Electron Track-Cluster Matching in Neutral Current Events

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**H1 Group**

Outline

- Motivation

- NC Events at the H1 Experiment

- Method and Event Selection

- Results

- Conclusion

Motivation

- Interested in improving the track-cluster matching in neutral current events

- We study the efficiencies of varying the cut on the distance between track and cluster

- What is the effect on the track finding and charge identification efficiency

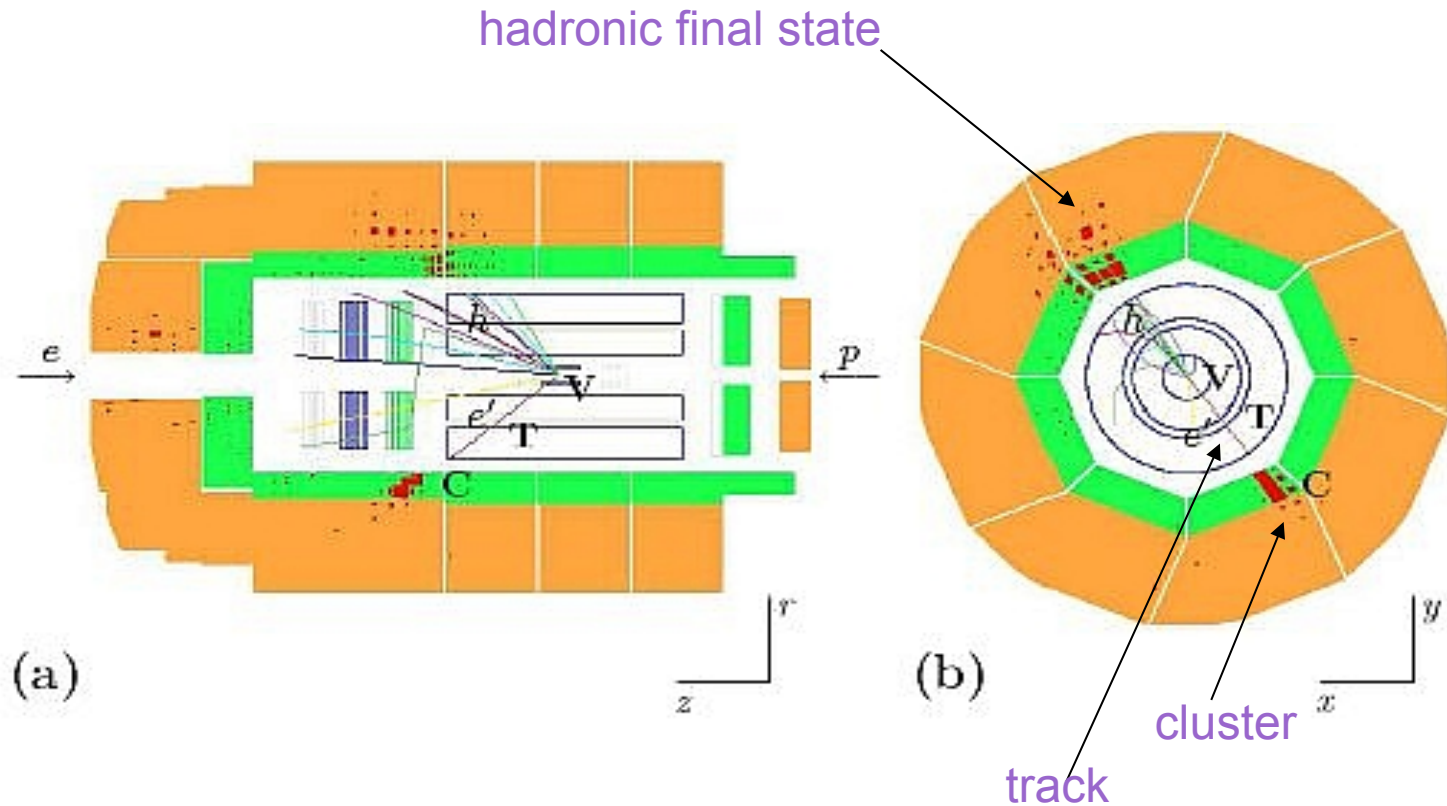# Neutral Current Events at the H1 Experiment
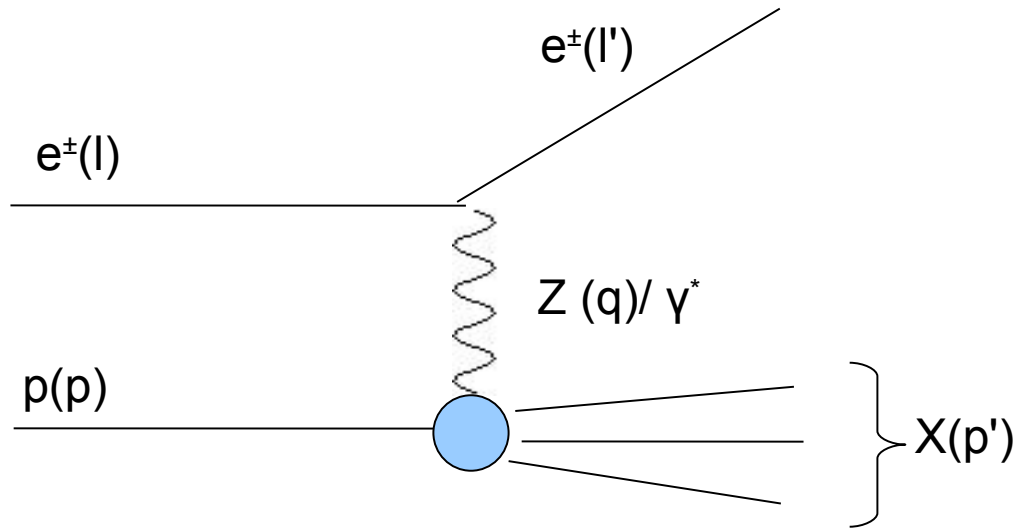
Used Variables

