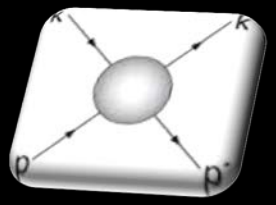
Does Confinement Influence High Energy Scattering?



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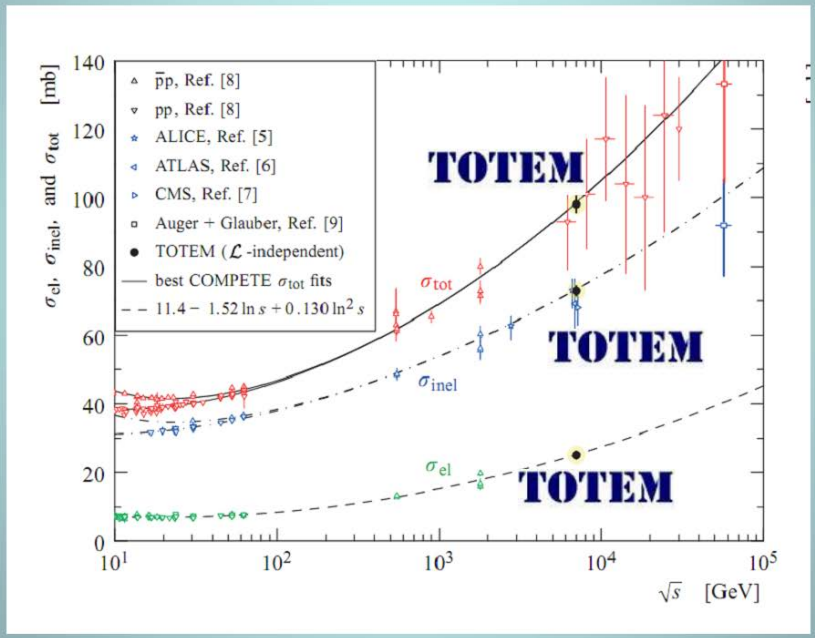
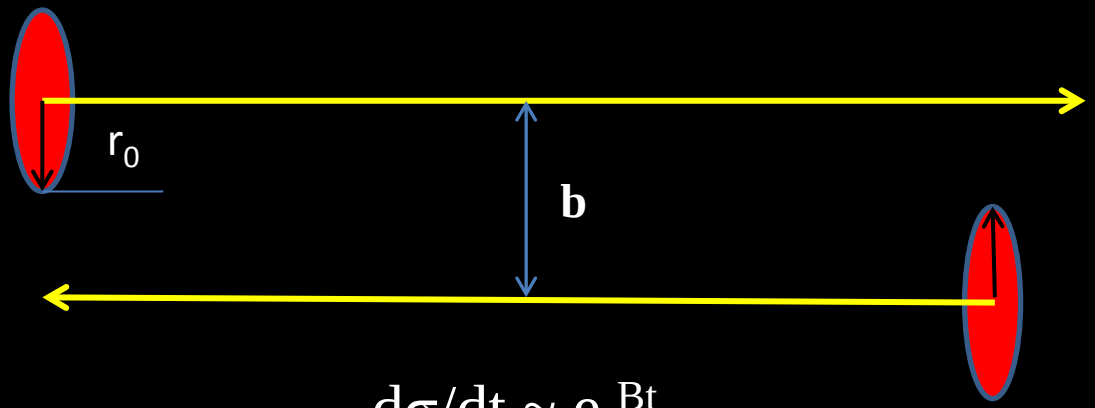
[V.A.P. & R. A. Ryutin, to submit to arXiv]

