INTEGRAL/IBIS Calibration Update

IBIS detector assembly:
- two stacked detection planes, lateral and bottom veto anticoincidence, passive tungsten shield

Collection area ~ 3000 cm²

Two-Layers detector:
1) 2mm thick CdTe (ISGRI)
2) 30mm thick CsI (PICsIT)

Field-of-view: ±14.5°FWZR (± 4.5°fully coded)

Lorenzo Natalucci, INAF/IASF-Roma

3rd IACHEC Meeting, Schloß Ringberg May 18-21 2008
Operating nominally since end of PV phase, ~5.5 years (all devices are ok), will soon enter AO-6 Programme execution

Highlights mainly from point sources observations: takes advantage of the large FOV and high angular resolution of IBIS (12’)

Constantly increasing number of sources in IBIS survey database: status by Oct 2007: 460 sources

**ISGRI INSTRUMENT PERFORMANCE**

Imaging performance is as expected: e.g. 1.8’ position error in ISGRI for $10\sigma$ source (verified on survey data against position of known sources)

Spectral performance is nominal, a better *gain calibration* and improved *charge loss correction*, implemented in OSA-7 software package, allows to reconstruct better quality spectra

Crab observations used to verify *response stability* and to correct for narrow band gain variations (broadband spectra are stable throughout the mission)
ISGRI GAIN CALIBRATION

ISGRI pixels gains are corrected vs variations against time, temperature and space environment conditions (using rates of the IREM particle counters)

Lower threshold drift correction, better low energy performance

Background spectrum for ISGRI reconstructed with OSA7 (spectrum from empty field observations during revolution 96 (effective exposure 36.4 ks)

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GAIN STABILITY

The performance of the gain correction can be checked by measuring corrected line energy positions, taken at different mission times.

ISGRI continuous gain decrease: on average ~3% /year

Background lines measured during Crab observations, 2ks pointings (comparison of data taken 3.1 years apart)

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OVERALL RESPONSE STABILITY

ISGRI Crab rates in broad energy channels are constant throughout the mission.

Minor, residual variations cause unwanted systematic deviations in the energy channels when building spectra: this effect is measured on the Crab and compensated by time dependent ARFs.

Good $\chi^2$ values can be obtained for sources as strong as the Crab or Cyg X-1 with corrected response and assuming average systematic error of $\sim 1$-$2\%$.
UPDATE AND OPEN ISSUES ON CRAB SPECTRA MODELLING

Improved model for charge loss, applied to the Crab count rate spectra yields evidence for either a break or curved shape.

A spectral break is best found around 100 keV, slope below this energy is ~2.13: normalization at 100 keV and low energy shape are very similar to SPI ones.

There are difficulties to constrain the high energy index, residual systematics do not allow an accurate absolute measurement. Index is taken from SPI measurement and response calibrated accordingly.

Work in progress: achieve better model at higher energies.
The IBIS Crab spectrum composed by ISGRI data from rev. 300 (net time: 30ks) and PICsIT data from revolutions 39-45 (net time: 563 ks).

\[ \Gamma_1 = 2.09 \pm 0.02, \]
\[ \Gamma_2 = 2.29 \pm 0.05 \]
\[ E_{br} = 96 \text{ keV} \]