Beam Test analysis for publication

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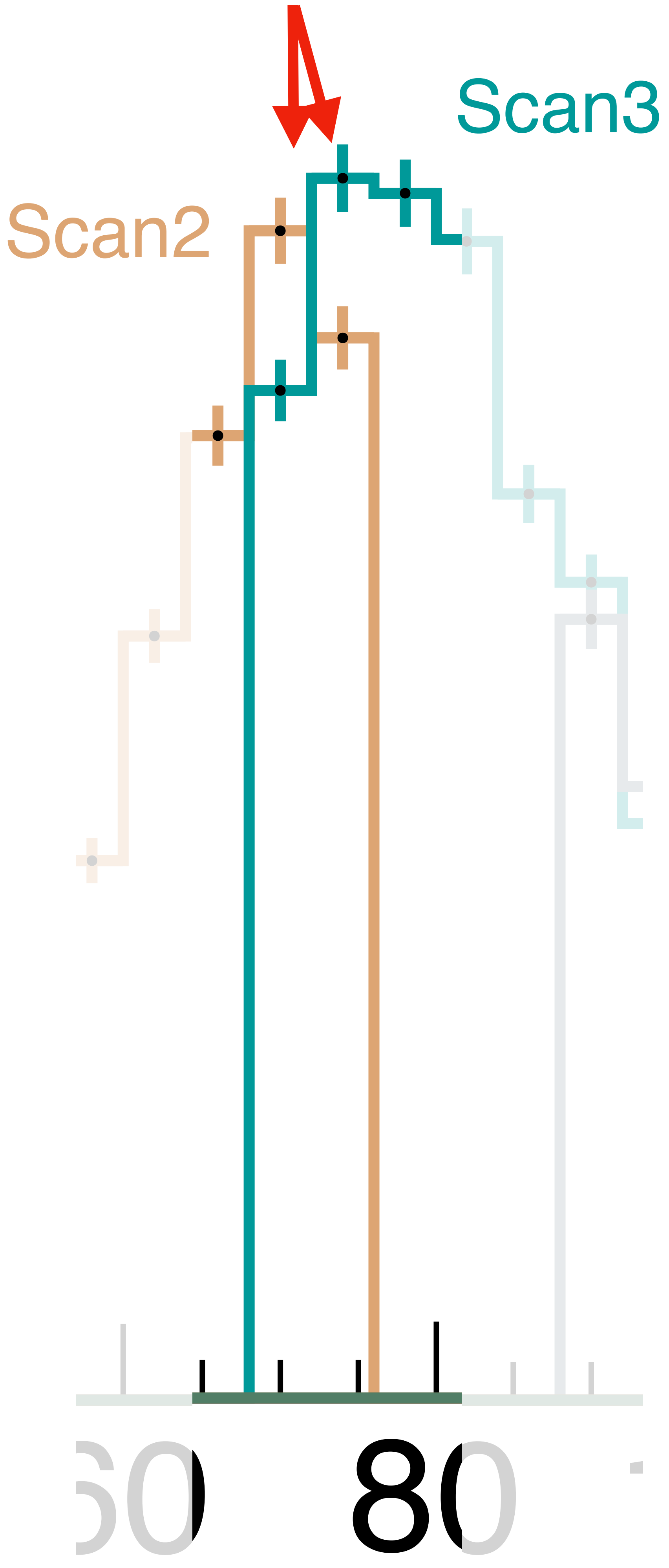
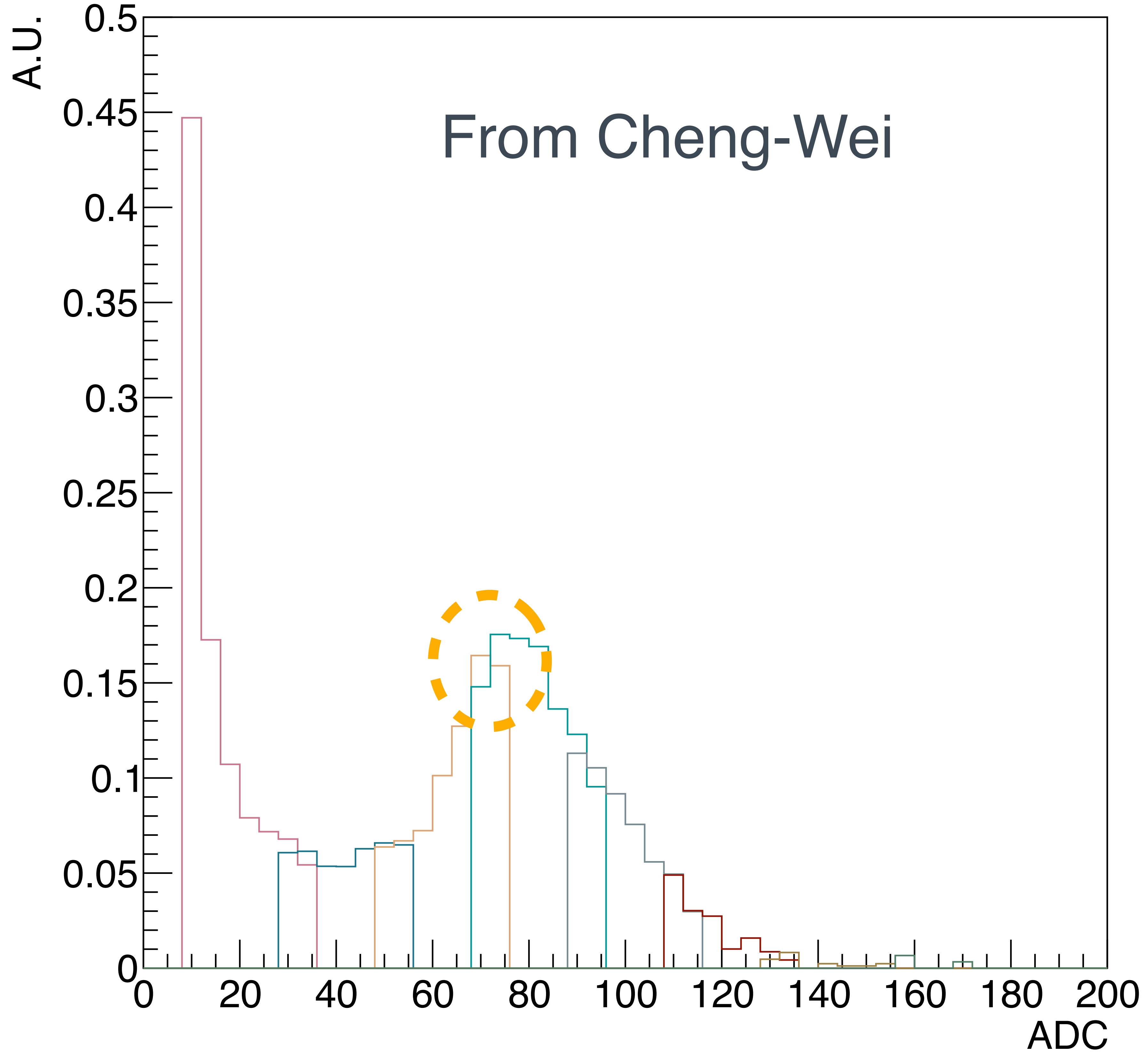
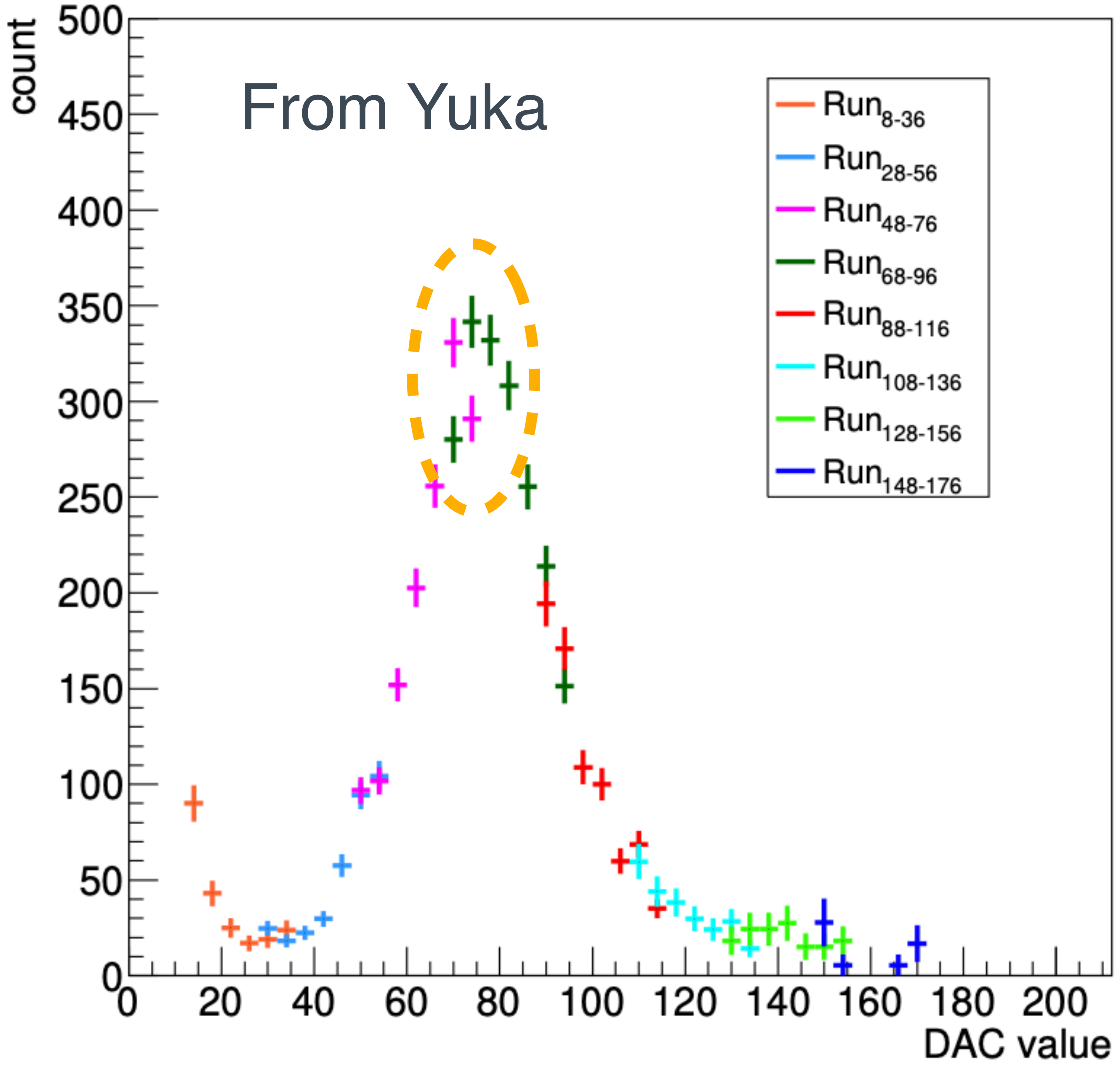
INTT meeting

Reminder, DAC Scan - in combining bins

The disagreement in the overlap bins between Scan2 and Scan3, observed in the past as well

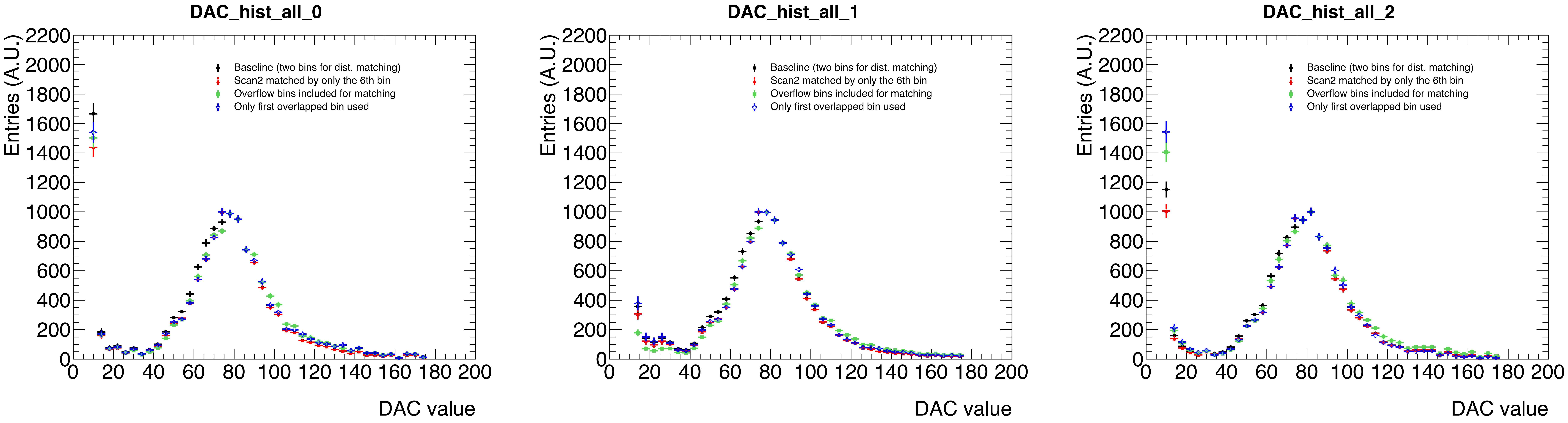




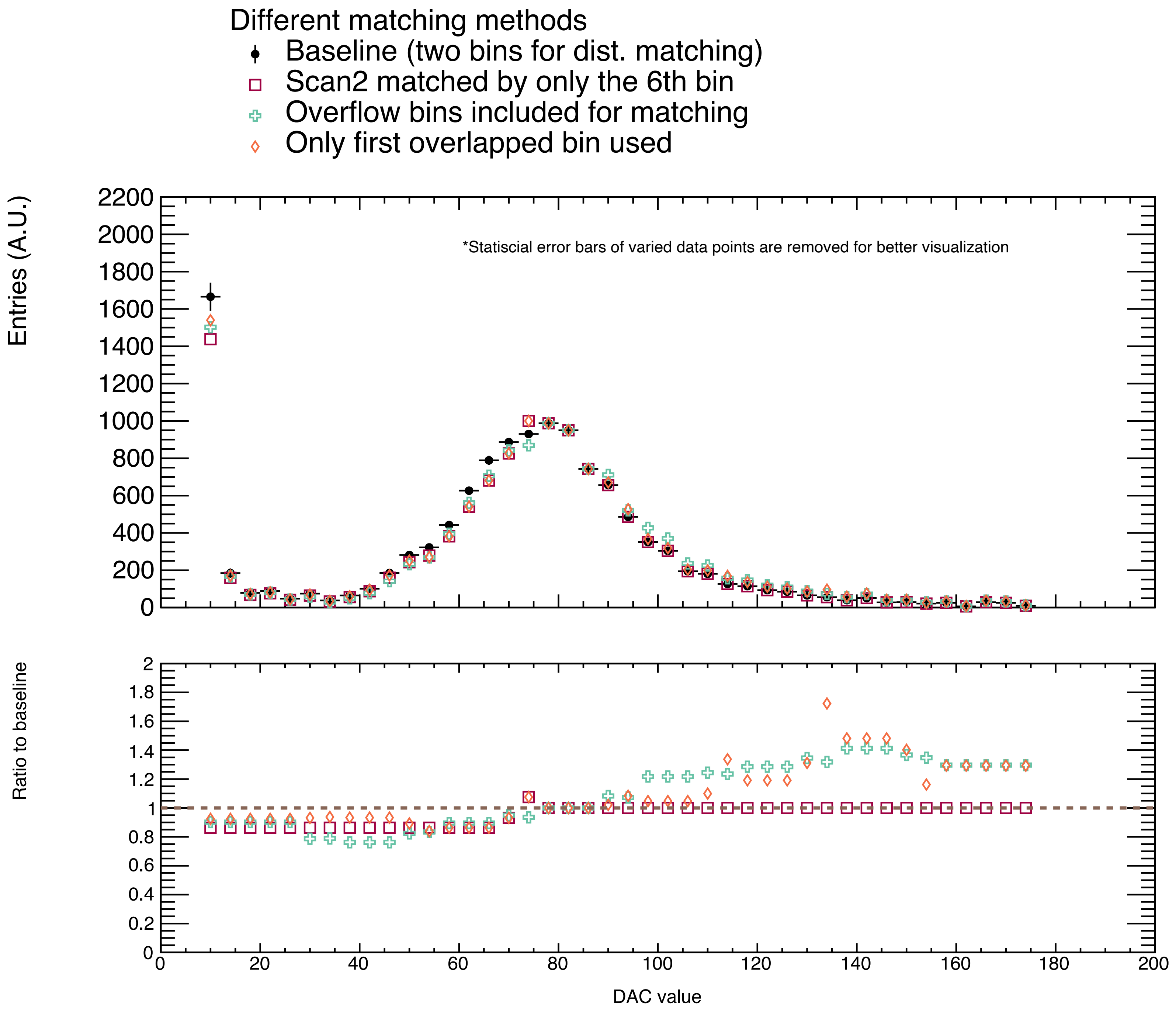


Energy deposit distribution (DAC Scan)

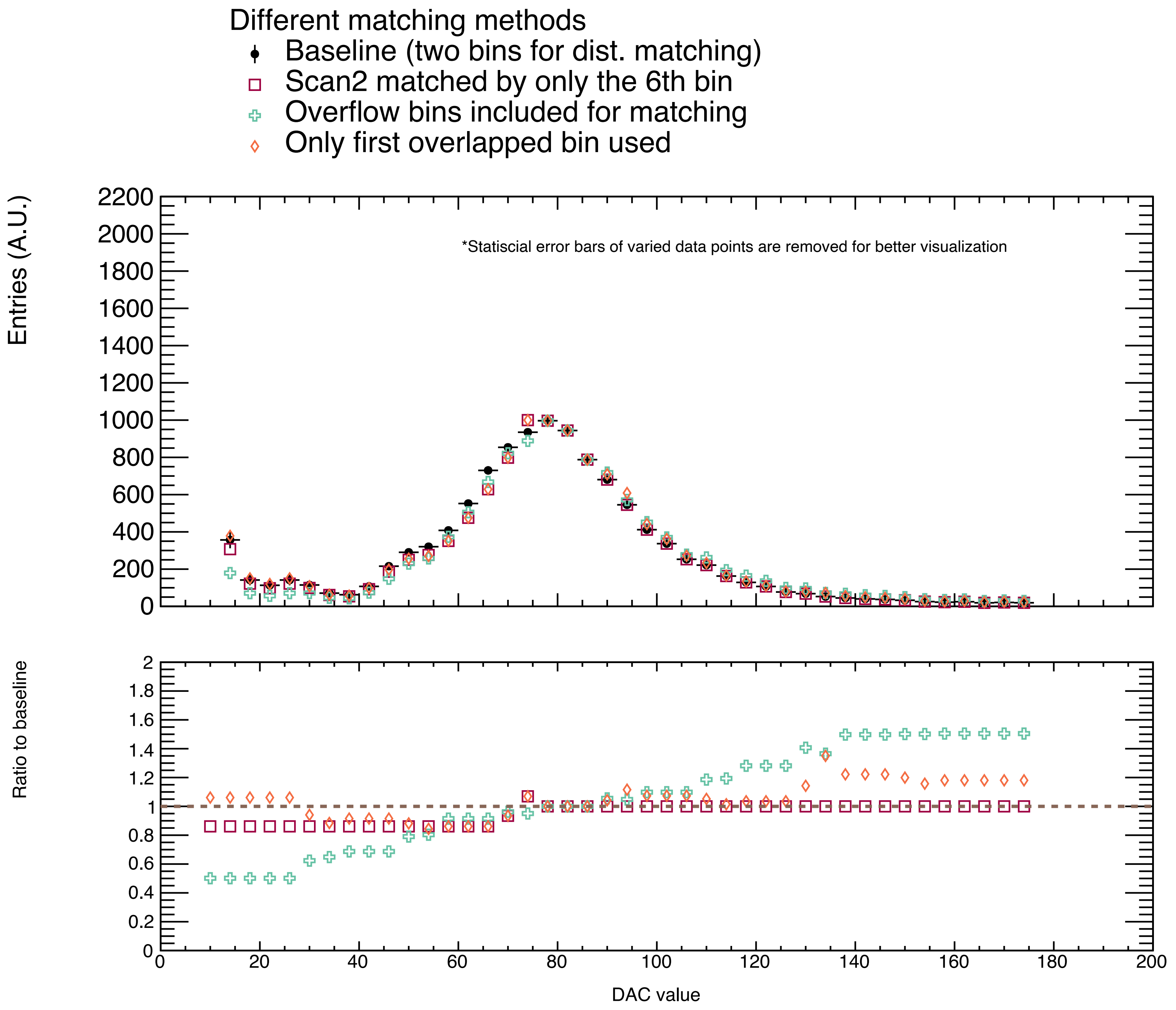
- As what we agreed in the INTT meeting last week
  - The statistical error inflation is removed in combining overlapped bins
    - Normal weighted average method used to combine overlapped bins
  - Bin disagreements between distributions are considered in the systematic uncertainty
  - In each bin, the maximal (up and down) variations are quoted as the systematic uncertainty
    - The statistical error bars of variations are not included in comparison



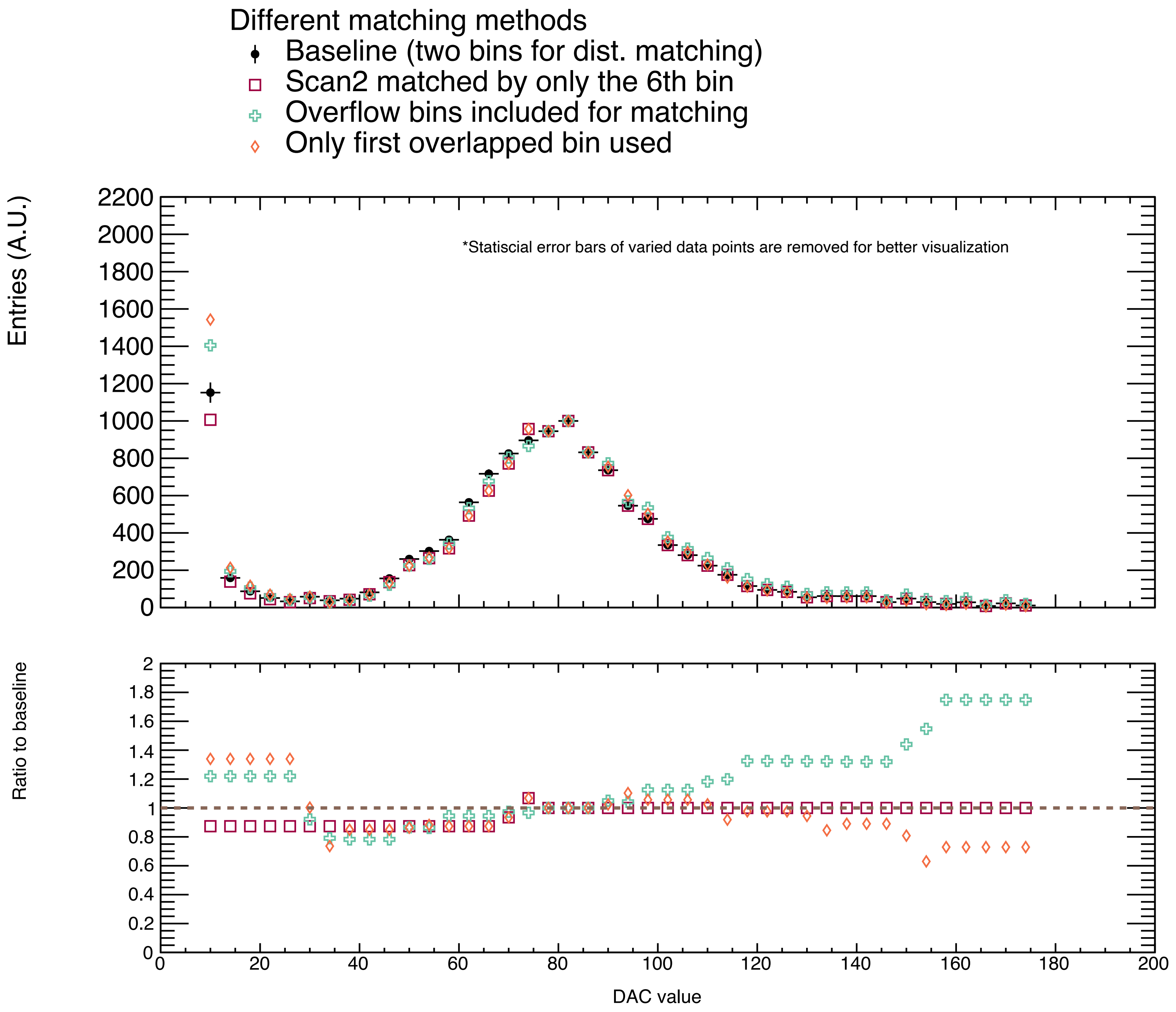
Energy deposit distribution (DAC Scan)



L0



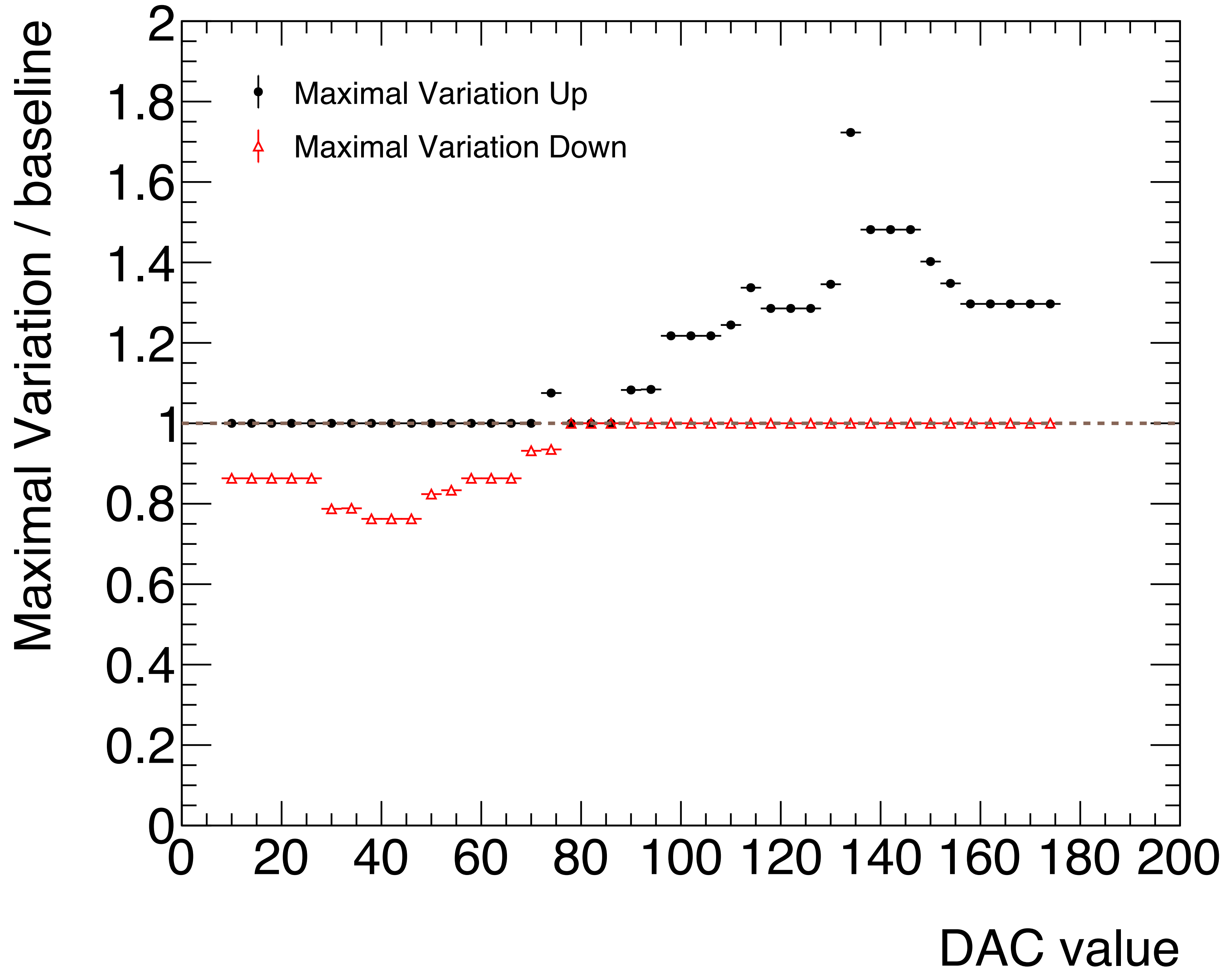
L1



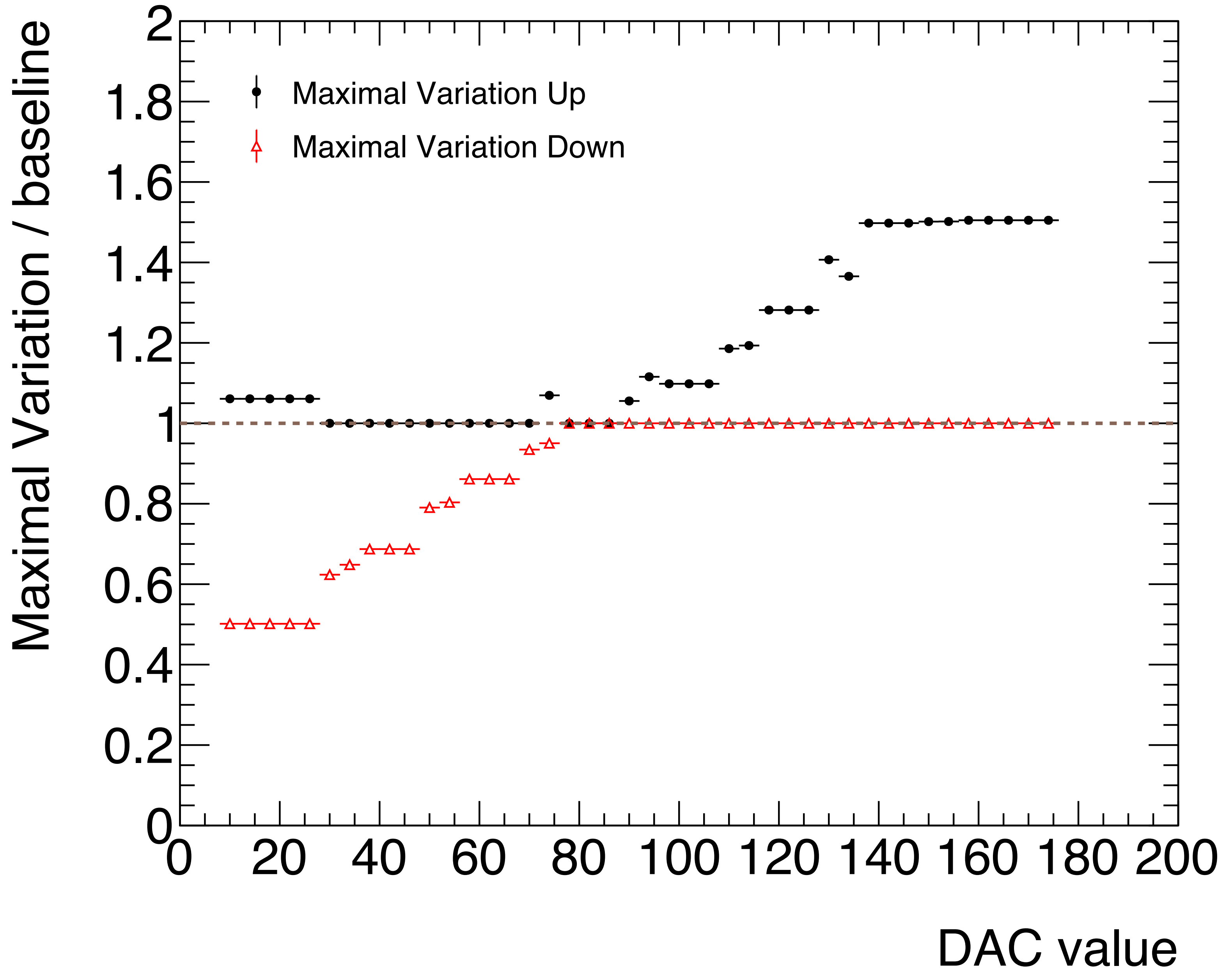
L2

Energy deposit distribution (DAC Scan)

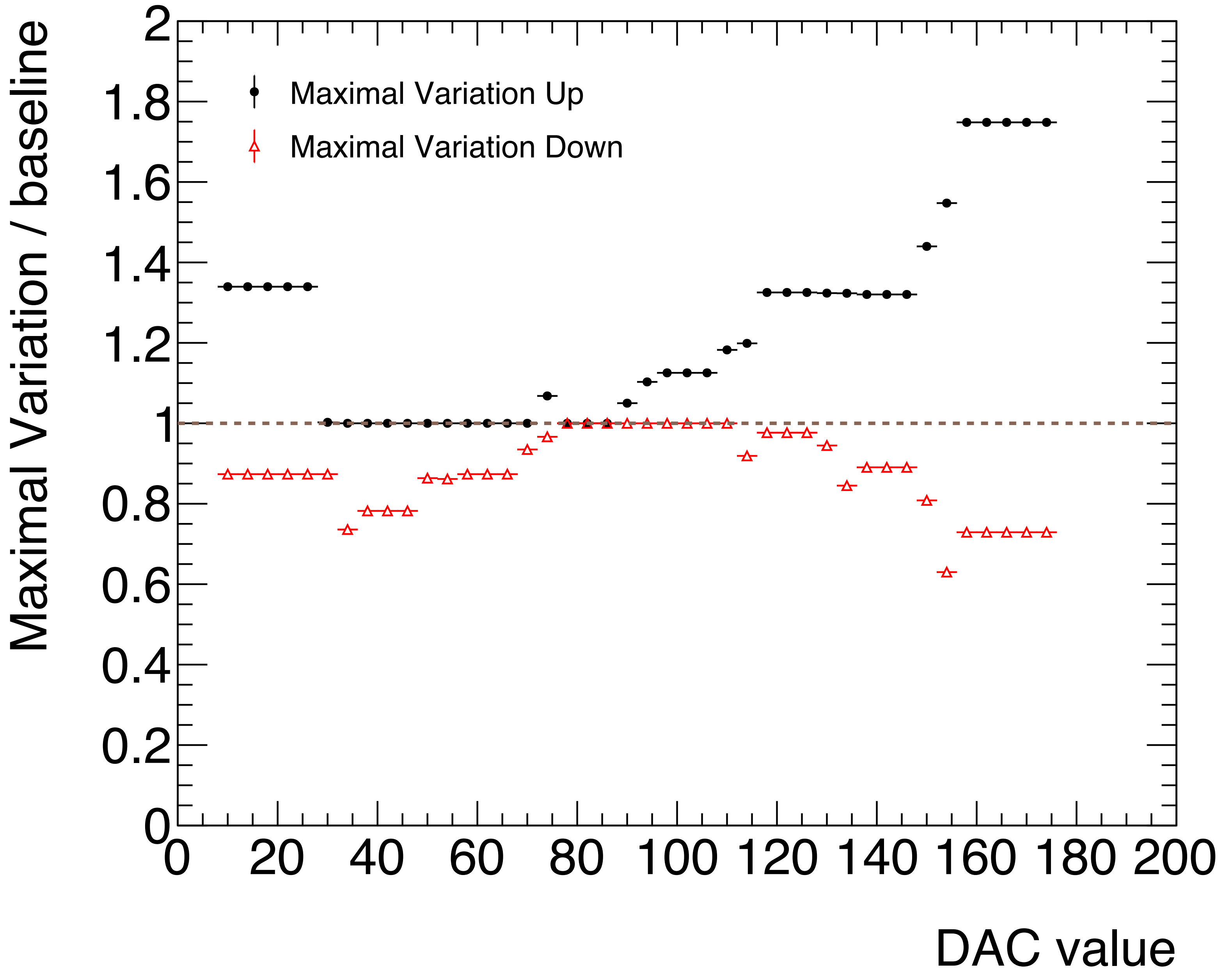
- In each bin, the maximal (up and down) variations are quoted as the systematic uncertainty



