

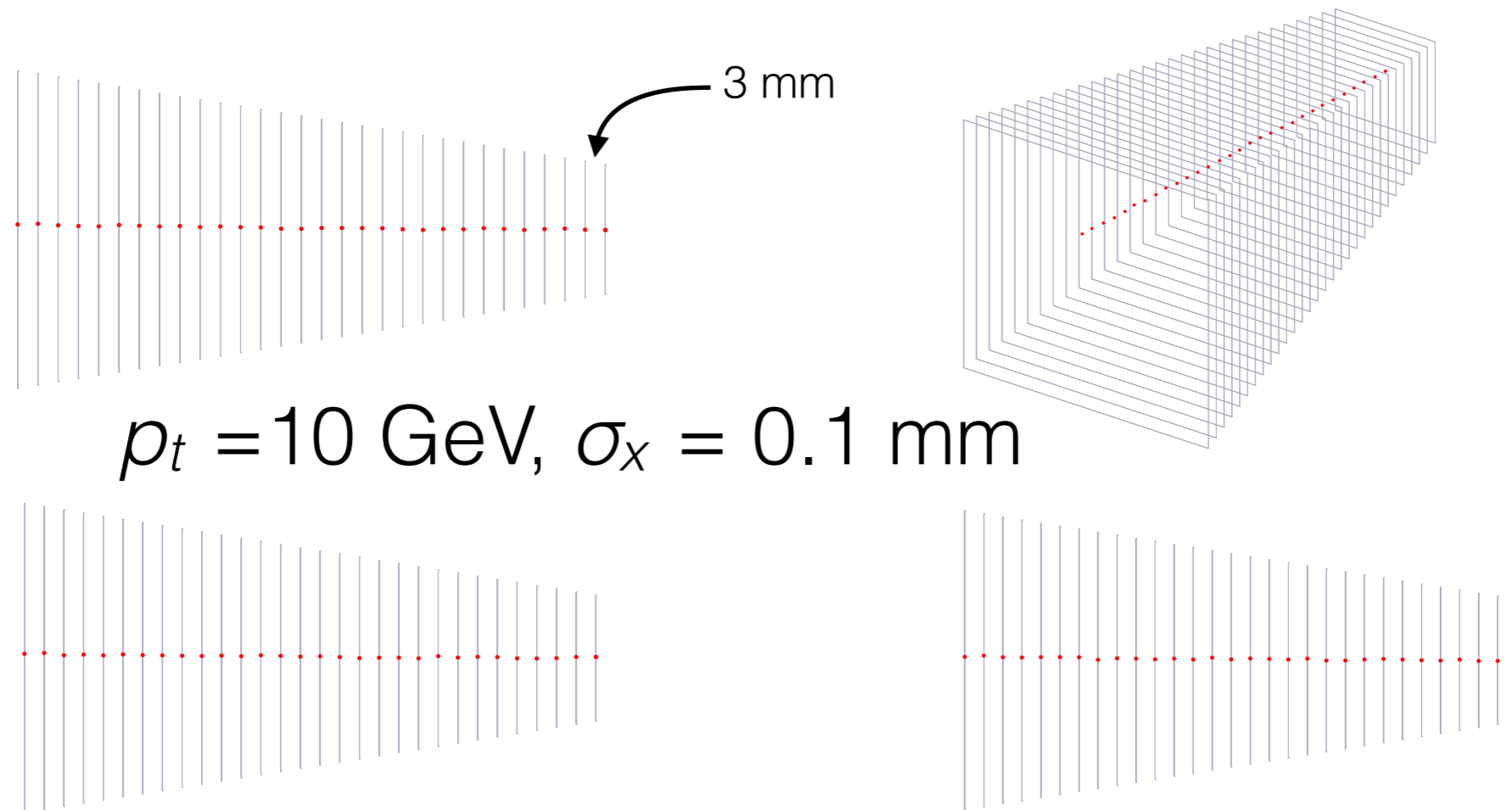
The properties of track fitting in Calorimeter

