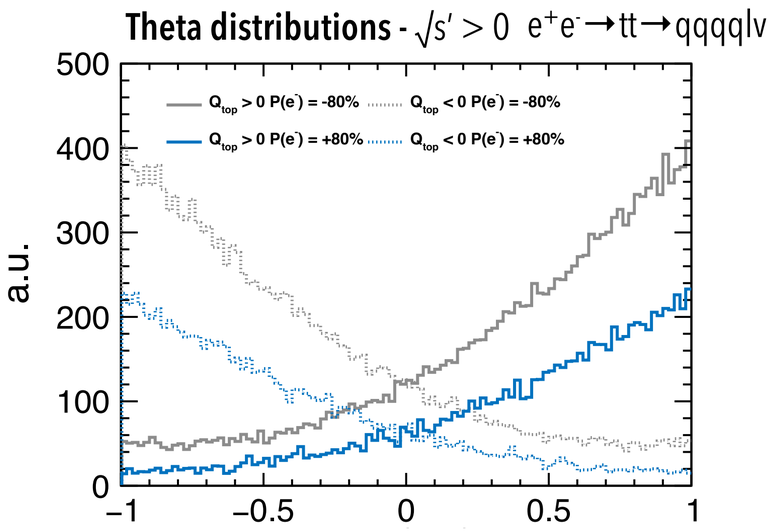
Update

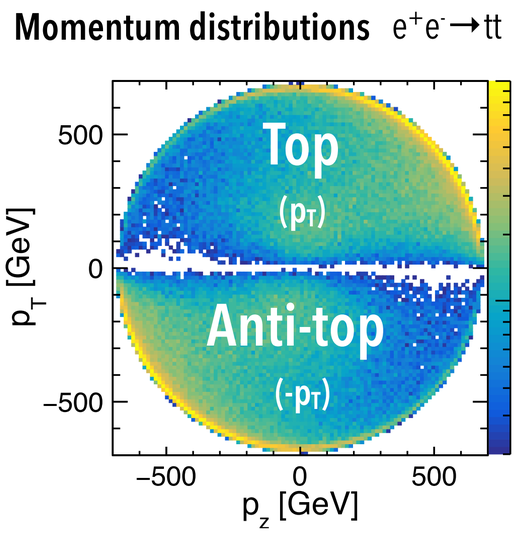
Top forward-backward asymmetry with boosted reconstruction methods

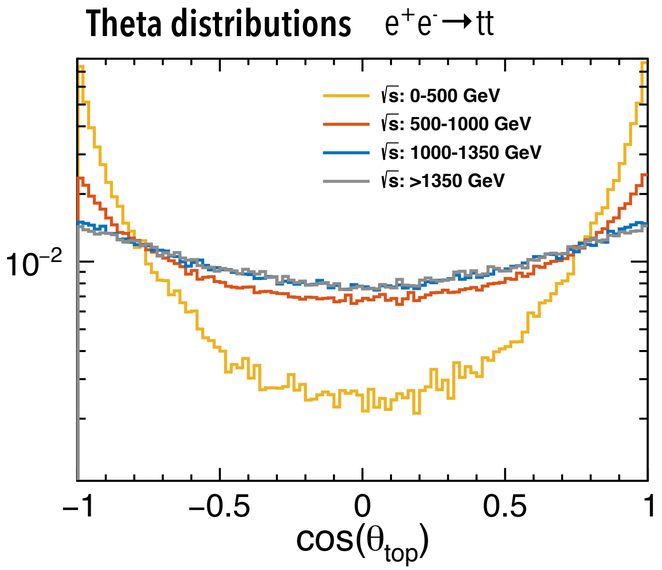
CLICdp Analysis Meeting 2017-09-14

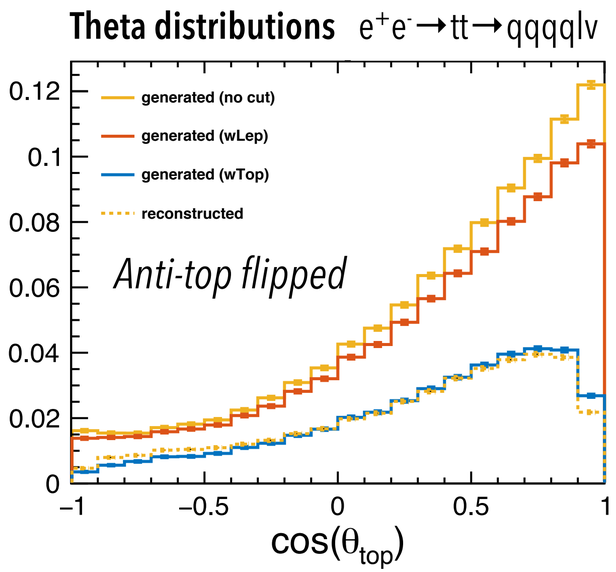
Rickard Ström rickard.stroem@cern.ch

Status of the analysis





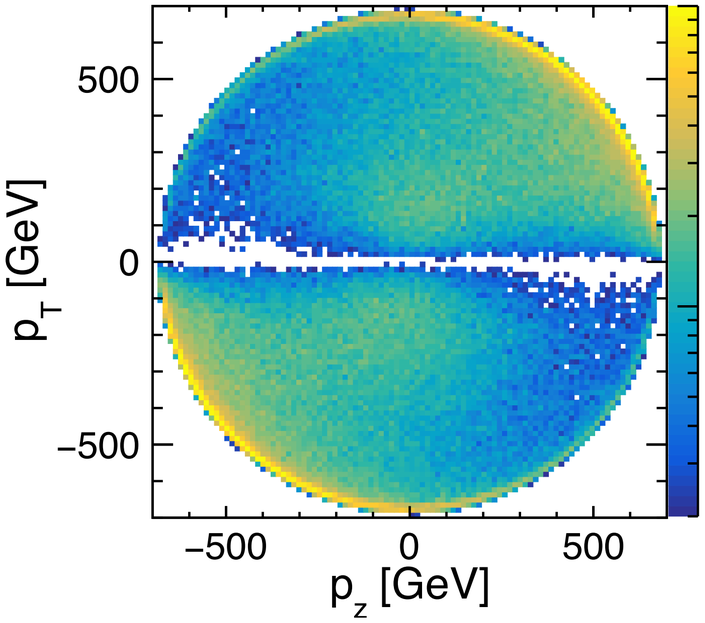


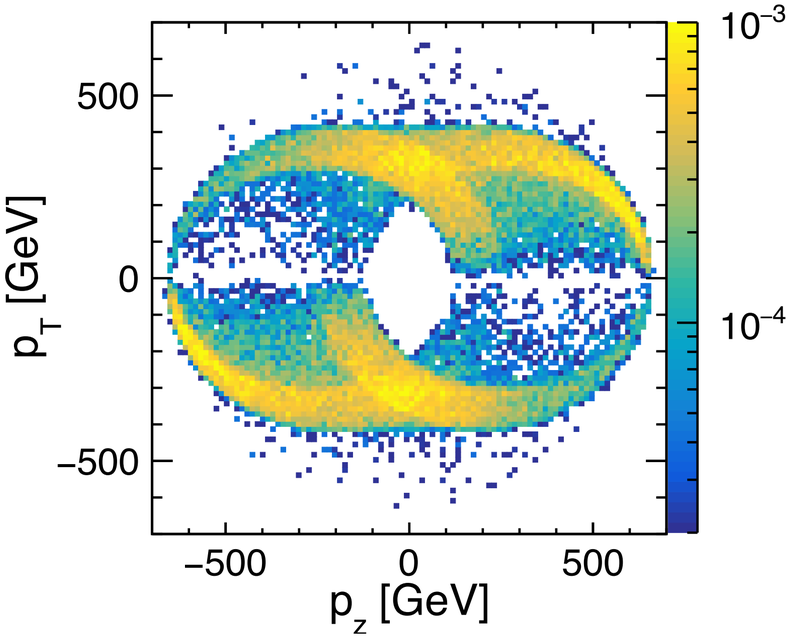


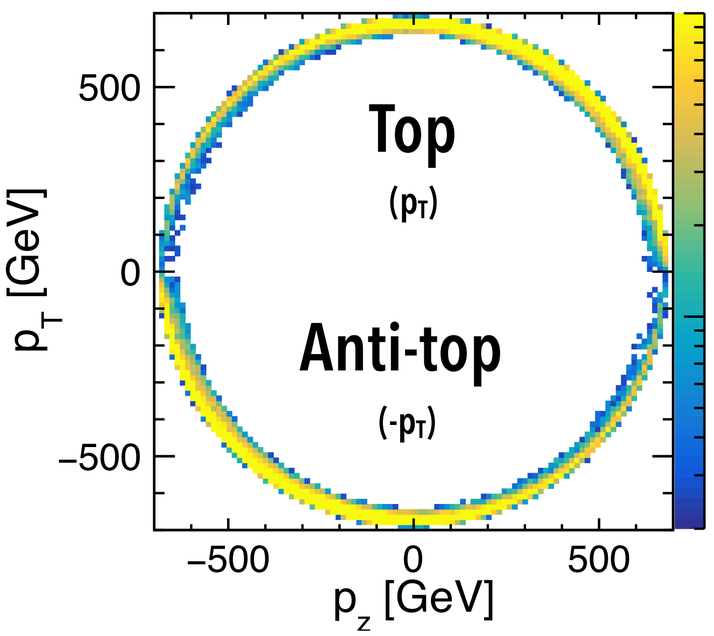
- *Signal*: $e^+e^- \rightarrow tt \rightarrow qqqqlv$
- *Backgrounds*: qqqqlv (not tt), qqqqqq, qqqqqq (not tt), qqqq, qqlv, qqll, qq, …
- 1 lep (charge), 1 hadronic top, 1 semi-leptonic top, …
- Less migration is observed for $P(e^-) = +80\%$
- Backgrounds substantially reduced at final level
- Relative error on A_{fb} (simple count, signal only):
  - **~2% (3%) for -80% (+80%)**
- **Ongoing:**
  - Sqrt(s) determination from reco.
  - Top tagging final optimisation (jet mass + tagger)
  - Extension to 3 TeV
  - Lab → centre-of-mass frame (small difference expected)
  - EFT extraction (curve fitting)

