Nuclear Physics Group Meeting 6/21

Week 4 Recap

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What has been done … (This Week)

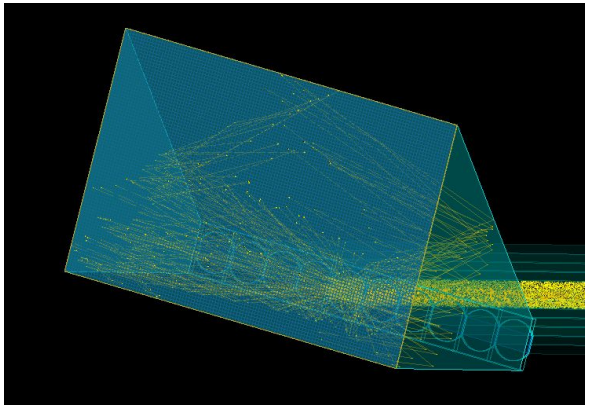
- Watched recording of ePIC General Meeting on 6/14

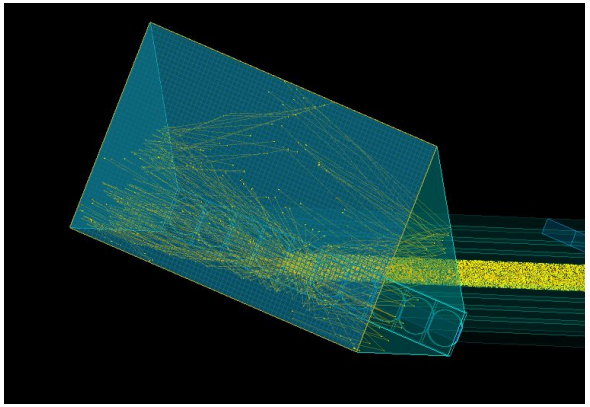
- Ran simulations for the single MCP covering entire detector plane configuration (-c 3) at varying polar angles and pixel size

- Ran baseline simulations for a qualitative time-cut comparison study and a time-resolution comparison study

-c 3 Event Display with Varying Pixel Sizes (Polar Angle = 30°)

