



- Mallorca, 2009 March 31

# Monitoring the MOS redistribution using the SNR 1ES0102.72

*Andrea Tiengo*

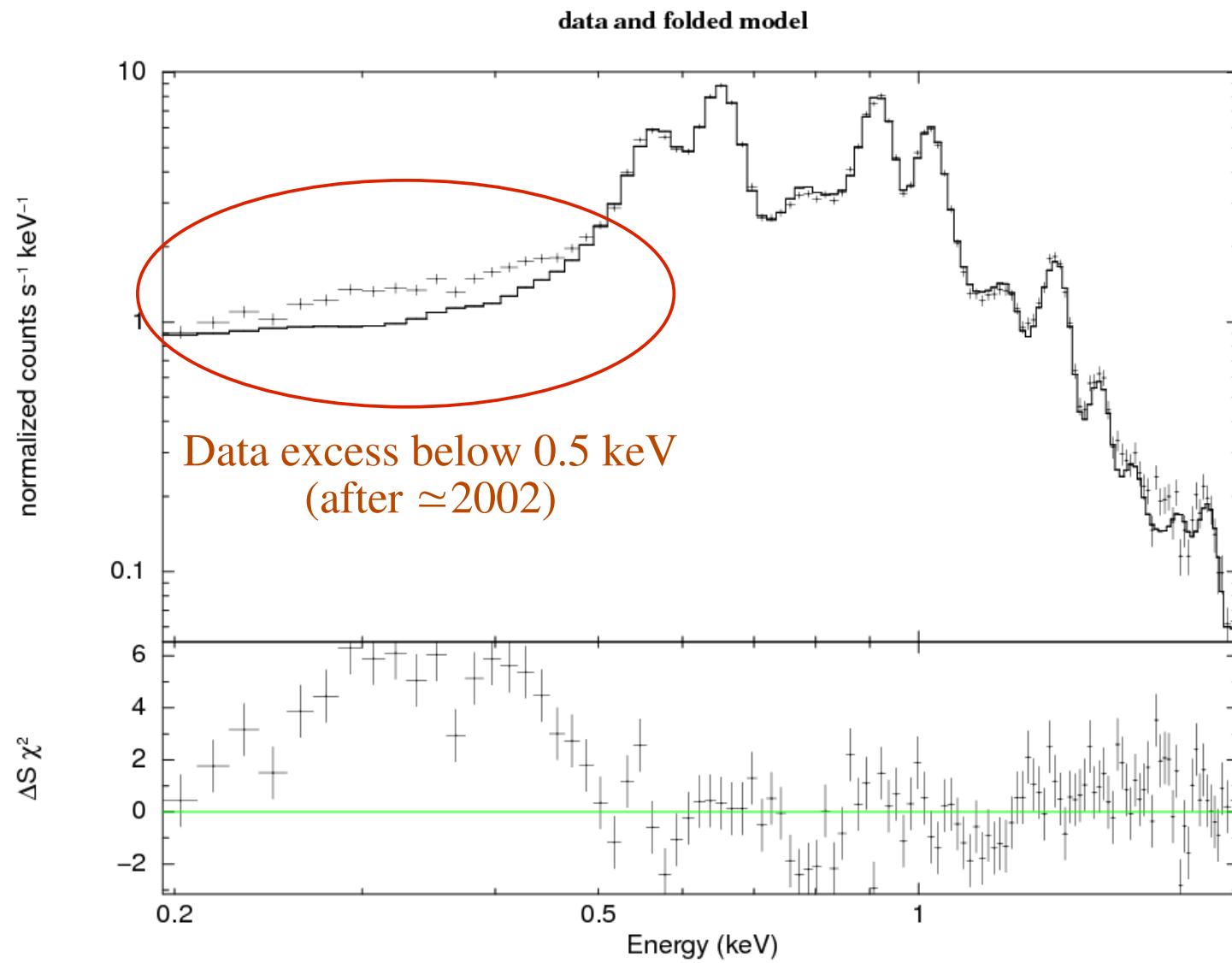
**INAF, IASF-Milano**

*In collaboration with*  
*Matteo Guainazzi & Steve Sembay*

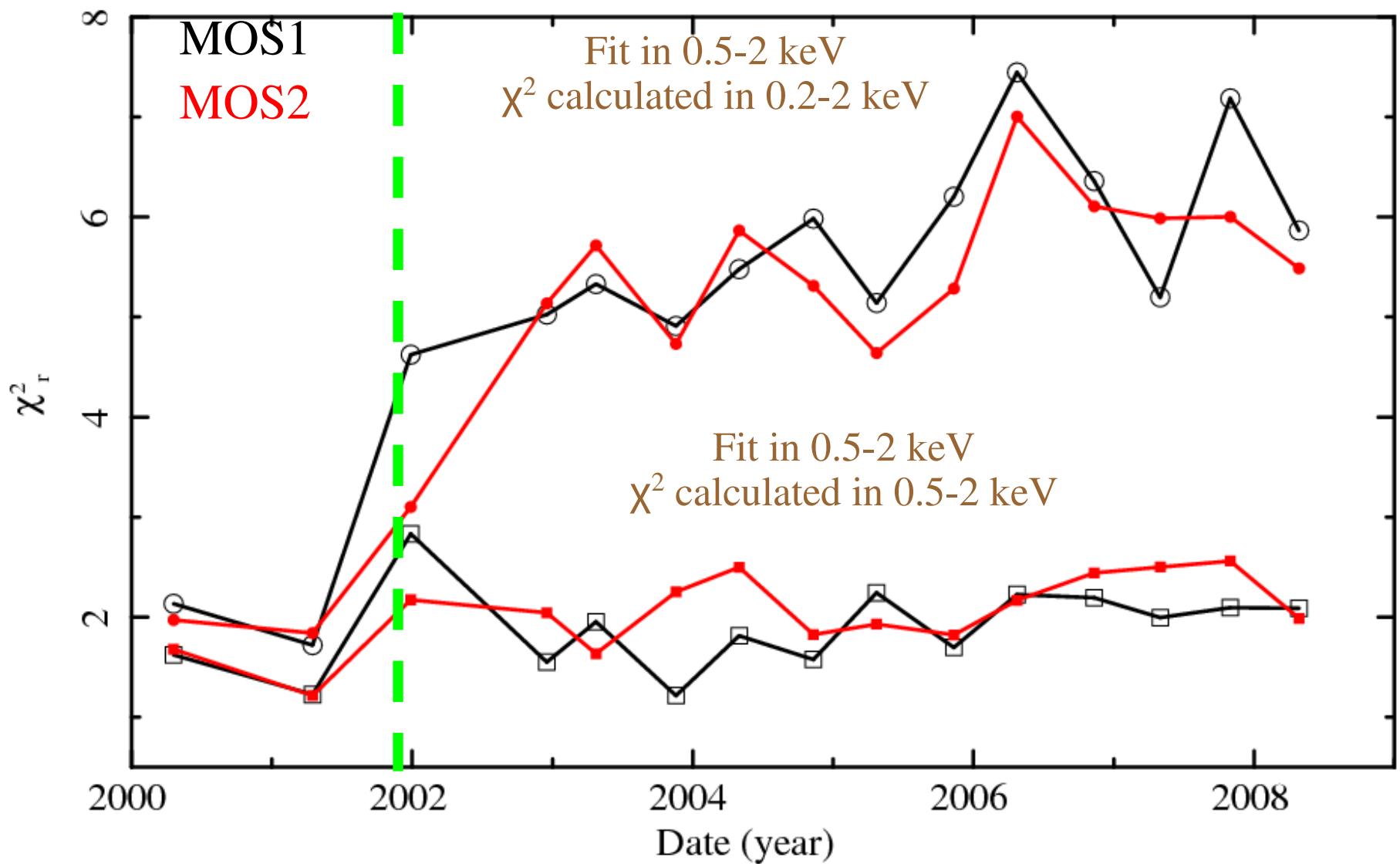
# Standard RMFs:

