# JEM-X Gain Calibration and Evolution

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SDAST meeting 38

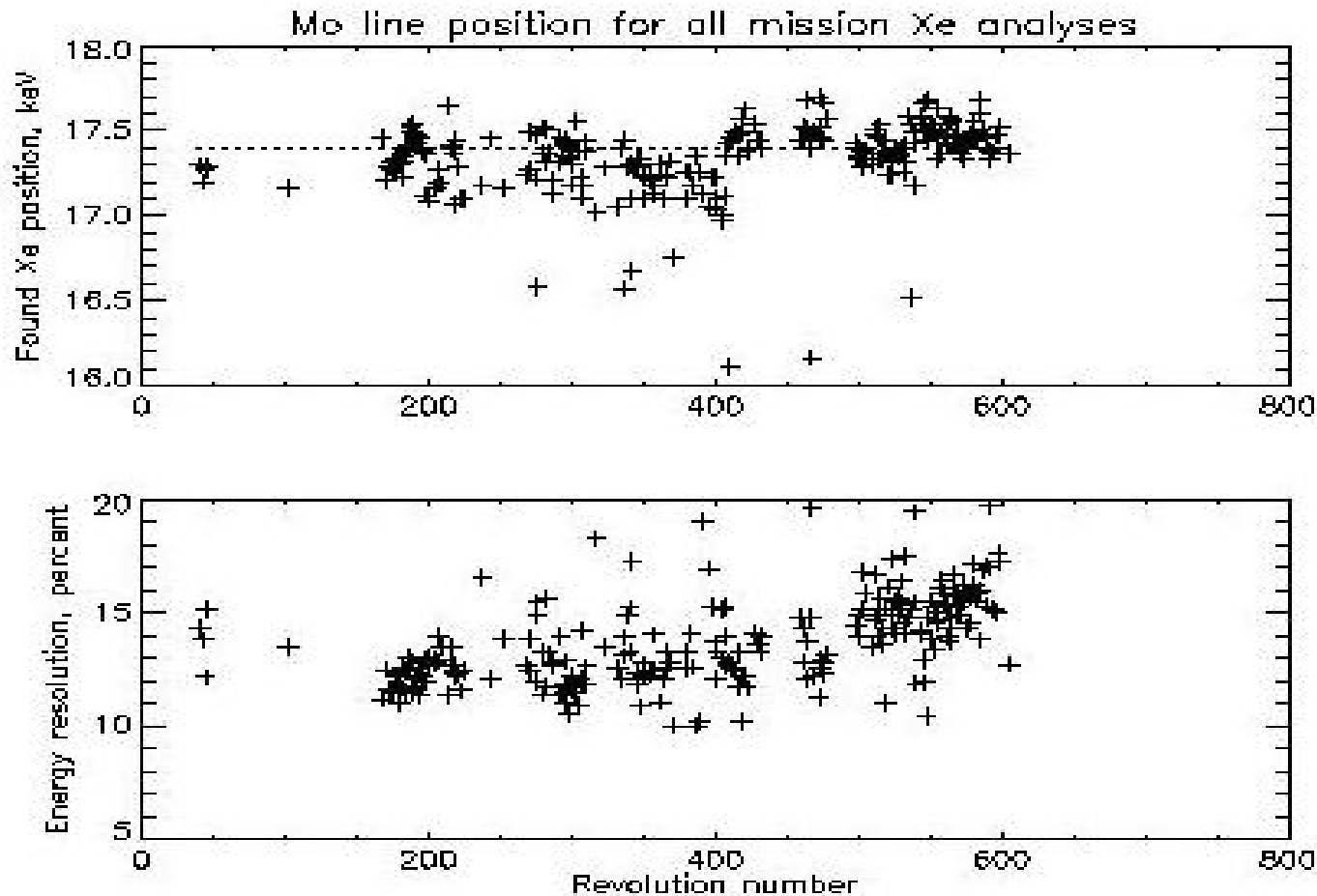November 28th-29th 2007, DNSC, Copenhagen

