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JEM-X SDAST Meeting 26: August 11–12th 2003 at The University Observatory, Helsinki, Finland

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1 Participants

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Pictures from the meeting can be seen at:
`http://www.astro.su.se/groups/head/SL/JEMX/SDAST/SDAST_Helsinki_2003.html`

2 PK: ISDC news and status

- ISDC now running in normal operations phase, quite smoothly
- Some problems analysing observations of many hundreds of SCWs with SPIROS
- Big staff changes, mostly downsizing: Jurek Borkowski has left, replaced by Daniel Rychiek; Mathias Beck taken over IBAS; Tess Jaffe leaving to do Ph.D. in cosmology at Garching; Volker Beckmann going to GSFC, replaced by Ingo Kreigenbohm; Laurent Lerusse following Tess ASAP; Aymeric Sauvignon already returned to Saclay; David Landriu returning to Saclay by end of the year.
- Next OSA release (3.0) in October with S/W freeze at end of September: must decide what we can achieve with ISSW before then
- AandA special issue articles going well - TC relieved

- Big effort to check survey data but nothing dramatic found yet
- Still waiting for next GRB in FOV: lots of ACS activity for GRBs but well-located events are few. Several ACS bursts every day since it picks up solar flare activity

3 JC: Dead anode monitoring

- Nine dead anodes at launch and 11 anodes died within first months of mission for JEM-X2
- Beginning of November 2002 HV on JEM-X2 decreased from 900V to 800V and anodes have been more stable since then
- End of January 4 more dead anodes discovered when suitable data became available, since then 2 more dead anodes discovered
- Status for JEM-X2 now: 28 dead anodes and 17 'sick' anodes, mostly neighbours
- Status for JEM-X1 now: 16 dead and 16 sick anodes, which we assume haven't changed since unit was switched off in January 2003
- Spectral resolution monitoring: JC made new sets of anode-binned spectra and fitted the Xe peak. Found a FWHM of 4 KeV, significantly larger than 3 KeV value found in January. What is the cause of this broadening? Don't know as yet.
- From anode-binned spectra JC also made new anode-based SPAG corrections, but these did not improve resolution at all compared to his previous anode/SPAG corrections. Results show that Carl's first order SPAG corrections contribute most to improvement of energy resolution compared to raw data, and JC's anode corrections help a small amount.

AI26.1 **AI 26.1:** On JC: Update list of instrument representative activities at ISDC. Due: 31 Aug

4 CAO: Dead anode and hotspot monitoring

- j_prp_verify will be redelivered next week with functionality to output one anode population histogram for each science window. Since this is part of SCW Pipeline all data is processed, including private data, with output in engineering directory so that DSRI offline tool can access all histograms
- CAO also written tool that collects all such histograms for a single revolution into a single image to be scrutinised for dying anodes and transient hotspots
- Histogram populations are normalised to 100 counts for expected number of events if events spread evenly over detector, and given length of each anode. Very short anodes at edges often give very big populations and are ignored to give best scaling on anode population time evolution images
- Dead anodes show up well on time evolution images, but yet to be seen if transient hotspots can be detected
- j_prp_verify does not give automatic alerts for suspected dead anodes and hotspots since statistical fluctuations invariably produce many false alerts.

5 NJW: Response matrix

- Three extensions in one fits file: JMXi-RMF.-RSP (redistribution matrix); JMXi-FBKD-MOD (PI binning table); JMXi-AXIS-ARF (ancilliary response, including quantum efficiency).
- Latest instances of delivered file are:

  jmxi_rmf_grp_oo4.fits Updates applicable prior to 2003-2-27 when rejection criteria changed

  jmxi_rmf_grp_0005.fits Updates for times after 2003-2-27

  jmxi_rmf_grp_0006.fits Copy of pre-launch values
- Redistribution matrix determined from ground calibration; ancilliary response determined from Crab calibration spectra
- Energy resolution after 2003-2-27 is worse: 14compared to 9
- A redistribution matrix for non-imaging modes also needs to be made because no SPAG corrections for these

6 CAO: Gain history

- Gain history table clearly shows increase in gain of JEM-X2 with time, and decrease in gain when HV is lowered. Small gain changes correlate with temperature changes
- Nothing to indicate that JEM-X1 experiences this gain increase, so some other process at work in JEM-X2
- Gain decay at beginning of each revolution is much less pronounced than at beginning of mission, and initial partial switch on shows no clear decay
- Peak intensities show steady radioactive decay as expected except for JEM-X2 anode 1, which between rev.s 30 and 50 shows variable, weaker-than-expected intensity, but problems resolved itself completely around rev. 50
- Transient low intensities show grey filter activity
- Calibration peaks show very little or no increase in peak width, though again strange behaviour for JEM-X2 anode 1 between rev. 30 and 50 with twice expected width.
- Conclusion: calibration spectra behaving well and tracking gain increase. Xe peak width increase must be due to some no-yet-understood SPAG variation since localised source spectra (i.e. calibration spectra) show no similar width increase.

