Challenges in shower reconstruction for pre-shower detector

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3rd Japan-Korea PHENIX collaboration meeting

MPC-EX



Mini-pad sensors



Pixels are 1.8x15mm²

What's done w/ MPC?

• We can measure π^{o} and η

very important measurement to study CNM and single spin asymmetry



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What can be done w/ MPC-EX?

- Tracking through the layers
 - before separate shower starting to merge
- Extent current π° measurement up to higher p_{T} ?





only w/ MPC

MPC + MPC-EX

How single y looks in MPC-EX?

- Number of layers photon interact
 - single y simulation into one position (η =3.4, ϕ =90°)



~90% photons interact with all (8) silicon layers



- Shower dispersion at 3rd x-y plane
 - blue π° , red γ

$$x_{cg} = \frac{\sum e_i \cdot (pad_index)}{\sum e_i}$$
$$x_{disp} = \frac{\sum e_i \cdot (pad_index - x_{cg})^2}{\sum e_i}$$

Distance between two photons



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- MPC-EX event displays of 50 GeV γ and π^o
 - incident position (η =3.4, ϕ =90°)
 - $\pi^{o} p_{T} \sim 3.3 \text{ GeV/c}$



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very hard to distinguish two gamma clusters in π^{o} event

• MPC-EX displays of 30 GeV π° – incident position (η =3.4, ϕ =90°) – $\pi^{\circ} p_{T} \sim 2.0 \text{ GeV/c}$



MPC-EX displays of 30 GeV π^o

 incident position (η=3.4, φ=90°)
 π^o p_T ~ 2.0 GeV/c



Both events are π^{o}

Now we can distinguish two gamma clusters π^{o} event, there might be still efficiency issue

MPC-EX displays of 10 GeV γ
 – incident position (η=3.4, φ=90°)



MPC-EX displays of 10 GeV γ
 – incident position (η=3.4, φ=90°)



In case of low energy EM showers, fluctuation will be another issue

- under development in MPC-EX group
 - plots from Aneta Iordanova
- Start from hit distribution from Hough transformation
 - single pion event



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Search 1st peak in projected histograms on x/y axis
 by using TSpectrum in ROOT



- Regenerate the hit distribution on (r,φ) plane
 - define r size of the 1st peak
- Search 2nd peak in distribution outside r range of the 1st peak



Search r position of the 2nd peak within in a certain φ range
 outside r cuts from the 1st peak



• Finally, we can get the position of two photon clusters



- Mass reconstruction
 - red : 1st is reconstructed, 2nd is from simulation
 - black : both are reconstructed



Another approach

• Purpose

- find all EM showers
- less sensitive to background sources and shower fluctuation
- Quick introduction to the procedure
 - filling energy sum of certain range (safely containing whole EM shower) instead of energy from single channel in the corresponding channel
 - searching for peaks in 2nd, 3rd, 4th XY layers independently
 piO (>20 GeV) as well as single photon are tagged as single peak
 - zoom in energy distribution around the peak position
 - adjust the range of energy sum fitting to single EM shower for piO/s separation
 - TSpectrum2 give us reasonable peak finding results
 - shower shape related variable also can be used as a second filter

BACK UP



- Shower dispersion at 1st x-y plane
 - blue π° , red γ



- Shower dispersion at 2nd x-y plane
 - blue π° , red γ



- Shower dispersion at 4th x-y plane
 - blue π° , red γ

How single y looks in MPC-EX?

- Center of longitudinal shower profile
 - single y simulation into one position (η =3.4, ϕ =90°)



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