Some Trigger Oldies but Goldies

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♡ For Matthias' trigger question, I want an E_T trigger which doesn't suffer distortion from 'fragmentation' or hadronization, compared to a cluster counting trigger with a low threshold which I think is better done in the mvd.

♡ As for EMCAL thresholds, normally I would use 4:

1) highest for single cluster= γ or π^0

2) lower for back-to-back π^0 or γ pairs

3) lowest EMCluster seed in each arm for $e^{\pm}$ pair trigger, but we know this threshold, it must be 1 GeV or less to see the J/Ψ

4) 1.2 to 1.5 GeV EMCluster threshold as a seed for the single $e^{\pm}$ trigger for charm. Again, we know this threshold.

Maybe the trigger 2 can have the same threshold as trigger 4, but it is unlikely. Alternatively, if we are lucky we can use trigger 3) threshold for singles also.

♡ I had discussed an electron trigger algorithm in PN85 6/10/93. It matches clusters in the EMCAL with an energy $E > E_{\rm thresh}$ with rings in the RICH. The only complication is that the EMcal measures η, ϕ while the RICH measures η and $\lambda = \delta + \phi$, where δ is the local tangent angle of the trajectory relative to the radial direction, also called α, β (???) in PHENIX. The good news is that since the EMCAL gives you the E of the cluster in question you know $\delta = \lambda_{\rm RICH} - \phi_{\rm EMCAL}$.

1.1 Track from the origin

For a particle emitted from the origin $\tau = 0$ and $\lambda_N = \phi_0$, the azimuthal angle of emission:

$$\sin\delta = \frac{R}{2\rho} \tag{5}$$

$$\sin(\phi - \phi_0) = \frac{R}{2\rho} = \sin\delta \tag{6}$$

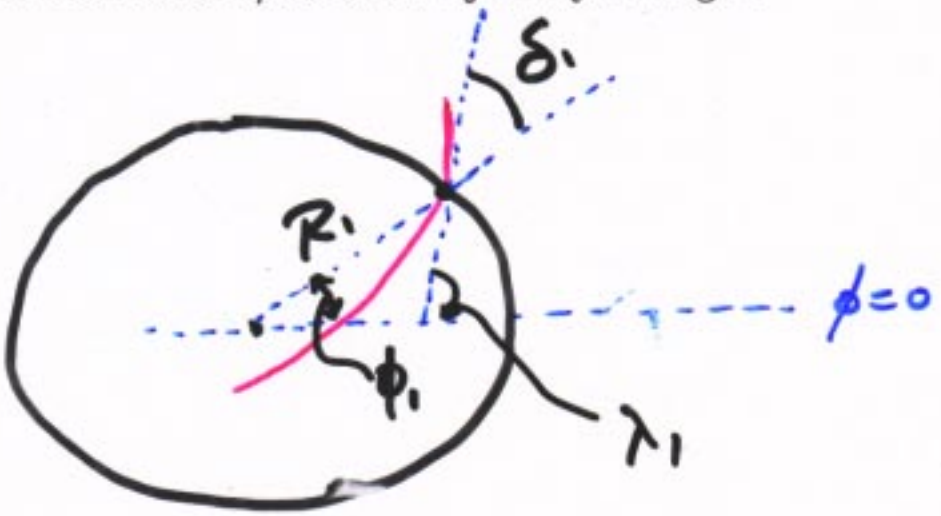
1.2 Field-free region

These equations work just as well for a field free region, inner radius R_i, outer radius R_o in which case $\rho_{io} = \infty$, with the result