$e^+e^- \rightarrow tt$ distributions

Generator level momentum @ 1.4 TeV





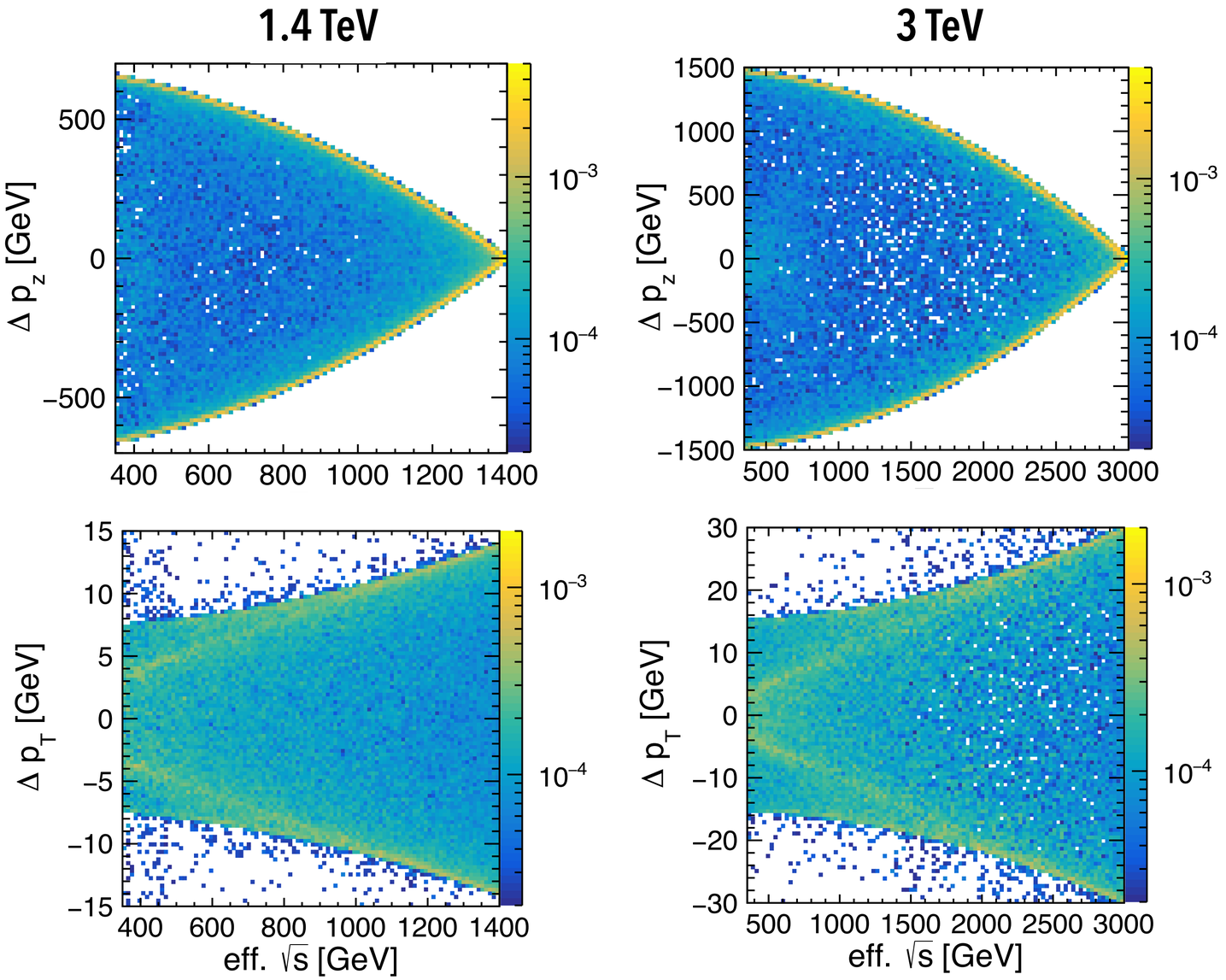


$\sqrt{s'} > 0$ GeV

700 GeV < $\sqrt{s'}$ < 900 GeV

$\sqrt{s'} > 1350$ GeV

$e^+e^- \rightarrow tt$ distributions

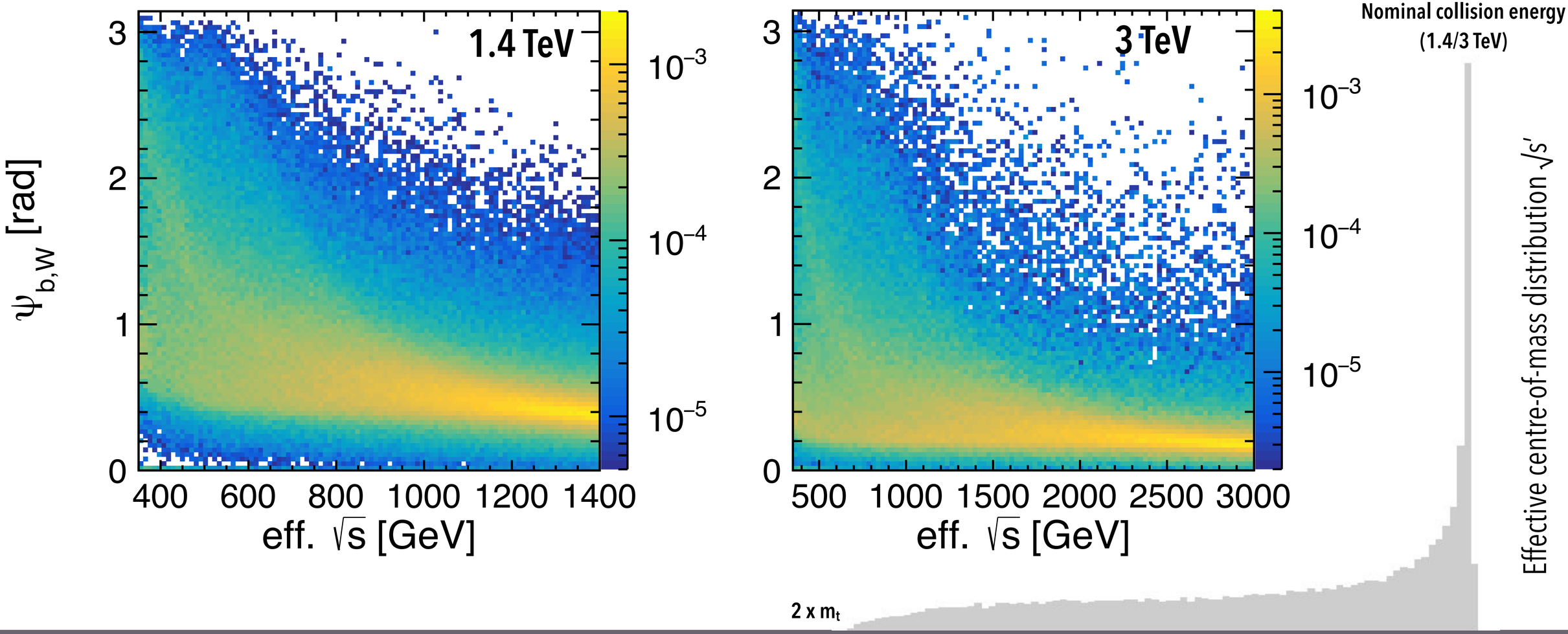


- Non-zero beam crossing angle (20 mrad at 3 TeV) and ISR leads to small unbalance in transverse direction
- Balanced in z-direction

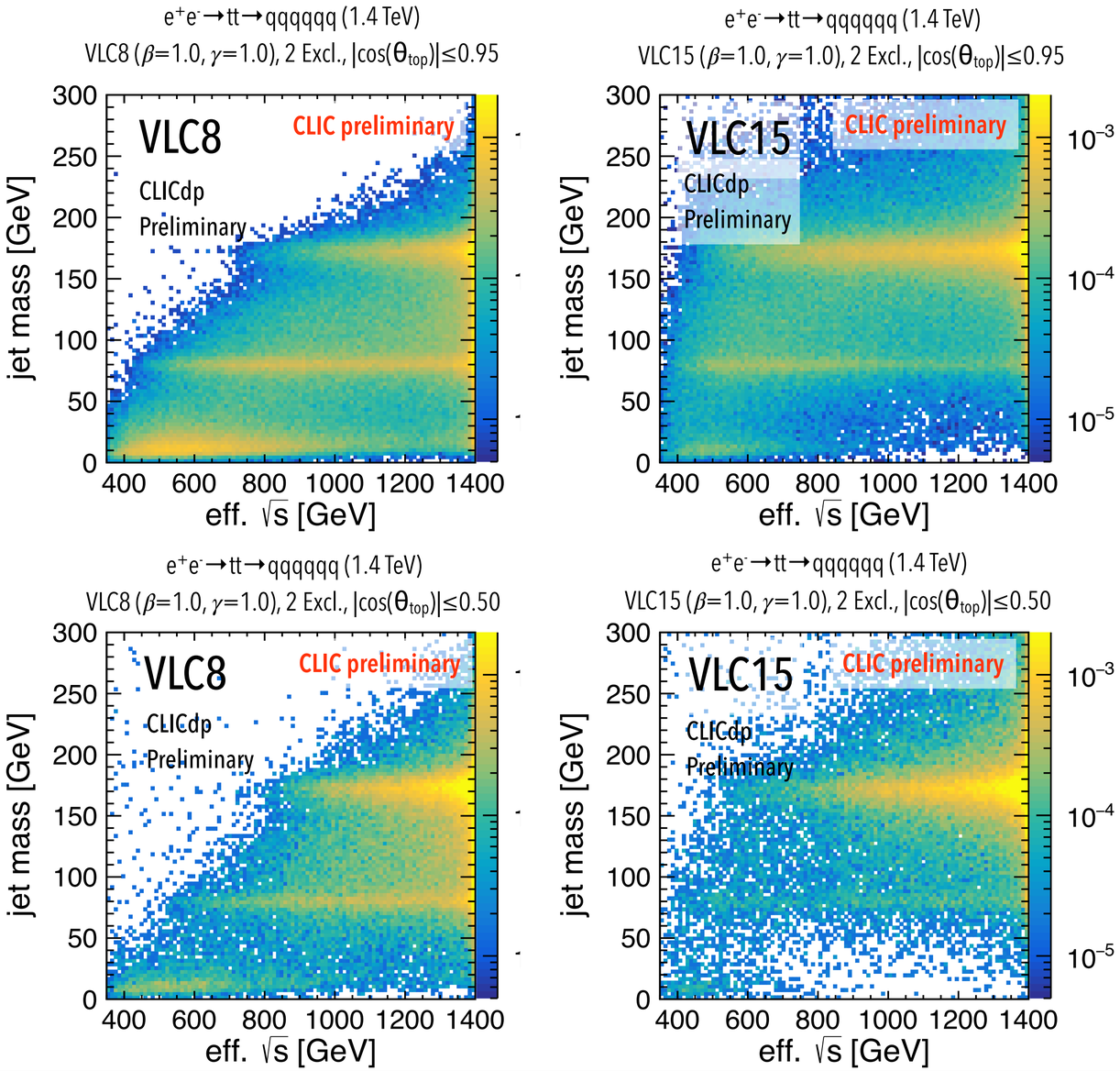
$e^+e^- \rightarrow tt$ distributions

Generator level distributions (flat in x-axis) - bW angle

- Why is the angle smaller at 1.4 TeV for the 3 TeV sample? **Boost in z-direction!**

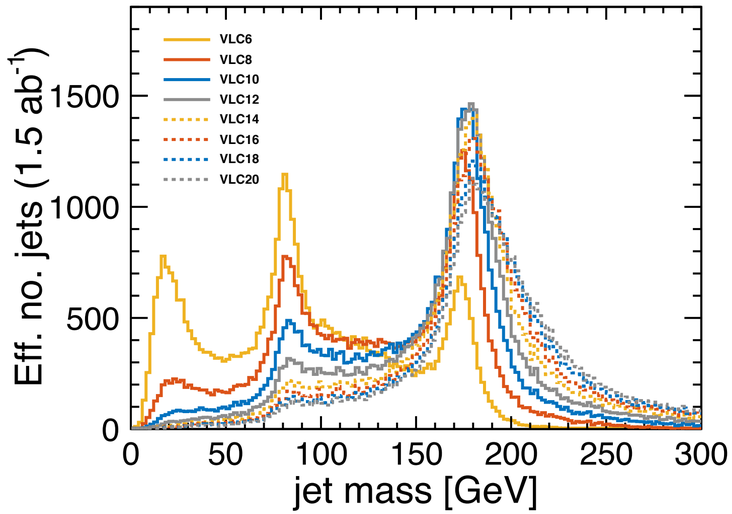


Jet clustering - fully-hadronic ttbar

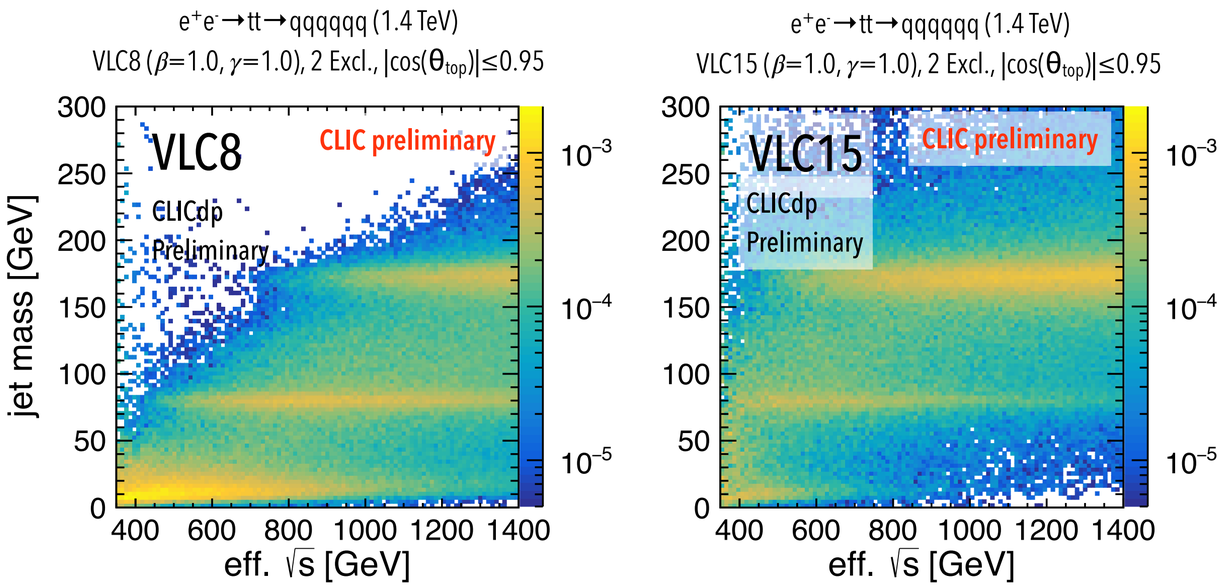


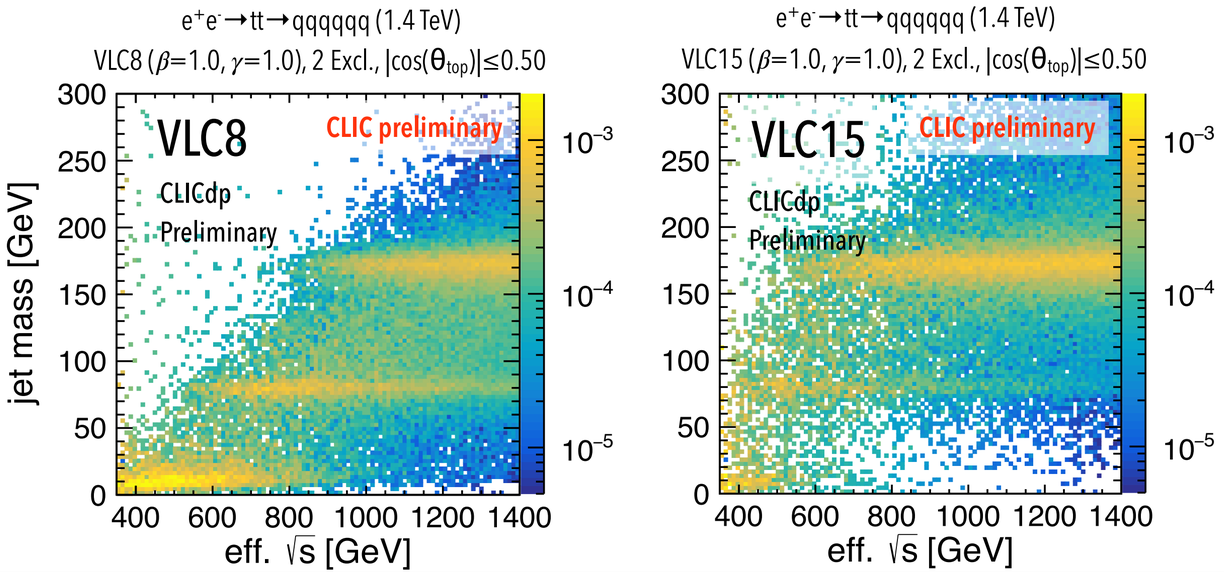
with raw eff sqrt(s) distribution

- Large-R jet radius needed (even at R=0.8 we see significant W at high eff. sqrt(S)
- Energy lost down the beam pipe (comp. cos(θ) cut at 0.95 vs 0.50)



