SmartPixels Report - 22/04/2026

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Reminders and Recent Progress

Reminders:

- We are working with publicly accessible **SmartPixels datasets** to assess the performance of **LGNs** for this task.
- Past results showed **comparable** performance of LGNs and **unquantized** torch models.

Recent Progress :

- Interfaced the LGN library with an optimized RTL generating script that provides rough ASIC/FPG estimates.
- Trained quantized torch (brevitas) models as a new baseline for the LGNs.
- Training on irradiated datasets to see online LGN feasibility.

Quantized Baseline Models (Model 2: y0+y-profile)

Reminder:

- As a baseline we recreated the **non-quantized** (torch) models from arxiv:2310.02474.
- **Model-2:** 14 inputs (y0 + y-profile).
- **Model-3:** 105 inputs (y0 + y-profile + timing).

Why make our own quantized baseline models:

- Original paper's ASIC model is **per y0**, and there is **no Model-3 quantized variant** .
- We can get a better comparison of LGN vs. Torch models performance when deployed online.

Model-2 Brevitas Quantized vs. LGN

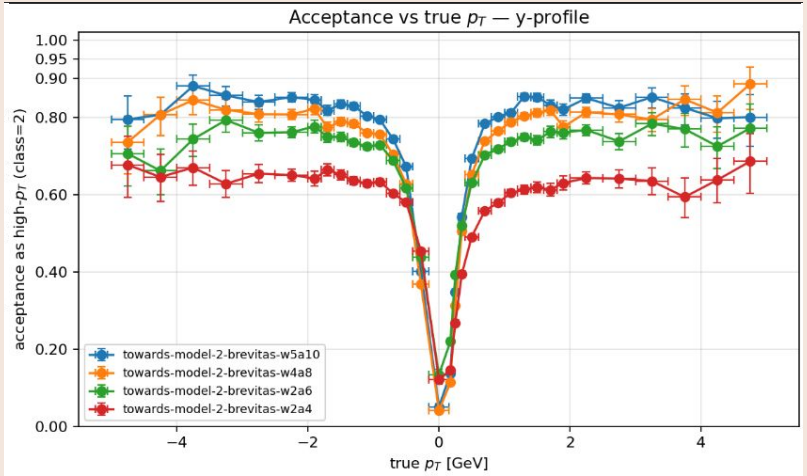


Fig 1. Quantized Torch models with different quantization bits for the weights (w) and activations (a)

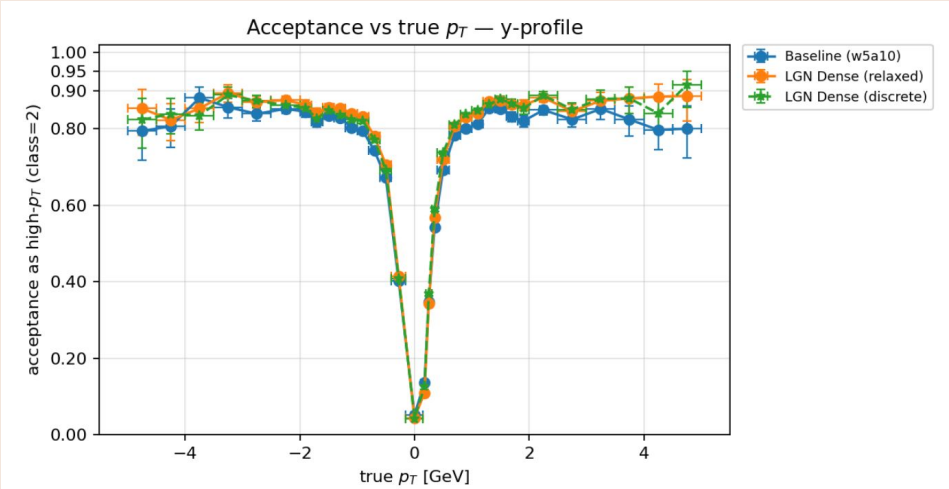


Fig 2. Model-2 LGN compared to best performing (largest) quantized Torch model

Model-3 Brevitas Quantized vs. LGN

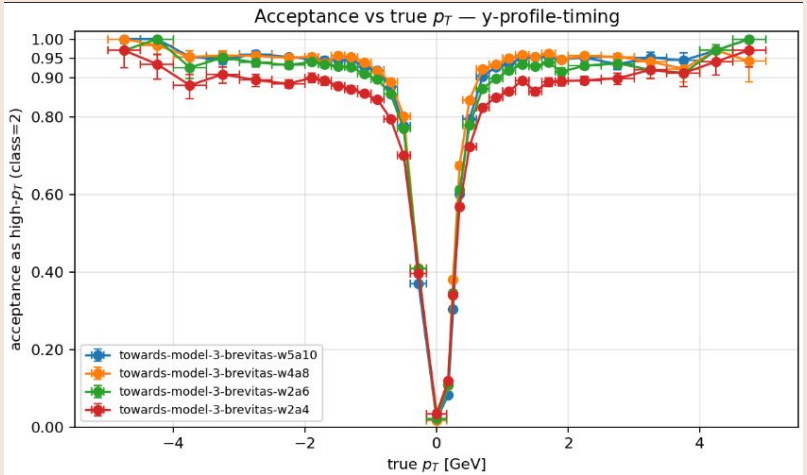


Fig 3. Quantized Torch models with different quantization bits for the weights (w) and activations (a)

