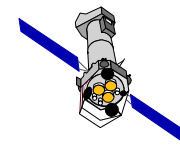


# The Reflection Grating Spectrometers

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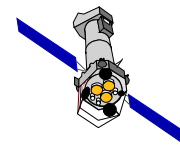
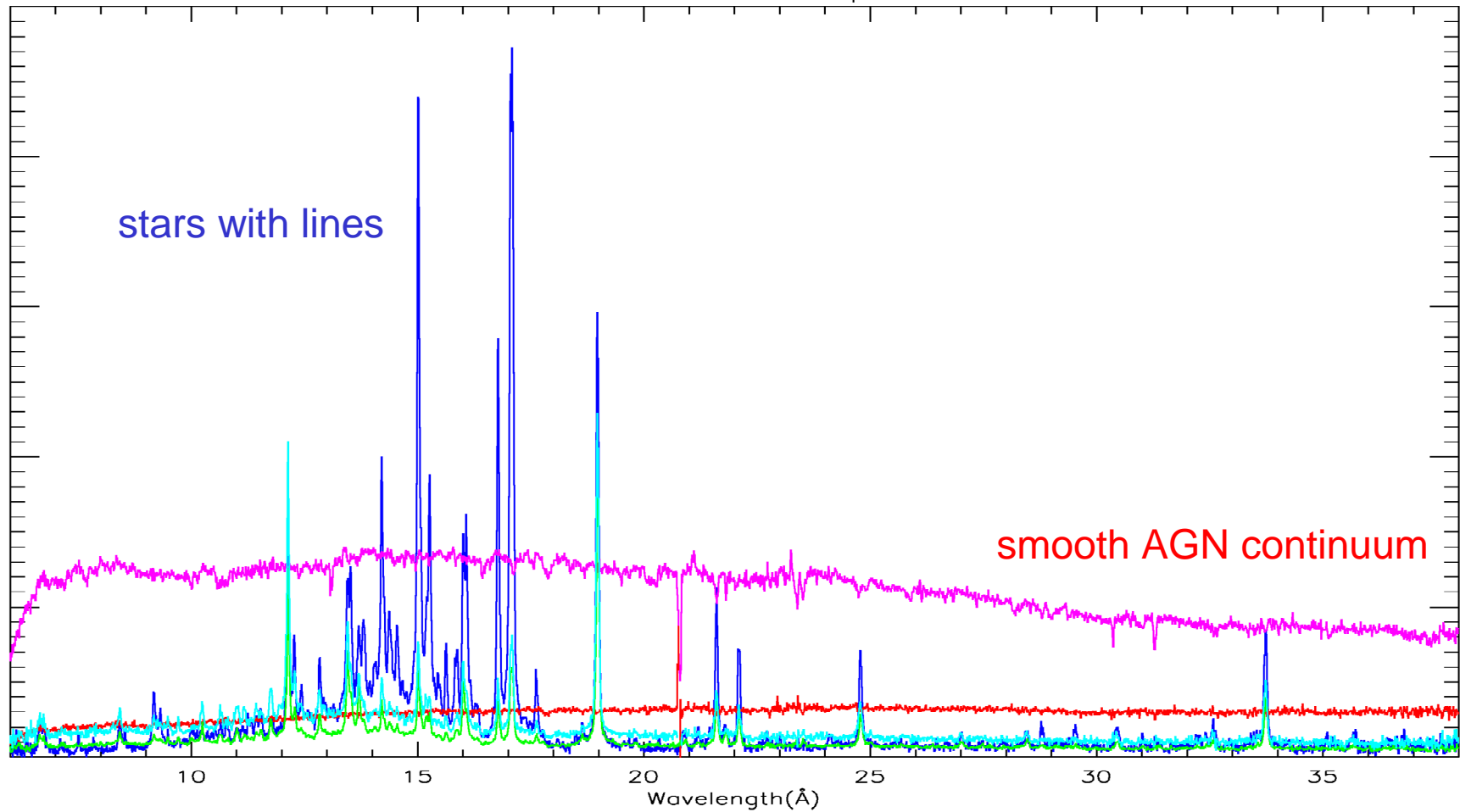
## SAS Workshop 30 June 2009

SRON : Columbia : MSSL : PSI : RSSD



***XMM-Newton***

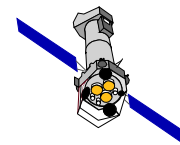
# Some nice RGS spectra



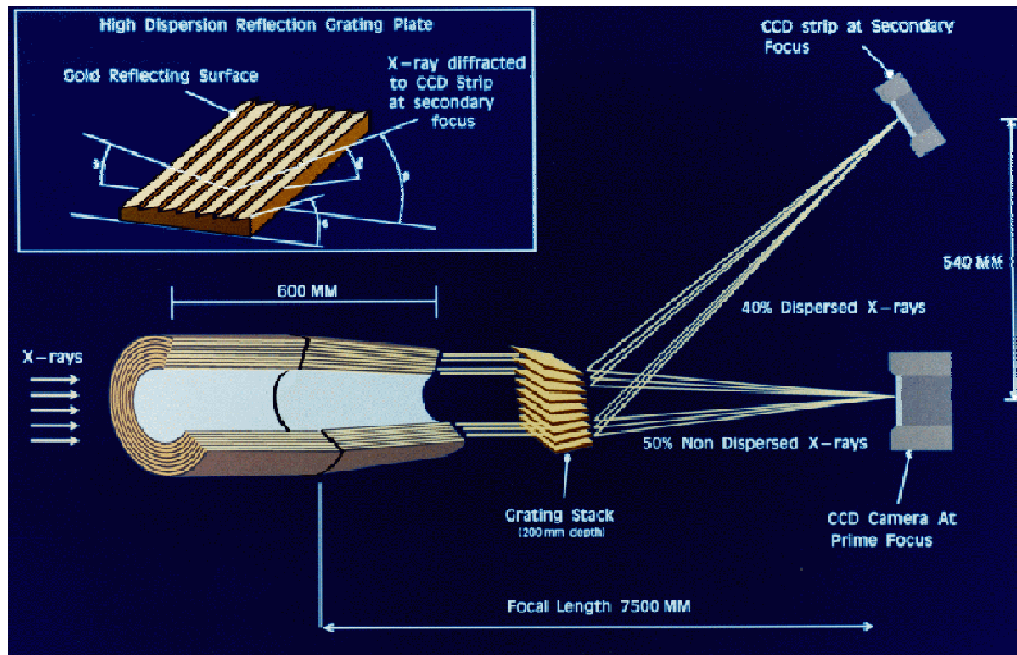
# How to get RGS spectra

---

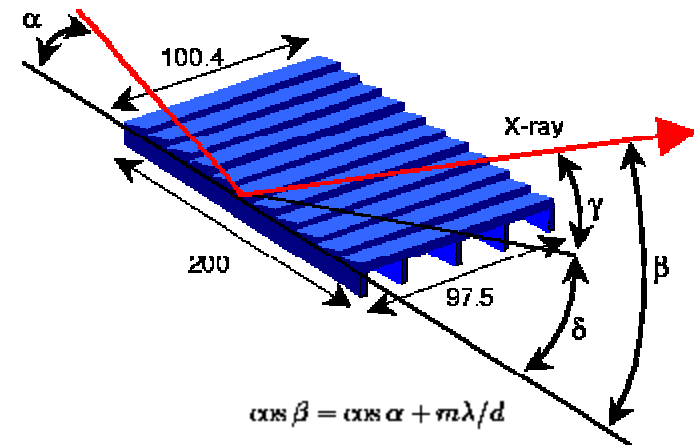
\$ rgsproc



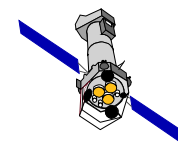
# An RGS instrument



$\text{area} \leq 140 \text{ cm}^2$   
 $6 \leq \lambda(\text{\AA}) \leq 38$   
 $0.33 \leq E(\text{keV}) \leq 2.0$   
 $\lambda/\Delta\lambda \leq 800$   
 $\Delta\lambda \sim 7 \text{ m\AA}$   
 field-of-view =  $\pm 2.5$  arcmin

