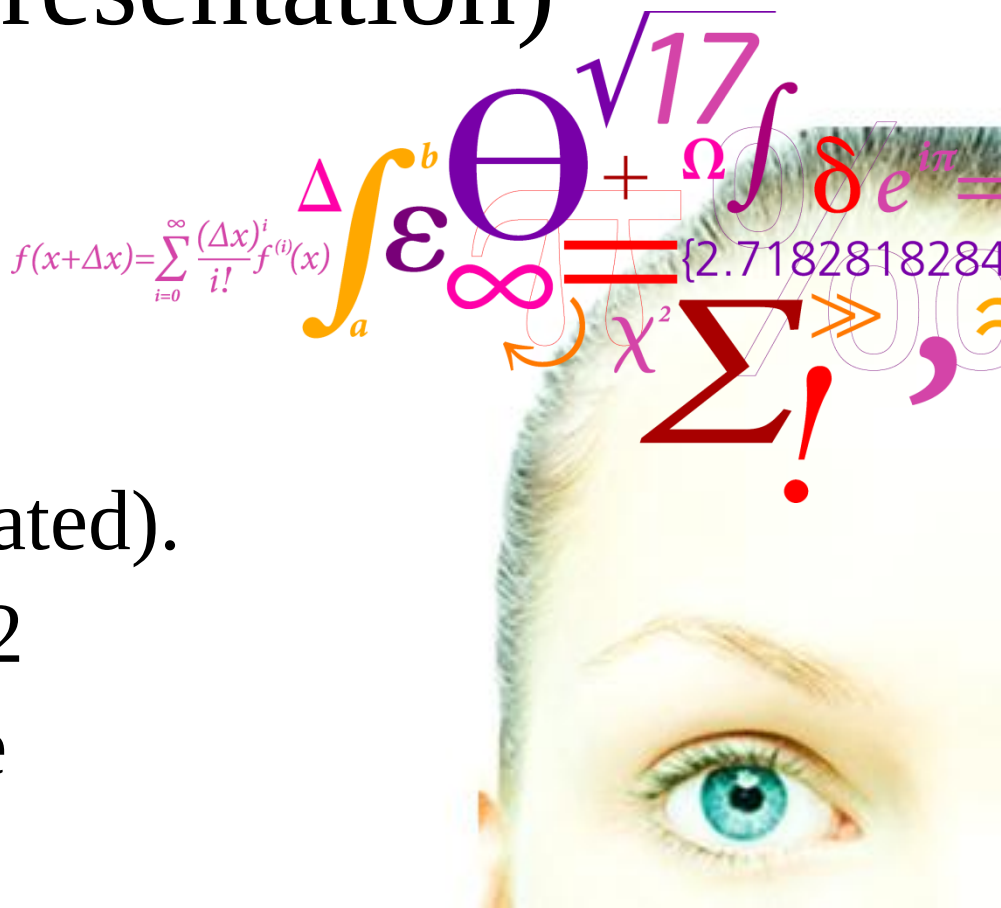
j_ima_iros version 4 (an updated version of my SDAST presentation)



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SDAST 44 (updated).
June 4, 2012
DTU Space

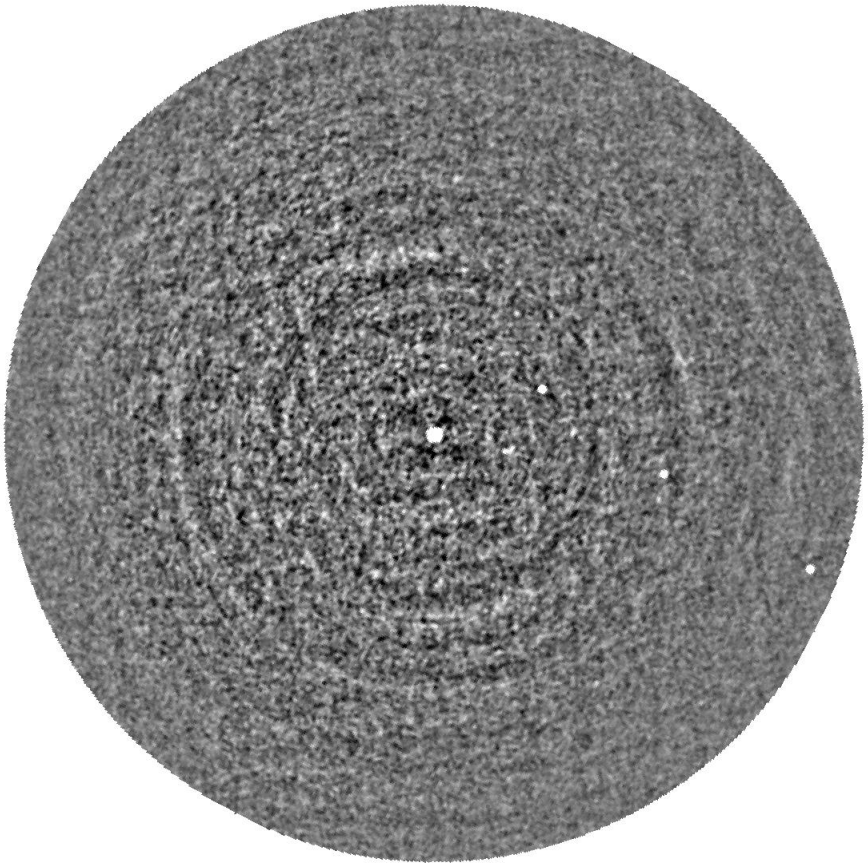
Capabilities of version 4

- The new version of j_ima_iros (4.0) is functionally equivalent to the old version, but the software package has been through a extensive rewriting and reorganization to prepare for the handling of eventlists and light curve extraction.
- A new feature is the improved images available through ”PIF-imaging” discussed at the SDAST meeting one year ago.

