

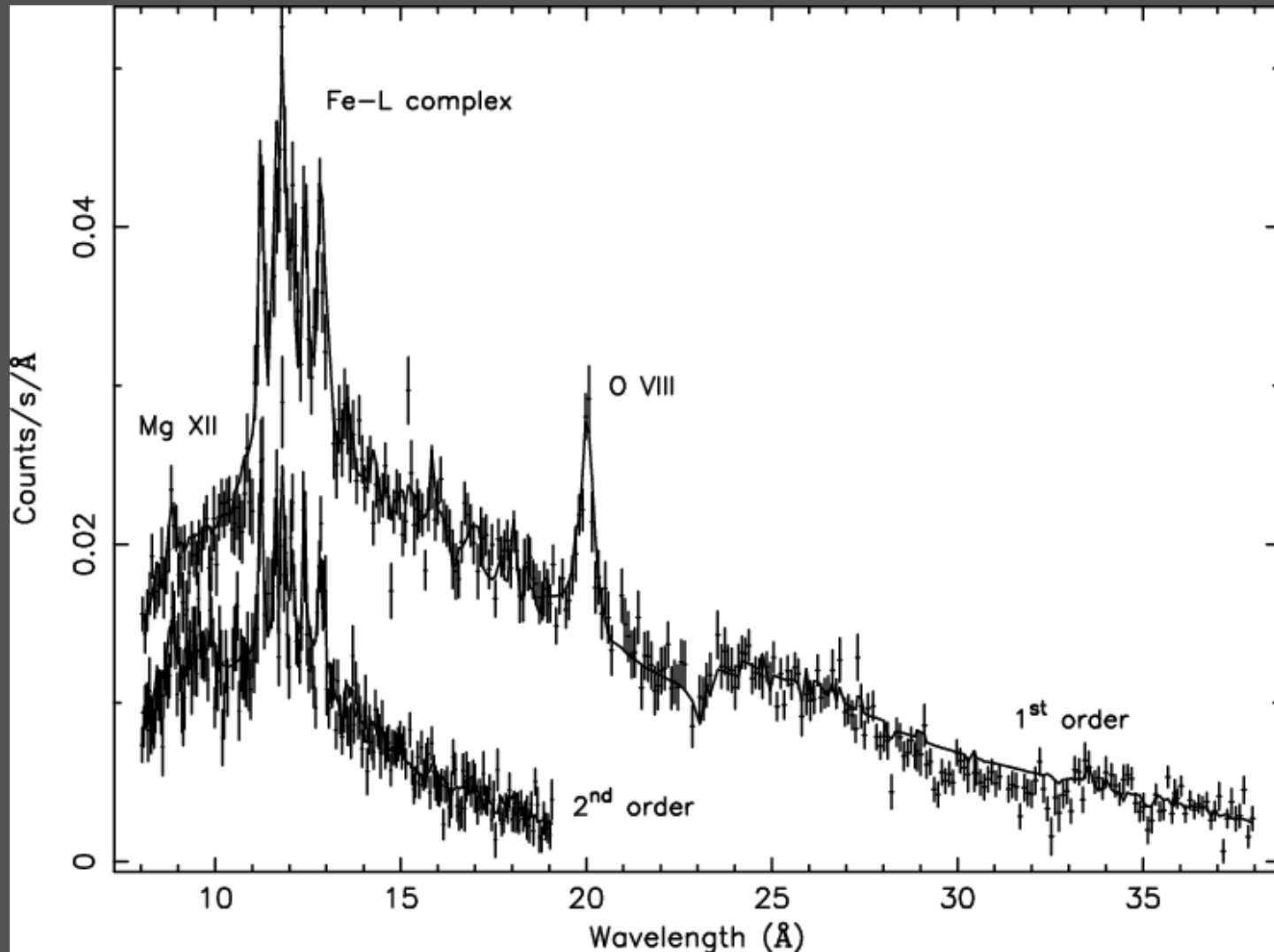
RGS Extended source analysis

Jelle de Plaa

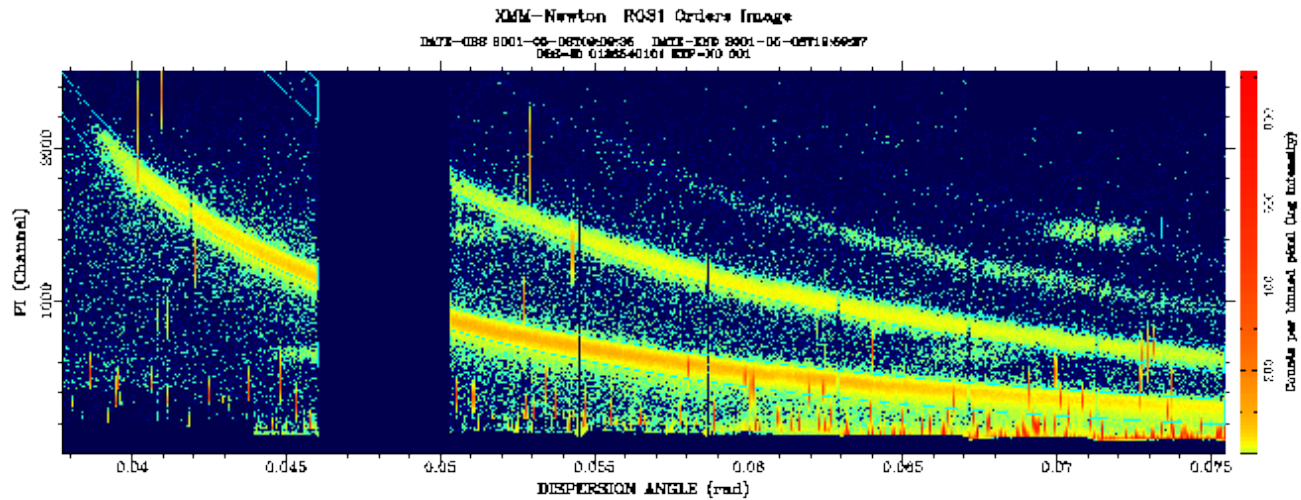
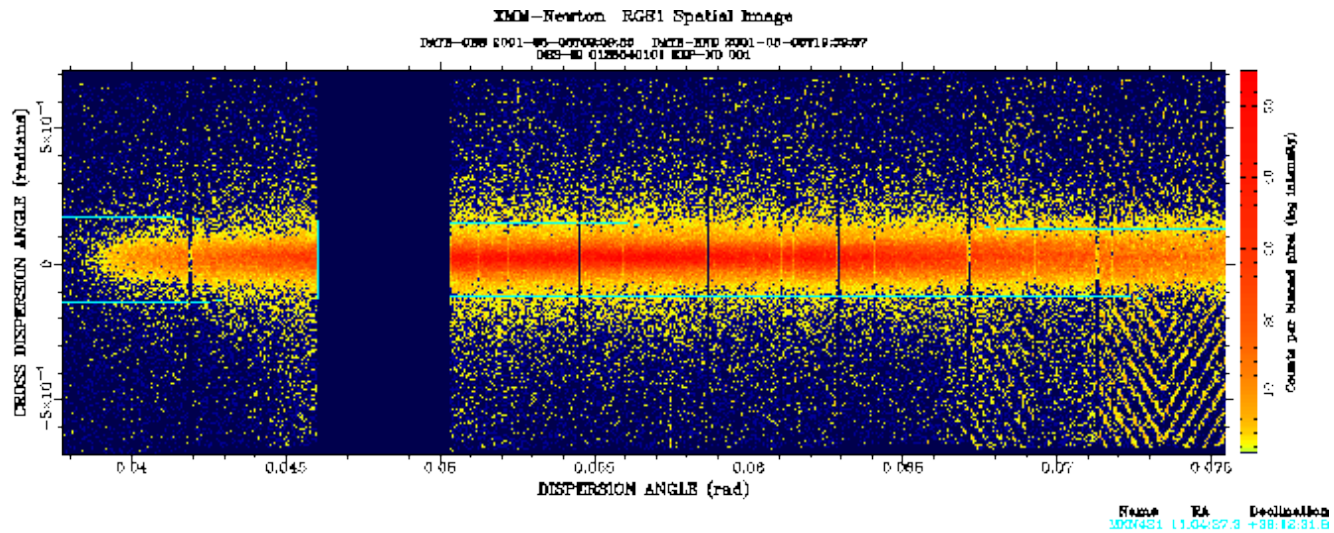
(Yan Grange, Cor de Vries, Jelle Kaastra, Frank Verbunt)



RGS cluster spectrum (Sersic 159-03)



RGS Banana plot



rsimplot version 1.11.8

Grating observations of extended sources

General problems:

- Spatial extent causes spectral 'blurring' (along dispersion direction)
- Line widths depend on ion emissivity profile and velocity structure
- How to extract spectrum from banana plot?
- Effective extraction region uncertain (selection only in cross-dispersion)
- FOV filled by extended source -> background

Most complete solution to date

Multivariate Monte Carlo method (Peterson et al. 2004)

Advantages:

- Capable of modeling RGS spectrum completely

Disadvantages:

- Computationally expensive
- Error estimation difficult
- A full 3D cluster model is needed (AGN feedback complicates model)
- Background model?

