IACHEC Thermal SNRs Working Group Report

WG Meeting Agenda

1. Martin Stuhlinger - The Phenomenological IACHEC model of N132D
2. Adam Foster - Constraining the Fe-K Emission of N132D with XMM pn and MOS
3. Nick Durham - ACIS Gain Calibration with Cas A
4. Paul Plucinsky - Using 1E 0102.2-7219 to monitor the ACIS contamination
5. Konrad Dennerl and Paul Plucinsky - Analysis of the eROSITA data of 1E 0102.2-7219

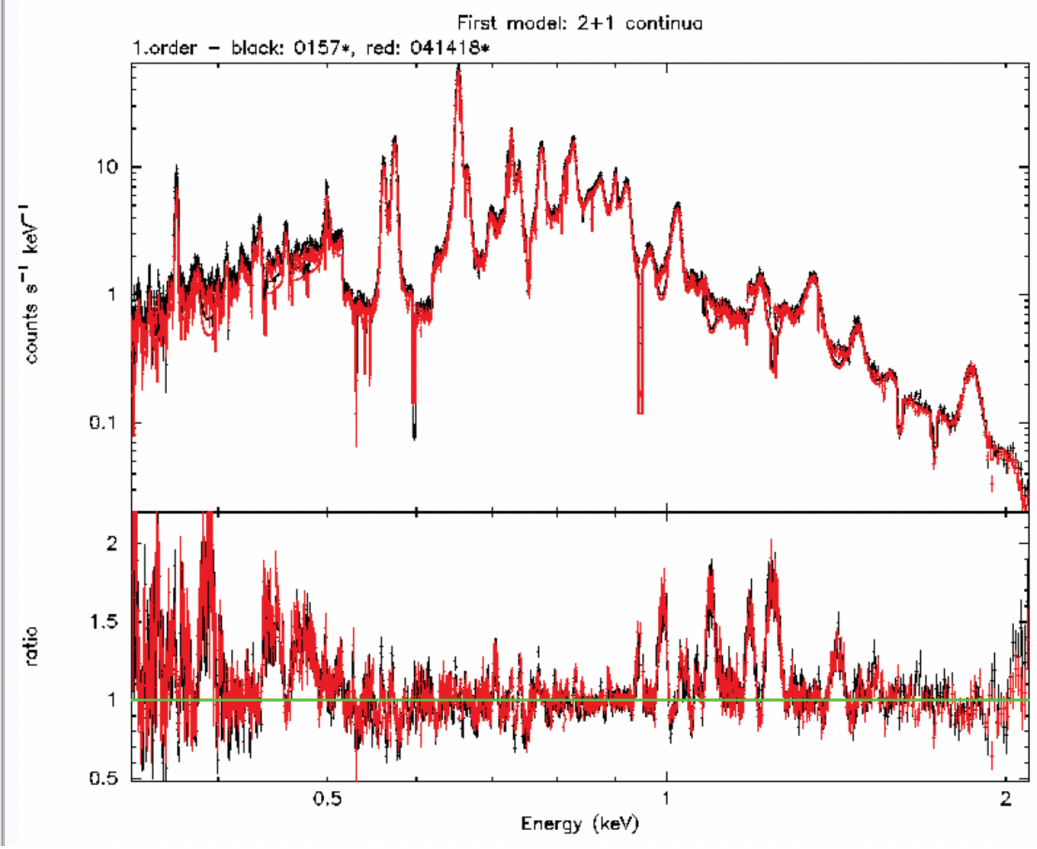
Phenomenological Model of N132D based on RGS Data

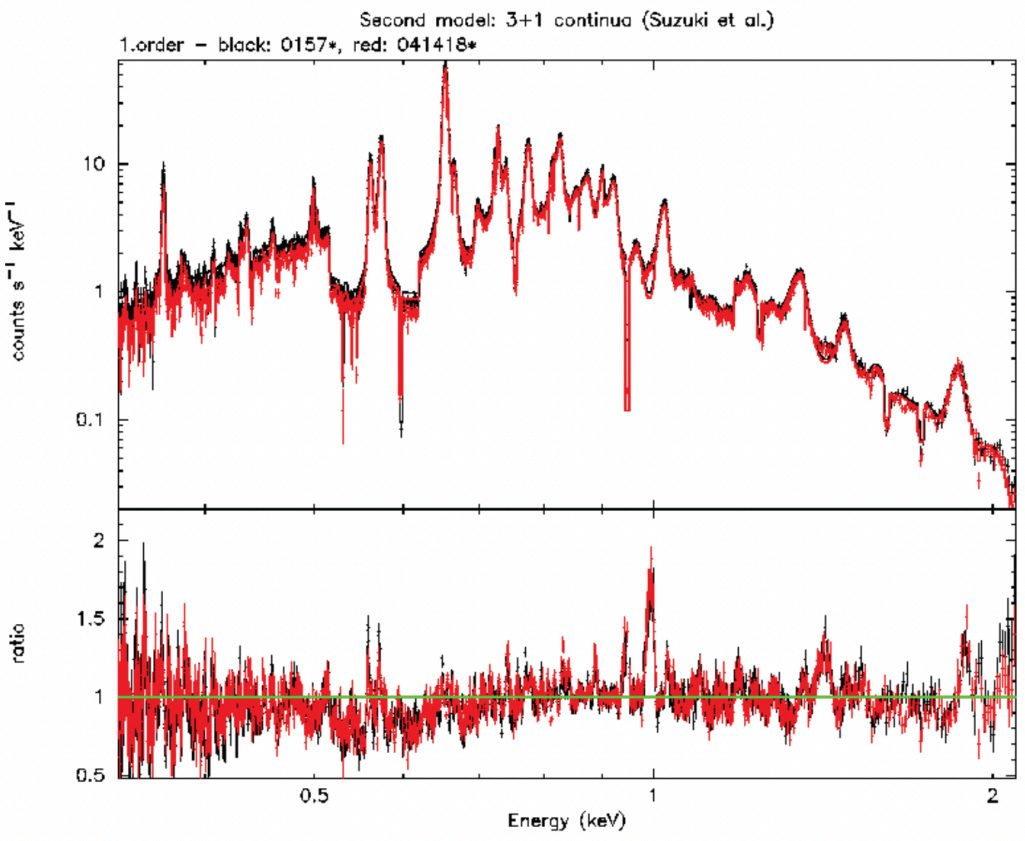
- Martin is using the RGS data to build a model for N132D similar to the IACHEC model for E0102
- Empirical model with Gaussians for the lines and no-line APECs for the continua
- compare to physical model in Suzuki et al. 2020

