N132D Update: Chandra data

Summary

- Fit the 2006 Chandra ACIS-S data of N132D, three observations (5532, 7259, 7266) for a total of 89 ks
- Use two models the so-called physical model "n132d_afoster_suzuki_vrnei_20210420" and the empirical model "N132D_E0310_v2.13_20210421.mdl"
- Both models are available on the IACHEC wiki page for the Thermal SNRs WG "https://wikis.mit.edu/confluence/display/iachec/Current+N132D+model"
- fit in the 4.5-8.0 keV band following the instructions I emailed to the group (included later in this presentation and we can review them in detail if necessary)
- compare the quality of the fits in the 4.5-8.0 keV band

General Fitting Instructions

- fit in the 4.5 – 8.0 keV band (the 8.0 keV is flexible, do what makes sense for your instrument. But I think we should be strict with the 4.5 keV start value)
- use unbinned spectra for fitting OR USE KAASTRA'S OPTIMAL BINNING METHOD USING THE FTOOL OPTIMAL BINNING (USING 'FTGROUPPHA' WITH 'BINTYPE=OPT')
- IF FITTING UNBINNED SPECTRA, USE THE SETPLOT REBIN COMMAND TO SHOW THE INTERESTING STRUCTURE IN THE FIT AND/OR RESIDUALS WHEN MAKING A PLOT TO SHARE
- use an explicit background model for your instrument, do not subtract background
- vary what parameters make sense for your background model, hopefully this is just a normalization
- use the C statistic as the fit statistic to determine the best fit
- use the Pearson chi square or chi square with the weighting by the model for test statistic (XSPEC allows one to calculate a fit statistic and a test statistic for the same fit)
- report the C statistic, Pearson chi square and DOF for the fits
- RUN THE GOODNESS COMMAND IN XSPEC WITH THE DEFAULT SETTINGS OF "SIM" AND "FIT" TO EVALUATE THE GOODNESS OF THE FIT. I WOULD SUGGEST "GOODNESS 100” IF THE COMPUTATION TIME IS REASONABLE, 100 BEING 100 ITERATIONS.
- make a plot of the data with the best fit model and the residuals in a panel below the fit in the 4.5 – 8.0 (?) keV band. PLEASE MAKE WHATEVER OTHER PLOTS MAKE SENSE FOR YOUR INSTRUMENT, BUT MAKE THIS ONE AT LEAST.

Physical Model Fitting Instructions

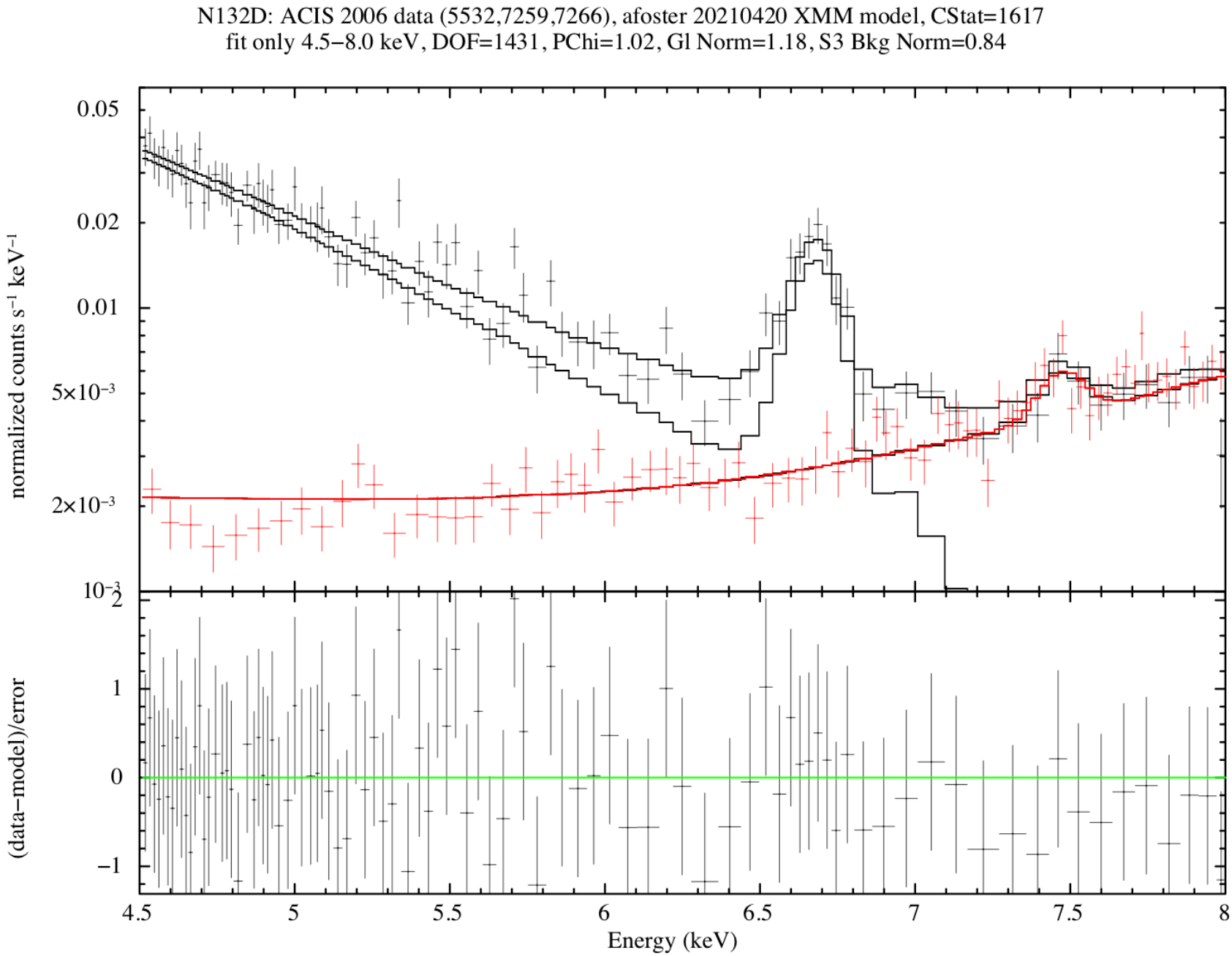
- ALLOW THE GLOBAL NORM TO VARY (**n132d:1**)
- allow the normalization of the high kT vrnei component (currently 4.77464 keV) to vary (**n132d:189**)
- set the neutral Fe K line normalization to 0 and freeze it (**n132d:192**)
- report C statistic, Pearson chi square, and DOF
- report best fit value on the normalization of the high kT vrnei component with 1 sigma uncertainty AND THE BEST FIT GLOBAL NORMALIZATION WITH 1 SIGMA UNCERTAINTY
- we may decide later that we need to allow the Fe and Ni abundances to vary but let's start simple

