# HETGS Effective Area Updates

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# Progress on Chandra Internal Calibration

- Analysis of HETGS data completed
  - see http://space.mit.edu/ASC/calib/heg_meg/meg_heg_report.pdf
    - Updated HEG and MEG efficiencies (ECR)
- HRMA reflectivities updated (ECR)
  - Eliminates Ir-M edge residuals
- Si-K edge fix under examination

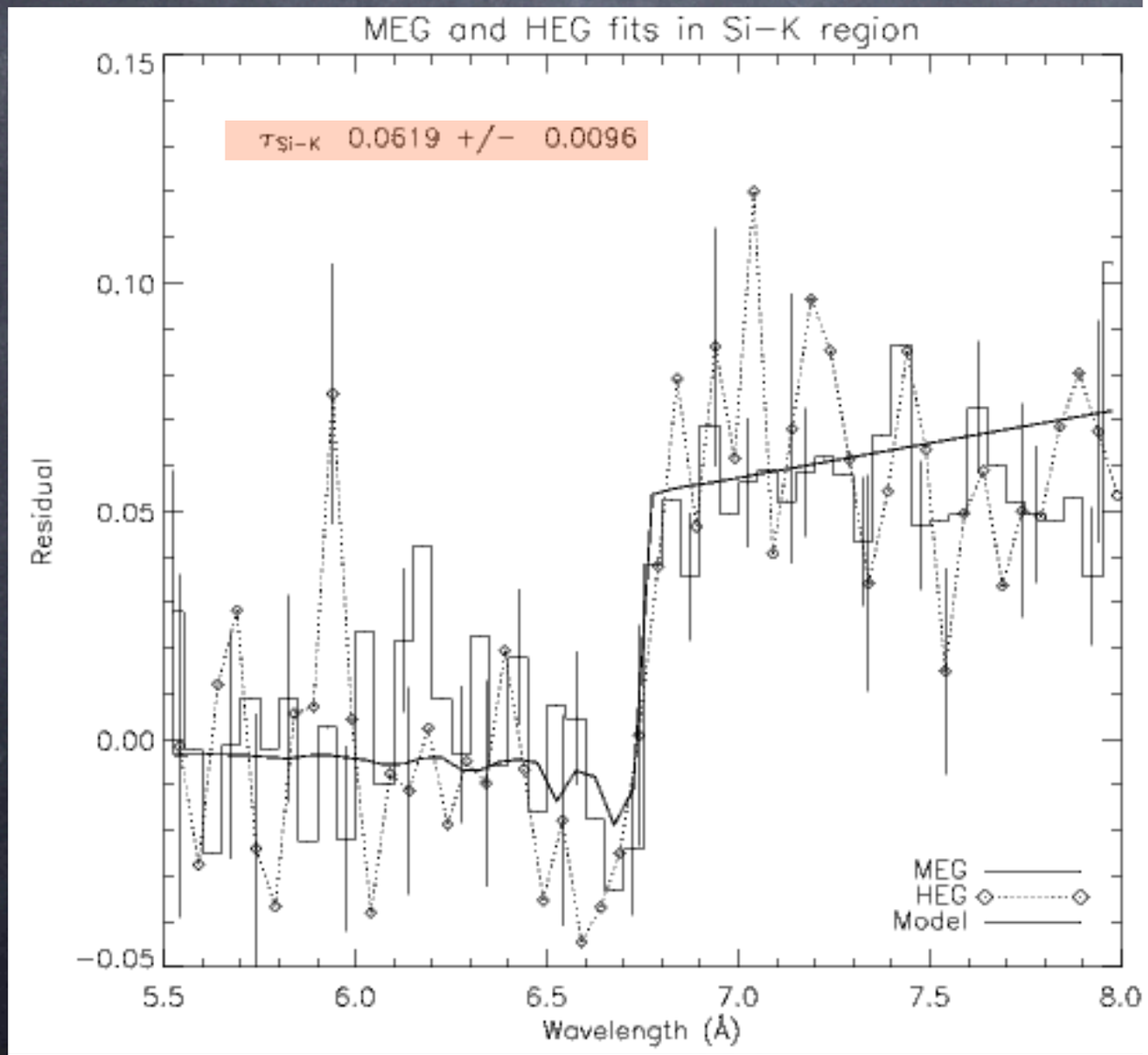
# Targets used in Analysis

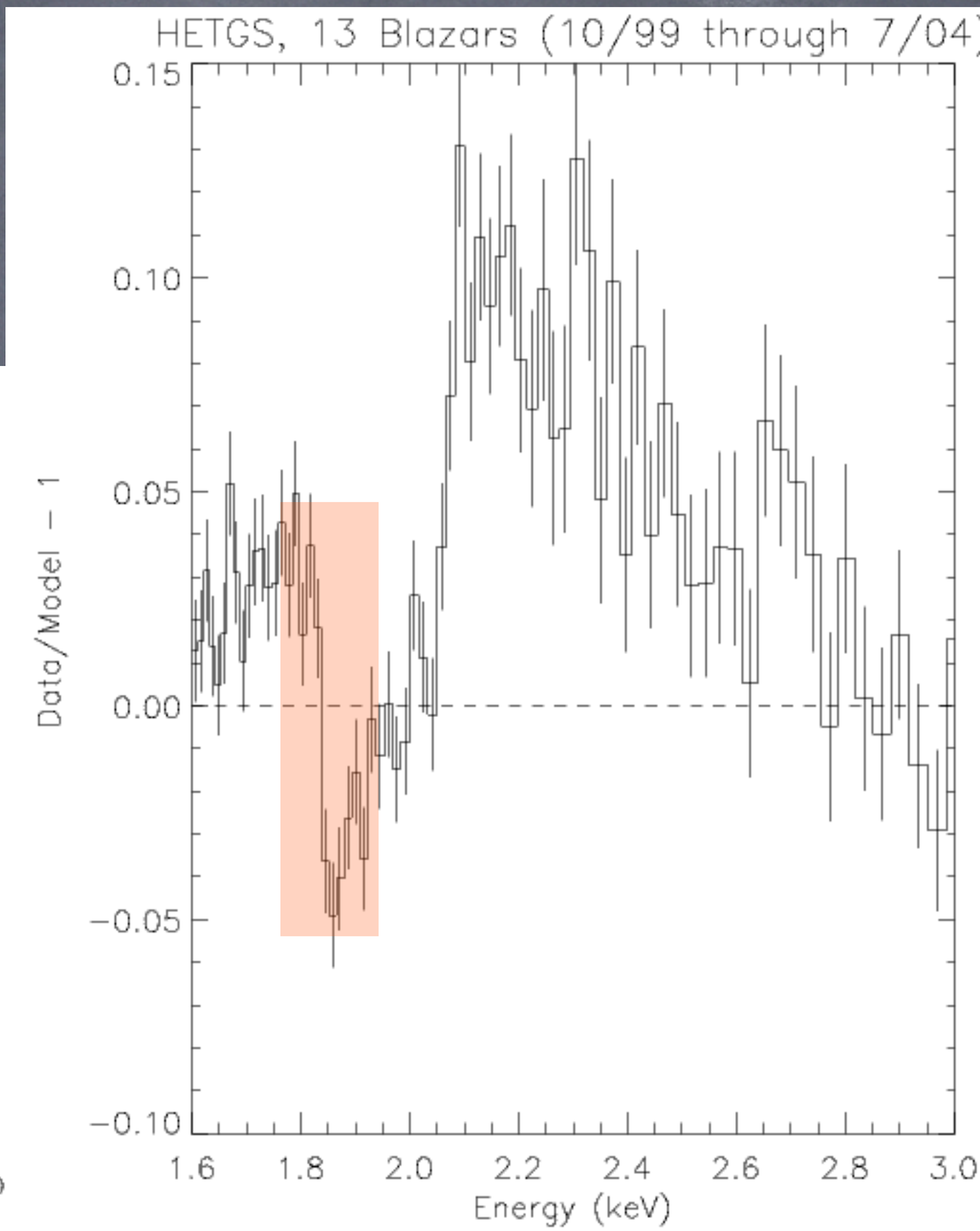
- All blazars, all in archive
- Fit with simple PL models, fix NH
- Mostly Cal targets
- No spectral pileup

