

Panel Discussions: Future Colliders and Superboosted Objects

3 slides

Gilad Perez

Weizmann Inst.



Slide #1: (additional) theoretical inputs

◆ Layman comment: theorists involvement => matching onto advance MC tools - cross communication with NLO/NNLO ?

Talks by: Larkoski; Moutl; Thaler ...

(apologies to people involved in other work)



Instructive discussion with Marat on prospects for automation.

partial list of recent works: -

Farhi, Feige, Freytsis & Schwartz; Becher, Frederix, Neubert & Rothen; Larkoski, Moutl & Neill (15);
Gerwick, Hoeche, Marzani & Schumann (14);
GENEVA: Alioli, Bauer, Berggren, Hornig, Tackmann, Vermilion, Walsh & Zuberi (12,15) and more ...

◆ Energy/precision frontier why? => understanding flavor.

Higgs in minimal standard model, 2 roles:

- (i) induce electroweak gauge boson masses & unitarization (high-E consistency);
- (ii) induce fermion masses & unitarization (high-E consistency) <=> not tested directly!

Slide #2: flavor a task for (future) colliders

$$q\bar{q} \rightarrow V_L V_L$$

(where V_L is the longitudinal boson)

$$\sqrt{s} \lesssim \frac{8\pi v^2}{\sqrt{6}m_{b,c,s,d,u}}$$

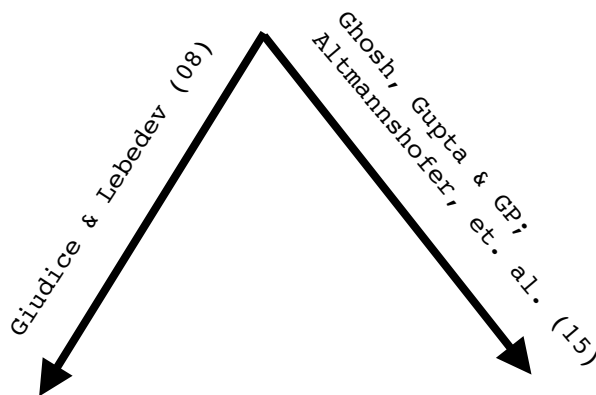
$$\approx 200, 1 \times 10^3, 1 \times 10^4, 2 \times 10^5, 5 \times 10^5 \text{ TeV.}$$

Appelquist & Chanowitz (87).

$$q\bar{q} \rightarrow nV_L$$

$$\sqrt{s} \lesssim 23, 31, 52, 77, 84 \text{ TeV.}$$

Maltoni, Niczyporuk & Willenbrock (01); Dicus and H.-J. He (05).



Fire-works in Higgs phys.: $m_{\text{light}} \propto \left(\frac{h}{\Lambda}\right)^n$

New EW sector: $m_{\text{light}} \propto \langle \bar{f}_{\text{TC}} f_{\text{TC}} \rangle, \cancel{h}$

Do you care?

- (i) in both cases TeV scale emerge \Rightarrow boosted h +light/ c -jet;
- (ii) possible direct test in $h \rightarrow$ light; exclusively approachable but \w large BGs \Rightarrow new venue for new type of jet substructure.

Slide #3: phenomenological issues

◆ Aspects of “superboosted” jets -

Given a detector, minimal angular scale: $\theta_{\text{had}} \approx \frac{d_{\text{had}}}{r_{\text{HCAL}}} \approx 0.1 \times \frac{\lambda_{\text{HCAL}}}{20 \text{ cm}} \times \frac{2 \text{ m}}{r_{\text{HCAL}}}$

Superboosted jets: substructure cannot be probed within the HCAL:

$$\delta R_{\text{superboost}} \sim \frac{2m_{W,Z,H,t}}{p_T} \lesssim \theta_{\text{had}} \sim 0.1 \quad p_{T \text{ superboosted}}^{W,Z,H,t} \gtrsim 1.6, 1.8, 2.5, 3.4 \text{ TeV}$$

- (i) is there a way out?
- (ii) how bad is this ? [loosing O(20%) of the jet substructure]
- (iii) is this true for coloured states? (like top)
- (iv) are “EW/h-sub-Sudakov” the next tau’s? (can we, ignore EW corrections)
- (v) is E mismatch a useful handle?