Energy Resolution of High Energy Photons

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Outline

• Study photon energy resolution
• Will compare the measured (BtaCandidate) photon energy with the ‘true’ photon energy implied by a kinematic fit.
• Will use $\mu\mu\gamma$ sample from ntuples generated for ISR analysis
  – Muons emit less bremsstrahlung radiation than electrons
  – The same ntuples are being used by the people studying edge correction effects
Data Samples

• Currently using:
  – ISR ntuples with a kinematic fit applied (produced from 89.3fb⁻¹ in release 12)
  – SP4 Monte Carlo (Release 10)

• Hope to use:
  – ISR ntuples taken from ~184fb⁻¹ of available data (runs 1-4) produced in release 14. Need to run kinematic fitting code over these, requiring some code modification
  – Ntuples from SP5 MC, which are going to be produced by the Inclusive Hadronic Particle Spectra AWG

• Only showing MC data today.
Photon Energy Spectrum

- Plot shows photon energy spectrum from $\mu\mu\gamma$ events, from MC truth
- Cuts applied:
  - # measured tracks = 2
  - # measured photons = 1
- Photons in range $\sim$1-8 GeV can be studied
Photon Energy Vs. $\cos\theta$

- Photons with energy in the range 1-3 GeV found over most of $\cos\theta$ range
- Higher energy photons found in forward direction
Photon Energy Resolution

• Plot shows:
  \[ E_{\text{meas}} - E_{\text{MC}} \]
  \[ E_{\text{meas}} - E_{\text{fit}} \]

• Cuts applied:
  – # measured tracks = 2
  – # measured photons = 1

• Kinematically fitted data approximates MC data quite well

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Photon resolution talk
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Photon Energy Resolution

- Plot shows:
  \[ E_{\text{meas}} - E_{\text{MC}} \]
  \[ E_{\text{fit}} - E_{\text{MC}} \]

- Cuts applied:
  - # measured tracks = 2,
  - # measured photons = 1

- The kinematically fitted photon energies are closer to the MC true energies than the measured photon energies

- Energy from kinematic fit is a good estimator for true energy
Future Work

• Look at data identifying muons
• Need to run fitting code over latest set of ISR ntuples
  – These contain PID selectors, which will allow for more flexible muon selection
• Look at SP5 MC produced for ISR analysis when it becomes available
• Quantify energy resolution as it varies with photon energy and with $\cos \theta$