

Calibration I

FADC analysis --- not yet finished...

- improve the calibration phenomenologically by **adding Gaussians** corresponding to the pileup, and avoid the “upper-rate cut”
- verify the amount of pileup events which is known from FADC analysis (only for 1st cycle)
- compare the pileup-fit with FADC analysis, and evaluate a systematic error of this calibration

Calibration 2

--- feedback to kaon triggered events ---

→ include the **low-energy tail** to estimate the tail amount at KHeX (interpolation / extrapolation using TiKa and NiKa)

→ iterative fitting with the tail (the parameters are fixed) maybe not influence the calibration within statistical error, but the tail structure is important for **evaluating the width of KHeX**

Kaon-trigger signal

- add **Compton tail** structure with fixed amount by simulation
stopped kaon distribution was gotten from the vertex data
- add low-energy tail (from calibration trigger data)
- need a conservative systematic error for the width

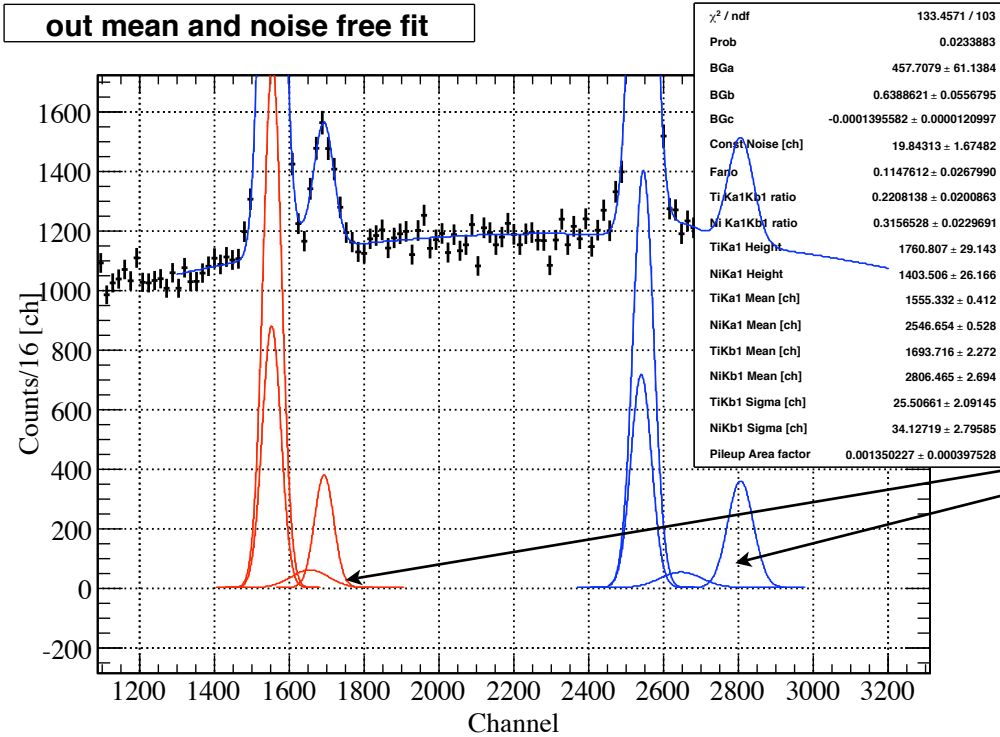
how evaluate ?

how accurate the Compton simulation ?

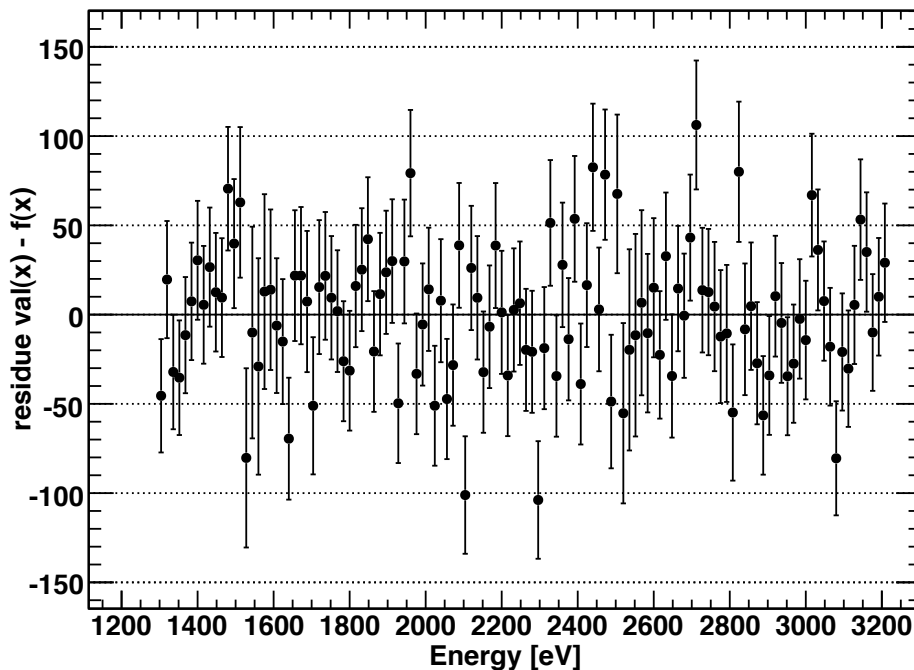
Calibration I

cycle1 sdd2

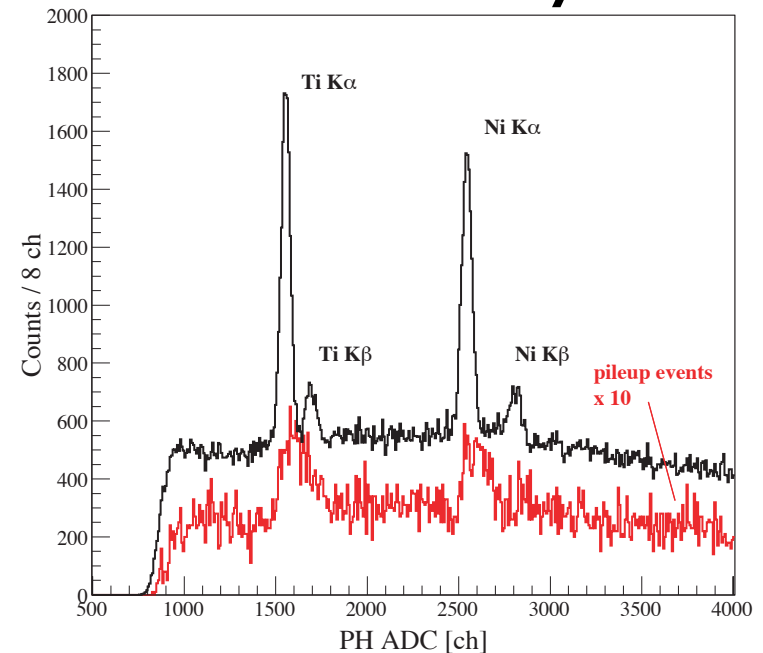
assume
pileup Gaussians



fit residue



FADC analysis



FCN=1204.14 FROM MINOS STATUS=SUCCESSFUL 4482 CALLS 5552 TOTAL
 EDM=3.94503e-07 STRATEGY= 1 ERROR MATRIX ACCURATE

cycle1 sdd2

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINOS ERRORS	
				NEGATIVE	POSITIVE
1	BGa	4.57708e+02	5.96824e+01	-6.10727e+01	6.12042e+01
2	BGb	6.38862e-01	5.43238e-02	-5.57191e-02	5.56398e-02
3	BGc	-1.39558e-04	1.18088e-05	-1.20925e-05	1.21069e-05
4	Const Noise [ch]	1.98431e+01	1.66281e+00	-1.74179e+00	1.60785e+00
5	Fano	1.14761e-01	2.66684e-02	-2.66070e-02	2.69909e-02
6	Ti Ka1Kb1 ratio	2.20814e-01	2.00793e-02	-1.97564e-02	2.04162e-02
7	Ni Ka1Kb1 ratio	3.15653e-01	2.29568e-02	-2.25521e-02	2.33862e-02
8	TiKa1 Height	1.76081e+03	2.91310e+01	-2.89778e+01	2.93076e+01
9	NiKa1 Height	1.40351e+03	2.61514e+01	-2.59997e+01	2.63327e+01
10	TiKa1 Mean [ch]	1.55533e+03	4.11709e-01	-4.11950e-01	4.11541e-01
11	NiKa1 Mean [ch]	2.54665e+03	5.27514e-01	-5.27670e-01	5.27510e-01
12	TiKb1 Mean [ch]	1.69372e+03	2.24826e+00	-2.24301e+00	2.30076e+00
13	NiKb1 Mean [ch]	2.80646e+03	2.65528e+00	-2.73867e+00	2.64982e+00
14	TiKb1 Sigma [ch]	2.55066e+01	2.08573e+00	-2.02912e+00	2.15379e+00
15	NiKb1 Sigma [ch]	3.41272e+01	2.78252e+00	-2.65628e+00	2.93542e+00
16	Pileup Area factor	1.35023e-03	3.97293e-04	-3.97021e-04	3.98035e-04
17	Pileup Shift [ch]	1.00000e+02	fixed		
18	Pileup Sigma factor	2.00000e+00	fixed		

reasonable values were chosen
 (will be updated iteratively ...)

e2c[eV/ch] = 2.993 +- 0.002
 icp[eV] = -144.713 +- 3.376
 TiKa1 Mean = 1555.332 +- 0.412
 NiKa1 Mean = 2546.654 +- 0.528
 TiKb1 Mean = 1693.716 +- 2.272
 NiKb1 Mean = 2806.465 +- 2.694
 noise [ch] = 19.843 +- 1.675
 Fano = 0.115 +- 0.027
 Chisq/ndf = 133.457/103

Ti EVENT
 KA1+KA2 = 10311
 Pileup = 462.562
 Pile/All = 0.0429351
 Ni EVENT
 KA1+KA2 = 9187.65
 Pileup = 454.682
 Pile/All = 0.0471548

~4-5 % : consistent
 with FADC analysis

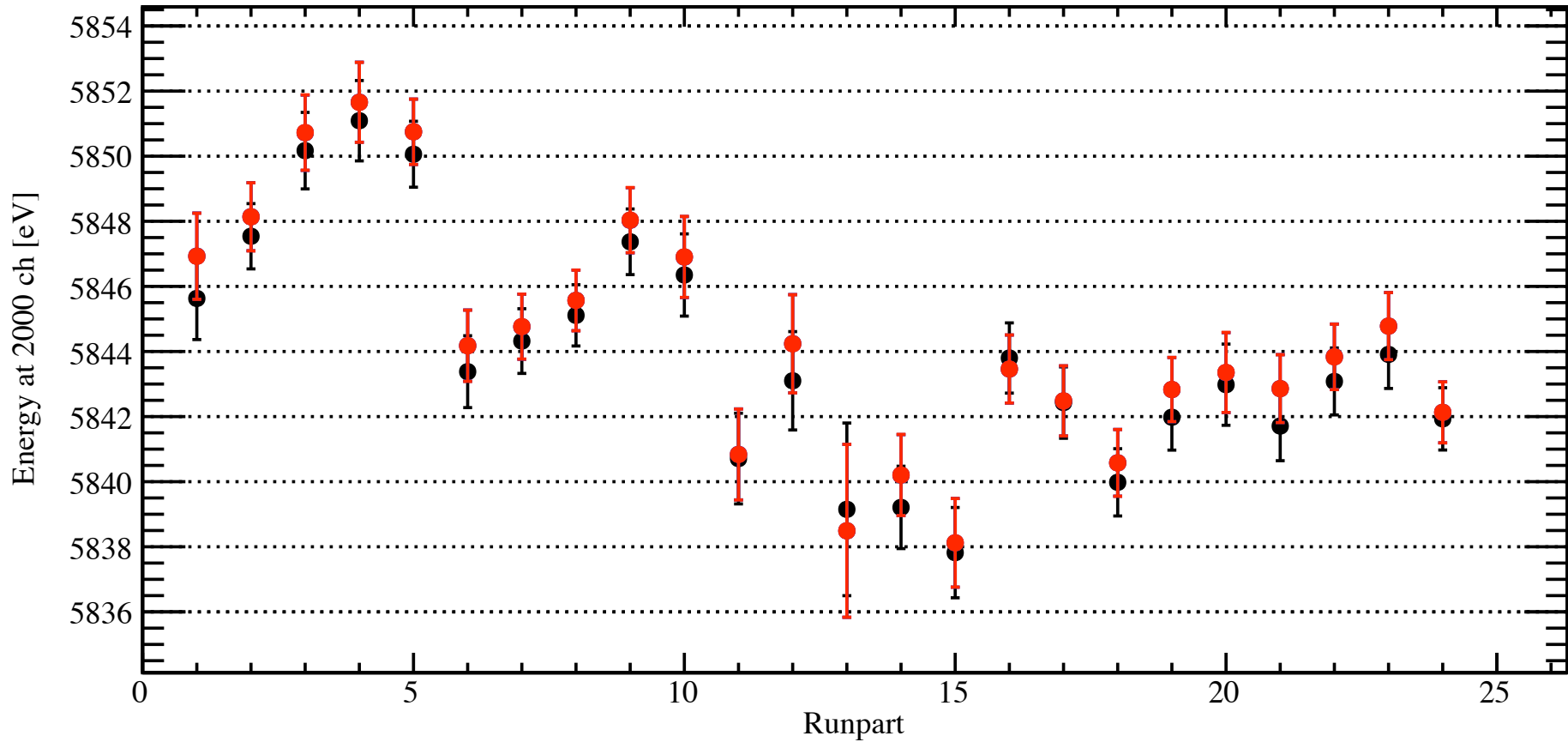
1st cycle

Comparison pileup-fit with upper-rate cut

- `sdd2` and `sdd4` are consistent with FADC analysis
- over estimation of pileup in `sdd5`'s fit ??