# Xe Line Analysis and Gain Aging

- Xe line analysis performed on every available science window for each revolution
- Xe line analysis performed on summed spectra for each revolution
-  With the use of reference channels we can keep the average Xe position between 29 and 30 keV
- For JEM-X1 we have 14 IMOD epochs
- For JEM-W2 we have 13 IMOD epochs
- JEM-X1 energy resolution has deteriorated from 9% to 14%
- JEM-X2 energy resolution deteriorated from 10% to 12%
- JEM-X2 gain aging began to reverse during dormant periods
    - Position of Xe line dropped very significantly
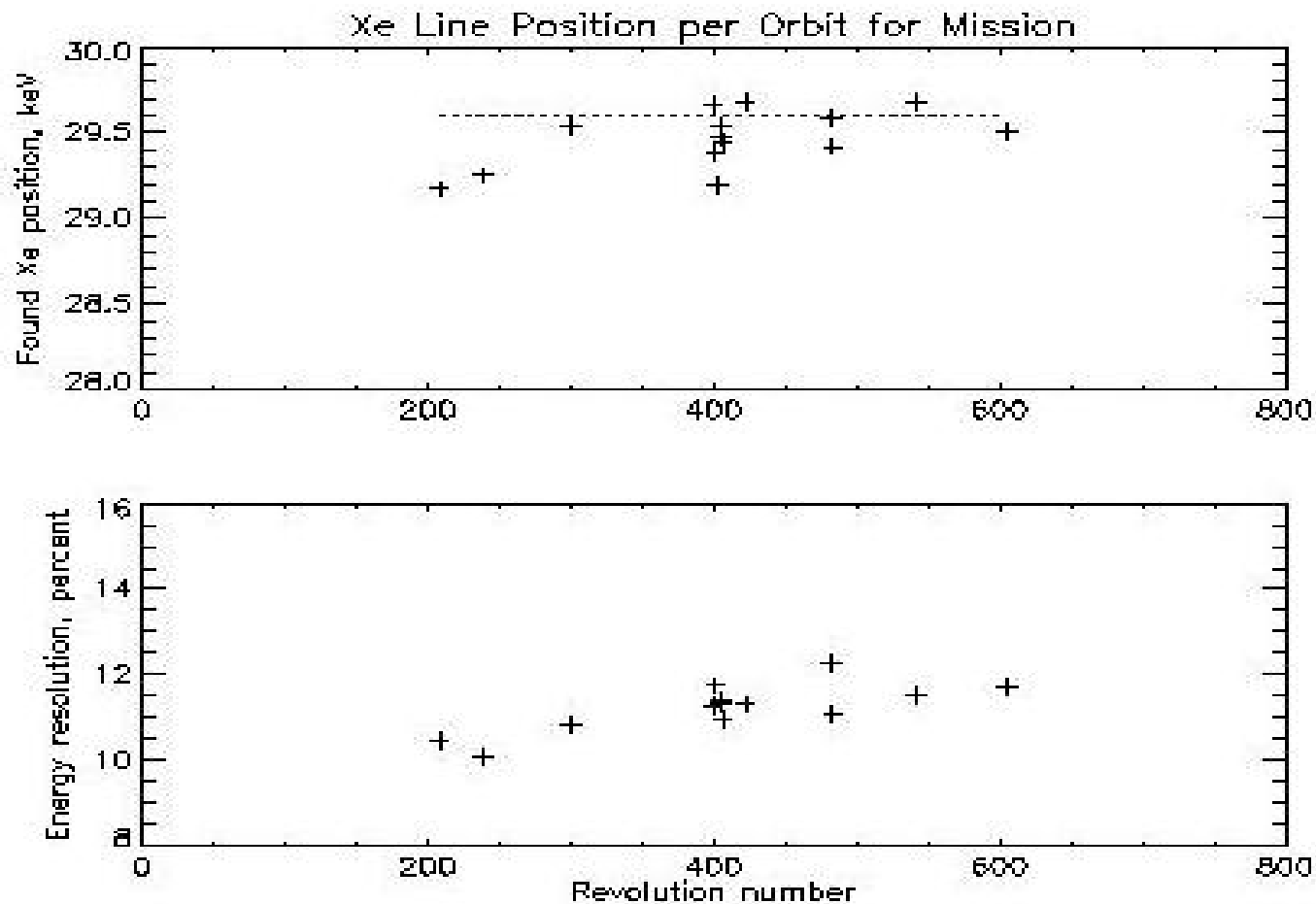    - New IMOD epochs added to make new reference channels

