

# EIC Tracking Simulation Studies

Nick Lukow

October 7, 2019

PID Meeting

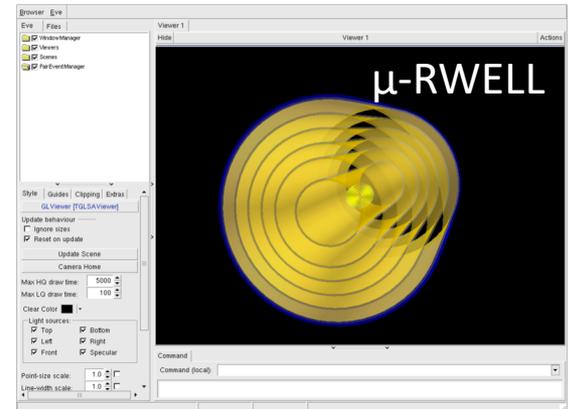
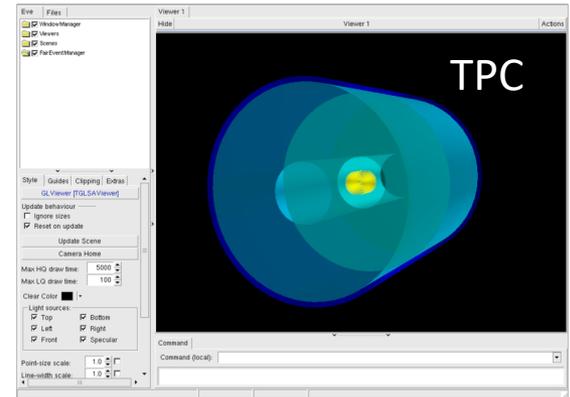
# Tracking Study

Determining the resolution of tracking by comparing the track parameterizations near where the DIRC would be (approximated to be at the edge of the tracker  $\sim 81\text{cm}$ ), to the true Monte Carlo track parameters at the same location.

Using simulation of TPC to determine its performance, and treating it as a baseline.

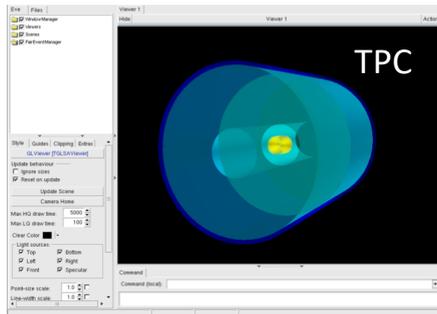
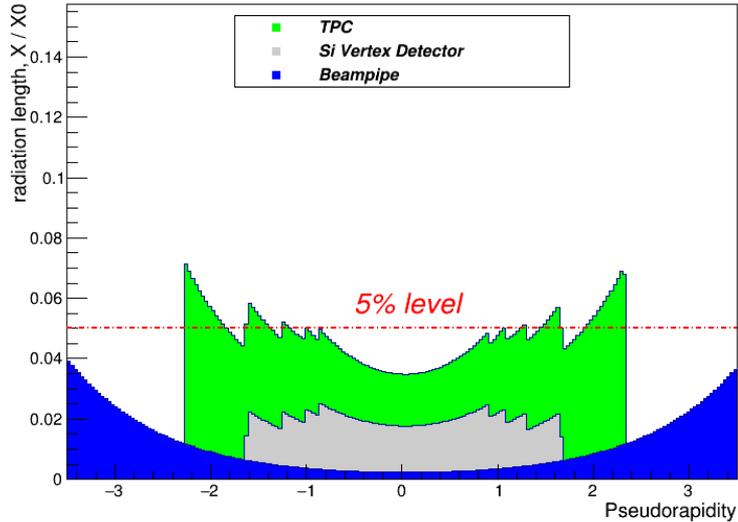
Using a  $\mu\text{RWELL}$  tracker with various azimuthal/longitudinal resolution settings (applied when hits are smeared), and determining what resolution is necessary for the  $\mu\text{RWELL}$  layers in order to perform comparably to the TPC (or to meet specifications)

Currently studying electrons at 1 and 6 GeV thrown at various values of theta (between 0 and 1 in pseudo-rapidity)



