Bend-down Optics Positron Asymmetry and Contamination Methods

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Outline

Bend-Down Optics Fix

4.74 GeV S = 0 e^+ Raw Asymmetries

- Scale factor was applied to first-order bend down momentum to fix shift in dp/p
- 4-Pass longitudinal positron asymmetries were checked to see affects of the optics fix
- Slight change in the asymmetries

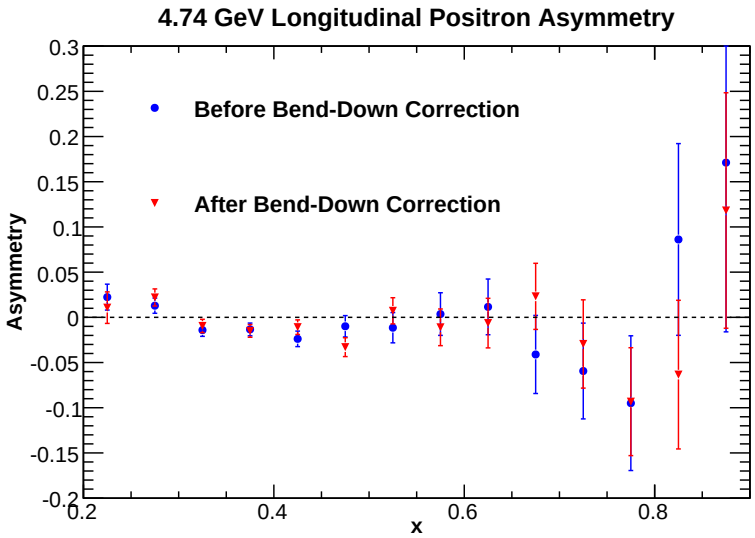

Figure: Bend-down positron asymmetries before and after bend-down optics fix.

Ideal Contamination Measurement

- Ideally select all electrons using all cuts except pre-shower
- Fit both hadron and electron peaks
- When applying all electron cuts but per-shower, there is not much of a peak to fit

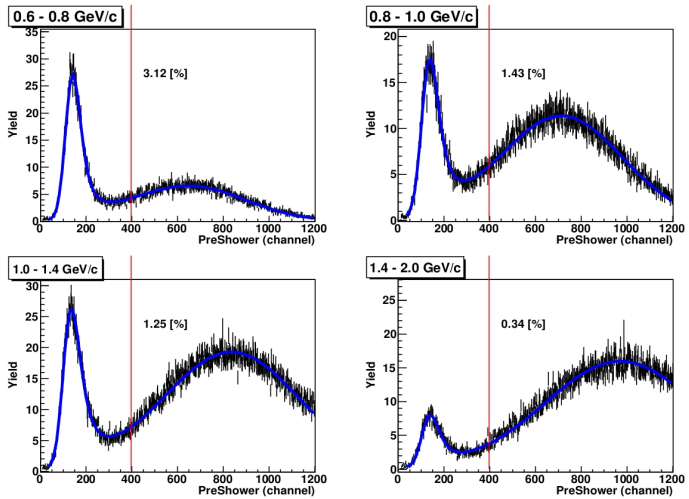

Figure: Shows ideal contamination procedure. Plots from Kalyan Allada's PhD thesis.

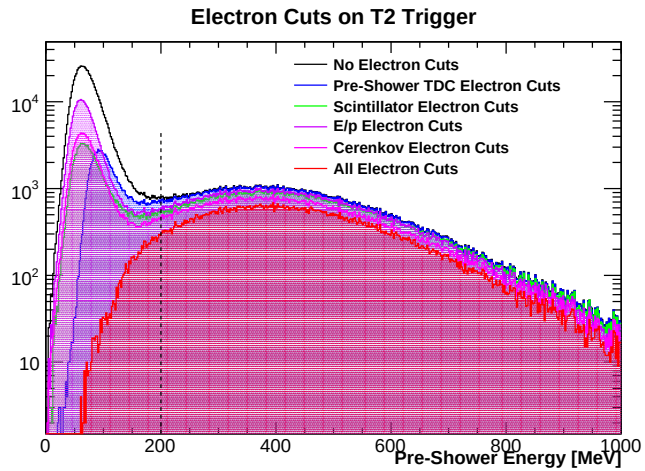

Figure: Applying all electron cut other than per-shower to d2n data.

