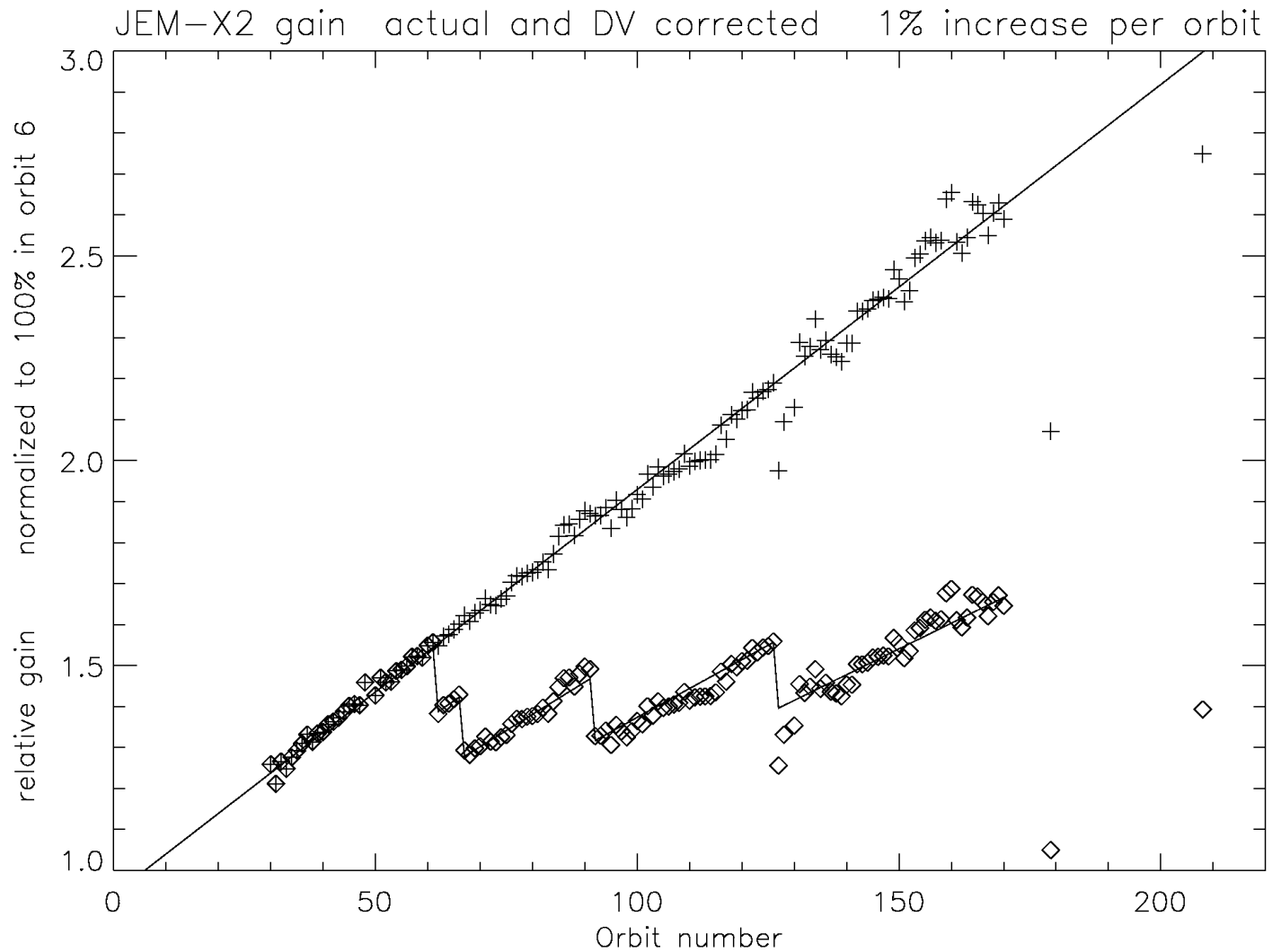


# **JEM-X Status**

Søren Brandt, DSRI

- JEM-X1 has been active since Crab calibration (March 5, 2004, Orbit 170) with the "new" selection criteria
- JEM-X1 performance is unchanged and nominal
- DV was lowered from 81 to 80 from orbit 198
- JEM-X2 is dormant since Orbit 171, but was activated for 6 hours in orbit 179 and for the full orbit 208.

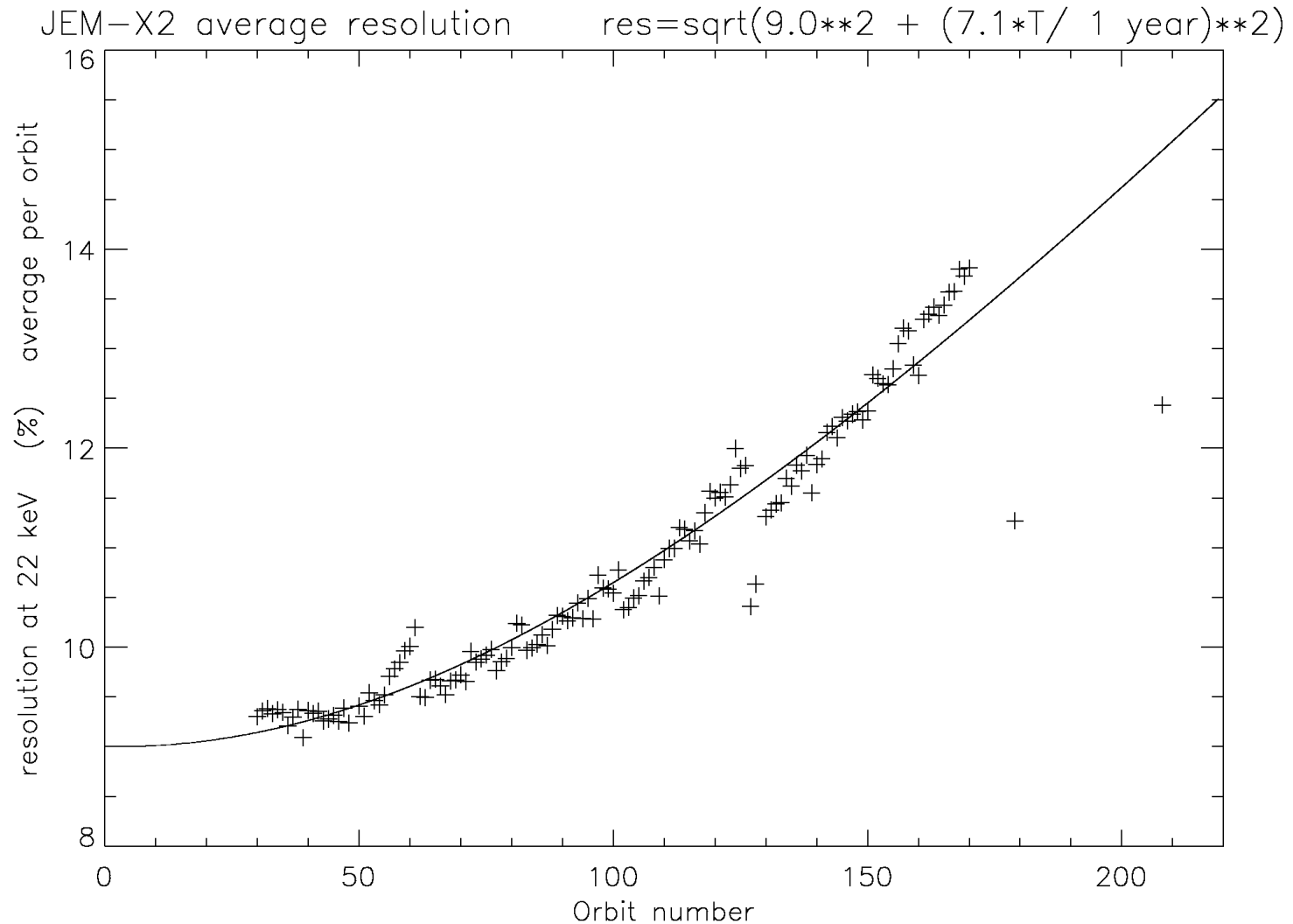
# JEM-X2 gain history



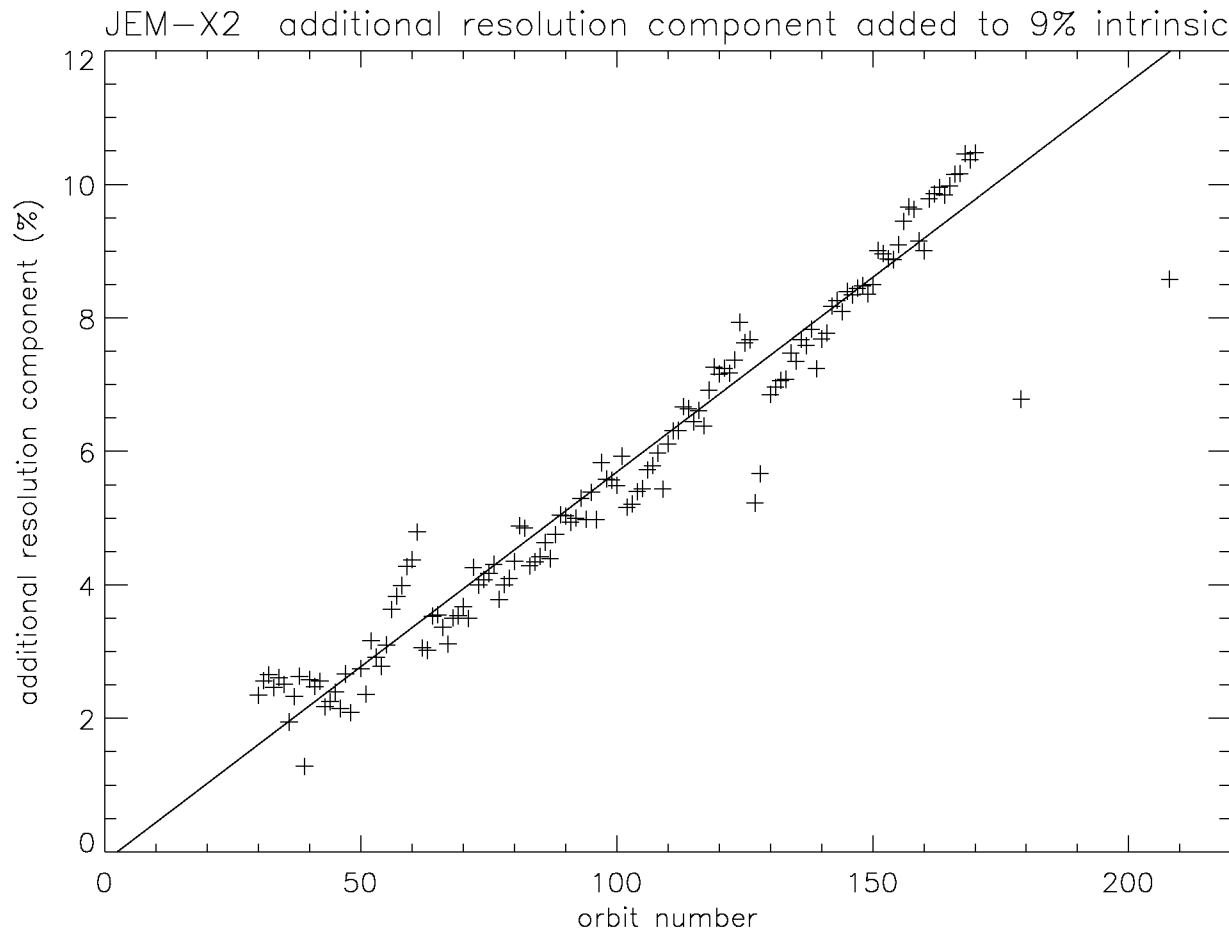
# Causes and effects of gain increase

- Change of glass plate conductivity by Cr ion drift when HV is on
- Effect is temperature dependent
- Negative side effects:
  - Reduced energy resolution
  - Change of "spatial gain" map
  - Increased gain dependence on intensity

