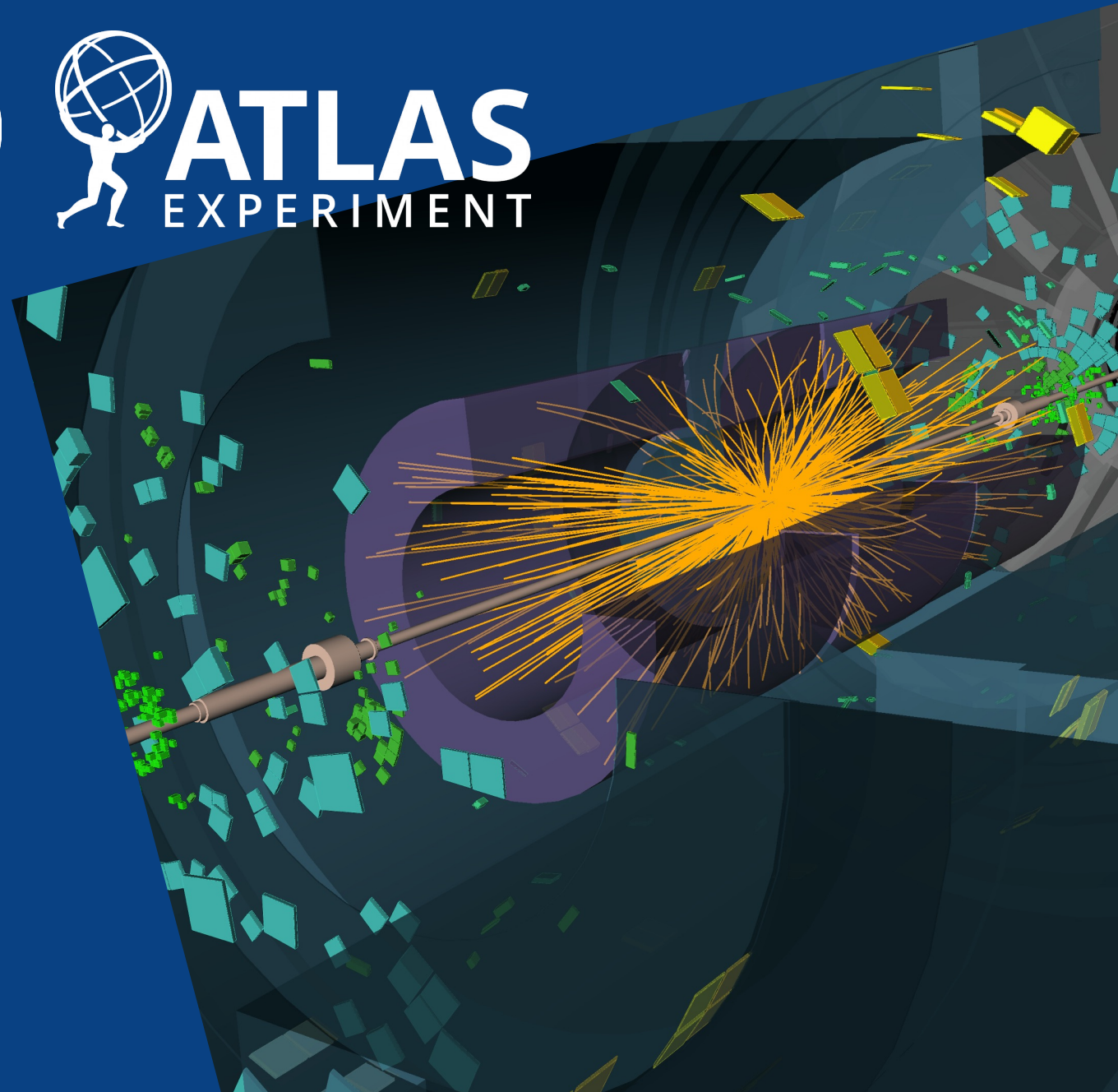




$t\bar{t}H$ production at the HL-LHC

Isabel Carr

Supervisor: Geoff Taylor



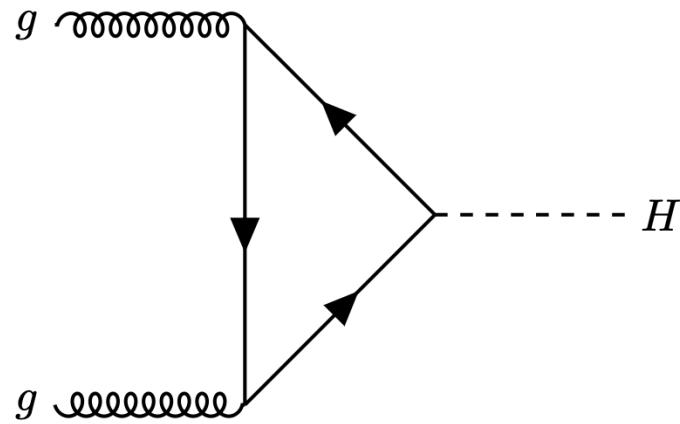


Motivations

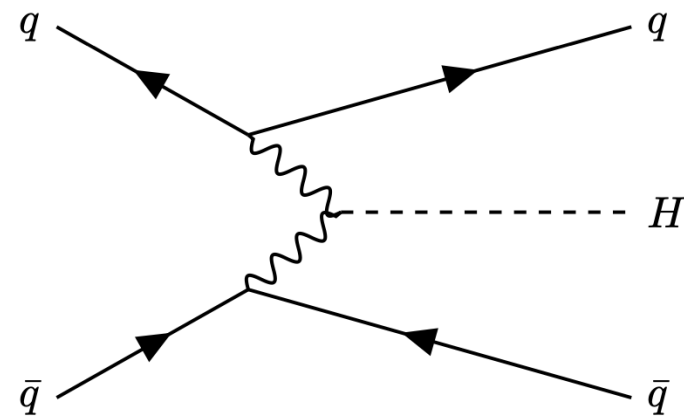
- One major goal of the HL-LHC upgrade is to attain precise measurements of Higgs boson properties
 - Precision Higgs measurements are a potential “portal” to new physics!
 - Yukawa coupling to top quark

Can be determined by measuring the rate of $t\bar{t}H$ production

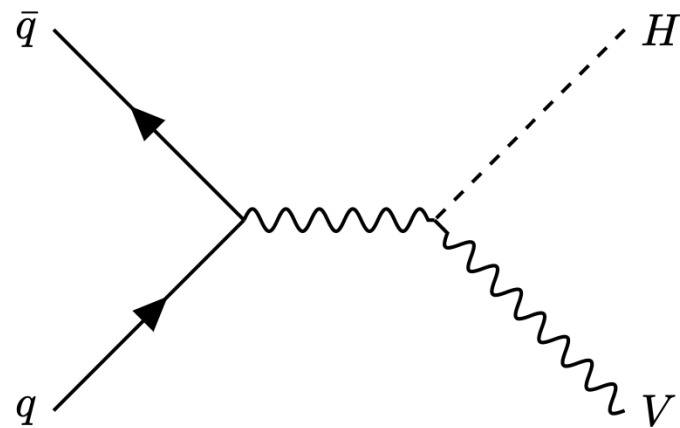
Production of Higgs Boson



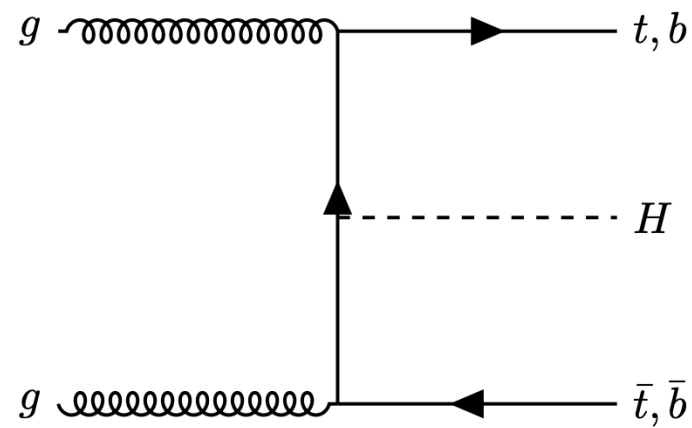
(a)