Stuhlinger(ESAC)

First model: Empirical Model

Second model: Suzuki et al. continua

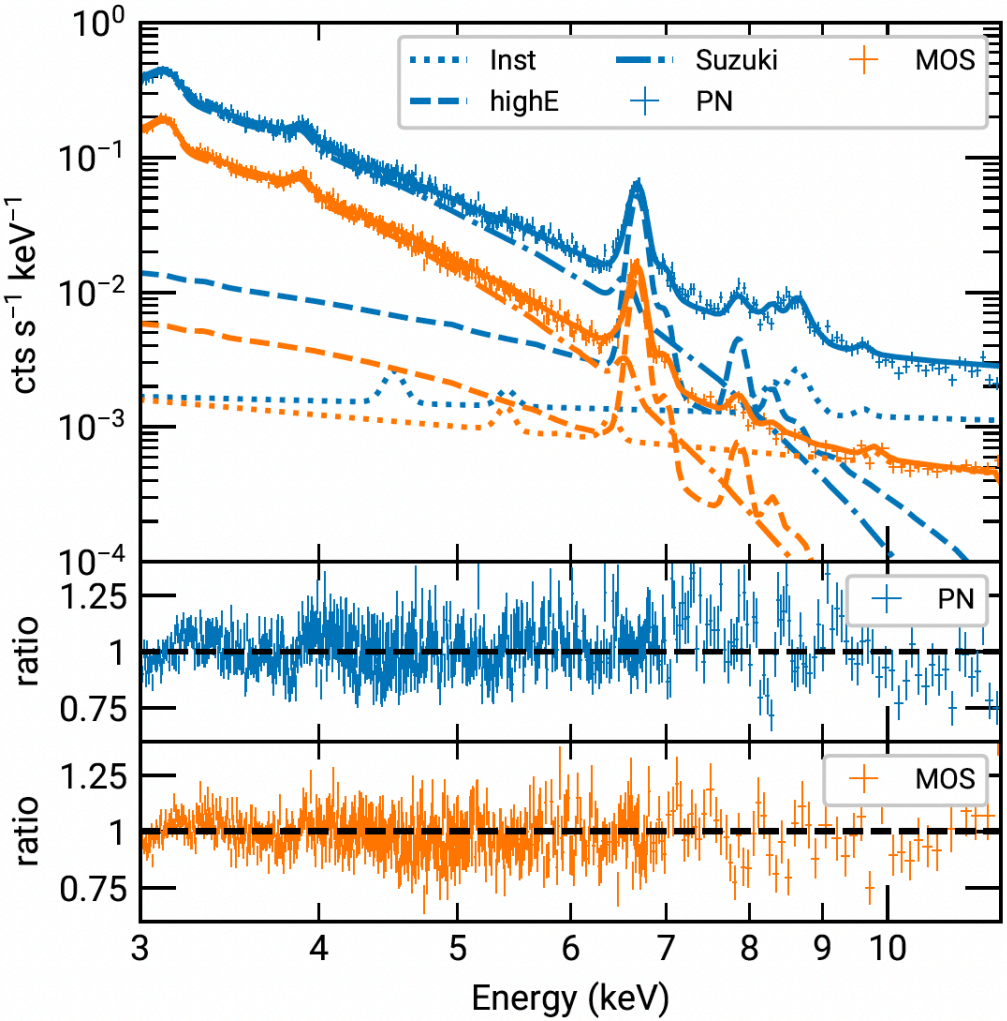




Model of the Fe-K region of N132D based on pn and MOS Data

- Adam is using the pn and MOS data to constrain the model in the Fe-K region **Foster(SAO)**
- Small modification to the existing IACHEC model for N132D
- no need for a neutral Fe-K line

Data shown have xcaladjust and absfluxcorr on.



Component	Equilibrium	Ionizing	Recombining
kT^a	$4.56^{+0.05}_{-0.20}$	$9.30^{+0.50}_{-1.73}$	$2.87^{+0.10}_{-0.06}$
Fe^b	$7.35^{+0.39}_{-0.76}$	$7.37^{+0.61}_{-0.24}$	$5.81^{+0.29}_{-0.01}$
τ^c	N/A	$2.53^{+0.58}_{-0.08}$	$5.97^{+0.02}_{-0.38}$ Upper bound
norm^d	$3.20^{+0.41}_{-0.13}$	$2.10^{+0.13}_{-0.08}$	$6.26^{+0.08}_{-0.48}$
Ca_{Suz} ^{b}	$1.07^{+0.02}_{-0.06}$	$1.03^{+0.02}_{-0.04}$	$1.04^{+0.01}_{-0.07}$
$norm_{Suz}$ ^{e}	$2.97^{+0.01}_{-0.01}$	$3.00^{+0.01}_{-0.01}$	$2.91^{+0.02}_{-0.02}$ consistent
d.o.f.	156575	156574	156574
cstat	119879	119885	119925
pchi	156903	156735	156522
goodness	68%	56%	45%

^{a}in keV

^{b}in solar photospheric values (Anders & Grevesse 1989)

^{c}in 10^{11} cm^{-3}s

^{d}in 10^{10}cm^{-5}

^{e}in 10^{12}cm^{-5}

MCMC optimizes cstat
Goodness uses pchi
Which fit is best?

