N132D/XMM Update

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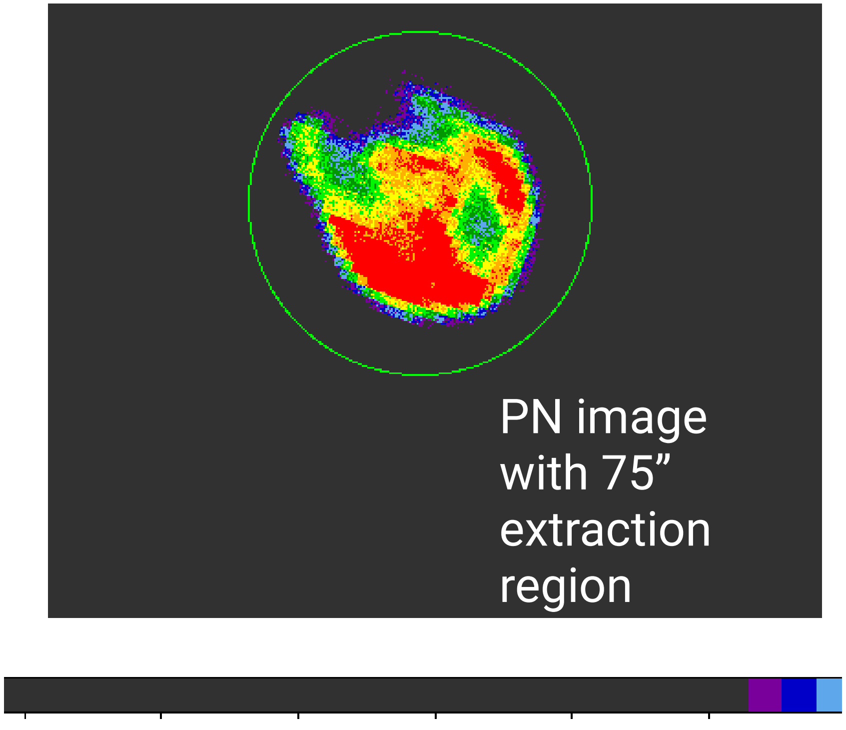
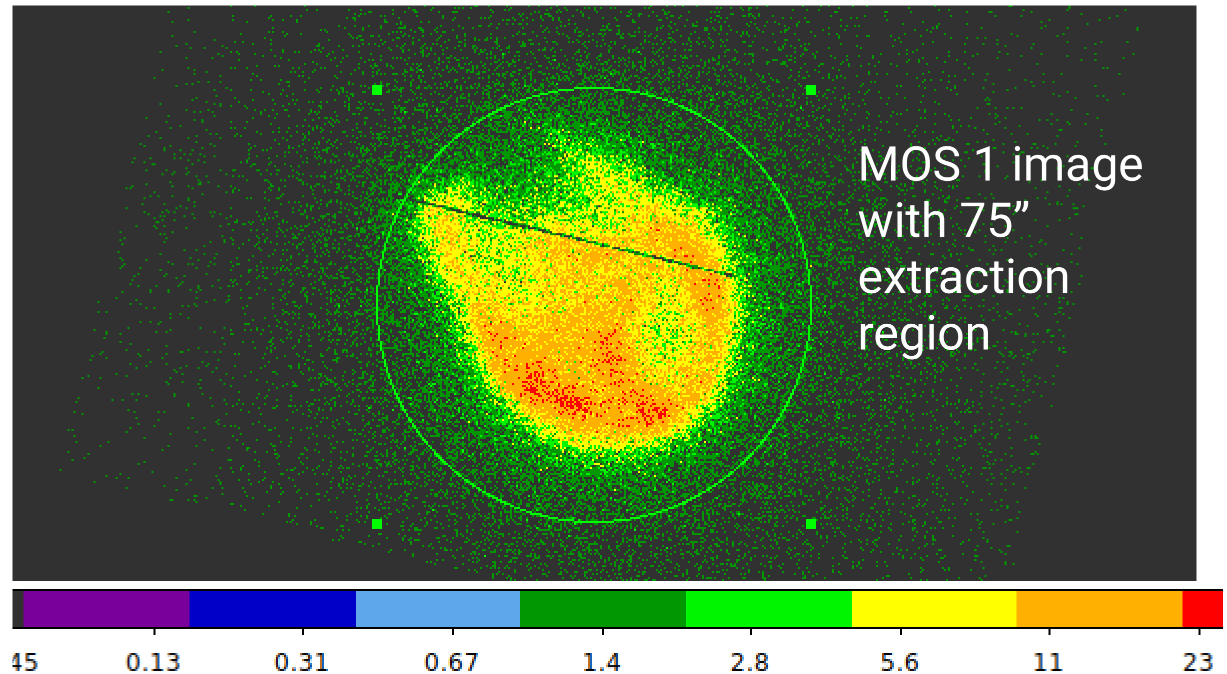
N132D XMM Dataset



