

Blank sky data analysis

Jenny Carter, University of Leicester
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Plan – review

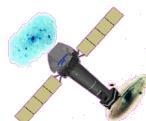
- Aim: Creation of long exposure blank sky EPIC BG event files
 - 1 – Writing of the tasks/scripts
 - 2 – Compiling list(s) of observations
 - 3 – Creating BG event and other files
 - 4 – Stacking BG event and other files
 - low BG, long duration observations, no diffuse sources, few central targets
- At last stage aims achieved:

Using 2XMM pipeline products

Script 1 – creates event files and exposure maps

Script 2 – merges created event files

Script 3 – merges created exposure maps



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General Procedure

Per instrument, filter and mode combination:

List of observations

no bright sources, long exposure etc



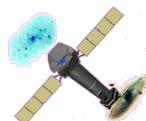
Create event lists and exposure maps



Merge event lists and exposure maps



One great big event list with an exposure map



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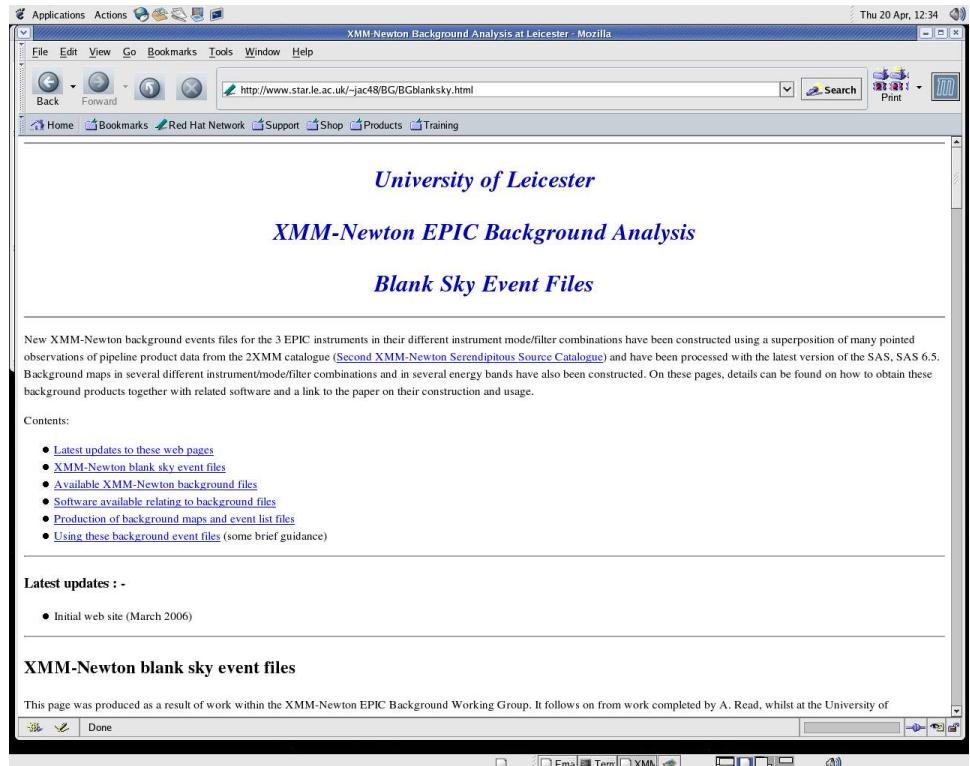
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Current status

- List of obs.
 - Bad obs. removed
- Improved ghosting procedure
- Web page
 - Scripts AMR, JAC
- Files to ESAC
 - Set 1 – unfilled (all)
 - Set 2 – filled (ready to go)



XMM-Newton EPIC Background Analysis at Leicester - Mozilla

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XMM-Newton EPIC Background Analysis

Blank Sky Event Files

New XMM-Newton background events files for the 3 EPIC instruments in their different instrument mode/filter combinations have been constructed using a superposition of many pointed observations of pipeline product data from the 2XMM catalogue ([Second XMM-Newton Serendipitous Source Catalogue](#)) and have been processed with the latest version of the SAS, SAS 6.5. Background maps in several different instrument/mode/filter combinations and in several energy bands have also been constructed. On these pages, details can be found on how to obtain these background products together with related software and a link to the paper on their construction and usage.

Contents:

- [Latest updates to these web pages](#)
- [XMM-Newton blank sky event files](#)
- [Available XMM-Newton background files](#)
- [Software available relating to background files](#)
- [Production of background maps and event list files](#)
- [Using these background event files \(some brief guidance\)](#)

Latest updates : -

- Initial web site (March 2006)

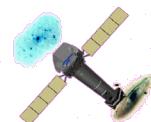
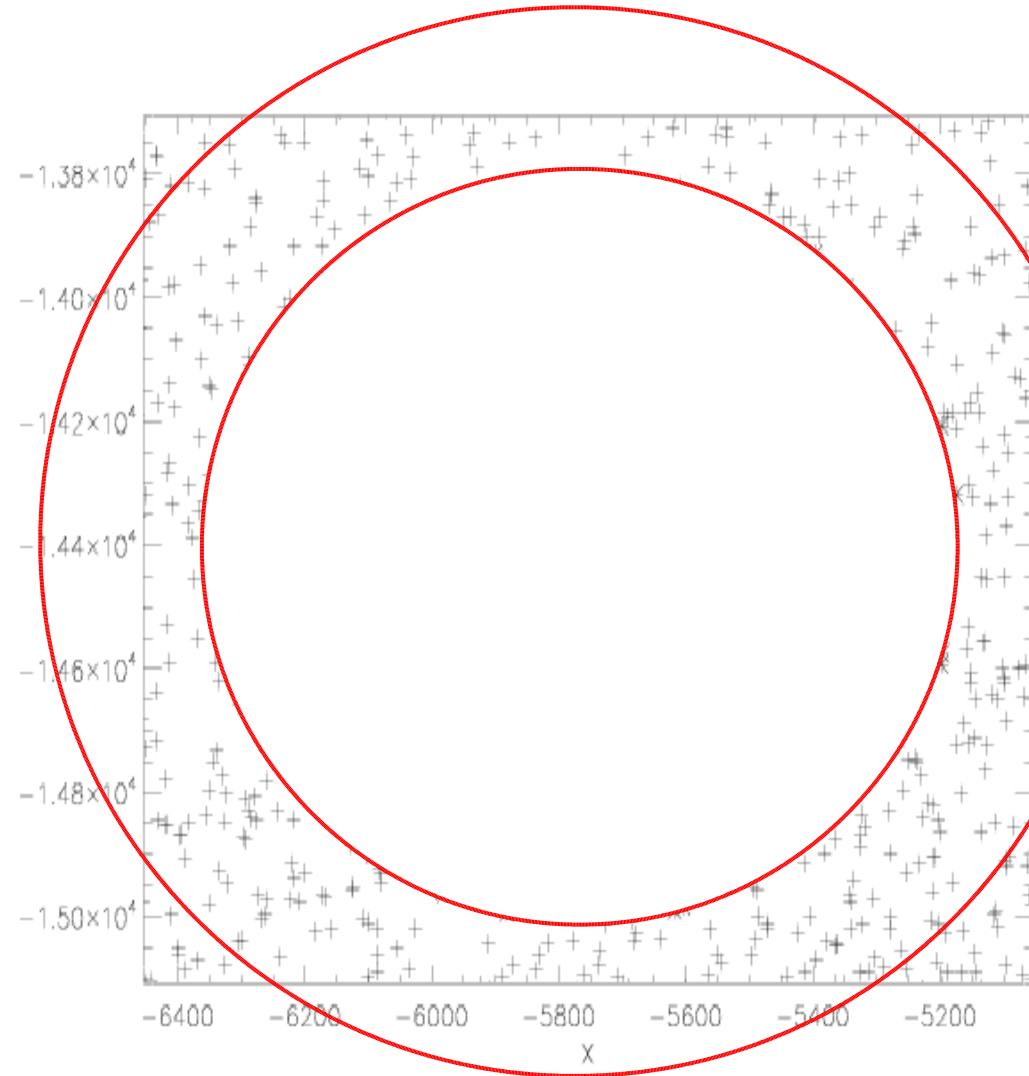
XMM-Newton blank sky event files

