Soft Gluon Resummation in Higgs plus jets Production at LHC

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Outline

- Soft gluon resummation (K_T resummation)
- soft gluon resummation in Higgs plus jets production at LHC
- Summary

soft gluon resummation (K_T resummation)

- Consider the production process pp →H(Z)+X

$$\frac{d\sigma}{dQ_T^2} \sim \frac{1}{Q_T^2}\{\ \alpha_S(L+1) \quad +\alpha_S^2(L^3+L^2) \quad +\alpha_S^3(L^5+L^4)+\alpha_S^4(L^7+L^6)+\ldots$$

$$+\alpha_S^2(\ L+\ \ 1) \quad +\alpha_S^3(L^3+L^2)+\alpha_S^4(L^5+L^4)+\ldots$$

$$+\alpha_S^3(\ L+\ \ 1)+\alpha_S^4(L^3+L^2)+\ldots\ \}$$

Where Q_T is the transverse momentum, and Q is the mass of H(Z), and $L = \mathrm{Log}[Q^2 / Q_T^2]$.

- We have to resum these large logs to make reliable predictions

Differential cross section can be written as :

$$\frac{d^3\sigma(M^2, q_\perp, y)}{d^2q_\perp dy} = \sigma_0 \int \frac{d^2\vec{b}}{(2\pi)^2} e^{-iq_\perp \cdot b_\perp} W(x_1, x_2, b, M^2)$$

W term can be factorized into :

$$W(x_1, x_2, b, M^2) = x_1 f(x_1, b, \xi_1, \mu) x_2 f(x_2, b, \xi_2, \mu) H(M^2, \mu) S(b, \mu)$$

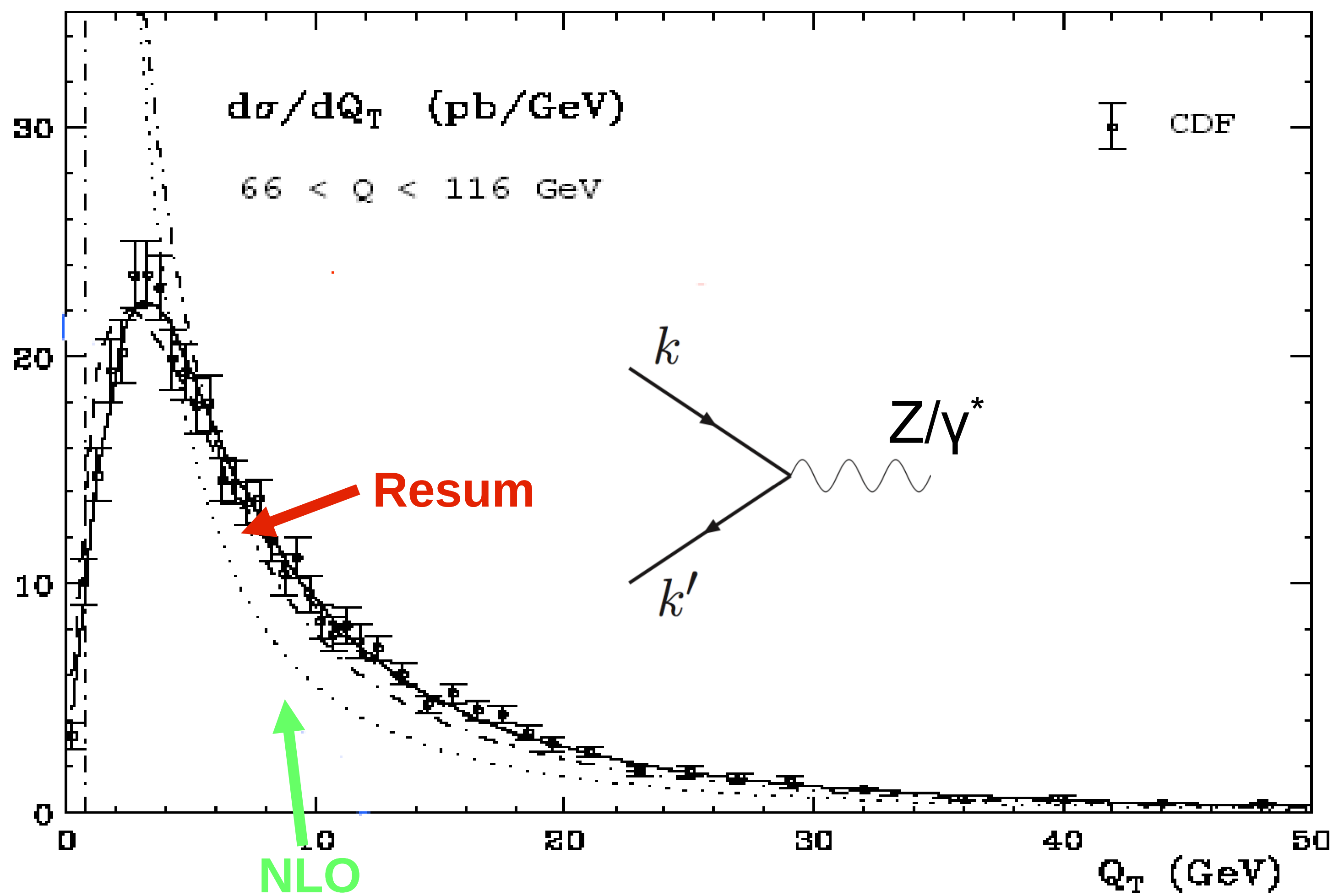
After evolving all the scales in W term to the same point

$$W(x_1, x_2, b, M^2) = x_1 f(x_1, b, b, b) x_2 f(x_2, b, b, b) H(M, \mu) \exp\left\{ -\int_{b_0^2/b^2}^{\mu^2} \left(A \ln\frac{M^2}{\mu^2} + B \right) \frac{d\mu^2}{\mu^2} \right\}$$

For $g\, g \rightarrow H + X$ $\quad A^{(1)}=C_A\, a_s/\pi \quad B^{(1)}=-2C_A\, \beta_0\, a_s/\pi$

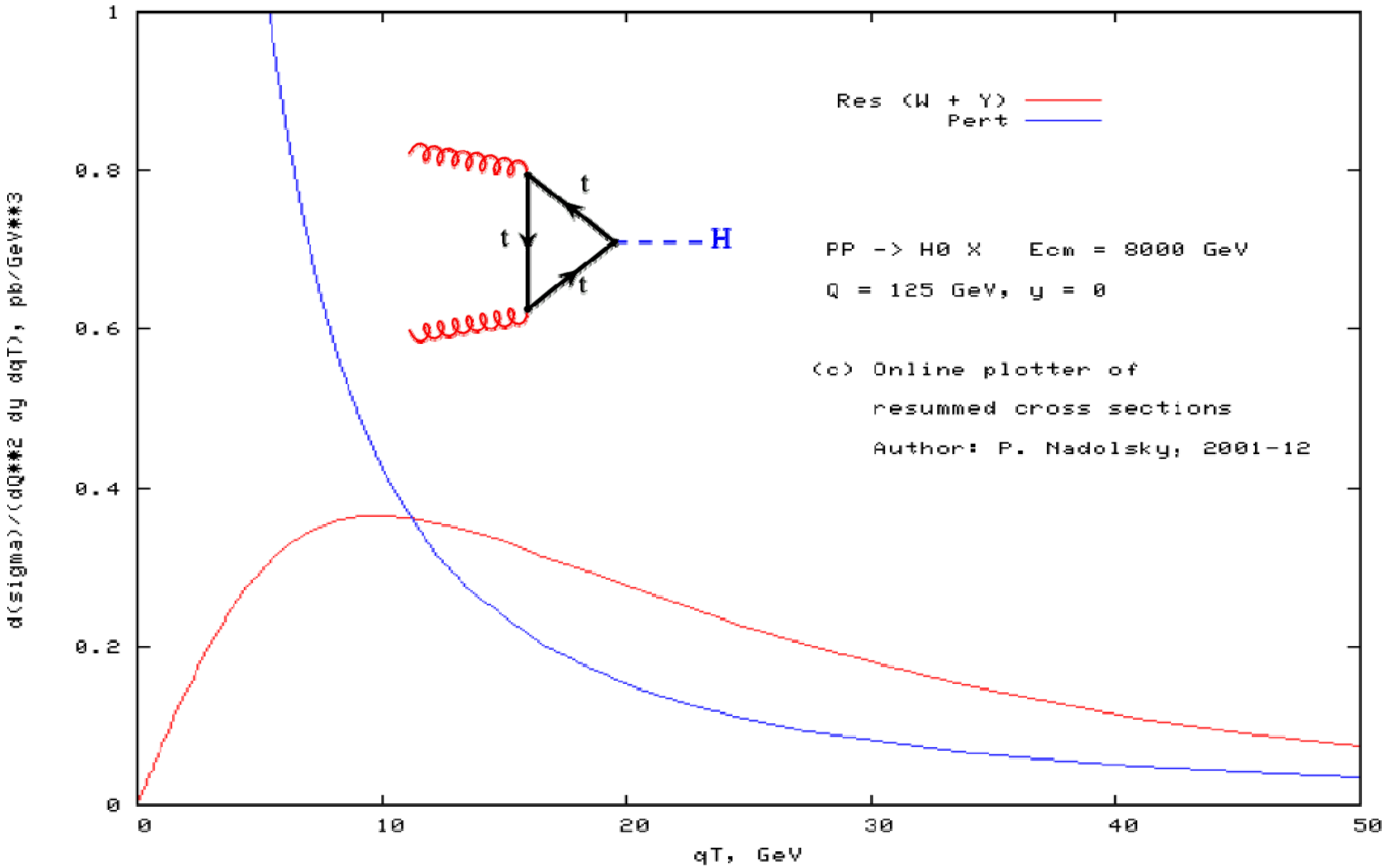
For $q\, q \rightarrow Z + X$ $\quad A^{(1)}=C_F\, a_s/\pi \quad B^{(1)}=-2C_F/3\, a_s/\pi$

Z production in pp collision



Kulesza, Sterman, Vogelsang, 02

Higgs production in pp collision

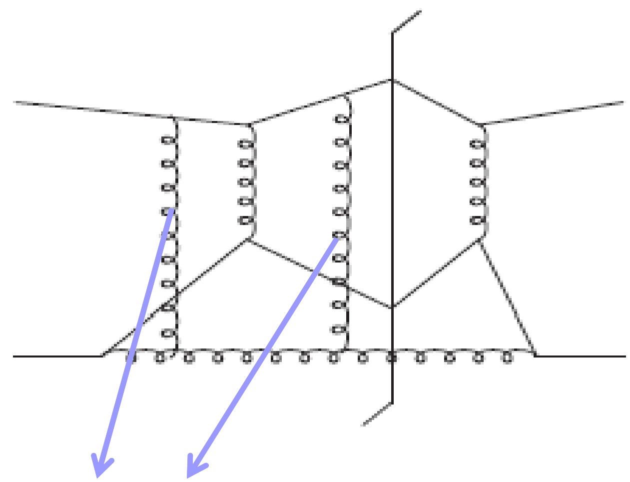


- The K_T resummation works very well in Drell-Yan or Higgs inclusive production processes

- We can apply it into the processes including three, four or more color particals

Factorization breaking

factorization breaking effects Collins-Qiu, 2007; Vogelsang-Yuan, 2007;Rogers-Mulders 2010



Glauber gluon ($l^+ l^- << l_t^2$ & $l_t \sim \lambda$)
It breaks ward identities

