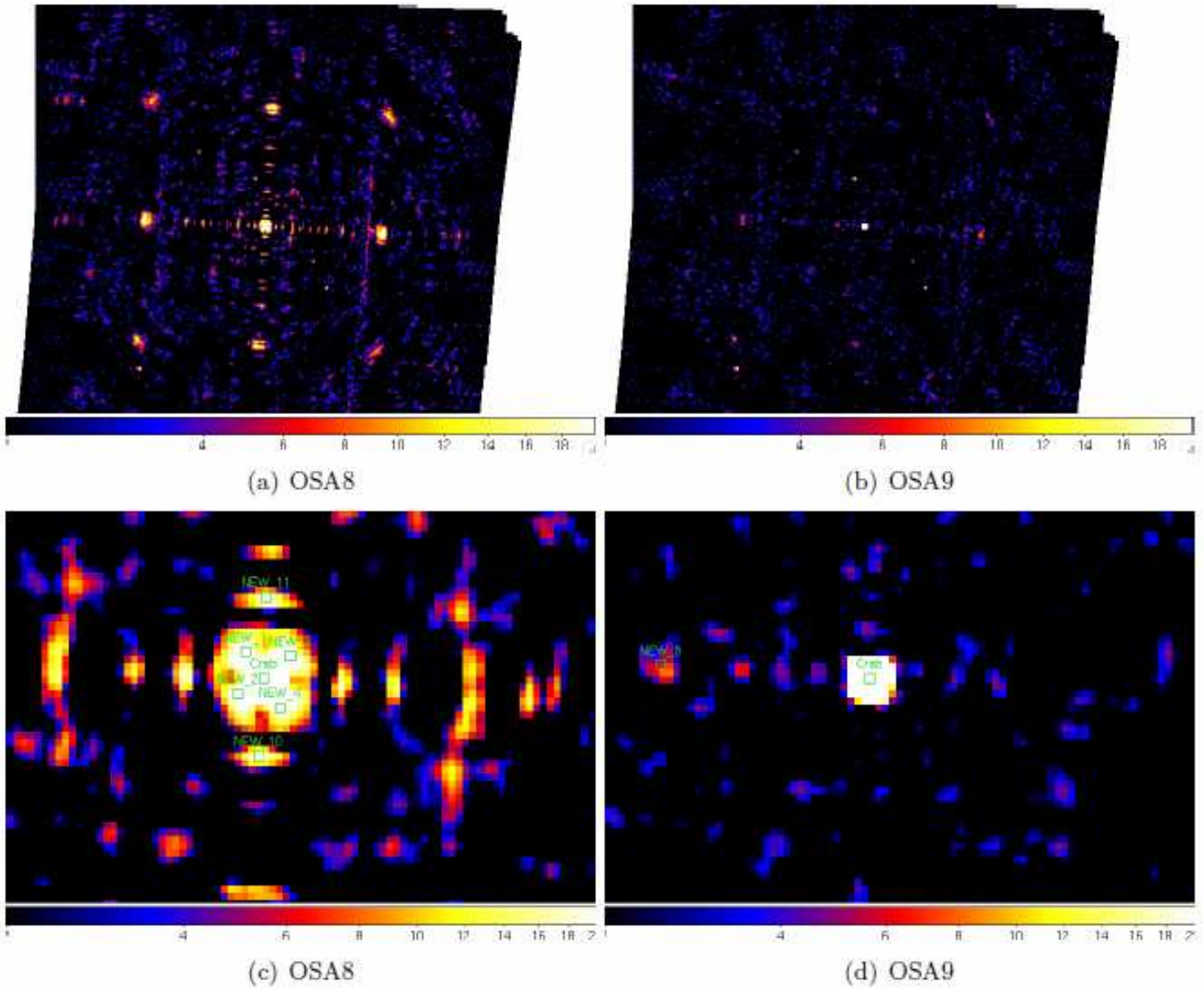
OSA-8 + Ghost buster
(*OSA-9*)
tests

Isabel Caballero, Andrea Goldwurm, Alexandra Gros,
François Lebrun, Lionel Prat, Jérôme Rodriguez,
Simona Soldi, and Juan A. Zurita Heras

Bright isolated sources: Crab and Sco X−1



(a) OSA8 (b) OSA9

(c) OSA8 (d) OSA9

Figure 1: *Top:* Significance map of the Crab region in the energy range 18–40 keV, scaled between 2 and 20σ. OSA 8 results are shown on the left, OSA 9 results on the right panels. *Bottom:* Zoom centred on Crab.