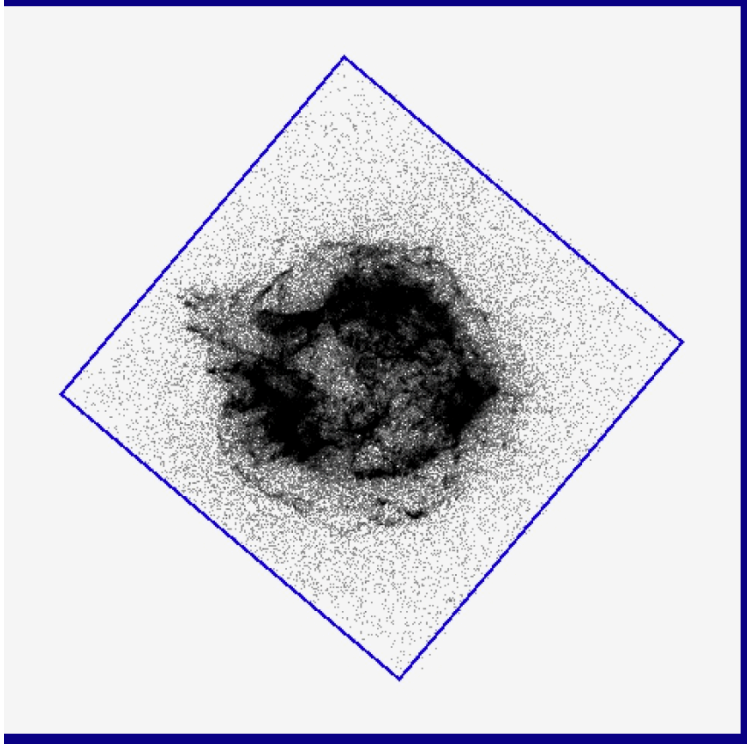
Using Cas A for the ACIS time-dependent gain correction

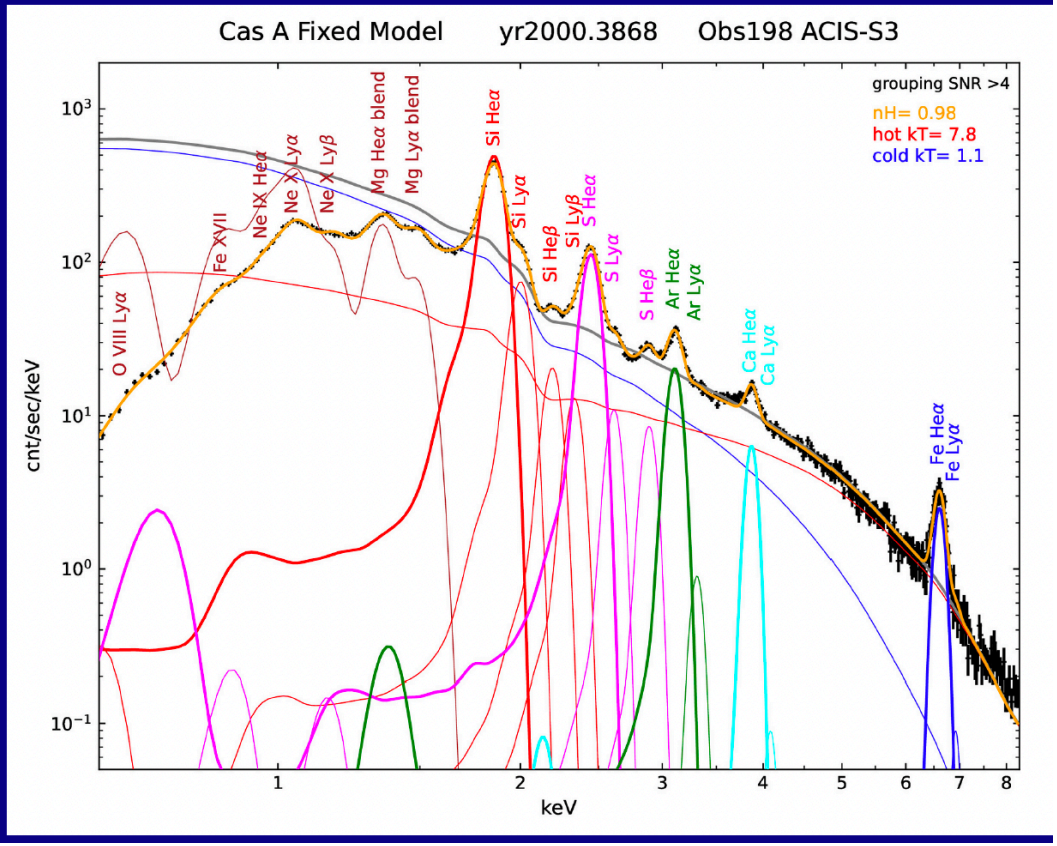
- Nick is developing a model that accounts for the velocity structure in Cas A
- Makes uses of the PCA analysis method described by Günther et al. 2021

Durham (SAO)

