# E570 meeting report

~a summary of the analysis on March 2007~

1. New calibration

2. Compton tail correction

→*see the report on 25/March/2007*

# 1. New calibratioon

**With high-energy and low-energy tails**

i) High-energy tail

***Pileup*** FADC analysis --- not yet finished

Add a free-intensity Gaussian phenomenologically

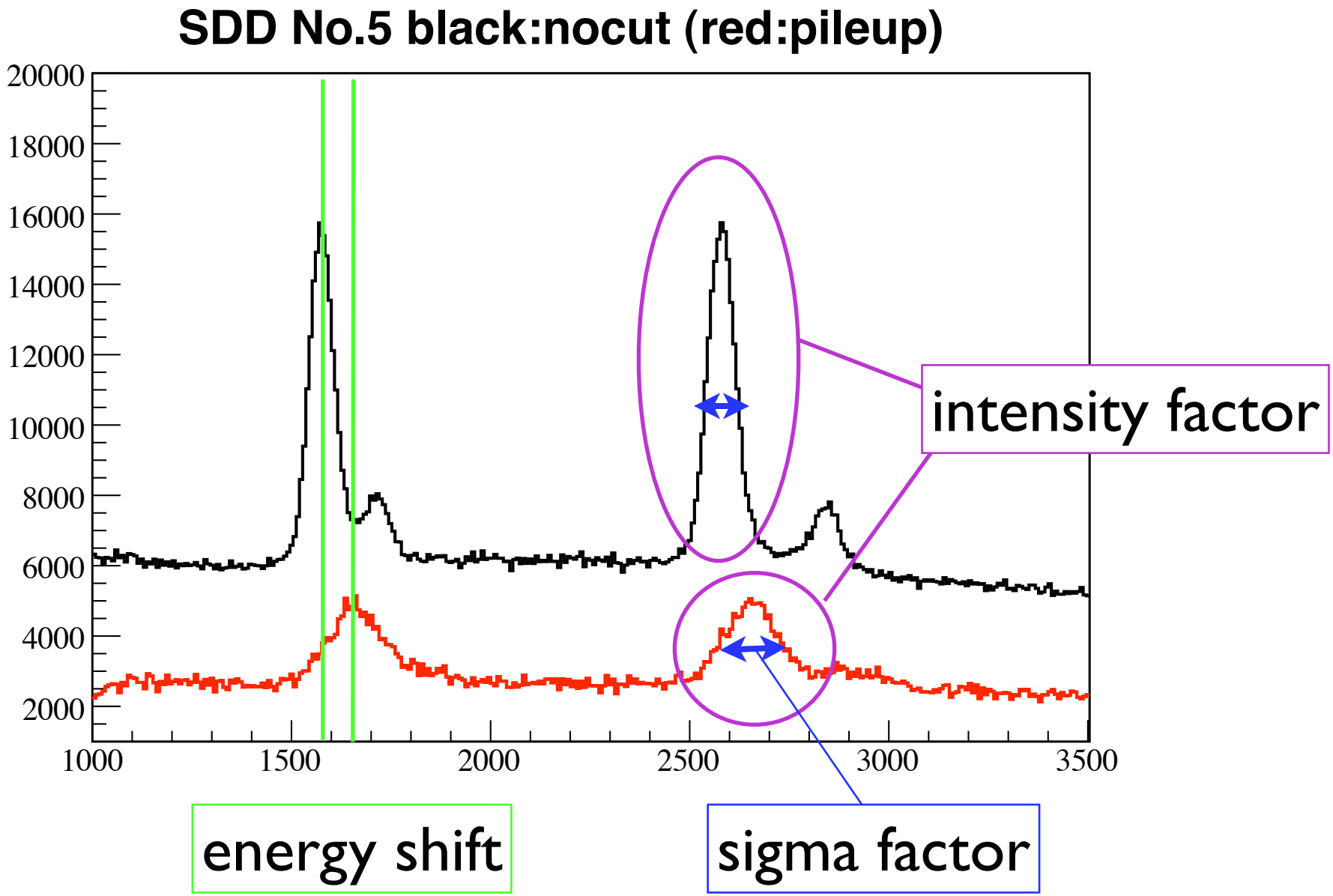
ii) Low-energy tail

***Response function***

Convolution of an exponential and a Gaussian

# i) High-energy tail *Flash ADC data*

**To get the initial parameters ....**



# i) High-energy tail

Simple Gaussian fit

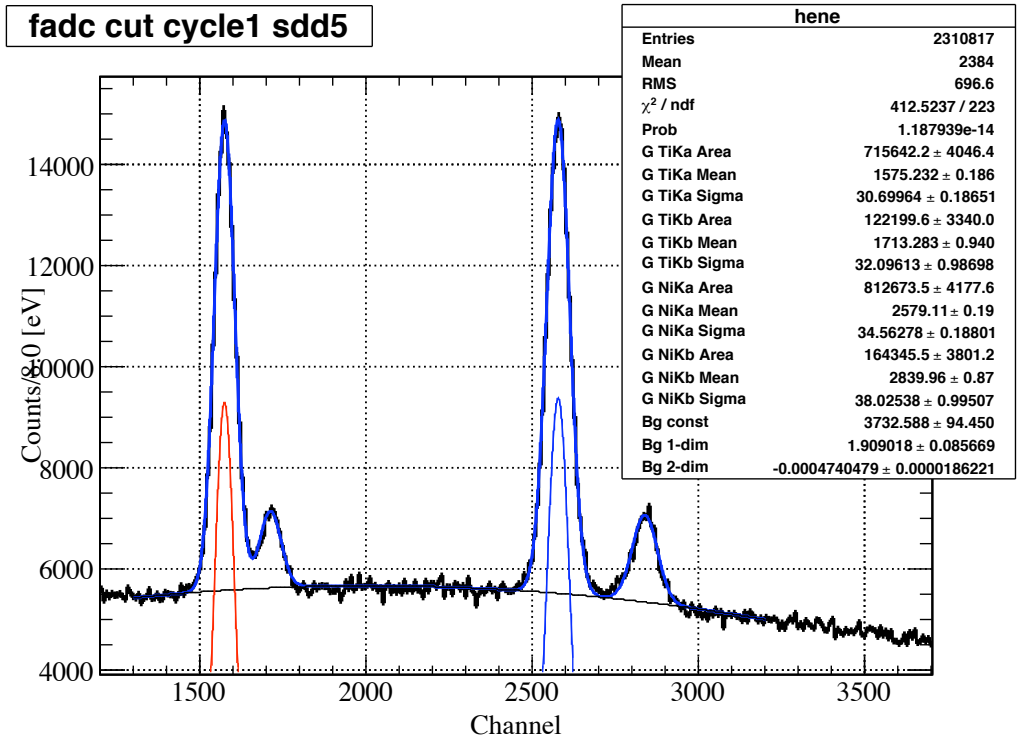
Get the three parameters

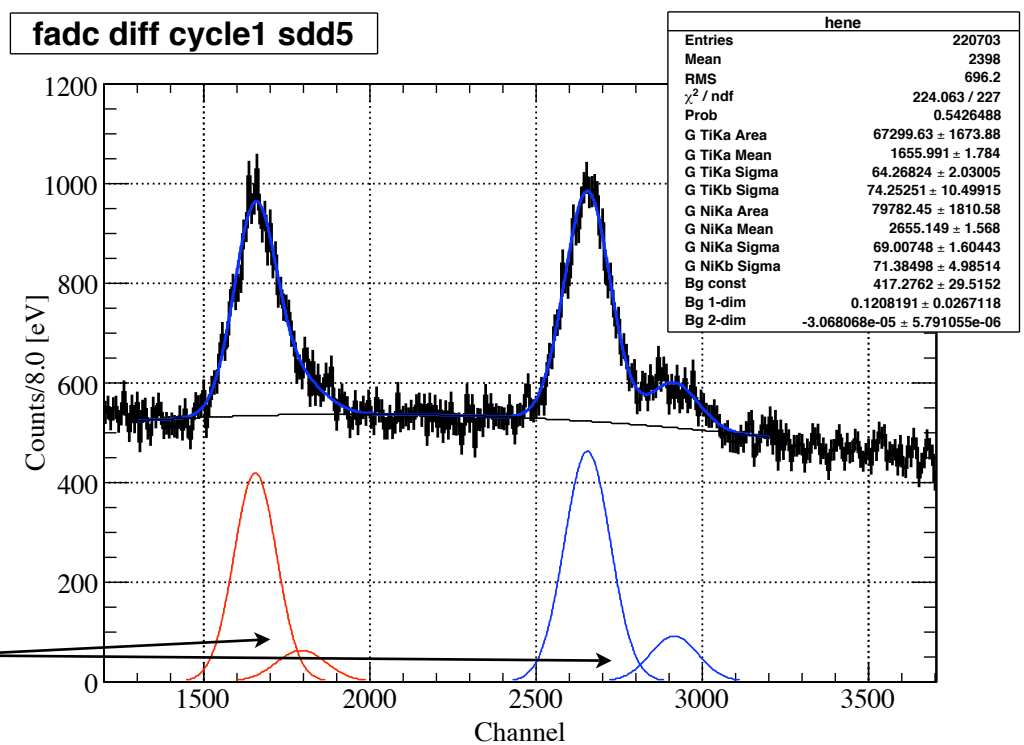
intensity factor: depends on the SDD

energy shift ~ 200 eV

sigma factor ~ 2

**Distances between Kα and Kβ position were fixed**



# i) High-energy tail

## SDD2

```
### pileup ratio ###
Ti : 0.0600437 +- 0.00186152