Bright isolated sources: Crab and Sco X−1

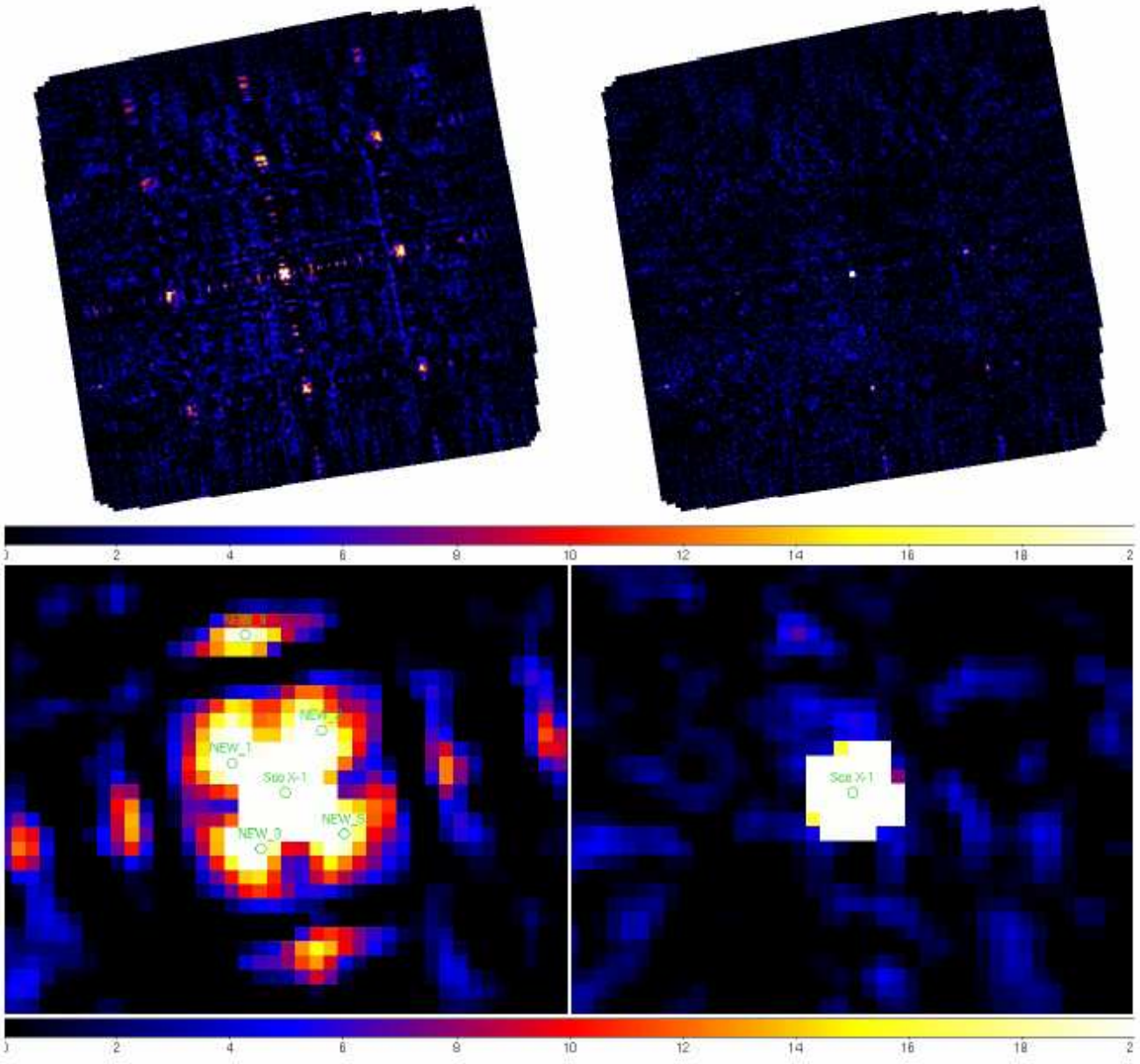


Figure 2: *Top:* Significance map of the Sco X−1 region in the energy range 18–40 keV, scaled between 0 and 20σ. OSA 8 results are shown on the left, OSA 9 results on the right panels. *Bottom:* Zoom centred on Sco X−1.

Bright sources: Crab and Sco X-1

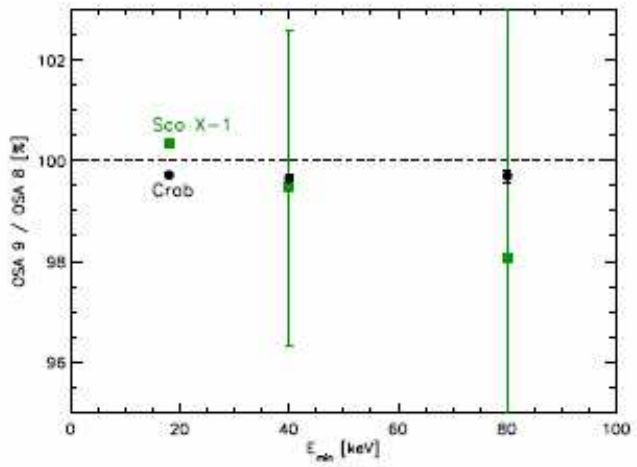
Significance

	Crab		Sco X−1	
	OSA8	OSA9	OSA8	OSA9
18–40 keV	4400.4	4387.7	2949.3	2959.8
40–80 keV	2497.9	2489.1	45.1	44.9
80–150 keV	1125.2	1121.9	6.5	6.3

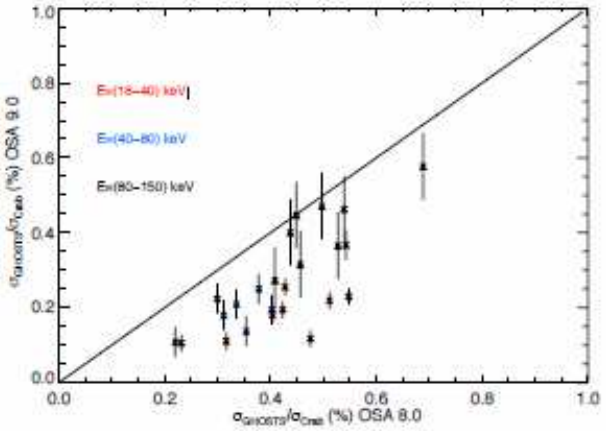
Localization accuracy