High-Energy Scattering 2014

Cross-sections vs Energy



Geometry of High-Energy Scattering



$$d\sigma/dt \sim e^{Bt},$$

$$< b^2> = \tfrac{1}{2} d(d\sigma/dt)/dt \ @\ t = 0$$

$$< b^2>_{min} = 2r_0^2$$

$$r_0 \approx (0.66\ \text{fm})^2 \approx 10.79\ \text{GeV}^{-2}$$

$$< r_{\|}> = 2p<\partial\ \text{arg}T(s,t)/\partial t>$$

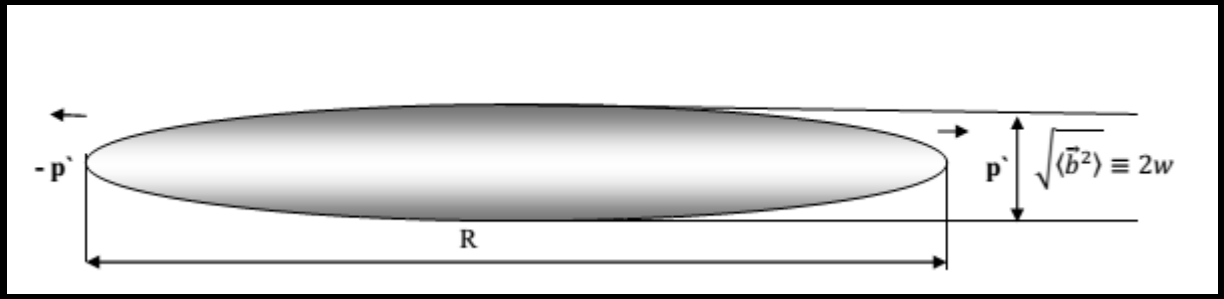
Spatial Scales

"Theory":

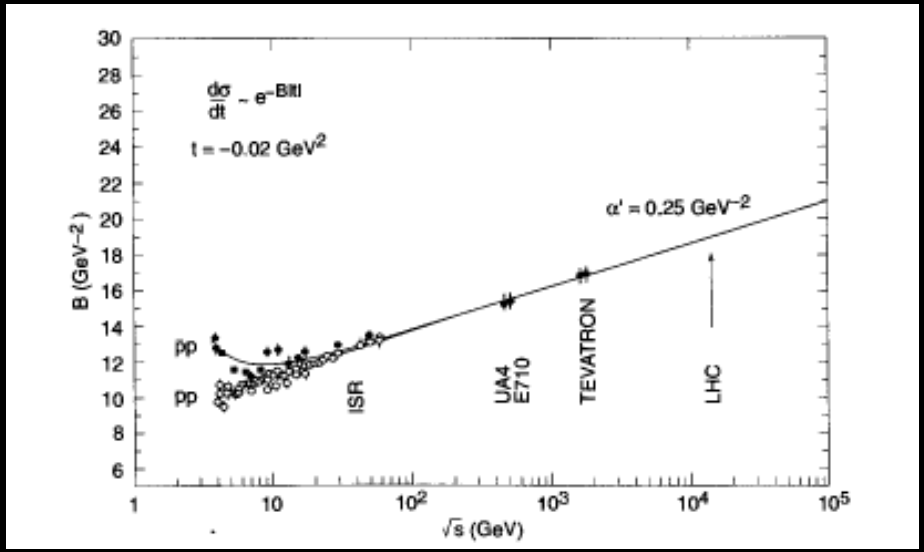
$$T(s,t) = \beta(t)(s\, e^{-i\pi/2})^{\alpha(t)}$$

$$\langle b^2 \rangle = 4\,\alpha`(0)\log(s/s_0) + 2\,r^2_0$$

$$R = \langle r_{\parallel} \rangle = 2p\langle \partial\, \arg T(s,t)/\partial t \rangle =$$
$$= \pi\alpha`(0)p \approx \pi\alpha`(0)\sqrt{s}$$



Data

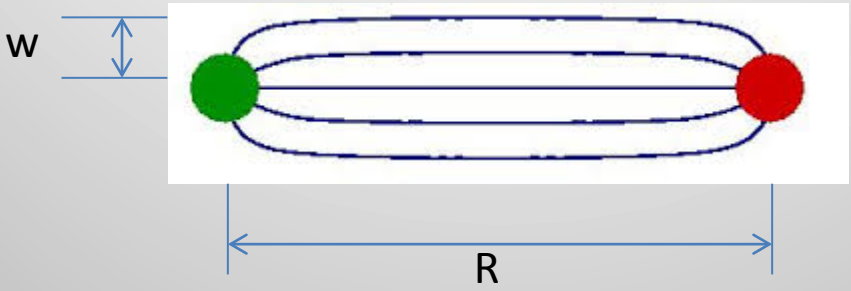


$\langle b^2 \rangle$ - evolution with energy

$\langle b^2 \rangle^{1/2}$ (TeVatron) ≈ 1.17 fm

R (TeVatron) ≈ 160 fm

Static Stringy Confinement



$$w^2 = [(D-2)/2\pi\sigma] \ln R$$

D=4

$$\frac{1}{2\pi\sigma} \equiv \alpha'(0) \quad \rightarrow \quad w^2 = 2\alpha`(0)\ln R$$

