Charmed Hadron Production at ZEUS

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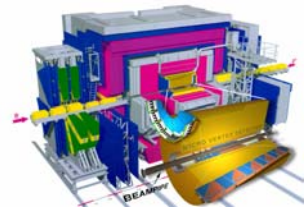
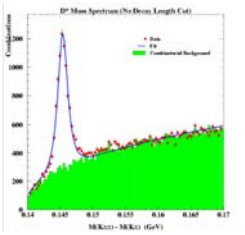
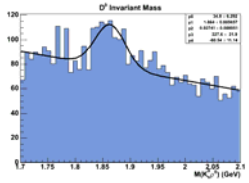
Outline



HERA and ZEUS

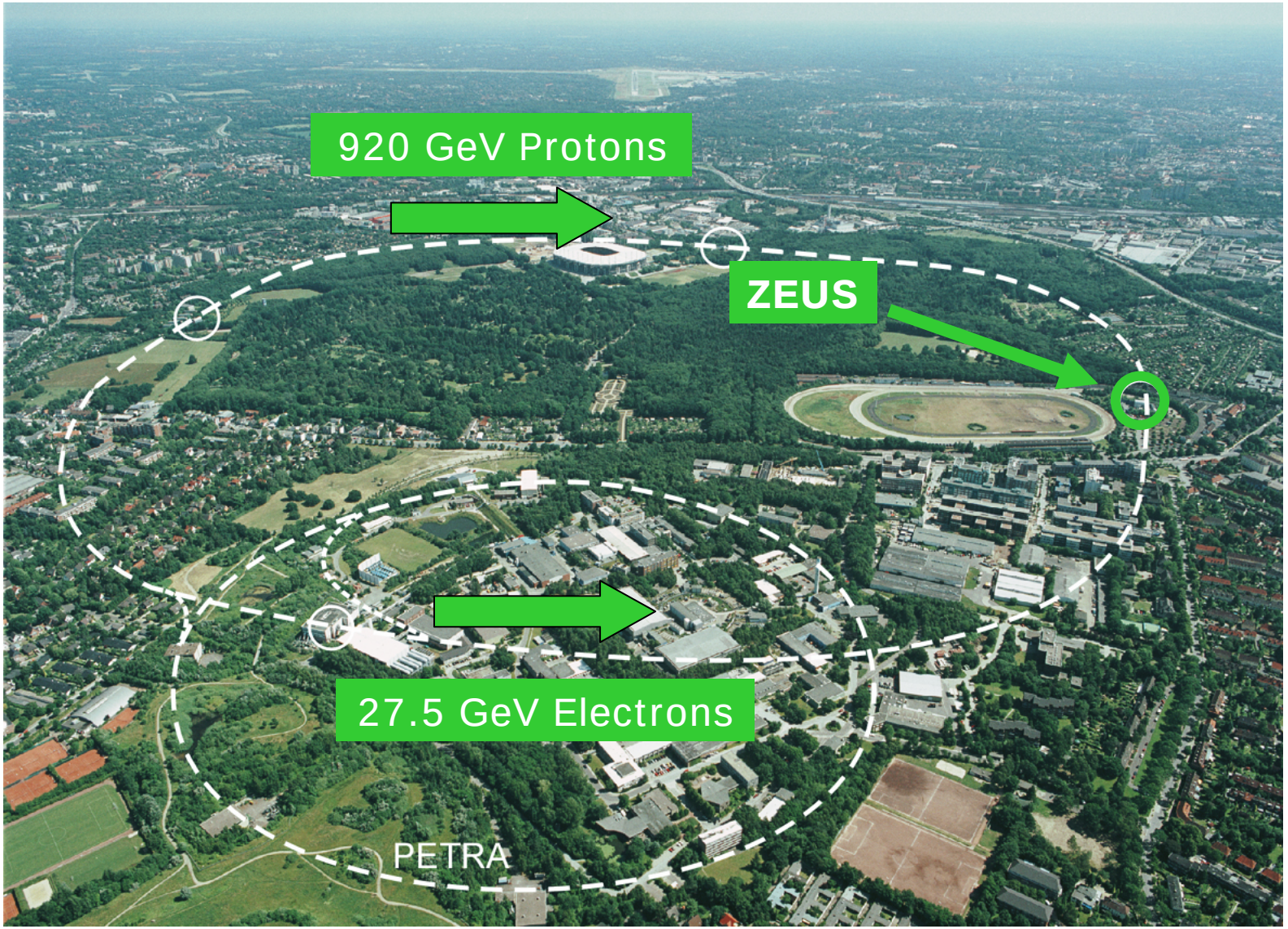


Charm in D* decays

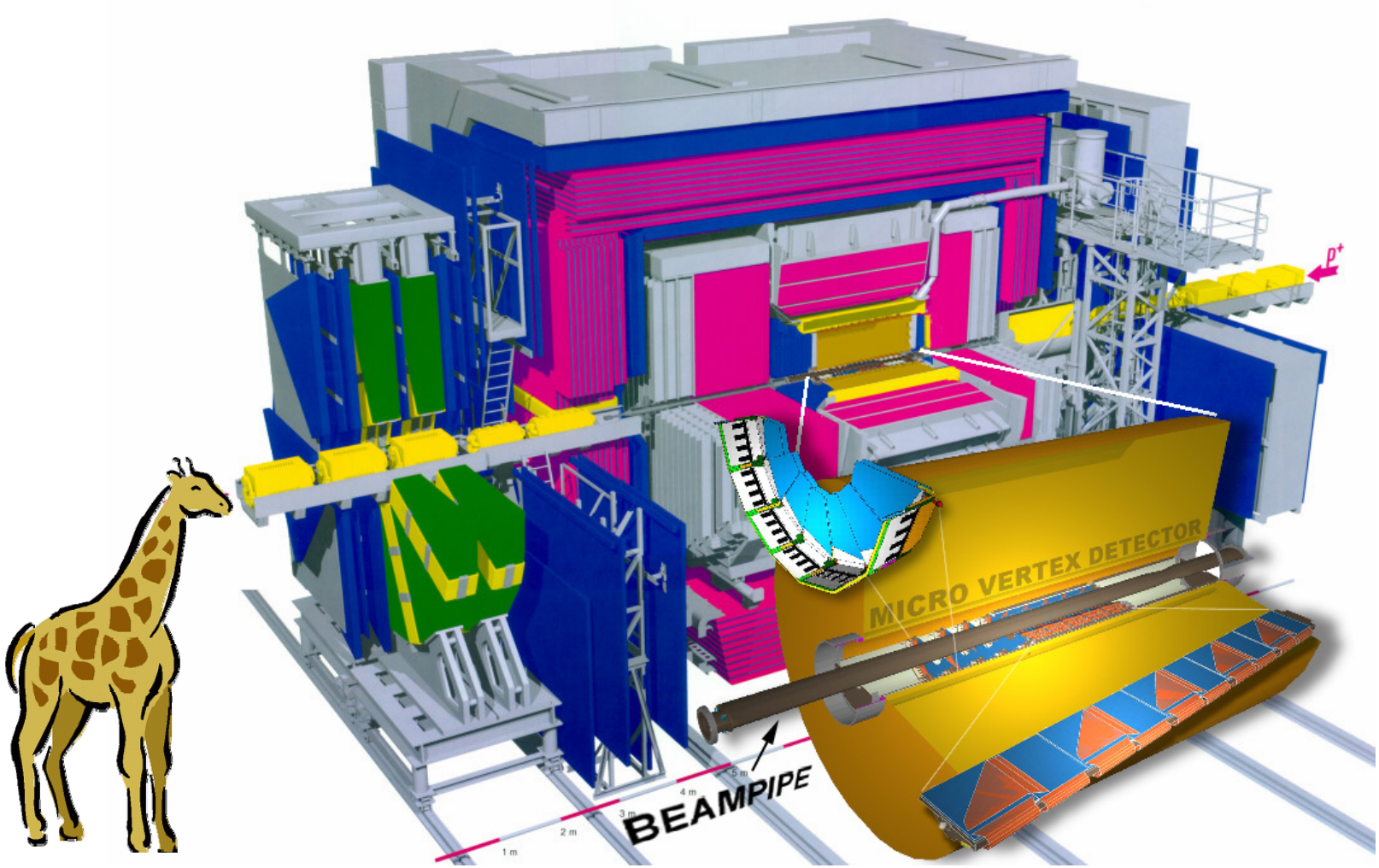


Charm in D^0 decays

ZEUS @ HERA



The ZEUS Detector



D* Decay in the ”Golden Channel”

