

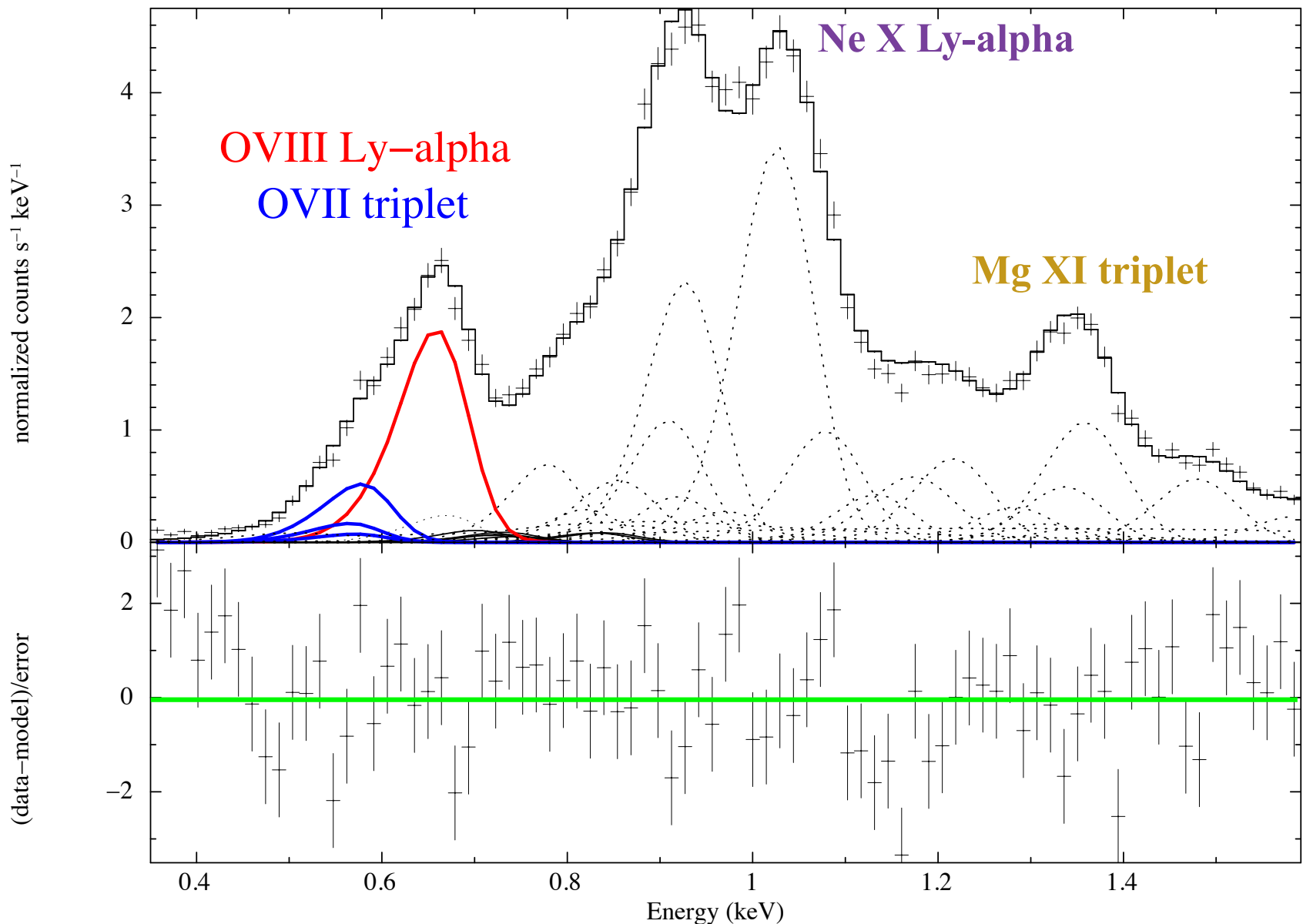


***The Evolution of the ACIS
Contamination Layer from 2010 to 2019***



Bright Line Complexes

Ne IX triplet



OBSID 20639
S3 3/2018
It is getting progressively more difficult to constrain the OVII normalization given the low number of counts.

