Apr 24, 2007 Hideyuki Tatsuno

E570 meeting report

FADC analysis

~confirmation of the final results~

Goal

Confirm the final results obtained by adding artificial pileups

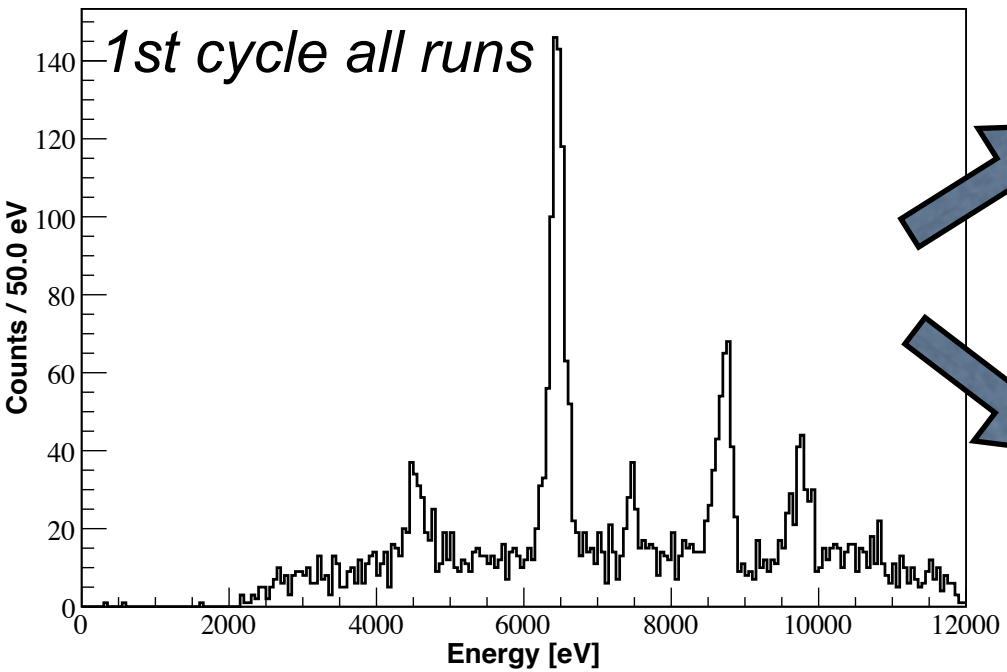
Method

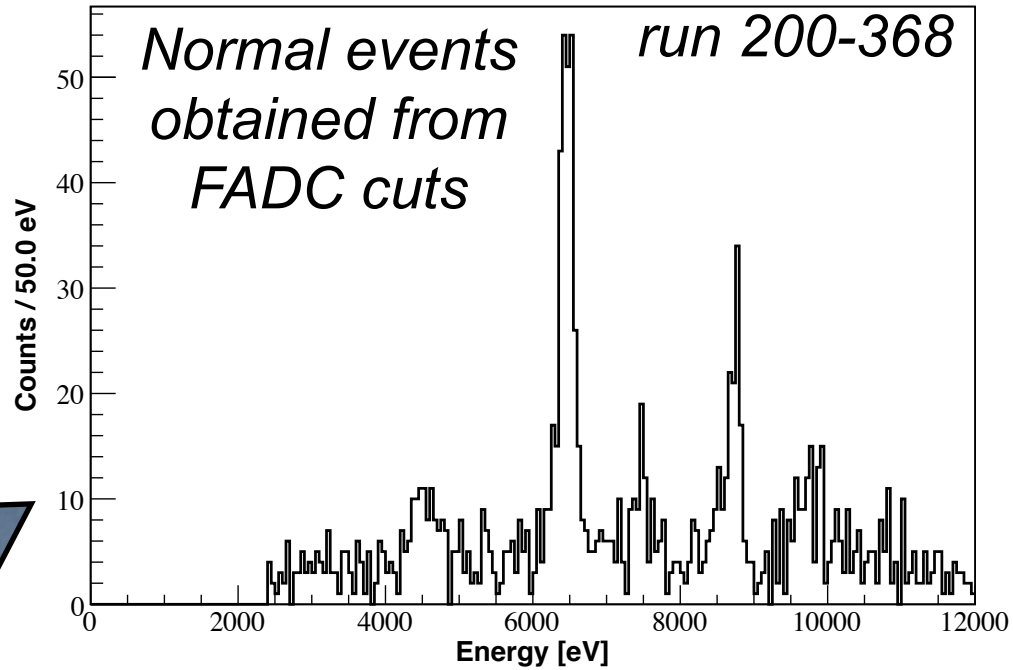
- remove the pileups using FADC data
- fit without pileup Gaussians

