44th SDAST meeting 05/2012

- OSA news:
  - OSA10 webpage now online for internal usage (UMs)
  - we are preparing OSA10-alpha version on login machines. It includes all the software already delivered.
  - For JEM-X is missing only j_ima_iros, but this has the major impact on the software.
- Open points for ISDC wrt to JemX software:
  - j_ima_iros
  - at present is necessary to run different times the analysis to obtain different bins for images, spectra and lc. We would like to avoid this! Would it be possible?
  - how are the signifcances in output in mosaic step and SPE computed? (discrepant values)
  - j_ima_iros_lc would be very important for JEM-X analysis!!
- JEM-X data in HEAVENS

OSA 10 documentation (preliminary)

http://www.isdc.unige.ch/integral/download/osa_doc-10.0

OSA 10-alpha (preliminary)

/unsaved_data/osa_int/current-Linux32.csh
/unsaved_data/osa_int/current-Linux64.csh

ln -s /isdc/arc/rev_3/scw
ln -s /isdc/arc/rev_3/ic
ln -s /isdc/arc/rev_3/idx
ln -s /isdc/arc/rev_3/aux
ln -s /isdc/arc/rev_3/cat

setenv COMMONLOGFILE +common.log
setenv COMMONSCRIPT 1
setenv ISDC_REF_CAT "/isdc/arc/rev_3/cat/hec/gnrl_refr_cat_0033.fits"
source /unsaved_data/osa_int/current-Linux32.csh
setenv REP_BASE_PROD $PWD

JEM-X documentation

sources located there will be less reliable as is reflected in the relative error of the flux determination.

6.6.3 The Mosaic Image

The IMA2 level produces JEM-X mosaic images by combining all the individual *j_ima_iros* images from the different science windows gathered in the observation group. The combined images have longer exposure time. As a consequence, weaker sources which are not visible in single ScW may appear in the mosaic images.

In what follows we consider an example of a JEM-X mosaic of the Galactic Center region for the revolution 0053 in March 2003. You can browse through the *INTEGRAL* data archive and check that within this revolution the pointings which have the Galactic Center within the JEM-X2 FOV are

```
scw/0053/005300410010.001/swg.fits[1]
scw/0053/005300420010.001/swg.fits[1]
scw/0053/005300490010.001/swg.fits[1]
scw/0053/005300510010.001/swg.fits[1]
scw/0053/005300580010.001/swg.fits[1]
scw/0053/005300590010.001/swg.fits[1]
scw/0053/005300650010.001/swg.fits[1]
scw/0053/005300660010.001/swg.fits[1]
scw/0053/005300670010.001/swg.fits[1]
scw/0053/005300680010.001/swg.fits[1]
scw/0053/005300740010.001/swg.fits[1]
scw/0053/005300750010.001/swg.fits[1]
scw/0053/005300760010.001/swg.fits[1]
scw/0053/005300820010.001/swg.fits[1]
```

Save the above list to the file `mos.lst`. To produce the mosaic image of these pointings you have first to create the corresponding observation group `mos` using the *og_create* tool, as has been explained above, and run the *jemx_science_analysis* up to the `IMA` level.

```
cd $REP_BASE_PROD
og_create idxSwg=mos.lst ogid=mos baseDir="./" instrument=JMX2
cd obs/mos
jemx_science_analysis startLevel="COR" \
   endLevel="IMA" jemxNum=2
```

Next, to produce the mosaic from the intensity images for each energy band you have to run the *jemx_science_analysis* script at `IMA2` level only:

```
jemx_science_analysis startLevel="IMA2" endLevel="IMA2" jemxNum=2
```

Again, do not forget to specify which of the JEM-X instruments you are interested in (`jemxNum=2` in our case). By default, "intensity" (RECONSTRUCTED), "variance", "significance" and "exposure" mosaic images will be produced.

The same result can be obtained calling `jemx_science_analysis` only once, from `startLevel="COR"` to `endLevel="IMA2"`, eventually skipping the intermediate levels with the command `skipLevels="LCR, SPE, BIN_S, BIN_T"`.

9 Known Issues and Limitations

1. The JEM-X lightcurves are deadtime corrected. DEADC in the lightcurve files are set to 1.0 (for XRONOS compatibility).

2. Due to changes of the on-board configuration, the detection efficiency has changed significantly several times during the mission history. In particular for pointings between revolutions 26 to 45, this means that the measured fluxes of stable sources – in particular at low energy – will strongly depend on the time when the data was taken. These changes are not corrected for in flux units (counts/dm2/s in the given energy interval) but taken into account in spectral responses.

3. The JEM-X detector gain varies significantly for a few hours after the instrument has been switched on. This mostly affects the beginning of each revolution but can also happen if the instrument was shut down, e.g., for solar flares. The pattern is very similar each time and modeled in the gain correction step even in complicated cases. Nevertheless, it could in principle fail, in which case linear-interpolation gain correction values would be used, which could lead to distorted spectra. Users are advised to check this possibility in case of highly unusual source spectra e.g. by consulting

   http://www.spacecenter.dk/~oxborrow/sdast/GAINresults.html

4. If the gain correction step fails then take a look at the gain history table. Gain correction failure is

probability to find a source in the depression caused by a neighboring source is highest. If a source is situated in such an indentation its peaksize is reduced accordingly, whereas there is no change for the source causing the feature. This is solely an image feature so *j_ima_iros* flux determinations are unaltered.