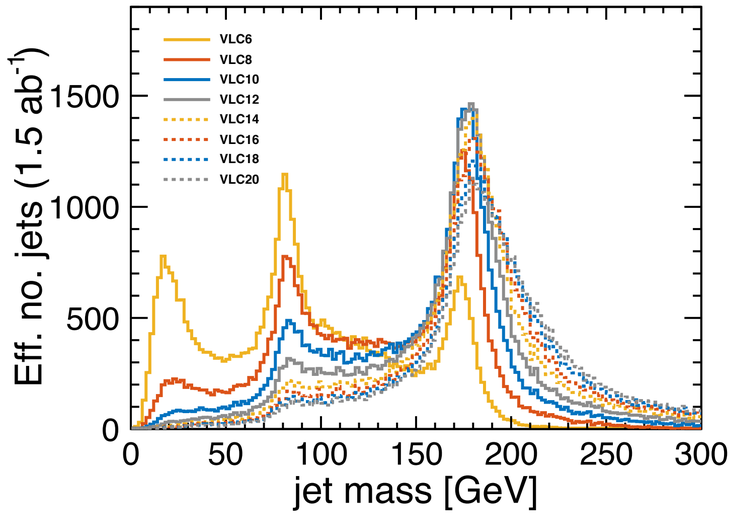
Jet clustering - fully-hadronic ttbar



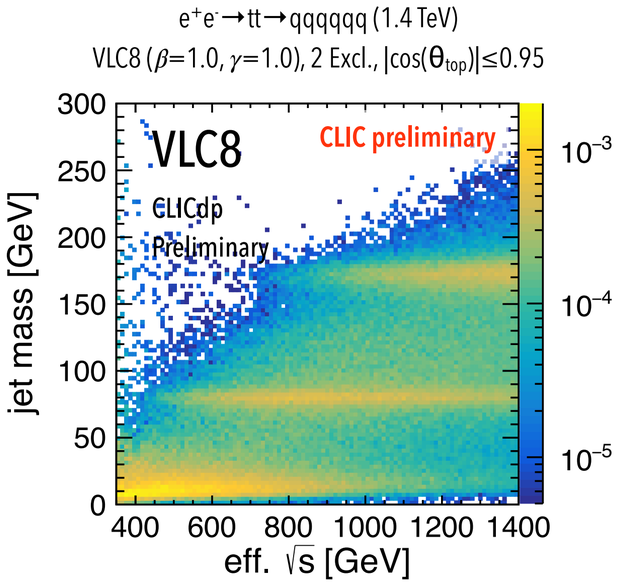


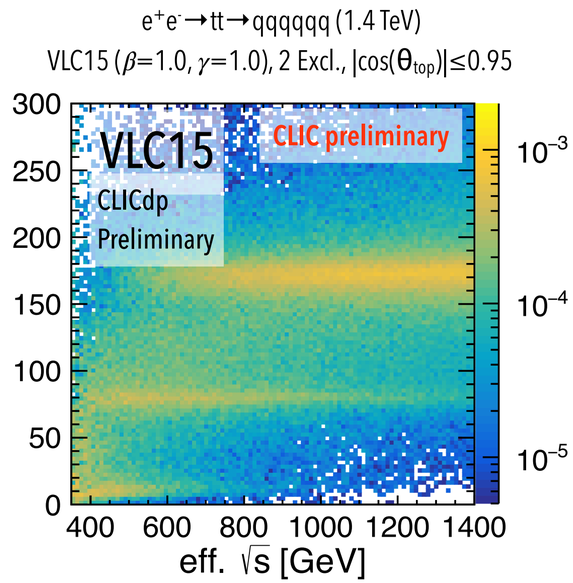
with flat eff sqrt(s) distribution

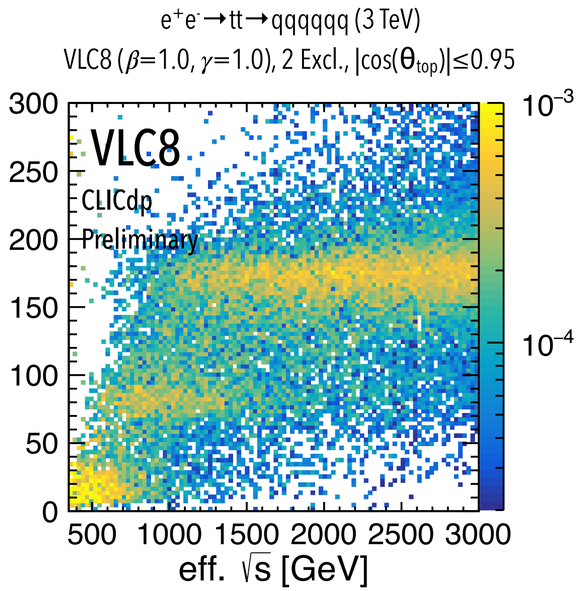
- Large-R jet radius needed (even at R=0.8 we see significant W at high eff. sqrt(S)
- Energy lost down the beam pipe (comp. cos(θ) cut at 0.95 vs 0.50)

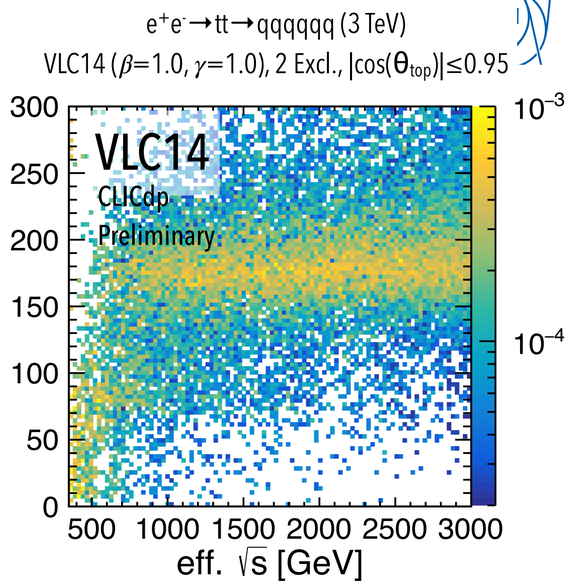


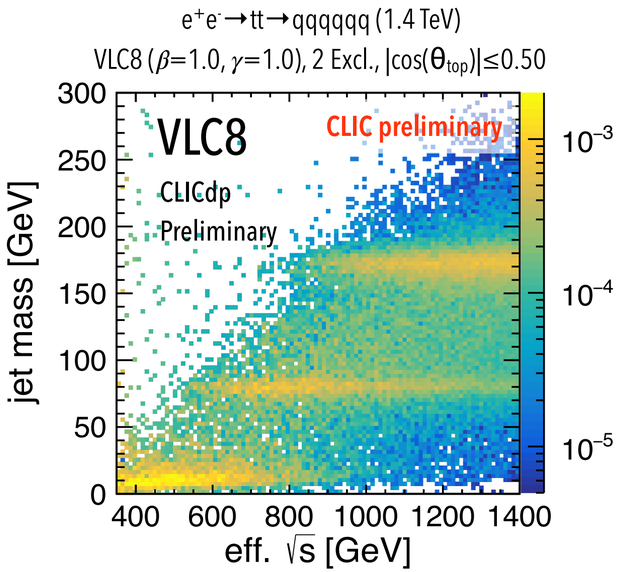
Jet clustering - fully-hadronic ttbar

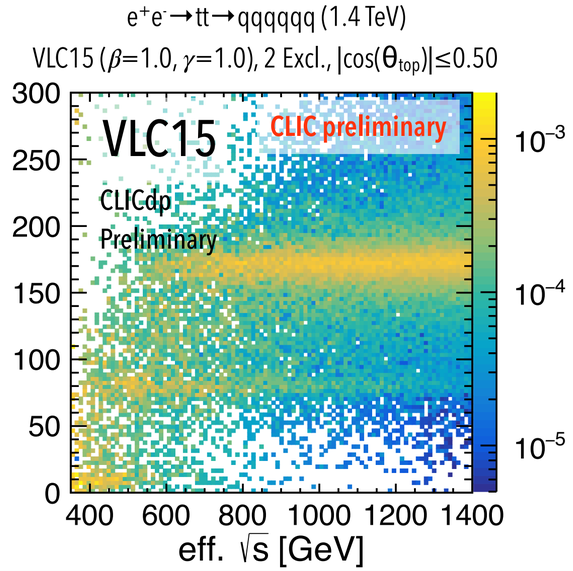




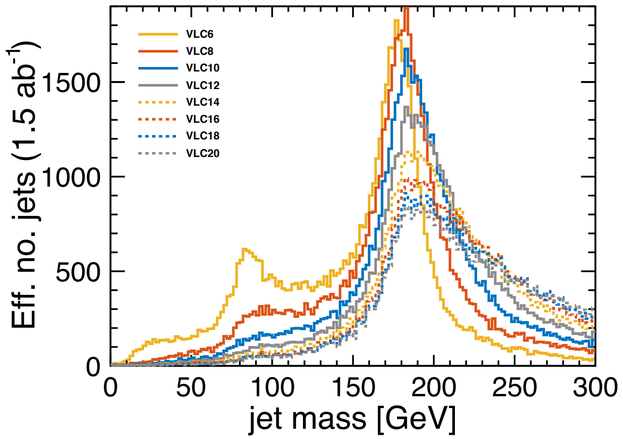








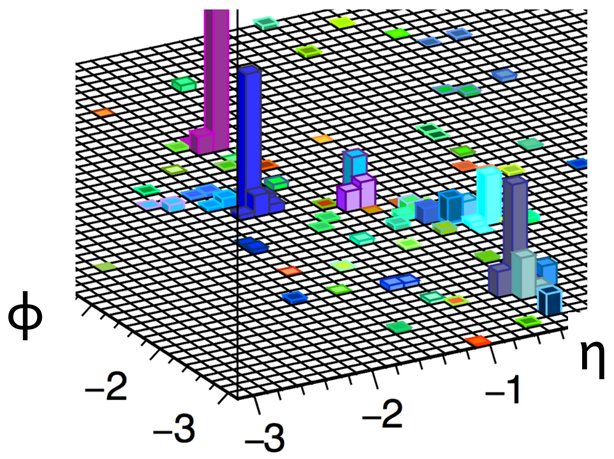
- Smaller radius is fine above 1.4 TeV



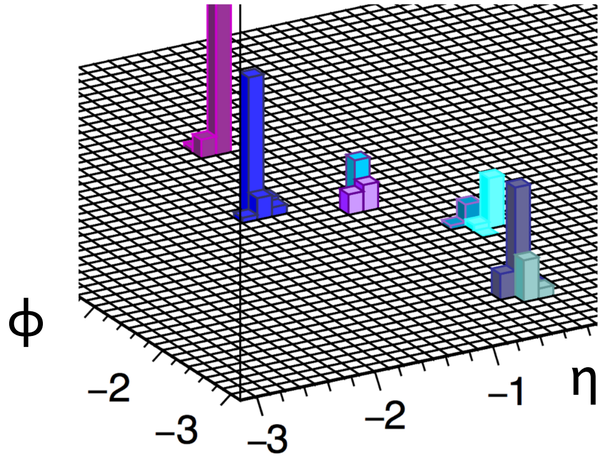
Jet trimming

- **Jet trimming** is a complementary way to reduce the impact from beamstrahlung
- Pre-clustering into micro-jets
  - Inclusive clustering with minimum p_T threshold
  - generalised kt algoritm (~ kt for e^+e^- + beam jets)
  - p_T threshold and micro-jet radius optimised (E_{th}=5 GeV, R=0.4)

