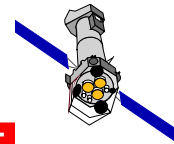


XMM-Newton — Chandra

Blazar

Flux Comparison

IACHEC, April 2009



XMM-Newton

Michael Smith, ESA

Blazar Pros & Cons

Objective: Comparison of XMM-Newton — Chandra fluxes in various bands.

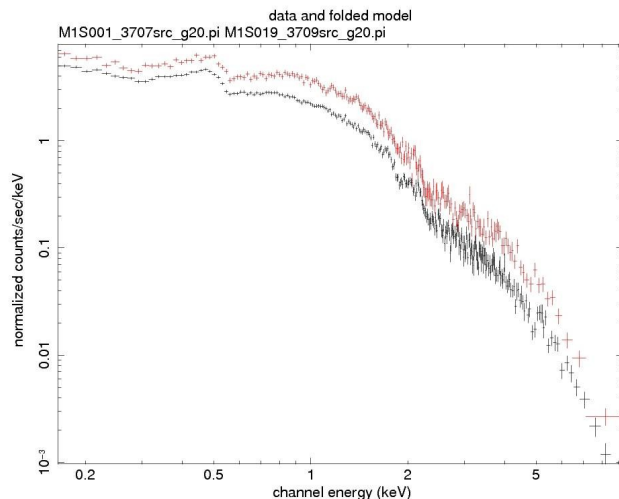
For this we're using a sample of Blazars: PKS2155-304, 3C273, H1426+428 and Mkn421

Pros:

- Bright
- Cover the 0.1 – 10.0 keV band
- Relatively simple spectra overall; (absorbed) power laws in narrow bands.

Cons:

- Bright
 - > Piled in EPIC -> PSF core excision introduces added uncertainty in flux determination
- Variable
 - > require coordinated observations
 - > need to use normalised fluxes to compare between observations
- Variable even within observation timescale
 - > simultaneous GTIs across instruments



14 coordinated observations,
resulting in **29 strictly simultaneous**
GTIs
for flux comparison

Analysis Details (I)

Data reduction:

Use latest publicly available s/w and calibration files:

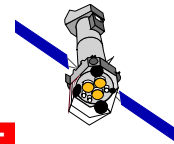
- SAS 8.0
- CIAO 4.1 + CALDB 4.1.1

Spectral fitting:

- Per band, fit an absorbed power-law and determine flux
- Fit instruments independently
- Chandra + / - grating orders jointly fit
- Use orders 1 – 10 for HRC LETG response

Energy bands are those used in the Cross Cal Archive:

- 0.15 – 0.33 keV (Lower EPIC bound – Lower RGS bound)
- 0.33 – 0.54 keV (- O-edge)
- 0.54 – 0.85 keV (O-VII, O-VIII)
- 0.85 – 1.50 keV (Ne-IX, Ne-X)
- 1.50 – 4.00 keV
- 4.00 – 10.0 keV



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Analysis Details (II)

Normalise fluxes within simultaneous exposures (GTIs) to compare instruments across observations:

But, normalise to what?

PN MOS RGS ACIS HRC

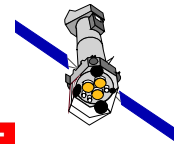
Preferably the same benchmark across all GTIs and bands.

- PN & MOS: when in TI mode no useful data in the lowest energy band
- RGS: no data in the lower or higher bands
- Chandra configurations vary from exposure to exposure

As compromise:

Use as benchmark the **Joint Fit Flux** of all instruments in use in a particular exposure.

Advantage of being “Psychologically Neutral”.



XMM-Newton

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CTIid Rev
 1703 0087
 1704 0087
 2462 0277
 2463 0277
 2464A 0277
 2464B 0277
 3166 0362
 3167 0362
 3168A 0362
 3168B 0362
 3706 0545
 3707 0545
 3709 0545
 3716 0545
 4406 0545
 4430 0655
 4431 0655
 5318 0807
 5169A 0835
 5169B 0835
 5170A 0835
 5170B 0835
 5172 0908
 5173 0908
 6088 1015
 6089 1015
 8379 1349
 8375 1387
 9704 1543