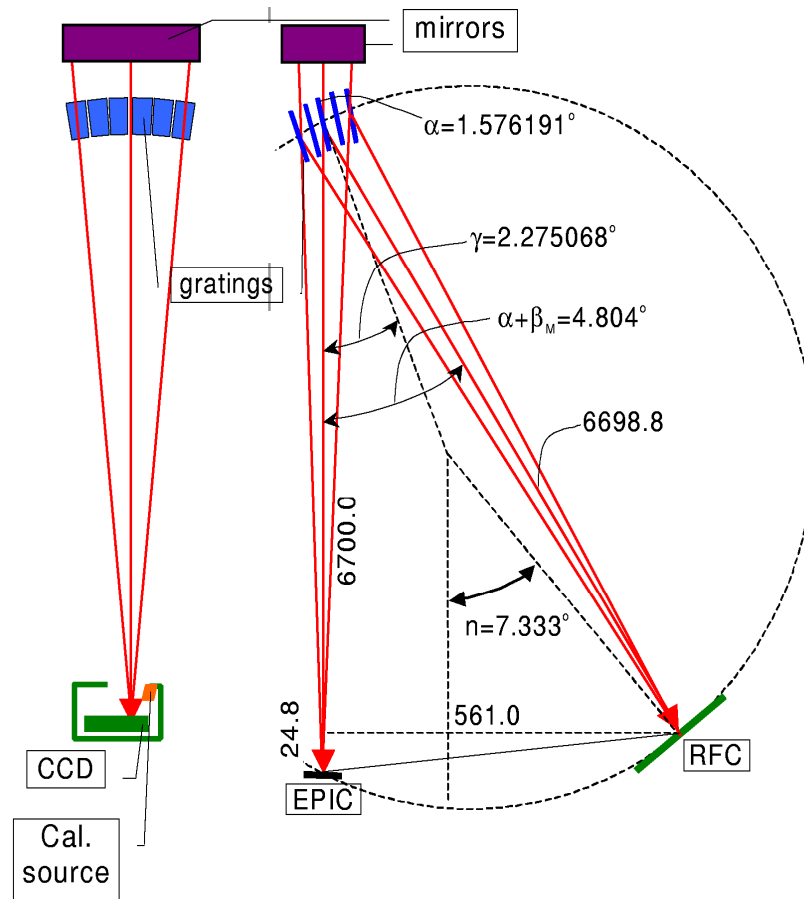


$$\cos \beta = \cos \alpha + m\lambda/d$$

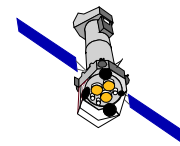


**XMM-Newton**

# RGS Optical Design



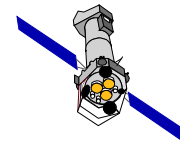
$$\cos\beta = \cos\alpha + m\lambda/d$$



# (The only) RGS mode

---

Spectroscopy aka Spectro (+ Q)  
High Event Rate with SES  
{ $\beta$ , X, T, PI}



***XMM-Newton***

# The usual RGS spectra

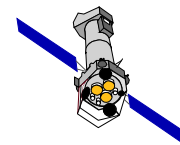
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## RGS1 & RGS2

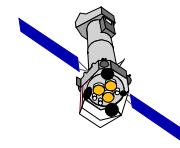
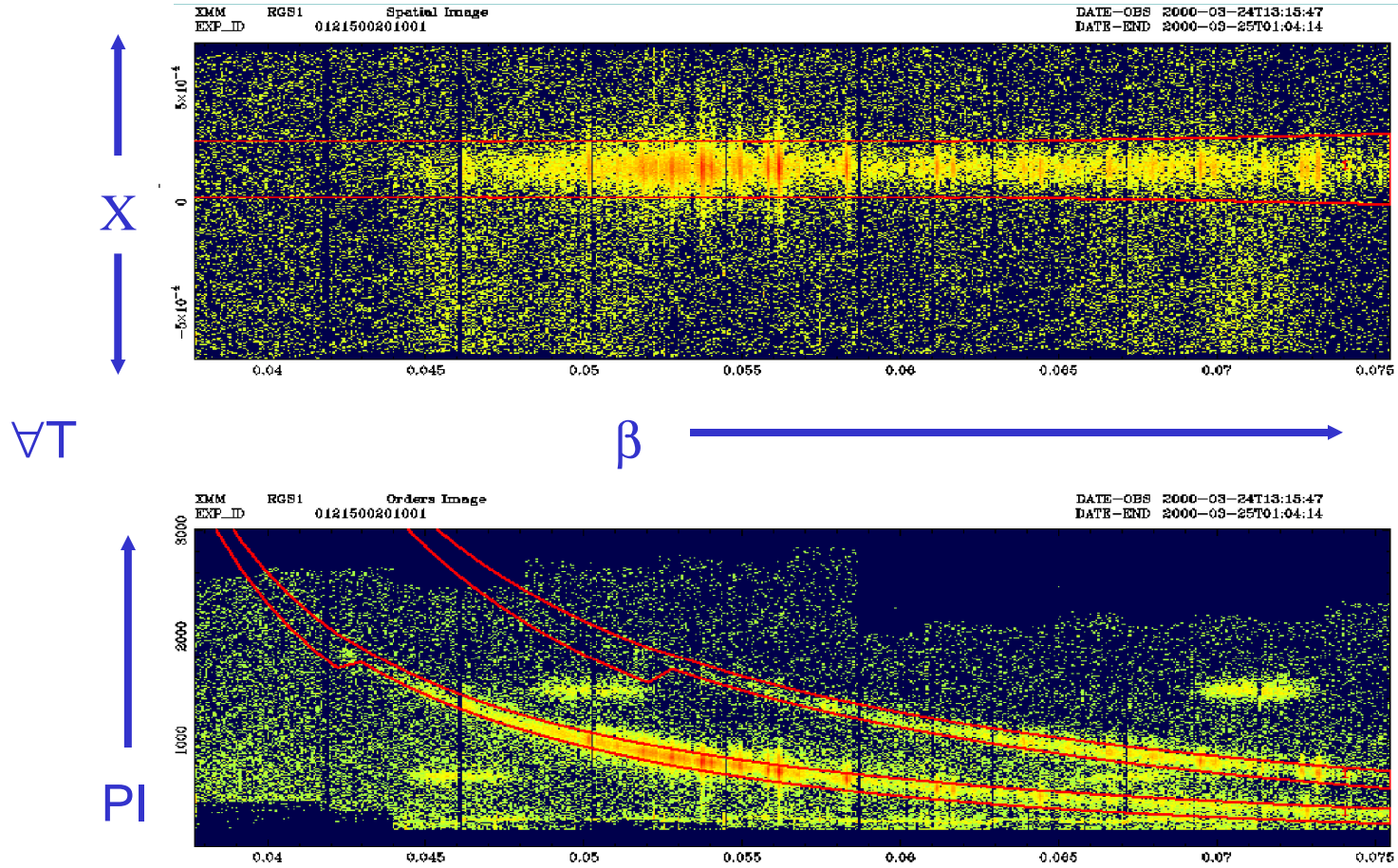
1<sup>st</sup> order ( $m=-1$ ) & 2<sup>nd</sup> order ( $m=-2$ )

