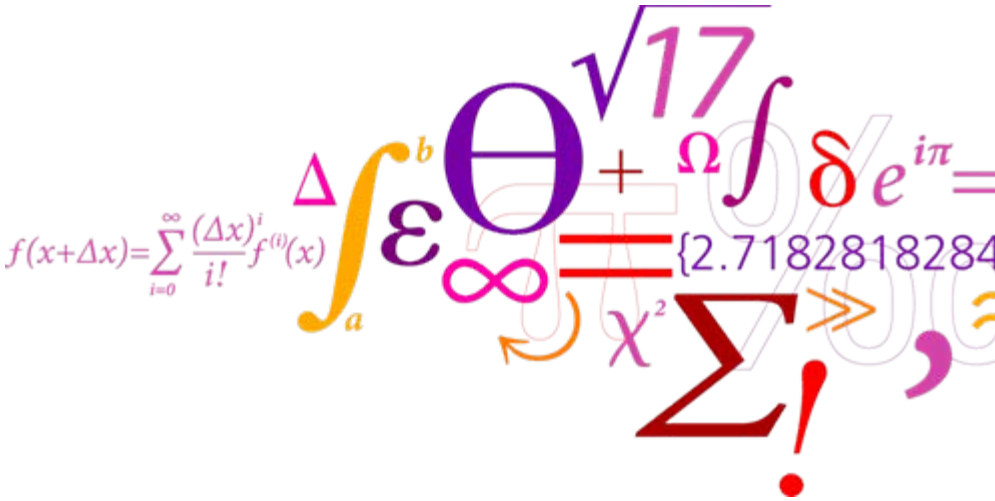
Xe Line Analysis and Gain Aging

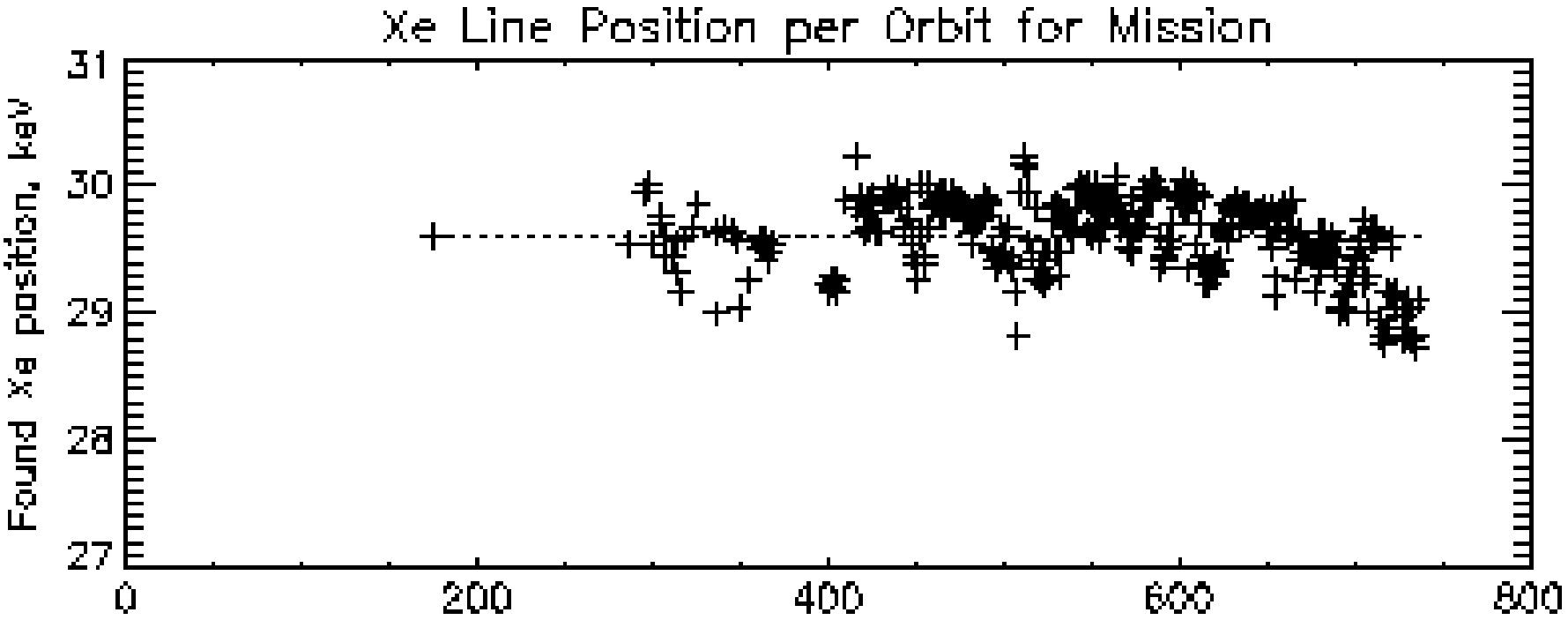
SDAST Meeting 40, 20th November 2008



DTU Space
National Space Institute

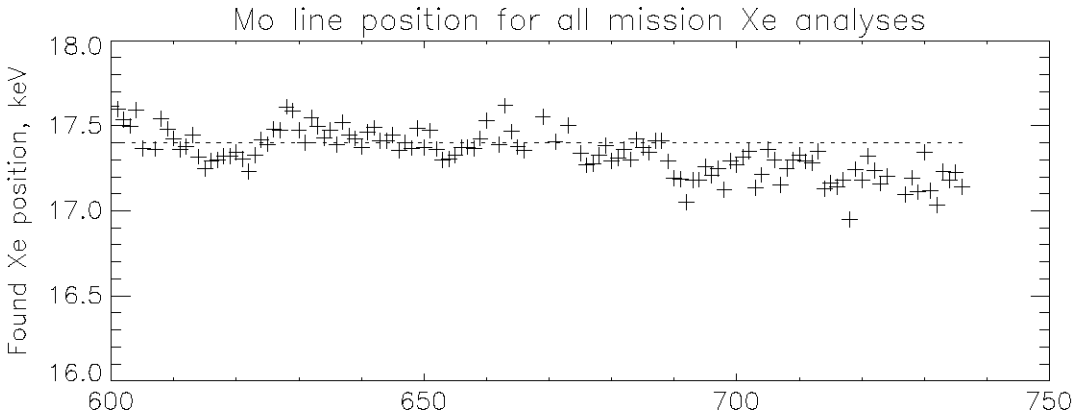