| Target | ObsID | Start Date | Exp. Time | $A$ ph cm$^{-2}$ s$^{-1}$ keV$^{-1}$ | $\Gamma$ |
|---|---|---|---|---|---|
| 3C 273 | 459[a] | 2000-01-10 | 38600 | 0.02534 ± 0.00011 | 1.666 ± 0.006 |
| 3C 273 | 2463 | 2001-06-13 | 26695 | 0.02389 ± 0.00013 | 1.731 ± 0.007 |
| 3C 273 | 3456[b] | 2002-06-05 | 24531 | 0.02015 ± 0.00013 | 1.771 ± 0.009 |
| 3C 273 | 3457[c] | 2002-06-05 | 24849 | 0.01771 ± 0.00012 | 1.668 ± 0.009 |
| 3C 273 | 3573 | 2002-06-06 | 29680 | 0.01931 ± 0.00012 | 1.787 ± 0.008 |
| 3C 273 | 4430 | 2003-07-07 | 27750 | 0.02927 ± 0.00015 | 1.823 ± 0.007 |
| 3C 273 | 5169 | 2004-06-30 | 29863 | 0.01755 ± 0.00011 | 1.720 ± 0.008 |
| PKS 2155-304 | 337[a] | 1999-10-20 | 38666 | 0.03762 ± 0.00013 | 2.642 ± 0.006 |
| PKS 2155-304 | 1705 | 2000-05-31 | 25508 | 0.03738 ± 0.00017 | 2.516 ± 0.008 |
| PKS 2155-304 | 1014 | 2000-05-31 | 25508 | 0.04322 ± 0.00018 | 2.469 ± 0.007 |
| PKS 2155-304 | 3167 | 2001-11-30 | 29653 | 0.05498 ± 0.00020 | 2.730 ± 0.007 |
| PKS 2155-304 | 3706 | 2002-11-29 | 27713 | 0.01970 ± 0.00013 | 2.705 ± 0.011 |
| PKS 2155-304 | 3708[d] | 2002-11-29 | 26624 | 0.02577 ± 0.00015 | 2.750 ± 0.010 |
| PKS 2155-304 | 5173 | 2004-11-23 | 26910 | 0.02427 ± 0.00015 | 2.796 ± 0.011 |
| 1H1821-63 | 1599 | 2001-02-09 | 101741 | 0.01450 ± 0.00006 | 2.021 ± 0.006 |
| Mk 421 | 1714 | 2000-05-29 | 21623 | 0.01481 ± 0.00009 | 2.024 ± 0.009 |
| 1H1426+428 | 3568 | 2001-02-09 | 103414 | 0.11968 ± 0.00036 | 2.400 ± 0.005 |
| 1H1426+428 | 6088 | 2005-06-25 | 40385 | 0.01375 ± 0.00006 | 1.970 ± 0.006 |

# Fixing the ACIS Si-K Edge

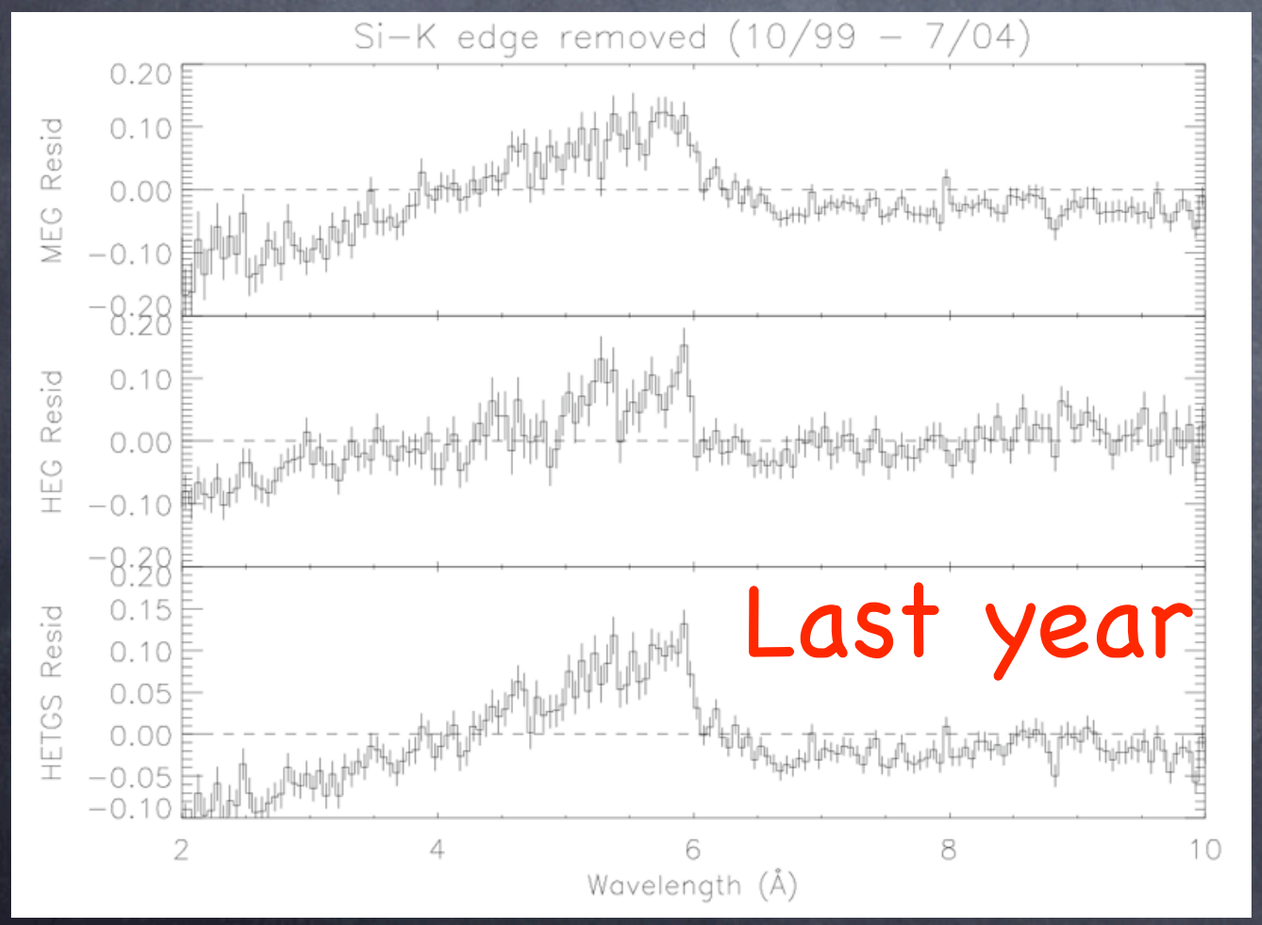
- Edge appeared after EA update
- Not result of RMF clipping
- Edge fixed with Si-K model