3600  $\lambda$ -channels

3400  $\beta$ -channels

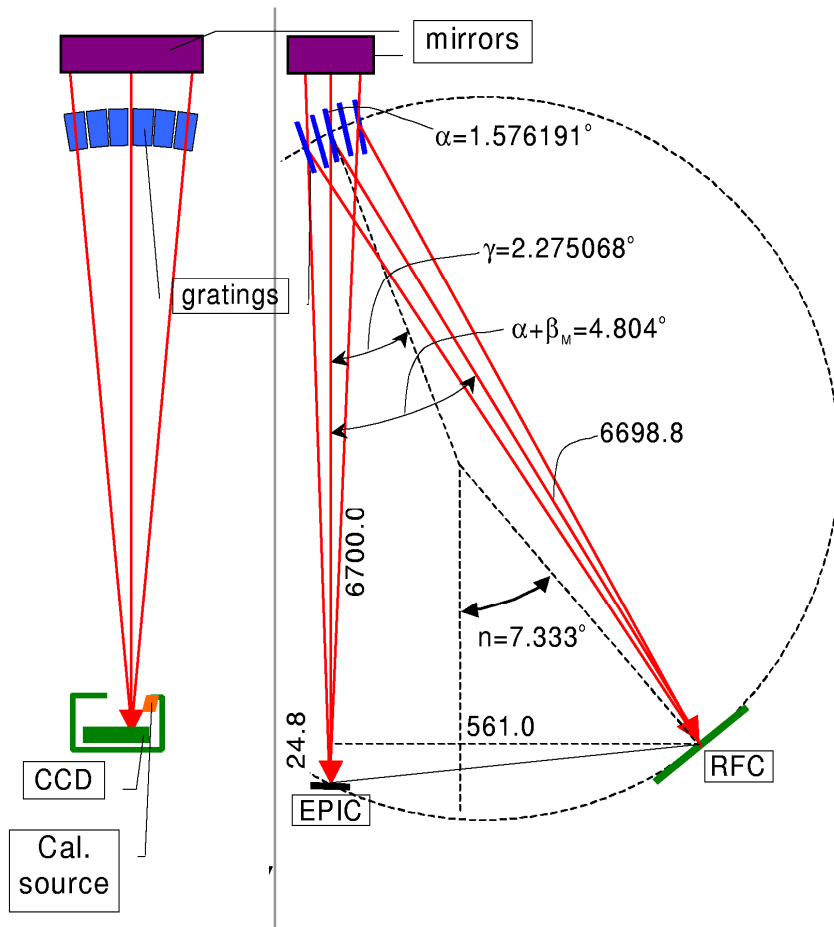


# RGS data space $\{\beta, X, T, PI\}$



# RGS SAS & CCF components

$$\cos\beta = \cos\alpha + m\lambda/d$$



**BORESIGHT**  
**LINCOORDS**  
**MISCDATA**

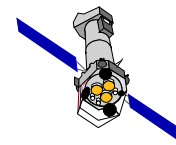
**rgsproc**

**HKPARMINT**

- atthkgen
- rgsoffsetcalc
- rgssources
- rgsframes
- rgsbadpix
- rgsevents
- evlistcomb
- gti.merge
- rgsangles
- rgsfilter
- rgsregions
- rgsspectrum
- rgsrmfgen
- rgsfluxer

**ADUCONV**  
**BADPIX**  
**CROSSPSF**  
**CTI**

**LINESPREADFUNC**  
**QUANTUMEFF**  
**REDIST**  
**EFFAREACORR**

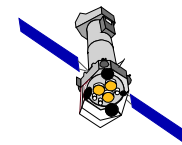


**XMM-Newton**

# What's happened to the RGS since launch ?

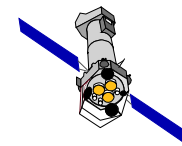
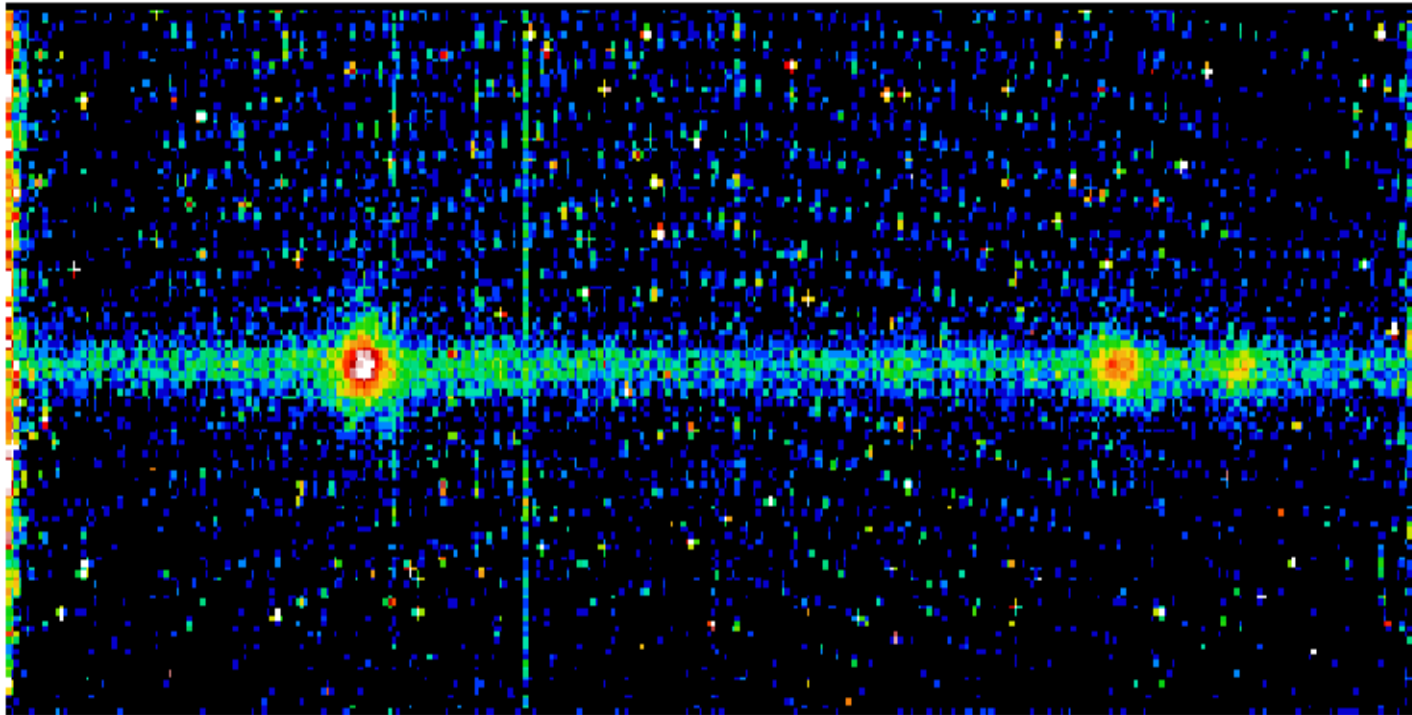
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- 2 CCDS have failed
  - after 1 week RGS2 CCD4
    - near the OVII triplet at 21Å
    - covered by RGS1 1<sup>st</sup> order
  - after 9 months RGS1 CCD7
    - near NeX Lyman  $\alpha$  at 12Å
    - covered by RGS1 2<sup>nd</sup> order and RGS2
- Detector contamination
  - linear build-up of carbon
  - loss of long-wavelength sensitivity
    - **EFFAREACORR CCF**
- RGS2 single-node CCD readout
  - takes longer
- Multi-pointing mode

