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aMC@NLO predictions for Wjj production at the Tevatron

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Abstract: We use aMC@NLO to predict the $\ell\nu$ + 2-jet cross section at the NLO accuracy in QCD matched to parton shower simulations. We find that the perturbative expansion is well behaved for all the observables we study, and in particular for those relevant to the experimental analyses. We therefore conclude that NLO corrections to this process cannot be responsible for the excess of events in the dijet invariant mass observed by the CDF collaboration.

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1 Introduction

Recently, CDF has reported [1] an excess of events in two-jet production in association with a W boson, in the form of a broad peak centered at $M_{jj} = 144\,\text{GeV}$ in the dijet invariant mass. By now, i.e. with a data set corresponding to an integrated luminosity of 7.3 fb^{-1}, the excess has reached a statistical significance of 4.1 σ w.r.t. the estimated Standard Model yield. In view of the possible implications for a BSM physics discovery, this anomaly has attracted a lot of attention, though it has so far failed to be confirmed by a very similar D0 analysis [2].

One of the major challenges in a measurement of this kind is posed by the need of reliable predictions and simulations of the processes that contribute to the observables of interest. In the CDF and D0 analyses, for instance, such simulations are typically performed by means of fully exclusive Monte Carlo programs based on tree-level matrix elements. In the case of multi-jet final states in association with weak bosons, a proper merging procedure [3–5] between multi-parton matrix elements (which give a reliable description of large-angle and large-energy emissions) and parton shower Monte Carlo's (PSMC's) (which give a reliable description of small-angle or small-energy emissions) is employed that allows the generation of inclusive jet samples for all relevant multiplicities, accurate to the leading order (LO) in perturbative QCD.

Yet, the uncertainties that affect LO predictions can be very large for rates, and smaller but still discernible for differential distributions. This is the reason why parton-level NLO and, when possible, NNLO computations of infrared safe observables are used. Alternatively, and if the statistics is sufficient, control data samples are employed. For example, a theoretical analysis based on the NLO computation of the SM yield for $\ell + 2$ jets + missing transverse energy (which with the cuts used by CDF and D0 gets contributions from, in order of importance, Wjj, Zjj, WW, $t\bar{t}$, single-t and WZ production) has recently appeared [6]. It has been shown that indeed the Wjj process gives by far the dominant contribution, and that the NLO QCD corrections are small. Unfortunately, even though more accurate from the theoretical point of view, such small-multiplicity, parton-level calculations cannot be directly compared to experimental analyses, since this would require events with high-multiplicity, fully-fledged hadronic final states.

In order to obtain predictions that are both accurate and employable in experimental analyses, an NLO calculation needs to be consistently matched to a PSMC. This can be currently achieved with the MC@NLO [7] or POWHEG methods [8, 9]. It is interesting to note that out of the processes listed above for the signature $\ell + 2$ jets + missing transverse energy, only the Wjj and Zjj contributions are not available in either of these frameworks. Given that the cross section of the latter process (within the experimental cuts adopted by CDF and D0) is smaller than that of the former by more than one order of magnitude, it is more urgent and highly desirable to have the best possible theoretical predictions for Wjj production, which is a fairly challenging task. The complexity stems not only from the NLO computation itself, but also from its subsequent matching with parton showers, where the technical difficulties arise mainly from the presence of phase-space singularities at the Born level, which need to be cut-off. While this problem has already been faced in the POWHEG implementation of dijet [10] and Wj/Zj [11] production, it is significantly simpler in these cases: a p_T cut on the "recoil" system (one parton in dijet, and the vector boson in Wj/Zj production) is sufficient to get rid of the divergences of the Born matrix elements. On the other hand, Wjj production features a final-state three-body (of which two light partons) kinematic configuration already at the Born level, which renders the cutting-off of the singularities highly non trivial. In fact, the kinematics of Wjj production is sufficiently involved to provide a proof that, if a successful matching of the NLO results with parton showers can be achieved, the same kind of matching technique can be applied to larger final-state multiplicities, without encountering any new problems of principle.

