L1 Jet Energy Corrections: Early 2018 results and comparisons to 2017

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23rd April, 2018

Motivational overview

◎ To compensate for various losses (p_{T}, η) when recording jet properties in the trigger, and ensure its performance is uniform across the detector

◎ Done by matching reference jets (GenJets) to L1 jets

◎ Use sample in particular pileup (PU) range, bin in $\left|\eta^{\mathrm{L1}}\right|$, then plot graphs of 1/response against p_{T}^{L1}, with response = $< p_{\mathrm{T}}^{\mathrm{L1}} / p_{\mathrm{T}}^{\mathrm{ref.}} >$

◎ Fit a function to each curve which becomes a “correction curve”

◎ Export the calibrations as LUTs

◎ Perform closure test to check calibrations

Matching logic

◎ Minimum GenJet momentum is $p_{\mathrm{T,\,min.}}^{\mathrm{ref.}} = 10$ GeV

◎ Each L1 jet inspected in descending p_{T}, and GenJet with $\Delta R < 0.25$ is searched for and matched to it. Multiple potential matches use jet with smallest ΔR

◎ Once matched, reference jet is removed from matching collection and move on to next L1 jet

◎ GenJets aren't fully propagated in the magnetic field, so their η is at the Primary Vertex

Software overview

◎ 2017:

- CMSSW version – 9.0.0.pre2 (most recent calibrations that are in firmware)
- Calo params – caloStage2Params_2017_v1_4_inconsistent
- Dataset – /QCD_Pt-15to3000_TuneCUETP8M1_Flat_13TeV_pythia8/RunIISpring16DR80-FlatPU20to70HcalNZSRAW_withHLT_80X_mcRun2_asymptotic_v14-v1/GEN-SIM-RAW

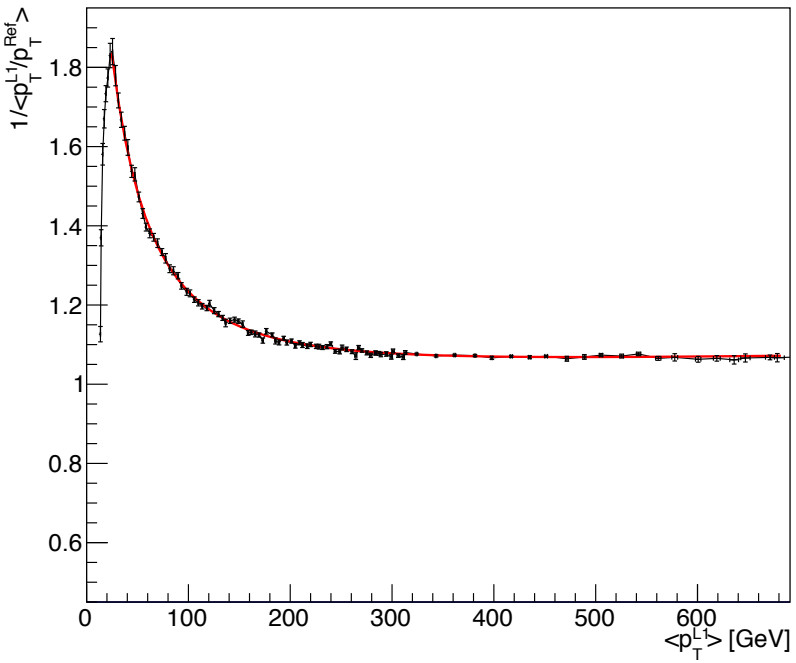
◎ 2018:

- CMSSW version – 10.0.3 (CRAB issue in 10.1.0)
- Calo params – **caloParams_2018_v1_1_inconsistent** + ECAL ZS params **caloParams_2018_v1_1_ECALZS_inconsistent** for extra study
- Dataset – /QCD_Pt-15to3000_TuneCP5_Flat_13TeV_pythia8/RunIISpring18DRNZSPU0to70_100X_upgrade2018_realistic_v10-v1/GEN-SIM-RAW

Correction curve examples

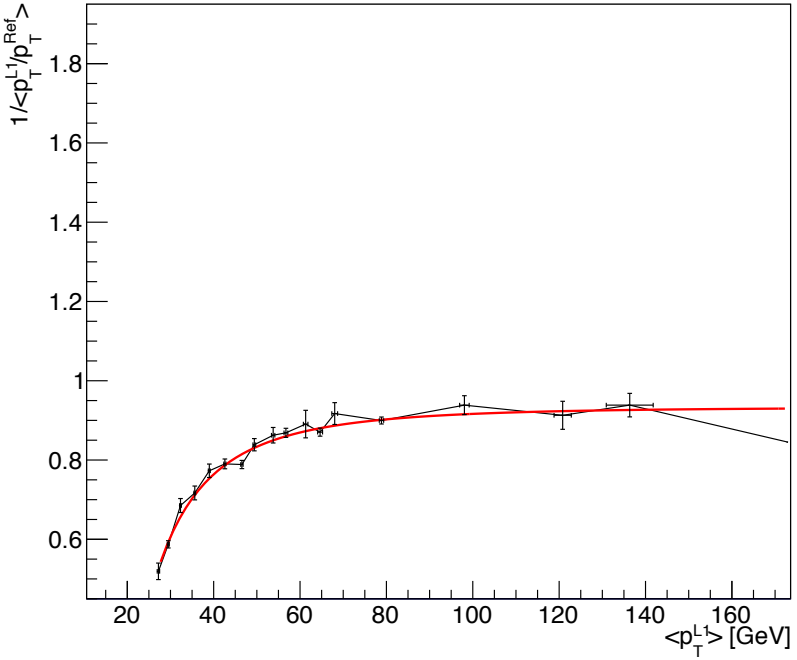
PU 50-60

$0.435 < |\eta| < 0.783$ (Barrel)



◎ At low η sharp response drop at low p_{T}which corrections fail to capture. So response plots are bad at low p_{T}

$4.191 < |\eta| < 5.191$ (HF)



