XMM-Newton — Chandra Cross-Calibration with Blazars

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14th IACHEC, Shonan Village Center, 20-23 May 2019

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- Sample of Blazars observed simultaneously XMM and Chandra:
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- 25 XMM-Newton observations coordinated with Chandra:
  - 40 strictly simultaneous exposures for flux comparison
- Instruments being compared are:
  - **EPIC**, **RGS**, **ACISS-L / HETG**, **HRCS-LETG**
- Data reduction:
  - SAS 17 + CCFs as of Jan 2019
  - CIAO 4.10 + CALDB 4.8.1

Data Analysis

- Energy bands:
  - 0.15 – 0.33 keV (Lower EPIC - Lower RGS bound)
  - 0.33 – 0.54 keV (Up to the O-edge)
  - 0.54 – 0.85 keV
  - 0.80 – 1.20 keV } O-VII/VIII , Ne-IX/X
  - 1.20 – 1.50 keV
  - 1.50 – 1.82 keV (Up to the Si-edge)
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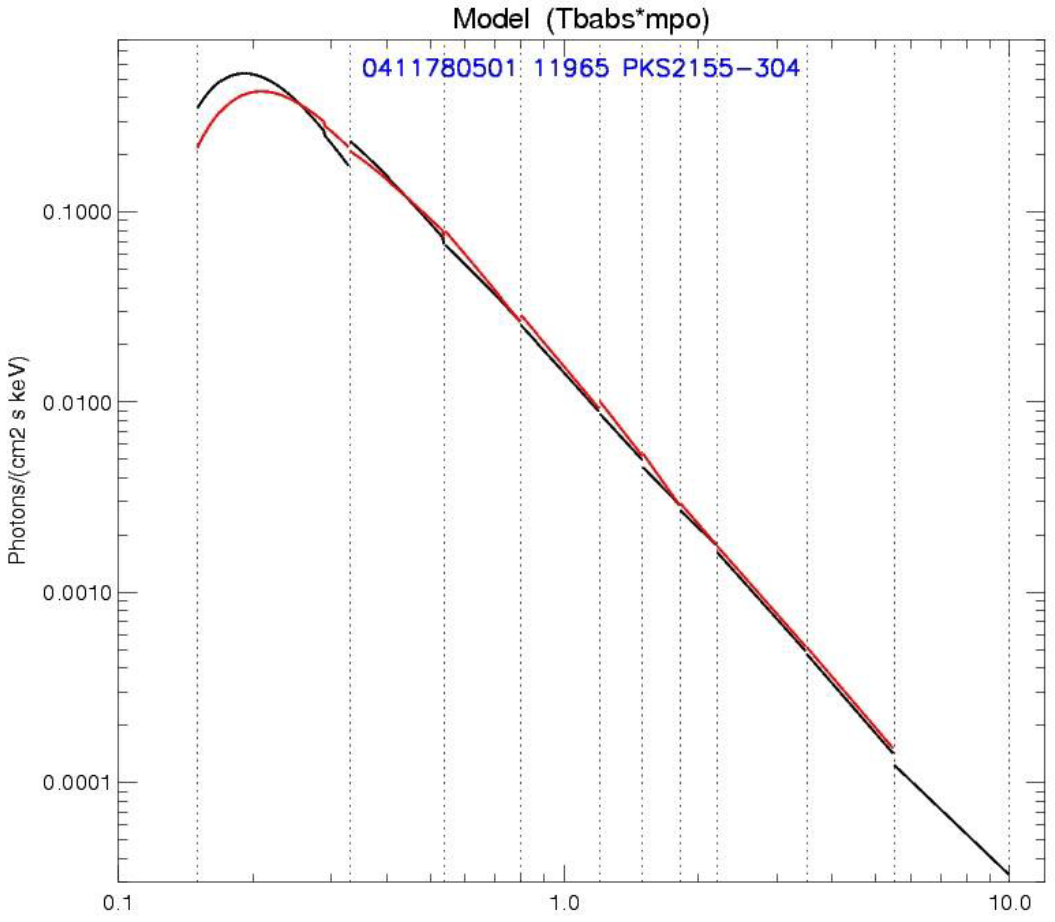
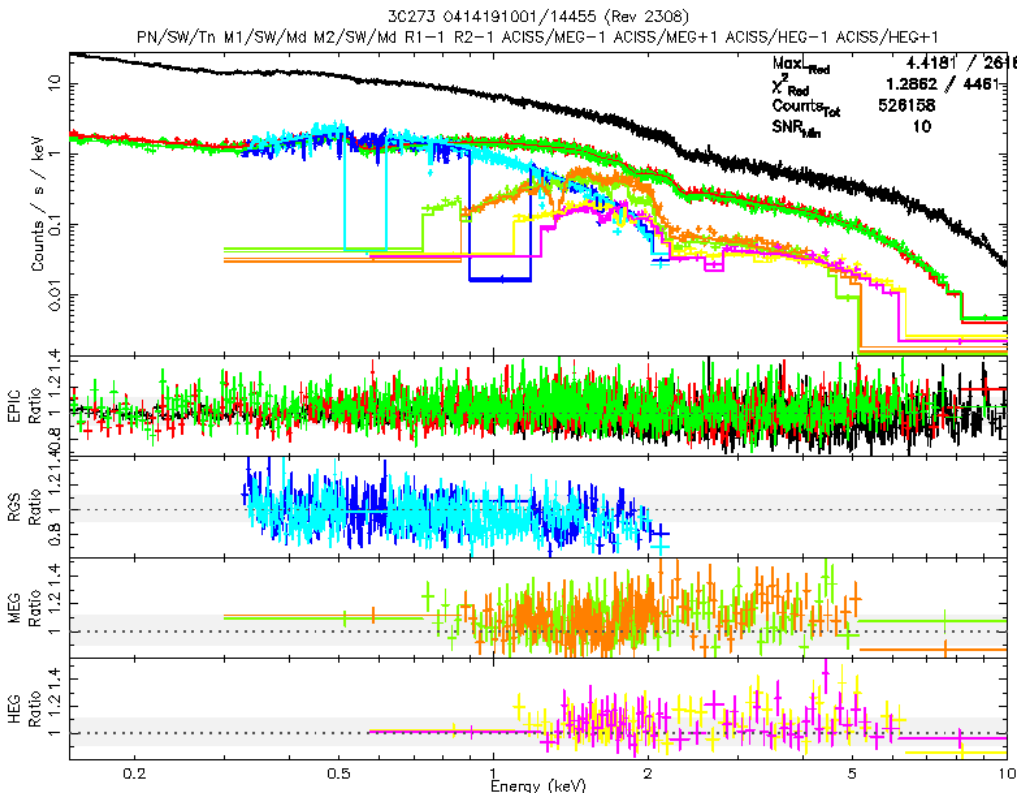
- Spectral fitting: model consists of:
  - multiple independent power laws
  - absorption with nH fixed
    - PKS 2155-304: 1.42 x 10^{20} cm^{-2}
    - 3C 273: 1.79 x 10^{20} cm^{-2}
    - H 1426+428: 1.36 x 10^{20} cm^{-2}
- Per simultaneous exposure:
  - fit each instrument independently
  - determine band fluxes from resulting best fits
  - normalise to the PN flux

