

Boston University Postdoc Search

David Sperka, Zeynep Demiragli, Jim Rohlf
[Boston University]

Nov 28, 2022

<https://inspirehep.net/jobs/2207200>



Boston University is a **private research university** with nearly **35,000 students**
Physics Department hosts: 46 Professors, 21 Postdoctoral researchers and visiting
faculty, **160 undergraduates** and **85 graduate** students

Jim Rohlf:

BU group leader, Member HCAL Institution board, Member Trigger-DAQ Institution Board, Member HGCAL Institution Board

Zeynep Demiragli:

BU group deputy leader, L2 EXO (current)/JetMET (past) coordinator, leads Dark Matter and Invisible Higgs searches, leads the electronics development for the Inner Tracker DTC System for the HL-LHC

David Sperka:

Data Scouting Coordinator, USCMS Software and Computing R&D Coordinator, strong involvement in L1 Global Trigger, Exotic Higgs Convener (past) and Higgs Combination Group Convener (past) coordinator, leading searches for Dark Photons and other Dark Sector signatures

Larry Sulak:

HCAL advisory board, CMS Systems: HCAL / HGCAL / MTD

Indara Suarez:

Leads searches of Top-Squark in single lepton final state, CSC Data Performance Group and Muon Machine Learning group coordinator, Member Muon Institution board, ETL

The successful candidate is expected to contribute to one or more of the following projects:

- **Adaptation of CMS Algorithms for Heterogeneous Computing:**
 - Currently porting Primary Vertex Reconstruction algorithms to run on GPUs
 - Integration of the GPU algorithm into the full CMSSW reconstruction workflow
- **Development of the Inner Tracker Backend Electronics (Apollo) for HL-LHC:**
 - Develop and implement the logic for the Inner Tracker firmware
 - Perform testing / integration and commissioning of the newly developed boards
- **Participate in diverse physics program.** Based on the candidates experience and interest these could include various Dark Sector searches (dark photons / ALPs / muon-philic gauge bosons using scouting data) and/or studies of the Higgs Boson.

Candidates should have:

- A strong background in programming in C++ and Python.
- Some VHDL / Vivado HLS, and Machine learning techniques are preferred but not required.
- Must have a Ph.D. in experimental high-energy physics or a related field by appointment start date.

Candidates must submit a CV, a brief statement about research experience and interests, and three reference letters (sent independently by the reference writers) to

cms-postdoc-search@physics.bu.edu

- **Adapting CMS reconstruction algorithms for GPUs**

- Supported by the USCMS S&C R&D Initiative
- Primary Vertex reconstruction algorithm (deterministic annealing) in 3D adapted for GPUs on CUDA
- Need to adapt to 4D (include timing information) and port to Alpaka (portability library)
- Integrate the algorithm into a full GPU workflow (pixel tracking + full tracking + vertices)

