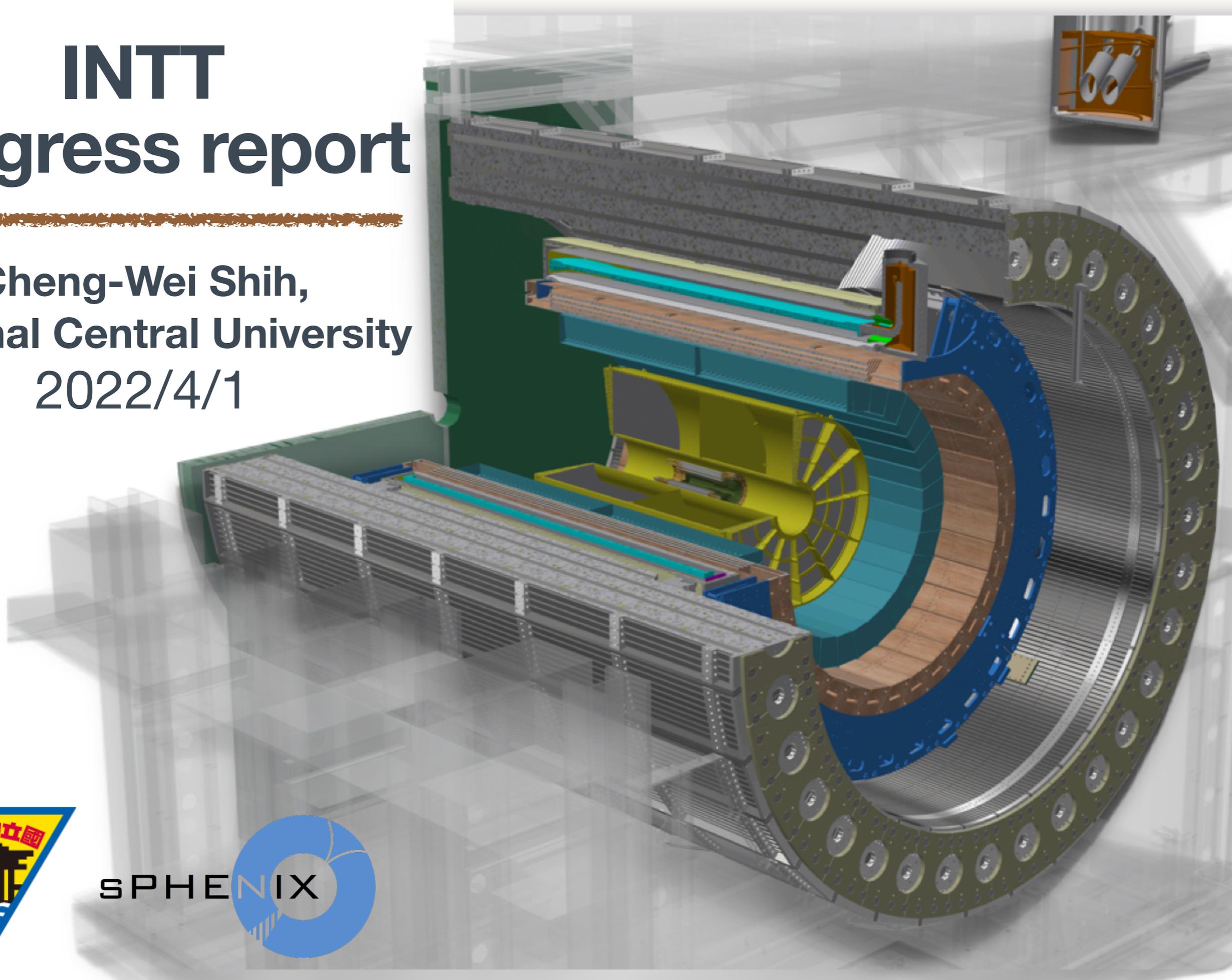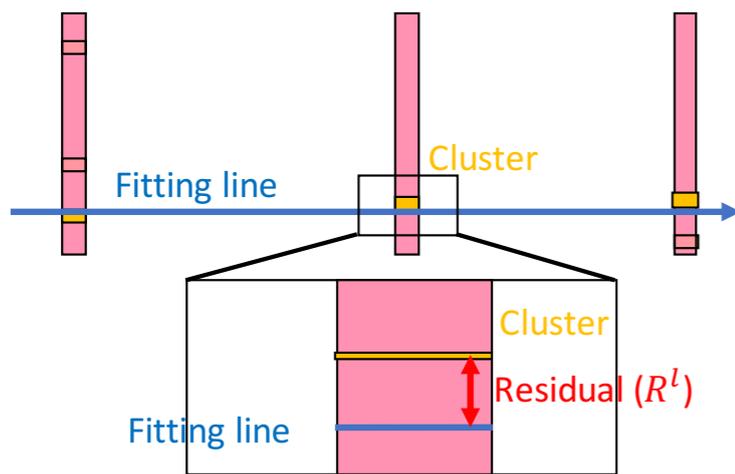# INTT progress report

