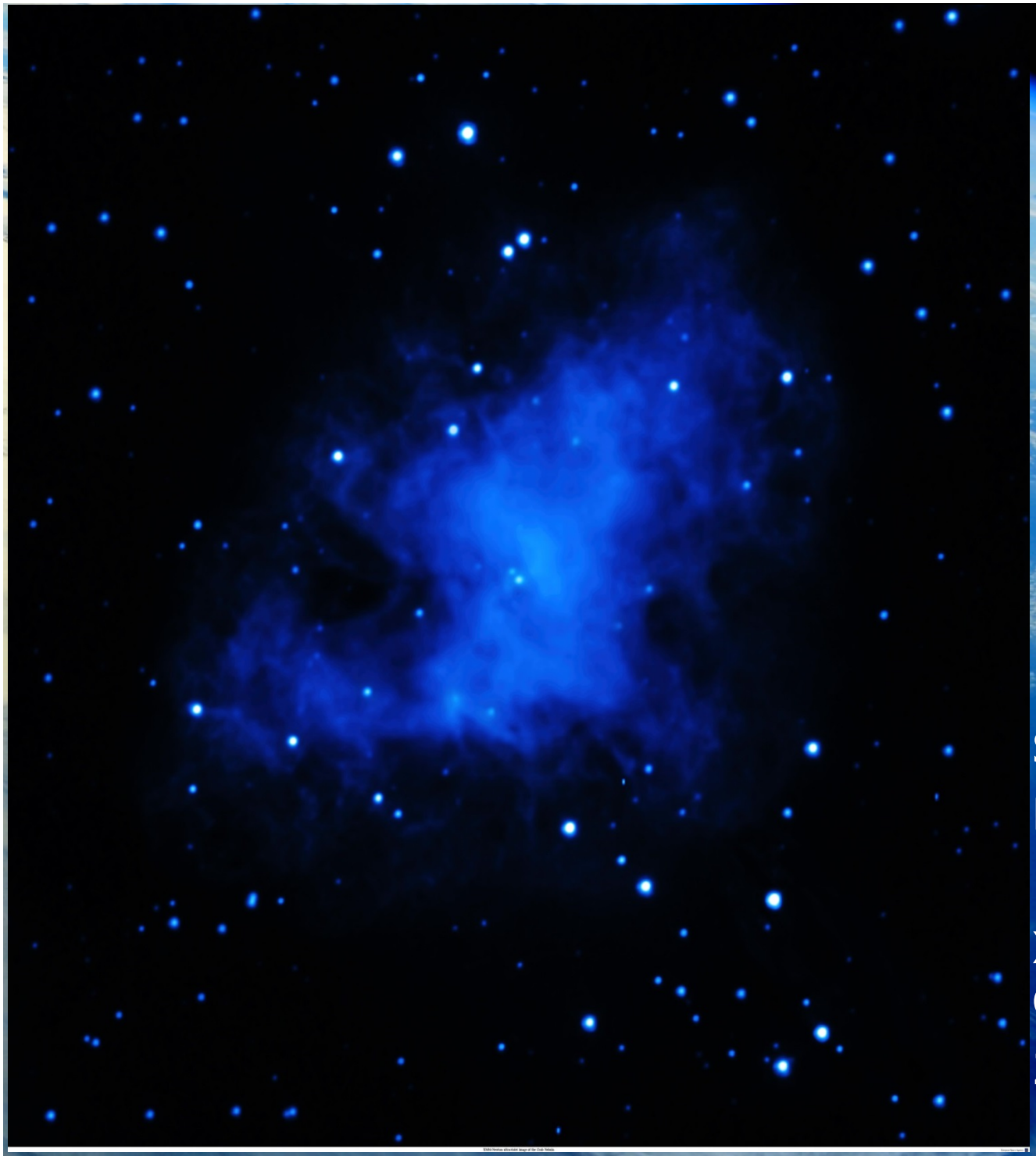

OM Calibration

Simon Rosen
ESAC

XMM-Newton Users Group meeting
2021 June 9-10

Outline

- UG recommendations 2020
- Recent OM calibration activity
- Forward look

UG recommendations (2020)

- Recommendation 2020-06-18/13: The UG recommends to continue the investigation of the reduced sensitivity patch of the OM detector so that correct photometric parameters can be obtained for sources within or close to this position.