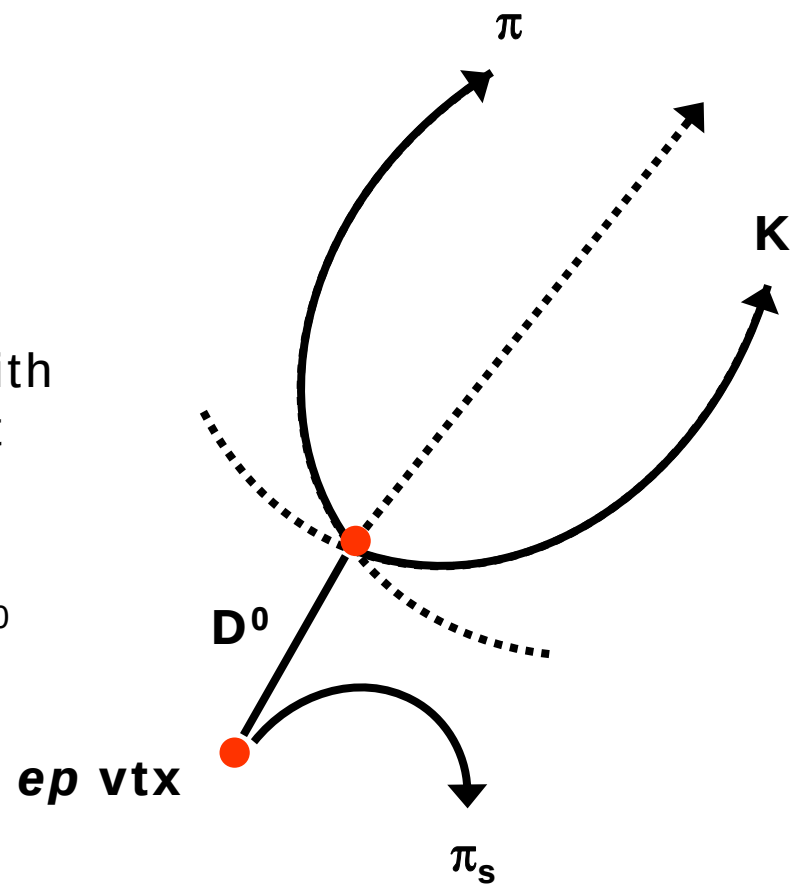
D*’s reconstructed in the decay channel
$D^* \rightarrow D^0 \pi_s \rightarrow (K\pi)\pi_s$

Main charm decay channel used in analyses of HERA-I data

Make all combinations of three tracks with appropriate charge and look at invariant mass

Slow pion effectively acts as a tag for D^0

Combinatorial method only, does not require reconstruction of D0 vertex



Decay Length

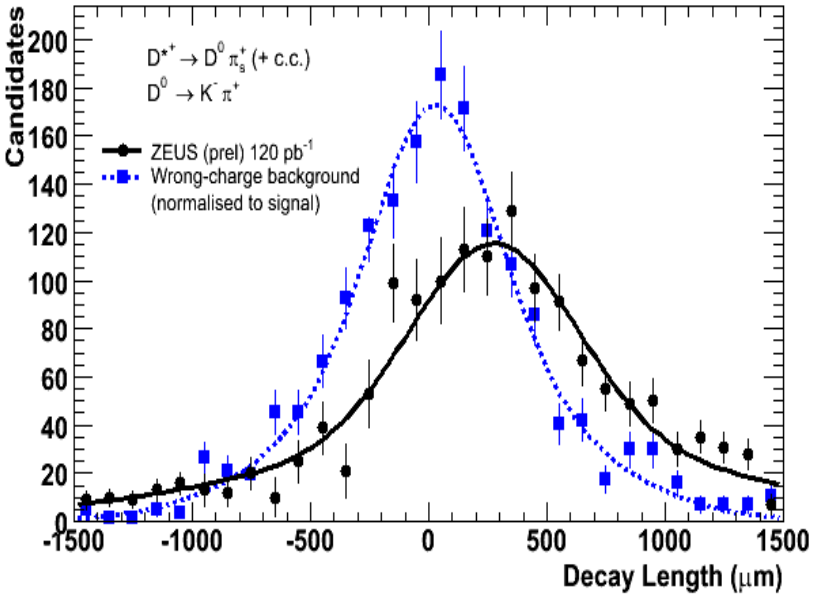
Microvertex detector improves tracking resolution and allows us to reconstruct D^0 decay vertex

Look at distance from primary to secondary vertex projected onto D^0 momentum vector for D* candidates

