SmeftFR v3 validation

In order to test validity of SmeftFR , we performed several types of numerical cross-checks against already existing codes:

- we compared **cross-sections** for various processes obtained with SmeftFR against the results obtained with SMEFT@NLO [1] package up to terms of $\mathcal{O}(\Lambda^{-2})$ (note that SMEFT@NLO, Dim6Top [2] and SMEFTsim [3] have been formally validated up to this order [4], so it is sufficient to compare with only one of these codes),
- we compared **matrix elements** for various processes obtained with SmeftFR against the results obtained with SMEFTsim package up to terms of $\mathcal{O}(\Lambda^{-2})$, testing all implemented dimension-6 operators (apart from B- and L- violating ones),
- we compared **matrix elements** for various processes obtained with SmeftFR against the results obtained with the code based on [6] (available at https://feynrules.irmp.ucl.ac.be/wiki/AnomalousGaugeCoupling) up to terms of $\mathcal{O}(\Lambda^{-4})$, testing all operators considered in [6].

For all comparisons which we performed we have used the (G_F, M_W, M_Z, M_H) input parameter scheme (option InputScheme $\to$ "GF" in SMEFTInitializeModel routine) with values of input parameters set to central values given in ref. [7] (unless stated otherwise below). In addition, CKM and PMNS matrices were approximated by unit matrices.

All comparisons were generated using SmeftFR v3.02.

1 Dimension-6 $\mathcal{O}(\Lambda^{-2})$ validation

1.1 Cross-sections comparison

For cross-sections comparison, all particle widths, fermion masses and Yukawa couplings, except for the top quark, were assumed to be zero. Each cross section was calculated assuming that all but one Wilson coefficients were set to zero and the non-vanishing one (displayed in the left column of Table 1) had the value of $\left|\frac{C_i}{\Lambda^2}\right| = 10^{-6}$ GeV^{-2}, while its sign was always chosen to increase $\mathcal{O}(\Lambda^{-2})$ cross section w.r.t. SM. The results are summarised in the 2nd and 3rd column of Table 1. As one can see, differences between both codes at the $\mathcal{O}(\Lambda^{-2})$ level never exceed 1%.

	SMEFT@NLO $\mathcal{O}(\Lambda^{-2})$	SmeftFR $\mathcal{O}(\Lambda^{-2})$	SmeftFR $\mathcal{O}(\Lambda^{-4})$
	$\mu^+\mu^- \to t\bar{t}$		
SM	0.16606 ± 0.00026	0.16608 ± 0.00024	-
C_{uW}^{33}	0.41862 ± 0.00048	0.41816 ± 0.00047	-
$C_{\varphi u}^{33}$	0.16725 ± 0.00027	0.16730 ± 0.00025	-
C_{lu}^{2233}	6.488 ± 0.016	6.491 ± 0.014	-
$C_{\varphi WB}$	0.21923 ± 0.00032	0.21940 ± 0.00030	0.22419 ± 0.00030
$C_{\varphi D}$	0.18759 ± 0.00030	0.18759 ± 0.00027	0.18829 ± 0.00027
	$\gamma\gamma \to t\bar{t}$		
SM	0.0037498 ± 0.0000050	0.0037498 ± 0.0000050	-
C_{uW}^{33}	0.008229 ± 0.000012	0.008235 ± 0.000012	-
$C_{\varphi WB}$	0.0053056 ± 0.0000086	0.0053056 ± 0.0000086	0.0055809 ± 0.0000090
$C_{\varphi D}$	0.0045856 ± 0.0000061	0.0045895 ± 0.0000064	0.0045882 ± 0.0000069
	$c\bar{c} \to t\bar{t}$		
SM	0.9553 ± 0.0017	0.9511 ± 0.0023	-
C_{uG}^{33}	1.1867 ± 0.0023	1.1854 ± 0.0021	-
C_{uW}^{33}	0.9641 ± 0.0018	0.9599 ± 0.0024	-
$C_{\varphi u}^{33}$	0.9555 ± 0.0017	0.9513 ± 0.0023	-
$C_{\varphi q3}^{33}$	0.9558 ± 0.0017	0.9515 ± 0.0023	-
C_{qu1}^{2233}	1.0111 ± 0.0018	1.0059 ± 0.0015	-
$C_{\varphi WB}$	0.9568 ± 0.0018	0.9520 ± 0.0018	0.9522 ± 0.0018
$C_{\varphi D}$	0.9558 ± 0.0017	0.9511 ± 0.0018	0.9511 ± 0.0018
	$pp \to t\bar{t}$		
SM	510.35 ± 0.72	510.46 ± 0.68	-
C_{uG}^{33}	664.33 ± 1.16	666.34 ± 0.90	671.08 ± 0.97
C_{uW}^{33}	510.63 ± 0.70	510.70 ± 0.80	-
$C_{\varphi u}^{33}$	510.37 ± 0.72	510.47 ± 0.68	-
$C_{\varphi q3}^{33}$	510.39 ± 0.72	510.65 ± 0.80	-
$\sum_{i=1,2} C_{qu1}^{ii33}$	516.31 ± 0.58	516.14 ± 0.64	-
$C_{\varphi WB}$	510.49 ± 0.68	510.52 ± 0.71	508.94 ± 0.79
$C_{\varphi D}$	510.38 ± 0.72	510.47 ± 0.68	508.89 ± 0.79

