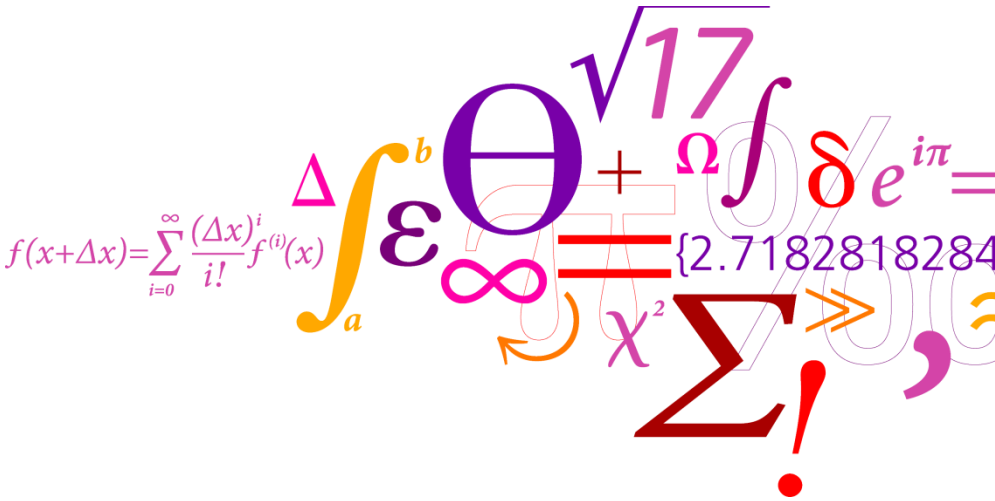
Problems and Challenges of JEM-X Energy Calibration

Carol Anne Oxborrow

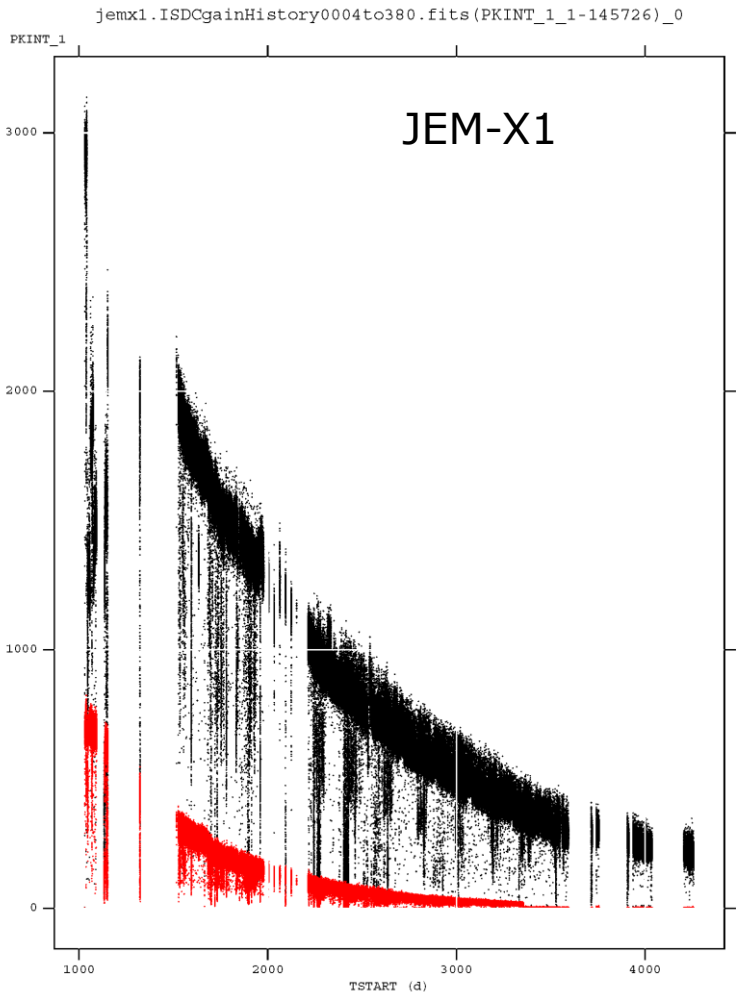


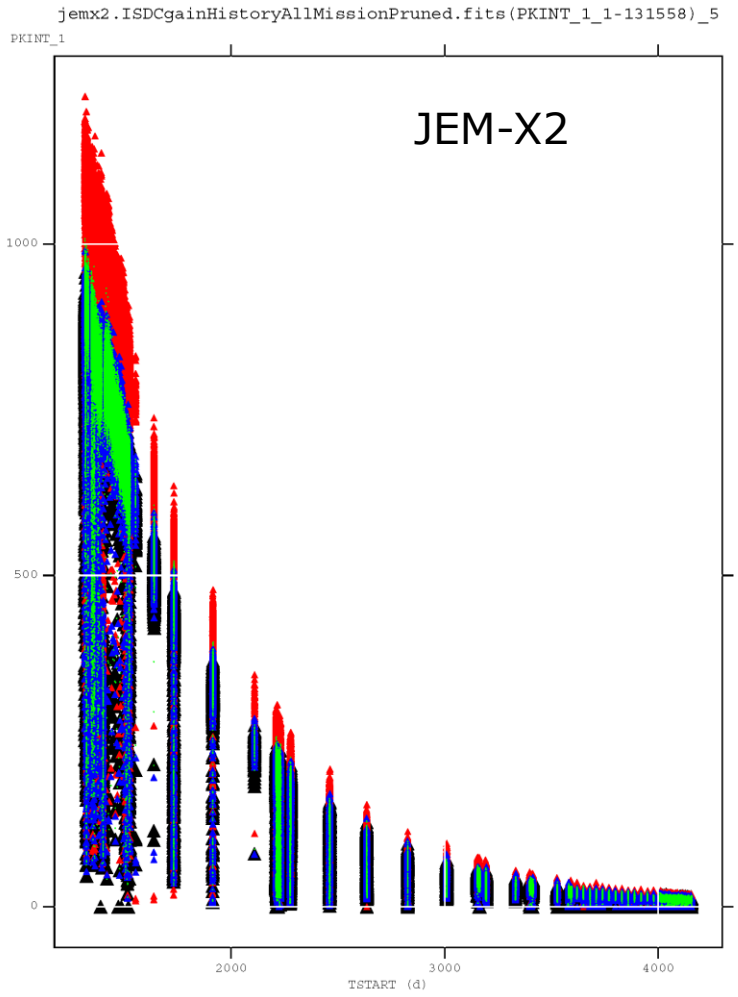
DTU Space
Institut for Rumforskning og -teknologi

Current Trends

- Weakening calibration sources
- Dying anodes
- Increased temperature dependence
- Increased sensitivity to particle event rates
  - Increased solar activity
- Increased differential temperature-related gain
- Coarse temperature determination

