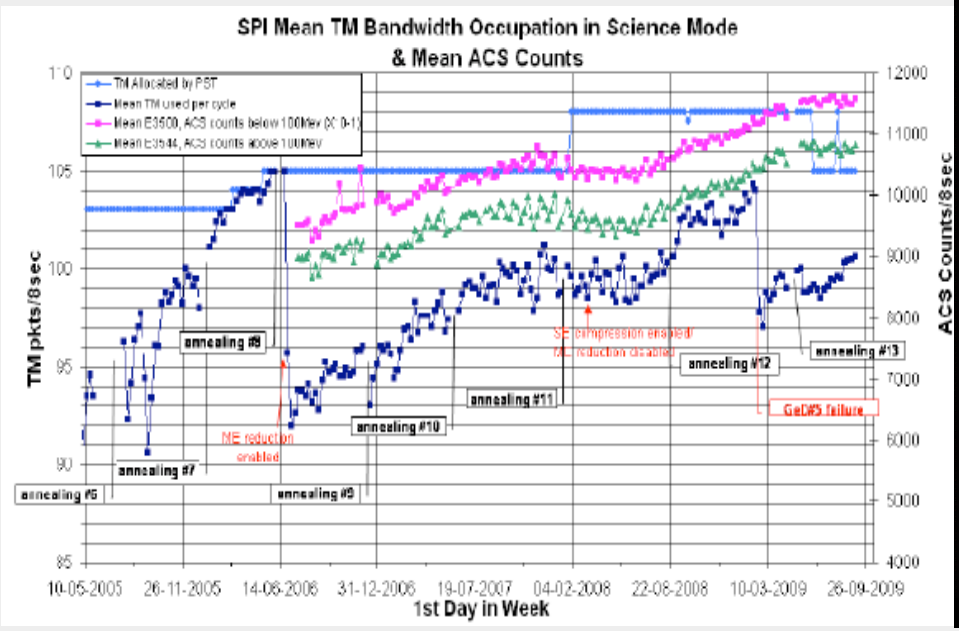
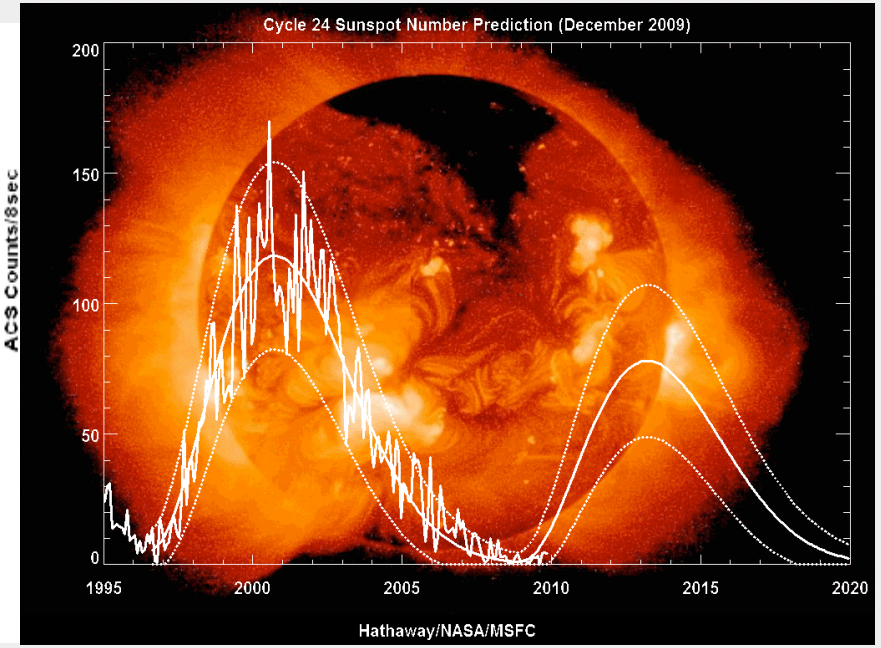
SPI STATUS

- 3 Ged failures
- 2 ACS FEE failures
- Regular background increase due to the low solar activity





- Regular improvements of on-board software:
  - Implementation of on-board data compression to stay into the allocated TM
- Energy resolution control
  - Regular annealings ---- each 6 months

IASW 4.3.5

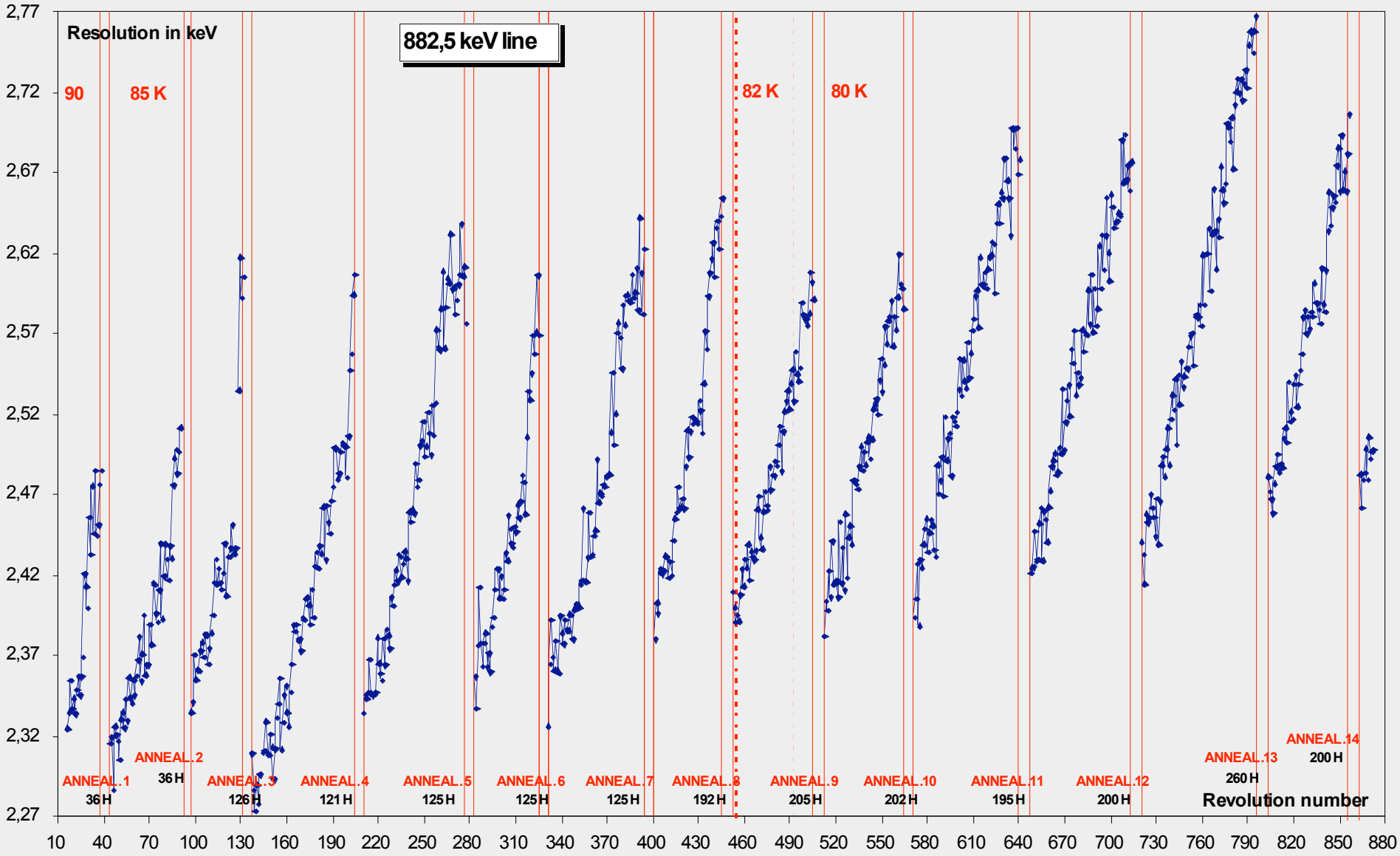
- Automatic reduction of HV to 1500V below the belts.
- On-board compression of PE events:
  - Compression without loss gain 3-4 pkts
  - Compression+reduction gain 9 Pkts….
- Test on november 5th:
  - New algorithm waiting activation.

