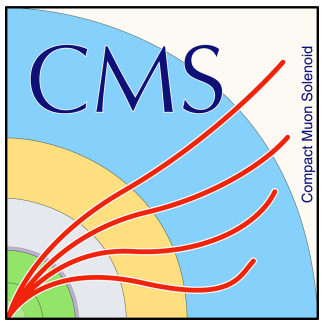
High p_T-jets angular correlations in CMS.

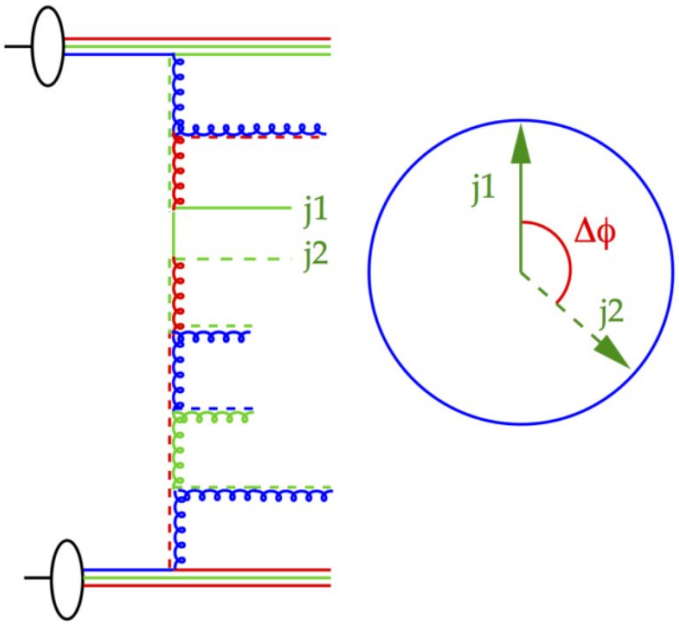
A. Bermudez Martinez on behalf of the QCD group

HLHE-LHC WG1 Meeting – QCD Physics

March 2, 2018



Back-to-back topologies



CMS Experiment at LHC, CERN
Data recorded: Sun Aug 14 13:01:17 2016 CEST
Run/Event: 278820 / 21368498
Lumi section: 18

