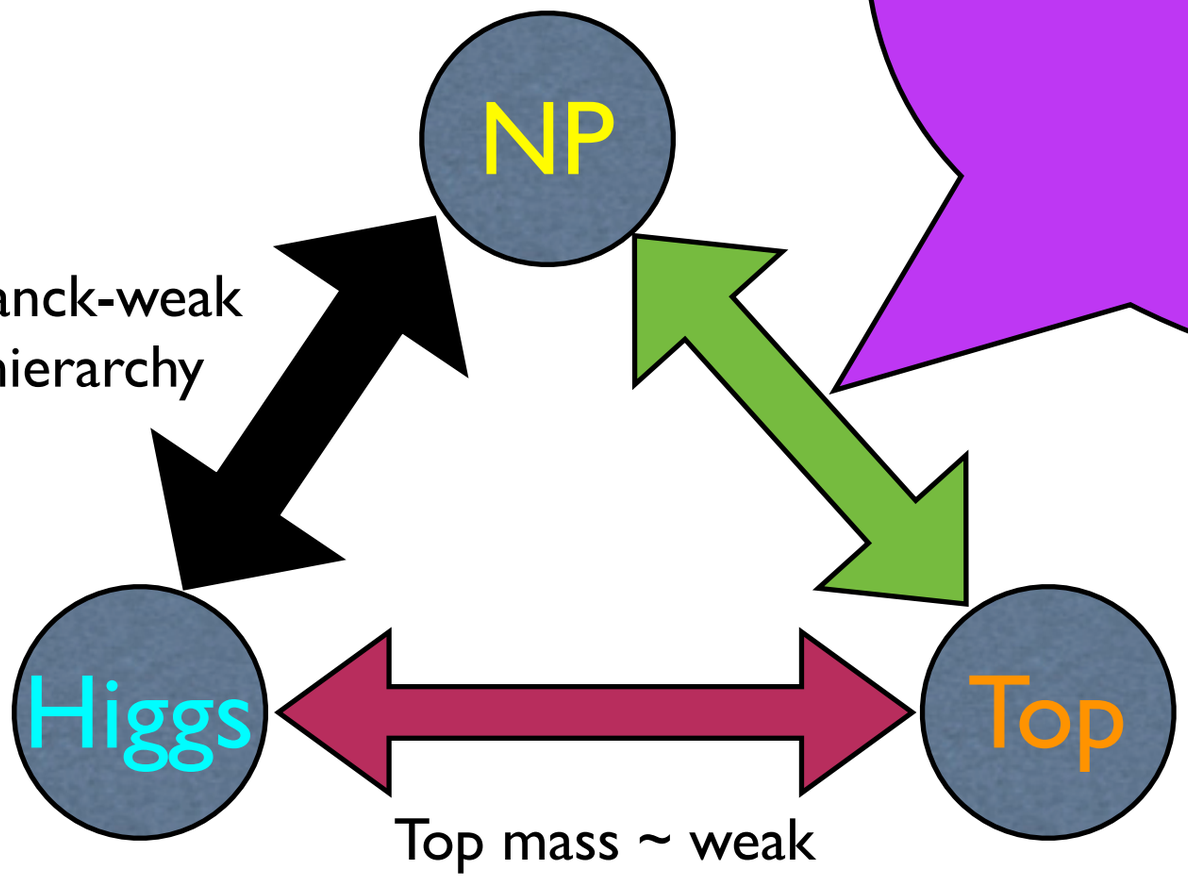
NEW PHYSICS (NP) IN TOP

(Top quark subgroup of High-Energy Frontier)

Why NP in top quark?

