RGS Instrument and Calibration Status

XMM-Newton Users' Group Meeting #25

ESAC, June 26-27 2024

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XMM-Newton Science Operations Centre

on behalf of the SRON and XMM-SOC RGS Teams

Outline

- Operations and Instrument Status
  - System Peak
  - Charge Transfer Efficiency
  - Bad Surface
  - Hot spots and hot columns

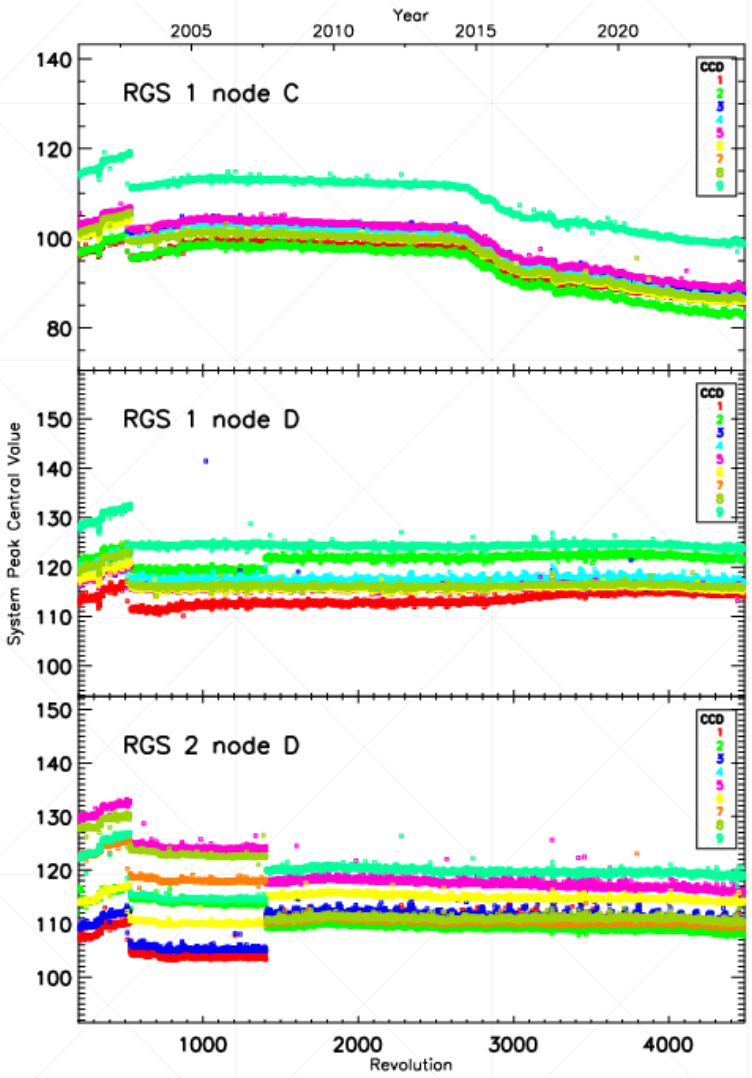
- Calibration and Monitoring
  - Wavelength Scale
  - Effective Area
  - Flux monitoring

Operations

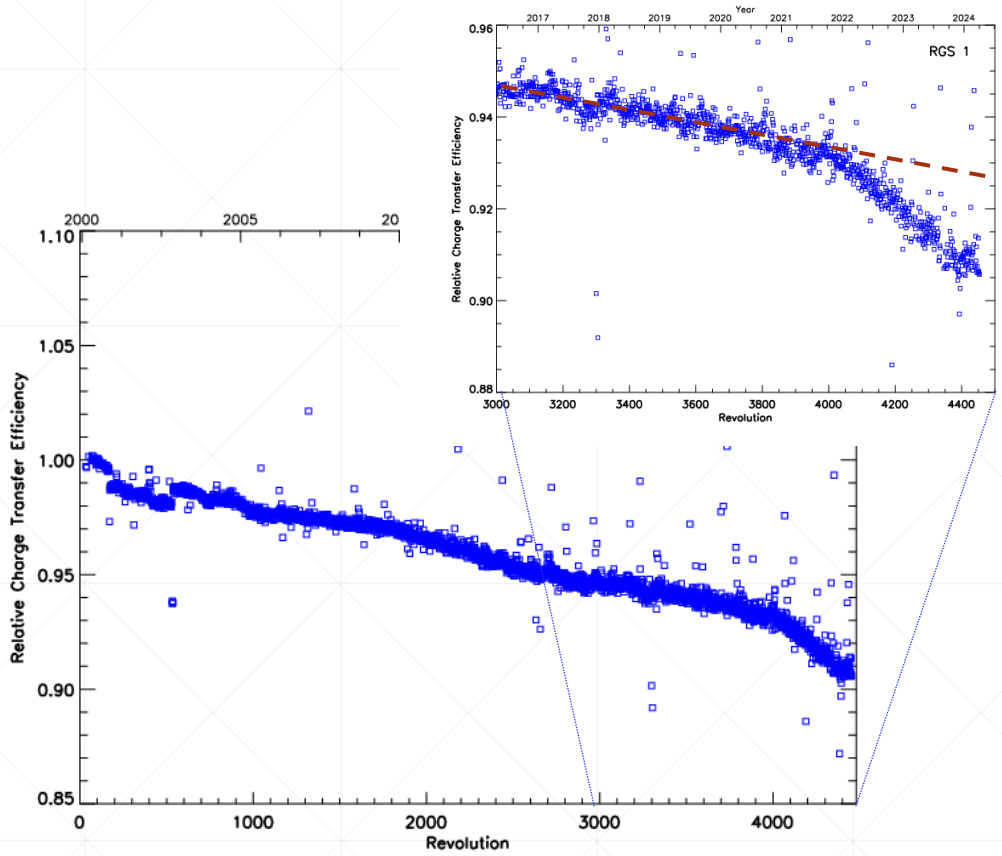
- Operations running without problems
- Same operational configuration
- No instrumental anomalies
- No degradation of the instrumental parameters, except for a steeper decrease in CTE