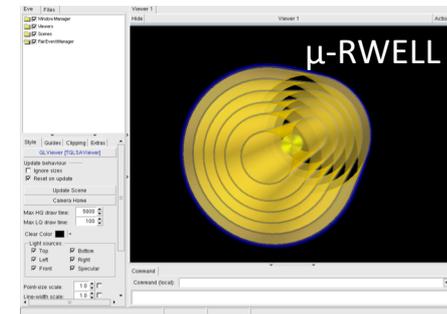
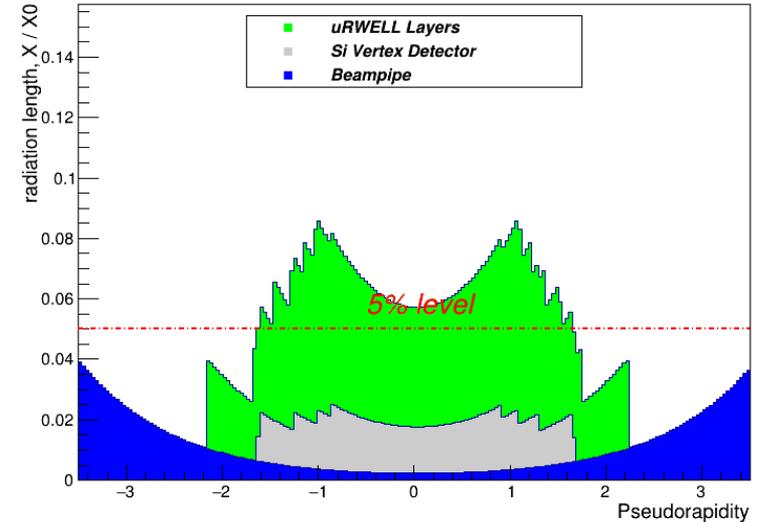
# Radiation Length Plots

EIC Detector Geometry: Radiation Length Scan



(Outer field cage and endcaps removed)

EIC Detector Geometry: Radiation Length Scan



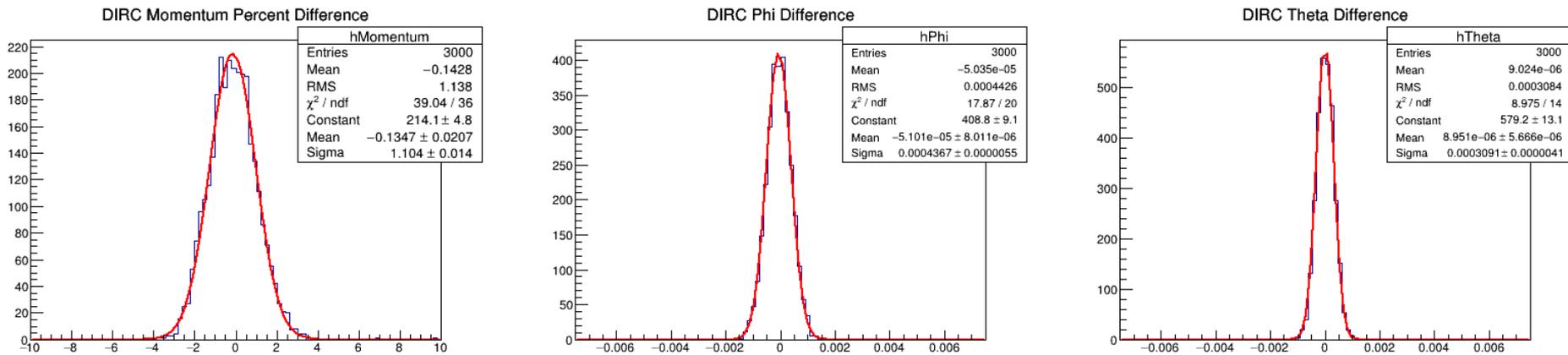
$X/X_0$  based on this:

<https://wiki.bnl.gov/eic/upload/URWELL-Geometry.pdf>

And modified for 200um thick PCB

# Tracking Study - Quantities

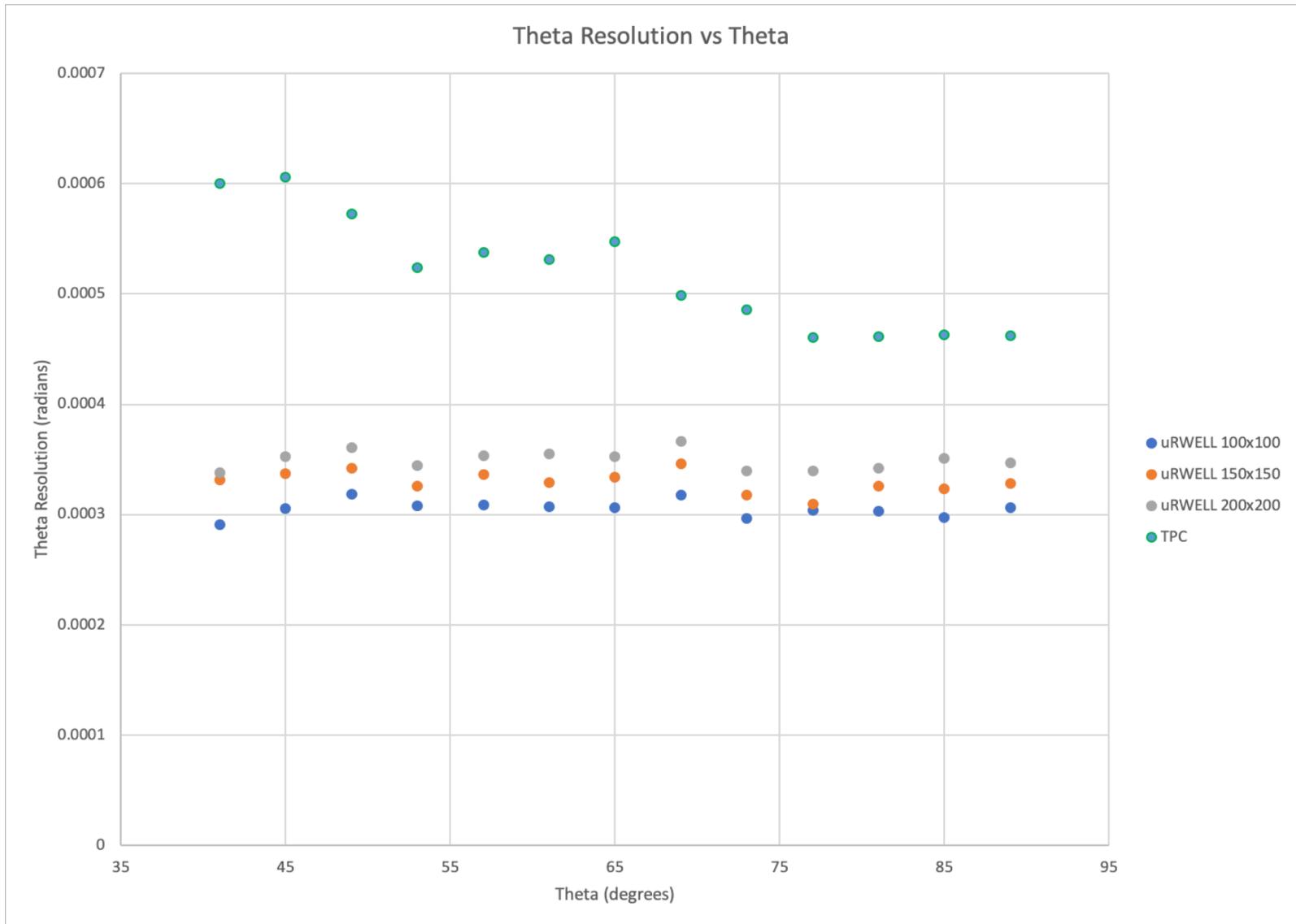
Differences between track parameterization at DIRC radius and true Monte Carlo values



