Status report : kink study

Work in progress

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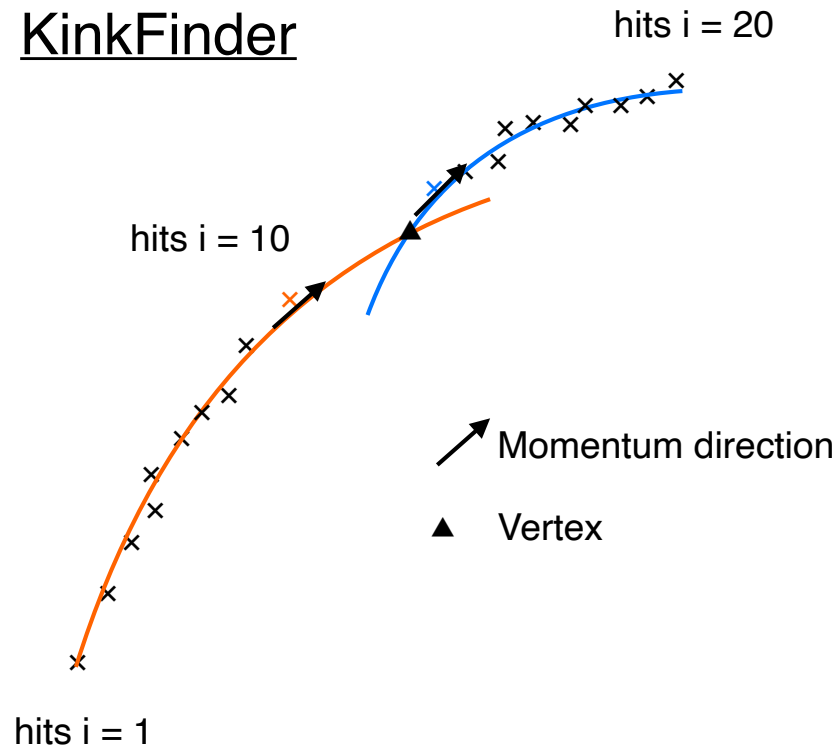
SOKENDAI