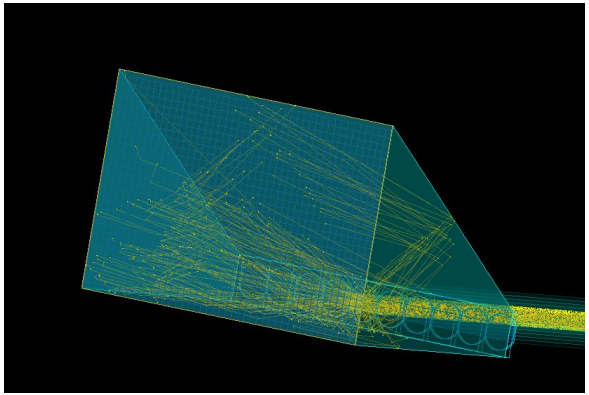
pixel size = 3 mm

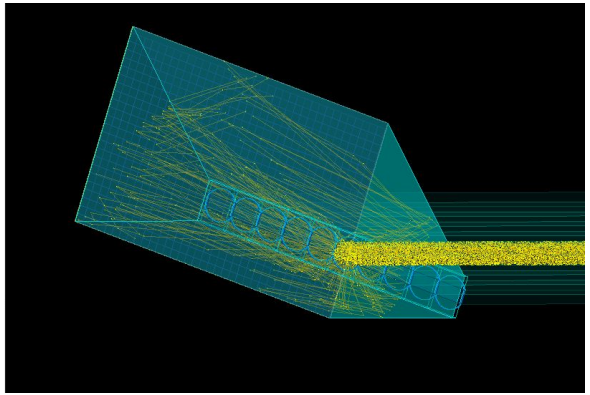




pixel size = 5 mm

pixel size = 8 mm

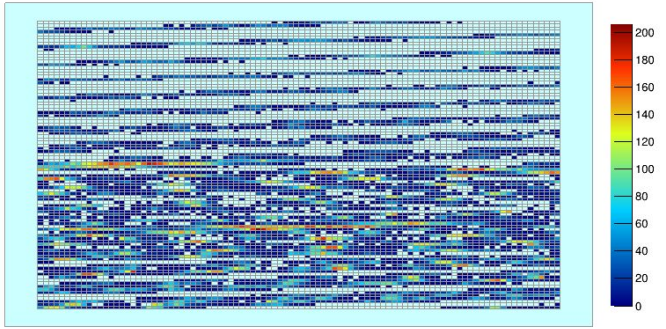


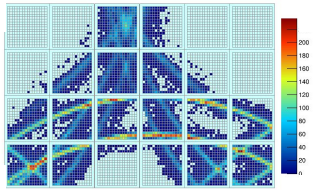


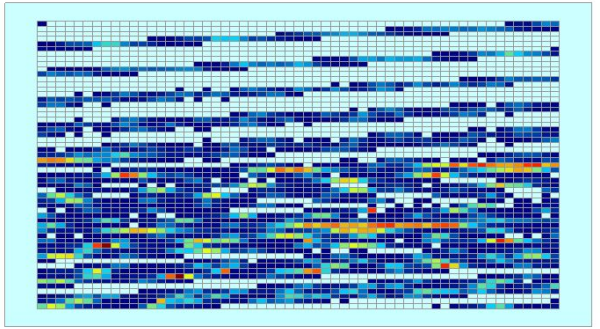
pixel size = 10 mm

-c 3 Hit Pattern with Varying Pixel Sizes (Polar Angle = 30°)