1) It shows at NNLO for unpolarized pp collision, unless you integrate out K_T
2) We assume the breaking effect is about M_P/K_T , when $M_P << K_T << Q$, the breaking effect is not large comparing with pQCD contribution

Heavy quark pair production at the hadron colliders

C. S. Li et al Phys.Rev. D88 (2013) 074004

The cross section can be factorized into

$$W_{kl}(x_i, b) = x_1 f_l(x_1, b, \xi_1^2, \mu^2, \rho) x_2 f_k(x_2, b, \xi_2^2, \mu^2, \rho) \mathrm{Tr}\left[\mathbf{H}(Q^2, \mu^2, \rho)\mathbf{S}(b, \mu^2, \rho)\right]$$

The Hard and soft part have to be expanded by a group of color basis

For the channel $q(i) + \bar{q}(j) \to t(k) + t(l)$, we adopt the bases

$$C_1(i,j,k,l) = \delta_{ij}\delta_{kl}, \qquad C_2(i,j,k,l) = T^d_{ij}T^d_{kl}\,.$$

While for $g(a) + g(b) \to t(k) + \bar{t}(l)$, we have the bases

$$C_1(a,b,k,l) = \delta^{ab}\delta_{kl}, \qquad C_2(a,b,k,l) = if^{abd}T^d_{kl}, \qquad C_3(a,b,k,l) = d^{abd}T^d_{kl}$$

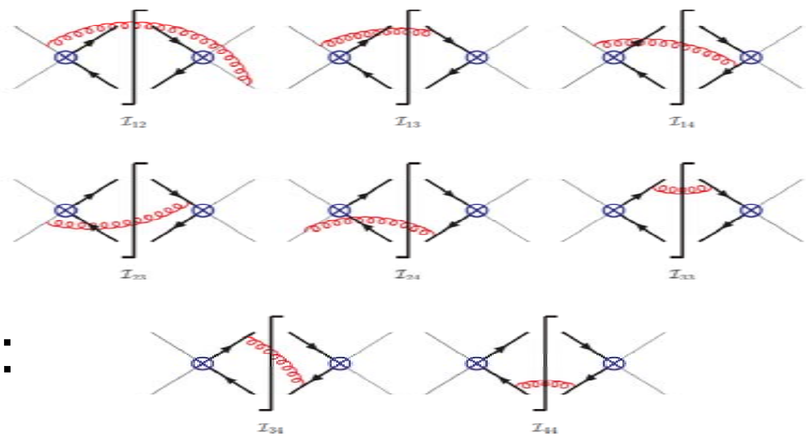
The soft factor's definition

We can definite the soft factor as:

$$\mathcal{L}_n^\dagger(\zeta^-,\zeta_\perp) = P\exp\left\{-ig\int_{-\infty}^{0} d\lambda n\cdot A^a(\lambda n+\zeta)T_a\right\}$$

$$S_{IJ} = \int_0^\pi \frac{(\sin\phi)^{-2\epsilon}}{\frac{\sqrt{\pi}\Gamma(\frac{1}{2}-\epsilon)}{\Gamma(1-\epsilon)}} d\phi\, C_{Iii'}^{bb'} C_{Jll'}^{aa'} \langle 0|\mathcal{L}_{vcb'}^\dagger \mathcal{L}_{vbc}\mathcal{L}_{\bar{v}ca'}^\dagger \mathcal{L}_{\bar{v}ac}\mathcal{L}_{nji}^\dagger \mathcal{L}_{ni'k}\mathcal{L}_{nkl}^\dagger \mathcal{L}_{nl'j}|0\rangle$$

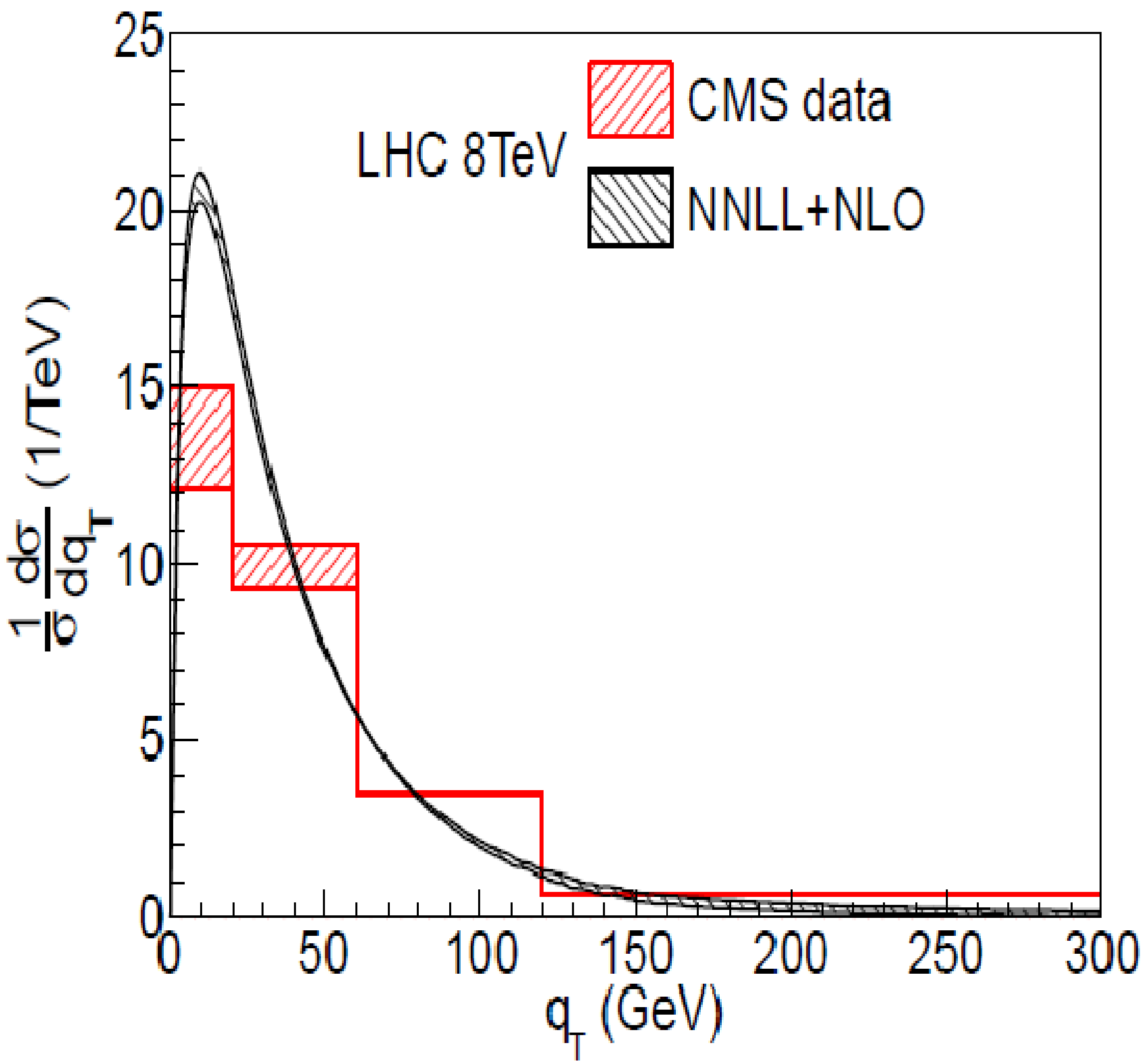
the evolution equation:



$$\frac{d}{d\ln\mu} S_{i\bar{i}}(\mu) = -\gamma_{i\bar{i}}^{s\dagger} S_{i\bar{i}}(\mu) - S_{i\bar{i}}(\mu)\gamma_{i\bar{i}}^{s}$$

Then you can get the W funtion:

$$W_{kl}\left(x_i, b_\perp, \frac{C_1^2}{C_2^2 b_\perp^2}\right) = f_k(x_A, C_1^2/(C_2^2/b_\perp^2)) f_l(x_B, C_1^2/(C_2^2/b_\perp^2))$$
$$\times Tr\left[\mathbf{H}(M_{c\bar{c}}^2, M_{c\bar{c}}^2)\mathrm{EXP}\{-\int_{C_1^2/b_\perp^2}^{M_{c\bar{c}}^2} \frac{d\mu}{\mu}\gamma_{i\bar{i}}^{s\dagger}\}\mathbf{S}(b, \frac{C_1^2}{C_2^2 b_\perp^2})\mathrm{EXP}\{-\int_{C_1^2/b_\perp^2}^{M_{c\bar{c}}^2} \frac{d\mu}{\mu}\gamma_{i\bar{i}}^{s}\}\right]$$



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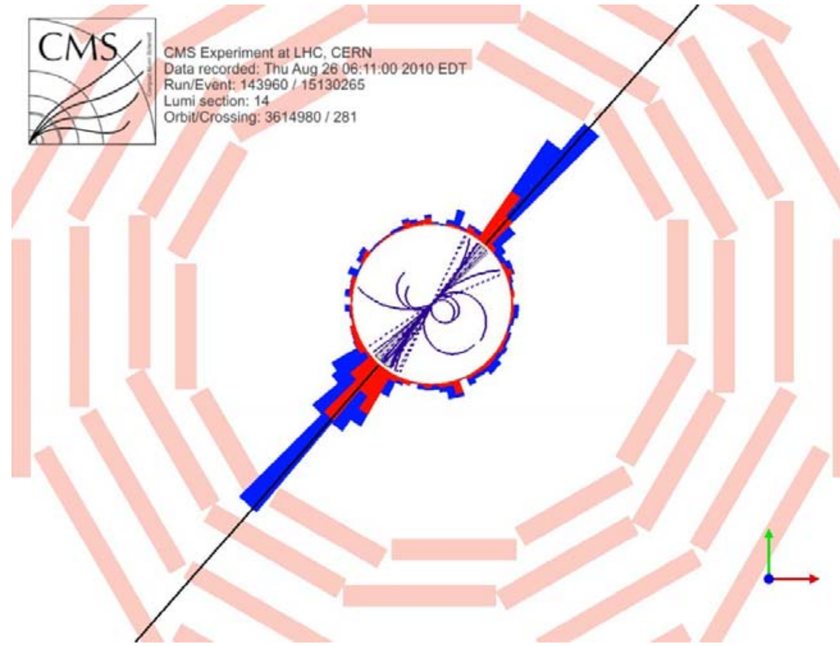
Soft Gluon Resummations in Dijet Azimuthal Angular Correlations at the Collider

Peng Sun,[1] C.-P. Yuan,[2] and Feng Yuan[1]

