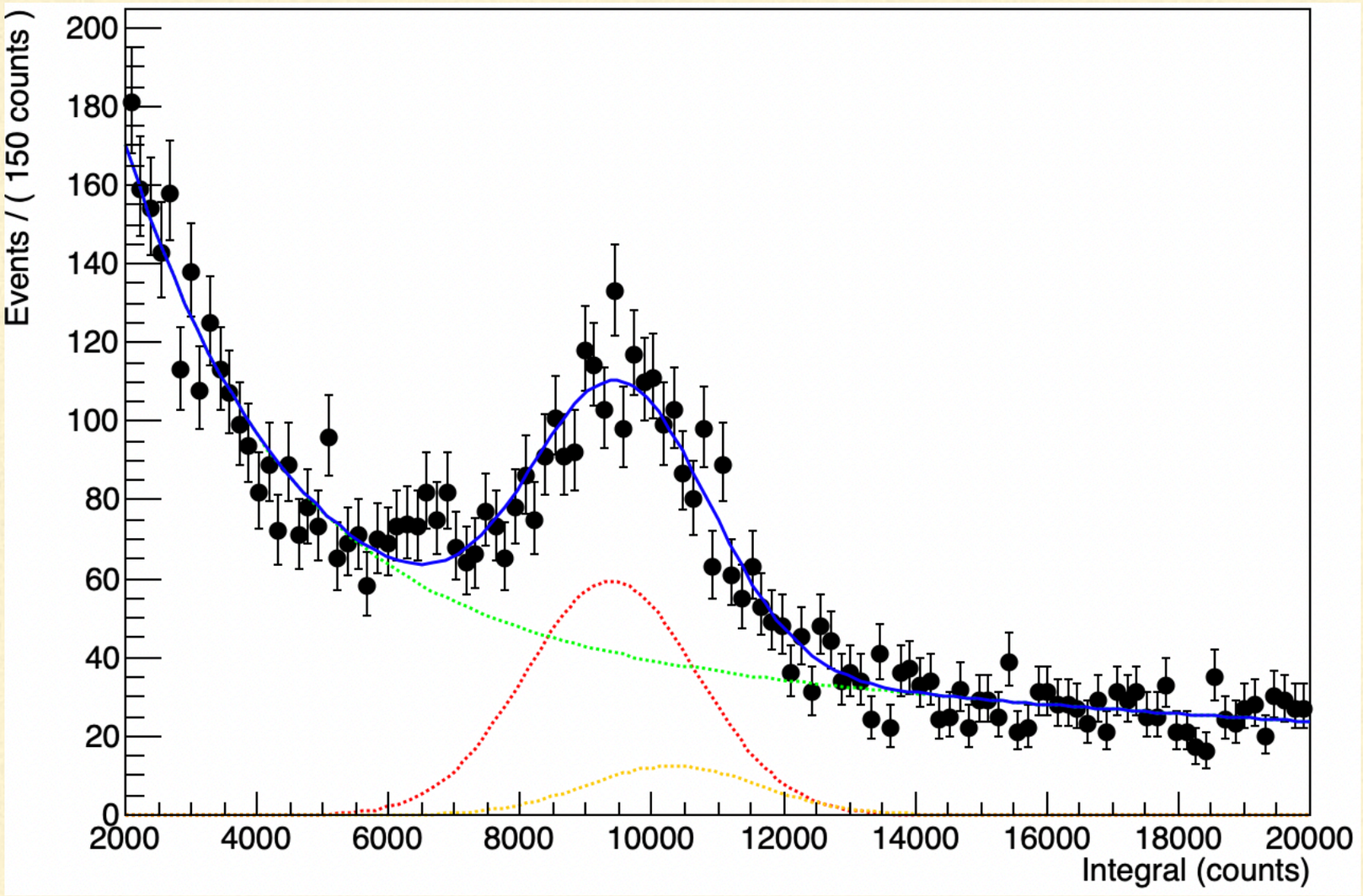
# Update on Data-MC comparison

# Double gaussian fit on Cu



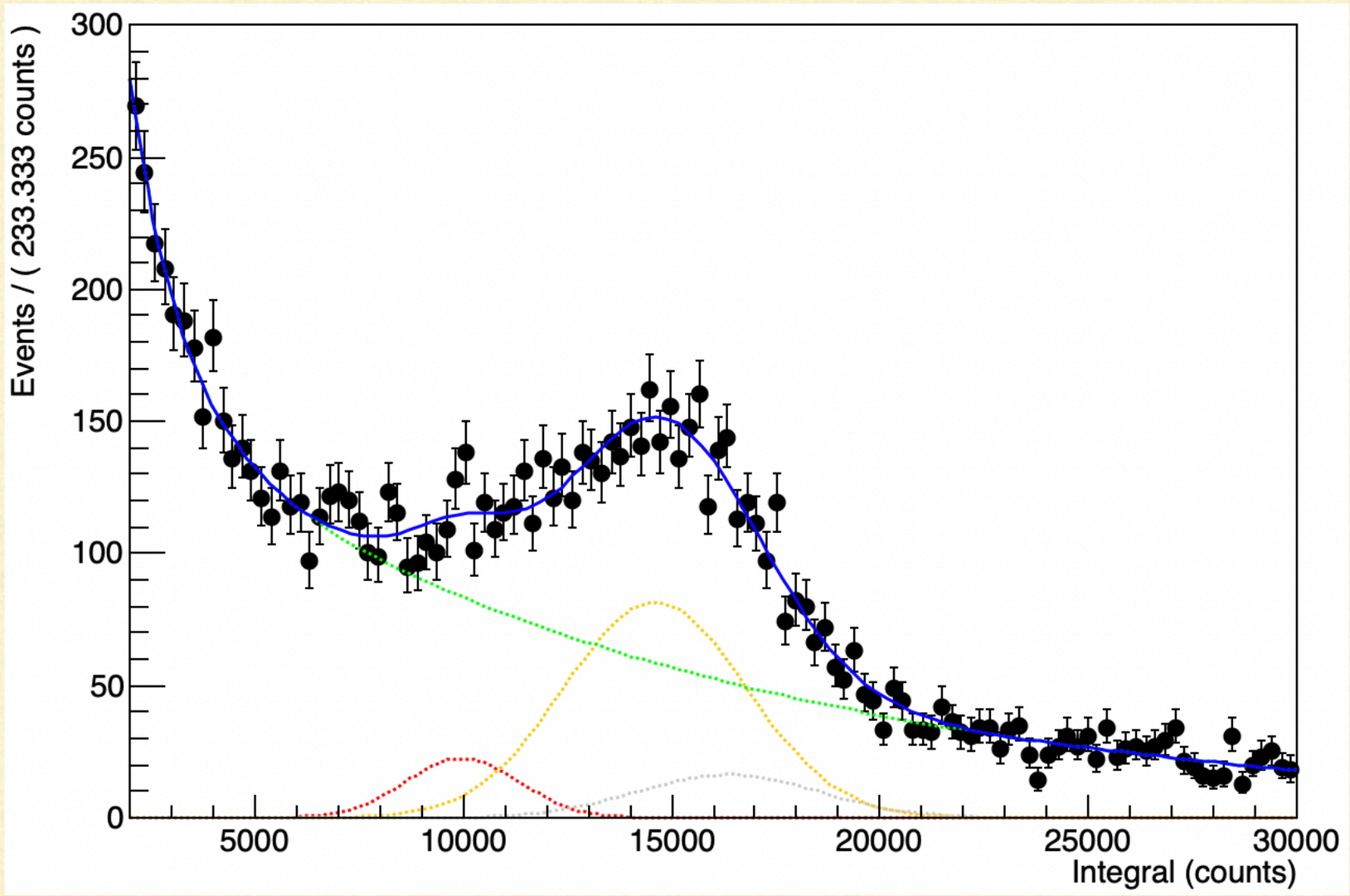

Mean2 bounded to 1.10 mean1 and same sigma from source documentation

Constrained yields fraction from source documentation

13.8% vs 14%

| EXT NO. | PARAMETER NAME | VALUE | ERROR | INTERNAL STEP SIZE | INTERNAL VALUE |
|---|---|---|---|---|---|
| 1 | alpha1 | -4.28330e-04 | 9.41981e-05 | 3.35365e-05 | 1.13144e+00 |
| 2 | alpha2 | -4.02670e-05 | 2.46327e-05 | 1.87103e-05 | 1.43859e+00 |
| 3 | bkgYield | 6.05507e+03 | 1.77969e+02 | 2.01799e-05 | -1.38453e+00 |
| 4 | coeff | 3.12465e-01 | 1.09703e-01 | 3.85737e-04 | -3.84472e-01 |
| 5 | mean1 | 9.38139e+03 | 7.05160e+01 | 9.45397e-05 | 9.67121e-01 |
| 6 | sigma1 | 1.30534e+03 | 1.17435e+02 | 4.40433e-04 | -5.69772e-01 |
| 7 | signalYield1 | 1.29475e+03 | 1.36279e+02 | 6.41126e-05 | -1.34536e+00 |