- Negative 4-momentum transfer:

 $Q^2 = -q^2 = -(l - l')^2$

- Bjorken factor : $x = Q^2 / 2p\,q$

- Inelasticity : $y = p\,q / p\,l$ or $y = (E_e - E_e')\,4E_e'\cos^2(\theta/2)$

A Neutral Current Event at H1

hadronic final state

cluster

track

(a)

(b)

- Scattered electron produces a track (T) as well as a high energy deposit (C) in the calorimeter (mainly in the electromagnetic part).
- Main source of background is photoproduction (the electron is scattered at such small angle that it escapes the main detector).

DCA : Distance between track and cluster
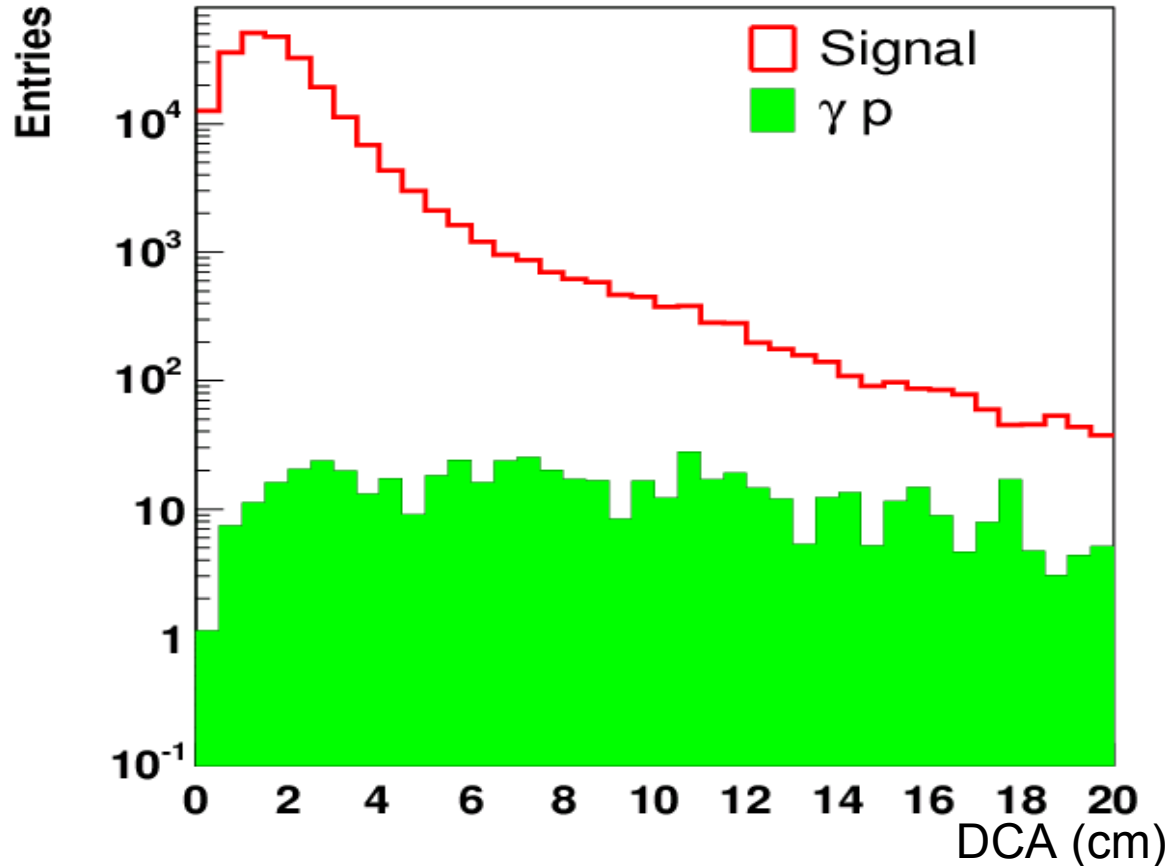
- DCA is a good variable to use in order to remove background