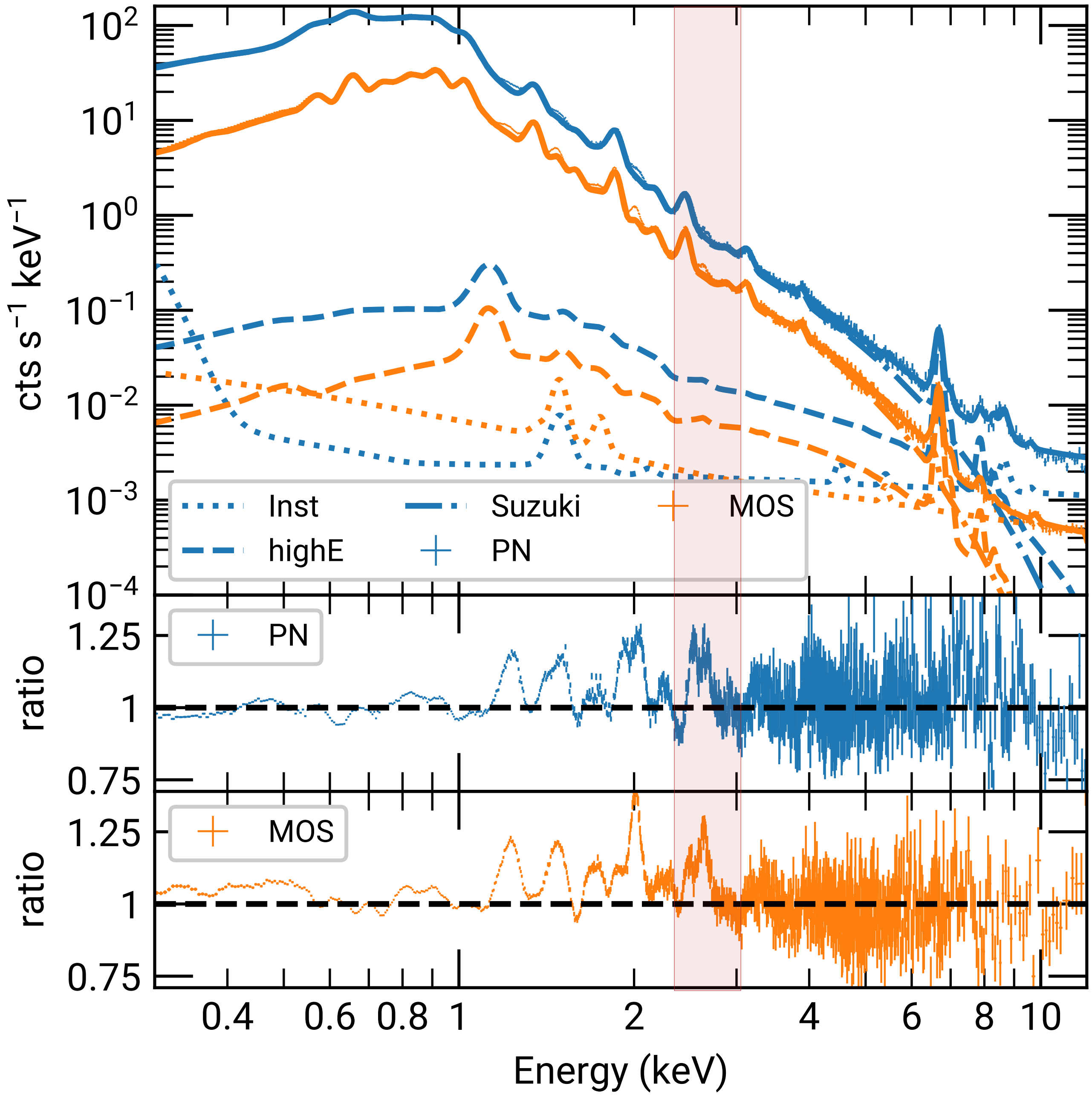


- Observed as calibration source for 20 years with XMM
- Many observing modes/offset pointings
  - Accepted modes:
    - PN: Prime Small Window, exposure>10ks, Thin or Med filter, >90% of remnant on chip.
    - MOS: Prime Partial W3 mode, exposure > 5ks, Thin or Med filter > 85% of the remnant on chip.

Total 353/785/813 ks of PN/MOS1/MOS2 data after homemade espfilt

Model