Method 1

1. Use pion PID cuts to select pions and fit pre-shower curve ($f_\pi(ps)$),where ps is pre-shower energy
2. Use electron cuts to select electrons and fit pre-shower curve ($f_e(ps)$)
3. π/e ratio =
$$\frac{\int_0^\infty f_\pi(ps)}{\int_0^\infty f_e(ps)}$$
4. π/e contamination ratio =
$$\frac{\int_{200}^\infty f_\pi(ps)}{\int_{200}^\infty f_e(ps)}$$

Method 1

Validity

- GEANT4 tags the particles thrown during the simulation
- Use GEANT4 PID to see how many of the events that pass electrons are really electrons
- Allows accuracy of the contamination estimate used by Method 1 to be checked

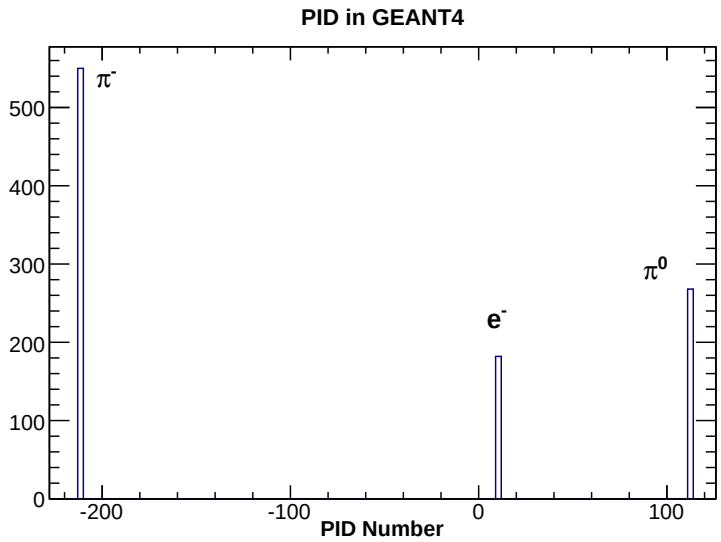

Figure: GEANT4 PID tags.

Method 1

Check

Contamination: 0.5%

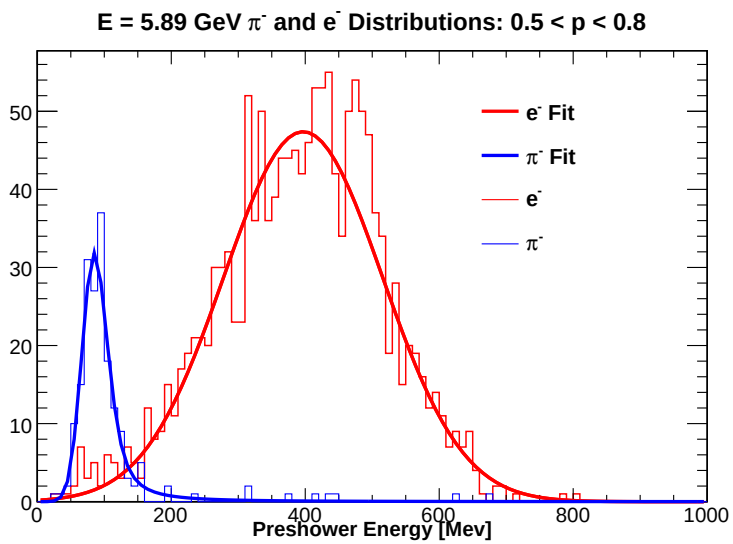

Figure: Fits to the pion and electron distributions, obtained from PID cuts.

Contamination: 6.13%

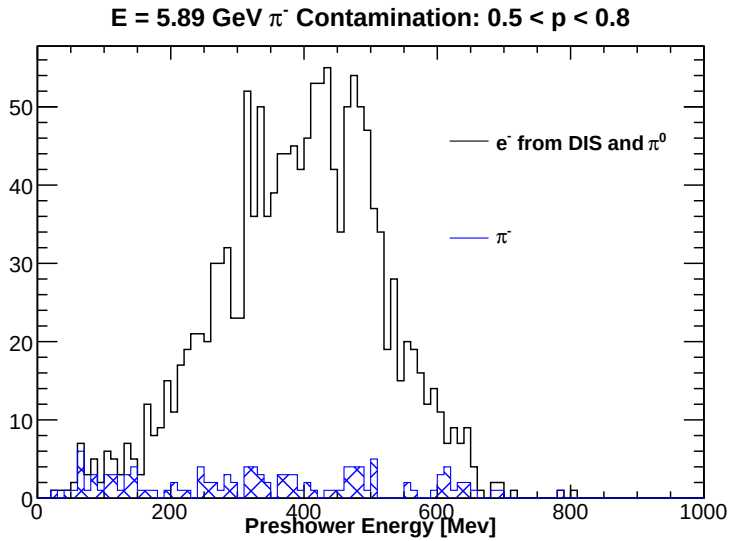

Figure: Number of events passing electron cuts that were tagged by GEANT4 as pions.