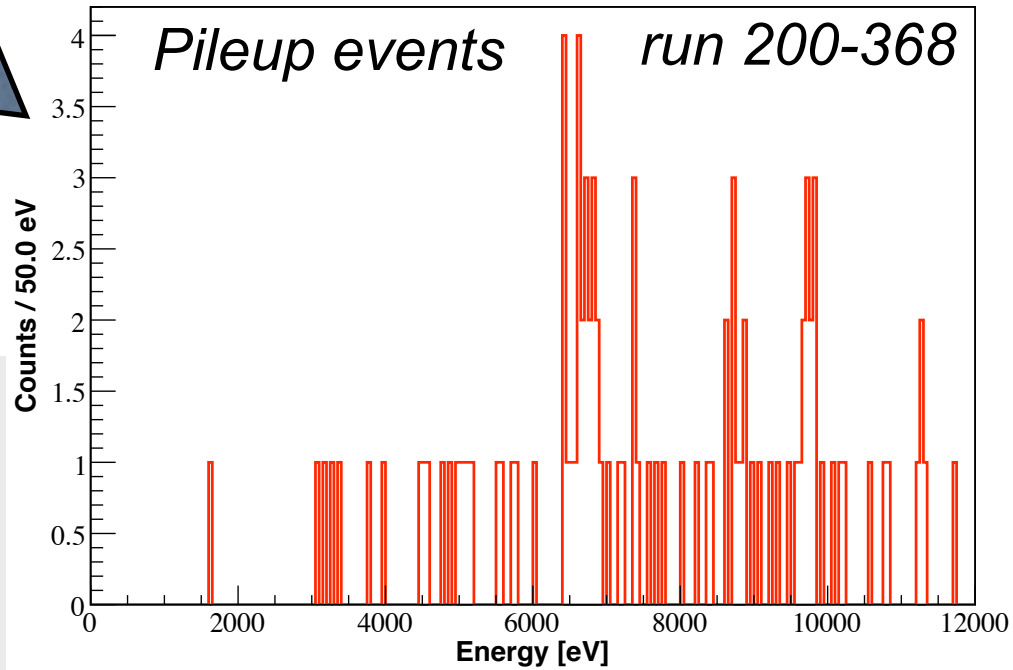
Data-set is limited
run 200-368

Remove the pileups

1st cycle, E549 trigger with
“kstop” and fiducial volume cuts





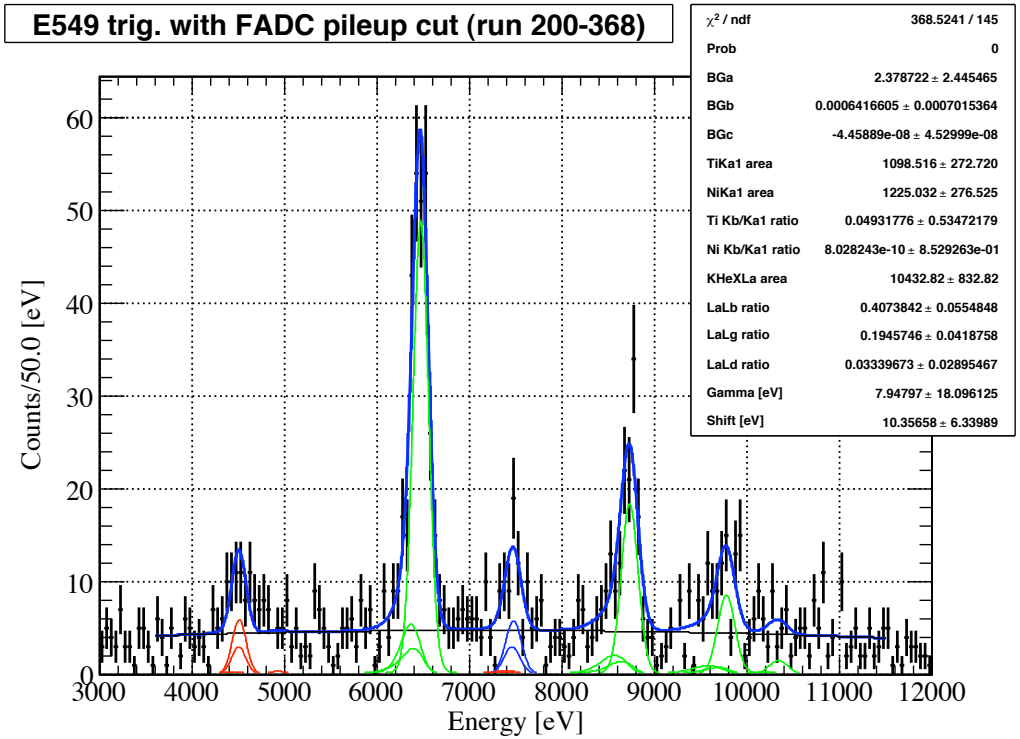


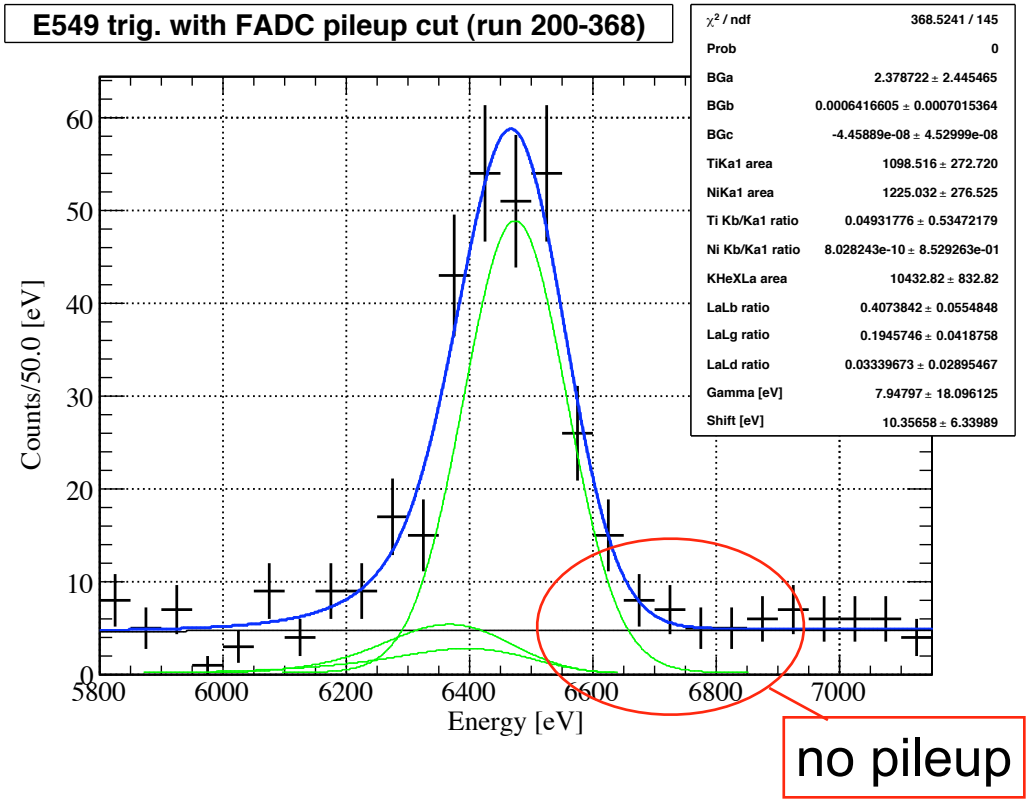
Cut conditions

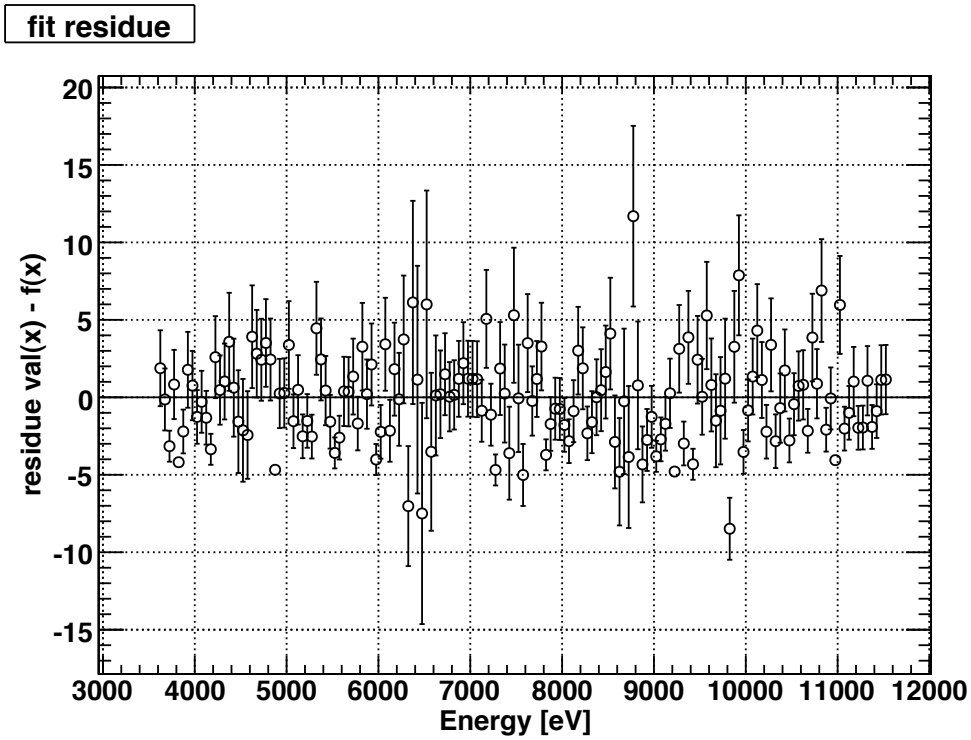
Main peak fit : chisqr<80000

Post slope fit : postsl > -0.015

Pre slope fit : baseline threshold cut







1st cycle, E549 trigger

With fiducial volume cuts and kstop cuts

Pileup events were removed by using FADC data

1st cycle, E549 trigger

With fiducial volume cuts and kstop cuts

```
FCN=779.509 FROM MINOS     STATUS=SUCCESSFUL   4768 CALLS        5163 TOTAL
                     EDM=9.9981e-08    STRATEGY= 1      ERROR MATRIX ACCURATE
 EXT PARAMETER                   PARABOLIC         MINOS ERRORS
 NO.   NAME      VALUE            ERROR      NEGATIVE      POSITIVE
  1  BGa          2.37872e+00   2.35307e+00  -2.39476e+00   2.49617e+00
  2  BGb          6.41661e-04   6.72893e-04  -7.13080e-04   6.89992e-04
  3  BGc         -4.45889e-08   4.34910e-08  -4.46411e-08   4.59586e-08
  4  Noise [eV]   5.62000e+01     fixed
  5  Fano         1.45000e-01     fixed
