TDAQ group report

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for the Mu2eII tdaq subgroup

Architectures under study

Two TDAQ architectures proposed so far:

1. **2-level Trigger (L1 Trigger + HLT)**
2. Software Trigger using GPUs

L1 + High Level Trigger

- Aggregate the data into a board equipped with multiple FPGAs
- Run the early stage of the track reconstruction + full calorimeter reconstruction
- Apply a L1 decision and move data to the HLT farm which runs full track reco

- **Main focus:**
    a. do some processing on FPGA and the remainder on software
    b. can we make a L1 trigger decision at FPGA level?
    c. track pattern-recognition on FPGA?
    d. **Need to develop FPGA algorithms**

L1 + High Level Trigger: where do we stand?

- **Jinyuan Wu** illustrated a possible algorithm that can be implemented on FPGA
  - Need to access performance with simulated data
- Ryan illustrated to Richie and I how to use Vivado for doing development using High Level Synthesis
  - Waiting the new simulated data
- We made a contribution to a white paper: **Applications and Techniques for Fast Machine-Learning in Science** – N. Tran et al., to be submitted on [Big Data and AI in High Energy Physics](#)
  - Paper under circulation for final review
- **Robert Soleti** recently showed interest in doing development with HLS4ML
- Potential help from a graduate student; waiting the end of August for the response of a grant submitted

Software Trigger on GPUs

- Antonio and I have been in contact with Gianluca Lamanna from Pisa
- He suggested us a way to make preliminary tests using **OpenAcc** to parallelize KinKal package
- OpenACC and the KinKal track-fitter algorithm are installed and ready to use on a workstation for tests

Main focus:
- In a few weeks, we will be ready to start tests on an NVIDIA GPU, thanks to the help and effort of the KinKal developers (Dave Brown)
- Interface with artdaq? Starting referring to the paper:
  - GPU-accelerated machine learning inference as a service for computing in neutrino experiments

Expected timeline

- Waiting simulated data from the Mu2e-II software group

    - This will allow us to start some preliminary tests

- We will restart our meeting once data will be ready to organize the work

    - We also would like to hear from the subgroup their ideas for their ROC development

- In the same period, we expect to move forward the GPU benchmark studies