Method 1

Breakdown

- Pion and electron distributions use different cut sets
- Pion PID cuts higher energy events to select cleaner pion sample
- Maybe biasing the contamination estimate

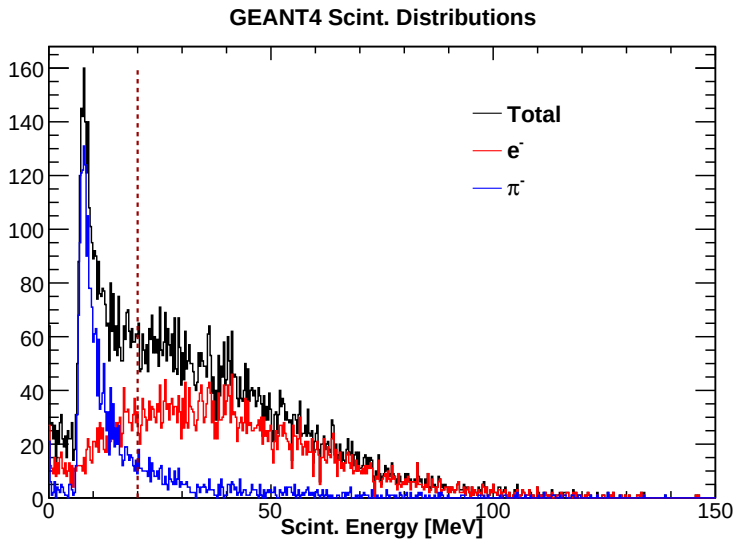

Figure: GEANT4 PID cuts applied to scintillator energy.

Method 2

1. Use same fit functions as method 1
2. Eyeball pion fit for low energy events that pass electron cuts
3. Fit higher energy electrons
4. Combine two fits and fit all events passing electron cuts
5. Both fits share a common cut set

Method 2

Check

- Fit method contamination:
  $7.72\% \pm 0.25\%$
- GEANT4 PID contamination:
  $6.13\% \pm 0.68\%$

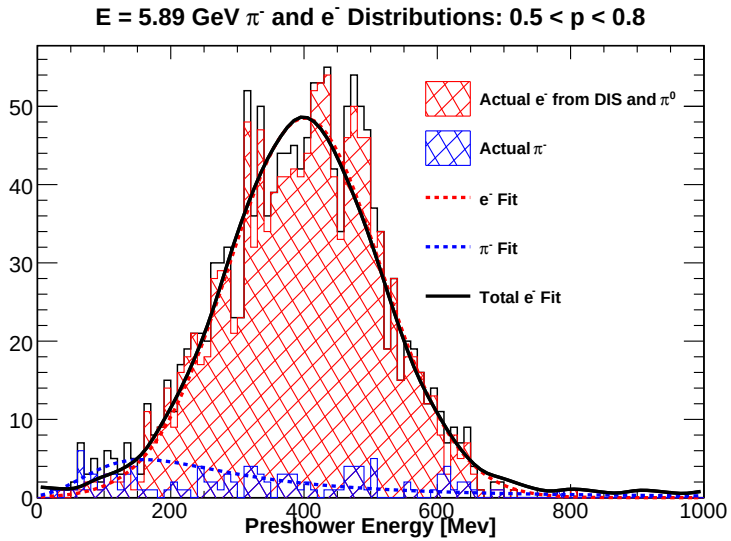

Figure: Fits to pion and electron distributions using a common cut set. These fits are compared to the number of events tagged as pions by GEANT4.

Contamination Summary

- Method 1:
  - Underestimates the pion contamination compared to GEANT4 PID
  - Most likely due to different pion and electron PID cuts leads to energy bias
- Method 2:
  - Does a good job estimating the pion contamination compared to GEANT4 PID
  - Difficult to fit pion contribution because not much there
  - Will be difficult to apply method 2 to data
  - Remove an electron cut from the data to do fit?

- Work on contamination
- Fit world g_1 and g_2 data for x < 0.275 (already done)
- Use world data to compute d_2 two ways:
  - Adding $x^2\,(2g_1 + 3g_2)$
  - $\overline{g_2} = g_2 - g_2^{WW}$,$g_2^{WW}$ at constant Q^2