Muon reconstruction in SAND including 3DST (FLUKA simulation)

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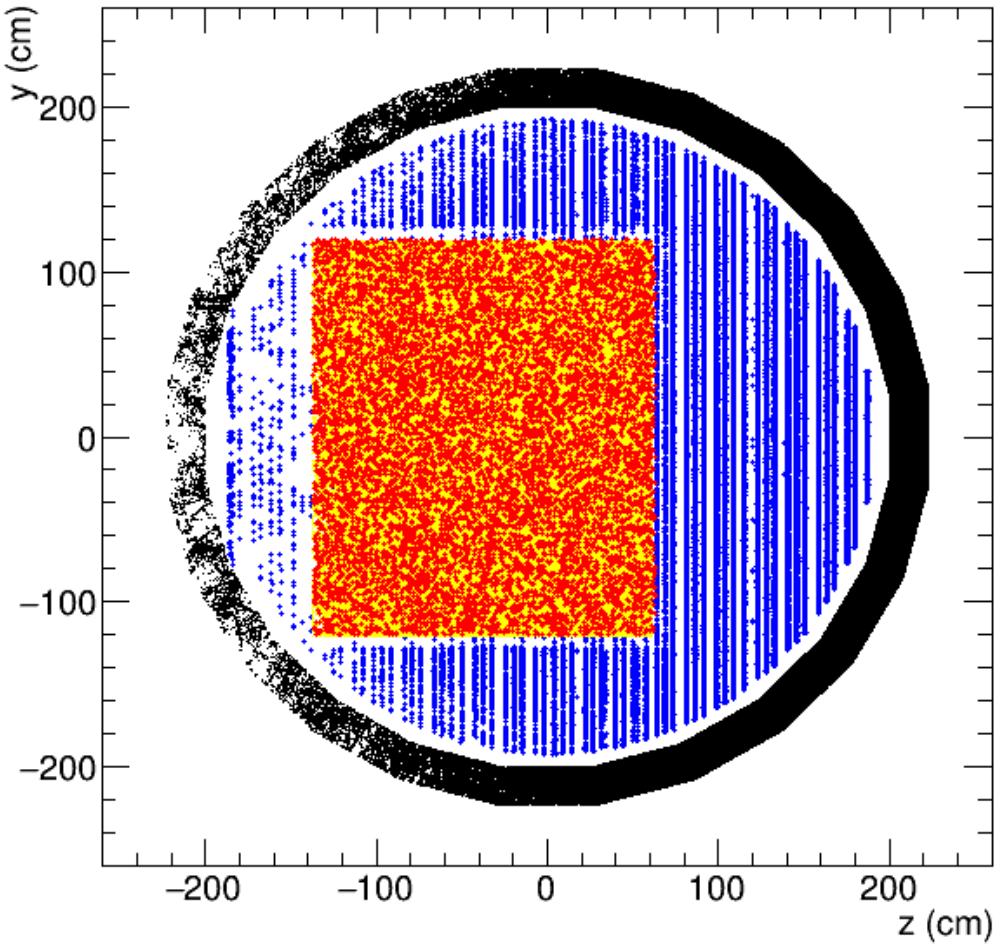
MC sample

10,000 ν_μ CC-Q.E. interactions in the 3DST



● Interaction vertices

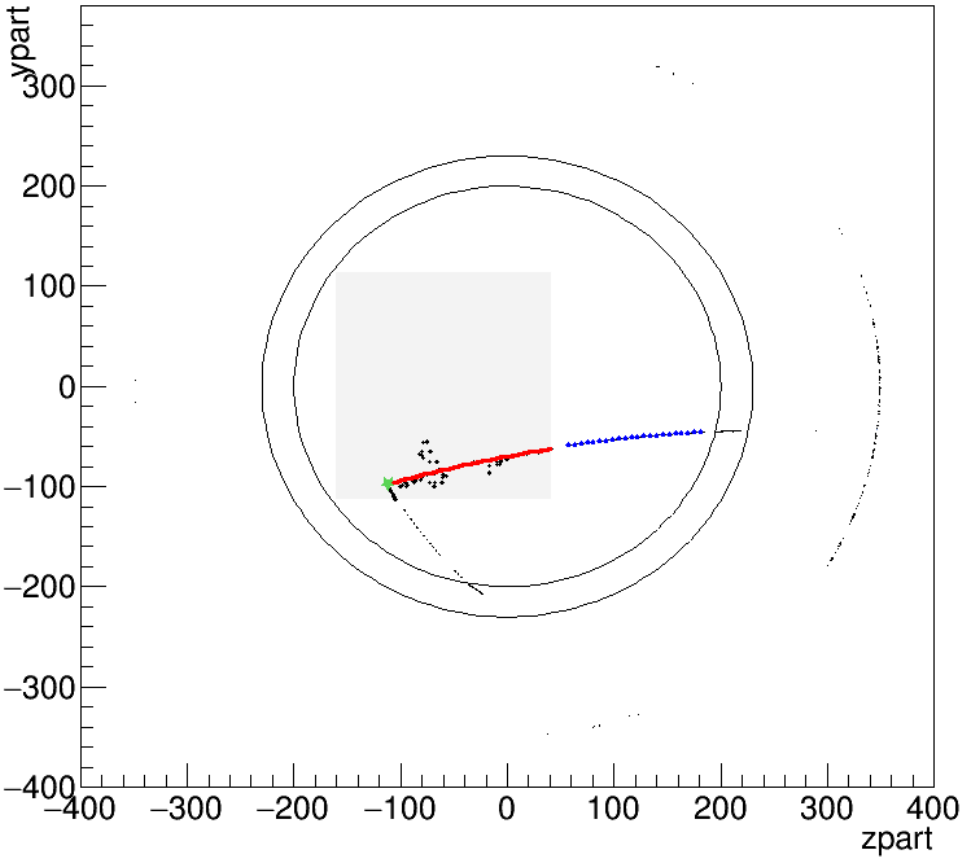
3DST
(2.24 x 2.24 x 2.4 m^3)