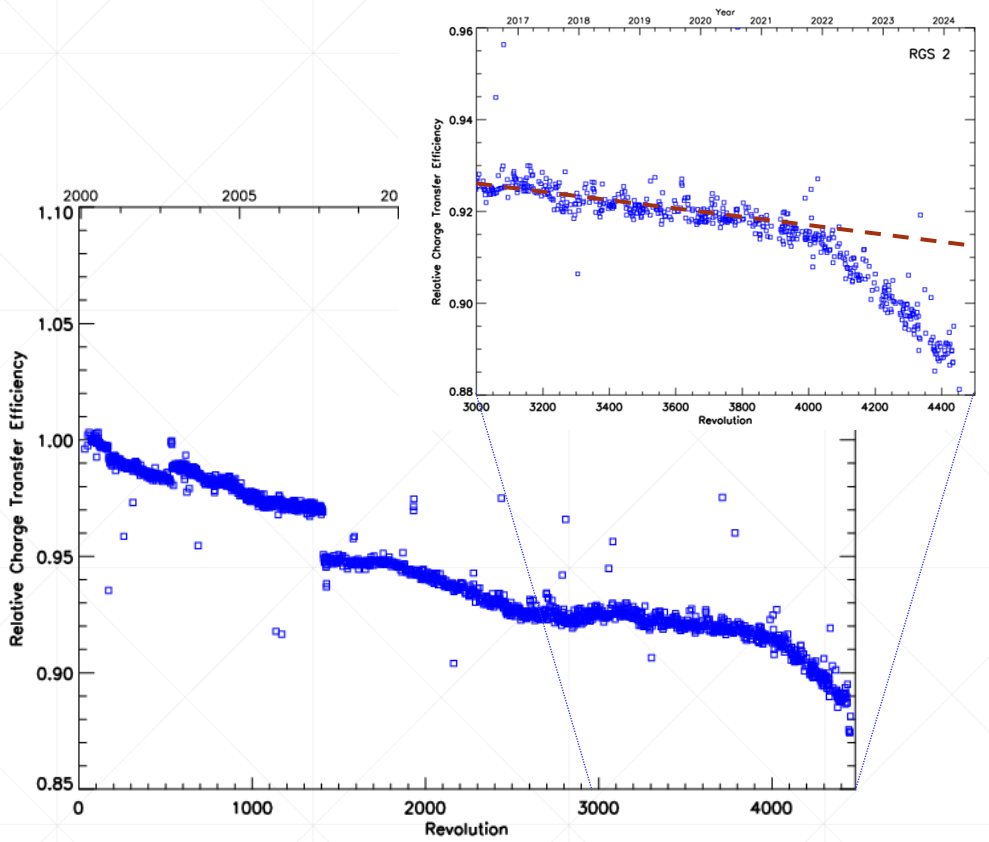
Instrument Status: System Peak

STABLE → NO NEED FOR CCF UPDATE



Instrument Status: CTE

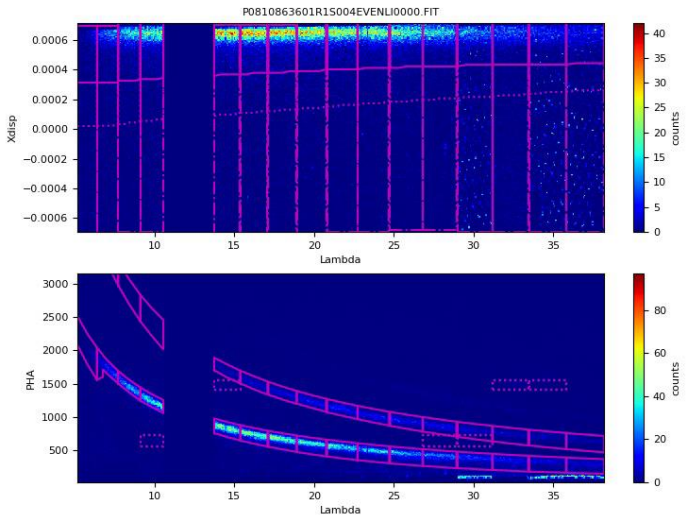


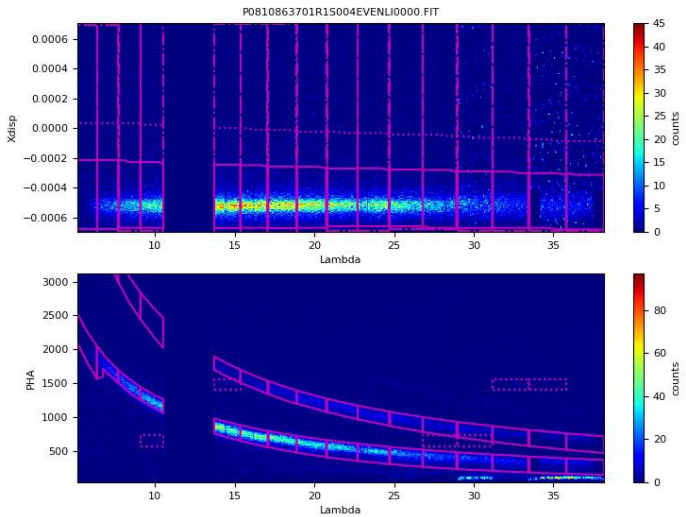


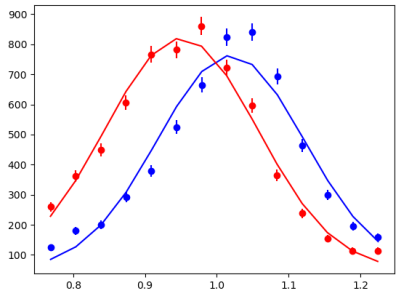
Monitoring from internal calibration sources

Instrument Status: CTE

Calibration is done trough dedicated observations of Mkn 421,
off-axis for the parallel CTI, on-axis for the the serial CTI





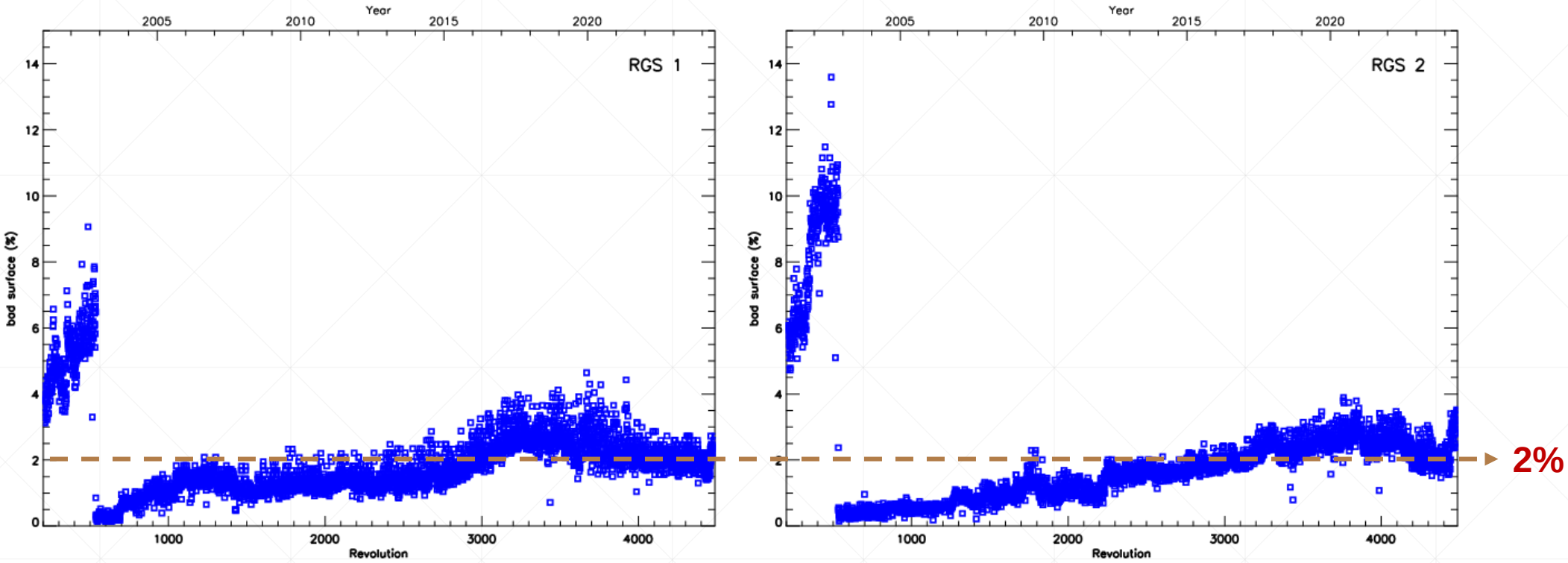


from J. dePlaa presentation
2024 RGS Calibration Meeting

CCF UPDATED MARCH 2024

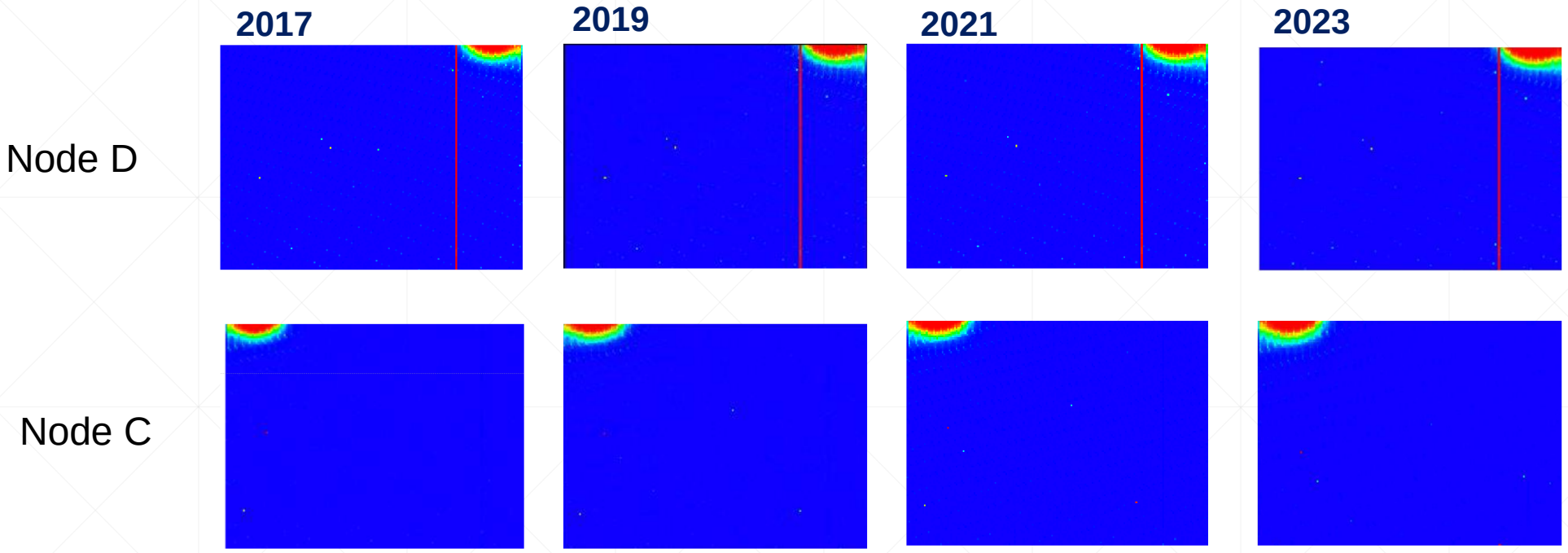
Release Note: CAL-SRN-405

Instrument Status: Bad Surface



STABLE

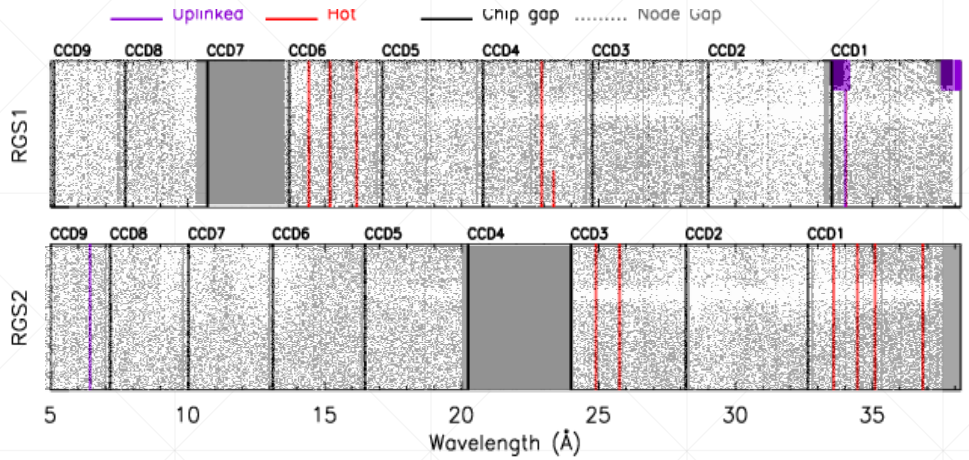
Instrument Status: Hot Spots in RGS1 CCD1