  6  TiKa1 area   1.09852e+03   2.72391e+02  -2.61732e+02   2.83707e+02
  7  NiKa1 area   1.22503e+03   2.75858e+02  -2.66045e+02   2.87006e+02
  8  Ti Kb/Ka1 ratio   4.93178e-02   5.34722e-01   at limit      2.70708e-01
  9  Ni Kb/Ka1 ratio   8.02824e-10   8.52926e-01   at limit      2.24380e-01
                                  WARNING -   - ABOVE PARAMETER IS AT LIMIT.
 10  KHeXLa area   1.04328e+04   8.30903e+02  -8.13200e+02   8.52432e+02
 11  LaLb ratio   4.07384e-01   5.52384e-02  -5.27929e-02   5.81766e-02
 12  LaLg ratio   1.94575e-01   4.16996e-02  -3.98913e-02   4.38602e-02
 13  LaLd ratio   3.33967e-02   2.87500e-02  -2.74430e-02   3.04663e-02
 14  Gamma [eV]   7.94797e+00   1.80961e+01   at limit      1.90891e+01
 15  Shift [eV]   1.03566e+01   6.31617e+00  -6.32641e+00   6.35336e+00
```

```
Const Noise  = 56.200 +-  0.000
KHeXLa Sigma = 82.068 +-  0.021
Fano         =  0.145 +-  0.000
lalb_ratio   =  0.407 +-  0.055
lalg_ratio   =  0.195 +-  0.042
Gamma        =  7.948 +- 18.096
Shift        = 10.357 +-  6.340
Chisq/NDF    = 368.524/145
```

shift = 10.4±6.3 eV

c.f. okada-fit -0.2±3.3 eV

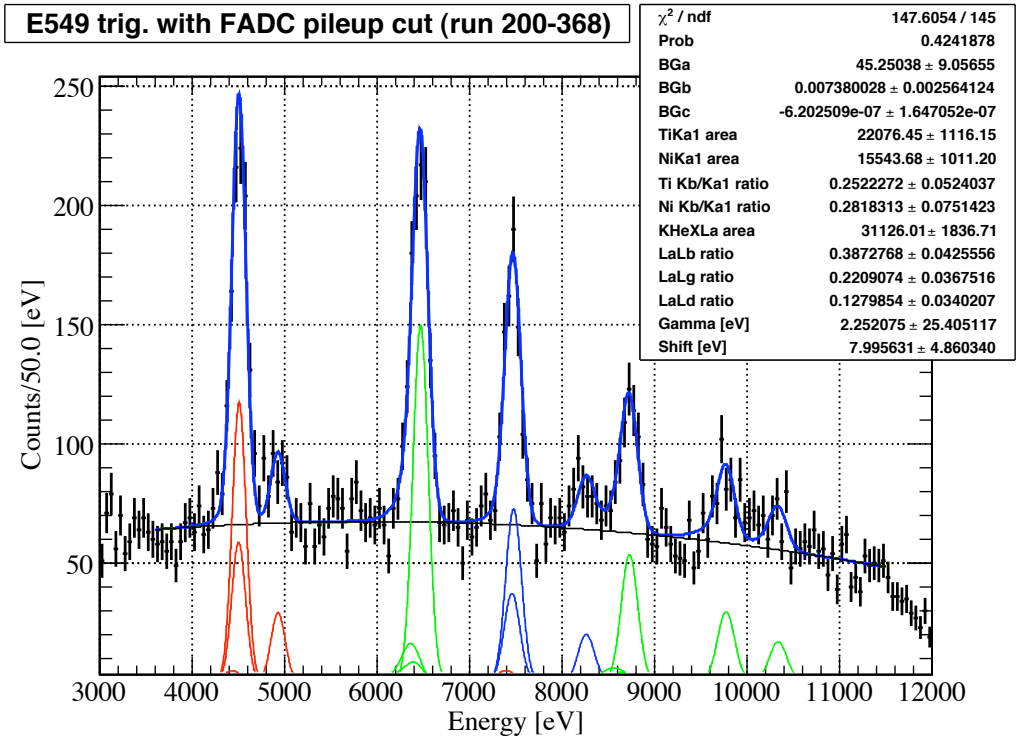
Bad chisqr !