Empirical Model Fitting Instructions

- all line energies are frozen
- freeze the normalization of the neutral Fe line to 0.0
- allow the Global Norm to vary (**source:1**)
- freeze the temperature of the high kT component
- allow the normalization of the high kT component to vary (**source:419**)
- allow the normalization of the Fe XXV He-alpha f line (**source:390**) to vary, the normalizations of the Fe XXV He-alpha f and i lines are linked to the normalization of the Fe XXV He-alpha r line. So, only one normalization in the Fe XVV He-alpha triplet is allowed to vary.
- allow the normalization of the Fe XXVI Ly-alpha line (**source:399**) to vary
- report C statistic, Pearson chi square, and DOF
- REPORT THE RESULT OF THE GOODNESS COMMAND
- report the best fitted values with 1 sigma uncertainties (delta C statistic of 1.0) for the Global Norm,normalization of the high kT component, normalization of the Fe XXV He-alpha r line, and the normalization of the Fe XXVI Ly-alpha line

2006 data fit 4.5-8.0 keV with the physical model. Only the global norm, the high kT VRNEI norm, & detector norm are allowed to vary.

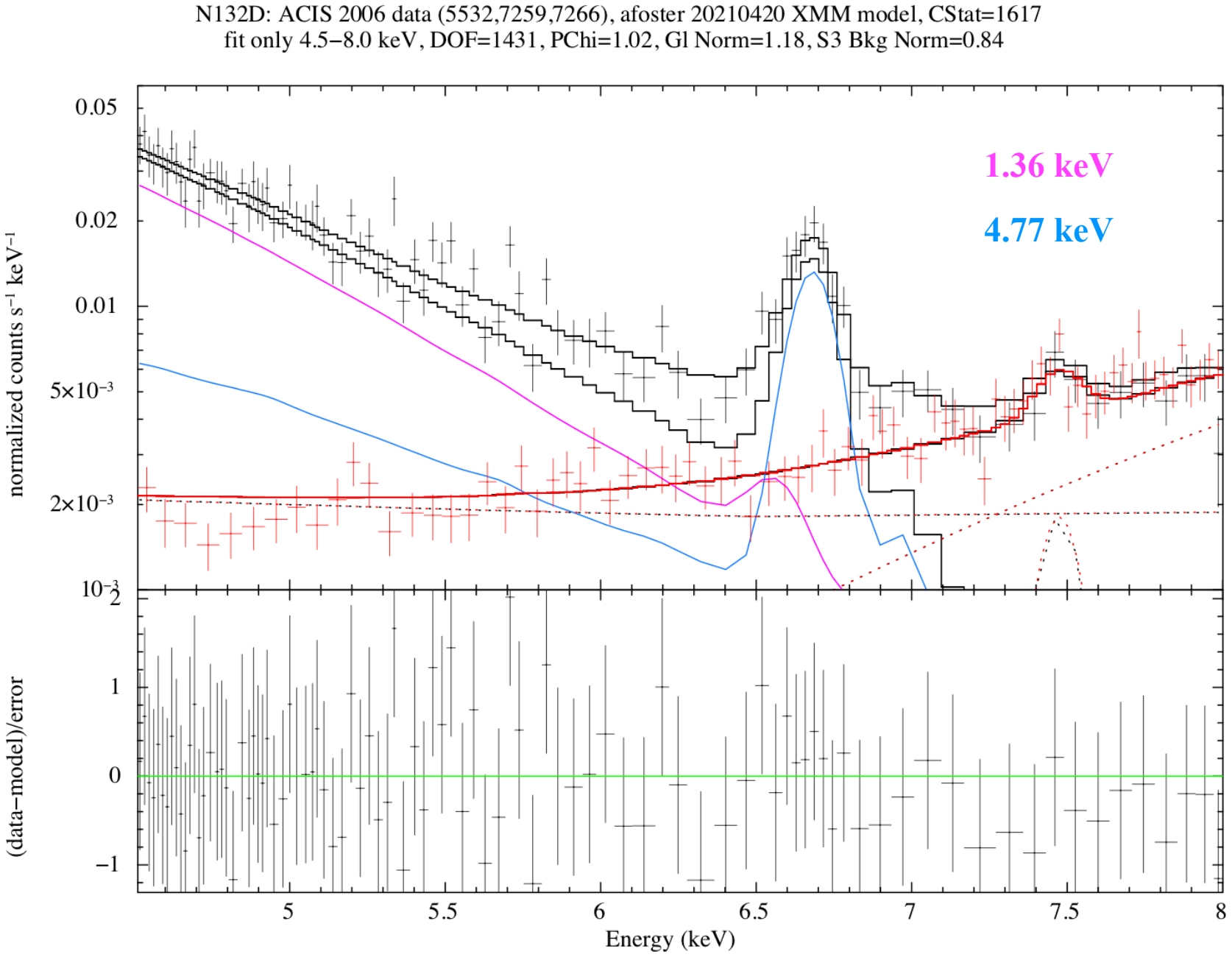
Global Norm= 1.18
VRNEI Norm= 7.4e-4
Det Norm= 0.84
Goodness= 65.0%



Which component dominates in which energy range ?

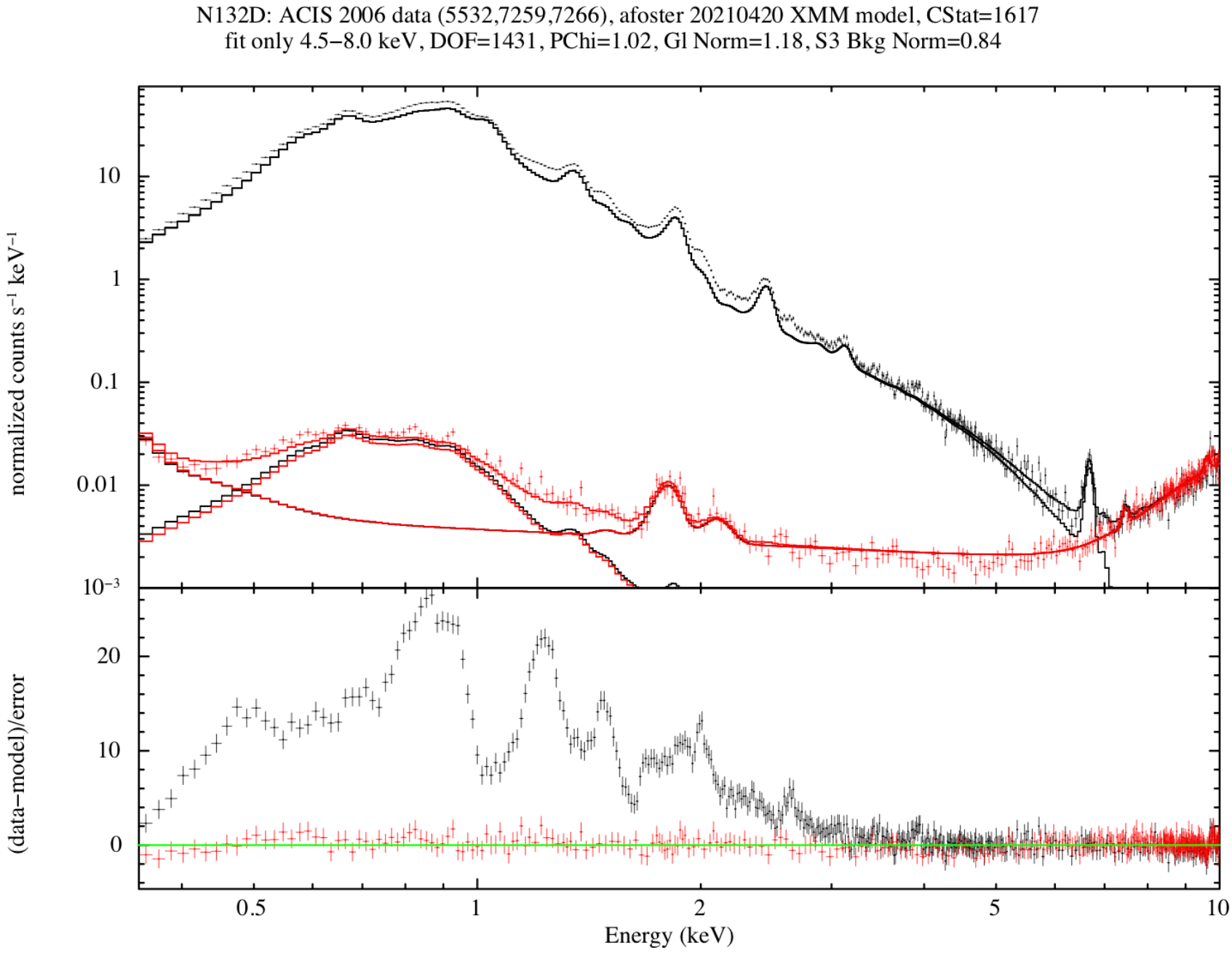
Only the global norm, the high kT VRNEI norm, & detector norm are allowed to vary.

