INTEGRAL
Status & Outlook

Kloster Seeon Workshop, 26-30 May 2003

Christoph Winkler
INTEGRAL Project Scientist, ESA-ESTEC
Christoph.Winkler@rssd.esa.int
INTEGRAL at ESA-ESTEC, one year ago

- Launch, orbit, spacecraft
- Instruments
- Some selected first results
- Outlook and future
INTEGRAL Launch
Baikonur, Kazakhstan, 17 October 2002, 04:41 UTC

Today: 221 days in orbit

- Compact Objects
  - WD, NS, BHC, GRB
- Stellar Nucleosynthesis
  - SNe, Novae, AGB, WR
- Galactic Structure
  - Cloud regions, mapping cont/line emission, ISM
- Galactic Centre

- Galaxies, Clusters, AGN
- Seyferts, Blazars, CDB
- Transrel. pair plasmas, Jets
- Identification of h.e. sources
- Unexpected Discoveries
Orbit injection performed by Russian 4-stage PROTON launcher with highest precision

Four perigee raise burn manoeuvres and one apogee adjust manouevre by s/c onboard propulsion system

Perigee raised from 651 km to 9050 km
### 72 h-Orbit
(Parameters @ Begin of Mission)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Achieved</th>
<th>Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perigee height (km)</td>
<td>9050</td>
<td>9000</td>
</tr>
<tr>
<td>Apogee height (km)</td>
<td>153657</td>
<td>153600</td>
</tr>
<tr>
<td>Inclination (deg)</td>
<td>52.2</td>
<td>51.6</td>
</tr>
</tbody>
</table>
Spacecraft status – only excellent news

- All subsystems: fully functional, high level of performance, no loss of redundancy.

- **Lifetime:** High margins on on-board fuel and power with full redundancy lead to lifetime expectation well above 5 years (design lifetime).

- **Observation time and efficiency:** Slew performance (large angles): spec’d accuracy = 5% of slew angle, actual accuracy = <0.5%.

- **Pointing stability** is one order of magnitude better than specified.

- Available **power** higher than spec’d -> large SAA (40 deg) will be maintained also during eclipse season and beyond nominal mission duration (L + 26 months) -> enhanced sky visibility
Ground Segment

- Mission Operations Centre (s/c and p/l commanding, safety and health) nominal

- Science Ops Centre (mission planning) nominal

- Science Data Centre (data processing and off-line science analysis) nominal

- Ground Stations Redu and Goldstone nominal, Goldstone (DSS-16): some coverage problems in early mission phase. Short (but ~ frequent) TLM gaps gave problems for SPI and PICSIT histogrammed data. Recent improvement.
Radiation Monitor: Proton flux, orbit adjustment

SREM count rates, decoded data

Count rates [1/sec]

October 2002

November

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
Radiation Monitor: Perigee Passage and critical altitude for instrument operations.
SPI – The gamma-ray Spectrometer on INTEGRAL.
Excellent spectra, good images.

OMC – Optical Monitor Camera.
• Fine spectroscopy of narrow lines
• Diffuse emission on > deg scales.
• 20 keV to 8 MeV
• 19 Ge detectors @ 90 K,
• E/ΔE ~500.
• 16° fully coded FOV. Angular resolution 2° FWHM
• 1300 kg
• PI Institutes: CESR Toulouse (F) and MPE Garching (D)

IBIS – The gamma-ray Imager onboard the INTEGRAL satellite. Excellent Imaging, good spectra.
• Source identification and monitoring in X-rays
• 3 –35 keV X-ray monitoring
• Microstrip Xe gas detectors
• 5° degree FOV with 3’ spatial resolution
• Energy resolution of 15% at 10 keV
• 65 kg
• PI institute: DSRI (Dk)

JEM-X - The Joint European X-ray Monitor
• Accurate point source imaging and location.
• Broad lines and continuum.
• 15 keV – 10 MeV
• 16384 CdTe (ISGRI), 4096 CsI (PICsIT) detectors. E/ΔE ~10.
• 9°x 9°degree fully coded FOV. Angular resol 12’ FWHM
• 630 kg
• PI Institutes: IAS Roma (I), CEA-Saclay (F), ITESRE – Bologna (I)

OMC
• Optical monitoring of high-energy sources
• 500 – 600 nm wavelength range
• CCD (2048 x 1024 pixels)
• 5° x 5° FOV, 20” imaging
• 17 kg
• Sensitivity: 18.2 mag in 1000 s
• PI Institute: INTA/LAEFF (Esp)

