Newsletter of the
INTEGRAL Science Operations Centre

No. 5 August 2002

Foreword

Christoph Winkler - Project Scientist

This is the last issue of the ISOC Newsletter before the launch of the INTEGRAL spacecraft scheduled for 17 October 2002.

The INTEGRAL spacecraft inside ESTEC's Large Space Simulator during the thermal vacuum test (Summer 2002).

The spacecraft flight model test programme was finished on schedule, all planned tests of the satellite were completed and the spacecraft has left the Netherlands for the Baikonur Cosmodrome in Kazachstan. Further important highlights of the programme since January 2002 were the scientific calibration of the payload (see below) and a number of successful flight acceptance reviews for scientific instruments and the spacecraft, and the readiness review for the ground segment. After arrival in Baikonur, key activities prior to launch include mating the spacecraft with the launcher, a number of additional functional tests and launcher preparations.

Loading of the payload module of the INTEGRAL spacecraft on Amsterdam airport for transport to the Baikonur launch site by Antonov 124 (23 August 2002) .

There have been some changes to ISOC personnel since the last ISOC newsletter #4 was issued (Jan. 2002). Due to private circumstances, Christoph Winkler is now temporarily working on a part-time scheme, and he is therefore supported in his tasks as Project Scientist by Rudolf Much (Deputy Project Scientist) and Arvind Parmar (Acting Project Scientist, Astrophysics Mission Division, SCI-SA). Astrid Orr (previously a contractor) accepted an ESA staff position - but remains at ISOC. ISOC welcomes new members of the scientific/engineering team, namely Erik Kuulkers, Tim Oosterbroek and Rees Williams.

The ISOC Newsletter is published by the INTEGRAL Science Operations Centre, Research and Science Support Department of ESA, ESTEC, Noordwijk, The Netherlands. See also http://astro.estec.esa.nl/Integral/isoc

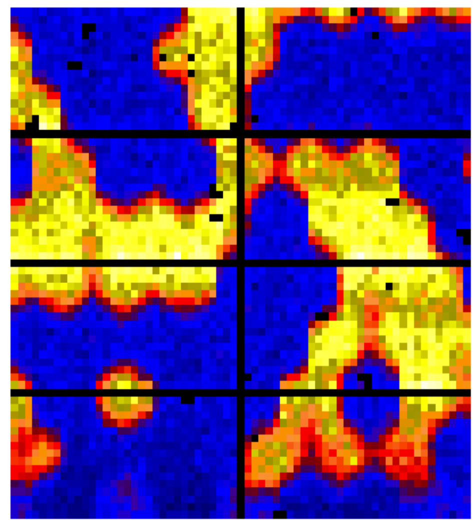
The Scientific Calibration of the Payload

Rudolf Much - Deputy Project Scientist

The calibration of the INTEGRAL instruments were carried out at unit, instrument and system level. The gamma-ray instruments SPI, IBIS and the X-ray monitor JEM-X were first calibrated at detector level using radioactive sources, X-ray generators or accelerator beams. A ground calibration campaign at instrument level was performed for SPI during April 2001 at the CEA centre of Bruyères le Châtel (France). Once integrated on the satellite a system level calibration for all instruments was performed at ESTEC from January 23 to February 6, 2002. The system level calibration had special importance for IBIS and JEM-X, because these instruments only achieved the final flight configuration (detector and mask) at this stage.

During the calibration campaign the instruments were in general operated as close as possible to in-orbit condition and in flight-representative configuration. Calibration runs were made with different radioactive sources covering the energy range from 59.5 keV to 2.75 MeV. The calibration was complemented by measurements using an X-ray generator. The sources were placed on-axis and at seven different off-axis angles. This ensured the measurement of the instrument response over a wide energy range and off-axis angle range.

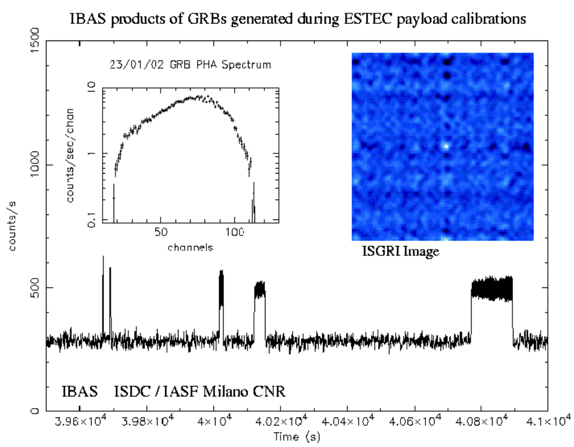
While the analysis of the calibration data is still ongoing, first results of the calibration data analysis are available. Meanwhile, the calibration data were also processed by the ISDC and were ingested into the ISDC archive. An important result was the first measurement of a predicted effect: the modulation of the photon flux from an off-axis source by the SPI mask. A shadowgram of the SPI mask is projected onto the IBIS detector if a source is located along the line of sight connecting the IBIS detector with the SPI mask (the combination of SPI mask and IBIS detector has been named the *SPIBIS* instrument). Due to the IBIS passive shielding this effect is only seen for strong sources > 300 keV. These criteria were fulfilled for the ^{24}Na source located ~40 degrees off-axis from the IBIS line of sight. The figure below shows a PICSIT image in the light of the ^{24}Na 1.37 MeV line. The structure in the image induced by the modulation of the photon flux by the SPI mask is clearly visible.