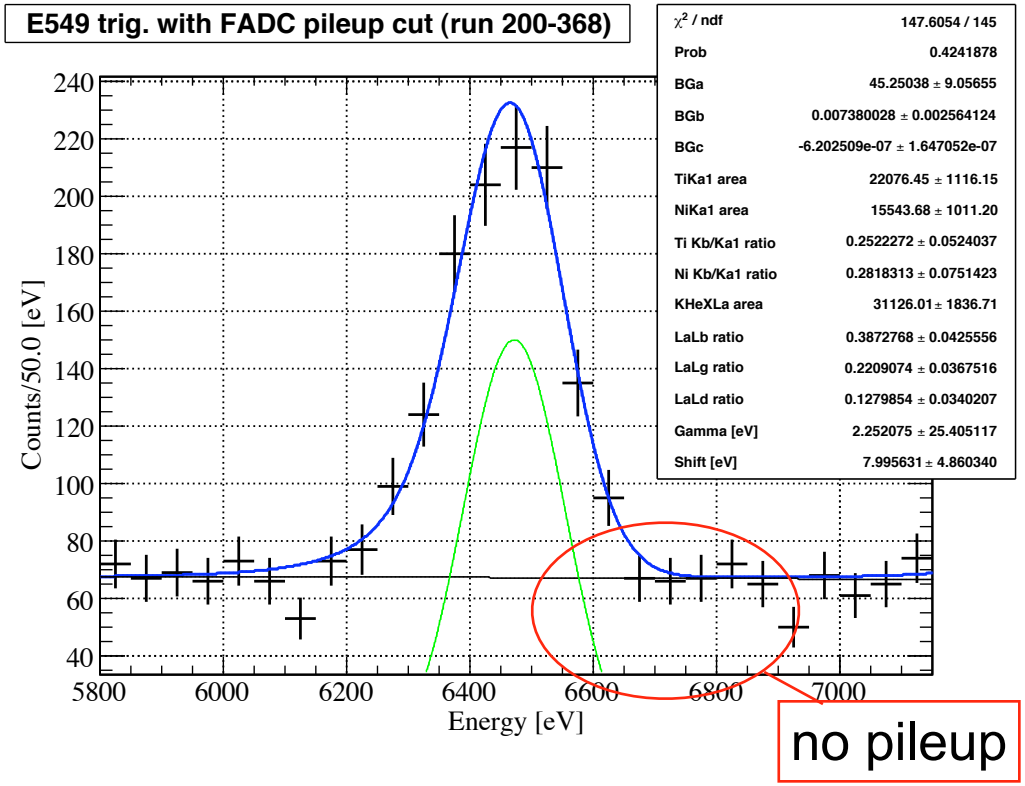
→ Background is not smooth ?
Try no-fiducial-volume cuts

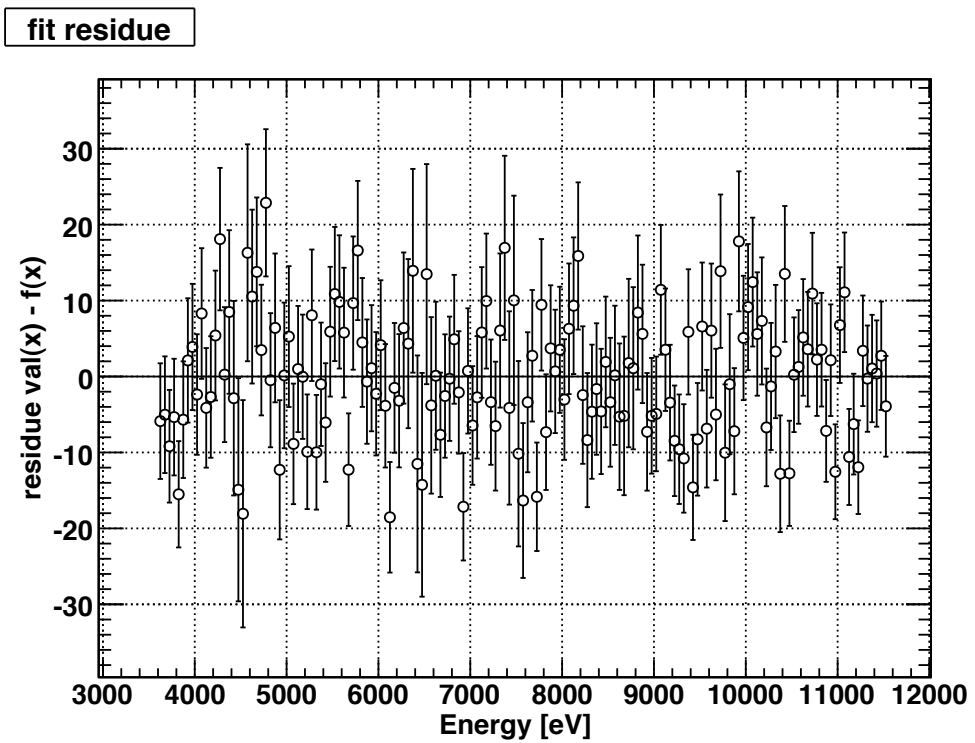
1st cycle, E549 trigger

```
16  TiKa1 mean [eV]   4.51084e+03     fixed
17  NiKa1 mean [eV]   7.47815e+03     fixed
18  TiKb1 mean [eV]   4.93181e+03     fixed
19  NiKb1 mean [eV]   8.26466e+03     fixed
20  Pile area factor   0.00000e+00     fixed
21  Pile shift [eV]   2.00000e+02     fixed
22  Pile sigma factor   2.00000e+00     fixed
23  Tail TiKa area factor   6.03720e-02     fixed
24  Tail NiKa area factor   9.82710e-02     fixed
25  Tail slope Ka   1.76200e+00     fixed
26  Tail Kb/Ka area factor   1.00000e+00     fixed
27  Tail La area factor   8.53181e-02     fixed
28  Tail Lb area factor   1.14170e-01     fixed
29  Tail Lg area factor   1.27517e-01     fixed
30  Tail Ld area factor   1.34708e-01     fixed
31  Tail slope L   1.76200e+00     fixed
32  Comp La shift   5.04600e+01     fixed
33  Comp La sigma   8.79800e+01     fixed
34  Comp La area   1.38406e-01     fixed
35  Comp La slope   8.75800e-01     fixed
36  Comp Lb shift   8.18100e+01     fixed
37  Comp Lb sigma   1.08568e+02     fixed
38  Comp Lb area   1.74475e-01     fixed
39  Comp Lb slope   1.22324e+00     fixed
40  Comp Lg shift   9.88300e+01     fixed
41  Comp Lg sigma   1.21491e+02     fixed
42  Comp Lg area   1.86872e-01     fixed
43  Comp Lg slope   1.33329e+00     fixed
44  Comp Ld shift   1.08500e+02     fixed
45  Comp Ld sigma   1.27516e+02     fixed
46  Comp Ld area   1.91088e-01     fixed
47  Comp Ld slope   1.45616e+00     fixed
48  Voigt r      4.00000e+00     fixed
```