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
Instrument status

Spectrometer SPI

• Activation of complex instrument very smooth (outgassing, active cooling to 90K, HV switch on)
• Excellent energy resolution, consistent with pre-launch values
• Sensitivity at different energies consistent or within factor ~2 of that expected

SPI status and first results: see next talk by Jürgen Knödlseder
Instrument status (cont’d)

- Smooth activation of complex instrument (16384 CdTe and 4096 CsI pixels)
- Excellent spatial resolution, consistent with pre launch values
- Sensitivity for both detectors (ISGRI – low energies, PICSIT – high energies) very close to pre-launch predictions.
- Low energy threshold ISGRI 14 keV

Imager IBIS
IBIS point source location

Expected PSLA vs S/N (see IBIS SPR)

Cyg X-3 offsets

Cyg X-1 offsets

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
Instrument status (cont’d)

OMC nominal and fully compliant with spec

JEM-X: loss of some anodes on $\mu$-strip detectors early in the mission, possibly caused by heavy CR ions.

Lower HV minimizes further losses and allows JEM-X operating throughout entire mission.

One out of two detectors is being used for science (Crab calibration: both in parallel).

Lower anode HV: low energy threshold ~4.5 keV (3 keV pre-launch), AO-1 sensitivity @ 6 keV reduced by 40%.

Crab: on-board selection criteria optimized leading to efficiency gain < 10 keV, sensitivity improvement.

Otherwise, JEM-X performs as expected.
## INTEGRAL observatory schedule

<table>
<thead>
<tr>
<th>2003</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Launch 17 Oct 2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument activation and check-out</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance and verification (PV) phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commissioning phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV phase - public data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AO-1 cycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPI annealing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crab calibration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### We are here

- **Cygnus region and empty fields.** Instrument low energy calibration and tuning. Instrument team data.
- **Crab nebula and pulsar.** Instrument high energy calibration and tuning. Public data.
Cyg X-1 simultaneous observations (only 4 weeks after launch)!

- Remarkably good agreement at very early mission phase.
- Indicates that ground calibration is fairly representative of in-flight calibration.
- ISDC s/w can reliably process spectral data from coded mask instruments.

Credit: K. Pottschmidt (ISDC), IBIS & SPI teams.
GRB’s in FOV

• 6 Gamma-ray bursts detected in ~6 months
  • GRB 021125
  • GRB 021219
  • GRB 030131
  • GRB 030227
  • GRB 030320
  • GRB 030501

• Pre-launch estimate: ~ 10-20 per year
### GRB’s in FOV

<table>
<thead>
<tr>
<th>GRB</th>
<th>Radius of error box</th>
<th>∆t, GCN</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRB 030227</td>
<td>5 arcmin</td>
<td>1 h, #1895</td>
</tr>
<tr>
<td>20 s</td>
<td>3 arcmin</td>
<td>3.5 h, #1896</td>
</tr>
<tr>
<td>Peak flux</td>
<td>6x10^{-8} erg/cm²/sec</td>
<td></td>
</tr>
<tr>
<td>(25-100) keV</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GRB 030227**  
20 s  
Peak flux 6x10^{-8} erg/cm²/sec  
(25-100) keV

**GRB's in FOV**

- **IBIS/ISGRI, (15-40) keV, 15 sec**
- **SPI, (20-200) keV, 18 sec**

---

*Kloster Seeon Workshop, 26-30 May 2003*  
*Christoph Winkler*
GRB 030227 – follow-up

- **Kiso** (2.1 h after event): R, I, V, B u.l.: 20.1m – 21.7m (GCN #1920/1900)
- **XMM** (~ 10 h after event): S1(A), EPIC/pn count rate 0.2 cts/sec (GCN #1901)
- **Isaac Newton Telescope** counterpart (12.2 hrs after event): R = 23.3m (GCN #1904)
- **Keck II** (Feb 28.24): R ~ 23.5m (GCN #1907)
- **Isaac Newton Telescope** fading counterpart (Feb 28.95): R < 24.2m (GCN #1915)
- **Keck II** (Mar 1.25): S1 (A) continues to fade ~ t-1 (GCN #1910)

Keck II, GCN #1907, Soderberg et al.
GRB 030227 (cont’d)

