Impact Parameter Cut for Phase 2 Trident Candidates

For reduction of interaction background

Overview:

The trident interactions cannot be reduced by a p_T cut as in the kink candidates. Instead the sum of the impact parameters of the "daughters" is used to greatly reduce the backgound. This is effective because the "decay length" is uniform in z and the kinematics are independent of z.

The Data Set

The Monte Carlo events are generated with the properties :

For interactions-

- ECC 800 configuration
- 10mm decay space (5 plates)
- hadrons from NC interactions
- 250 mrad cut on primary hadrons

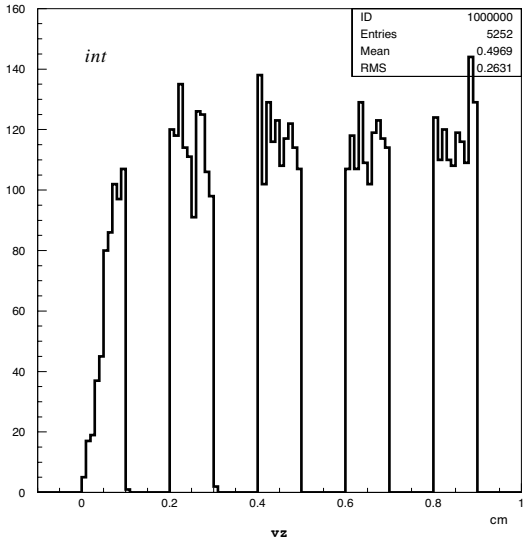
For charm decays-

- lepton always assumed to be primary hadron
- only $D^{\pm}$ used (for now)
- $D^{\pm}$ produced in ν_e CC interactions

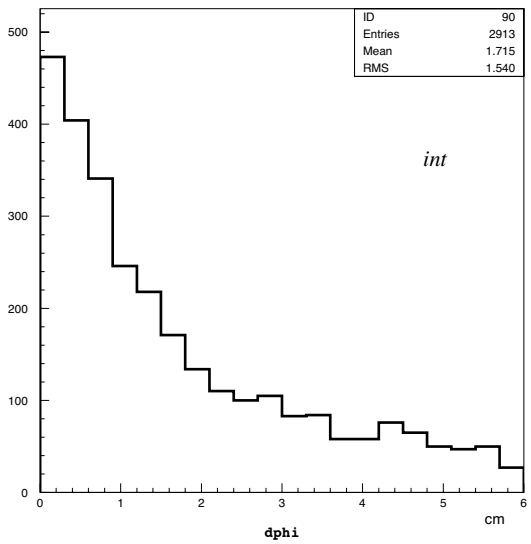
For tau decays-

- two modes used : $\pi^+\pi^+\pi^-\nu$ (9.3%) and $\pi^+\pi^+\pi^-\pi^0\nu$ (4.1%)