# JEM-X2 energy resolution

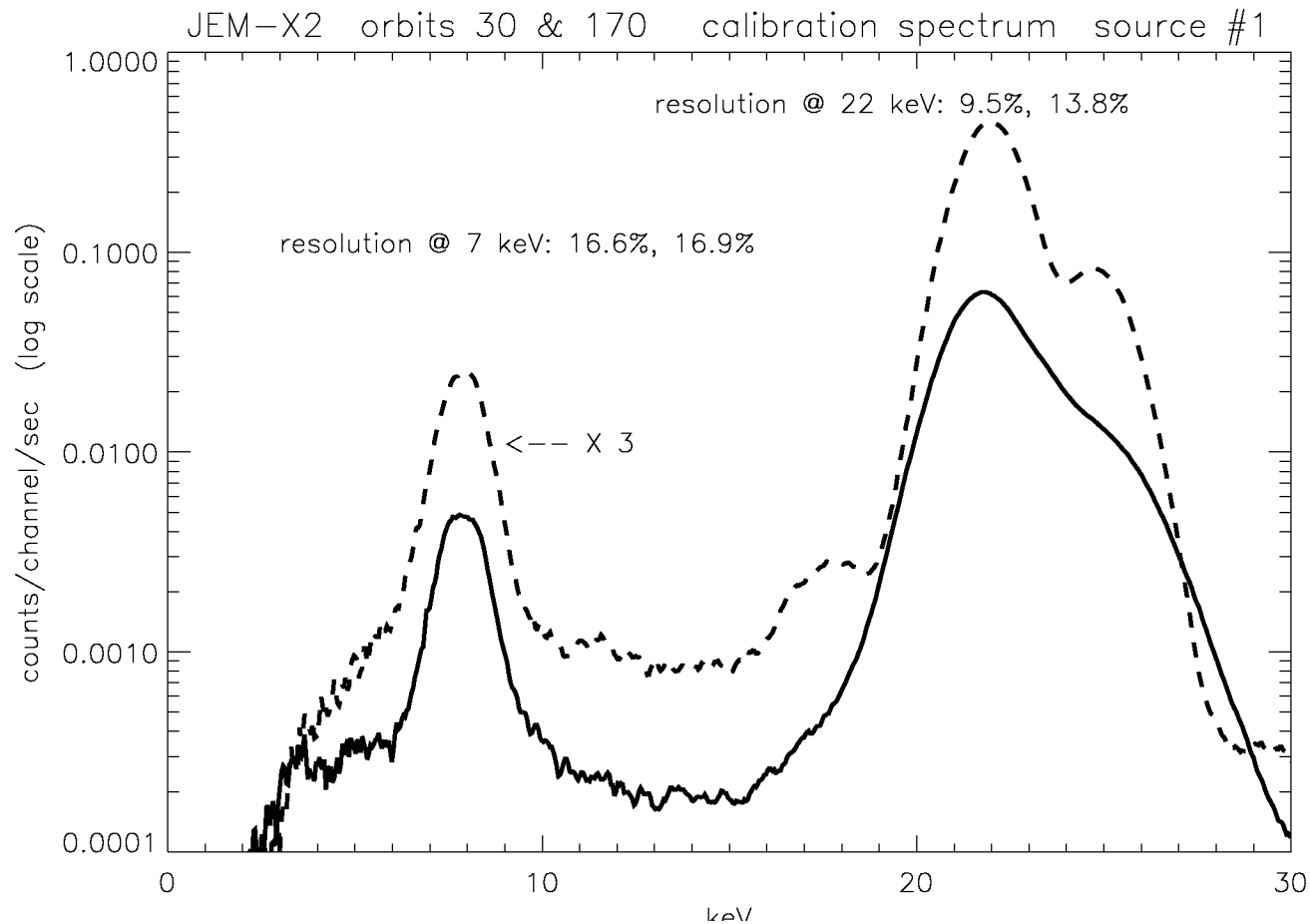


# JEM-X2 added resolution component linear increase with time



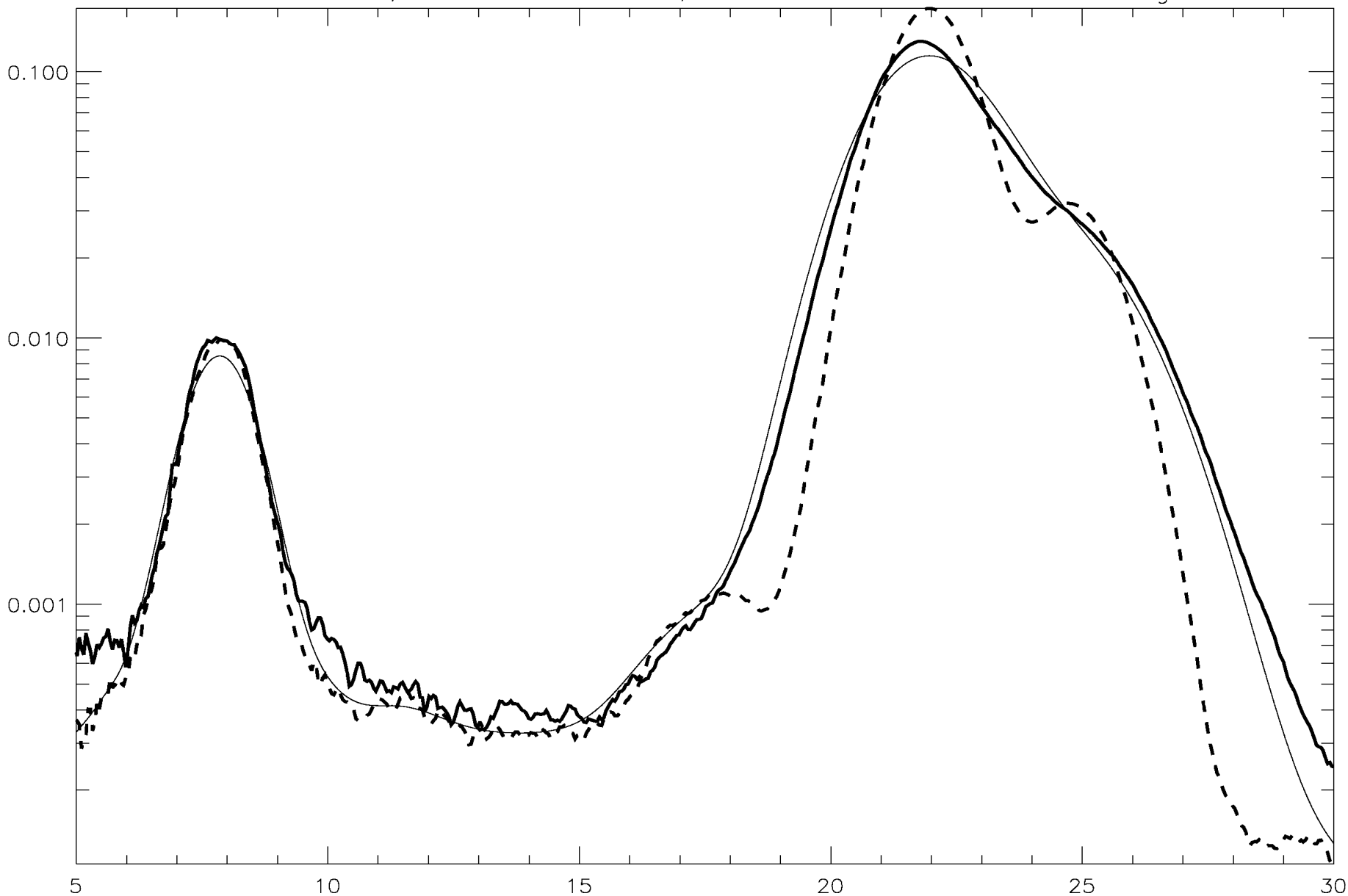
# JEM-X2 Cd spectra, orbit 30 & 170

- Low energy spectrum broaden less



# JEM-X2 Resolution as function of energy?

Solid line: rev 170, dashed line: rev 30, thin line: rev30 folded with 10% gaussian



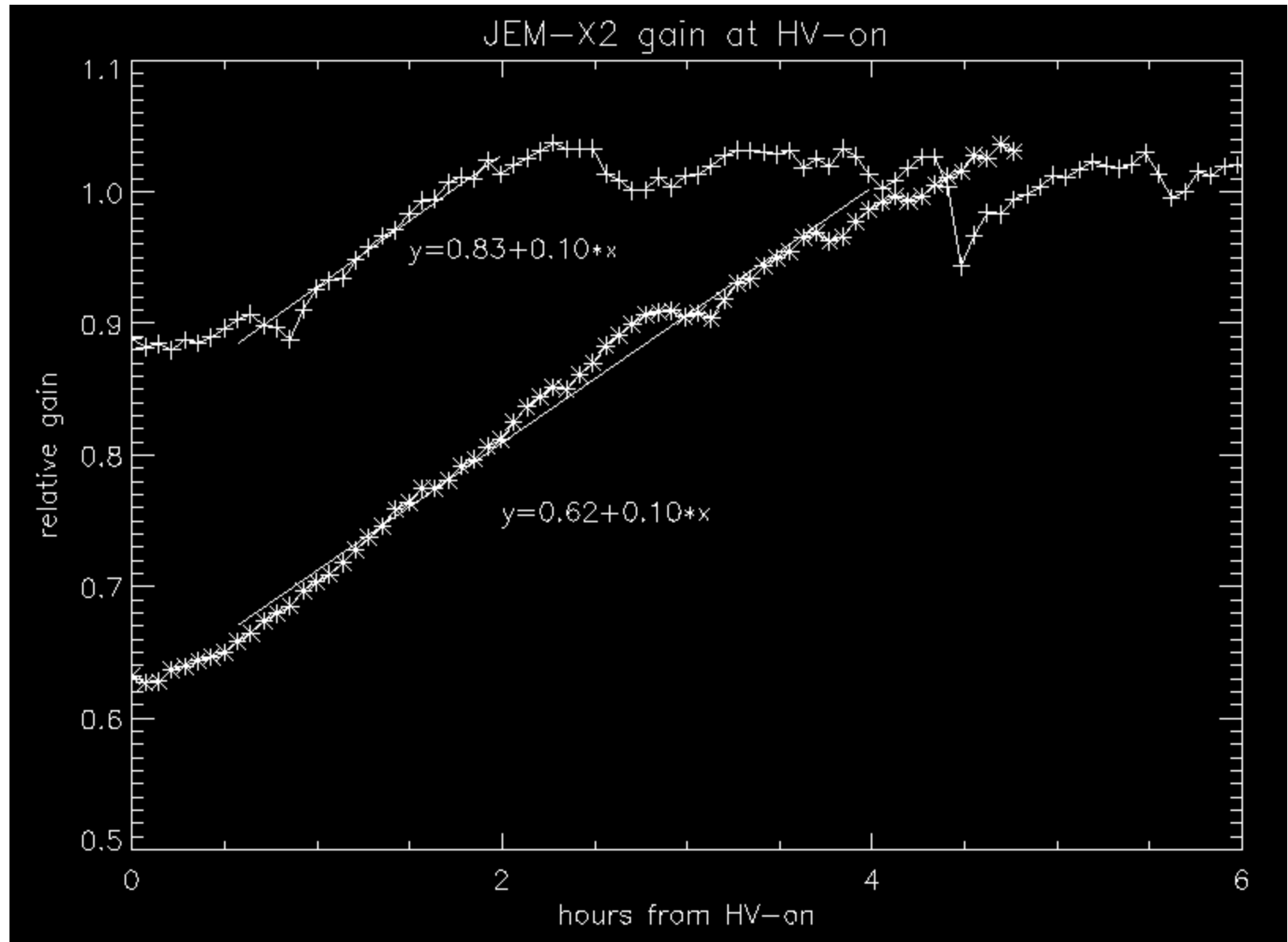
# JEM-X2 re-activations

- 26 days and 87 days of HV off
- Electrical properties of plate recovered but one year of "ageing" accrues in a few hours
- 5 hours in orbit 179 too short for stable gain
- Orbit 208 activation seems to show gain increased by 7% over 110 days even with HV off
- Some of orbit 208 had "hot stripe", possibly caused by sparking in the veto area combined with "open" selection criteria at low "energy".



