Dear Fran,

Michael Begel, Gabriella Carini and I would like to submit an LDRD-A with the title The 'ABC' of cognizant Data Acquisitions
The BNL organizations are PO and IO, the PIs are "Begel, Michael" <begel@bnl.gov>, "Carini, Gabriella" <carini@bnl.gov>,  and myself.
I include below the description of the project we will refine this in the next week further and develop a full proposal.

**Description of Project:**
We propose to address the challenge of increasing data rates at EIC and synchrotron facilities by integrating edge based AI/ML data reduction and signal processing techniques into the data acquisition system (DAQ) front end electronics.
Data rates at the LHC have reached 0.5 Pb/s and the EIC and synchrotron facilities are rapidly approaching 100 Gb/s and are anticipated to generate multiple exabytes of data per year. Conventional methods for handling such data quantities pose both engineering and scientific challenges. From the engineering perspective, large data infrastructures require sizable budgets for continuing  maintenance.  From a purely scientific perspective, post processing of exascale data is time consuming and delays time to publication by years.
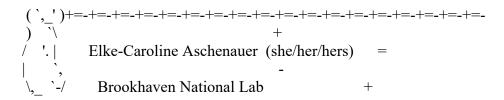Our AI/ML approach will provide a ~100x reduction in the data storage requirements and ~10x reduction in power consumption using two different methods. The first method will reduce data rates and power consumption by implementing deep neural networks (DNN) running on commodity FPGAs in front end electronics close to the detector  to classify and filter out events that contain little useful scientific information. The second method will reduce the data storage requirements and time to publication by using both DNN based self-supervised learning for autonomous recalibration and channel classification techniques implemented in FPGAs to improve signal-to-noise.
This project is fully aligned with ongoing research at BNL as all HEP, NP and most BES experiments operated at an accelerator facility; enhancing the purity of the recorded data would optimize use of the luminosity/ brilliance of these expensive to operate facilities. The researchers involved in this LDRD have significant experience in designing and operating large collider experiments and are therefore best suited to make this LDRD a success and integrate this modern approach into other data acquisition systems.

Cheers
Gabriella, Michael and Elke


Note: Please do not feel obligated to respond to this message outside of your work hours.

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