Table 1: Cross-sections (in pb) obtained using MadGraph5 with UFO models provided by SMEFTatNLO at the $\mathcal{O}(\Lambda^{-2})$ order of the EFT expansion and SmeftFR at the $\mathcal{O}(\Lambda^{-2})$ and $\mathcal{O}(\Lambda^{-4})$ orders of the EFT expansion for a chosen set of processes and SMEFT operators. An empty cell indicates that no $\mathcal{O}(\Lambda^{-4})$ terms appear in the amplitude.

1.2 Matrix elements comparison

We have used similar procedure for matrix elements $\mathcal{A}$ comparison. Once again each matrix element was calculated assuming that all but one Wilson coefficients were set to zero and the non-vanishing one had the value of $\frac{C_i}{\Lambda^2} = 10^{-6}$ GeV^{-2}. We obtained almost identical results from SMEFTsim and SmeftFR for all of the studied processes, see Tables 2 and 3, with the relative differences defined as:

$$\Delta = \left|\mathcal{A}_{\texttt{SmeftFR}} - \mathcal{A}_{\texttt{SMEFTsim}}\right| / \mathcal{A}_{\texttt{SMEFTsim}} \tag{1.1}$$

not exceeding 0.1%, usually being much smaller.

	SmeftFR	SMEFTsim	Δ
`g g > g g`			
SM	54.806	54.791	0.03%
C_G	149.35	149.35	0.00%
$C_{\tilde{G}}$	149.35	149.33	0.01%
`z z > w+ w-`			
SM	3.2688	3.2688	0.00%
C_W	20.602	20.602	0.00%
$C_{\tilde{W}}$	20.661	20.661	0.00%
$C_{\varphi WB}$	3.7462	3.7462	0.00%
$C_{\varphi\Box}$	3.4727	3.4727	0.00%
$C_{\varphi D}$	3.5563	3.5563	0.00%
`a a > w+ w-`			
SM	0.5168	0.5168	0.00%
C_W	3.4688	3.4726	0.11%
$C_{\tilde{W}}$	3.4793	3.4802	0.03%
$C_{\varphi WB}$	0.7838	0.7838	0.00%
`w+ w- > w+ w-`			
SM	0.4593	0.4593	0.00%
C_W	3.6653	3.6653	0.00%
$C_{\tilde{W}}$	3.6774	3.6774	0.00%
$C_{\varphi\Box}$	0.5375	0.5375	0.00%
$C_{\varphi D}$	0.4818	0.4818	0.00%
`h h > h h`			
SM	0.2024	0.2024	0.00%
C_{φ}	1.1980	1.1980	0.00%
$C_{\varphi\Box}$	0.9399	0.9399	0.00%
$C_{\varphi D}$	0.1024	0.1024	0.00%
`w+ w- > h h`			
SM	0.0218	0.0218	0.00%
$C_{\varphi W}$	0.4662	0.4662	0.00%
$C_{\varphi\Box}$	0.1221	0.1221	0.00%
$C_{\varphi D}$	0.0663	0.0663	0.00%
`z z > h h`			
SM	0.0416	0.0416	0.00%
$C_{\varphi W}$	0.3088	0.3088	0.00%
$C_{\varphi\tilde{W}}$	0.2968	0.2968	0.00%
$C_{\varphi B}$	0.0658	0.0658	0.00%
$C_{\varphi\tilde{B}}$	0.0626	0.0626	0.00%
$C_{\varphi WB}$	0.1210	0.1210	0.00%
$C_{\varphi\tilde{W}B}$	0.1148	0.1148	0.00%
`g g > h h`			
SM	0.0000	0.0000	0.00%
$C_{\varphi G}$	0.1373	0.1373	0.00%
$C_{\varphi\tilde{G}}$	0.1373	0.1373	0.00%
`e+ e- > z h`			
SM	0.0021	0.0021	0.00%
C_{eW}^{11}	0.3336	0.3336	0.00%
C_{eB}^{11}	0.0972	0.0972	0.00%
$C_{\varphi l1}^{11}$	0.2559	0.2559	0.00%
$C_{\varphi l3}^{11}$	0.2536	0.2536	0.00%
$C_{\varphi e}^{11}$	0.1956	0.1956	0.00%