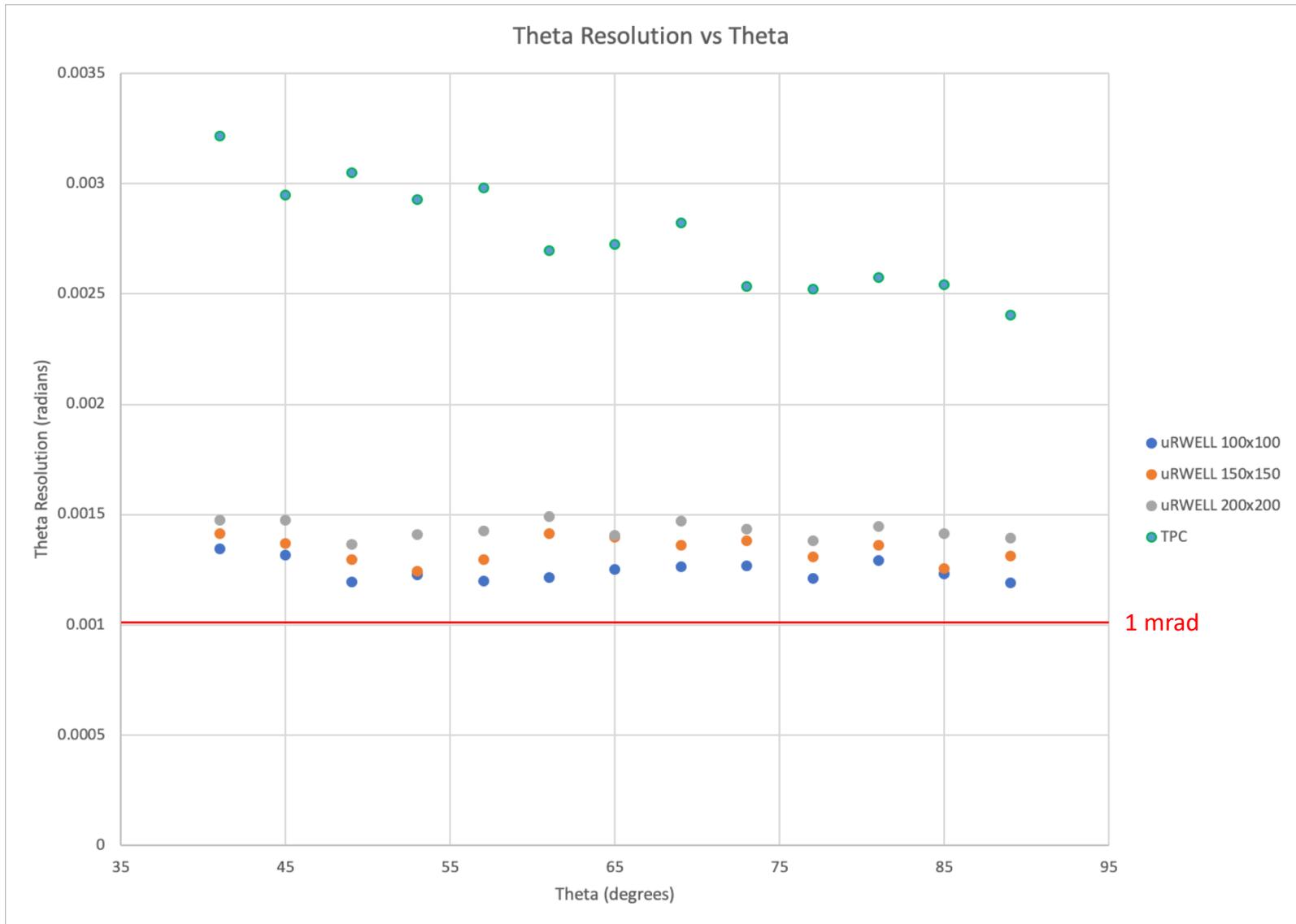
*6 GeV electrons at 65 degrees in uRWELL detector with 100um single point resolution*

Currently looking at the Phi, Theta, and Momentum resolutions at the DIRC radius (and IP)

# Theta Resolution – 6 GeV electrons



# Theta Resolution – 1 GeV electrons



# To Do

- Currently getting more accurate TPC information to use in these simulations
  - Perhaps the TPC will perform better than shown here
- Re-run simulations using pions as well
- Also start looking at  $p_t$  in addition to momentum, theta, and phi resolution.

# Backup Slides

# Details

## GEANT Options

### Processes

○ Pair production, PAIR:	0
○ Compton scattering, COMP:	0
○ Photoelectric effect, PHOT:	0
○ Photofission, PFIS:	0
○ Delta rays, DRAY:	0
○ Annihilation, ANNI:	0
○ Bremsstrahlung, BREM:	0
○ Hadronic processes, HADR:	0
○ Muon nuclear interaction, MUNU:	0
○ Decay, DCAY:	0
○ Energy loss, LOSS:	2
○ Multiple scattering, MULS:	3

