

Revisions to the HRC-S Quantum Efficiency at Energies above the Carbon Edge

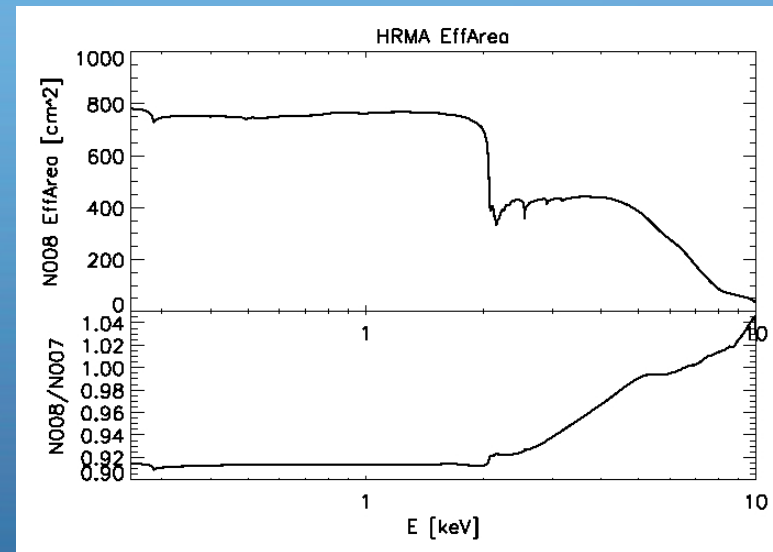
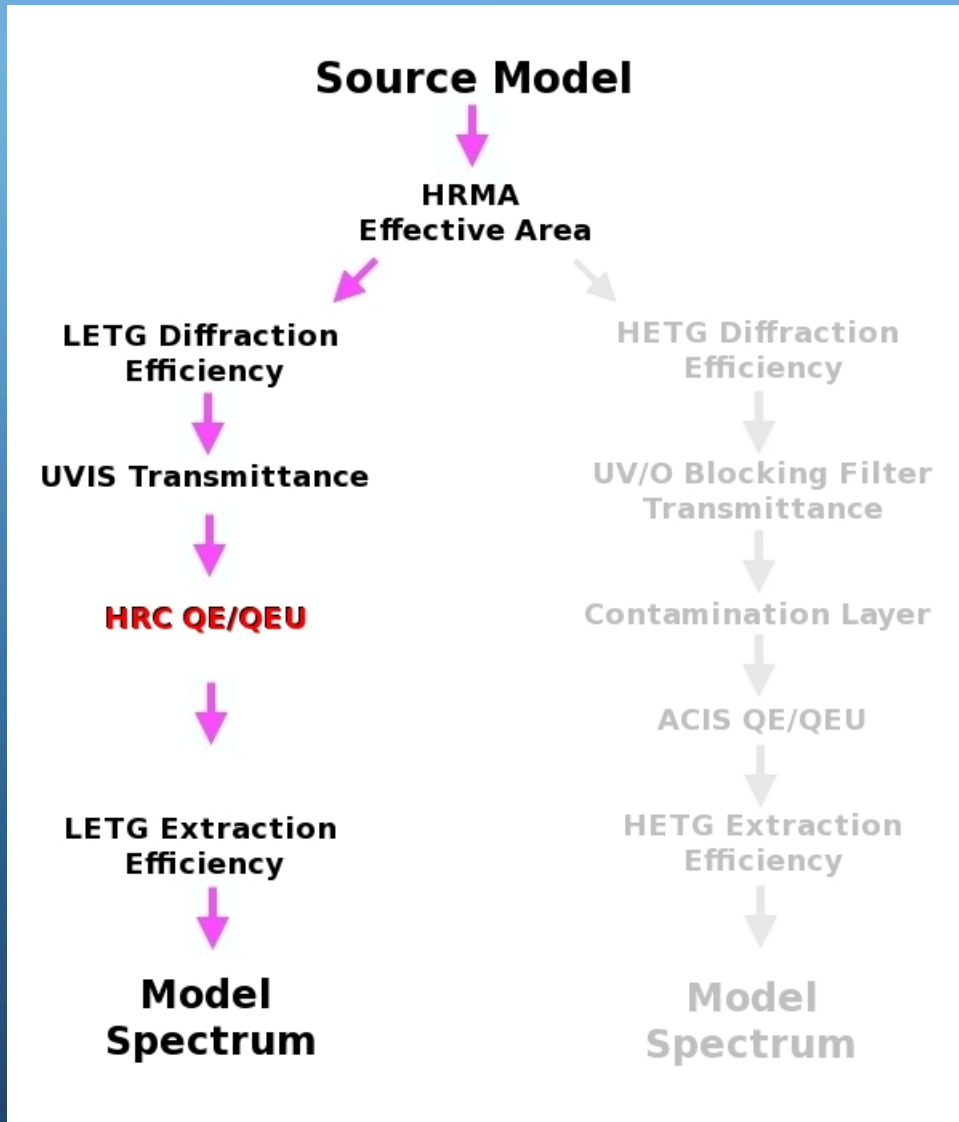


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Outline

- **Motivation for HRC-S QE Revision**
 - *New HRMA Effective Area Model*
 - *Accumulated In-flight Observation Database*
- **In-flight Analysis**
 - *QE Revision Procedure*
 - *Calibration Source*
 - *Models & Fits*
- **Results**
 - *Prototype QE*
- **Future**
 - *Cross-calibration*

