

IHEP Diffractive group

<http://sirius.ihep.su/CMS/higgsdiff/diff.html>

V.Petrov, R.Ryutin, A.Sobol et al.



Diffractive pattern in EDDE

R. Ryutin

Outline

- Diffraction: basic problems
- Double Diffraction: patterns and their interpretation
- EDDE generator updates

Diffractive processes and the interaction region

Heisenberg's Uncertainty principle:

$$\Delta p \Delta x \geq \frac{1}{2}$$

$$\cos \theta = 1 + \frac{t}{2p^2}$$

$$p_T = p \sin \theta, \quad p_L = p \cos \theta, \quad p \sim \sqrt{s}$$

Transverse size of the interaction region:

$$\Delta x_T \geq \frac{1}{2\sqrt{\langle p_T^2 \rangle - \langle p_T \rangle^2}} \simeq \frac{1}{\sqrt{\langle -t \rangle}}$$

Longitudinal size of the interaction region:

$$\Delta x_L \geq \frac{1}{2\sqrt{\langle p_L^2 \rangle - \langle p_L \rangle^2}} \simeq \frac{p}{\sqrt{\langle t^2 \rangle - \langle t \rangle^2}}$$

For e^{bt} distribution:

$$\Delta x_T \geq \sqrt{b}$$

$$\Delta x_L \geq bp \sim b\sqrt{s}$$

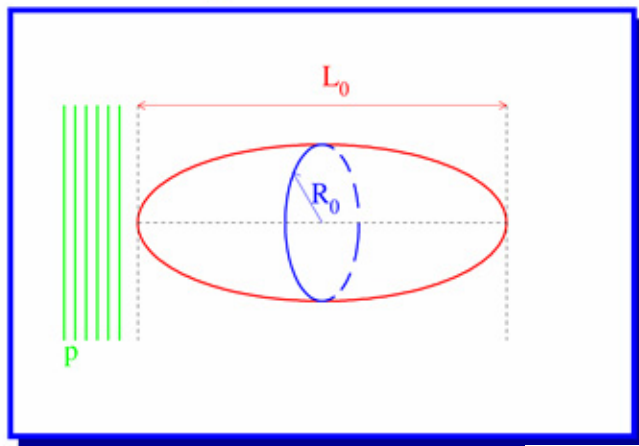
Diffractive processes and the interaction region

GENERIC PATTERN OF THE INTERACTION REGION

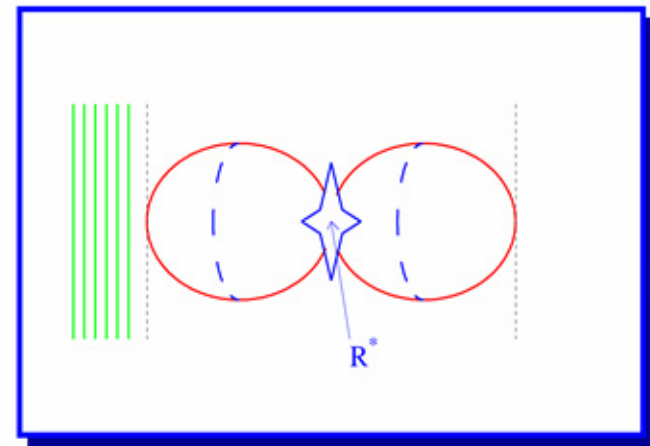
$$L_0 \simeq \sqrt{s}/m^2 \simeq 40000 \text{ fm at LHC}$$