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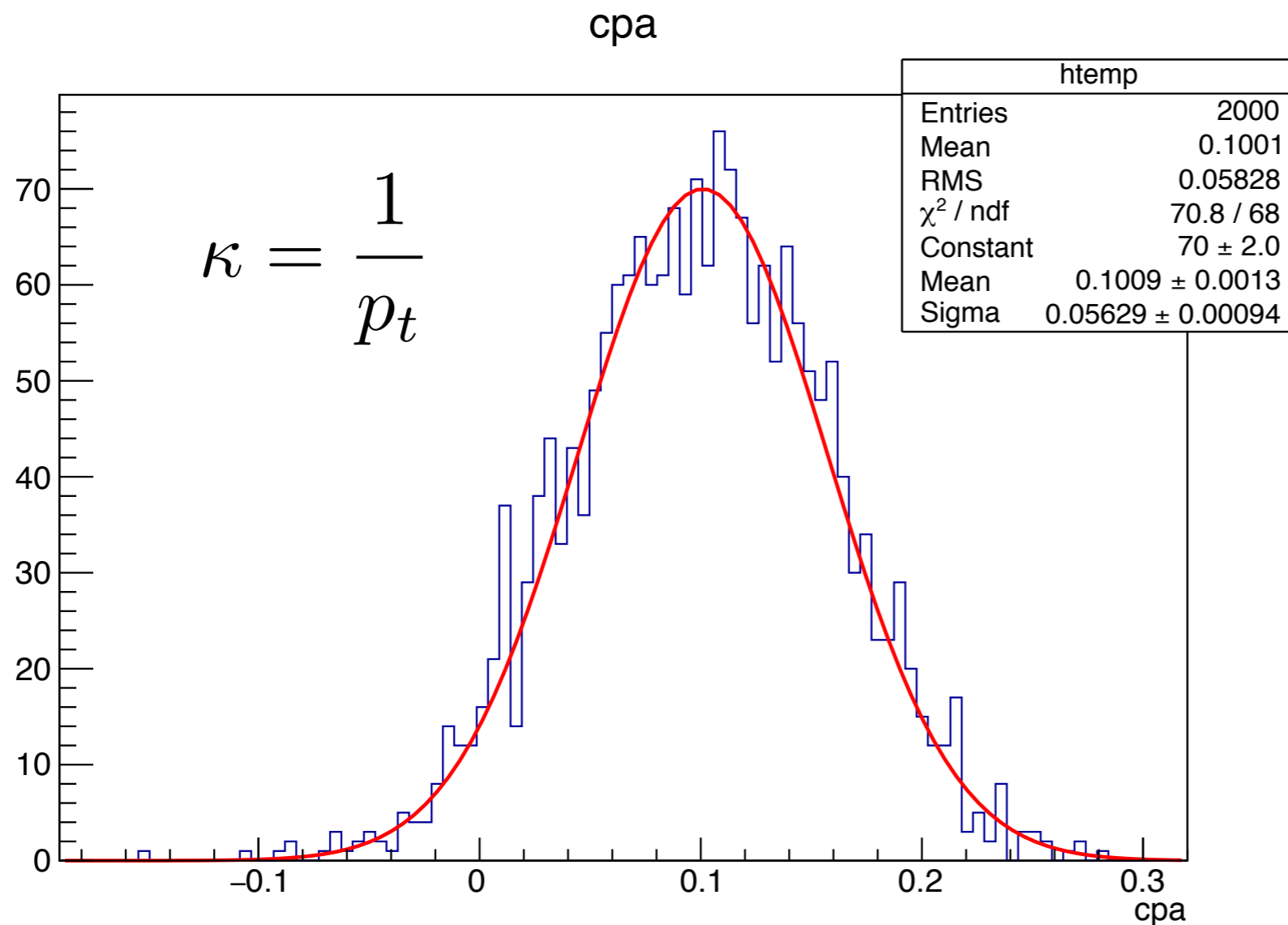
Track fitting with KalTest

- KalTest: a Kalman filter track fitting software package.