ANNEALING: 14th SUMMARY

- Start: October 19th
- 105C on October 21th
- 200 hours at 105C
- November 1st: CDE on
- November 4th CDE2 pair stops for 2hrs: LCL trip
- November 5th Camera switch-on at 98k
- Smooth reactivation with some GeD pollution
- Nominal HV settings at 80K
- Recovery not perfect but “good”

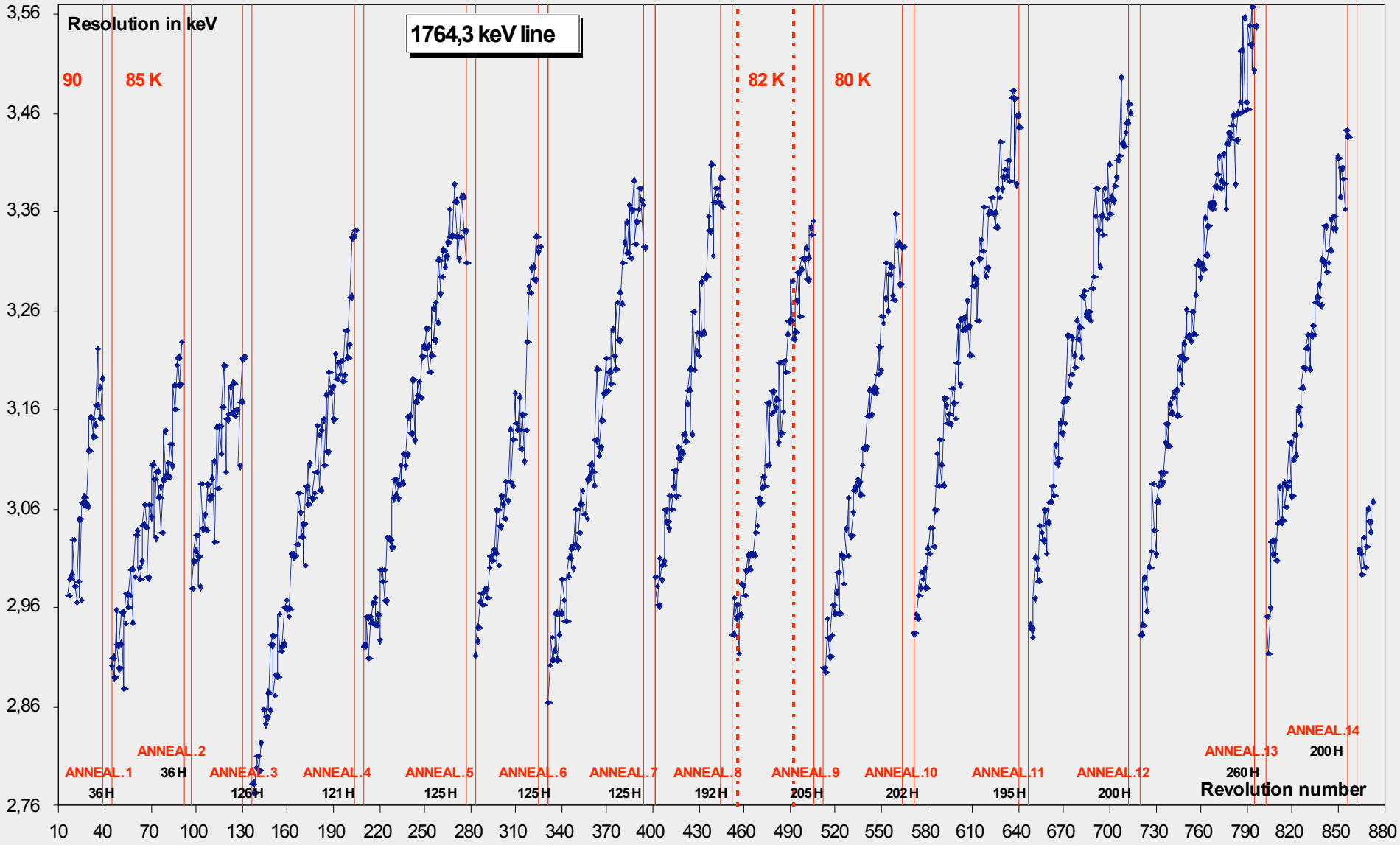
ENERGY RESOLUTION HISTORY: 882.5 keV

- Regular annealing (GeD at 105C) restore GeD energy resolution.