# Double gaussian fit on Rb




Mean3 bounded to 1.120 mean2 and same sigma

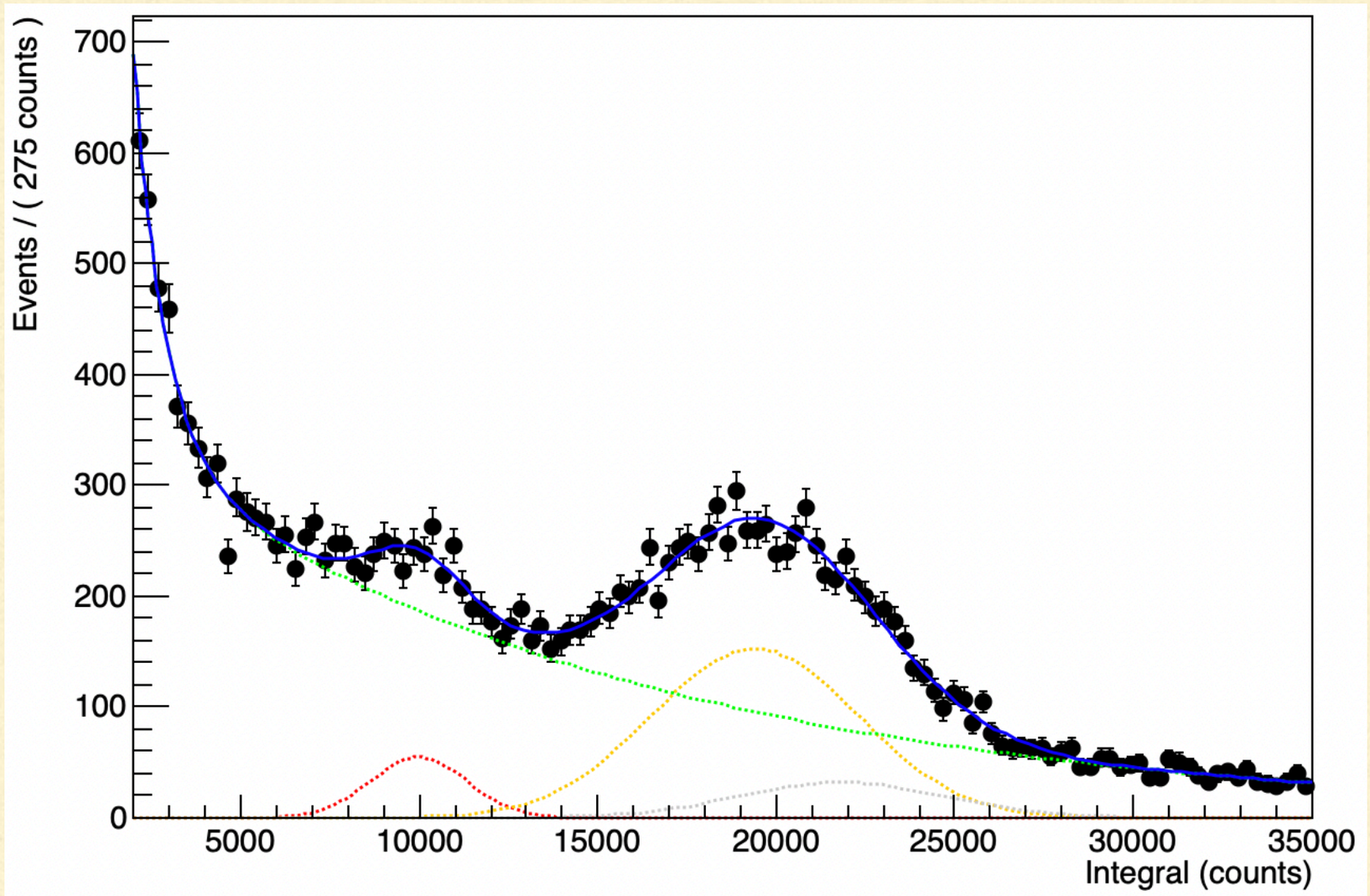
Constrained yields fraction

Constrained Cu mean

15% vs 16%

| NO. | NAME | VALUE | ERROR | SIZE | DERIVATIVE |
|---|---|---|---|---|---|
| 1 | alpha1 | -8.32499e-04 | 2.03659e-04 | 3.19895e-03 | 5.37473e-02 |
| 2 | alpha2 | -7.63805e-05 | 3.12548e-06 | 1.96472e-04 | 9.99874e-01 |
| 3 | bkgYield | 8.24003e+03 | 1.52481e+02 | 1.24793e-04 | -1.07221e+00 |
| 4 | coeff | 7.90836e-02 | 2.01866e-02 | 2.30272e-03 | -9.17672e-02 |
| 5 | mean2 | 1.46088e+04 | 1.03313e+02 | 4.94727e-04 | -3.77335e-01 |
| 6 | sigma2 | 2.18040e+03 | 1.06001e+02 | 1.88685e-03 | -1.78025e-02 |
| 7 | signalYield1 | 3.28848e+02 | 8.53455e+01 | 8.45125e-04 | -4.28740e-01 |
| 8 | signalYield2 | 1.90671e+03 | 8.77816e+01 | 1.23215e-04 | 1.67824e+00 |

