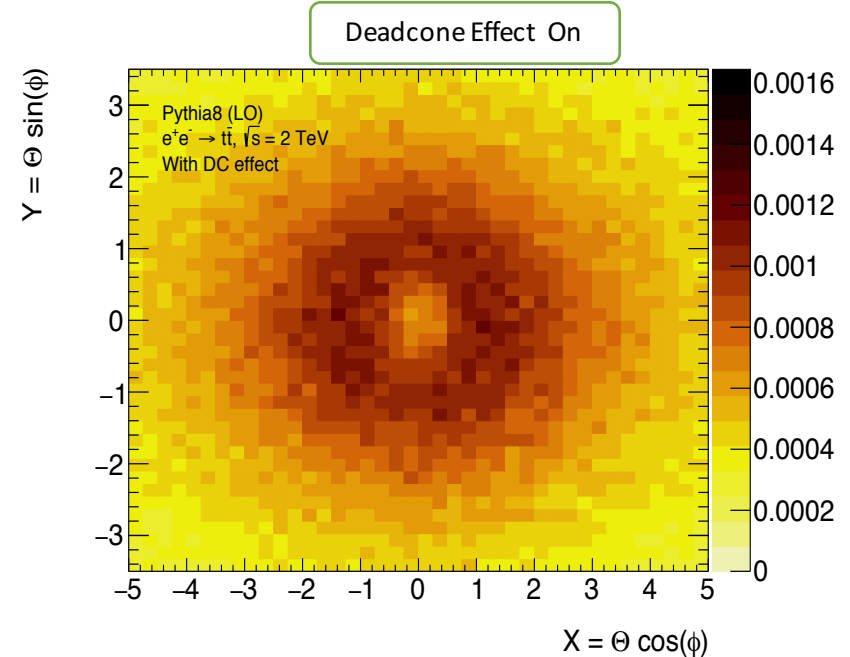
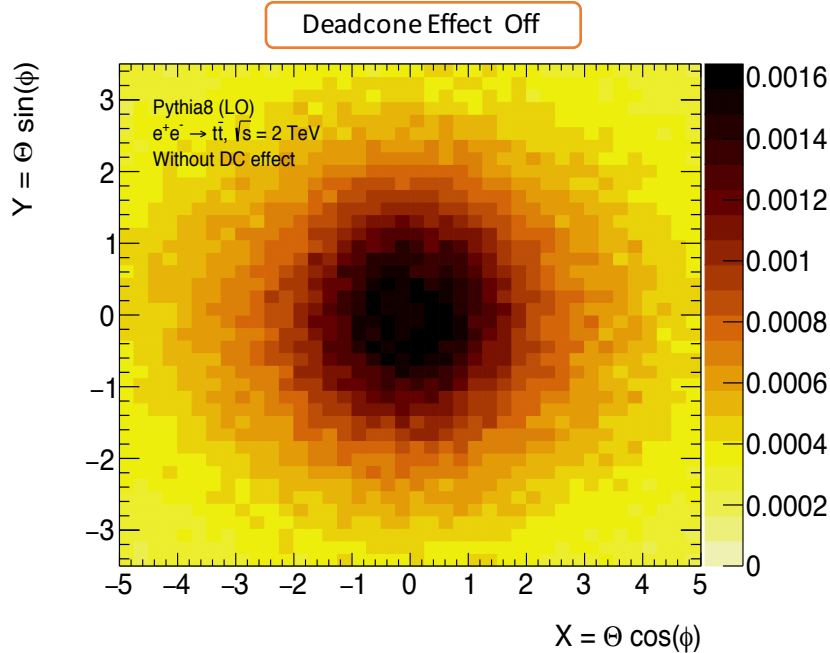




Deadcone @ HL-LHC

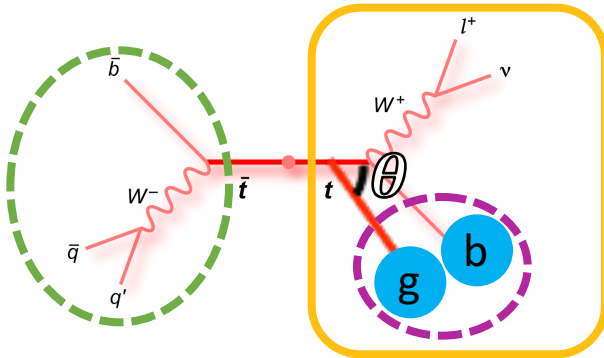
Ian Connelly, Jay Howarth, Jacob Rawling, Yvonne Peters

What is the dead-cone effect?