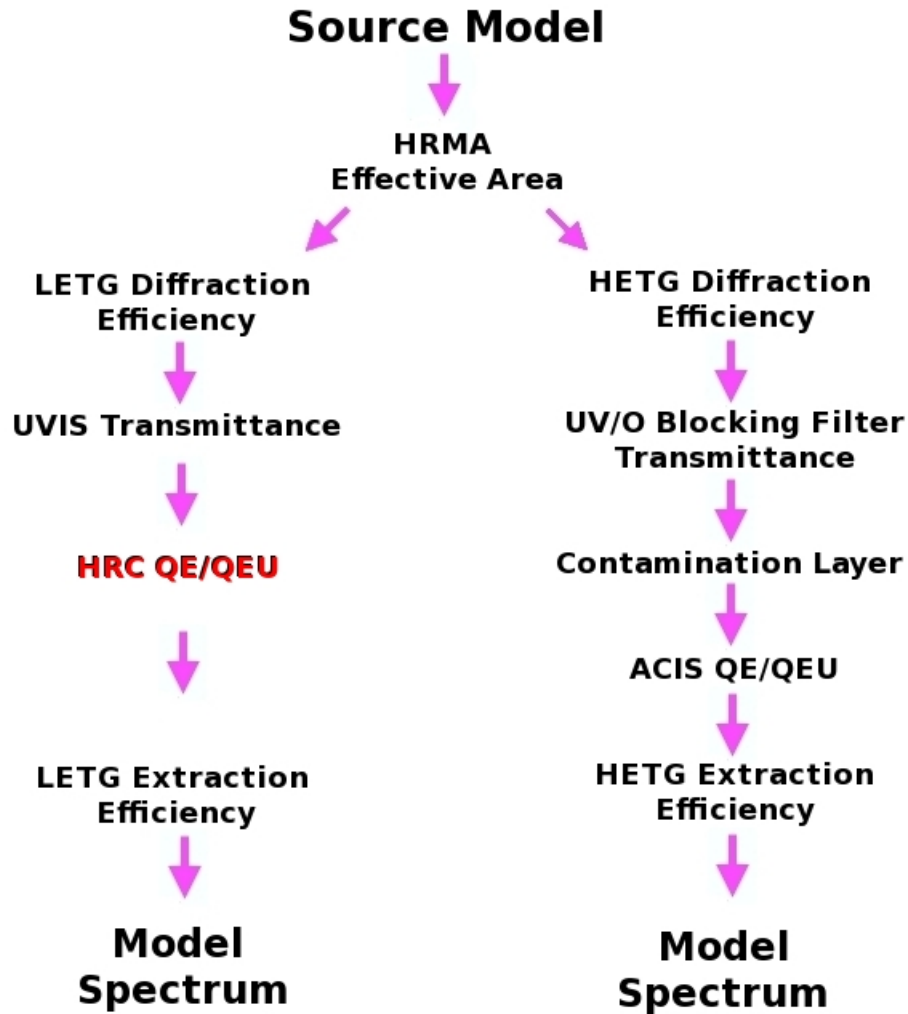
New HRMA Model Effects



*New (N008) HRMA Eff_area
Model Released: Jan 2009*

*In-Flight HRC QE Calibration =
Sensitive to any HRMA change*

In-flight HRC QE Calibration Procedure



HETG/ACIS-S Observation

- Assume a Source Model
- Fold SM through HETG Calibration and fit in XSpec

LETG/HRC-S Observation (of same Source)

- Use HETG/ACIS-S Source Model Parameters (ie PhoIndex, Normalization, etc.)
- Fold through LETG Calibration
- Compare Residuals of Observation Spectrum to Model Spectrum