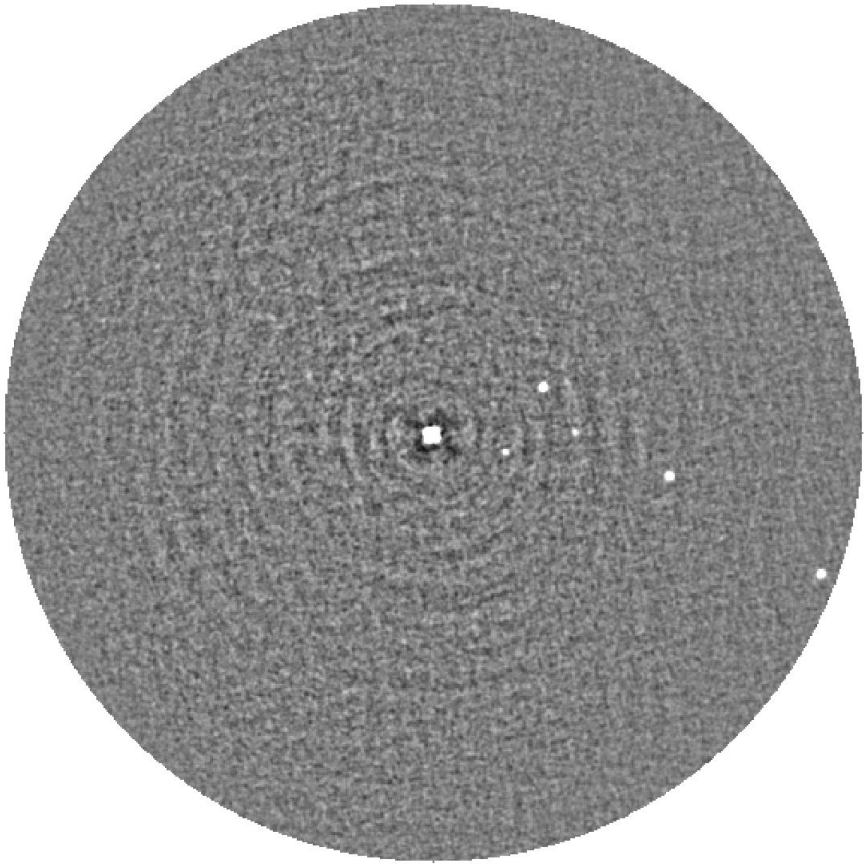
The PIF-imaging technique

- The standard image generation with *j_ima_iros* is based on the backprojection technique. The noise in images produced with this technique increses near strong sources.
- Significant suppression of this source generated noise can be obtained by assigning weights to the individual shadowgram pixels according to the source signal expected locally.
- For the moment the PIF-images should be used for source finding only, flux extraction should be based on the j_ima_iros fits (for single scws) or from mosaics of the conventional image type for weak sources.

Image improvements



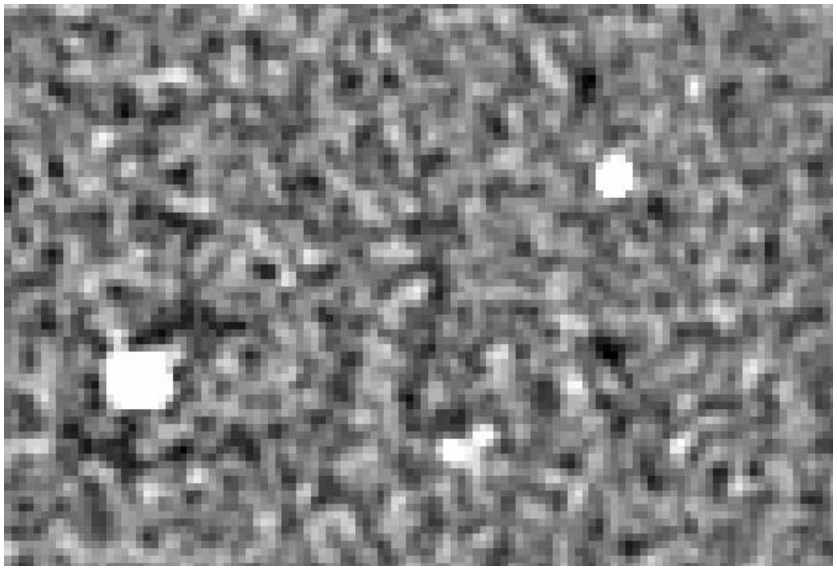
Mosaic from conventional images



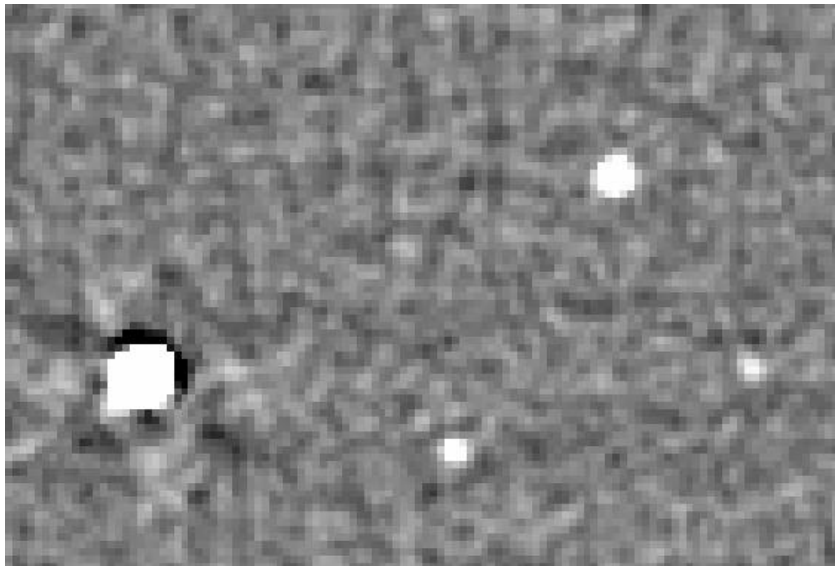
Mosaic from PIF-images

Artefact suppression

- An additional advantage of eliminating the strongly illuminated shadowgram pixels is the suppression of image artefacts.



