Signal-background interference effects for $gg \to H \to W^+W^-$ beyond leading order

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We study the effect of QCD corrections to the $gg \to H \to W^+W^-$ signal-background interference at the LHC for a heavy Higgs boson. We construct a soft-collinear approximation to the next-to-leading order (NLO) and next-to-next-to-leading order (NNLO) corrections for the background process, which is exactly known only at leading order (LO). We estimate its accuracy by constructing and comparing the same approximation to the exact result for the signal process, which is known up to NNLO, and we conclude that we can describe the signal-background interference to better than $\mathcal{O}(10\%)$ accuracy. We show that our result implies that, in practice, a fairly good approximation to higher order QCD corrections to the interference may also be obtained by rescaling the known LO result by a K factor computed using the signal process.

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I. INTRODUCTION

Search for the Higgs boson at the LHC has been a remarkable success so far. Indeed, both the ATLAS and CMS collaborations have announced the discovery of a new boson, whose properties are compatible with that of the Standard Model Higgs particle, with mass $m_h \approx 125$ GeV. Both collaborations also excluded additional Higgs-like bosons in a large mass range $m_h \lesssim 600$ GeV [1,2]. The interpretation of the excesses observed in various production and decay channels, as originating from a single spin-zero particle, was made possible by detailed theoretical predictions for the Higgs boson production and decay rates; see Ref. [3] for an overview.

However, these experimental results do not imply that there are no additional Higgs-like bosons with masses 600 GeV $\lesssim m_h \lesssim 1$ TeV. In fact, the search for such particles is well underway [4]. In the Standard Model, as the Higgs boson becomes heavier, its total decay width grows rapidly $\Gamma_h \sim m_h^3$ thanks to contributions of the longitudinal electroweak bosons: for $m_h \sim 600$ GeV, the width is close to 120 GeV. Since the finite-width effects change the distribution of the invariant masses of the decay products of the Higgs boson, their understanding is important for developing experimental search strategies.

There are two finite width effects that influence the Higgs boson line shape. First, the Higgs propagator must assume the Breit-Wigner form in the resonant regime $1/(s - m_h^2) \to 1/(s - m_h^2 + im_h\Gamma_h)$. While this modification is literally correct for a light (and therefore narrow) Higgs boson, for a heavy Higgs, it must be modified; the proper way to do this was subject to a significant discussion in recent literature; see Refs. [5,6] and references therein. The second effect is the interference with the background. Note that, in principle, the two effects are not completely independent of each other since modifications of the Breit-Wigner form for the propagator change the very definition of the "background" in the resonance region, but discussion of these subtleties is beyond the scope of this paper.

Our goal is to consider the interference of the signal process $gg \to H \to W^+W^-$ and the background process $gg \to W^+W^-$ for a *heavy* Higgs boson.[1] This interference was first computed at leading order in Refs. [7,9]. Although the $gg \to W^+W^-$ amplitude appears at one loop, it is enhanced at the LHC by the large gluon flux, making the interference effects non-negligible. An obvious shortcoming of Refs. [7,9] is that their analysis of the interference is performed at leading order in perturbative QCD as far as the Higgs boson signal is concerned. This is unfortunate since, for the Higgs boson signal, higher order QCD corrections are extremely important, as they enhance the total rate by more than a factor two [10–12]. It is therefore interesting to explore their impact on the signal-background interference.

Such an endeavor, however, is highly nontrivial. Indeed, a full next-to-leading order (NLO) and next-to-next-to-leading order (NNLO) QCD calculation of background amplitudes requires evaluation of two- and three-loop $2 \to 2$ Feynman diagrams which is beyond the reach of the current computational technology. On the other hand, it is well known [13] that for the Higgs boson signal a large fraction of radiative corrections is captured by the soft-collinear approximation. Since this approximation should be particularly suitable for the description of a *heavy* Higgs boson, we construct a soft-collinear approximation for the entire $gg \to W^+W^-$ amplitude that includes both the signal and the background and study the impact of these corrections on the interference.

