Asymptotic effects in jet production at high energies

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Outline

- Introduction
- BFKL-GLAPD evolution and MC event generator Ulysses
- Jet observables for BFKL and new physics searches at LHC
- Summary

BFKL in LLA:

- Fadin, Kuraev & Lipatov (75-77)
- Balitsky & Lipatov (78) $\alpha_{I\!P}^{LLA}(0) \simeq 1.5$

CCFM-evolution: importance of angle ordering

- Catani, Ciafaloni, Fiorani & Marchesini (87-89)
  $\alpha_{I\!P}^{CCFM}(0) \simeq 1.3$

BFKL in NLA:

- Fadin & Lipatov (89-98)
- Fadin, Lipatov, Fiore, Fiorani, Kotsky et al (93-97)
- Camici & Ciafaloni (96-98)
- Brodsky, Fadin, VK, Lipatov & G.Pivovarov (98-99)
  $\alpha_{I\!P}^{NLA}(0) \simeq 1.2$

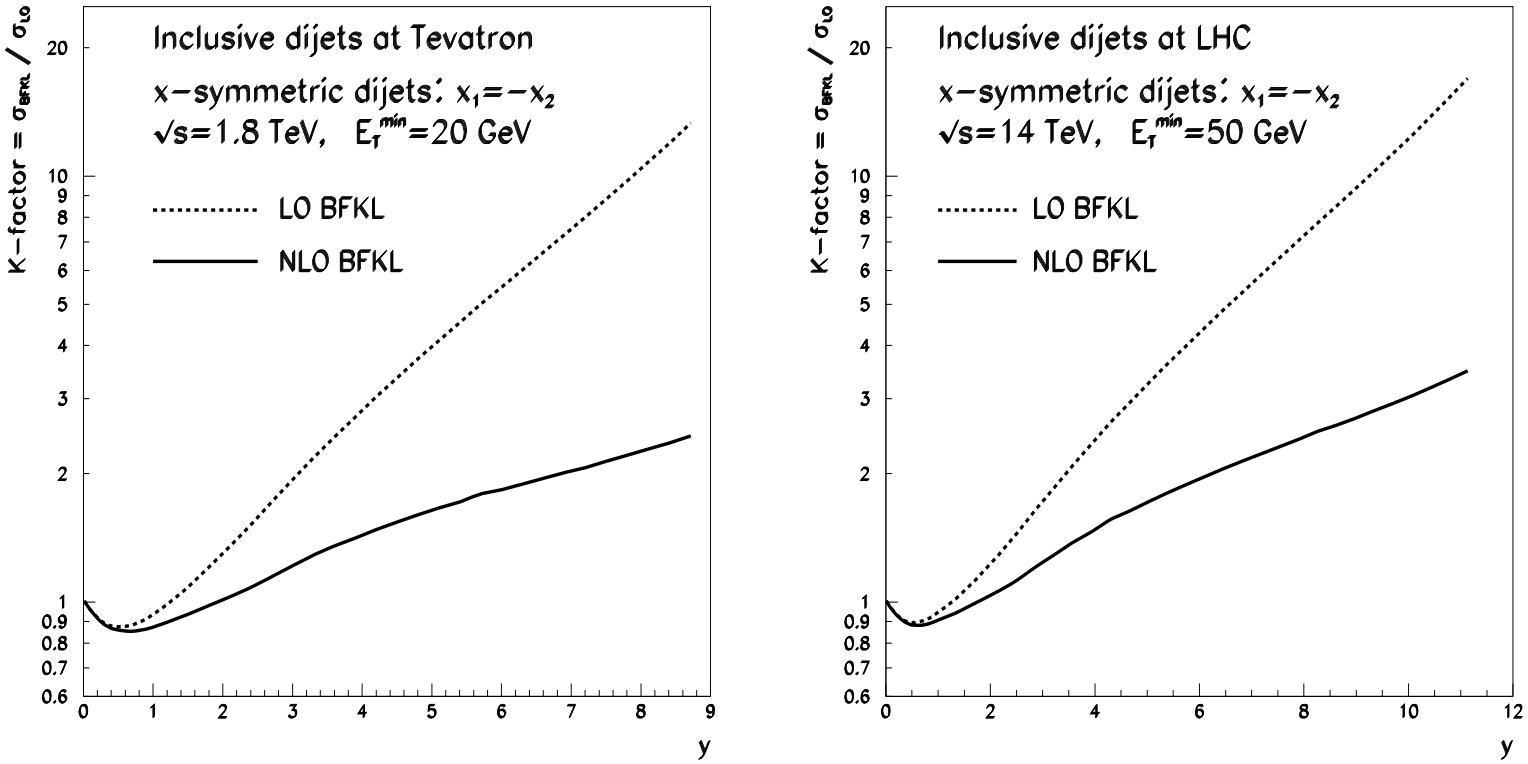
Jet production in BFKL: effective Feynman rules