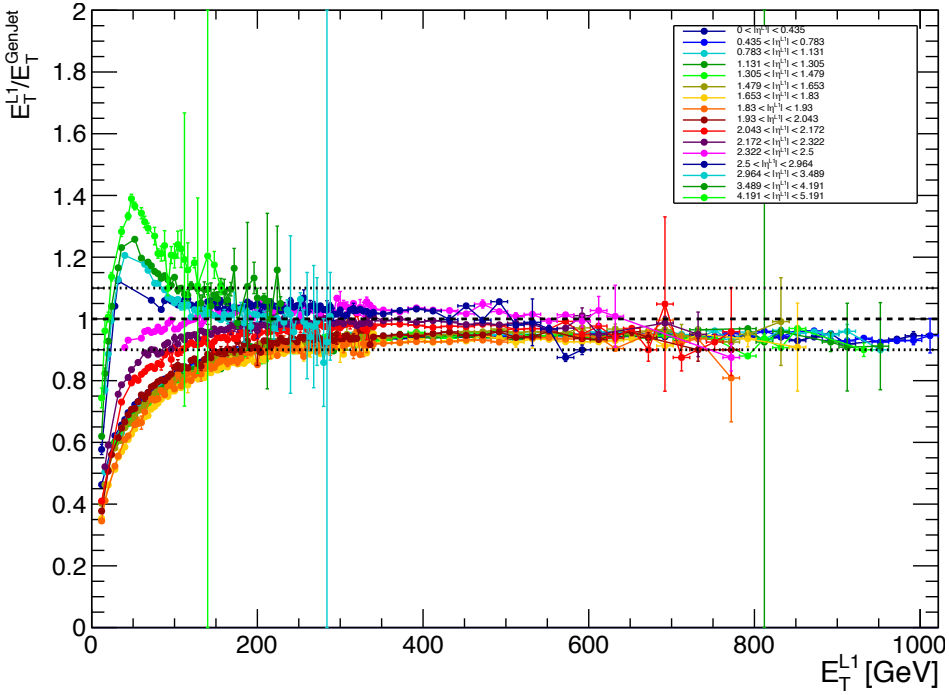
◎ At high η response drops at low p_{T} and very large error bars at high p_{T}. Makes it difficult to fit

◎ At low p_{T} outside fit limits, use the same correction as the last point for which the fit converges

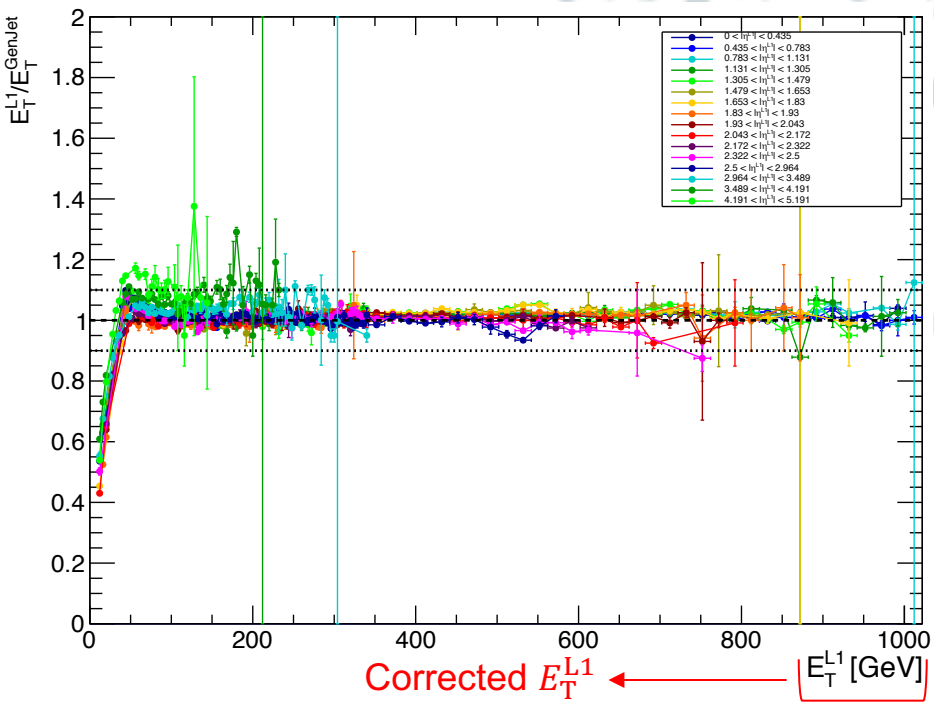
Response curves (2018)

PU 50-60

Normal params, before corrections



Normal params, after corrections



◎ Curves are pre-fit, where only matching has been performed. Only useful for comparing spread in response before and after JECs

◎ Spikes and fluctuations show difficulty in fitting for high η (low stats) and low p_T. Smoothed out as much as possible in correction curves

Binning in $|\eta|$

Eta range	iEta range
0 – 0.435	1 – 5
0.435 – 0.783	6 – 9
0.783 – 1.131	10 – 13
1.131 – 1.305	14 – 15
1.305 – 1.479	16 – 17
1.479 – 1.653	18 – 19
1.653 – 1.83	20 – 21
1.83 – 1.93	22 – 22
1.93 – 2.043	23 – 23
2.043 – 2.172	24 – 24
2.172 – 2.322	25 – 25
2.322 – 2.5	26 – 26
2.5 – 2.964	27 – 28
2.964 – 3.489	29 – 32
3.489 – 4.191	33 – 36
4.191 – 5.191	37 – 41