# Double gaussian fit on Mo



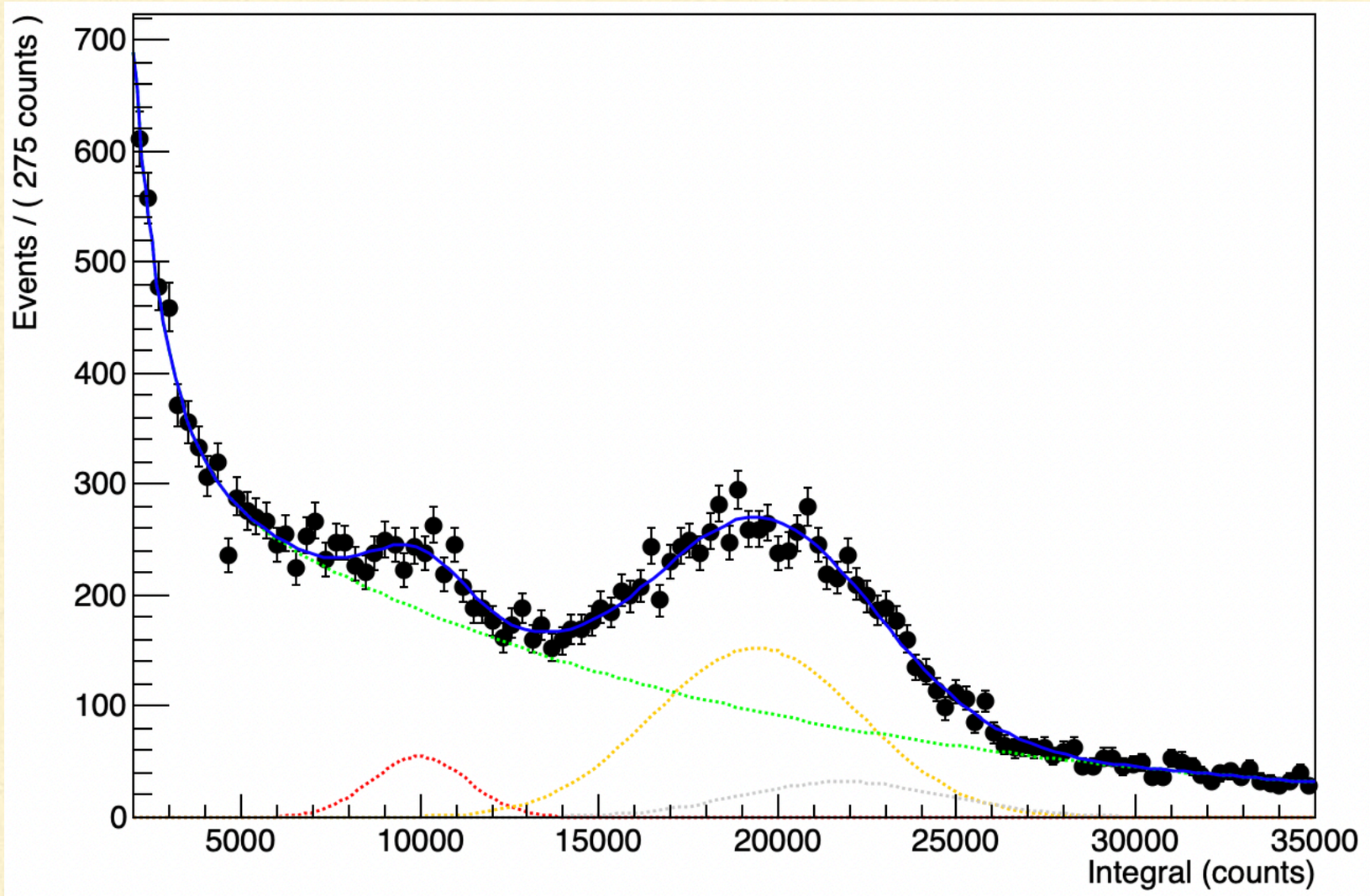

Mean3 bounded to 1.130 mean2 and same sigma

Constrained yields fraction

14.8% vs 17%

| EXT NO. | PARAMETER NAME | VALUE | ERROR | INTERNAL STEP SIZE | INTERNAL VALUE |
|---|---|---|---|---|---|
| 1 | alpha1 | -1.16902e-03 | 1.71361e-04 | 1.27124e-04 | 8.33683e-01 |
| 2 | alpha2 | -7.10160e-05 | 1.84765e-06 | 3.07742e-05 | 1.39415e+00 |
| 3 | bkgYield | 1.63514e+04 | 3.14178e+02 | 2.99647e-05 | -1.26393e+00 |
| 4 | coeff | 6.83733e-02 | 1.06076e-02 | 3.39315e-04 | -1.04168e+00 |
| 5 | mean1 | 9.96767e+03 | 4.16740e+02 | 3.04834e-03 | 8.10894e+00 |
| 6 | mean2 | 1.94070e+04 | 7.94466e+01 | 7.42602e-05 | -2.38502e+00 |
| 7 | sigma1 | 1.36191e+03 | 3.17642e+02 | 3.32460e-04 | -5.42025e-01 |
| 8 | sigma2 | 2.88913e+03 | 8.70284e+01 | 6.67955e-05 | -6.77620e-01 |
| 9 | signalYield1 | 6.78042e+02 | 1.80312e+02 | 3.59063e-05 | -1.40960e+00 |
| 10 | signalYield2 | 4.01262e+03 | 1.33287e+02 | 2.80257e-05 | -1.44449e+00 |

# Double gaussian fit on Ag



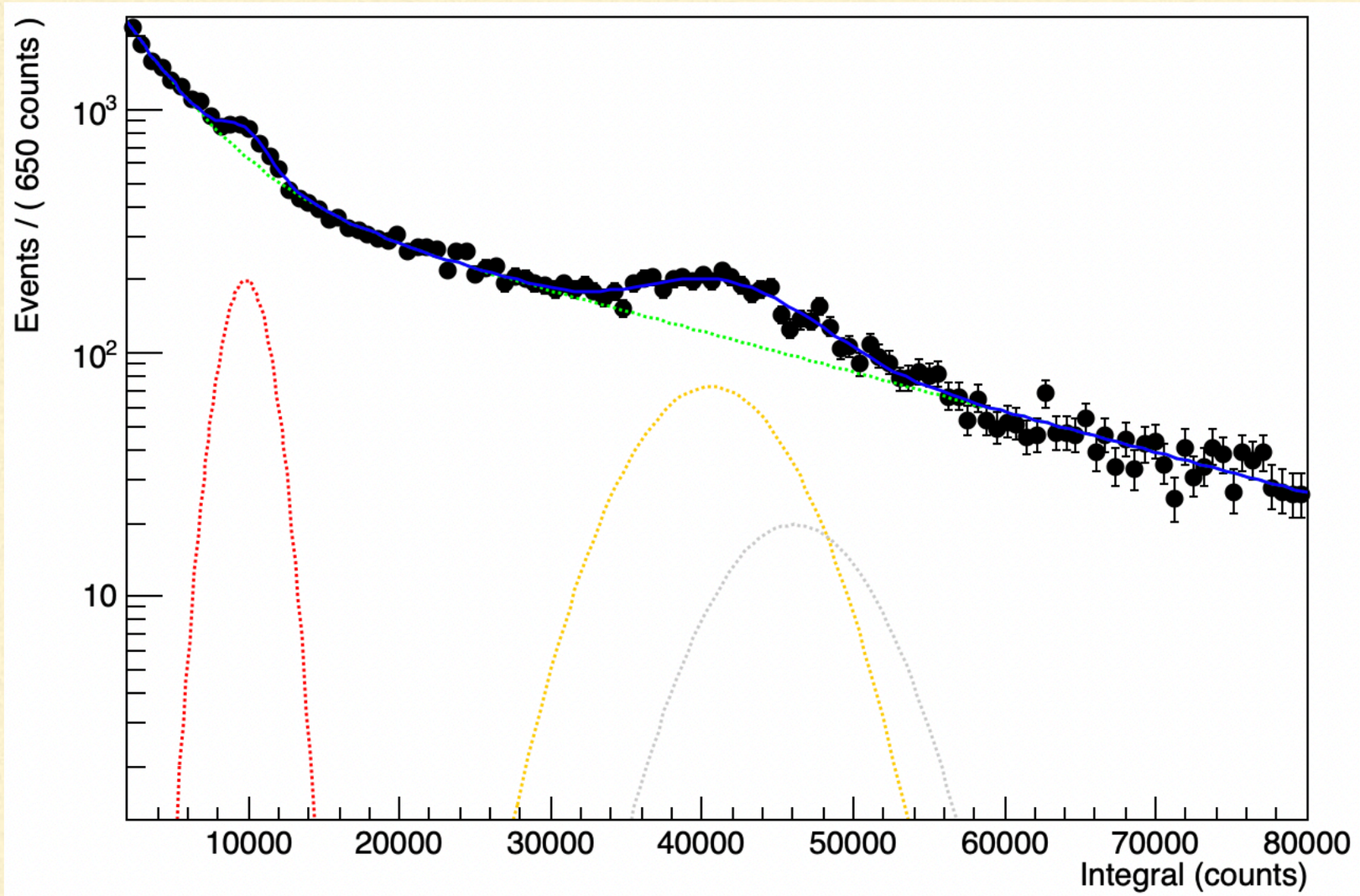

Mean3 bounded to 1.130 mean2 and same sigma

Constrained yields fraction

16.3% vs 17%

| EXT NO. | PARAMETER NAME | VALUE | ERROR | INTERNAL STEP SIZE | INTERNAL VALUE |
|---|---|---|---|---|---|
| 1 | alpha1 | -1.16902e-03 | 1.71361e-04 | 1.27124e-04 | 8.33683e-01 |
| 2 | alpha2 | -7.10160e-05 | 1.84765e-06 | 3.07742e-05 | 1.39415e+00 |
| 3 | bkgYield | 1.63514e+04 | 3.14178e+02 | 2.99647e-05 | -1.26393e+00 |
| 4 | coeff | 6.83733e-02 | 1.06076e-02 | 3.39315e-04 | -1.04168e+00 |
| 5 | mean1 | 9.96767e+03 | 4.16740e+02 | 3.04834e-03 | 8.10894e+00 |
| 6 | mean2 | 1.94070e+04 | 7.94466e+01 | 7.42602e-05 | -2.38502e+00 |
| 7 | sigma1 | 1.36191e+03 | 3.17642e+02 | 3.32460e-04 | -5.42025e-01 |
| 8 | sigma2 | 2.88913e+03 | 8.70284e+01 | 6.67955e-05 | -6.77620e-01 |
| 9 | signalYield1 | 6.78042e+02 | 1.80312e+02 | 3.59063e-05 | -1.40960e+00 |
| 10 | signalYield2 | 4.01262e+03 | 1.33287e+02 | 2.80257e-05 | -1.44449e+00 |