VK & G.Pivovarov (06)

Conformal invariance of LLA BFKL:

VK & G.Pivovarov (06)

Navelet & Peschanski (97)



Dijet K-factor: VK & G.Pivovarov (06)

Unified BFKL-GLAPD evolution: Sudakov-DDT formfactor

$$a(x,\mu^2) = \int^{\mu^2} \frac{\mathrm{d}k_t^2}{k_t^2}\, f_a(x,k_t^2,\mu^2), \quad a = g,q,\bar{q}$$

$$\frac{\partial\, a(x,k_t^2)}{\partial \log k_t^2} = \frac{\alpha_S(k_t^2)}{2\pi} \sum_b \int_x^1 \mathrm{d}z\, P_{ab}(z)\, b\left(\frac{x}{z},k_t^2\right) - \frac{a(x,k_t^2)}{T_a(k_t^2,\mu^2)}\, \frac{\partial\, T_a(k_t^2,\mu^2)}{\partial \log k_t^2}$$

$$T_a(k_t^2,\mu^2) \equiv \exp\left(-\int_{k_t^2}^{\mu^2} \frac{\mathrm{d}\kappa_t^2}{\kappa_t^2}\, \frac{\alpha_S(\kappa_t^2)}{2\pi} \sum_b \int_0^1 \mathrm{d}\zeta\, \zeta\, P_{ba}(\zeta)\right)$$

Dokshitzer, Diakonov & Troyan (78-80)

Unified BFKL-GLAPD evolution: unintegrated PDFs

$$\text{GLAPD}-\text{DDT}: f_a(x,k_t^2,\mu^2) \equiv \frac{\partial}{\partial \log k_t^2}\left[\, a(x,k_t^2)\, T_a(k_t^2,\mu^2)\,\right]$$

$$= T_a(k_t^2,\mu^2)\,\frac{\alpha_S(k_t^2)}{2\pi}\sum_b \int_x^1 \mathrm{d}z\, P_{ab}(z)\, b\left(\frac{x}{z},k_t^2\right)$$

Unified BFKL – GLAPD:

$$f_g(x,k_t^2,\mu^2) = T_g(k_t,\mu)\,\frac{\alpha_S(k_t^2)}{2\pi}\left\{\int_x^{\mu/(\mu+k_t)} dz \int^{k_t^2}\frac{dk_t'^2}{k_t'^2}\left[\bar{P}(z)\, h_g\left(\frac{x}{z},k_t'^2\right)\right.\right.$$

$$\left. + P_{gq}(z)\sum h_q\left(\frac{x}{z},k_t'^2\right)\right] + 2N_C\int_x^{\mu/(\mu+k_t)}\frac{dz}{z}\int\frac{d^2q}{\pi q^2}$$