STT 'digits'

Calorimeter Hits

Muon momentum reconstruction

Typical event



Muon momentum in STT (p_{yz} and dip-angle)

+

Muon energy loss in 3DST from energy deposit or range (vertex reco needed)

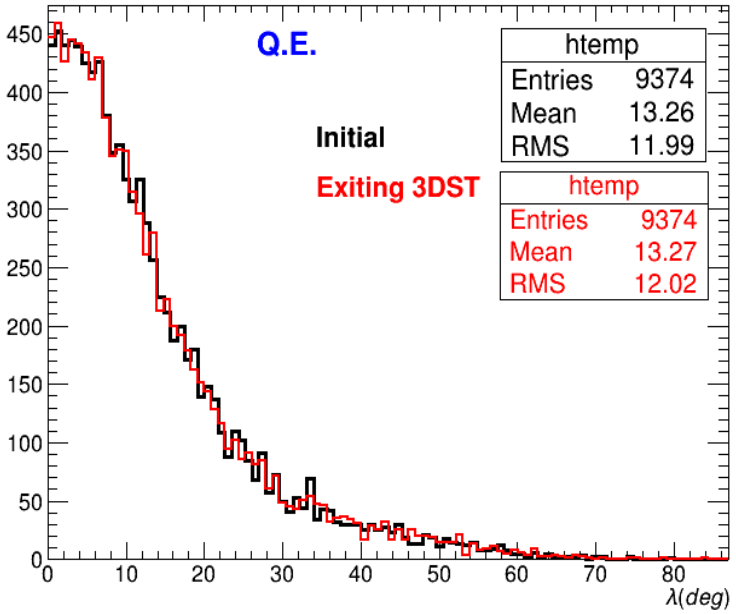
+

Dip-angle change due to MS in 3DST

λ_0: dip-angle at production

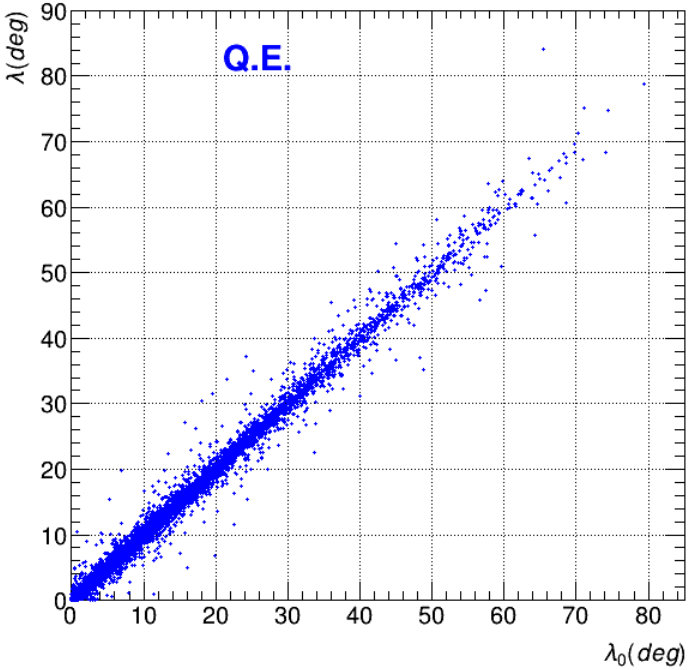