Global Norm= 1.18
VRNEI Norm= 7.4e-4
Det Norm= 0.84
Goodness= 65.0%



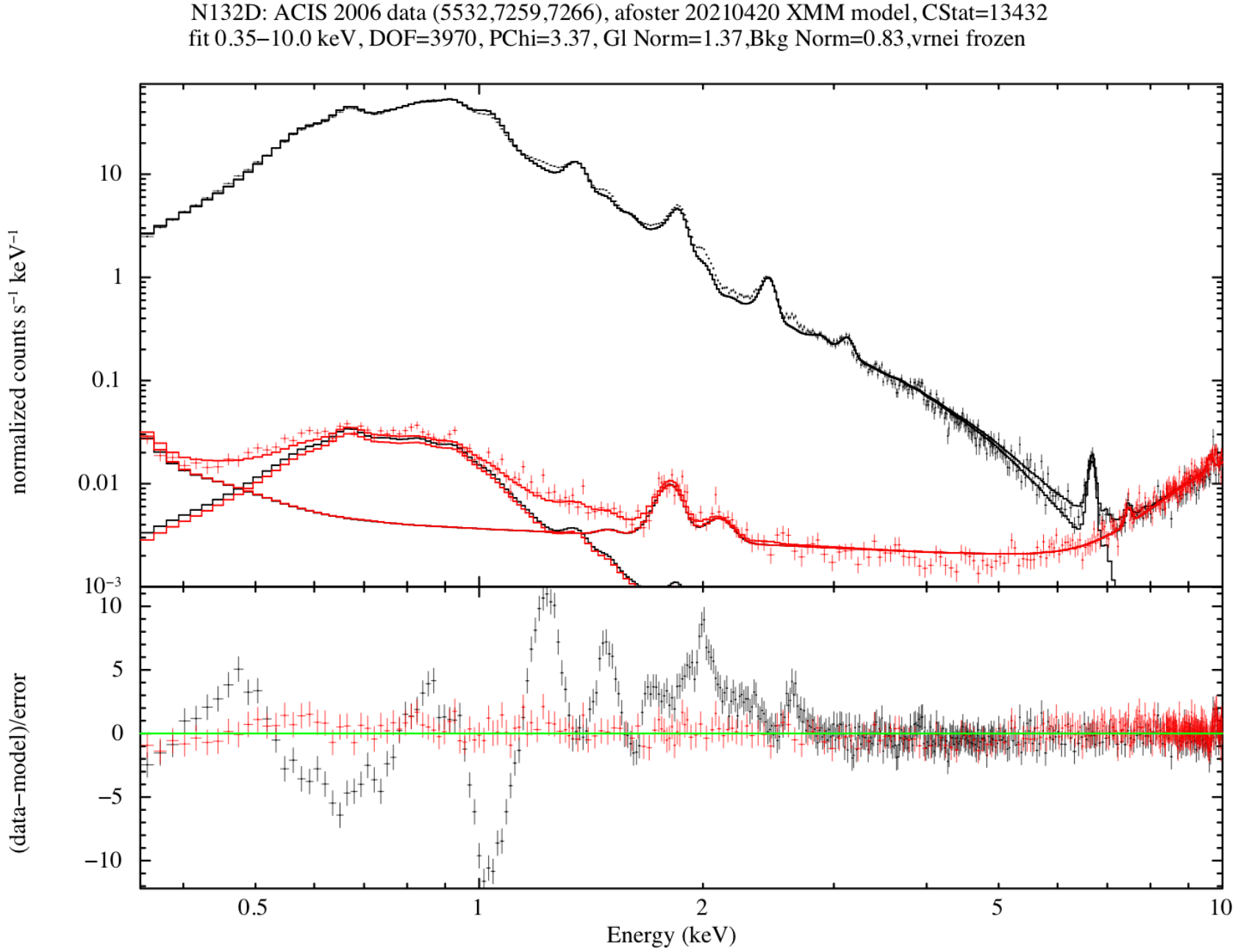
2006 data fit 4.5-8.0 keV with the physical model. Only the global norm, the high kT VRNEI norm, &detector norm are allowed to vary.

