



THE UNIVERSITY OF
CHICAGO



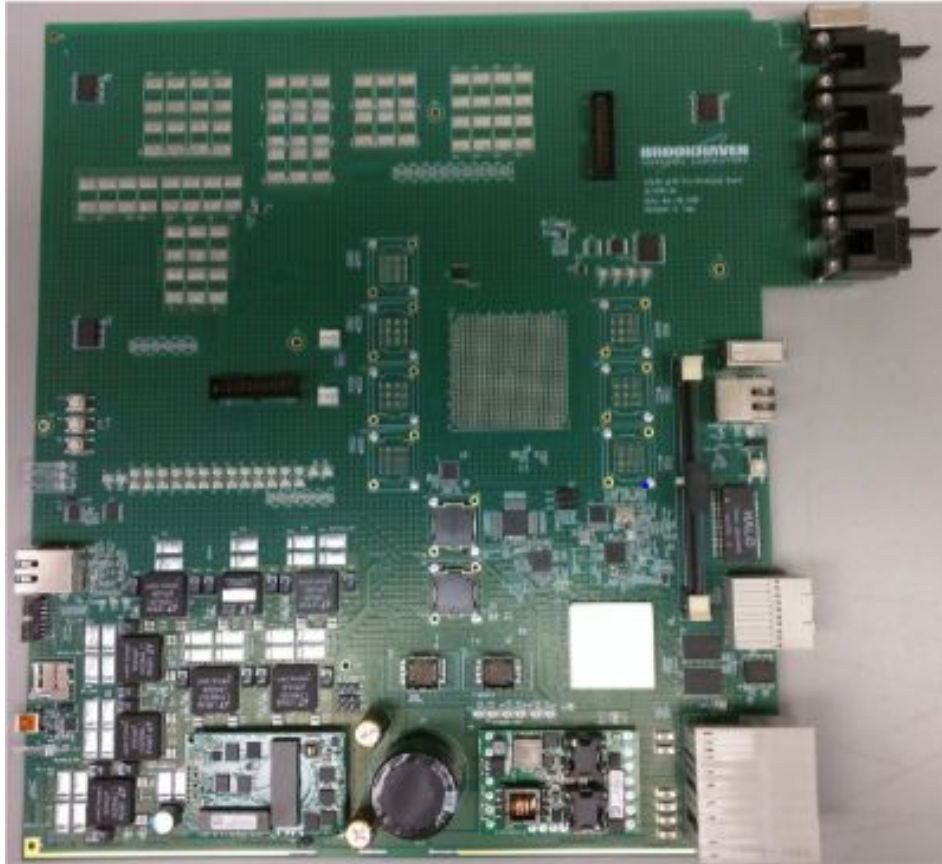
Preliminary gFEX Trigger Efficiency and Event Pile-up Studies

By Sarah Kroeker

For CSU ATLAS summer student presentations
July 29th, 2016



What is gFEX ?



Super fancy, expensive module/electronic board

⇐ prototype 😊




What is gFEX ?

- ❖ Part of Phase II upgrades to LHC (in year ~2020)

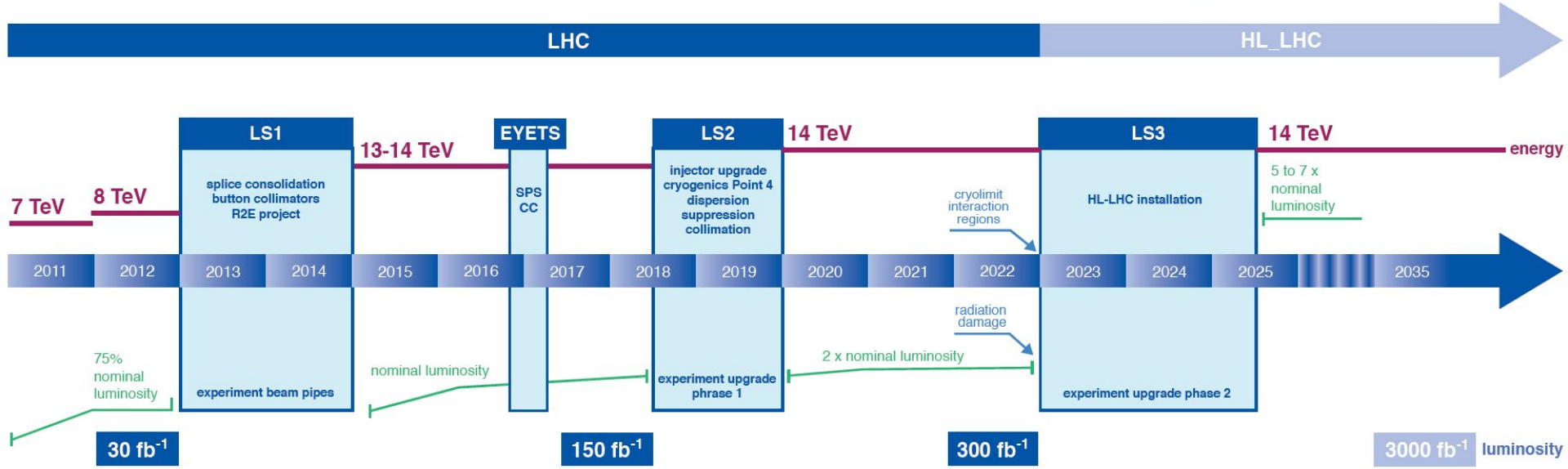


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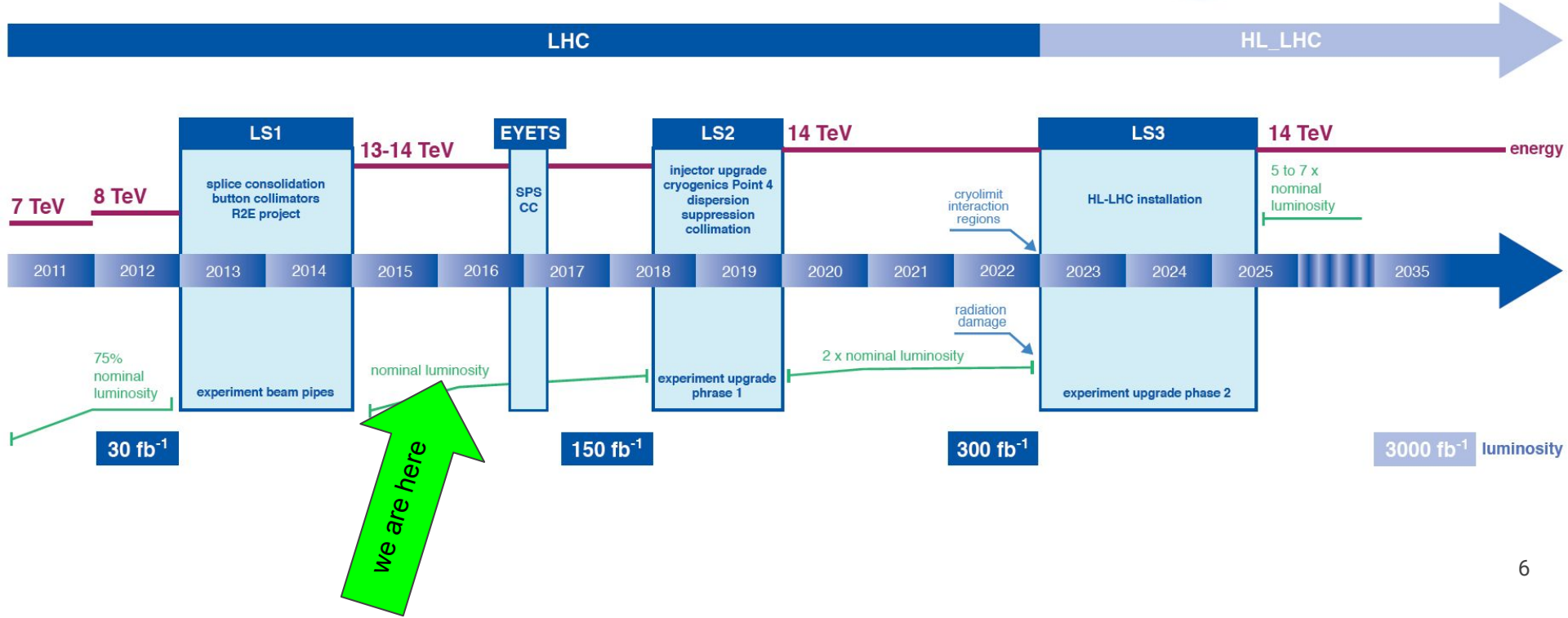
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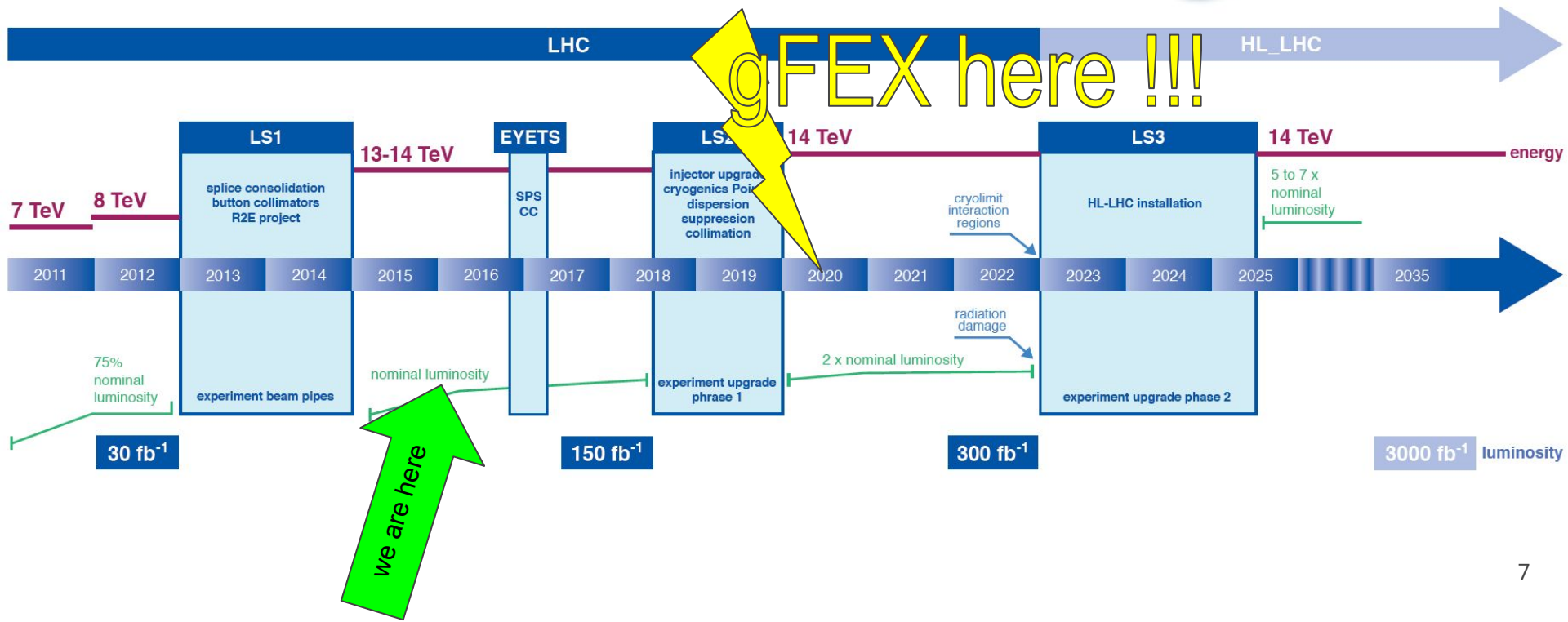
LHC / HL-LHC Plan