2024/06/20

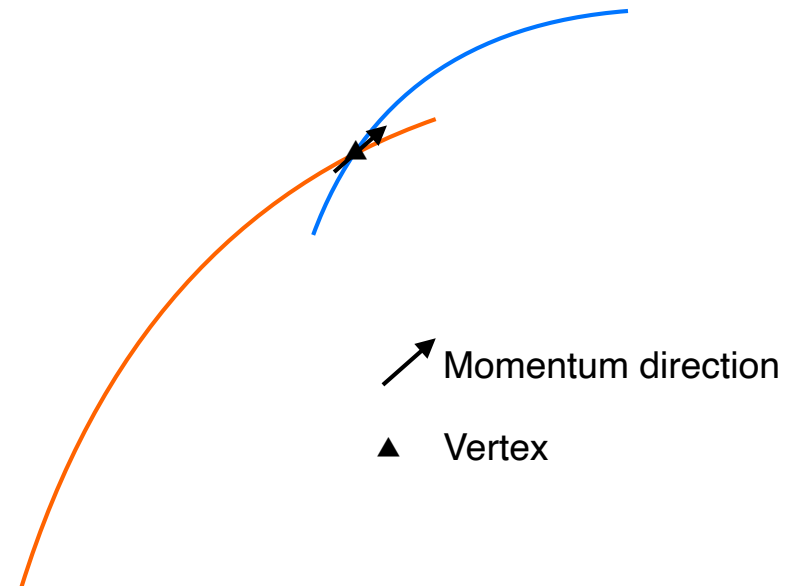# How to get momentum infomation

KinkFinder

hits i = 20

hits i = 10

hits i = 1

Momentum direction

▲ Vertex

Fit first / last 10 hits to helix
Helix momentum at last/first hits

Momentum at vertex

Momentum direction
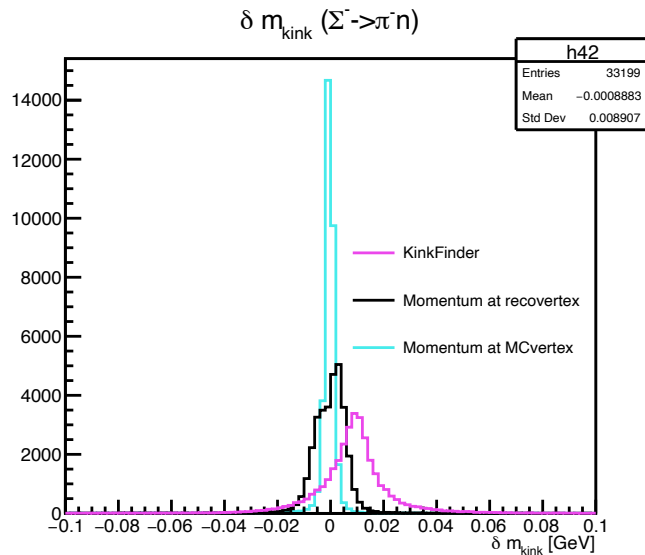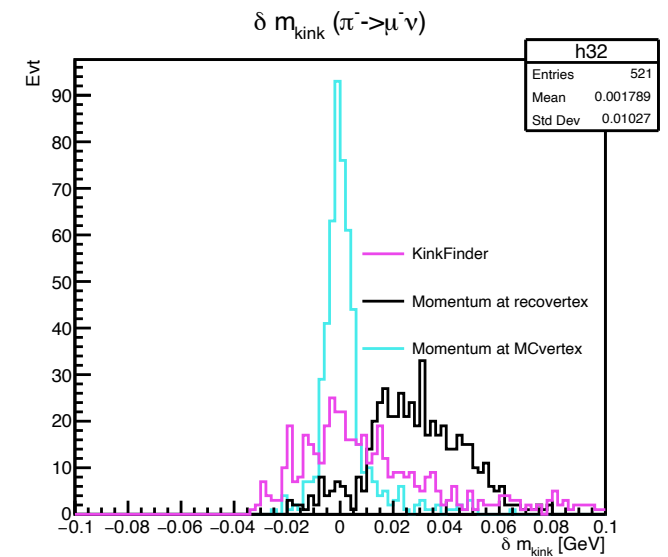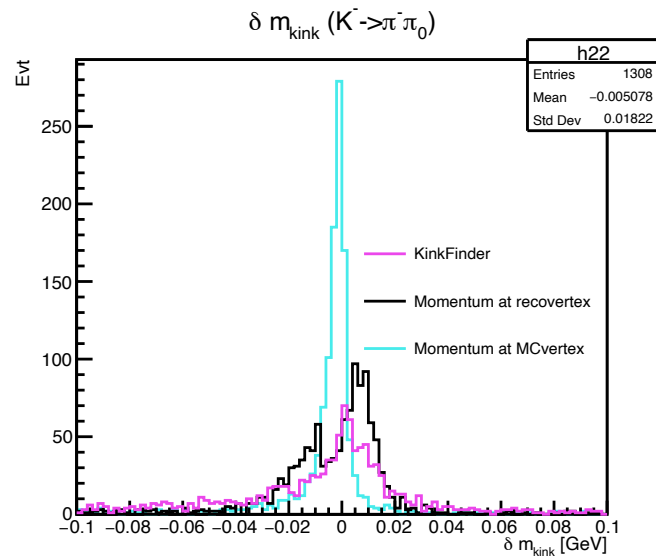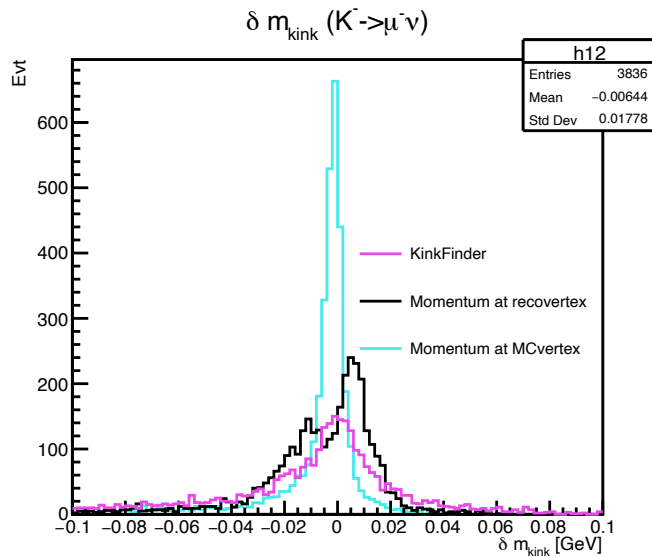
▲ Vertex