STABLE → NO NEED FOR CCF UPDATE

RGS Diagnostic Trend Analysis Reports

Instrument Status: Hot Columns



Columns ***rejected on-board***

1 in RGS1 CCD 1
1 in RGS2 CCD 9

Columns flagged as ***advisory*** in CCF

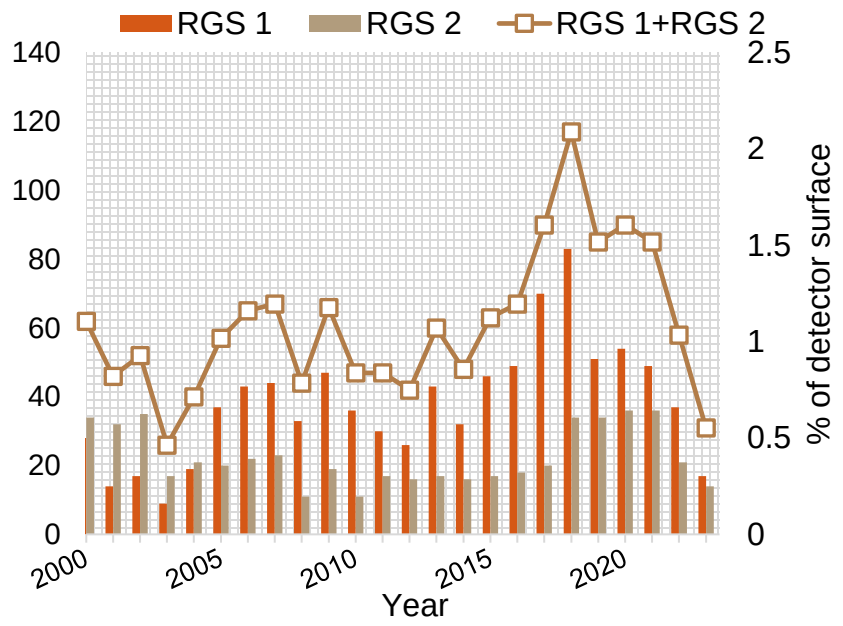
6 in RGS1 (3 in CCD6 + 2 in CCD4 +1 in CCD1)
6 in RGS2 (2 in CCD3 + 4 in CCD 1)

STABLE → NO NEED FOR CCF UPDATE

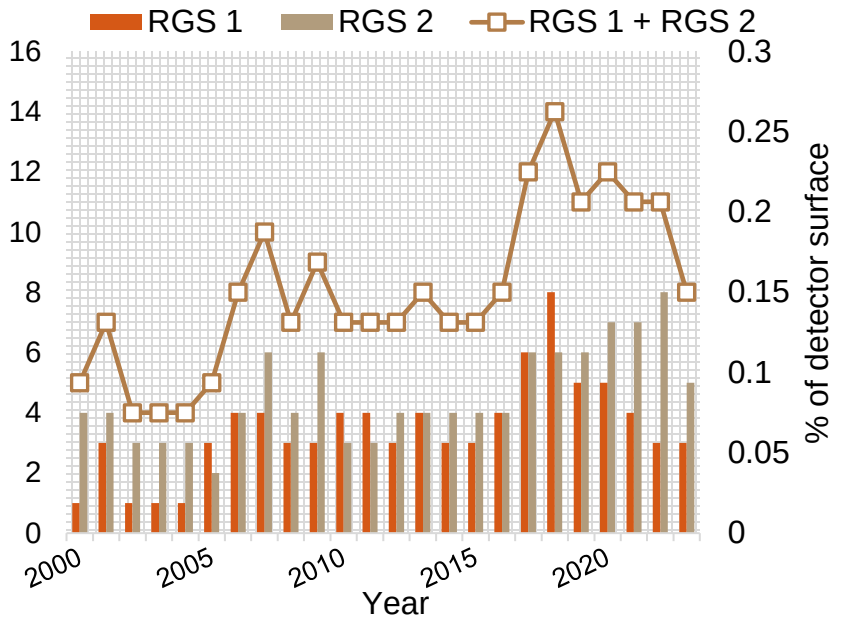
RGS Diagnostic Trend Analysis Reports

Instrument Status: Hot Columns

Columns found hot in more than 25% of the observations

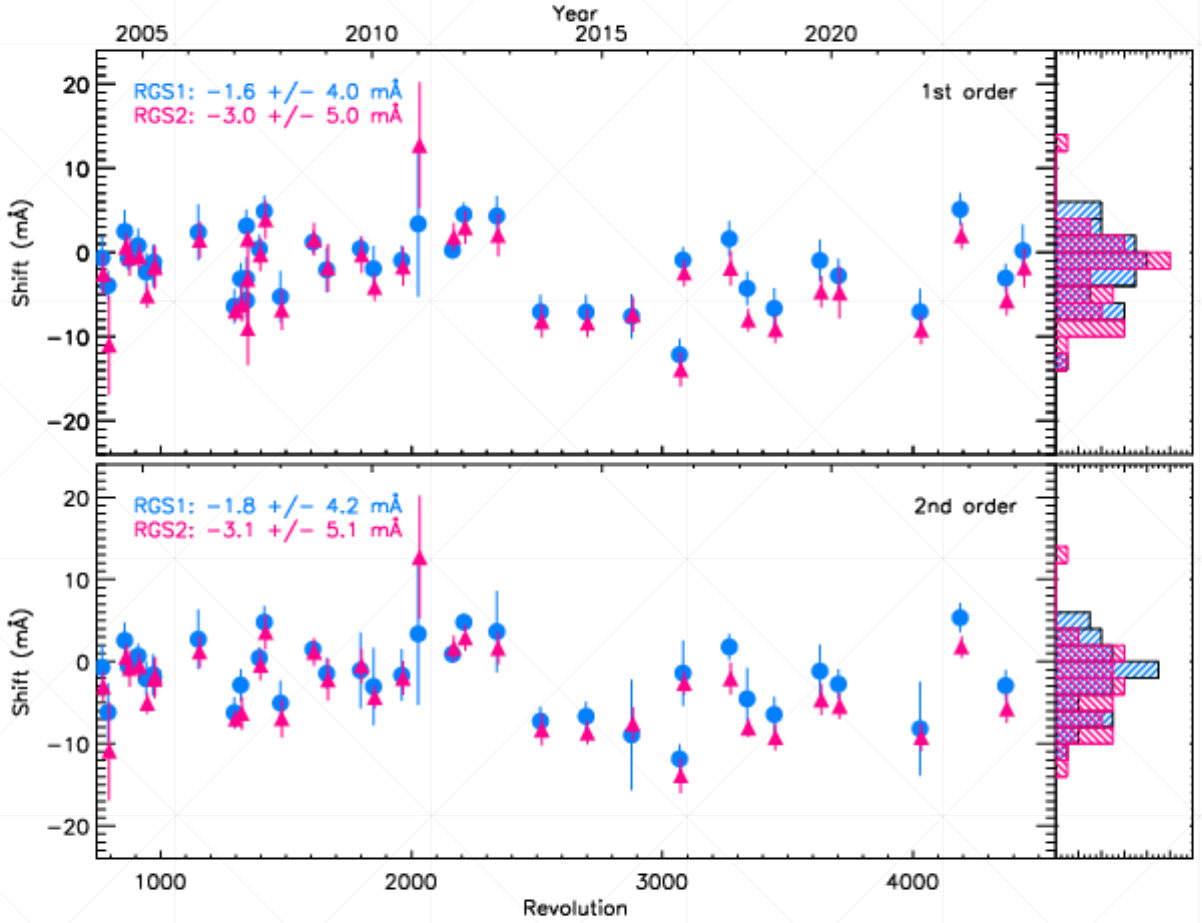


Columns found hot in more than 95% of the observations



RGS Diagnostic Trend Analysis Reports

Wavelength Scale



Wavelength shift of spectra of bright emission-line stars

Shift of individual lines (median ± σ)	
RGS 1	RGS 2
1st order	
-2 ± 5 mÅ [335 lines]	-3 ± 5 mÅ [348 lines]
2nd order	
-2 ± 5 mÅ [206 lines]	-3 ± 5 mÅ [259 lines]

STABLE

Effective Area

EFFAREACORR

Small scale Effective Area correction applied **by default**, with rgsproc/rgsrmfgen parameter

`witheffectivaeracorrection=yes`

CCF UPDATED APRIL 2023

Correction with respect to EPIC-pn (aka Rectification) applied with rgsproc/rgsrmfgen non-default option

`withrectification=yes`

CCF UPDATED SEPTEMBER 2023

Effective Area and Rectification Corrections haven been applied in the Bulk Reprocessing. This will be the default in SASv22

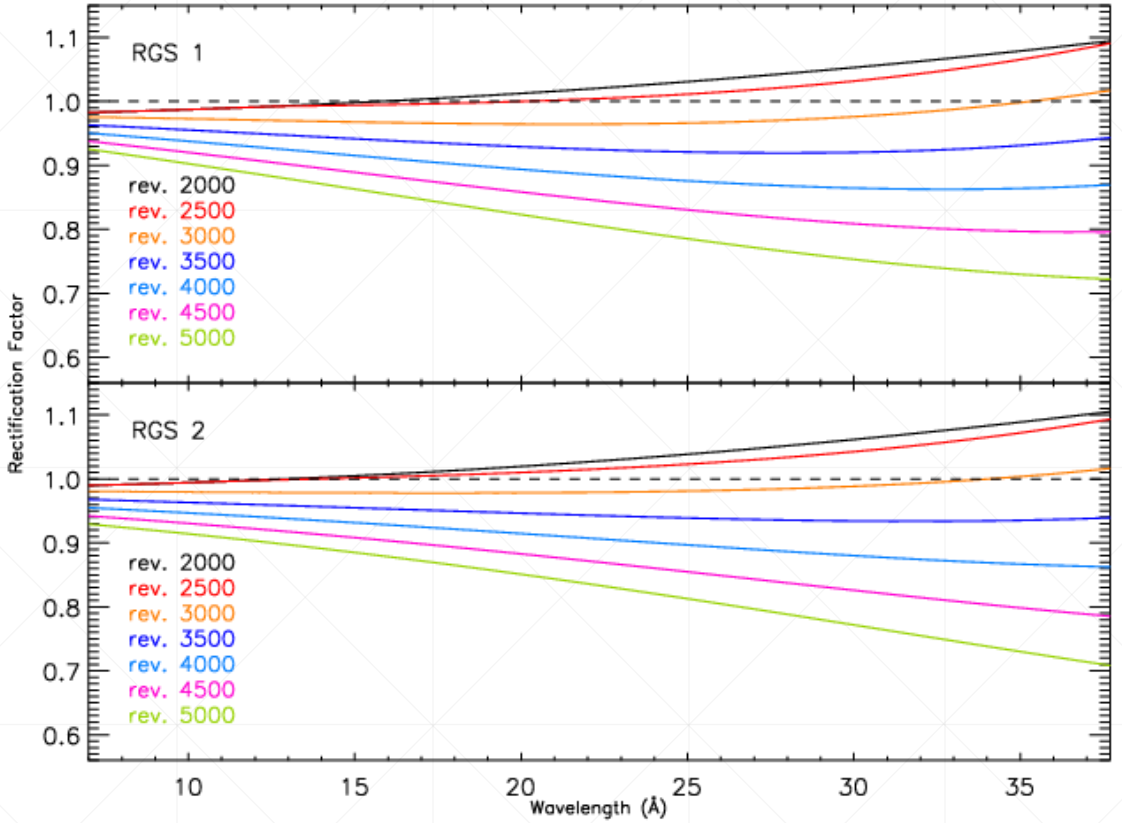
```
rgsproc/rgsrmfgen witheffectiveareacorrection=yes
withrectification=yes
```

