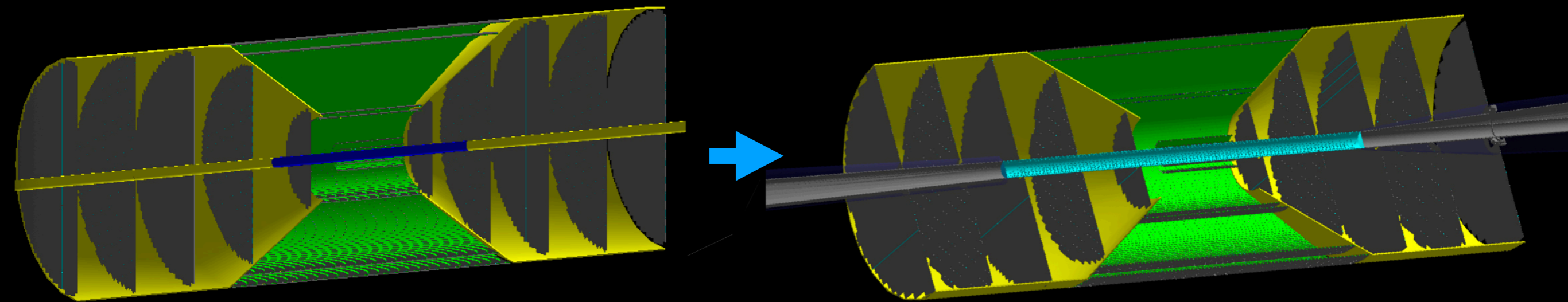


# Update on All-Si tracker studies

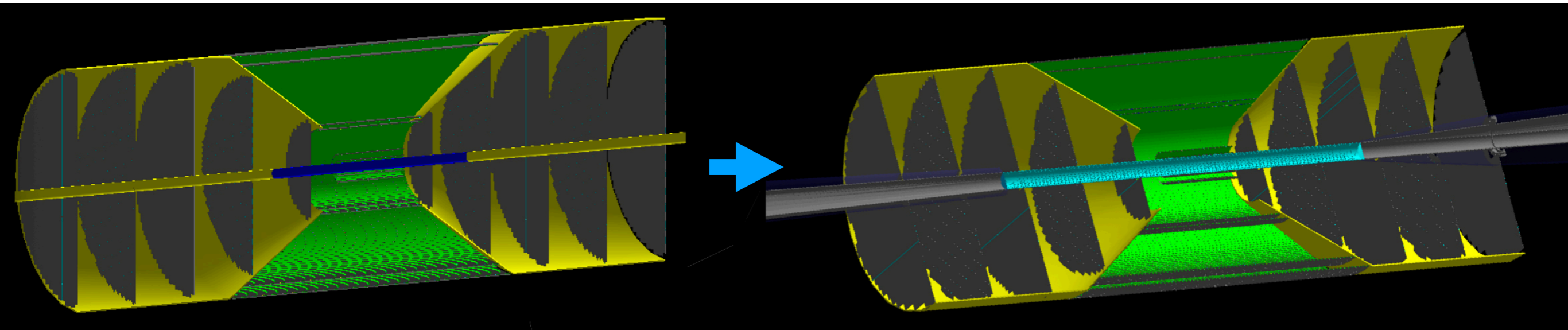


Rey Cruz-Torres

08/18/2020

# To recap

- Updated All-Si tracker geometry to accommodate new beampipe
  - Barrel:
    - outer two layers kept identical to previous geometry
    - inner two layers increased in radii to fit beampipe
    - middle two layers positioned following fast-simulation results
  - Disks:
    - increased inner radii to fit beampipe
    - chips increased in width to avoid stave gaps