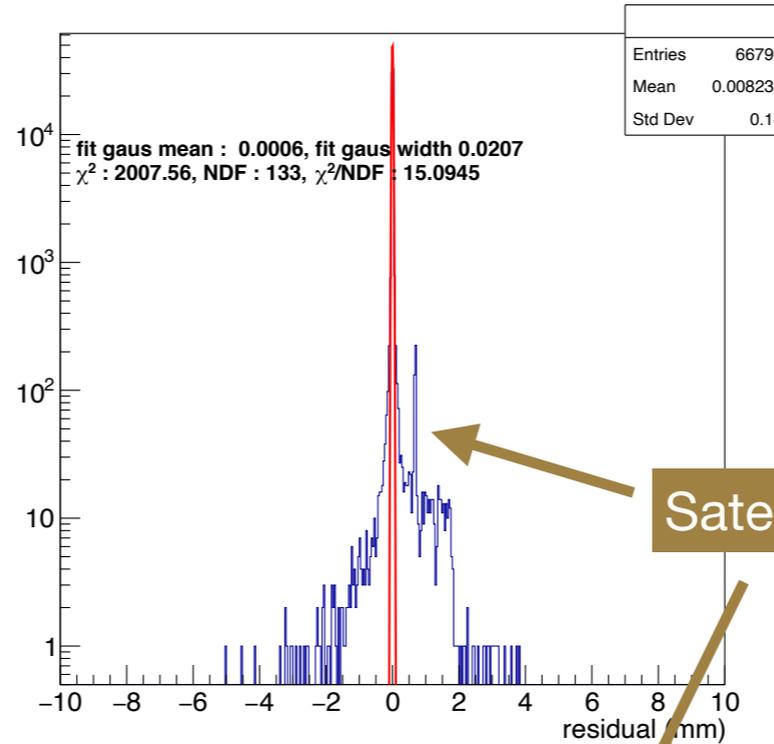**Cheng-Wei Shih,
National Central University**
2022/4/1

Testbeam - residual comparison

U10
run89_no_clone.root
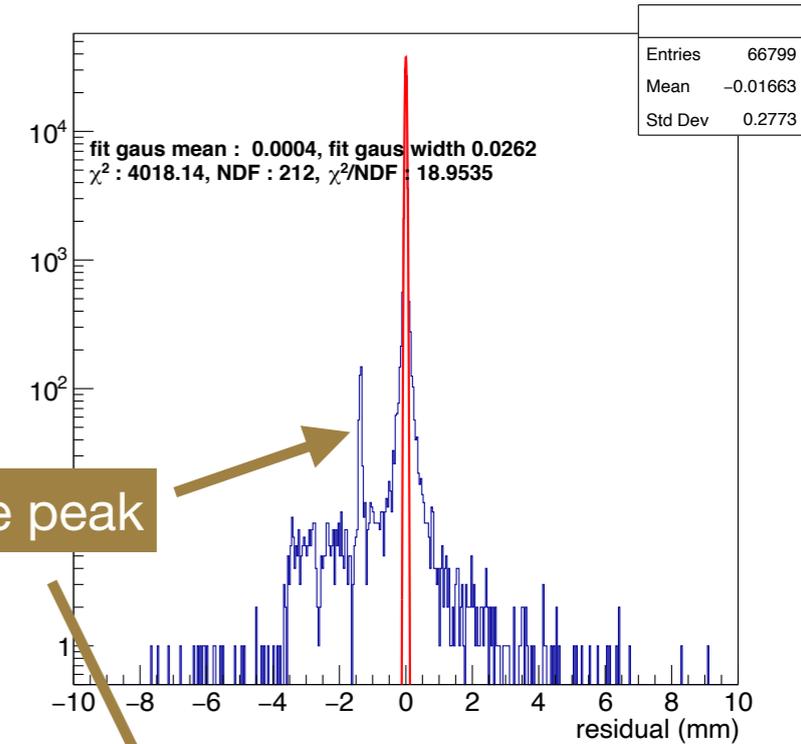alignment, 0.2850 mm @ l1
With BEC