- Analysis of **15** MOS1&2 observations of **1E0102-7219** using SAS8 and August 2007 CCFs
- Reduction follows S.Sembay's guideline in the IACHEC Wiki
  - Consistent results with the published analysis
- Fit with the “ultimate model”, leaving free only:
  - The normalization and the width of the four brightest emission lines (O<sup>VII</sup>, O<sup>VII</sup>, Ne<sup>IX</sup>, Ne<sup>X</sup>)
  - An overall model normalization factor
  - gain fit in XSPEC

# Typical spectrum



# $\chi^2$ versus time



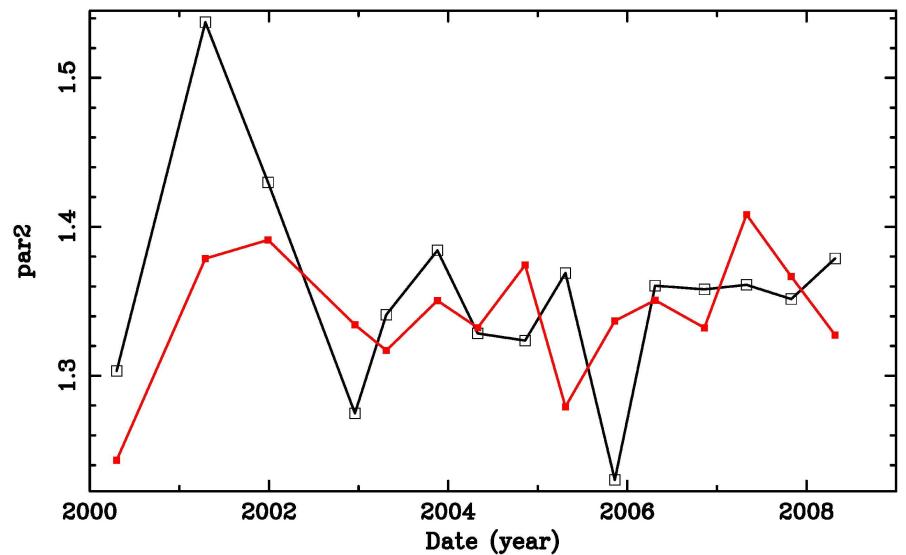
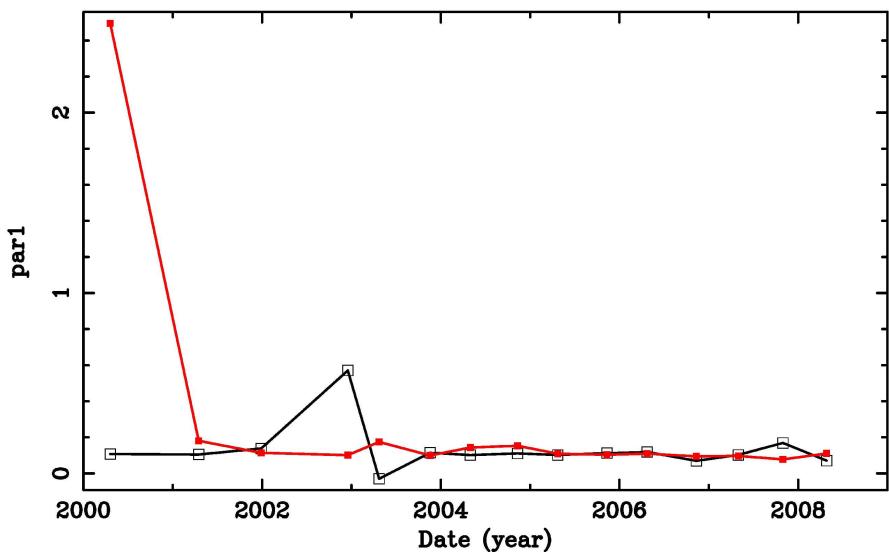
# RMF optimization with Steve's algorithm:

- 4 free parameters:
  - **par0**: defines the strength and shape of the surface loss shoulder and varies between 0 and 1. Low values mean a strong shoulder
  - **par1 & par2**: define the intrinsic energy resolution:  $\text{res} = \text{par1} + \text{par2} \cdot \sqrt{\text{Energy(eV)}}$
  - **par3**: normalization factor