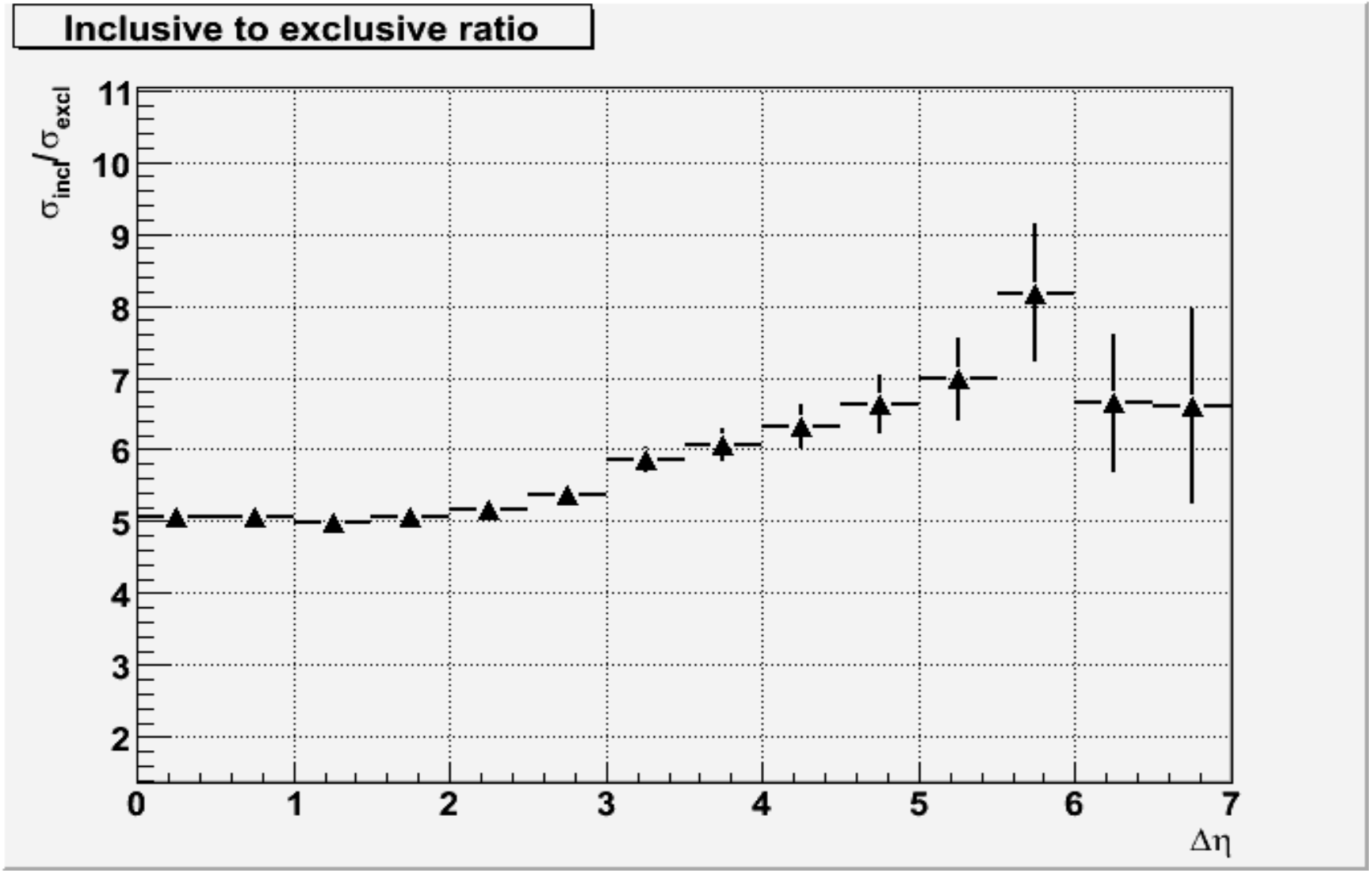
$$\left.\times\left[\frac{k_t^2}{k_t'^2}\, h_g\left(\frac{x}{z},k_t'^2\right) - \Theta(k_t^2-q^2)\, h_g\left(\frac{x}{z},k_t^2\right)\right]\right\},\ \bar{P}(z) = P_{gg}(z) - \frac{2N_C}{z}$$

Watt, Martin & Ryskin (03-04), Kimber, Martin & Ryskin (01)
Kimber, Kwiecisnki, Martin & Stasto (97)
Shuvaev, Golec-Biernat, Martin & Ryskin (99)

MC event generator with BFKL-GLAPD evolution

Ulysses: based on Pythia

Gavrilov, VK , Krokhotin, Safronov & G.Pivovarov (08)



Dijet K-factor at LHC: full CMS simulation (arbirary normalization)

Gavrilov, VK , Krokhotin, Safronov & G.Pivovarov (08)

Search for new physics at LHC dijets

- TransPlanskian regime: $\hat{s}_{jj} \gg M_D$
- Giudice, Rattazi & Wells (99),(02)

Summary

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- Potential for search of new physics

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