5) Multi-Mission Study

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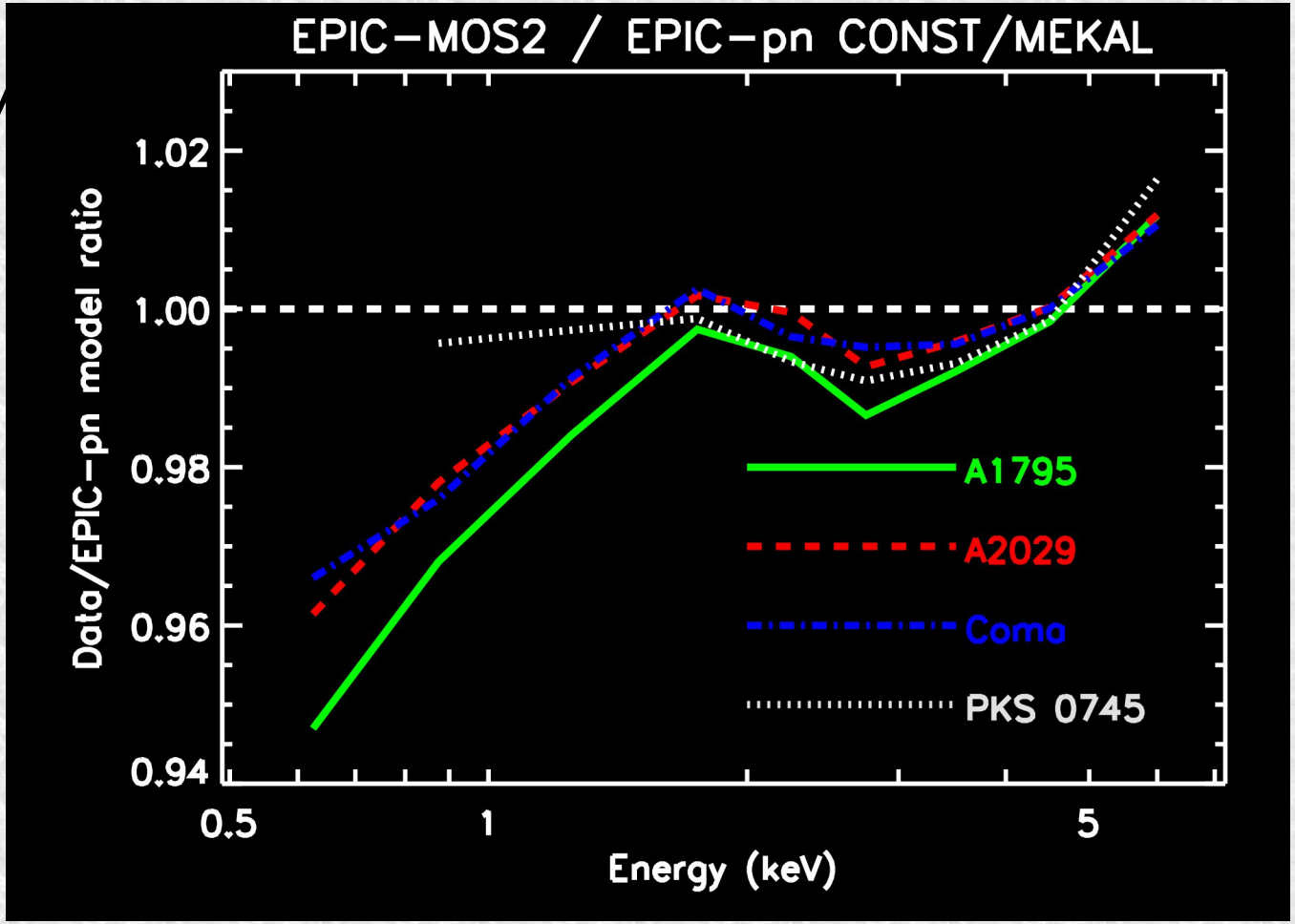
- Comparison of cluster measurements with XMM-Newton/EPIC, Chandra/ACIS, Swift/XRT, Suzaku/XIS, ROSAT/PSPC and NuSTAR: 6 missions, 12 instruments
- Residual ratios to evaluate the effective area cross-calibration:
  - We use EPIC-pn as a reference. (Try also ACIS, **TBD**)
  - For instrument **i** we calculate the median and the mean absolute deviation of the ratio

$$R_{i/pn} = \frac{data_i}{model_{pn} \otimes resp_i} \times \frac{model_{pn} \otimes resp_{pn}}{data_{pn}}$$