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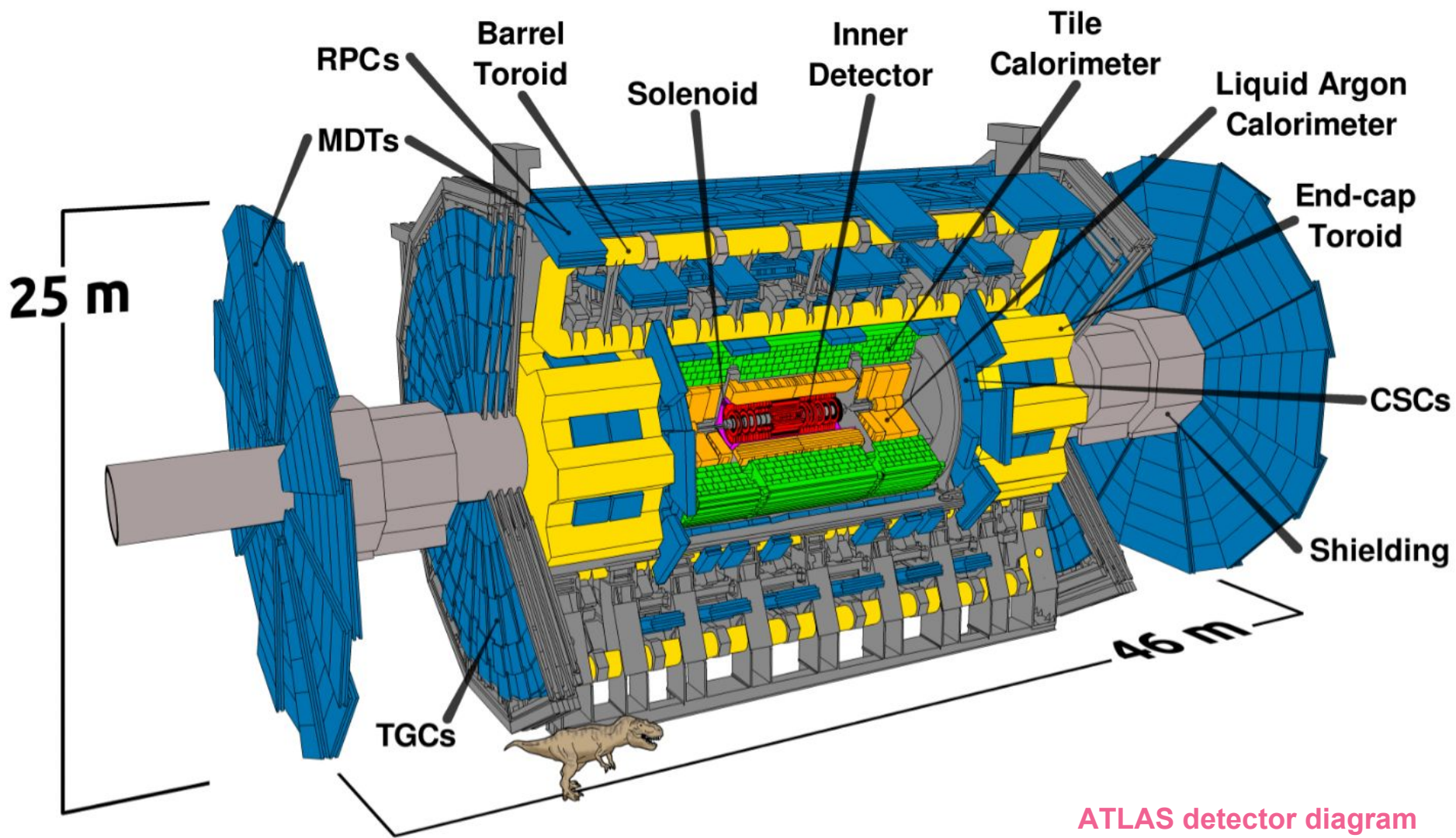
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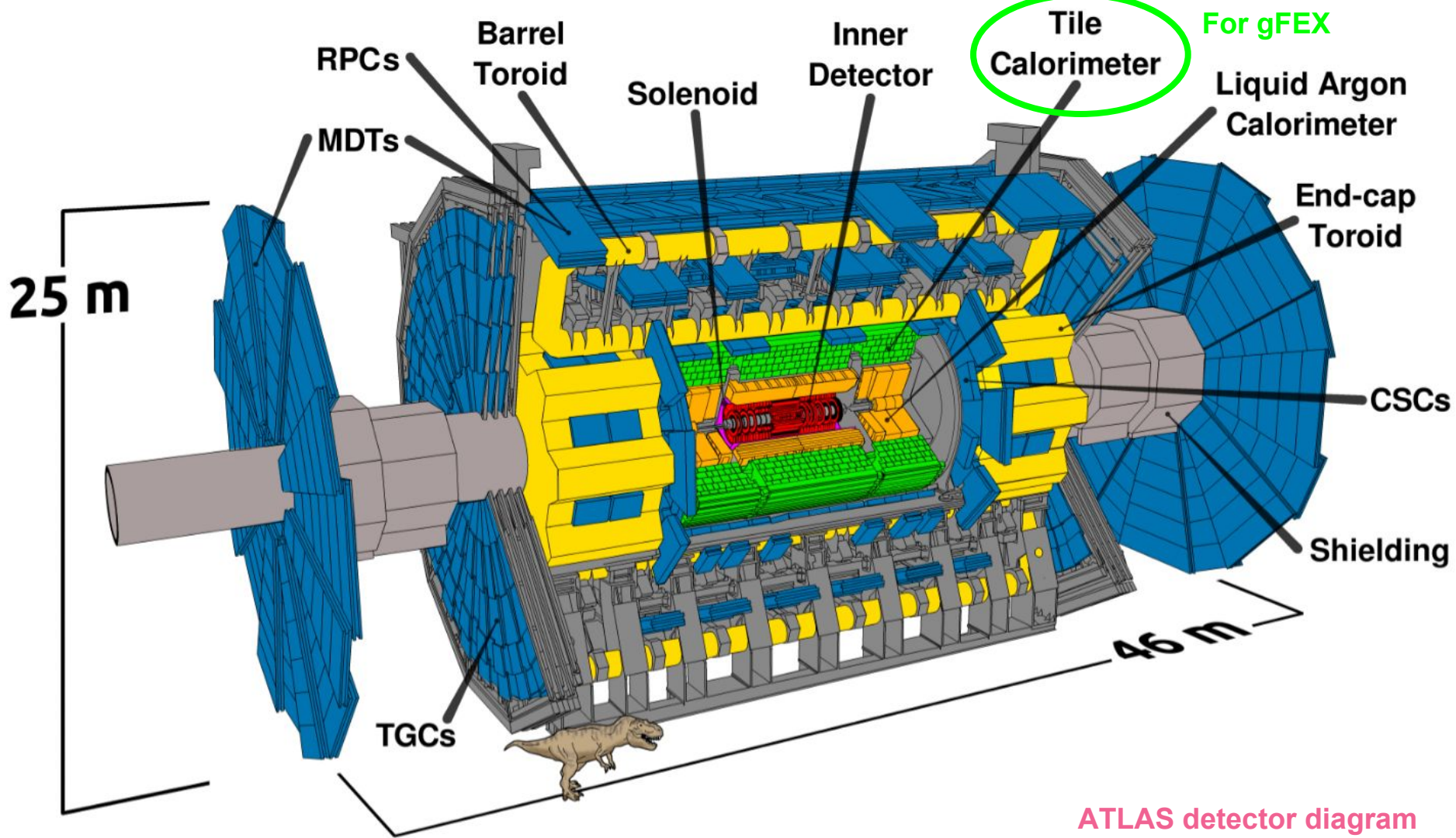


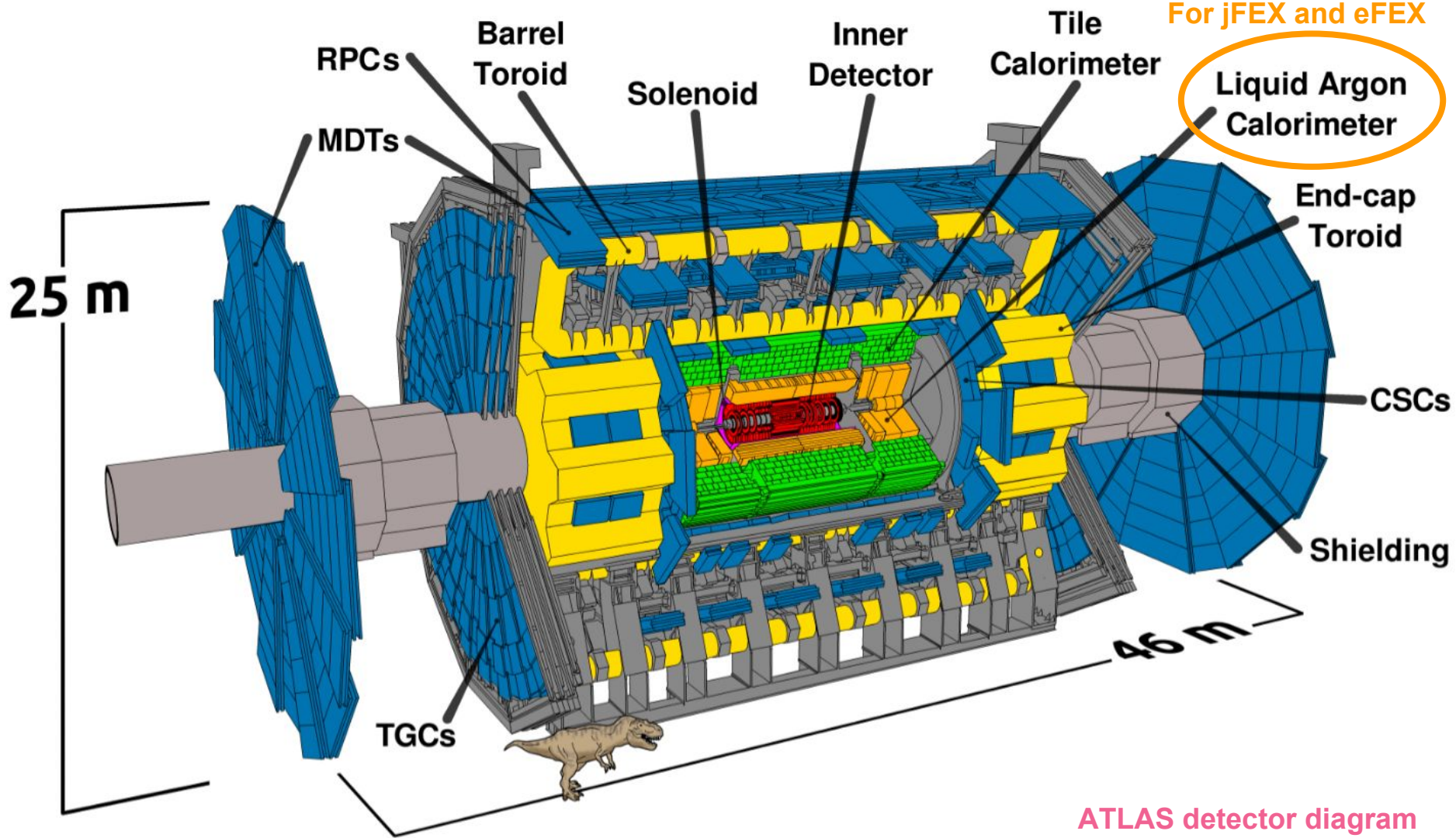
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Muon Spectrometer

Muon

Neutrino

(gFEX)

