N132D observations with eROSITA

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Spectra of **N132D** obtained in the **first 3 eR**osita **All-S**ky **S**urveys (`eRASS1, eRASS2, eRASS3') were analysed to check the current energy calibration (≈1.8-2.0 ks per TM and eRASS)

This was done individually for each survey, for each TM, for singles and for all valid patterns, using the IACHEC[1] and an empirical[2] model of N132D.

[1]v2.14, [2]based on the fit of the RGS data by Suzuki et al. (2020) for the low-energy part and a VNEI component for the high-energy part fitted by A. Foster to EPIC-pn and MOS data

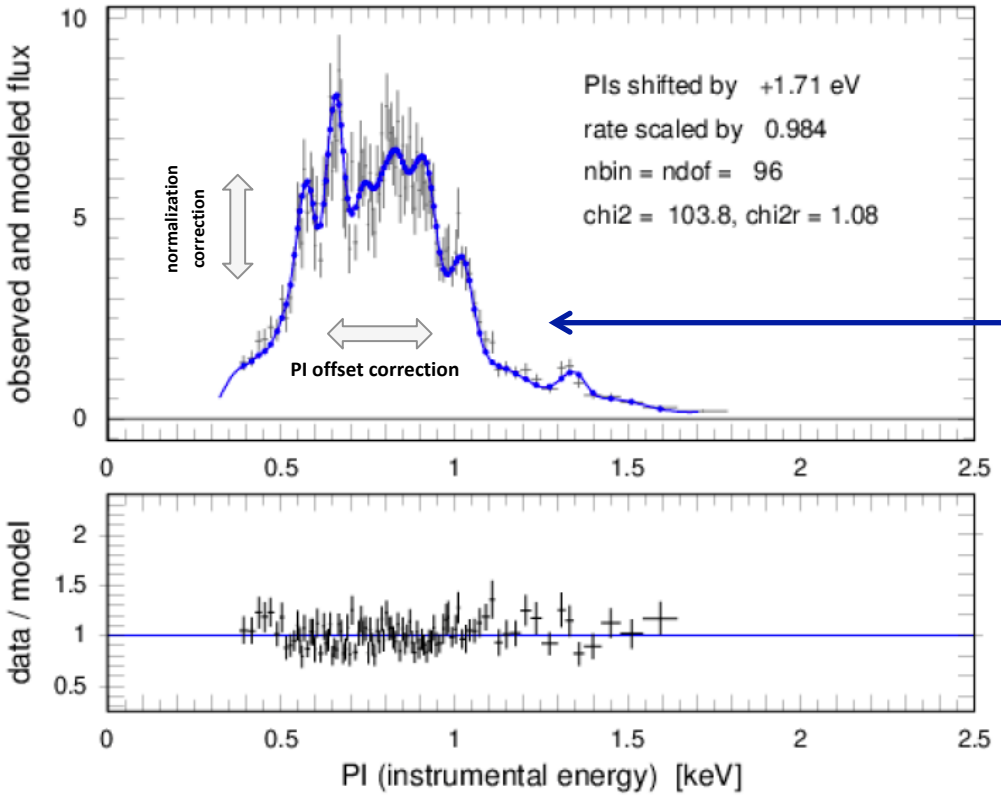
→ 3 surveys, 7 TMs, 2 pattern selections, 2 spectral models → 3 x 7 x 2 x 2 = 84 spectra

Main goal: check for internal consistency of two major calibration quantities:
energy scale and **flux normalization**

Method:

1. use the spectral model **without any modification,** multiply it with the ARF and fold it through the RMF (only this step makes use of XSPEC)
2. interpolate the folded spectrum, so that it can be evaluated at any PI value
3. compose a **χ^2 map** for a grid of **[energy offset, normalization correction]** by shifting the measured PI values and scaling the counts, and computing the χ^2 for each grid point

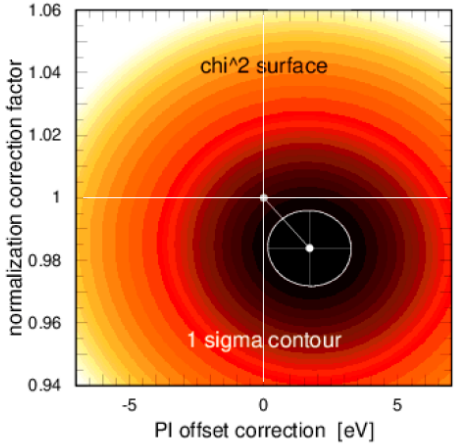
Example: TM4 in eRASS2, using just singles, with IACHEC model spectrum of N132D



unmodified „fixed“ IACHEC spectrum, just multiplied with ARF and folded through RMF, and spline-interpolated