(b)



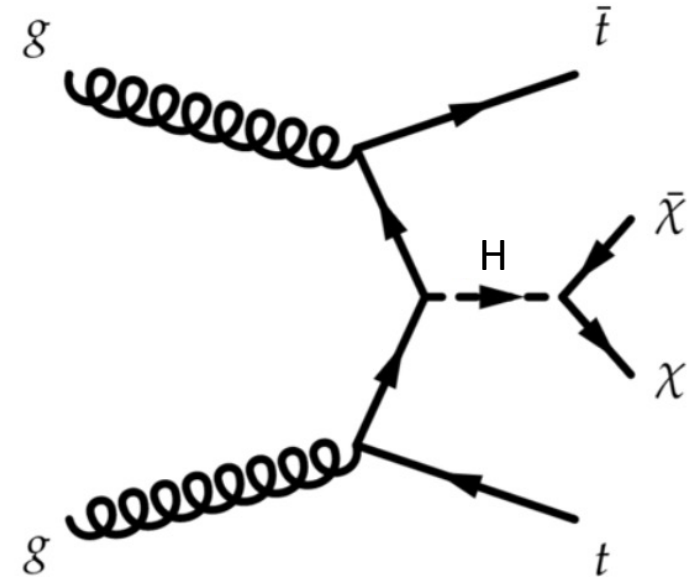
(c)



(d)

Another possible source of new physics

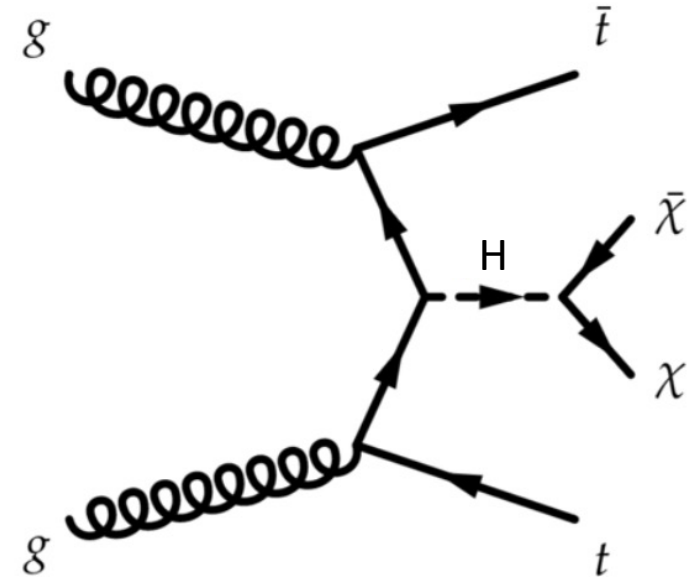
- One decay mode of interest is Higgs decaying into ‘invisible’ particles $\chi\bar{\chi}$



Another possible source of new physics

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Dark matter?

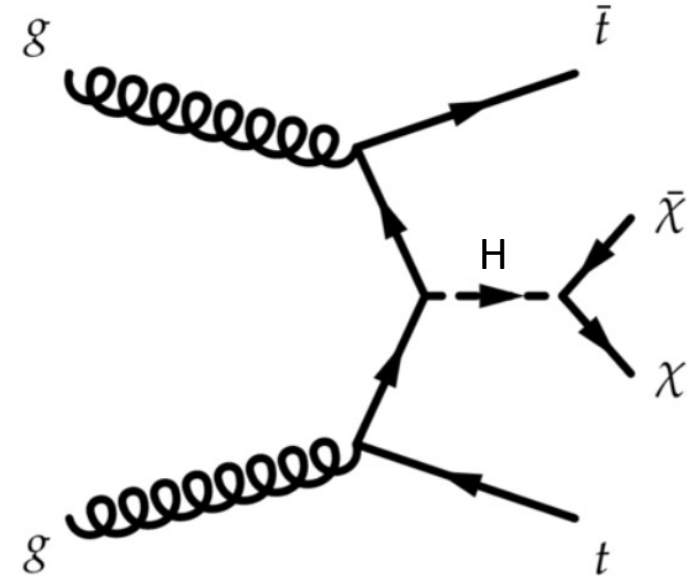


Another possible source of new physics

- One decay mode of interest is Higgs decaying into ‘invisible’ particles $\chi\bar{\chi}$

Dark matter?

→ $\sim 1:10^6$ signal to background



Another possible source of new physics

- One decay mode of interest is Higgs decaying into ‘invisible’ particles $\chi\bar{\chi}$

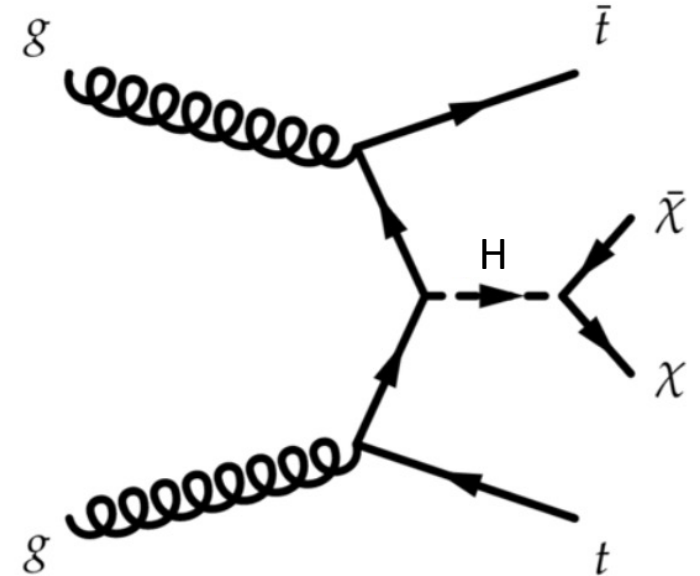
Dark matter?