- Important parameters : spatial resolution of calorimeter hit (σ_x), multiple scattering(MS), energy loss(dE/dx)

The first check



$$\kappa = \frac{1}{p_t}$$

without MS

B : 3.5 T

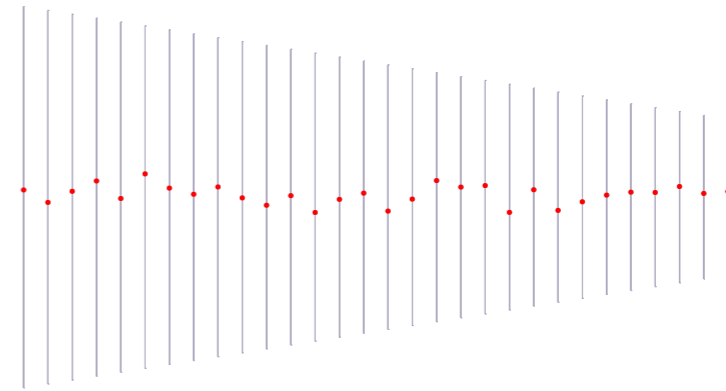
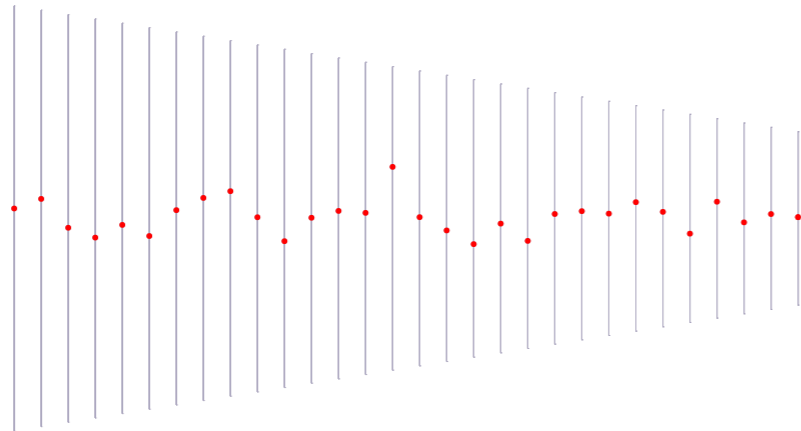
$L \sim 90$ mm

σ_x : 0.1 mm

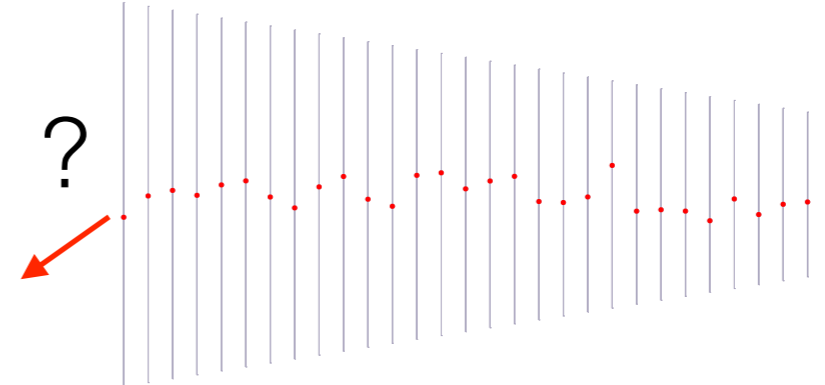
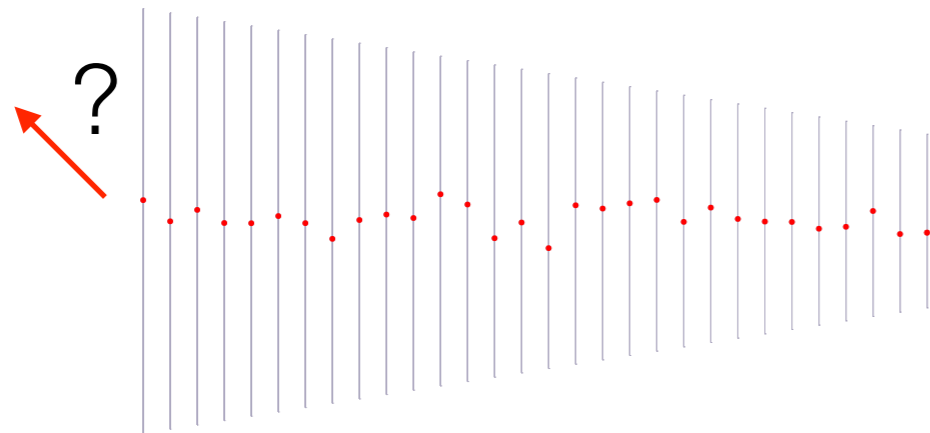
N : 30