PN □ (TIMING ×)
 M1 □ (TIMING ×)
 M2 □ (TIMING ×)
 R1 ◇
 R2 ◇

ACISS-HEG □
 ACISS-MEG □
 ACISS-LEG □
 HRCS-LEG □
 HRCI-LEG □

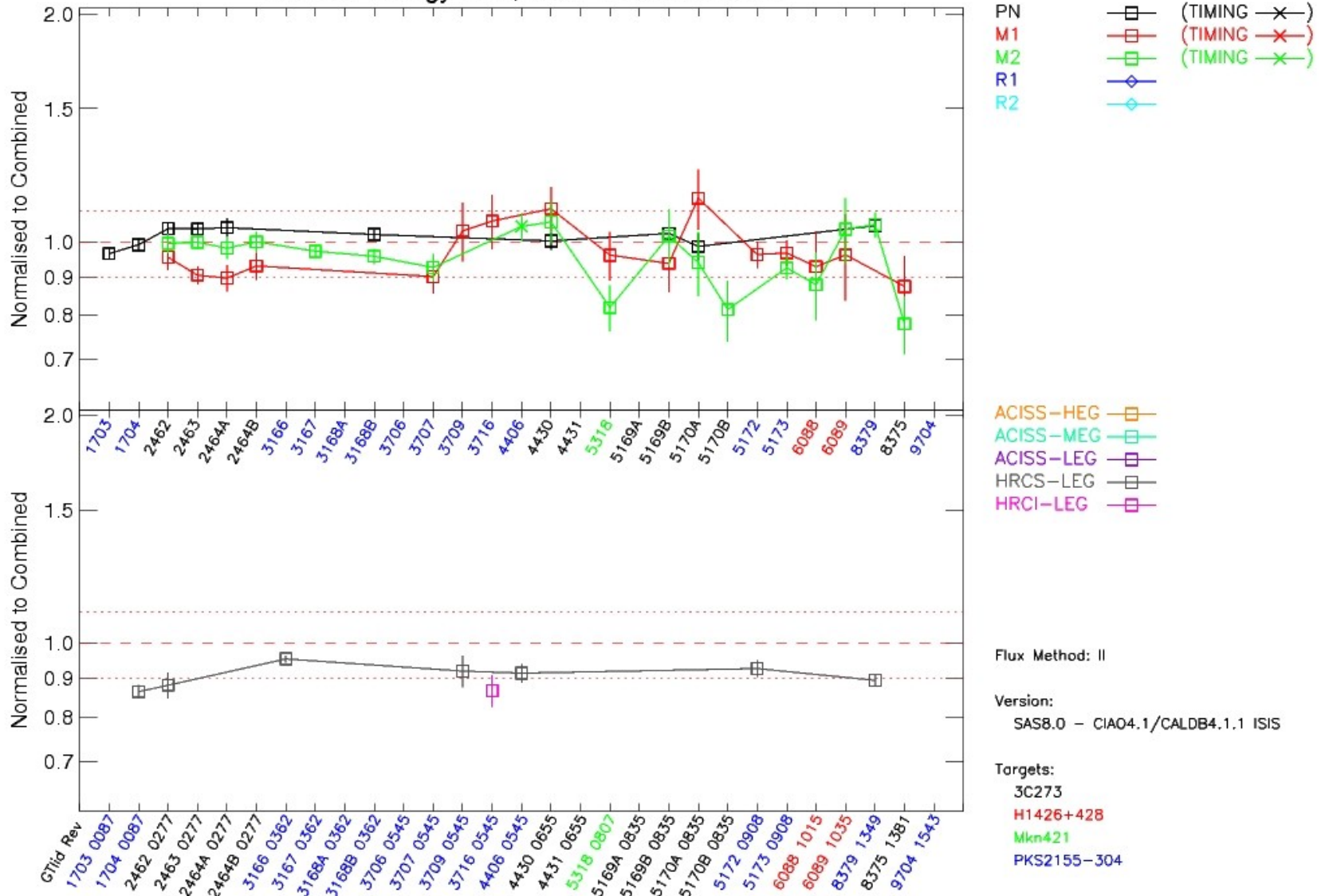
Flux Method: II

Version:
 SAS8.0 - CIAO4.1/CALDB4.1.1 ISIS

Targets:
 3C273
 H1426+428
 Mkn421
 PKS2155-304

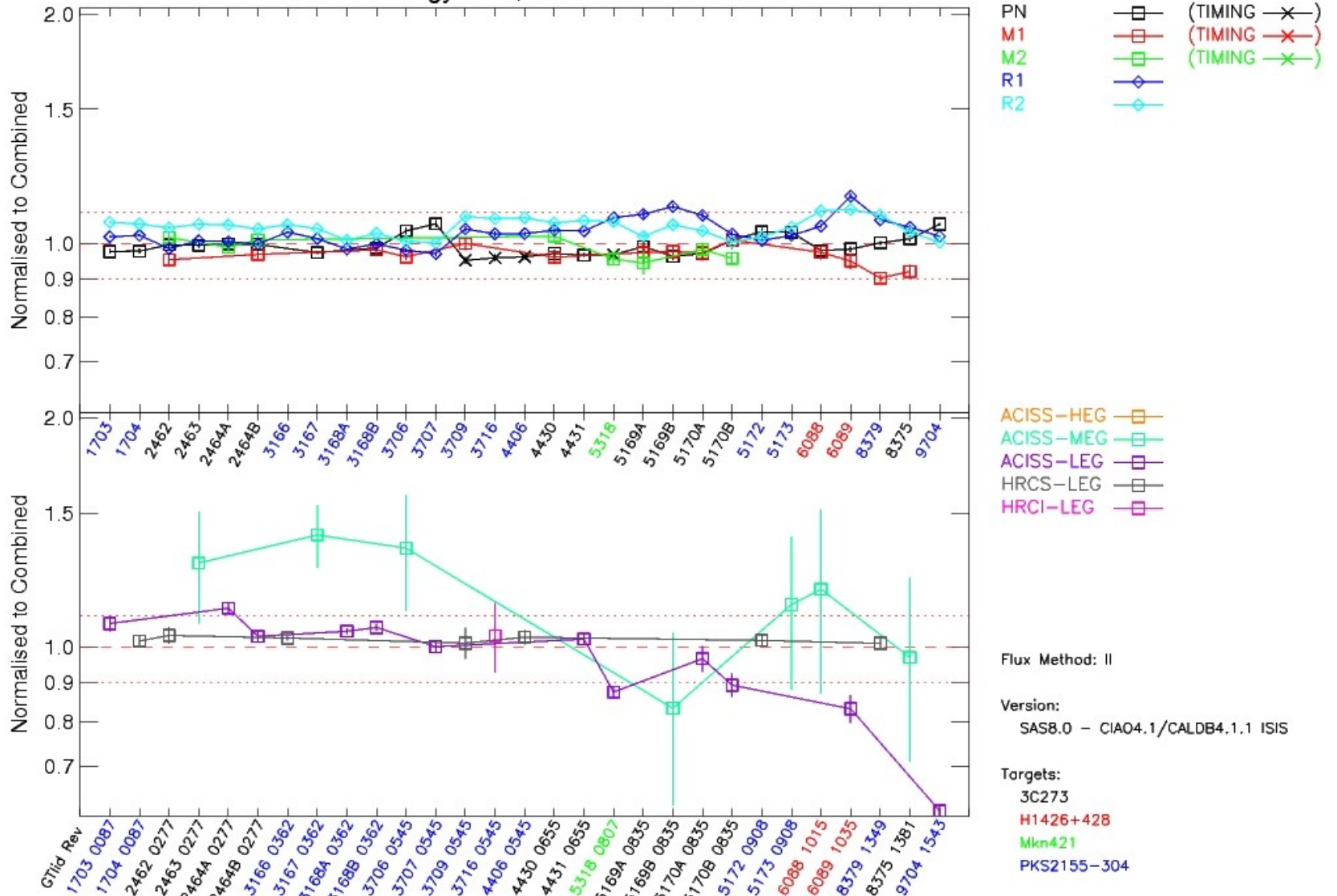