**HETG Calibration
Uncertainties?**

Calibration Source Selection Criteria

Soft Spectrum
Low Absorption
Multiple Configurations
Consistent Aimpoint

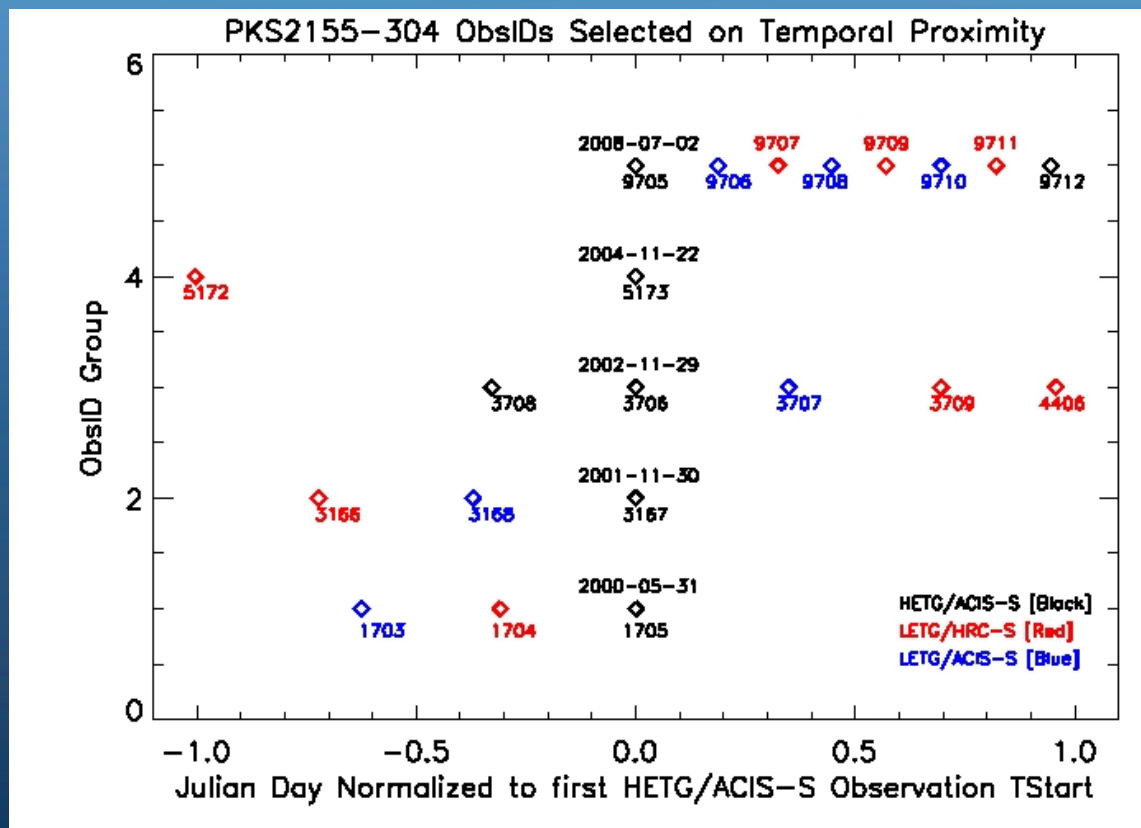


PKS 2155-304

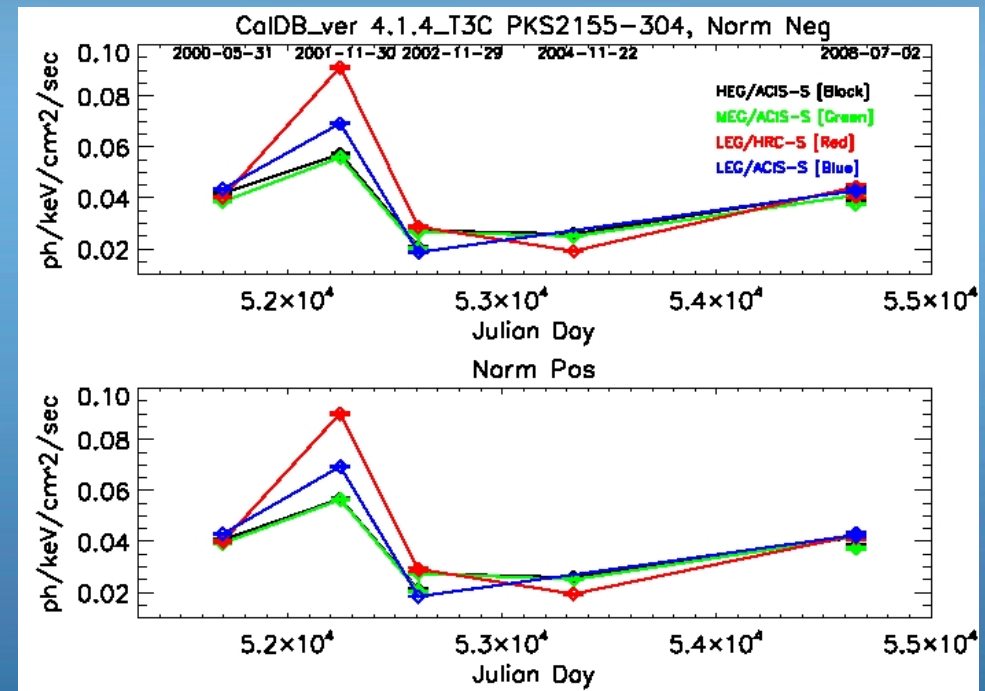
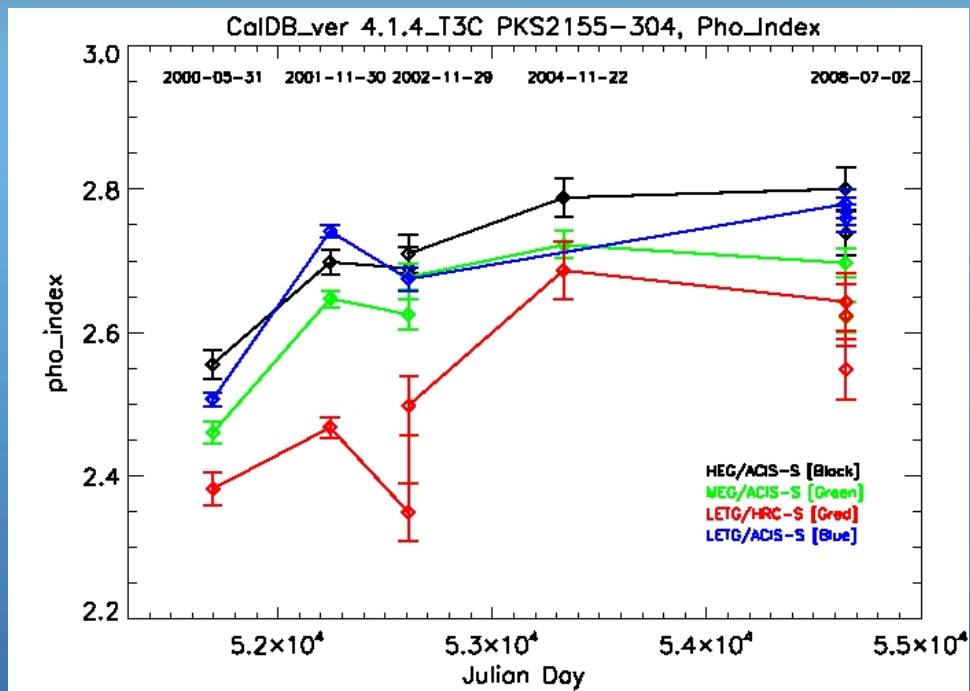
Problems:

Variability

Multiple Configuration
Observations within
close temporal proximity



Fit nH-Absorbed PowerLaw



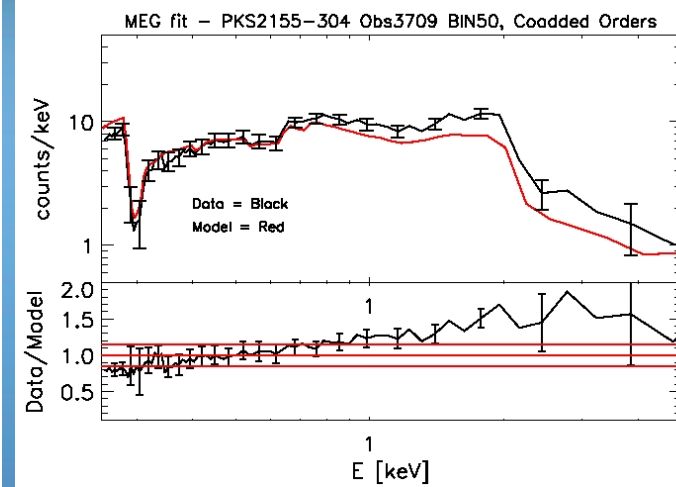
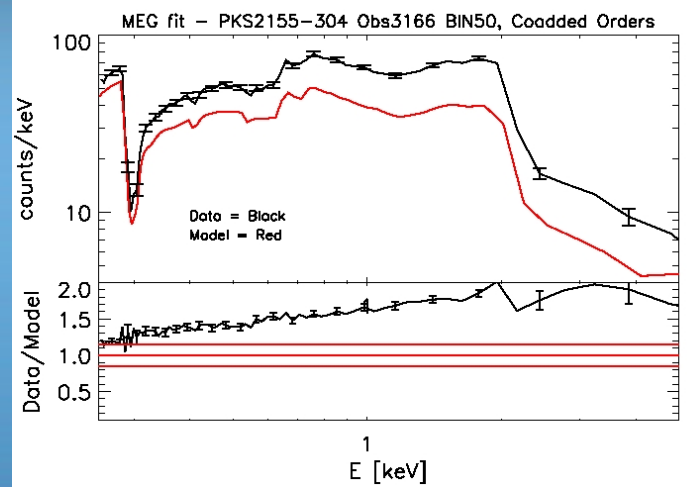
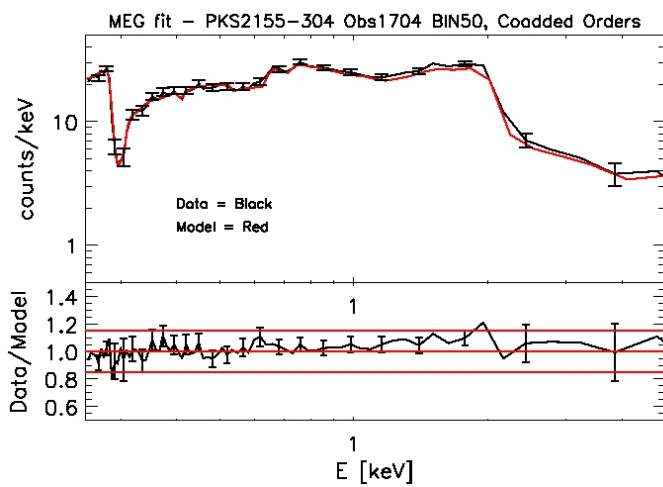
LEG PhoIndex < MEG