This page was produced as a result of work within the XMM-Newton EPIC Background Working Group. It follows on from work completed by A. Read, whilst at the University of

Filling the source holes in the event files - ‘Ghosting’

- Match the area of the source hole to the area of an annulus surrounding the hole
- Copy the events in the ring
- Randomise the DETX, DETY positions of these copied events inside the annulus
- Add these events to the event file

- Consider complicated situations (multi-holes, edges etc.)
- (attcalc [to 0, 0, 0] to correct X, Y positions)



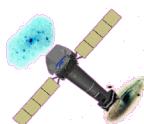
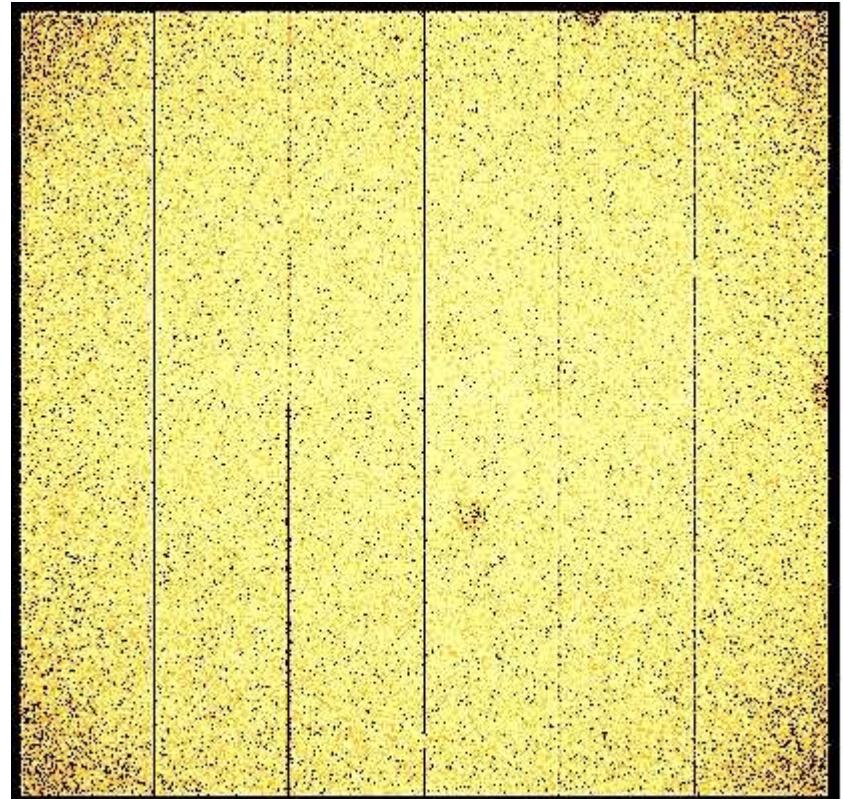
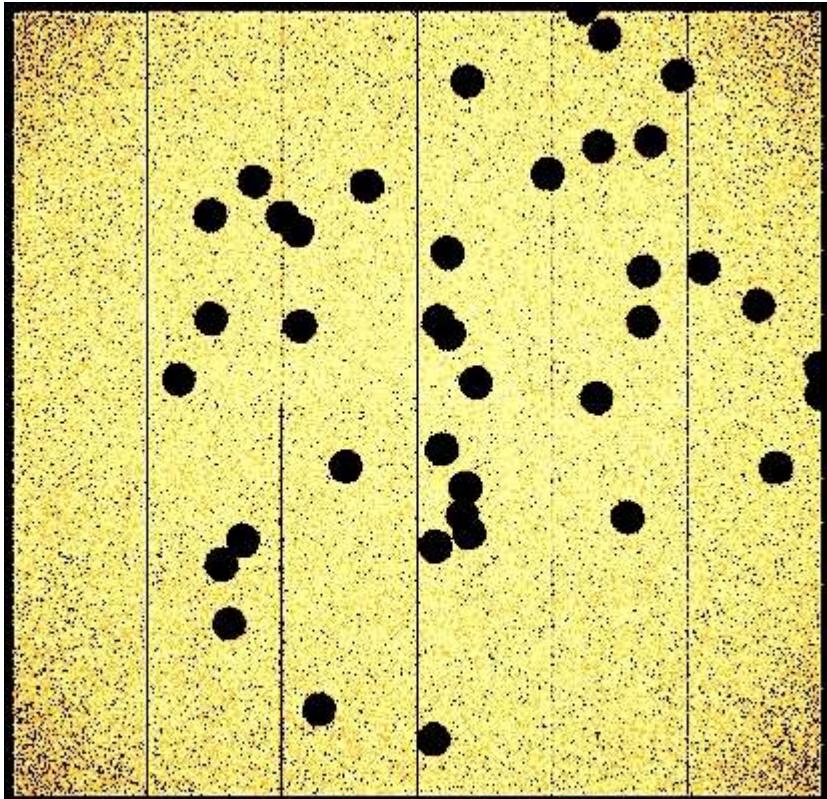
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Example PN file ghosting procedure