Common solutions in SAS

SAS rgsregions: Region selection and banana control

Issues:

- Cross-dispersion selection can be made, but:
 - Is a rectangular extraction region proper?
 - What is the optimal pdistinctl value?
 - Do we need a PI cut off?
 - Interference by calibration sources/system peak

Open question: Would it be possible to use optimal extraction algorithms on banana plot?

Common solutions in SAS (II)

rgsrmfgen: Convolve spatial profile with RMF

Problems:

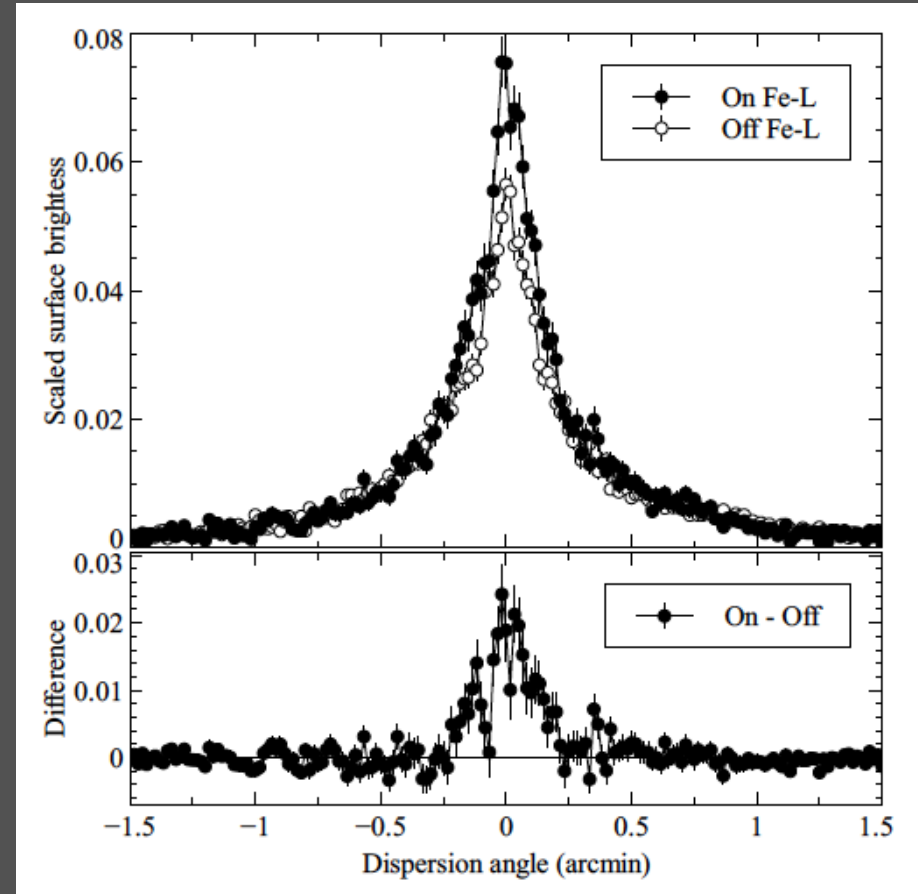
- Uncertainty line width not in fit error
- Differences between line profiles of individual lines not taken into account

Alternative: Model line width in spectral fit (SPEX)

Velocity broadening measurements

Example:

- Fold Chandra spatial profile through RGS response
- However, every line profile is different due to spatial distribution ions.
- Systematic uncertainties in method estimated to be ~ 160 km/s



Sanders & Fabian 2013

Common solutions in SAS (III)