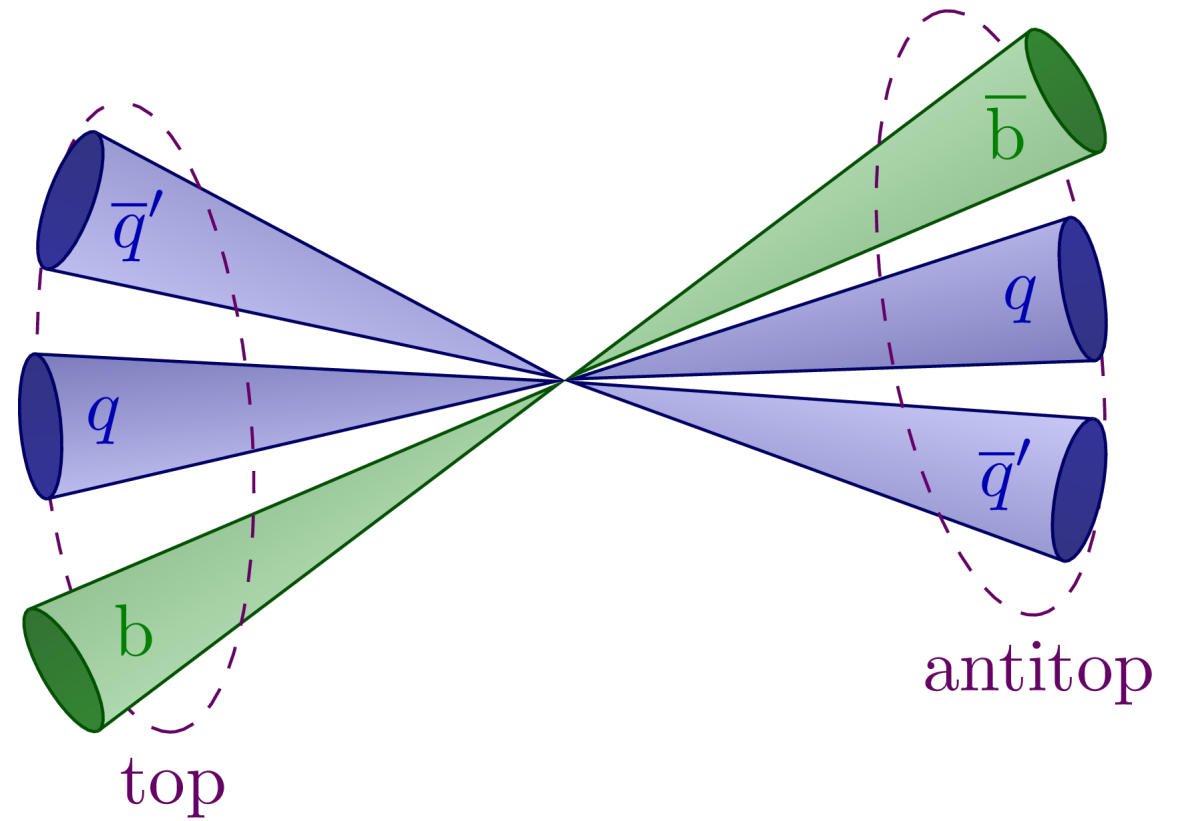
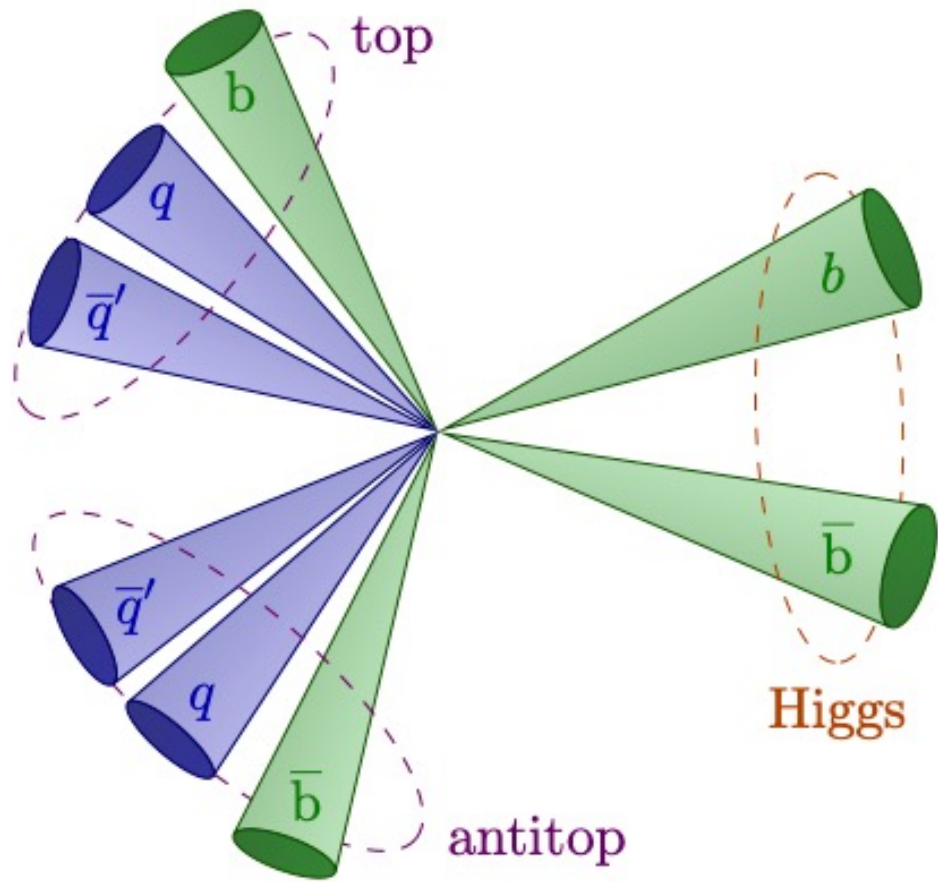
→ $\sim 1:10^6$ signal to background

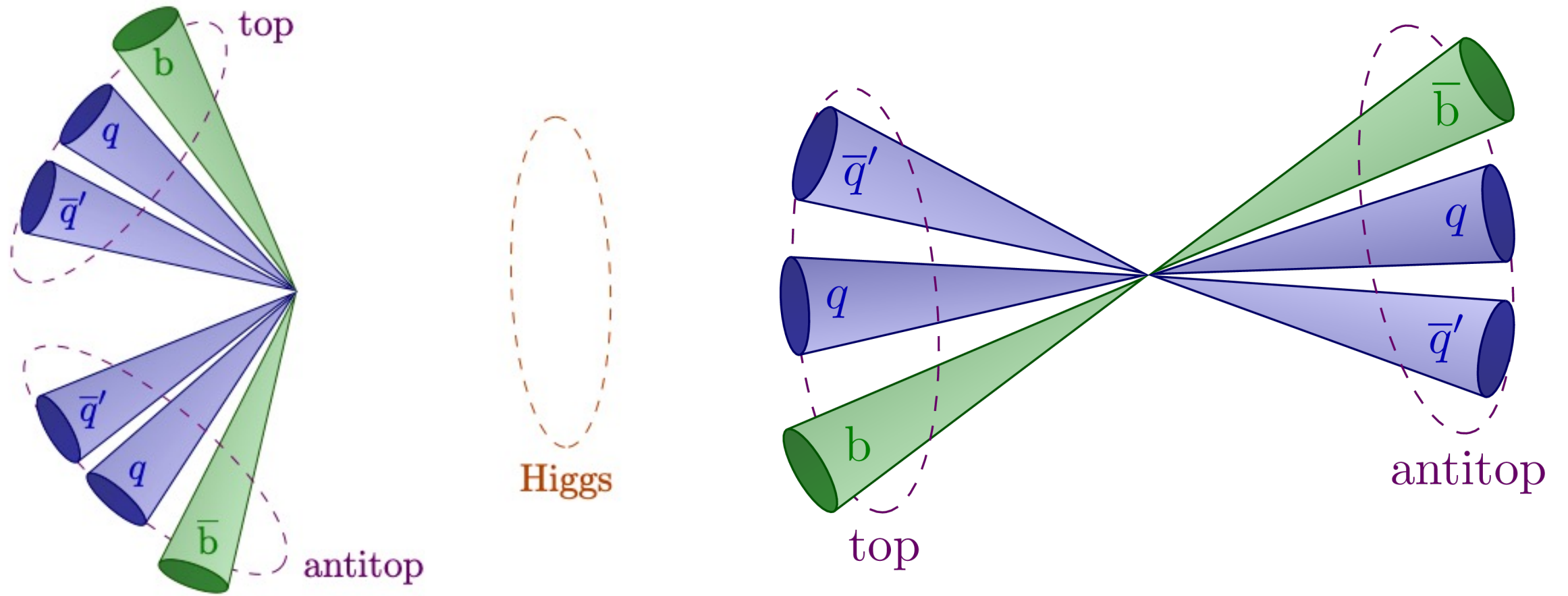
- Look identical to background?