# RMF optimization with Steve's algorithm:

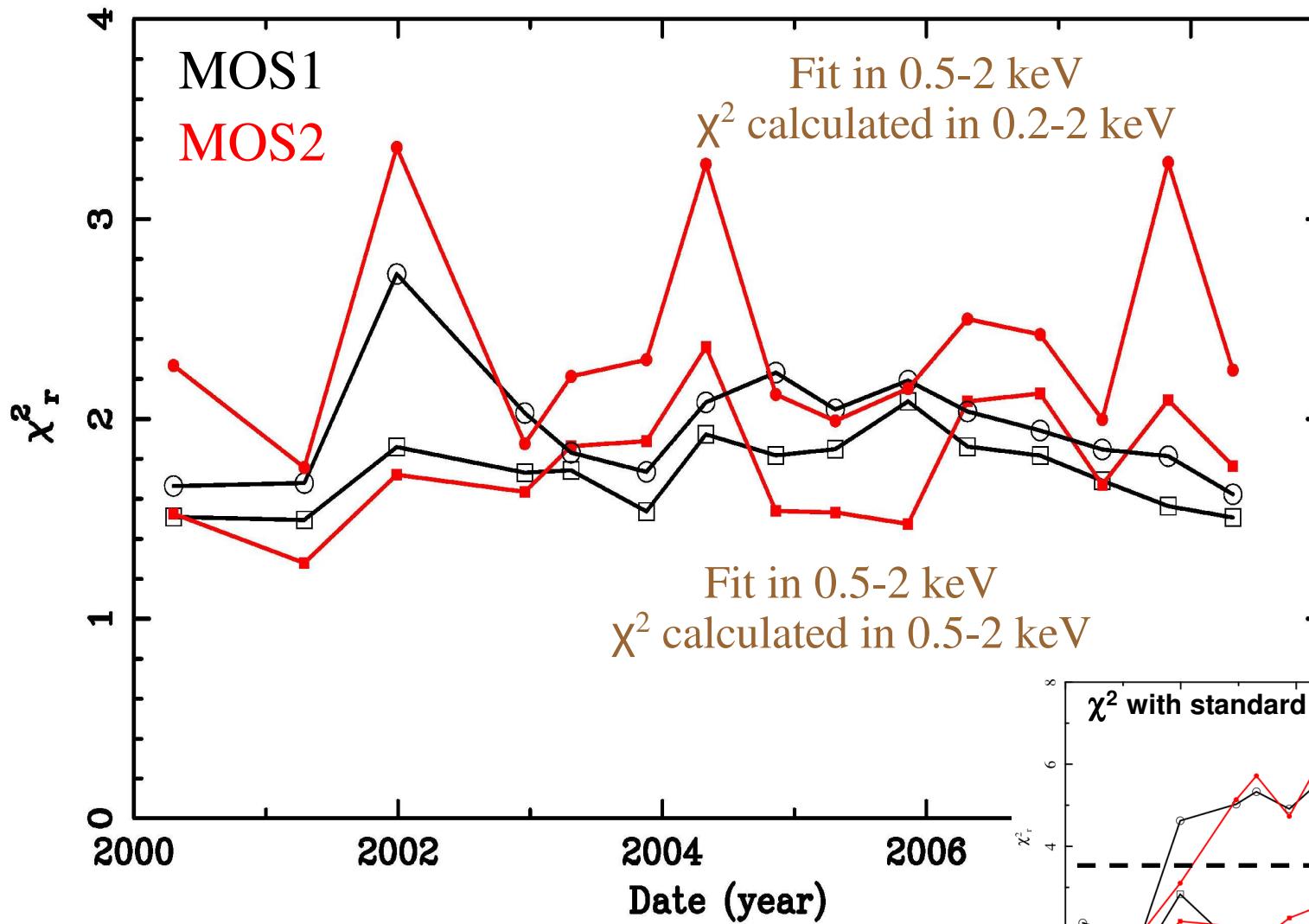
MOS1

MOS2

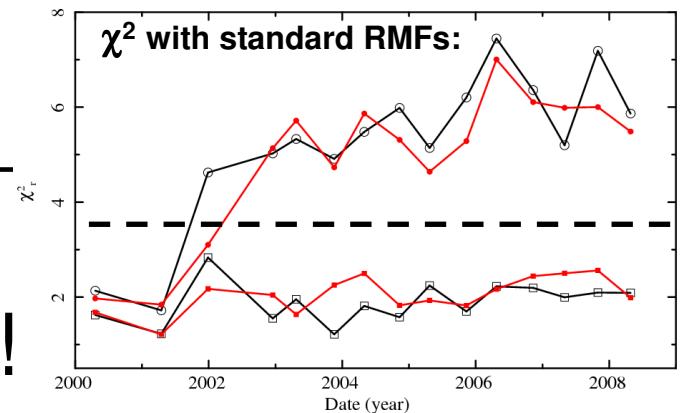


- Fixing **par1=0 & par2=1.35** does NOT increase the  $\chi^2 \Rightarrow$  Only **par0 & par3** left free to vary

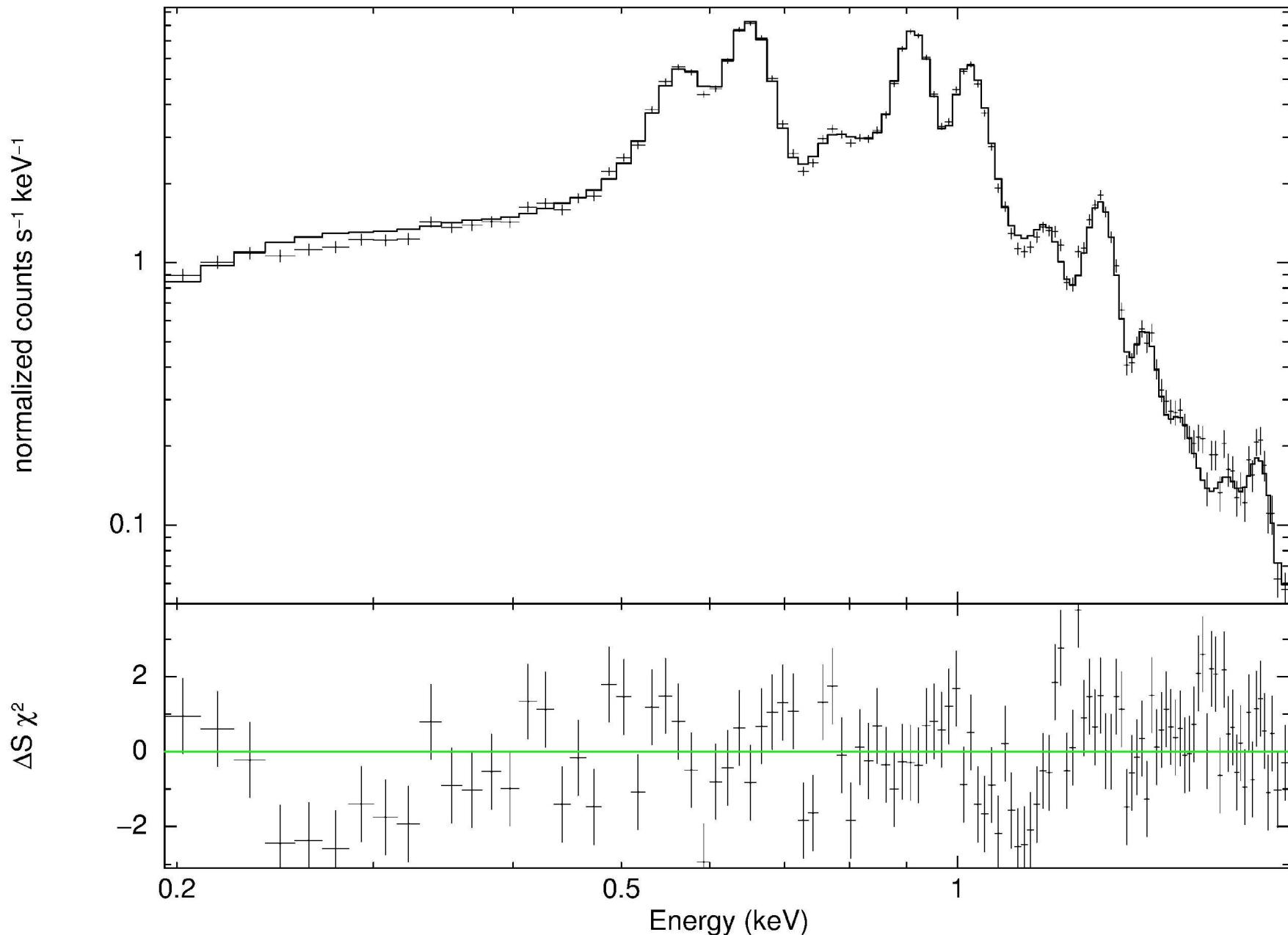
# $\chi^2$ with new RMFs:



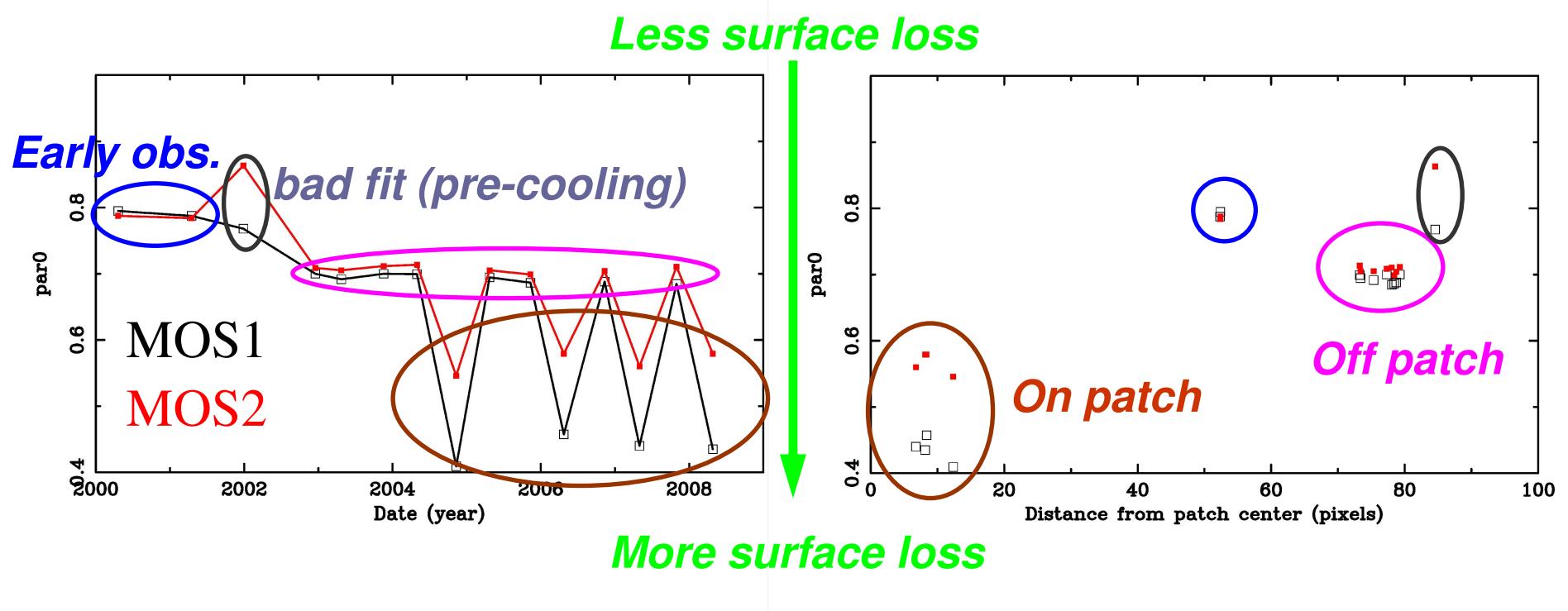
New RMFs are much better!