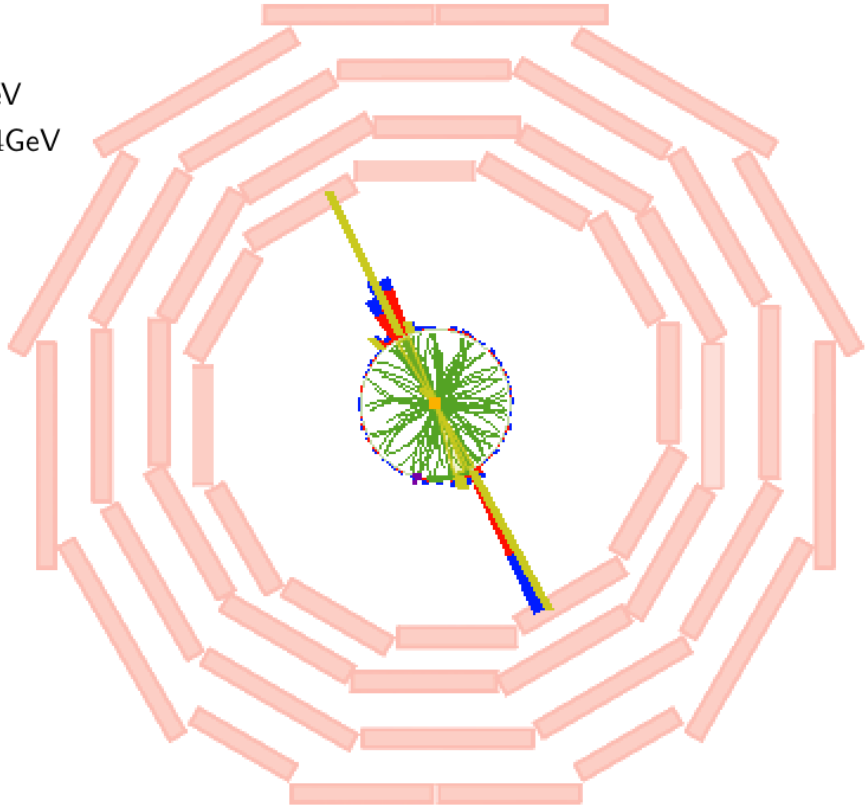
Leading $p_T = 696$GeV

Subleading $p_T = 694$GeV

Leading $y = 0.23$

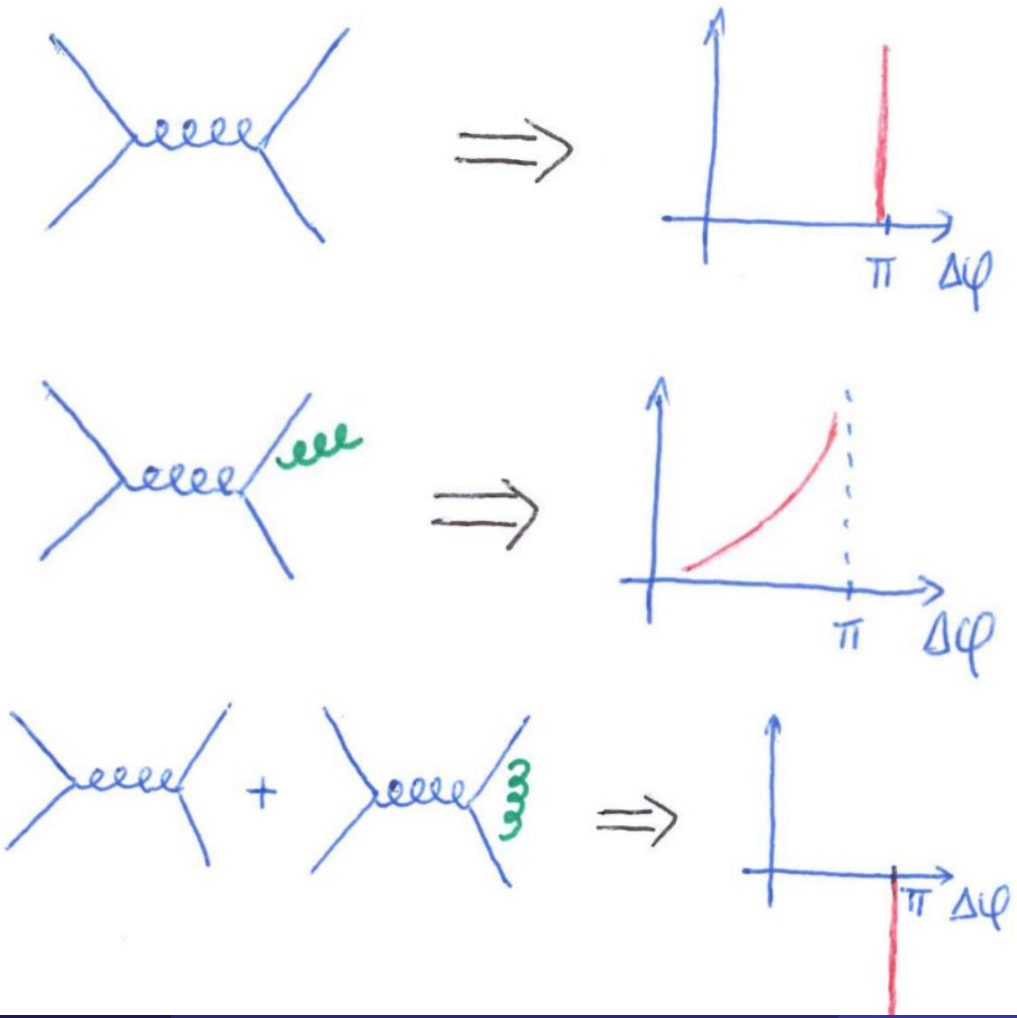
Subleading $y = 0.57$

$\Delta\phi_{1,2} = 178.2°$



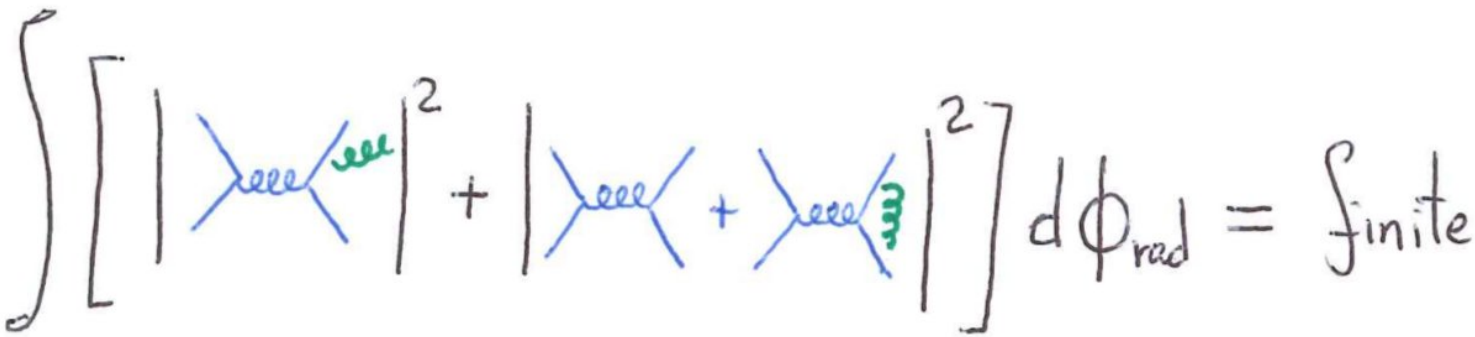
Why is it interesting?

- Not addressable at fixed order in pQCD $\rightarrow$ sensitive to all orders.
- Test for resummation strategies.



Why is it interesting?

- Not addressable at fixed order in pQCD $\rightarrow$ sensitive to all orders.