AI 26.2: On CAO: Investigate behaviour JEM-X2 anode 1 calibration source. Due: 31 Aug AI26.2

7 PK: Misalignment matrix

- Latest version delivered July 17th 2003
- Scatter in found Crab position using ISSW gives δdec= δRA $\approx \pm 40$ arcseconds for JEMX-1; δdec$\approx$ ± 20 arcsecs and δRA$\approx$ -40 to +20 arcsecs for JEM-X2. Scatter for on-axis sources is only a few arcseconds however.

- JEM-X2 results show clear systematic patterns reflecting mask geometry
- Should remember that we're often still better than historical data
- To improve misalignment matrix will require better understanding of instrument characteristics and ISSW
- Limitation on misalignment improvement is about 5–10 arcseconds
- NL thinks several other factors should be taken into account:
  - Rotation between instrument and star trackers as well as misalignment between detector and mask
  - Non-orthogonality of anodes and backplanes
  - Tilt angle of collimator
- Source positions and misalignment considerations very important when deciding amount of vignetting which has been shown to be paramount in determining fluxes

AI26.3 **AI 26.3:** On PK: Verify systematic position offset depends on off-axis angle. Due: 22 Aug

8 NL: Instrument status and source extraction

See attached text file NLcontribution26.txt

9 ALL: XRONOS compatibilty

- SL, NJW, PK and Ken Ebisawa have agreed on a strategy for all but REST data which has variable length integration times
- XRONOS is not fully OGIP compatible so chokes on our TIME_DEL column which is OGIP compatible
- For REST data russians suggest using a standard very long integration time coupled with the FRAC_EXP (fractional exposure) column, but mangles meaning of FRAC_EXP somewhat
- People using REST data, which is quite rare will have to use another offline tool for timing analysis

AI26.4 **AI 26.4:** On PK: Check data templates are XRONOS compatible. Due: 22 Aug

10 SM: Background Handling

- Has made spectra of different segments of detector area, reduced to 48 catalogue model spectra
- Uranium peaks in instrument background comes from beryllium window
- Stray calibration photons can be seen over entire detector
- Side 'ears', especially visible in JEM-X2, come from capacitive coupling of side anodes and veto anodes

- Side areas contain many fluorescence lines, not all identified yet
- Xe peak appears quite broad in all the spectra
- Surprisingly strong Ni peak in calibration overspill areas
- Diffuse background shows a distinct vignetting modulation from centre to edges of detector which is included in spatial variation though models predict a constant coverage. NL suggests this is due to reduce electronic efficiency at edges
- SM has very nice smooth diffuse background spectrum which is subtracted before finding instrument background
- SM made a map of catalogue spectra index values to use for each ring segment of detector. All segments have equal area
- Could perhaps use hardware trigger counter to determine strengh of background. Found in JMXi-CSSW-HRW.
- Probably can never hope to remove all background during solar flares
- NJW's imaging program must be handed a background model, it cannot find background by itself the way NL's program can
- Next step in development must be to apply these spectra and spatial background variations in NJW's program and see how/whether this improves imaging and source finding. Until this is done no further progress can be made, and discussing improvements is pointless

AI 26.5: On SM: Check data includes Carl's SPAG and JC's anode corrections. Due: 31 Aug AI26.5
AI 26.6: On PK, NJW: How to implement/calculate responses for different modes. Due: 31 Aug AI26.6

11 NJW: status of instrument model group

- Delivered instances 29–34 covering launch to current time, which includes new DETE, ECAL and SPAG tables
- New collimator description needed to include:
  - Misalignment of walls which are not parallel to detector strips. This could be up to 0.6deg
  - Collimator tilt. This could be done by adding second layer of node positions to current collimator description: one to describe top of collimator, the other to describe the bottom node positions
- Also need to add a pixel size map. Currently CORX and CORY describe positions of pixel centres, but not pixel sizes, though the two are not unrelated
- Jumpiness in fluxes and lightcurves between SCWs is due to sensitivity to vignetting and source position determination: NJW waiting for someone to make a vignetting table (VIGN-MOD) with better resolution