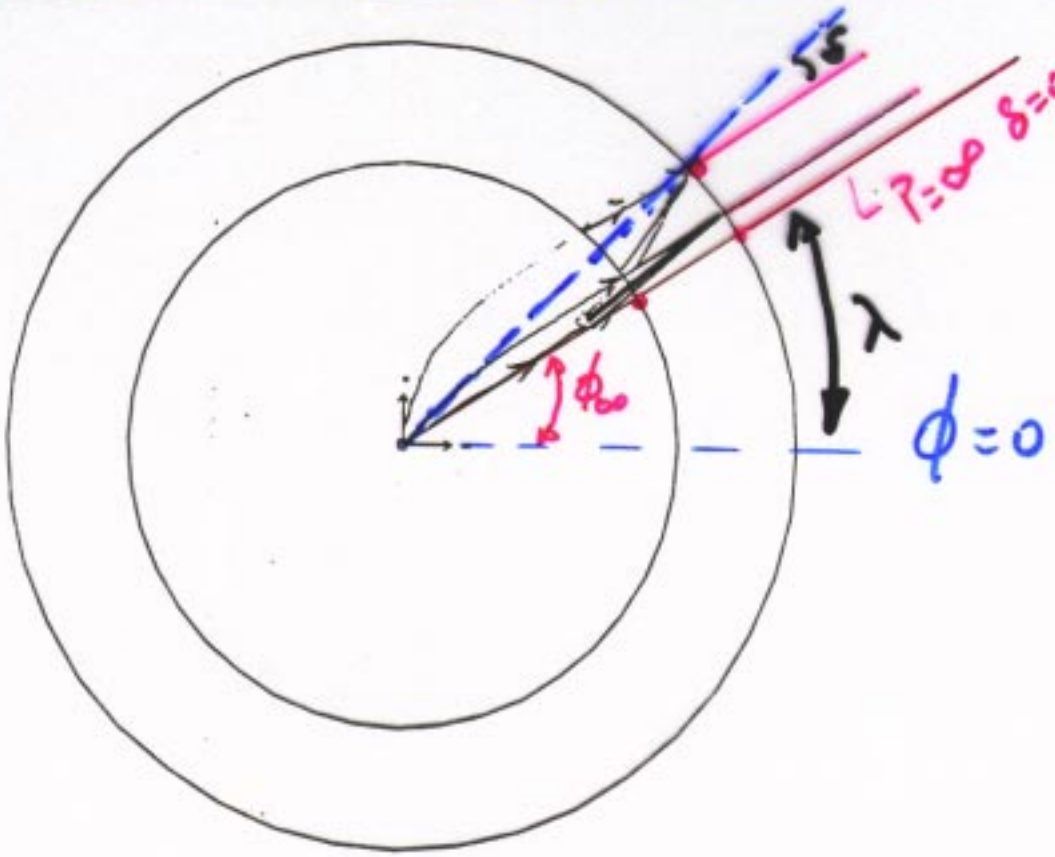
$$\sin\delta_o = \frac{R_i}{R_o}\sin\delta_i \tag{7}$$

$$\phi_o - \phi_i = \delta_i - \sin^{-1}\left(\frac{R_i \sin\delta_i}{R_o}\right) \quad . \tag{8}$$

Note that the trajectory vector does not change in the field free region, but the local tangent angle δ to the radius changes because the azimuthal coordinate ϕ of the trajectory changes.



RICH IMAGES $\lambda \propto \theta$ NOT $\phi \propto \theta$



- ALL 3 TRAJECTORIES IMAGE AT THE SAME POINT ϕ_∞ = AZIMUTHAL COORDINATE AT RICH FOR INFINITE MOMENTUM TRACK
- 3 TRAJECTORIES DRAWN ALL HAVE THE SAME $\lambda = \phi_\infty$
- FOR TRACKS WITH THE SAME $\lambda = \phi_\infty$

