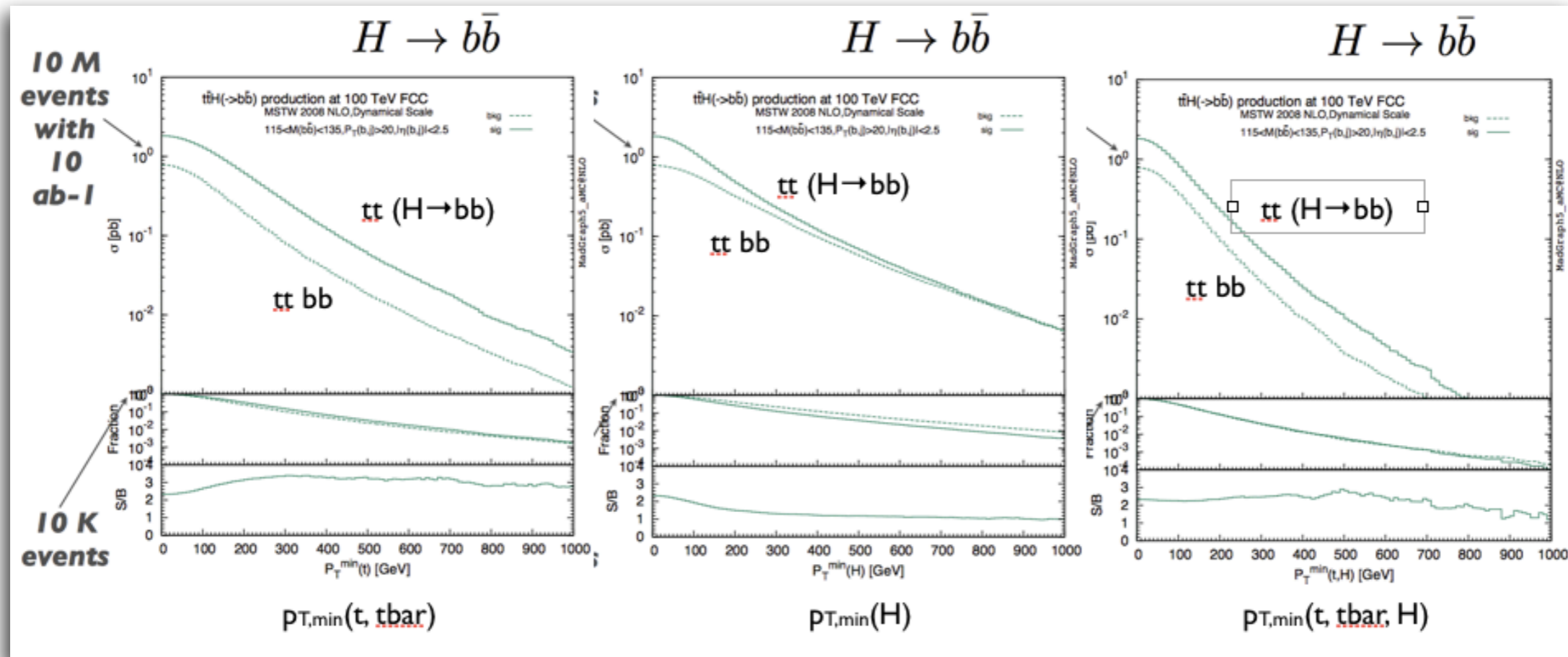


Physics with boosted objects at 100 TeV

- Extended applications and new measurement opportunities -- including precision physics -- with “standard” (i.e. $O(\approx \text{TeV})$) boosted objects.

