

μ -e scattering
questions on Muon beam
and μ/e ID

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14 December 2017
Bologna, MUonE Meeting

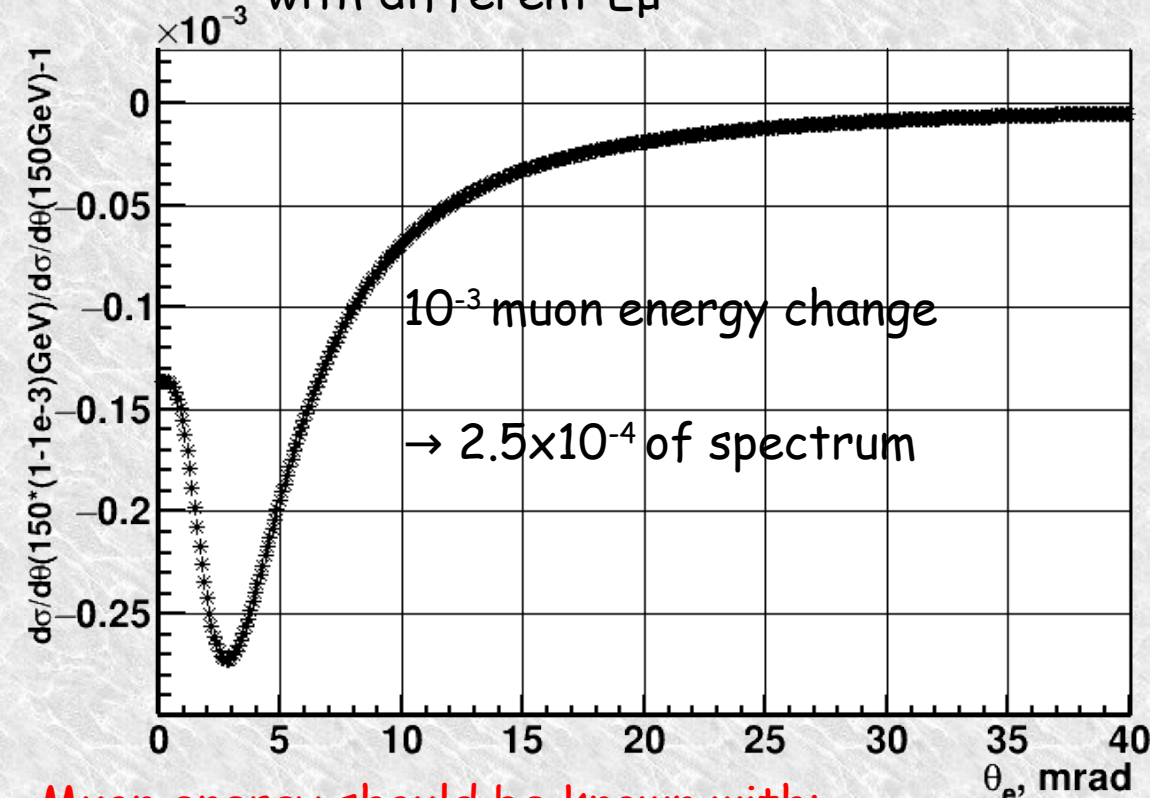
Precision on muon energy

Cross-section vs angle spectrum should be known at 10^{-5}

Energy loss(40x 1 cm Be)/ $E_\mu \sim 10^{-3}$

Change of LO $d(\text{cross-section})/d\theta_e$

with different E_μ



$d\sigma/d\theta/(d\sigma/d\theta)_0$ ($\theta_e \sim 3\text{mrad}$)

$\sim (1 + 0.3 * dE_\mu/E_\mu - 0.5 * 0.3 * (dE_\mu/E_\mu)^2)$

And much less in normalization region

10^{-3} muon energy change (between last and first target) $\rightarrow 2.5 \times 10^{-4}$