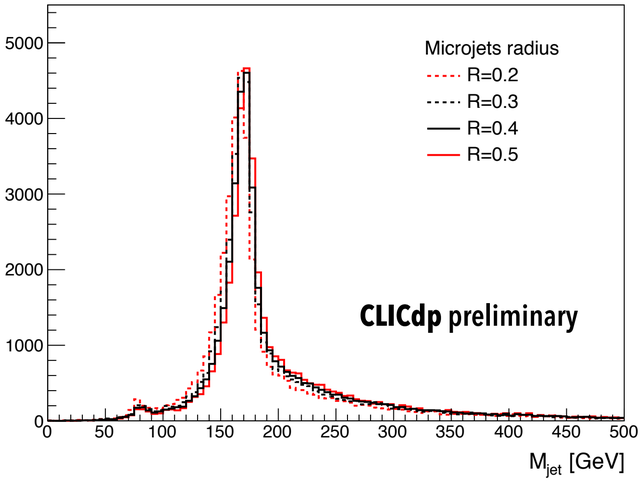
BEFORE TRIMMING



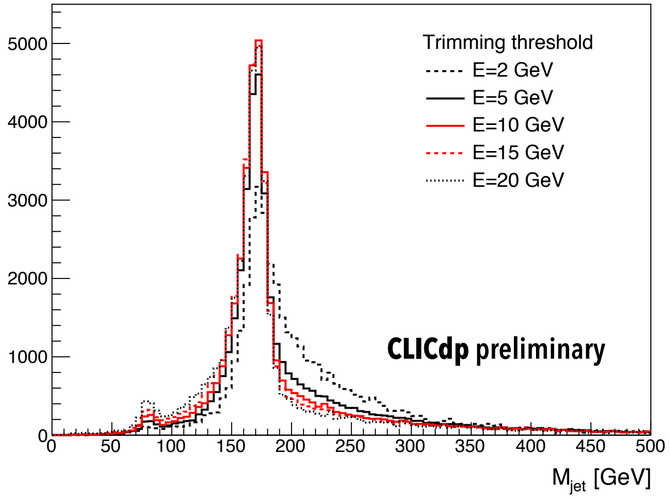
AFTER TRIMMING



Different micro-jet radius



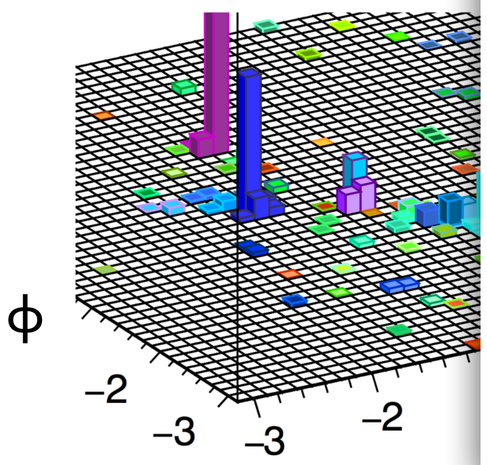
Different p_T thresholds

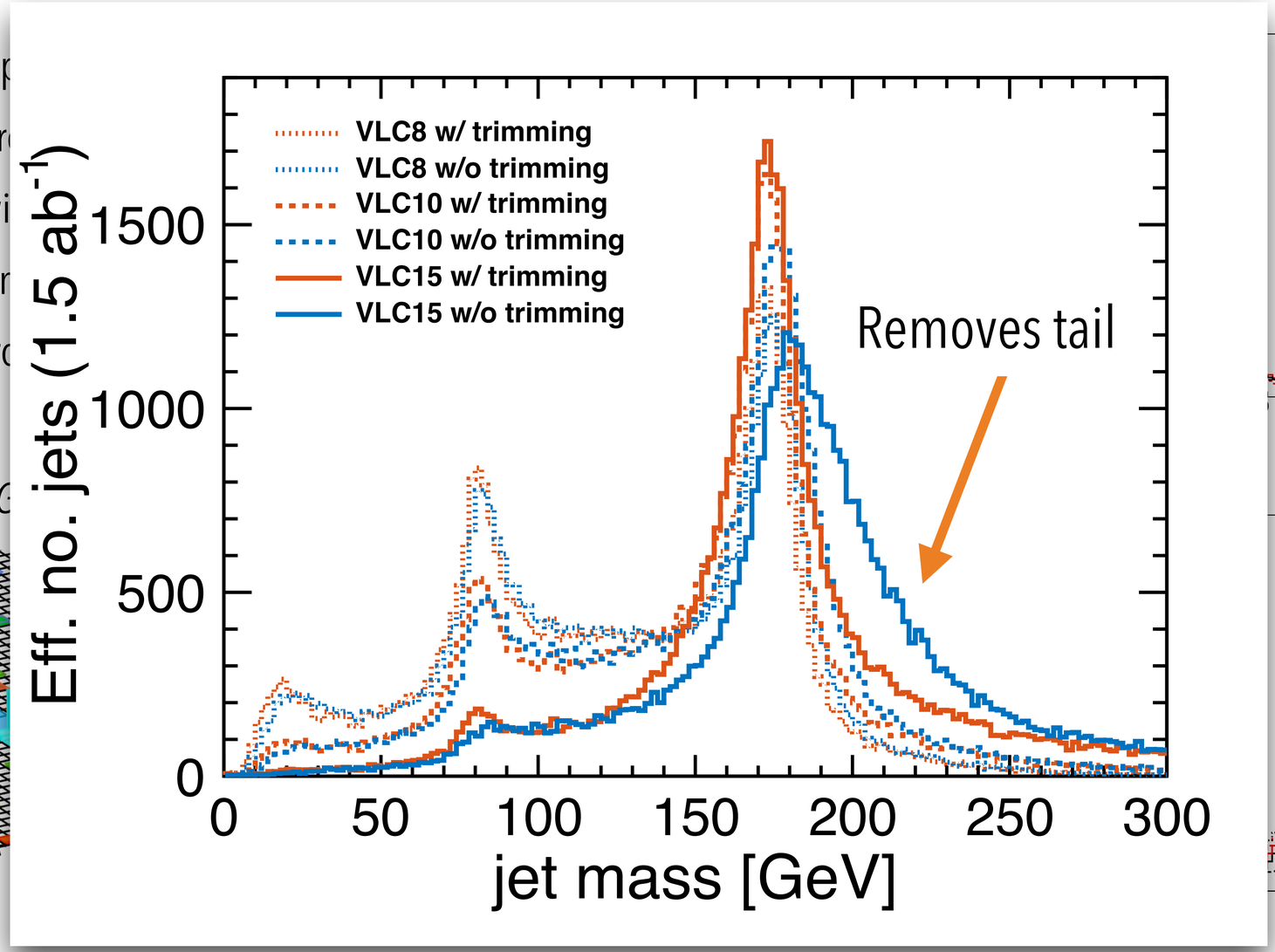


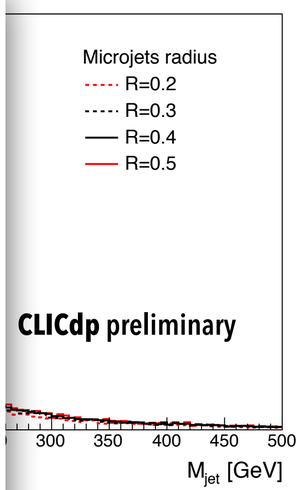
Jet trimming

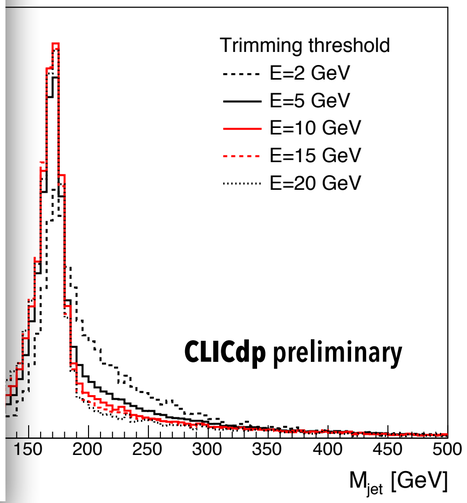
- **Jet trimming** is a comp
- Pre-clustering into micr
  - Inclusive clustering wi
  - generalised kt algoritr
  - p_T threshold and micr

BEFORE TRIMMING



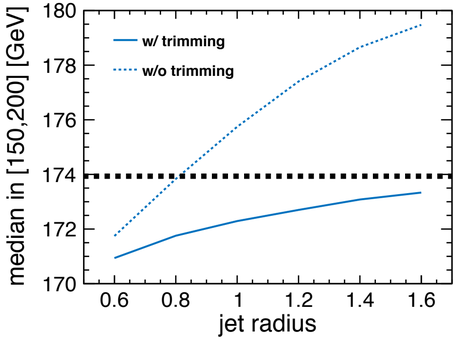


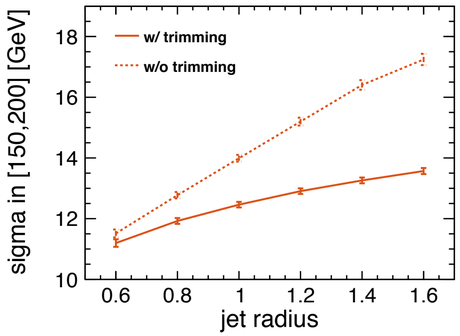




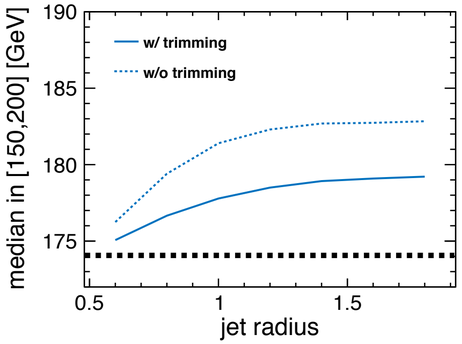
Jet trimming - 1.4 TeV vs 3 TeV

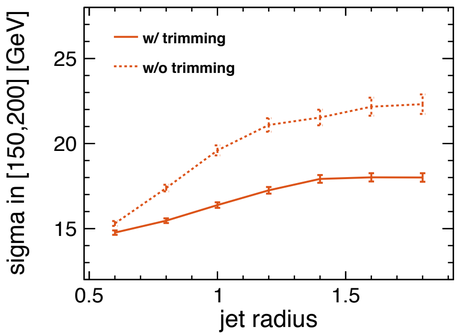
$e^+e^- \rightarrow tt \rightarrow qqqqqq$ (1.4 TeV), VLC (β=1.0, γ=1.0), 2 Excl., $|\cos(\theta_{top})| \leq 0.95$

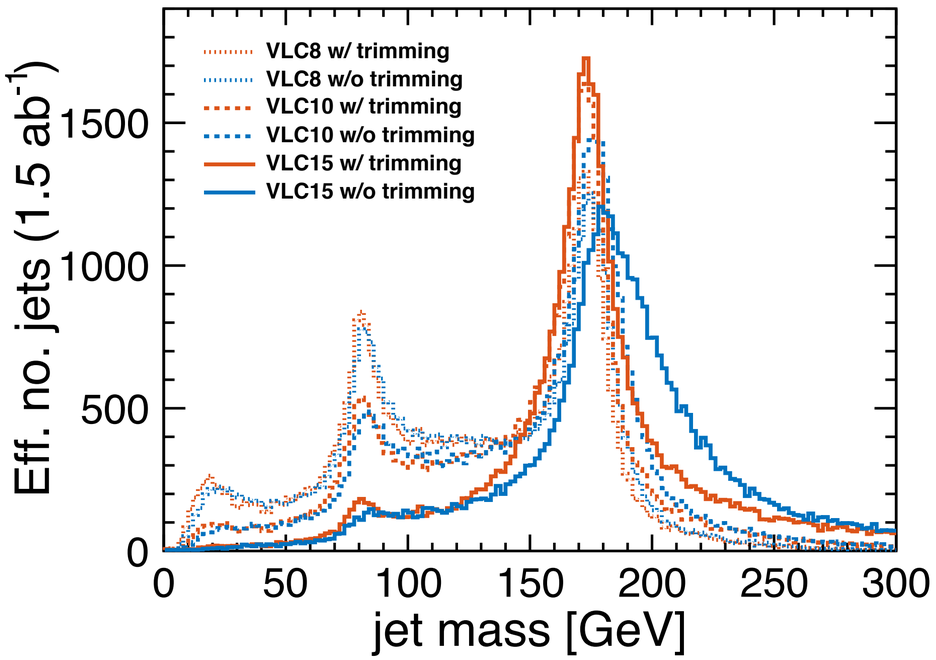


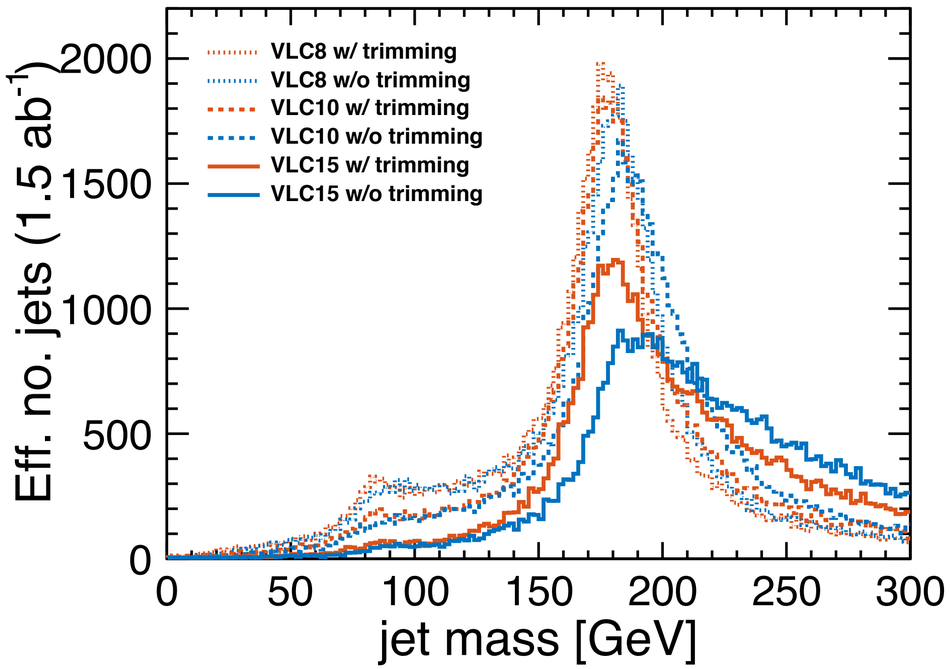


$e^+e^- \rightarrow tt \rightarrow qqqqqq$ (3 TeV), VLC (β=1.0, γ=1.0), 2 Excl., $|\cos(\theta_{top})| \leq 0.95$