### Cuts

○ Gammas, CUTGAM:	1.0E-3	} (GeV)
○ Electrons, CUTELE:	1.0E-3	
○ Neutral hadrons, CUTNEU:	1.0E-3	
○ Charged hadrons, CUTHAD:	1.0E-3	
○ Muons, CUTMUO:	1.0E-3	
○ Electron bremsstrahlung, BCUTE:	1.0E-3	
○ Muon and hadron brems., BCUTM:	1.0E-3	
○ Delta-rays by electrons, DCUTE:	1.0E-3	
○ Delta-rays by muons, DCUTM:	1.0E-3	
○ Direct pair production by muons, PPCUTM:	1.0E-3	
○ Time of flight, TOFMAX:	1.0E10	

## TPC Digitization Details:

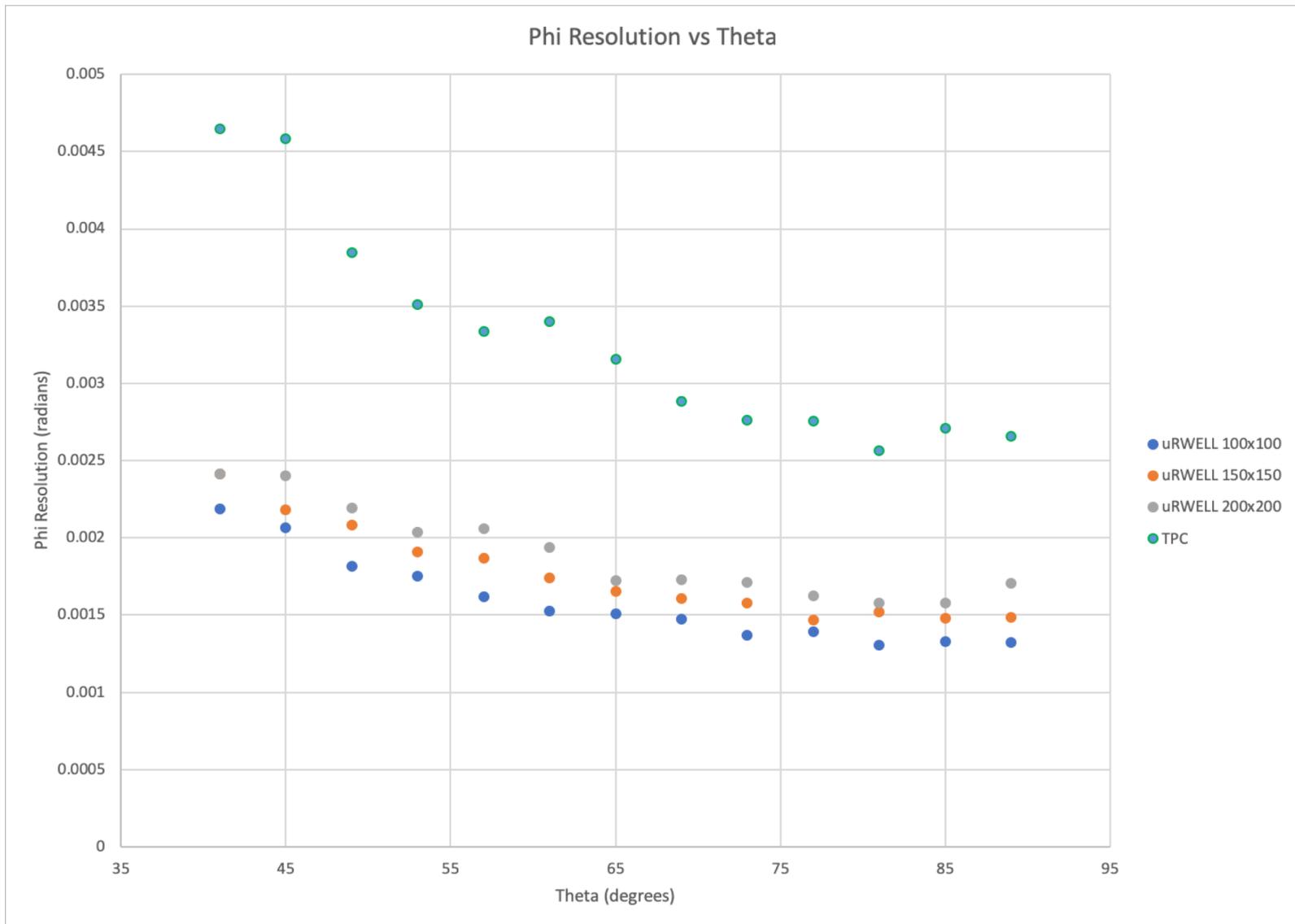
55 hits

Transverse Intrinsic Resolution: 200 [um]  
Transverse Dispersion: 15 [um/sqrt(D[cm])]