# Xe line evolution for JEM-X 1
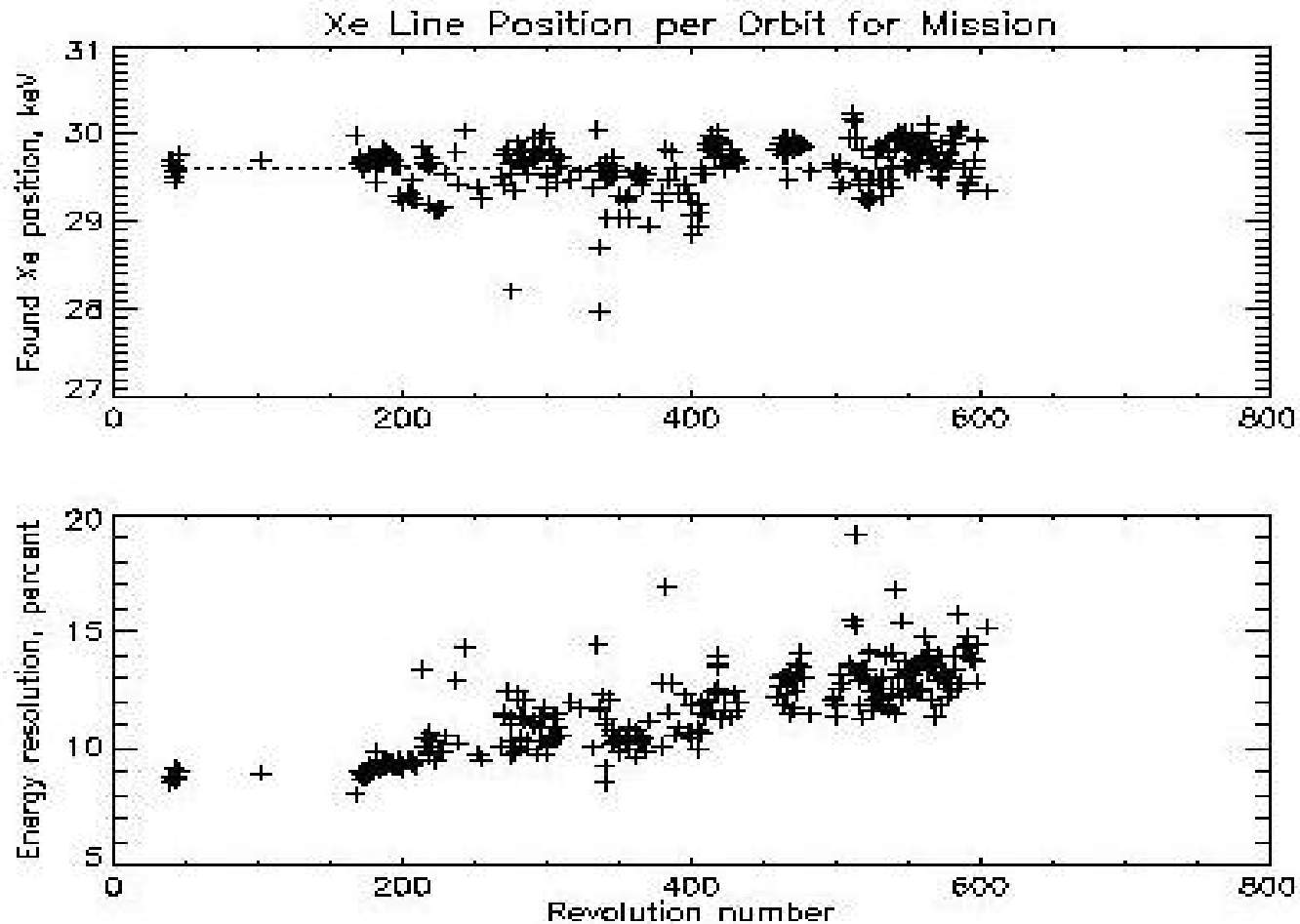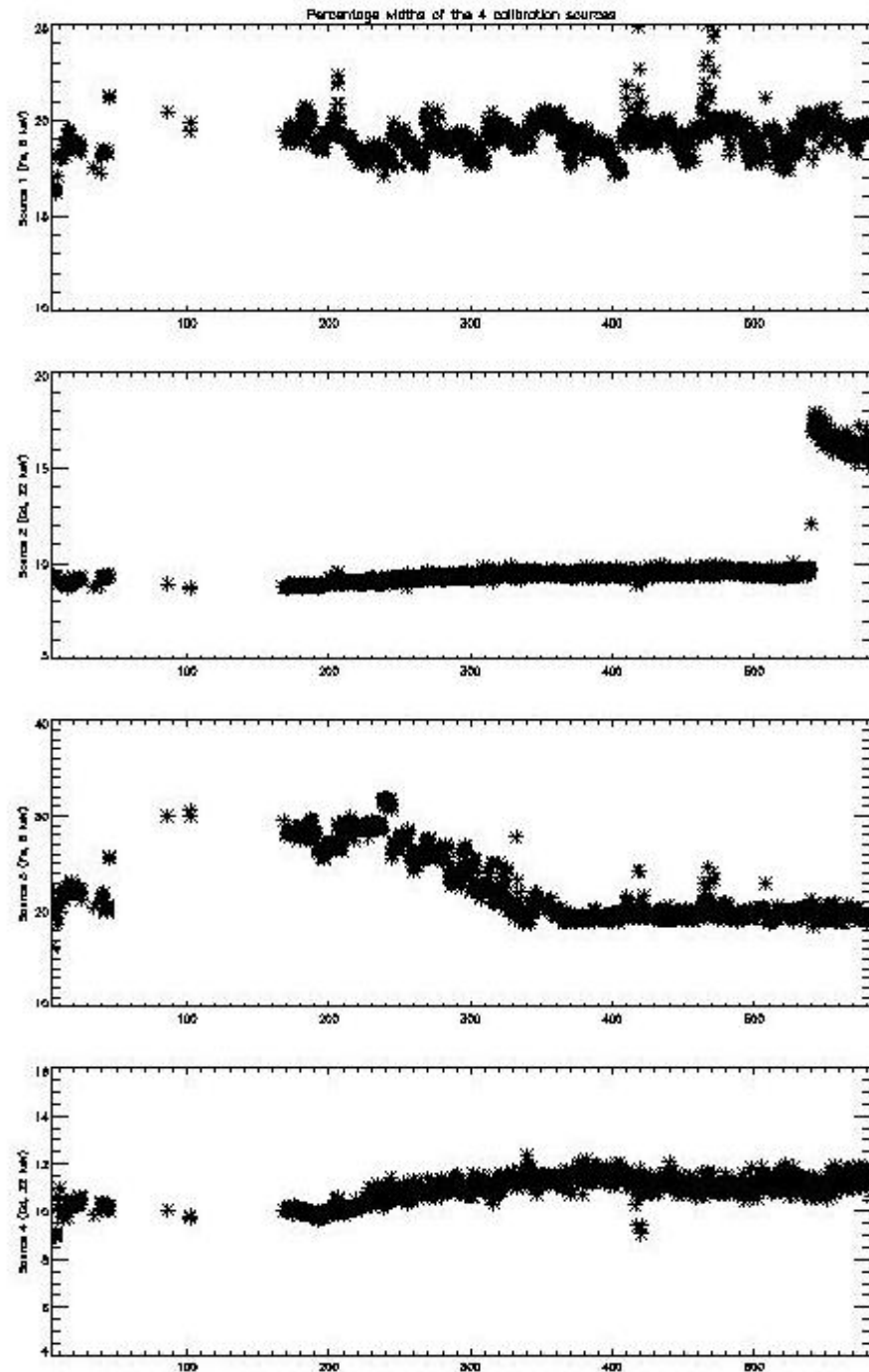
# JEM-X1 Molybdenum Line Position



