

TDAQ input to ESG

Florida Tech, Princeton, Boston U, Northwestern U, Cornell, U of
Pitt, CMU, The Ohio State U, MIT, UC Irvine, SMU, Duke, BNL,
FNAL, SLAC, ANL

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Past and current efforts

- The US institutions contributed to all the areas of TDAQ of the CMS and ATLAS experiments. There is existing expertise to make a comparable contribution to FCCee experiments.
- The current efforts are focused on triggering, e-fpga's, and high-speed data links. There is a large overlap with “blue-sky R&D” and many of these were presented at CPAD'24.
- There is a lot of overlap with the AIM group for AI/ML circuits on-detector
- The emphasis of the current R&D is on exploration and characterization of new technologies.
 - UChicago: “Real time top jets identification with FPGA's”
 - SLAC: E-FPGAs for on-detector AI/ML
 - Versatile SLAC Neural Network Library (SNL) for FPGA, GPU Direct RDMA using SLAC's open source DMA engine
 - Many other institutions are using AI/ML for triggering and on-detector data processing
 - FNAL and LBNL are working on Si-photonics fiber-optical data links.

Planned efforts

- There are proposal to do more R&D if funding available in the future
 - Dense wavelength division multiplexing VCSELs -fiber-optical data links (SMU)
 - Rad-hard commercial FPGAs for detector readout and on-detector triggering (SMU)
 - Emerging heterogeneous computing and Edge ML (SLAC, Boston U, and others)
 - Embedded FPGAs (SLAC)
 - On-detector analog compute (BNL+)
 - Autonomous TDAQ with AI/ML (SLAC)
 - ML in FE electronics and DAQ using FPGAs (Indian U)
 - Dataflow simulations