

# INTT progress report

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**Cheng-Wei Shih**  
**National Central University**

2022/1/14



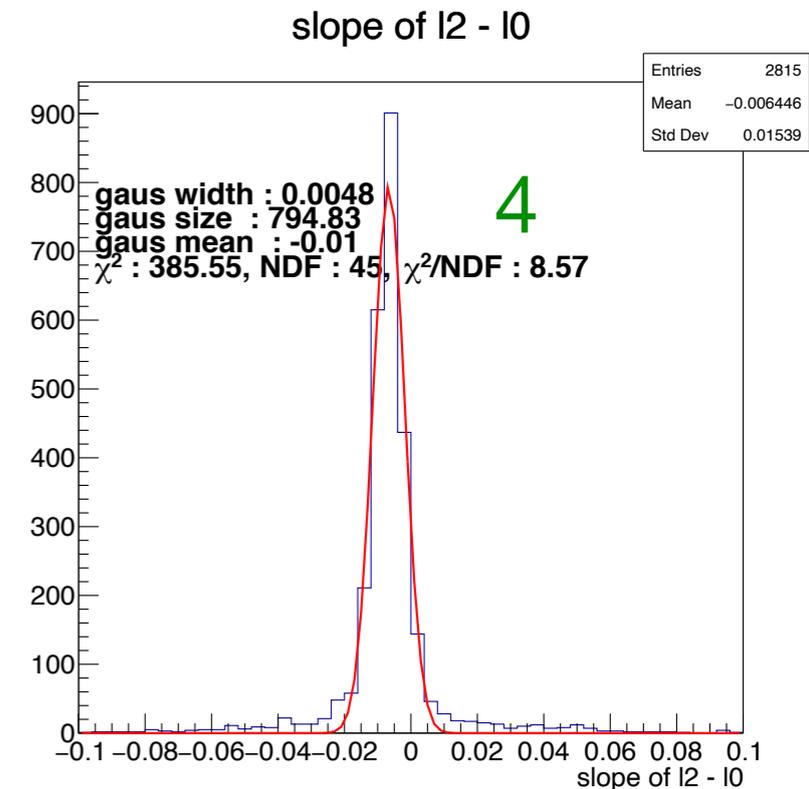
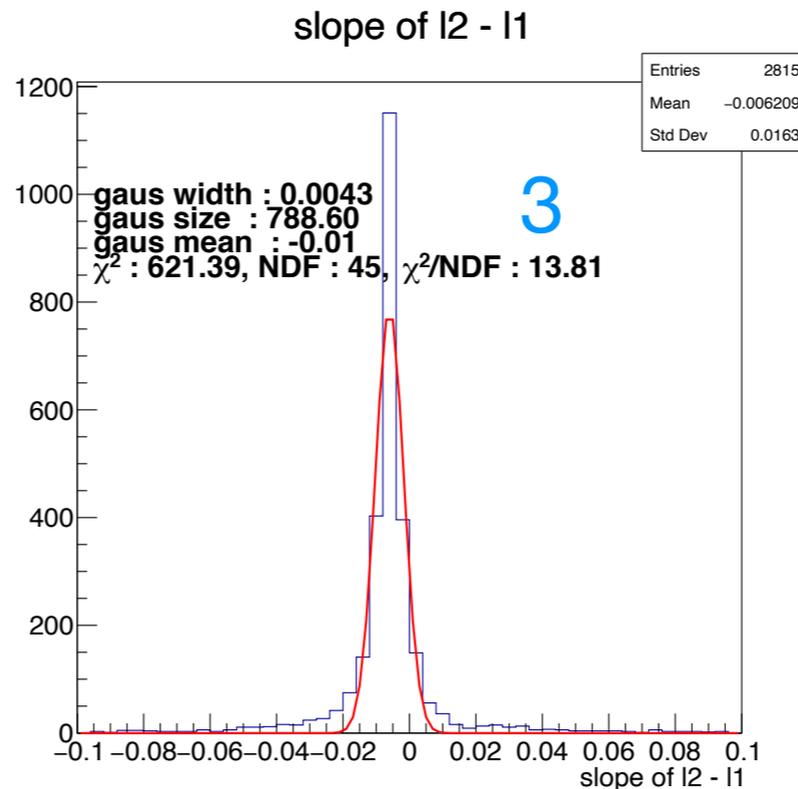
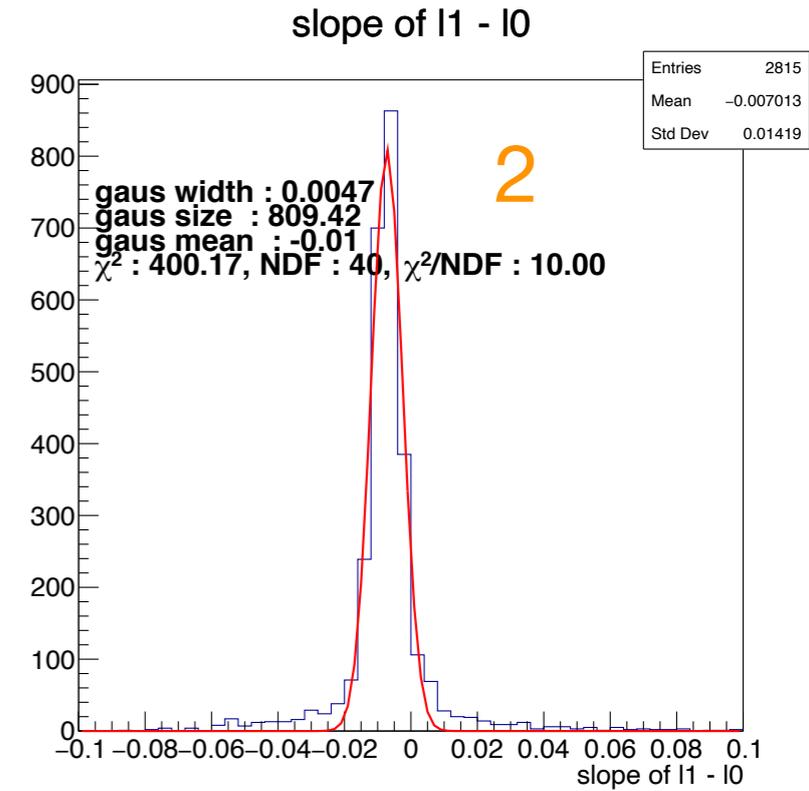
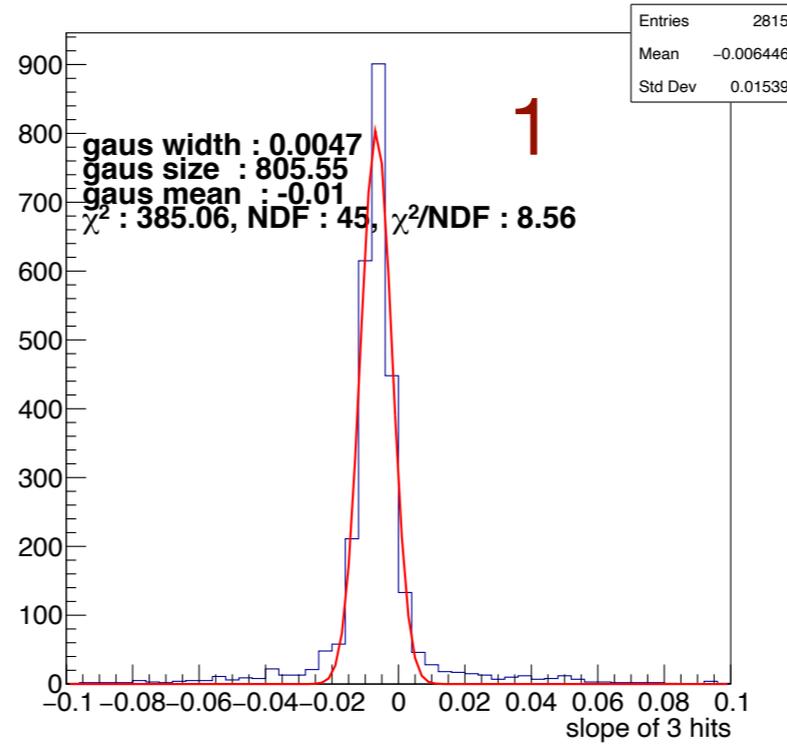
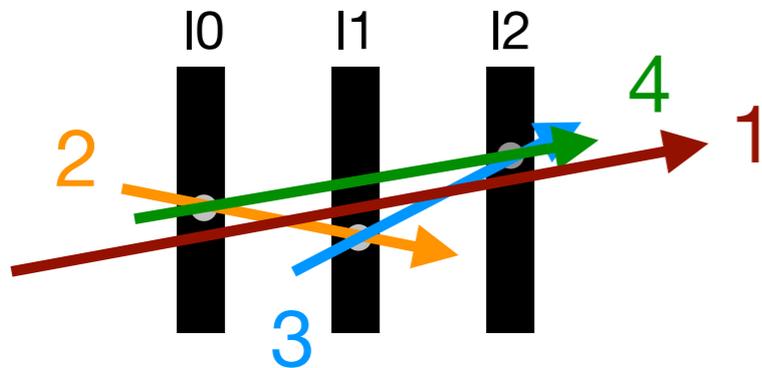
# // Scattering