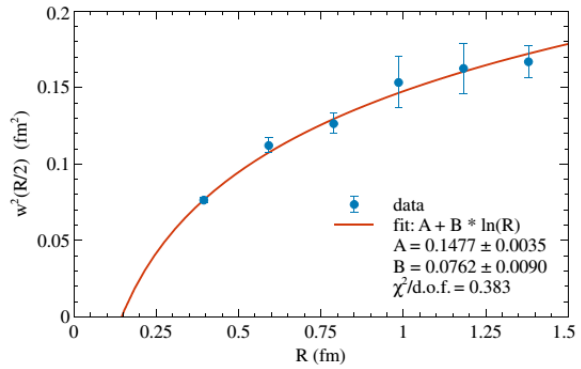
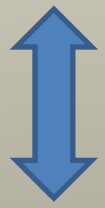


Fig. 2. The width squared of the $q\bar{q}$ confining string as function of its length [2].

Scattering vs String

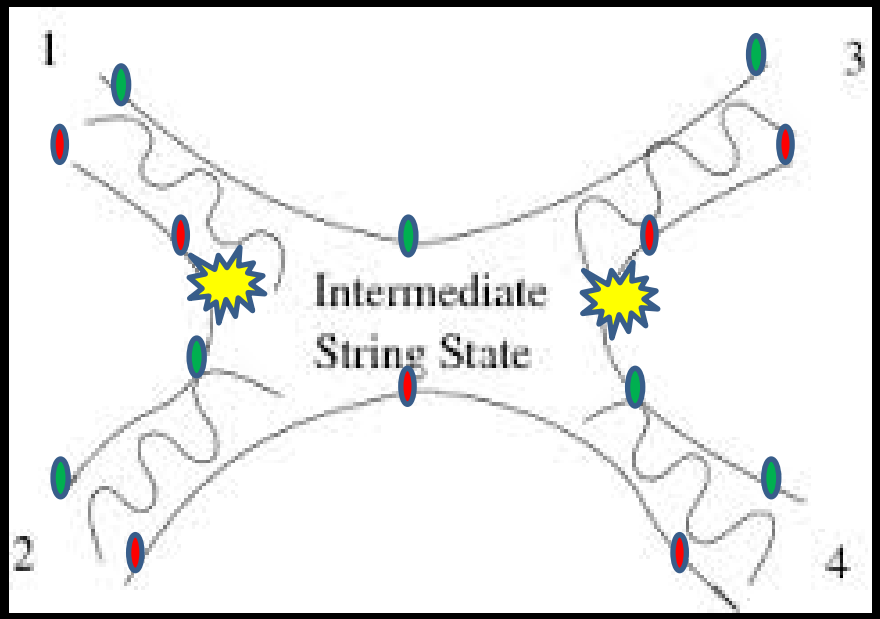
$\langle b^2 \rangle = 4\,\alpha`(0)\log(s) + \ldots$ $\qquad$ $R \approx \pi\alpha`(0)\sqrt{s} + \ldots$

$$w^2_{scat} = \frac{\langle \vec{b}^2 \rangle}{4} = 2\alpha'(0)\ln(R)$$



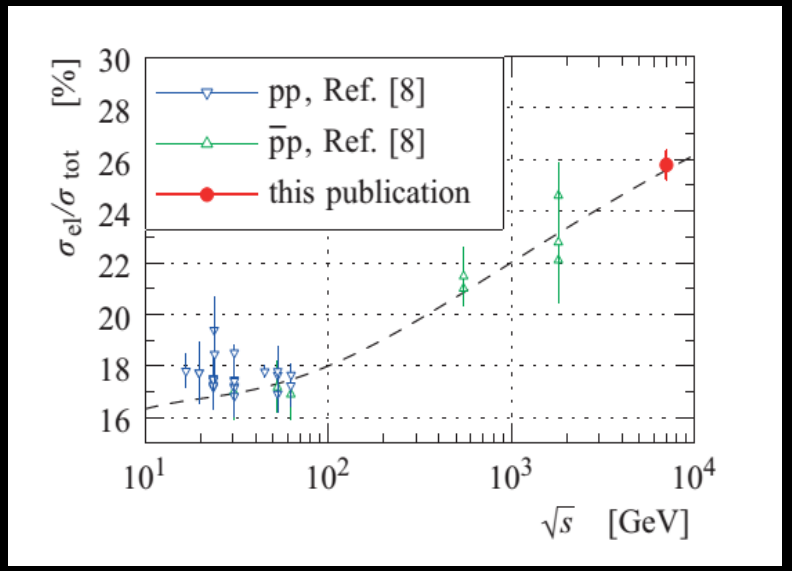
$$w^2_{string} = 2\alpha`\ln R$$

How long the string can be stretched?