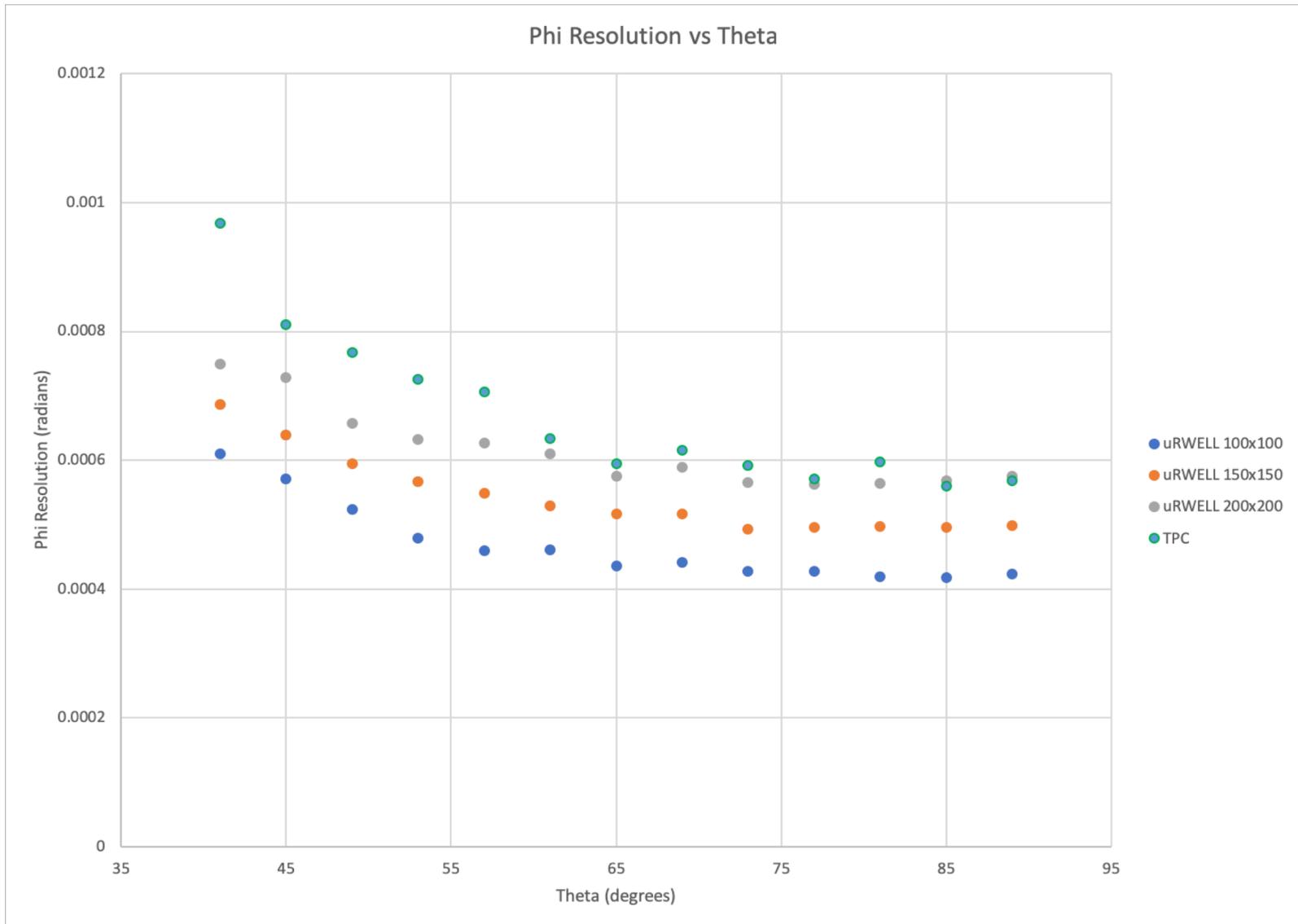
Longitudinal Intrinsic Resolution: 100 [um]  
Longitudinal Dispersion: 1 [um/sqrt(D[cm])]