- **Responsible for the L1 GT Menu and Emulator**

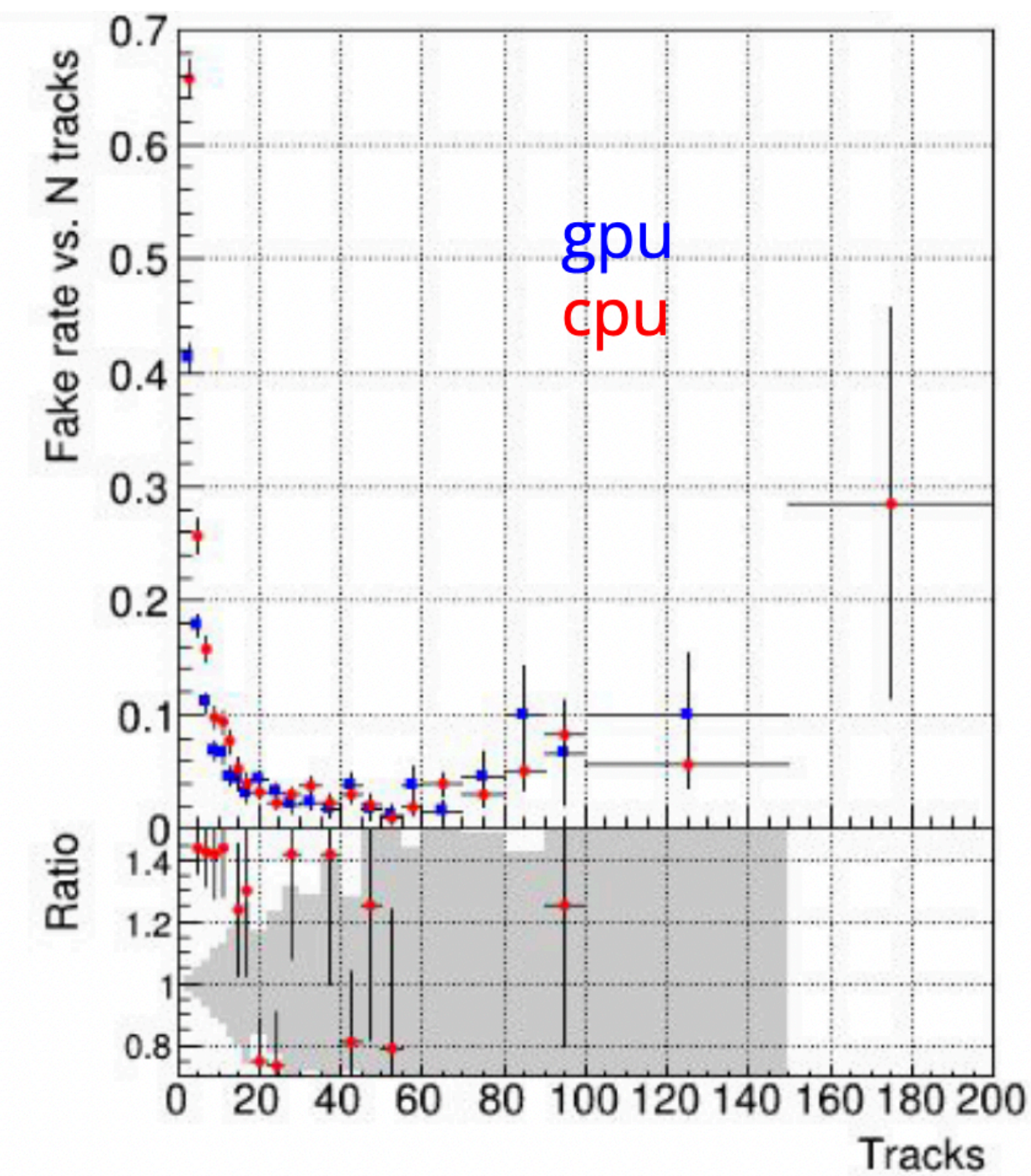
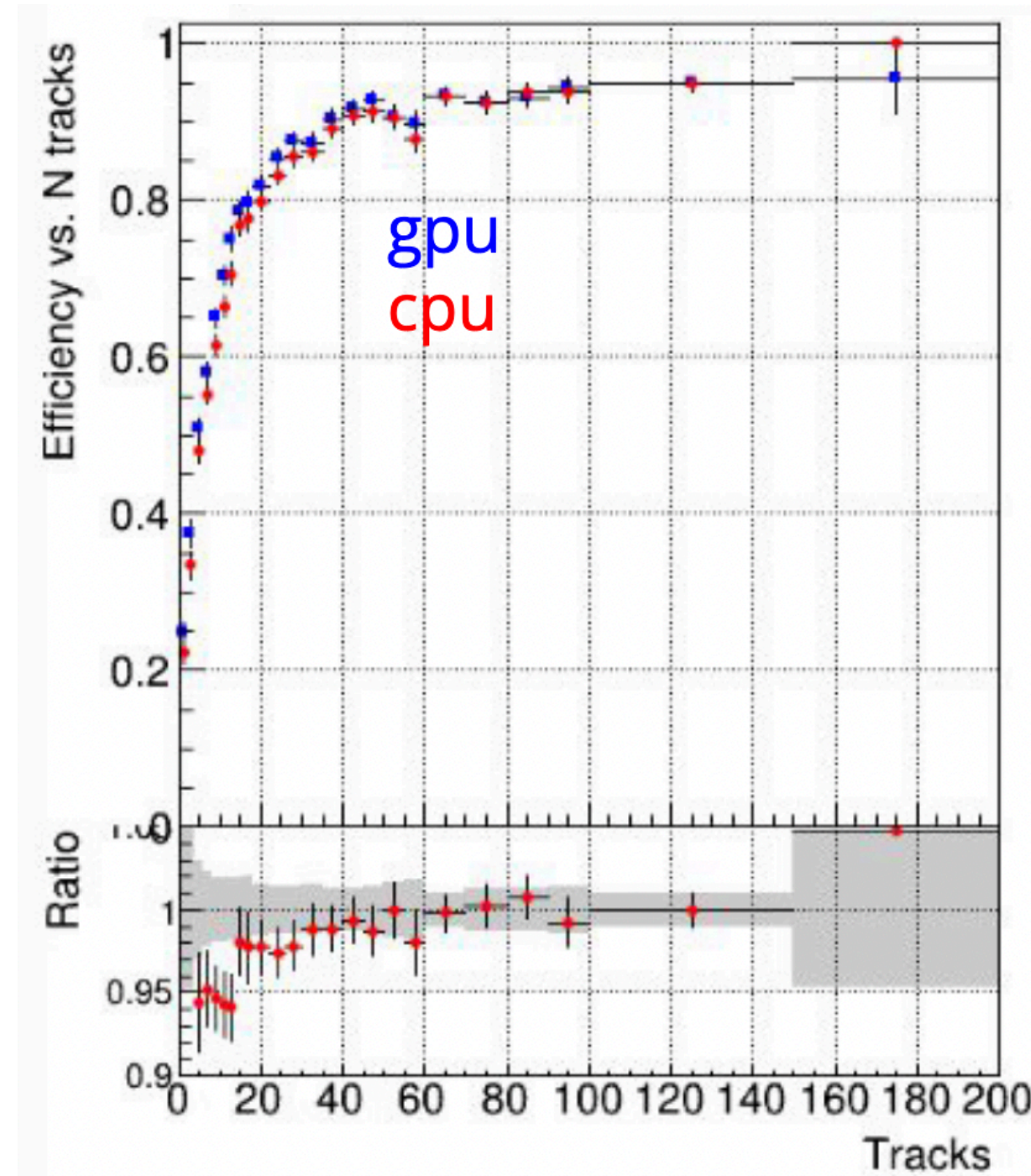
- Develop L1 trigger menus for Run 3 data taking
- Integrate new algorithms (e.g. 3-muon triggers, muon showers, HCAL timing) into software emulator and ensure compatibility with the L1 uGT firmware