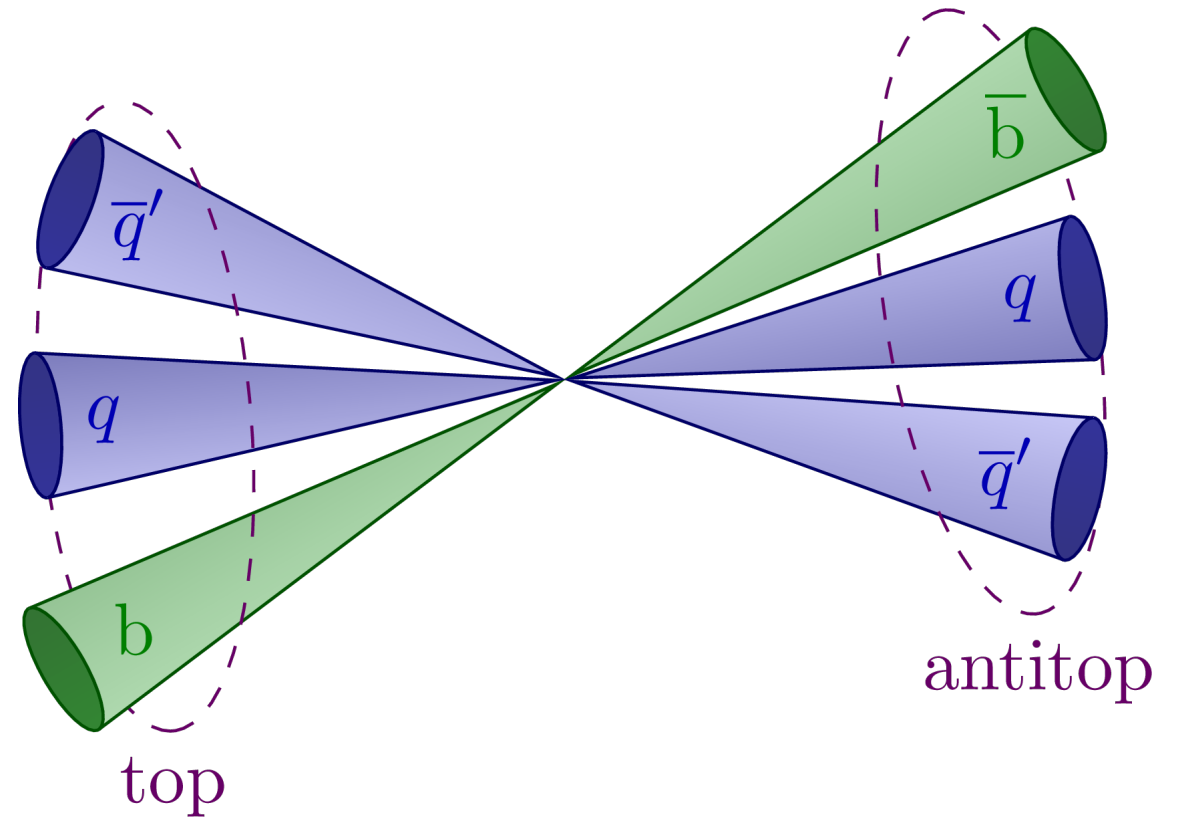
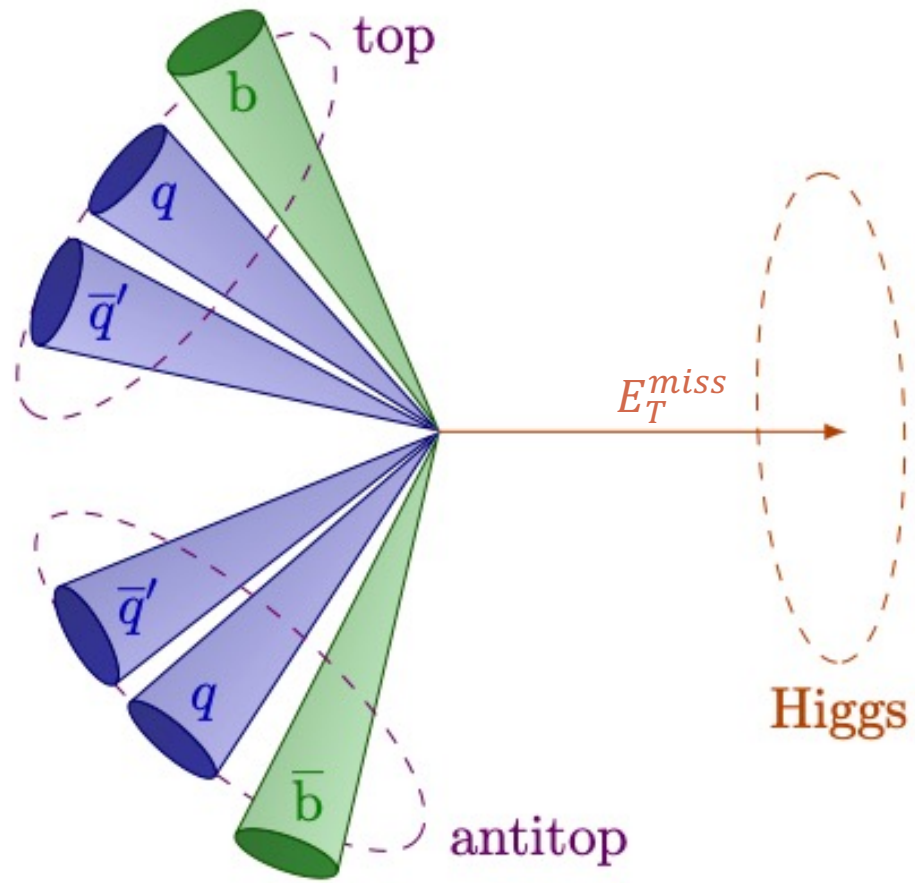
‘Missing’ E_T ?

Different kinematics?

