OBSERVAÇÕES:
*** Para ficar mais fácil de ler o documento ***
(1) Texto em VERMELHO é para ser revisado. Uma vez revisado mudar o texto para AZUL.

We are thankful to the reviewer for the detailed analysis and the important points raised on our submitted work. In what follows, after quoting each part of the report, we present our comments and changes in this revised version.

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"1. The considered elastic, total, and diffractive cross sections are by far dominated by soft, non-perturbative physics. Therefore, the connection to perturbative QCD and the parton language is masked by non-perturbative effects. It should be explained and emphasized in the paper."

- Comments/changes

[Mateus: Podem alterar à vontade a resposta.]

The referee is right. Thanks for pointing that out. In a Regge pole model, the increase of hadronic cross sections is associated with Pomeron exchange. In the QCD framework, the Pomeron can be undestood as a bound state of reggeized gluons, where in its simplest configuration a color singlet made up of two reggeized gluons. And this reassembles to the nonperturbative characteristic of QCD.

In the minijet models, or also named QCD-inspired, the observed increase in hadronic cross sections is, indeed, dominated by hard parton-parton scatterings in hadrons. More specifically, driven mainly by gluon-gluon processes. However, this elementary subprocesses are plagued by infrared divergences which, somehow, have to be regularized in order to separate both perturbative and nonperturbative dynamics of QCD. This was briefly mentioned in the end of the paragraph after Eq.(39): "*[...] the infrared divergences present in the elementary subprocesses at low transferred momenta will be regularized using the approach proposed in the Refs. [16, 17].*"

In this respect the changes that follow have been performed in the text.

- We inform the above replacement in the text in page ...

".... TEXTO DO PAPER..."
in place of
"... Escrever mudanças aqui!..."

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"2. The related question is the magnitude of σ_{pQCD} in eq.38. How large is its contribution to σ_{eik}? I expect that it contributes only a few percent. As a result, the sensitivity to the factor of K introduced by eq.39 should be very small. I think it is important to explain and discuss these points."

- Comments/changes

[Mateus: Podem alterar à vontade a resposta.]

Notice that the soft component in the eikonal cross-section is written taking into account Regge-Gribov parametrizations. One on hand there are the presence of two secondary Reggeons, one even-under-crossing and the other odd-under-crossing. Both these two components are known to contribute only in the lower-energy region, at least for forward observables. On the other hand, there is also the presence of a critical Pomeron, dennoted by σ_0. However the latter is not energy-dependent, *i.e.* it only adds up like a "constant" value in σ_{eik}.