AI 26.7: On NL: Make finer vignetting table (5% variation?). Due: 31 Aug AI26.7

12 CAO: DETE, SPAG and ECAL tables

- Longterm trend analysis of electronic calibration data performed to provide updated values for ECAL-MOD and stop the 'non-linearity' alerts produced for the FAST anodes:
  - None of 43 amplifiers show any worrying trends though each has distinct offset, slope and linearity.
  - Found offsets show clear increase after change in ECAL procedure, while non-linearities show clear decreases
  - Slopes are sensitive to HV values, and increase with decreasing HV
  - No increase in FAST anode non-linearity, but values need to be raised to cut out unnecessary alerts
- In addition to Carl's SPAG corrections with telemetry coordinates, j_cor_gain implements JC's anode corrections though these are relatively small (a few percent) compared with Carl's (upto 30%)
- The added corrections improve the energy resolution only slightly
- DETE-MOD has been updated to include hotspots, dead anodes, dead anode neighbours, inactive detector area and calibration spectra overflow areas. Removing all events with non-zero STATUS values sharpens Xe peak very slightly, but reduces noise from Fe/Cd photons considerably
- ISSW downstream of j_cor_position which sets these STATUS values must determine how to use the STATUS word for themselves
- SL should look in DETE-MOD to determine exposure where no events have been found. Otherwise compare the total number of -COR events (same as total number of -RAW events) and compare to number of events selected with the desired STATUS value

13 PK: Good Time Intervals (GTIs)

- Merged GTI created from separate GTIs determined from: HK limits; attitude stability; data gaps and user-defined GTIs
- Generic ISDC tools handle this, producing one table per SCW so user must produce one table valid for each SCW. GTIs are used to select events using DAL3
- But how is exposure calculated and how does this tool handle buffer flushing at beginning of each pointing? Must be sure data-gap program can handle gaps at the END of a SCW, i.e. buffer flushing, since this not be apparent if there are no events after the gap.
- Slew events may be lost in the flush, which isn't a problem, but the buffer is large an for high countrates events at end of pointing before the slew may still be waiting to be transmitted
- NL not happy with event weighting being used to correct for grey filter values below 31. This scews the statistics and is very bad for imaging
- NL thinks that effective exposure PER EVENT should be calculated using each event's DELTA_TIME value which can be interpreted as an individual integration time for the event
- Where counts have been reduced by a factor of n, NL thinks it's very important that users are told we're dealing with statistics associated with, say, 1000 events and not with $n \times 1,000$ events

- SL's program uses only the real events to calculate statistics/errors then uses photon weighting for countrates and fluxes

AI 26.8: On PK: Check data-gap tool can handle buffer flushing. Due: 31 Aug AI26.8
AI 26.9: On NJW: Investigate shadowgrams not built on weighted events. Due: 31 Aug AI26.9
AI 26.10: On PK: Plan DAL3JEMX tool to calculate fractional exposure. Due: 31 Aug AI26.10
AI 26.11: On CAO: Check deadtimes with buffer flushing. Due: 31 Aug AI26.11
AI 26.12: On NJW: IMA level to output significance maps. Due: 30 Sep AI26.12
AI 26.13: On NJW,NL,PC: Make plan for Paul to work on NL's imaging routine. Due: 30 Sep AI26.13

14 ALL: Multi-SCW analyses

- JC presented results of 3C273 using 12 SCWs analysed with OSA2.0. Source only visible in one of SCWs, but much clearer with 12 SCWs mosaiced together. Unfortunately source can't be seen in printed output.
- Used SCWs from revs 28, 29 and 30. Mosaicing tool is useful for staring pointings in this manner
- HOWEVER, it is a very limited tool because so generic. Cannot handle instrument-specific characteristics and cannot back-deconvolve to find source events, or do timing analyses. Also has problems making sharp images for dither patterns where faint sources appear at different points on detector sky
- Also mosaicing doesn't calculate significance of each pixel in the final mosaic. This is difficult because JEM-X has no distinct edge to its images, just a gradual vignetting due to the collimator.
- PC thinks this is a standard problem already solved by his software
- Sky significance and source significance can both vary within a SCW and vary strongly between SCWs thanks to dithering (esp. 5×5 dithering), because 'corner' SCWs only add noise to the mosaic because these are generally empty fields for JEM-X, so adding them does not increase significance or statistics as one would expect
- Above considerations only apply to expected catalogue sources not to TOO and unexpected transient sources
- JEM-X has such a gradual edge to it's pictures that mosaicing properly depends (like everything else) on understanding and applying correctly, the vignetting

AI 26.14: On ALL: Circulate emails with mosaicing tool ideas. Due: 30 Sep AI26.14

15 PK: OSA Development

So what can we expect in OSA 3.0 and what will have to wait till later?