- Recommendation 2020-06-18/14: The UG recommends to continue to work on the OM serendipitous UV source catalogue version 5 and is looking forward to the release of this catalogue (anticipated to be at the end of 2020).

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- Recommendation 2020-06-18/18: The UG strongly appreciates the improvements made to the pipeline. The UG recommends to continue improving it and to include the following products and options:
  Merged OM light curves
  OM broad band fluxes in OGIP compliant files
  Broad spectral energy distribution plots including OM and EPIC data

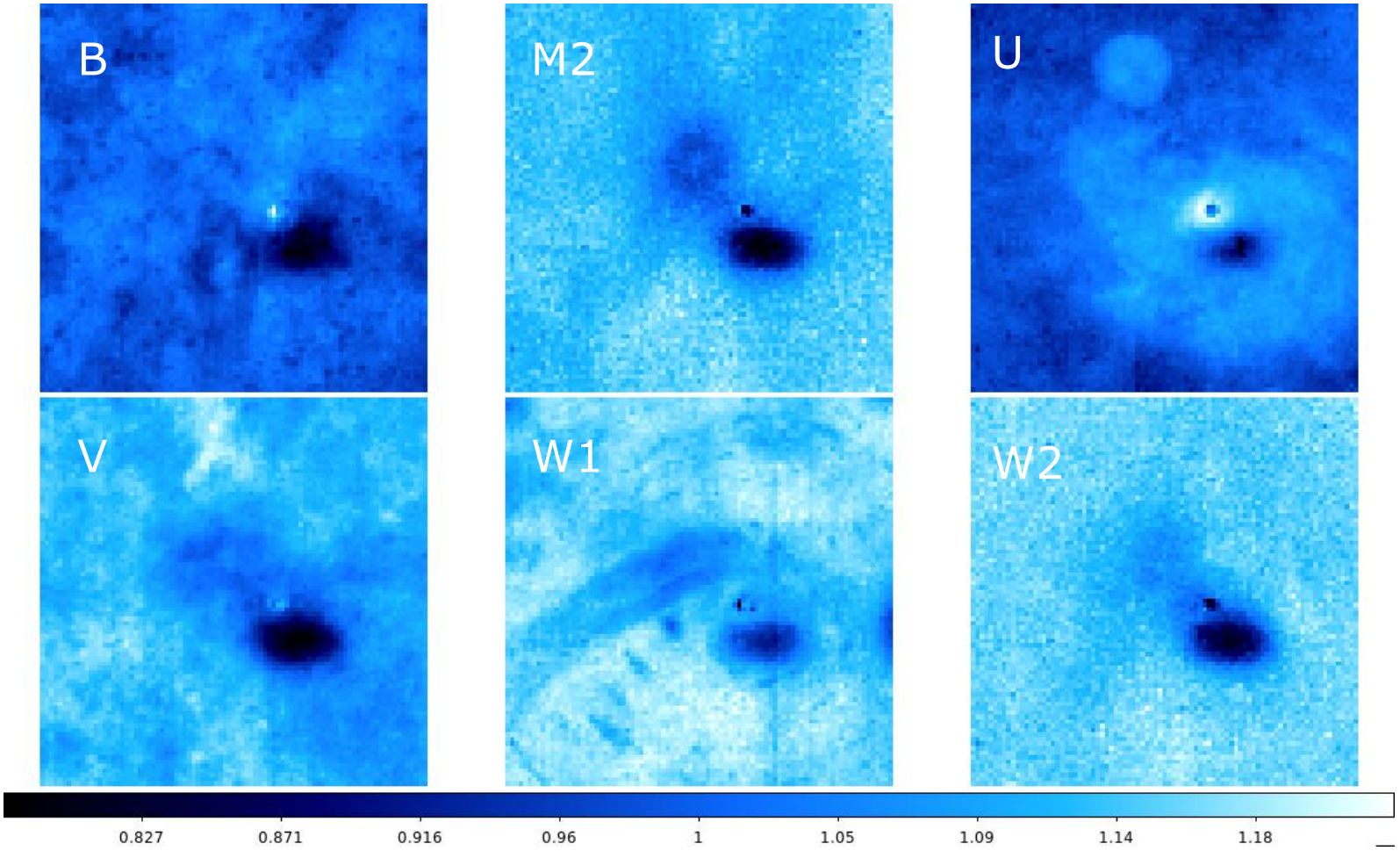
Jupiter patch

- Monitoring of standards at boresight, at patch core and outside patch
- **Note – impact at boresight (most targets) is small (3-8%). Patch 0.5% of FoV**
  - Now described in OM Calibration document (Sept 2020)

- Report by SOC/MSSL considered activities, timescales and manpower needed to switch to OM spare instrument chain
  - Conclusions: Not advocated due to…
    - Concern about single-point failure risk of beam deflector mirror
    - Downtime of instrument/delay in data usability until new calibration ready
    - Limited manpower (mainly for calibration).

- Exploring approaches to characterizing Jupiter patch profile (flatfields, per filter), from sky data.

Exploratory analysis for making JP flatfields per filter



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SUSS5 catalogue

- **XMM-OM SUSS5** released, via XSA, alongside 4XMM-DR10 in Dec 2020

  https://www.cosmos.esa.int/web/xmm-newton/om-catalogue
- Complete reprocessing of OM data with SAS 18 and latest calibration

Time-span	Feb 2000 - Feb 2020
Observations	10,628
Detections	8,863,922
	4.87 million in at least 1 UV filter ~118k in all 3 UV filters
Unique sources	5,965,434
Observed more than once 2 or more best quality dets	1,120,654 ~344k(W1), 74k(M2), 44k(W2)
Largest no. of repeat dets	75(W1), 46(M2), 38(W2)

- Aiming for next version in late 2022:
  - Exploring SAS upgrades to improve identification of quality issues