Xe analysis for JEM-X1, whole mission

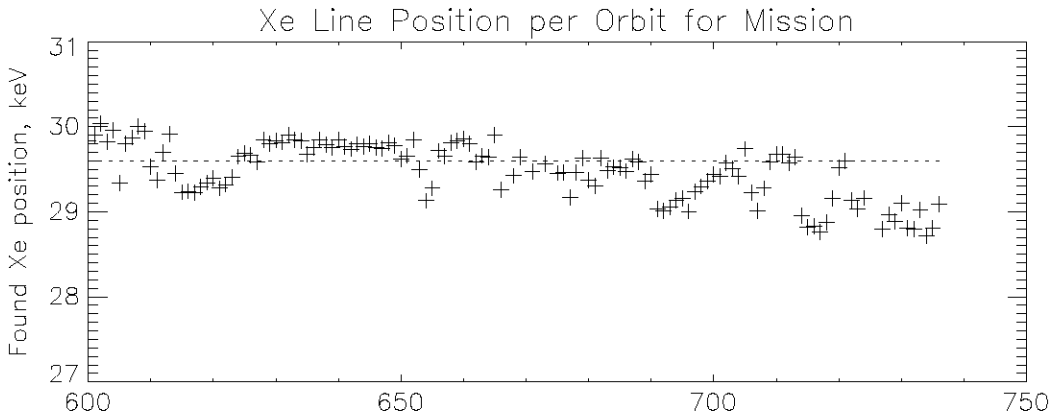
- Apart for general scatter, line appears to show steady droop in later revolutions



Is this just an effect of high gain?

