Cookbook:

- sections <u>USEFUL TO KNOW!</u> (see slide6), <u>USEFUL RECEPIES FOR THE INTEGRAL AND JEM-X DATA</u> <u>ANALYSIS</u> (see slide7, to be checked) and <u>DISPLAYING RESULTS OF THE LIGHTCURVE EXTRACTION</u> (see slide 8) added/adapted from ISGRI cookbook
- 7.1 Setting Up the Analysis Data:

Jem-X calibration files are continuously produced by the JEM-X Team for new revolutions. To be sure to have all the latest calibrations, update your copy of the Instrument Characteristics each time you want to analyse new data, using the rsync command as explained at the URL http://www.isdc.unige.ch/integral/analysis#Software.

• 7.5 Examples of Image Creation:

removed note "The "Save As" option saves only the main parameters of the analysis shown in the front panel of GUI. All the hidden parameters remain at their default values each time you restart the analysis."

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7.5.3 THE MOSAIC IMAGE:

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
[...]
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".

(idem in SPECTRAL EXTRACTION FROM MOSAIC IMAGE)

7.6 Source Spectra Extraction:

Two spectral extraction algorithms can be used to extract the spectrum of a JEM-X source: the "standard" spectral extraction carried out at the SPE level (discussed in Section 7.6.1), and the spectral extraction from mosaic images (discussed in Section 7.6.7). Both of them originate from the imaging step.

7.6.1 Spectral Extraction at SPE level

(10min)

3 places: data; software; cookbook

– cookbook K.I. :

Due to changes of the on-board configuration, the detection efficiency has changed significantly several times during the mission history. 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.

Spectra and lightcurves from weak sources when there is one or more strong sources in the FOV may be contaminated with counts from these strong sources. This happens because the source extraction does not take into account the presence of the other sources.

A light curve extraction on a Darwin platform may crash. In the OSA7 version of j ima iros the reported source position in JMXi-SRCL-RES in columns RA OBJ and DEC OBJ will always be the one found by j ima iros. There are columns (from OSA7) RA CAT and DEC CAT that reflect the catalog position if a user catalog has been defined. The SPE and LCR levels will read the RA OBJ and DEC OBJ columns and do the extraction using those. In order to force the use of the catalog positions – which is recommended – the JMXi-SRCL-RES table must be manipulated e.g. by an ftool, to update columns RA OBJ and DEC OBJ and DEC OBJ.

• software K.I. :

- 7. Light curve extraction is unchanged in OSA 9 compared to OSA 8 in order to allow the easy generation of short-bin light curves. However, long-term stability is not assured in this case; the user interested in long-term light curves or who doesn't need time bins shorter than the length of a science window is advised to generate light curves from the imaging step, as explained in the cook book.
- 8.While several failure conditions have been fixed in this release, j_ima_iros may still occasionally exit with a floating point exception when there are too few photons in the shadowgram. Normally, increasing the size of energy bins or lengthening the duration of the user GTIs (if possible) should solve the problem.
- 9. It has been noticed that in mosaics of JEM-X images a plus-like depression in the background around certain sources can occur. This can happen for sources that are too weak to be noticed in the search 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 effect of an unnoticed source since the distribution of position amplify the angles is guite narrow, in particular for the sources near the galactic center, which is also where the 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.
- 10.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 according to the rate of events accepted as X-rays and the filling automatically, 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 power spectra of arrival times of events from very bright should be taken in interpreting with a very significant grey filter, as OPO artifacts may show up. sources 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 arev filter setting. Therefore, if noticing transient features in the power spectra of strong sources it should be checked if this is limited to a period of a specific very grey filter setting. Please check the User Manual for further explanations.

2.4 Useful to know!

In this section we report some general informations that might be useful when using OSA. The same informations can be found also in the IBIS $Cookbook^5$.

• How do I get some help with the executables?

All the available help files are stored under \$ISDC_ENV/help. To visualize a help file interactively type tool_name --h once your environment is set (i.e. the command *which tool_name* should return the path to it).

• Where are the parameter files and how can I modify them?