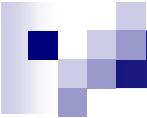
MOS1, pattern 0, obs. 0412980501, 080419 (new rmf)



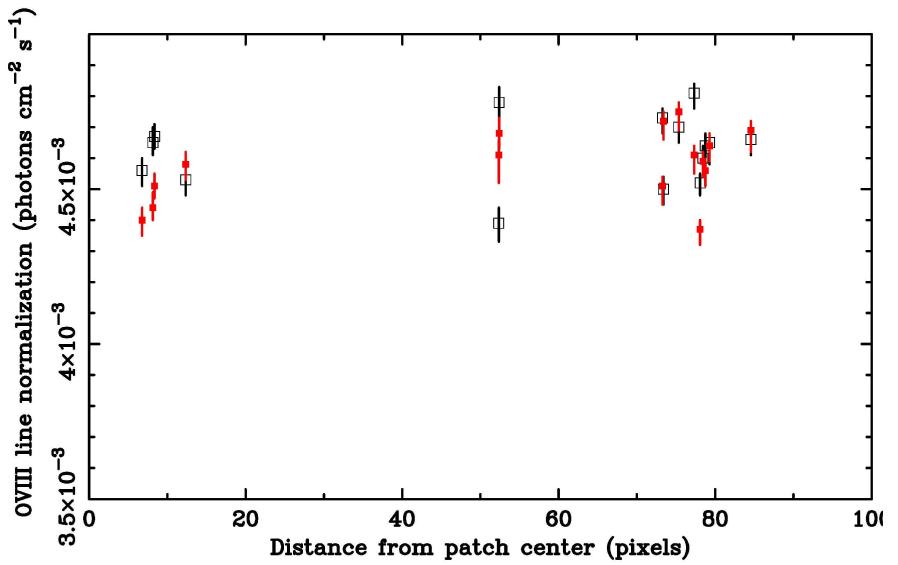
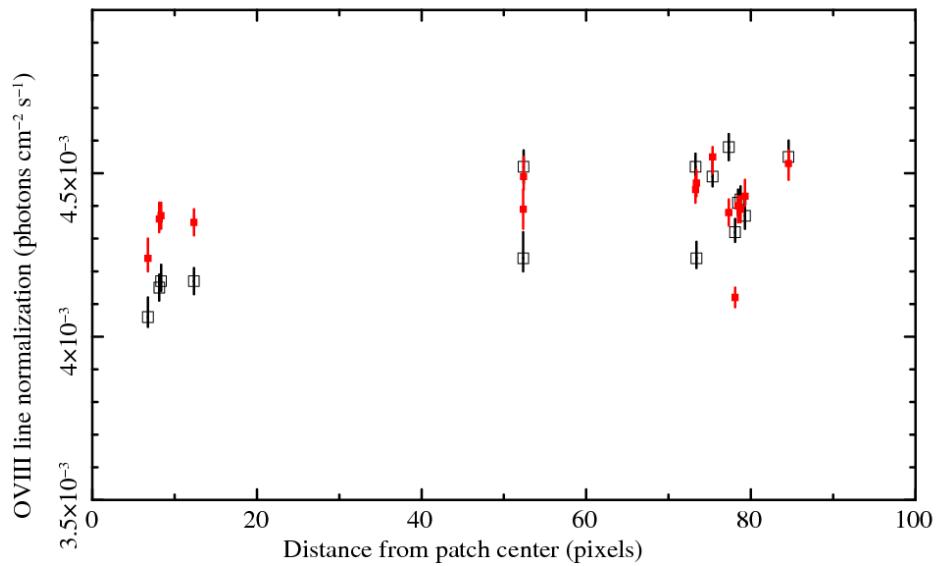
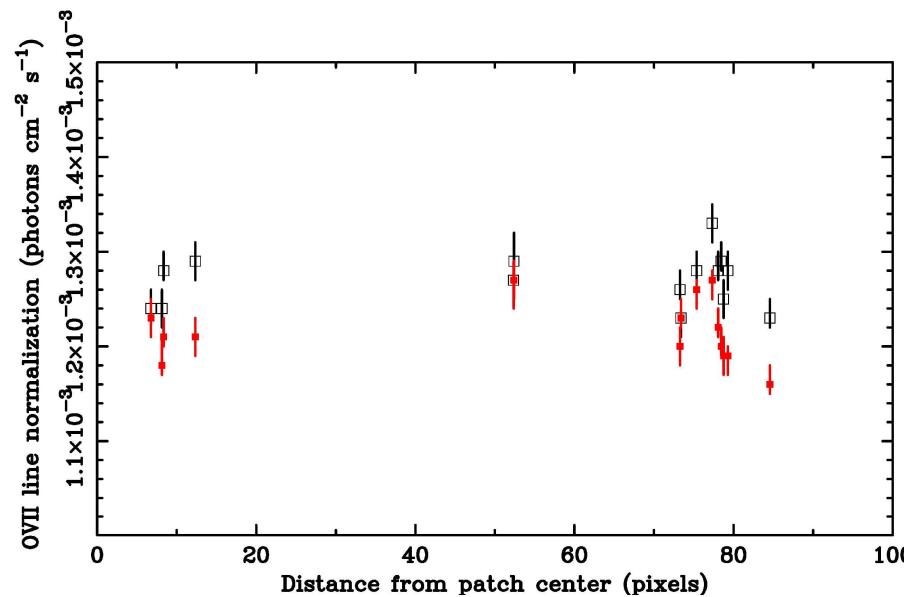
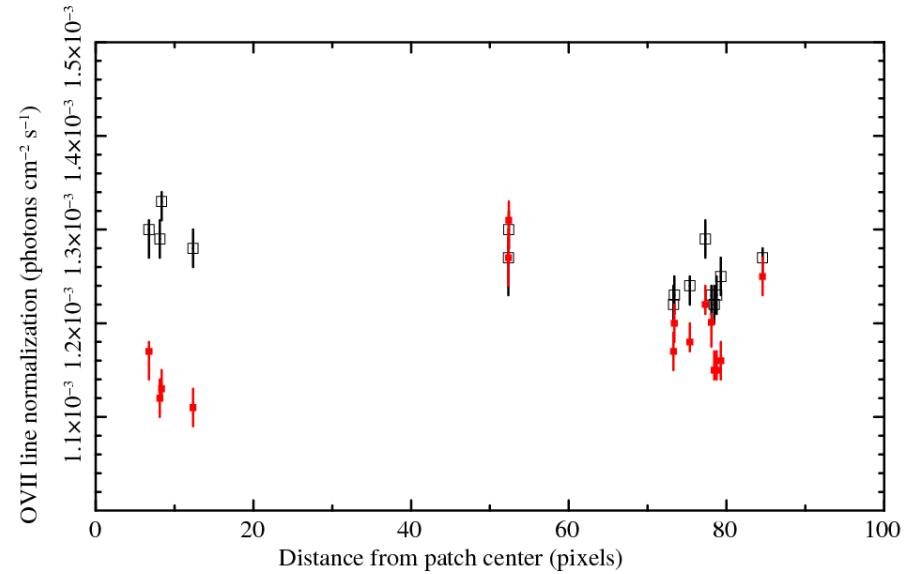
# Shoulder strength ( $\text{par0}$ ):

