

Discussion on Rate and μ TPC

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Mar 27th, 2026 – ECT Meeting

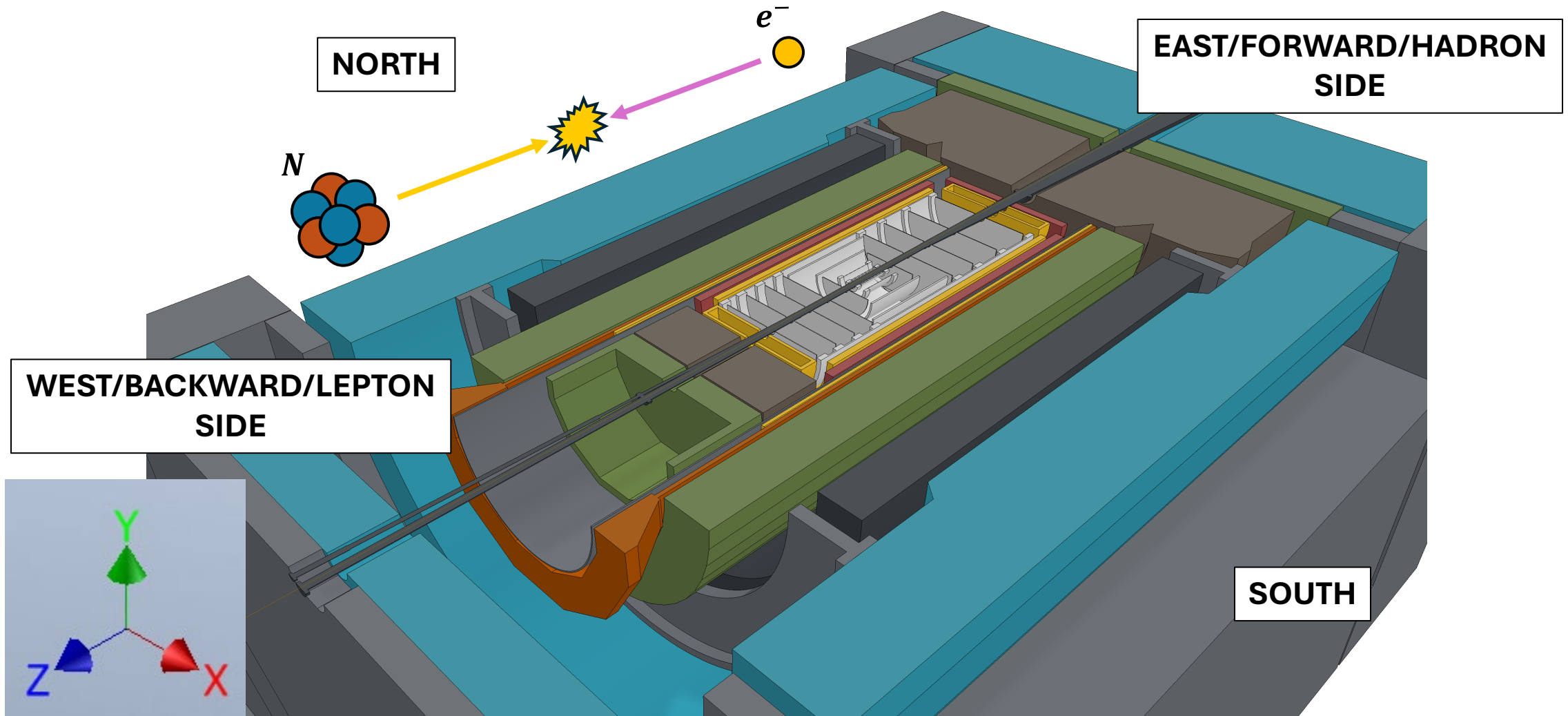
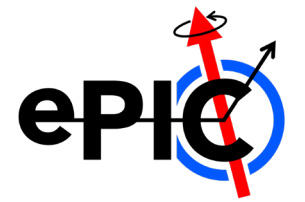


Rate

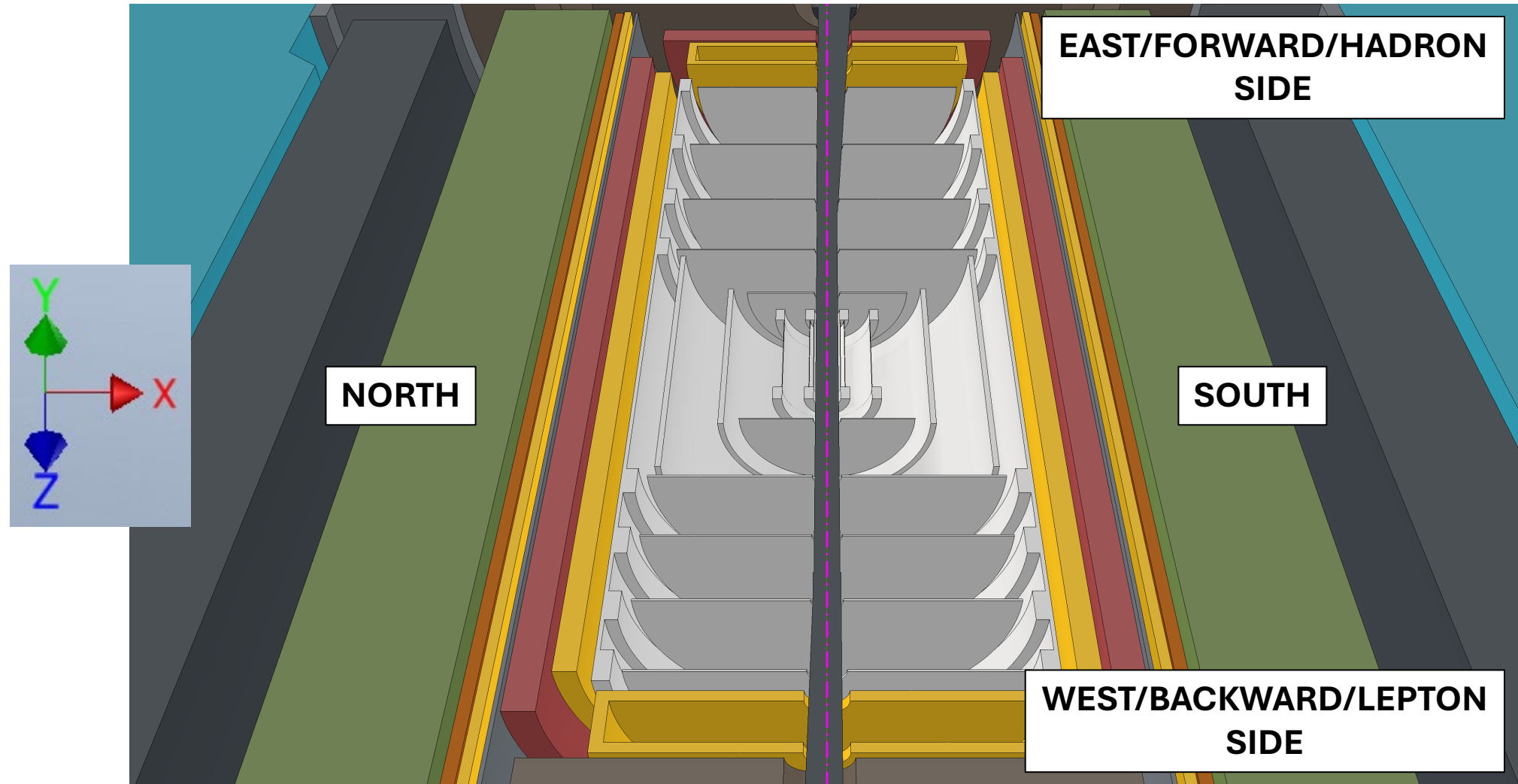
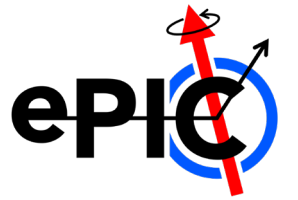
The Issue at Hand: Concerning Rates on ECT Forward