[1]For the light $m_h = 125$ GeV Higgs boson the interference is negligible if proper signal-selection criteria are applied [7,8].

This paper is organized as follows. In Sec. II we sketch the construction of the soft-collinear approximation. In Sec. III we present numerical results. We conclude in Sec. IV.

II. SETUP

We begin by describing the setup of our computation. We are interested in higher order QCD corrections to the interference between the signal process $gg \to H \to W^+W^-$ and the pure QCD background $gg \to W^+W^-$. We compute these corrections in the soft gluon approximation, which is known to describe the full NLO and NNLO Higgs cross section to very good accuracy. We will numerically assess the accuracy of our approximation in Sec. III by comparing it with known NLO and NNLO results for the signal process.

The cross section for the production of a W^+W^- pair with invariant mass Q^2, fully differential in the kinematics variables of the two W's, is given by

$$\begin{aligned} \mathrm{d}\sigma(\tau, y, \{\theta_i\}, Q^2) = \int & \mathrm{d}x_1 \mathrm{d}x_2 \mathrm{d}z f_g(x_1, \mu_\mathrm{F}) f_g(x_2, \mu_\mathrm{F}) \\ & \times \delta(\tau - x_1 x_2 z) \\ & \times \mathrm{d}\hat\sigma\left(z, \hat y, \{\hat\theta_i\}, \alpha_s, \frac{Q^2}{\mu_\mathrm{R}^2}, \frac{Q^2}{\mu_\mathrm{F}^2}\right), \end{aligned} \tag{1}$$

where f_g is the gluon distribution, and $\mathrm{d}\hat\sigma$ is the differential partonic cross section for the process

$$g(p_1) + g(p_2) \to W^+(p_{W^+}) + W^-(p_{W^-}) + X, \tag{2}$$

with $(p_{W^+} + p_{W^-})^2 = Q^2$; μ_F and μ_R are the factorization and the renormalization scales, $\alpha_s = \alpha_s(\mu_\mathrm{R})$ is the strong coupling constant at the scale μ_R, $\tau \equiv Q^2/s$. We denote by y the rapidity of the W pair, and by $\{\theta_i\}$ a generic set of variables describing the kinematics of the decay products of the W^+W^- system in the hadronic center-of-mass frame; they are related to the corresponding variables $\hat y, \{\hat\theta_i\}$ in the partonic center-of-mass frames by a boost with rapidity $y_\mathrm{cm} = \frac{1}{2}\ln\frac{x_1}{x_2}$, and thus the $\hat\theta_i$ are functions of $\{\theta_i\}$, x_1, x_2 and z.

In the soft ($z \to 1$) limit, the rapidity distribution of the W^+W^- pair is entirely determined by the inclusive cross section [14–16], up to corrections suppressed by powers of $(1-z)$, and the partonic cross section in Eq. (1) takes the form

$$\begin{aligned} &\mathrm{d}\hat\sigma\left(z, \hat y, \{\hat\theta_i\}, \alpha_s, \frac{Q^2}{\mu_\mathrm{R}^2}, \frac{Q^2}{\mu_\mathrm{F}^2}\right) \\ &\quad = \mathrm{d}\hat\sigma^{(0)}(\{\hat\theta_i\}, \alpha_s) z G\left(z, \alpha_s, \frac{Q^2}{\mu_\mathrm{R}^2}, \frac{Q^2}{\mu_\mathrm{F}^2}\right), \end{aligned} \tag{3}$$

where $\mathrm{d}\hat\sigma^{(0)}(\{\hat\theta_i\}, \alpha_s)\delta(1-z)$ is the leading order partonic cross section, and $G(z, \alpha_s, Q^2/\mu_\mathrm{R}^2, Q^2/\mu_\mathrm{F}^2)$ is the inclusive coefficient function computed in the soft limit, i.e. (up to the explicit z factor) the inclusive partonic cross section normalized to the leading order in such a way that $G(z, \alpha_s) = \delta(1-z) + \mathcal{O}(\alpha_s)$.