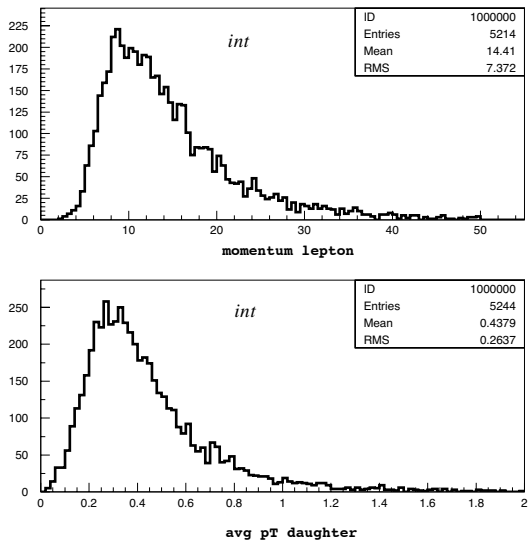
Interaction data



z vertex distribution



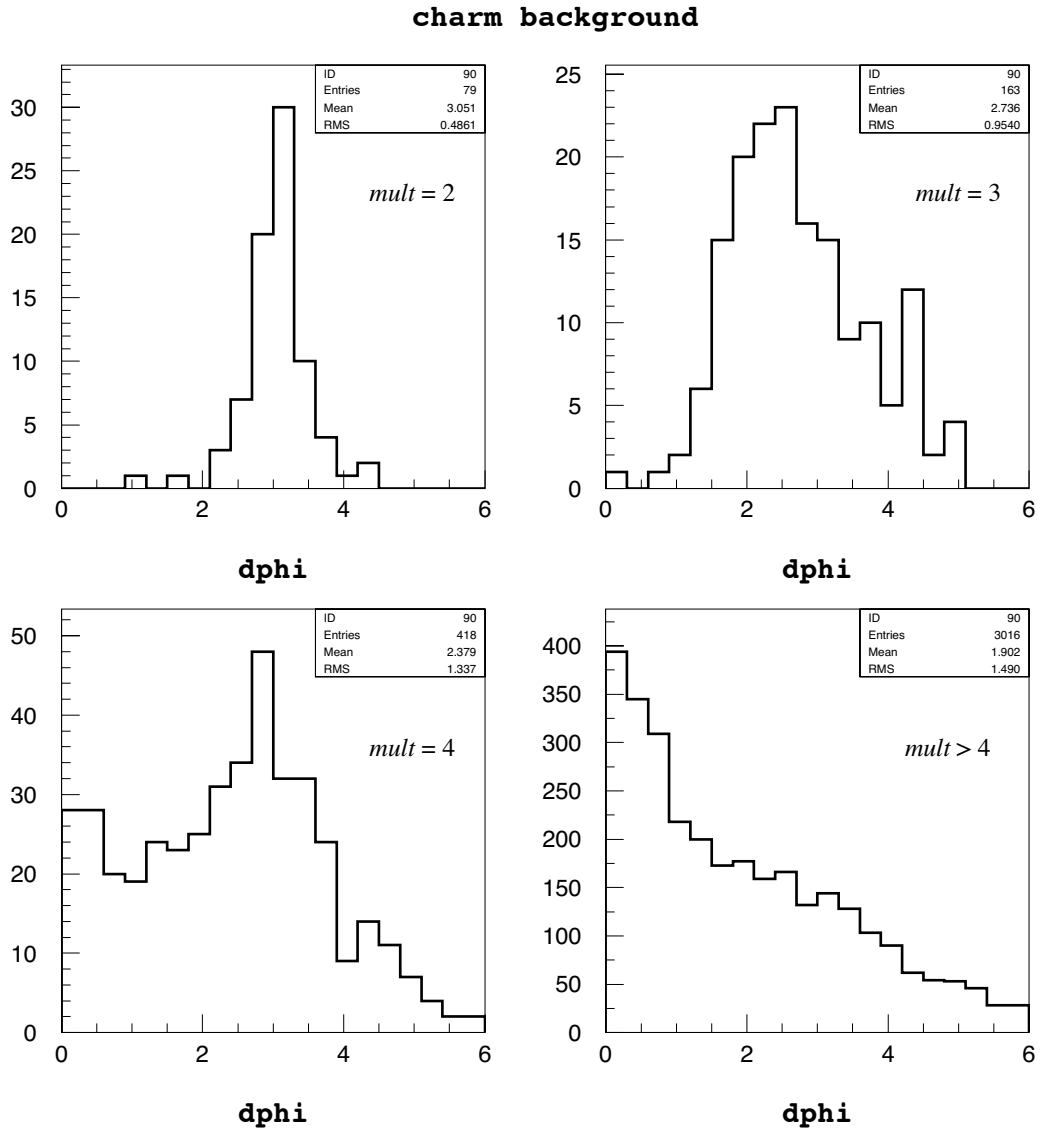
$\Delta\phi$ distribution



"lepton" momenta / "daughter p_T"