All the available executables for the analysis of *INTEGRAL* data are under \$ISDC_ENV/bin. The corresponding parameter files are stored under \$ISDC_ENV/pfiles/*.par. The first time you launch a script, the system will copy the specific tool.par from \$ISDC_ENV/pfiles/ to a local directory (/user_name/pfiles/). The parameter file in the local directory is the one used for the analysis and is the one you can modify. If this parameter file is missing (e.g. you have deleted it), the system will just re-copy it from \$ISDC_ENV/pfiles/ as soon as you launch the script again. The system knows what to copy from where thanks to the \$PFILES environment variable that is also used in FTOOLS (http://heasarc.gsfc.nasa.gov/ftools/). Each parameter is characterized with a letter that specifies the parameter type, i.e:

- help with the executables
- parameter files where are/ how to modify
- groups and indices

- '[1]' after a FITS file name
- general functionalities of the GUI (save as; load; hidden)
- GUI enabled/disabled.
 parameters specified as 'name=value'



2.9 User GTIs

The way of creating User Good Time Intervals is described in the Introduction to the *INTEGRAL* Data Analysis [1]; a convenient tool gti_user exists for this purpose. To use your own GTI within the JEM-X analysis you should set two parameters: GTI_gtiUser, defining the location of your file, and GTI_TimeFormat defining the time format of the user GTI table. The possible values of the GTI_TimeFormat are IJD for the Integral Julian Date (see Introduction to the *INTEGRAL* Data Analysis [1]), UTC, and OBT. Below you find an example of the command to launch the JEM-X analysis with the default values and the user GTI table user_gti.fits

jemx_science_analysis startLevel="COR" endLevel="IMA" \
COR_outputExists=y \
DEAD_outputExists=n \
GTI_gtiUser="user_gti.fits[1]" \
GTI_TimeFormat="IJD"

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3 Useful recipes for the INTEGRAL and JEM-X data analysis

In this Section we give a number of recipes that can be useful in the analysis of INTEGRAL data in general. These recepies can also be found in the IBIS cookbook available at URL http://www.isdc.unige.ch/integral/analysis

3.1 Rerunning the Analysis

Read this if you would like to redo part of your analysis, e.g. if your run has crashed, or if you want to change some parameters.

In case you want to re-run the analysis with different parameters, run og_create but this time with a different "ogid" parameter. This will create a new tree under obs/ogid where all the new results will be

- re-running the analysis
- usage of predefined BTIs
- Combining results from different obs-groups
- create your own catalogue (?)
- barycentr.(?)





Stop Time 12866 17:06:41:925

Figure 10: Crab lightcurve, first energy band.

It is also possible to sum up lightcurves from different observation groups. The method to do this is the same as in the spectral case.

The vignetting by the collimator and mask support structure of JEM-X has a more complex structure than originally thought. Therefore, source fluxes can vary significantly, of the order of 10%, from one Science Window to the next. At off-axis angles of 5 degrees this can even reach 30% in bad cases. The modeling of vignetting at the IMA and SPE steps is at the moment much better than this.

2.8.4Displaying the Results of the Lightcurve Extraction

To see the source lightcurve, you should plot the column RATE with error ERROR versus column TIME, whereas to see the background lightcurve, you should plot column BACKV with error BACKE versus TIME. To display the resulting lightcurve it is convenient to use the *lcurve* program from the FTOOLS package:

```
lcurve
Number of time series for this task [] 1
Ser. 1 filename +options (or Ofile of filenames +options) [] crab_lc.fits[2]
Name of the window file ('-' for default window)[] -
Newhin Time or negative rehinning[] 100
```



