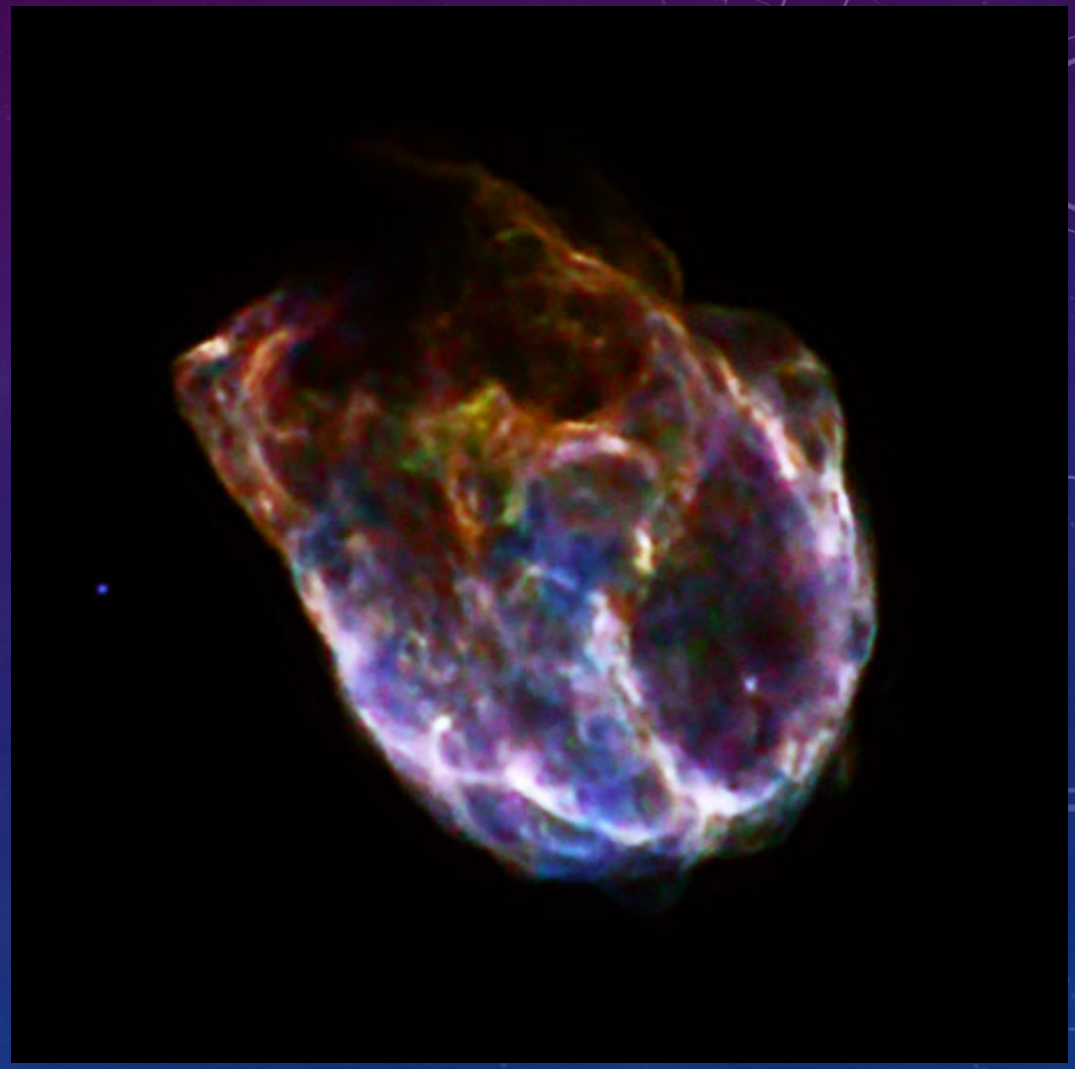
N132D

NUSTAR BACKGROUNDS, STATISTICS, AND FITTING

N132D IN A NUTSHELL

- O-rich supernova remnant in the LMC.
- About 3kyr old.
  - From dynamical measurements of ejecta knots.
- Core-collapse
  - From asymmetry arguments.
- About 1.5.x2 arcminutes in size.
- Possible target for future high-energy, high-resolution calibration (i.e., Resolve on XARM).



Chandra image (0.3-0.5 keV, 0.5-0.75 keV, 0.75-7 keV)