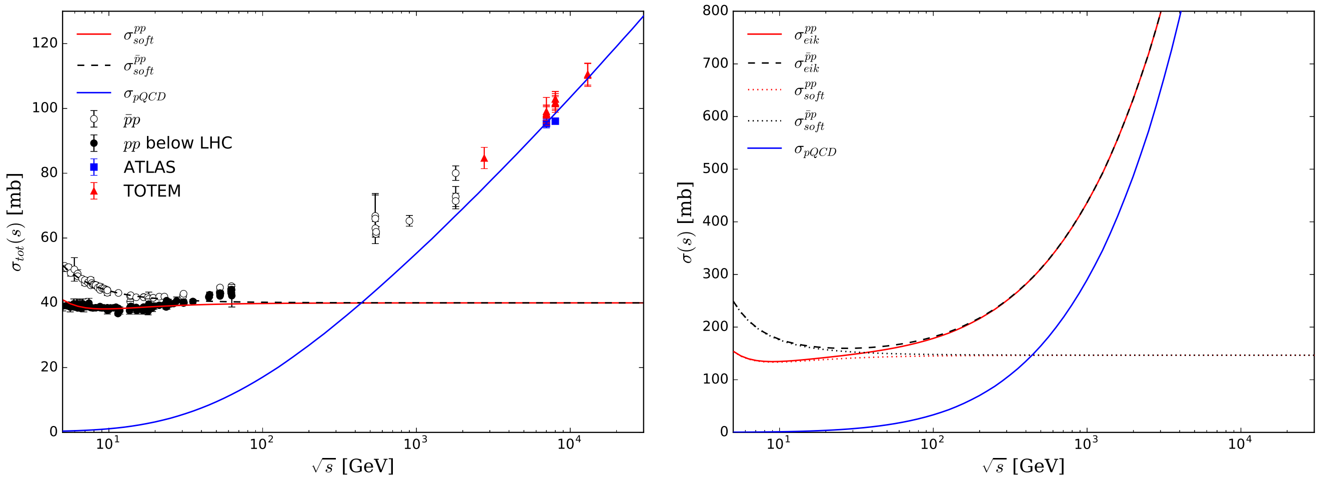

Figure 1: Blablabla.

The high-energy dependence of the cross sections is driven mainly by processes involving the gluon contribution, since it gives the dominant contribution at small-x. Our attempt here is to let the σ_{pQCD} be responsible for the high-energy dynamics. This component represents the hard scattering among partons within hadrons, and therefore gives the dominant contribution asymptotically at high energies.

To answer you query in a more convenient way, perhaps Fig.1 help us to enlighten. In the left panel is depicted the fit to the whole total cross-section data set by considering the eikonal cross-section with and without the pQCD component. The right panel displays the eikonal cross-section and its components. Notice that σ_{pQCD} has a significant contribution and, indeed, plays a crucial part in the high-energy region.

The referee is right in respect of the contribution of the $\mathcal{K}$ factor. However this tiny contribution is related to the different functional choices of Q^2. Here, we considered $Q^2_{min} \equiv |t|^2$, more specifically $Q^2_{min} = 1.3$ GeV^2. Recall that high-order perturbative contributions may change the normalization, as well as the shape of the jet (parton-parton) differential cross-section. The inclusion of $\mathcal{K}$ is just an approximation due to the lack of a next-to-leading order functional (closed) form to these jet differential cross sections.

In this respect the changes that follow have been performed in the text.

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"3. Is there any physical motivation for the used models of the distributions $p(\alpha)$ in eq.31 and the average number of interactions $\langle n(s,b)\rangle$ in eq.37? In my opinion, it is not enough to simply write "we assume" without giving any reasoning why such an Anzatz could be appropriate and what physics it captures."

- Comments/changes

[Paulo]: O texto abaixo é mais um compilado de argumentos que eu acredito justificar a escolha da distribuição gamma. Podemos discutir depois. Fiquem a vontade para modificar.

These are indeed important aspects that may need some clarification. We thank the referee for raising these points.

The $p(\alpha)$ is the probability distribution of α, a real positive number defined as the mapping between the possible configurations C_i of the proton to the set of real numbers, assuming that the set of configurations can be approximated by a continuum. In practice, this allow us to calculate an integral over real numbers $\int d\alpha p(\alpha)$ instead an integral over all possible configurations $\int dC_i P_h(C_i)$.

The gamma distribution considered has the needed features: it is defined for positive values of its variable (α); it shows the expected limit for $\omega \to 0$, corresponding to no fluctuations; and it also has an analytical structure that allow us, in some extent, to obtain analytical (closed) expressions.

One could, of course, consider a gaussian distributions, that have similar features. However it is defined for negative and positive real values. It seems to us strange to exclude the negative values of the variable domain since the gaussian is symmetric around the mean, here fixed at 1. Therefore we would not "cut" the distribution in the symmetry axis. Of course, this is the case in which we want to keep the assumption of the original model in mapping configurations C_i to positive real values.

With respect to $\langle n(b,s)\rangle$, as mentioned in the text, we follow the factorization introduced by Durand and Pi in the late 1980s. This factorization consists in writing the average number of partonic interactions $\langle n(b,s)\rangle$ as multiplication of two independent functions: one that depends only on the energy (σ_{eik}) and contains the dynamics of the interaction (Regge inspired for the soft component and mini-jet/QCD for the hard one) and another that is a function of the impact parameter only and encodes the matter distribution of the interacting particles. As pointed out by the authors of Ref. [13], this factorization is consistent with the QCD parton distribution functions (pdf) evolution, where the b-dependence of the pdf is factorized. For small x, with the onset of saturation effects, it is expected that this factorization will not be valid anymore, due to the appearance of correlations between pdfs and b distributions. Certainly, this is an important topic that deserves a careful study, but we believe that it is out of the scope of the present paper.