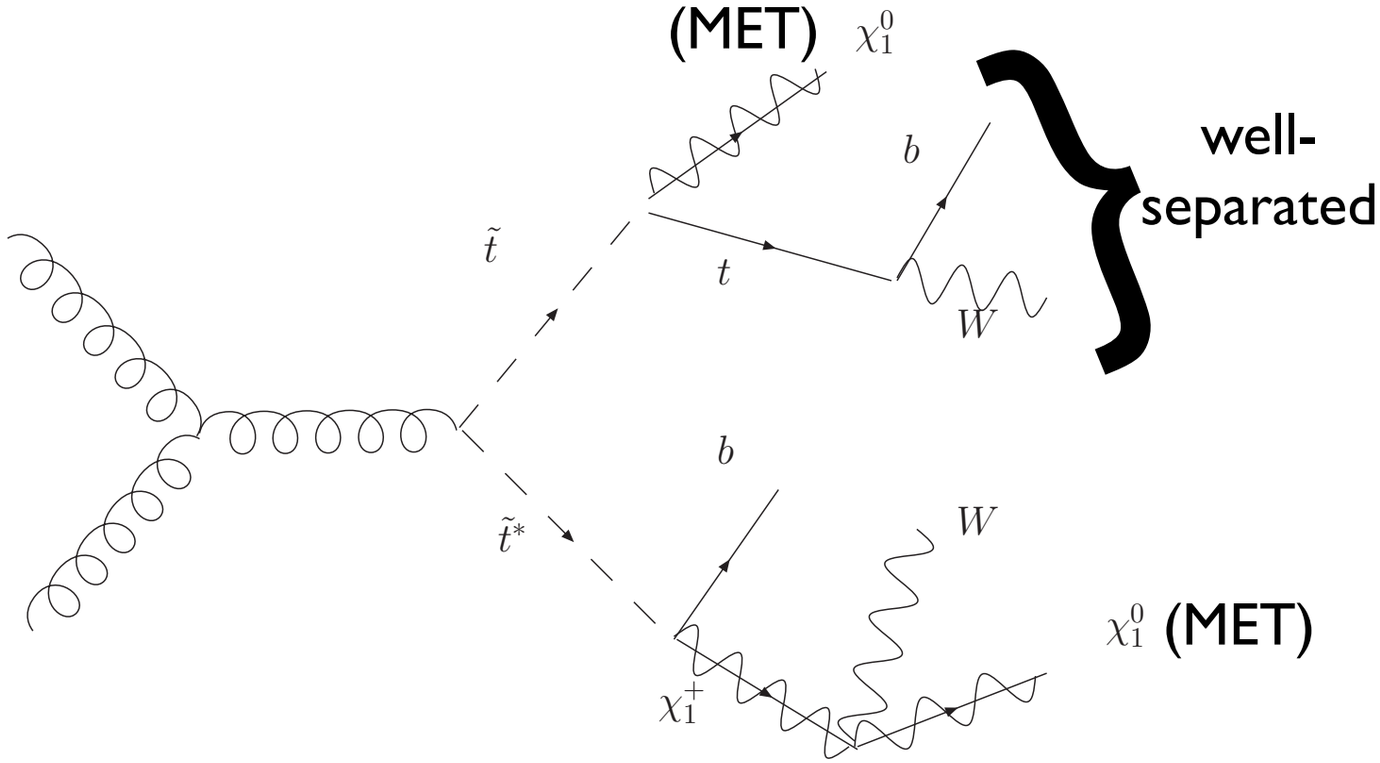


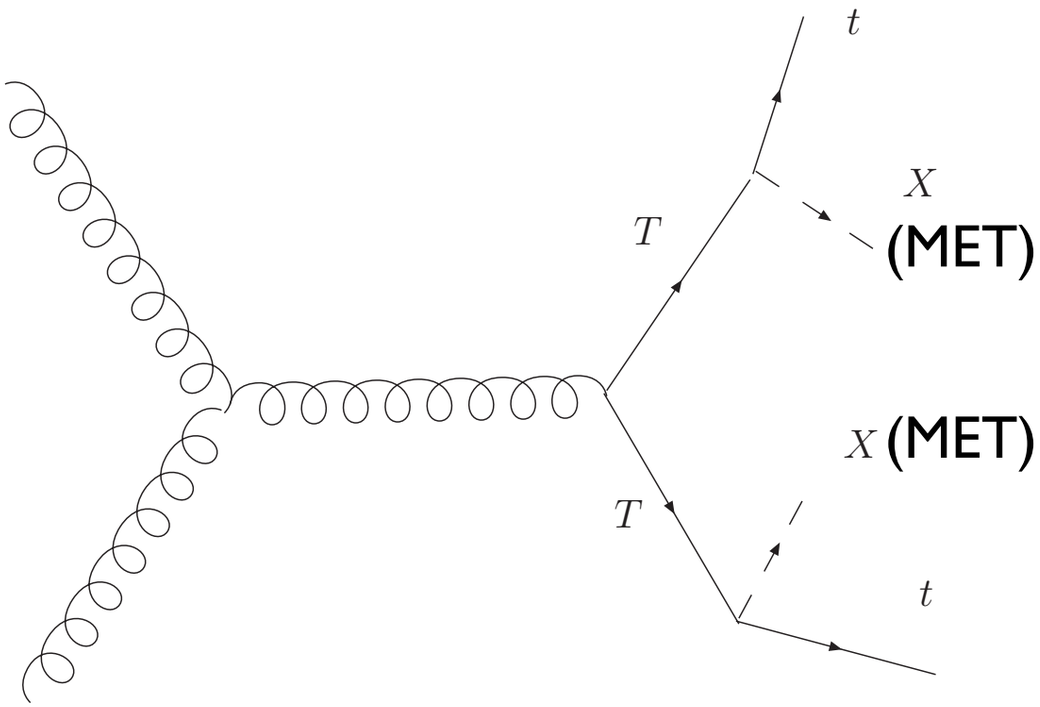
LIGHT (BELOW 1 TEV) NP:

TOP PARTNER

cancels divergence
in Higgs mass from
top loop

Top partner → "top-like" + MET

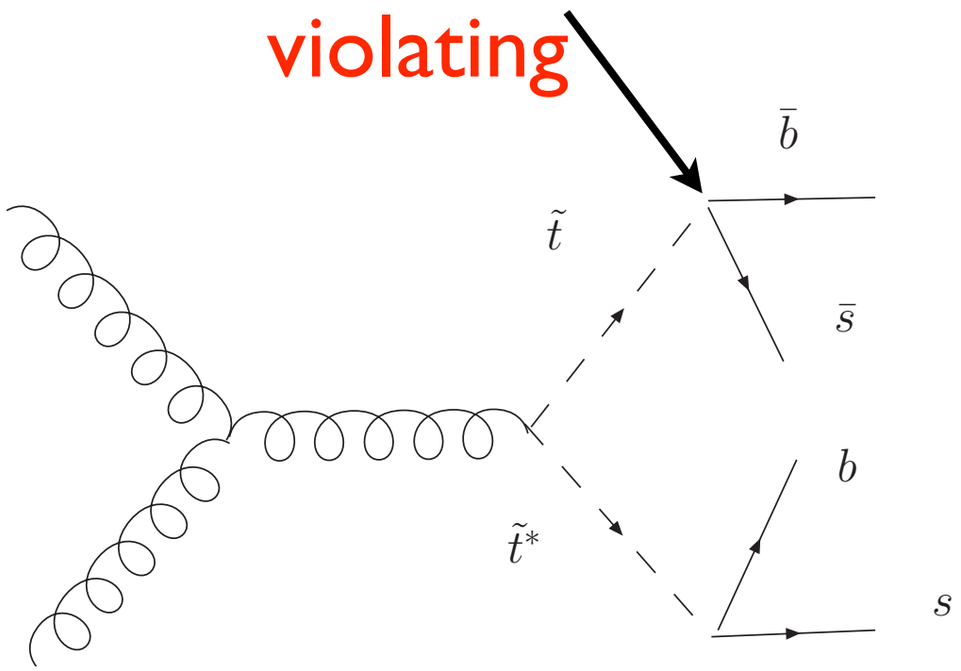


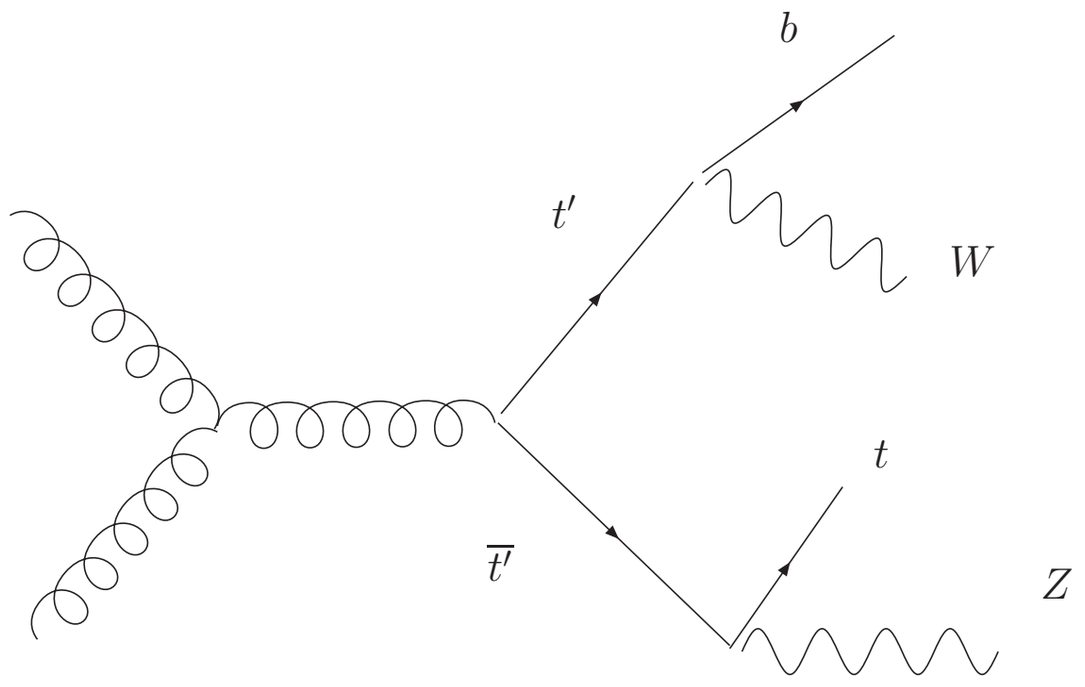


- How well can we get rid of top background (MET from SM)?
- How well can we distinguish "scalar top partner" (aka. "stop") from fermionic (little-Higgs with T-parity) at LHC?