Example: $t\bar{t}H$

$$115 < M(b\bar{b}) < 135, P_T(b,j) > 20, |\eta(b,j)| < 2.5$$



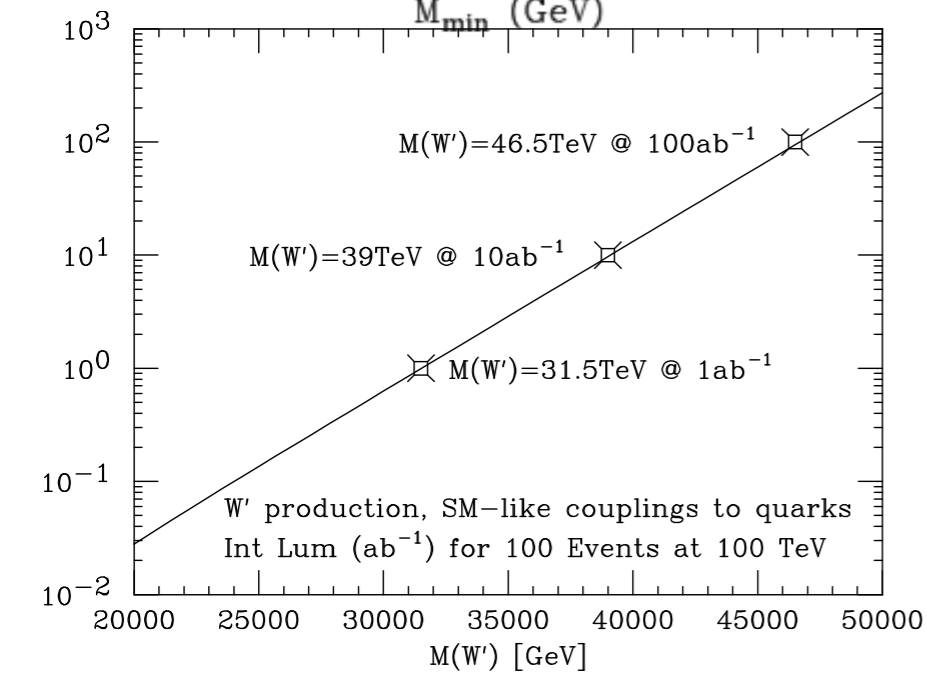
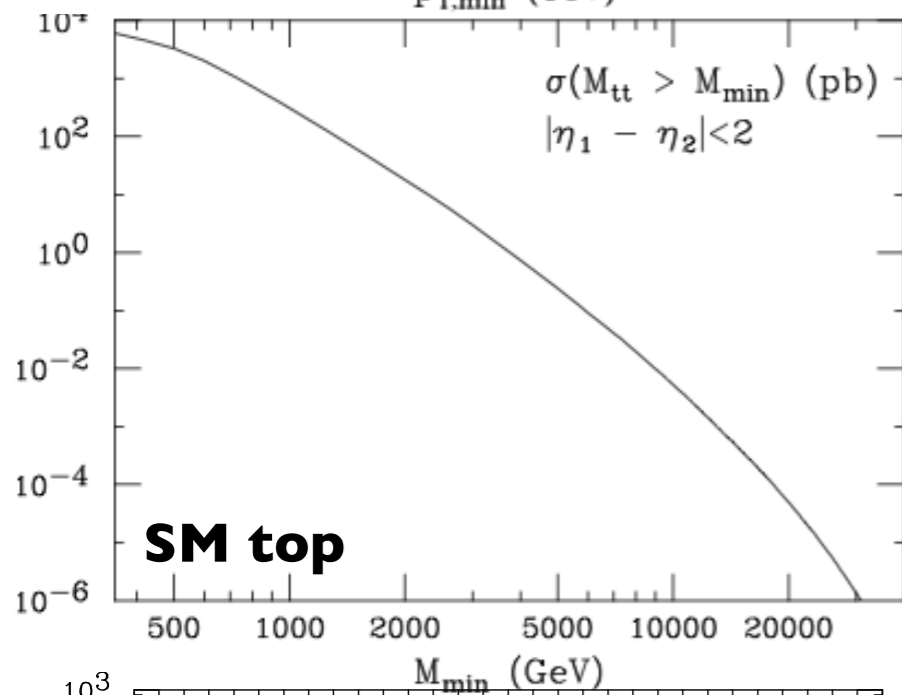
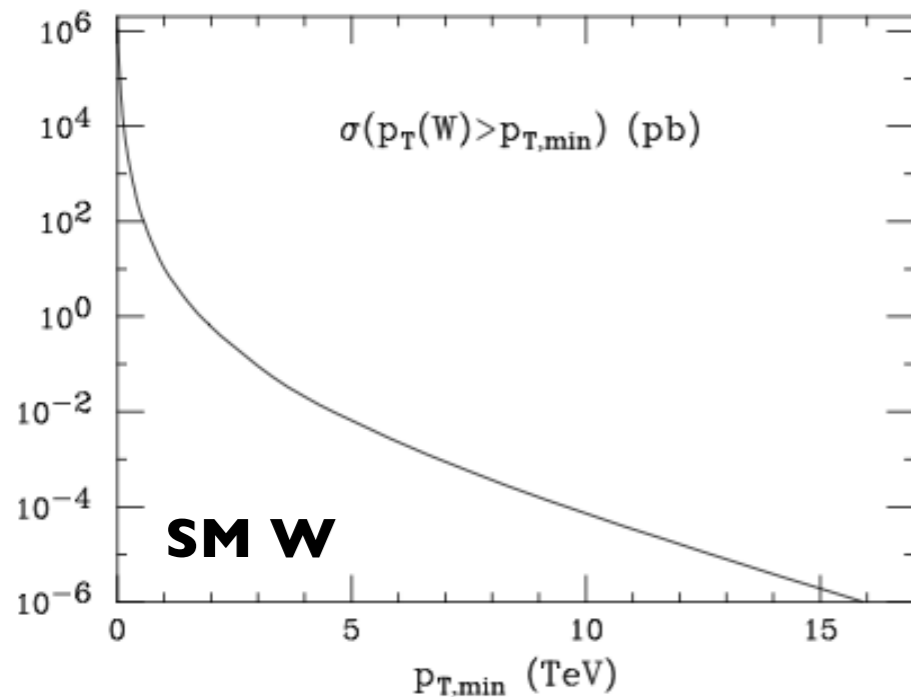
H-S Shao and MLM, preliminary, H&BSM@100 TeV wshop

