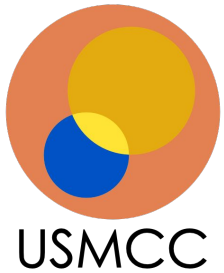
BIB mitigation with AI

Simons progress report
27 March 2026

John Dervan[1], Kiley Kennedy[2], Ryan Roberts[3]

[1]*University of Tennessee, Knoxville*
[2]*Princeton University*
[3]*University of Chicago*



Major updates since last time

- ***Meetings**: Wednesdays at 11 am ET [Indico] — all are welcome!*

- **BDTs for BIB rejection**
  - Heard update from Jordan + nice discussion

- **SNNs (UTK)**
  - Applications to ECAL
  - Previous work: developing a training dataset

- **Outlining our overarching goals/pillars—subject to shuffling + redefinition!**
  - Defining operation of ML-enabled FEs
  - Towards a public dataset for BIB rejection
  - More advanced synthesis of BIB rejection models
  - Benchmark models using current technologies under consideration (DNN, BDT, SNN, LGN)

Current roadblocks

- **LGN** – unclear why we cannot exactly reproduce public results with SmartPixels dataset
- **Smartpix Training** – Messy environment for quantized training and synthesis – QKeras out of date, hls4ml differences for Vitis and Catapult
- **Smartpix Lab Testing** – Noisy filter outputs make validation harder

Open tasks

- **LGNs**: proceed with synthesis
- **SNNs**: iterate on dataset, want to first conclude ECAL study before moving to smartpixels
- **DNNs**: Want to refine estimates of chip area, data rate. Eventually validate synthesis on FPGA.
    - Longer term: consider differential distributions, digitization implementation.