Only the hits from first BCO group are considered  
slope of 3 hits

Run 89

I1 position correction : ON

- 1 : 3 hits fit
- 2 : slope of I1-I0
- 3 : slope of I2-I1
- 4 : slope of I2-I0



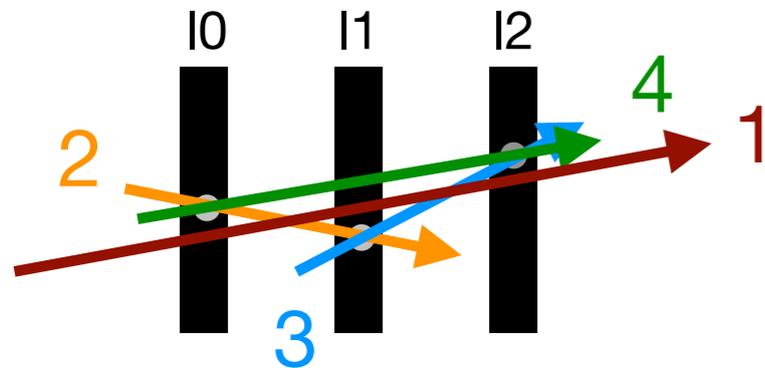
# // Scattering

Only the hits from first BCO group are considered  
slope of 3 hits

Run 89

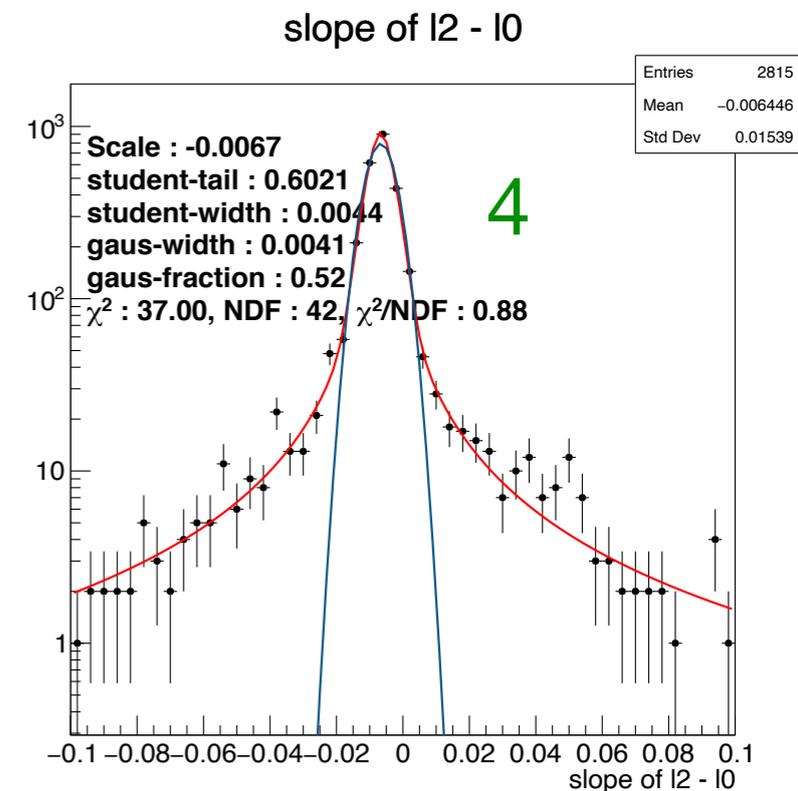
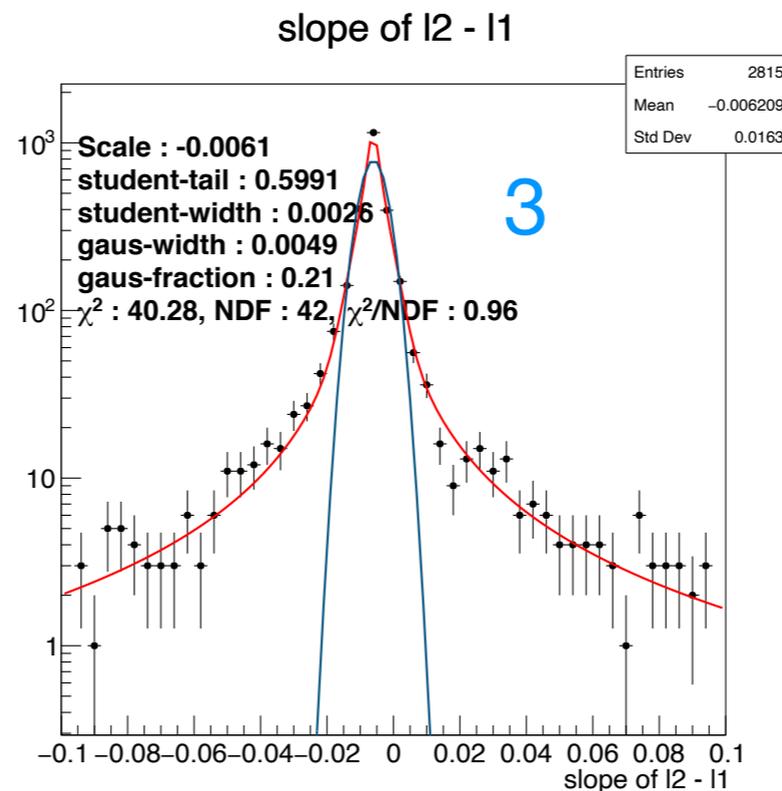
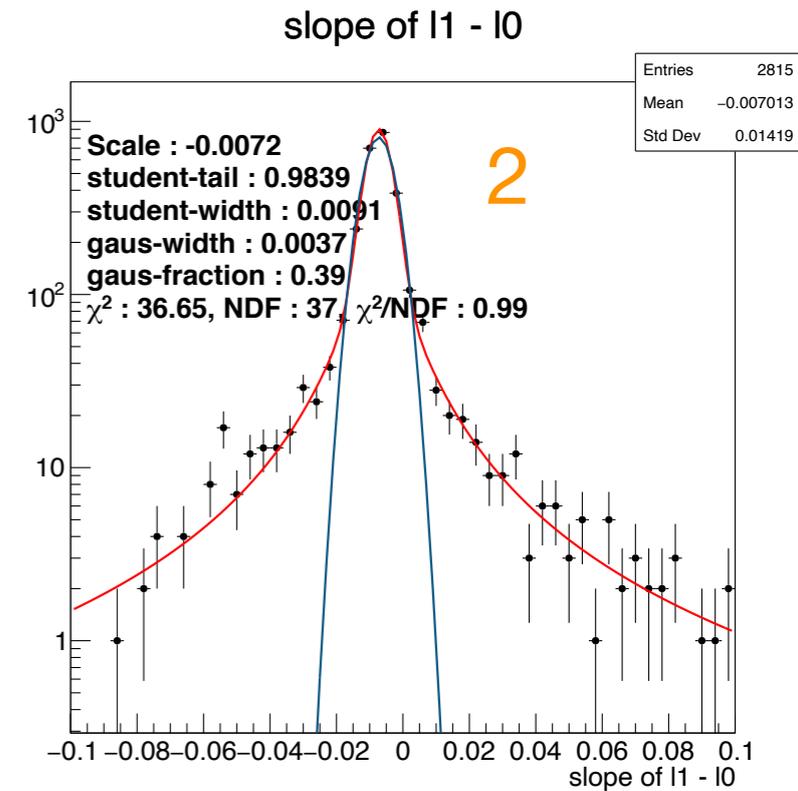
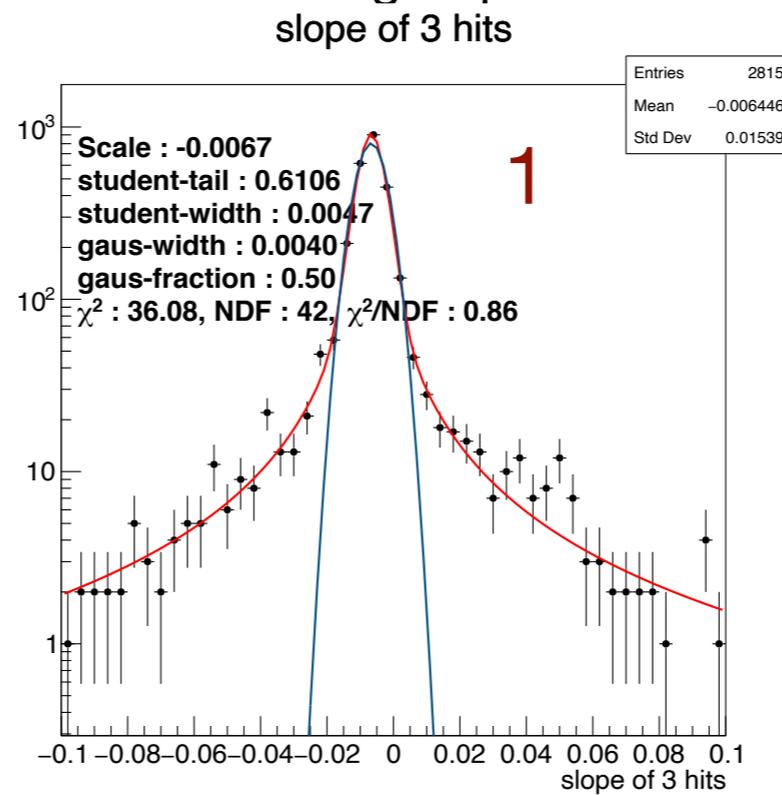
I1 position correction : ON

