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The process gg → WW as a background to the Higgs signal at the LHC

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Abstract: The production of W pairs from the one-loop gluon fusion process is studied. Formulas are presented for the helicity amplitudes keeping the top mass finite, but all other quark masses zero. The correlations among the leptons coming from the W bosons are kept. The contribution of this background to the Higgs boson search in the WW decay mode at the LHC is estimated by applying the cuts foreseen in experimental searches using the PYTHIA Monte Carlo program. Kinematic distributions for the final state leptons are compared to those of the Higgs boson signal and of the $q\bar{q} \to WW$ background. After applying final cuts, the gg background is found to be large, at the level of 35% of the $q\bar{q}$ background. The characteristics of the gg background are very similar to those of the signal. Therefore, an experimental normalization of this background component appears to be very difficult and the uncertainty must largely be determined by theory. As a result, the significance of a Higgs signal in the $gg \to H \to WW$ mode at the LHC is reduced.

Keywords: Higgs Physics, Standard Model, Hadronic Colliders.

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Contents

1. Introduction

The Standard Model is well established and in agreement with all collider data. The only part of the model, not explored so far, is the Higgs sector. Because this sector plays a distinguished role in the theory, being responsible for the masses and mixings of all particles, the search for the Higgs boson is one of the highest priorities at the LHC. Within the Standard Model all properties of the Higgs boson are fixed when its mass is known. From indirect limits the Higgs boson is expected to have a mass in the range $114.4\,\mathrm{GeV/c^2} < m_H < 246\,\mathrm{GeV/c^2}$ (95% C.L.) [1]. When the Higgs mass is above the Z pair threshold, it decays with a large branching fraction into Z bosons, that can be discovered in the "golden" $\ell^+\ell^+\ell^-\ell^-$ decay mode. As long as $m_H \gtrsim 130$ $\mathrm{GeV/c^2}$ the decay into four leptons can still be used. Within the region $155\,\mathrm{GeV/c^2} < m_H < 170\,\mathrm{GeV/c^2}$ the ZZ^* branching fraction goes through a minimum, while the WW^* decay mode opens up. In this mass range the $gg \to H \to WW \to \ell\nu\,\ell\nu$ [2] and the recently established vector boson fusion mode $qq \to qqH \to qqWW \to qq\,\ell\nu\,\ell\nu$ [3–5] have the largest discovery potential. Since two neutrinos appear in the final state, no invariant mass peak can be reconstructed. This implies that there is a large background from the W pair production process $q\bar{q} \to WW$. This background can only be reduced by considering the specific differences in distributions between the signal and background processes. The first important difference is in the rapidity distributions of the final state leptons. The $q\bar{q} \to WW$background tends to be produced at a larger rapidity, because of the harder distribution of the valence quarks, whereas the signal comes from gluon fusion. The second difference lies in the lepton correlations, since the W bosons from the Higgs boson decay are in a scalar state. It was shown in ref. [2] that it is possible, using these differences, to strongly improve the signal-to-background ratio, in comparison to older calculations that ignored the spin correlations [6, 7]. To get a high confidence level for the signal, a normalization of the background is needed in a phase space region where the signal contribution is small. Using Monte Carlo calculations an extrapolation into the signal region needs to be performed. Hereby it is assumed that the shape of the distributions can be well predicted, even when the normalization is uncertain.

The features that distinguish the $q\bar{q}$ background from the signal are absent in the $gg \to WW$ process. Since the gg process can be quite large in the signal region, a calculation of this process is necessary. The gluon fusion process has been studied in the literature before, however, without accounting for correlations among the final decay products [8, 9]. For the $gg \to ZZ$ process, full calculations with correlations do exist [10, 11]. These programs can easily be adapted to the production of W bosons, as long as the quarks inside the loop are degenerate, so as to describe the effect of the light quarks only. For the top-bottom generation this is not correct and one has to separately calculate this contribution to the helicity amplitudes. The formulas will be rather complicated compared to the formulas of ref. [12] in the massless case. Since a priori the presence of a heavy particle in the loop can affect the distributions, one has to check this contribution. Ultimately we found out, however, that the effect is negligible (10%) as compared to the calculation with only the light quarks.

The programs for the cross section calculation were interfaced with the PYTHIA Monte Carlo program [13], so as to allow for a more realistic analysis. The comparison between the two backgrounds was performed at leading order, since no K-factor for the gluon process is known. Next-to-leading order (NLO) programs exist for the $q\bar{q}$ process [14–19], however, only rough estimates on the significance of the K-factors for the backgrounds can be made at present.

The outline of the paper is as follows: in section 2 some theoretical issues are discussed, in section 3 the simulation and the event selection is presented, in section 4 results for the different distributions are given and conclusions are drawn in section 5. The new formulas for the helicity amplitudes are given in the appendix.

2. Theoretical issues

For the process $gg \to W^+W^-$, which appears first at the one loop level, a new calculation has been performed. In this calculation we included the full dependence on the masses of the quarks inside the loop but restricted ourselves to on-shell W bosons and used the narrow-width approximation instead. Only the box graphs contribute. Off-shell W bosons would only be interesting in the threshold region, but otherwise lead to negligible corrections, since there is no interference with the signal. The contribution of the squared top-quark loop is of the order of 1% while the interference with light quarks gives a contribution of the order of 10%.

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To obtain the full spin correlation we calculated the helicity amplitudes for $gg \to WW$ and used spin matrices to combine them with the polarized decay amplitudes for $W \to \ell\nu$. The calculation has been performed using standard techniques [20, 21] to reduce the tensor integrals appearing in the calculation and has been checked in several limits against known calculations [8, 10, 12]. The remaining scalar integrals have been evaluated numerically using the programs of Refs. [22, 23]. The helicity amplitudes can be obtained from the authors[1] together with the full Monte Carlo program.

Since no NLO calculation is available, the effect of the NLO corrections can at present only be estimated. Since the calculation is at leading order, the renormalization scale dependence emerges only from the parton distribution functions (pdf) and the running of α_s and we chose $Q^2 = \hat{s}/4$.

3. Simulation and event selection

In several studies [2, 24, 25] it has been shown that the $q\bar{q} \to WW$, top pair and single top production constitute the principal backgrounds in the Higgs boson search in the $gg \to H \to WW \to \ell\nu\,\ell\nu$ mode. In the present study the $gg \to WW$ contribution of the background is compared to the $q\bar{q} \to WW$ and $t\bar{t}$ backgrounds. Both the Higgs boson signal and the background processes were generated with PYTHIA 6.226 [13] using the CTEQ5L [26] structure function parametrization. The decays of the W bosons into all lepton flavours ($e\nu, \mu\nu$ and $\tau\nu$) have been included. Since in the event selection only electrons and muons are considered, tau leptons only contribute if they decay leptonically. For the $q\bar{q} \to WW$ process the full W decay correlations and off-shell effects are included in Pythia. For $t\bar{t}$ no spin correlations between the top-decays and no off-shell effects are considered [27]. Since the tt background can be suppressed effectively and an experimental normalization of the tt background should be possible by asking for two b-jets, these effects are ignored for the moment. The $gg \to WW$ background was also generated with CTEQ5L and interfaced to PYTHIA using the *Les Houches Accord* matrix element interface [28].

The signal selection is divided into two parts: a preselection is applied to identify the final state and to reduce all backgrounds that contain no true W pair and in a final selection the signal is separated from the dominant backgrounds as far as possible. It should be stressed that no simulation of detector effects was performed and cuts were applied based on particle level information available in PYTHIA.

3.1 Preselection

1. The final state is triggered and selected by requiring exactly two isolated leptons of opposite charge (e or μ) with $p_T(\ell_1) > 20\,\mathrm{GeV/c}$ and $p_T(\ell_2) > 10\,\mathrm{GeV/c}$ in the pseudorapidity interval $|\eta| < 2.5$. A lepton reconstruction efficiency of 90% independent of p_T and η was assumed. A lepton is considered to be isolated if not more than 10 GeV of energy is carried by all particles within $\Delta R = \sqrt{(\Delta\eta)^2 + (\Delta\phi)^2} < 0.2$ of the lepton.

[1]See e-mail addresses on the title page.

2. The missing transverse momentum $p_T^{\rm miss}$ is defined as the sum of all neutrinos, ignoring experimental smearing and resolution effects, and is required to be larger than 40 GeV/c. This cut reduces all potential backgrounds with no intrinsiv $p_T^{\rm miss}$ from neutrinos, e.g., $q\bar{q} \to Z \to ee/\mu\mu$.

3. The modulus of the vector sum of the two leptons and the $p_T^{\rm miss}$ vector in the transverse plane is required to be smaller than 60 GeV/c. This requirement mainly reduces the huge $t\bar{t}$ background.

4. Jets are reconstructed using a cone algorithm with $\Delta R = 0.7$ and a particle seed of $p_T > 2$ GeV/c. Furthermore, a jet is called a b-jet if a b quark is found within $\Delta R < 0.4$ of the jet axis. For b-jets a detector reconstruction efficiency of 60% and a light jet mistag probability of 1% is assumed. To reduce the $t\bar{t}$ background, no jets with p_T above 40 GeV/c are allowed within $|\eta| < 4.5$ and no b-jets with p_T above 20 GeV/c within $|\eta| < 2.5$.

5. Events containing Z bosons are rejected by requiring that two same flavour leptons of opposite charge may not have an invariant mass within 10 GeV/c^2 of the Z mass.

6. $Z \to \tau\tau$ events with $\tau \to \ell\nu\nu$ have the same final state as the signal, but the leptons tend to be back-to-back. All events where the azimuthal opening angle $\Delta\phi_{\ell\ell}$ between the two leptons is larger than 3.0 are rejected. Using the collinear approximation [29], it is possible to reconstruct the τ momenta. If the collinear approximation is successful, $\Delta\phi_{\ell\ell}$ is larger than 2.0 and one of the τ-decay leptons carries less than 50% of the τ momentum, the event is rejected.

3.2 Final selection

7. Some tails of the backgrounds are removed by requiring $\Delta\eta(\ell_1, \ell_2) < 1.5$ and $\eta_{\ell\ell} := \eta(\vec{p}_{\ell_1} + \vec{p}_{\ell_2}) < 3.0$.

8. A cut on the pseudorapidity of the sum of the two leptons, $\eta_{\ell\ell} < 1.47$, strongly suppresses the $q\bar{q} \to WW$ background.

9. The transverse mass M_T, defined as $M_T := \sqrt{2 \cdot p_T(\ell_1 + \ell_2)\, p_T^{\rm miss} \cdot (1 - \cos\phi_T)}$, where ϕ_T is the transverse opening angle between $\vec{p}_T^{\,\rm miss}$ and the sum of the two leptons $\vec{p}_T(\ell_1 + \ell_2)$, is required to be in the range $m_H - 30\,{\rm GeV/c^2} < M_T < m_H$. Given the shapes of the transverse mass distributions for signal and backgrounds, this cut helps to increase the signal-to-background ratio for Higgs boson masses above 150 GeV/c^2.

10. A final cut on $\Delta\phi_{\ell\ell} < 1.0$ exploits the main difference between signal and background.

4. Results

The acceptance for a Higgs boson signal with a mass of 170 GeV/c^2 and for the various backgrounds after the application of the successive cuts is summarized in table 1. At the level of the basic acceptance cuts, i.e., requiring two leptons and the cut on the missing

	signal (fb) $m_H = 170$ GeV/c^2	background (fb) $qq \to WW$	$gg \to WW$	$t\bar{t}$	Total
Lepton acceptance + p_T^{miss} (cuts 1+2)	230.9	825.9	113.8	11698	12638
+ Jet vetos, anti $t\bar{t}$ and anti Z cuts (cuts 3-6)	122.9	535.2	67.7	102.6	705.5
+ cut (7)	113.4	363.7	51.9	72.0	487.6
+ $\eta_{\ell\ell}$ (cut 8)	76.9	190.9	33.6	40.6	265.1
+ Transverse mass (cut 9)	21.5	24.4	7.0	8.7	40.1
+ $\Delta\phi_{\ell\ell}$ (cut 10)	19.3	11.6	4.1	2.6	18.3

Table 1: Accepted signal (for $m_H = 170\,\text{GeV/c}^2$) and background cross-sections in fb for the $H \to WW \to \ell\nu\ell\nu$ (with $\ell = e, \mu$) channel after the application of successive cuts. The contributions from $W \to \tau\nu \to \ell\nu\nu\nu$ are included.

transverse momentum (cuts 1 and 2), the total background is dominated by $t\bar{t}$ production. This background can be largely suppressed by applying jet vetos and a cut on the total transverse momentum of the dilepton-p_T^{miss} system. After the preselection cuts, the WW background is dominant and sums up to a cross section of 603 fb. This is roughly five times larger than the signal cross section. At that stage, the newly considered $gg \to WW$ contribution amounts to only about 11% of the total WW background.

Further cuts on the transverse mass M_T of the dilepton-p_T^{miss} system, on the pseudorapidity of the dilepton system $\eta_{\ell\ell}$ and on the azimuthal separation between the two leptons $\Delta\phi_{\ell\ell}$ are applied to improve the signal-to-background ratio. The motivation for these cuts is illustrated in figures 1 and 2, where the transverse mass and the pseudorapidity $\eta_{\ell\ell}$ are shown versus $\Delta\phi_{\ell\ell}$ for signal events with $m_H = 170\,\text{GeV/c}^2$ and for the various backgrounds considered. These plots show a striking difference between the $q\bar{q} \to WW$ and the $gg \to WW$ backgrounds. Whereas the $q\bar{q} \to WW$ background peaks at large values of $\Delta\phi_{\ell\ell}$ and $\eta_{\ell\ell}$, the $gg \to WW$ distributions are more signal like, i.e., a significant fraction of the $gg \to WW$ background has both small $\Delta\phi$ and small $\eta_{\ell\ell}$ values.

The additional cuts applied in the signal selection (cuts 7-10) aim to reduce in particular the WW background. After all cuts, the signal-to-background ratio is found to be at the level of 1. For an integrated luminosity of 10 fb^{-1} at the LHC about 193 signal events and a total background of 183 events are expected. The background is still dominated by WW events, which account for a fraction of about 86%. About 26% of the WW background results from the $gg \to WW$ process. The increase in the fraction of the $gg \to WW$ background is due to the different behaviour of the $gg \to WW$ and $q\bar{q} \to WW$ backgrounds in the $\Delta\phi_{\ell\ell}$ and $\eta_{\ell\ell}$ distributions, as discussed above. The final signal selection cuts favour the $gg \to WW$ component.

