RGS Status

XMM-Newton Users' Group Meeting #23

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on behalf of the SRON and XMM-SOC RGS Teams

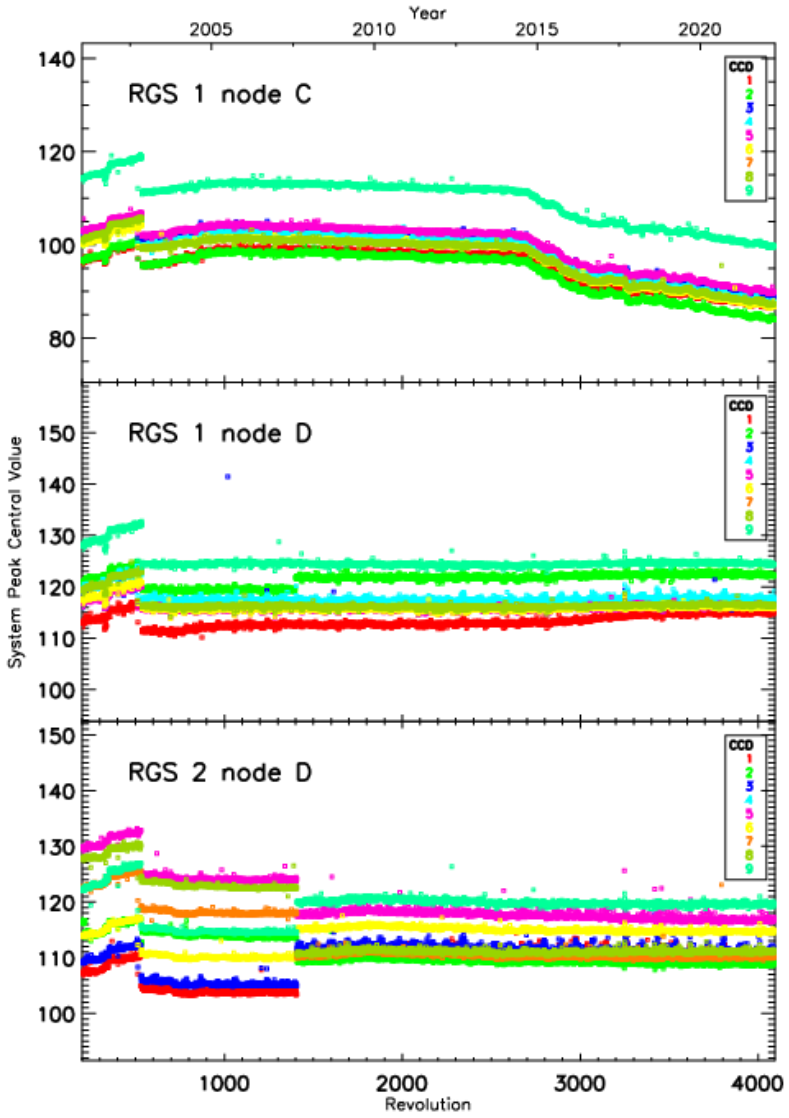
Outline

- Operations and Instrument Status
  - System Peak
  - Charge Transfer Efficiency
  - Bad Surface
  - Hot spots and hot columns
- Calibration
  - Wavelength Scale
  - Effective Area

Operations

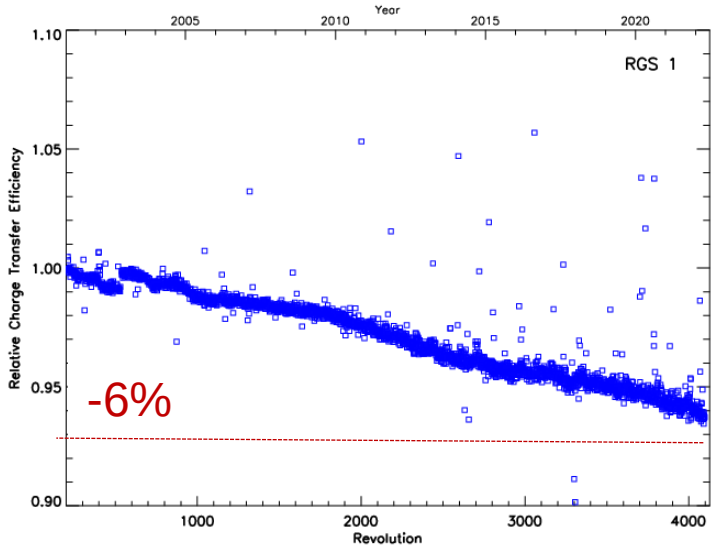
- RGS operations running smoothly
- Same operational configuration
- No instrumental anomalies
- No unexpected degradation of the instrumental parameters

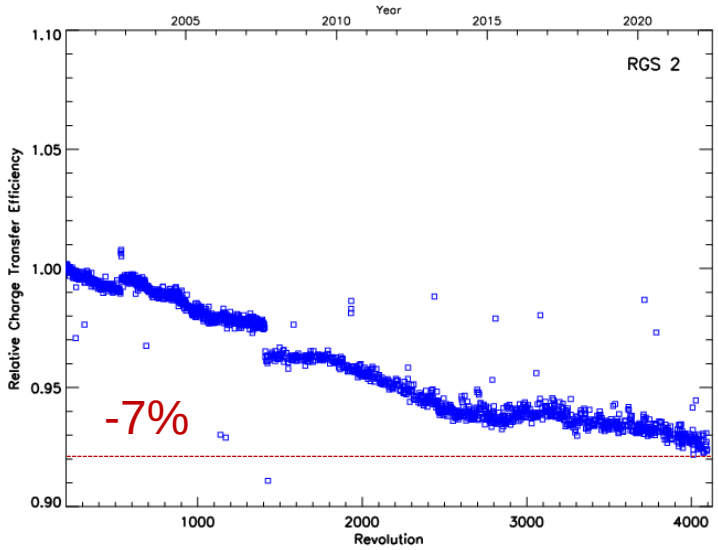
Instrument Status



System Peak (readout noise + dark current)