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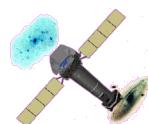
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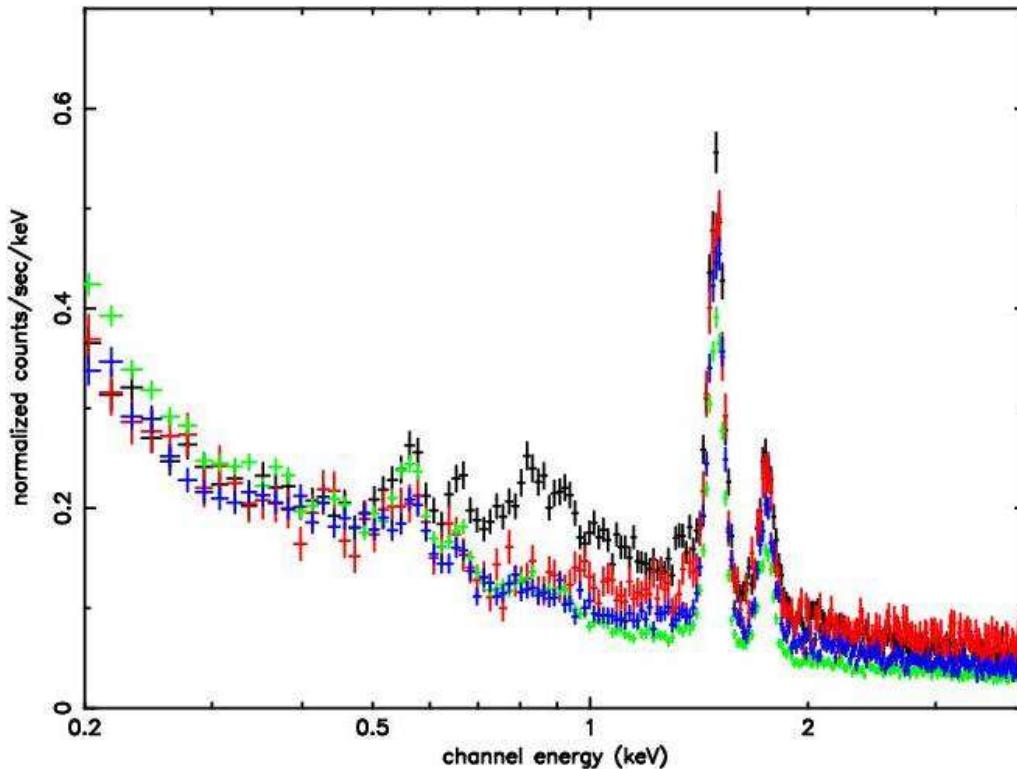
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Details of observations

Instrument	Mode	Filter	N _{OBS}	Exp.time (s)
MOS1	FF	Thick	12	3.01e5
MOS1	FF	Medium	65	1.58e6
MOS1	FF	Thin	113	2.19e6
MOS2	FF	Thick	13	3.44e5
MOS2	FF	Medium	67	1.68e6
MOS2	FF	Thin	111	2.09e6
PN	FF	Thick	10	2.37e5
PN	FF	Medium	33	1.08e6
PN	FF	Thin	42	9.93e5
PN	FFext	Thick	3	58664
PN	FFext	Medium	30	4.62e5
PN	FFext	Thin	62	8.25e5



Location dependence



- MOS 1, thin, full-frame event file
- Galactic Centre enhancement features
- Tool produced for selection of events from a certain area of sky

expression = ‘circle(0, 0, 10000, DETX, DETY)’