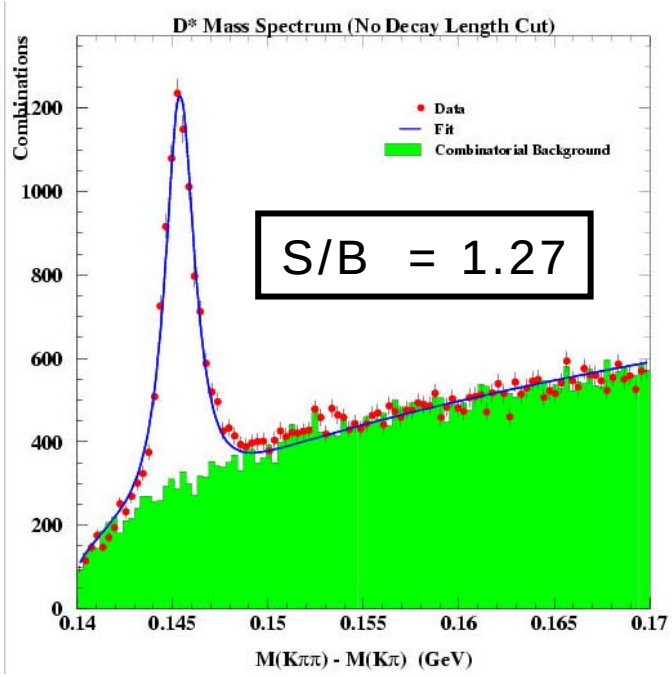
Random combinations of tracks equally likely to have +ve and –ve sign

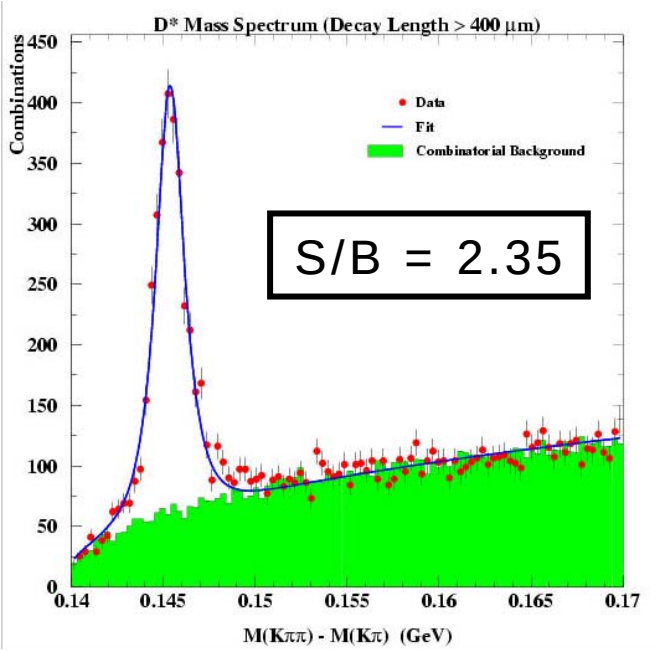
Real decays should give an excess of +ve decay lengths

Asymmetry seen in Data →



Decay Length Cuts





Cutting on decay length can improve signal/background ratio

More useful for other charm decay channels

$D^0 \rightarrow K^0_s \rho^0$ Decay Channel

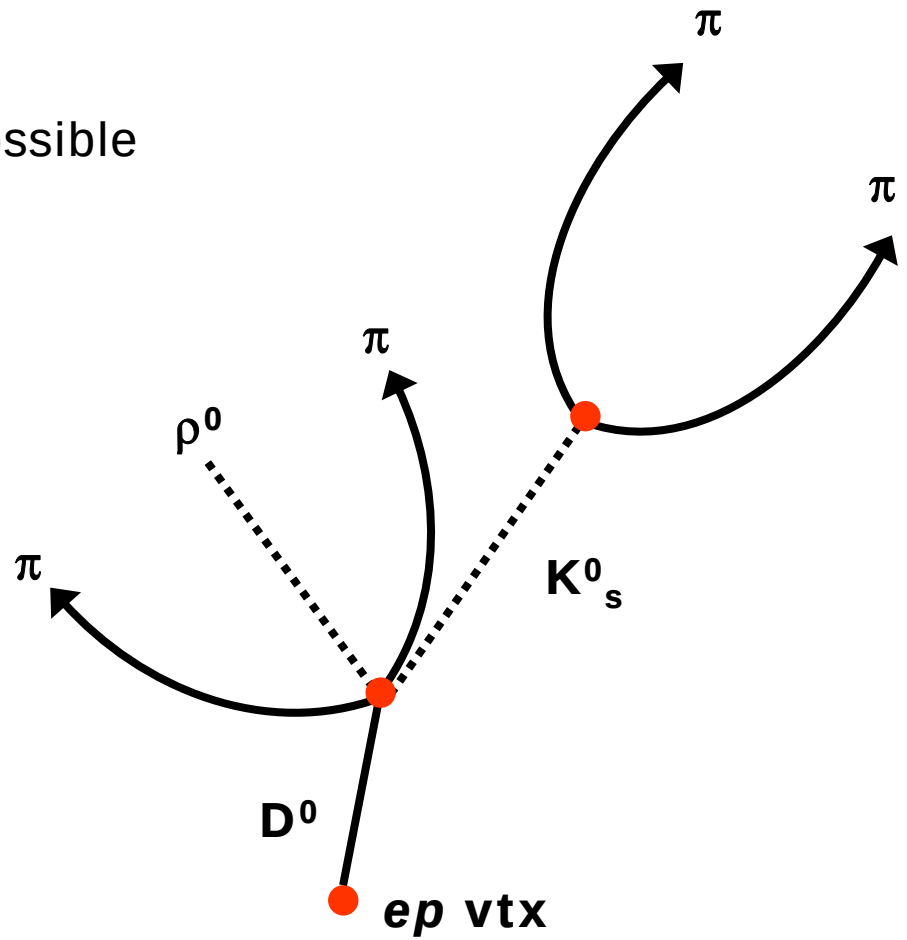
Calculating the decay length requires revertexing the event