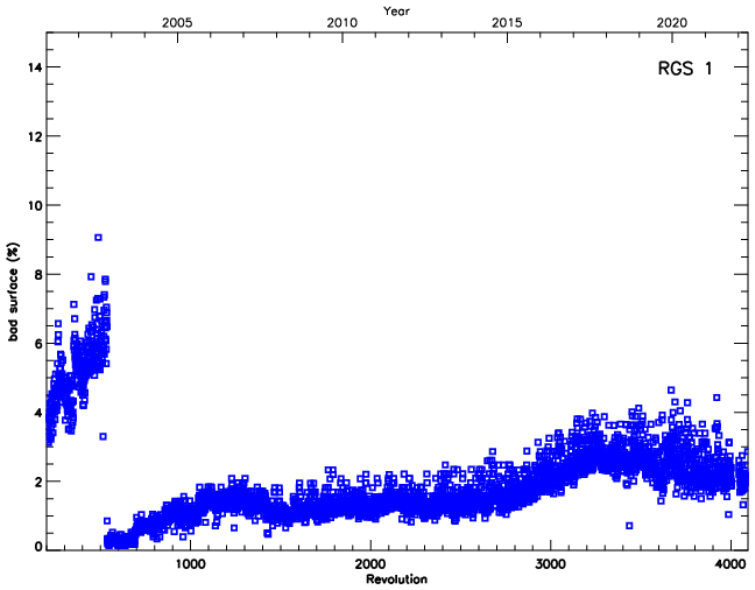
Instrument Status

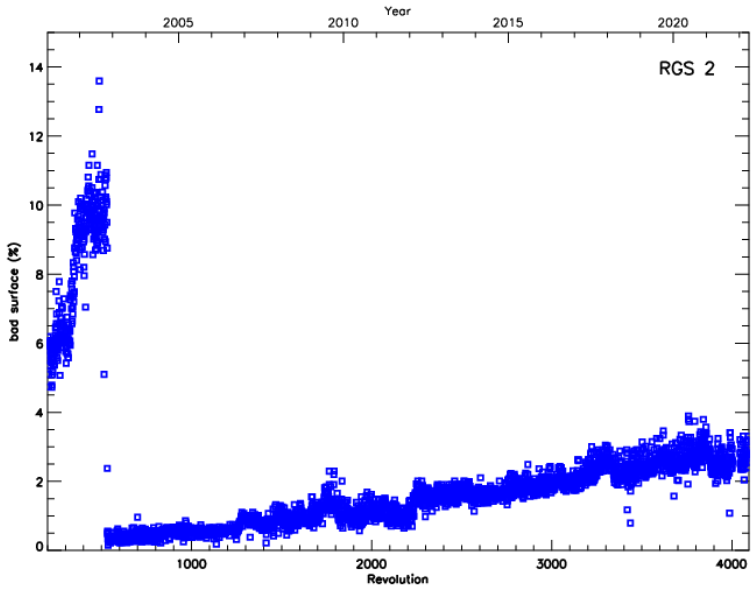




Charge Transfer Efficiency

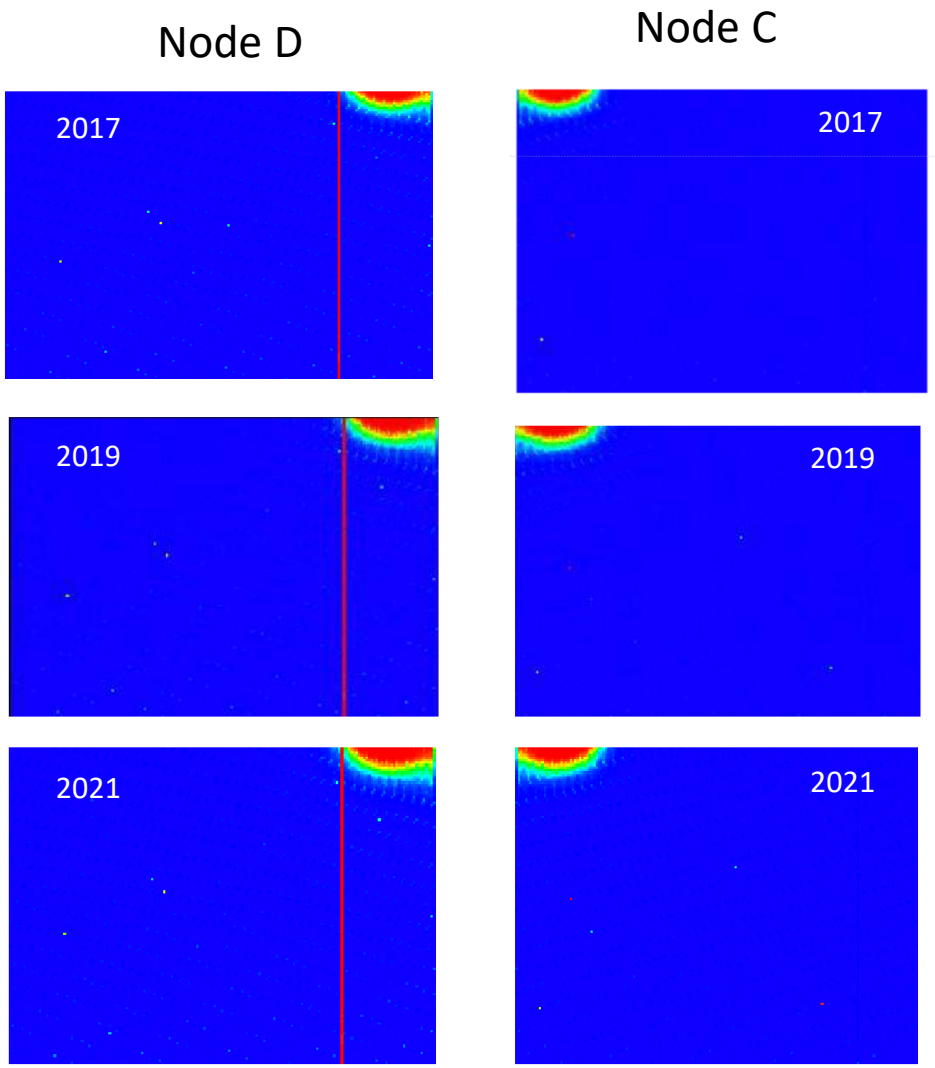
Jan 2022:
CCF issued with updated Gain and CTI correction