Decaying Calibration Sources



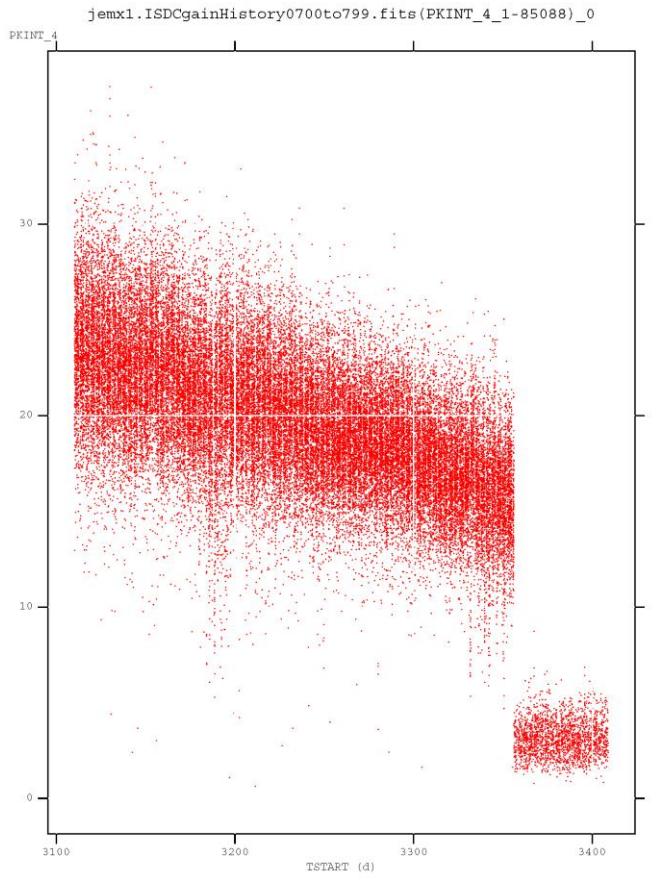


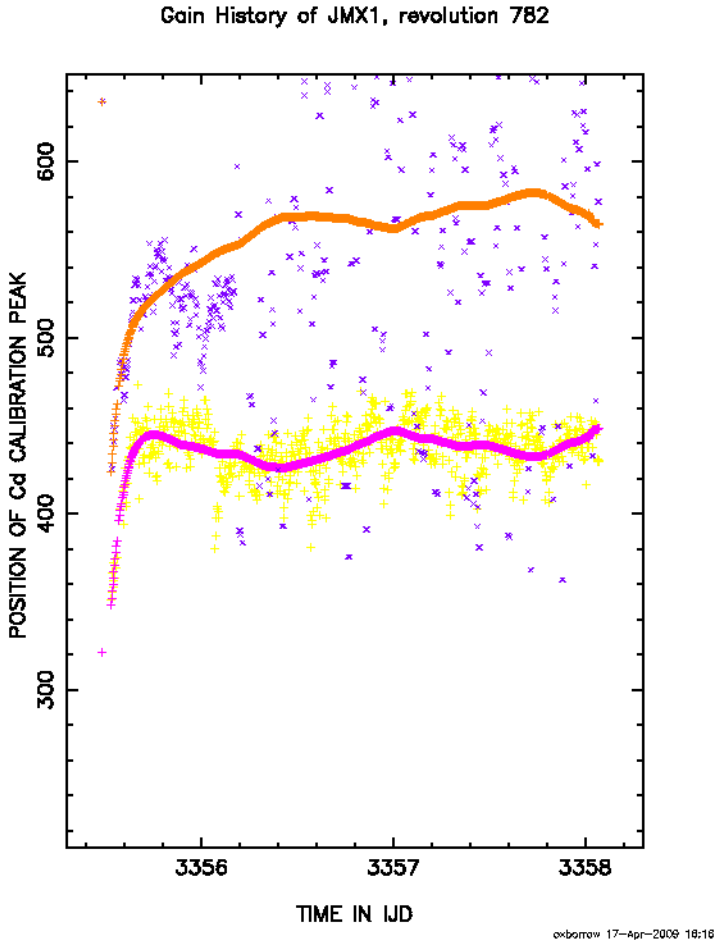
Decay As Expected (with exceptions)

JEM-X1	Then 1325	Now 4157	Factor	Tau	Tau (actual)
Source 1	3023	264	11.5	2.52 yr	2.74 yr
Source 2	1756	14.5	121	466 d	462.6 d
Source 3	2211	175	12.6	2.42 yr	2.74 yr
Source 4	791	1.8	439	369 d	462.6 d

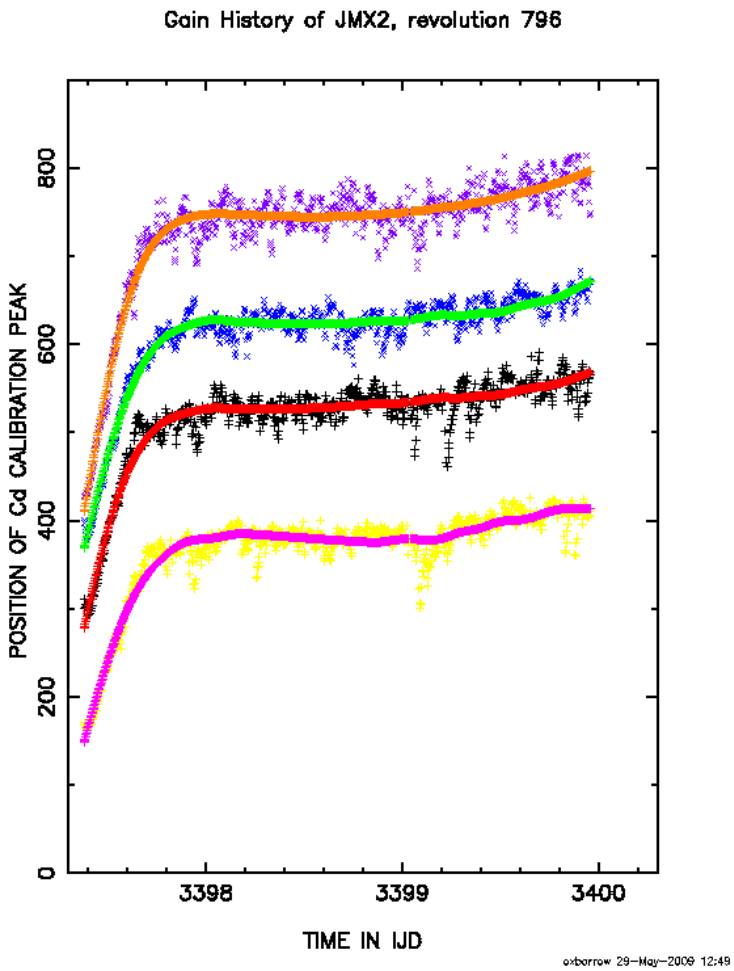
JEM-X2	Then 1032	Now 4260	Factor	Tau	
Source 1	911	12.8	71	460 d	462.6 d
Source 2	1166	16.8	69	463 d	462.6 d
Source 3	948	14.4	66	468 d	462.6 d
Source 4	984	13.8	71	460 d	462.6 d