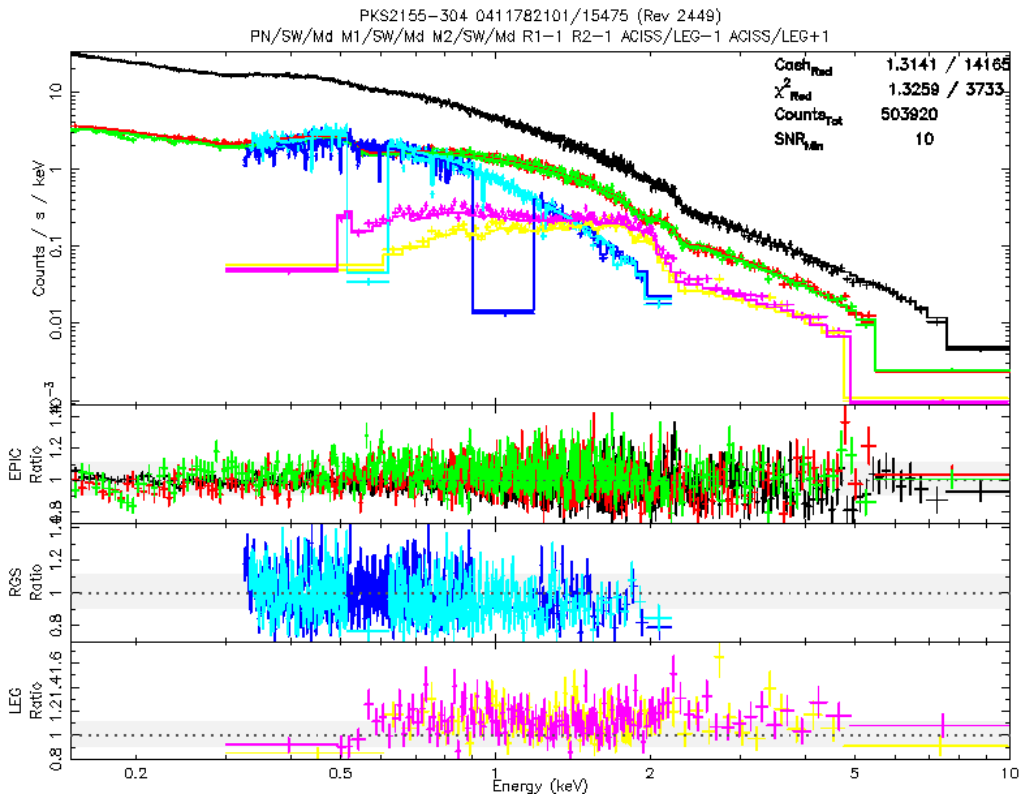


Data Analysis

3C 273



PKS 2155-304



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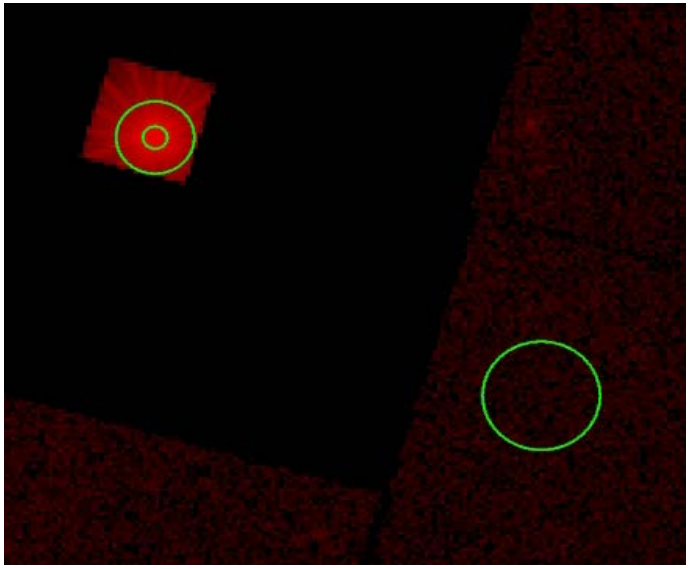
Systematic uncertainties:

- Pile-up:
  - EPIC requires excision of PSF core: use source extraction annuli.
  - Per observation: for both MOSs use the largest common outer radius within window, and a common inner radius.
