Planned R&D at Columbia-Nevis Labs

- The Columbia group is planning to contribute to R&D related to **data selection and triggering, architecture/hardware design**

- Columbia group on DUNE:
3 faculty (<1 FTE each), ~0.5 postdoc, ~0.5 student

- Resources and expertise available
    - In-house (Nevis Labs) expertise on electronics design, including firmware design
    - Newly renovated lab space available for low-noise electronics testing in cold/warm
    - GPU cluster (2 GPU towers available)
    - Experience with LArTPC readout (MicroBooNE and SBND)
    - LArTPC trigger development efforts commencing this year (SBND)
    - Established collaboration with Computer Science Dept. on CNN implementation on fpga

Planned R&D at Columbia-Nevis Labs

- **Additional R&D efforts: DNN-based readout & trigger**

- Have been exploring application of CNNs for APA image classification:
    - nnbar vs. atmospheric neutrino events
    - Single SN interaction + background vs. background only

- Results look promising (high selection efficiency, low mis-ID rate, relatively fast inference (~20-30ms on GPUs)), so we plan to:

    1. Expand classification to multiple off-beam event classes: nnbar, nucleon decay, atmospheric neutrinos, cosmogenic events, SN interactions, background only
    2. Demonstrate efficiency, mis-classification rate across all classes
    3. Investigate susceptibility to changing detector conditions, noise, etc.
    4. Understand speed of inference & optimization
    5. Understand power consumption & optimization
    6. Demonstrate feasibility/scalability