Offset [”]	Crab	Sco X−1
OSA8	4.7	4.9
OSA9	4.6	4.6

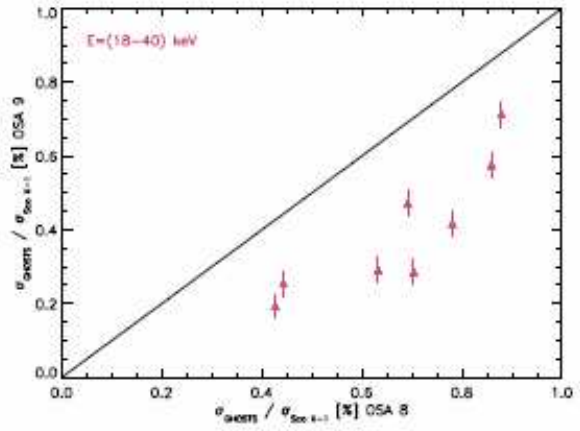
Bright isolated sources: Crab and Sco X−1



(a) $\sigma_{\mathrm{OSA9}}/\sigma_{\mathrm{OSA8}}$ of Crab and Sco X−1



(b) $\sigma_{\mathrm{ghost}}/\sigma_{\mathrm{Crab}}$ OSA 9 vs 8



(c) $\sigma_{\mathrm{ghost}}/\sigma_{\mathrm{ScoX-1}}$ OSA 9 vs 8

Figure 3: *Top:* Significance ratio OSA 9 over OSA 8 versus energy for the Crab and Sco X−1. *Bottom:* Ghosts significances normalized to the source significance in each energy bands for the Crab (left) and in the 18–40 keV band for Sco X−1 (right).