PREVIOUS OBSERVATIONS

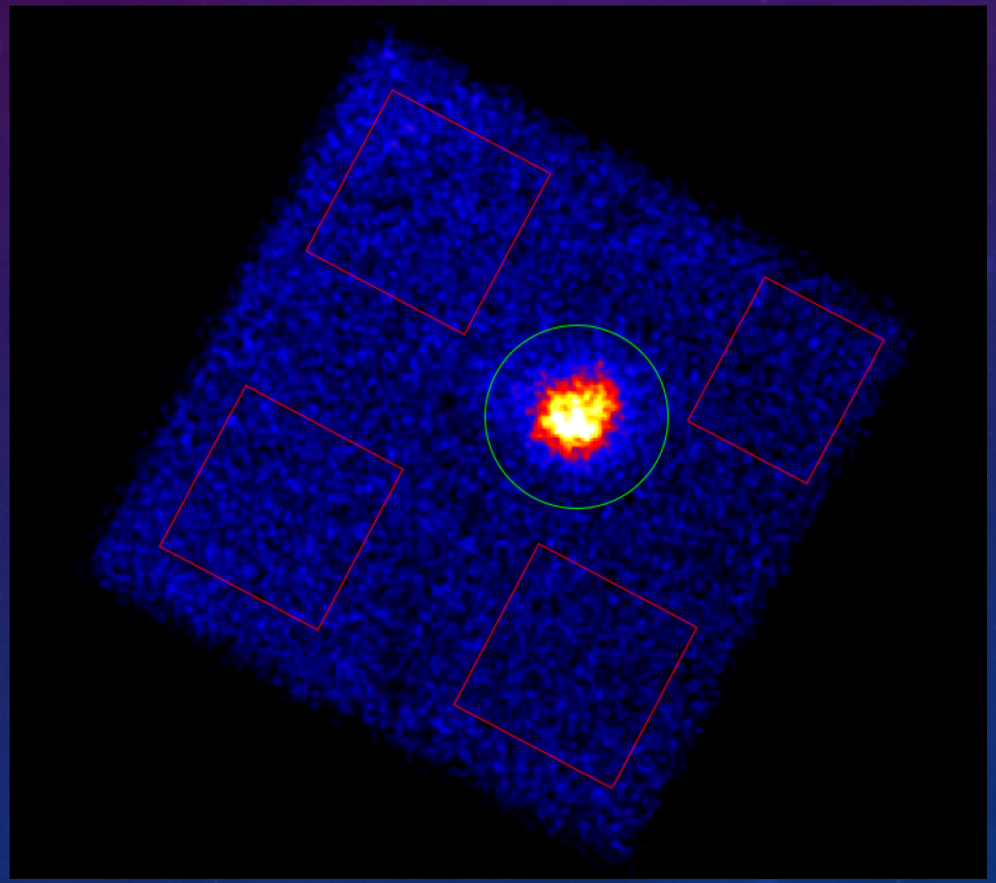
- Observed during AO1 and reported along with *Suzaku* observations
  - PI: Aya Bamba, https://doi.org/10.3847/1538-4357/aaa5a0
- Major results:
  - Discovery of a “hot” (kT=6 keV) thermal component.
  - No non-thermal emission. ☹
- Complications:
  - Source detected up to ~15 keV, then dominated by background.
  - Stray light
  - Complex underlying spectral model.

SO WHAT?

- We've been "volunteered" to look more closely at N132D since it's an IACHEC calibration target
  - Especially important for "good" spectrometers that go above 2 keV (Resolve, Athena-XIFU, etc).

- Also using it for testing "best practices" for handling the NuSTAR background models.