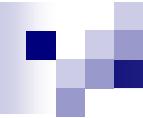


- Depends only on distance from patch, epoch and camera

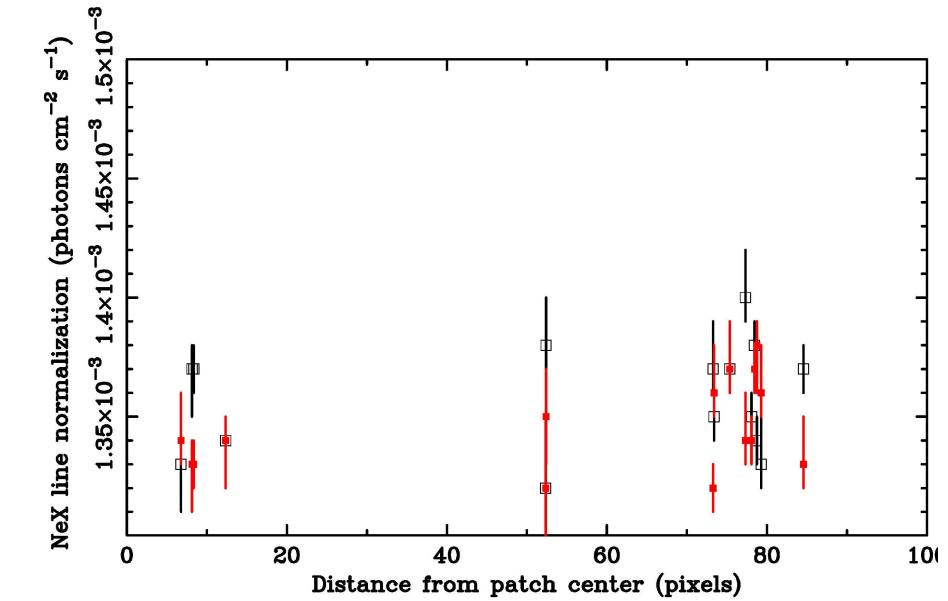
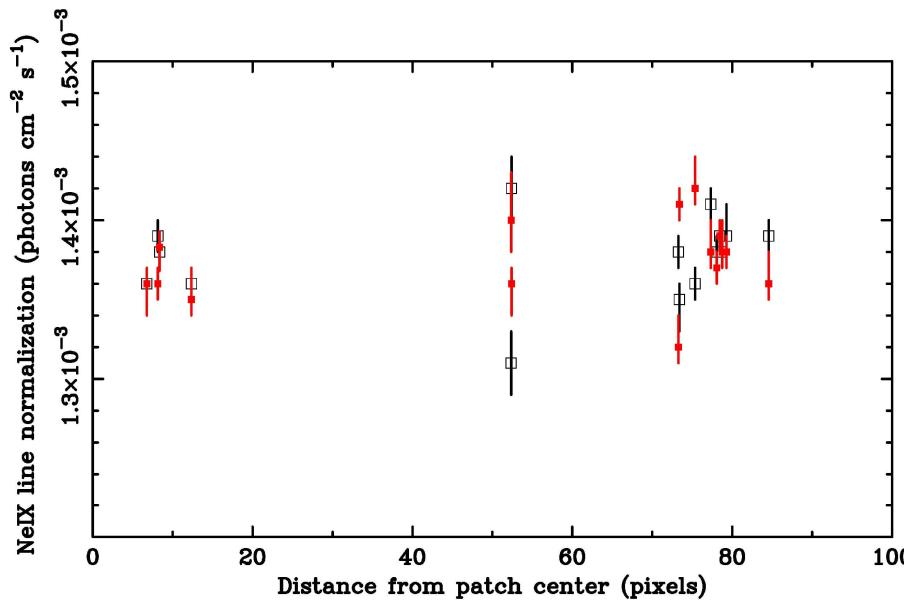
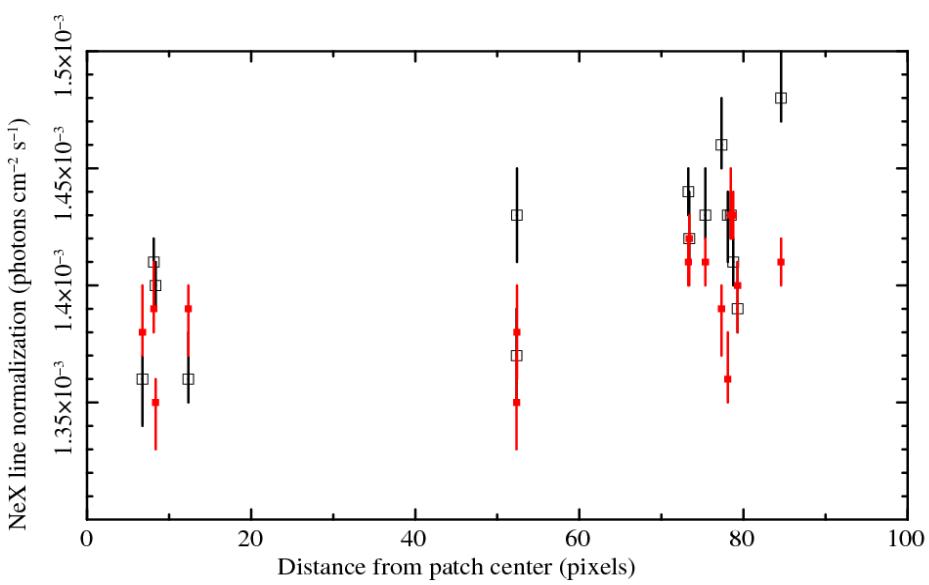
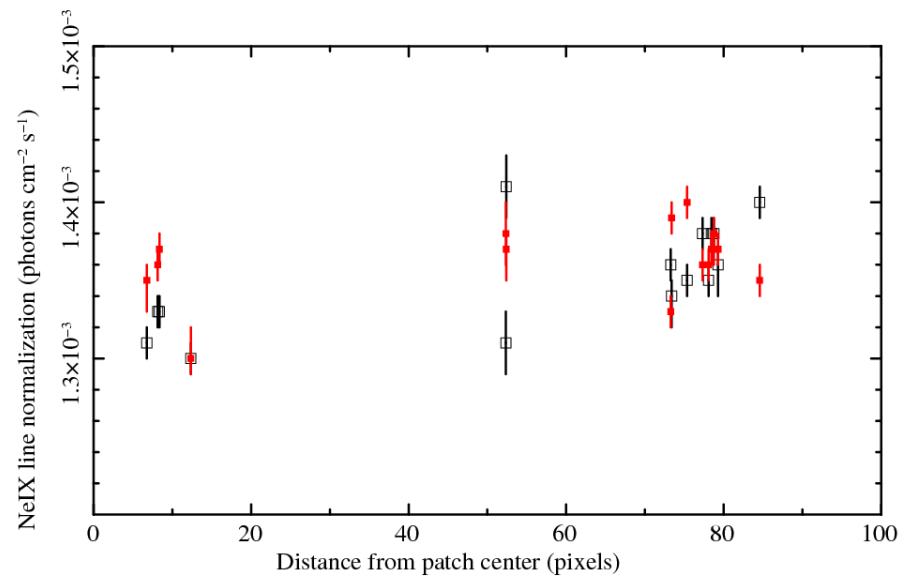