Mo line position for all mission Xe analyses

# JEM-X2 Xe line Position

Percentage widths of the 4 calibration sources

JEMX-1
Calibration spectra
 widths:
Every point on detector
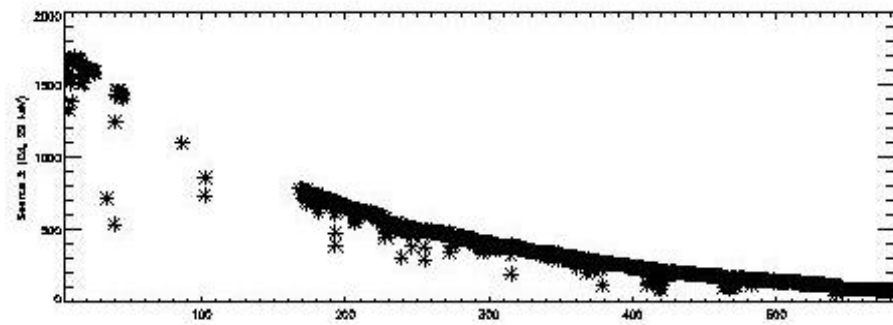plate evolves differently

# JEM-X1

Calibration source
strengths:

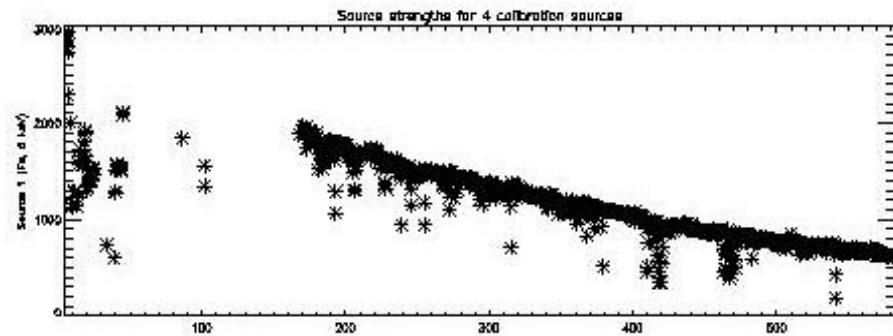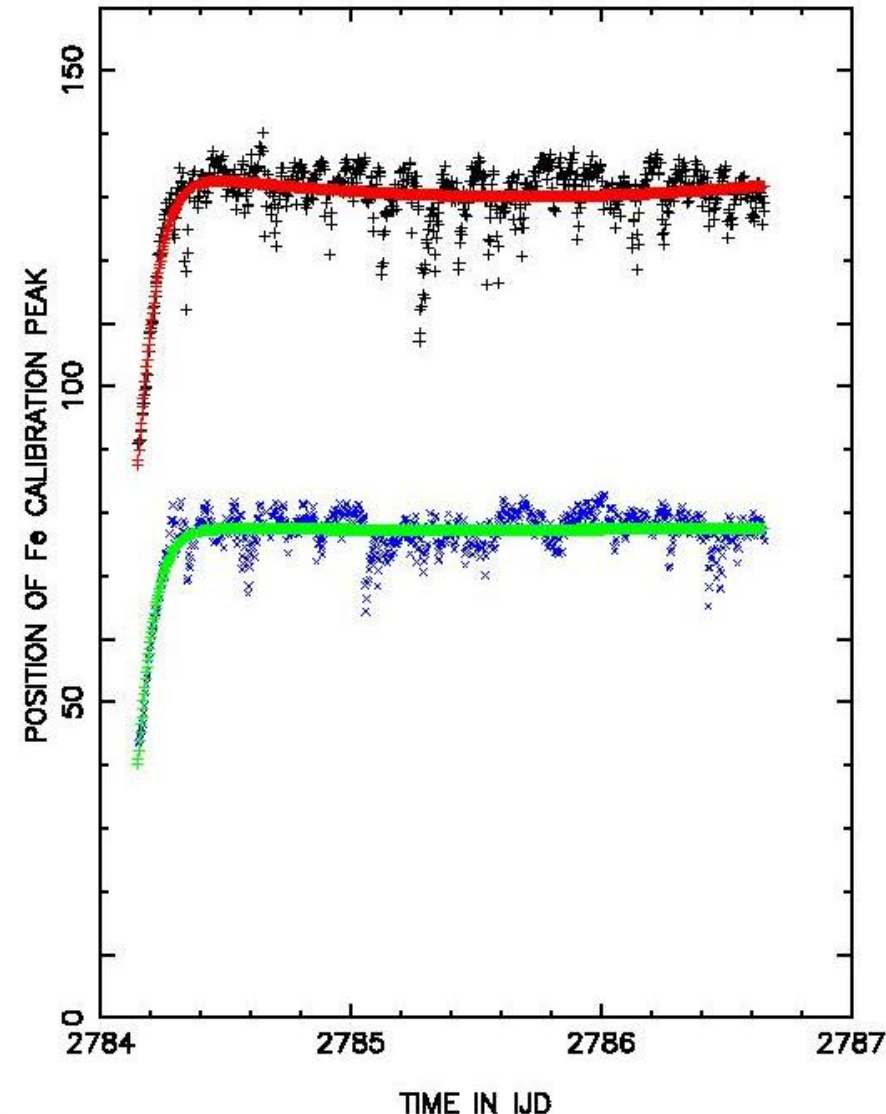- Summed spectra used
- Strengths rev. 170
  - Source 1: 2000
  - Source 2: 800
  - Source 3: 1400
  - Source 4: 300
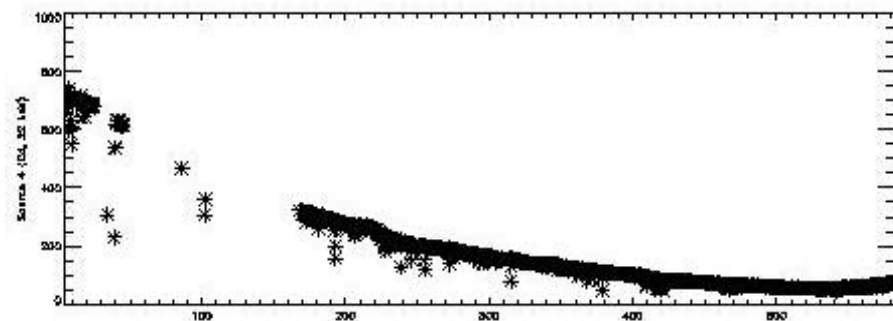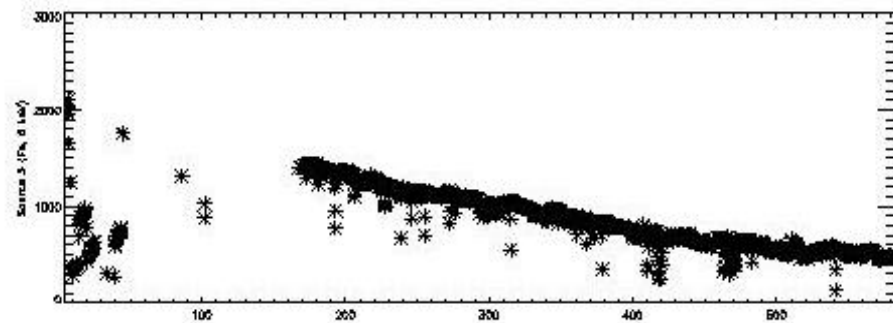
# IC Gain Tables for Difficult Revolutions