- Studied single-particle resolutions

# $|\vec{p}|$ resolution comparison between geometries

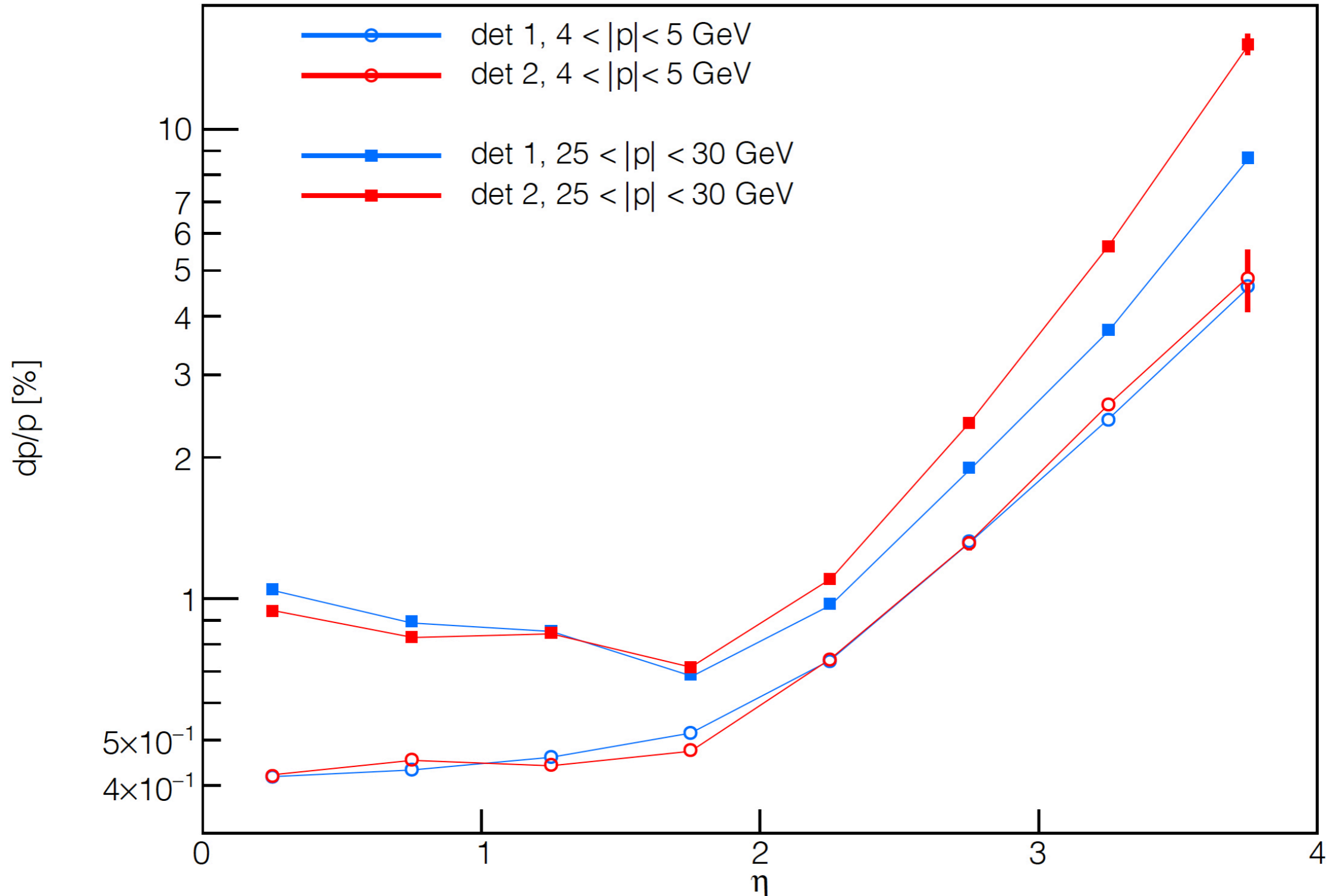
$\pi^-$

Beast (B = 3.0 T) field

$20 \times 20 \mu\text{m}$  pixel

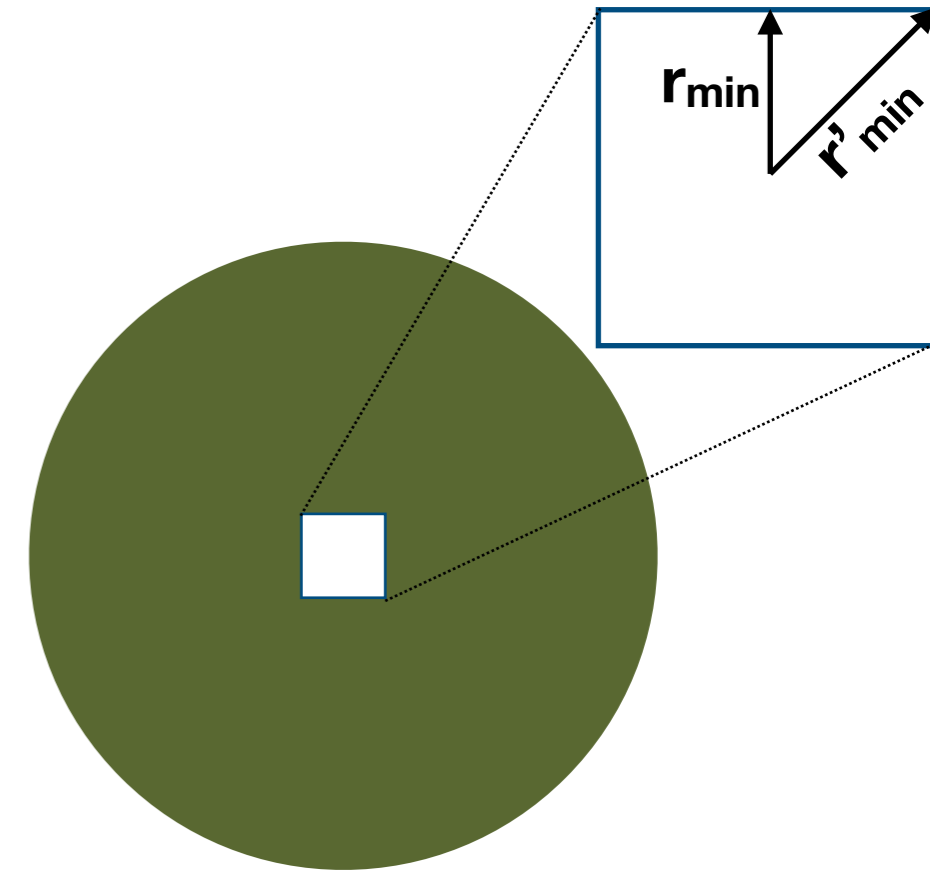
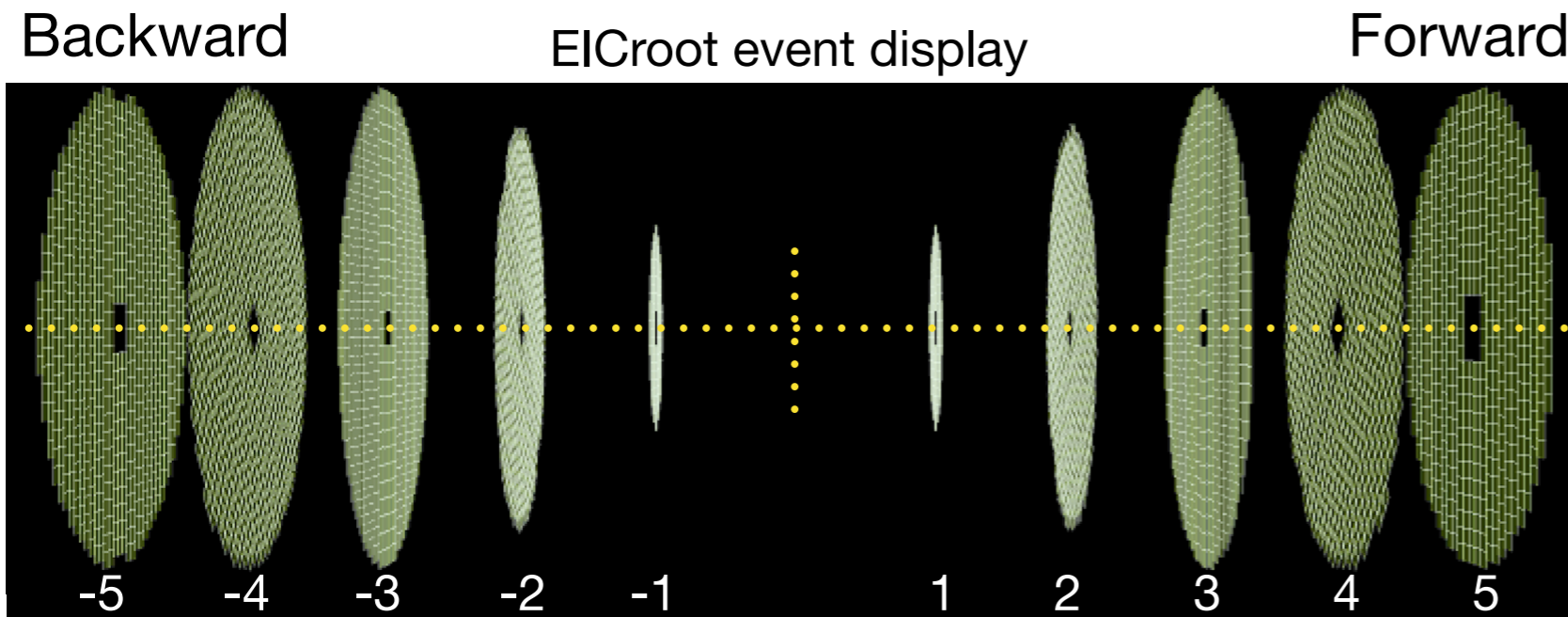
det 1  $\equiv$  original geometry