Hadronic Calorimeter

Proton

Neutron

The dashed tracks are invisible to the detector

Electromagnetic Calorimeter

Photon

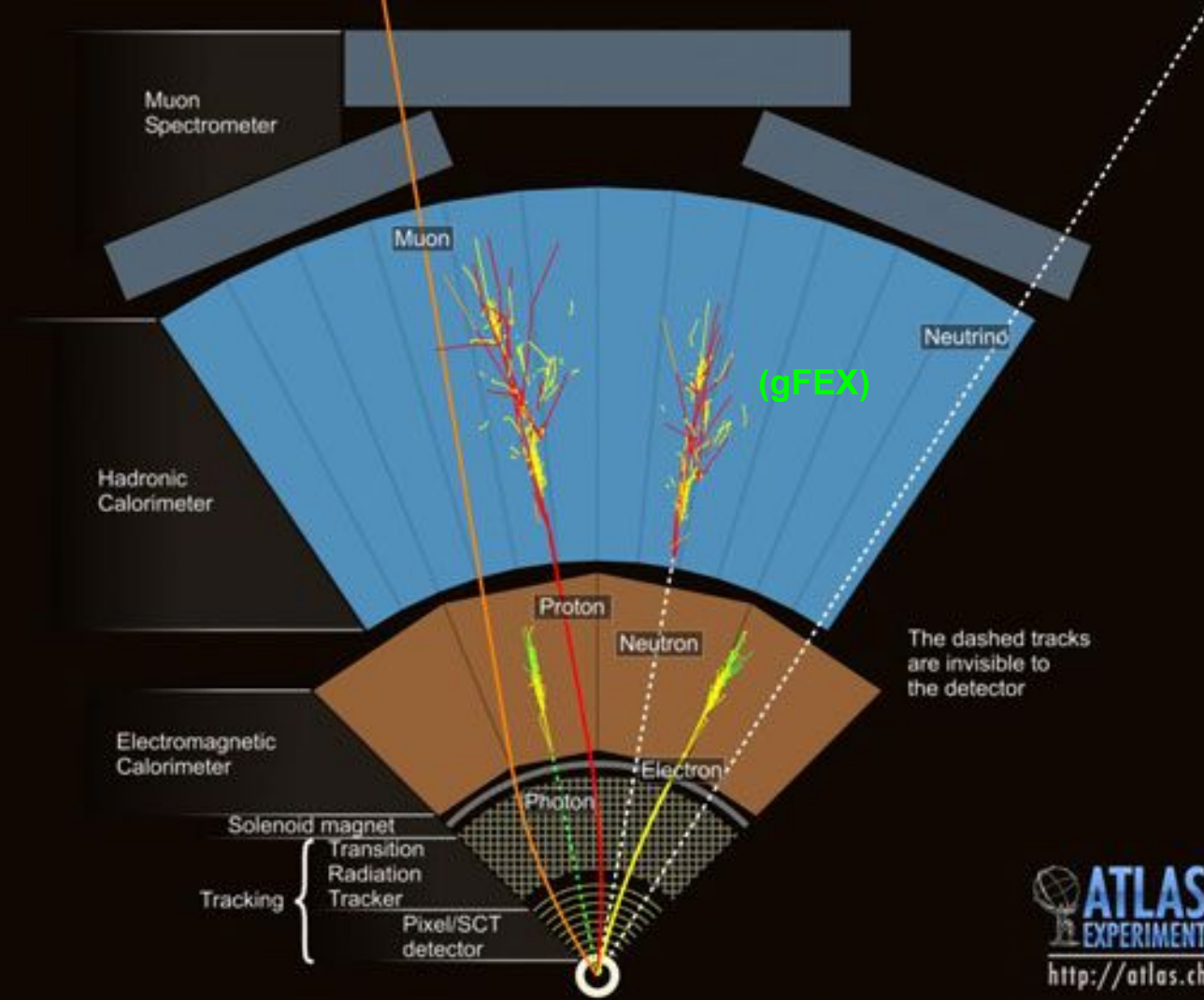
Electron

Solenoid magnet


Tracking

Transition Radiation Tracker

Pixel/SCT detector




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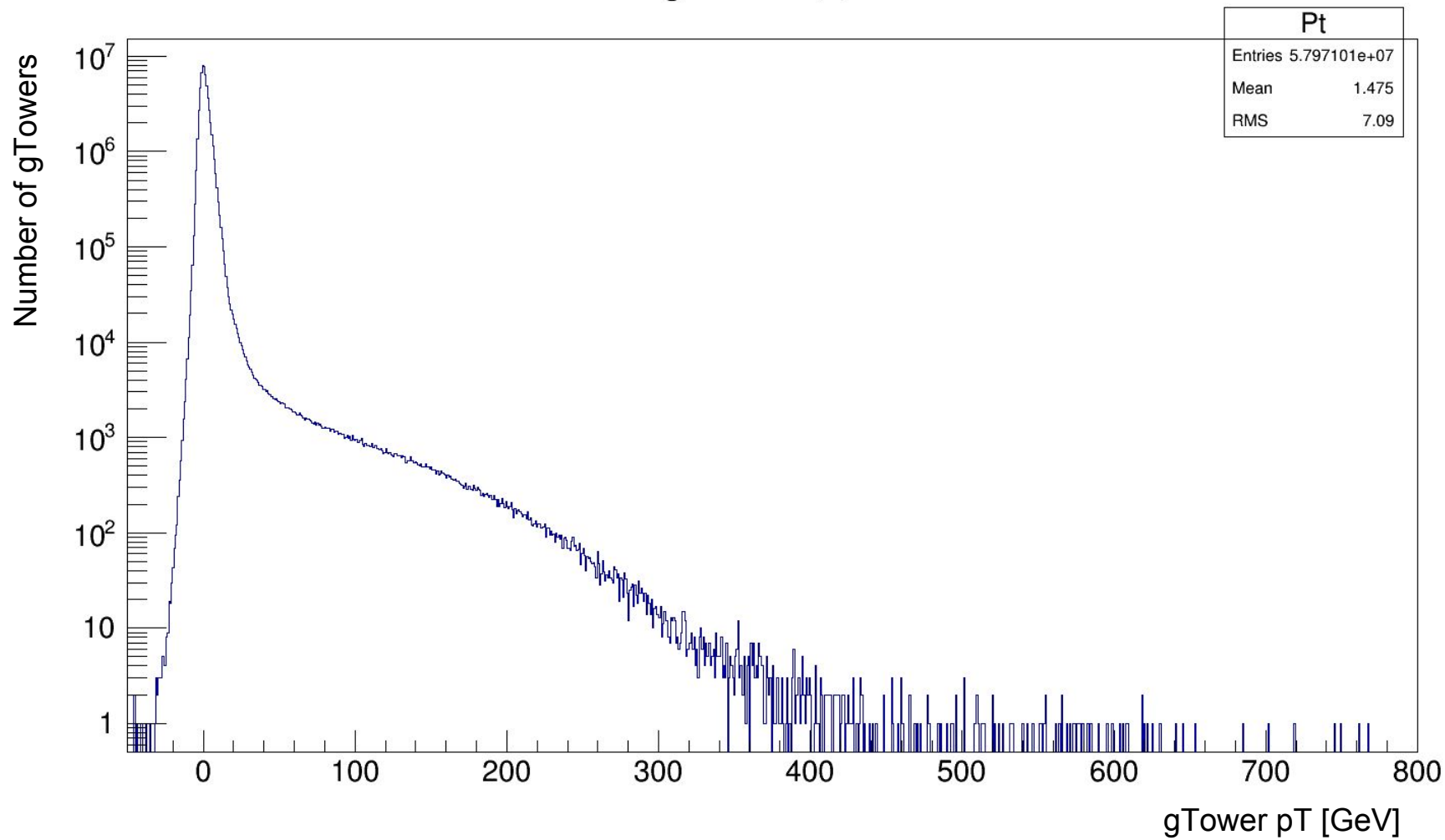


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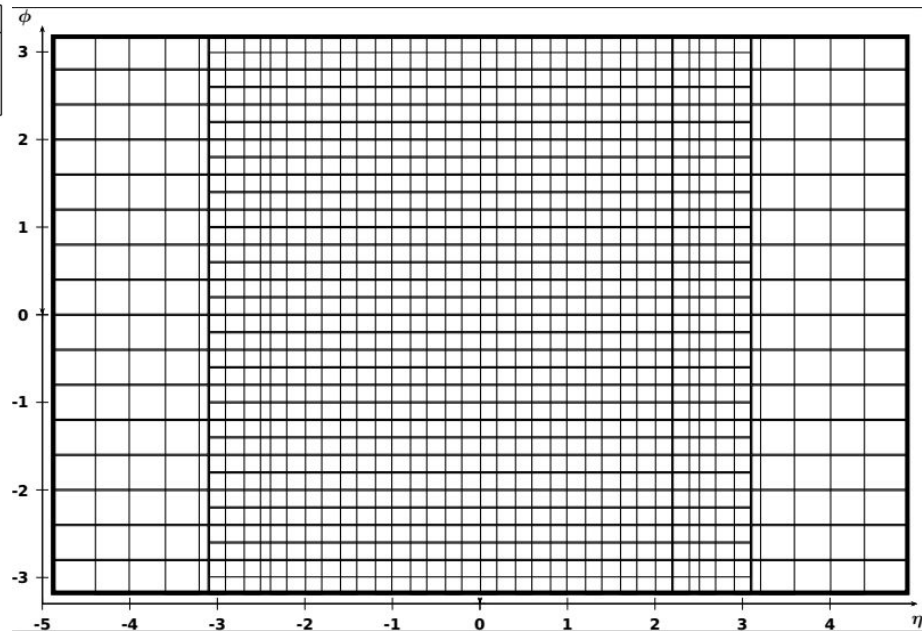
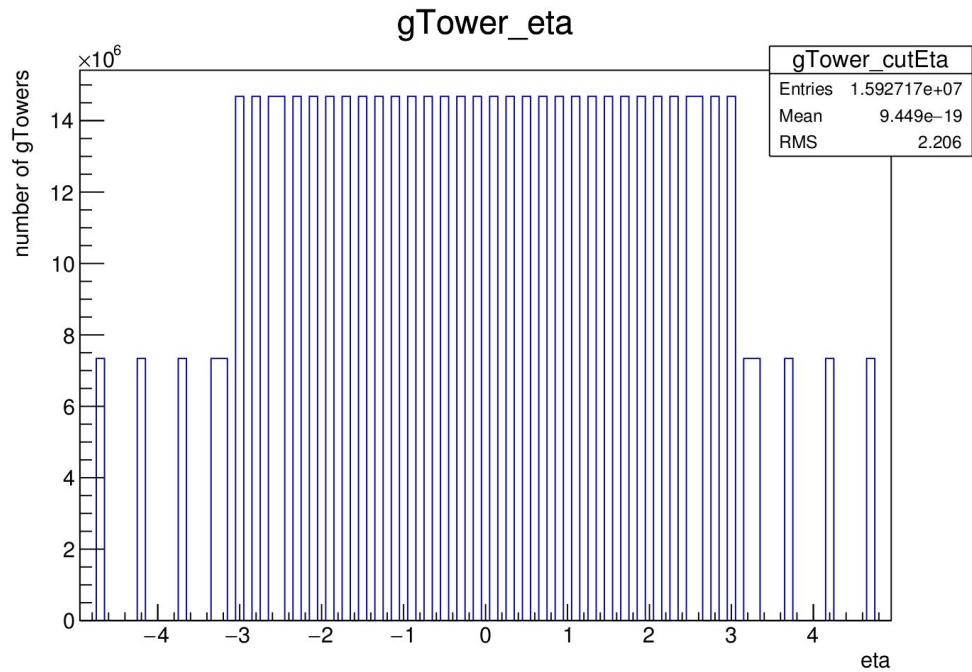
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gTowers_Pt



gTower Granularity




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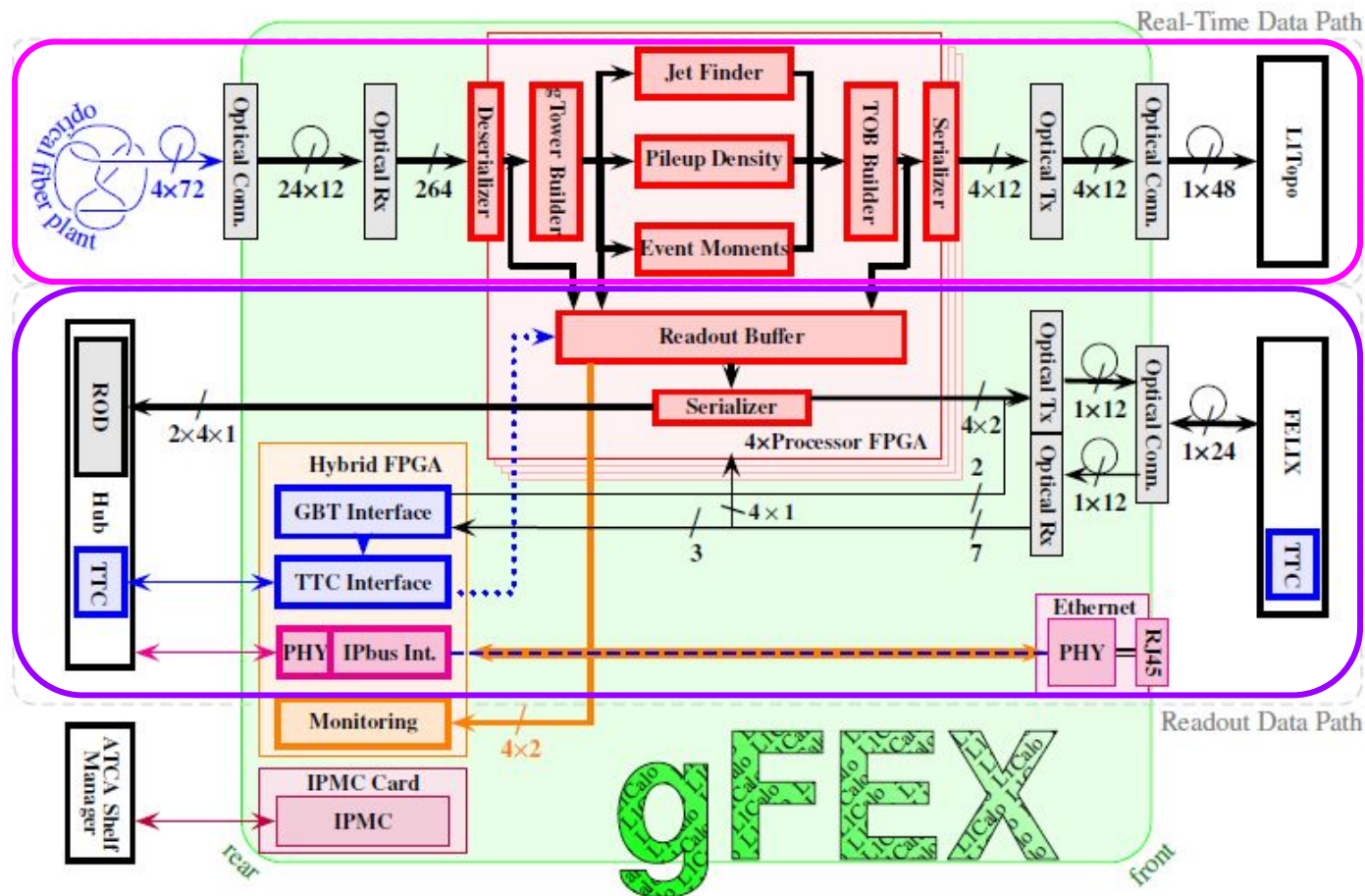