- 1 : 3 hits fit
- 2 : slope of I1-I0
- 3 : slope of I2-I1
- 4 : slope of I2-I0



$$f_{\text{telescope}}(\theta) = N \cdot \left( (1-a) \cdot \frac{1}{\sigma_G \sqrt{2\pi}} e^{-\frac{(\theta-\mu)^2}{2\sigma_G^2}} + a \cdot \frac{\Gamma(\frac{\nu+1}{2})}{\sqrt{\nu\pi}\sigma\Gamma(\frac{\nu}{2})} \left( 1 + \frac{(\theta-\mu)^2}{\nu\sigma^2} \right)^{-\frac{\nu+1}{2}} \right).$$

Gaussian + student-t



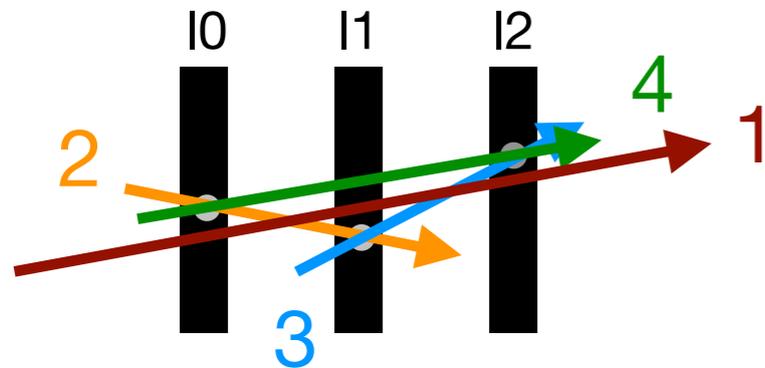
# // Scattering

All BCO group are considered  
slope of 3 hits

Run 89

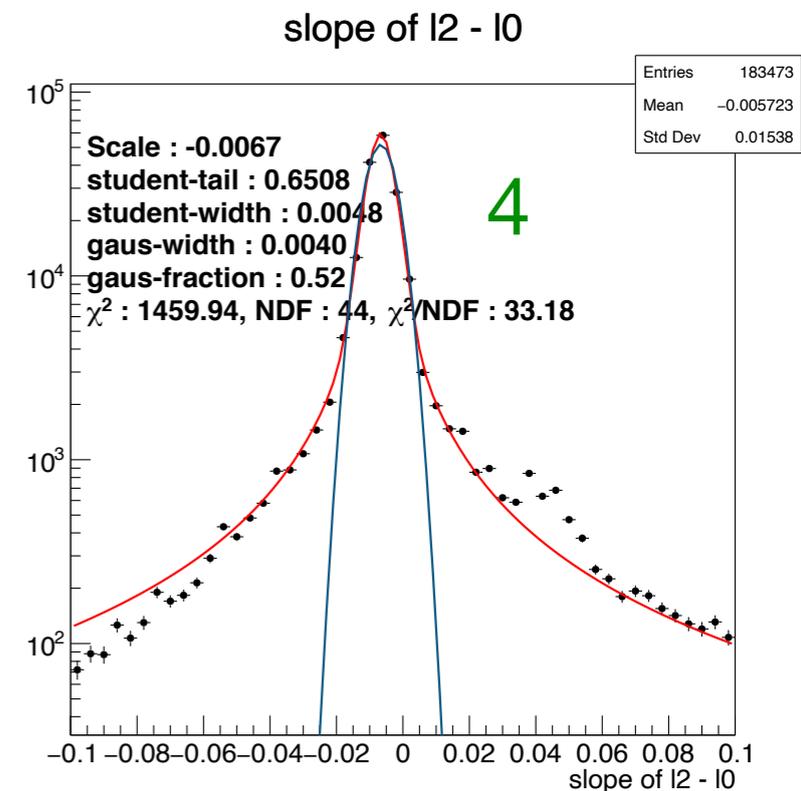
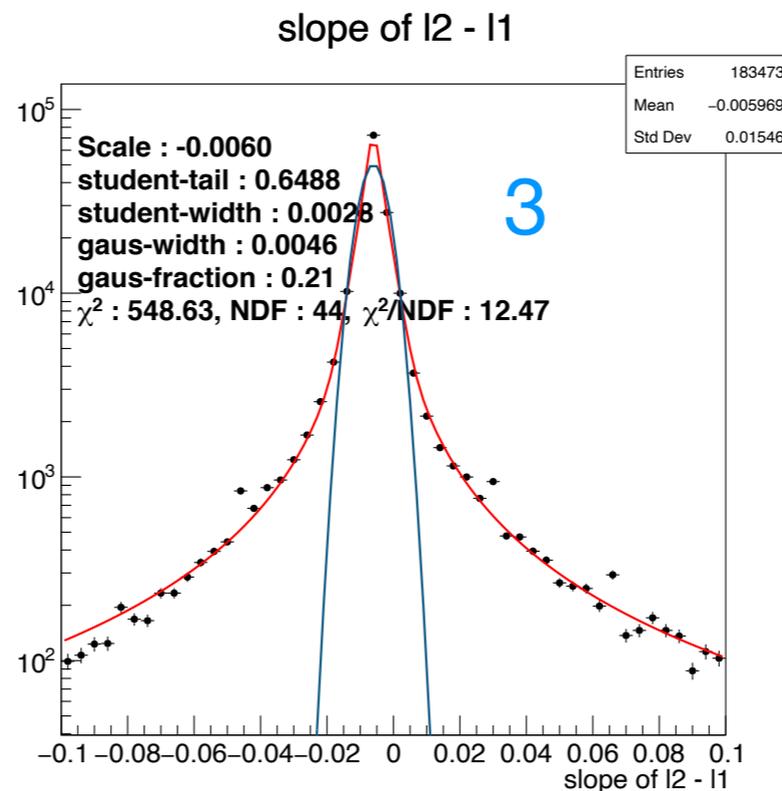
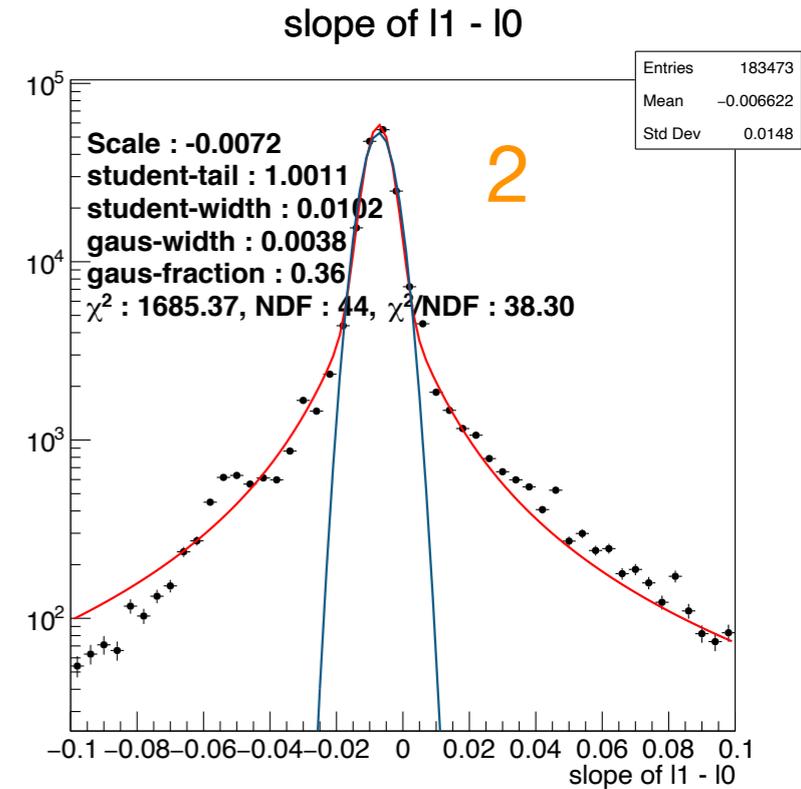
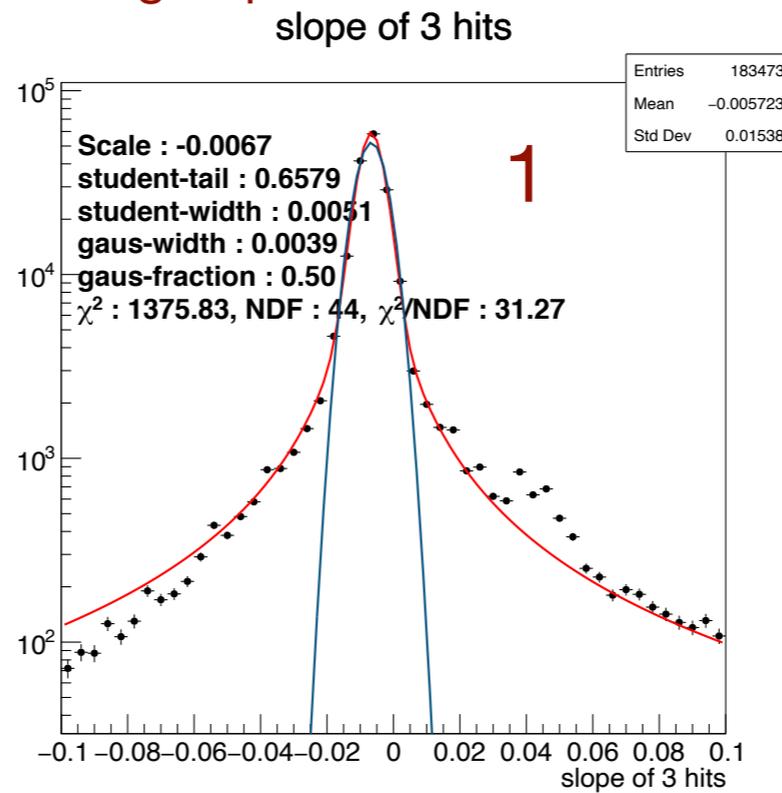
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Gaussian + student-t