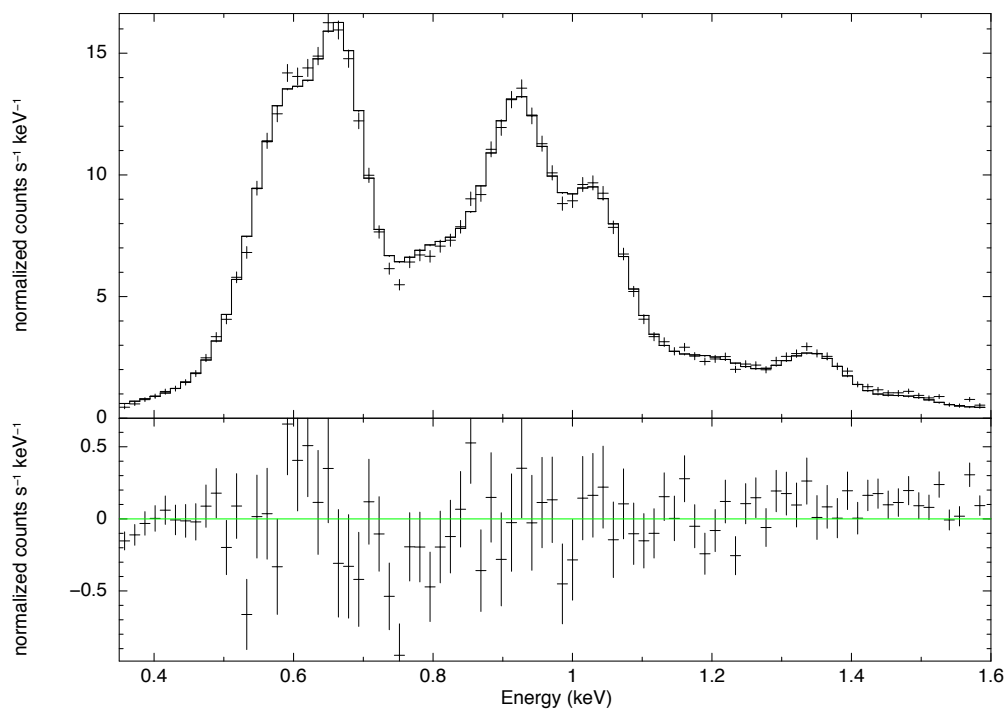


E0102 over Time

E0102 is observed once a year in 3 positions on S3
We fit it with the standard IACHEC model to verify the contamination model
If the model is correct, the line normalizations should be constant with time even though the effective area at low energies is changing by a large amount

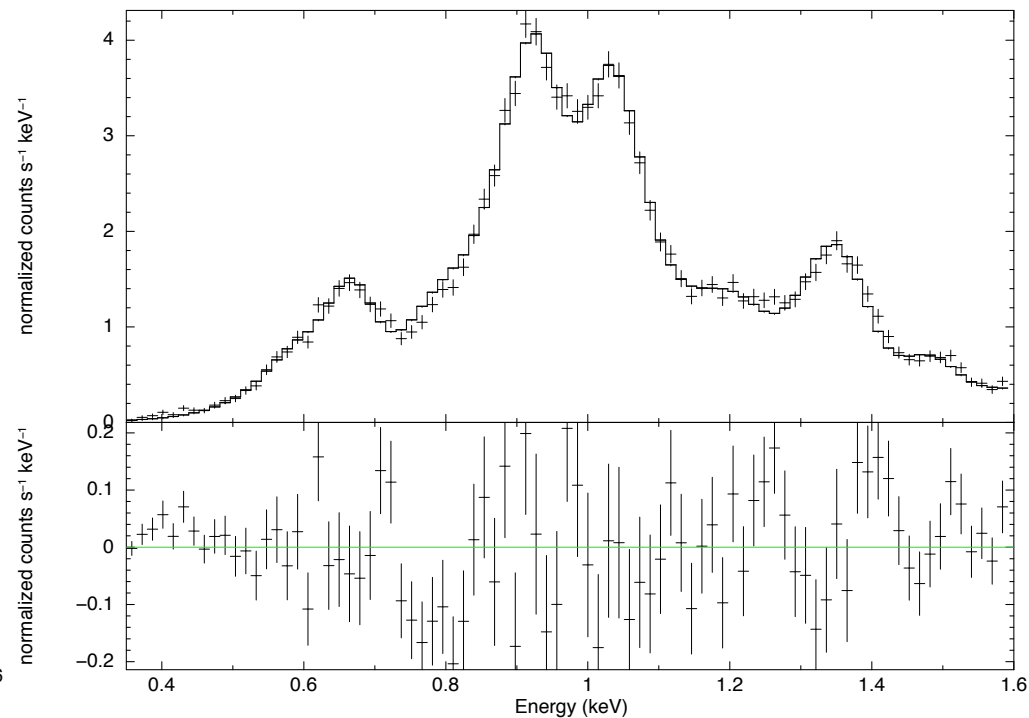
S3 2003

contamN0012, CIAO 4.11, CALDB 4.8.2, Gain correction applied to the data
S3, ObsID 3545, C-stat=139.223, dof=80, Q-stat=143.5, reduced Q stat=1.79



S3 2019

contamN0012, CIAO 4.11, CALDB 4.8.2, Gain correction applied to the data
S3, ObsID 21804, C-stat=128.096, dof=80, Q-stat=139.5, reduced Q stat=1.74





E0102 over Time

E0102 is observed once a year in at the aim point position on I3 but in 2019 we resumed observing E0102 at three positions on I3

Only 5 parameters are free in the fits, a global normalization and the normalizations for O VII, O VIII, Ne IX, and Ne X