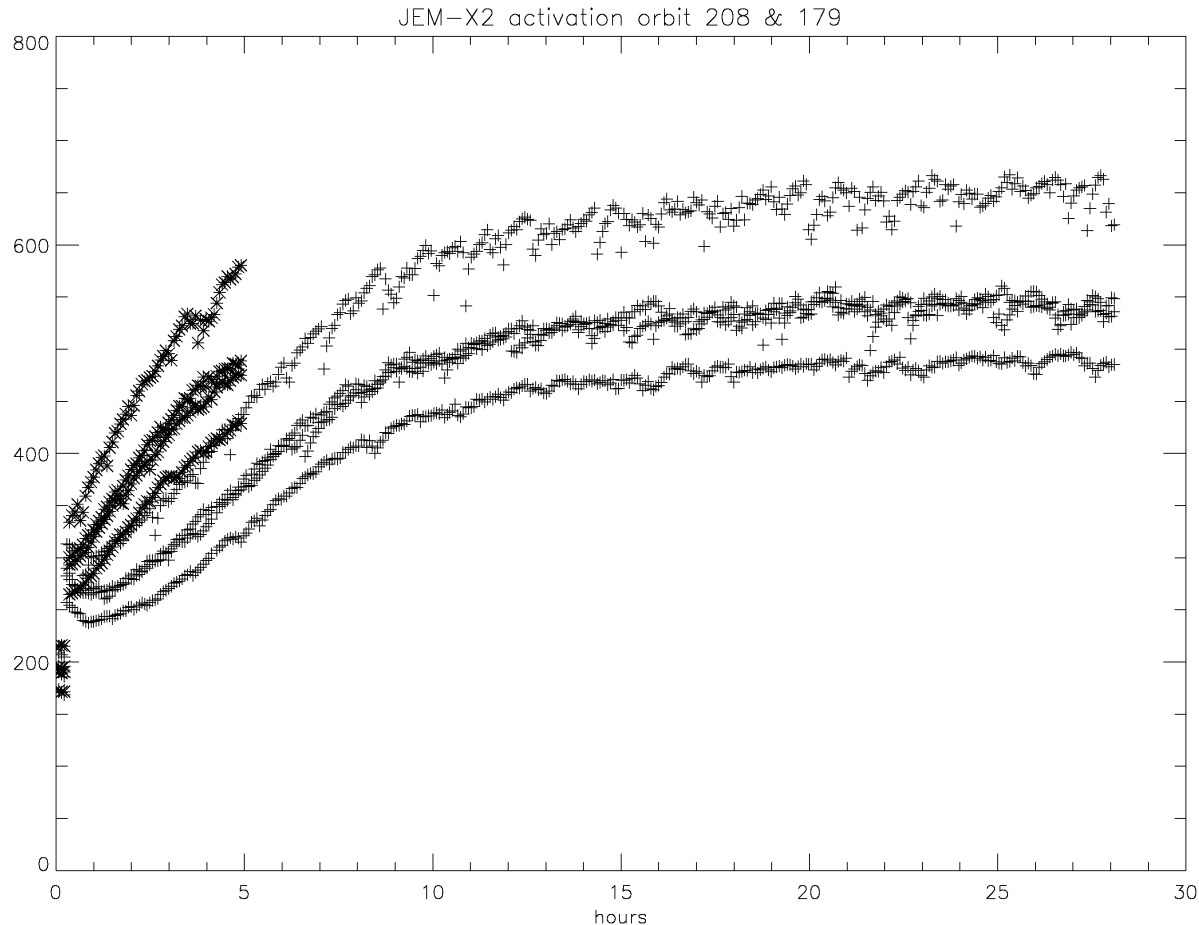
# JEM-X2 gain at start-up

## 26 days versus 11 hours of HV off



# JEM-X2 gain in orbits 179, 208

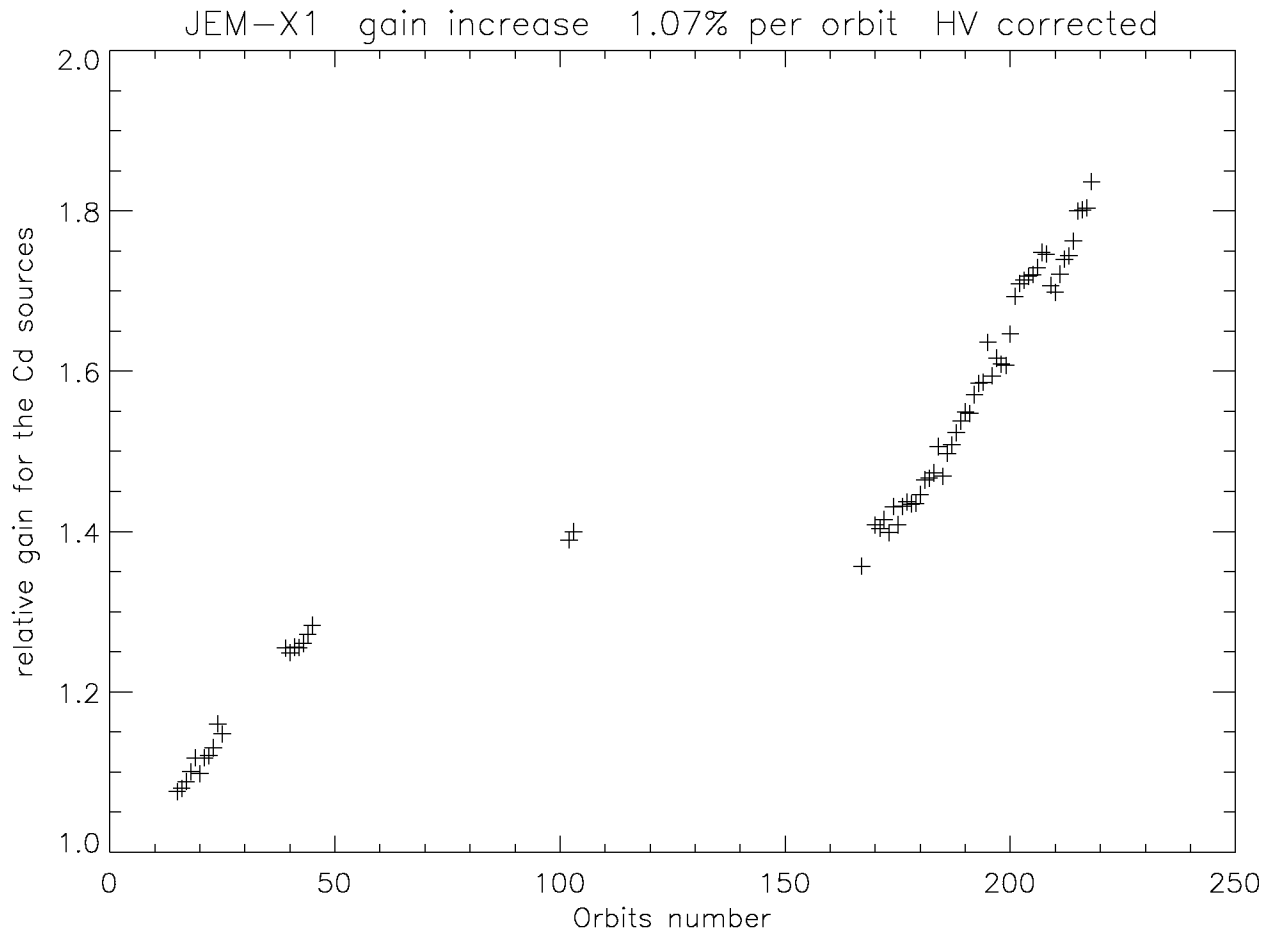
(gain at start-up in 208 influenced by eclipse)



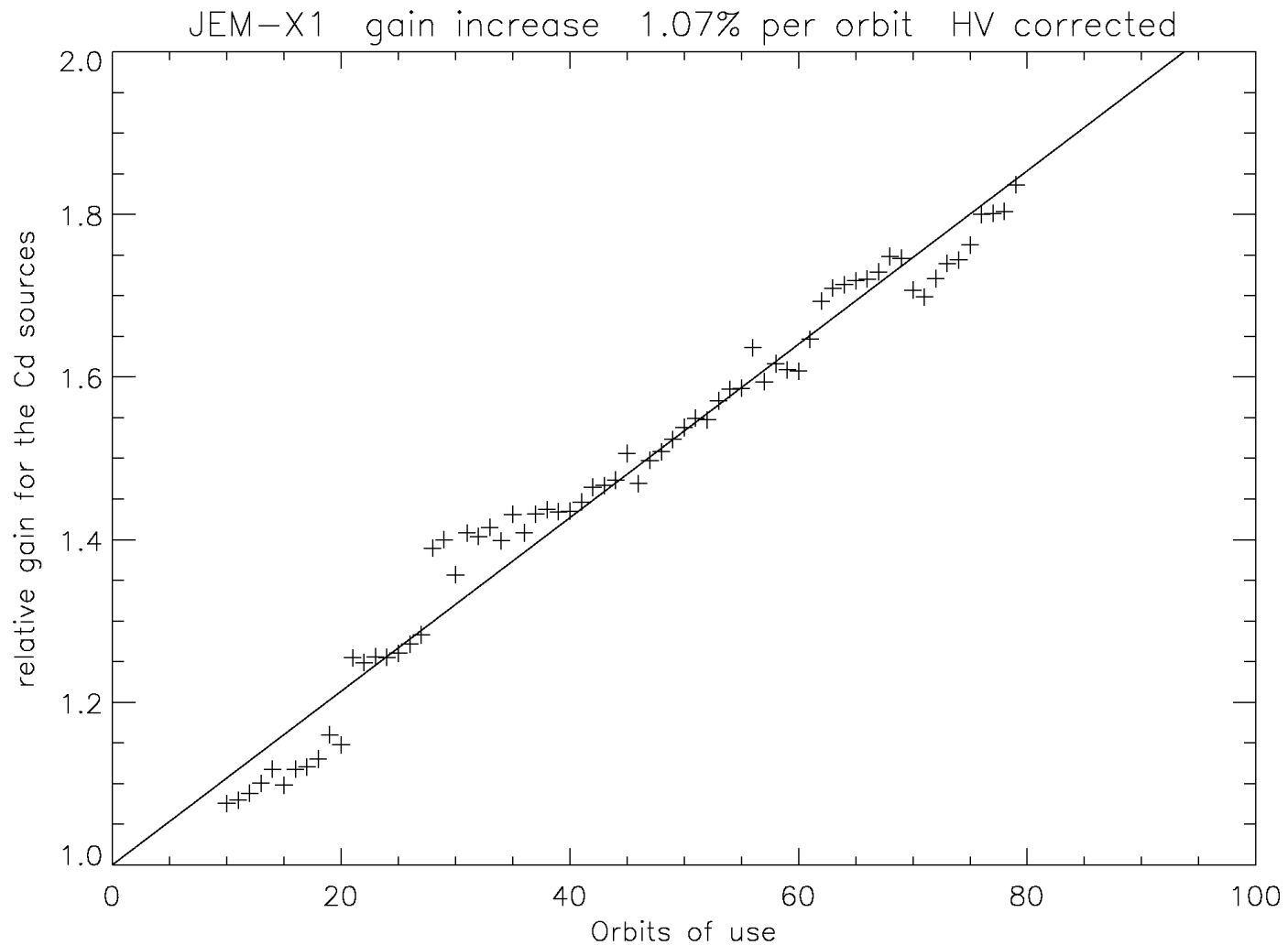
# JEM-X1 gain evolution

- JEM-X1 gain increase seems to follow same trend as JEM-X2, 1% per orbit (glass effect)
- The ageing factor is now 1.8 in JEM-X1 and 2.8 in JEM-X2
- Gain increase during HV off periods (?)
- Energy resolution trend more unclear
- Individual cal sources drift apart