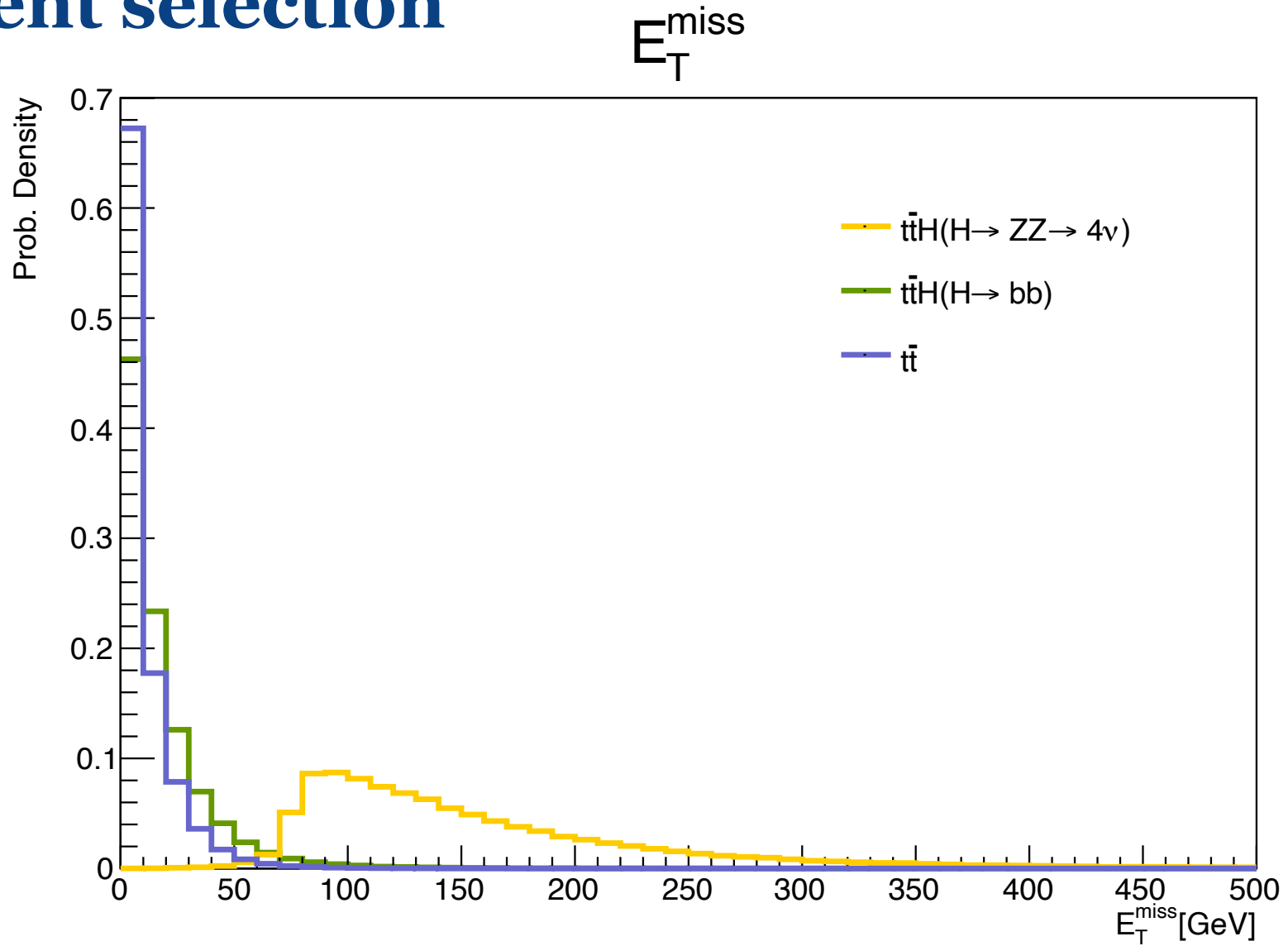




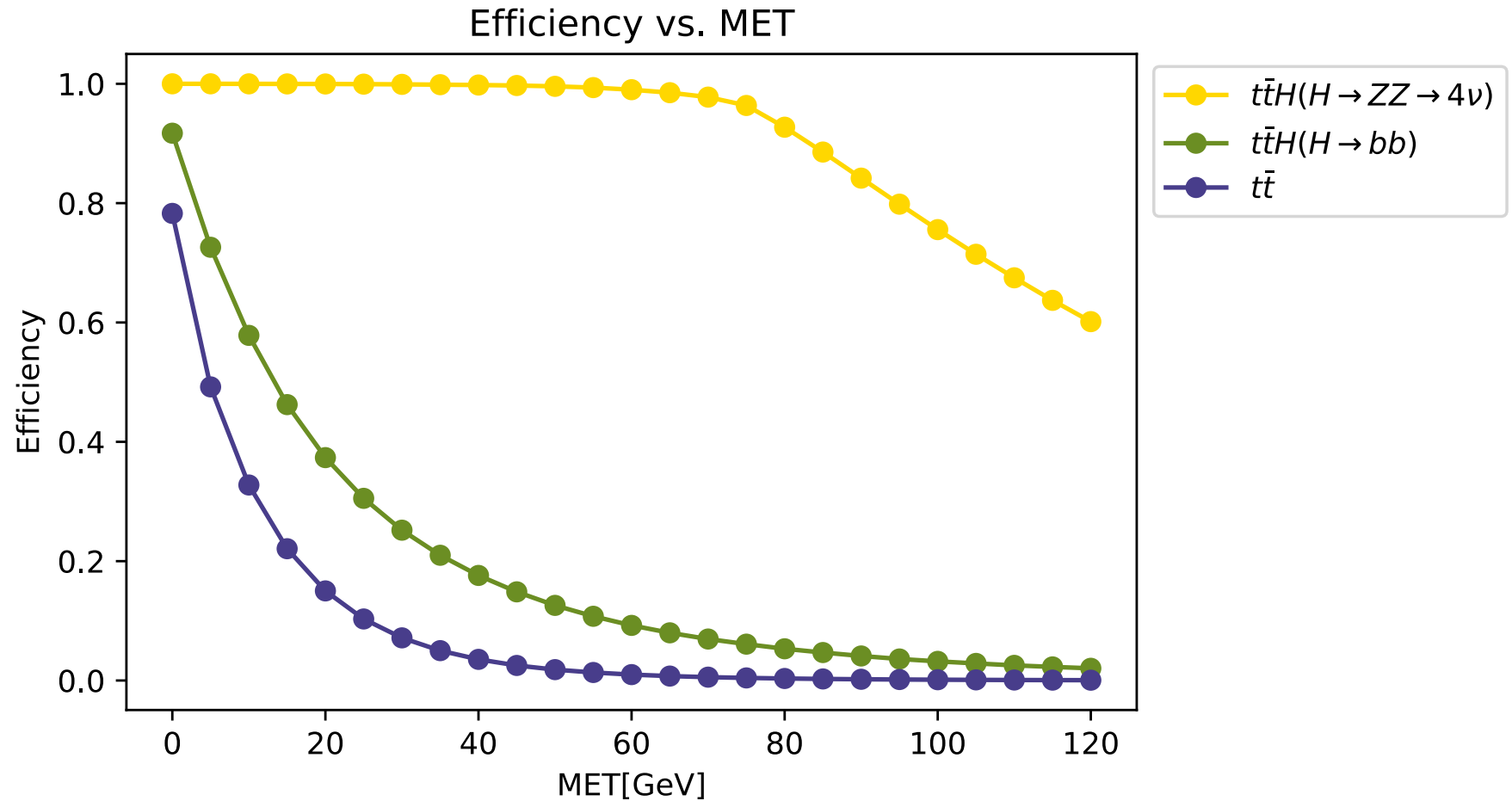