L0

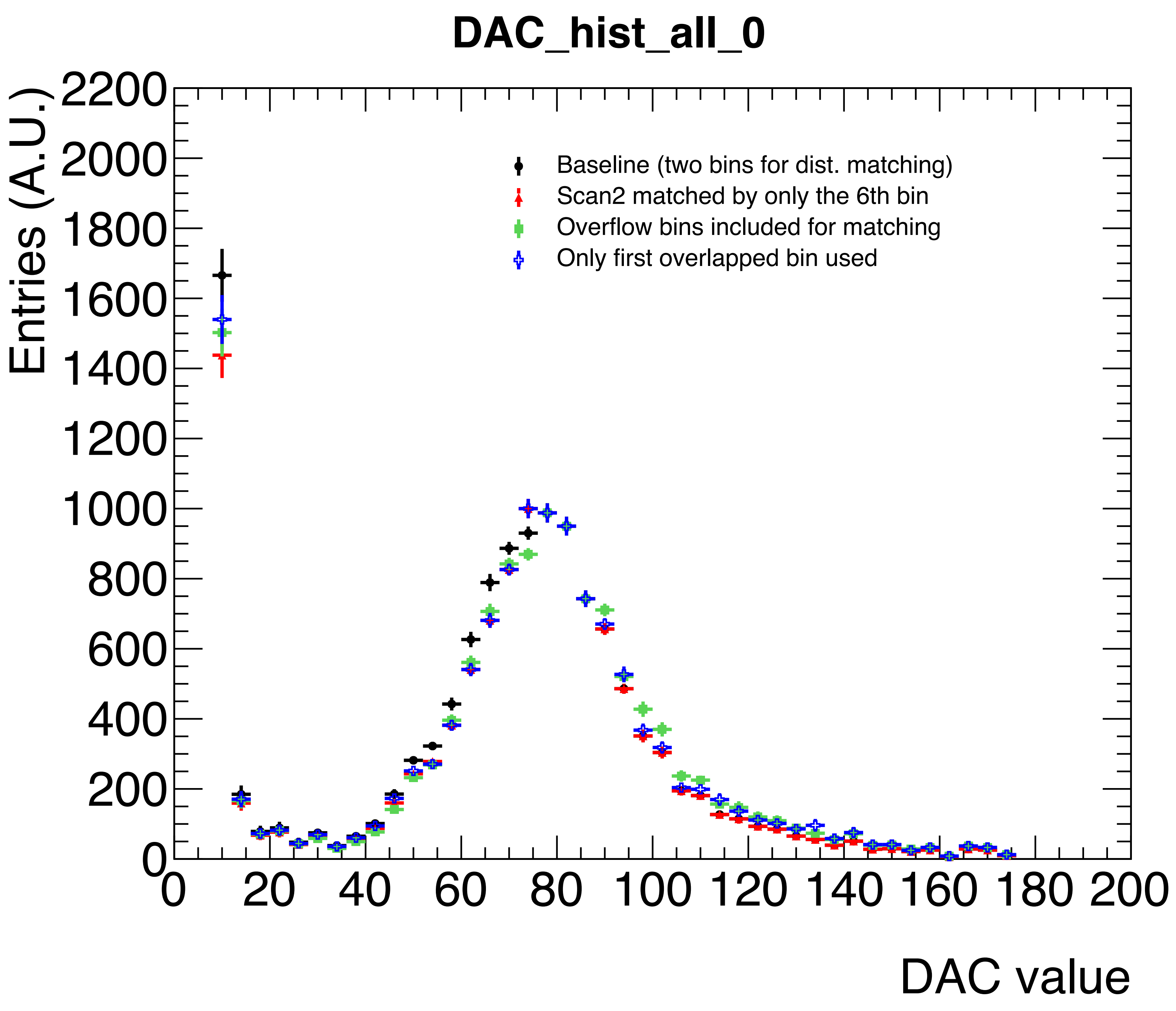


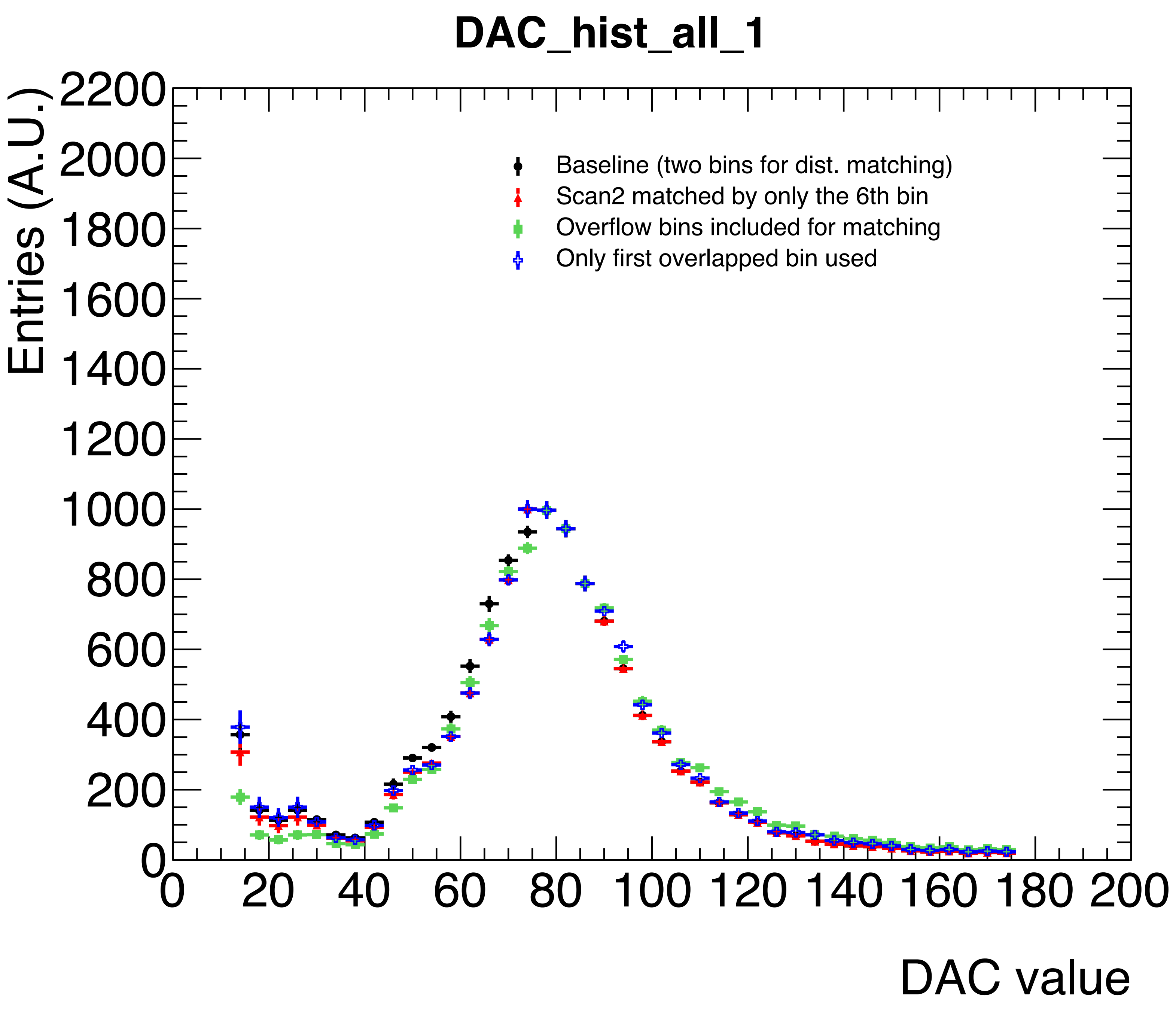
L1

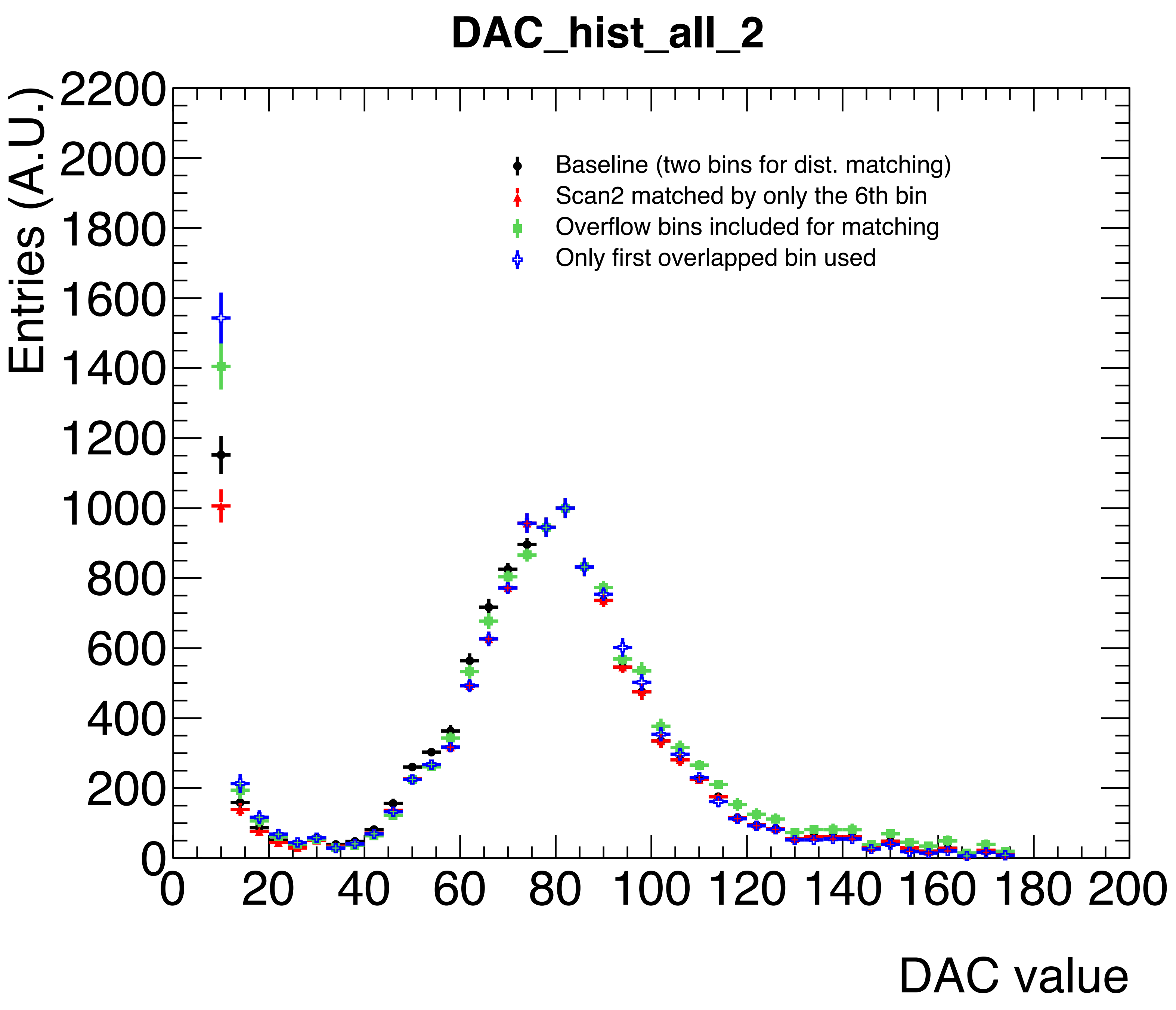


L2

Energy deposit distribution (DAC Scan)

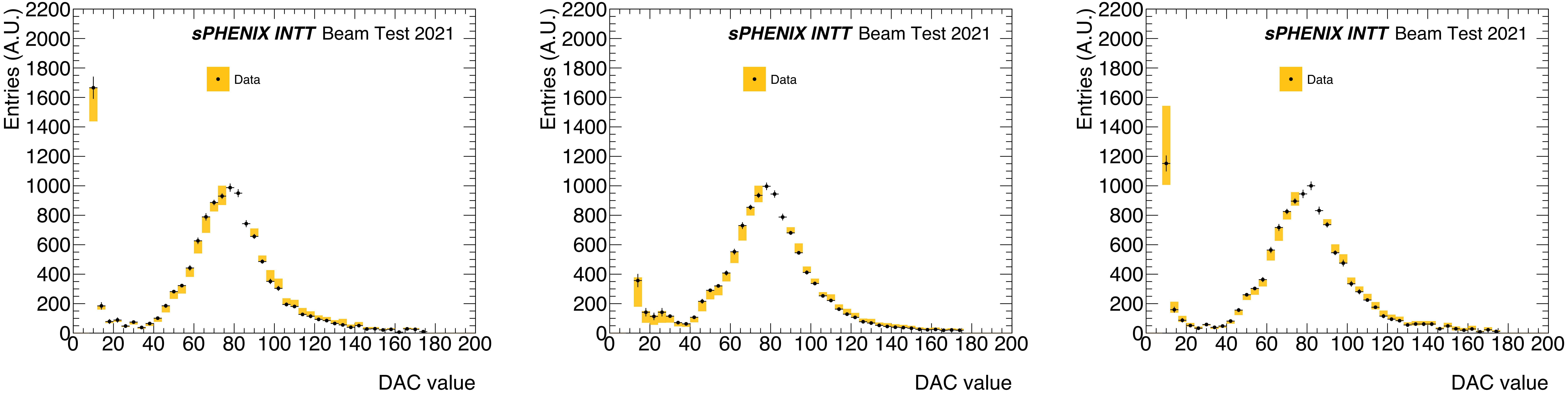






Energy deposit distribution (DAC Scan)

- In each bin, the maximal (up and down) variations are quoted as the systematic uncertainty
  - Baseline: two overlapped bins for distribution matching
  - Bin statistical error inflation due to bin disagreement is removed

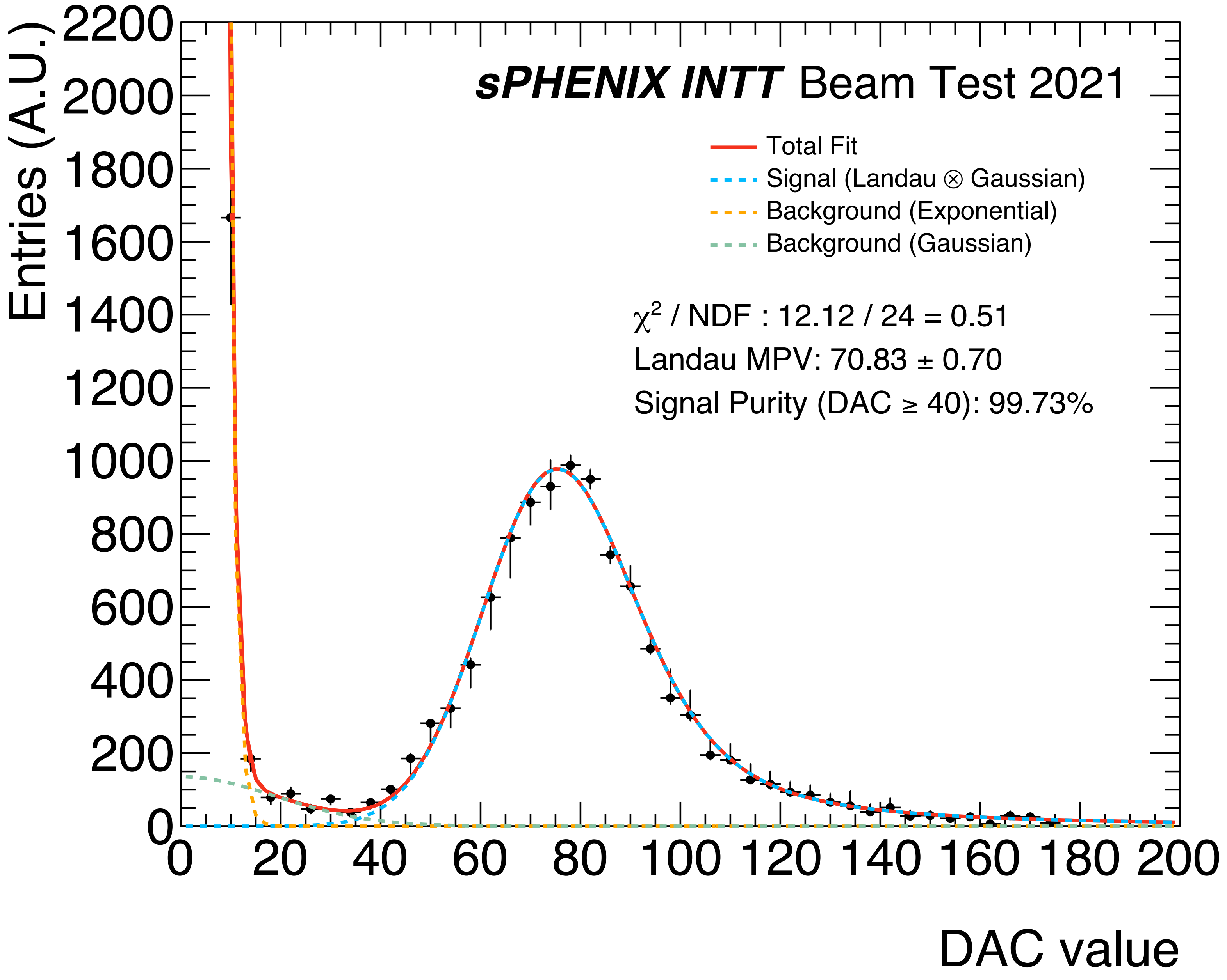


L0 L1 L2

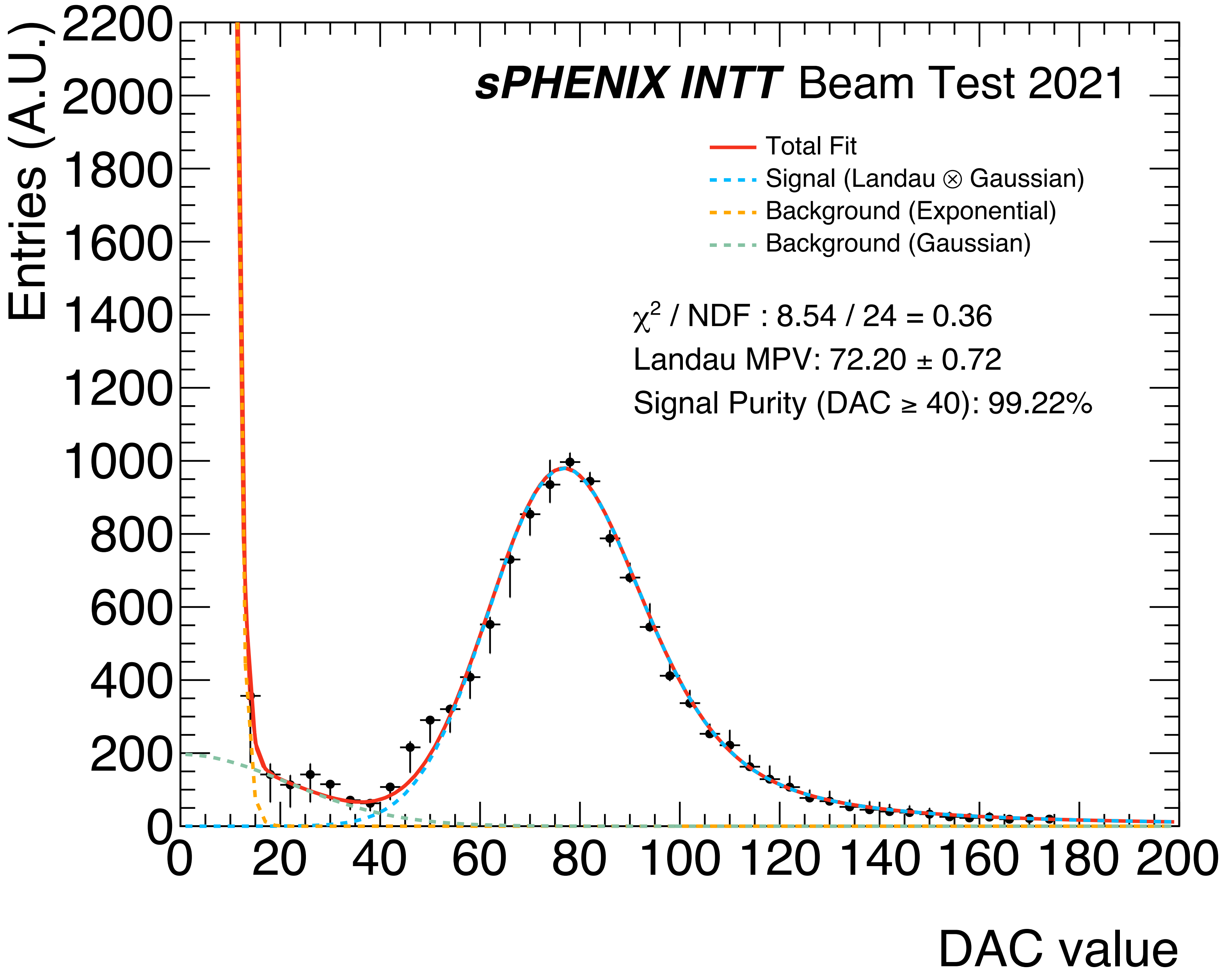
Energy deposit distribution (DAC Scan)

- Signal component: Landau-Gaussian convolution
- Background: Exponential + Gaussian
- Fit range: 8 to 140 DAC
- Signal Purity {DAC ≧ 40}: > 99%

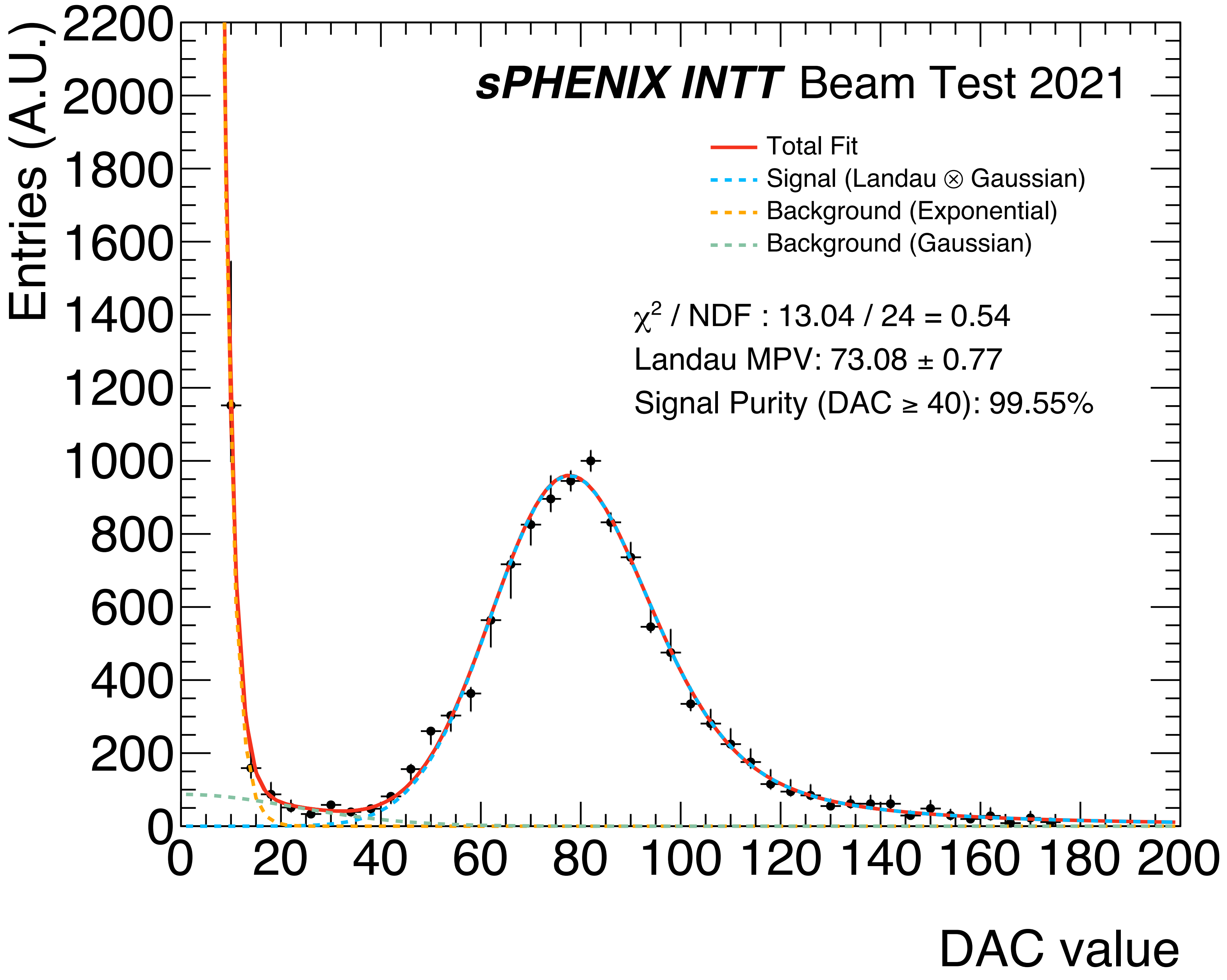
Plot to be in paper (tentative)



L0



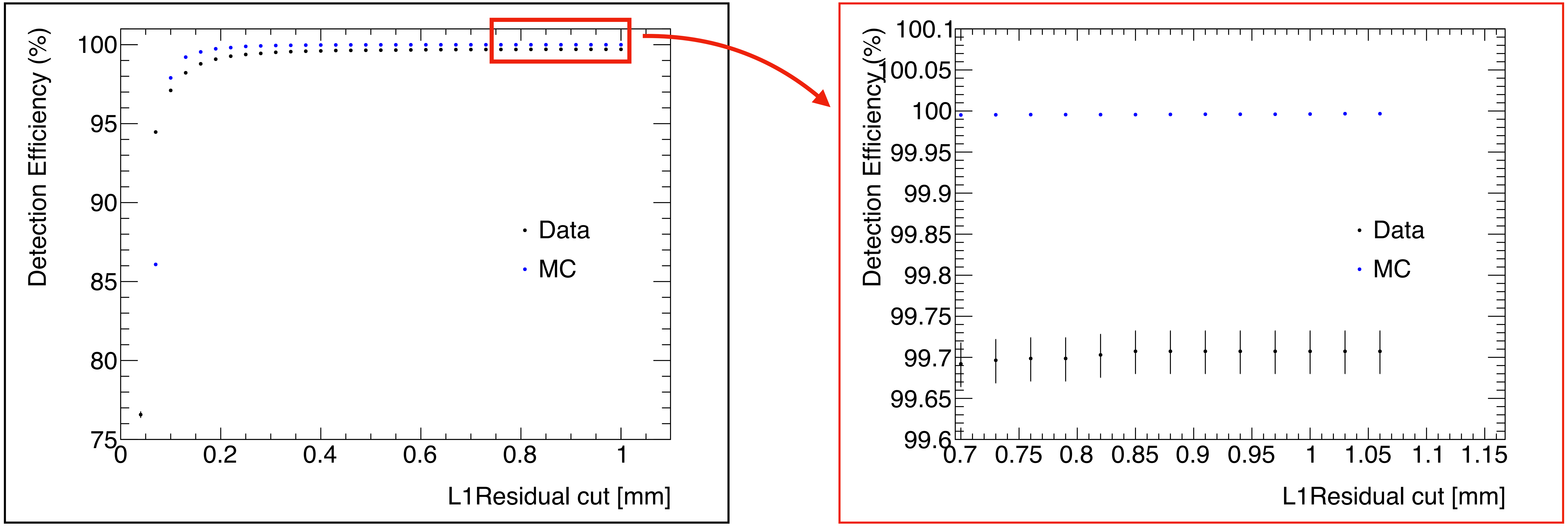
L1



L2

Hit detection efficiency

- Hit detection efficiency:
  - Itaru: the simulation should be used to determine the proper residual cut
  - **Goal: we want the residual cut as small as possible, but also make sure no physics (signal hits) is artificially discarded**
- According to the simulation study, with the residual cut larger than 0.7 mm, the hit detection efficiency is measured to be > 99.995% (@0.7 mm, effi. = 99.9952%)
  - **Residual cut of 0.7 mm is applied to data**
  - No additional correction applied to data (Nearly 100% of hits are retained in MC)
  - Residual cut variation is removed from the systematic uncertainty sources (Differences of effi. with residual cut from 0.7 mm to 1.0 mm well within their stat. unc.)



Hit detection efficiency - systematic unc.

Sources considered for estimating the systematic uncertainty

Source	Variation	Run52			Run89		
		Numerator	Denominator	Efficiency(%)	Numerator	Denominator	Efficiency(%)
Baseline		42972	43099	99.705	50511	50746	99.537
(New) Column	U8 → U9 (Run52) U10 → U11(Run89)	44210	44301	99.795	37156	37338	99.513
Slope Cut	0.01 → 0.013	43658	43795	99.687	51384	51623	99.537
	0.01 → 0.007	41759	41877	99.718	48633	48856	99.544
Boundary Cut	8 ch → 11 ch	42972	43099	99.705	49397	49625	99.541
	8 ch → 5 ch	42972	43099	99.705	51629	51873	99.530

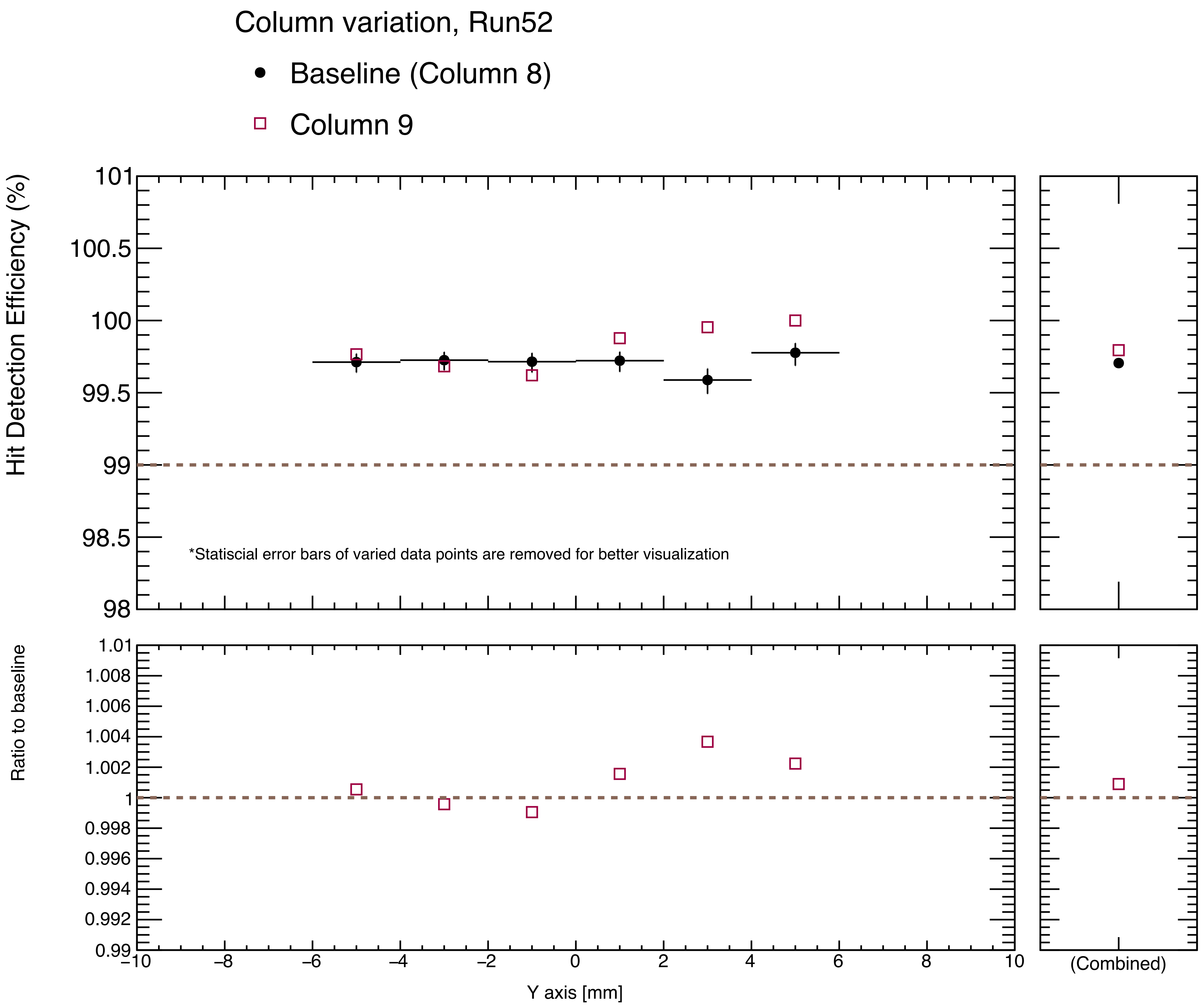
considered in the past

Residual cut is removed from the systematic uncertainty sources

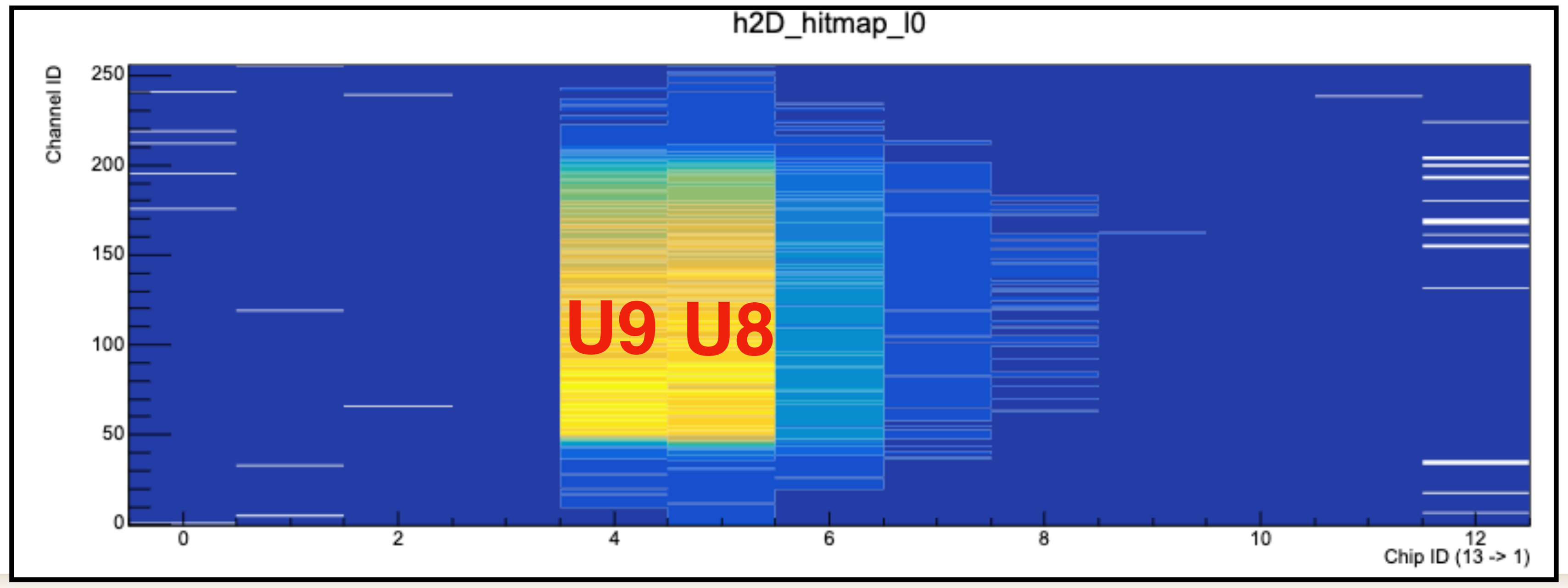
The numbers are statistically combined for estimating systematic uncertainty

