

# Pipeline Processing System

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**XMM-Newton Science Operations Centre** 



# What does PPS stand for ?



### **PPS stands for Pipeline Processing System:**

a standard data reduction pipeline for top-level products

### What is the purpose of the pipeline,

- production of top-level scientific products
- serve as quick-look data to users and facilitate scientific exploitation of the data
- ensure an homogeneous level in scientific quality
  - produced with the same SAS software package available for users
  - screened and validated following some standards

### The top-level products include,

- data from each EPIC, RGS and OM instruments
  - calibrated clean event files, sky images, source lists, spectra, time series, cross correlation multiwavelength information with archival catalogues (ACDS)

### I. PPS Processing



The pipeline infrastructures was developed, maintained and run by the Survey Science Centre (SSC) at University of Leicester, UK



Since March 1st 2012, the responsibility of running the pipeline has been transferred to the XMM-Newton Science Operations Centre (SOC) at ESAC, Spain

### General Procedure:

- 1) ODFs are processed by the pipeline at the SOC
- 2) products are sent to SOC and SSC members for screening
- 3) validation reports are created
- 4) made available through the XMM-Newton Science Archive (XSA)

Details under <a href="http://xmm.esac.esa.int/external/pipeline">http://xmm.esac.esa.int/external/pipeline</a>

## **II. PPS Processing**



- Only public versions of SAS are used in the pipeline processing, to ensure homogeneity and reproducibility
  - When a new SAS version becomes available, it is implemented in the pipeline
- One bulk reprocessing of all available XMM observations took place between December 1999 (the mission start) and May 2007.
  - The current XSA contains data homogeneously processed with SAS6.9 or newer
- The next bulk reprocessing of the data has taken place and will be available in the XSA in the summer 2013.
  - The XSA will contain data homogeneously processed with SAS12.0.1 or newer



### **PPS Contents: Scientific Products**



The pipeline products include data from each EPIC, RGS and OM instruments.

- Calibrated clean event files
- Background flaring filtering
- Attitude history plots
- Images (with exposure, background and sensitivity maps)
- Source lists
- Source Specific Products
  - Light curves
  - Spectra (with background and ancillary file, no RMF files)
- Multiwavelength cross-correlation information
- Quick look previews
- Processing log
- Screening report

Products come in a number of FITS, ASC, PDF, PNG, URL and HTML formats.

All the information can be accessed from a single file: index.html



### **PPS Contents: index.html**





OBS Summary

PPS Summary

EPIC Summary OM Summary

RGS Summary

Catalogue Summary

#### 0552270501 Observation Data Summary File

RevolutionTargetScheduled LengthObserver1547V2491 Cyg39339Dr Jan-Uwe Ness

Guest Observer Information

Proposal Target Information

Observation Record

Instrument Information

Exposure and Configuration Information

#### Guest Observer Information

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#### Proposal Target Information

Science Type

: V2491 Cyq Target Target RA [hms] : 19 43 2.10 Taget Dec [dms] : 32 19 12.80 Proposed Duration [s] : 38600 Boresight RA [hms] : 19 43 2.10 Boresight Dec [dms] : 32 19 12.80 Lower Pos Ang : 0 Upper Pos Ang : 360 SC Pos Ana : N : 7