Conventional mosaic



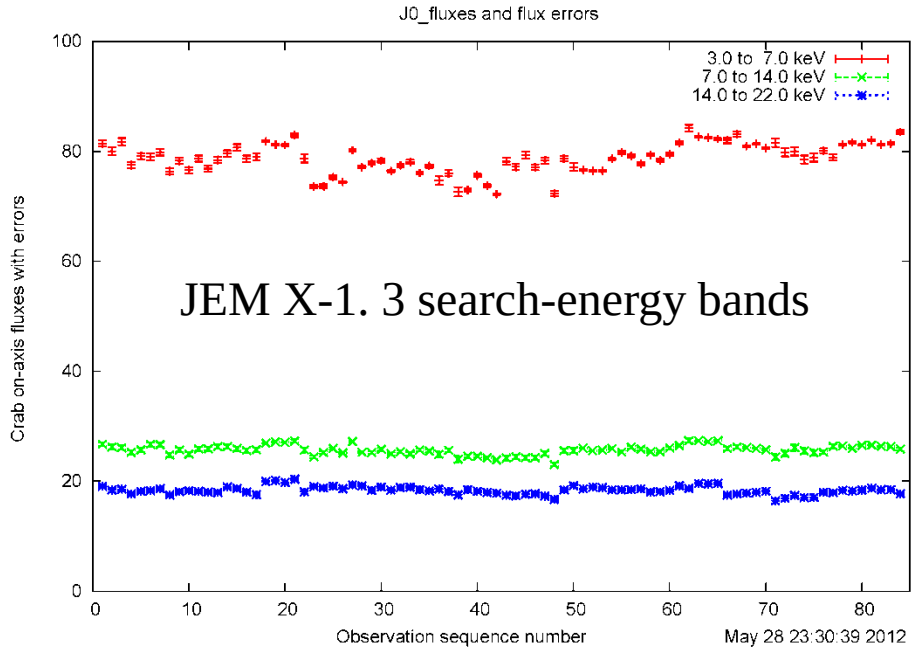
PIF-image mosaic

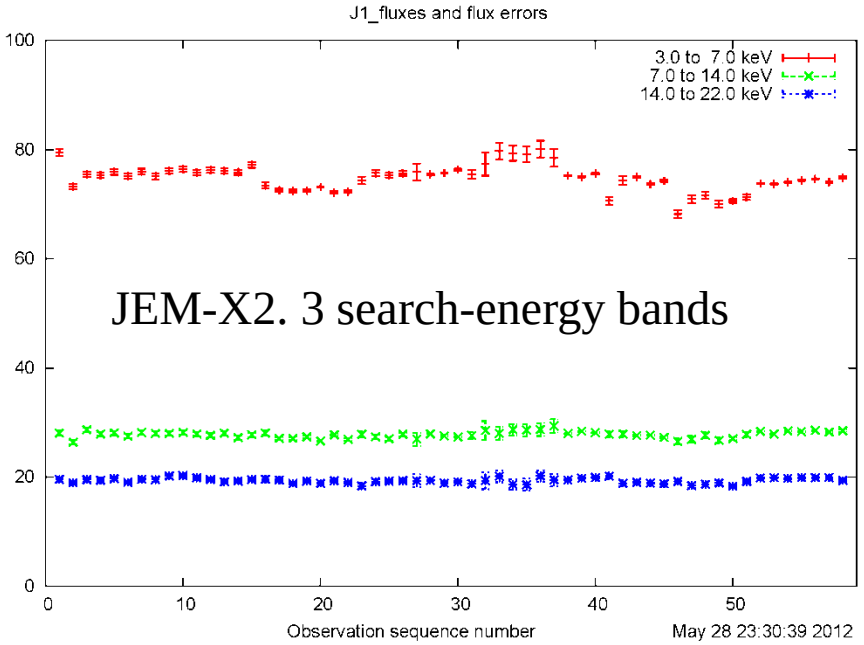
Error estimation - a recurring problem

- Version 4.0 and 4.0.1 of j_ima_iros had major flaws in the error estimates for the source fluxes.
- In version 4.0.2 the error estimates for the fitted fluxes are derived through an iterative procedure where the flux of each source is shifted away from its optimum value until the chi-square for the fit has increased by unity.
- In most cases, however, the derived errors overestimate the actual flux scatter. Why?