Hit detection efficiency as a function of Y axis

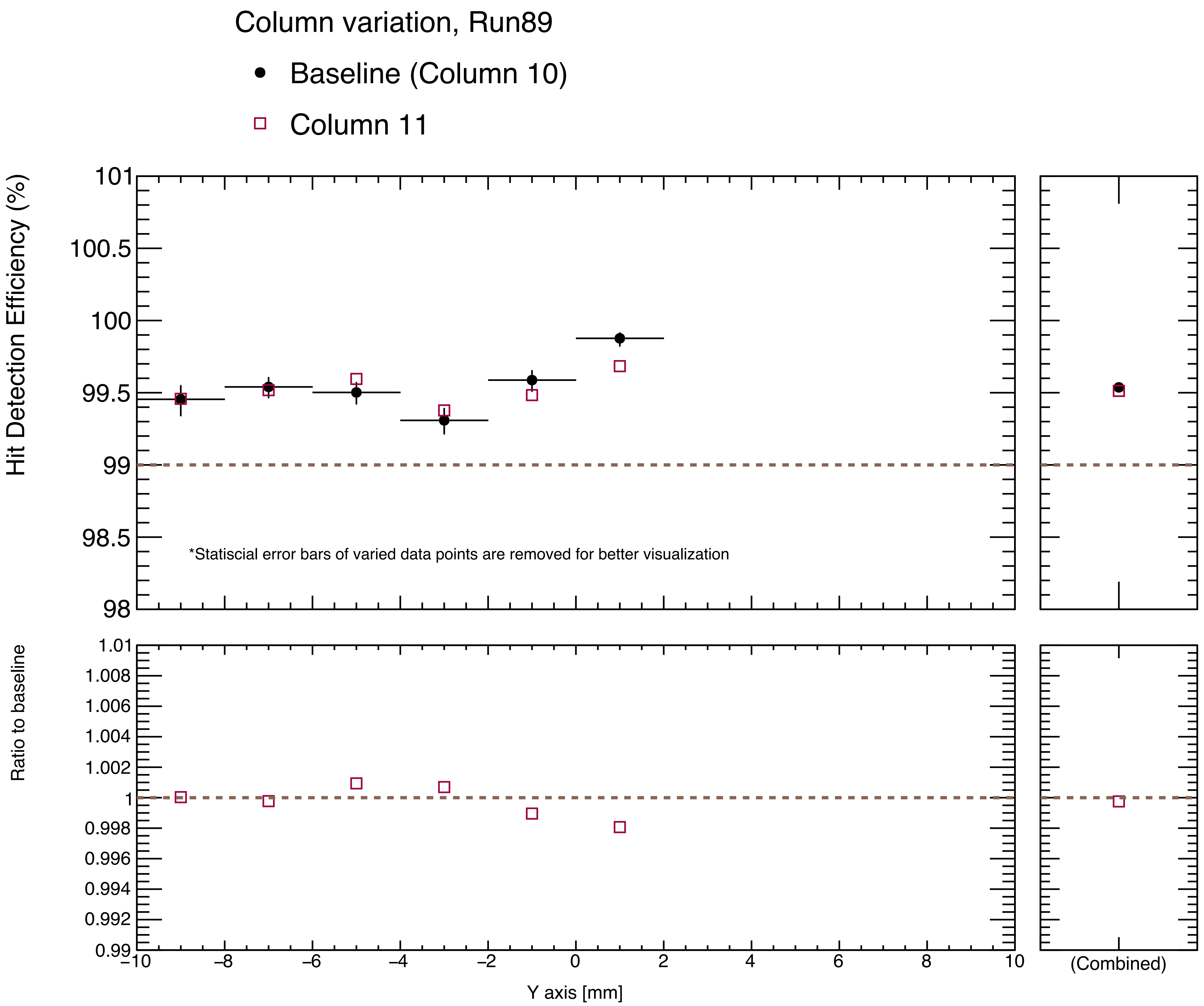
Run52



*Statiscial error bars of varied data points are removed for better visualization



Run89



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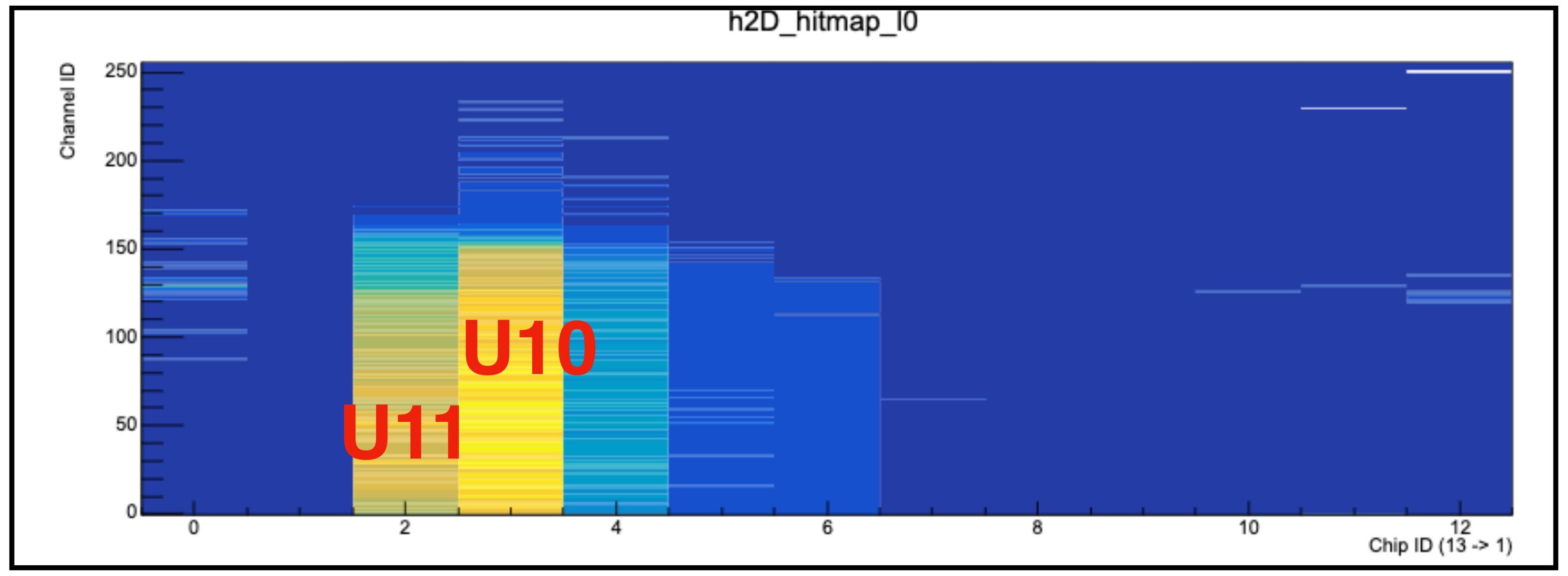
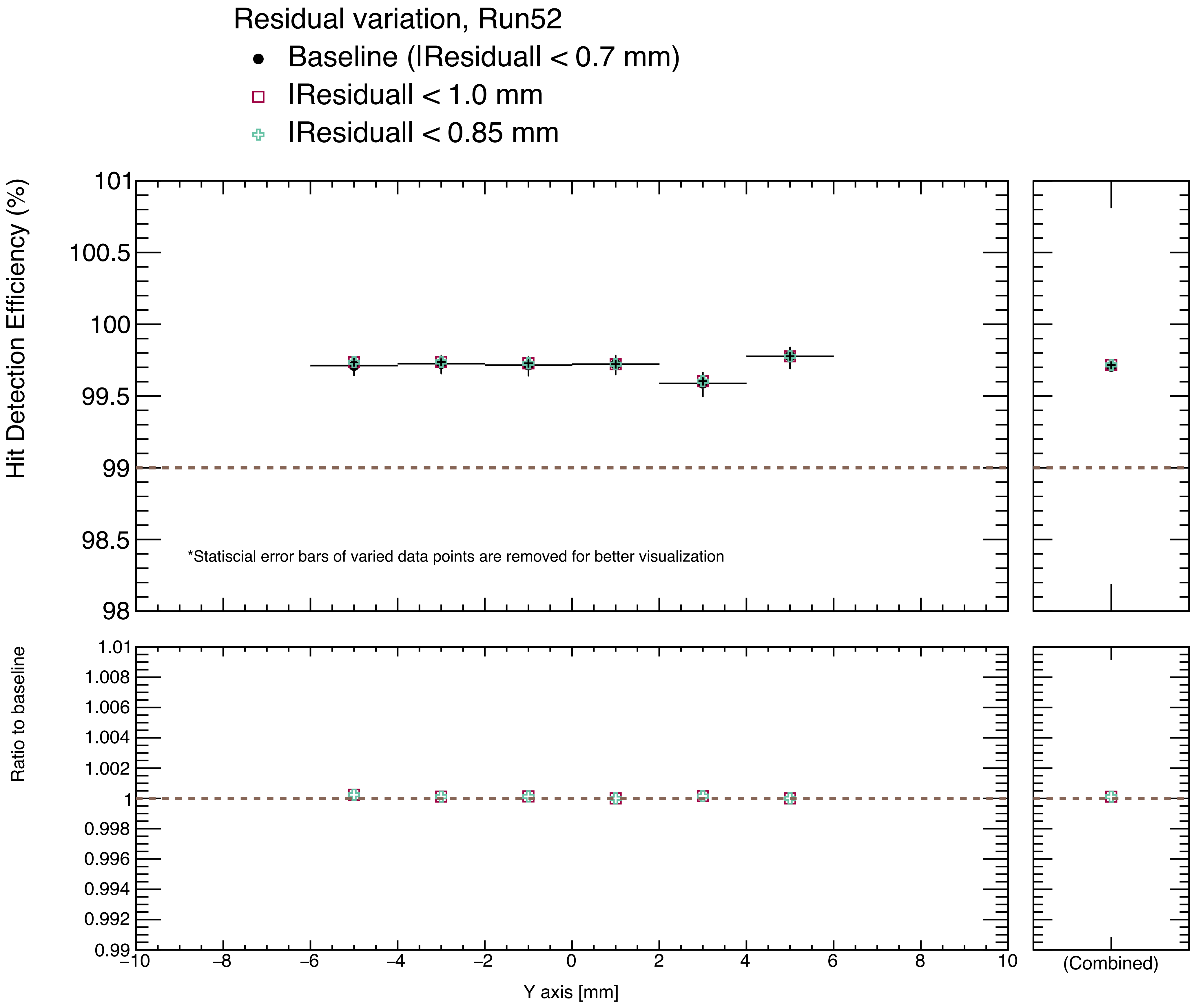
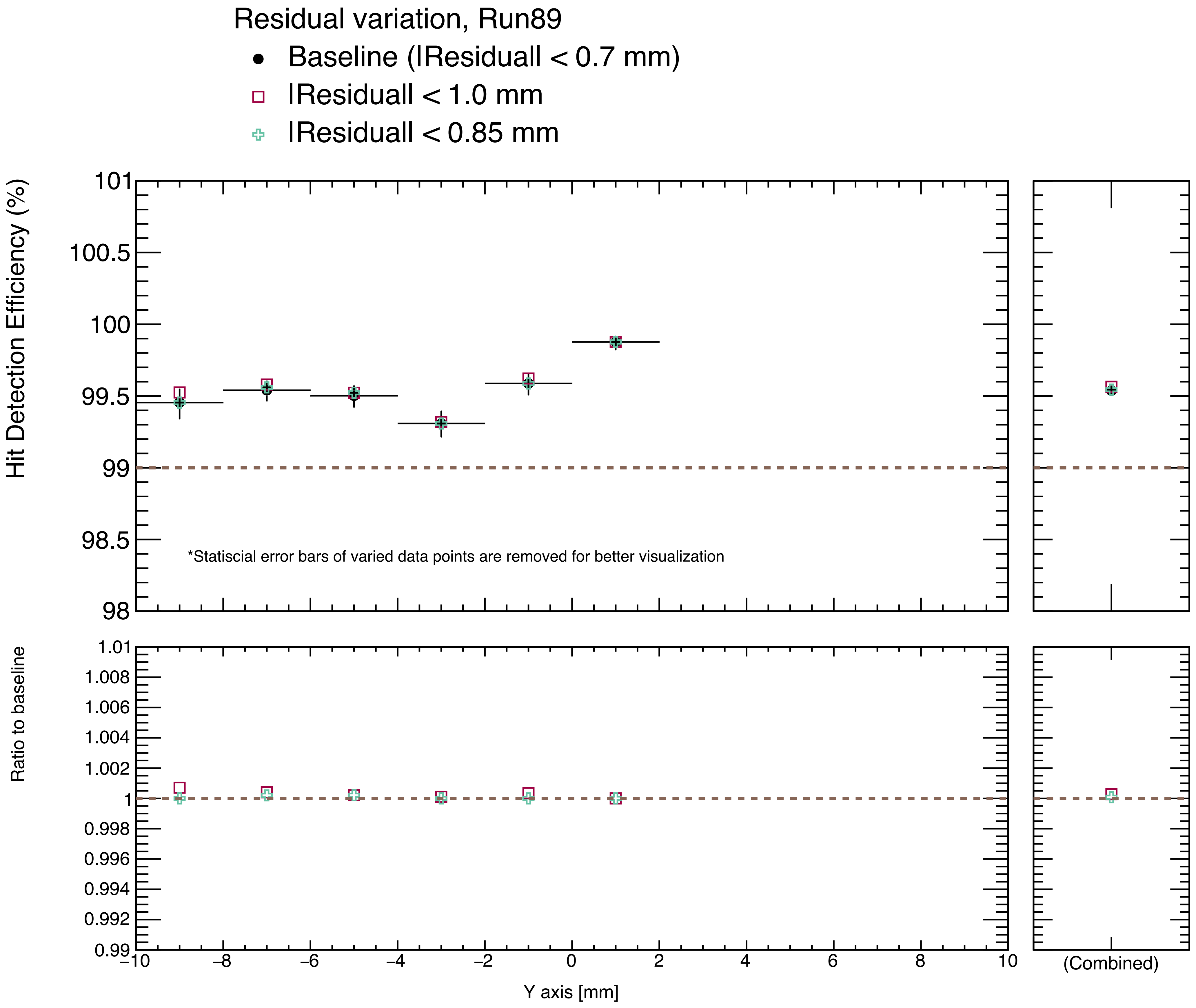


Hit detection efficiency as a function of Y axis

Run52



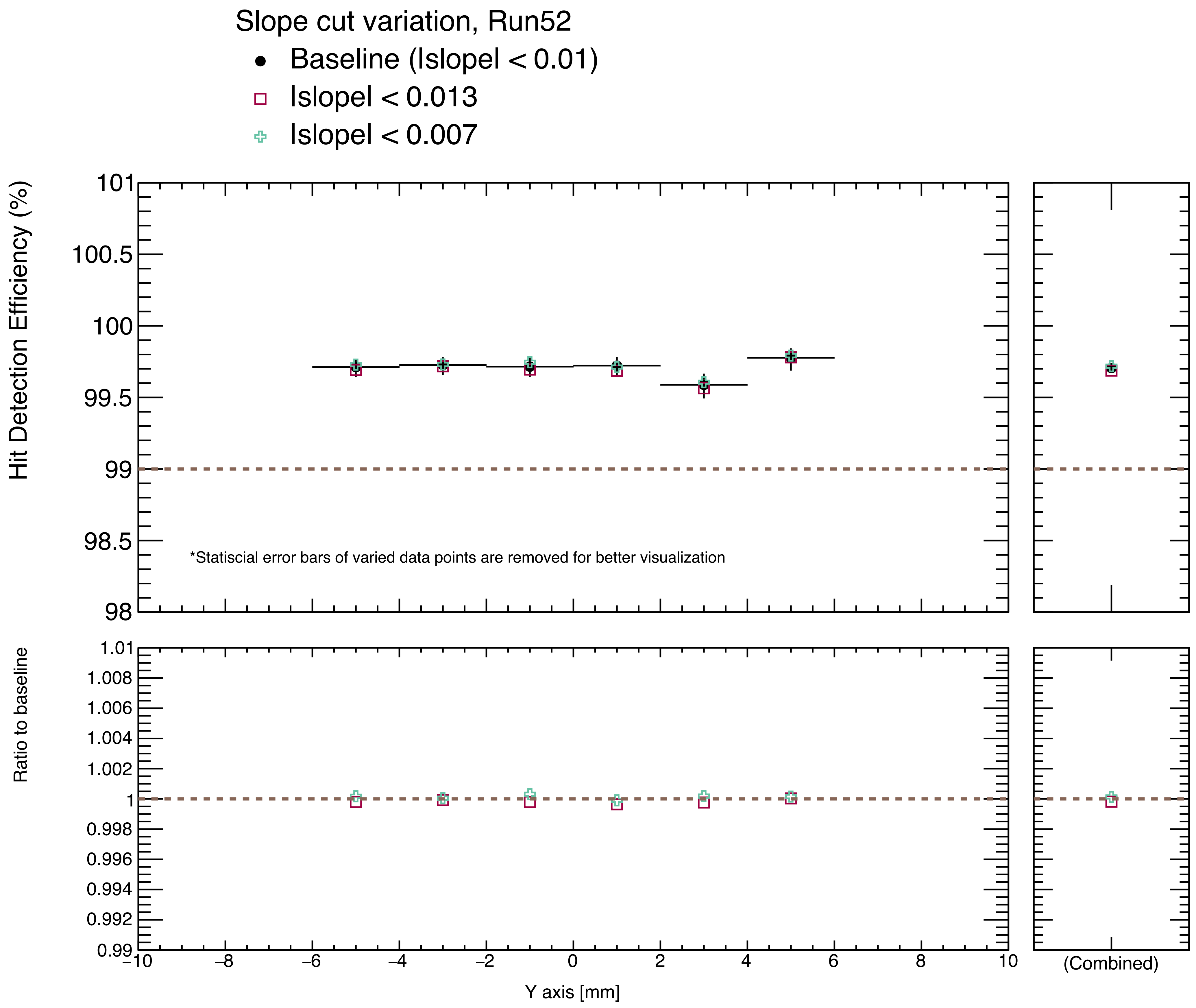
Run89



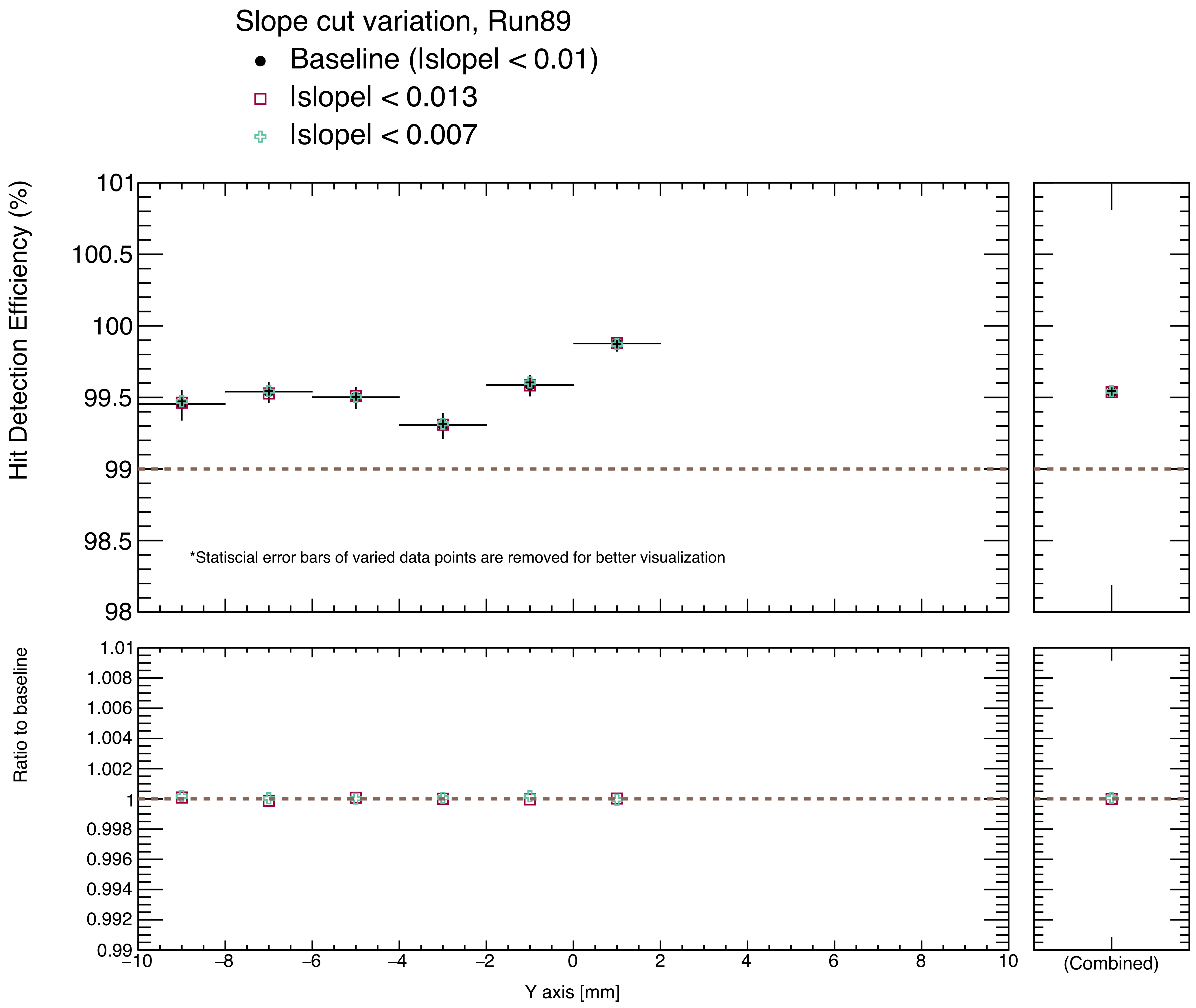
Just for your reference, not used in the systematic uncertainty estimation for the moment

Hit detection efficiency as a function of Y axis

Run52

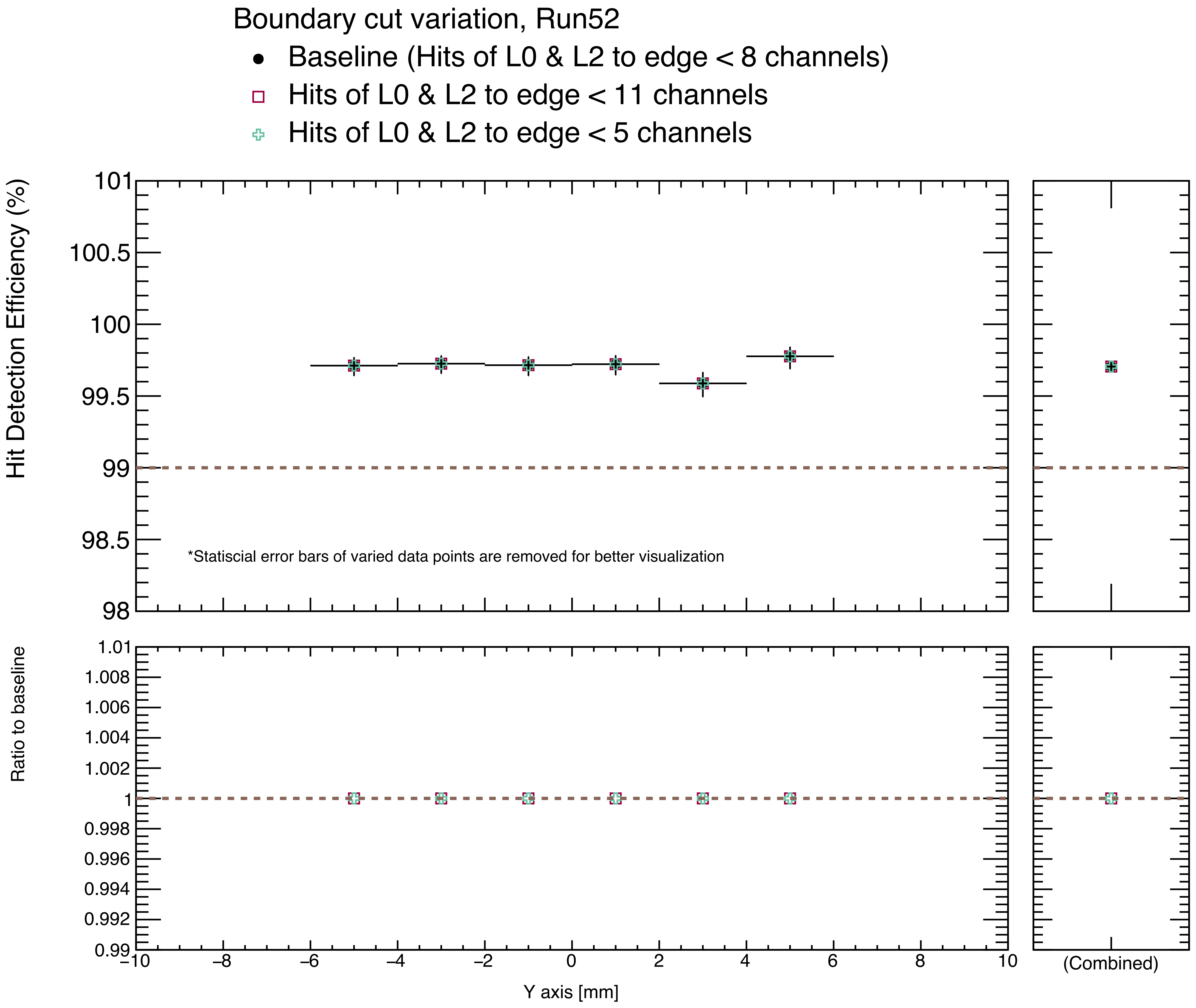


Run89

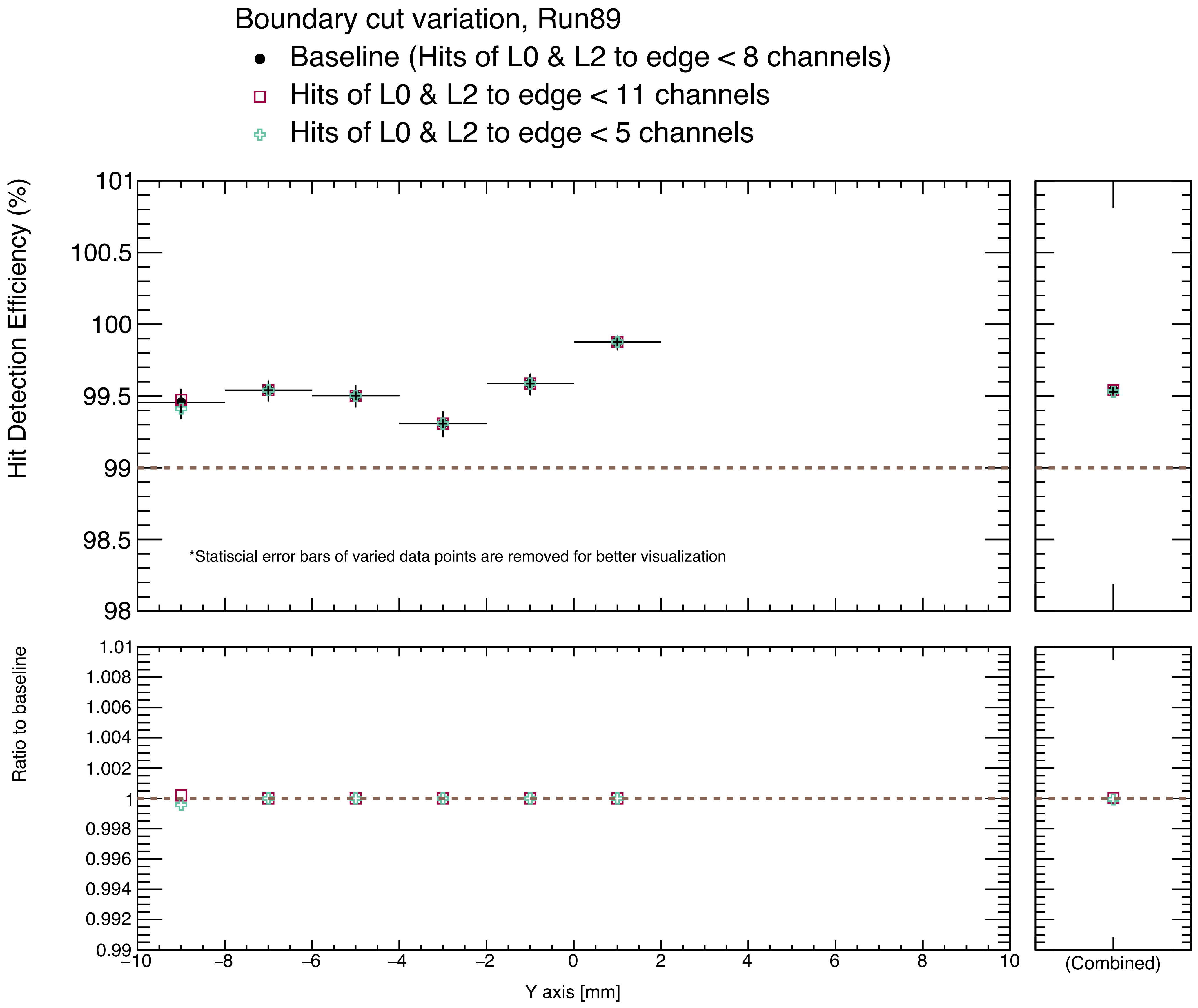


Hit detection efficiency as a function of Y axis

Run52

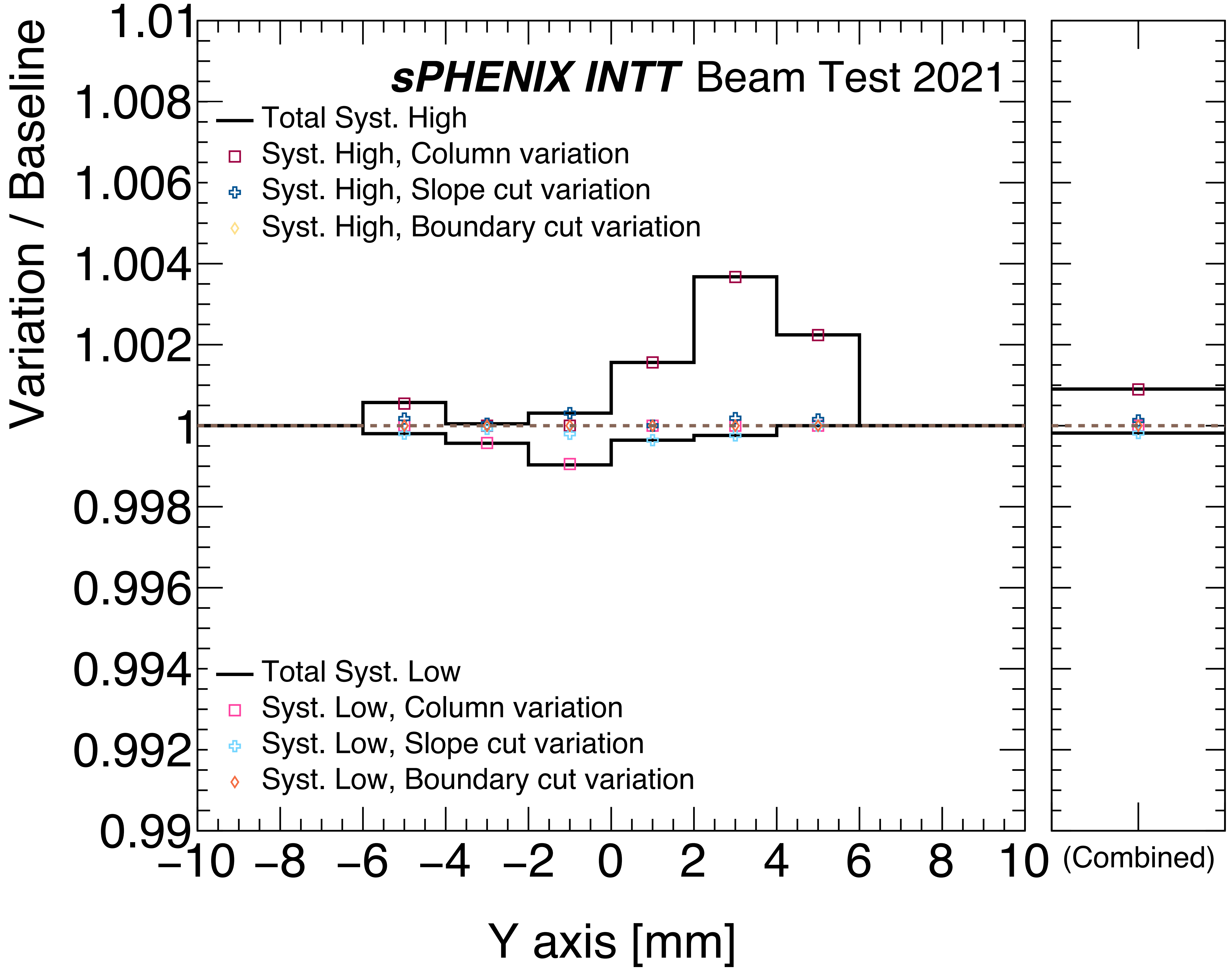


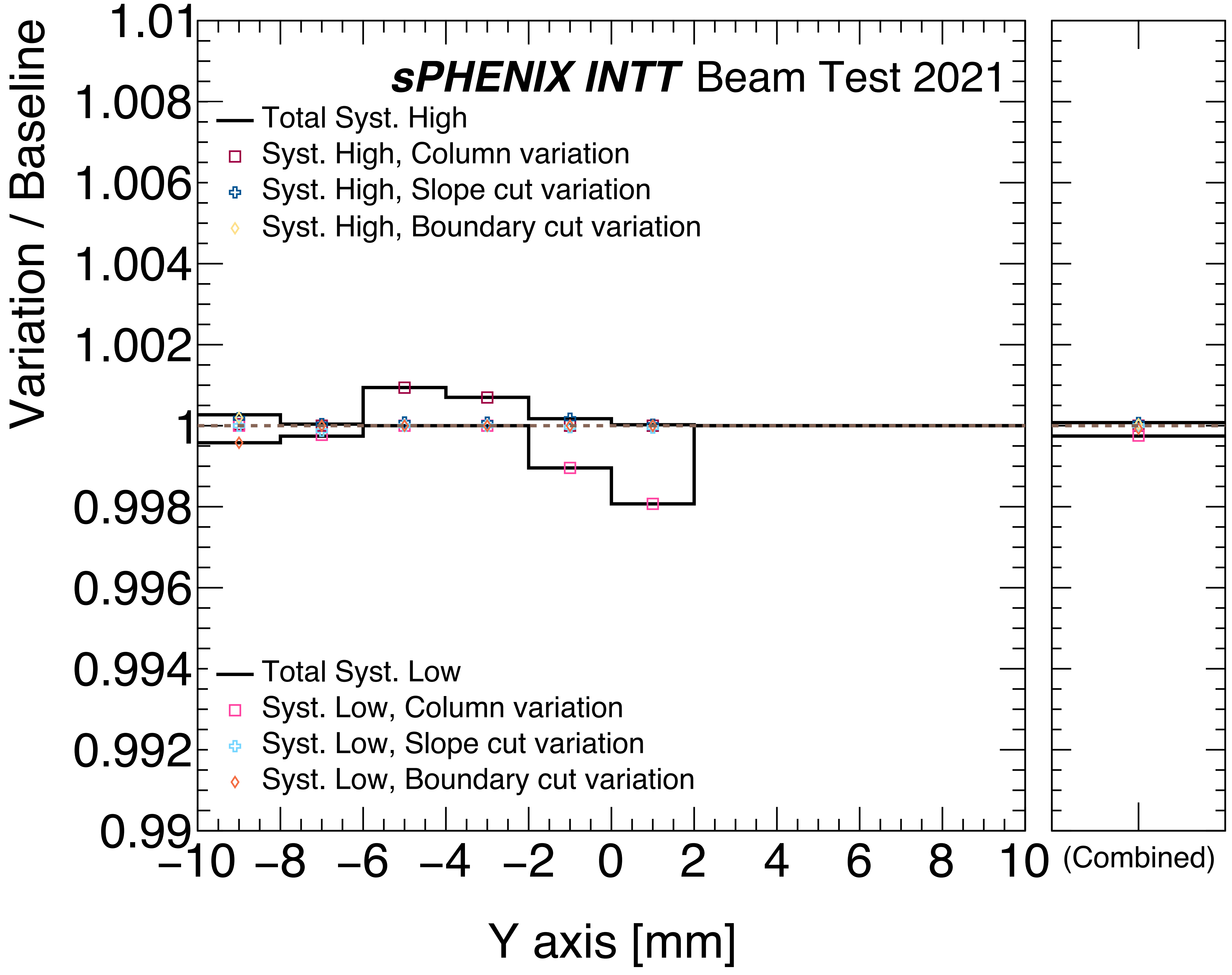
Run89



Hit detection efficiency as a function of Y axis

The total systematic uncertainty in each bin is obtained by summing all sources in quadrature