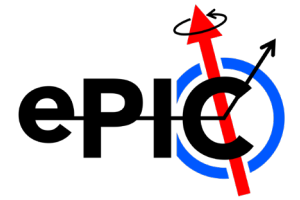
Determining the Coordinate System



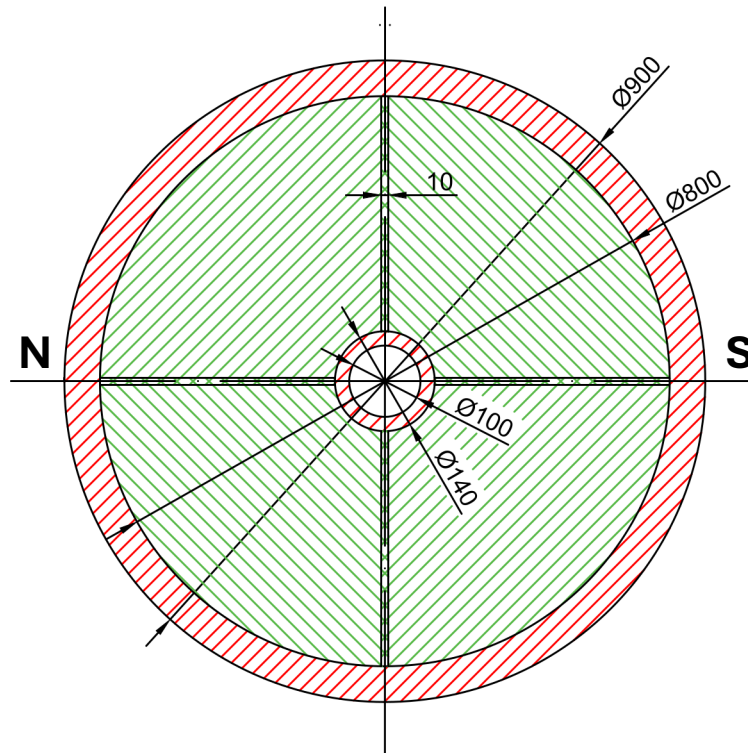
Determining the Coordinate System



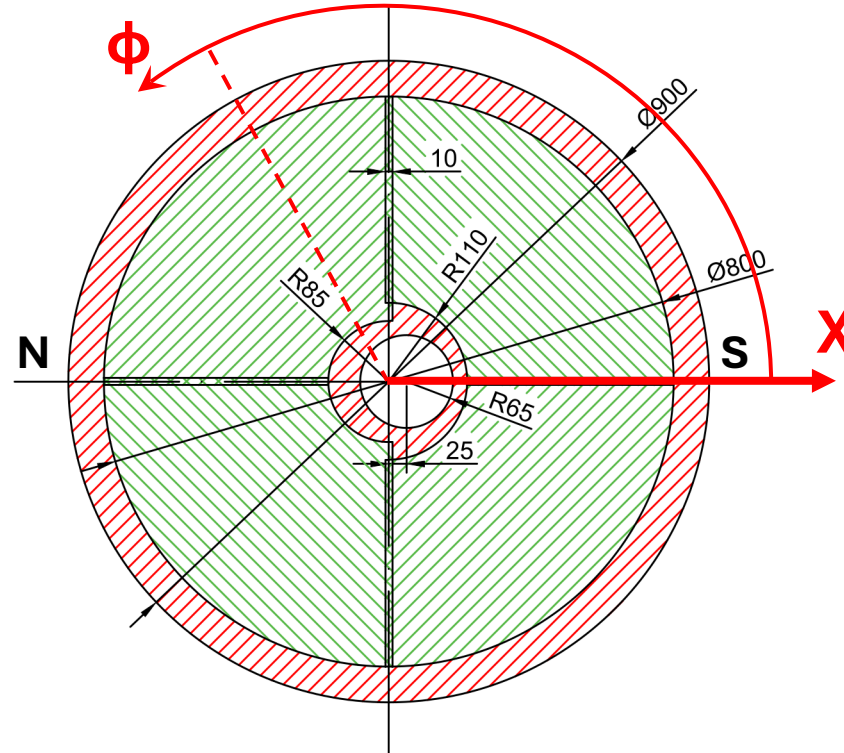
Determining the Coordinate System



WEST/ELECTRON/BACKWARD
SIDE



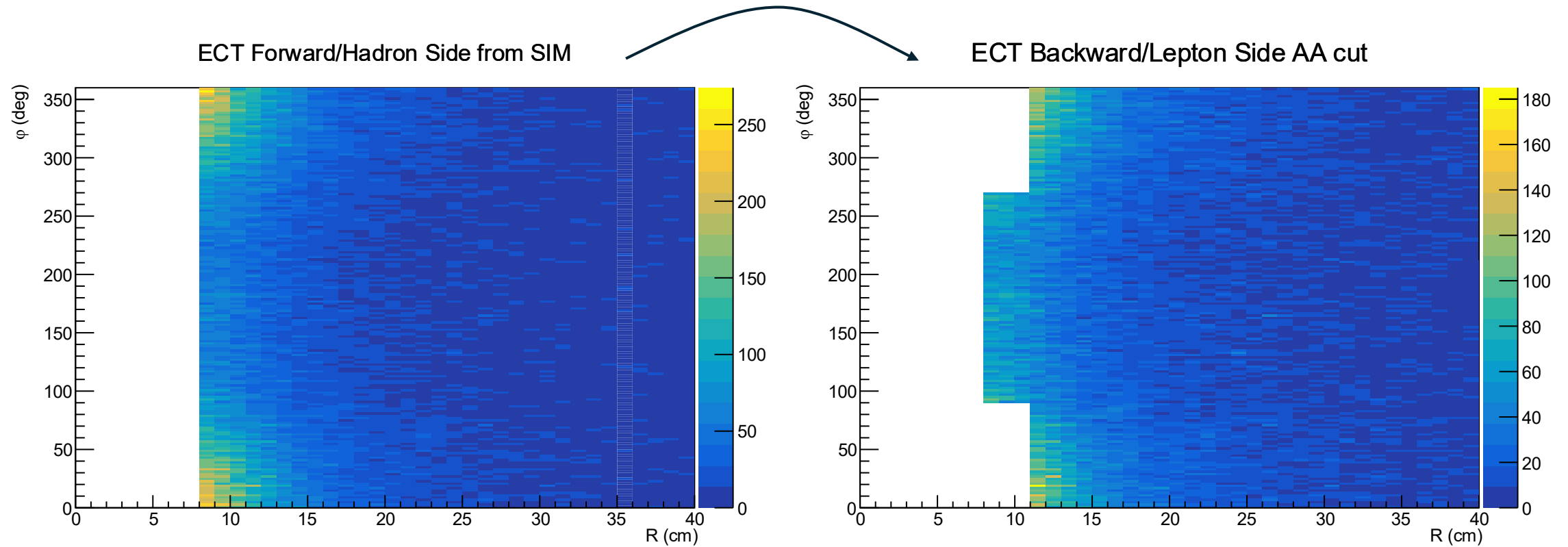
EAST/HADRON/FORWARD