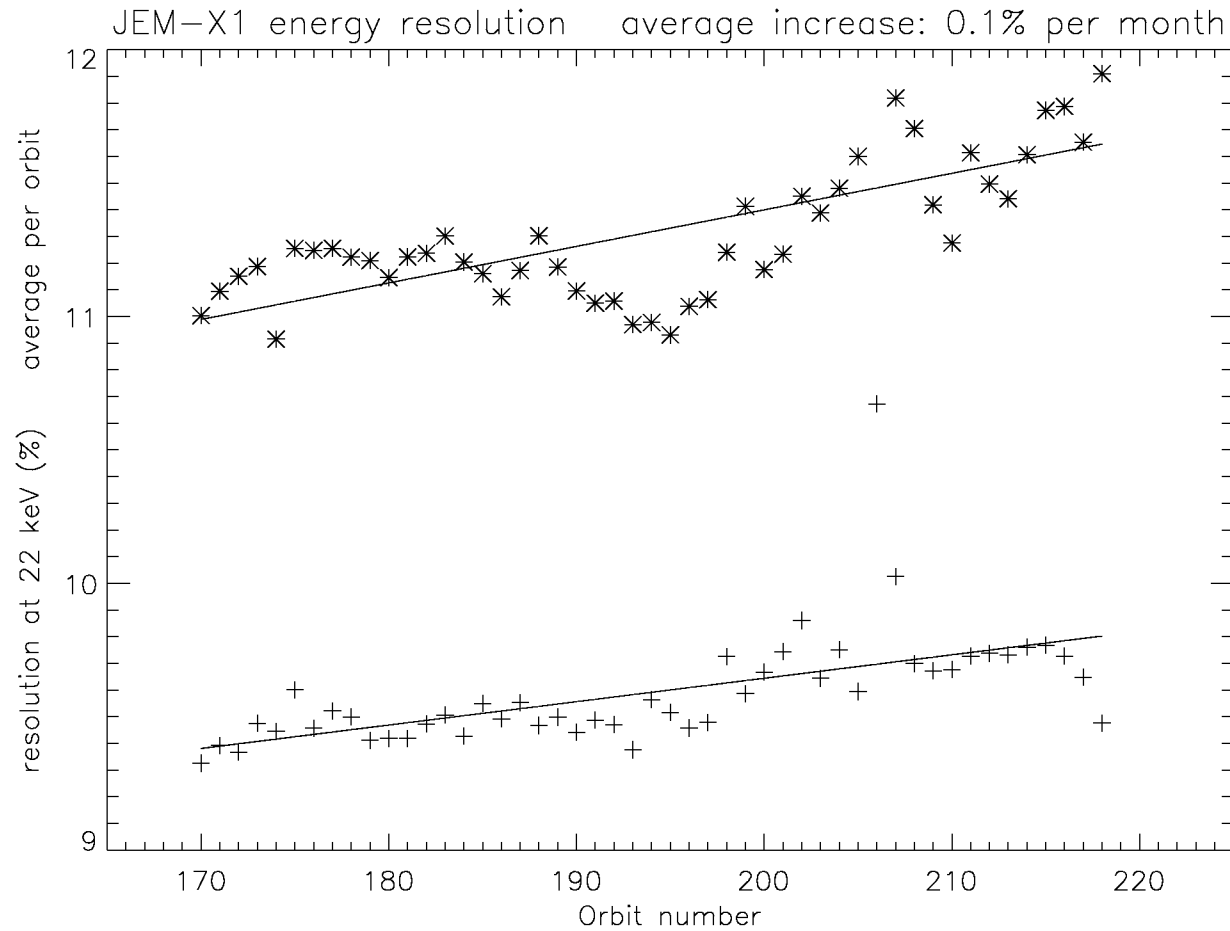
# JEM-X1 relative gain (HV corrected)



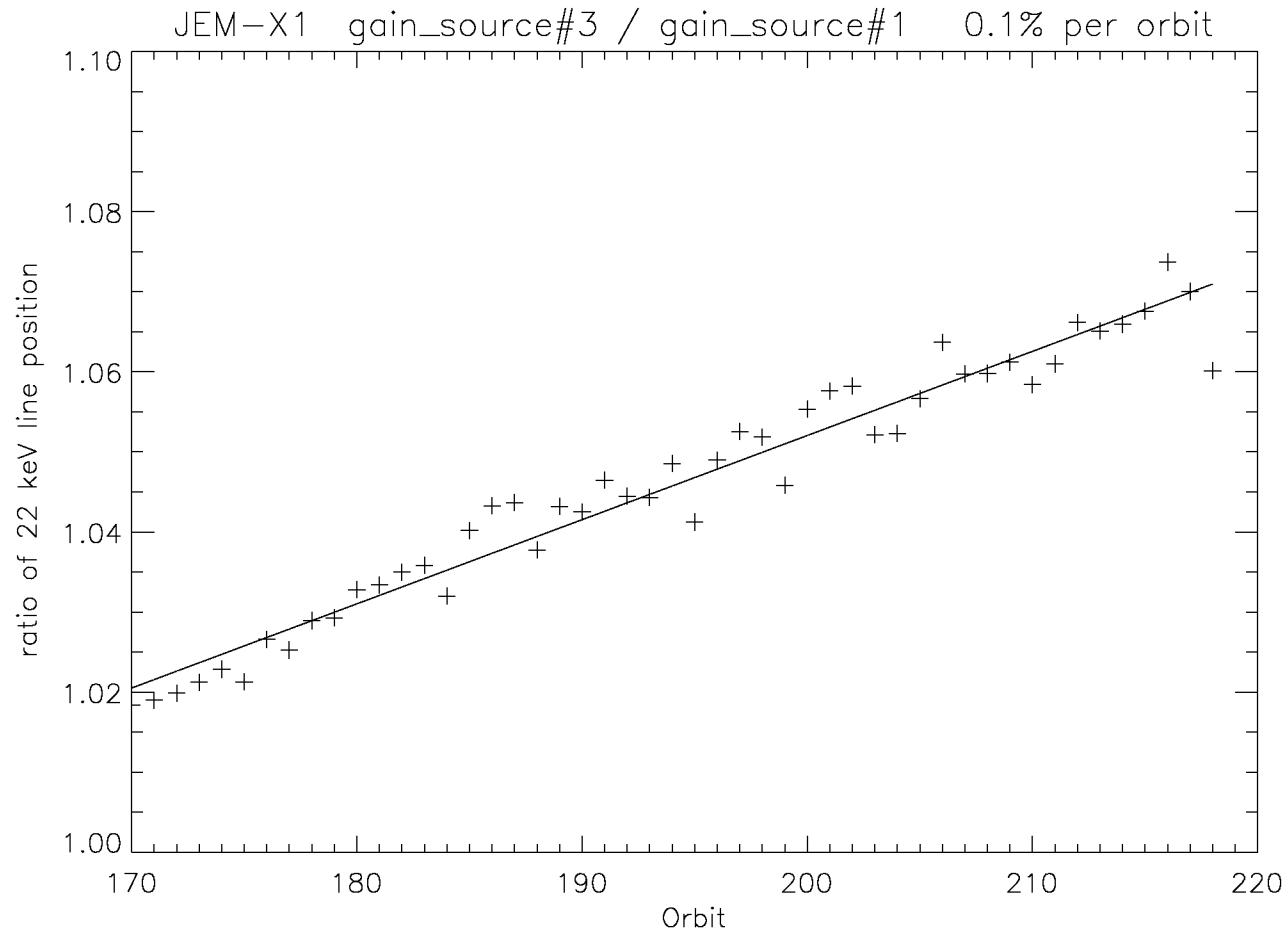
# JEM-X1 relative gain (HV corrected)



# JEM-X1 energy resolution



# JEM-X1 cal source #1 and #3 drift apart by 0.1% per orbit



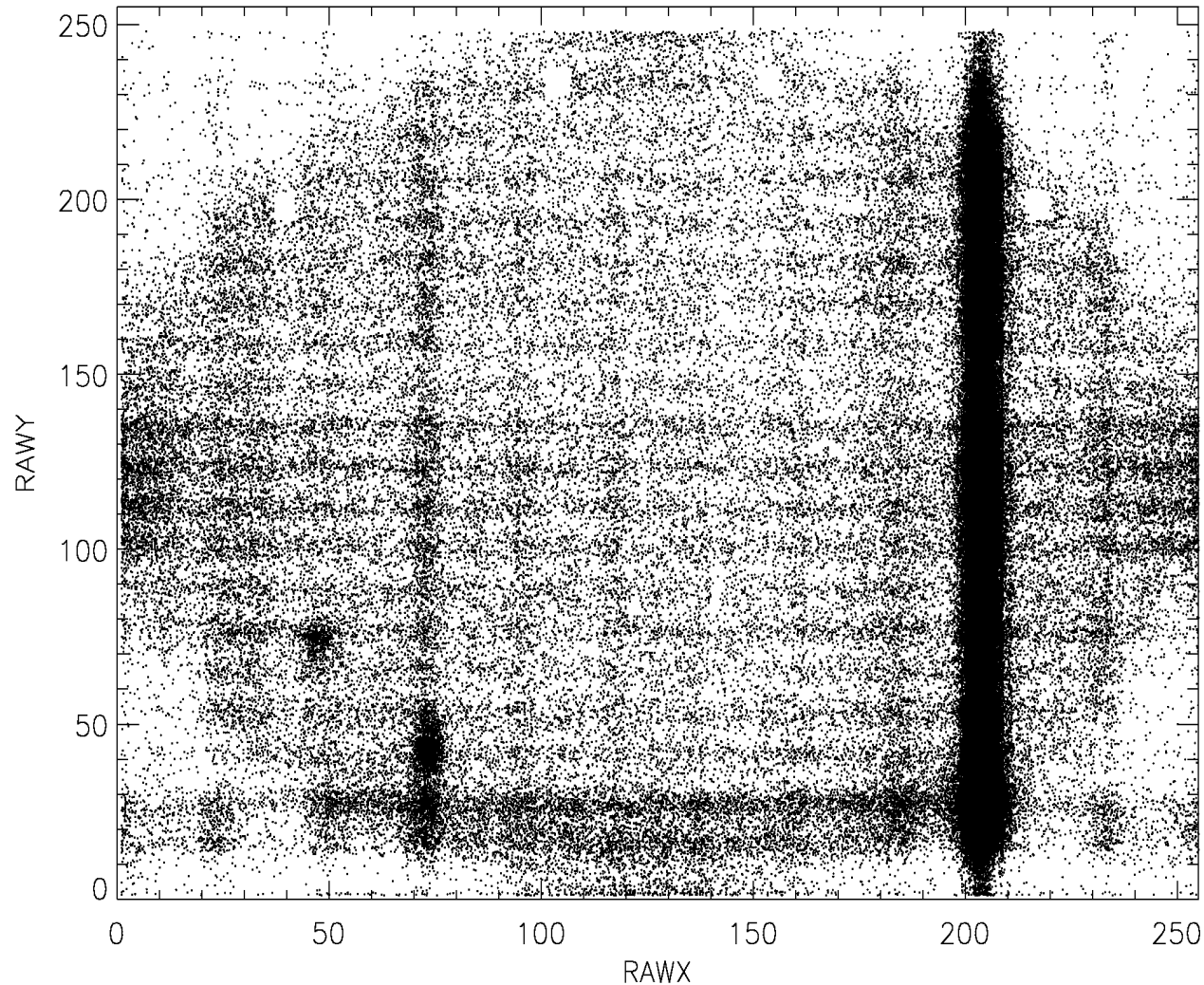
# New Selection Criteria: Hot spots

- New selection criteria (since orbit 170) opens for increases hot spot activity at very low (unphysical energies)
- Handled well by CAO SW
- Usually low impact on TM, but introduces some time variable background
- Implement low energy cut-off on board or on ground