det 2  $\equiv$  updated geometry



# Disk updates to the All-Si tracker

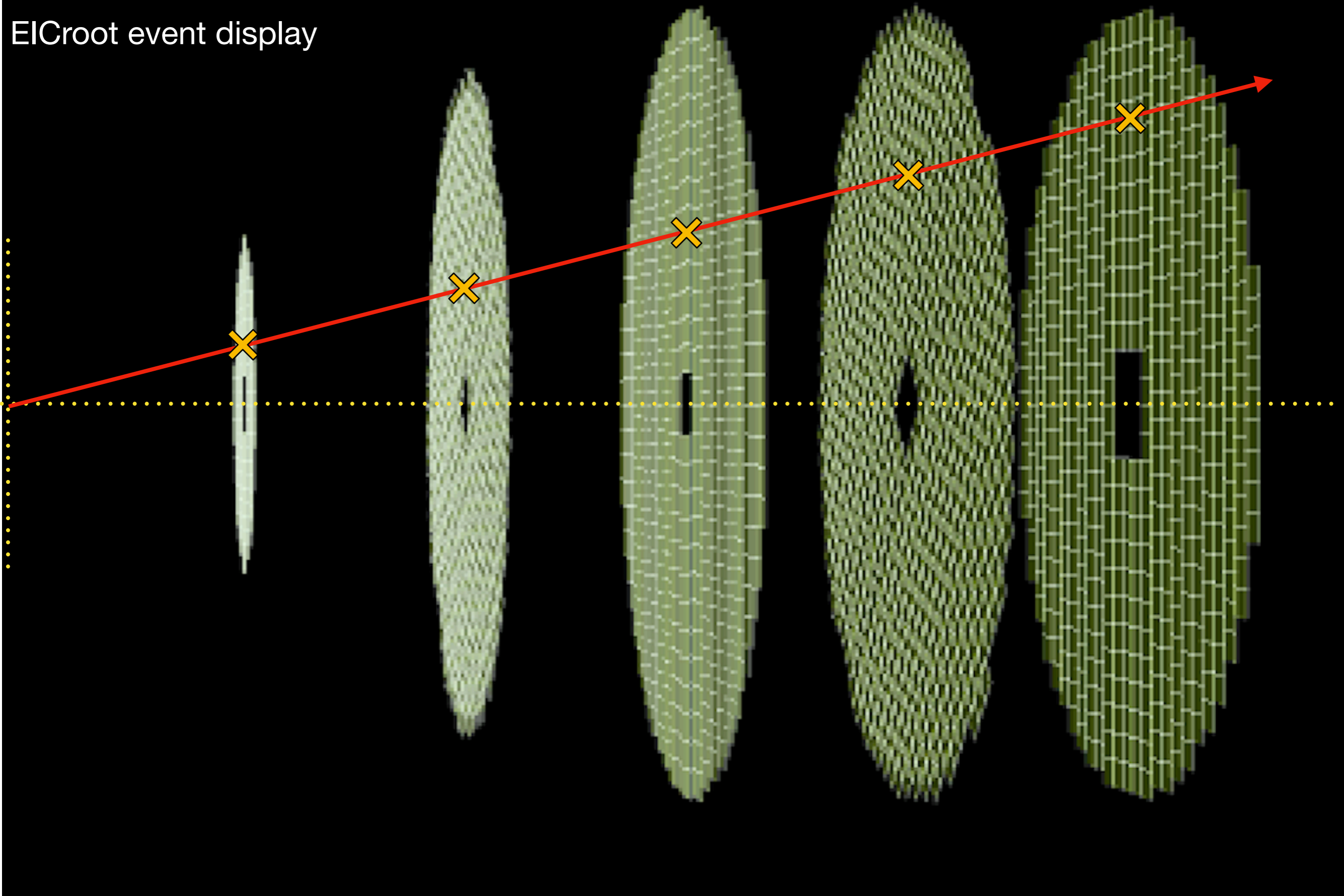
	Disk number	z position ("Z") [cm]	axis rotation ("R") [deg]	outer radius [cm]	inner radius [cm]	stave width [cm]	stave separation [cm]	$\eta_{max}$
Backward	-5	-121	0	43.23	4.41	3.00	2.60	-4.00 — -3.66
	-4	-97	45	43.23	3.70	2.60	2.20	-3.96 — -3.61
	-3	-73	0	43.23	3.18	2.50	1.80	-3.83 — -3.48
	-2	-49	45	36.26	3.18	2.50	1.80	-3.43 — -3.08
	-1	-25	0	18.50	3.18	2.50	1.80	-2.76 — -2.42
Forward	1	25	0	18.50	3.18	2.50	1.80	2.76 — 2.42
	2	49	45	36.26	3.18	2.50	1.90	3.43 — 3.08
	3	73	0	43.23	3.50	2.60	2.00	3.73 — 3.38
	4	97	45	43.23	4.70	3.20	2.60	3.72 — 3.37
	5	121	0	43.23	5.91	3.80	3.30	3.71 — 3.37



Disk acceptance starts to deteriorate for  $|\eta| > 2.42$

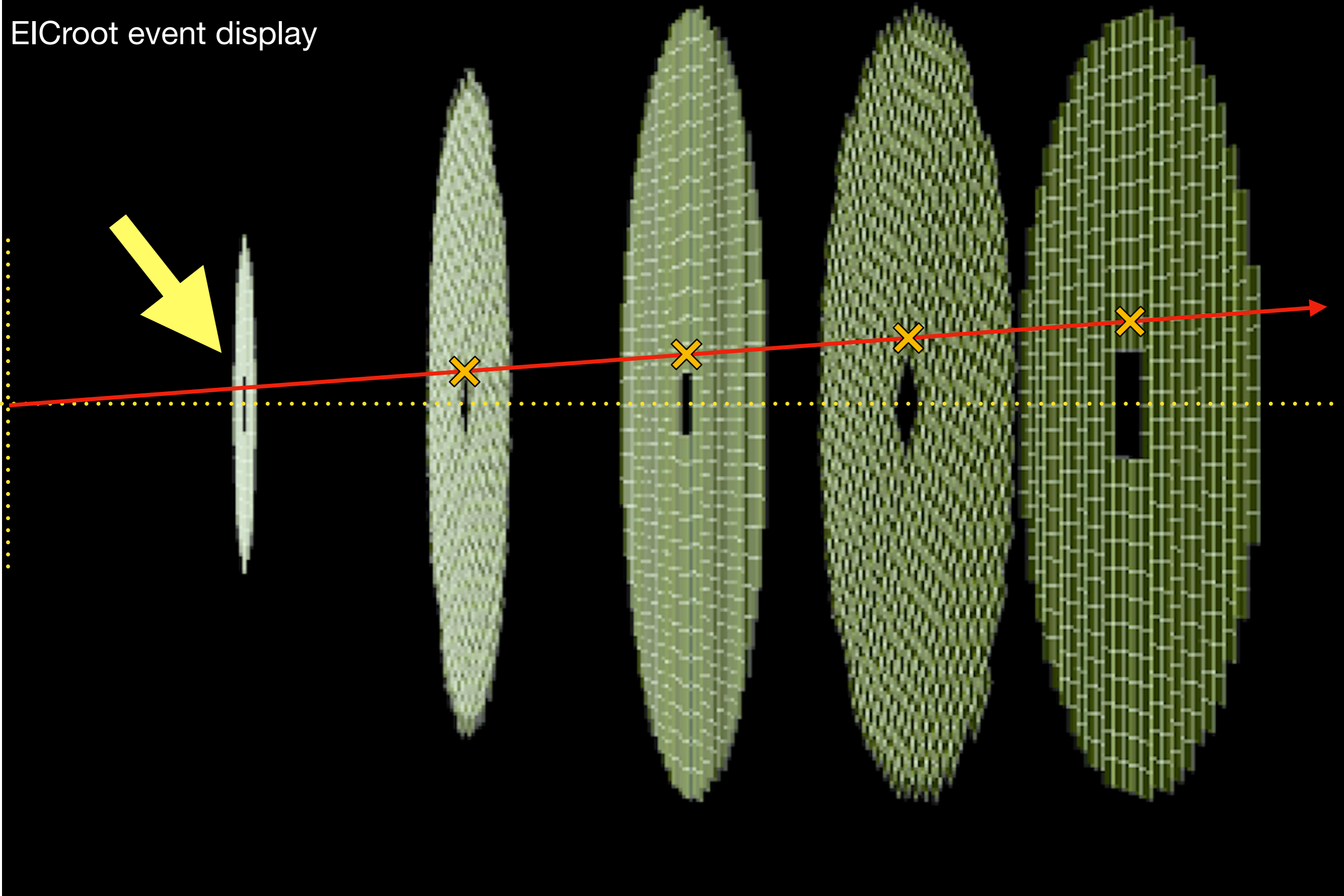
# For better visualization:

ElCroot event display

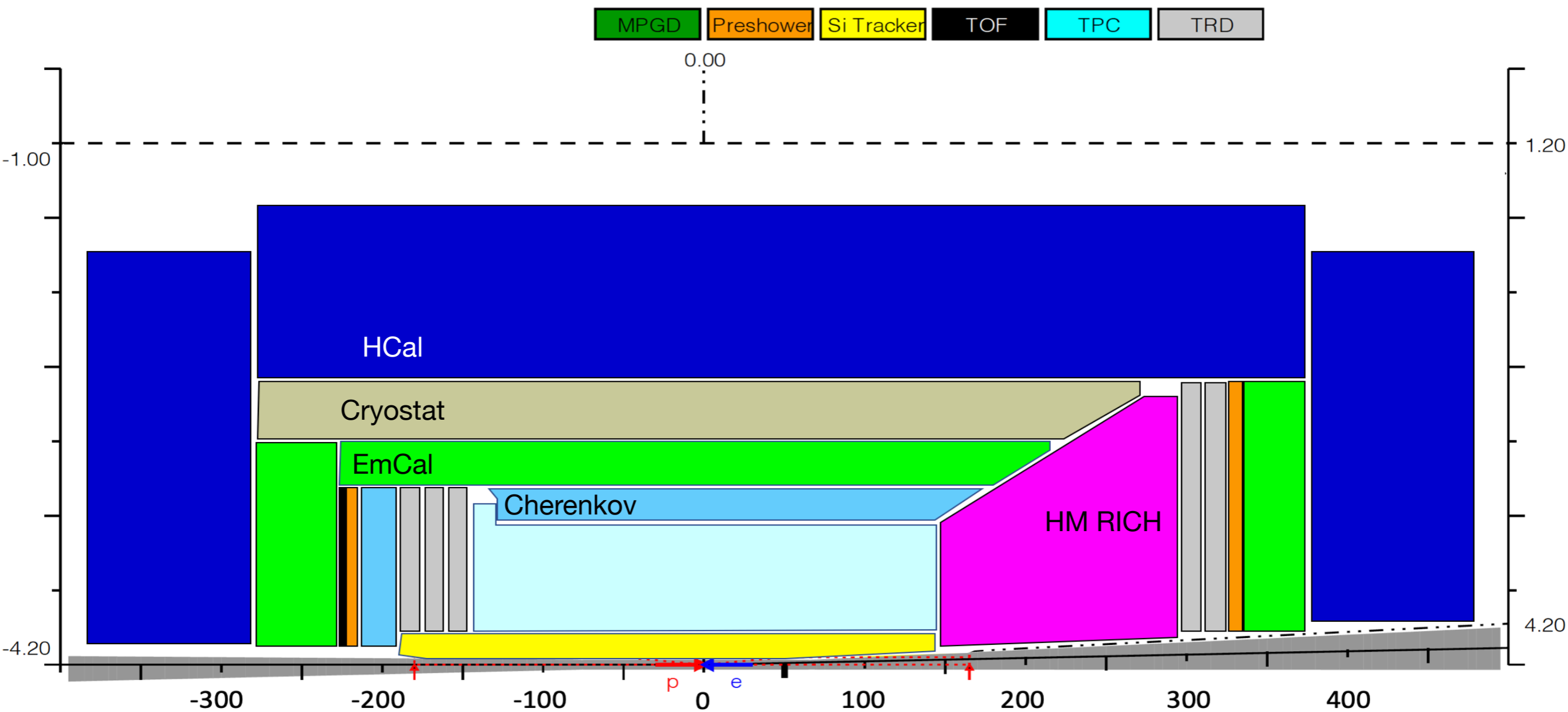


# For better visualization:

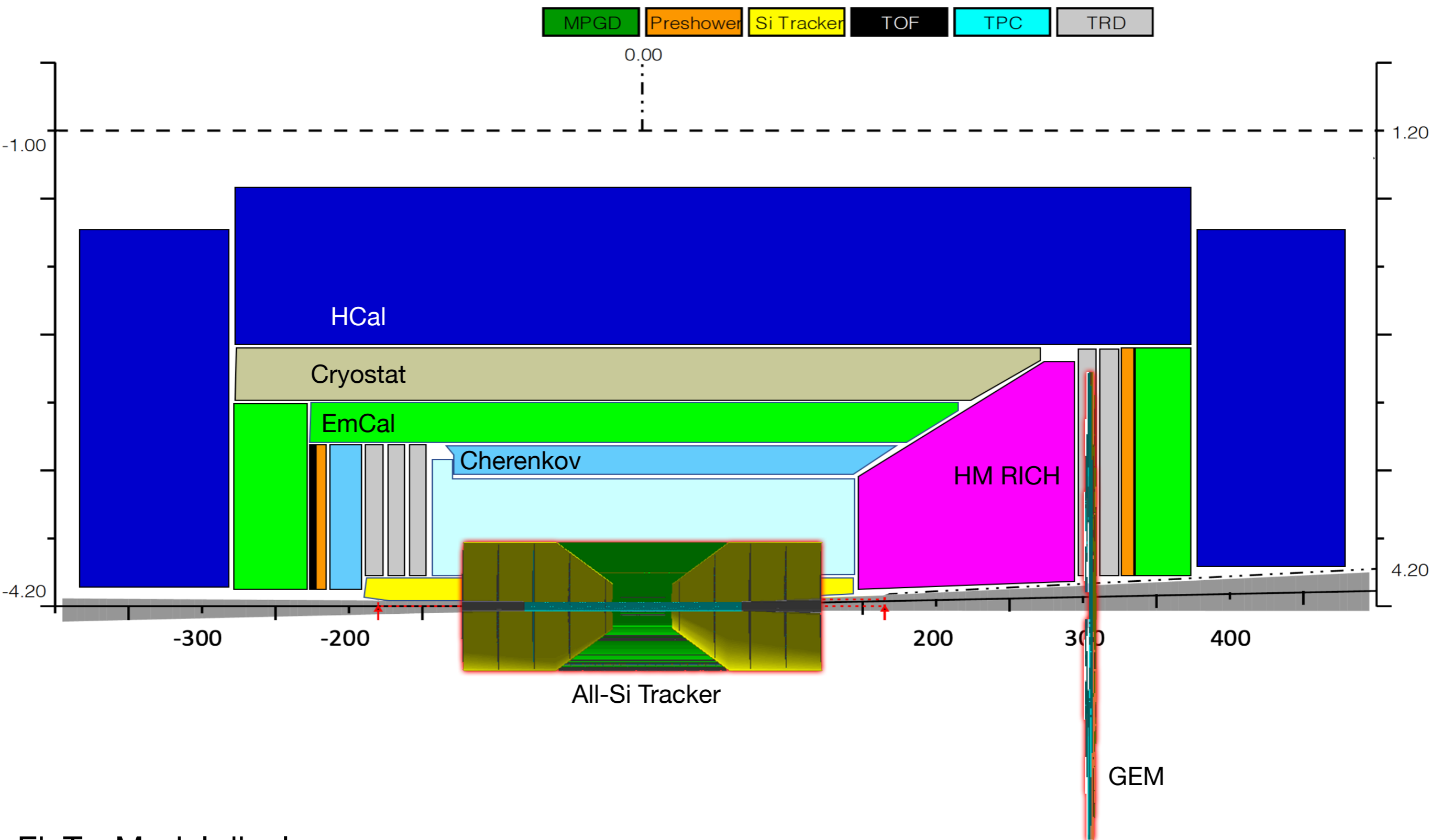
ElCroot event display



# Placement of GEM in forward region



# Placement of GEM in forward region





# GEMs in Fun4All

[https://github.com/eic/fun4all\\_macros/blob/master/common/G4\\_GEM\\_EIC.C](https://github.com/eic/fun4all_macros/blob/master/common/G4_GEM_EIC.C)