Ni : 0.0591151 +- 0.00226488
### pileup shift ###
Ti : 50.7044 +- 2.12396 ch
Ni : 54.4967 +- 2.54789 ch
### pileup sigma factor ###
Ti : 2.44314 +- 0.0790862
Ni : 2.29951 +- 0.089012
```

## SDD4

```
### pileup ratio ###
Ti : 0.0738164 +- 0.00188199
Ni : 0.0678744 +- 0.00218771
### pileup shift ###
Ti : 72.9659 +- 1.58374 ch
Ni : 74.0153 +- 2.0235 ch
### pileup sigma factor ###
Ti : 2.06538 +- 0.0579406
Ni : 2.15888 +- 0.0740092
```

## SDD5

```
### pileup ratio ###
Ti : 0.0940409 +- 0.00239866
Ni : 0.0981728 +- 0.00228437
### pileup shift ###
Ti : 80.7594 +- 1.79374 ch
Ni : 76.0396 +- 1.57945 ch
### pileup sigma factor ###
Ti : 2.09345 +- 0.0673382
Ni : 1.99658 +- 0.0476742
```

# Remark (SDD-by-SDD)

▶ **Energy shift depends on the SDD also**

It is not considered here, beacause we have no imformation about the 2nd cycle data

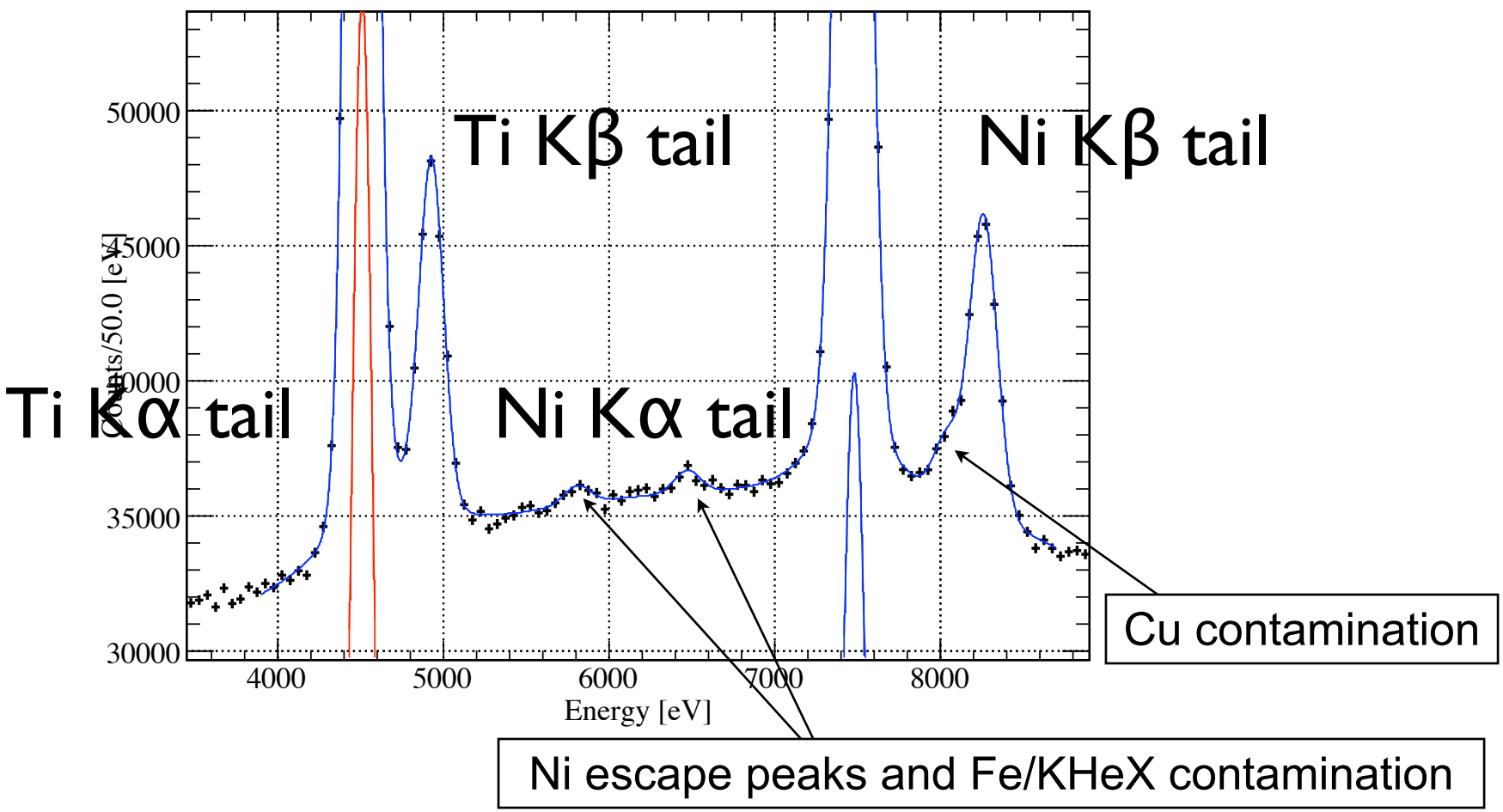
# ii) Low-energy tail *Calibration-triggered data*