# Double gaussian fit on Ba



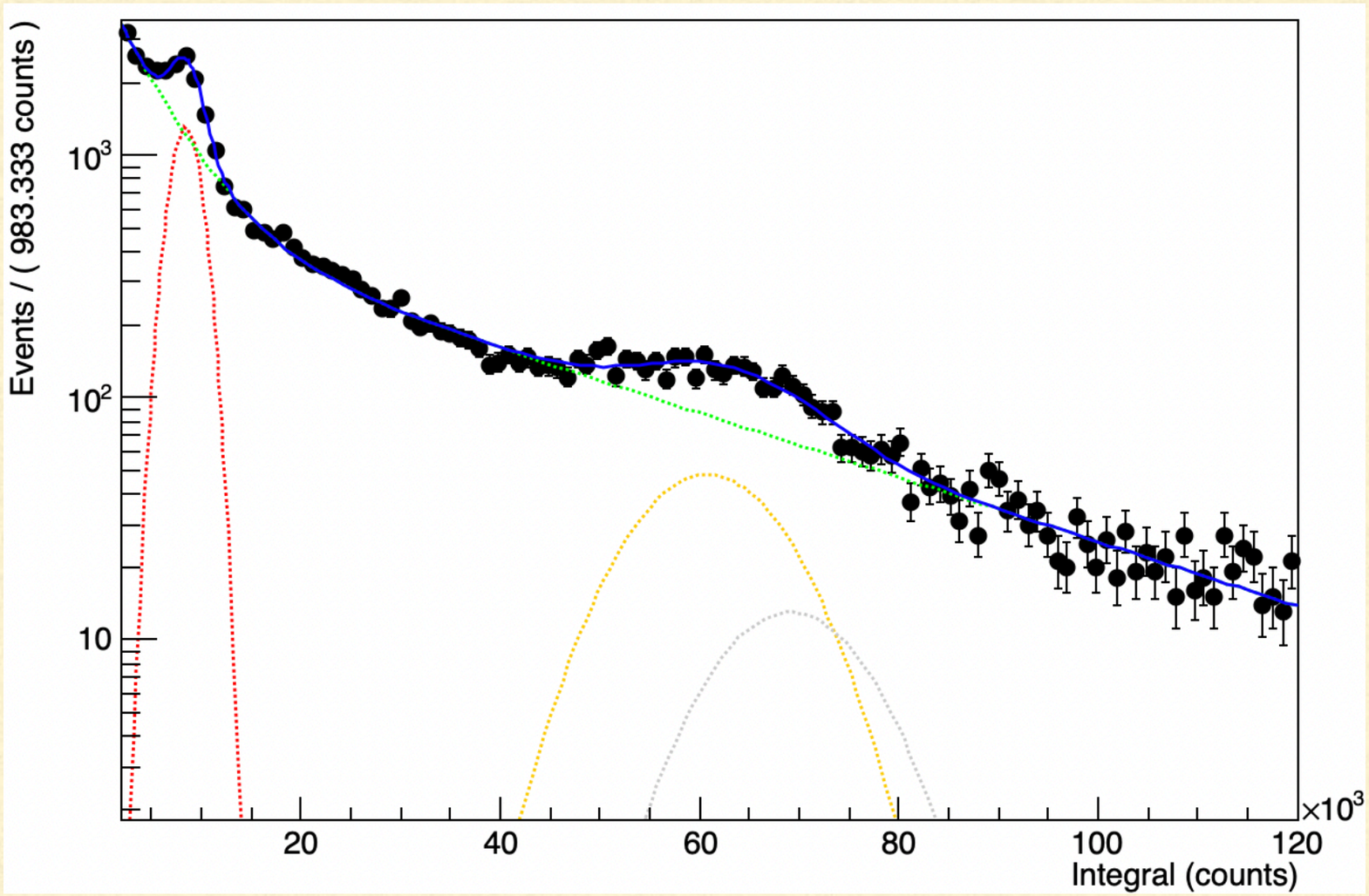

Mean3 bounded to 1.136 mean2 and same sigma

Free Yields compatible

11% vs 13%

| EXT NO. | PARAMETER NAME | VALUE | ERROR | INTERNAL STEP SIZE | INTERNAL VALUE |
|---|---|---|---|---|---|
| 1 | alpha1 | -2.47382e-04 | 1.39208e-05 | 1.61994e-05 | 1.23834e+00 |
| 2 | alpha2 | -3.81101e-05 | 7.66516e-07 | 4.30303e-06 | 1.44227e+00 |
| 3 | bkgYield | 3.09958e+04 | 2.94812e+02 | 7.08972e-06 | -1.14678e+00 |
| 4 | coeff | 3.55686e-01 | 1.63065e-02 | 5.38611e-05 | -2.92793e-01 |
| 5 | mean1 | 9.82320e+03 | 2.25148e+02 | 7.17941e-04 | 1.25160e+00 |
| 6 | mean2 | 4.05644e+04 | 7.96675e+02 | 9.52063e-05 | 5.56504e-01 |
| 7 | sigma1 | 1.42409e+03 | 2.91227e+02 | 3.24061e-04 | -5.12045e-01 |
| 8 | sigma2 | 4.55445e+03 | 5.69647e+02 | 4.05615e-04 | 3.22597e+00 |
| 9 | signalYield1 | 1.09267e+03 | 2.48659e+02 | 4.31721e-05 | -1.36423e+00 |
| 10 | signalYield2 | 1.27395e+03 | 2.70512e+02 | 1.08719e-05 | -1.50024e+00 |
| 11 | signalYield3 | 3.44569e+02 | 2.35472e+02 | 1.80032e-05 | -1.60787e+00 |