👍 Extended
👍 Bright
👍 Strong line emission

👎 Complicated spectrum
👎 Si velocities -4,000 to +6,000 km/sec (-13eV to + 20eV)
👎 Evolving spatially

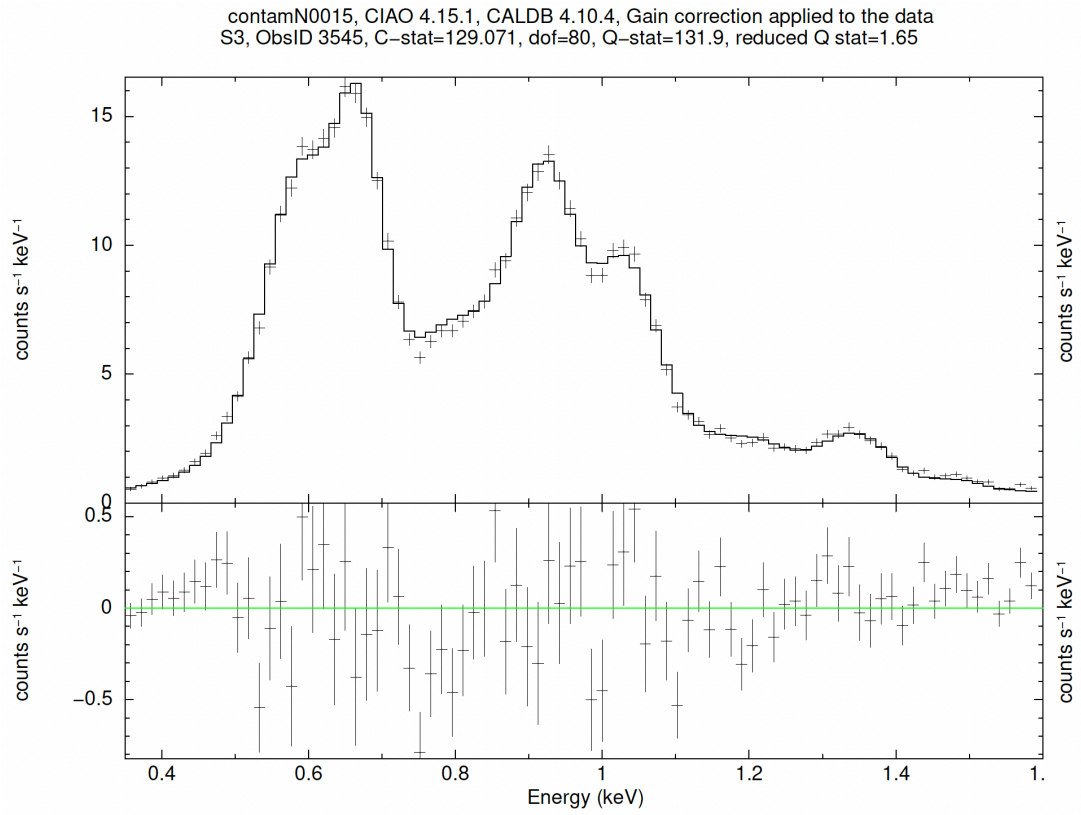




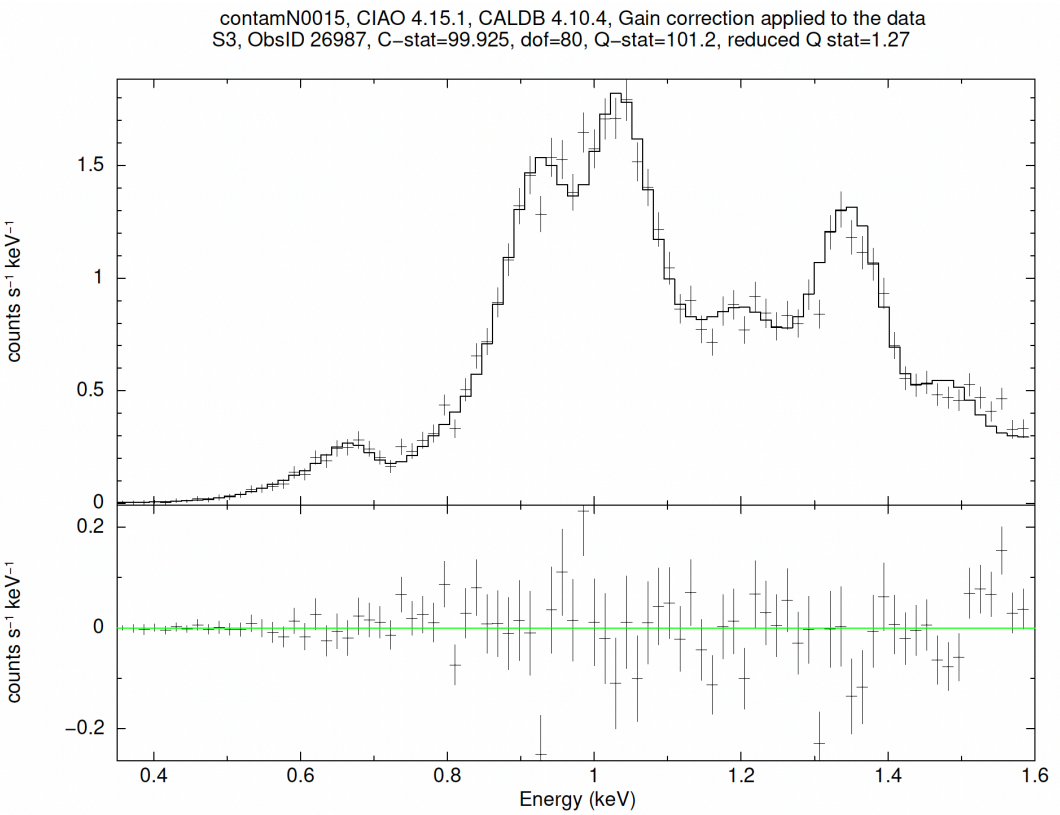
Verification of the ACIS Contamination Model with E0102

