ANNEALING 10th

2. PROCEDURE

For this tenth annealing, the annealing duration has been reduced at 202 hours instead of 205 hours.

The major events concerning this annealing are described below:

- The 29th of May around 22h30, the annealing heaters have been switched on.
- The 31st of May around 11h45, the annealing Ge detectors temperature reached 106 °C. This temperature was maintained during 202 hours.
- The 8th of June around 20h50, the annealing heaters have been stopped.
- The 11th of June around 14h00, the cryocoolers have been switched on.
- The 15th of June at 17h00, the camera has been switched on at 99K.

For this annealing, we did not perform again the cold box outgassing : the cold box was kept stable at -65 degree Celsius.

Cold plate temperature	T° = 98.5 K	T° = 98 K	T° = 97.6 K	T° = 97.3 K	T° = 96.9 to 95.5 K
High Voltage	HV = 2 kV	HV = 2.5 kV	HV = 3 kV *(GeD#12 at 2,5 kV)*	HV = 3.5 kV *(GeD#12 at 2,5 kV)*	HV =4 kV *(GeD#12 at 2,5 kV)*
Detector	Energy resolution in keV				
0	1,96	1,91	1,83	2,01	1,98
1	1,94	1,85	1,83	1,91	1,88
2					
3	1,94	1,83	1,79	1,92	1,97
4	2,19	2,28	2,12	2,25	2,16
5	1,85	1,8	1,91	2,01	1,88
6	1,91	2,01	1,89	1,92	1,99
7	2,01	1,95	2,04	2,05	2,1
8	1,92	1,93	1,97	1,86	1,91
9	1,89	1,79	1,85	1,84	1,91
10	2,05	1,95	1,99	1,91	1,86
11	1,92	1,83	1,89	1,96	1,93
12	2,18	2,42	2,51	2,67	2,37
13	1,84	1,87	2,04	1,9	1,94
14	2,14	2,08	2,09	2,05	2,07
15	1,95	1,75	1,92	1,9	1,96
16	1,93	1,9	1,87	1,89	1,9
17					
18	1,93	1,92	1,96	1,98	1,95

At 98K, GeD#12 exhibits an abnormal energy resolution. Moreover it has been impossible to set the HV to a value greater than 2.5 kV because of a dramatic increase of the energy resolution.

3.3. Different lines : last measurement from revolution 571

Cold plate temperature is between 79.2 K and 81.2 K. All detectors are at 4 kV, except GeD #12 at 3.5 kV.
Table of resolution in keV:

Detector	198.3 keV line	882.5 keV line	1107 keV line	1764 keV line	1778 keV line	2754 keV line
0	1,97	2,34	2,65	2,92	2,87	4,06
1	1,89	2,35	2,61	2,99	2,85	3,89
2						
3	1,95	2,4	2,66	2,88	3,06	3,68
4	2,18	2,49	2,85	2,96	3,09	3,95
5	1,85	2,24	2,56	2,72	2,83	3,67
6	1,97	2,42	2,78	2,89	3,07	3,92
7	1,87	2,38	2,68	2,88	2,93	3,81
8	1,91	2,39	2,84	2,93	3,16	3,57
9	1,86	2,38	2,68	2,92	2,95	3,74
10	1,89	2,2	2,68	2,74	3,18	3,73
11	1,91	2,35	2,7	2,85	3,02	4,05
12	2,19	2,58	2,99	3,06	3,47	4,05
13	1,92	2,42	2,65	3,02	3,06	3,69
14	2,02	2,47	2,72	2,84	3,25	4,22
15	1,92	2,32	2,72	2,84	3,17	3,8
16	1,9	2,39	2,72	2,73	2,9	3,71
17						
18	1,9	2,37	2,73	2,9	3,23	3,81