# JEM-X2 hot stripe map (PHA < 50)

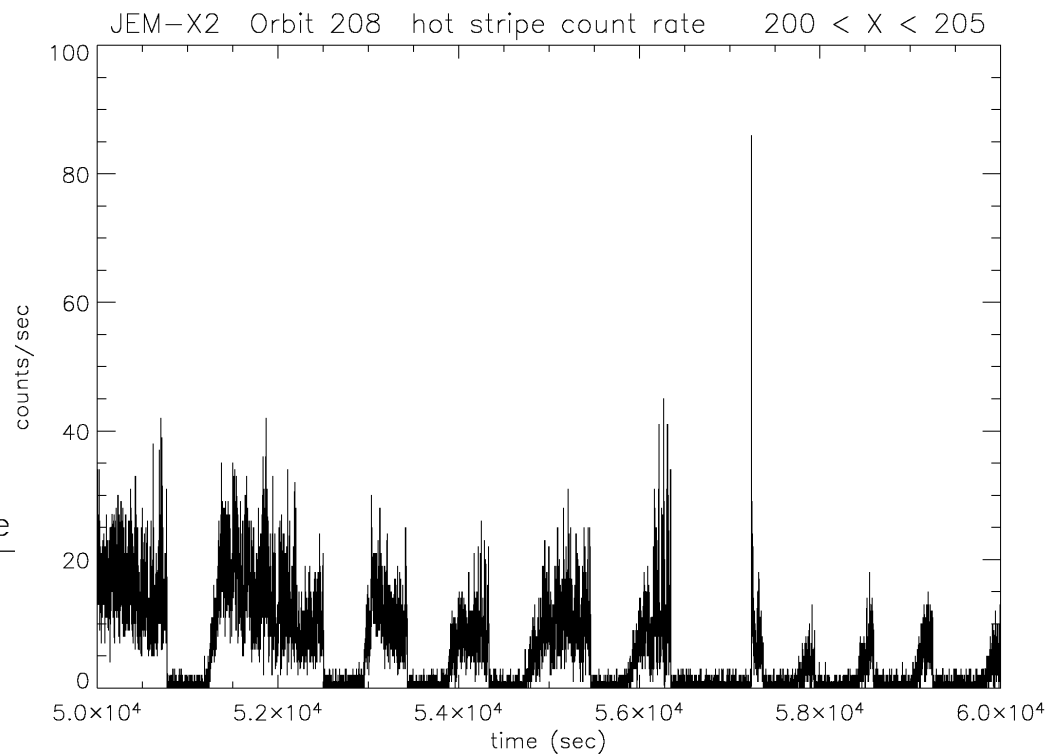
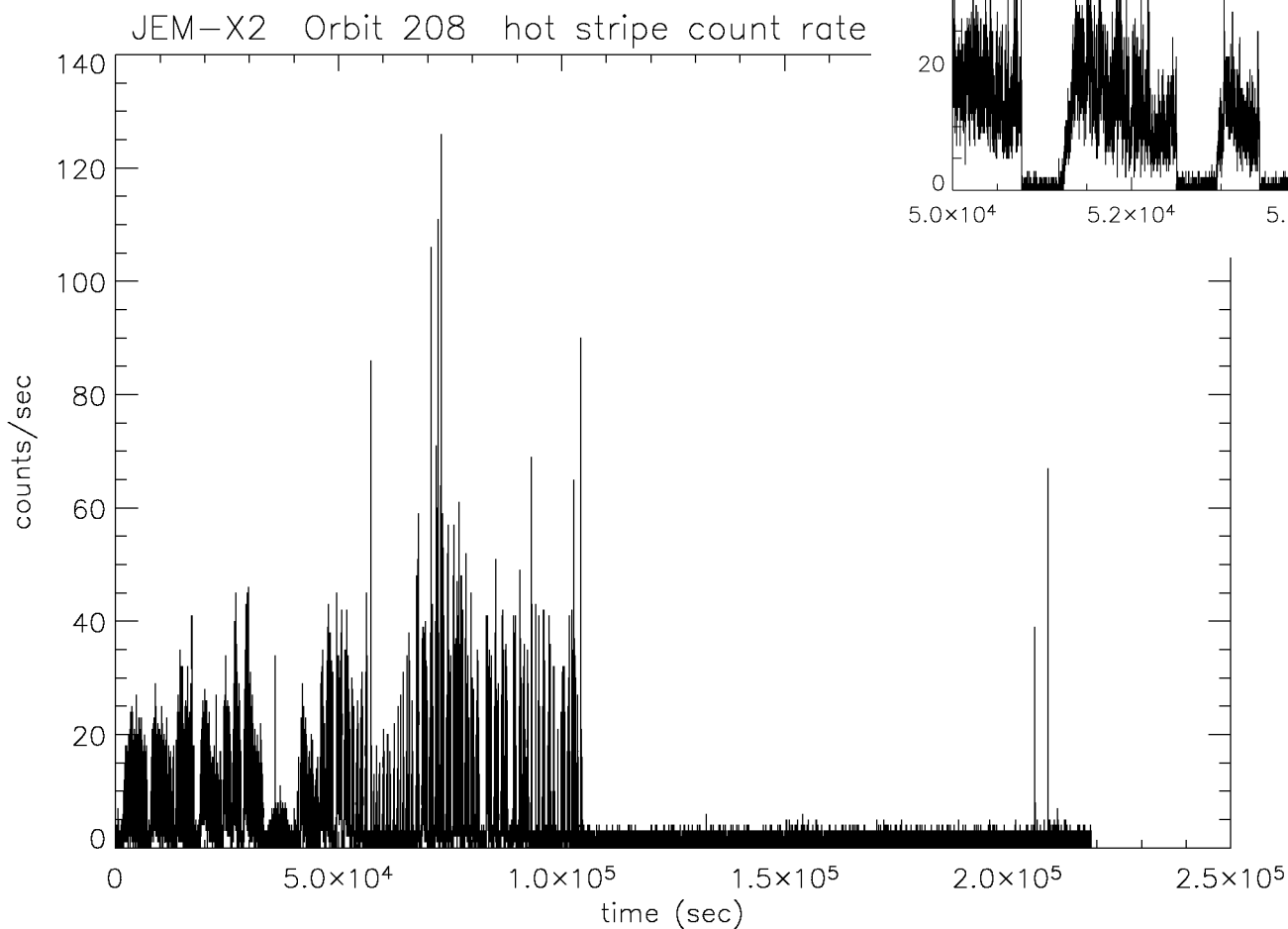
PHA range: 0–49