- Good revolutions look like this
- Good smoothing
- Some initial settling
- Xe line settles within 29-30 keV
- Slight temperature effect

Xe line postion evolution unit jemx1: orbit 0591



POSITION OF Fe CALIBRATION PEAK

TIME IN IJD
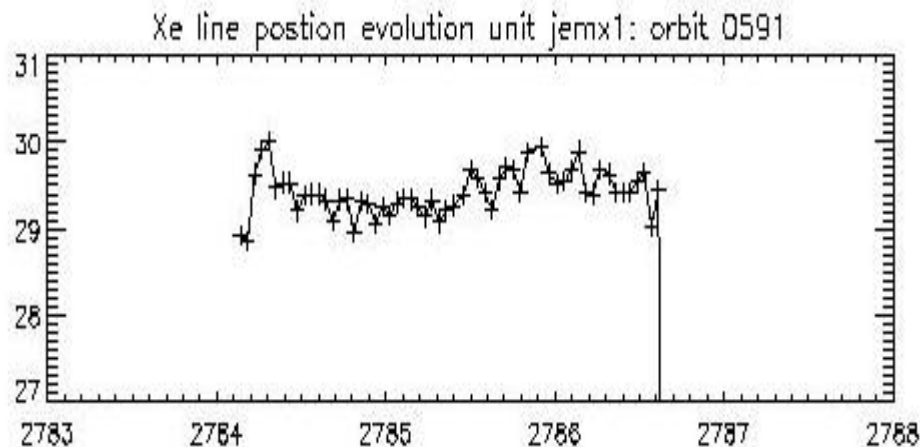
# Bad Revolution
## Example 1: JEM-X2 605

- Gain history table too sparse
- Linear interpolation used
- Xe position VERY noisy