Figure 3 A block diagram of the gFEX module. Shown are the real-time (to L1Topo) and readout data paths (to Hub/ROD and FELIX).

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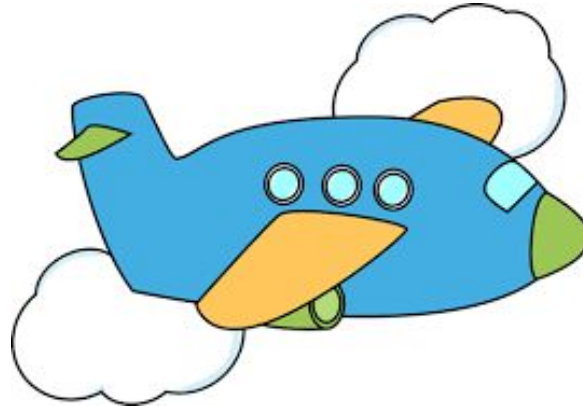


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Finding Large Radius Jets !!!



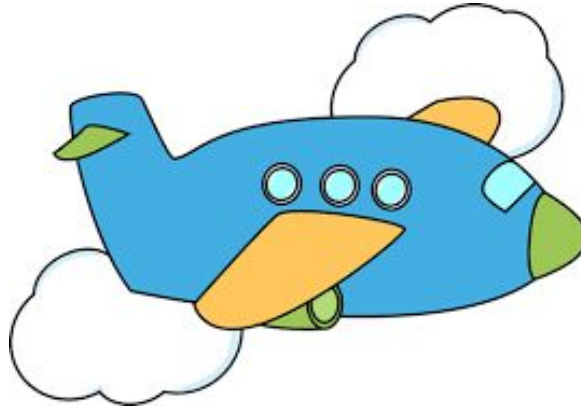
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- **Lorentz boosted Higgs, W, & Z bosons, top quarks, etc.**



My Job - Efficiency Studies

- ❖ 1. Explore expected efficiency of gFEX



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gFEX Timeline

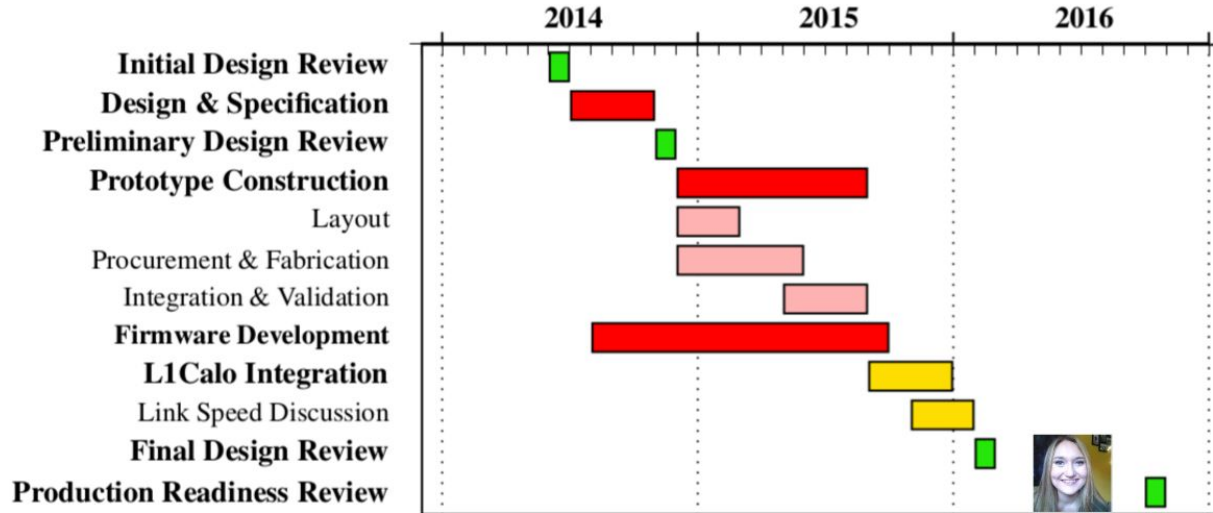


Figure 22 GANTT chart for the construction of the prototype gFEX module.



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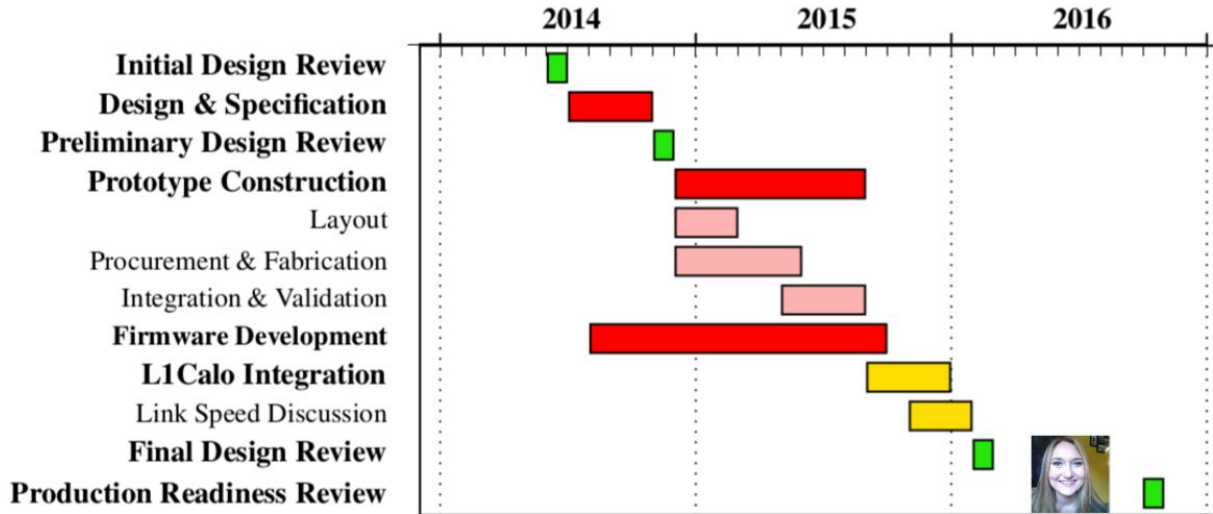


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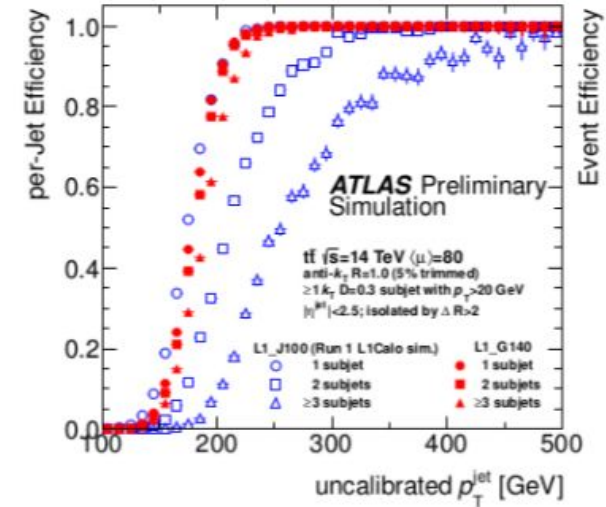


Figure 6 Trigger efficiency turn-on curves comparing the gFEX $R = 1.0$ jet trigger to the Run 1 style L1_J100 and L1_HT200 jet triggers (both expected to be unprescaled in Run 2). All samples use the $\langle \mu \rangle = 80$ Upgrade Monte Carlo simulation. The left two plots are for $t\bar{t}$ while the right plot is $WH \rightarrow t\bar{t}b\bar{b}$. The left plot shows the efficiency per “isolated” jet binned in the number of subjects identified offline, while the right two plots display the event-level trigger efficiency. The first 12 bunches from each bunch train were removed prior to analysis in correspondence with the TDAQ TDR [2].



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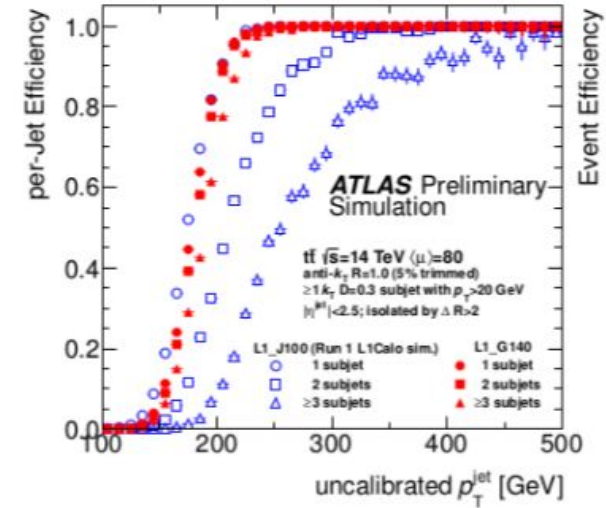


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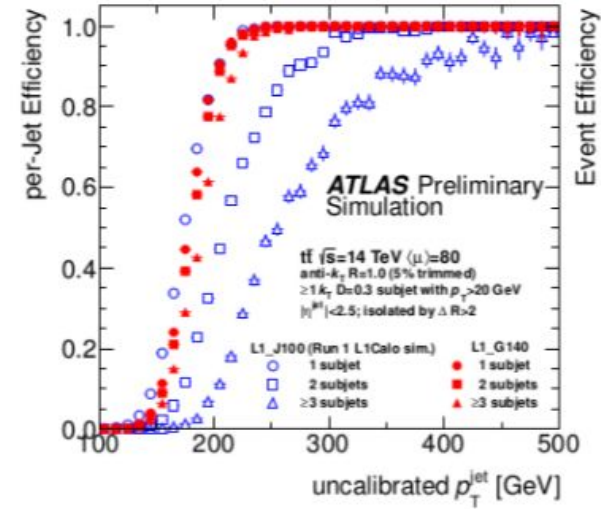


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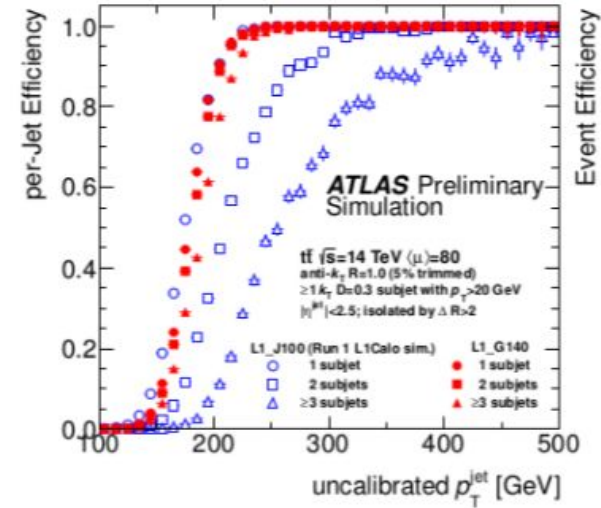