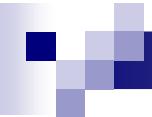
## Line norm. with standard RMFs    Line norm. with new RMFs



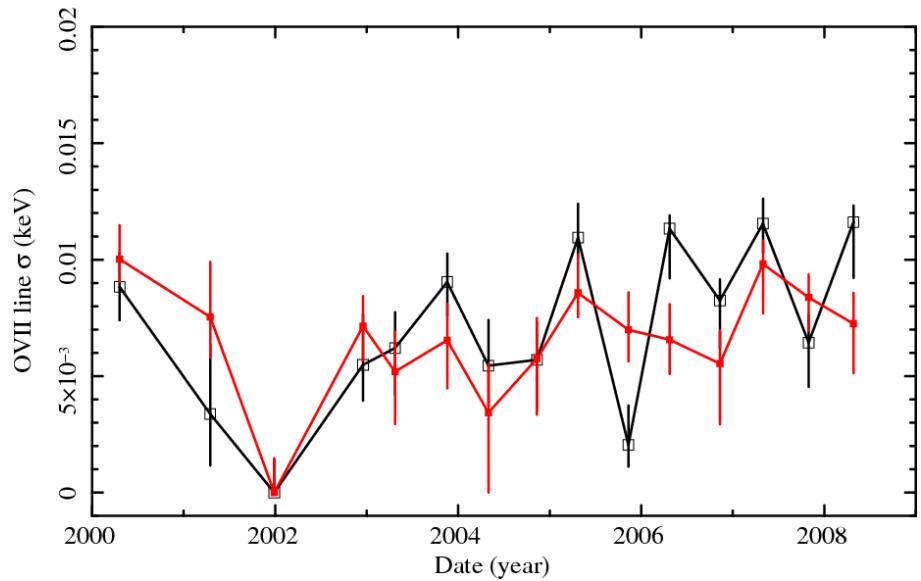


## Line norm. with standard RMFs    Line norm. with new RMFs

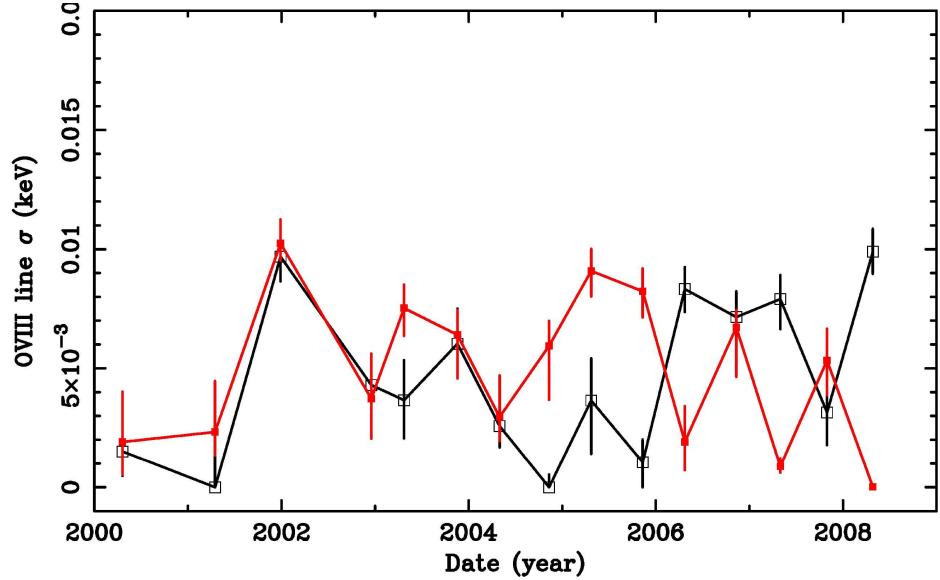
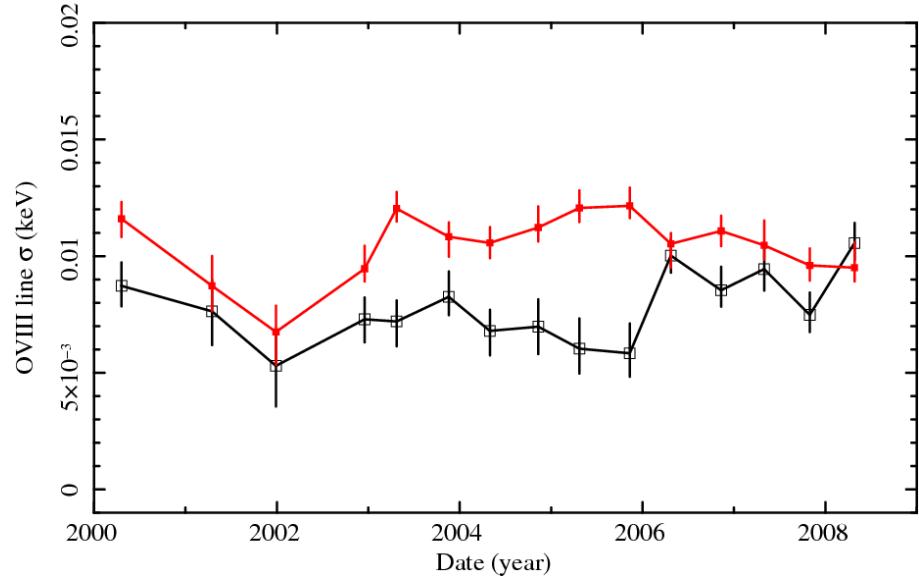
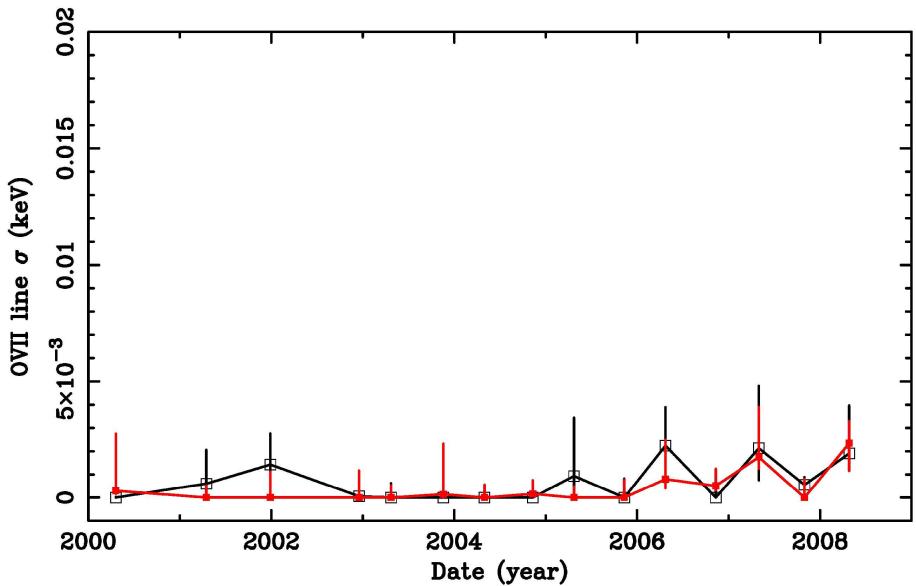