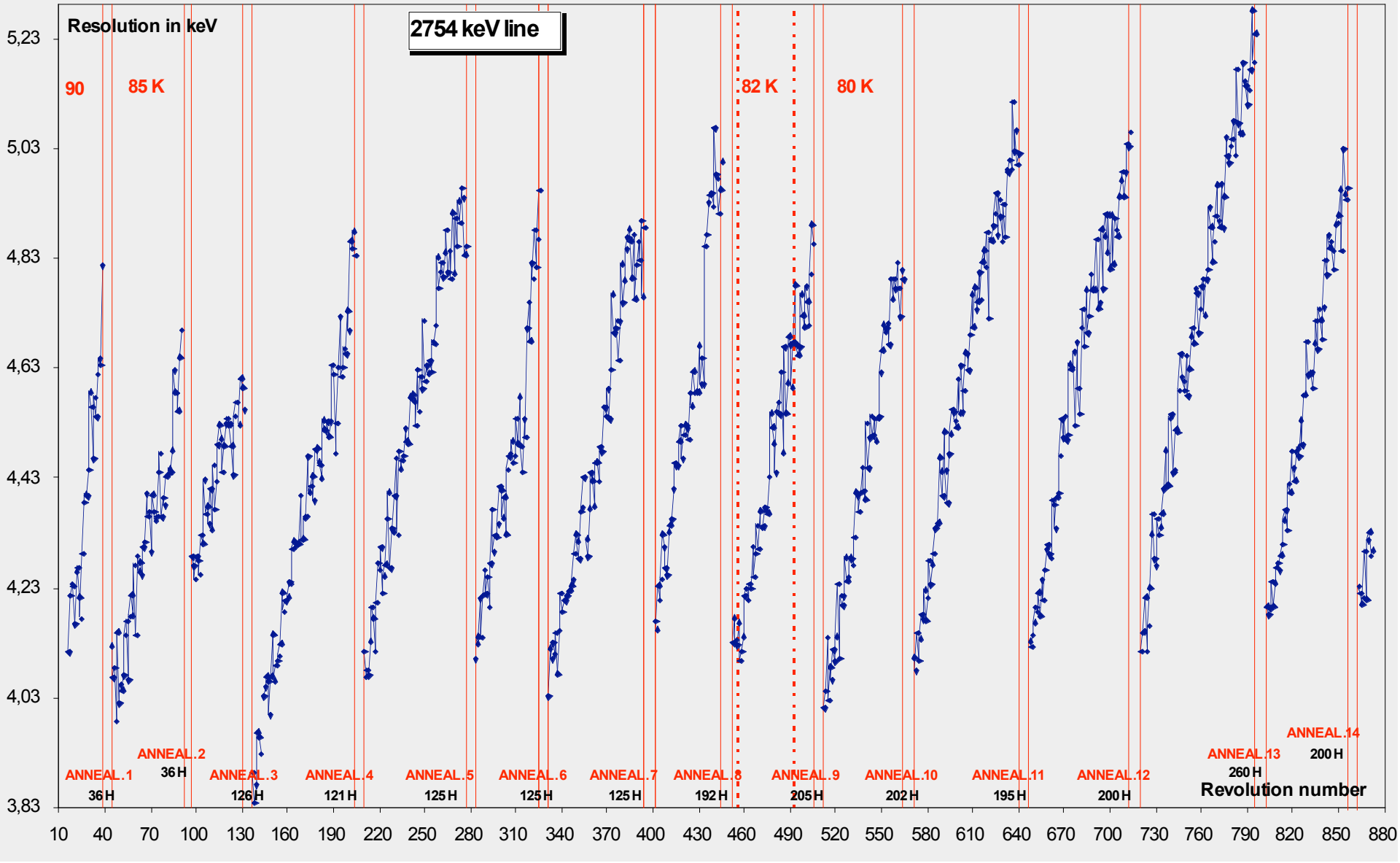
ENERGY RESOLUTION HISTORY: 1764.3 keV

- Regular annealing (GeD at 105C) restore GeD energy resolution.



ENERGY RESOLUTION HISTORY: 2754 keV

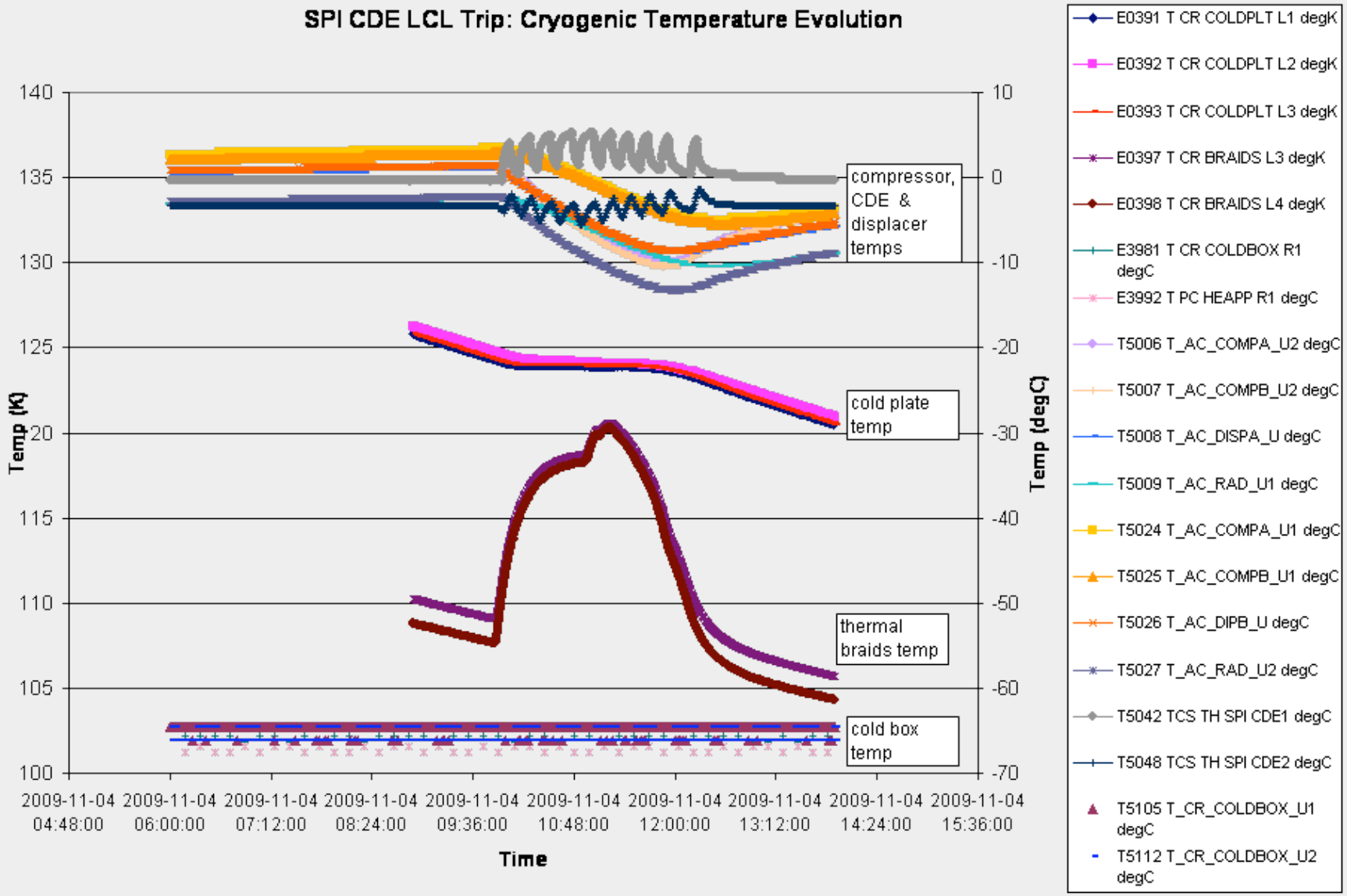
- Regular annealing (GeD at 105C) restore GeD energy resolution.