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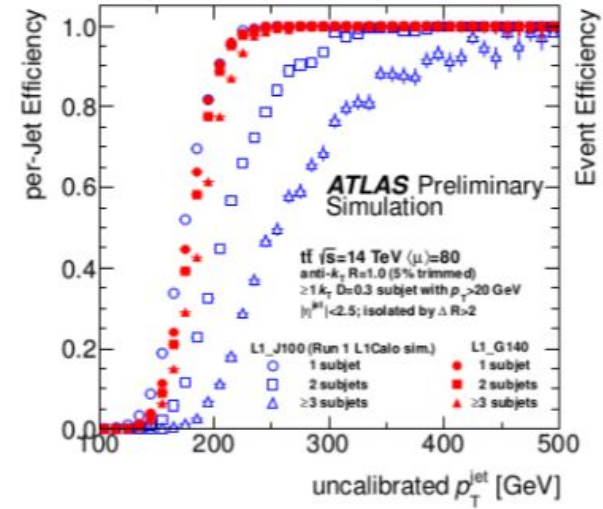


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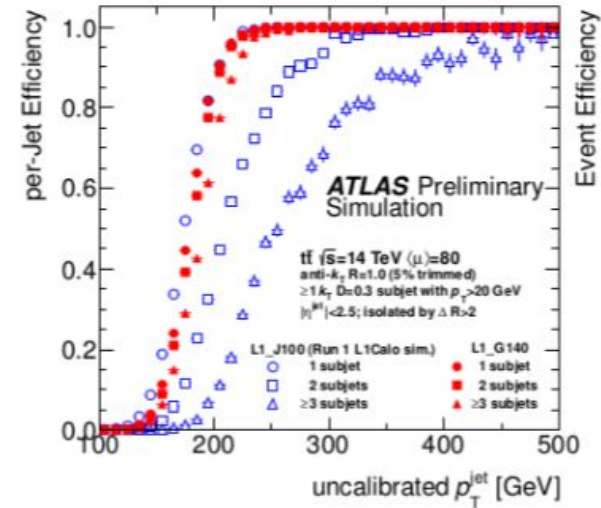


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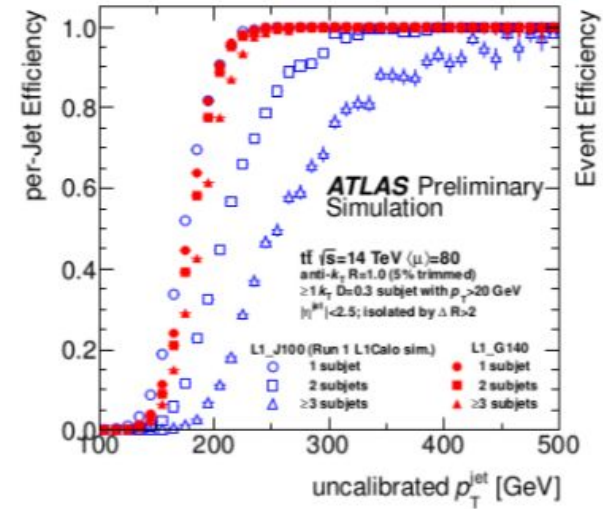


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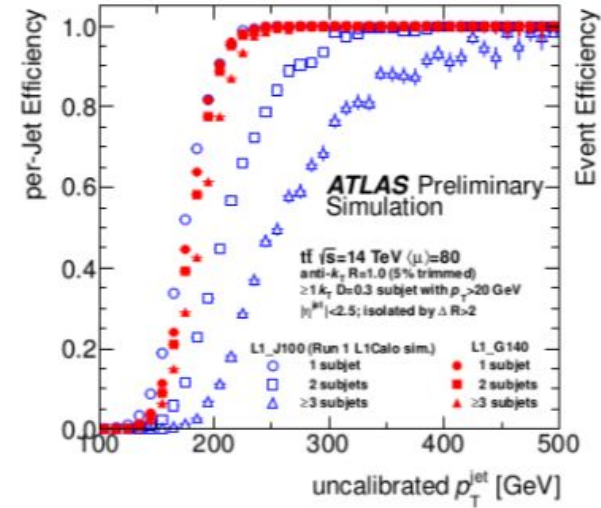


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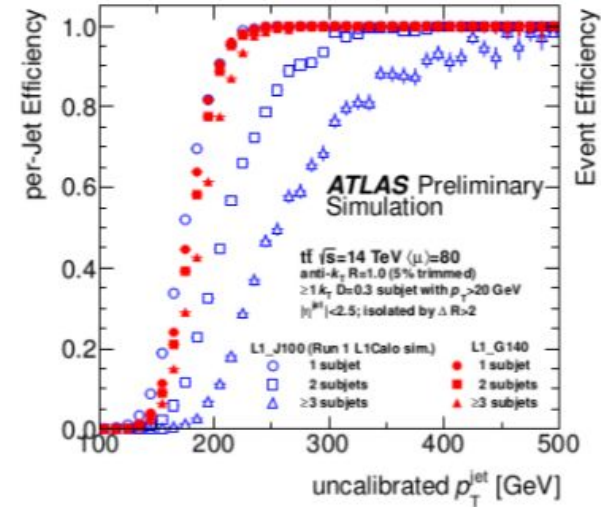


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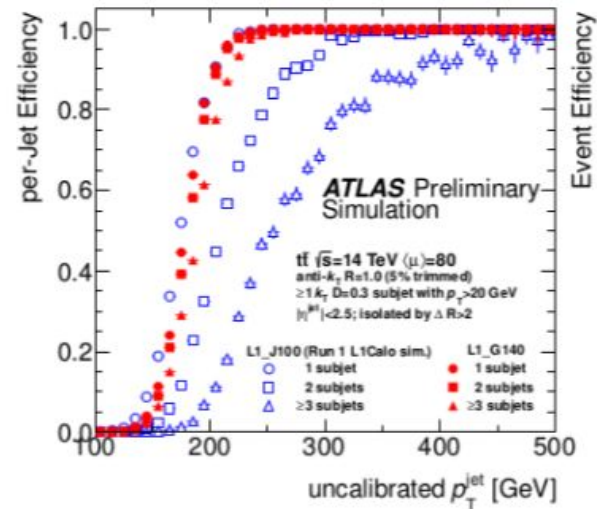


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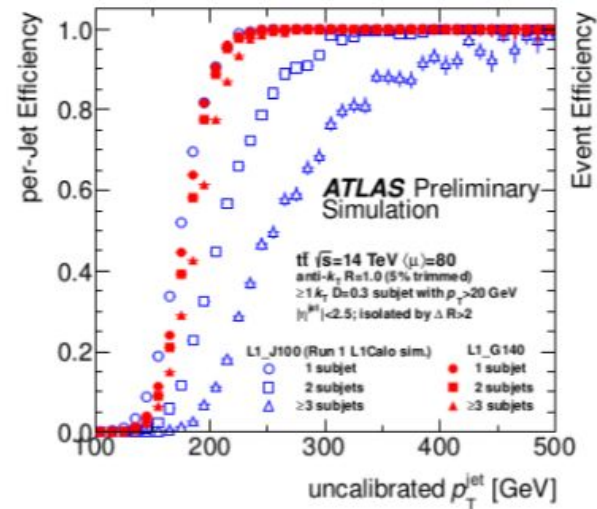


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 - Can jets within an event overlap/share gTowers?

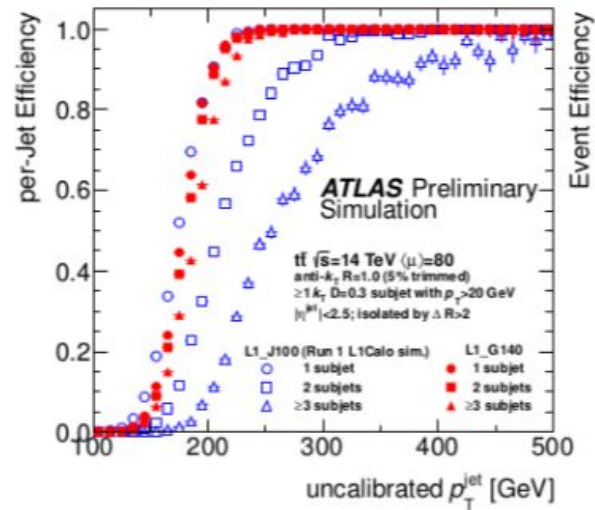


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Seeded Simple-Cone Jet Algorithm

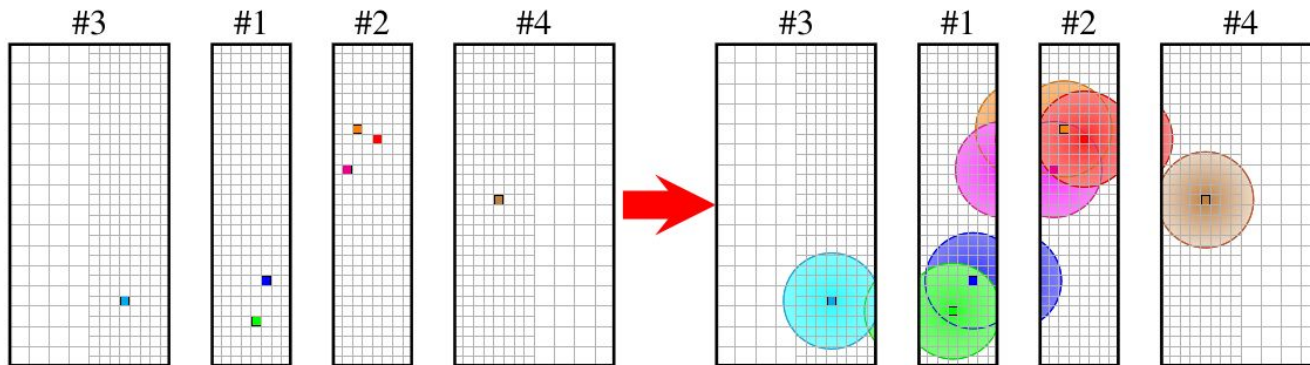


Figure 4 Left: Seeding step for identifying large- R jets by selecting towers over a threshold E_T value. Right: Summing the energy around the seeds within $\Delta R \lesssim 1.0$.