0552270501 PPS Processing Summary Scheduled Length Revolution Observer 1547 V2491 Cva 39339 Dr Ian-Uwe Ness EPIC Exposures Processed OM Exposures Processed **RGS Exposures Processed** EPIC Exposures processed by PPS Inst. Exp. Id Sched Mode Datamode Filter Position Duration Exposure SrcDet SSP Flare Scrn Actual Start EMOS1 S001 Y PrimePartialW2 Imaging MEDIUM FILTER C 39013 25792 Y Y Y 2008-05-20T14:05:09 2008-05-21T00:55:22 EMOS2 S003 Y PrimePartialW2 Imaging MEDIUM FILTER C 2008-05-20T14:05:08 2008-05-21T00:55:26 39018 29692 FastTiming MEDIUM 2008-05-20T14:24:08 2008-05-21T00:58:25 OM Exposures processed by PPS Inst ExpID Sched Detector Mode Data-Mode Filter Duration Actual Start OM S006 Y REDUNDANT Image Fast imaging UVW1 3899 2008-05-20T14:13:21 2008-05-20T15:18:20 OM S007 Y REDUNDANT Image Fast, imaging UVW1 4399 2008-05-20T15:23:28 2008-05-20T16:36:47 OM S010 Y REDUNDANT Image Fast, imaging UVM2 4400 2008-05-20T19:48:49 2008-05-20T21:02:09 OM S011 Y REDUNDANT Image Fast, imaging UVM2 4400 2008-05-20T21:07:16 2008-05-20T22:20:36 REDUNDANT Image Fast, imaging UVW2 4399 2008-05-20T22:25:43 2008-05-20T23:39:02 REDUNDANT Image Fast, imaging UVW2 4399 2008-05-20T23:44:11 2008-05-21T00:57:30 RGS Exposures processed by PPS Inst. Exp. Id Sched Mode Datamode Event Filtering Duration Actual Start Actual End RGS1 S004 Y HighEventRateWithSES Spectroscopy rejflags,attGTl,hkGTI 39335 2008-05-20T14:03:53 2008-05-21T00:59:28 HighEventRateWithSES Spectroscopy rejflags,attGTI,hkGTI 39307 2008-05-20T14:04:25 2008-05-21T00:59:32 Generic Products Content P0552270501OBX000ATTTSR0000.FTZ. ATTITUDE TIME SERIES P0552270501OBX000CALIND0000.FTZ CALIBRATION INDEX FILE P05522705010BX000CDSLG10000.PNG CDS LOGO 1 P0552270501OBX000CDSLG20000.PNG CDS LOGO 2

# PPS Contents: what is (will be) new?



- Use of new empirical 2D PSF
- Source products available for sources with > 100 counts
- Extraction regions for EPIC source products have been redesigned.
- 0.00001 0.00003 0.00007 0.00015 0.00031 0.00063 0.00127 0.00255 0.00509

MOS1 2D PSF

- Source region: optimized circular (eregionanalyse)
- Bkg region: circular with 70% useful area
- Background flaring filtering is done now on a S/N basis rather than using a fix count rate cut. The cut is placed where the S/N peaks.
- Improved astrometric corrections
- RGS spectra computed in wavelength scale
- RGS time series available



# **PPS Contents: I. Cross-correlation products**





OBS Summary

**PPS Summary** 

**EPIC Summary** 

OM Summary

**RGS Summary** 

Catalogue Summary

#### **Summary Pages**

<u>EPIC sources</u> and their correlations	Correlations of EPIC sources with archival catalogues (sorted by EPIC source number). This page lists a summary of EPIC and catalogue data and provides links to finding charts and detailed catalogue extractions.	
Archival content of EPIC field of view	Archival catalogue entries found in EPIC field of view (sorted by right ascension) independently of their correlation with EPIC sources. The list of catalogues searched is a subset of those queried around EPIC positions. This page gives a summary of the archival data and provides links to detailed catalogue extractions.	

#### Archival Catalogues

#### **Catalogues searched**

List of all catalogues searched, position error properties (columns used and statistical value) and cross-correlation statistics for the observation. This page provides links to the detailed descriptions of matching catalogues.

#### **Graphical Products**

Field of view entries overlayed on an EPIC image	Positions of a selection of archival catalogue entries present in the field of view overlayed on an EPIC image.
EPIC image overlayed on a ROSAT image	XMM images are shown as red contours overlayed on a grey-scale ROSAT image extracted from pointed or survey observations. Green crosses show the positions of EPIC sources.  This product is not generated when no ROSAT observation covers the EPIC field of view .