SIDE



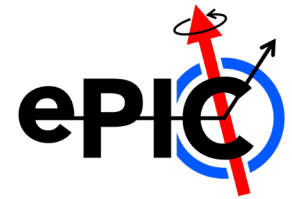
Rate distribution seems symmetric w.r.t. the horizontal plane → **sense of rotation does not matter**

The orientation of +X does

ECT Forward AA cuts



Hottest Channel Calculation

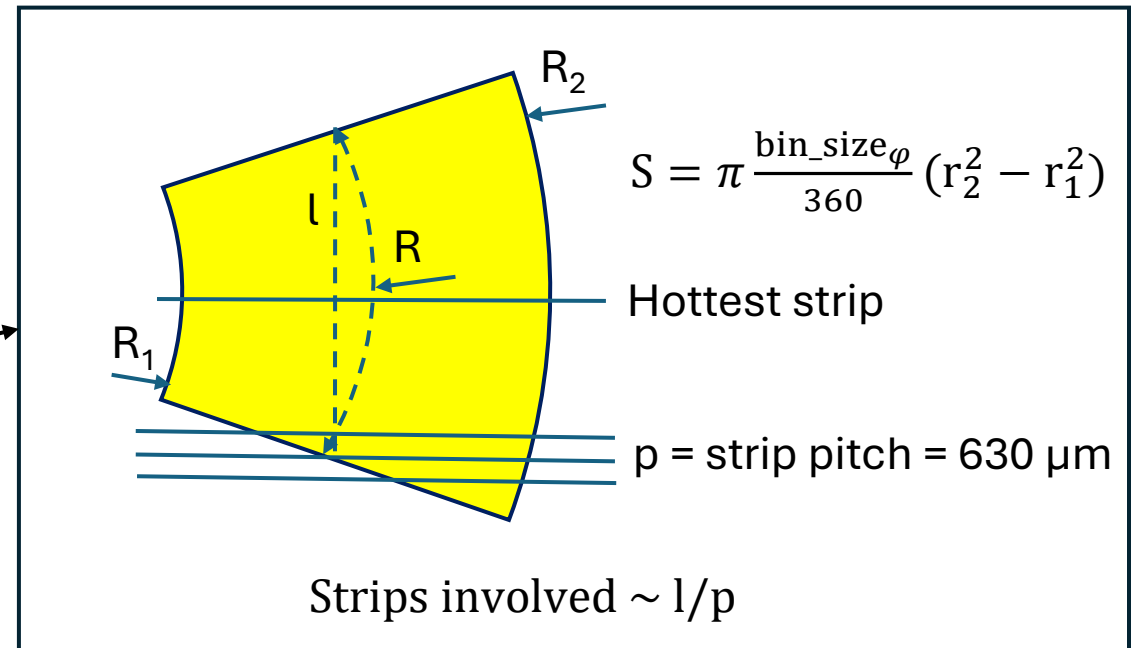
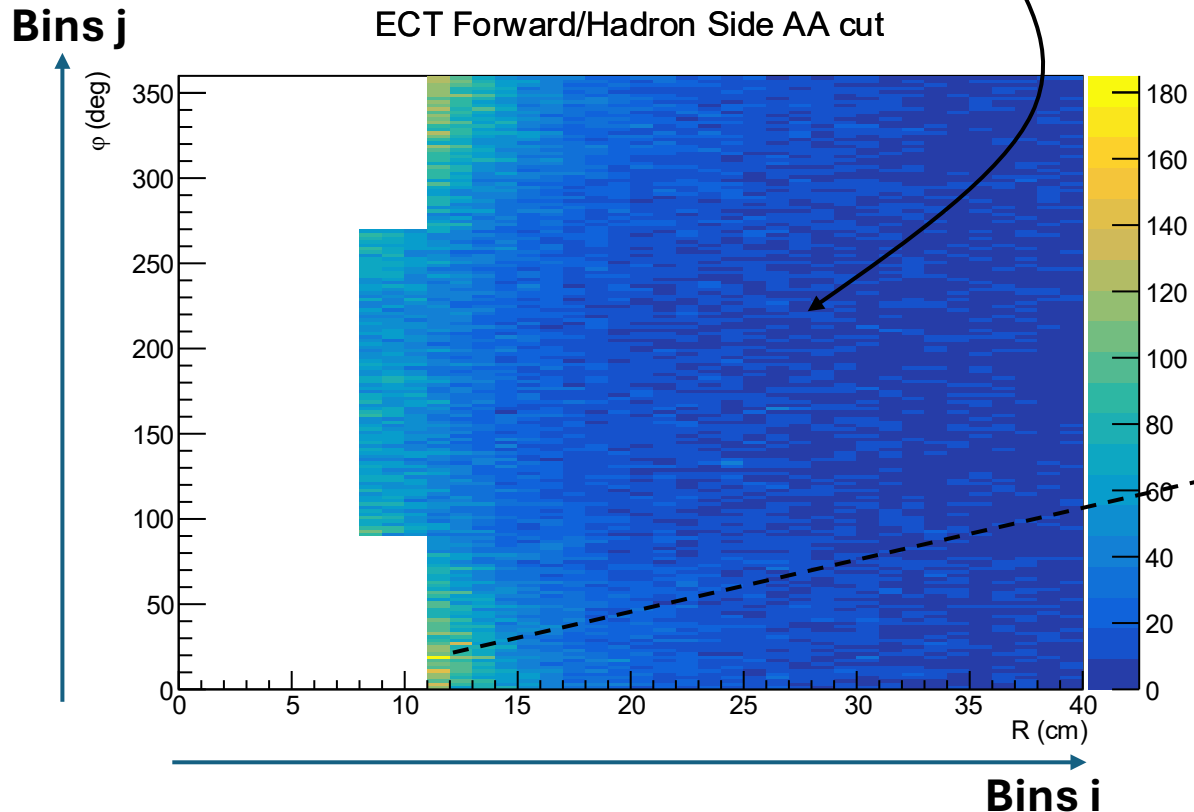