Inconsistent LEG-MEG
variance

PhoIndex sensitive to
variability

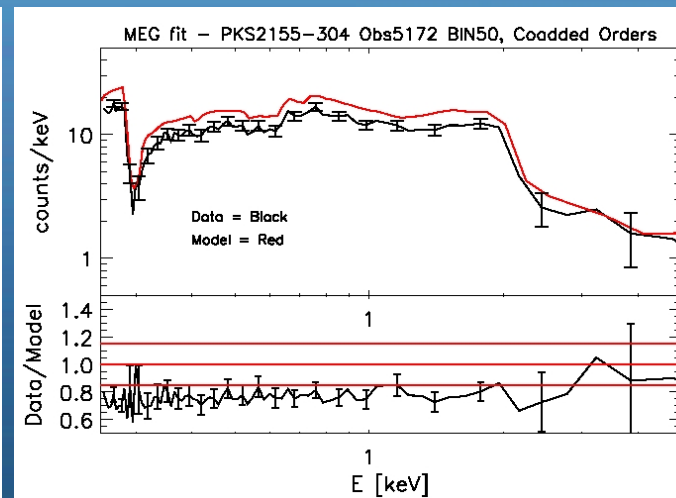
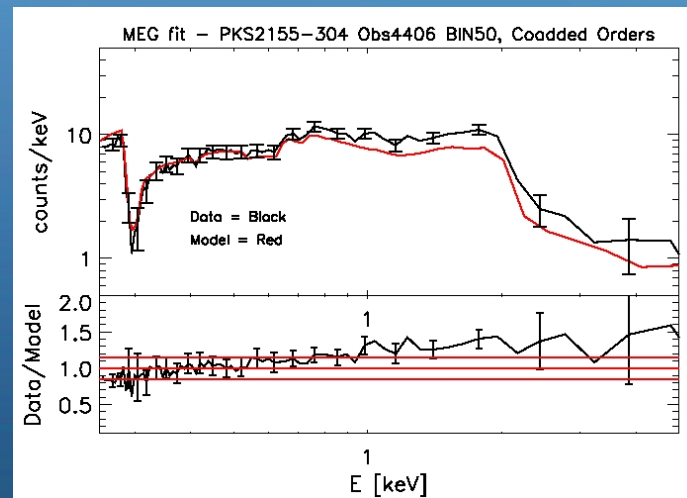
- *Xspec & Sherpa*
- *Chi-Gehrels & Cash-Statistic*
- *Separate Fits for Positive / Negative Orders*
- *Energy Range: 0.8 – 5.0 keV*
- *NH = 1.42e20 cm² <- LAB Survey*

HRC-S/LEG Using ACIS-S/MEG Parameters



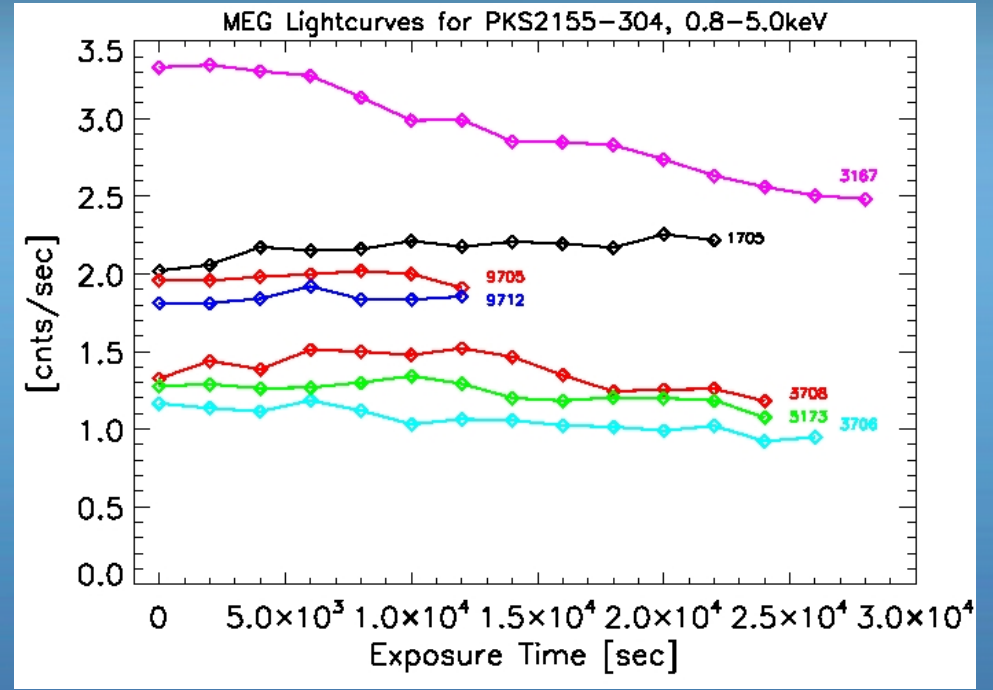
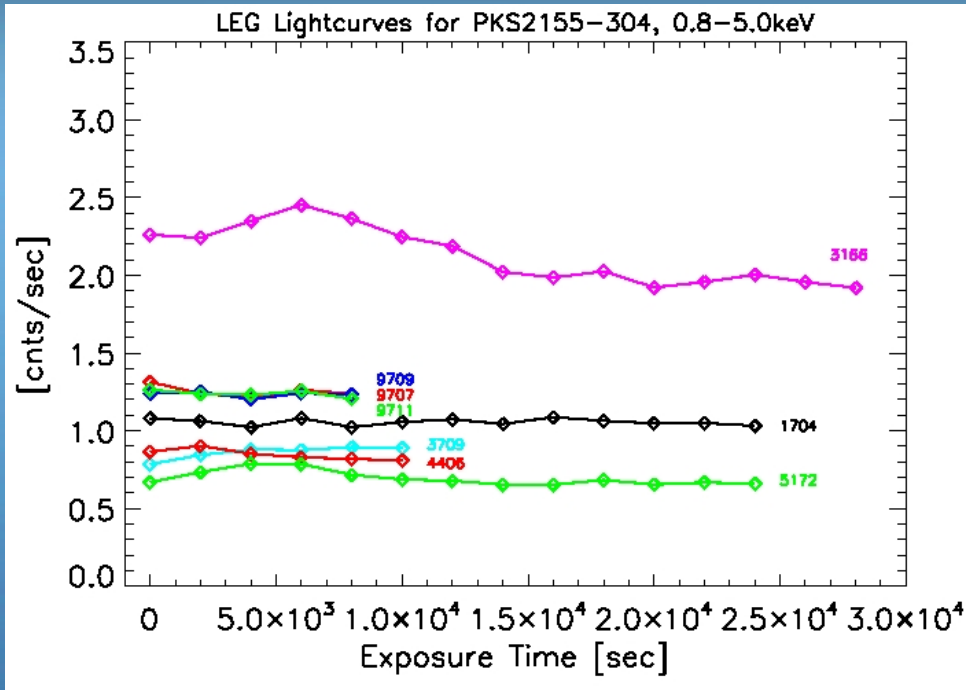
Bad Fits!