#### Full Catalogue Extractions

race catalogue Extractions				
	Full catalogue extractions for entries correlating with EPIC sources	All measurements available for archival entries in correlation with EPIC sources. Entries are grouped <b>by archival catalogue</b> .  Direct link to this page is available from the summary page.		
	Full catalogue extractions for entries with positions within the EPIC field of view	All measurements available for archival entries with positions within the EPIC field of view (independently of their correlation with EPIC sources). Entries are grouped <b>by archival catalogue</b> . Direct link to this page is available from the summary page.		



# **PPS Contents: II. Cross-correlation products**

RGS Summary

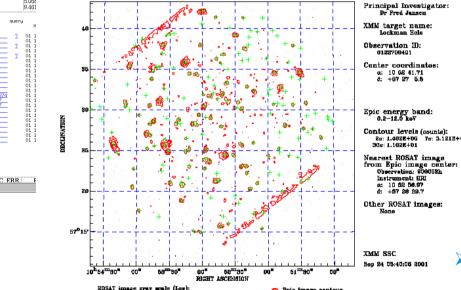
Catalogue Summary





Finding Chart for this source

OBS Summary PPS Summary **EPIC Summary** OM Summary File Edit View Go Communicator A 🧀 N \* Reckmarks 1 Location: file:/home/mousinsz/data2/yww/GO/NGC424/PPS/PG002942301CAX000SRCSUM0000.HTM ✓ 🊰 What's Belated 🗂 Catalogs 🗂 Journals 🗂 Tools 🗂 XMM 📑 XXX This page lists all archival catalogue entries correlating with EPIC sources, sorted by increasing distance between centres of error ellipses. An archival and an EPIC source are possibly the same object if the distance between them corresponds to the 99.3% confidence level (3 Gaussian sigma) given their respective positional uncertainties. Links in CAT\_ENT. NAME column point to catalogue descriptions. Links in CAT\_ENT. ANAME column point to the full catalogue respective fostituding interstanties. Emission of instruction from the databague accorptions. Emission of the Engineering of a section grouping all extractions for this catalogue). For Simbad and Ned entries the "?" in query column allows to query in real time these databases for this source. For each catalogue a representative measurement (CAT\_MEAS) has been selected. Its value is printed in CAT\_VAL column. CAT\_NUM is an absolute archival entry number which can be used to locate archival entries on the catalogue plot product for instance. Finding Chart for this source DEC RADEC\_ERR XMM + ROSAT images ACDS V4.69 01 11 27.549 -38 05 5.068



+ Detected Enio sources

PPS products available:

- correlation of EPIC sources with ~100 catalogues (positional coincidence at 99.93% c.l.)
- archive content of the EPIC field-of-view (independently on EPIC detection) in X-ray catalogues and SIMBAD
- field-of-view entries overlaid on an EPIC image
- EPIC image contours and detected sources overlaid on a greyscale ROSAT image

No cross-correlation for OM sources



# **PPS Contents: III. Cross-correlation products**





OBS Summary

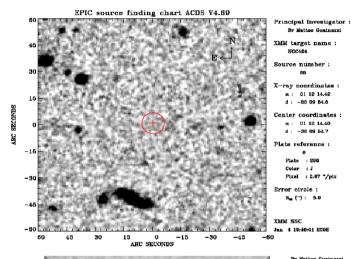
PPS Summary

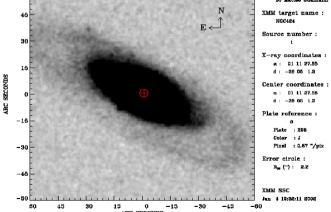
**EPIC Summary** 

OM Summary

RGS Summary

Catalogue Summary





### Finding Charts for every EPIC source

- I finding chart, 2x2 arcminutes with 1 arcsecond pixel is available for each detected EPIC source, centred on its best position
- EPIC flux contours or error circles are overlayed
- start information for follow-up programs or multiwavelength campaigns



# **Summary**



- The PPS is an easy and good way to start looking at the data
- The products are carefully screened and the events files can be used to extract science products
- Reprocessing is only necessary in special cases
- Great wealth of correlation products and catalogue information that is very difficult to obtain by hand