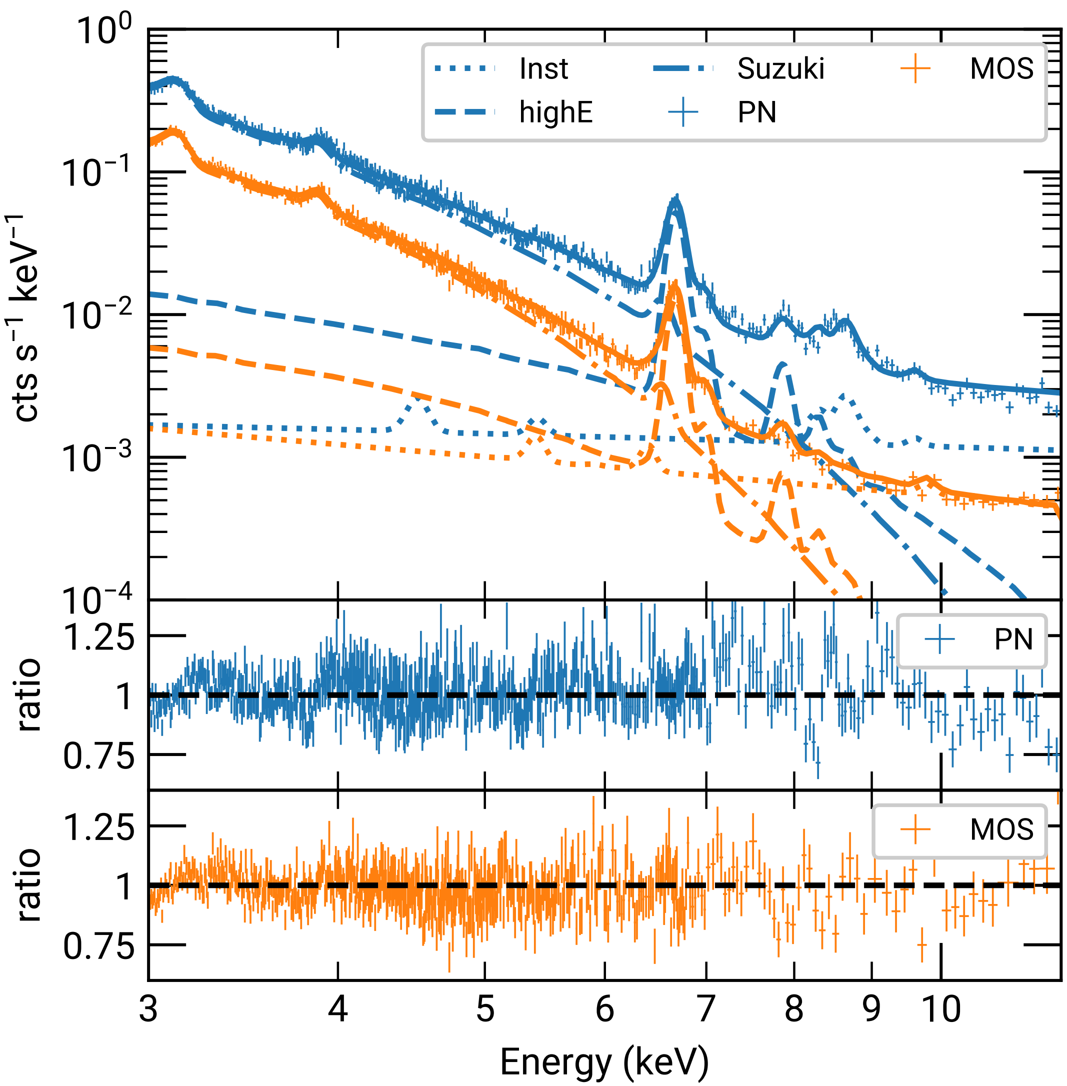
- Model spectrum from 0.3-10.0keV
- Model from Suzuki paper:
  - 3 NEI, all $n_e t$=9.8e10 cm^{-3} s; kT=0.2, 0.563 and 1.36keV
  - Need to increase norm by 15%
- We add in an additional NEI at ~4.5keV for the Fe K region.
- Instrument background model taken from Snowden ESAS (MOS) and filter wheel closed (PN), amplitude left as free parameter.
- CXB modeled as power law.