In this paper, we compute the NLO QCD corrections to the process $p\bar{p} \to \ell\nu jj$,[1] and, for the first time and in a fully-automated way, consistently match them to the HERWIG parton shower [12–14] according to the MC@NLO formalism [7], as implemented in the aMC@NLO program [15]. One-loop corrections are obtained with MadLoop [16], which is based on the OPP reduction method [17] and on its implementation in CutTools [18]. All the other contributions to the parton-level NLO cross section are dealt with by MadFKS [19], which is based on the FKS subtraction method [20], and takes care of determining the MC counterterms needed in the MC@NLO approach. Throughout the paper, we often refer to "the W boson" or to "Wjj production"; this is only for the sake of brevity, since we actually deal with the leptonic process mentioned before, and thus doing we fully retain the information on production and decay spin correlations and off-shell effects.

We begin by showing that the cutting-off of Born-level singularities (which is an arbitrary procedure) has no impact on the predictions in the kinematic regions of interest. We also show that NLO corrections are moderate, and depend mildly on the kinematics. We conclude by presenting our predictions for the dijet invariant mass, closely following the CDF analysis.

2 Method and validation

The Wjj NLO cross section receives contributions from processes with $W+2$-parton and $W+3$-parton final states; although these diverge when independently integrated over the

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[1] The mass of the charged lepton ℓ is set equal to zero. Furthermore, since we do not compare our predictions to data here, it is sufficient to consider only positively-charged leptons of one flavor.

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phase space, their combination into any infrared-safe observable is finite, thanks to the KLN and factorization theorems. For this to happen, it is a crucial condition that there be two observable jets in the final state. Although such a condition can be easily included in the definition of the short-distance cross sections, this is not the way one follows nowadays. A much-preferred option (and the only one which is viable when matching to PSMC's) is that of imposing jet cuts at the very last step of the computation (the physics analysis), since this gives one the flexibility of e.g. using several jet-finding algorithms in parallel. It should be clear, however, that some cuts (called generation cuts henceforth) must still be imposed at the level of short-distance cross sections, which otherwise would diverge upon integration, as mentioned before. Generation cuts are therefore a technical trick that allow one to work with finite quantities; the idea is that kinematic configurations that do not pass these cuts would anyhow not contribute to the observable cross sections, which is what permits one to discard them; in other words, cross sections are not biased by generation cuts. We remind the reader that, in the case of cross sections involving jets, generation cuts are imposed on the kinematics of the jets that result from applying a jet-finding algorithm to the underlying parton configurations. In general, different jet kinematics will be associated with real-emission contributions (that in our case have three final-state partons), and with counterterms, virtual, and Born contributions (that have two final-state partons here). Thanks to the infrared safety property of jet algorithms, these differences will tend to vanish in the soft and collinear limits.

Unfortunately, it is not straightforward to prove that indeed physical observables are unbiased, which constitutes a necessary and very strong consistency check of one's computation. An analytic proof not being viable, one exploits the fact that generation cuts are arbitrary. Hence, one imposes several generation cuts, and then verifies that in the kinematic regions of interest physical observables do not depend on them. This opens the question of how to define generation cuts, and it is obvious that a necessary condition is that they must be looser than the loosest of the set of cuts imposed in the physics analysis. When performing a perturbative calculation at the parton level, it is quite easy to understand whether generation cuts are sufficiently loose. This is because generation and analysis cuts are imposed on kinematic configurations that have the *same* multiplicities and particle contents. Things are significantly more complicated when one matches matrix-element computations with parton showers; the latter will in fact generally increase the final-state multiplicities w.r.t. those relevant to short-distance cross sections, and the relationship between the quantities being cut at the generation and analysis level becomes blurred. The upshot of this is the following: when considering the matching with parton showers, generation cuts are typically softer than those one would need if only performing perturbative parton-level computations, and they affect larger kinematic ranges than in the latter case.

In order to address this (among others) problem, at the LO one "merges" different parton multiplicities in a way consistent with parton showers [3–5]. Although a generalization of these procedures to NLO is in its infancy [21–27], we may observe that when the merging at the LO is restricted to processes whose multiplicities differ by one unit (e.g., the W+2 and W+3 partons samples in Wjj production), then one is actually dealing with a subset

Parameter	value	Parameter	value
m_W	80.419	Γ_W	2.0476
G_F	$1.16639\cdot 10^{-5}$	α^{-1}	132.50698
m_t	174.3	m_Z	91.118
$\alpha_S^{(\mathrm{NLO})}(m_Z)$	0.12018	$\alpha_S^{(\mathrm{LO})}(m_Z)$	0.13939

Table 1. Settings of physical parameters used in this work, with dimensionful quantities given in GeV.

of the matrix elements used in the well-established NLO-PSMC matching procedures such as MC@NLO (a subset, since the virtual correction are not included). Hence, one may anticipate that unphysical effects, the reduction of whose impact necessitates a merging procedure at the LO, are smaller in the context of matched NLO computations of a given multiplicity. We shall later see an explicit example of this fact.