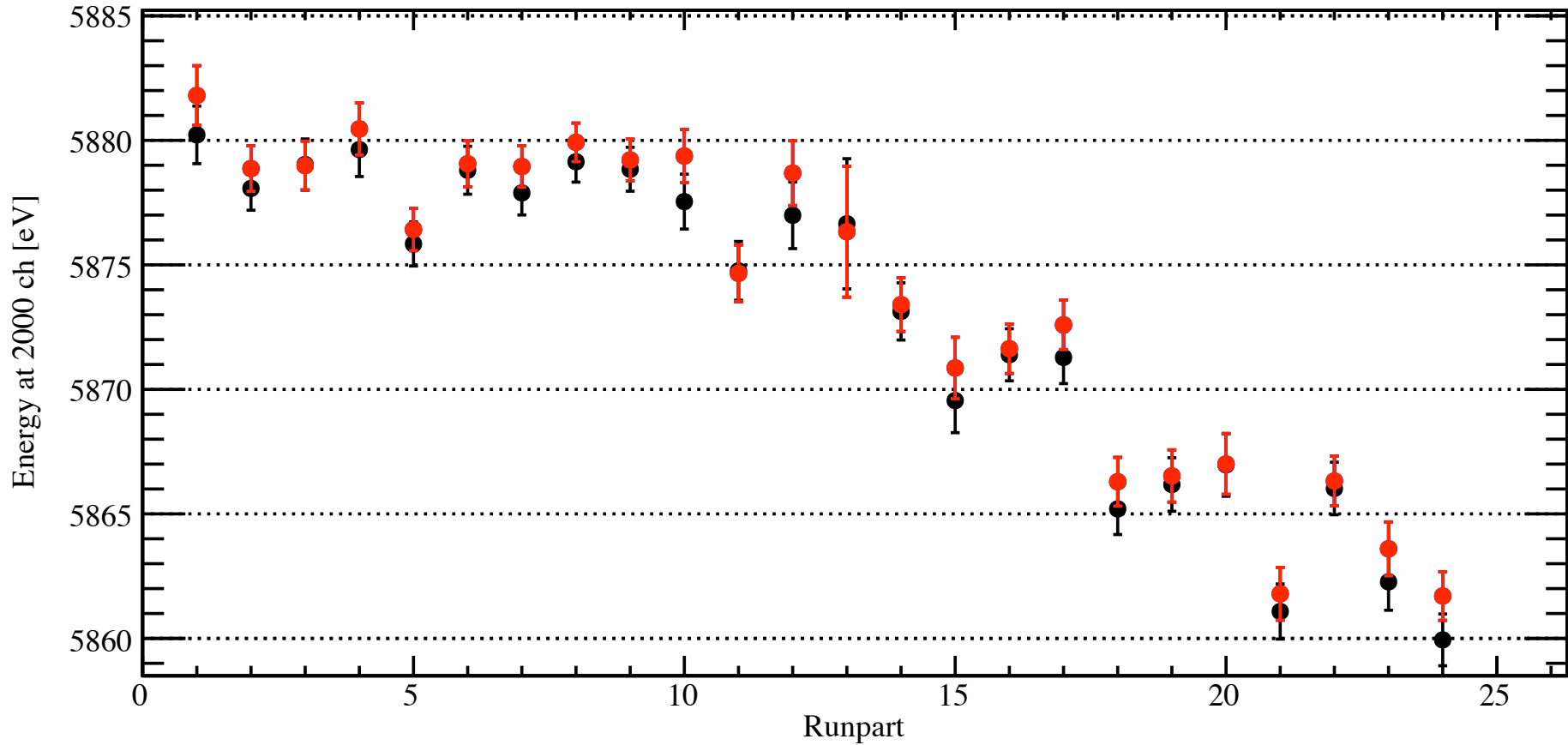
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle1 out sdd2



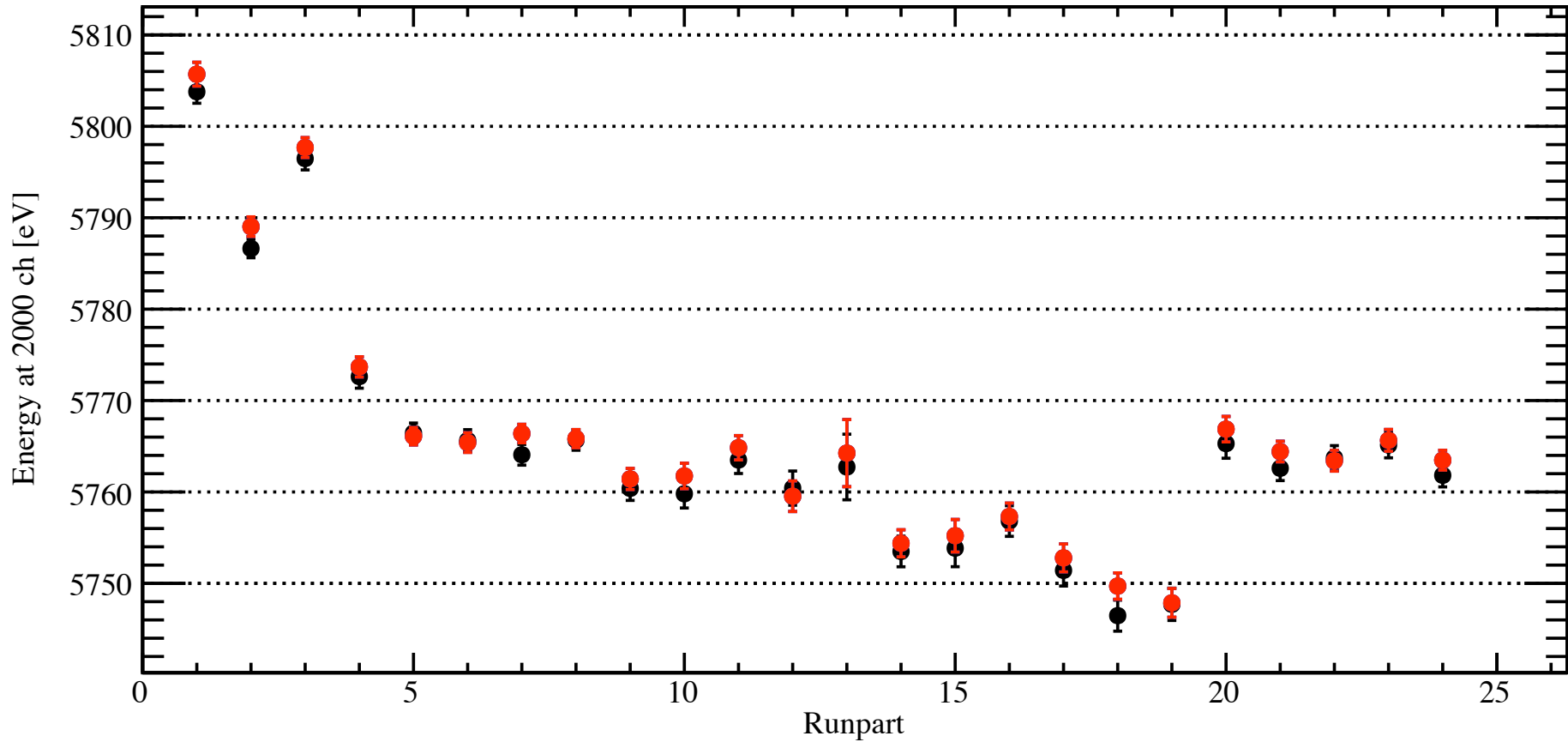
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle1 out sdd4



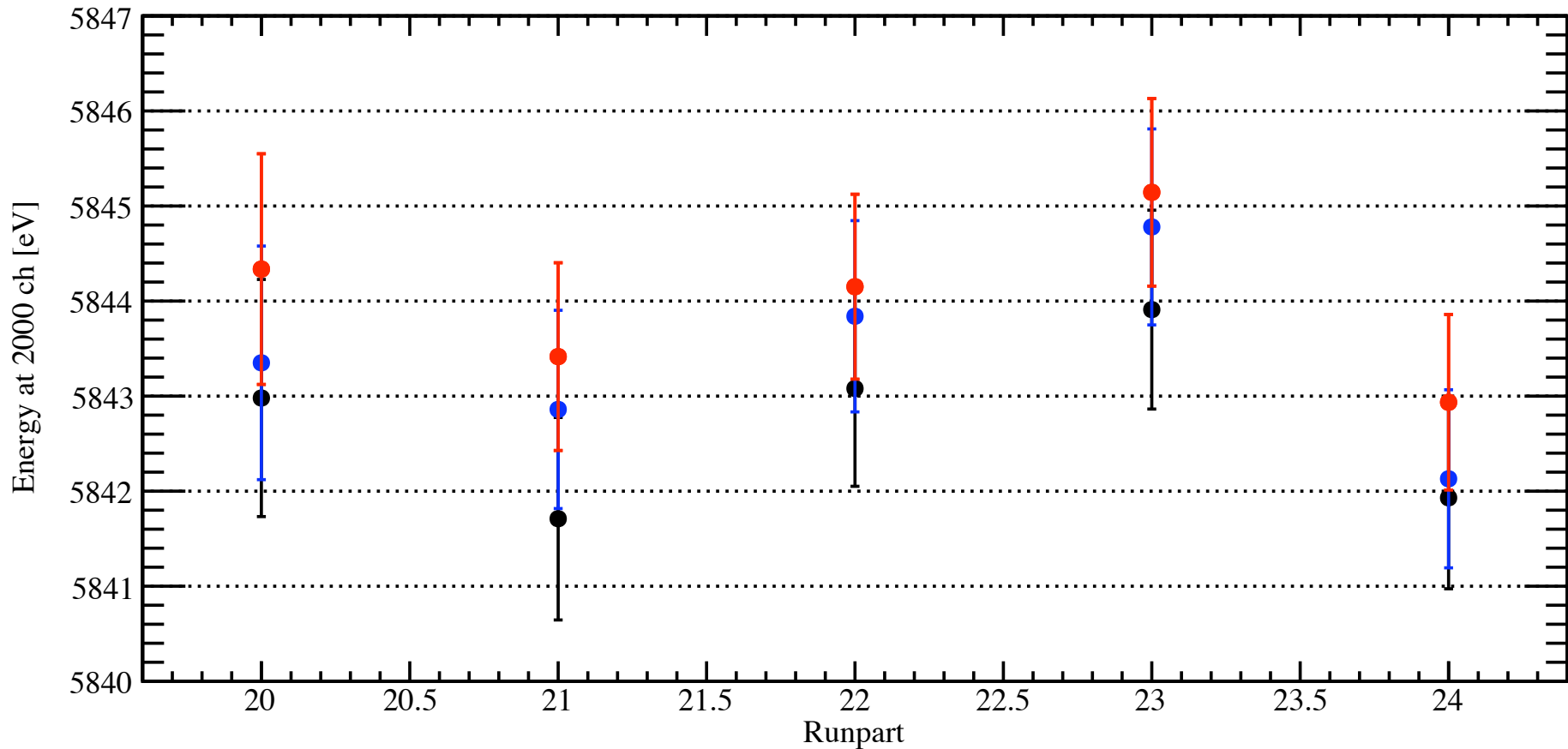
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle1 out sdd5



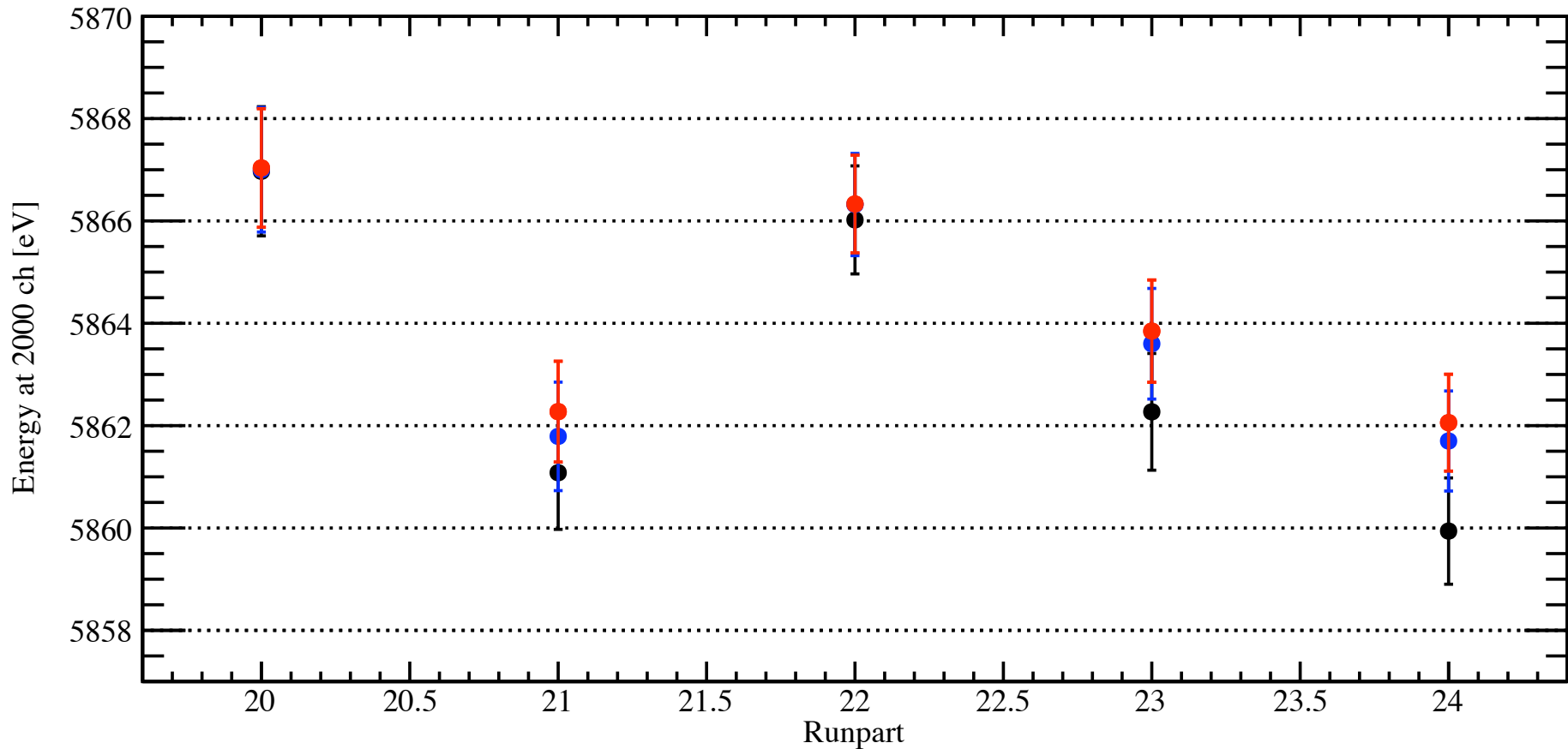
red : pileup cuts by FADC
blue : with pileup Gaussian
black : upper-rate cut

converted energy cycle1 out sdd2



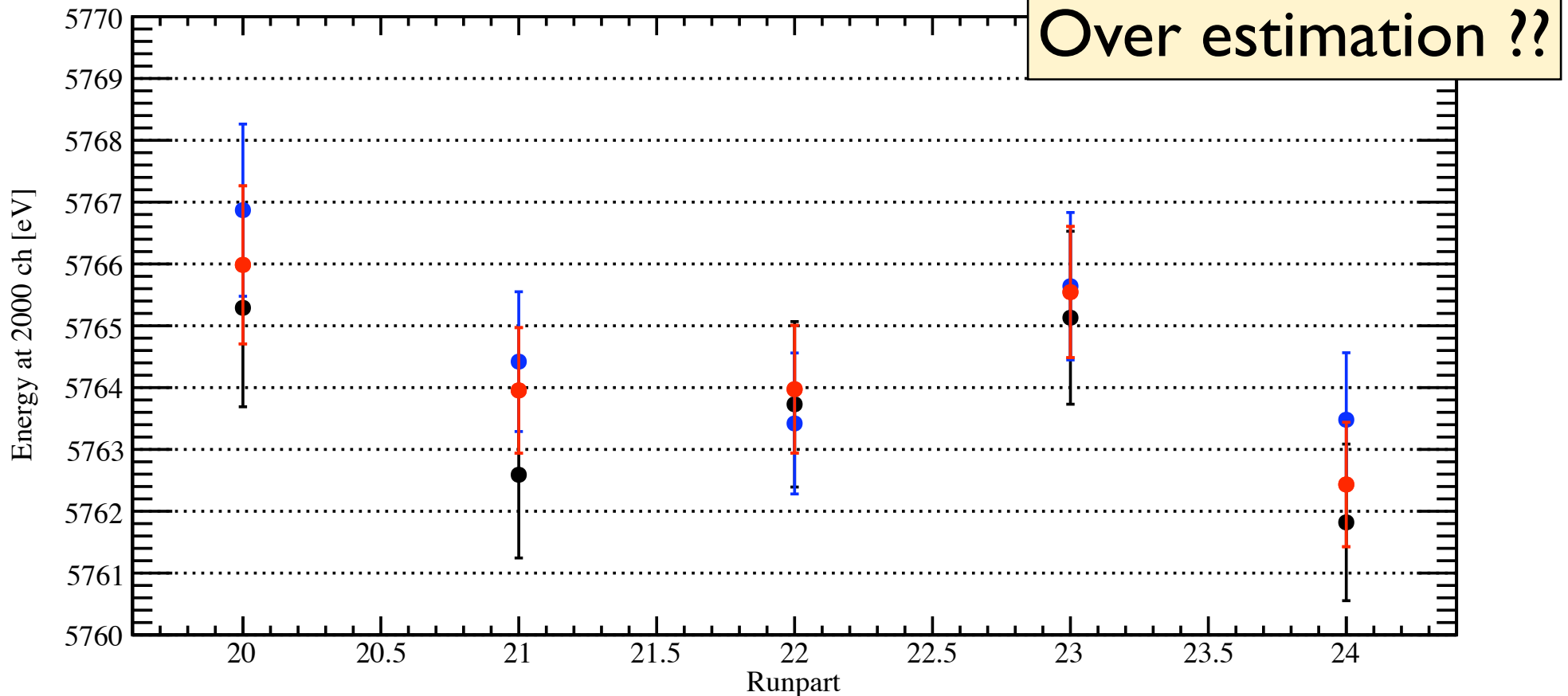
red : pileup cuts by FADC
blue : with pileup Gaussian
black : upper-rate cut