Case study: Crab fluxes

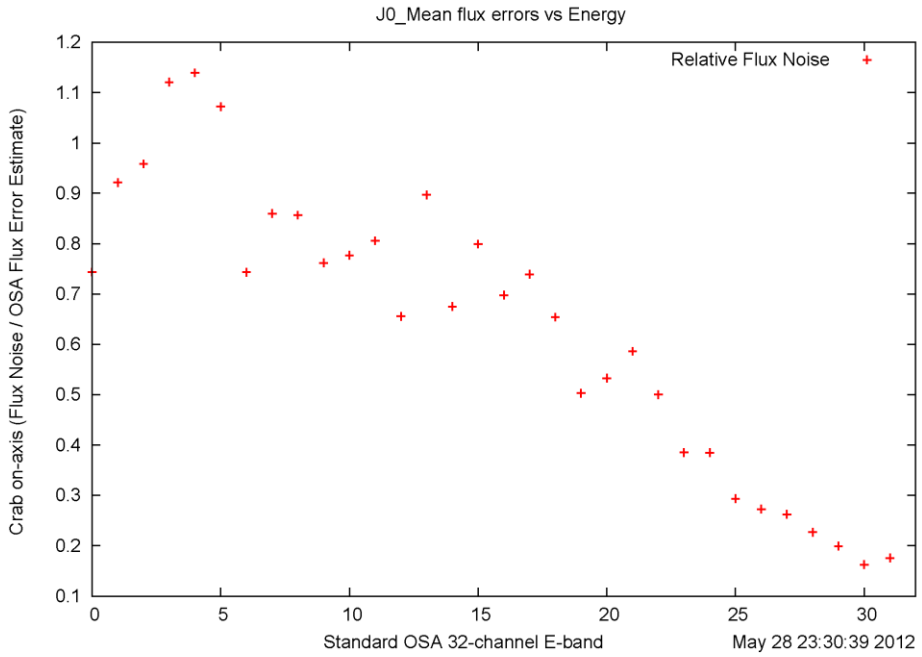
- 144 Crab on-axis observations have been selected between rev 239 and 966.
- Fluxes and flux-errors were found with j_ima_iros 4.0.2 using OSA standard 32-channel energy bins. (Strongly deviant scws have been eliminated – causes must be identified).

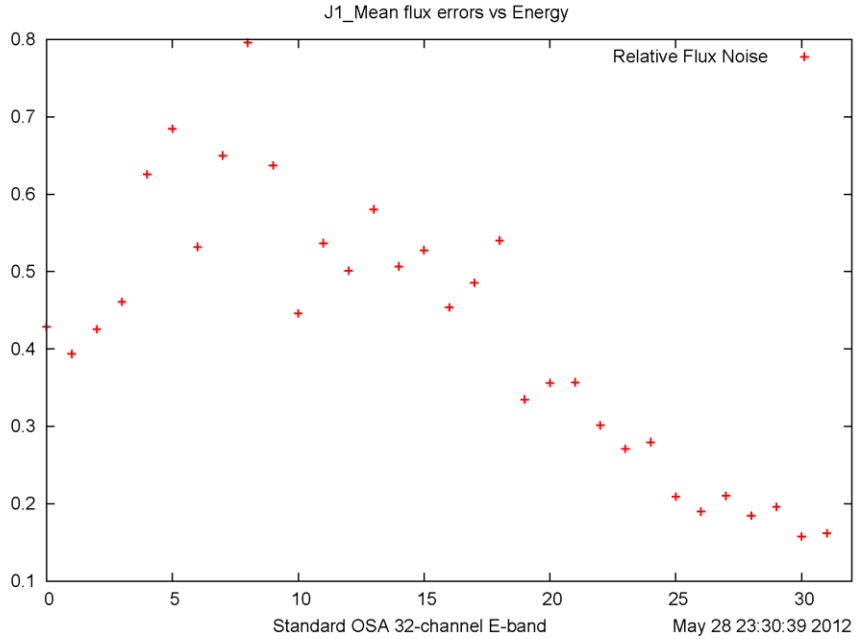




Case study II

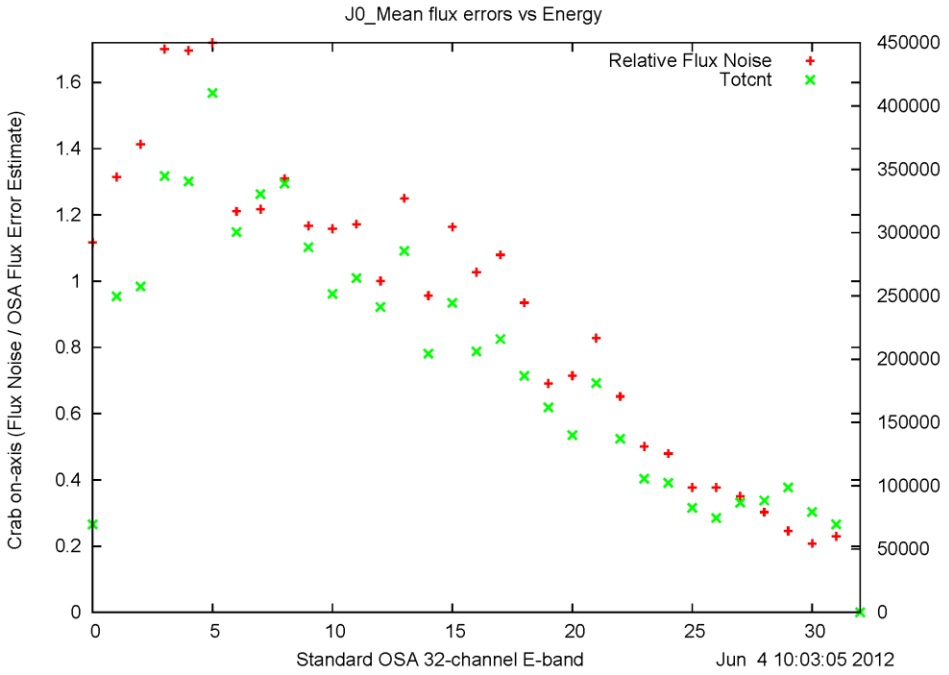
- For each of the 32 standard energy band the weighted mean flux was calculated. The variance of the measured deviation divided by the flux error is found for each energy channel. If the fluxes and the error estimates are correct the mean value should be near unity.
- However, the values found deviate significantly from unity – and moreover exhibits a clear energy dependence ???

