IRIS-HEP RETREAT

LIGHTNING TALK

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Sep 12, 2019

- Bei Wang, Ph.D. in computational science and engineering, **software engineer** at Princeton university
- Has been working on R&D in parallel computing applications for over 8 years in plasma physics, fluid dynamics and high energy physics
  - Co-PI of **Intel Parallel Computing Center (IPCC)** at Princeton
  - Code development and optimization on modern computing architectures

- **Motivation:**
  - MkFit is a parallelized KF-based code that does particle tracking and reconstruction on multicore CPUs and manycore GPUs
  - MkFit needs all hits as an input
  - Currently, all hits needed by MkFit are obtained from a CPU code that performs strip unpacking and clustering serially
- **Goal:**
  - Investigating strip unpacking and clustering on GPU
  - Could also use the GPU to produce hits in the MkFit data format

Current Status

- Developed a parallel version of the clustering algorithm
  - Git repo: https://github.com/beiwang2003/strip_clustering_gpu
  - Data are stored as Structure-of-Array (SoA) format
  - SIMD friendly implementation
  - Scale on multicore CPU using OpenMP

Cluster Criteria

- The ADC value of each strip must be > 2*noise
- At least one strip has ADC value > 3*noise
- The quadrature sum of ADC values of the cluster must be >=5*the quadrature sum of the noise
- The strips are consecutive or have gap of at most N strips (N is a input parameter)

1. Find out all seed strips
   - we call strip with ADC > 3*noise as seed strip
2. Keep only one seed strip (the first one now) if there are multiple seed strips with consecutive strip id
   - issue: we might still have duplicated clusters generated from non-consecutive strips
3. For each non-consecutive seed strip, find the left and right boundary of the candidate cluster
4. For each candidate cluster, check if it is a true cluster. If so, do some adjustment for its adc values. A true cluster satisfies:
   - Squared noise is large enough
   - chargePerCM is large enough

Future Work

- Developing the first GPU version of the code (in CUDA)
- Current clustering algorithm assumes that the input data for a single event are stored in SoA format. More work is needed if the output from unpacking is in a different format
- Benchmark with the CPU version