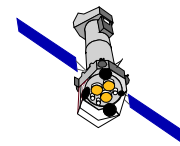
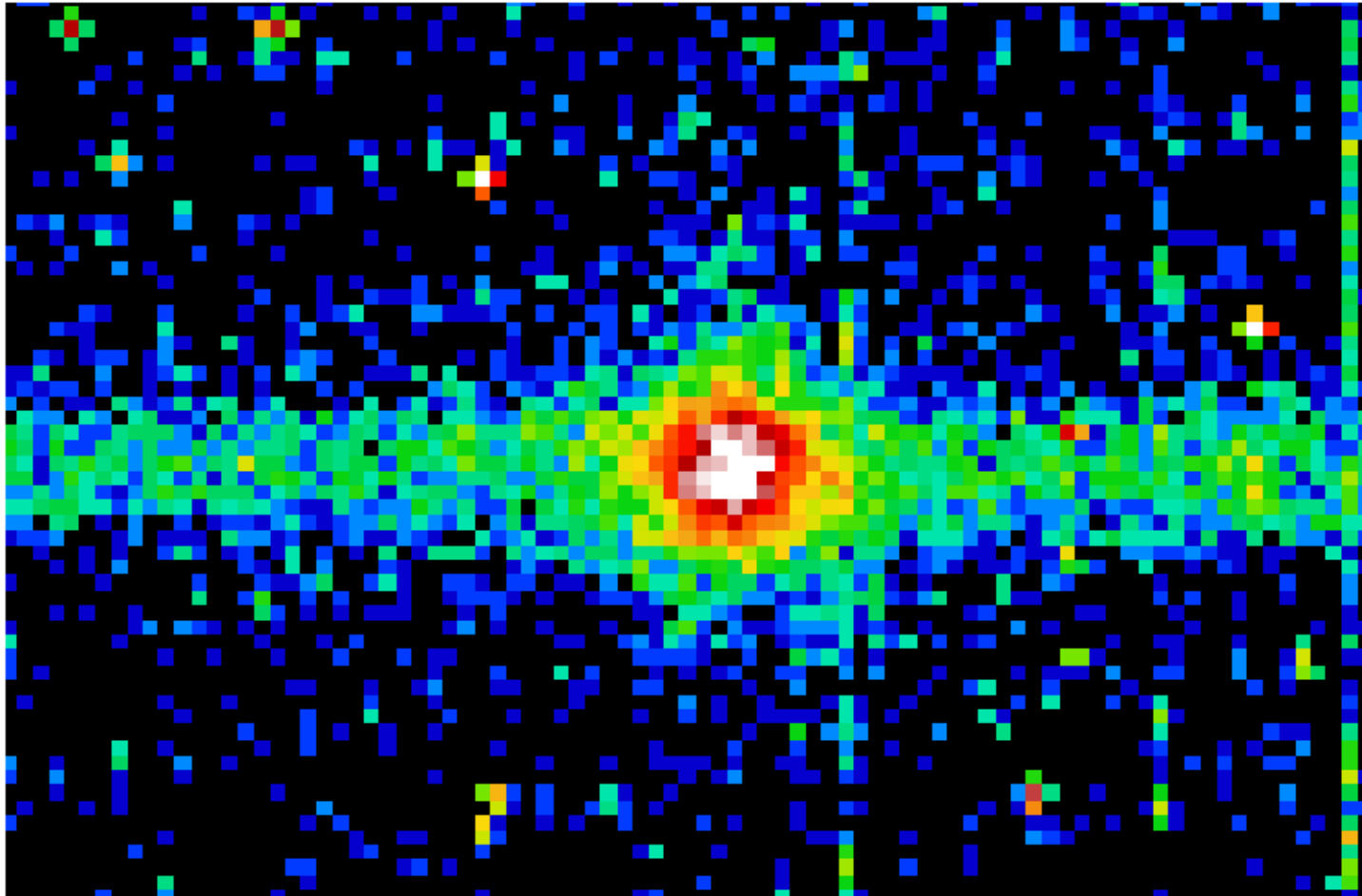