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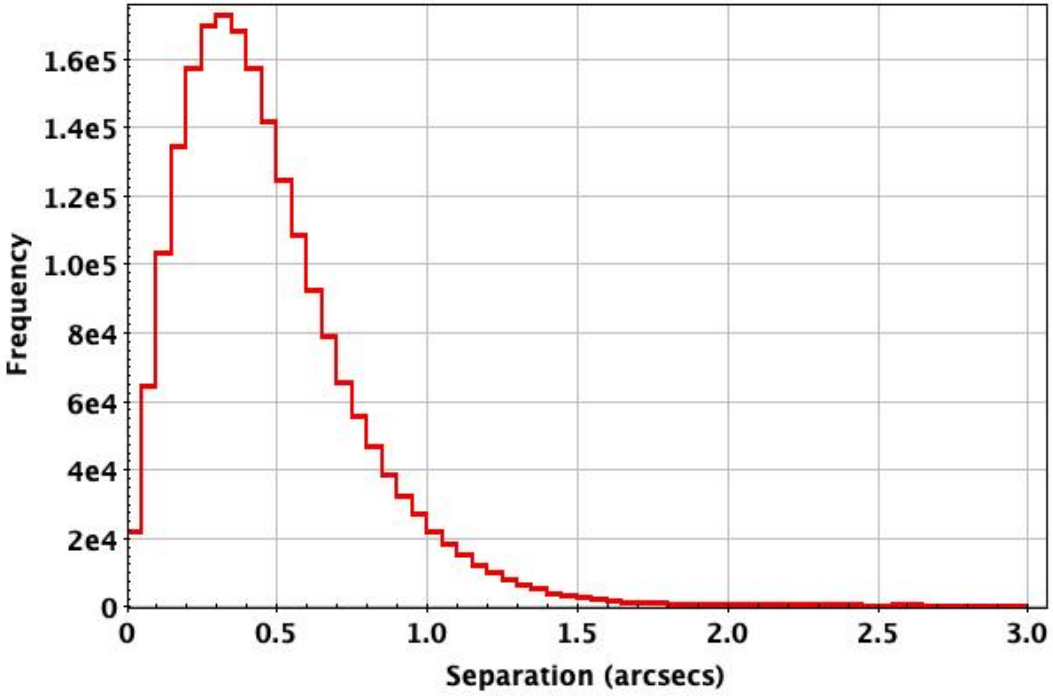
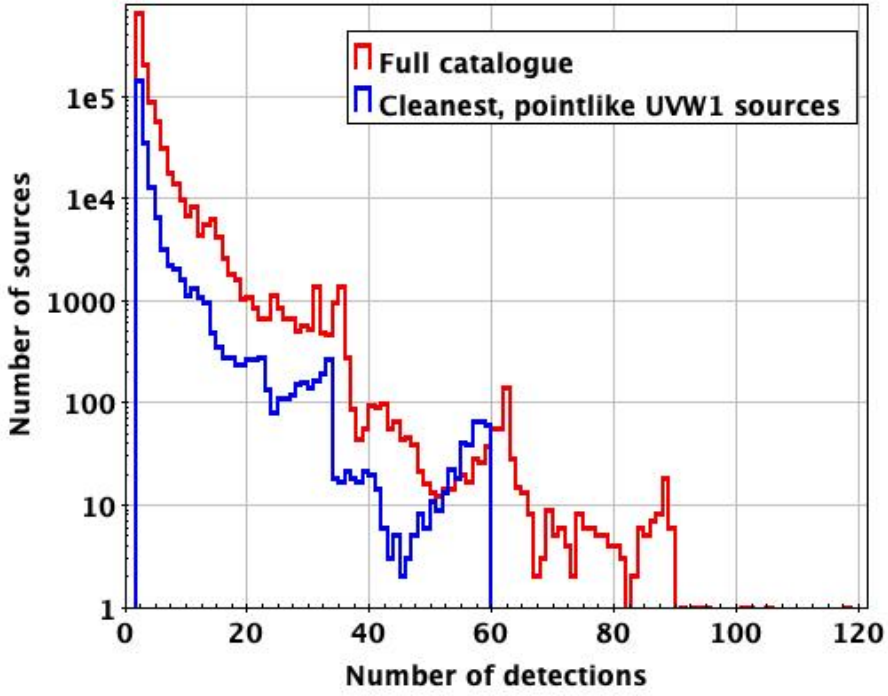
XMM-OM SUSS5 catalogue (Dec 2020)

Offsets of 'best quality' detections cf GAIA-DR2 (95% matches)



Repeated detections



Mean offset=0.48", 95% < 1.05"

