Evaluation of the d_0 resolution from data

- Track impact parameter ($r\phi$) resolution in pp
- Pulls on the impact parameter
- First ideas to extract the resolution from real data

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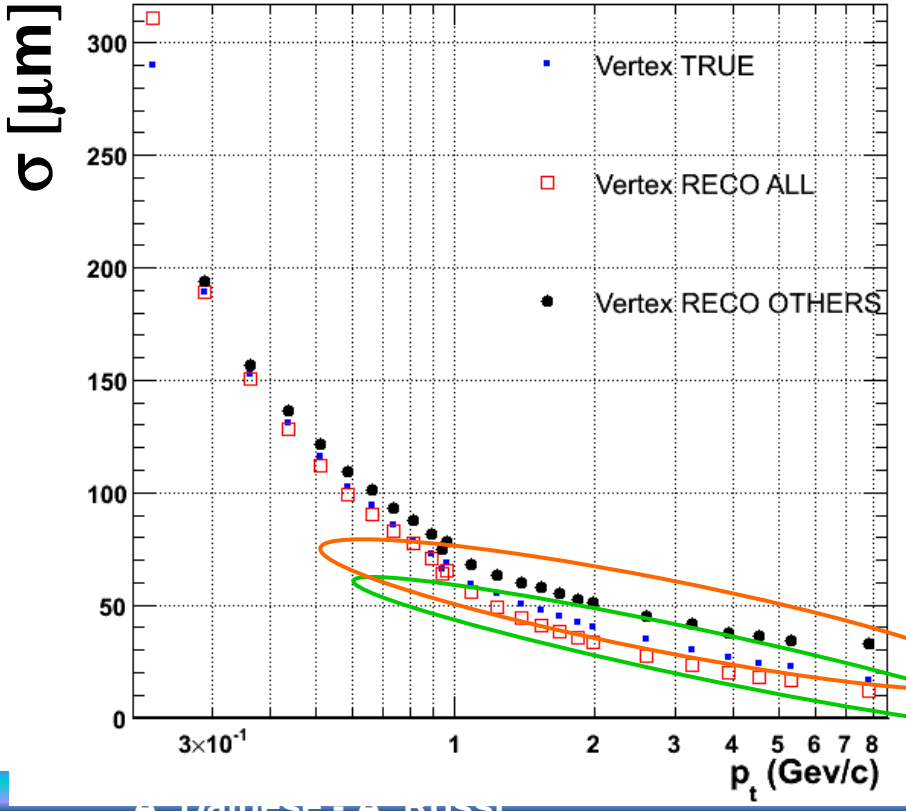
Track impact parameter measurement in pp collisions

- Track impact parameter resolution: $\sigma_{d0} = \sigma_{vtx} \oplus \sigma_{track}$
- Vertex reconstructed from tracks
- Bias (underestimate of d_0) if the considered track is used for vertex fit:

σ of d_0 distribution for primaries

true vertex from simul.
reco vertex using all tracks
reco vertex excluding current track



effect of vertex uncertainty

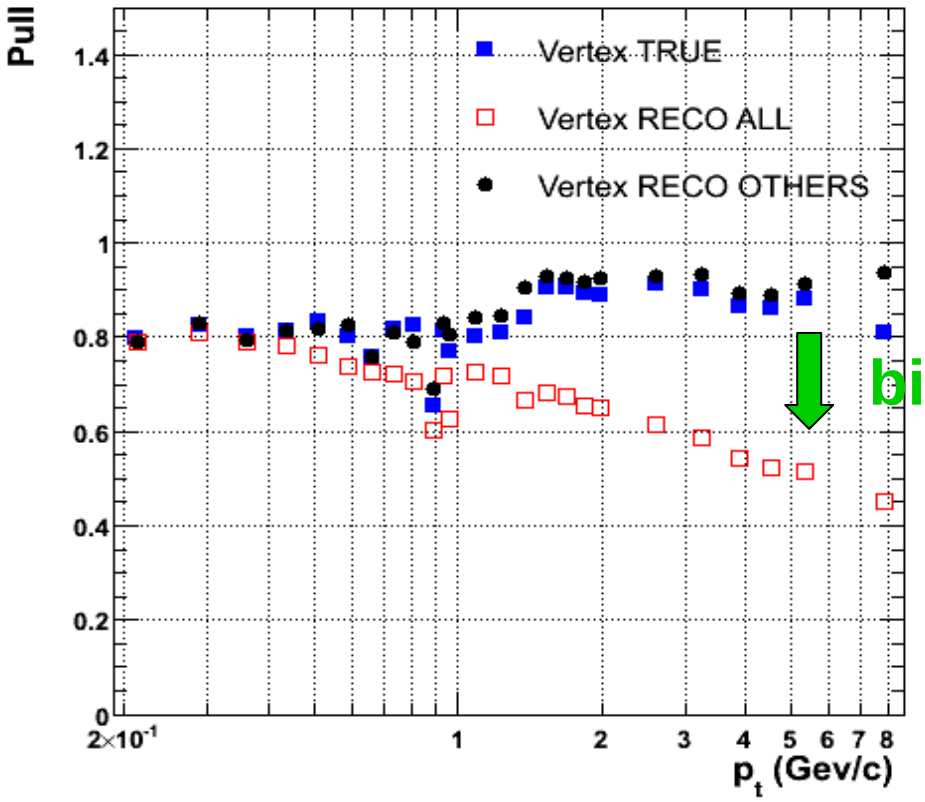
bias!