converted energy cycle1 out sdd4



red : pileup cuts by FADC
blue : with pileup Gaussian
black : upper-rate cut

converted energy cycle1 out sdd5



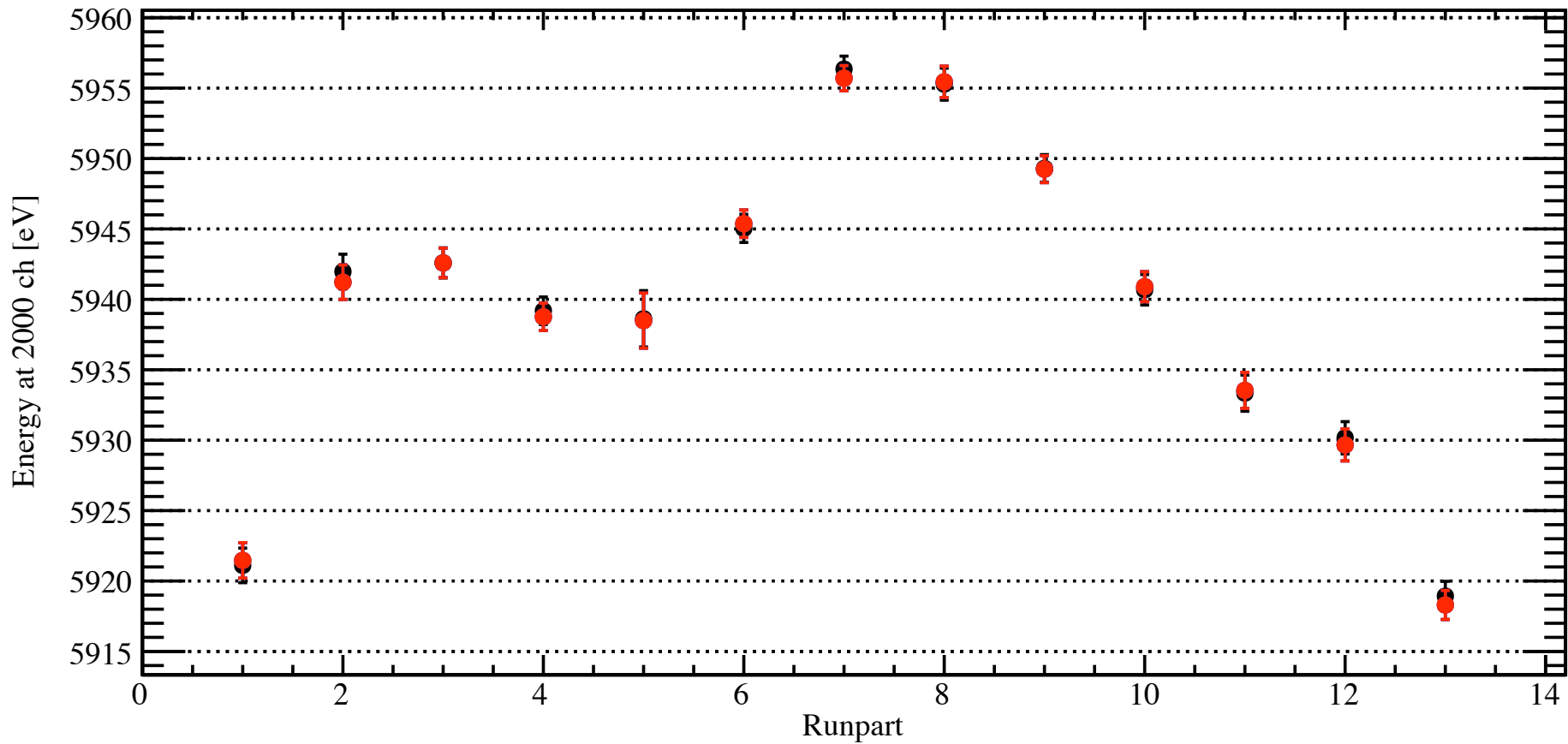
2nd cycle

Comparison pileup-fit with upper-rate cut

→ almost same, no problem

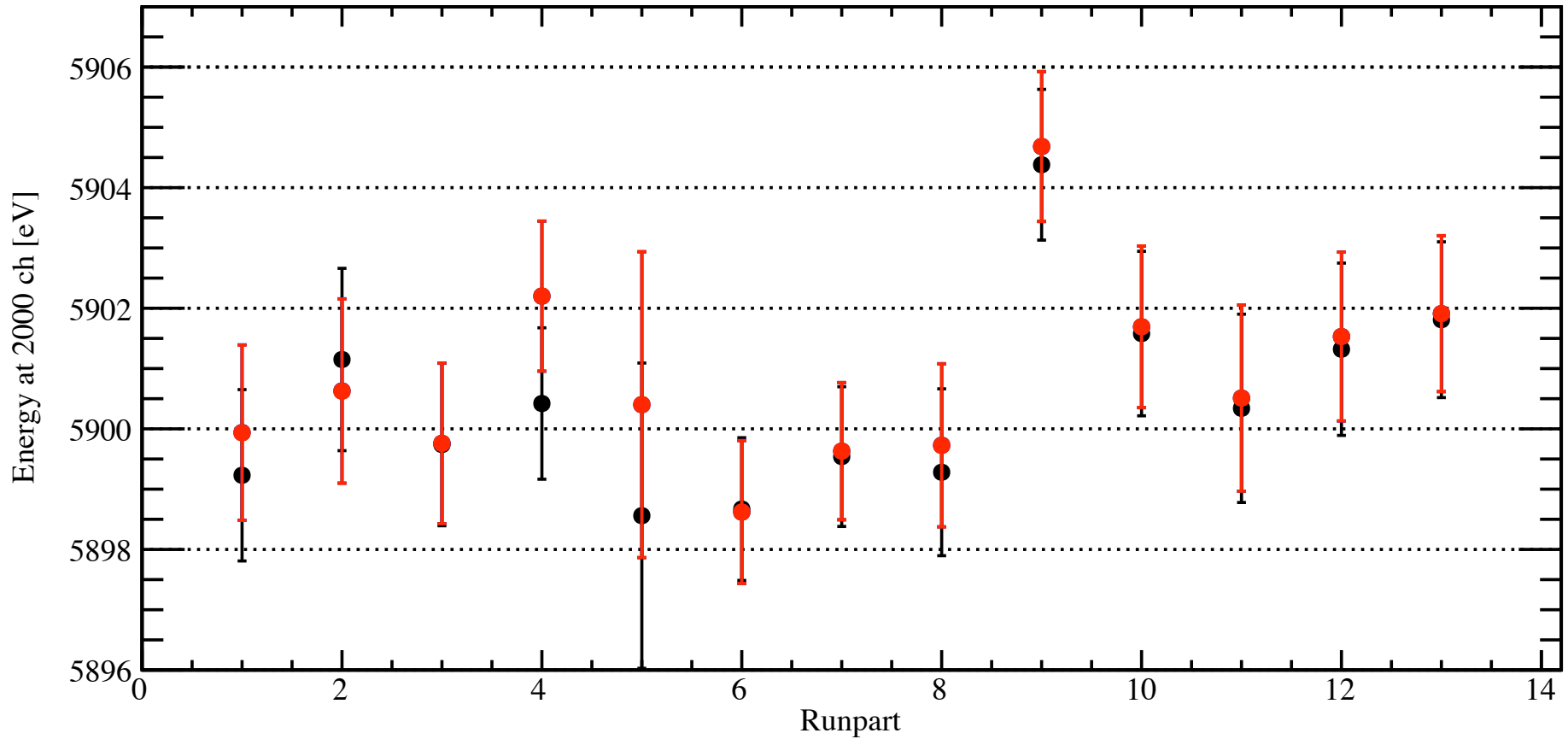
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle2 out sdd1



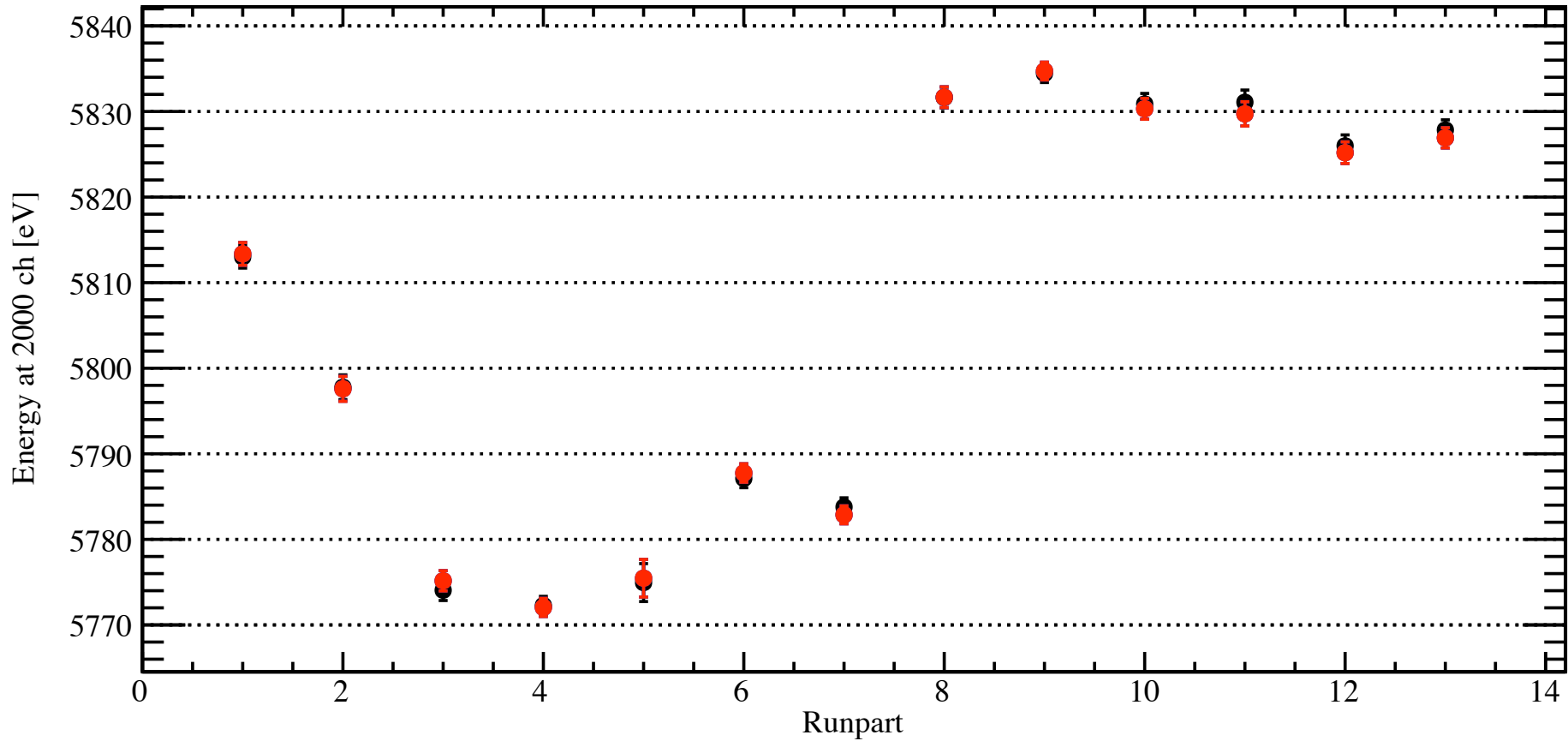
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle2 out sdd2



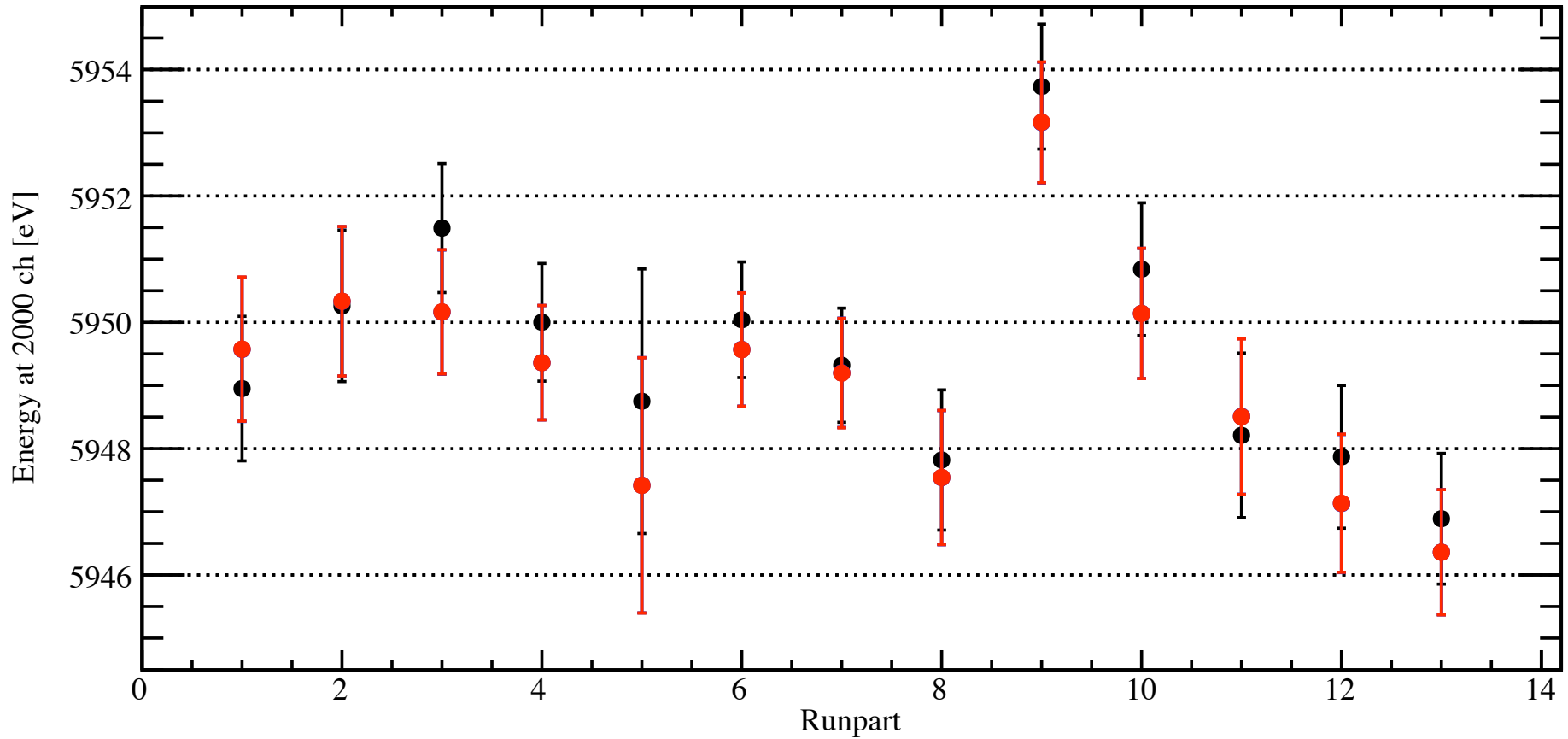
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle2 out sdd3