Barrel

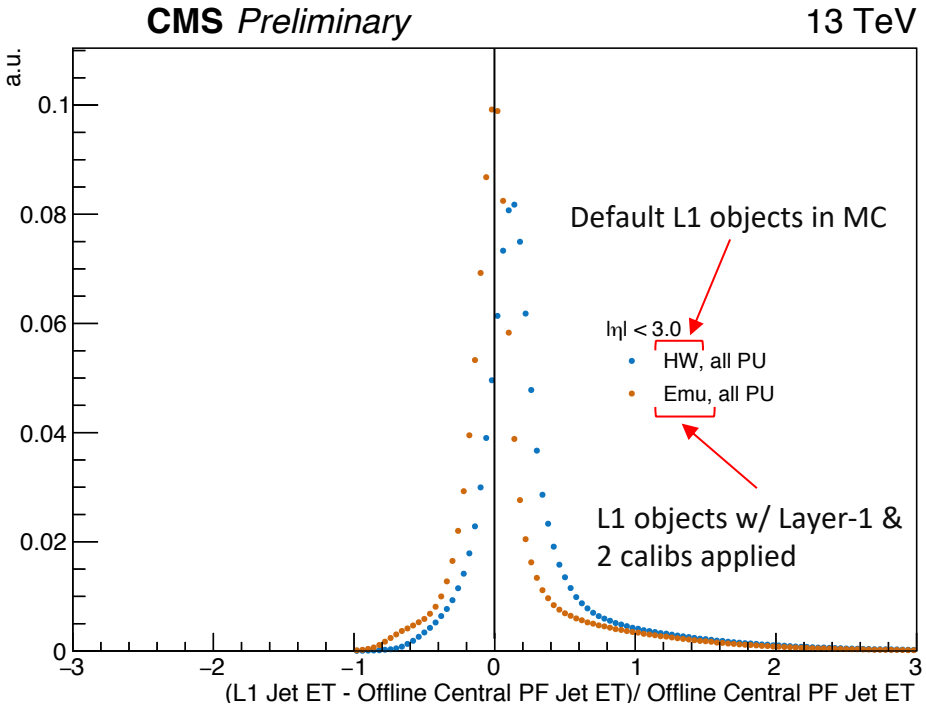
End cap

HF

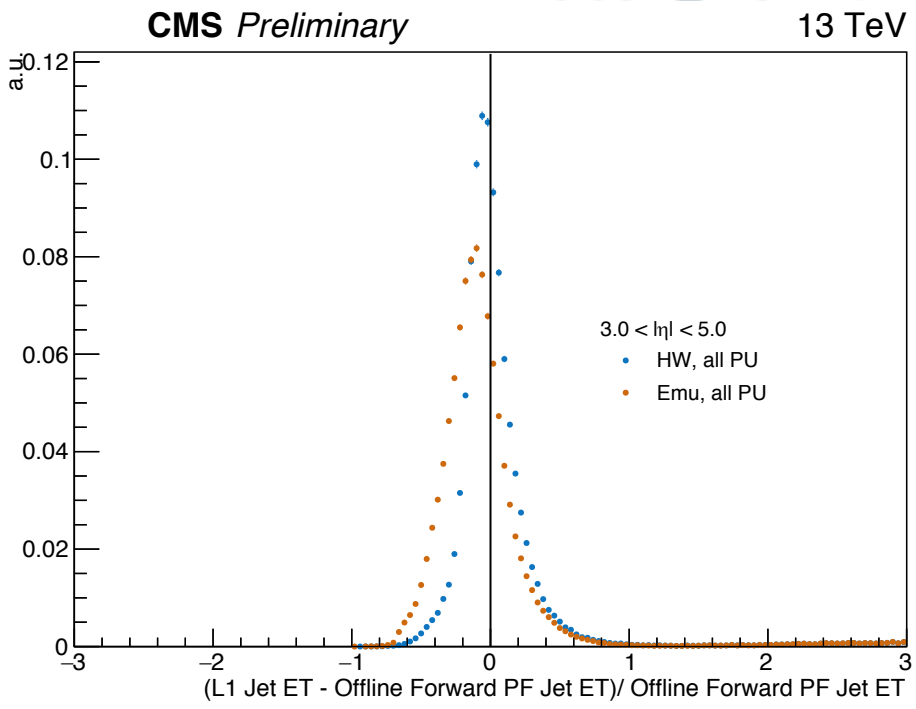
Resolution plots (2018)

*from Aaron, replace w/ GenJet plots

Barrel + end cap



HF



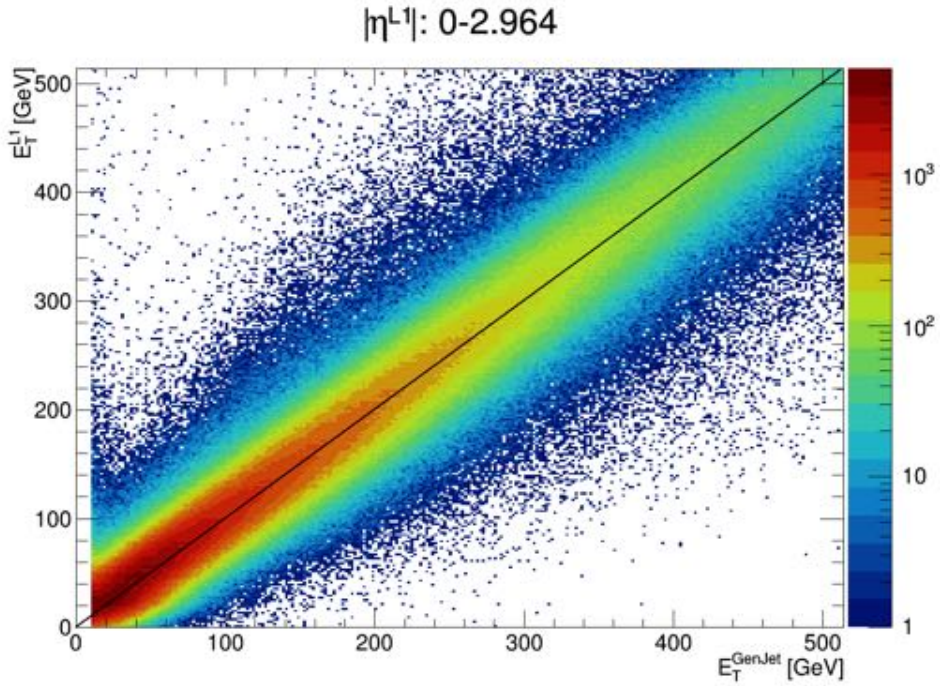
◎ Plots in central region look okay, degraded resolution for Emu in HF with new calibrations

◎ Suspected problem in HF, but Layer-2 calibrations seem fine

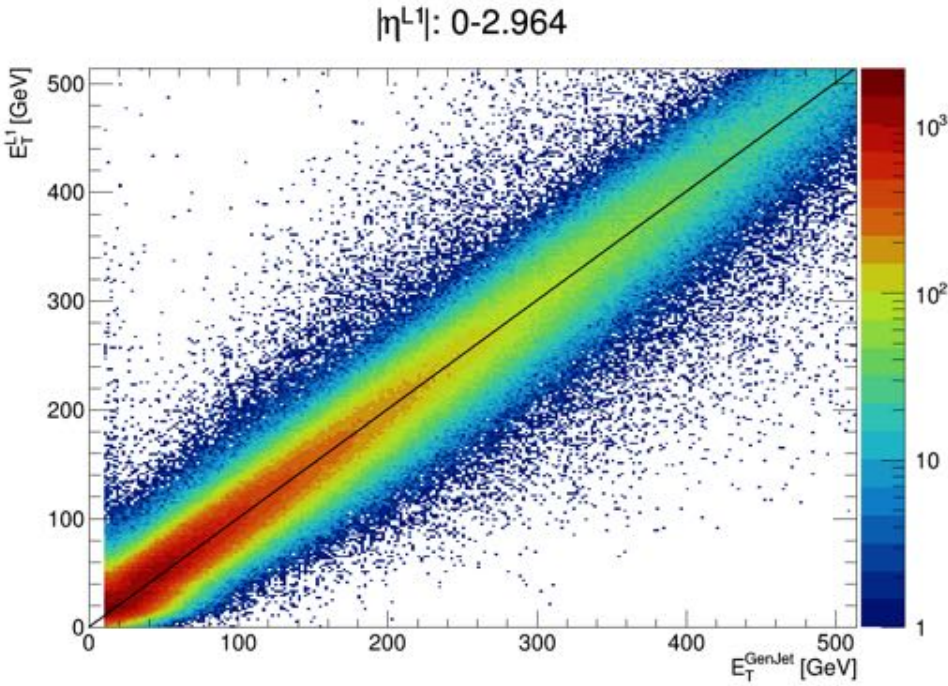
Scatter plots (2017 vs 2018)