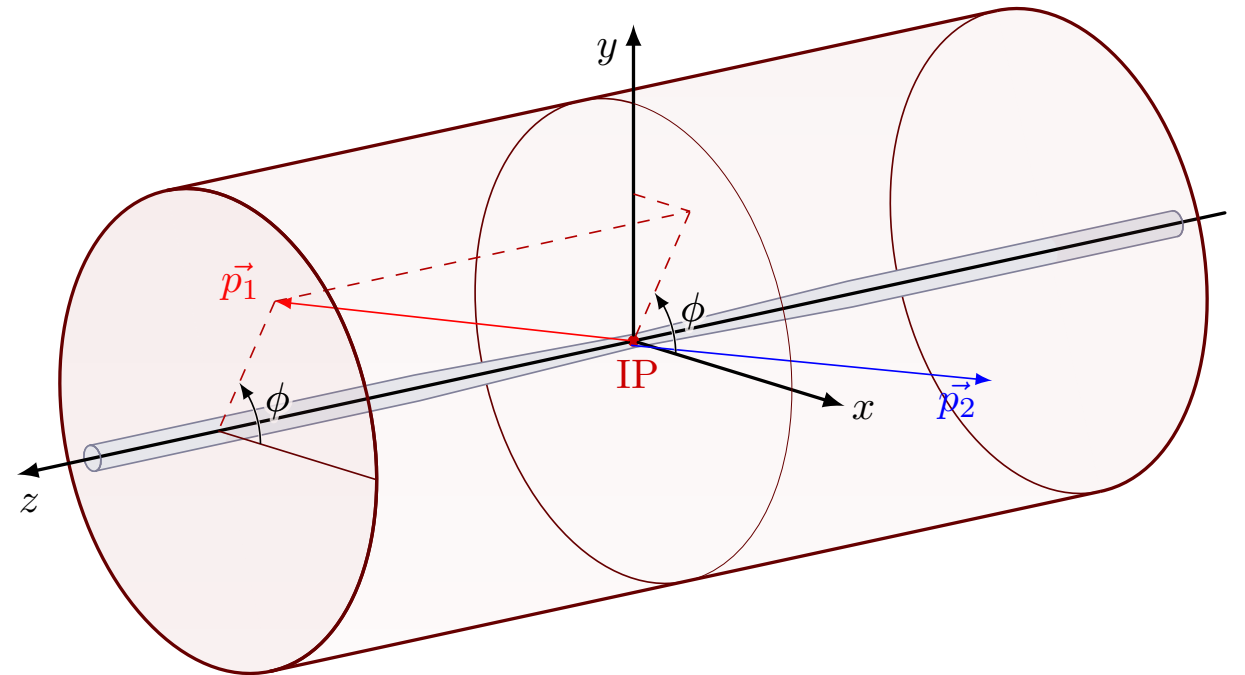
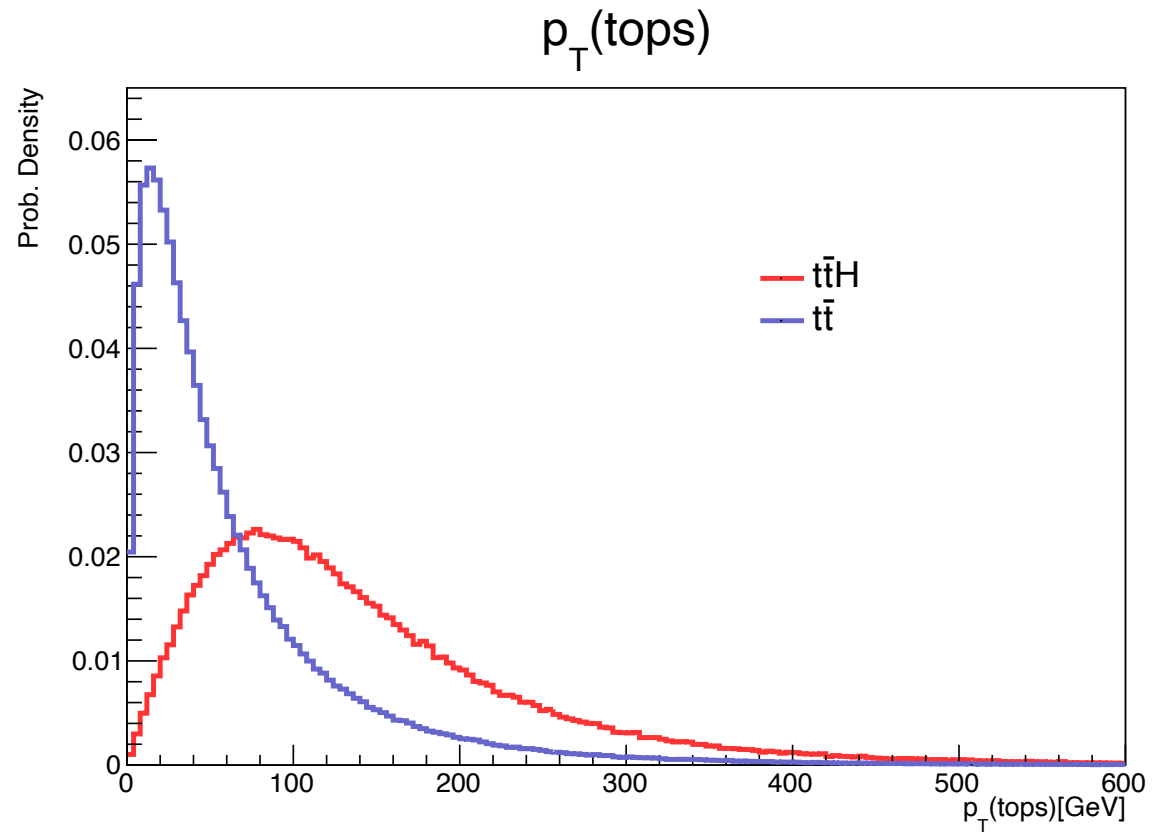
Event selection



