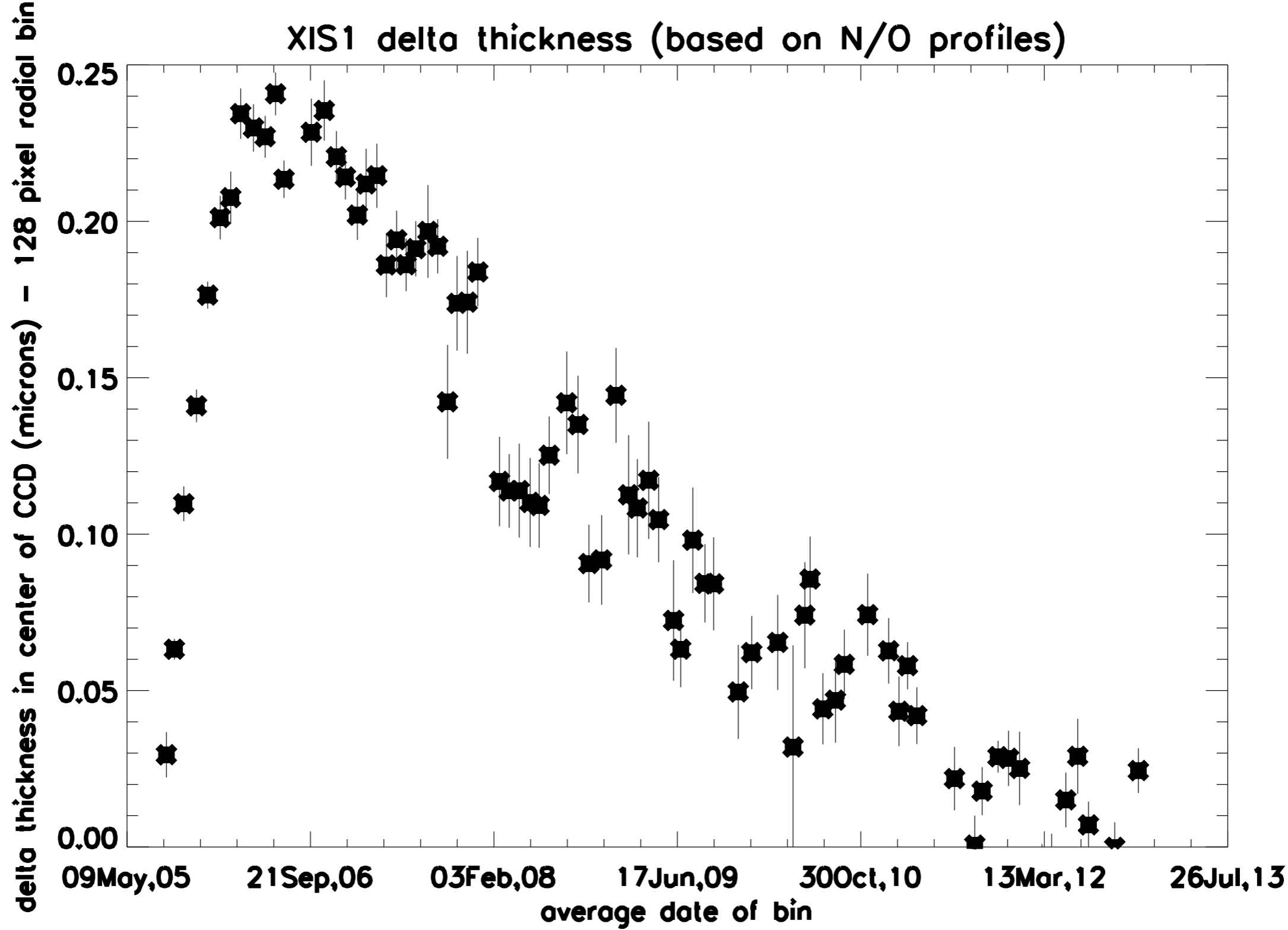
Suzaku XIS Contamination Composition

XIS1 (BI)