0.15 - 0.33 keV

Relative Energy Flux, 0.15 - 0.33 keV Band



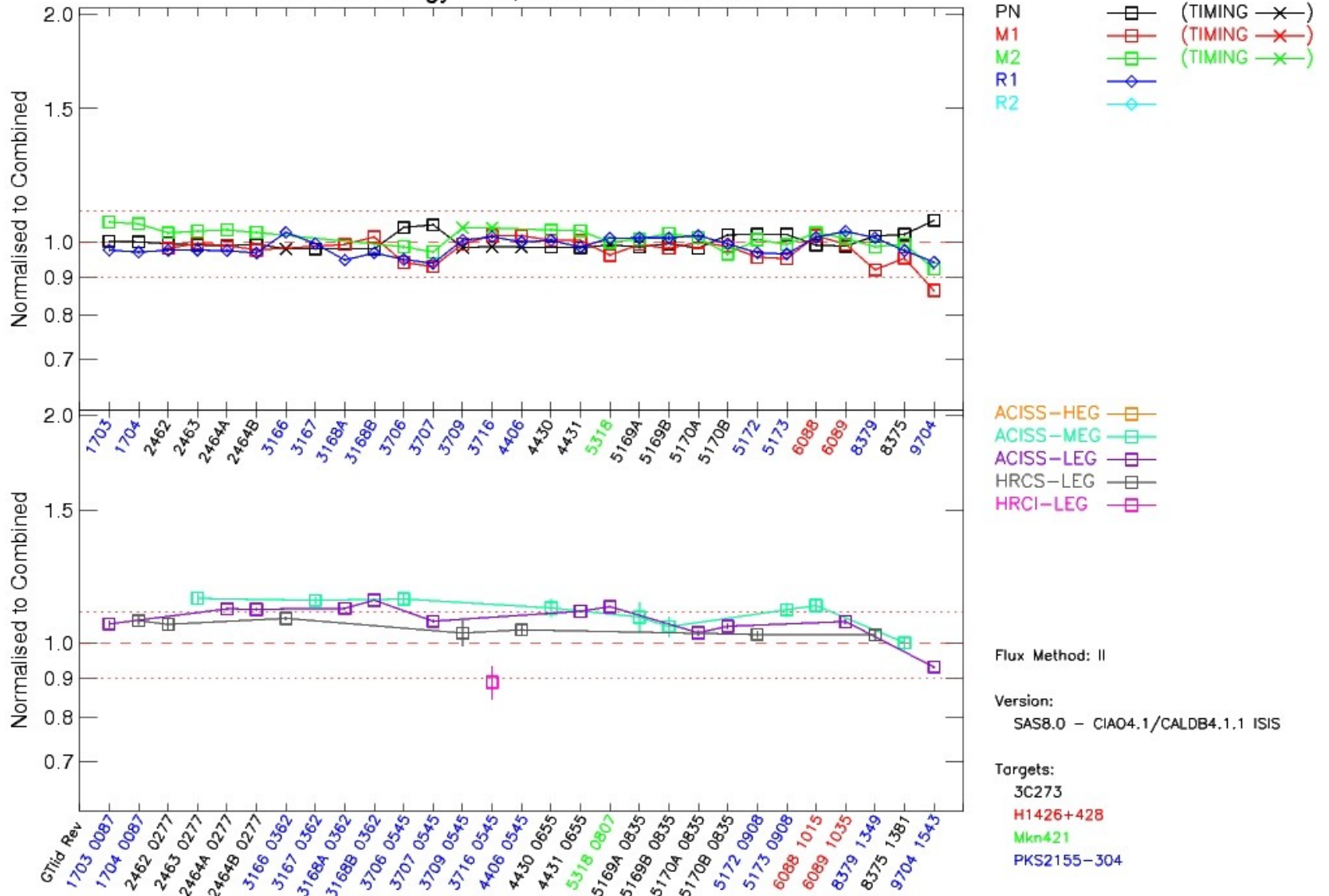
0.33 - 0.54 keV

Relative Energy Flux, 0.33 - 0.54 keV Band



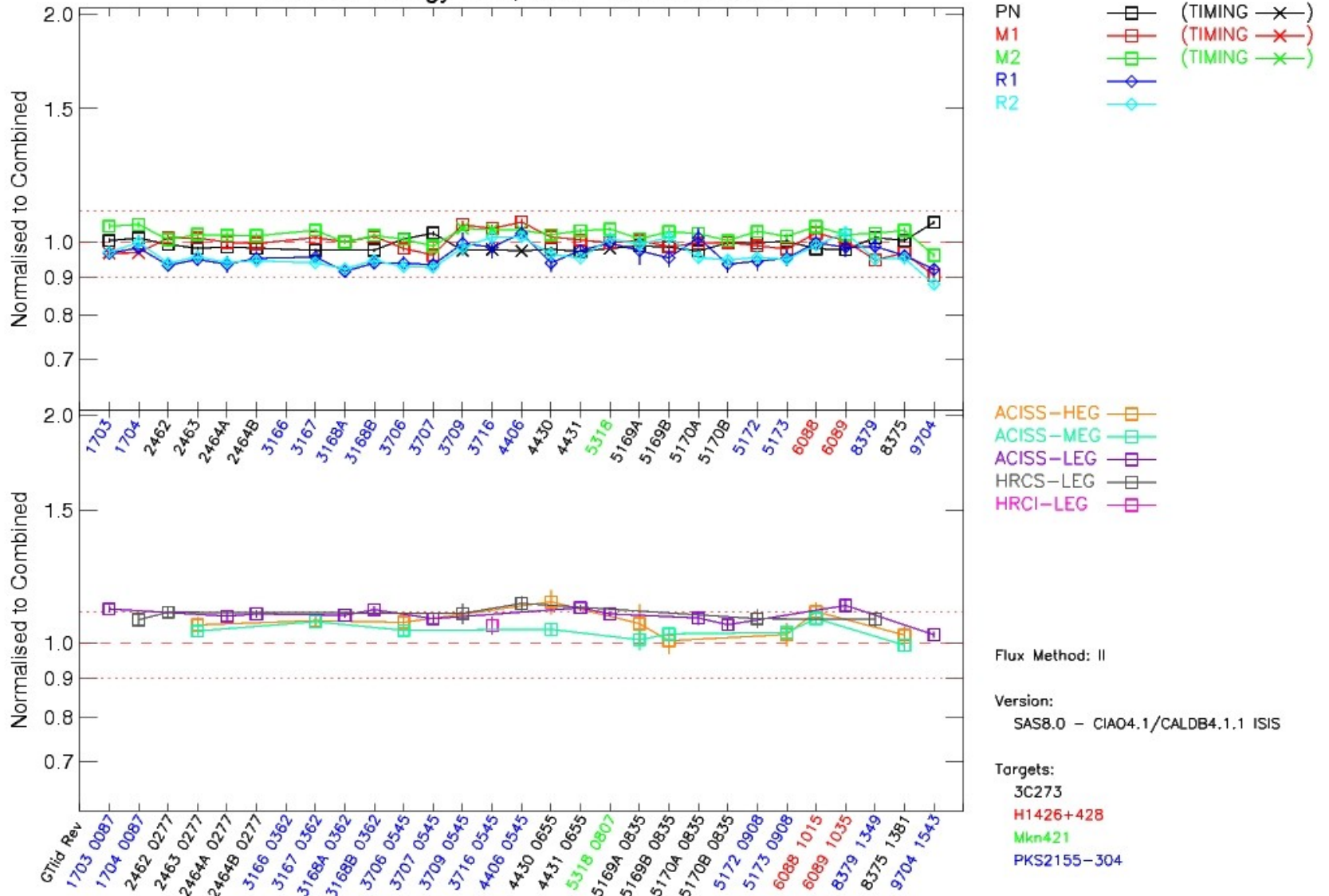
0.54 - 0.85 keV

Relative Energy Flux, 0.54 - 0.85 keV Band



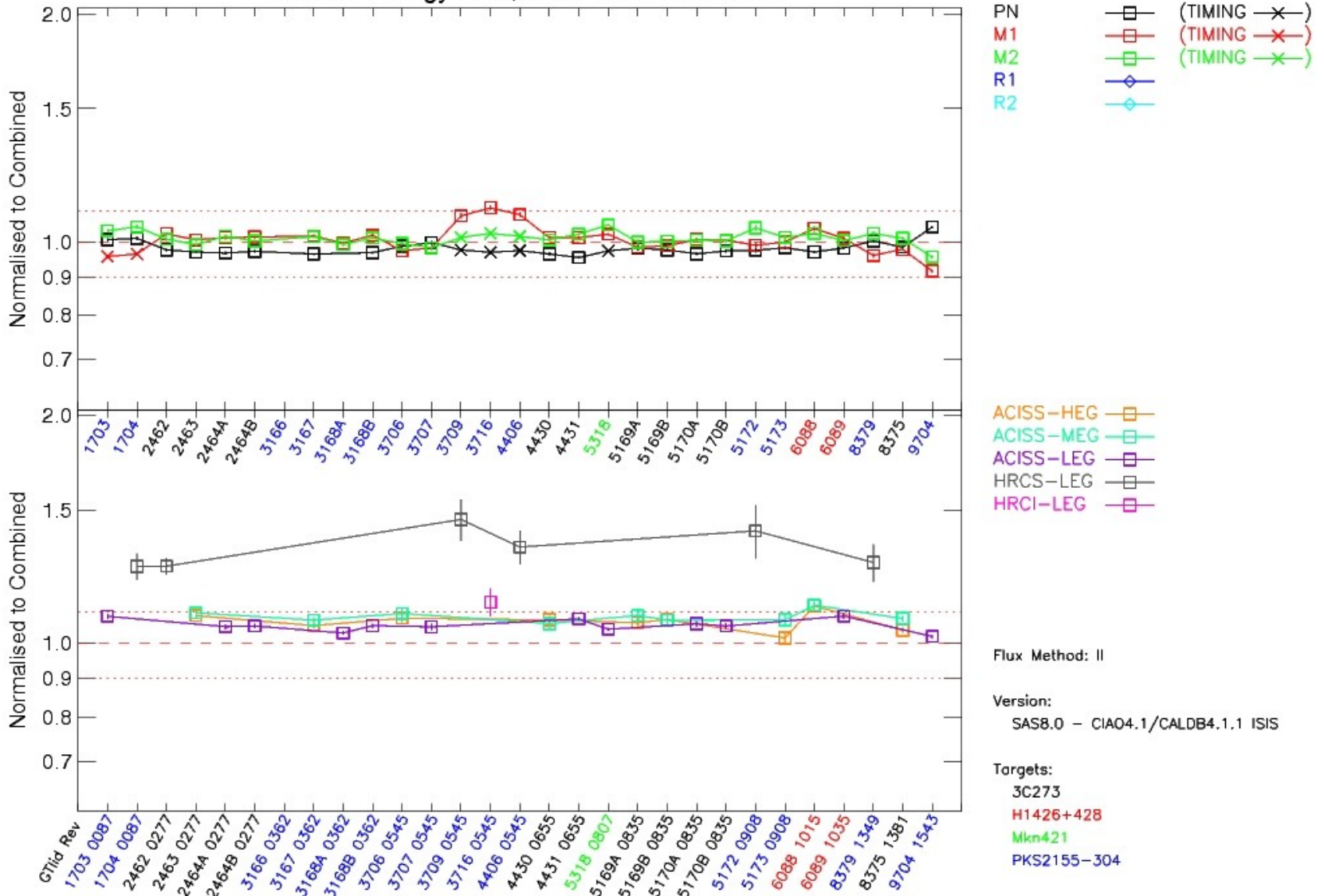