$$\boxed{\phi_\infty - \phi = \delta = \text{const}^{-1} R/2p}$$

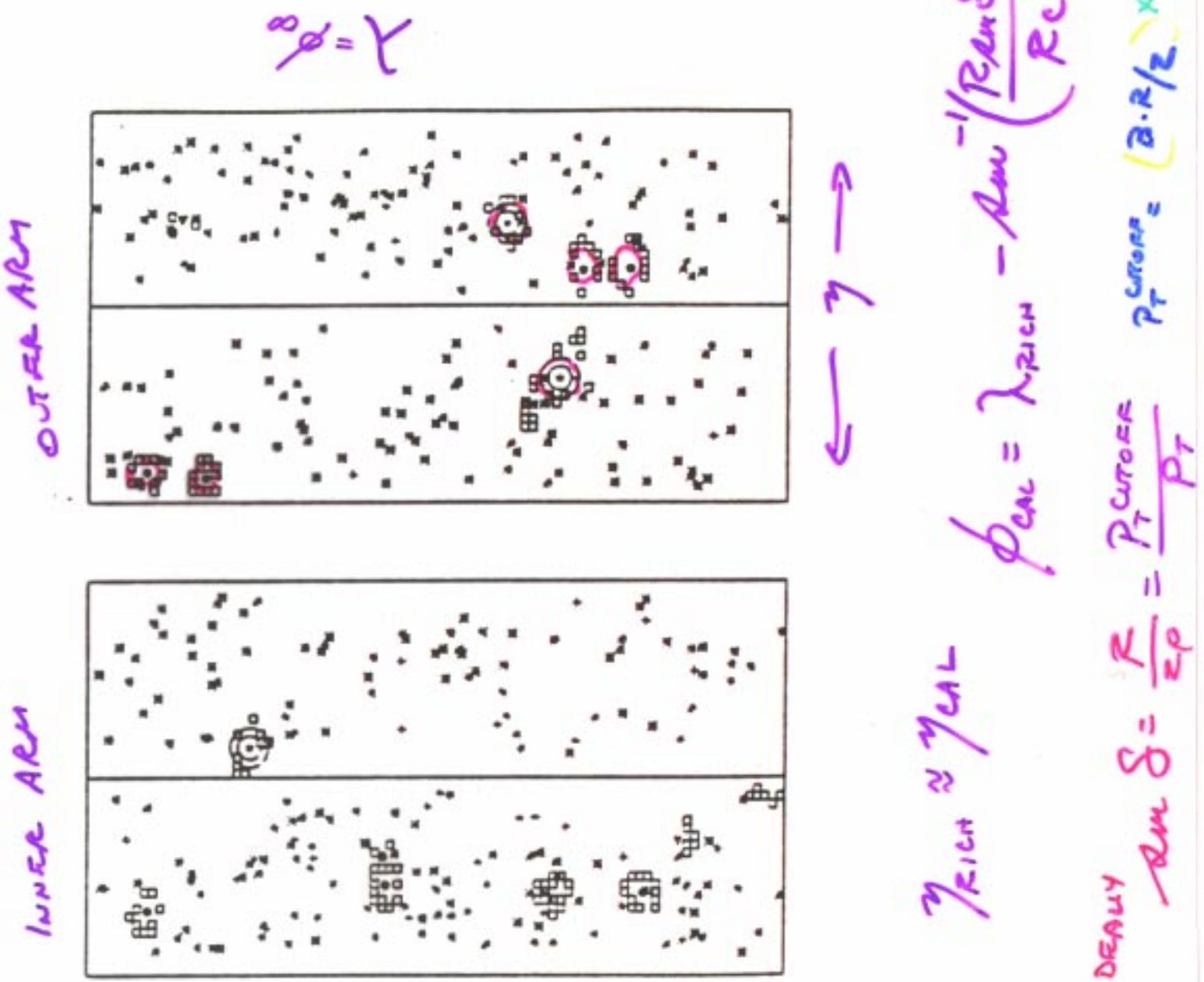
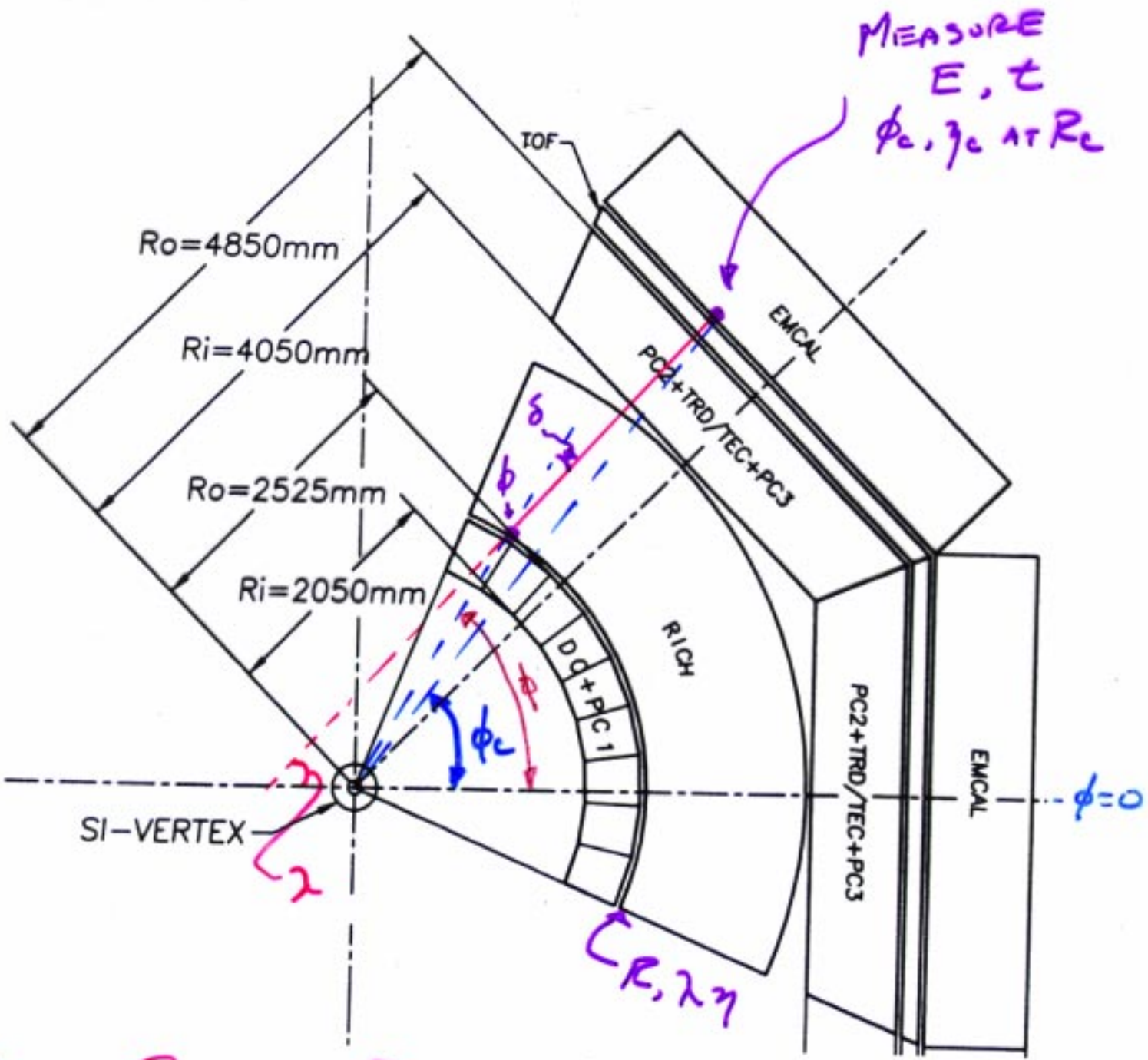