Use full track fits
trackstate momentum at
reconstructed vertex
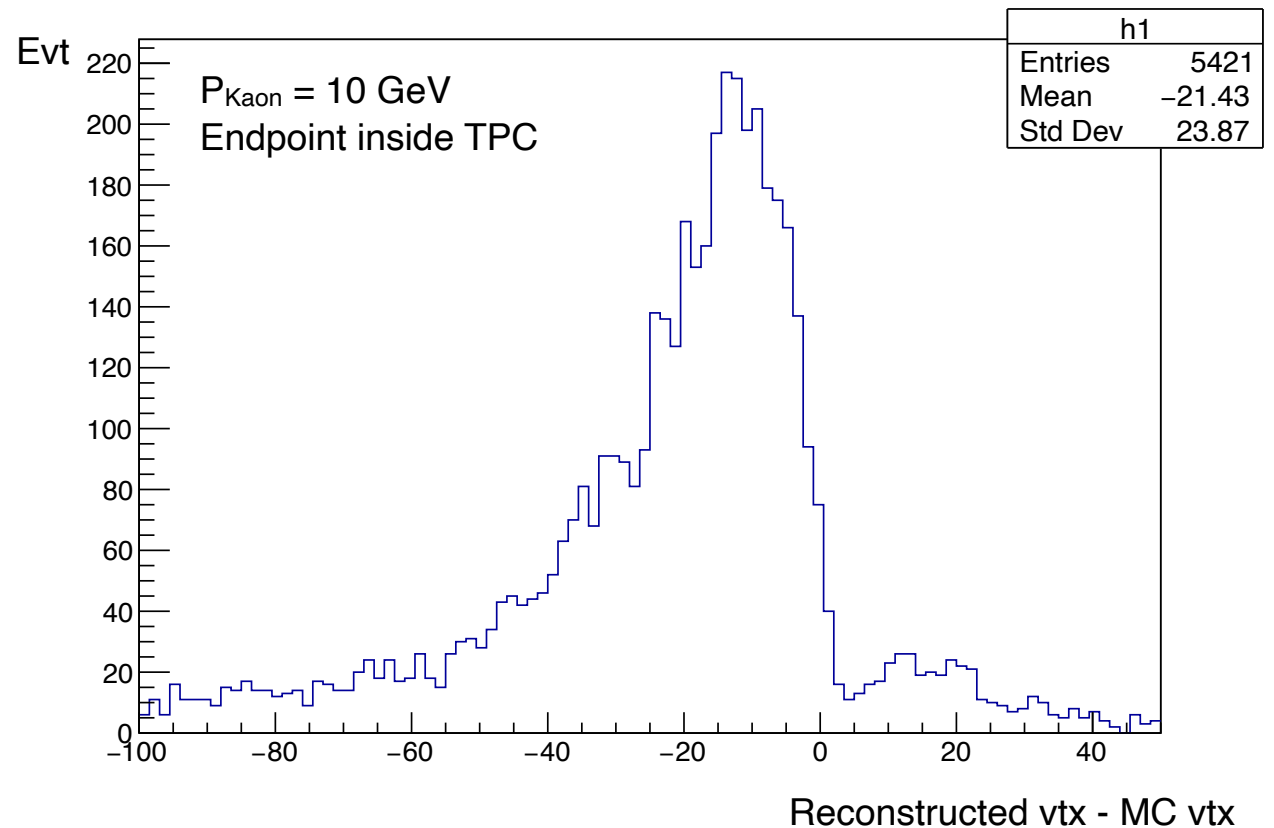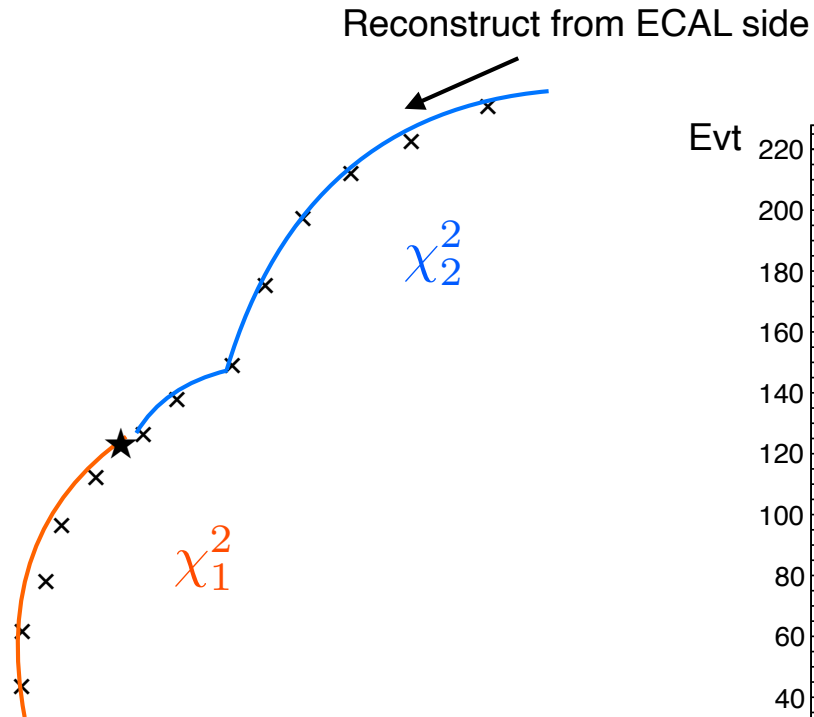
Comparison of δm distribution