Run52


Run89

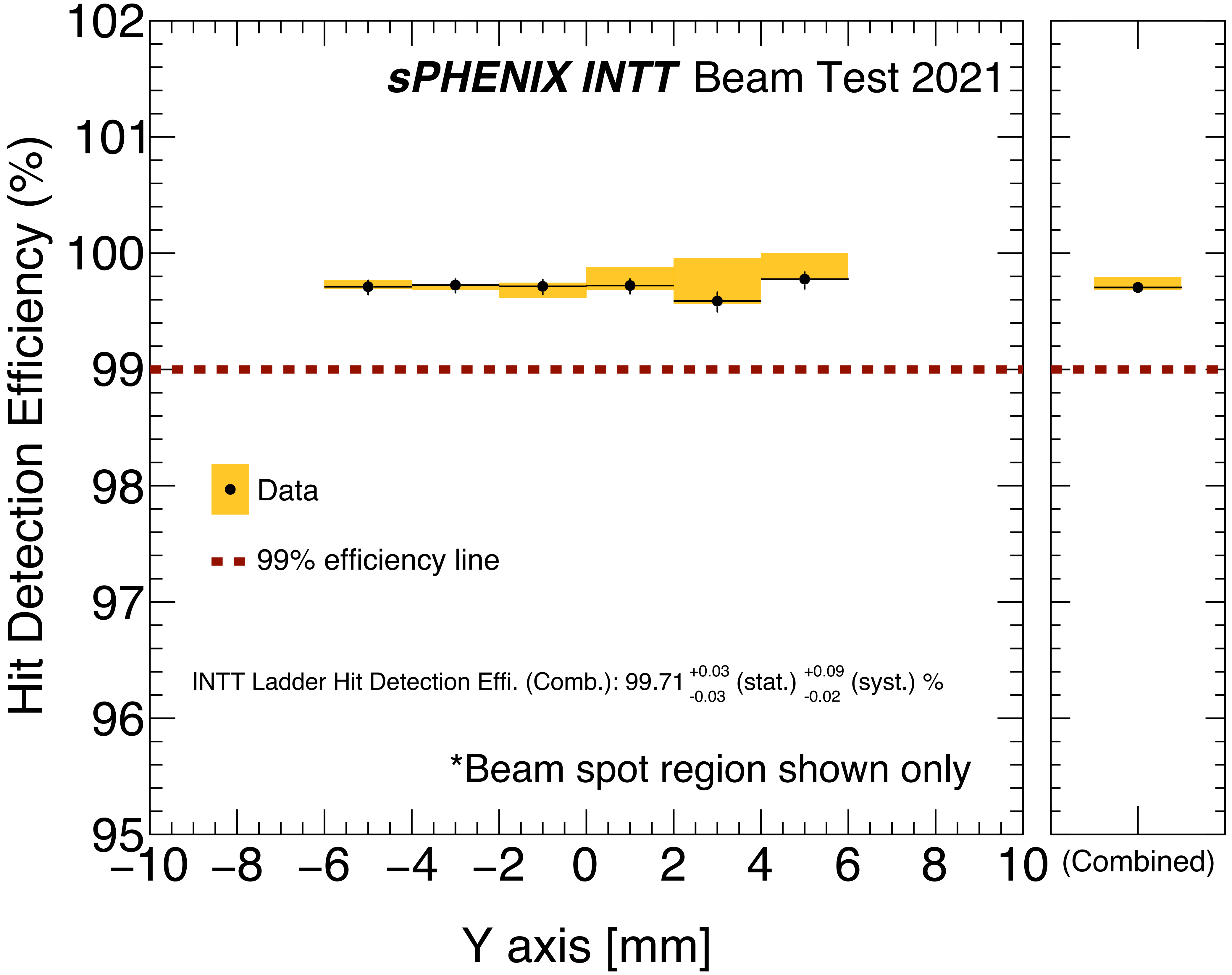
Hit detection efficiency as a function of Y axis

Run52

Hit detection efficiency (combined):

It was: $99.668\,^{+0.028}_{-0.030}(stat.)\,^{+0.109}_{-0.144}(syst.)\,\%$

It is : $99.705\,^{+0.026}_{-0.028}(stat.)\,^{+0.090}_{-0.018}(syst.)\,\%$

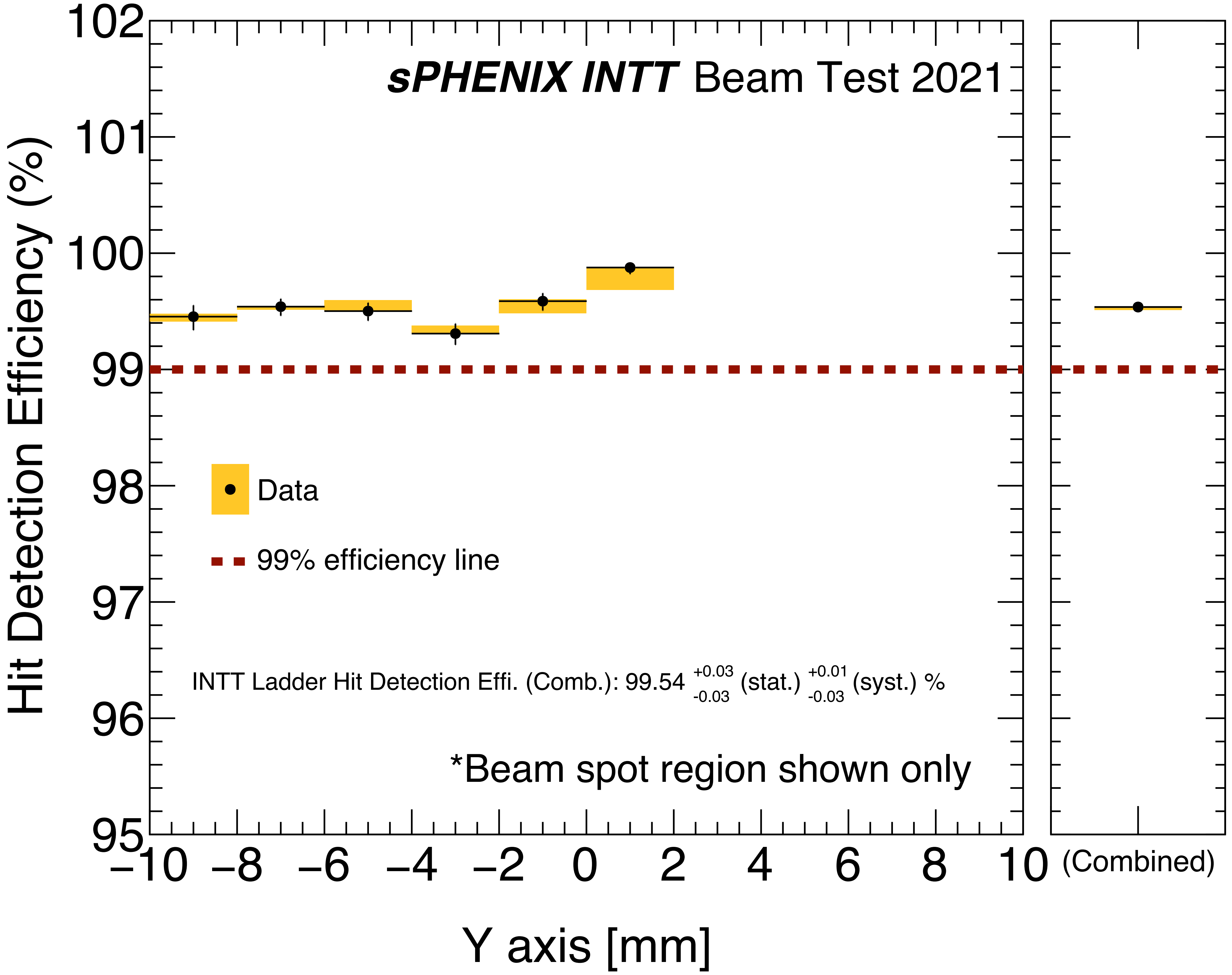


Run89

Hit detection efficiency (combined):

It was: $99.497\,^{+0.031}_{-0.033}(stat.)\,^{+0.046}_{-0.109}(syst.)\,\%$

It is : $99.537\,^{+0.030}_{-0.032}(stat.)\,^{+0.008}_{-0.025}(syst.)\,\%$



Recap - hit detection efficiency of L1

Debut of **fitting method** with effi. under control: 2022/Jan/07

Debut of **DUT method**: 2022/Dec/02

In ELPH report

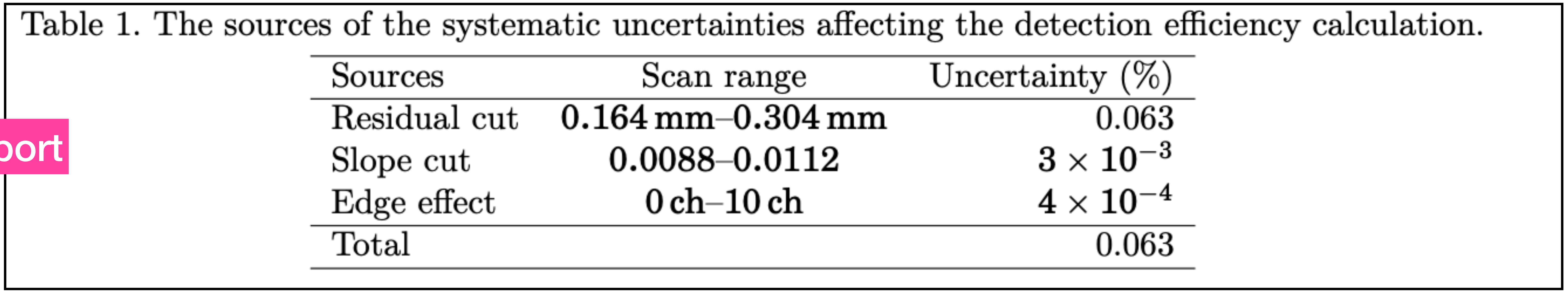


Table 1. The sources of the systematic uncertainties affecting the detection efficiency calculation.

Sources	Scan range	Uncertainty (%)
Residual cut	0.164 mm–0.304 mm	0.063
Slope cut	0.0088–0.0112	3×10^{-3}
Edge effect	0 ch–10 ch	4×10^{-4}
Total		0.063

$$99.33 \pm 0.04(\mathrm{stat}) \pm 0.06(\mathrm{sys})\,\%$$

------------New------------

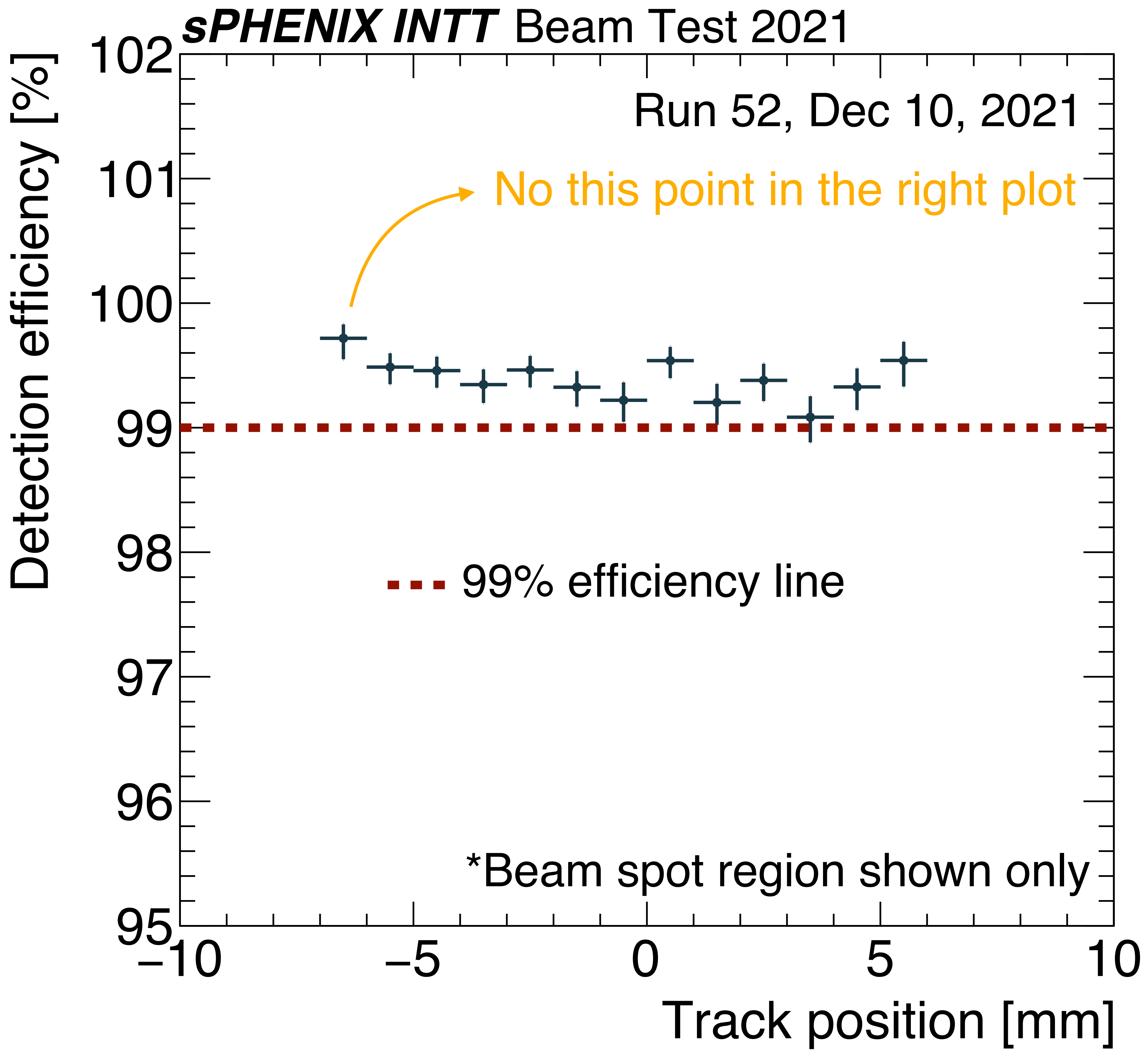
From Run52, hit detection efficiency (Combined): $99.705\ ^{+0.026}_{-0.028}(stat.)\ ^{+0.090}_{-0.018}(syst.)\ \%$

- In ELPH report, the average of variation is used as uncertainty (insensitive to the tested variations)
  - In new result: differences are summed up in quadrature (conventional way)
  - In new result: one more source considered: **column variation**
- 0.234 mm (0.7 mm) is used for Residual cut in ELPH (New results)
  - Good agreement with MC in residual distribution obtained, therefore loose the selection a bit

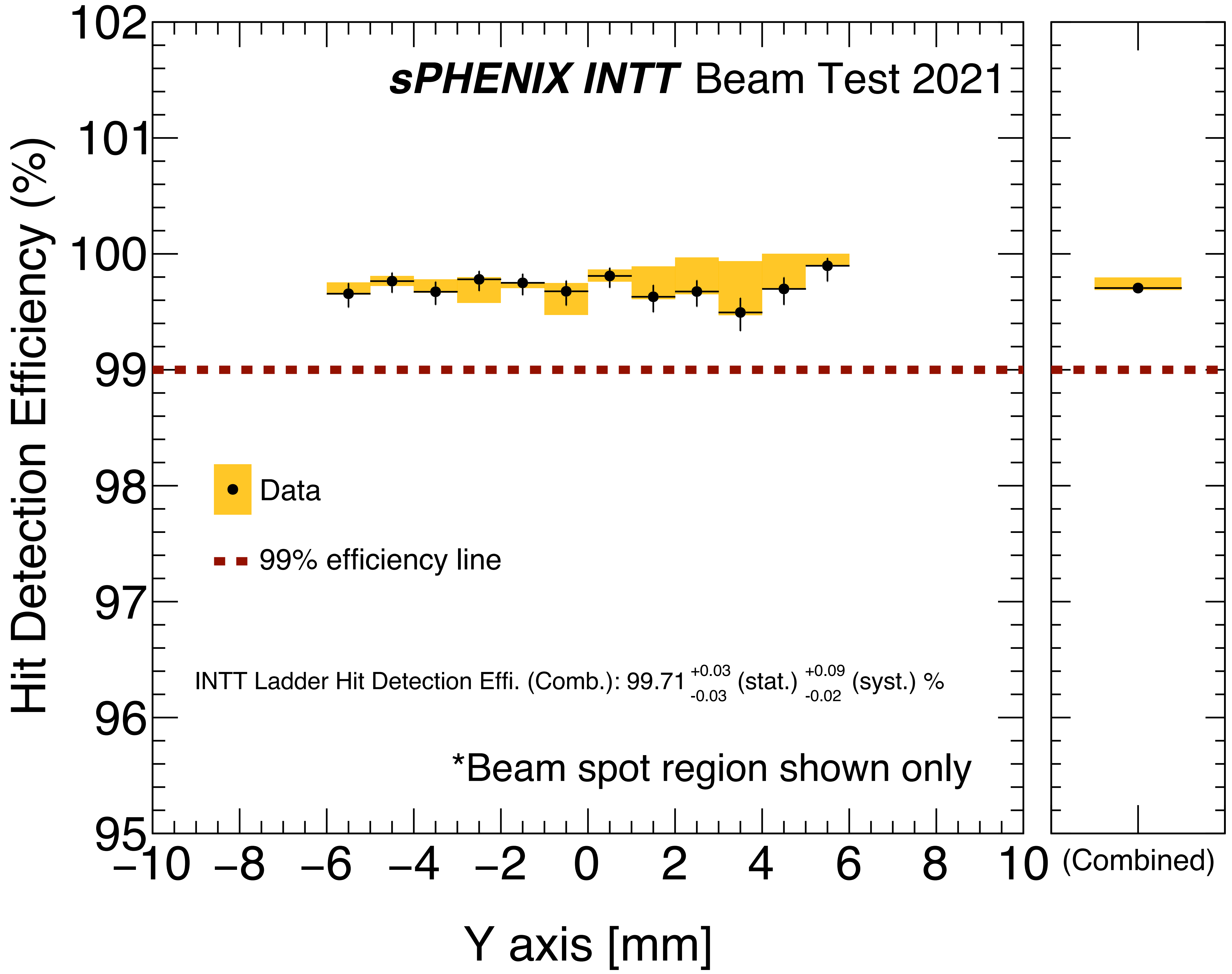
Recap - hit detection efficiency of L1

Debut of **fitting method** with effi. under control: 2022/Jan/07
Debut of **DUT method**: 2022/Dec/02

The previous plot (the one on ELPH report)



The new plot with same bin width for comparison



In comparing the baseline data points, basically same shape

Things that might affect detection efficiency

- The current measured hit detection efficiency in data: > 99.5% (w/ Residual cut 0.7 mm)

- Precision limit of physics model in GEANT in large angle
  - The used residual cut determined by MC is too narrow, efficiency goes down ↓

- Possible extra background/noise hit contamination in data
  - Extra hits that somewhat match to the reconstructed track, efficiency goes up ↑
  - What fraction of hits that are noise hits, but are treated as signal hits due to their small L1 residuals?

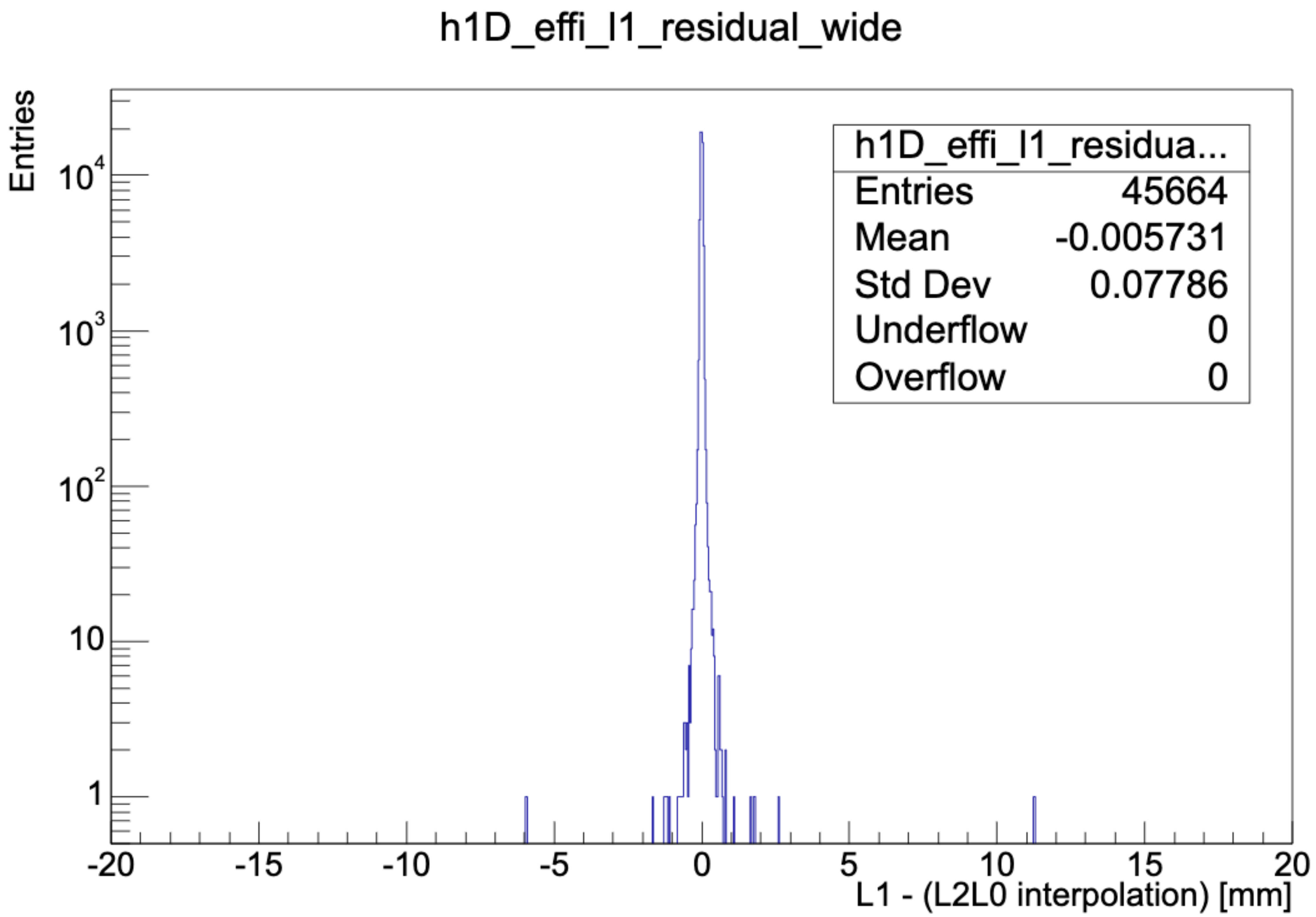
- Hit detection **inefficiency** due to the threshold setting
  - Assuming the threshold is set to be too high, efficiency goes down ↓

- INTT readout system (including silicon, signal transmission, processing, etc.)
  - Hits are somewhat dropped along the way from detection to data storage, efficiency goes down ↓

Things that might affect detection efficiency

- Is the residual cut determined by MC too narrow that makes efficiency go down↓?
  - Even if we have no residual cut (set the residual cut to be 20 mm), the efficiency increases only 0.0393%

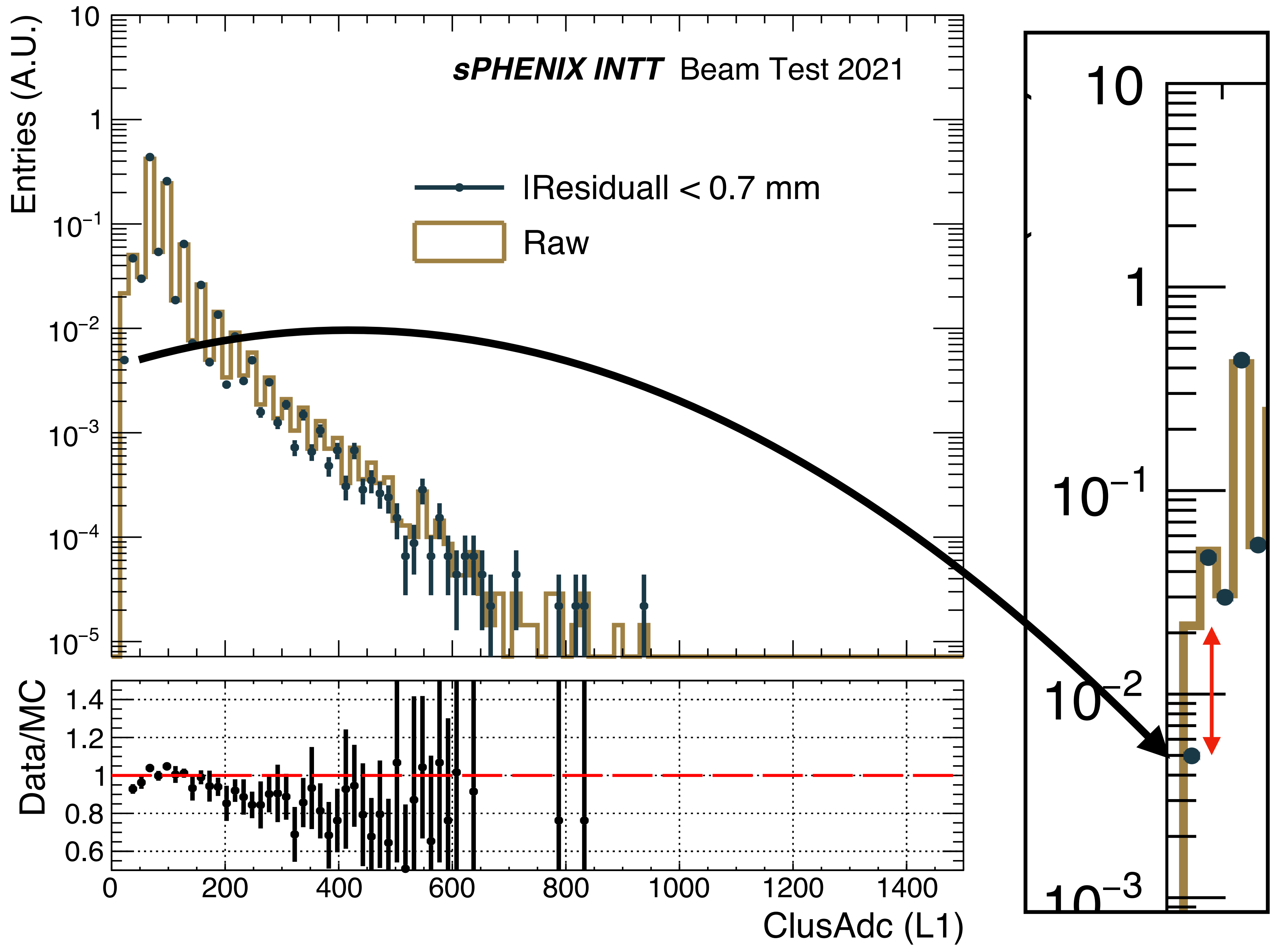
Residual cut	numerator	Increment	denominator	efficiency
0.7 mm	45646	0	45787	99.6921
1.0 mm	45653	7	45787	99.7073
3 mm	45662	16	45787	99.7270
5 mm	45662	16	45787	99.7270
20 mm	45664	18	45787	99.7314

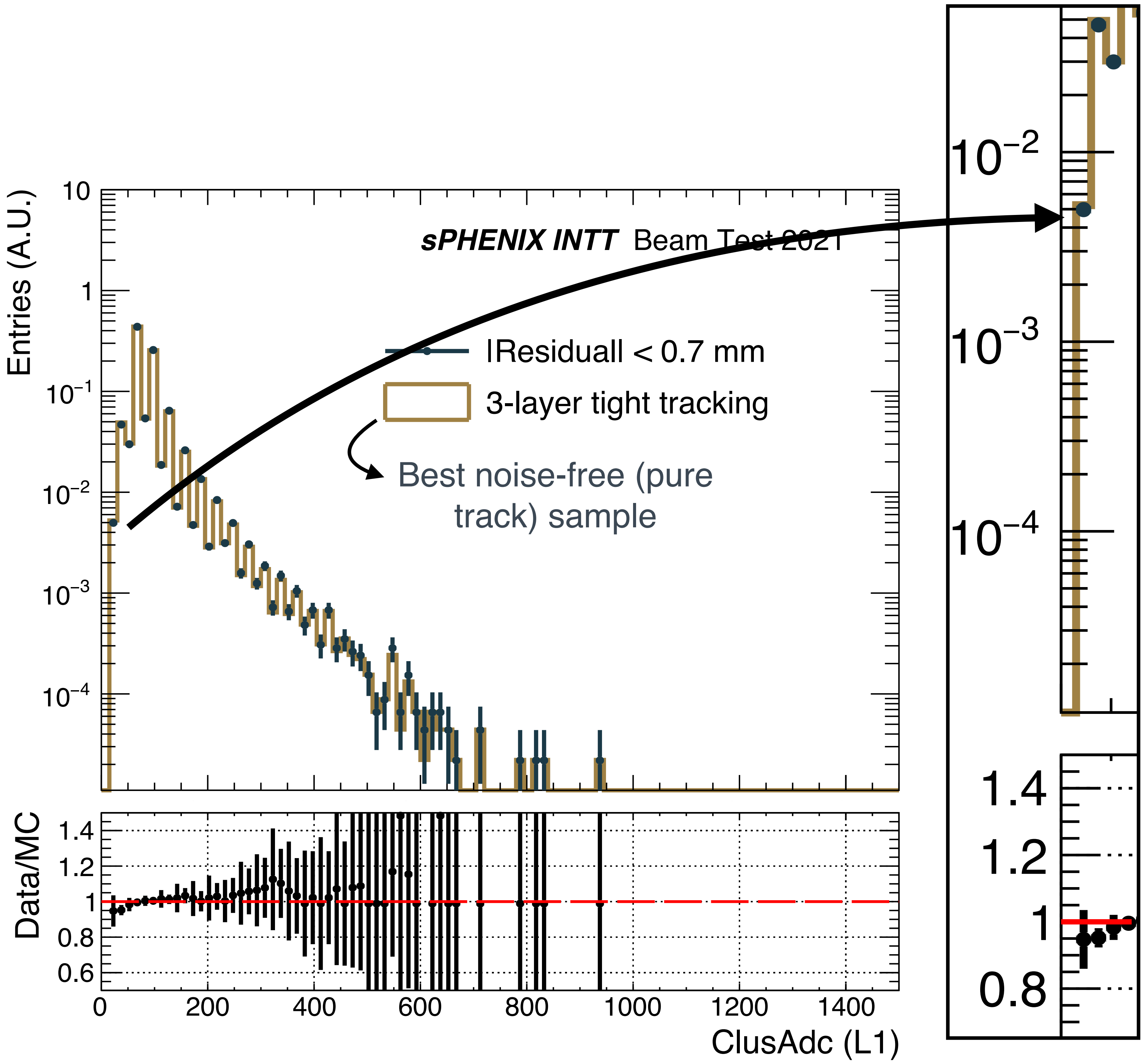


Threshold cut should not be the concern

Things that might affect detection efficiency

- Noise hits been counted as good hits in detection efficiency measurement?
  - Can be probed by cluster ADC distribution





Best noise-free (pure track) sample

- (Left Figure) In the Raw distribution, more single-hit clusters with hit ADC = 0
  - The noise hits are reduced in the hit finding in the detection efficiency measurement
- (Right Figure) The 3-layer tight* tracking is the most powerful way to reject noise hits in the beam test configuration
  - Good agreement in the first bin → marginal noise contamination