- The latter term corrects for deviations btw. pn model and pn data which cannot be produced by the model (no point in comparing other data with a model which does not fit pn data)

Model accuracy does not matter much

- For the relative effective area comparison the accuracy of the reference model does not matter much
- Proof: MOS2/pn residuals ratios for the sample using phabs x mekal or a constant model for fitting pn spectra: above 1 keV differences at the level of statistical error of 2%.



Cluster selection criteria

- Hot enough so that we
  - have enough counts at the highest energies
  - minimise the 1 keV line emission (we are studying the effective area, not PSF or energy scale calibr.)

  → kT > 6 keV

- Not too distant so that the cluster is not too faint i.e. z < X
- Observed with XMM-Newton, Chandra, Suzaku, Swift and ROSAT by > 10ks

→ **A1795, A2029, Coma, PKS 0745-19**

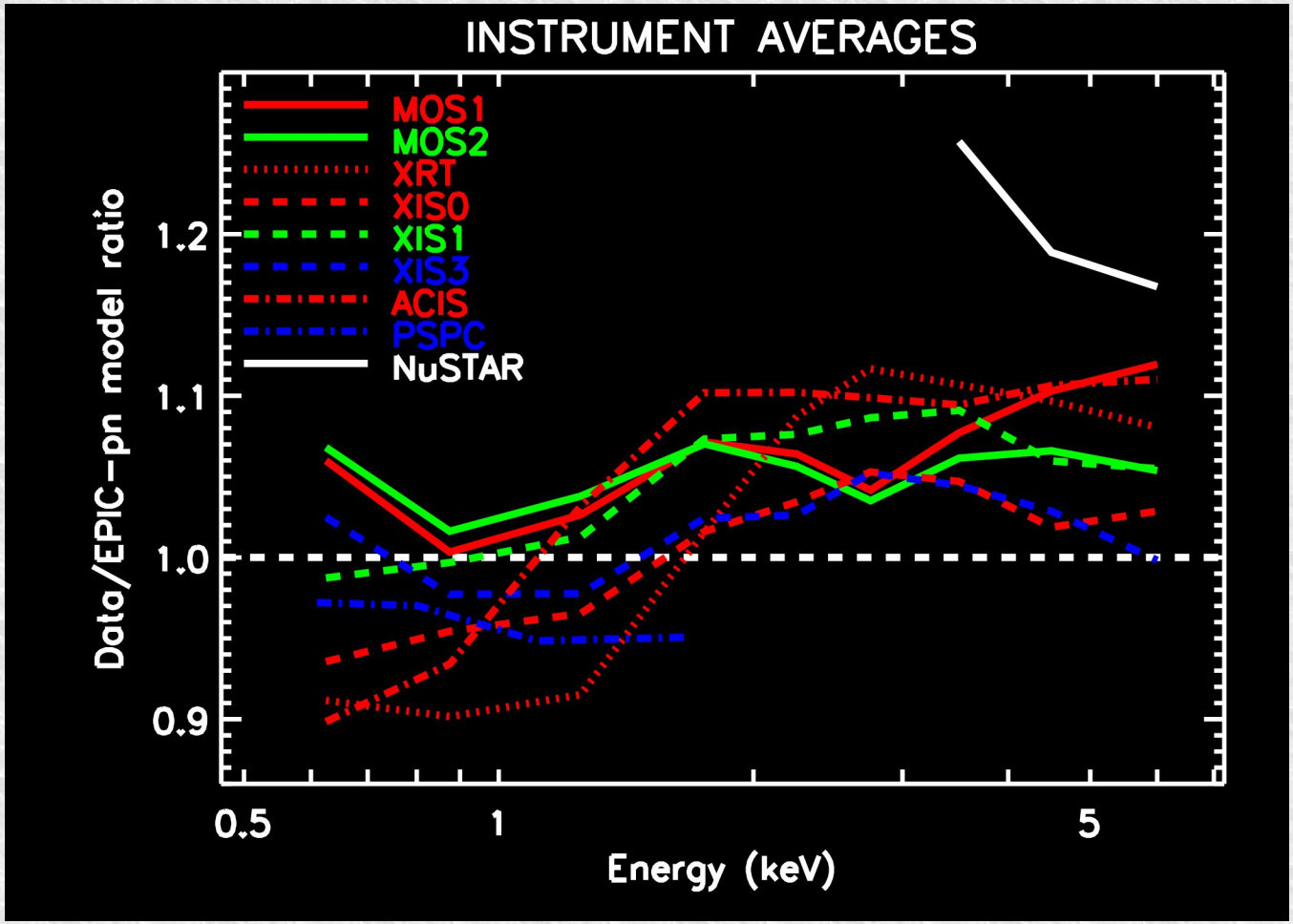
(Maybe more, TBD)