Total events = $N = 6000$
 Event duration = $t = 2 \mu s$

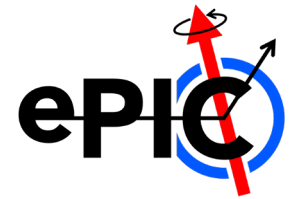
Aggregated data for both disks

$$\text{Hotest Bin Rate} = \frac{1}{2} \frac{\text{BinContent}(\text{Hottest_Bin})}{N S t}$$

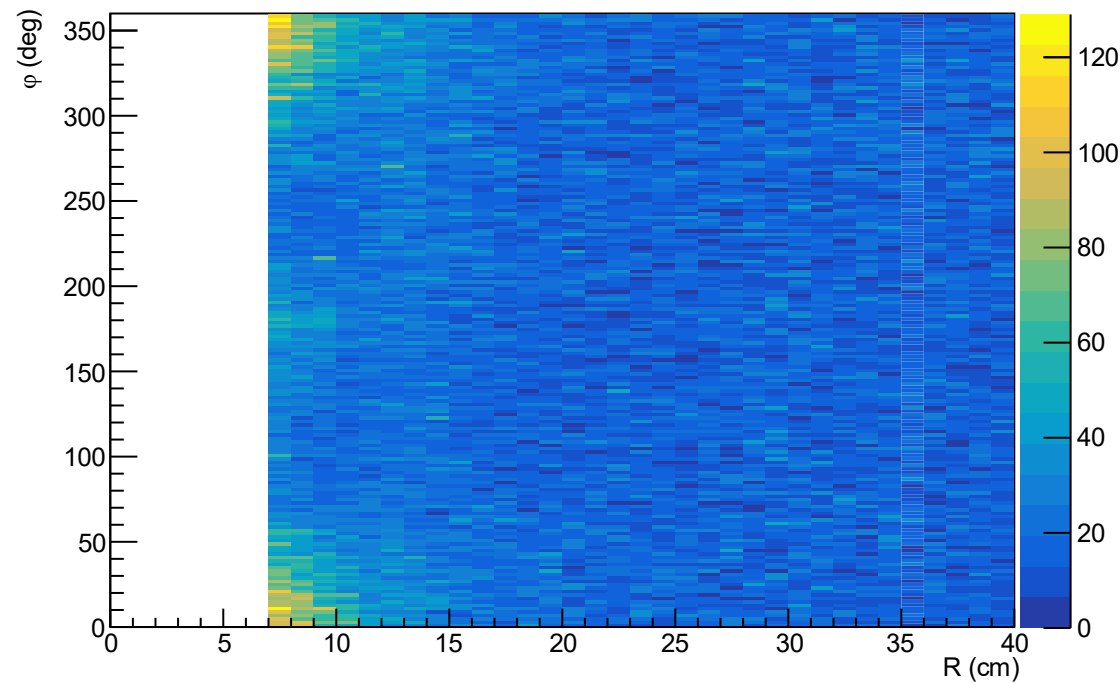
$$\text{Hotest Channel Rate} = \frac{1}{2} \sum_i \frac{\text{BinContent}(i)}{N t} \frac{p}{l}$$