pixel size = 3 mm

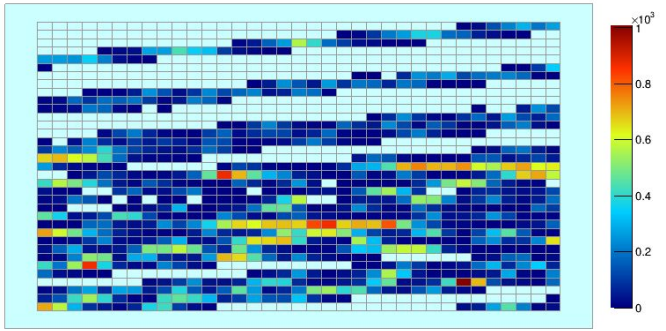


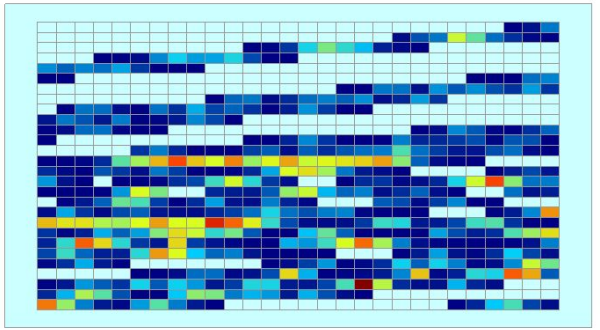




pixel size = 5 mm

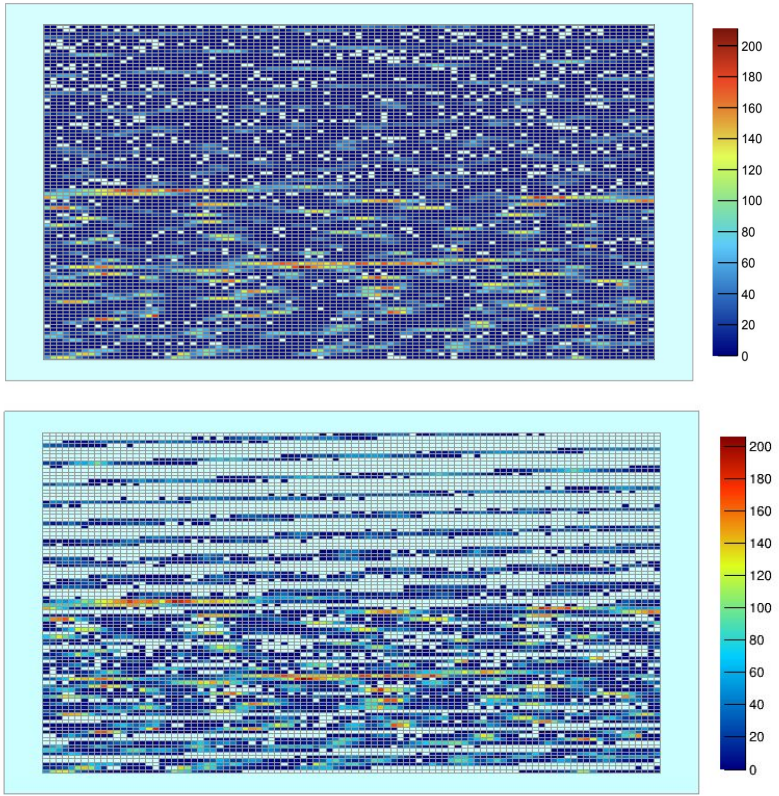
pixel size = 8 mm





pixel size = 10 mm

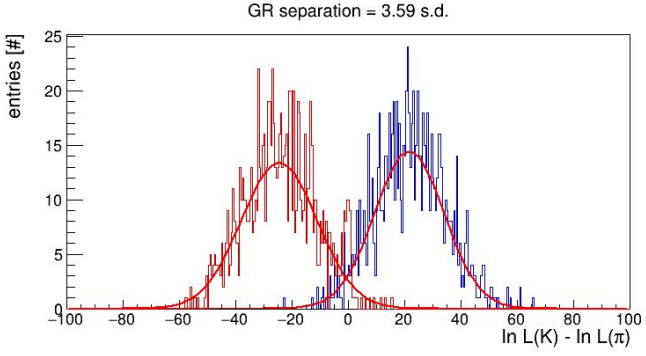
-c 3 Hit Pattern Before and After Reconstruction (30°)

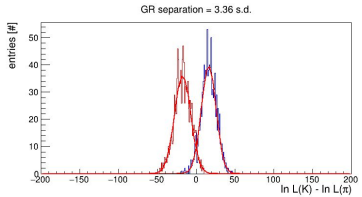


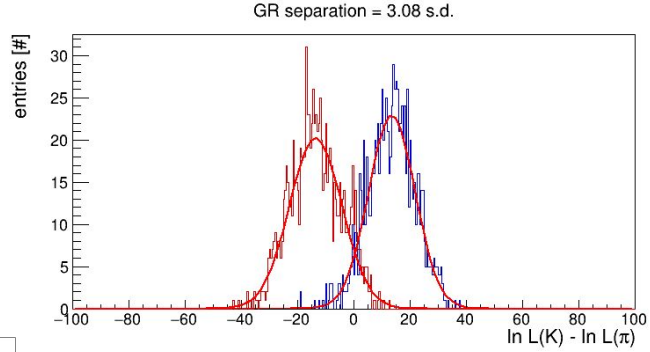
- Significant decrease in the number of fired pixels in the hit pattern
- Result of the time cuts used during the reconstruction process to exclude noise and photons reflected off the mirrored end
- Next week, will work to access the output plot of the number of photons pre-reconstruction to compare

-c 3 GR (Gaussian Resolution) Separation with Varying Pixel Sizes (Polar Angle = 30°)

pixel size = 3 mm

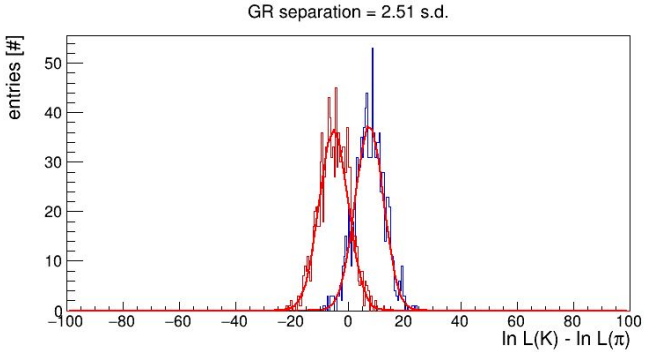


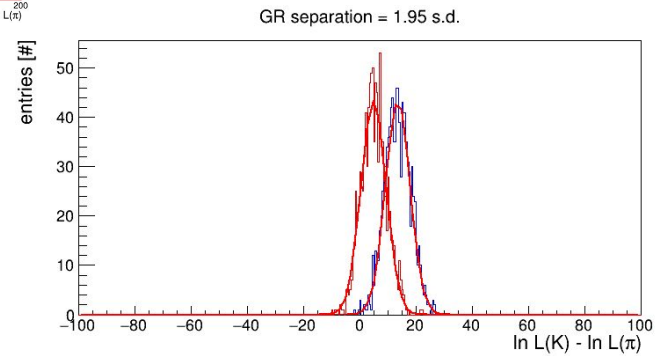




pixel size = 5 mm

pixel size = 8 mm





pixel size = 10 mm

What is Time Resolution?

- Timing resolution refers to the precision with which a sensor can measure the arrival time of single photons

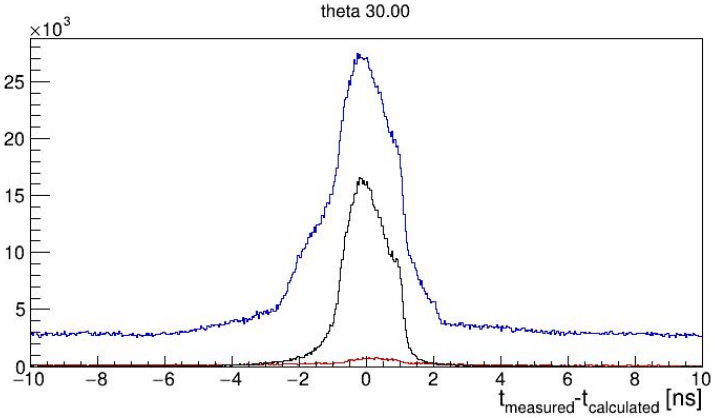
- Temporal Precision: Smallest time interval that a sensor can distinguish between the arrival of two photons