- Test for resummation strategies.



If $p_T^{rad} \sim 30\,GeV$ and $-\frac{\alpha_S}{2\pi} ln^2 \frac{(p_T^{rad})^2}{(p_T^{max})^2} \sim 1 \Rightarrow p_T^{max} \sim 2\,TeV$

- Truly perturbative resummation effects at large scales

Why is it interesting?

- Not addressable at fixed order in pQCD $\rightarrow$ sensitive to all orders.
- Test for resummation strategies.
- Factorization (collinear/kt) and factorization breaking.

---

q_T

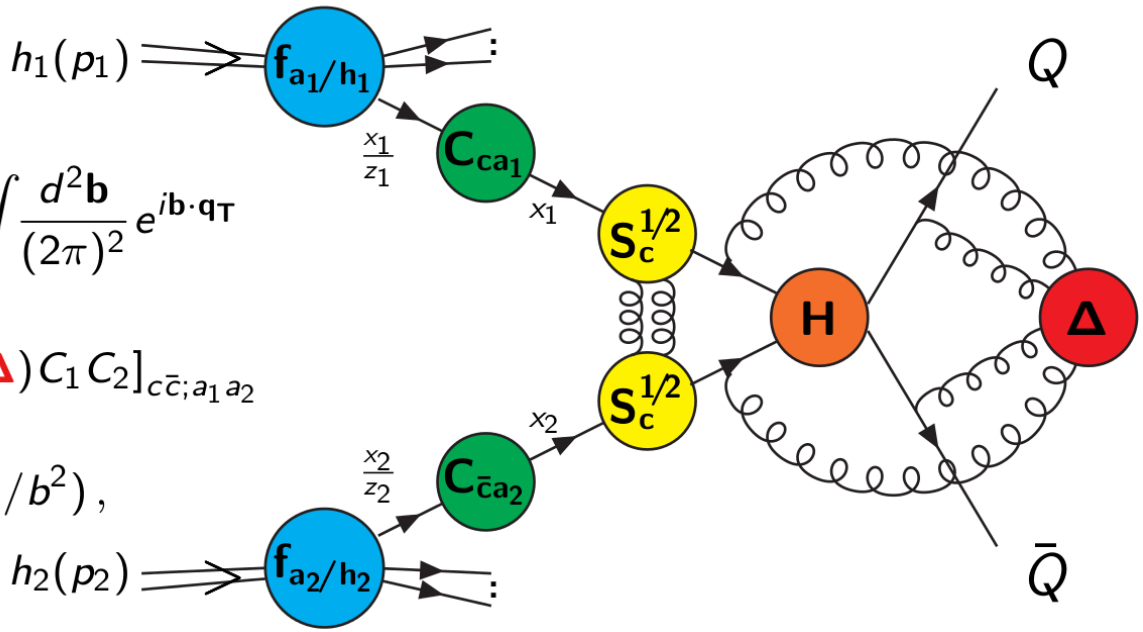
Resummation for heavy-quark hadroproduction