## Parameters:

$$\eta_{\min} = 1.40$$

$$\eta_{\max} = 3.69$$

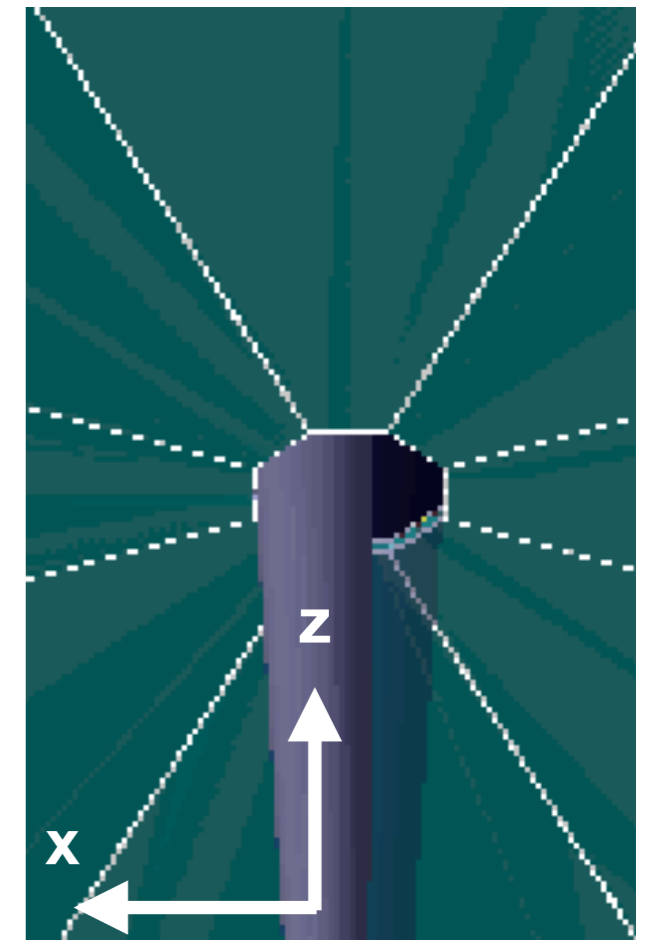
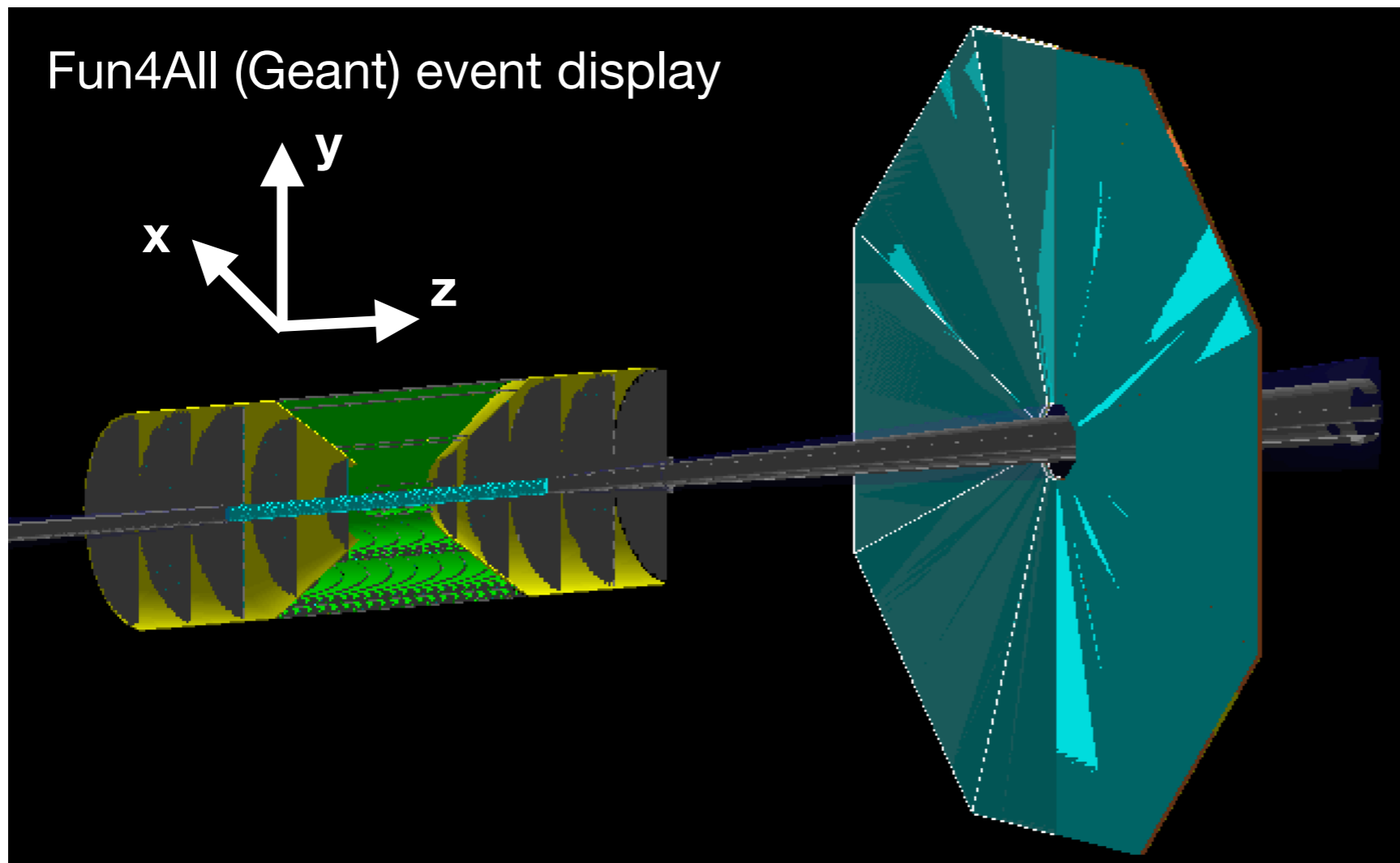
z position = 300 cm

# sectors = 8

## Spatial resolution:

$$\sigma(\hat{r}) = 50 \mu\text{m} \longrightarrow \text{tunable}$$

$$\sigma(\hat{\phi}) = 50 \mu\text{m} \longrightarrow \text{best-case scenario}$$