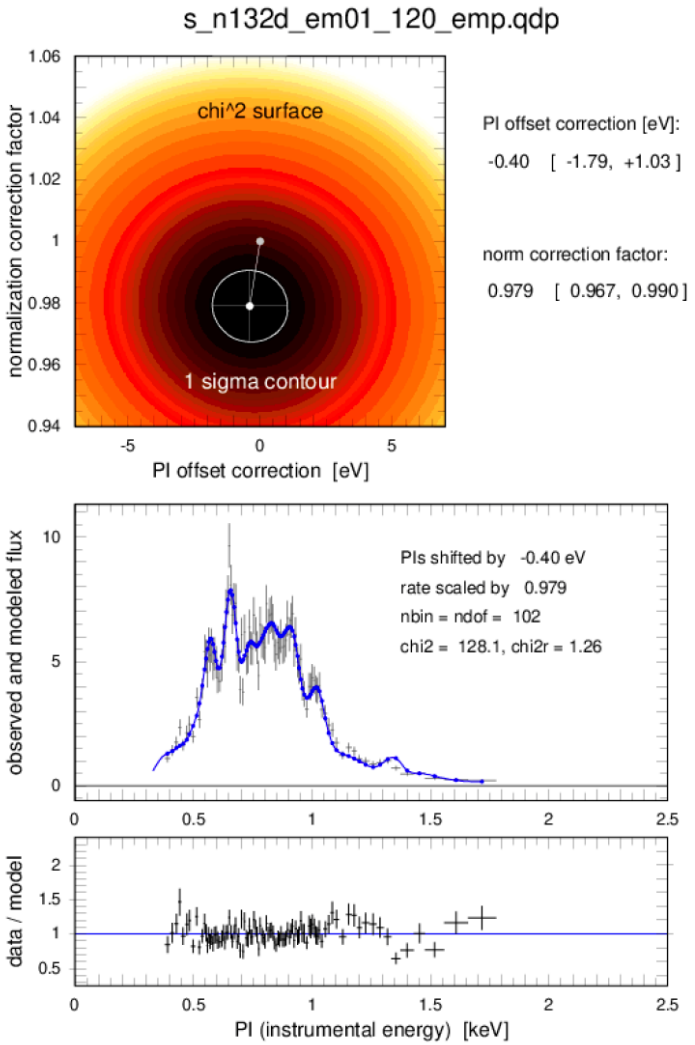
the **observed** spectrum is allowed to be shifted horizonally and scaled vertically

resulting χ^2 surface:



PI offset correction [eV]:
+1.71 [+0.15, +3.25]

norm correction factor:
0.984 [0.972, 0.996]



example:

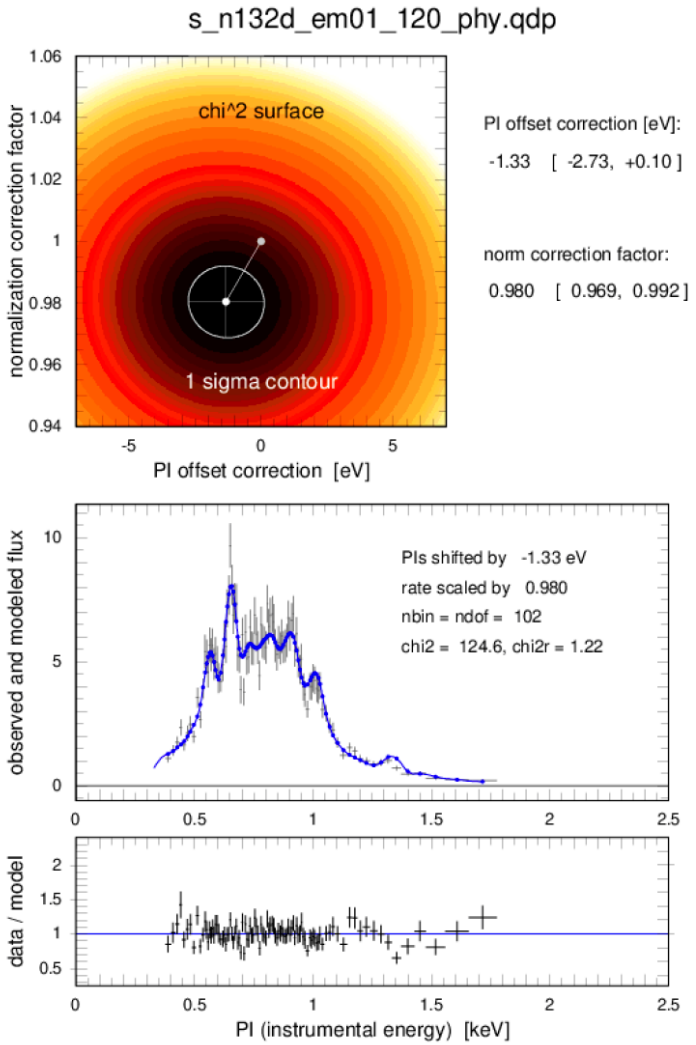
TM1

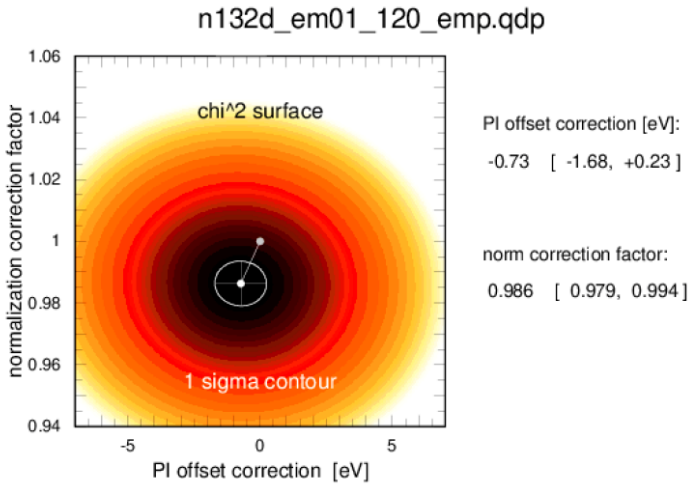
eRASS1

singles only

IACHEC model

physical model





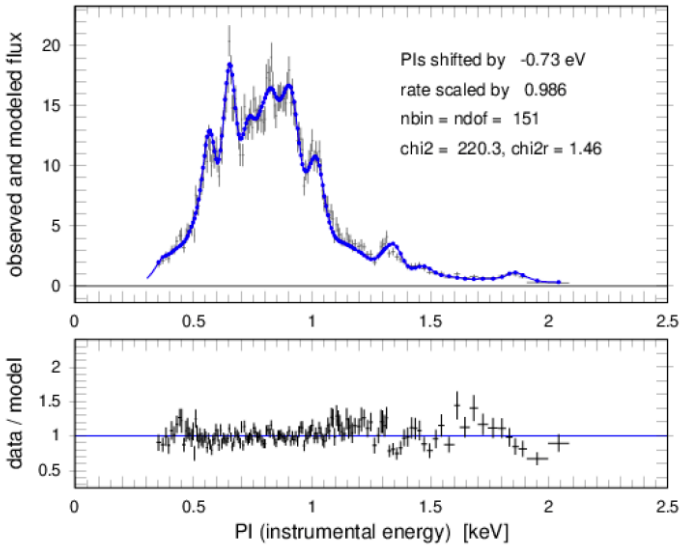
example:

TM1

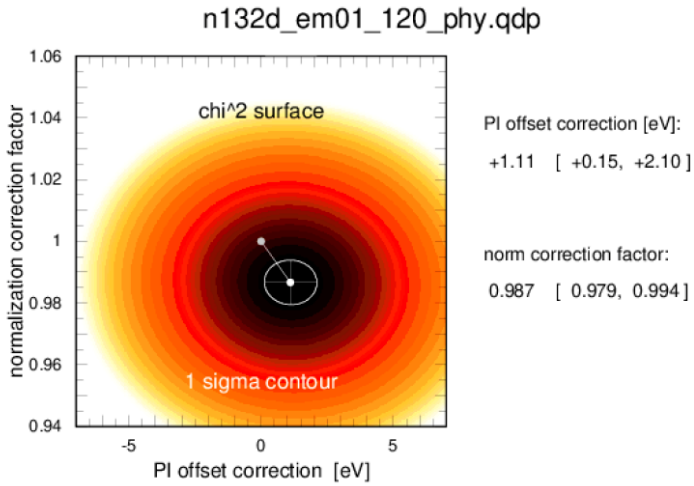
eRASS1

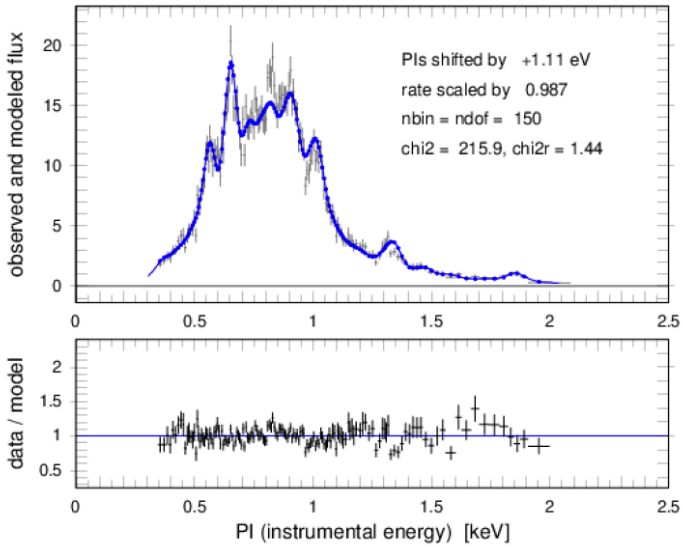
all valid patterns

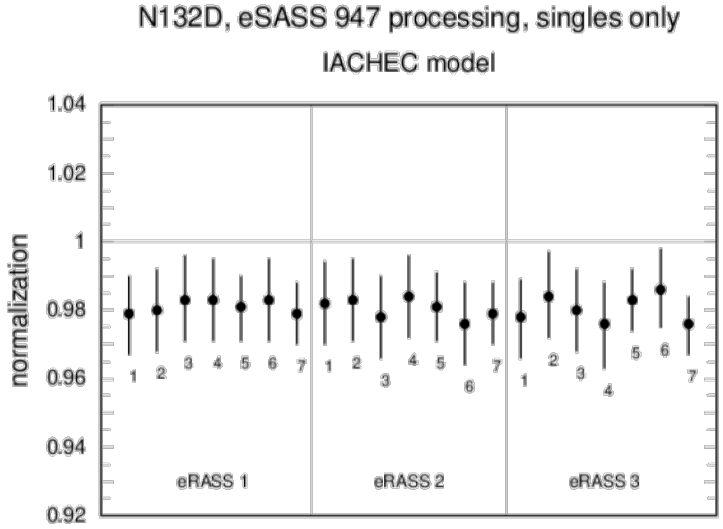
IACHEC model

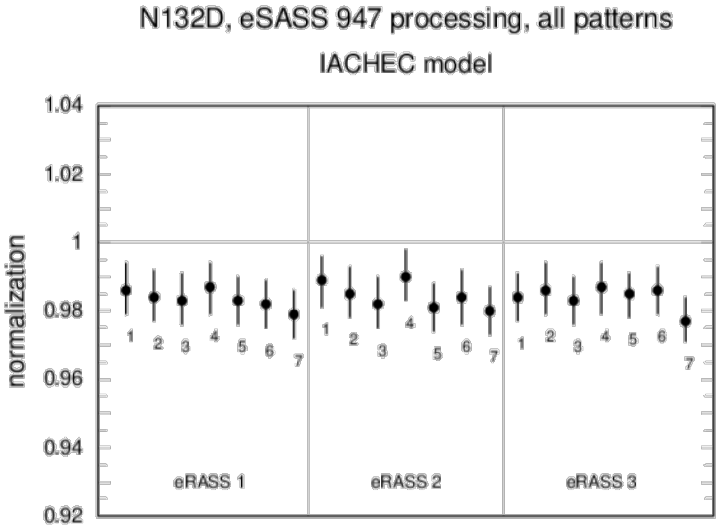


physical model

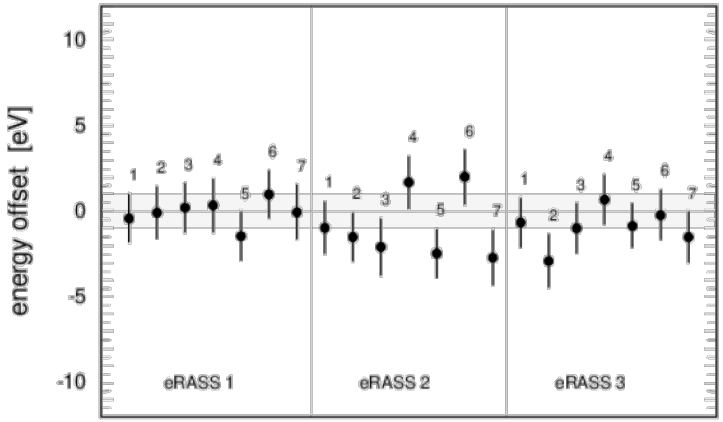


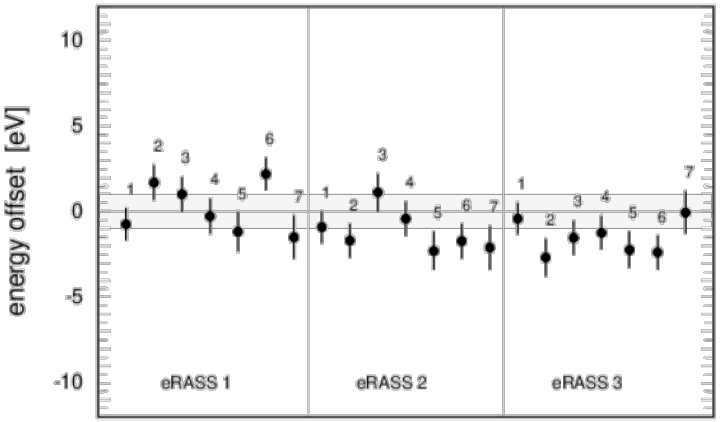


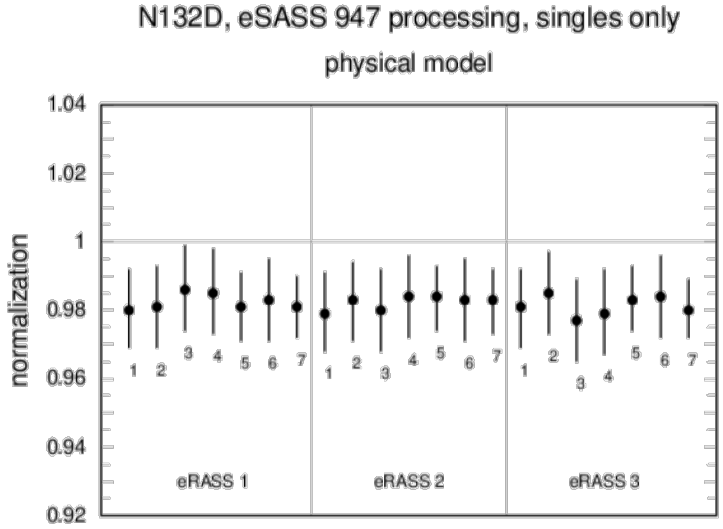