zero pileup







1st cycle, E549 trigger

No fiducial volume cuts
and no kstop cuts

Pileup events were removed by
using FADC data

1st cycle, E549 trigger

No fiducial volume cuts and no kstop cuts

```
FCN=1115.64 FROM MINOS     STATUS=SUCCESSFUL   4223 CALLS        4593 TOTAL
                     EDM=4.13688e-07    STRATEGY= 1      ERROR MATRIX ACCURATE
 EXT PARAMETER                   PARABOLIC         MINOS ERRORS
 NO.   NAME      VALUE            ERROR      NEGATIVE      POSITIVE
  1  BGa          4.52504e+01   8.94568e+00  -8.97381e+00   9.13929e+00
  2  BGb          7.38003e-03   2.54088e-03  -2.59424e-03   2.53401e-03
  3  BGc         -6.20251e-07   1.63229e-07  -1.62845e-07   1.66565e-07
  4  Noise [eV]   5.62000e+01     fixed
  5  Fano         1.45000e-01     fixed
  6  TiKa1 area   2.20764e+04   1.11567e+03  -1.10539e+03   1.12692e+03
  7  NiKa1 area   1.55437e+04   1.00997e+03  -1.00065e+03   1.02174e+03
  8  Ti Kb/Ka1 ratio   2.52227e-01   5.22149e-02  -5.12145e-02   5.35929e-02
  9  Ni Kb/Ka1 ratio   2.81831e-01   7.45888e-02  -7.34508e-02   7.68338e-02
 10  KHeXLa area   3.11260e+04   1.95785e+03  -1.67724e+03   1.99617e+03
 11  LaLb ratio   3.87277e-01   4.24392e-02  -4.14228e-02   4.36883e-02
 12  LaLg ratio   2.20907e-01   3.66579e-02  -3.58901e-02   3.76131e-02
 13  LaLd ratio   1.27985e-01   3.39252e-02  -3.33051e-02   3.47363e-02
 14  Gamma [eV]   2.25208e+00   2.54051e+01   at limit      1.56593e+01
 15  Shift [eV]   7.99563e+00   4.84794e+00  -4.84289e+00   4.87779e+00
```

```
 Const Noise  = 56.200 +-  0.000
 KHeXLa Sigma = 82.060 +-  0.016
 Fano         =  0.145 +-  0.000
 lalb_ratio   =  0.387 +-  0.043
 lalg_ratio   =  0.221 +-  0.037
 Gamma        =  2.252 +- 25.405
 Shift        =  7.996 +-  4.860
 Chisq/NDF    = 147.605/145
```

shift = 8.0±4.9 eV

c.f. okada-fit -0.2±3.3 eV

Good chisqr !

1st cycle, E549 trigger

```
16  TiKa1 mean [eV]   4.51084e+03     fixed
17  NiKa1 mean [eV]   7.47815e+03     fixed
18  TiKb1 mean [eV]   4.93181e+03     fixed
19  NiKb1 mean [eV]   8.26466e+03     fixed
20  Pile area factor   0.00000e+00     fixed
21  Pile shift [eV]   2.00000e+02     fixed
22  Pile sigma factor   2.00000e+00     fixed
23  Tail TiKa area factor   6.03720e-02     fixed
24  Tail NiKa area factor   9.82710e-02     fixed
25  Tail slope Ka   1.76200e+00     fixed
26  Tail Kb/Ka area factor   1.00000e+00     fixed
27  Tail La area factor   8.53181e-02     fixed
28  Tail Lb area factor   1.14170e-01     fixed
29  Tail Lg area factor   1.27517e-01     fixed
30  Tail Ld area factor   1.34708e-01     fixed
31  Tail slope L   1.76200e+00     fixed
32  Comp La shift   5.04600e+01     fixed
33  Comp La sigma   8.79800e+01     fixed
34  Comp La area   1.38406e-01     fixed
35  Comp La slope   8.75800e-01     fixed
36  Comp Lb shift   8.18100e+01     fixed
37  Comp Lb sigma   1.08568e+02     fixed
38  Comp Lb area   1.74475e-01     fixed
39  Comp Lb slope   1.22324e+00     fixed
40  Comp Lg shift   9.88300e+01     fixed
41  Comp Lg sigma   1.21491e+02     fixed
42  Comp Lg area   1.86872e-01     fixed
43  Comp Lg slope   1.33329e+00     fixed
44  Comp Ld shift   1.08500e+02     fixed
45  Comp Ld sigma   1.27516e+02     fixed
46  Comp Ld area   1.91088e-01     fixed
47  Comp Ld slope   1.45616e+00     fixed
48  Voigt r      4.00000e+00     fixed
```