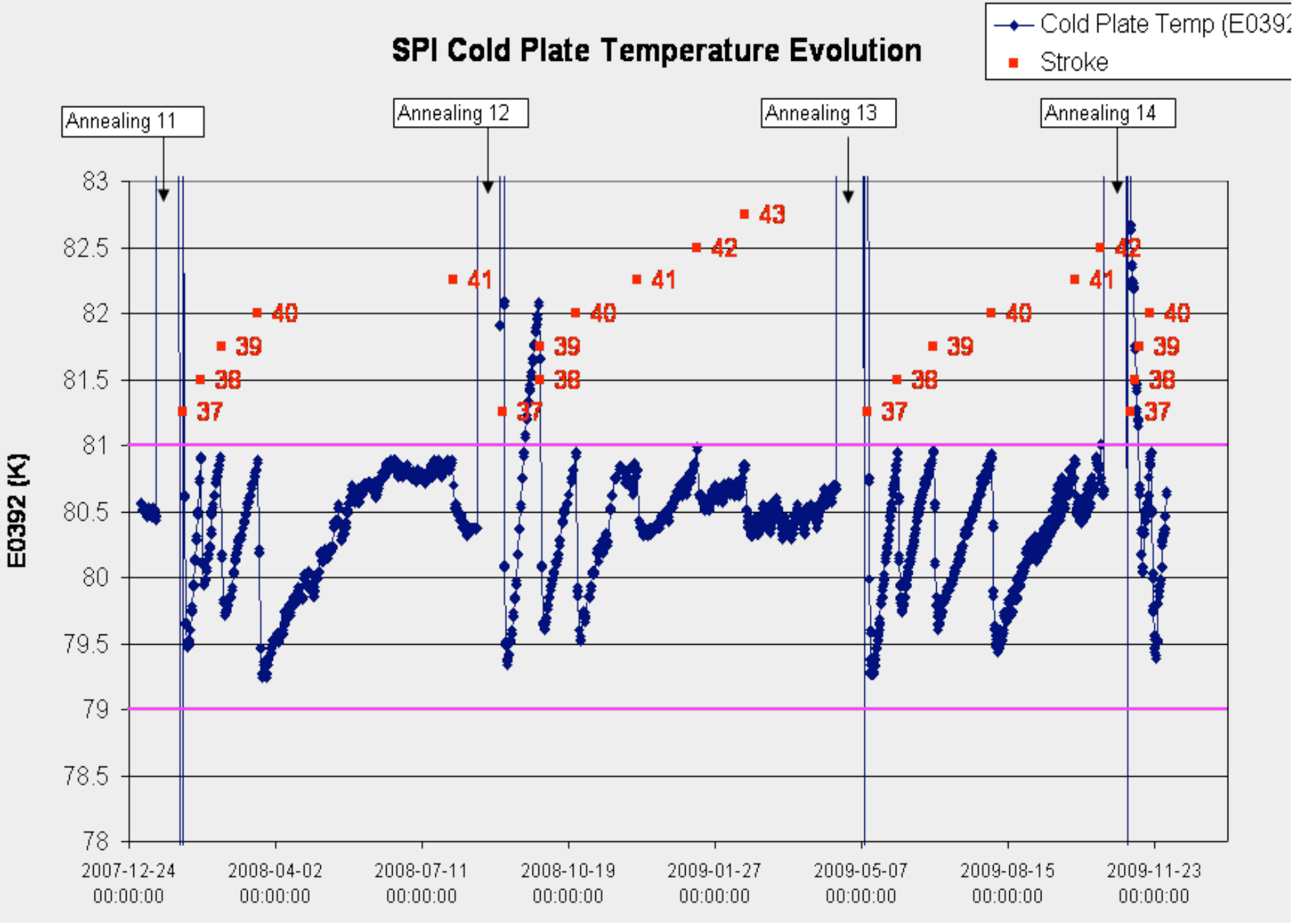
LCL “ANOMALY”

- November 4th LCL powering CDE2 opened
  - During the cooling phase GeD’s at 120K
  - With compressors at full stroke
  - During working hours
- CDE2 stops for 2hrs:
  - 13K Cold finger temperature increase
  - CDE1 was master then didn’t stop
- Smooth reactivation of CDE2

LCL “ANOMALY”