**To get the initial parameters ....**

Need high statistics

Summed over the “first-calibrated” histogram without the tails

⇨ Iterative calibration



# ii) Low-energy tail

for example

```
FCN=3032.8 FROM MINOS     STATUS=SUCCESSFUL  23236 CALLS       24599 TOTAL
                     EDM=0.516355    STRATEGY= 1      ERROR MATRIX ACCURATE
 EXT PARAMETER                   PARABOLIC         MINOS ERRORS
 NO.   NAME      VALUE            ERROR      NEGATIVE      POSITIVE
  1  BGa          5.18261e+03   2.42468e+02  -1.58230e+02   4.51154e+02
  2  BGb          2.75663e+00   7.61915e-02  -1.42885e-01   4.92997e-02
  3  BGc         -2.06642e-04   5.87928e-06  -3.81476e-06   1.10000e-05
  4  Const Noise [eV]   5.36449e+01   1.10932e+00  -1.18655e+00   1.37646e+00
  5  Fano         1.26942e-01   5.80312e-03  -7.18350e-03   6.22604e-03
  6  Ti Kb/Ka1 ratio   2.45352e-01   3.75513e-03  -4.38177e-03   4.20160e-03
  7  Ni Kb/Ka1 ratio   2.77590e-01   4.89939e-03  -6.27820e-03   4.99491e-03
  8  TiKa1 Area   3.88211e+06   2.13249e+04  -2.27844e+04   2.67148e+04
  9  NiKa1 Area   3.27078e+06   2.87139e+04  -3.68568e+04   2.97086e+04
 10  TiKa1 Mean [eV]   4.51061e+03   3.20023e-01  -4.12755e-01   3.29539e-01
 11  NiKa1 Mean [eV]   7.47813e+03   5.15659e-01  -5.27654e-01   6.58482e-01
 12  TiKb1 Mean [eV]   4.92970e+03   1.10743e+00  -1.31986e+00   1.22036e+00
 13  NiKb1 Mean [eV]   8.25834e+03   1.39945e+00  -1.64679e+00   1.56266e+00
 14  TiKb1 Sigma [eV]   7.30439e+01   1.17772e+00  -1.33074e+00   1.36455e+00
 15  NiKb1 Sigma [eV]   8.20612e+01   1.50379e+00  -1.83511e+00   1.61609e+00
 16  Pile area factor   5.23214e-02   3.24040e-03  -3.93917e-03   3.48921e-03
 17  Pile shift [eV]   2.00000e+02     fixed
 18  Pile sigma factor   2.00000e+00     fixed
 19  Tail area factor TiKa   4.59549e-02   6.66323e-03  -9.79445e-03   5.94841e-03
 20  Tail area factor NiKa   9.88965e-02   8.59257e-03  -8.40441e-03   1.14657e-02
 21  Tail slope factor   2.50034e+00   3.11972e-01  -3.40639e-01   3.77744e-01
 22  Tail area factor Kb/Ka   1.00000e+00     fixed
 23  Escape area factor NiKa   9.65383e-03   2.02194e-03  -2.11939e-03   2.53064e-03
 24  Escape mean NiKa [eV]   5.81716e+03   2.03673e+01  -2.34355e+01   2.33032e+01
 25  FeKa area factor   2.19575e-02   3.08598e-03  -3.07440e-03   4.04372e-03
 26  FeKa mean [eV]   6.46839e+03   1.36760e+01  -1.54970e+01   1.57277e+01
 27  CuKa area factor   6.48064e-02   3.81961e-03  -4.53324e-03   4.22372e-03
 28  CuKa mean [eV]   8.04104e+03     fixed
```

Pileup param.

LE tail param.

Kβ/Kα tail intensity factor = 1

*Newly added parameters*

# ii) Low-energy tail Remarks

- **The tail intensity depends on the energy**

```
19  Tail area factor TiKa   4.59549e-02   6.66323e-03  -9.79445e-03   5.94841e-03
20  Tail area factor NiKa   9.88965e-02   8.59257e-03  -8.40441e-03   1.14657e-02
21  Tail slope factor   2.50034e+00   3.11972e-01  -3.40639e-01   3.77744e-01
22  Tail area factor Kb/Ka   1.00000e+00     fixed
```

*Ni Kα has about twice larger tail than Ti Kα*

- **Kβ tail parameters have to be fixed**

*To avoid the conflict with the pileup and the Cu contamination*

*The exponential slope is common with the Kα*

- **Kβ tail intensity can change (1~2 times) (e.g. KMM radiative Auger effect)**

*I checked the no-influence of the factor of the Kβ tail intensity (1~2 times) on the Kα peak*

# Problems

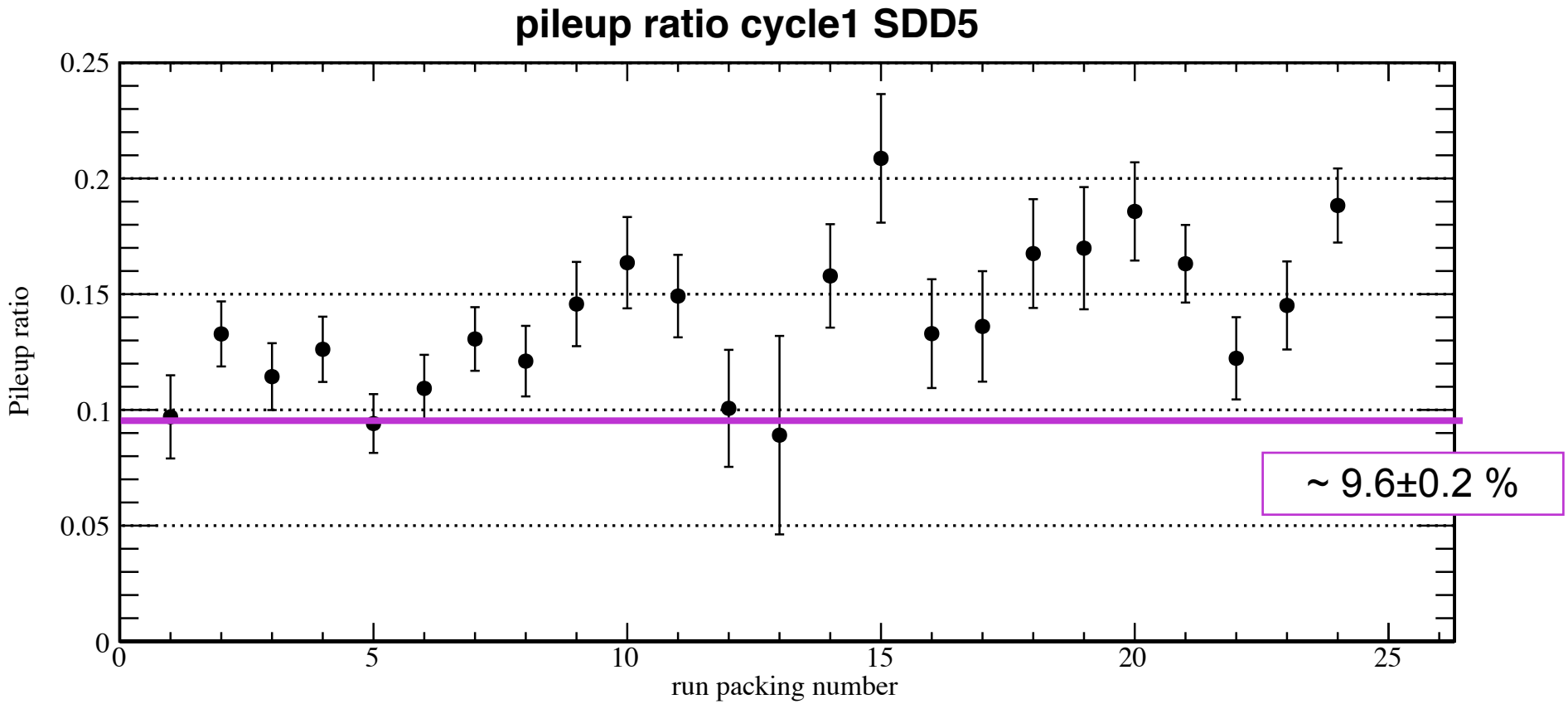
i) High-energy tail

- Fitted pileup intensity of SDD5 (1st) is too large
- There is no idea to verify the pileup intensity of the second cycle data (FADC data have a hard problem for the 2nd-cycle event matching)

ii) Low-energy tail

- The Ti Kα tail intensity of SDD1 (2nd ) is too small
- How do we estimate the low-energy tail intensity of KHeX ?