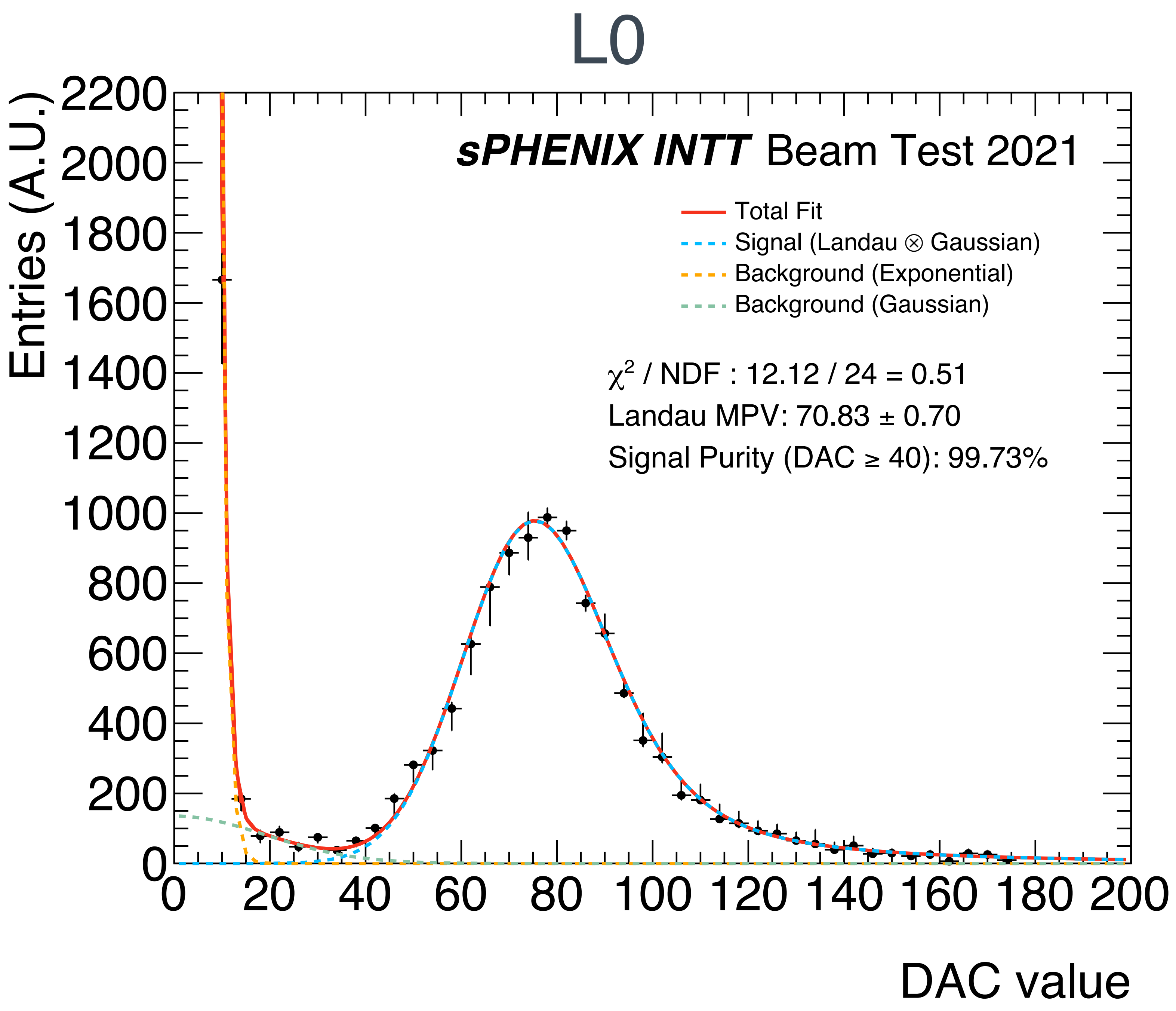
Noise hit contamination is marginal

*tight: single cluster in each selected column, no cluster in adjacent columns, track slope < 0.01 and L1 residual < 0.7 mm

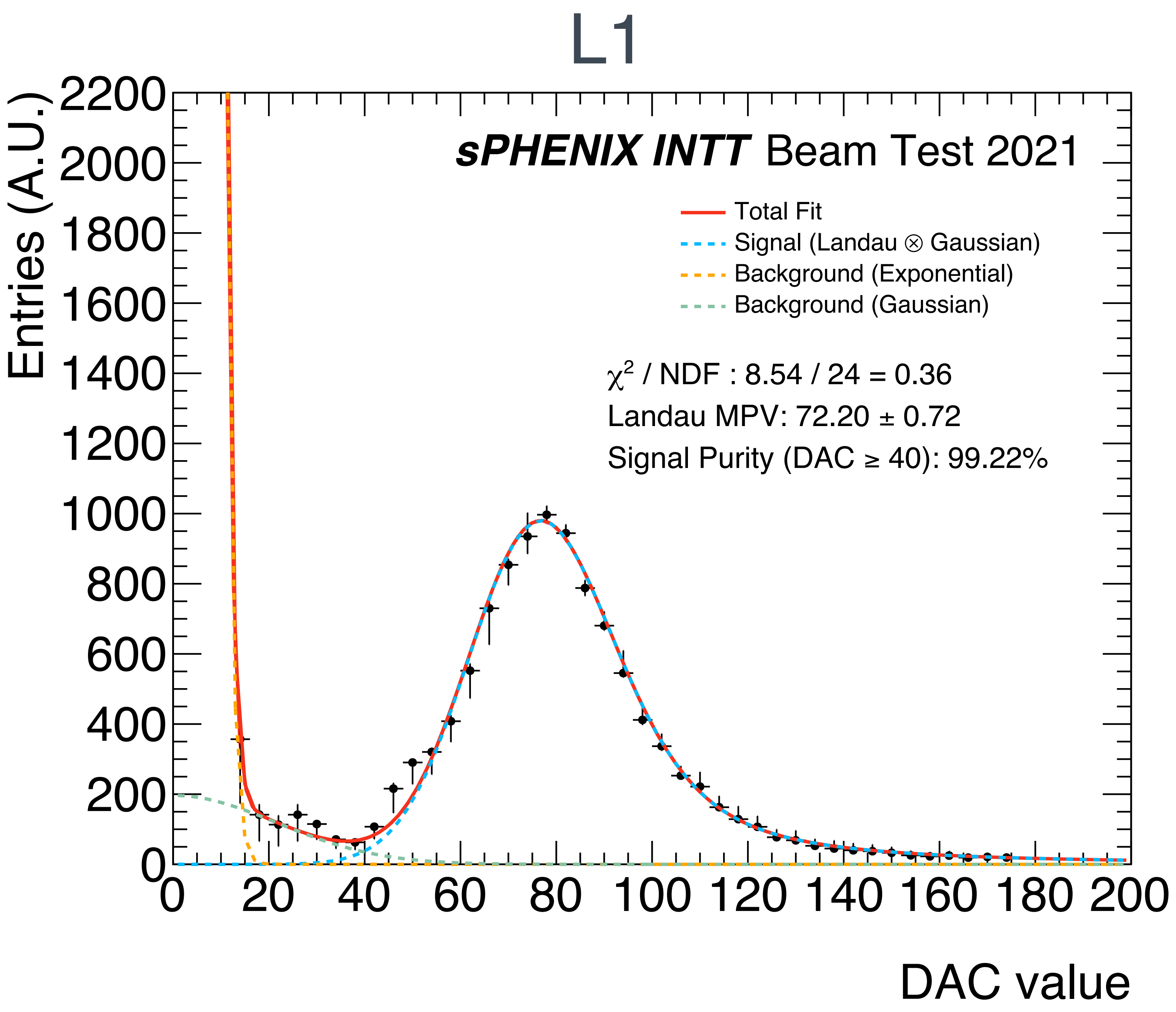
Things that might affect detection efficiency

- Is the threshold setting of 15 ADC too high that might kill the signal leading to low detection efficiency?
  - Can be probed by the energy deposit distributions

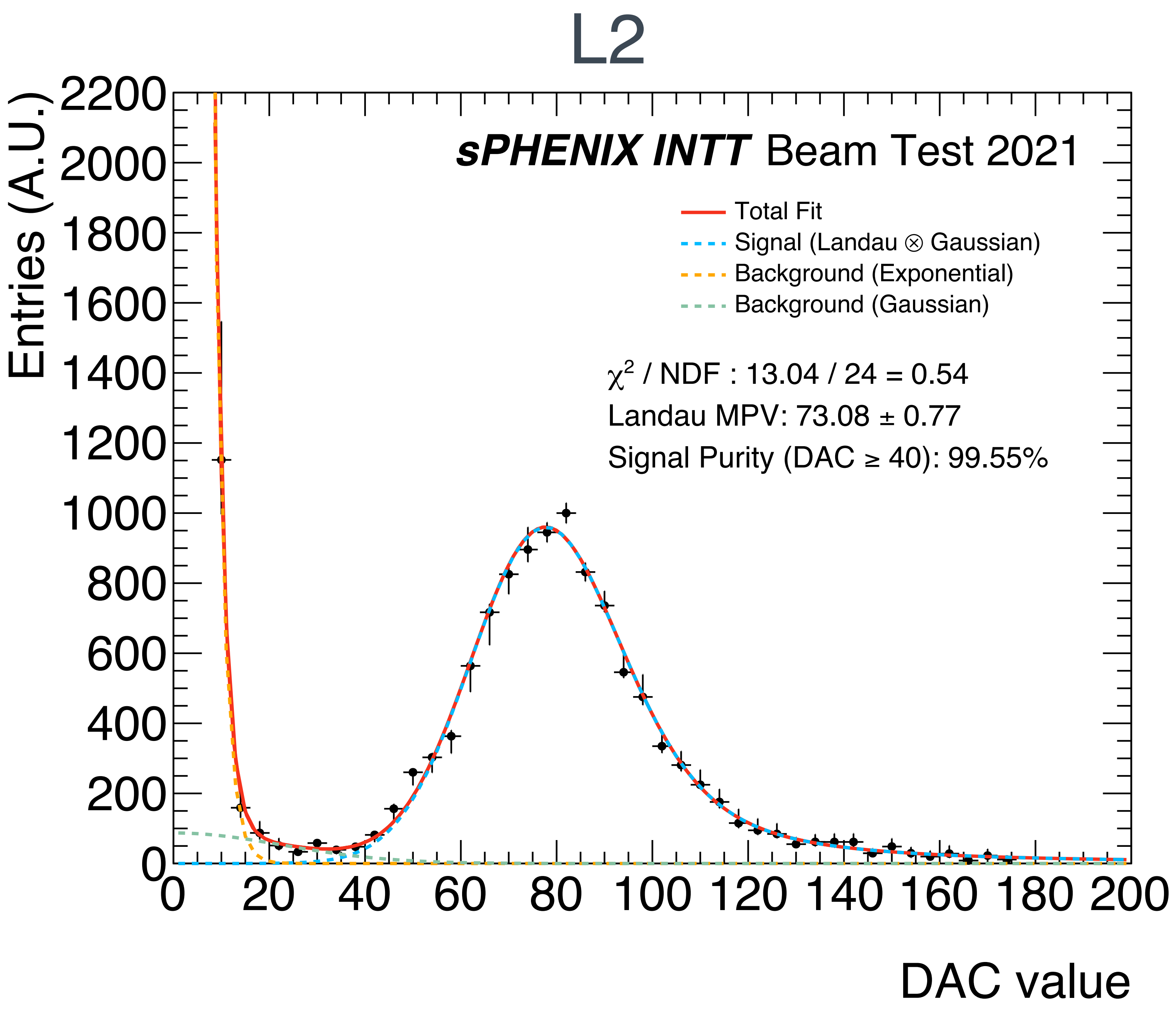
L0
Integral 0-15 = 0.3065,
Integral 0-210 = 42250.3702,
<u>Ratio = 7.25516e-06</u>



L1
Integral 0-15 = 0.1960,
Integral 0-210 = 42618.2116,
<u>Ratio = 4.59845e-06</u>



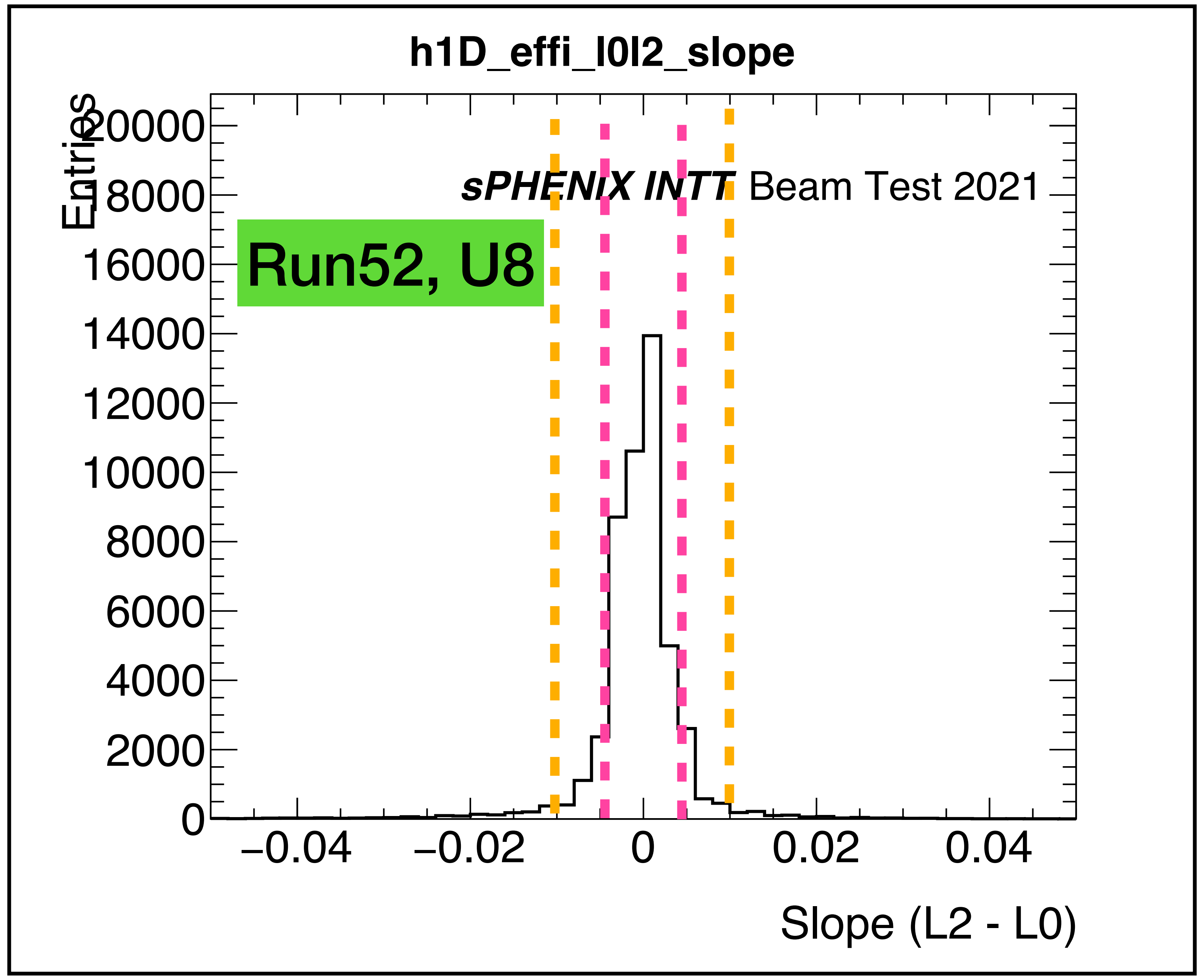
L2
Integral 0-15 = 0.3882,
Integral 0-210 = 42598.5011,
<u>Ratio = 9.11214e-06</u>



The inefficiency due to threshold selection is very very small

Extra test, tightening the slope cut

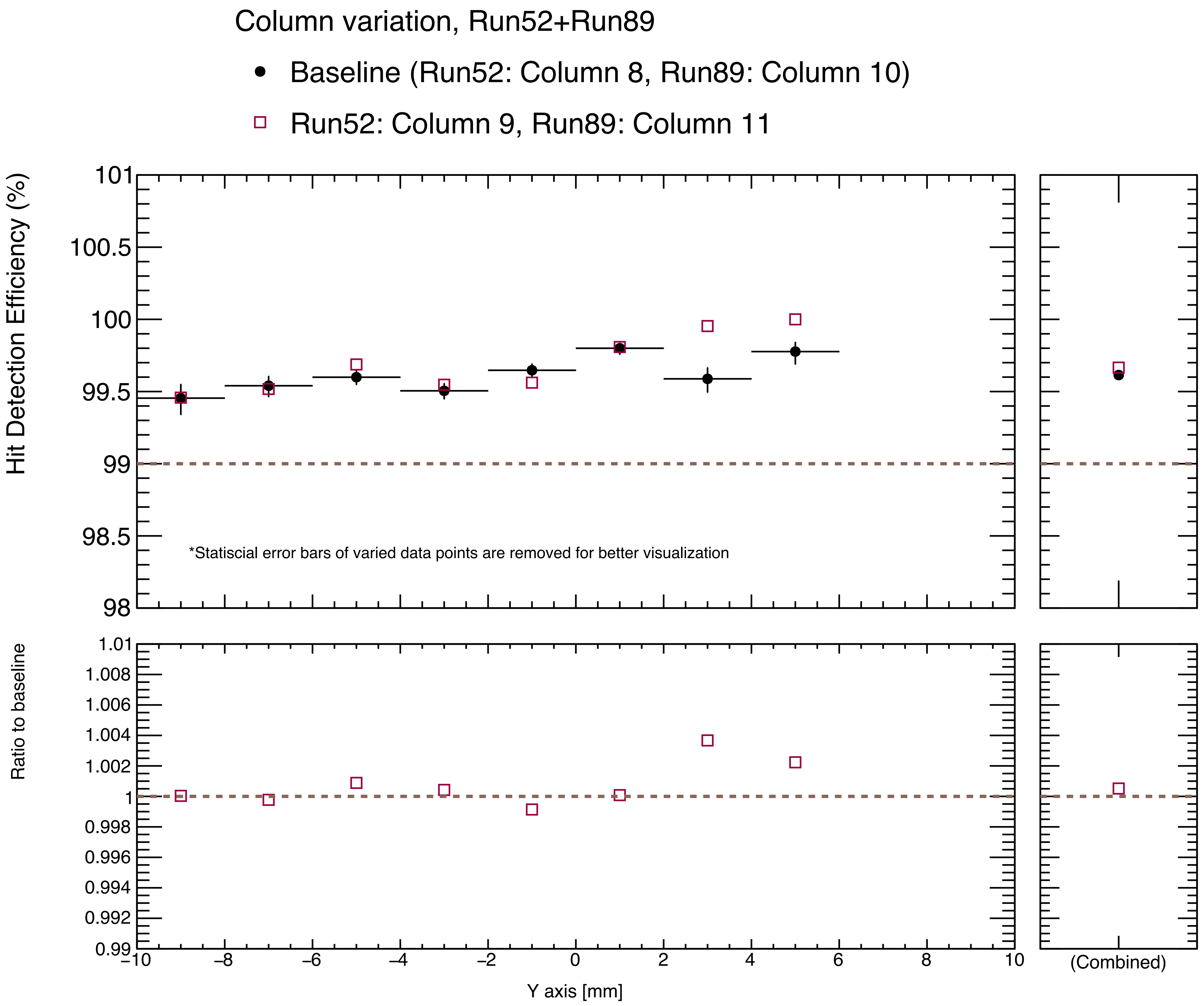
- The baseline is 0.01 with the variations of 0.007 and 0.013
- The trial: 0.004

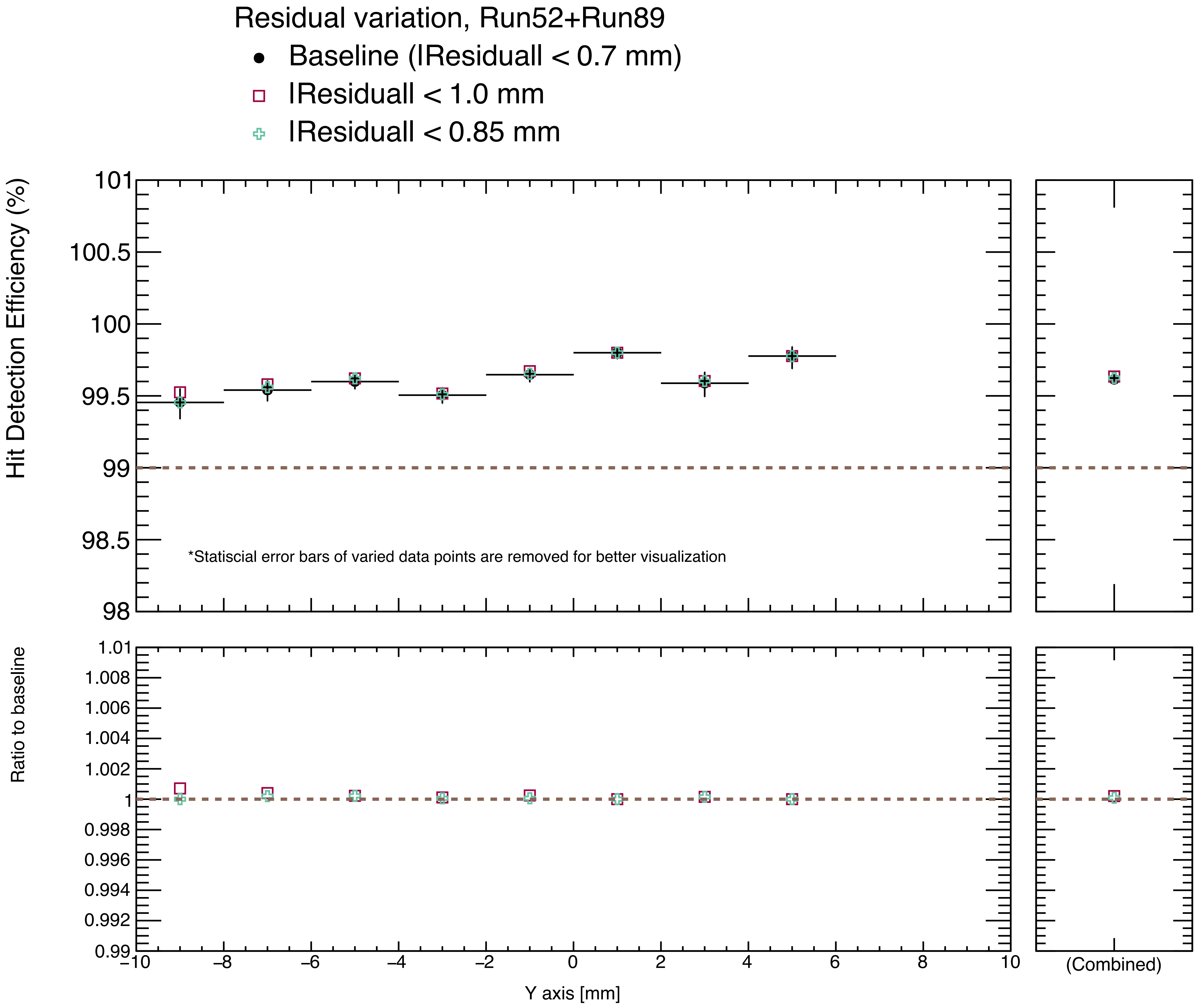


Efficiency moves from 99.6921% to 99.7125%, no dramatic change

Final, Run52 & Run89 combined

Wider coverage in Y axis: -10 mm to 6 mm





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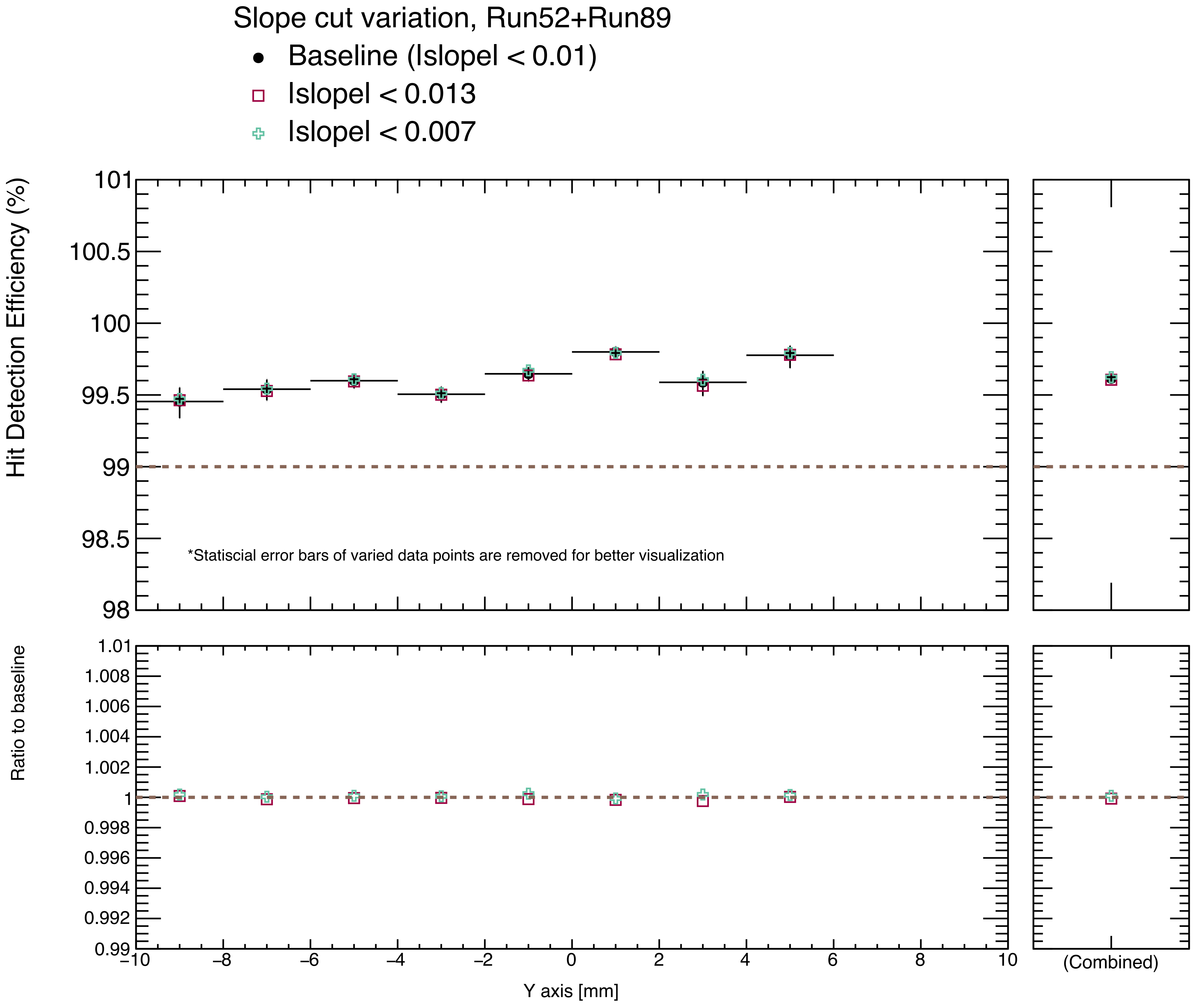
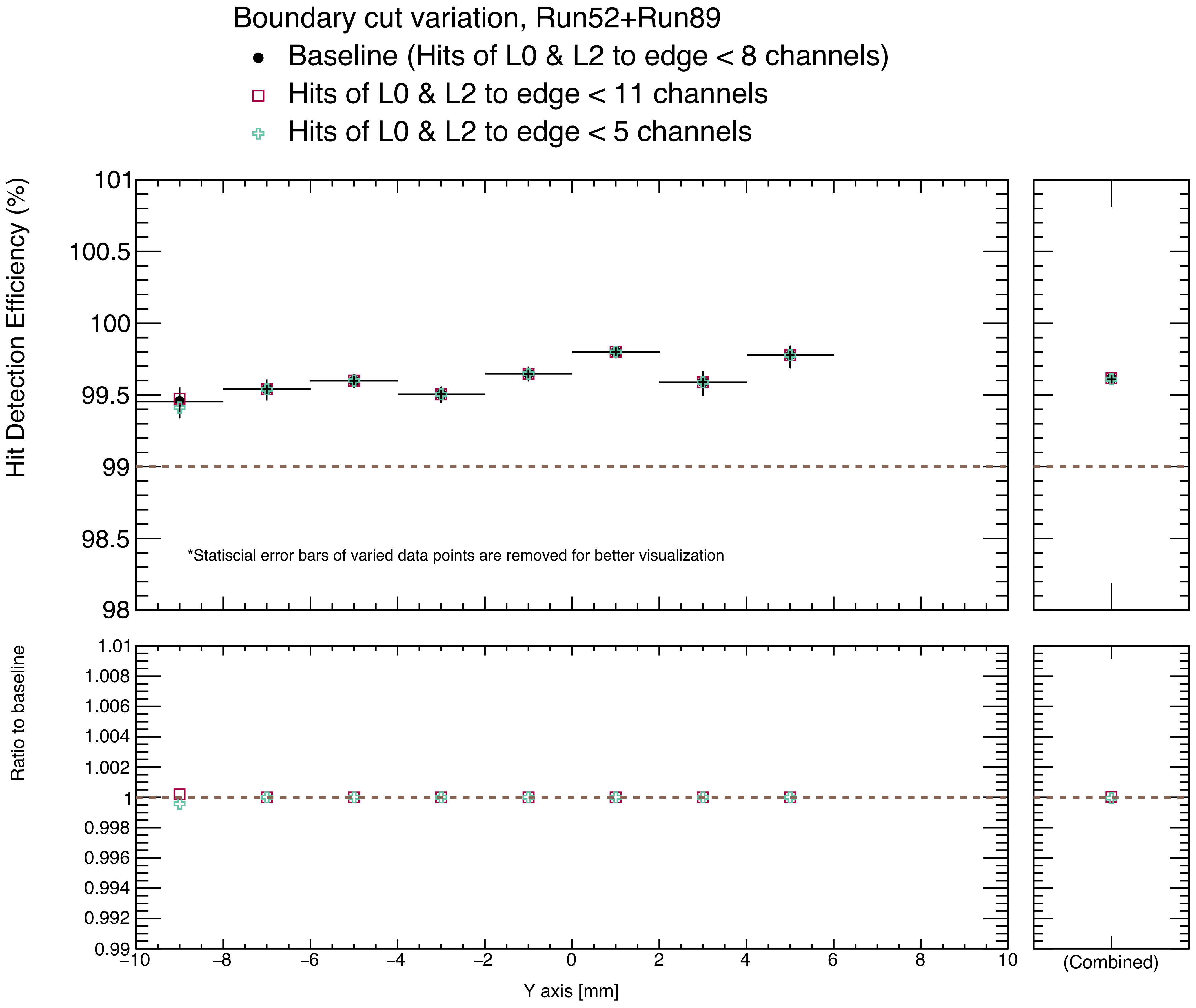
Final, Run52 & Run89 combined

Wider coverage in Y axis: -10 mm to 6 mm



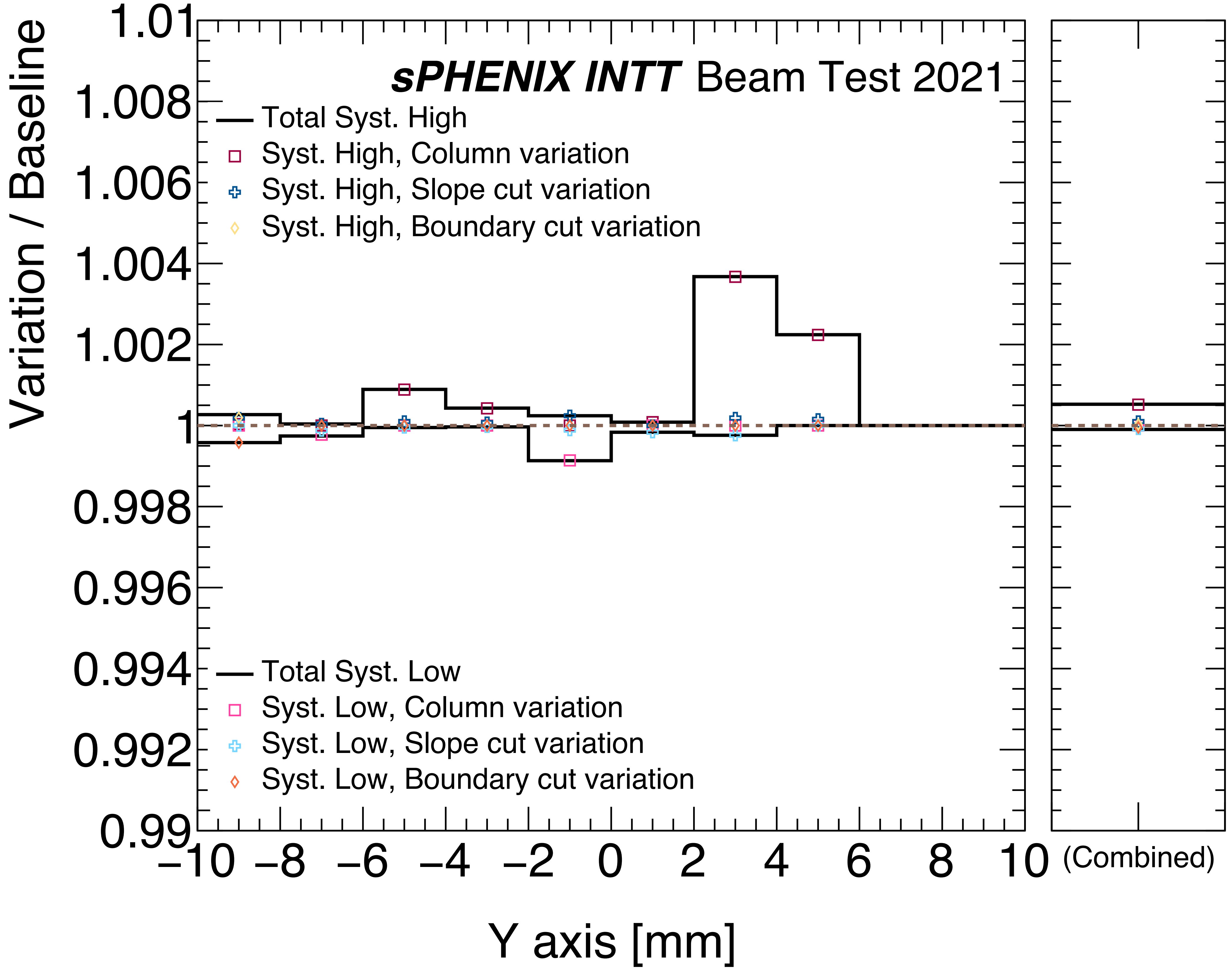


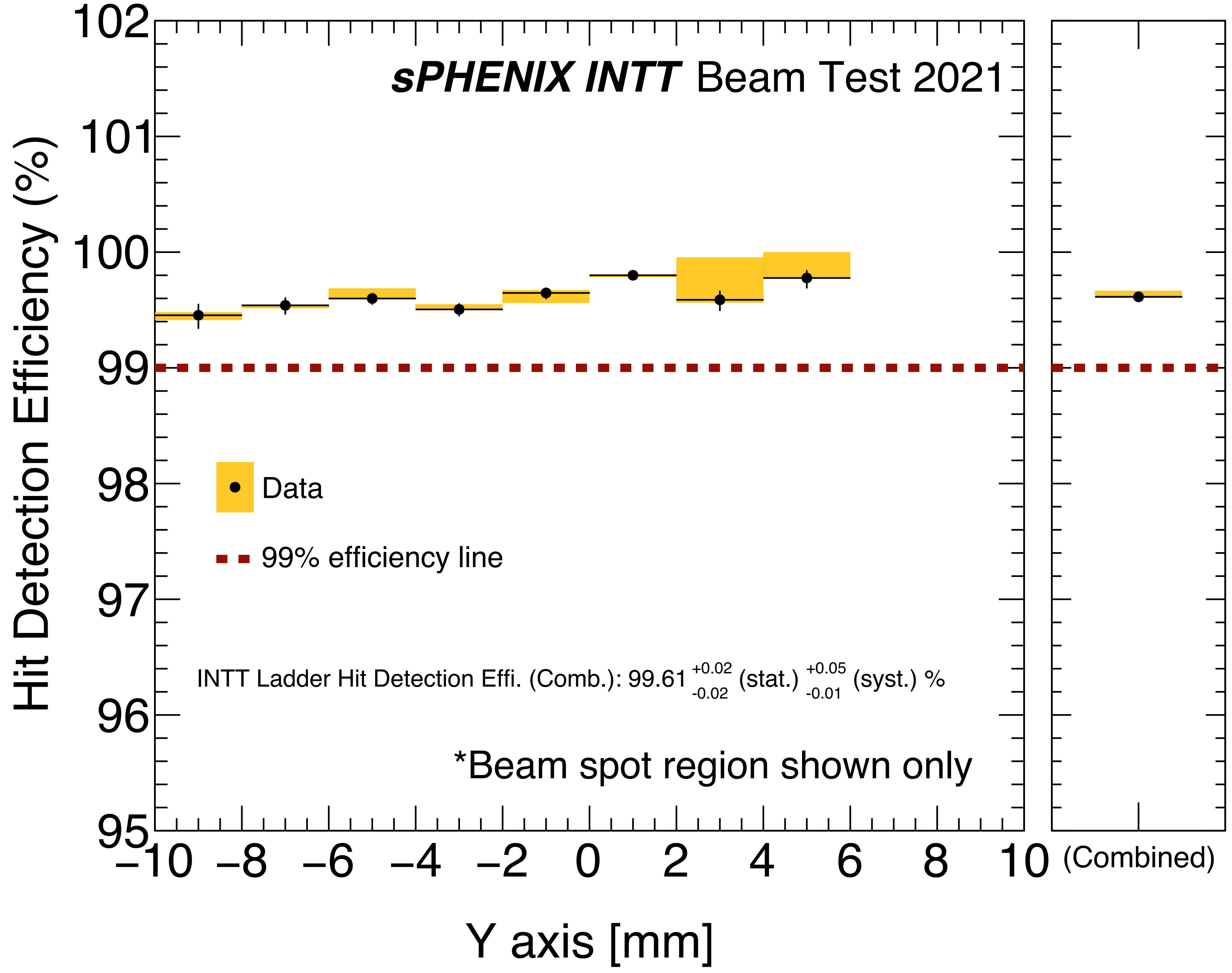
Final, Run52 & Run89 combined

Hit detection efficiency (Combined)