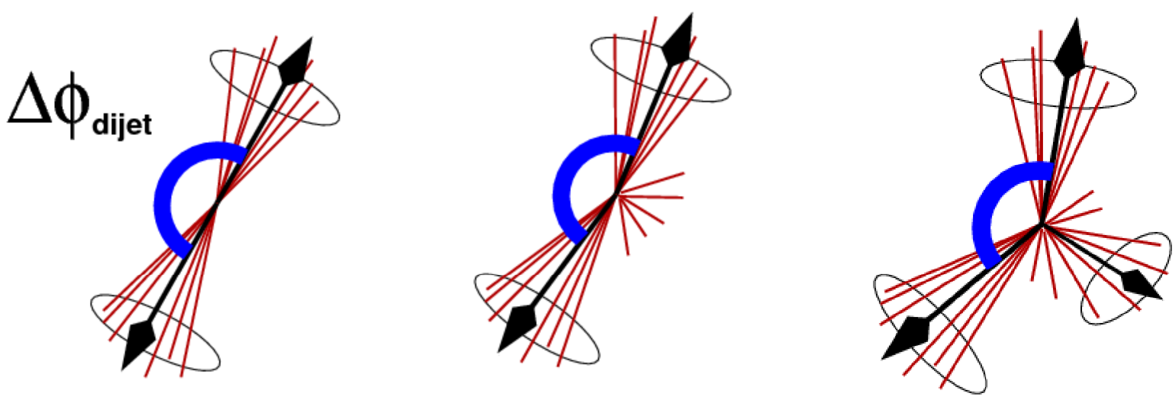
Abstract

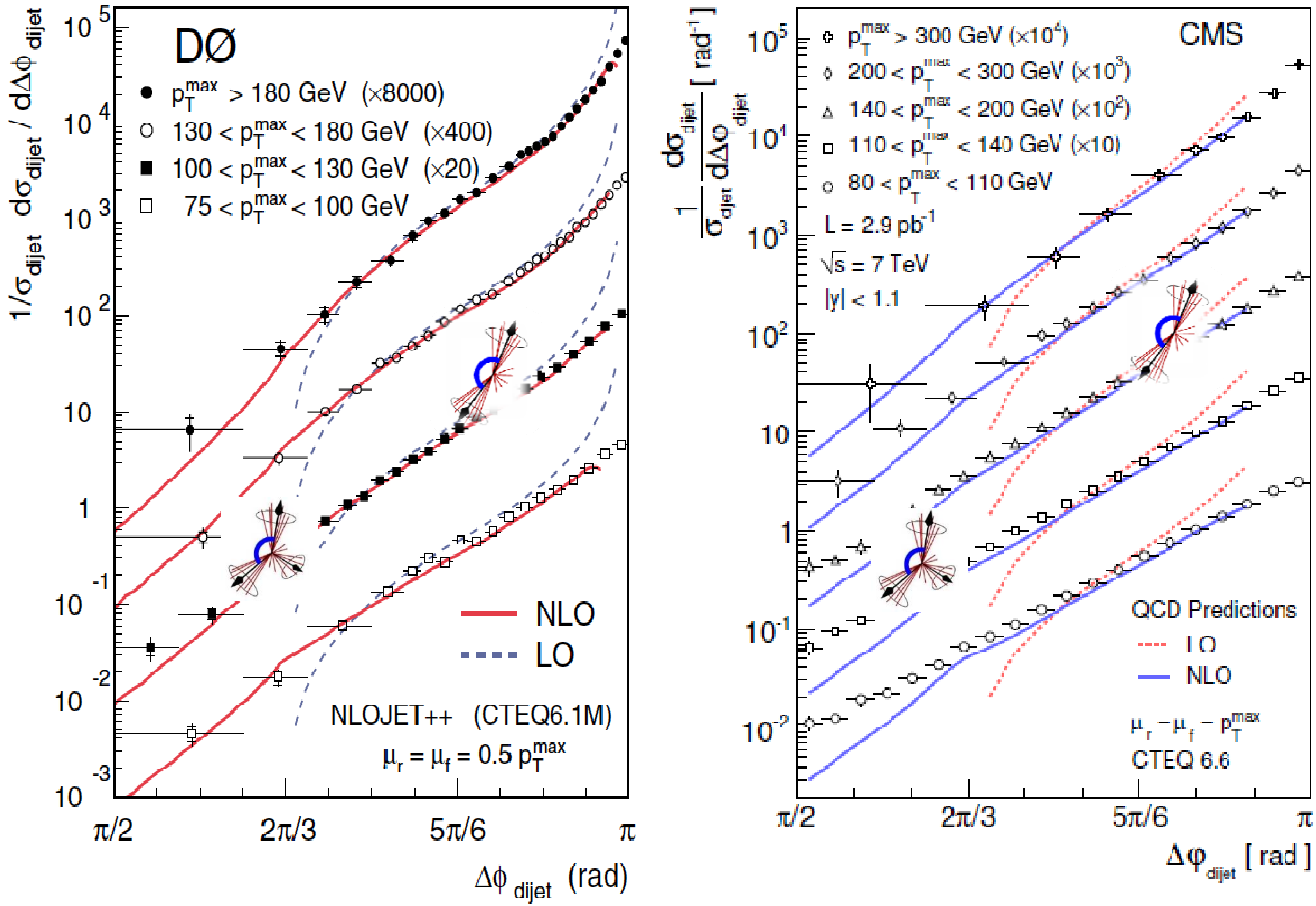
We derive the all order soft gluon resummation in dijet azimuthal angular correlation in *pp* collisions at the next-to-leading logarithmic level. The relevant coefficients for the resummation Sudakov factor, and the soft and hard factors are calculated. The theory predictions agree well with the experimental data from D0 collaboration at the Tevatron.

Dijet production at the hadron colliders



- Most abundant events
- Almost back-to-back
- De-correlation comes
  - Hard gluon jet
  - Soft gluon radiation





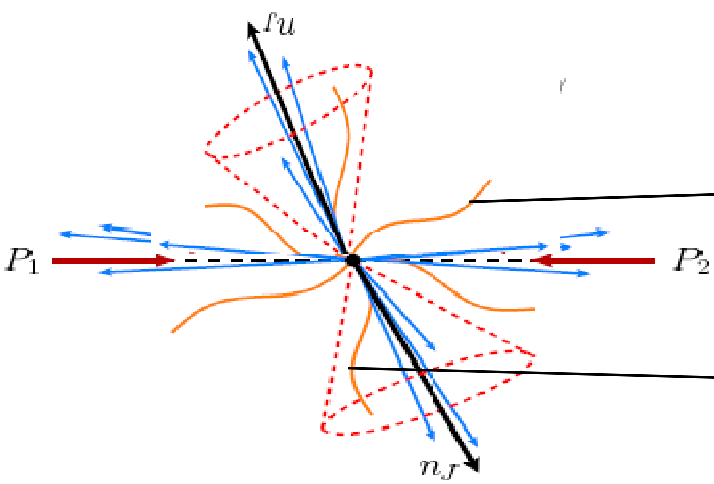
DØ
p_T^{max} > 180 GeV (×8000)
130 < p_T^{max} < 180 GeV (×400)
100 < p_T^{max} < 130 GeV (×20)
75 < p_T^{max} < 100 GeV
NLO
LO
NLOJET++ (CTEQ6.1M)
$\mu_r = \mu_f = 0.5\ p_T^{max}$
$1/\sigma_{dijet}\ d\sigma_{dijet} / d\Delta\phi_{dijet}$
$\Delta\phi_{dijet}$ (rad)
CMS
p_T^{max} > 300 GeV (×10⁴)
200 < p_T^{max} < 300 GeV (×10³)
140 < p_T^{max} < 200 GeV (×10²)
110 < p_T^{max} < 140 GeV (×10)
80 < p_T^{max} < 110 GeV
L = 2.9 pb⁻¹
√s = 7 TeV
|y| < 1.1
QCD Predictions
LO
NLO
$\mu_r = \mu_f = p_T^{max}$
CTEQ 6.6
$\frac{1}{\sigma_{dijet}} \frac{d\sigma_{dijet}}{d\Delta\varphi_{dijet}}$ [rad⁻¹]
$\Delta\varphi_{dijet}$ [rad]

There three kinds of large logarithms in the processes: $(\mathrm{Log}(q_\perp/P_J))^2$, $\mathrm{Log}(q_\perp/P_J)$ and $\mathrm{Log}(R)\mathrm{Log}(q_\perp/P_J)$

$$\frac{d^4\sigma}{dy_1 dy_2 dP_J^2 d^2q_\perp} = \sum_{ab} \sigma_0 \left[\int \frac{d^2\vec{b}_\perp}{(2\pi)^2} e^{-iq_\perp \cdot b_\perp} W_{ab\to cd}(x_1, x_2, b_\perp) + Y_{ab\to cd} \right]$$

where

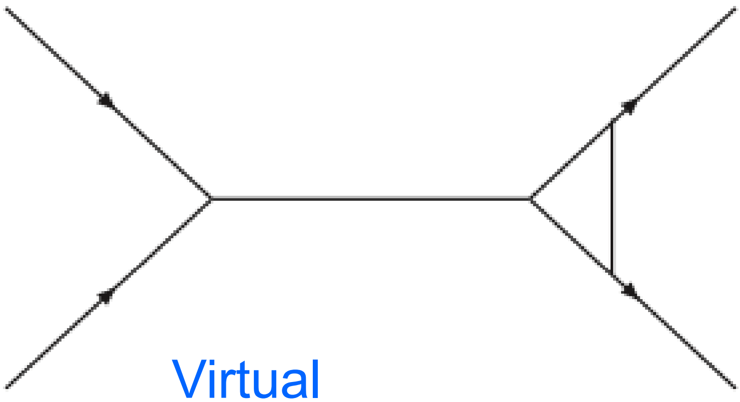
$$W_{ab\to cd}\left(x_i, b\right) = x_1\, f_a(x_1, b, \zeta^2, \mu^2, \rho) x_2 f_b(x_2, b, \bar{\zeta}^2, \mu^2, \rho) \mathrm{Tr}\left[\mathbf{H}_{ab\to cd}(Q^2, \mu^2, \rho) \mathbf{S}_{ab\to cd}(b, \mu^2, \rho)\right]$$



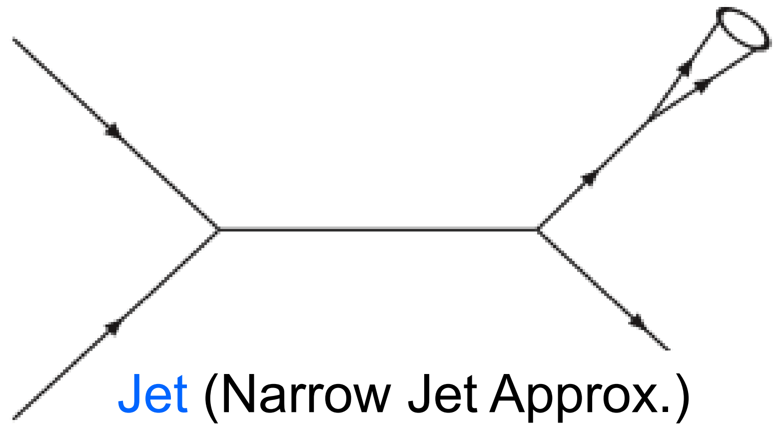
It will contribute to Δφ distribution.