	SmeftFR	SMEFTsim	Δ
`e+ e- > h h`			
SM	0.0000	0.0000	0.00%
$C_{e\varphi}^{11}$	0.0706	0.0706	0.00%
`e+ e- > w+ w-`			
SM	0.0169	0.0169	0.00%
C_{eW}^{11}	1.6746	1.6745	0.00%
$C_{\varphi l1}^{11}$	0.1830	0.1830	0.00%
$C_{\varphi l3}^{11}$	0.3096	0.3096	0.00%
$C_{\varphi e}^{11}$	0.2175	0.2175	0.00%
`ū d > w- z`			
SM	0.0034	0.0034	0.00%
C_{uW}^{11}	0.2495	0.2495	0.00%
C_{dW}^{11}	0.2490	0.2490	0.00%
$C_{\varphi q3}^{11}$	0.1955	0.1955	0.00%
$C_{\varphi ud}^{11}$	0.0418	0.0418	0.00%
`ū u > h h`			
SM	0.0000	0.0000	0.00%
$C_{u\varphi}^{11}$	0.0235	0.0235	0.00%
`d̄ d > h h`			
SM	0.0000	0.0000	0.00%
$C_{d\varphi}^{11}$	0.0235	0.0235	0.00%
`ū u > z h`			
SM	0.0008	0.0008	0.00%
C_{uW}^{11}	0.1113	0.1113	0.00%
C_{uB}^{11}	0.0325	0.0325	0.00%
$C_{\varphi q1}^{11}$	0.0601	0.0601	0.00%
$C_{\varphi q3}^{11}$	0.0884	0.0884	0.00%
$C_{\varphi u}^{11}$	0.0802	0.0802	0.00%
`d̄ d > z h`			
SM	0.0010	0.0010	0.00%
C_{dW}^{11}	0.1115	0.1115	0.00%
C_{dB}^{11}	0.0327	0.0327	0.00%
$C_{\varphi q1}^{11}$	0.0916	0.0916	0.00%
$C_{\varphi q3}^{11}$	0.0916	0.0916	0.00%
$C_{\varphi d}^{11}$	0.0715	0.0715	0.00%
`ū d > w- h`			
SM	0.0016	0.0016	0.00%
C_{uW}^{11}	0.1424	0.1424	0.00%
C_{dW}^{11}	0.1424	0.1424	0.00%
$C_{\varphi q3}^{11}$	0.0377	0.0377	0.00%
$C_{\varphi ud}^{11}$	0.1767	0.1767	0.00%
`g g > ū u`			
SM	0.5291	0.5291	0.00%
C_{uG}^{11}	0.6130	0.6130	0.00%
`g g > d̄ d`			
SM	0.5291	0.5291	0.00%
C_{dG}^{11}	0.6130	0.6130	0.00%

Table 2: Matrix elements and their relative differences for a given processes obtained using `MadGraph5` with UFO models provided by `SmeftFR` and `SMEFTsim` at the $\mathcal{O}(\Lambda^{-2})$ order of the EFT expansion. Bosonic and 2-fermion dimension-6 WCs included.