- ACIS S3 data fit from 2003 until 2023
- only 5 free parameters in the fits, global norm, OVII, OVIII, NeIX, NeX norms
- OVII does not produce useful data in 2023, OVIII is still useful at this time

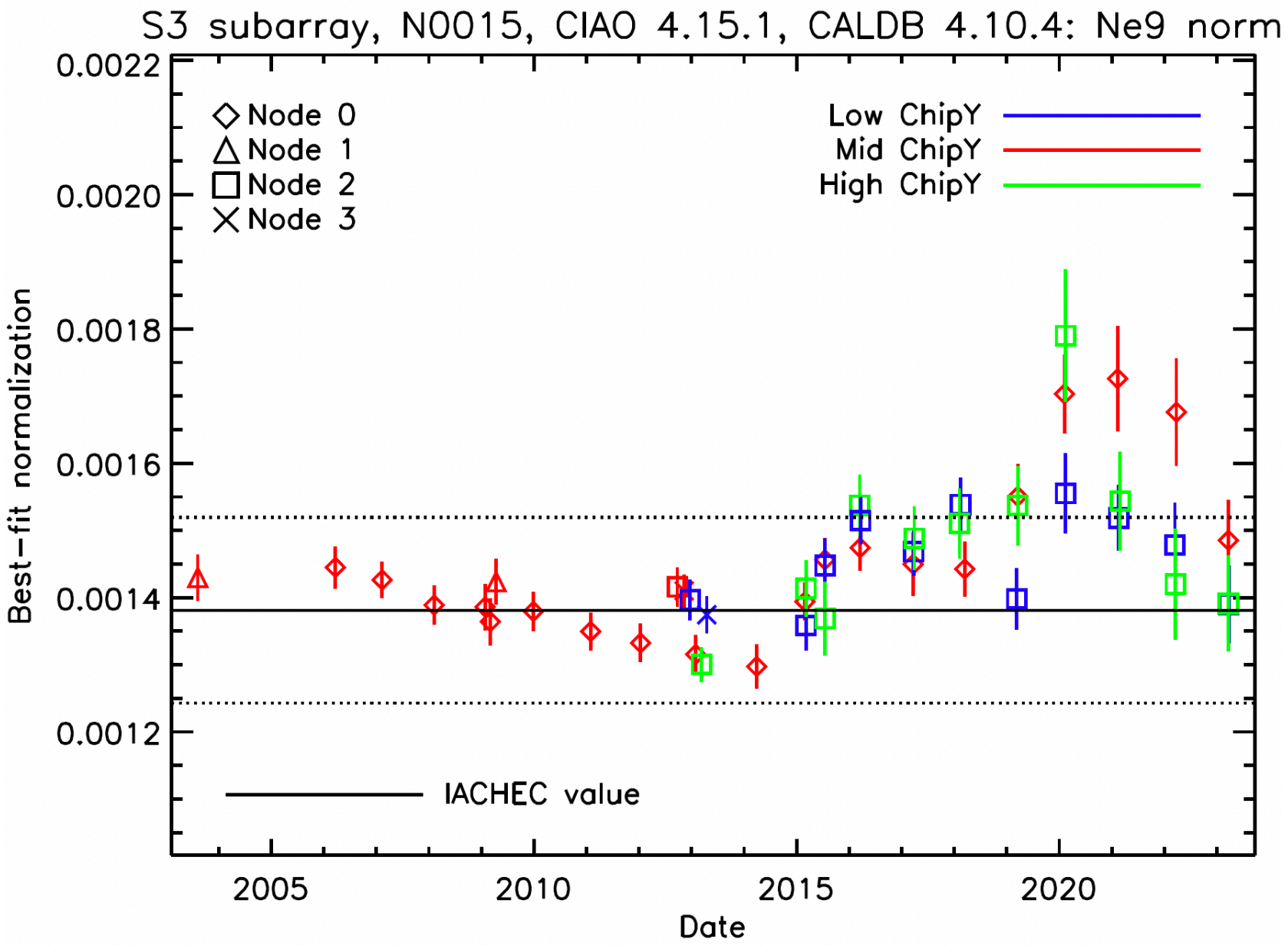
ACIS S3 2003



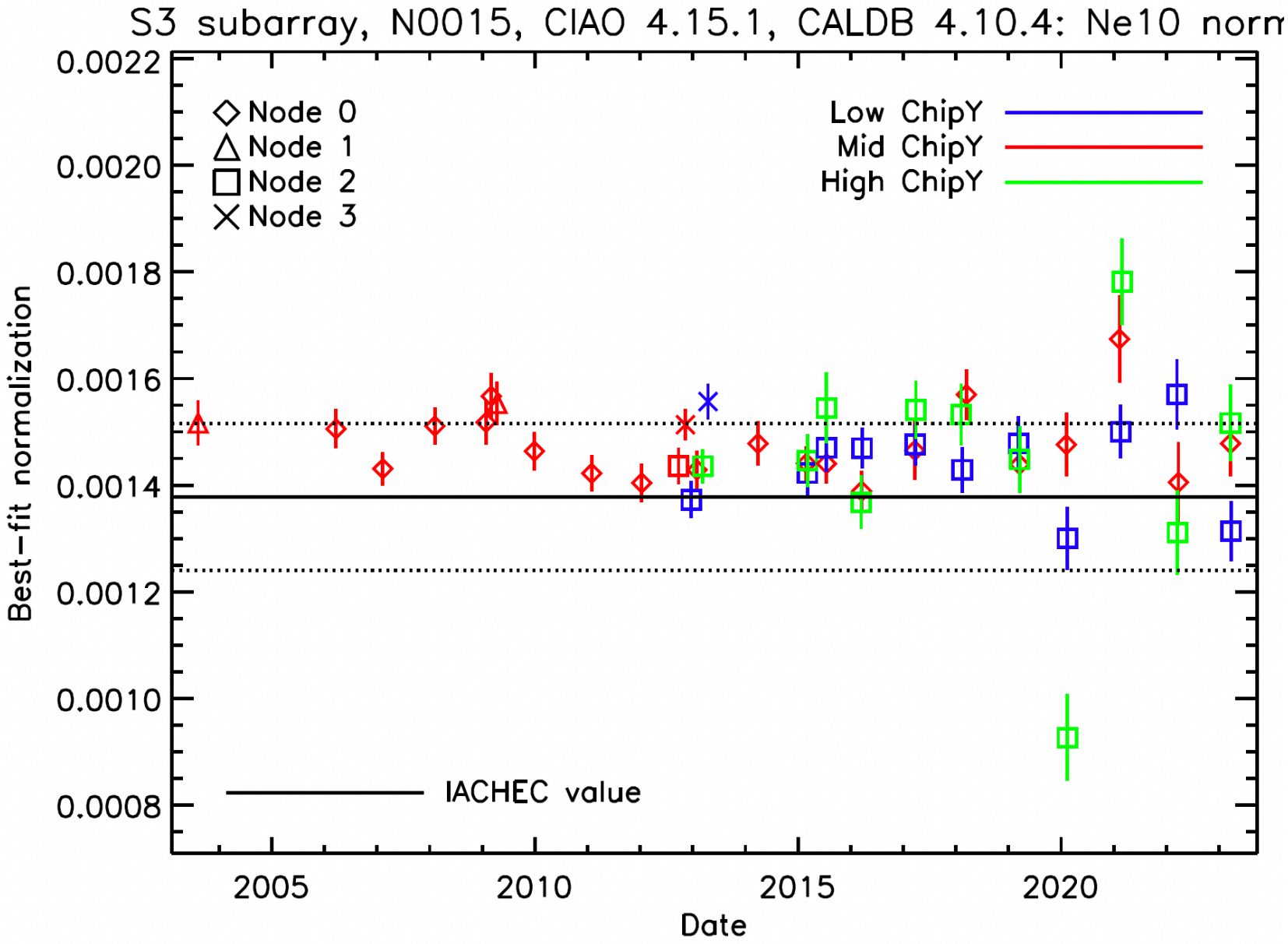
ACIS S3 2023