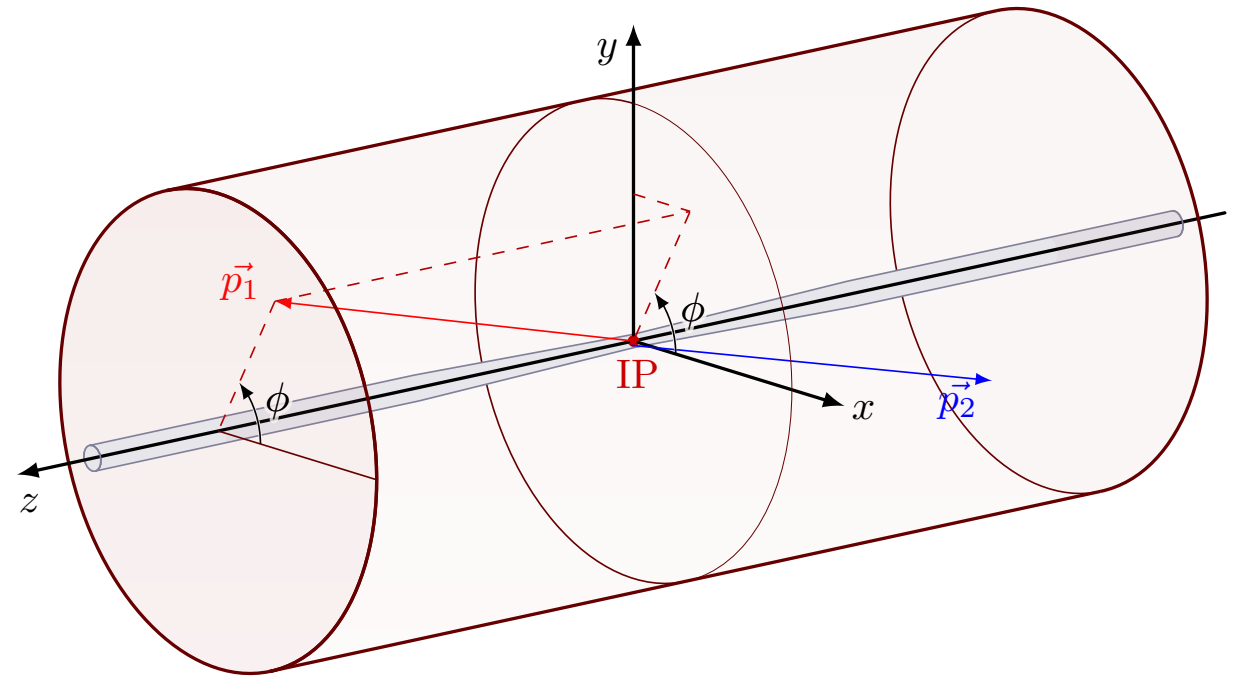
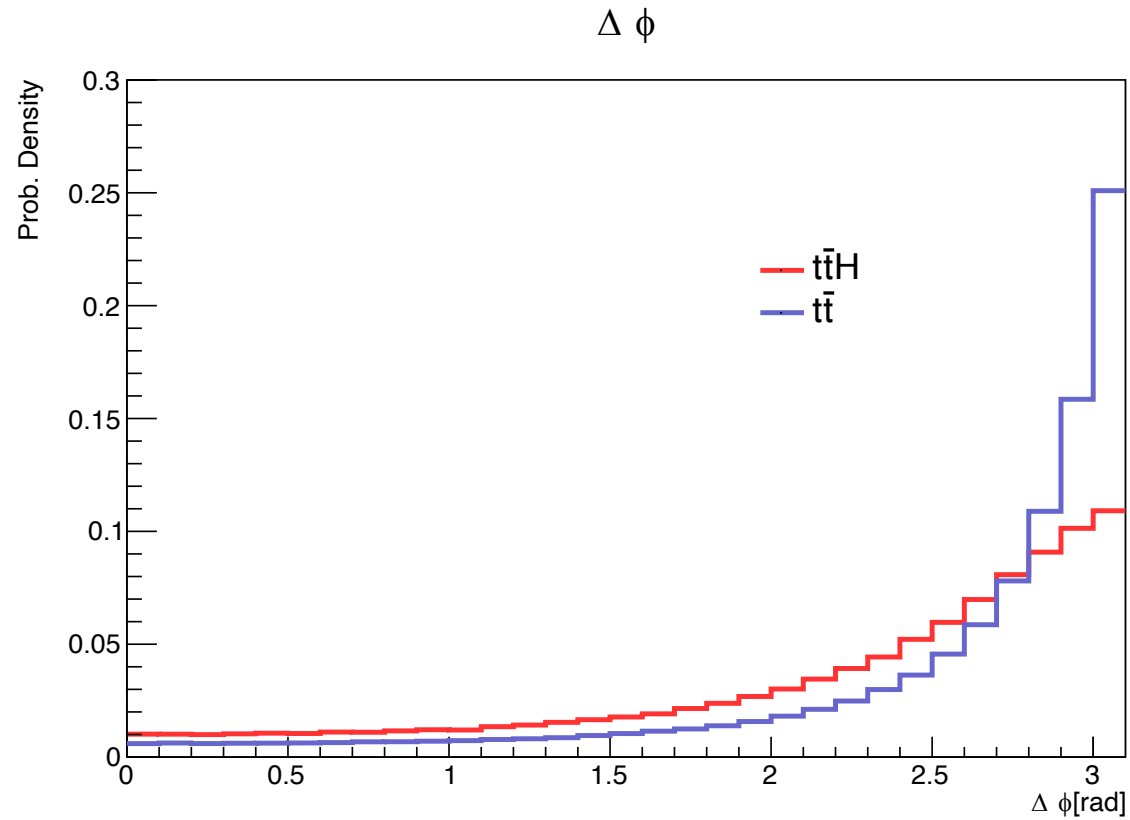
Event selection

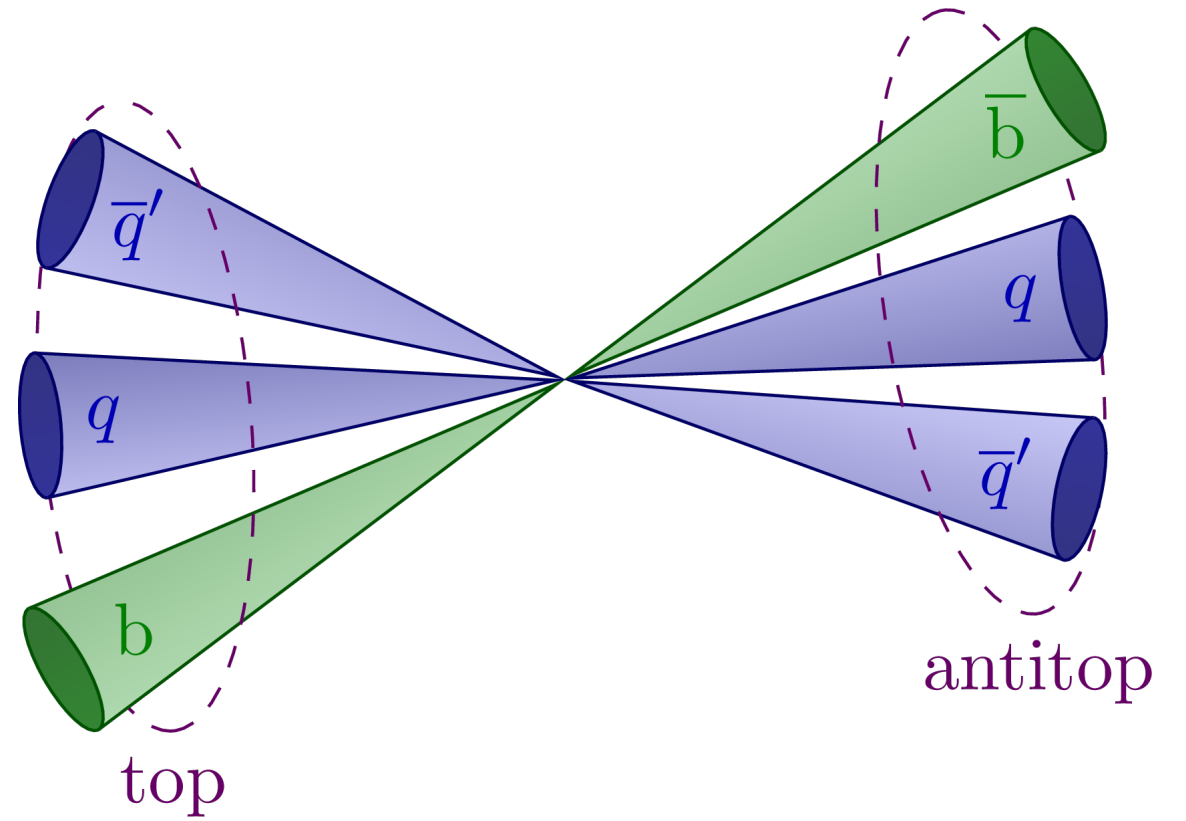
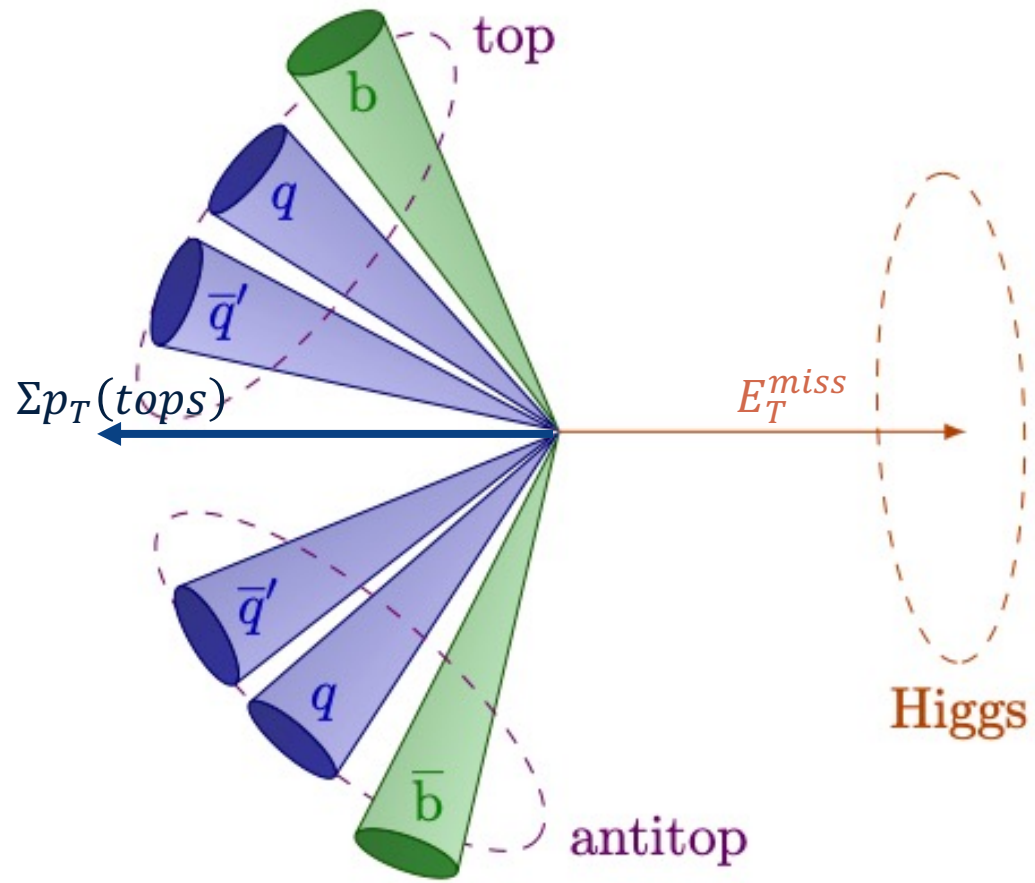


