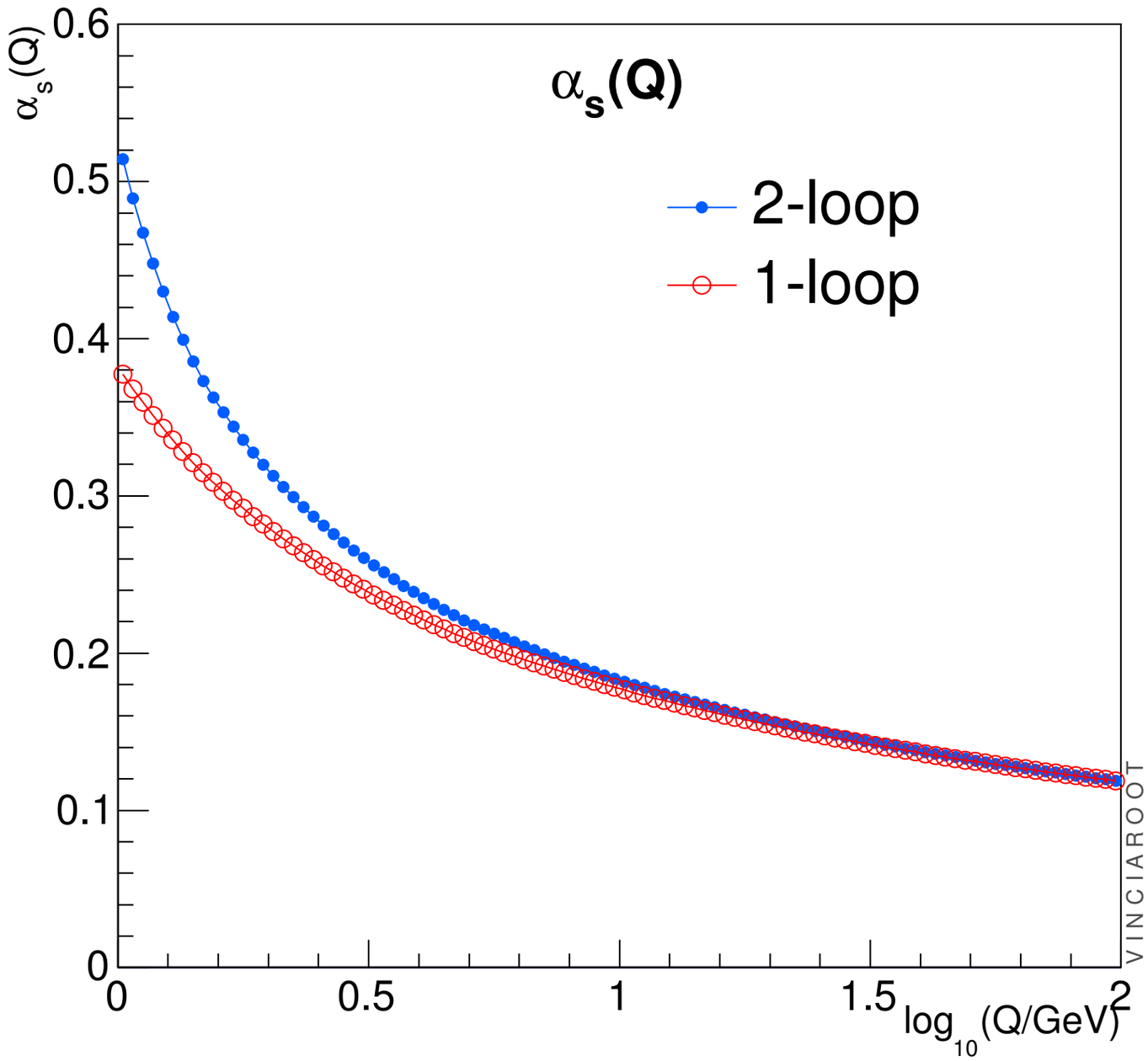
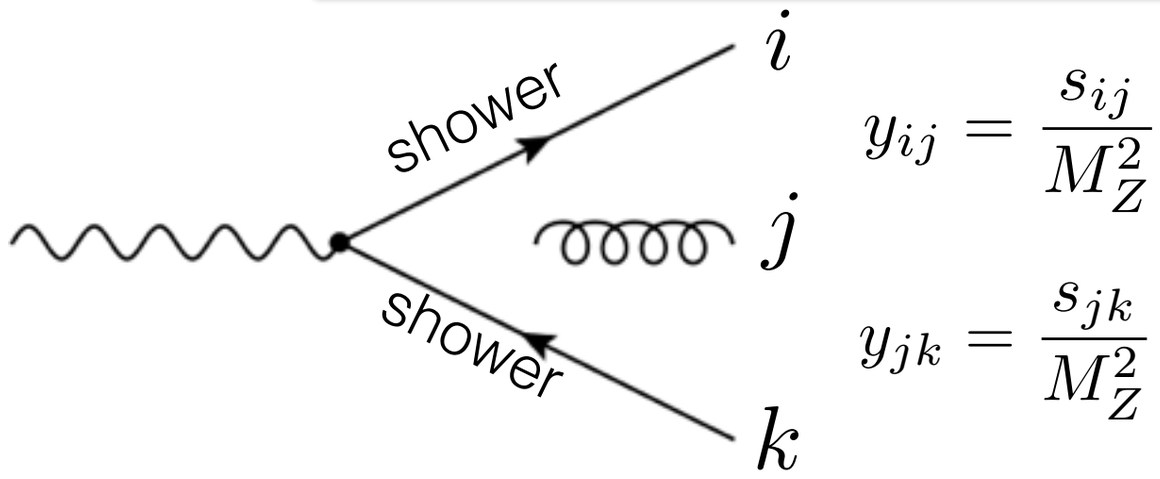