- Presently a DCA < 6 cm is used

- This study investigates the effect of loosening the cut to 12 cm
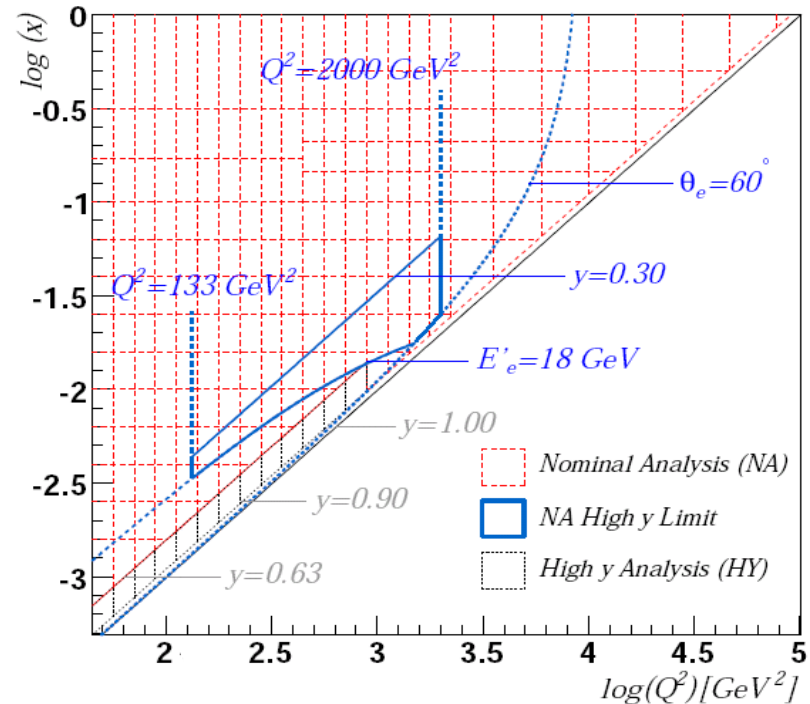
Method and Event Selection