To conclude this discussion, we mention that, although there is ample freedom in the choice of generation cuts, in practice it is convenient to employ the same jet-finding algorithm at the matrix element level as in the physics analysis, since this renders it a bit easier the task of applying generation cuts which are looser than the analysis ones.

As a technical aside, we point out that the MC@NLO formalism does not require modifications in order to be applied to processes whose Born contribution is divergent, and one simply imposes generation cuts when computing MC@NLO short-distance cross sections, fully analogously to what is done at the LO. Using the results of ref. [7], it is easy to show [15] that this should be done in the following way. All contributions to $\mathbb{S}$ events, and the MC counterterms relevant to $\mathbb{H}$ events, are cut according to the corresponding Born configuration (which thus has a W+2 parton kinematics). The contributions of the real-emission matrix elements to $\mathbb{H}$ events are cut according to corresponding W+3 parton kinematics.

Our predictions are obtained with the electroweak parameters reported in table 1. For the (N)LO computations we use the MSTW(n)lo200868cl [28] PDFs, which also set the value of $\alpha_S(M_Z)$. The renormalization and factorization scales are chosen equal to $H_T/2$, with $H_T = \sum_i p_{T,i} + \sqrt{p_T^2(\ell\nu) + M^2(\ell\nu)}$. The sum here runs over all final-state QCD partons, and all the quantities that appear in the definition of H_T are computed at the matrix-element level, i.e., before showering. We have not included the simulation of the underlying event in our predictions.

We define jets by means of the anti-k_T algorithm [29] with $R = 0.4$, as implemented in FastJet [30]. Generation cuts are imposed by demanding the presence of at least two jets at the hard-subprocess level (hence, at this stage the inputs to the jet-finding algorithm are two- or three-parton configurations). All jets thus found are required to have either $p_T > 5\,\mathrm{GeV}$ or $p_T > 10\,\mathrm{GeV}$. The short-distance cross sections defined with these cuts are used to obtain unweighted events as customary in MC@NLO. Such events are then showered by HERWIG, and the resulting hadronic final states are used to reconstruct about sixty observables (involving leptons, jets, lepton-jet, and jet-jet correlations) for each of the two generation p_T cuts mentioned above. These observables are organized in three