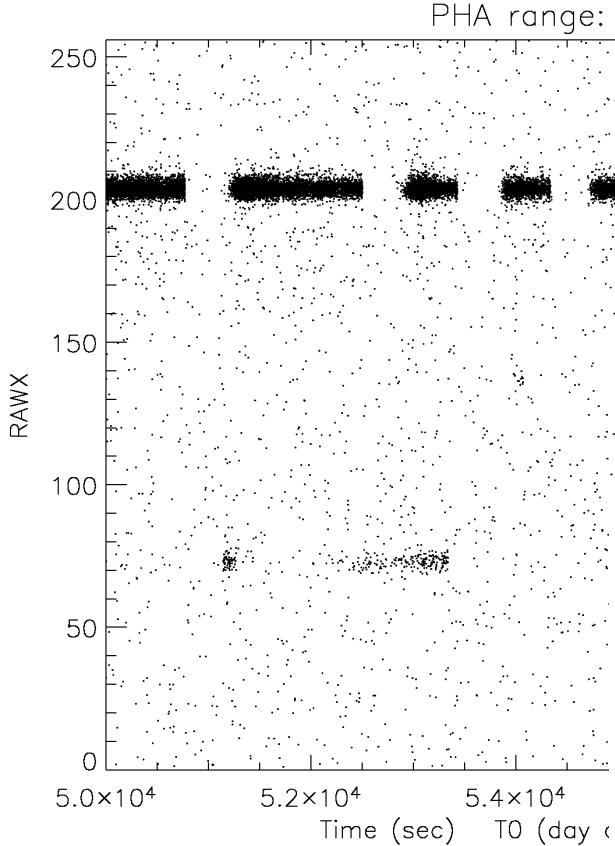
# JEM-X2

## 208

10000 second  
segment →

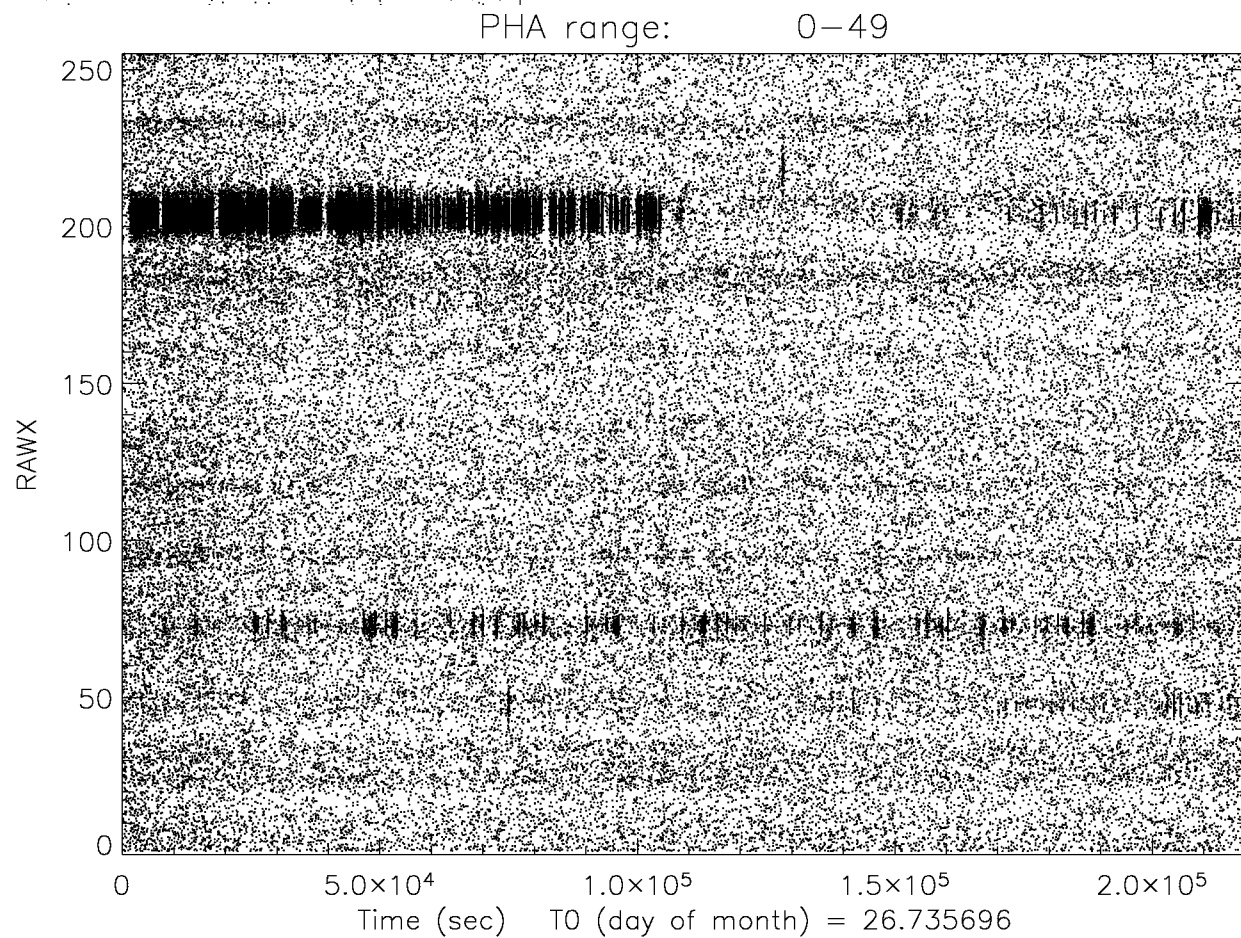


← Full orbit  
stripe count rate



T-X for PHA<50

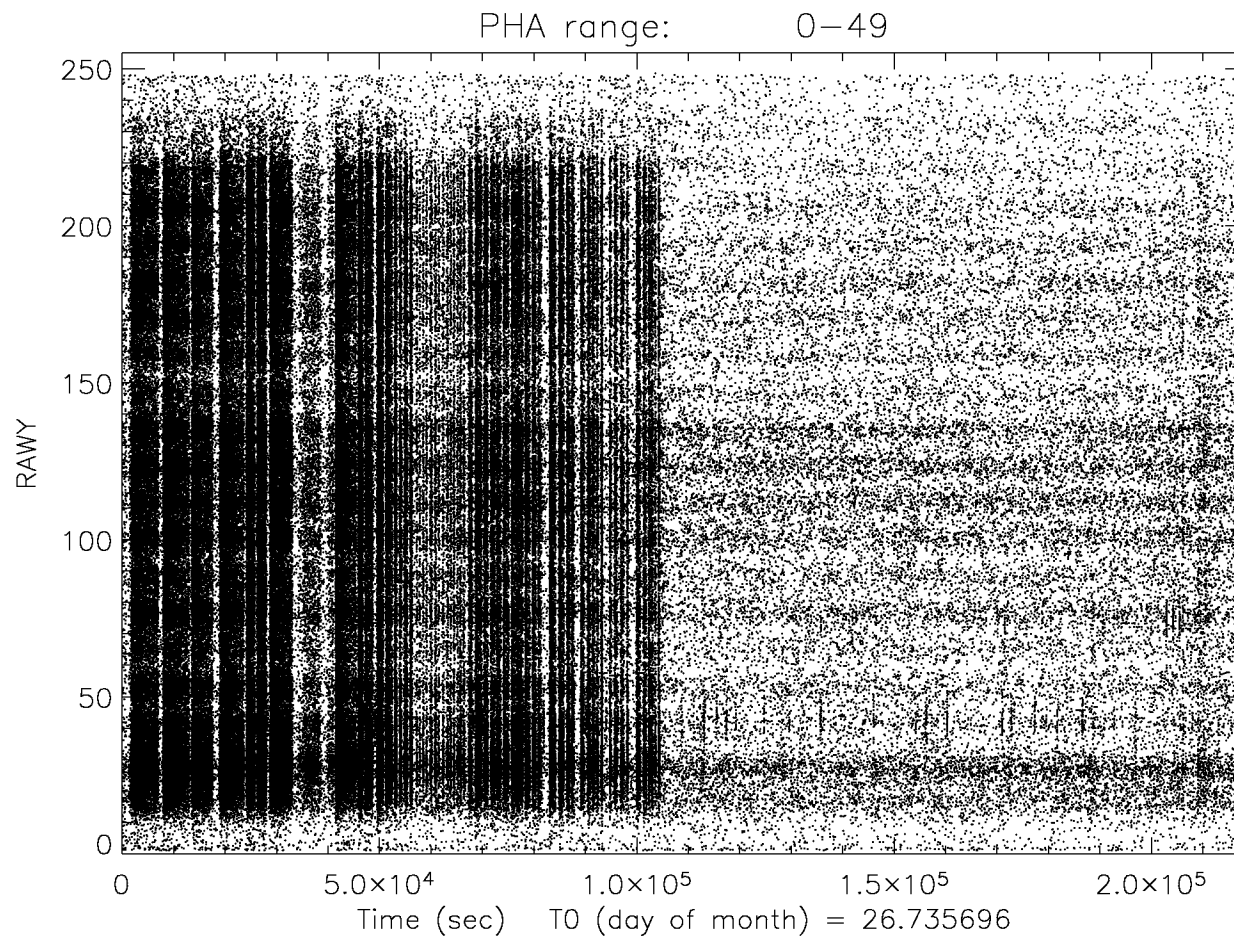
← 10000 second  
segment



JEM-X2 208

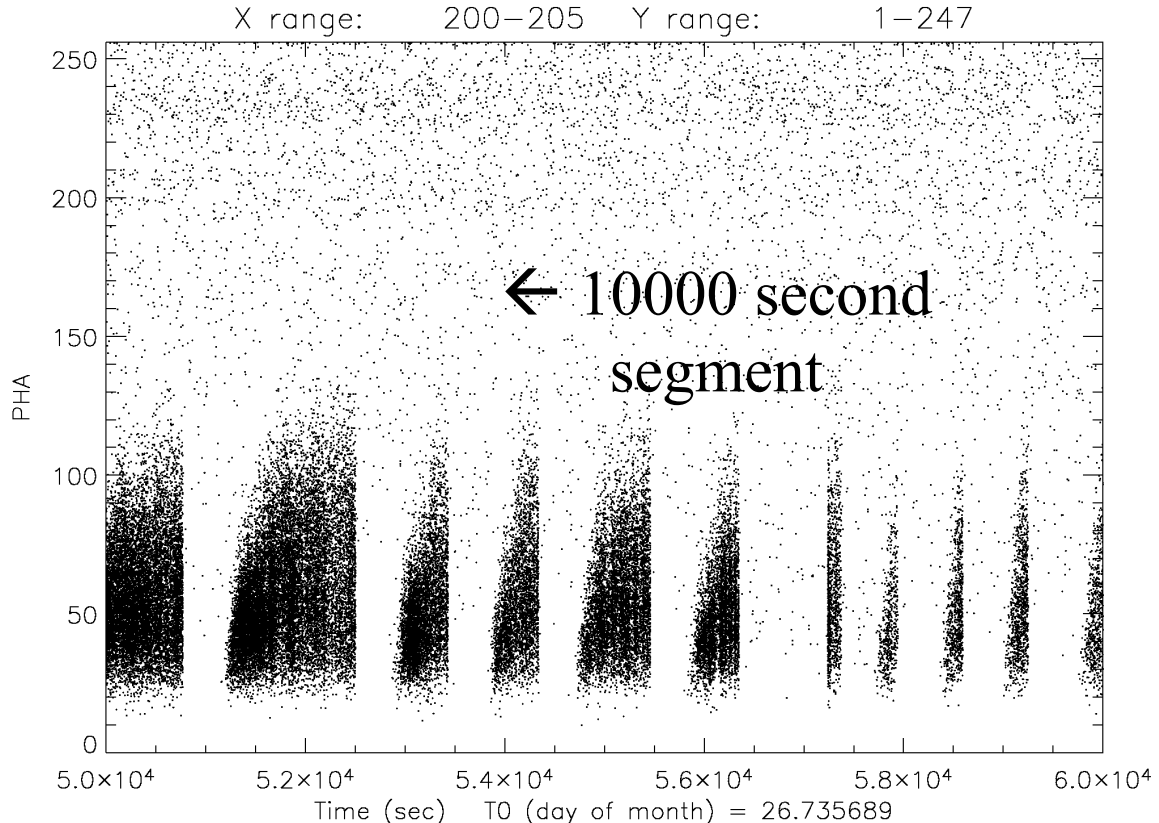
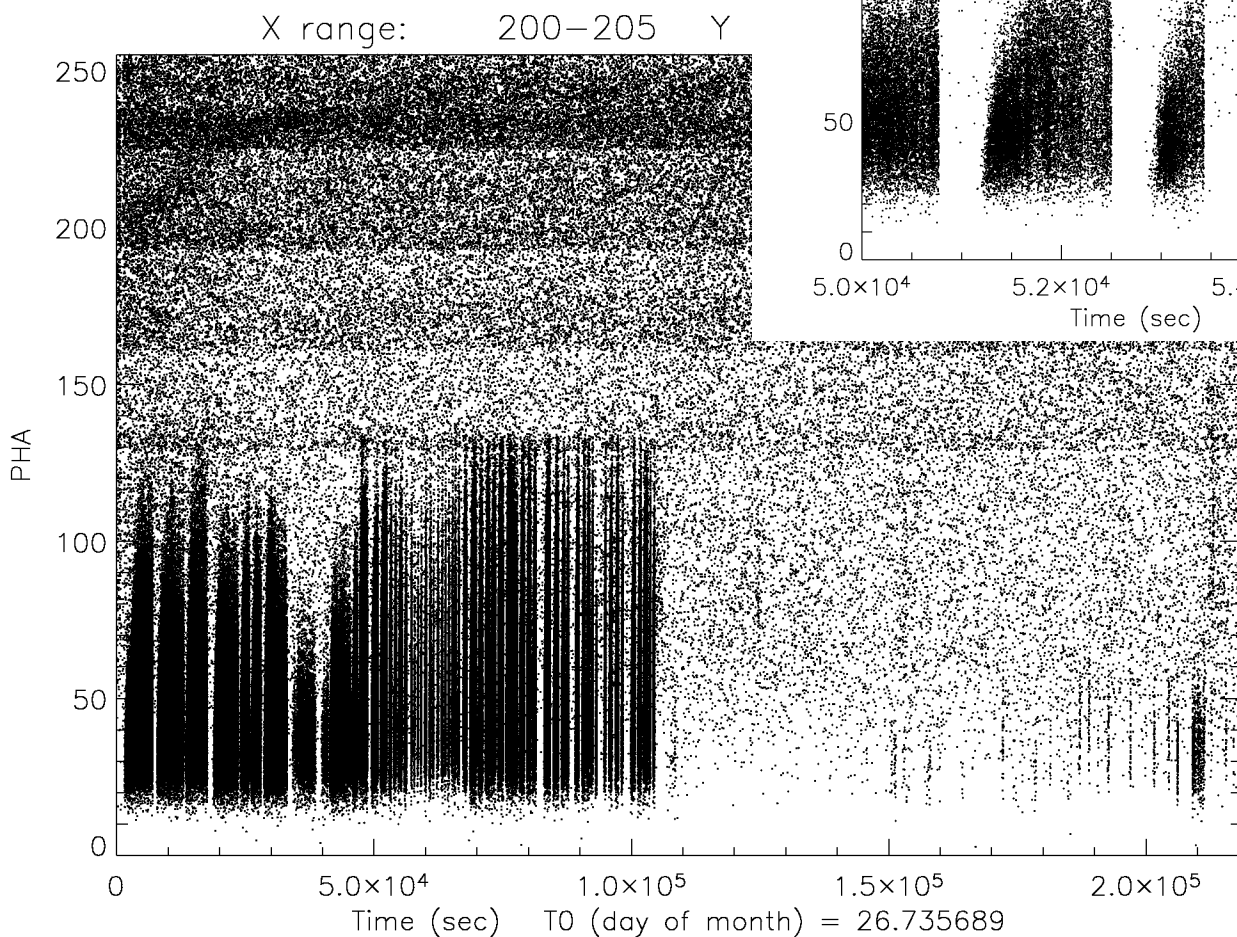
Full orbit →