U10
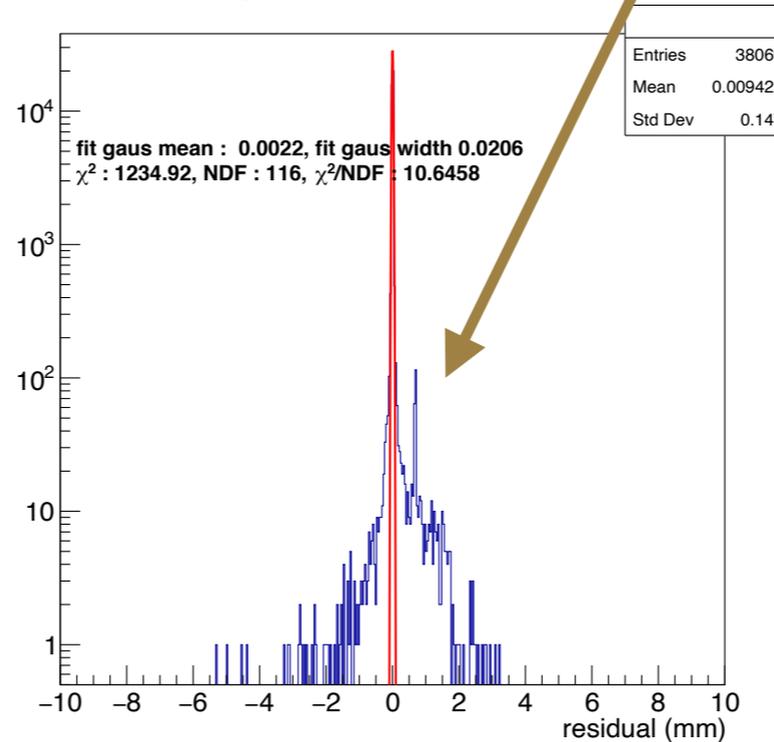run88_no_clone.root

alignment, 0.2913 mm @ l1
With BEC

Fitting line
Cluster
Cluster
Residual (R^l)
Fitting line

layer0 Y axis residual

Entries	66799
Mean	0.008239
Std Dev	0.14

fit gaus mean : 0.0006, fit gaus width 0.0207
χ^2 : 2007.56, NDF : 133, χ^2/NDF : 15.0945

layer1 Y axis residual

Entries	66799
Mean	−0.01663
Std Dev	0.2773

fit gaus mean : 0.0004, fit gaus width 0.0262
χ^2 : 4018.14, NDF : 212, χ^2/NDF : 18.9535

Satellite peak

layer0 Y axis residual

Entries	38069
Mean	0.009422
Std Dev	0.147

fit gaus mean : 0.0022, fit gaus width 0.0206
χ^2 : 1234.92, NDF : 116, χ^2/NDF : 10.6458

layer1 Y axis residual

Entries	38069
Mean	−0.01912
Std Dev	0.2888

fit gaus mean : -0.0029, fit gaus width 0.0241
χ^2 : 2090.50, NDF : 185, χ^2/NDF : 11.3000
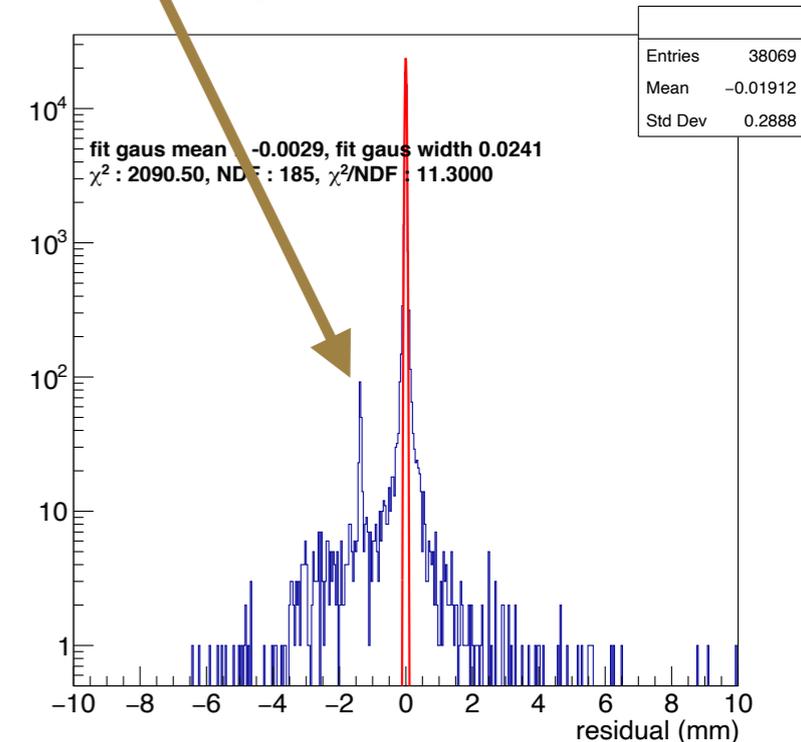
Testbeam - residual comparison