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Fast mode oscillations

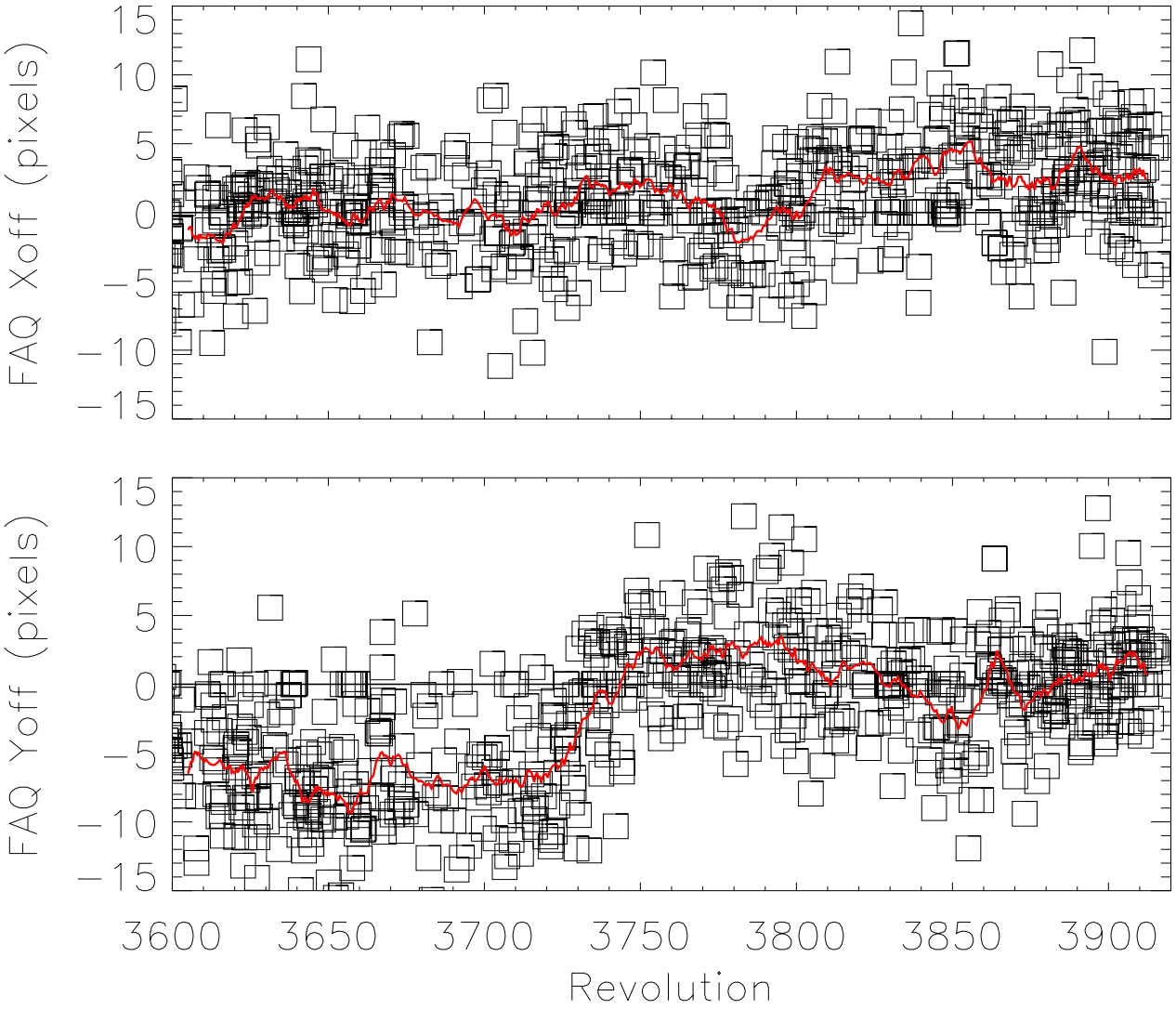
- Fast mode oscillations outlined in latest XMM OM Calibration status document (Sept. 2020) and described in more detail in
  https://xmmweb.esac.esa.int/docs/documents/CAL-TN-0224.pdf

- Exact cause difficult to pin down.

- Flux oscillations not reliably correctable. Aim to minimise occurrence of such cases via updated boresight.