# Fitted pileup intensity of SDD5 (1st) is too large

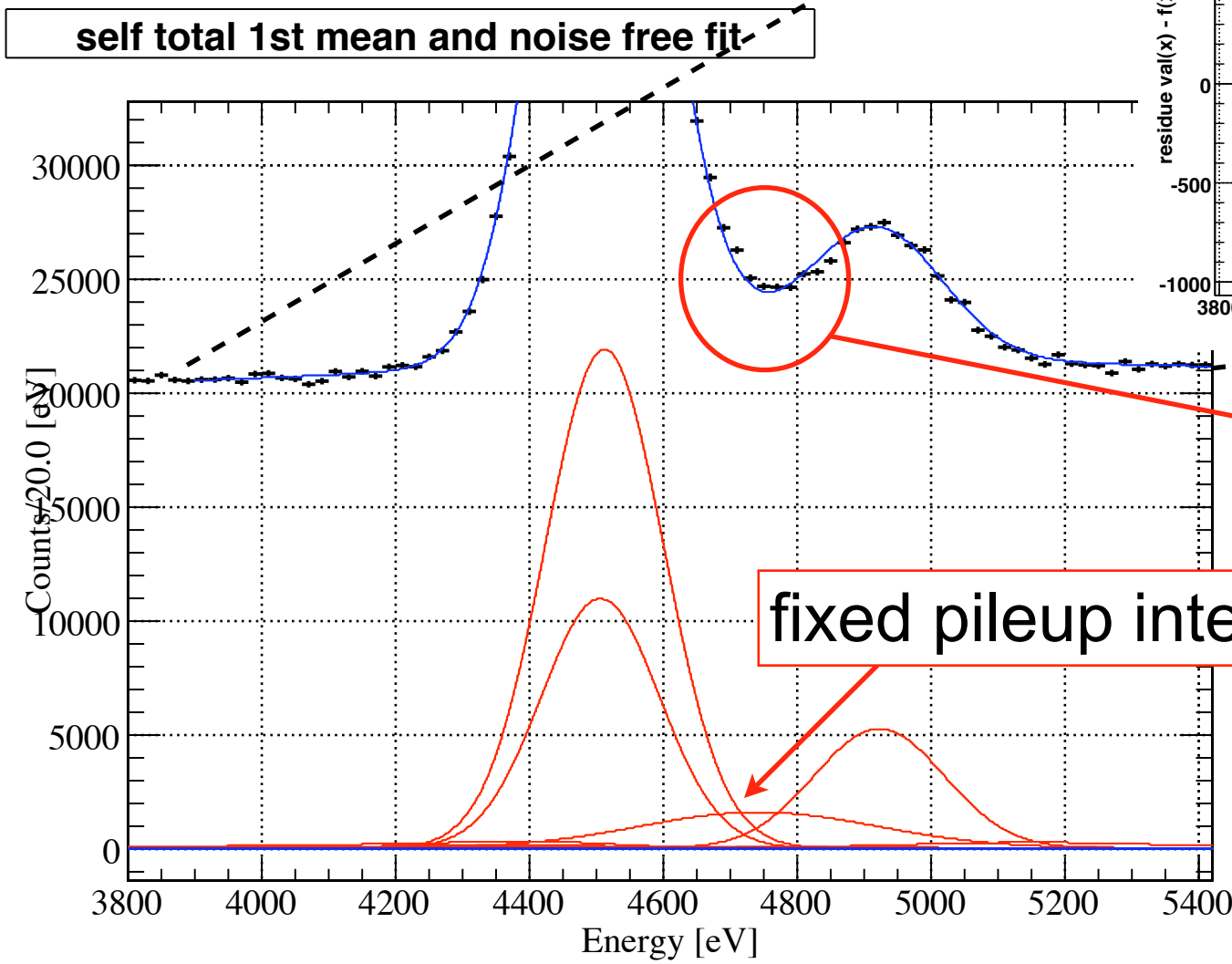


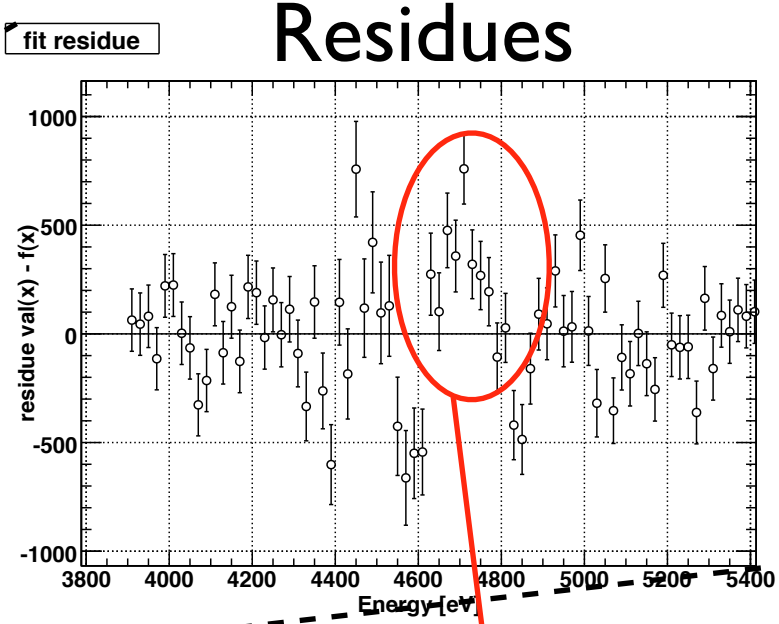

```
### pileup ratio ###
 Ti : 0.0940409 +- 0.00239866
 Ni : 0.0981728 +- 0.00228437
```

From FADC data

# *If the intensity is fixed...*

## SDD5-1st Ti




Excess still exists...