Xe line postion evolution unit jemx2: orbit 0605
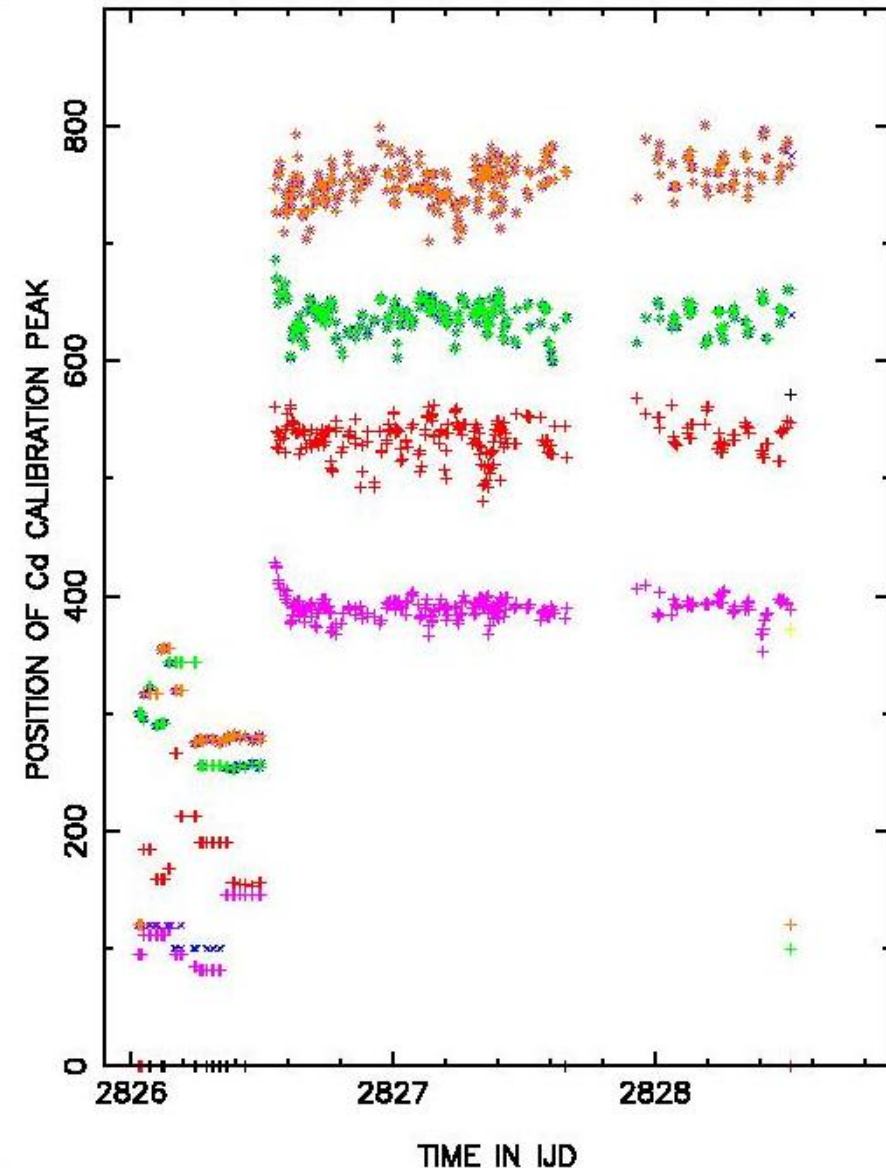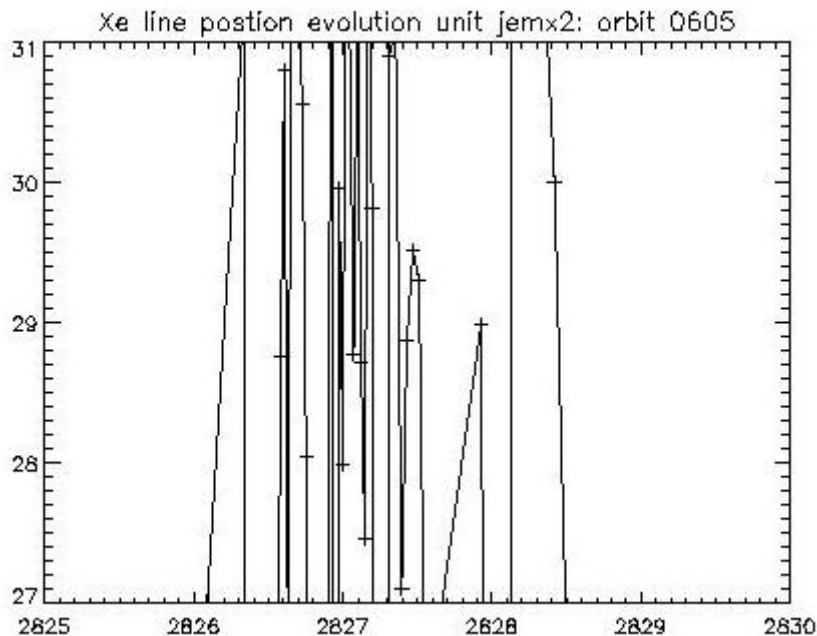
# Bad Revolution Example 2: JEM-X1 Rev 418

- SCO X-1 Observations
- Target source contamination
  - Source very soft
  - Source 4 (Cd) very weak
  - SCO X-1 fitted as Cd peak!
- Identical problems with revs:
  - 410
  - 417
  - 418
  - 419
  - 420
  - 422
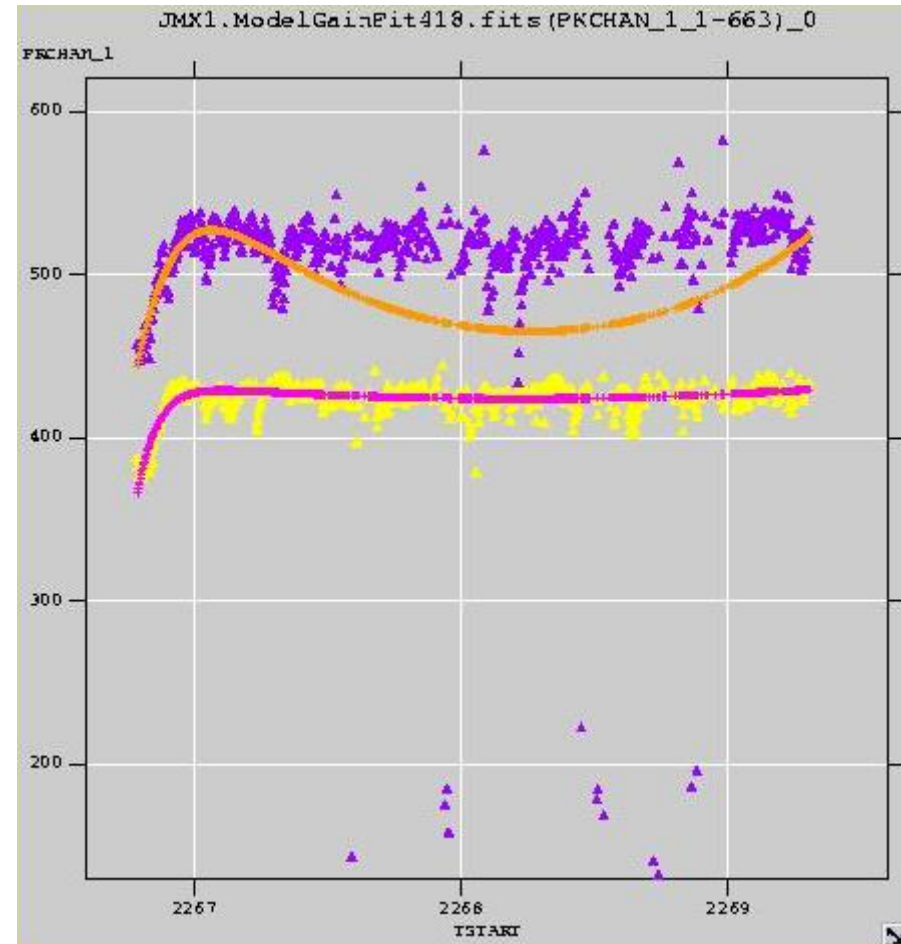
# IC Tables JMXi-GAIN-OCL Delivered to ISDC