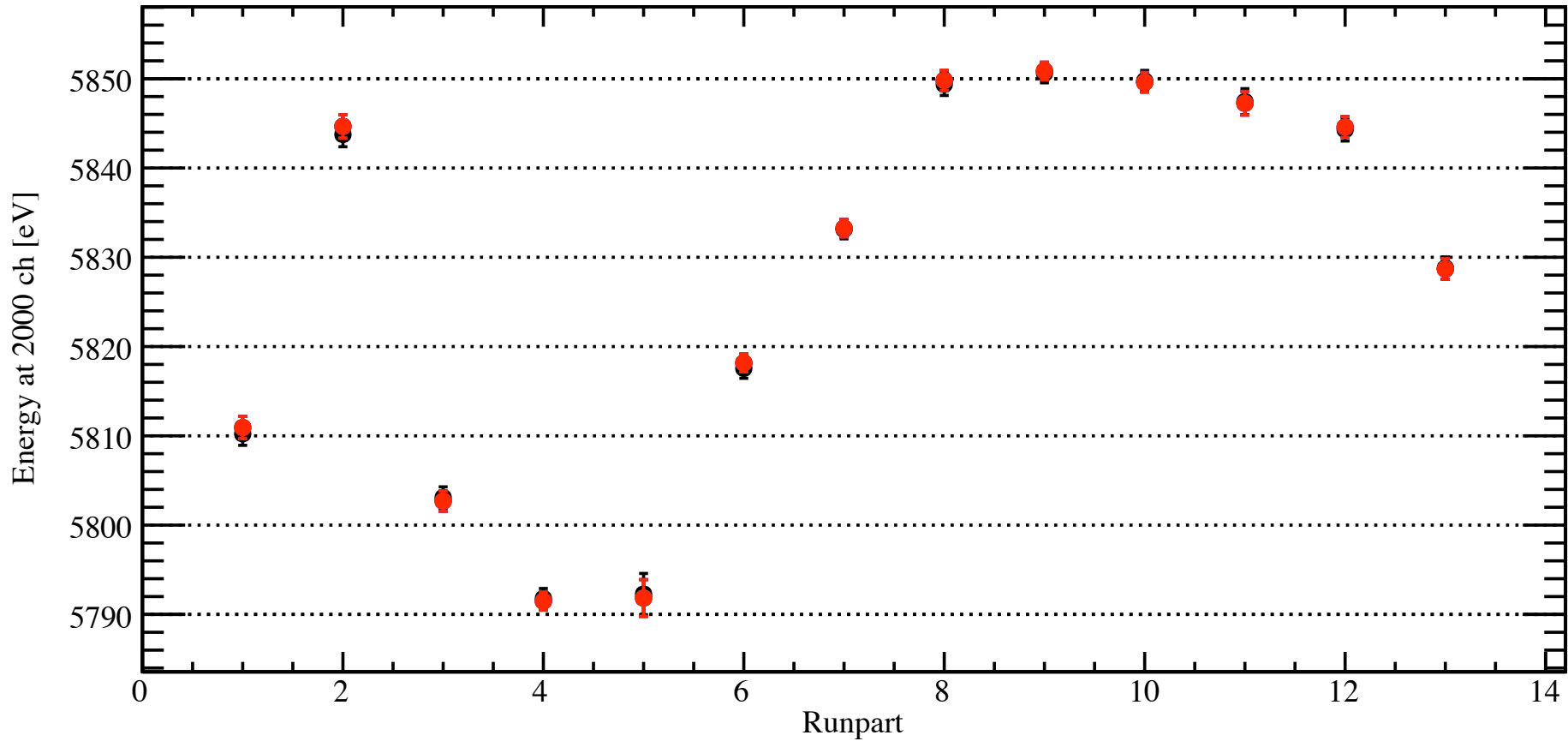
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle2 out sdd4



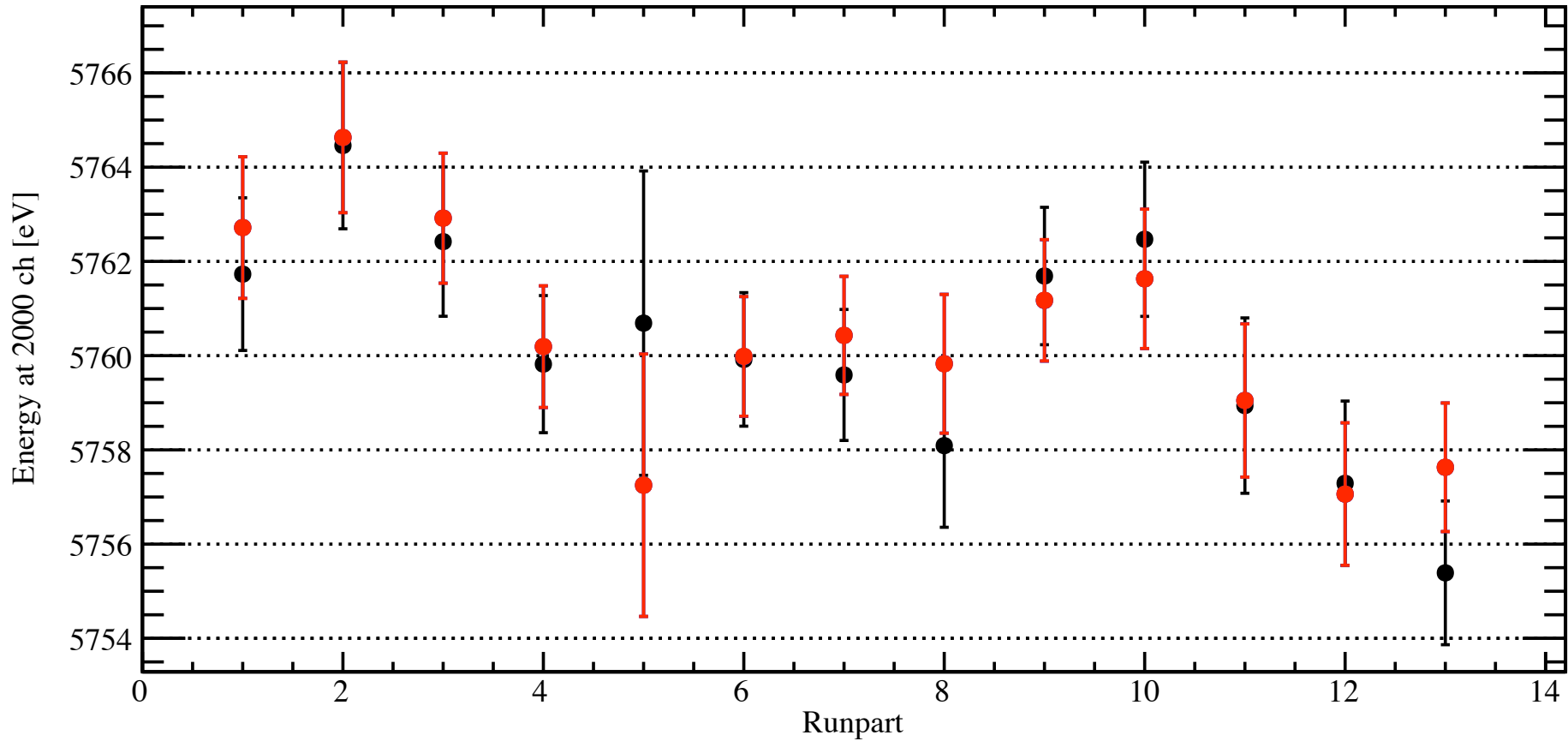
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle2 out sdd5



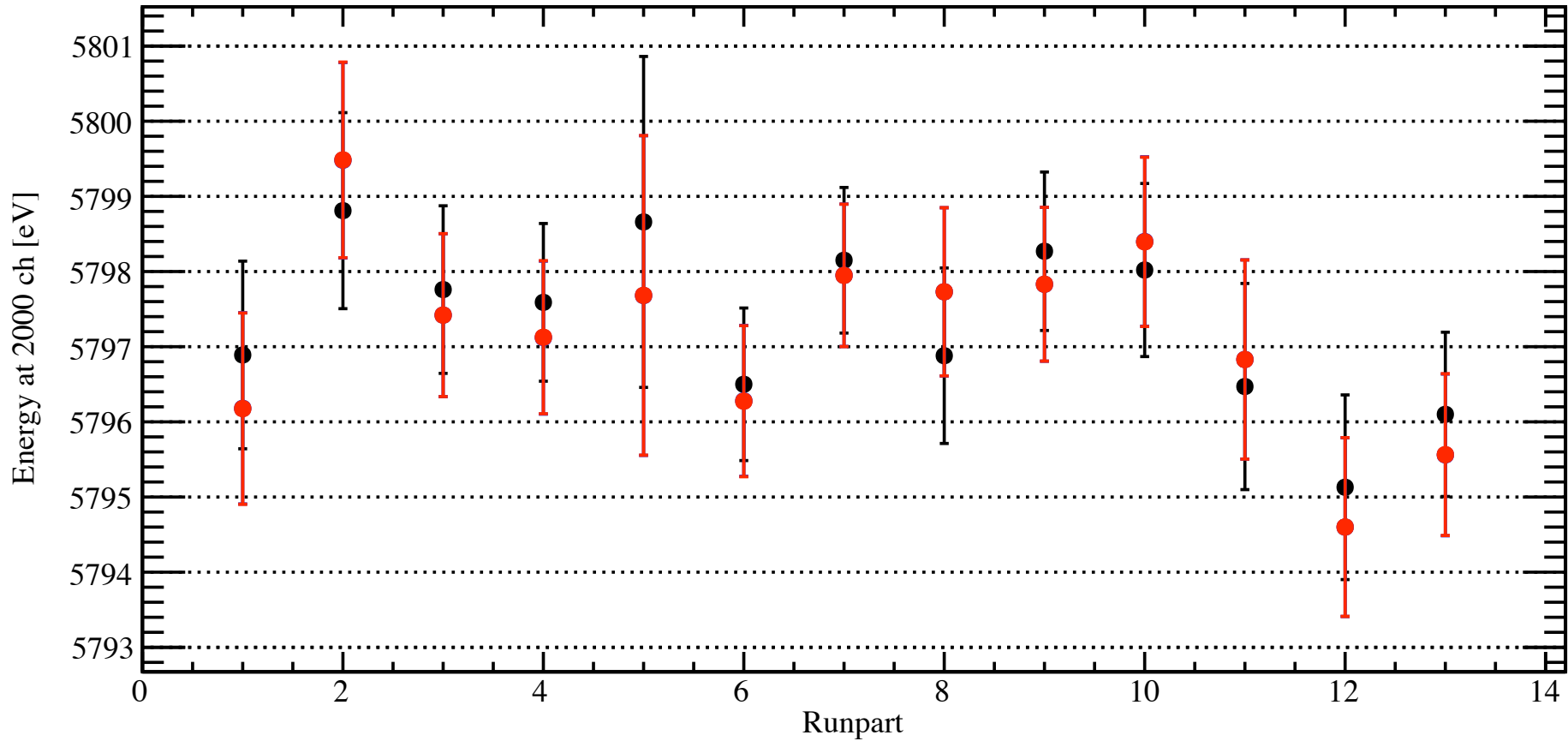
red : with pileup Gaussian
black : upper-rate cut

converted energy cycle2 out sdd7



red : with pileup Gaussian
black : upper-rate cut

converted energy cycle2 out sdd8

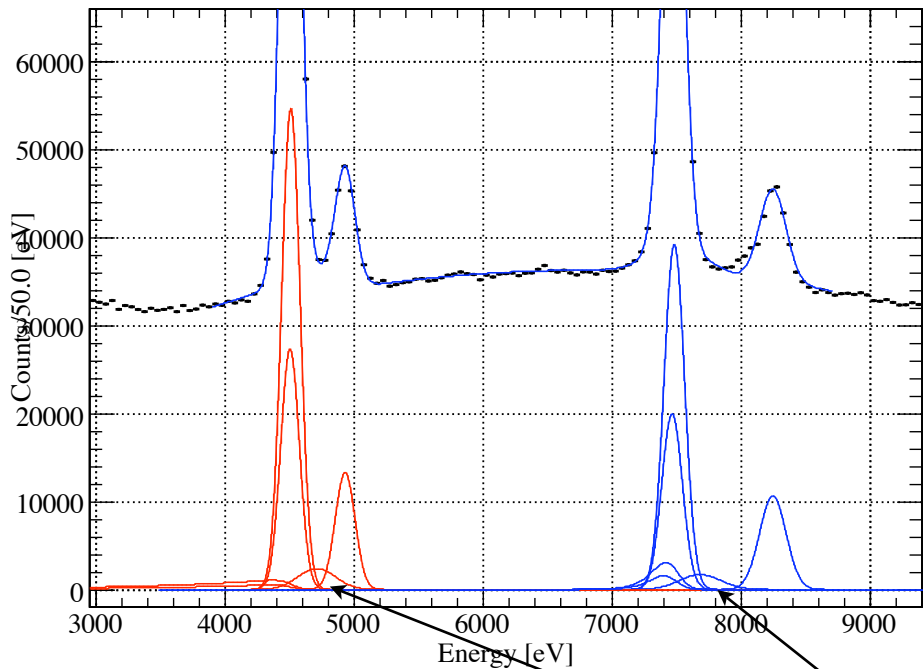


Low-energy tail fitting (response function)

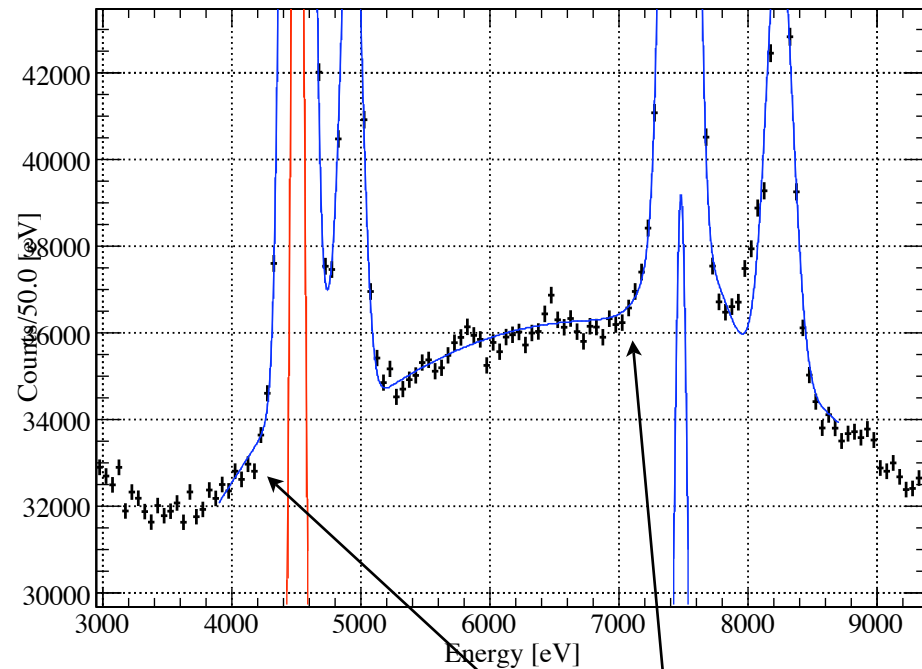
SDD-by-SDD
summed up calibrated histograms
using pileup Gaussian fit

(before iterative fit)