IBIS, PL index = 1.85 +/- 0.2

SPI, PL index = 1.92 +/- 0.3

S. Mereghetti et al., 2003 (submitted)
GRB 030227 (XMM afterglow obs.)

XMM afterglow lightcurve, $F \sim t^{-0.97}$
S. Mereghetti et al., 2003

XMM, PL $\sim 2.1$

P. Den Hartogh/SRON Utrecht

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
GRB’s in FOV (cont’d)

<table>
<thead>
<tr>
<th>GRB</th>
<th>Radius of error box</th>
<th>$\Delta t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRB 030501</td>
<td>3 arcmin</td>
<td>IBAS: 10 sec</td>
</tr>
<tr>
<td>Avge flux: 5-10 Crab</td>
<td></td>
<td>GCN #2183</td>
</tr>
<tr>
<td>$\Delta t$ = 4.3 hrs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- $\Delta t = 20$ sec: TAROT counterpart? (R~15 mag, 3'', GCN 2188)
- Wise obs., 16.5 hrs, Ru.l. = 20 mag, GCN 2201
- CrAO obs., 18.8 hrs/2.8d, u.l. 20 mag, GCN 2202
IBAS performance

Performance of IBAS localizations of GRBs

- Internal IBAS Alerts
- Distributed after off-line analysis:

030131
021125
030227
030320
030501
021219
030501

Error radius (arcmin)

Seconds after GRB start

10^{-1}  10^0  10^1  10^2  10^3  10^4  10^5  10^6

S.Mereghetti – 5/3/2003

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
INTEGRAL galactic plane scans

Sensitivities (3σ) per pointing (2200 sec):

JEM-X: 3 mCrab @ 10 keV, IBIS: 10 mCrab @ 100 keV, SPI: 500 mCrab @ 1 MeV
Kloster Seeon Workshop, 26-30 May 2003

Christoph Winkler

IBIS team

Mosaic of 11 pointings (24200 sec), IBIS/ISGRI, 15-40 keV

GPS scan (29 Jan 2003)

\[ \Delta \Delta l = 270^{\circ} - 337^{\circ} \]

4U 1630-47, BHC
First TOO follow-up observation (PI: J. Tomsick) on 1 & 2 Feb 2003, 300 ksec

IGR J16318-4848

First new (transient) source detected by INTEGRAL (IBIS/ISGRI) during GPS at Jan 29.271 UT (IAUC # 8063).
First new (transient) source detected by INTEGRAL (IBIS/ISGRI) during GPS at Jan 29.271 UT (IAUC # 8063). Outside JEM-X FOV.

- R.A. = 16h31m52s, Decl. = -48°48'.5 (equinox 2000.0; error ~ 2'). Source flux (15-40 keV): 50-100 mCrab. The source was observed to vary significantly on a timescale of 1000 s.

More INTEGRAL data obtained during (1st) TOO follow-up observation of 4U 1630-47, IGR source ~ 1 deg off (PI: Tomsick, 1-2 Feb 2003): variable, sometimes fainter than 10 mCrab.

2nd INTEGRAL source (IGR J16320-4751) detected (IAUC #8076).

- RXTE follow-up (2 Feb): 3 mCrab, position possibly not consistent. Prelim search in archival BeppoSax WFC data: no detection ~ mCrab.

- XMM follow up observation (25 ksec, 10 Feb, IAUC # 8072): Highly absorbed variable source consistent with INTEGRAL position.
IGR J16318-4848 (cont’d)

- ASCA archival data (1994) detection of highly absorbed source at a level of ~ 2 mCrab, hint of iron line emission (IAUC #8070)

- Clear source detected in 2MASS all-sky q/l archive consistent with ASCA and XMM position: J=10 mag, H and K = 9 mag (1 mag error). Digitized Sky Survey (II) search reveals I-band counterpart, and Ru.I. of 21 mag. Midcourse Space Experiment (MSX5C catalogue) with 0.45 Jy @ 8 microns. Heavily absorbed source (IAUC #8076).
IGR J16318-4848 (cont’d)

M. Revnivtsev et al., astro-ph/0303274, 12 March 2003:

- Multiwavelength analysis suggests that IGR J16318-4848 is an X-ray binary enshrouded by a dense envelope, possibly a wind-fed HMXB similar to GX 301-2.

- First representative of previously unknown population of highly absorbed galactic X-ray sources?

**Fig. 5.** Broadband spectrum of IGR J16318-4848. Crosses represent the measured fluxes of the source in infrared bands. Filled circles represent the source flux, corrected for the galactic reddening with $A_v = 13$, open circles with $A_v = 20$. The dotted and dashed curves represent a rough approximation of the near infrared points by a Planck spectrum with effective temperatures 3000 K and 20 000K respectively.