Due to the presence of neutrinos in the final state, it is not possible to reconstruct a Higgs boson mass peak. Evidence for a Higgs boson signal has therefore to be extracted from an excess of events above the backgrounds. Unlike in the case of a narrow Higgs boson resonance, the background cannot be determined in the experiment from sideband distributions. The difficulty of a signal extraction is illustrated in figure 3, where the

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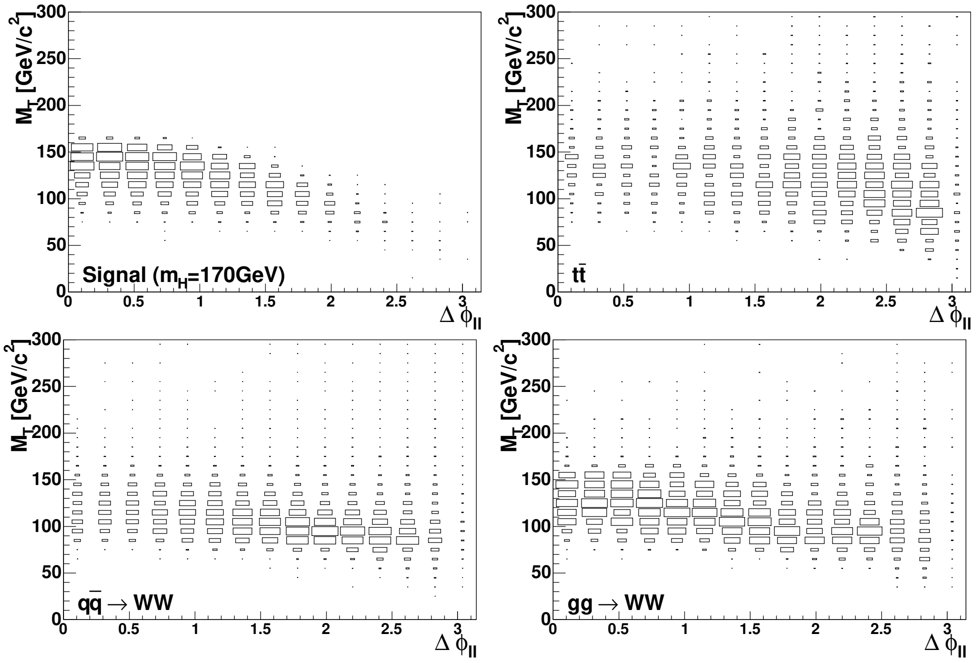

Figure 1: Distributions of the transverse mass M_T versus $\Delta\phi_{\ell\ell}$ for signal events with $m_H = 170\,\mathrm{GeV/c^2}$ and for the $t\bar{t}$, $q\bar{q} \to WW$ and $gg \to WW$ backgrounds.

distribution of the reconstructed transverse mass is shown for a Higgs boson signal with $m_H = 170\,\mathrm{GeV/c^2}$ and the backgrounds after all cuts, except the transverse mass cut (cut 9).

However, it has been shown in several experimental studies [2, 4, 30] that in particular the distribution of the azimuthal separation $\Delta\phi_{\ell\ell}$ can be used to constrain and to normalize the background. The dominant $qq \to WW$ and $t\bar{t}$ backgrounds, which have been considered so far, show after the application of selection cuts a rather flat behaviour. Therefore, it was hoped that, after a normalization of the backgrounds in the region of $\Delta\phi_{\ell\ell} > 1.5$, a reliable extrapolation of the background could be performed with the help of Monte Carlo calculations. Unfortunately, this situation is changed if the $gg \to WW$ background is included, since this background has a large component which shows a signal-like behaviour. Primarily it leads to an increased WW background of the order of 35%. In addition, due to potentially large uncertainties on the shape of the $gg \to WW$ background, the extrapolation uncertainties and therefore the systematic uncertainties on the background estimates in the signal region increase. The $\Delta\phi_{\ell\ell}$ distribution found after the application of all cuts is shown in figure 4 for two Higgs boson masses ($m_H = 170\,\mathrm{GeV/c^2}$ and $m_H = 140\,\mathrm{GeV/c^2}$).

5. Conclusions

The production of W pairs from the one-loop gluon fusion process is found to significantly increase the WW background in the Higgs search in $H \to WW \to \ell\nu\,\ell\nu$ final states at the LHC. Since for this background the correlations of the final state leptons are similar to those

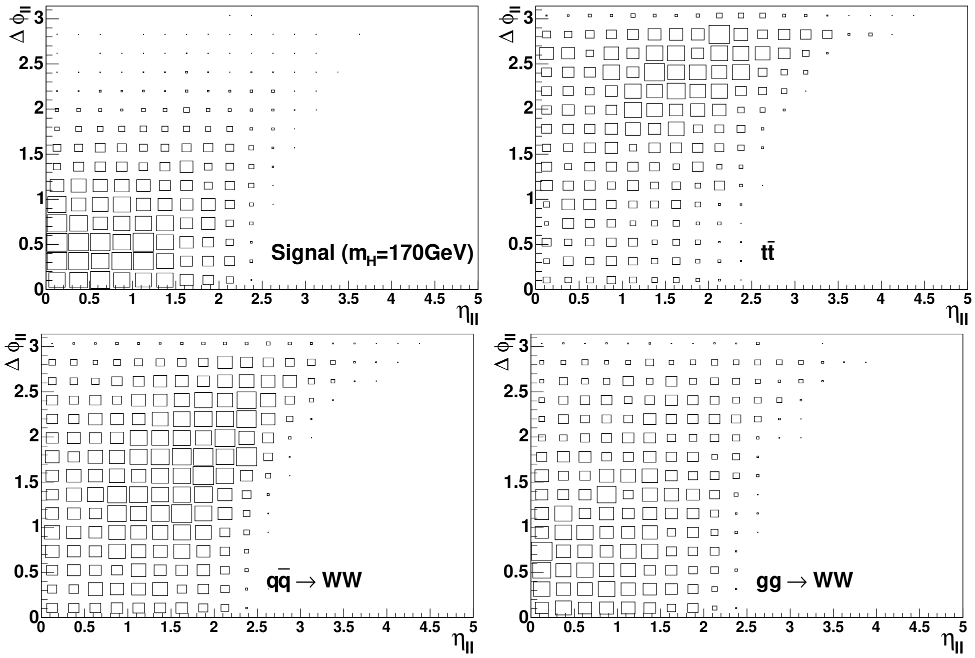

Figure 2: Distributions of the azimuthal separation $\Delta\phi_{\ell\ell}$ versus $\eta_{\ell\ell}$ for signal events with $m_H = 170\,\mathrm{GeV/c^2}$ and for the $t\bar{t}$, $q\bar{q} \to WW$ and $gg \to WW$ backgrounds.

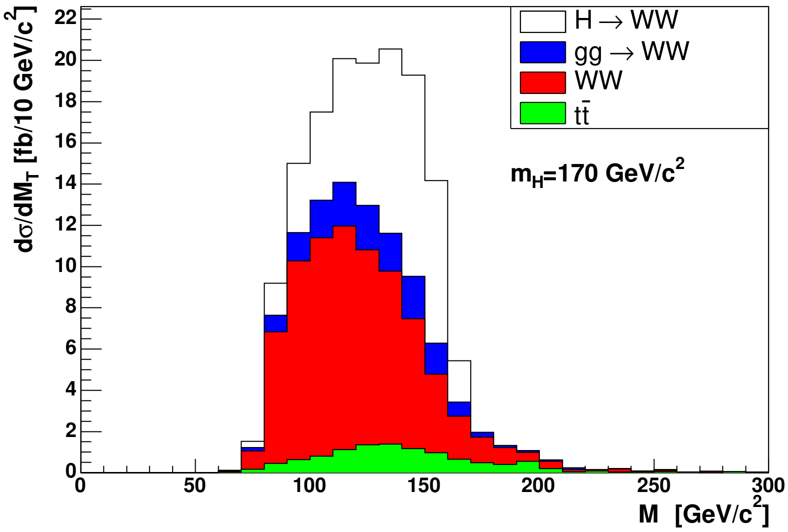

Figure 3: Distribution of the transverse mass M_T for a Higgs boson signal with $M_H = 170\,\mathrm{GeV/c^2}$ and backgrounds. The accepted cross section $d\sigma/dM_T$ (in fb / $10\,\mathrm{GeV/c^2}$) including efficiency and acceptance factors is shown.

of the Higgs boson signal, the fraction of the $gg \to WW$ contribution is enhanced by the selection cuts foreseen in the experimental searches, e.g., for a Higgs boson with a mass of $170\,\mathrm{GeV/c^2}$, the WW background is increased by 35% due to the $gg \to WW$ contribution, after final cuts are applied. This larger background decreases the sensitivity of the LHC experiments for Higgs boson searches in the $gg \to H \to WW$ mode. Due to the presence

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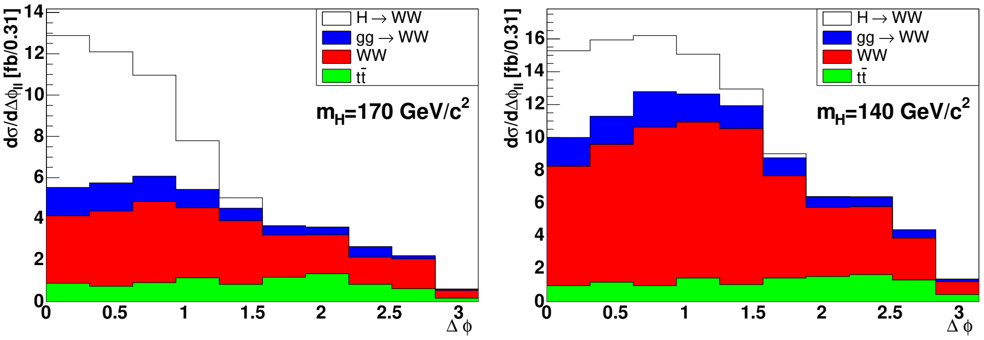

Figure 4: Distribution of the azimuthal separation $\Delta\phi_{\ell\ell}$ between the two leptons after all cuts for backgrounds and Higgs bosons signals with $m_H = 170\,\mathrm{GeV/c^2}$(left) and $m_H = 140\,\mathrm{GeV/c^2}$(right).

of two neutrinos in the final state no mass peak can be reconstructed and it is necessary to normalize the background in a phase space region where the signal contribution is small, for example, using the distribution of the azimuthal difference between the leptons. Due to the large $gg \to WW$ contribution in the signal region, this normalization and subsequent extrapolation into the signal region might be affected with larger uncertainties. They lead in turn to larger systematic uncertainties on the background and thereby reduce the signal significance further.

It should be stressed that the experimental collaborations should include the $gg \to WW$background in their detailed detector simulation and re-evaluate the signal significance in the $gg \to H \to WW$ mode. Given the striking differences between the leading order $q\bar{q} \to WW$ and the one-loop gluon-fusion process $gg \to WW$ in the final state lepton correlations, it appears necessary to use a full NLO calculation in form of an event-by-event Monte Carlo generator for a more reliable estimate of the Higgs boson discovery potential in this channel.

Acknowledgments

During the final phase of our work we became aware that also the group of ref. [31] was working on the same process. We compared our results with theirs and with the older literature. The amplitudes are in agreement with each other. M.D. wants to thank David Rainwater for many useful discussions.

A. Helicity amplitudes

In this appendix we give the helicity amplitudes needed for the process $gg \to W^+W^-$[2]. We limit ourselves to present the results for the case of one massless and one heavy quark with mass m_1. The helicity configurations are defined for all incoming particles. In total there are 8 independent amplitudes. The others can be obtained by bose symmetry and

[2]The full Monte Carlo program including the helicity amplitudes can be obtained by email from the authors (see addresses on the title page).

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parity transformation, e.g.

$$
\begin{aligned}
M_{++--}(\beta) &= M_{++++}(\beta)\,,\\
M_{+++-}(\beta) &= M_{++-+}(\beta)\,,\\
M_{+---}(\beta) &= M_{+-++}(\beta)\,,\\
M_{+--+}(\beta) &= M_{+-+-}(-\beta)\,,\\
M_{+++0}(\beta) = M_{++0+}(\beta) &= M_{++-0}(-\beta) = M_{++0-}(-\beta)\,,\\
M_{+-+0}(\beta) = M_{+-0+}(-\beta) &= M_{+--0}(-\beta) = M_{+-0-}(\beta)\,.
\end{aligned}
$$

where

$$\beta = -\sqrt{1-4\frac{M_W^2}{s}}\,.$$

To obtain shorter expressions we introduce several new functions

$$
\begin{array}{lll}
s_1 = s - M_W^2, & s_2 = s - 2M_W^2, & s_4 = s - 4M_W^2,\\
t_1 = t - M_W^2, & t_2 = t - 2M_W^2, & \\
u_1 = u - M_W^2, & u_2 = u - 2M_W^2, & \\
Y = ut - M_W^4, & \Delta = i\sqrt{\dfrac{Y}{2s_4M_W^2}}. &
\end{array}
$$

The helicity amplitudes are given in terms of the one loop scalar integrals which are denoted as follows

$$
\begin{aligned}
B_0(s) &= B(s,m_1^2,m_1^2)\\
B_1(s) &= B(s,m_1^2,0)\\
B_2(s) &= B(s,0,0)\\
C_0(s) &= C(0,0,s,m_1^2,m_1^2,m_1^2)\\
C_1^1(s) &= C(s,M_W^2,M_W^2,m_1^2,m_1^2,0)\\
C_1^2(s) &= C(0,s,M_W^2,m_1^2,m_1^2,0)\\
C_2^1(s) &= C(s,M_W^2,M_W^2,0,0,m_1^2)\\
C_2^2(s) &= C(0,s,M_W^2,0,0,m_1^2)\\
D_1(s,t) &= D(0,0,M_W^2,M_W^2,s,t,m_1^2,m_1^2,m_1^2,0)\\
D_2(s,t) &= D(0,M_W^2,0,M_W^2,s,t,m_1^2,m_1^2,0,0)\\
D_3(s,t) &= D(0,0,M_W^2,M_W^2,s,t,0,0,0,m_1^2)\,.
\end{aligned}
$$

Here we followed the notation given in [22].