Norm at low energies is underestimated, but shape looks reasonable overall



2006 data fit 0.35-10.0 keV with the physical model. Only the global norm &detector norm are allowed to vary.

Global Norm= 1.37
VRNEI Norm= frozen
Det Norm= 0.83
Goodness= 100%

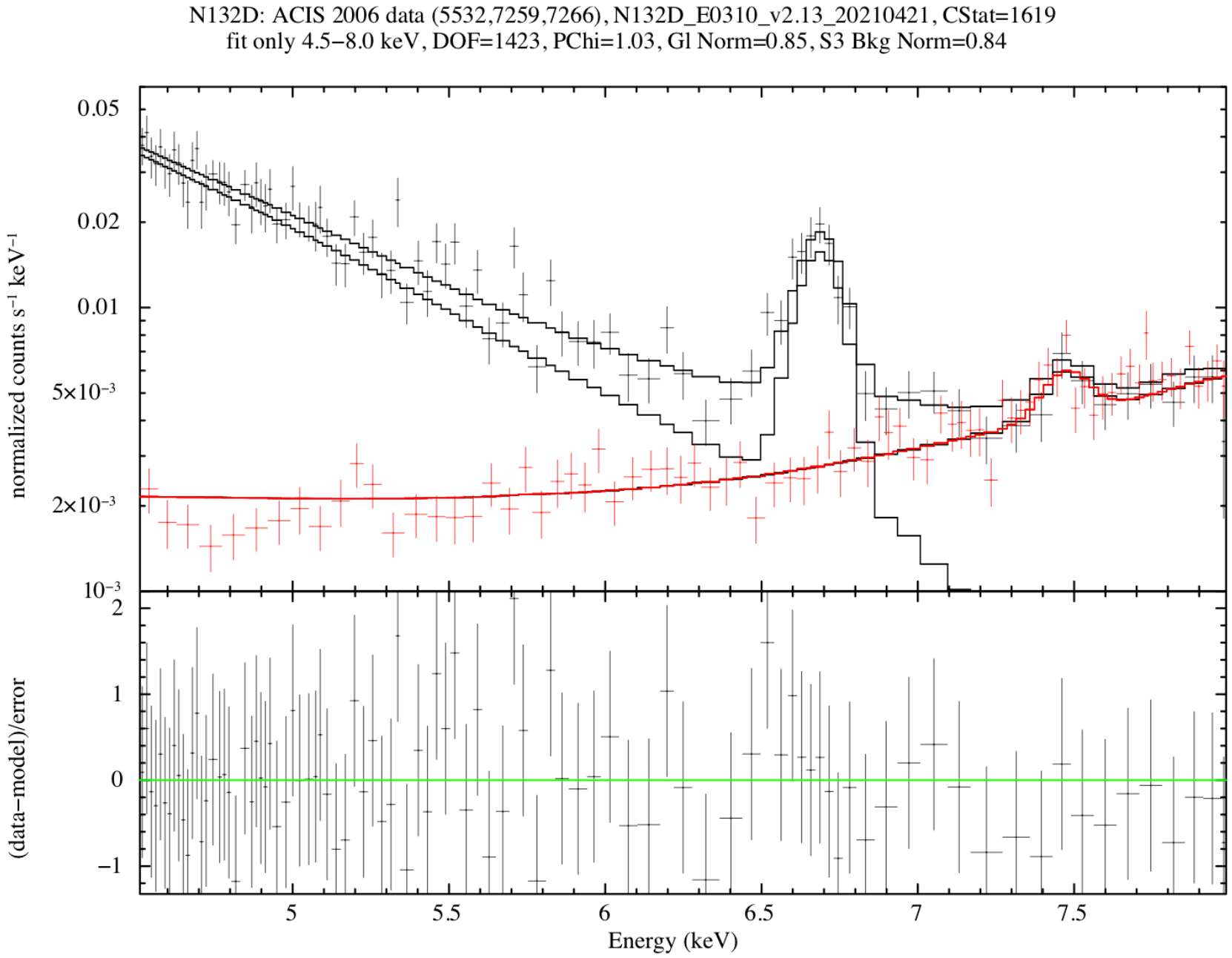


Physical Model Fit Results

Instrument	Gl. Norm	vrnei Norm	CStat	DOF	PChi	Goodness
initial	1.00	7.08E-04				
ACIS	1.18+/-0.05	7.39+/-0.89 E-04	1617	1431	1.02	65%
Suzaku						
NuSTAR						
pn						
MOS1						
MOS2						
Swift						

2006 data fit 4.5-8.0 keV with the empirical model. Global norm, the high kT nlapec norm, Fe XXV He-α norm and Fe XXVI Ly-α norm are allowed to vary.

Global Norm= 0.85
nlapec Norm= 1.19e-3
Goodness= 80.0%



2006 data fit 4.5-8.0 keV with the empirical model. Global norm, the high kT nlapec norm, Fe XXV He-α norm and Fe XXVI Ly-α norm are allowed to vary.