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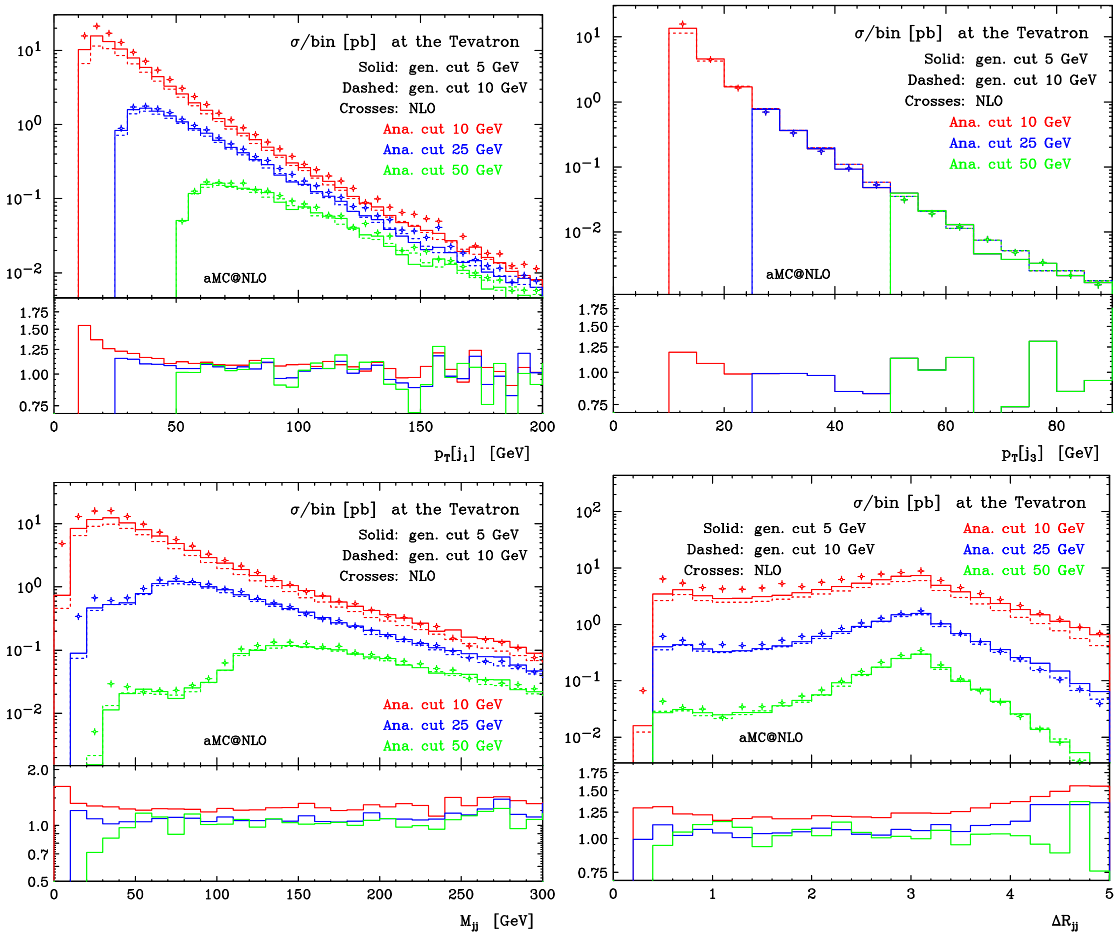

Figure 1. Transverse momentum of the hardest jet (upper left plot), transverse momentum of the third-hardest jet (upper right plot), invariant mass of the pair of the two hardest jets (lower left plot), and distance between the two hardest jets in the $\eta - \varphi$ plane (lower right plot), in Wjj events and as predicted by aMC@NLO (histograms), and with parton-level NLO computations (symbols). See the text for details.

classes, each being associated with jets[2] defined by imposing their transverse momenta to be larger than 10, 25, and 50 GeV; these conditions will be called analysis cuts henceforth. We finally check that the tighter the analysis cuts, the smaller the difference between the results obtained with the two generation cuts.

As an example of the outcome of this exercise, we present in figure 1 the transverse momentum of the hardest jet, the dijet invariant mass, and the ΔR separation between the two hardest jets. In the main frame of each plot there are six histograms: the three solid ones correspond to generation cuts $p_T = 5\,\text{GeV}$, while the three dashed ones correspond to generation cuts $p_T = 10\,\text{GeV}$. The upper (red), middle (blue), and lower (green) pairs of histograms are obtained with the analysis cuts $p_T = 10$, 25, and 50 GeV, respectively.

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[2] We stress that such jets are now reconstructed by clustering all stable final-state hadrons that emerge from the shower.

The lower insets display three curves, obtained by taking the ratios of the $p_T = 5\,\mathrm{GeV}$ generation-cut results over the $p_T = 10\,\mathrm{GeV}$ generation-cut results, for the three given analysis cuts (in other words, these are the ratios of the solid over the dashed histograms). Fully-unbiased predictions are therefore equivalent to these ratios being equal to one in the kinematic regions of interest.