0.85 - 1.50 keV

Relative Energy Flux, 0.85 - 1.50 keV Band



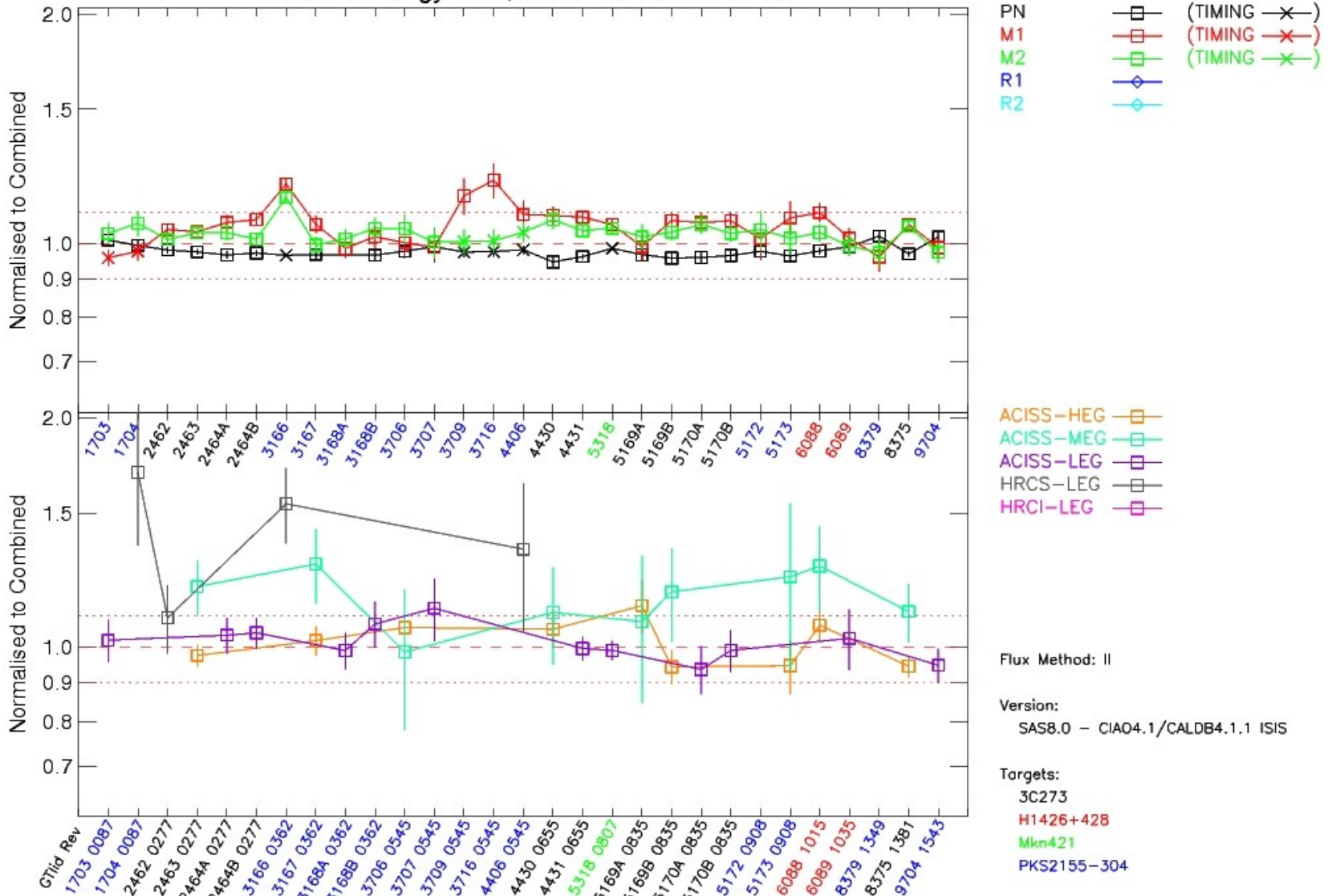
1.50 - 4.00 keV

Relative Energy Flux, 1.50 - 4.00 keV Band

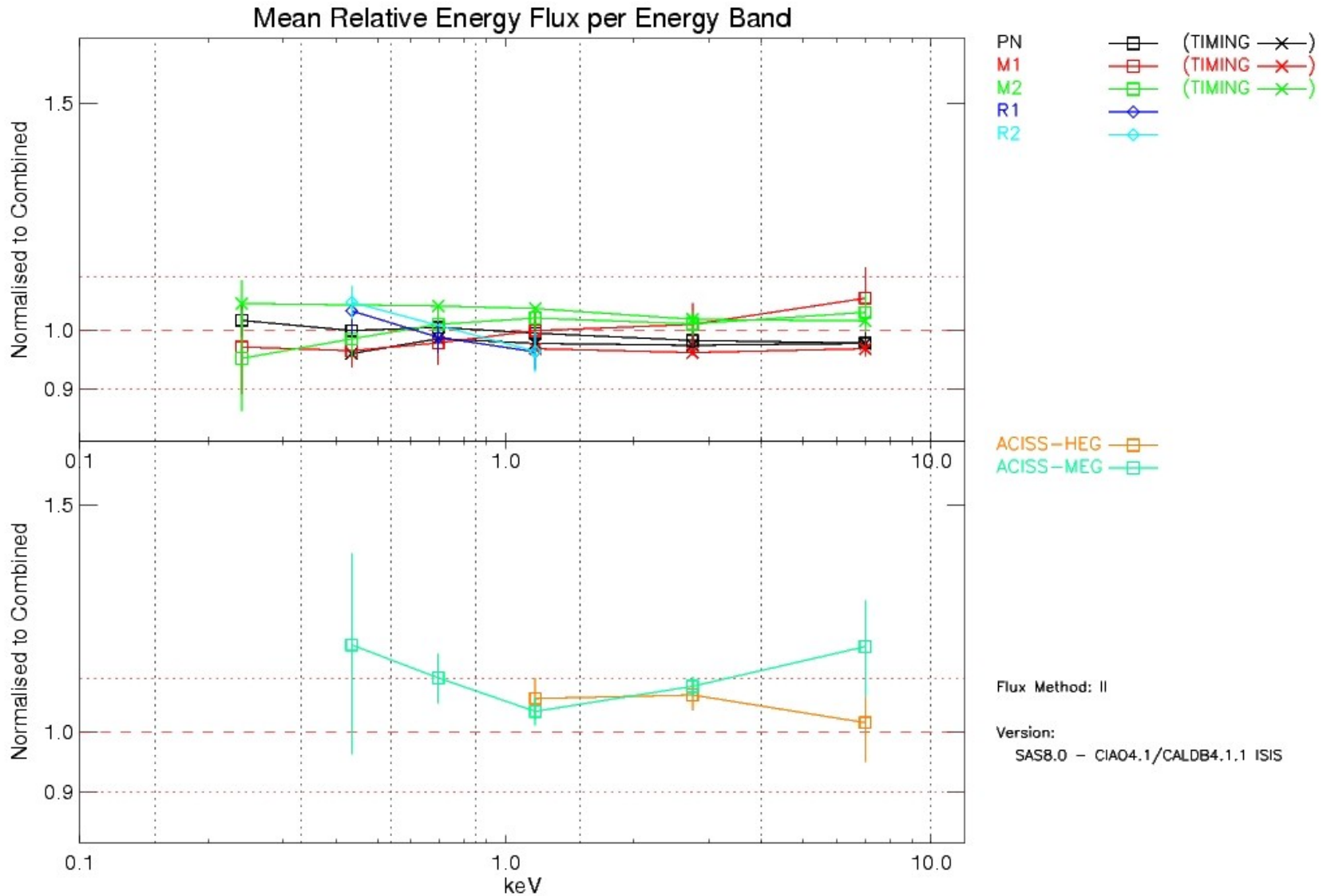


4.00 - 10.0 keV

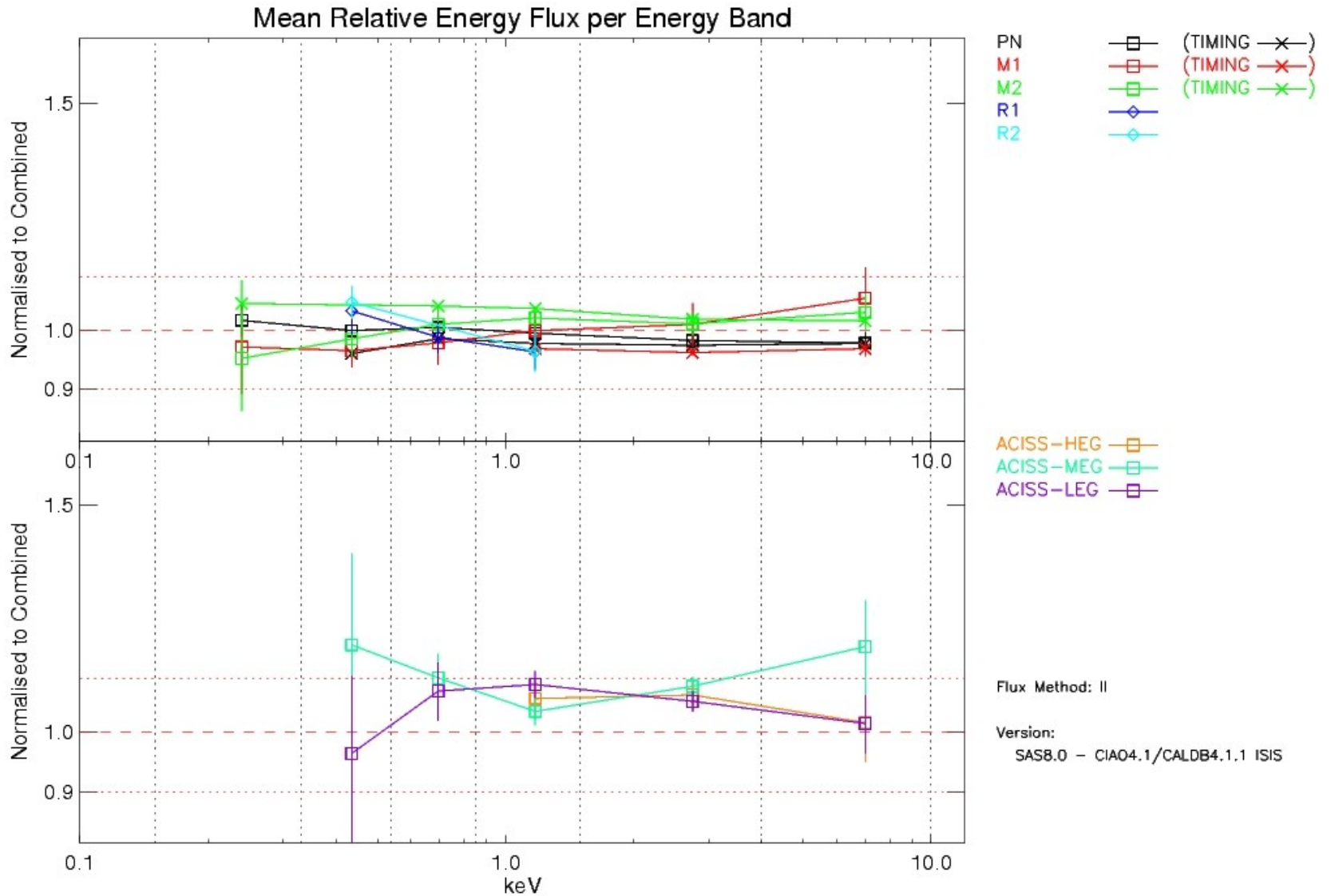
Relative Energy Flux, 4.00 - 10.00 keV Band