λ : dip-angle at 1° STT hit

Dip-angle of muon trajectory



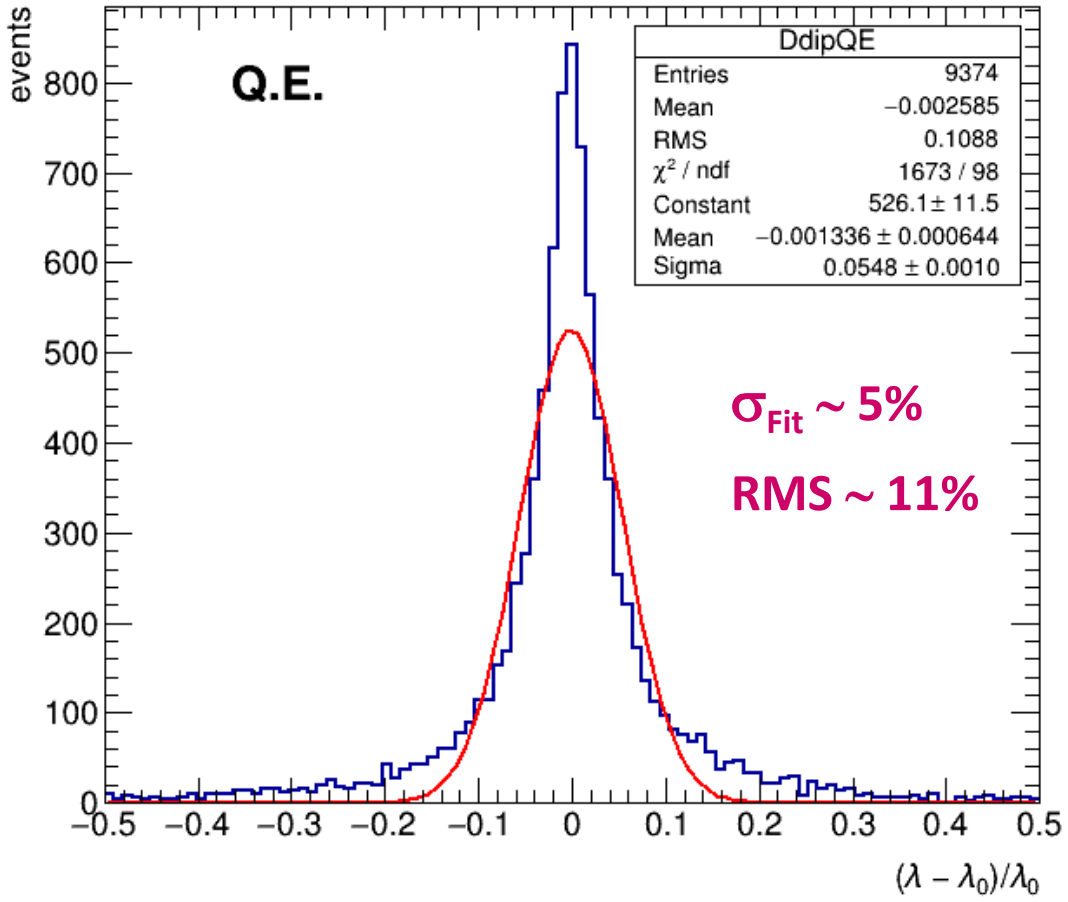
Distributions of dip-angle at generation (λ_0) and when entering STT (λ)

Correlation between λ and λ_0



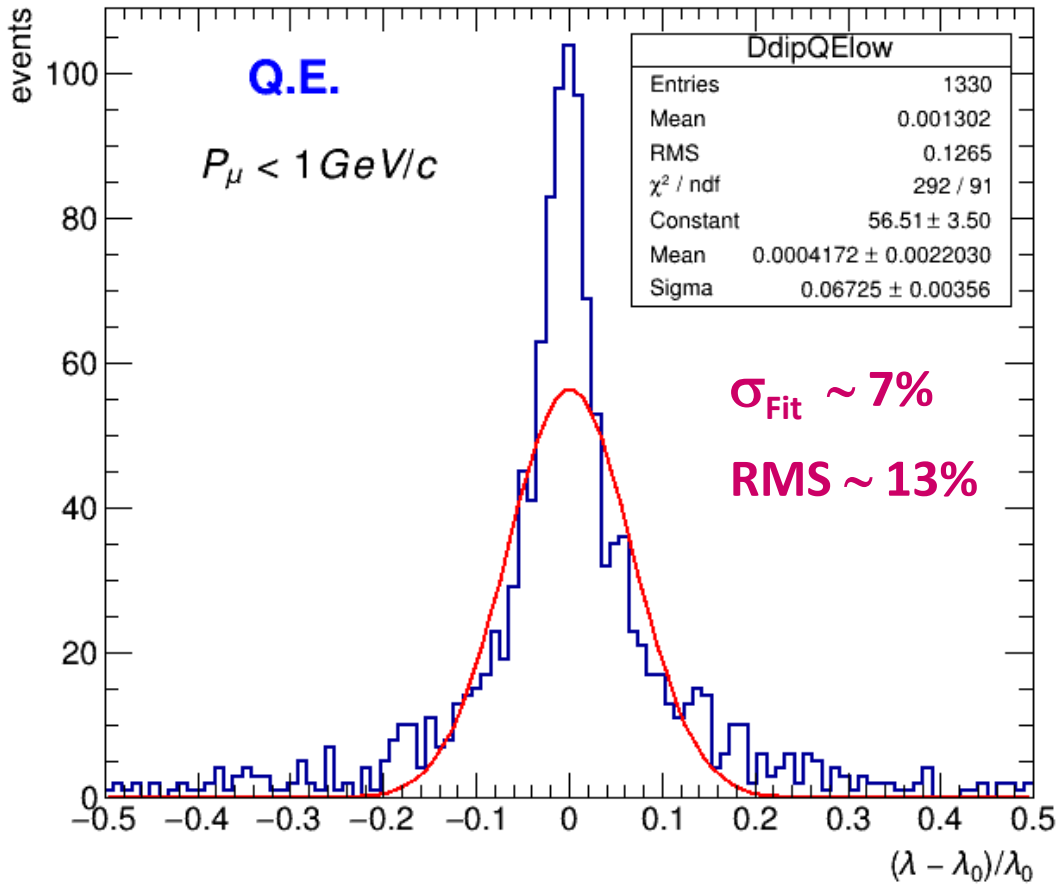
Change of dip-angle in 3DST

Relative variation of dip-angle (from λ_0 to λ)



Change of dip-angle in 3DST (low E events)