# One of the ~~nine~~ eight RGS2 CCDs

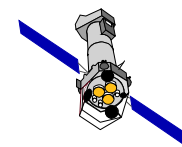
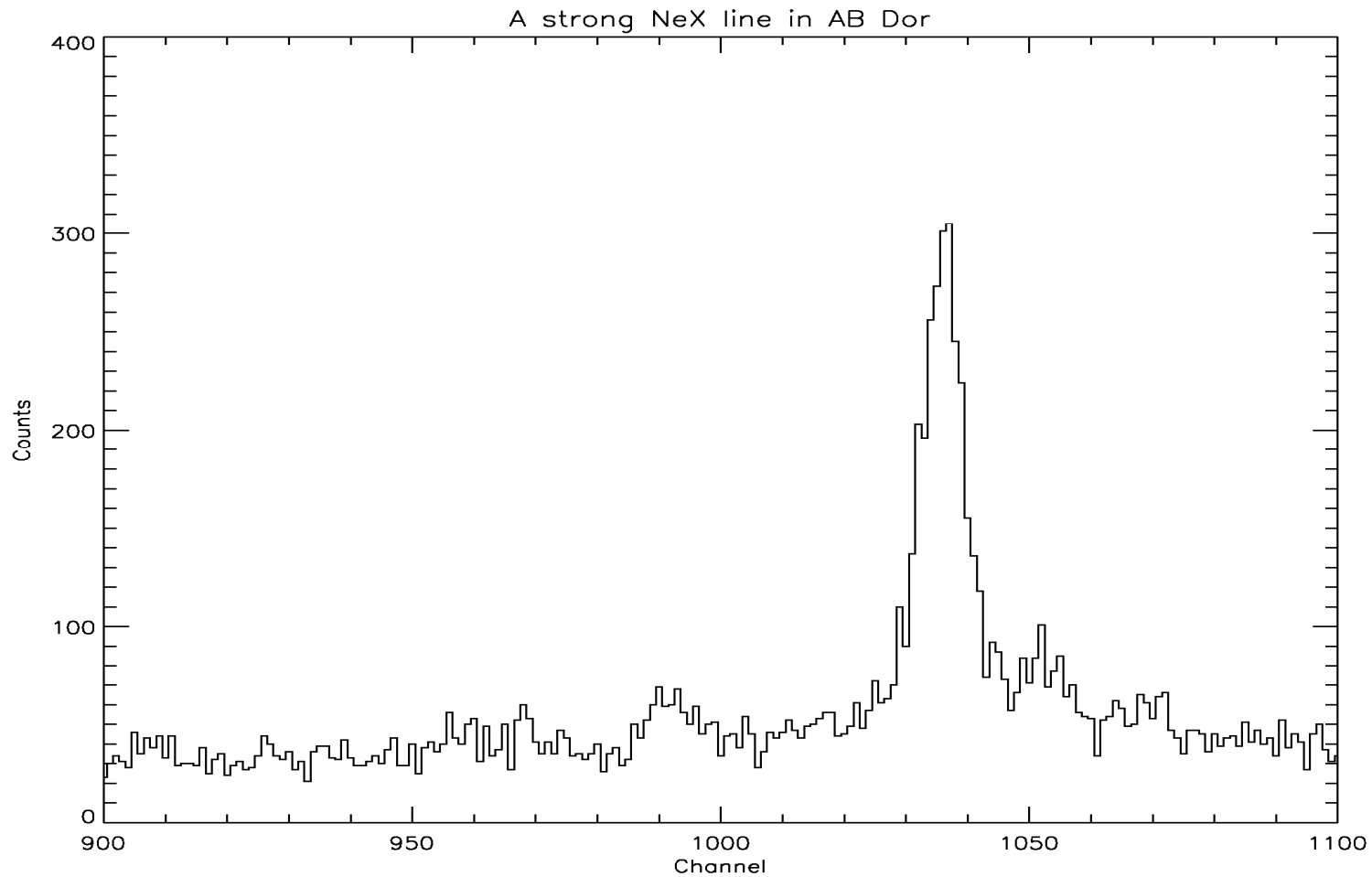
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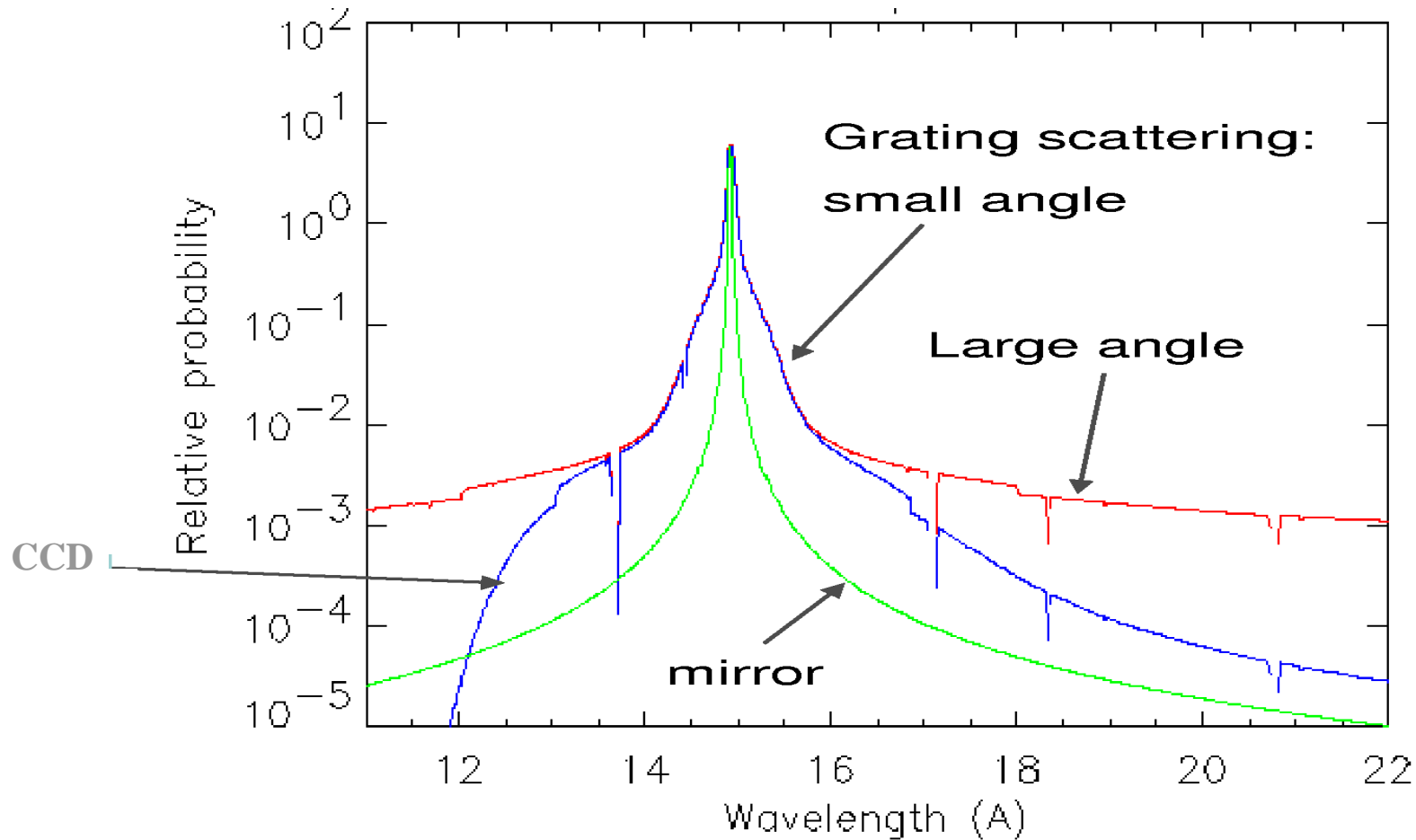
# O VIII $\lambda 18.971\text{\AA}$ emission line