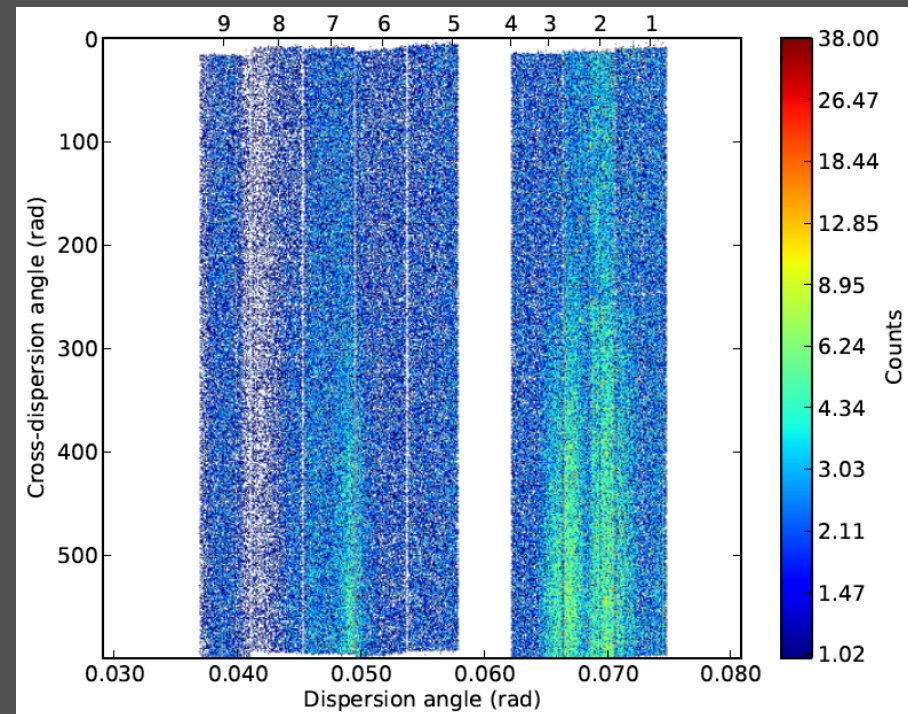
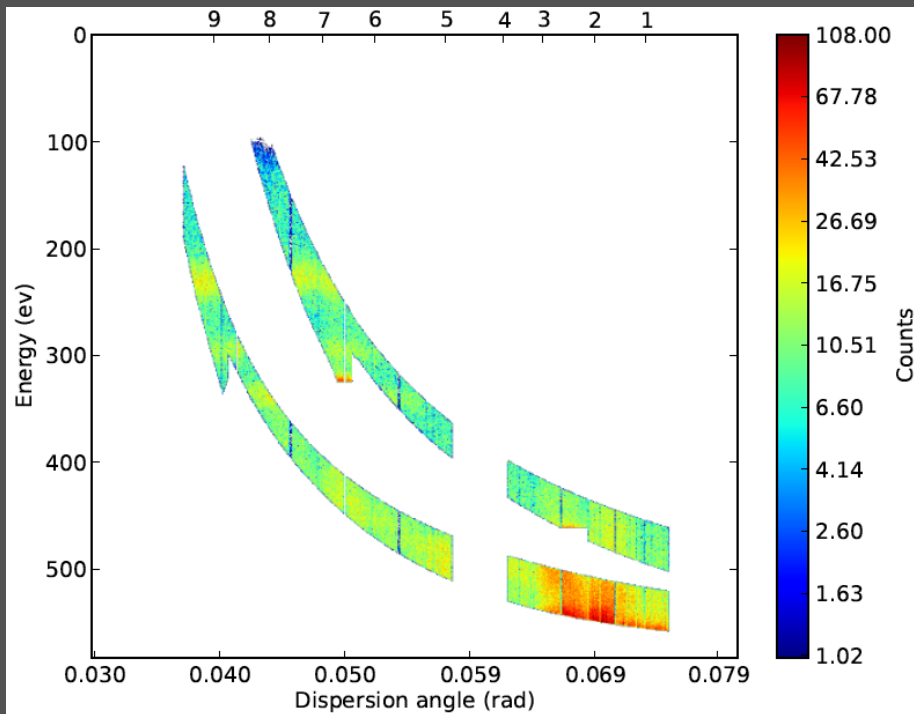
rgsbkgmodel: Model RGS background

In general a good solution, but:

- Model mainly addresses particle background
- Possible variability in instrumental background not included (29-33 Ang)

Influence of system peak (around 30 A)