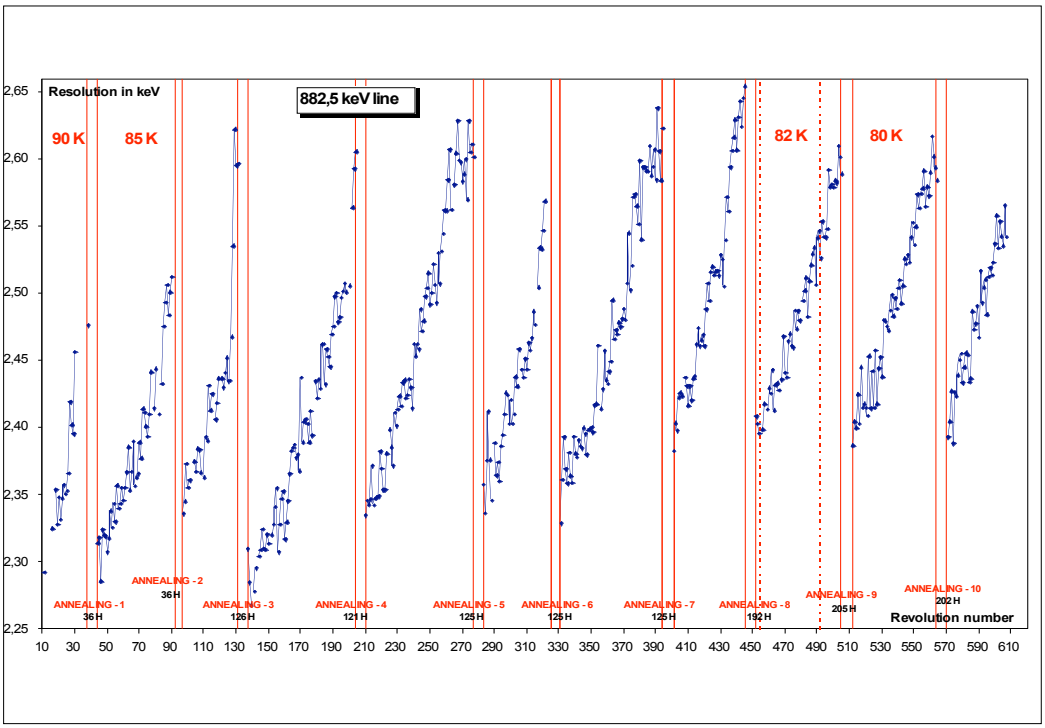
5. GeD #12 ANOMALY

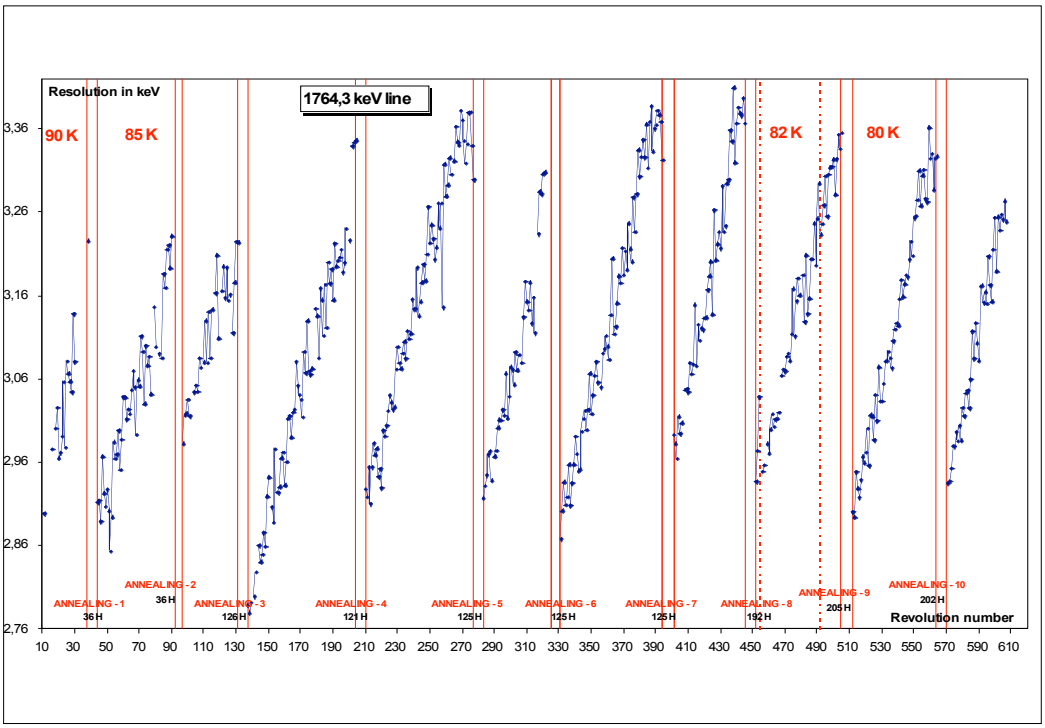
The GeD#12 showed degraded performance at high temperature (at 98 K, see table in 3.1). Further tests have been done at 82 K during revolution 570. The energy resolution clearly degrades with the high voltage.