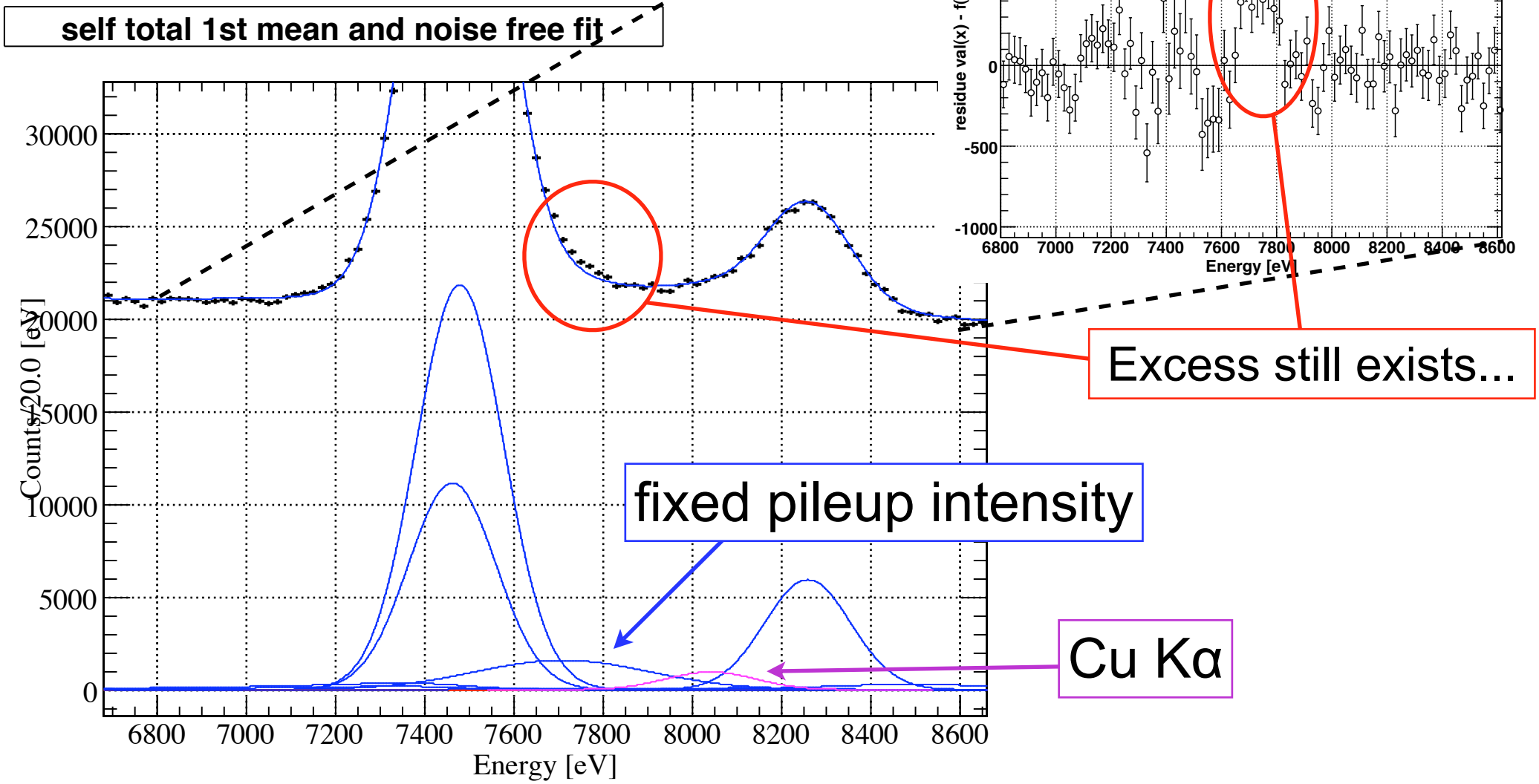
fixed pileup intensity

```
16  Pile area factor    9.60000e-02      fixed
17  Pile shift [eV]    2.30000e+02      fixed
18  Pile sigma factor    2.00000e+00      fixed
```

← from FADC data

# *If the intensity is fixed...*

## SDD5-1st Ni




```
16  Pile area factor    9.60000e-02      fixed
17  Pile shift [eV]    2.30000e+02      fixed
18  Pile sigma factor    2.00000e+00      fixed
```

← from FADC data

# SDD5-1st

***If the intensity is fixed...***

```
FCN=3282.75 FROM MINOS     STATUS=SUCCESSFUL  13866 CALLS       15332 TOTAL
                     EDM=1.49372e-05    STRATEGY= 1      ERROR MATRIX ACCURATE
 EXT PARAMETER                   PARABOLIC         MINOS ERRORS
 NO.   NAME      VALUE            ERROR      NEGATIVE      POSITIVE
  1  BGa          1.50559e+04   4.36835e+02  -5.32684e+02   4.96717e+02
  2  BGb          2.05148e+00   1.30368e-01  -1.49981e-01   1.57887e-01
  3  BGc         -1.74941e-04   9.56541e-06  -1.14875e-05   1.10429e-05
  4  Const Noise [eV]   7.14291e+01   1.17406e+00  -1.19937e+00   1.18551e+00
  5  Fano         1.59034e-01   7.41271e-03  -7.55274e-03   7.49106e-03
  6  Ti Kb/Ka1 ratio   2.60843e-01   4.93683e-03  -4.94491e-03   5.16646e-03
  7  Ni Kb/Ka1 ratio   2.66625e-01   4.17424e-03  -4.15442e-03   4.22772e-03
  8  TiKa1 Area   4.85212e+06   2.13996e+04  -2.26228e+04   2.09856e+04
  9  NiKa1 Area   5.36440e+06   2.48857e+04  -2.67638e+04   2.38169e+04
 10  TiKa1 Mean [eV]   4.51236e+03   3.63418e-01  -3.72523e-01   3.75624e-01
 11  NiKa1 Mean [eV]   7.47920e+03   4.11644e-01  -4.08022e-01   4.27849e-01
 12  TiKb1 Mean [eV]   4.92290e+03   1.44751e+00  -1.45058e+00   1.44582e+00
 13  NiKb1 Mean [eV]   8.25881e+03   1.53539e+00  -1.54501e+00   1.52737e+00
 14  TiKb1 Sigma [eV]   9.66567e+01   1.78491e+00  -1.77381e+00   1.83126e+00
 15  NiKb1 Sigma [eV]   9.63865e+01   1.56477e+00  -1.54897e+00   1.58947e+00
 16  Pile area factor   9.60000e-02     fixed
 17  Pile shift [eV]   2.30000e+02     fixed
 18  Pile sigma factor   2.00000e+00     fixed
 19  Tail area factor TiKa   3.28109e-02   9.96704e-03  -1.03034e-02   1.18216e-02
 20  Tail area factor NiKa   3.96768e-02   5.78673e-03  -5.94003e-03   5.97574e-03
 21  Tail slope factor   3.84226e+00   9.99660e-01  -8.54814e-01   1.22234e+00
 22  Tail area factor Kb/Ka   1.00000e+00     fixed
 23  Escape area factor NiKa   4.12781e-03   1.74617e-03  -1.74631e-03   1.74737e-03
 24  Escape mean NiKa [eV]   5.73694e+03   2.93832e+01  -3.06748e+01   3.02173e+01
 25  FeKa area factor   5.31207e-03   2.75525e-03  -2.81325e-03   2.79454e-03
 26  FeKa mean [eV]   6.51551e+03   6.64409e+01  -7.98219e+01   6.35336e+01
 27  CuKa area factor   4.44676e-02   3.73329e-03  -3.75774e-03   3.71057e-03
 28  CuKa mean [eV]   8.04104e+03     fixed
```

←Fixed pileup

```
Ti EVENT
KA1+KA2         = 363909
Pileup          = 34935.2
Pile/(KA1+KA2) = 0.096
Ni EVENT
KA1+KA2         = 405012
Pileup          = 38881.1
Pile/(KA1+KA2) = 0.096
TiKa1 Mean    = 4512.360 +-  0.374
TiKb1 Mean    = 4922.896 +-  1.448
NiKa1 Mean    = 7479.203 +-  0.418
NiKb1 Mean    = 8258.811 +-  1.536
Const Noise   = 71.429 +-  1.192
Fano          =  0.159 +-  0.008
TiKb1 Noise   = 96.657 +-  1.803
NiKb1 Noise   = 96.386 +-  1.569
Chisq/NDF     = 420.279/217
```

Ti Kβ was pulled

ref. 4931.81 eV

Need more pileup !