Pulls on the impact parameter

- Bias is visible also if one looks at the pulls:

true vertex from simul.
reco vertex using all tracks
reco vertex excluding current track

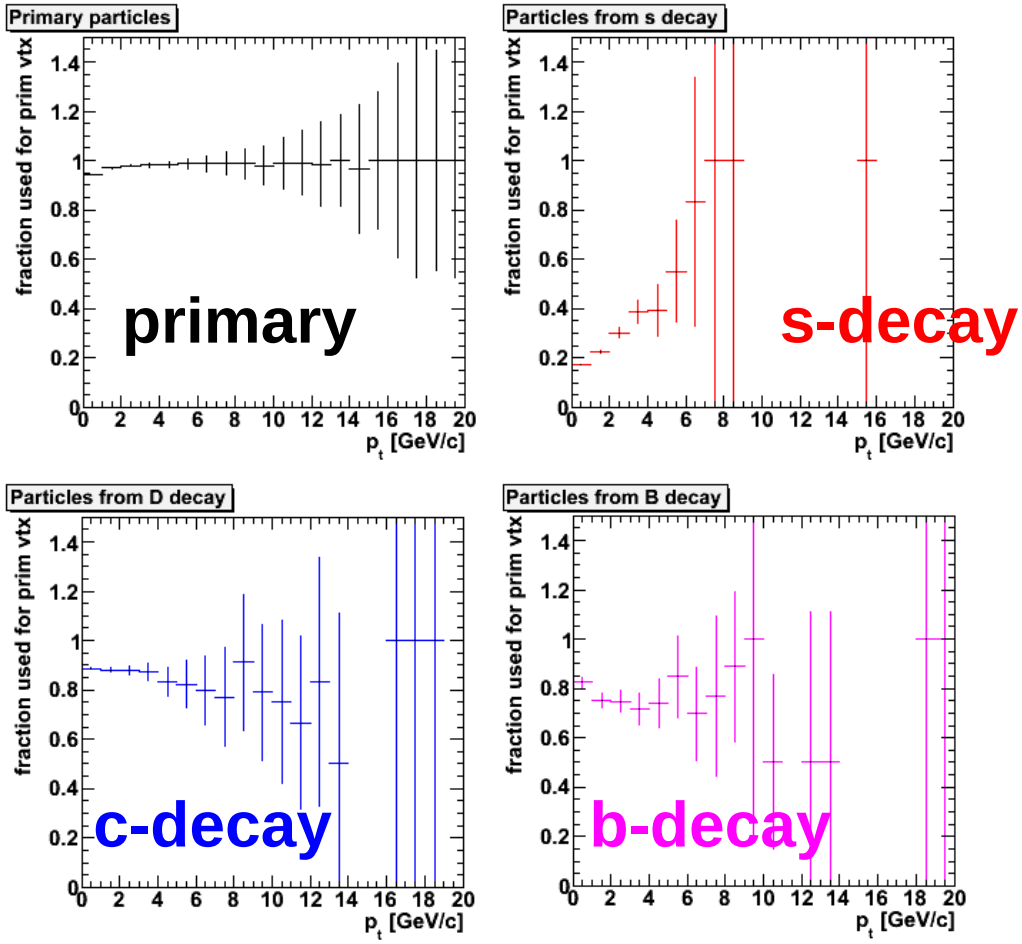
σ of d_0/error(d_0) distr. for primaries



bias!

Tracks used for vertex reco

- Fraction of tracks of given origin used in vertex fit:



➔ **this bias could be relevant for charm/beauty studies**

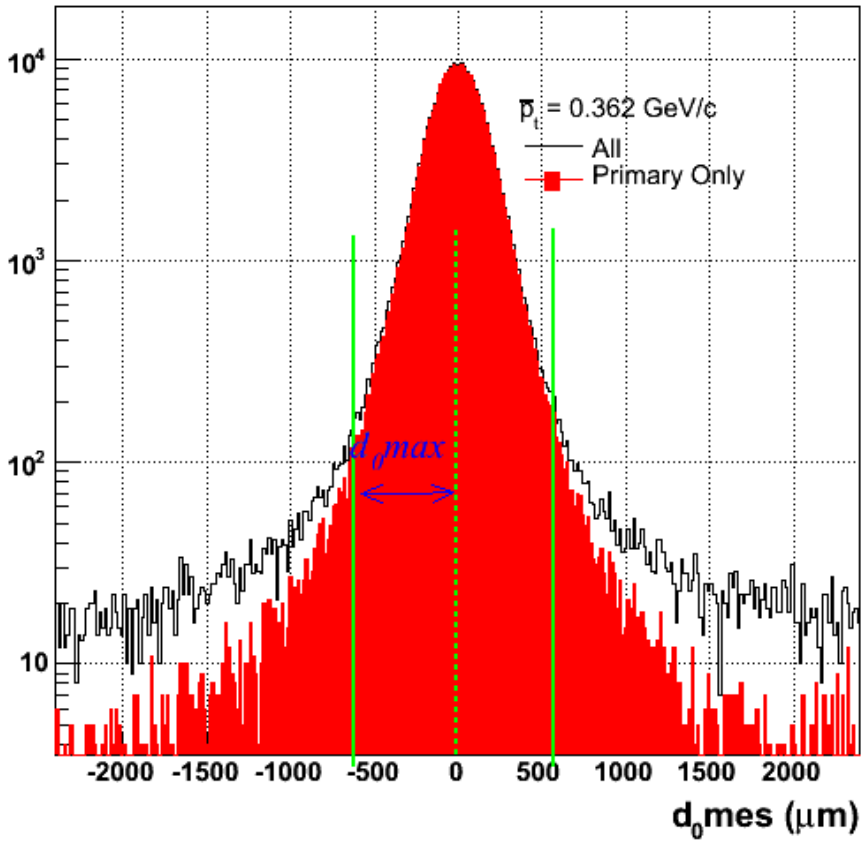
Evaluation of d_0 res. from data

Motivation: For all analyses using d_0 cuts (charm and beauty in particular), very important to extract d_0 resolution from data in order to check whether it is reproduced by the simulation

First-day approach:

d_0 distribution is dominated by primary particles for $|d_0|<d_0MAX$

➡ Gaussian fit in this range provides the resolution

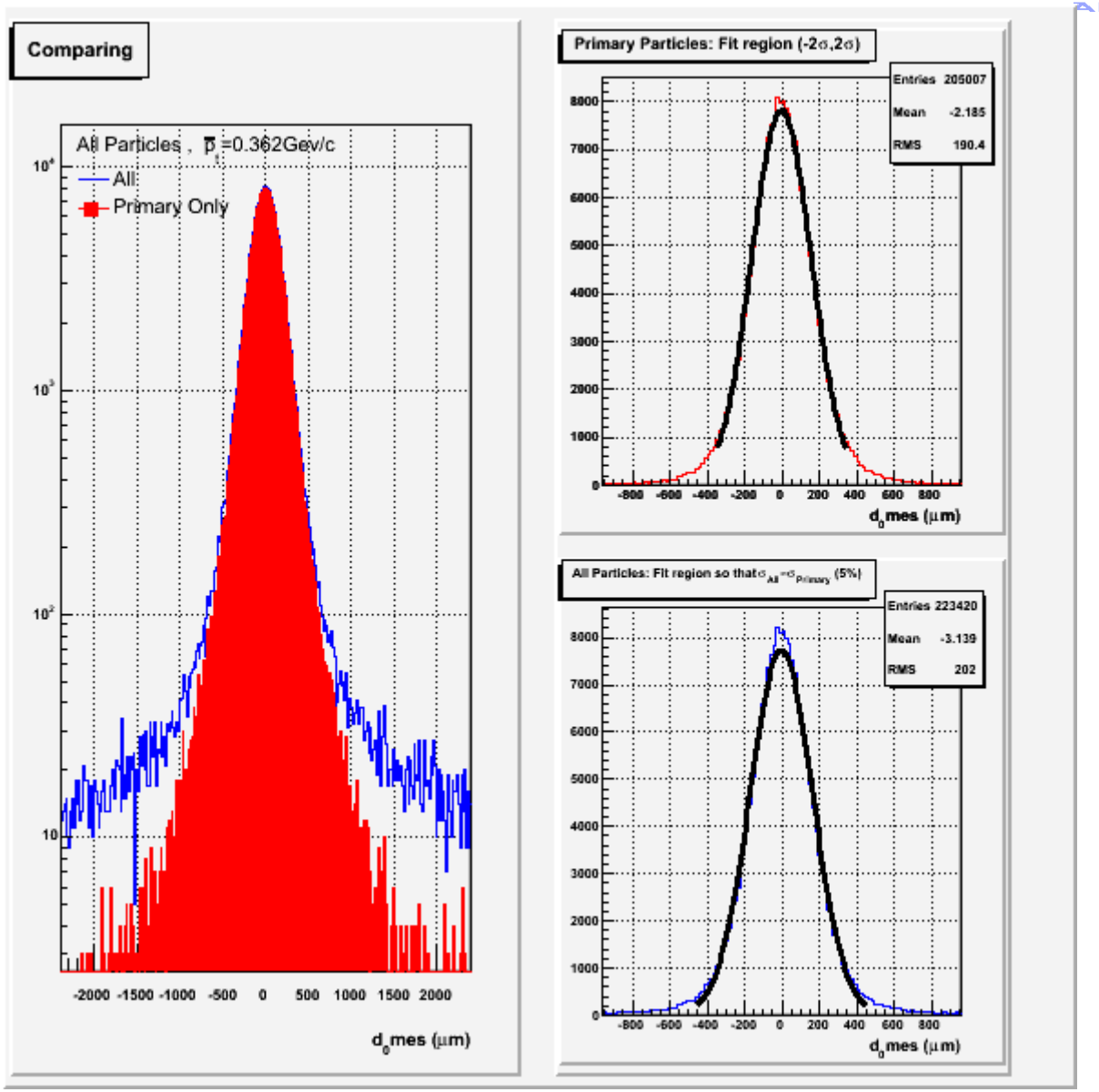


Exercise:

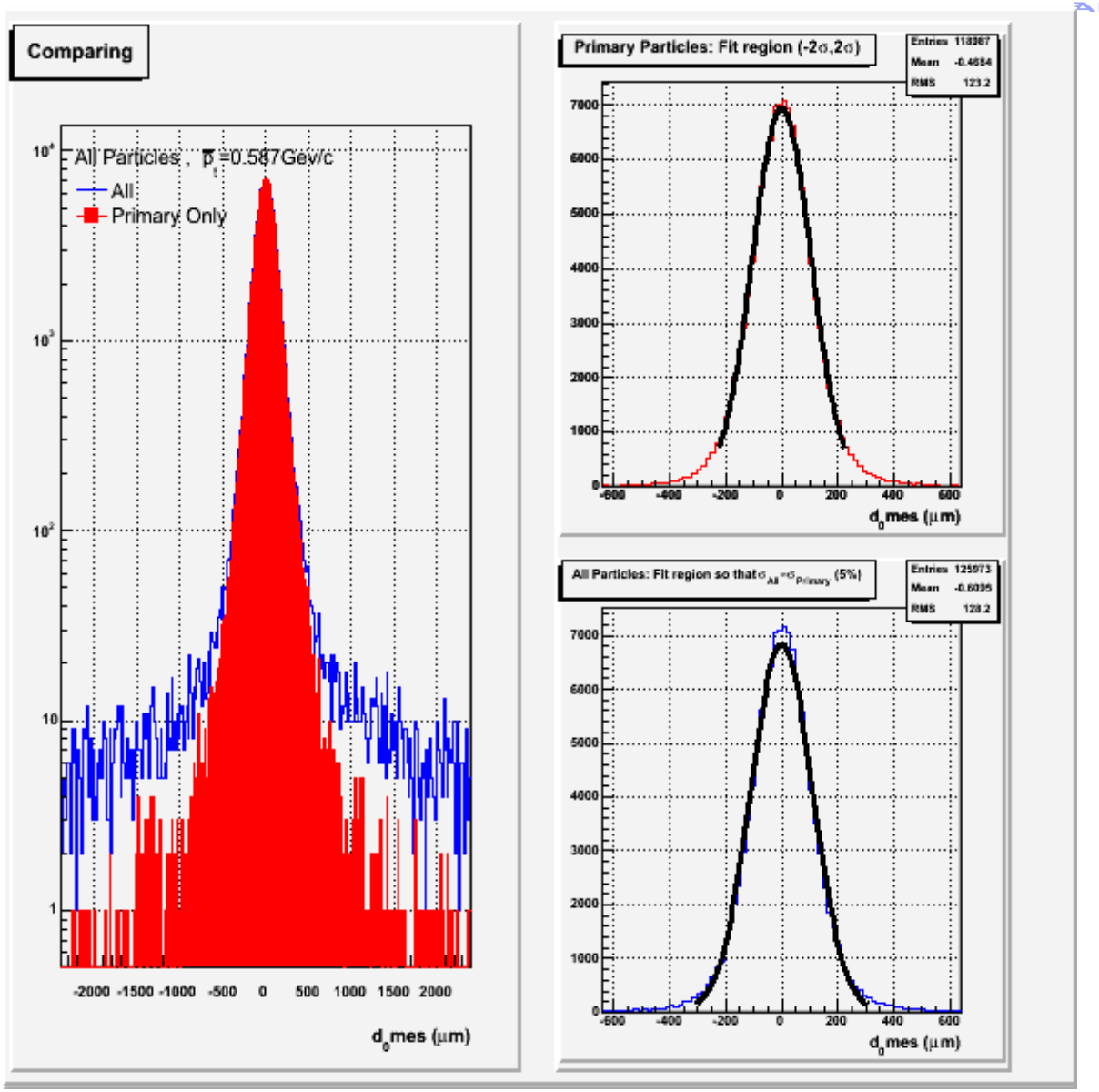
- Used PYTHIA pp events (PDC06-like cocktail)
- Vertex reconstructed using the tracks
- In bins of p_t, consider distribution of d_0 w.r.t. reco vertex, for primaries and for all tracks
- Fit of primaries gives d_0 resolution
- On distribution of all tracks, used iterative procedure to fit in interval $|d_0|<d_0MAX$, with d_0MAX gradually decreasing
- Stop when extracted σ is equal (within 5%) to σ of primaries