- FAQ analysis shows offsets consistently reduced now since boresight update in Apr 2020.
  - *Analysis of fast mode target centring where FAQ fails needs to be done.*

Fast mode



Recent OM FAQ offsets
(1 pixel = 0.5”)

Since boresight update
(~ rev 3720), mean
Y_{off} : -6.7 → +0.8 pixels

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New OM products

1. Merged OM light curve
2. OM broad band fluxes in OGIP compliant files
3. Broad spectral energy distribution plots including OM and EPIC data

1 & 2 : How-to explained in OM SAS threads

OM RELATED THREADS

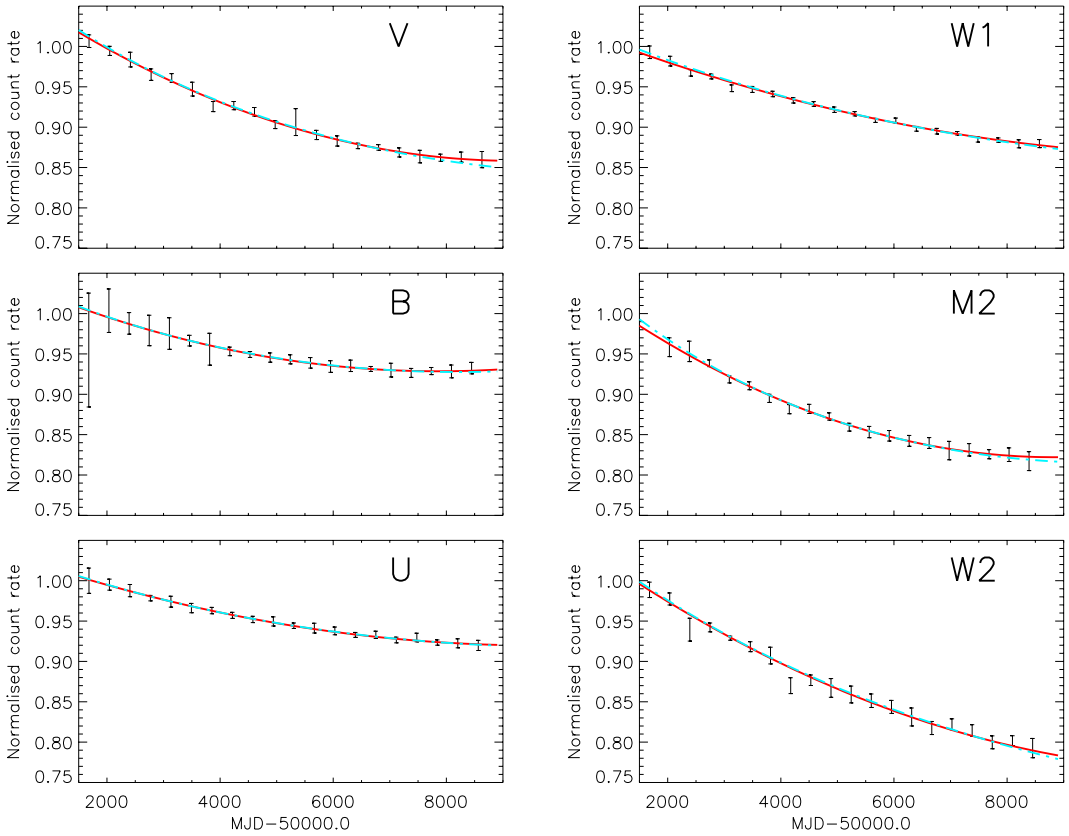
All in one go: from raw data (ODF) to science products		
- Analysis chain for point-like sources: `xmmextractor`	command line	
Step-by-Step		
- OM image mode data processing chain	processing chain	command line
- OM fast mode data processing chain	processing chain	command line
- OM Grism processing chain	processing chain	command line
- Interactive OM photometry	command line	
- Converting OM data to OGIP II format (use in `xspec`)	command line	
- Converting OM grism spectra for use in `xspec`	command line	
- Combining OM fast mode time series into a single data set	command line	

Pipeline now generates products routinely (P. Rodriguez)

Other OM-related activity

1. Time-dependent sensitivity

Based on fits to 'constant' sources (> 5 obs) in the SUSS5 catalogue.