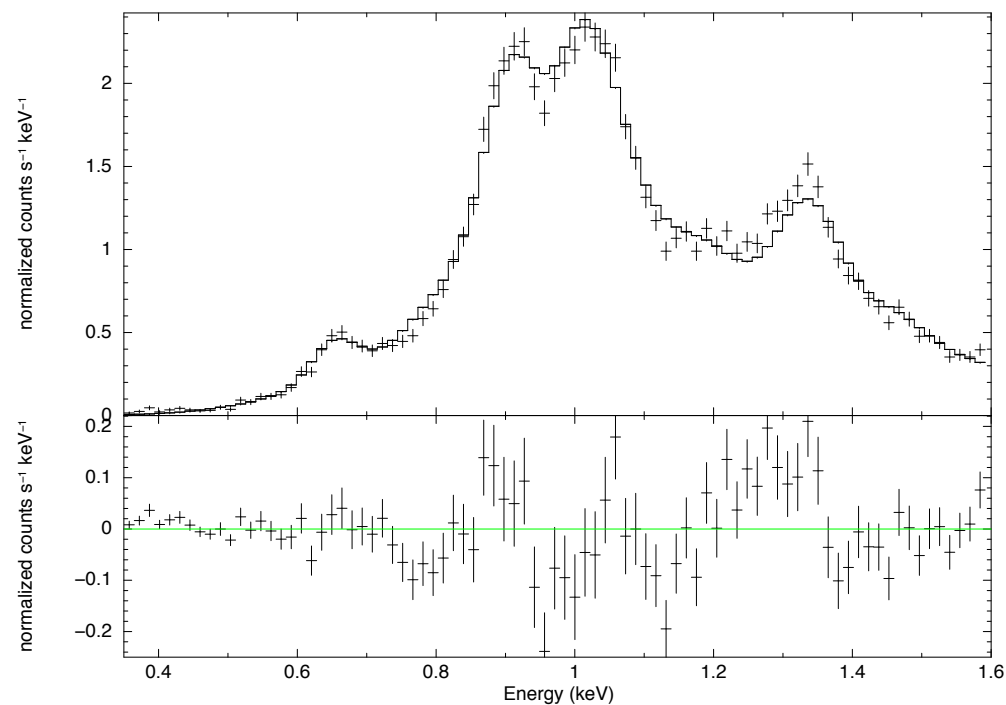
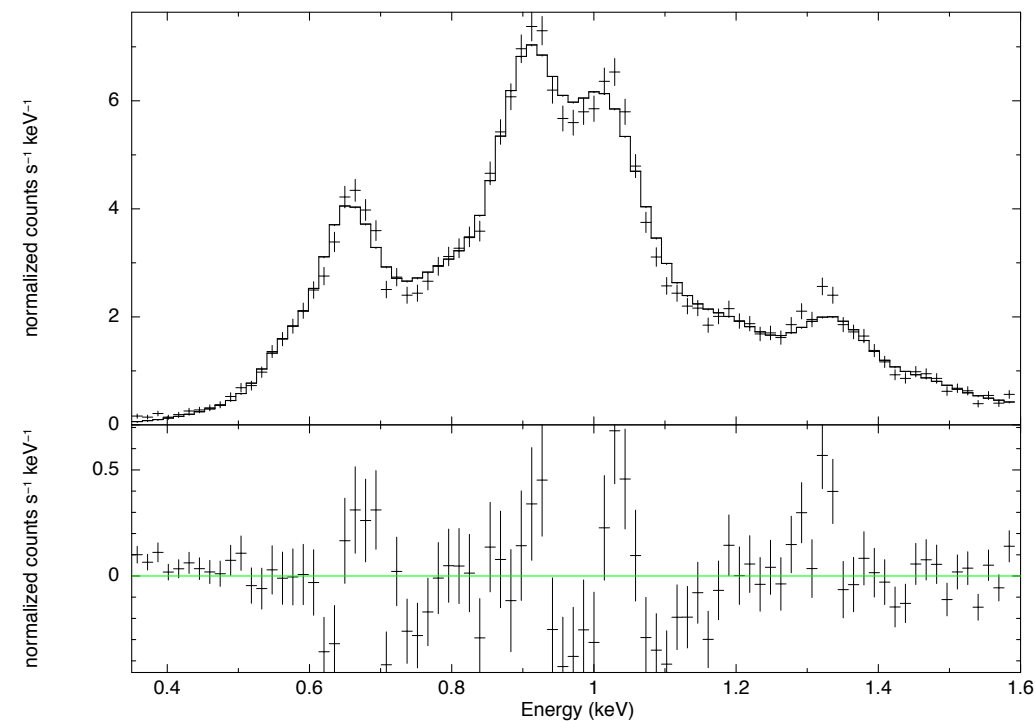
I3 fits would benefit if the Mg XI normalization were free

I3 2006

I3 2019

contamN0012, CIAO 4.11, CALDB 4.8.2, Gain correction applied to the data
I3, ObsID 6756, C-stat=164.095, dof=80, Q-stat=175.0, reduced Q stat=2.19

contamN0012, CIAO 4.11, CALDB 4.8.2, Gain correction applied to the data
I3, ObsID 21803, C-stat=193.066, dof=80, Q-stat=219.7, reduced Q stat=2.75