3% beam energy spread $\rightarrow 10^{-4}$ shift in signal region

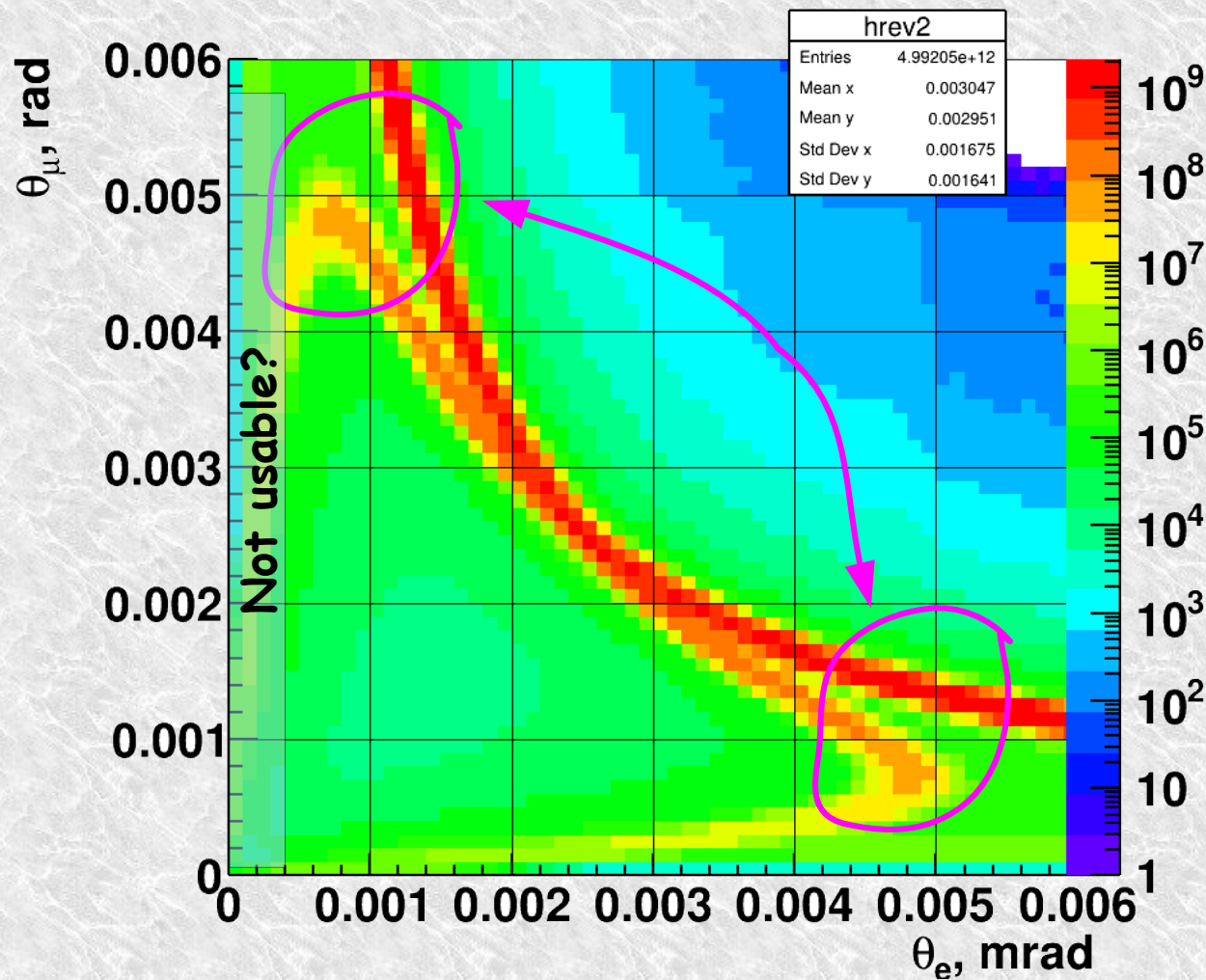
Muon energy should be known with:

10^{-5} in spectrum \rightarrow Muon beam energy 4×10^{-5}

Energy loss at targets 4%

beam energy spread $\delta\sigma/\sigma_{E_{\text{beam}}} < 3 \times 10^{-5} / (\sigma_{E_{\text{beam}}}^2 / E^2)$

miss e/ μ ID problem



Can not separated μ/e by tracking at 1-5 mrad

Number of events at 5mrad vs 1 mrad $\sim 5/1$

μ/e ID should be at $1./5 \times 10^{-5}$?