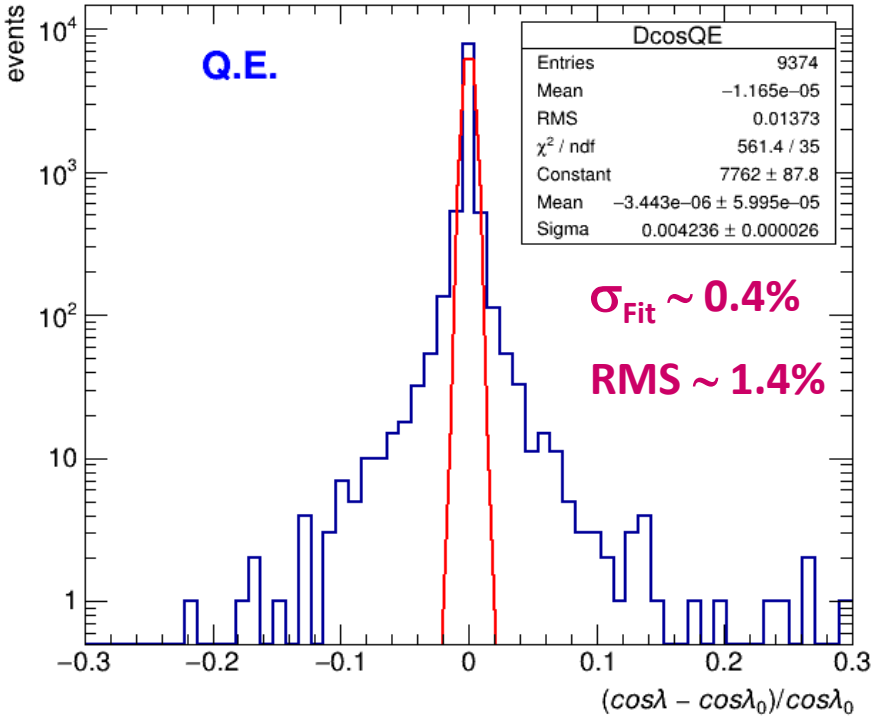
Relative variation of dip-angle for low momentum muons

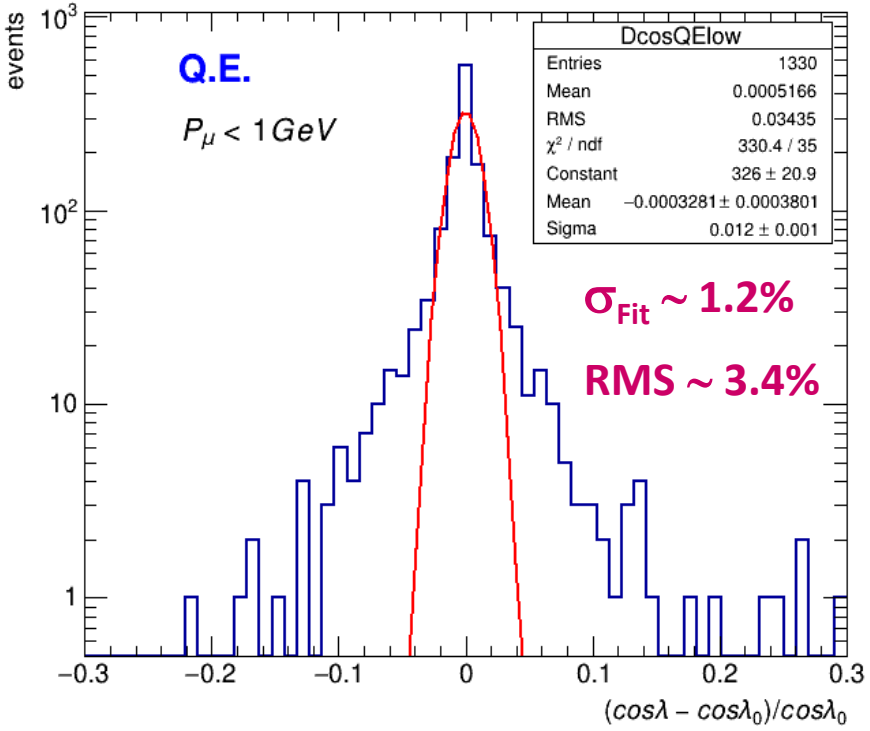


Change of cos(dip-angle) in 3DST

Relative variation of cos(dip-angle), directly related to total P_μ reconstruction:

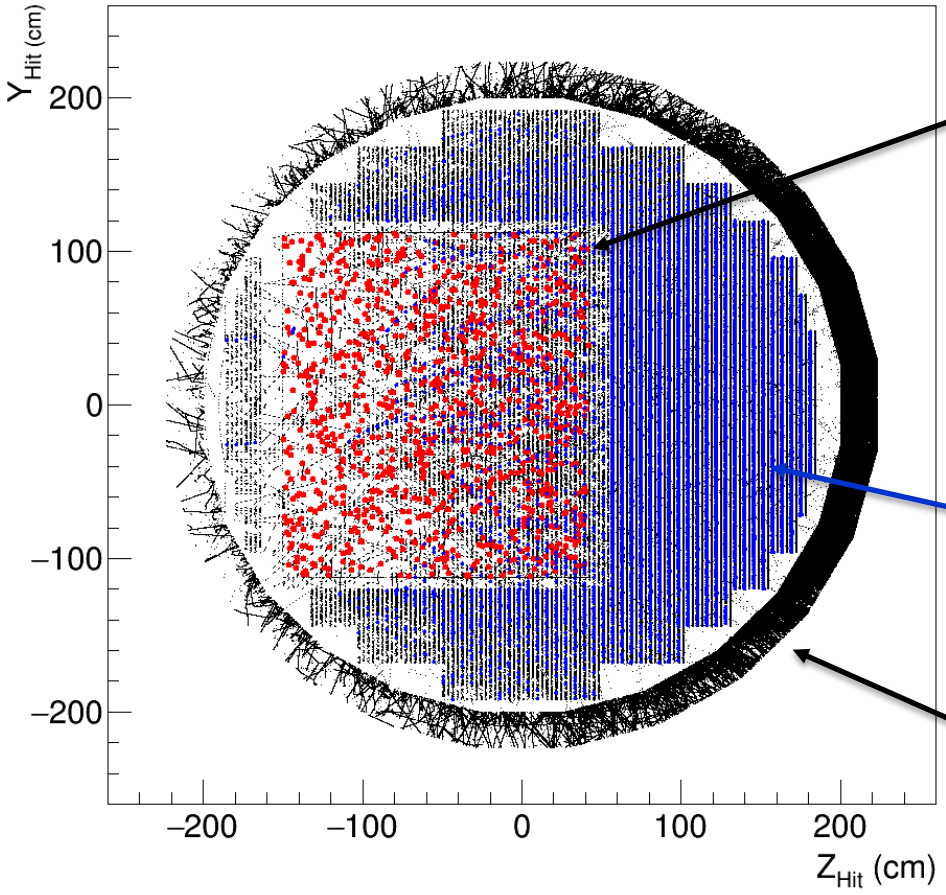
$$P_\mu = p_{yz} / \cos(\lambda)$$





Previous MC sample (all CC channels)

5,000 ν_μ-CC interactions in the 3DST



3DST
(2.24 x 2.24 x 2.4 m³)

Interaction vertices

STT MC hits (all particles)
STT 'digits' (muons)

Old STT layout

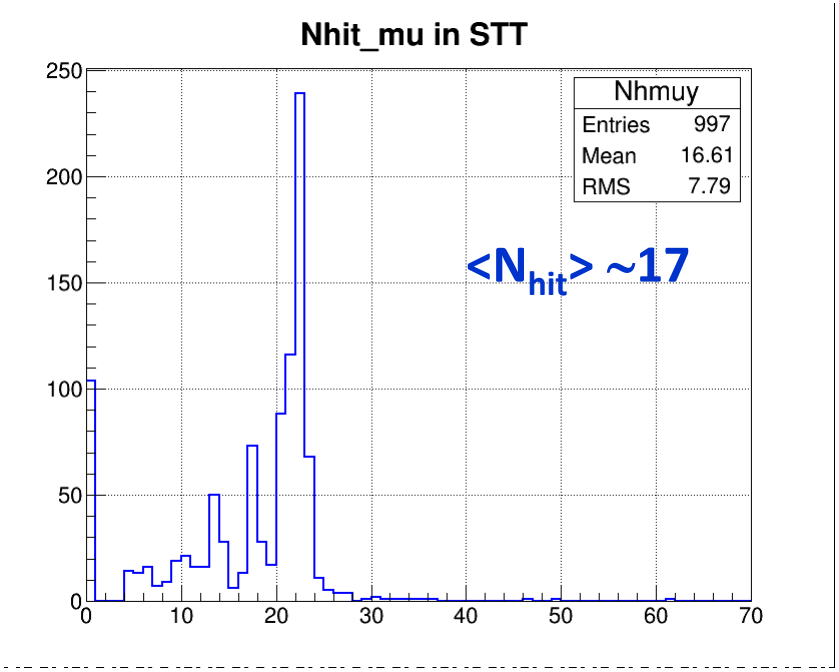
Calorimeter

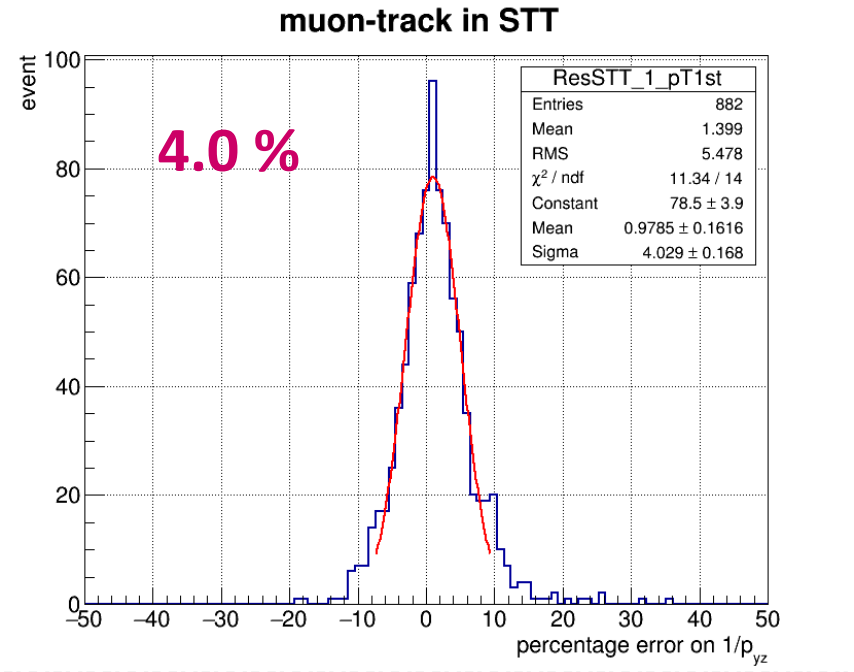
Muon p_{yz} reconstruction in STT

- Fit (by a circle) of μ-track in yz view, (Δz=0.01mm, Δy=0.2 mm)