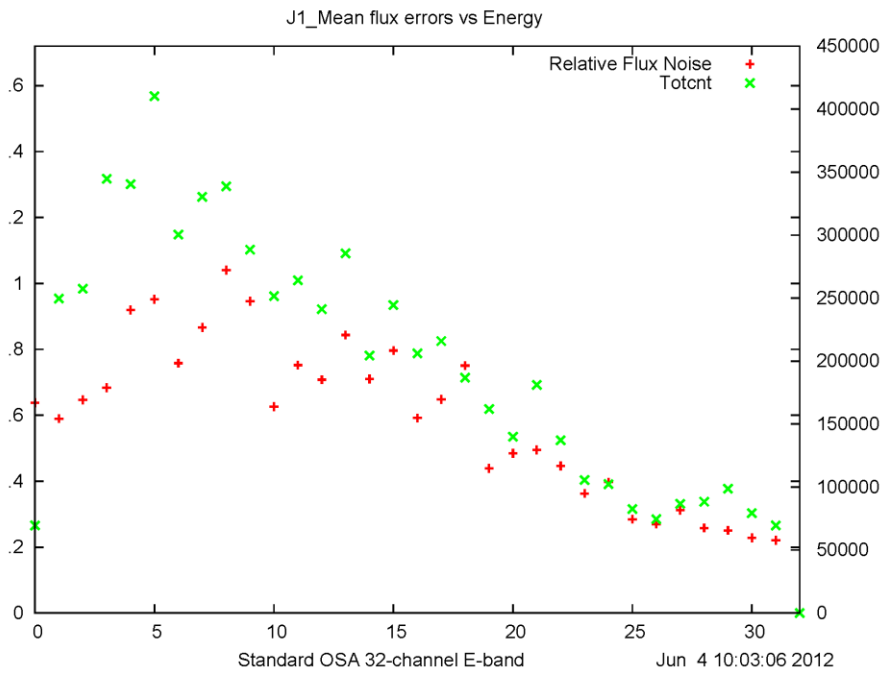




Remarkable correlation

- Plotting the total counts for each energy bin we note a very clear correlation between the relative flux error and the counts (32 E-bands)

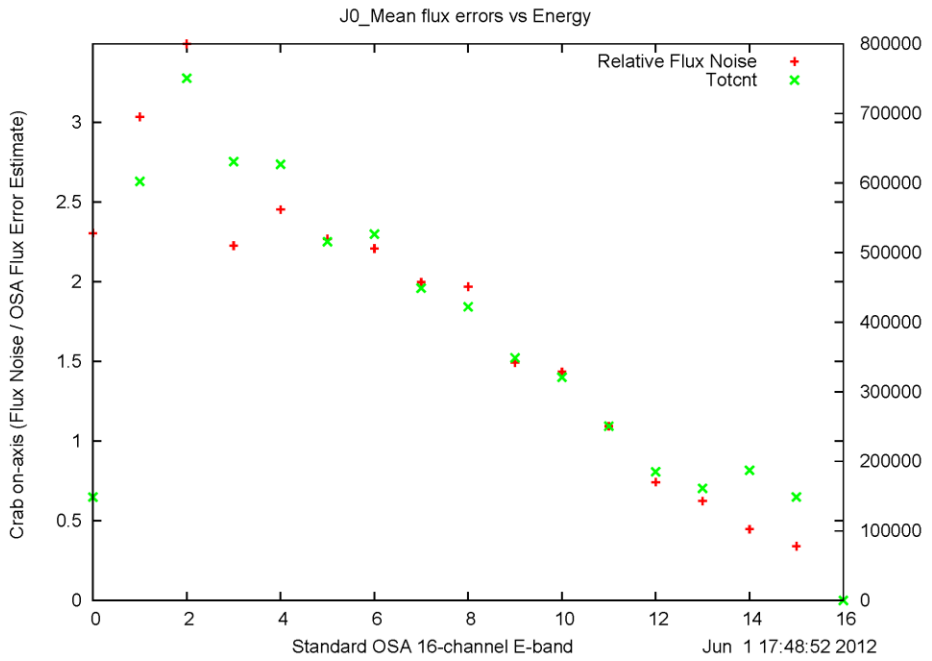




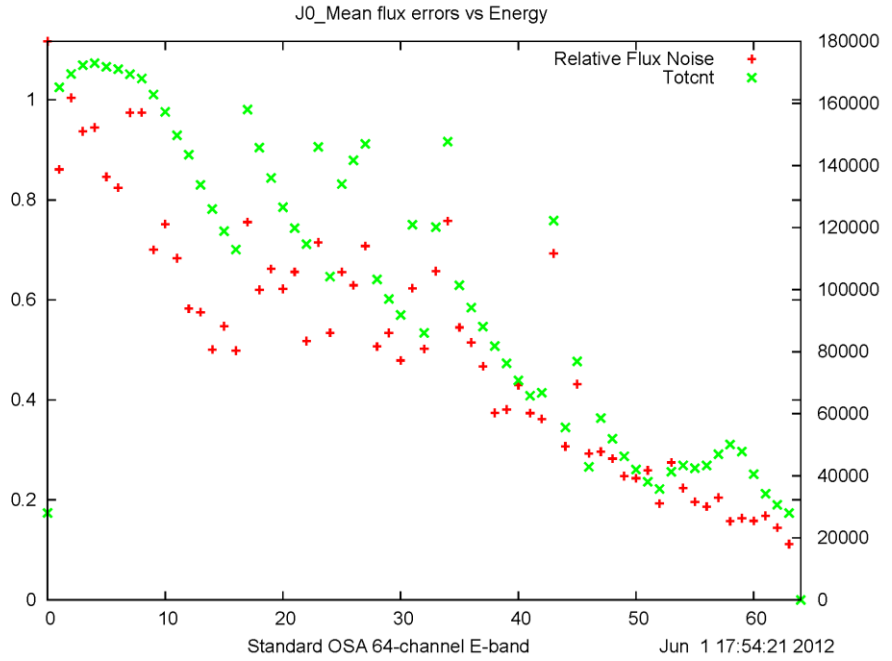
Further correlations

- The correlation persists when the number of energy bins is modified.