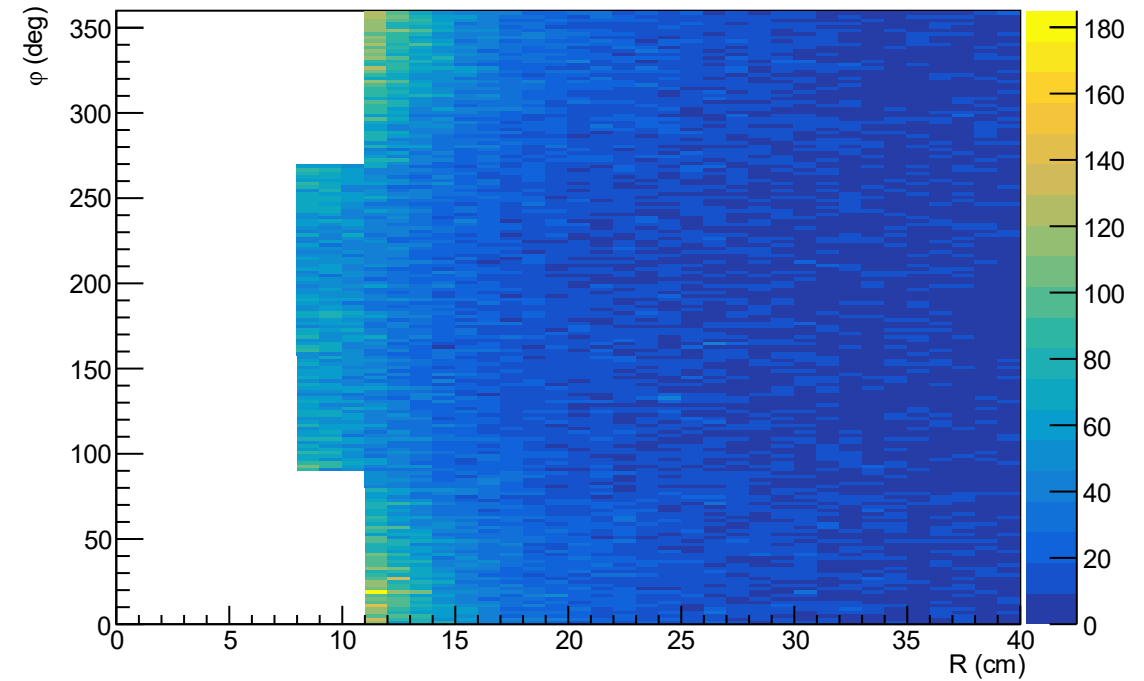
Rate Summary



ECT Backward/Lepton Side from SIM

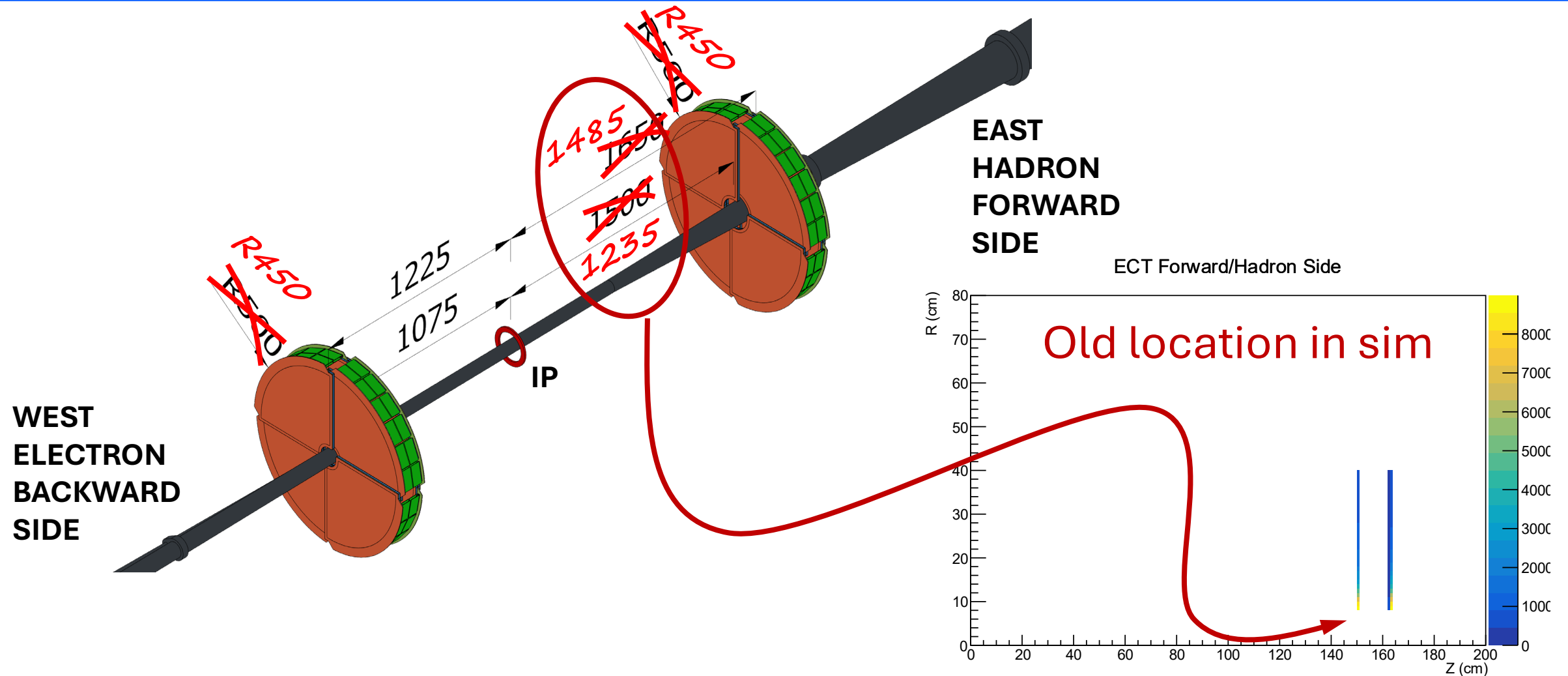
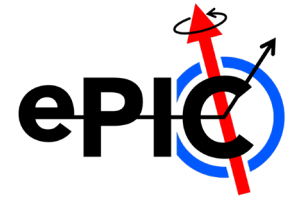


ECT Forward/Hadron Side AA cut

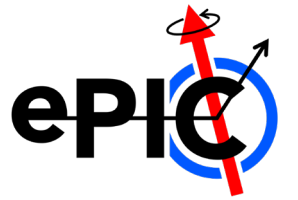


	Backward/Lepton	Forward/Hadron
Hottest Bin Rate	20531 Hz/cm ²	19202 Hz/cm ²
Hottest Channel Rate	5681 Hz	4266 Hz