- Apparently not, Mo shows the same tendency



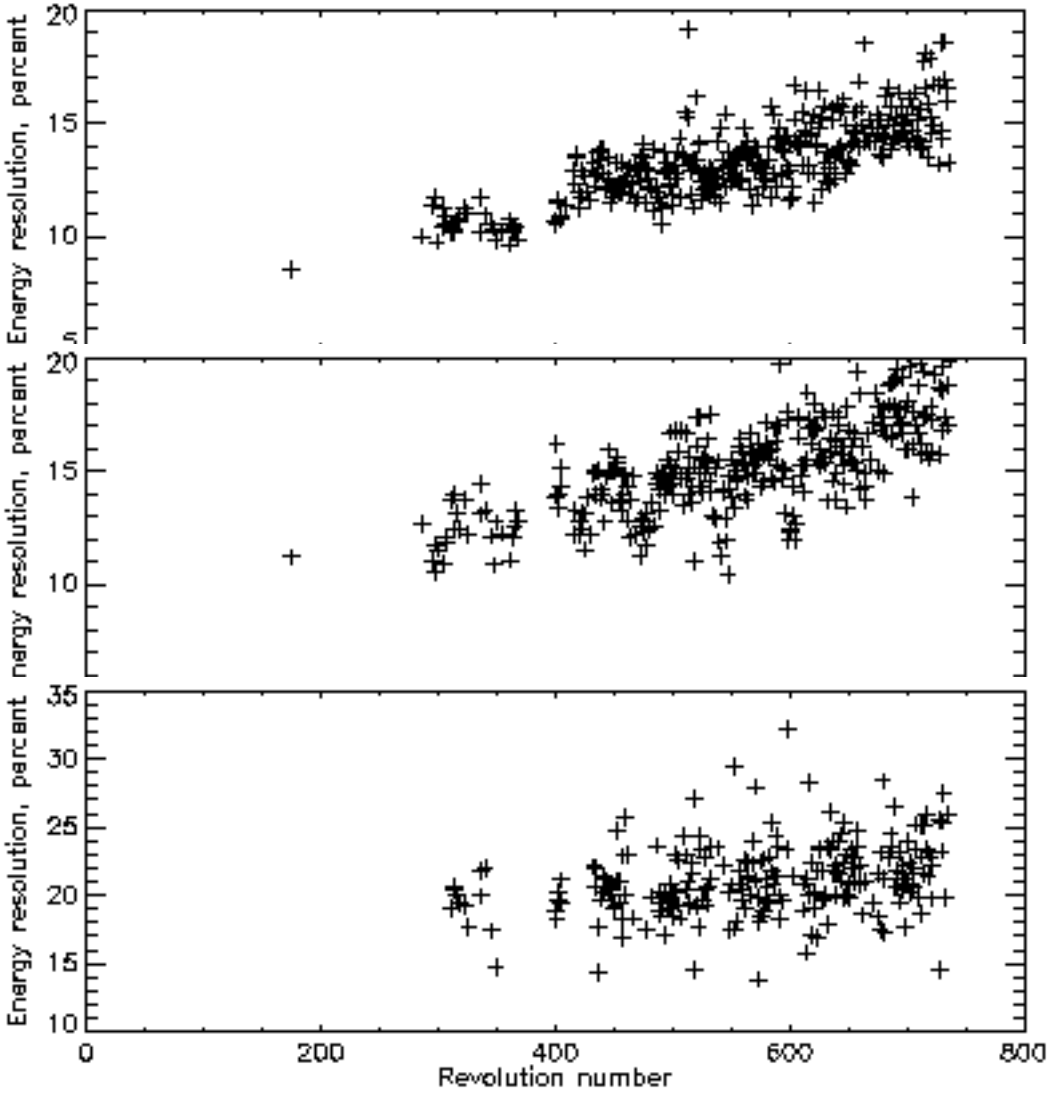


Now we see differential gain aging in reverse

- Gain has increased as the microstrip plate ages
- This is why we have to switch HV down occasionally
- BUT the heavily irradiated calibration areas aged less quickly than the rest of the plate
- Plade continually had more channels per keV than calibration areas so that Xe line events from the plate appeared higher than they should according to the calibration sources
- Regular update of calibration reference channels have kept Xe line stable
- NOW, however, calibration areas are no longer strongly irradiated
- Calibration source area gain is slowly catching up with the rest of the plate
- Xe line appears too low when corrected with latest reference channels
- Regular update of calibration reference channels (this time changing in the opposite direction) will be needed to keep Xe line stable

