

partner (MG name)	$Q$	couplings			
		$W^\pm$	$Z$	$h$	$W^\pm W^\pm$
$T_{2/3}$ (T23)	2/3	$c_L^{TW}, c_R^{TW}$	$c_L^{TZ}, c_R^{TZ}$	$c_L^{Th}, c_R^{Th}$	—
$B_{1/3}$ (B13)	-1/3	$c_L^{BW}, c_R^{BW}$	$c_L^{BZ}, c_R^{BZ}$	$c_L^{Bh}, c_R^{Bh}$	—
$X_{5/3}$ (X53)	5/3	$c_L^{XW}, c_R^{XW}$	—	—	—
$Y_{4/3}$ (Y43)	-4/3	$c_L^{YW}, c_R^{YW}$	—	—	—
$V_{8/3}$ (V83)	8/3	—	—	—	$c_L^{VW}, c_R^{VW}$

TABLE I: List of top partners, their electric charges and couplings.

The top partners, their charges and couplings are listed in the Table I. The couplings  $c_{[L/R]}^{[A][B]}$  are the coefficients in the Lagrangian defining the strength of interaction of the composite partners with SM top and bottom quarks. Subscript denotes the chirality of the SM quarks, superscript corresponds to the name of the top partner ( $[A]$ ) and a gauge or the Higgs boson ( $[B]$ ), while the type of the SM quarks (top or bottom) in the vertex follows from the electric charge conservation. For example  $c_L^{TW}$ ,  $c_L^{Th}$  and  $c_L^{VW}$  enter the Lagrangian respectively as (subscripts denoting charges are omitted)

$$c_L^{TW} \bar{T}_L \gamma_\mu b_L W^\mu + h.c. \quad (.1)$$

$$c_L^{Th} \bar{T}_R t_L h + h.c. \quad (.2)$$

$$\frac{c_L^{VW}}{\Lambda} \bar{V}_R t_L W_\mu W^\mu + h.c. \quad (.3)$$

where the scale  $\Lambda$  (“LAMBDA” in the MG model, default value 3 TeV) appears only in the couplings of the charge 8/3 state  $V$ . All the couplings are assumed to be real. In the MadGraph model the couplings are given in the format  $c[L/R][A][B]$ . The names, allowing to specify the order of the given interaction needed for the process, are defined as  $[L/R][A][B]$  (for instance “generate p p > T b~ j LTW=0” will only generate processes with a right-handed coupling  $c_R^{TW}$ ).

Masses and widths are denoted as  $M[A]$  and  $W[A]$  respectively. The decay widths are computed automatically for all the partners, except  $V_{8/3}$ . Therefore, in the  $V_{8/3}$  case the overall normalization of the cross sections of the processes which include top partner decays will not be correct in general, and in order to obtain correct values one would need to compute the total width (for example using MadGraph) for given values of parameters and set it in the model card.