M_{++++}.

$$
\begin{aligned}
&M_{++++} =\\
&= \frac{16\,(D_1(s,u)+D_1(s,t)+D_2(t,u))\,{m_1}^6}{s_4} +
\end{aligned}
$$

$$
\begin{aligned}
&+\ \frac{2\,{m_1}^2}{\beta\,s\,s_4\,t_1\,u_1}(8\,C_1^2(u)\,{M_W}^2\,s\,(s+(-2+\beta)\,s_2)\,t_1+(8\,C_1^2(t)\,{M_W}^2\,s\,(s+(-2+\beta)\,s_2)+\\
&+\ t_1\,(\beta\,(16\,C_0(s)\,{M_W}^2\,s+s_2\,(4\,D_1(s,u)\,{M_W}^2\,s+4\,D_1(s,t)\,{M_W}^2\,s+\\
&+\ D_2(t,u)\,(s^2-2\,s\,s_2-(t-u)^2)))+(s-2\,s_2)\,(8\,C_0(s)\,s+4\,D_1(s,u)\,{M_W}^2\,s+\\
&+\ 4\,D_1(s,t)\,{M_W}^2\,s+D_2(t,u)\,s^2-2\,D_2(t,u)\,s\,s_2-D_2(t,u)\,t^2+2\,D_2(t,u)\,t\,u-\\
&-\ D_2(t,u)\,u^2)))\,u_1)-\\
&-\ \frac{1}{2\,\beta\,s^2\,s_4\,{t_1}^2\,{u_1}^2}(4\,B_1(M_W^2)\,{M_W}^2\,s\,(s+(-2+\beta)\,s_2)\,(s^4-2\,s^3\,s_2+4\,s^2\,(t-u)^2-\\
&-\ 2\,s\,s_2\,(t-u)^2-(t-u)^4)+4\,B_1(u)\,s\,(-s+2\,s_2-\beta\,s_2)\,{t_1}^2\,(s^3-2\,(t-u)^2\,u+\\
&+\ 2\,s^2\,(t+2\,u)+s\,(t^2+2\,t\,u+5\,u^2))-16\,\beta\,{M_W}^2\,s^2\,t_1\,(s^2-2\,s\,s_2-(t-u)^2)\,u_1+\\
&+\ 8\,s^2\,(s-2\,s_2)\,t_1\,(s^2-2\,s\,s_2+(t-u)^2)\,u_1+4\,C_1^2(t)\,(s+(-2+\beta)\,s_2)\,{t_1}^3\,(s^2-2\,s\,s_2-\\
&-\ (t-u)^2)\,{u_1}^2+4\,C_2^2(t)\,(s+(-2+\beta)\,s_2)\,{t_1}^3\,(s^2-2\,s\,s_2-(t-u)^2)\,{u_1}^2+\\
&+\ D_2(t,u)\,(s+(-2+\beta)\,s_2)\,{t_1}^2\,(s^2-2\,s\,s_2-(t-u)^2)\,(s^2-2\,s\,s_2+(t-u)^2)\,{u_1}^2+\\
&+\ 4\,B_1(t)\,s\,(-s+2\,s_2-\beta\,s_2)\,(s^3-2\,t\,(t-u)^2+2\,s^2\,(2\,t+u)+s\,(5\,t^2+2\,t\,u+u^2))\,{u_1}^2+\\
&+\ 4\,C_1^2(u)\,(s+(-2+\beta)\,s_2)\,{t_1}^2\,(s^2-2\,s\,s_2-(t-u)^2)\,{u_1}^3+\\
&+\ 4\,C_2^2(u)\,(s+(-2+\beta)\,s_2)\,{t_1}^2\,(s^2-2\,s\,s_2-(t-u)^2)\,{u_1}^3)-\\
&-\ \frac{4\,{m_1}^4}{\beta\,s\,s_4}\,(2\,(D_1(s,u)+D_1(s,t))\,s\,(s-2\,s_2)+\beta\,(8\,C_0(s)\,s+2\,D_1(s,u)\,s^2+\\
&+\ 2\,D_1(s,t)\,s^2+D_2(t,u)\,s^2-2\,D_2(t,u)\,s\,s_2+D_2(t,u)\,t^2+4\,C_1^2(t)\,t_1+4\,C_2^2(t)\,t_1-\\
&-\ 2\,D_2(t,u)\,t\,u+D_2(t,u)\,u^2+4\,C_1^2(u)\,u_1+4\,C_2^2(u)\,u_1))\,.
\end{aligned}
$$

M_{+++-}.

$$
\begin{aligned}
&M_{+++-}=\\
&=-\frac{1}{s^2\,s_4\,{t_1}^2\,{u_1}^2}((s^2-2\,s\,s_2+(t-u)^2)\,(-2\,B_1(M_W^2)\,{M_W}^2\,s\,(s^3+s^2\,s_2-\\
&-\ s\,(t-u)^2+s_2\,(t-u)^2)+4\,B_1(u)\,{M_W}^2\,s\,{t_1}^2\,(s-2\,u)+u_1\,(-2\,{M_W}^2\,s\,(4\,B_1(t)\,t+\\
&+\ D_2(t,u)\,s_2\,{t_1}^2)\,u_1+s^2\,(-4\,s_2\,t_1+{M_W}^2\,(4\,B_1(t)+D_2(t,u)\,{t_1}^2)\,u_1)+\\
&+\ {M_W}^2\,{t_1}^2\,u_1\,(D_2(t,u)\,(t-u)^2+4\,(C_1^2(t)\,t_1+C_2^2(t)\,t_1+(C_1^2(u)+C_2^2(u))\,u_1)))))-\\
&-\ \frac{4\,(D_1(s,u)+D_1(s,t)+D_2(t,u))\,{m_1}^6\,(s^2-2\,s\,s_2-(t-u)^2)}{s_4\,Y}+\\
&+\ \frac{{m_1}^4}{s\,s_4\,Y}\,(8\,C_0(s)\,s\,(s^2-2\,s\,s_2-(t-u)^2)+4\,C_1^2(t)\,t_1\,(s^2-2\,s\,s_2-(t-u)^2)+\\
&+\ 4\,C_2^2(t)\,t_1\,(s^2-2\,s\,s_2-(t-u)^2)+\\
&+\ D_2(t,u)\,(3\,s^2-6\,s\,s_2-(t-u)^2)\,(s^2-2\,s\,s_2+(t-u)^2)+\\
&+\ 4\,D_1(s,u)\,s\,(s^3-3\,s_2\,(t-u)^2+s^2\,(5\,t+u)+s\,(7\,t^2+2\,t\,u-u^2))+\\
&+\ 4\,D_1(s,t)\,s\,(s^3-3\,s_2\,(t-u)^2+s^2\,(t+5\,u)+s\,(-t^2+2\,t\,u+7\,u^2))+\\
&+\ 4\,C_1^2(u)\,(s^2-2\,s\,s_2-(t-u)^2)\,u_1+4\,C_2^2(u)\,(s^2-2\,s\,s_2-(t-u)^2)\,u_1)+\\
&+\ \frac{{m_1}^2}{2\,s\,s_4\,t_1\,u_1\,Y},(C_1^2(u)\,t_1\,(3\,s^5+2\,s_2\,(t-u)^4-s\,(t-u)^3\,(5\,t+3\,u)+2\,s^4\,(5\,t+7\,u)+
\end{aligned}
$$

$$+\ 2\,s^3\,(5\,t^2+14\,t\,u-3\,u^2)-4\,s^2\,u\,(-5\,t^2+10\,t\,u+11\,u^2))+16\,C_1^1(s)\,s^2\,(s-2\,s_2)^2\,t_1\,u_1\,-$$
$$-\ 8\,C_0(s)\,s\,s_2\,t_1\,(s^2-2\,s\,s_2-(t-u)^2)\,u_1-4\,C_2^2(t)\,(s-2\,s_2)\,{t_1}^2\,(s^2-2\,s\,s_2+(t-u)^2)\,u_1\,-$$
$$-\ D_2(t,u)\,(2\,s-3\,s_2)\,t_1\,(s^2-2\,s\,s_2+(t-u)^2)^2\,u_1\,+$$
$$+\ C_1^2(t)\,(3\,s^5+2\,s_2\,(t-u)^4+s\,(t-u)^3\,(3\,t+5\,u)+2\,s^4\,(7\,t+5\,u)\,-$$
$$-\ 4\,s^2\,t\,(11\,t^2+10\,t\,u-5\,u^2)+s^3\,(-6\,t^2+28\,t\,u+10\,u^2))\,u_1\,+$$
$$+\ 2\,D_1(s,u)\,s\,t_1\,(s^4-4\,s^3\,s_2+(t^2-u^2)^2+2\,s^2\,(3\,t^2+4\,t\,u-u^2)\,+$$
$$+\ 4\,s\,(t^3+t^2\,u-3\,t\,u^2-3\,u^3))\,u_1\,+$$
$$+\ 2\,D_1(s,t)\,s\,t_1\,(s^4-4\,s^3\,s_2-2\,s^2\,(t^2-4\,t\,u-3\,u^2)+(t^2-u^2)^2\,-$$
$$-\ 4\,s\,(3\,t^3+3\,t^2\,u-t\,u^2-u^3))\,u_1\,-$$
$$-\ 4\,C_2^2(u)\,(s-2\,s_2)\,t_1\,(s^2-2\,s\,s_2+(t-u)^2)\,{u_1}^2)\,.$$

M_{+++0}.

$$M_{+++0} =$$
$$= \frac{2\,(-1+\beta)\,\Delta\,{M_W}^2}{\beta\,s^2\,{t_1}^2\,{u_1}^2}(-4\,B_1(M_W^2)\,{M_W}^2\,s\,(-3\,s^2+(t-u)^2)\,(t-u)\,+$$
$$+\ 4\,B_1(u)\,s\,{t_1}^2\,(s^2+2\,(t-u)\,u+s\,(t+3\,u))-u_1\,(4\,B_1(t)\,s^3\,u_1-2\,s\,(4\,B_1(t)\,t\,+$$
$$+\ D_2(t,u)\,s_2\,{t_1}^2)\,(t-u)\,u_1+{t_1}^2\,(t-u)\,u_1\,(D_2(t,u)\,(t-u)^2+4\,(C_1^2(t)\,t_1+C_2^2(t)\,t_1\,+$$
$$+\ (C_1^2(u)+C_2^2(u))\,u_1))+s^2\,(u\,(8\,t_1+4\,B_1(t)\,u_1-D_2(t,u)\,{t_1}^2\,u_1)\,+$$
$$+\ t\,(-8\,t_1+12\,B_1(t)\,u_1+D_2(t,u)\,{t_1}^2\,u_1))))\,+$$
$$-\ \frac{8\,(D_1(s,u)+D_1(s,t)+D_2(t,u))\,\Delta\,{m_1}^6\,(t-u)}{\beta\,Y}\,+$$
$$+\ \frac{2\,\Delta\,{m_1}^4}{\beta\,s\,Y}(-(D_1(s,u)\,s\,(2\,s^2+2\,(-s_2+i\,(-1+\beta)\,s_2)\,(t-u)\,+$$
$$+\ s\,((3+i+(1-i)\,\beta)\,t+(5-i-(1-i)\,\beta)\,u)))\,+$$
$$+\ D_1(s,t)\,s\,(2\,s^2-2\,(-s_2+i\,(-1+\beta)\,s_2)\,(t-u)+s\,((5-i-(1-i)\,\beta)\,t\,+$$
$$+\ (3+i+(1-i)\,\beta)\,u))+(t-u)\,(8\,C_0(s)\,s-i\,D_2(t,u)\,s^2\,+$$
$$+\ (1+i)\,\beta\,D_2(t,u)\,s\,(s-2\,s_2)+2\,i\,D_2(t,u)\,s\,s_2+D_2(t,u)\,t^2+4\,C_1^2(t)\,t_1+4\,C_2^2(t)\,t_1\,+$$
$$-\ 2\,D_2(t,u)\,t\,u+D_2(t,u)\,u^2+4\,C_1^2(u)\,u_1+4\,C_2^2(u)\,u_1))\,+$$
$$-\ \frac{(-1+\beta)\,\Delta\,{m_1}^2}{2\,\beta\,s\,t_1\,u_1\,Y}(8\,C_0(s)\,s\,((-1+i)\,s-2\,i\,s_2)\,t_1\,(t-u)\,u_1\,+$$
$$+\ (4+4\,i)\,C_2^2(t)\,(s-2\,s_2)\,{t_1}^2\,(t-u)\,u_1\,+$$
$$+\ D_2(t,u)\,((3+i)\,s-(4+2\,i)\,s_2)\,t_1\,(s^2-2\,s\,s_2+(t-u)^2)\,(t-u)\,u_1\,+$$
$$-\ 2\,D_1(s,u)\,s\,((-1+i)\,s-2\,i\,s_2)\,t_1\,(s^2-2\,s\,s_2+t^2-u^2)\,u_1\,+$$
$$+\ 2\,D_1(s,t)\,s\,((-1+i)\,s-2\,i\,s_2)\,t_1\,(s^2-2\,s\,s_2-t^2+u^2)\,u_1\,+$$
$$-\ C_1^2(t)\,(8\,s^4+s^3\,(23\,t+25\,u)+2\,s_2\,(t-u)\,(t^2+4\,i\,{t_1}^2-2\,t\,u+u^2)\,+$$
$$+\ 4\,s^2\,(2\,t^2+7\,t\,u+7\,u^2)-s\,(t-u)\,(5\,t^2+4\,i\,{t_1}^2+14\,t\,u+13\,u^2))\,u_1\,+$$
$$+\ (4+4\,i)\,C_2^2(u)\,(s-2\,s_2)\,t_1\,(t-u)\,{u_1}^2\,+$$
$$+\ C_1^2(u)\,t_1\,(8\,s^4+s^3\,(25\,t+23\,u)+4\,s^2\,(7\,t^2+7\,t\,u+2\,u^2)\,+$$

$$- \; 2\,s_2\,(t-u)\,(t^2 - 2\,t\,u + u^2 + 4\,i\,{u_1}^2) + s\,(t-u)\,(13\,t^2 + 14\,t\,u + 5\,u^2 + 4\,i\,{u_1}^2)))$$

M_{++00}.

$$\begin{aligned}
&M_{++00} = \\
&= \frac{8\,(D_1(s,u) + D_1(s,t) + D_2(t,u))\,{m_1}^6\,s}{{M_W}^2\,s_4} + \\
&- \; \frac{2\,{m_1}^4}{{M_W}^2\,s_4}, (8\,C_0(s)\,s + 4\,D_1(s,t)\,{M_W}^2\,s + 8\,D_1(s,t)\,{M_W}^2\,s_2 + \\
&+ \; 4\,D_1(s,u)\,{M_W}^2\,(s + 2\,s_2) + 4\,C_1^2(t)\,t_1 + 4\,C_2^2(t)\,t_1 - 9\,D_2(t,u)\,t\,u + 3\,D_2(t,u)\,t_2\,u + \\
&+ \; 4\,C_1^2(u)\,u_1 + 4\,C_2^2(u)\,u_1 + 3\,D_2(t,u)\,t\,u_2 - D_2(t,u)\,t_2\,u_2) + \\
&- \; \frac{8\,{M_W}^2}{s^2\,s_4\,{t_1}^2\,{u_1}^2}, (B_1(M_W^2)\,{M_W}^2\,s\,(s^4 - 2\,s^3\,s_2 + 4\,s^2\,(t-u)^2 - 2\,s\,s_2\,(t-u)^2 - (t-u)^4) + \\
&- \; B_1(u)\,s\,{t_1}^2\,(s^3 - 2\,(t-u)^2\,u + 2\,s^2\,(t + 2\,u) + s\,(t^2 + 2\,t\,u + 5\,u^2)) + \\
&- \; u_1\,(B_1(t)\,s\,(s^3 - 2\,t\,(t-u)^2 + 2\,s^2\,(2\,t + u) + s\,(5\,t^2 + 2\,t\,u + u^2))\,u_1 + \\
&- \; 4\,t_1\,Y\,(-2\,s^2 + t_1\,u_1\,(C_1^2(t)\,t_1 + C_2^2(t)\,t_1 + C_1^2(u)\,u_1 + C_2^2(u)\,u_1 - D_2(t,u)\,Y)))) + \\
&+ \; \frac{2\,{m_1}^2}{{M_W}^2\,s\,s_4\,t_1\,u_1}(C_1^2(u)\,{M_W}^2\,t_1\,(7\,s^3 + 2\,s_2\,(t-u)^2 + 4\,s^2\,(3\,t + 4\,u) + \\
&+ \; s\,(3\,t^2 + 18\,t\,u + 11\,u^2)) + \\
&+ \; u_1\,(C_1^2(t)\,{M_W}^2\,(7\,s^3 + 2\,s_2\,(t-u)^2 + 4\,s^2\,(4\,t + 3\,u) + s\,(11\,t^2 + 18\,t\,u + 3\,u^2)) + \\
&+ \; 4\,t_1\,(C_0(s)\,s\,(s^2 - 2\,s\,s_2 + 2\,{s_2}^2) + {M_W}^2\,(2\,D_1(s,u)\,{M_W}^2\,s\,s_2 + 2\,D_1(s,t)\,{M_W}^2\,s\,s_2 + \\
&+ \; C_2^2(t)\,s_4\,t_1 + C_2^2(u)\,s_4\,u_1 + 3\,D_2(t,u)\,s\,Y - 4\,D_2(t,u)\,s_2\,Y)))) \,.
\end{aligned}$$