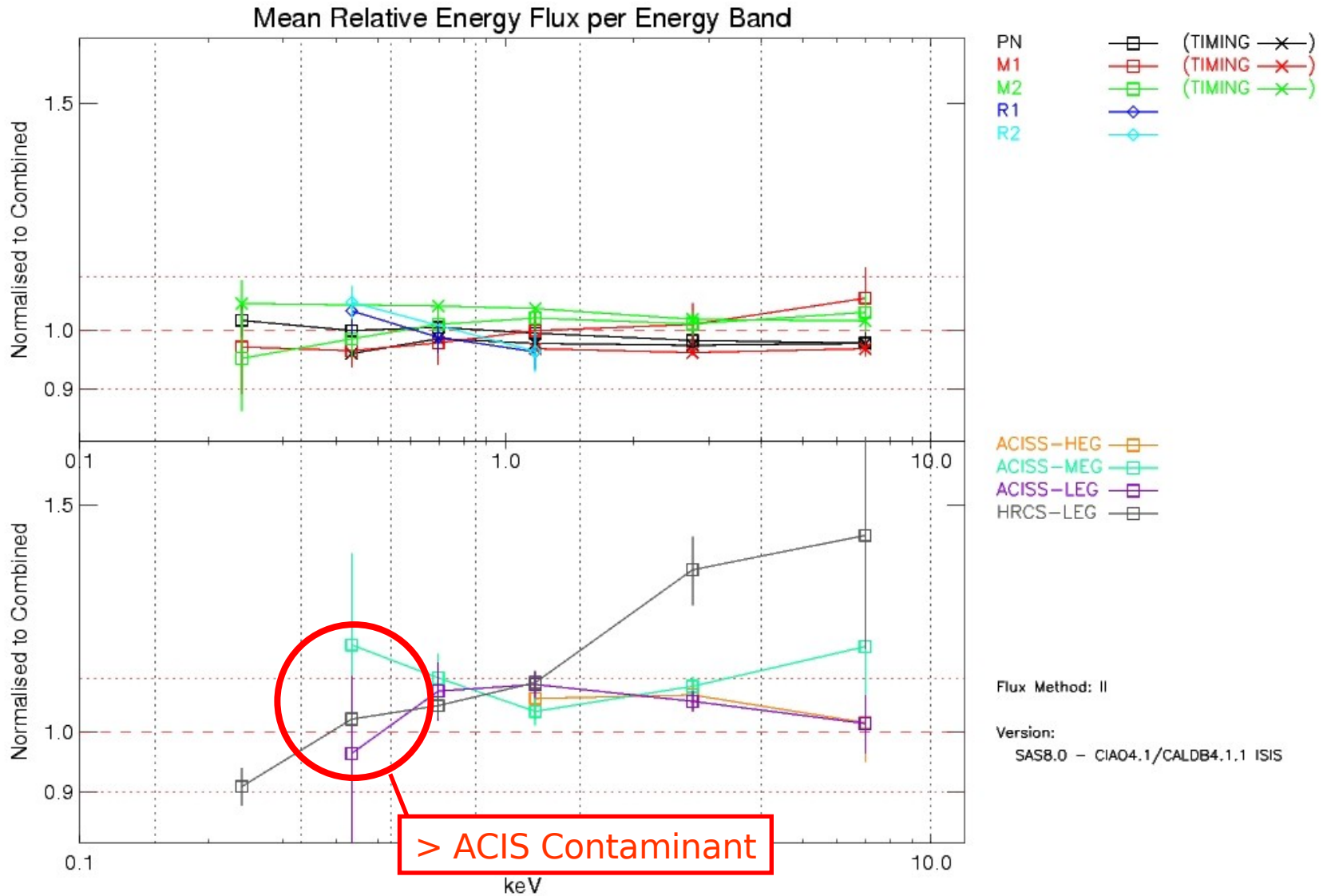
Mean Relative Flux per Band



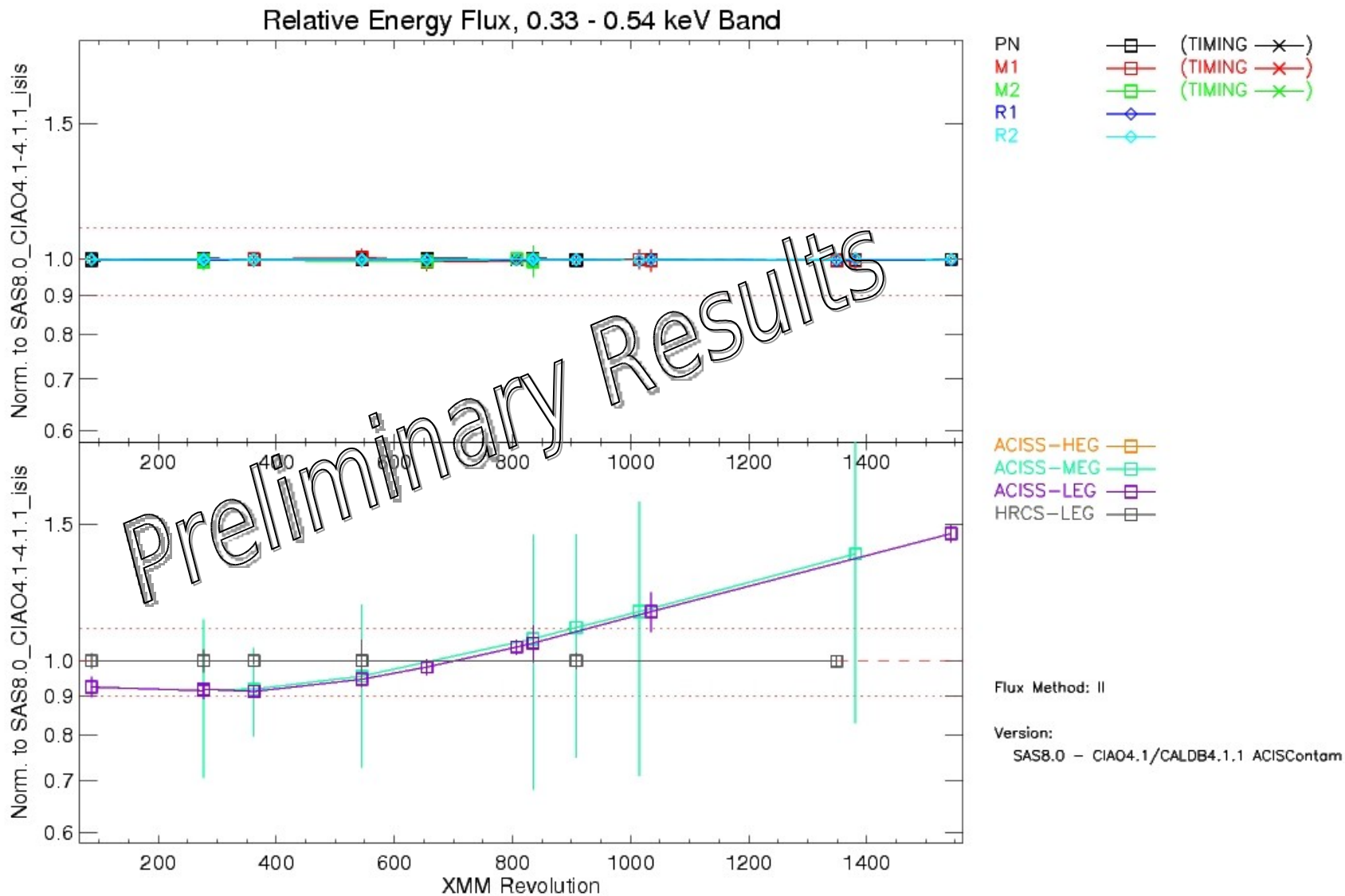
Mean Relative Flux per Band