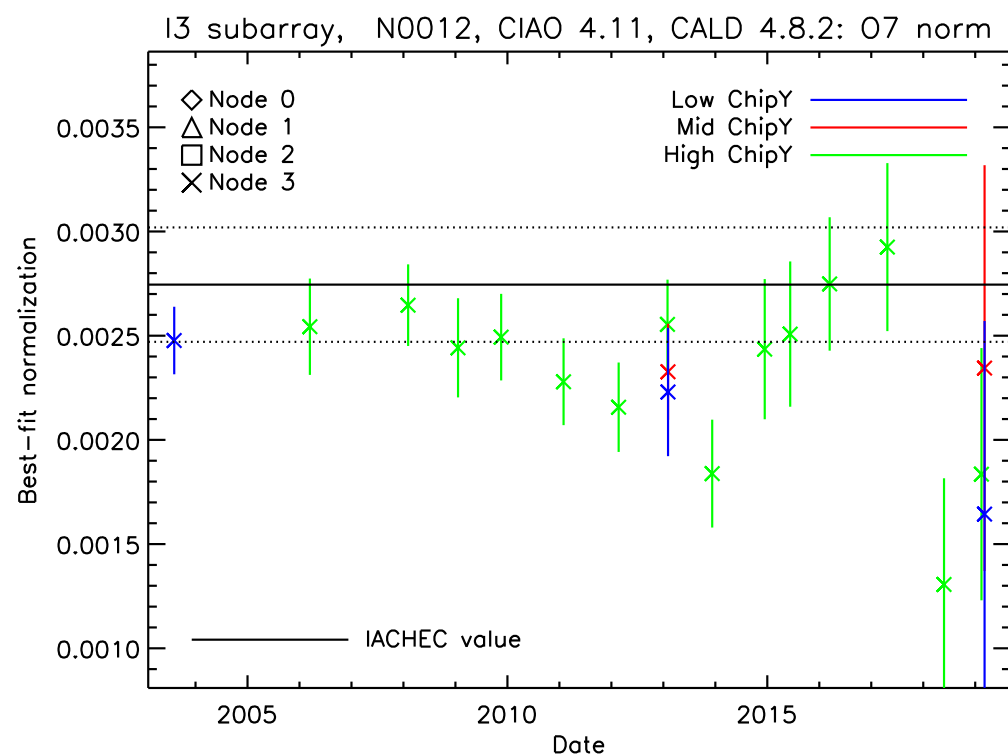
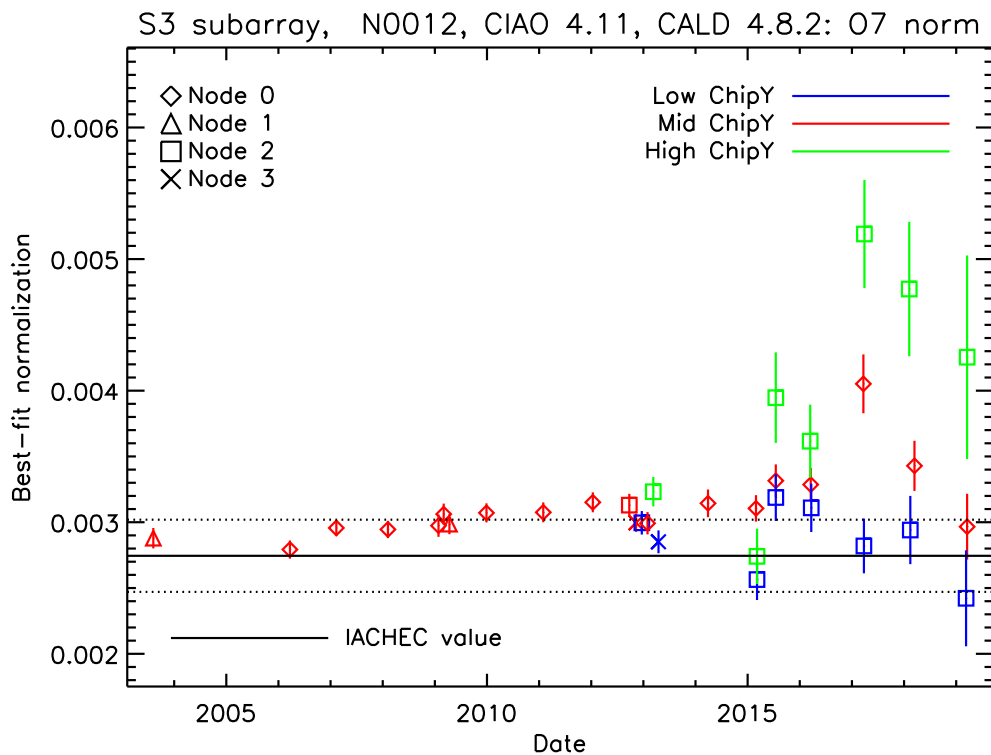


E0102 O VII Line Normalizations

- in general the OVII line normalizations have large uncertainties
- OVII line norm on S3 appears to indicate an under correction at high chipy
- OVII line norm on I3 appears to indicate an over correction, but given the uncertainties the discrepancy is less than 1σ