In the same limit, the momenta of the W bosons in the partonic center-of-mass frame are given by

$$\hat p_{W^\pm} = \frac{\sqrt{Q^2}}{2}(1, \pm\beta\sin\hat\theta, 0, \pm\beta\cos\hat\theta) \tag{4}$$

with $\hat\theta$ the W boson scattering angle in the partonic center-of-mass frame, and $\beta = \sqrt{1 - 4m_W^2/Q^2}$ (for simplicity, we have assumed that the W bosons are on shell, but we will not make this assumption in the sequel). The kinematics of the process in the soft limit is therefore the same as the leading order kinematics, except that the total energy squared is rescaled by a factor z.

The boost that relates the partonic and hadronic center-of-mass frames is fixed by taking for the momenta of the colliding gluons either $p_1 = zx_1P_1$, $p_2 = x_2P_2$ or $p_1 = x_1P_1$, $p_2 = zx_2P_2$, where $P_{1,2}$ are four-momenta of the colliding protons [15]. Alternatively, one may also take as momenta of the colliding gluons $p_1 = \sqrt{z}x_1P_1$, $p_2 = \sqrt{z}x_2P_2$ [14]. These two choices coincide in the soft limit up to terms suppressed by two powers of $(1-z)$ [16] and, in fact, give very similar results for observables considered in this paper. We will make the first choice at NLO, where it is actually exact, while at NNLO we will take the average of the results obtained with either choice cases.

We now turn to the explicit form of the coefficient function $G(z, \alpha_s, Q^2/\mu_\mathrm{R}^2, Q^2/\mu_\mathrm{F}^2)$, which contains the core of our soft-collinear approximation. We first sketch the important features of the soft gluon approximation and its modifications by focusing on the next-to-leading order. Further details on this, including required modifications at NNLO, can be found in Refs. [17,18].

Working to NLO accuracy and in the soft limit and neglecting all nonsingular terms, we write the function G as (we suppress explicit scale dependence for simplicity)

$$\begin{aligned} G(z, \alpha_s) = \delta(1-z) + \frac{\alpha_s}{2\pi}\Big[& 8C_A\mathcal{D}_1(z) \\ & + \left(\frac{2\pi^2}{3}C_A + c_1\right)\delta(1-z)\Big], \end{aligned} \tag{5}$$

where $\mathcal{D}_i(z) = [\ln^i(1-z)/(1-z)]_+$ and c_1 is the ratio of the infrared regulated higher order virtual contributions to the cross section and the leading order cross section for $gg \to W^+W^-$; see [17] for its proper definition.[2] For our purposes, the important feature of this formula is that nonuniversal NLO corrections for the process $gg \to WW$ only enter through the coefficient c_1. This is because only emissions from external gluon lines in each diagram

[2]Because we consider here the $2 \to 2$ scattering process, c_1 does depend on the scattering angle. We assume that this dependence is mild and systematically ignore it in this paper. Partial justification for this assumption is given below.

contribute to the amplitude in the soft limit. For the signal-only process $gg \to H \to WW$, c_1 is known both in the infinite m_t [19,20] approximation and for finite m_t [21]. The determination of c_1 for the interference would require the evaluation of complicated $gg \to W^+W^-$ amplitudes which is beyond existing technical capabilities.

However, we note that the value of c_1 can be obtained without any computation in the kinematic limit $4m_W^2 \ll Q^2 \ll 4m_t^2$, $m_b \sim m_t$. In this limit, the interference is dominated by the contribution of longitudinally polarized W bosons, which can be obtained from QCD corrections to the production of two neutral scalars $gg \to HH$ in the heavy top mass limit [22]. Since both the box contribution for $gg \to HH$ and the triangle contribution for $gg \to H$ are described by the same effective Lagrangian, the virtual QCD corrections should be identical in the two cases. Although the assumptions $Q^2 \ll 4m_t^2$, $m_t \sim m_b$ are not really justified, we take the value for c_1 that is obtained in that limit as a reference value, and estimate the sensitivity of the final result to its variations.