# // Summary

- G4 seems not to include the coulomb scattering in default.
- The scattering distribution can be fit well by using the supervision of Gaussian and student-t distribution.
  - For the high statistic case, the parameters seem to need fine tune.

**Back up**

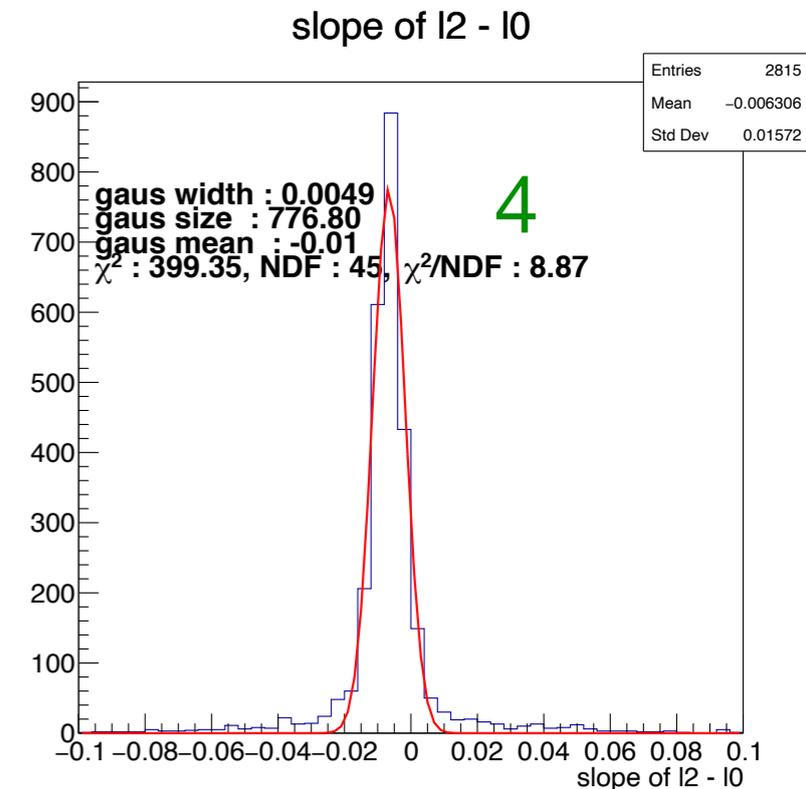
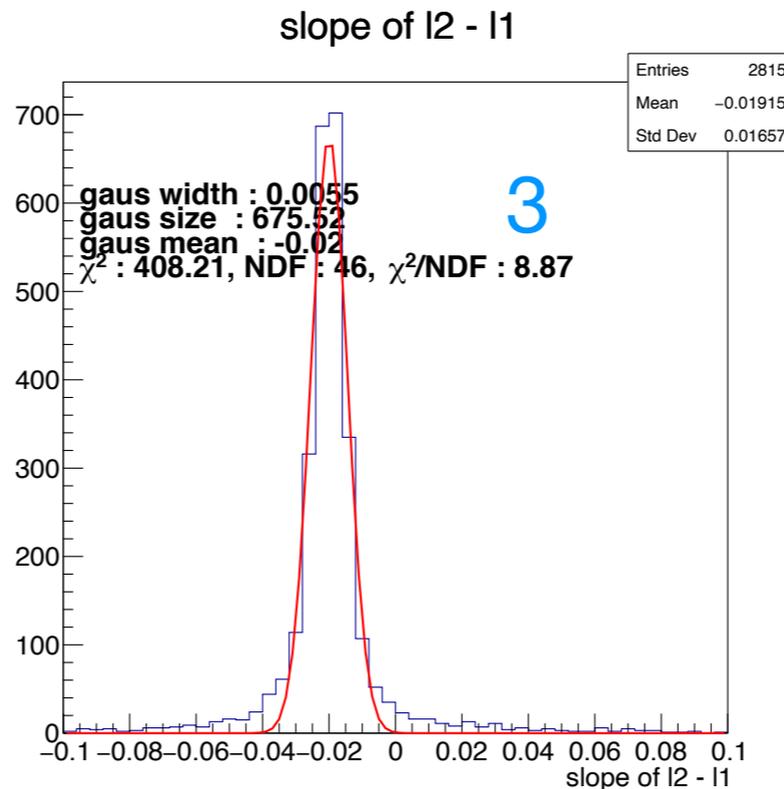
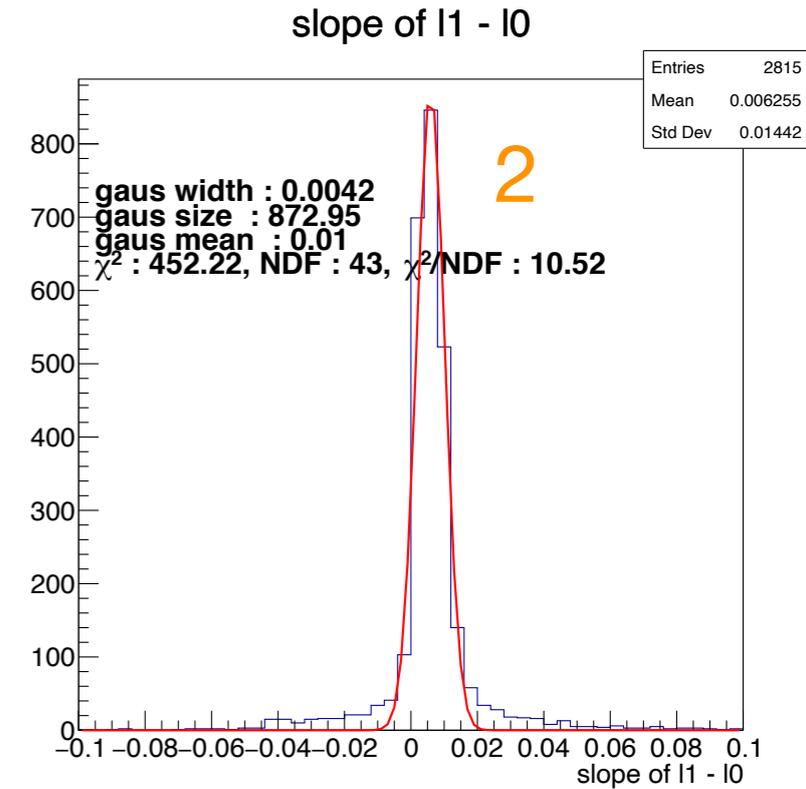
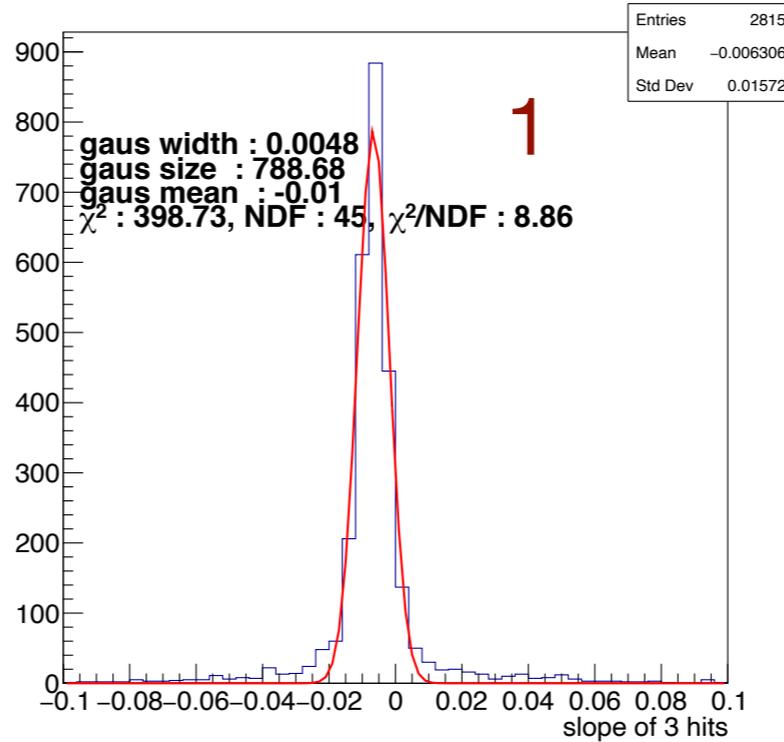
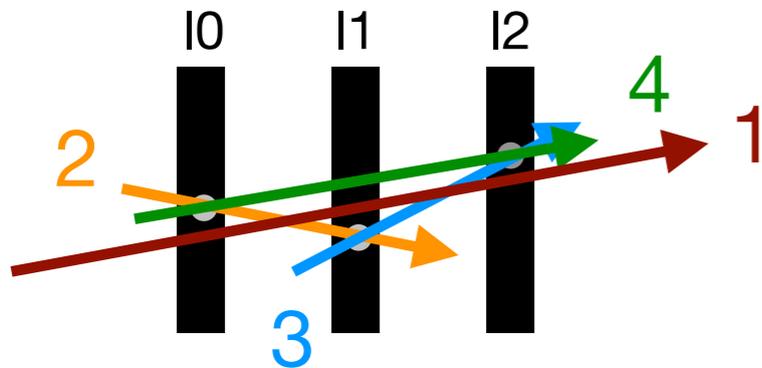
# // Scattering