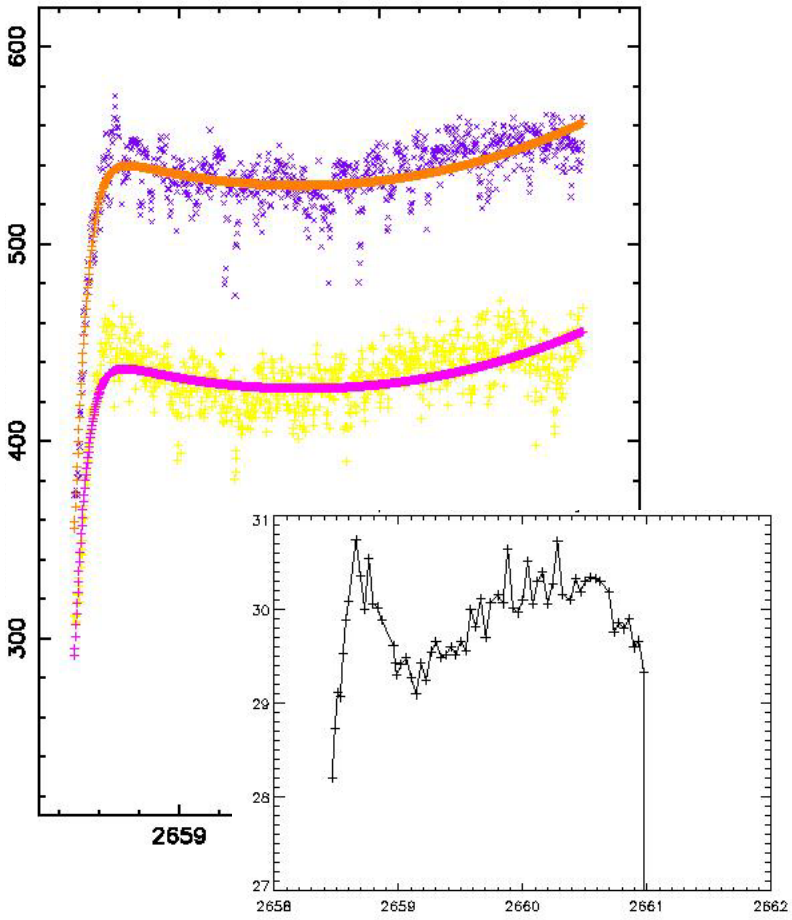
Changing Energy Resolution