  - However, radii vary from observation to observation, and are generally different from the PN radii.
  - Differing annuli may introduce systematic uncertainties due to imperfect EE correction and RMF weighting.



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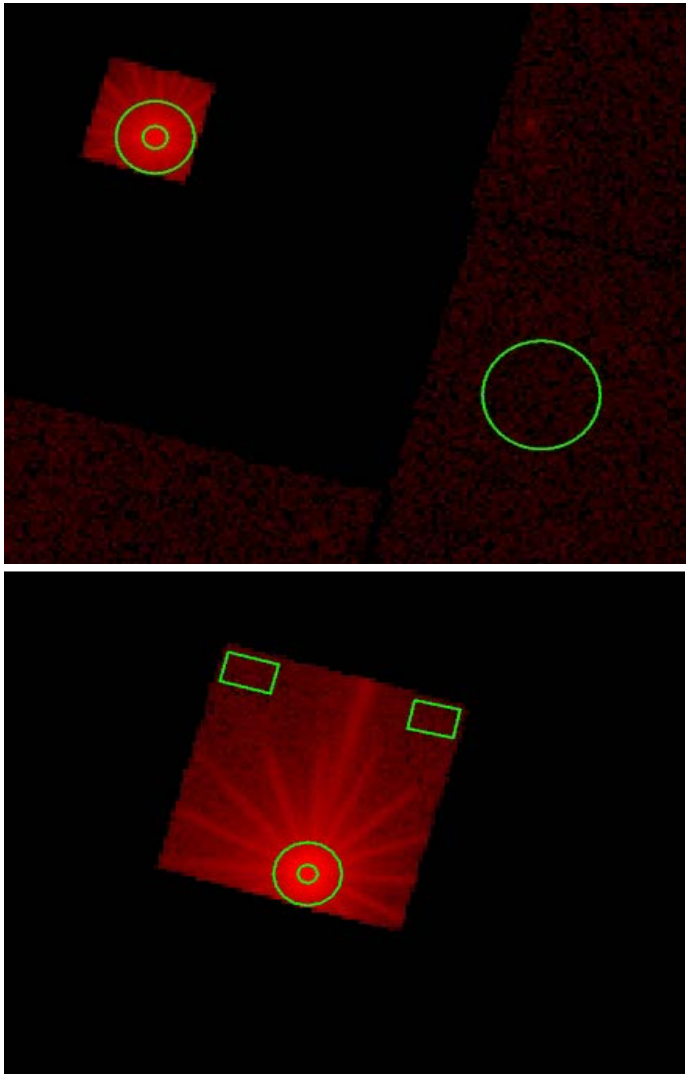
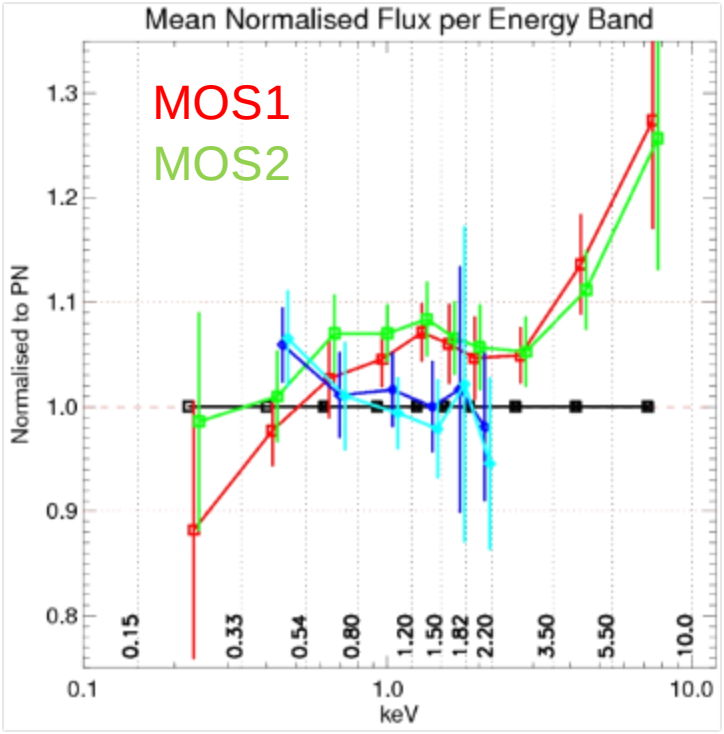
- PN background:
  - Extracted from regions within the small window: some degree of source contamination.