- Is ILC needed for the above purpose (e.g., for heavier top partner)?
- What if MET is small ("compressed" spectrum: top partner is degenerate with top + invisible)?

Top partner⟶"top-like", but no MET

R-parity violating





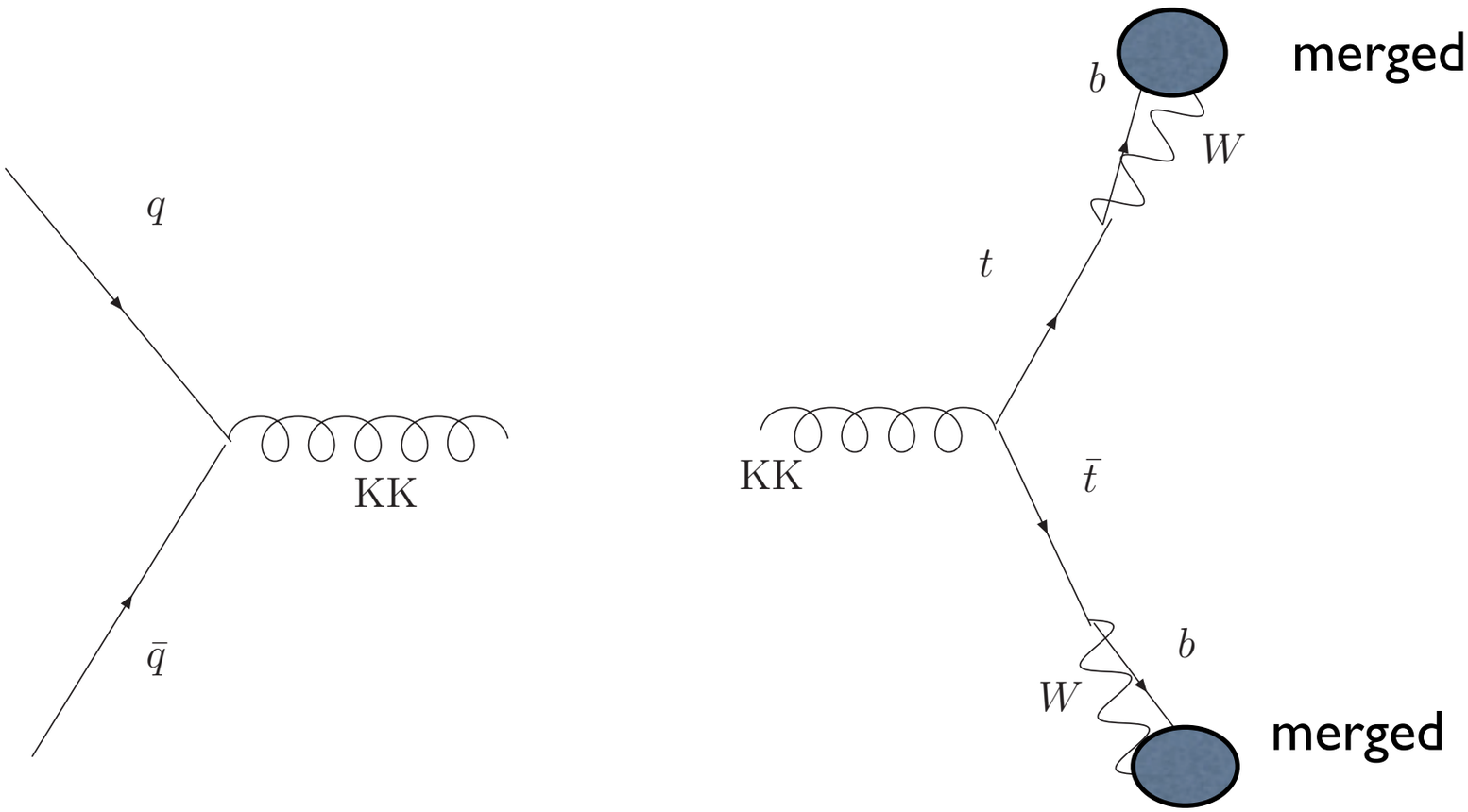
- Can natural stop hide ?