# Hot stripe, T-Y for PHA < 50



# T-PHA for hot stripe

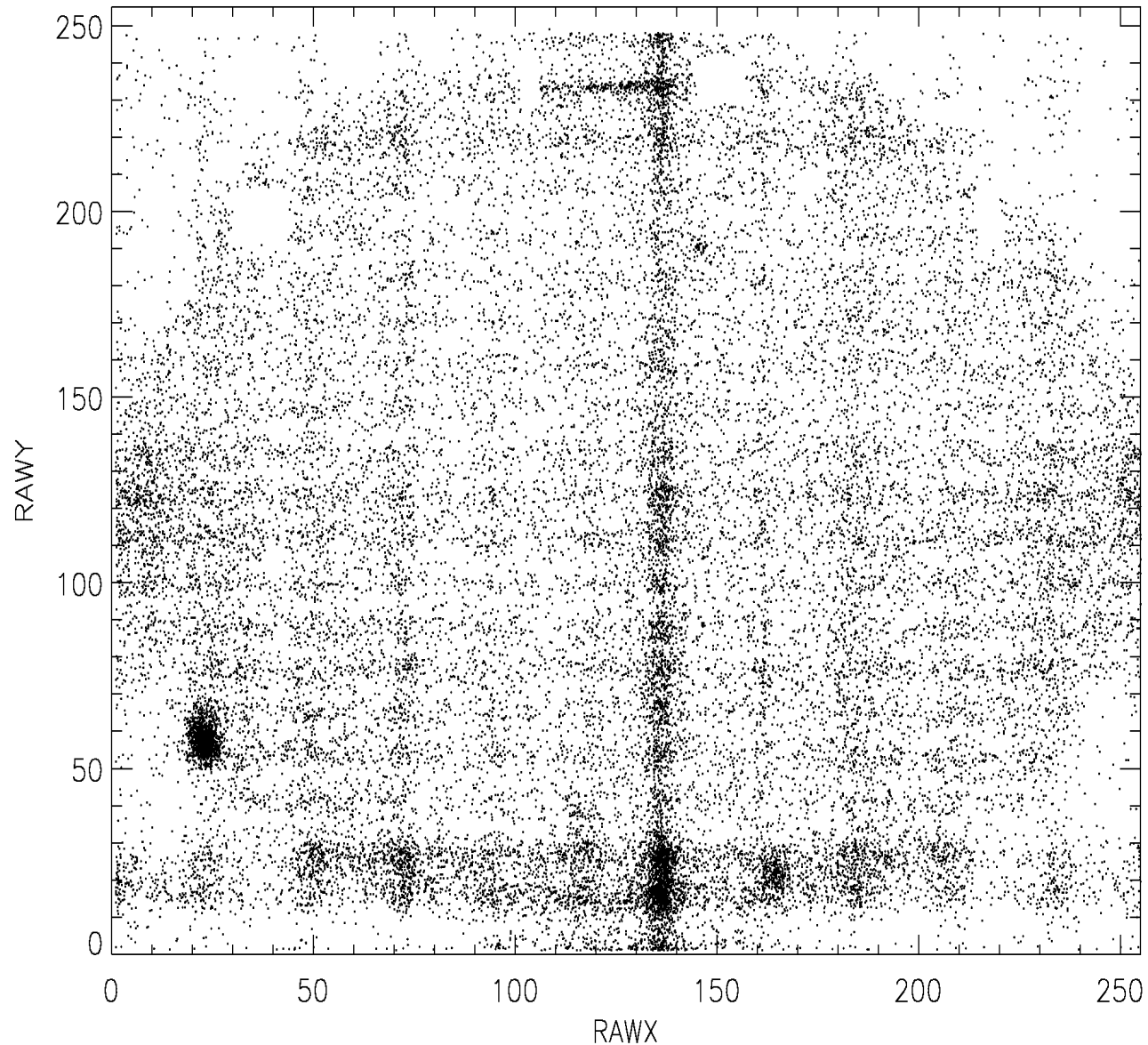
10000 second  
segment →



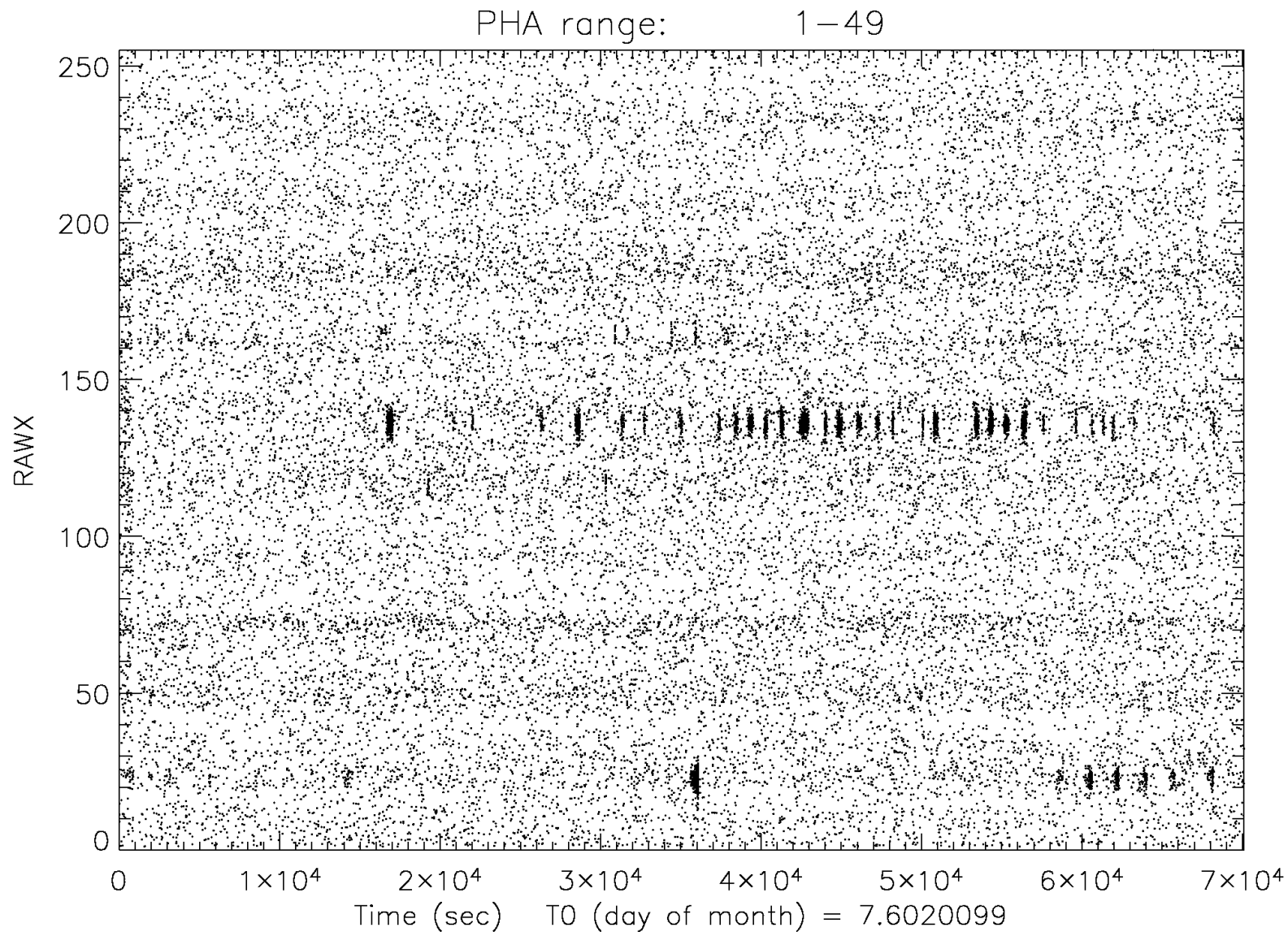
← Full orbit

# JEM-X1 hot spots, orbit 222

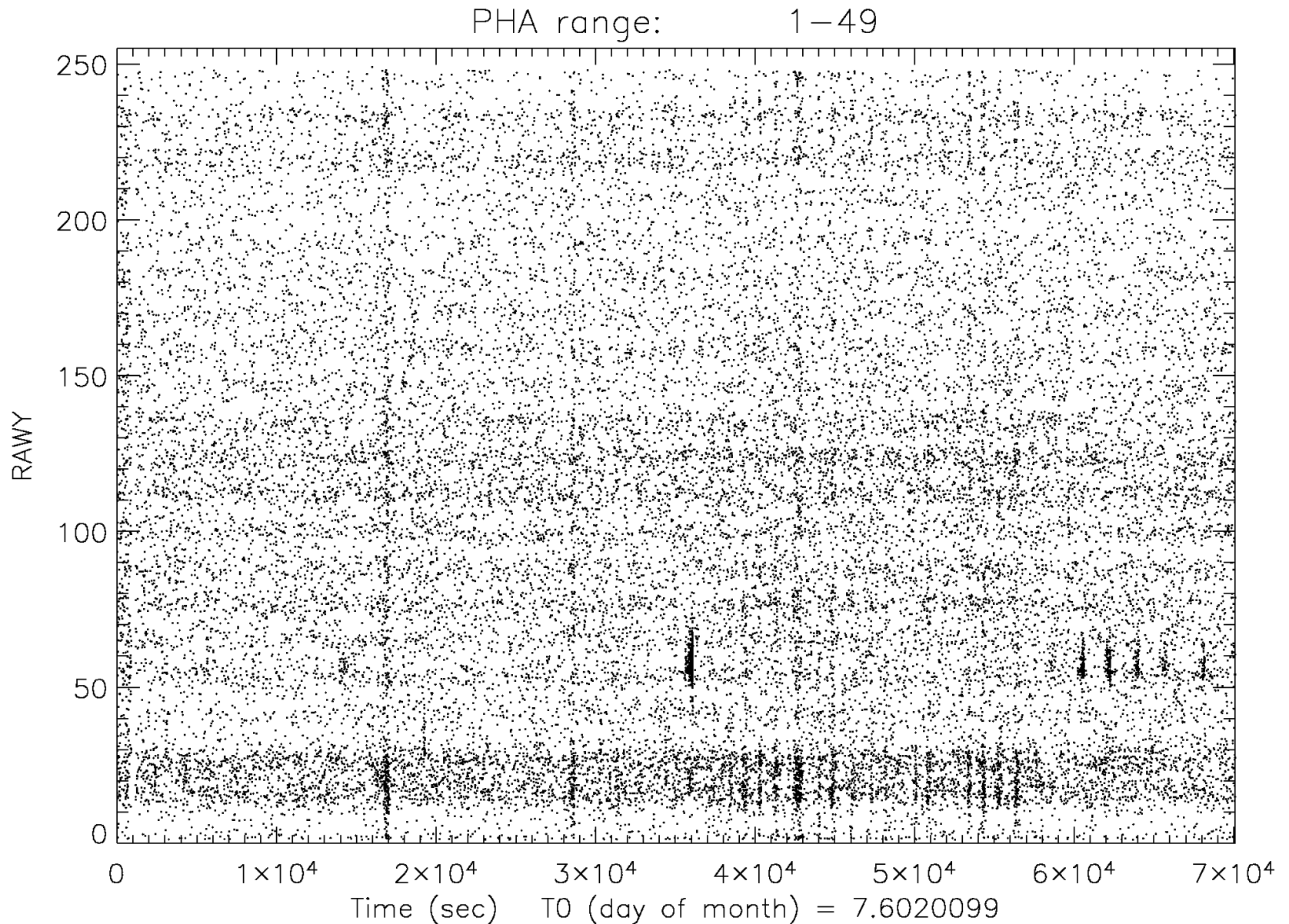
PHA range: 1–49



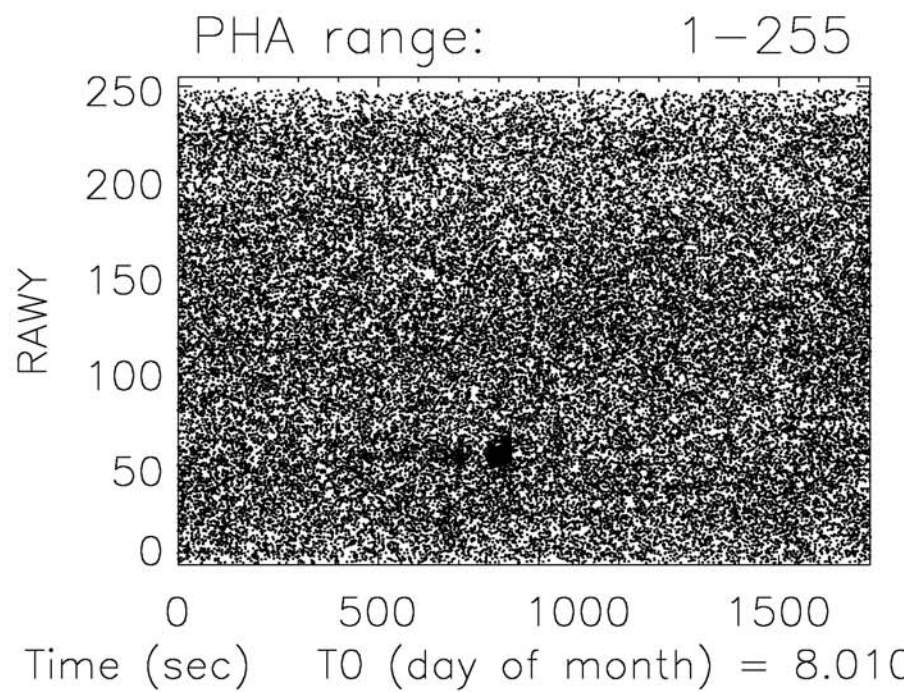
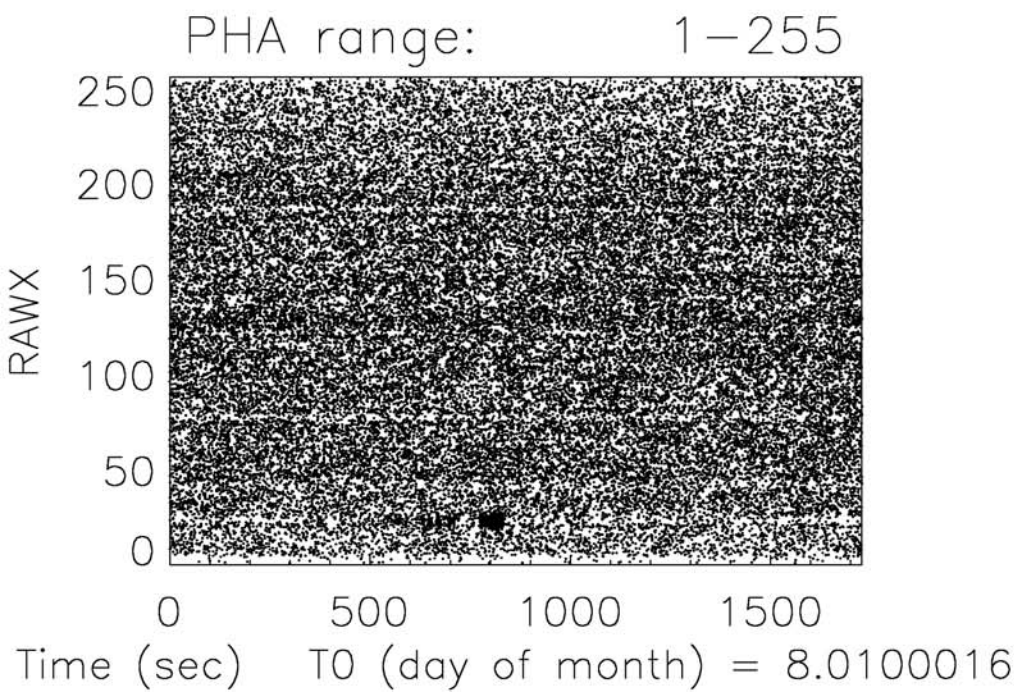
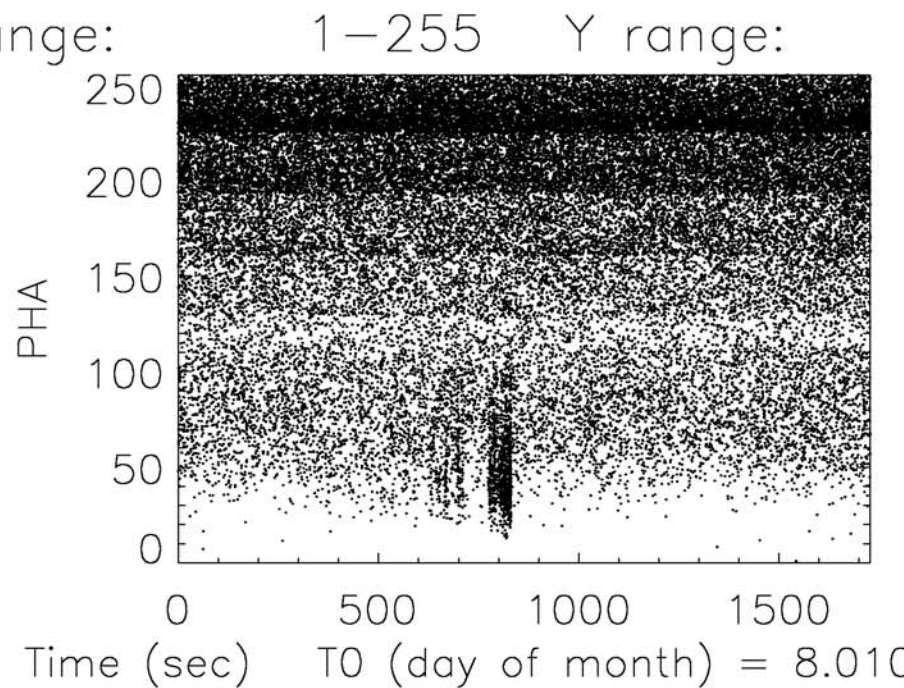
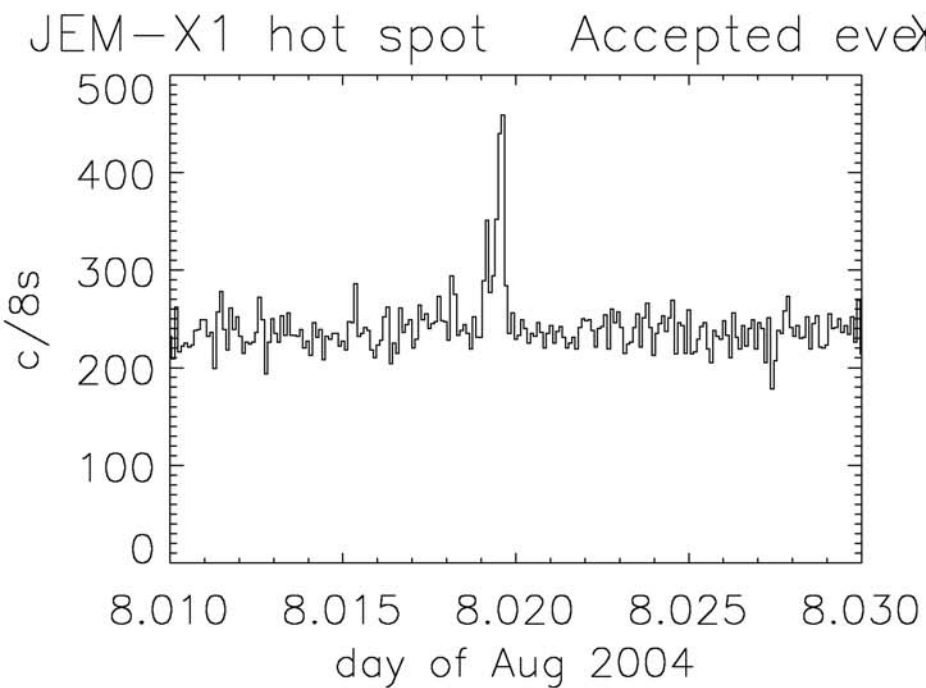
# JEM-X1 hot spots, T-X, 1 day