Rectification Correction

EFFAREACORR

Re-derived in September 2023 following the update of the Effective Area correction in April 2023

Release Note: CAL-SRN-401

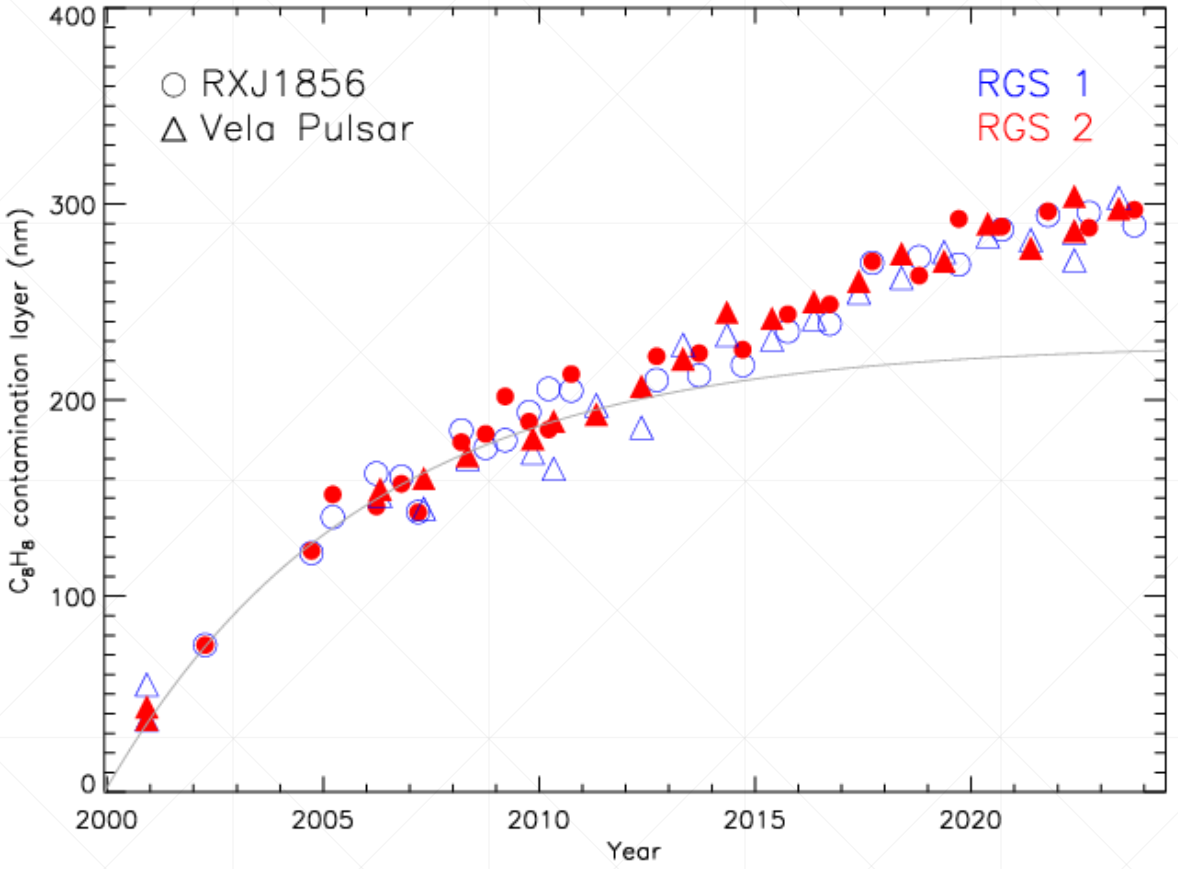


Contamination

Since 2015, extra contamination present, not consistent with Hydrocarbons.

New contaminant unknown (could be Related to Hydrazine?)

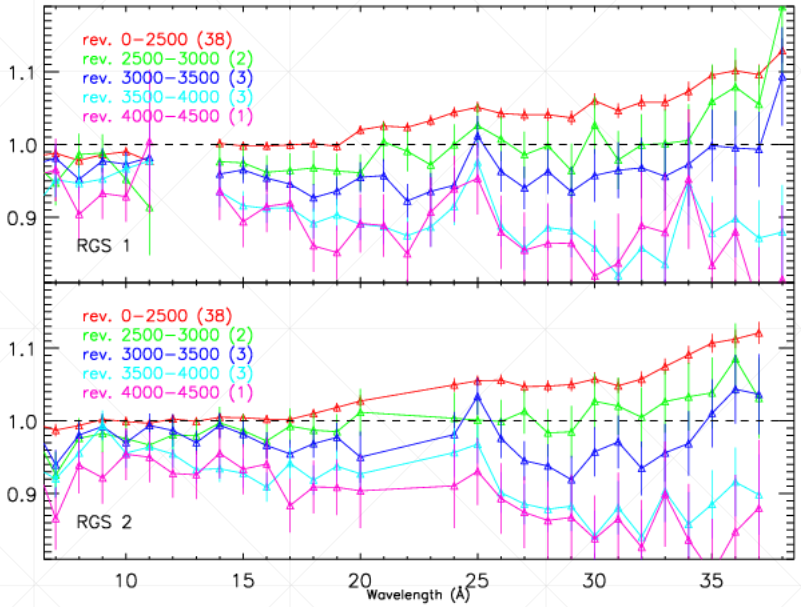
Emprically corrected through the “Rectification Correction”

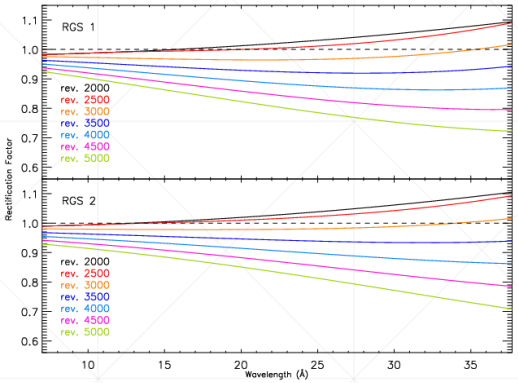


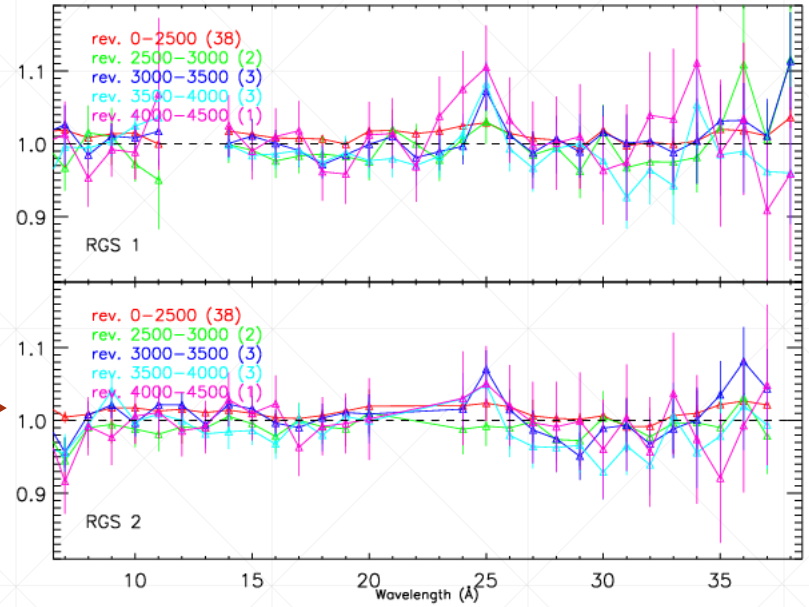
Rectification Correction

Application to a sample of BL Lacs (consistency check)