The soft approximation of Eq. (5) is of course only defined up to subleading terms. An optimal choice of subleading terms can be found [18] by using a combination of analiticity arguments in Mellin space, and information on universal subleading terms in the $z \to 1$ limit, arising partly from the exact soft-gluon kinematics [16] and partly from universal collinear splitting kernels [13,23]. A discussion of this optimal soft approximation is beyond the scope of this paper, and we refer to Ref. [18] for a full discussion. Here, we note that the best approximation proposed in [18] (called soft$_2$ there) effectively amounts to performing in Eq. (5) the replacement

$$\mathcal{D}_i(z) \to \mathcal{D}_i(z) + \delta\mathcal{D}_i(z),$$
$$\delta\mathcal{D}_i(z) = (2 - 3z + 2z^2)\frac{\ln^i \frac{1-z}{\sqrt{z}}}{1-z} - \frac{\ln^i(1-z)}{1-z}, \quad (6)$$

where $\delta\mathcal{D}_i(z)$ is an ordinary function (not a distribution). In what follows, we will call the approximation based on Eq. (5) with such replacement a "soft-collinear" approximation. We will quantify the impact of subleading effects by comparing this improved soft-collinear approximation to a purely soft result.

At higher orders the soft approximation Eq. (5) is also known: see e.g. Eq. (79) in [17]. We improve it analogously to Eq. (6); see Ref. [18] for details. This soft-collinear approximation is the basis for the NLO and NNLO numerical results for the signal and the interference that we discuss in the next section.

III. NUMERICAL RESULTS

We consider the process $gg \to W^+(e^+\nu)W^-(e^-\bar{\nu})$ at the LHC for two values of the center-of-mass energy: $\sqrt{s} = 8$ TeV and $\sqrt{s} = 13$ TeV. We take the Higgs mass to be $m_h = 600$ GeV, and its total decay width to be $\Gamma_h = 122.5$ GeV [24]. All numerical results presented below are obtained with a fixed-width Breit-Wigner function. We have checked that use of the running width in the Breit-Wigner propagator [25] leads to results for the signal and interferences that differ by an amount that is below our accuracy goal, and we expect that the same is likely to be the case for a full treatment of finite-width effects [5,6]. Moreover, we have found that the QCD radiative corrections are insensitive to the propagator, to the accuracy we work to. We let both the W bosons decay leptonically and reconstruct all kinematic variables from the charged lepton and neutrino momenta. We take the W total width to be $\Gamma_W = 2.11$ GeV and heavy quark masses $m_t = 172.5$ GeV and $m_b = 4.4$ GeV.

We use the NNPDF2.3 parton distribution functions (PDF) set [26] at NLO and NNLO, with $\alpha_s(m_Z) = 0.118$. Throughout this paper, we set the renormalization and factorization scales equal to the Higgs boson mass $\mu_{\rm R} = \mu_{\rm F} = m_h$. In constructing our soft-collinear approximation, we retain the exact m_t and m_b dependence where available. For example, we use the exact value of c_1, Eq. (5), for the signal process, while for the analogous $\mathcal{O}(\alpha_s^2)$ coefficient c_2 we use the value computed in the infinite m_t (pointlike) approximation. Note that with this choice, all logarithmic terms at NNLO have the exact m_t and m_b dependence, while the coefficient of the $\delta(1-z)$ term is only approximate. As mentioned in Sec. II, for the interference we take the result in the $m_W^2 \ll Q^2 \ll m_t^2$, $m_b \sim m_t$ limit as our reference value.

To assess the quality of the soft-collinear approximation, we first test it against the signal-only $gg \to H$ process at NLO and NNLO. Results are shown in Table I for two values of the collider energy. The K factors computed (without including the Higgs decay) using the exact theory[3] are compared to those obtained with our soft-collinear approximation, or with the so-called N-soft approximation, defined in Ref. [18]. The latter amounts to approximating the partonic cross section with the inverse Mellin transform of a pure N-space soft approximation, in which only powers of $\ln N$ and constant terms are kept.