- natural fermionic top partner (e.g., composite Higgs) allowed by LHC?

(aka 4th generation/exotic quark)

INTERMEDIATE (1-5 TEV)NP: RESONANCE IN TOP PAIR

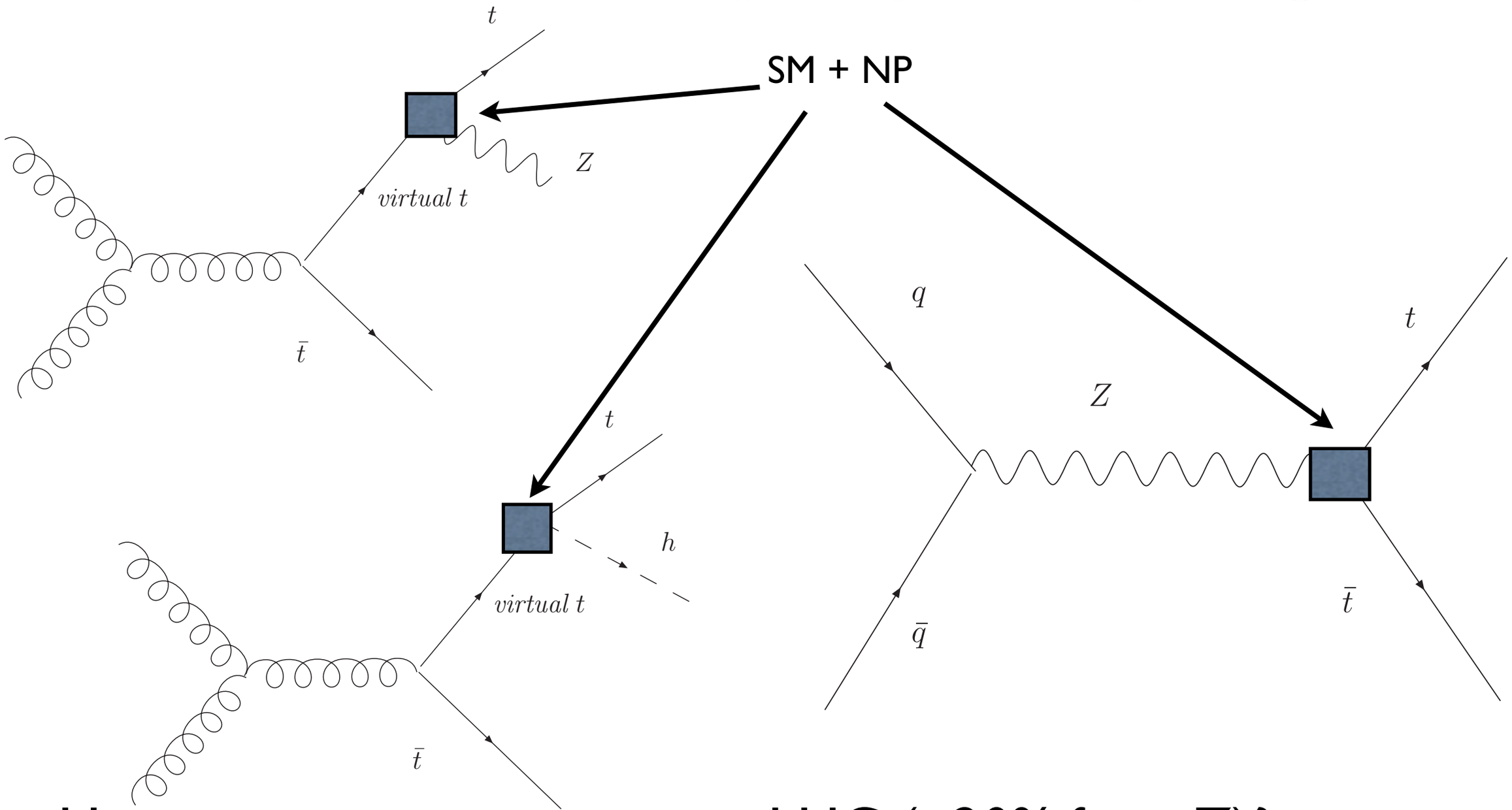