SPI CDE LCL Trip: Cryogenic Temperature Evolution
Temp (K)
Temp (degC)
Time
140
135
130
125
120
115
110
105
100
10
0
-10
-20
-30
-40
-50
-60
-70
2009-11-04 04:48:00
2009-11-04 06:00:00
2009-11-04 07:12:00
2009-11-04 08:24:00
2009-11-04 09:36:00
2009-11-04 10:48:00
2009-11-04 12:00:00
2009-11-04 13:12:00
2009-11-04 14:24:00
2009-11-04 15:36:00
compressor, CDE & displacer temps
cold plate temp
thermal braids temp
cold box temp
E0391 T CR COLDPLT L1 degK
E0392 T CR COLDPLT L2 degK
E0393 T CR COLDPLT L3 degK
E0397 T CR BRAIDS L3 degK
E0398 T CR BRAIDS L4 degK
E3981 T CR COLDBOX R1 degC
E3992 T PC HEAPP R1 degC
T5006 T_AC_COMPA_U2 degC
T5007 T_AC_COMPB_U2 degC
T5008 T_AC_DISPA_U degC
T5009 T_AC_RAD_U1 degC
T5024 T_AC_COMPA_U1 degC
T5025 T_AC_COMPB_U1 degC
T5026 T_AC_DIPB_U degC
T5027 T_AC_RAD_U2 degC
T5042 TCS TH SPI CDE1 degC
T5048 TCS TH SPI CDE2 degC
T5105 T_CR_COLDBOX_U1 degC
T5112 T_CR_COLDBOX_U2 degC

LCL “ANOMALY” ---- CONSEQUENCES



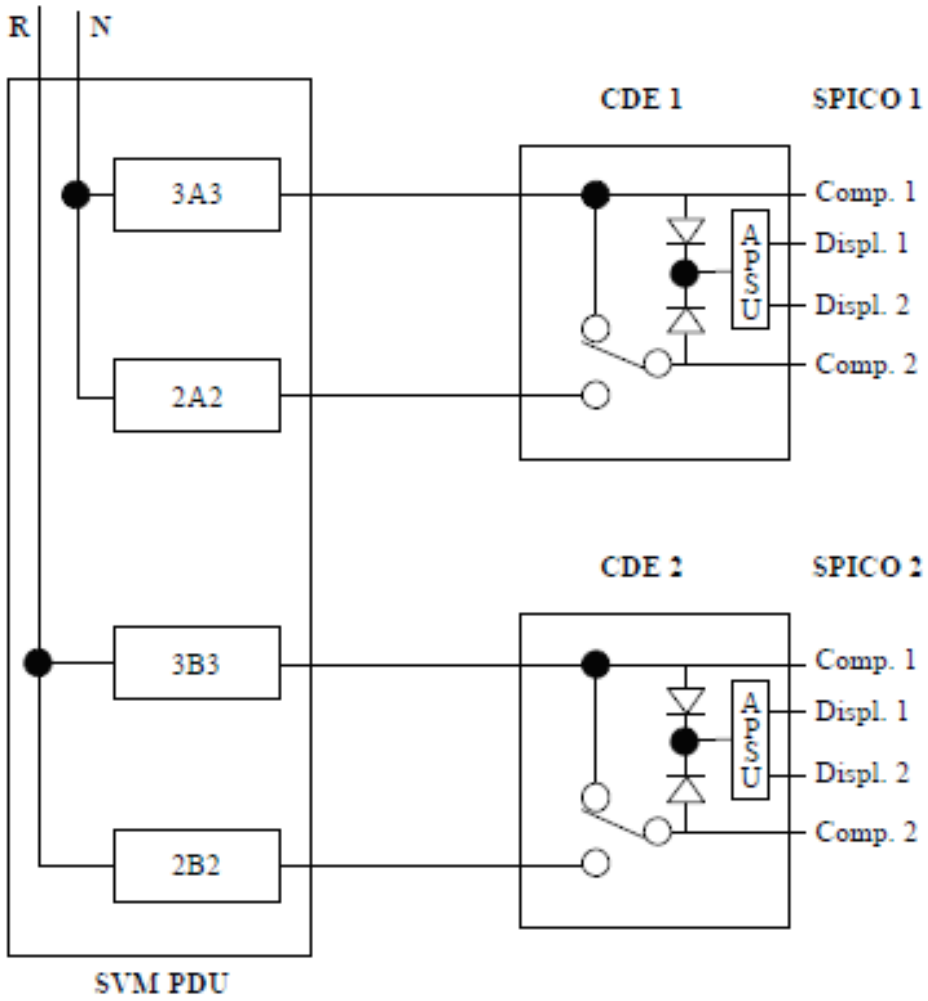
LCL “ANOMALY” ---- CONSEQUENCES

- Cooling system efficiency decrease is due to contamination transfer.
- This very high degradation rate is probably due to the cold tip reheat….
- When at maximum stroke (43 for this configuration) the cold plate temp will drift…
- Then we will go to annealing….
- Probably in January.

LCL “ANOMALY”

- LCL trip are more and more frequent
- Consequences on SPI are very high
- This case was easy…in case of problem over night on the master CDE it would have been worse
- We have to retry to switch to backup configuration:
  - 1 LCL per compressor.