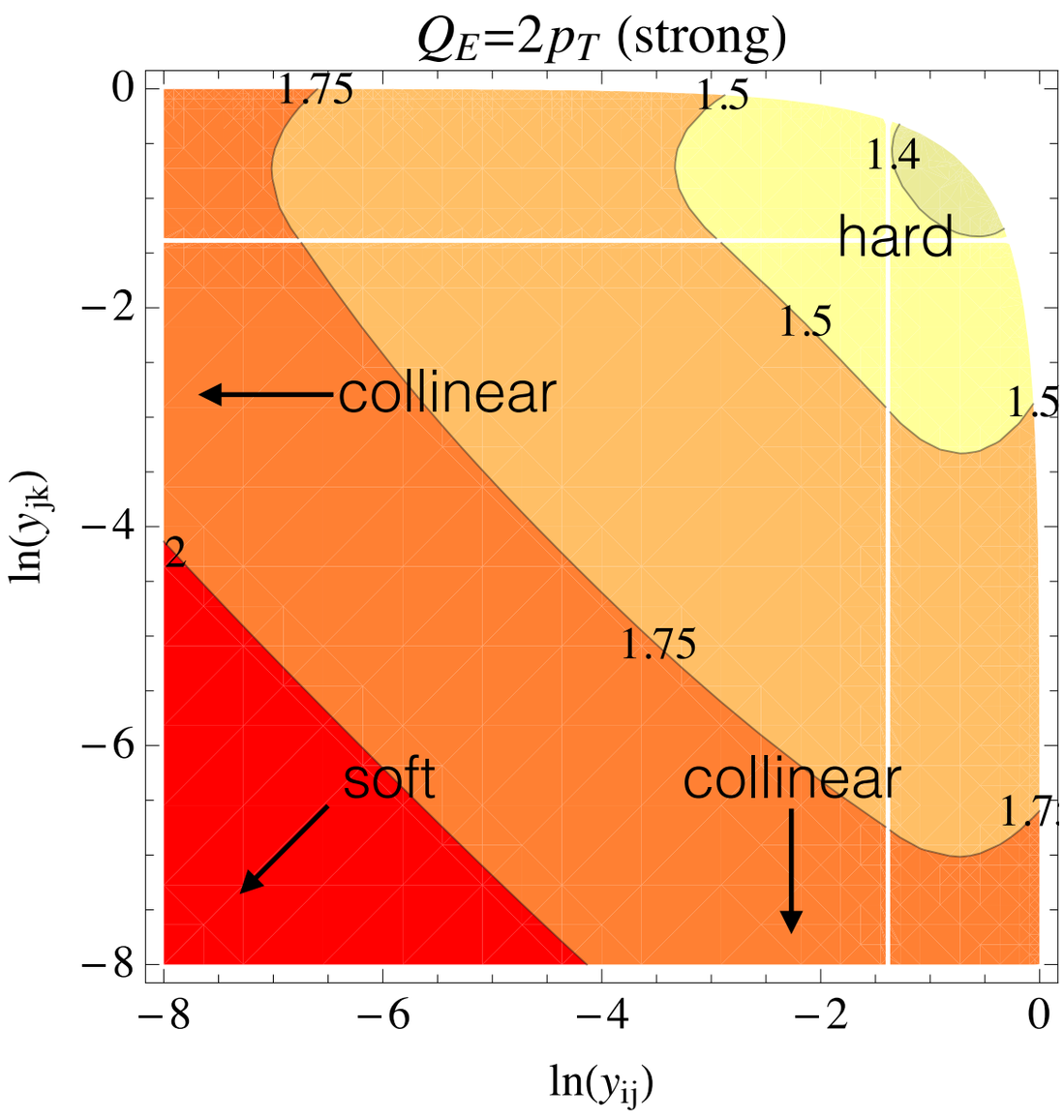
Skands, TASI Lectures, arXiv:1207.2389

Hartgring, Laenen, Skands, arXiv:1303.4974

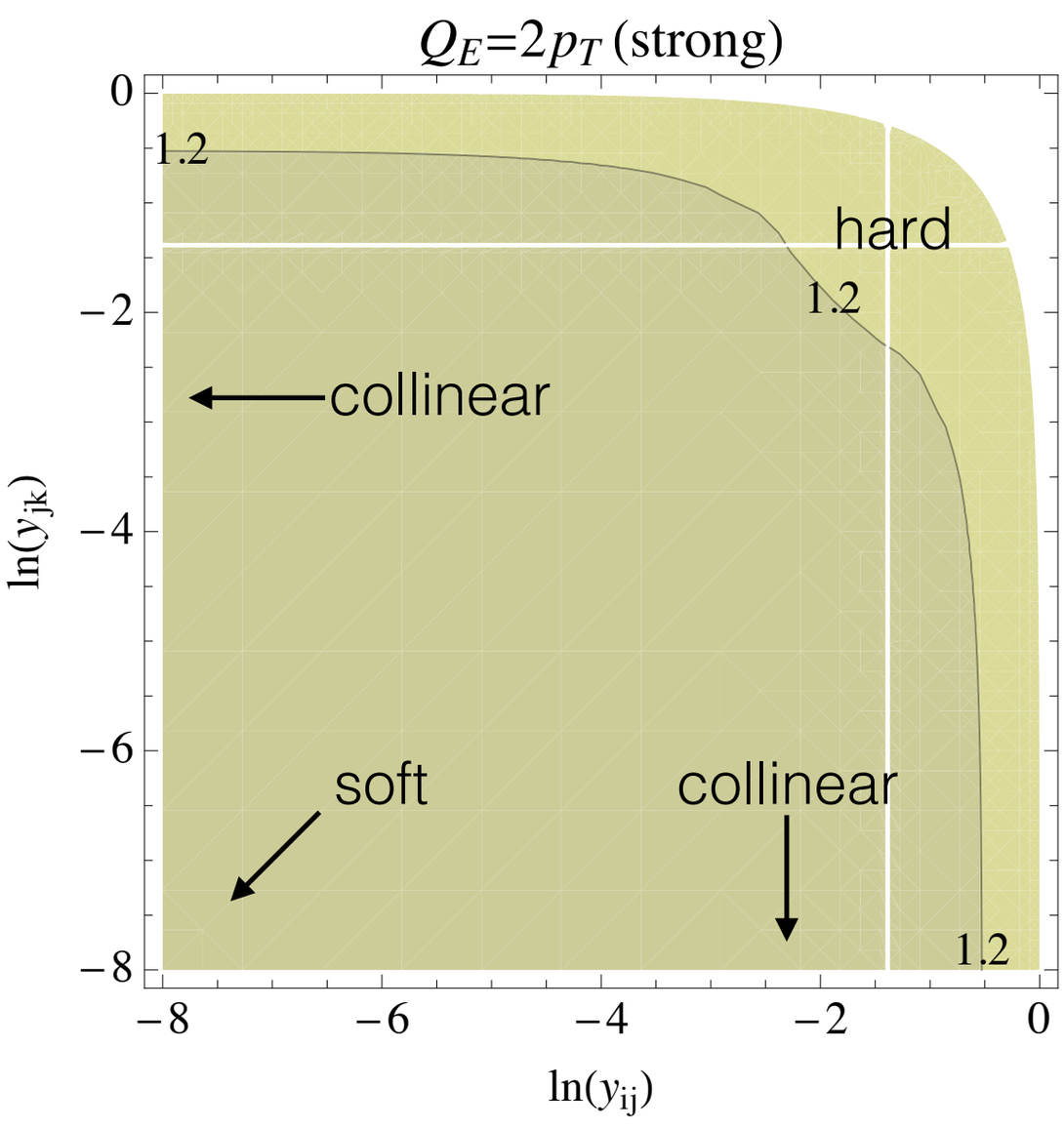
Z → 3 Jets

Size of NLO "K" factor over phase space





(a) $\mu_{\rm PS} = \sqrt{s}$



(b) $\mu_{\rm PS} = p_\perp$

Hartgring, Laenen, Skands, arXiv:1303.4974

Z → 3 Jets Size of NLO "K" factor over phase space

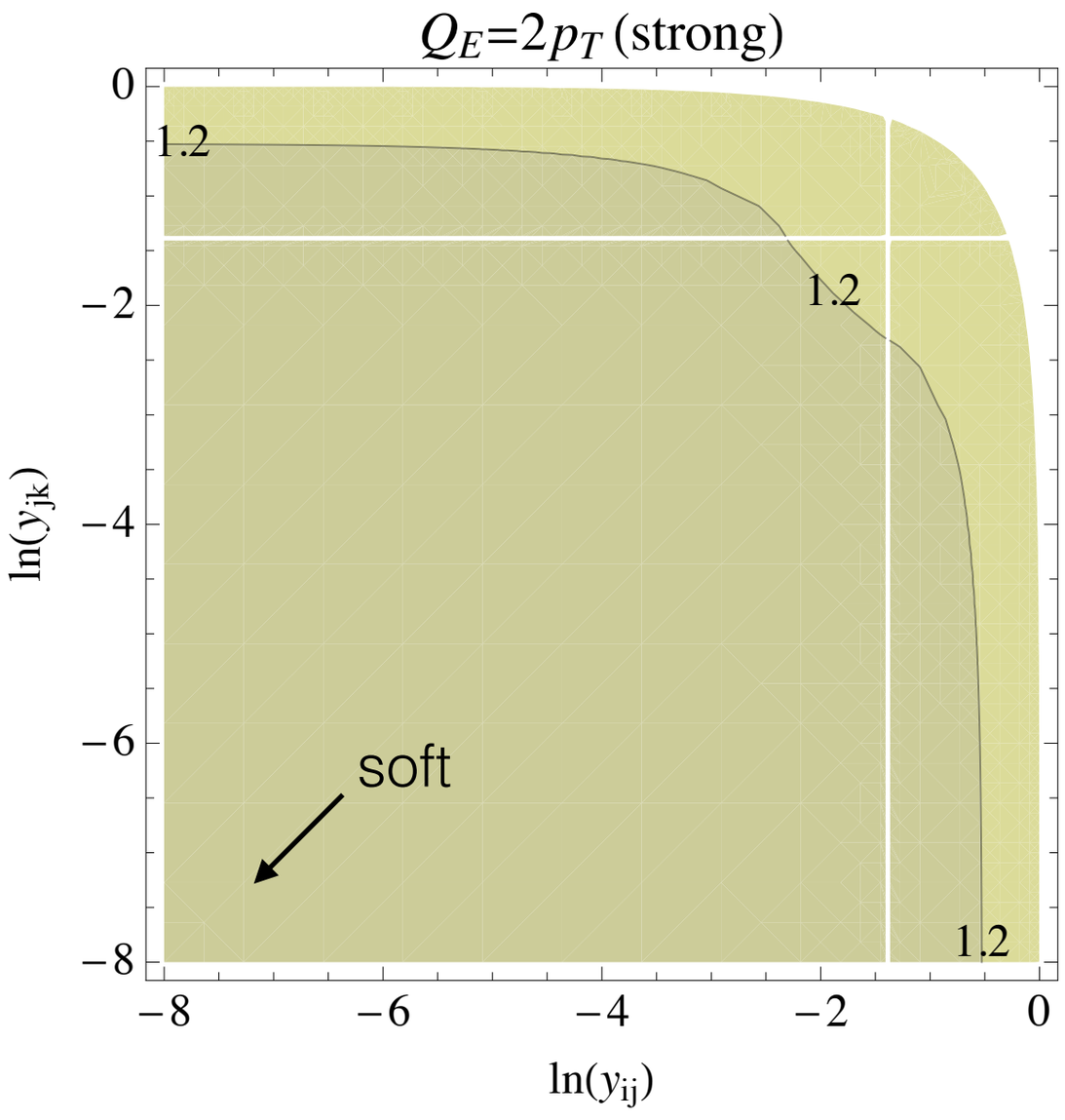
The "CMW" factor

$$k_{\mathrm{CMW}} = \exp\left(\frac{67 - 3\pi^2 - 10n_F/3}{2(33 - 2n_F)}\right) = \begin{cases} 1.513 & n_F = 6 \\ 1.569 & n_F = 5 \\ 1.618 & n_F = 4 \\ 1.661 & n_F = 3 \end{cases}$$