Ne IX Line Normalization vs. Time



Ne X Line Normalization vs. Time

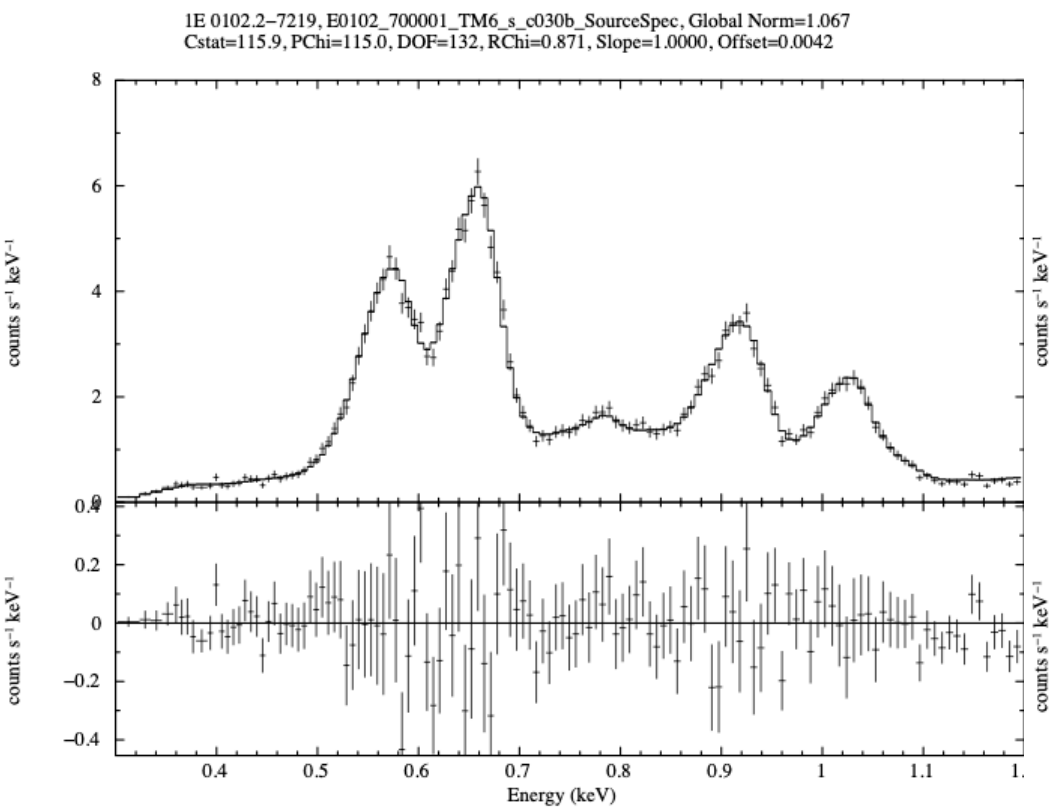


Fitting the eROSITA data of E0102 with the IACHEC Model

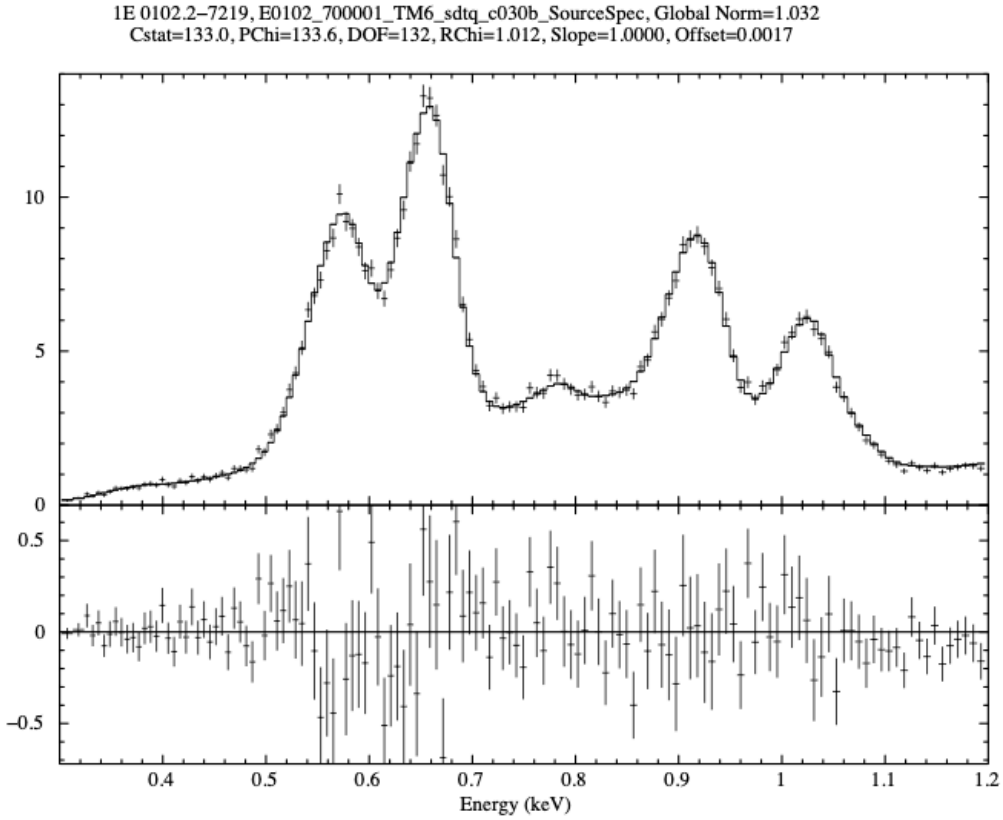
- IACHEC standard, empirical model published in Plucinsky et al. 2017, A&A, 597, A35