Plehn, Reimitz, Schnell, : arXiv:1507.08169

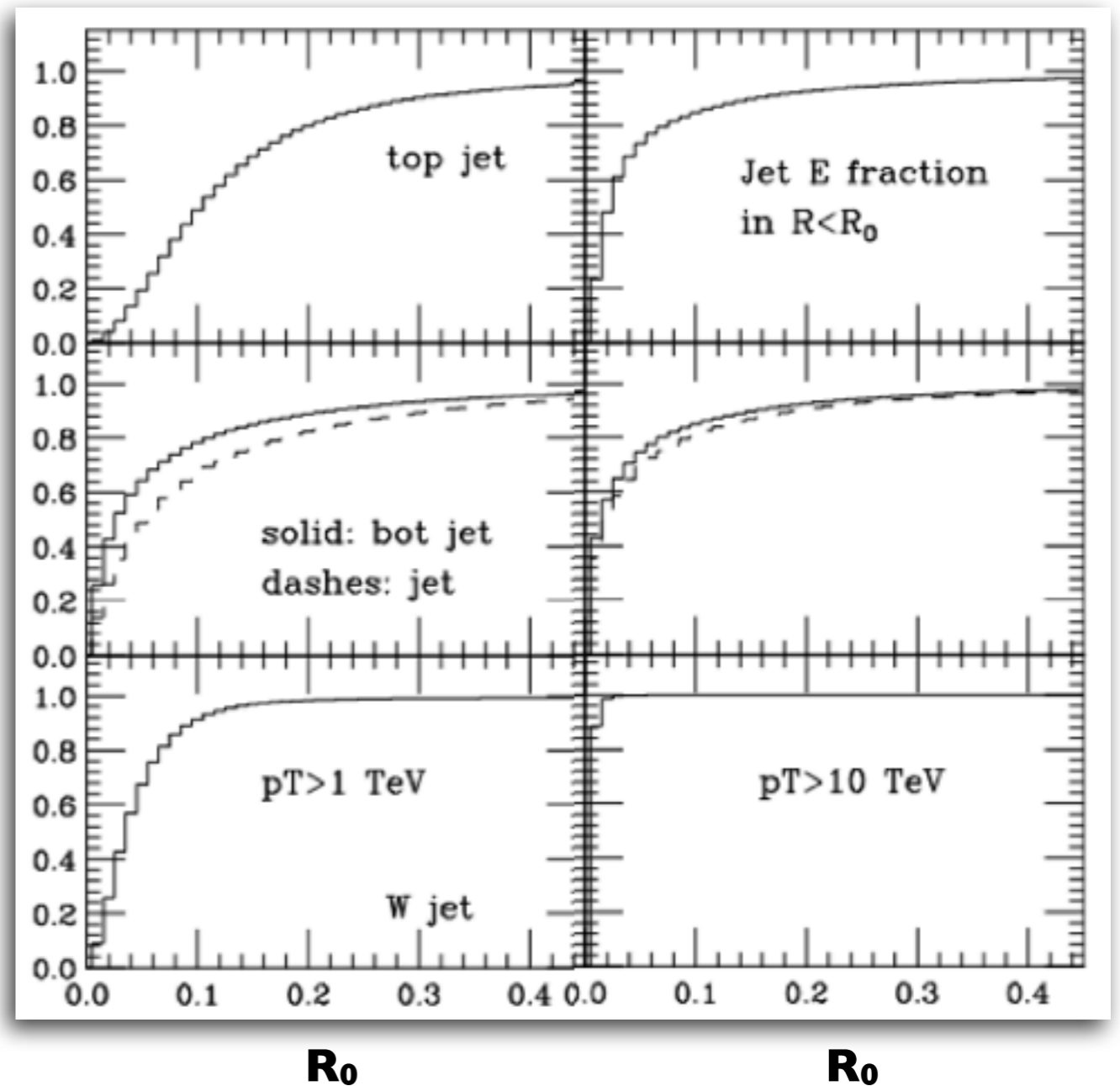
- Opportunities and challenges of hyper-boosted -- $O(> 5-10 \text{ TeV})$ -- objects (examples: next page)