RGS/EPIC-pn Flux Ratio



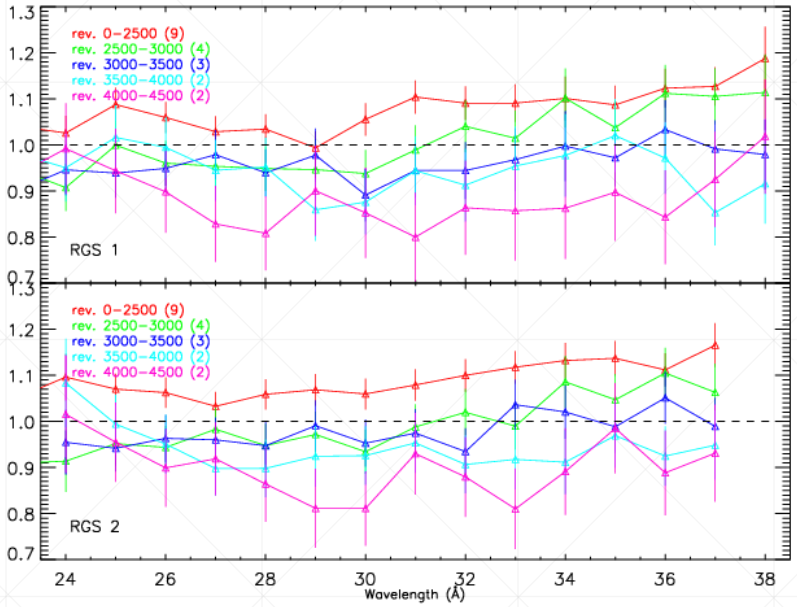


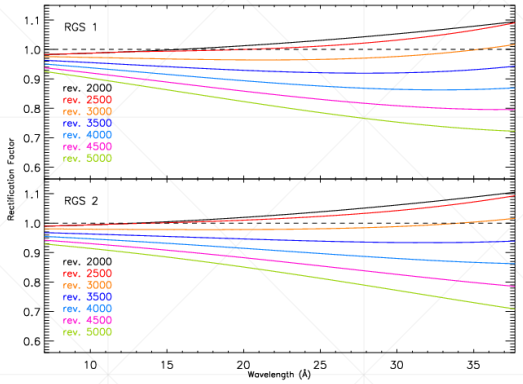


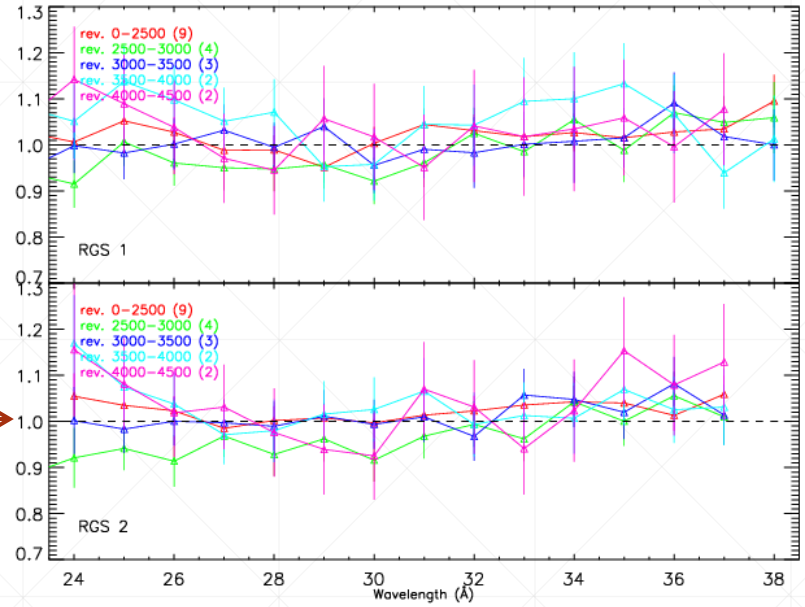
Rectification Correction

Application to the ISN RXJ1856-3754

RGS/EPIC-pn Flux Ratio



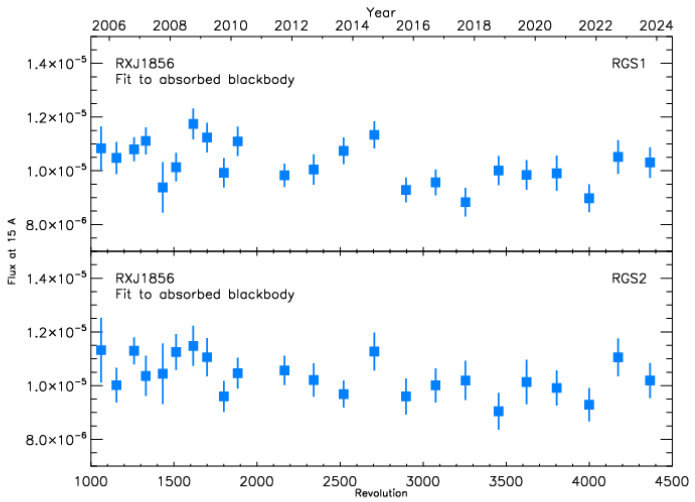




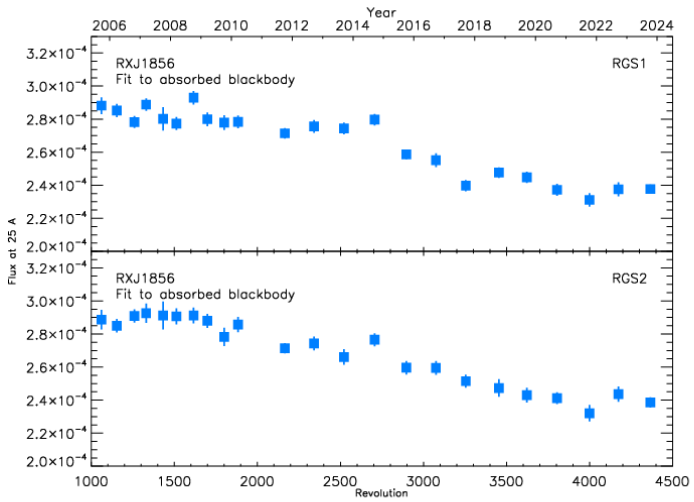
Flux Monitoring: RXJ1856-3754

Flux from fit to an absorbed Blackbody with fixed column density

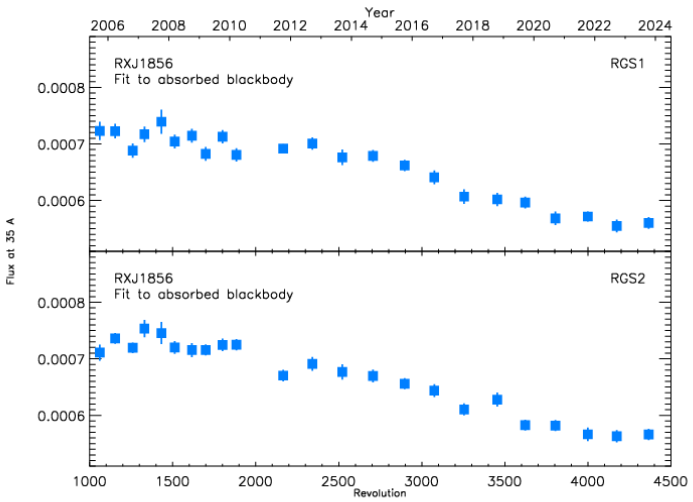
15Å



25Å



35Å



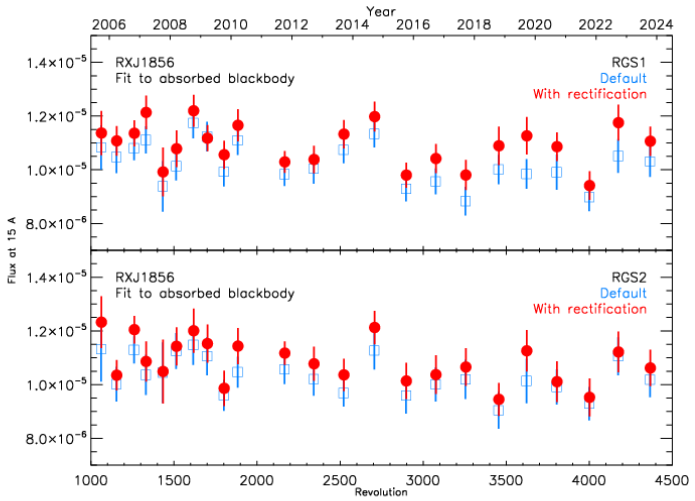
Flux (10^{-4} ph/cm^2/s/Å)

