Trevor Nelson

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My TAC-HEP R&D project:

My project has been to rewrite a part of the CMS e/gamma reconstruction algorithm to run on GPUs. The e/gamma reconstruction algorithm utilizes information from the electromagnetic calorimeter and tacker to reconstruct electrons and photons. I am specifically rewriting the seeding step which identifies hit patterns in the tracker that may correspond to electron trajectories. For this project we are using the ALPAKA portability library to allow the code to run on different types of hardware including GPUs. We want to be able to run the seeding algorithm on GPUs in order to speed up the e/gamma reconstruction algorithm for HL LHC. The ultimate goal of the project is to have a portable version of the e/gamma seeding code that can run on GPUs implemented into CMSSW.

Accomplishments:

- Learned how to write software that can run on a GPU
- Wrote initial version of GPU compatible endcap propagator
- Performed Efficiency studies comparing performance of GPU compatible algorithm with the algorithm as it is currently implemented in CMSSW

Next steps:

- Fully implement endcap propagator into the GPU compatible algorithm
- Implement code to reject hits in invalid layers of tracker into the GPU compatible algorithm
- Perform timing studies between GPU compatible algorithm and currently implemented algorithm on CMSSW

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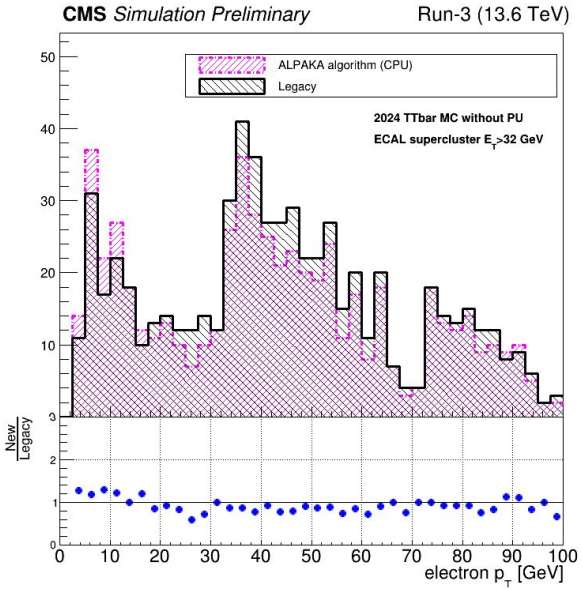
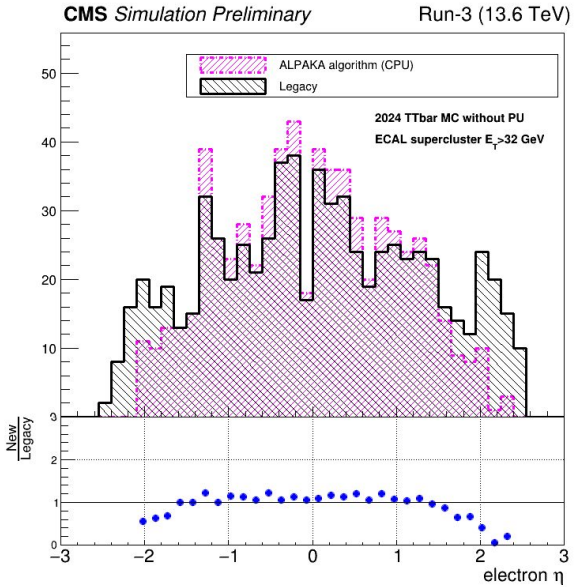


Transverse momentum distribution of reconstructed electrons on current CMSSW seeding algorithm (legacy) and new GPU compatible ALPAKA seeding algorithm running on CPU



Pseudorapidity distribution of reconstructed electrons on current seeding CMSSW algorithm (legacy) and new GPU compatible seeding ALPAKA algorithm running on CPU

Deviation In endcap region between algorithms being fixed