NUSTAR SOURCE AND BACKGROUND REGIONS



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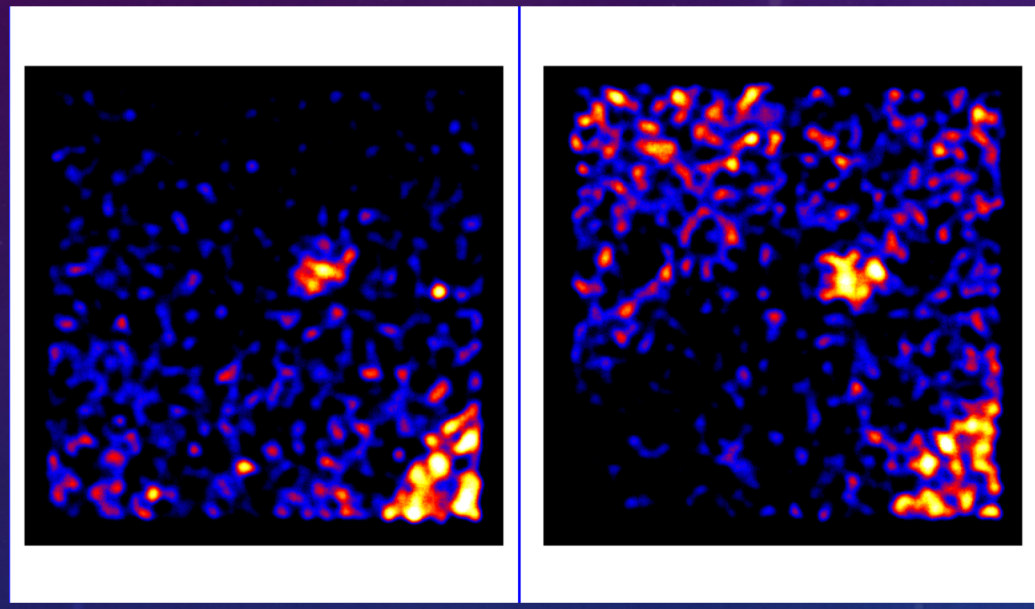
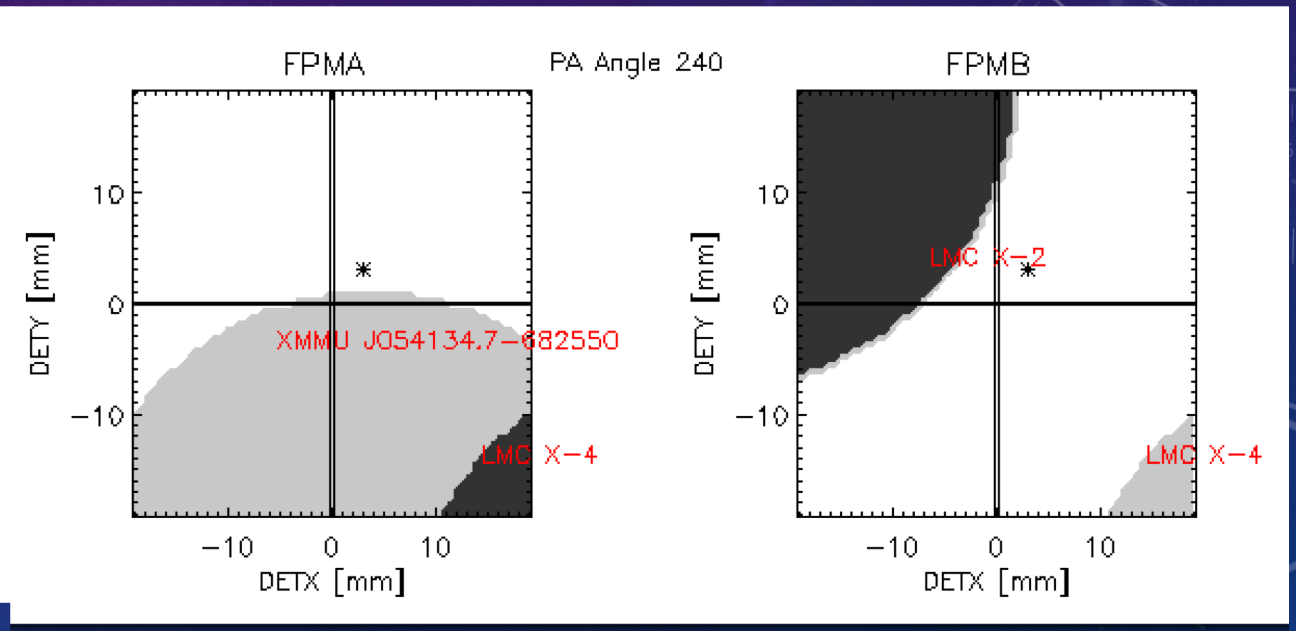
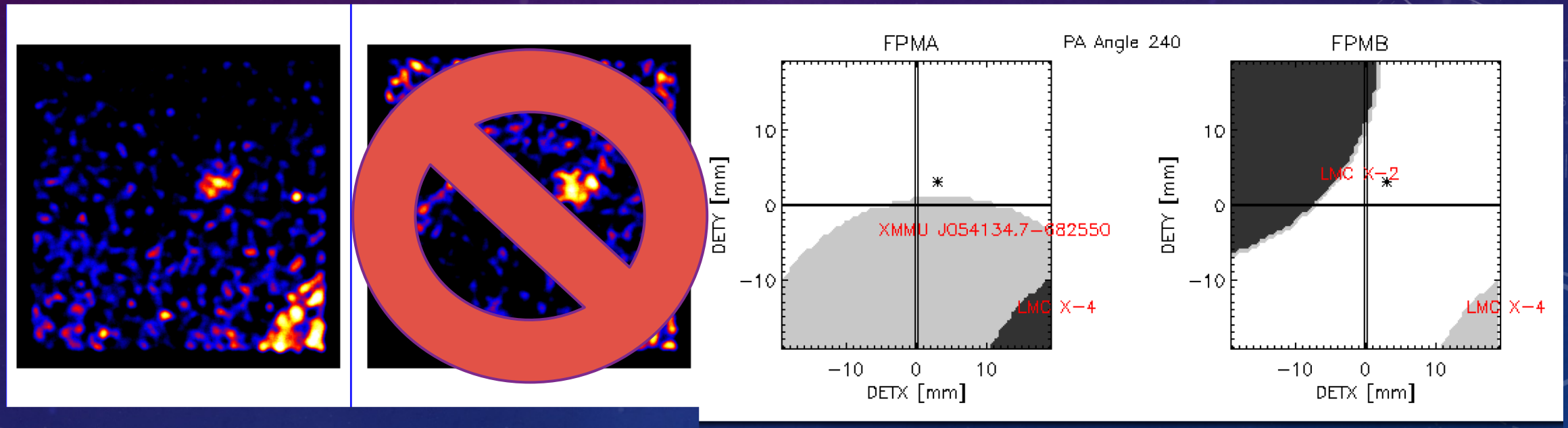


NuSTAR 10-20 keV in Detector Coords



Estimated straylight contribution

NUSTAR SOURCE AND BACKGROUND REGIONS



NuSTAR 10-20 keV in Detector Coords

Estimated straylight contribution

PLAN

- Use nuskybgd to using the regions for FPMA.
  - model_output branch on GitHub.
- Project into the “source” region.
  - Still pondering how to properly handle this, for now, keep fixed after fitting.
- Use C-stat to fit the source+backgorund
  - Main goal is to check the IACHEC model, which does not currently include a high-T component.
- Everything (nuskybgd and source modeling) uses the “optimal binning” from Kaastra & Bleeker (2016; A&A 587, A151).