$$R_0 \sim \frac{1}{m} \ln s \sim 1 \text{ fm}$$

$$p \simeq E_{LHC}$$



SHORT TIME/DISTANCE PERTURBATION

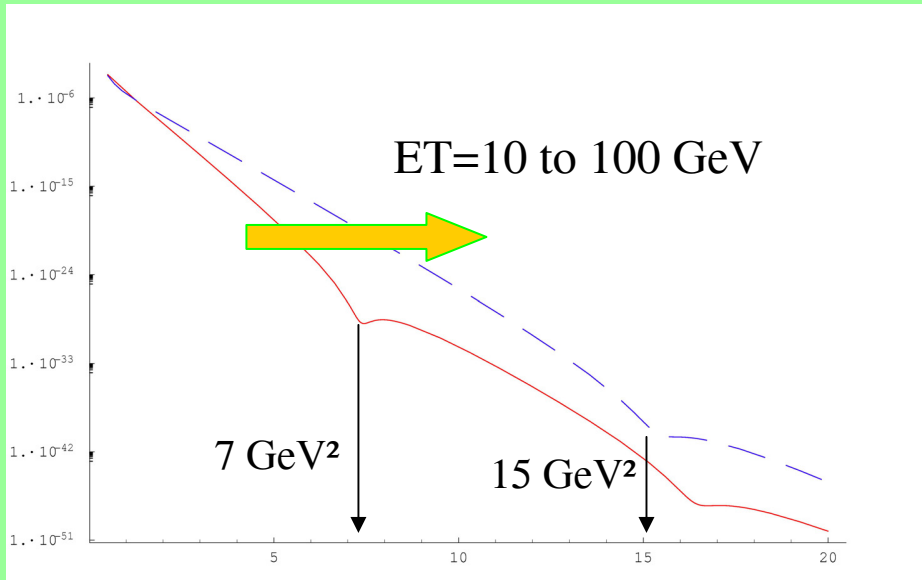


$$R^* \sim 1/Q$$

$$\langle R^2 \rangle \sim \alpha' \ln \frac{s}{Q^2} \xrightarrow{\text{absorbtion}} \langle R^2 \rangle \sim \alpha' \frac{\ln^2 \frac{s}{Q^2}}{\ln Q^2}$$

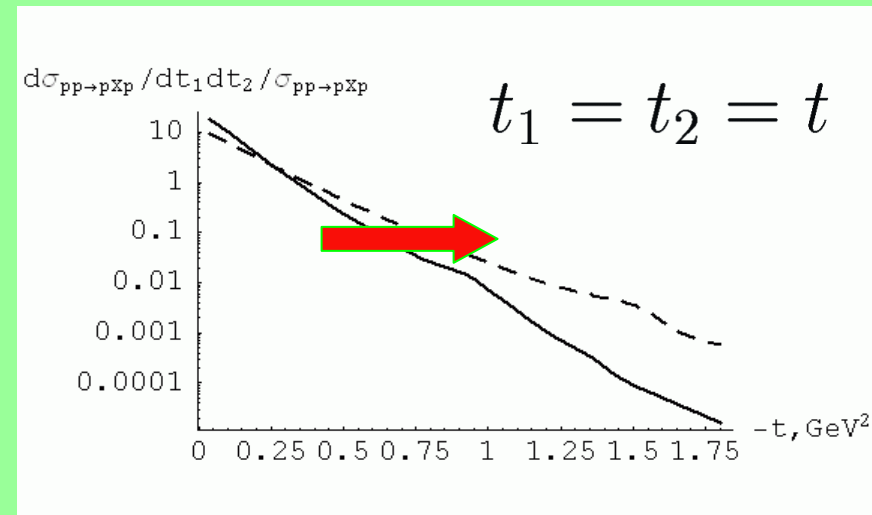
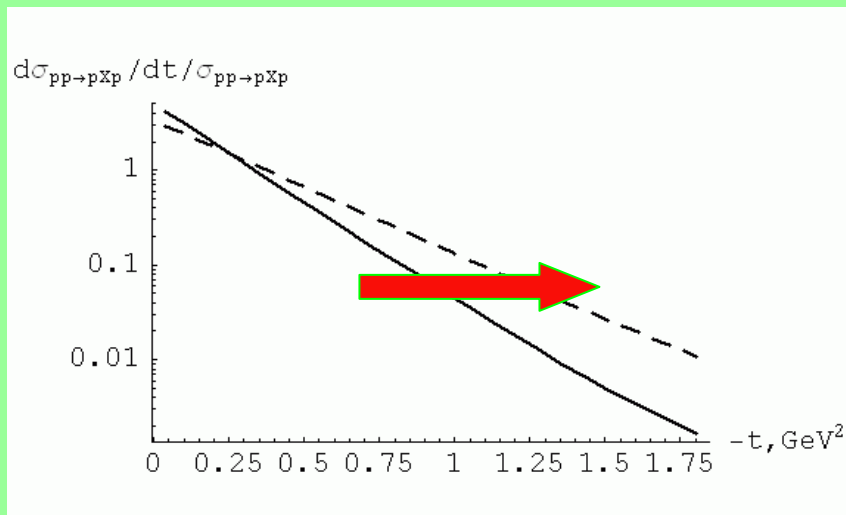
$$\langle R^2 \rangle \sim \alpha_s(Q^2) \ln^2(s/Q^2)$$