M_{+-+0}.

$$\begin{aligned}
&M_{+-+0} = \\
&= \frac{-4(D_1(s,u) + D_1(s,t) + D_3(s,t) + D_3(s,u) + 2D_2(t,u))\Delta {m_1}^8 s(\beta s + t - u)}{\beta Y^2} + \\
&+ \frac{\Delta {M_W}^2}{2\beta {t_1}^2 {u_1}^2 Y^2}(2B_1(M_W^2){M_W}^2(-(\beta(s^4 - s^3 s_2 - s s_2(t-u)^2 + (t-u)^4)) + \\
&- (s^2 s_2 - 2s(t-u)^2 + s_2(t-u)^2)(t-u))(s^2 - 2ss_2 + (t-u)^2) + \\
&+ B_1(u){t_1}^2(s^2 - 2ss_2 + (t-u)^2)((1+\beta)s^3 + s^2(3(1+\beta)t + u + 5\beta u) + s(3(1+\beta)t^2 + \\
&+ 2(-1+3\beta)tu - (1+\beta)u^2) + (t-u)((1+\beta)t^2 + 2(-1+\beta)tu - (7+3\beta)u^2)) + \\
&- 2\beta s t_1 (s^2 - 2ss_2 + (t-u)^2)^2 u_1 + 2t_1(s^2 - 2ss_2 + (t-u)^2)^2 (t-u)u_1 + \\
&+ 4B_0(s){t_1}^2(s^2 - 2ss_2 + (t-u)^2)(-is + 2is_2 + t + \beta(s + i(t-u)) - u){u_1}^2 + \\
&+ D_3(s,t)st{t_1}^2((-1+i)(-1+\beta)s^3 + (7 + 17i - (3+5i)\beta)t^3 + (-5 + 13i + \\
&+ (5+3i)\beta)t^2 u - (1-i)(3+\beta)tu^2 - (1-i)(-1+\beta)u^3 - (1-i)s^2((-1+5\beta)t + \\
&+ 3(-1+\beta)u) + s((-1 + 9i + (1+7i)\beta)t^2 - (2-2i)(1+3\beta)tu + \\
&- (3-3i)(-1+\beta)u^2)){u_1}^2 + \\
&+ D_1(s,t)st{t_1}^2((-1-i)(-1+\beta)s^3 + (7 - 17i - (3-5i)\beta)t^3 - (5 + 13i + \\
&- (5-3i)\beta)t^2 u - (1+i)(3+\beta)tu^2 - (1+i)(-1+\beta)u^3 - (1+i)s^2((-1+5\beta)t + \\
&+ 3(-1+\beta)u) - s((1 + 9i - (1-7i)\beta)t^2 + (2+2i)(1+3\beta)tu + (3+3i)(-1+\beta)u^2)){u_1}^2 +
\end{aligned}$$

$$
\begin{aligned}
&+2C_1^2(t){t_1}^3((1+i)(-1+\beta)s^3+(-7+17i+(3-5i)\beta)t^3+(5+13i-(5-3i)\beta)t^2u+\\
&+(1+i)(3+\beta)tu^2+(1+i)(-1+\beta)u^3+(1+i)s^2((-1+5\beta)t+3(-1+\beta)u)+\\
&+s((1+9i-(1-7i)\beta)t^2+(2+2i)(1+3\beta)tu+(3+3i)(-1+\beta)u^2)){u_1}^2+\\
&+2C_2^2(t){t_1}^3((-1+i+(1-i)\beta)s^3+(-7-17i+(3+5i)\beta)t^3-(-5+13i+\\
&+(5+3i)\beta)t^2u+(1-i)(3+\beta)tu^2+(-1+i+(1-i)\beta)u^3+(1-i)s^2((-1+5\beta)t+\\
&+3(-1+\beta)u)+s(-((-1+9i+(1+7i)\beta)t^2)+(2-2i)(1+3\beta)tu+\\
&+3(-1+i+(1-i)\beta)u^2)){u_1}^2+\\
&+D_3(s,u)s{t_1}^2u((-1-i)(1+\beta)s^3-(1+i)(1+\beta)t^3-(1+i)(-3+\beta)t^2u+\\
&+(5+13i+(5-3i)\beta)tu^2+(-7+17i-(3-5i)\beta)u^3-(1+i)s^2(3(1+\beta)t+u+\\
&+5\beta u)+s((-3-3i)(1+\beta)t^2-(2+2i)(-1+3\beta)tu+(1+9i+(1-7i)\beta)u^2)){u_1}^2+\\
&+D_1(s,u)s{t_1}^2u((-1+i)(1+\beta)s^3-(1-i)(1+\beta)t^3-(1-i)(-3+\beta)t^2u+\\
&+(5-13i+(5+3i)\beta)tu^2-(7+17i+(3+5i)\beta)u^3-(1-i)s^2(3(1+\beta)t+u+\\
&+5\beta u)+s((-3+3i)(1+\beta)t^2-(2-2i)(-1+3\beta)tu+(1-9i+(1+7i)\beta)u^2)){u_1}^2+\\
&+4B_2(s){t_1}^2(s^2-2ss_2+(t-u)^2)(i(s-2s_2)+t-u+\beta(s+i(-t+u))){u_1}^2+\\
&+B_1(t)(s^2-2ss_2+(t-u)^2)((-1+\beta)s^3+s^2((-1+5\beta)t+3(-1+\beta)u)+\\
&+(t-u)((-7+3\beta)t^2-2(1+\beta)tu-(-1+\beta)u^2)+s(-((-1+\beta)t^2)+3(-1+\beta)u^2+\\
&+2t(u+3\beta u))){u_1}^2+\\
&+2C_3(s)s{t_1}^2((t-u)(s^2-2ss_2-3t^2-2tu-3u^2)+\beta(s^3-4s^2s_2-2s_2(t-u)^2+\\
&+s(t^2+6tu+u^2))+i(s^3-2s^2s_2-s(3t^2+2tu+3u^2)+\beta(t-u)(-s^2+2ss_2+\\
&+3t^2+2tu+3u^2)-8(t^3+t^2u+tu^2+u^3))){u_1}^2+\\
&+2C_0(s)s{t_1}^2((t-u)(s^2-2ss_2-3t^2-2tu-3u^2)+\beta(s^3-4s^2s_2-2s_2(t-u)^2+\\
&+s(t^2+6tu+u^2))+i(-s^3+2s^2s_2+\beta(t-u)(s^2-2ss_2-3t^2-2tu-3u^2)+\\
&+s(3t^2+2tu+3u^2)+8(t^3+t^2u+tu^2+u^3))){u_1}^2+\\
&+2C_2^1(s){t_1}^2(\beta s(s^3-2s^2s_2+s(t-u)^2-4s_2(t-u)^2)+(s-2s_2)(s^2+2ss_2+\\
&+(t-u)^2)(t-u)+i(\beta s(t-u)(s^2-6ss_2+9t^2+14tu+9u^2)-(s-2s_2)(s^3+\\
&-4s^2s_2+2s_2(t-u)^2+s(5t^2+6tu+5u^2)))){u_1}^2+\\
&+2C_1^1(s){t_1}^2(\beta s(s^3-2s^2s_2+s(t-u)^2-4s_2(t-u)^2)+(s-2s_2)(s^2+2ss_2+\\
&+(t-u)^2)(t-u)+i(-(\beta s(t-u)(s^2-6ss_2+9t^2+14tu+9u^2))+(s-2s_2)(s^3+\\
&-4s^2s_2+2s_2(t-u)^2+s(5t^2+6tu+5u^2)))){u_1}^2+\\
&+2C_2^2(u){t_1}^2((1+i)(1+\beta)s^3+(1+i)(1+\beta)t^3+(1+i)(-3+\beta)t^2u+(-5-13i+\\
&-(5-3i)\beta)tu^2+(7-17i+(3-5i)\beta)u^3+(1+i)s^2(3(1+\beta)t+u+5\beta u)+\\
&+s((3+3i)(1+\beta)t^2+(2+2i)(-1+3\beta)tu+(-1-9i-(1-7i)\beta)u^2)){u_1}^3+\\
&+2C_1^2(u){t_1}^2((1-i)(1+\beta)s^3+(1-i)(1+\beta)t^3+(1-i)(-3+\beta)t^2u-(5-13i+\\
&+(5+3i)\beta)tu^2+(7+17i+(3+5i)\beta)u^3+(1-i)s^2(3(1+\beta)t+u+5\beta u)+\\
&-s((-3+3i)(1+\beta)t^2-(2-2i)(-1+3\beta)tu+(1-9i+(1+7i)\beta)u^2)){u_1}^3)+\\
&+\frac{\Delta {m_1}^4}{2\beta Y^2}(8C_1^1(s)s(\beta(s^2-2ss_2-(t-u)^2)+2(s-2s_2)(t-u))+\\
&+8C_2^1(s)s(\beta(s^2-2ss_2-(t-u)^2)+2(s-2s_2)(t-u))+\\
&+8C_1^2(t)t_1(-s^2+(2t-\beta t_1)(t-u)-s(3t-3\beta t_1+u))+\\
&+8C_2^2(t)t_1(-s^2+(2t-\beta t_1)(t-u)-s(3t-3\beta t_1+u))+\\
&+8C_0(s)s(-(\beta(2s^2-ss_2+(t-u)(2i{M_W}^2+t-u)))+2s_1(-t+u)+\\
&+i(-(ss_2)+t^2+6tu+u^2))+\\
&-D_2(t,u)(s^2-2ss_2+(t-u)^2)(\beta(2s^2+(t-u)(-2is_2+t-u)+s(-4s_2+3it-3iu))+\\
&+s(t-u)-i(s^2-6ss_2+6t^2+20tu+6u^2))+
\end{aligned}
$$

$$
\begin{aligned}
&- 8C_3(s)s(2s_1(t-u) + i(-(ss_2) + t^2 + 6tu + u^2) + 2\beta(ss_1 + iM_W{}^2(-t+u))) + \\
&+ D_3(s,t)s((-1+i)(2+\beta)s^3 - (7-19i)t^3 + (13+59i)t^2u - (5-17i)tu^2 + \\
&- (1-i)u^3 + s((20+28i-(17+7i)\beta)t^2 + 6(4i+(1+3i)\beta)tu - (1-i)(4+5\beta)u^2) + \\
&+ s^2((1+11i)t - (5-5i)u - 4\beta(is_2 - 2t + u)) + \\
&- 2\beta(t-u)(s_2(-t+u) + i(5t^2 + 6tu + u^2))) + \\
&+ D_1(s,t)(-((4+i+i\beta)s^4) + s^3(10s_2 + 8\beta t_1 - i((3+7\beta)t + (-3+\beta)u)) + \\
&- s^2((-2+i(9+\beta))t^2 - u(16\beta t_1 - (6-15i)u + 3i\beta u) + \\
&+ 2t(4\beta t_1 + (6-9i)u + 9i\beta u)) + \\
&+ s((-18+i(-1+3\beta))t^3 + u^2(8\beta t_1 + (2+17i)u + 5i\beta u) + \\
&+ t^2(8\beta t_1 + (22-13i)u + 7i\beta u) - tu(16\beta t_1 + (6-29i)u + 15i\beta u)) + \\
&+ 2(t-u)^2((1+i\beta)s_2(t-u) + i(3t^2 + 10tu + 3u^2))) + \\
&+D_3(s,u)s((-1-i)(-2+\beta)s^3 + (1+i)t^3 + (5+17i)t^2u - (13-59i)tu^2 + (7+19i)u^3 + \\
&+ s((-1-i)(-4+5\beta)t^2 + 6(4i+(1-3i)\beta)tu + (-20+28i-(17-7i)\beta)u^2) + \\
&+ s^2((5+5i)t - (1-11i)u + 4\beta(is_2 - t + 2u)) + \\
&- 2\beta(t-u)(s_2(-t+u) + i(t^2 + 6tu + 5u^2))) + \\
&+ 8C_1^2(u)u_1(s^2 + (t-u)(2u + \beta u_1) + s(t + 3(u + \beta u_1))) + \\
&+ 8C_2^2(u)u_1(s^2 + (t-u)(2u + \beta u_1) + s(t + 3(u + \beta u_1))) + \\
&+ D_1(s,u)((4+i(-1+\beta))s^4 + 2(t-u)^2((1+i\beta)s_2(t-u) + i(3t^2 + 10tu + 3u^2)) + \\
&+ s^3(-10s_2 + i((3+\beta)t + (-3+7\beta)u) + 8\beta u_1) + s^2((6-3i(-5+\beta))t^2 + \\
&+ u((-2+i(-9+\beta))u - 8\beta u_1) + 2t(3(2+3i(1+\beta))u + 8\beta u_1)) + \\
&- s((2+i(-17+5\beta))t^3 + u^2((-18+i+3i\beta)u - 8\beta u_1) + \\
&- t^2((6+29i+15i\beta)u + 8\beta u_1) + tu((22+13i+7i\beta)u + 16\beta u_1)))) + \\
&+ \frac{\Delta m_1{}^2}{8\beta s t_1 u_1 Y^2}(D_2(t,u)t_1(s^2 - 2ss_2 + (t-u)^2)^2(-i(s-2s_2)^2 + s(t-u) + \\
&+ \beta s(s - 2s_2 + it - iu))u_1 + \\
&+ 16B_2(s)st_1(s^2 - 2ss_2 + (t-u)^2)(\beta s + t - u)u_1 + \\
&+ 16B_0(s)st_1(s^2 - 2ss_2 + (t-u)^2)(-(\beta s) - t + u)u_1 + \\
&+ 2D_3(s,t)s^2t_1((-1+i+(1-i)\beta)s^4 + (-9-47i+(7+17i)\beta)t^4 + 2(-6-50i + \\
&- (3-3i)\beta)t^3u - 2(-9+21i+(4+8i)\beta)t^2u^2 + (2-2i)(2+3\beta)tu^3 + (-1+i + \\
&+ (1-i)\beta)u^4 + (2-2i)s^3(t + 4\beta t + 2(-1+\beta)u) - 2s^2((-3+15i+(2+10i)\beta)t^2 + \\
&- (1-i)(4+11\beta)tu - (3-3i)(-1+\beta)u^2) + 2s((-11-37i+(6+2i)\beta)t^3 - 2(-4 + \\
&+ 16i + (1+11i)\beta)t^2u + (5-5i)(1+2\beta)tu^2 + 2(-1+i+(1-i)\beta)u^3))u_1 + \\
&+ 2D_3(s,u)s^2t_1((1+i)(1+\beta)s^4 + (1+i)(1+\beta)t^4 + (2+2i)(-2+3\beta)t^3u + 2(-9 + \\
&- 21i - (4-8i)\beta)t^2u^2 - 2(-6+50i+(3+3i)\beta)tu^3 + (9-47i+(7-17i)\beta)u^4 + \\
&+ (2+2i)s^3(2(1+\beta)t + (-1+4\beta)u) + 2s^2((3+3i)(1+\beta)t^2 + (1+i)(-4+11\beta)tu + \\
&+ (-3-15i-(2-10i)\beta)u^2) + 2s((2+2i)(1+\beta)t^3 + (5+5i)(-1+2\beta)t^2u + 2(-4 + \\
&- 16i - (1-11i)\beta)tu^2 + (11-37i+(6-2i)\beta)u^3))u_1 + \\
&+ 4C_2^2(t)t_1{}^2((-4+3i-(1-2i)\beta)s^4 + s^3((-5+16i+(12+9i)\beta)t + (-11+4i + \\
&- (4-7i)\beta)u) - 4i(t^2-u^2)^2 + s^2((18+35i-(5+4i)\beta)t^2 + 2(-4+9i + \\
&+ (5+14i)\beta)tu + (-10-5i-(5-8i)\beta)u^2) + s((3+18i)t^3 + (7+50i)t^2u + \\
&- (7-6i)tu^2 - (3+10i)u^3 - \beta(t-u)(-2s_2t + 11it^2 + 2s_2u + 18itu + 3iu^2)))u_1 + \\
&+ 8C_0(s)st_1(i(s^4 - 2s^3s_2 + s^2(t-u)^2 + 4ss_2(t-u)^2 + \beta s(t-u)(s^2 + 2ss_2 - 3t^2 + \\
&- 10tu - 3u^2) - 4(t^2-u^2)^2) - 2(t-u)(-(s^2s_2) + s_2(t-u)^2 - 2s(t^2+u^2)) + \\
&+ 2\beta s(s^3 - s^2s_2 - s_2(t-u)^2 + s(3t^2 - 2tu + 3u^2)))u_1 +
\end{aligned}
$$