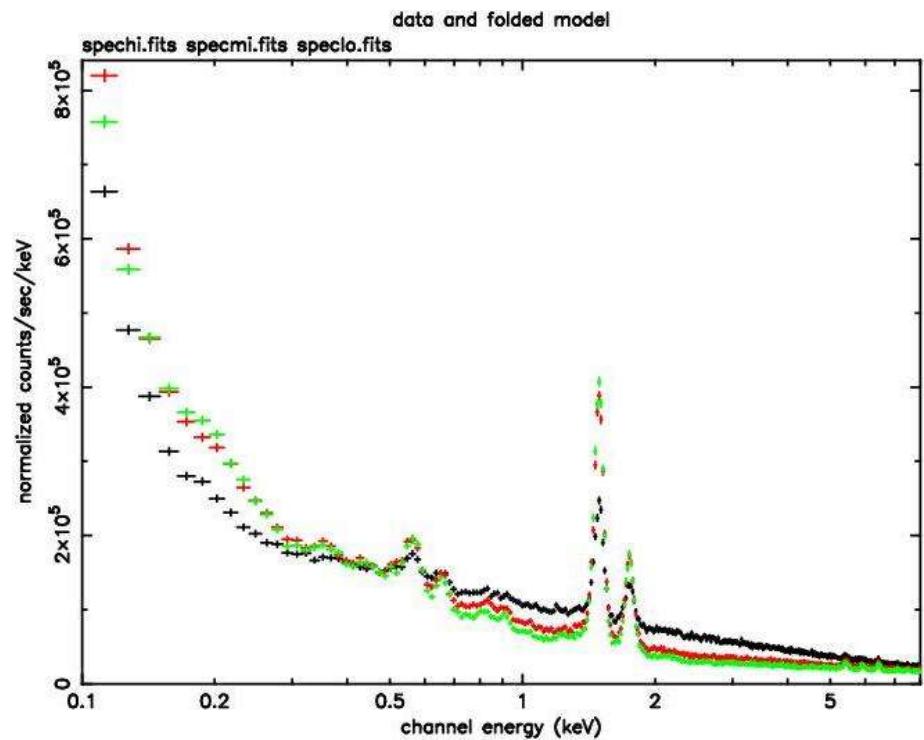
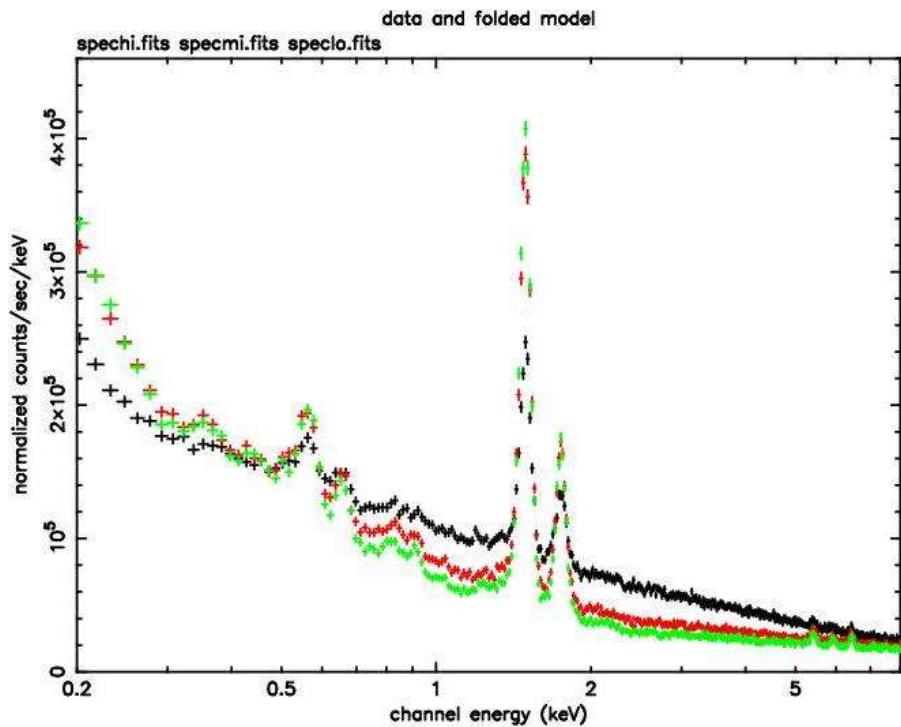
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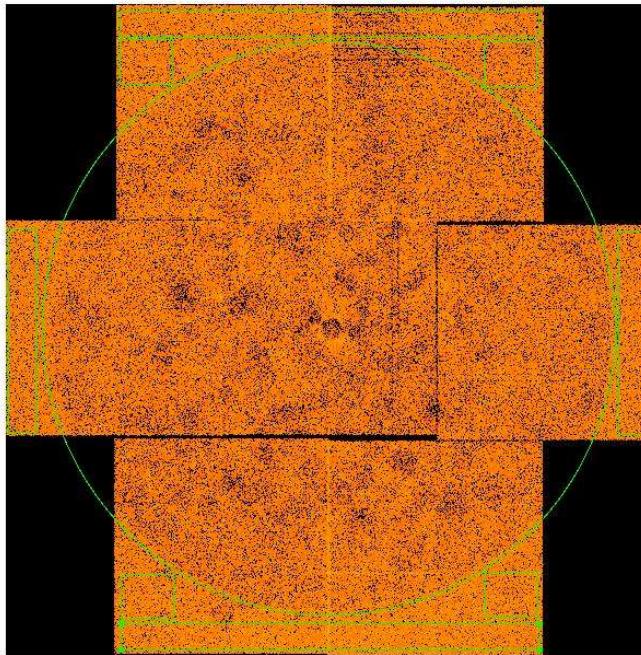
Count rate dependence



- Users may wish to make a selection based on count rate
- Differences between high, medium and low count rates

Out of FOV count rate – instrumental particle BG

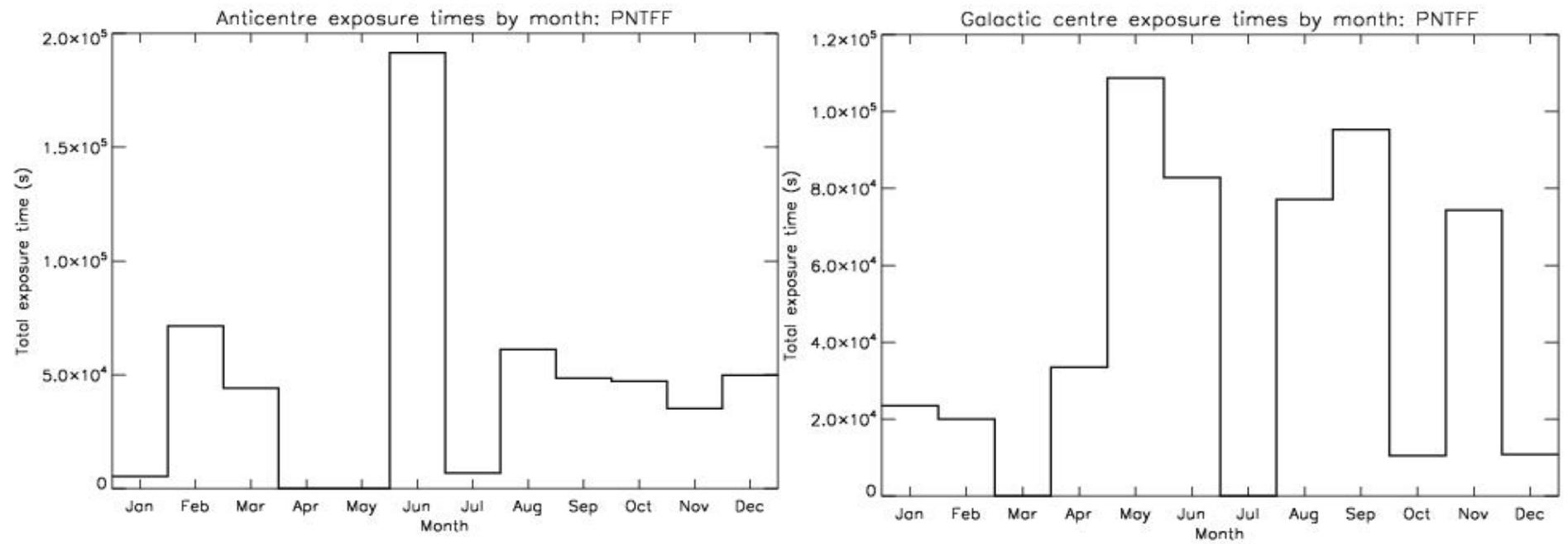
- All instruments, patterns = 0 and patterns ≤ 12 (MOS) or ≤ 4 (PN), with $(PI \geq 2500 \&\& PI \leq 6000)$
- Differences, Anti-centre – winter, Galactic Centre – summer ??



