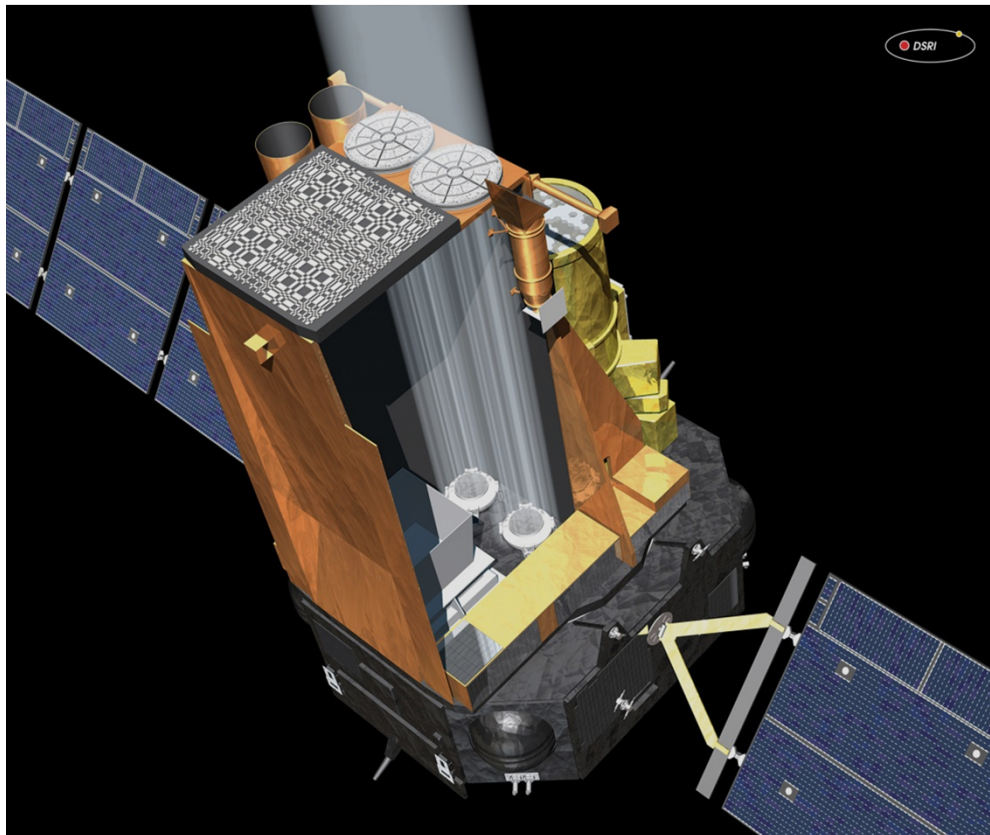


Technical University of Denmark



JEM-X Status, Feb 2018

Søren Brandt



 **DTU Space**
National Space Institute

Anode status

- Was on average ~2-3% loss per year (256 anodes in total), but now << 1% per year
- JEM-X1 (~1450 orbits of use)
 - 63 of 256 anodes affected (~25% of area)
 - 35 dead (4 pre-launch, latest loss in 2011)
 - 12 neighbor
 - 16 unstable or low
- JEM-X2 (~1050 orbits of use)
 - 64 of 256 anodes affected (almost 25% of area)
 - 32 dead (9 pre-launch) (latest loss in Aug 2013)
 - 16 neighbor
 - 16 unstable or low

No anode loss in more than 6 years!

No anode loss in ~5 years!

Gain evolution

- JEM-X1 DV setting was lowered to DV=69 (~690V) in rev. 1010, Jan 20, 2011, and to DV=68 (~680V) in rev. 1089, Sep 13 2011, June 21 2012 DV=67 (~670V) in rev 1183, DV=66 (660V) in rev 1257, **in rev 1397, Mar 24 2014 DV=65 (660 V)**
- Gain (at constant HV) has increased by a factor of ~4
- Gain dependence on detector temperature has increased from 1% per degree to >5% per degree
- We will **increase** JEM-X1 HV at the next Crab calibration
- JEM-X2 DV setting is was lowered to DV=70 in rev. 1010, to DV=69 in rev. 1089, DV=68 (~680V) in rev 1183, DV=67 (670V) in rev 1257, **in rev 1397, Mar 24 2014 DV=66 (660 V)**
- Gain evolution is caused by ion conducting glass substrate of the micro-strip plate