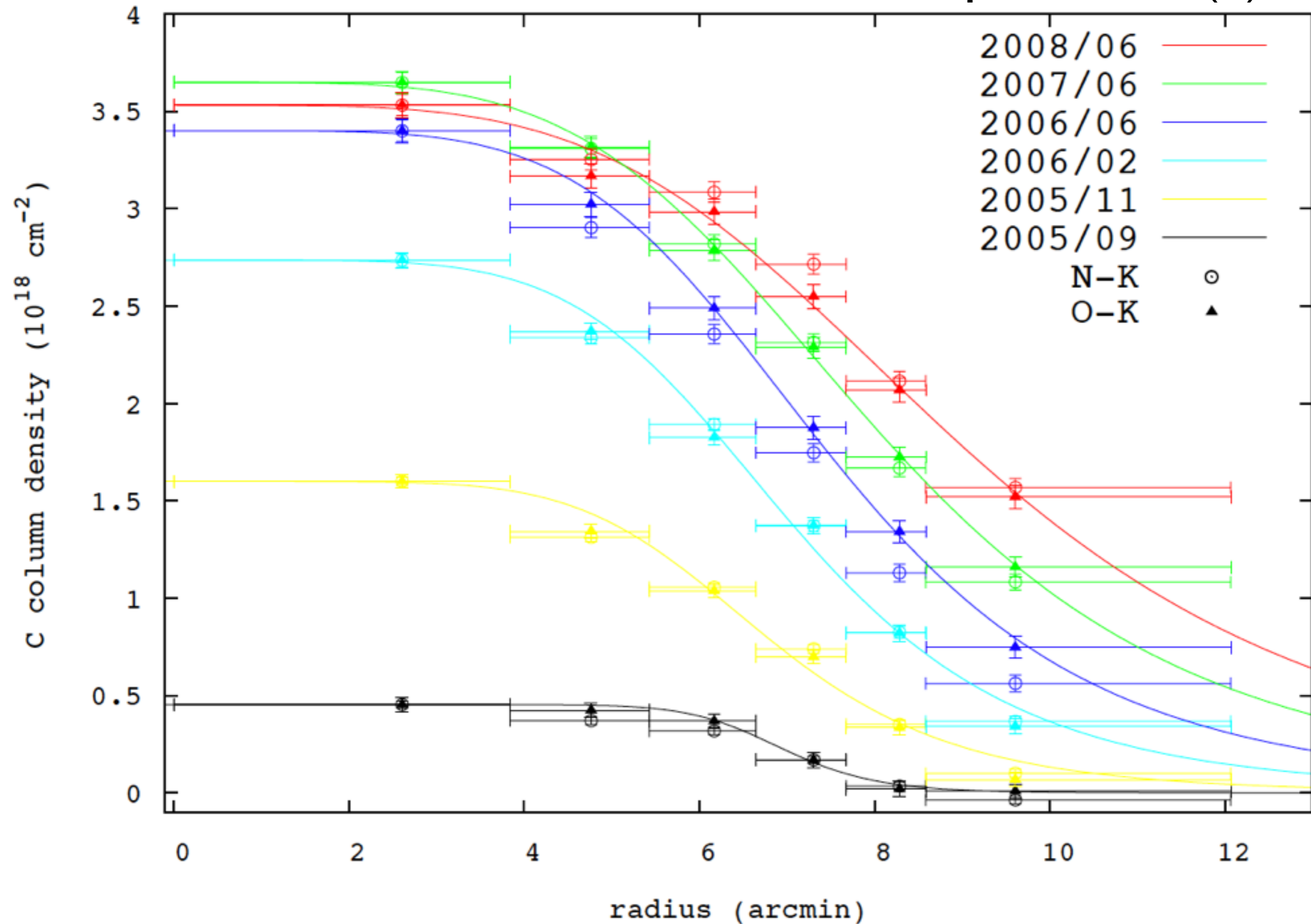
XIS2 (FI)