It will not

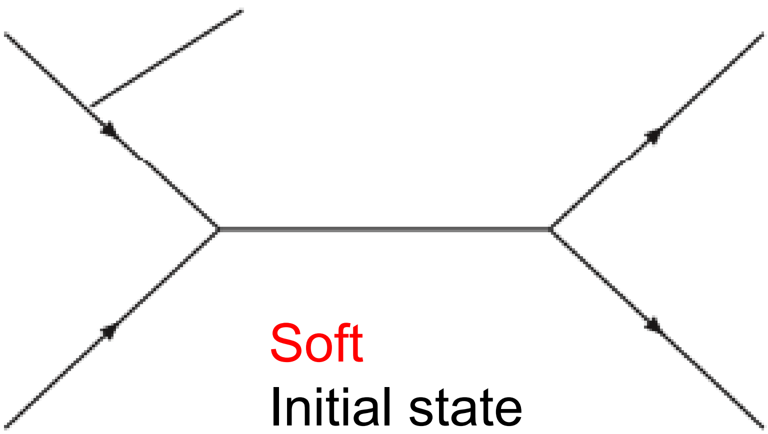
Soft and collinear gluon at one-loop



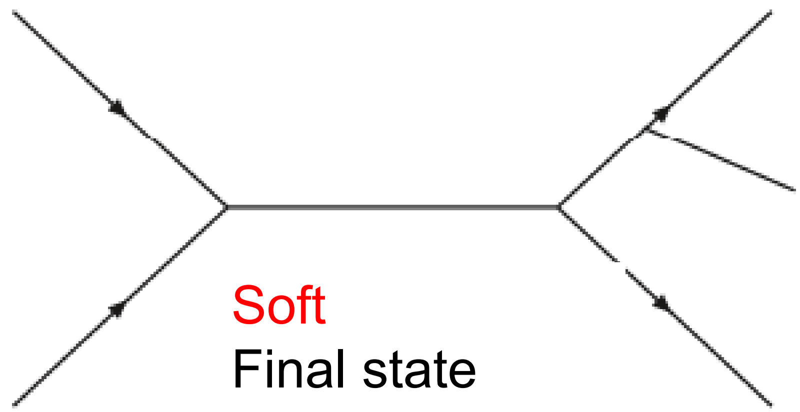
Virtual
Ellis-Sexton 86



Jet (Narrow Jet Approx.)
Jager-Stratmann-Vogelsang 2004



Soft
Initial state



Soft
Final state
(out of jet cone)

$$S_{IJ} = \int_0^{\pi} \frac{d\phi_0}{\pi} C^{bb'}_{Iii'} C^{aa'}_{Jll'} \langle 0 | \mathcal{L}^{\dagger}_{vcb'}(b_\perp) \mathcal{L}_{vbc}(b_\perp) \mathcal{L}^{\dagger}_{\bar{v}ca'}(0) \mathcal{L}_{\bar{v}ac}(0) \mathcal{L}^{\dagger}_{nji}(b_\perp) \mathcal{L}_{\bar{n}i'k}(b_\perp) \mathcal{L}^{\dagger}_{\bar{n}kl}(0) \mathcal{L}_{nl'j}(0) | 0 \rangle$$

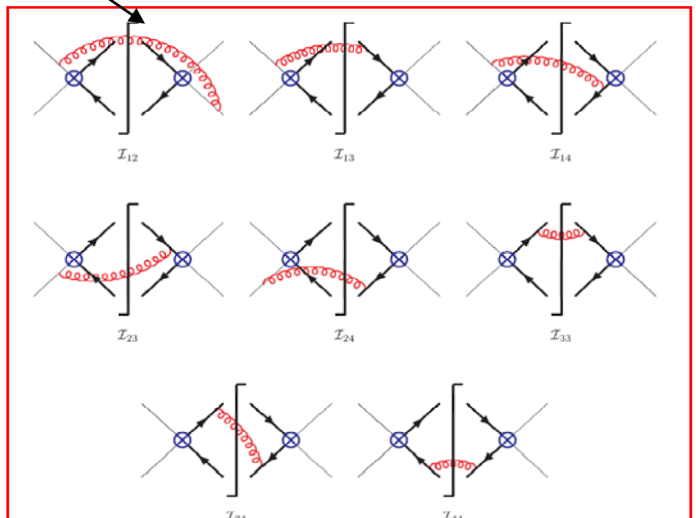
The soft factor satisfies

$$\frac{d}{d\ln\mu} S_{IJ}(\mu) = -\Gamma^{s\dagger}_{IJ'} S_{J'J}(\mu) - S_{IJ'}(\mu)\Gamma^{s}_{J'J}$$

$c_1 = f^{a_1a_2c_1} f_{a_3a_4c_1}$, $c_2 = f^{a_1a_3c_1} f_{a_2a_4c_1} + f^{a_1a_4c_1} f_{a_2a_3c_1}$, $c_3 = d^{a_1a_2c_1} f_{a_3a_4c_1}$,

$c_4 = f^{a_1a_2c_1} d_{a_3a_4c_1}$, $c_5 = d^{a_1a_4c_1} f_{a_2a_3c_1}$, $c_6 = \delta^{a_1a_2}\delta^{a_3a_4}$, $c_7 = \delta^{a_1a_3}\delta^{a_2a_4}$, $c_8 = \delta^{a_1a_4}\delta^{a_2a_3}$

$c_1 = \delta^{a_1a_2}\delta_{a_3a_4}$, $c_2 = i f^{a_1a_2c}\, t^c_{a_3a_4}$, $c_3 = d^{a_1a_2c}\, t^c_{a_3a_4}$



Cross checks

- Divergences cancelled out between virtual, jet, sot contributions (dimension regulation applied)
- Final results :double logs, single logs, ..

$$W^{(1)}(b_\perp)|_{logs.} = \frac{\alpha_s}{2\pi}\left\{h^{(0)}_{q_iq_j\to q_iq_j}\left[-\ln\left(\frac{\mu^2 b_\perp^2}{b_0^2}\right)(\mathcal{P}_{qq}(\xi)\delta(1-\xi')+\mathcal{P}_{qq}(\xi')\delta(1-\xi))-\delta(1-\xi)\right.\right.$$
$$\left.\times\delta(1-\xi')\left(C_F\ln^2\left(\frac{Q^2b_\perp^2}{b_0^2}\right)+\ln\left(\frac{Q^2b_\perp^2}{b_0^2}\right)\left(-3C_F+C_F\ln\frac{1}{R_1^2}+C_F\ln\frac{1}{R_2^2}\right)\right)\right]$$
$$\left.-\delta(1-\xi)\delta(1-\xi')\ln\left(\frac{Q^2b_\perp^2}{b_0^2}\right)\Gamma^{(qq')}_{sn}\right\}, \qquad (71)$$

Quark channel: $q_iq_j \rightarrow q_iq_j$

After solving the evolution equations

$$W_{ab\to cd}(x_1,x_2,b) = x_1 f_a(x_1,\mu=c_0/b_\perp)x_2 f_b(x_2,\mu=c_0/b_\perp)e^{-S_{Sud}(Q^2,b_\perp)}$$
$$\times \mathrm{Tr}\left[\mathbf{H}_{ab\to cd}\exp[-\int_{c_0/b_\perp}^{Q}\frac{d\mu}{\mu}\gamma^{s\dagger}]\mathbf{S}_{ab\to cd}\exp[-\int_{c_0/b_\perp}^{Q}\frac{d\mu}{\mu}\gamma^{s}]\right]$$

where

$$S_{Sud}(Q^2,b_\perp,C_1,C_2) = \int_{C_1^2/b_\perp^2}^{C_2^2Q^2}\frac{d\mu^2}{\mu^2}\left[\ln\left(\frac{Q^2}{\mu^2}\right)A + B + D_1\ln\frac{2}{R_1} + D_2\ln\frac{2}{R_2}\right]$$

For g g → jj $A_{gg}=C_A\, a_s/\pi$ $B_{gg}=-2C_A\,\beta_0\, a_s/\pi$

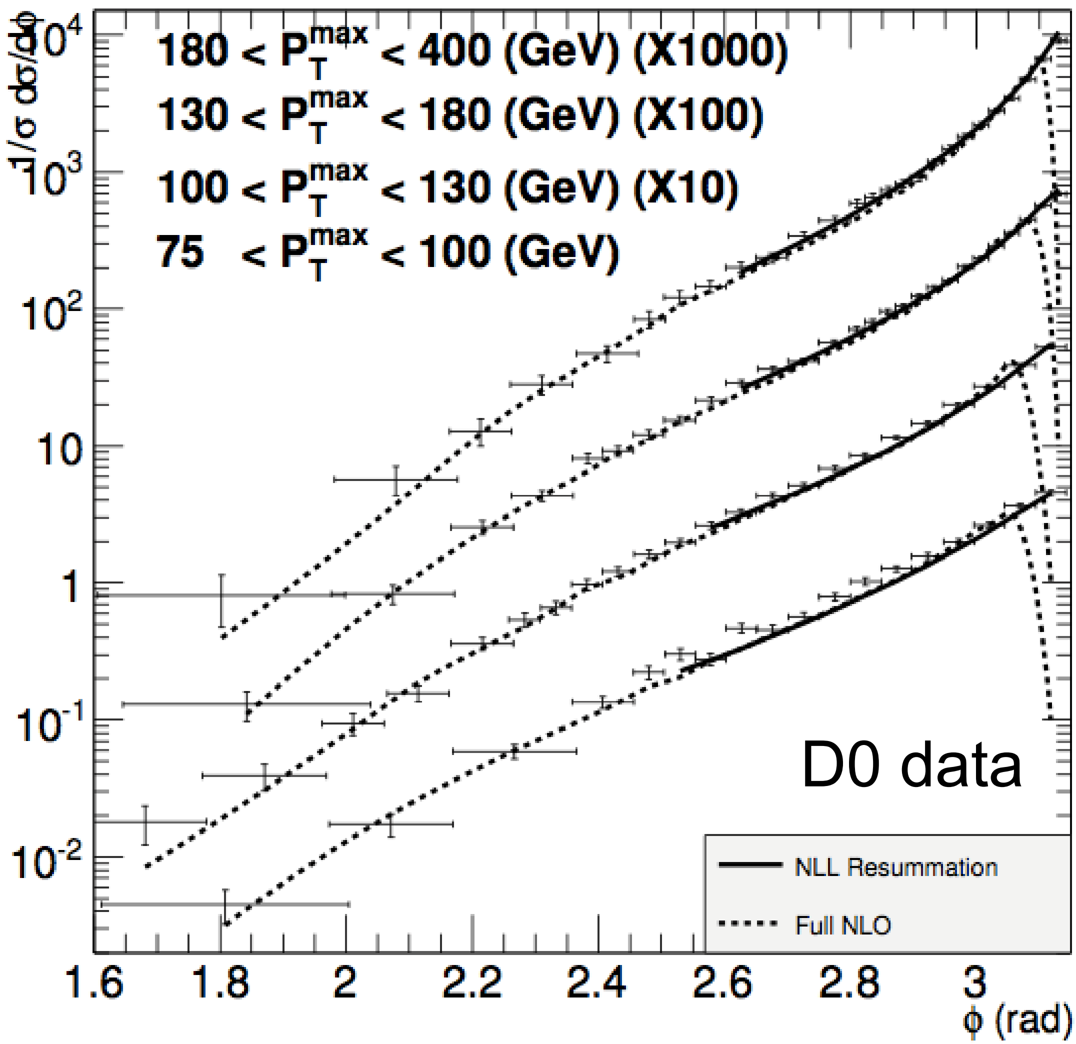
For q q → jj $A_{qq}=C_F\, a_s/\pi$ $B_{qq}=-2C_F/3\, a_s/\pi$

