

1 EPIC calibration

1.1 Matters arising from Meeting “ Operations interface between ESA and the PI teams (M. Kirsch)

- EPIC onboard SW knowledge needs to be maintained (back up for Eckhard and Tony in combination with interface at ESAC needs to be build up) SS UGB
- Lela should be checked re radiation monitoring (MK)
- MPE and Leicester see no problems in CAL support for the next 4-5 years:
 - MPE: KD, FH, UGB, VB,MJF
 - Leicester: SS, AR, JC, 1.5 NN, TA
 - Milano: Andrea Tiengo (new/replacing Gabriele Villa)
- CAL and SAS team at ESAC need more manpower than proposed in LMs talk
 - MIN: 2.5 FTE CAL, 1 FTE EPIC SAS (see future cal plan)
- Spare chain status should be checked by GV (SCOS2000)
- CALCLOSED/CLOSED observations need to be reviewed

1.2 Status of the long-term calibration plan (M. Kirsch)

- Report on Calibration campaign 2007 see also http://xmm.esac.esa.int/~xmmdoc/EPIC/EPIC_calibration_campaign_2007.txt
- Request to XMM SMM to keep ESAC CAL SAS team on 2.5 CAL FTE + 1 SAS FTE till 2011
- Main cal development in the plan for 2008-2010
 - pn new redistribution and rate dependent CTI
 - MOS patch calibration currently rather crude
 - full EPIC off axis calibration

1.3 Calibration activities - the MOS perspective (S. Sembay)

- MOS pn effective area differences may have the origin in a dead layer on the CCDs. That layer may consist out of an organic complex. New QE files based on a mathematical component.
- Changes in resolution based on 1ES0102 comparisons with RGS and LETG (wider resolution for later observations)
- Better flux agreement with RGS for on axis sources
- For extended/off axis sources MOS give lower flux then the RGS

1.4 Calibration - pn cti/gain (K. Dennerl)

- Master offset maps introduced for epreject
- CTI (Quadrant box temperature) implemented in Gain correction

1.5 Calibration - pn response/effective area (F. Haberl)

- Effective area update (XRT3 CCF) above 4 keV (released)
- Gain/CTI correction refinement for timing mode (in CCF) improves residuals around the O-edge
- Redistribution problem below 500 eV.
- Redistribution problem around 800 eV, may be related to SW energy calibration issue of the order of only 5 eV that may cause the residuals → SW mode needs slight energy correction at 800-1000 eV
- Redistribution model is not sophisticated enough at low energies.
Low energy upward redistribution from events below lower threshold is not modelled at all.
→ in order to improve that SW changes are required
- The low energy differences are not seen as a resolution problem

1.6 Calibration activities at ESAC (M. Kirsch)

- NRCO's & EOR's
- MOS column dependent CTI verification
- pn Burst mode calibration
- pn time jump detection
- automation of pn relative and absolute timing monitoring
- MOS timing mode calibration
- XMM-Chandra Cross Calibration
- calibration preview tool and diagnostic tools

1.7 The XMM point spread function (A. Read)

- Create 2D PSF images from 200 XMM XSA observations
- Simpler PSFs improve source searching
- More complex PSFs improve source parameterisation
- Difference in ARFs compared to SCISIM-2D and EXTENDED-1D PSFs
- PSFs (especially for MOS2) are not circularly symmetric -> different shapes at different off-axis angles -> cannot be rotated and stacked -> sacrifice either stretch or shape
- pn/MOS Flux ratios possibly improve using new 2-D PSFs

2 Cross Calibration

2.1 Calibration Activities - the rgs perspective (M. Kirsch/A. Pollock)

- New RGS effective area correction will bring RGS closer to pn.
- Time dependent discrepancy will be cured
- RGS will end up around -2/+5 % re pn flux
-

2.2 The Cross cal preview tool (M. Kirsch)

- Extensions and also available now for Chandra data

2.3 Calibration - Chandra and Chandra-XMM X-cal I (P. Pluchinsky)

- ACIS calibration updates in CALDB 3.3.0
- CALDB update planned for graded mode
- Improvements in continuous clocking mode planned re CTI calibration
- Update of contaminant
- Focal plane Operating temperatures may have to be increased by 1-2 deg (temperature of satellite is increasing (some pitch angles are only allowed for limited time) this has consequences for XMM/Chandra cross cal observation windows
- 1E0102- Cross Calibration:
 - CCD instruments prefer harder continuum spectra
 - RGS and HETG agree on flux of bright lines
 - RGS and HETG compromise on existence of weak lines
 - RGS and HETG agree on width of the lines

2.4 Calibration - Chandra and Chandra-XMM X-cal II (H. Marshal)

- Comparing fluxes in band-passes with respect to M. Smith analysis
 - 0.54-0.85 keV band LEG direct fluxes are 15 % low compared to Smith model derived fluxes (not understood)
 - 0.85-1.5 keV band: LEG direct fluxes are 7 % low, MEG and HEG 2-3 low
 - 1.5-4: LEG/MEG direct fluxes are within 1 % (ok)