Boosted top pair



- How "robust" are the techniques?
- What is the ultimate LHC reach?

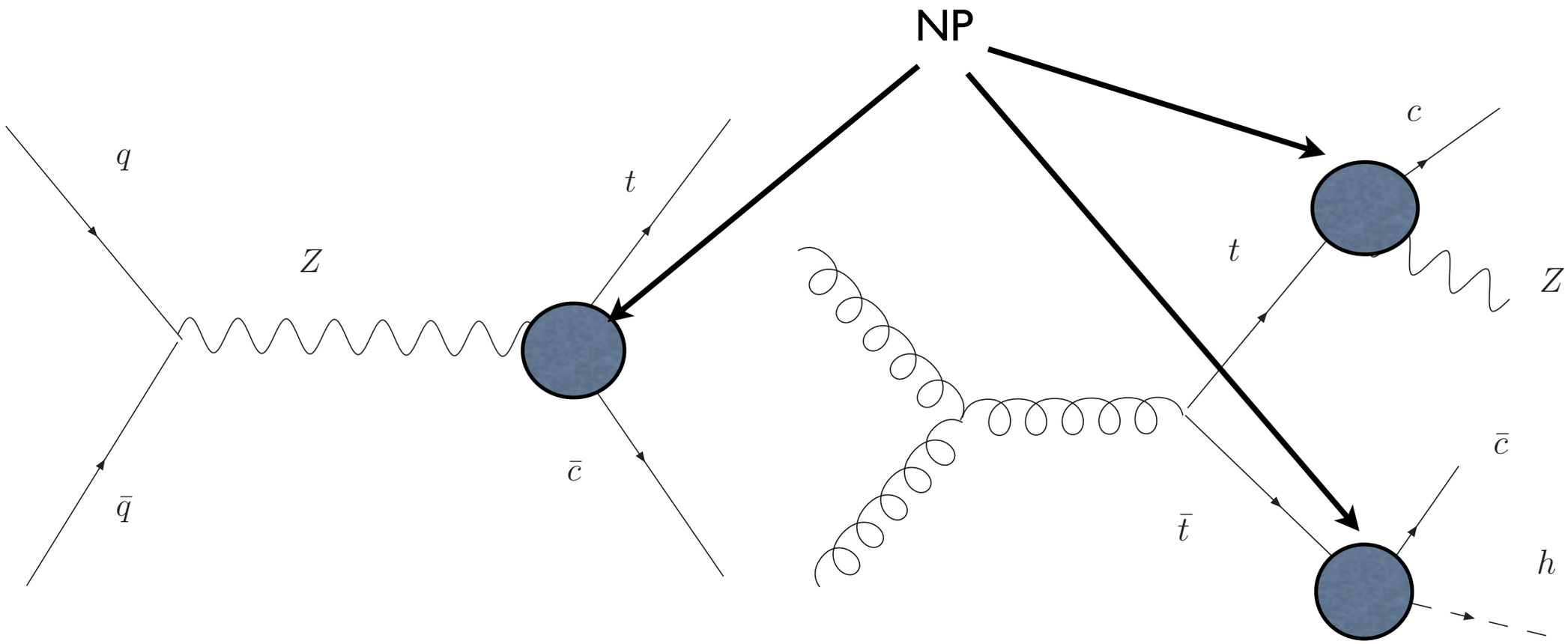
HEAVY (ABOVE 5 TEV) NP: INDIRECT EFFECTS ON TOP PROPERTIES