S3

I3



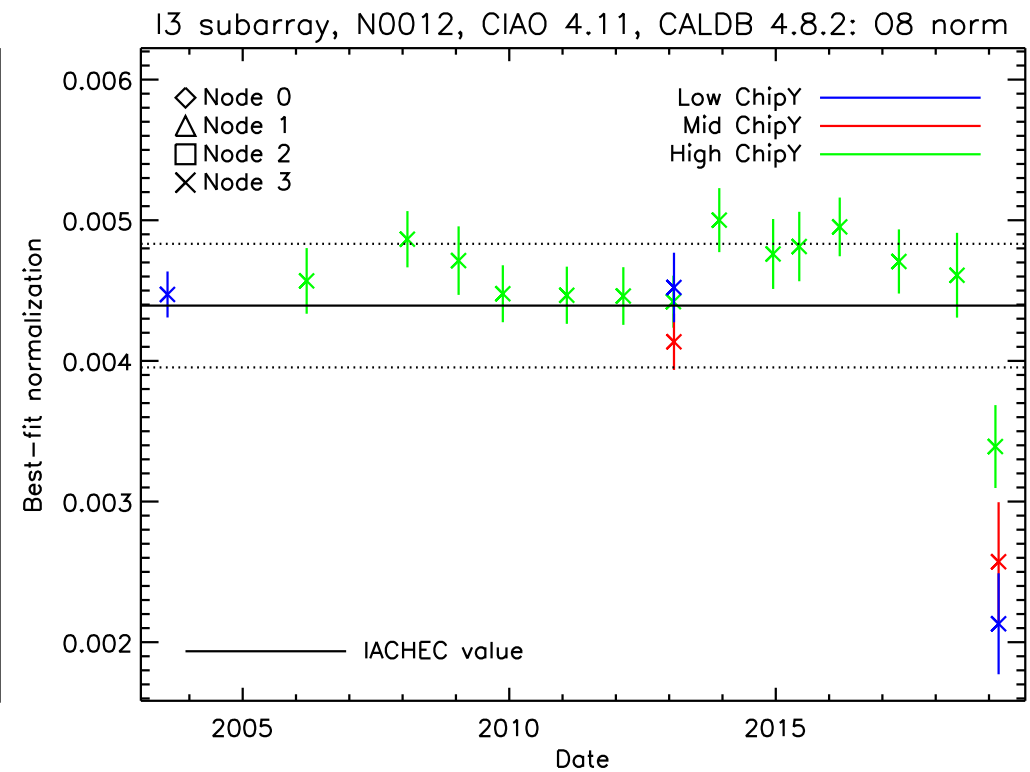
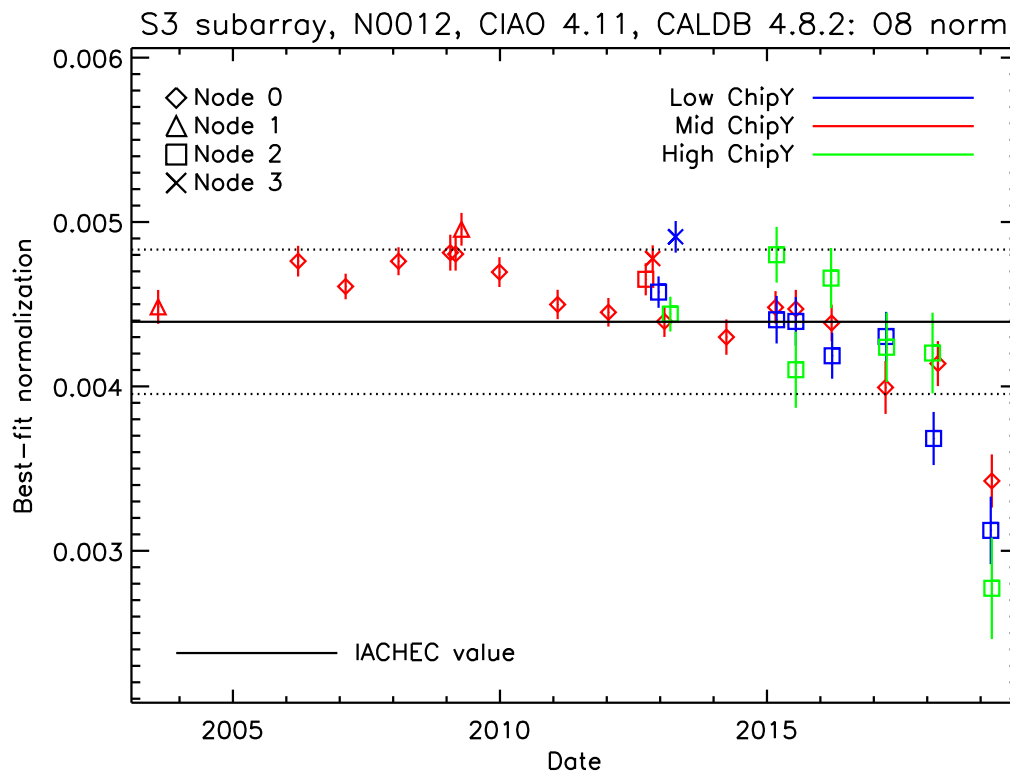


E0102 O VIII Line Normalizations

- **S3 shows a decrease in the apparent normalization in 2019 at all three positions that were measured, an apparent continuation of the trend seen in 2017-2018**
- **I3 shows a decrease in the apparent normalization in 2019 at all three positions that were measured**