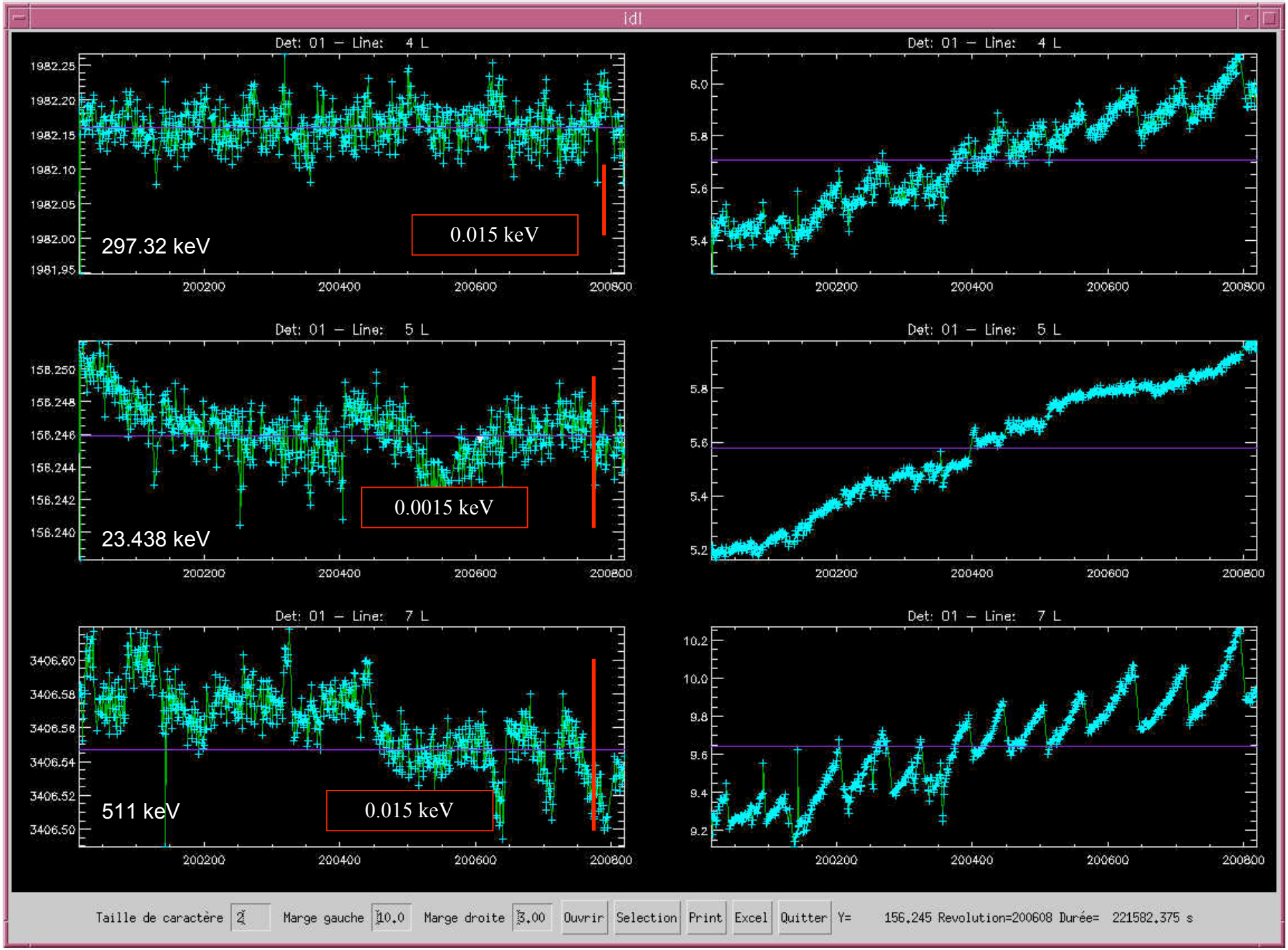
CDE “backup” configuration

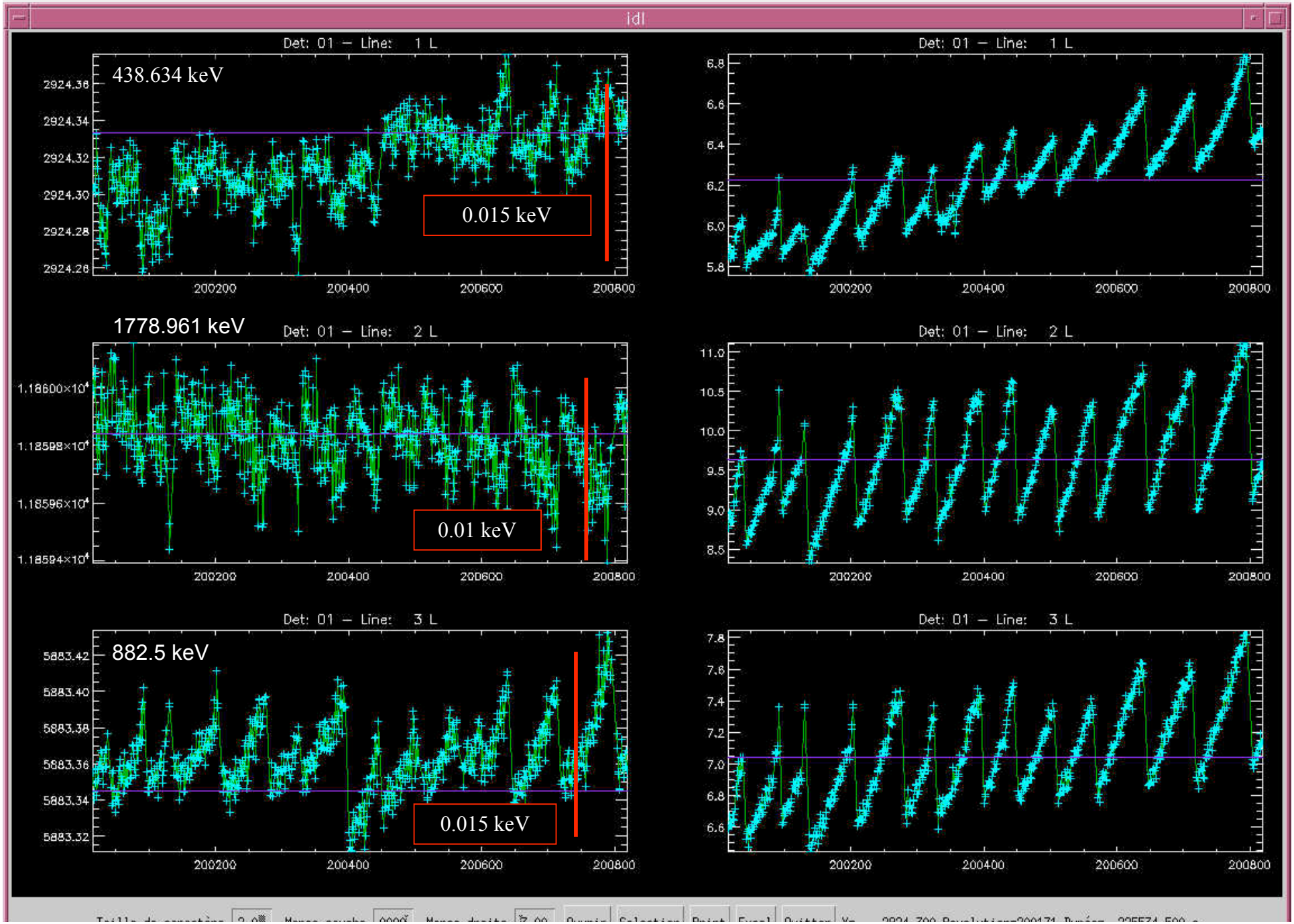


First attempt in April the relay didn’t move….