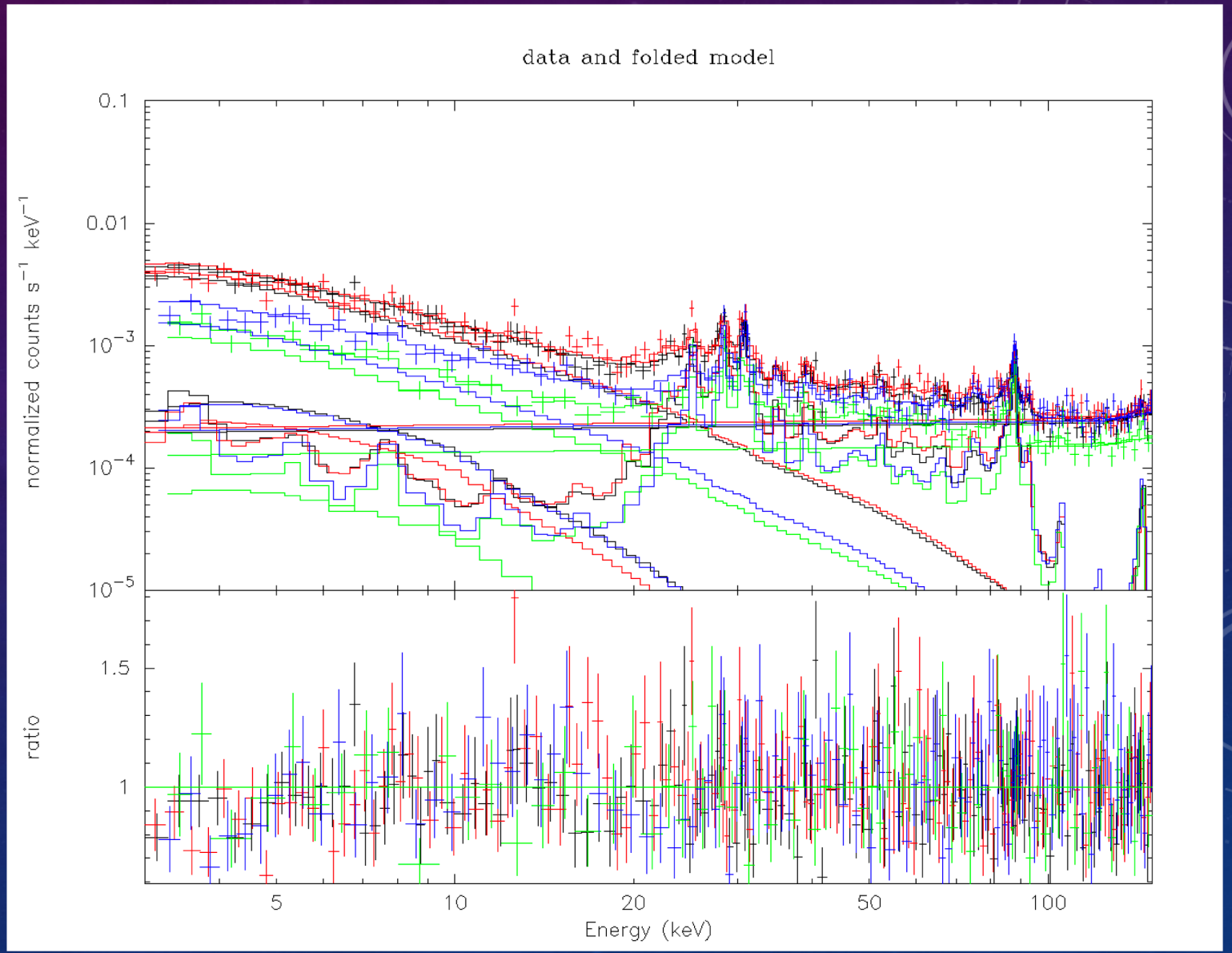
NUSKYBGD

Four background regions w/joint fit using the “new” nuskybgd version.

Use standard projection to estimate the background component in the source region.

But use “model” version where we retain the model components instead of subtracting background.

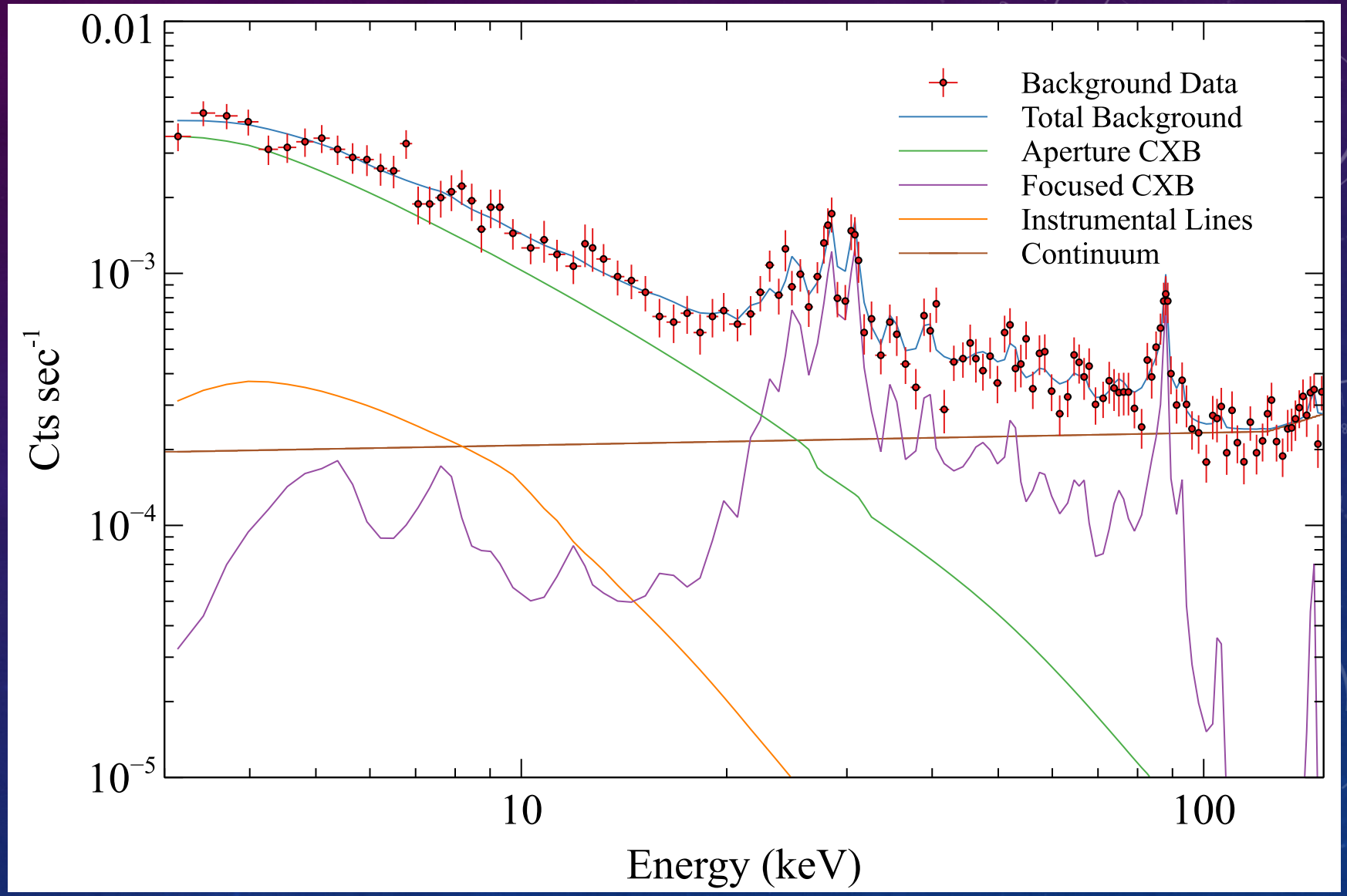
“nuskybgd_spec_models” to be checked into git shortly.