# Double gaussian fit on Tb




Mean3 bounded to 1.136 mean2 and same sigma

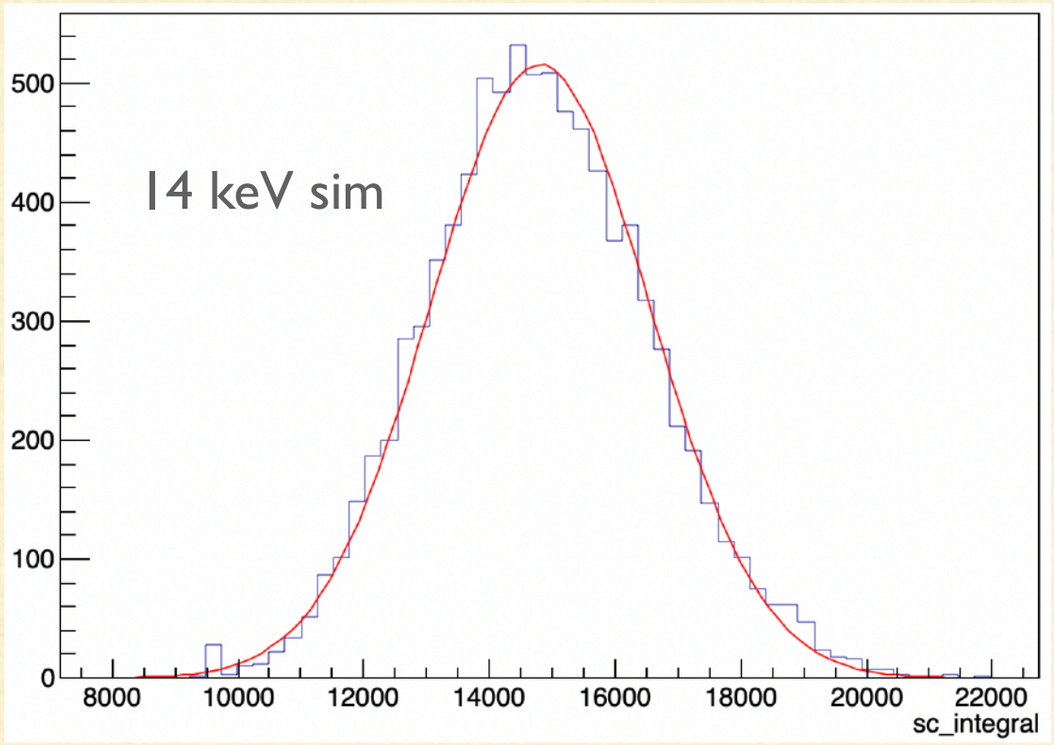
Constrained yields fraction

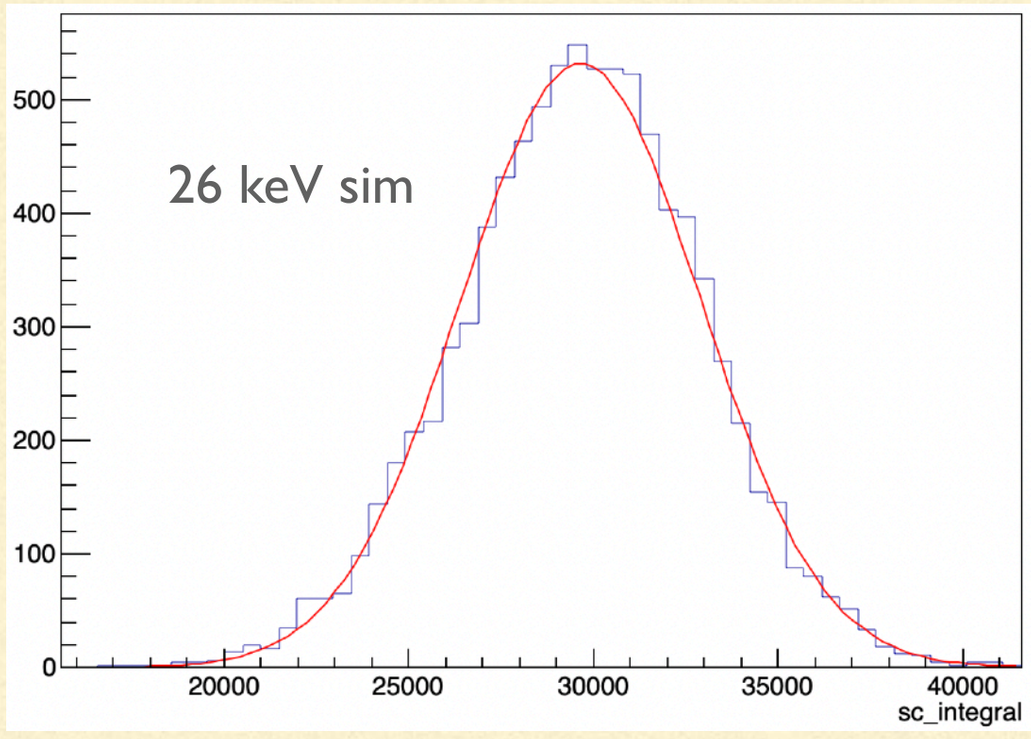
12% vs 13.5%

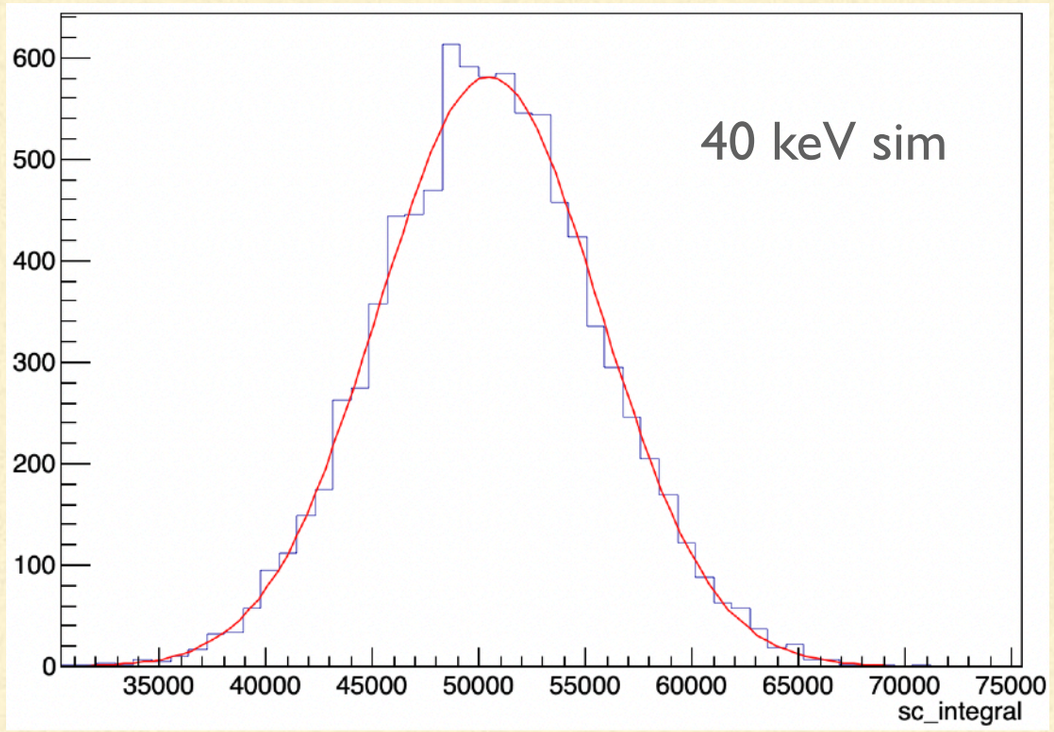
| NO. | NAME | VALUE | ERROR | STEP SIZE | VALUE |
|---|---|---|---|---|---|
| 1 | alpha1 | -2.02567e-04 | 5.93663e-06 | 2.93191e-04 | 1.27034e+00 |
| 2 | alpha2 | -3.05944e-05 | 5.90957e-07 | 9.84581e-05 | 1.45604e+00 |
| 3 | bkgYield | 3.12111e+04 | 2.65136e+02 | 1.84594e-04 | -1.14529e+00 |
| 4 | coeff | 4.71640e-01 | 1.20728e-02 | 1.28312e-03 | -5.67503e-02 |
| 5 | mean1 | 8.38558e+03 | 4.86781e+01 | 2.09792e-03 | 5.68936e-01 |
| 6 | mean2 | 6.07947e+04 | 5.84954e+02 | 3.55879e-03 | 7.65860e-01 |
| 7 | sigma1 | 1.53338e+03 | 5.36282e+01 | 2.41142e-03 | -4.60534e-01 |
| 8 | sigma2 | 7.35852e+03 | 5.83274e+02 | 1.20079e-02 | 2.96958e+00 |
| 9 | signalYield1 | 5.05056e+03 | 2.07443e+02 | 7.21408e-04 | -1.11876e+00 |
| 10 | signalYield2 | 9.01755e+02 | 7.04008e+01 | 2.26806e-04 | -1.51174e+00 |