- We remove the track requirement and look at the efficiency of finding tracks.
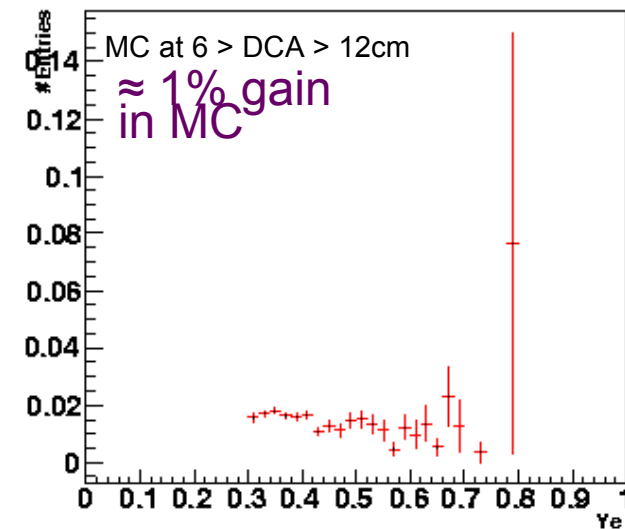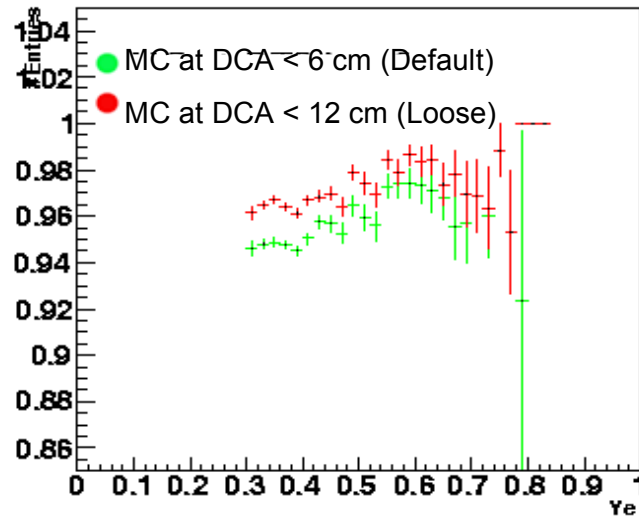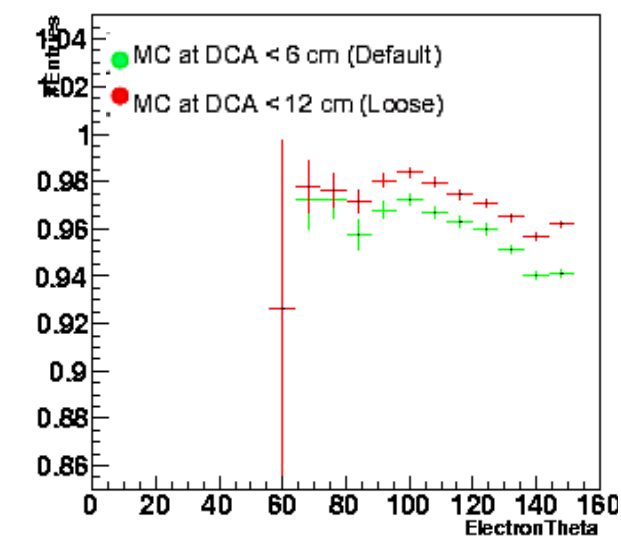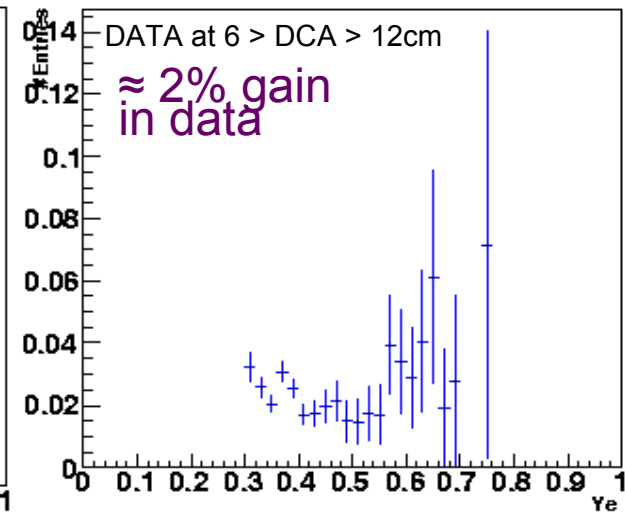- We also look at the charge identification efficiency.
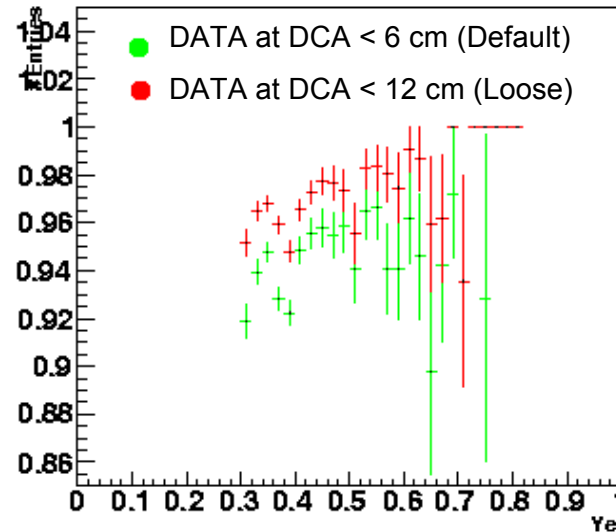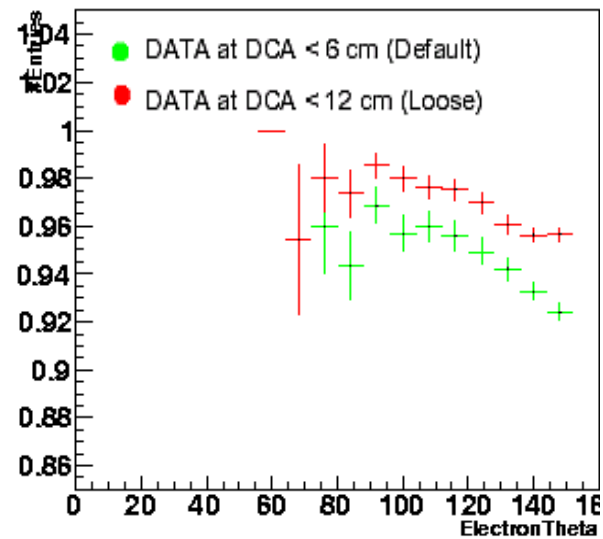
- **Data Set**