PU 50-60

2017



2018, normal params



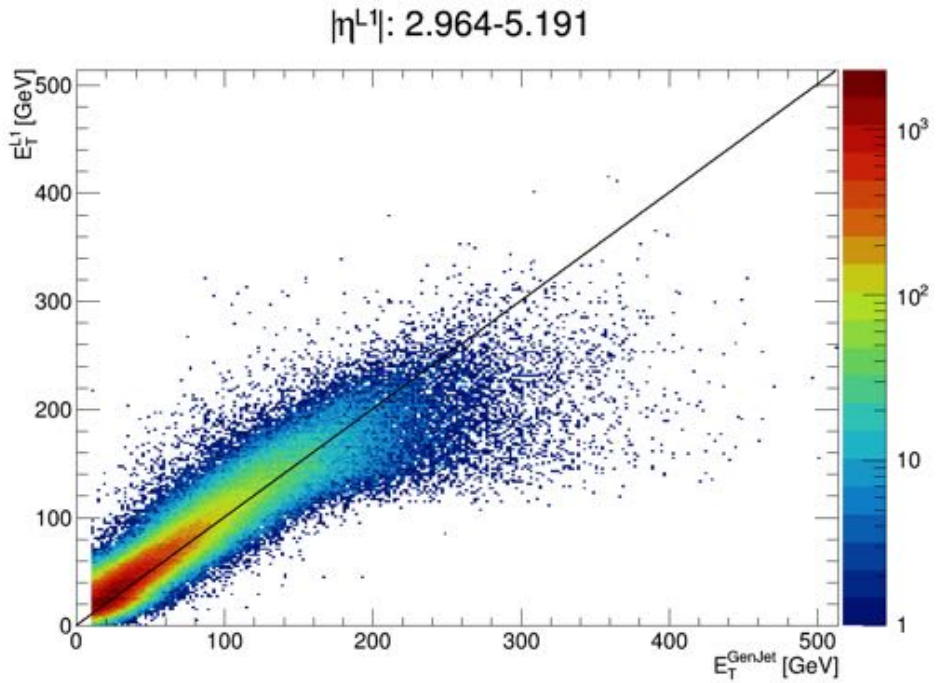
After corrections. Entire BE

◎ Scale is slightly different in each plot because 2017 dataset contained 10M events, while 2018 dataset contained 5M

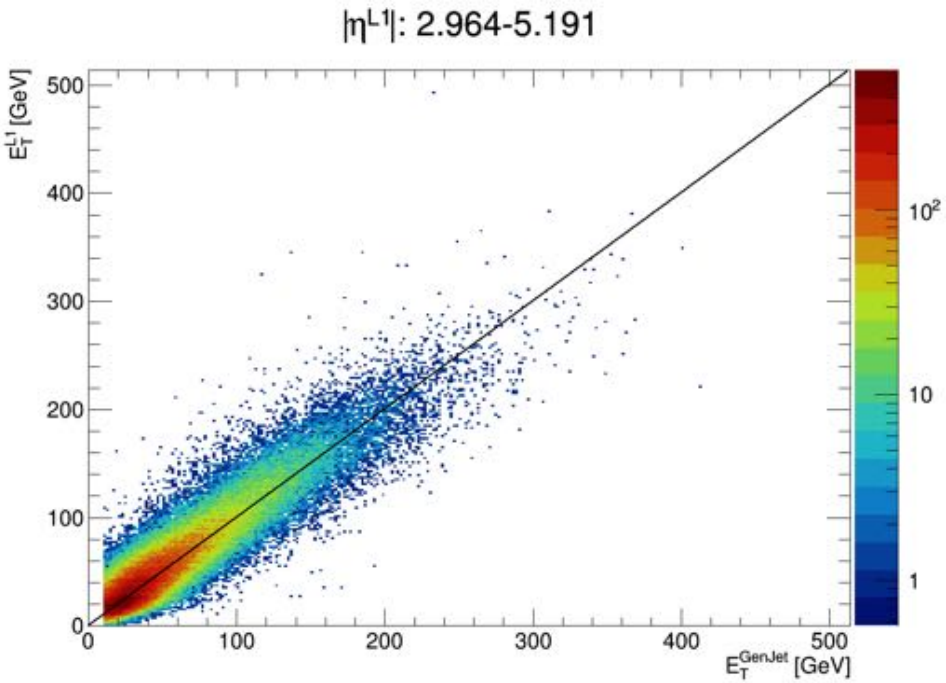
Scatter plots (2017 vs 2018)

PU 50-60

2017



2018, normal params



After corrections. Entire HF

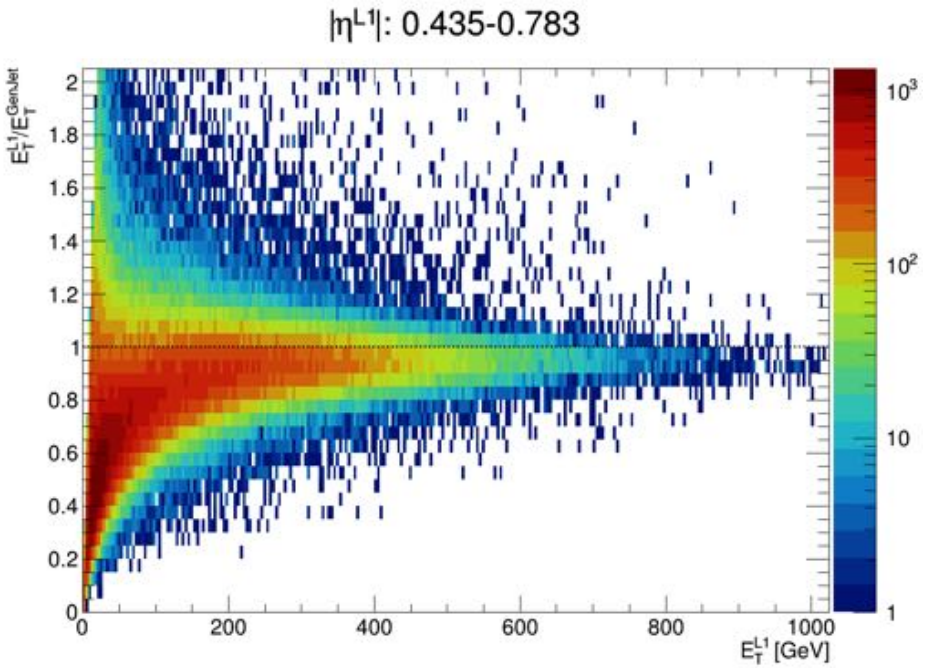
◎ Plateau in 2017 plot due to TT saturation of 128 GeV in HF. These jets are now given a maximum p_T of 1024 GeV