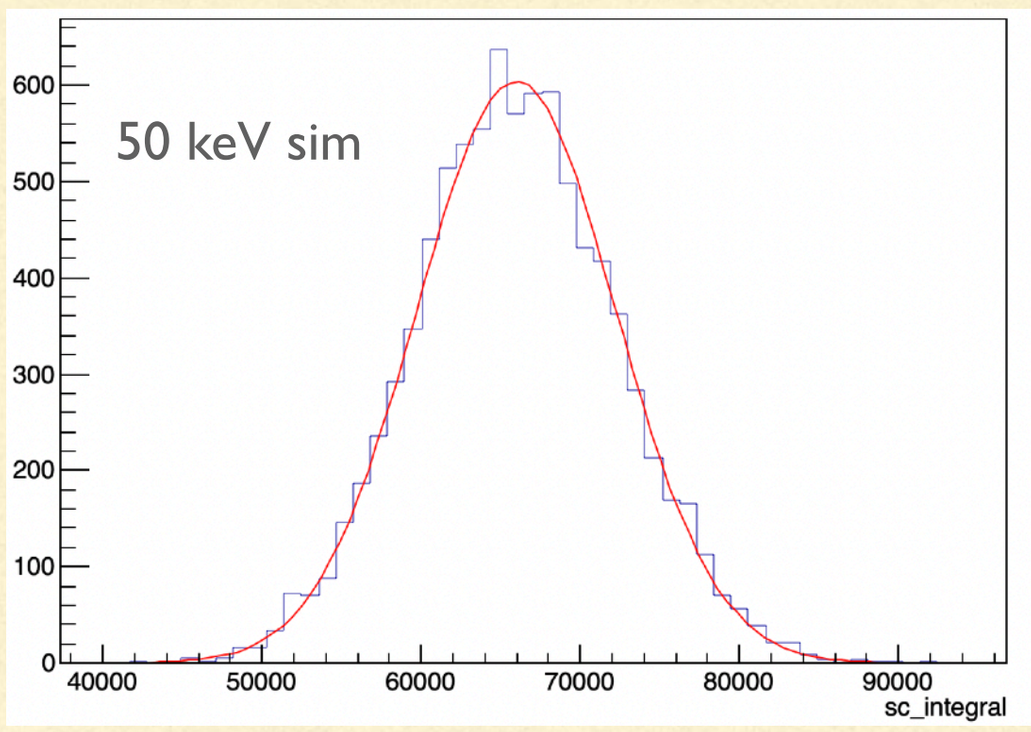
# Simulations

Symmetric gaussian distributions



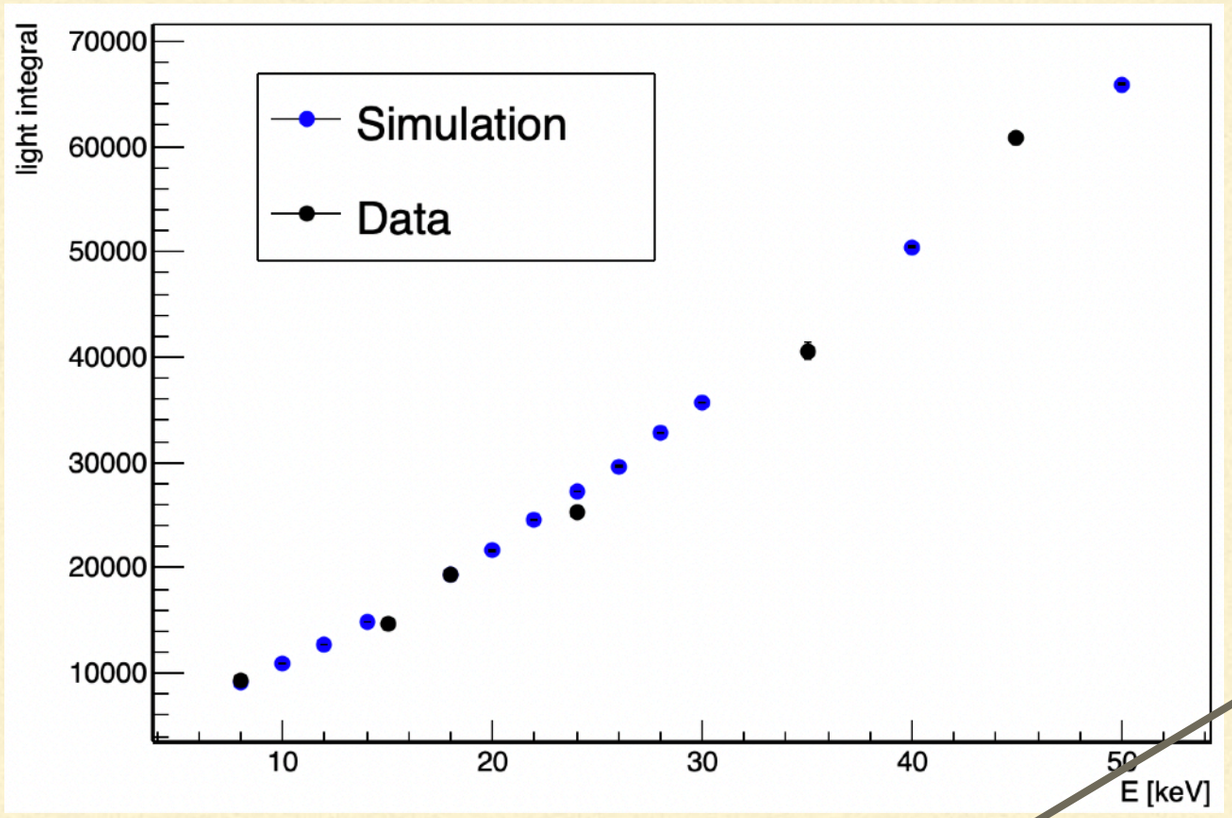



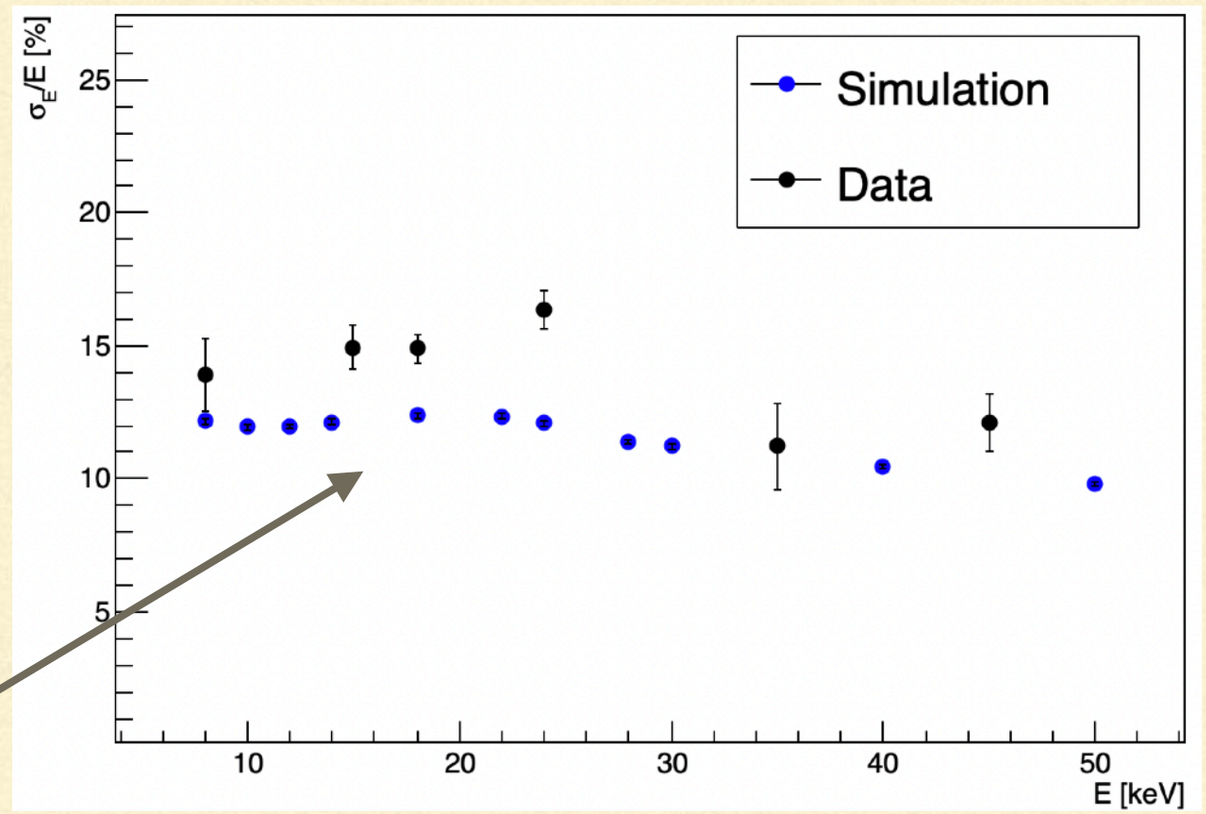



# Comparison with high statistic simulation

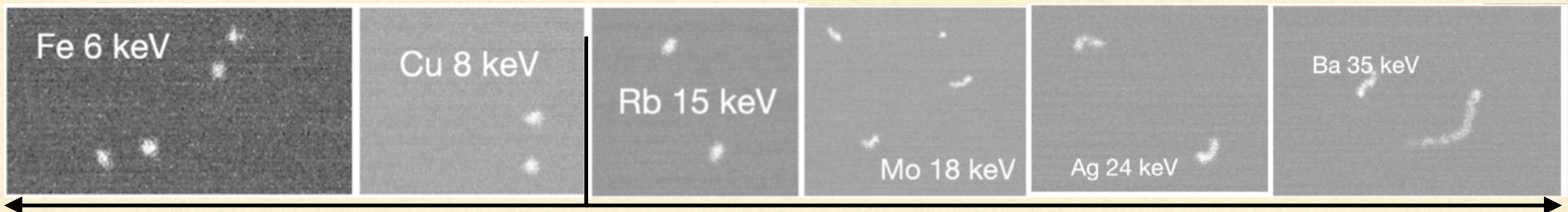
10.000 tracks to understand better the Ereso behaviour




Why there is this bump? Present also in the simulation→ real effect

# My explaination




1st regime:

- Only head of the track, increasing the energy increase the charge density in the spot