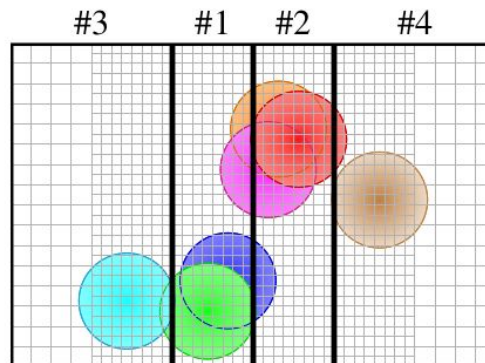
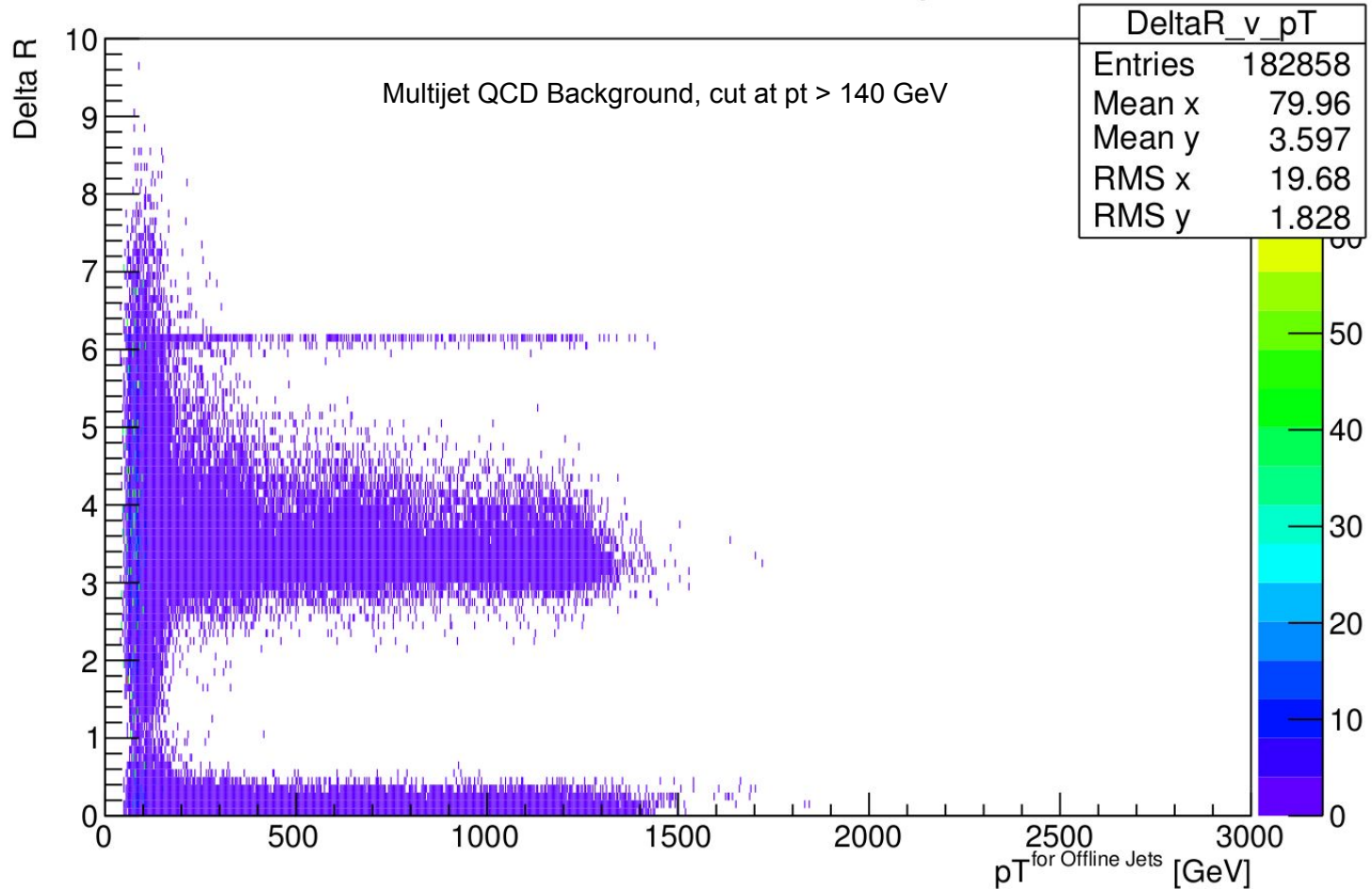
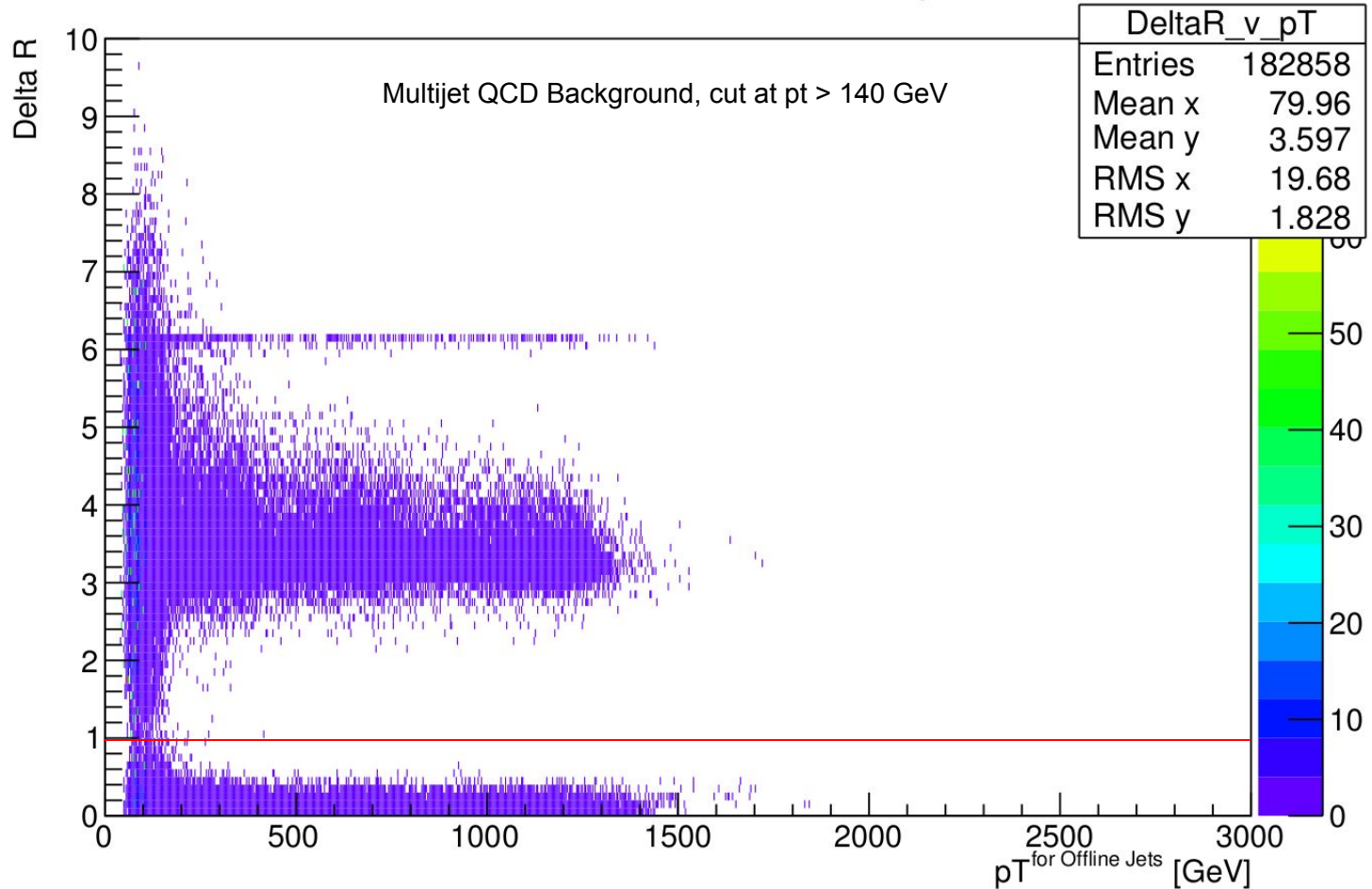


Figure 5 The final large- R jets. Each jet is stored on the Processor FPGA that produced the seed.

DeltaR versus Offline Jet pT

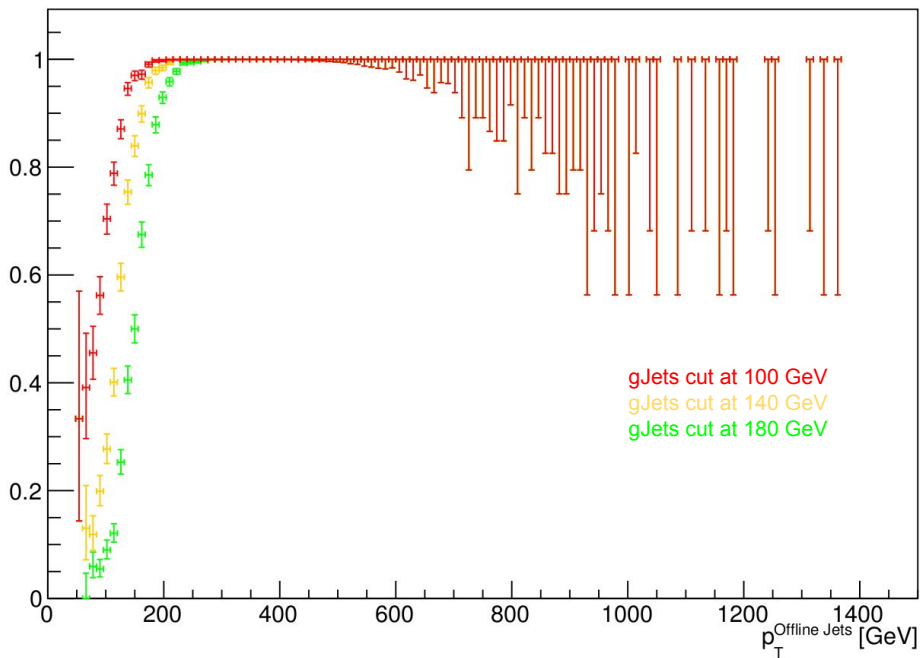


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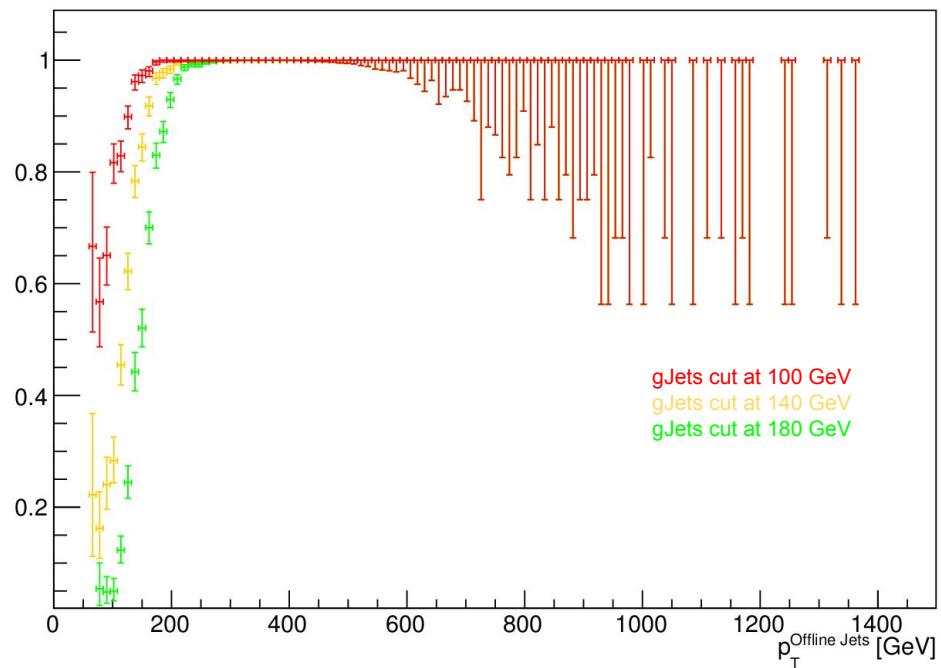


Preliminary Pileup Correction
Efficiency Plots for W' signal, mass = 800 [GeV], **all events**