Diffractive patterns

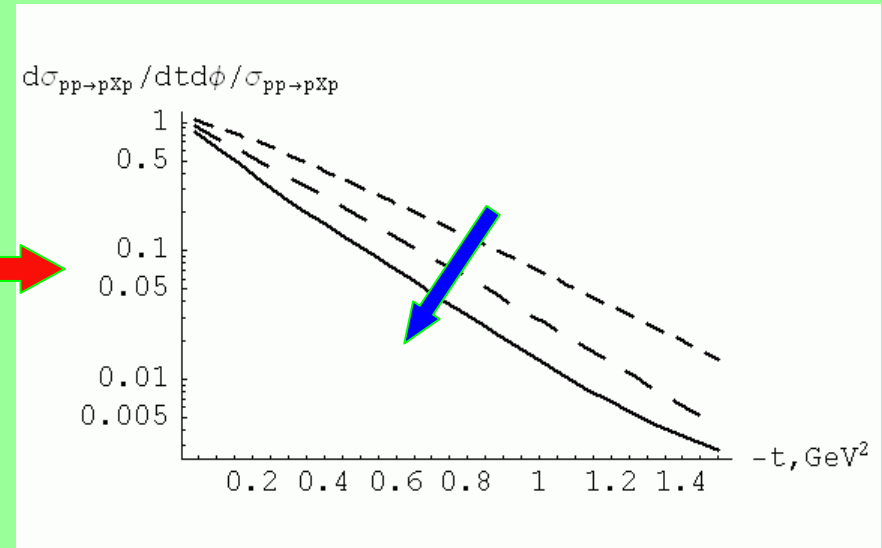
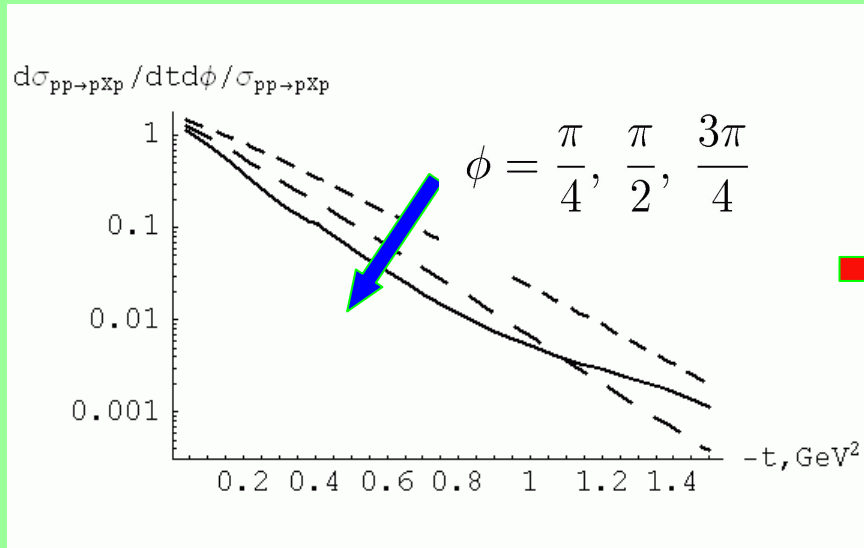


LHC: EDD di-jet production
 (shift of the diffractive pattern with increasing of the additional hard scale)