- Get d_0MAX values to be used on the data, as function of p_t
  - WARNING: possible bias due to differences on secondary/primary ratio in simulation and in real events

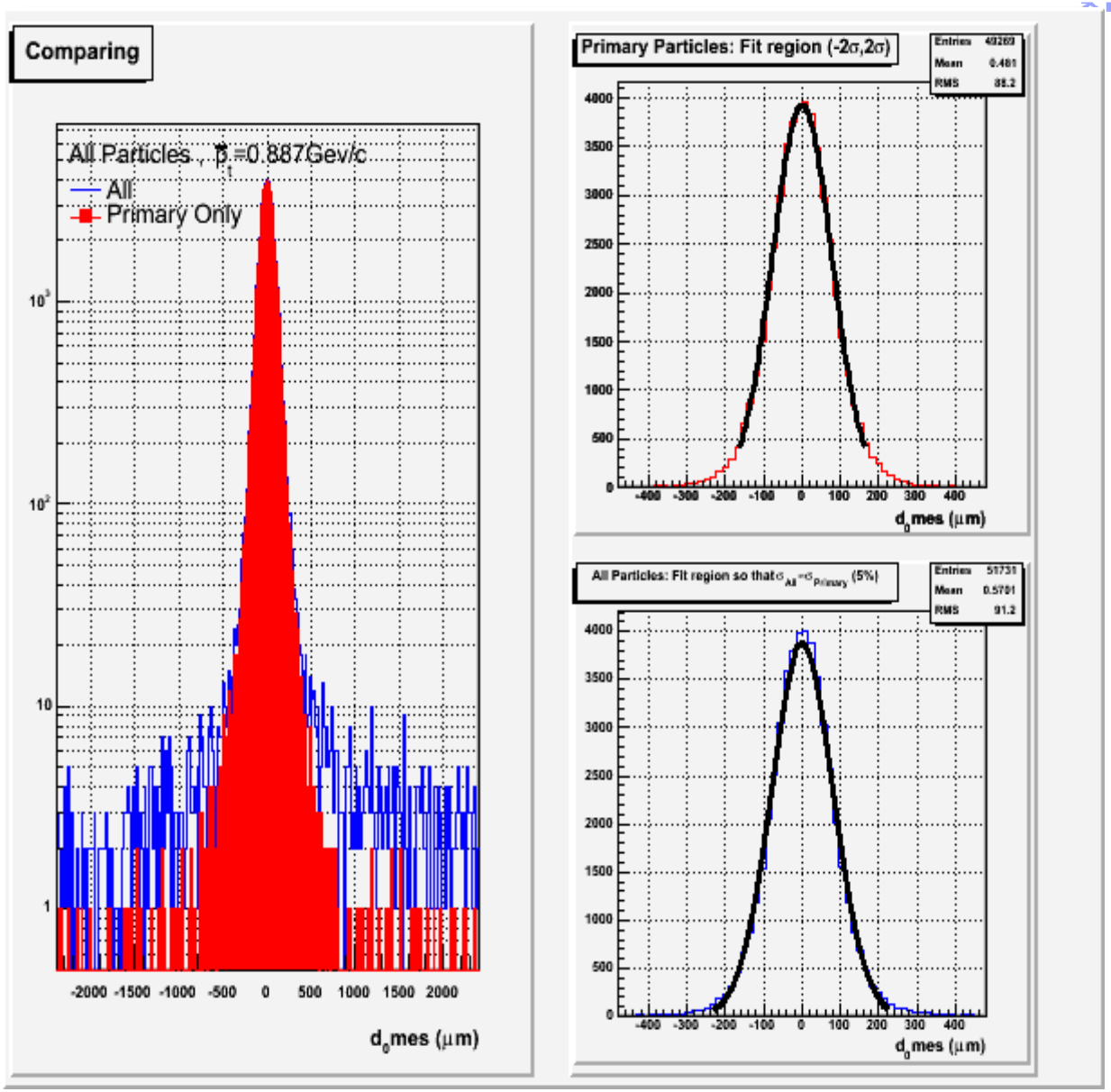
$p_t \approx 0.4$ GeV/c



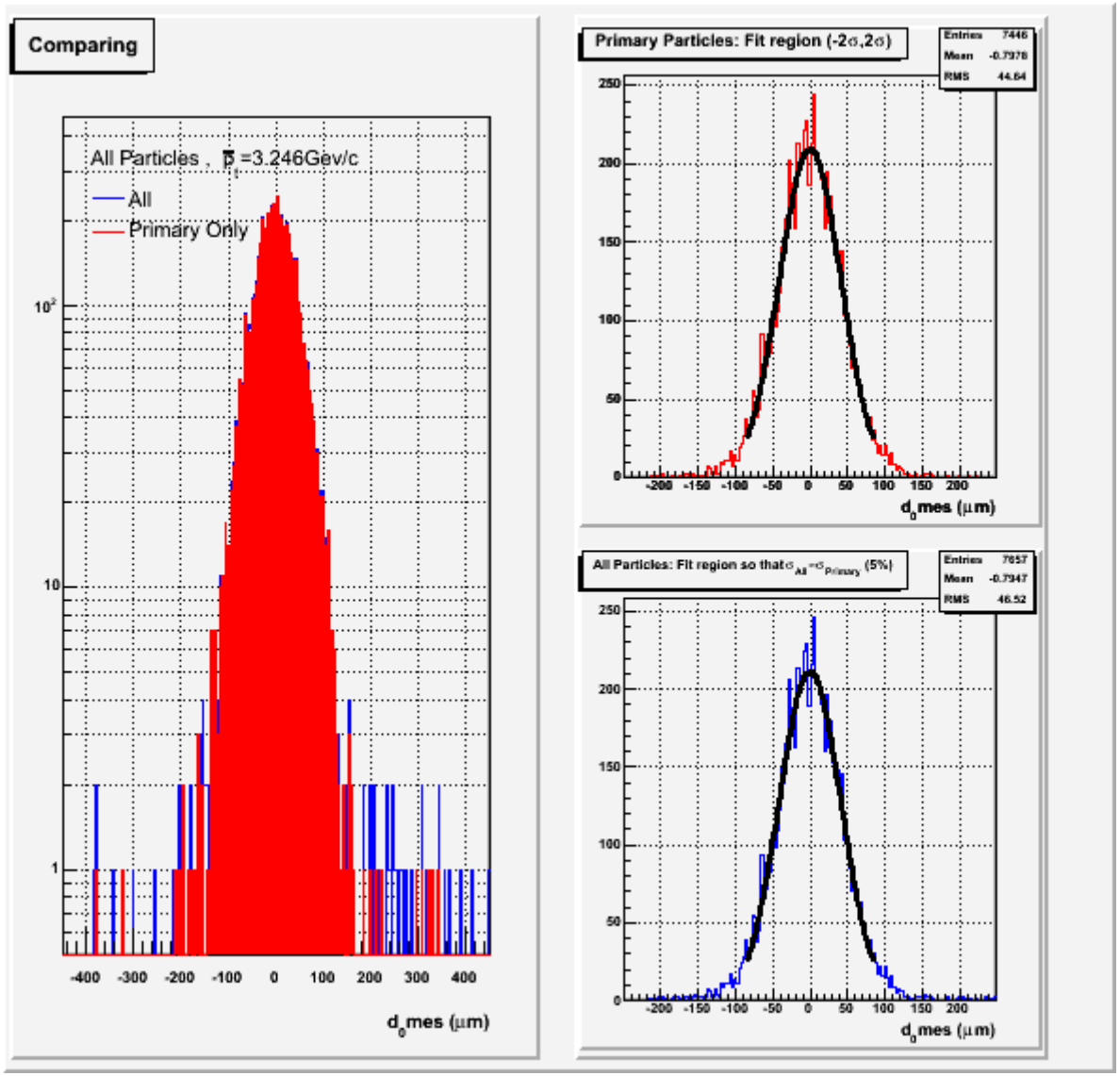
$p_t \approx 0.6$ GeV/c