TTATUS Accepted ISDC Software Problem Report SPR-04945 DATE Dec 20,2010 ORIGINATOR LP EMAIL lucia.pavan@unige.ch ITTLE j.ima_iros not creating images for low number of counts PRIORITY routine REFERENCE OSA S/W ENV At present, in cases of really few counts, j_ima_iros task fails to produce an image. (This was noticed e.g. for a total of 5 counts. An example is in scw 060500250010, in the 3.0-4.0 keV band, channels 46-58). PROBLEM DESCRIPTION j_ima_iros should write an image even in the case where it would be completely empty (i.e. too few counts). PROBLEM EVALUATION 2010.12.20 accented
STATUS Accepted ISDC Software Problem Report SPR-04945 DATE Dec 20,2010 ORIGINATOR LP EMAIL lucia.pavan@unige.ch Iteration in the second sec
DATE Dec 20,2010 ORIGINATOR LP EMAIL lucia.pavan@unige.ch TITLE j.ima_iros not creating images for low number of counts PRIORITY routine REFERENCE OSA S/W ENV AffECTED ITEMS AffECTED ITEMS j.ima_iros [JMX-ISSW] AFFECTED ITEMS j.ima_iros sol creatly few counts, j_ima_iros task fails to produce an image. (This was noticed e.g, for a total of 5 counts. An example is in scw 060500250010, in the 3.0-4.0 keV band, channels 46-58). PROBLEM DESCRIPTION j_ima_iros should write an image even in the case where it would be completely empty (i.e. too few counts). PROBLEM EVALUATION 2.00,2010 OCCE DATE Dec 20,2010 2010.13.20 accentred 2010.13.20 accentred
OKRGRATOR LP EMAIL lucia.pavan@unige.ch TITLE j_ima_iros not creating images for low number of counts PRIORITY routine REFERENCE OSA S/W ENV AFFECTED ITEMS AFFECTED ITEMS j_ima_iros [JMX-ISSW] AFFECTED ITEMS j_ima_iros [JMX-ISSW] PROBLEM DESCRIPTION At present, in cases of really few counts, j_ima_iros task fails to produce an image. (This was noticed e.g. for a total of 5 counts. An example is in scw 060500250010, in the 3.0-4.0 keV band, channels 46-58). PROBLEM DESCRIPTION j_ima_iros should write an image even in the case where it would be completely empty (i.e. too few counts). PROBLEM EVALUATION ZCEB DATE Dec 20,2010 2010.12.20 accented 2010.12.20 accented
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TITLE j_ima_iros not creating images for low number of counts PRIORITY routine REFERENCE OSA SW ENV
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SW ENV AFFECTED ITEMS j_ima_iros [JMX-ISSW] AFFECTED ITEMS At present, in cases of really few counts, j_ima_iros task fails to produce an image. (This was noticed e.g. for a total of 5 counts. An example is in scw 060500250010, in the 3.0-4.0 keV band, channels 46-58). PROBLEM DESCRIPTION j_ima_iros should write an image even in the case where it would be completely empty (i.e. too few counts). PROBLEM EVALUATION Dcc 20,2010 CCB DATE Dcc 20,2010
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PROBLEM EVALUATION CCB DATE Dec 20,2010 2010-12-20 acconted
CCB DATE Dec 20, 2010
CCB DATE Dec 20,2010 2010 2010
CCB DATE Dec 20,2010
CCB DATE Dec 20, 2010
CCB COMMENTS 2010-12-20 accepted





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incp.//	uxpdf uxpdf uxpdf uxpdf
STATUS= Accepted	ISDC Software Problem Report SPR-04913
DATE	Feb 18,2010
ORIGINATOR	Niels J. Westergaard
EMAIL	njw@space.dtu.dk
TITLE	Type definition discremency between i ima, chadowaram and dalliemy
PRIORITY	rype deminion discrepancy between j_inia_snadowgran and datsjenix
REFERENCE	JEMX-ISSW
	OSA
S/W ENV	
AFFECTED ITEMS	j_ima_shadowgram [JMX-ISSW] dal3jemx [NIM]
PROBLEM DESCRIPTION	Running of jemx_science_analysis with narrow energy bins and short timeintervals resulting in shadowgrams without any events have returned with error -1412 from j_ima_shadowgram.
PROBLEM EVALUATION	This occurs when a shadowgram contains no events in which case the event type (evtType) gets assigned 'J_ISG_BOTHTYPES' with value -1 as defined in j_ima_shadowgram.h. However, 'evtType' has been declared as JEMX_type which in dal3jemx.h has been defined as 'enum (0 -> 5)' i.e. not including -1. The easiest and quickest solution is to change the assignment in j_ima_shadowgram to 'FULL' (with value 0) when no events are present. But in the (slightly hypothetical) situtation when both FULL and REST events are existing in the shadowgram there is no way to report this fact. It could be amended by extending the 'enum' definition in dal3jemx.h to include FULLREST = 6, thus making it possible to get rid of J_ISG_BOTHTYPES in j_ima_shadowgram.h.
CCB DATE	Mar 3,2010
	2010-03-03 re-assigned for j_ima_shadowgram. The initial delivery was only a temporary solution.
CCB COMMENTS	2010-02-24 Scan_DB : j_ima_shadowgram [JMX-ISSW] -> j_ima_shadowgram [jmx-issw].
	2010-02-19 accepted