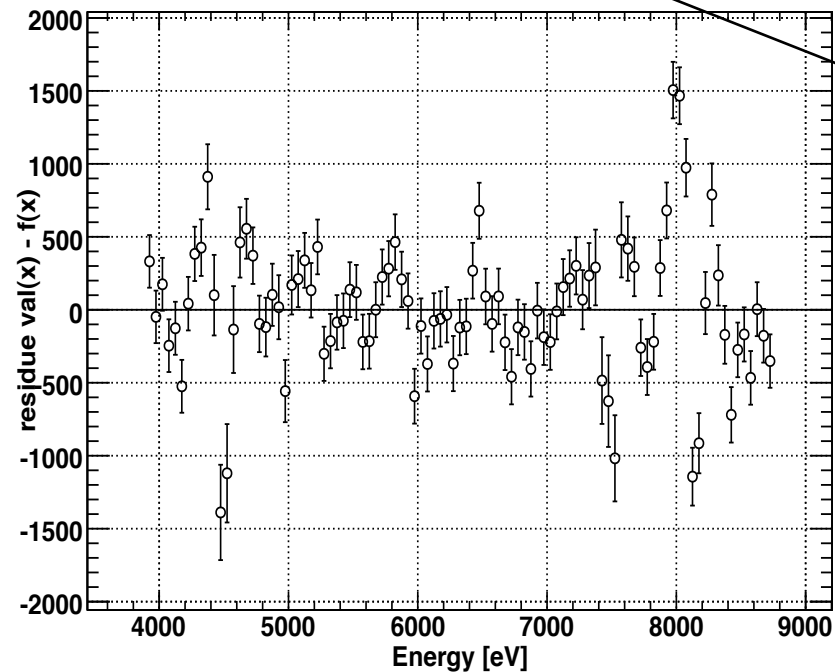
self total 1st mean and noise free fit



self total 1st mean and noise free fit



fit residue



pileups

tails

K alpha tails were added

K alpha tails were added

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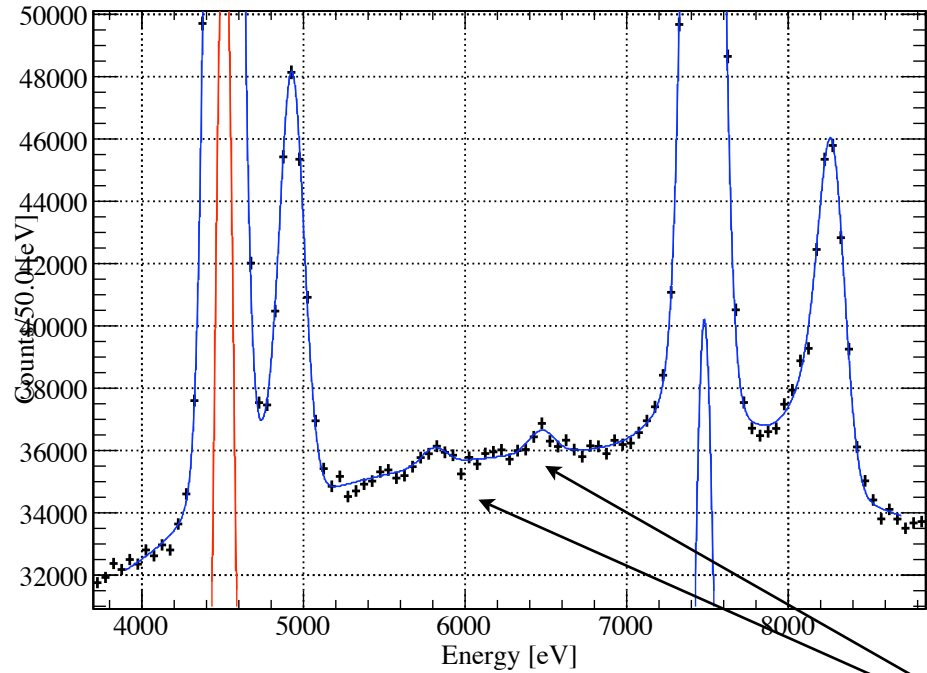
FCN=1572.15 FROM MINOS      STATUS=SUCCESSFUL 15706 CALLS      19648 TOTAL
      EDM=5.46599e-05      STRATEGY= 1      ERROR MATRIX ACCURATE
EXT PARAMETER              PARABOLIC          MINOS ERRORS
NO.  NAME      VALUE      ERROR      NEGATIVE      POSITIVE
 1  BGa      7.27023e+03  8.45533e+02 -1.28161e+03  1.30463e+03
 2  BGb      8.55064e+00  2.50449e-01 -3.88021e-01  3.81459e-01
 3  BGC      -6.30777e-04  1.83413e-05 -2.78693e-05  2.83078e-05
 4  Const Noise [eV]  5.77471e+01  1.25121e+00 -1.31469e+00  1.29536e+00
 5  Fano      1.05744e-01  7.23544e-03 -7.57652e-03  7.43778e-03
 6  Ti Kb/Ka1 ratio  2.57864e-01  4.15370e-03 -4.40866e-03  4.46794e-03
 7  Ni Kb/Ka1 ratio  3.47458e-01  8.87181e-03 -8.84203e-03  9.63958e-03
 8  TiKa1 Height  5.47032e+04  1.82988e+02 -1.87437e+02  1.84450e+02
 9  NiKa1 Height  3.91932e+04  5.62025e+02 -6.56182e+02  5.07760e+02
10  TiKa1 Mean [eV]  4.51084e+03  2.85847e-01 -2.86679e-01  2.88798e-01
11  NiKa1 Mean [eV]  7.48235e+03  8.09072e-01 -7.67926e-01  8.78302e-01
12  TiKb1 Mean [eV]  4.93119e+03  1.15046e+00 -1.15209e+00  1.14970e+00
13  NiKb1 Mean [eV]  8.24586e+03  1.53139e+00 -1.54138e+00  1.53179e+00
14  TiKb1 Sigma [eV]  7.60879e+01  1.28852e+00 -1.33375e+00  1.35799e+00
15  NiKb1 Sigma [eV]  1.02496e+02  2.09084e+00 -2.09137e+00  2.13181e+00
16  Pile area factor  4.31710e-02  2.49603e-03 -2.52651e-03  2.52850e-03
17  Pile shift [eV]  2.00000e+02  fixed
18  Pile sigma factor  2.00000e+00  fixed
19  Tail area factor TiKa  1.28147e-01  4.93578e-02 -4.24011e-02  1.09390e-01
20  Tail area factor NiKa  1.10012e-01  1.93028e-02 -1.74321e-02  2.23766e-02
21  Tail slope factor 0-dim  1.40133e+01  7.17908e+00 -5.52035e+00  1.52730e+01
22  Tail slope factor 1-dim  1.36669e+00  1.88416e-01 -1.80803e-01  2.09673e-01
    
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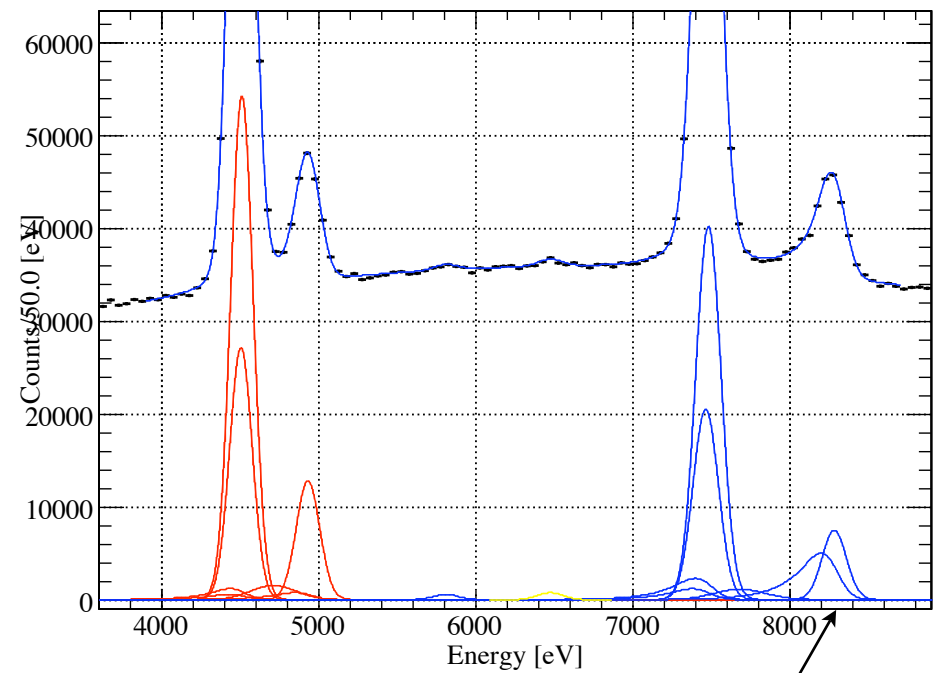
Ti EVENT
KA1+KA2      = 295267
Pileup       = 16996
Pile/All    = 0.0544283
Ni EVENT
KA1+KA2      = 236411
Pileup       = 13518
Pile/All    = 0.0540873
TiKa1 Mean   = 4510.839 +- 0.288
TiKb1 Mean   = 4931.189 +- 1.151
NiKa1 Mean   = 7482.348 +- 0.823
NiKb1 Mean   = 8245.856 +- 1.537
Const Noise  = 57.747 +- 1.305
Fano         = 0.106 +- 0.008
TiKb1 Noise  = 76.088 +- 1.346
NiKb1 Noise  = 102.496 +- 2.112
Chisq/NDF   = 375.108/76
    