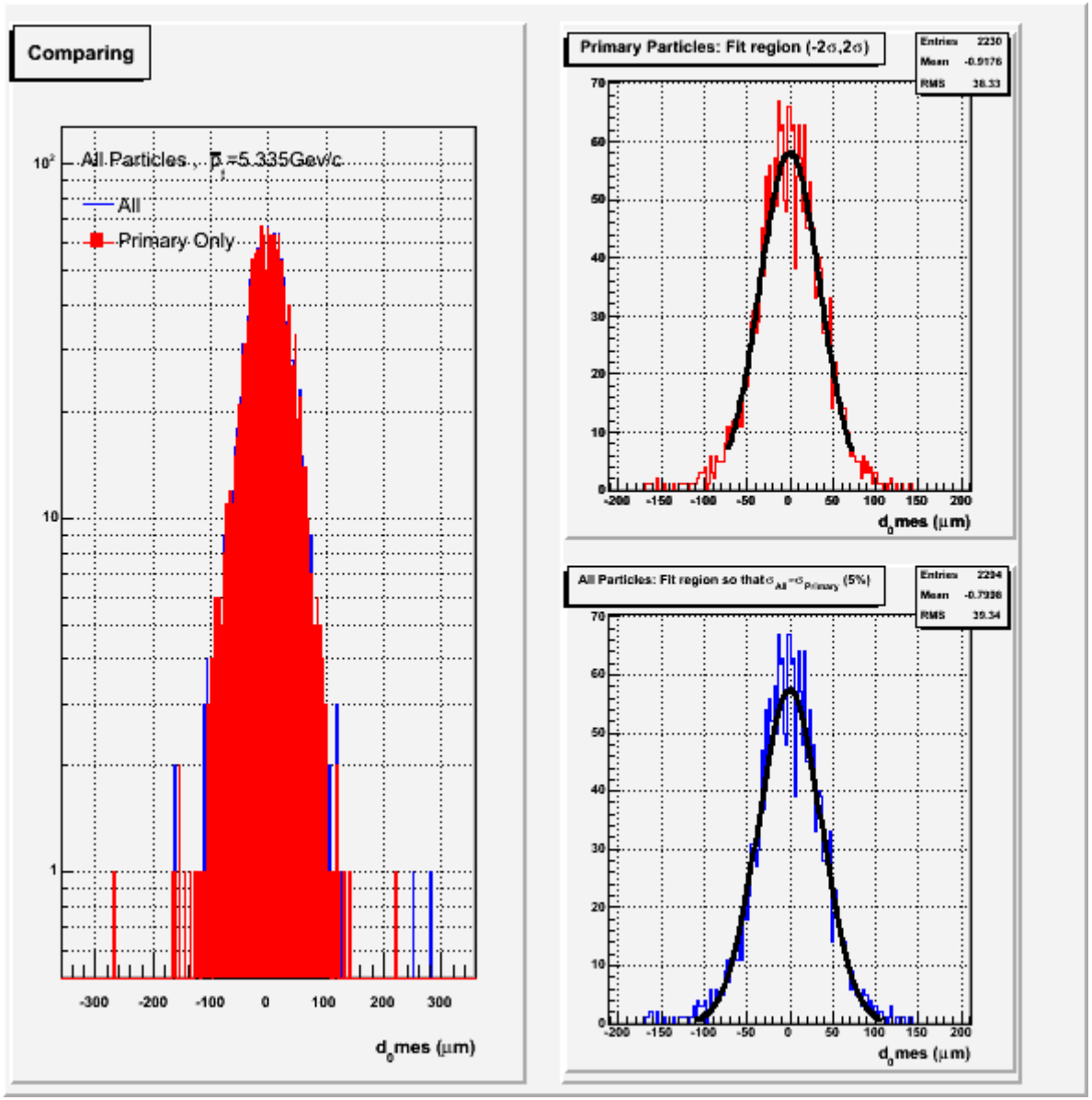
$p_t \approx 0.9$ GeV/c



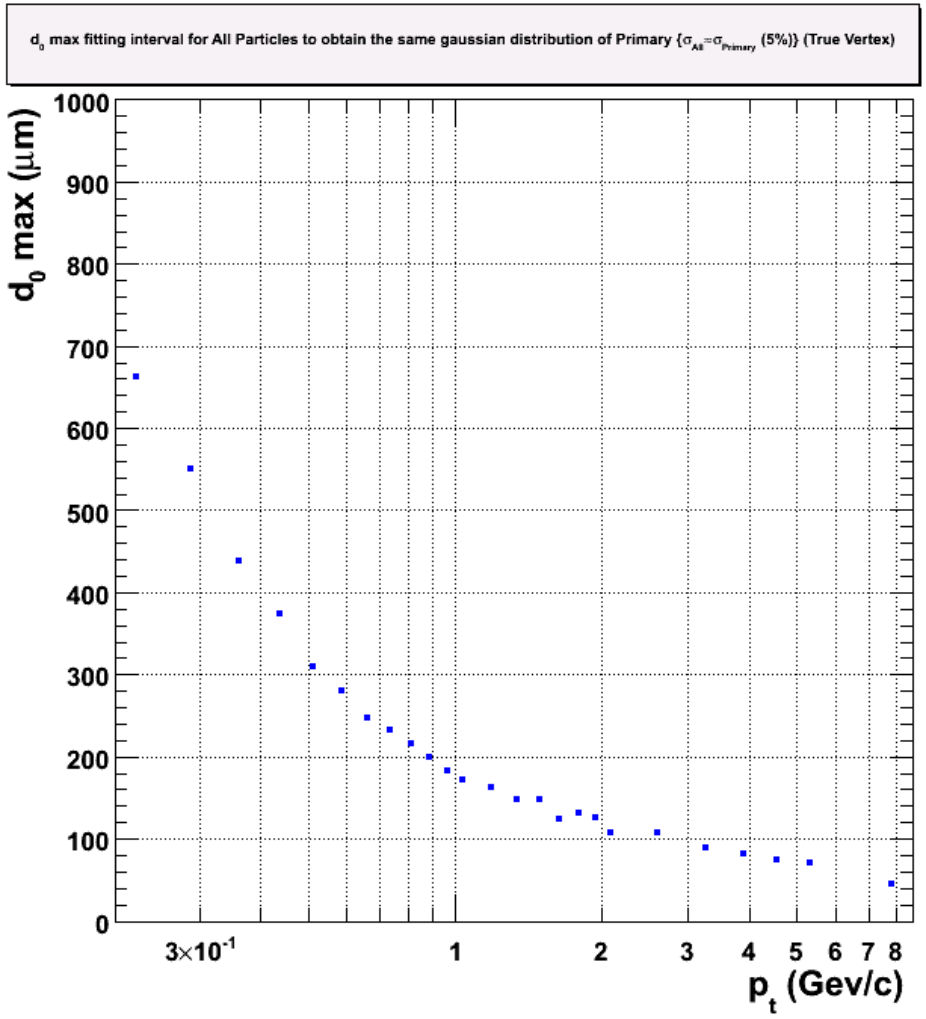
$p_t \approx 3.2$ GeV/c

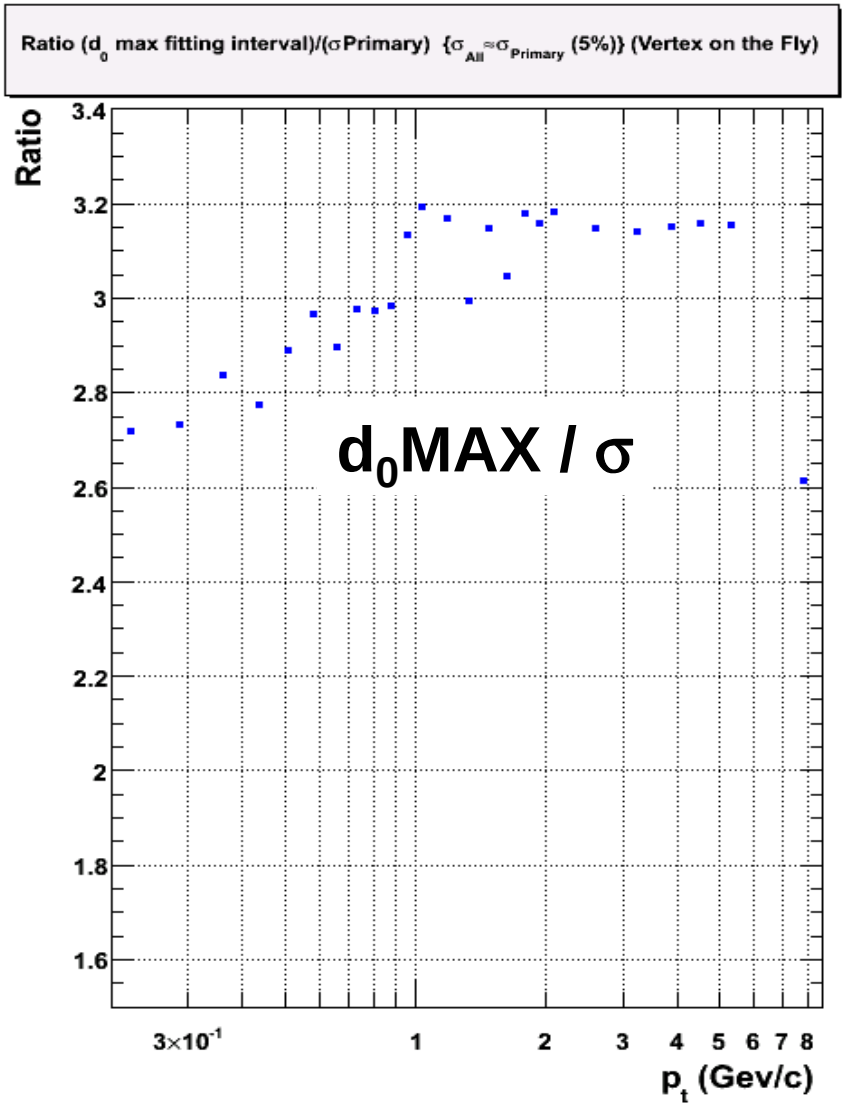


$p_t \approx 5.3$ GeV/c



Fit range for evaluation of resolution





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Conclusions and Outlook

- A gaussian fit of all tracks' d_0 distr. in the range ~ (-3σ, $+3\sigma$) allows to extract the d_0 resolution from the data
- Extracted resolution is a convolution of track position resolution and primary vertex resolution (the latter is relevant only for high-p_t tracks)

- Need to devise method to separate track and vertex contributions
  - Idea to get track position resolution at high-p_t: use distribution of DCA between pairs of high-p_t tracks (exploiting the fact that most high-p_t tracks are primary)
- Consider other methods
  - Idea (to be checked): use cosmics crossing all detector

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