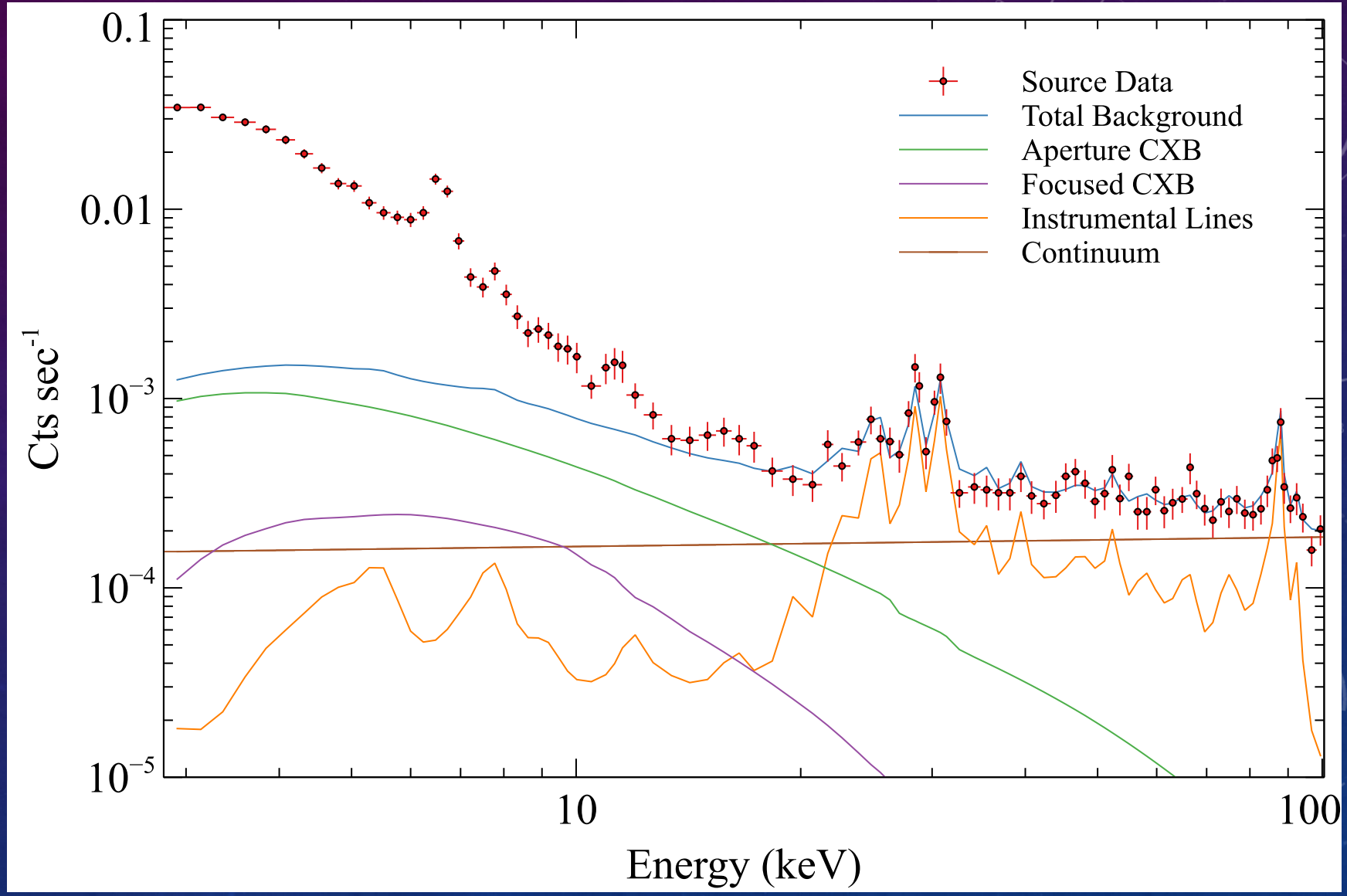
NUSKYBGD PT2

Fit for a single region after a joint fit to all four.