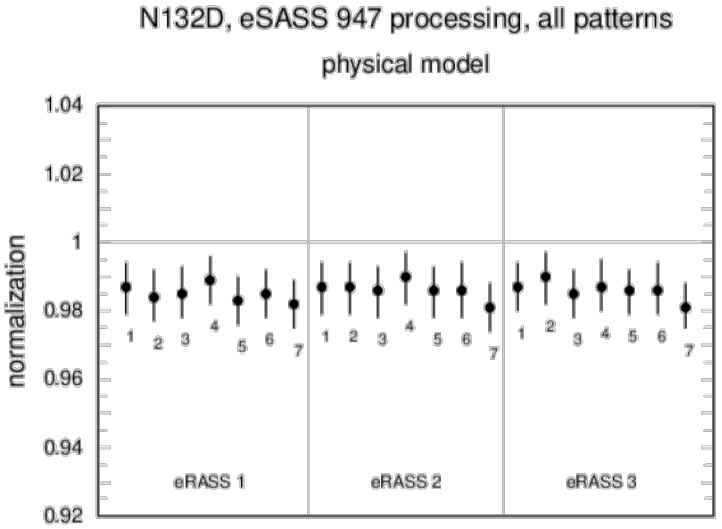


1σ error bars

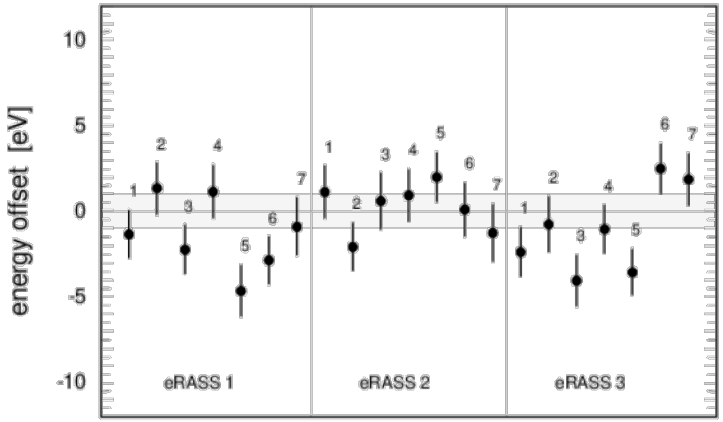


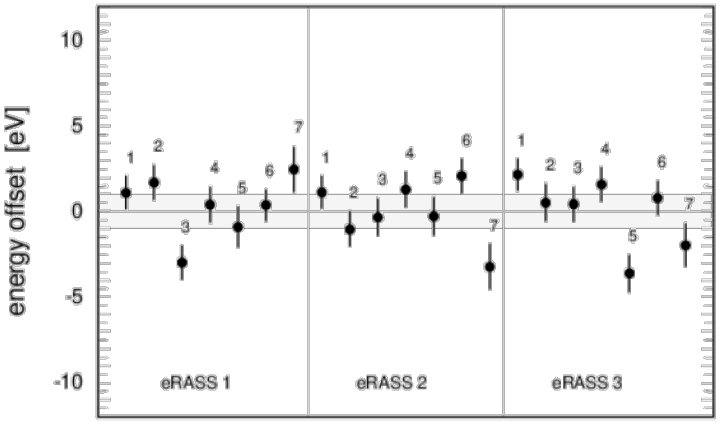






1σ error bars





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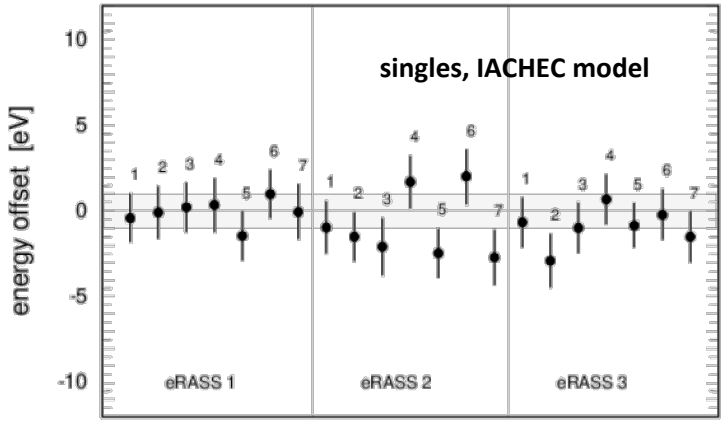
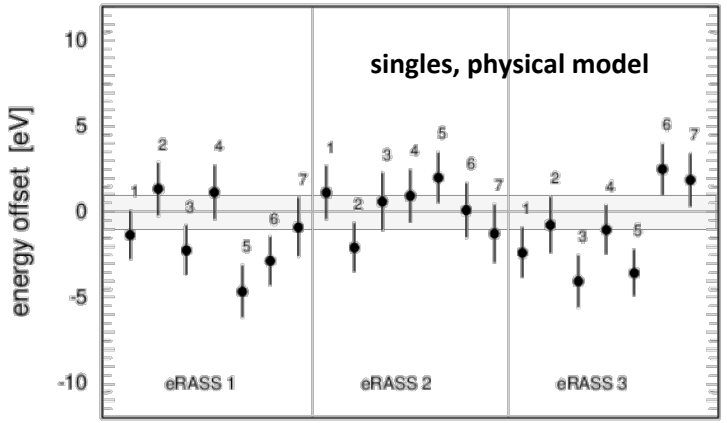
Summary:

1. normalization: consistently too low by ≈ 2%
2. energy scale:
   - accurate to ≈ ± 1 eV for IACHEC model
   - larger deviations for physical model

no systematic temporal trend over 1½ years

no obvious differences between TMs

Thanks to the IACHEC work on the N132D model spectrum it is possible to determine the absolute energy scale of each eROSITA TM in the energy range 0.5 − 1.1 keV for an exposure time of ≈2 ks to an accuracy of ± 1 eV.