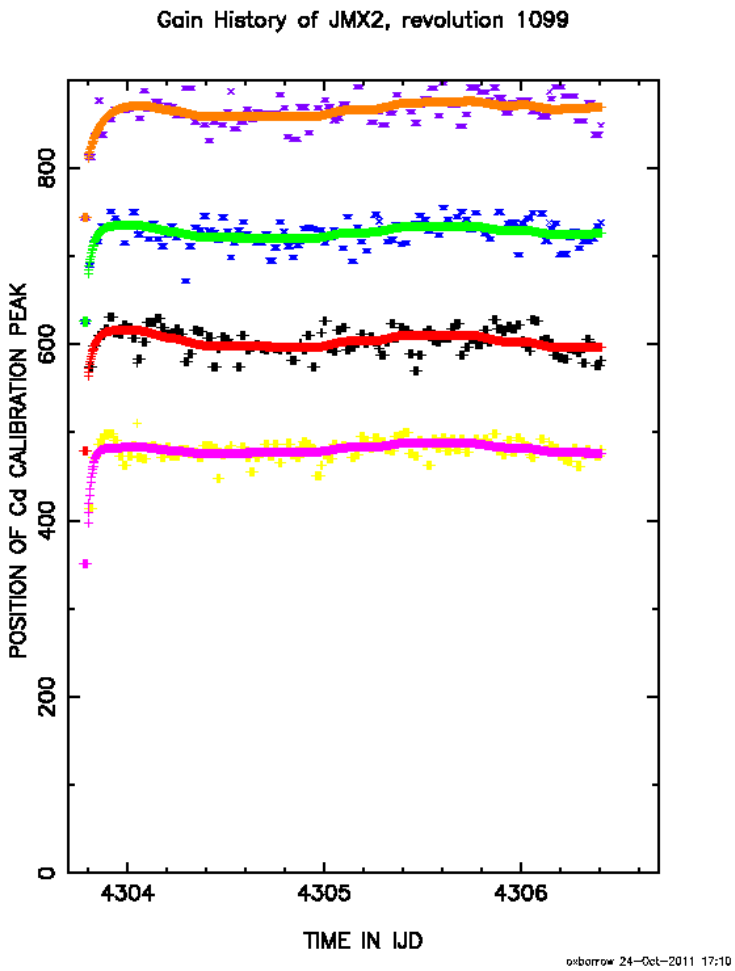
JEM-X1 Source 4 Burnout, Rev. 782



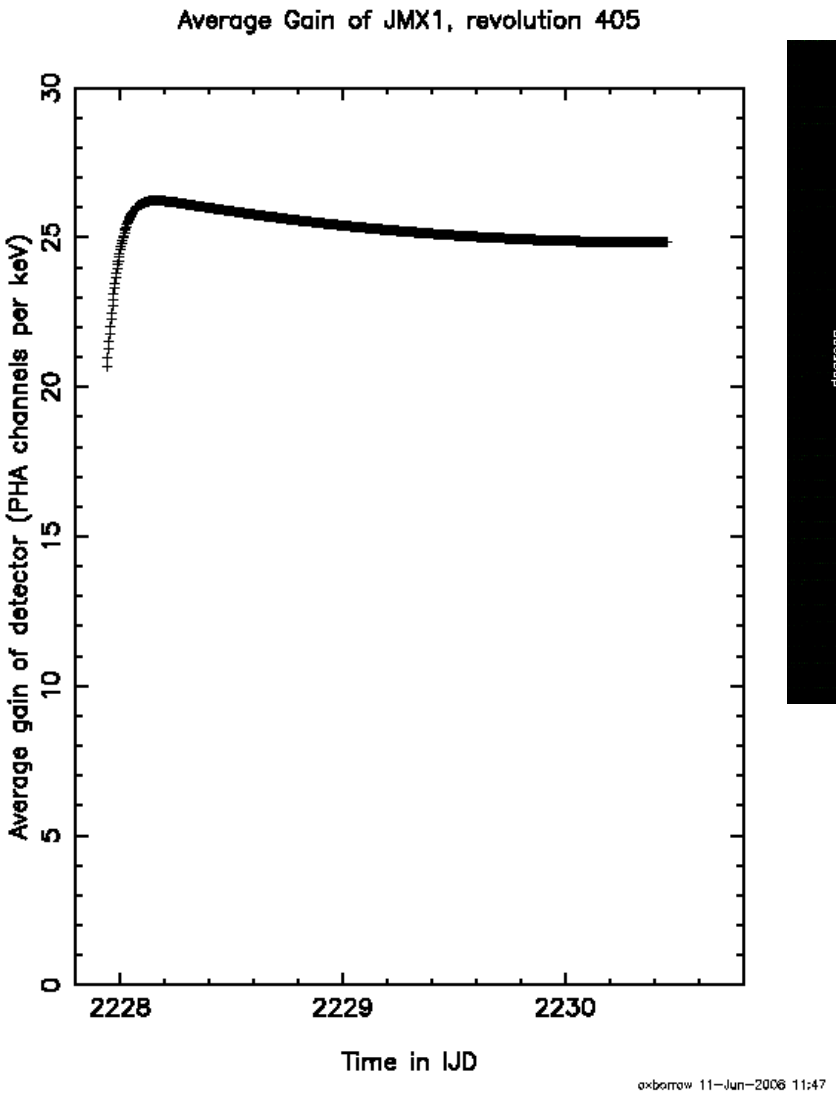


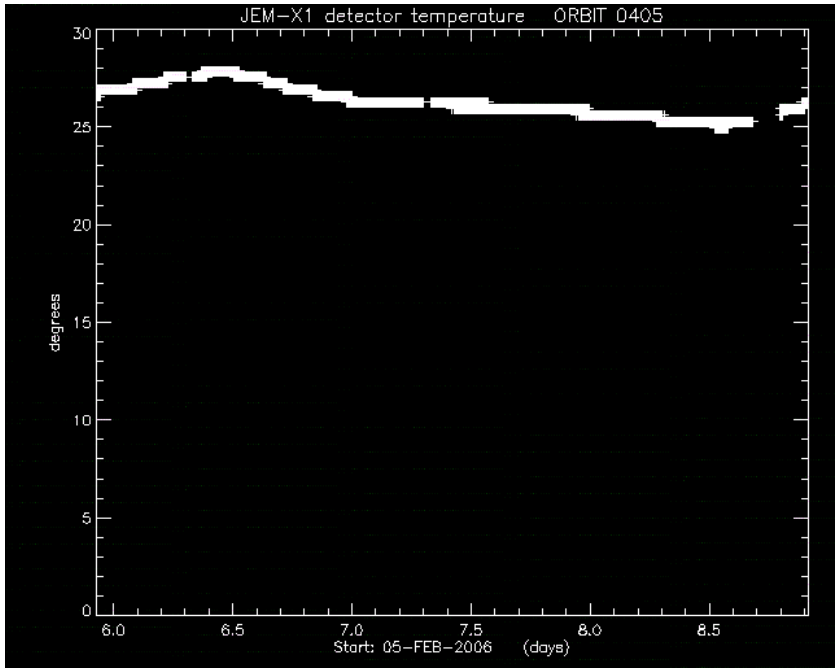
Summation of Weak Spectra





Temperature Dependence Rev. 405



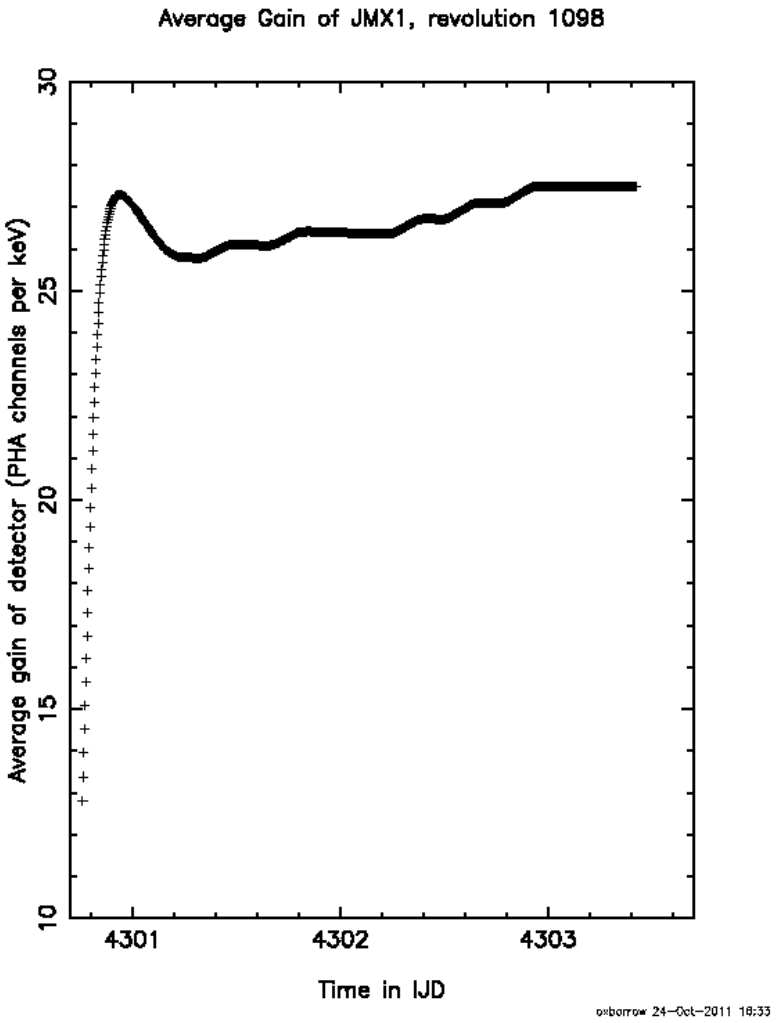


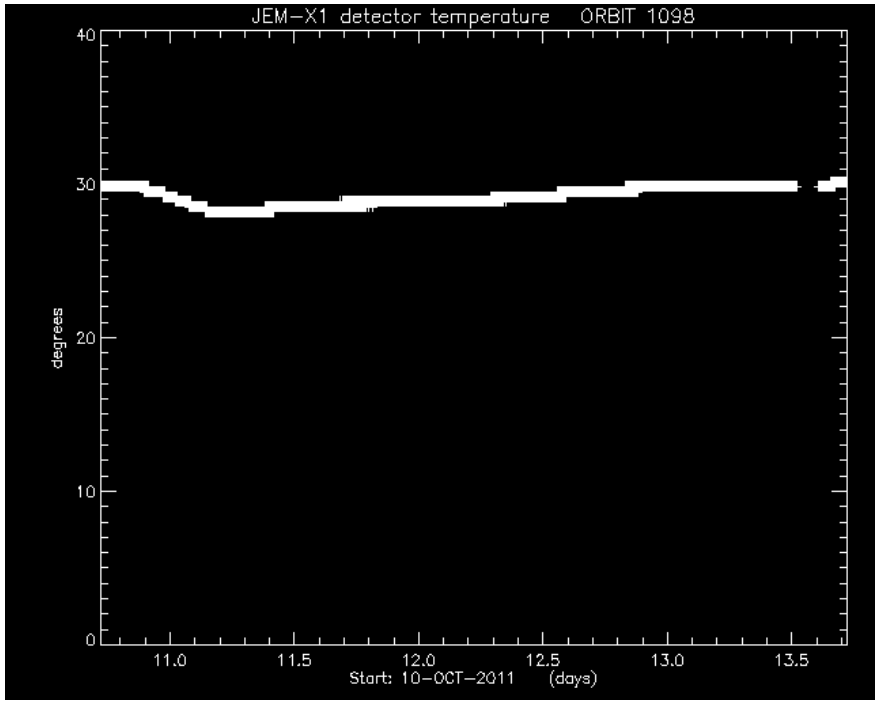
2.8 degree temp. variation gives