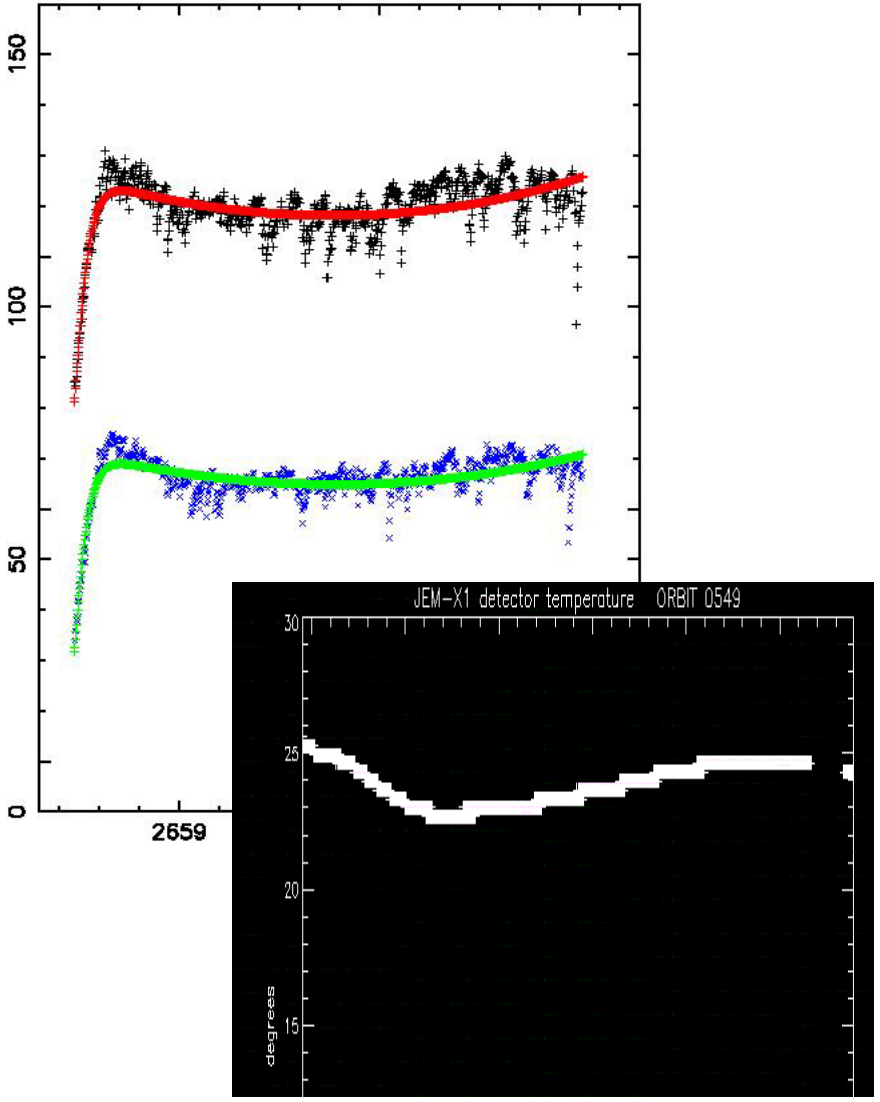
- Xe, 29.6keV
- Mo, 17,4keV
- Cu/Si 8,04keV