```

reasonable values
were chosen

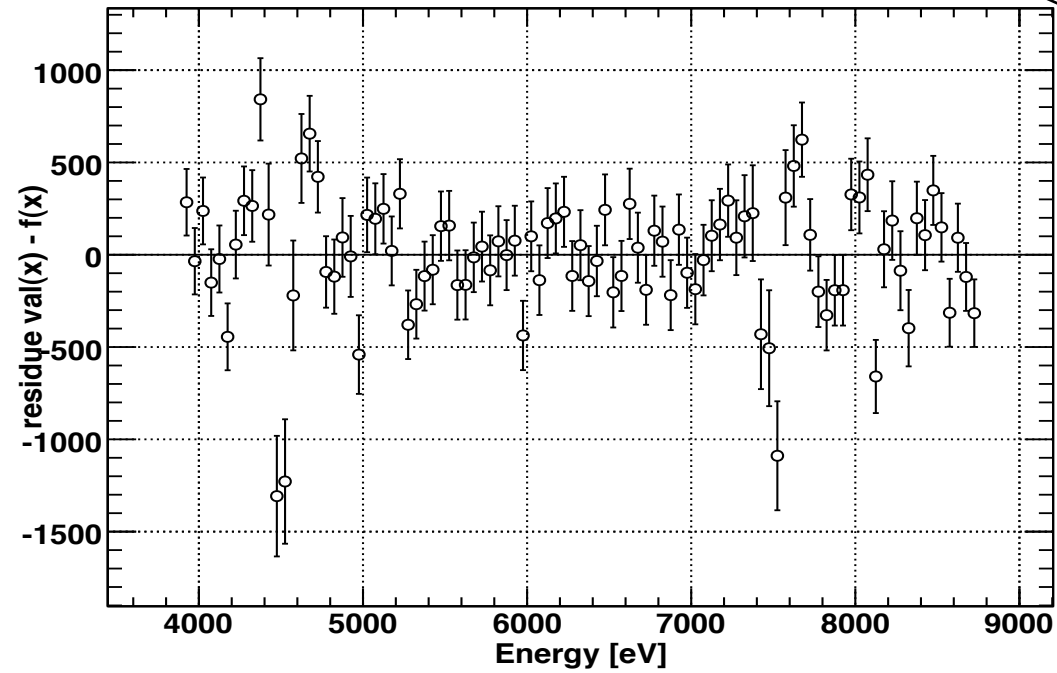
self total 1st mean and noise free fit



self total 1st mean and noise free fit



fit residue



Ni Ka escape and Fe/KHeXLa

too large !!
Copper ?

K alpha and K beta tails were added

(and Ni Ka escape and Fe ?)

FCN=1308.22 FROM MIGRAD STATUS=CONVERGED 2865 CALLS 2866 TOTAL
 EDM=0.000148632 STRATEGY= 1 ERROR MATRIX UNCERTAINTY 2.6 per cent

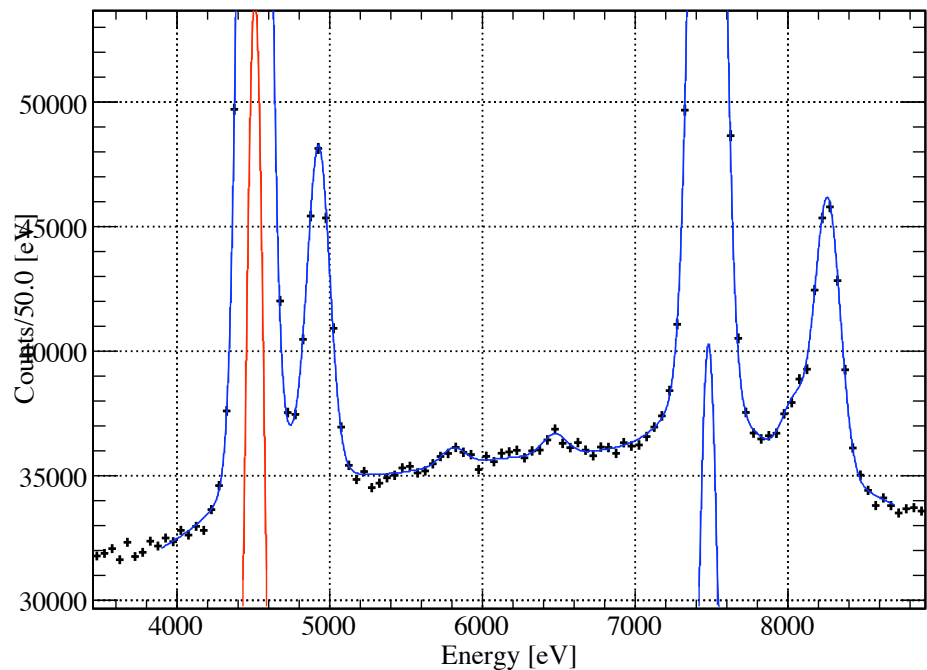
EXT NO.	PARAMETER NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	BGa	1.38010e+04	9.88643e+01	-6.19564e-01	1.31107e-04
2	BGb	6.60765e+00	1.80074e-02	1.01358e-04	5.41288e+00
3	BGc	-4.94331e-04	2.40487e-06	-3.78498e-09	-5.77595e+02
4	Const Noise [eV]	5.45803e+01	1.23985e+00	-2.27557e-03	1.96285e-04
5	Fano	1.24110e-01	6.69923e-03	5.37817e-05	2.69447e+00
6	Ti Kb/Ka1 ratio	2.46580e-01	8.88101e-03	4.05926e-05	2.34282e+00
7	Ni Kb/Ka1 ratio	1.76537e-01	1.88842e-02	1.80991e-04	3.20050e+00
8	TiKa1 Height	5.42447e+04	2.24593e+02	5.80079e-01	8.83523e-06
9	NiKa1 Height	4.01922e+04	3.00206e+02	1.40460e+00	4.37528e-05
10	TiKa1 Mean [eV]	4.51139e+03	3.27854e-01	-6.60141e-04	6.71743e-03
11	NiKa1 Mean [eV]	7.48200e+03	5.58754e-01	-2.75218e-03	7.43735e-03
12	TiKb1 Mean [eV]	4.93212e+03	1.99650e+00	-2.58092e-04	-8.57609e-02
13	NiKb1 Mean [eV]	8.28332e+03	3.54677e+00	-2.85742e-03	4.42851e-02
14	TiKb1 Sigma [eV]	7.47853e+01	1.49515e+00	7.13506e-03	-2.05781e-03
15	NiKb1 Sigma [eV]	7.66957e+01	2.29247e+00	2.24660e-02	-1.60853e-03
16	Pile area factor	2.77370e-02	5.31086e-03	-5.13096e-05	6.51719e-01
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	3.77518e-02	6.47825e-03	-8.82689e-06	-1.96344e-02
20	Tail area factor NiKa	9.92188e-02	1.01495e-02	-5.22306e-05	1.86746e-01
21	Tail slope factor Ka	2.17027e+00	2.80314e-01	1.12740e-03	-8.34135e-04
22	Tail area factor TiKb	1.06164e-01	8.07389e-02	-7.61393e-05	-6.26867e-02
23	Tail area factor NiKb	1.20701e+00	2.00132e-01	-1.87385e-03	3.85845e-01
24	Tail slope factor Kb	2.30860e+00	2.92613e-01	1.46942e-03	-8.15841e-02
25	Escape area factor NiKa	4.55858e-05	1.03337e-05	1.03753e-05	-1.05228e+00
26	Escape mean NiKa [eV]	5.80936e+03	1.96724e+01	-3.49493e-04	-7.06232e-03
27	FeKa Height	7.40474e+02	1.28066e+02	2.15246e-09**	at limit **
28	FeKa mean ? [eV]	6.47470e+03	9.86187e+00	9.12935e-04	-2.88953e-01

KA1+KA2 = 291659
 Pileup = 10786.3
 Pile/All = 0.0356637
 Ni EVENT
 KA1+KA2 = 245618
 Pileup = 9023.45
 Pile/All = 0.0354359
 TiKa1 Mean = 4511.394 +- 0.328
 TiKb1 Mean = 4932.120 +- 1.996
 NiKa1 Mean = 7481.999 +- 0.559
 NiKb1 Mean = 8283.324 +- 3.547
 Const Noise = 54.580 +- 1.240
 Fano = 0.124 +- 0.007
 TiKb1 Noise = 74.785 +- 1.495
 NiKb1 Noise = 76.696 +- 2.292
 Chisq/NDF = 113.758/70

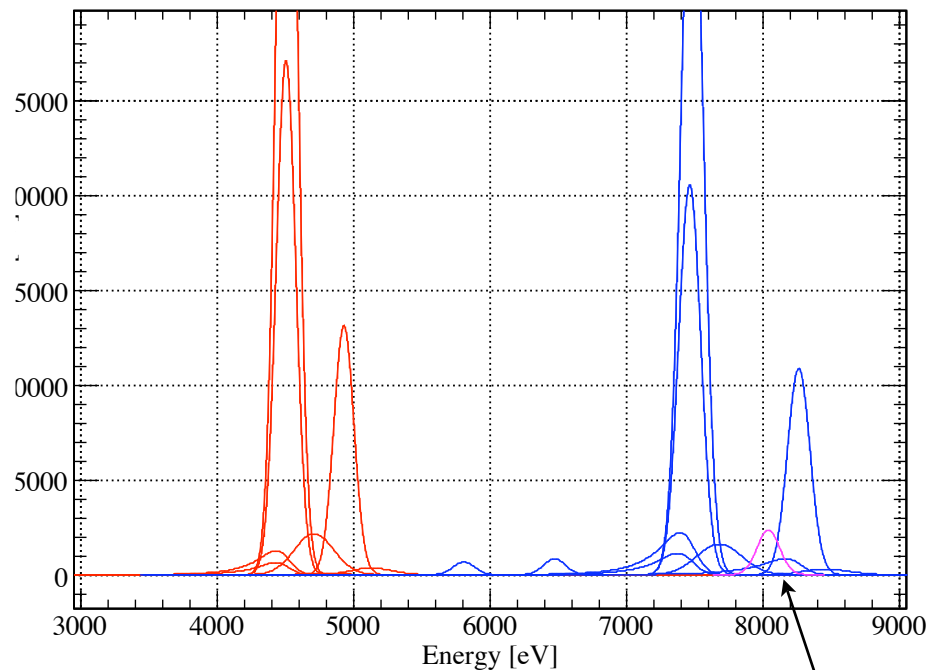
**K alpha and K
 beta tails
 were added**

(and Ni Ka escape and Fe ?)

self total 1st mean and noise free fit

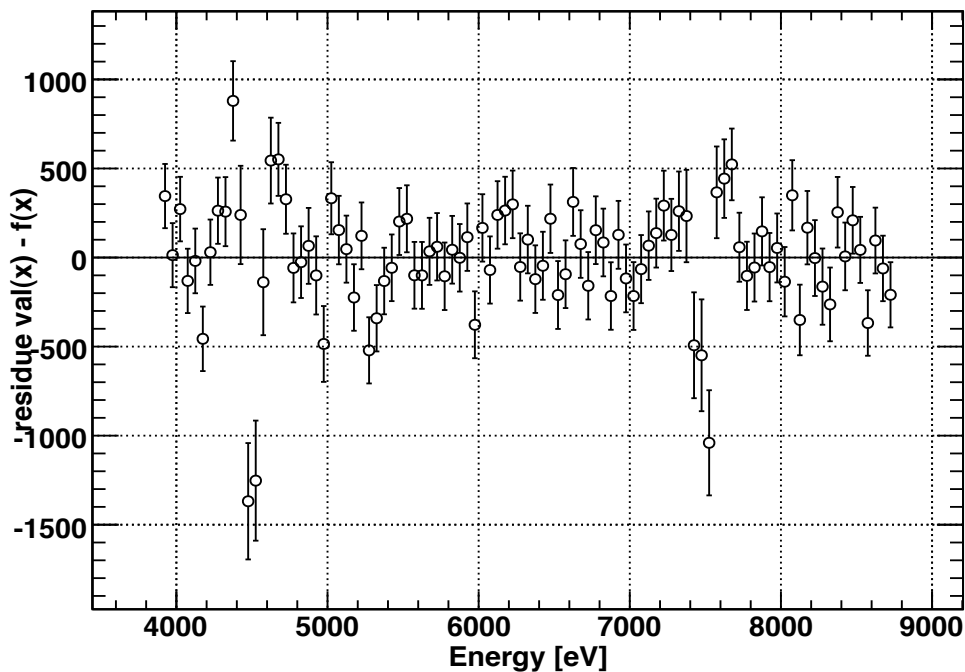


self total 1st mean and noise free fit



Copper Ka

fit residue



K alpha, K beta tails and Cu contamination were added (and Ni Ka escape and Fe ?)

FCN=1285.26 FROM MINOS STATUS=PROBLEMS 27816 CALLS 75296 TOTAL
EDM=2.00366e-06 STRATEGY= 1 ERROR MATRIX ACCURATE

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINOS ERRORS	
				NEGATIVE	POSITIVE
1	BGa	1.33324e+04	6.32912e+02	-6.80638e+02	6.78230e+02
2	BGb	6.74927e+00	1.98690e-01	-2.13668e-01	2.13650e-01
3	BGc	-5.06883e-04	1.53020e-05	-1.64401e-05	1.64472e-05
4	Const Noise [eV]	5.42869e+01	1.18628e+00	-1.20212e+00	1.18242e+00
5	Fano	1.24356e-01	6.21482e-03	-6.26633e-03	6.22488e-03
6	Ti Kb/Ka1 ratio	2.49170e-01	4.14387e-03	-5.46725e-03	4.17293e-03
7	Ni Kb/Ka1 ratio	2.75898e-01	1.11044e-02	-1.63722e-02	1.06613e-02
8	TiKa1 Height	5.42258e+04	2.19979e+02	-2.26880e+02	2.16253e+02
9	NiKa1 Height	4.02824e+04	2.65735e+02	-2.83567e+02	2.53233e+02
10	TiKa1 Mean [eV]	4.51125e+03	3.36721e-01	-3.34670e-01	3.42873e-01
11	NiKa1 Mean [eV]	7.48162e+03	5.43628e-01	-5.31307e-01	5.62217e-01
12	TiKb1 Mean [eV]	4.92985e+03	1.15709e+00	-1.15769e+00	1.48721e+00
13	NiKb1 Mean [eV]	8.26334e+03	2.44915e+00	-2.35462e+00	2.98408e+00
14	TiKb1 Sigma [eV]	7.34536e+01	1.29357e+00	-1.27719e+00	1.30570e+00
15	NiKb1 Sigma [eV]	8.23047e+01	1.63112e+00	-1.63390e+00	1.63939e+00
16	Pile area factor	5.27789e-02	4.33984e-03	-5.88356e-03	4.29869e-03
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	4.33089e-02	7.13304e-03	-7.22630e-03	7.31176e-03
20	Tail area factor NiKa	1.02211e-01	8.98444e-03	-8.66165e-03	9.48268e-03
21	Tail slope factor Ka	2.46660e+00	3.13678e-01	-2.98463e-01	3.50798e-01
22	Tail area factor TiKb	1.00000e-02	1.06684e-01	at limit	5.52316e-02
			WARNING -	- ABOVE PARAMETER IS AT LIMIT.	
23	Tail area factor NiKb	1.62287e-01	1.01141e-01	-9.49048e-02	1.13379e-01
24	Tail slope factor Kb	3.00000e+00	1.56653e+00	-9.19916e-01	at limit
			WARNING -	- ABOVE PARAMETER IS AT LIMIT.	
25	Escape area factor NiKa	1.01567e-02	2.05364e-03	-2.05783e-03	2.05955e-03
26	Escape mean NiKa [eV]	5.80944e+03	1.84969e+01	-1.88384e+01	1.85976e+01
27	FeKa Height factor	1.96895e-02	3.13141e-03	-3.14256e-03	3.15079e-03
28	FeKa mean [eV]	6.47370e+03	1.59089e+01	-1.59237e+01	1.61378e+01
29	CuKa Height factor	5.92334e-02	9.68776e-03	-1.02513e-02	9.51086e-03
30	CuKa mean [eV]	8.04104e+03	fixed		

Ti EVENT
KA1+KA2 = 290764
Pileup = 15346.2 Pile/All = 0.050133
Ni EVENT KA1+KA2 = 245695
Pileup = 12967.5
Pile/All = 0.050133
TiKa1 Mean = 4511.254 +- 0.339
TiKb1 Mean = 4929.852 +- 1.322
NiKa1 Mean = 7481.617 +- 0.547
NiKb1 Mean = 8263.335 +- 2.669
Const Noise = 54.287 +- 1.192
Fano = 0.124 +- 0.006
TiKb1 Noise = 73.454 +- 1.291
NiKb1 Noise = 82.305 +- 1.637
Chisq/NDF = 90.743/69

**K alpha, K beta
tails and Cu
contamination
were added**

(and Ni Ka escape and Fe ?)

K beta tail parameters conflict that of CuKa
they are fixed to converge the fit.

→ next : fix these parameters except for
pileup-intensity and re-fit the calibration
histograms iteratively (see another PDF
file)

fit results
SDD-by-SDD

FCN=1287.45 FROM MINOS STATUS=SUCCESSFUL 10448 CALLS 12184 TOTAL
 EDM=0.000215697 STRATEGY= 1 ERROR MATRIX ACCURATE

cycle1_sdd2

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINOS ERRORS	
				NEGATIVE	POSITIVE
1	BGa	1.31507e+04	6.37025e+02	-6.62742e+02	6.57997e+02
2	BGb	6.79697e+00	2.01355e-01	-2.08637e-01	2.09008e-01
3	BGc	-5.09551e-04	1.56094e-05	-1.61788e-05	1.61772e-05
4	Const Noise [eV]	5.36913e+01	1.14696e+00	-1.16179e+00	1.14299e+00
5	Fano	1.27109e-01	6.05576e-03	-6.09594e-03	6.06905e-03
6	Ti Kb/Ka1 ratio	2.44778e-01	3.96394e-03	-3.93113e-03	4.00331e-03
7	Ni Kb/Ka1 ratio	2.78992e-01	5.44913e-03	-5.41492e-03	5.50309e-03
8	TiKa1 Height	5.41904e+04	2.20358e+02	-2.26098e+02	2.16582e+02
9	NiKa1 Height	4.02962e+04	2.64414e+02	-2.79228e+02	2.53180e+02
10	TiKa1 Mean [eV]	4.51125e+03	3.37720e-01	-3.34999e-01	3.42583e-01
11	NiKa1 Mean [eV]	7.48161e+03	5.41111e-01	-5.30590e-01	5.55107e-01
12	TiKb1 Mean [eV]	4.93098e+03	1.11687e+00	-1.11785e+00	1.11659e+00
13	NiKb1 Mean [eV]	8.26237e+03	1.40388e+00	-1.40875e+00	1.40141e+00
14	TiKb1 Sigma [eV]	7.27656e+01	1.22703e+00	-1.21315e+00	1.24191e+00
15	NiKb1 Sigma [eV]	8.22818e+01	1.55398e+00	-1.53670e+00	1.57589e+00
16	Pile area factor	5.29668e-02	3.46212e-03	-3.47188e-03	3.45796e-03
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	4.53494e-02	6.94141e-03	-6.97091e-03	7.04062e-03
20	Tail area factor NiKa	1.00646e-01	8.96886e-03	-8.66932e-03	9.39449e-03
21	Tail slope factor Ka	2.45909e+00	3.17440e-01	-2.94688e-01	3.51856e-01
22	Tail area factor TiKb	4.50000e-02	fixed		
23	Tail area factor NiKb	1.00000e-01	fixed		
24	Tail slope factor Kb	2.50000e+00	fixed		
25	Escape area factor NiKa	1.00269e-02	2.05160e-03	-2.04851e-03	2.05941e-03
26	Escape mean NiKa [eV]	5.80904e+03	1.86078e+01	-1.89566e+01	1.87014e+01
27	FeKa Height factor	1.92102e-02	3.12583e-03	-3.13088e-03	3.13557e-03
28	FeKa mean [eV]	6.47359e+03	1.61085e+01	-1.61322e+01	1.63209e+01
29	CuKa Height factor	6.46435e-02	3.89331e-03	-3.90400e-03	3.88372e-03
30	CuKa mean [eV]	8.04104e+03	fixed		

Ti EVENT
 KA1+KA2 = 290088
 Pileup = 15365.1
 Pile/All = 0.0503025
 Ni EVENT
 KA1+KA2 = 246047
 Pileup = 13032.3
 Pile/All = 0.0503025
 TiKa1 Mean = 4511.249 +- 0.339
 TiKb1 Mean = 4930.985 +- 1.117
 NiKa1 Mean = 7481.610 +- 0.543
 NiKb1 Mean = 8262.371 +- 1.405
 Const Noise = 53.691 +- 1.152
 Fano = 0.127 +- 0.006
 TiKb1 Noise = 72.766 +- 1.228
 NiKb1 Noise = 82.282 +- 1.556
 Chisq/NDF = 92.934/72

K beta params were fixed



```

FCN=1324.55 FROM MINOS      STATUS=SUCCESSFUL  24835 CALLS      26242 TOTAL
EDM=0.363709  STRATEGY= 1      ERROR MATRIX ACCURATE

EXT PARAMETER              PARABOLIC              MINOS ERRORS
NO.  NAME                  VALUE                ERROR                NEGATIVE              POSITIVE
 1  BGa                    2.27474e+04         6.52864e+02         -4.50374e+02         1.03519e+03
 2  BGb                    6.61019e+00         2.06322e-01         -3.30041e-01         1.41150e-01
 3  BGc                    -5.37905e-04        1.61049e-05         -1.10376e-05         2.57868e-05
 4  Const Noise [eV]      5.13641e+01         1.16941e+00         -1.22451e+00         1.35409e+00
 5  Fano                   1.32558e-01         5.87245e-03         -6.94075e-03         5.99718e-03
 6  Ti Kb/Ka1 ratio      2.40685e-01         3.84128e-03         -4.28750e-03         4.16443e-03
 7  Ni Kb/Ka1 ratio      2.79496e-01         5.48496e-03         -6.05822e-03         6.03294e-03
 8  TiKa1 Height         6.11250e+04         3.92966e+02         -4.83742e+02         3.89765e+02
 9  NiKa1 Height         4.95078e+04         4.62022e+02         -6.37269e+02         4.04539e+02
10  TiKa1 Mean [eV]      4.51137e+03         4.00851e-01         -4.38828e-01         4.47249e-01
11  NiKa1 Mean [eV]      7.48076e+03         6.40019e-01         -5.85468e-01         8.27854e-01
12  TiKb1 Mean [eV]      4.93140e+03         1.04478e+00         -1.14518e+00         1.14431e+00
13  NiKb1 Mean [eV]      8.26203e+03         1.24225e+00         -1.42406e+00         1.29931e+00
14  TiKb1 Sigma [eV]     6.94707e+01         1.14731e+00         -1.26527e+00         1.24423e+00
15  NiKb1 Sigma [eV]     8.18986e+01         1.37495e+00         -1.61456e+00         1.39787e+00
16  Pile area factor     8.40259e-02         3.26419e-03         -3.75955e-03         3.39979e-03
17  Pile shift [eV]      2.00000e+02         fixed
18  Pile sigma factor    2.00000e+00         fixed
19  Tail area factor TiKa 6.19148e-02         8.83482e-03         -1.00846e-02         9.81641e-03
20  Tail area factor NiKa 8.49376e-02         1.32219e-02         -1.15847e-02         1.81455e-02
21  Tail slope factor Ka  1.69083e+00         2.41020e-01         -2.62142e-01         2.55164e-01
22  Tail area factor TiKb 6.10000e-02         fixed
23  Tail area factor NiKb 8.60000e-02         fixed
24  Tail slope factor Kb  2.00000e+00         fixed
25  Escape area factor NiKa 1.97739e-03         1.78867e-03         -1.86991e-03         2.05388e-03
26  Escape mean NiKa [eV] 5.71067e+03         6.53645e+01         at limit              1.30595e+02
27  FeKa Height factor    8.93220e-03         2.78358e-03         -2.73421e-03         3.38090e-03
28  FeKa mean [eV]        6.67686e+03         4.35059e+01         -4.97359e+01         4.69893e+01
29  CuKa Height factor    6.72439e-02         3.52692e-03         -3.84914e-03         3.88334e-03
30  CuKa mean [eV]        8.04104e+03         fixed

```

cycle1_sdd4