3 AOB

3.1 The XMM MOS life test facility (T. Abbey)

- Test reproducing the MOS patch in the lab
- Using micro channel plates to focus x-ray beam
- Radiation dose to high (does estimation error) → caused much stronger damage than intended in the centre
- Looking for area where damage is more comparable to the in orbit CCD
- Annealing of the CCD at 130 deg and continue experiment with the right dose

3.2 Slews (R. Saxton)

- Fast Slew
 - Report on status of scientific outcome of Slew survey
 - Theoretically 25 % of sky covered, but denser observation area at ecliptic poles
- Slow slew
 - Test went fine (described on XMM web pages)
 - Pattern 0 for MOS need to be calibrated
 - For efficiency need to have legs of at least 1 h, since turn around time is 17 min
 - Position error is 4 arsec, similar to pointed obs for low cont rates

3.3 BGWG (A. Read)

- Background component table is now detailed and complete
- XMM-ESAS is working fine spatially and spectrally 'for MOS' (pn is work in planning)
- Blank sky files are maintained updated and used (useful comments and questions by user received)
- Complete filter wheel closed data nearly ready to be released for MOS
- Script to perform "nice" image creation
- Soft proton flaring
- Next Meeting: Start of the Mallorca 05-07/11 BG/OPS/CAL - i.e. on the 5th

3.4 Dates:

- IACHEC 8-11 May LA, US
- Next EPIC-CAL meeting: 05-07 November, Mallorca
- Next EPIC BG working group: linked to CAL meeting
- 11-13 September EPIC Consortiums meeting

4 Long term calibration plan

- 2007 (CAL accuracy 10 %)
 - cal campaign as described
 - build up Suzaku cross cal + more CHANDRA cross cal
- 2008-2010 (Goal: Cal accuracy ~ statistical uncertainty)
 - pn new redistribution and rate dependent CTI
--> deeper investigation and SAS development
 - MOS patch calibration currently rather crude
--> deeper investigation and SAS development
 - full EPIC off axis calibration
--> deeper investigation and SAS development
 - pn double effect behaviour + pn-vent hole effects
--> deeper investigation and SAS development
 - sufficient expertise in SAS support in combination with calibration is needed at least till 2011 (ESAC: 2.5 FTE EPIC calibration + 1 FTE EPIC SAS)
- as of 2011
 - routine instrument monitoring (CTI, BAD PIX, offset)
--> routine CAL updates (CTI, BAD PIX, offset)
 - contingency calibration....(if possible at all?)

5 Actions items

AI_EPIC_CAL_18_01: Contact Andra Tiengo and arrange integration into EPIC cal and task responsibilities (SS/MK)

AI_EPIC_CAL_18_02: Review CALCLOSED/CLOSED observation strategy (MK)

AI_EPIC_CAL_18_03: Comment on ESAC proposal for Flare screening (AI_EPIC_CAL_17_05) (HB/UGB)

6 Open old action items

AI_EPIC_CAL_17_03: MK, MM to test FIFO reset correction

AI_EPIC_CAL_17_08: SS to calibrate Pattern 0 for 3x3 mode

AI_EPIC_CAL_16_05: Provide estimate for the need of additional MOS CLOSED observations (SSn)

AI_EPIC_CAL_14_1: Additional time column with other 0 point for OHL (RD, MK, MJF)

AI_EPIC_CAL_14_3: MK to implement time jump in a Qcheck type procedure in the long term

7 Closed old action items in period of last Cal_meeting to this CAL-meeting

- AI_EPIC_CAL_16_01: Implement LW CTI refinement into CCF before August (MK, MJF)
- AI_EPIC_CAL_16_03: Implement column dependent CTI/Gain correction (RS, DB)
- AI_EPIC_CAL_17_01: MK to propose strategy for EFF non-focus CCD calibration
- AI_EPIC_CAL_17_02: MK and KD to implement new pn time/temperature dependent CTI/Gain by end 2006
- AI_EPIC_CAL_17_04: MS and MK to follow up flare screening method with regard to the effects of hot pixel, possible badpixfind changes required
- AI_EPIC_CAL_17_05: MK to collect input for Chandra short guide by 18.11. 2006
- AI_EPIC_CAL_17_06: MST to updated CC status including Chandra XMM flux table by 16.12.2006
- AI_EPIC_CAL_17_07: MST to coordinate flux bands with SSC

8 Splinter meetings

8.1 Cross Cal (MK, SS, HM, PP, MS. FH, KD, VB)

The results of Michael Smith have been discussed.

Summary:

- Chandra data show in the low energy flux bands less flux than pn and above 4 keV more flux than pn.
- The variation of MOS fluxes for PKS2155 may be related to fitting aspects in combination with the spectral shape of PKS2155 in those observations. A correlation between photon index and flux is present in those data.
- The analysis should be made available to the user in an "easy to digestible" way. Perhaps it may be included in the Cross Calibration status documents.

9 Summary from the discussion session on "Future instrument operations" from 11.04.2007 (by L. Metcalfe)

A number of points that had previously been specified by Steve Sembay were discussed.