Inspection of figure 1, and of its analogues not shown here, allows us to conclude that the results follow the expected pattern: when one tightens the analysis cuts, the bias due to the generation cuts is reduced, and eventually disappears. Although all observables display this behaviour, the precise dependence on generation cuts is observable-specific; the three cases of figure 1 have been chosen since they are representative of different situations. The transverse momentum of the hardest jet shown in the upper plot of figure 1 is (one of) the very observable(s) on which generation cuts are imposed. Therefore, as one moves towards large p_T's, one expects the bias due to generation cuts to decrease, regardless of values of the p_T cut used at the analysis level. This is in fact what we see. Still, a residual dependence on generation cuts can be observed at relatively large p_T's for looser analysis cuts; this could in fact be anticipated, since the events used here are Wjj ones — hence, the next-to-hardest jet will tend to have a transverse momentum as close as possible to the analysis p_T cut, and thus to the region affected by the generation bias in the case of looser analysis cuts. The dijet invariant mass, shown in the middle plot of figure 1, tells a slightly different story. Namely, the hard scale associated with this observable is not in one-to-one correspondence with that used for imposing the analysis cuts, at variance with the p_T of the hardest jet discussed previously. Hence, the effects of the generation-level cuts are more evenly distributed across the whole kinematical range considered, as can be best seen from the lower inset. Essentially, the bias here amounts largely to a normalization mismatch, which disappears when tightening the analysis cuts. Finally, the ΔR distribution, presented in the lower part of figure 1, is representative of a case where both shapes and normalization are biased. There is a trend towards larger biases at large ΔR, which is understandable since this region receives the most significant contributions from large-rapidity regions, where the transverse momenta tend to be relatively small and hence closer to the bias region. For all the observables considered in figure 1, we have also computed the parton-level NLO results (with MadFKS and MadLoop), which are shown as symbols in the plots. As can be seen from the figure, these results are quite close to the corresponding aMC@NLO ones, and especially so when the analysis cuts are tightened. Some differences can still be observed, due to the fact that the jets reconstructed using aMC@NLO events are at the hadronic level, and emerge from high-multiplicity final states.

We conclude this section with some further comments on validation exercises. Firstly, we started by testing the whole machinery in the simpler case of Wj production. Although, as was discussed before, for this process generation cuts may be imposed on $p_T(W)$, we have chosen to require the presence of at least one jet with a transverse momentum larger than a given value, so as to mimic the strategy followed in the Wjj case. Secondly, we have checked that we obtain unbiased results by suitably changing the jet-cone size. Thirdly, we have exploited the fact that the starting scale of the shower is to some extent arbitrary, and the dependence upon its value is very much reduced in the context of an NLO-PSMC matched computation. As was discussed in ref. [31], in MC@NLO the information on the starting scale is included in the MC counterterms, and the independence of the physical results of its value constitutes a powerful check of a correct implementation. We have verified that this is indeed the case, by considering several different scale choices in a neighbourhood of the partonic, Born-level, c.m. energy.

3 Wjj production at the Tevatron

The hard events obtained with the generation cuts described above can be used to impose the selection cuts employed by the CDF collaboration [1]. The latter are as follows (where with "lepton" we always mean the charged one):

- minimal transverse energy for the lepton: $E_T(\ell) > 20\,\mathrm{GeV}$;
- maximal pseudorapidity for the lepton: $|\eta(\ell)| < 1$;
- minimal missing transverse energy: $\not{E}_T > 25\,\mathrm{GeV}$;
- minimal transverse W-boson mass: $M_T(\ell\nu) > 30\,\mathrm{GeV}$;
- jet definition: JetClu algorithm with 0.75 overlap and $R = 0.4$;
- minimal transverse jet energy: $E_T(j) > 30\,\mathrm{GeV}$;
- maximal jet pseudorapidity: $|\eta(j)| < 2.4$;
- minimal jet pair transverse momentum: $p_T(j_1j_2) > 40\,\mathrm{GeV}$;
- minimal jet-lepton separation: $\Delta R(\ell j) > 0.52$;
- minimal jet-missing transverse energy separation: $\Delta\phi(\not{E}_T j) > 0.4$;
- hardest jets close in pseudorapidity: $|\Delta\eta(j_1j_2)| < 2.5$;
- lepton isolation: transverse hadronic energy smaller than 10% of the lepton transverse energy in a cone of $R = 0.4$ around the lepton.
- jet veto: no third jet with $E_T(j) > 30\,\mathrm{GeV}$ and $|\eta(j)| < 2.4$;

These cuts (and their analogues in the D0 analysis [2], which give very similar results in the "signal" region) are tighter than the $p_T = 25\,\mathrm{GeV}$ analysis cut previously discussed. Since the latter was seen to give unbiased results in the central rapidity regions relevant here, we deem our approach safe. The cuts reported above (which we dub "exclusive") have also been slightly relaxed by CDF (see [32]), by accepting events with three jets or more in the central and hard region — this amounts to not applying the jet-veto condition reported in the last bullet above; we call these cuts "inclusive".

