

Few comments on the inelastic diffraction (S. Ostapchenko, arXiv: 1103.5684)

- **high mass diffraction (HMD)** – traditionally described by PPP-asymptotics: $\propto dM_X^2 / (M_X^2)^{\alpha_{\mathbb{P}}(0)}$
- in most MC generators implemented as $\propto dM_X^2 / M_X^2$
– corresponds to the 'critical Pomeron': $\alpha_{\mathbb{P}}(0) = 1!$
- however, energy rise of σ_{pp}^{tot} implies $\alpha_{\mathbb{P}}(0) > 1$
 - \Rightarrow steeper M_X^2 -distribution!
- additionally – low mass diffraction (LMD)
 - low mass diffractive excitations (e.g. Δ^+)
 - other triple-Reggeon contributions, e.g. PPR: $\propto dM_X^2 / M_X^3$
- large low mass diffraction evidenced by HERA diffractive data:
 $\sim 20\%$ difference for diffractive SFs measured with rap-gap and proton tagging techniques – due to $M_X < 1.5$ GeV!

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M_X^2 -distribution for HMD – strongly modified by absorptive effects due to 'enhanced' (multi- \mathbb{P}) diagrams (SO, arXiv: 1003.0196)

- for very peripheral collisions (large impact parameter b):
close to PPP-shape $\propto dM_X^2/(M_X^2)^{\alpha_{\mathbb{P}}(0)}$
- for more central collisions (smaller b):
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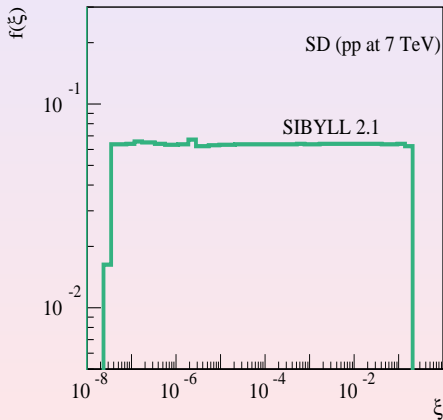
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Illustration: M_X^2 -distribution from CR interaction models

- compare $\xi = dM_X^2/s$ -distribution $f_{SD}(\xi) \equiv \xi/\sigma_{SD} d\sigma_{SD}/d\xi$ for single diffraction in SIBYLL 2.1 (arXiv: 0906.4113) and QGSJET II-04 (arXiv: 1010.0137):

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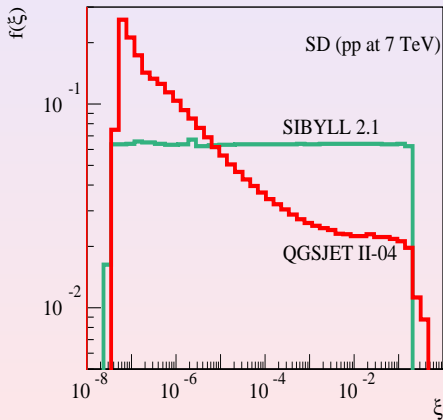
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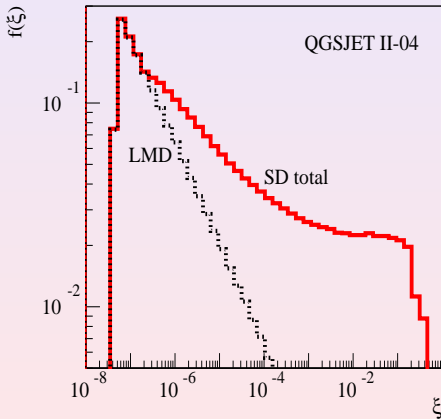
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- flat ξ -distribution in SIBYLL ($\propto dM_X^2/M_X^2$)
- complicated ξ -shape in QGSJET-II – multi- \mathbb{P} graph resummations

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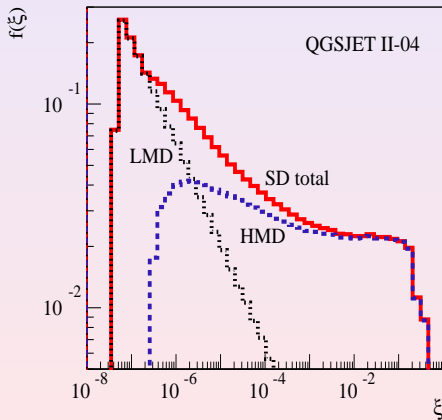
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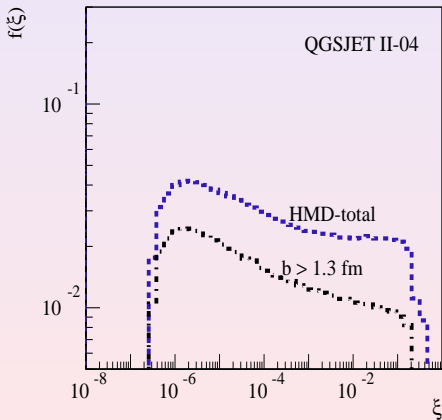
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- nontrivial shape for HMD: due to absorptive effects

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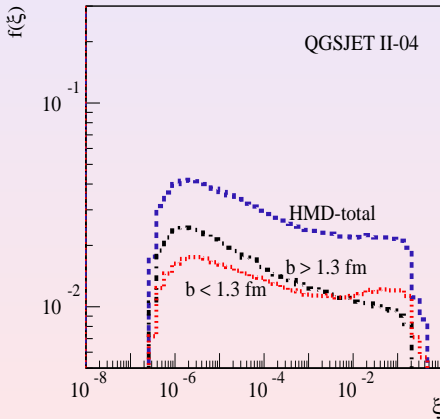
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- steeper ξ -shape at large b : weaker absorptive effects

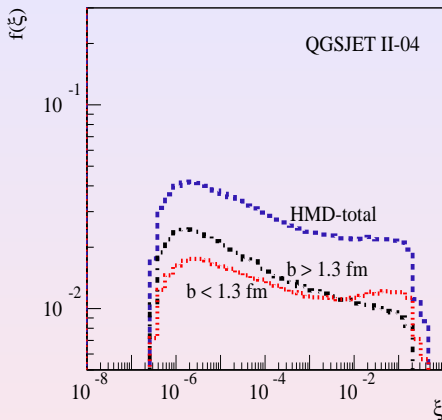
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- even more complicated behavior for double diffraction

Impact on experimental analysis / MC generators

- ultimate way: use alternative MC generators
/ develop a microscopic treatment of diffraction
- at present: introduce tunable parameters for M_X^2 -distribution
- minimal input (3 parameters): $d\sigma/dM_X^2 = \frac{C_{\text{PPP}}}{(M_X^2)^{\alpha_{\text{P}}(0)}} + \frac{C_{\text{PPR}}}{M_X^3}$
(small mass resonances can be 'mimicked' extending PPP and PPR to very low masses – due to Finite Energy Sum Rules)
- better with 4 parameters – to mimic absorptive affects:

$$d\sigma/dM_X^2 = \frac{C_{\text{PPP}}}{(M_X^2)^{\alpha_{\text{P}}(0)}} + \frac{C_{\text{multi-P}}}{M_X^2} + \frac{C_{\text{PPR}}}{M_X^3}$$

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