- Physicist Contributions:

- Postdoctoral Associate: **Elisa Fontanesi (L1 Trigger), Carlos Erice Cid (GPUs)**
- Graduate Students: **Anna Tsatsos, + recruiting more students**

- Collaborators:

- Co-develop the Primary Vertex Reconstruction algorithms with INFN Milano-Bicocca
- L1 GT work with University of Illinois Chicago, HEPHY Vienna



- **Utilizing Data Scouting to perform searches for dark sector physics**

- Have published one paper (EXO-19-018) with leading sensitivity to dark photons above 20 GeV
- Another search from 1-10 GeV nearing approval (EXO-21-005)
- Implemented a very low mass Diphoton trigger for Run 3 to search for Axion Like Particles
- Also planning to include Z decays to 3 photons to extend mass range of ALP searches

- **Searching for explanations of Muon g-2**

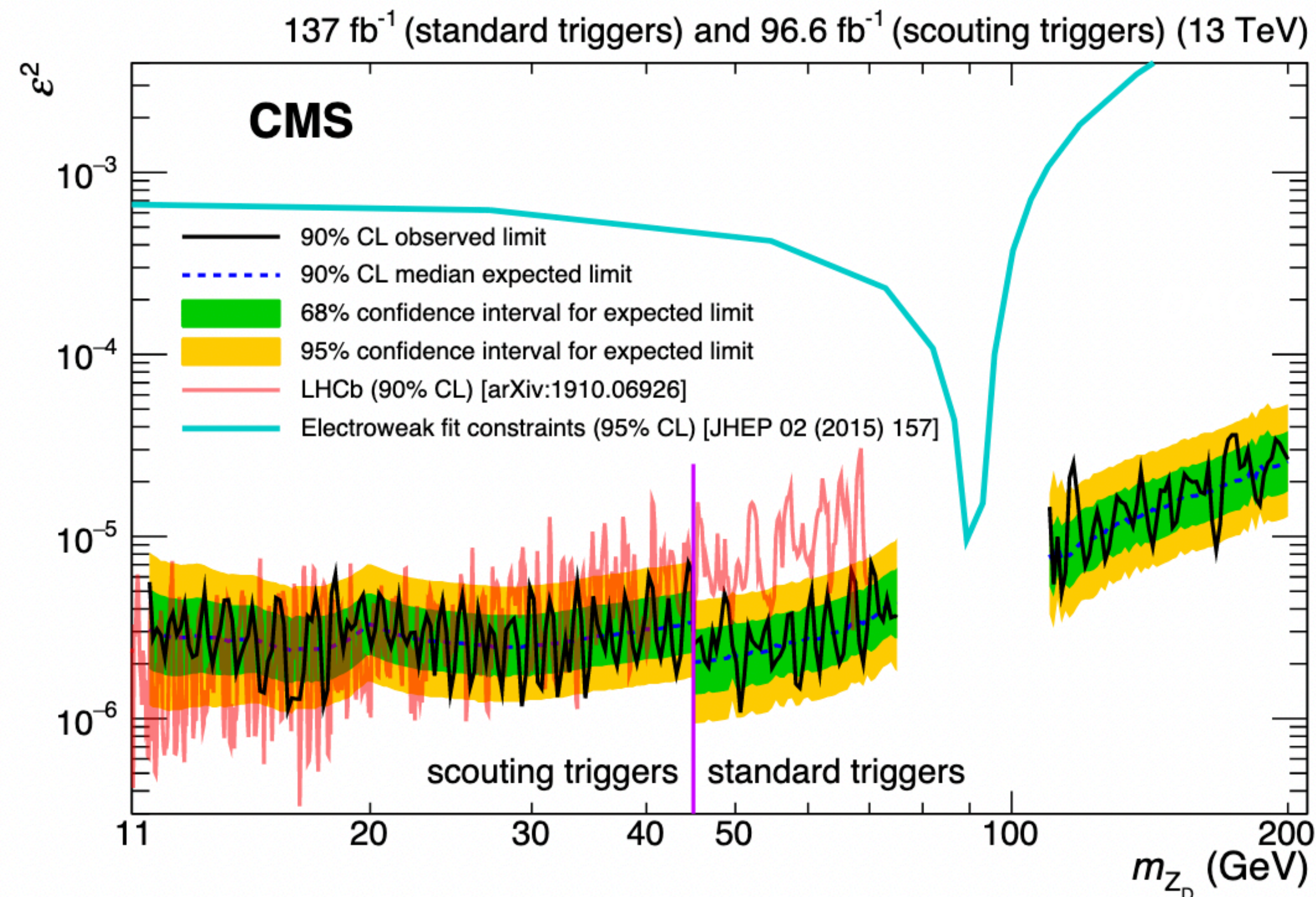
- Performed a search for muon-philic gauge bosons using Z boson decays to 4 muons (EXO-18-008)
- Plan to extend these searches to other production/decay modes