➡ crucial ingredient in the definition of benchmarks for detector design

high- p_T rates and jet structure: examples

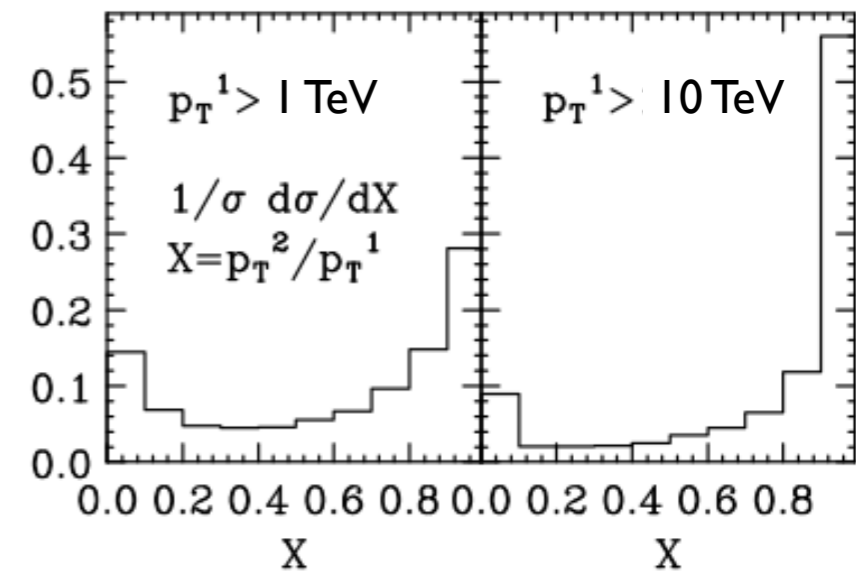