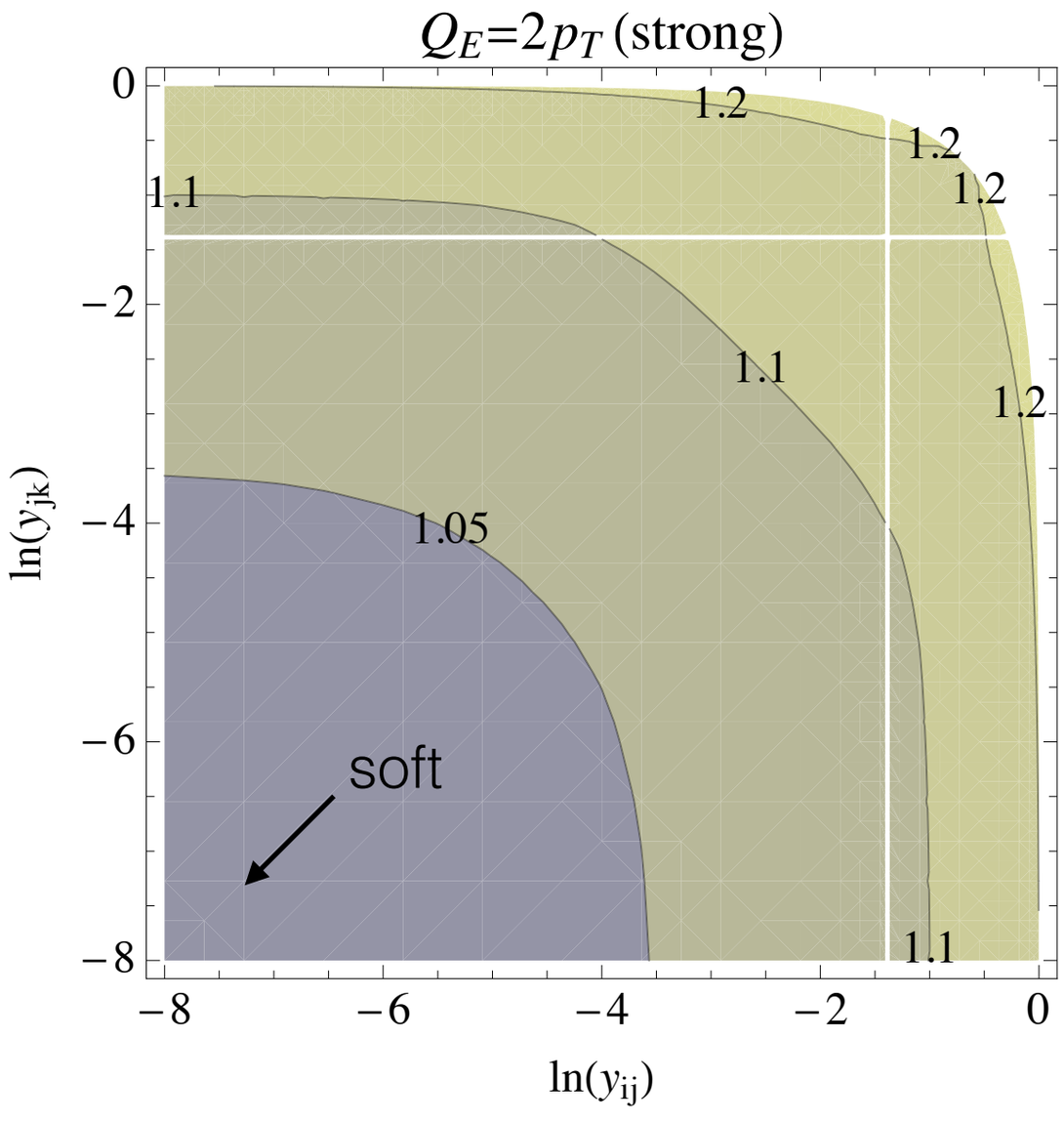
Catani, Marchesini, Webber, NPB349 (1991) 635

: Constant shift by

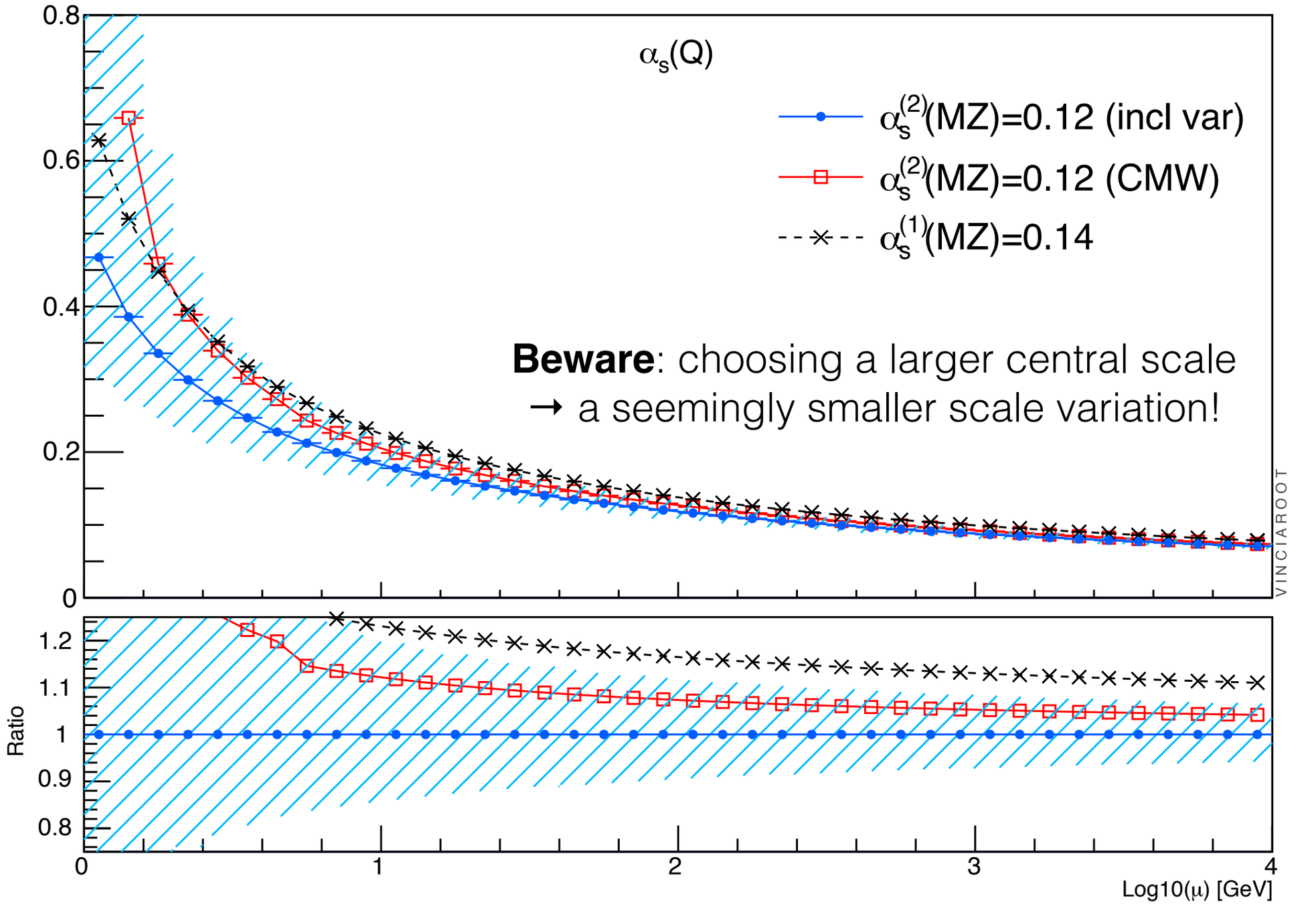
$$\frac{\alpha_s}{2\pi}\frac{\beta_0}{2}\ln\left(k_{\mathrm{CMW}}^2\right) \sim 0.07$$