# JEM-X1 hot spots, T-Y, 1 day





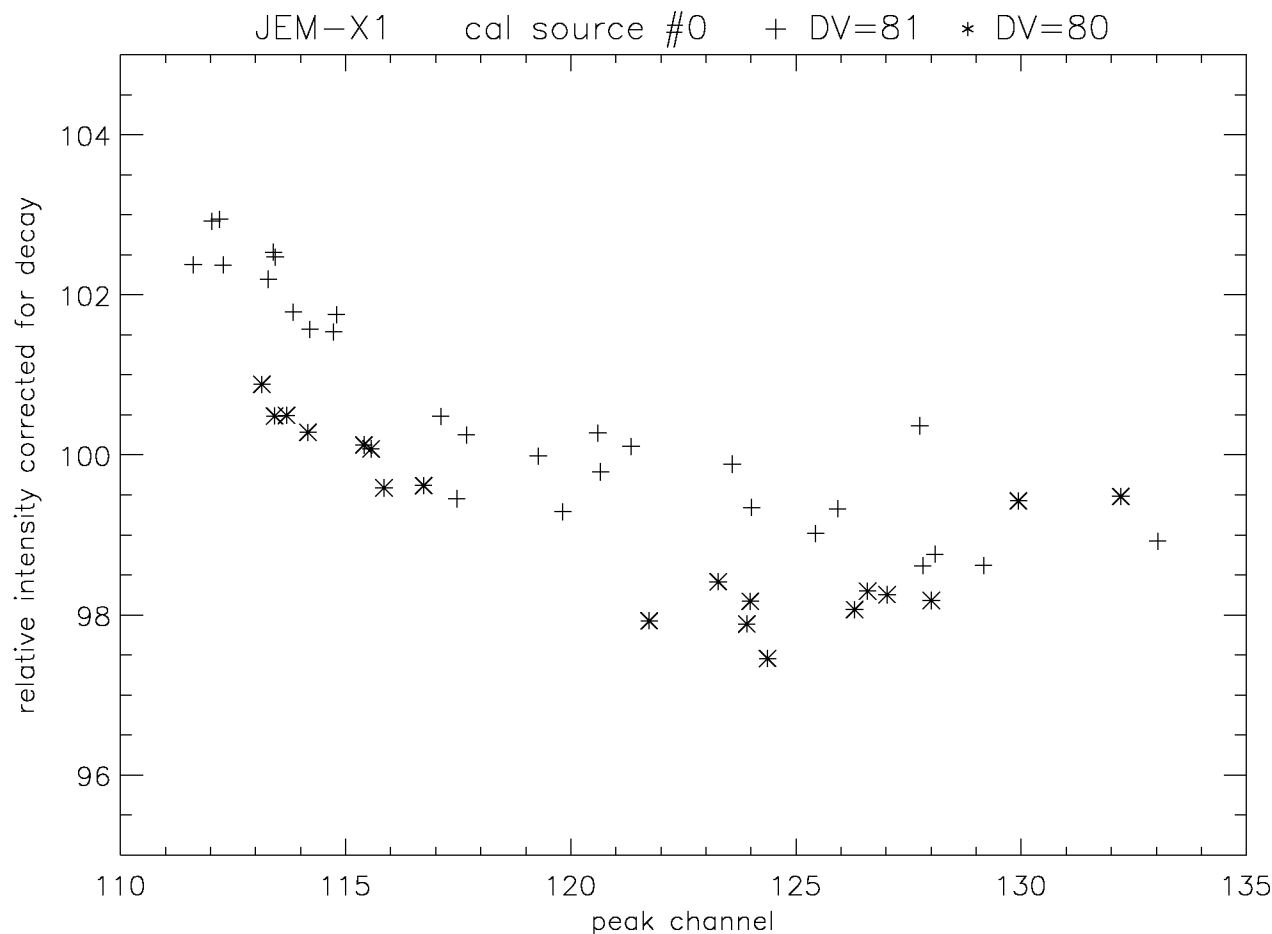


# ”New” Selection Criteria: response kink

- New (since orbit 170) selection criteria introduce a ”break” in the background at raw-PHA=115
- Break is ”fixed”, therefore locally (T,X,Y) gain dependent corresponding to 5-8 keV
- Does it hurt the accuracy of the ARF?

# Response kink?

Cal-source accepted intensity as function of mean position in PHA, 5% effect (orb 170-218)



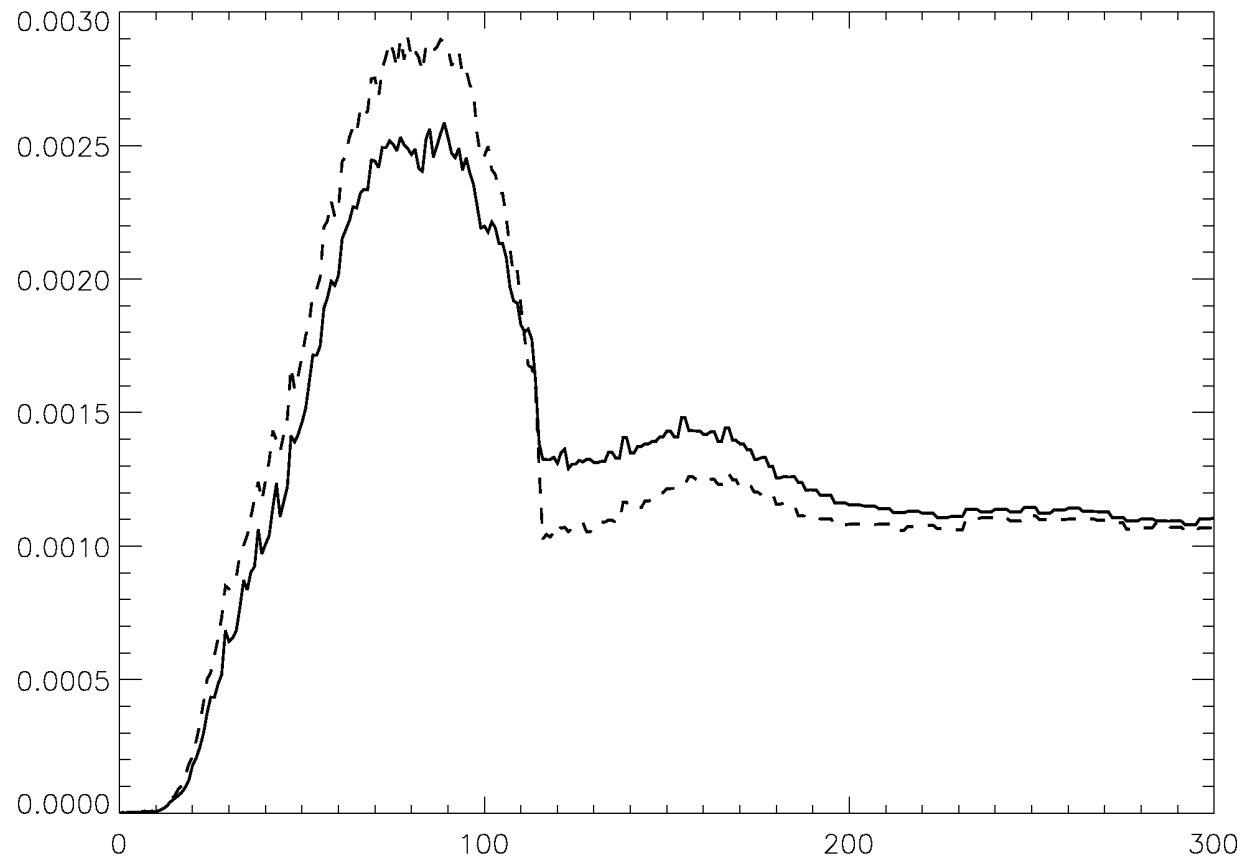
# The "8 MHz, 1 WS" incident

- During automatic onboard recovery after eclipse (orbit 206) an onboard CRC check failed, leaving the DFEE CPU in the start-up 8 MHz-1WS state, instead of 16 MHz-0WS
- This went unnoticed for 1.5 orbits (206, 207 scwin 42) due to low priority of OEM (on-event-message) reporting it
- Effect I: dead time increased by a factor 2.5 (handled by pipeline)
- Effect II: "funny" spectrum at lower energies (not understood, "sample-and-hold" electronics problem??)

# Background at 8 MHz vs. 16 MHz

- PHA background spectra are different at 8 and 16 MHz CPU rate. Why?

NOTE: (this also illustrates the "kink" at PHA=115)



# Operational wish list

- Finer sampling of the vignetting function (will be implemented soon, to some degree)
- Switch off dormant DFEE to operate active unit at lower temperature (briefly tested, under evaluation)
- DPE SW patch to increase alert level of failed DFEE recovery (ready, in the works)
- Experiments with VC setting to check possible gas contamination => better resolution (maybe??)
- Lower energy cut-off onboard to avoid (most) hot spots. DFEE patch (maybe)
- Handling of IREM crashes (DPE patch: no thanks. Disable JEM-X reaction: maybe)

# Conclusions and concerns

- Loss of anode strips is not a concern
- Hot spots is not a serious concern
- Gas degradation may be checked by drift voltage
- JEM-X micro-strip plate aging **is still a concern**
  - Eventually resulting in:
    - Reduced energy resolution (intrinsic + spatial variations)
    - Potentially rate dependent gain

# Conclusions (II)

- Until we see the "End of Mission" sign, the "One JEM-X only" strategy ensures continued support of INTEGRAL mission
- Operating at lower temperature with the dormant JEM-X DFEE off may slow down the ageing somewhat
- Continue Xe line monitoring as end-to-end test of performance and processing