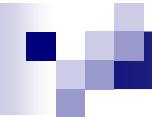


## Line width with standard RMFs

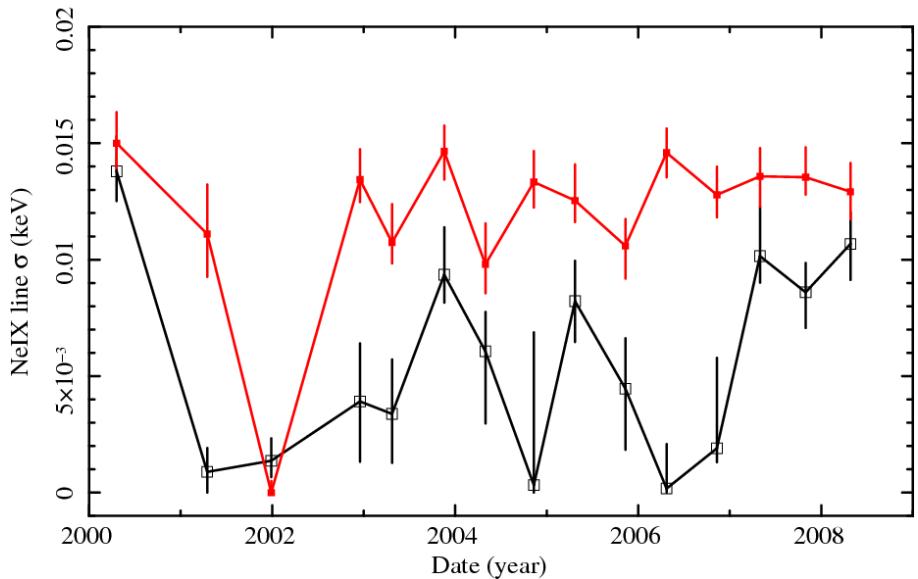


## Line width with new RMFs

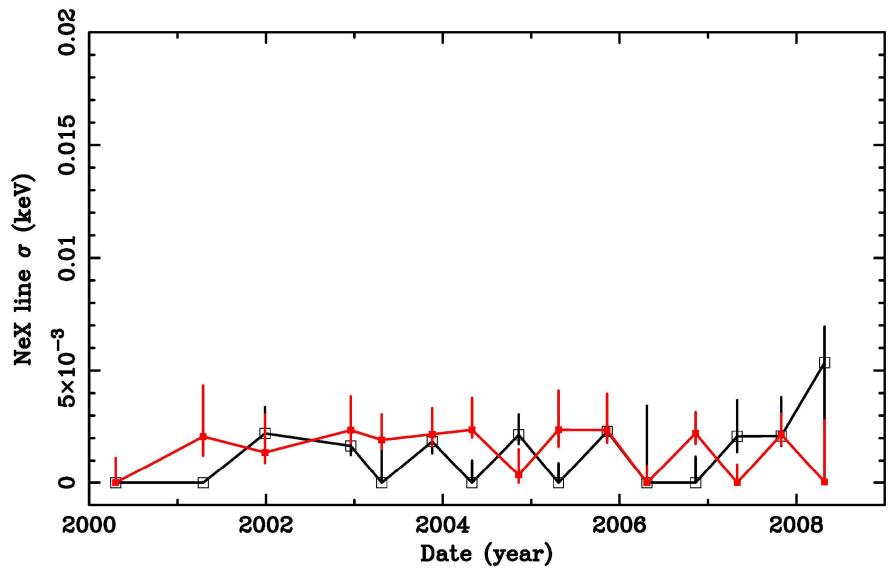
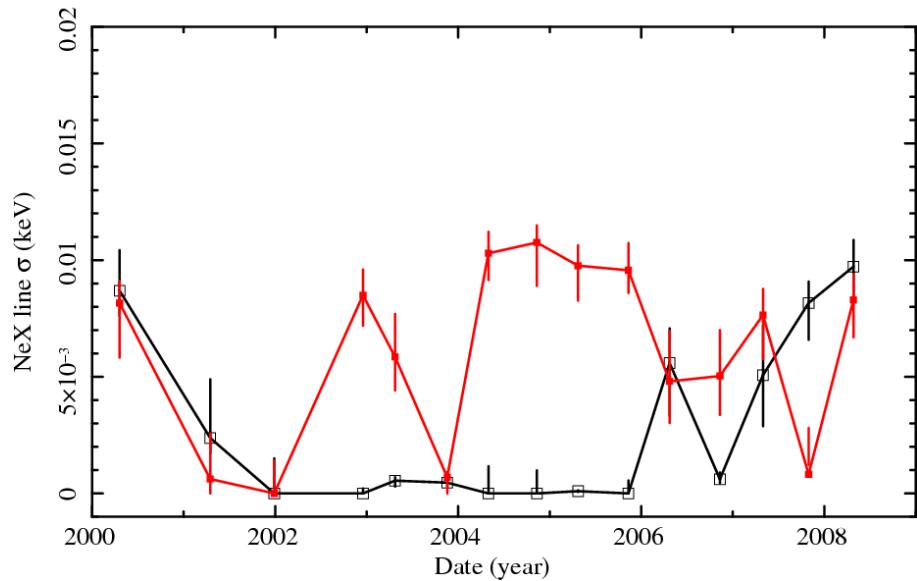
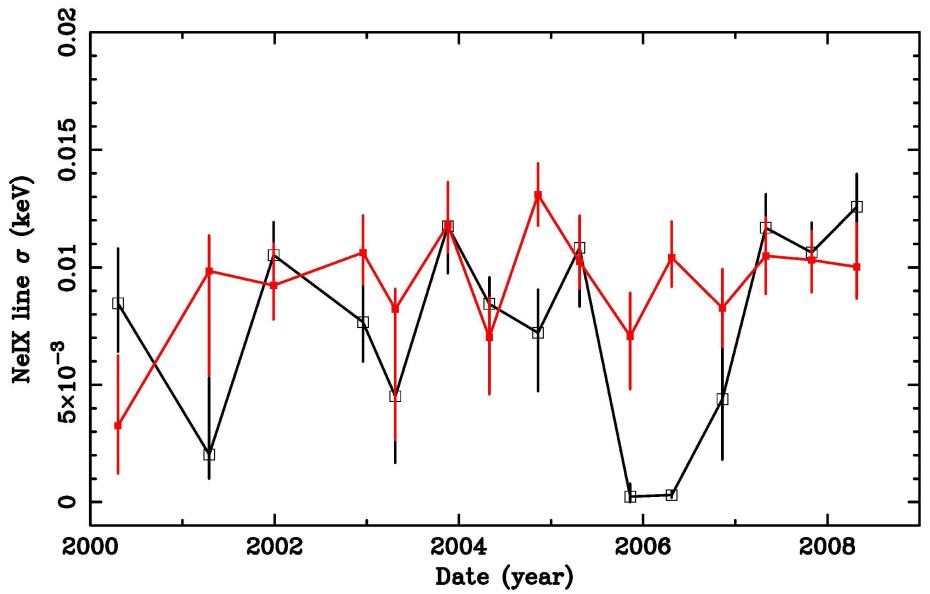