5.8% average gain variation

~ 2.1% gain increase per degree

Temperature Dependence Rev. 1098



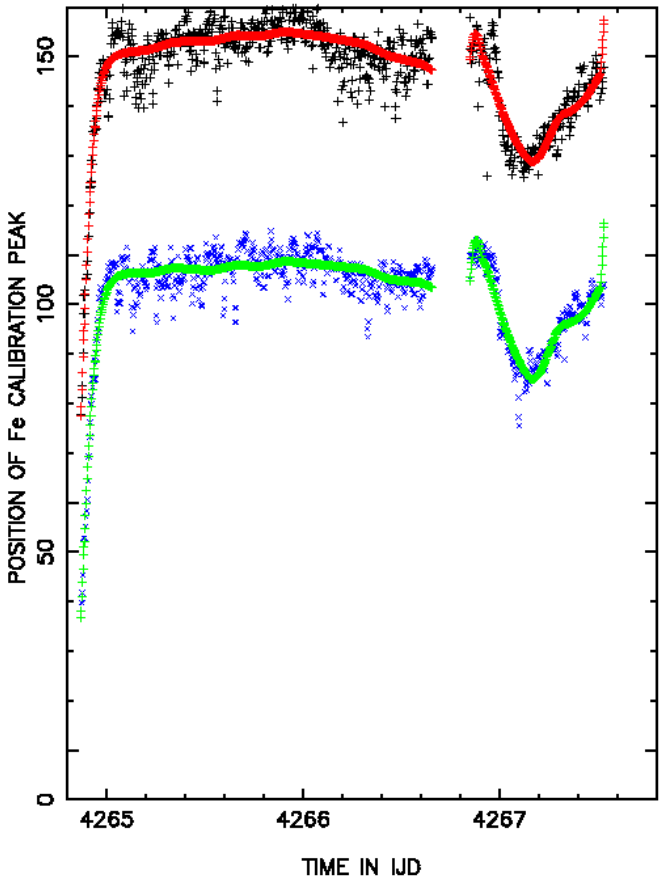


2 degree temperature variation

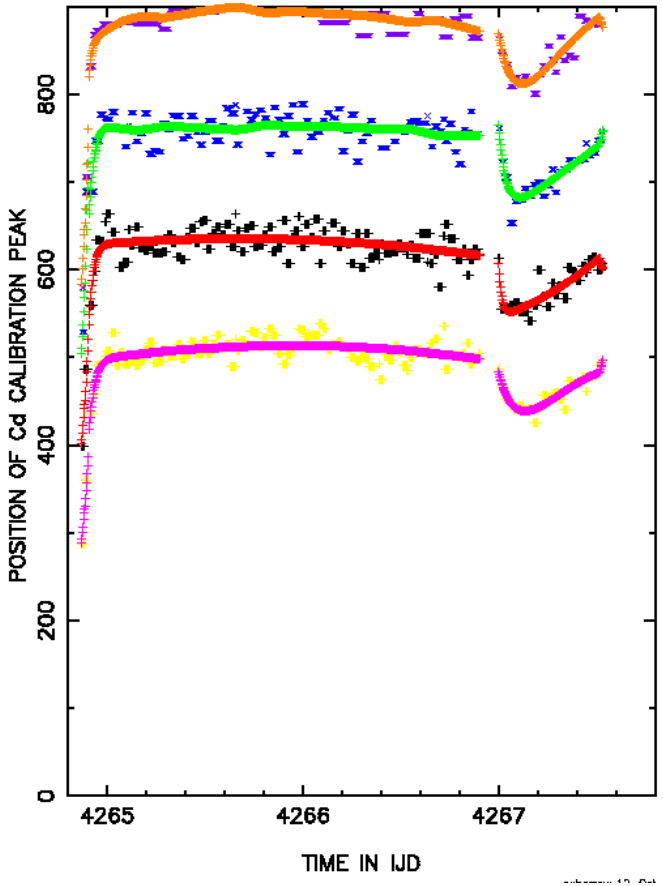
~ 3.5% average gain change per degree

Strong Temperature-independent Gain Variations (rev. 1086)