Energy Calibration and Detector Temperature Variation

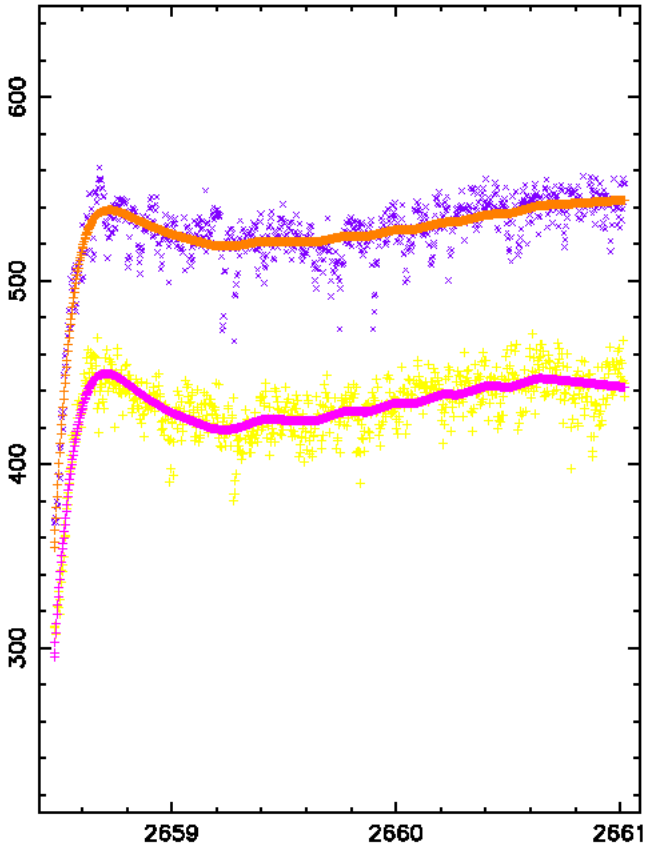
- Example, revolution 549, version 7.4

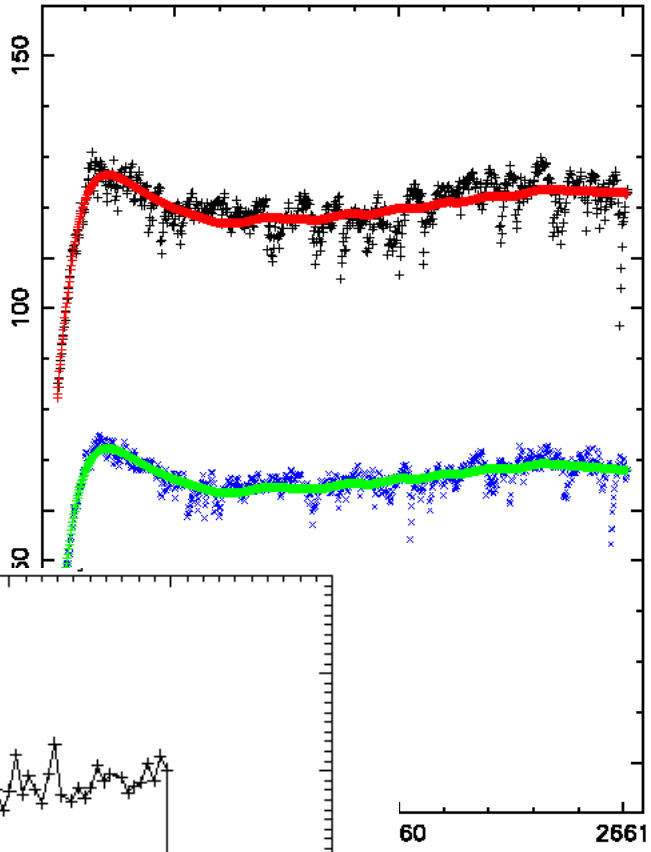


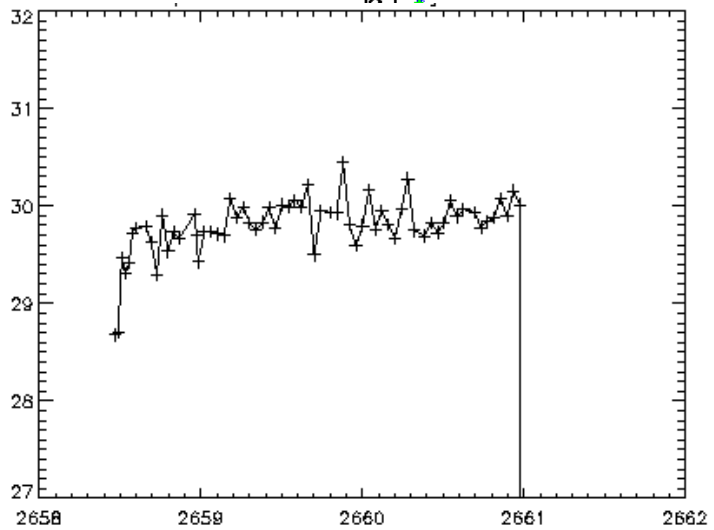


So add a linear temperature dependency to the empirical model (one extra parameter to fit) Version 8.0.