RGS1	0.10 +/- 0.01	RGS1	2.7 +/- 0.2	RGS1	6.6 +/- 0.6
RGS2	0.10 +/- 0.01	RGS2	2.7 +/- 0.2	RGS2	6.7 +/- 0.6

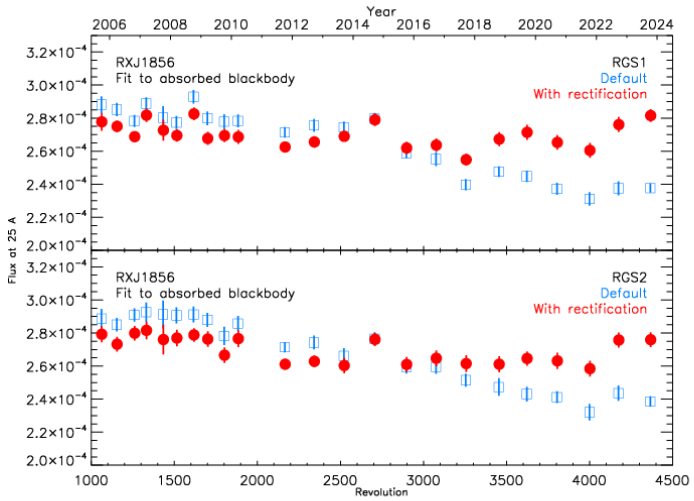
Flux Monitoring: RXJ1856-3754

Flux from fit to an absorbed Blackbody with fixed column density

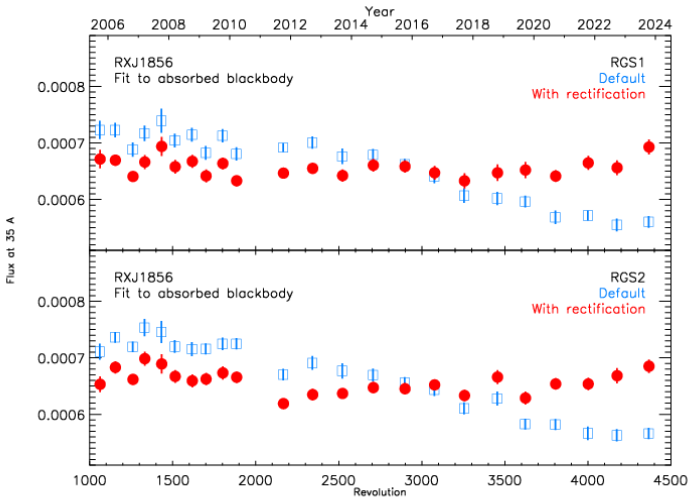
15Å



25Å



35Å



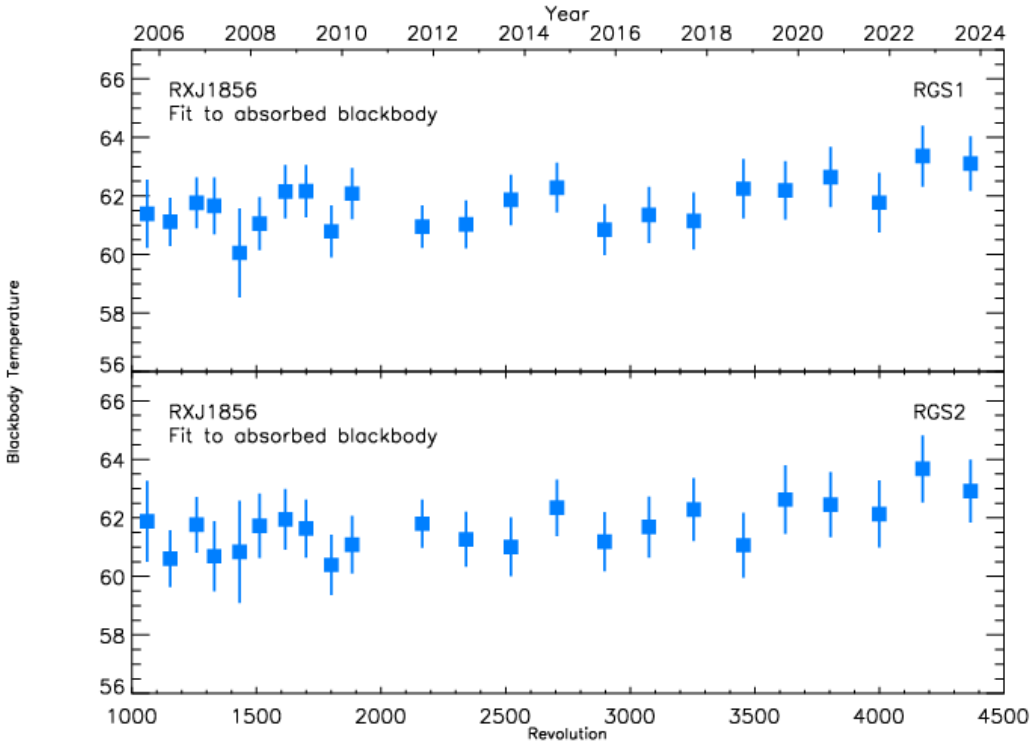
Flux (10^{-4} ph/cm^2/s/Å)

RGS1	0.10 +/- 0.01	0.11 +/- 0.01
RGS2	0.10 +/- 0.01	0.11 +/- 0.01

RGS1	2.7 +/- 0.2	2.7 +/- 0.1
RGS2	2.7 +/- 0.2	2.7 +/- 0.1

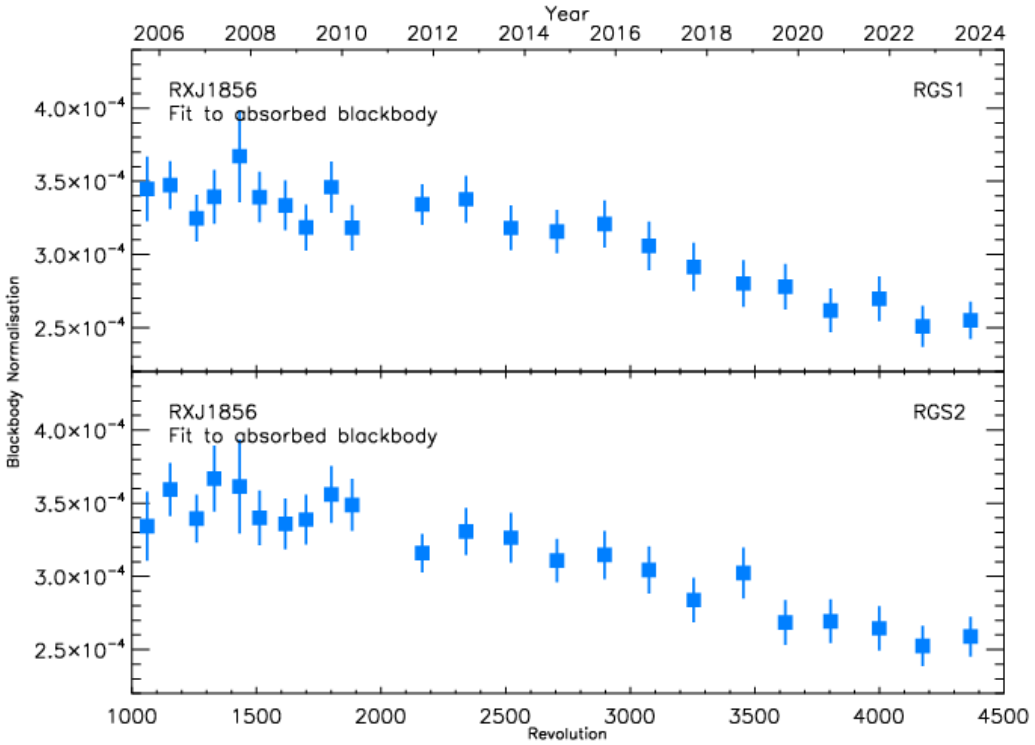
RGS1	6.6 +/- 0.6	6.6 +/- 0.2
RGS2	6.7 +/- 0.6	6.6 +/- 0.2