Period	Lumi (pb-1)
06 e-	54.98

- **$133 < Q^2 < 2000$ GeV^2**
- **$y_e > 0.3$ and $y_{e\,\Sigma} > 0.3$**
- **Central Vertex in 0 +/- 35 cm**
- **$45 < EmPz < 65$**
- **$0.5 < Ptbal < 1.4$**
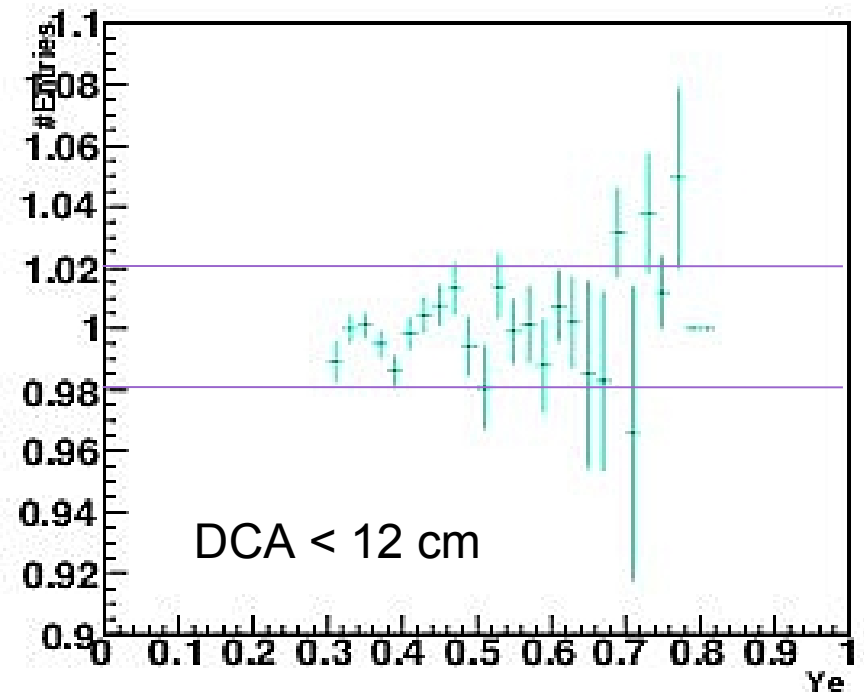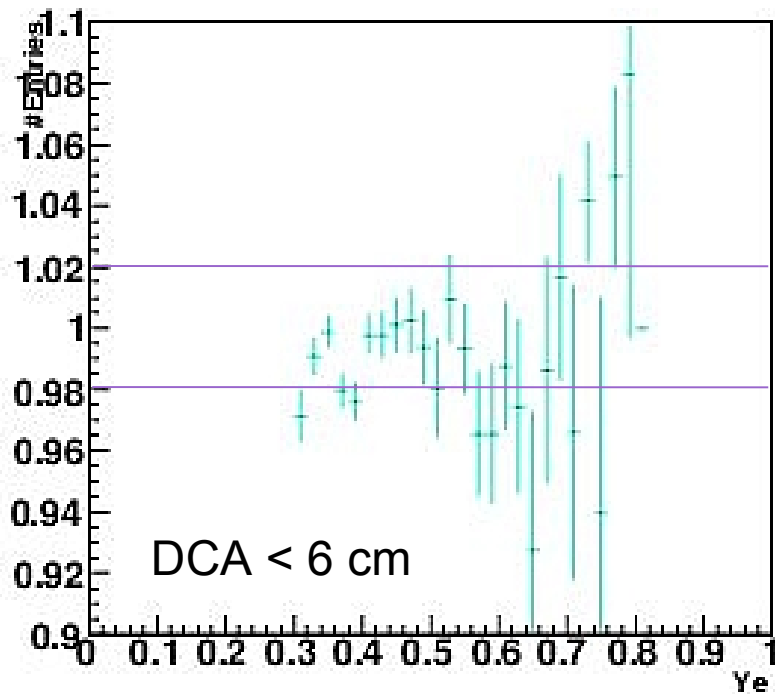- **E'e > 18 GeV**