For q g → jj $A_{qg}=(A_{gg}+A_{qq})/2$ $B_{qg}= =(B_{gg}+B_{qq})/2$

for quark jet $D_i=C_F\, a_s/\pi$

for gluon jet $D_i=C_A\, a_s/\pi$

Compared to the data



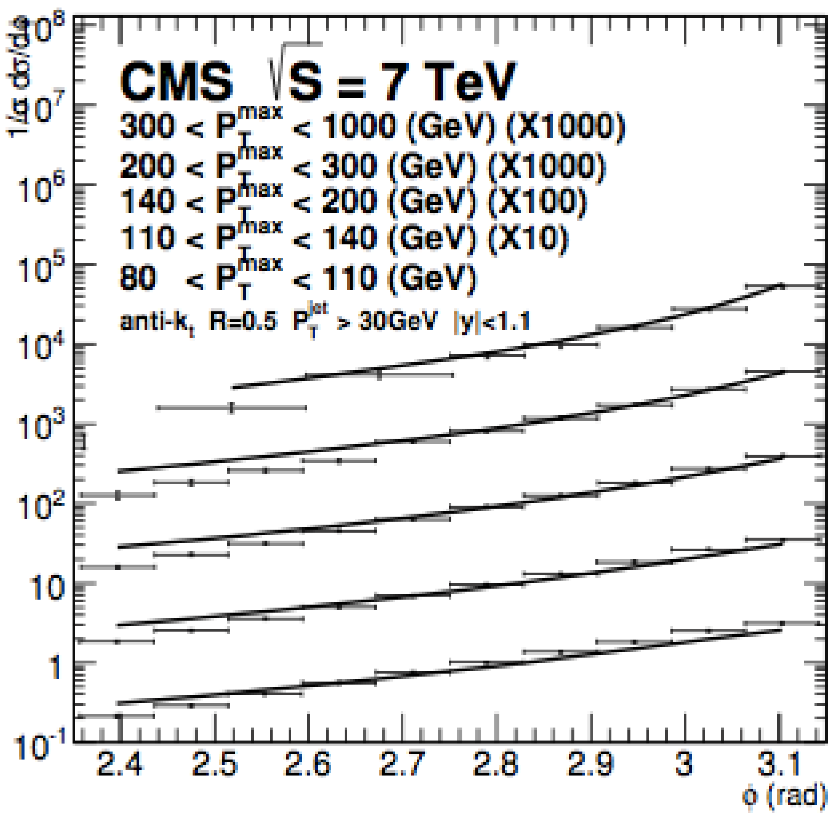
NLL Resummation:
Sun,C.P.Yuan, F.Yuan, PRL2014

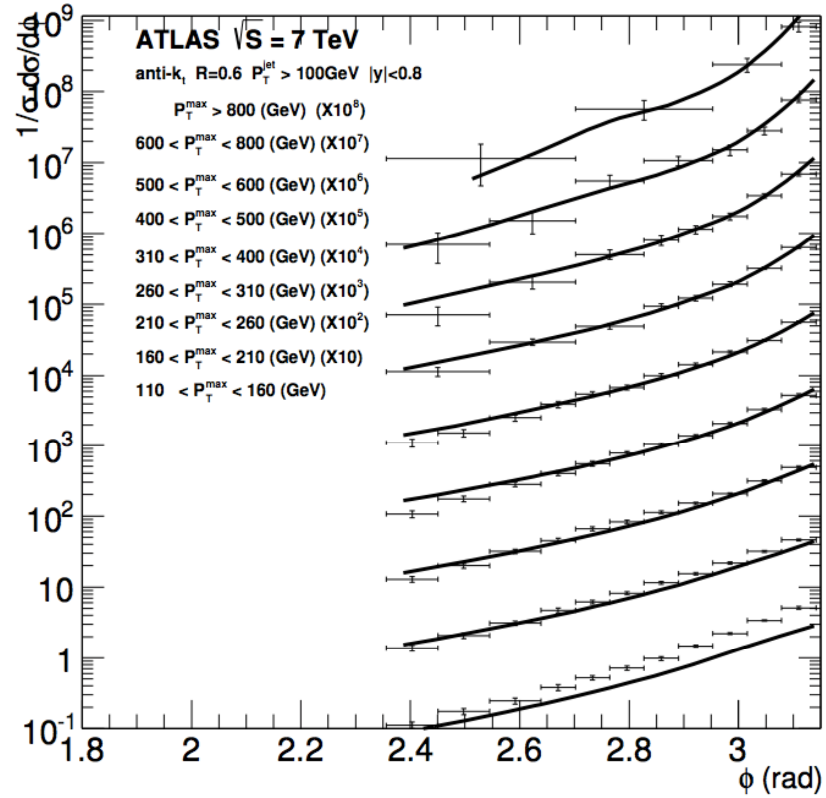
$$x_1 f_a(x_1, \mu = b_0/b_\perp) x_2 f_b(x_2, \mu = b_0/b_\perp) e^{-S_{\rm Sud}(Q^2, b_\perp)}$$

$$\mathrm{Tr}\left[\mathbf{H}_{ab\to cd}\exp[-\int_{b_0/b_\perp}^{Q}\frac{d\mu}{\mu}\gamma^{s\dagger}]\mathbf{S}_{ab\to cd}\exp[-\int_{b_0/b_\perp}^{Q}\frac{d\mu}{\mu}\gamma^{s}]\right]$$

Full NLO: Nagy 2002, NLOJET++

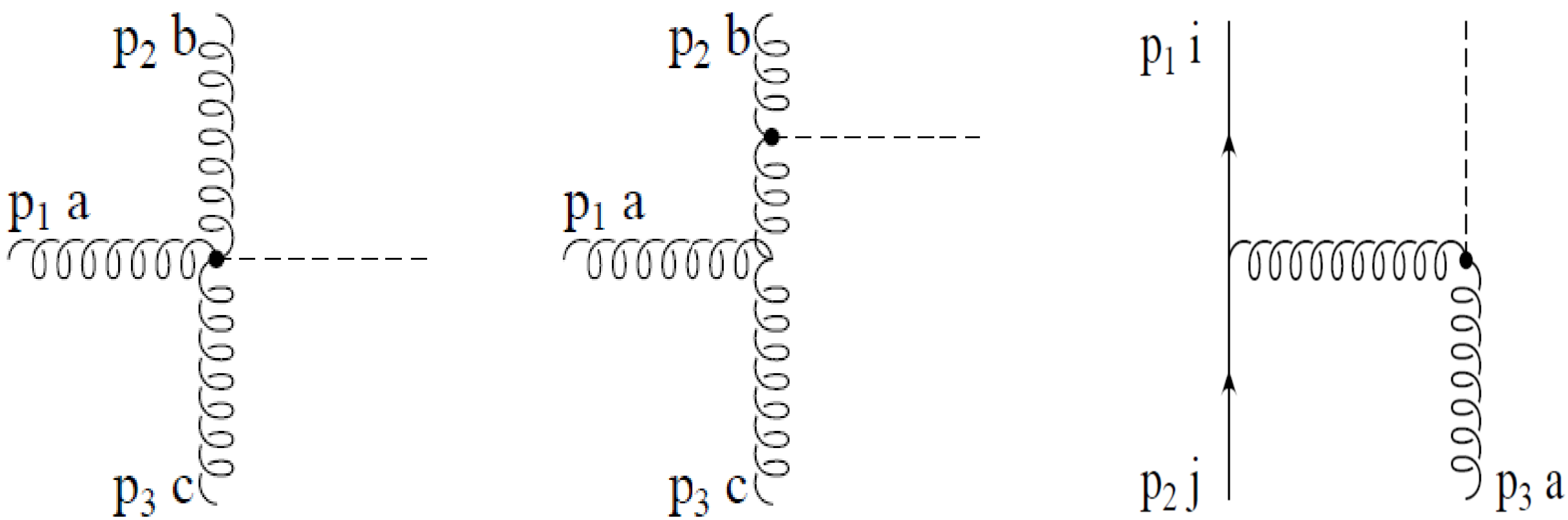
At the LHC


CMS $\sqrt{S}$ = 7 TeV
300 < P_T^{max} < 1000 (GeV) (X1000)
200 < P_T^{max} < 300 (GeV) (X1000)
140 < P_T^{max} < 200 (GeV) (X100)
110 < P_T^{max} < 140 (GeV) (X10)
80 < P_T^{max} < 110 (GeV)
anti-k_t R=0.5 P_T^{jet} > 30GeV |y|<1.1
$1/\sigma\, d\sigma/d\phi$
ϕ (rad)

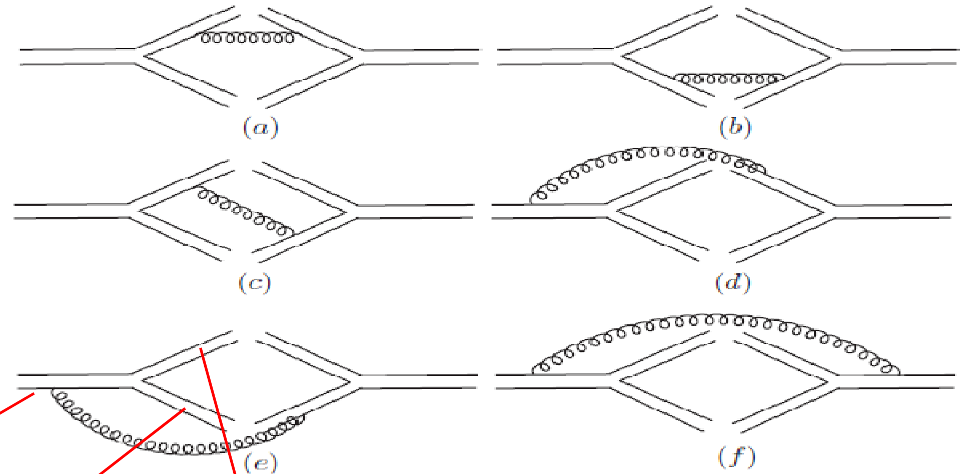

ATLAS $\sqrt{S}$ = 7 TeV
anti-k_t R=0.6 P_T^{jet} > 100GeV |y|<0.8
P_T^{max} > 800 (GeV) (X10^8)
600 < P_T^{max} < 800 (GeV) (X10^7)
500 < P_T^{max} < 600 (GeV) (X10^6)
400 < P_T^{max} < 500 (GeV) (X10^5)
310 < P_T^{max} < 400 (GeV) (X10^4)
260 < P_T^{max} < 310 (GeV) (X10^3)
210 < P_T^{max} < 260 (GeV) (X10^2)
160 < P_T^{max} < 210 (GeV) (X10)
110 < P_T^{max} < 160 (GeV)
$1/\sigma\, d\sigma/d\phi$
ϕ (rad)

Higgs plus one jet productions in pp collision

- the leading order feynman diagrams



The soft factor



The definition of soft factor:

$$\overline{S}(b_\perp,\mu,\rho)=\frac{\int_0^\pi \frac{(\sin\phi)^{-2\epsilon}}{a_1}d\phi\,\langle 0|\mathcal{L}^\dagger_{\bar{v}ca'}(b_\perp)\mathrm{Tr}\left[\mathcal{L}^\dagger_{n_c}(b_\perp)\mathrm{T}^{a'}\mathcal{L}^\dagger_{n_{\bar{c}}}(b_\perp)\mathcal{L}_{n_{\bar{c}}}(0)\mathrm{T}^{a}\mathcal{L}_{n_c}(0)\right]\mathcal{L}_{\bar{v}ac}(0)|0\rangle}{\mathrm{Tr}[\mathrm{T}^d\mathrm{T}^d]}$$

At the one loop order

$$\overline{S}^{(1)}_{\mathrm{JMY}}(b_\perp,\mu,\rho)\;=\;\frac{\alpha_s}{2\pi}\{C_A\ln\frac{c_0^2}{b_\perp^2\mu^2}\,(B_{final}+\ln\rho^2+\ln\frac{\tilde{Q}^2}{\zeta^2}-1)+C_{final}\}$$