$$\sigma \left(\frac{1}{p_t} \right) = \frac{\sigma_x}{0.3BL^2} \sqrt{\frac{720}{N+4}} = 5.4 \times 10^{-2}$$

Position resolution increased



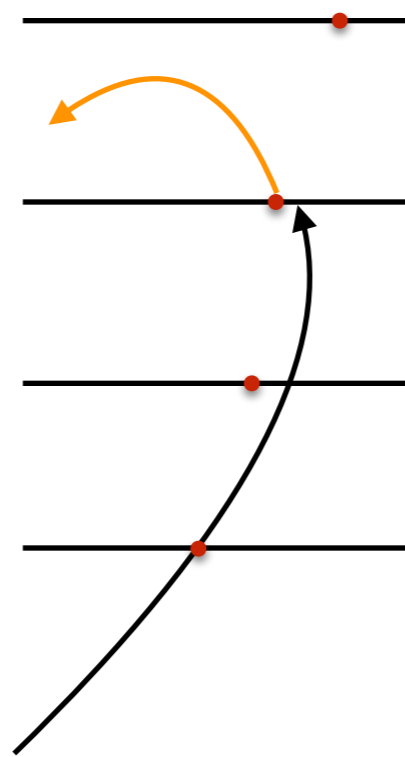
$$p_t = 10 \text{ GeV}, \sigma_x = 5 \text{ mm} / \sqrt{12} \approx 1.5 \text{ mm}$$



Consequence: $\sigma_x \uparrow \rightarrow \sigma \left(\frac{1}{p_t} \right) \uparrow$

An interruption

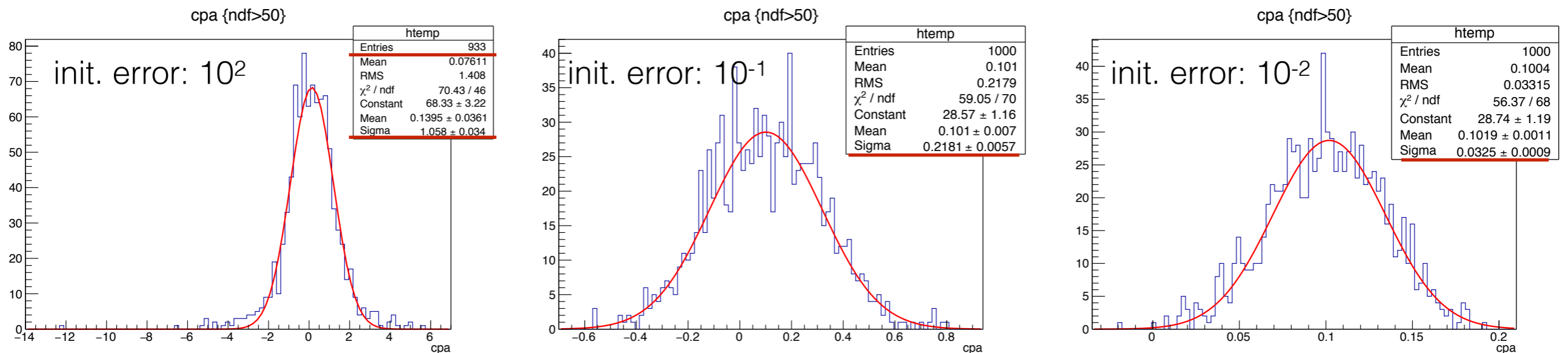
However, KalTest (based on Kalman filter) is a local fitter. When the hit spatial resolution is big enough, the following case happens usually