	SmeftFR	SMEFTsim	Δ
e+ e- > e+ e-			
SM	0.0196	0.0196	0.00%
C_{ll}^{1111}	1.4222	1.4222	0.00%
C_{le}^{1111}	2.7660	2.7660	0.00%
C_{ee}^{1111}	1.4265	1.4265	0.00%
e+ e- > mu+ mu-			
SM	0.0067	0.0067	0.00%
C_{ll}^{1122}	0.4173	0.4173	0.00%
C_{le}^{1122}	0.5555	0.5555	0.00%
C_{ee}^{1122}	1.5393	1.5393	0.00%
c c̄ > t t̄			
SM	0.6131	0.6131	0.00%
C_{qq1}^{2233}	1.0491	1.0491	0.00%
C_{qq3}^{2233}	1.0491	1.0491	0.00%
C_{qu1}^{2233}	1.1046	1.1046	0.00%
C_{qu8}^{2233}	1.0479	1.0479	0.00%
C_{uu}^{2233}	1.0272	1.0272	0.00%
s s̄ > b b̄			
SM	0.5638	0.5638	0.00%
C_{qq1}^{2233}	0.9648	0.9648	0.00%
C_{qq3}^{2233}	0.9648	0.9648	0.00%
C_{qu1}^{2233}	1.0464	1.0464	0.00%
C_{qu8}^{2233}	0.9940	0.9940	0.00%
C_{dd}^{2233}	0.9298	0.9298	0.00%
b b̄ > t t̄			
SM	0.3540	0.3540	0.00%
C_{qq1}^{3333}	0.6352	0.6352	0.00%
C_{qq3}^{3333}	2.1164	2.1164	0.00%
C_{qu1}^{3333}	0.8183	0.8183	0.00%
C_{qu8}^{3333}	0.7886	0.7886	0.00%
C_{qd1}^{3333}	0.5939	0.5939	0.00%
C_{qd8}^{3333}	0.4697	0.4697	0.00%
C_{ud1}^{3333}	0.4461	0.4461	0.00%
C_{ud8}^{3333}	0.4596	0.4596	0.00%
C_{quqd1}^{3333}	1.2776	1.2776	0.00%
C_{quqd8}^{3333}	0.4656	0.4656	0.00%

	SmeftFR	SMEFTsim	Δ
mu+ mu- > t t̄			
SM	0.0305	0.0305	0.00%
C_{lq1}^{2233}	1.1088	1.1088	0.00%
C_{lq3}^{2233}	1.7862	1.7862	0.00%
C_{eu}^{2233}	1.2129	1.2129	0.00%
C_{lu}^{2233}	1.2129	1.2129	0.00%
C_{qe}^{2233}	0.0305	0.0305	0.00%
C_{lequ1}^{2233}	1.4427	1.4427	0.00%
C_{lequ1}^{2233}	4.8271	4.8271	0.00%
e+ e- > b b̄			
SM	0.0164	0.0164	0.00%
C_{lq1}^{1133}	1.7684	1.7684	0.00%
C_{lq3}^{1133}	1.7684	1.7684	0.00%
C_{ed}^{1133}	1.6042	1.6042	0.00%
C_{ld}^{1133}	0.2982	0.2982	0.00%
C_{qe}^{1133}	0.0164	0.0164	0.00%
C_{ledq}^{1133}	1.5163	1.5163	0.00%
e+ mu- > s b̄			
SM	0.0000	0.0000	0.00%
C_{lq1}^{1223}	1.4681	1.4681	0.00%
C_{lq3}^{1223}	1.4681	1.4681	0.00%
C_{ed}^{1223}	1.4681	1.4681	0.00%
C_{ld}^{1223}	0.2708	0.2708	0.00%
C_{ledq}^{1223}	0.7500	0.7500	0.00%
e+ e- > d d̄			
SM	0.0164	0.0164	0.00%
C_{qe}^{1111}	0.2759	0.2759	0.00%

Table 3: Matrix elements and their relative differences for a given processes obtained using MadGraph5 with UFO models provided by SmeftFR and SMEFTsim at the $\mathcal{O}(\Lambda^{-2})$ order of the EFT expansion. 4-fermion dimension-6 WCs included.

1.3 Differences in notation between SmeftFR and SMEFTsim

SmeftFR and SMEFTsim use the same Warsaw basis [8]. However, there are some differences after the rotation to the mass basis for 4-fermion couplings. SmeftFR notation is given in detail in [9] while SMEFTsim uses the notation equivalent to [10]. The relations between 4-fermion WCs in SMEFTsim ($\tilde{C}$) and SmeftFR (C) bases relevant for comparisons between the codes are given by (V is the CKM matrix):

$$\begin{aligned}
\tilde{C}^{(1)ijkl}_{quqd} &= V^{im} C^{(1)mjkl}_{quqd} \\
\tilde{C}^{(8)ijkl}_{quqd} &= V^{im} C^{(8)mjkl}_{quqd} \\
\tilde{C}^{(1)ijkl}_{lequ} &= V^{km} C^{(1)ijml}_{lequ} \\
\tilde{C}^{(3)ijkl}_{lequ} &= V^{km} C^{(3)ijml}_{lequ}
\end{aligned} \tag{1.2}$$

