EPIC BG working group: 9th meeting: 22/03/10 – Madrid

Location : Faculty of Mathematics, Complutense University

Agenda

15:00 - 17:00	[Minutes - IdC]
- Introduction and action items from last meeting	[AR]
- Updates to the Blank Sky Project	[JC]
- Solar Wind Charge Exchange as seen by XMM-Newton	[JC]
- BGWG SOC activities (FWC/ESAS)	[IdC]
- Discussion: Web Pages, BG Components, FWC data, new scripts/tools, long-term BG trends etc.	[AR + all]
- Summing-up - AOB - Plans for the next period - Next meeting	

Also 23/03/10 in CAL meeting:

- MOS CCD Noise	[AR]

Apologies:

SS

ME

WP

Open/ongoing action Items from last meetings

AI_EPIC_BG_WG_01_12: on MF: Once any BG or Closed fits files had been obtained, the user can change their CCF_PATH etc. setup so that a new cifbuild would incorporate these extra files. This enables the BG/Closed events files (e.g. the ones used in SS's task) to be used in the SAS, without them having to be included in the CCF files. - ONGOING - Interface TBD (MF & RS, CG: for esas in SAS)

AI_EPIC_BG_WG_03_08: on MF: UHB update section 3.2.4: outside FoV eff. area (up to 80 arcmin), Update of CCF (currently not supported, calview, 15 arcmin, TBC) OPEN – provide numbers from simulations by B. Aschenbach

AI_EPIC_BG_WG_03_10: on SM: provide BGWG with script on bkg treatment in spectral analysis (after publication of related paper) – OPEN

AI_EPIC_BG_WG_03_11: on AR/HC: check HK parameters for anomalous MOS FWC data- ONGOING

AI_EPIC_BG_WG_04_02: on SS/K. Kuntz: try to extend MOS tools such that they also work for EPIC-pn by about June 2007 – ONGOING (see presentation KK)

AI_EPIC_BG_WG_04_08: on AR: trigger the generation of smaller sub-sets of EPIC-pn FWC data (with M. Freyberg) Þ update of FWC web page needed – ONGOING (low priority as no user demand)

AI_EPIC_BG_WG_06_07: On SM: to provide new threshold numbers for the Fin/Fout tool to AR to allow him another update of that script (specifically to account for the MOS1 CCD6 loss) – OPEN

AI_EPIC_BG_WG_07_04 On JC: continue investigation of possible solutions to ghosting problem - ONGOING

AI_EPIC_BG_WG_07_07 On CG & IdC: to check BGWG pages from a users point of view and to provide ideas for further improvement of the documentation – OPEN

AI_EPIC_BG_WG_07_08 On CG & IdC: to consider preparation of simple analysis threads and recipes for the analysis of extended sources (mentioning complexity & different approaches) – ONGOING (documentation of esas SAS task & thread needed)

New Action Items resulting from the March 2009 meeting:

AI_EPIC_BG_WG_08_01 On JC: Add example current Blank Sky files to web form so that 'standard' requests might be fulfilled avoiding duplications of such requests

AI_EPIC_BG_WG_08_02 On JC: Implement some changes to web page text taking into account user comments

AI_EPIC_BG_WG_08_03 On JC: Add to Blank Sky request response page information on the exposure weighted NH from the used component files

AI_EPIC_BG_WG_08_04 On AR & JC: Consider and plan the long term support for the Blank Sky delivery system, i.e. a transfer from the semi- to a full-automatic system

AI_EPIC_BG_WG_08_05 On KK & CG: Discuss possibilities to simplify the calibration files for esas

AI_EPIC_BG_WG_08_06 On ME: Take care of the implementation of the new approach for FWC observations at the SOC: Change of Routine calibration Plan, two versions of RCFs, scheduling procedure

AI_EPIC_BG_WG_08_07 On IdC: Prepare a draft version of the planned report of BGWG activities to the XMM-Newton User Group meeting in May 2009, and iterate it with AR

AI_EPIC_BG_WG_08_08 On KK: Look at whether anomalous MOS cases can come and go within observations.

End of actions

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Background WG Meeting Presentations

Meetings Table

- Mallorca, April 2009
- Mallorca, April 2008
- Mallorca, November 2007
- Palermo, April 2007
- Mallorca, October 2006
- MPE, May 2006
- MPE, November 2005
- ESAC, June 2005

- Mallorca, April 2009
  - Meeting summary [pdf]
  - A.Read
    - Introduction and action items from last meeting [ppt]

XMM-Newton EPIC Background Components

Table summarizing the components within the XMM-Newton EPIC Background; temporal, spectral and spatial properties.

