National Central University & RIKEN

June 19th, 2024 INTT meeting



INTT vertex Z reconstruction

Cheng-Wei Shih

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Vertex Z - procedures

- 1. Update the cluster ϕ and radius based on the reconstructed average vertex XY
- 2. Loop over all the inner and outer cluster pairs, keep the pairs which pass the $\Delta \phi$ cut and DCA cut (proto-tracklets)
- 3. Move to the Z-Radius plane. For each proto-tracklets, the full strip lengths of the two clusters (inner and outer) are considered. Project the **possible vertex Z*** to the Z axis (radius = 0)
- 4. Fill all the **possible vertex Zs*** of all the proto-tracklets into the histogram
- 5. Fit the distribution with **Gaussian function + offset** to determine the reconstructed vertex Z for single event (fit parameter and fit range tunable)

Possible vertex Z^{*}: the shapes are different based on the methods INTT meeting









- Suggestion given by Akiba san
- i.e., weighting the entry by (1./"possible vertex Z range")

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1 Constant 9.84366e+02 9.66740e+00 1.36905e-03 6.97515e-07		400	-
2 Mean 3.38231e-02 1.91429e-02 5.48619e-07 -2.23329e-04			
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2.02799e+00 5.45754e-02 -8.71696e-06 -3.11292e-04 3 Sigma [FitResultPtr) <nullptr TFitResult> >ot [9] htemp->Fit("gaus","","",-2.5,2.5) 400 CN=31.3958 FROM MIGRAD STATUS=CONVERGED 68 CALLS 69 TOTAL EDM=1.38919e-08 STRATEGY= 1 ERROR MATRIX UNCERTAINTY 3.5 per cent EXT PARAMETER STEP FIRST 200 NAME ERROR SIZE DERIVATIVE NO. VALUE 9.62338e+02 9.47119e+00 8.28067e-02 2.37302e-05 1 Constant 2 Mean -1.48302e-01 2.08696e-02 -2.11826e-05 -4.23607e-03 1.95373e+00 3.12570e-02 -5.09078e-05 4.01835e-02 3 Sigma FitResultPtr) <nullptr TFitResult>

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.a+ [101 □
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• Idea: the weight of each combination filled into the 1D histogram should be the same,



Entries weighted Fit mean : 3.382e-02 Fit width : 1.8439e+00

Original Fit mean : -1.483e-01 Fit width : 1.9537e+00

~6% improvements

Cheng-Wei Shih (NCU, Taiwan)



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For each combination Outer barrel

Inner barrel

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• Idea given by Akiba san. For each combination, take into account of the distribution of the possible vertex Z range, and normalize the distribution, and fill into the histogram. (Used to assume the Uniform distribution of the vertex Z)

Justification of using possible vertex Z range / sqrt(12): The region with higher probability is presumably selected









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Caveat: for each combination in single event, have to have the shape, and fill that into histogram, not trivial... Not easy, but still have the way to make it happen

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Trapezoidal

(final vertex Z given by average of 7 gaussian fits with the fit ranges of

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Very central events

9.5% improvement

18.4% improvement

Number of valid clusters > 1000

Valid clusters: cluster adc > 35 && cluster phi size < 6

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6.2% improvement

12.8% improvement

Back up

INTT geometry

INTT: 2 sensors X 2 sides of half-ladders X 56 ladders = 224 sensors

Notation: B_xL_{yzz} x: Barrel ID (0 for inner or 1 for outer) y: Layer ID (0 for inner or 1 for outer) zz: Ladder ID (from 0 to 15)

Axis (Right-haded coordinate) x-axis: $\vec{y} \times \vec{z}$ y-axis: Vertically upward direction

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