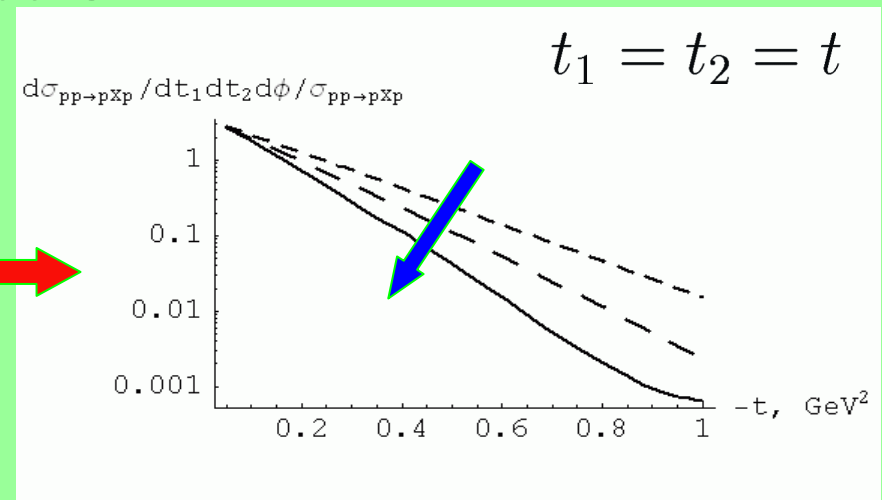
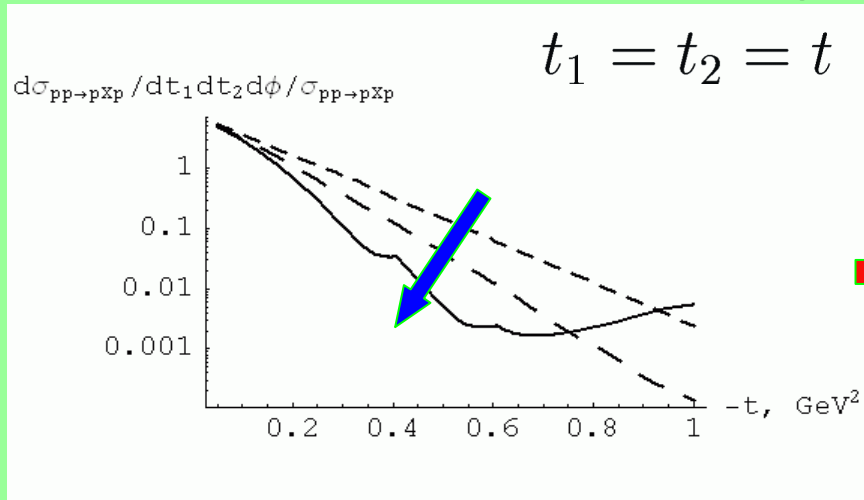
EDD production of 0⁺⁺ resonances with M=3 to 300 GeV