Bad Surface

RGS1 CCD1 Hot Spots

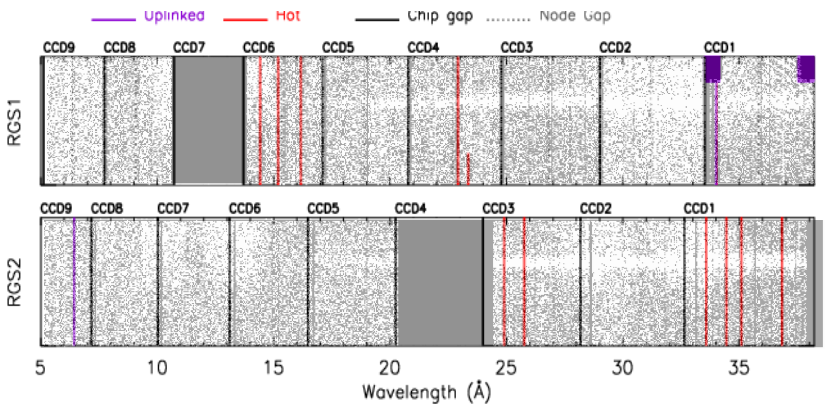


New masks uploaded in June 2021

July 2021:
Final CCF released

Hot Columns

Report for 2021 issued beginning May

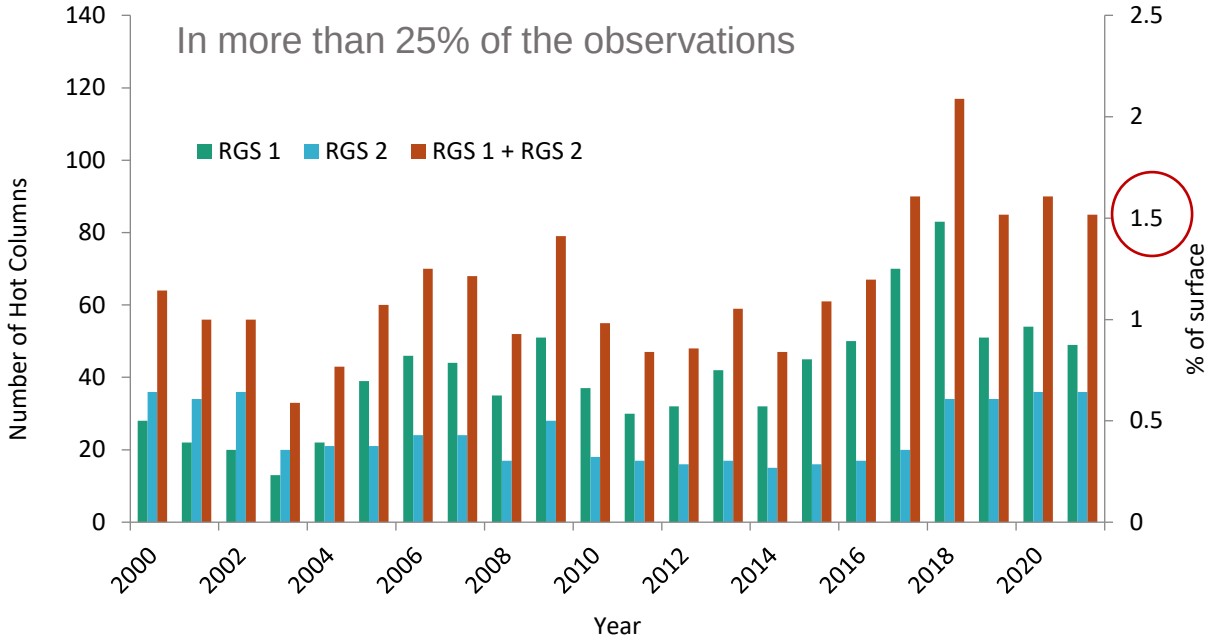


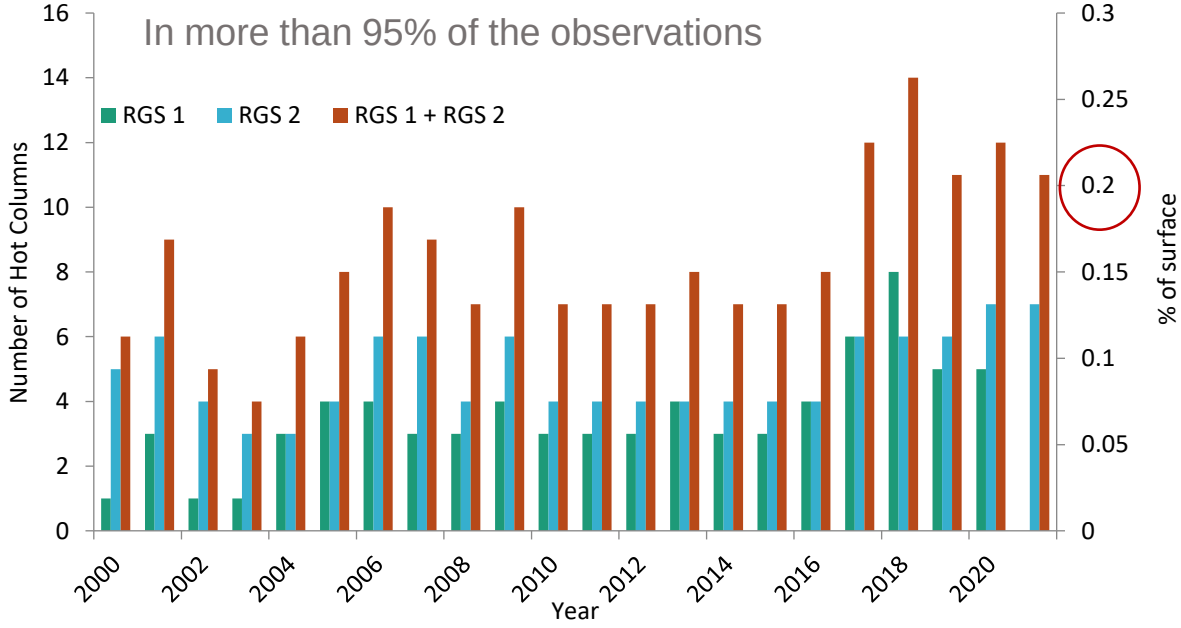
Columns ***rejected on-board***

1 in RGS1 CCD 1
1 in RGS2 CCD 9

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

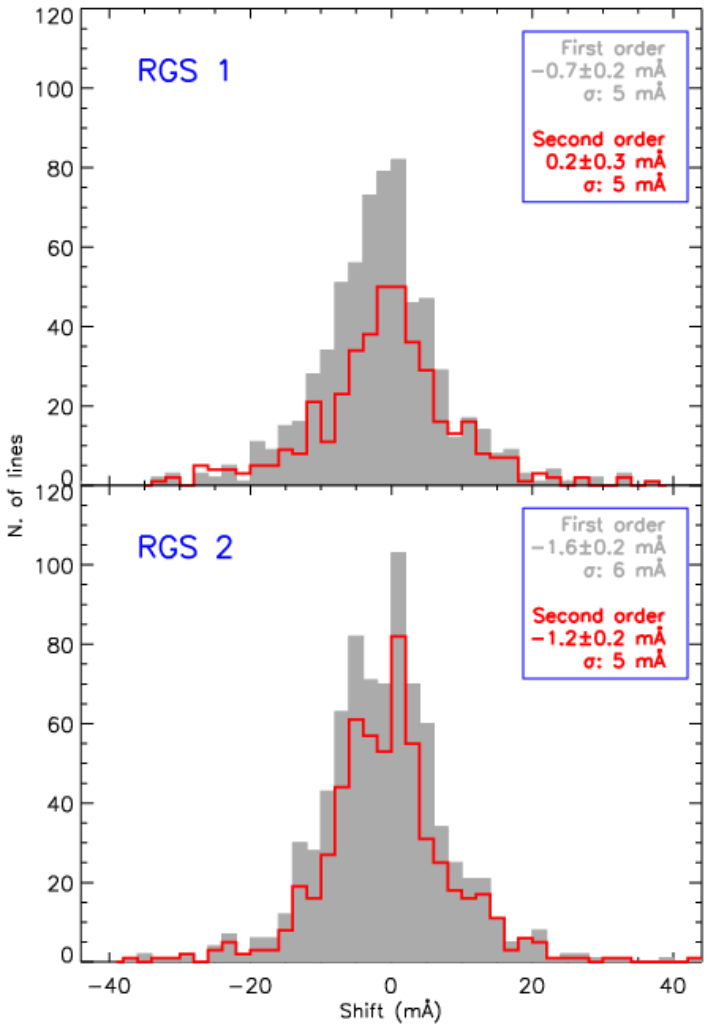