Shadowgram of the SPI mask recorded by IBIS/PICSIT. Source (^{24}Na) at ~40 degree off-axis (see text).

Using ray-tracing and the INTEGRAL mass model, the observed *SPIBIS* modulations will be modelled and verified using ground and in-flight calibration. This will provide a means of subtracting the modulation should an observation be performed when a bright source is detected in *SPIBIS*. In parallel, the ISOC has identified AO-1 observations which could potentially be affected by the *SPIBIS* problem. Appropriate observing times will be chosen for those observations: i.e. the position angle of the spacecraft will be such that there are no strong sources illuminating the IBIS detector through the SPI mask.

During part of the system calibration the INTEGRAL Science Data Center received the telemetry stream in real-time. A few artificial Gamma-ray Bursts were produced by switching on and off an X-ray generator during this period. The ISGRI data have been analyzed in real time by the INTEGRAL Burst Alert Software (IBAS) running at the ISDC. The IBAS software triggered on the GRB's and produced an image and light curve as shown below.



Artificial GRB during payload system calibration using real-time link between spacecraft and ISDC: the ISGRI image shown uses data integrated over 10 seconds. The observed count rate corresponds roughly to about 0.7 Crab. During the longest burst interval (130 s) the fluence is estimated to about 1.5 x 10^{-6} ergs/cm^2 (15 - 70 keV)

Changes in the GRB Data Release Policy

Astrid Orr - Operations Scientist

The INTEGRAL Science Working Team has recently endorsed a change in the data release policy on Gamma Ray Bursts (GRBs). The purpose of this change is to facilitate coordinated observations with a rapid response. According to the current AO-1 policy the event data from a GRB are treated in the same way as a Target of Opportunity (TOO) event. In other words, the PI will receive the data corresponding to a GRB detected during General Programme or Core Programme pointed observations. The GRB locations and trigger times will be publicly available, thanks to the rapid INTEGRAL Burst Alert System (IBAS, operated at the ISDC).

Recent discussions between ISDC staff and the science operations team for XMM-Newton in the context of XMM-Newton follow-up observations of GRBs showed that XMM-Newton (and also probably Chandra) operations staff would prefer to receive some advance information on burst flux and duration. They use an estimate of the GRB flux to check if they can obtain a useful spectrum with XMM-Newton before deciding to change their mission planning. Large flux uncertainties arise in the case of GRBs due to the exponential decays and our poor knowledge of the relationship between gamma and X-ray fluxes. ISDC believes that both 1) the number of counts integrated over the burst and 2) the duration should be given in the IBAS alert. Those numbers are easy to calculate in real time from the data and do not involve any calibration. Using a simple scaling law, the XMM-Newton team (or whoever is interested) could then get a rough idea of the flux of the burst. In addition, information on the duration of the burst may also be an interesting parameter in combination with the strength of the X-ray afterglow.

Without any information on burst flux or duration, XMM-Newton would not be able to react in time to burst alerts from INTEGRAL. The INTEGRAL Science Working Team has agreed to publicly release information on GRB fluxes and durations in addition to the already public data on GRB locations and trigger times. The details concerning the energy range for the flux values and the definition of the GRB durations are still under discussion and information will be provided in due time.

The AO-1 Short Term & Long Term Plan

Paul Barr - Resident Astronomer

During the routine operations, all INTEGRAL scientific observations are pre-planned. The observation start times and durations are timed to the nearest second. Planning is done on a revolution-by-revolution basis (i.e. in three-day segments)

The short term plan

Detailed planning is possible up to five weeks in advance, since that is when the exact ground station availability is known. Once a schedule is created, the ISOC will post a summary on the WWW. This will contain information such as source name, coordinates, start time and duration. This has two purposes: an INTEGRAL observer can see when his/her observation will be performed, and any astronomer would be able to perform coordinated observations with other facilities. In addition, the web page will be updated, e.g. as an observation flips from 'scheduled' to 'successfully observed', and thus publicly tracks the history of the mission.