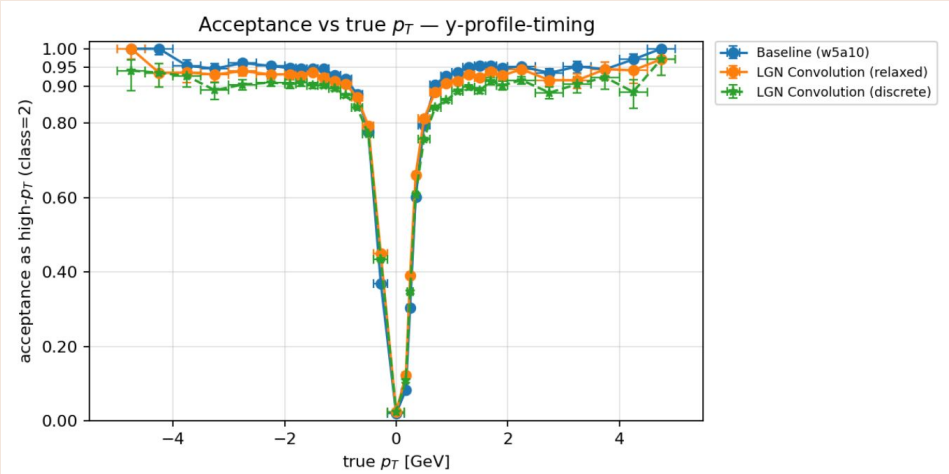


Fig 4. Model-3 LGN compared to best performing (largest) quantized Torch model

DA4ML Preliminary ASIC

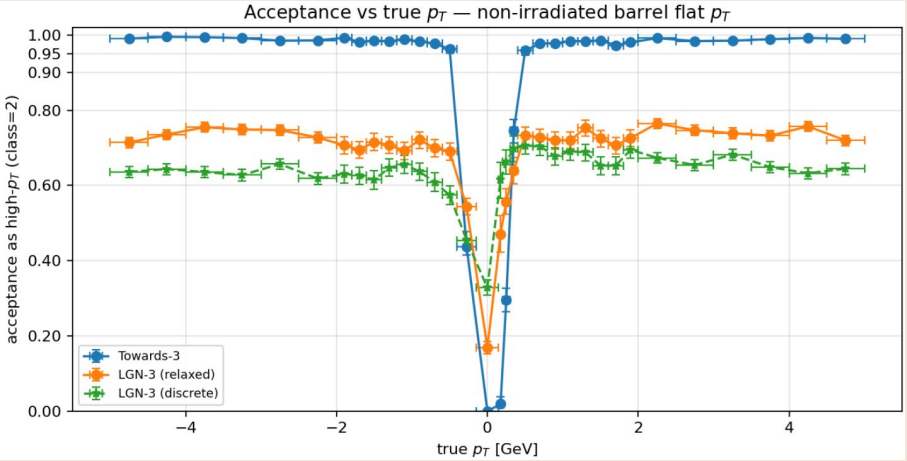
Model 2 Reports:

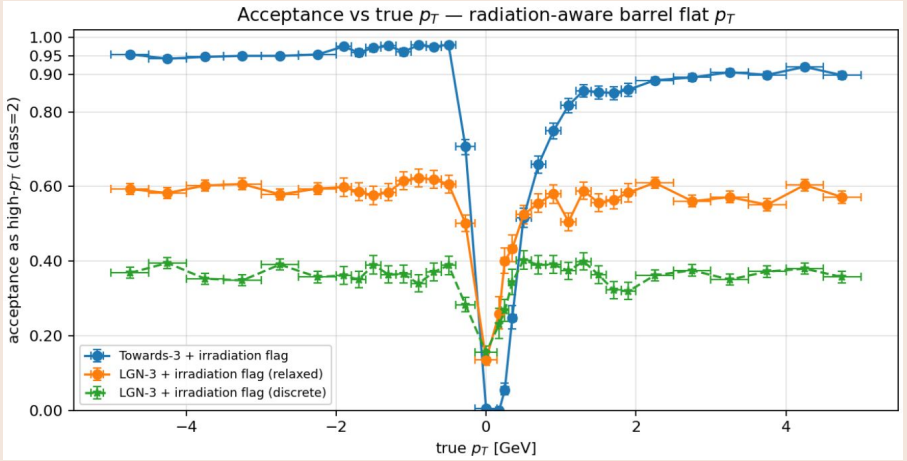
- **Comb shape** : 9 inputs -> 3 outputs
- **Estimated ASIC cost:** 23728 LUTs
- **Pipeline latency:** 6 cycles
- **Target Fmax:** 240.00 MHz
- **Target latency:** 25.00 ns
- **Clock period:** 4.1666667

Model 3 Reports:

- **Comb shape** : 105 inputs -> 3 outputs
- **Estimated ASIC cost:** 54099 LUTs
- **Pipeline latency:** 7 cycles
- **Target Fmax:** 280.00 MHz
- **Target latency:** 25.00 ns
- **Clock period:** 4.1666667

Radiation Damage **Preliminary** Results





- Zenodo:17180303 has 2 simulated radiation datasets: 370fb and 1100fb.
- Additional flag is given depending on the radiation level of the event.

- The results are **expected:**
  - LGNs need a lot of optimization and we still don't fully know the dataset well. This was a test of the pipeline rather than performance.