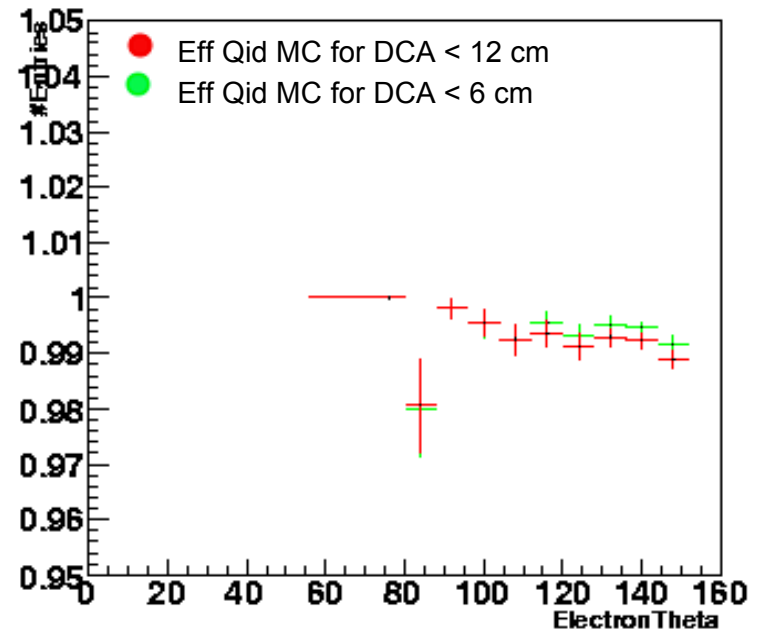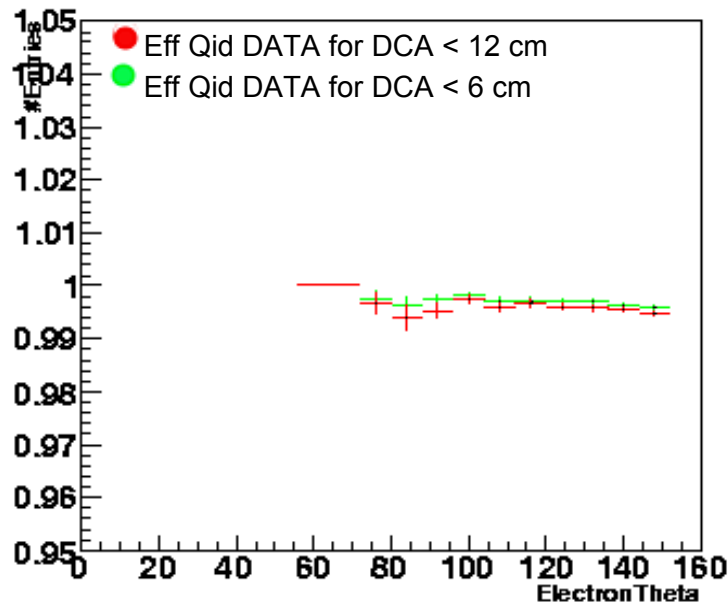# Results : **Track efficiency in DATA and Signal MC**