Backup

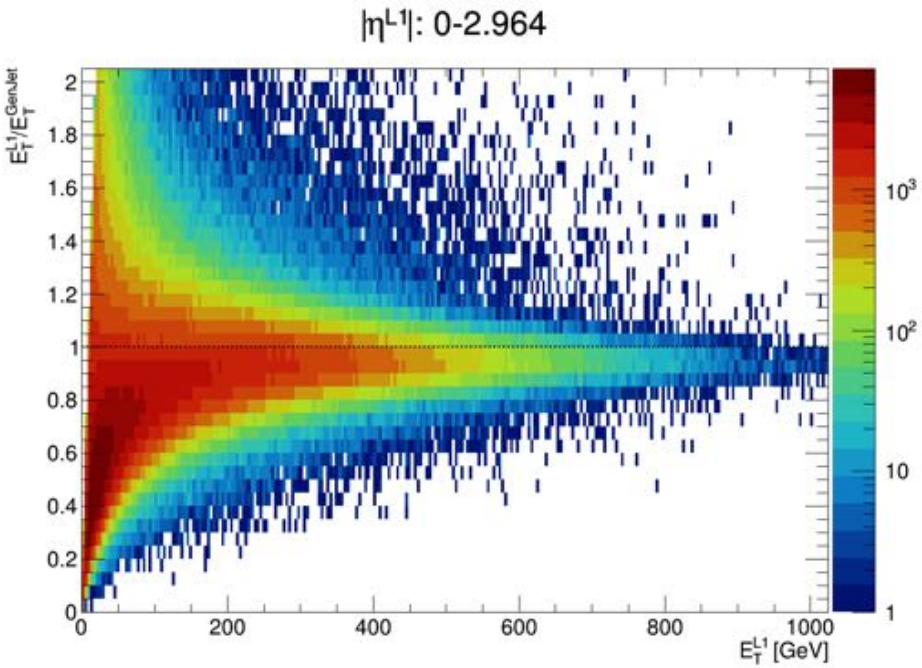
Absolute response plots (2018)

PU 50-60

Single bin in Barrel



Entire BE



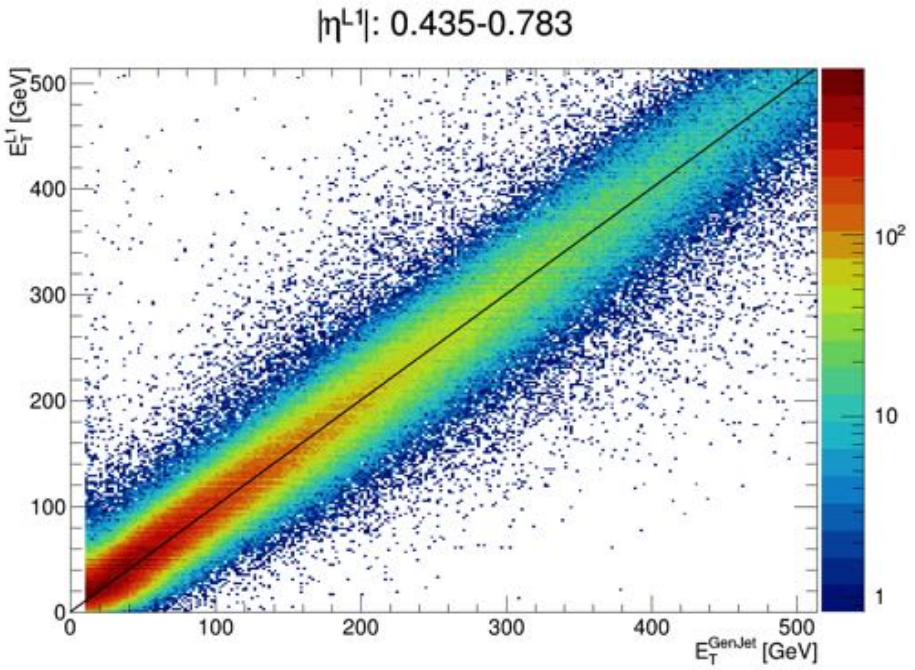
Normal params, before corrections

◎ Highlights spread in response at low p_T

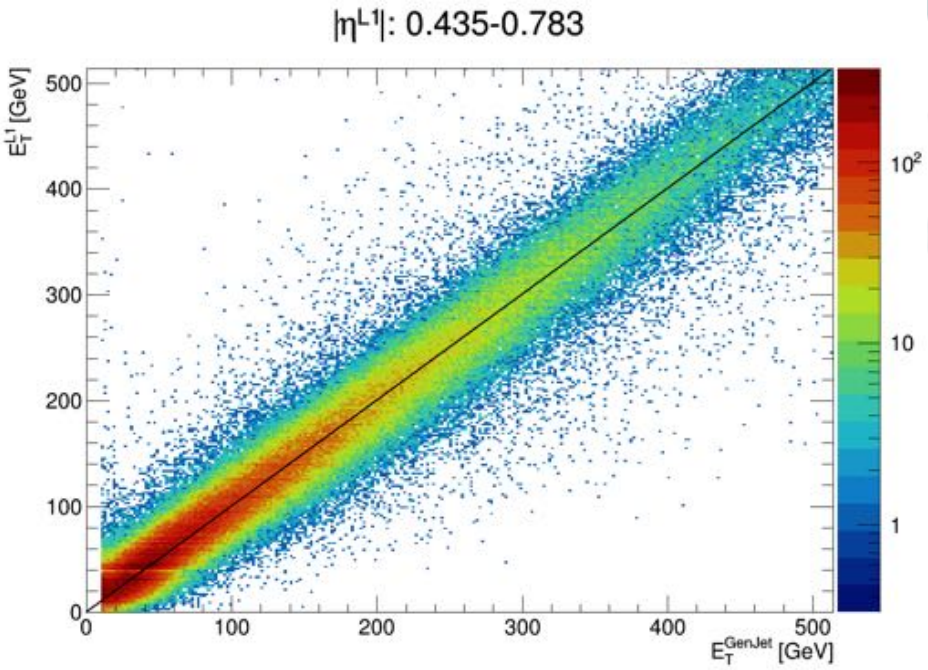
Scatter plots (2017 vs 2018)