$$\delta m_{kink} \equiv m_{reco_K} - m_{true_K}$$
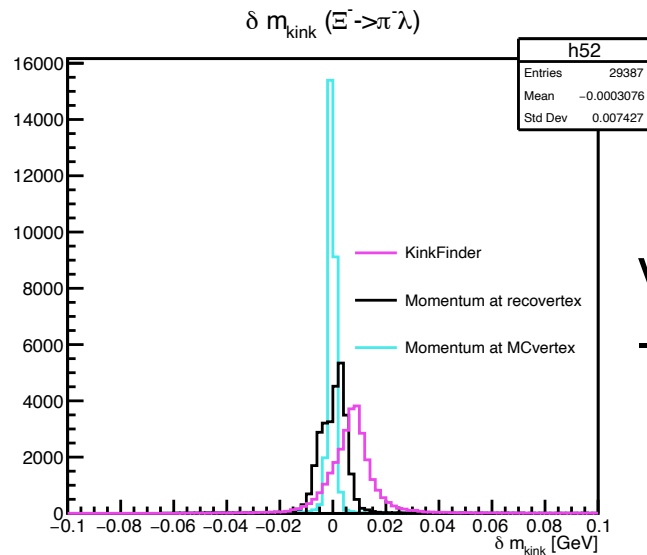
Vertex reconstruction improved
-> δm distribution is improved

Marlintrk bias at vertex

Reconstruct from ECAL side

χ_2^2

χ_1^2

Evt

P_{Kaon} = 10 GeV
Endpoint inside TPC

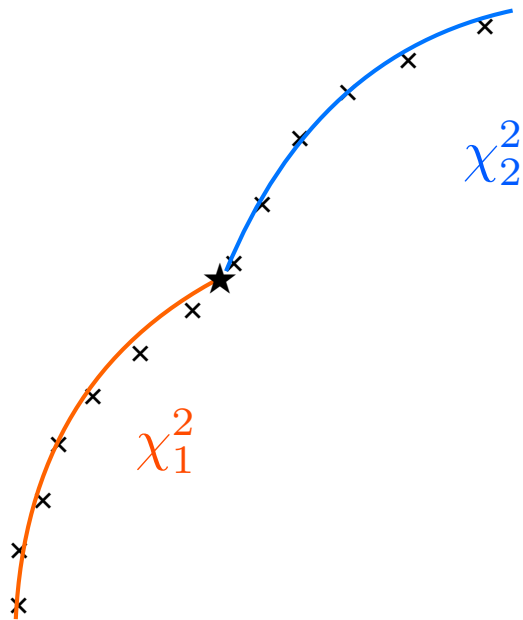| h1	
Entries	5421
Mean	−21.43
Std Dev	23.87