*FADC cut was not enough ?*

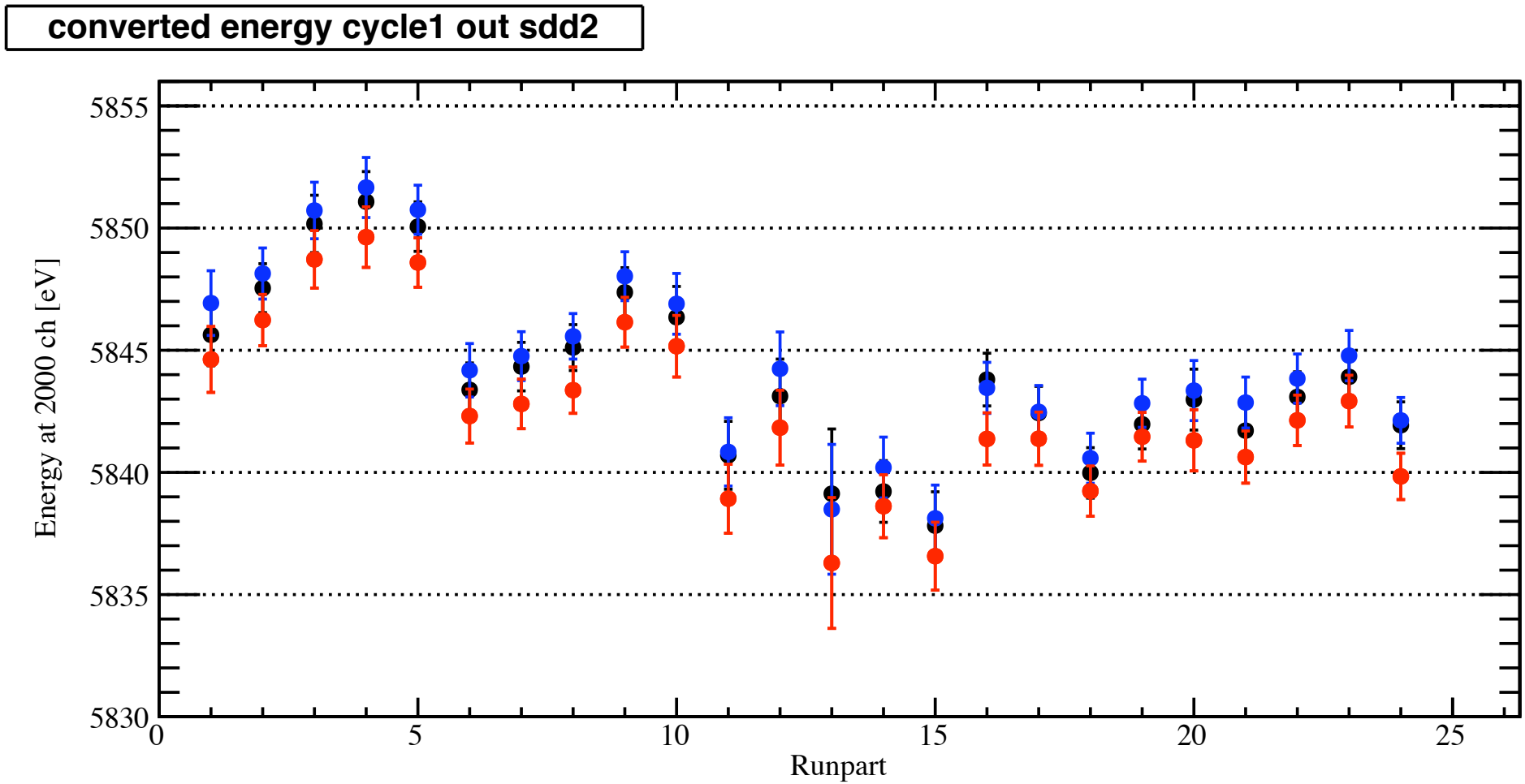
# New calibration

# 1st cycle SDD2

**black : upper-rate cut**

**blue : w/ pileup, w/o LE-tail**

**red : iterative calibration**




- Systematic tendency can be seen (w/ LE-tail < w/o LE-tail)

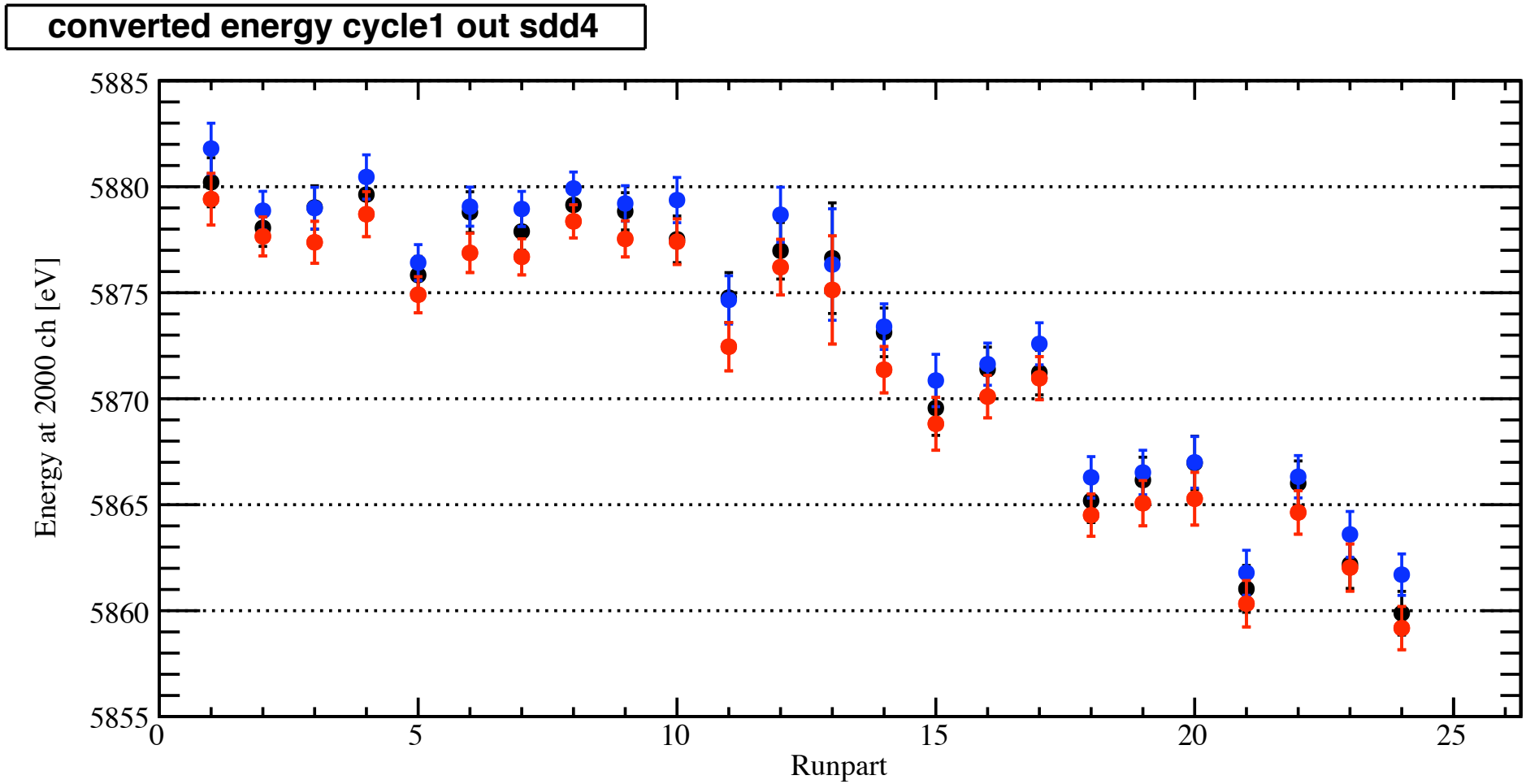
⇒ Low-energy tail has to be considered when the pileup Gaussian (high-energy tail) is added.

