Search for new physics beyond the LHC using integral dispersion relations and *pp* elastic scattering data

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[arxiv:]130*.**** with T. Weiler

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$$f_{pp,p\bar{p}} = \lim_{\varepsilon \to 0} \mathscr{F}(\pm(E + i\varepsilon), t = 0)$$

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$$\rho_{pp}(E)\sigma_{pp}(E) = \frac{4\pi}{p}\Re f_{pp}(0) + \mathcal{P}\frac{E}{p\pi}\int_m^\infty dE'\,\frac{p'}{E'}\left[\frac{\sigma_{pp}(E')}{E'-E} - \frac{\sigma_{p\bar{p}}(E')}{E'+E}\right]$$

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IDR $\Rightarrow$ model dependent calculation of ρ.

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$$h_1(s) = d\Theta(s - s_{tr})$$

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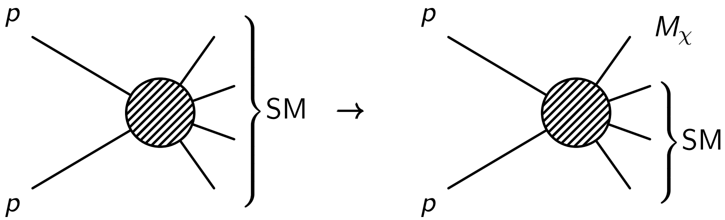

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Where $z = \sigma_{inel}/\sigma_{tot} \sim 0.7$.

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$$h_3(s) = z\frac{1-2\epsilon+(\epsilon-1)\xi_\chi^{-\epsilon}+\epsilon\xi_\chi^{1-\epsilon}}{1-2\epsilon+(\epsilon-1)\xi_p^{-\epsilon}+\epsilon\xi_p^{1-\epsilon}}\Theta(1-\xi_\chi)$$

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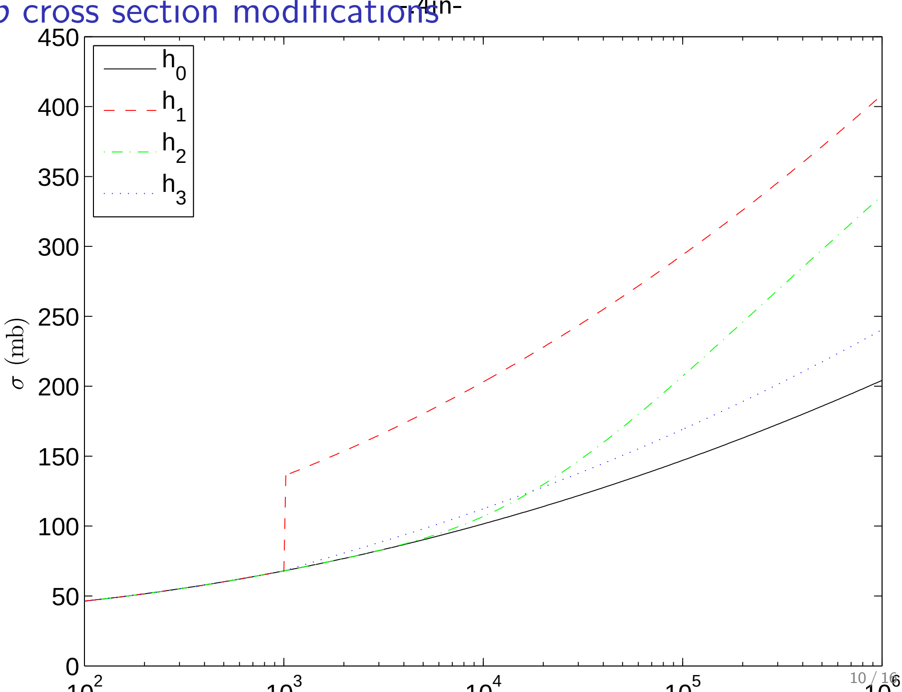
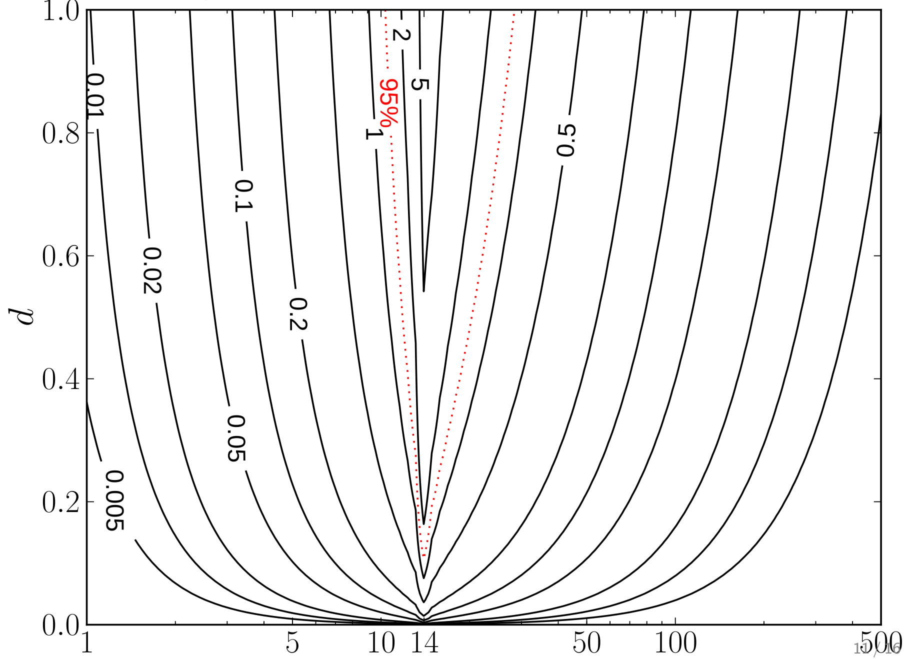
These can be generally described as a step function, h_1, at the relevant energy with the magnitude of the step large - up to a factor of ten.