- Major improvement in position of Xe line





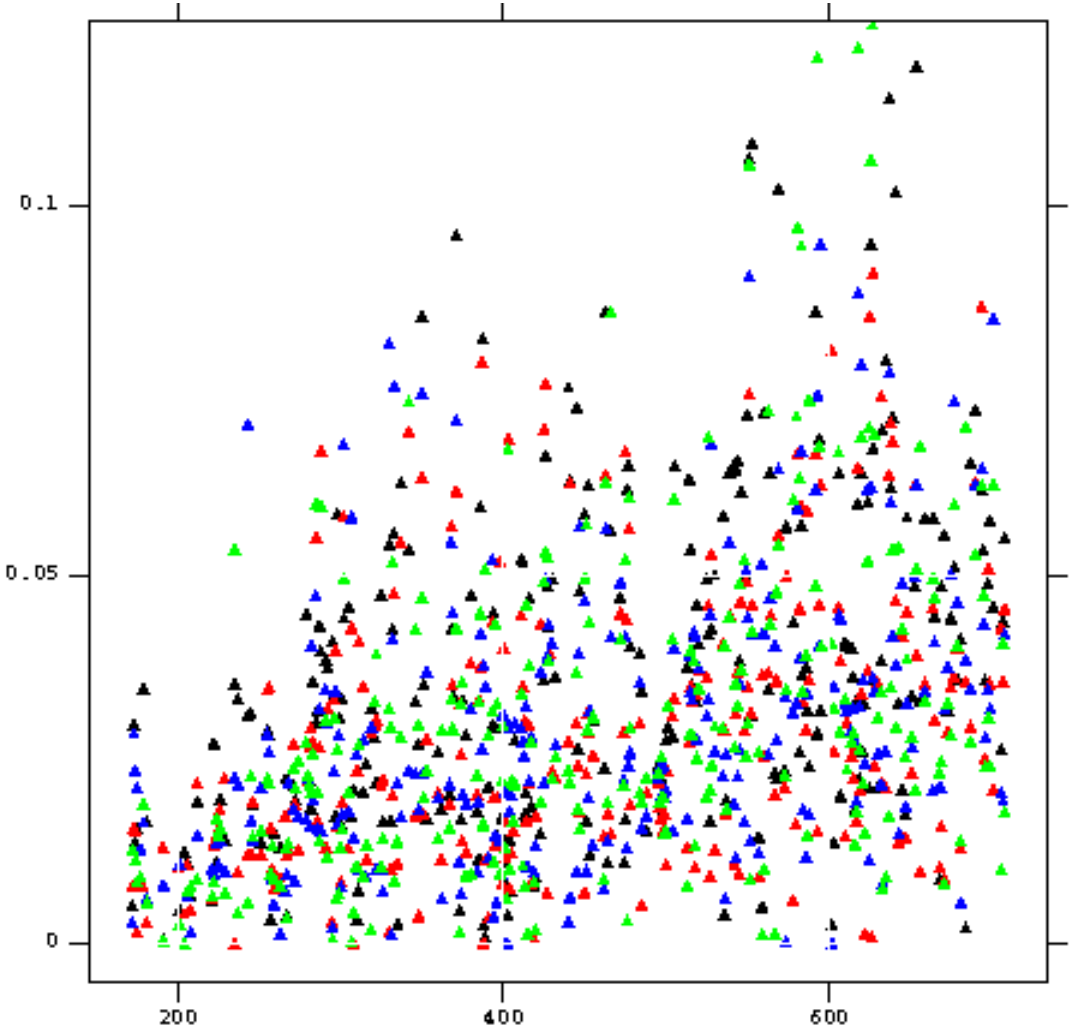


Does an extra free fitting parameter add instability to the gain fitting process?

- Conclusion is no:
  - ALL available JEM-X1 revolutions have been successfully fitted with this new model. 494 revolutions in all
  - Only 5 failed to process (mostly lacking access to data)
  - 1 defaulted to linear interpolation of gain values (same for 7.4)
  - 5 revolutions failed to fit correctly on 1 source
  - 1 revolution failed to fit correctly on 2 sources

- BUT:
  - Linear parameter can take wild values where temperature variation is negligible
  - It can be misused to over-fit noise (1 revolution had a small glitch fitted with temperature parameter)
  - Revolutions before about 400 can all function well without the version 8.0 model
  - Parameter is a little ad hoc since it's mixed in a model with purely empirical components from version 7.4

Temperature Coefficients for the four calibration sources



Xe Analysis and j_cor_gain 8.0

- New delivery also includes deglitching:
  - Gain smoothing models fitted to each source
  - Any gain history values significantly below the model given model values
  - Gain smoothing models refitted with deglitched gain history data
  - Provides small improvements in some revolutions with single large glitches, and Weidenpointners Sco X-1 data (already IC'd)
- Expect to redeliver j_cor_gain at least one more time before freeze for next OSA release
- Current version mainly for integration purposes

- Xe analysis can only be done on revolutions where I (lund account) have access to all the science data i.e. not revolutions with long observations belonging to keypr060 etc.