Only the hits from first BCO group are considered  
slope of 3 hits

Run 89

I1 position correction : OFF

- 1 : 3 hits fit
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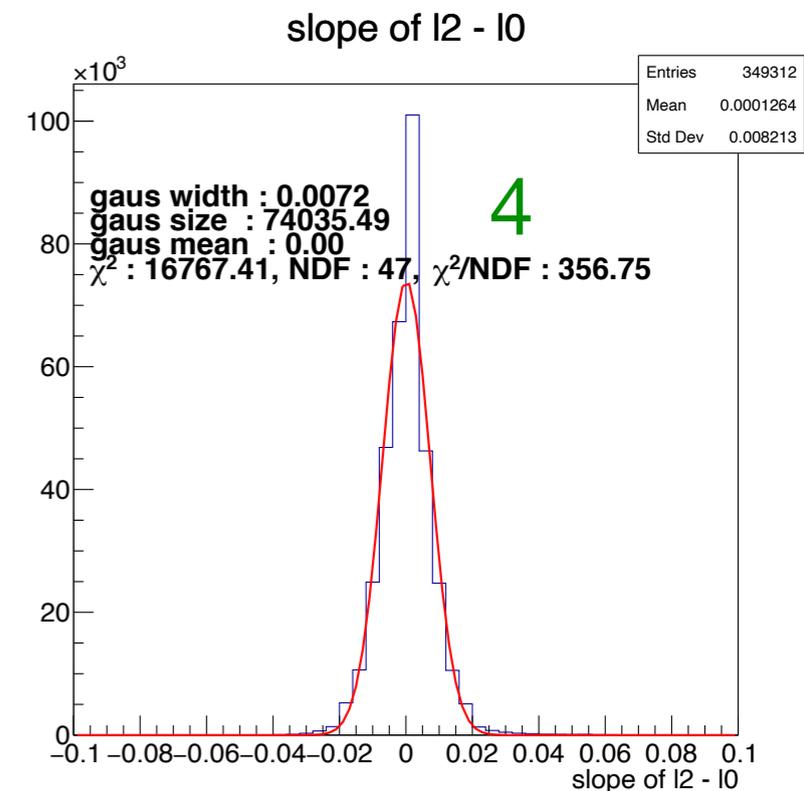
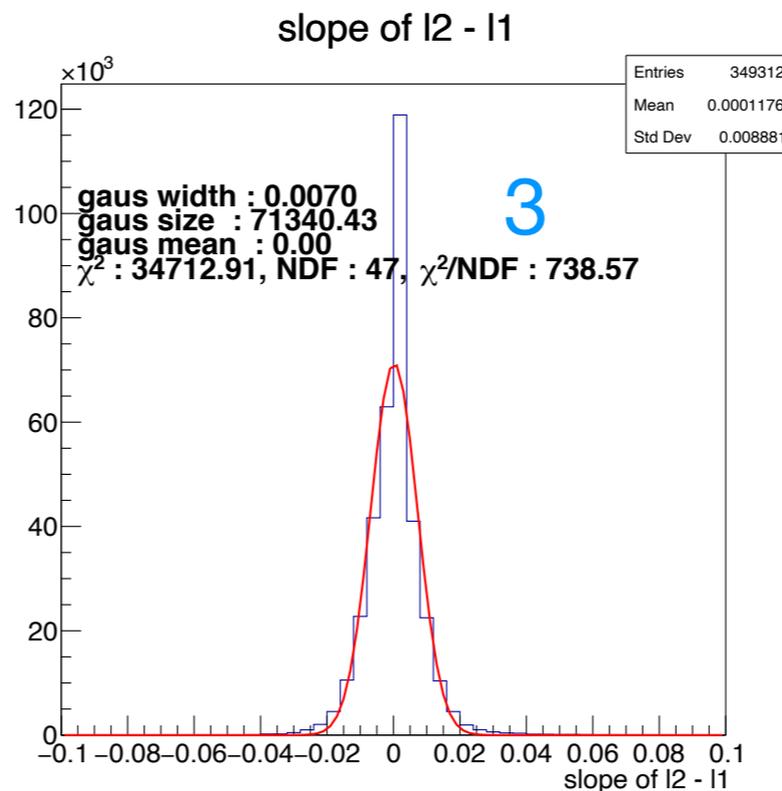
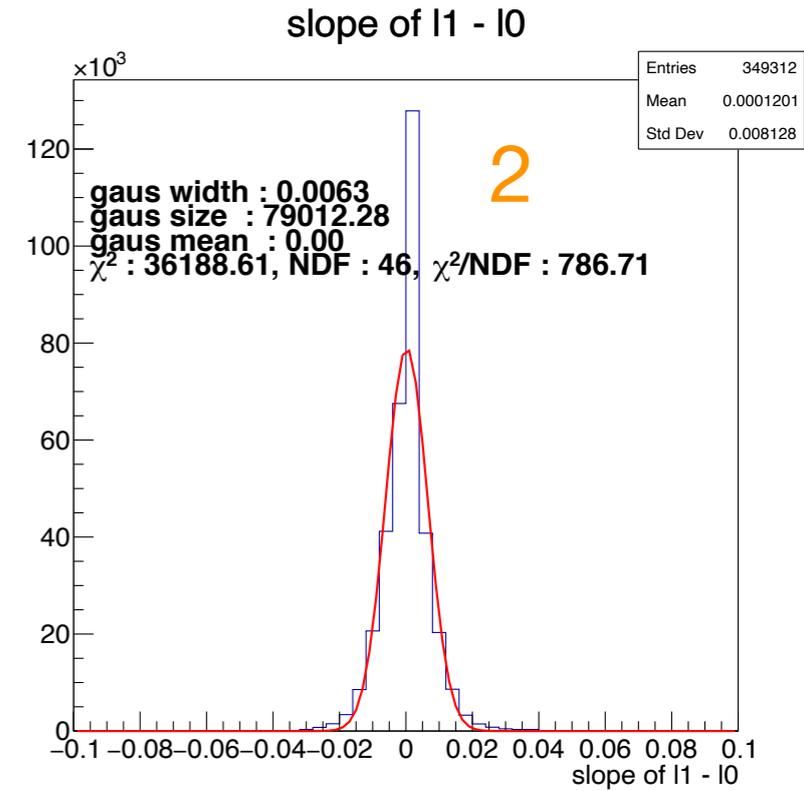
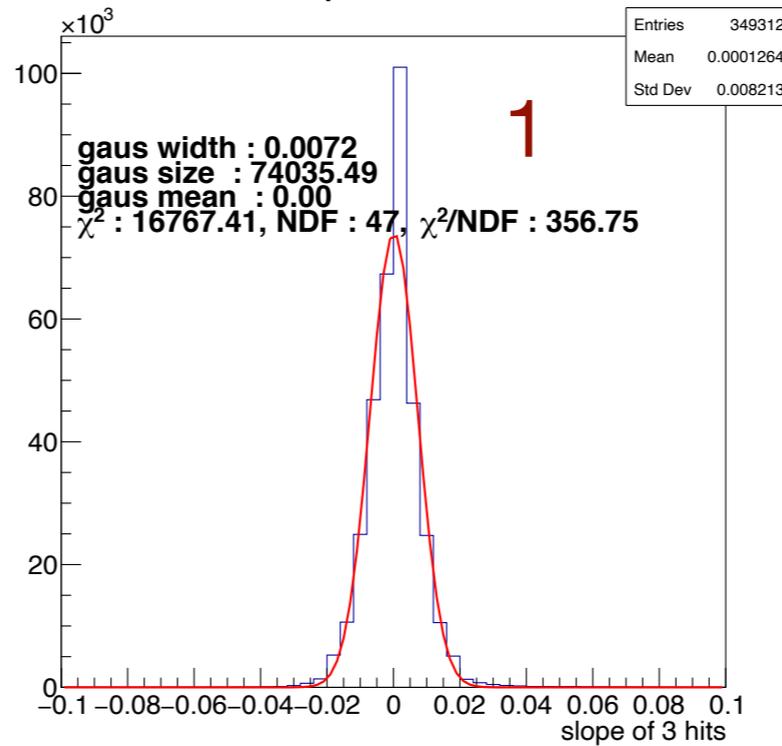
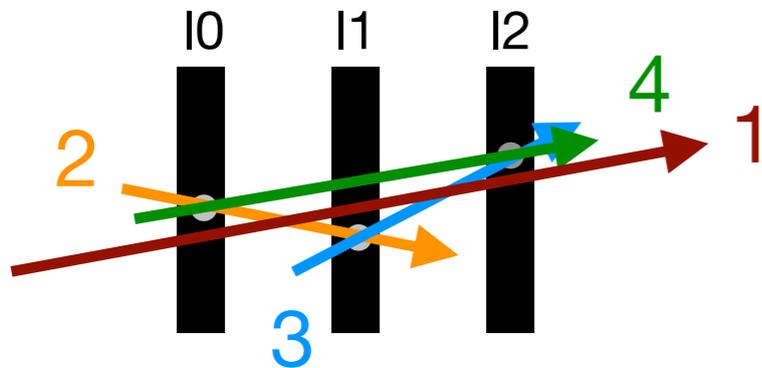