Crab spectrum

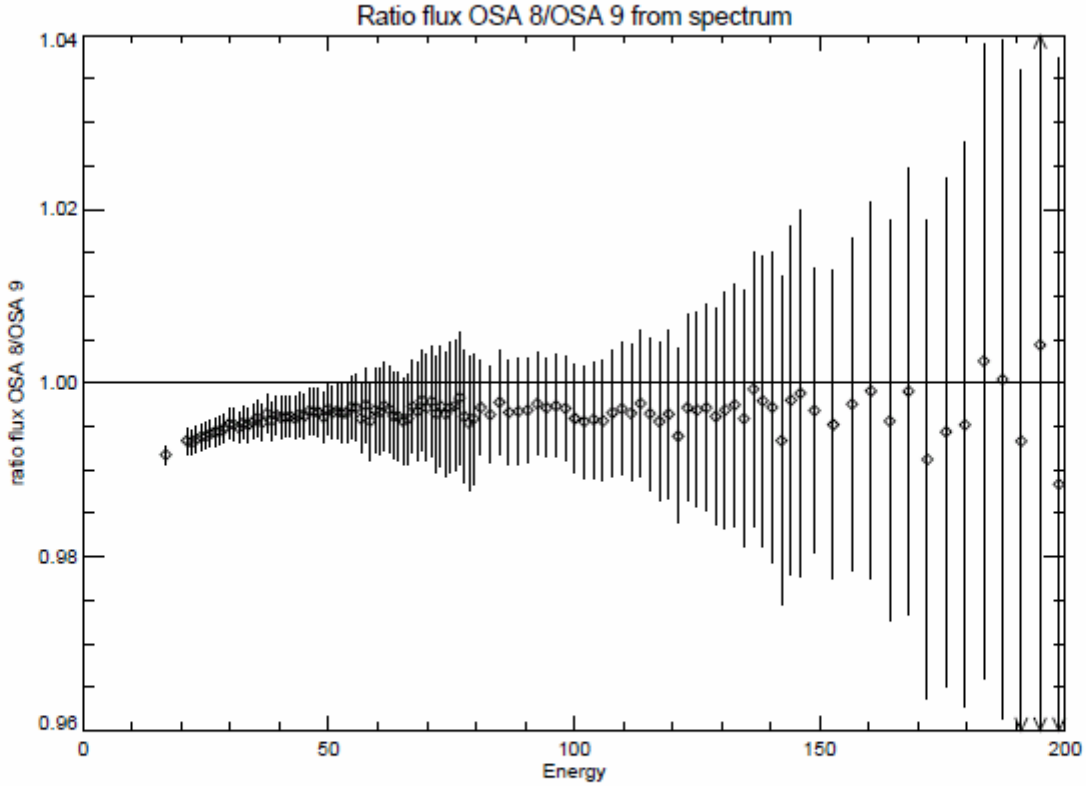


Figure 5: Ratio between the Crab spectra extracted with OSA 8 and OSA 9.