Track can't propagate any more,
fitting stops :(

Solution I

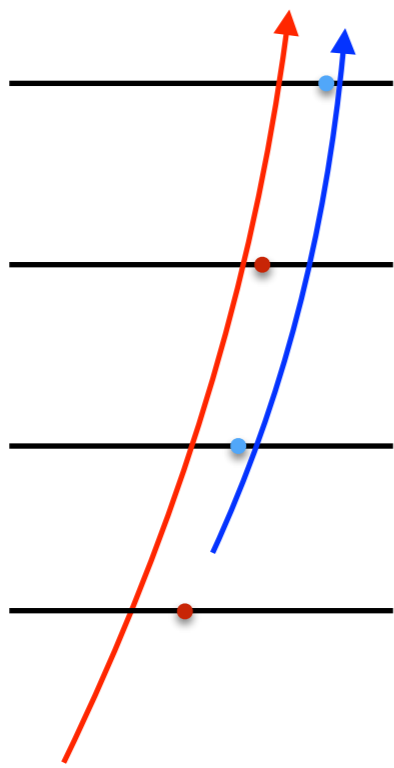
- We know the parameters of charge track with one precision by tracker. This maybe use for next tracking in ECAL.
- Initial track: parameters from tracker; **proper covariance matrix**.



- Maybe this fitting (almost propagation) is not trivial. It can give particle energy when entering HCAL, or some interaction (including decay) information to us.

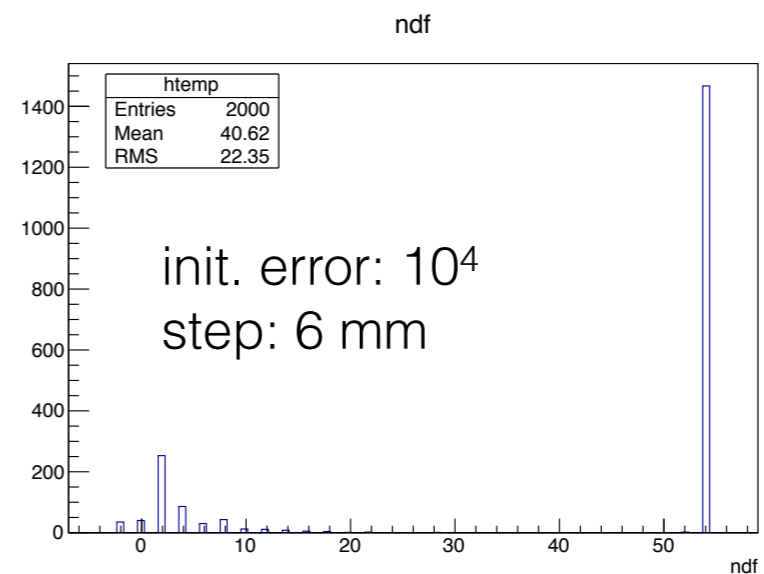
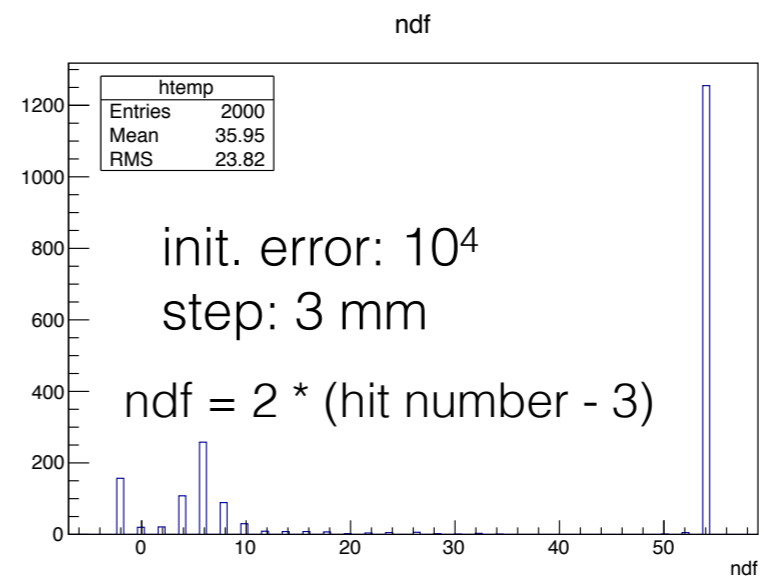
Solution II