Impact of PSF Calibration

Previous PSF calibration



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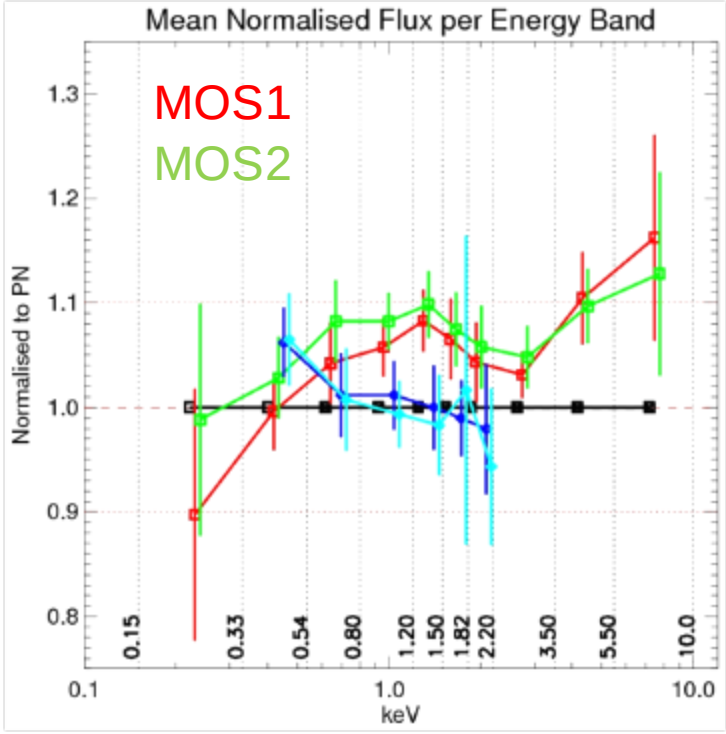

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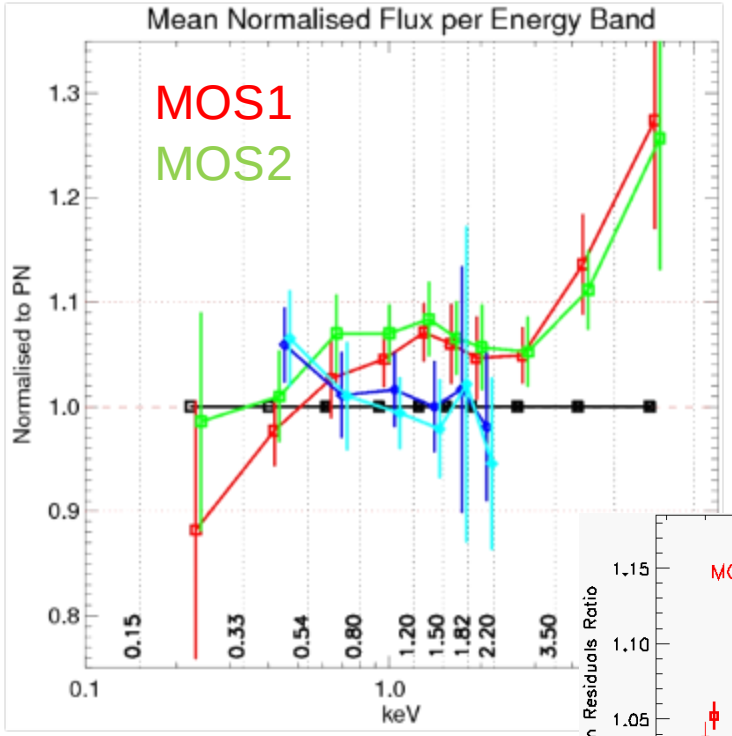