S3

I3



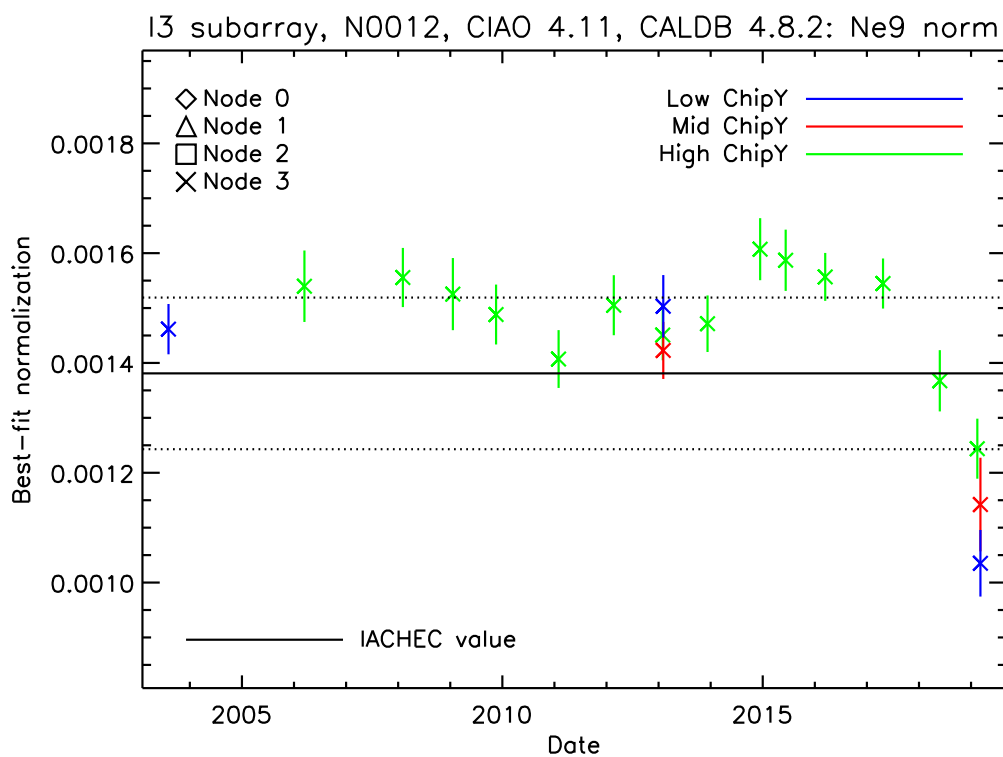
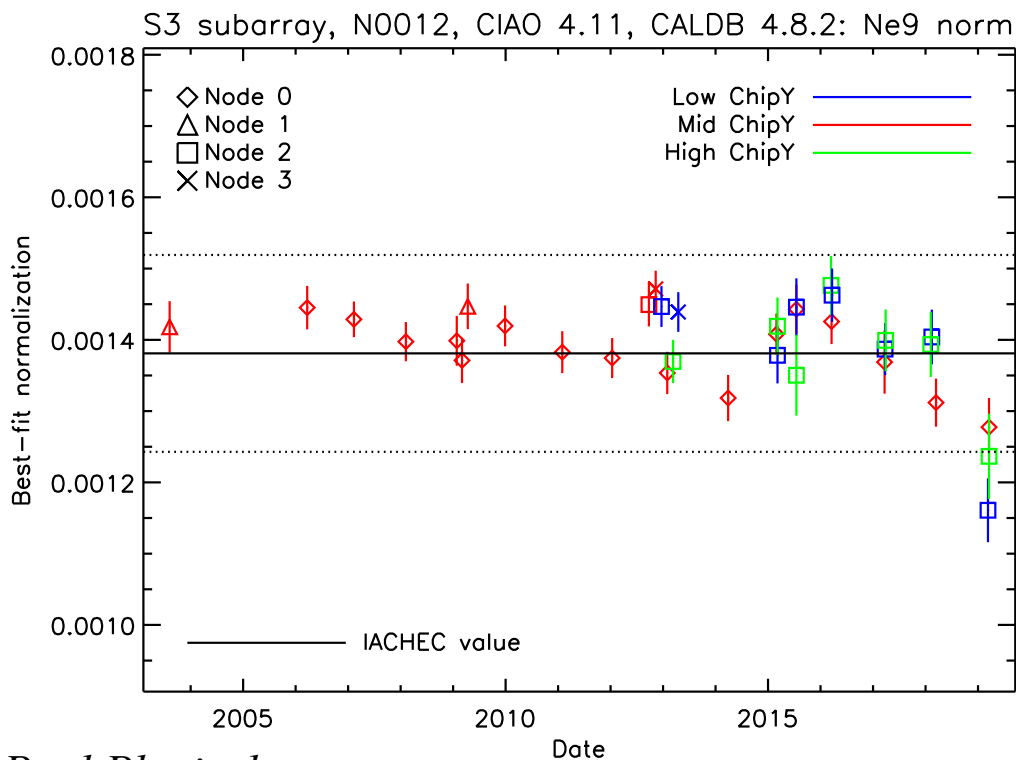


E0102 Ne IX Line Normalizations

- **S3** shows a decrease in the apparent normalization in 2019 at all three locations
- **I3** shows a decrease in the apparent normalization in 2019 at all three locations