Better efficiency in DATA and MC for DCA < 12 cm
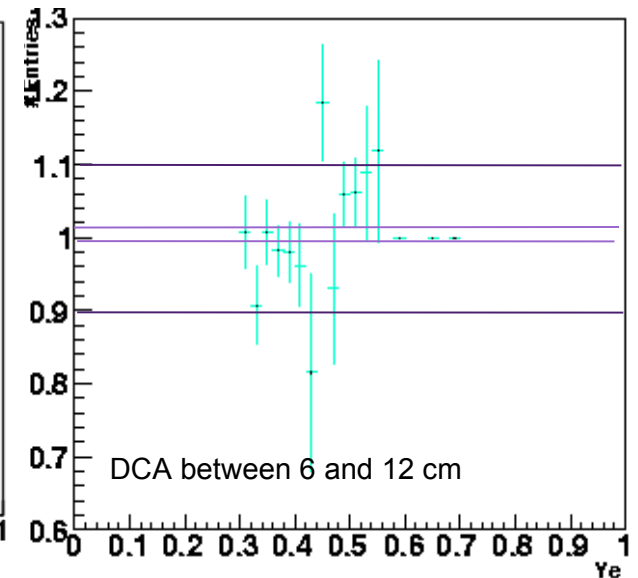
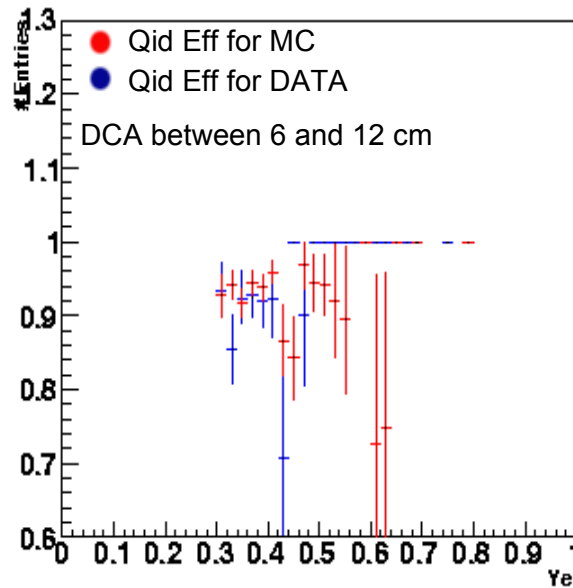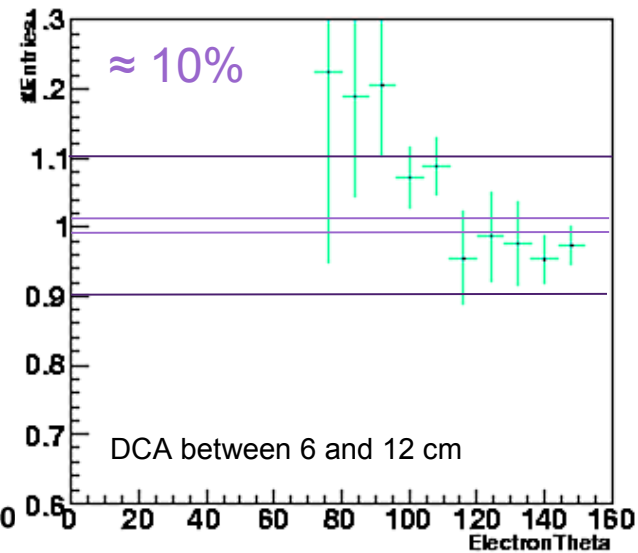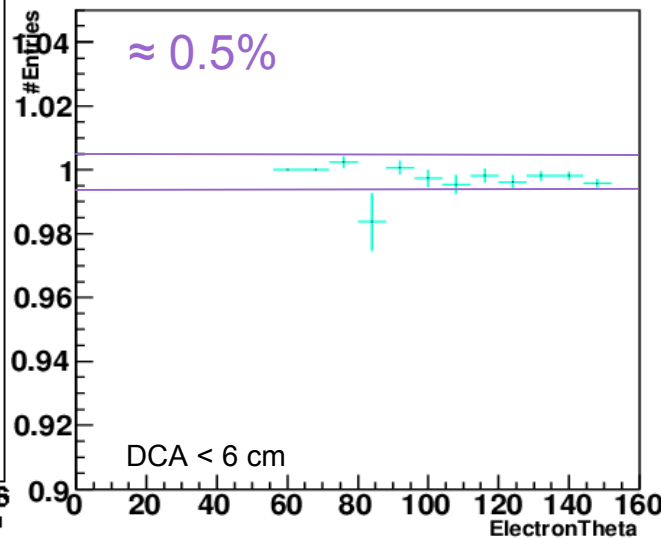# Level of agreement between Data and MC

DCA < 6 cm

DCA < 12 cm

Similar level of agreement (approximately 2%)

Charge Identification Efficiency

The efficiency is taken as the fraction of events from the sample with a charge matching the beam lepton charge.
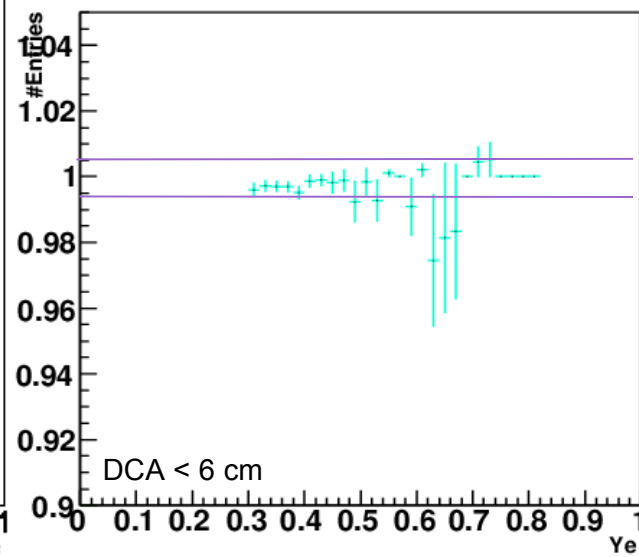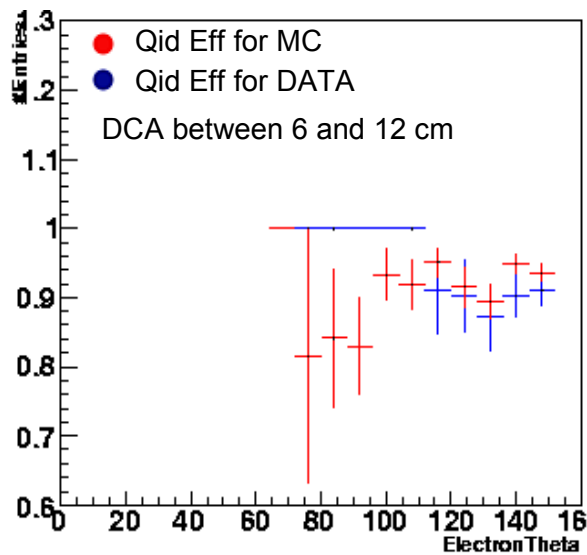
- The level of agreement worsens considerably with DCA between 6 and 12 cm.
- For a given systematic uncertainty on the Qid Eff, we will get twice the relative uncertainty on the cross section .e.g. A 1% uncertainty on the level of agreement will lead to a 2% error on the cross section.