From sulphur down, there are inconsistencies between MOS and PN which make simultaneous modeling untenable for this project.

Data shown have xcaladjust and absfluxcorr on.

Declare Suzuki norm "close enough", focus on E>3.5keV region.



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	$2.53^{+0.58}_{-0.08}$	$5.97^{+0.02}_{-0.38}$
$norm^d$	$3.20^{+0.41}_{-0.13}$	$2.10^{+0.13}_{-0.08}$	$6.26^{+0.08}_{-0.48}$
$Ca_{Suz}{}^b$	$1.07^{+0.02}_{-0.06}$	$1.03^{+0.02}_{-0.04}$	$1.04^{+0.01}_{-0.07}$
$norm_{Suz}{}^e$	$2.97^{+0.01}_{-0.01}$	$3.00^{+0.01}_{-0.01}$	$2.91^{+0.02}_{-0.02}$
d.o.f.	156575	156574	156574
cstat	119879	119885	119925
pchi	156903	156735	156522
goodness	68%	56%	45%

Upper bound

consistent

[a] in keV

[b] in solar photospheric values (Anders & Grevesse 1989)

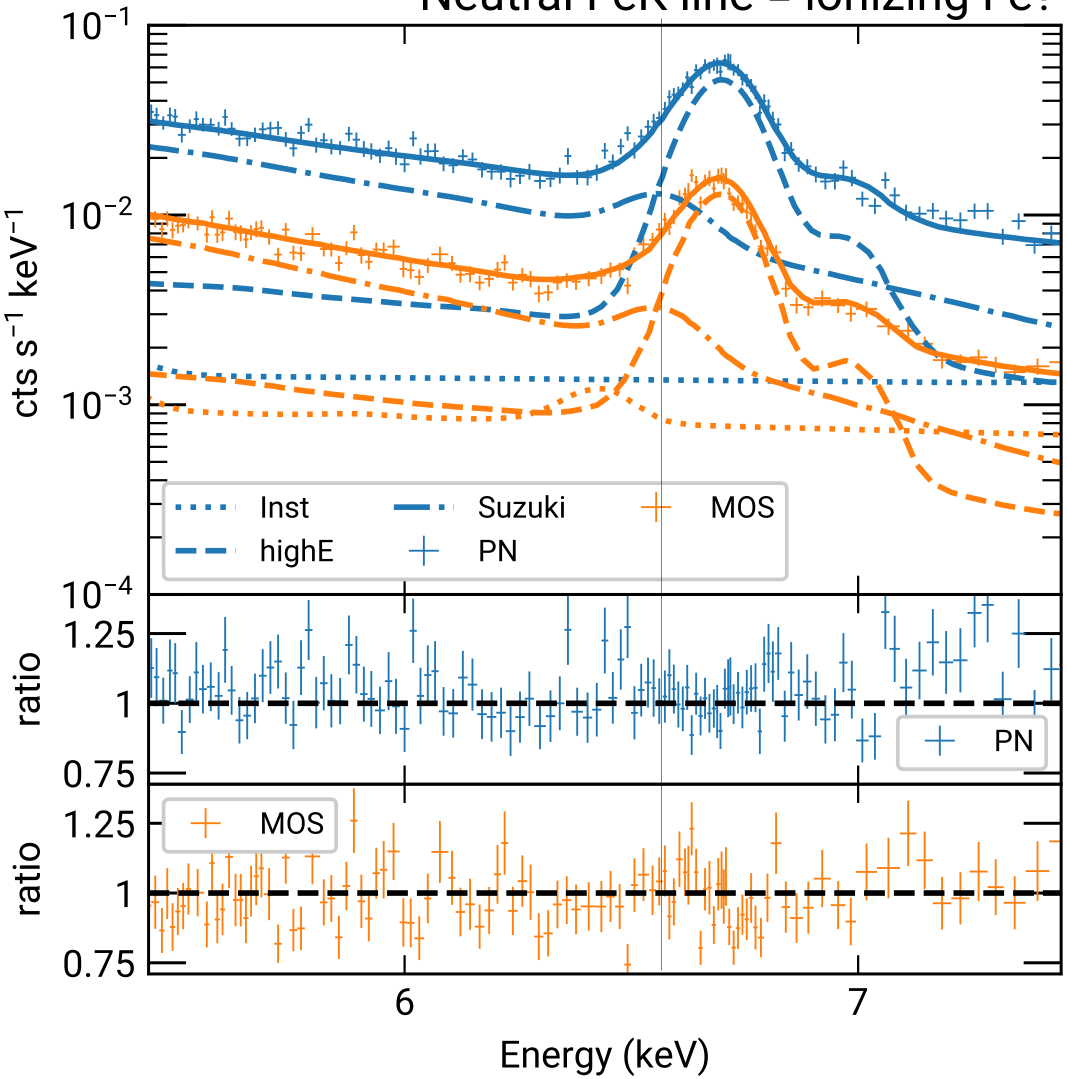
[c] in 10^{11} cm^{-3}s

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

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

MCMC optimizes cstat
Goodness uses pchi
Which fit is best?

Neutral FeK line = ionizing Fe?