Problem with the Location of the Hadron Disks



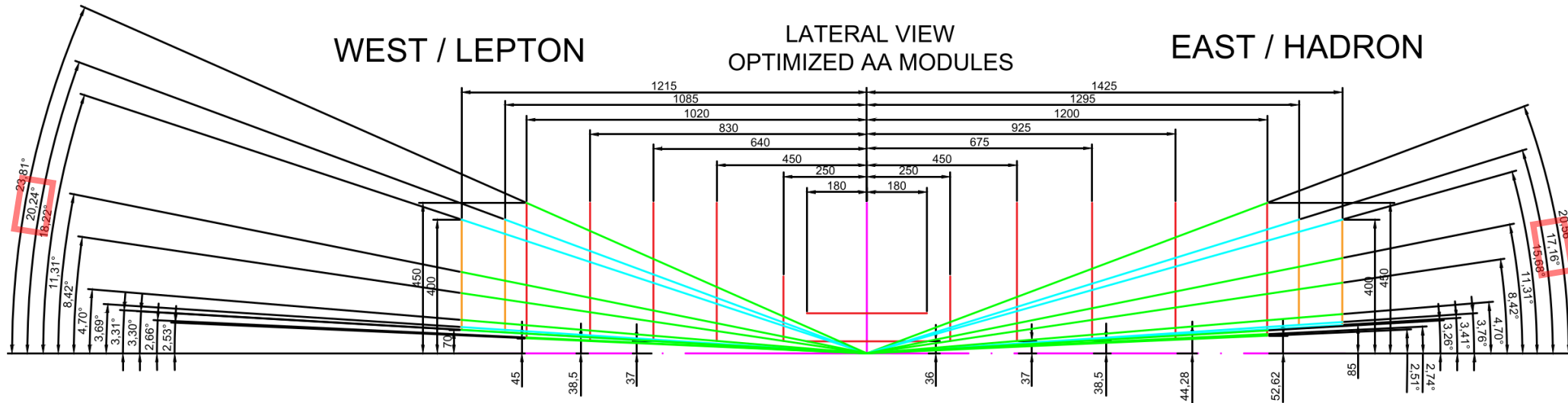
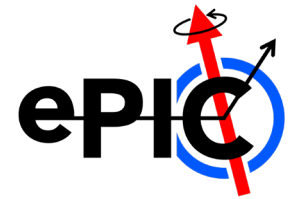
Summary



- The geometry of the ECT in the simulation does not match the latest CAD model
- If the coordinate systems of CAD and simulation match, then the rate distribution's main bump will be cut after the implementation of the latest geometry
- I will work at a new simplified geometrical model to be used in the simulation (AA, overall geometry, materials' table)

μ TPC

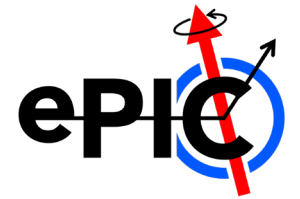
Angles of Incidence for the ECT



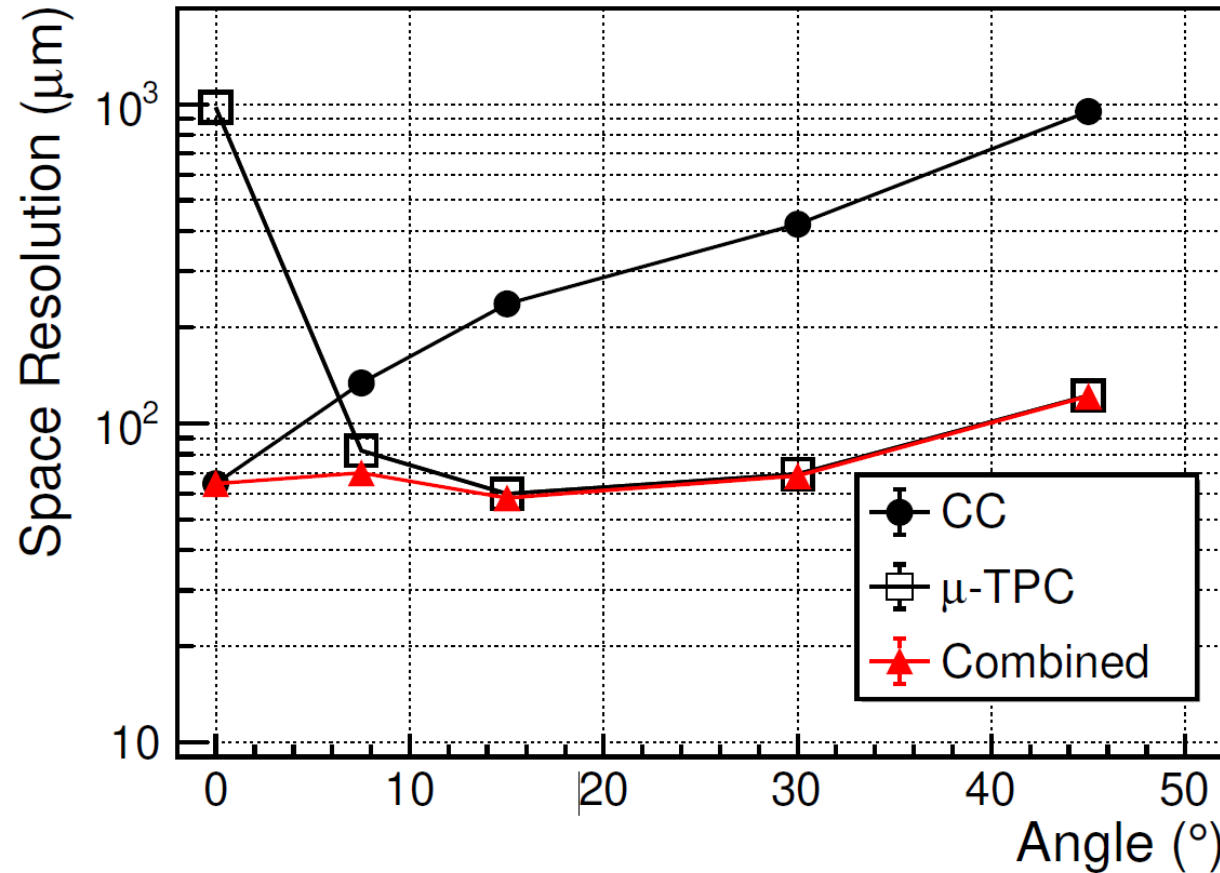
Ignoring **B** contribution:

Maximum Angle of Incidence on the Detectors	
West/Backward/Lepton Side	East/Forward/Hadron Side
20.24°	17.16°

μ TPC with μ -RWELL (Ar:CO₂:CF₄)