# 1st cycle SDD4

**black : upper-rate cut**

**blue : w/ pileup, w/o LE-tail**

**red : iterative calibration**



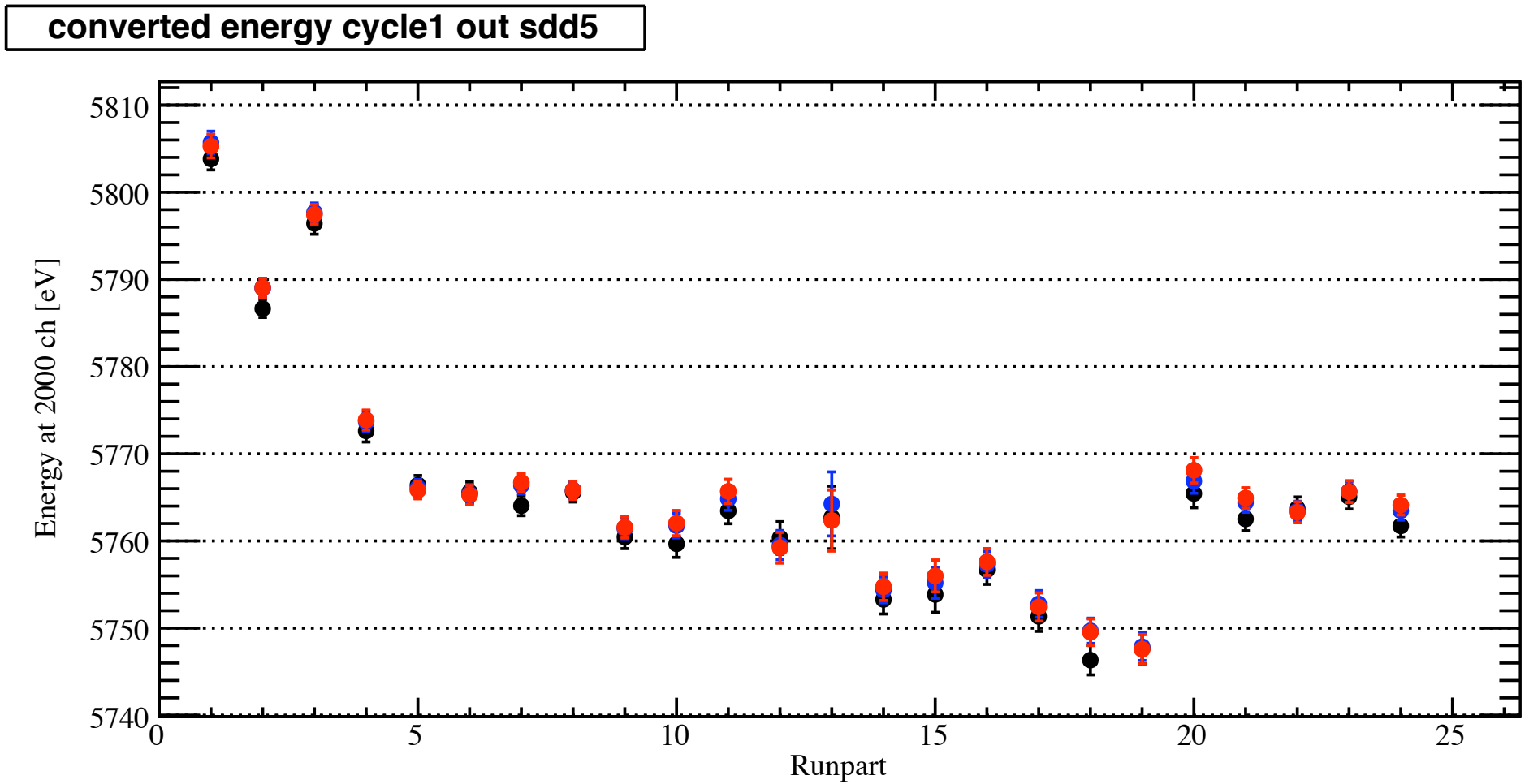

▶ SDD4 has the same tendency

# 1st cycle SDD5

**black : upper-rate cut**

**blue : w/ pileup, w/o LE-tail**

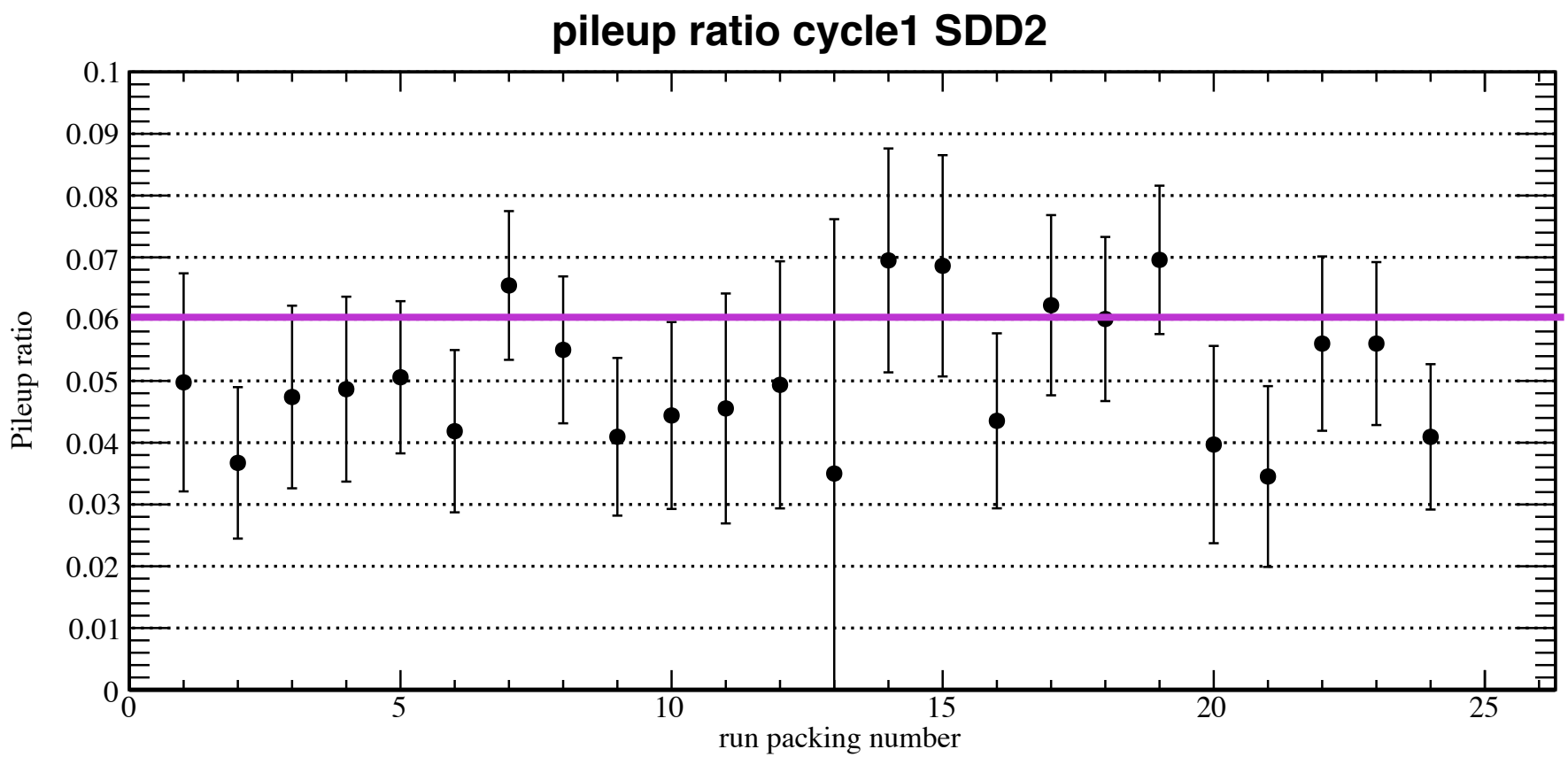
**red : iterative calibration**




- There is no systematic difference

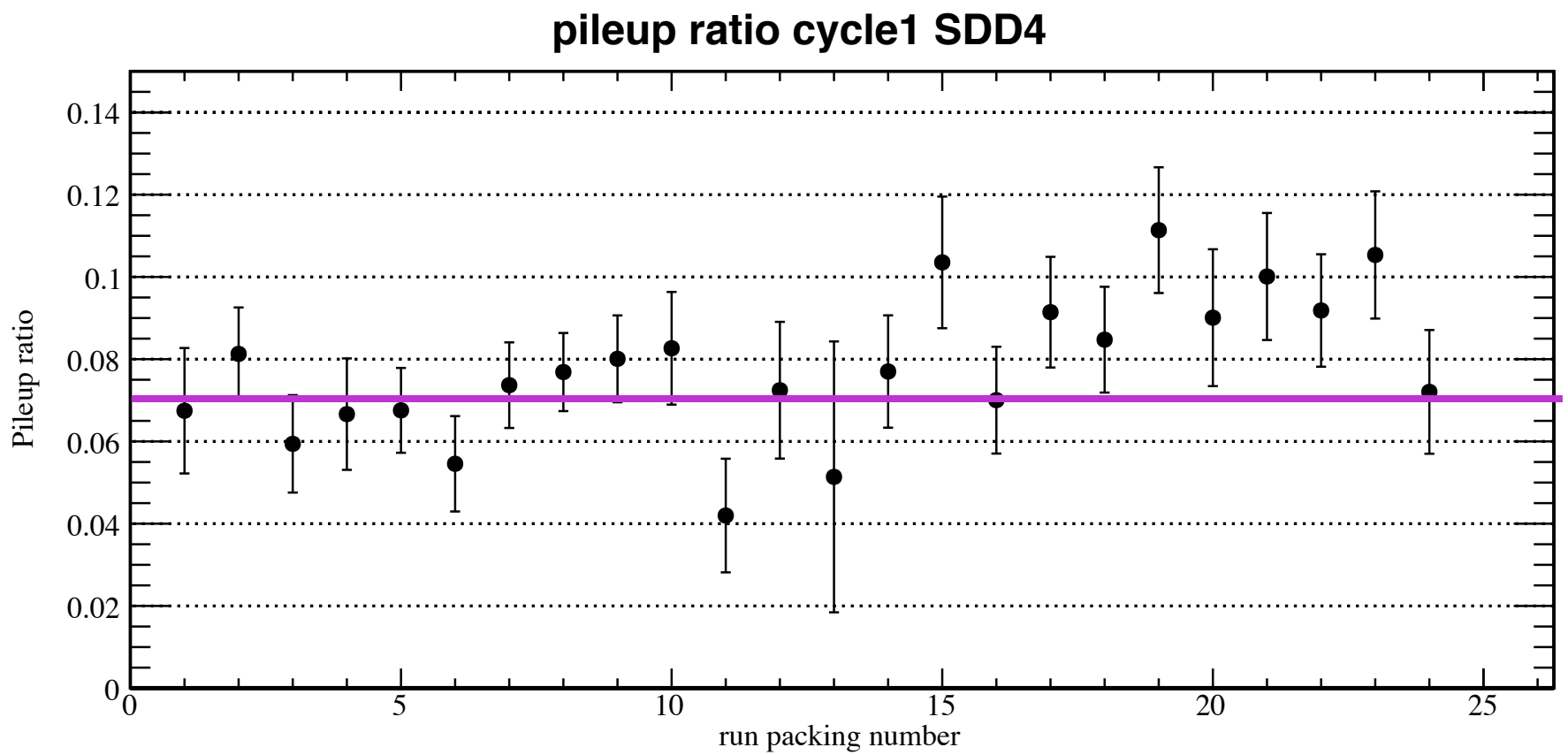
Spare

# SDD2




```
### pileup ratio ###
Ti : 0.0600437 +- 0.00186152
Ni : 0.0591151 +- 0.00226488
```

# SDD4




```
### pileup ratio ###
Ti : 0.0738164 +- 0.00188199
Ni : 0.0678744 +- 0.00218771
```

# Ti Kα tail intensity of SDD1 (2nd ) is too small

## SDD1-2nd

Kβ tail intensity factor = 1

```
FCN=2772.68 FROM MINOS     STATUS=SUCCESSFUL  11313 CALLS       12993 TOTAL
                    EDM=0.000101701    STRATEGY= 1      ERROR MATRIX ACCURATE
 EXT PARAMETER                   PARABOLIC         MINOS ERRORS
 NO.   NAME      VALUE            ERROR      NEGATIVE      POSITIVE
  1  BGa          1.30745e+03   1.14319e+02  -1.26145e+02   1.27542e+02
  2  BGb          1.15780e+00   3.78471e-02  -4.23048e-02   4.18390e-02
  3  BGc         -8.55093e-05   3.00587e-06  -3.32209e-06   3.34982e-06
  4  Const Noise [eV]   4.62324e+01   1.58438e+00  -1.62123e+00   1.58413e+00
  5  Fano         1.14951e-01   7.43257e-03  -7.56475e-03   7.45514e-03
  6  Ti Kb/Ka1 ratio   2.55093e-01   5.16199e-03  -5.14571e-03   5.19043e-03
  7  Ni Kb/Ka1 ratio   2.77641e-01   6.27843e-03  -6.26957e-03   6.34923e-03
  8  TiKa1 Area   1.43831e+06   6.61444e+03  -6.60129e+03   6.63551e+03
  9  NiKa1 Area   1.42378e+06   2.17928e+04  -2.41936e+04   1.99252e+04
 10  TiKa1 Mean [eV]   4.51055e+03   3.18195e-01  -3.18388e-01   3.18155e-01