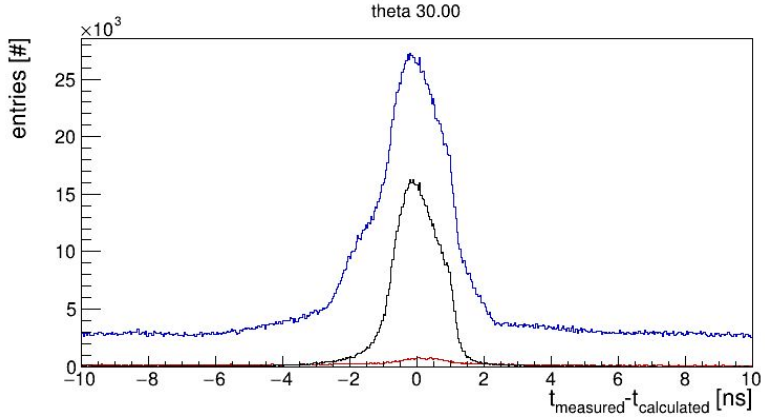
- Jitter: Random fluctuations in the measured arrival times of photons, measure of uncertainty in timing measurements

- Ideal timing resolution is 0. Current expected value for hpDIRC is 100 ps

Varying Time Resolution (30°)

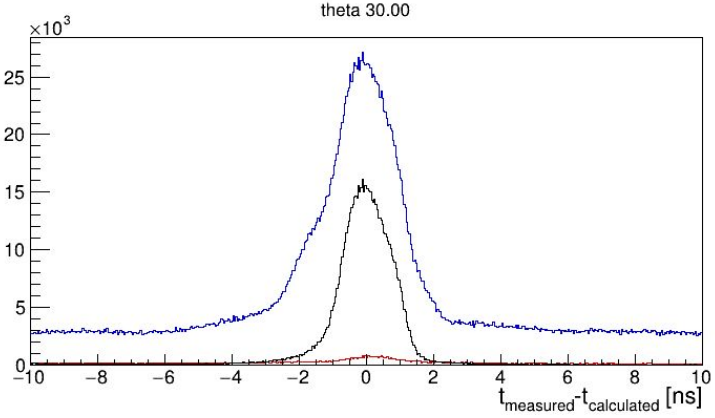
timeres = 0 ps

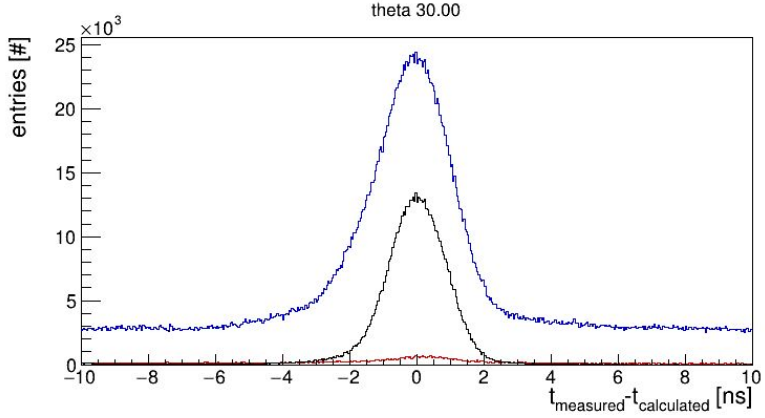




timeres = 100 ps

timeres = 200 ps





timeres = 500 ps

What is Time Cut?

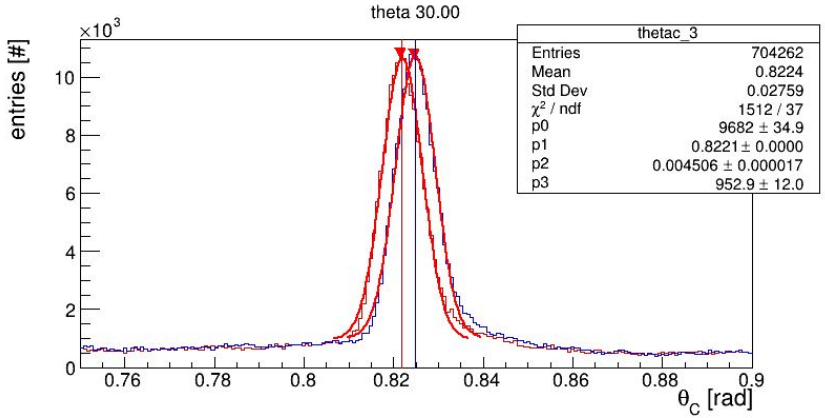
- The time cut is a value used as a comparison threshold to filter out photon hits based on the absolute value of the time difference between the measured and calculated hit time