U8

run52_no_clone.root

alignment, 0.2908 mm @ l1

Without BEC

Fitting line

Cluster

Cluster

Residual (R^l)

Fitting line

layer0 Y axis residual

Entries	56101
Mean	0.001138
Std Dev	0.1161

fit gaus mean : -0.0004, fit gaus width 0.0210
χ^2 : 1276.83, NDF : 127, χ^2/NDF : 10.0538

residual (mm)

layer1 Y axis residual

Entries	56101
Mean	−0.002275
Std Dev	0.2322

fit gaus mean : 0.0020, fit gaus width 0.0269
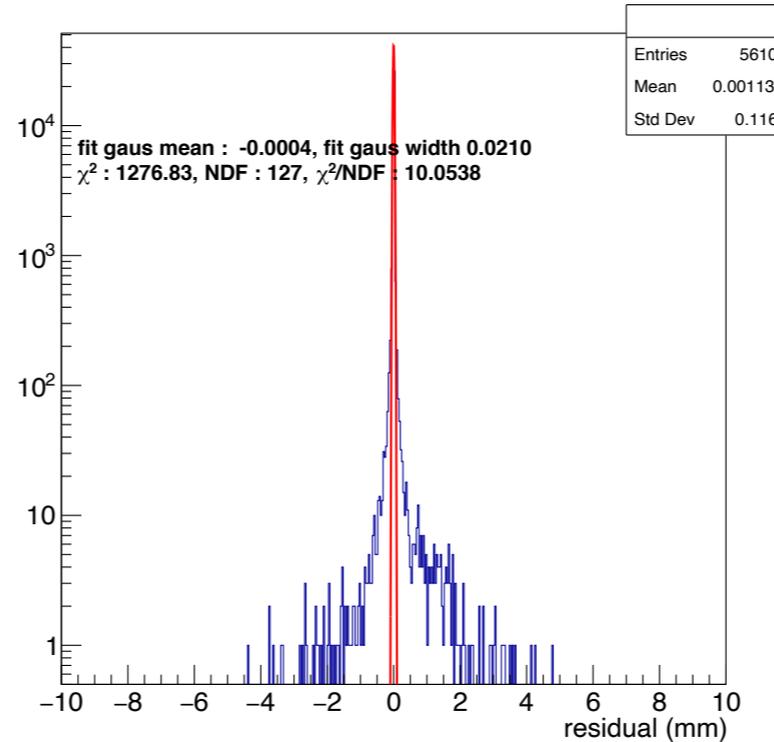χ^2 : 3179.74, NDF : 198, χ^2/NDF : 16.0593
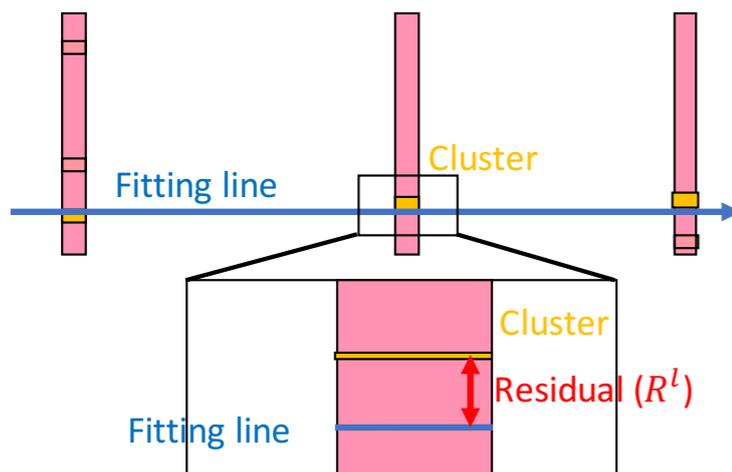
residual (mm)