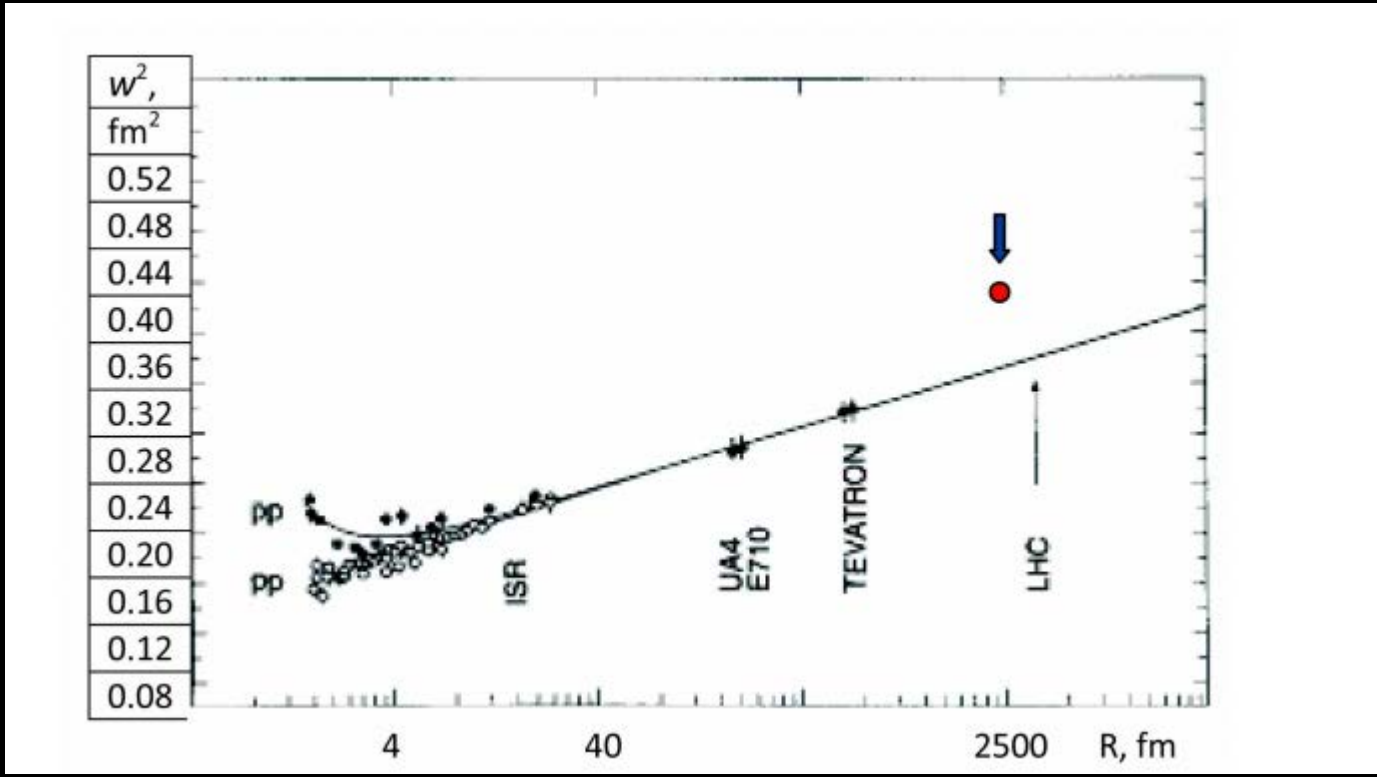


"Survival probability" of the long (O(10^2 fm) flux, σ_{el}/σ_{tot}

σ_{el}/σ_{tot}= 23% @TeVatron



LHC: Spoiling or Modifying?



$R \approx \pi\alpha`(0)[\alpha(0)-1]\log(s)\sqrt{s} + \ldots$

$\langle b^2 \rangle = 4\,\alpha`(0)\,[\alpha(0)-1][\log(s)]^2 \ldots$

???

$w^2 = 2\alpha` \ln R + \ldots$

$w^2 = 4\alpha`\Delta\,(\ln R)^2 + \ldots$