DATE ACCEPTCI	ISDC Software Problem Report SPR-04737
ORIGINATOR	Niels Lund
EMAIL	nl@space.dtu.dk
TITLE	j ima iros, wrong array dimensioning, incomplete array initialization
PRIORITY	urgent
REFERENCE	JEMX-ISSW
S/W ENV	OSA 7
AFFECTED ITEMS	j_ima_iros [JEMX_ISSW]
	NAN welves have appeared in the appear (aby legal) is the findersh working
PROBLEM DESCRIPTION	NAN-values have appeared in the array 'sky_local' in the findpeak routine. The NAN-values themselves were caused by an incomplete initialization of the array. In j_ima_iros.h the array 'logger.det_rad_lim' is declared with EEMAX (=4) elements, but in 'j_ima_iros_prepare' it is being initialized with as many values as there are energy bands. Running with more than 4 energy bands causes overwriting of the subsequent parameters in the 'logger'-structure, which can have disastrous consequences (No sources are found with j_ima_iros).
PROBLEM EVALUATION	'sky_local'-problem in 'findpeak': All values of 'sky_local' are initialized to 0.0 in the beginning of 'findpeak. Dimensioning of 'det_rad_lim': The array is dimensioned with 'EE256' (=256) elements i 'j_ima_iros.h'
CCB DATE	Sep 25, 2007
CCB COMMENTS	2007-09-25 MG: Accepted.

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http://	http	r// http:// http:// http:// http:// http:// http://
		UPDATE
STATUS=	Accepted	ISDC Software Problem Report SPR-04522
DATE		Jun 27, 2006
ORIGINATOR		Carol Anne Oxborrow
EMAIL		oxborrow@spacecenter.dk
TITLE		j_scripts should make hotspot removal a default of the pipeline
PRIORITY		routine
REFERENCE		JEMX-ISSW
		JEM-X science pipeline - shadowgram level BIN_I and imaging level IMA
S/W ENV		
AFFECTED IT	EMS	j_scripts [JMX-ISSW] pipeline_lib [JW] j_ima_iros [JMX-ISSW] j_src_properties [JMX-ISSW] j_ima_shadowgram [JMX-ISSW]
PROBLEM DE	SCRIPTION	As a default (1.2. In the absence of a user overfield the scripts and science pipeline should give the rowSelect parameter passed into the showdowgram and imaging levels as "&&STATUS<256". Otherwise, events detected by j_cor_gain as belonging to a hotspot turn up in the image, often with bad results. The syntax "&&STATUS<256" is required since the input string is added to other selections made automatically by the programs.
		This should be very easy to achieve. Silvia should ask NJW for advice where exactly to add this default if she's uncertain of the effect and scope of the rowSelect parameter. It should be noted that in Stefan Larsson's source extraction programs event selection is considerably stricter and it is expected that "STATUS==0" is the default here.
		Sep 20, 2006 Carol Anne Oxborrow:
PROBLEM EV	ALUATION	expanded to include j_ima_iros, which must be able to add the '&&' prefix to the rowStatus string if this is not provided by the user or the scripts. It might
		be a little much for users to remember the double ampersand once they start tampering with the default values in the GUI.This will also be needed for the forthcoming j_src_properties too.
		New Affected Items: j_ima_iros j_src_properties



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