It was: $99.576\,^{+0.021}_{-0.022}(stat.)\,^{+0.079}_{-0.125}(syst.)\,\%$

Numbers to be in paper (tentative) It is : $99.61\,^{+0.02}_{-0.02}(stat.)\,^{+0.05}_{-0.01}(syst.)\,\%$





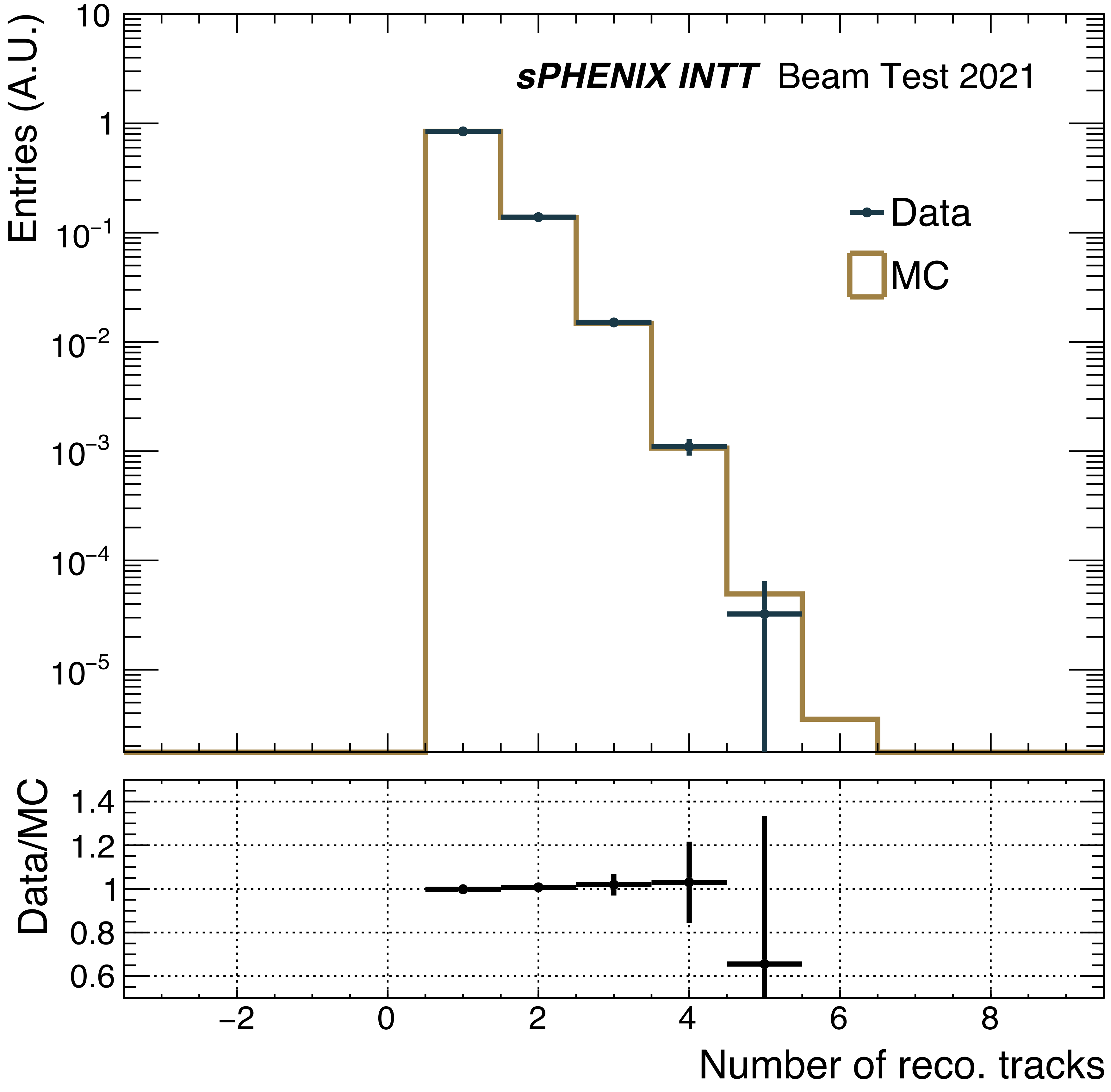
Plot to be in paper (tentative)

The 0.4% inefficiency can be due to signal processing (from detection to data storage) and simulation modeling limitation

Number of reconstructed tracks

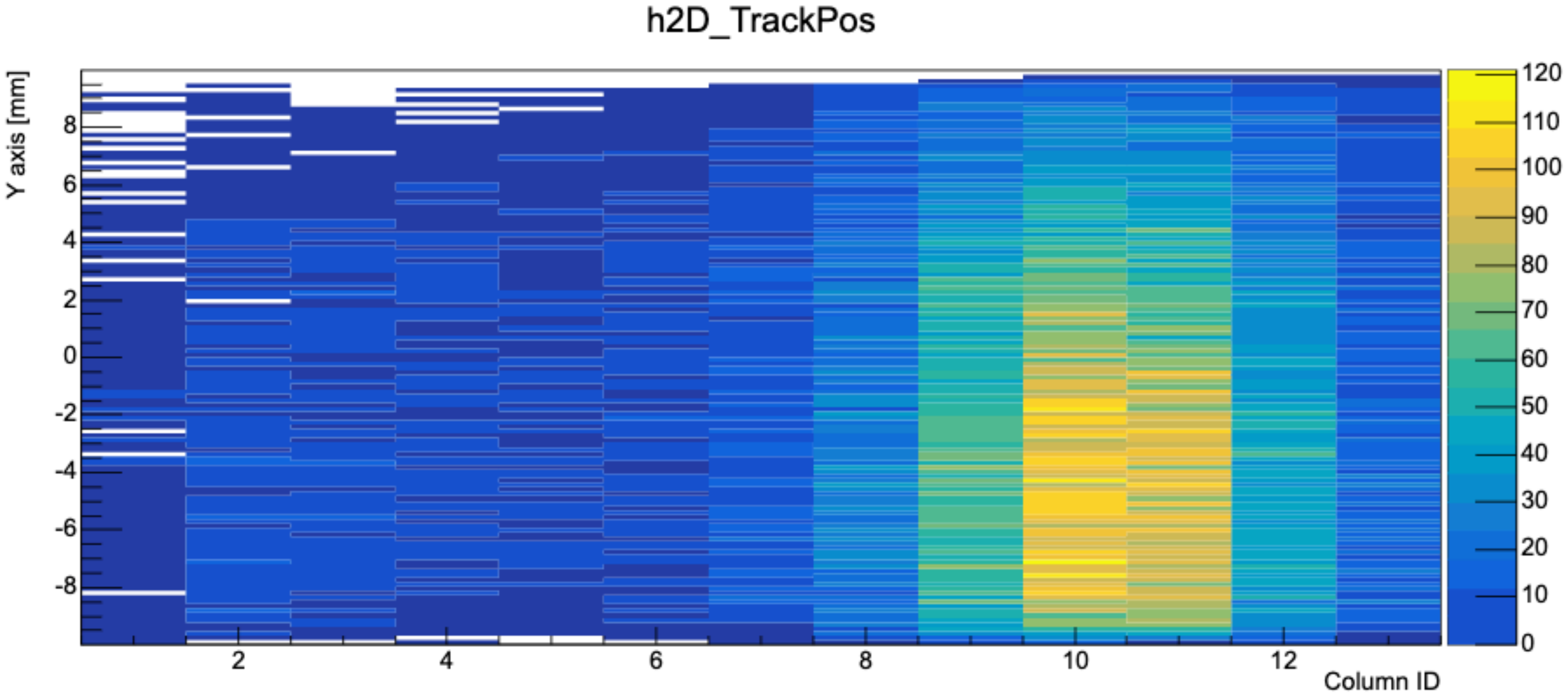
- Change the residual cut for track QA from 0.5 mm to 0.7 mm, to be in line with what used in hit detection efficiency

All columns included



Plot to be in paper (tentative)

Track position in data



Summary

- Energy deposit distribution (DAC Scan)
  - Genki: are the distribution shapes of U9, U10, and U11 the same? → **Yes**
  - Takashi: what is the proper way to combine distributions → **As what we agreed last week, the statistical error inflation is removed, and the maximal variation is quoted as systematic uncertainty**

- Residual distribution
  - Genki: in L1L0 slope distributions, why there are dips in distributions? → **As demonstrated, due to binning effect**

- Hit detection efficiency:
  - Itaru: the simulation should be a reference to determine the proper residual cut → **As demonstrated with simulation, > 99.995% of hits can be retained with a residual cut of 0.7 mm. Residual cut of 0.7 mm is then used in data**
  - Itaru: Any things that might affect the detection efficiency measurement → **Yes, the effects due to Residual cut, noise hit, and threshold setting are evaluated. And they are marginal**

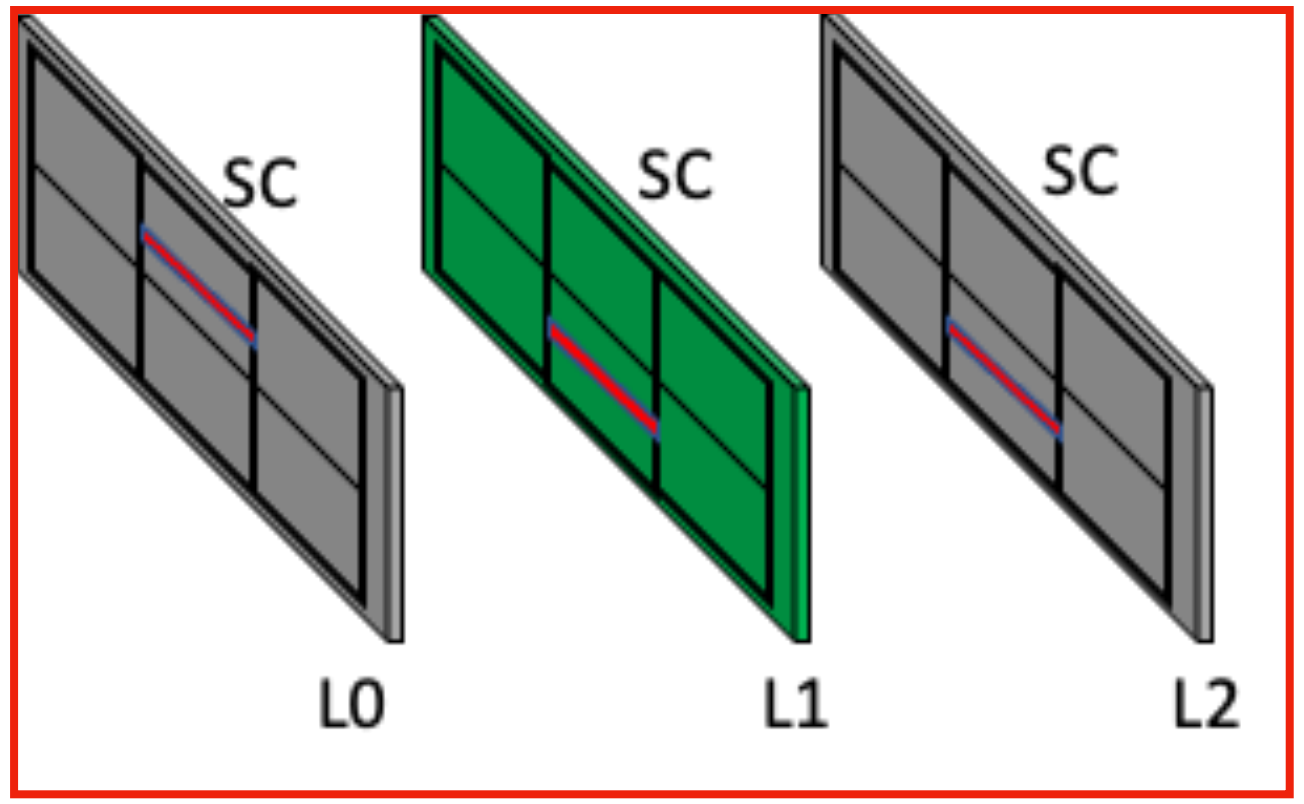
Back up

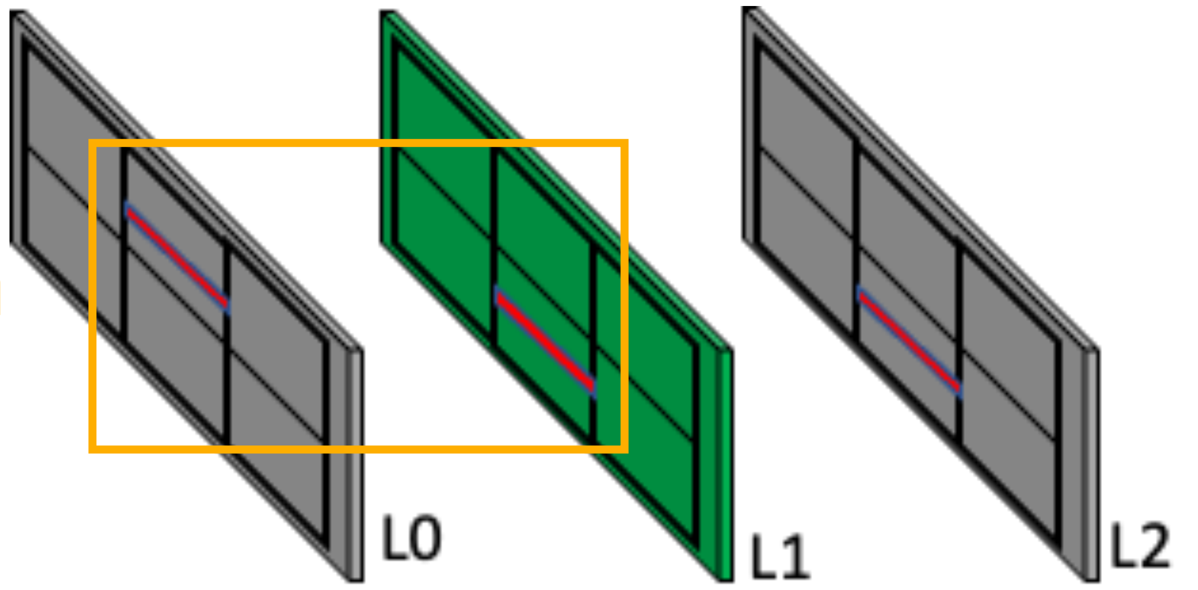
Scattering comparison with MC

- Method: L0L1 are used for reconstructing proto-track (have constrain), set L2 free

- Data: Run52, column U8, events with clone hit are discarded
- MC: beam spot at center of ladder, U11 is used

- For both data and MC:
    - L1 alignment correction and L0L1 slope re-centering applied
    - Event selection:
        - Single hit in each layer
        - Hits should be at the Selected Column (SC)
        - |L0L1_slope| ≤ 0.01
        - |L0L1_avg_pos| ≤ 5 mm (Ladder coverage: ±10 mm)
    - Check residual: L1 - (L2L0 interpolation)
        - Quantity used in hit detection efficiency analysis





Constrain on proto-track

Hit detection efficiency

- Method: DUT approach (Detector Under Test)
  - Use L0 and L2 to reconstruct tracks. When good track is found, check clusters in L1
- Data: Run52 and Run89
- L1 alignment correction and L0L2 slope re-centering applied before event selection

Tracking	Events with clone hits found are discarded
	Single cluster in Selected Column (SC) of L0 (abbr. SCL0) and L2 (abbr. SCL2) required
	For three layers, require no cluster in adjacent columns (SC-1 & SC+1)

Track QA	Edge exclusion	(ladder bottom edge + 8 ch) < Y-pos of SCL0 and SCL2 < (ladder top edge - 8 ch)
	Cluster ADC	Cluster Adc of SCL0 > adc0 && Cluster Adc of SCL2 > adc0
	Slope cut	fabs(slope of SCL2 - SCL0) < 0.01
	Track pos.	Focus on beam spot region (Run52: -6 to 6 mm, Run89: -10 to 2 mm)

Good track classification	Residual	Smallest |CL1 - CL2&CL0 interpolation| < 0.7 mm

$$\text{Effi.} = \frac{\text{Good Events and L1 Good Cluster Found}}{\text{Good Events}} = \frac{N(L0 \bigcap L1 \bigcap L2)}{N(L0 \bigcap L2)}$$

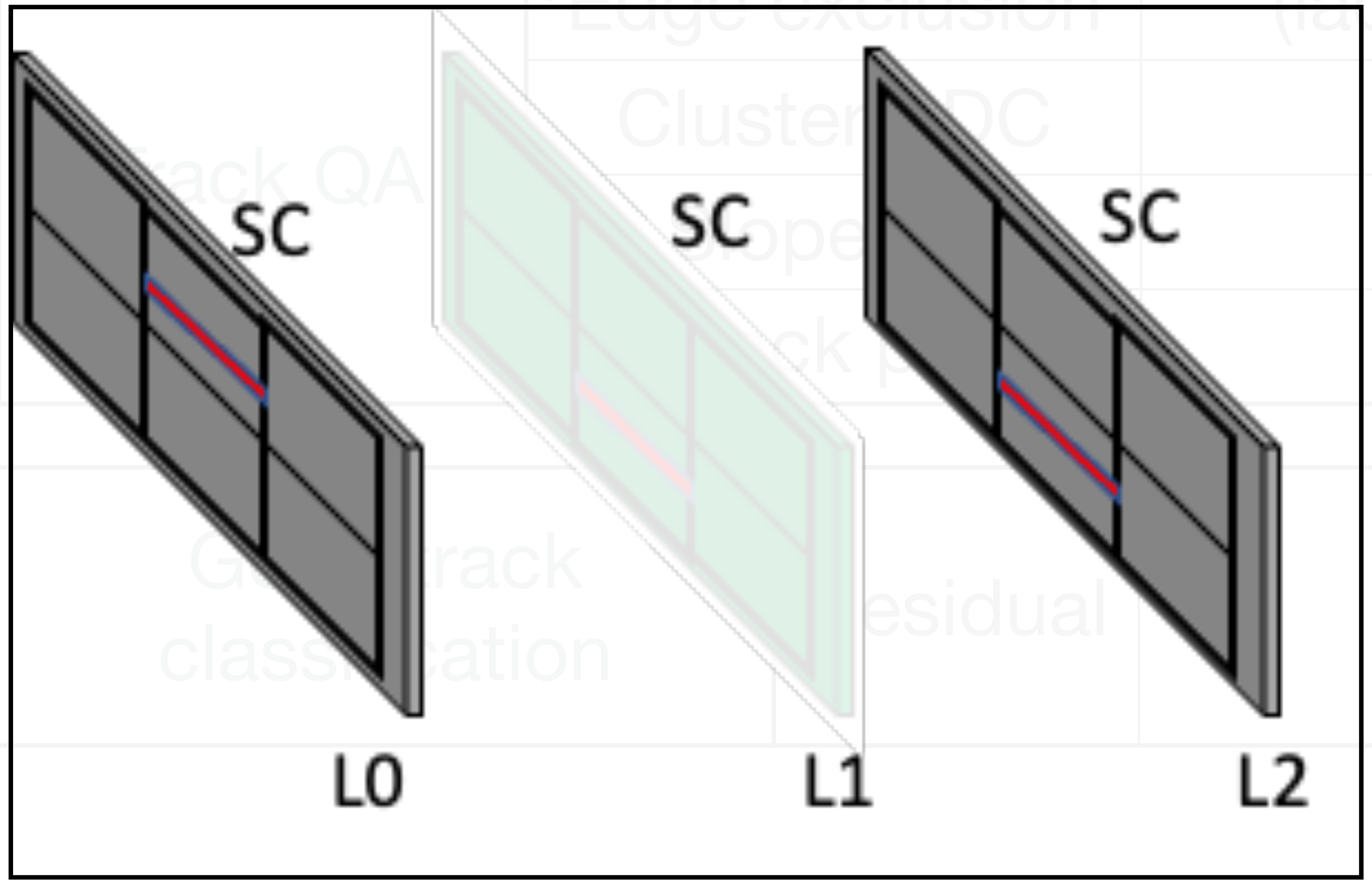
Hit detection efficiency

- Method: DUT approach (Detector Under Test)
  - Use L0 and L2 to reconstruct tracks. When good track is found, check L1
- Data: Run52, Colum[illegible]9, Events with clone hit are discarded
- L1 [illegible] CL0 [illegible]

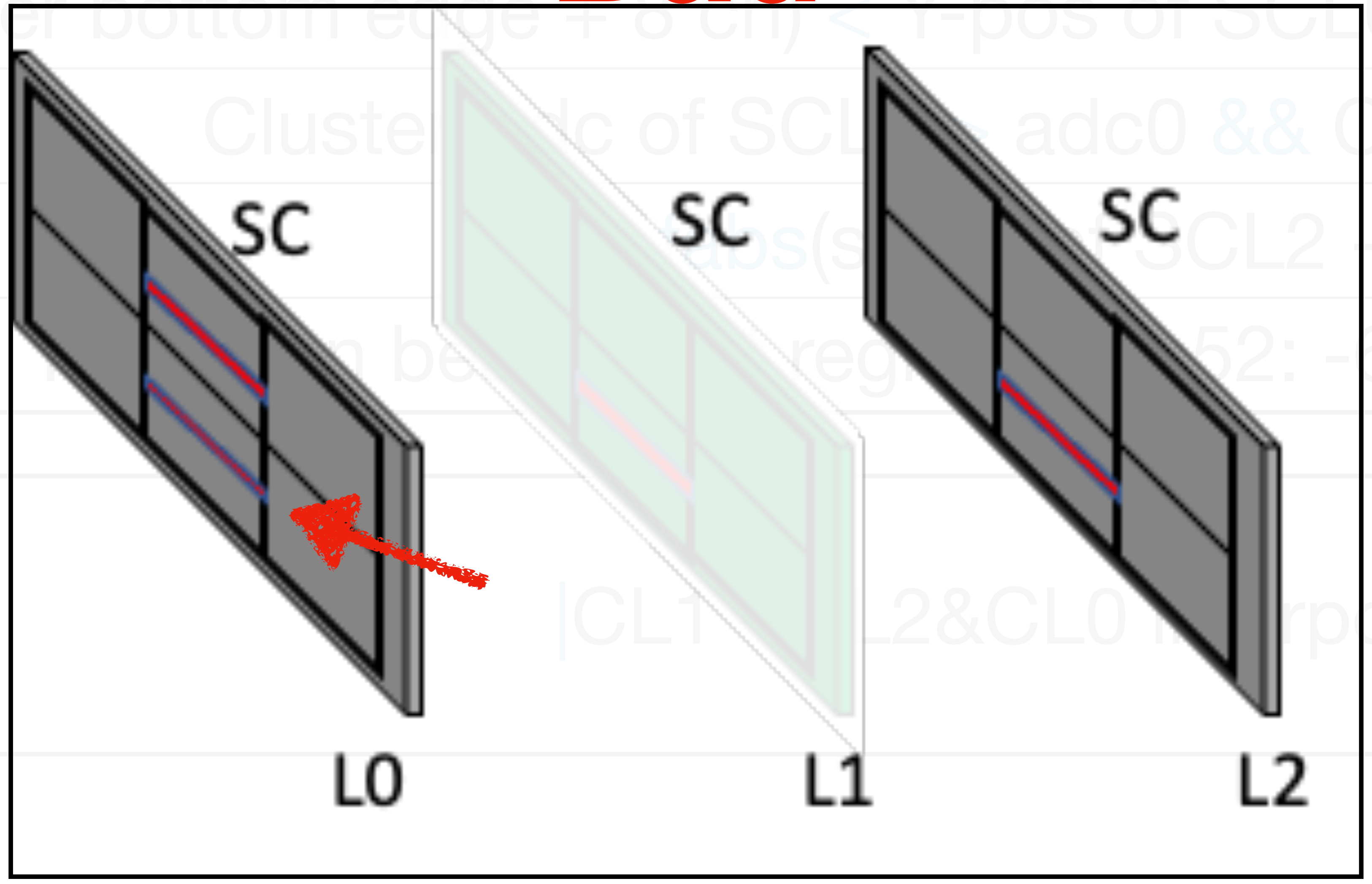
To minimize the ambiguity of track reconstruction
(Only two layers for track reco., to improve the purity, tight selection required)

Tracking	Events with clone hits found are discarded	
	Single cluster in Selected Column (SC) of L0 (abbr. SCL0) and L2 (abbr. SCL2) required	
	For three layers, require no cluster in adjacent Columns (SC-1 & SC+1)	
Track QA	Edge exclusion	(ladder bottom edge + 8 ch) < Y-pos of SCL0 and SCL2 < (ladder top edge - 8 ch)
	Cluster ADC	Cluster Adc of SCL0 > adc0 && Cluster Adc of SCL2 > adc0
	Slope	abs(s[illegible] SCL2 - S[illegible] [illegible].01
	Track [illegible]	[illegible] be[illegible] reg[illegible]52: -6 to [illegible] Run[illegible] 6 [illegible]
Good track classification	Residual	|CL1 [illegible] L2&CL0 interpolation| < 0.[illegible] mm

Good



Bad



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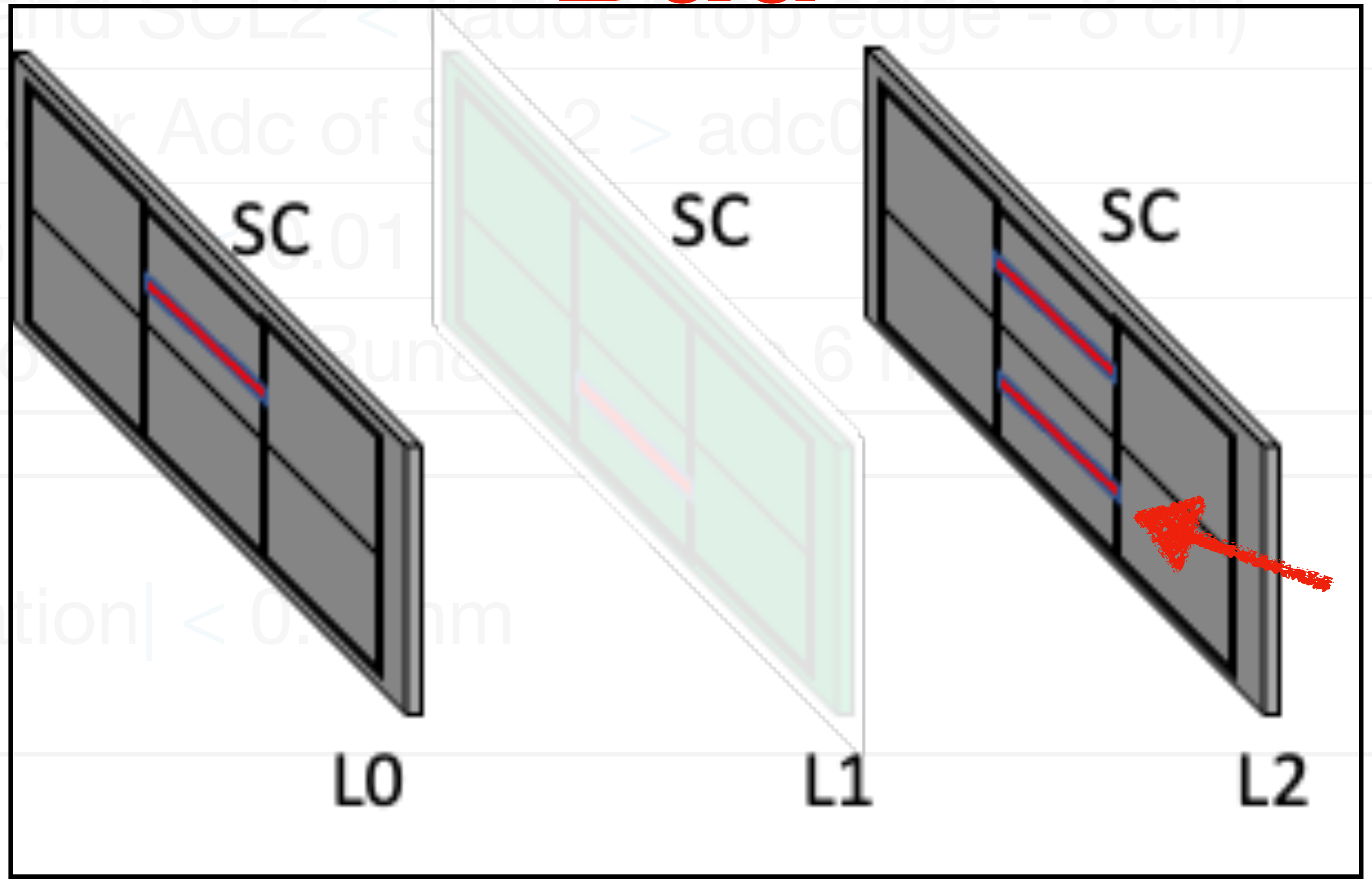


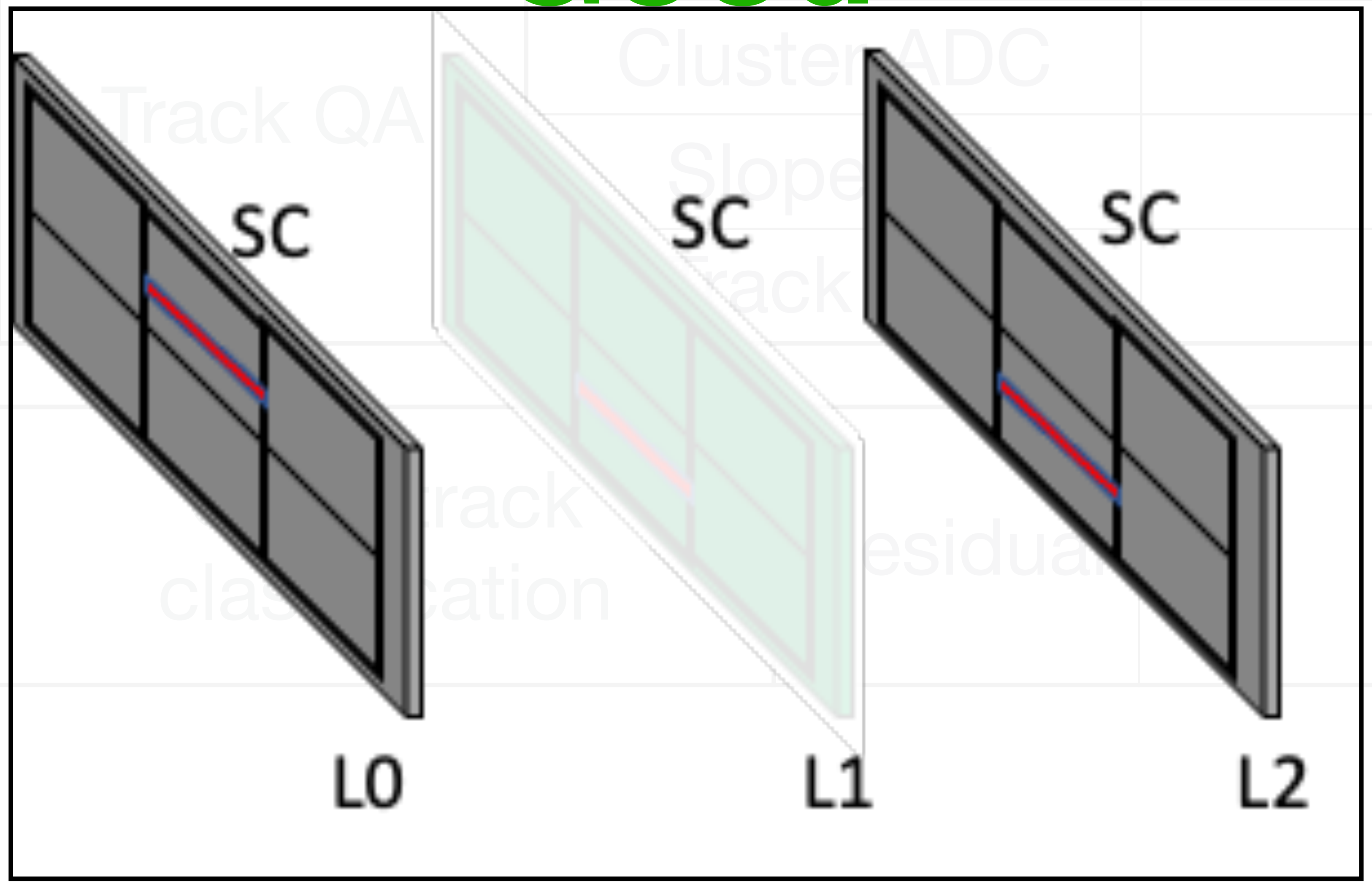
Hit detection efficiency

- Method: DUT approach (Detector Under Test)
  - Use L0 and L2 to reconstruct tracks. When good track is found, check L1
- Data: Run52, Column U8. Events with clone hit are discarded

To account for the misalignment in the longitudinal axis (x axis)

Tracking	Events with clone hits found are discarded
	Single Cluster in Selected Column (SC) of L0 (abbr. SCL0) and L2 (abbr. SCL2) required
	For three layers, require no cluster in adjacent columns (SC-1 & SC+1)