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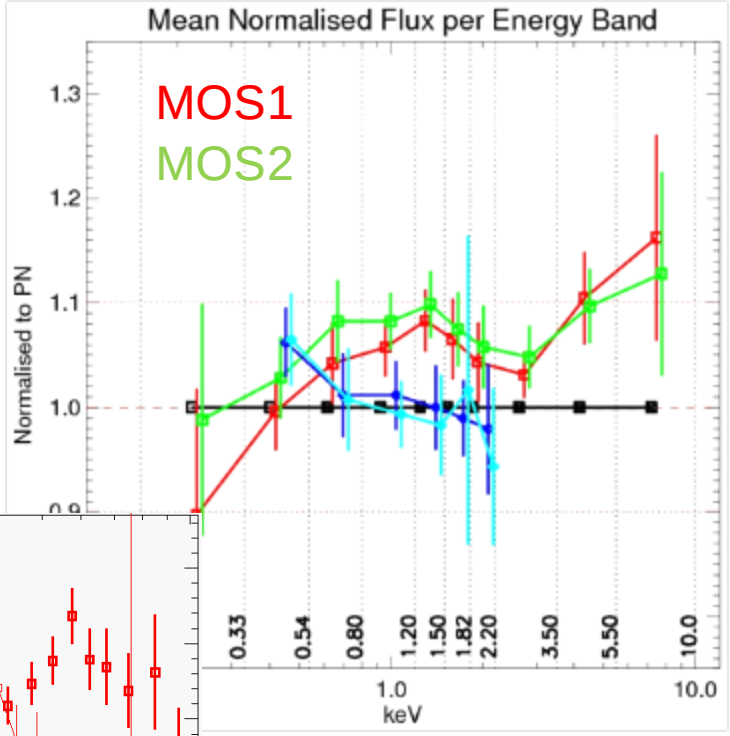
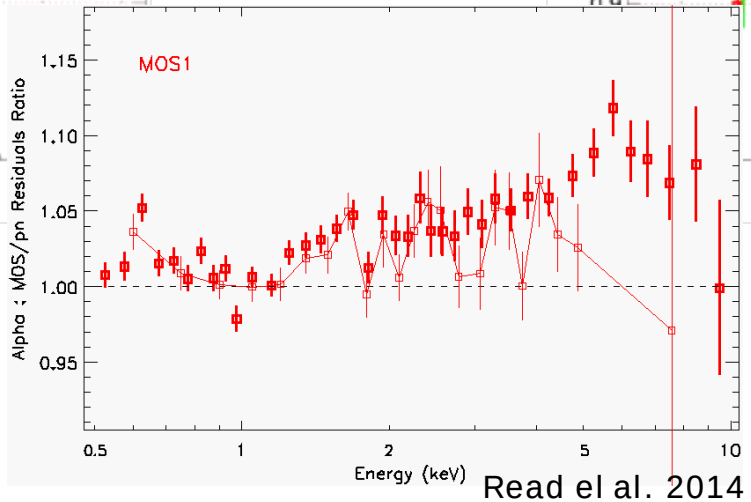
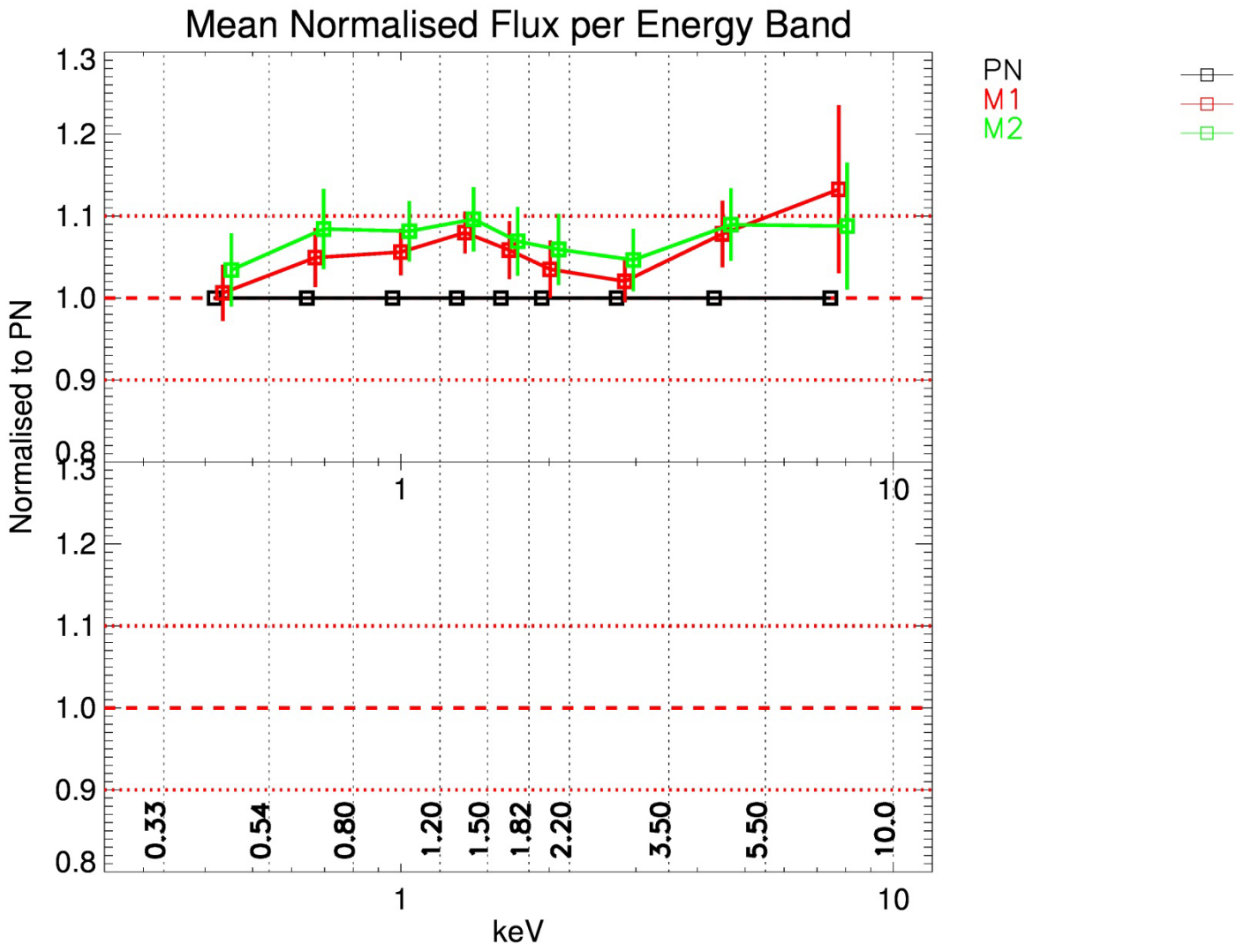