(b) $\mu_{\mathrm{PS}} = p_\perp$



$\mu_{\mathrm{PS}} = p_\perp$, with CMW



2 Loop: $\alpha_s(M_Z)=0.12$ $\Lambda_3 = 0.37$ $\Lambda_4 = 0.32$ $\Lambda_5 = 0.23$

1 Loop: $\alpha_s(M_Z)=0.14$ $\Lambda_3 = 0.37$ $\Lambda_4 = 0.33$ $\Lambda_5 = 0.26$

(In all cases, 5-flavor running is still used above mt)

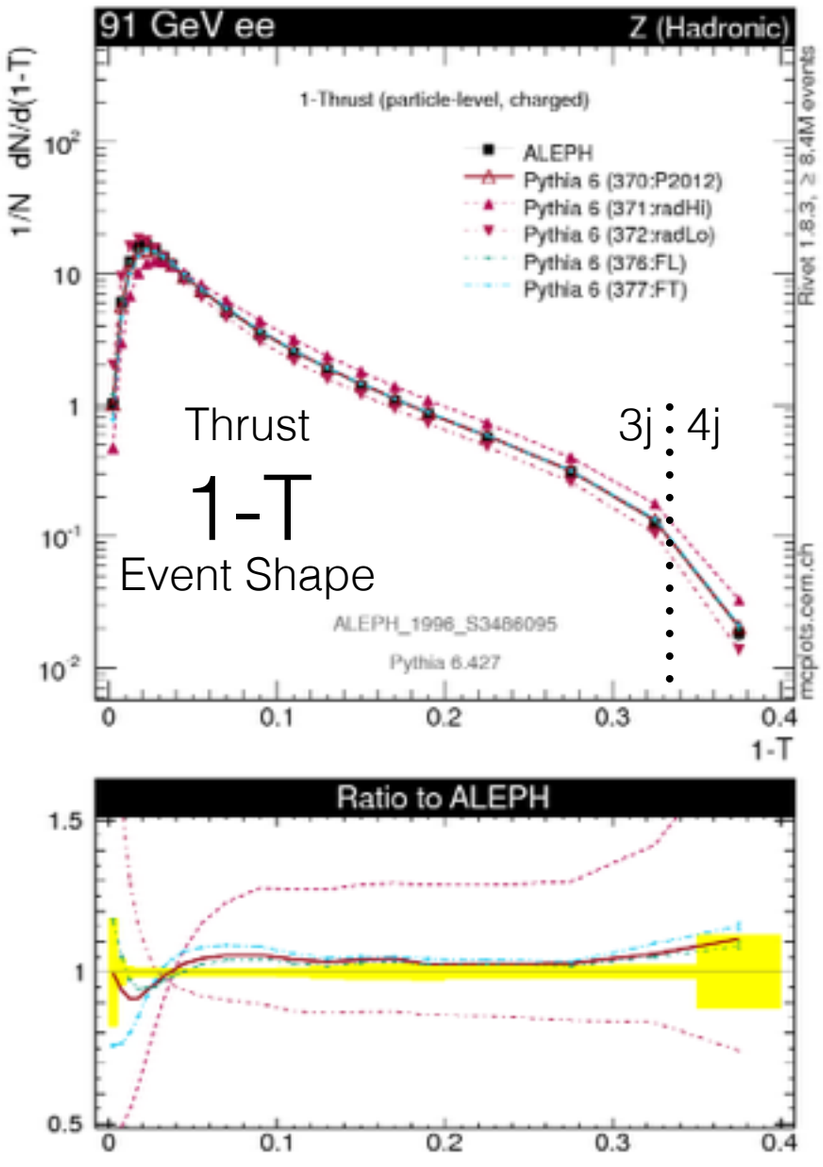
Variations in e^+e^-

μ_R by factor 2 in either direction

Pythia 6 “Perugia 2012 : Variations”

(with central choice $\mu_R = p_T$, and $\alpha_s(M_Z)^{(1)} \sim 0.14$)

Skands, arXiv:1005.3457



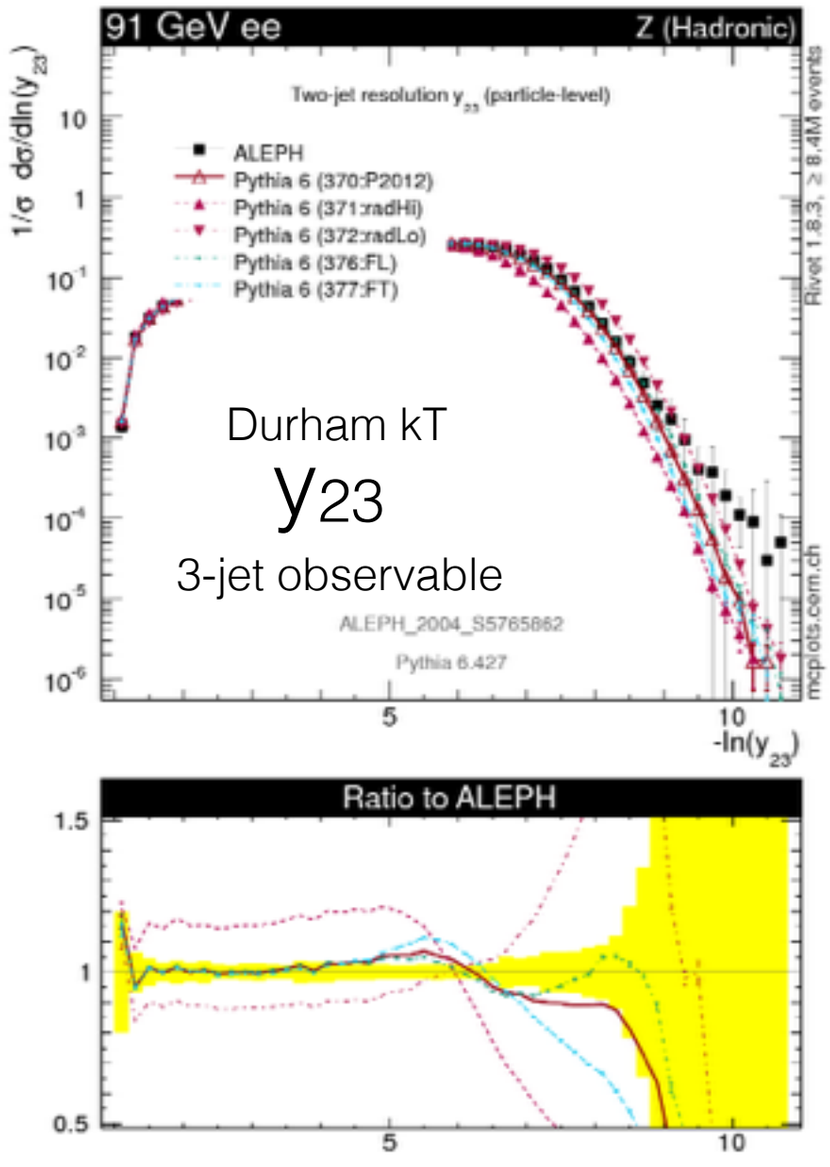
Thrust

1-T

Event Shape

3j | 4j

→ Factor 2 looks pretty extreme?