# // Scattering

Only the hits from first BCO group are considered  
slope of 3 hits

G4 simulation  
(Not latest model)  
(Beam quality not considered)

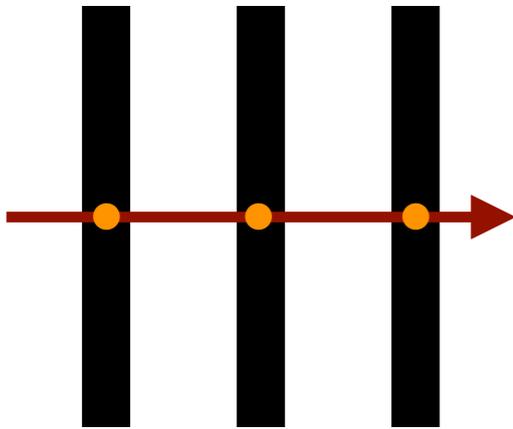
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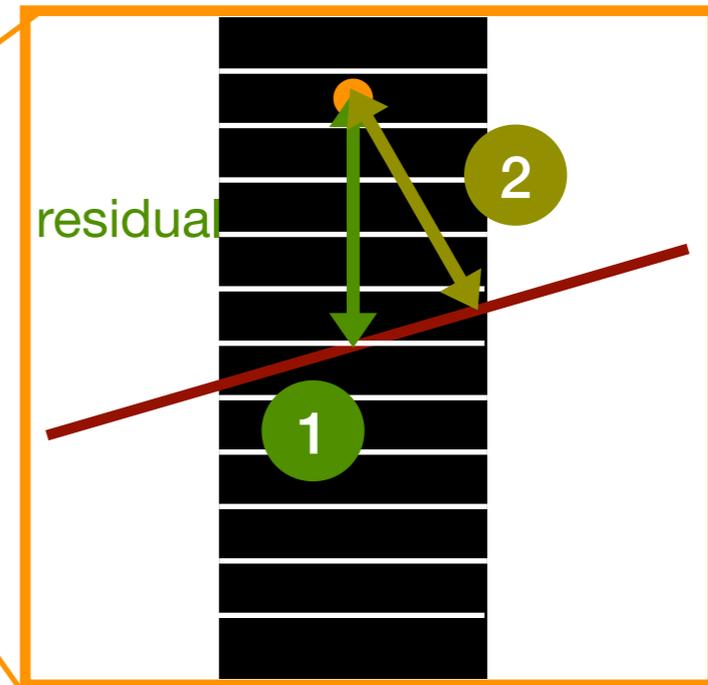
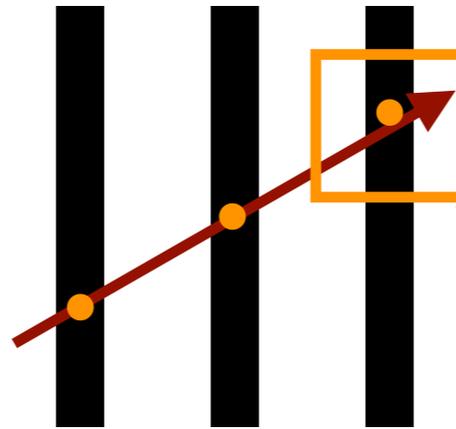
# // Some definitions