# Beware Poisson statistics

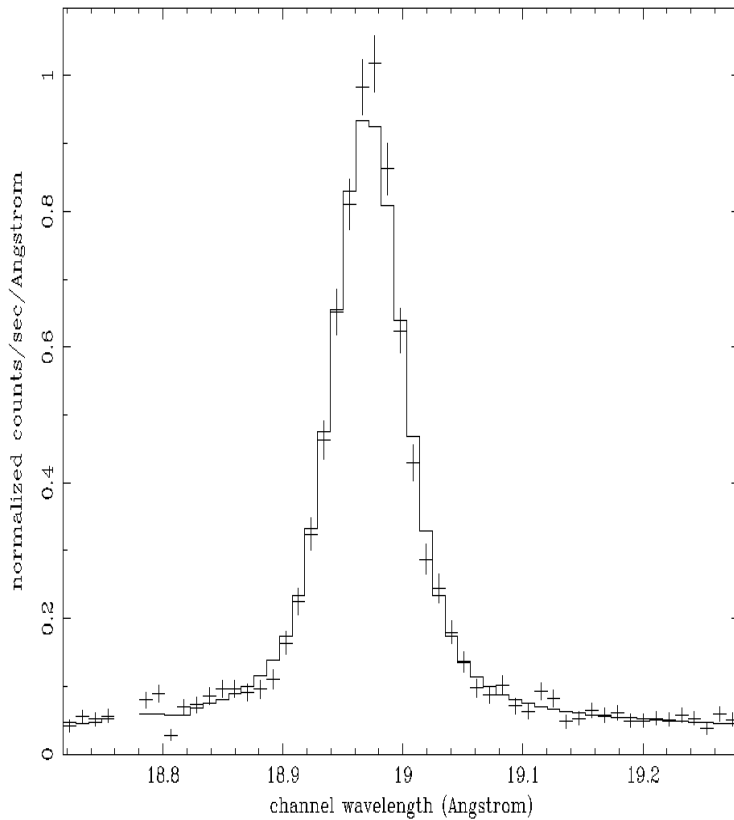


# RGS line-spread function components



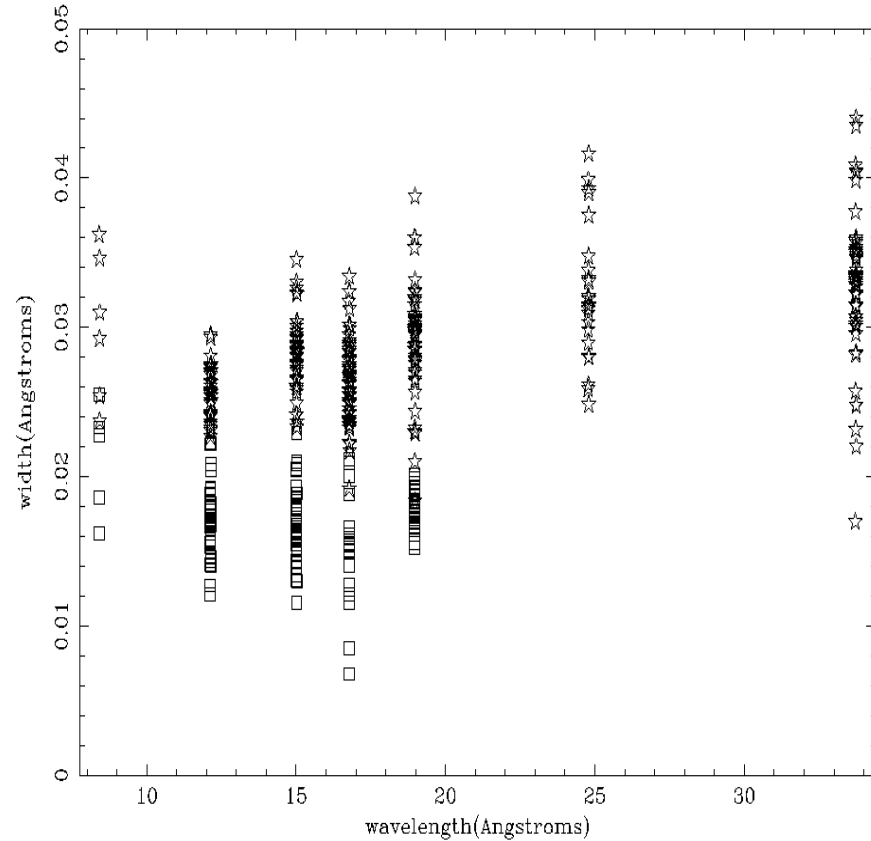
# RGS observed LSF and resolving power

AB Dor RGS2 OVIII emission line

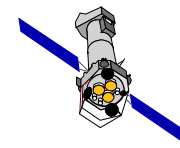


apollock 25-Sep-2002

Observed RGS Instrumental Spectral Line Widths

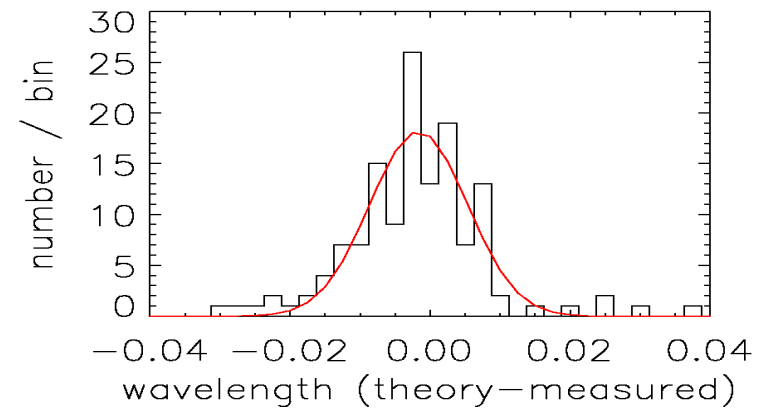
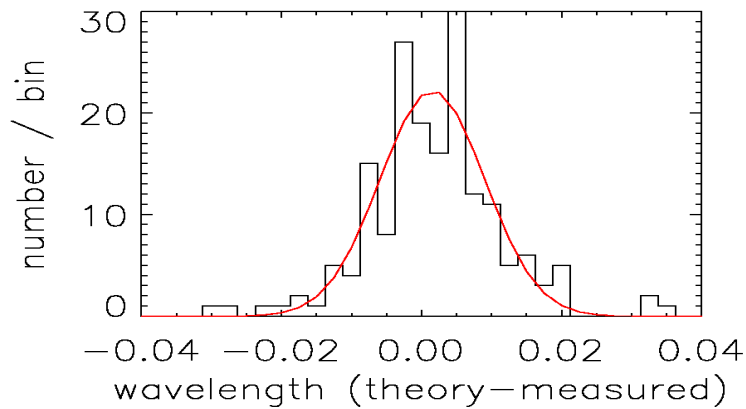
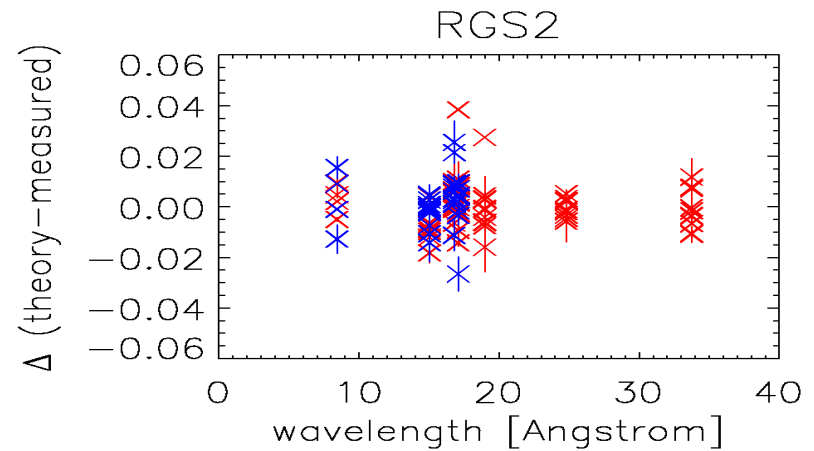
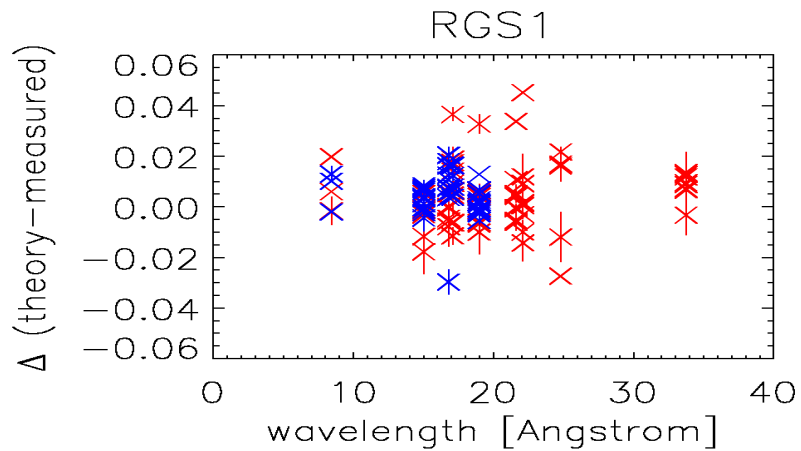