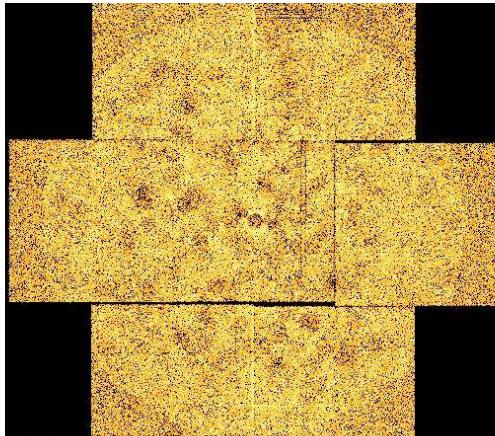
Differences between instruments, patterns and locations

Instrumen	Mode	Filter	Position	Pattern	CR (cts/s/arcmin ² x 10 ⁻⁴)
MOS 1	FF	T	N/A	0	2.69
MOS 1	FF	T	N/A	12	4.01
MOS 2	FF	T	N/A	0	2.87
MOS 2	FF	T	N/A	12	4.21
PN	FF	T	AC	0	19.2
PN	FF	T	AC	4	29.6
PN	FF	T	GC	0	36.4
PN	FF	T	GC	4	56.1

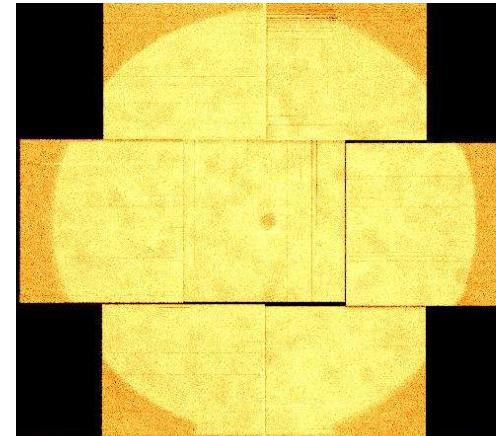




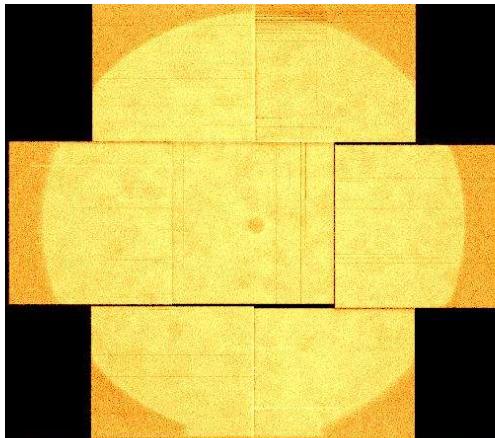
Final files – pictures MOS 1, unfilled



M1 K FF

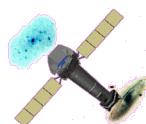


M1 T FF



M1 M FF

Images made from
the final event files



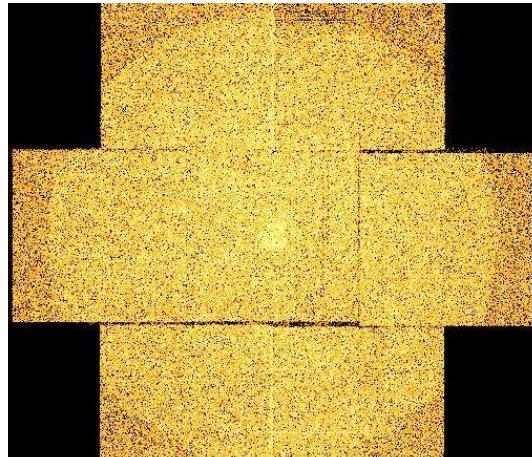
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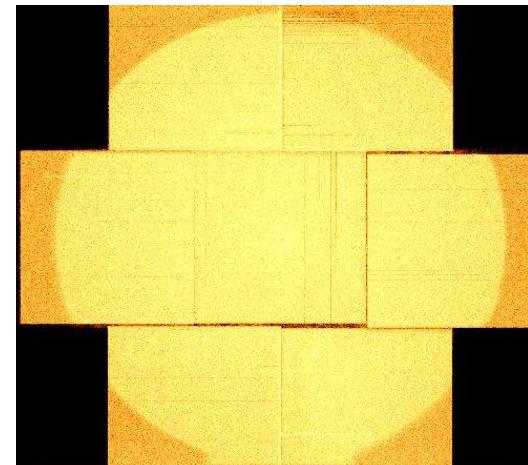


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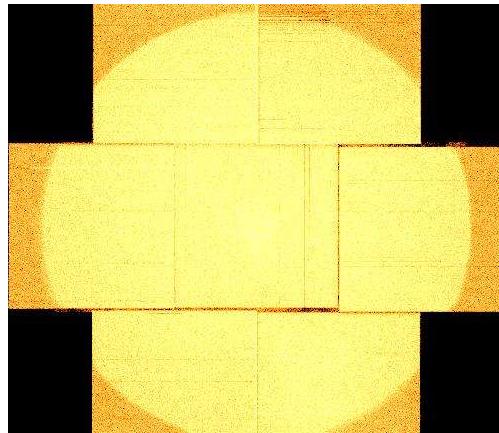
Final files – pictures MOS 1, refilled