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nlapec Norm= 1.19e-3
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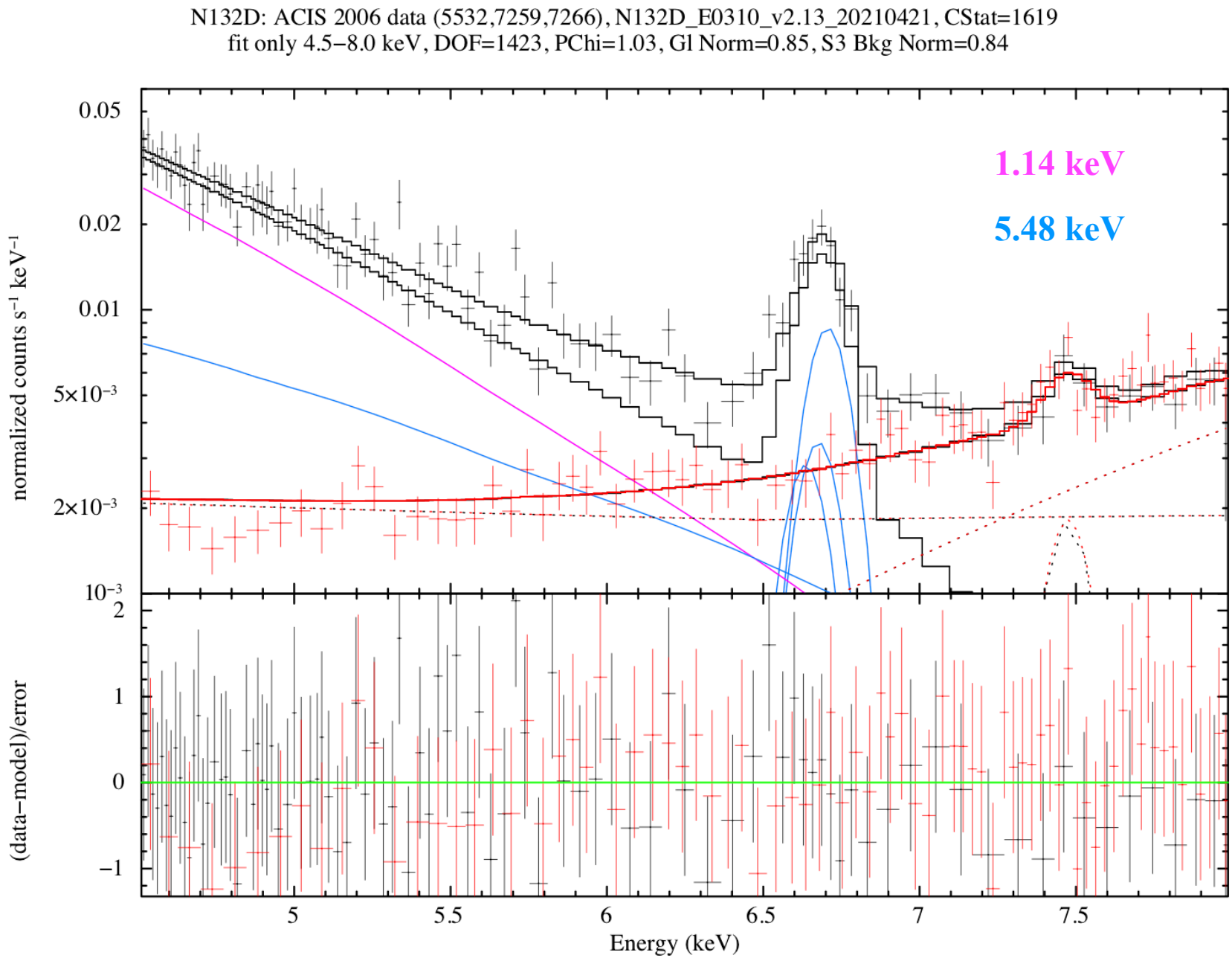
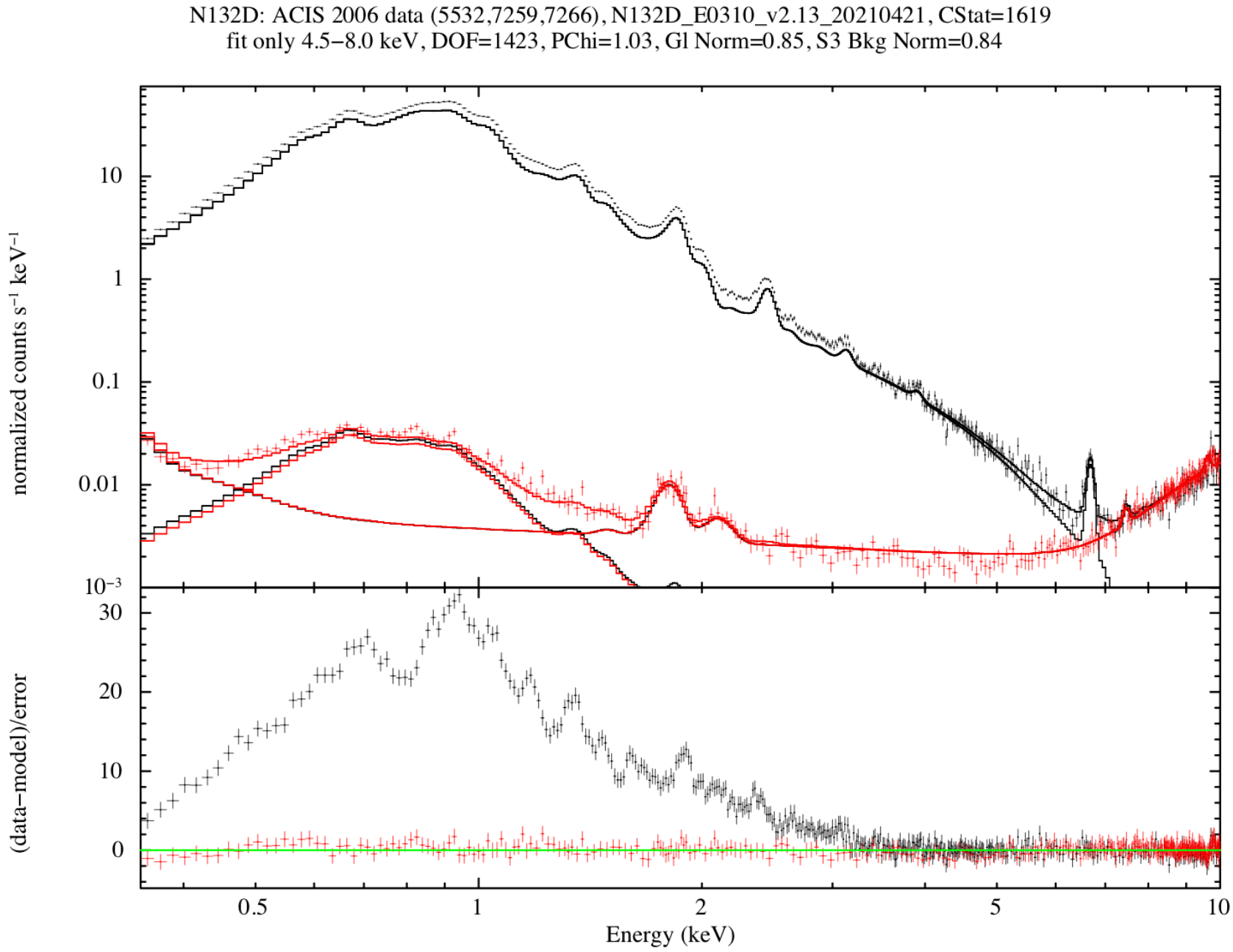