PU 50-60

2017



2018, normal params

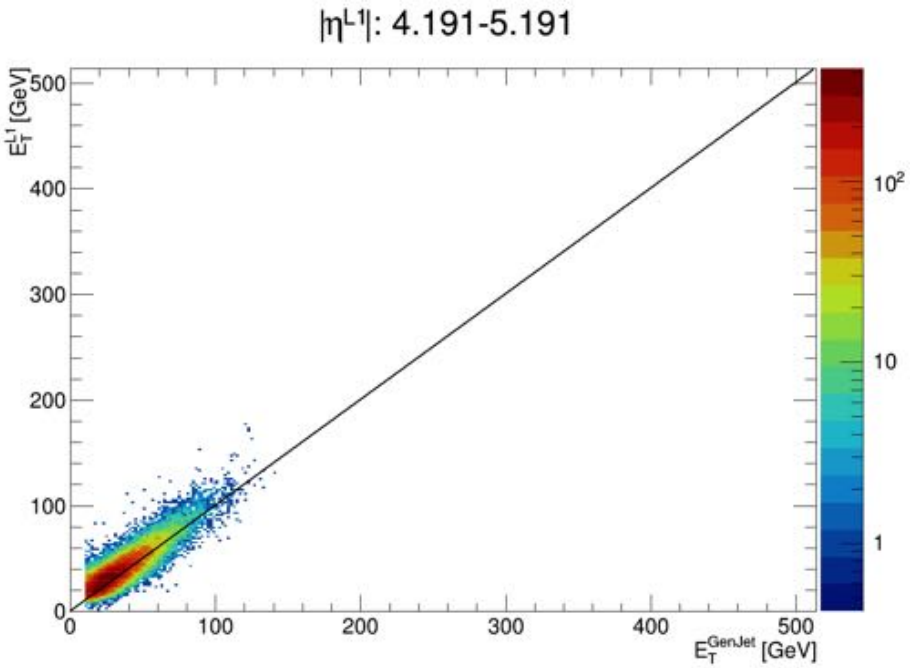


Single bin in Barrel

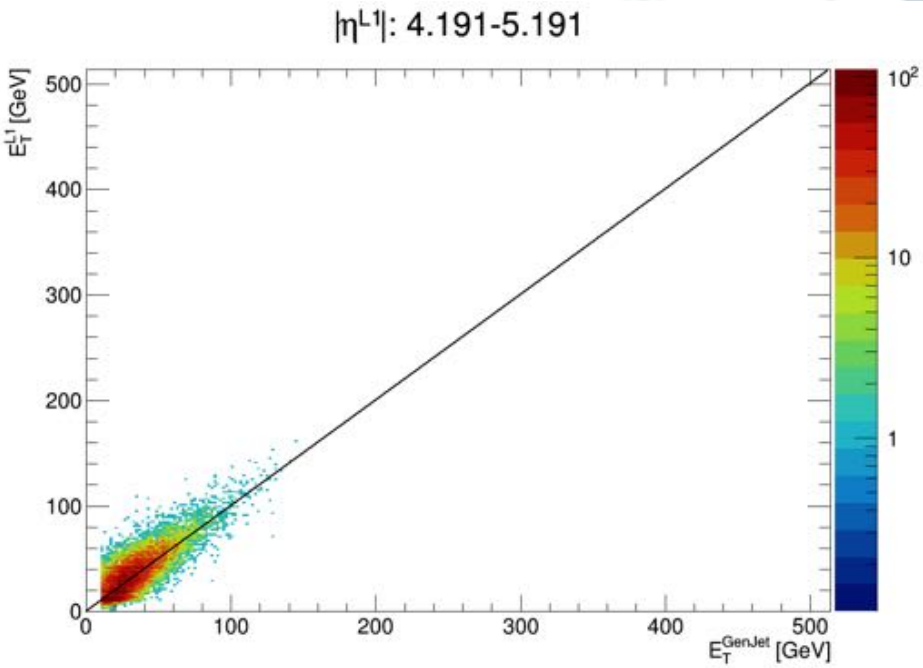
Scatter plots (2017 vs 2018)

PU 50-60

2017



2018, normal params

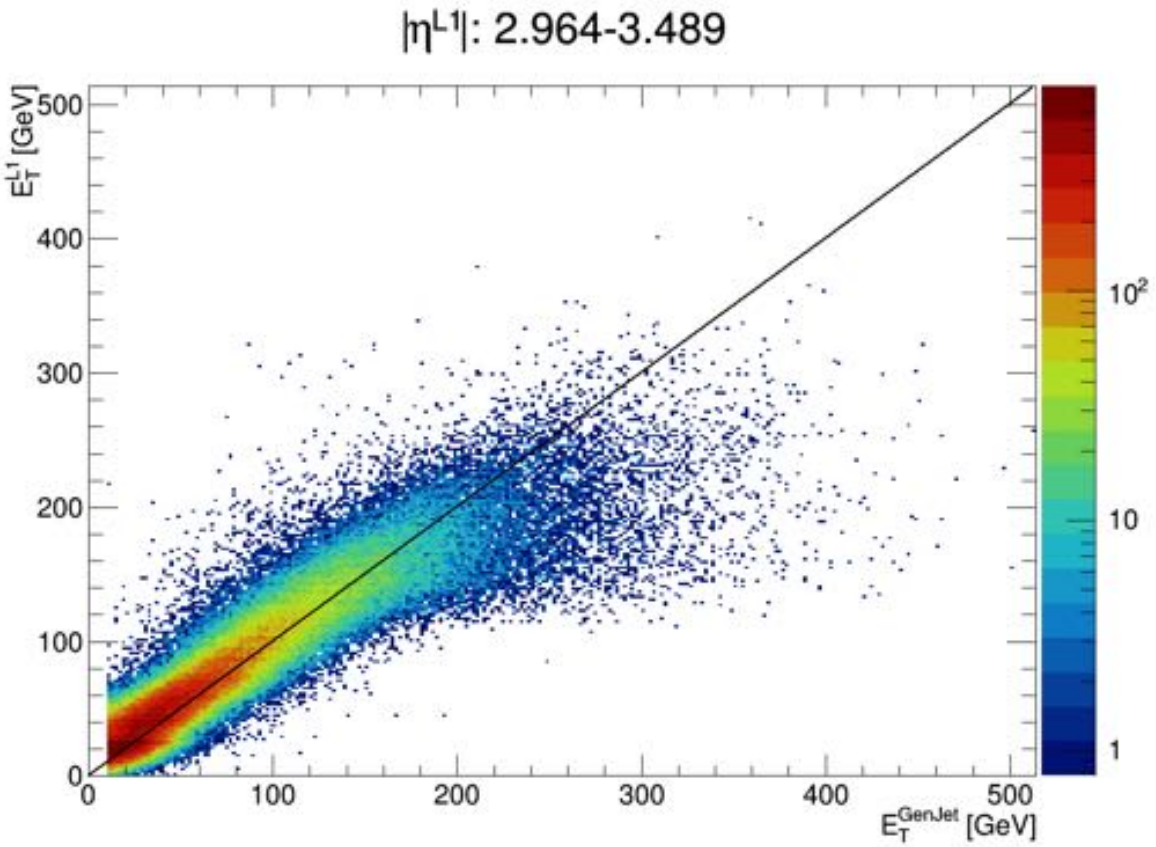


Single bin in HF

Scatter plots (2017 offending bin)