Radial Intrinsic Resolution: 0 [um]

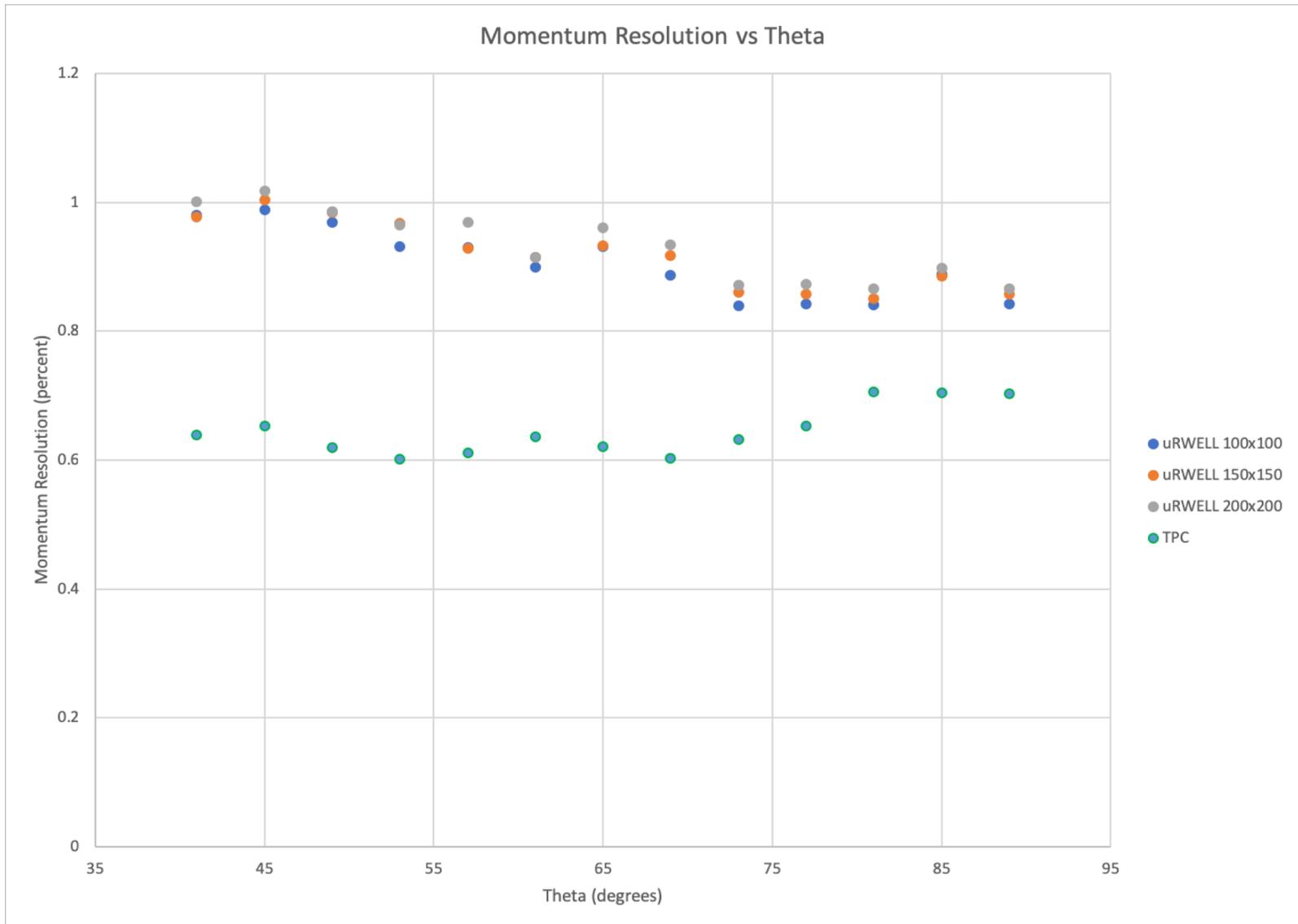
# Phi Resolution – 1 GeV electrons



# Phi Resolution – 6 GeV electrons



# Momentum Resolution – 1 GeV electrons



# Momentum Resolution – 6 GeV electrons

