

LOMV Mentions at the US-ATLAS Summer Workshop

Hector's talk on Upgrade Physics:

Upgrade physics projections
(and performance studies)

Hector de la Torre Perez
Northern Illinois University

ATLAS EXPERIMENT

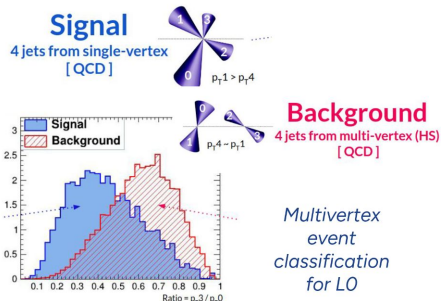
US ATLAS SUMMER WORKSHOP 2023

Northern Illinois University

The first of two examples (out of 16) he showed was the [talk by Tomás and Santiago!](#)

ML in FPGA

Lots of interest for Run 3, Global trigger, EF Tracking, Calorimeter readout, Muons



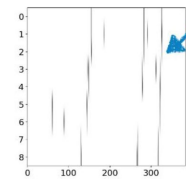
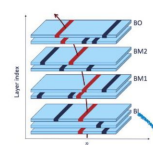
by Tomás Bazzano, [full slides](#)

20

Dedicated [Informal forum](#) recently organized with 16 contributions !!!



LO Muon trigger using CNN



by Graziella Russo, [full slides](#)

Thesis award for related work

Maria won an Outstanding Grad Student Award for her work on Global

From trigger to data analysis: looking for new physics at the LHC using deep learning techniques

Maria Mazza

US ATLAS Summer Workshop 2023



July 19, 2023

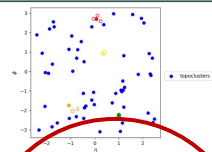


A cone jet reconstruction algorithm for Global

Optimized algorithm

- Seeds: 42 EM topoclusters with $E_T > 5$ GeV
- Constituents: 42 EM topoclusters with $E_T > 2$ GeV and $dR < 0.4$ from the seed
- Energy overlap removal: if a topocluster belongs to more than one seed, it is assigned only to the highest energy seed
- Recombination scheme:

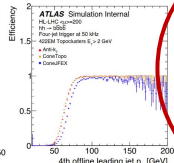
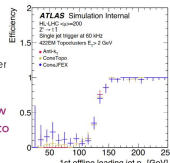
$$E_{T,i}^{jet} = \sum_{j \in i} E_{T,j} \quad \eta^{jet} = \eta^{seed}, \quad \phi^{jet} = \phi^{seed}, \quad m^{jet} = 0$$



Trigger efficiencies at fixed trigger rate

- $Z' \rightarrow \bar{t}t$ for 1J trigger
- $hh \rightarrow b\bar{b}b\bar{b}$ for 4J trigger

Cone jets (ConeTopo) show comparable performance to offline anti- k_r .



Preliminary firmware simulation

Target	Estimated	Uncertainty
4.17 ns	3.027 ns	1.13 ns

DSP	FF	LUT
681	131719	81755

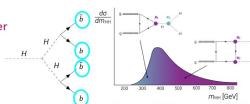
Resource consumption close to expected FPGA budget of 25%.

DSP 19 %, FF 7.8 %, LUT 9.7 %

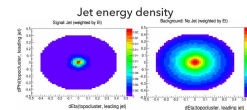
Improving the multi-jet trigger: ML for pileup-jet rejection

Measurement of non-resonant $HH \rightarrow b\bar{b}b\bar{b}$ crucially relies on multi-jet trigger efficiency and is one of the key challenges for the HL-LHC trigger upgrade.

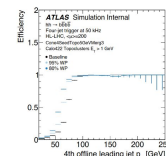
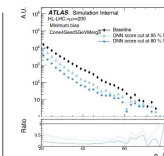
Can we use a DNN to quantify the probability of the jet to be pileup using the energy pattern of its constituents?



Courtesy of Katharine Loney (SMU)



- Pileup like radiation is uncorrelated from hard-scatter, resulting in a more diffuse energy pattern
- The DNN is trained to identify true QCD from pileup



- Constant pileup rejection as a function of p_T
- Improvement of ~ 10 GeV in $HH \rightarrow b\bar{b}b\bar{b}$ 100% efficiency point

Coming soon: synthesize NN to optimized FPGA firmware **hls 4 ml**

Maria Mazza (MSU)

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12

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11