G. Bencivenni *et al* 2021 *JINST* **16** P08036



Parameters	
Technology	μ -RWELL
Gas mixture	Ar:CO ₂ :CF ₄ (45:15:40)
Drift gap	6 mm
R/O segmentation	1D, 400 μ m pitch
R/O electronics	APV25-SRS
Particle species	Muons, 150 GeV

$$\frac{1}{\sigma_{comb}^2} = \frac{1}{\sigma_{CC}^2} + \frac{1}{\sigma_{\mu TPC}^2}$$

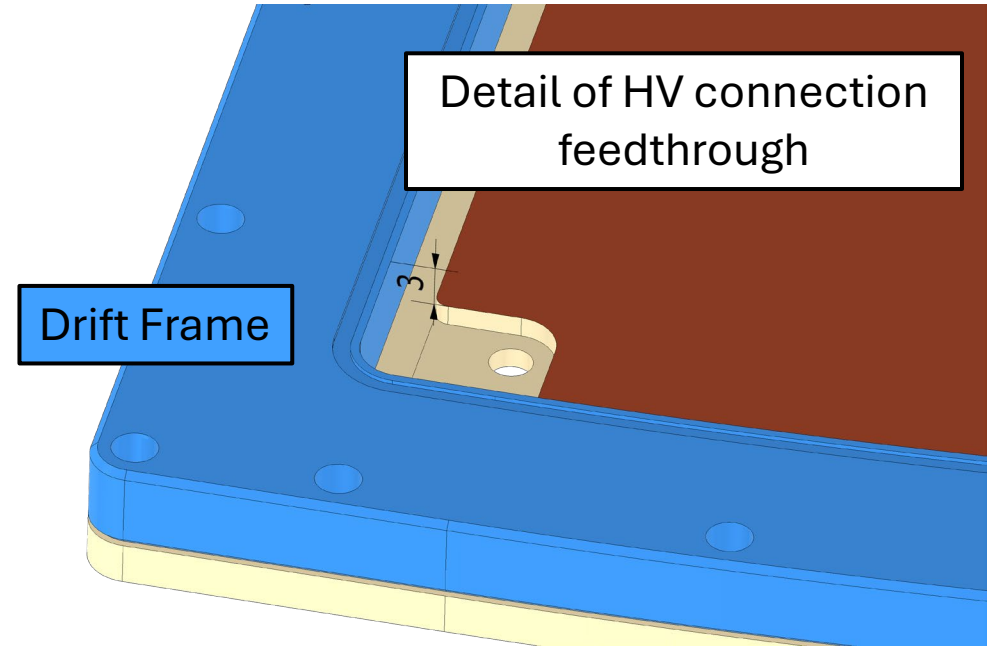
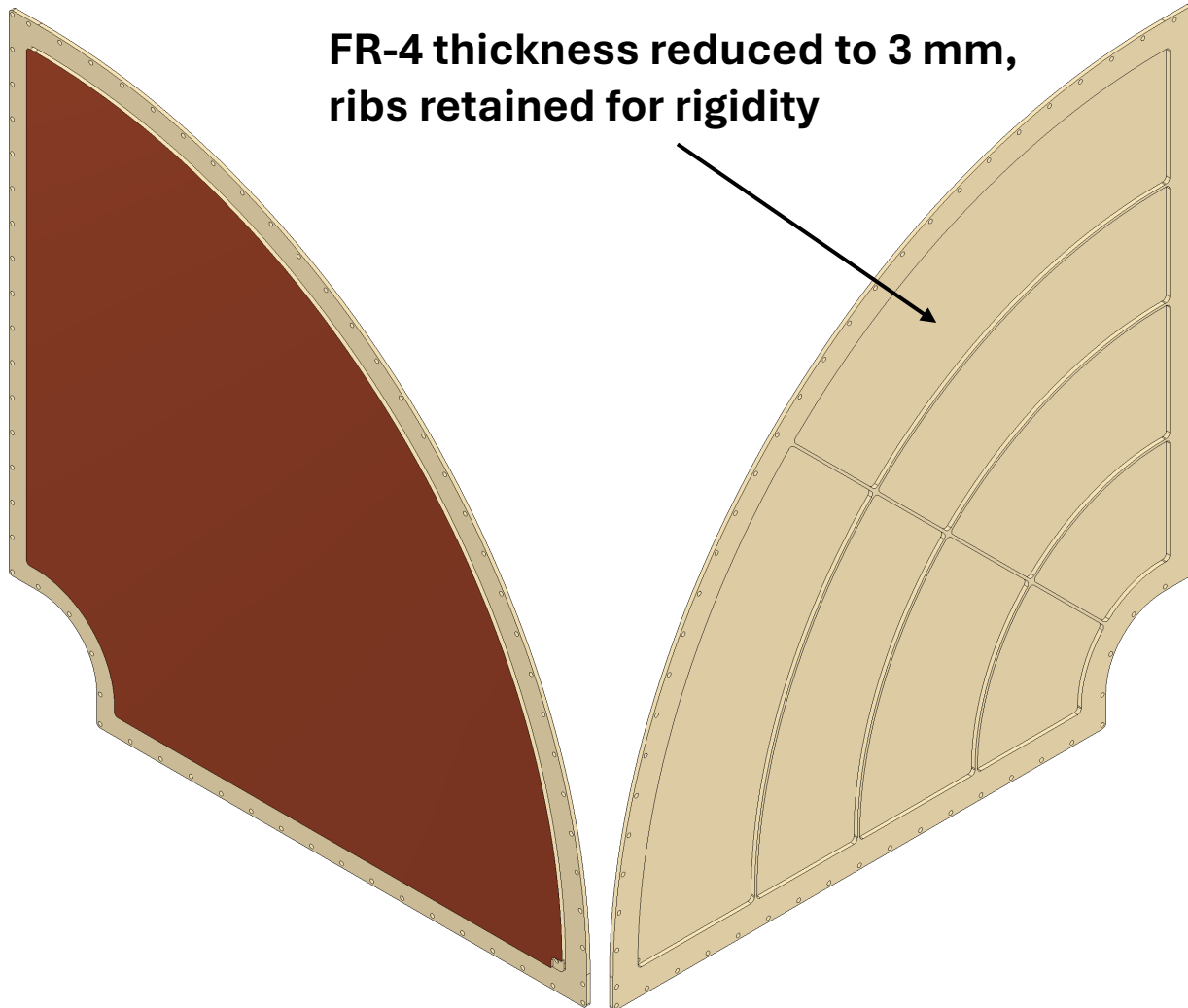
(a) Comparison of the two algorithms at a drift field $E_D=1$ kV/cm.