“Track” in HCAL has no priori parameters. **Providing that fitting with larger step can avoid the track propagation interruption at some degree(???)**, we want to try this proposal:



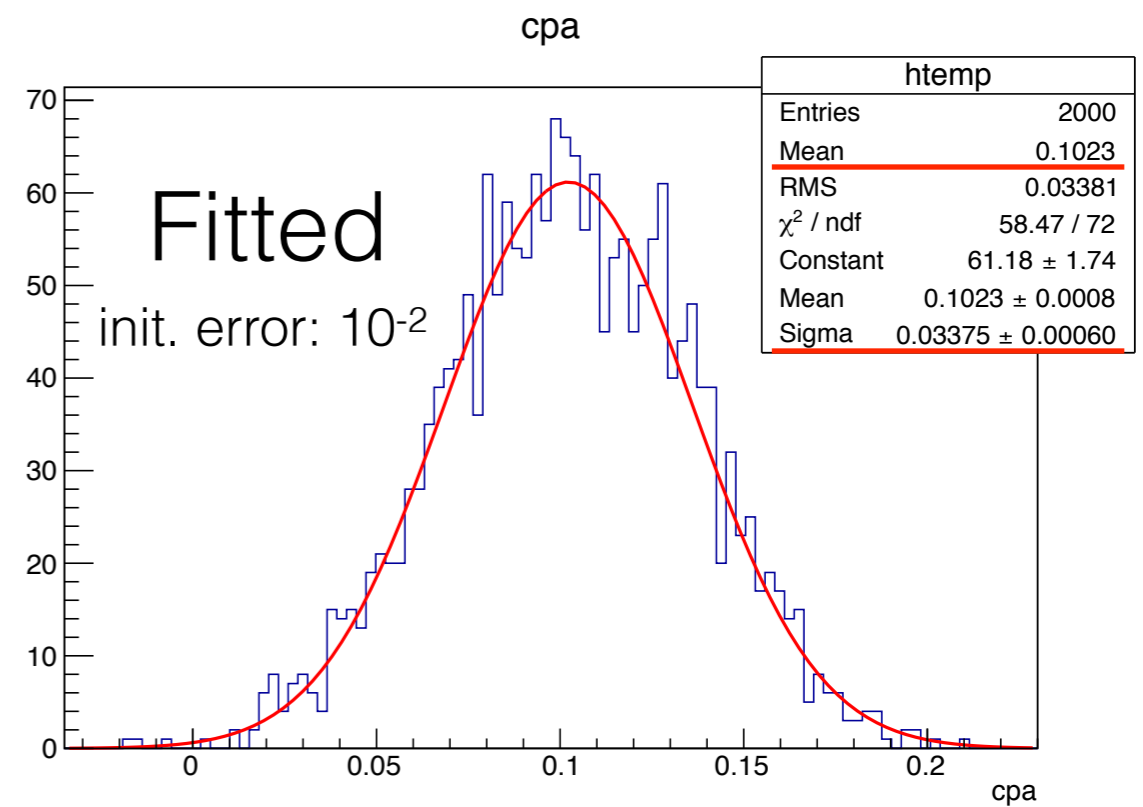
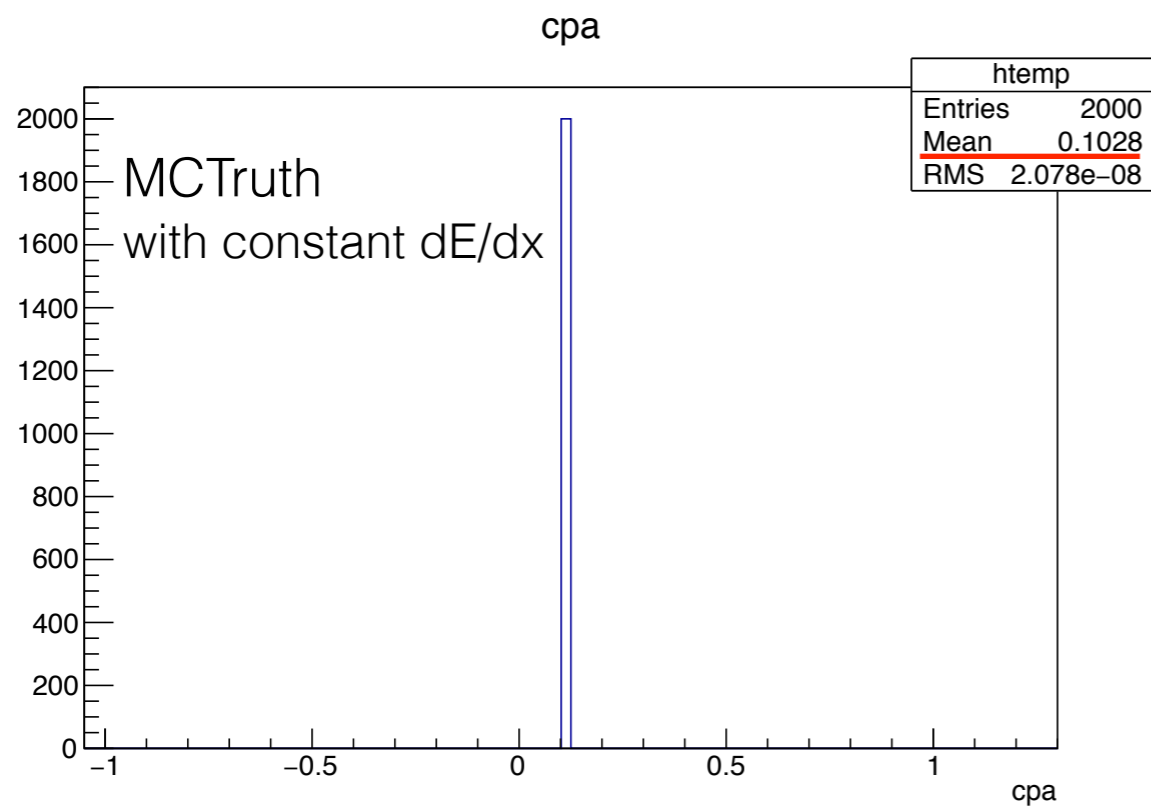
Start with rough track parameters