11. A count-limiting mechanism, the grey filter, is actived, when sources corresponding to more than 0.75 Crab on-axis are in the field of view. The grey filter is adjusting itself automatically, according to the rate of events accepted as X-rays and the filling level of the onboard telemetry buffer. Ideally, a grey filter should randomly reject events. However, the mechanism implemented is only pseudo-random. Therefore some care should be taken in interpreting power spectra of arrival times of events from very bright sources with a very significant grey filter, as QPO artifacts may show up. Normally, the automatic grey filter is varying over a science window. This fortunately has the effect of "averaging" out power spectra artifacts, as they are specific to a particular grey filter setting. Therefore, if noticing transient features in the power spectra of very strong sources it should be checked if this is limited to a period of a specific grey filter setting. Please check the User Manual for further explanations.

12. Since 30 March 2012, there is a new instance of the Instrument Model Group (IMOD files version 22) produced by the JEM-X Team. The usage of these new IMOD files is highly recommended, and will be automatic upon update of your copy of the Instrument Characteristics files. Note however that the data are fully reliable only above 5 keV.

for sources in the individual science windows. The cleaning process excludes (known) source areas. It operates horizontally and vertically since the systematics are strongest in these directions. However, adding many images can amplify the effect of an unnoticed source since the distribution of position angles is quite narrow, in particular for the sources near the galactic center, which is also where the

detection significances

an example for GX 3+1

- results (residuals) from a std mosaic run (in 5 scw):

  jmx2_obs_res.fits (scw): 21.33, 35.47, 54.23, 74.73, 63.56 (in 3-7-11-20—3-10-20 keV?)

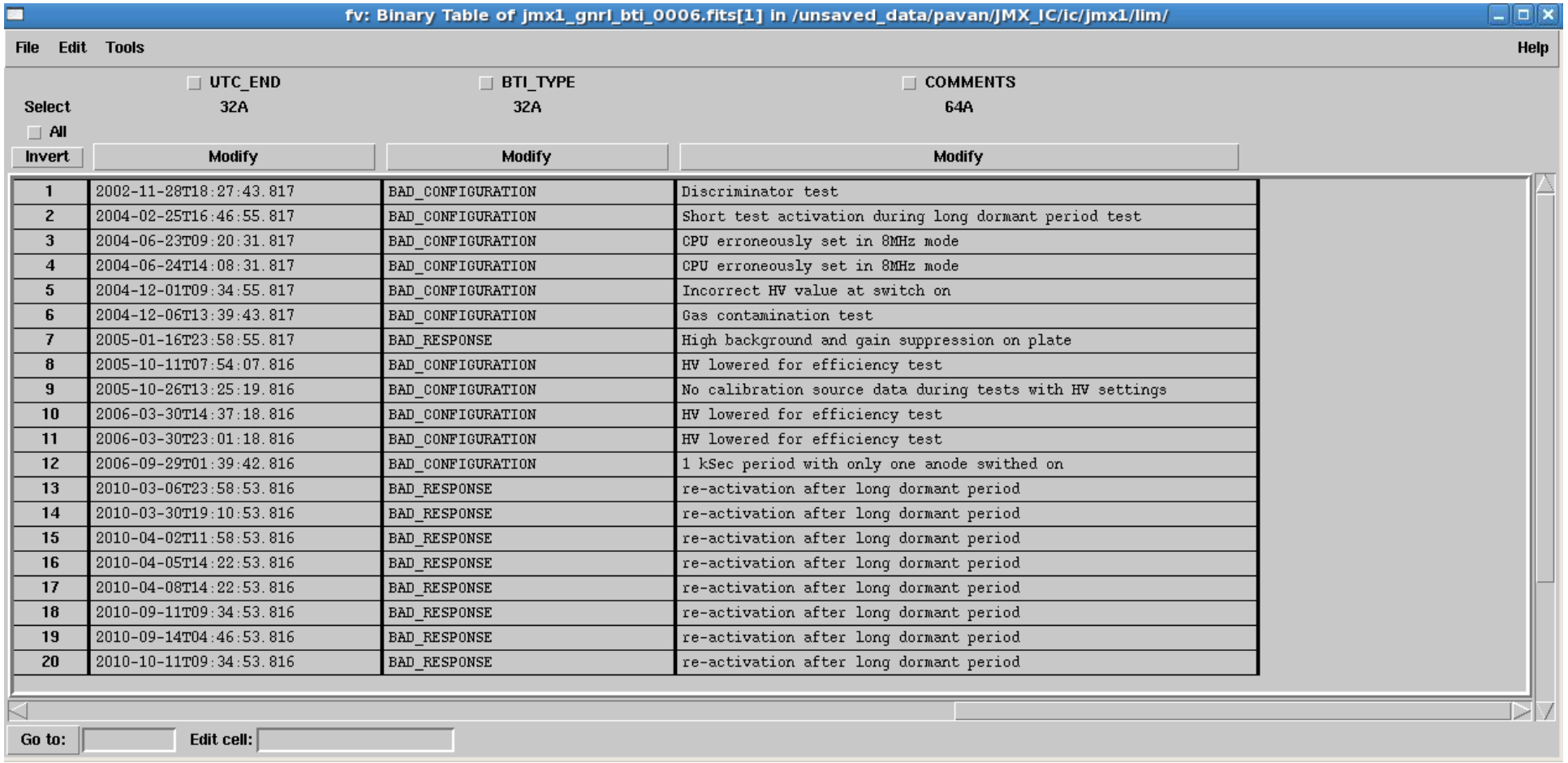
  sloc_res_soft.fits (mosaic): 215.15 detsig (ampl, sigma, chi2) 3-10keV