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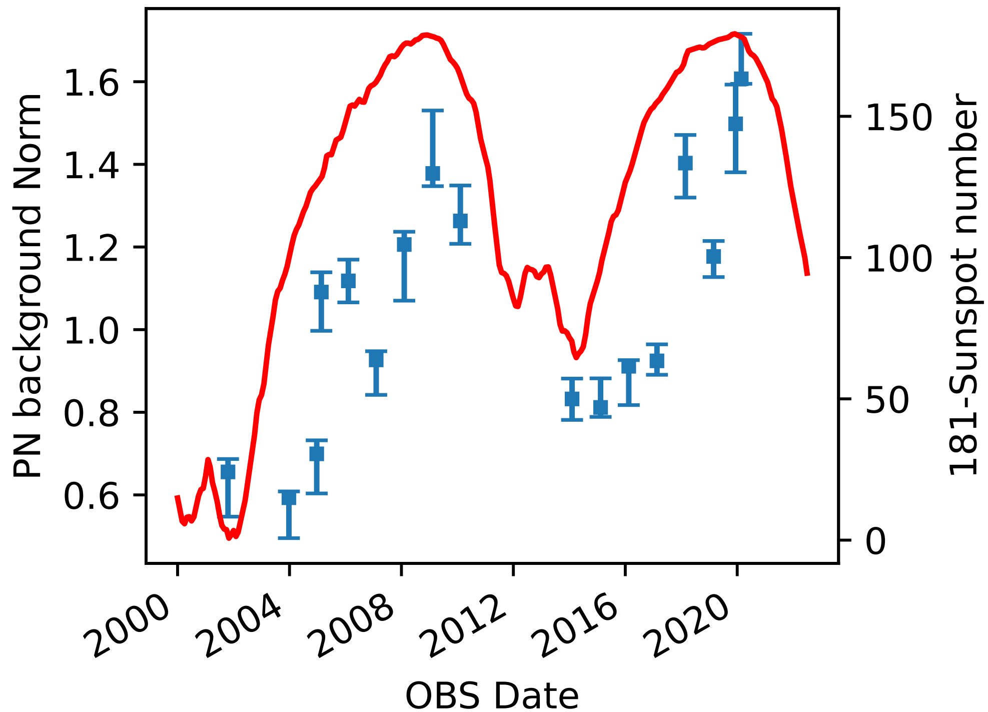
Goodness uses pchi
Which fit is best?

These numbers imply ~4% of Fe in the remnant
Is hot (why… physics question)

To obtain a good fit it was necessary to play with the reprocessing a bit:

(1) Uncouple instrument backgrounds for PN (not MOS)

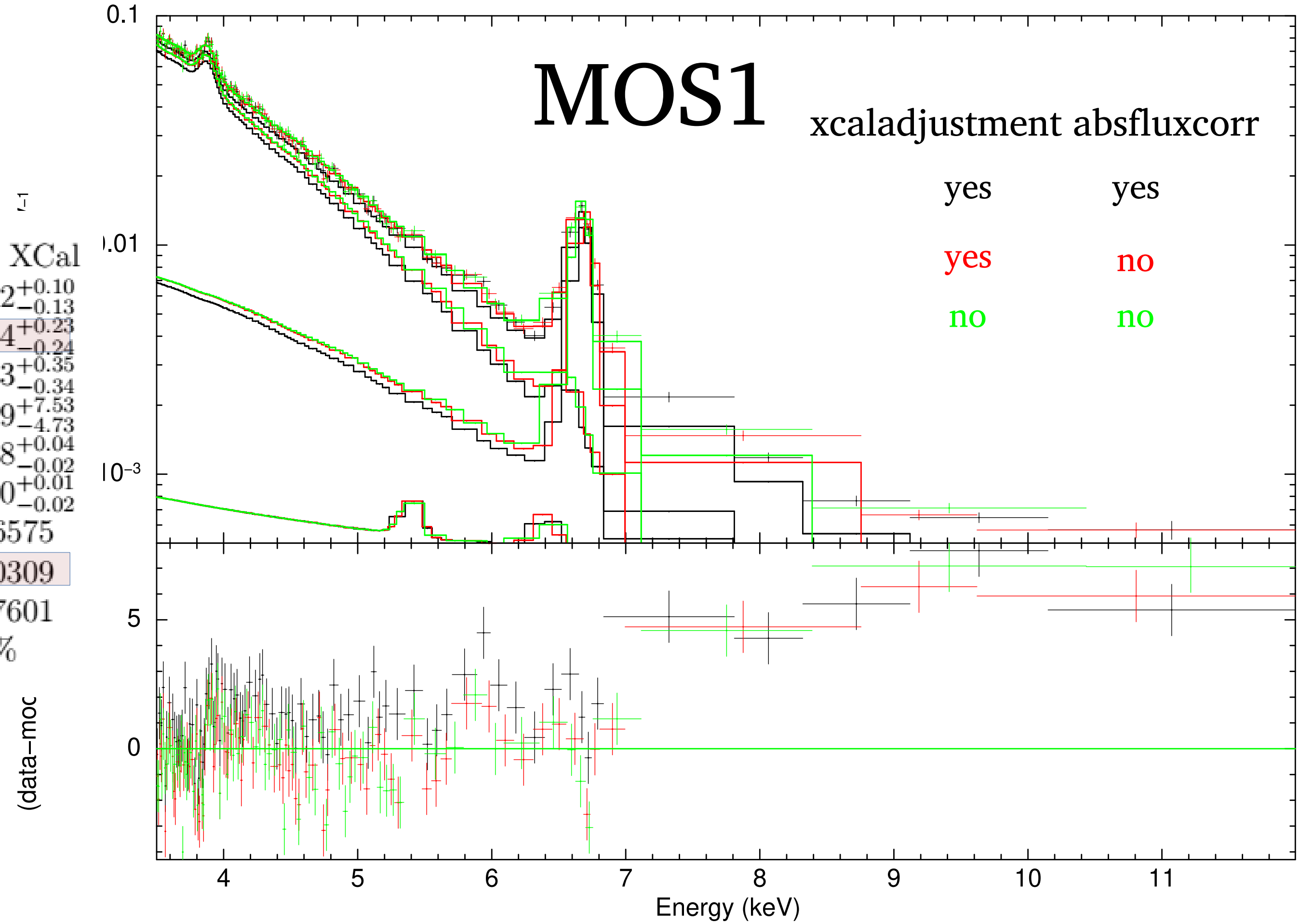
PN background has an constant which starts at 1, free to vary
Returns values from 0.5 to 1.7
Without this, results are highly volatile as all
fits are bad; large variation in
temperatures & abundances