6 in RGS1 (3 in CCD6 + 2 in CCD4 +1 in CCD1)
6 in RGS2 (2 in CCD3 + 4 in CCD 1)





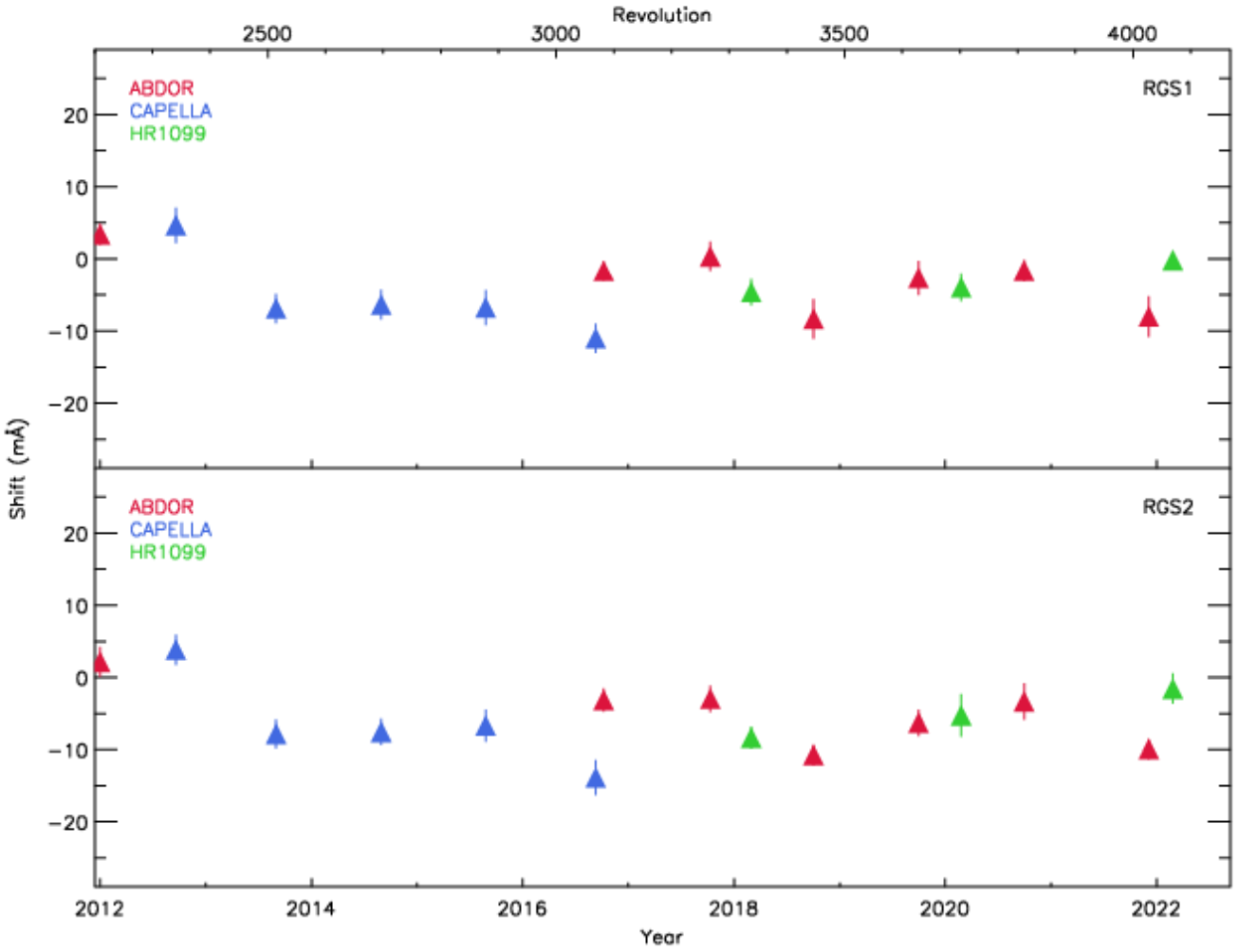
Wavelength scale

shifts of individual lines



Accuracy ≈ 5 mÅ

Mean shift per spectrum



Wavelength scale stable

Wavelength scale

- **USG Recommendation 2021-06-10/11:**

The UG recommends to continue investigations whether it is possible to further improve the wavelength scale and the line spread function of the RGS

- Δλ vs time ?