Both approximations reproduce the exact result to $\mathcal{O}(3\%)$ or better in all configurations. At $\sqrt{s} = 8$ TeV, where the soft-collinear terms are expected to dominate [28], our soft-collinear approximation reproduces the exact result to better than $\mathcal{O}(2\%)$, while at higher energy, $\sqrt{s} = 13$ TeV, the agreement deteriorates slightly, because

[3] At NNLO, an exact result valid for large Higgs masses is not currently available. For our result, we use the exact result at NLO [19] plus the pointlike result at $O(\alpha_s^2)$, improving it with those m_t, m_b dependent terms which are fully determined by lower orders (which include all soft-collinear terms). We have checked that the result obtained in this way is stable upon variation of small-z terms up to the accuracy shown in Table I, which is a consequence of the dominance of soft-collinear terms for a heavy Higgs boson at the LHC [28].

TABLE I. K factors for the inclusive Higgs-only cross section in the narrow width approximation, with $m_h = 600$ GeV, computed using the exact theory, our best soft-collinear approximation, and an unimproved soft approximation (see text for details). The (N)NLO result is computed using (N)NLO PDFs, while the reference LO cross section is always computed with NLO PDFs. Numerical results are obtained using the code found in [27].

	$\sqrt{s} = 8$ TeV		$\sqrt{s} = 13$ TeV	
	NLO	NNLO	NLO	NNLO
exact	2.150	2.78	2.074	2.67
soft collinear	2.187	2.820	2.127	2.730
N soft	2.135	2.700	2.073	2.607

TABLE II. Results (in fb) for the Higgs-only cross section σ_H and the signal + interference cross section σ_{Hi}, with $m_h = 600$ GeV. No cuts on the final state applied. The errors represent the uncertainty on the soft-collinear approximation and on the unknown background coefficients, estimated as explained in the text.

	$\sqrt{s} = 8$ TeV			$\sqrt{s} = 13$ TeV		
	LO	NLO	NNLO	LO	NLO	NNLO
σ_H	0.909	1.99(5)	2.6(1)	3.77	8.1(2)	10.3(5)
σ_{Hi}	1.188	2.6(1)	3.4(3)	4.56	9.7(4)	12.5(9)
$\sigma_H/\sigma_H^{\rm LO}$		2.19(5)	2.8(1)		2.14(5)	2.7(1)
$\sigma_{Hi}/\sigma_{Hi}^{\rm LO}$		2.2(1)	2.9(2)		2.13(9)	2.8(2)

nonsoft terms become relatively more important. However, whereas at NNLO the soft-collinear approximation is more accurate than the N-soft approximation, at NLO the opposite happens. This occurs because numerically the N-soft approximation happens to be closer to the exact result than our improved soft-collinear one in the small-N limit. Since the small-N limit is beyond the region of applicability for both of these approximations, we consider this feature to be accidental but note that one can improve both of these approximations by matching them to the correct small-N limit [29]. In what follows we use the soft-collinear approximation as the default and take the spread of values between the soft-collinear and the N-soft approximations as an estimate of the uncertainty due to deficiencies of these approximations in the small-N region.

We have also checked the reliability of our approximation for differential distributions when decays are included. Indeed, at NLO accuracy, we find that our approximate results for the lepton p_t and rapidity distributions and for the lepton invariant mass m_{ll} distribution are in good agreement with the full result obtained from MCFM [30].

Having assessed the accuracy of our approximation, we can now apply it to study higher order corrections to the signal-background interference. As explained in the previous section, we need the exact leading order prediction for the interference. We extract it from Ref. [7], as implemented in MCFM. For the Higgs boson signal, we use the exact expression obtained as discussed above. For the background, we include the contributions of all the three quark generations; see [7] for details. We also need the infrared-regulated virtual cross section c_1, and the analogous NNLO coefficient c_2. As already mentioned, we take the signal values for these coefficients $\bar{c}_{1,2}$ as a reference, and study the impact of virtual corrections on the interference by varying $c_{1,2}$ in the range $-5\bar{c}_{1,2} < c_{1,2} < 5\bar{c}_{1,2}$.