U8

run54_no_clone.root

alignment, 0.2911 mm @ l1

Without BEC

layer0 Y axis residual

Entries	71904
Mean	0.0004607
Std Dev	0.1138

fit gaus mean : -0.0001, fit gaus width 0.0209
χ^2 : 1605.27, NDF : 132, χ^2/NDF : 12.1611

residual (mm)

layer1 Y axis residual

Entries	71904
Mean	−0.0009214
Std Dev	0.2277

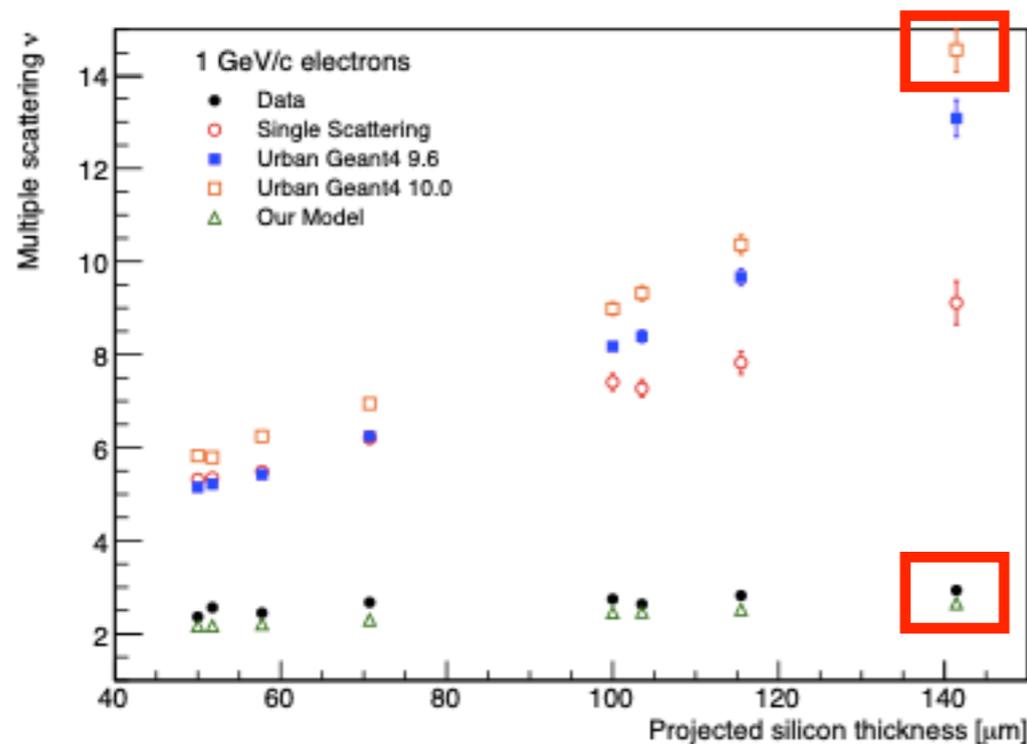fit gaus mean : 0.0001, fit gaus width 0.0242
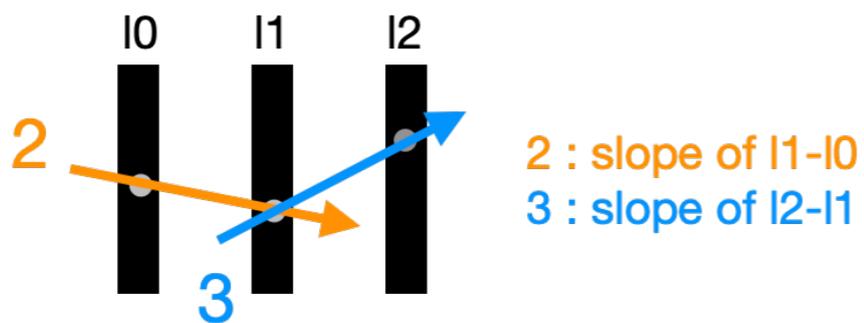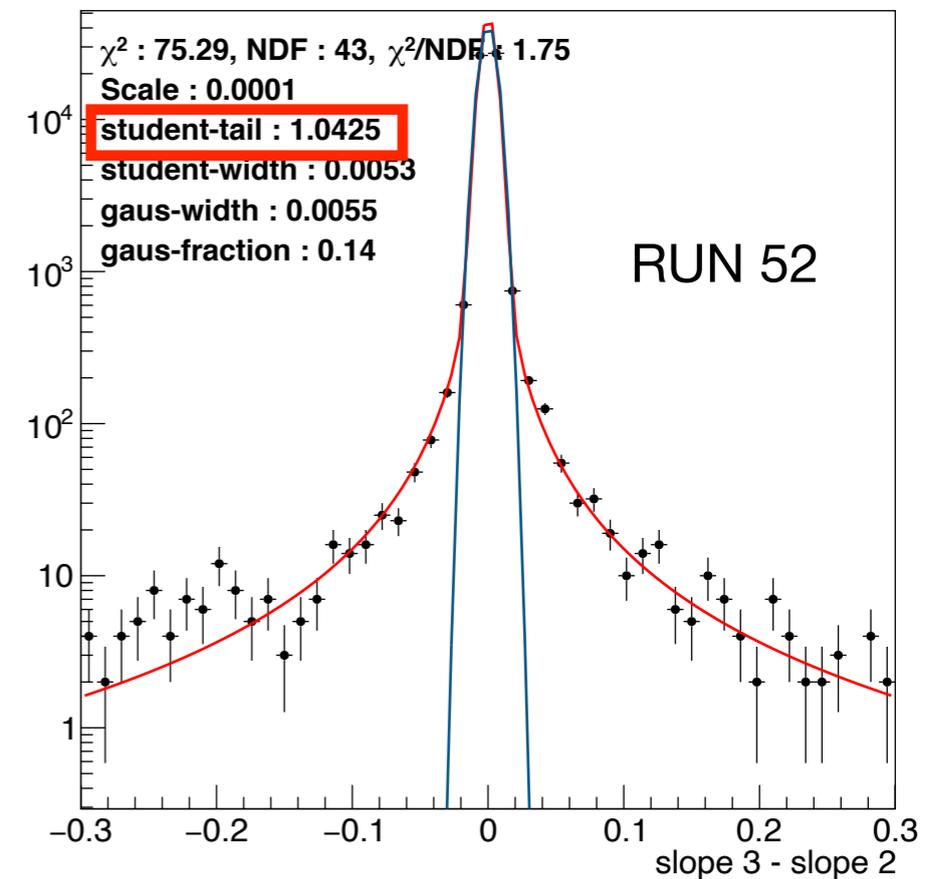