- Dennerl provided spectra and response files for the "***c30b***" processing
- three observations of E0102: 700001 (20191107), 710000(20200618), 740004(20211127)
- only 5 free parameters in the fits, global norm, OVII, OVIII, NeIX, NeX norms

Dennerl (MPE), Plucinsky(SAO)

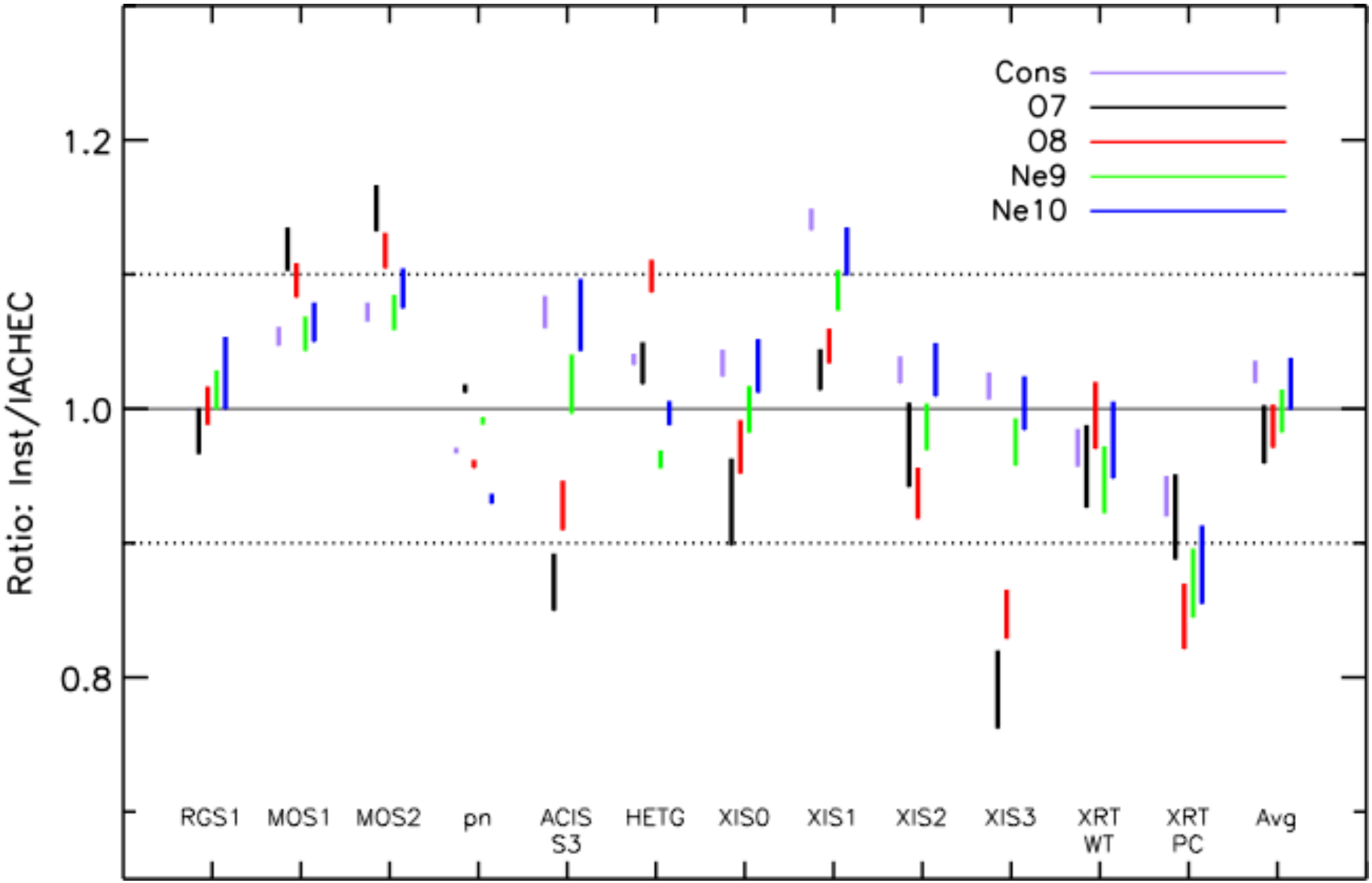
eROSITA TM6 "s"