We first discuss the impact of QCD corrections on the inclusive cross section. Following Ref. [7], we compare the signal-only cross section σ_H with the background-subtracted cross section $\sigma_{Hi} \equiv \sigma_{gg\to WW} - \sigma_{gg\to WW}|_{\rm bg\,only}$, which includes interference effects. We report our results for the signal only cross section σ_H and the signal +interference cross section σ_{Hi} for $c_{1,2} = \bar{c}_{1,2}$ in Table II. To facilitate the comparison with the results of Ref. [7], LO results are computed using NLO PDFs. For the signal, the quoted error is obtained by comparing our soft-collinear approximation to the N-soft approximation. For the background, we also consider the additional uncertainty coming from independently varying the $c_{1,2}$ coefficients for the first two and the third generation in the $-5\bar{c}_{1,2} < c_{1,2} < 5\bar{c}_{1,2}$ range. This leads to an uncertainty of about 6% on the interference predictions which, combined with the uncertainty of the soft approximation, gives an overall uncertainty of about 8%–9% at NNLO; see Table II. This uncertainty is of same order of magnitude as the current uncertainties in the Higgs production rate $\sigma_{\rm NNLO}$ related to higher order QCD radiative corrections, PDF and α_s uncertainties etc.; see [3]. We conclude that our approach to estimate higher order corrections to the signal-background interference in the Higgs production offers a robust framework and adequate phenomenological precision.

We turn to a discussion of the impact of the interference in a more realistic setup, by imposing selection cuts on leptons and neutrinos. Apart from the standard acceptance cuts on the lepton rapidity η_l, lepton transverse momentum p_t, and missing energy $\not{E}_t$,

$$|\eta_l| < 2.5, \qquad p_t > 25 \text{ GeV}, \qquad \not{E}_t > 20 \text{ GeV}, \qquad (7)$$

we impose additional signal-enhancement cuts, linearly extrapolating numerical values given in Ref. [31]. To this end, we require at least one lepton with $p_t > 130$ GeV, and

TABLE III. Same as Table II, but with Higgs-based cuts on the final state. See text for details.

	$\sqrt{s} = 8$ TeV			$\sqrt{s} = 13$ TeV		
	LO	NLO	NNLO	LO	NLO	NNLO
σ_H	0.379	0.83(2)	1.07(5)	1.55	3.29(8)	4.2(2)
σ_{Hi}	0.427	0.93(3)	1.20(7)	1.66	3.5(1)	4.5(2)
$\sigma_H/\sigma_H^{\rm LO}$		2.19(5)	2.8(1)		2.13(5)	2.7(1)
$\sigma_{Hi}/\sigma_{Hi}^{\rm LO}$		2.19(7)	2.8(2)		2.12(6)	2.7(1)

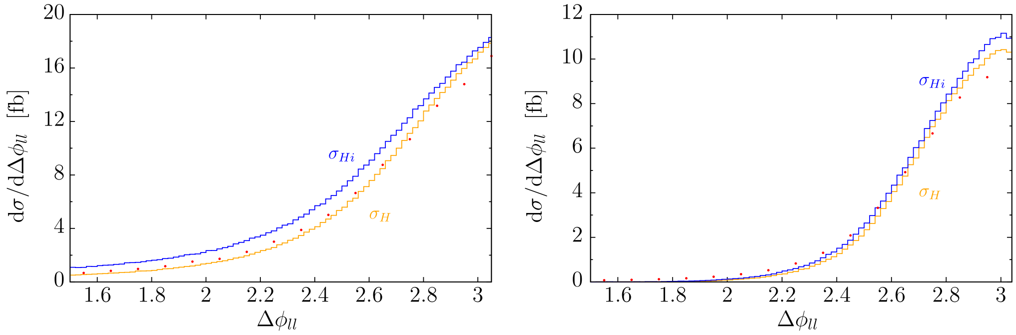

FIG. 1 (color online). Lepton azimuthal distance $\Delta\phi_{ll}$ distribution in the fully inclusive case (left panel) and with experimental cuts (right panel) computed with the NNLO QCD soft-collinear approximation described in the text. Dots show the rescaled MCFM result for the signal $d\sigma_{\mathrm{NLO}}^{\mathrm{MCFM}} \times K_{\mathrm{NNLO}}/K_{\mathrm{NLO}}$, where $K_{\mathrm{(N)NLO}}$ is the inclusive K factor.