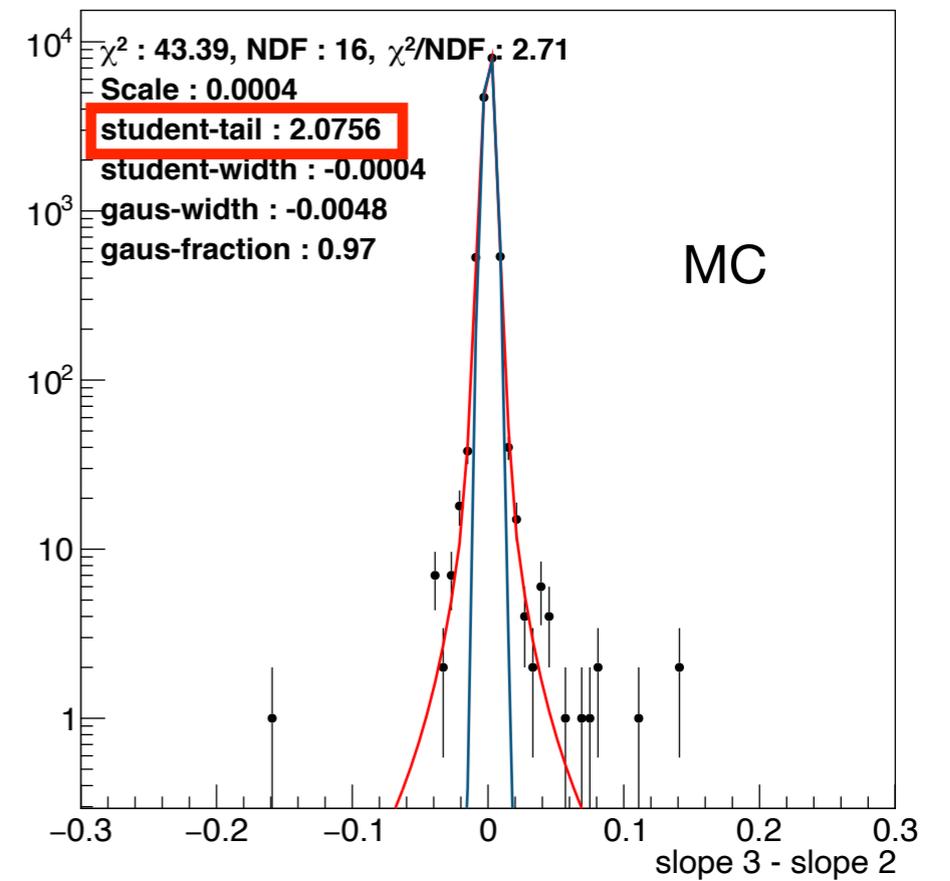χ^2 : 3328.93, NDF : 219, χ^2/NDF : 15.2006
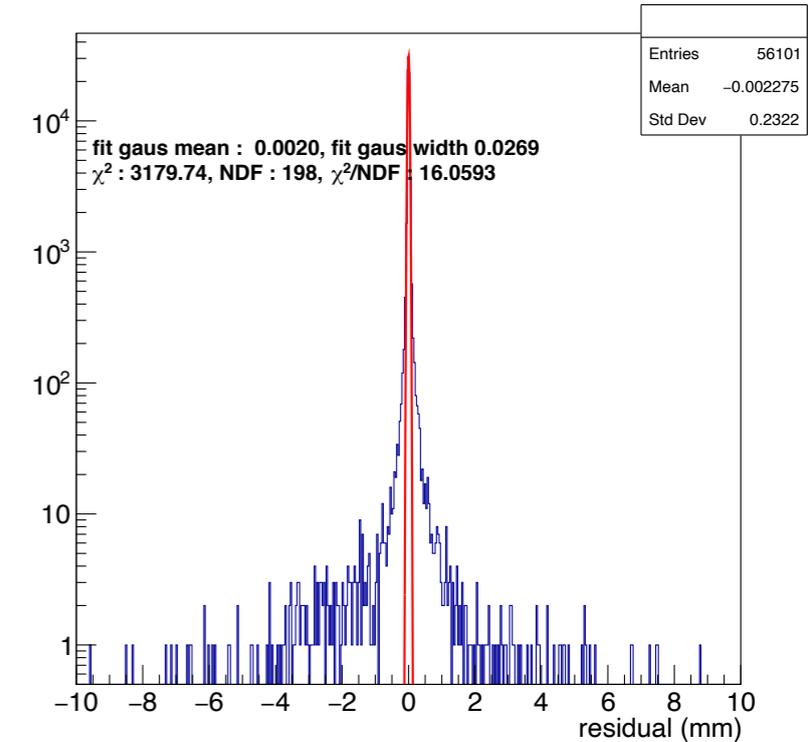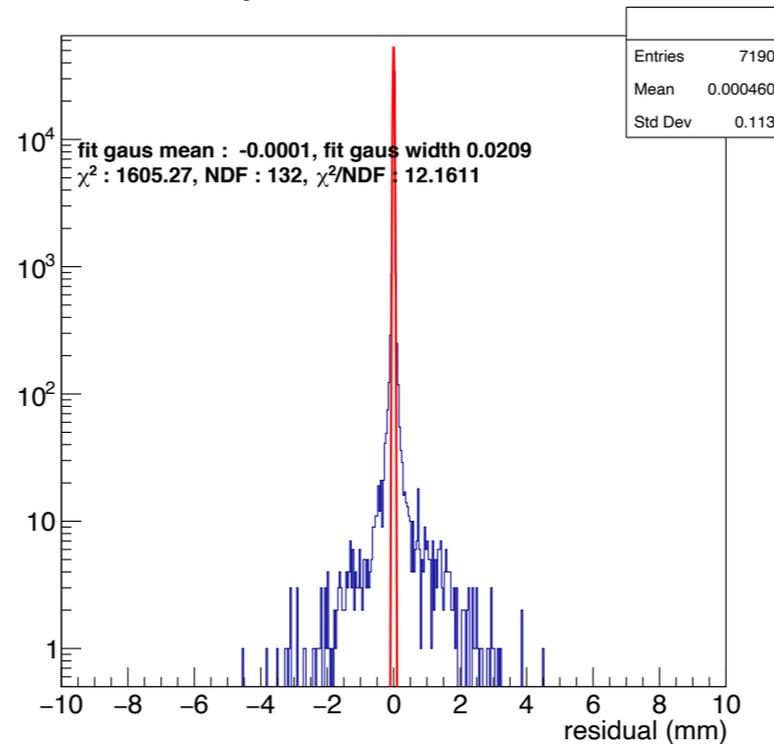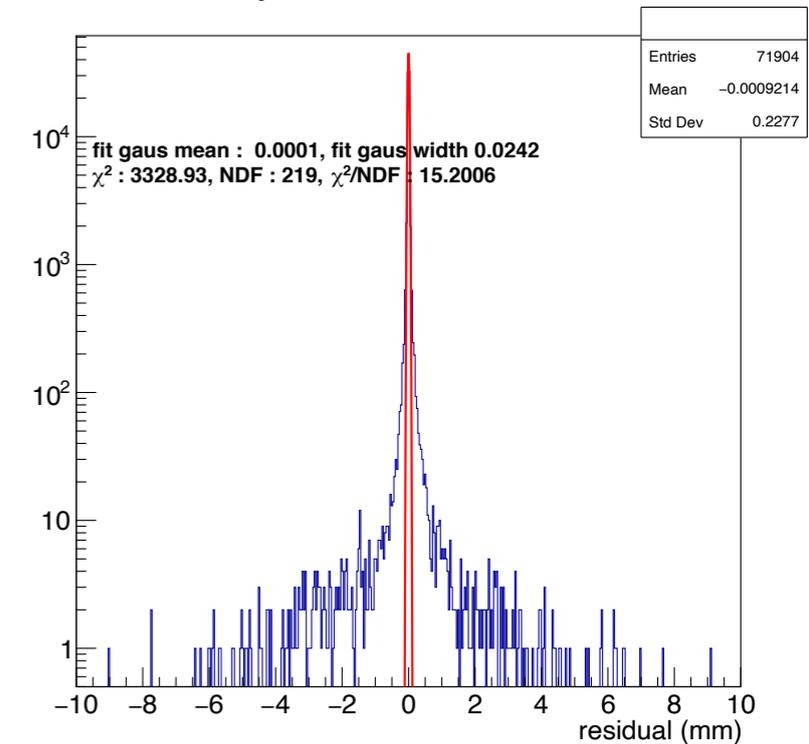
residual (mm)