Marginal design of the relay command

Test again with repeated pulses….


idl
Det: 01 — Line: 4 L
297.32 keV
0.015 keV
Det: 01 — Line: 4 L
Det: 01 — Line: 5 L
23.438 keV
0.0015 keV
Det: 01 — Line: 5 L
Det: 01 — Line: 7 L
511 keV
0.015 keV
Det: 01 — Line: 7 L
Taille de caractère
Marge gauche
Marge droite
Ouvrir
Selection
Print
Excel
Quitter
Y= 156.245 Revolution=200608 Durée= 221582.375 s

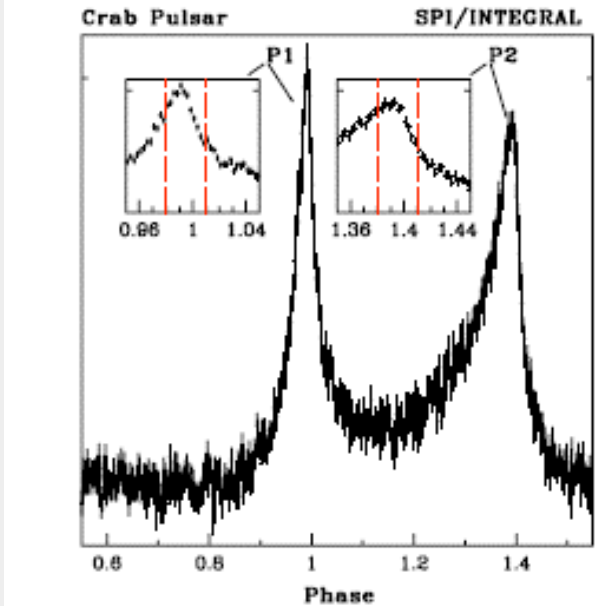

idl
Det: 01 – Line: 1 L
438.634 keV
0.015 keV
Det: 01 – Line: 1 L
1778.961 keV
Det: 01 – Line: 2 L
0.01 keV
Det: 01 – Line: 2 L
Det: 01 – Line: 3 L
882.5 keV
0.015 keV
Det: 01 – Line: 3 L

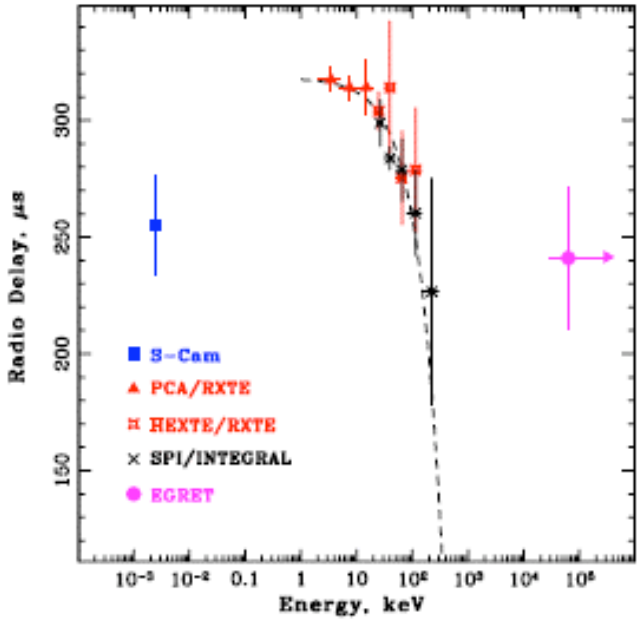
The Crab pulsar

(Molkov, Jourdain and Roques, accepted to ApJ)

- Intensive work on Crab pulsar by S. Molkov
- Detection of some ground station synchro problems

  Solved by iterative work with ESOC
- Optimization of S/N using SPI response
- Delay of 275+/-15 μs between 20-200 keV and radio
- Hints of delay evolution with photon energy





INSTRUMENTAL KNOWLEDGE

DEDICATED 2008 CALIBRATION CAMPAIGN on Crab in 5x5

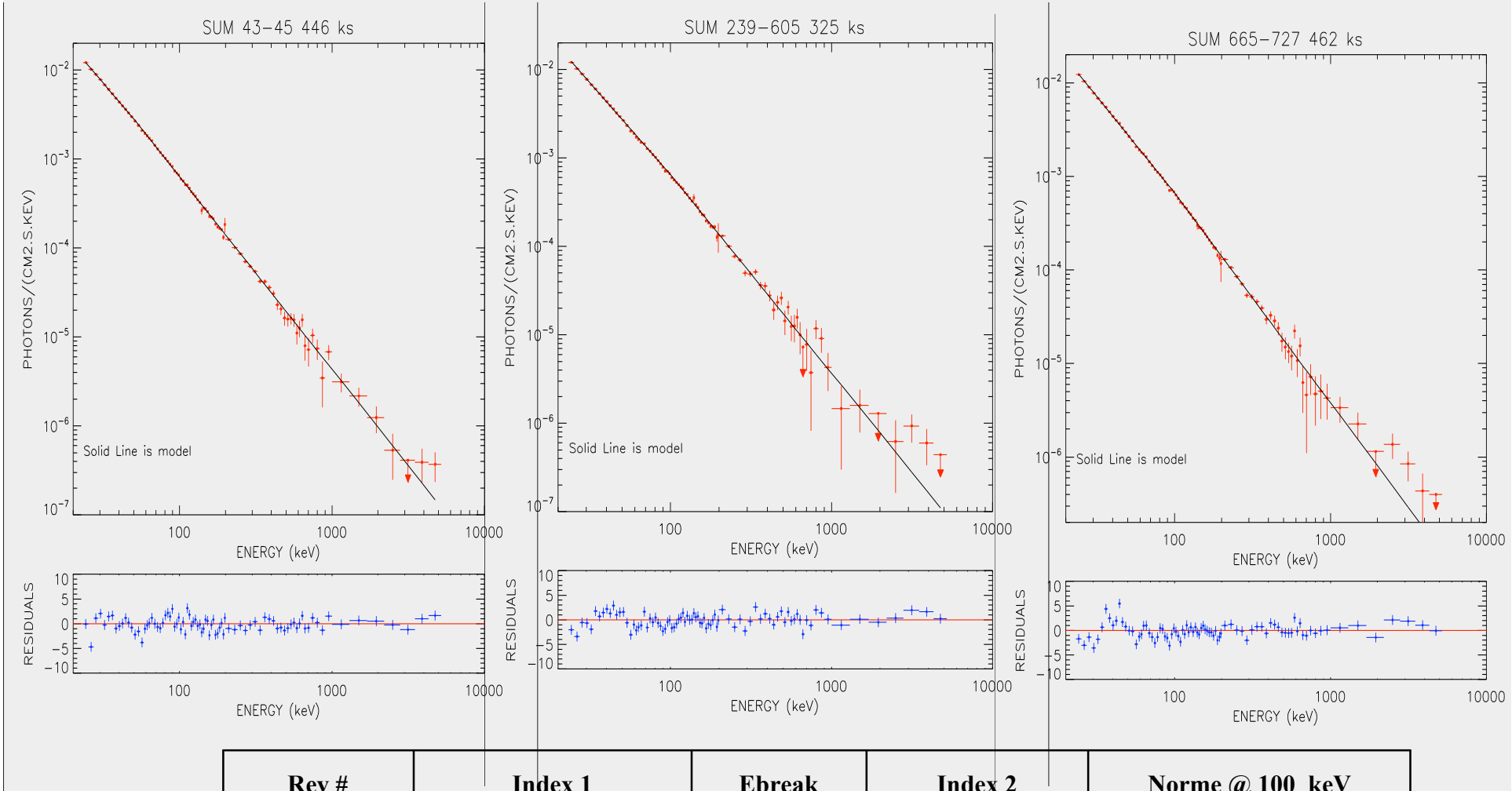
THANKS TO LONG EXPOSURES, INVESTIGATIONS ON