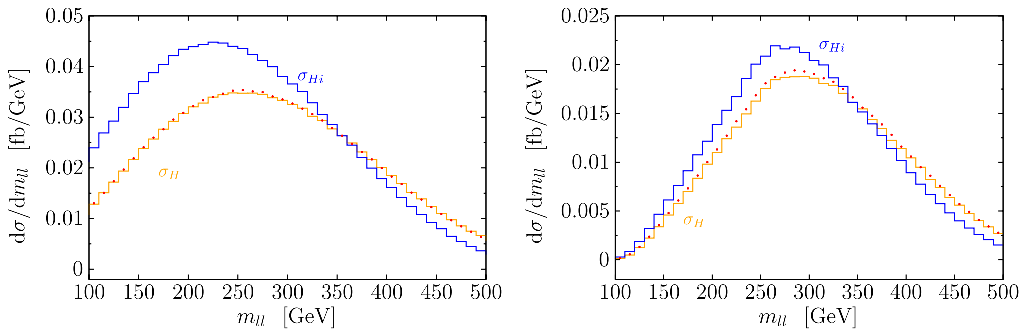

FIG. 2 (color online). Same as Fig. 1, but for the lepton invariant mass m_{ll} distribution.

impose the following cuts on the lepton invariant mass m_{ll}, azimuthal separation $\Delta\phi_{ll}$ of the two leptons and transverse mass of the W^+W^- pair $m_\perp$:

$$m_{ll} < 500\ \mathrm{GeV}, \qquad \Delta\phi_{ll} < 3.05, \qquad 120\ \mathrm{GeV} < m_\perp < m_h. \tag{8}$$

We note that we have validated the soft-collinear approximation at NLO QCD against MCFM for the differential distributions, so that we believe that our results are reliable even when cuts on the final state are imposed. We report our results in Table III. We see that the impact of the interference is mildly (but notably) reduced when the Higgs-selection cuts are applied to the final state particles. Note also that radiative corrections to the interference are rather similar to corrections to the signal cross section.

We conclude this section by showing the effect of the interference on selected kinematic distributions at the 13 TeV LHC. In Fig. 1 we plot the difference of the azimuthal angle $\Delta\phi_{ll}$ of the two charged leptons with (right panel) and without (left panel) Higgs-selection cuts. In Fig. 2 we do the same for the invariant mass of the charged leptons m_{ll}. We plot the NNLO QCD results obtained with our soft-collinear approximation as described in Sec. II, using $c_{1,2} = \bar{c}_{1,2}$ for the interference case. We see that the Higgs-selection cuts reduce the importance of the interference, as already seen in the total rate.

An interesting feature of our results is that our approximation reproduces, to a good accuracy, all the kinematic distributions as obtained with MCFM. In particular, all the distributions can be perfectly reproduced by rescaling the MCFM leading order distributions by the inclusive NNLO K factor. For the signal, we also compare our NNLO approximation against the known NLO distributions, rescaled by the NNLO/NLO inclusive K factor (also shown in the plots). Also in this case, the agreement is excellent; the only exception is the azimuthal angle distribution where differences are seen at large relative angles. This is due to the fact that our soft-collinear approximation does not reproduce the effects of a hard emission, which modify the angular distribution. Note, however, that the azimuthal angle cut plays an insignificant role in separating the *heavy* Higgs boson from the background so that the impact of this mismatch on corrections to the interference is minor.

IV. CONCLUSIONS

We have estimated the impact of QCD radiative corrections on the signal-background interference in a $gg \to H \to W^+W^-$ process for a heavy Higgs boson. We constructed a soft-collinear approximation to higher order

QCD corrections and verified its validity by comparing it to exact results for $gg \to H$, including kinematic distributions of the Higgs decay products. We find that QCD radiative corrections enhance the signal-background interference by a significant amount which, however, is very similar to the perturbative QCD enhancement of the signal cross section.

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