Count rate plots, giving an estimate of the to-be-expected EPIC background in 'low background' periods, both in-FOV (~photons+particles) and out-FOV (~particles), are available here.

	PARTICLES			PHOTONS	
	SOFT PROTONS	INTERNAL (cosmic-ray induced)	ELECTRONIC NOISE	HARD X-RAYS	SOFT X-RAYS
Source	Few x 100 keV solar protons, accelerated by magnetospheric reconnection events. Dominate times of high-BG.	Interaction of High Energy particles (cosmic rays) with detector - associated instrumental fluorescence.	(1) Bright pixels & (parts of) columns. (2) CAMEX readout noise (pn). (3) (4) Artificial Low-E enhancements in outer MOS CCDs (Also dark current - thought negligible).	X-ray background (AGN etc), Single Reflections from outside FOV, Out-of-time (OOT) events (pn)	Local Bubble, Galactic Disk, Galactic Halo, Solar Wind Charge Exchange (SWCX), Single Reflections from outside FOV, Out-of-time (OOT) events (pn)
Variable? (per Observation)	Flares (up to >1000%). Unpredictable. Significant quiescent component (long flares) - survive GTI screening. (Also additional possible 'irreducable' component).	+/-10%. MOS: >2keV continuum unchanged, small changes in fluorescence lines. <1.5keV continuum varies - may be be due to Al redistribution. pn: Difference between continuum and lines (some correlation).	(1) +/-10%. (2) Very constant. (3) (4) Believed constant.	Constant.	Constant. Long obs. may see effect of SWCX (e.g. variations at 0.5-1.2 keV [OVIII/MgXI], but not at 2-4 keV).
Variable? (Obs. to Obs.)	Unpredictable. Affect 30%-40% of time. Flaring SP increasing? Quiescent SP not evolving. More SPs far from apogee. More SPs in winter than in summer. Low-E flares turn on before high-E.	Majority @ +/-15%. Can be x10 higher in high radiation periods. No increase after solar flares. Plus above 'per Observation' variations.	(1) >1000% (pixels come and go, also [micro-]meteorite damage). (2) Mode-dependent (lowest eFF, then FF, LW, highest SW) (3) effects 5-20+% of obs. (4) effects 20-50% of obs. (factor increases with high BG rate)	Constant. OOT events (pn) mode-dependent (LW:0.16%, FF:6.3%, eFF:2.3%)	Variation with RA/Dec (+/-35%). SWCX may affect observations differently. OOT events (pn) mode-dependent (LW:0.16%, FF:6.3%, eFF:2.3%)
Spectral	Variable. Unpredictable. Continuum spectrum (no lines), fitted by unfolded xspec PL (double-exponential or broken power law [break energy stable ~3.2 keV]) model for E>0.5keV (E<0.5keV, less flux is seen). Variable in intensity + shape (higher the intensity, flatter the slope).	Flat (MOS index~0.2) + fluorescence + detector noise. MOS: 1.5keV Al-K, 1.7keV Si-K. Det.noise <0.5keV. High-E lines (Cr, Mn, Fe-K, Au). PN: 1.5keV Al-K. No Si (self-absorbed). Cu-Ni-Zn-K (~8keV). MIP noise <0.3keV.	(1) low-E (<300eV), tail may reach higher-E. (2) low-E (<300eV). (3) (4) low-E (<500eV) (3) High-rate plus soft excess.	1.4 power law. Below 5keV, dominates over internal component. Above 5keV, internal component component dominates (in times of low-BG).	Thermal with ~<1keV emission lines. Extragalactic @>0.8keV, index=1.4. Galactic - emission/absorption varies. SWCX very soft, with unusual OVIII/OVII line ratios (plus others) - Strong OVIII & MgXI
Spatial - Vignetted?	Yes (scattered) - Vignetting is flatter than for photons - low-E SPs extremely flat, higher-E SPs steeper	No - flat (see below).	(1,2) No. (3) No/unclear (out-FOV) (see below) (4) Yes - evident in vignetting maps (in-FOV). (similar, smaller-magintude vignetting asymmetries seen in pn).	Yes.	Yes.
Spatial - Structure?	Perhaps, in MOS due to the RGA. No structure seen in pn. SP feature seen in MOS1-CCD2 at low-E. SPs observed only inside FOV.	Yes. Detector + construction. MOS: outer CCDs more Al, less Si. CCD edges more Si. Less Si out-FOV. Continuum diff. between out-FOV and in-FOV below Al line (redistribution?). More Au out-FOV. Changes in high-E lines. CCD-to-CCD: line intensity variations, energies/widths stable. PN: Line intensities show large spatial variations from electronic board. Central 'hole' in high-E lines (~8keV).. Residual MIP contribution near CAMEX readout (low-E, non-singles, parallel to readout).	Yes. (1) Individual pixels & columns. (Also [pn] sections of columns away from CAMEX, near to FOV centre) (2) Near pn readout (CAMEX), perpendicular to readout. (3) MOS1 CCDs 4 & 5, MOS2 CCDs 2 & 5 - unusual in- & out-FOV differences (esp. MOS1 CCD4) and spatial inhomogeneities. (4) MOS1 CCDs 2 & 5.	No. Single reflections: Diffuse flux from 0.4-1.4 deg (out-FOV) is ~7% of in-FOV signal. Effective area of 1 telescope ~3 sq.cm at 20-80 arcmintes off-axis. OOT events (pn) smeared along readout from bright sources of X-rays. (extra BG in pn LW mode due to frame store area).	No, apart from real astronomical objects. Exgal.>0.8keV spatially uniform. SWCX over whole FOV. Single reflections: Diffuse flux from 0.4-1.4 deg (out-FOV) is ~7% of in-FOV signal. Effective area of 1 telescope ~3 sq.cm at 20-80 arcmintes off-axis. OOT events (pn) smeared along readout from bright sources of X-rays. (extra BG in pn LW mode due to frame store area).
Patterns	Distribution similar to genuine X-rays.	Distribution different from genuine X-rays.	Distribution different from genuine X-rays.	Genuine X-ray distribution.	Genuine X-ray distribution.