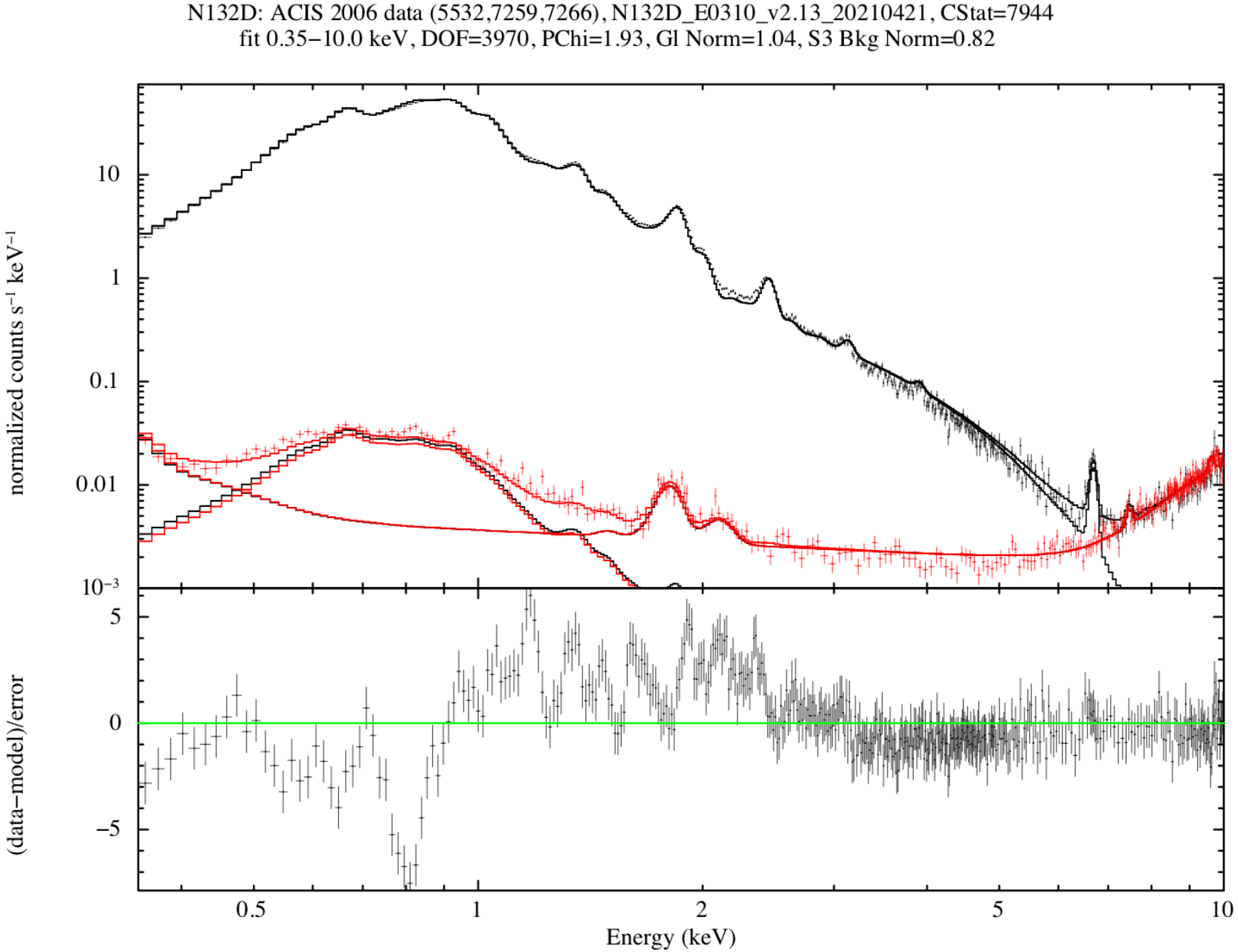
2006 data fit 4.5-8.0 keV with the empirical model. Global norm, the high kT nlapec norm, Fe XXV He-α norm and Fe XXVI Ly-α norm are allowed to vary.

Global Norm= 0.85
nlapec Norm= 1.19e-3
Goodness= 80.0%



2006 data fit 0.35-10.0 keV with the empirical model. Global norm & detector bkg norm are allowed to vary. All other parameters frozen.

Global Norm= 1.04



Empirical Model Fit Results

Instrument	Gl. Norm	nlapec Norm	Fe XXV He-α f	Fe XXVI Ly-α	CStat	DOF	PChi	Goodness
initial	1.00	1.17E-03	2.95E-06	2.18E-07				
ACIS	0.85+/-0.09	1.19+/-0.45 E-03	4.07+/-0.53 E-06	5.80+/-5.80 E-07	1619	1423	1.03	80.0%
Suzaku								
NuSTAR								
pn								
MOS1								
MOS2								
Swift								