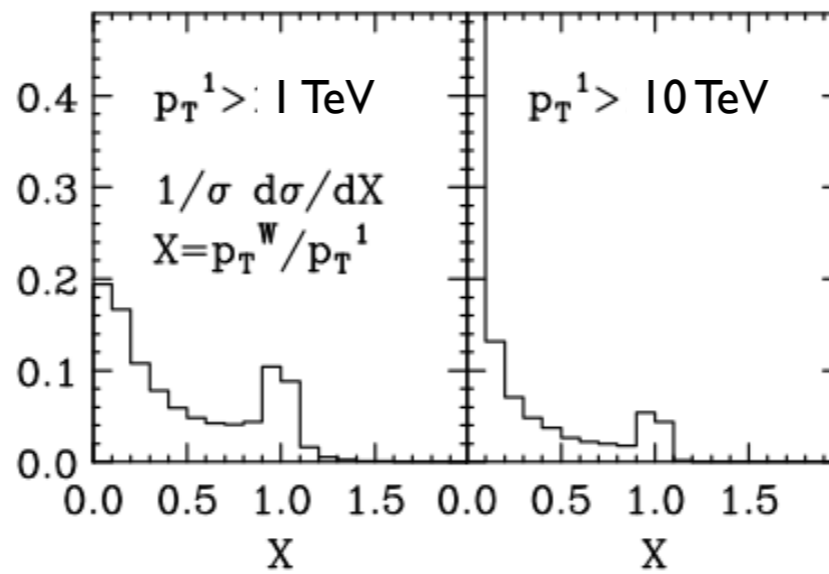
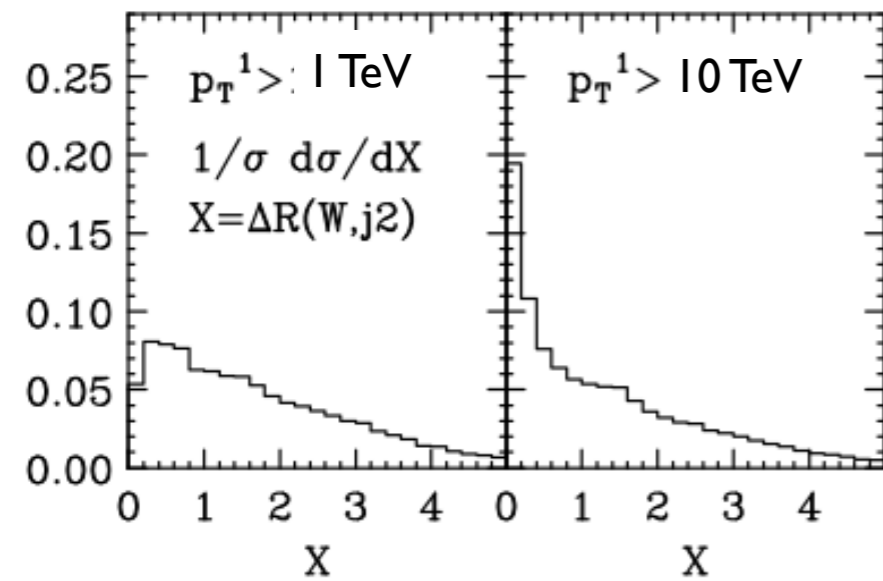
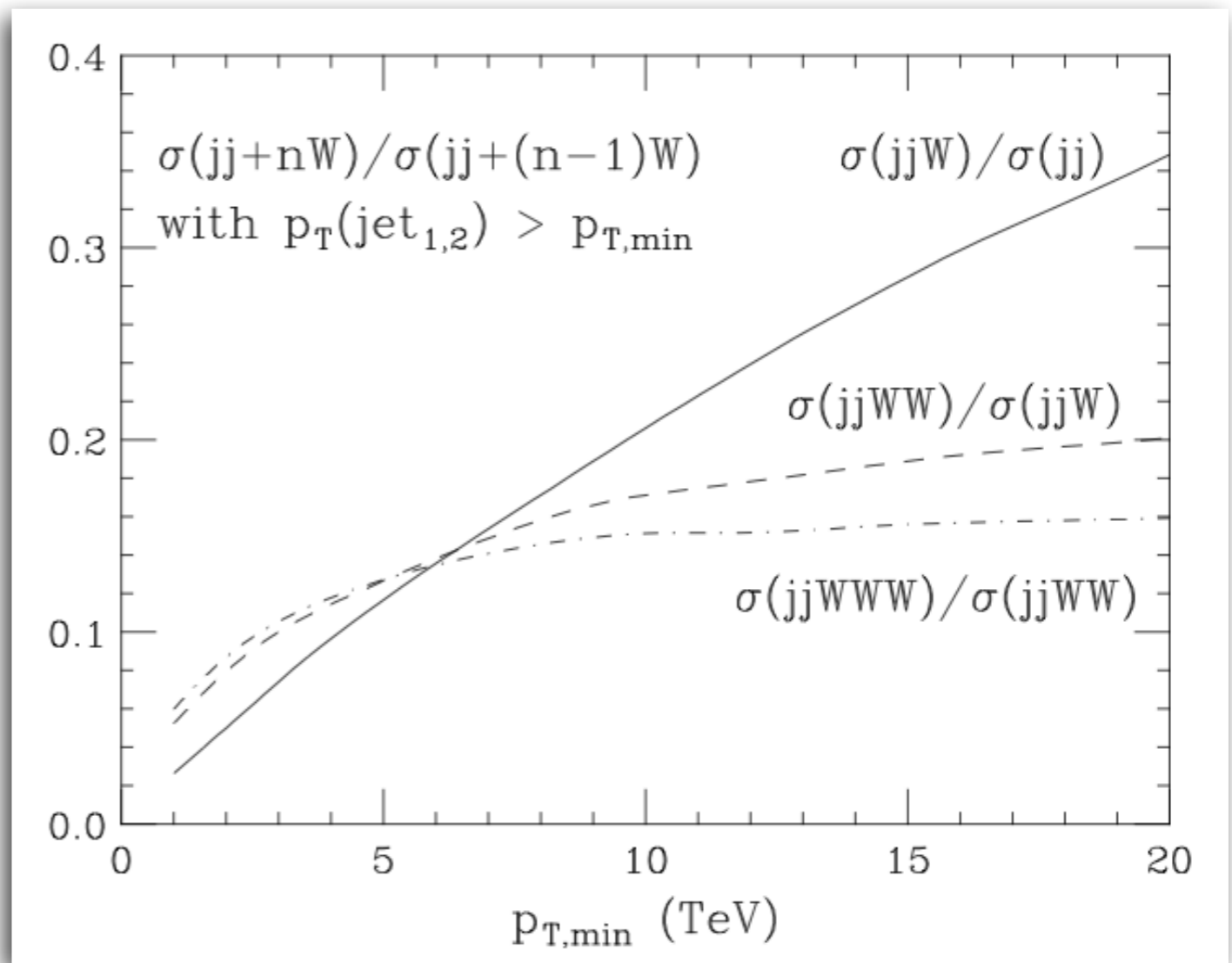