Charm data

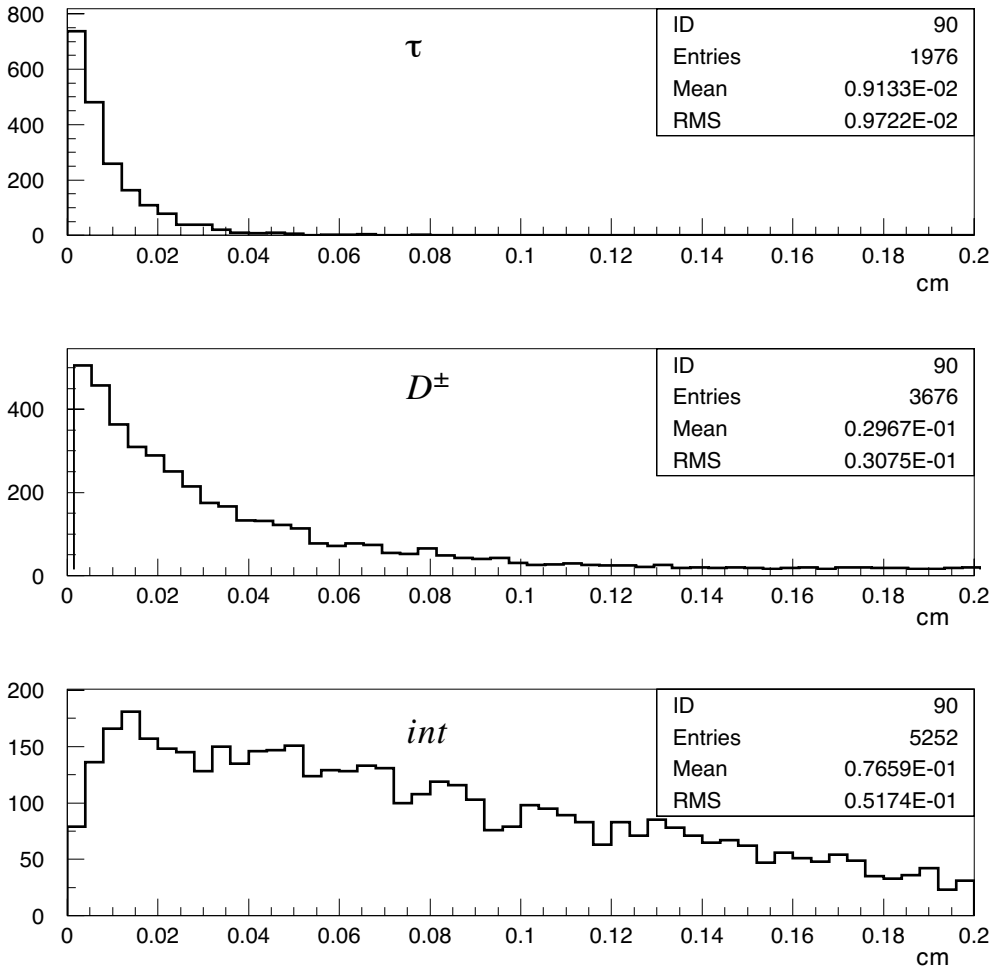
$\Delta\phi$ distribution changes as a function of primary multilplicity: from signal-like to random-like.



Impact Parameter Distributions

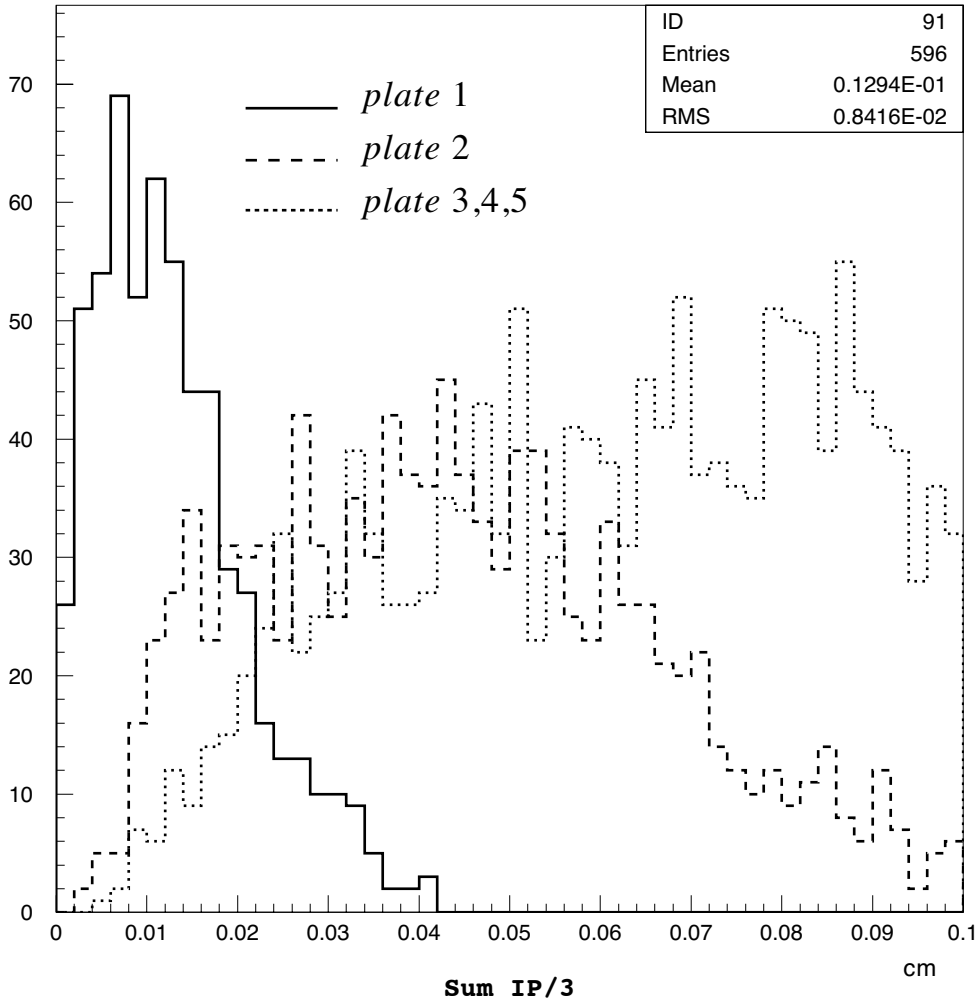
The average IP distributions (Σ ip / 3) are shown for the tau, charm, and interaction MC data. The mean of the tau and D distributions are close to the generated lifetimes (these distributions are not corrected for decay-mode kinematics).