Not tested yet



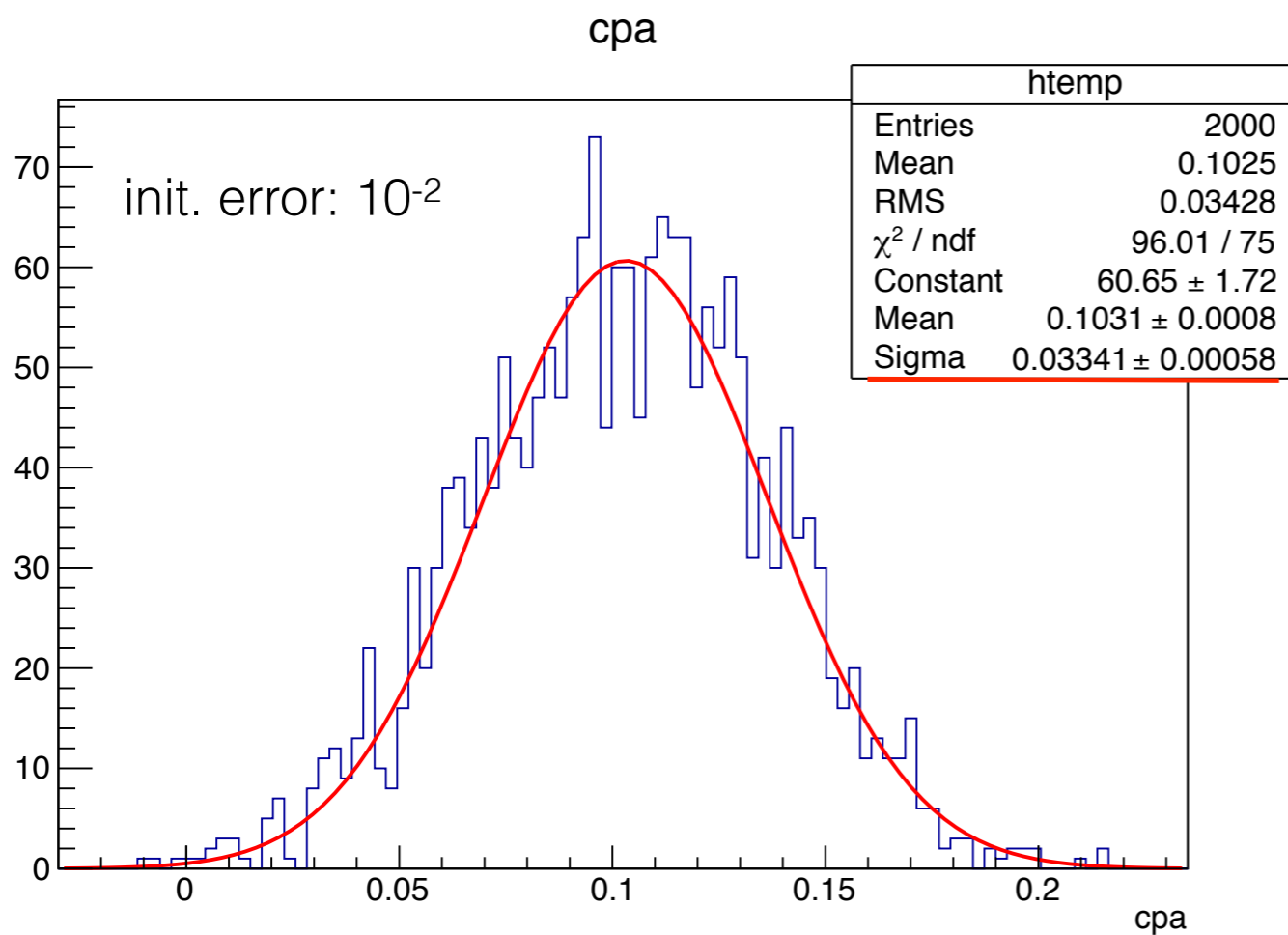
dE/dx

$p_t = 10$ GeV, $\sigma_x = 0.1$ mm, with dE/dx calculated by Bethe-Bloch formula (W: $A = 183.84$, $Z = 74$, $\rho = 19.25$)



M.S.

$p_t = 10$ GeV, $\sigma_x = 0.1$ mm, with dE/dx and M.S.
(W: $A = 183.84$, $Z = 74$, $\rho = 19.25$, $L_{\text{rad}} = 0.35$ cm)



The error of fitted parameter is mainly determine by the initial error of track parameter.