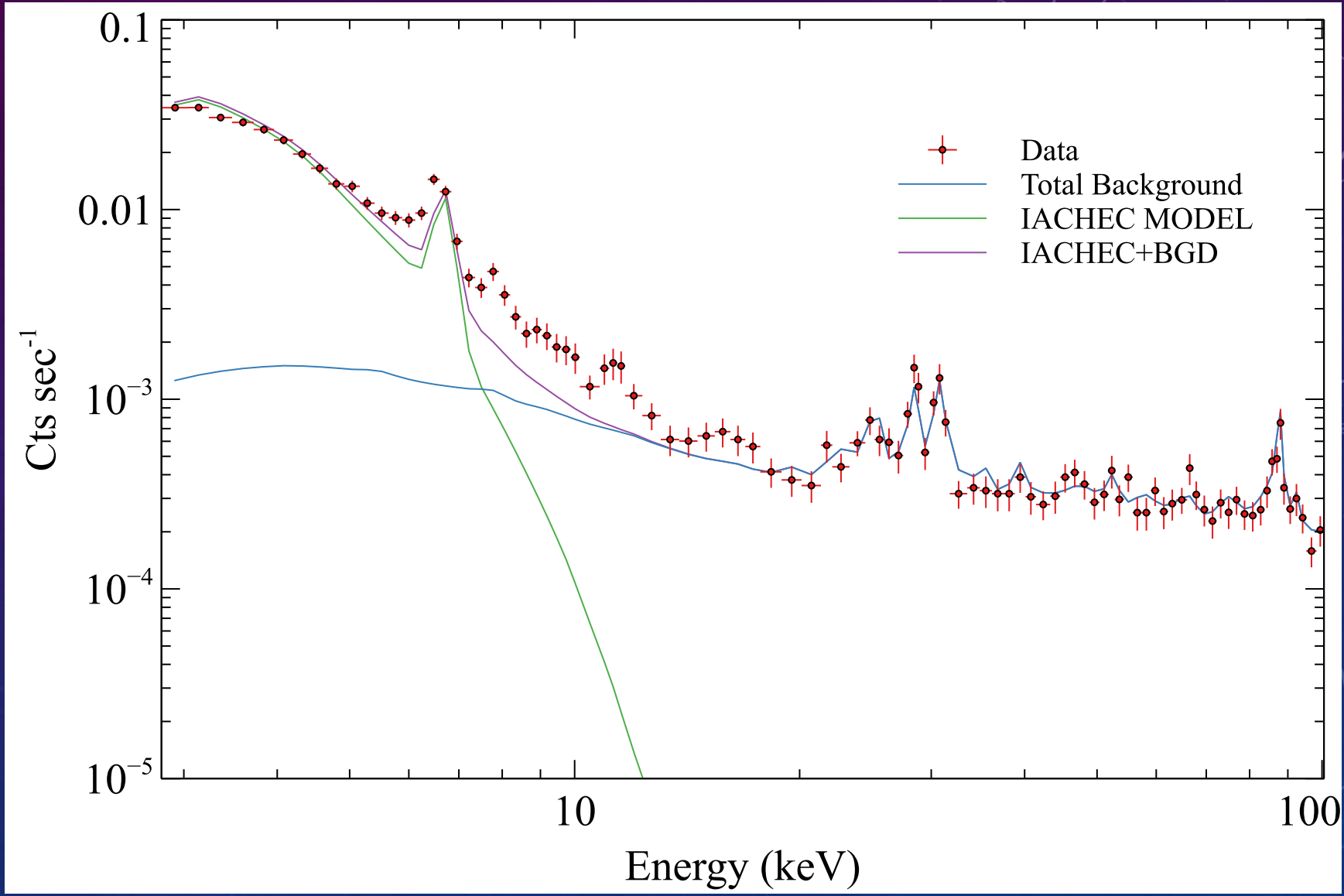
Just to make it easier to see what's contributing where.