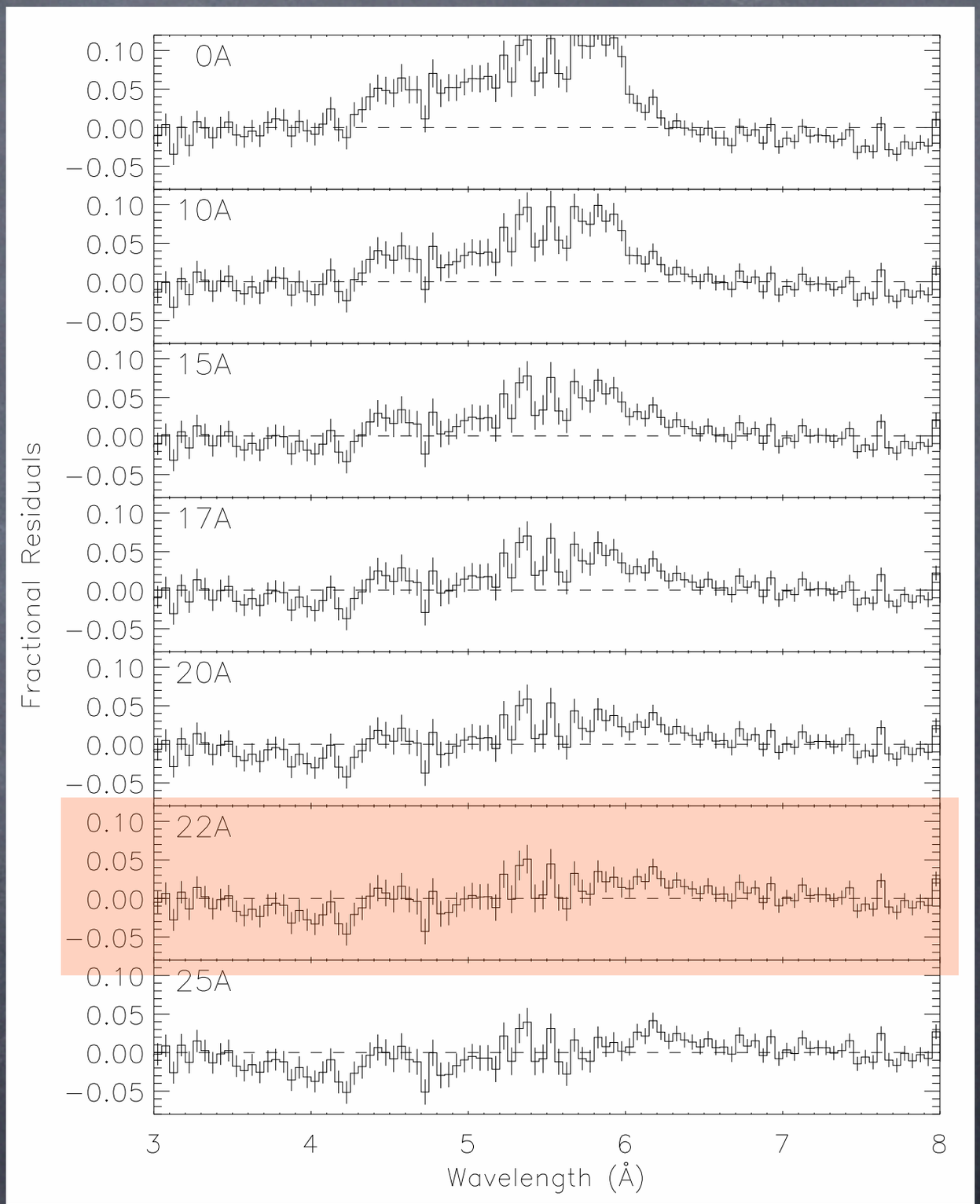


# Ir-M Residual Eliminated

- Updated HRMA EA and better HEG/MEG
- Residuals reduced to less than 5%
- $\chi^2$ minimized at 22Å OL