- MEG Pho_Index, Norm
- Coadded +/- Orders
- Residual Slope = Positive
- Due to LEG Pho_Index Systematics



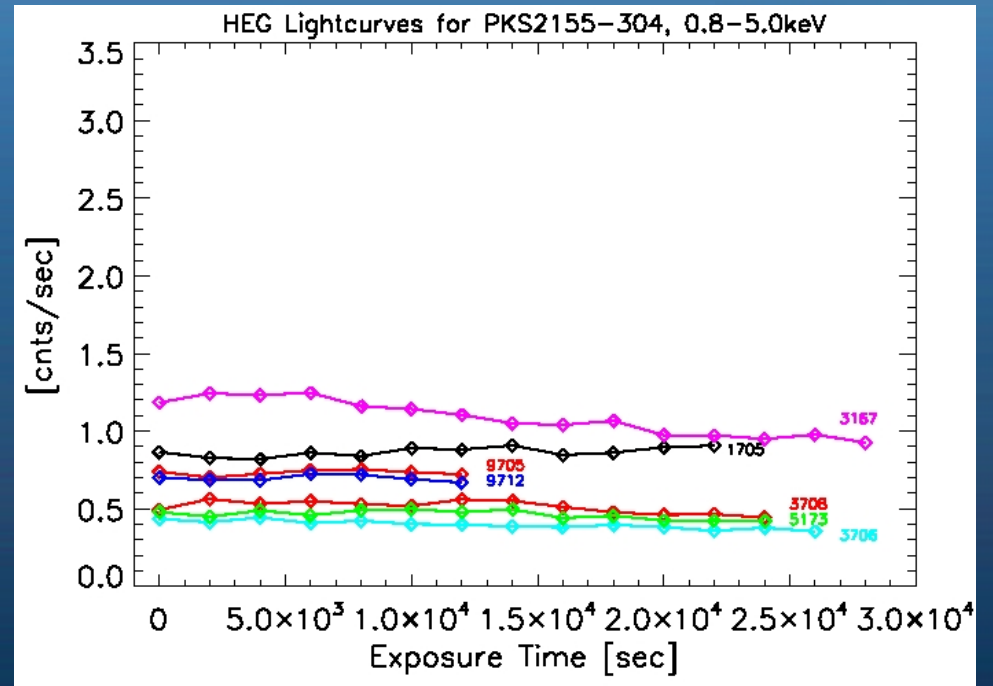
**Residual Inconsistency
Due to Source
Variability**

PKS 2155-304 Lightcurves

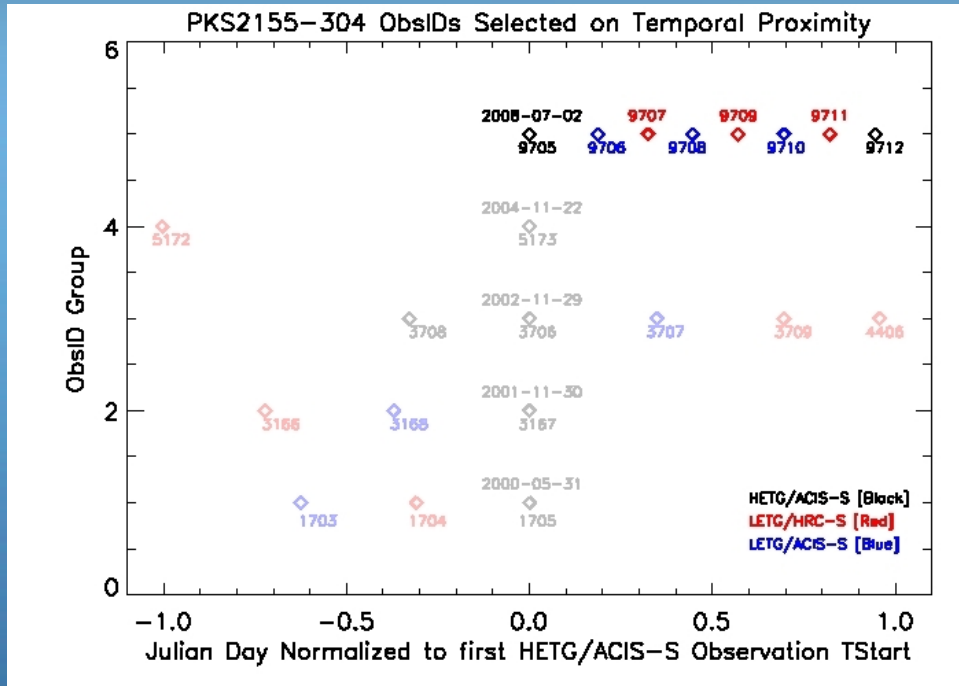


PKS 2155-304 = VARIABLE

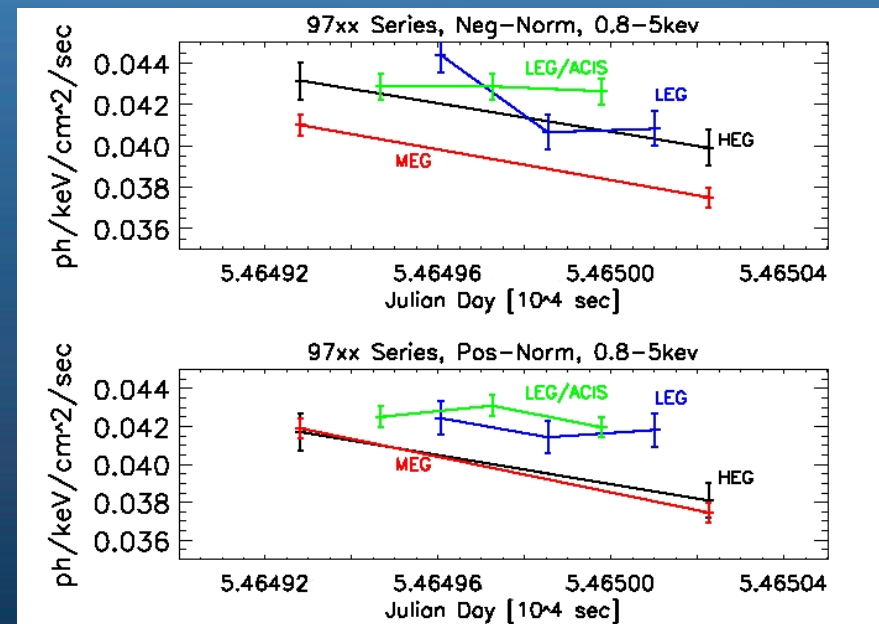
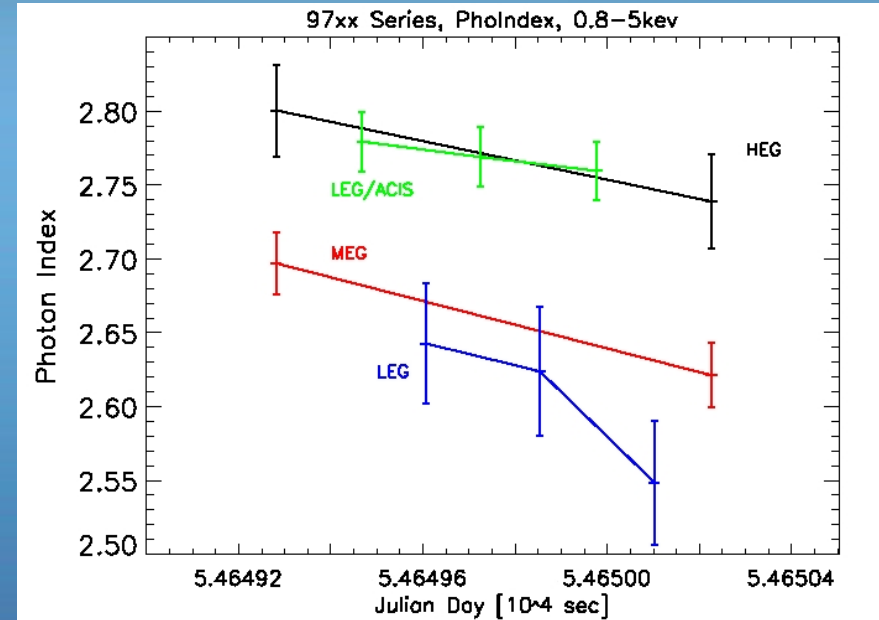
Δ Flux \gg A Few Percent
is a Problem