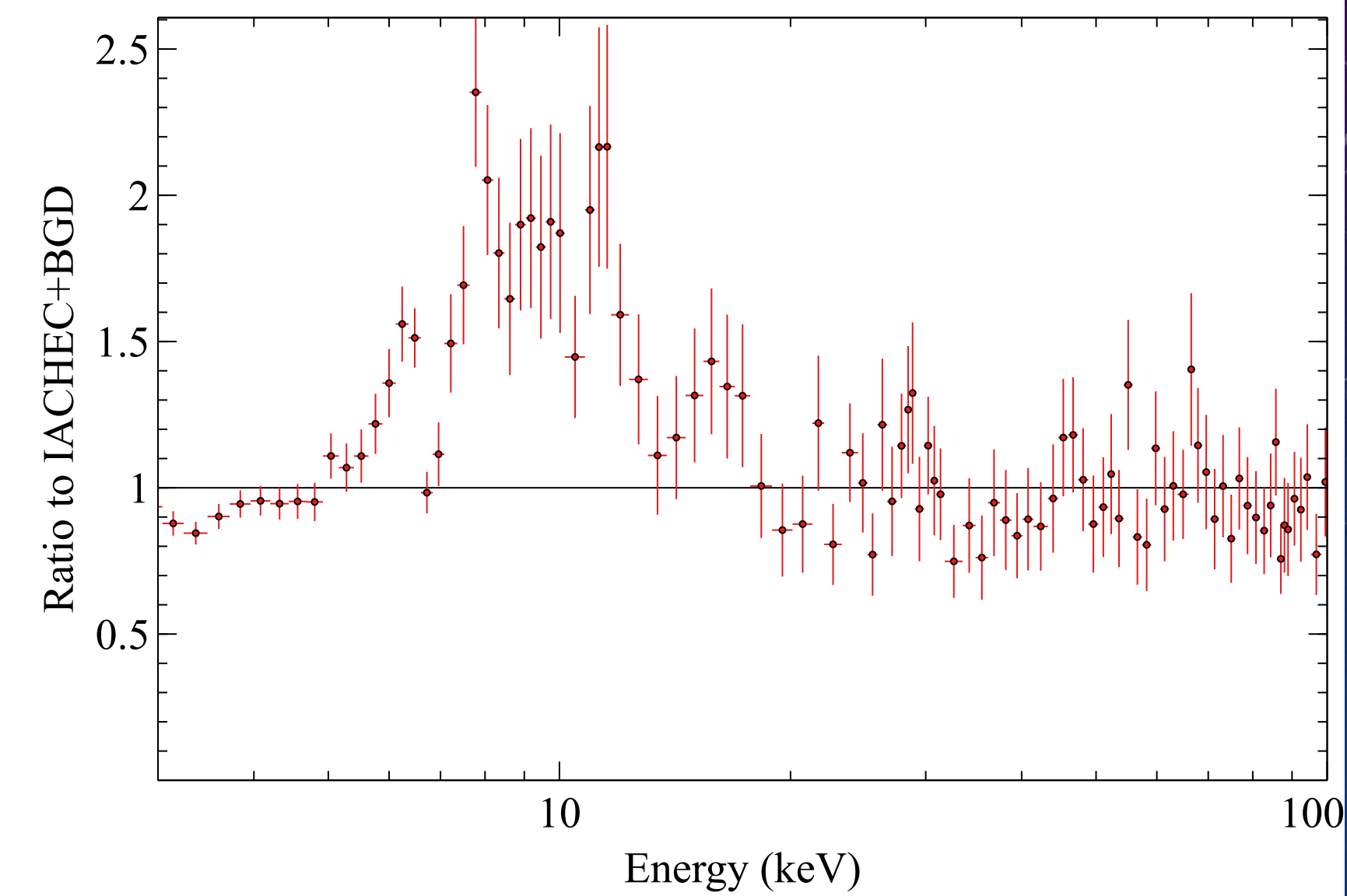
SOURCE+ BACKGROUND



IACHEC MODEL



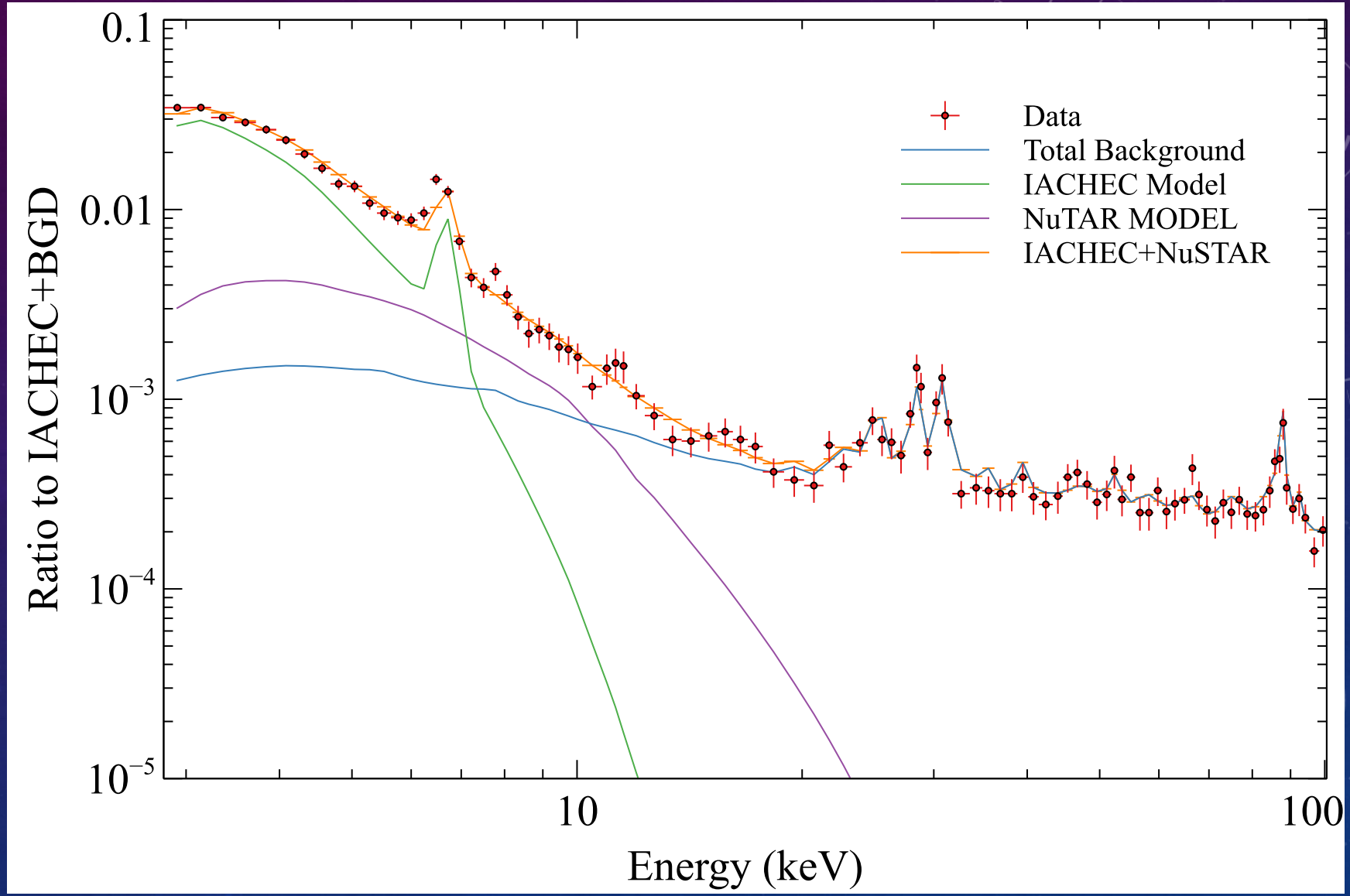
RATIO TO IACHEC MODEL



ADDED A HOT THERMAL COMPONENT

Additional ”hot” nlapec consistent with Bamba et al.

But that line structure…

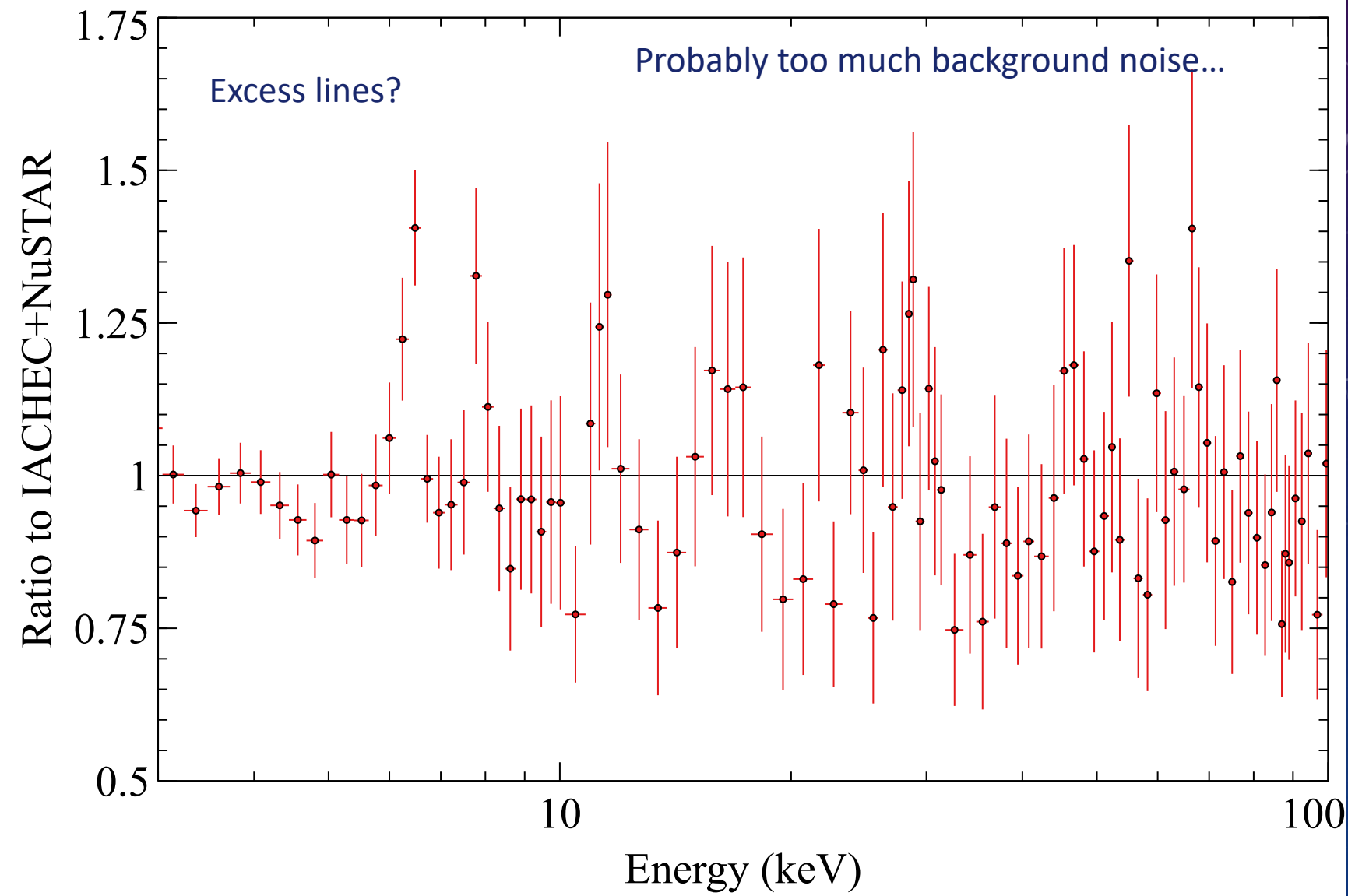


ADDED A HOT THERMAL COMPONENT

Additional ”hot” nlapec consistent with Bamba et al.

Can fit additional lines at 6.4 And 7.95 keV (also seen in *Suzaku* spectrum).

“Edge” feature at 10ish keV is odd…too low statistics for this to be an unmodeled ARF feature (I think).



PATH FORWARD

- Work out “optimal” **energy range** for fitting in this formalism.
- Add in FPMB (see if that just makes things more complicated…)
- Recover Mode06 data
- …or just ask Fiona for a deeper observation for calibration purposes.