zero pileup

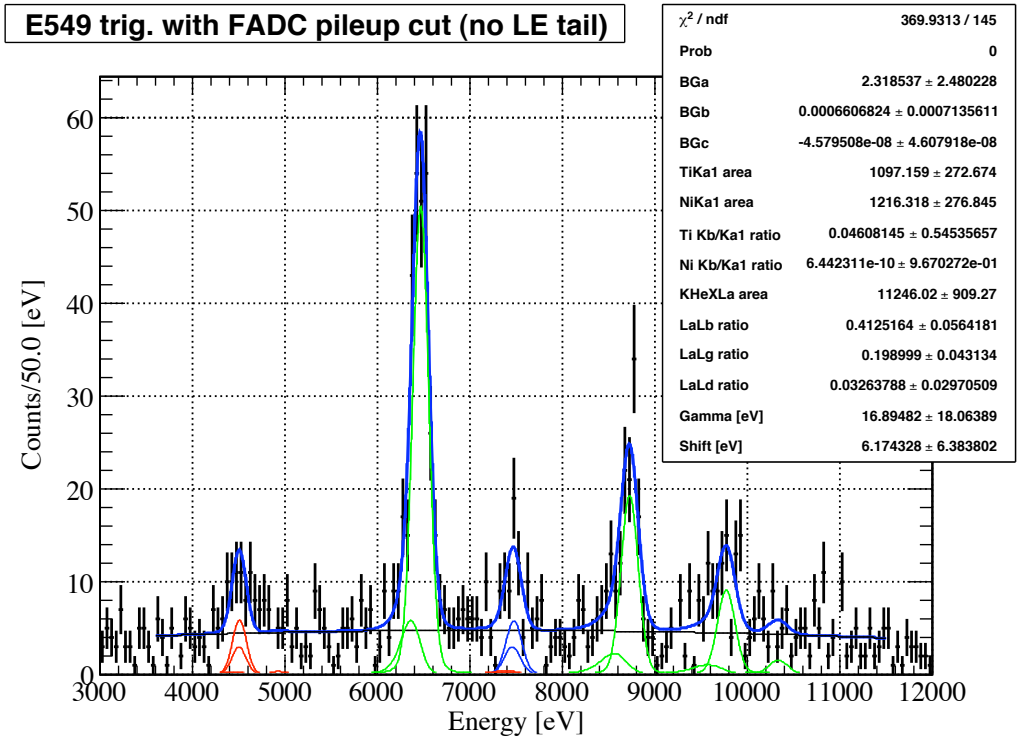
Tendency

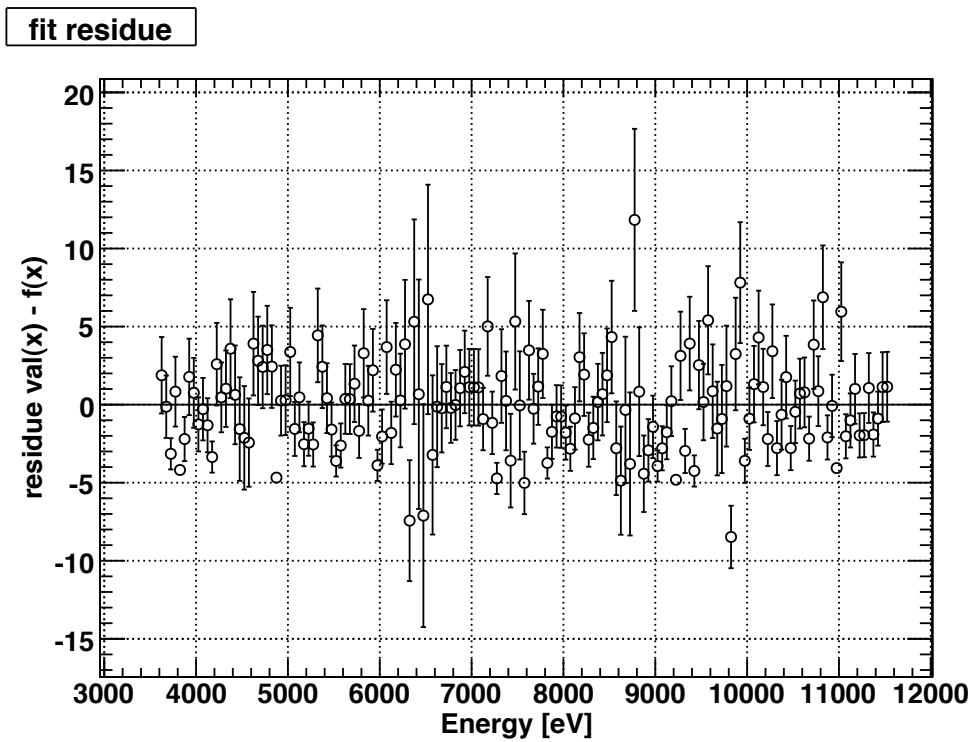
Fitted shift is more “attractive” !

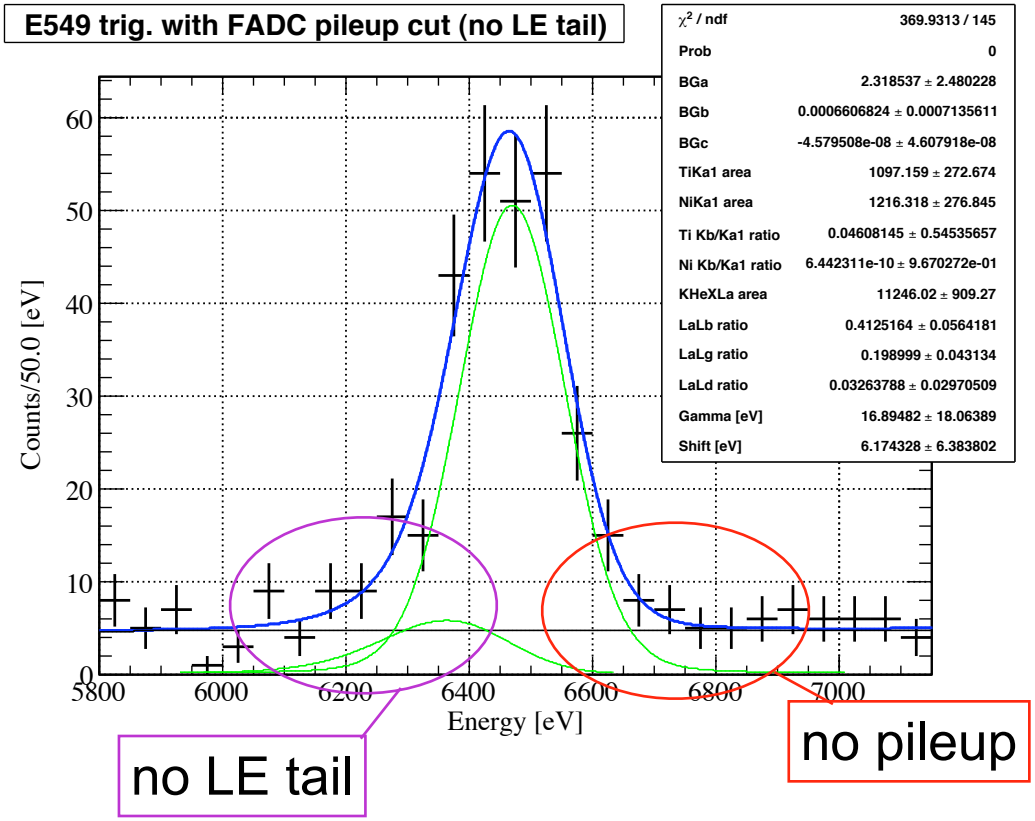
Why ?

Pileup rejection is not enough ?

How about no-LE-tail fit ?







1st cycle, E549 trigger

With fiducial volume cuts and kstop cuts

Pileup events were removed by using FADC data

1st cycle, E549 trigger

No fiducial volume cuts and no kstop cuts

```
FCN=780.55 FROM MINOS     STATUS=SUCCESSFUL   5345 CALLS        5715 TOTAL
                     EDM=1.2083e-07    STRATEGY= 1      ERROR MATRIX ACCURATE
 EXT PARAMETER                   PARABOLIC         MINOS ERRORS
 NO.   NAME      VALUE            ERROR      NEGATIVE      POSITIVE
  1  BGa          2.31854e+00   2.33139e+00  -2.40550e+00   2.55496e+00
  2  BGb          6.60682e-04   6.68246e-04  -7.32724e-04   6.94398e-04
  3  BGc         -4.57951e-08   4.32386e-08  -4.49434e-08   4.72149e-08
  4  Noise [eV]   5.62000e+01     fixed
  5  Fano         1.45000e-01     fixed
  6  TiKa1 area   1.09716e+03   2.72231e+02  -2.61676e+02   2.83671e+02
  7  NiKa1 area   1.21632e+03   2.75542e+02  -2.65912e+02   2.87778e+02
  8  Ti Kb/Ka1 ratio   4.60815e-02   5.45357e-01   at limit      2.70824e-01
  9  Ni Kb/Ka1 ratio   6.44231e-10   9.67027e-01   at limit      2.45567e-01
                                WARNING -   - ABOVE PARAMETER IS AT LIMIT.
 10  KHeXLa area   1.12460e+04   9.04476e+02  -8.86506e+02   9.32030e+02
 11  LaLb ratio   4.12516e-01   5.61528e-02  -5.36844e-02   5.91519e-02
 12  LaLg ratio   1.98999e-01   4.29180e-02  -4.10601e-02   4.52071e-02
 13  LaLd ratio   3.26379e-02   2.94726e-02  -2.81182e-02   3.12920e-02
 14  Gamma [eV]   1.68948e+01   1.80639e+01   at limit      1.90637e+01
 15  Shift [eV]   6.17433e+00   6.36034e+00  -6.38260e+00   6.38501e+00
```

```
 Const Noise  = 56.200 +-  0.000
 KHeXLa Sigma = 82.054 +-  0.021
 Fano         =  0.145 +-  0.000
 lalb_ratio   =  0.413 +-  0.056
 lalg_ratio   =  0.199 +-  0.043
 Gamma        = 16.895 +- 18.064
 Shift        =  6.174 +-  6.384
 Chisq/NDF    = 369.931/145
```