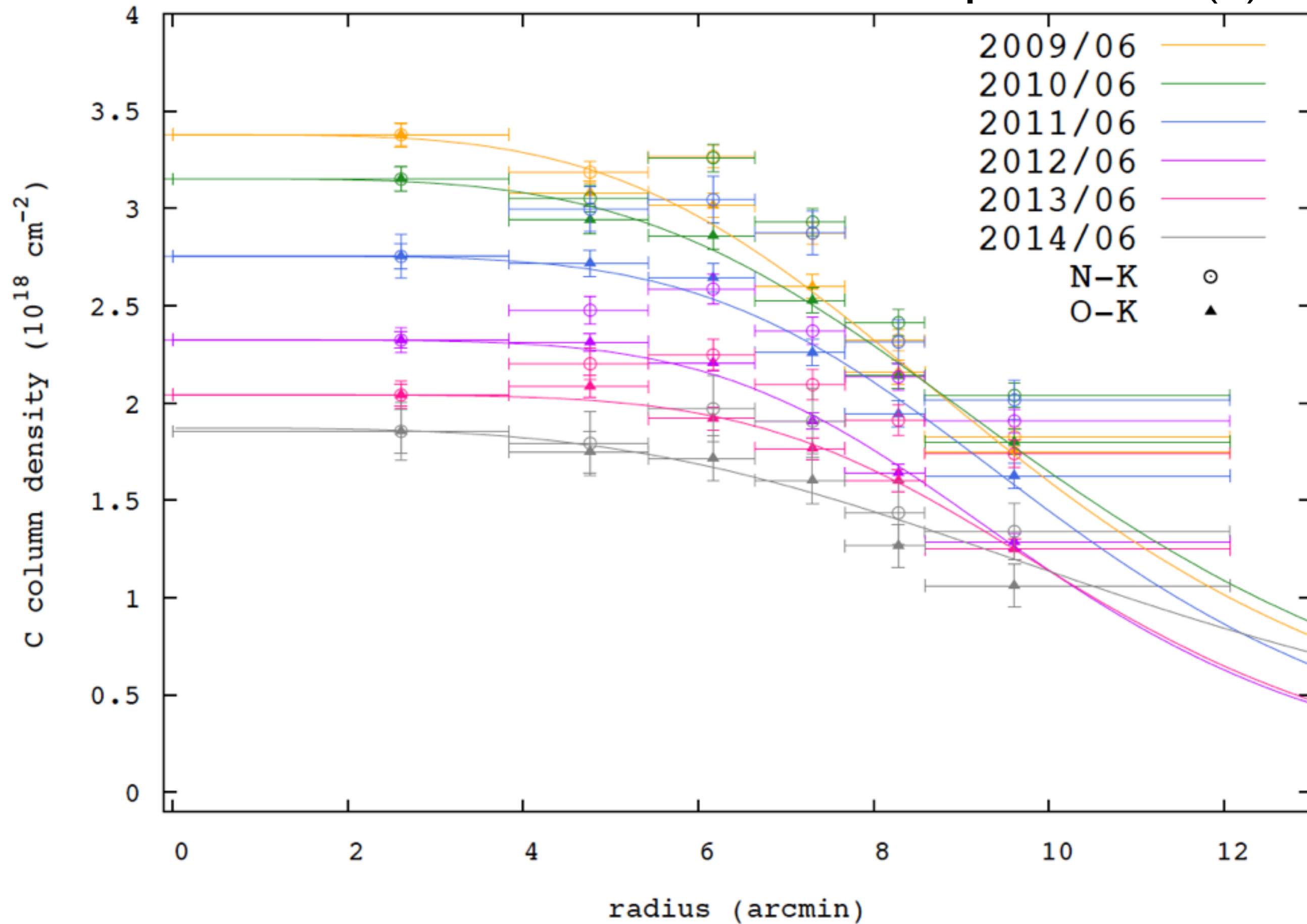
Suzaku XIS Contamination Radial Dependence (I)



Suzaku XIS Contamination Radial Dependence (2)