apollock 25-Sep-2002 14:38

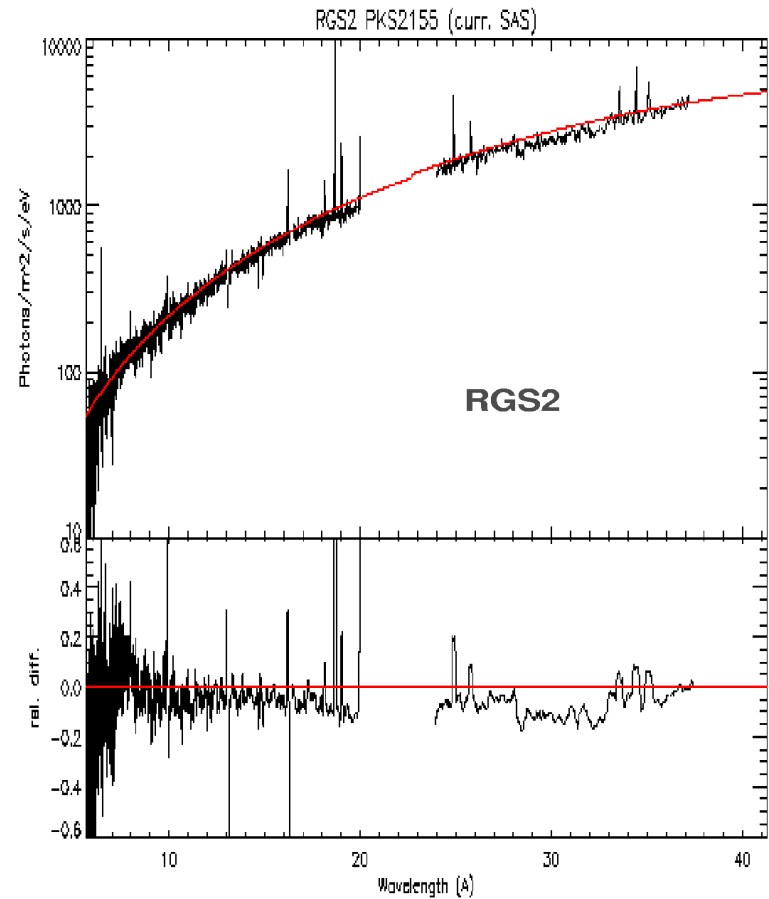
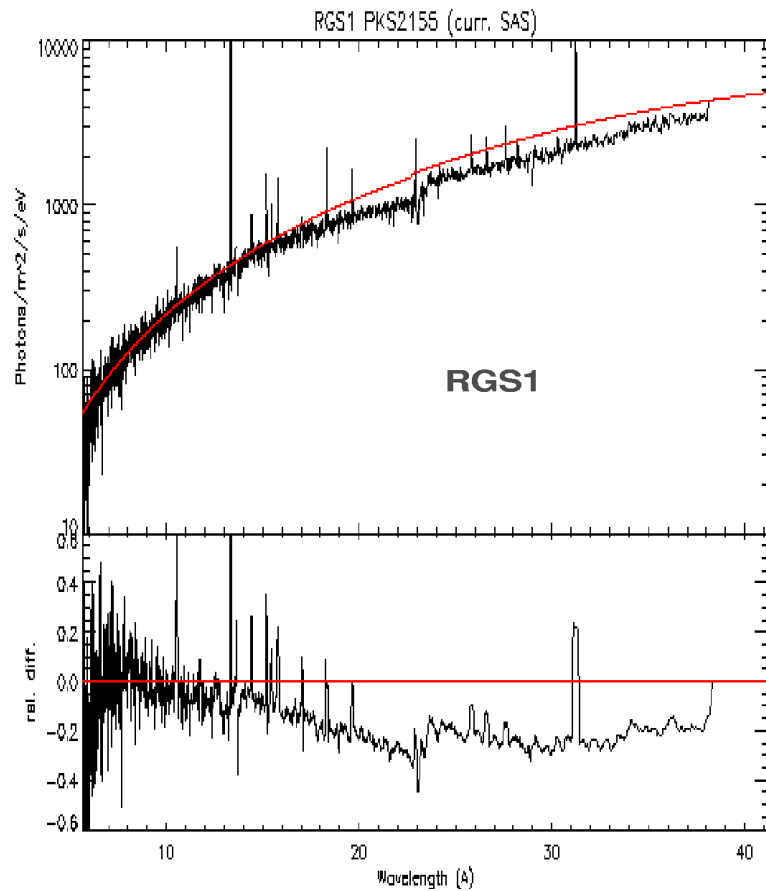


**XMM-Newton**

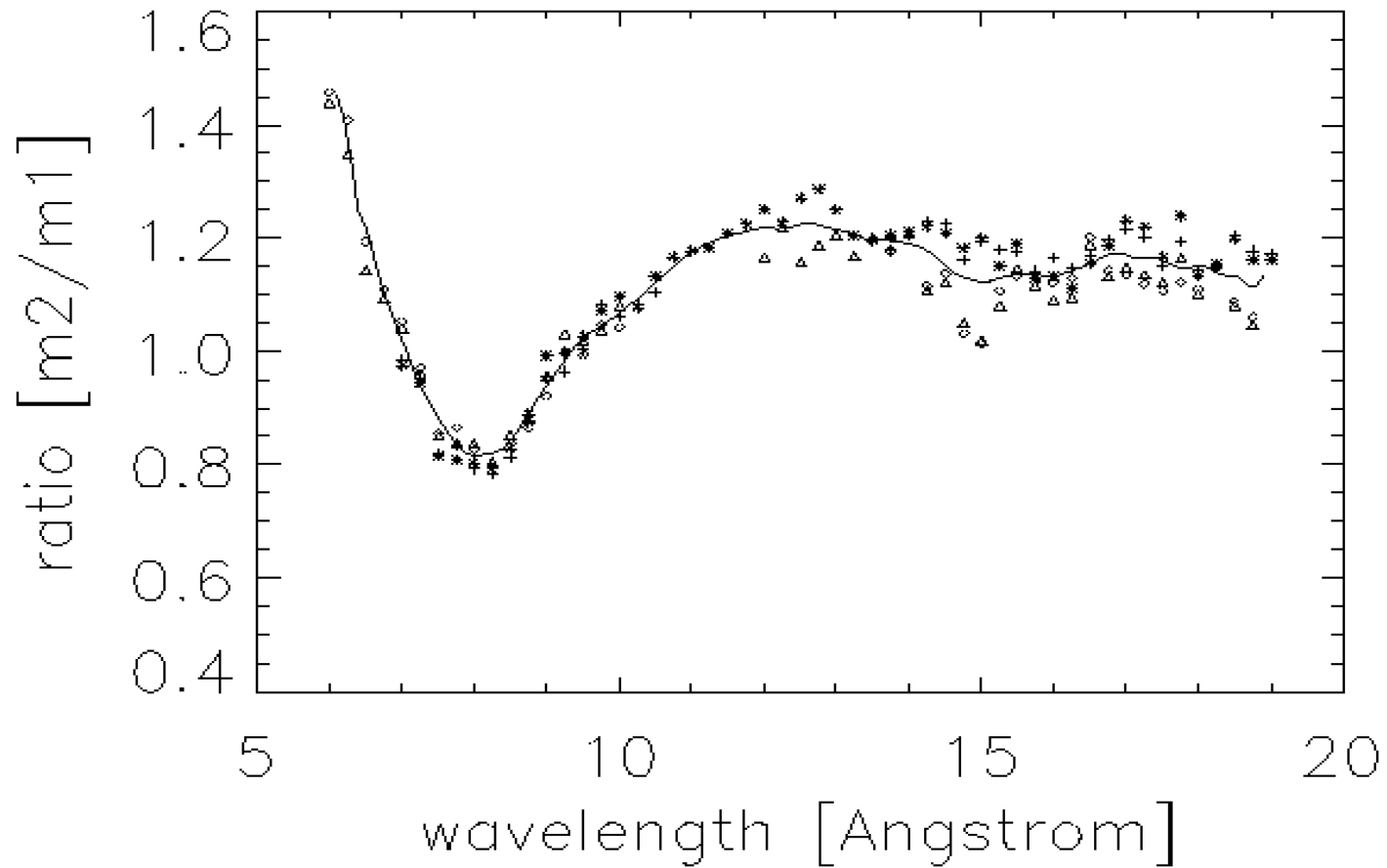
# RGS wavelength scale ( $\sigma \sim 7 \text{ m\AA}$ )