[Catani,Grazzini,Torre('14)]

$$\frac{d\sigma^{(res)}}{d^2\mathbf{q_T}dM^2dyd\mathbf{\Omega}} = \frac{M^2}{s}\sum_{c=q,\bar{q},g}\left[d\sigma^{(0)}_{c\bar{c}}\right]\int\frac{d^2\mathbf{b}}{(2\pi)^2}e^{i\mathbf{b}\cdot\mathbf{q_T}}$$

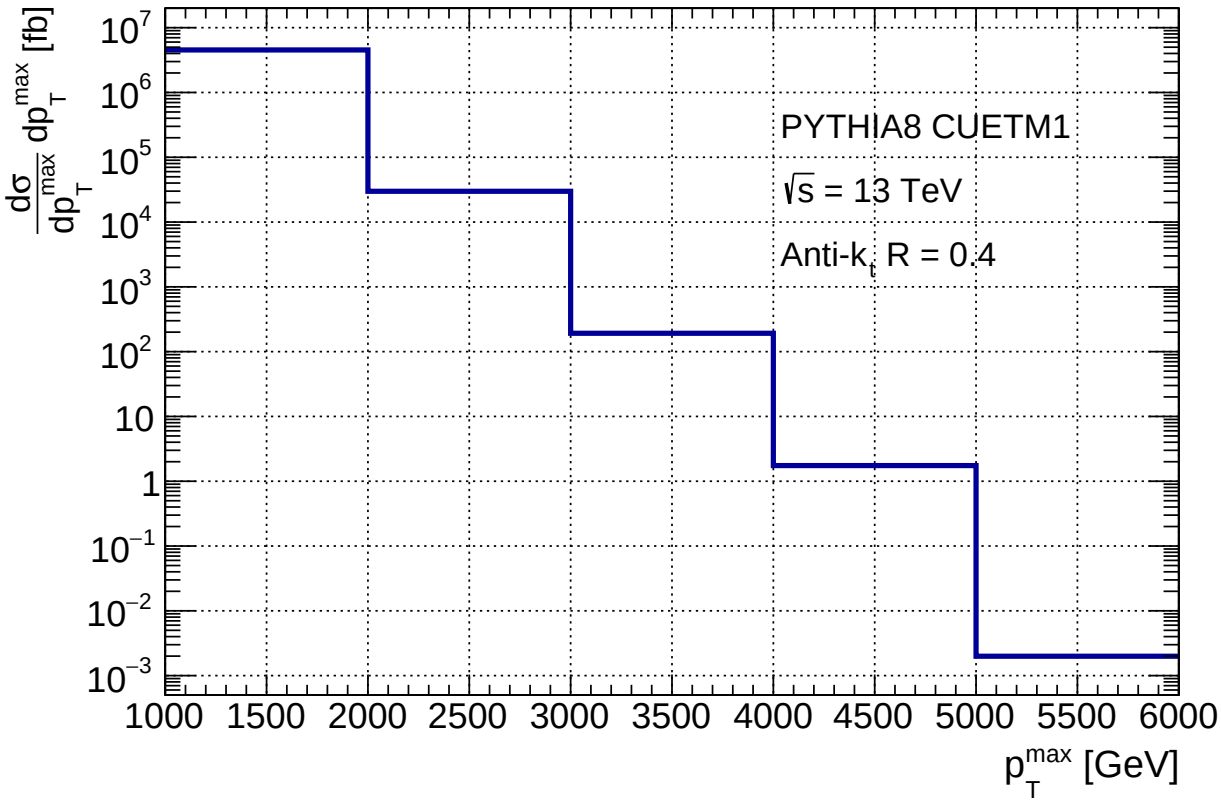
$$\times\ S_c(M,b)\sum_{a_1,a_2}\int_{x_1}^1\frac{dz_1}{z_1}\int_{x_2}^1\frac{dz_2}{z_2}\left[(\mathbf{H\Delta})C_1C_2\right]_{c\bar{c};a_1a_2}$$