Stacked blank field observations

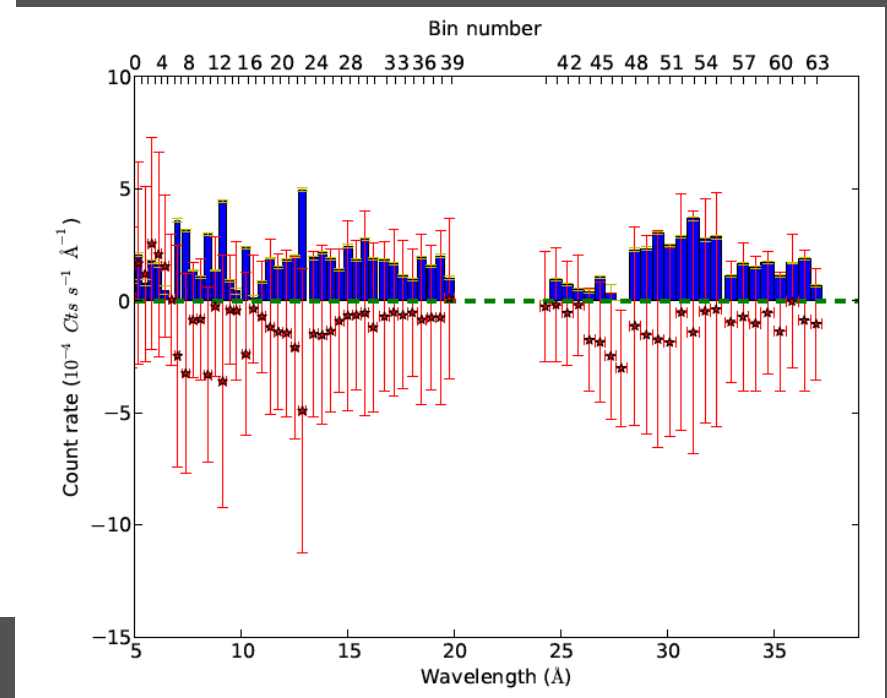
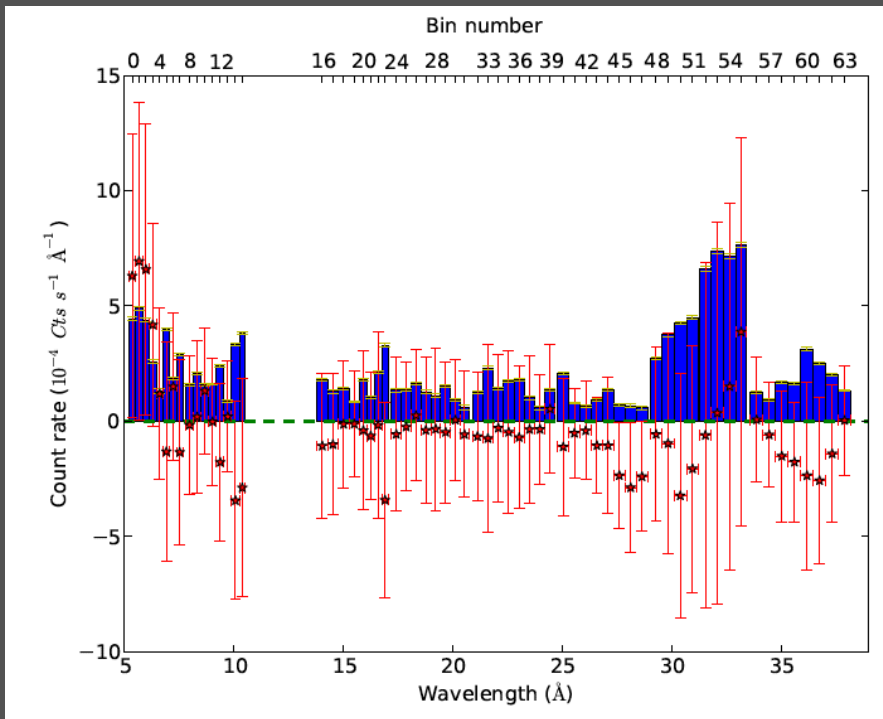


Instrumental background variation

Variable background present in CCD2 of RGS1

RGS1

RGS2



Possible projects to improve analysis

- Improve model background spectra
- Find optimal extraction parameters for spectra
- Effective area calibration for extended sources (banana dependence/Coma?)
- Further develop Monte-Carlo method