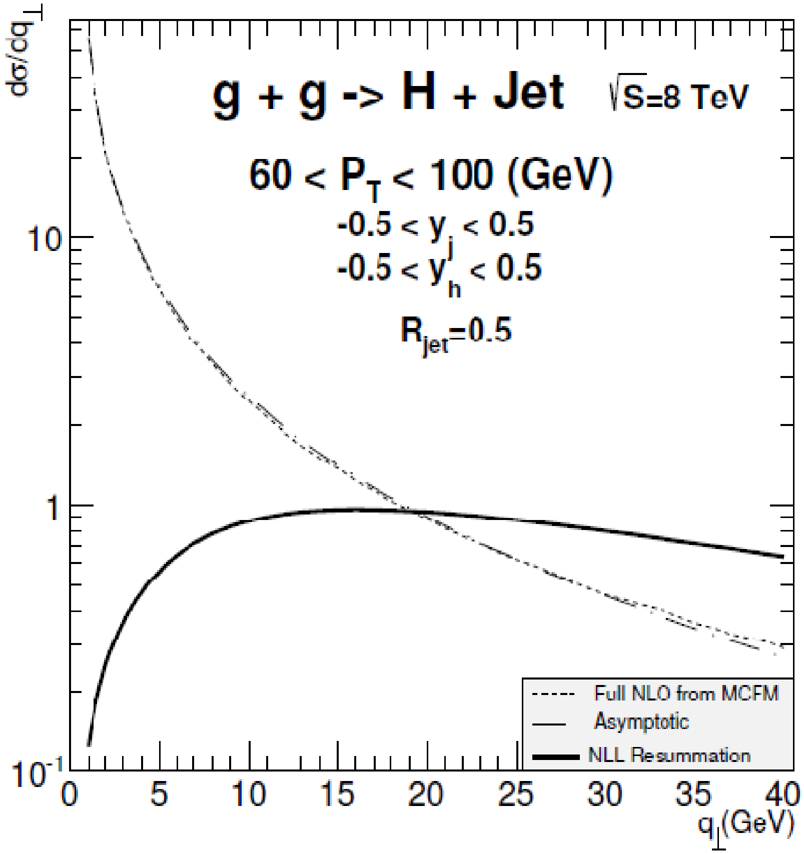
Sudakov form factor:

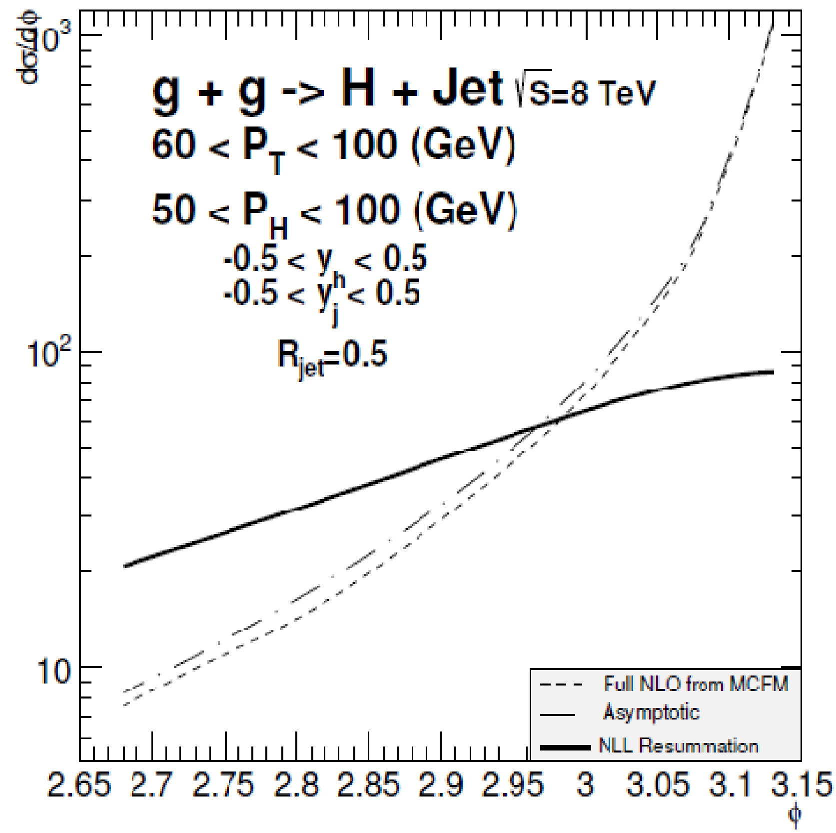
$$S_{sud}=-\int_{\tilde{Q}_0}^{\tilde{Q}}\frac{d\mu}{\mu}\left(\ln\frac{\tilde{Q}}{\mu}\gamma_K(\mu)-\gamma_S(\mu,1)+\frac{\alpha_s C_A}{\pi}(1-2\beta_0-\ln\frac{\tilde{Q}_0^2 b_\perp^2}{c_0^2})\right)$$

$$\gamma_K(\mu)\;=\;\frac{2\alpha_s(\mu)C_A}{\pi},$$

$$\gamma_S(\mu,\rho)\;=\;-\frac{\alpha_s(\mu)C_A}{\pi}(B_{final}+\ln\rho-1)$$

Higgs + jet production in pp collision





- Higgs+Jet, Sun, C.-P. Yuan, F. Yuan, Phys.Rev.Lett. 114 (2015) 202001

Resummation scale dependence

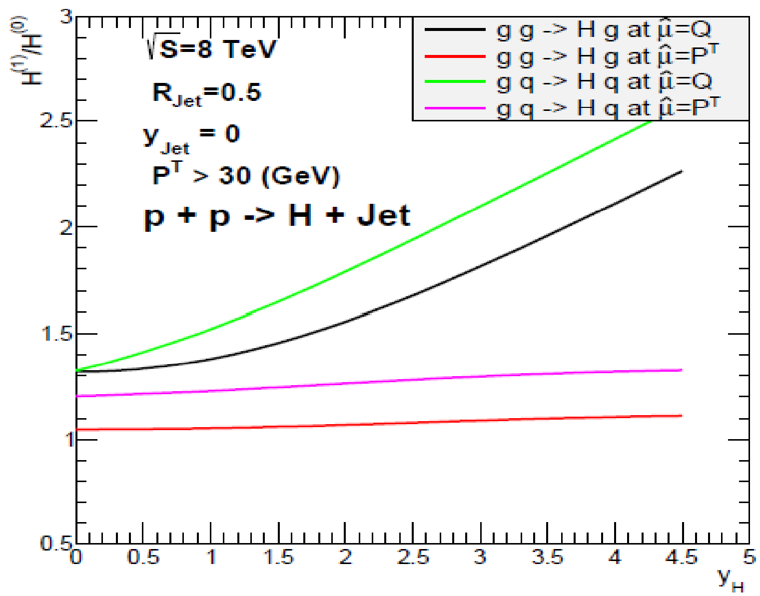
$$W_{gg\to Hg}(x_1, x_2, b) = H_{gg\to Hg}(s, \hat{\mu}) x_1 f_g(x_1, \mu = b_0/b_\perp) x_2 f_g(x_2, \mu = b_0/b_\perp) e^{-S_{\text{Sud}}(s, \hat{\mu}^2, b_\perp)}$$

$$S_{\text{Sud}}(b) = \int_{b_0^2/b^2}^{\hat{\mu}^2} \frac{d\mu^2}{\mu^2} \left[\ln\left(\frac{s}{\mu^2}\right) A + B + D \ln \frac{1}{R^2} \right]$$

- The resummation scale dependence between hard part and Sudakov factor will be cancelled to each other order by order

- However, we found

$$s \sim P_t \sqrt{P_t^2 + M_h^2}\ \text{EXP}(|y_J - y_h|)$$



Hard factor at NLO

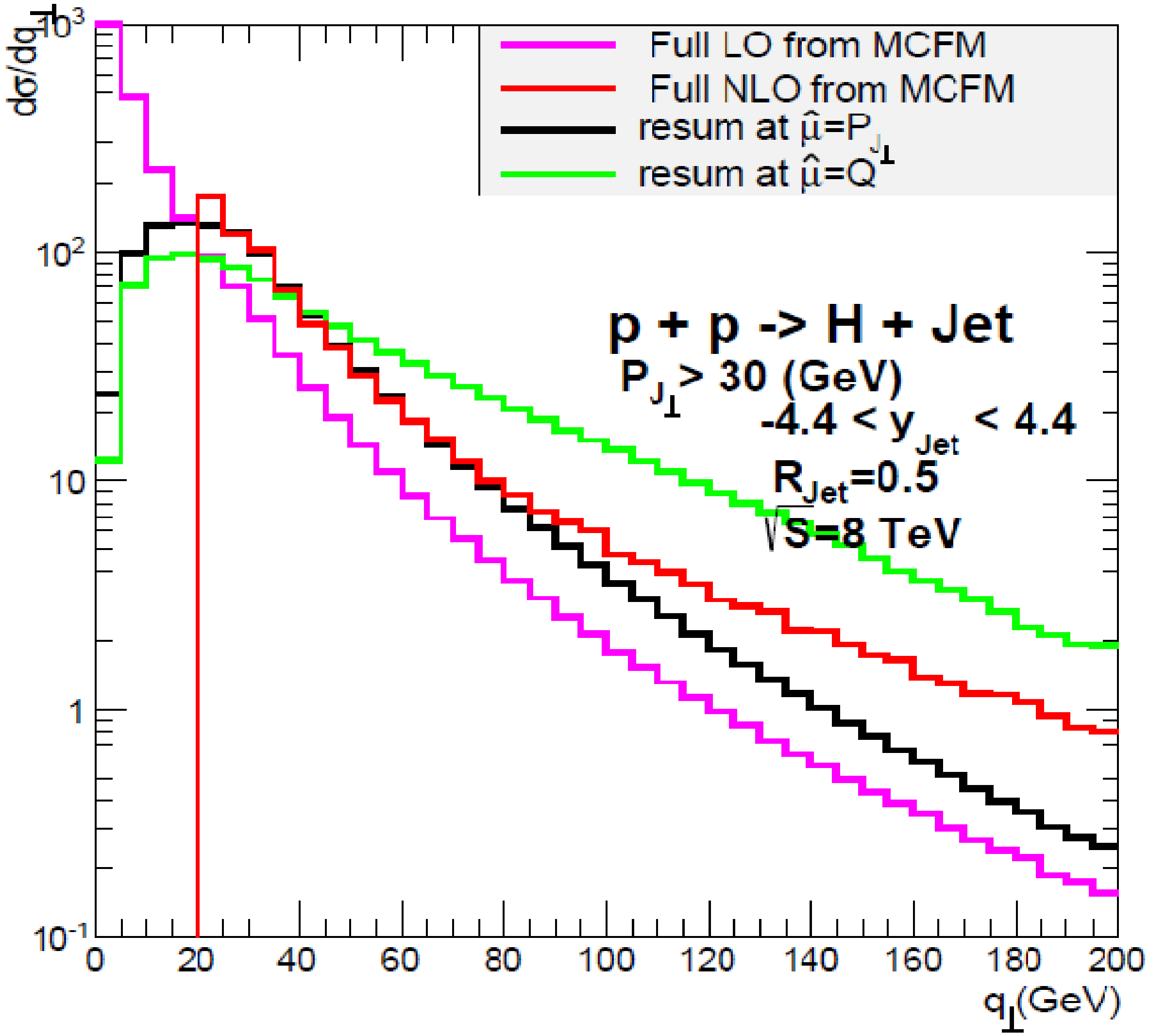
for G G ⟶ G H

$$H^{(1)}_{gg\to Hg} - H^{(0)}_{gg}\frac{\alpha_s C_A}{2\pi}\left[\ln^2\left(\frac{\hat{\mu}^2}{P_{J\perp}^2}\right)+2\beta_0\ln\frac{\hat{\mu}^2}{P_{J\perp}^2R^2}+\ln\frac{1}{R^2}\ln\frac{\hat{\mu}^2}{P_{J\perp}^2}-6\beta_0\ln\frac{\hat{\mu}^2}{\tilde{\mu}^2}-2\ln\left(\frac{P_{J\perp}^2}{\hat{\mu}^2}\right)\ln\left(\frac{s}{\hat{\mu}^2}\right)\right.$$
$$-2\ln\frac{s}{-t}\ln\frac{s}{-u}+\ln^2\left(\frac{\tilde{t}}{m_h^2}\right)-\ln^2\left(\frac{\tilde{t}}{-t}\right)+\ln^2\left(\frac{\tilde{u}}{m_h^2}\right)-\ln^2\left(\frac{\tilde{u}}{-u}\right)$$
$$\left.+2\mathrm{Li}_2\left(1-\frac{m_h^2}{s}\right)+2\mathrm{Li}_2\left(\frac{t}{m_h^2}\right)+2\mathrm{Li}_2\left(\frac{u}{m_h^2}\right)+\frac{67}{9}+\frac{\pi^2}{2}-\frac{23}{54}N_f\right]+\delta H^{(1)}\ , \qquad (6)$$