$$\times\ f_{a_1/h_1}(x_1/z_1,b_0^2/b^2)f_{a_2/h_2}(x_2/z_2,b_0^2/b^2)\,,$$

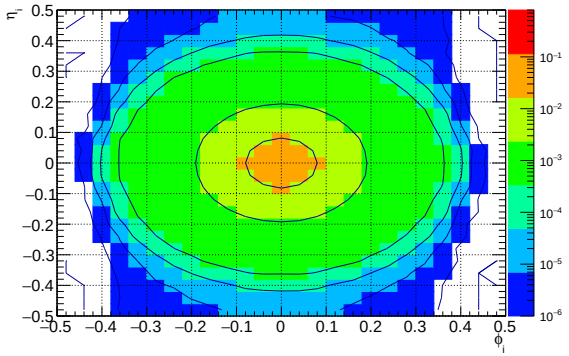


How far can we get?

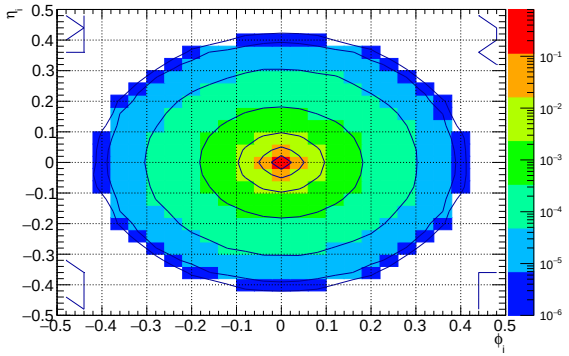
- Absolute leading jet cross section in bins of p_T^{max}
- Luminosity $36 fb^{-1} \rightarrow 100 fb^{-1} \rightarrow 300 fb^{-1} \rightarrow 3000 fb^{-1}$
- $3000 fb^{-1} \Rightarrow N_{jets}^{p_T > 4000\,GeV} \sim 6000$



$p_T \sim 30\,GeV$



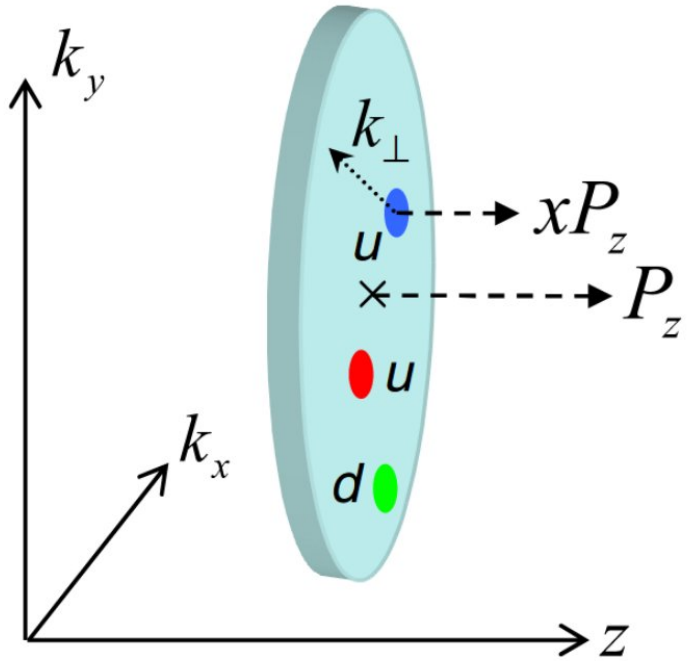
$p_T \sim 5000\,GeV$



How far can we get?