S3

I3





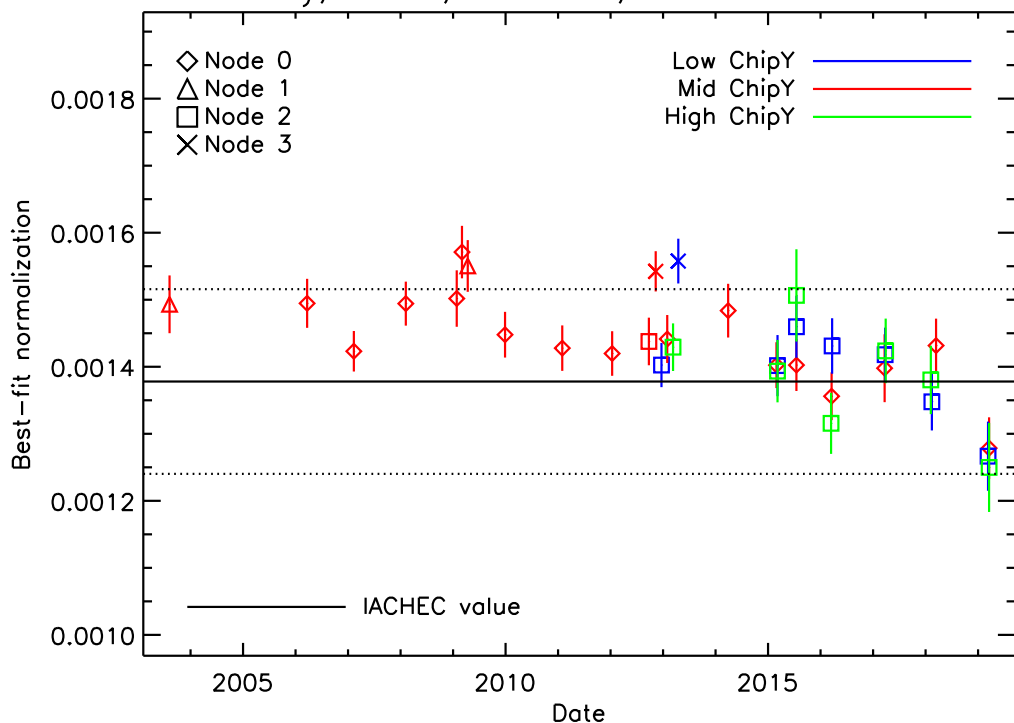
E0102 Ne X Line Normalizations

- **S3** shows a decrease in the apparent normalization in 2019 at all three positions
- **I3** shows a decrease in the apparent normalization in 2019 at all three positions