PU 50-60

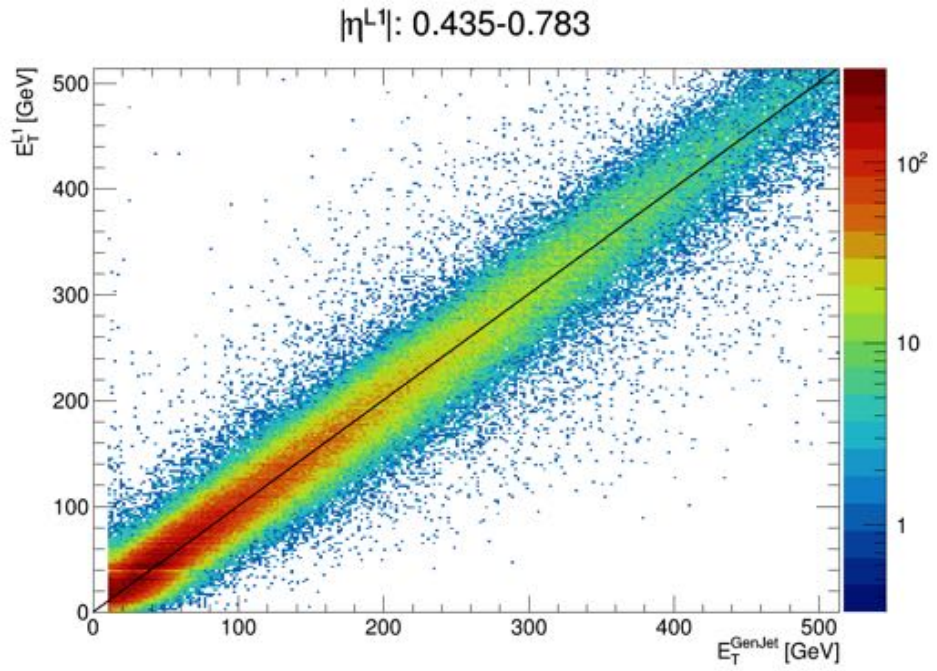
2017, after corrections. Single bin in HF



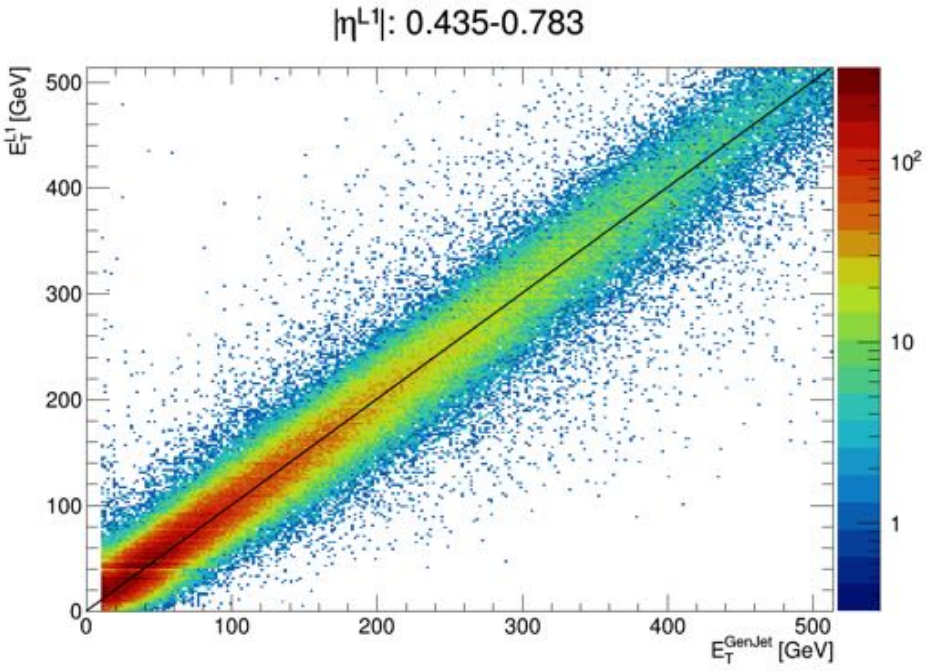
Scatter plots (normal vs ECAL ZS)