M. Revnivtsev et al., astro-ph/0303274, 12 March 2003
GRS 1915+105

• Black hole in binary system
• 12 kpc (~ 40,000 Ly)
• Mass ~ 14 solar masses > Black Hole!
• Jets (1st galactic microquasar)

VLA, 3.5 cm, Mirabel & Rodriguez (1994)
GRS 1915+105, 43 ksec mosaic
(PI: D. Hannikainen)

15-40 keV

40-100 keV

D. Hannikainen & J. Rodriguez

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
GRS 1915+105, Lightcurve

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler

D. Hannikainen & S. Brandt
10 new IGR sources detected by INTEGRAL, ...so far....
10 new IGR sources detected by INTEGRAL, ...so far....

- **IGR J16318-4848**, Jan 29, during GPS scan (IAUC #8063) – see previous discussion
- **IGR J16320-4751**, Feb 1, during 4U 1630-47 follow-up (IAUC #8076)
- **IGR J19140+098**, Mar 6, during GRS 1915+105 observation (IAUC #8088)
- **IGR J17464-3213**, Mar 21, BHC (ATEL #132), VLA radio counterpart detected (Apr 1, IAUC #8105), IGR source = H1743-322 (HEAO, last outburst 1977)

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
10 new IGR sources cont’d

- IGR J17091-3624, **Apr 14**, during pointed/GCDE, 20 mCrab > 40 mCrab, softening of hard spectrum (ATEL 149)
- IGR J18539+0727, **Apr 17**, GPS + GRS1915 obs, 20 mCrab (15-100) keV (ATEL 151)
- IGR J18325-0756, **Apr 23**, GCDE, 10 mCrab (15-40 keV), 5 mCrab (!) (40-100) keV >> 40/25 mCrab >> 10/5 mCrab within 5 days (ATEL 154)
- IGR J17597-2201, **Apr 29**, GCDE, 5 mCrab (15-40) keV, 5-10 mCrab variations Mar 30-Apr 24 (ATEL 155). IGR source = XTE J1759-220: NS in short-period binary (ATEL 156)
- IGR J18483-0311, **May 2**, GCDE, 10 mCrab (15-40 keV), 5 mCrab (40-100 keV). Possible outburst to 40 mCrab on Apr 26. 20 mCrab @ 4-18 keV (JEM-X)
Near the Galactic Centre

IBIS/ISGRI
100 ksec
(15-40) keV

3 transient systems in outburst

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
Crab lightcurve

Kloster Seeon Workshop, 26-30 May 2003
Christoph Winkler
IBIS shadowgrams of Crab pulsar (33 ms)
### Executed AO-1 observations
(30 Dec 2002 – 25 May 2003, revolutions #26 - #74)

<table>
<thead>
<tr>
<th>Target</th>
<th>ksec</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR 2251-178</td>
<td>170</td>
<td>Orr</td>
</tr>
<tr>
<td>SN 1987A (LMC, LMC X-4, PSR B0540-69)</td>
<td>1080</td>
<td>Amalgamated (Knoedlseder, Mereghetti, Lutovinov, Kanbach)</td>
</tr>
<tr>
<td>3C 273</td>
<td>240</td>
<td>Courvoisier</td>
</tr>
<tr>
<td>SN 1006</td>
<td>250</td>
<td>Reynolds</td>
</tr>
<tr>
<td>Cas A/Tycho SNR</td>
<td>190</td>
<td>Amalgamated (Vink, Decourchelle)</td>
</tr>
<tr>
<td>Coma Cluster</td>
<td>510</td>
<td>Vikhlinin</td>
</tr>
<tr>
<td>4U 1630-47 (TOO)</td>
<td>300</td>
<td>Tomsick</td>
</tr>
<tr>
<td>XTE J1720-318 (TOO)</td>
<td>178</td>
<td>Goldwurm</td>
</tr>
<tr>
<td>Crab (calibration)</td>
<td>1500</td>
<td><strong>Public data</strong></td>
</tr>
</tbody>
</table>
## Executed AO-1 observations (cont’d)
(30 Dec 2002 – 25 May 2003, revolutions #26 - #74)

