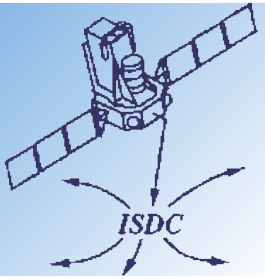
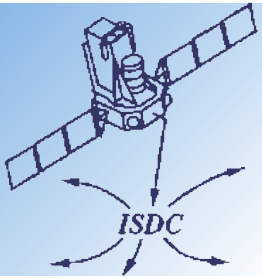
Offline Scientific Analysis



- **Overview**
- **OSA building blocks**
- **Possibilities & limitations**
- **Outlook to the future: OSA 4.2 and 5**

The big picture



Science data
Housekeeping
Auxiliary data
Calibration data

Instrument Configuration

Catalog(s)

User inputs

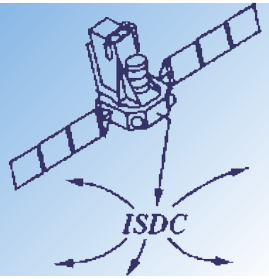
Technical Processing
telemetry decoding, auto-calibration, time stamps, (corrections, GTIs, deadtimes)

Scientific Analysis
(corrections, GTIs, deadtimes), catalogs, background, binning, image deconvolution, source search, source spectra, source lightcurves

Images, Source Lists, Spectra, Light Curves

FTOOLS, XSPEC, XRONOS, private S/W
further analysis, model fitting, ...

OSAs Role



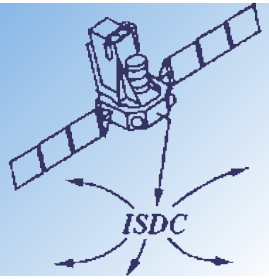
What OSA software is supposed to do

- Reduce & deconvolve INTEGRAL scientific data.
- Provide correct fluxes in images, spectra and lightcurves useable for further analysis.
- Allow reasonable customization of analysis.

What OSA software does ***not*** attempt

- ✗ Deep image analysis.
- ✗ Spectral model fitting.
- ✗ Timing analysis (period search, FFT, ...).

Building blocks



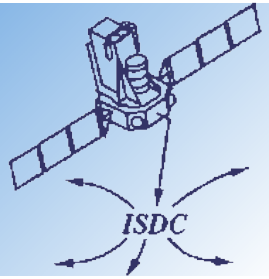
Analysis Executables

- Parameter-driven programs (FTOOLs) in C/C++/F90.
- Largely *instrument specific software*, written by the hardware teams or ISDC, plus generic tools.

Analysis Scripts

- 'Glue' to tie together executables, select correct calibration data and serve as front-end (also GUI).
- Written as C/C++ code using **isdcroot**.
- Parameter files as for executables, but also GUI definition.

Behind the scenes



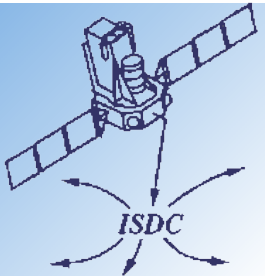
Support software libraries

- DALxxx libraries for data access (general, instruments, housekeeping, auxiliary data, ...).
- PIL for parameter handling.
- RIL for log messages.

isdcroot

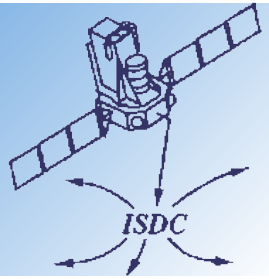
- Variant of CERN's ROOT.
- C/C++ interpreter.
- ISDC libraries built in (good prototyping tool).
- Methods to call scripts & executables.

Development & Maintenance



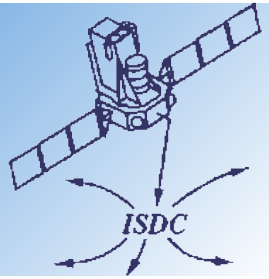
- Joint development of ISDC and instrument teams. Still considerable effort to keep up with improvements in deconvolution and changes for better user support.
  OSA 4.1: 165 software deliverables.
- Major releases about twice a year with full tests and documentation updates. Minor releases as required by important s/w updates.
- Operating Systems: Solaris, Linux.
  Looking into Mac OS/X support.

Achievements



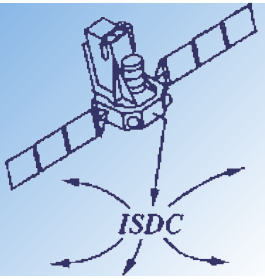
- Working analysis software to obtain images, source fluxes, spectra and lightcurves while handling *INTEGRAL* specifics: coded masks, long observations, dithering.
- First scientific results soon after launch.
- Scientific results obtained for weak sources (down to few mCrab).
- Absolute timing verified to ~0.2 ms.

Limitations



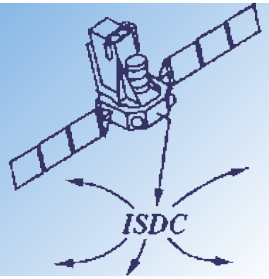
- ✗ Remaining significant systematic effects in reconstructed fluxes, esp. off-axis effects.
- ✗ Energy responses (ISGRI, JEM-X) Crab-fudged but imperfect.
- ✗ Intercalibration not settled.
- ✗ Background handling still relatively rough.
- ✗ Limited support for time resolved analysis.
- ✗ Several generic tools not fully mature.
- ✗ User friendlyness only adequate.

OSA 4.2 plans



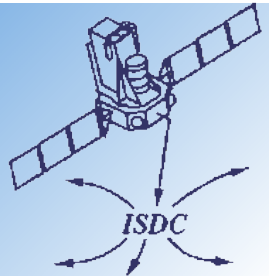
- **Release end October / begin November**
- **General**
  - Generic tools improved & better documented.
  - Support for simplified directory structure for all instruments.

OSA 4.2 plans



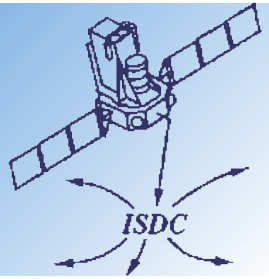
- **IBIS**
  - Improved ISGRI energy response.
  - Improved background correction.
  - More robust spectral extraction for weak and off-axis sources in ISGRI.
  - PICsIT spectral extraction and response?
- **SPI**
  - No major changes for this release

OSA 4.2 plans



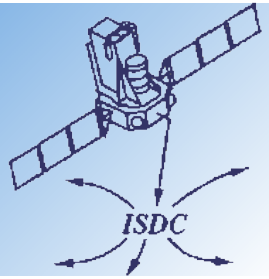
- **JEM-X**
  - Further improved gain corrections.
  - Regularized, non-skewed shadowgrams.
  - Updated responses with corrected areas.
- **OMC**
  - Flux calculation significantly improved for difficult cases (OSA 4.1).
  - More details (e.g. assumed PSF) in output data.
  - Automatic images for trigger mode data.

OSA 5 plans



- **Release March 2005**
  - Removal of NAG dependence.
  - Newer version of ROOT used.
- **IBIS**
  - Phase resolved spectroscopy, period search
  - Compton analysis?
- **SPI**
  - Phase resolved spectroscopy.

OSA 5 plans



- **JEM-X**
  - Major update of imaging capabilities: fine resolved images, mosaics, IROS, better fluxes.
  - Improvement of flux reconstruction in general.
  - Map of used & problematic pixels.
  - Updated background models, better usage.
- **OMC**
  - Support for single source analysis and fine tuning of source position by user.