16 energy bands

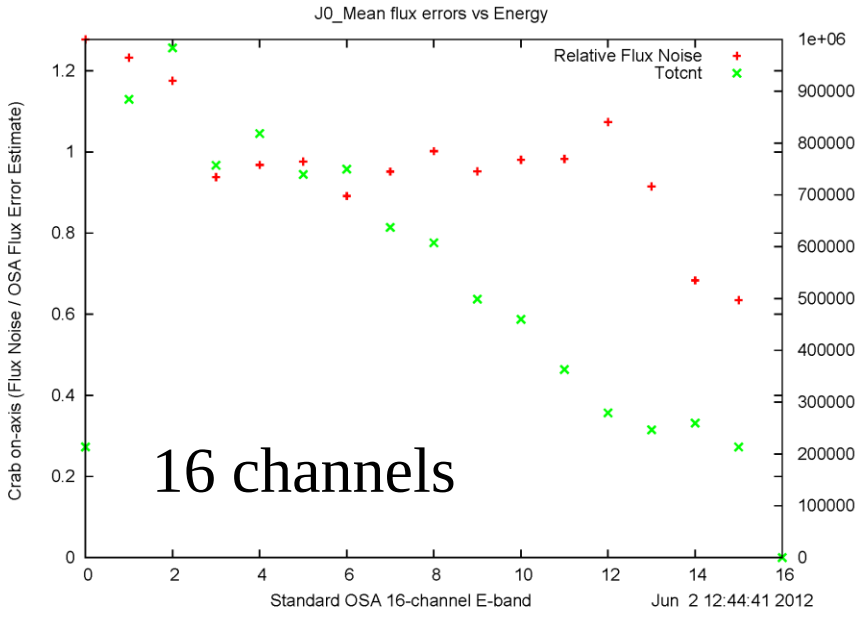


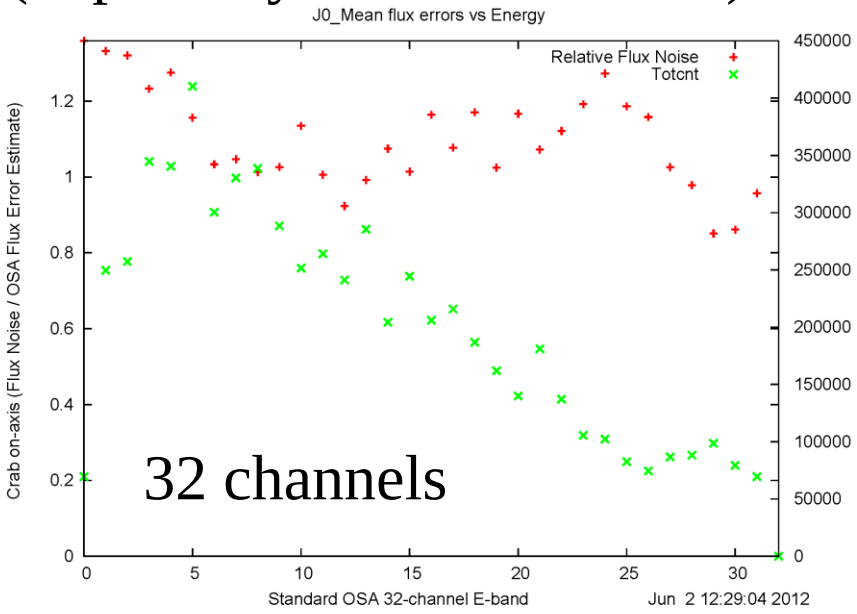
64 energy bins

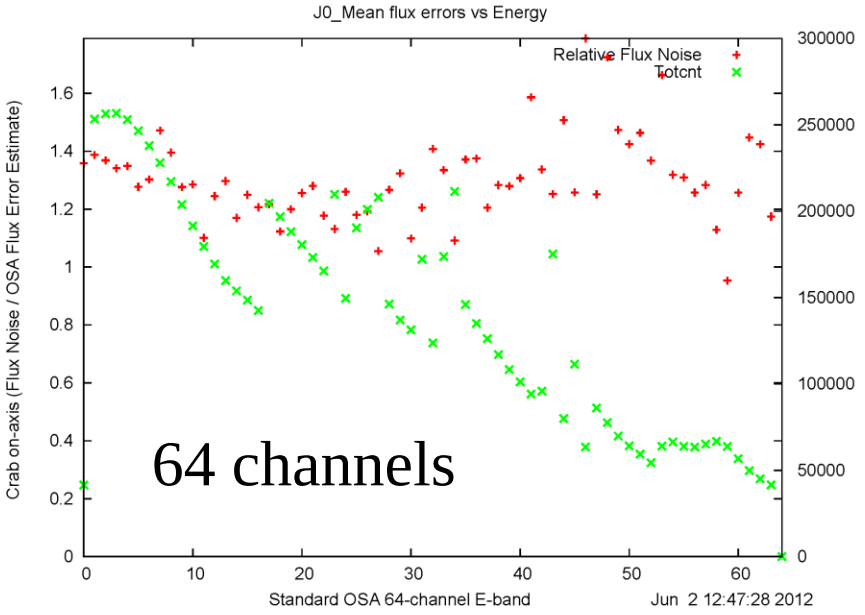


Introducing ad-hoc correction

An ad-hoc correction has been introduced, linear in the total counts in the energy band, and with one scale factor for all energy bins.
(Separately for each JEM-X).