- Physicist Contributions:

- Postdoctoral Associate: **Elisa Fontanesi**
- Graduate Students: **Anna Tsatsos, Chris Cosby, + recruiting more students**

- Collaborators:

- Dark Photon searches with MIT, ALP Searches with IHEP Beijing, IP2I Lyon, Saha Institute



- **Prof. Sperka is also involved in a fixed target experiment at FNAL called SpinQuest**
 - High intensity 120 GeV proton beam dump experiment to search for long-lived dark photons
 - Current spectrometer able to search for dimuon decays, data taking starting in January
 - Also working on an EMCal upgrade of the spectrometer to open searches in the dielectron final state
 - Electronics for the upgrade being developed at Boston University
 - Stage-0 approval from FNAL, expected to install the EMCal in 2024

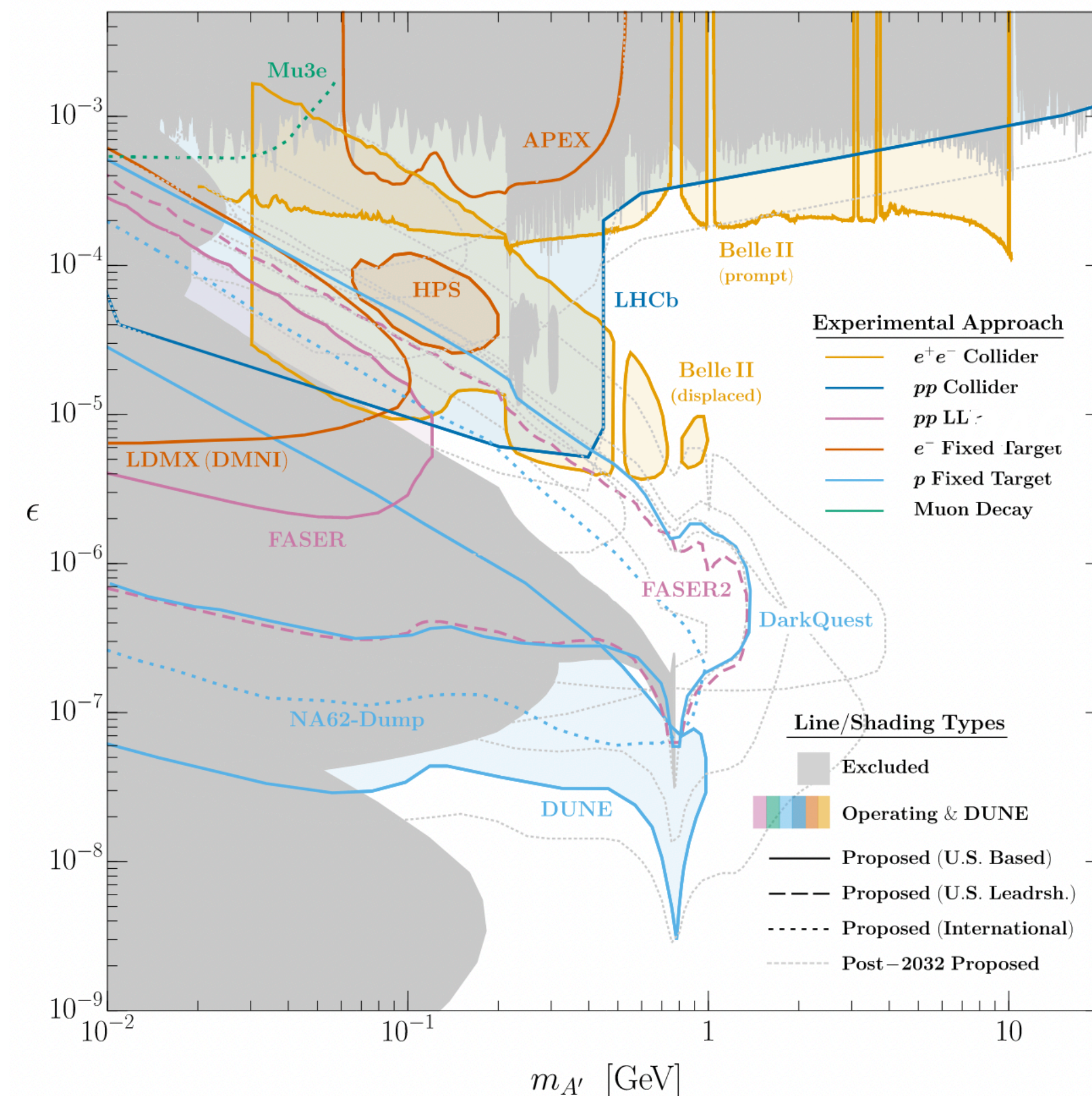
• Physicist Contributions:

- Postdoctoral Associate:
- Graduate Students: **Zijie Wan, + recruiting more students**

• Collaborators:

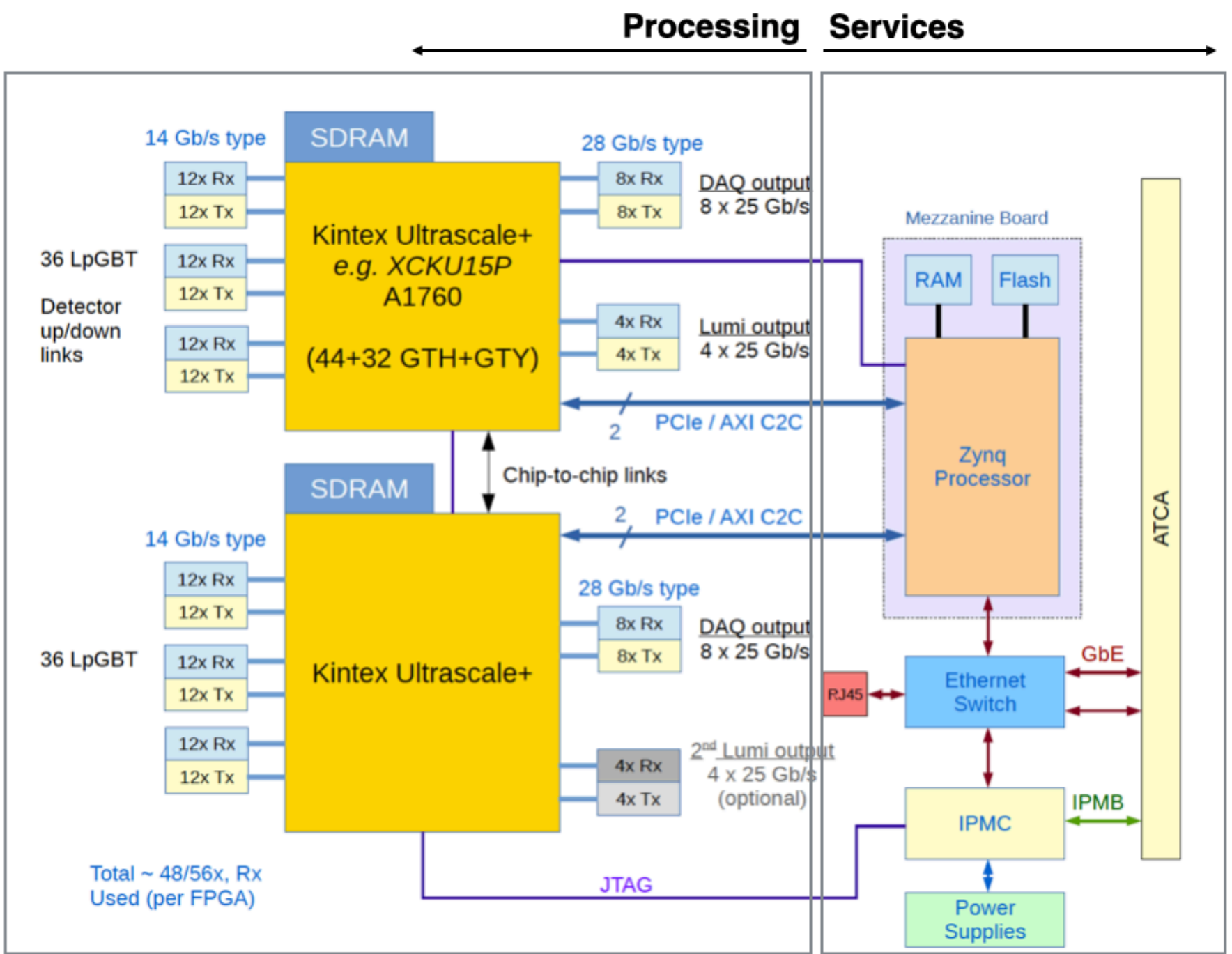
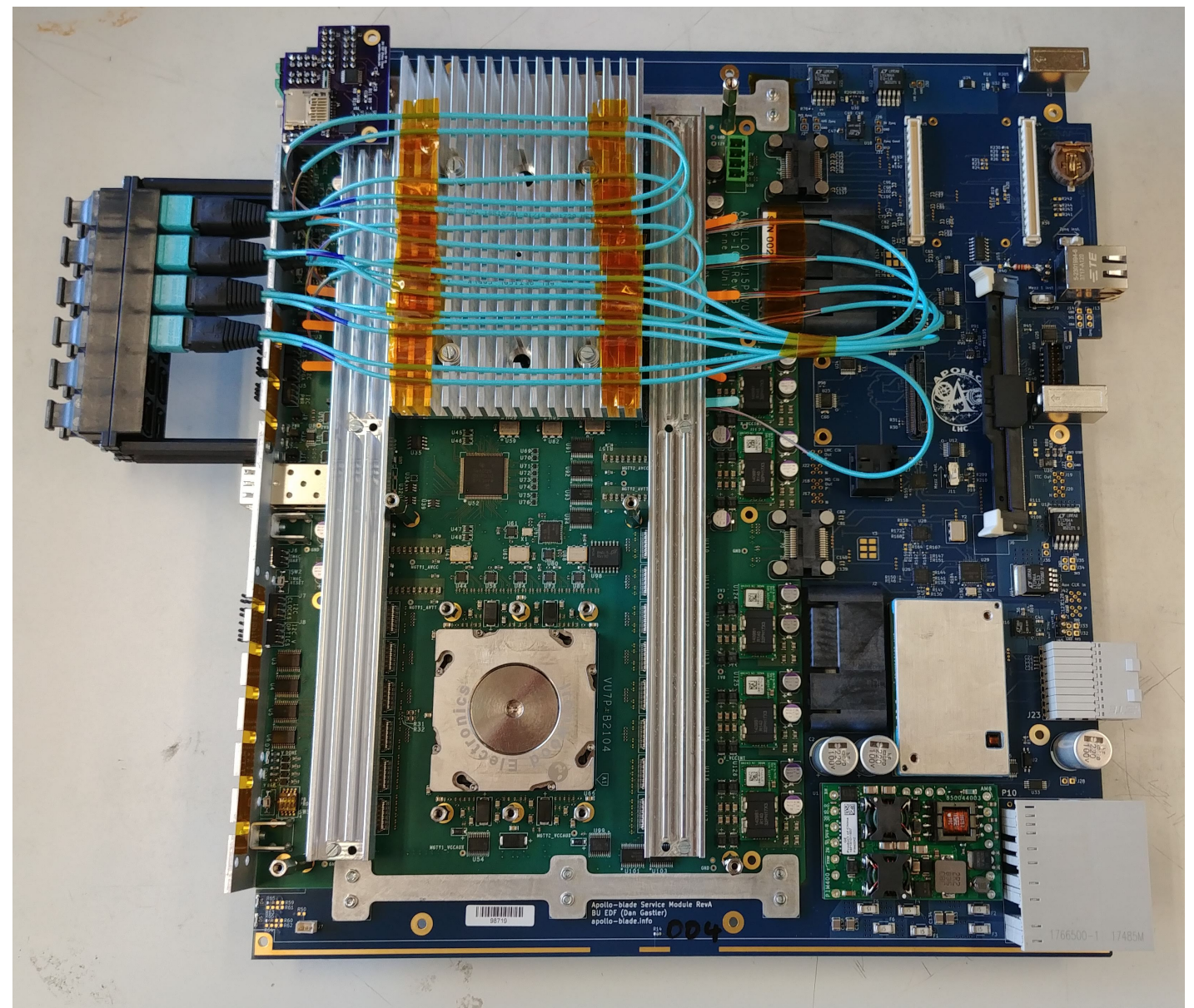
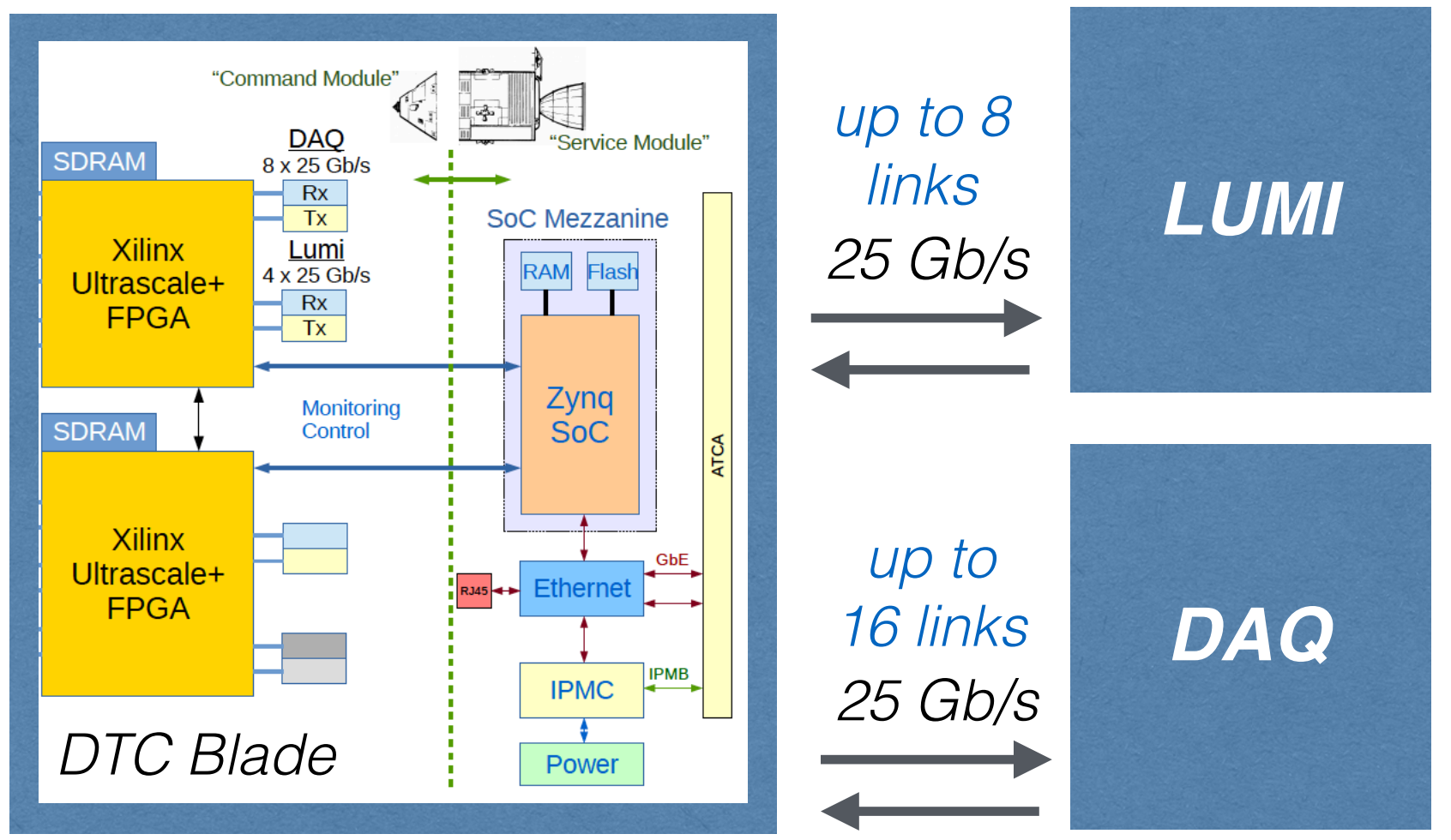
