

BIB mitigation with AI

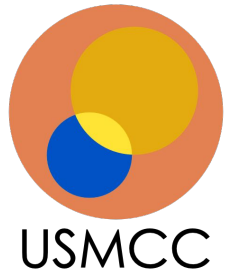
Simons progress report
10 April 2026

John Dervan¹, Kiley Kennedy², Ryan Roberts³

¹*University of Tennessee, Knoxville*

²*Princeton University*

³*University of Chicago*



Meetings:

Wednesdays at 11 am ET

[\[Indico\]](#) — all welcome!

Major updates since last time

- **Report on model development and synthesis – Daniel / Chicago**
 - Model Development: 3 architectures in progress, 2 detailed here
 - Hyperparameter scans done (e.g., weight quant), however input preprocessing needs to be applied
 - Performance evaluated as background rejection (for sig effs of 99%, 98%, 95%) vs N(LUTs+ FF)
 - *Requested input on how performance is evaluated*
 - Synthesis:
 - Moderate disagreement between QKeras and HLS prediction when inputs not normalized/scaled (bit overflow, e.g., $37 = 100101 \rightarrow -11010 = -26$)
 - Disagreement significantly reduced with log normalization
- **Report on LGN synthesis – Lino / Mila**
 - Mostly technical work
 - [torchlogix](#) – python library to train LGNs, developed by Lino, Elliott, Mila & others
 - Currently unable to translate LGN models into verilog or C without significant engineering by hand
 - Working to interface torchlogix with [da4ml](#), enabling efficient synthesis of arbitrary models

Current roadblocks

- **LGN** –
- **Smartpix Training** –
- **Smartpix Lab Testing** – Noisy filter outputs make validation harder

Open tasks

- **LGNs**: should wrap up torchlogix/da4ml interface in the next few days, then proceed with retraining and 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