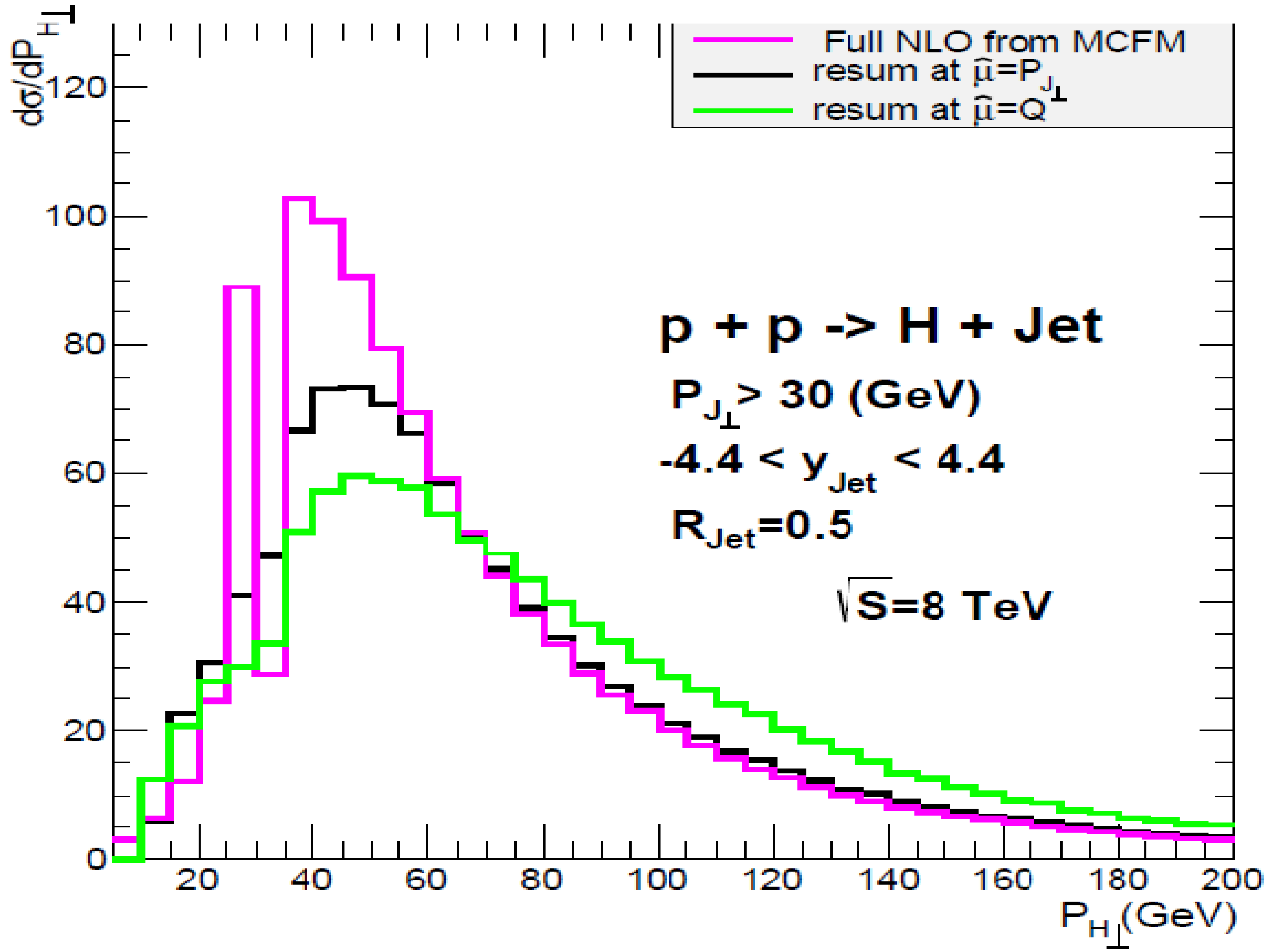
for G Q ⟶ Q H

$$H^{(1)}_{gq\to Hq} = H^{(0)}\frac{\alpha_s}{2\pi}\left\{C_A\left[\frac{1}{2}\ln^2\left(\frac{\hat{\mu}^2}{P_{J\perp}^2}\right)+\ln\left(\frac{P_{J\perp}^2}{\hat{\mu}^2}\right)\ln\left(\frac{u}{t}\right)+\ln\left(\frac{P_{J\perp}^2}{\hat{\mu}^2}\right)\ln\left(\frac{s}{\hat{\mu}^2}\right)-2\ln\frac{-t}{\hat{\mu}^2}\ln\frac{-u}{\hat{\mu}^2}\right.\right.$$
$$\left.-4\beta_0\ln\frac{-u}{\hat{\mu}^2}-6\beta_0\ln\frac{\hat{\mu}^2}{\tilde{\mu}^2}+2\mathrm{Li}_2\left(\frac{u}{m_h^2}\right)-\ln^2\frac{\tilde{u}}{-u}+\ln^2\frac{\tilde{u}}{m_h^2}+\frac{7}{3}+\frac{4\pi^2}{3}\right]$$
$$+C_F\left[\frac{1}{2}\ln^2\left(\frac{\hat{\mu}^2}{P_{J\perp}^2}\right)+\frac{3}{2}\ln\frac{\hat{\mu}^2}{P_{J\perp}^2R^2}+\ln\frac{1}{R^2}\ln\frac{\hat{\mu}^2}{P_{J\perp}^2}-\ln\frac{P_{J\perp}^2}{\hat{\mu}^2}\ln\frac{u}{t}-\ln\frac{P_{J\perp}^2}{\hat{\mu}^2}\ln\frac{s}{\hat{\mu}^2}+3\ln\frac{-u}{\hat{\mu}^2}\right.$$
$$\left.\left.+2\mathrm{Li}_2\left(1-\frac{m_h^2}{s}\right)+2\mathrm{Li}_2\left(\frac{t}{m_h^2}\right)-\ln^2\left(\frac{\tilde{t}}{-t}\right)+\ln^2\left(\frac{\tilde{t}}{m_h^2}\right)-\frac{3}{2}-\frac{5\pi^2}{6}\right]+20\beta_0\right\}+\delta H^{(1)}\ .$$

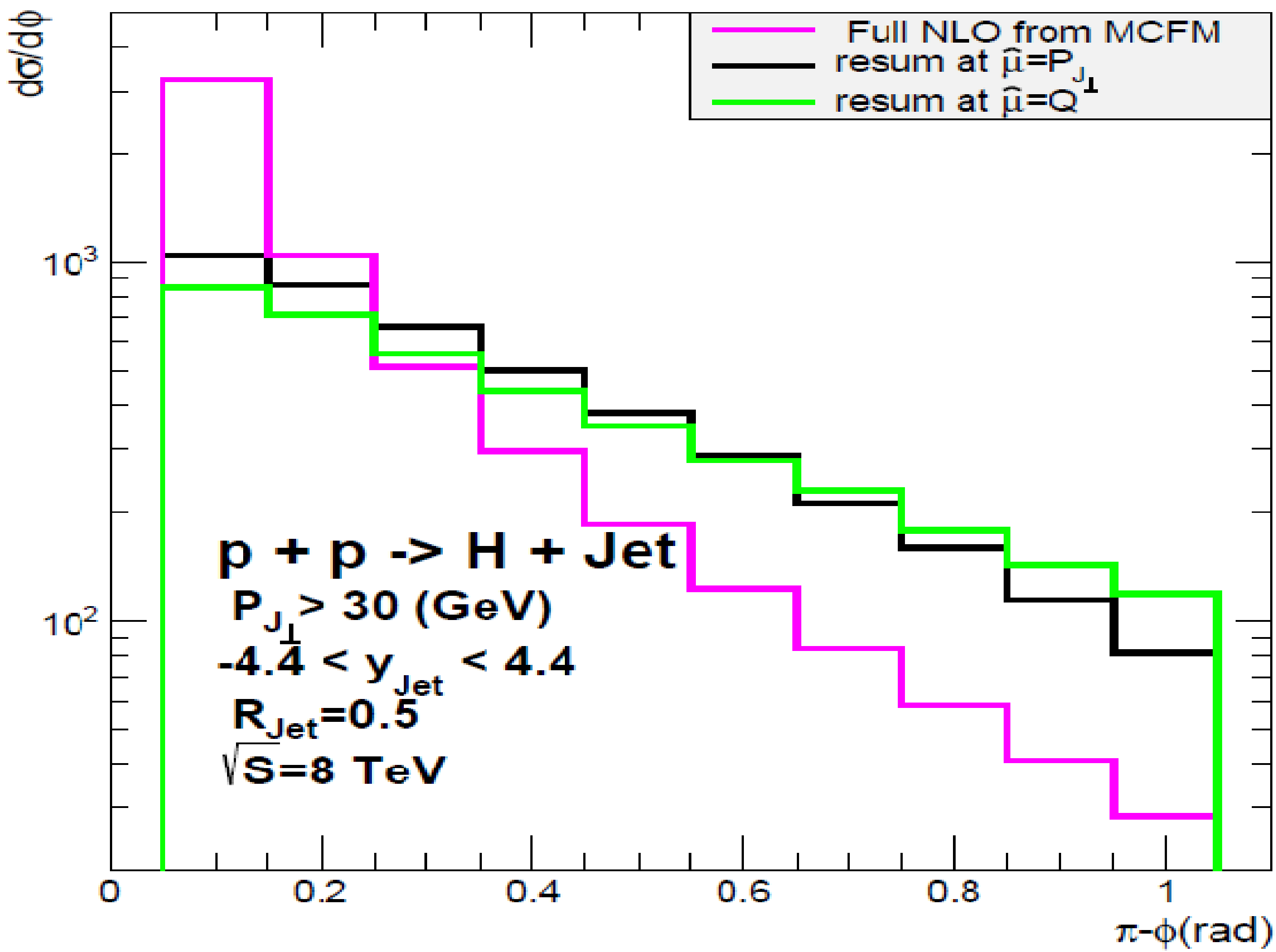
$q_\perp$ distribution of Higgs plus leading jet system