We make the following changes in the text in order to clarify these points... [???]

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"4. The free parameters in table I are fitted to the available data on the total cross section. It is known very well that the total cross section is only weakly sensitive to Good-Walker fluctuations since they average at the amplitude level, see eq. 21. In particular, the total cross section does not constrain the dispersion of the distribution $p(\alpha)$. Hence, it is not clear how fixing the model parameters using the total cross section, one can make reliable predictions for the diffractive cross sections, which are sensitive to the dispersion of the distribution $p(\alpha)$. It needs to be explained."

- Comments/changes

Escrever aqui!

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"5. What is the reason for setting the subtraction constant $C = 0$ in eq.41?"

- Comments/changes

To determine the subtraction constant C appearing in the dispersion relations, we need to consider a simultaneous fit to σ_{tot} and ρ parameter data. We have done tests with this possibility, but the inclusion of the ρ parameter did not show significant improvement of the results compared to those obtained with fits only to σ_{tot} data, and the values of C in these cases were compatible with zero within the uncertainties. An important aspect of this constant is that it is only important at the low energies, given that $C/s \sim 0$ for high energies. In this sense, the value of C is not important in what concerns the description of high-energy data and predictions. Therefore, we believe that to consider $C = 0$ is the simplest assumption to predict the energy dependence of ρ.

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"6. The discrepancy between the theory description and the data in fig. 4 requires more discussion. For instance, how can the model be improved to provide a better description? What does it tell us about the physics of the proposed model?"

- Comments/changes

[Mateus: aqui tô falando coisas que eu penso sobre o perfil e a relação de dispersão.]

There are a few things to consider here. As pointed out in paragraph after Eq.(43), the model is able to describe the experimental data for the differential elastic cross-section at small $|t|$-values, but fails to describe the position of the dip. Moreover, it also predicts the presence of multiple dips as expected from eikonalized models. And we known from experiment that it is not the case. As for the ρ-parameter, we do not have good predictions at the high-energy region, and the same goes to the $\bar{p}p$ data at $\sqrt{s} = 541$ GeV. Both behaviors may possibly be associated with either the simplistic form of the overlap distribution function, *i.e.* the partonic matter distribution inside the hadron, or the way which was obtained the real part of the scattering amplitude by means of dispersion relation.

The latter can be improved if, since the formula, we consider the eikonal (average number of interactions) as a complex function written in terms of even and odd components connected by crossing-symmetry. In this approach, one would not be able to apply the dispersion relation in the scattering amplitude, since now it would not be able to relate the even (odd) amplitude with just even (odd) eikonal, see Ref.[13] (Phys. Rev. D 40, 1436 (1989)). Following this approach, a few things would need to be rewritten, as for example:

$$\sigma_{\rm soft} = A_1 \left(\frac{s}{s_0} e^{-i\pi/2} \right)^{-\delta_1} \pm A_2 \left(\frac{s}{s_0} e^{i\pi/2} \right)^{-\delta_2} + \sigma_0 \ ,$$

where the phase factor $e^{\pm i\pi/2}$, which ensures the correct analycity properties of the amplitude, is a result of an integral dispersion relation. The same could be performed in the minijet cross-section,

$$\sigma_{\rm pQCD} = \sigma_{\rm minijet}(s \to s e^{-i\pi/2}).$$

This would provide us a way to obtain the imaginary component or the eikonal cross-section. As strange as it sounds, this would represent the imaginary eikonal function. The problem is that Eqs.(32-34) were obtained assuming that $\langle n(b,s) \rangle$ is real. Presently, we do not known if these expressions are valid for a complex $\langle n(b,s) \rangle$.

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Sincerely yours,

M. Broilo, V.P. Gonçalves and P.V.R.G. Silva.
V.P. Gonçalves (by the authors).