Flux Monitoring: RXJ1856-3754



eV

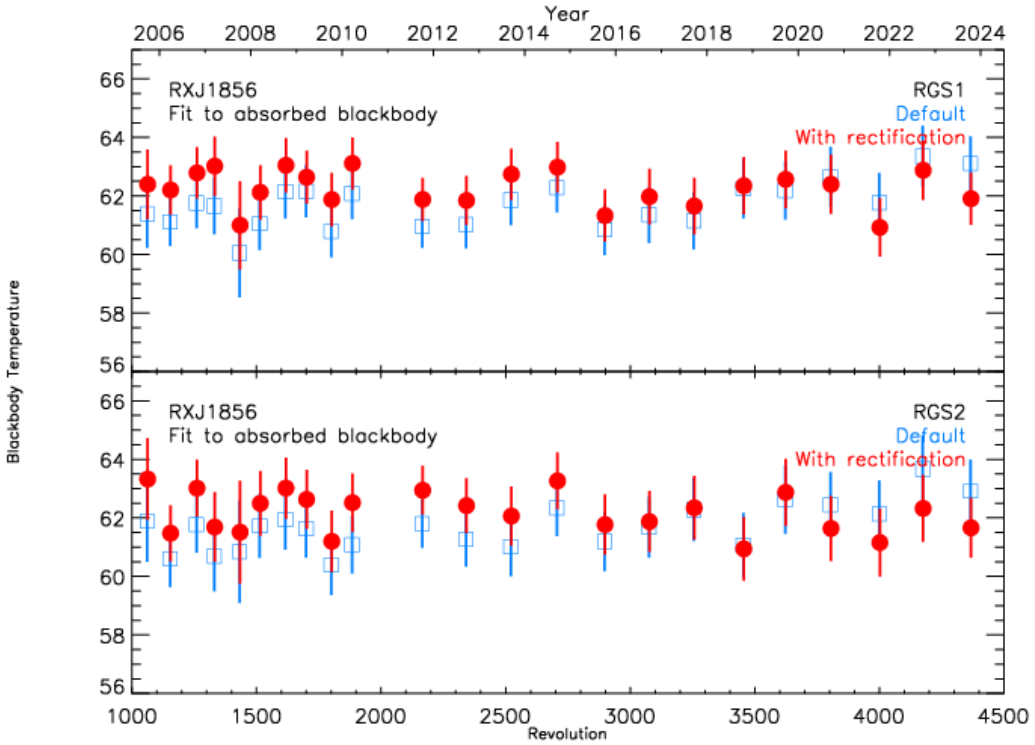
RGS1	61.7 +/- 0.8
RGS2	61.7 +/- 0.8



10^{-4} photons/cm^2/s/Å

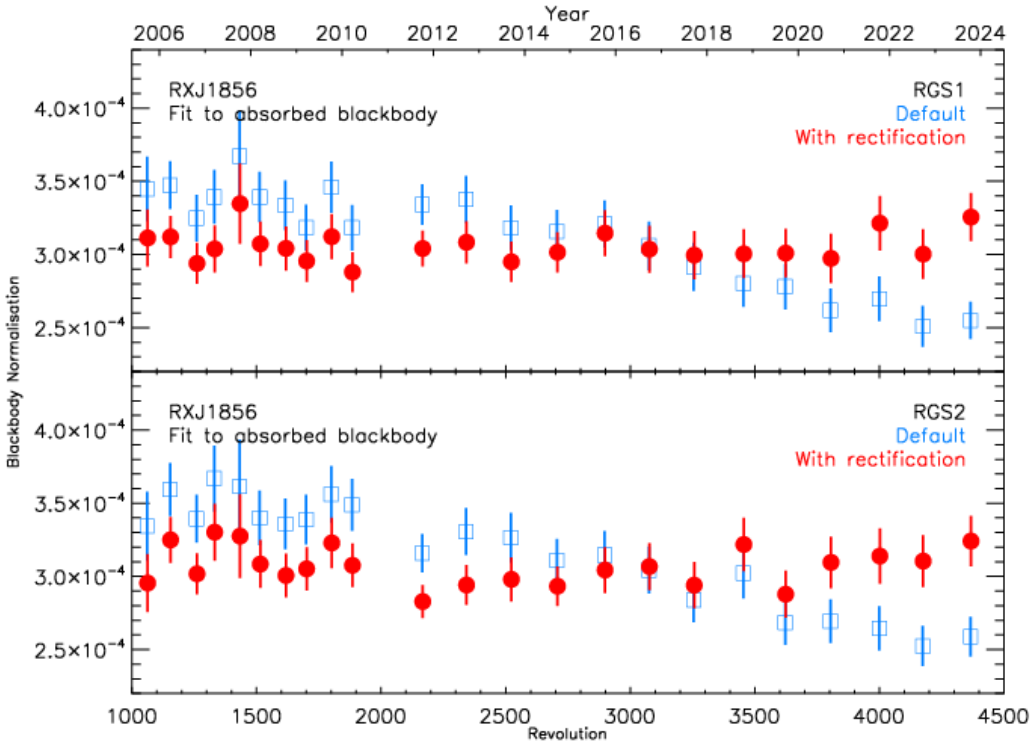
RGS1	3.1 +/- 0.3
RGS2	3.2 +/- 0.4

Flux Monitoring: RXJ1856-3754



eV

RGS1	61.7 +/- 0.8	62.2 +/- 0.6
RGS2	61.7 +/- 0.8	62.2 +/- 0.7



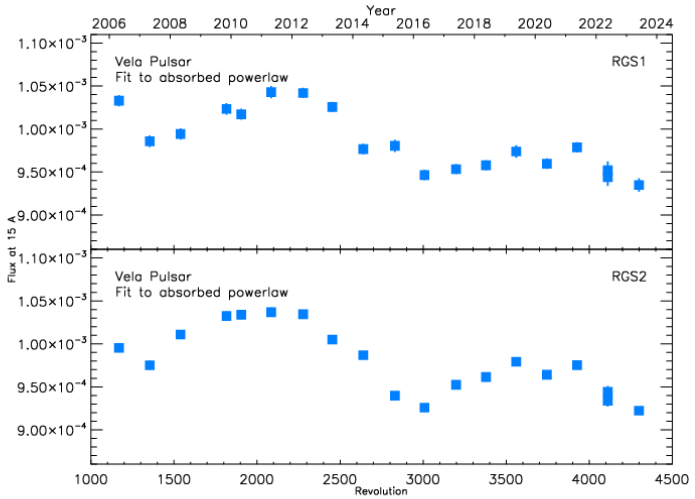
10^{-4} photons/cm^2/s/Å

RGS1	3.1 +/- 0.3	3.1 +/- 0.1
RGS2	3.2 +/- 0.4	3.1 +/- 0.1

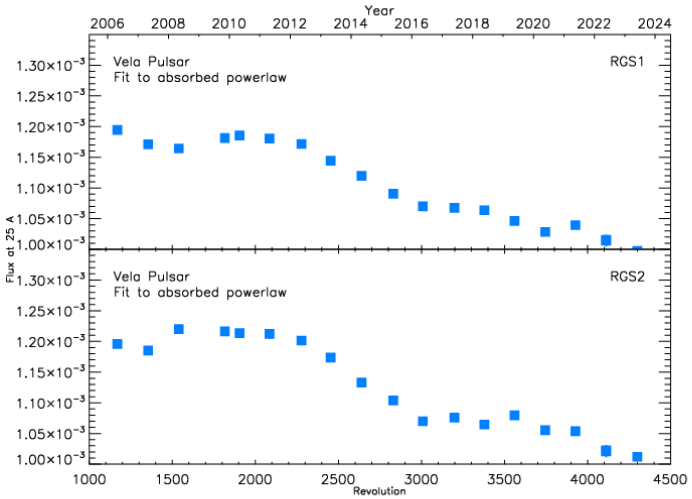
Flux Monitoring: Vela Pulsar

Flux from fit to an absorbed Powerlaw with fixed column density

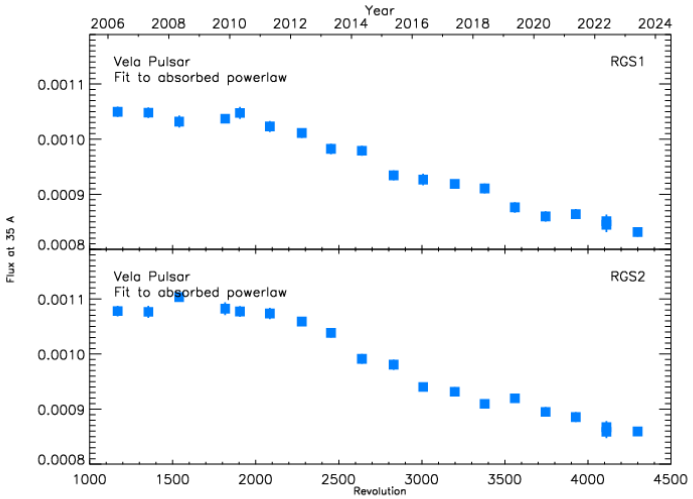
15Å



25Å



35Å



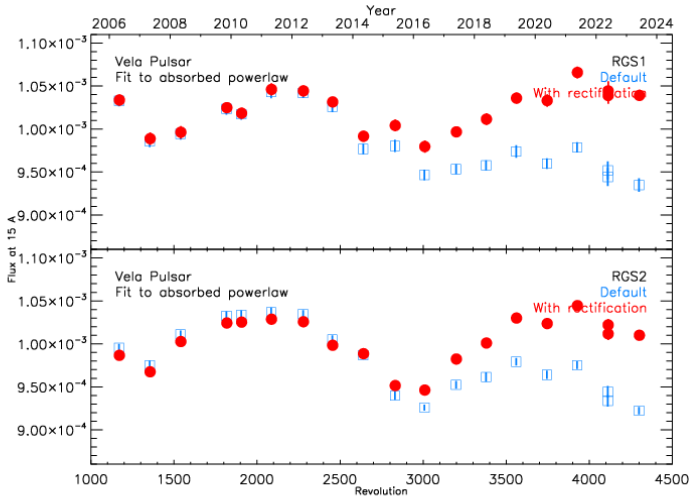
Flux (10^{-3} ph/cm^2/s/Å)