Shift in existing top couplings



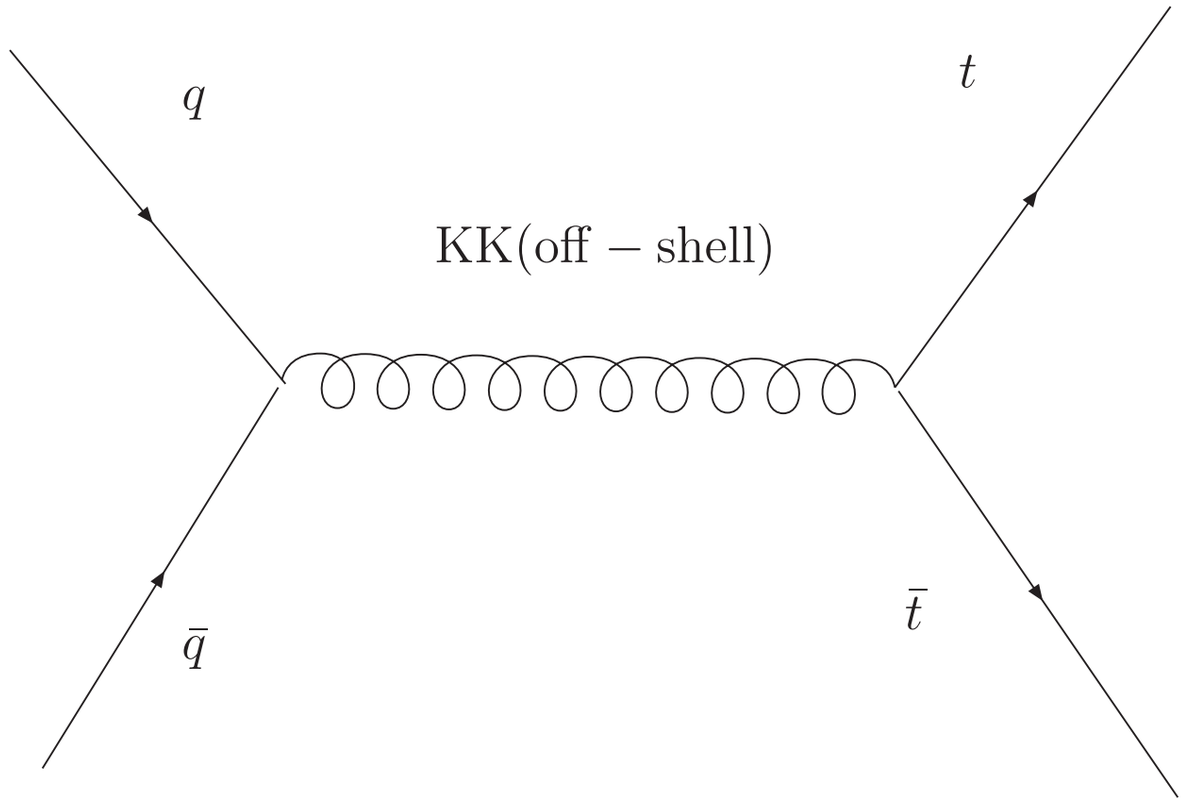
- How well can we measure at LHC (~20% for ttZ)?
- Is ILC needed for precision relevant for NP models (~10% for ttZ)?
- also tbW...

Rare top decays (SM negligible)



- How well can LHC measure?
- Is ILC needed for sensitivity relevant for NP models?
- also t ⟶ b H+...

(Other) effects on top pair production



- Anomaly in top forward backward asymmetry (at Tevatron...and LHC eventually?) vs. not in charge asymmetry (currently at LHC)
- Excluded by other data (e.g., di-jet, same-sign top)?
- How well do we know SM prediction?

Join the fun!

BACK-UP

Overlaps with...

- SM top physics/QCD ("background")
- detector issues with top (e.g. boosted)
- New particles subgroup
- Electroweak (e.g., precision fit)
- Higgs subgroup (e.g., coupling to top: flavor-preserving/violating)

Why top?

- NP at TeV scale to address Planck-weak hierarchy
- ...must couple to Higgs
- Top quark couples strongly to Higgs
- NP couples to top quark