Figure 2.43: A typical hit pattern on the Cherenkov detector for a simulated Au + Au central collision event for a charged particle multiplicity of $dN_c/dy = 1000$. The hit pixel in the



ASSUME R IS AT THE BOUNDARY OF B OR IN FIELD-FREE REGION

Figure 6.1: Schematic of PHENIX detector including the tracking subystem.

$$\phi_c - \phi = \delta - \sin^{-1}\left(\frac{R \sin\delta}{R_c}\right) \qquad \lambda = \phi + \delta$$

$$\boxed{\phi_c - \lambda = \sin^{-1}\left(\frac{R \sin\delta}{R_c}\right)} \qquad \sin\delta \sim \frac{p_T^{\text{cutoff}}(R)}{p_T}$$

$\rightarrow 0$ AS P_T INCREASES

MJT E-trigger strategy PN85 6/10/93

- Match λ, η hits on RICH
  - To η, ϕ_c hits on EMCal
    - within 1 ns of $\beta = 1$
    - charged only
      - for different slices of E
      - or for $E > E_{\rm thresh}$

- Then Match p and E when tracks are available
- Then Reject Dalitz & Conversions
  - when HBD is available
  - or with low magnetic field setting

- Also Select Dalitz and Conversions!
  - see 'Charm in PHENIX—a signal or a background?
    `http://www.phenix.bnl.gov/~sapin/charm96.ps.gz`
  - see many experts largely concentrated in light/heavy PWG