$$
\begin{aligned}
&+8C_3(s)s^2t_1((t-u)(s^2-6ss_2+t^2+6tu+u^2)+2i(s^3-4s^2s_2-4s_2{}^3+7st^2+\\
&+10stu+7su^2)-\beta(s^3-2s_2(t-u)(4iM_W{}^2+t-u)+s(5t^2-2tu+5u^2)))u_1\\
+\quad &+C_1^2(t)(\beta s(7s^5-6s_2(t-u)^4+s^4(6t+34u)+s(t-u)^2(23t^2+10tu+31u^2)+\\
&+2s^3(33t^2-2tu+33u^2)+4s^2(5t^3+22t^2u-11tu^2+16u^3))+4it_1{}^2((3+2\beta)s^4+\\
&+s^3((16+9\beta)t+(4+7\beta)u)-4(t^2-u^2)^2+s^2((35-4\beta)t^2+2(9+14\beta)tu+\\
&+(-5+8\beta)u^2)+s((18-11\beta)t^3+(50-7\beta)t^2u+3(2+5\beta)tu^2+(-10+3\beta)u^3))+\\
&+s(4s^5+s^4(-5t+21u)-4s^3(10t^2+tu-11u^2)-(t-u)^3(21t^2+22tu+5u^2)+\\
&+s^2(-6t^3-54t^2u+14tu^2+46u^3)+s(-60t^4+60t^3u-44t^2u^2+20tu^3+24u^4)))u_1+\\
&+2D_1(s,t)st_1((3+i(3+\beta))s^5+2s^3((4+i(11-3\beta))t^2+(11+4i(6+\beta))tu+\\
&+(13+13i)u^2+\beta(2t_1{}^2+7iu^2))-2(t-u)^2(\beta s_2(4t_1{}^2+is_2(t-u))+(3t+u)(t^2-u^2+\\
&+is_2(3t+u)))+2s^4(4t+7u+i(-7s_2+\beta(t+3u)))+2s^2((11+4i(1+\beta))t^3-2(1+\\
&+4i(-3+2\beta))t^2u+t((11+32i)u^2-4\beta(t_1{}^2-iu^2))+4((3+3i)u^3+2\beta u(t_1{}^2+iu^2)))+\\
&+s((-3+i(15+13\beta))t^4+2(3+4i(-4+\beta))t^3u+(10+40i)tu^3+(11+11i)u^4+\\
&+\beta(20t_1{}^2u^2+9iu^4)+6t^2((-4+5i)u^2+\beta(2t_1{}^2-5iu^2))))u_1+\\
&+8C_1^1(s)st_1(-2\beta s^2(s^2-2ss_2-(t-u)^2)-4s^2(s-2s_2)(t-u)+i(-(\beta s(t-u)(3s^2+\\
&-10ss_2+7t^2+18tu+7u^2))+(s-2s_2)(s^3-4s^2s_2+2s_2(t-u)^2+s(t^2+14tu+u^2))))u_1+\\
&+8C_2^1(s)st_1(2\beta s^2(s^2-2ss_2-(t-u)^2)+4s^2(s-2s_2)(t-u)+i(-(\beta s(t-u)(3s^2-\\
&-10ss_2+7t^2+18tu+7u^2))+(s-2s_2)(s^3-4s^2s_2+2s_2(t-u)^2+s(t^2+14tu+u^2))))u_1+\\
&+4C_2^2(u)t_1(-((-4-3i+(1+2i)\beta)s^4)+s^3((11+4i-(4+7i)\beta)t+(5+16i+\\
&+(12-9i)\beta)u)-4i(t^2-u^2)^2+s^2(-((-10+5i+(5+8i)\beta)t^2)+2(4+9i+\\
&+(5-14i)\beta)tu+(-18+35i-(5-4i)\beta)u^2)+s((3-10i)t^3+(7+6i)t^2u+\\
&-(7-50i)tu^2-(3-18i)u^3-\beta(t-u)(-2s_2t+3it^2+2s_2u+18itu+11iu^2)))u_1{}^2+\\
&+C_1^2(u)t_1(\beta s(7s^5-6s_2(t-u)^4+s^4(34t+6u)+s(t-u)^2(31t^2+10tu+23u^2)+\\
&+2s^3(33t^2-2tu+33u^2)+4s^2(16t^3-11t^2u+22tu^2+5u^3))-s(4s^5+s^4(21t-5u)+\\
&+s^3(44t^2-4tu-40u^2)+(t-u)^3(5t^2+22tu+21u^2)+2s^2(23t^3+7t^2u-27tu^2-3u^3)+\\
&+4s(6t^4+5t^3u-11t^2u^2+15tu^3-15u^4))+4i((3-2\beta)s^4+s^3((4-7\beta)t+(16-9\beta)u)+\\
&-4(t^2-u^2)^2+s^2(-((5+8\beta)t^2)+(18-28\beta)tu+(35+4\beta)u^2)+s(-((10+3\beta)t^3)+\\
&+3(2-5\beta)t^2u+(50+7\beta)tu^2+(18+11\beta)u^3))u_1{}^2)+\\
&+2D_1(s,u)st_1u_1(-((3+i(-3+\beta))s^5)-2s^4(7t+4u+i(7s_2+\beta(3t+u)))+\\
&-2s^3((13+i(-13+7\beta))t^2+(11+4i(-6+\beta))tu+(4-11i-3i\beta)u^2-2\beta u_1{}^2)+\\
&-2(t-u)^2((t+3u)(t^2-u^2+is_2(t+3u))+\beta s_2(is_2(t-u)+4u_1{}^2))+\\
&-2s^2(4(3+i(-3+2\beta))t^3+(11+4i(-8+\beta))t^2u+(11+4i(-1+\beta))u^3+4\beta uu_1{}^2+\\
&-2t((1+4i(3+2\beta))u^2+4\beta u_1{}^2))+s((-11+i(11-9\beta))t^4-(10-40i)t^3u+\\
&-2(3+4i(4+\beta))tu^3+(3+15i-13i\beta)u^4+12\beta u^2u\_1^2+\\
&+t^2(6(4+5i(1+\beta))u^2+20\beta u_1{}^2))))+\\
&+\frac{\Delta m_1{}^6}{16\beta Y^2}(128C_0(s)s(\beta s+t-u)-128C_3(s)s(\beta s+t-u)+\\
&+32D_2(t,u)(2\beta s(s^2-2ss_2+(t-u)(2iM_W{}^2+t-u))+(s^2-2ss_2+\\
&+(t-u)^2)(t-u)+2is(ss_2-t^2-6tu-u^2))+\\
&+32D_3(s,t)s(2(s+4t)t_1+\beta s(5t+t_2)+\\
&+i(ss_2+2\beta M_W{}^2t-t^2-2\beta M_W{}^2u-6tu-u^2))+\\
&+32D_1(s,u)((-1+3\beta)s^3+(t-u)^3+s^2(is_2+5\beta t-4u-\beta u)+s((2-i)t^2+\\
&+2\beta(t-u)(iM_W{}^2+t-u)-(4+6i)tu+(2-i)u^2))+\\
&+D_1(s,t)(32\beta s(3s^2-s(t-5u)+2(t-u)^2)+32(s^3+4s^2t-2s(t-u)^2+(t-u)^3)+
\end{aligned}
$$

$$+\, i(64\beta {M_W}^2 s(t-u) - 32s(-(ss_2) + t^2 + 6tu + u^2))) +$$
$$+\, 32D_3(s,u)s(i(ss_2 + 2\beta {M_W}^2 t - t^2 - 2\beta {M_W}^2 u - 6tu - u^2) +$$
$$-\, 2(s+4u)u_1 + \beta s(5u + u_2)))\,.$$

M_{+-+-}.

$$M_{+-+-} =$$
$$= \frac{{m_1}^8\, s}{\beta\, s_4\, Y^2} - 2\,(D_1(s,u) + D_1(s,t) + D_3(s,t) + D_3(s,u) +$$
$$+\, 2\, D_2(t,u))(\beta\,(s^2 - 2\,s\,s_2 - (t-u)^2) + 2\,s_4\,(-t+u)) +$$
$$+\, \frac{{m_1}^6}{\beta\, s_4\, Y^2}(4\,C_3(s)\,s\,(\beta\,(-s^2 + 2\,s\,s_2 + (t-u)^2) + 2\,s_4\,(t-u)) +$$
$$+\, 4\,C_0(s)\,s\,(\beta\,(s^2 - 2\,s\,s_2 - (t-u)^2) + 2\,s_4\,(-t+u)) -$$
$$-\, 4\,D_2(t,u)\,(\beta\,(3\,s^2 - (t-u)^2 - 2\,s\,(3\,s_2 + i\,t - i\,u)) - 2\,s_4\,(i\,s + 2\,t - 2\,u))\,Y +$$
$$+\, 2\,D_3(s,u)\,s\,(-(s_4\,(s^2 - 2\,s\,s_2 + t^2 + 6\,t\,u - 7\,u^2)) -$$
$$-\, \beta\,(s^2\,(t - 5\,u) + (t-u)^2\,(t + 3\,u) + 2\,s\,(t^2 - 4\,t\,u - 5\,u^2)) + 2\,i\,(s_4 + \beta\,(t-u))\,Y) +$$
$$+\, 2\,D_3(s,t)\,s\,(s_4\,(s^2 - 2\,s\,s_2 - 7\,t^2 + 6\,t\,u + u^2) + \beta\,(s^2\,(5\,t - u) - (t-u)^2\,(3\,t + u) +$$
$$+\, 2\,s\,(5\,t^2 + 4\,t\,u - u^2)) + 2\,i\,(s_4 + \beta\,(t-u))\,Y) +$$
$$+\, D_1(s,u)\,(2\,s_4\,(s^3 - 3\,s\,(t-u)^2 - 2\,(t-u)^3 + 4\,s^2\,u) + \beta\,(3\,s^4 - (t-u)^4 + 2\,s^3\,(7\,t + u) +$$
$$+\, 2\,s\,(t-u)^2\,(3\,t + 5\,u) + s^2\,(18\,t^2 + 4\,t\,u - 6\,u^2)) + 4\,i\,s\,(s_4 + \beta\,(t-u))\,Y) +$$
$$+\, D_1(s,t)\,(-2\,s_4\,(s^3 + 4\,s^2\,t - 3\,s\,(t-u)^2 + 2\,(t-u)^3) + \beta\,(3\,s^4 - (t-u)^4 +$$
$$+\, 2\,s\,(t-u)^2\,(5\,t + 3\,u) + 2\,s^3\,(t + 7\,u) + s^2\,(-6\,t^2 + 4\,t\,u + 18\,u^2)) + 4\,i\,s\,(s_4 + \beta\,(t-u))\,Y)) + +$$
$$+\, \frac{{m_1}^4}{4\,\beta\,s\,s_4\,Y^2}(8\,C_1^1(s)\,s\,s_4\,(-2\,\beta\,s\,(s^2 - 2\,s\,s_2 - 2\,(t-u)^2) + (-5\,s^2 + 10\,s\,s_2 + (t-u)^2)\,(t-u)) + +$$
$$+\, 8\,C_2^1(s)\,s\,s_4\,(-2\,\beta\,s\,(s^2 - 2\,s\,s_2 - 2\,(t-u)^2) + (-5\,s^2 + 10\,s\,s_2 + (t-u)^2)\,(t-u)) +$$
$$+\, 8\,C_1^2(t)\,t_1\,(-2\,s_4\,t_1\,(2\,s^2 - (t-u)^2 + s\,(7\,t + u)) - \beta\,s\,(s^3 + 2\,(t-u)^2\,(3\,t + 2\,u) +$$
$$+\, s^2\,(-4\,t + 6\,u) + s\,(-11\,t^2 - 6\,t\,u + 9\,u^2))) +$$
$$+\, 8\,C_2^2(t)\,t_1\,(-2\,s_4\,t_1\,(2\,s^2 - (t-u)^2 + s\,(7\,t + u)) - \beta\,s\,(s^3 + 2\,(t-u)^2\,(3\,t + 2\,u) +$$
$$+\, s^2\,(-4\,t + 6\,u) + s\,(-11\,t^2 - 6\,t\,u + 9\,u^2))) +$$
$$+\, 8\,C_1^2(u)\,u_1\,(-(\beta\,s\,(s^3 + s^2\,(6\,t - 4\,u) + 2\,(t-u)^2\,(2\,t + 3\,u) + s\,(9\,t^2 - 6\,t\,u - 11\,u^2))) +$$
$$+\, 2\,s_4\,(2\,s^2 - (t-u)^2 + s\,(t + 7\,u))\,u_1) +$$
$$+\, 8\,C_2^2(u)\,u_1\,(-(\beta\,s\,(s^3 + s^2\,(6\,t - 4\,u) + 2\,(t-u)^2\,(2\,t + 3\,u) + s\,(9\,t^2 - 6\,t\,u - 11\,u^2))) +$$
$$+\, 2\,s_4\,(2\,s^2 - (t-u)^2 + s\,(t + 7\,u))\,u_1) -$$
$$-\, 8\,C_3(s)\,s^2\,(\beta\,(3\,s^2\,s_2 - 6\,s\,{s_2}^2 - (t-u)\,(3\,s_2\,t - 3\,s_2\,u + 4\,i\,Y)) - 2\,s_4\,(3\,s_2\,(t-u) + 2\,i\,Y)) -$$
$$-\, 32\,D_2(t,u)\,(\beta\,s\,(s - 3\,s_2 - i\,t + i\,u) + s_4\,(-2\,i\,s - t + u))\,Y^2 +$$
$$+\, 3\,D_3(s,t)\,s^2\,(16\,s_4\,t\,t_1\,(3\,t - t_2) + \beta\,(s^4 - 4\,s^3\,s_2 + 6\,s^2\,(-3\,t^2 + 2\,t\,u + u^2) +$$
$$+\, (-3\,t^2 + 2\,t\,u + u^2)^2 + 4\,s\,(-11\,t^3 - 9\,t^2\,u + 3\,t\,u^2 + u^3)) - 8\,i\,(2\,s_4\,t + \beta\,t_1\,(3\,t - t_2))\,Y) +$$
$$+\, 8\,C_0(s)\,s\,(2\,s_4\,(s^2 + s\,s_2 + (t-u)^2)\,(t-u) - \beta\,s\,(2\,s^3 - 5\,s^2\,s_2 - 7\,s_2\,(t-u)^2 +$$
$$+\, 4\,s\,(t^2 + u^2)) - 4\,i\,s\,(s_4 + \beta\,(t-u))\,Y) +$$
$$+\, D_1(s,u)\,s\,(-(\beta\,(s^5 + 16\,s^4\,(t-u) - 12\,s_2\,(t-u)^4 + s\,(t-u)^2\,(49\,t^2 + 6\,t\,u - 39\,u^2) +$$
$$+\, s^3\,(54\,t^2 - 52\,t\,u - 2\,u^2) + 4\,s^2\,(19\,t^3 - 23\,t^2\,u + 5\,t\,u^2 + 15\,u^3))) +$$
$$+\, 16\,s_4\,(s^2 + (t-u)^2 + s\,(2\,t - u))\,u_1\,(3\,u - u_2) + 4\,i\,(-4\,s_4\,(s^2 + (t-u)^2 + s\,(2\,t - u)) +$$
$$+\, \beta\,(3\,s^3 - 2\,(t-u)^3 + 4\,s^2\,(t + 2\,u) - s\,(t^2 - 6\,t\,u + 5\,u^2)))\,Y) +$$
$$+\, 3\,D_3(s,u)\,s^2\,(\beta\,(s^4 - 4\,s^3\,s_2 + 6\,s^2\,(t^2 + 2\,t\,u - 3\,u^2) + (t^2 + 2\,t\,u - 3\,u^2)^2 +$$