- This filtering reduces the noise and inaccuracies of the reconstruction process

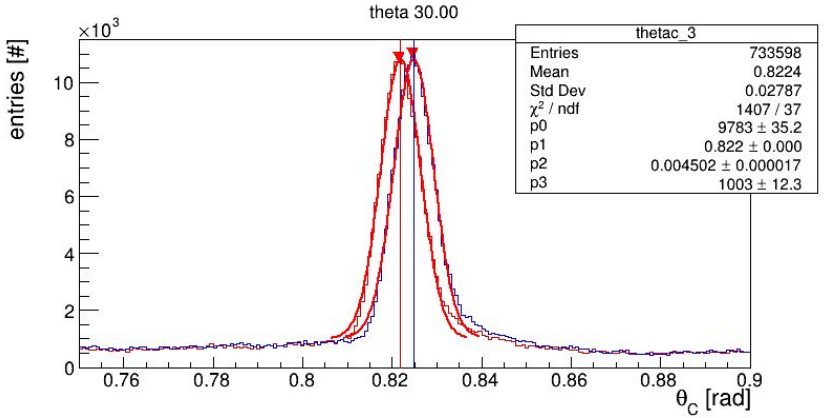
- Smaller values of the time cut are more restrictive and result in fewer photons after reconstruction than a larger time cut value

Varying Time Cut (30°)

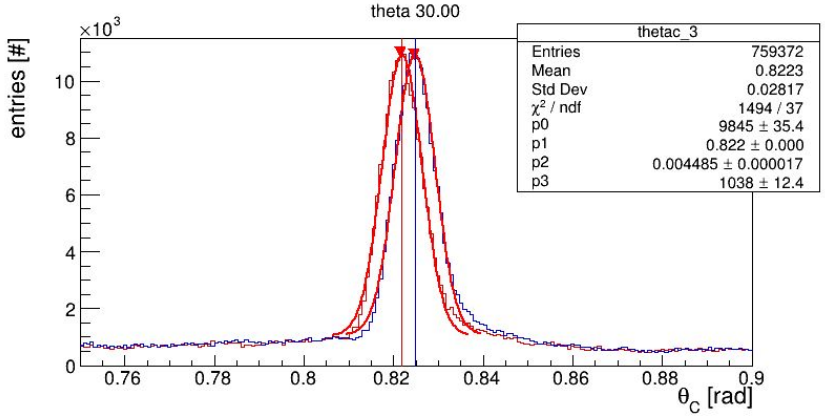
time cut = 0 ps



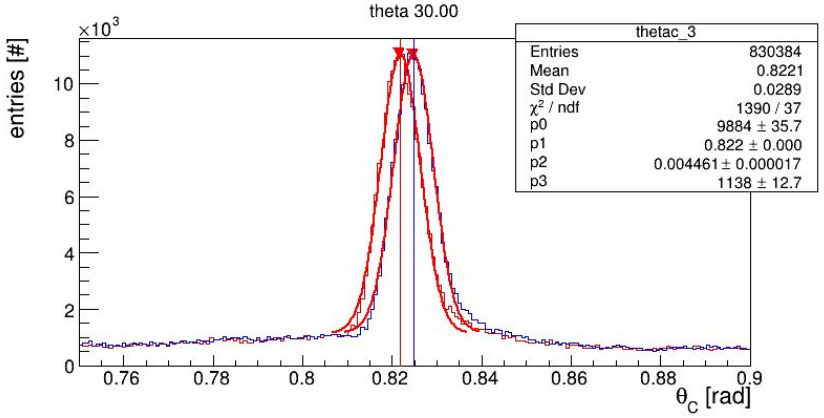
time cut = 100 ps



time cut = 200 ps



time cut = 500 ps



What needs to be done … (Next Week)

- Continue the time cut and time resolution comparisons in a more quantitative manner rather than the qualitative approach of this week

- Access the time difference plots as ROOT files to apply a Gaussian fit to the histograms

- Use this quantitative data to assess how quickly hpDIRC behavior deteriorates with poor time resolution / how much hpDIRC behavior improves with better time resolution