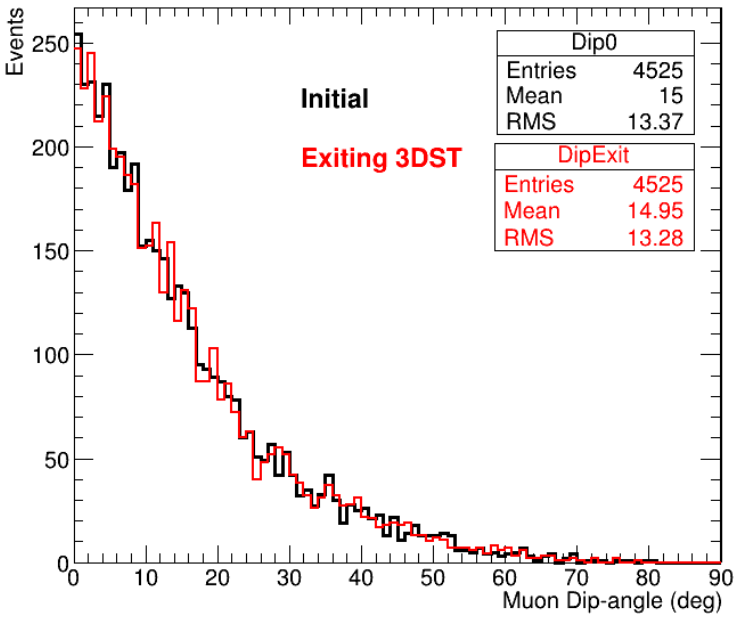
  $\Rightarrow$ Rec-p_{yz} [GeV/c] = 0.18 * R_{curv} [m]

➢ Muon-p_{yz} resolution from STT tracks:



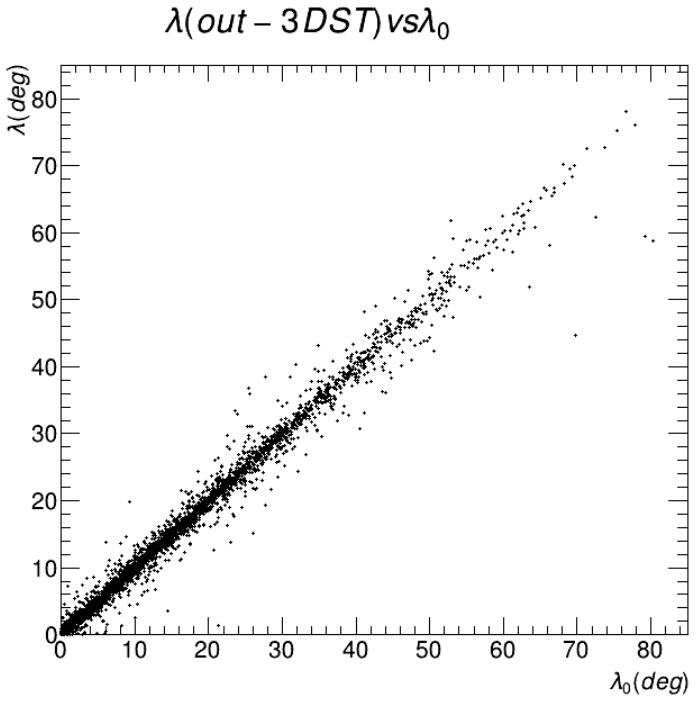


Dip-angle of muon trajectory (QE, RES, DIS)