## 3 hits case

Expected event



Large angle, but still ok  
As long as the residual  
smaller than window size

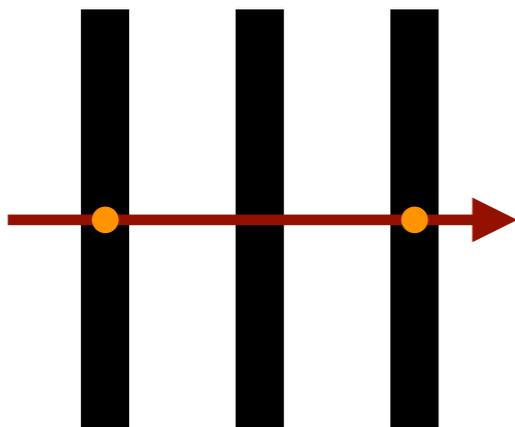


Current algorithm:

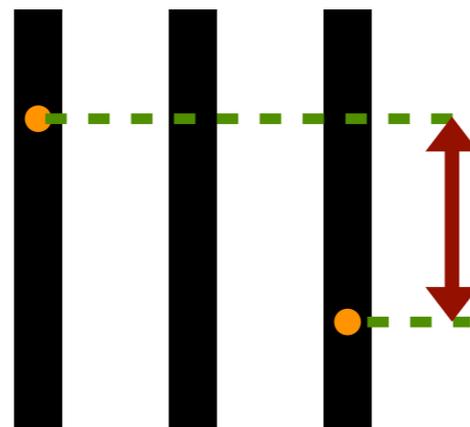
method 1 is used for residual calculation

## 2 hits case

Expected event



Is it a good event ?



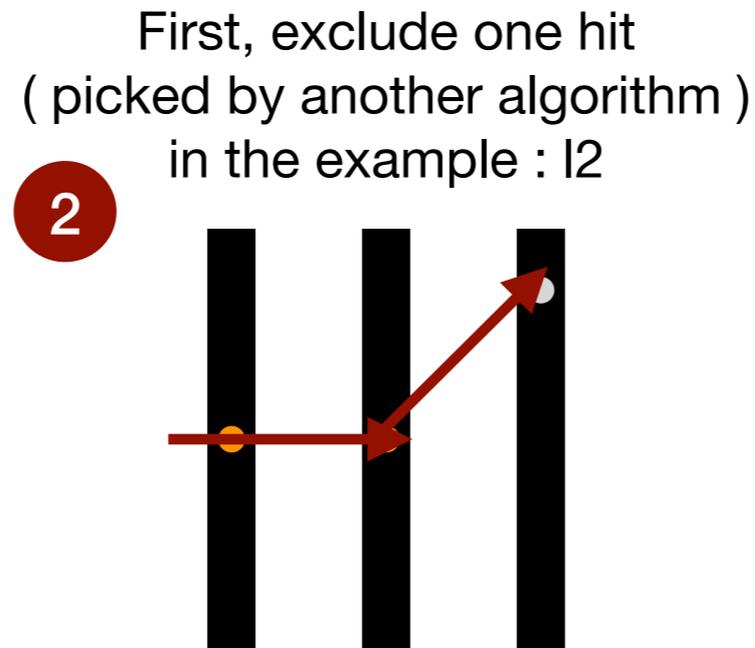
Position difference

Current algorithm :

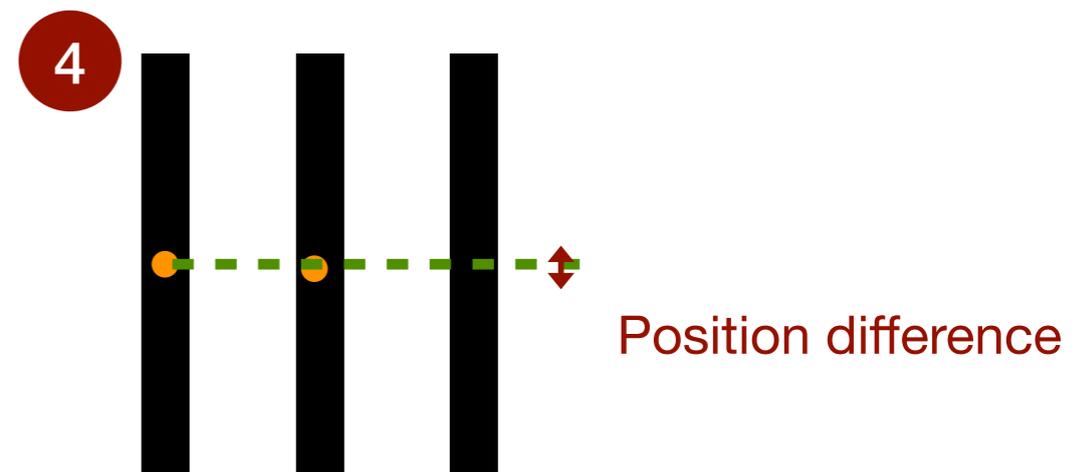
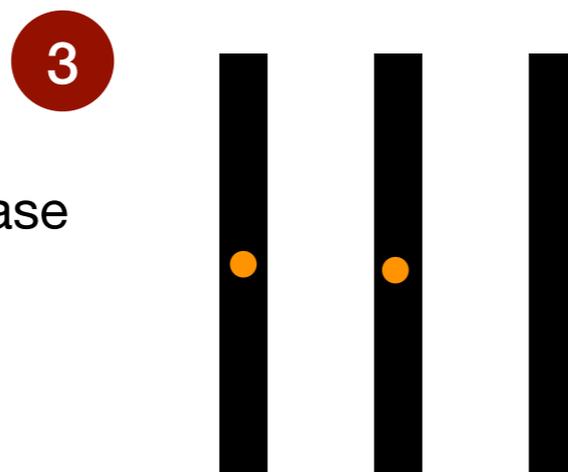
If the position difference > window size  $\rightarrow$  000  
else  $\rightarrow$  101

# // Some definitions

3 hits case



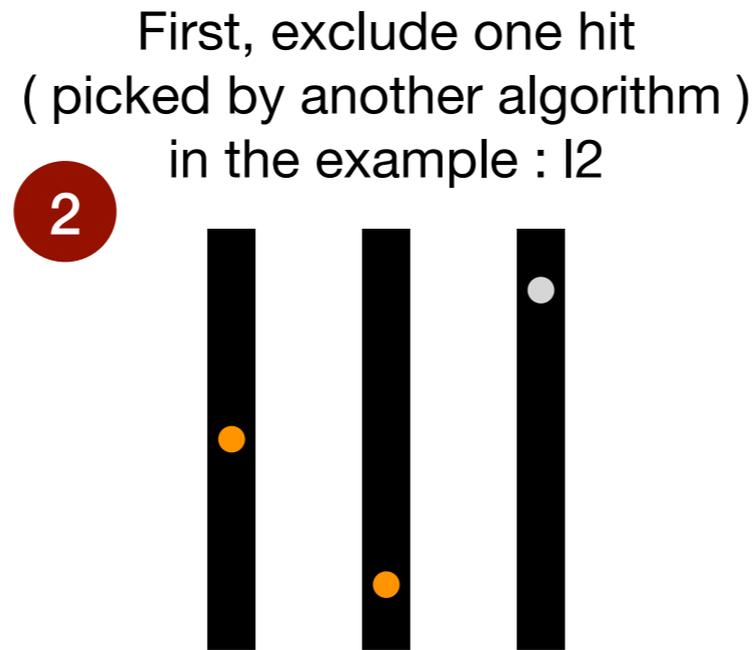
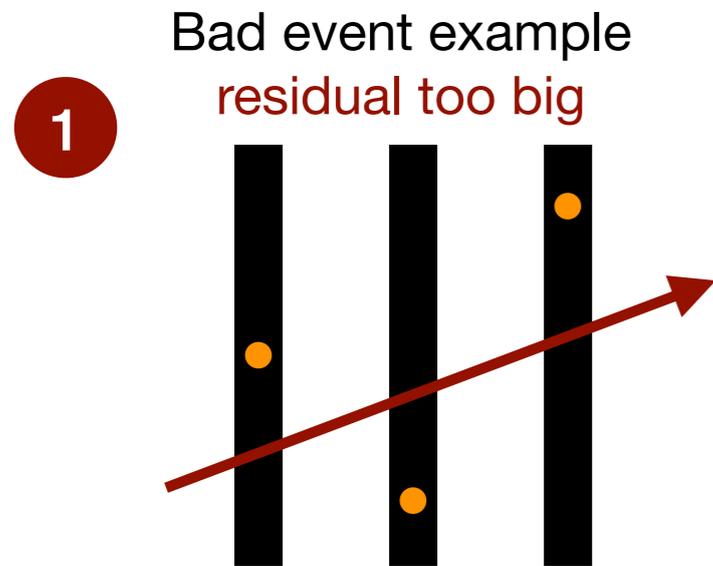
Now this event becomes a 2 hits case  
2 hits algorithm is performed