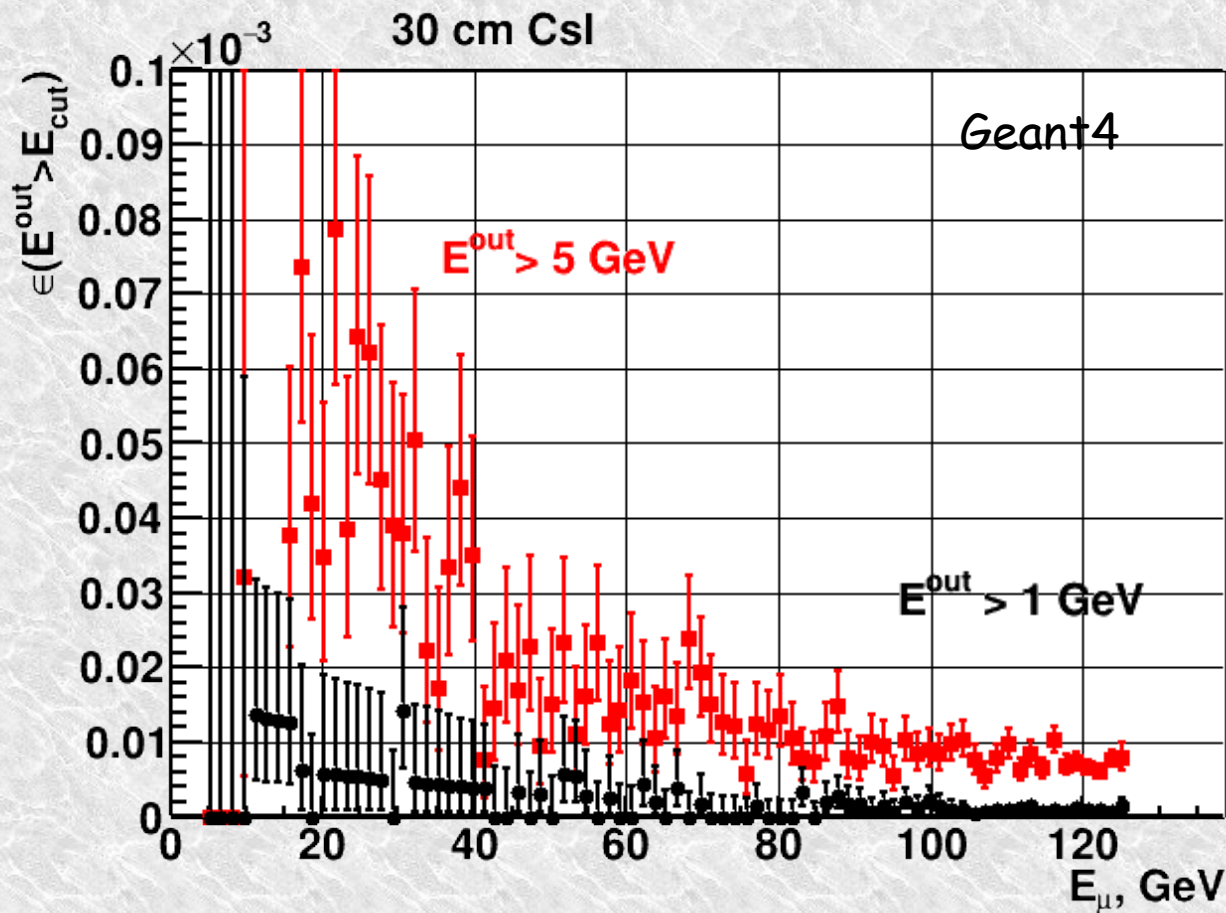
Angle μ out vs e ~ 5 mrad
 $\rightarrow 5\text{mm}/1\text{m}$ distance between impact point at calorimeter

Mollier radius (transverse size of electromagnetic shower) \sim few cm (3.5 cm CsI, 2.2 cm BGO)

$\theta_e < 0.5$ mrad can't be used at all? Similar to events with low angle muon and higher angle of electron : huge background from low momentum electron
 $\theta_e = 0.5 \rightarrow \min E_\mu = 15 \text{ GeV}$, $\max x = 0.93$

Using muon system?