$$
\begin{aligned}
&+4\,s\,(t^3+3\,t^2\,u-9\,t\,u^2-11\,u^3))-16\,s_4\,u\,u_1\,(3\,u-u_2)-8\,i\,(2\,s_4\,u+\beta\,u_1\,(-3\,u+u_2))\,Y)+\\
&+D_1(s,t)\,s\,(-16\,s_4\,(s^2-s\,(t-2\,u)+(t-u)^2)\,(3\,t\,t_1-t_1\,t_2+i\,Y)-\\
&-\beta\,(s^5-16\,s^4\,(t-u)-4\,(t-u)^3\,(3\,s_2\,(t-u)-2\,i\,Y)-2\,s^3\,(t^2+26\,t\,u-27\,u^2-6\,i\,Y)-\\
&-s\,(t-u)\,(39\,t^3-45\,t^2\,u-43\,t\,u^2+49\,u^3+20\,i\,t\,Y-4\,i\,u\,Y)+\\
&+4\,s^2\,(15\,t^3+5\,t^2\,u-23\,t\,u^2+19\,u^3+8\,i\,t\,Y+4\,i\,u\,Y))))+\\
&+\frac{1}{8\,\beta\,s_4\,{t_1}^2\,{u_1}^2\,Y^2}(8\,B_1(M_W^2)\,{M_W}^2\,(-2\,s_4\,(t-u)\,(s^4-s^3\,s_2+s^2\,{s_2}^2-3\,s\,s_2\,(t-u)^2+\\
&+2\,(t-u)^2\,(t^2+u^2))-\beta\,(-3\,s^5\,s_2+3\,{s_2}^2\,(t-u)^4-4\,s^2\,(t-u)^2\,(t^2+u^2)+\\
&+s^4\,(9\,t^2+10\,t\,u+9\,u^2)+4\,s^3\,(t^3+t^2\,u+t\,u^2+u^3)+s\,(t-u)^2\,(t^3+7\,t^2\,u+7\,t\,u^2+u^3)))\,Y+\\
&+4\,B_1(u)\,{t_1}^2\,(-(s_4\,(s^4+t^4+4\,t^3\,u-18\,t^2\,u^2-12\,t\,u^3+25\,u^4+4\,s^3\,(t+2\,u)+\\
&+s^2\,(6\,t^2+20\,t\,u+6\,u^2)+4\,s\,(t^3+4\,t^2\,u-3\,t\,u^2-2\,u^3)))+\beta\,(s^4\,(t+5\,u)+\\
&+4\,s^3\,(t^2+7\,t\,u+6\,u^2)+2\,s^2\,(3\,t^3+25\,t^2\,u+37\,t\,u^2+7\,u^3)+(t-u)^2\,(t^3+11\,t^2\,u+23\,t\,u^2+\\
&+13\,u^3)+4\,s\,(t^4+9\,t^3\,u+13\,t^2\,u^2-t\,u^3-6\,u^4)))\,Y+\\
&+4\,B_1(t)\,(s_4\,(s^4+25\,t^4-12\,t^3\,u-18\,t^2\,u^2+4\,t\,u^3+u^4+4\,s^3\,(2\,t+u)+s^2\,(6\,t^2+20\,t\,u+6\,u^2)-\\
&-4\,s\,(2\,t^3+3\,t^2\,u-4\,t\,u^2-u^3))+\beta\,(s^4\,(5\,t+u)+4\,s^3\,(6\,t^2+7\,t\,u+u^2)+\\
&+(t-u)^2\,(13\,t^3+23\,t^2\,u+11\,t\,u^2+u^3)+2\,s^2\,(7\,t^3+37\,t^2\,u+25\,t\,u^2+3\,u^3)+\\
&+4\,s\,(-6\,t^4-t^3\,u+13\,t^2\,u^2+9\,t\,u^3+u^4)))\,{u_1}^2\,Y+\\
&+16\,B_0(s)\,{t_1}^2\,{u_1}^2\,(\beta\,s_2\,(-3\,s^2+6\,s\,s_2+(t-u)^2)+4\,s_4\,(s_2\,(t-u)-2\,i\,Y))\,Y+\\
&+16\,B_2(s)\,{t_1}^2\,{u_1}^2\,(\beta\,s_2\,(-3\,s^2+6\,s\,s_2+(t-u)^2)+4\,s_4\,(s_2\,(t-u)+2\,i\,Y))\,Y+\\
&+128\,{M_W}^2\,s_4\,t_1\,(t-u)\,u_1\,Y^2+128\,\beta\,s_2\,t_1\,u_1\,Y^3+\\
&+2\,C_2^1(s)\,s_4\,{t_1}^2\,{u_1}^2\,(\beta\,s\,(s^4-4\,s^3\,s_2-2\,s^2\,(t-u)^2+(t-u)^2\,(9\,t^2+14\,t\,u+9\,u^2)-\\
&-4\,s\,(3\,t^3+5\,t^2\,u+5\,t\,u^2+3\,u^3))+2\,(t-u)\,(s^4-4\,s^3\,s_2+(t^2-u^2)^2-2\,s^2\,(t^2+u^2)-\\
&-4\,s\,(3\,t^3+7\,t^2\,u+7\,t\,u^2+3\,u^3))+4\,i\,s_2\,(-3\,s^2+6\,s\,s_2+4\,\beta\,s\,(t-u)+(t-u)^2)\,Y)+\\
&+2\,C_3(s)\,s\,{t_1}^2\,{u_1}^2\,(8\,s_2\,s_4\,(t-u)\,(-s^2+2\,s\,s_2+t^2+u^2)+\beta\,s_2\,(3\,s^4-12\,s^3\,s_2+\\
&+2\,s^2\,(t^2+18\,t\,u+u^2)+(t-u)^2\,(3\,t^2+2\,t\,u+3\,u^2)-4\,s\,(5\,t^3-t^2\,u-t\,u^2+5\,u^3))+\\
&+4\,i\,(-2\,\beta\,(s^2-2\,s\,s_2-{s_2}^2)\,(t-u)-s_4\,(s^2-2\,s\,s_2-3\,t^2-2\,t\,u-3\,u^2))\,Y)+\\
&+2\,C_0(s)\,s\,{t_1}^2\,{u_1}^2\,(8\,s_2\,s_4\,(t-u)\,(-s^2+2\,s\,s_2+t^2+u^2)+\beta\,s_2\,(3\,s^4-12\,s^3\,s_2+\\
&+2\,s^2\,(t^2+18\,t\,u+u^2)+(t-u)^2\,(3\,t^2+2\,t\,u+3\,u^2)-4\,s\,(5\,t^3-t^2\,u-t\,u^2+5\,u^3))+\\
&+4\,i\,(2\,\beta\,(s^2-2\,s\,s_2-{s_2}^2)\,(t-u)+s_4\,(s^2-2\,s\,s_2-3\,t^2-2\,t\,u-3\,u^2))\,Y)+\\
&+2\,C_1^1(s)\,s_4\,{t_1}^2\,{u_1}^2\,(\beta\,s\,(s^4-4\,s^3\,s_2-2\,s^2\,(t-u)^2+(t-u)^2\,(9\,t^2+14\,t\,u+9\,u^2)-\\
&-4\,s\,(3\,t^3+5\,t^2\,u+5\,t\,u^2+3\,u^3))+2\,(t-u)\,(s^4-4\,s^3\,s_2+(t^2-u^2)^2-2\,s^2\,(t^2+u^2)-\\
&-4\,s\,(3\,t^3+7\,t^2\,u+7\,t\,u^2+3\,u^3))+4\,i\,s_2\,(3\,s^2-(t-u)^2+s\,(-6\,s_2+4\,\beta\,(-t+u)))\,Y)+\\
&+2\,C_2^2(t)\,{t_1}^3\,{u_1}^2\,(-(s^4\,(s_4+\beta\,(5\,t+u)))+4\,s^3\,(s_2\,s_4-\beta\,(5\,t^2+6\,t\,u+u^2))-\\
&-\beta\,(t^2-u^2)\,(5\,t^3-3\,t^2\,u-u\,(u^2+4\,i\,Y)-t\,(u^2+12\,i\,Y))+\\
&+2\,s^2\,(s_4\,(5\,t^2-2\,t\,u-3\,u^2-2\,i\,Y)+\beta\,(t^3-21\,t^2\,u-17\,t\,u^2-3\,u^3-10\,i\,t\,Y-2\,i\,u\,Y))+\\
&+4\,s\,(s_4\,(7\,t^3+9\,t^2\,u+t\,u^2-u^3+2\,i\,s_2\,Y)-\beta\,s_2\,(11\,t^3+t^2\,u-3\,t\,u^2-u^3-10\,i\,t\,Y-2\,i\,u\,Y))-\\
&-s_4\,(17\,t^4-4\,t^3\,u+u^4-2\,t^2\,(5\,u^2+14\,i\,Y)+4\,i\,u^2\,Y-4\,t\,(u^3+2\,i\,u\,Y)))+\\
&+D_1(s,t)\,s\,t\,{t_1}^2\,{u_1}^2\,(s^4\,(s_4+\beta\,(5\,t+u))+4\,s^3\,(-(s_2\,s_4)+\beta\,(5\,t^2+6\,t\,u+u^2))+\\
&+\beta\,(t^2-u^2)\,(5\,t^3-3\,t^2\,u-t\,u^2-u^3+12\,i\,t\,Y+4\,i\,u\,Y)+s_4\,(17\,t^4-4\,t^3\,u+u^4+\\
&+t^2\,(-10\,u^2+28\,i\,Y)-4\,i\,u^2\,Y-4\,t\,(u^3-2\,i\,u\,Y))-2\,s^2\,(s_4\,(5\,t^2-2\,t\,u-3\,u^2+2\,i\,Y)+\\
&+\beta\,(t^3-21\,t^2\,u-17\,t\,u^2-3\,u^3+10\,i\,t\,Y+2\,i\,u\,Y))-4\,s\,(s_4\,(7\,t^3+9\,t^2\,u+t\,u^2-u^3-2\,i\,s_2\,Y)-\\
&-\beta\,s_2\,(11\,t^3+t^2\,u-3\,t\,u^2-u^3+10\,i\,t\,Y+2\,i\,u\,Y)))+\\
&+2\,C_1^2(t)\,{t_1}^3\,{u_1}^2\,(-(s^4\,(s_4+\beta\,(5\,t+u)))+4\,s^3\,(s_2\,s_4-\beta\,(5\,t^2+6\,t\,u+u^2))-\\
&-\beta\,(t^2-u^2)\,(5\,t^3-3\,t^2\,u-t\,u^2-u^3+12\,i\,t\,Y+4\,i\,u\,Y)-s_4\,(17\,t^4-4\,t^3\,u+u^4+
\end{aligned}
$$