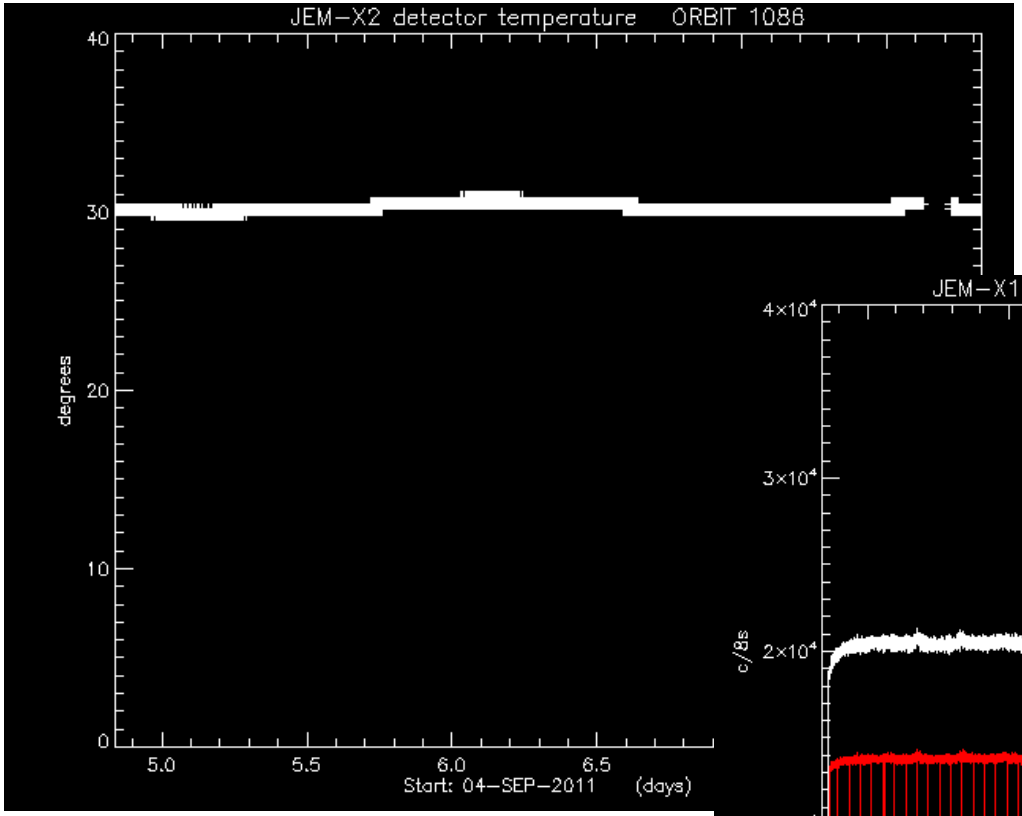
JEM-X1



JEM-X 2

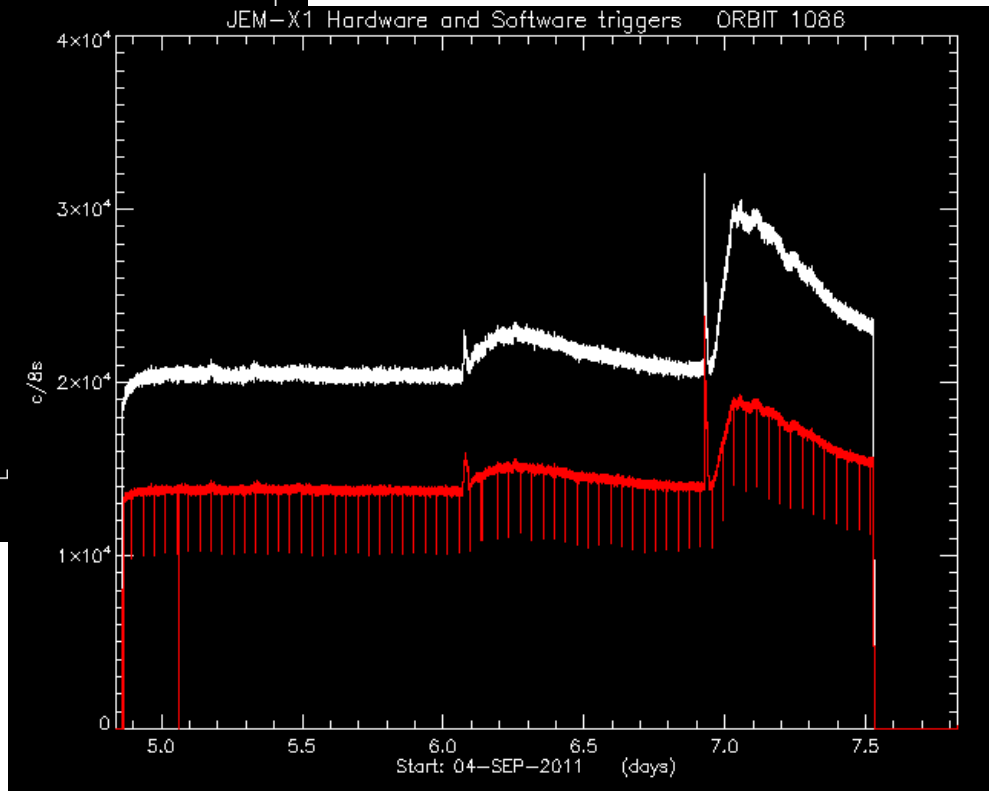


Rev. 1086 Temperature and Event Rate



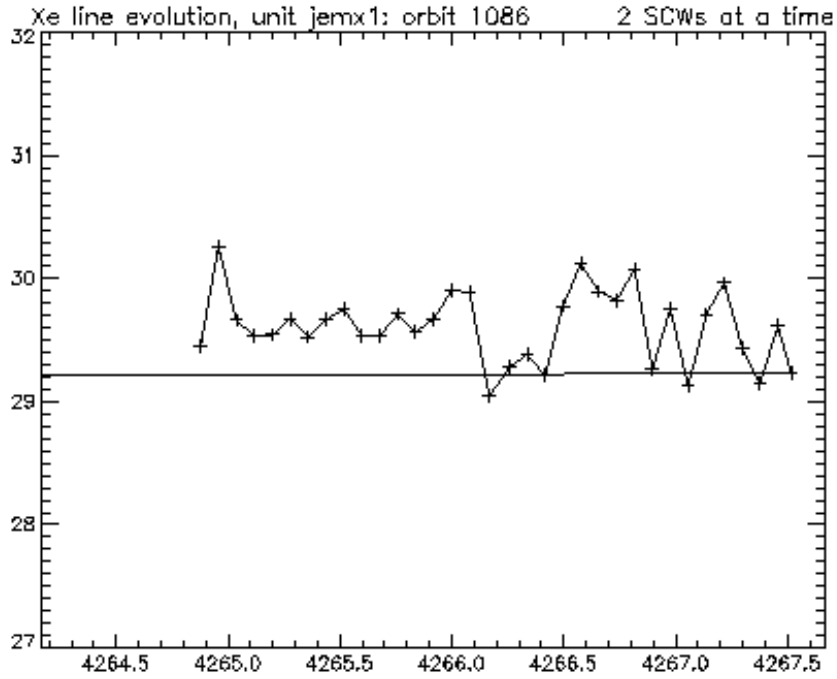
TEMPERATURE

TRIGGERS

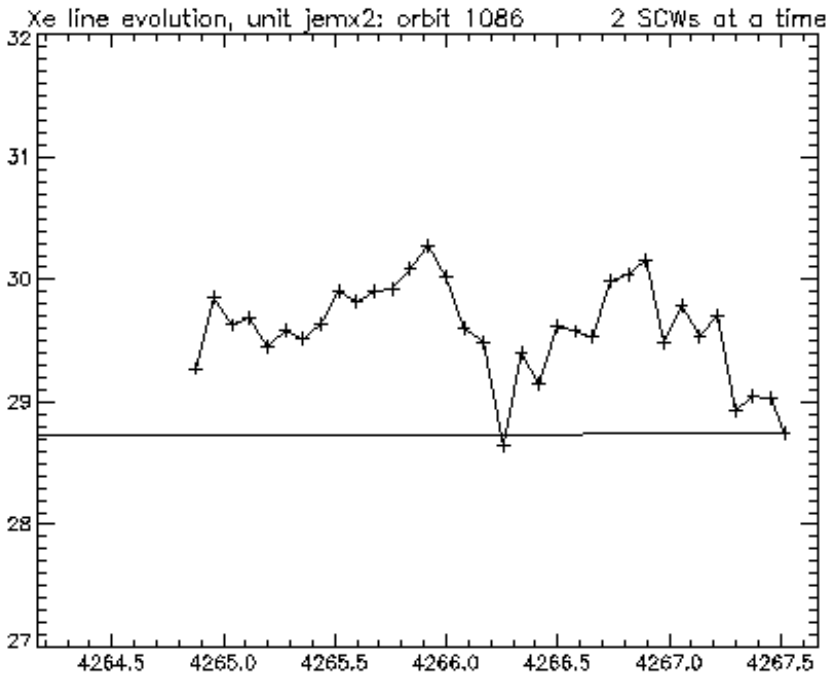


IC-corrected Xe Line: Rev. 1086

JEM-X1

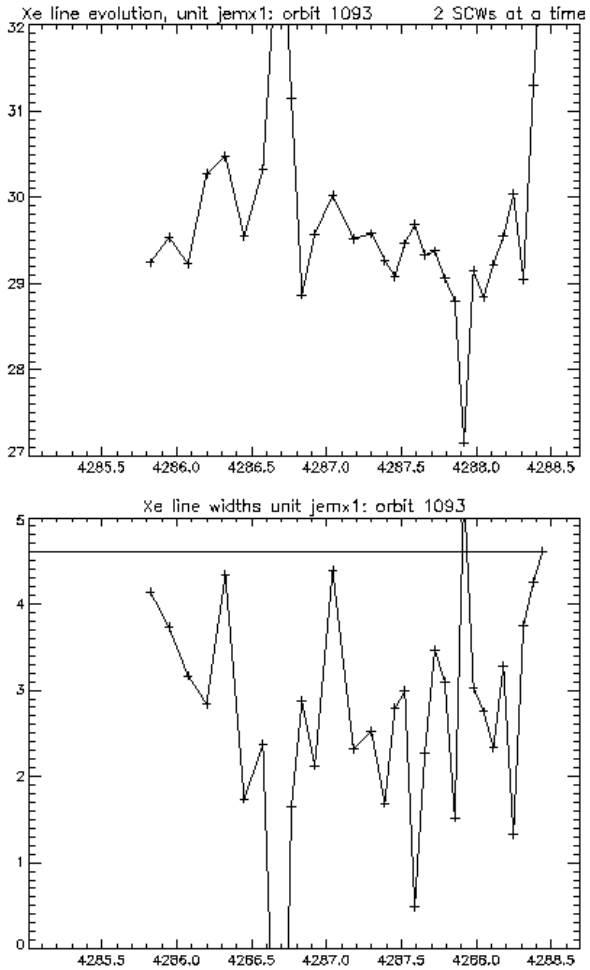


JEM-X 2

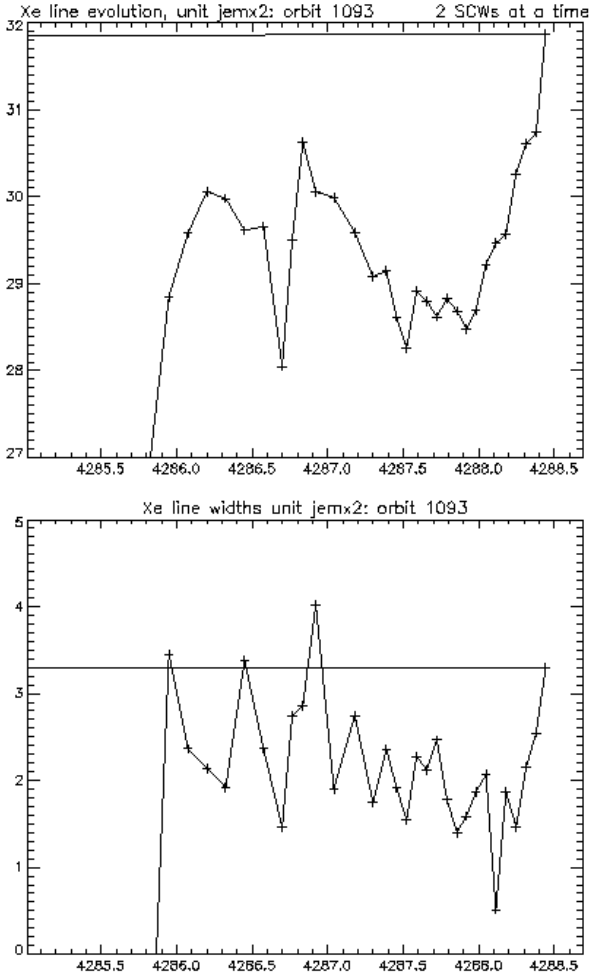


Rev. 1093 – results so far

JEM-X1