Conquering Variability: July 2008 Series



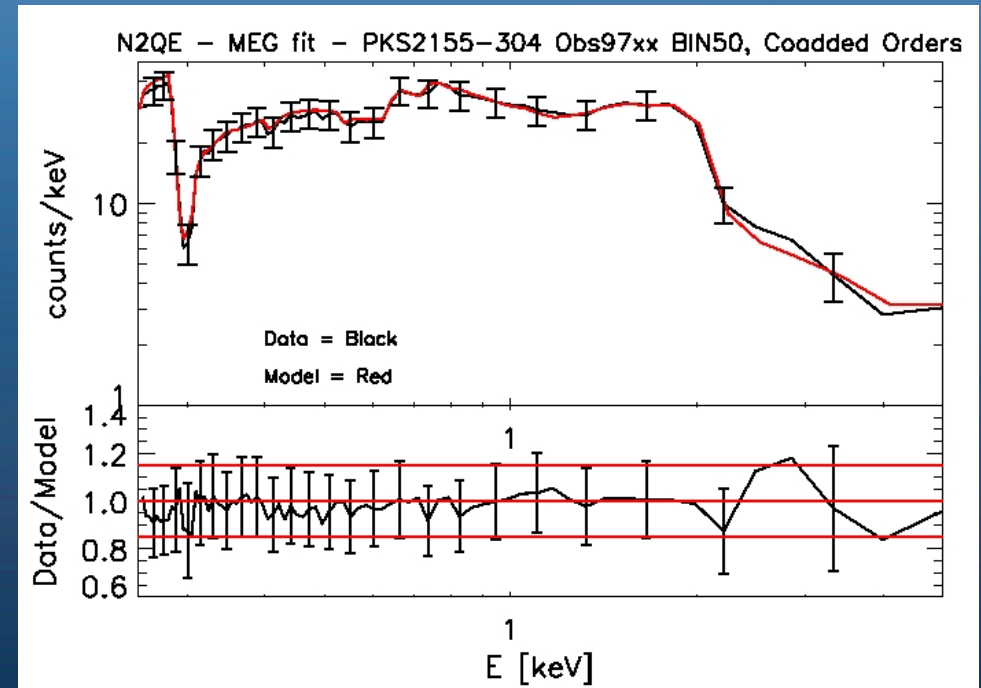
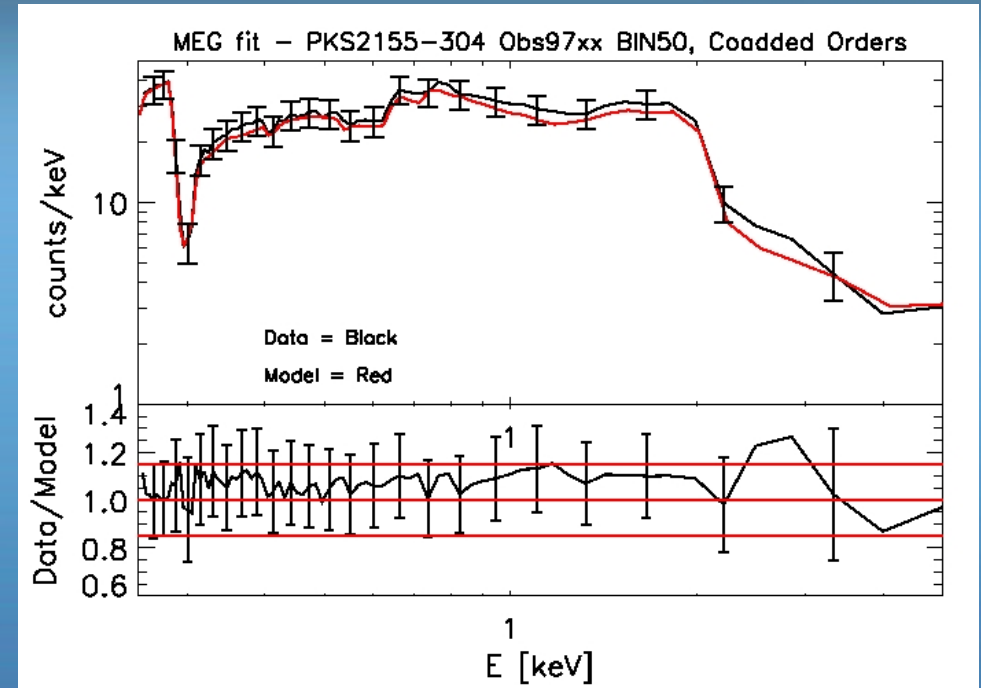
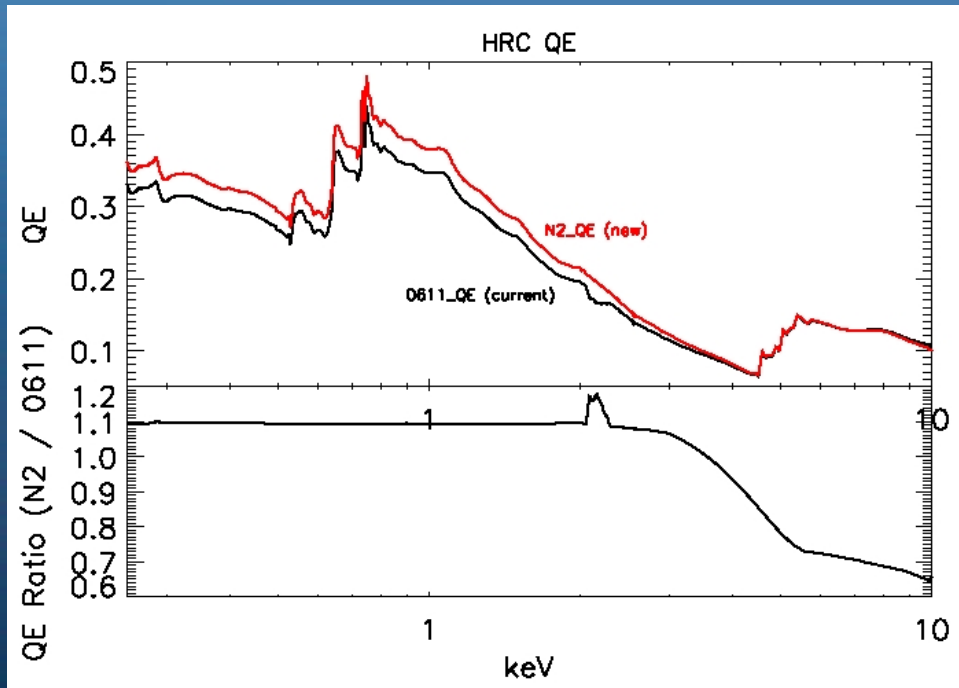
- 97xx Series
- MEG showing ~ monotonic declines
- Interpolate to LETG observation dates