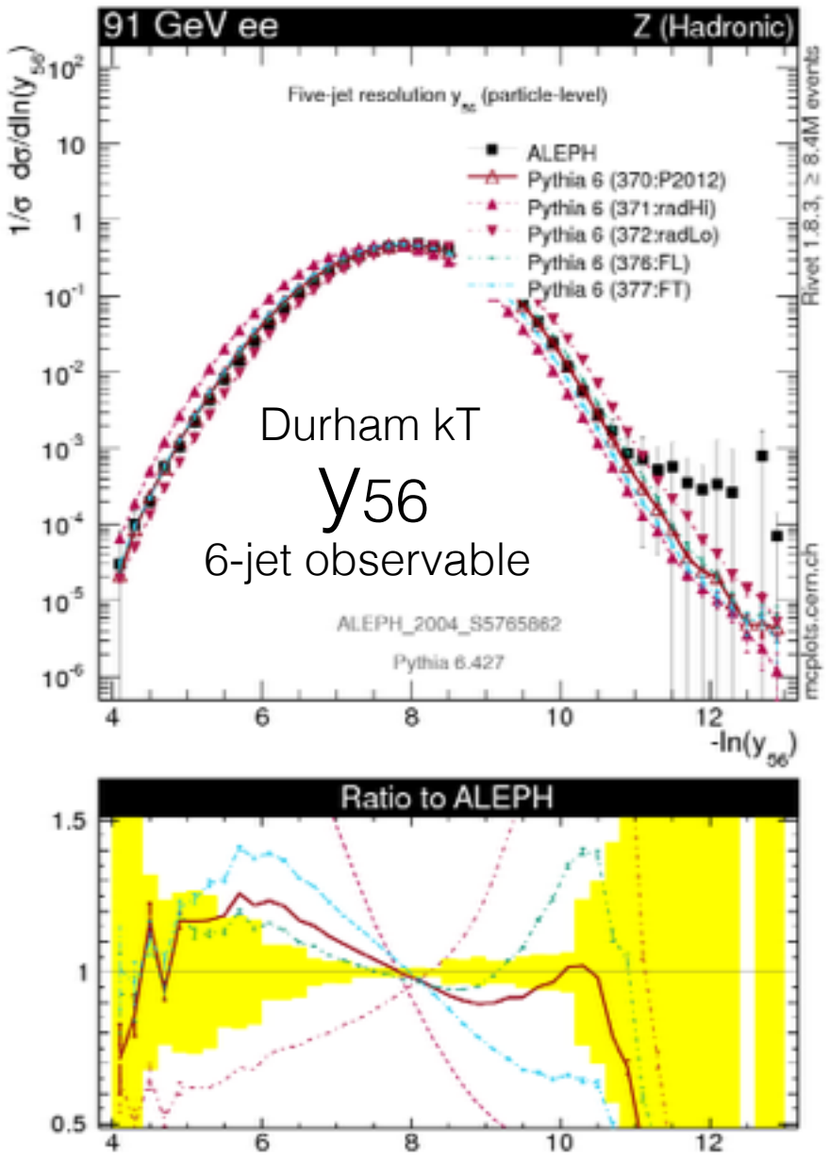


Durham kT

y_{23}

3-jet observable

$\propto \alpha_s^1$



Durham kT

y_{56}

6-jet observable

$\propto \alpha_s^4$

Beware! α_s pileup

See mcplots.cern.ch

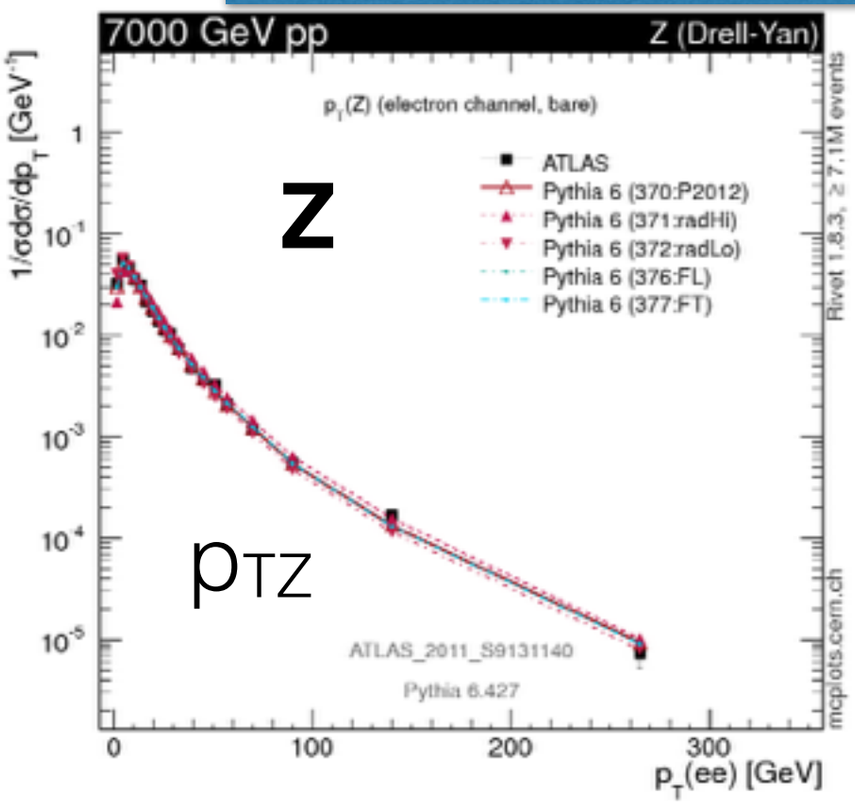
Karneyeu et al, arXiv:1306.3436

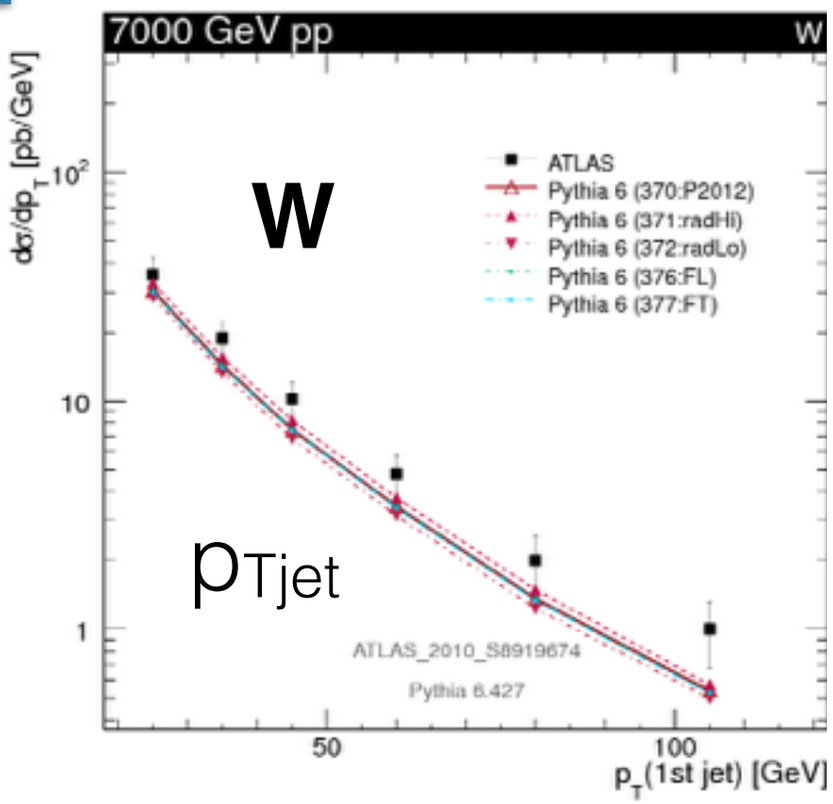
Variations in pp

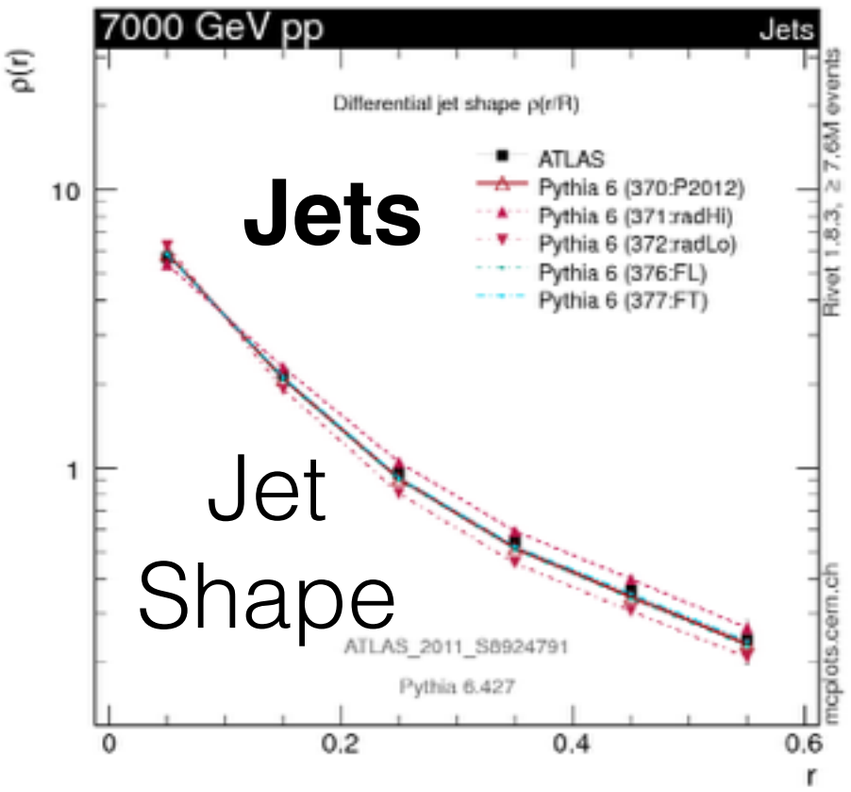
μ_R by factor 2 in either direction

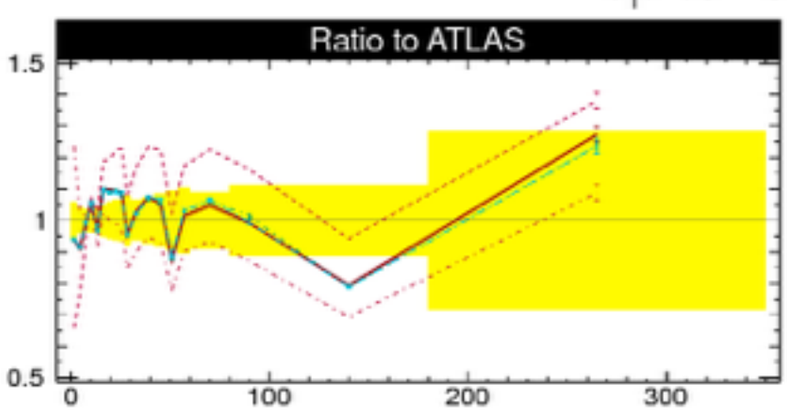
Pythia 6 “Perugia 2012 : Variations” (with central choice $\mu_R = p_T$, and $\alpha_s(M_Z)^{(1)} \sim 0.14$)