```

Ti EVENT
KA1+KA2      = 322305
Pileup       = 27082
Pile/All = 0.0775128
Ni EVENT
KA1+KA2      = 300203
Pileup       = 25224.9
Pile/All = 0.0775128
TiKa1 Mean   = 4511.370 +- 0.443
TiKb1 Mean   = 4931.402 +- 1.145
NiKa1 Mean   = 7480.756 +- 0.707
NiKb1 Mean   = 8262.032 +- 1.362
Const Noise  = 51.364 +- 1.289
Fano         = 0.133 +- 0.006
TiKb1 Noise  = 69.471 +- 1.255
NiKb1 Noise  = 81.899 +- 1.506
Chisq/NDF    = 112.054/72

```

FCN=1375.14 FROM MINOS STATUS=SUCCESSFUL 12484 CALLS 13552 TOTAL
 EDM=0.000176042 STRATEGY= 1 ERROR MATRIX ACCURATE

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINUS NEGATIVE	MINOS POSITIVE
1	BGa	3.91906e+04	1.15835e+03	-1.50134e+03	1.47748e+03
2	BGb	4.68912e+00	3.49245e-01	-4.47248e-01	4.53671e-01
3	BGc	-4.18901e-04	2.56227e-05	-3.31709e-05	3.27520e-05
4	Const Noise [eV]	7.04102e+01	1.12280e+00	-1.13776e+00	1.12199e+00
5	Fano	1.50534e-01	7.01316e-03	-7.04997e-03	7.05677e-03
6	Ti Kb/Ka1 ratio	2.32237e-01	5.48175e-03	-5.59660e-03	5.84162e-03
7	Ni Kb/Ka1 ratio	2.90851e-01	5.34363e-03	-5.30434e-03	5.41195e-03
8	TiKa1 Height	5.38623e+04	1.76335e+02	-1.76876e+02	1.76372e+02
9	NiKa1 Height	5.36965e+04	1.67664e+02	-1.67500e+02	1.68074e+02
10	TiKa1 Mean [eV]	4.50895e+03	3.98250e-01	-4.18898e-01	4.26088e-01
11	NiKa1 Mean [eV]	7.47770e+03	3.58533e-01	-3.64027e-01	3.62876e-01
12	TiKb1 Mean [eV]	4.93018e+03	1.60439e+00	-1.61726e+00	1.60616e+00
13	NiKb1 Mean [eV]	8.25865e+03	1.58798e+00	-1.60123e+00	1.57744e+00
14	TiKb1 Sigma [eV]	8.58093e+01	1.97360e+00	-1.98217e+00	2.04882e+00
15	NiKb1 Sigma [eV]	9.95608e+01	1.76108e+00	-1.74114e+00	1.79627e+00
16	Pile area factor	1.56272e-01	5.18266e-03	-5.20660e-03	5.16433e-03
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	2.99192e-02	1.15019e-02	-1.33218e-02	1.36252e-02
20	Tail area factor NiKa	7.50828e-02	7.89545e-03	-8.35025e-03	8.35239e-03
21	Tail slope factor Ka	6.00000e+00	fixed		
22	Tail area factor TiKb	2.80000e-02	fixed		
23	Tail area factor NiKb	7.40000e-02	fixed		
24	Tail slope factor Kb	6.00000e+00	fixed		
25	Escape area factor NiKa	6.64621e-03	1.79618e-03	-1.79617e-03	1.80668e-03
26	Escape mean NiKa [eV]	5.73552e+03	2.35313e+01	-2.40338e+01	2.38183e+01
27	FeKa Height factor	5.85857e-03	2.61973e-03	-2.66684e-03	2.66382e-03
28	FeKa mean [eV]	6.52367e+03	8.65851e+01	-4.59479e+02	6.95092e+01
29	CuKa Height factor	4.41370e-02	4.17656e-03	-4.24340e-03	4.16013e-03
30	CuKa mean [eV]	8.04104e+03	fixed		

cycle 1 sdd5

too large

Ti EVENT
 KA1+KA2 = 351792
 Pileup = 54975.2
 Pile/All = 0.135151
 Ni EVENT
 KA1+KA2 = 390866
 Pileup = 61081.3
 Pile/All = 0.135151
 TiKa1 Mean = 4508.951 +- 0.422
 TiKb1 Mean = 4930.182 +- 1.612
 NiKa1 Mean = 7477.698 +- 0.363
 NiKb1 Mean = 8258.650 +- 1.589
 Const Noise = 70.410 +- 1.130
 Fano = 0.151 +- 0.007
 TiKb1 Noise = 85.809 +- 2.015
 NiKb1 Noise = 99.561 +- 1.769
 Chisq/NDF = 142.562/73

fixed to converge...
 2nd cycle SDD5 params.
 were used

FCN=1193.54 FROM MINOS STATUS=SUCCESSFUL 16424 CALLS 18489 TOTAL
 EDM=2.95198e-05 STRATEGY= 1 ERROR MATRIX ACCURATE

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINUS NEGATIVE	ERRORS POSITIVE
1	BGa	3.21061e+03	3.22785e+02	-3.44712e+02	3.33704e+02
2	BGb	2.88108e+00	1.03546e-01	-1.08959e-01	1.11077e-01
3	BGc	-2.13039e-04	8.10966e-06	-8.71387e-06	8.60717e-06
4	Const Noise [eV]	4.61589e+01	1.77770e+00	-1.79602e+00	1.73824e+00
5	Fano	1.14602e-01	7.93717e-03	-8.01483e-03	7.89486e-03
6	Ti Kb/Ka1 ratio	2.55928e-01	5.79950e-03	-5.59176e-03	5.80681e-03
7	Ni Kb/Ka1 ratio	2.79090e-01	7.55635e-03	-7.41913e-03	7.79178e-03
8	TiKa1 Height	2.21804e+04	1.33090e+02	-1.32855e+02	1.23830e+02
9	NiKa1 Height	1.89972e+04	2.20911e+02	-2.45646e+02	2.01565e+02
10	TiKa1 Mean [eV]	4.50999e+03	4.64885e-01	-3.87020e-01	4.60188e-01
11	NiKa1 Mean [eV]	7.48105e+03	7.77029e-01	-7.42864e-01	8.14381e-01
12	TiKb1 Mean [eV]	4.92780e+03	1.47856e+00	-1.48008e+00	1.47809e+00
13	NiKb1 Mean [eV]	8.26336e+03	1.77611e+00	-1.78568e+00	1.77038e+00
14	TiKb1 Sigma [eV]	6.60092e+01	1.52158e+00	-1.50389e+00	1.53981e+00
15	NiKb1 Sigma [eV]	7.77509e+01	1.85731e+00	-1.83576e+00	1.88694e+00
16	Pile area factor	3.60476e-02	4.14872e-03	-4.15003e-03	4.14111e-03
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	3.03007e-03	1.27973e-02	at limit	1.01144e-02
20	Tail area factor NiKa	9.05672e-02	1.56044e-02	-1.41951e-02	1.73727e-02
21	Tail slope factor Ka	1.93800e+00	3.77789e-01	-3.31665e-01	4.43640e-01
22	Tail area factor TiKb	3.00000e-03	fixed		
23	Tail area factor NiKb	9.00000e-02	fixed		
24	Tail slope factor Kb	2.00000e+00	fixed		
25	Escape area factor NiKa	4.67862e-03	2.61932e-03	-2.62391e-03	2.62985e-03
26	Escape mean NiKa [eV]	5.82746e+03	4.46140e+01	-5.23925e+01	4.69476e+01
27	FeKa Height factor	8.62972e-03	4.13577e-03	-4.13892e-03	4.15246e-03
28	FeKa mean [eV]	6.75914e+03	3.35707e+01	-3.71103e+01	3.41186e+01
29	CuKa Height factor	2.38712e-02	4.88408e-03	-4.89163e-03	4.87874e-03
30	CuKa mean [eV]	8.04104e+03	fixed		

cycle2 sdd1

Ti EVENT
 KA1+KA2 = 106798
 Pileup = 3849.82
 Pile/All = 0.0347934
 Ni EVENT
 KA1+KA2 = 105649
 Pileup = 3808.41
 Pile/All = 0.0347934
 TiKa1 Mean = 4509.994 +- 0.424
 TiKb1 Mean = 4927.803 +- 1.479
 NiKa1 Mean = 7481.048 +- 0.779
 NiKb1 Mean = 8263.356 +- 1.778
 Const Noise = 46.159 +- 1.767
 Fano = 0.115 +- 0.008
 TiKb1 Noise = 66.009 +- 1.522
 NiKb1 Noise = 77.751 +- 1.861
 Chisq/NDF = 97.306/72

```

FCN=1204.97 FROM MINOS      STATUS=SUCCESSFUL  26536 CALLS      28143 TOTAL
                        EDM=0.41636  STRATEGY= 1      ERROR MATRIX ACCURATE
EXT PARAMETER              PARABOLIC              MINOS ERRORS
NO.  NAME      VALUE      ERROR      NEGATIVE      POSITIVE
 1  BGa      5.05494e+03  3.89027e+02 -2.72882e+02  6.74508e+02
 2  BGb      2.43034e+00  1.20452e-01 -2.12415e-01  8.30962e-02
 3  BGc     -1.84995e-04  9.24240e-06 -6.35140e-06  1.63506e-05
 4  Const Noise [eV]  5.99344e+01  1.80417e+00 -1.86001e+00  2.21810e+00
 5  Fano      1.18285e-01  1.08451e-02 -1.33950e-02  1.11274e-02
 6  Ti Kb/Ka1 ratio  2.41017e-01  6.31937e-03 -7.47309e-03  6.65719e-03
 7  Ni Kb/Ka1 ratio  2.85941e-01  9.06012e-03 -1.07070e-02  9.64783e-03
 8  TiKa1 Height  2.08182e+04  1.25697e+02 -1.37142e+02  1.47288e+02
 9  NiKa1 Height  1.49408e+04  1.63666e+02 -2.31342e+02  1.53074e+02
10  TiKa1 Mean [eV]  4.51165e+03  5.23271e-01 -6.61741e-01  5.29736e-01
11  NiKa1 Mean [eV]  7.48102e+03  9.59552e-01 -9.09113e-01  1.26462e+00
12  TiKb1 Mean [eV]  4.93192e+03  1.81686e+00 -2.05541e+00  2.01699e+00
13  NiKb1 Mean [eV]  8.26195e+03  2.35428e+00 -2.77536e+00  2.50768e+00
14  TiKb1 Sigma [eV]  7.48817e+01  1.94633e+00 -2.18265e+00  2.16174e+00
15  NiKb1 Sigma [eV]  8.61017e+01  2.52075e+00 -2.98846e+00  2.66078e+00
16  Pile area factor  3.52148e-02  5.86395e-03 -7.15176e-03  5.99256e-03
17  Pile shift [eV]  2.00000e+02  fixed
18  Pile sigma factor  2.00000e+00  fixed
19  Tail area factor TiKa  3.84414e-02  1.07041e-02 -1.53268e-02  9.16010e-03
20  Tail area factor NiKa  8.62887e-02  1.50907e-02 -1.37717e-02  2.14099e-02
21  Tail slope factor Ka  2.51772e+00  6.54282e-01 -6.48471e-01  8.23694e-01
22  Tail area factor TiKb  4.40000e-02  fixed
23  Tail area factor NiKb  8.00000e-02  fixed
24  Tail slope factor Kb  3.30000e+00  fixed
25  Escape area factor NiKa  9.75825e-03  3.34929e-03 -3.52340e-03  3.98733e-03
26  Escape mean NiKa [eV]  5.75734e+03  5.41646e+01 -5.62200e+01  5.70669e+01
27  FeKa Height factor  1.58625e-02  5.02675e-03 -4.95158e-03  6.38810e-03
28  FeKa mean [eV]  6.43052e+03  3.15363e+01 -3.63724e+01  3.47368e+01
29  CuKa Height factor  3.59285e-02  6.30710e-03 -7.17301e-03  6.95889e-03
30  CuKa mean [eV]  8.04104e+03  fixed

```

cycle2 sdd2