- Each file covers one instrument and one revolution
- Always be sure to have the newest set of IC files
- /isdc/arc/rev_2/ic/jmx1/cal
- /isdc/arc/rev_2/ic/jmx2/cal
- New IC files are delivered whenever the need arises: not just for major OSA releases
- JEM-X1 Revolutions: 276, 332, 336, 358, 410, 417, 418, 419, 420, 422, 464, 465, 467
- JEM-X2 Revolutions: 300, 365, 422, 482, 541, 605

# Results with IC Gain History Tables
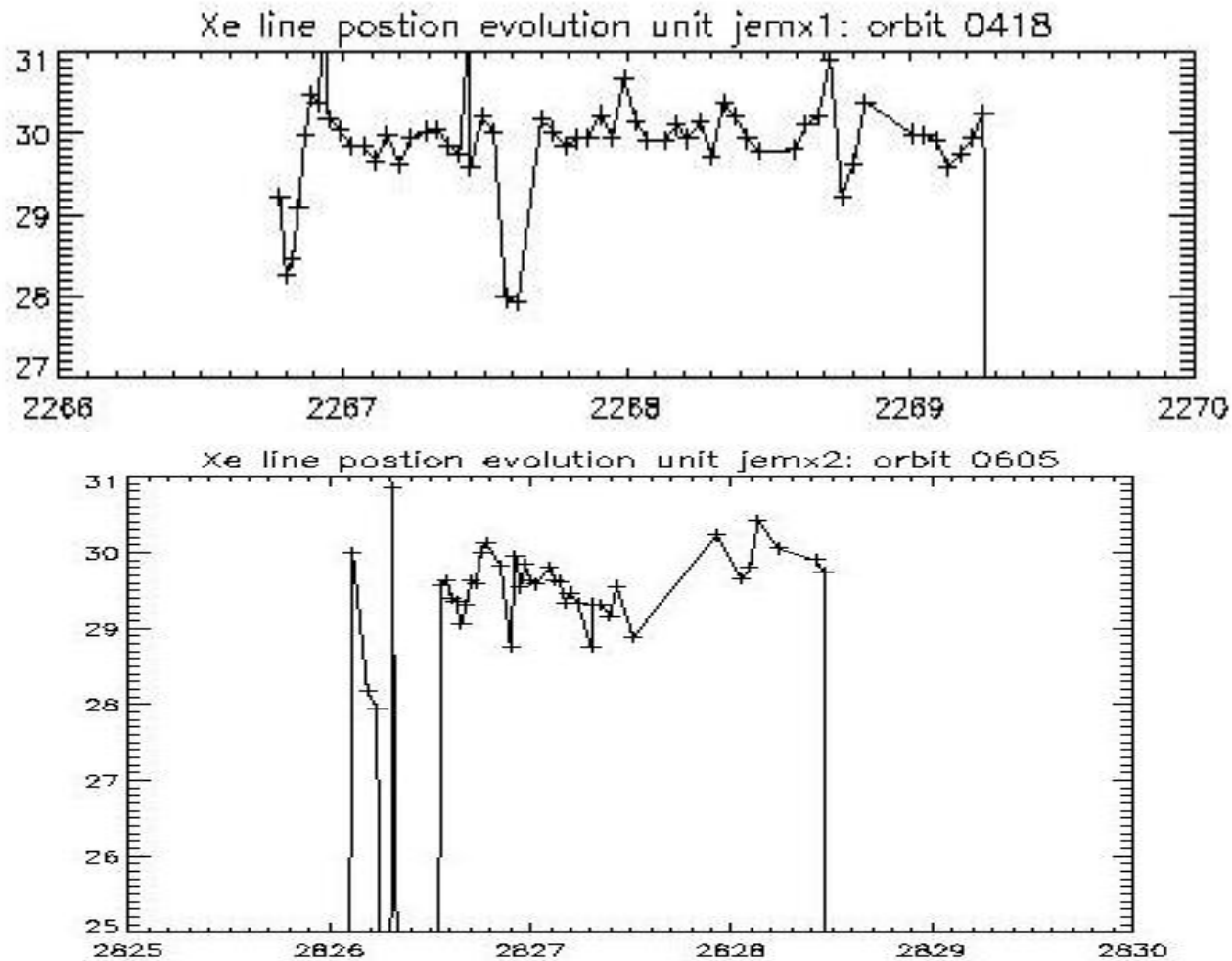
# Plans for Improved Gain Calibration

- Step 1: Updated SPAG, ideally one for every IMOD epoch
- Step 2: Updated reference channels for the latest epochs
  - Needs the new SPAG first
  - JEM-X 1 Xe position a little high for last revolutions
- Step 3: Offline temperature-dependent smoothing
  - Offline tool to add HK data to Gain History tables
  - IC gain history tables delivered with temperature dependence
- Step 4: Pipeline temperature-dependent smoothing
  - HK addition tool becomes part of Revolution File Pipeline
  - All revolutions have temperature-dependent smoothing
- Step 5: Automatic patching of sparse gain history tables
  - Small addition to j_cor_gain.