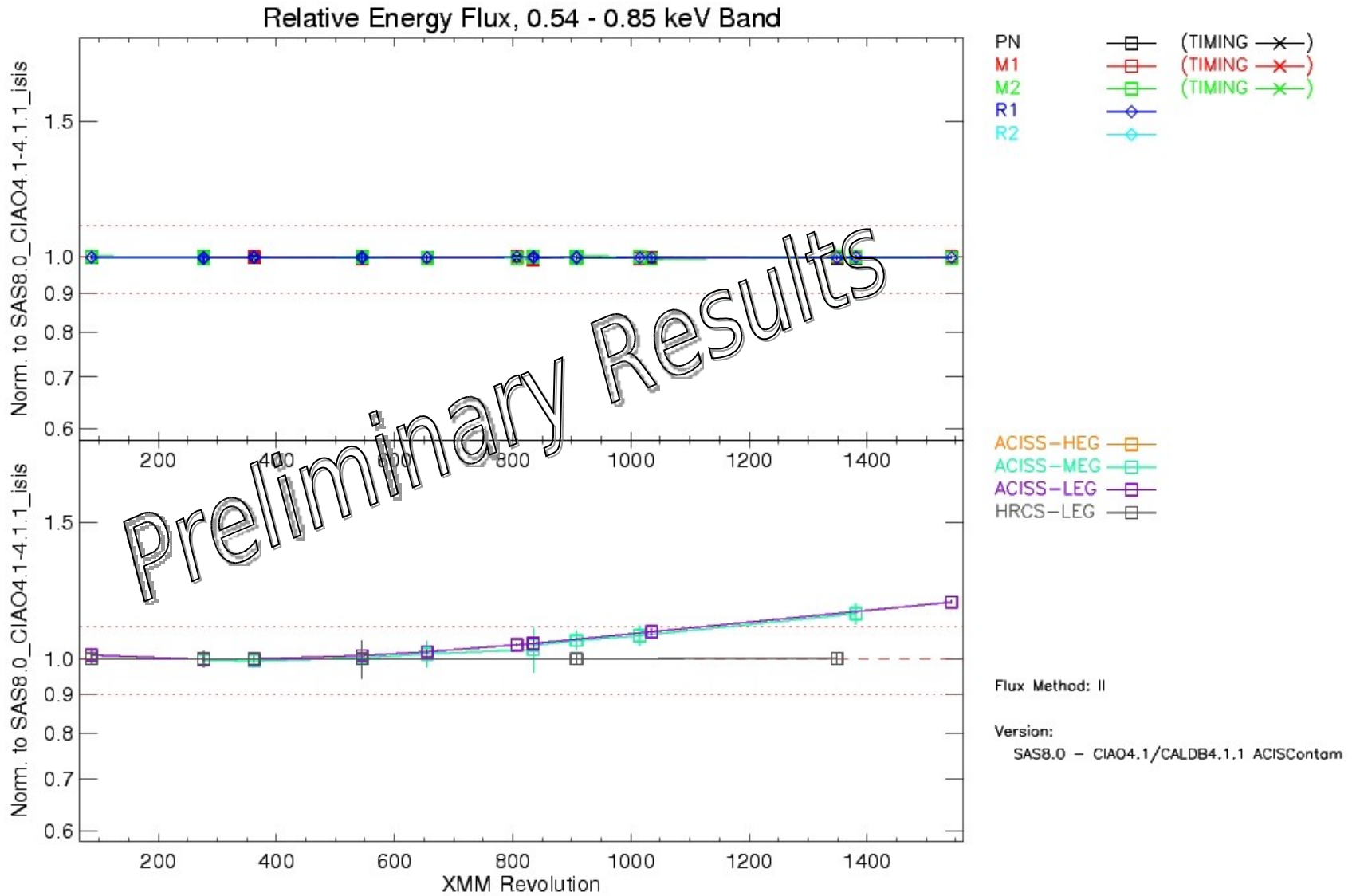
Mean Relative Flux per Band



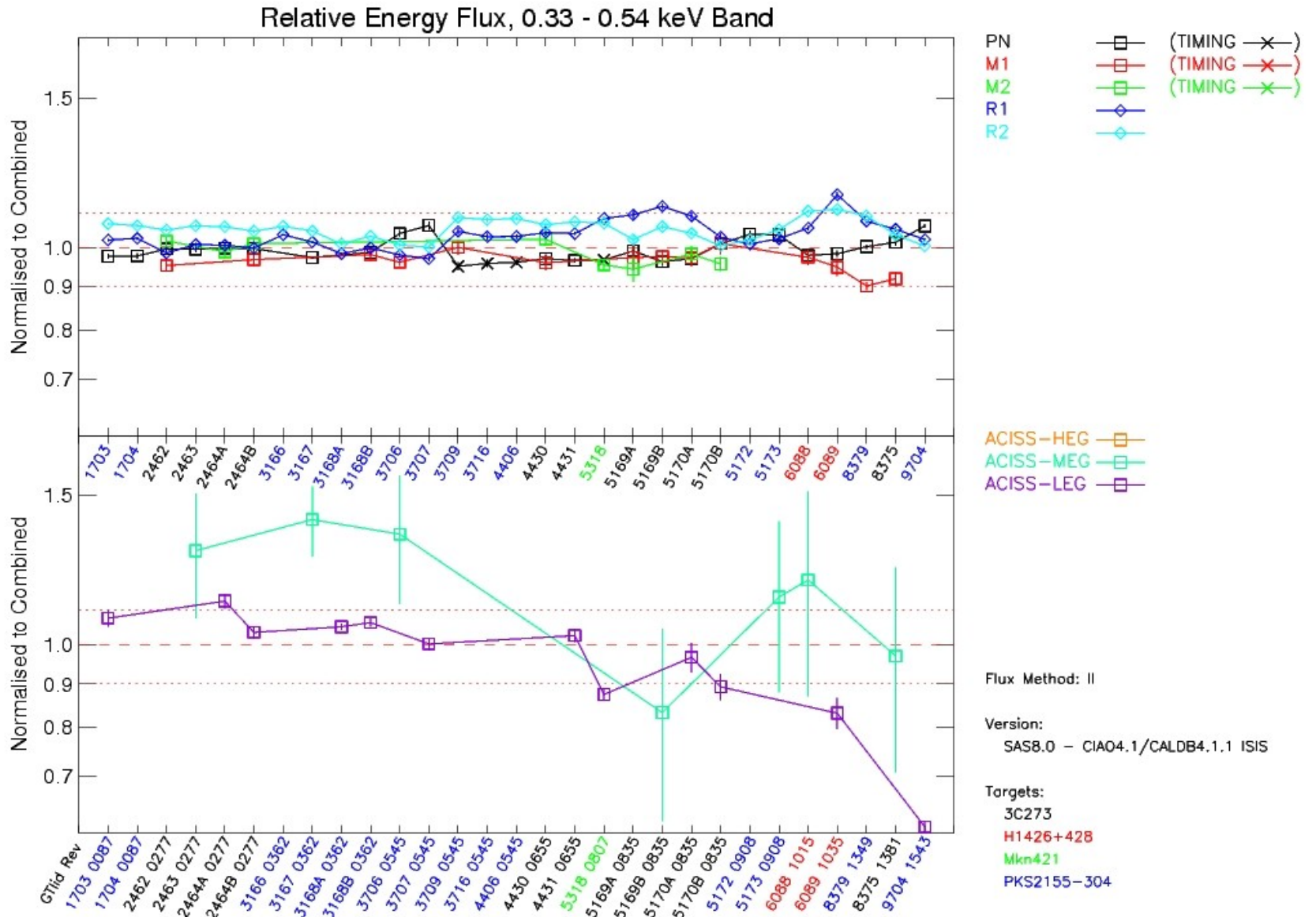
New ACIS Contaminant Model (H. Marshall et al.)