```

Ti EVENT
KA1+KA2      = 117417
Pileup       = 4134.81
Pile/All    = 0.0340169
Ni EVENT
KA1+KA2      = 94381.4
Pileup       = 3323.62
Pile/All    = 0.0340169
TiKa1 Mean   = 4511.654 +- 0.596
TiKb1 Mean   = 4931.922 +- 2.036
NiKa1 Mean   = 7481.018 +- 1.087
NiKb1 Mean   = 8261.952 +- 2.642
Const Noise  = 59.934 +- 2.039
Fano         = 0.118 +- 0.012
TiKb1 Noise  = 74.882 +- 2.172
NiKb1 Noise  = 86.102 +- 2.825
Chisq/NDF    = 106.803/72

```

FCN=1190.95 FROM MINOS STATUS=SUCCESSFUL 14936 CALLS 16678 TOTAL
 EDM=2.24553e-05 STRATEGY= 1 ERROR MATRIX ACCURATE

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINOS ERRORS	
				NEGATIVE	POSITIVE
1	BGa	3.25939e+03	3.55752e+02	-3.89406e+02	3.99087e+02
2	BGb	2.81212e+00	1.13277e-01	-1.27793e-01	1.23705e-01
3	BGc	-2.11014e-04	8.80367e-06	-9.60907e-06	9.89107e-06
4	Const Noise [eV]	5.46280e+01	1.86723e+00	-1.88054e+00	1.87627e+00
5	Fano	1.41778e-01	1.01632e-02	-1.03642e-02	1.00583e-02
6	Ti Kb/Ka1 ratio	2.43602e-01	6.06519e-03	-6.00747e-03	6.13800e-03
7	Ni Kb/Ka1 ratio	2.80895e-01	7.75033e-03	-7.61216e-03	8.01931e-03
8	TiKa1 Height	2.14315e+04	1.21928e+02	-1.27027e+02	1.19919e+02
9	NiKa1 Height	1.77074e+04	2.01880e+02	-2.32627e+02	1.79343e+02
10	TiKa1 Mean [eV]	4.51070e+03	5.00617e-01	-4.99358e-01	5.12113e-01
11	NiKa1 Mean [eV]	7.48120e+03	9.27095e-01	-8.74714e-01	9.88010e-01
12	TiKb1 Mean [eV]	4.92723e+03	1.68723e+00	-1.69149e+00	1.68465e+00
13	NiKb1 Mean [eV]	8.26047e+03	1.99426e+00	-2.00884e+00	1.98461e+00
14	TiKb1 Sigma [eV]	7.35790e+01	1.85791e+00	-1.83317e+00	1.88399e+00
15	NiKb1 Sigma [eV]	8.52679e+01	2.14976e+00	-2.12167e+00	2.19037e+00
16	Pile area factor	3.63067e-02	5.21518e-03	-5.23604e-03	5.20738e-03
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	2.17386e-02	9.90185e-03	-1.00897e-02	1.01921e-02
20	Tail area factor NiKa	8.19057e-02	1.37311e-02	-1.22155e-02	1.61697e-02
21	Tail slope factor Ka	2.37957e+00	7.08992e-01	-5.71994e-01	9.31107e-01
22	Tail area factor TiKb	2.30000e-02	fixed		
23	Tail area factor NiKb	8.20000e-02	fixed		
24	Tail slope factor Kb	2.50000e+00	fixed		
25	Escape area factor NiKa	1.13651e-02	2.79871e-03	-2.79580e-03	2.82526e-03
26	Escape mean NiKa [eV]	5.75367e+03	2.43196e+01	-2.36589e+01	2.58635e+01
27	FeKa Height factor	1.55652e-02	4.18782e-03	-4.21199e-03	4.22415e-03
28	FeKa mean [eV]	6.27953e+03	2.86738e+01	-2.92202e+01	2.92711e+01
29	CuKa Height factor	2.31948e-02	5.33785e-03	-5.36242e-03	5.31429e-03
30	CuKa mean [eV]	8.04104e+03	fixed		

cycle2 sdd3

Ti EVENT
 KA1+KA2 = 118657
 Pileup = 4308.05
 Pile/All = 0.0350347
 Ni EVENT
 KA1+KA2 = 112353
 Pileup = 4079.18
 Pile/All = 0.0350347
 TiKa1 Mean = 4510.698 +- 0.506
 TiKb1 Mean = 4927.232 +- 1.688
 NiKa1 Mean = 7481.203 +- 0.931
 NiKb1 Mean = 8260.469 +- 1.997
 Const Noise = 54.628 +- 1.878
 Fano = 0.142 +- 0.010
 TiKb1 Noise = 73.579 +- 1.859
 NiKb1 Noise = 85.268 +- 2.156
 Chisq/NDF = 94.986/72

FCN=1187.64 FROM MINOS STATUS=SUCCESSFUL 17219 CALLS 18477 TOTAL
 EDM=0.109597 STRATEGY= 1 ERROR MATRIX ACCURATE

cycle2 sdd4

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINOS ERRORS	
				NEGATIVE	POSITIVE
1	BGa	8.17725e+03	3.92627e+02	-3.33215e+02	5.53646e+02
2	BGb	2.34774e+00	1.23969e-01	-1.75593e-01	1.05125e-01
3	BGc	-1.89602e-04	9.60323e-06	-8.16889e-06	1.35432e-05
4	Const Noise [eV]	4.36949e+01	1.62799e+00	-1.66437e+00	1.71020e+00
5	Fano	1.27856e-01	6.61728e-03	-7.00714e-03	6.71095e-03
6	Ti Kb/Ka1 ratio	2.38179e-01	5.79861e-03	-6.23438e-03	5.74312e-03
7	Ni Kb/Ka1 ratio	2.86118e-01	6.24199e-03	-6.70594e-03	6.22871e-03
8	TiKa1 Height	2.36736e+04	1.33635e+02	-1.32990e+02	1.43631e+02
9	NiKa1 Height	2.31825e+04	1.52732e+02	-1.67778e+02	1.50547e+02
10	TiKa1 Mean [eV]	4.51043e+03	4.35785e-01	-4.87743e-01	4.19761e-01
11	NiKa1 Mean [eV]	7.47964e+03	5.52221e-01	-5.40242e-01	6.01768e-01
12	TiKb1 Mean [eV]	4.93117e+03	1.57559e+00	-1.62216e+00	1.63258e+00
13	NiKb1 Mean [eV]	8.26032e+03	1.58882e+00	-1.67860e+00	1.60467e+00
14	TiKb1 Sigma [eV]	6.46501e+01	1.71177e+00	-1.76371e+00	1.76908e+00
15	NiKb1 Sigma [eV]	7.93315e+01	1.71677e+00	-1.80498e+00	1.74477e+00
16	Pile area factor	5.86728e-02	4.06364e-03	-4.37303e-03	4.02859e-03
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	3.54524e-02	1.00409e-02	-1.20656e-02	9.12285e-03
20	Tail area factor NiKa	7.56440e-02	8.78709e-03	-8.46996e-03	9.75025e-03
21	Tail slope factor Ka	2.97206e+00	5.76292e-01	-5.28401e-01	6.89365e-01
22	Tail area factor TiKb	3.50000e-02	fixed		
23	Tail area factor NiKb	7.60000e-02	fixed		
24	Tail slope factor Kb	3.00000e+00	fixed		
25	Escape area factor NiKa	6.88445e-03	2.39095e-03	-2.39411e-03	2.54439e-03
26	Escape mean NiKa [eV]	5.58757e+03	2.77547e+01	-2.92047e+01	2.99529e+01
27	FeKa Height factor	1.14662e-02	3.62277e-03	-3.51452e-03	3.99841e-03
28	FeKa mean [eV]	6.40490e+03	2.65551e+01	-2.86443e+01	2.73639e+01
29	CuKa Height factor	1.69825e-02	4.36065e-03	-4.54284e-03	4.46062e-03
30	CuKa mean [eV]	8.04104e+03	fixed		

Ti EVENT
 KA1+KA2 = 114079
 Pileup = 6693.35
 Pile/All = 0.0554211
 Ni EVENT
 KA1+KA2 = 130771
 Pileup = 7672.72
 Pile/All = 0.0554211
 TiKa1 Mean = 4510.434 +- 0.454
 TiKb1 Mean = 4931.167 +- 1.627
 NiKa1 Mean = 7479.636 +- 0.571
 NiKb1 Mean = 8260.324 +- 1.642
 Const Noise = 43.695 +- 1.687
 Fano = 0.128 +- 0.007
 TiKb1 Noise = 64.650 +- 1.766
 NiKb1 Noise = 79.332 +- 1.775
 Chisq/NDF = 73.077/72

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FCN=1200.56 FROM MINOS      STATUS=SUCCESSFUL  30692 CALLS      31802 TOTAL
                        EDM=0.420833  STRATEGY= 1      ERROR MATRIX ACCURATE
EXT PARAMETER              PARABOLIC              MINOS ERRORS
NO.  NAME      VALUE      ERROR      NEGATIVE      POSITIVE
 1  BGa      1.42915e+04  7.37648e+02 -1.33558e+03  5.64940e+02
 2  BGb      1.63097e+00  2.36928e-01 -1.83665e-01  4.22876e-01
 3  BGc     -1.50515e-04  1.78823e-05 -3.17678e-05  1.39527e-05
 4  Const Noise [eV]  5.74148e+01  1.52171e+00 -1.74933e+00  1.74800e+00
 5  Fano      1.51472e-01  8.11795e-03 -9.80301e-03  8.81570e-03
 6  Ti Kb/Ka1 ratio  2.40787e-01  6.25345e-03 -6.16058e-03  8.40086e-03
 7  Ni Kb/Ka1 ratio  2.87033e-01  6.34056e-03 -6.78915e-03  7.86820e-03
 8  TiKa1 Height  2.61973e+04  1.20324e+02 -1.55464e+02  1.25567e+02
 9  NiKa1 Height  2.43733e+04  1.20234e+02 -1.57376e+02  1.23728e+02
10  TiKa1 Mean [eV]  4.50970e+03  4.68237e-01 -4.14172e-01  7.08255e-01
11  NiKa1 Mean [eV]  7.47927e+03  5.08003e-01 -5.65194e-01  6.21258e-01
12  TiKb1 Mean [eV]  4.92823e+03  1.78355e+00 -2.20572e+00  1.87920e+00
13  NiKb1 Mean [eV]  8.26279e+03  1.76987e+00 -2.01671e+00  2.04744e+00
14  TiKb1 Sigma [eV]  7.62521e+01  2.03267e+00 -2.10705e+00  2.58475e+00
15  NiKb1 Sigma [eV]  8.85523e+01  1.94797e+00 -2.11343e+00  2.37463e+00
16  Pile area factor  8.37436e-02  5.65067e-03 -6.76000e-03  5.93936e-03
17  Pile shift [eV]  2.00000e+02  fixed
18  Pile sigma factor  2.00000e+00  fixed
19  Tail area factor TiKa  2.36088e-02  1.36947e-02 -1.11552e-02  2.15965e-02
20  Tail area factor NiKa  8.01216e-02  1.70862e-02 -1.99557e-02  1.79508e-02
21  Tail slope factor Ka  6.01018e+00  2.05316e+00 -2.19183e+00  2.29720e+00
22  Tail area factor TiKb  2.60000e-02  fixed
23  Tail area factor NiKb  8.30000e-02  fixed
24  Tail slope factor Kb  6.00000e+00  fixed
25  Escape area factor NiKa  7.27067e-03  2.46789e-03 -3.22997e-03  2.50181e-03
26  Escape mean NiKa [eV]  5.75954e+03  3.27557e+01 -4.01683e+01  3.91857e+01
27  FeKa Height factor  5.82780e-03  3.69096e-03 -4.56253e-03  3.89252e-03
28  FeKa mean [eV]  6.23275e+03  7.70228e+01 -1.13777e+02  1.30800e+02
29  CuKa Height factor  3.74457e-02  4.90722e-03 -6.21971e-03  4.95647e-03
30  CuKa mean [eV]  8.04104e+03  fixed

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cycle2 sdd5

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Ti EVENT
KA1+KA2      = 151307
Pileup       = 12671
Pile/All    = 0.0772725
Ni EVENT
KA1+KA2      = 160985
Pileup       = 13481.4
Pile/All    = 0.0772725
TiKa1 Mean   = 4509.702 +- 0.561
TiKb1 Mean   = 4928.233 +- 2.042
NiKa1 Mean   = 7479.270 +- 0.593
NiKb1 Mean   = 8262.793 +- 2.032
Const Noise  = 57.415 +- 1.749
Fano         = 0.151 +- 0.009
TiKb1 Noise  = 76.252 +- 2.346
NiKb1 Noise  = 88.552 +- 2.244
Chisq/NDF    = 65.982/72

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FCN=1226.8 FROM MINOS STATUS=SUCCESSFUL 17197 CALLS 18391 TOTAL
 EDM=7.24139e-06 STRATEGY= 1 ERROR MATRIX ACCURATE

cycle2 sdd7

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINUS NEGATIVE	MINUS POSITIVE
1	BGa	1.40873e+04	5.18324e+02	-5.93981e+02	5.73056e+02
2	BGb	2.12203e+00	1.60391e-01	-1.78908e-01	1.82623e-01
3	BGc	-1.87588e-04	1.22904e-05	-1.39036e-05	1.37057e-05
4	Const Noise [eV]	6.45729e+01	1.92939e+00	-1.96523e+00	1.92874e+00
5	Fano	1.50535e-01	1.17119e-02	-1.19035e-02	1.17009e-02
6	Ti Kb/Ka1 ratio	2.37508e-01	7.93102e-03	-7.83409e-03	8.11069e-03
7	Ni Kb/Ka1 ratio	2.89704e-01	9.49834e-03	-9.33701e-03	9.77435e-03
8	TiKa1 Height	2.16429e+04	1.44085e+02	-1.56282e+02	1.38789e+02
9	NiKa1 Height	1.92552e+04	1.68165e+02	-2.01622e+02	1.53190e+02
10	TiKa1 Mean [eV]	4.51000e+03	6.58939e-01	-6.57296e-01	6.78517e-01
11	NiKa1 Mean [eV]	7.47916e+03	8.47665e-01	-8.09664e-01	9.25782e-01
12	TiKb1 Mean [eV]	4.93371e+03	2.41112e+00	-2.41559e+00	2.41229e+00
13	NiKb1 Mean [eV]	8.25741e+03	2.84355e+00	-2.89391e+00	2.80549e+00
14	TiKb1 Sigma [eV]	8.47123e+01	2.73153e+00	-2.68855e+00	2.78377e+00
15	NiKb1 Sigma [eV]	9.96082e+01	3.10253e+00	-3.03398e+00	3.20461e+00
16	Pile area factor	1.08699e-01	7.35912e-03	-7.39109e-03	7.34694e-03
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	3.57571e-02	1.30141e-02	-1.34255e-02	1.36668e-02
20	Tail area factor NiKa	5.95956e-02	1.23110e-02	-1.18370e-02	1.36408e-02
21	Tail slope factor Ka	2.58440e+00	8.26193e-01	-7.11727e-01	1.06131e+00
22	Tail area factor TiKb	3.90000e-02	fixed		
23	Tail area factor NiKb	5.80000e-02	fixed		
24	Tail slope factor Kb	2.60000e+00	fixed		
25	Escape area factor NiKa	7.73051e-03	3.15814e-03	-3.15461e-03	3.16762e-03
26	Escape mean NiKa [eV]	5.66470e+03	3.57253e+01	-3.75239e+01	3.68928e+01
27	FeKa Height factor	7.36492e-03	4.67857e-03	-4.71054e-03	4.71937e-03
28	FeKa mean [eV]	6.43948e+03	1.32381e+02	-1.08110e+02	1.65246e+02
29	CuKa Height factor	2.05776e-02	7.21792e-03	-7.35407e-03	7.09703e-03
30	CuKa mean [eV]	8.04104e+03	fixed		

Ti EVENT
 KA1+KA2 = 133777
 Pileup = 14541.4
 Pile/All = 0.098042
 Ni EVENT
 KA1+KA2 = 134064
 Pileup = 14572.6
 Pile/All = 0.098042
 TiKa1 Mean = 4510.002 +- 0.668
 TiKb1 Mean = 4933.709 +- 2.414
 NiKa1 Mean = 7479.158 +- 0.868
 NiKb1 Mean = 8257.405 +- 2.850
 Const Noise = 64.573 +- 1.947
 Fano = 0.151 +- 0.012
 TiKb1 Noise = 84.712 +- 2.736
 NiKb1 Noise = 99.608 +- 3.119
 Chisq/NDF = 87.561/72

FCN=1183.96 FROM MINOS STATUS=SUCCESSFUL 13164 CALLS 14857 TOTAL
 EDM=1.42476e-05 STRATEGY= 1 ERROR MATRIX ACCURATE

cycle2 sdd8

EXT NO.	PARAMETER NAME	VALUE	PARABOLIC ERROR	MINOS ERRORS	
				NEGATIVE	POSITIVE
1	BGa	3.61245e+03	3.50958e+02	-3.82301e+02	3.84516e+02
2	BGb	3.08434e+00	1.12414e-01	-1.23464e-01	1.22526e-01
3	BGc	-2.29603e-04	8.81744e-06	-9.60361e-06	9.66311e-06
4	Const Noise [eV]	4.96206e+01	1.76565e+00	-1.80562e+00	1.75154e+00
5	Fano	1.38393e-01	8.00417e-03	-8.08872e-03	8.01138e-03
6	Ti Kb/Ka1 ratio	2.50105e-01	6.42397e-03	-6.35567e-03	6.51175e-03
7	Ni Kb/Ka1 ratio	2.71683e-01	6.83567e-03	-6.76466e-03	6.98366e-03
8	TiKa1 Height	2.09694e+04	1.46026e+02	-1.57602e+02	1.39692e+02
9	NiKa1 Height	2.11093e+04	1.84832e+02	-2.07422e+02	1.69291e+02
10	TiKa1 Mean [eV]	4.51083e+03	5.59192e-01	-5.47779e-01	5.81455e-01
11	NiKa1 Mean [eV]	7.48015e+03	6.81348e-01	-6.51587e-01	7.18002e-01
12	TiKb1 Mean [eV]	4.93109e+03	1.75495e+00	-1.75676e+00	1.75536e+00
13	NiKb1 Mean [eV]	8.25993e+03	1.80162e+00	-1.81138e+00	1.79662e+00
14	TiKb1 Sigma [eV]	7.27412e+01	1.93208e+00	-1.90434e+00	1.96162e+00
15	NiKb1 Sigma [eV]	8.32160e+01	2.01113e+00	-1.98666e+00	2.04831e+00
16	Pile area factor	4.90039e-02	4.60363e-03	-4.62017e-03	4.60239e-03
17	Pile shift [eV]	2.00000e+02	fixed		
18	Pile sigma factor	2.00000e+00	fixed		
19	Tail area factor TiKa	3.59671e-02	1.15938e-02	-1.14789e-02	1.22705e-02
20	Tail area factor NiKa	6.86038e-02	1.16899e-02	-1.08768e-02	1.29191e-02
21	Tail slope factor Ka	2.11099e+00	4.45492e-01	-3.99504e-01	5.03585e-01
22	Tail area factor TiKb	3.60000e-02	fixed		
23	Tail area factor NiKb	6.90000e-02	fixed		
24	Tail slope factor Kb	2.50000e+00	fixed		
25	Escape area factor NiKa	9.66685e-03	2.40550e-03	-2.40883e-03	2.41581e-03
26	Escape mean NiKa [eV]	5.73496e+03	2.28871e+01	-2.27488e+01	2.38528e+01
27	FeKa Height factor	9.62367e-03	3.69533e-03	-3.71205e-03	3.72043e-03
28	FeKa mean [eV]	6.43856e+03	3.55240e+01	-3.34722e+01	4.33991e+01
29	CuKa Height factor	2.26281e-02	4.65418e-03	-4.66985e-03	4.63906e-03
30	CuKa mean [eV]	8.04104e+03	fixed		

Ti EVENT
 KA1+KA2 = 109711
 Pileup = 5376.27
 Pile/All = 0.0467147
 Ni EVENT
 KA1+KA2 = 127902
 Pileup = 6267.68
 Pile/All = 0.0467147
 TiKa1 Mean = 4510.834 +- 0.565
 TiKb1 Mean = 4931.092 +- 1.756
 NiKa1 Mean = 7480.154 +- 0.685
 NiKb1 Mean = 8259.932 +- 1.804
 Const Noise = 49.621 +- 1.779
 Fano = 0.138 +- 0.008
 TiKb1 Noise = 72.741 +- 1.933
 NiKb1 Noise = 83.216 +- 2.017
 Chisq/NDF = 79.295/72