# Gain Calibration with IC Files

- Pipeline generation of gain history tables
  - JMXi-GAIN-CAL-IDX
- Offline creation of IC gain history tables
  - JMXi-GAIN-OCL
- Pipeline uses IC table for a revolution if it exists
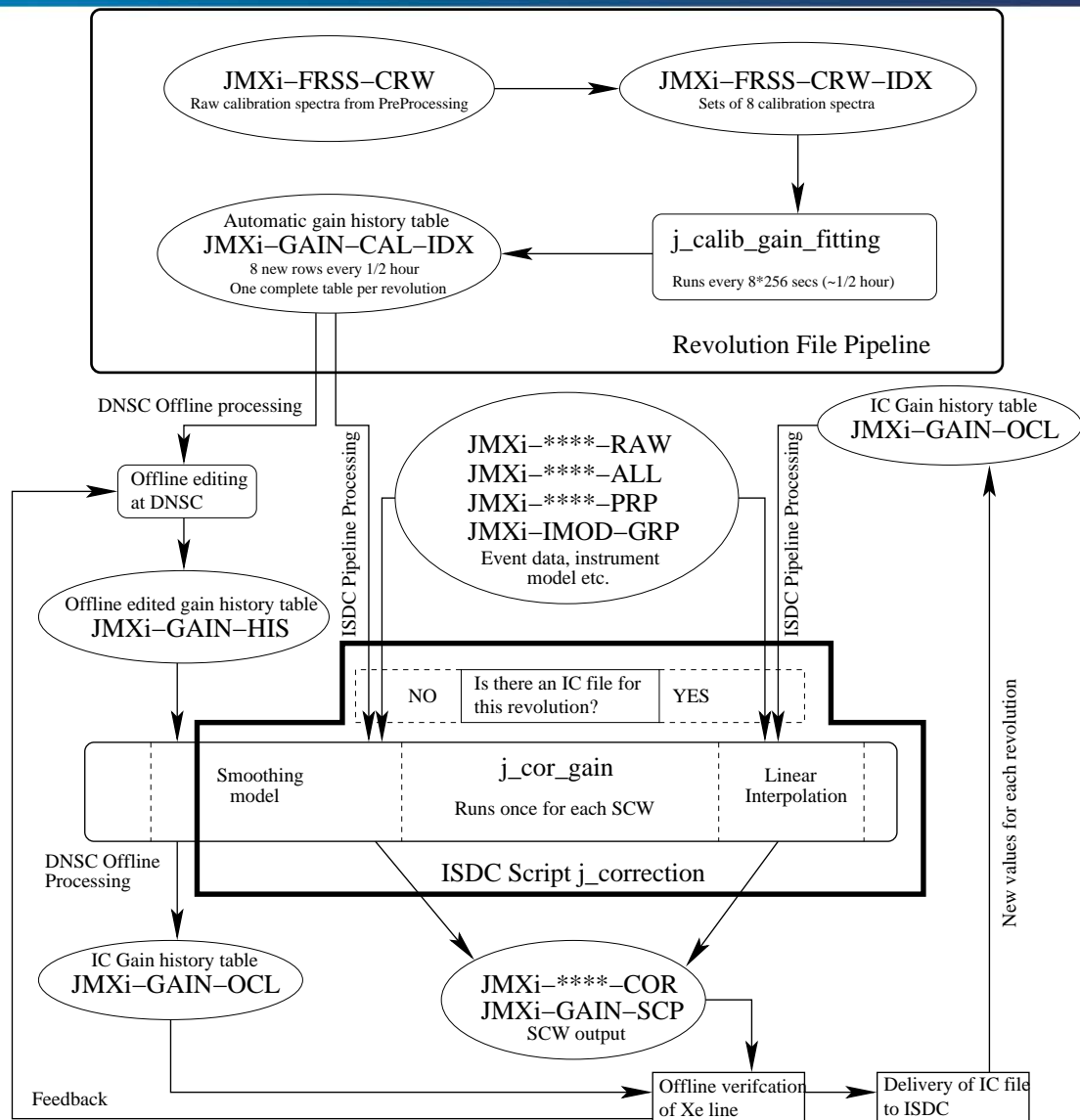
# Offline Temperature Dependence

- As before except offline IC gain history table smoothing includes temperature parameters

- So for revolutions that really need temperature dependence IC tables will be delivered

- Offline smoothing model will be tested for pipeline stability

# Pipeline Processing With Temperature Dependence

- Once temperature dependent smoothing is verified, add this smoothing model into the pipeline version of j_cor_gain

- Retain offline IC file creation for unexpected problems

- Temperature dependence is growing steadily (factor of 3)

- Need tool at end of Revolution File Pipeline to add HK data (SCW by SCW) to Gain History tables.

# SDAST Action Item List

| ID Number | Status | Respon-sible | Due | Description |
|---|---|---|---|---|
| AI27.7 | OPEN | NJW | 19 July 2007 | Make spectral response matrix for REST events and non-imaging data modes |
| AI34_1 | OPEN | CBJ/NL/NJW | 06/06/ 2006 | Determine azimuthal angle characteristics parameters (collimator, SPAG, vignetting etc). NL team leader. |
| AI35_2 | OPEN | NJW | 12/3/ 2007 | Initiate procedures to up date IMOD files with detector map |
| AI35_3 | OPEN | SP | 31/5/ 2007 | Verify that output of j_src_properites (lightcurves) is expressed in flux and spectra have the correct ARFs for current gain |
| AI35_5 | ON-GOING | NJW,CBJ? SB? | 31/5/ 2006 | Prove that the electronic efficiency will produce high quality ARF for Crab observation interpretation |

# Action Items  (New)