  No significative trend with time

- Δλ vs λ ?

  No clear relation between wavelength and line shifts

- Assesment of the LSF

  No indications of degradation

- Monitoring continues

Effective Area

Three time-dependent corrections:

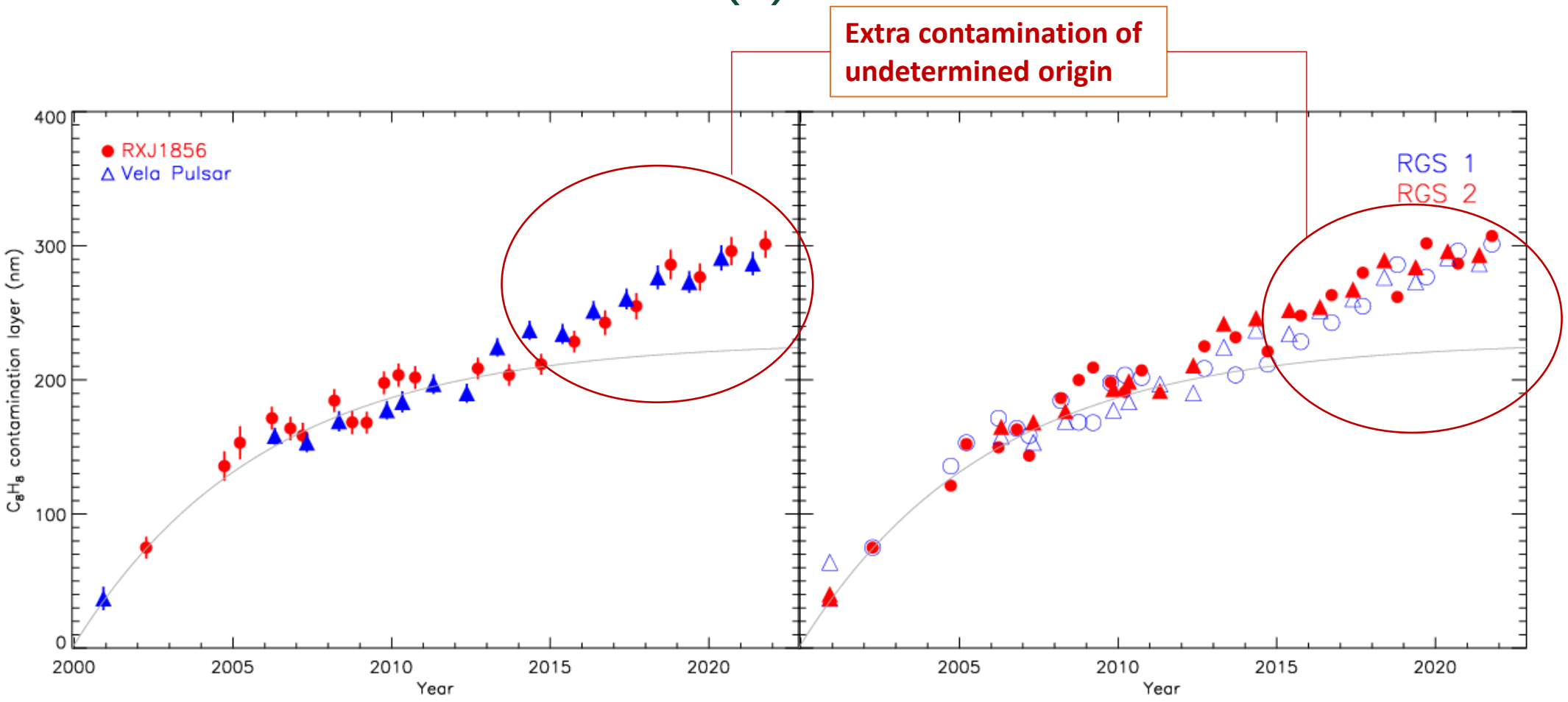
- Contamination correction, applied **by default,** , with rgsproc/rgsrmfgen parameter dyneffareacorr=yes

- Small scale Effective Area correction* applied **by default**, with rgsproc/rgsrmfgen parameter witheffectivaeracorrection=yes

- Correction with respect to EPIC-pn* (Rectification Factors) can be applied with rgsproc/rgsrmfgen non-default option withrectification=yes

- Formally valid until February 2019

Effective Area: Contamination (?)