(2) Looking at the effect of the cross calibration

		Original	WithXcal	No XCal
n132d	kT	$4.56^{+0.05}_{-0.20}$	$4.51^{+0.07}_{-0.17}$	$4.42^{+0.10}_{-0.13}$
n132d	Fe	$7.35^{+0.39}_{-0.76}$	$5.75^{+0.16}_{-0.57}$	$4.54^{+0.23}_{-0.24}$
n132d	norm $\times 10^{-4}$	$3.20^{+0.41}_{-0.13}$	$4.31^{+0.46}_{-0.10}$	$5.73^{+0.35}_{-0.34}$
n132d	$\mathrm{norm}_{6.4} \times 10^{-8}$	$5.66^{+9.53}_{-2.54}$	$8.33^{+4.55}_{-5.33}$	$9.49^{+7.53}_{-4.73}$
suzuki	Ca	$1.07^{+0.02}_{-0.06}$	$1.02^{+0.03}_{-0.04}$	$1.08^{+0.04}_{-0.02}$
suzuki	norm $\times 10^{-2}$	$2.97^{+0.01}_{-0.01}$	$2.93^{+0.01}_{-0.02}$	$3.00^{+0.01}_{-0.02}$
	d.o.f.	156575	156575	156575
	cstat	119879	120157	120309
	pchi	156903	157380	157601
	goodness	68%	72%	86%

Overal 10% change in Fe content (Fe * norm)



In No Xcal case, PN background drops 5% on average
MOS background increases 5%

- Data above 3 keV can be pretty well fit with an additional ~4.6keV plasma component
  - Equilibrium or NEI are roughly equivalent
- This is aided by the lack of counts and resolution of course
- No need for neutral Fe
- Cross calibration settings in SAS arfgen make a small but significant difference.
  - Cross calibration improves fit; NuStar correction less relevant
- PN instrument background highly dependent on the solar cycle
  - (MOS less so? Or just not enough counts?)