5.1 Preliminary results

(ACIS COMA TBD)

Residuals ratios

- The average instr/pn residual ratio of each pair

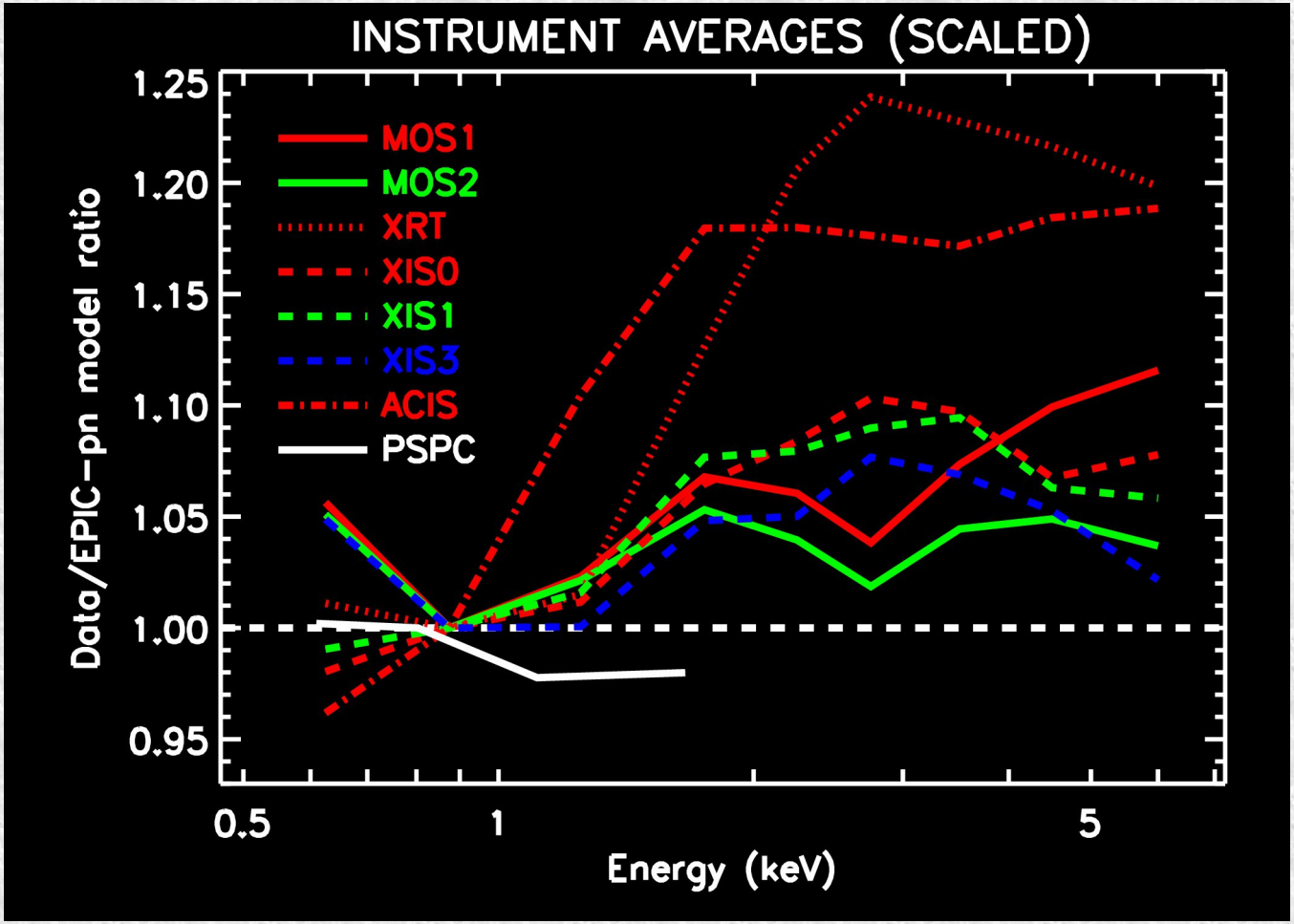


All instruments show higher flux than pn at > 2 keV, but with a varying degree

Most instruments show lower flux than pn at < 2 keV, but with a varying degree

Scaled residuals ratios

- The average instr/pn residual ratio of each pair, scaled to unity at 0.75-1.0 keV



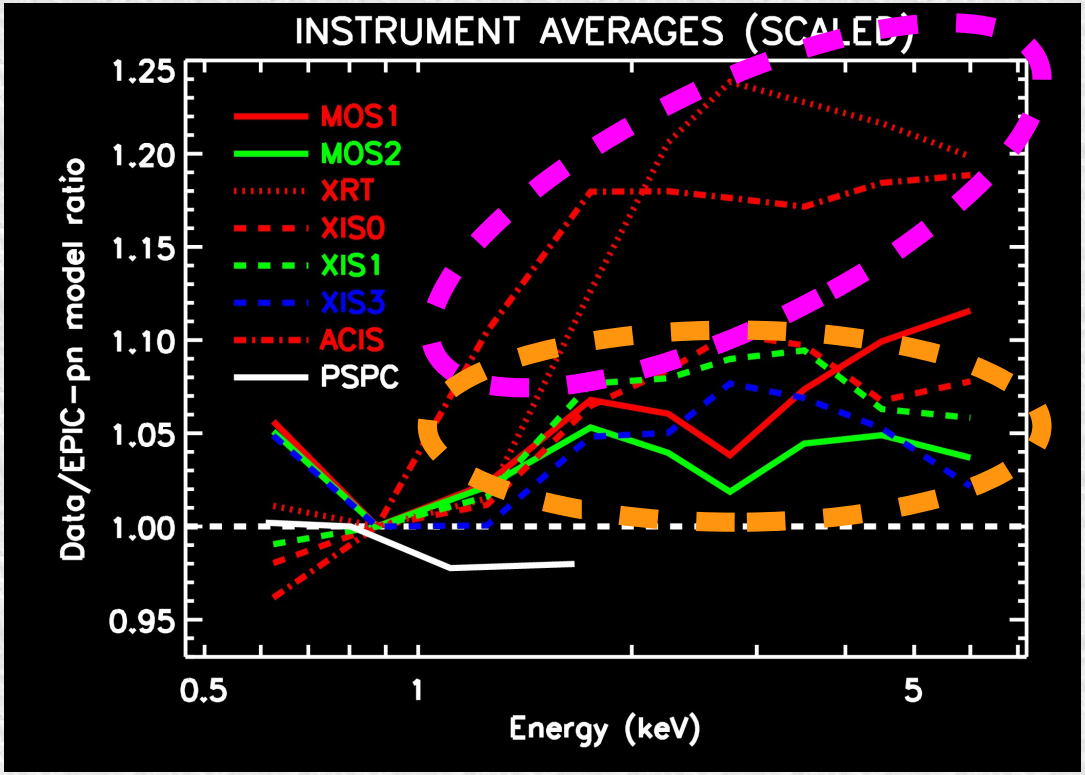
1) XMM/MOS and Suzaku/XIS similar: 10% increase at 1-2 keV

2) Swift/XRT and Chandra/ACIS similar: 20% increase at 1-2 keV gradient

➔ Not a single instrument is quilty

Scaled residuals ratios

Request to IACHEC community: explain why there are the two groups.



A) Chandra/ACIS + Swift/XRT

B) EPIC/MOS + Suzaku/XIS

The average instr/pn residual ratio of each pair, scaled to unity at 0.75-1.0 keV

I.e. is (are) there some element(s) of the effective area instrumentation or calibration that is (are) common within the groups, but different btw. the groups?