Preliminary plots

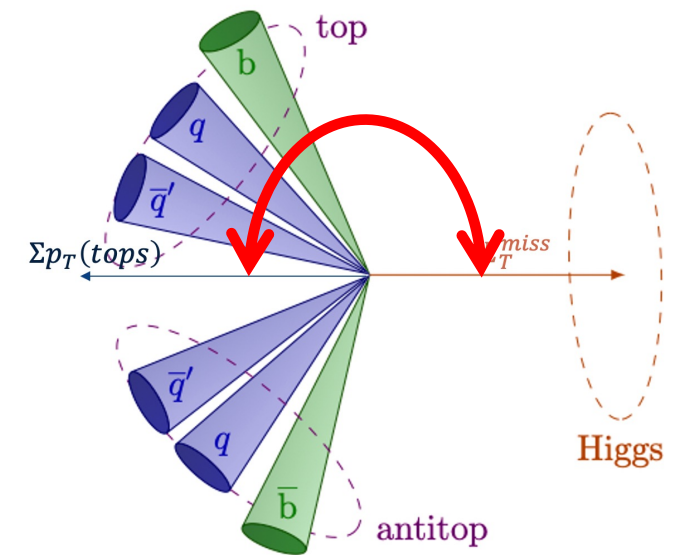
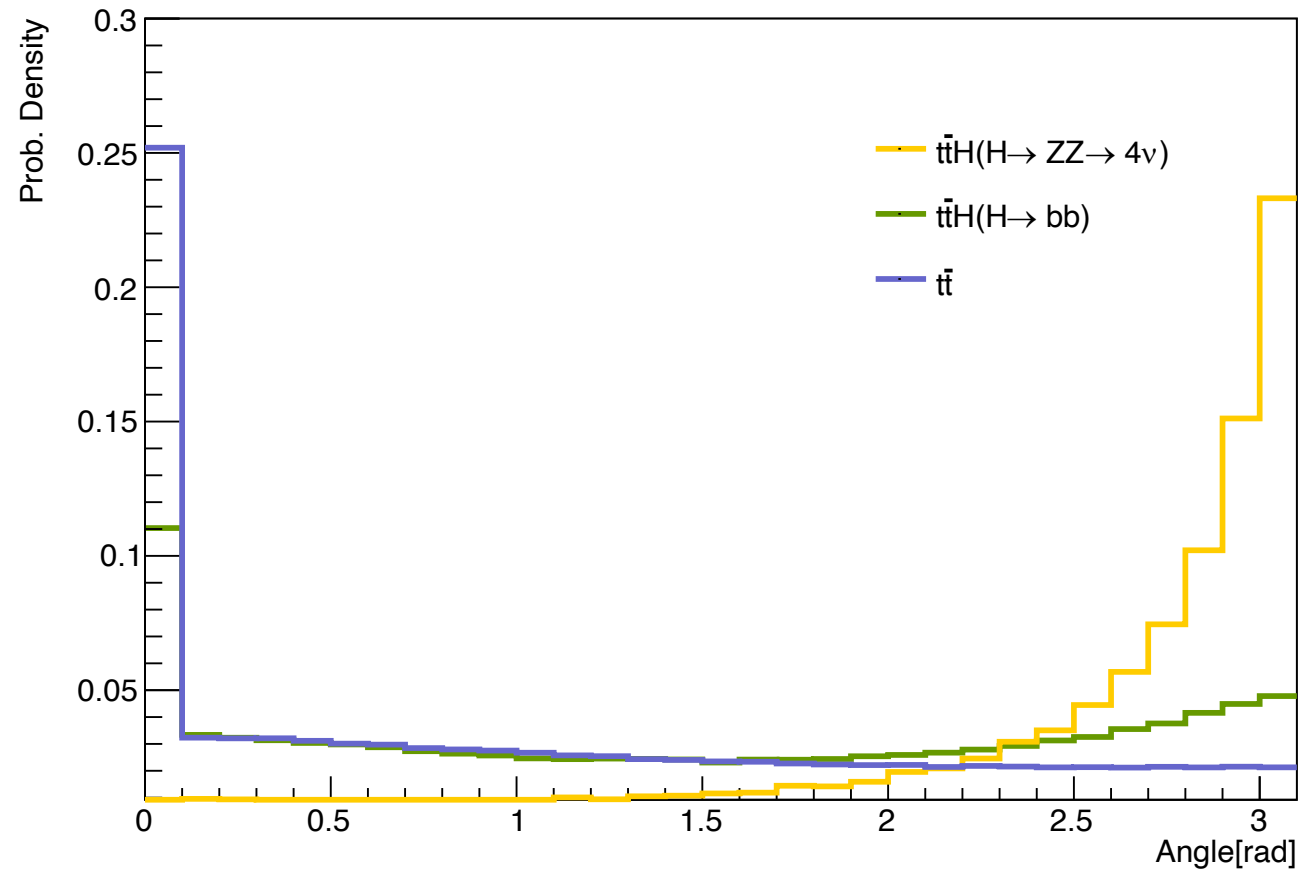


Preliminary plots





Preliminary plots





Questions to answer in the future:

- With the new HL-LHC upgrade:
 - How can we improve the sensitivity to this $t\bar{t}H$ process?
 - How much better can we measure this decay with new technology?
- This region also has a large number of background processes
 - Can we get better discrimination between signal and background events?
 - How sensitive are we to inefficiencies with this new geometry?



Thank you