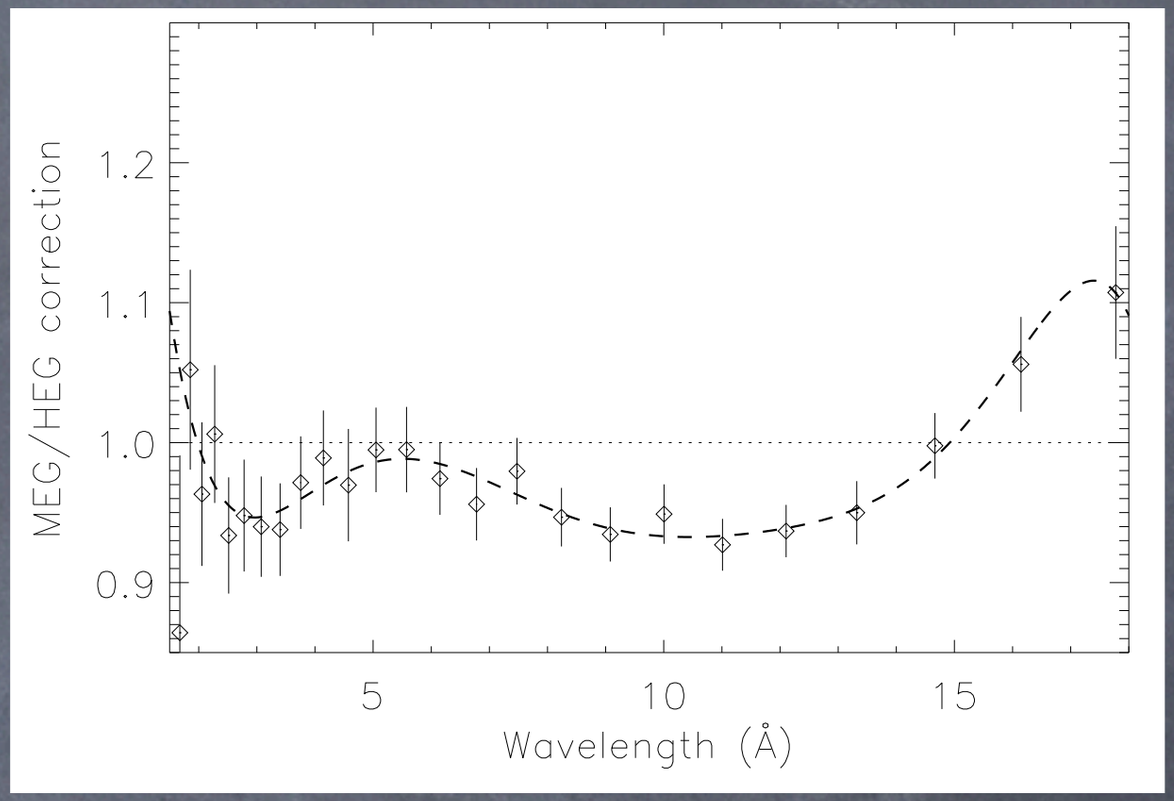


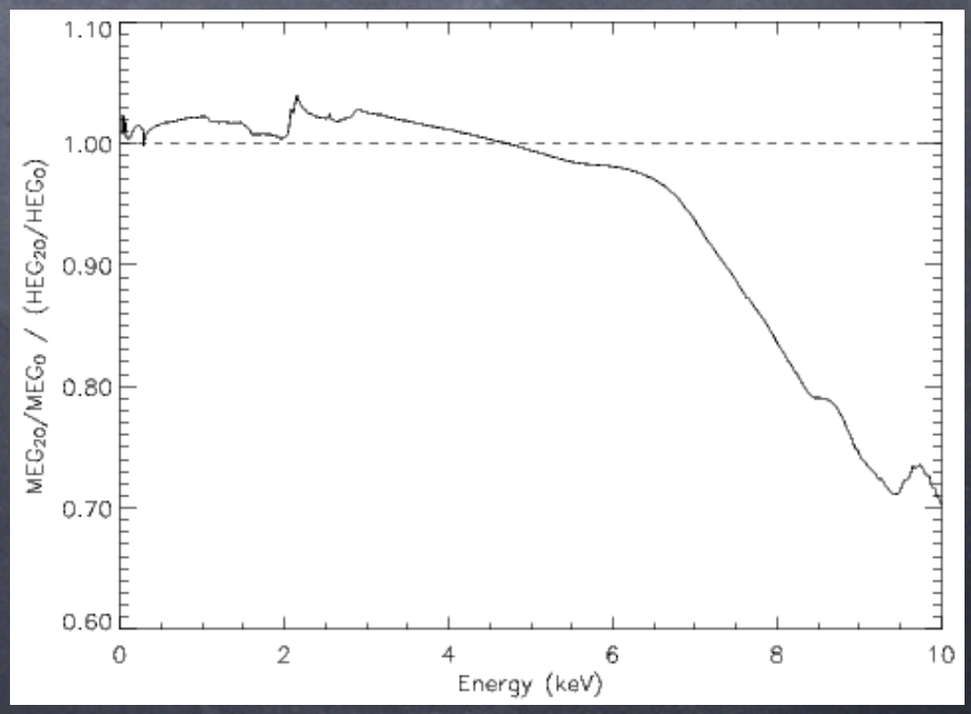




HLM – HETGS EA

# HEG/MEG Correction

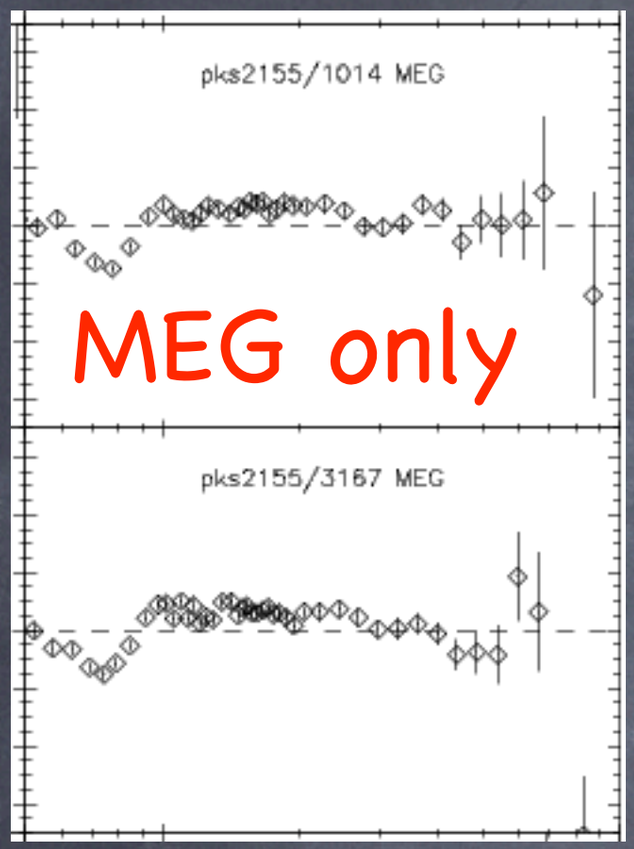
- Robust comparison: mostly independent of HRMA or ACIS
- Applied fixes to HRMA, ACIS first
- Doesn't give absolute correction
- Need external info to allocate correction to HEG or MEG