Jet E fraction in $R < R_0$

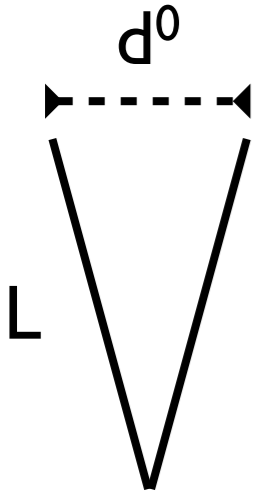


\Rightarrow needs tagging capability up to $p_T \sim 10\text{-}15 \text{ TeV}$

EW structure of high-pt jets

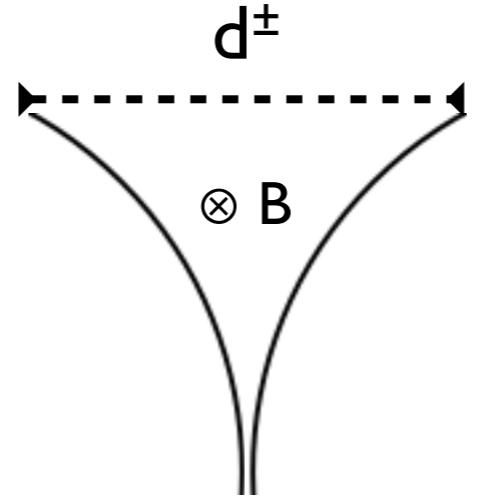


Scaling laws



$$d^0 \sim L \cdot k_{\perp} / p_T$$

$$\sim L \cdot 2m / E_T$$



$$d^{\pm} \sim L \cdot 0.3 BL / p_T$$

$$\sim 0.3 N_{\text{part}} (BL^2) / E_T$$

k_{\perp} : transverse p w.r.t. jet axis
 p_T : particle pT (GeV)
 E_T : jet pT
 L : calorimeter inner radius (m)
 B : magn field (Tesla)
 N_{part} : # of particles in the jet
 $\langle z \rangle = \langle p_T \rangle / E_T \sim 1 / N_{\text{part}}$

x 7

For 14 TeV \rightarrow 100 TeV:

$m \rightarrow m, E_T \rightarrow 7x E_T$

$BL^2 \rightarrow \sim 7x BL^2 \Rightarrow B \rightarrow \sim 1.5x B, L \rightarrow \sim 2x L$

$d^{\pm} \rightarrow d^{\pm} \quad d^0 / d^{\pm} \rightarrow 1/3 x d^0 / d^{\pm}$

\Rightarrow neutral core density grows much more than charged core's density

NB: $N_{\text{channels}} \sim (L/d)^2 \Rightarrow$

$N_{\text{channels}}^{\pm} \rightarrow \sim 4x N_{\text{channels}}^{\pm}$
 $N_{\text{channels}}^0 \rightarrow \sim 10x N_{\text{channels}}^0$

some relevant recent discussions from FCC-hh mtgs

- BSM and H at 100 TeV (March 2015)
 - <http://indico.cern.ch/event/352868/other-view?view=standard>
 - G.Salam: general thoughts on hyper-boosted objects
 - M.Selvaggi: hyper-boosted tops (*see also talk at BOOST2015*)
 - M.Pierini: hyper-boosted color-singlet dijets
 - J.Love: 10-20 TeV Z' \rightarrow $t\bar{t}$ (*see also talks at BOOST2015*)
- FCC-hh BSM informal group mtg, (Febr 2015)
 - <http://indico.cern.ch/event/377004/>
 - C.Doglioni: Calorimeter resolution issues in resonance searches
- FCC-hh workshop (May 2014)
 - <http://indico.cern.ch/event/304759/>
 - Pierini (W/Zs), Selvaggi (tops)