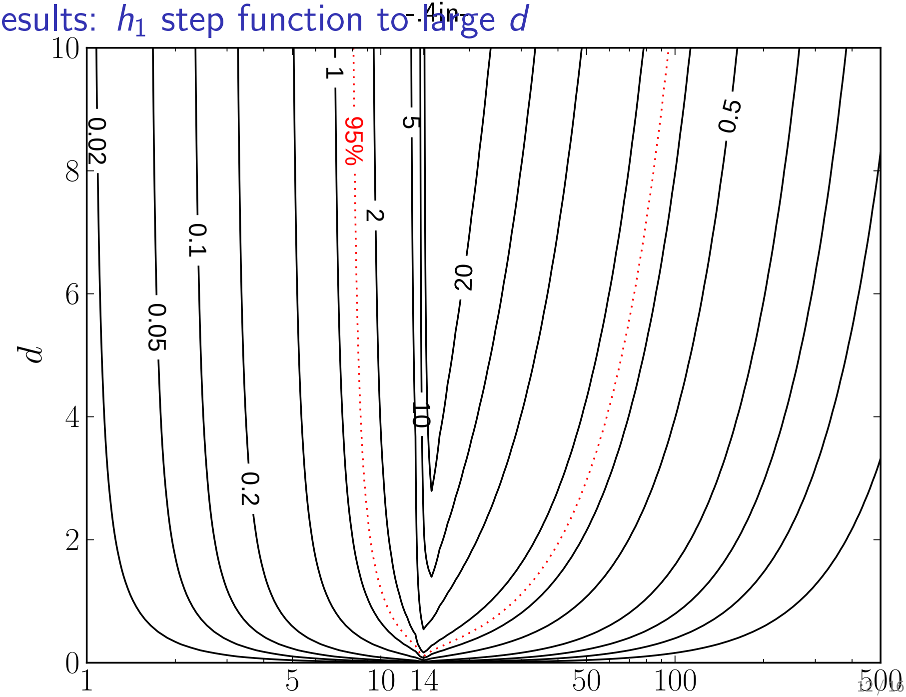
pp cross section modifications



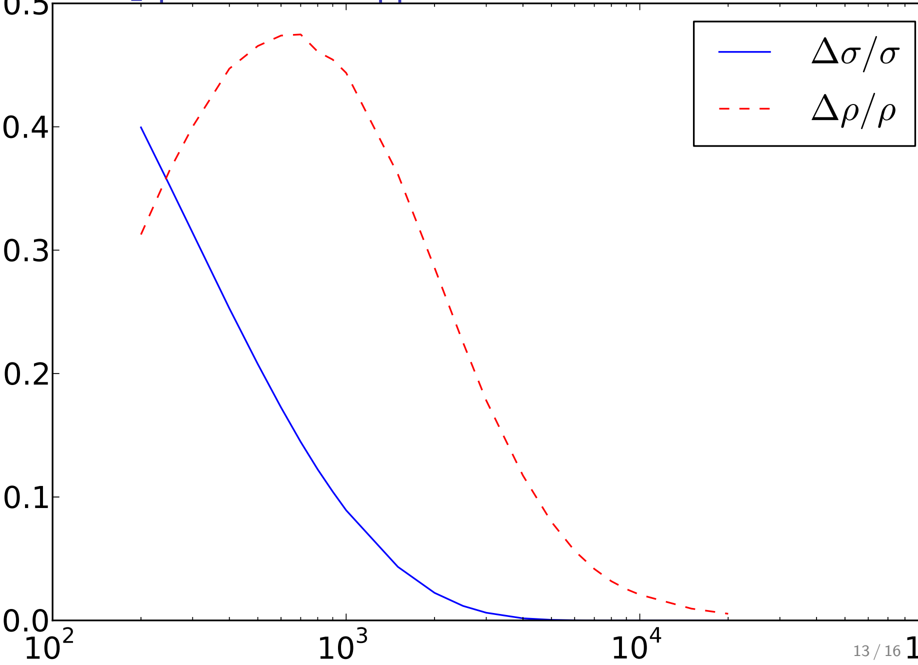
Results: h_1 step function -.4in-



Results: h_1 step function to large d

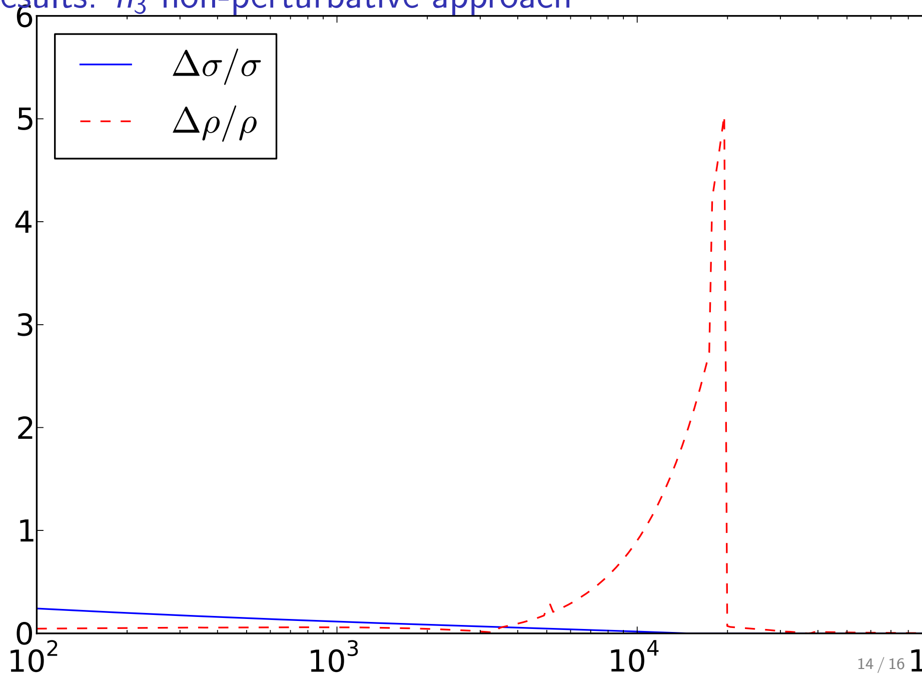


Results: h_2 perturbative approach



Results: h_3 non-perturbative approach

.4in



Discussion and conlusions

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- Perturbative models do not allow for large enough modifications.
- A non-perturbative approach is more successful in a narrow region.

Thank you for your time.
Questions?

Non-perturbative cross section reproduces Froissart bound when properly expanded

[noframenumbering] We noted that the cross section function that goes into the modification h_3 rises like $\log^2 s$ in the appropriate limit:

$$\sigma \propto 1 - \xi_p - \log \xi_p + \left(1 - \xi_p + \xi_p \log \xi_p + \frac{1}{2} \log^2 \xi_p\right) \epsilon + \mathcal{O}(\epsilon^2)$$

with higher order ϵ terms resulting in higher orders of $\log s$ following the above pattern.

Integral Dispersion Relations: Integration Contour