Crab light curve

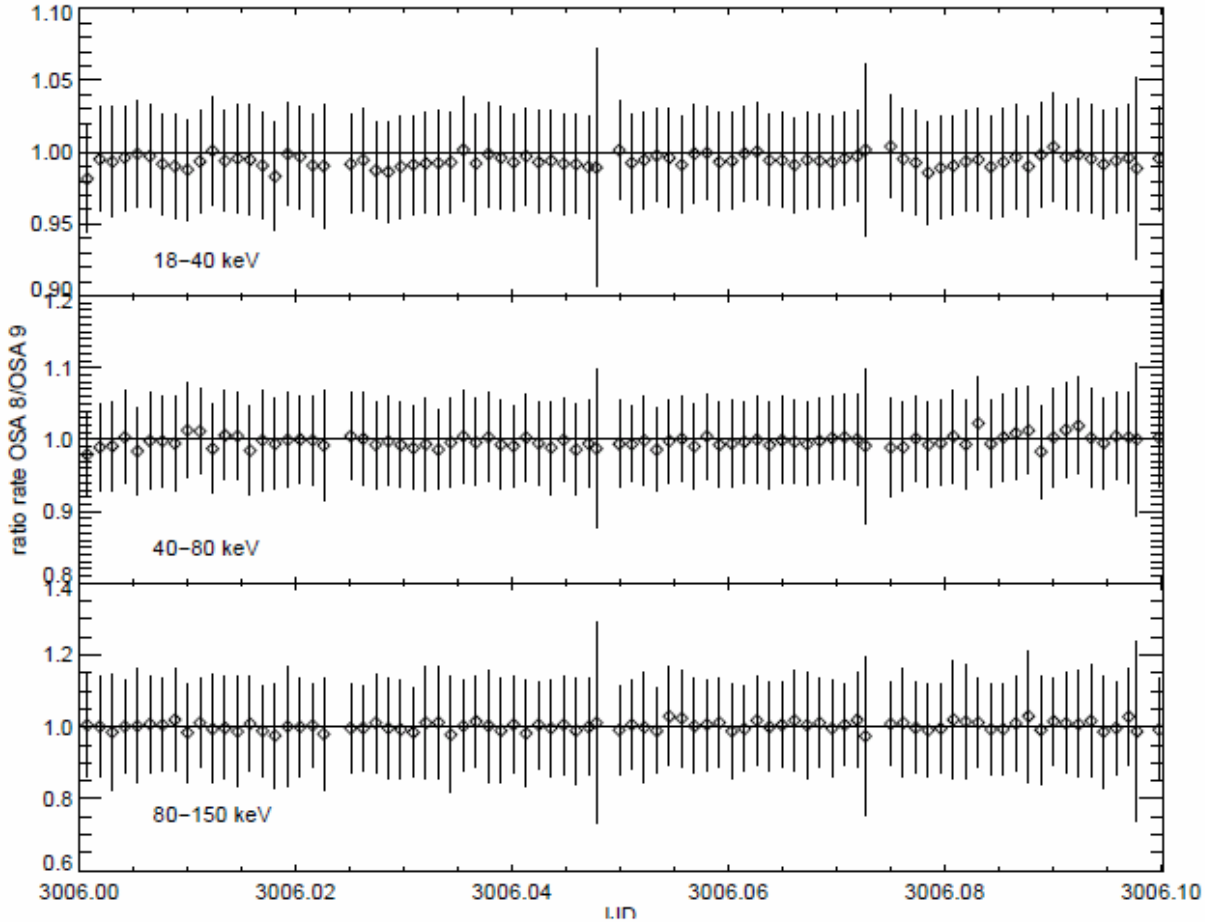