-3.8 eV

shift = 6.2±6.4 eV

c.f. okada-fit -0.2±3.3 eV

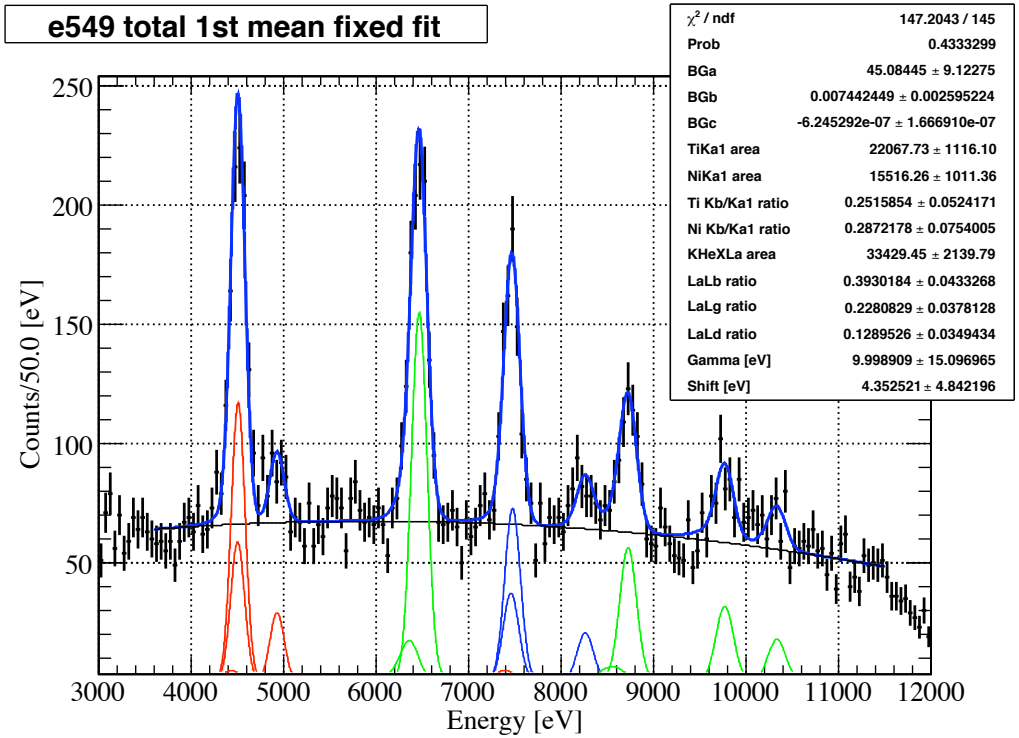
Chisqr wasn't improved

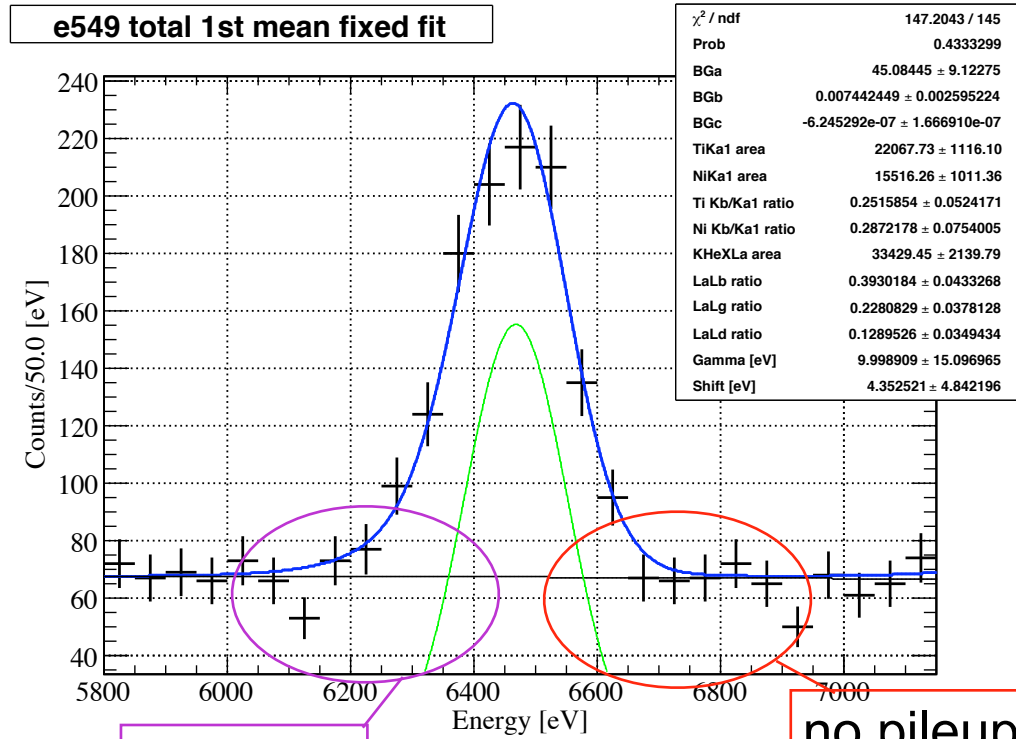
1st cycle, E549 trigger

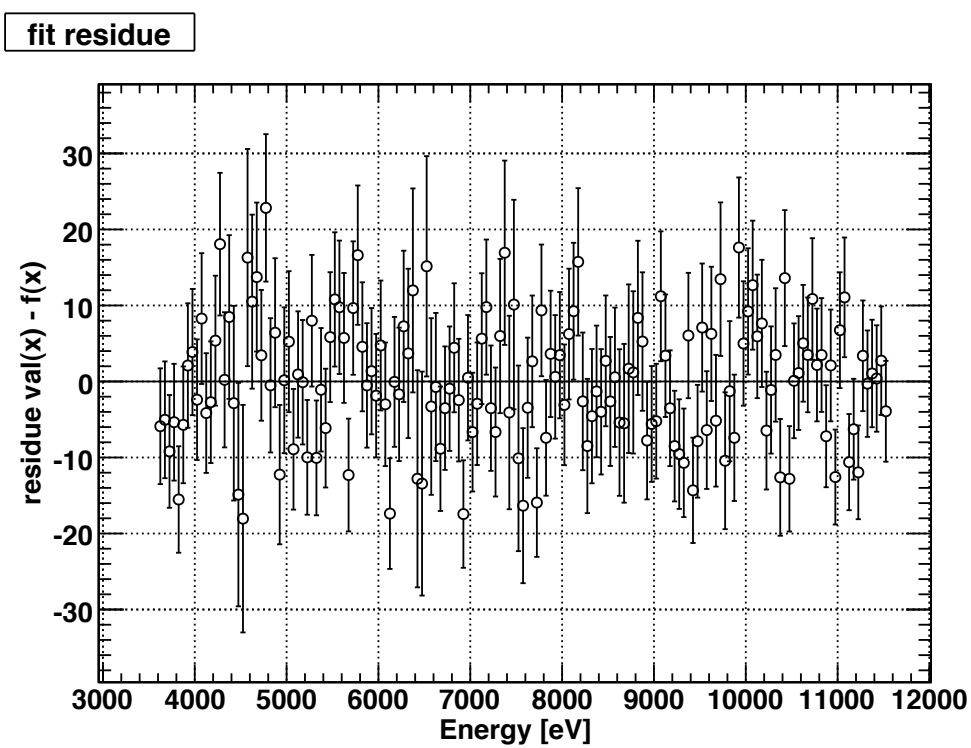
```
16  TiKa1 mean [eV]   4.51084e+03     fixed
  17  NiKa1 mean [eV]   7.47815e+03     fixed
  18  TiKb1 mean [eV]   4.93181e+03     fixed
  19  NiKb1 mean [eV]   8.26466e+03     fixed
  20  Pile area factor   0.00000e+00     fixed
  21  Pile shift [eV]   2.00000e+02     fixed
  22  Pile sigma factor   2.00000e+00     fixed
  23  Tail TiKa area factor   6.03720e-02     fixed
  24  Tail NiKa area factor   9.82710e-02     fixed
  25  Tail slope Ka   1.76200e+00     fixed
  26  Tail Kb/Ka area factor   1.00000e+00     fixed
  27  Tail La area factor   0.00000e+00     fixed
  28  Tail Lb area factor   0.00000e+00     fixed
  29  Tail Lg area factor   0.00000e+00     fixed
  30  Tail Ld area factor   0.00000e+00     fixed
  31  Tail slope L   1.76200e+00     fixed
  32  Comp La shift   5.04600e+01     fixed
  33  Comp La sigma   8.79800e+01     fixed
  34  Comp La area   1.38406e-01     fixed
  35  Comp La slope   8.75800e-01     fixed
  36  Comp Lb shift   8.18100e+01     fixed
  37  Comp Lb sigma   1.08568e+02     fixed
  38  Comp Lb area   1.74475e-01     fixed
  39  Comp Lb slope   1.22324e+00     fixed
  40  Comp Lg shift   9.88300e+01     fixed
  41  Comp Lg sigma   1.21491e+02     fixed
  42  Comp Lg area   1.86872e-01     fixed
  43  Comp Lg slope   1.33329e+00     fixed
  44  Comp Ld shift   1.08500e+02     fixed
  45  Comp Ld sigma   1.27516e+02     fixed
  46  Comp Ld area   1.91088e-01     fixed
  47  Comp Ld slope   1.45616e+00     fixed
  48  Voigt r      4.00000e+00     fixed
```