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Conclusions

- A gain of approximately 2% events in data is observed when loosening the cut on DCA from 6 to 12 cm.

- *However* events with a DCA between 6 and 12 cm have a 10% level of agreement between data and MC for the charge finding efficiency, as opposed to 0.5% for events with DCA < 6 cm.
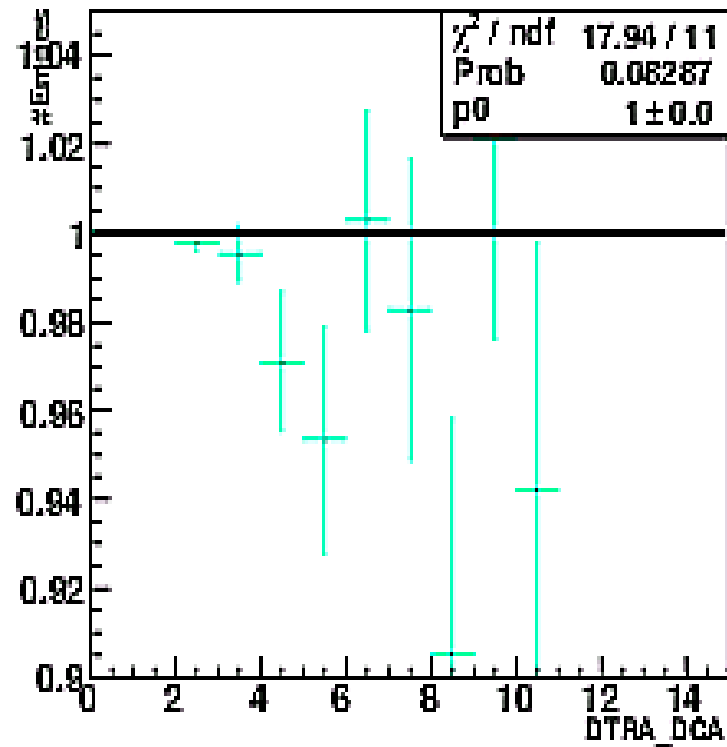
  This correspond to a 20% and 1% error on the cross section respectively.

- *So Overall* choosing DCA < 12 cm leads to a relative uncertainty on the cross section of about 1.4% (compared to the default 1%).

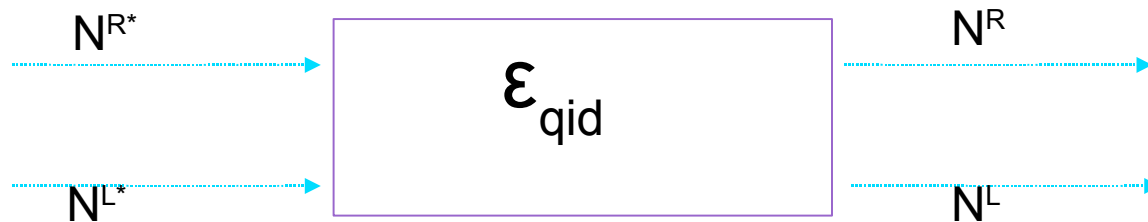# Thank you for your attention!

Backup Slides

Level of agreement for Qid as a function of DTRA_DCA

Correction Uncertainties – Qid Efficiency

R*- tracks whose true charge matches that of the beam

L*- tracks whose true charge does not match that of the beam

N^{R*} ε_{qid} N^{R}

N^{L*} N^{L}

R- tracks whose reconstructed charge matches the beam charge
L- tracks whose reconstructed charge does not match the beam charge