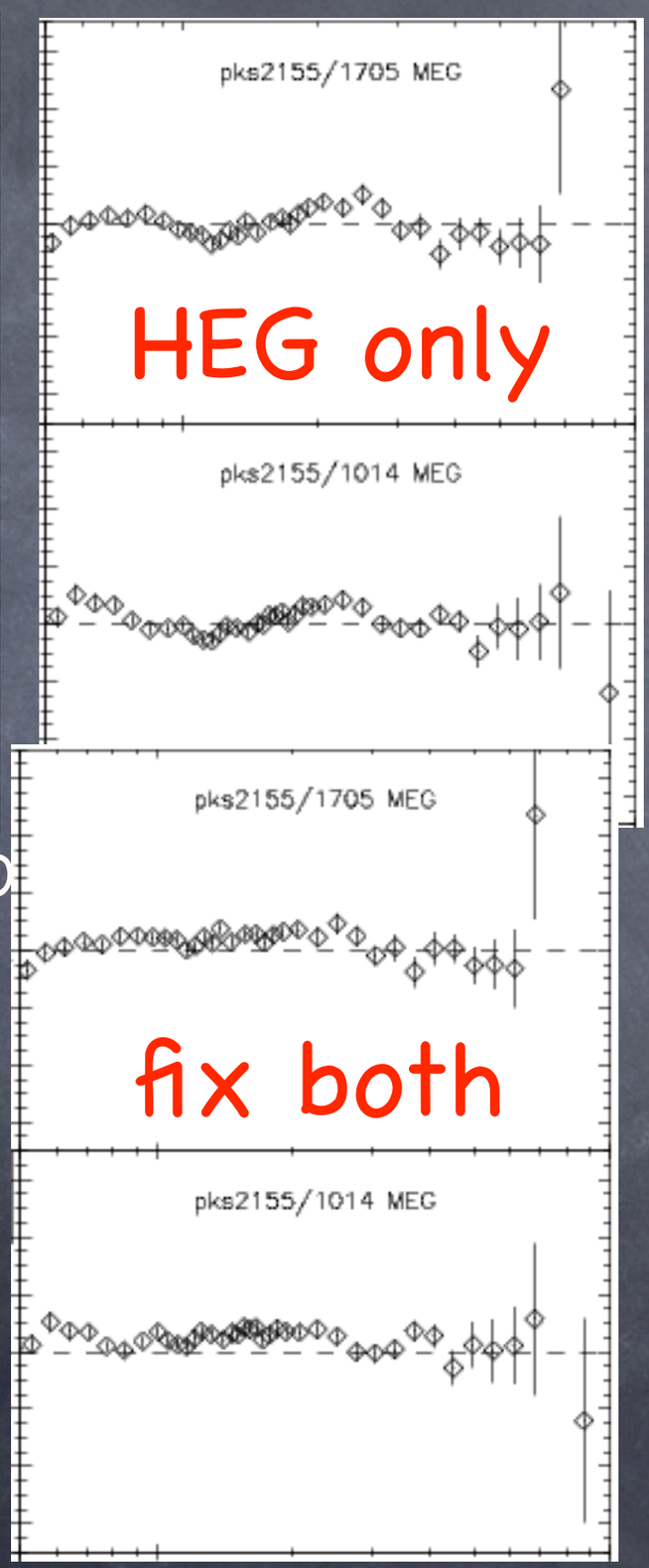


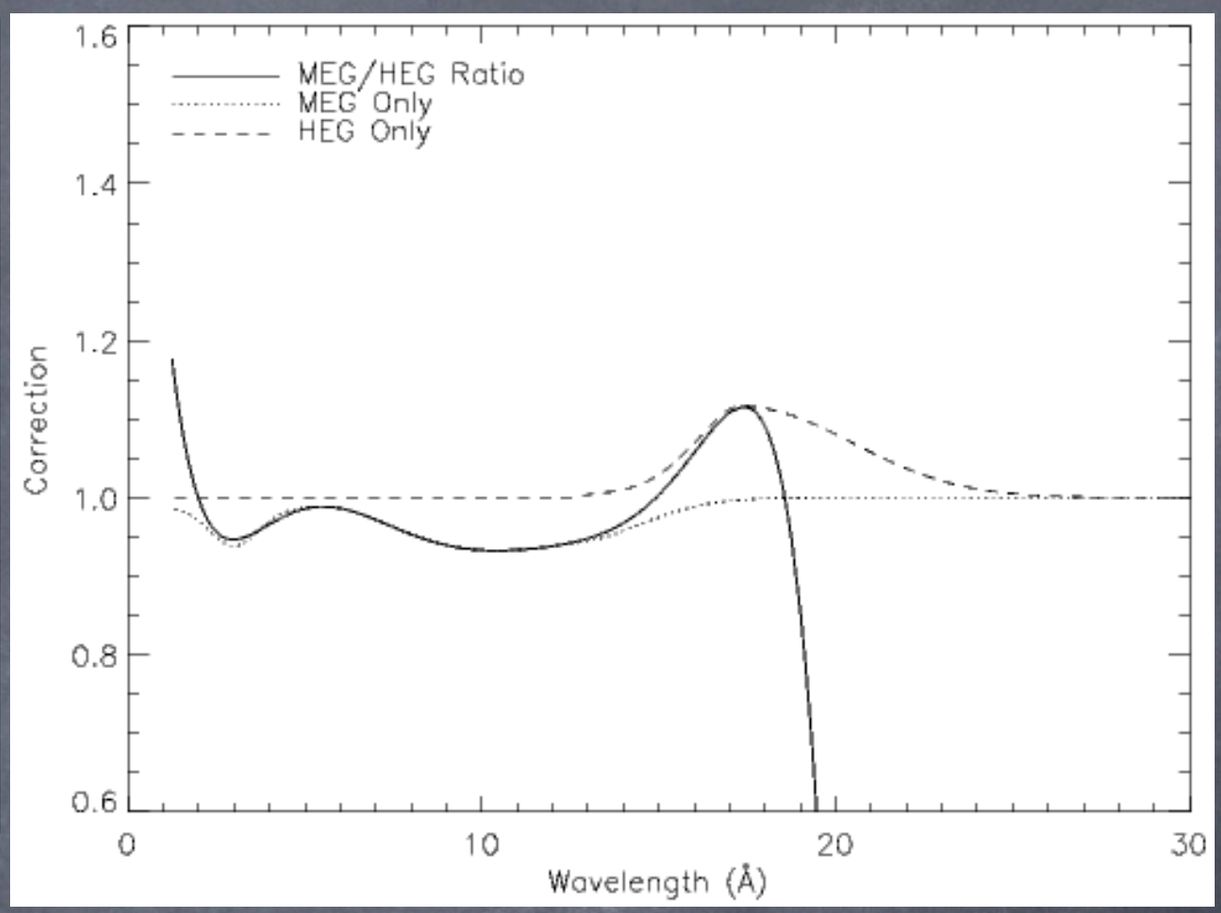




HLM — HETGS EA

# MEG/HEG Fix Allocation



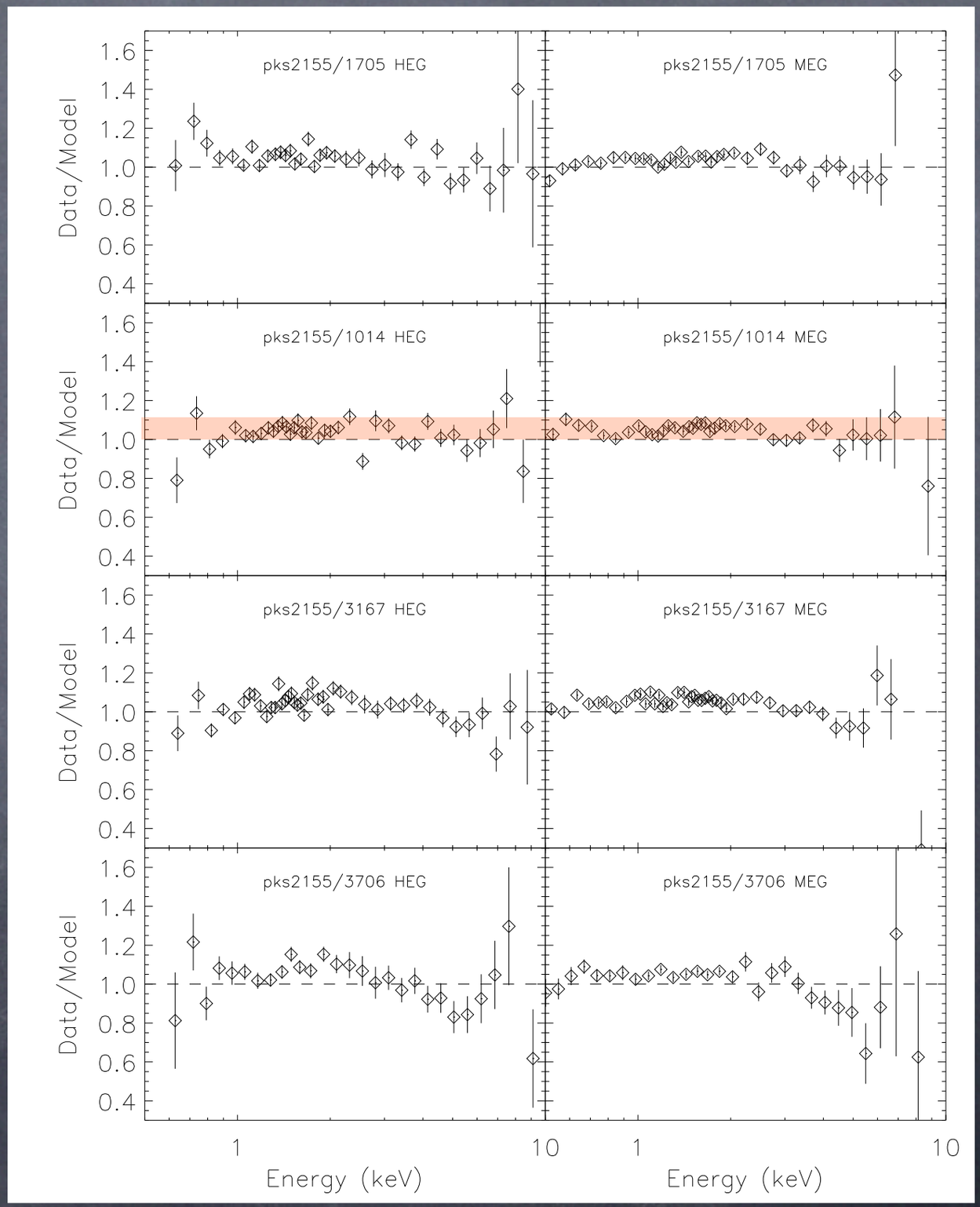




- MEG or HEG fix only gives poor residuals
- Allocate ratio fix crossover at about 1 keV

# MEG-HEG fix Allocation

- Systematic residuals less than 5%
- Overall curvature is likely to be real
  - BLLs: concave down
  - 3C 273: soft excess and broad Fe-K line



# Work in Progress

- Cross-cal with LETGS
- Fits require changing spectral slope
  - 3C 273: a soft excess, broad Fe line (?)
  - BLLs: gradual steepening
    - Coordinate modeling between projects
- Cross-calibration with XMM-Newton
  - Many Observations to be examined
  - Significant progress in XMM internal cal