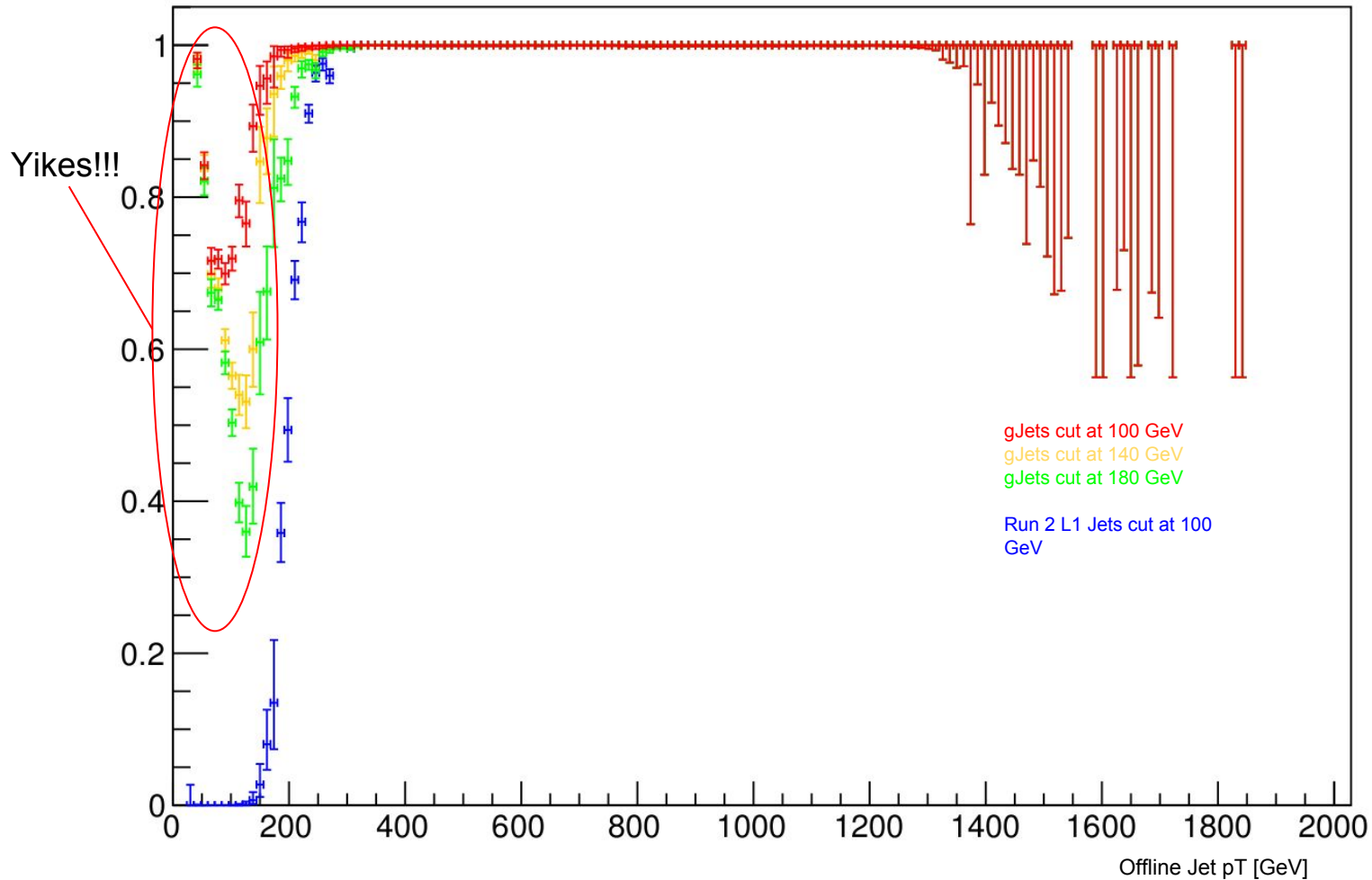
Efficiency



Efficiency with cut on deltaR < 1.0



gFEX Efficiency for Multijet QCD Background



Issues

- ❖ Something may be wrong with MC15 Samples generated for gFEX studies:



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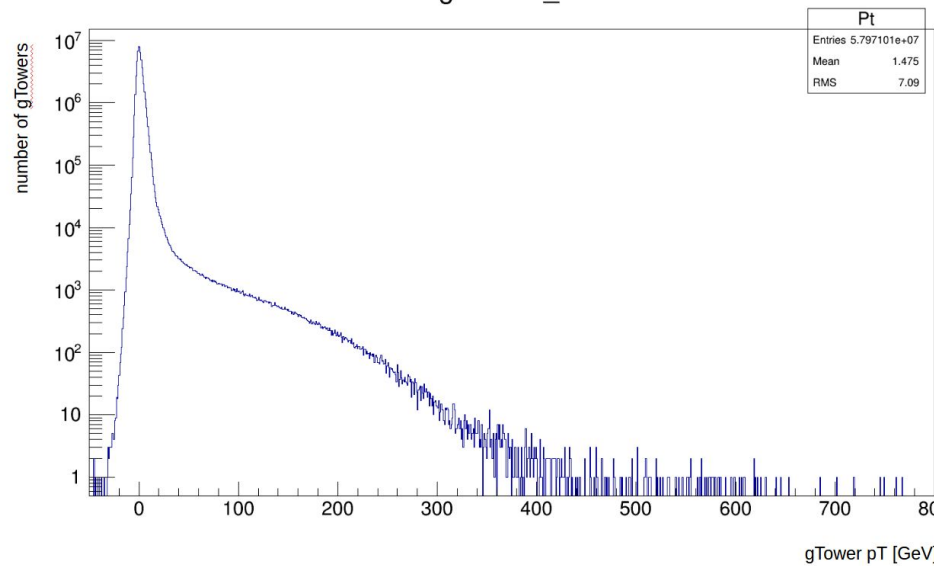
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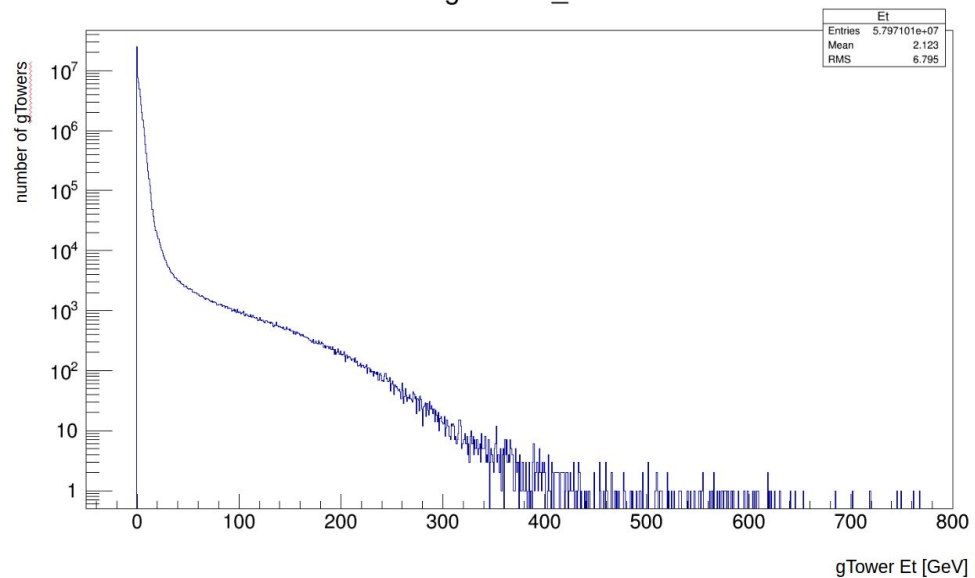
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gTowers_Pt



gTowers_Et



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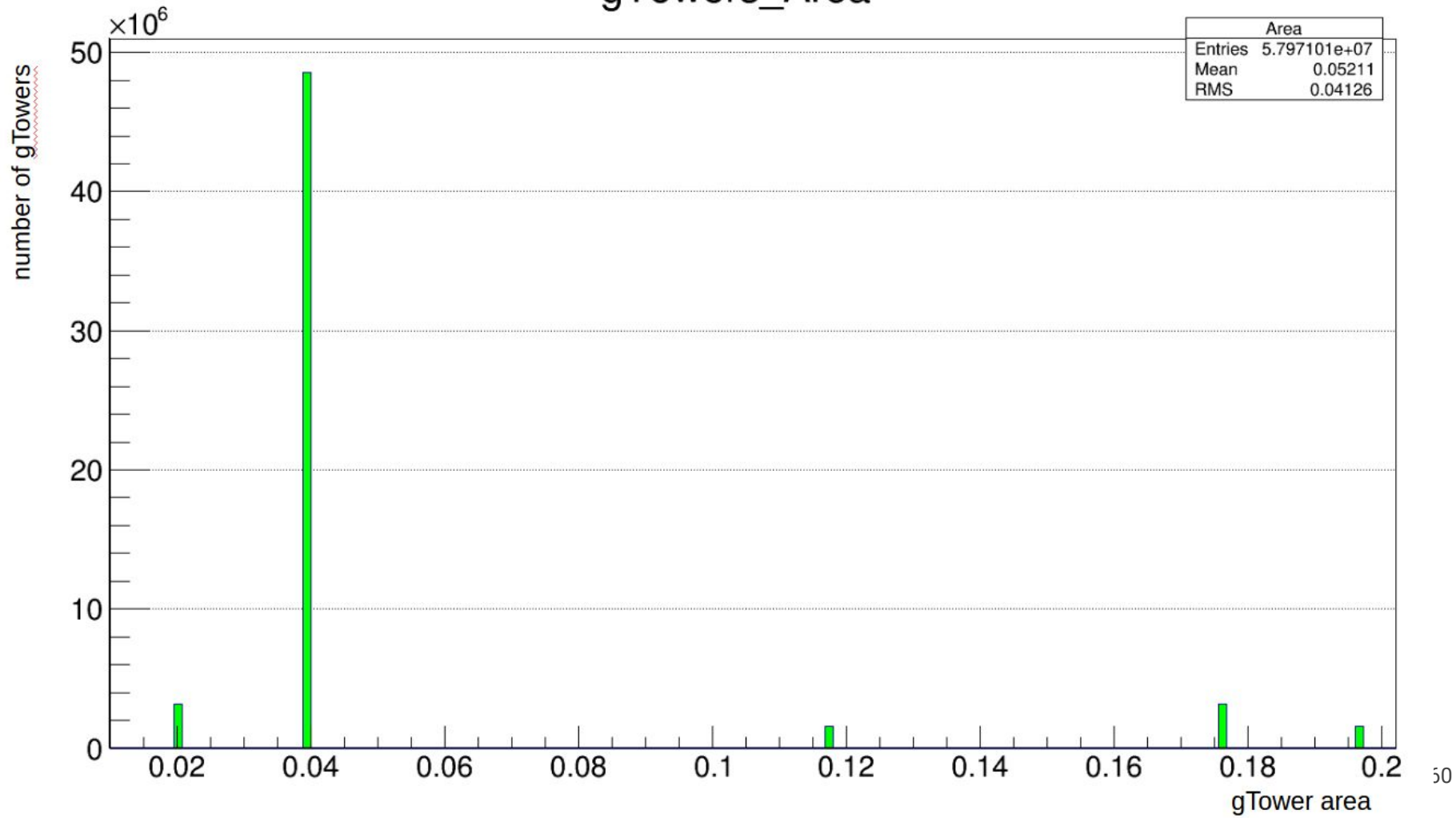
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- gTower areas are not correct



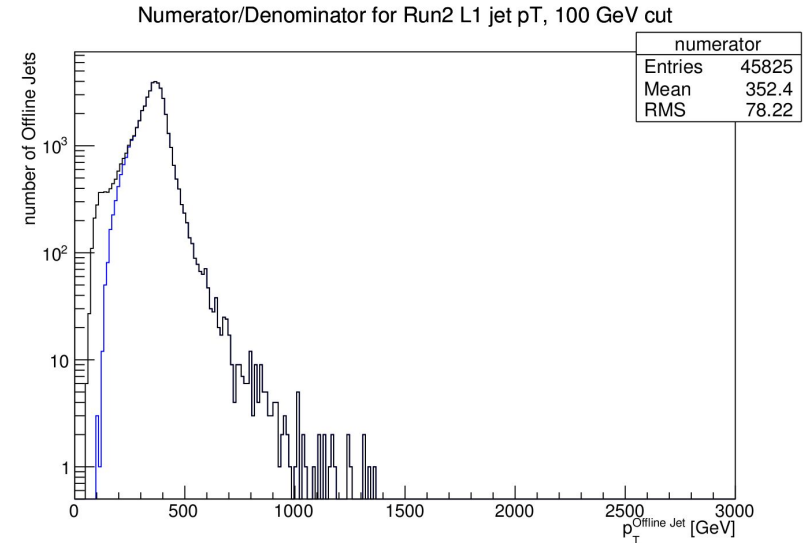
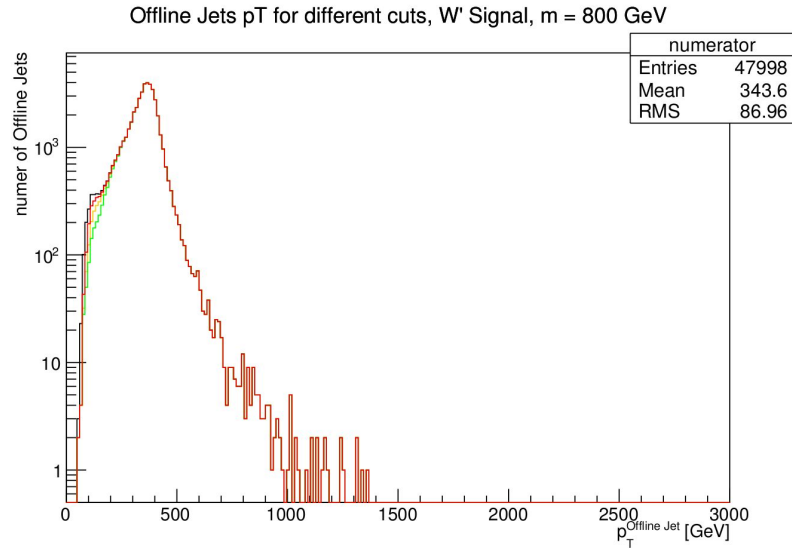
gTowers_Area



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- No big change in turn-on curves at different thresholds ???