Anticipated OM throughput

Filter	2022
V	0.86
B	0.93
U	0.92
UVW1	0.87
UVM2	0.82
UVW2	0.78

Worst case (W2): further ~1.6% decline by 2025

Decline is corrected in SAS

CCF to be updated this year.

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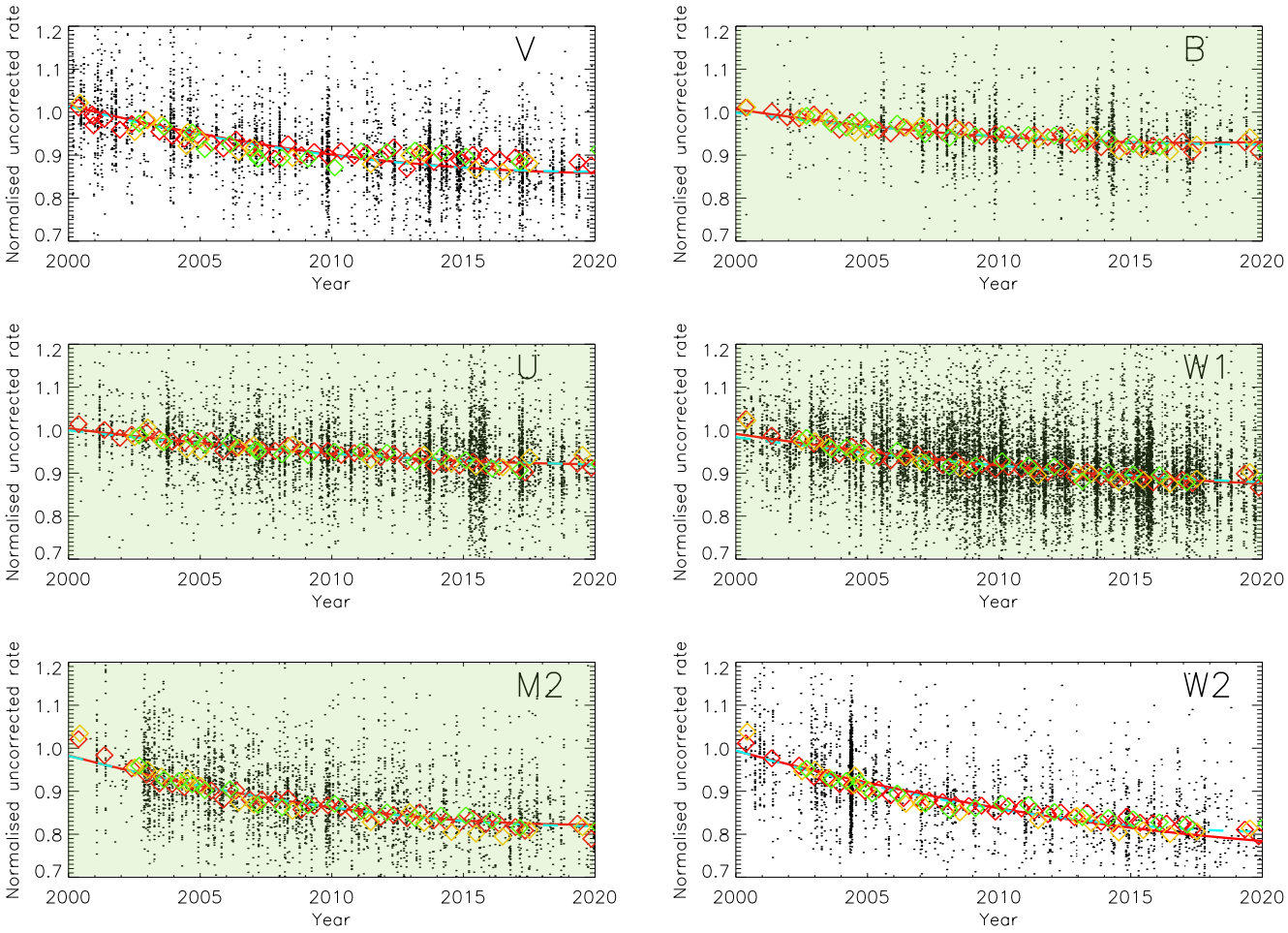
Time-dependent sensitivity