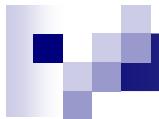


## Line width with standard RMFs

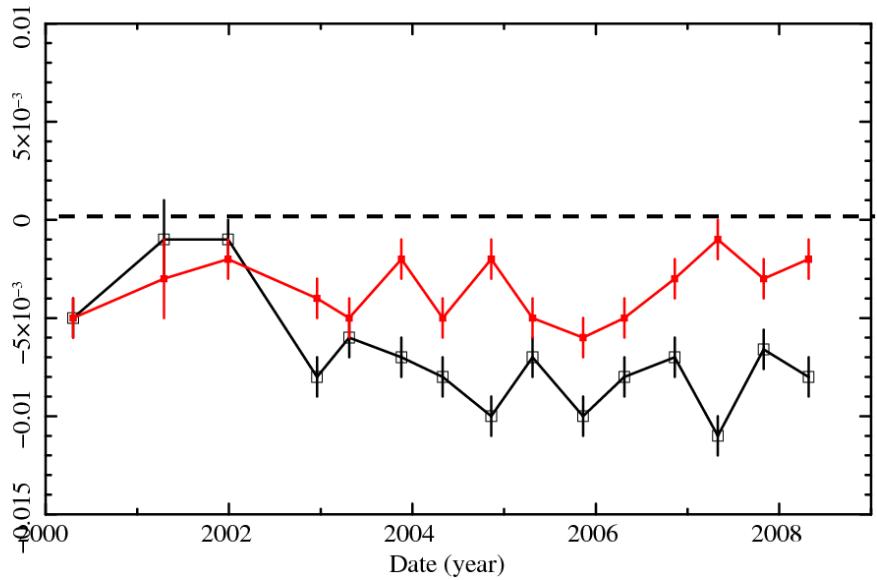
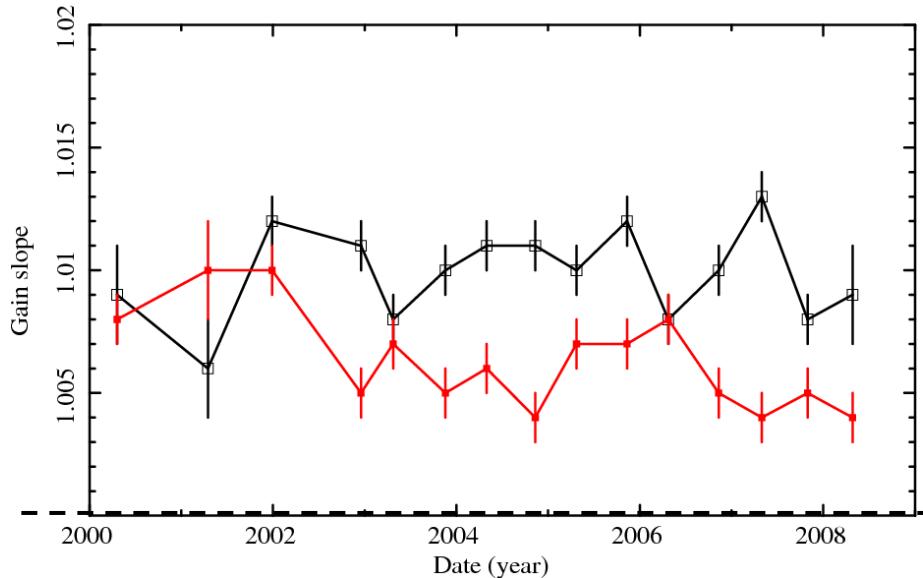


## Line width with new RMFs

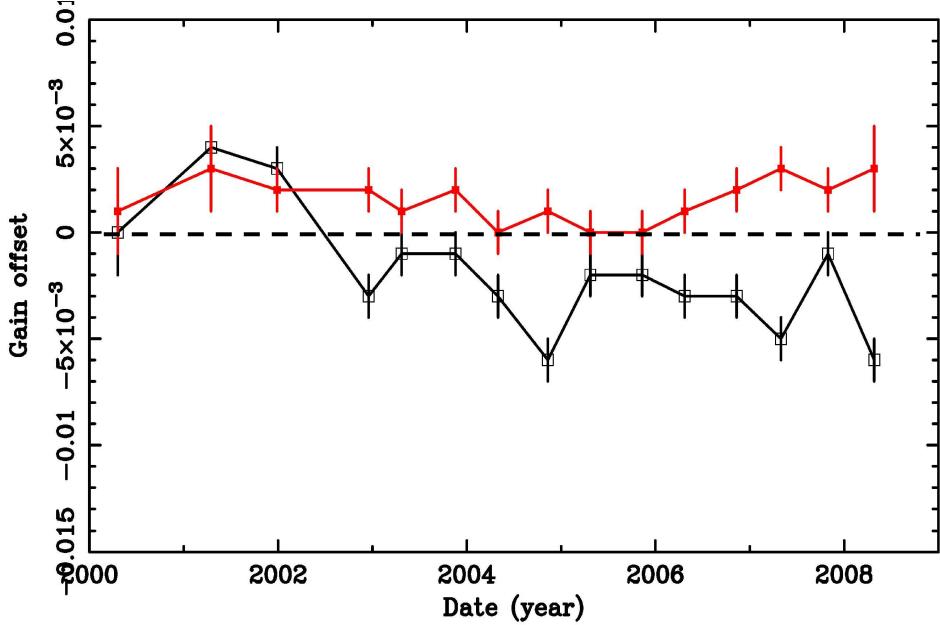
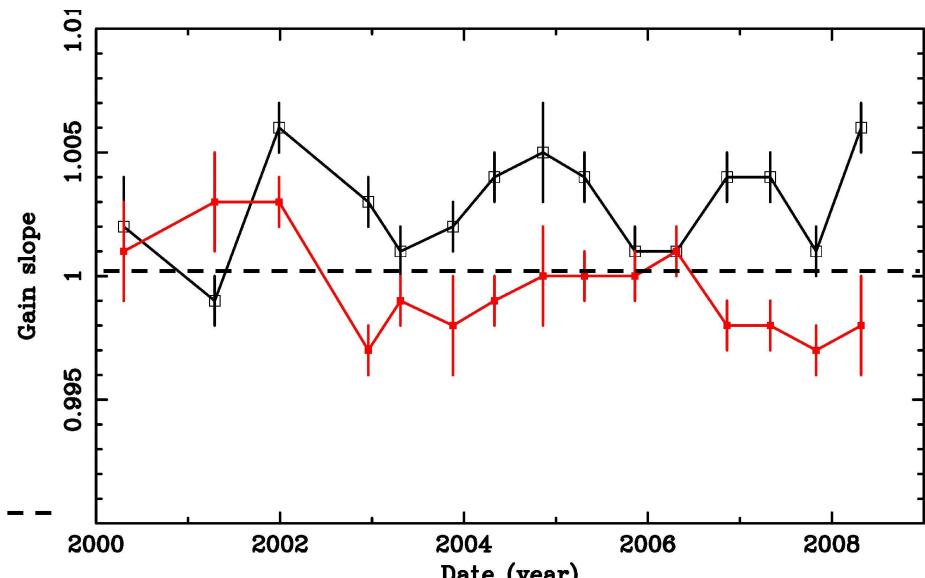




## Gain fit with standard RMFs



## Gain fit with new RMFs





# Summary:

- Phenomenological model for RMF seems to work:
  - Depends only on epoch, position and MOS unit
  - Substantially reduces residuals in 0.2-0.5 keV range
  - Gives better values of line normalizations and gain
  - Stable energy resolution
- Future work:
  - More observations: other positions/epochs (~2002)
  - Different sources