Good



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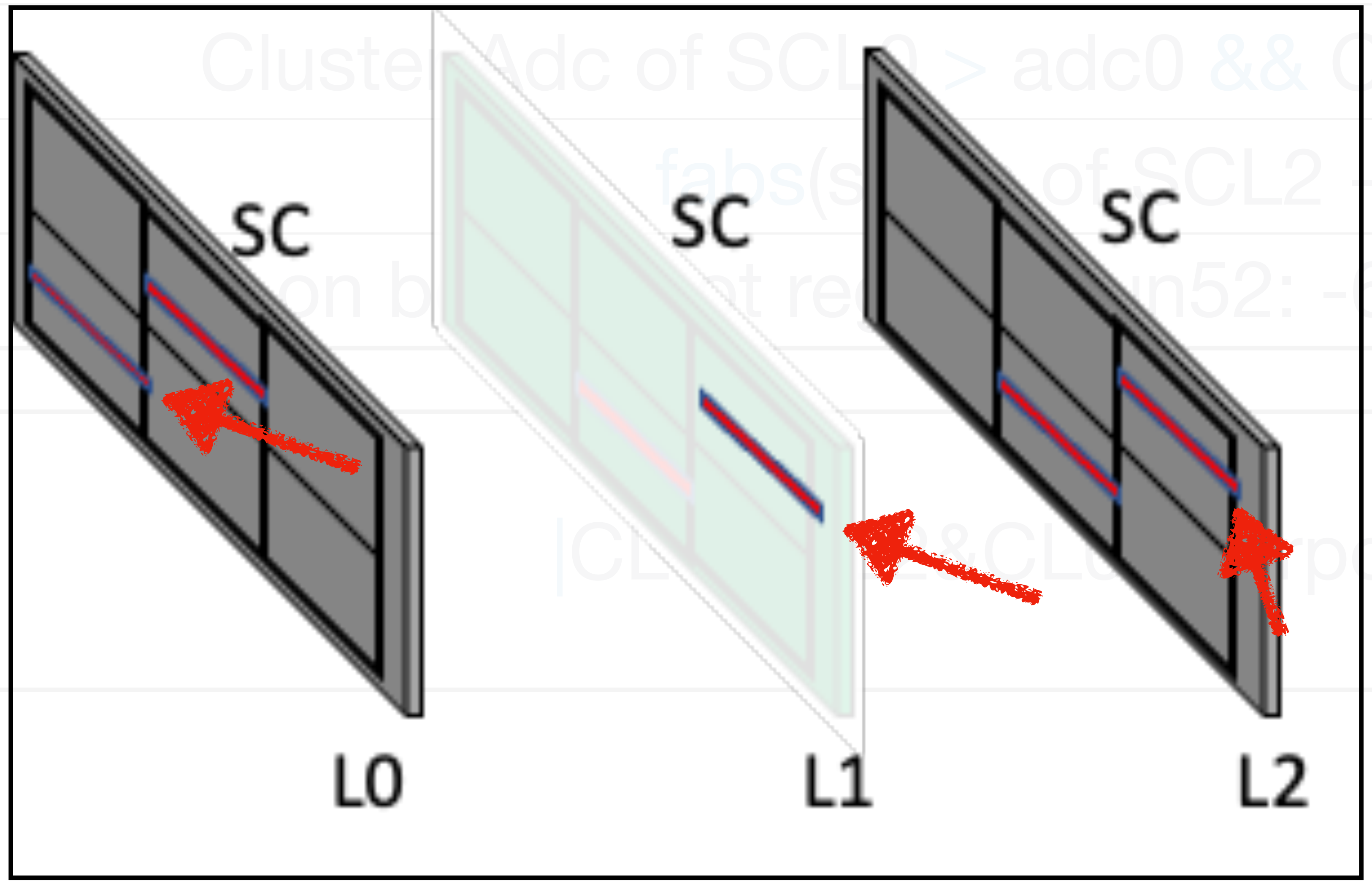

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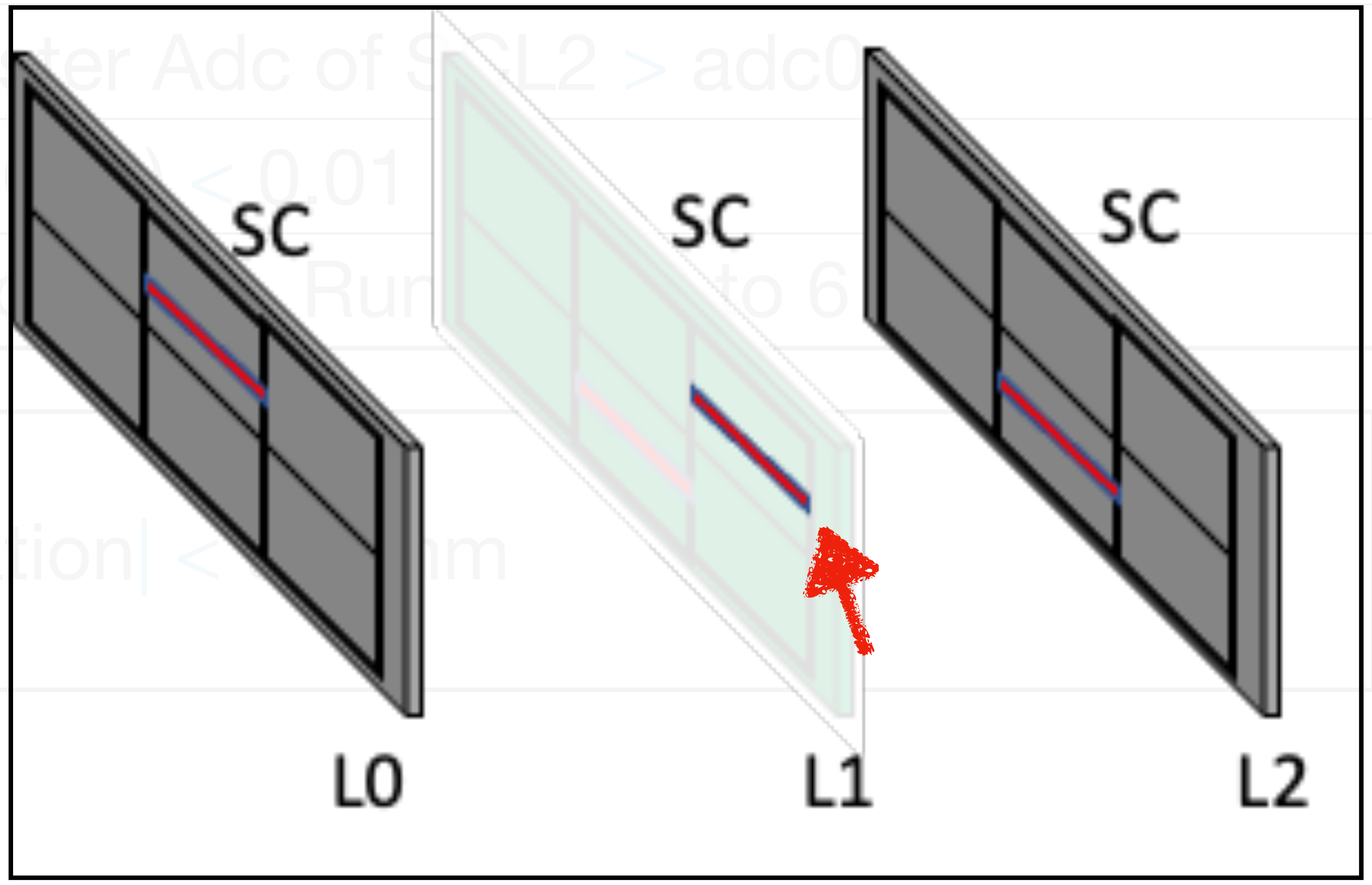
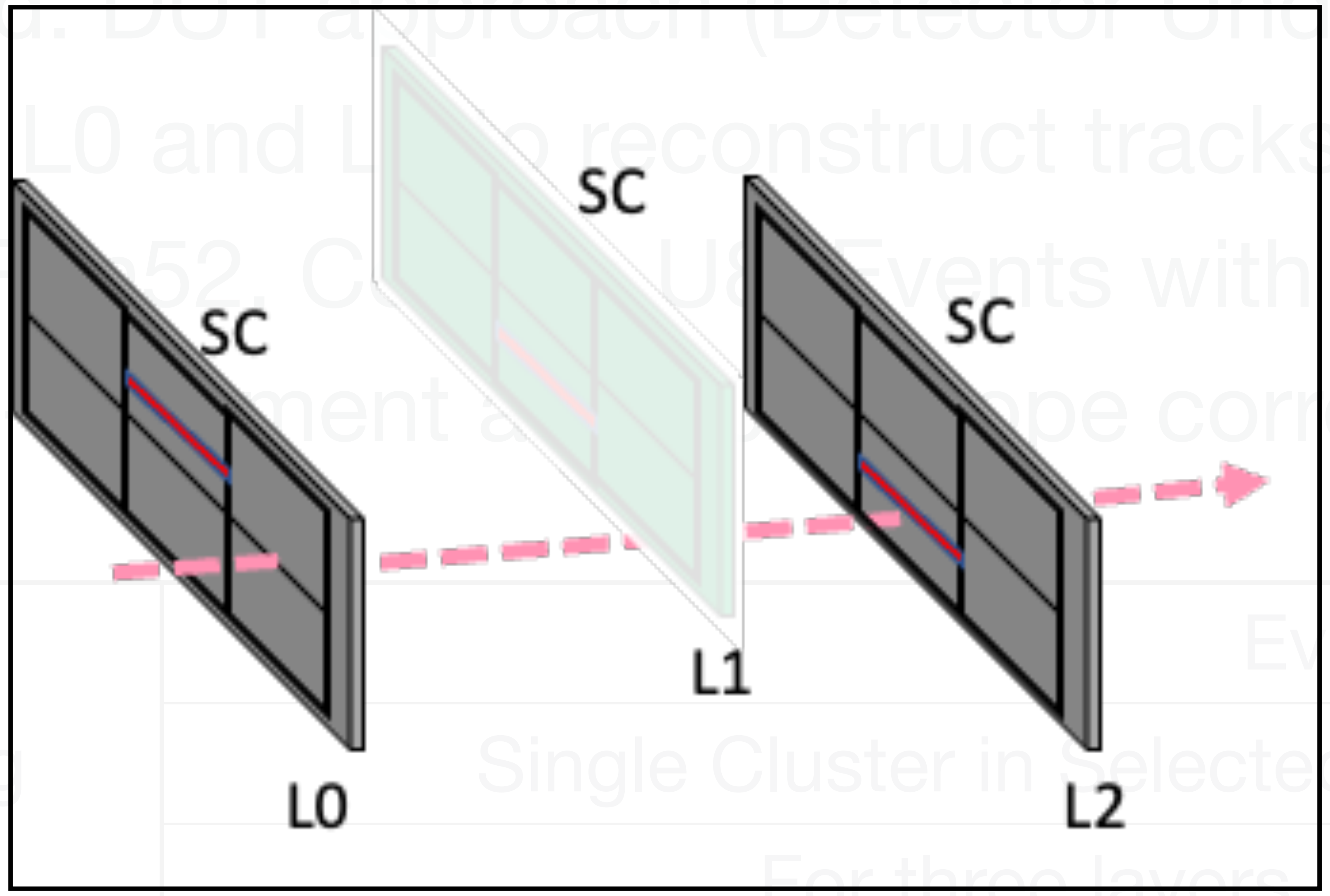
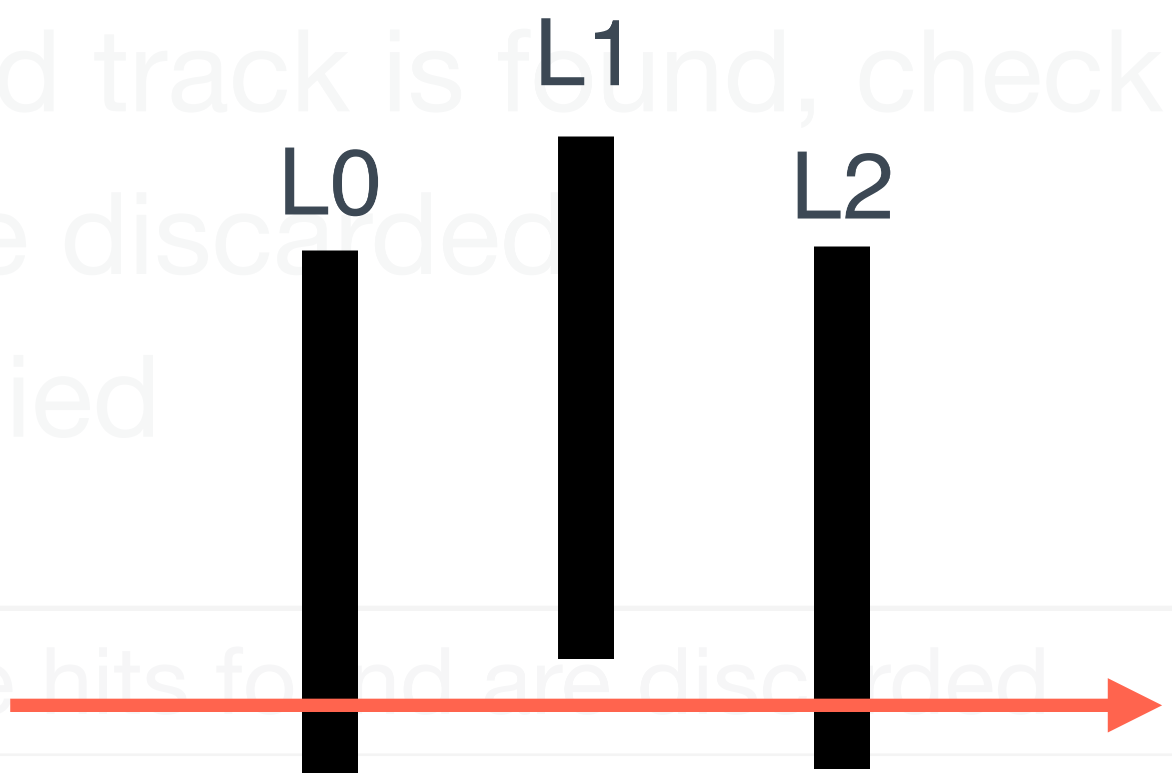


Hit detection efficiency

- Method: DUT approach (Detector Under Test)
  - Use L0 and L[illegible] reconstruct tracks. When good track is found, check L1
- Data: R[illegible]52, C[illegible] U8[illegible]Events with clone hit are discarded
- L1 mis[illegible]ment a[illegible]pe corrections applied





Tracking	Events with clone hits found are discarded	
	Single Cluster in Selected Column (SC) of L0 (abbr. SCL0) and L2 (abbr. SCL2) required	
	For three layers, require no cluster in adjacent Columns (SC-1 & SC+1)	

Track QA	Edge exclusion	(ladder bottom edge + 8 ch) < Y-pos of SCL0 and SCL2 < (ladder top edge - 8 ch)
	Cluster ADC	Cluster Adc of SCL0 > adc0 && Cluster Adc of SCL2 > adc0
	Slope cut	fabs(slope of SCL2 - SCL0) < 0.01
	Track pos	Focus on beam spot region (Run52: -6 to 6 mm, Run89: -10 to 6 mm)

Good track classification	Residual	|CL1 - CL2&CL0 interpolation| < 0.5 mm

To account for the misalignment in the transverse axis (y axis)

Hit detection efficiency

- Method: DUT approach (Detector Under Test)
  - Use L0 and L2 to reconstruct tracks. When good track is found, check L1
- Data: Run52, Column U8. Events with clone hit are discarded
- L1 mis-alignment and L0L2 slope corrections applied

To minimize tracks reconstructed by noise hits

(Only two layers for track reco., to improve the purity, tight selection required)

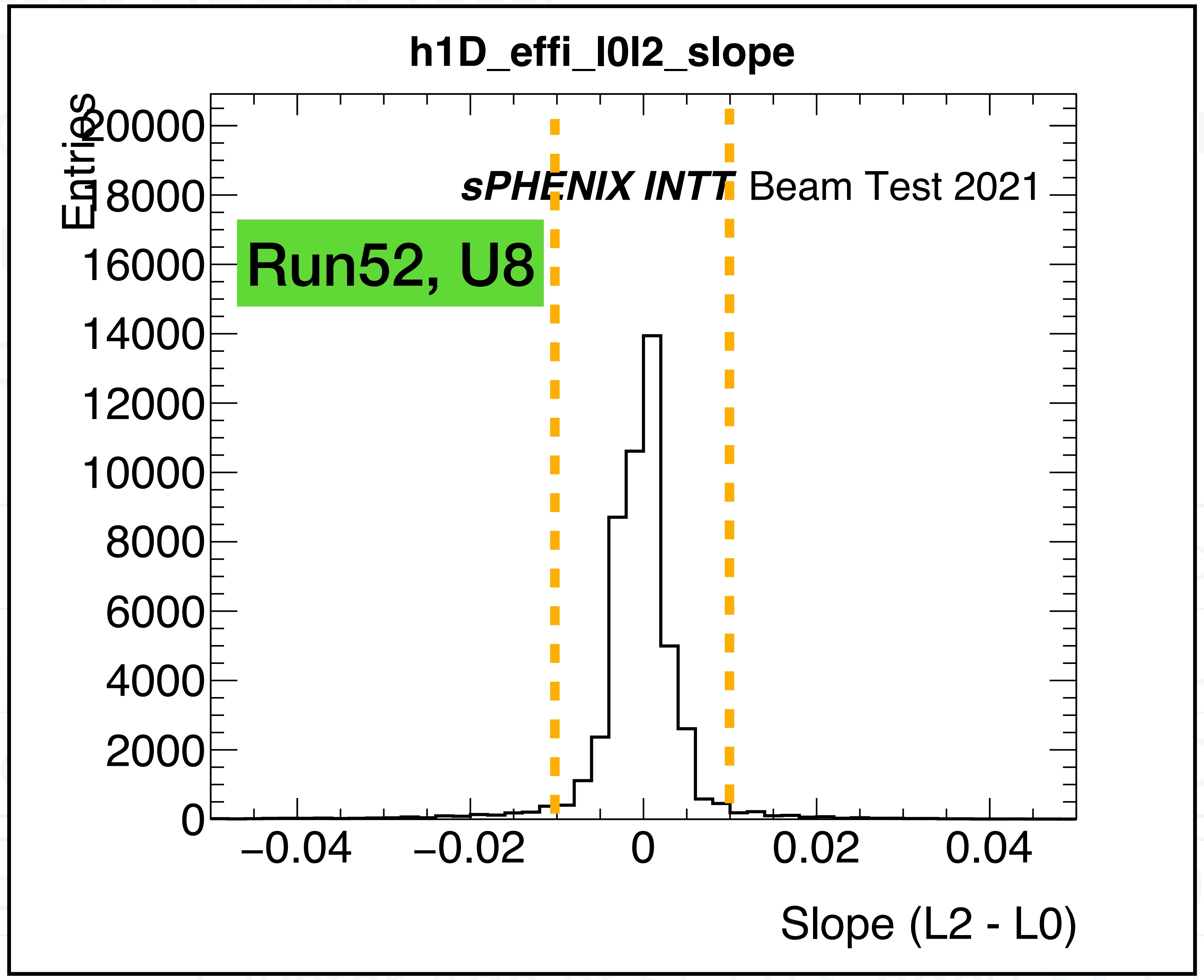
Tracking	[illegible]
	Single Cluster in Selected Column (SC) of L0 (abbr. SCL0) and L2 (abbr. SCL2) required
	For three layers, require no cluster in adjacent Columns (SC-1 & SC+1)

Track QA	Edge exclusion	(ladder bottom edge + 8 ch) < Y-pos of SCL0 and SCL2 < (ladder top edge - 8 ch)
	Cluster ADC	Cluster Adc of SCL0 > adc0 && Cluster Adc of SCL2 > adc0
	Slope cut	fabs(slope of SCL2 - SCL0) < 0.01
	Track pos	Focus on beam spot region (Run52: -6 to 6 mm, Run89: -10 to 6 mm)

Good track classification	Residual	|CL1 - CL2&CL0 interpolation| < 0.5 mm

Hit detection efficiency

- Method: DUT approach (Detec… …r Test)
  - Use L0 and L2 to reconstru… …nd, check L1
- Data: Run52, Column U8. Eve…
- L1 mis-alignment and L0L2 sl…



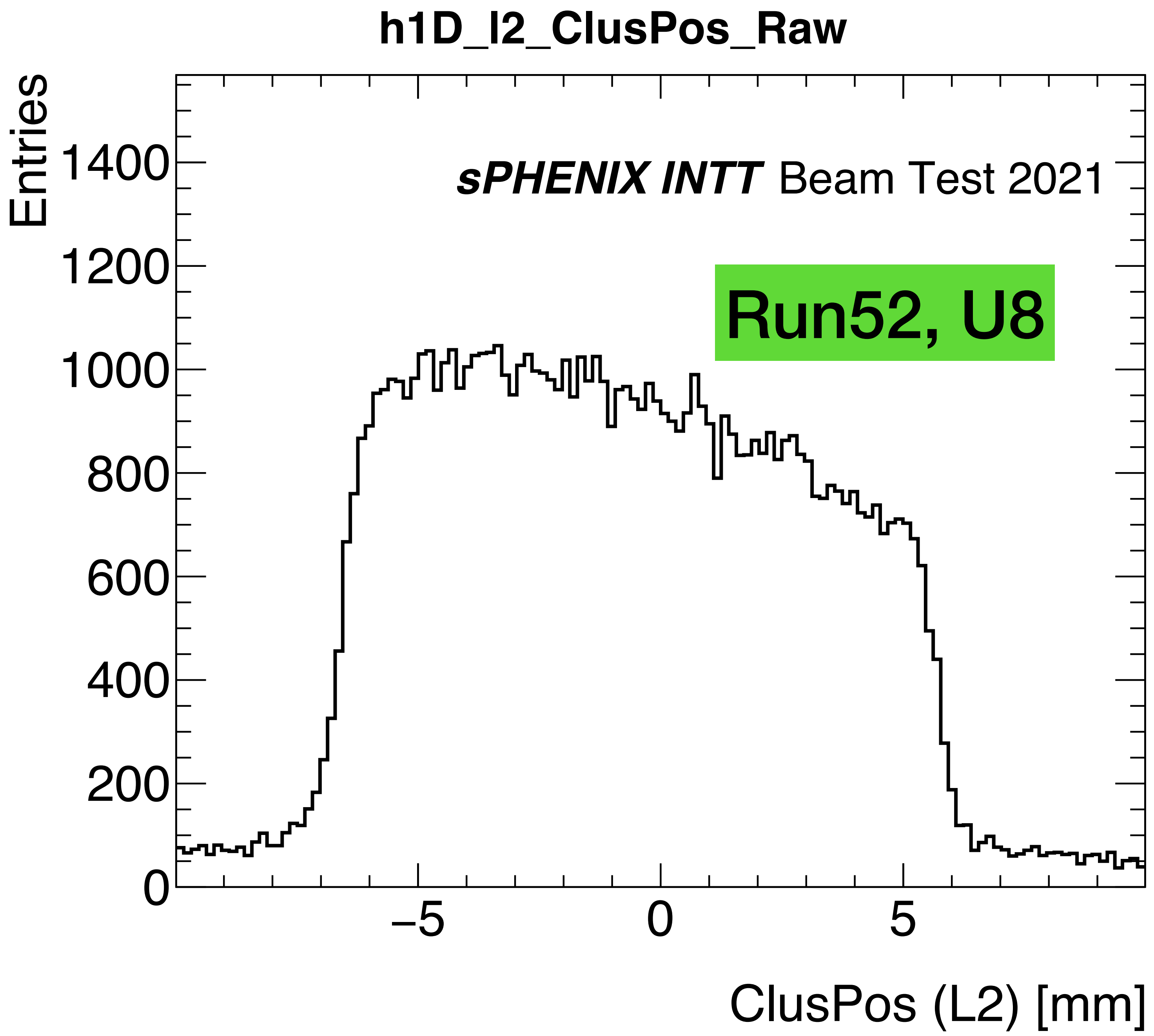
Tracking		…iscarded
	Single Cluster i…	…0) and L2 (abbr. SCL2) required
	For thr…	…Columns (SC-1 & SC+1)
Track QA	Edge exclusion	(lad… …and SCL2 < (ladder top edge - 8 ch)
	Cluster ADC	Cluster Adc of SCL0 > adc0 && Cluster Adc of SCL2 > adc0
	Slope cut	fabs(slope of SCL2 - SCL0) < 0.01
	Track pos	Focus on beam spot region (Run52: -6 to 6 mm, Run89: -10 to 6 mm)

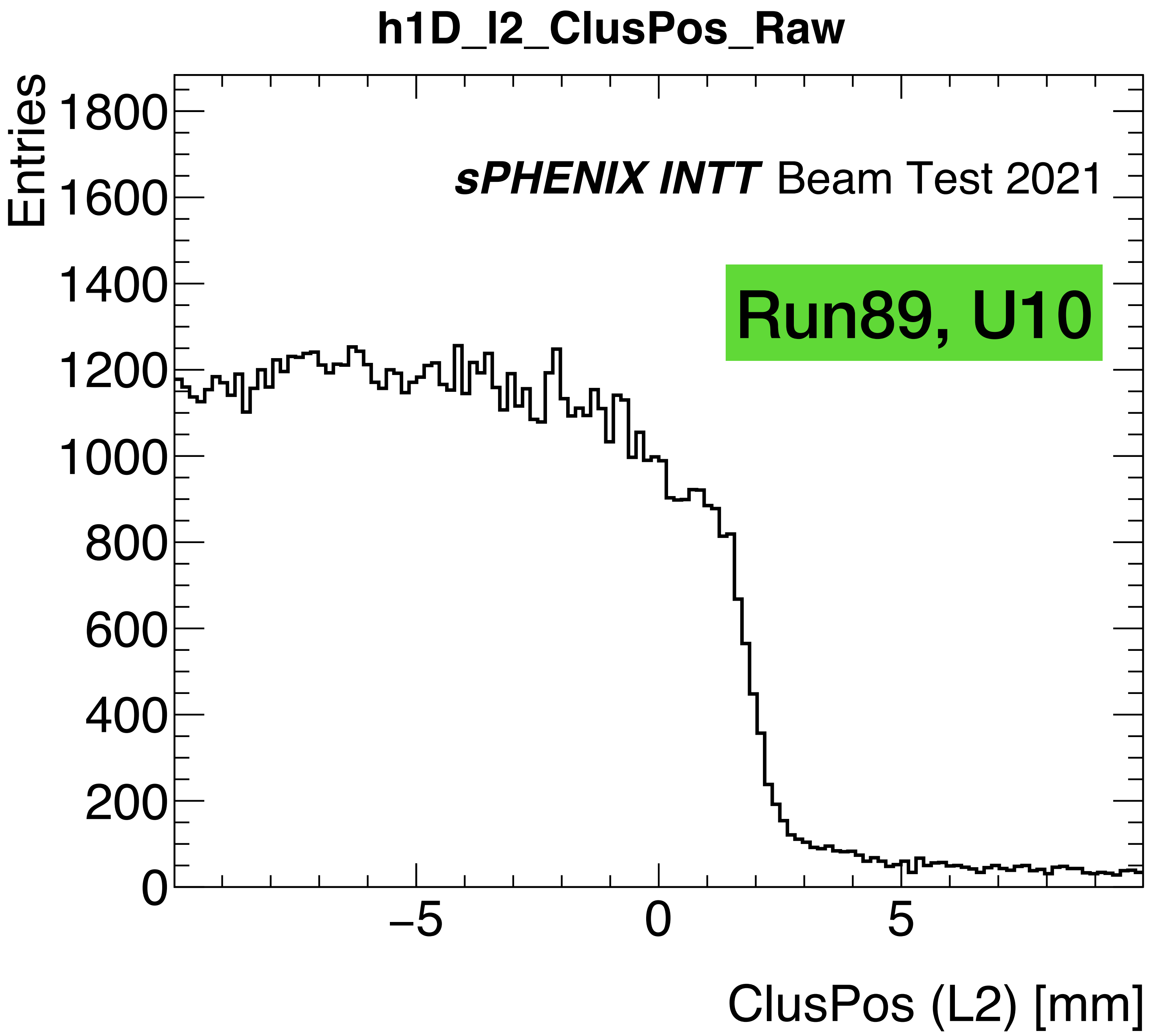
Good track classification	Residual	|CL1 - CL2&CL0 interpolation| < 0.5 mm

To make sure that reco. tracks are coming from the beam

Hit detection efficiency

- Method: DUT approach (Detector Under Test)
  - Use L0 a en goo
- Data: Run5 hit ar
- L1 mis-alig s app





Tracking		th clon
		nn (SC) equired
		no clu
Track QA	E	+ 8 ch) edge - 8 ch)
		c of SC c0
	Slope cut	fabs(slope of SCL2 - SCL0) < 0.01
	Track pos.	Focus on beam spot region (Run52: -6 to 6 mm, Run89: -10 to 2 mm)

To make sure that reco. tracks are coming from the beam

Good track classification	Residual	|CL1 - CL2&CL0 interpolation| < 0.5 mm

The last criterion for the event selection
(Events that pass this one are then considered as Good Events, the denominator)

Hit detection efficiency

- Method: DUT approach (Detector Under Test)
  - Use L0 and L2 to reconstruct tracks. When good track is found, check L1
- Data: Run52, Column U8. Events with clone hit are discarded
- L1 mis-alignment and L0L2 slope corrections applied

Tracking	Events with clone hits found are discarded
	Single Cluster in Selected Column (SC) of L0 (abbr. SCL0) and L2 (abbr. SCL2) required
	For three layers, require no cluster in adjacent Columns (SC-1 & SC+1)

When Good Event is found, then check clusters in L1

Track QA	Edge exclusion	(ladder bottom edge + 8 ch) < Y-pos of SCL0 and SCL2 < (ladder top edge - 8 ch)
	Cluster ADC	Cluster Adc of SCL0 > adc0 && Cluster Adc of SCL2 > adc0
	Slope cut	fabs(slope of SCL2 - SCL0) < 0.01
	Track pos	Focus on beam spot region (Run52: -6 to 6 mm, Run89: -10 to 6 mm)

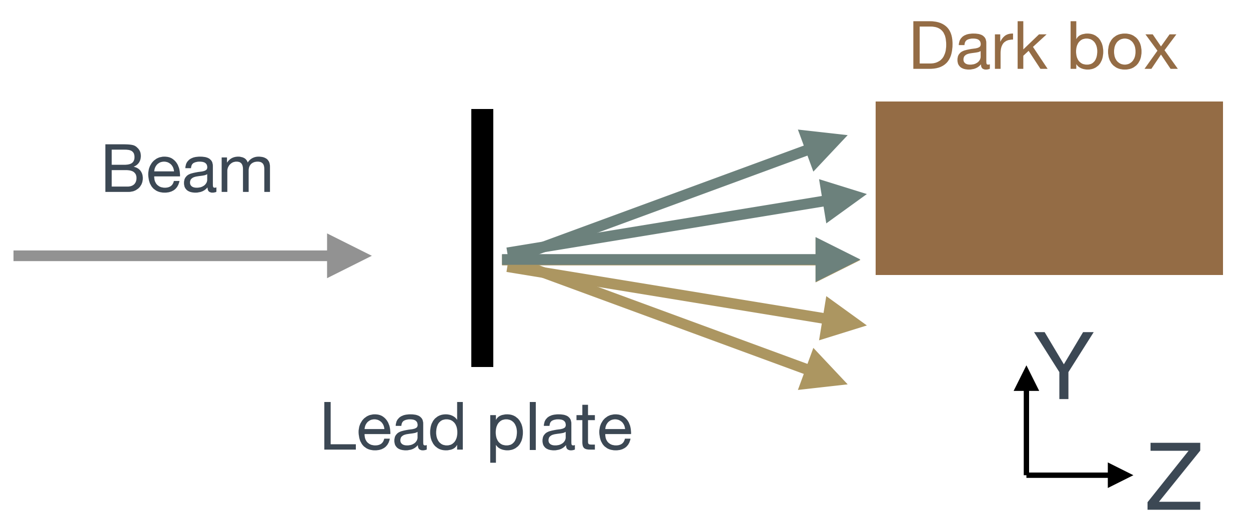
Good track classification	Residual	smallest |CL1 - CL2&CL0 interpolation| < 0.7 mm

$$\text{Effi.} = \frac{\text{Good Events and L1 Good Cluster Found}}{\text{Good Events}} = \frac{N(L0 \bigcap L1 \bigcap L2)}{N(L0 \bigcap L2)}$$

Number of reco. tracks compared to MC

- Data Run64 (thin lead plate in between beam and INTT telescope)

- Method:
  - Track reconstruction performed by looping over clusters of three layers in each column
  - The combination quality is evaluated by fitting the clusters with slope line. The combination with the smallest reduced chi-square is checked
  - **Good reco. track: Residual (L1 - L2L0 interpolation) < 0.7 mm**
  - One column could have more than one reconstructed track in one event
  - Single cluster can only be involved in one track
  - All 13 columns are checked



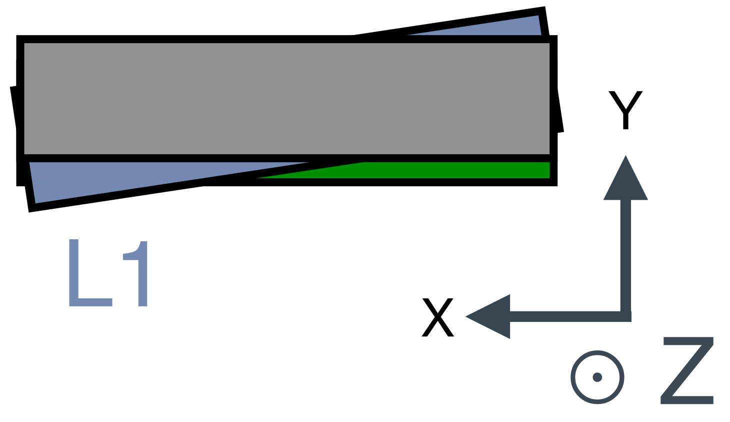
- Key correction: L1 alignment correction for all 13 columns

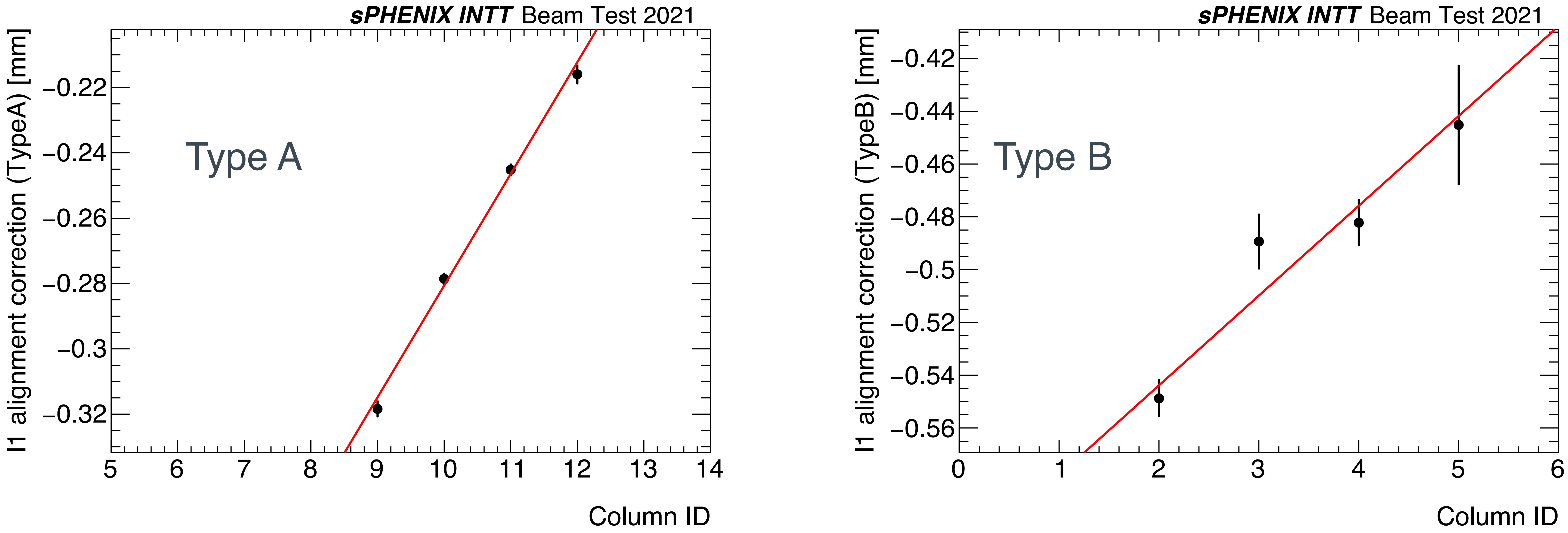
- In data, events with clone hit are discarded