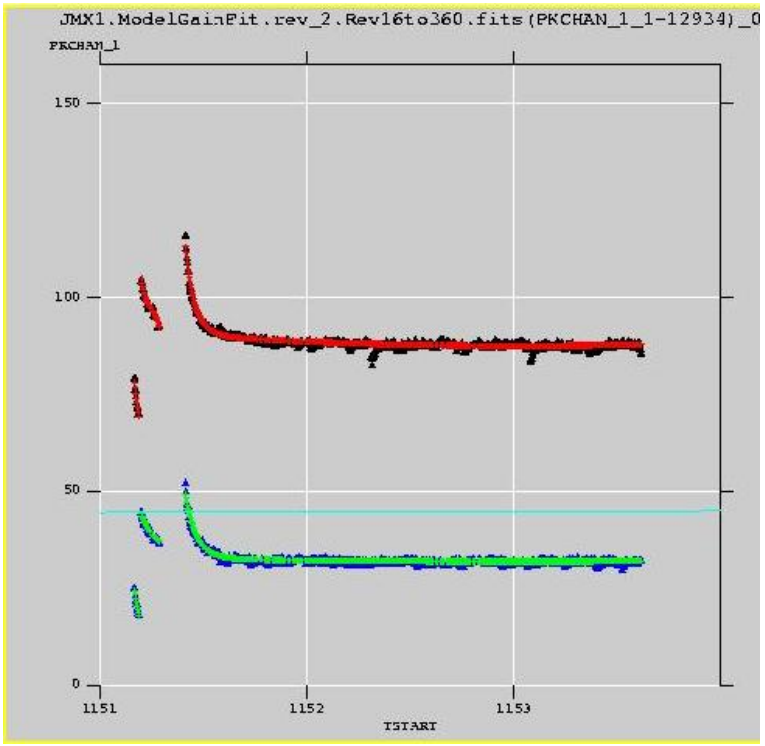


JEM-X 2

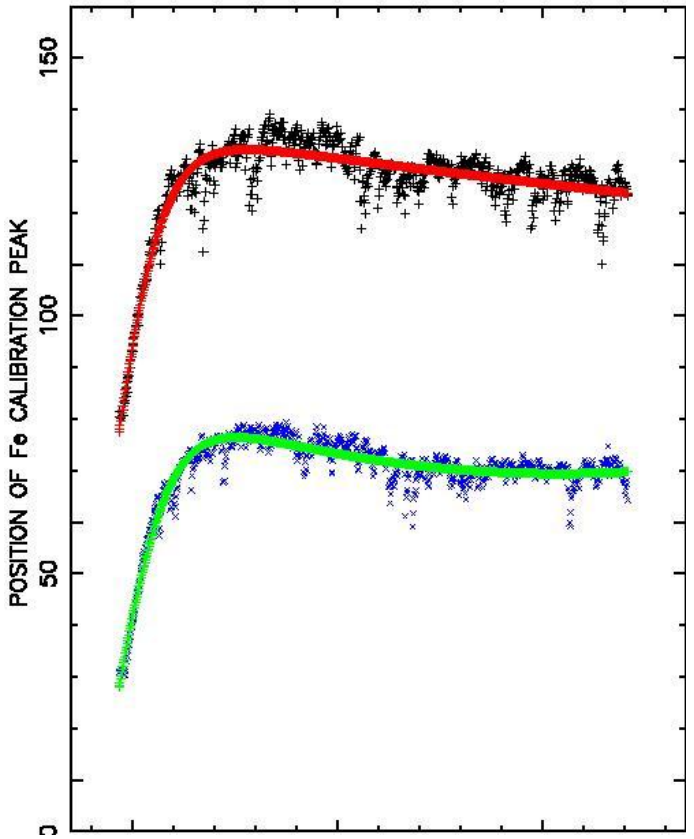


Gain Effects 1: Plate charging

JEM-X1 Fe sources

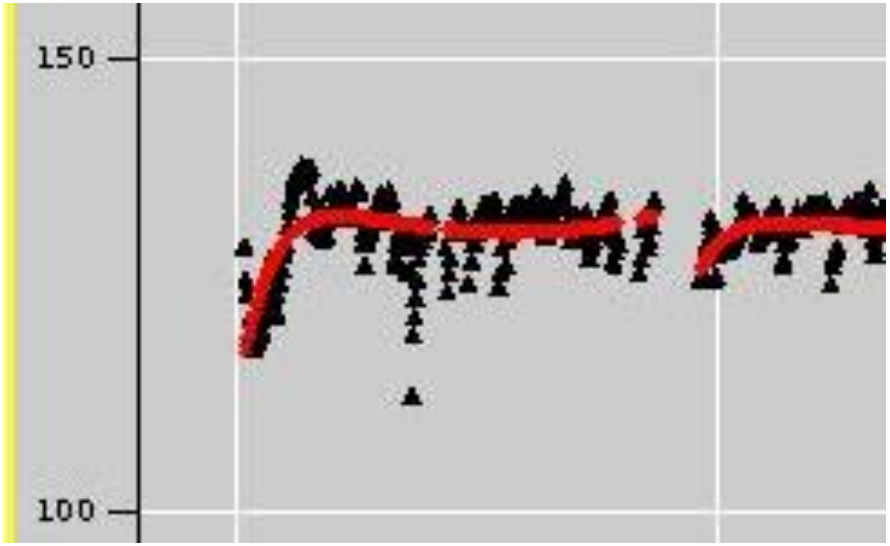


Rev 45 – Downswing

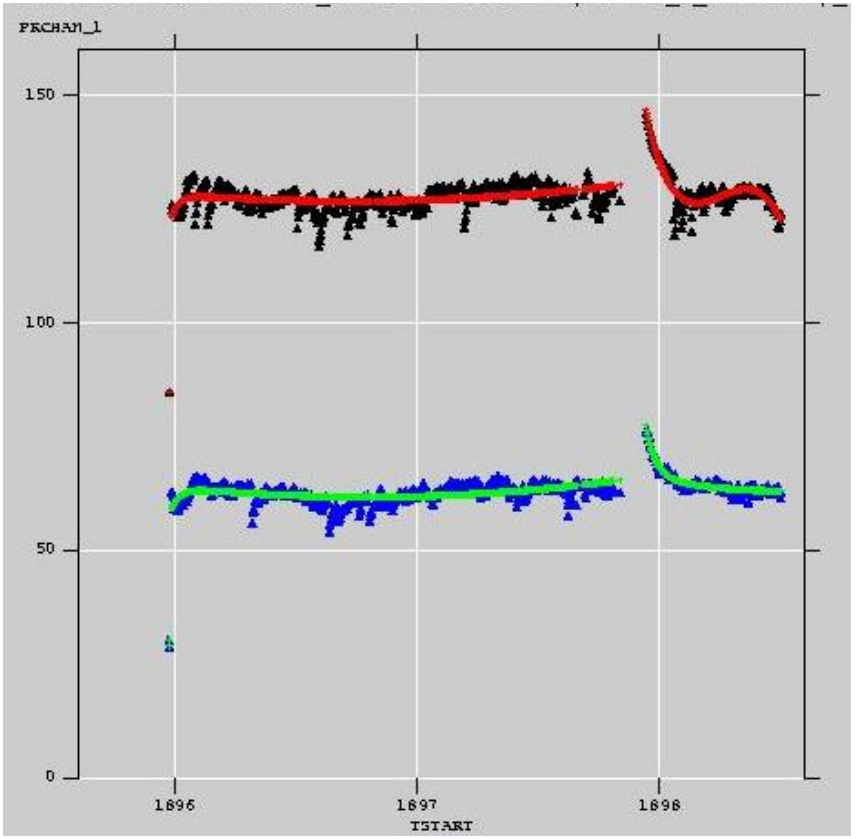


Rev 499 - Upswing

Competing charging effects

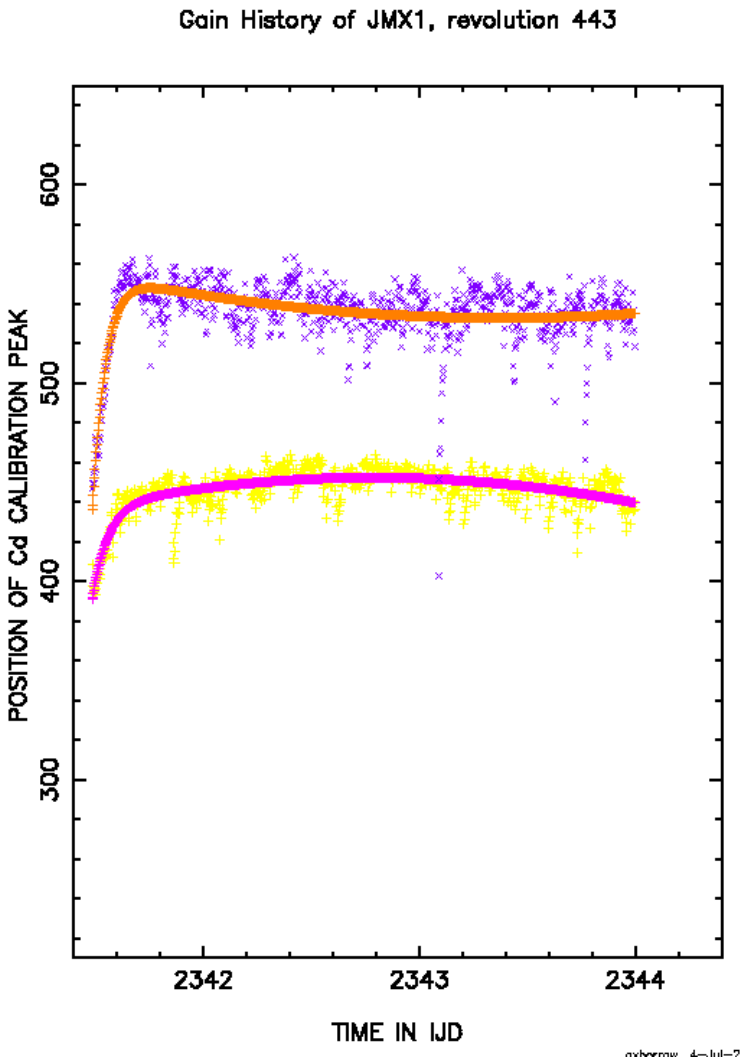


Rev 398 – "The Hook" competing downswing and upswing

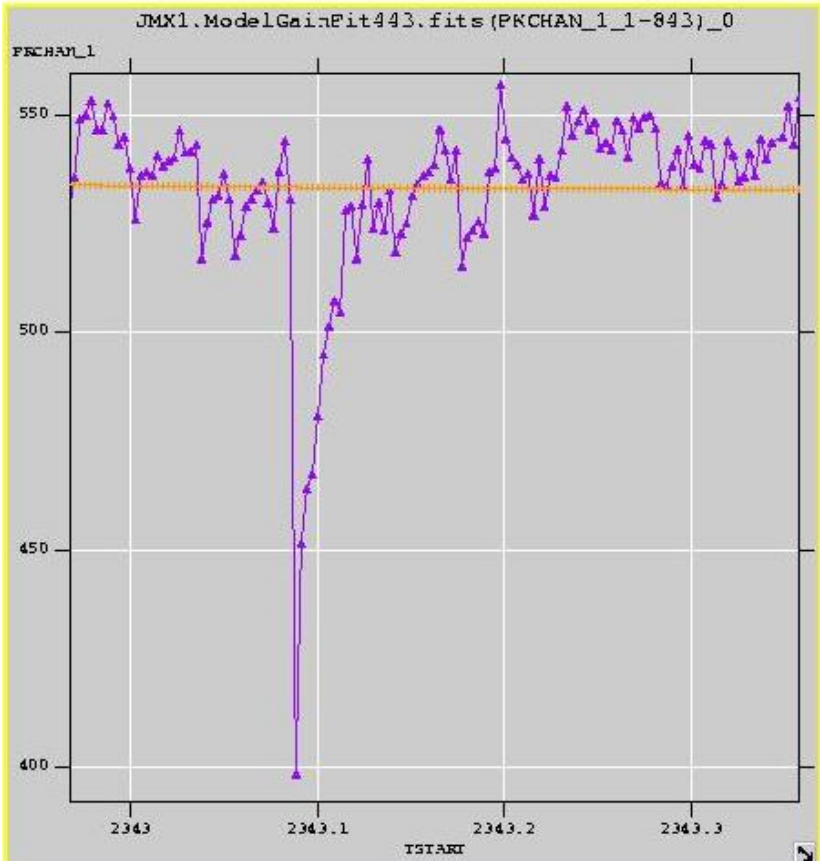


Rev 294 – upswing and downswing