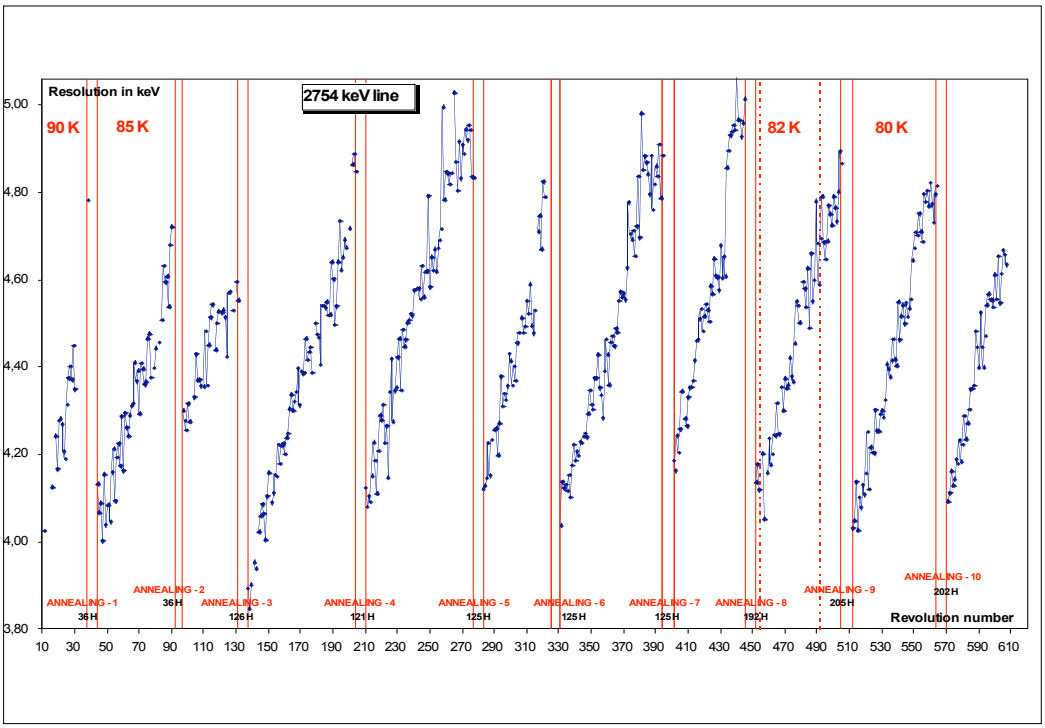
In the following table, we can see the results of the tests for various HV and the comparison with last annealing:

GeD#12 HV		2,5 kV	3 kV	3,5 kV	4 kV
198 keV line, resolution in keV	after annealing 10, **82 K** (rev 570)		2,22	2,25	2,4
	after annealing 10, **80 K** (rev 571)			2,19	
	after annealing 9, **80 K** (rev 514)	2,02	2,1	2,16	2,4

We have thus decided to set the HV at 3.5 kV which should provide a good charge collection with minimal energy resolution degradation.
The energy resolution obtained with 3.5 kV is 2.19 and is similar to the result of revolution 514 after ninth annealing.


Resolution in keV
882,5 keV line
90 K
85 K
82 K
80 K
ANNEALING - 1
36 H
ANNEALING - 2
36 H
ANNEALING - 3
126 H
ANNEALING - 4
121 H
ANNEALING - 5
125 H
ANNEALING - 6
125 H
ANNEALING - 7
125 H
ANNEALING - 8
192 H
ANNEALING - 9
205 H
ANNEALING - 10
202 H
Revolution number


Resolution in keV
1764,3 keV line
90 K
85 K
82 K
80 K
ANNEALING - 1
36 H
ANNEALING - 2
36 H
ANNEALING - 3
126 H
ANNEALING - 4
121 H
ANNEALING - 5
125 H
ANNEALING - 6
125 H
ANNEALING - 7
125 H
ANNEALING - 8
192 H
ANNEALING - 9
205 H
ANNEALING - 10
202 H
Revolution number



Conclusions

- SPI energy resolution still under control
- High degradation rate:
  - Particles rate still increasing…….
- GeD12 behaviour needs attention
  - No degradation since annealing 9th
- What is the « good » HV after 5 years?

Next Annealing

- Proposal: start early january.
- Degradation will exceed the previous max
- But:
  - I want to increase the annealing interval…
  - Solar activity should restart in 2008 providing a gain in degradation rate.