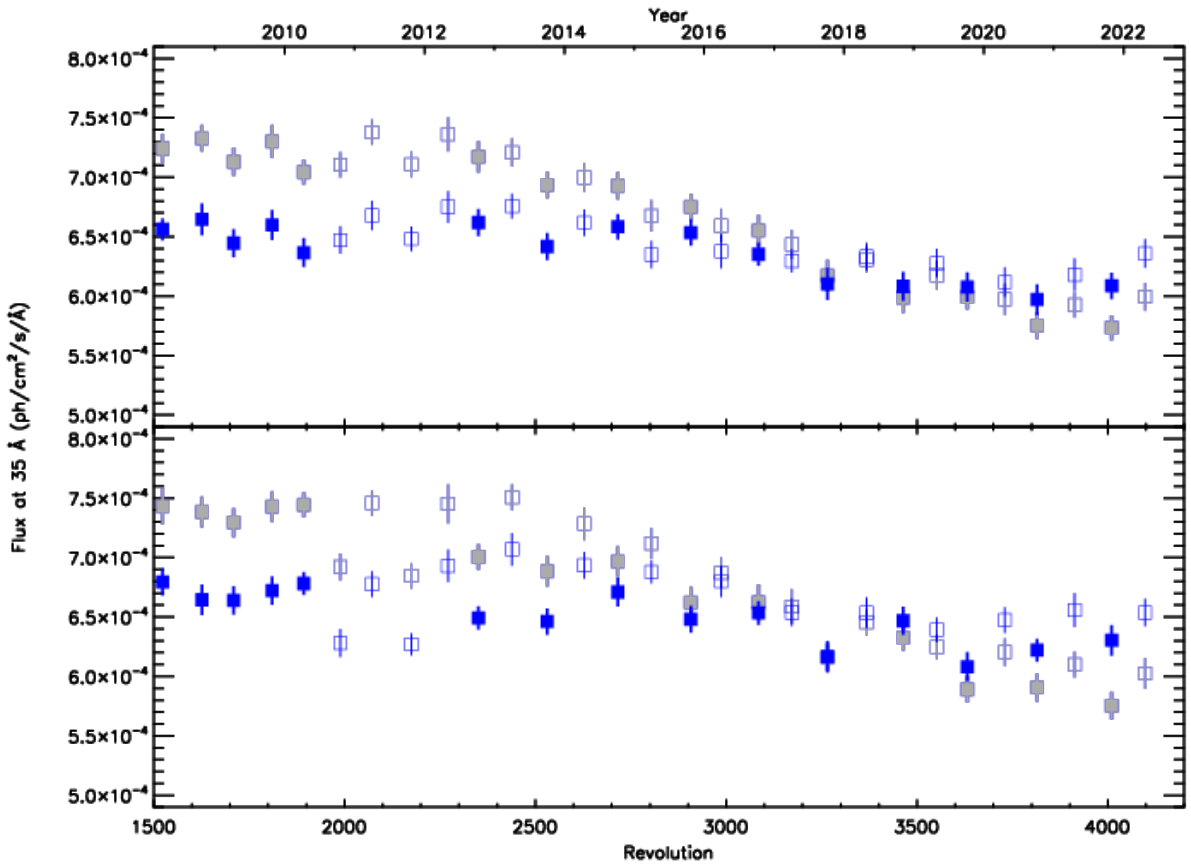


- Increase in the thickness of the C_8H_8 contamination layer?
- Increase in the thickness of the O layer?

X very different wavelength dependence
X would require an increase of 300 nm
X no changes in instrumental O edge