M1 K FF



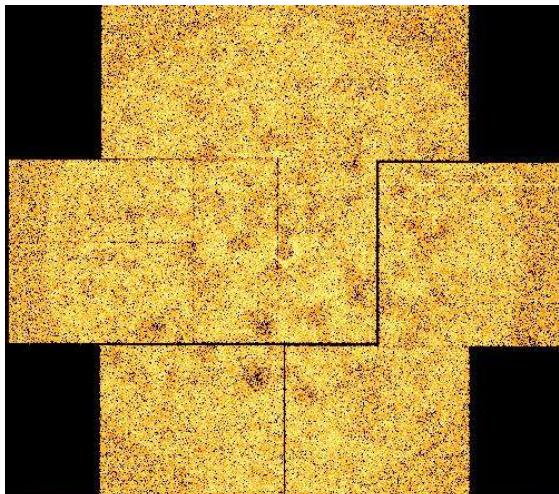
M1 T FF



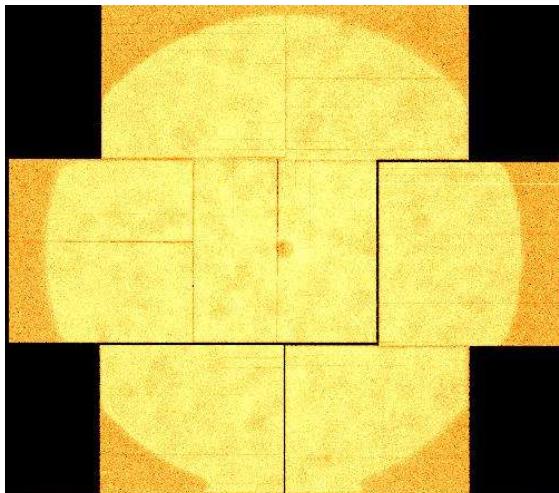
M1 M FF

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the final event files

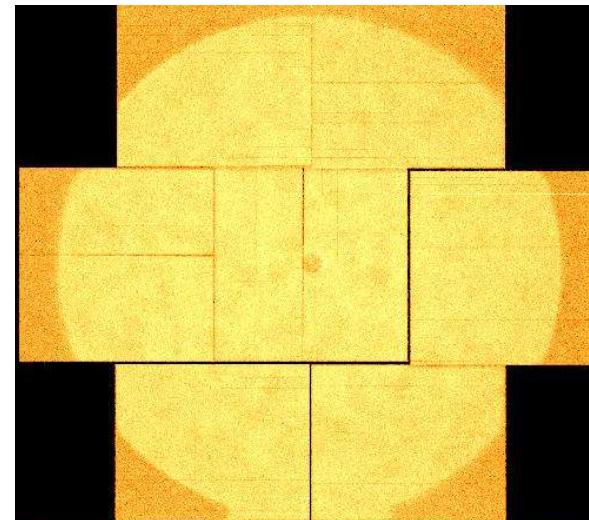
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M2 K FF

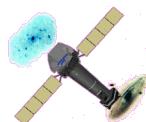


M2 M FF



M2 T FF

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the final event files



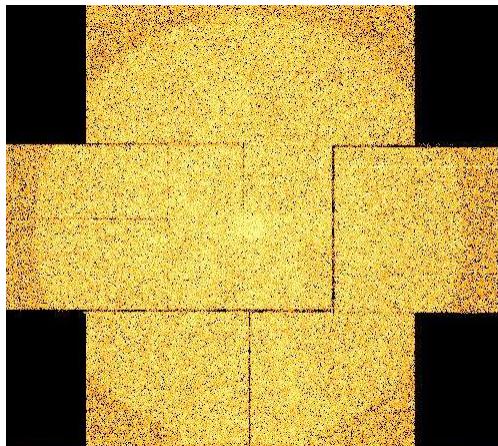
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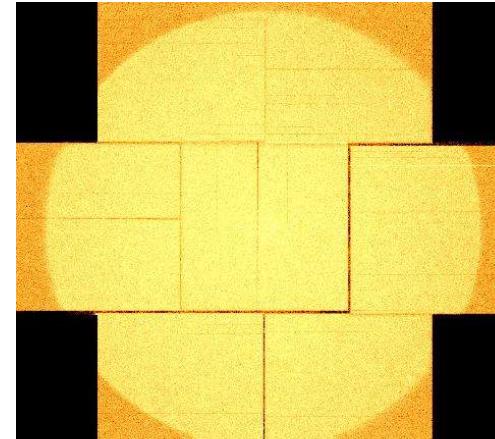


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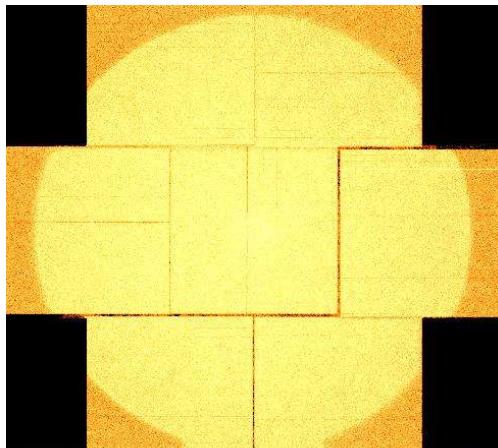
Final files – pictures MOS 2, refilled



M2 K FF

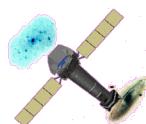


M2 T FF



M2 M FF

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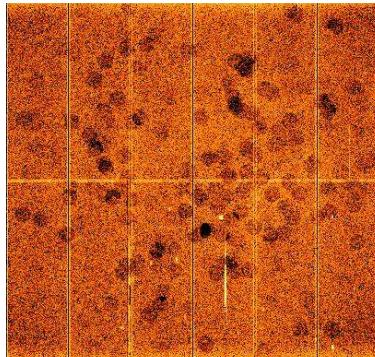
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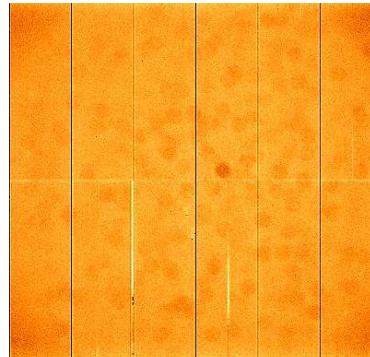


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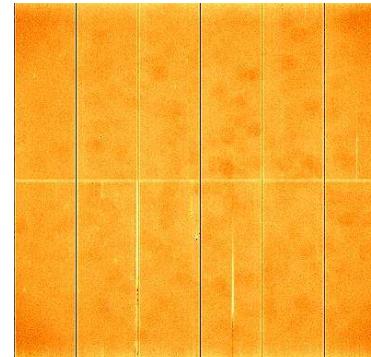
Final files – pictures PN, unfilled