Sample of non-piled-up on-axis sources

Read el al. 2014

Mean Normalised Instrumental Fluxes



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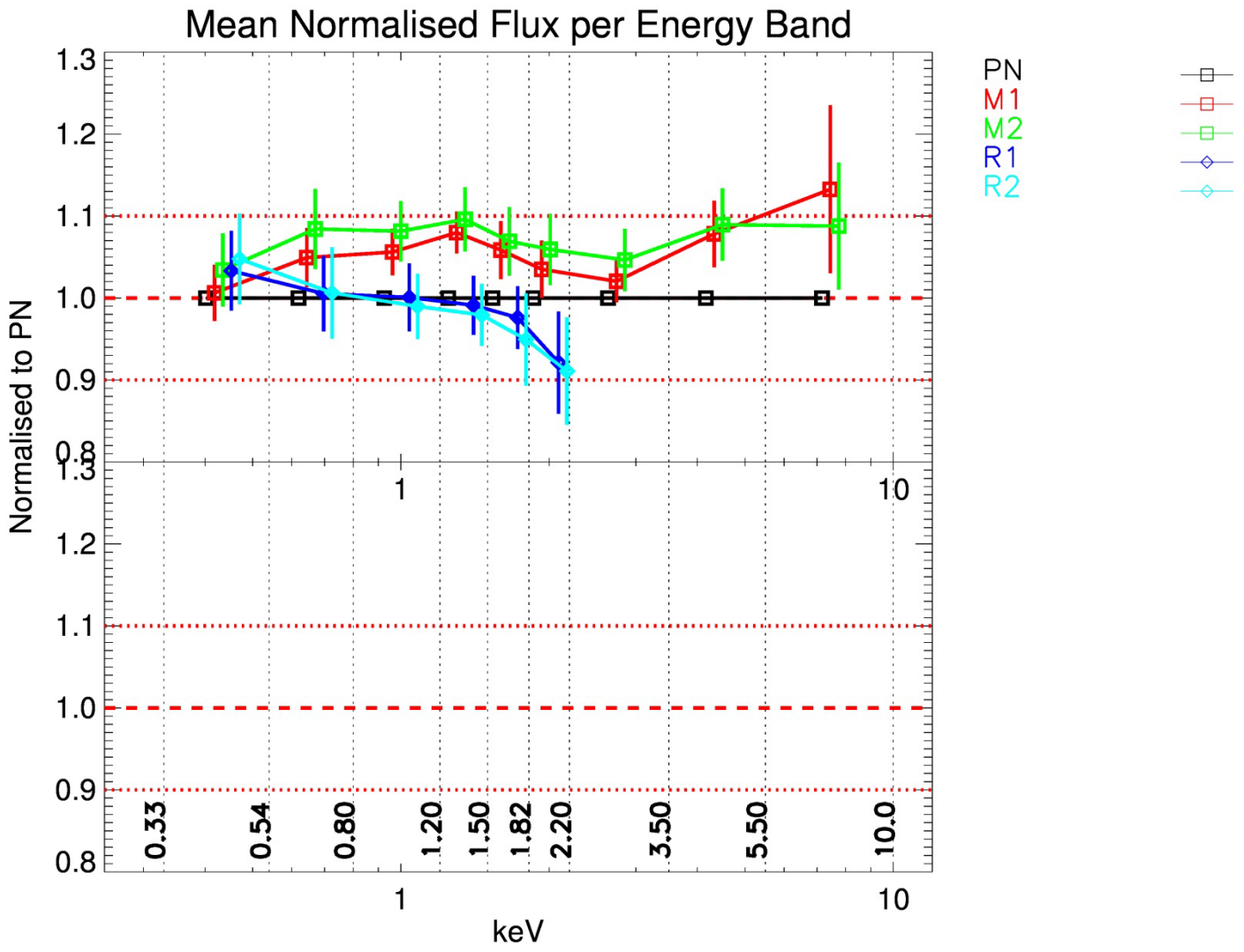