Finally, one has to take into account symmetrization properties of 4-fermion operators. These are automatically taken into account by SmeftFR if numerical values of

WCs are initialised with `WCXFInput` command and, when running `SmeftFR` interfaces, by the `SMEFTInitializeMB` routine. If user decides to set their values "by hand" in the `MadGraph5` run, then he/she has to keep track of these dependencies on his/her own.

2 Dimension-8 $\mathcal{O}(\Lambda^{-4})$ validation

We have used similar procedure for matrix elements comparison at the $\mathcal{O}(\Lambda^{-4})$ order of the EFT expansion. Each matrix element was calculated assuming that all but one Wilson coefficients were set to zero and the non-vanishing one had the value of $\frac{C_i}{\Lambda^2} = 10^{-11}$ GeV^{-4} (`SmeftFR` uses the basis of [5] while `AnomalousGaugeCoupling` uses the basis of [6] for Dimension-8 operators and the translations between the operators in both bases can be found in the 1st and 2nd row of the Table 4). Despite the difference in input scheme between the codes, which had to be taken into account by tuning the input parameters of `AnomalousGaugeCoupling` (`AGC`) accordingly, we obtained almost identical results from `AGC` and `SmeftFR` codes for all of the studied processes.

Basis of [5]	Basis of [6]	`SmeftFR`	`AGC`	Δ
`w+ w- > h h`				
SM		0.0218	0.0218	0.00%
$C^{(2)}_{\varphi^4 D^4}$	$C^{(0)}_S$	0.2191	0.2191	0.00%
$C^{(3)}_{\varphi^4 D^4}$	$C^{(1)}_S$	1.5868	1.5868	0.00%
$C^{(1)}_{\varphi^4 D^4}$	$C^{(2)}_S$	0.2191	0.2191	0.00%
$\frac{1}{2}C^{(2)}_{W^2\varphi^2 D^2}$	$C^{(0)}_M$	2.5622	2.5622	0.00%
$-\frac{1}{2}C^{(1)}_{W^2\varphi^2 D^2}$	$C^{(1)}_M$	0.2307	0.2307	0.00%
$\frac{1}{4}\left(C^{(1)}_{W^2\varphi^2 D^2} - C^{(4)}_{W^2\varphi^2 D^2}\right)$	$C^{(7)}_M$	0.0576	0.0576	0.00%
`z z > h h`				
SM		0.0416	0.0416	0.00%
$C^{(2)}_{\varphi^4 D^4}$	$C^{(0)}_S$	0.0916	0.0916	0.00%
$C^{(3)}_{\varphi^4 D^4}$	$C^{(1)}_S$	1.7156	1.7156	0.00%
$C^{(1)}_{\varphi^4 D^4}$	$C^{(2)}_S$	1.7156	1.7156	0.00%
$\frac{1}{2}C^{(2)}_{W^2\varphi^2 D^2}$	$C^{(0)}_M$	1.5589	1.5589	0.00%
$-\frac{1}{2}C^{(1)}_{W^2\varphi^2 D^2}$	$C^{(1)}_M$	0.1773	0.1773	0.00%
$C^{(1)}_{B^2\varphi^2 D^2}$	$C^{(2)}_M$	0.5406	0.5406	0.00%
$-C^{(4)}_{B^2\varphi^2 D^2}$	$C^{(3)}_M$	0.0920	0.0920	0.00%
$\frac{1}{2}C^{(1)}_{WB\varphi^2 D^2}$	$C^{(4)}_M$	0.4761	0.4761	0.00%
$\frac{1}{2}C^{(4)}_{WB\varphi^2 D^2}$	$C^{(5)}_M$	0.1456	0.1456	0.00%
$\frac{1}{4}\left(C^{(1)}_{W^2\varphi^2 D^2} - C^{(4)}_{W^2\varphi^2 D^2}\right)$	$C^{(7)}_M$	0.0580	0.0580	0.00%