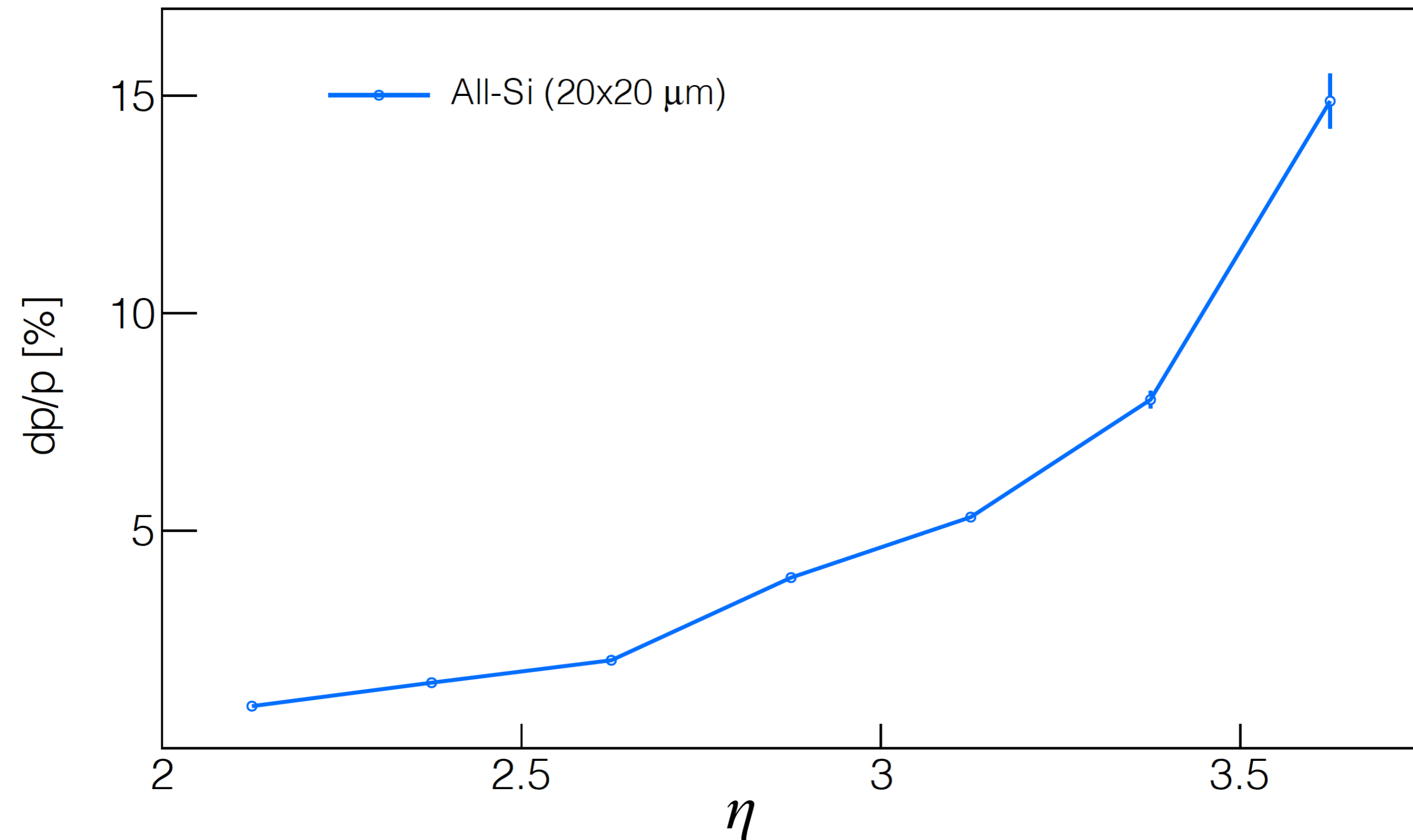


# Effect of adding a GEM in forward region

$\pi^-$   
Beast (B = 3.0 T) field

$$25 < p < 30 \text{ GeV}/c$$

**GEM:**  
 $\sigma(\hat{r}) = 50 \mu\text{m}$   
 $\sigma(\hat{\phi}) = 50 \mu\text{m}$

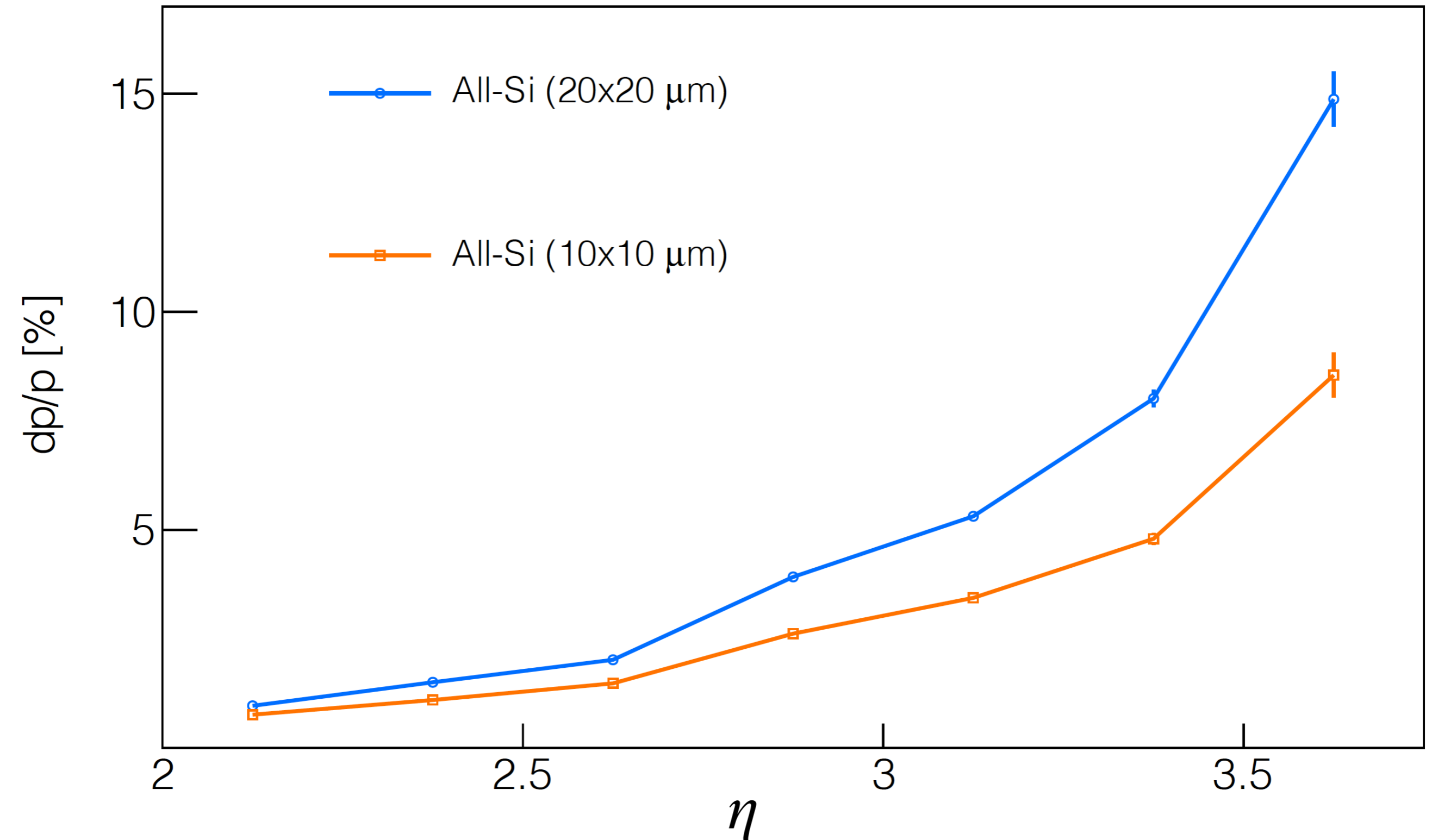


# Effect of adding a GEM in forward region

$\pi^-$   
Beast (B = 3.0 T) field

$$25 < p < 30 \text{ GeV}/c$$

**GEM:**  
 $\sigma(\hat{r}) = 50 \mu\text{m}$   
 $\sigma(\hat{\phi}) = 50 \mu\text{m}$

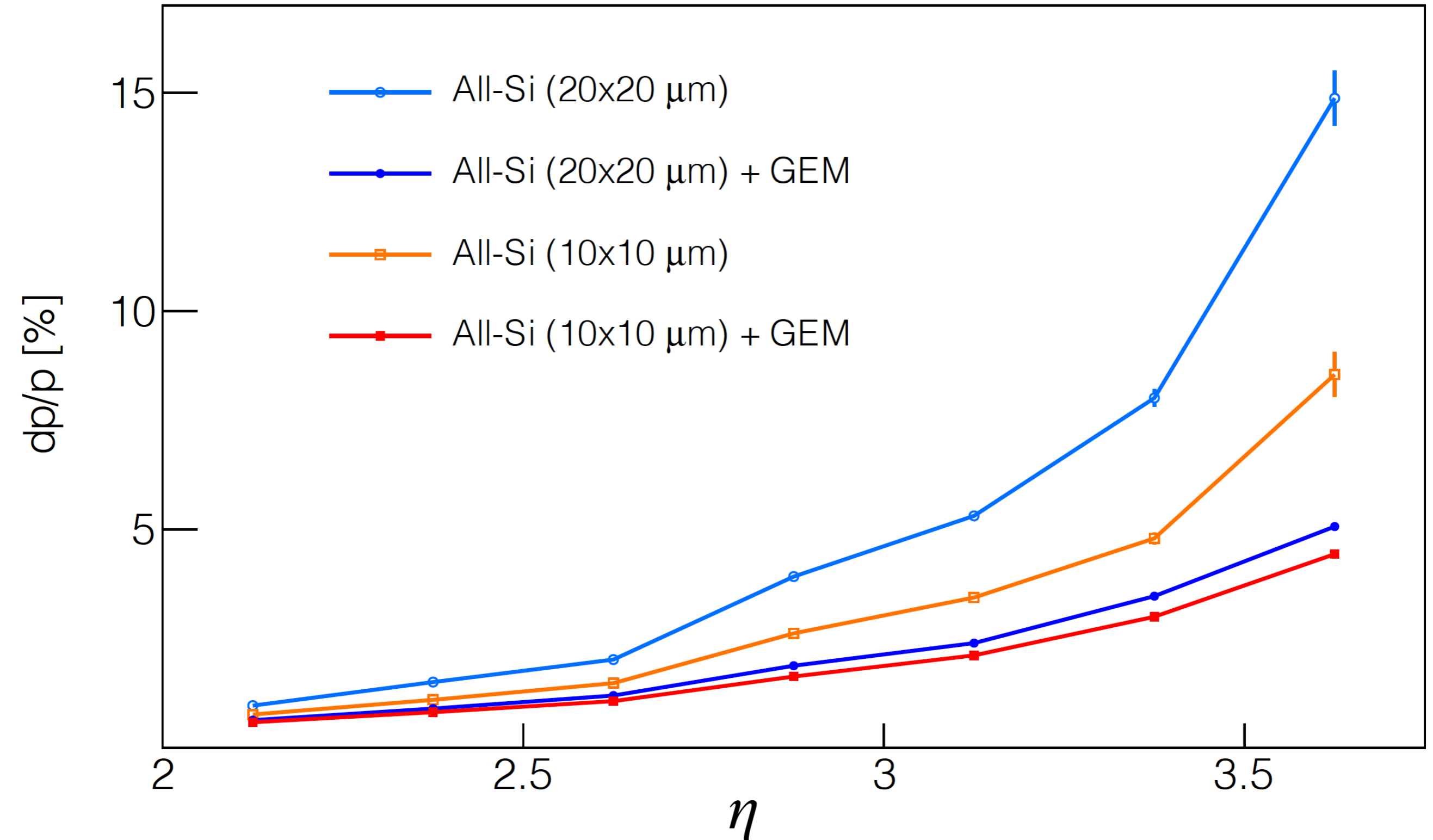