Distributions of dip-angles λ_0 and λ

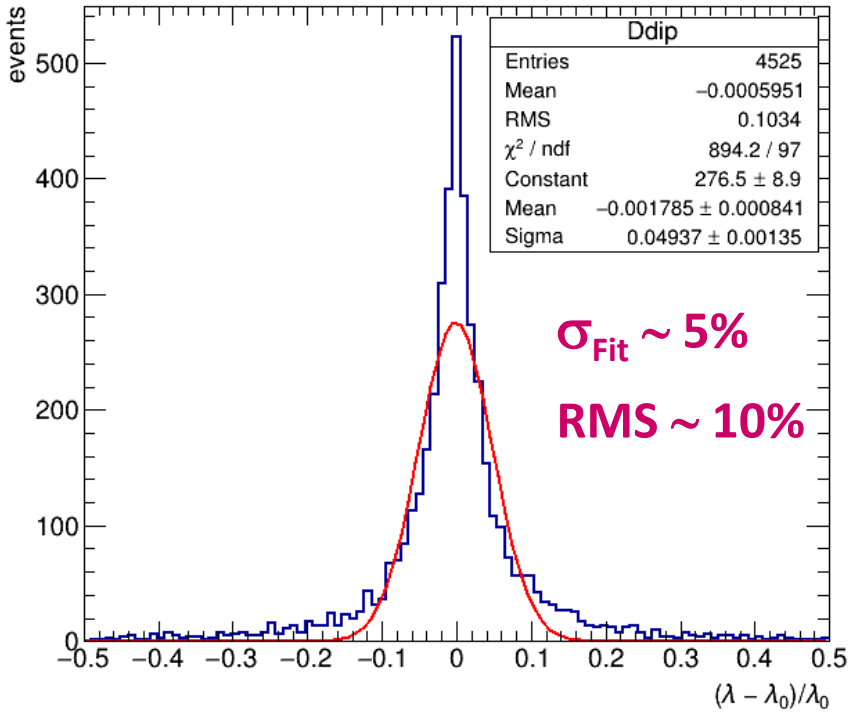
Correlation between λ and λ_0

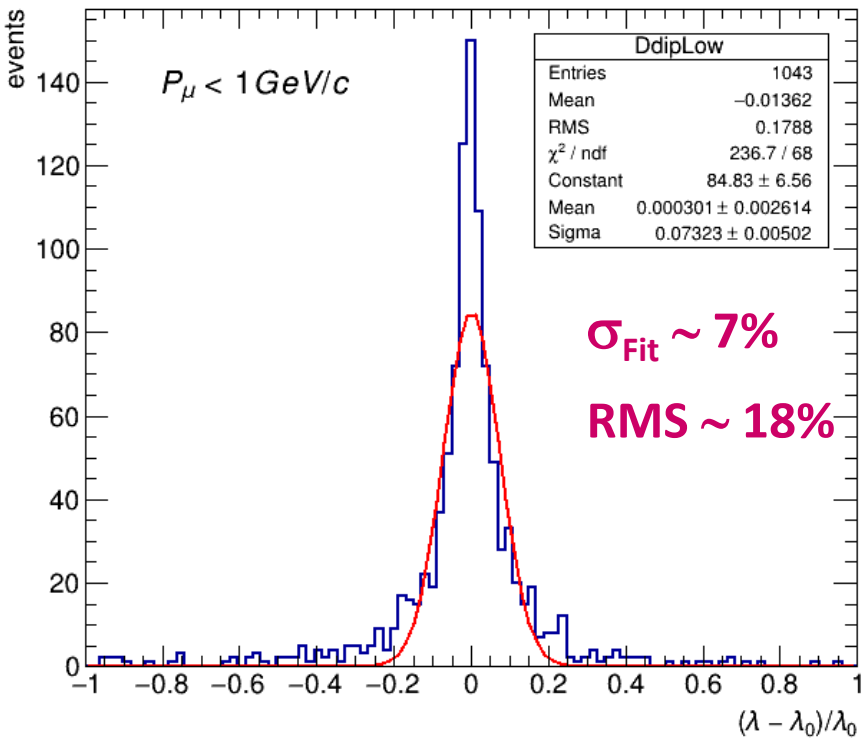


Change of dip-angle in 3DST

All interaction channels

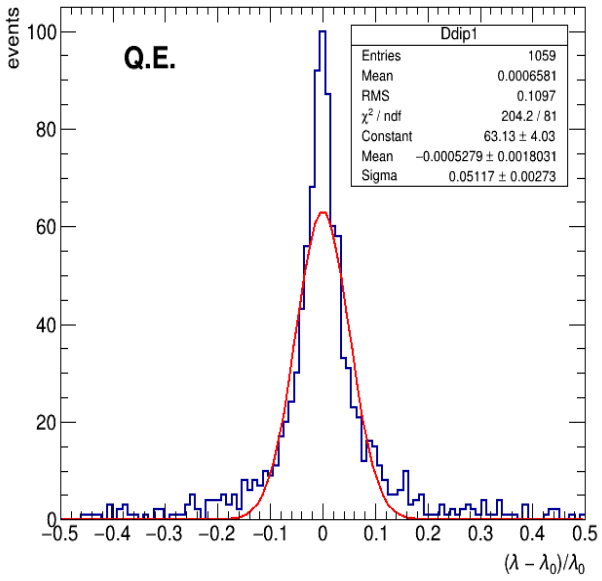
Relative variation of dip-angle (from λ_0 to λ)