Inefficiency to lose muon after 30 cm CsI

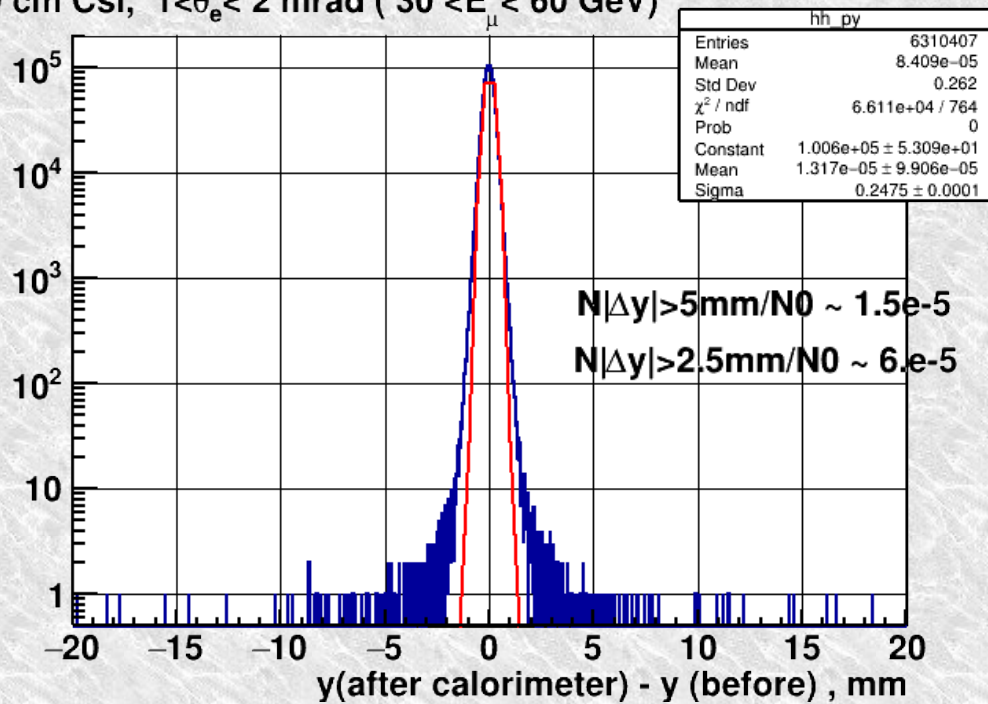


For 30 GeV muon ($\theta_e \sim 1 \text{ mrad}$)

Muon will pass calorimeter
with $\sim \sim 10^{-5}$

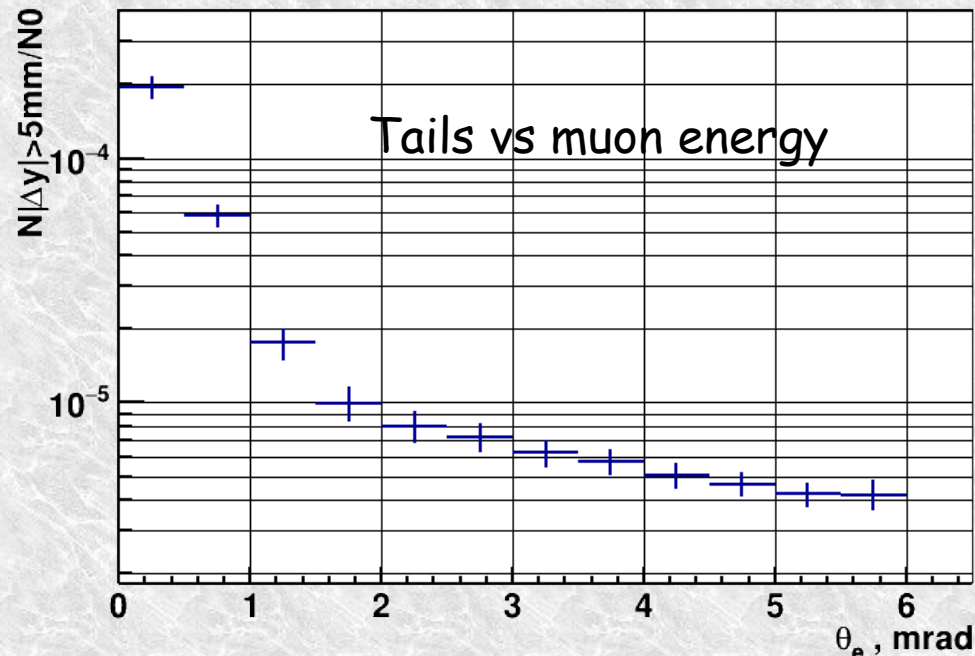
Muon after calorimeter

30 cm CsI, $1 < \theta_e < 2$ mrad ($30 < E < 60$ GeV)



Sigma of muon position after 30cm CsI ~ 0.25 mm (should be compared to 5 mm distance between μ/e)

tails $\sim 10^{-5}$



Question

Muon energy should be known with:

10^{-5} in spectrum \rightarrow Muon beam energy 4×10^{-5}

Energy loss at targets 4%

beam energy spread $\delta\sigma/\sigma_{E_{\text{beam}}} < 3 \times 10^{-5} / (\sigma_{E_{\text{beam}}}^2 / E^2)$

(if 3% beam spread \rightarrow it should be known with 3%)

μ^+ / e^- ID should be at $1./5 \times 10^{-5}$

Is it necessary something in addition,

like additional B field to split better 2 tracks

Or tracker after Bfield to measure charge of tracks?