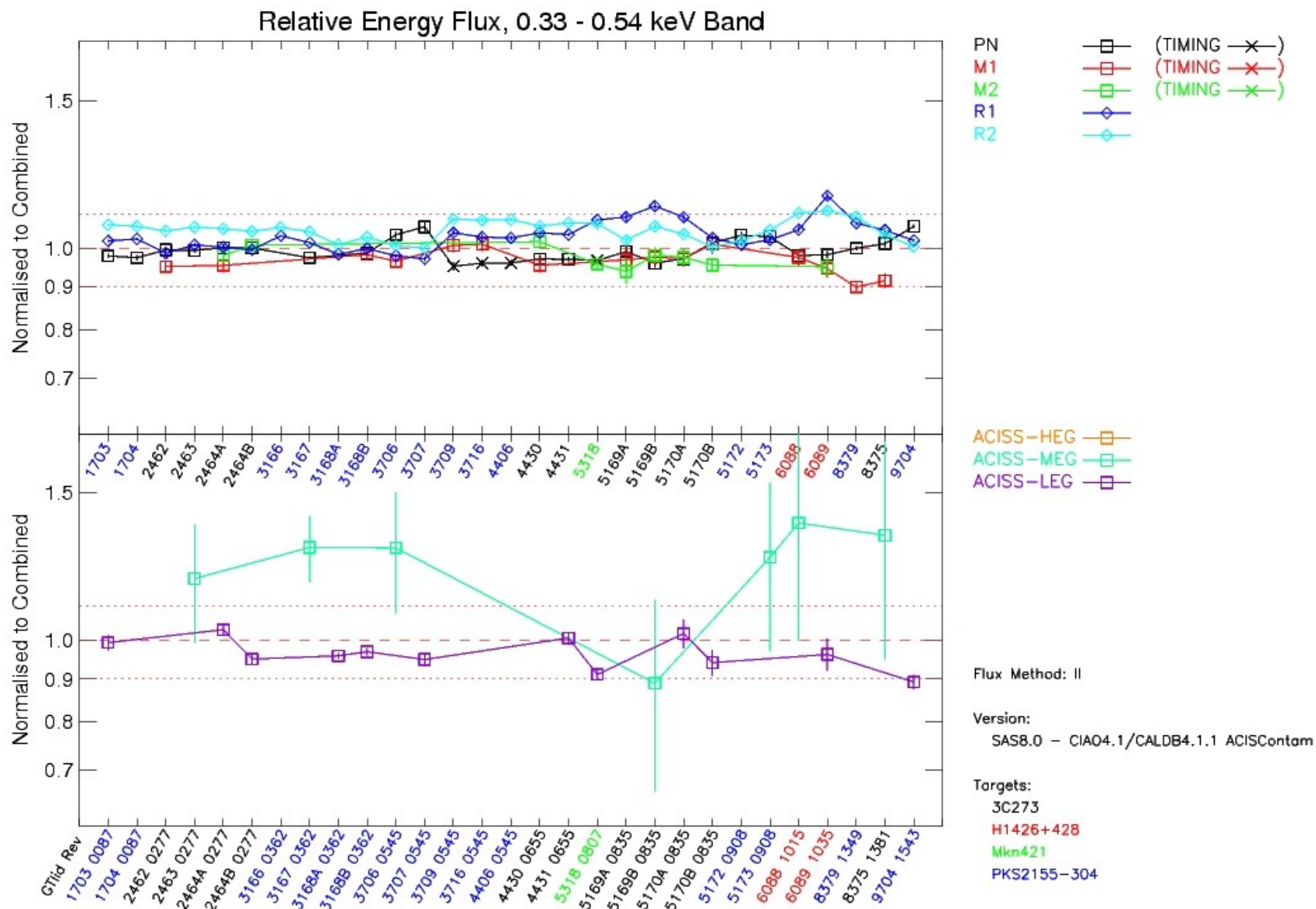
New ACIS Contaminant Model (H. Marshall et al.)



0.33 – 0.54 keV — CALDB 4.1.1



0.33 – 0.54 keV — Preliminary ACIS Contaminant Modification



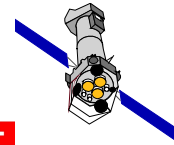
Summary

HRCS LEG:

Trend: From 10 % deficit w.r.t. PN (5% wrt MOS) in 0.15 - 0.33 keV band
to 10% excess w.r.t. PN (5% wrt MOS) at 1.0 keV
to ~30% excess above 1.5 keV

ACISS HEG/MEG:

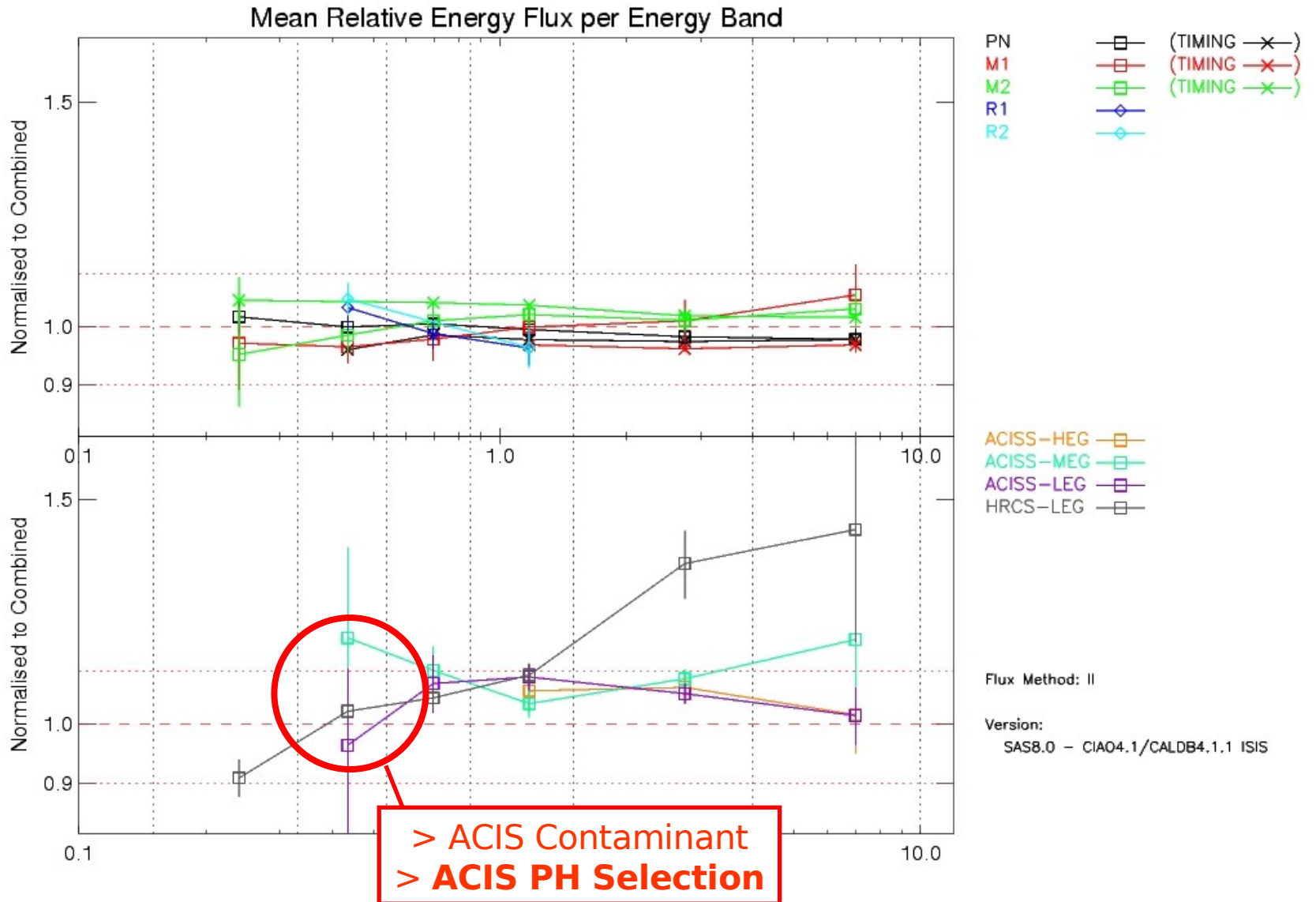
- 10% excess w.r.t. EPIC in 0.54 – 0.85 keV band (MEG)
- 5% excess w.r.t. EPIC in 0.85 - 4.00 keV bands
- Above 4.0 keV HEG and MEG diverge: HEG within +/- 10%,
MEG 10-20% excess