$$+t^2(-10u^2+28iY)-4iu^2Y-4t(u^3-2iuY))+2s^2(s_4(5t^2-2tu-3u^2+2iY)+$$
$$+\beta(t^3-21t^2u-17tu^2-3u^3+10itY+2iuY))+4s(s_4(7t^3+9t^2u+tu^2-u^3-2is_2Y)-$$
$$-\beta s_2(11t^3+t^2u-3tu^2-u^3+10itY+2iuY)))+$$
$$+D_3(s,t)stt_1{}^2u_1{}^2(s^4(s_4+\beta(5t+u))+4s^3(-(s_2s_4)+\beta(5t^2+6tu+u^2))+$$
$$+\beta(t^2-u^2)(5t^3-3t^2u-u(u^2+4iY)-t(u^2+12iY))-4s(s_4(7t^3+9t^2u+tu^2-$$
$$-u^3+2is_2Y)-\beta s_2(11t^3+t^2u-3tu^2-u^3-10itY-2iuY))+s_4(17t^4-4t^3u+u^4-$$
$$-2t^2(5u^2+14iY)+4iu^2Y-4t(u^3+2iuY))+s^2(s_4(-10t^2+4tu+6u^2+4iY)+$$
$$+2\beta(-t^3+21t^2u+17tu^2+3u^3+10itY+2iuY)))+$$
$$+2C_1^2(u)t_1{}^2u_1{}^3(s^4(s_4-\beta(t+5u))-4s^3(s_2s_4+\beta(t^2+6tu+5u^2))-$$
$$-\beta(t^2-u^2)(t^3+t^2u+3tu^2-5u^3+4itY+12iuY)+s_4(t^4-4t^3u+17u^4+$$
$$+t^2(-10u^2+4iY)-28iu^2Y-4t(u^3+2iuY))+4s(s_4(t^3-t^2u-9tu^2-7u^3-2is_2Y)+$$
$$+\beta s_2(t^3+3t^2u-tu^2-11u^3+2itY+10iuY))+2s^2(s_4(3t^2+2tu-5u^2+2iY)-$$
$$-\beta(3t^3+17t^2u+21tu^2-u^3+2itY+10iuY)))+$$
$$+D_1(s,u)st_1{}^2uu_1{}^2(s^4(-s_4+\beta(t+5u))+4s^3(s_2s_4+\beta(t^2+6tu+5u^2))+$$
$$+\beta(t^2-u^2)(t^3+t^2u+3tu^2-5u^3+4itY+12iuY)+s_4(-t^4+4t^3u-17u^4+$$
$$+2t^2(5u^2-2iY)+28iu^2Y+4t(u^3+2iuY))+4s(s_4(-t^3+t^2u+9tu^2+7u^3+2is_2Y)-$$
$$-\beta s_2(t^3+3t^2u-tu^2-11u^3+2itY+10iuY))+s^2(-2s_4(3t^2+2tu-5u^2+2iY)+$$
$$+2\beta(3t^3+17t^2u+21tu^2-u^3+2itY+10iuY)))+$$
$$+D_3(s,u)st_1{}^2uu_1{}^2(s^4(-s_4+\beta(t+5u))+4s^3(s_2s_4+\beta(t^2+6tu+5u^2))+$$
$$+\beta(t^2-u^2)(t^3+t^2u+3tu^2-5u^3-4itY-12iuY)-s_4(t^4-4t^3u+17u^4-$$
$$-2t^2(5u^2+2iY)+28iu^2Y-4t(u^3-2iuY))-4s(s_4(t^3-t^2u-9tu^2-7u^3+2is_2Y)+$$
$$+\beta s_2(t^3+3t^2u-11u^3-t(u^2+2iY)-10iuY))-2s^2(s_4(3t^2+2tu-5u^2-2iY)+$$
$$+\beta(-3t^3-17t^2u-21tu^2+u^3+2itY+10iuY)))+$$
$$+2C_2^2(u)t_1{}^2u_1{}^3(s^4(s_4-\beta(t+5u))-4s^3(s_2s_4+\beta(t^2+6tu+5u^2))-$$
$$-\beta(t^2-u^2)(t^3+t^2u+3tu^2-5u^3-4itY-12iuY)+s_4(t^4-4t^3u+17u^4-$$
$$-2t^2(5u^2+2iY)+28iu^2Y-4t(u^3-2iuY))+4s(s_4(t^3-t^2u-9tu^2-7u^3+2is_2Y)+$$
$$+\beta s_2(t^3+3t^2u-11u^3-t(u^2+2iY)-10iuY))+2s^2(s_4(3t^2+2tu-5u^2-2iY)+$$
$$+\beta(-3t^3-17t^2u-21tu^2+u^3+2itY+10iuY)))+$$
$$+\frac{m_1{}^2}{8\beta ss_4t_1u_1Y^2}(32B_2(s)st_1(\beta(-3s^2+6ss_2+(t-u)^2)+4s_4(t-u))u_1Y+$$
$$+32B_0(s)st_1(\beta(3s^2-6ss_2-(t-u)^2)+4s_4(-t+u))u_1Y+$$
$$+64D_2(t,u)(\beta s_2+is_4)t_1u_1Y^3+4C_3(s)s^2t_1u_1(-8s_4(t-u)(s^2-2ss_2-2(t^2+tu+u^2))+$$
$$+\beta(3s^4-12s^3s_2-2s^2(t^2-14tu+u^2)+(t-u)^2(7t^2+10tu+7u^2)-$$
$$-4s(7t^3+5t^2u+5tu^2+7u^3))+16is_2(s_4+\beta(t-u))Y)+$$
$$+4C_0(s)st_1u_1(4s_4(t-u)(2s^3-5s^2s_2-s_2(t-u)^2-2s(t^2+u^2))-$$
$$-\beta s(3s^4-16s^3s_2+2s^2(7t^2+30tu+7u^2)+(t-u)^2(15t^2+26tu+15u^2)-$$
$$-8s(t^3-3t^2u-3tu^2+u^3))+8i(s_4(s^2+(t-u)^2)+2\beta ss_2(t-u))Y)+$$
$$+16C_2^1(s)ss_4t_1u_1(-2\beta ss_2(s^2-2ss_2-2(t-u)^2)+s_2(-5s^2+10ss_2+(t-u)^2)(t-u)+$$
$$+i(-3s^2+6ss_2+4\beta s(t-u)+(t-u)^2)Y)+$$
$$+16C_1^1(s)ss_4t_1u_1(\beta s(s^3-2s^2s_2+s(t-u)^2-6s_2(t-u)^2)+(t-u)(s^3+s^2s_2-$$
$$-3s_2(t-u)^2-s(5t^2+14tu+5u^2))+i(-3s^2+6ss_2+4\beta s(t-u)+(t-u)^2)Y)+$$
$$+4C_2^2(u)t_1u_1{}^2(16ss_4u(s^2-2ss_2+t^2+tu-2u^2)+\beta(3s^5-13s^4s_2-s_2(t-u)^4+$$
$$+s^3(22t^2+36tu-18u^2)+s(t-u)^2(7t^2+18tu+15u^2)+s^2(18t^3+30t^2u-50tu^2-62u^3))+$$
$$+4i(s_4(s^2+2s(t-3u)+(t-u)^2)+\beta s(-3s^2+6ss_2-3t^2-2tu+5u^2))Y)+$$

$$
\begin{aligned}
&+4\,C_2^2(t)\,{t_1}^2\,u_1\,(-16\,s\,s_4\,t\,(s^2-2\,s\,s_2-2\,t^2+t\,u+u^2)+\beta\,(3\,s^5-13\,s^4\,s_2-s_2\,(t-u)^4+\\
&+s\,(t-u)^2\,(15\,t^2+18\,t\,u+7\,u^2)+s^3\,(-18\,t^2+36\,t\,u+22\,u^2)+s^2\,(-62\,t^3-50\,t^2\,u+30\,t\,u^2+\\
&+18\,u^3))+4\,i\,(\beta\,s\,(3\,s^2-6\,s\,s_2-5\,t^2+2\,t\,u+3\,u^2)+s_4\,(s^2+(t-u)^2+s\,(-6\,t+2\,u)))\,Y)+\\
&+C_1^2(t)\,u_1\,(-4\,s\,s_4\,(s^5-s^4\,(t-5\,u)+(t-u)^3\,(15\,t^2+6\,t\,u-u^2)+2\,s^3\,(t^2-6\,t\,u+5\,u^2)+\\
&+2\,s^2\,(13\,t^3-3\,t^2\,u-15\,t\,u^2+5\,u^3)+s\,(-11\,t^4+36\,t^3\,u-2\,t^2\,u^2-28\,t\,u^3+5\,u^4))-\\
&-\beta\,(5\,s^7+s_2\,(t-u)^6+s^6\,(29\,t+33\,u)+s\,(t-u)^4\,(23\,t^2+30\,t\,u+3\,u^2)+s^5\,(13\,t^2+\\
&+146\,t\,u+89\,u^2)-s^2\,(t-u)^2\,(81\,t^3-21\,t^2\,u-153\,t\,u^2-35\,u^3)+s^4\,(21\,t^3-29\,t^2\,u+\\
&+267\,t\,u^2+125\,u^3)+s^3\,(119\,t^4+44\,t^3\,u-222\,t^2\,u^2+220\,t\,u^3+95\,u^4))+\\
&+16\,i\,{t_1}^2\,(\beta\,s\,(3\,s^2-6\,s\,s_2-5\,t^2+2\,t\,u+3\,u^2)+s_4\,(s^2+(t-u)^2+s\,(-6\,t+2\,u)))\,Y)+\\
&+D_3(s,t)\,s^2\,t_1\,u_1\,(-(s_4\,(s^4-4\,s^3\,s_2+(3\,t+u)^2\,(9\,t^2-10\,t\,u+u^2)+s^2\,(-42\,t^2+4\,t\,u+6\,u^2)-\\
&-4\,s\,(23\,t^3+25\,t^2\,u+t\,u^2-u^3)))-\beta\,((t-u)^2\,(3\,t+u)^3+s^4\,(11\,t+u)+\\
&+4\,s^3\,(11\,t^2+12\,t\,u+u^2)+s^2\,(-46\,t^3+98\,t^2\,u+70\,t\,u^2+6\,u^3)+4\,s\,(-45\,t^4-42\,t^3\,u+12\,t^2\,u^2+\\
&+10\,t\,u^3+u^4))+4\,i\,(-(s_4\,(s^2-2\,s\,s_2-23\,t^2-2\,t\,u+u^2))-\beta\,(-13\,t^3+3\,t^2\,u+9\,t\,u^2+u^3+\\
&+s^2\,(11\,t+u)+2\,s\,(11\,t^2+12\,t\,u+u^2)))\,Y)+D_3(s,u)\,s^2\,t_1\,u_1\,(s_4\,(s^4-4\,s^3\,s_2+\\
&+s^2\,(6\,t^2+4\,t\,u-42\,u^2)+(t+3\,u)^2\,(t^2-10\,t\,u+9\,u^2)+4\,s\,(t^3-t^2\,u-25\,t\,u^2-23\,u^3))-\\
&-\beta\,((t-u)^2\,(t+3\,u)^3+s^4\,(t+11\,u)+4\,s^3\,(t^2+12\,t\,u+11\,u^2)+2\,s^2\,(3\,t^3+35\,t^2\,u+49\,t\,u^2-\\
&-23\,u^3)+4\,s\,(t^4+10\,t^3\,u+12\,t^2\,u^2-42\,t\,u^3-45\,u^4))+4\,i\,(-(s_4\,(s^2-2\,s\,s_2+t^2-2\,t\,u-23\,u^2))+\\
&+\beta\,(t^3+9\,t^2\,u+3\,t\,u^2-13\,u^3+s^2\,(t+11\,u)+2\,s\,(t^2+12\,t\,u+11\,u^2)))\,Y)+\\
&+D_1(s,t)\,s\,t_1\,u_1\,(s_4\,(s^5+6\,s^4\,(3\,t+u)-2\,(t-u)^3\,(3\,t+u)^2+2\,s^3\,(7\,t^2+34\,t\,u+7\,u^2)+\\
&+s\,(t-u)^2\,(73\,t^2+62\,t\,u+9\,u^2)+s^2\,(-40\,t^3+88\,t\,u^2+16\,u^3))-\beta\,(4\,s^6+2\,{s_2}^2\,(t-u)^4+\\
&+s^5\,(13\,t+23\,u)-18\,s^4\,(t^2-2\,t\,u-3\,u^2)-2\,s^3\,(5\,t^3+69\,t^2\,u-9\,t\,u^2-33\,u^3)-\\
&-s\,(t-u)^2\,(75\,t^3+75\,t^2\,u-7\,t\,u^2-15\,u^3)+4\,s^2\,(17\,t^4-2\,t^3\,u-52\,t^2\,u^2-6\,t\,u^3+11\,u^4))+\\
&+4\,i\,(-(s_4\,(s^3+4\,s^2\,(2\,t+u)+2\,(t-u)^2\,(3\,t+u)+s\,(-11\,t^2+14\,t\,u+5\,u^2)))+\\
&+\beta\,(4\,s^4+2\,s_2\,(t-u)^3+5\,s^3\,(t+3\,u)-4\,s^2\,(t^2-5\,u^2)+s\,(17\,t^3-15\,t^2\,u-13\,t\,u^2+11\,u^3)))\,Y)+\\
&+C_1^2(u)\,t_1\,(4\,s\,s_4\,(s^5+s^4\,(5\,t-u)+(t-u)^3\,(t^2-6\,t\,u-15\,u^2)+2\,s^3\,(5\,t^2-6\,t\,u+u^2)+\\
&+2\,s^2\,(5\,t^3-15\,t^2\,u-3\,t\,u^2+13\,u^3)+s\,(5\,t^4-28\,t^3\,u-2\,t^2\,u^2+36\,t\,u^3-11\,u^4))-\\
&-\beta\,(5\,s^7+s_2\,(t-u)^6+s^6\,(33\,t+29\,u)+s^5\,(89\,t^2+146\,t\,u+13\,u^2)+s\,(t-u)^4\,(3\,t^2+30\,t\,u+\\
&+23\,u^2)+s^2\,(t-u)^2\,(35\,t^3+153\,t^2\,u+21\,t\,u^2-81\,u^3)+s^4\,(125\,t^3+267\,t^2\,u-29\,t\,u^2+21\,u^3)+\\
&+s^3\,(95\,t^4+220\,t^3\,u-222\,t^2\,u^2+44\,t\,u^3+119\,u^4))+16\,i\,(s_4\,(s^2+2\,s\,(t-3\,u)+(t-u)^2)+\\
&+\beta\,s\,(-3\,s^2+6\,s\,s_2-3\,t^2-2\,t\,u+5\,u^2))\,{u_1}^2\,Y)+\\
&+D_1(s,u)\,s\,t_1\,u_1\,(-(s_4\,(s^5+6\,s^4\,(t+3\,u)+2\,s^3\,(7\,t^2+34\,t\,u+7\,u^2+2\,i\,Y)+\\
&+2\,(t-u)^2\,(t+3\,u)\,(t^2+2\,t\,u-3\,u^2+4\,i\,Y)+8\,s^2\,(2\,t^3+11\,t^2\,u-5\,u^3+2\,i\,t\,Y+4\,i\,u\,Y)+\\
&+s\,(9\,t^4+44\,t^3\,u-42\,t^2\,u^2-84\,t\,u^3+73\,u^4+20\,i\,t^2\,Y+56\,i\,t\,u\,Y-44\,i\,u^2\,Y)))-\\
&-\beta\,(4\,s^6+s^5\,(23\,t+13\,u)+2\,s_2\,(t-u)^3\,(s_2\,(t-u)-4\,i\,Y)+s^4\,(54\,t^2+36\,t\,u-18\,u^2+\\
&+16\,i\,Y)+2\,s^3\,(33\,t^3+9\,t^2\,u-69\,t\,u^2-5\,u^3+30\,i\,t\,Y+10\,i\,u\,Y)+\\
&+4\,s^2\,(11\,t^4-6\,t^3\,u-2\,t\,u^3+17\,u^4+t^2\,(-52\,u^2+20\,i\,Y)-4\,i\,u^2\,Y)+\\
&+s\,(t-u)\,(15\,t^4-8\,t^3\,u+75\,u^4+t^2\,(-82\,u^2+44\,i\,Y)-8\,i\,t\,u\,Y-68\,i\,u^2\,Y)))).
\end{aligned}
$$