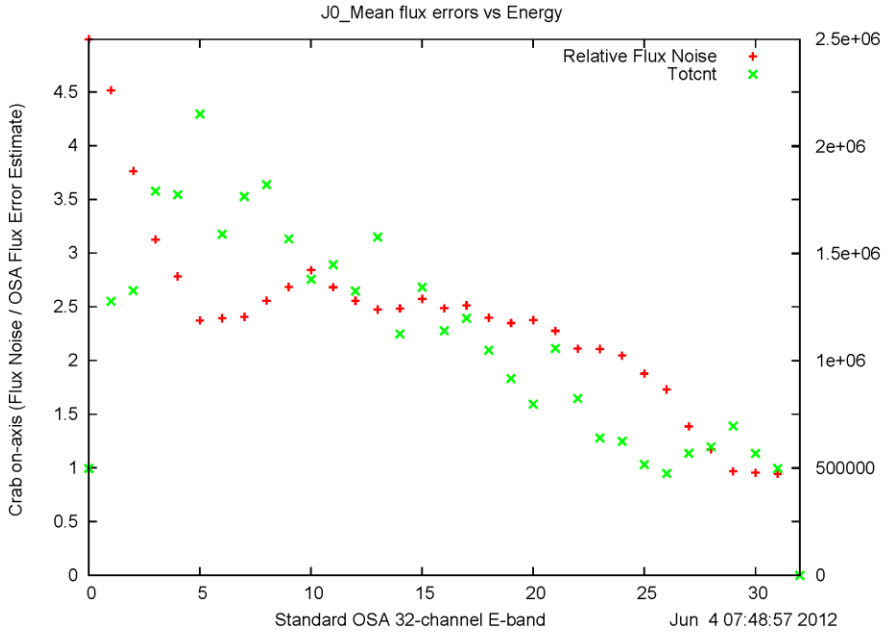


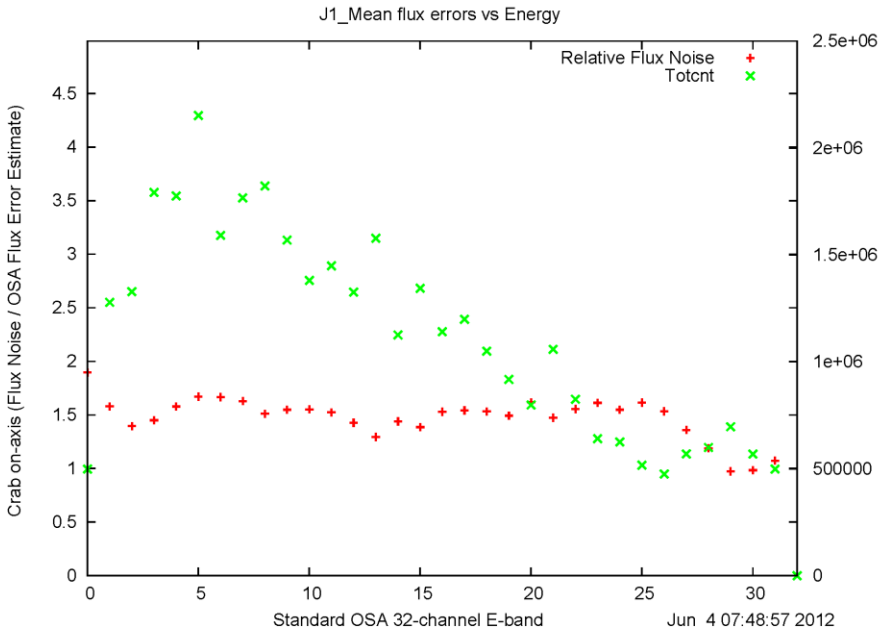




Applying correction to full set

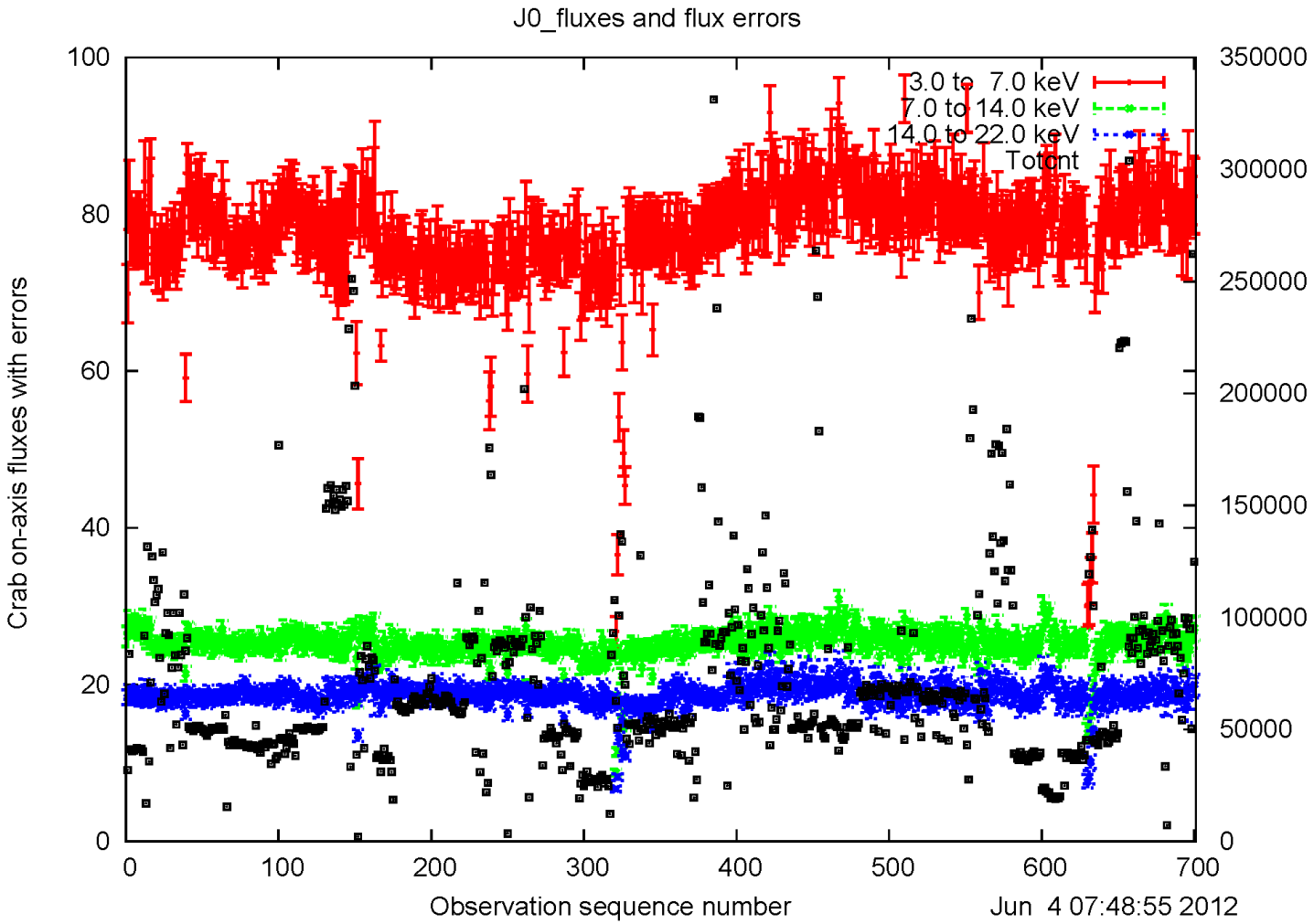
The ad-hoc correction derived from the on-axis Crab observations have been applied to my ”full” set of Crab observations (Crab calibrations between rev 170 and 966). The results are reasonably satisfactory.