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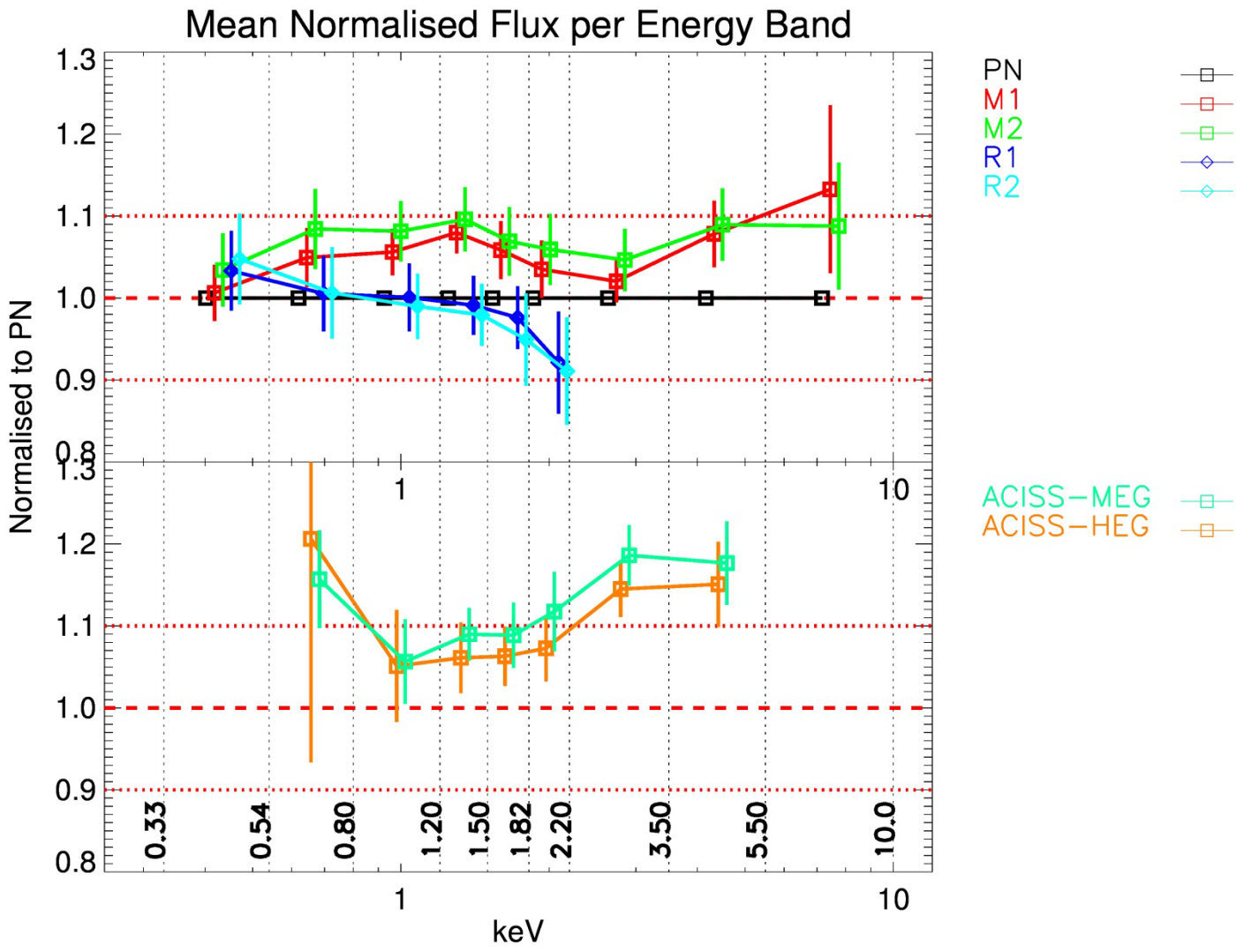

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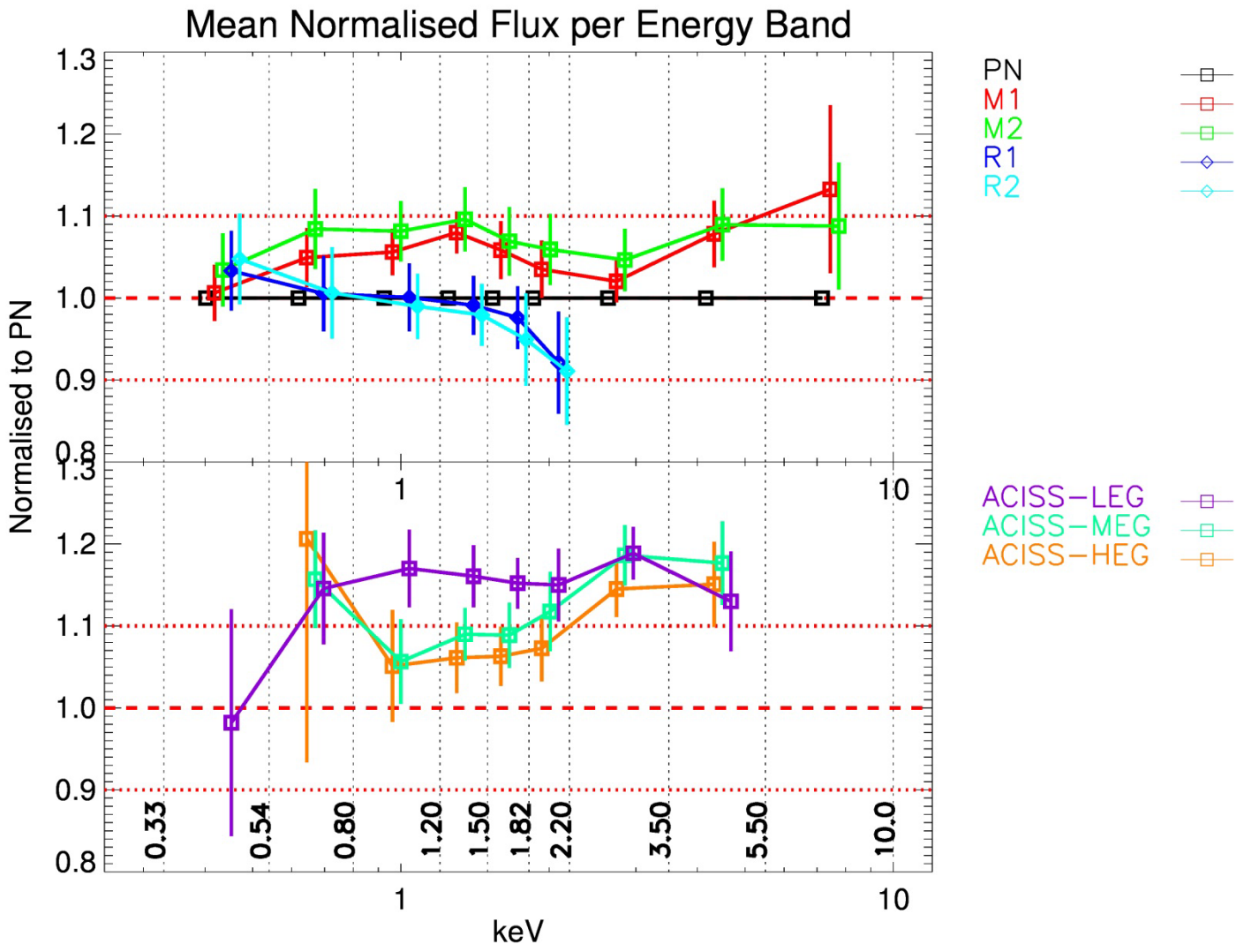