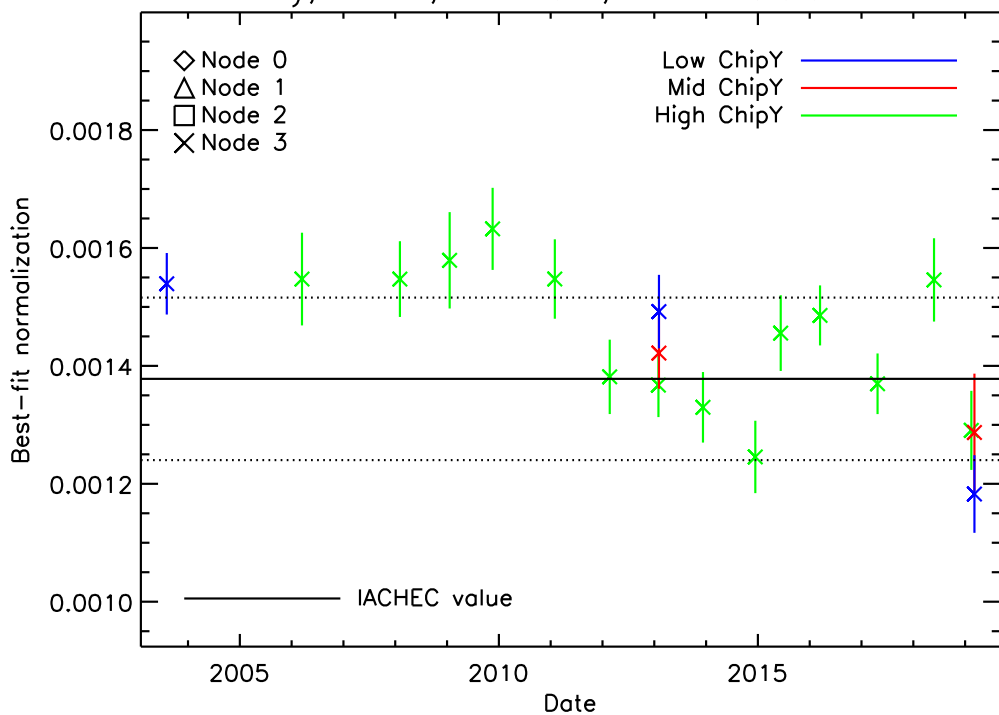
S3

I3

S3 subarray, N0012, CIAO 4.11, CALDB 4.8.2: Ne10 norm



I3 subarray, N0012, CIAO 4.11, CALDB 4.8.2: Ne10 norm





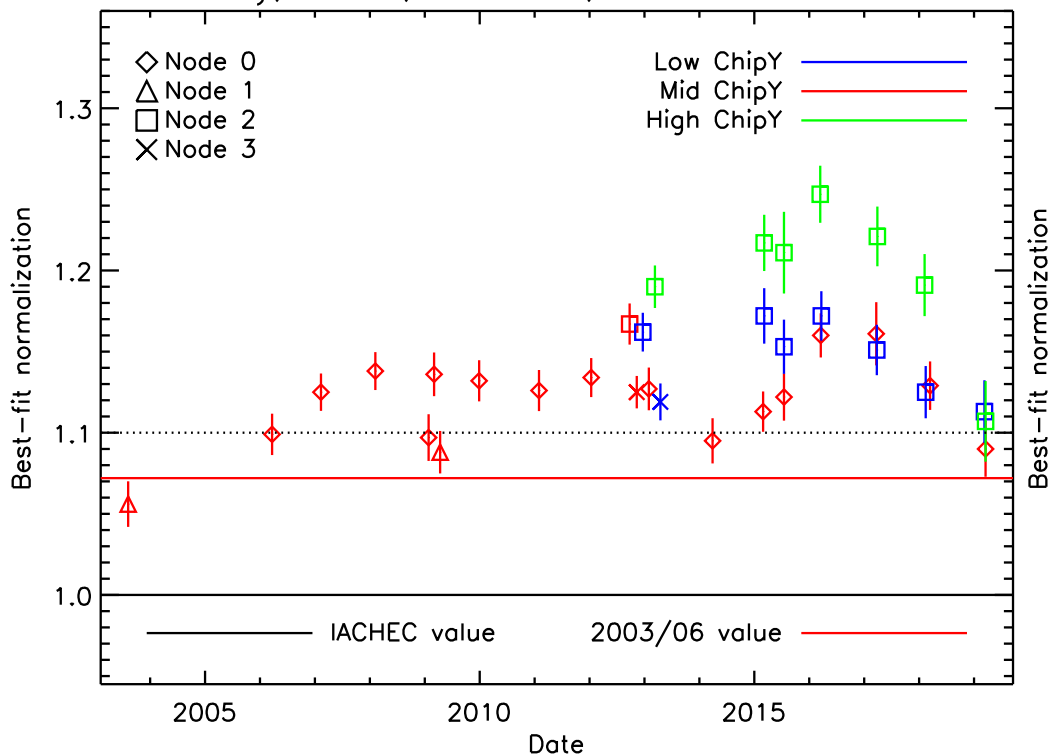
E0102 Global Normalizations

- S3 global normalization shows significant fluctuations with time from 2010-2019 especially at high chipy
- I3 global normalization also shows significant fluctuations with time from 2010-2019 especially at high chipy

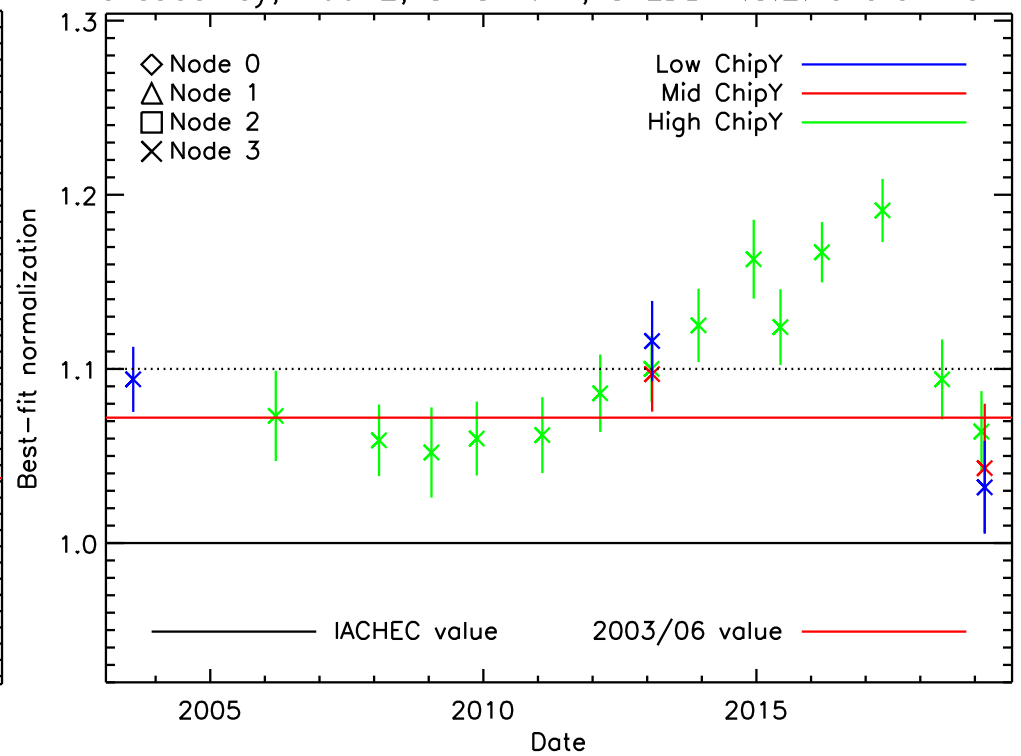
S3

I3

S3 subarray, N0012, CIAO 4.11, CALDB 4.8.2: overall norm



I3 subarray, N0012, CIAO 4.11, CALDB 4.8.2: overall norm





Conclusion

- **The N0012 contamination file appears to be under-estimating the accumulation rate of the contamination layer from 2017-2019 for both S3 and I3**
- **This under-estimate appears to affect the on-axis data (mid chipy on S3 and high chipy on I3) and off-axis data near the edges of the filter (low and high chipy on S3 and low chipy on I3)**