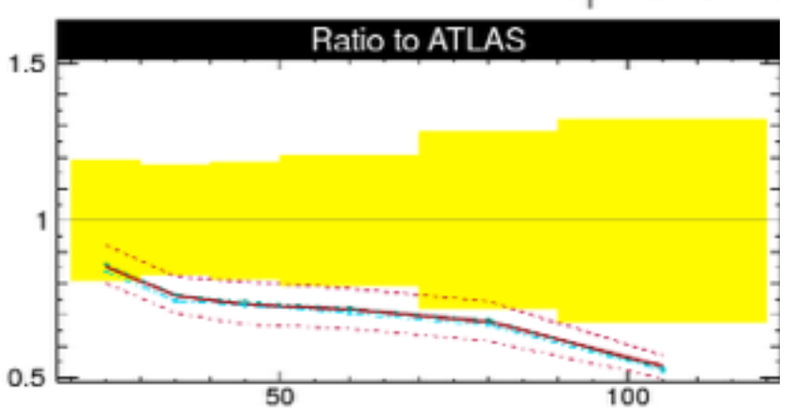
Skands, arXiv:1005.3457

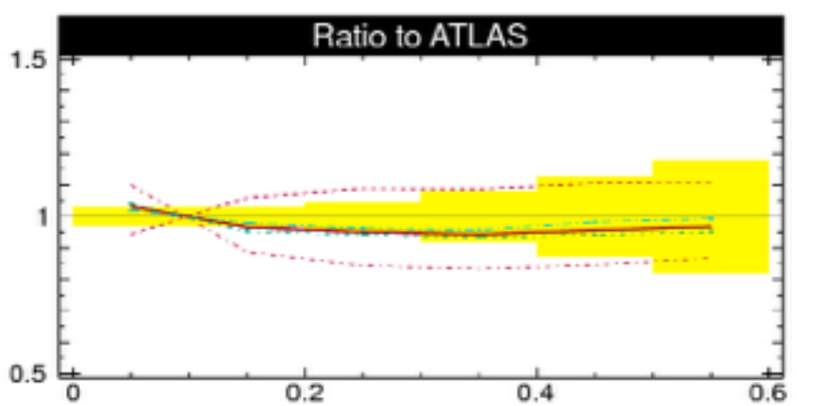












Jet Shape

$1/\sigma\ d\sigma/dp_T$

“normalized”

$d\sigma/dp_T$

“dimensionful”

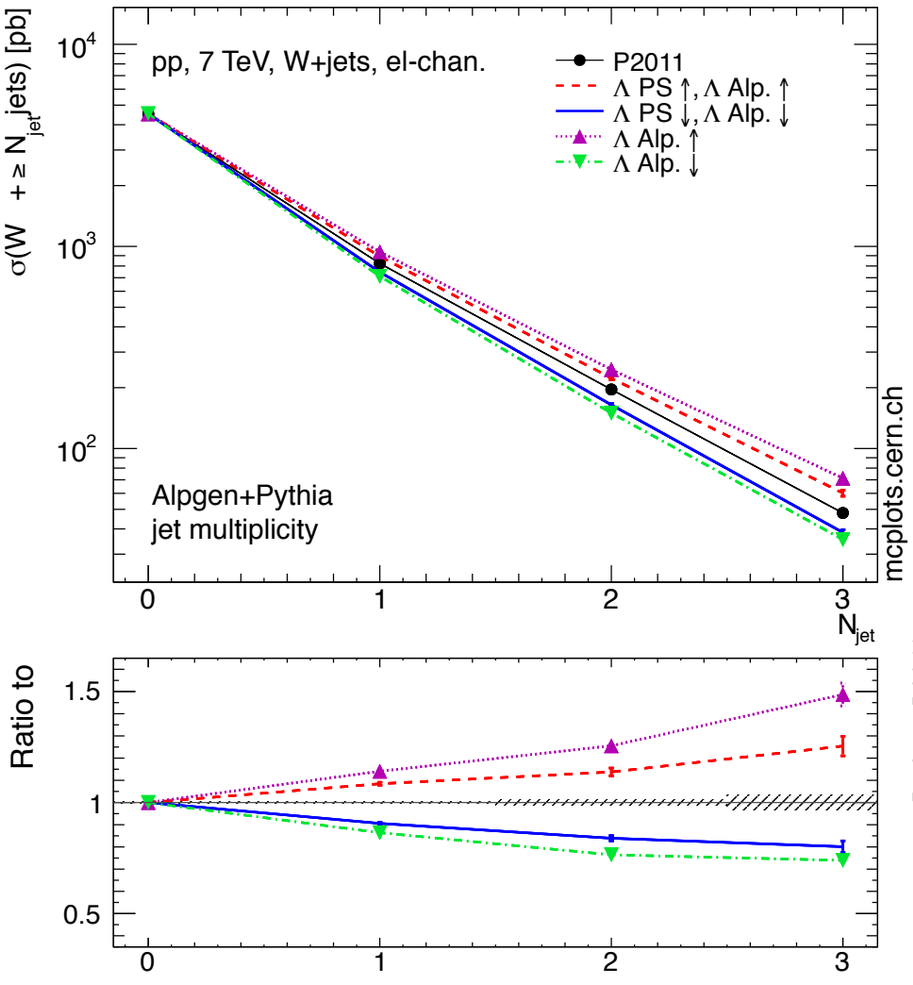
→ Factor 2 looks reasonable?