Scattering study

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

l0   l1   l2

2 : slope of l1-l0
3 : slope of l2-l1

slope 3 - slope 2

χ^2 : 43.39, NDF : 16, χ^2/NDF : 2.71
Scale : 0.0004
student-tail : 2.0756
student-width : -0.0004
gaus-width : -0.0048
gaus-fraction : 0.97

MC

slope 3 - slope 2

χ^2 : 75.29, NDF : 43, χ^2/NDF : 1.75
Scale : 0.0001
student-tail : 1.0425
student-width : 0.0053
gaus-width : 0.0055
gaus-fraction : 0.14

RUN 52

slope 3 - slope 2

Summary

- There is a satellite peak in the residual distributions of run 88 & 89. But the run 52 & 54 don't have such peak.

- The discrepancy of the scattering distribution between MC and data is huge. Similar discrepancy is shown in the paper as well.

Back up

The raw number of the run89

```
run 89
run file : BeamData_20211210-2043_0_filter // note : below : use all chips, NO boundary cut.
layer 3 final counting :
 N_HHH : 2653
 N_LHH : 20
 N_HLH : 14
 N_HHL : 79
 N_LLL : 795
=====3-layers=====efficiency results==========
99.25178    +0.16552    -0.20651
99.47507    +0.13841    -0.18048
97.10835    +0.32092    -0.35737
=====3-layers=====efficiency results==========


run file : BeamData_20211210-2043_0_filter  // note : below : use all chips, add the boundary cut.
layer 3 final counting :
 N_HHH : 2552
 N_LHH : 18
 N_HLH : 13
 N_HHL : 41
 N_LLL : 680
=====3-layers=====efficiency results==========
99.29961    +0.16320    -0.20610
99.49318    +0.13856    -0.18251
98.41882    +0.24454    -0.28482
=====3-layers=====efficiency results==========
```

```
run file : BeamData_20211210-2043_0_filter // note : only chip10 or chip23. with l0 correction -0.2825. NO boundary cut.
layer 3 final counting :
 N_HHH : 1227
 N_LHH : 9
 N_HLH : 2
 N_HHL : 42
 N_LLL : 283
=====3-layers=====efficiency results==========
99.27184    +0.23776    -0.33078
99.83727    +0.10510    -0.21423
96.69031    +0.50257    -0.58190
=====3-layers=====efficiency results==========

run file : BeamData_20211210-2043_0_filter // note : only chip10 or chip23. with l0 correction -0.2825. add boundary cut.
layer 3 final counting :
 N_HHH : 1175
 N_LHH : 9
 N_HLH : 2
 N_HHL : 11
 N_LLL : 243
=====3-layers=====efficiency results==========
99.23986    +0.24818    -0.34522
99.83008    +0.10975    -0.22368
99.07251    +0.27472    -0.36997
=====3-layers=====efficiency results==========
```