- Current background handling models put into IC: OSA 3.0
- Backgroung model used in IMA level: OSA 3.0
- Backgroung model used in SPE and LCR levels: OSA 3.0?

- radiusLimit parameter for BIN_S and BIN_T levels: OSA 3.0
- Response with real energy response: OSA 3.0
- Response for different data-taking formats: OSA 4.0
- Improved IMOD tables (pixel size, collimater): OSA 4.0
- Use STATUS flag in IMA, SPE, LCR, BIN_S, BIN_T: OSA 3.0
- Improved JMXi-VIGN-MOD: OSA 3.0
- DETSIG images from IMA: OSA 3.0
- Data gap GTI must handle buffer flush: OSA 3.0
- Multi-SCW imaging: OSA 4.0 or later
- LCR compatibility with XRONOS: OSA 3.0

OSA 4.0 is expected in Spring 2004 with freeze in early 2004

16 SMN: Scripts status

- src_collect is a new tool by PK to combine found source lists. SCREW 1144

AI26.15 **AI 26.15:** On SL: Put meeting photographs on the Net. Due: 22 Aug

17 JC: ISDC rotation

- One last GCDE and then all private observations until mid-September. So no need for representative to handle matters arising from GPS or GCDE, however PK also absent from ISDC all September
- NJW, CAO and NL at ISDC for Consortium Meeting 22nd–23rd September, so NJW can extend this stay
- NL to handle last galactic scan
- Will make further plans when observing planning is made known

18 ALL: SPR and SCREW status

The following change items are still open and should all be closed by the end of September S/W freeze:

ADD SCREW 950: 16-bit STATUS flag, otherwise implemented by all software now. SPR 1123; SPR 1794

j_prp_status_table SCREW-1233

j_prp_verify SCREW 1071; SPR 2726; SPR 2466: delivery next week

j_calib_adc SCREW 967: cancel

j_cor_gain SCREW 1200

j_bkg_spec_sel SPR 2247

j_bkg_scal_calc SPR 3087; SPR 2875; SPR 3147

j_ima_basic_recon SPR 2853; SPR 3141

j_ima_source_find SCREW 1230; SCREW 1106; SPR 3125; SPR 2817; SPR 2601; SPR 2581

j_src_spectra SCREW 1210; SCREW 920; SCREW 747; SPR 2991;

j_src_lc SCREW 1228; SCREW 920; SCREW 1219; SPR 2579

j_scripts SCREW 1230; SCREW 1209; SCREW 1106

19 CAO: ADD status

- ADD needs updating pretty badly. Update in October after OSA3.0 release
- Deadline for contributions from SDAST: 9.00 Monday 13th October
- ADD to be published on Net by end of Friday 24th October

20 SMN: Other business

- Working on SMC q_source_identify has misidentified a source. It is clearly SMCX-1 but has been identified as J01176-7330 which is about 45 arcminutes away
- Problem is in q_source_identify, which may be searching too widely for possible sources, this should be looked into
- SMN's spectrum of EXO2030 compares very favourably with ISGRI spectrum except that ISGRI always shows excess counts in one particular channel, and this seems to be a fault of the instrument or its processing
- SMN used radiusLimit parameter, but without re-calculating the effective detector area, so in fact, her results and ISGRI should NOT agree. Another niggly problem to look into

21 ALL: next meeting

- It was unanimously decided that the next SDAST meeting should be held at GACE in Valencia on November 24th and 25th
- See you all there!

22 New Action Items

AI26.1	JC: Update list of instrument representative activities at ISDC	Due: 31 Aug
AI26.2	CAO: Investigate behaviour JEM-X2 anode 1 calibration source	Due: 31 Aug
AI26.3	PK: Verify systematic position offset depends on off-axis angle	Due: 22 Aug
AI26.4	PK: Check data templates are XRONOS compatible	Due: 22 Aug
AI26.5	SM: Check data includes Carl's SPAG and JC's anode corrections	Due: 31 Aug
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