V & W2

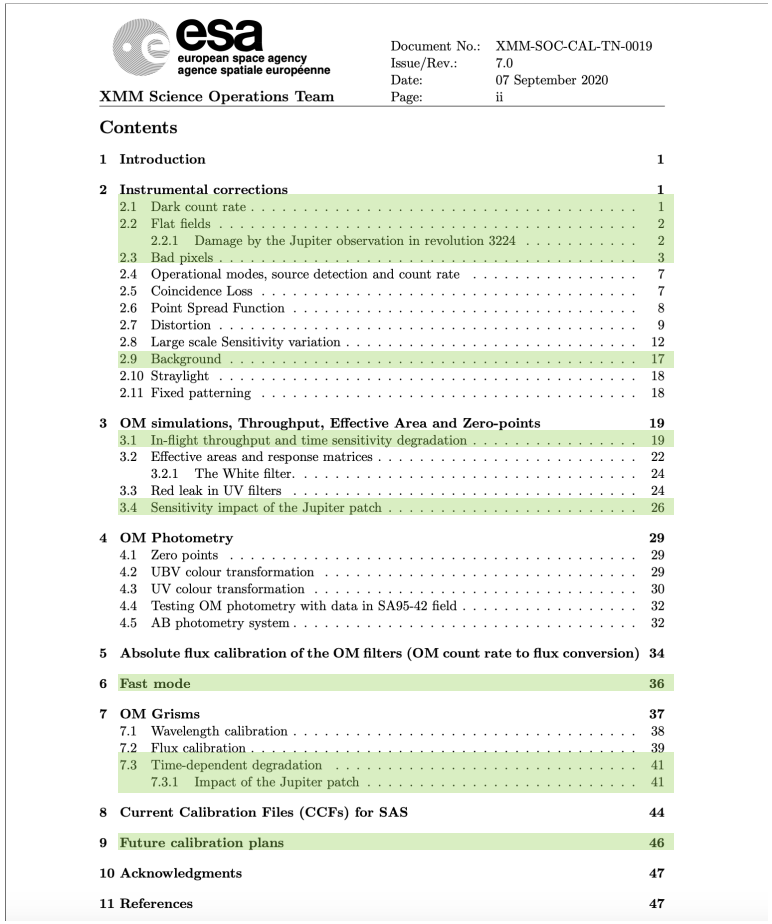
Standards deviate from bulk source trend by 1-3%

Cause under investigation

Other OM-related activity

2. Substantial update of OM Calibration status document (Sept. 2020)

– last revised 2011 (https://xmmweb.esac.esa.int/docs/documents/CAL-TN-0019.pdf)



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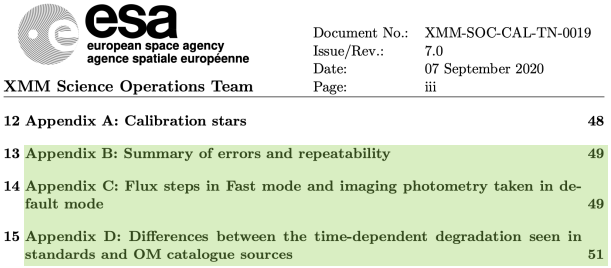

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Forward look

- Updates to the time-dependent sensitivity declines for the filters and grisms
- V & W2 filter time-dependent sensitivity declines of standards cf catalogue bulk data
- SAS improvements in preparation for next XMM-OM SUSS catalogue
- As time permits, effort to create flat fields for the Jupiter patch

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