In addition to the aMC@NLO predictions, we have performed parton-level LO and NLO computations. Finally, we have showered events obtained by unweighting LO matrix

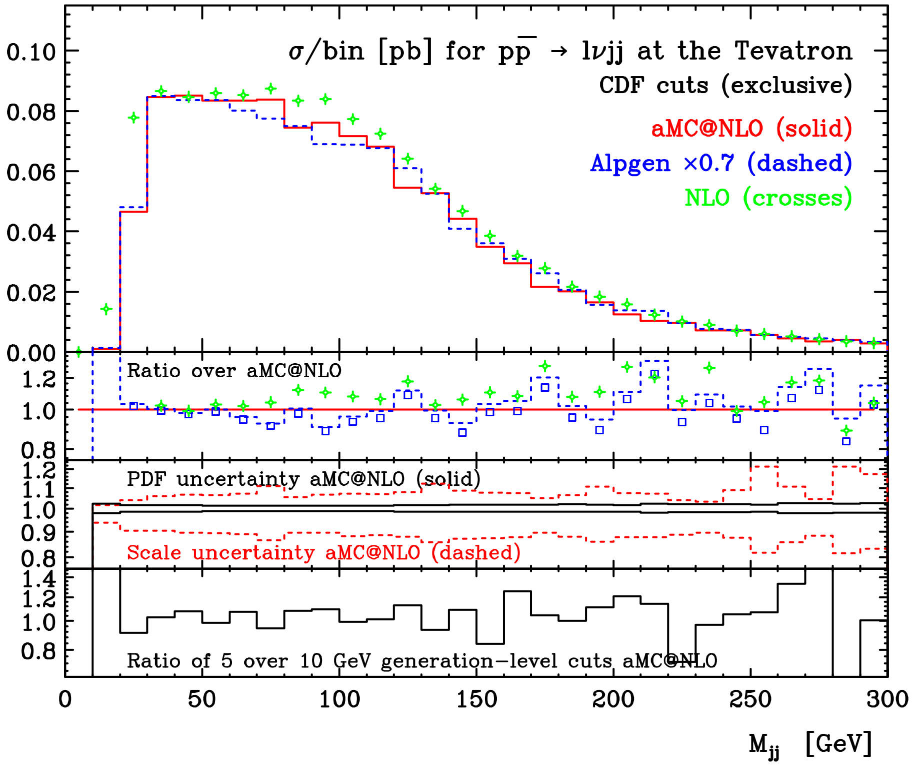

Figure 2. Invariant mass of the pair of the two hardest jets, with CDF/D0 exclusive cuts. See the text for details.

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elements as well. As is well known, the latter case is potentially plagued by severe double-counting effects which, although formally affecting perturbative coefficients of order higher than leading, can be numerically dominant. We have indeed found that this is the case for the cuts considered here: predictions obtained with generation cuts $p_T = 5\,\mathrm{GeV}$ and $p_T = 10\,\mathrm{GeV}$ (and with anti-k_T algorithm and $R = 0.4$) differ by 30% or larger for total rates (shapes are in general better agreement), even for the analysis cut of $p_T = 50\,\mathrm{GeV}$. We have therefore opted for using a matched LO sample, which we have obtained with Alpgen [33] interfaced to HERWIG through the MLM prescription [5]. In order to do this, we have generated $W + n$ parton events, with $n = 1, 2, 3$. The dominant contribution to Wjj observables is due to the $n = 2$ sample, but that of $n = 3$ is not negligible. The size of the $n = 1$ contribution is always small, and rapidly decreasing with dijet invariant masses; it is thus fully safe not to consider $W + 0$ parton events.