- Reaching high fractions of proton momentum

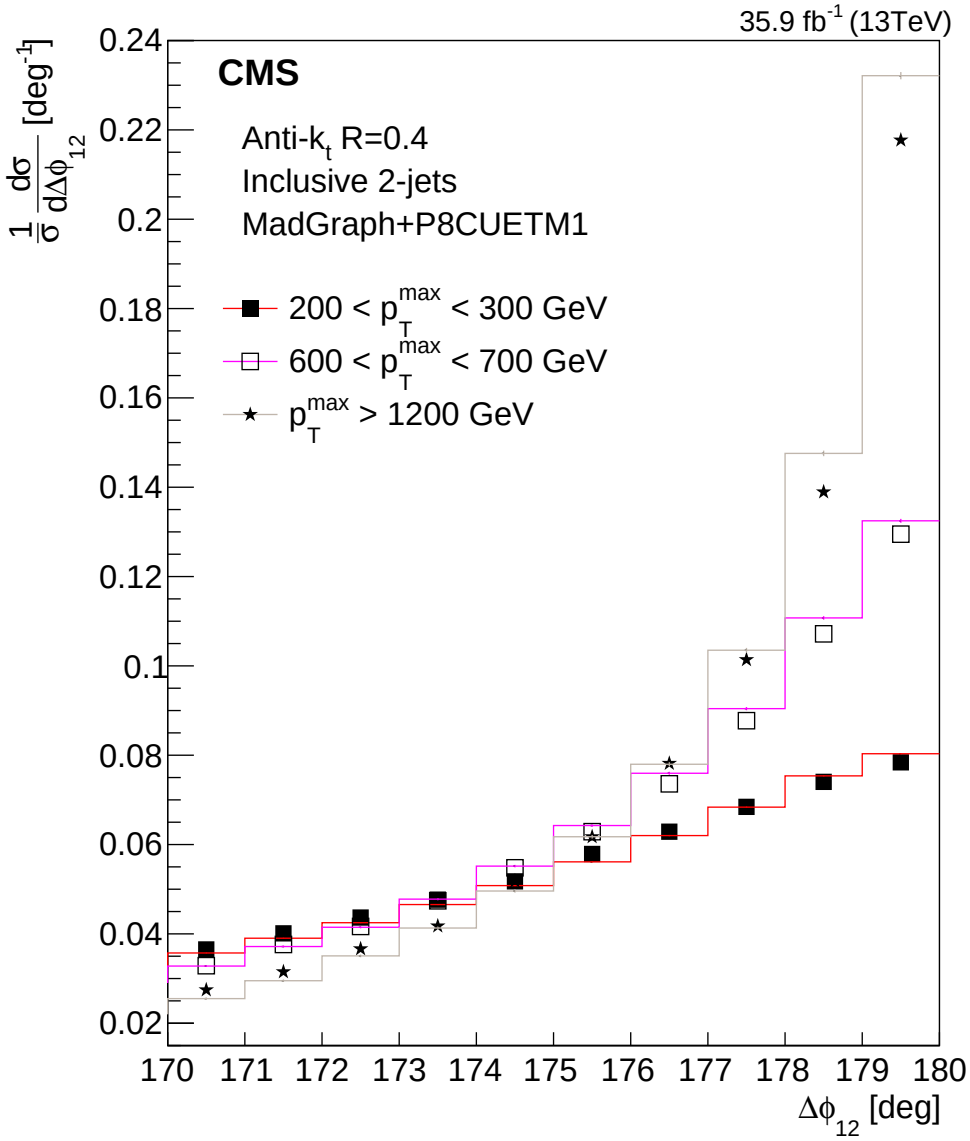
p_T^{max} [GeV]	x
1000	~ 0.15
2000	~ 0.30
3000	~ 0.46
4000	~ 0.61
5000	~ 0.77



EPL 88 61001 (5pp)