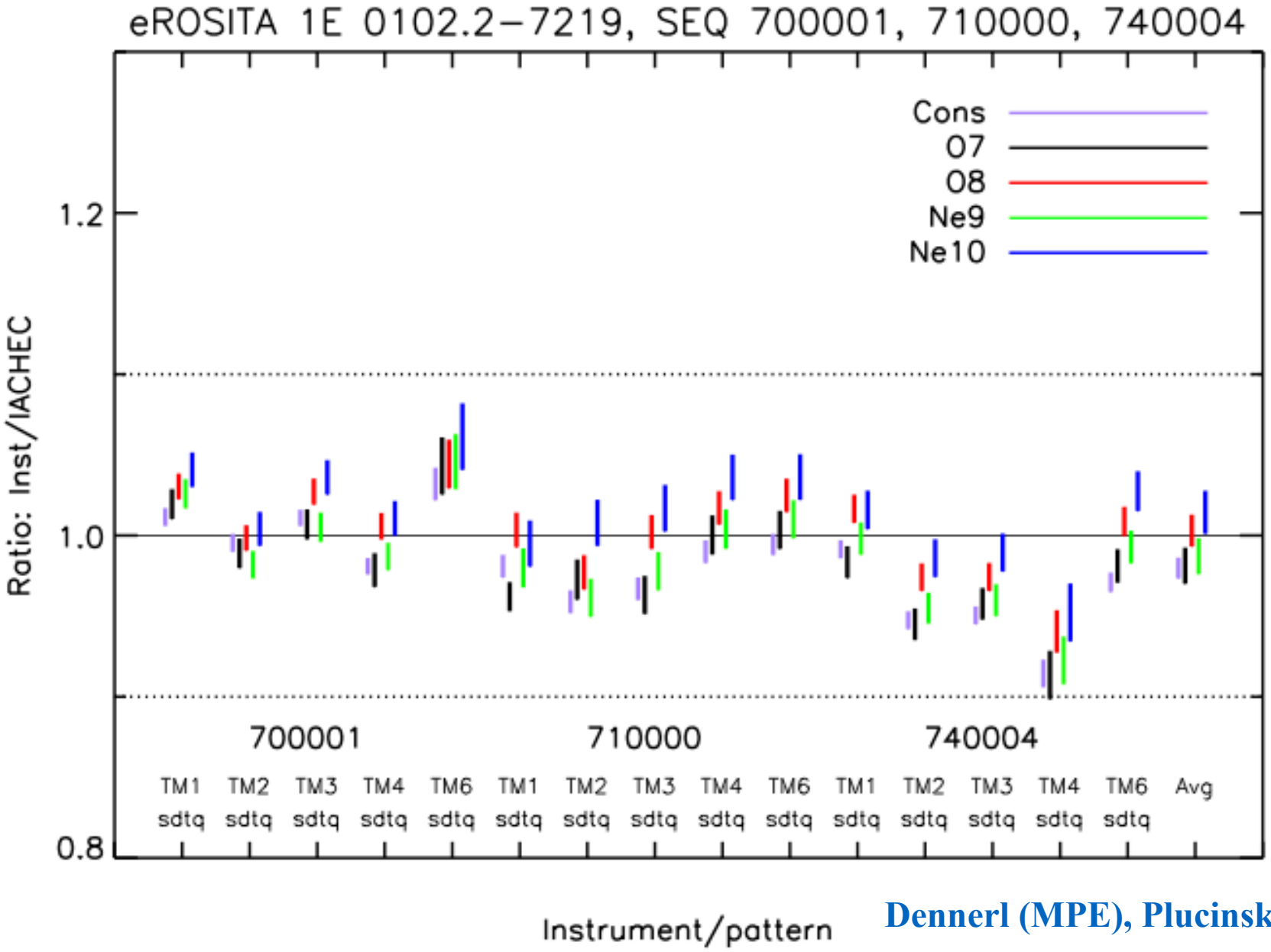
eROSITA TM6 "sdtq"



E0102 Line Normalizations vs. Time (Plucinsky et al. 2017)



eROSITA Line Normalizations vs. Time ("sdtq" events)



Dennerl (MPE), Plucinsky(SAO)