- Resolution improves with energy but there is saturation

2nd regime:

- Tracks start to have an tail with low charge density → higher fluctuation + track head saturation
- Worsening in resolution

3nd regime:

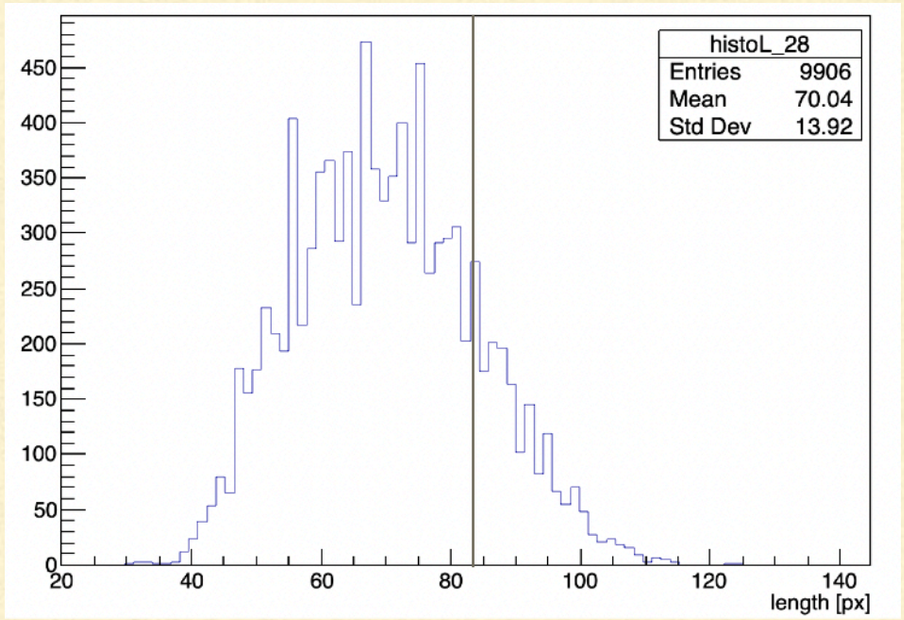
- Tracks start to have an long tail with low charge density → fluctuation averaged + track head saturation less important
- Improvement in resolution

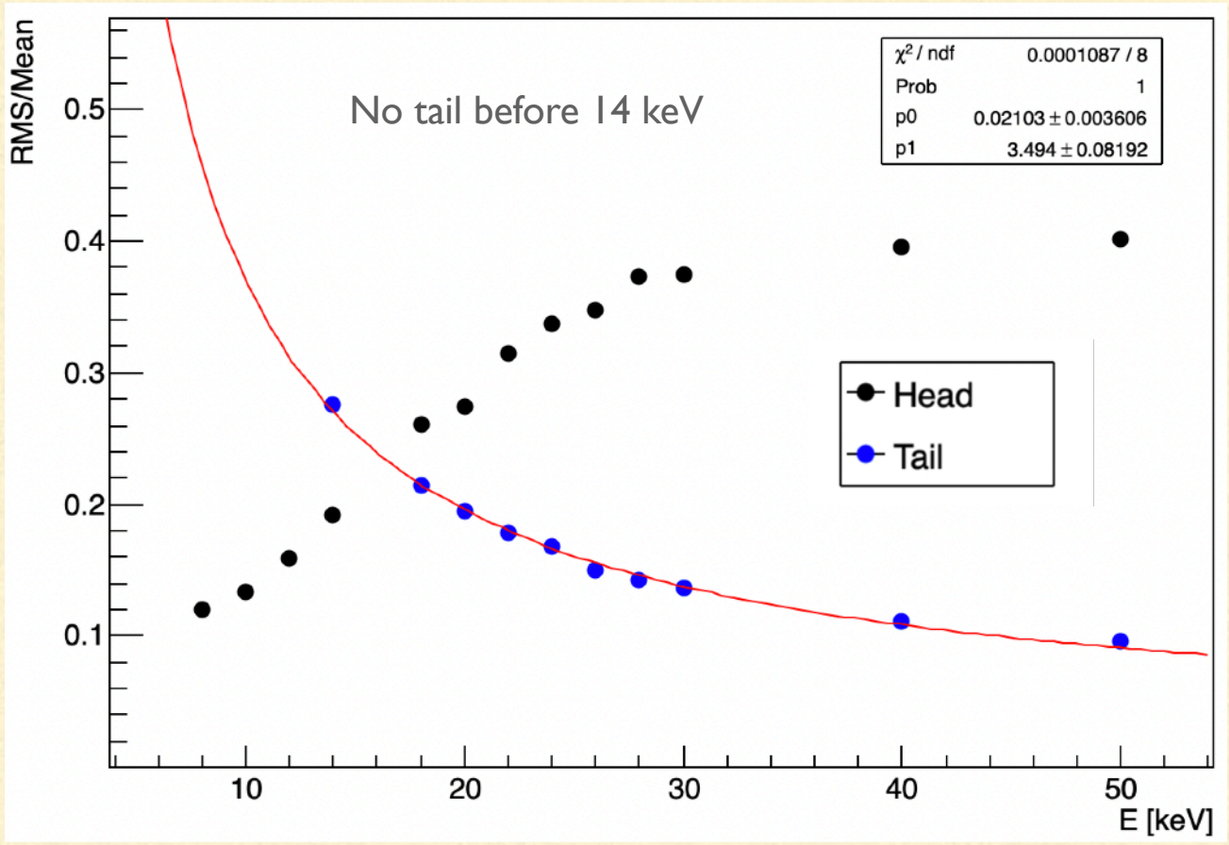
How to prove it?