Reconstructed vtx - MC vtx

In Marlin track reconstruction, when chisq is bad, tracking is stopped.
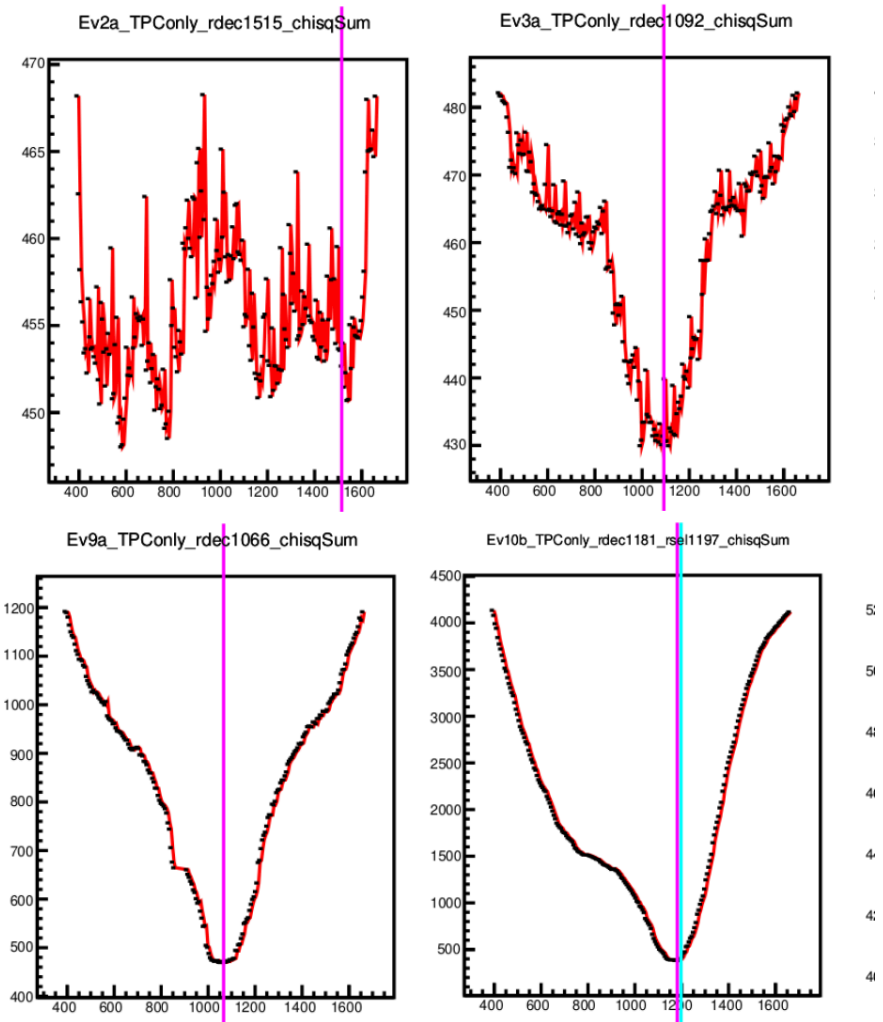-> vertex is bias to smaller radius.