QE Version - N2

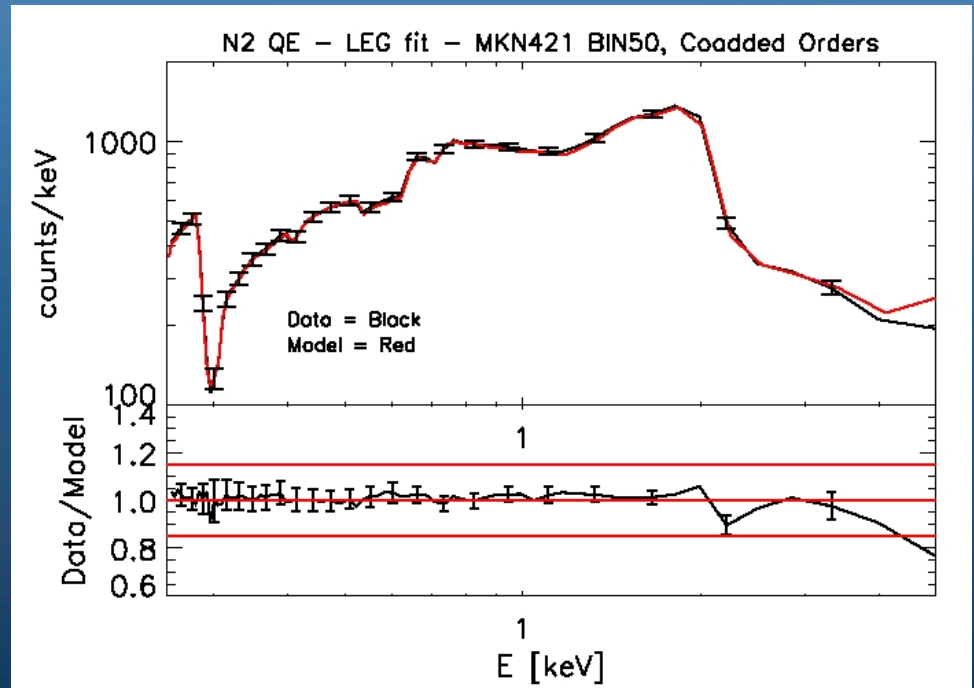
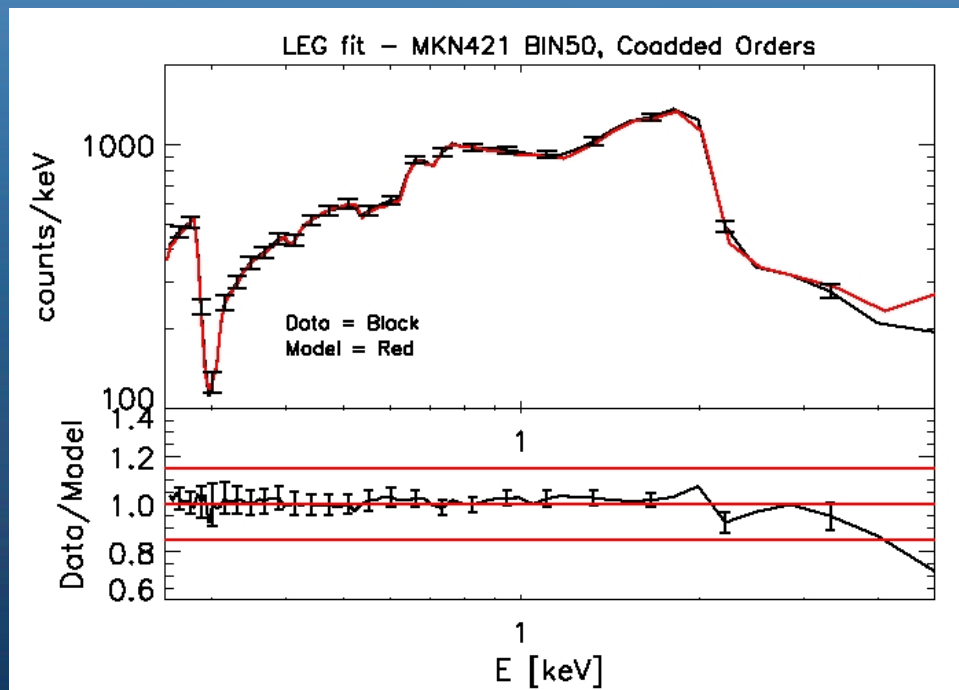
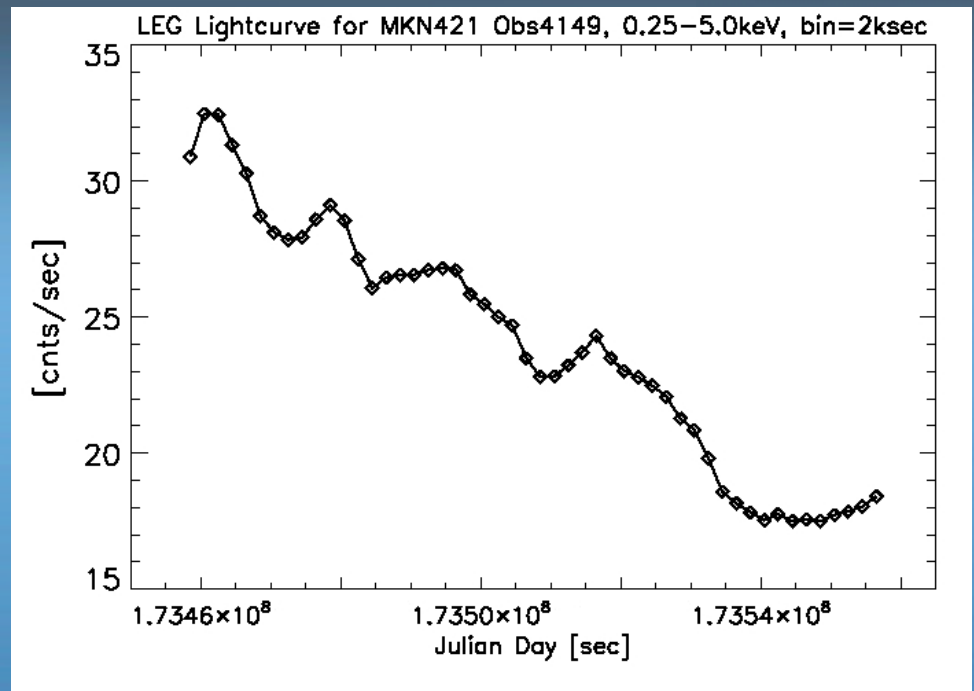
- Multiply QE by the change in the HRMA
- Smooth 2 keV bump