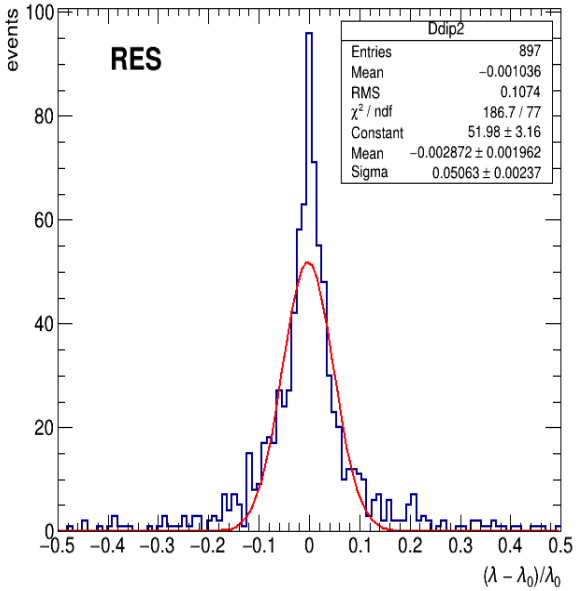
Change of dip-angle in 3DST

Relative variation of dip-angle for the 3 interaction channels



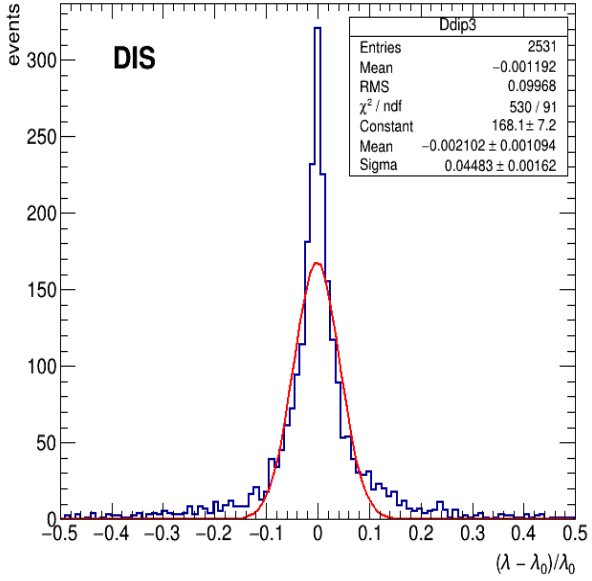
$\sigma_{Fit} \sim 5\%$

RMS ~ 11%



$\sigma_{Fit} \sim 5\%$

RMS ~ 11%

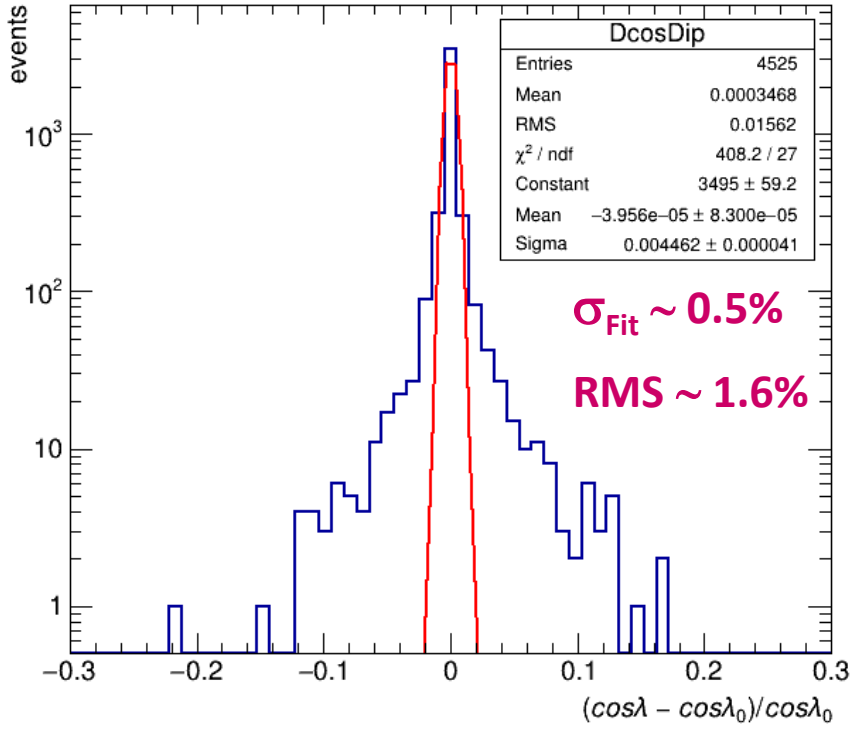
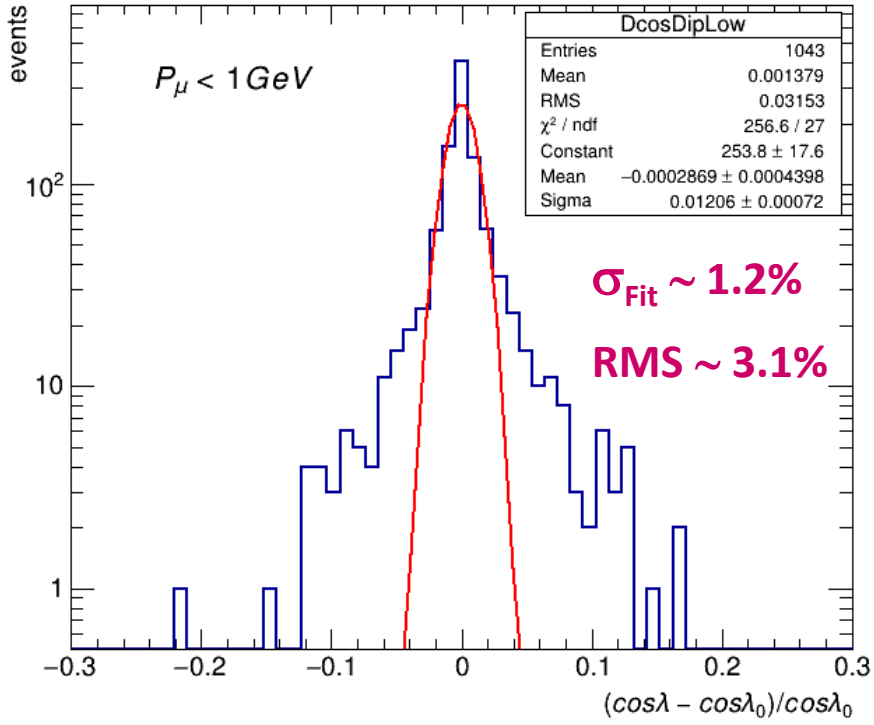


$\sigma_{Fit} \sim 4\%$

RMS ~ 10%

Change of cos(dip-angle) in 3DST

Relative variation of cos(dip-angle), directly related to total P_μ reconstruction:

$$P_\mu = p_{yz} / \cos(\lambda)$$

Any interaction channels