See mcplots.cern.ch

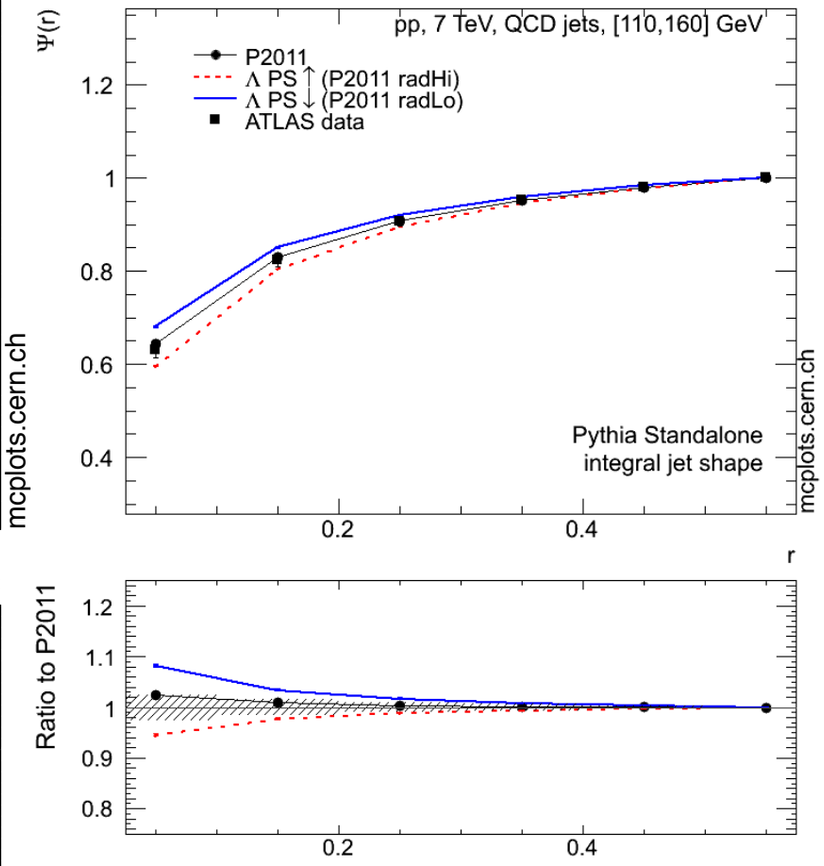
Karneyeu et al, arXiv:1306.3436

Cooper et al., arXiv:1109.5295

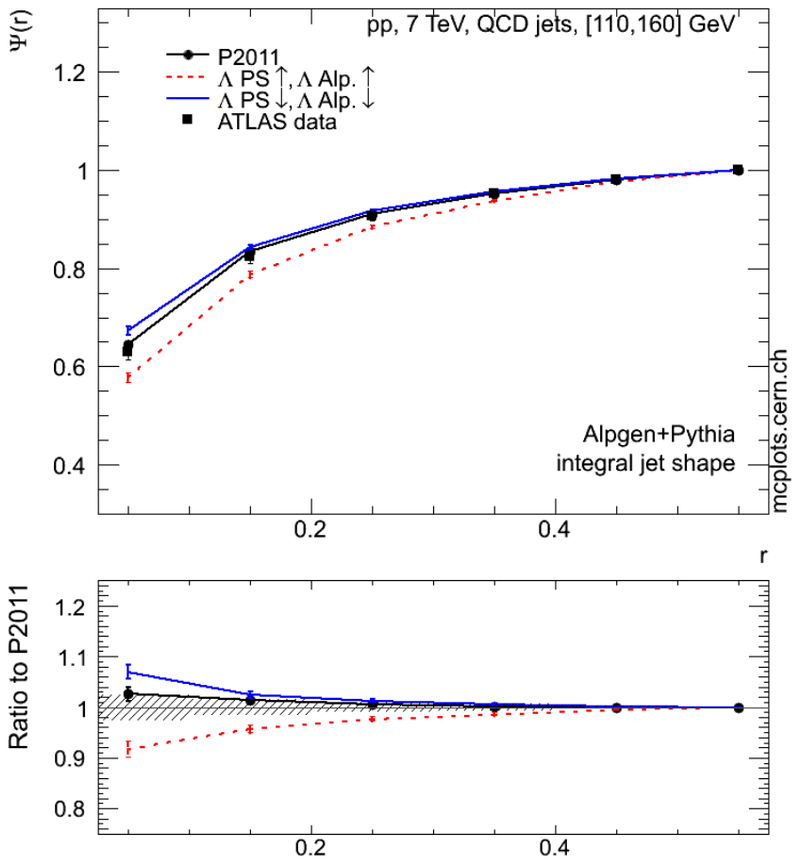
Matrix Elements (E.g., AlpGen/MadGraph + Herwig/Pythia) W+jets



NJets



Jet Shape PS

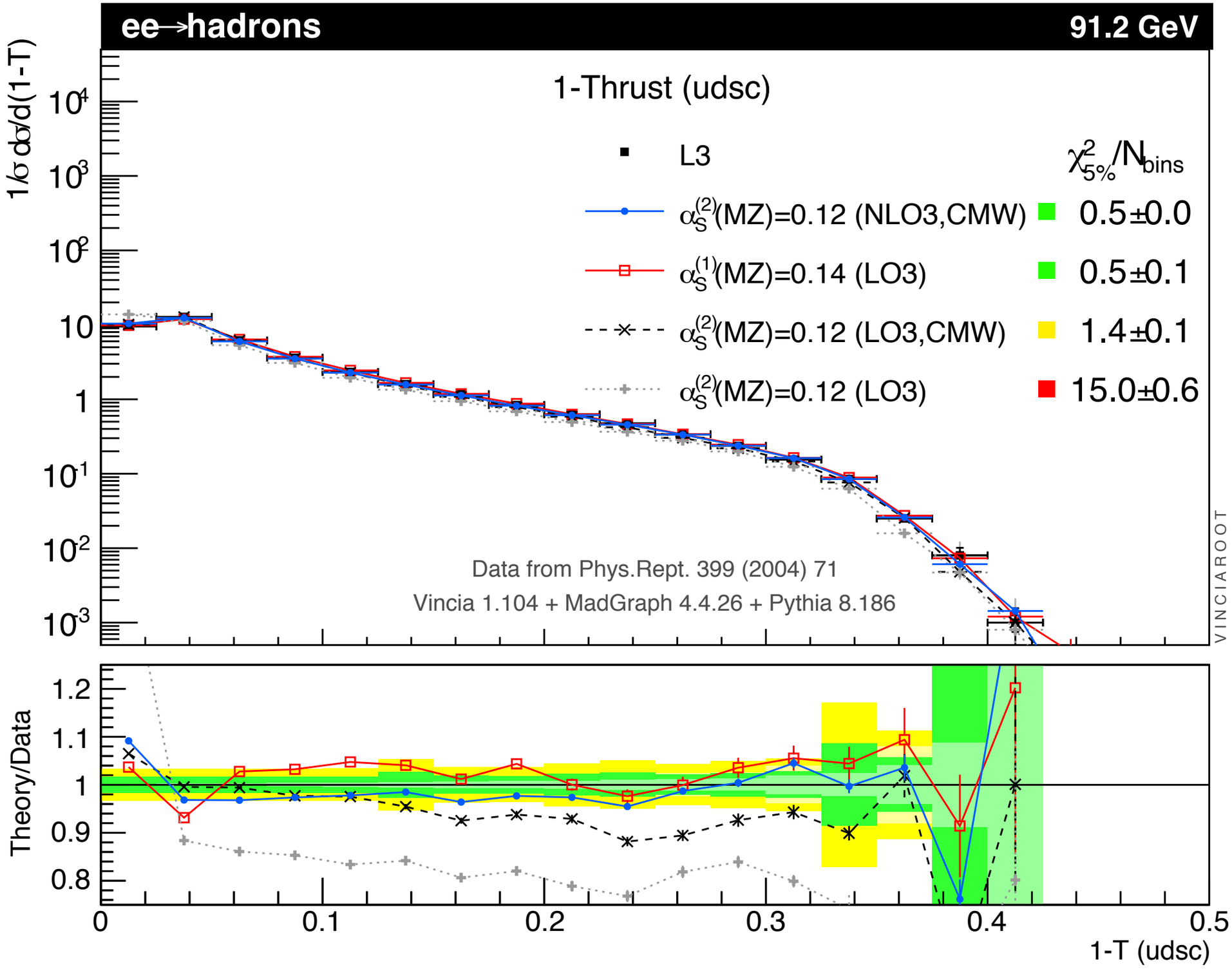


Jet Shape ME+PS

NJets: dominated by ME (+Sudakov from PS)
Jet Shapes: dominated by PS

From multi-leg LO to multi-leg NLO

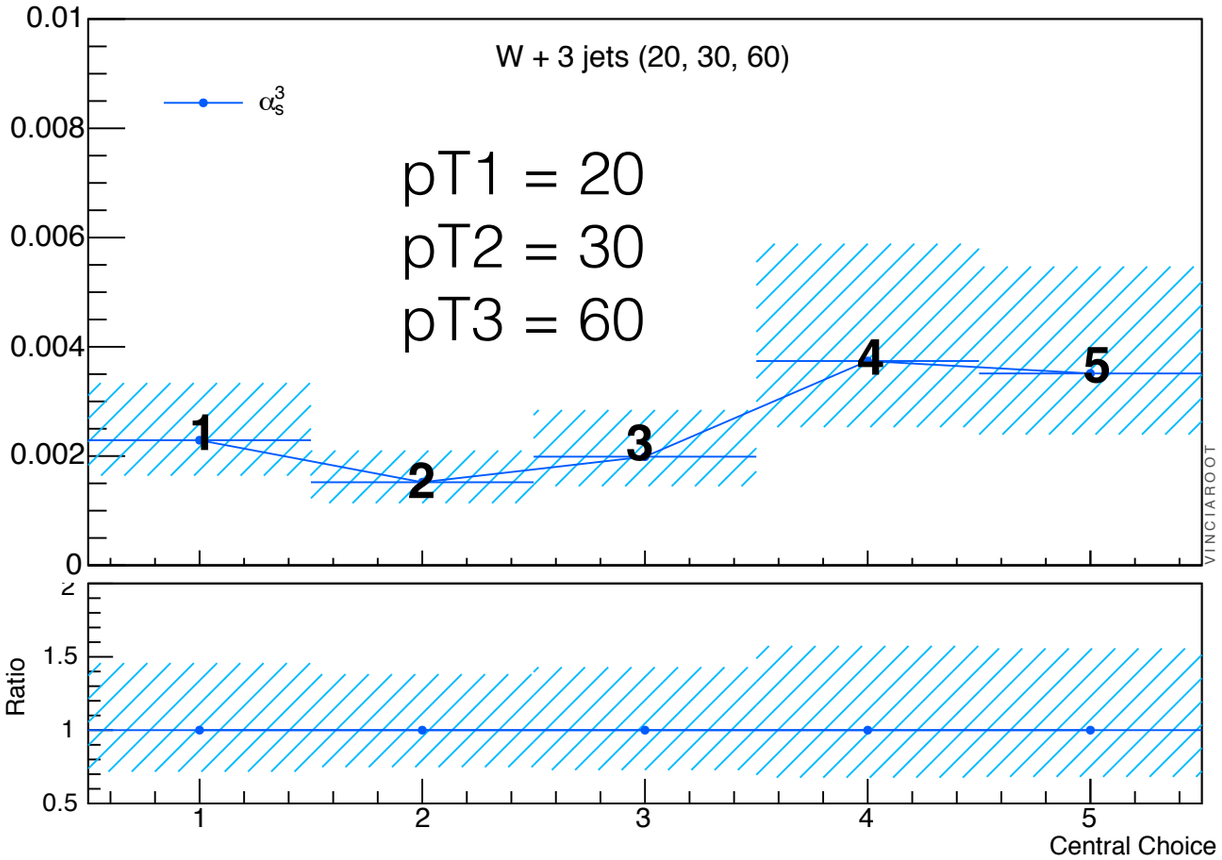
Hartgring, Laenen, Skands, arXiv:1303.4974