RGS1	0.99 +/- 0.04	RGS1	1.10 +/- 0.07	RGS1	0.95 +/- 0.08
RGS2	0.98 +/- 0.04	RGS2	1.12 +/- 0.08	RGS2	0.98 +/- 0.09

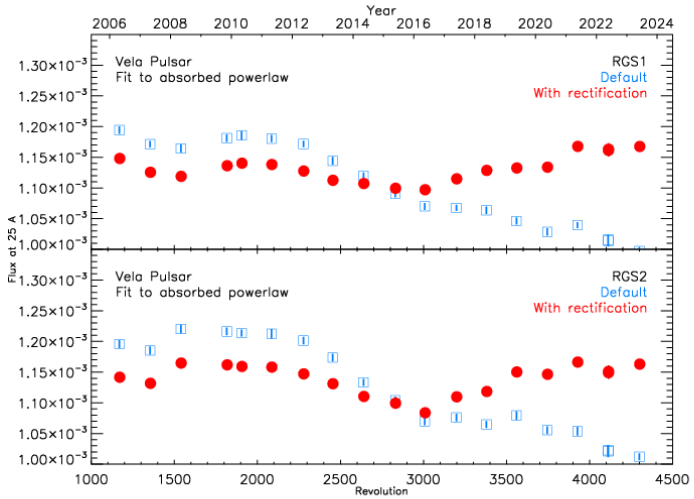
Flux Monitoring: Vela Pulsar

Flux from fit to an absorbed Powerlaw with fixed column density

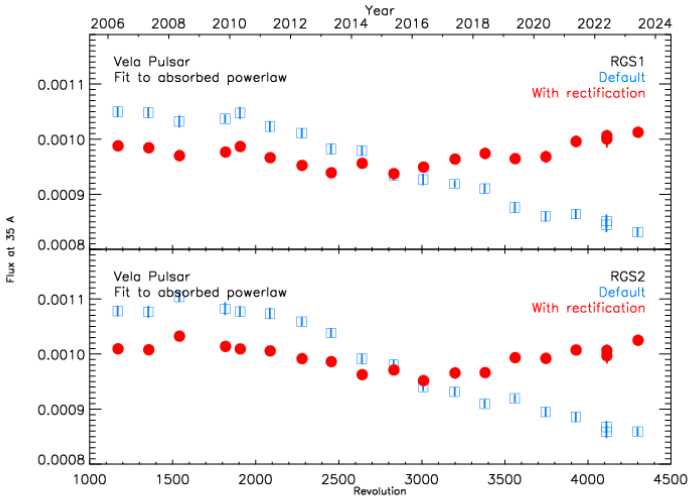
15Å



25Å



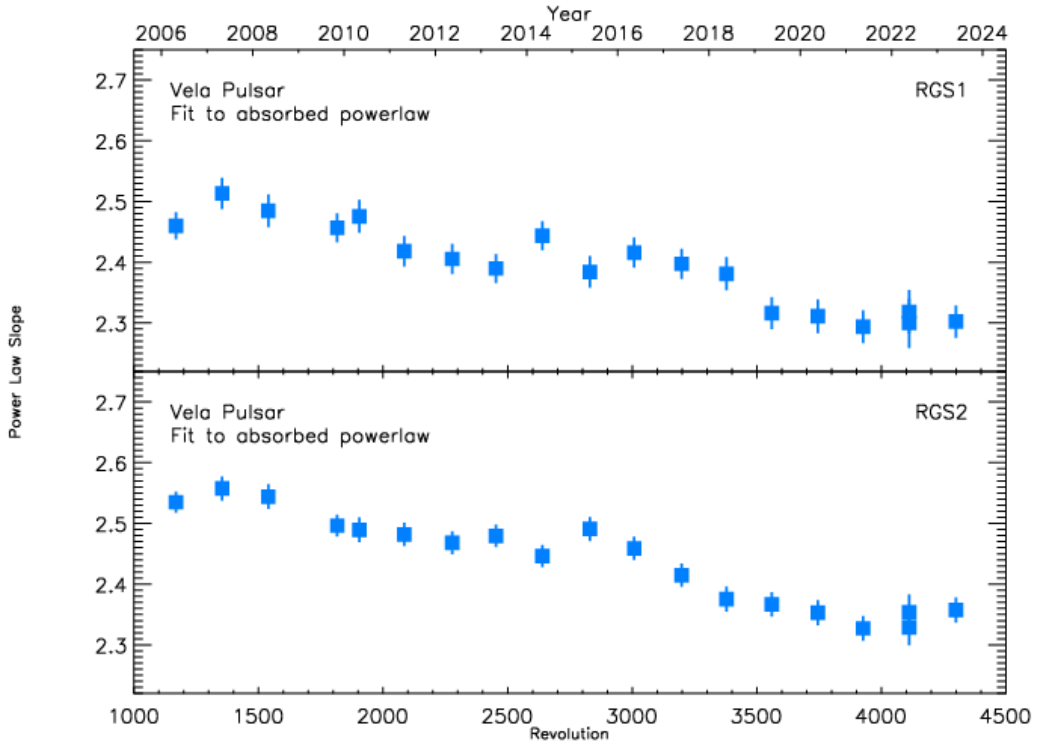
35Å

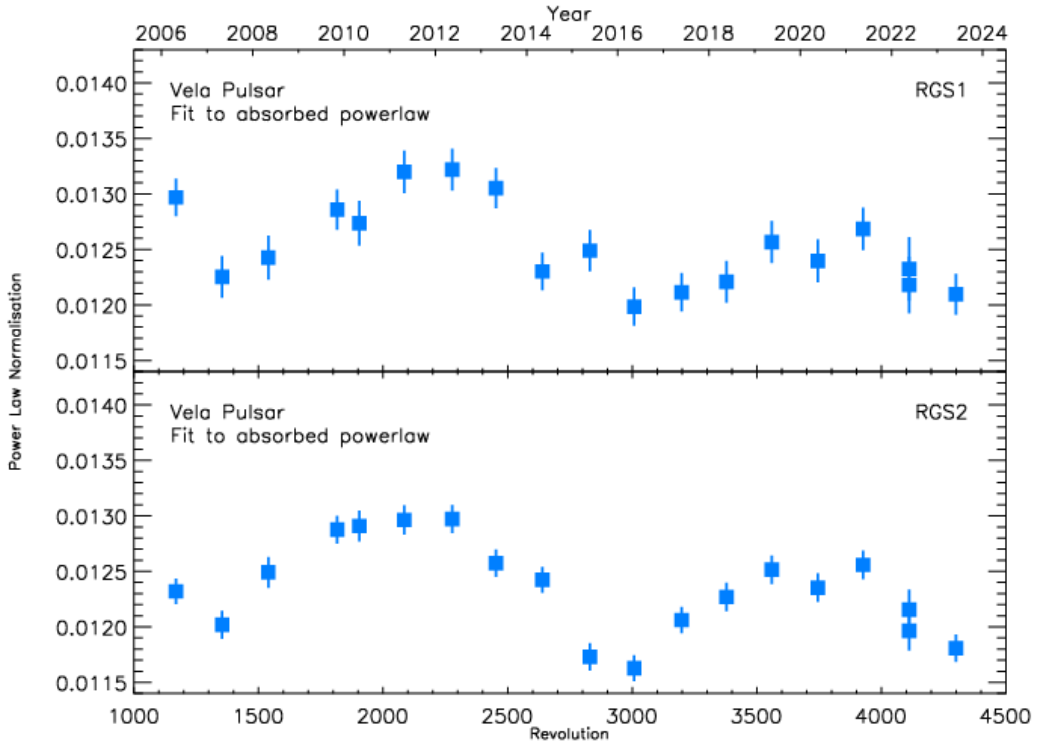


Flux (10^{-3} ph/cm^2/s/Å)

RGS1	0.99 +/- 0.04	1.02 +/- 0.02	RGS1	1.10 +/- 0.07	1.13 +/- 0.02	RGS1	0.95 +/- 0.08	0.97 +/- 0.02
RGS2	0.98 +/- 0.04	1.00 +/- 0.03	RGS2	1.12 +/- 0.08	1.14 +/- 0.02	RGS2	0.98 +/- 0.09	0.99 +/- 0.02

Flux Monitoring: Vela Pulsar



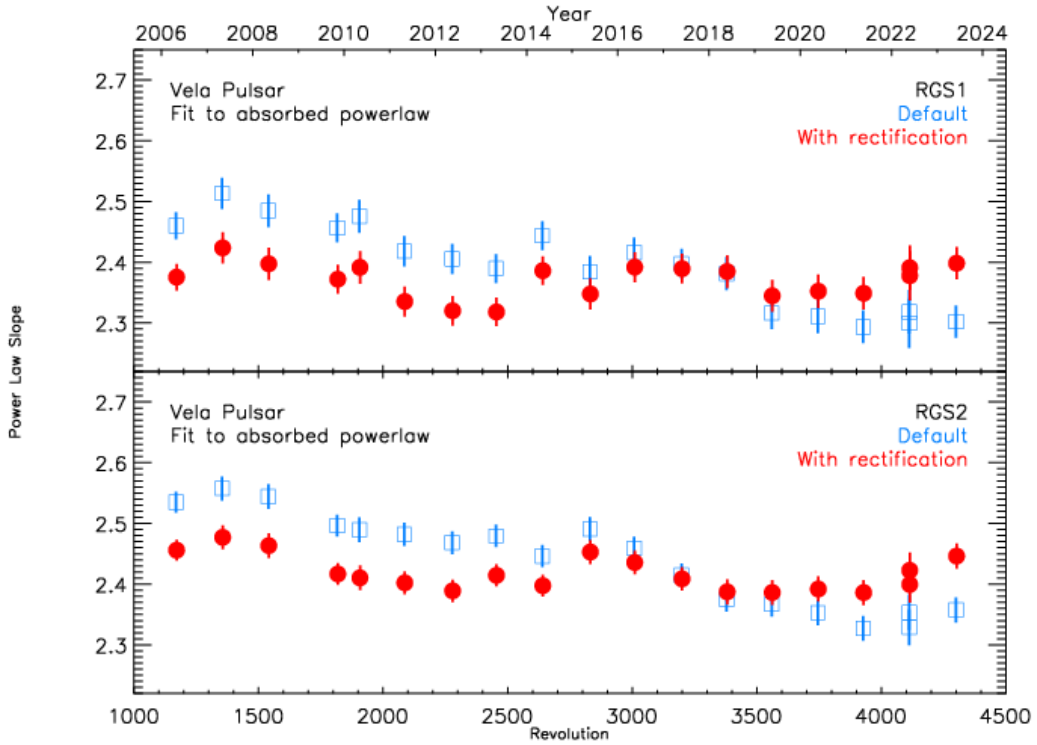


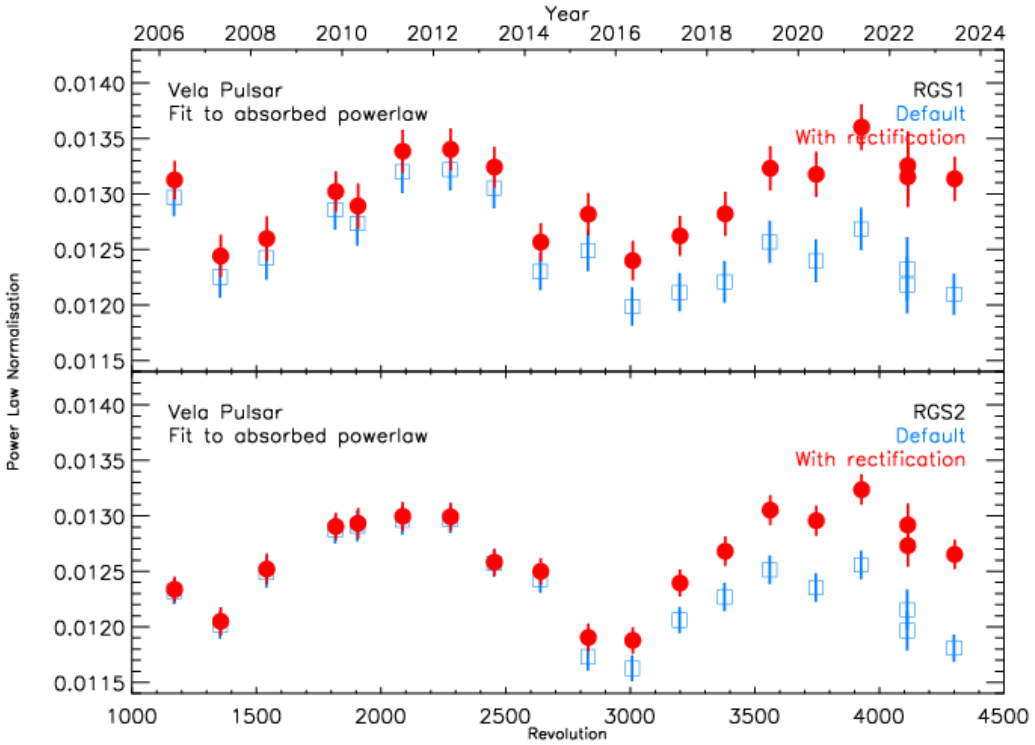
RGS1	2.39 +/- 0.07
RGS2	2.44 +/- 0.08

10^{-2} photons/cm^2/s/Å

RGS1	1.25 +/- 0.04
RGS2	1.24 +/- 0.04

Flux Monitoring: Vela Pulsar





RGS1	2.39 +/- 0.07	2.37 +/- 0.03
RGS2	2.44 +/- 0.08	2.42 +/- 0.03

10^{-2} photons/cm^2/s/Å

RGS1	1.25 +/- 0.04	1.30 +/- 0.04
RGS2	1.24 +/- 0.04	1.26 +/- 0.04

Summary

Operations and Instrument Status

- Operations running smoothly
- No unexpected behaviour in the instrumental performance, except for a steeper decrease in CTE **-> CCF UPDATED**
- No changes in hot columns / hot spots **-> NO CCF UPDATE NEEDED**

Wavelength scale

- Wavelength scale stable
- No significative trend with time
- No degradation in spectral resolution

Effective Area

- Variations in Effective Area continuously monitored
- Empirical corrections to take into account the observed change in Effective Area in place
  - Effective area correction **-> CCF UPDATED**
  - Rectification correction **-> CCF UPDATED**