  sloc_res_hard.fits (mosaic): 61.95 detsig 10-20keV

- mosaic_spec results: F(3-10)= 81.7+/- 0.72 cps →113.5

  F(10-20)=11.6+/- 0.35 cps→33.14

BTI definition


fv: Binary Table of jmx1_gnrl_bti_0006.fits[1] in /unsaved_data/pavan/JMX_IC/ic/jmx1/lim/

File Edit Tools Help

Select All | UTC_END 32A | BTI_TYPE 32A | COMMENTS 64A

Invert | Modify | Modify | Modify

	UTC_END	BTI_TYPE	COMMENTS
1	2002-11-28T18:27:43.817	BAD_CONFIGURATION	Discriminator test
2	2004-02-25T16:46:55.817	BAD_CONFIGURATION	Short test activation during long dormant period test
3	2004-06-23T09:20:31.817	BAD_CONFIGURATION	CPU erroneously set in 8MHz mode
4	2004-06-24T14:08:31.817	BAD_CONFIGURATION	CPU erroneously set in 8MHz mode
5	2004-12-01T09:34:55.817	BAD_CONFIGURATION	Incorrect HV value at switch on
6	2004-12-06T13:39:43.817	BAD_CONFIGURATION	Gas contamination test
7	2005-01-16T23:58:55.817	BAD_RESPONSE	High background and gain suppression on plate
8	2005-10-11T07:54:07.816	BAD_CONFIGURATION	HV lowered for efficiency test
9	2005-10-26T13:25:19.816	BAD_CONFIGURATION	No calibration source data during tests with HV settings
10	2006-03-30T14:37:18.816	BAD_CONFIGURATION	HV lowered for efficiency test
11	2006-03-30T23:01:18.816	BAD_CONFIGURATION	HV lowered for efficiency test
12	2006-09-29T01:39:42.816	BAD_CONFIGURATION	1 kSec period with only one anode swithed on
13	2010-03-06T23:58:53.816	BAD_RESPONSE	re-activation after long dormant period
14	2010-03-30T19:10:53.816	BAD_RESPONSE	re-activation after long dormant period
15	2010-04-02T11:58:53.816	BAD_RESPONSE	re-activation after long dormant period
16	2010-04-05T14:22:53.816	BAD_RESPONSE	re-activation after long dormant period
17	2010-04-08T14:22:53.816	BAD_RESPONSE	re-activation after long dormant period
18	2010-09-11T09:34:53.816	BAD_RESPONSE	re-activation after long dormant period
19	2010-09-14T04:46:53.816	BAD_RESPONSE	re-activation after long dormant period
20	2010-10-11T09:34:53.816	BAD_RESPONSE	re-activation after long dormant period

Go to: Edit cell:

new BTIs?

- rev's notes in CarolAnne's GAINresults web-page:
  - I found a few "problematic" revolutions not already included into the BTIs list.
    - are not solved with an off-line calibration file,-
    - are not listed in the BTI table, -
    - but still might give difficult-to-interpret results.

e.g. REV. 508 "JemX-1: the Xe line analysis clearly shows that the energy correction is consistently too low.[...]It is strongly advised that users do not use data from this very short revolution in any application requiring good energy determination."

→ for a naïve user isn't it too difficult to go through the entire table? (entire day to go through all)

- among the BTIs?:
  - either putting them among the BAD_RESPONSE ones;
  - or a new flavour of BTIs? (maybe something like "Dubious Calibration").

easier to filter out (or in) these periods, without mixing them with the real BAD_RESPONSE cases.

Include into these new "dubious" Time Intervals also the first few (6-7?) SCWs of each revolution?

- The "problematic" revs (that I spotted) are:

  416 - Jmx1, entire revolution
  508 - Jmx1, entire revolution
  605 - Jmx2, entire revolution
  666 - Jmx2, first 20 scws
  797 - Jmx2, first half of the revolution
  1030- Jmx1, first half of the revolution