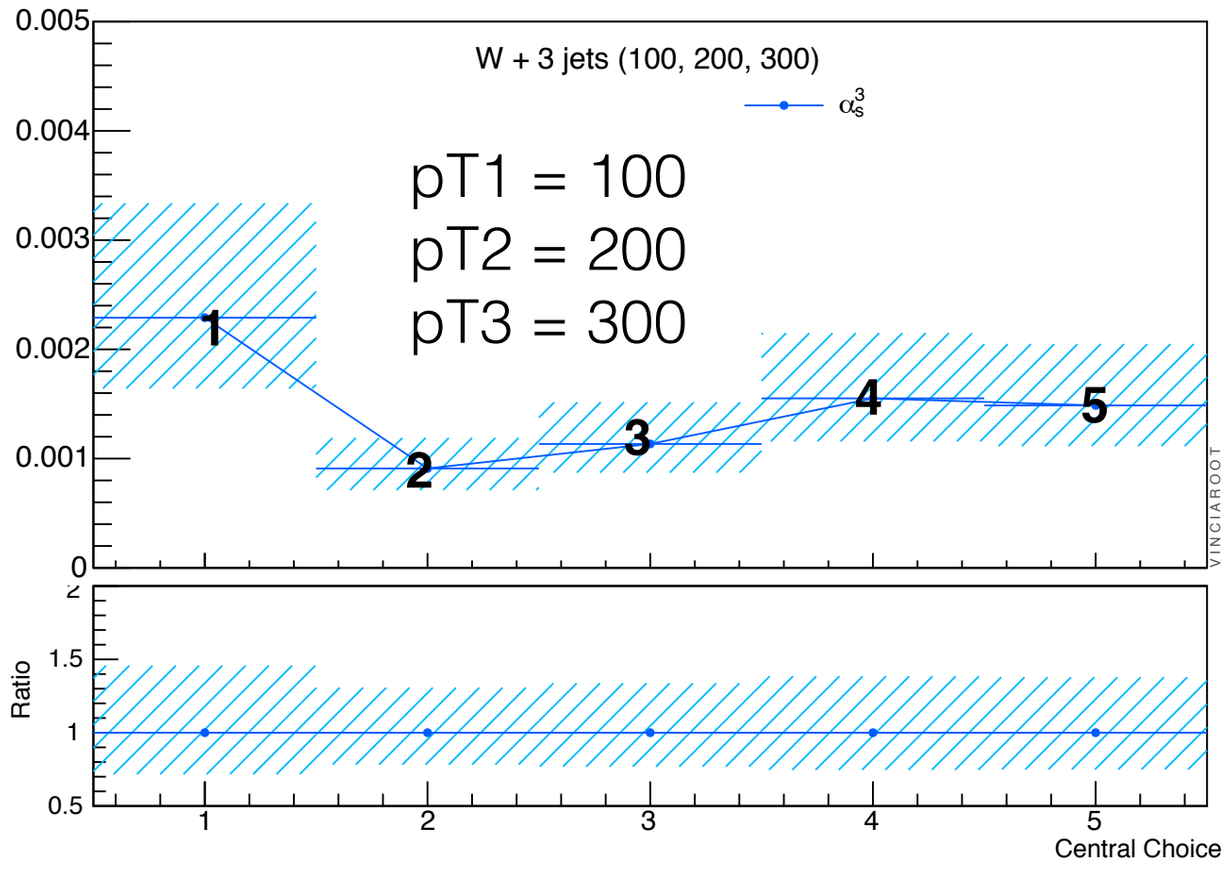


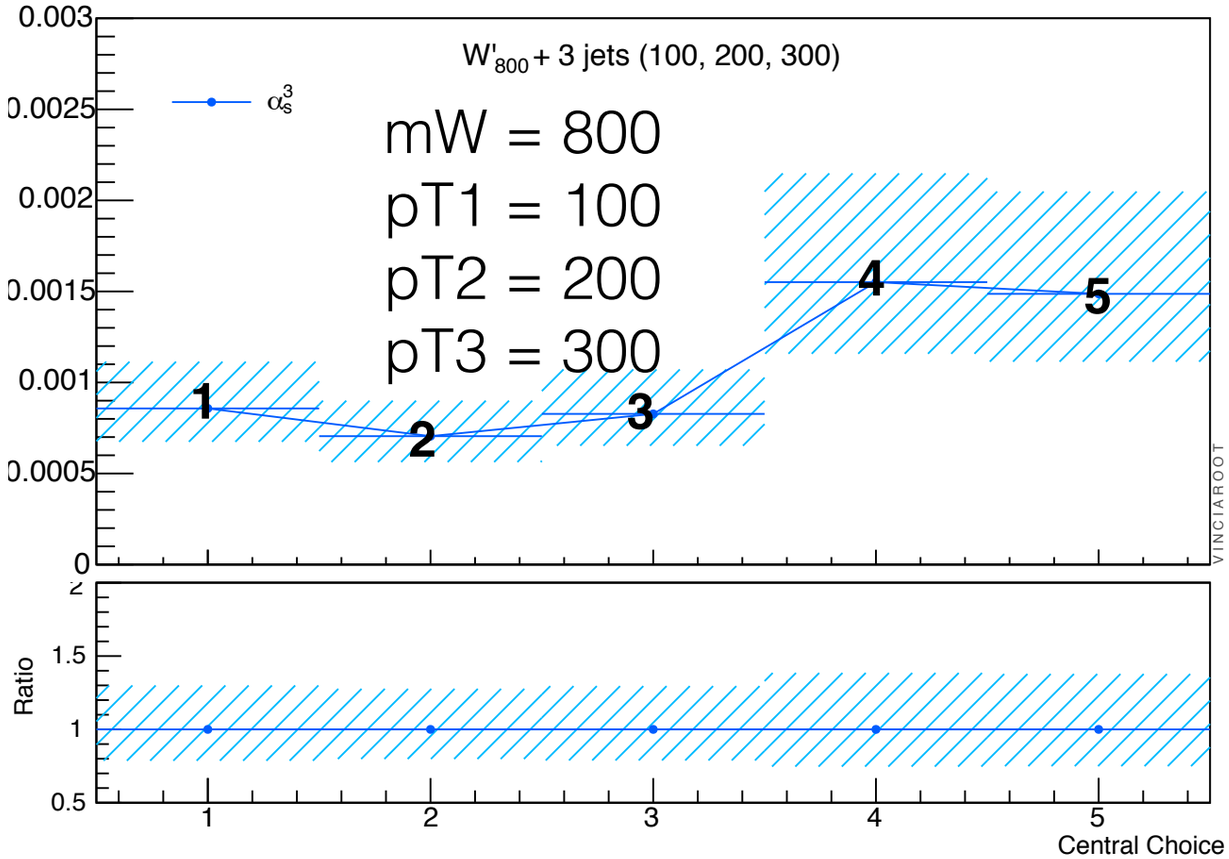
Multi-scale problems

E.g., in context of ME matching with many legs

Example: W+3







1: MW
2: MW + Sum(|pT|)
3: -“- (quadratically)
4: Geometric mean pT (~PS)
5: Arithmetic mean pT