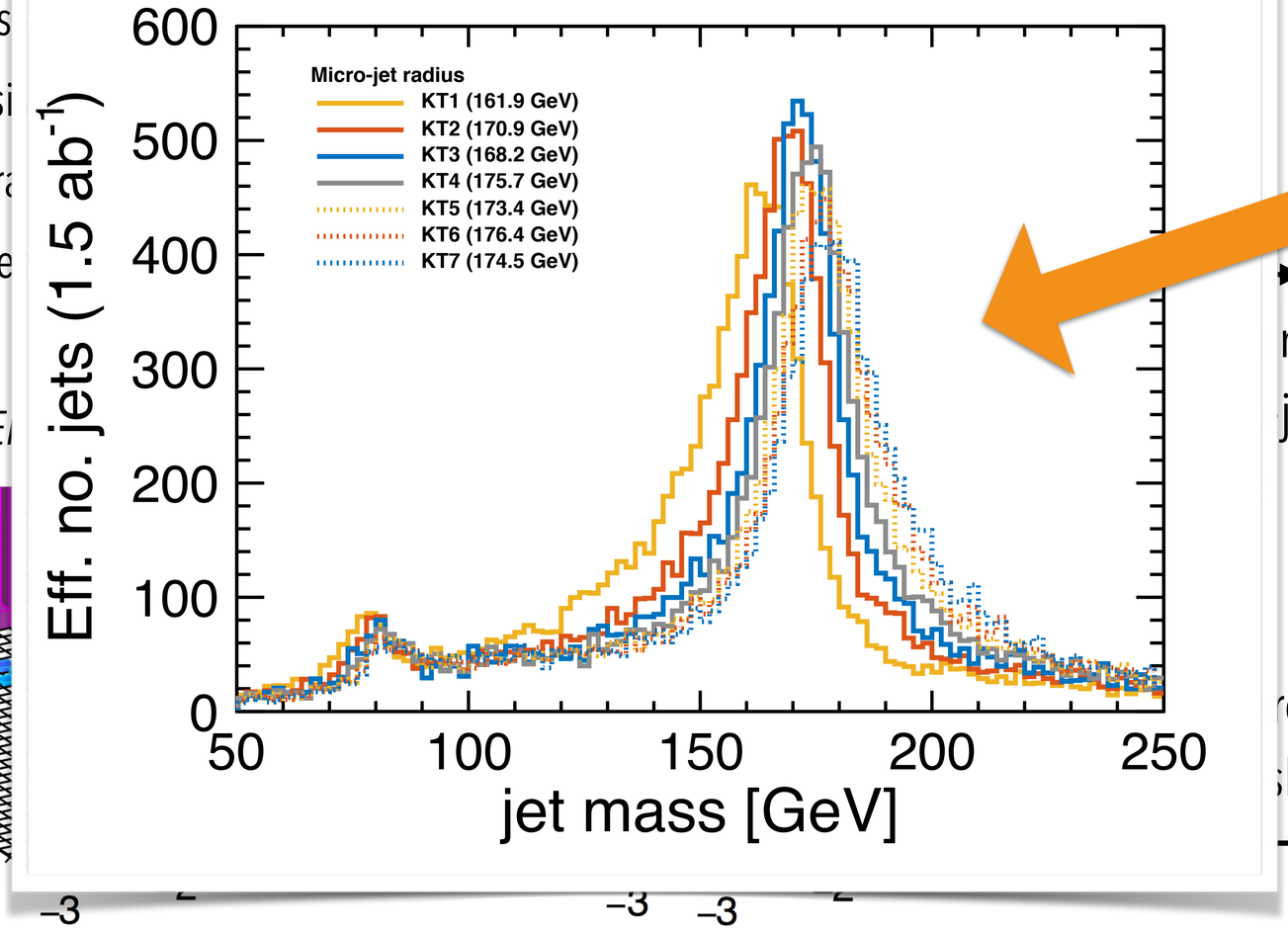


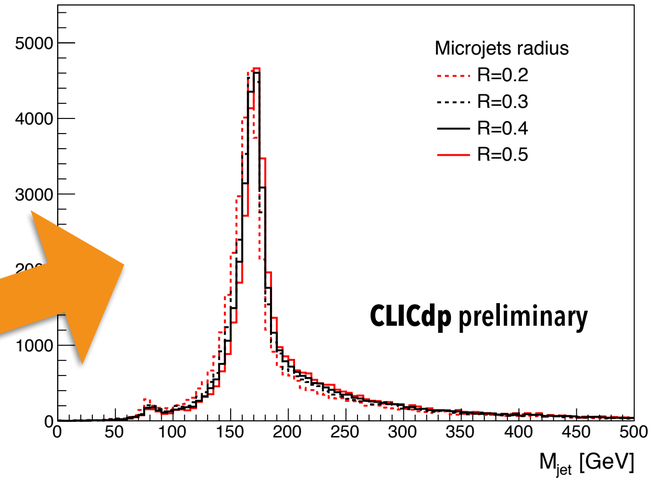


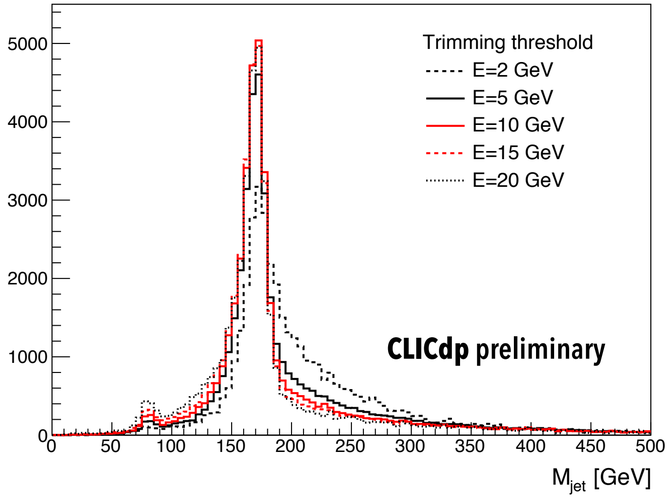


Jet trimming re-optimising

- Jet trimming: **Why is this not compatible with previous study?**
- Pre-clus
  - Inclusi
  - genera
  - p_T thre

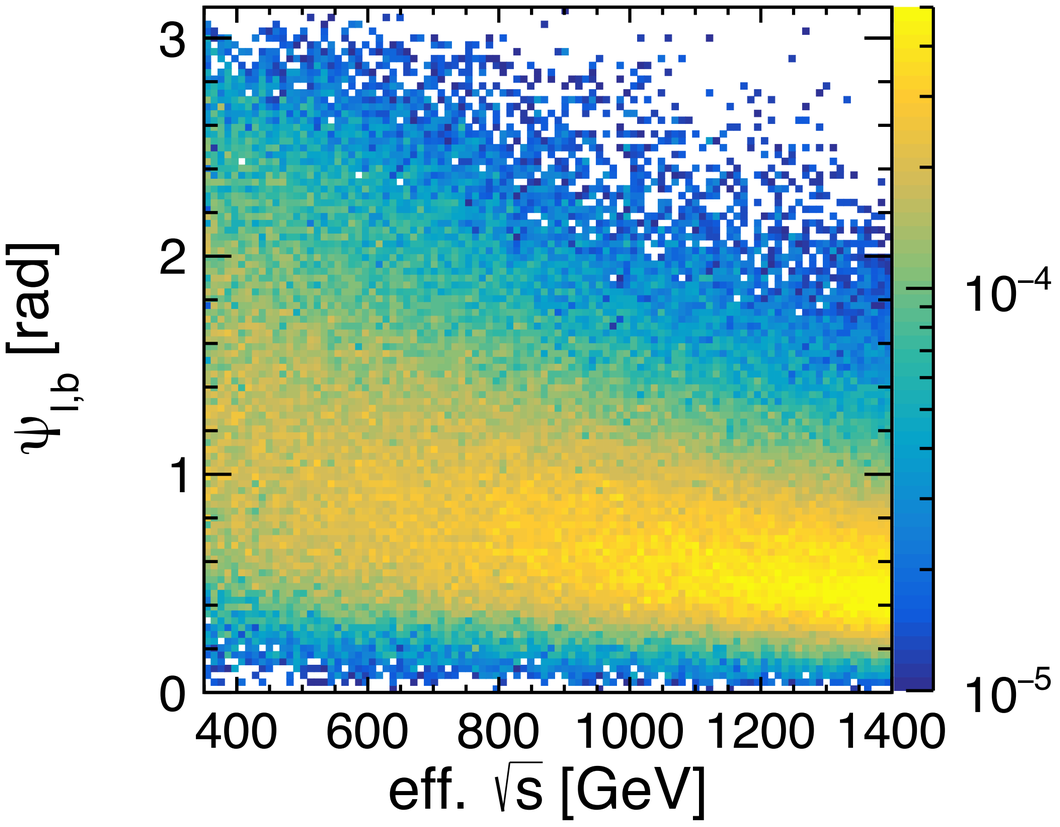


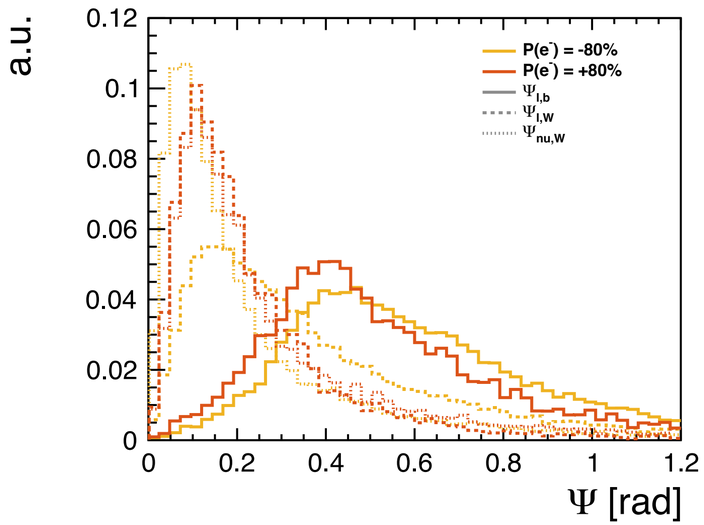




Jet reconstruction - semi-leptonic ttbar

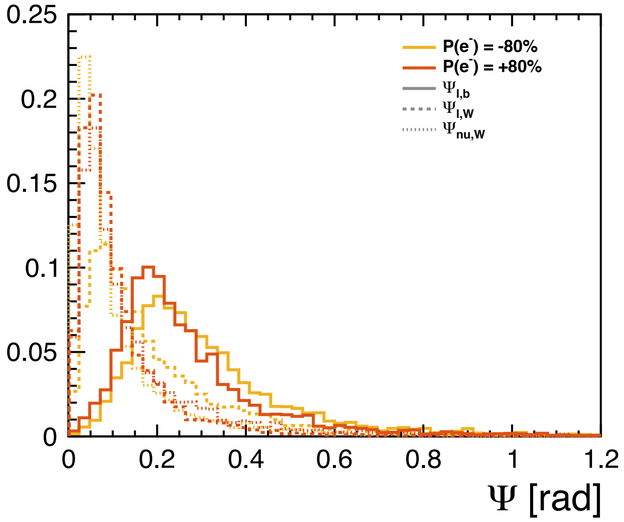
- If lepton too close to b-jet, standard lepton isolation might be suboptimal (revise for 3 TeV)





1.4 TeV

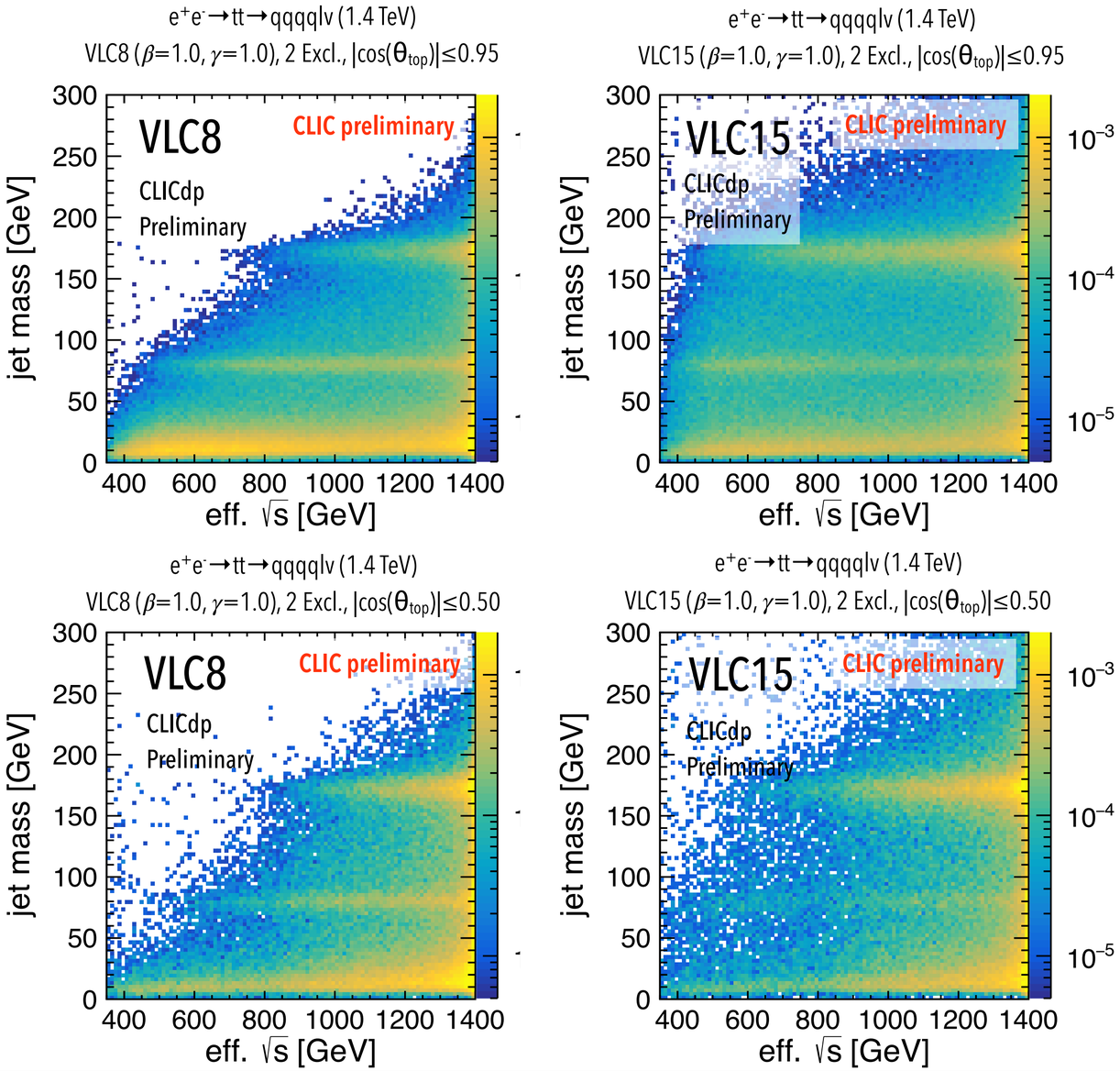
Ψ_{lb}: 23-26° (peak)



3 TeV

Ψ_{lb}: 10-15° (peak)

