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GOLIA: an INTEGRAL archive @INAF-IASF Milano

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Abstract. We present the archive of the *INTEGRAL* data developed and maintained at INAF-IASF Milano. The archive comprises all the public data currently available (~8.5 years of data). The data are downloaded from the ISDC and a customized analysis is routinely performed on the IBIS/ISGRI data. The scientific products include individual pointing images and the associated detected source lists in several energy bands, as well as light-curves. Documentation and ad-hoc tools to browse and visualize the results have been developed. The whole database (raw data and products) enables a local and easy access to the hard X-ray long-term behavior of a vast sample of sources.

Key words. X-rays: general – Gamma rays: general – Methods: data analysis

1. Introduction

The INTErnational Gamma-Ray Astrophysics Laboratory, *INTEGRAL* (Winkler et al. 2003), is a medium-sized ESA mission successfully launched in October 2002. Its payload consists of two main γ–ray instruments, the spectrometer SPI (Vedrenne et al. 2003) and the imager IBIS (Ubertini et al. 2003), covering the 15 keV – 10 MeV band, two X–ray monitors JEM–X (4–35 keV, Lund et al. 2003) and an optical monitor OMC (Mas-Hesse et al. 2003).

To increment and ease the exploitation of *INTEGRAL* data at INAF-IASF Milano, we undertook the task of preparing and maintaining an *INTEGRAL* archive, GOLIA (Giant On-Line *INTEGRAL* Archive), which provides a local database of the available public data, and offers easy-to-browse IBIS/ISGRI (Lebrun et al. 2003) data products for a quick and efficient view of the hard X–ray sky, locally and interactively available at INAF-IASF Milano.

2. A walk through GOLIA

The archive *Owner* performs the following tasks: **downloads** all the *INTEGRAL* public data via the ISDC Data Centre for Astrophysics, Geneva[1]; using the official OSA 9.0 software package, performs **image reconstruction and analysis** for each pointing

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[1] http://www.isdc.unige.ch/integral/

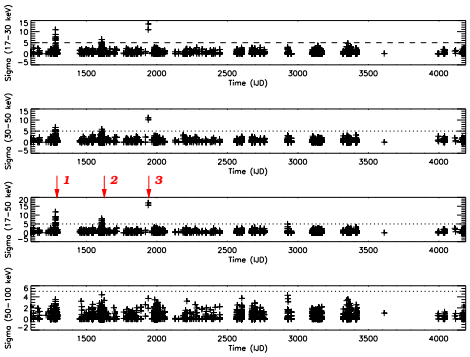

Fig. 1. ~2 ks bin light-curve of the transient IGR J11215−5952: 2442 pointings, 4.8 Ms. Jan 2003 (IJD~1107) to Jun 2011 (IJD~4190). Sigma ≧5 (horizontal line) is a detection. Arrow number 3 is related to the discovery outburst (Lubiński et al. 2005) while number 1 and 2 are the previously unnoticed outburst that we discovered thanks to GOLIA (Sidoli, Paizis & Mereghetti 2006).

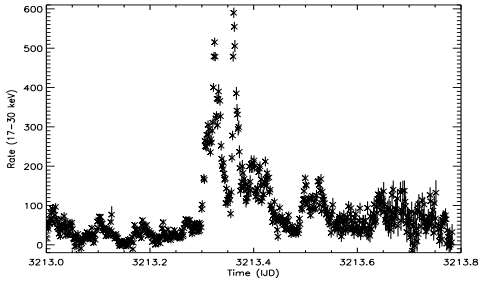

Fig. 2. 17–30 keV, 100 s bin light-curve of 4U 1700–377, 0.8 day zoom.

(~2 ks) in four energy bands (17–30, 30–50, 17–50 and 50-100 keV); performs **lightcurve extraction** in the 17–30 keV band with 100 s bins for the sources detected in the imaging step. A set of *ad-hoc* tools to browse through the results (for known and new sources) has been developed to ease the access to the archive. Figures 1 and 2 show examples of visualization of the data products.

The whole analysis was done on a single server HP ML330G6, openSUSE 11.4, two processors Xenon Quad-Core E5506, 2.13 GHz and RAM 8 GB (cost ~2300 Euro in June 2011), with 12 external 1 Tb disks (213 Euro/disk). Currently a total of 83733 pointings were analyzed, December 2002 to August 2011, ~8.5 years of data (~1.3 Tb for the products vs ~4.8 Tb for the data - excluding SPI). The IBIS/ISGRI analysis time of the 8.5 years of data has been about 8 months, while a parallel analysis on more servers will result in a much lower processing time. Quick visualization of the imaging results, tracing back recently discovered sources, personalized mosaics, 100 s bin light-curves on selected and vast datasets, etc., lead to new discoveries, ideas and collaborations. Once the setup is running, the maintenance and update of the archive is easy. Maps, light-curves, raw data, fits and ASCII files can all be accessed by the local *users*, enabling a personalized usage of the archive and triggering further detailed investigations. Long term light-curves can be easily extracted also by non-*INTEGRAL* experts (matter of a few seconds for the 2 ks binning) and a systematic view of different classes of sources can be performed, enabling interesting discoveries and trends as well as providing a complementary view with other on-going missions. A more detailed description of the archive, and its scientific outcome, has been recently submitted (Paizis et al.).

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References

Lebrun, F., et al. 2003, A&A, 411, L141
Lubiński, P., et al. 2005, The Astronomer's Telegram, 469
Lund, N., et al. 2003, A&A, 411, L231
Mas-Hesse, J. M., et al. 2003, A&A, 411, L261
Sidoli, L., Paizis, A., & Mereghetti, S. 2006, A&A, 450, L9
Ubertini, P., et al. 2003, A&A, 411, L131
Vedrenne, G., et al. 2003, A&A, 411, L63
Winkler, C., et al. 2003, A&A, 411, L1