How to get vertex infomation

New version

χ_2^2

χ_1^2

chiSq-trk1
+
chisq-trk2

Ev2a_TPConly_rdec1515_chisqSum

Ev3a_TPConly_rdec1092_chisqSum

Ev9a_TPConly_rdec1066_chisqSum

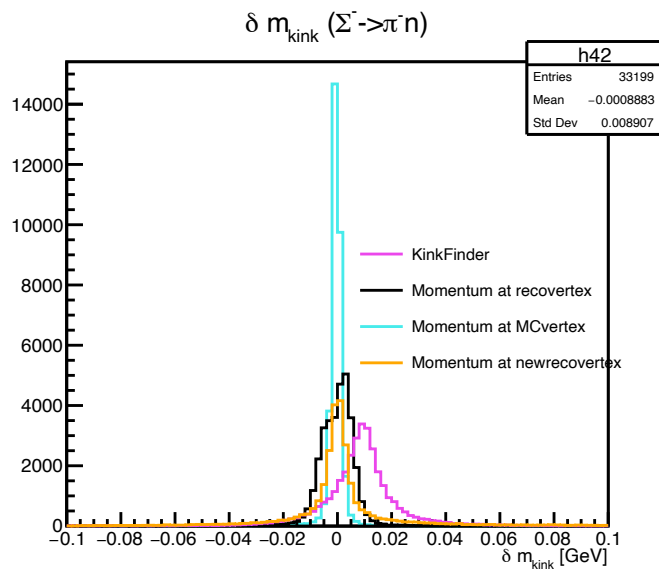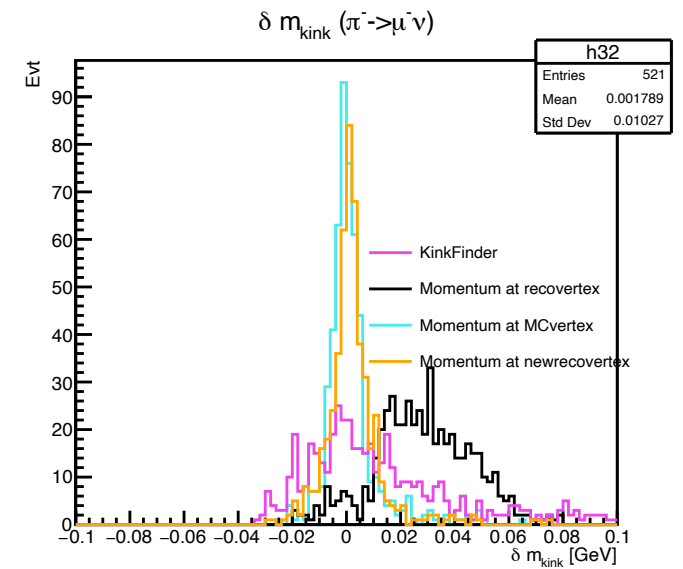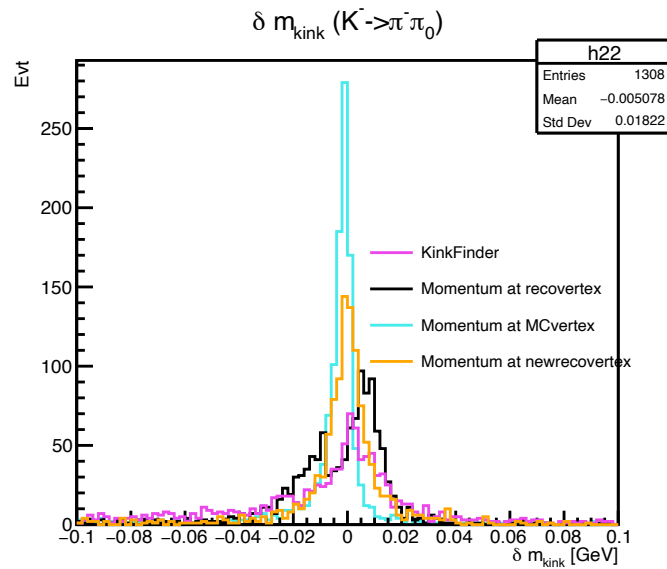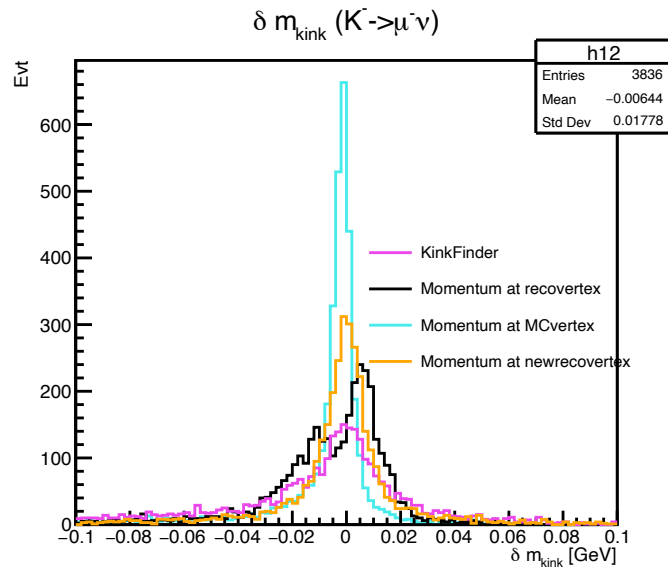Ev10b_TPConly_rdec1181_rsel1197_chisqSum