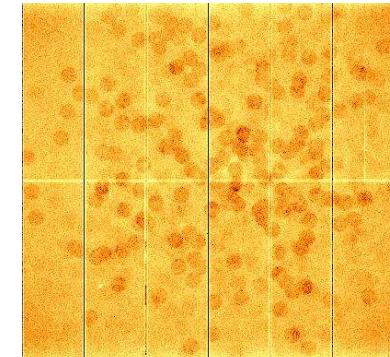
PN K EF



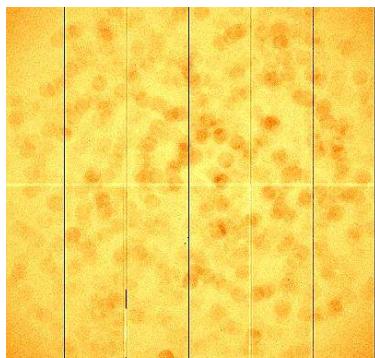
PN M EF



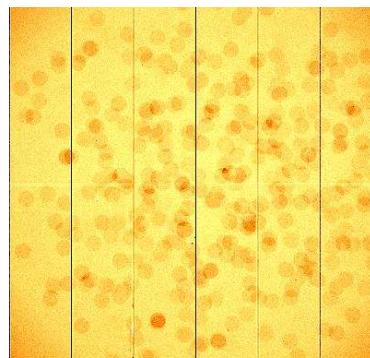
PN T EF



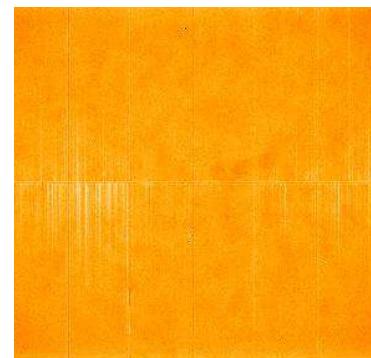
PN K FF



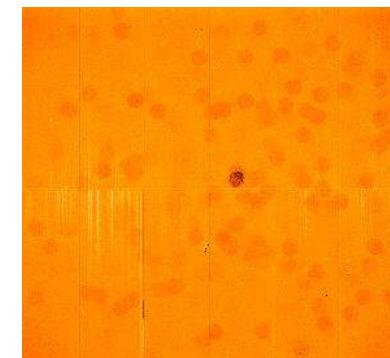
PN M FF
anticentre



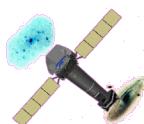
PN M FF
Galactic centre



PN T FF
anticentre



PN T FF
Galactic centre



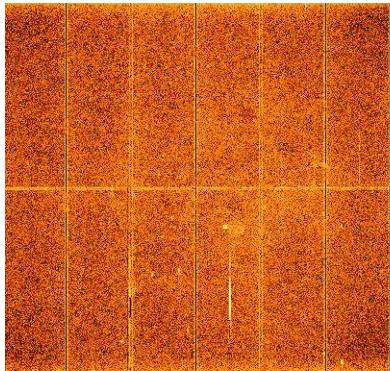
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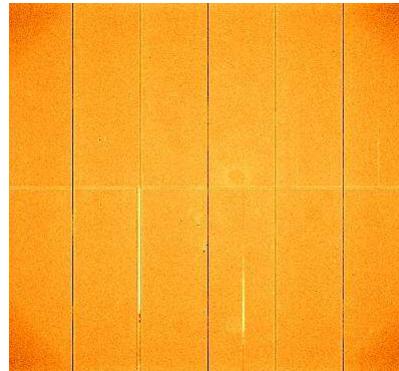


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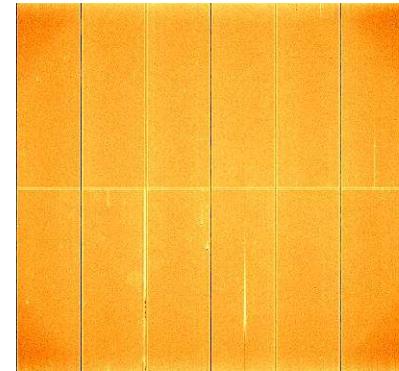
Final files – pictures PN, refilled



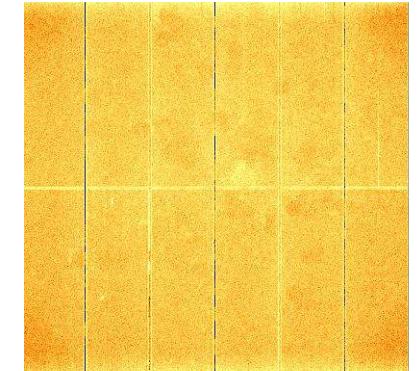
PN K EF



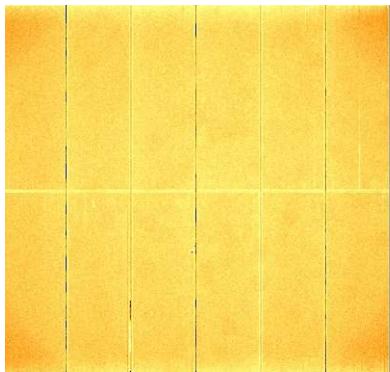
PN M EF



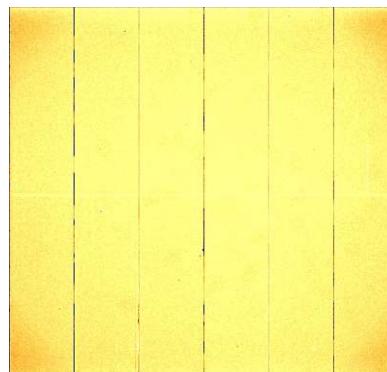
PN T EF



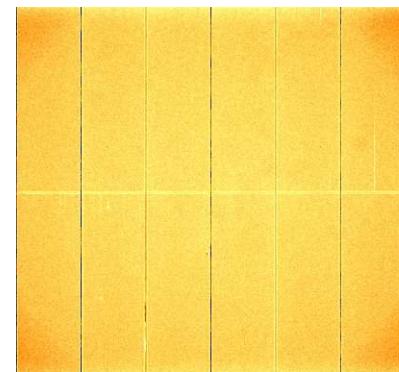
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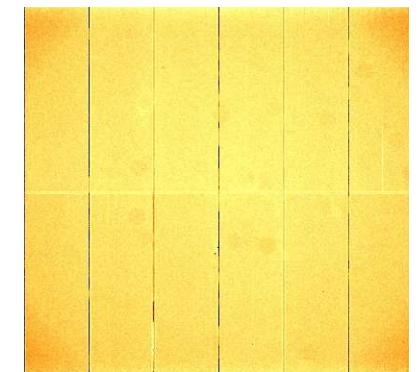
PN M FF
anticentre



PN M FF
Galactic centre



PN T FF
anticentre



PN T FF
Galactic centre

Tools available on the web page

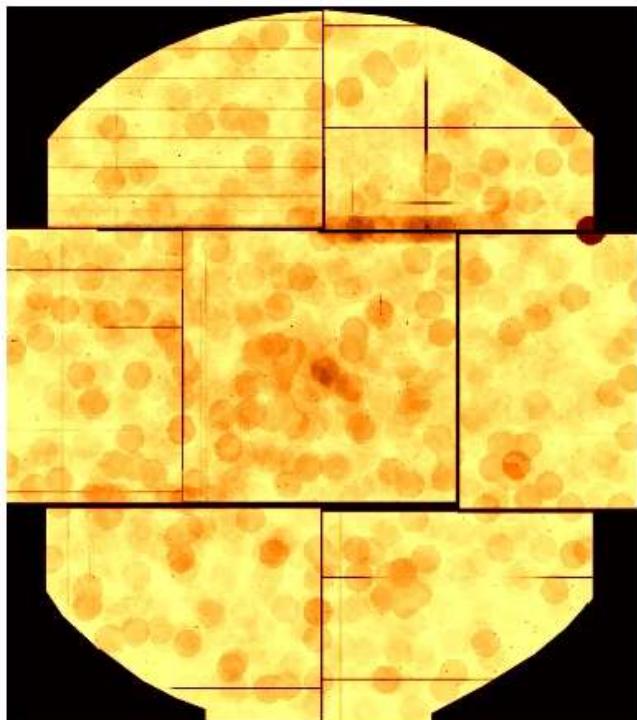
- SkyCast - attcalc
- BGrebinimage2SKY_2006 – rebinning, positioning
- SelectRADec – select events based on angular separation