JEM-X Gain Calibration in OSA

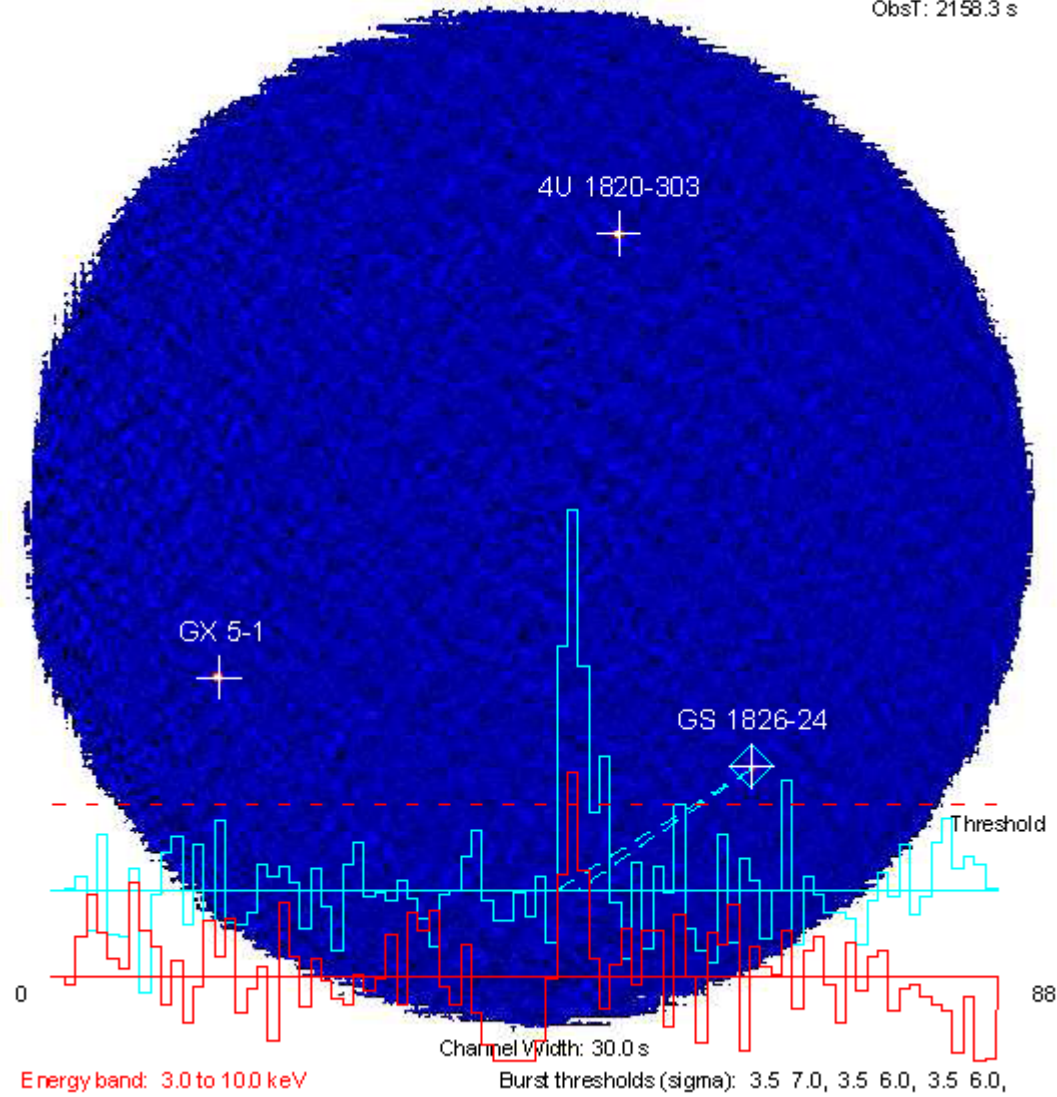
- Gain calibration requires continued efforts because of the decaying calibration sources
 - Further complicated by increased dependence on temperature = more variation over an orbit
- Calibration data must be collected in increasing time periods
- offline analysis of gain required to ensure correct results
 - However, usually automatic near-real time corrections are not too bad
- Calibration analysis is more difficult in orbits with grey filter
 - More TM has helped avoid grey filter “interruptions” in gain curves
 - But still periods of grey filter, also when background is high.
- Calibration provided by “Instrument Characteristics” tables delivered to ISDC for each revolution
- The gain calibration will rely only on the Xe fluorescence background line at 29.6 keV and temperature variation modeling

Improvements in the JEM-X analysis software for OSA 11

- In OSA-11 an improved light curve extraction tool has been included in the `j_ima_iros` software.
- The light curves are output in the same format as in the previous releases
- The cross talk between source light curves is reduced in the new tool, compared to the old.

JEM-X1_054200610010

ObsT: 2158.3 s



Conclusion

- JEM-X is running smoothly (with various signs of age)
- No anode loss for many years
- Gain evolution is slowing down (no HV reduction since March 2014)
- Gain fitting is becoming more challenging, as calibration sources decay and temperature dependence increases
- Back plane rejection criteria was updated in JEM-X1, April 2016
- Running both JEM-X1 and JEM-X2 was implemented in Oct 2010, as sufficient telemetry became available
 - Improved statistics and reduction of imaging systematics
 - Increased TM allocation in 2012 has reduced number of cases with grey filter and thus improved the stability of gain fitting
- Instrument Team is still intact – but also busy with other projects
 - Niels Lund, Carl Budtz-Jørgensen, Niels Jørgen Westergaard, Ib Lundgaard Rasmussen have emeritus status
- PRODEX not funding INTEGRAL in 2018 (internal support)
- We expect JEM-X and to operate smoothly in the extensions 2018-2019 (and beyond... maybe not all the way to 2029 ☺)
 - Performance is monitored to ensure that running both units will not endanger the future use