 11  NiKa1 Mean [eV]   7.48068e+03   7.50514e-01  -7.14228e-01   7.92670e-01
 12  TiKb1 Mean [eV]   4.92866e+03   1.40105e+00  -1.40396e+00   1.39940e+00
 13  NiKb1 Mean [eV]   8.26231e+03   1.79204e+00  -1.80000e+00   1.79071e+00
 14  TiKb1 Sigma [eV]   6.51877e+01   1.43339e+00  -1.41659e+00   1.45195e+00
 15  NiKb1 Sigma [eV]   7.77279e+01   1.79998e+00  -1.78064e+00   1.82433e+00
 16  Pile area factor   3.57843e-02   3.85903e-03  -3.86824e-03   3.85004e-03
 17  Pile shift [eV]   2.00000e+02     fixed
 18  Pile sigma factor   2.00000e+00     fixed
 19  Tail area factor TiKa   5.00000e-03     fixed
 20  Tail area factor NiKa   8.37622e-02   1.35491e-02  -1.22708e-02   1.53990e-02
 21  Tail slope factor   2.20409e+00   5.37614e-01  -4.58775e-01   6.55599e-01
 22  Tail area factor Kb/Ka   1.00000e+00     fixed
 23  Escape area factor NiKa   4.00051e-03   2.59806e-03  -2.60446e-03   2.62590e-03
 24  Escape mean NiKa [eV]   5.80460e+03   9.33769e+01  -8.35067e+01   9.37962e+01
 25  FeKa area factor   1.10574e-02   4.00594e-03  -4.03998e-03   4.03743e-03
 26  FeKa mean [eV]   6.42367e+03   5.62430e+01  -7.93448e+01   4.93823e+01
 27  CuKa area factor   2.27947e-02   4.73495e-03  -4.74358e-03   4.72698e-03
 28  CuKa mean [eV]   8.04104e+03     fixed
```

```
Ti EVENT
KA1+KA2         = 107873
Pileup          = 3860.17
Pile/(KA1+KA2) = 0.0357843
Ni EVENT
KA1+KA2         = 107495
Pileup          = 3846.64
Pile/(KA1+KA2) = 0.0357843
TiKa1 Mean    = 4510.553 +-  0.318
TiKb1 Mean    = 4928.659 +-  1.402
NiKa1 Mean    = 7480.684 +-  0.753
NiKb1 Mean    = 8262.308 +-  1.795
Const Noise   = 46.232 +-  1.603
Fano          =  0.115 +-  0.008
TiKb1 Noise   = 65.188 +-  1.434
NiKb1 Noise   = 77.728 +-  1.802
Chisq/NDF     = 249.636/217
```

**Ti Kα low-energy tail intensity was fixed (only 0.5%)**