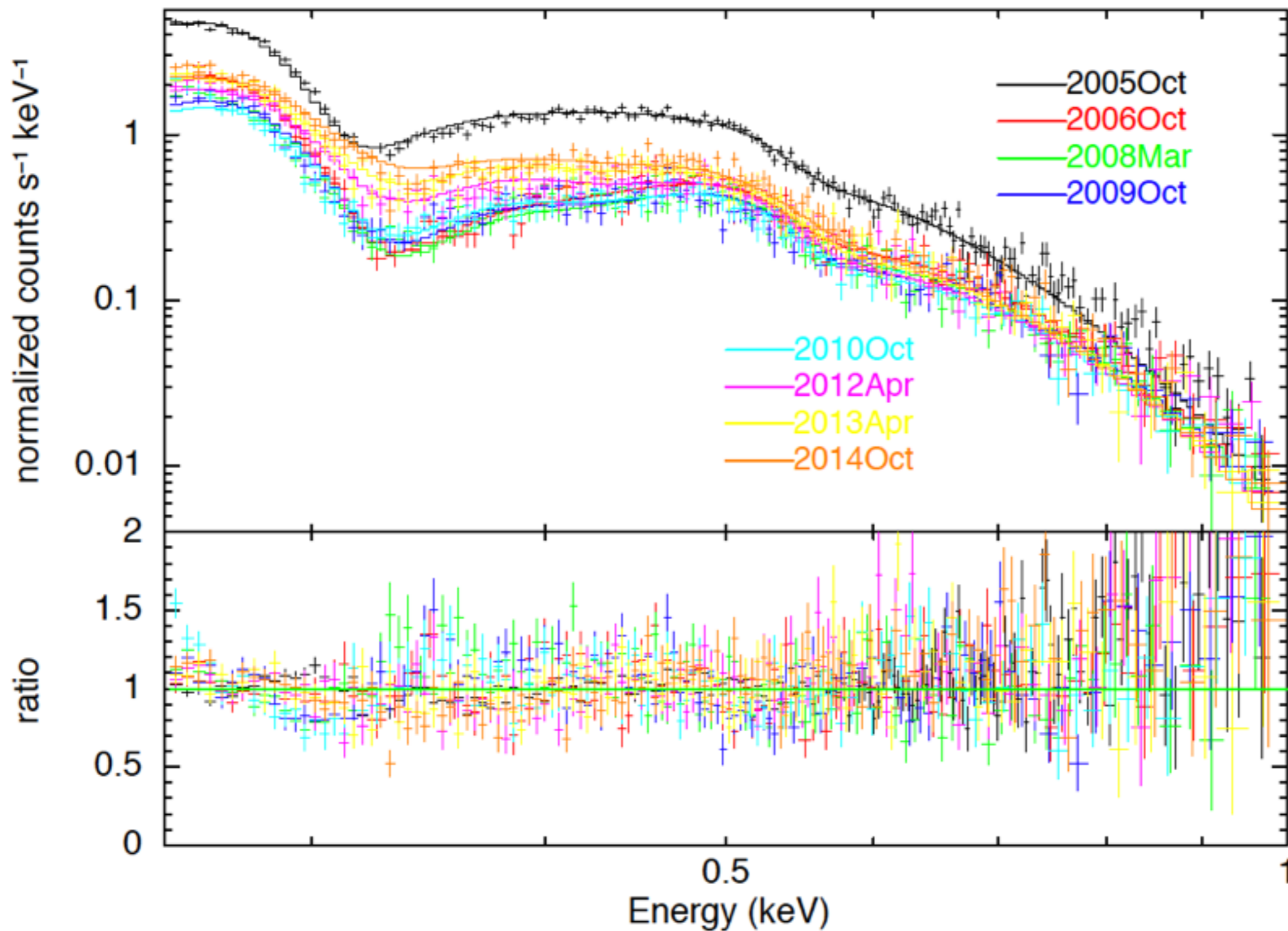


Suzaku XIS Contamination Radial Dependence (3)



Suzaku XIS Contamination Model Quality

RXJ1856 xissimarfgn-with-HCNO-model



Suzaku XIS Contamination – What Is It?

Leak of tar-like material at IRU-SA

- A leak of tar-like material was found to leak at the mount point of IRU-SA on Oct. 26, 2005, after the thermal vacuum test of Astro-F (akari).

DEHP (a common form of phthalic ester)

$$E = 1.3 \times 10^4 \text{ K} \quad P_0 = 7.1 \times 10^{14} \text{ Pa}$$

One of the most common outgas in the satellite.

DEHP = diethylhexyl phthalate

C₂₄H₃₈O₄



Summary

- contamination level increased quickly
(XIS after 3 months ~ ACIS after 6 years)
now decreasing at 10% per year
- C:N:O changes with time
started out C:O ~ 6 ~ DEHP, but not now
- decrease below C-edge: H? He? something else?
- $A_{\text{eff}} (E > 0.7 \text{ keV})$ is good to ~5%
 $A_{\text{eff}} (E < 0.7 \text{ keV})$ is (not) good to 10-50%, especially near edges

XIS Contamination TODO

- investigate 2005–2006 XIS3 behavior
- investigate dependence on gain, response
- constrain (and publish) systematic error vs. CCD vs. time vs. radius