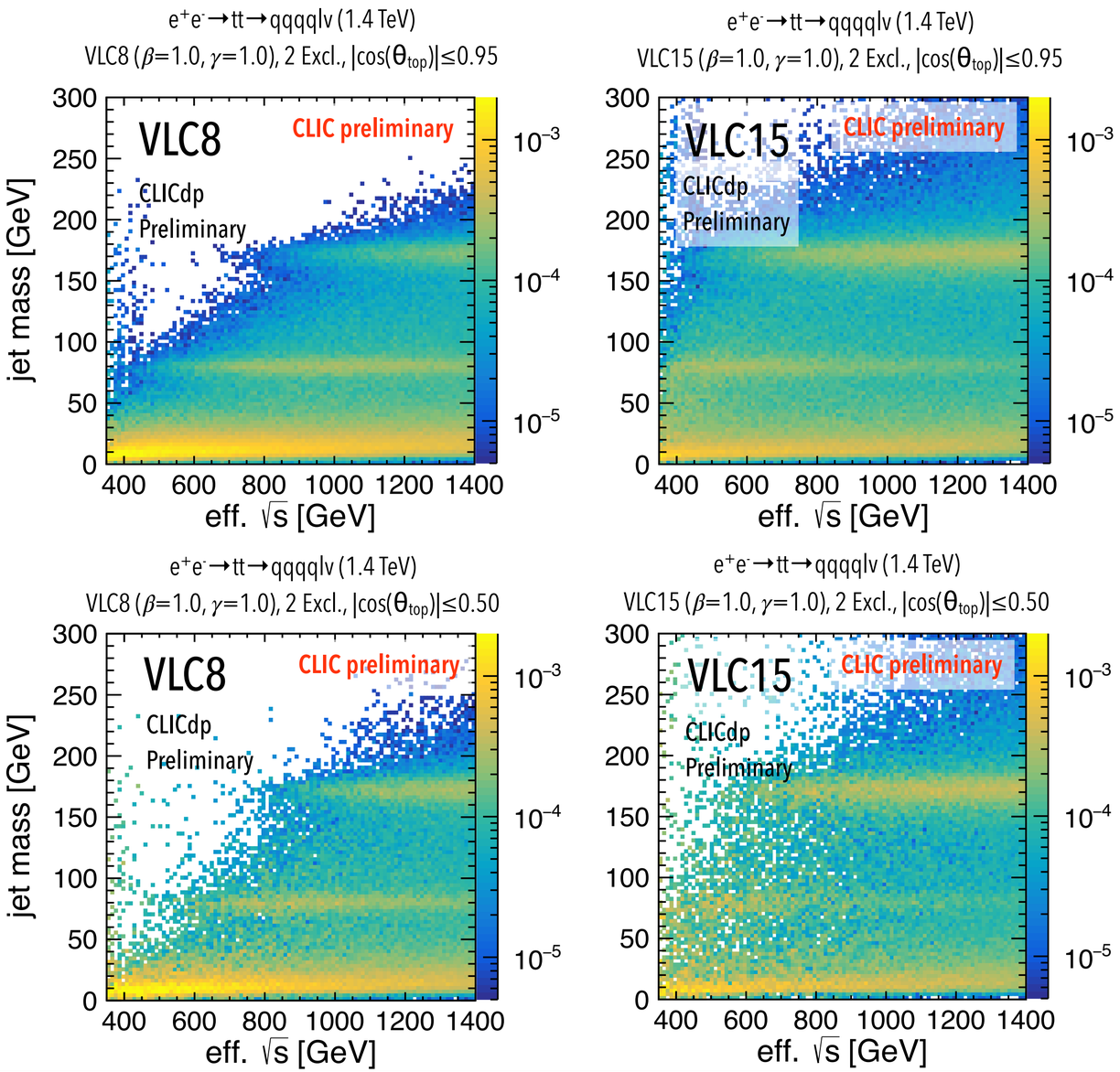
Jet clustering - semi-leptonic ttbar



with raw eff sqrt(s) distribution

- Large-R jet radius needed (even at R=0.8 we see significant W at high eff. sqrt(S)
- Energy lost down the beam pipe (comp. cos(θ) cut at 0.95 vs 0.50)

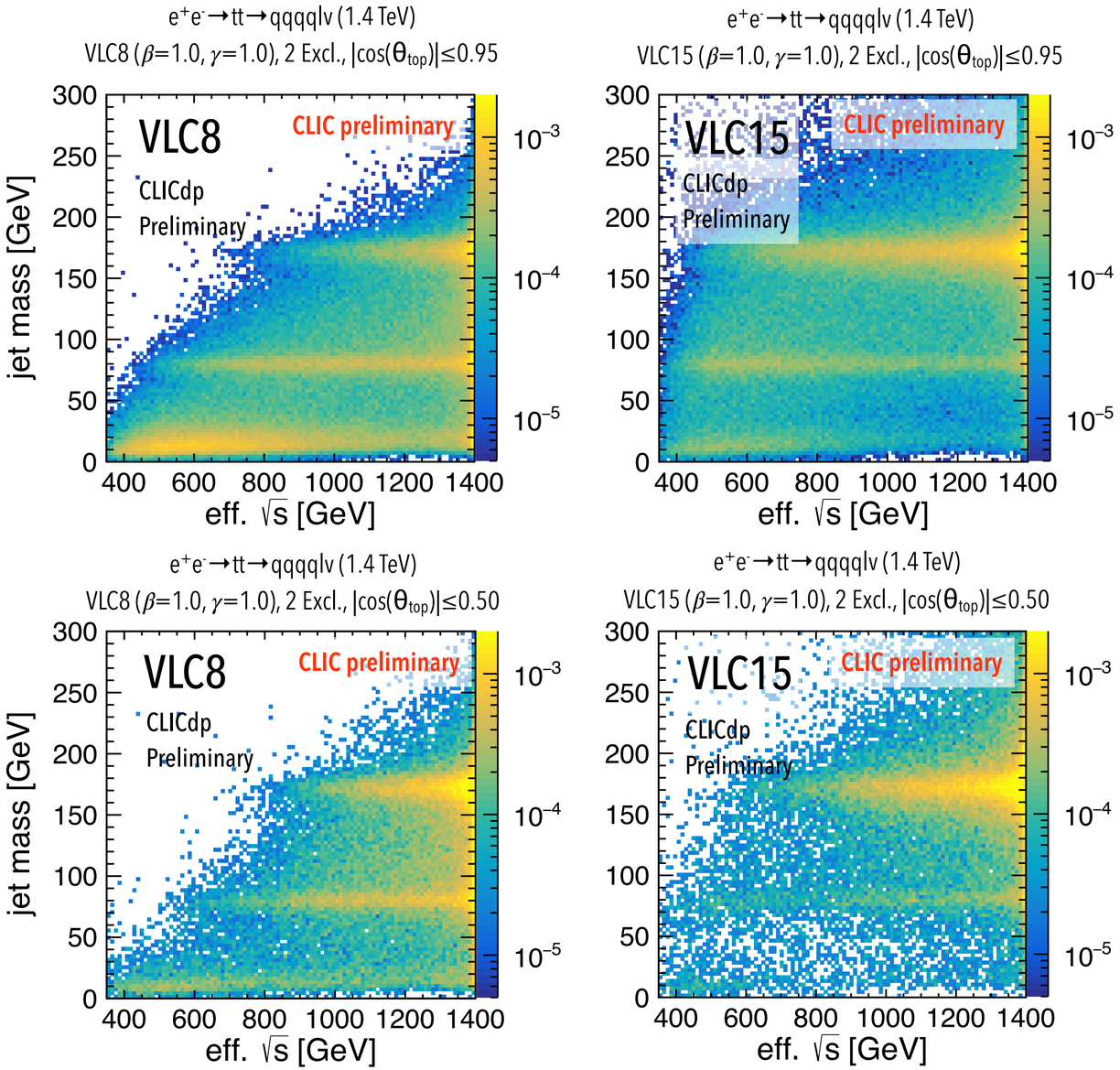
Jet clustering - semi-leptonic ttbar



with flat eff sqrt(s) distribution

- Large-R jet radius needed (even at R=0.8 we see significant W at high eff. sqrt(S)
- Energy lost down the beam pipe (comp. cos(θ) cut at 0.95 vs 0.50)

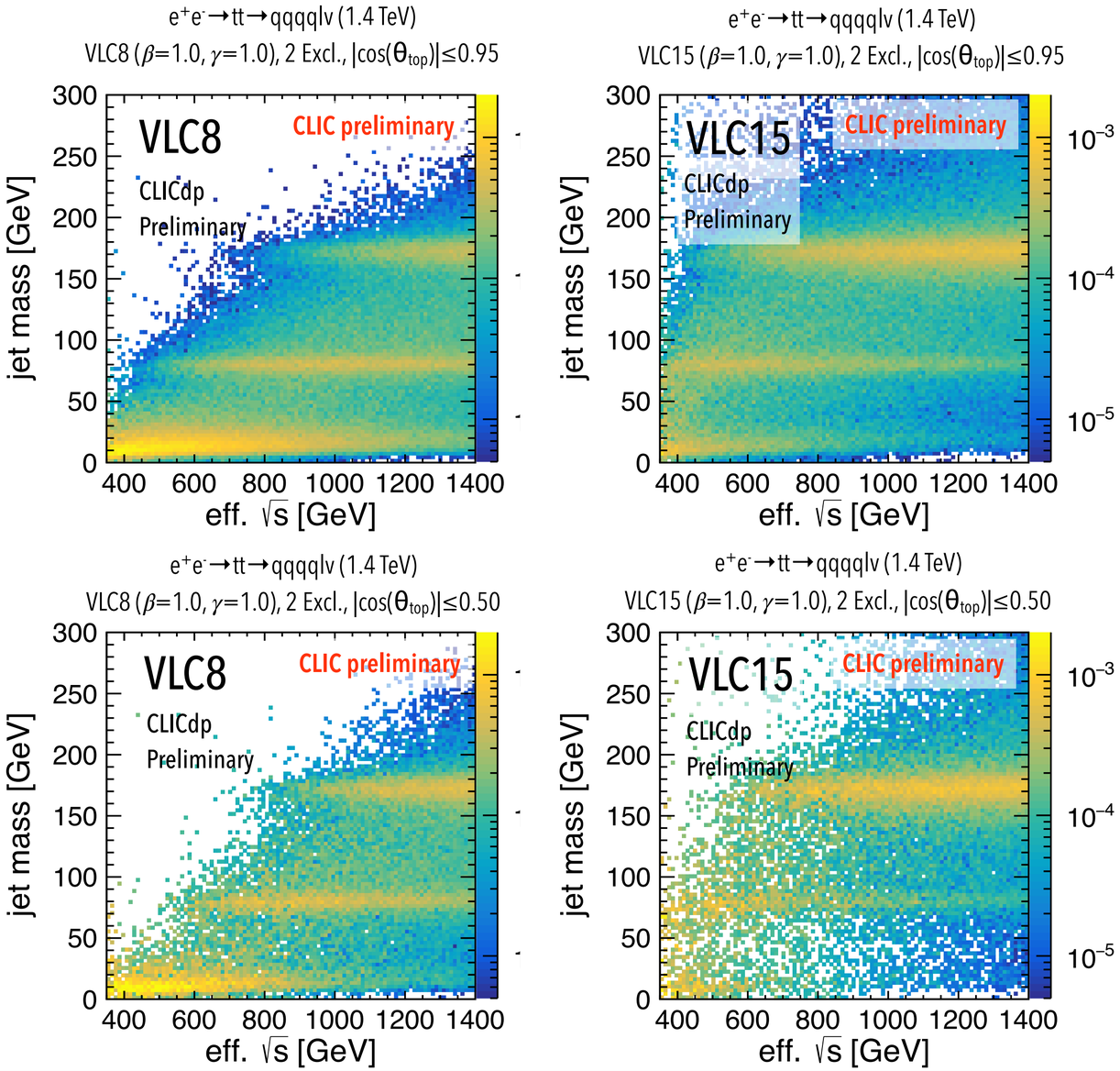
Jet clustering - semi-leptonic ttbar



with raw eff sqrt(s) distribution
+ highest energy jet ONLY

- Large-R jet radius needed (even at R=0.8 we see significant W at high eff. sqrt(S)
- Energy lost down the beam pipe (comp. cos(θ) cut at 0.95 vs 0.50)