I try to cut track at every hits position, calculate $\chi_1^2 + \chi_2^2$

a hit corresponded to minimum $\chi_1^2 + \chi_2^2$ is assumed as a kink vertex.

Figures by Daniel

Comparison of δm distribution - new!
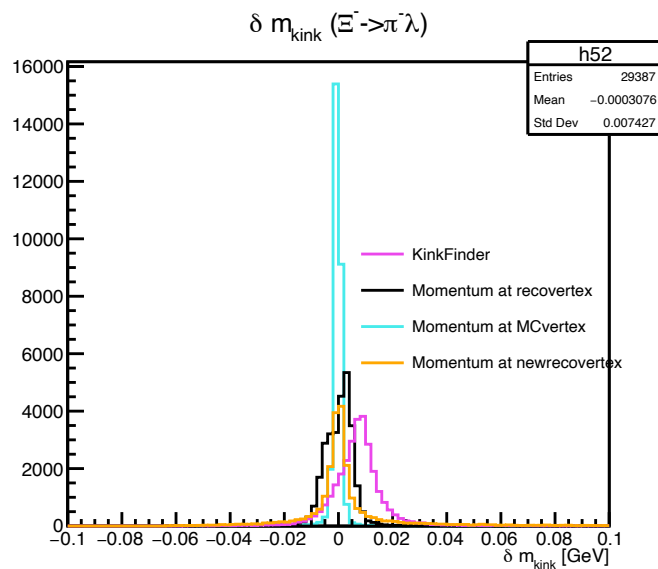
Improving mass resolution!

Next step

I want to complite until LCWS
- vertex fitting
- Fix likelihood function

What is kink mass?
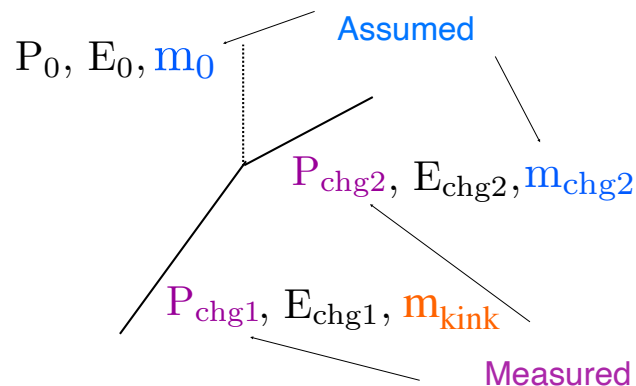# which particle produced kink?

Using $P_0 = P_{chg1} - P_{chg2}$, (Momentum conservation)

$$E_0 = \sqrt{P_0^2 + m_0^2} = \sqrt{(P_{chg1} - P_{chg2})^2 + m_0^2}$$

$$E_{chg2} = \sqrt{P_{chg2}^2 + m_{chg2}^2}$$

(Energy conservation)

P_0, E_0, m_0 — Assumed

$P_{chg2}, E_{chg2}, m_{chg2}$

$P_{chg1}, E_{chg1}, m_{kink}$ — Measured

fig.Schematic of kink

$$m_{kink} \equiv \sqrt{(E_{chg2} + E_0)^2 - P_{chg1}^2}$$

Table 1. Tested kink decay in standard kinkfinder

	m_{chg2}	m_0
$\pi^{\pm}/K^{\pm} \to \mu^{\pm}\nu$	m_{μ}	0
$K^{\pm} \to \pi\pi$	m_{π}	m_{π}
$\Sigma^{+}/\Sigma^{-} \to \pi n$	m_{π}	m_n
$\Sigma^{+} \to p\pi_0$	m_p	m_{π}
$\Xi^{-} \to \pi\Lambda$	m_{π}	m_{Λ}

Choose best decay hypothesis using kink mass