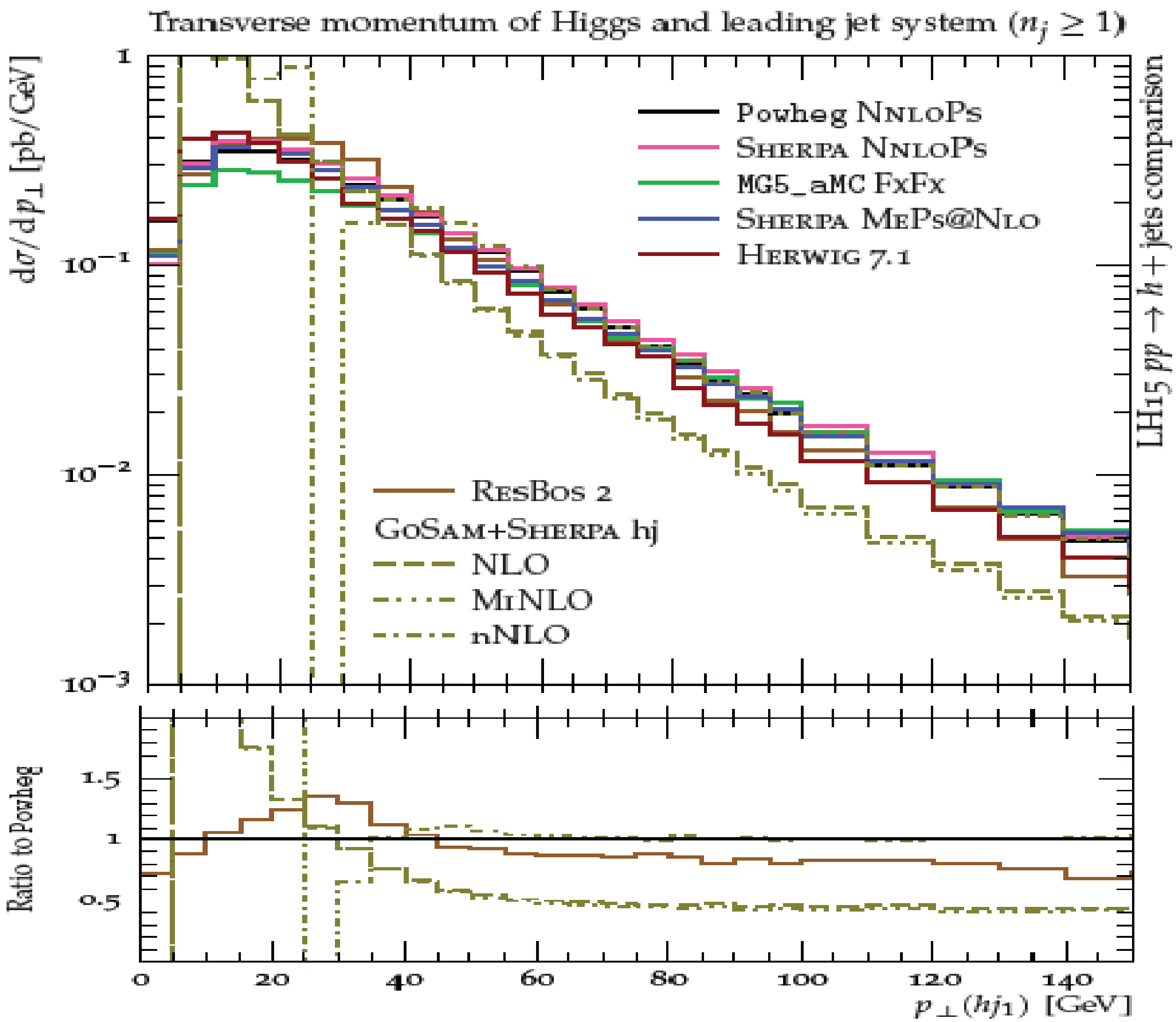
Higgs $P_\perp$ distribution



distribution of the azimuthal angle between Higgs and leading jet

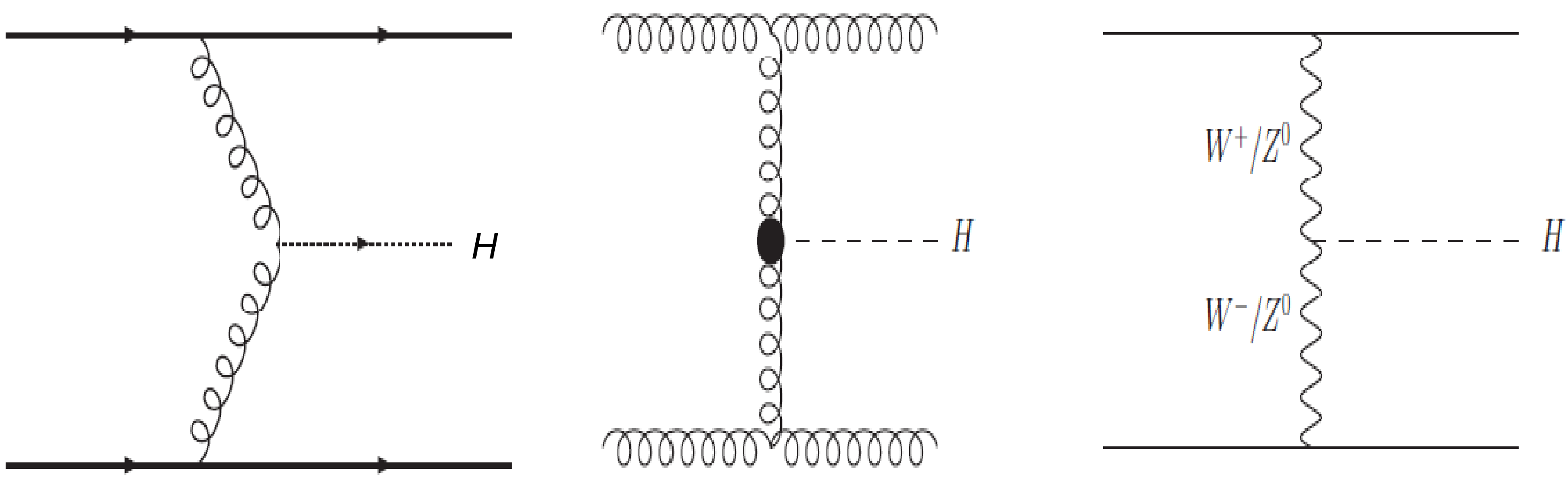


Comparison to MC generators and Fixed Order



Higgs plus two jets production in pp collisions at large Δy_{jj} region

- The dominant contributions at tree level



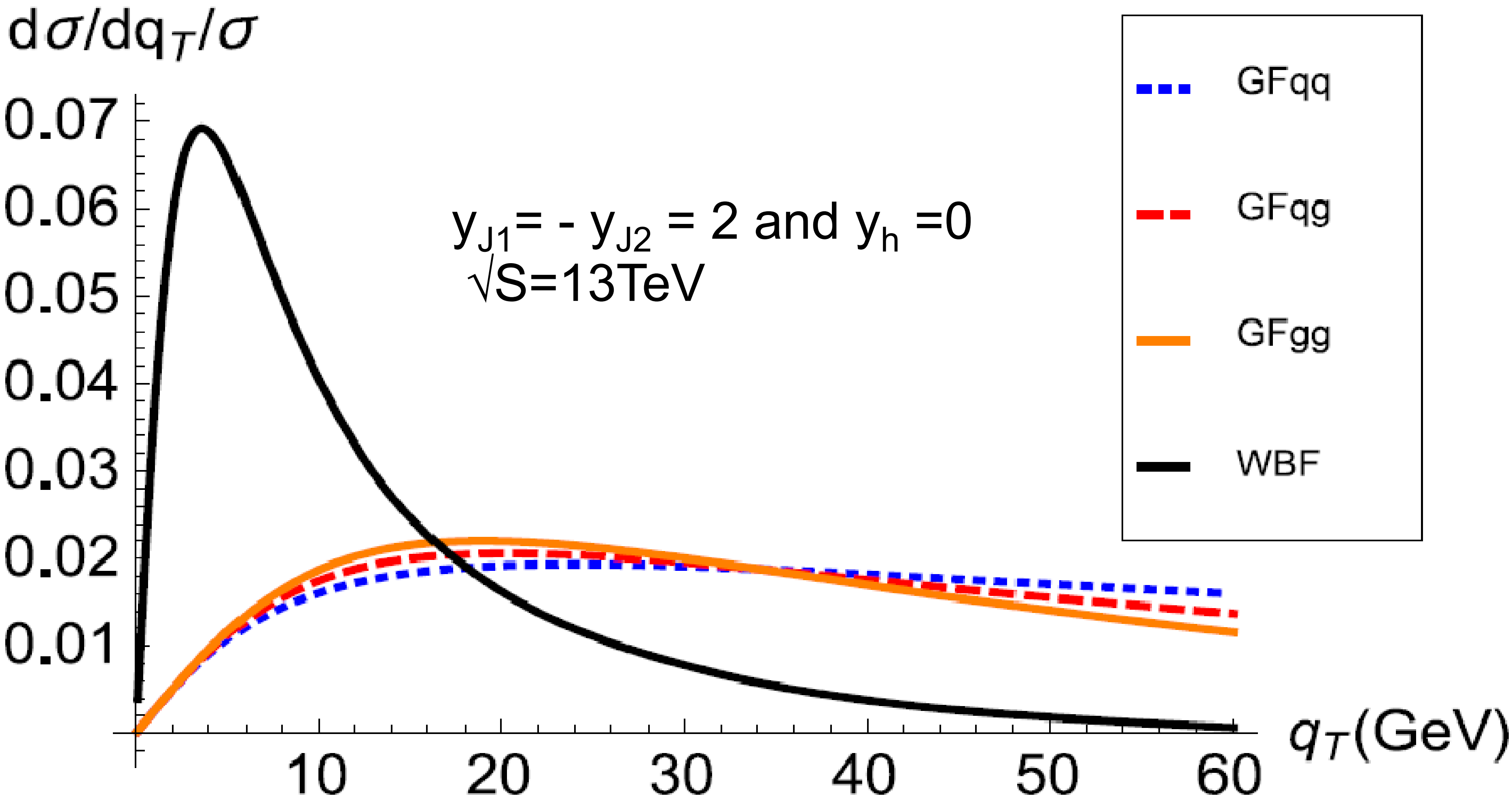
Sudakov factors

$$S_a(\hat{\mu}, b_\perp) = \int_{\mu_b^2}^{\hat{\mu}^2} \frac{d\mu^2}{\mu^2} \left[\ln\left(\frac{s}{\mu^2}\right) A_a + B_a + D_a \ln\frac{1}{R^2} + \gamma_a'^s \right]$$

- Where A and B coefficients are the same as Drell-Yan or Higgs plus 0 jet production.
- The coefficient D is decided by color structure of jet.

$$\gamma_{qWBF}'^s = -C_F \ln\frac{u_1}{t_1}, \quad \gamma_{qGF}'^s = (C_A - C_F)\ln\frac{u_1}{t_1}, \quad \gamma_{gGF}'^s = 0$$

- In the large Δy_{jj} region, $|u_1| \gg |t_1|$



- q_T is the total transverse momentum of Higgs plus two leading jets

Summary

- The soft gluon resummation can help us to make a precise prediction of the SM
- We also can use the resummation effect to suppress some background event

Thank you very much!