PU 50-60

2018, normal params



2018, ECAL ZS params



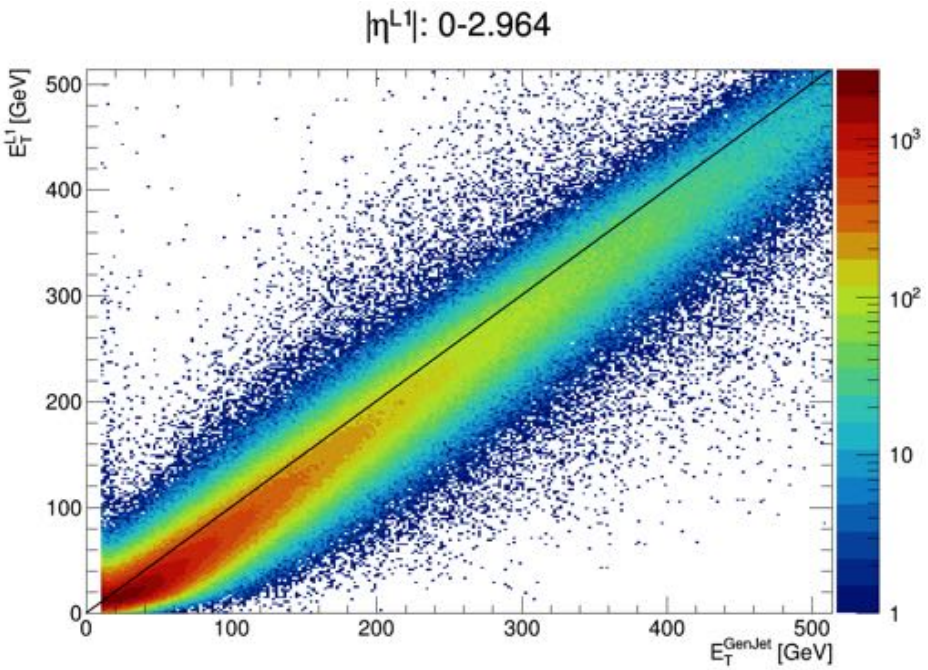
Single bin in Barrel

◎ Run using same dataset so expect very similar results

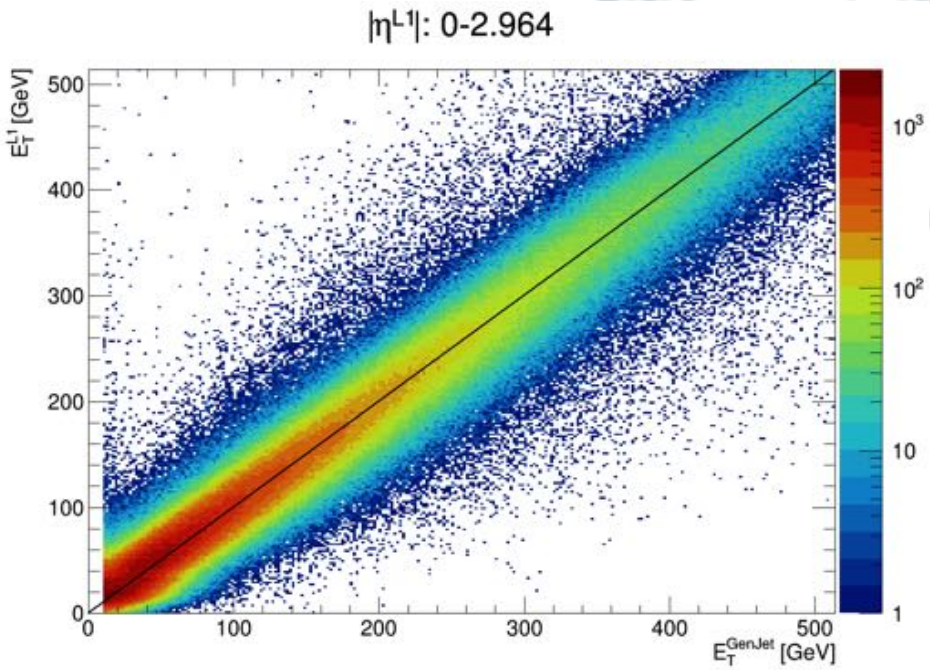
Scatter plots (2018, BE)

PU 50-60

Normal params, before corrections



Normal params, after corrections

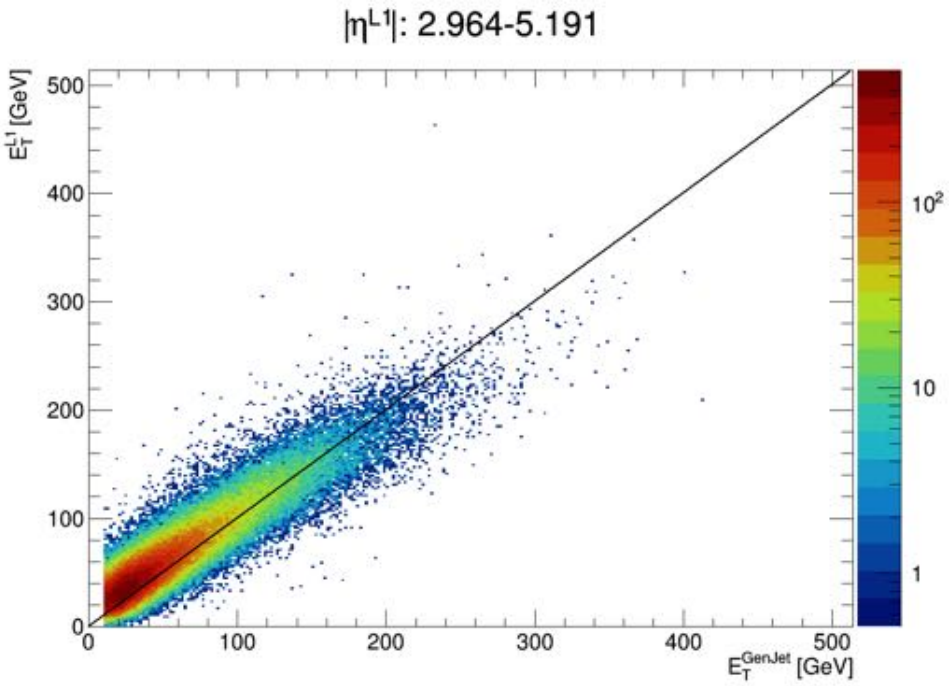


Entire BE

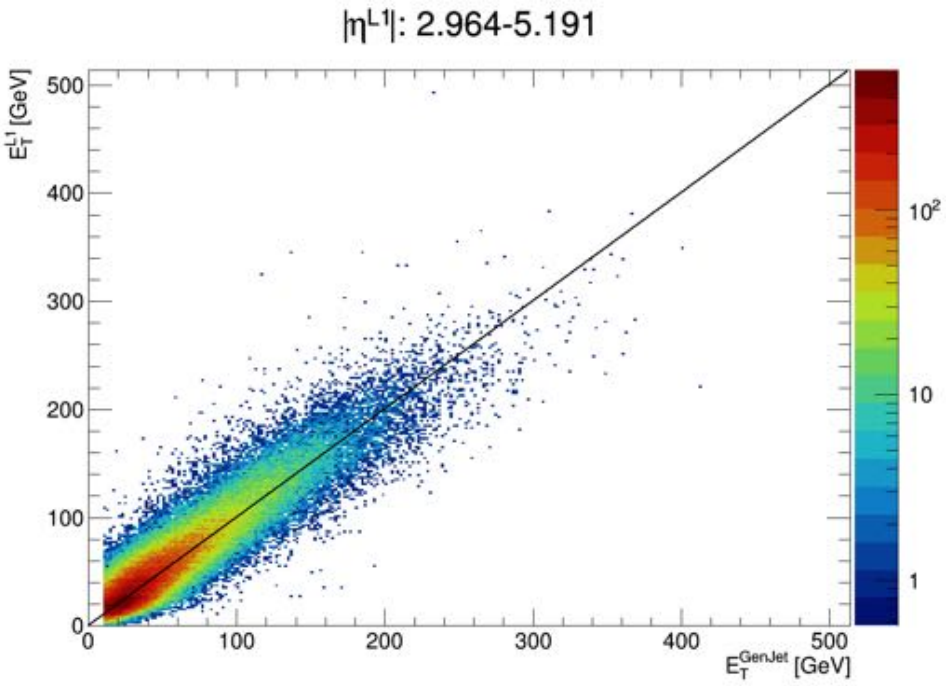
Scatter plots (2018, HF)

PU 50-60

Normal params, before corrections



Normal params, after corrections



Entire HF