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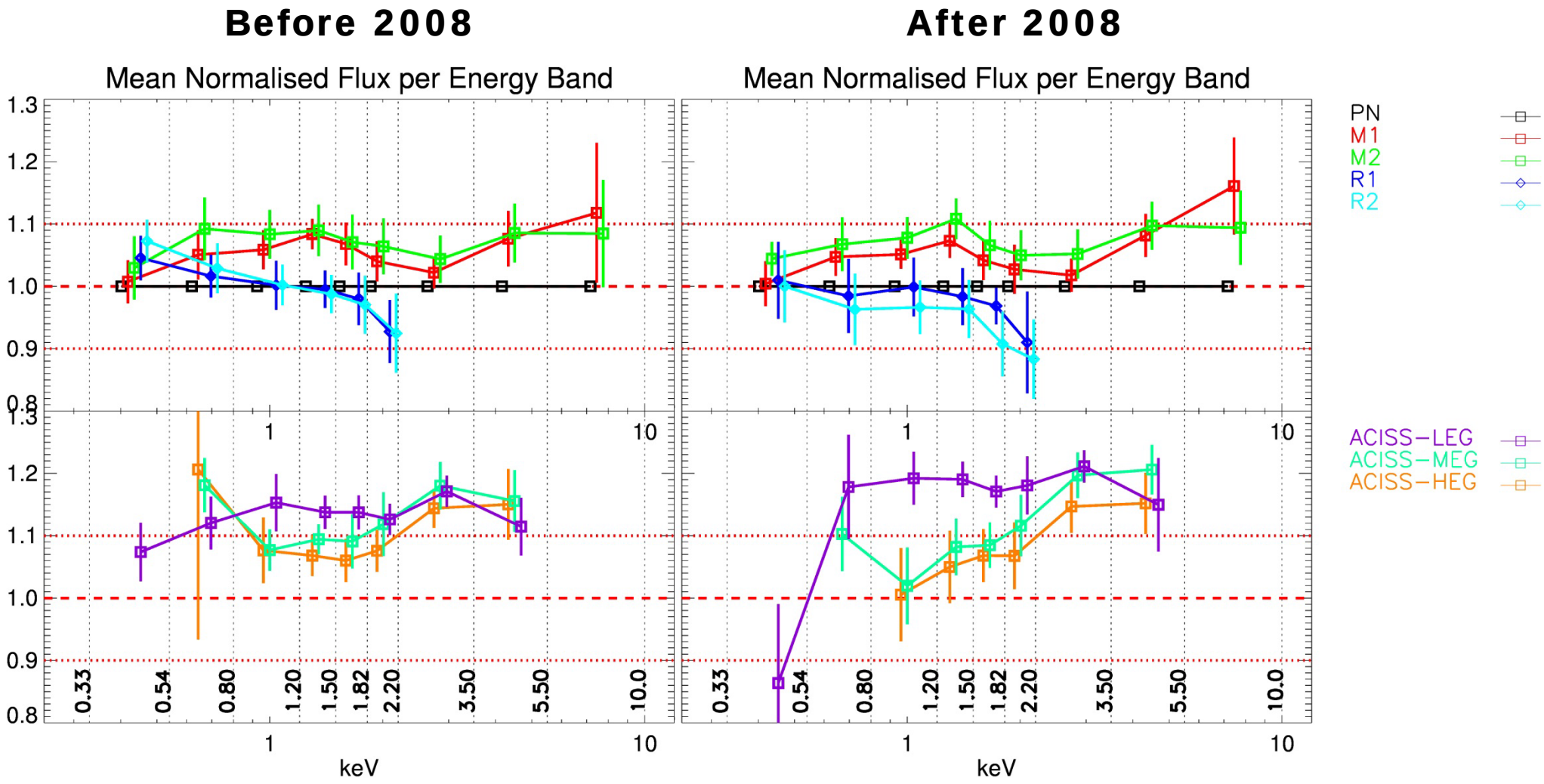

Fit Statistic