Effective Area: Flux monitoring

RXJ1856-3754 @ 35Å



Contamination + Eff. Area correction

Contamination + Eff. Area correction + Rectification

RGS1

$6.8 \pm 0.6 \times 10^{-4}$

$6.4 \pm 0.2 \times 10^{-4}$

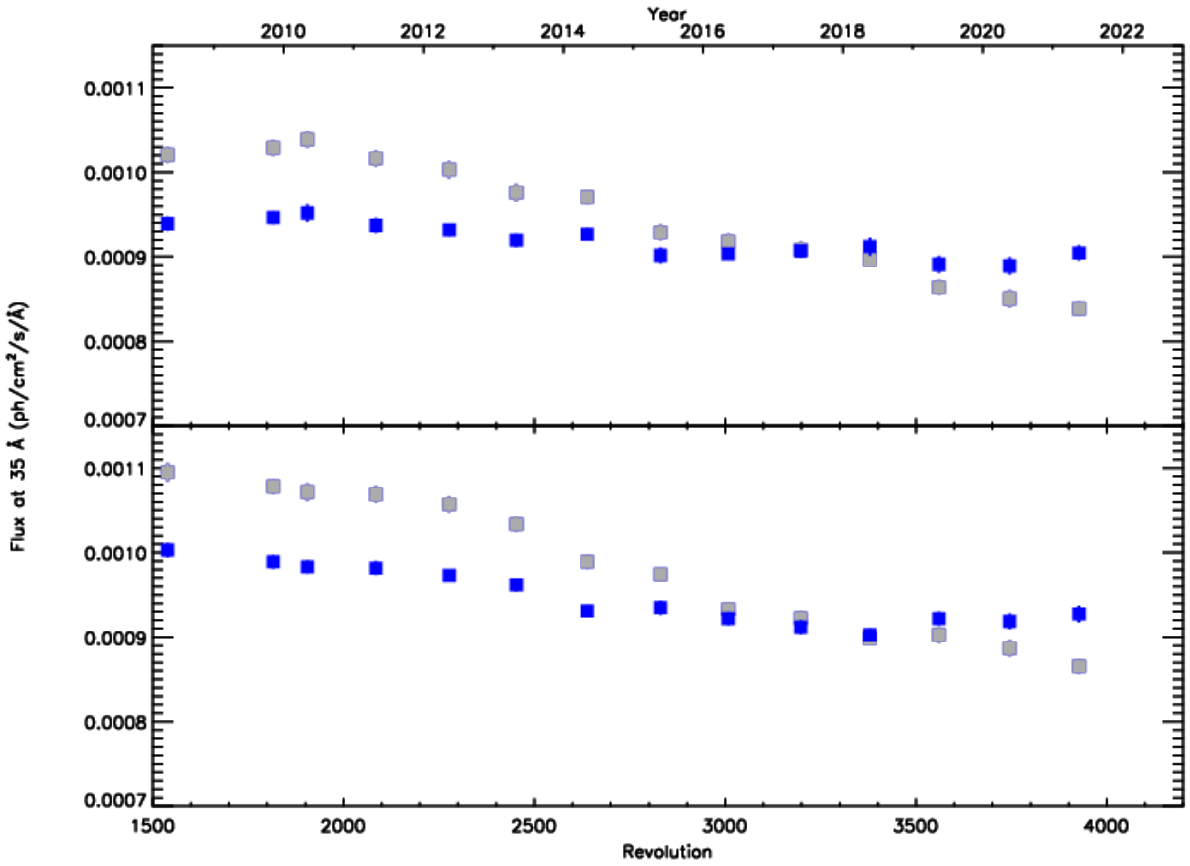
RGS2

$6.9 \pm 0.6 \times 10^{-4}$

$6.5 \pm 0.2 \times 10^{-4}$

Effective Area: Flux monitoring

Vela Pulsar @ 35Å



Contamination + Eff. Area correction

Contamination + Eff. Area correction + Rectification

RGS1

$9.7 \pm 0.7 \times 10^{-4}$

$9.2 \pm 0.2 \times 10^{-4}$

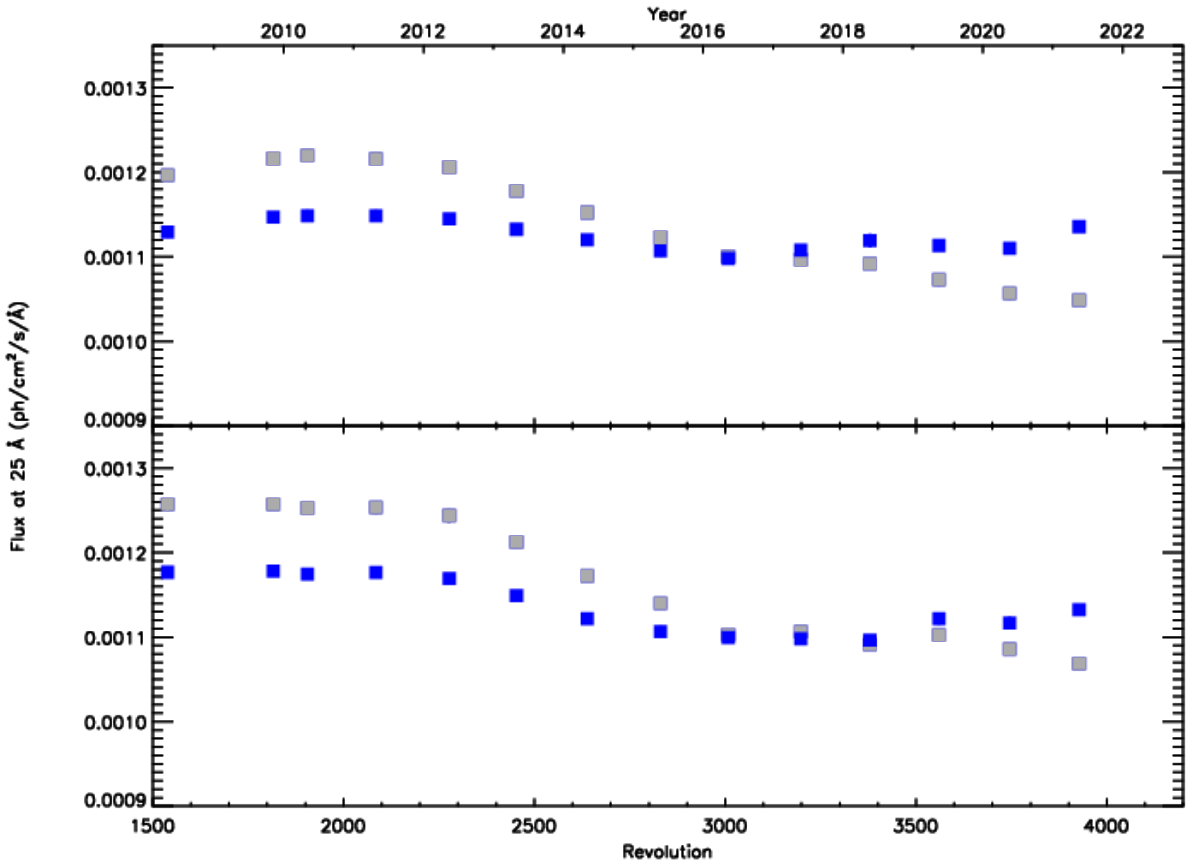
RGS2

$10.0 \pm 0.8 \times 10^{-4}$

$9.3 \pm 0.3 \times 10^{-4}$

Effective Area: Flux monitoring

Vela Pulsar @ 25Å



Contamination + Eff. Area correction

Contamination + Eff. Area correction + Rectification

RGS1

$11.3 \pm 0.6 \times 10^{-4}$

$11.2 \pm 0.3 \times 10^{-4}$

RGS2

$12.0 \pm 0.8 \times 10^{-4}$

$11.5 \pm 0.6 \times 10^{-4}$

Effective Area: Evaluation of corrections

- 64 observations of BL Lacs (3C 273, PKS2155, 1ES1553)
- Three data sets:
  - Only contamination correction (SAS default)
  - + Effective area correction (now SAS default)
  - + rectification correction (non-default)
- Simultaneous fit of RGS1 and RGS2 with a simple model (absorbed powerlaw)