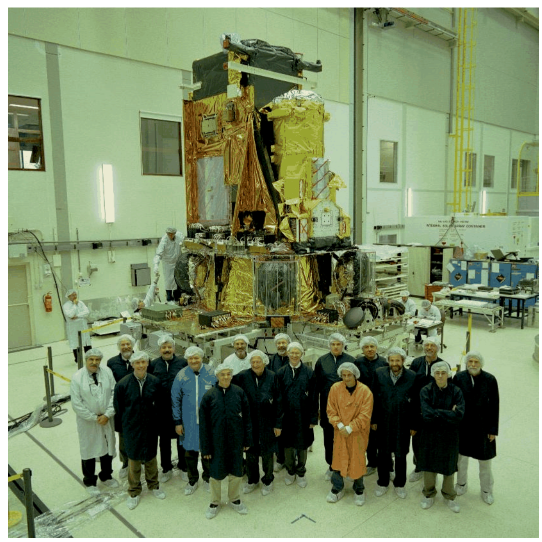
The current **draft** short term plan for the revolutions #25 (27 Dec. 2002) up to #37 (03 Feb. 2003) is shown in Table 2 on page 6 below. Note that here is still some uncertainty associated with the end of the Performance & Verification (PV) observations, currently assumed to be 26 December 2002. The plan will be available on the ISOC WWW pages.

The long term plan

Although it may be very difficult for observers to organize large-scale coordinated observing programmes with other facilities, ISOC intends to support the planning of these observations on a best effort basis. The long term plan is mainly driven by target visibility and shall be used to optimize the observing strategy. In principle the entire mission could be planned a year to some detail in advance (with the caveat of minor perturbations due to lack of knowledge of exact ground station coverage). However, experience has shown that this can be very unreliable. Perturbations to such a plan in the real world - e.g. re-planning for a target of opportunity, or because a planned exposure failed - soon propagate into the future. Thus a detailed long-term plan may soon become inaccurate. Although this is less so for known fixed time observations, e.g. the GPS. We will publish a long term plan on the ISOC WWW later this year, however, observers planning co-ordinated observations should always consult the short term plan for latest updates.

Any Other Business

A brochure on INTEGRAL (ESA BR-189) can be obtained, free of charge, from the ISOC; a PDF version can be found on the INTEGRAL WWW. Also, the August 2002 issue of the ESA Bulletin will be specially devoted to INTEGRAL. Please contact http://esa-pub.esa.int/bookshop/epdgi.html .



Members of the INTEGRAL Science Working Team (ISWT) at ESTEC (26 March 2002) visiting INTEGRAL.

Job Opportunity at ISOC

There is an opening for 2 Research Fellows in the area of high-energy astrophysics. Preference will be given to candidates who are interested in data analysis from the INTEGRAL mission (to be launched on 17 October 2002) and also from XMM-Newton. The positions are based at ESTEC, the Technology and Science Centre of ESA in Noordwijk, The Netherlands. Fellowships are initially awarded for a period *of one year, with the possibility of an extension to a maximum duration of two years.*

INTEGRAL will provide unprecedented imaging and spectral resolution in the gamma-rays as well as concurrent X-ray and optical monitoring. The INTEGRAL Science Operations Center (ISOC) is based at ESTEC and is responsible for the scheduling of the INTEGRAL observing programme and support to the Project Scientist. The ISOC scientists are also expected to undertake research. The selected candidates are expected to work closely with members of the ISOC or X-ray group at ESTEC. The scientific interests of the team cover everything from coronal plasmas, pulsars, X-ray binaries, to Active Galactic Nuclei. In addition, there is a complete archive of all the BeppoSAX public data (more than 1000 observations, many of which are unpublished) and close links to the XMM-Newton team here at ESTEC and at Vilspa. The team was very successful in obtaining XMM-Newton observing time in both the AO-1 and AO-2 observing rounds.

We offer a competitive salary and excellent working conditions. There is normally money available for Fellows to go to a couple of overseas conferences a year plus other travel as necessary. A Ph.D., or equivalent, plus a good publication record are the pre-requisites to be considered for an RFship and you have to be a citizen of an ESA member, or cooperating state. You can find out more about the Fellowship program under:

http://www.esa.int/hr/indexeduc.html

If you would like to find out more please contact Arvind Parmar (aparmar@rssd.esa.int) or Christoph Winkler (cwinkler@rssd.esa.int). If you are interested in applying, then the next step is to fill in the expression of interest form which you can find under:

http://ssd.esa.int/resources/staffvacancies/staffvacanciesmain.htm

and submit it to:

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http://astro.estec.esa.nl/Integral/isoc
E-mail:*name*@rssd.esa.int
(*name* = first initial and surname, max 8 characters)
ISOC helpdesk: inthelp@rssd.esa.int

