Preshower Update

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Topics for today

• Use of DIRC variables in classifiers

• Energy correction using nHits

• Pi0 plots (fits using pi0 peak and bkg parameters)
DIRC Variables

- Add thetaC, thetaCError, nBkgPhotons, chiSqr, ndf, chiSqrPerNdf as inputs to classifiers

- Cannot just add DIRC variables as inputs to classifiers

- DIRC info not necessarily reliable when fitFailed=true
DIRC Variables

• DIRC info always exists when fitFailed=false

• 3 scenarios when fitFailed=true
  – 1) DIRC info does not exist
  – 2) thetaC = 0 (→ all other DIRC vars set to zero)
  – 3) DIRC info exists and is non-zero (“good” info)

• No information to be gained if DIRC info does not exist or is zero (“bad info”)

• If DIRC vars are to be used when fitFailed = true, require “good” DIRC info

• Include DIRC info if fitFailed = false
DIRC Variables

- **fitFailed = false**
  - EMC variables + nHits and DIRC variables as inputs to separate classifiers for testing
  - Efficiency and purity depend weakly on DIRC cut (~50% preshowers, ~8% non-preshowers fall here)

- **fitFailed = true, “good” DIRC info**
  - Efficiency and purity depend weakly on DIRC cut (~50% preshowers, ~8% non-preshowers fall here)
  - DIRC vars more important but efficiency is very low for purity>50% (~30% preshowers, ~55% non-preshowers fall here)

• Use EMC variables + nHits and DIRC variables as inputs to separate classifiers for testing

• Require event to pass EMC classifier cut and DIRC classifier in order to be classified as signal
• May not be able to do anything useful with events with “bad” DIRC info
Theta Correction

- Previously using theta correction \( E_{\text{corr}} \sim 1/\sin \theta \)
- All preshowers at the same theta receive the same energy correction
- Would like an event-by-event correction

\[ E_{\text{corr}} = a/\sin \theta \]
nHits Correction

- Believed no correlation existed between nHits and $E_{\text{loss}}$ (expect a positive correlation)

- Use profiles of $E_{\text{loss}}$ in nHits bins to determine value of $E_{\text{loss}}$ for a given bin (same procedure as for theta correction, see 06/11/08 talk)

nHits = 10
Non-Preshower: peak = -0.007 GeV
mean = -0.018 GeV

Preshower: peak = -0.037 GeV
mean = -0.056 GeV

$E_{\text{corr}} = 0.030$ GeV (peak)
$E_{\text{corr}} = 0.038$ GeV (mean)
nHits Correction

$E_{\text{loss}}$ constant for non-preshowers

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<thead>
<tr>
<th>Energy Loss (mean)</th>
<th>Energy Loss (peak)</th>
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<td>Preshowers</td>
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<td>Preshowers</td>
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![Graphs showing energy loss vs. nHits for preshower and non-preshower events]
Can we combine the nHits correction with the theta correction?
Chapter 11

nHits & Theta Correction

- Repeat procedure used for nHits and theta to produce histograms of eLoss for 20 nHits bins and 6 (evenly spaced) theta bins (see nCrystals/theta correction in 06/11/2008 talk)

- Low statistics for non-preshowers (bad fits)
nHits & Theta Correction

Energy Correction: Theta Bin 0

Energy Correction: Theta Bin 1

Energy Correction: Theta Bin 2

Energy Correction: Theta Bin 3

Energy Correction: Theta Bin 4

Energy Correction: Theta Bin 5
nHits & Theta Correction (means vs peaks)

20 nHits bins, 6 theta bins

10 nHits bins, 12 theta bins
nHits & Theta Correction (Comparison with Theta Correction)

20 nHits bins, 6 theta bins, profile peaks

20 nHits bins, 6 theta bins, profile means
nHits & Theta Correction (Comparison with Theta Correction)

10 nHits bins, 12 theta bins, profile peaks

10 nHits bins, 12 theta bins, profile means
Initial values determined from separate fits to peak and bkg. Does not change fits.

$\pi^0$ Plots

Novosibirsk function + pol3

High side bkg fit better than low side
Initial values determined from separate fits to peak and bkg. Does not change fits.

$\pi^0$ Plots

Crystal Ball function + pol3

Low side bkg fit better than high side. Peak fit better.
To Do…

• Determine which classifier is best
  – Generally only marginal differences in efficiency and purity with no clear “winner”
  – When should we use DIRC variables?

• Determine which energy correction is best
  – How do we do this? Pi0 plots for all events would be best, but differences in peaks and widths are very small

• Explore other ways to determine effectiveness of correction other than width and peak of fit to pi0 plots