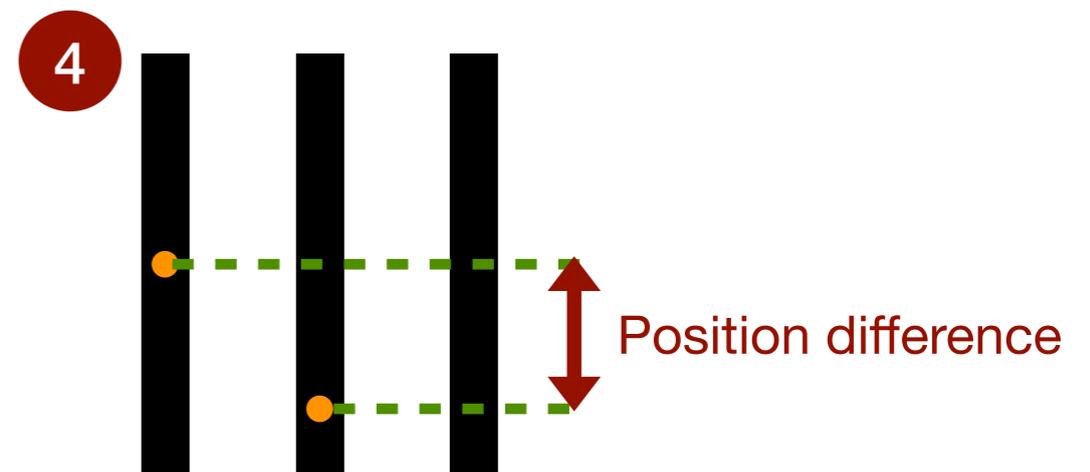
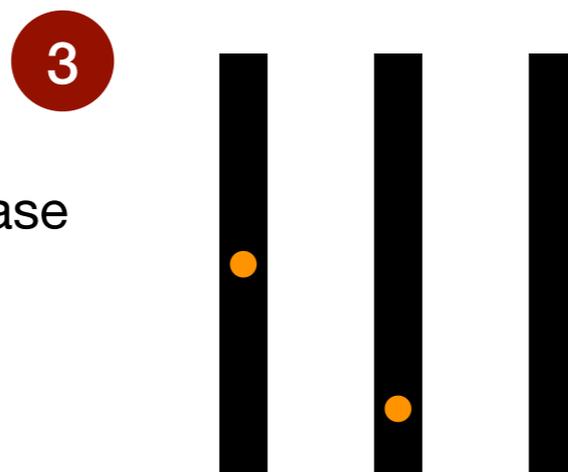
Position difference  $<$  window size  
→ final profile 1 1 0

# // Some definitions

3 hits case



Now this event becomes a 2 hits case  
2 hits algorithm is performed



Position difference  $>$  window size  
→ final profile 0 0 0

# // Production run stu

```
run file : BeamData_20211210-0302_0_filter
layer 3 final counting :
  N_HHH : 2832
  N_LHH : 10
  N_HLH : 16
  N_HHL : 38
  N_LLL : 578
run 52
=====3-layers=====efficiency results=====
|| 10 : 99.64814 %
|| 11 : 99.43820 %
|| 12 : 98.67596 %
=====3-layers=====efficiency results=====
```

```
run file : BeamData_20211210-0329_0_filter
layer 3 final counting :
  N_HHH : 3463
  N_LHH : 15
  N_HLH : 26
  N_HHL : 62
  N_LLL : 809
run 53
=====3-layers=====efficiency results=====
|| 10 : 99.56872 %
|| 11 : 99.25480 %
|| 12 : 98.24113 %
=====3-layers=====efficiency results=====
```

```
run file : BeamData_20211210-0427_0_filter
layer 3 final counting :
  N_HHH : 3524
  N_LHH : 12
  N_HLH : 18
  N_HHL : 49
  N_LLL : 745
run 54
=====3-layers=====efficiency results=====
|| 10 : 99.66063 %
|| 11 : 99.49181 %
|| 12 : 98.62860 %
=====3-layers=====efficiency results=====
```

```
run file : BeamData_20211210-0458_0_filter
layer 3 final counting :
  N_HHH : 3458
  N_LHH : 16
  N_HLH : 17
  N_HHL : 64
  N_LLL : 755
run 55
=====3-layers=====efficiency results=====
|| 10 : 99.53944 %
|| 11 : 99.51079 %
|| 12 : 98.18285 %
=====3-layers=====efficiency results=====
```

```
run file : BeamData_20211210-0609_0_filter
layer 3 final counting :
  N_HHH : 3511
  N_LHH : 23
  N_HLH : 24
  N_HHL : 60
  N_LLL : 768
run 57
=====3-layers=====efficiency results=====
|| 10 : 99.34918 %
|| 11 : 99.32107 %
|| 12 : 98.31980 %
=====3-layers=====efficiency results=====
```

```
run file : BeamData_20211210-0642_0_filter
layer 3 final counting :
  N_HHH : 3399
  N_LHH : 203
  N_HLH : 19
  N_HHL : 46
  N_LLL : 807
run 58
=====3-layers=====efficiency results=====
|| 10 : 94.36424 %
|| 11 : 99.44412 %
|| 12 : 98.66473 %
=====3-layers=====efficiency results=====
```

```
run file : BeamData_20211210-2018_0_filter
layer 3 final counting :
  N_HHH : 1530
  N_LHH : 21
  N_HLH : 7
  N_HHL : 55
  N_LLL : 449
run 88
=====3-layers=====efficiency results=====
|| 10 : 98.64603 %
|| 11 : 99.54457 %
|| 12 : 96.52997 %
=====3-layers=====efficiency results=====
```

```
run file : BeamData_20211210-2018_0_filter
layer 3 final counting :
  N_HHH : 2654
  N_LHH : 20
  N_HLH : 13
  N_HHL : 80
  N_LLL : 794
run 89
=====3-layers=====efficiency results=====
|| 10 : 99.25206 %
|| 11 : 99.51256 %
|| 12 : 97.07388 %
=====3-layers=====efficiency results=====
```

# // To do 2021/12/23

- ~~effi. vs BCO phase~~
  - ~~combine others data file~~
- ~~effi. as function of run ID~~
- 3 hits angle, 2\*(2 hits angle) distributions (single/multi coulomb scattering), residual plots
  - Use rest groups in event for the study
  - Log plot
  - studnet-t distribution
  - $(I1-I0) - (I2-I1)$
  - ~~Or combine all production data~~
- angle cut in the detection effi.
- Try to estimate the amount of mis-alignment in longitudinal axis.
- nth BCO group to be picked study

# // To do, low priority

- alignment rotational correction
- multi-track
- with BEC
- To check the data of the testbeam last time not really understand ayaka's algorithm
- camac\_adc3 : small scintillator, it has some function.

# // To do source test 2021/01/07

- Study the group issue (unsymmetrical entry)
  - MPV of adc of each channel vs channel entry
  - Test-pulse : gain (slope) of each channel vs entry ? or just compare
- Mask the noisy channel
- without source
  - scan the threshold 15, 25, 35, 40. each one 10 mins, find the best one.
  - 2000 electrons -> corresponding adc setting ?
- with source
  - adc0 : 40 -> 2 mins for each chip -> OK