Possible additions:

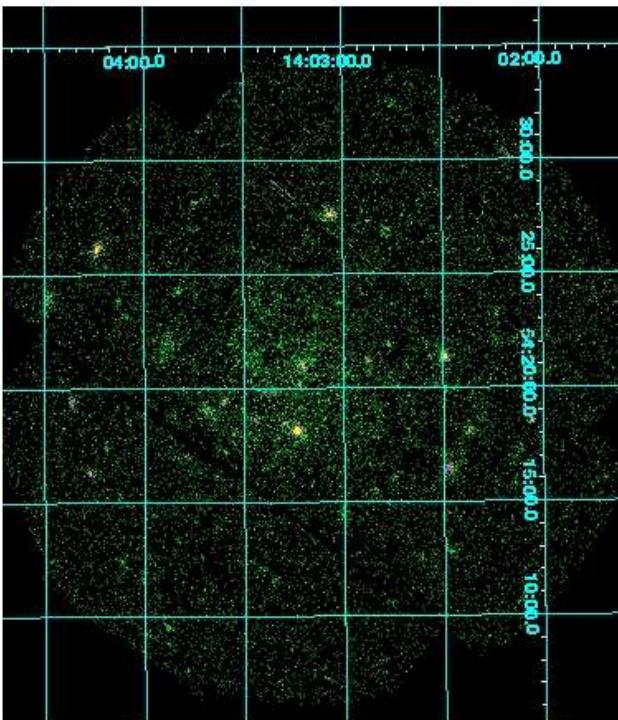
- OOT
- Count rate selection tool

- Use of BGrebinimage2SKY_2006 to transform/rebin from DET to SKY

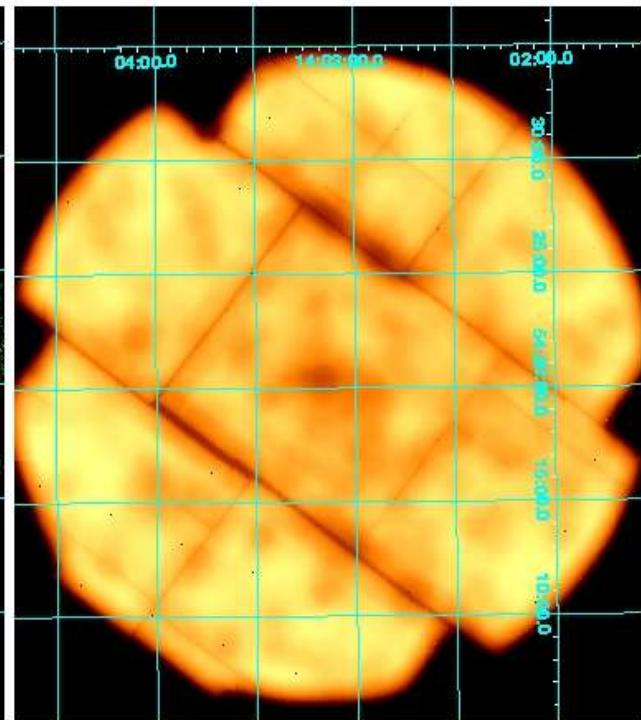
BG Exposure map (4) in
detector coordinates

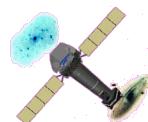


User's image (??) in sky
coordinates



BG Exposure map (??) in
user's sky coordinates



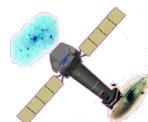


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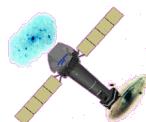
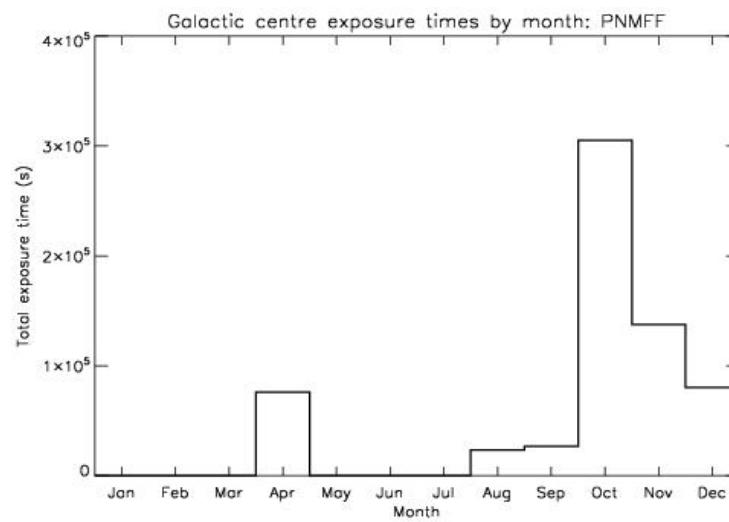
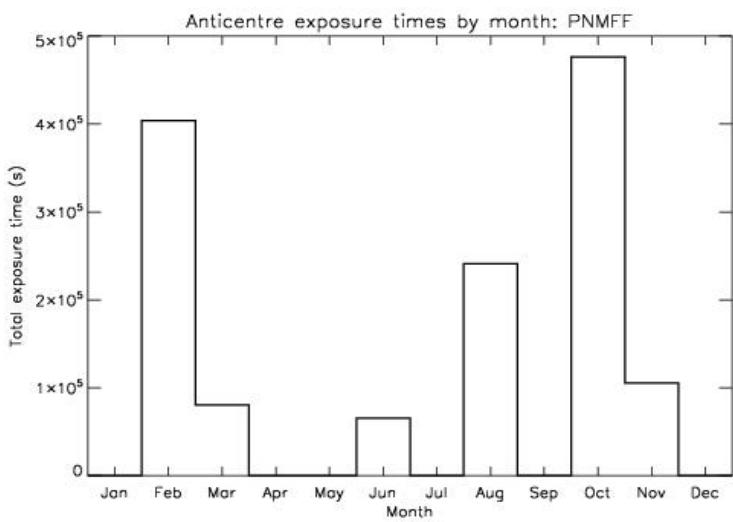


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