In figures 2 and 3 we present our predictions for the invariant mass of the pair of the two hardest jets with exclusive and inclusive cuts, respectively. The three histograms in the main frames are the aMC@NLO (solid red), Alpgen+MLM (dashed blue), and NLO parton level (green symbols) predictions. The two NLO-based results are obtained with the $p_T = 10\,\mathrm{GeV}$ generation cuts. The Alpgen+MLM curves have been rescaled to be as close as possible to the NLO ones, since their role is that of providing a prediction for the shapes, but not for the rates (incidentally, this is also what is done in the experimental analyses when control samples are not available). The upper insets show the ratios of the Alpgen+MLM

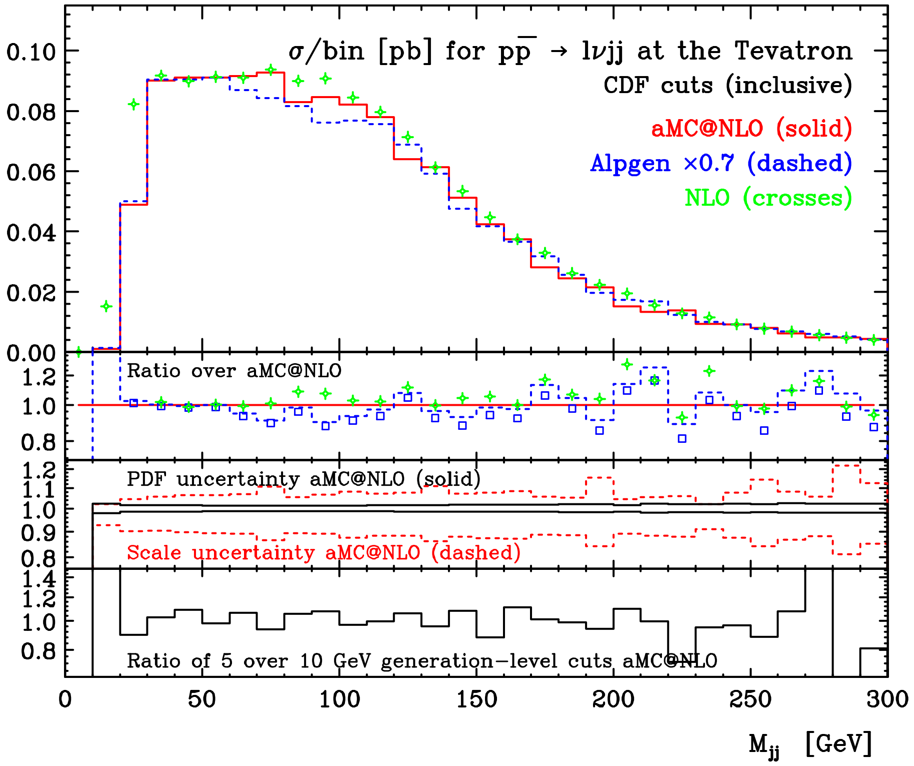

Figure 3. Invariant mass of the pair of the two hardest jets, with CDF/D0 inclusive cuts. See the text for details.

and NLO results over the aMC@NLO ones. The middle insets display the fractional scale (dashed red) and PDF (solid black) uncertainties given by aMC@NLO, computed with the reweighting technique described in ref. [34]. The lower insets show the ratios of the aMC@NLO results obtained with the two generation cuts, and imply that indeed there is no bias due to generation cuts. We have also checked that removing the lepton isolation cut does not change the pattern of the plots, all results moving consistently upwards by a very small amount. The fraction of the 10M generated events passing the inclusive-analysis cuts for the $p_T = 10\,\mathrm{GeV}$ (5 GeV) generation cuts is 0.92% (0.35%), with the fraction of negative-weight events equal to 29% (34%). In the case of exclusive cuts, the fractions of events passing the cuts are marginally smaller, and those of negative events the same as those reported above. We point out that the accuracy to which the scale dependence is determined cannot be directly inferred from these numbers, being much better than a simple counting would suggest. In fact, as discussed in ref. [34], by using a reweighting technique predictions obtained with different scale or PDF settings are correlated (i.e., they are obtained with the same random number seeds in both the NLO and the MC runs).

By inspection of figures 2 and 3, we can conclude that the three predictions agree rather well, and are actually strictly equivalent, when the theoretical uncertainties affecting aMC@NLO are taken into account (i.e., it is not even necessary to consider those relevant to Alpgen+MLM and parton-level NLO). This is quite remarkable, also in view of the fact that the dominant contribution to the latter, the scale dependence, amounts to a mere

$(+10\%, -15\%)$ effect. We have verified that such a dependence is in agreement with that predicted by MCFM [35].