It is clear that a cut in IP will greatly increase S/B in the tau sample, especially eliminating interactions.



Impact Parameter Distributions (cont)

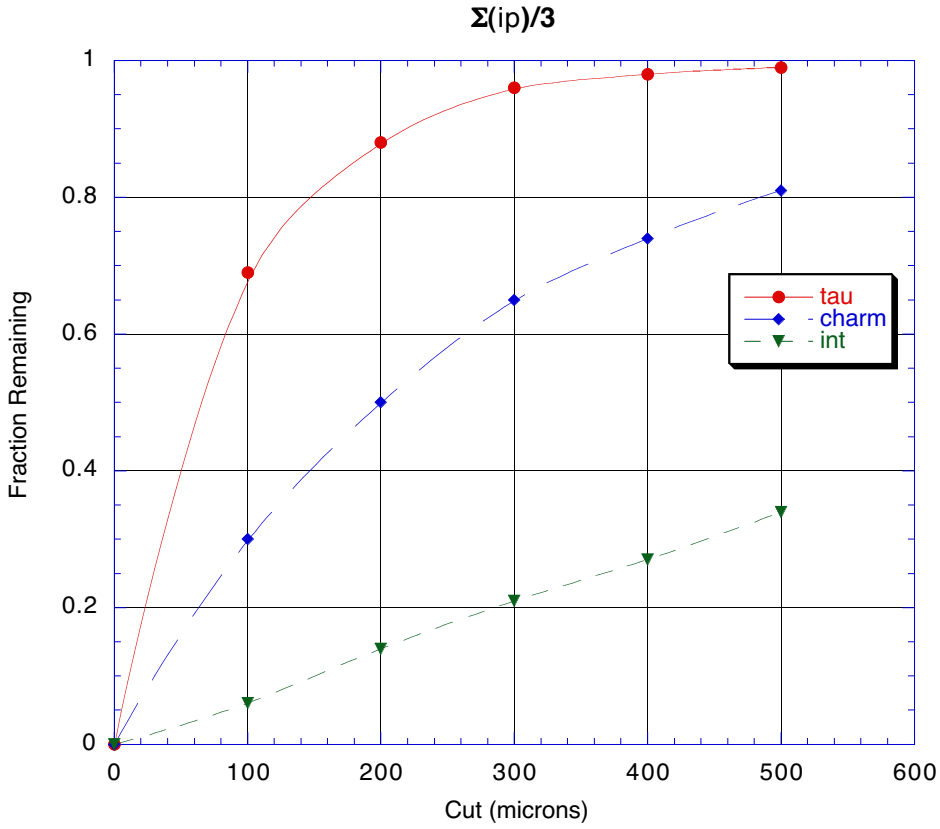
An IP cut is much more effective for long decays. Here "plate 1" is the same plate as the primary vertex, while "plate 2" is 2mm downstream.



Impact Parameter Distributions (cont)

This graph shows the fraction of candidates remaining from taus, charm background, and interactions, as a function of an IP cut.

A cut at 300μm retains 96% of tau and retains 21% of the interactions and 65% of charm.



Remaining Work

In MC

- include one more tau mode ($\pi^+\omega\nu$)
- turn on K*π mode in charm decays
- include $\Delta\phi$ in tau ntuple

Background Estimate

- Estimate interaction and charm backgrounds with IP cut