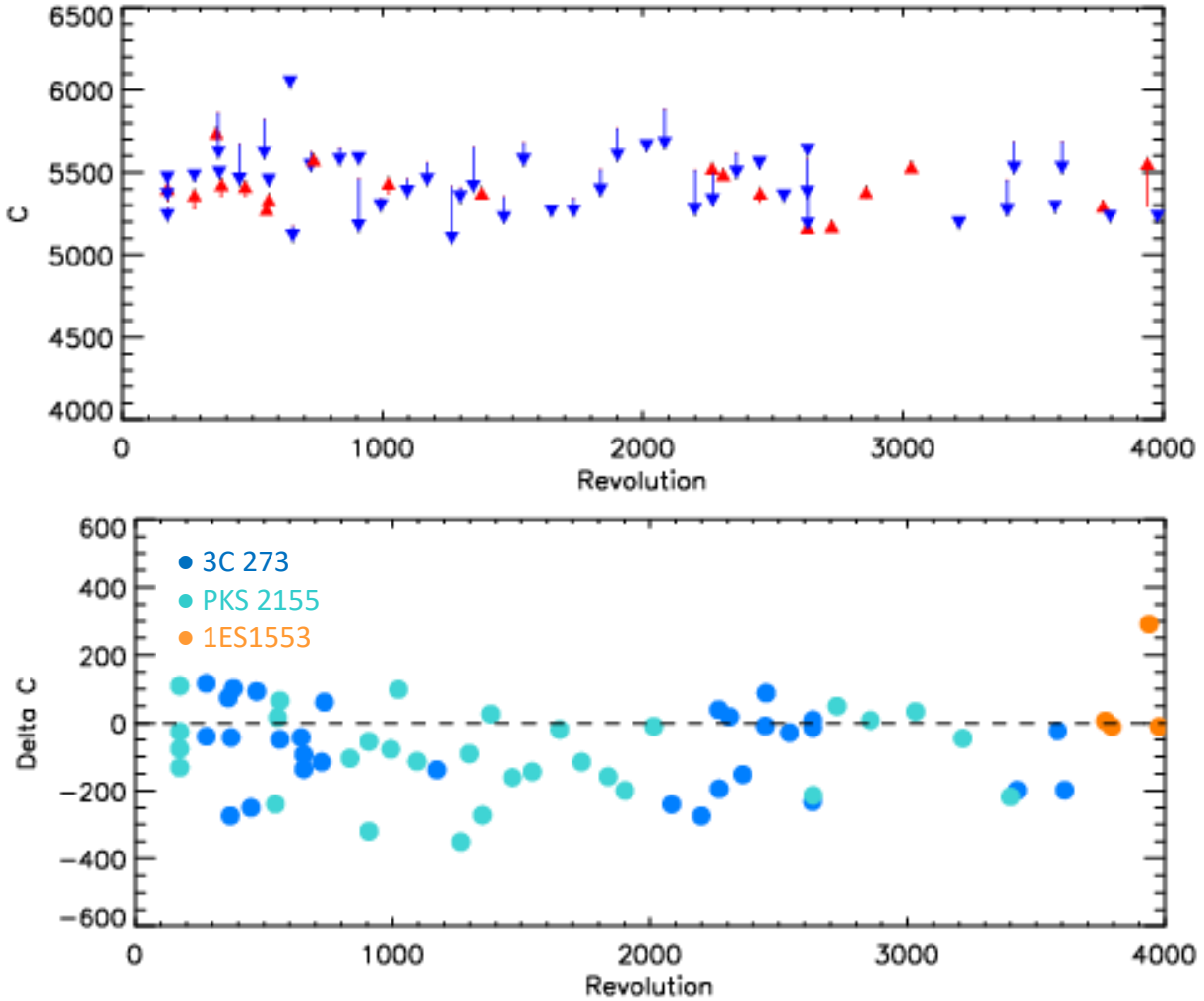
Effective Area: Evaluation of corrections

Target	n	a	c
All	64	56%	70%
3C 273	30	56%	70%
PKS 2155	30	53%	73%
1ES 1553	4	75%	50%

a) Fraction of observations for which the fit improves after effective area correction
(wrt to only contamination correction)

a) Fraction of observations for which the fit improves after rectification correction
(wrt to contamination+eff area correction)

Change in the quality of fit after eff. Area correction and rectification



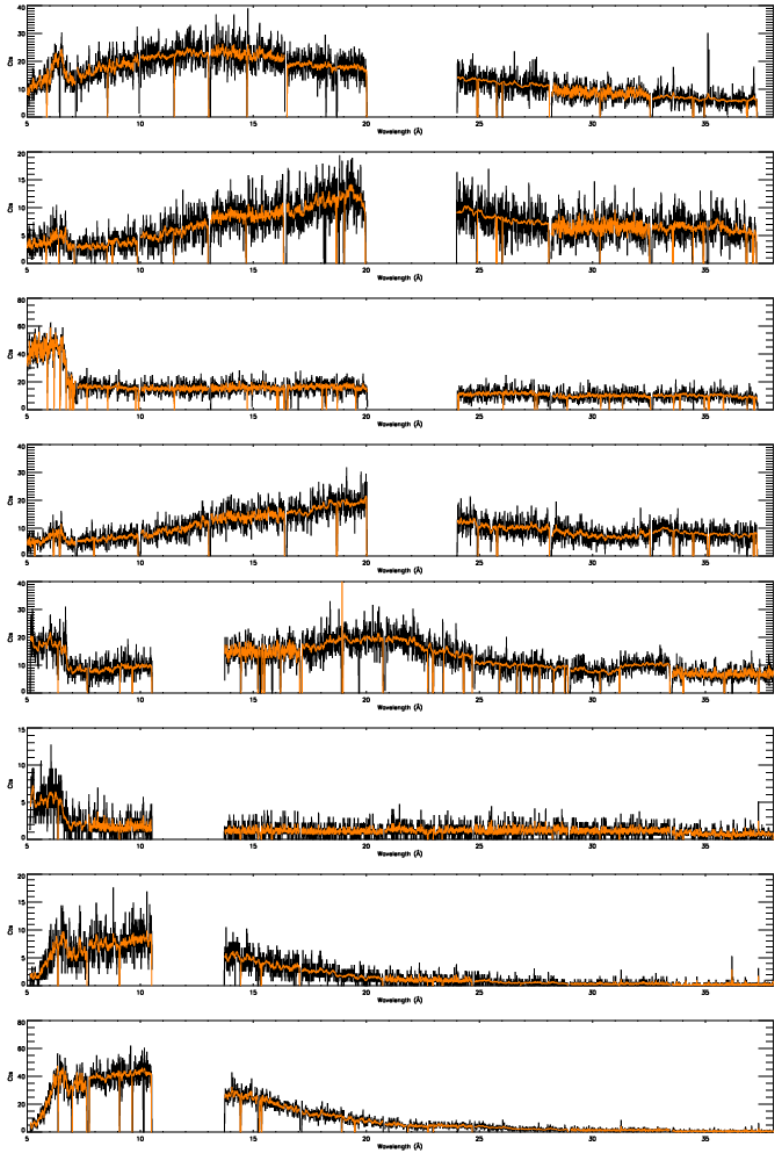
New Background Handling Methods

- **UG Recommendation 2020-06-18/12:**

The UG recommends to continue the evaluation of new methods for background subtraction for the RGS detectors.

New Background Handling Methods

- Wiener filtering of the background spectrum
- Implemented in SAS as a Phyton task (not public)
- Testing and evaluation of first version
- Implementation of improvements for next version in progress



method by J. Kaastra

Summary

- Operations and Instrument Status
  - Operations running without problems
  - No unexpected behaviour in the instrumental performance
- Wavelength scale
  - Wavelength scale stable
  - No significative trend with time
  - No degradation of the LSF
  - Continuous monitoring
- Effective Area
  - Variations in Effective Area continuously monitored.
  - Corrections to take into account the observed change in Effective Area in place
- Implementation of new methods for background subtraction on-going