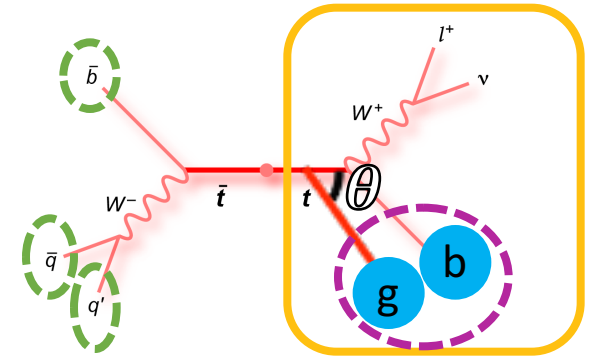
The Dead Cone Effect: Radiation from a massive particle with mass m and energy E is suppressed for emission angles $\theta \lesssim \theta_D = \frac{m}{E}$

- **Never** been measured
- Fundamental predication of radiation in gauge invariant QFTs
- Hard to measure experimentally— $\theta_D \ll 1$ **EXCEPT** in tops!



Boosted $t\bar{t}$ lepton + jets
Hadronic top for event selection.

Reconstruct a leptonic top (LT)



Resolved $t\bar{t}$ lepton + jets
Resolved hadronic top for event selection.

Reconstruct a leptonic top (LT)

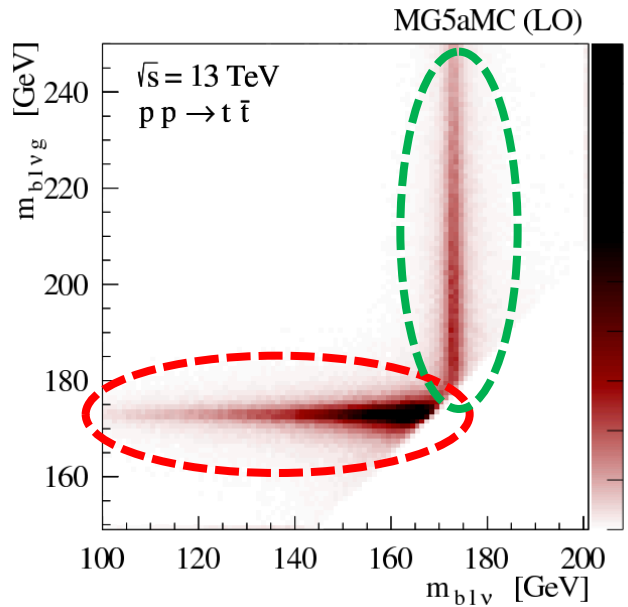
Associated a fat jet to b-tagged jet from the LT

Fat b-jet has a two prong structure

ΔR match a prong to b-jet. The other is the gluon candidate

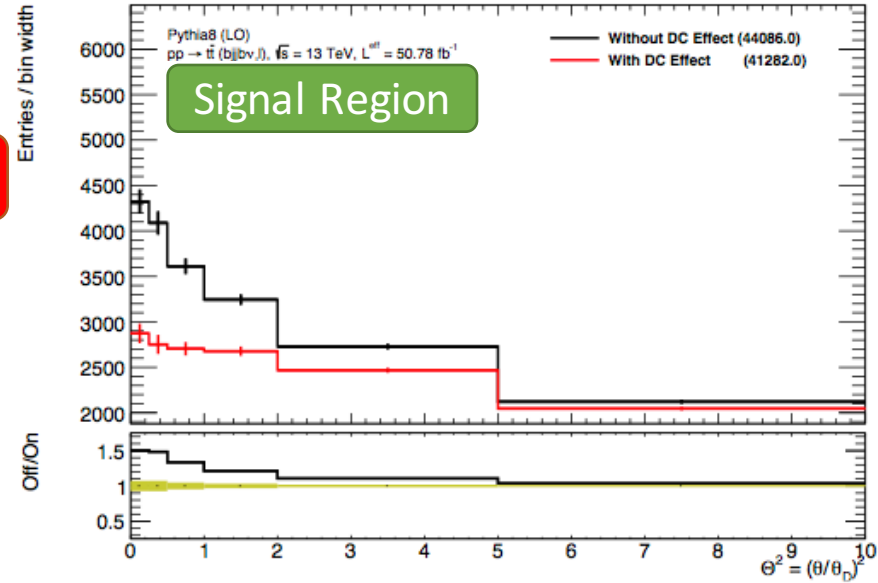
Measure $\Theta = \frac{\theta}{\theta_D}$;
In regions of $m_{bl\nu}$ and $m_{bl\nu g}$

Motivated by:
<https://arxiv.org/abs/1606.03449>



Signal

b-quark FSR



- **MC:** Pythia8 has a switch for turning on and off the deadcone
 - To my knowledge no other MC generator has this
 - Will have to be a measurement accurate to LO
- **Particle level pythia8 toy study**
 - Differences in event yield due to selection, shape difference substantial
- **Challenges needed to overcome:**
 - Custom overlap removal of leptons and large-R jet constituents needs implementing
 - SoftDrop would be ideal groomer – currently not available
 - Calibration of sub-prongs will be required

- Person Power: Ian Connelly, Jay Howarth, Jacob Rawling (Analyser), Yvonne Peters
- Final State: $t\bar{t}$, lepton + jets
- Expected output: Differential dead-cone measurement
- Status of Analysis: Perspective studies on-going. Signal samples are being produced in ATLAS.
- Needed Theoretical Inputs: None
- Desired Theoretical Inputs: NLO samples that model a deadcone on/off hypothesis