Table 1: ISOC personnel

Name	**Function**	**Phone**	**Mailcode**
Winkler, C.	Project Scientist	3591	SCI-SD
Parmar, A.	Acting Project Scientist	4532	SCI-SA
Much, R.	Deputy Project Scientist	4756	SCI-SDG
Hansson, L.	ISOC Manager	3471	SCI-SDG
Sternberg, J.	System Engineer	4001	SCI-SDG
Nolan, J.	Operations Engineer	3401	SCI-SDG
Barr, P.	Resident Astronomer	5139	SCI-SDG
Orr, A.	Operations Scientist	3943	SCI-SDG
Kuulkers, E.	Operations Scientist	6145	SCI-SDG
Oosterbroek, T.	Operations Scientist	3612	SCI-SDG
Dean, N.	Software Engineer	3959	SCI-SDG
Greenwood, S.	Software Engineer	5084	SCI-SDG
Jacobs, F.	Software Engineer	4507	SCI-SDG
Jeanes, A.	Software Engineer	4246	SCI-SDG
Treloar, J.	Software Engineer	4528	SCI-SDG
Williams, O.R.	Software Engineer	4645	SCI-SDG
Riemens, M.	Secretary	4754	SCI-SD

Table 2: INTEGRAL AO-1 Short Term (Draft) Plan[a]

Revol. #	Start Date	Source	Source RA (J2000)	Source Dec (J2000)	Proposal # PI
25	27 Dec. 2002	SN 1987A	05 38 28.3	-69 15 03	120148 Knödlseder
26	30 Dec. 2002	GPS start gal. longitude = 129^o -> stop gal. longitude = 73^o			Core Programme ISWT[b]
		3C 273	12 29 6.7	+02 03 09	120023 Courvoisier
		GPS start gal. longitude = 310^o -> stop gal. longitude = 253^o			Core Programme ISWT
		SN 1987A	05 38 28.3	-69 15 03	120148 Knödlseder
27	02 Jan. 2003	SN 1987A	05 38 28.3	-69 15 03	120148 Knödlseder
28	05 Jan. 2003	GPS start gal. longitude = 123^o -> stop gal. longitude = 83^o			Core Programme ISWT
		3C 273	12 29 6.7	+02 03 09	120023 Courvoisier
		GPS start gal. longitude = 305^o -> stop gal. longitude = 270^o			
		SN 1987A	05 38 28.3	-69 15 03	120148 Knödlseder
29	08 Jan. 2003	SN 1987A	05 38 28.3	-69 15 03	120148 Knödlseder
30	11 Jan. 2003	SN 1987A	05 38 28.3	-69 15 03	120148 Knödlseder
31	14 Jan. 2003	GPS start gal. longitude = 309^o -> stop gal. longitude = 269^o			Core Programme ISWT
		3C 273	12 29 6.7	+02 03 09	120023 Courvoisier

Table 2: INTEGRAL AO-1 Short Term (Draft) Plan[a]

Revol. #	Start Date	Source	Source RA (J2000)	Source Dec (J2000)	Proposal # PI
31	14 Jan. 2003	GPS start gal. longitude = 128^o -> stop gal. longitude = 83^o			Core Programme ISWT
		SN 1987A	05 38 28.3	-69 15 03	120148 Knödlseder
32	17 Jan. 2003	SN 1987A	05 38 28.3	-69 15 03	120148 Knödlseder
33	20 Jan. 2003	GPS start gal. longitude = 93^o -> stop gal. longitude = 133^o			Core Programme ISWT
		GPS start gal. longitude = 274^o -> stop gal. longitude = 313^o			Core Programme ISWT
		Vela region	08 52 48.0	-44 35 6.0	Core Programme ISWT
34	23 Jan. 2003	NGC 4945	13 05 0.0	-49 28 4.8	120047 Deluit
35	26 Jan. 2003	GPS start gal. longitude = 280^o -> stop gal. longitude = 319^o			
		GPS start gal. longitude = 88^o -> stop gal. longitude = 139^o			
		2CG 135+01	02 40 31.9	+61 13 48.0	120232 Tavani
36	29 Jan. 2003	2CG 135+01	02 40 31.9	+61 13 48.0	120232 Tavani
		Vela region	08 52 48.0	-44 35 6.0	Core Programme ISWT
37	01 Feb 2003	GPS start gal. longitude = 334^o -> stop gal. longitude = 267^o			Core Programme ISWT
		GPS start gal. longitude = 87^o -> stop gal. longitude = 155^o			Core Programme ISWT
		Cas A	23 51 43.0	+62 03 54.0	120125 Vink

a. The current version will be made available on http://astro.estec.esa.nl/Integral/isoc
b. ISWT = INTEGRAL Science Working Team