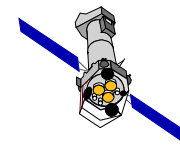
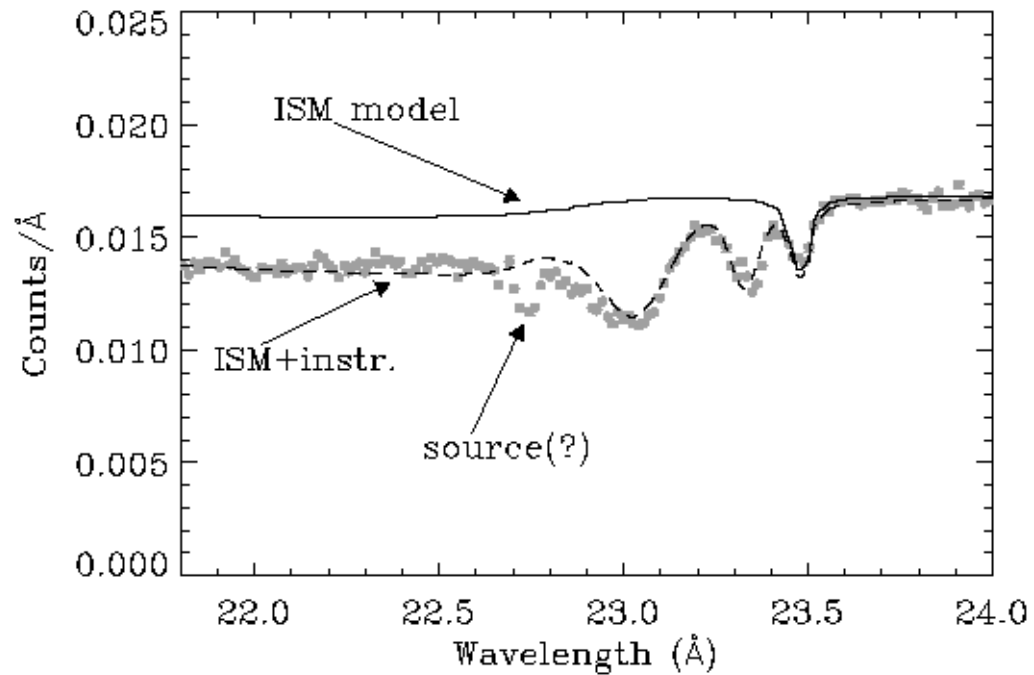
# RGS1 & RGS2 broadband comparison



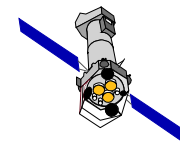
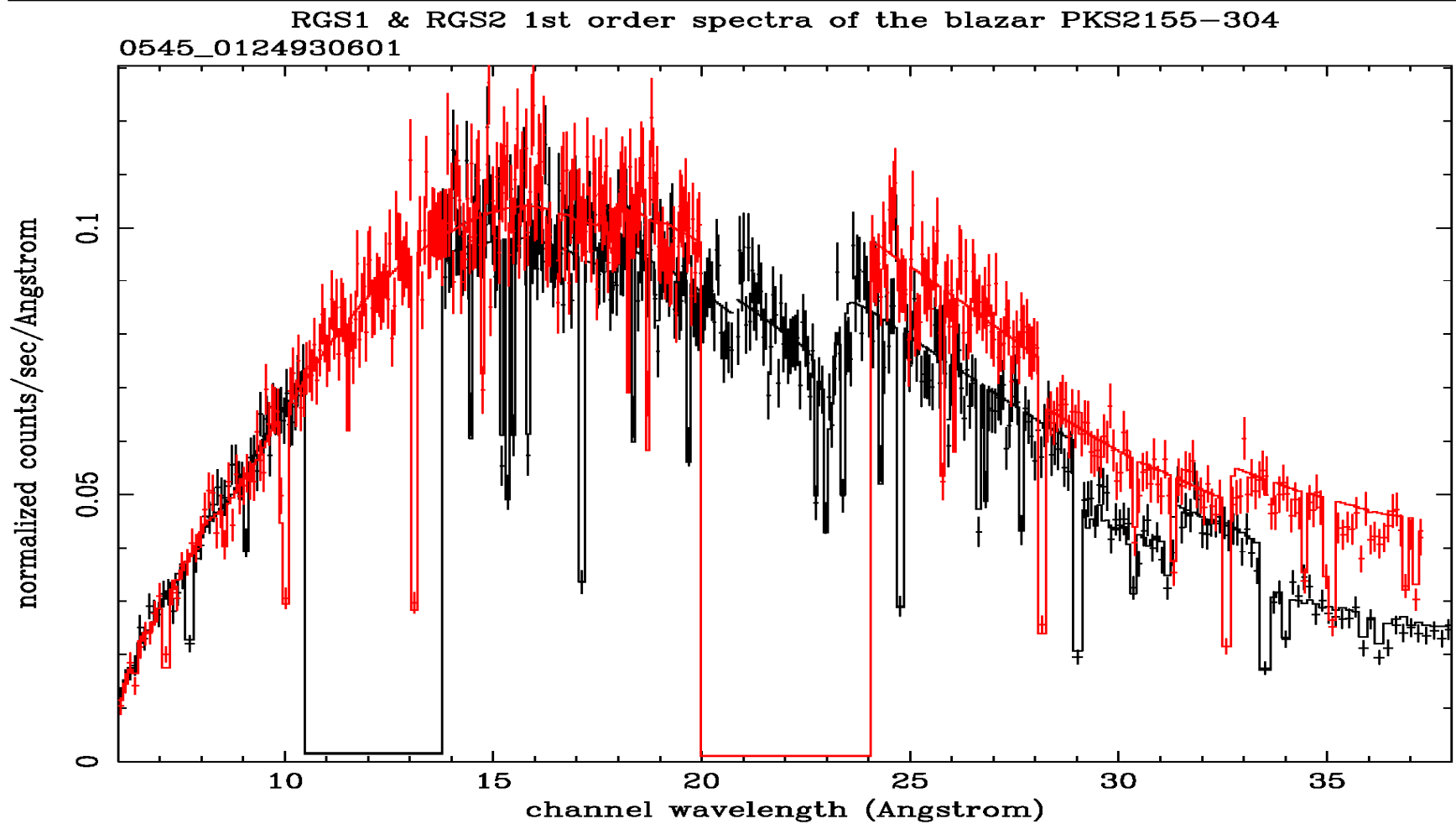
# RGS order-to-order



# RGS instrumental Oxygen edge



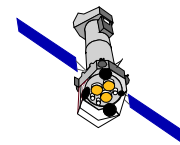
# RGS spectrum of PKS2155-304



# How to get a nice RGS spectrum plot

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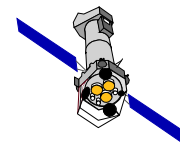
\$ rgsfluxer



# How to get an RGS light curve

---

\$ rgs1acor



***XMM-Newton***

# Some nice RGS spectra