Basis of [5]	Basis of [6]	`SmeftFR`	`AGC`	Δ
`w+ w+ > w+ w+`				
SM		2.9395	2.9395	0.00%
$C^{(2)}_{\varphi^4 D^4}$	$C^{(0)}_S$	6.5868	6.5868	0.00%
$C^{(3)}_{\varphi^4 D^4}$	$C^{(1)}_S$	2.9307	2.9307	0.00%
$C^{(1)}_{\varphi^4 D^4}$	$C^{(2)}_S$	2.9307	2.9307	0.00%
$\frac{1}{2}C^{(2)}_{W^2\varphi^2 D^2}$	$C^{(0)}_M$	4.2146	4.2146	0.00%
$-\frac{1}{2}C^{(1)}_{W^2\varphi^2 D^2}$	$C^{(1)}_M$	2.6295	2.6295	0.00%
$\frac{1}{4}\left(C^{(1)}_{W^2\varphi^2 D^2} - C^{(4)}_{W^2\varphi^2 D^2}\right)$	$C^{(7)}_M$	3.9113	3.9113	0.00%
$\frac{1}{4}C^{(1)}_{W^4}$	$C^{(0)}_T$	23.541	23.541	0.00%
$\frac{1}{4}C^{(3)}_{W^4}$	$C^{(1)}_T$	98.636	98.636	0.00%
$\frac{1}{16}\left(C^{(1)}_{W^4} + C^{(3)}_{W^4} + C^{(4)}_{W^4}\right)$	$C^{(2)}_T$	6.2602	6.2602	0.00%
`z z > z z`				
SM		0.0820	0.0820	0.00%
$C^{(2)}_{\varphi^4 D^4}$	$C^{(0)}_S$	2.6660	2.6660	0.00%
$C^{(3)}_{\varphi^4 D^4}$	$C^{(1)}_S$	2.6660	2.6660	0.00%
$C^{(1)}_{\varphi^4 D^4}$	$C^{(2)}_S$	2.6660	2.6660	0.00%
$\frac{1}{2}C^{(2)}_{W^2\varphi^2 D^2}$	$C^{(0)}_M$	3.9388	3.9388	0.00%
$-\frac{1}{2}C^{(1)}_{W^2\varphi^2 D^2}$	$C^{(1)}_M$	0.6317	0.6317	0.00%
$C^{(1)}_{B^2\varphi^2 D^2}$	$C^{(2)}_M$	1.3635	1.3635	0.00%
$-C^{(4)}_{B^2\varphi^2 D^2}$	$C^{(3)}_M$	0.2214	0.2214	0.00%
$\frac{1}{2}C^{(1)}_{WB\varphi^2 D^2}$	$C^{(4)}_M$	1.1997	1.1997	0.00%
$-\frac{1}{2}C^{(4)}_{WB\varphi^2 D^2}$	$C^{(5)}_M$	1.0921	1.0921	0.00%
$\frac{1}{4}\left(C^{(1)}_{W^2\varphi^2 D^2} - C^{(4)}_{W^2\varphi^2 D^2}\right)$	$C^{(7)}_M$	0.3474	0.3474	0.00%
$\frac{1}{4}C^{(1)}_{W^4}$	$C^{(0)}_T$	57.045	57.045	0.00%
$\frac{1}{4}C^{(3)}_{W^4}$	$C^{(1)}_T$	57.045	57.045	0.00%
$\frac{1}{16}\left(C^{(1)}_{W^4} + C^{(3)}_{W^4} + C^{(4)}_{W^4}\right)$	$C^{(2)}_T$	13.2092	13.2092	0.00%
$\frac{1}{2}C^{(1)}_{W^2B^2}$	$C^{(5)}_T$	18.870	18.870	0.00%
$\frac{1}{2}C^{(3)}_{W^2B^2}$	$C^{(6)}_T$	18.870	18.870	0.00%
$\frac{1}{16}\left(C^{(1)}_{W^2B^2} + C^{(3)}_{W^2B^2} + C^{(4)}_{W^2B^2}\right)$	$C^{(7)}_T$	4.4206	4.4206	0.00%
$C^{(1)}_{B^4}$	$C^{(8)}_T$	6.2832	6.2832	0.00%
$\frac{1}{4}\left(2C^{(1)}_{B^4} + C^{(2)}_{B^4}\right)$	$C^{(9)}_T$	1.5190	1.5190	0.00%

Table 4: Matrix elements and their relative differences for a given processes obtained using `MadGraph5` with UFO models provided by `SmeftFR` and `AGC` at the $\mathcal{O}(\Lambda^{-4})$ order of the EFT expansion.

References

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