In spite of their being not significant for the comparison with data, it is perhaps interesting to speculate on the tiny differences between the central aMC@NLO, Alpgen+MLM, and NLO predictions. The total rates given by aMC@NLO and NLO are close but not identical; this is normal, and is a consequence of the fact that the kinematical distributions in the two computations are different, and thus differently affected by the hard cuts considered here. More interestingly, the M_{jj} distribution predicted at the NLO is (very) slightly harder than that of aMC@NLO, especially in the case of exclusive cuts. This is best seen in the upper insets of figures 2 and 3, and is due to the fact that the fraction of events with a third central and hard jet is larger in aMC@NLO than at the parton-level NLO. This argument applies also to the case of inclusive cuts. In fact, by requiring the two hardest jets to have a large invariant pair mass, and given the presence of a W boson, one forces extra QCD radiation to be fairly soft, since relatively-hard radiation is strongly suppressed by the damping of the PDFs at large Bjorken x's. This effectively imposes a veto-like condition on the events, which however, at $M_{jj} \simeq 300\,\mathrm{GeV}$, is still larger than the explicit 30 GeV one imposed by CDF; hence, NLO predictions for inclusive cuts are slightly harder than the aMC@NLO ones, but less than in the case of exclusive cuts. We point out that a veto on the third jet (be it explicit or effective) introduces a new mass scale in the problem, whose ratio over M_{jj} may grow large. In such a situation, the resummation of large logarithms performed by the shower constitutes an improvement over fixed-order results. Given the level of agreement we find here, we can conclude the resummation effects are still fairly marginal.

As far as the comparison between the central aMC@NLO and Alpgen+MLM predictions is concerned, this is affected by the choice of the hard scales, which are different in the two codes: in Alpgen, the transverse W-boson mass is adopted (the renormalization scale is then effectively redefined through the reweighting of the matrix elements by α_S factors, which is specific of the merging procedure [3]). In spite of this, the agreement between the two results is quite good, with Alpgen+MLM being slightly harder than aMC@NLO (this effect being of the same order or smaller than that observed with parton-level NLO results). We have also compared Alpgen+MLM with aMC@NLO, by setting the hard scales in the latter equal to the transverse W-boson mass.[3] The ratio of these two results is shown as open boxes in the upper inset of figures 2 and 3, whence one sees a marginal improvement in the agreement between the two predictions w.r.t. the case corresponding to $\mu = H_T/2$, which is our aMC@NLO default. We finally stress again that the MLM prescription is crucial to get rid of double-counting effects in LO samples. While double counting is guaranteed not to occur at the NLO in MC@NLO, it can still affect terms of $\mathcal{O}(\alpha_S^4)$ and beyond. Although we did not see any evidence of these in the form of generation-cut dependence, we have also heuristically extended the MLM prescription to NLO, by requiring the two hardest jets after shower to be matched with two jets reconstructed at the hard-subprocess

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[3] Note that, since we determine the scale dependence through the reweighting technique of ref. [34], we do not need to run aMC@NLO a second time.

level (where they play the same roles as the partons in the original MLM matching). This prescription has had no visible effect on our results. Although this is a process-dependent conclusion, it confirms the naive expectation that NLO-PSMC matching is less prone to theoretical systematics than its LO counterpart, and suggests that a reduction of the dependence upon unphysical merging parameters can be achieved by extending the CKKW or MLM procedures to the NLO.

4 Conclusions

In this paper, we have presented the automated computation of the Wjj cross section to the NLO accuracy in QCD, and its matching to parton showers according to the MC@NLO formalism. This is the first time that a process of this complexity has been matched to an event generator beyond the LO. We believe this is significant not only as a phenomenological result, but also in view of the fact that it is also the first time that the MC@NLO prescription has been applied to a process that requires the presence of cutoffs at the Born level in order to prevent phase-space divergences from appearing. In fact, the structure of such divergences in Wjj production is sufficiently involved to provide evidence that no new problems of principle are expected in the application of MC@NLO to processes with even larger final-state multiplicities.

We have given predictions for the dijet invariant mass in Wjj events, using the same cuts as CDF and D0 in the signal region. Perturbative, parton-level results agree well with those obtained after shower, and we do not observe any significant effects in the shape of distributions due to NLO corrections, which therefore cannot be responsible for the excess of events observed by the CDF collaboration.

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