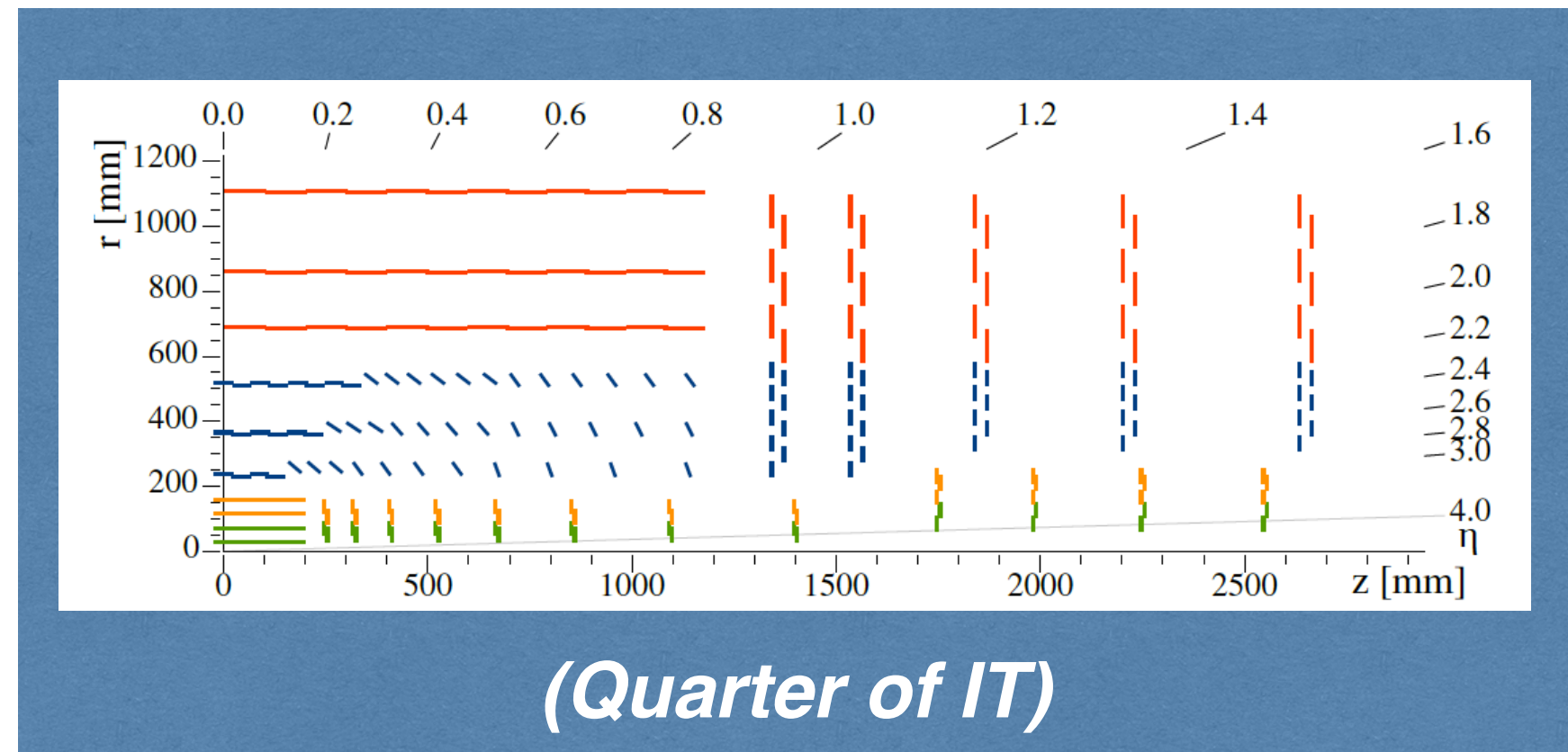
- MIT, FNAL, Johns Hopkins, Purdue, Brandeis