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Changes to the Web Pages

EPIC Background	RGS Background	OM Background	XMM-

EPIC

Introduction

The XMM-Newton observatory provides unrivalled capabilities for detecting low surface brightness emission features from extended and diffuse galactic and extragalactic sources, by virtue of the large f the high throughput yielded by the heavily nested telescope mirrors. In order to exploit the excellent EPIC data from extended objects, the EPIC background, now known to be higher than estimated pre-l thoroughly.

There are several different components to the EPIC background:

1. Photons:
   - The astrophysical background, dominated by thermal emission at lower energies (E<1 keV) and a power law at higher energies (primarily from unresolved cosmological sources). This backgrou energies.
   - Solar wind charge exchange.
   - Single reflections from outside the field of view, out-of-time events etc.
2. Particles:
   - Soft proton flares with spectral variations from flare to flare. For weak sources the only option is to select quiet time periods from the data stream for analysis.
   - Internal (cosmic-ray induced) background, created directly by particles penetrating the CCDs and indirectly by the fluorescence of satellite material to which the detectors are exposed.
3. Electronic Noise:
   - Bright pixels, columns etc., readout noise etc.

A table summarizing the temporal, spectral and spatial properties of these EPIC background components is available here.

There have been various attempts to describe/model the EPIC Background in the past. This page will provide an overview on all sources of background analysis and modelling pointing out the recomme treatment by the EPIC consortium.

In 2005 the XMM-Newton EPIC Background working group was founded as a steering and supervising committee to provide the user with clear information on the EPIC Background and (SAS)-Tools (TE correctly for various TBD scenarios.

Current progress of the XMM-Newton EPIC Background working group can be monitored here.

Products

- XMM-Newton Extended Source Analysis Software package, XMM-ESAS
  Released in March 2006 by the EPIC Background Working Group allowing the user to model the quiescent particle background both spectrally and spatially for the EPIC MOS detectors.
- New XMM-Newton 'blank sky' background event files
  Released in November 2008 by the EPIC Background Working Group: A major reworking of the blank sky project, incorporating the entire XMM-Newton EPIC database. Users within the c blank sky files specifically catered for, and precisely tuned to their own particular needs.
- Filter Wheel Closed data
  Released in September 2006 by the EPIC Background Working Group the stacked collections of Filter Wheel Closed (FWC) data are available for the MOS and pn cameras.
- Further EPIC Background Scripts
  - Estimation of the residual Soft Proton flare contamination
  - Background correction for faint extended EPIC PN emission
  - The 'images' Script: a tool to create attractive XMM-Newton images

End