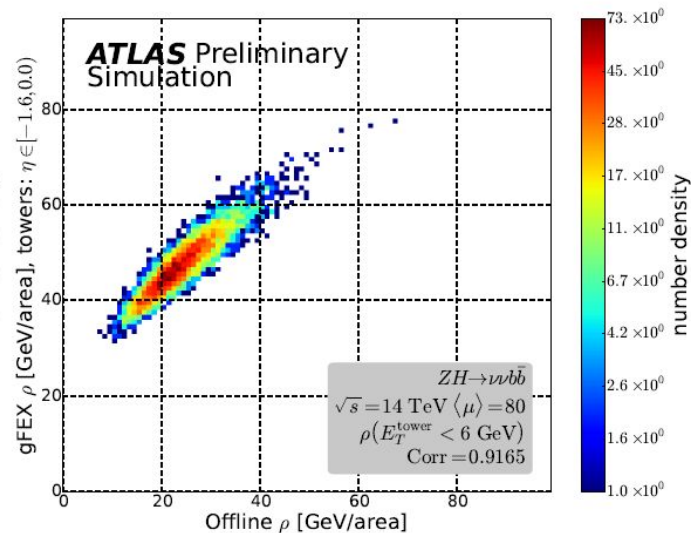
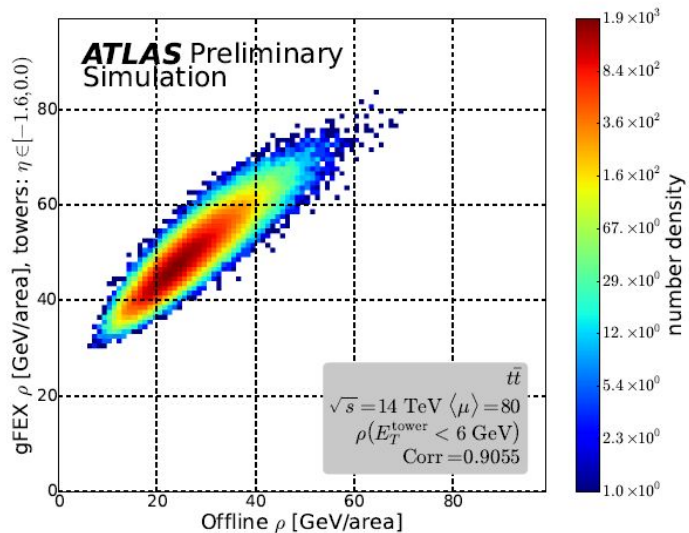
My Job - Pileup Studies

- ❖ 2. Pile-up studies (work-in-progress)



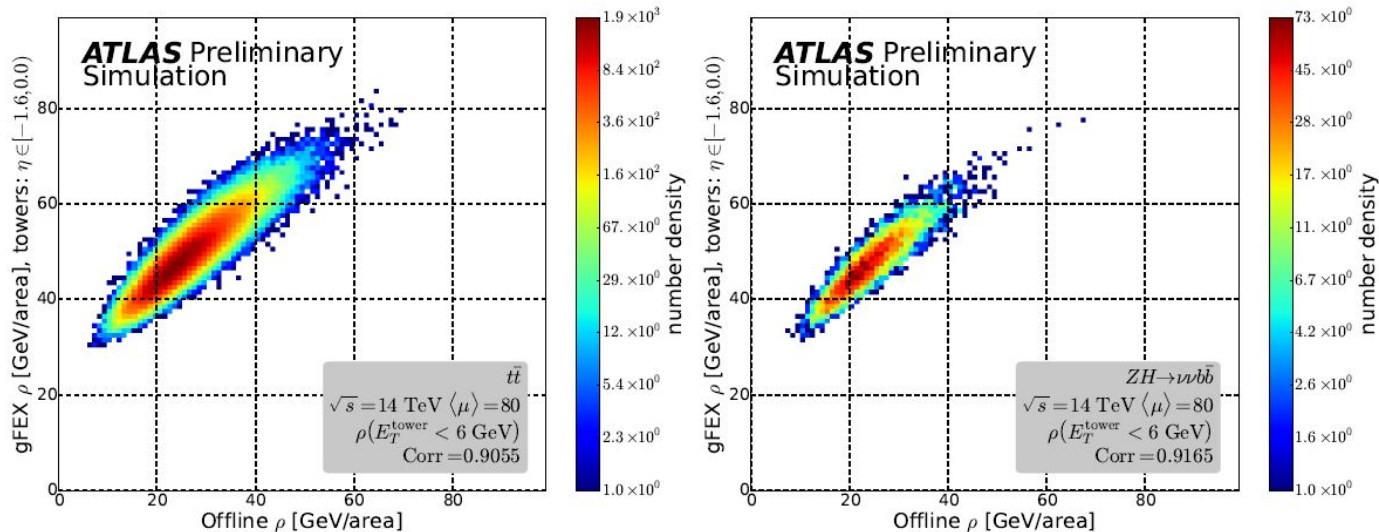
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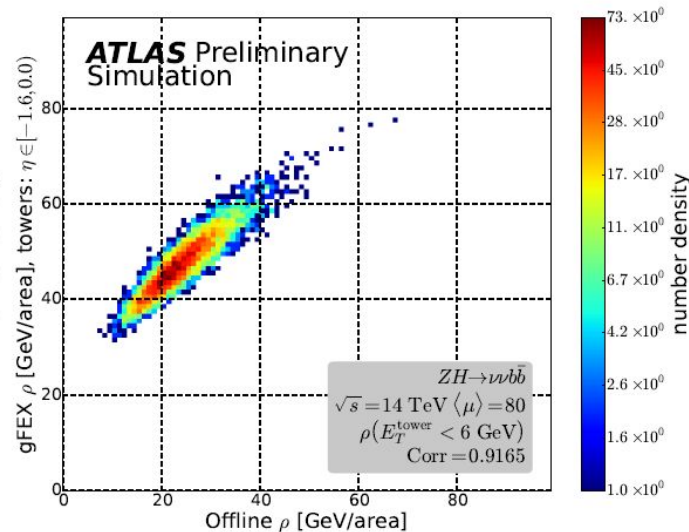
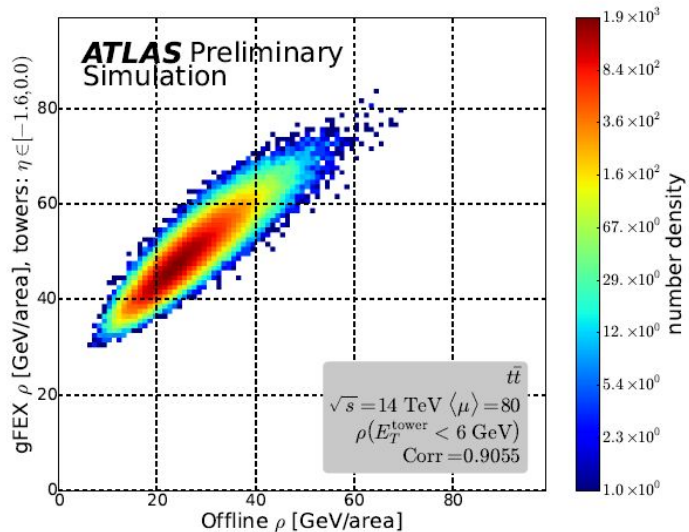


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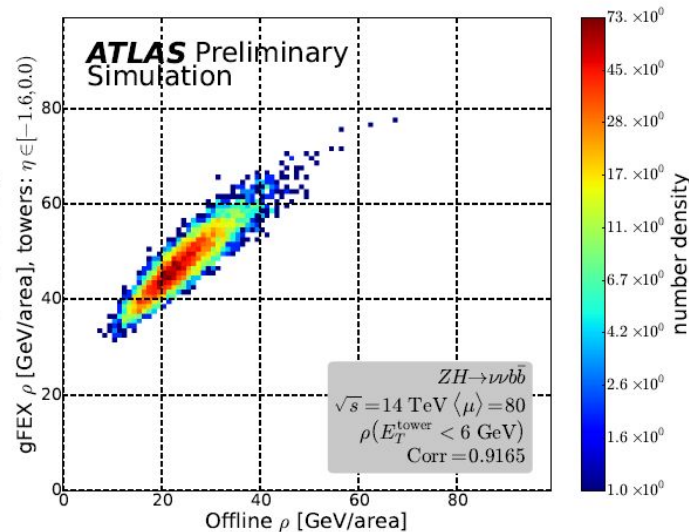
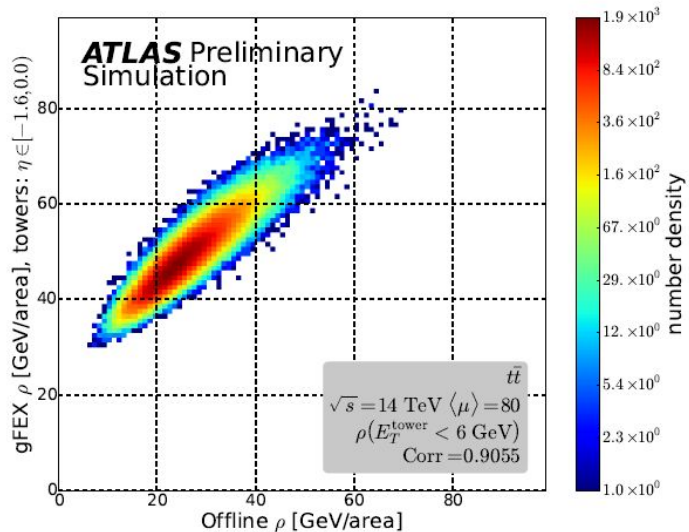
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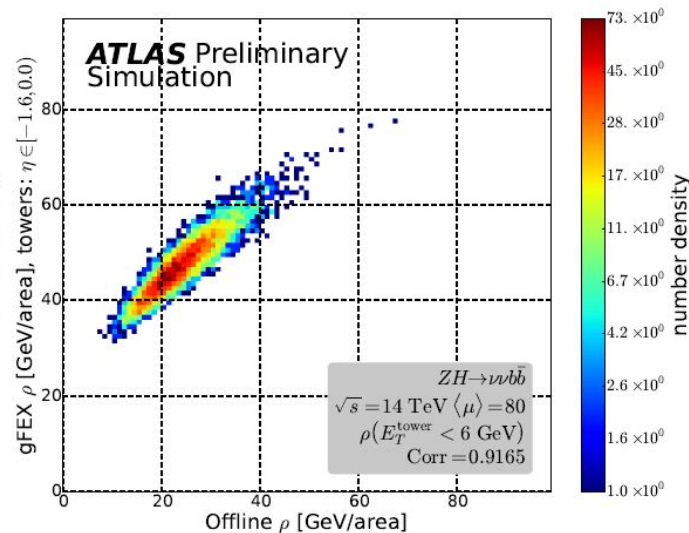
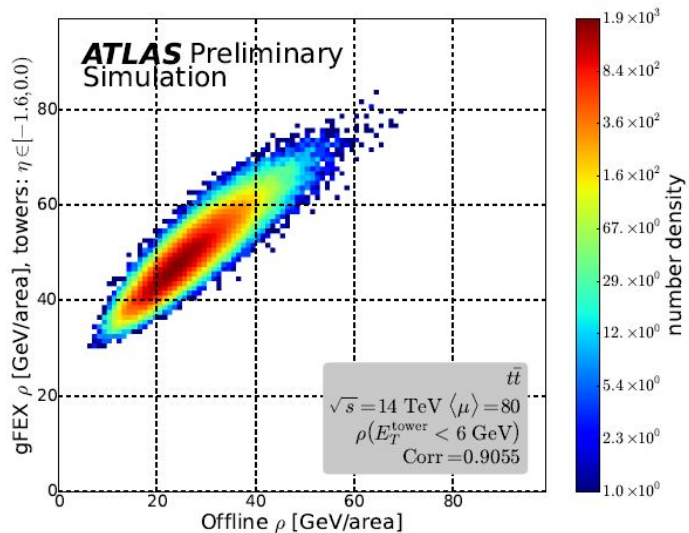
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❖ Currently not seeing much improvement :(



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 - During LS2, jFEX and eFEX will be installed, as well as upgrades to gFEX



Muchas gracias!

¿Preguntas?