M_{+-00}.

$$
\begin{aligned}
&M_{+-00}=\\
&=\frac{4\,(D_1(s,u)+D_1(s,t)+D_3(s,t)+D_3(s,u)+2\,D_2(t,u))\,{m_1}^8\,s^2}{{M_W}^2\,s_4\,Y}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{2\,{m_1}^6\,s}{{M_W}^2\,s_4\,Y}(4\,C_0(s)\,s-4\,C_3(s)\,s+3\,D_1(s,u)\,s^2+3\,D_1(s,t)\,s^2-2\,D_3(s,t)\,s^2-\\
&-2\,D_3(s,u)\,s^2+D_2(t,u)\,s^2-2\,D_3(s,t)\,{s_2}^2-2\,D_3(s,u)\,{s_2}^2+(3+i)\,D_1(s,u)\,s\,t-\\
&-(1-i)\,D_1(s,t)\,s\,t+(1+i)\,D_3(s,t)\,s\,t-(3-i)\,D_3(s,u)\,s\,t+2\,i\,D_2(t,u)\,s\,t-\\
&-D_1(s,u)\,t^2-D_1(s,t)\,t^2-3\,D_2(t,u)\,t^2-(1+i)\,D_1(s,u)\,s\,u+(3-i)\,D_1(s,t)\,s\,u-\\
&-(3+i)\,D_3(s,t)\,s\,u+(1-i)\,D_3(s,u)\,s\,u-2\,i\,D_2(t,u)\,s\,u-6\,D_1(s,u)\,t\,u-\\
&-6\,D_1(s,t)\,t\,u-10\,D_2(t,u)\,t\,u-D_1(s,u)\,u^2-D_1(s,t)\,u^2-3\,D_2(t,u)\,u^2)+\\
&+\frac{{m_1}^4}{2\,{M_W}^2\,s_4\,Y}(-16\,C_1^2(t)\,s\,t_1\,t_2-16\,C_2^2(t)\,s\,t_1\,t_2+8\,C_0(s)\,s\,(8\,{M_W}^2\,s_1+i\,s\,(t-u))-\\
&-4\,C_1^1(s)\,s\,(s^2-2\,s\,s_2-(t-u)^2)-4\,C_2^1(s)\,s\,(s^2-2\,s\,s_2-(t-u)^2)+\\
&+D_3(s,u)\,s\,((1+i)\,s^3-4\,{s_2}^2\,((1+i)\,t+(5-i)\,u)-2\,s^2\,((1+i)\,t+(9-3\,i)\,u)+\\
&+s\,((-7-7\,i)\,t^2-(42-6\,i)\,t\,u-(23-i)\,u^2))+\\
&+D_3(s,t)\,s\,((1-i)\,s^3-4\,{s_2}^2\,((5+i)\,t+(1-i)\,u)-2\,s^2\,((9+3\,i)\,t+(1-i)\,u)-\\
&-s\,((23+i)\,t^2+(42+6\,i)\,t\,u+(7-7\,i)\,u^2))+\\
&+D_1(s,t)\,((7+i)\,s^4+4\,s^3\,(2\,i\,t+(4-i)\,u)-4\,(t^2-u^2)^2+s^2\,((7+5\,i)\,t^2-\\
&-(22-6\,i)\,t\,u+(7-11\,i)\,u^2)+2\,s\,((5+3\,i)\,t^3-(5+i)\,t^2\,u-(13-i)\,t\,u^2-(3+3\,i)\,u^3))+\\
&+D_1(s,u)\,((7-i)\,s^4+4\,s^3\,((4+i)\,t-2\,i\,u)-4\,(t^2-u^2)^2+s^2\,((7+11\,i)\,t^2-\\
&-(22+6\,i)\,t\,u+(7-5\,i)\,u^2)+2\,s\,((-3+3\,i)\,t^3-(13+i)\,t^2\,u-(5-i)\,t\,u^2+(5-3\,i)\,u^3))+\\
&+8\,C_3(s)\,s\,(2\,s^2+2\,{s_2}^2+s\,(-2\,s_2+i\,(-t+u)))-16\,C_1^2(u)\,s\,u_1\,u_2-\\
&-16\,C_2^2(u)\,s\,u_1\,u_2+8\,D_2(t,u)\,(4\,{s_2}^2+s\,(-3\,s_2+i\,(-t+u)))\,Y)+\\
&+\frac{2\,{M_W}^2}{s_4\,{t_1}^2\,{u_1}^2\,Y}(2\,C_1^1(s)\,{t_1}^2\,(s_2\,(-s^2+2\,s\,s_2+(t-u)^2)+2\,i\,s\,s_4\,(t-u))\,{u_1}^2-\\
&-D_1(s,t)\,s\,t\,{t_1}^2\,(s^2-2\,s\,s_2+5\,t^2-6\,i\,t\,t_1+2\,i\,t_1\,t_2+2\,t\,u+u^2)\,{u_1}^2+\\
&+2\,C_1^2(t)\,{t_1}^3\,(s^2-2\,s\,s_2+5\,t^2-6\,i\,t\,t_1+2\,i\,t_1\,t_2+2\,t\,u+u^2)\,{u_1}^2+\\
&+2\,C_0(s)\,s\,{t_1}^2\,(s^2-2\,s\,s_2+3\,t^2+2\,i\,s_2\,(t-u)+2\,t\,u+3\,u^2)\,{u_1}^2+\\
&+2\,C_3(s)\,s\,{t_1}^2\,(s^2-2\,s\,s_2+3\,t^2+2\,t\,u+3\,u^2+2\,i\,s_2\,(-t+u))\,{u_1}^2-\\
&-D_3(s,t)\,s\,t\,{t_1}^2\,(s^2-2\,s\,s_2+5\,t^2-2\,i\,t_1\,t_2+u^2+2\,t\,(3\,i\,t_1+u))\,{u_1}^2+\\
&+2\,C_2^2(t)\,{t_1}^3\,(s^2-2\,s\,s_2+5\,t^2-2\,i\,t_1\,t_2+u^2+2\,t\,(3\,i\,t_1+u))\,{u_1}^2+\\
&+2\,C_2^1(s)\,{t_1}^2\,(-(s^2\,s_2)+s_2\,(t-u)^2+2\,s\,({s_2}^2+i\,s_4\,(-t+u)))\,{u_1}^2-\\
&-D_1(s,u)\,s\,{t_1}^2\,u\,{u_1}^2\,(s^2-2\,s\,s_2+t^2+2\,t\,u+5\,u^2+6\,i\,u\,u_1-2\,i\,u_1\,u_2)+\\
&+2\,C_1^2(u)\,{t_1}^2\,{u_1}^3\,(s^2-2\,s\,s_2+t^2+2\,t\,u+5\,u^2+6\,i\,u\,u_1-2\,i\,u_1\,u_2)-\\
&-D_3(s,u)\,s\,{t_1}^2\,u\,{u_1}^2\,(s^2-2\,s\,s_2+t^2+2\,t\,u+5\,u^2-6\,i\,u\,u_1+2\,i\,u_1\,u_2)+\\
&+2\,C_2^2(u)\,{t_1}^2\,{u_1}^3\,(s^2-2\,s\,s_2+t^2+2\,t\,u+5\,u^2-6\,i\,u\,u_1+2\,i\,u_1\,u_2)-\\
&-4\,B_1(u)\,{t_1}^2\,(s^2-2\,s\,s_2+t^2+2\,t\,u+5\,u^2)\,Y+\\
&+2\,B_1(M_W^2)\,(s^4-2\,s^3\,s_2-6\,s\,s_2\,(t-u)^2+4\,s^2\,(t^2+u^2)+(t-u)^2\,(3\,t^2+2\,t\,u+3\,u^2))\,Y-\\
&-4\,B_1(t)\,(s^2-2\,s\,s_2+5\,t^2+2\,t\,u+u^2)\,{u_1}^2\,Y-32\,t_1\,u_1\,Y^2)+\\
&+\frac{{m_1}^2}{4\,{M_W}^2\,s\,s_4\,t_1\,u_1\,Y}(4\,C_1^1(s)\,s\,t_1\,((2\,s^2-s\,s_2-2\,{s_2}^2)\,(s^2-2\,s\,s_2-(t-u)^2)\times\\
&\times 2\,i\,s^2\,s_4\,(t-u))\,u_1+
\end{aligned}
$$

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$$
\begin{aligned}
&+4\,C_2^1(s)\,s\,t_1\,(-((2\,s^2-3\,s\,s_2+2\,s_2{}^2)\,(s^2-2\,s\,s_2-(t-u)^2))-2\,i\,s^2\,s_4\,(t-u))\,u_1+\\
&+4\,C_0(s)\,s^2\,t_1\,(-3\,s^3+2\,s^2\,s_2-2\,i\,(2\,s^2-3\,s\,s_2+2\,s_2{}^2)\,(t-u)+\\
&+4\,s_2\,(t-u)^2-s\,(t^2-10\,t\,u+u^2))\,u_1+\\
&+4\,C_3(s)\,s^2\,t_1\,(s^3+6\,s^2\,s_2+8\,s_2{}^3-2\,i\,(2\,s^2-3\,s\,s_2+2\,s_2{}^2)\,(t-u)-\\
&-s\,(13\,t^2+30\,t\,u+13\,u^2))\,u_1+\\
&+2\,D_1(s,t)\,s\,t_1\,((-1-i)\,s^5+s^4\,((1-5\,i)\,t-(2+2\,i)\,u)-2\,s_2{}^2\,(s_2+\\
&+i\,(t-u))\,(t-u)^2-2\,s^3\,((2+2\,i)\,t^2-(5-7\,i)\,t\,u-(1+i)\,u^2)-s^2\,((1+3\,i)\,t^3+\\
&+(2+6\,i)\,t^2\,u-(19-15\,i)\,t\,u^2-(8+8\,i)\,u^3)+s\,s_2\,((-11+i)\,t^3+(7-9\,i)\,t^2\,u-\\
&-(5-15\,i)\,t\,u^2-(7+7\,i)\,u^3))\,u_1+\\
&+4\,C_2^2(t)\,t_1{}^2\,((1-i)\,s^4-2\,s^3\,((4+3\,i)\,t-i\,u)+2\,(t^2-u^2)^2-s^2\,((13+5\,i)\,t^2+\\
&+(18+2\,i)\,t\,u+(1-7\,i)\,u^2)-2\,s\,(3\,t^3+2\,i\,s_2{}^2\,(t-u)+9\,t^2\,u+5\,t\,u^2-u^3))\,u_1+\\
&+2\,D_1(s,u)\,s\,t_1\,((-1+i)\,s^5-2\,s_2{}^2\,(s_2+i\,(t-u))\,(t-u)^2+s^4\,((-2+2\,i)\,t+\\
&+(1+5\,i)\,u)+2\,s^3\,((1-i)\,t^2+(5+7\,i)\,t\,u-(2-2\,i)\,u^2)+s\,s_2\,((-7+7\,i)\,t^3-\\
&-(5+15\,i)\,t^2\,u+(7+9\,i)\,t\,u^2-(11+i)\,u^3)+s^2\,((8-8\,i)\,t^3+(19+15\,i)\,t^2\,u-\\
&-(2-6\,i)\,t\,u^2-(1-3\,i)\,u^3))\,u_1+\\
&+2\,D_3(s,t)\,s^2\,t_1\,((1-i)\,s^4+(1-i)\,s^3\,(3\,t+4\,u)+s_2{}^2\,((17+7\,i)\,t^2+\\
&+(6-6\,i)\,t\,u+(1-i)\,u^2)+2\,s^2\,((10+2\,i)\,t^2+(7-7\,i)\,t\,u+(3-3\,i)\,u^2)+\\
&+s\,((31+9\,i)\,t^3+(50-2\,i)\,t^2\,u+(19-19\,i)\,t\,u^2+(4-4\,i)\,u^3))\,u_1+\\
&+2\,D_3(s,u)\,s^2\,t_1\,((1+i)\,s^4+(1+i)\,s^3\,(4\,t+3\,u)+2\,s^2\,((3+3\,i)\,t^2+(7+7\,i)\,t\,u+\\
&+(10-2\,i)\,u^2)+s_2{}^2\,((1+i)\,t^2+(6+6\,i)\,t\,u+(17-7\,i)\,u^2)+s\,((4+4\,i)\,t^3+\\
&+(19+19\,i)\,t^2\,u+(50+2\,i)\,t\,u^2+(31-9\,i)\,u^3))\,u_1+\\
&+C_1^2(t)\,(s^6+2\,s_2{}^2\,(t-u)^4+10\,s^5\,(3\,t+u)+4\,s^4\,(13\,t^2+27\,t\,u+8\,u^2)+\\
&+2\,s\,(t-u)^2\,(7\,t^3+17\,t^2\,u+17\,t\,u^2+7\,u^3)+4\,s^3\,(19\,t^3+22\,t^2\,u+35\,t\,u^2+\\
&+12\,u^3)+s^2\,(81\,t^4+48\,t^3\,u+18\,t^2\,u^2+72\,t\,u^3+37\,u^4)-4\,i\,s\,t_1{}^2\,(s^3+s^2\,(6\,t-\\
&-2\,u)+4\,s_2{}^2\,(t-u)+s\,(5\,t^2+2\,t\,u-7\,u^2)))\,u_1+\\
&+4\,C_2^2(u)\,t_1\,((1+i)\,s^4-2\,s^3\,(i\,(t-3\,u)+4\,u)+2\,(t^2-u^2)^2-s^2\,((1+7\,i)\,t^2+\\
&+(18-2\,i)\,t\,u+(13-5\,i)\,u^2)-2\,s\,(-t^3+2\,i\,s_2{}^2\,(t-u)+5\,t^2\,u+9\,t\,u^2+3\,u^3))\,u_1{}^2+\\
&+C_1^2(u)\,t_1\,(s^6+2\,s_2{}^2\,(t-u)^4+10\,s^5\,(t+3\,u)+4\,s^4\,(8\,t^2+27\,t\,u+13\,u^2)+\\
&+2\,s\,(t-u)^2\,(7\,t^3+17\,t^2\,u+17\,t\,u^2+7\,u^3)+4\,s^3\,(12\,t^3+35\,t^2\,u+22\,t\,u^2+\\
&+19\,u^3)+s^2\,(37\,t^4+72\,t^3\,u+18\,t^2\,u^2+48\,t\,u^3+81\,u^4)+4\,i\,s\,(s^3-2\,s^2\,(t-3\,u)+\\
&+4\,s_2{}^2\,(-t+u)+s\,(-7\,t^2+2\,t\,u+5\,u^2))\,u_1{}^2)-\\
&-64\,D_2(t,u)\,M_W{}^2\,s_2\,t_1\,u_1\,Y^2)
\end{aligned}
$$

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