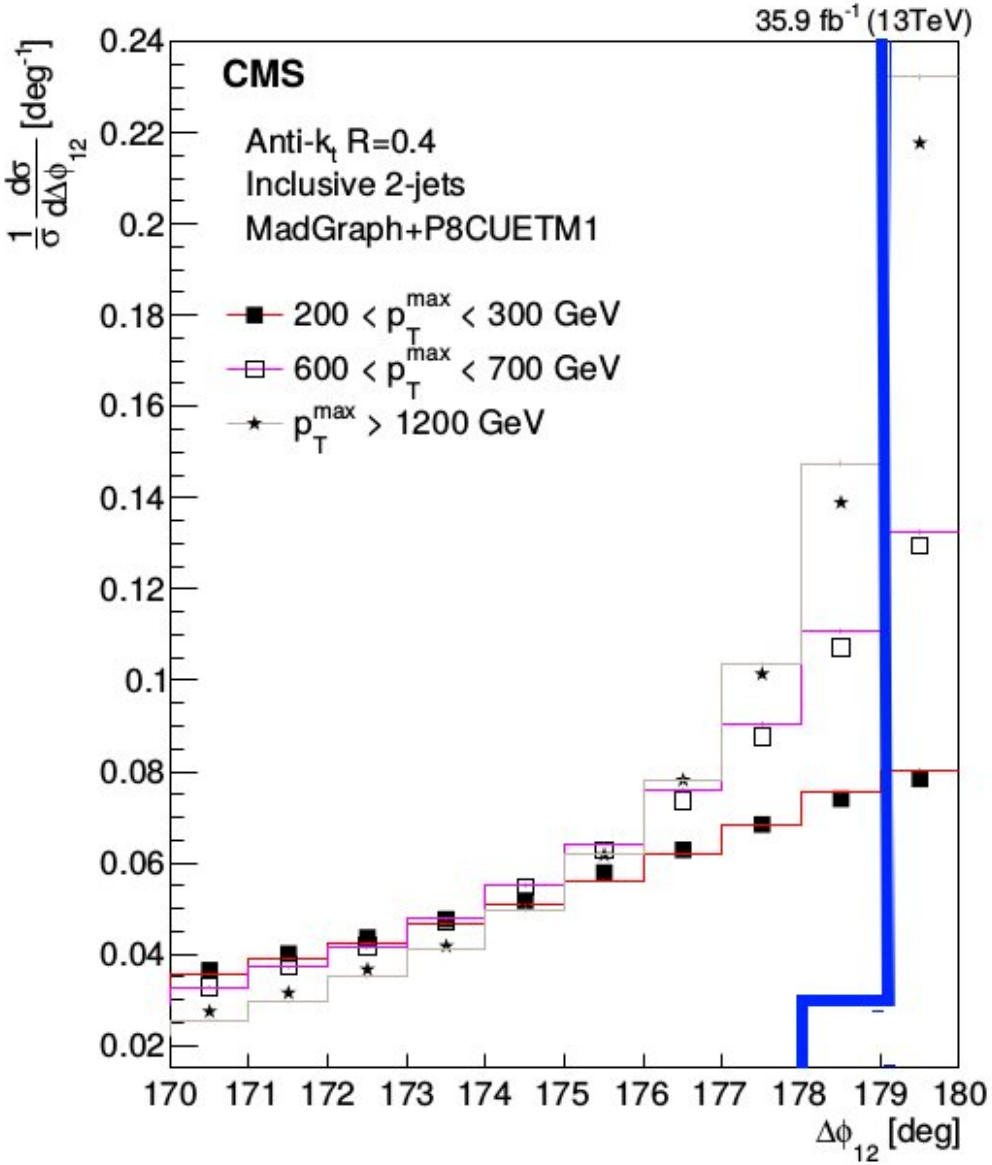
What do we have so far?

- Back-to-back region increasingly important with p_T^{max}
- $\Delta\phi$ resolution $\sim 0.5°$



What we would like to see

- Back-to-back region increasingly important with p_T^{max}
- $\Delta\phi$ resolution $\sim 0.5^\circ$
- Going to the extremes



Conclusions and outlook

- Pencil-like high-pT jets of up to 5 TeV

- Probing large fractions of proton momentum

- Probing truly perturbative resummation effects

- Testing factorization, factorization breaking?

Thank you for your attention.