We arrive at our first QE revision

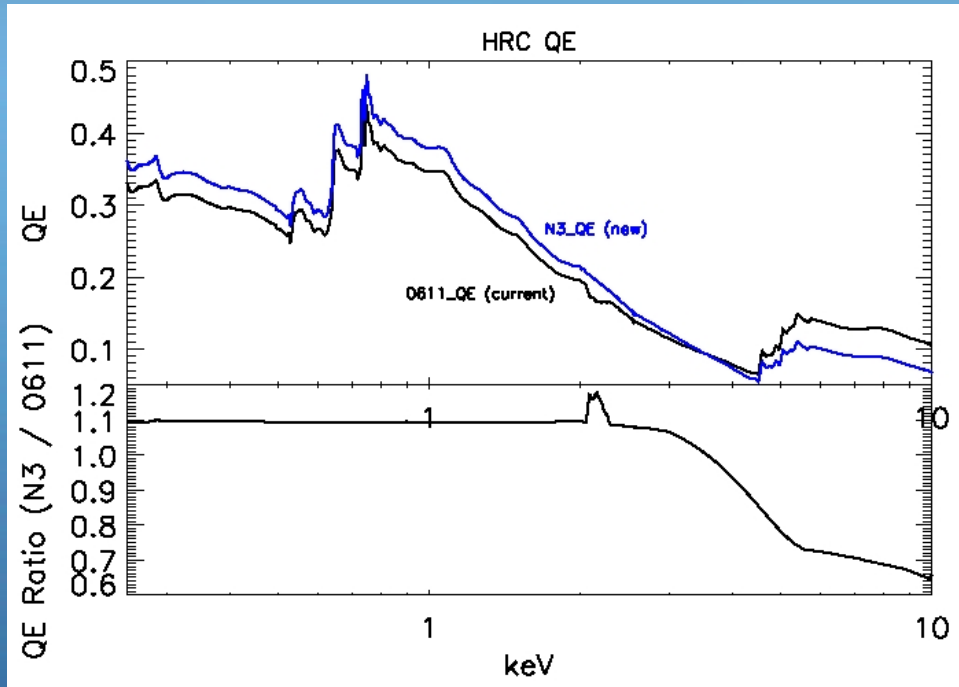


Serendipity! Mkn 421

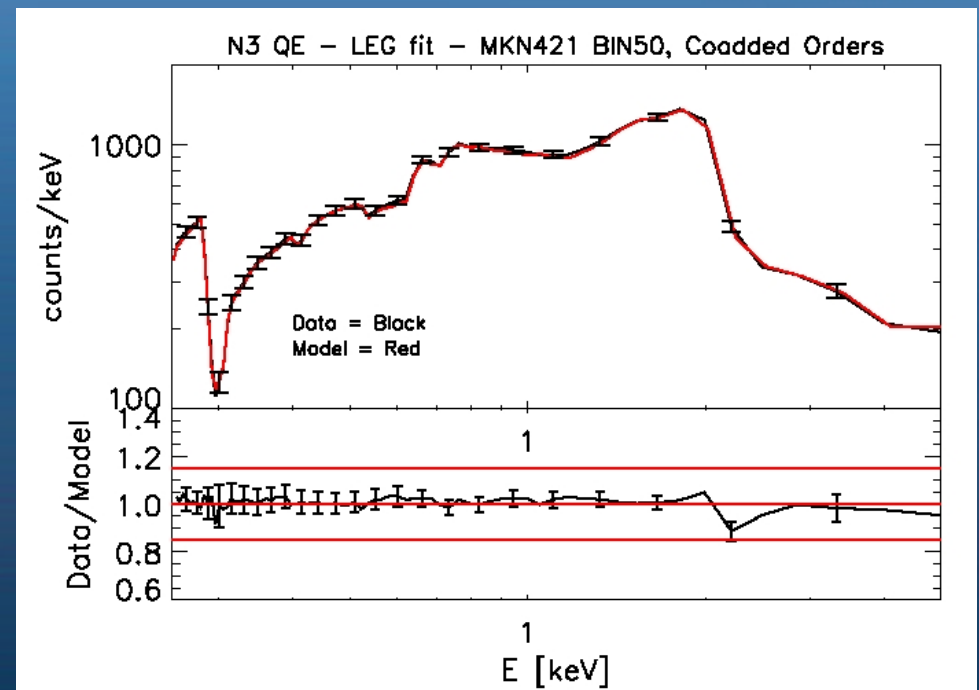
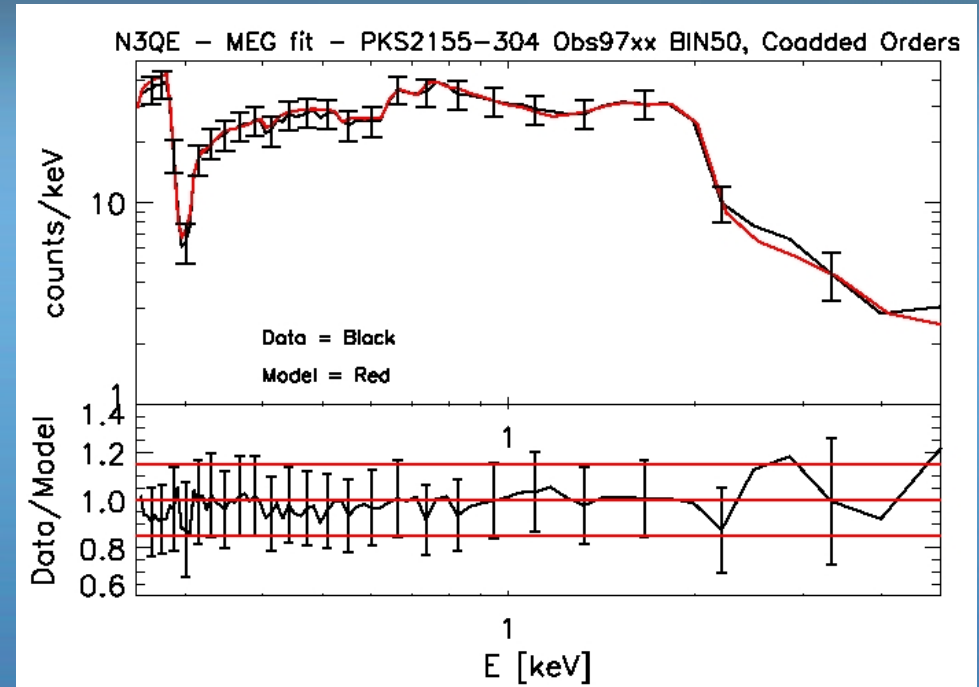
- 100 ksec Observation (ObsID 4149)
- Variable LC:
- Split into four 25 ksec pieces
- Fit in XSpec - Absorbed PowerLaw
Energy range 0.25 - 5.0 keV
- Fine QE correction



QE Version N3



- Attenuated at $E > 3$ keV
- Based on Mkn 421 smoothed residual fit
- Improvement in both PKS 2155-304 and Mkn 421



Future

- Further Revisions to our current prototype
- Release Data Late September / Early October
In time for POG
- Prototype Available for testing Early September
Prototype is usable in XSpec / Sherpa

Further Along

- Revisions Utilizing Simultaneous XMM Observations?