XMM-Newton

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Mean Relative Flux per Band

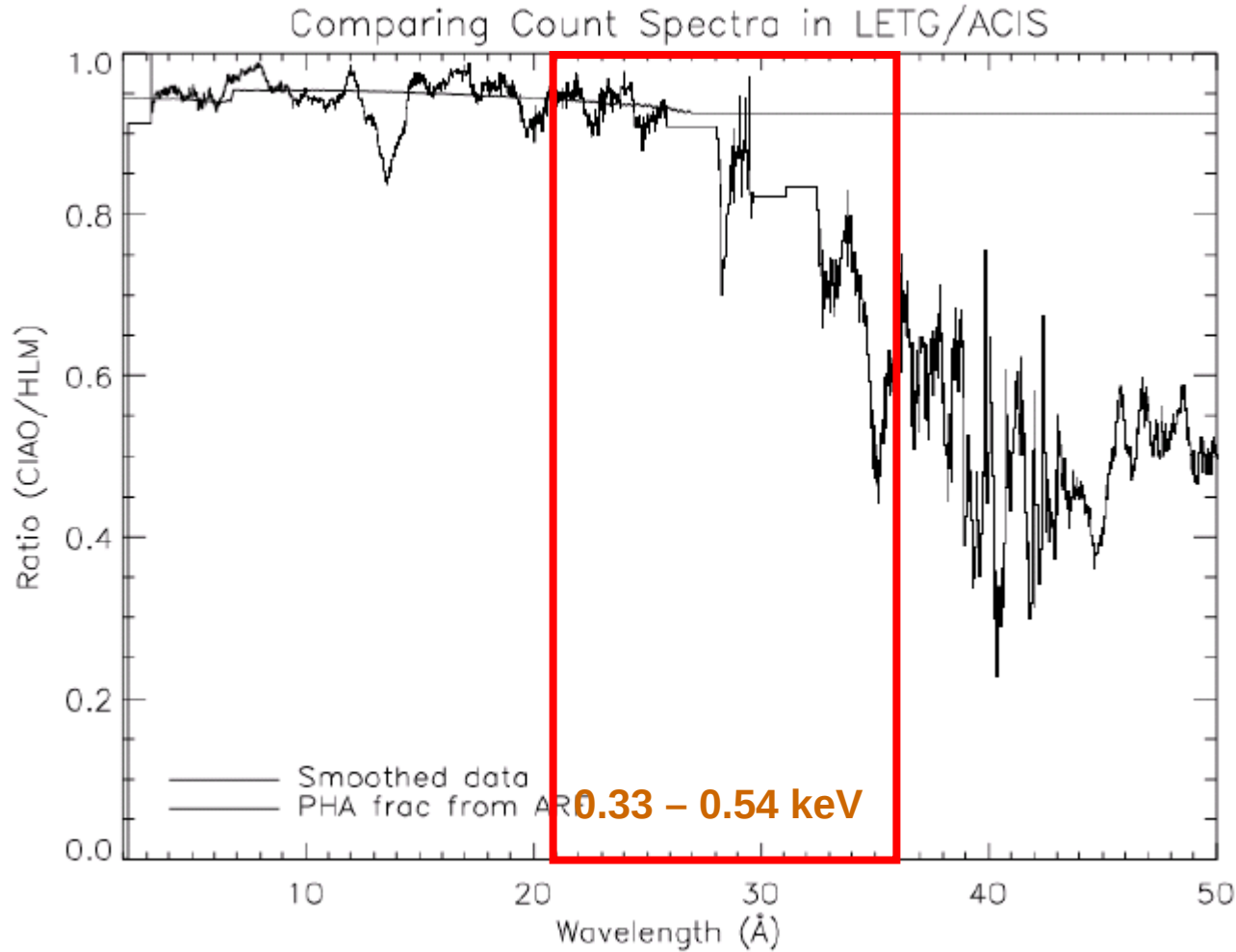


CIAO PH Selection for ACIS (H. Marshall)

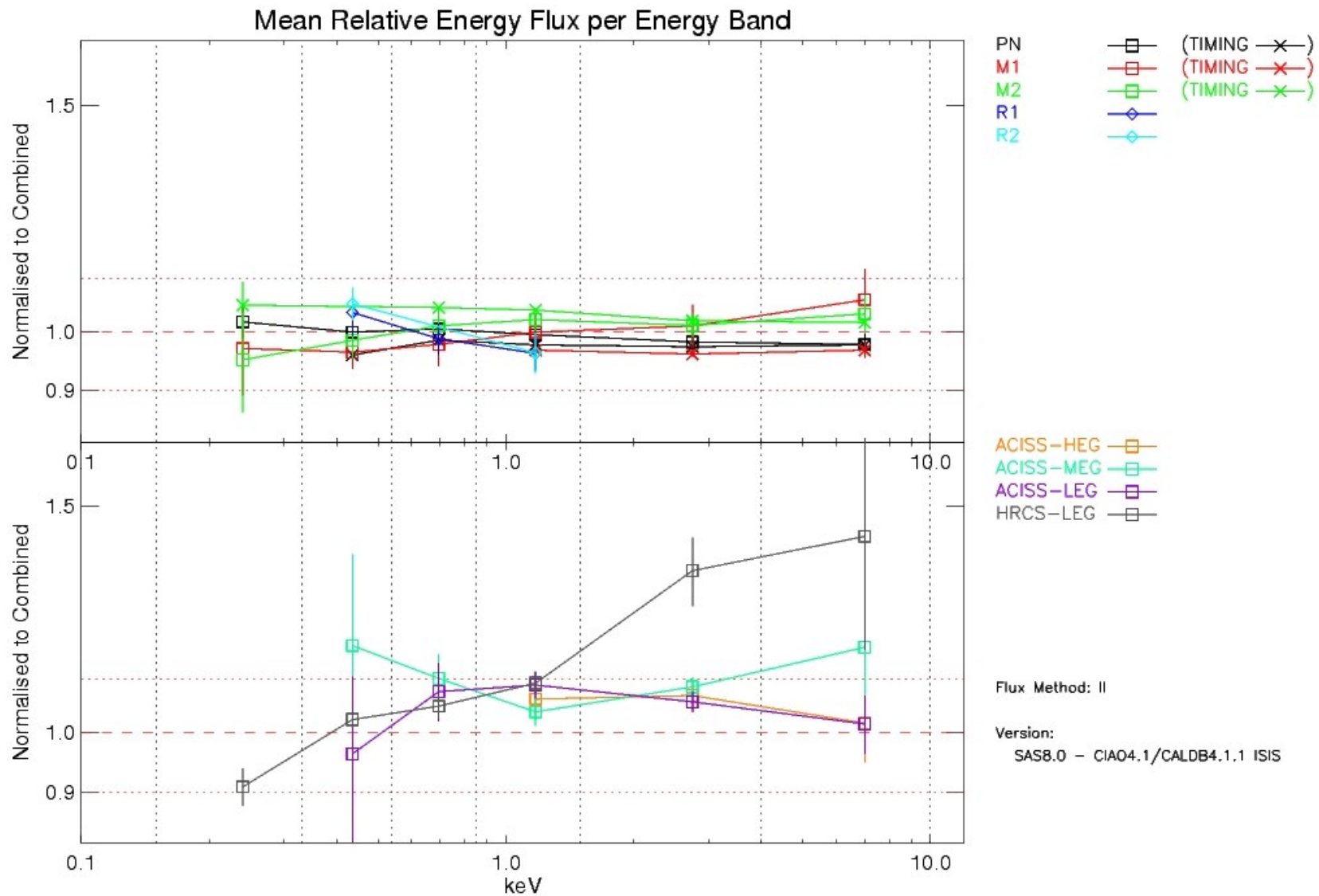
CIAO PH selection is incomplete

Results from gain errors

May vary from observation to observation



Mean Relative Flux per Band — CALDB4.1.1



Mean Relative Flux per Band — Preliminary Modification