Jet clustering - semi-leptonic ttbar



with flat eff sqrt(s) distribution
+ highest energy jet ONLY

- Large-R jet radius needed (even at R=0.8 we see significant W at high eff. sqrt(S)
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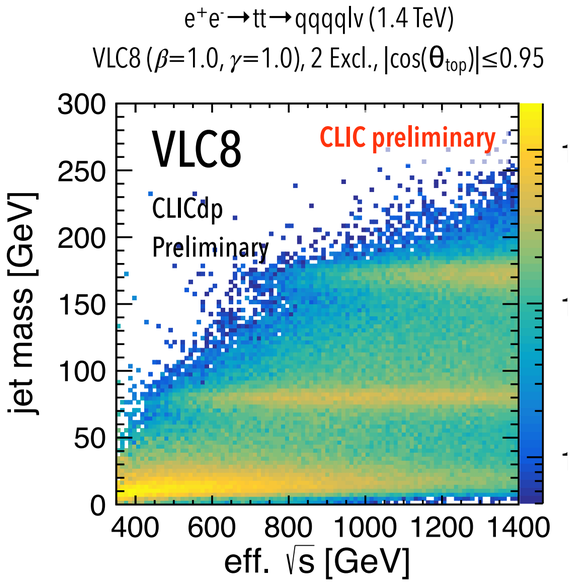
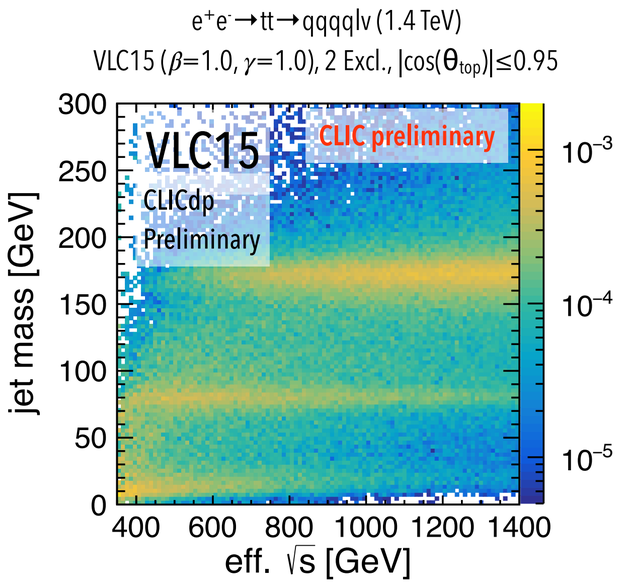
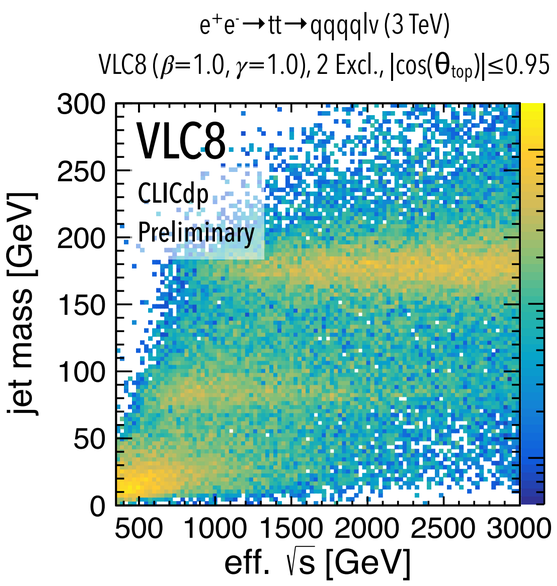
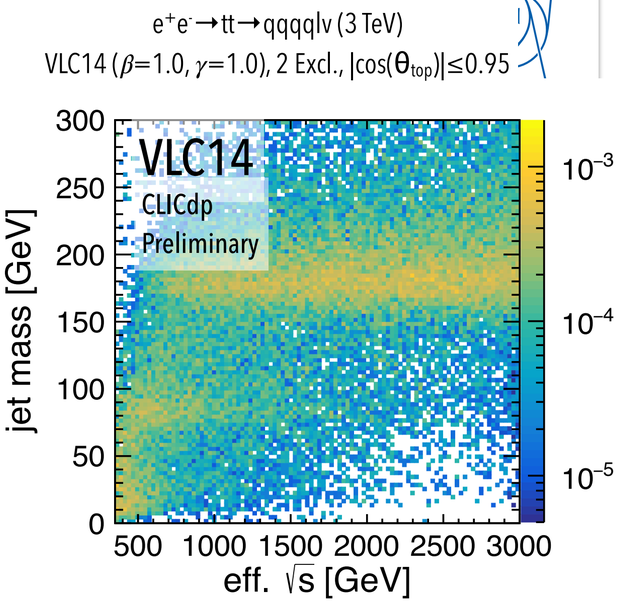
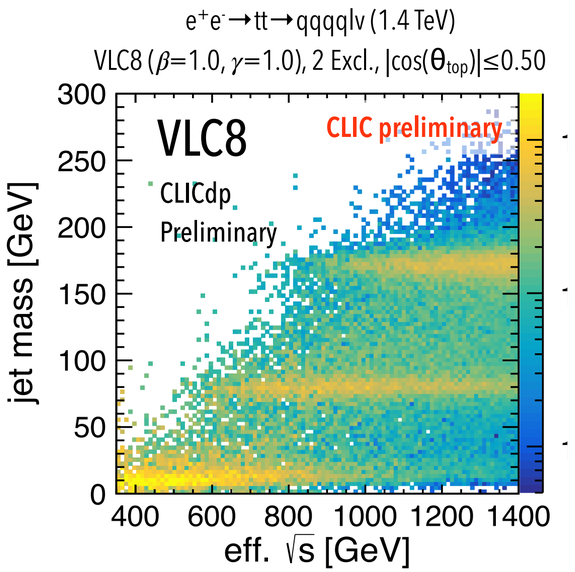
Jet clustering - semi-leptonic ttbar

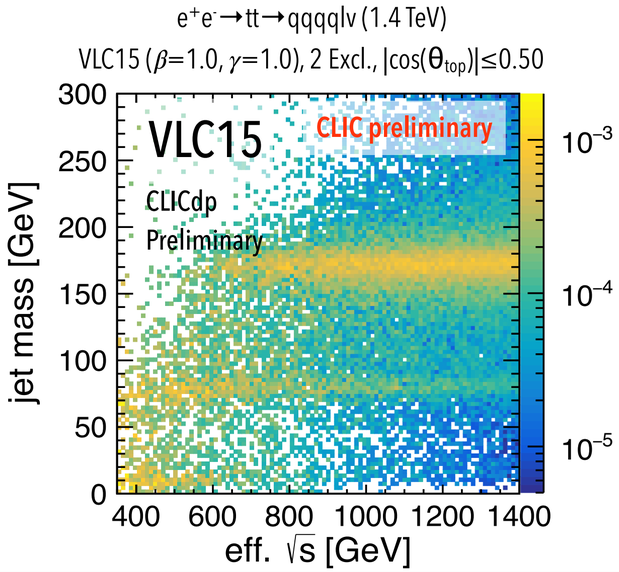






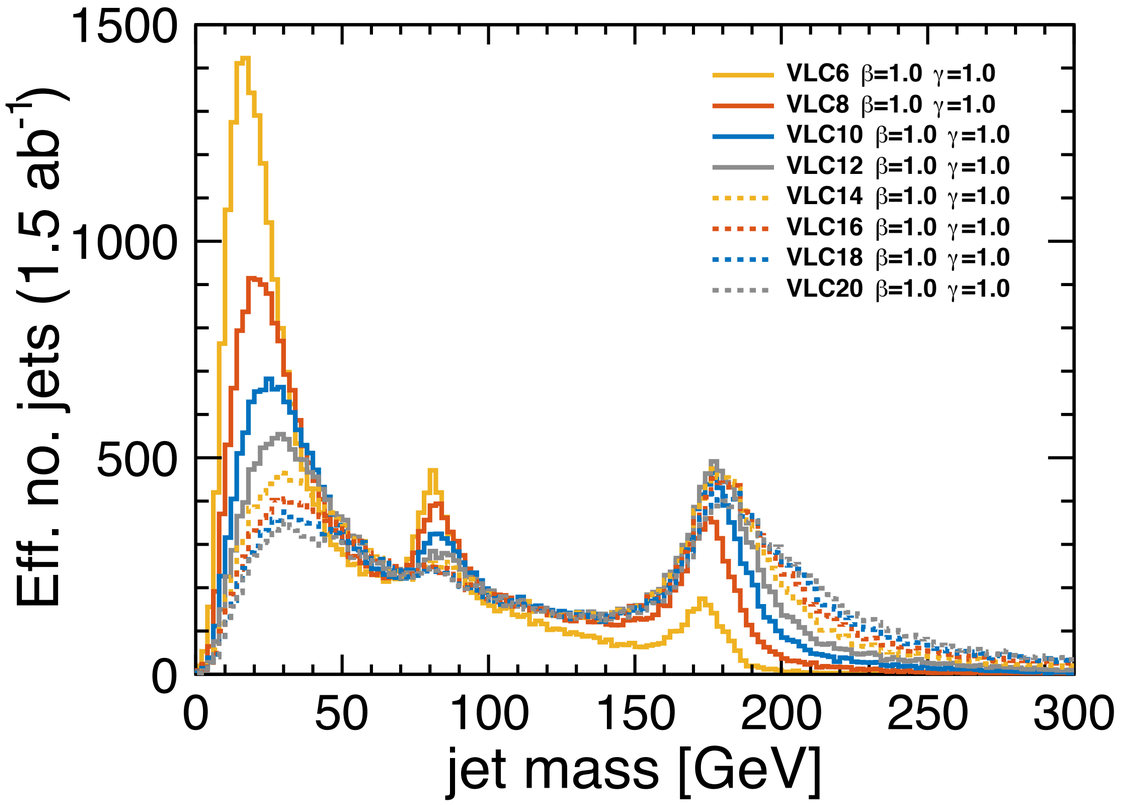




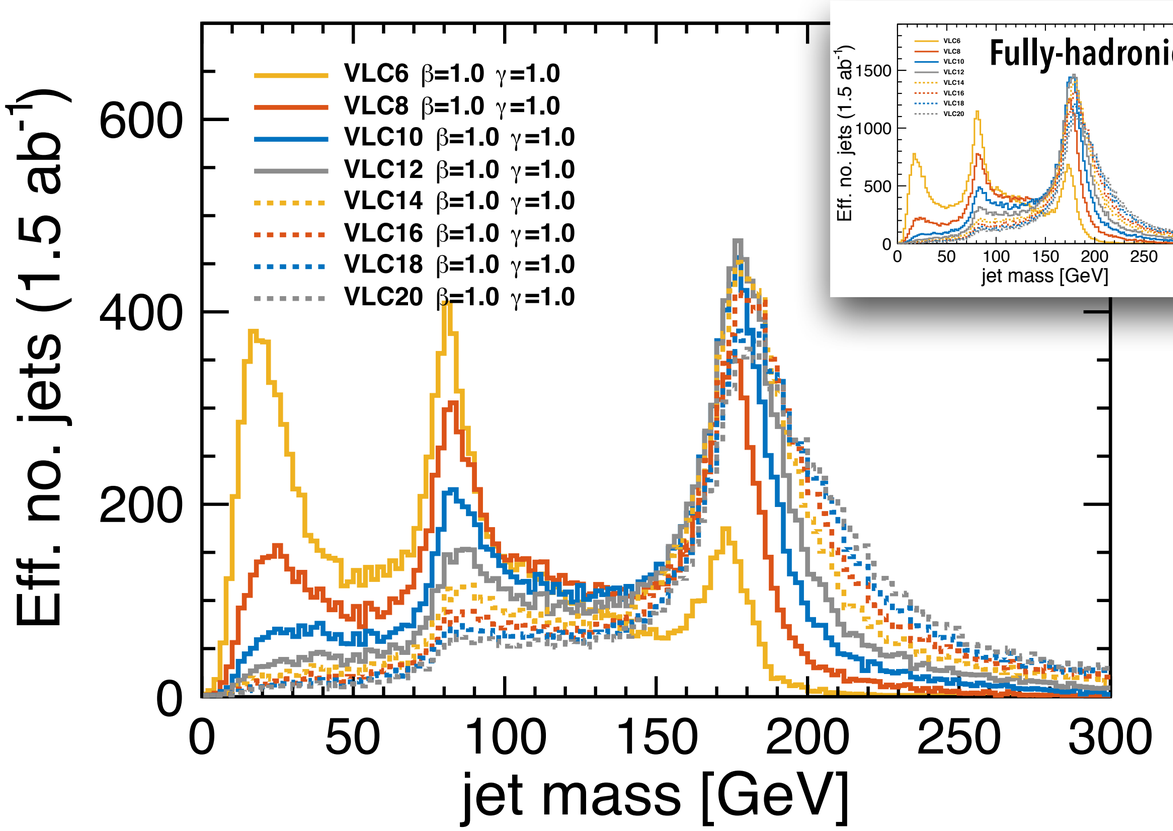


Jet clustering - semi-leptonic ttbar

2 excl. jets



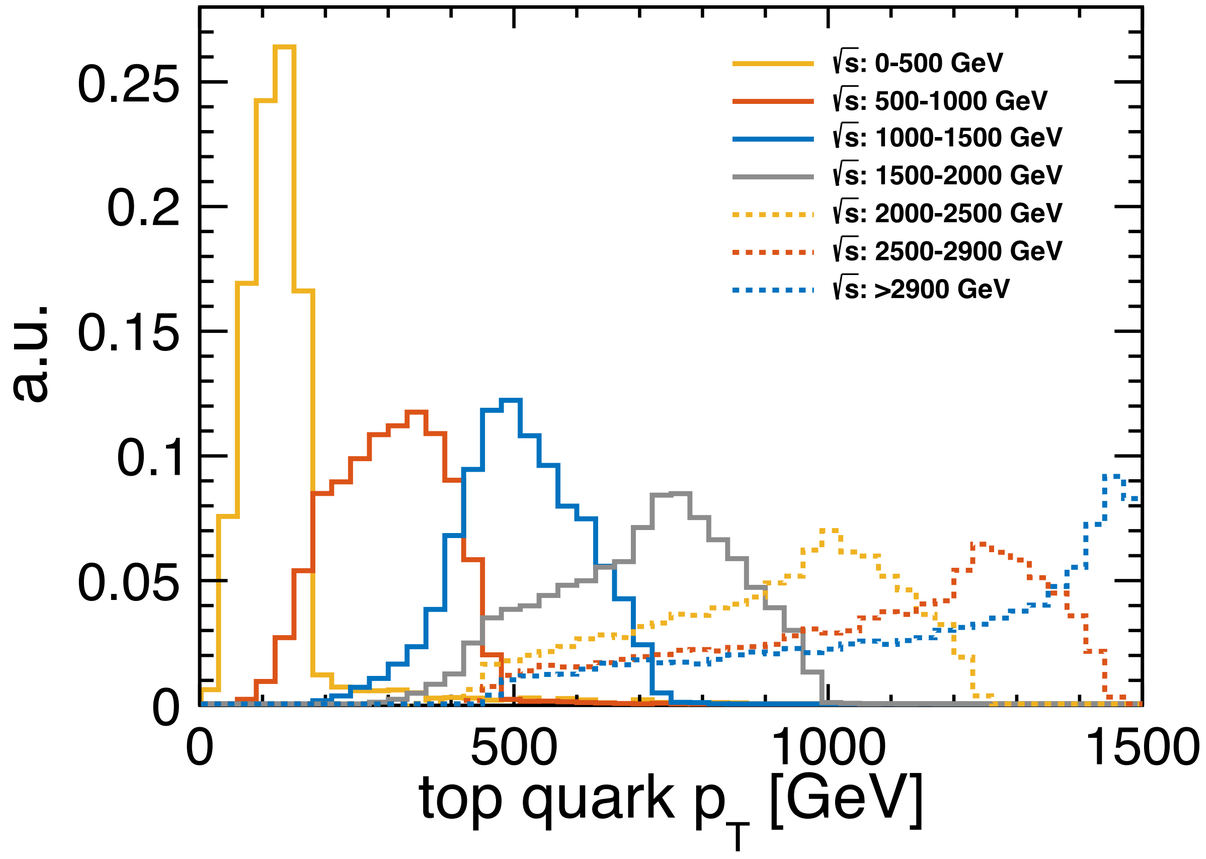
2 excl. jets - with highest energy jet ONLY