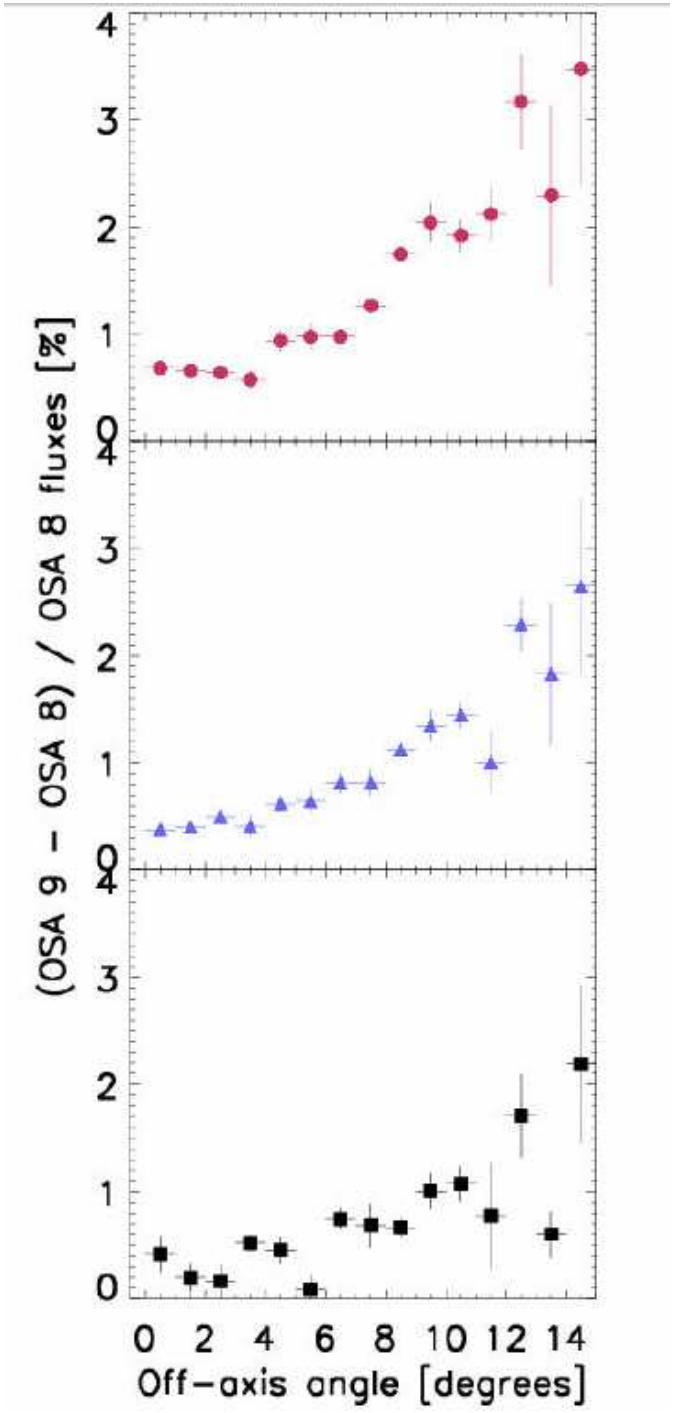