Number of reco. tracks compared to MC

- In **Data**: L1 alignment correction for all 13 columns
  - By fitting method (each column has different L1 alignment correction)
    - Beam spot not wide enough to coverage the whole ladder
  - The ladder L1 is slightly tilted in the Z axis with respect to L0&L2

*Not to scale



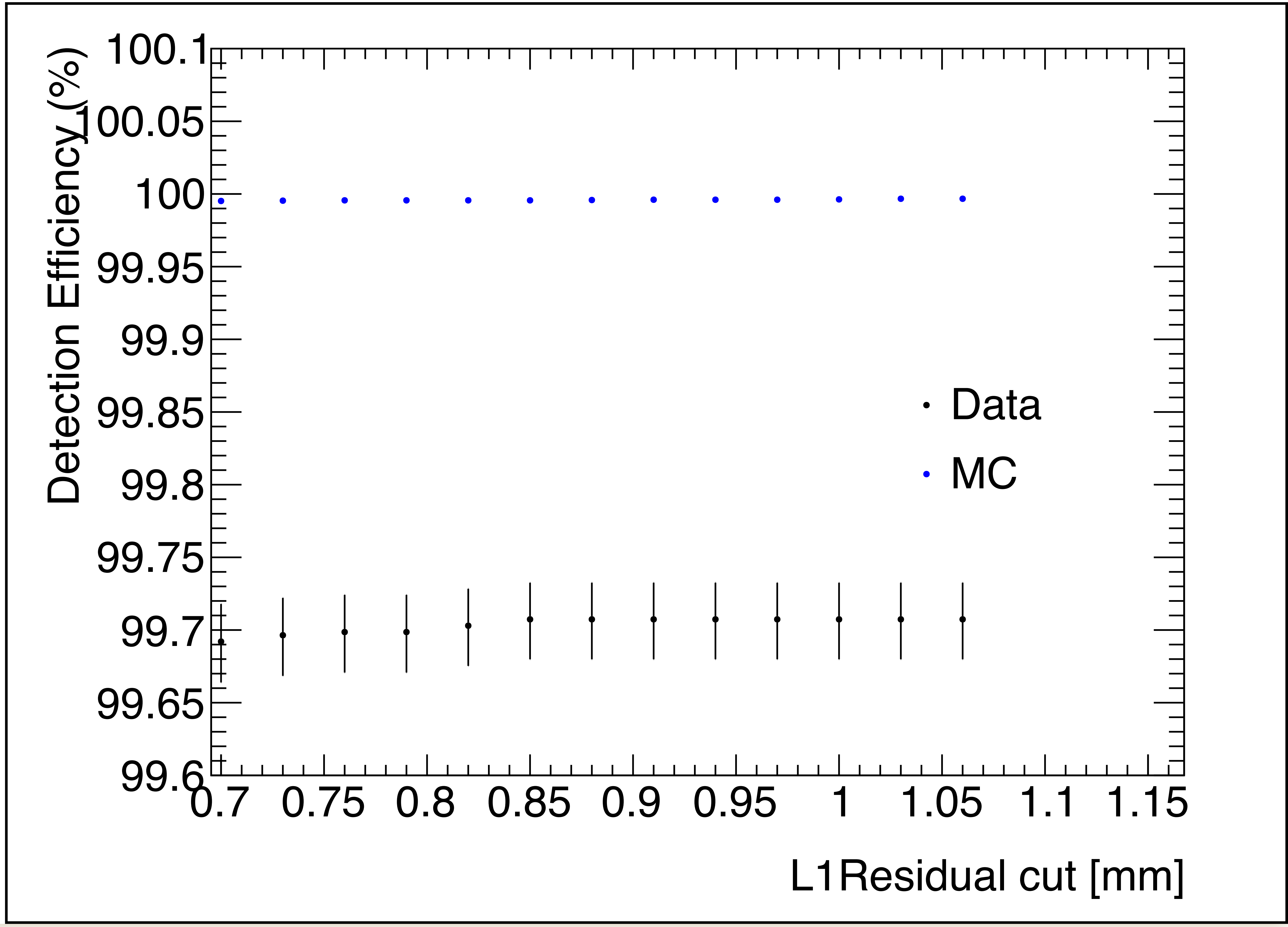


- In **Simulation**: No L1 rotation, correction for all columns given by average of L1 alignments measured by columns U9, U10 and U11 (beam spot region)

The update of the residual cut for hit detection efficiency

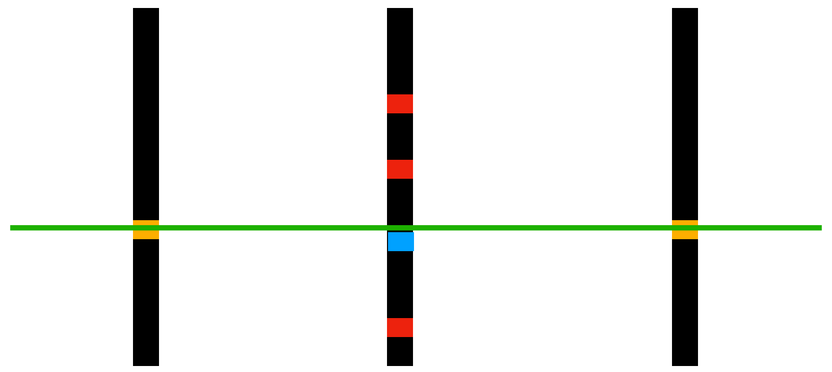
- All Simulation points (blue circles) are with the detection efficiencies above 99.995% in the given range (residual cut from 0.7 mm to 1.0 mm), and the statistical errors of blue circles are in the order of 0.001%, which are marginal
- I therefore conclude that the residual cut should be in the range of 0.7 mm to 1.0 mm

- Procedures:
  - In data, measure the detection effi. with L1 residual cut of 0.7, 0.85, 1.0 mm (to cover the control region)
  - Set the effi. value with residual cut of 0.85 to be the baseline
  - The variation of effi. values with residual cut of 0.7 and 1.0 mm comparing to baseline would be the systematic uncertainty (which would be very close to zero according to the black circles)
  - **No correction applied to data**
    - Since the Simulation shows over the 99.995% detection efficiency in the given region
    - (The Simulation is used to obtain the range of the proper residual cut)



Detection efficiency measurement

Basically set L1 to be free → L1 could have multiple clusters when a good track (formed by L0&L2) is found

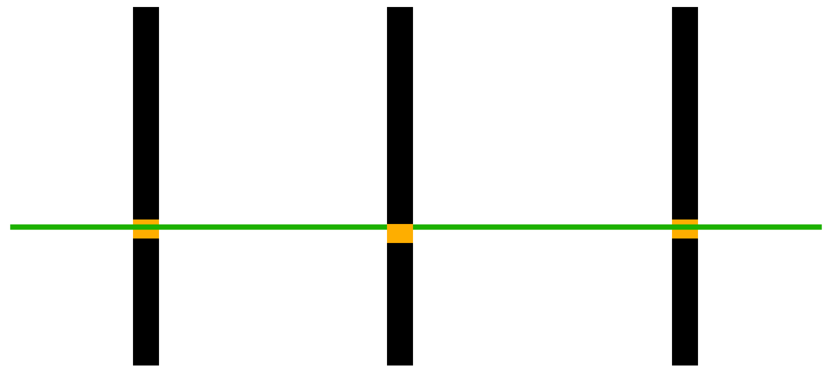


Noise hits

The cluster that matches to the reconstructed track

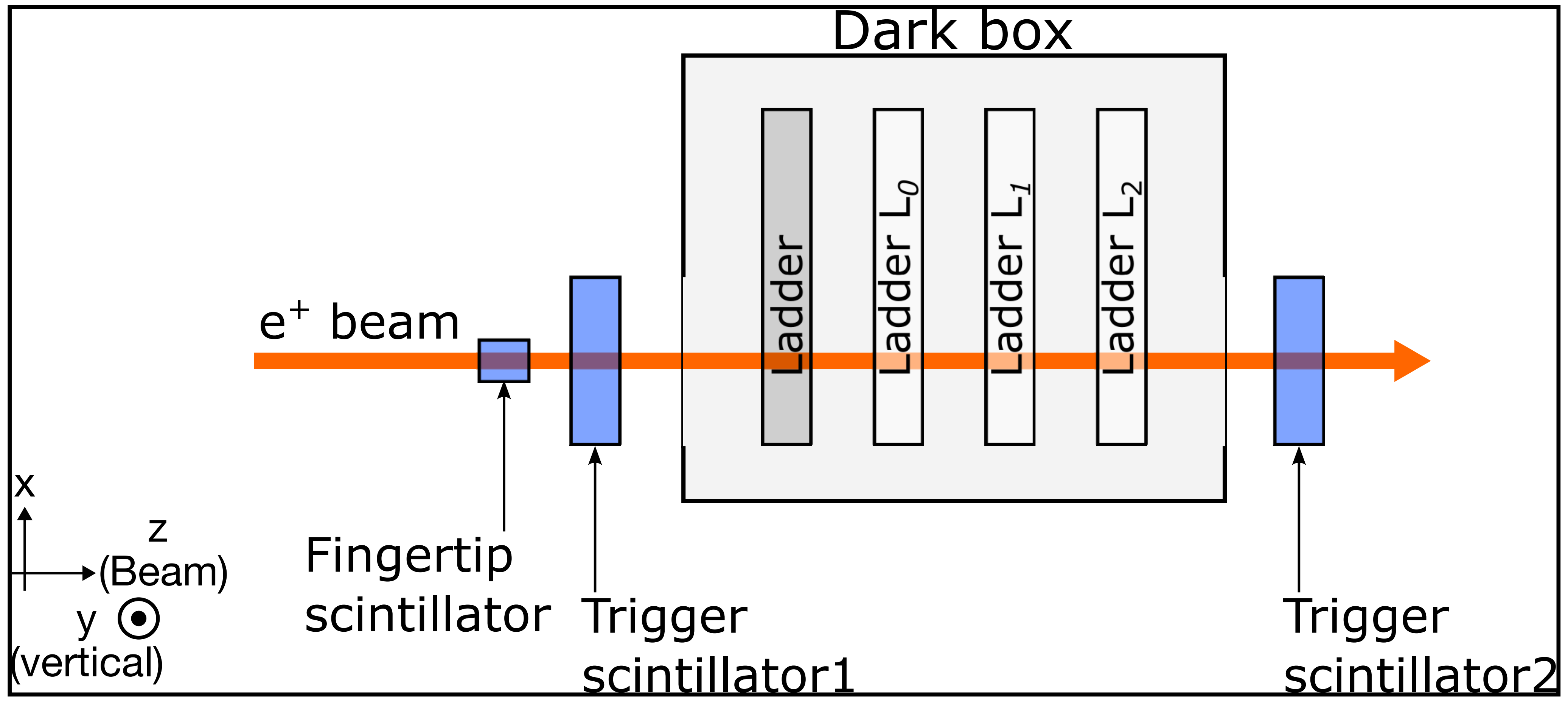
3-layer tight tracking

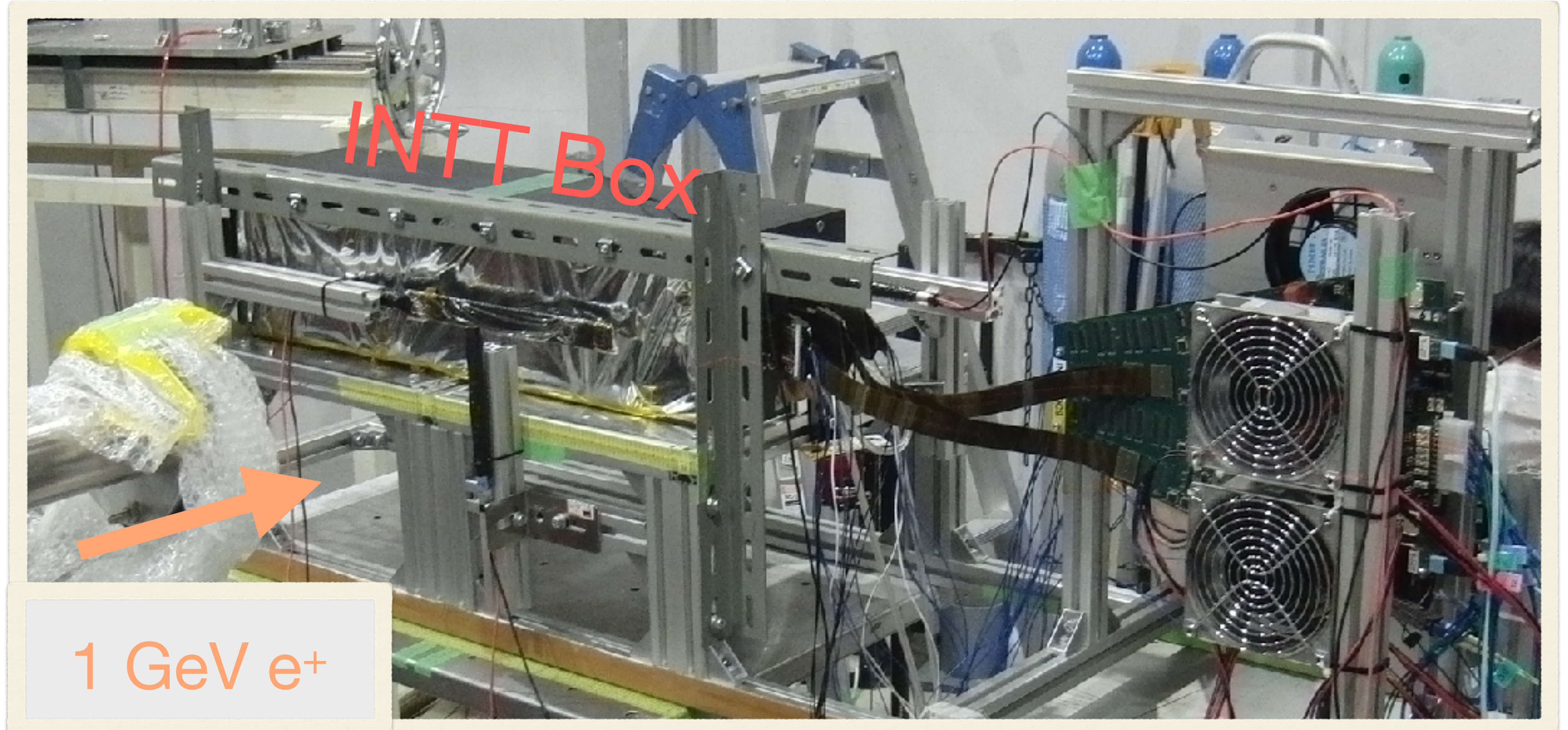
Requiring only one cluster in the selected column (SC) of L0, L1, and L2

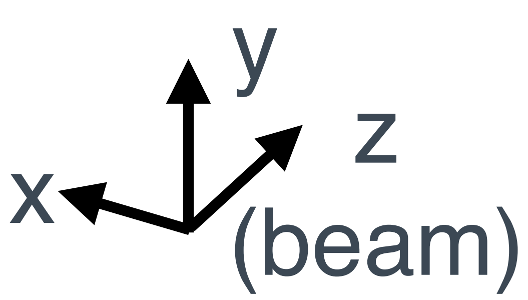


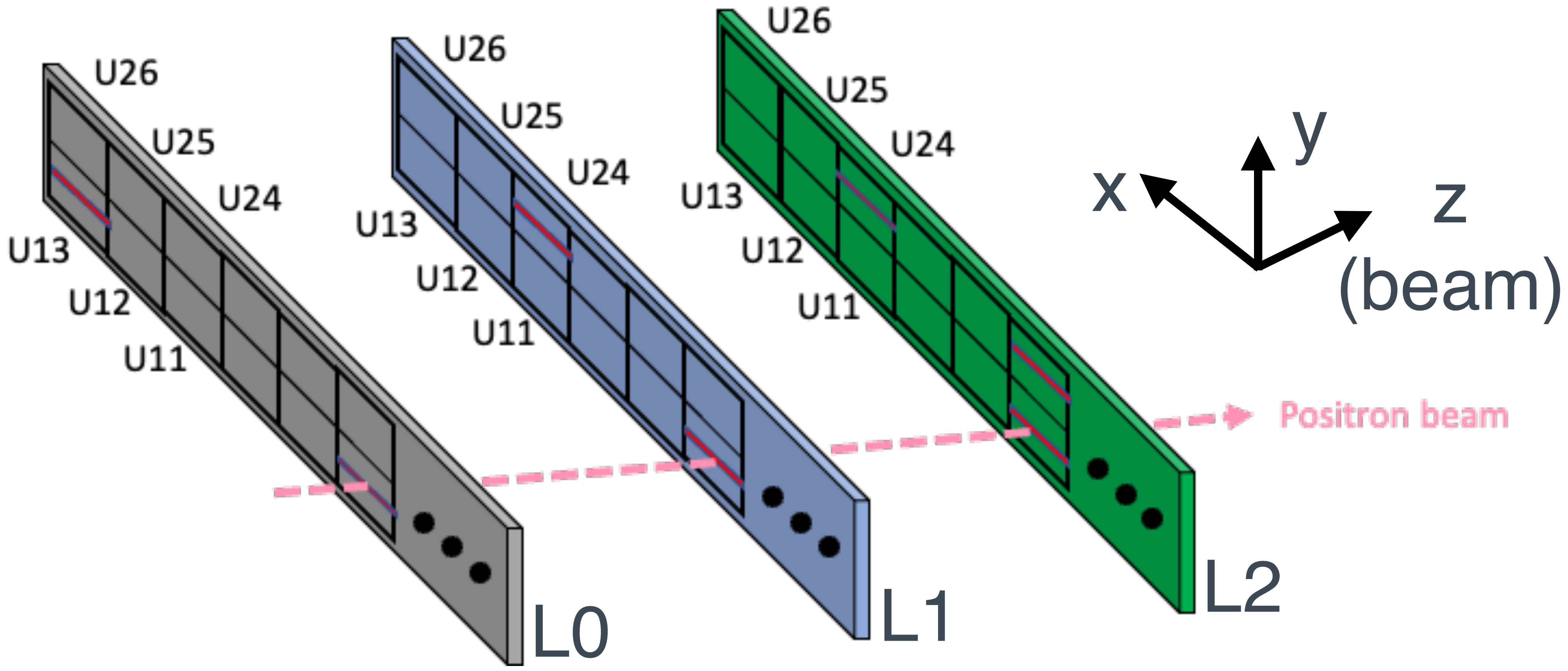
General information

- A beam test experiment was performed at the end of 2021, ELPH, Japan
  - Four ladders were placed in the dark box
    - First ladder deactivated due to light leakage
  - Beam time: 2021/Dec/07 to 2021/Dec/10
- Positron beam with energy of 1000 MeV was used
- Main goal: ladder hit detection efficiency

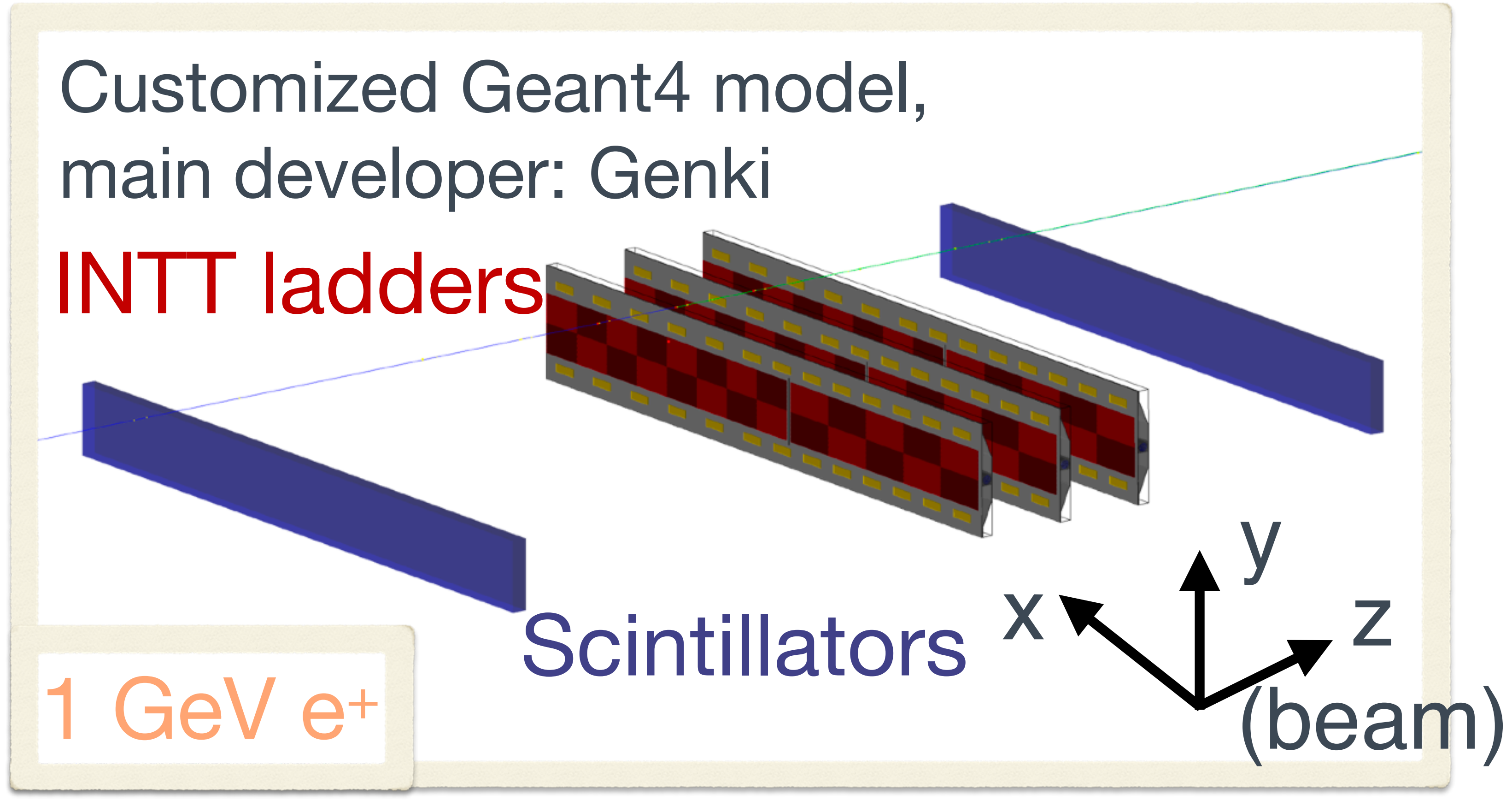








Y axis in beam test corresponds to the ϕ axis at 1008-IR

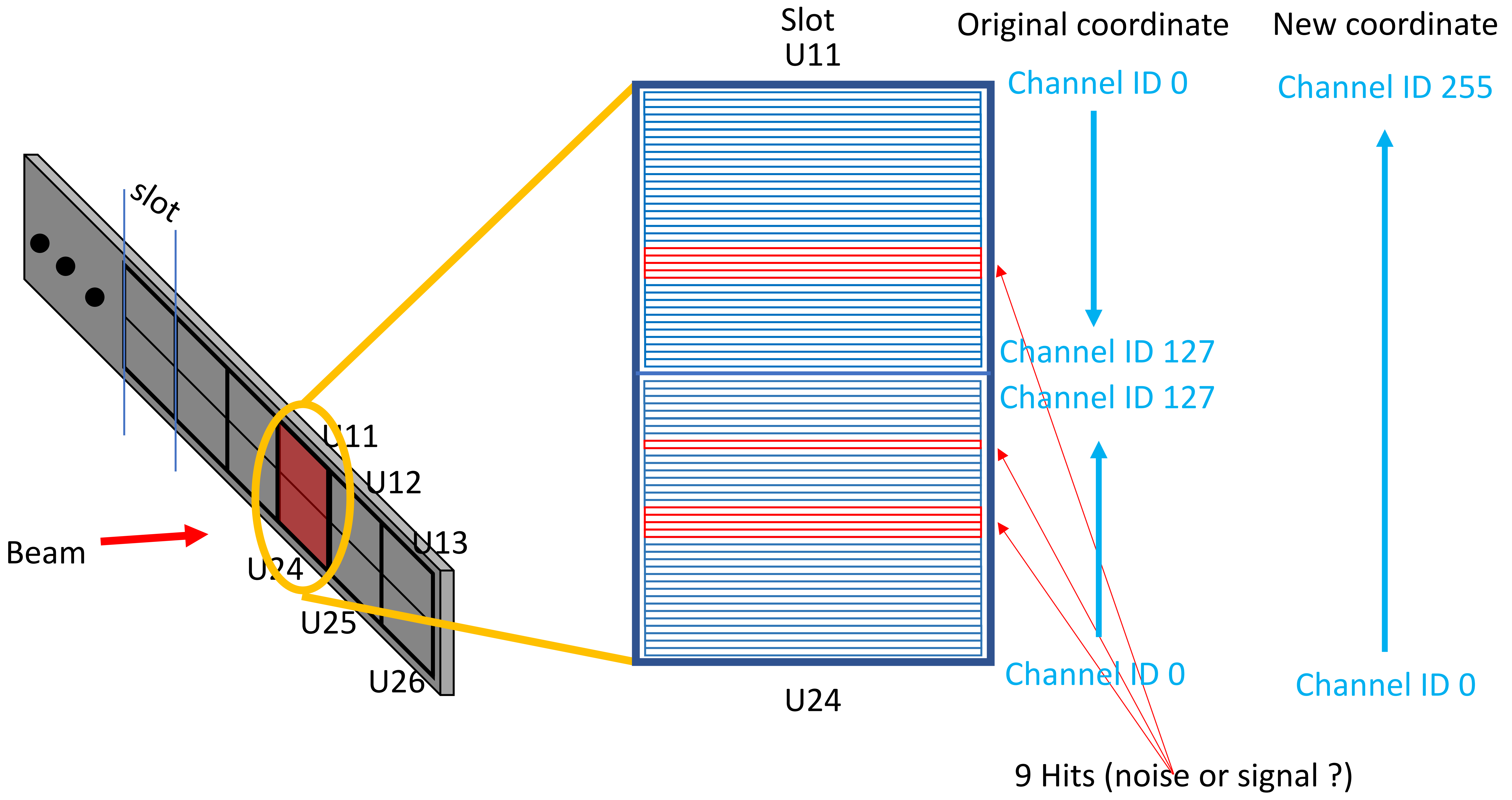


Customized Geant4 model, main developer: Genki

Clustering - 1

Clustering was performed column by column

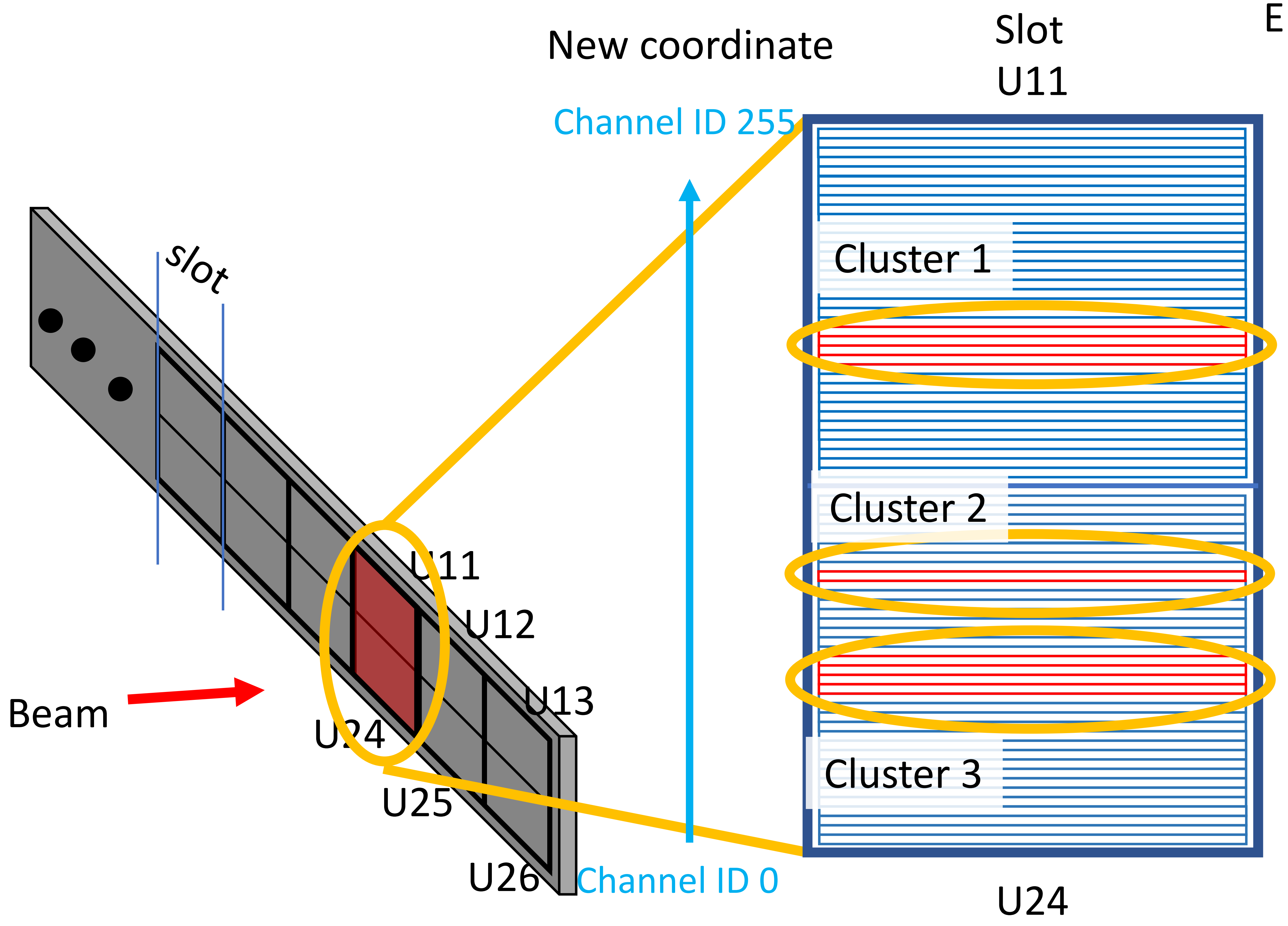
Tracking algorithm



Clustering - 2

Clustering was performed column by column

Tracking algorithm



Energy-weighted method is applied

$$P_j^l = \frac{\sum_n C_n E_n}{\sum_n E_n}$$

C_n : position (mm) in y-axis of channel n in cluster

E_n : energy deposit of channel n in cluster

P_j : final position in y-axis of cluster j

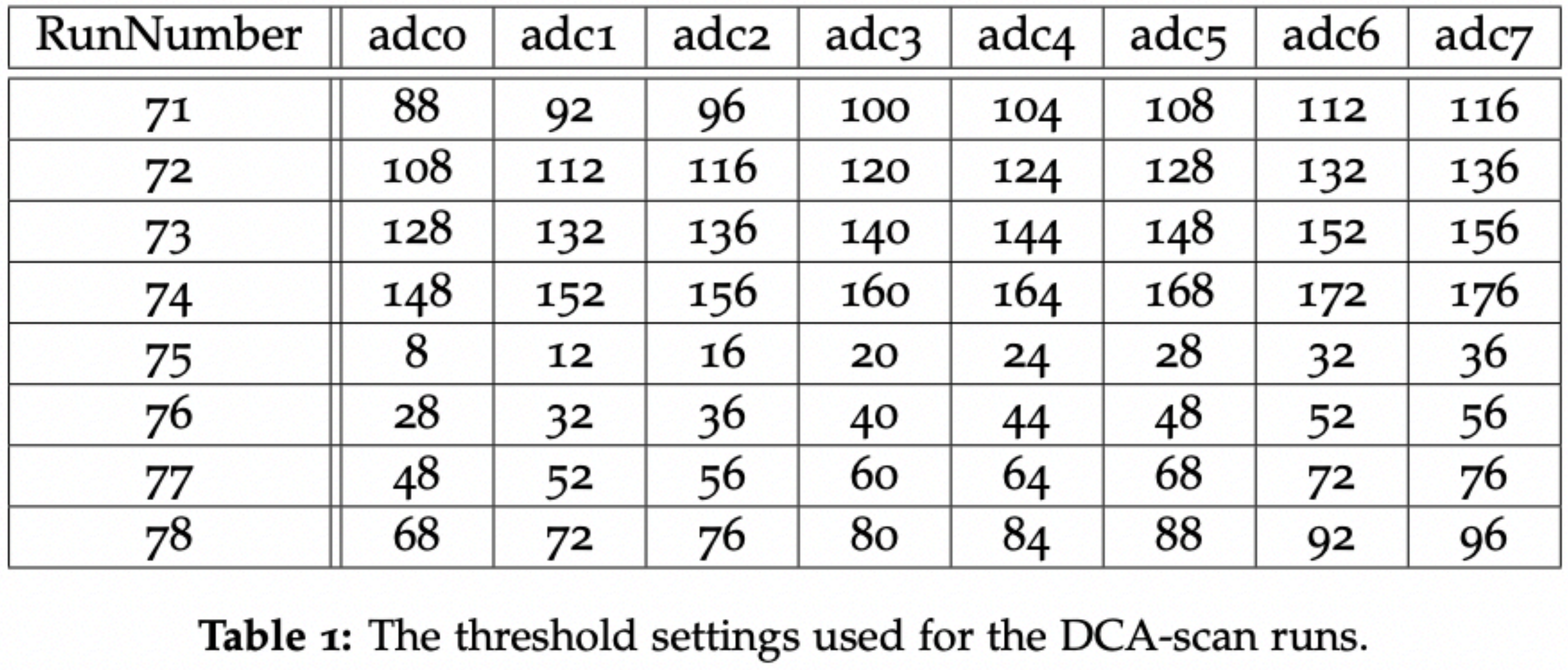
Cluster : the adjacent channels

	Cluster 1	Cluster 2
Chan_id :	3 4 5 6	8 9 10

reduce

9 fired-channels -> 3 positions

DAC Scan table



RunNumber	adc0	adc1	adc2	adc3	adc4	adc5	adc6	adc7
71	88	92	96	100	104	108	112	116
72	108	112	116	120	124	128	132	136
73	128	132	136	140	144	148	152	156
74	148	152	156	160	164	168	172	176
75	8	12	16	20	24	28	32	36
76	28	32	36	40	44	48	52	56
77	48	52	56	60	64	68	72	76
78	68	72	76	80	84	88	92	96

Table 1: The threshold settings used for the DCA-scan runs.