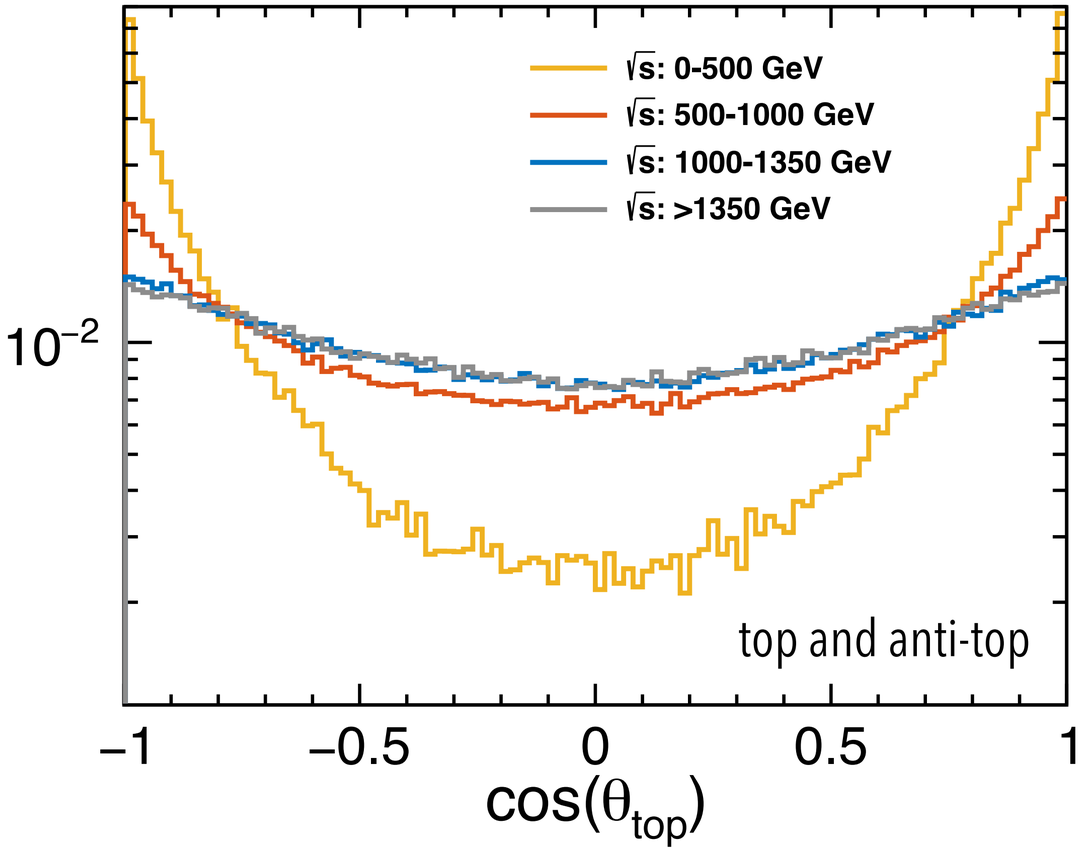
Backup

$e^+e^- \rightarrow tt$ distributions

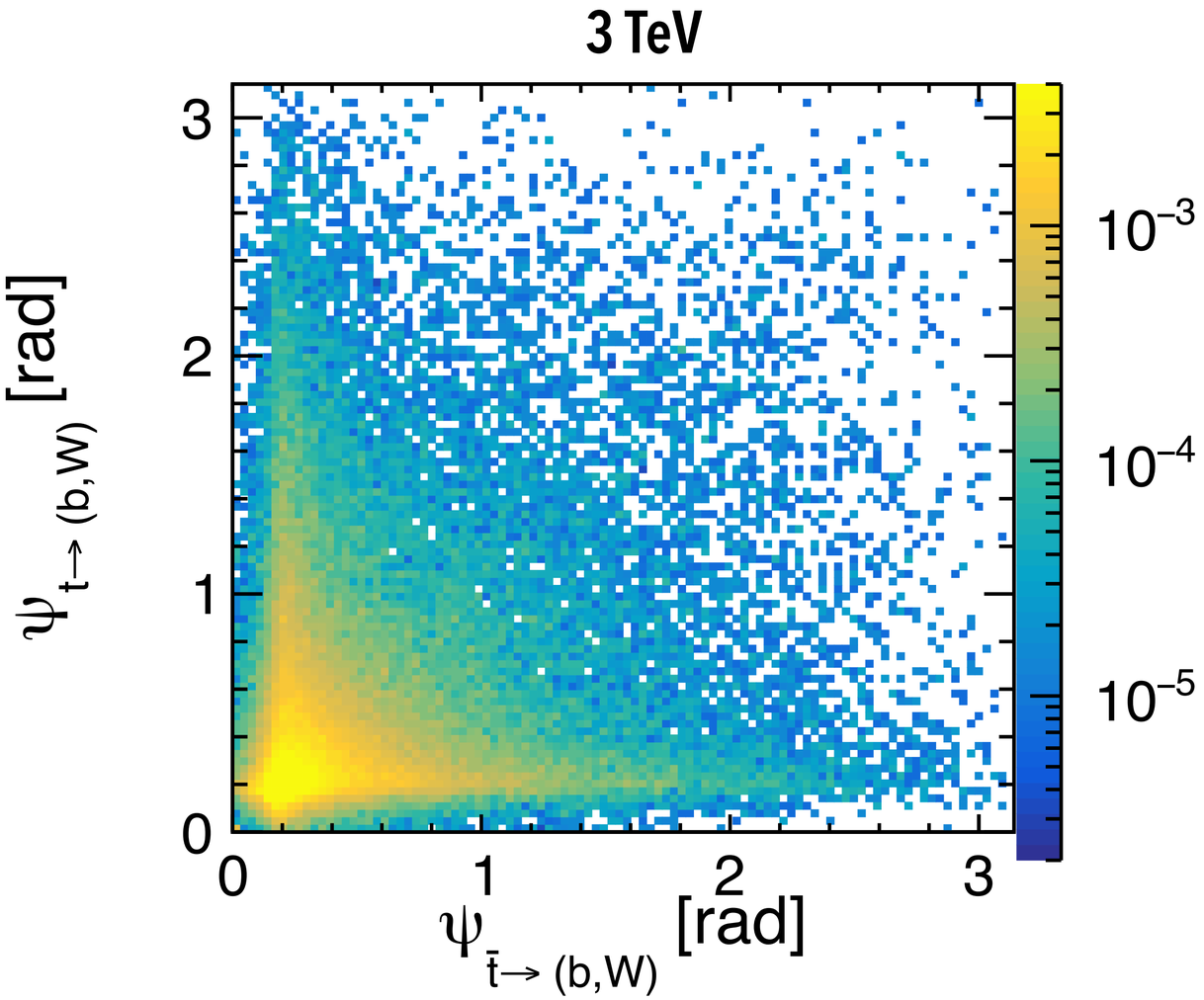
Generator level distributions (3 TeV) - p_T



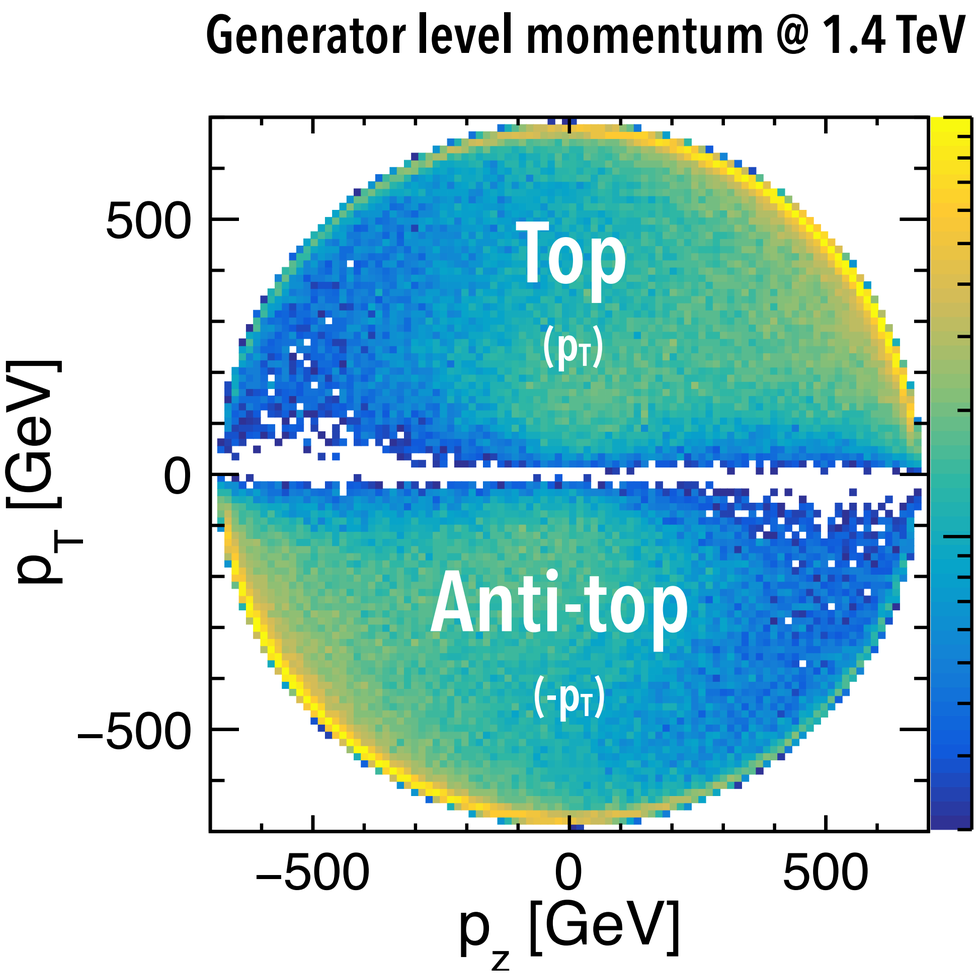
Generator level distributions (1.4 TeV) - theta

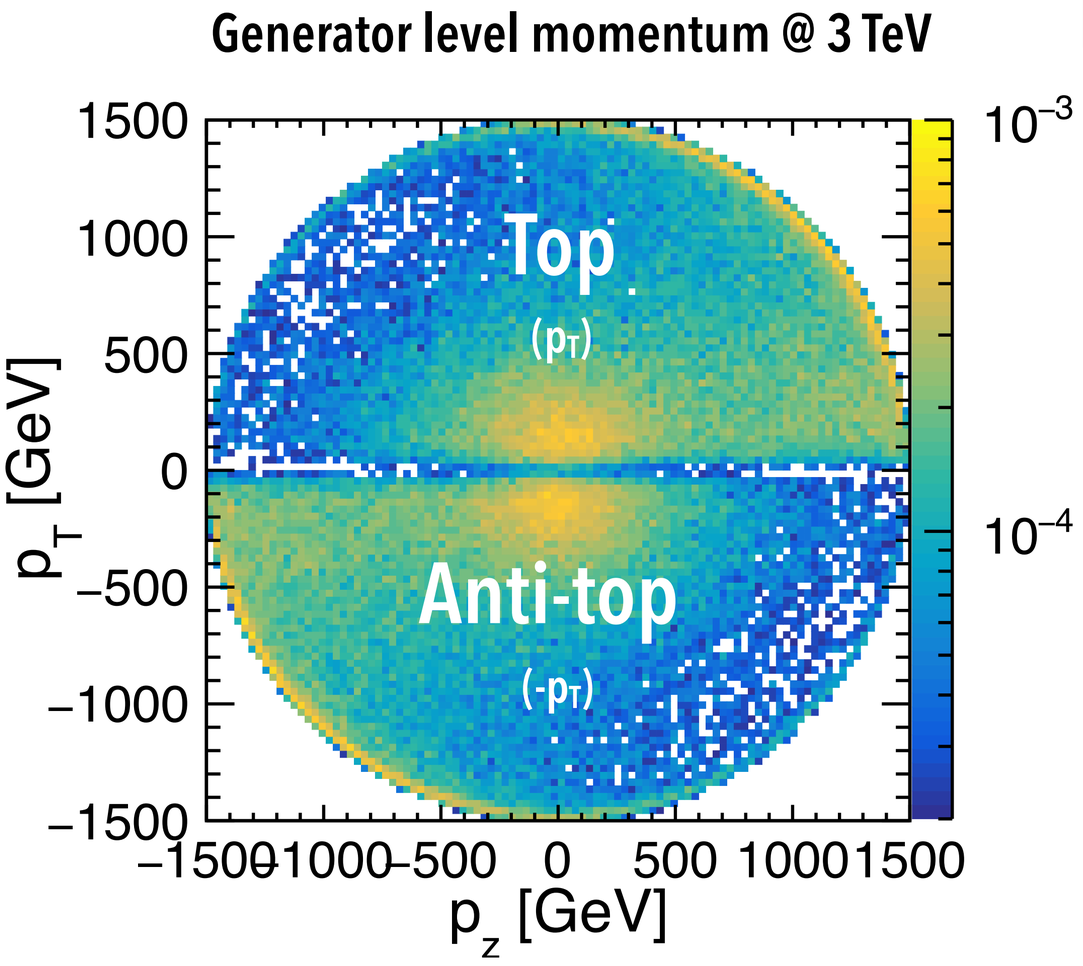


$e^+e^- \rightarrow t\bar{t}$ distributions



$e^+e^- \rightarrow tt$ distributions





$\sqrt{s'} > 0$ GeV