Summary



- The **maximum angles of incidence** on the ECT are **about 20°** and 17° for the lepton and hadron side, respectively
- In μ -RWELL detectors with 1-D 400 μm pitch strip readout and 6 mm drift gap operating in $\text{Ar}:\text{CO}_2:\text{CF}_4$ (45:15:40) μTPC significantly improves the resolution at angles of incidence between 10° and 20°
- In triple-GEM detectors with 2-D 630 μm pitch strip readout and 5 mm drift gap operating in $\text{Ar}:\text{iC}_4\text{H}_{10}$ (91.5:8.5) the improvement between 10° and 20° seems much lower
- **Hard to tell solely from literature if μTPC could be effective in our final configuration**, dedicated simulations could shed some light on the matter
- Alternatively, **it could be worth studying both 3 and 6 mm configurations**

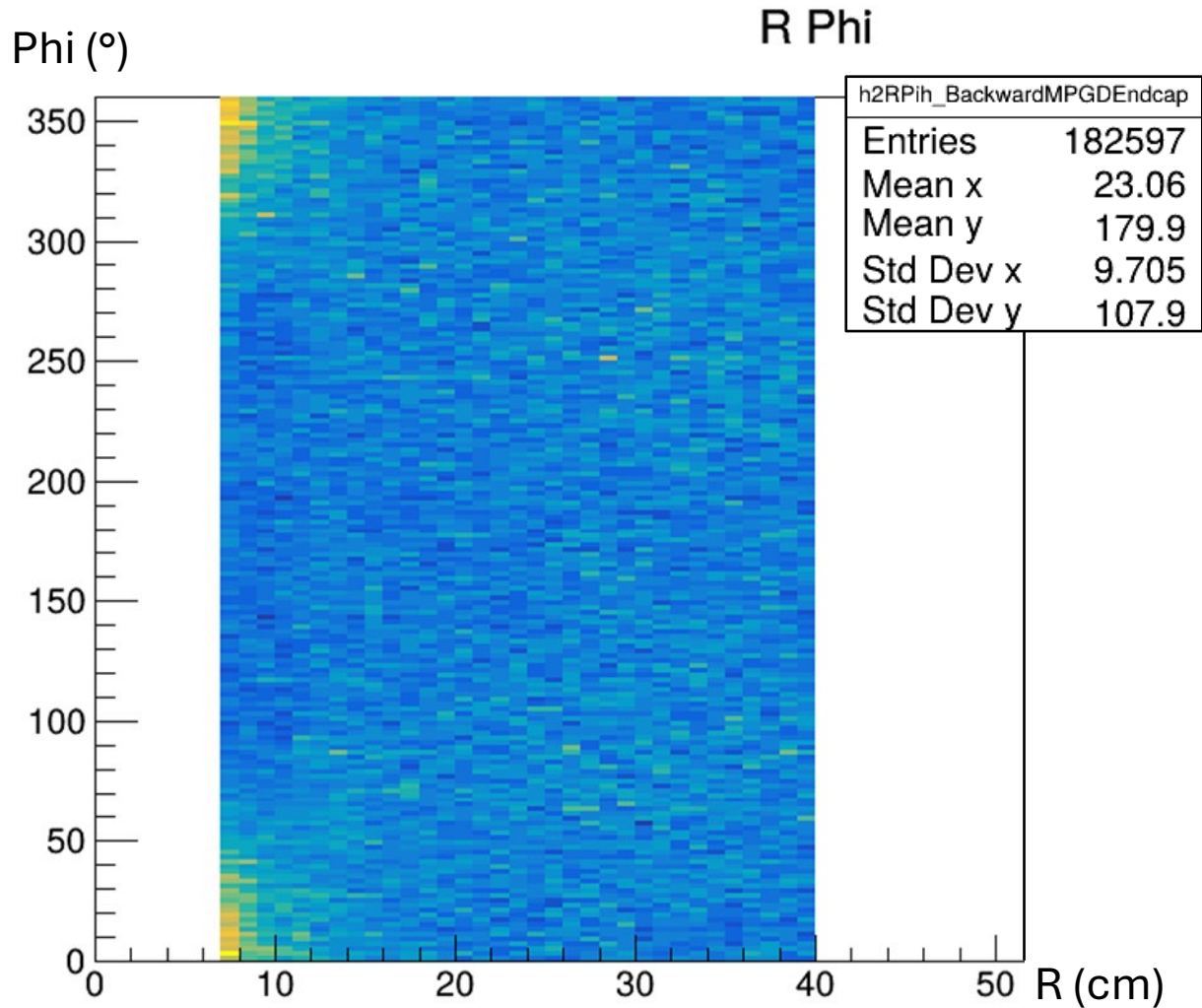
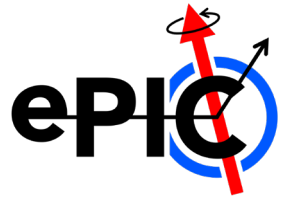
Special Cathode for 3 mm Drift Gap Study



Enables 3 mm drift gap testing by replacing a single component of the current quadrant prototypes

Backup

ECT Backward



5 μm

	10x275		10x100	
	Hz/cm2	Hz/channel	Hz/cm2	Hz/channel
ECT Backward Near	6.77E+03	1.67E+04	6.14E+03	1.51E+04
ECT Backward Far	6.78E+03	1.67E+04	6.06E+03	1.49E+04
ECT Forward Near	1.26E+04	3.11E+04	1.27E+04	3.12E+04
ECT Forward Far	1.34E+04	3.30E+04	1.35E+04	3.33E+04

10 μm

	10x275		10x100	
	Hz/cm2	Hz/channel	Hz/cm2	Hz/channel
ECT Backward Near	6.63E+03	1.63E+04	5.99E+03	1.47E+04
ECT Backward Far	6.48E+03	1.59E+04	5.73E+03	1.41E+04
ECT Forward Near	1.25E+04	3.08E+04	1.24E+04	3.06E+04
ECT Forward Far	1.38E+04	3.39E+04	1.33E+04	3.27E+04

No change for the backward side
The geometry matches the model