Very CPU-intensive to do this for all possible D^0 candidates

Therefore use channel where final state pions can be tagged as coming from intermediate states:

$$D^0 \rightarrow K^0_s \rho^0 \rightarrow (\pi^+ \pi^-) (\pi^+ \pi^-)$$

Should reduce the number of D^0 candidates per event to a manageable number for revertexing

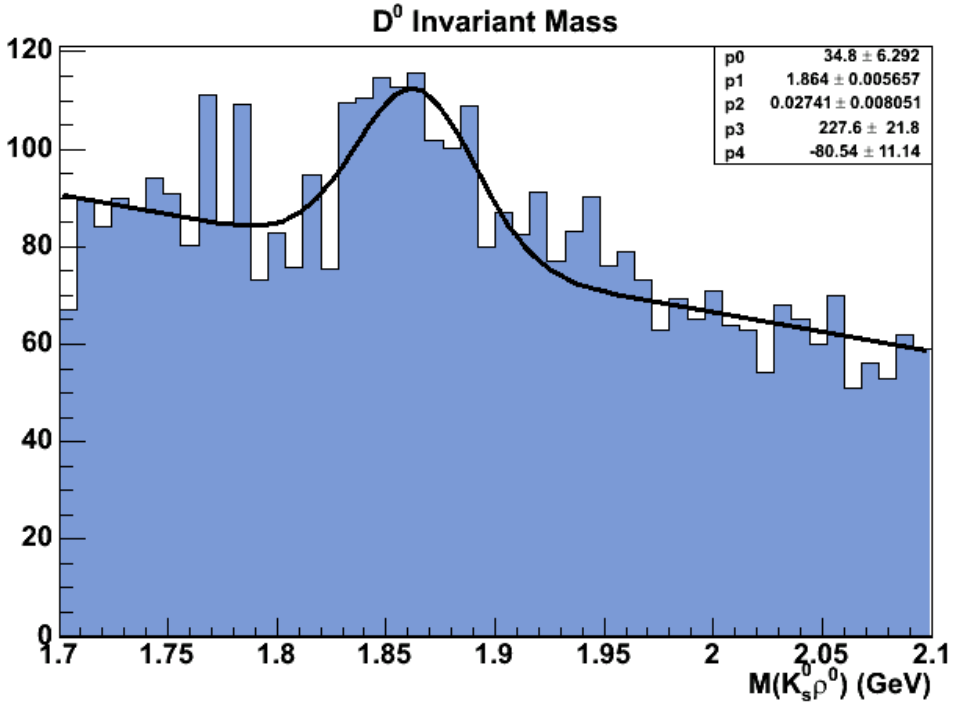


$D^0 \rightarrow K^0_s \rho^0$ MC Studies

This channel not previously studied at ZEUS

MC studies show signal above background (inclusive DIS events)

=> Looks promising



MC Vertex used for calculating decay length (revertexing of *ep* vertex not yet done)

Next Steps

- Implement revertexing for D^0 candidates passing cuts
- Look for this channel in data
- Look at other channels:

$$D^{\pm} \rightarrow K^0_s \rho^0 \pi^{\pm} \rightarrow (\pi^+ \pi^-)\ (\pi^+ \pi^-)\ \pi^{\pm}$$

$$\Lambda_c^+ \rightarrow K^0_s p \rightarrow (\pi^+ \pi^-)\ p$$

$$\Lambda_c^+ \rightarrow \Lambda^0 \pi^+ \rightarrow (p \pi^-)\ \pi^+$$

Summary

Charm is seen in ZEUS data

Decay length cut improves Signal/Background

Signal for D^0 in $K^0_s \rho^0$ channel seen in MC

Will look in data and for other decays soon