# Effect of adding a GEM in forward region

$\pi^-$   
Beast (B = 3.0 T) field

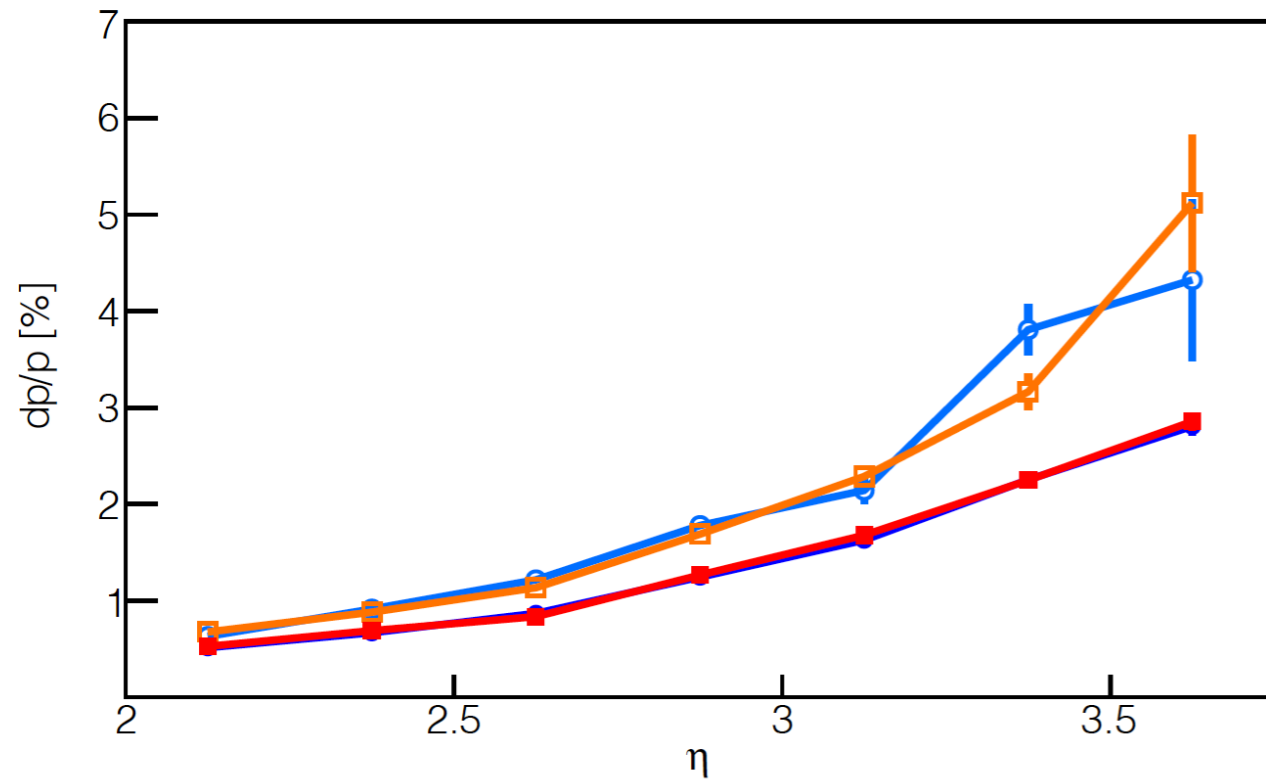
$25 < p < 30 \text{ GeV}/c$

**GEM:**  
 $\sigma(\hat{r}) = 50 \mu\text{m}$   
 $\sigma(\hat{\phi}) = 50 \mu\text{m}$

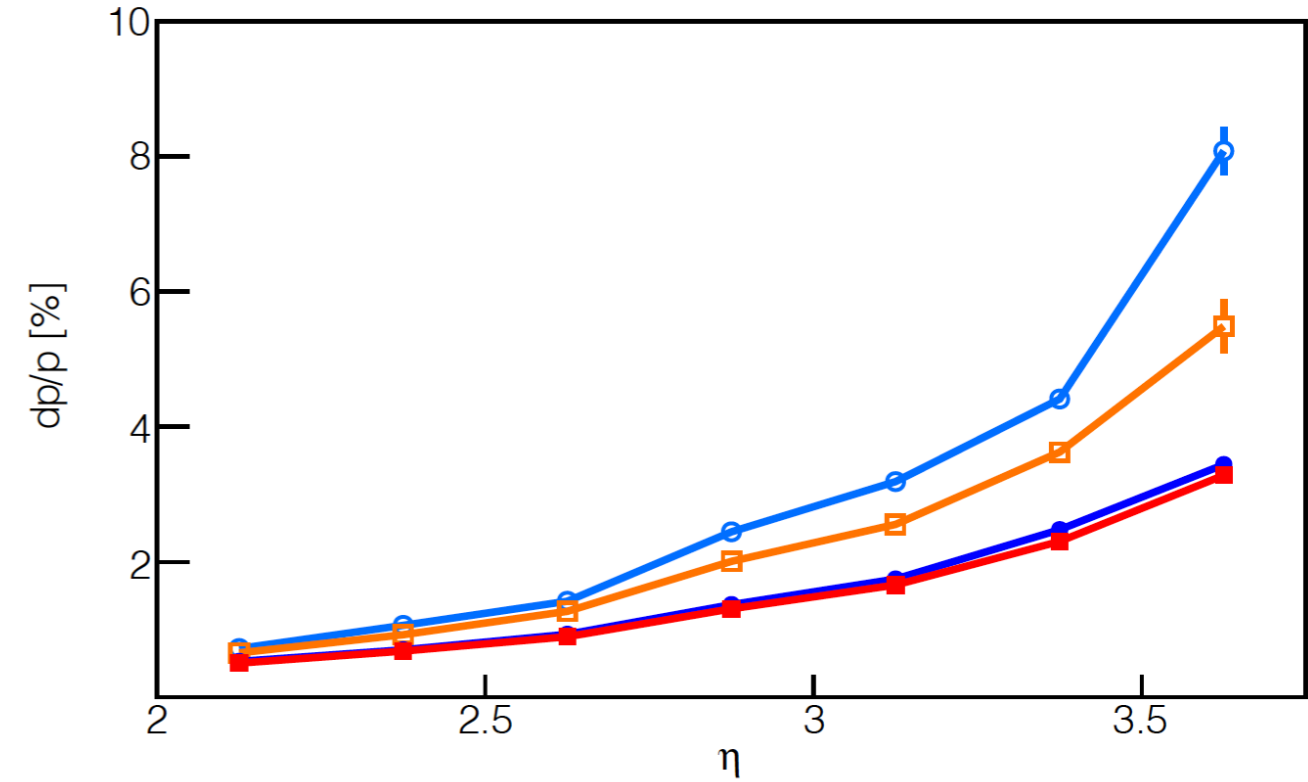


# Effect of adding a GEM in forward region

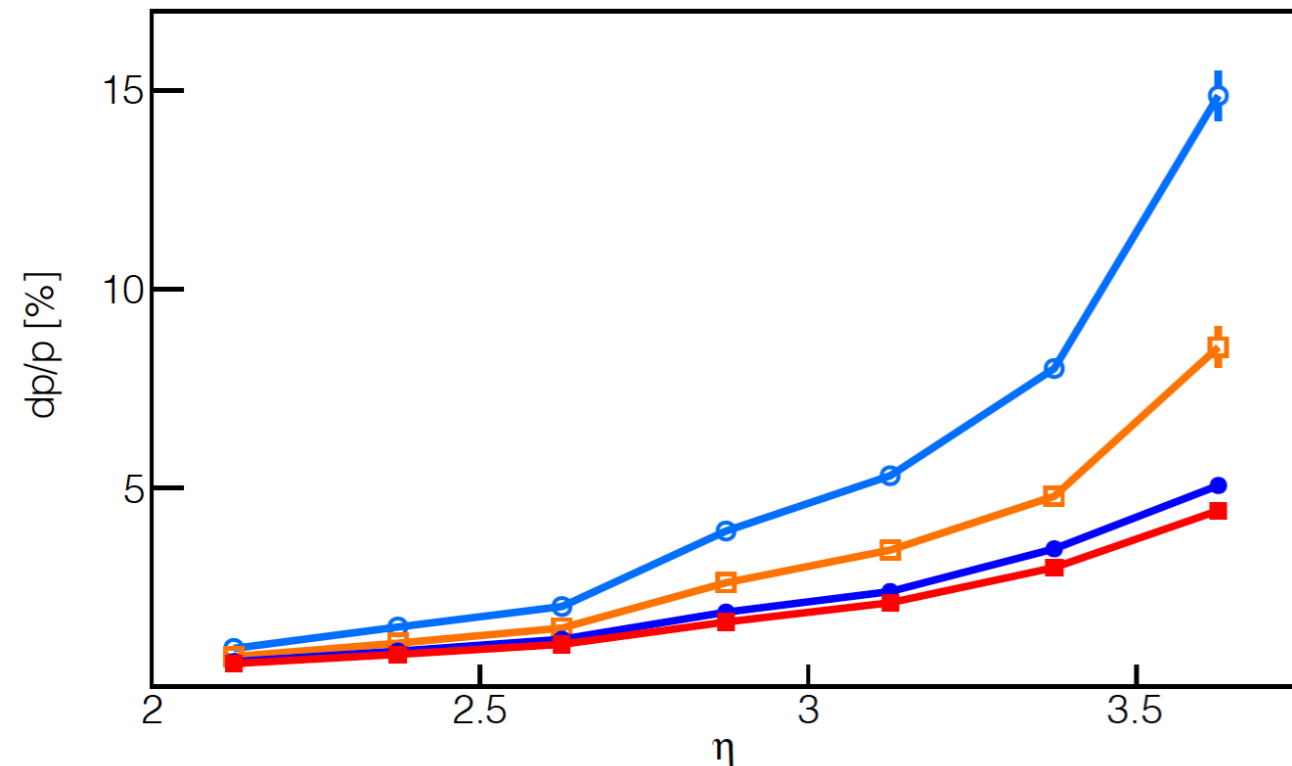
4 < p < 5 GeV/c



10 < p < 15 GeV/c



25 < p < 30 GeV/c



- All-Si (20x20 μm)
- All-Si (20x20 μm) + GEM
- All-Si (10x10 μm)
- All-Si (10x10 μm) + GEM

**GEM:**  
 $\sigma(\hat{r}) = 50 \mu\text{m}$   
 $\sigma(\hat{\phi}) = 50 \mu\text{m}$

$\pi^-$   
 Beast (B = 3.0 T) field

# Conclusions

- Deterioration of momentum resolution at forward/backward rapidities due to acceptance.
- $50 \mu\text{m}$  GEM placed at  $z = 300$  cm has strong impact on momentum resolution at higher momenta and pseudorapidities.

## Next steps:

- Add HM RICH material
- Test effect with worse resolution GEM
- test GEM in electron-going region