zero pileup

zero LE-tail







1st cycle, E549 trigger

No fiducial volume cuts
and no kstop cuts

Pileup events were removed by
using FADC data

1st cycle, E549 trigger

No fiducial volume cuts and no kstop cuts

```
FCN=1115.31 FROM MINOS     STATUS=SUCCESSFUL   3098 CALLS        3465 TOTAL
                     EDM=1.12035e-08    STRATEGY= 1      ERROR MATRIX ACCURATE
 EXT PARAMETER                   PARABOLIC         MINOS ERRORS
 NO.   NAME      VALUE            ERROR      NEGATIVE      POSITIVE
  1  BGa          4.50845e+01   8.99423e+00  -9.08160e+00   9.16391e+00
  2  BGb          7.44245e-03   2.55815e-03  -2.60375e-03   2.58670e-03
  3  BGc         -6.24529e-07   1.64367e-07  -1.66207e-07   1.67175e-07
  4  Noise [eV]   5.62000e+01     fixed
  5  Fano         1.45000e-01     fixed
  6  TiKa1 area   2.20677e+04   1.11561e+03  -1.10539e+03   1.12681e+03
  7  NiKa1 area   1.55163e+04   1.01035e+03  -1.00084e+03   1.02187e+03
  8  Ti Kb/Ka1 ratio   2.51585e-01   5.22271e-02  -5.12304e-02   5.36037e-02
  9  Ni Kb/Ka1 ratio   2.87218e-01   7.48587e-02  -7.36973e-02   7.71037e-02
 10  KHeXLa area   3.34294e+04   2.13625e+03  -2.10155e+03   2.17802e+03
 11  LaLb ratio   3.93018e-01   4.32091e-02  -4.21749e-02   4.44788e-02
 12  LaLg ratio   2.28083e-01   3.77155e-02  -3.69189e-02   3.87066e-02
 13  LaLd ratio   1.28953e-01   3.48423e-02  -3.42005e-02   3.56863e-02
 14  Gamma [eV]   9.99891e+00   1.50970e+01   at limit      1.55666e+01
 15  Shift [eV]   4.35252e+00   4.83168e+00  -4.83243e+00   4.85196e+00
```

```
 Const Noise  = 56.200 +-  0.000
 KHeXLa Sigma = 82.048 +-  0.016
 Fano         =  0.145 +-  0.000
 lalb_ratio   =  0.393 +-  0.043
 lalg_ratio   =  0.228 +-  0.038
 Gamma        =  9.999 +- 15.097
 Shift        =  4.353 +-  4.842
 Chisq/NDF    = 147.204/145
```

-3.6 eV

shift = 4.4±4.8 eV

c.f. okada-fit -0.2±3.3 eV

1st cycle, E549 trigger

```
16  TiKa1 mean [eV]   4.51084e+03     fixed
17  NiKa1 mean [eV]   7.47815e+03     fixed
18  TiKb1 mean [eV]   4.93181e+03     fixed
19  NiKb1 mean [eV]   8.26466e+03     fixed
20  Pile area factor   0.00000e+00     fixed
21  Pile shift [eV]   2.00000e+02     fixed
22  Pile sigma factor   2.00000e+00     fixed
23  Tail TiKa area factor   6.03720e-02     fixed
24  Tail NiKa area factor   9.82710e-02     fixed
25  Tail slope Ka   1.76200e+00     fixed
26  Tail Kb/Ka area factor   1.00000e+00     fixed
27  Tail La area factor   0.00000e+00     fixed
28  Tail Lb area factor   0.00000e+00     fixed
29  Tail Lg area factor   0.00000e+00     fixed
30  Tail Ld area factor   0.00000e+00     fixed
31  Tail slope L   1.76200e+00     fixed
32  Comp La shift   5.04600e+01     fixed
33  Comp La sigma   8.79800e+01     fixed
34  Comp La area   1.38406e-01     fixed
35  Comp La slope   8.75800e-01     fixed
36  Comp Lb shift   8.18100e+01     fixed
37  Comp Lb sigma   1.08568e+02     fixed
38  Comp Lb area   1.74475e-01     fixed
39  Comp Lb slope   1.22324e+00     fixed
40  Comp Lg shift   9.88300e+01     fixed
41  Comp Lg sigma   1.21491e+02     fixed
42  Comp Lg area   1.86872e-01     fixed
43  Comp Lg slope   1.33329e+00     fixed
44  Comp Ld shift   1.08500e+02     fixed
45  Comp Ld sigma   1.27516e+02     fixed
46  Comp Ld area   1.91088e-01     fixed
47  Comp Ld slope   1.45616e+00     fixed
48  Voigt r      4.00000e+00     fixed
```

zero pileup

zero LE-tail

Summary

Pileup events were removed by using FADC data, and the final results were checked by fitting without "pileup Gaussians"

As a result, the shift was more attractive !

Pileup rejection is not enough ?

The low-energy-tail influence is same as the Okada-san'report (~ −4 eV)