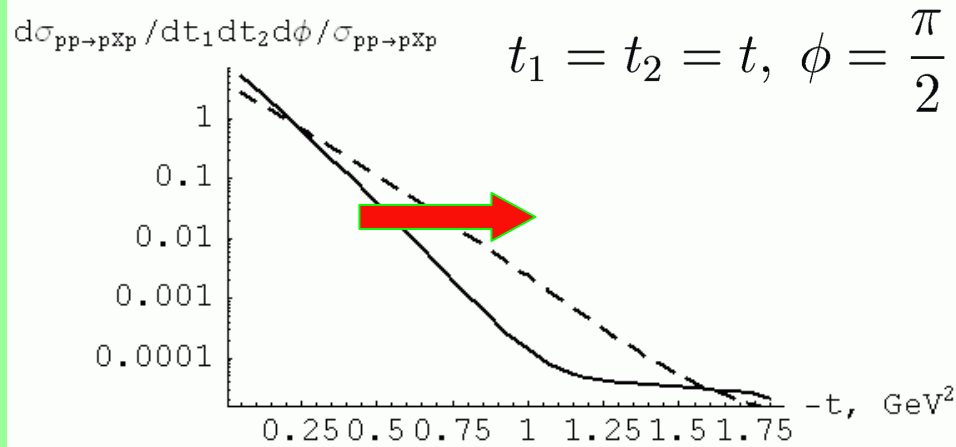
Diffractive patterns



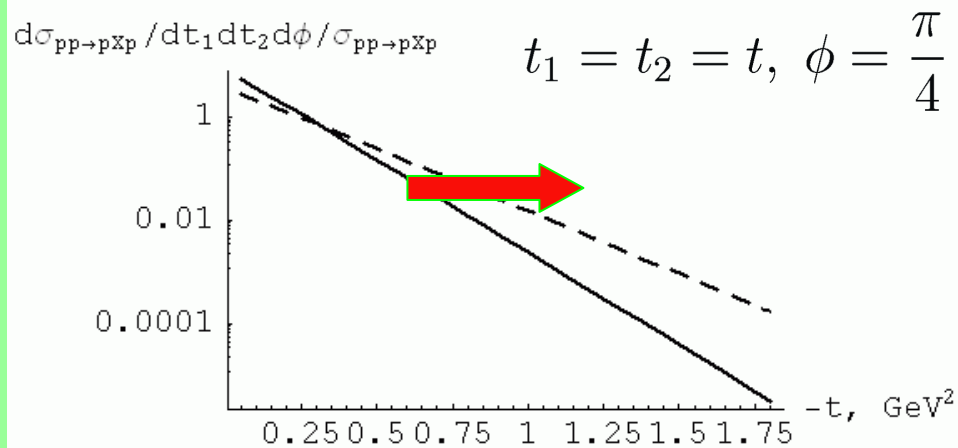
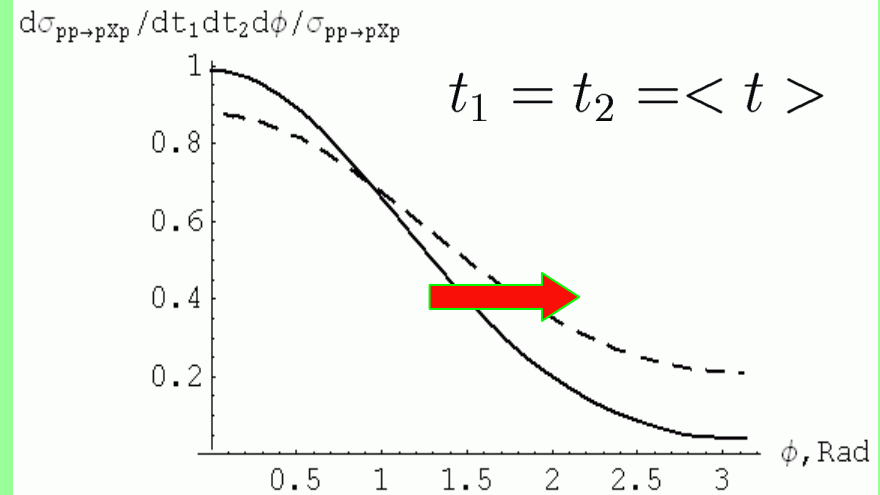
$M=3 \text{ to } 300 \text{ GeV}$



Diffractive patterns



$M=3$ to 300 GeV



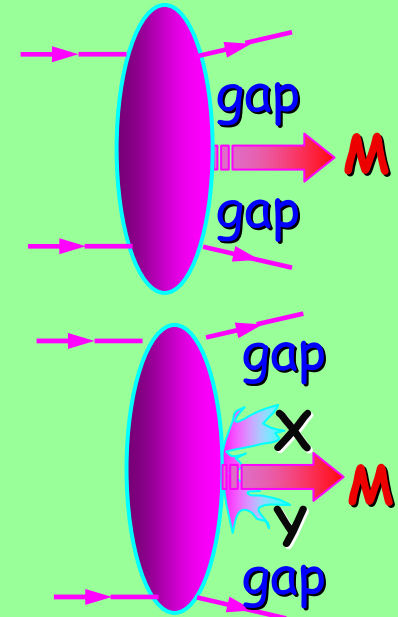
Diffraction: basic problems

Measurements of azimuthal and t -distributions: (diffractive pattern)

- size and shape of the interaction region
- dependence on the additional hard scale
- direct model independent information about the dynamics of the interaction at large distances
- information about the central system (EDDE) and interplay between different scales

Generator EDDE updates

- Based on Regge-eikonal model (V. Petrov and R. Ryutin, JHEP 0408 (2004) 013)
- EDDE2.0 (2006): Exclusive and **Semi-Inclusive** (NEW)
 - SM Higgs
 - RS1 extra dimensions Higgs mixed with Radion
 - 2 and 3 jets: $b\bar{b}, gg, b\bar{b}g, ggg$
 - 2 photons
 - small mass objects like glueballs and $\chi_{c,b}$
- Azimuthal angle between forward protons depends from quantum numbers of central mass which allow to distinguish between, for example, 0^{++} and 0^{-+} Higgs
- Energy dependence of the cross sections



In progress:

Inclusive double diffractive production of the listed above objects