The following summarises the main points of that discussion, following each of Steve's questions :==>

Taking questions 1 and 2 together:

- >>1) What is the minimum technical manpower required for future
- >> instrument operations given the requirements of supporting the
- >> science objectives of XMM?
- >>2) What manpower/expertise is actually expected to be available to
- >> support instrument operations in the future from the PI teams and
- >> ESA?

[In what follows please bear in mind that, apart from any manpower figures mentioned below in the calibration or SAS areas, it is currently planned to retain indefinitely about 2.5 SOE instrument engineering type people at the SOC, dedicate to the interface between the SOC and the ESOC-based MOC.]

In response to a suggestion by Metcalfe that the SOC calibration/instrument-expert manpower could be reduced to 1 MOS expert and 1 pn expert from say 2010 onwards, and that the SAS manpower at the SOC could fall to 1.5 fte on a similar timescale, (these are much more severe cuts than the AWG considered acceptable) the meeting took the view that across this range of activities an additional 1.5 ftes should be maintained at the SOC until at least 2011 to cover evolving instrument calibration and related necessary SAS developments, and they justified this requirement in some detail. Retaining such resources does not conflict with the scenario endorsed, for example, by the AWG earlier this year. (For statements of EPIC manpower available or needed at Leicester, MPE or elsewhere in the EPIC consortium, I defer to the responsible EPIC managers or the PI.)

Tony Abbey argued from the Swift precedent that PI personnel could complement real-time mission support if (as in the Swift case) relevant experts could be easily contacted (e.g. by mobile) with instrument telemetry readily available to them (e.g. via simple ADSL). Metcalfe underlined the major differences between Swift and an observatory mission like XMM-Newton.

Little progress was possible in considering needed resources in the calibration/user support area beyond 2011, and this has to be considered in the context of the MEOR. [The whole question of retirement and replacement of key personnel arises in this context.]

- >>3) Are the instruments expected/constrained to operate as they are
- >> for the foreseeable future or is there any
- >> expectation/justification for change?
- >> e.g. What is the status of the slow-slew? Are there outstanding
- >> issues assuming this will be a supported observing mode?
- >> e.g. Assume we had a science driver for annealing the MOS
- >> CCDs...could we or would we do this?
- >>4) Is the calibration programme likely to change/adapt in the future
- >> and what implications does this have for instrument operations?
- >>5) How could/would we handle instrument failures in the new
- >> operational environment?

The SOC is proceeding with the implementation of the Slow Slew Survey.

The question of annealing is not resource-driven, but rather is driven by our ignorance of whether the process would be beneficial or harmful overall. But in general people seem to take the view that we can, if we have to, continue to do the same kinds of "engineering" things as we have done in the past, but with longer delays and down-time as resources decline.

The above bullets are closely bound-up with the occurrence of contingencies. Current proposals for specific identified and needed calibration improvements do not go beyond 2011. In that situation LM comes back to the idea of needing only 1 instrument expert per instrument at the SOC post-2011.

- >> 6) The instrument spare chain and the SCOS 2000 system. This facility
- >> will require substantial funding to support. Is this facility
- >> actually useful? Can both the instrument teams and ESA provide the
- >> necessary level of support to justify the expenditure?

Paraphrasing some notes from Gabriele Villa:-->

The conclusion reached on the last day of the meeting can be summarised as follows:

- a) the EPIC System Team at Milano will check the status of the EGSE of the Spare Chains. They already know that the one in Leicester is working O.K. and personnel are planning to go to Panter to check the status of the p-n EGSE.
- b) If also the p-n EGSE is working, or better, if the ISU is working, then they will proceed with the planning of the operations to implement the S2K S/W.
- c) To do this, Leicester (Tony Abbey) will procure two W.S. for the

S2K S/W implementation, IASF-Milano will procure two P.C. to interface the ISU with the "new" Work Stations and the S2K S/W. LABEN has to write some S/W for the two P.C.s and to "translate" some (100-200) TLC to be operated from the P.C.s. ESA (ESAC? ESOC?) has to provide the implementation of the S2K S/W into the two W.S.

d) If the ISU (MOS and/or p-n) are not working, no operations. The testing will only be done connecting Test Equipment at some intermediate point of the Spare Chains as we are doing now to test the Camera Head.

After the Palermo meeting, Milano had a meeting with LABEN to explain this plan and to ask them to prepare a detailed estimate of the work to be done (PC S/W and TLC).

As a result of this meeting, Milano will send ESAC (Guillermo Buenadicha) a list of information which is necessary for LABEN to do the job.

Then Milano will have another meeting with LABEN and will try to finalise both the technical and financial plan to proceed with the operations.

As agreed at the meeting in ESAC last year, once the work starts, the reference person will be Tony Abbey.

>> 7) Related to operations and calibration is the technical support
 >> behind the SAS and pipeline processing. What is the future level
 >> of this support? Is there a danger of the SAS being frozen? What
 >> support could be supplied by the instrument teams.

SOC is reasonably confident that we can maintain a healthy SAS, in part by making use of greater network capabilities for remote working and "grid" capabilities, but this assumes that substantial support is maintained also in the PI teams and the SSC consortium.