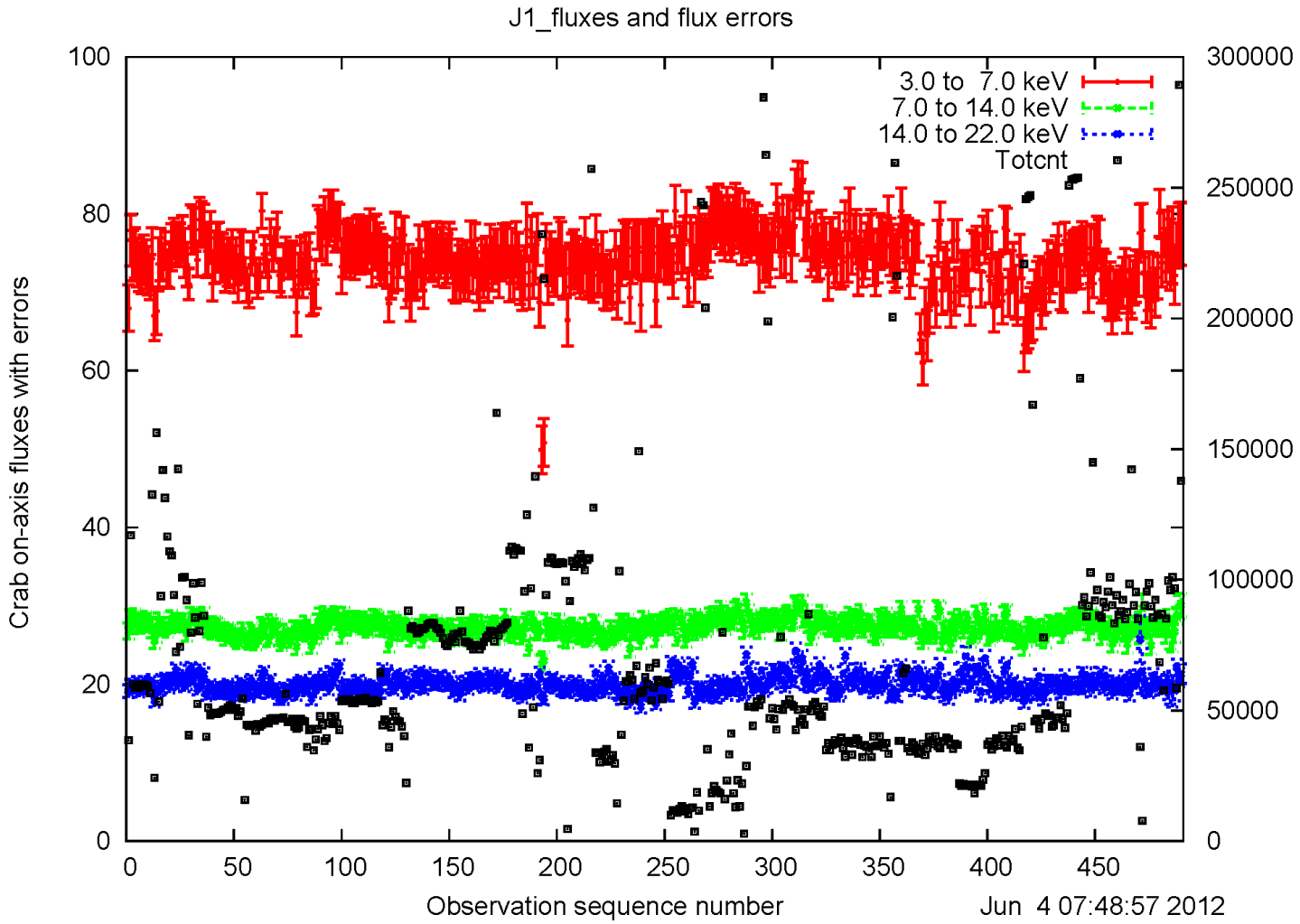
Fluxes and errors for the 3 search bands

701 SCWs for JEM-X1



Fluxes and errors for the 3 search bands

480 SCWs for JEM-X2



Conclusions

- I have apparently not understood how to calculate sensible errors. What did I do wrong with the chi-square normalization?

- The estimated errors now appear as being too small. Can you suggest ways to analyze the data which could help us determine better scale factor values for the two JEM-X units?