<https://inspirehep.net/jobs/2145979>



- Collaboration with the Electronics Design Facility at BU - **Director Eric Hazen**
 - 3 full time senior engineers + 1 new hire on the way
 - Experiences in electronics development in various experiments: m2e, g-2, ATLAS (Muon System), CMS (HCAL readout, uTCA, ATCA development for the IT)
- Physicist Contributions:
 - Postdoctoral Associate: **Si Hyun Jeon**
 - Graduate Students: **Alp Akpinar, John Barlow, Gianfranco de Castro**
 - Also work with many undergraduate students
- Collaborators:
 - Co-develop the boards with Cornell University
 - Co-develop the firmware with KSU, and Rice Universities
 - Many European collaborators as well

Data, Trigger Control System



The DTC system will be comprised of a total of 28 custom developed ATCA blades

- Physicist Contributions:
 - Postdoctoral Associate: **Carlos Erice Cid**
 - Graduate Students: **Alp Akpinar, Gianfranco De Castro + more students being recruited**
 - Also work with many undergraduate students
- Collaborators:
 - Monojet / V: main collaborators were: MIT, U Wisconsin
 - VBF Higgs Invisible: Imperial, Bristol, CERN
 - SUEPs: Many institutions a few of them are: Fermilab, Cornell, MIT, CERN, U Maryland, Tennessee. SUEP idea is too big for just a few groups! many different directions to explore -> very interesting from early Run3 too!