Figure 6: Crab light curve (bin step of 100 s) in rev. 665 in the 18–40 (top), 40–80 (middle) and 80–150 keV (bottom) energy ranges.

Crab off axis

Figure 7: Dependence of the (FOSA 9−FOSA 8)/FOSA 8 flux ratio on the off-axis angle for Crab observations. Every point represents the average of the results from the analysis of 10 ScW. From the top to the bottom, results for the 18–40, 40–80 and 80–150 keV bands are reported.



Isolated bright sources: summary

- OSA 9 significantly improves the imaging for bright and isolated sources;
- The source significance in mosaics decreases in average by < 1%;
- The ratio (ghost)/(source) decreases down to 50%
- The source flux increases with OSA 9 up to 1% and 4% with respect to OSA 8 in the 18–40 keV band, when the source is in the FCFOV and PCFOV, respectively. This effect decreases with increasing energy.

Crowded fields: cleaner images

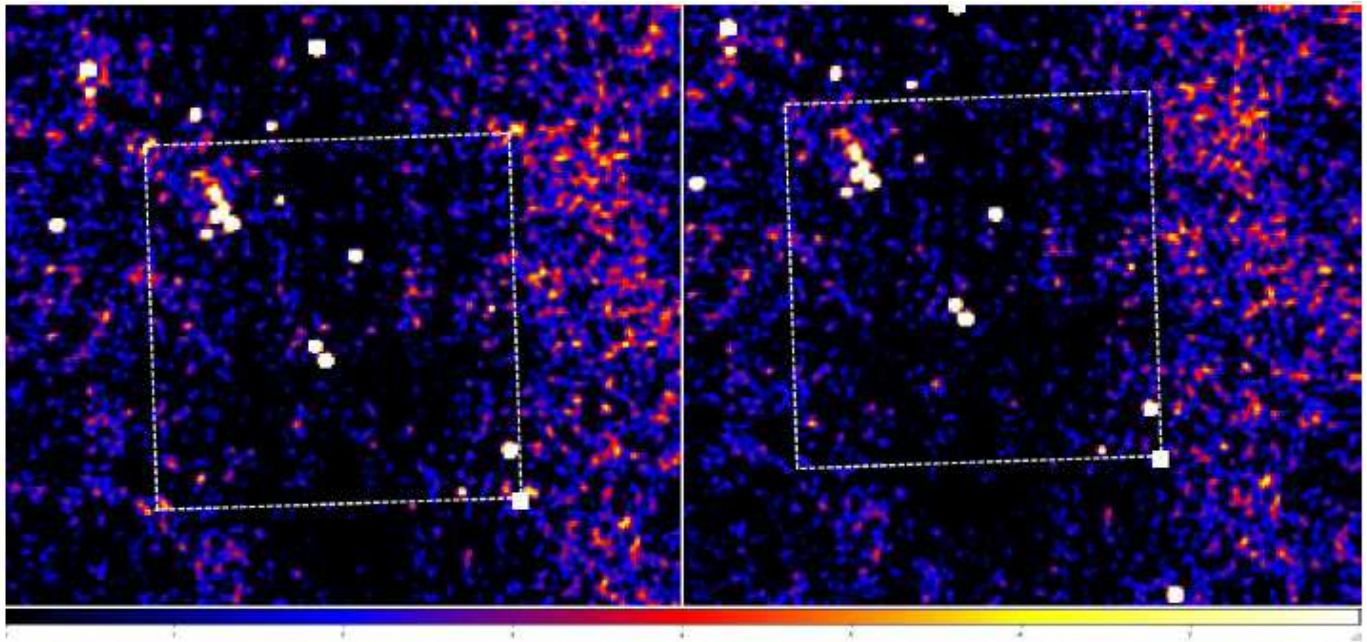


Figure 9: 18–40 keV significance maps of the Galactic centre with scale 0–8σ zoomed on the field of 4U 1700−377. The dashed box (size 10.6°) emphasizes the position of 4U 1700−377 (corner bottom-right) and its ghosts. *T*op to bottom: Tests 1a–d. *h*Left: OSA 8, and *r*ight: OSA 9.

Conclusions for OSA-8 + Ghost buster

- Concerning the bright sources both isolated and in crowded fields (e.g. Crab, Sco X-1, GRS 1915+105), we conclude that there is a significant improvement in the images obtained
- The images are cleaner, with the significance of the main ghosts decreased by up to 50%. The significance of the sources is slightly decreased, and their flux increased, as expected.
- We therefore recommend the release of OSA 9 only together with the new NOMEX correction map

the following advices should be made to the general user

- OSA 9 brings significant improvements over OSA 8 for the imaging of bright sources, and the search of faint sources in the regions around bright sources. No striking results are observed on short exposures and concerning the ghost cleaning of fainter (< 80 − 100) sources, therefore only minor improvements are expected for survey type works, aiming to detect faint sources in deeply exposed fields. If the user is not interested in any of this kind of analyses, there is no need for him/her to install OSA 9.
- The user should do a standard run of OSA 9 and check the sources in the field of view.
- In case there are bright sources not included in the very bright source catalogue (e.g. transients that are bright in the analysed specific data set), they should be added to the very bright source list and OSA 9 should be run again.
- In addition, if a specific source is not detected at ScW level, then its ghosts will not to be cleaned with the standard software and therefore, also the use of ghost buster will not lead to any improvement. In this case, the OBS1 SearchMode parameter should be set to 3 and a user catalogue should be input through the CAT refCat parameter.
- We suggest to make the selection of very bright sources on the basis of their significance obtained in the analysis of the specific data set
- The user should be careful not to add too many sources to the very bright source list since this can lead to worse results in the images.