<table>
<thead>
<tr>
<th>Target</th>
<th>ksec</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRS 1915+105</td>
<td>300</td>
<td>Hannikainen</td>
</tr>
<tr>
<td>Centaurus A</td>
<td>152</td>
<td>Rothschild</td>
</tr>
<tr>
<td>Aql X-1 (TOO)</td>
<td>330</td>
<td>Molkov</td>
</tr>
<tr>
<td>Perseus Cluster</td>
<td>100</td>
<td>Hornstrup</td>
</tr>
<tr>
<td>XTE J1550-564 (TOO)</td>
<td>190</td>
<td>Lewin</td>
</tr>
<tr>
<td>XT 1741-322 (TOO)</td>
<td>443</td>
<td>Parmar</td>
</tr>
<tr>
<td>SS 433 + Ser X-1</td>
<td>500</td>
<td>Amalgamated (Cherepashchuk, Palazzi)</td>
</tr>
<tr>
<td>Cygnus region + Cyg X-2</td>
<td>84</td>
<td>Amalgamated (Di Salvo, Knödlseder)</td>
</tr>
<tr>
<td>X1916-053</td>
<td>15</td>
<td>Bazzano</td>
</tr>
</tbody>
</table>
## Executed AO-1 observations (cont’d)

(30 Dec 2002 – 25 May 2003, revolutions #26 - #74)

<table>
<thead>
<tr>
<th>Target</th>
<th>ksec</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mrk 509</td>
<td>72</td>
<td>Fabian</td>
</tr>
<tr>
<td>Mrk 273</td>
<td>100</td>
<td>Dermer</td>
</tr>
<tr>
<td>Mrk 231</td>
<td>100</td>
<td>Mirabel</td>
</tr>
<tr>
<td>NGC 4736</td>
<td>100</td>
<td>Della-Ceca</td>
</tr>
<tr>
<td>NGC 4151 + NGC 4395 + NGC 4258</td>
<td>122</td>
<td>Amalgamated (Zdziarski, Dean)</td>
</tr>
<tr>
<td><strong>GRS 1915+105 (TOO)</strong></td>
<td>200</td>
<td>ISWT</td>
</tr>
<tr>
<td><strong>GPS</strong></td>
<td>710</td>
<td>ISWT (core time)</td>
</tr>
<tr>
<td><strong>GCDE</strong></td>
<td>1940</td>
<td>ISWT (core time)</td>
</tr>
</tbody>
</table>

### Today, 26 May: NGC 4151
# Long term planned (fixed time) observations

<table>
<thead>
<tr>
<th>Date</th>
<th>Target</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>3C 273</td>
<td>CourvoisieR</td>
</tr>
<tr>
<td>June</td>
<td>3C 279</td>
<td>Collmar</td>
</tr>
<tr>
<td>August</td>
<td>Sco X-1</td>
<td>v.d. Klis/Stella</td>
</tr>
<tr>
<td>August</td>
<td>Galactic Centre</td>
<td>Sunyaev/Goldwurm</td>
</tr>
<tr>
<td>Sep</td>
<td>Centaurus A</td>
<td>Rothschild</td>
</tr>
<tr>
<td>Oct</td>
<td>GRS 1915+105</td>
<td>Hannikainen</td>
</tr>
<tr>
<td>Oct</td>
<td>0716+714</td>
<td>Wagner</td>
</tr>
<tr>
<td><strong>Every 12th day</strong></td>
<td><strong>GPS scans</strong></td>
<td><strong>ISWT</strong></td>
</tr>
</tbody>
</table>
Future important events

AO-2, release: 15 July 2003, proposals due: 01 September 2003

Astronomy & Astrophysics INTEGRAL Special: Instrument description, calibration and first scientific results (Dec 2003)

5th INTEGRAL Workshop, 16 – 20 Feb 2004, Munich, Germany

- First circular distributed 03 March
- Abstracts due 01 November
The Future

- INTEGRAL operations funded until 16 Dec 2004
- Mission extension via request to SPC for funding
- Presentations to AWG & SSAC (Oct 03), SPC (Nov 03)
- Scientific approach (CP, open time, ISWT role) under study
- If extension approved, ISOC moves to Vilspa/Spain (locations of ESA’s SOC’s)
INTEGRAL - Conclusions

- Spacecraft is in great shape.
- Instruments work nominally. Expected performance very close to pre-launch predictions.
- Commissioning and PV phase completed successfully and on schedule.
- Observing programme is in full swing.
- First very exciting scientific data are coming in, more will come.
- INTEGRAL was proposed to ESA in 1989 – 14 years ago. Hardware development started 1995. We have enjoyed moments of great excitement and have overcome periods of great difficulty.
- Today, INTEGRAL is in space, a great gamma-ray observatory for the scientists world-wide.