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Instructions for using the Shrinking Cone

The prototype for the Shrinking Cone is

```
void ShrinkingConeD3PDAlg(TLorentzVector tau,vector* inputtracks20, vector*
inputtracks20charge, vector* inputtracks40, vector* inputtracks40charge, vector*
outputtracksgood, vector* outputtracksgoodcharge, vector* outputtracksbad, vector*
outputtracksbadcharge, int& nProng, int& flag, float& pi0angle);
```

All the variables for input and output are declared by the user and passed to the function.

The attached document `ShrinkingConeD3PDAlg.h` contains all the necessary functions and prototypes. Please copy and paste its contents into your header (.h) file.

Input Variables

- `tau` : This is the four vector for the reco tau
- `inputtracks20`: This collection of four vectors contains the tracks with $dR < 0.2$ w.r.t. the tau.
 - ◆ **IMPORTANT**: The mass of each track must be nonzero! [You can set it to the π^\pm mass (0.13957 GeV)]
- `inputtracks20charge`: This contains the charges of the tracks in `inputtracks20`
- `inputtracks40`: This collection of four vectors contains the tracks with $dR < 0.4$ w.r.t. the tau.
 - ◆ **IMPORTANT**: The mass of each track must be nonzero! [You can set it to the π^\pm mass (0.13957 GeV)]
- `inputtracks40charge`: This contains the charges of the tracks in `inputtracks40`

Output Variables

- `outputtracksgood`: This collection of four vectors are the tracks which are consistent with tau kinematics
- `outputtracksgoodcharge`: This contains the charges of the tracks in `outputtracksgood`
- `outputtracksbad`: This collection of four vectors are the tracks which are **not** consistent with tau kinematics
- `outputtracksbadcharge`: This contains the charges of the tracks in `outputtracksbad`
- `nProng`: This value ranges from 0 to 3, and corresponds to the number of tracks in `outputtracksgood`
 - ◆ `nProng = 0` correspond to taus classified as *fakes*
 - ◆ `nProng = 1` corresponds to 1 prong taus
 - ◆ `nProng = 2` correspond to taus with only 2 reconstructed tracks (most likely 3 prong taus).
 - ◆ `nProng = 3` corresponds to 3 prong taus.
- `flag`: This tells the quality of the classification
 - ◆ `flag = 0` corresponds to taus which are classified as *fakes*.
 - ◆ `flag = 1` corresponds to *good* taus
 - ◆ `flag = 2` corresponds to *conditional* taus.
 - ◇ `nProng = 1`: corresponds to taus with 2 reconstructed tracks in which the lowest pT track has been classified as spurious
 - ◇ `nProng = 2`: corresponds to taus with 3 reconstructed tracks in which the lowest pT track has been classified as spurious
 - ◇ `nProng = 3`: corresponds to taus with 4 reconstructed tracks in which the 3 highest pT tracks have been found consistent with tau kinematics
- `pi0angle` returns the angle around the tau jet axis which contains 99% of truth π^0 s
 - ◆ `pi0angle = -99` for fakes (`flag = 0`)

Other Notes

- Any tau with five (5) or more tracks in the cone of $dR < 0.2$ w.r.t. the tau axis will automatically be classified as a fake tau. All tracks will be returned in the `outputttracksbad` collection.
 - There is a special case for fakes. Ordinarily, if $nProng = 0$, then $flag = 0$ as well. However, taus with three tracks of the same sign ($l_{tau} charge = 3$) which are otherwise consistent with tau kinematics will be saved.
 - ◆ They will be denoted by $nProng = 3$ AND $flag = 0$
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