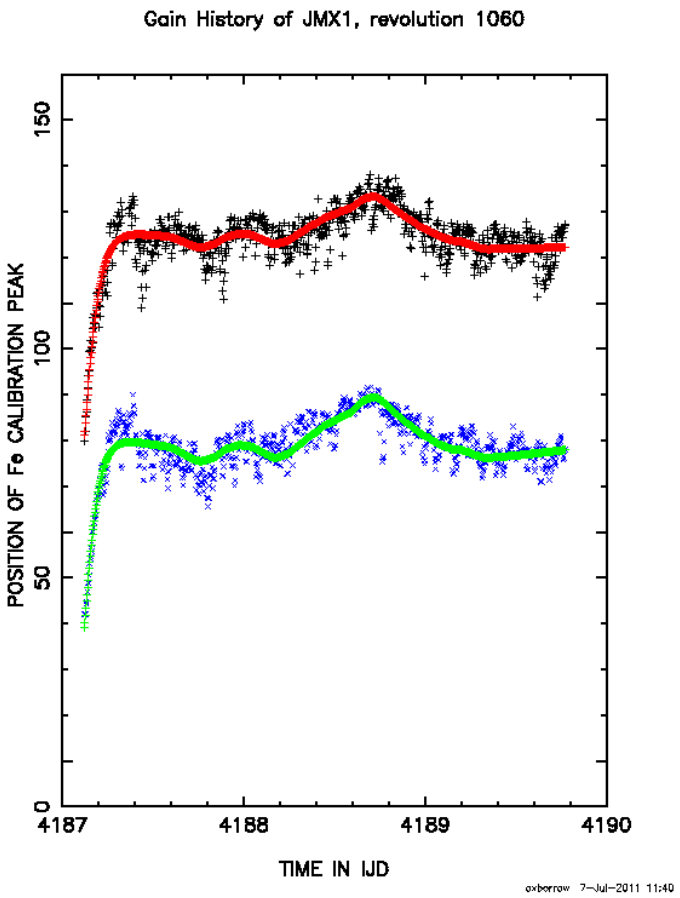
Gain Effects 2: Glitches

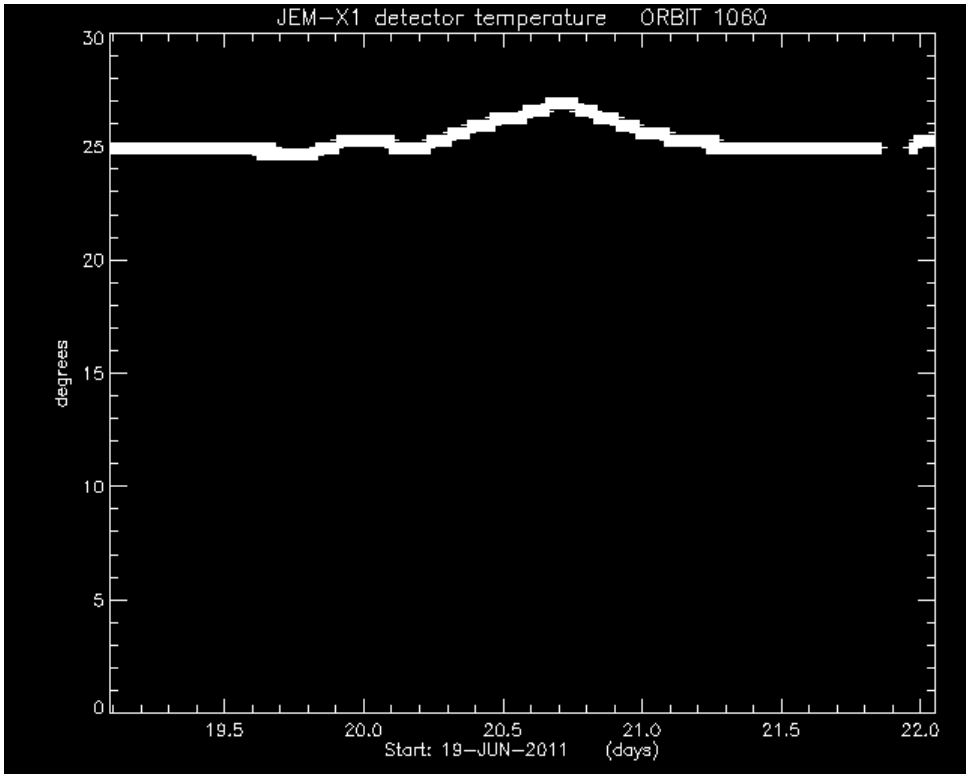


JEM-X1 Rev. 443 – 30% drop



Gain Effects 3: Linear Temperature Dependence

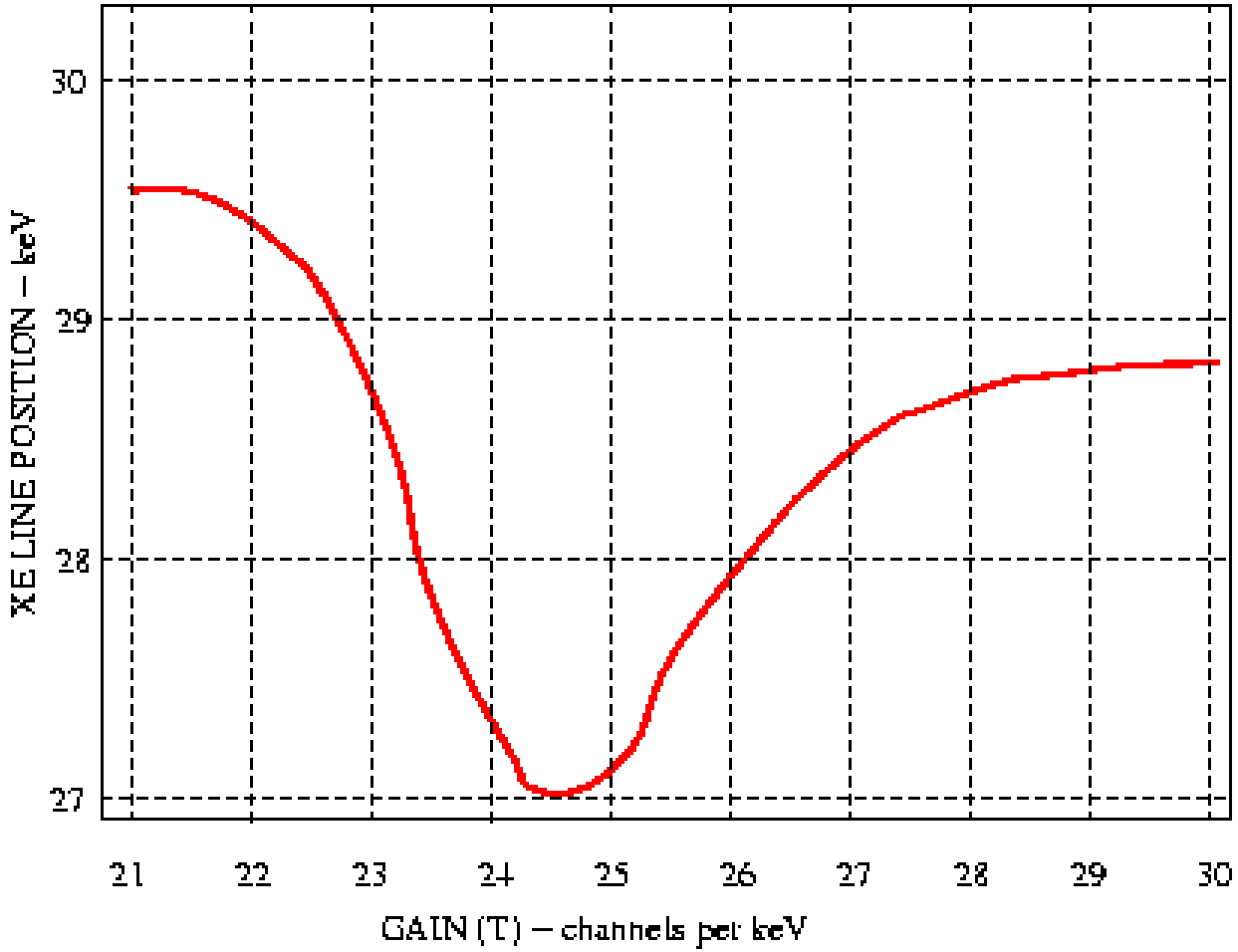




Event rate stable:

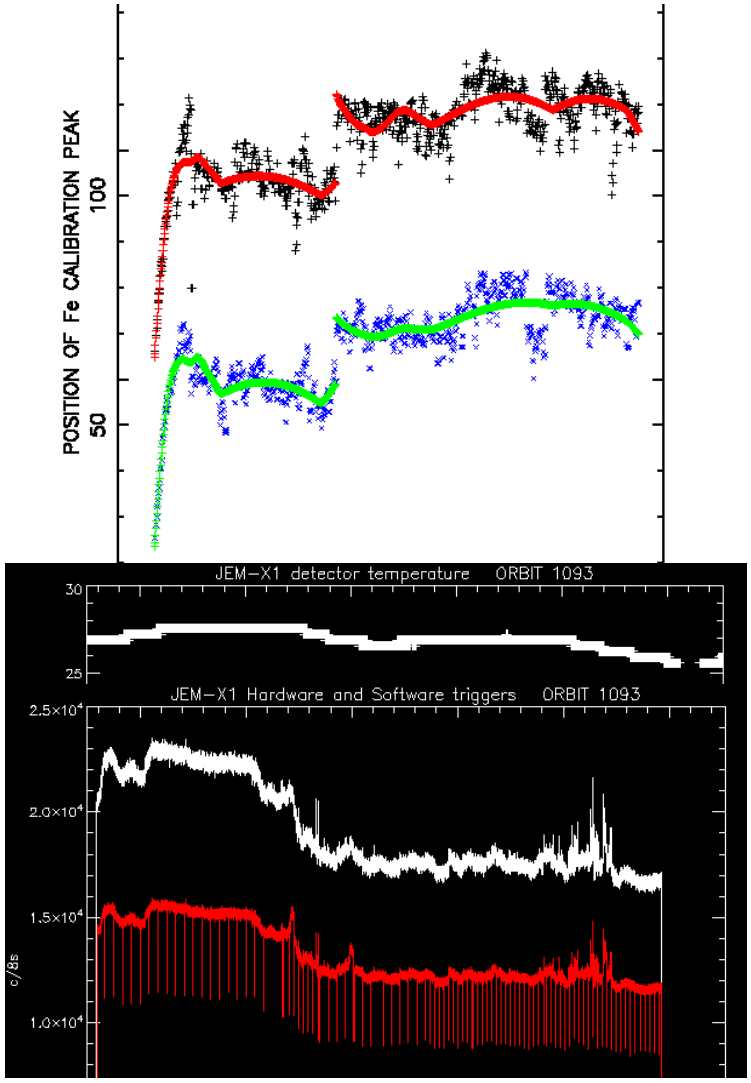
19,000 hard triggers, 13,000 soft triggers

Gain Effects 4:
Non-linear Temperature Effect

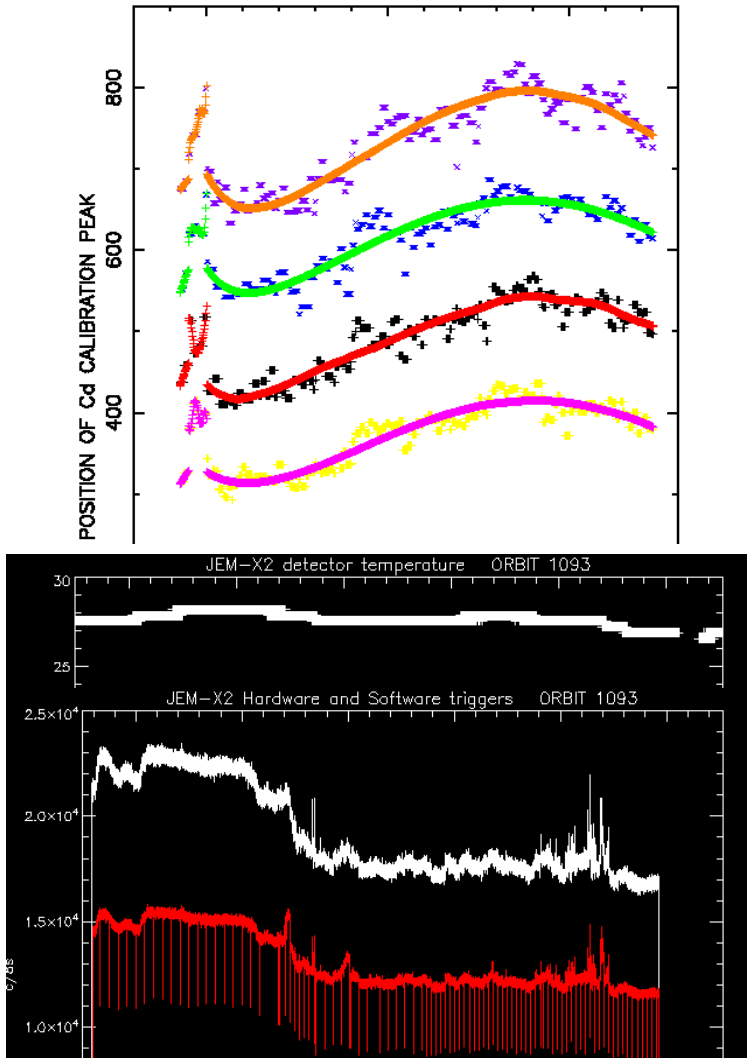


Gain Effects 5: Event Rate Dependence

JEM-X1, rev 1093



JEM-X 2, rev 1093



Conclusions

- IC gain history tables needed until end of the mission
- Also need event rate dependency
- Complexity and size of temperature effects expected to increase
- Need to update reference channels for OSA 10
- Energy determination can be kept within 2-3% of the ideal for majority of science windows
- Guilio will be an important asset for the JEM-X team