- SYSTEMATIC EFFECT (above ~ 700 keV)
- EMPTY FIELDS
- STABILITY OF THE GAIN CORRECTION AT HIGH ENERGY
- INSTRUMENT STABILITY AT HIGH ENERGY

→ RELIABLE DATA UP TO A FEW MEV
IN THE STANDARD 5X5 PATTERN

The Crab spectrum

(Jourdain & Roques, ApJ, 2009)



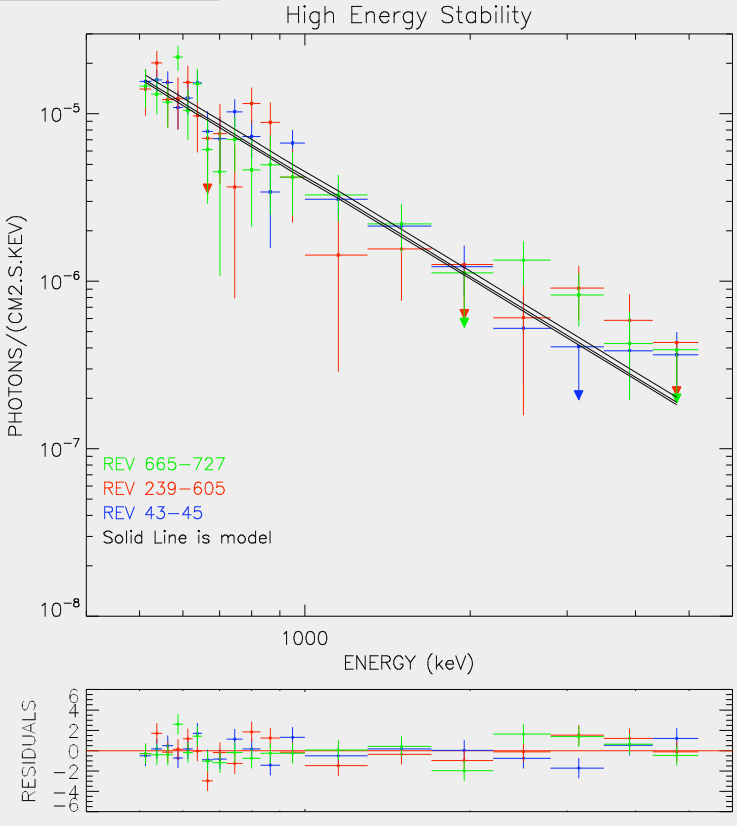
Rev #	Index 1	Ebreak	Index 2	Norme @ 100 keV
Sum 1	2.07	100 keV	2.24	6.6 10^{-4} ph/cm^2 s.keV
Sum 2	2.07	100 keV	2.25	6.55 10^{-4} ph/cm^2 s.keV
Sum 3	2.065	100 keV	2.25	6.7 10^{-4} ph/cm^2 s.keV

The Crab spectrum

(Jourdain & Roques, ApJ, 2009)

- Very good stability of the spectral parameters
- A simultaneous broken PL fit gives Ind1=2.04 Ind2=2.18 Eb=62 keV
  - But spectrum is probably smoothly curved.
- Better fit with **$F(E) = N \cdot E^{a+b.\log(E/E0)}$**
  - With E0 fixed to 20 keV: a=1.79 b=0.134 N= 3.97 ph/cm²/s/keV

- Very good high energy stability
- Rejection of the Batse excess above 700 keV (Ling & Wheaton, 2003)
- Investigation still to be done above 3 MeV



Revolution 839

- First observation on the Crab Nebula with 16 detector configuration
- New dithering (IBIS proposal) « 5x5 wide » 182 ks
- 22 ks JEM-X arc (end of rev 239)

Dithering Pattern

Flux on a scw timescale

Histogram of measured fluxes

REV 839 Averaged spectrum

Parameters	$\alpha 1$	$\alpha 2$	Flux @ 100 keV ph/cm2 s keV
Rev 839	2.07	2.24	$6.45\ 10^{-4}$
To compare :			
Sum 1 (rev 43 to 45)	2.07	2.24	$6.45\ 10^{-4}$
Sum 2 (rev 239 to 605)	2.07	2.25	$6.35\ 10^{-4}$
Sum 3 (rev 665 to 727)	2.06	2.25	$6.5\ 10^{-4}$

FUTURE CALIBRATIONS

ONE PATTERN (50ks) PROVIDES « ENOUGH » STATISTICS UP TO ~ 200 keV

- Each annealing increases the central hole size: the high energy efficiency will necessarily decrease.
- 4 Revs allows a good control of SPI up to ~2 MeV
- AIM is to obtain

RELIABLE DATA UP TO A FEW MEV
IN THE STANDARD 5X5 PATTERN
AND
REFERENCE SPECTRA FOR CROSS-CALIBRATION

« good » cross calibration only exists for 16 ks !