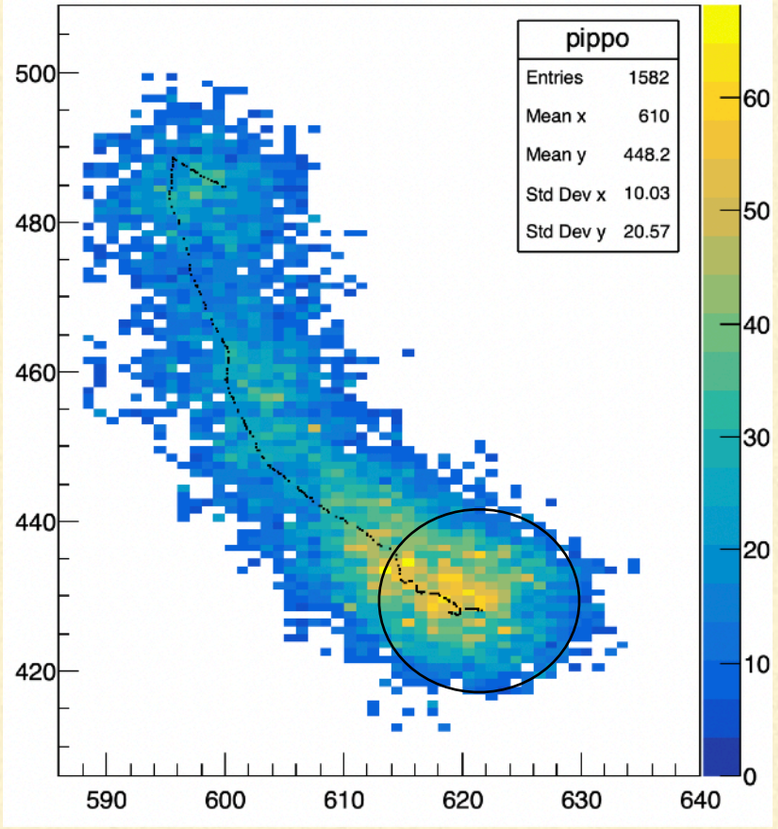
Studying separately the behaviour of the head and the tail of the tracks

# Analysis

- Selection of tracks “parallel to the gem plane” in the last quintile of the length distribution (just for semplicity)
- Selection of the head as al the pixels in a circumference of 12 px radius
- Study the mean and RMS distribution for the head and the tail of the track separately



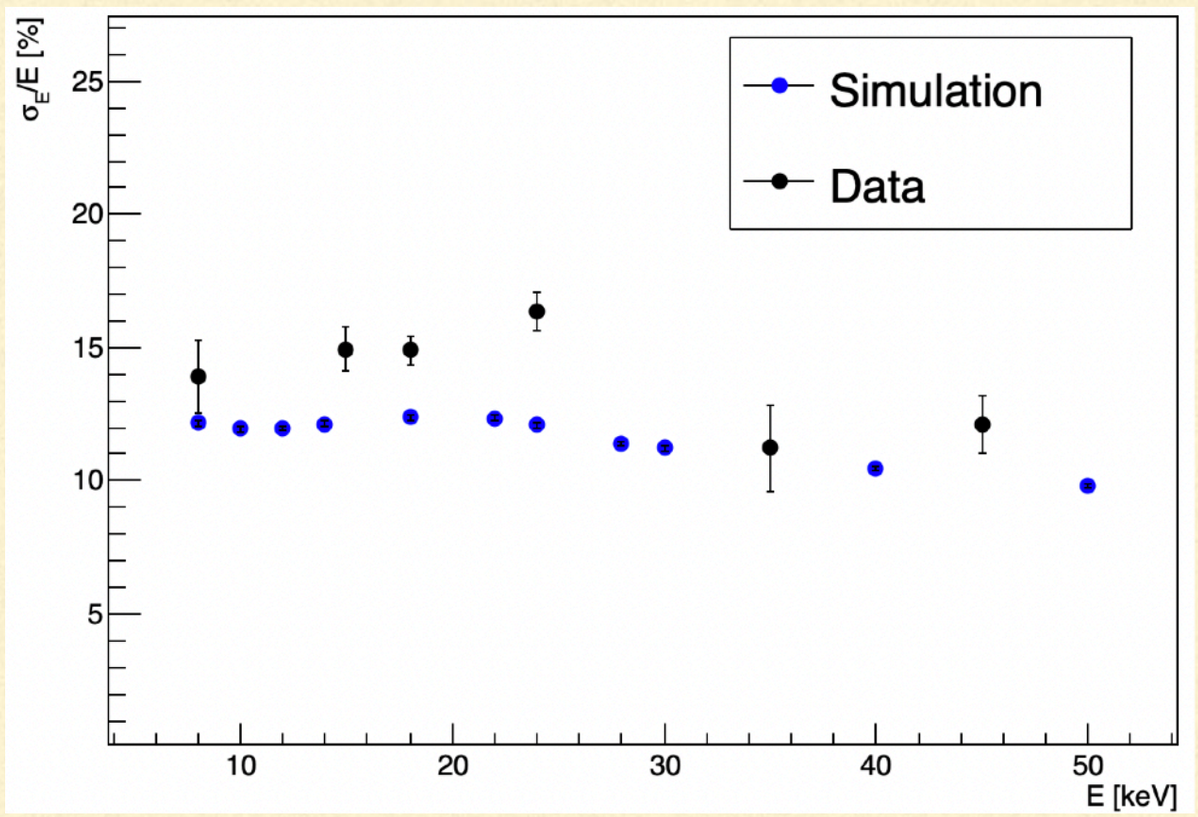



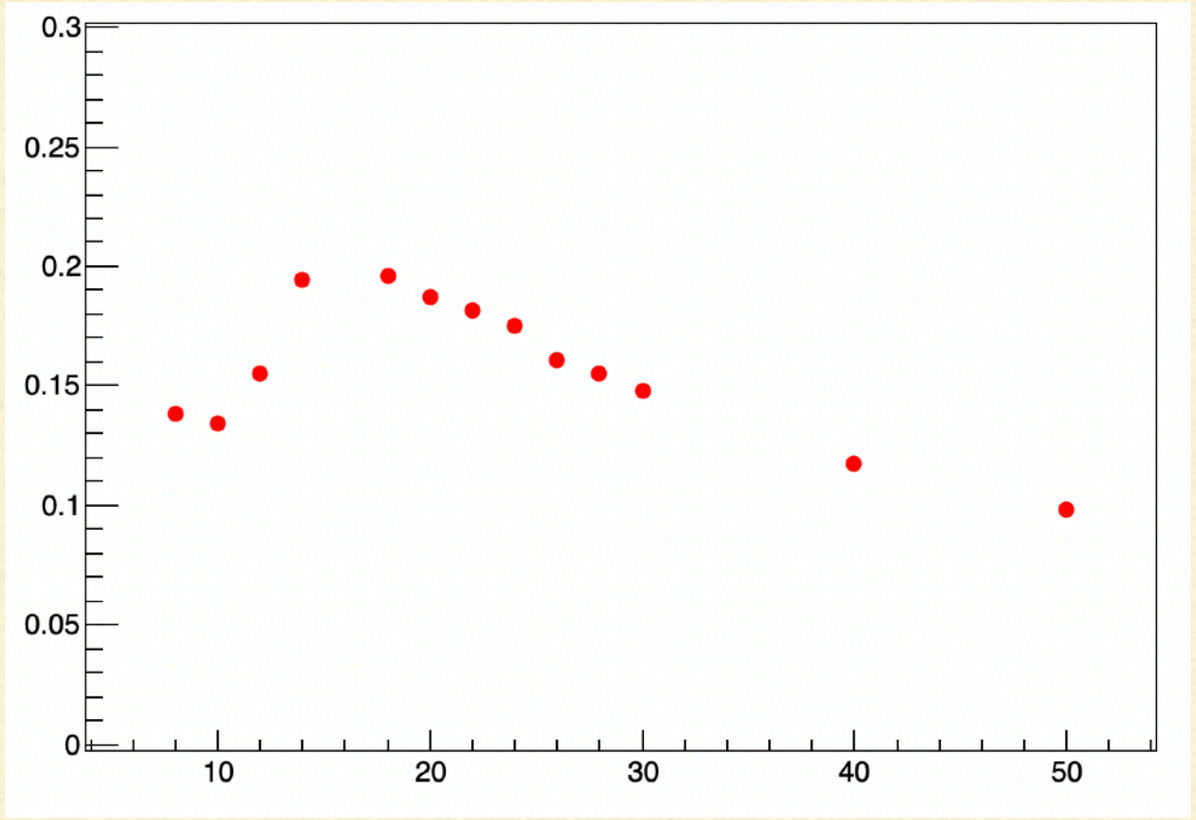



# How to combine the results?

- At high energy the head component is less relevant (smaller fraction of the track).
- To retrieve the original resolution one could sum the component weighting for the fraction of the track they occupy

- Plot obtained by weighting the component for the average fraction of the track they occupy




- Kind of able to reproduce the behaviour, not perfect
  - Maybe the average, maybe they combine in a more complex way