Dark Vector Doublet Model (DVDM)

August 15, 2019

1 Signatures from DVDM at the LHC

Due to the great similarity of the DVDM with respect to the i2HDM it is posible to reproduce the same mono-jet signature at LHC. The feynamn diagrams that contribute to the mono-jet signature are $gg \to V_1V_1$+jet, $gq \to V_1V_1$+jet and $q\overline{q} \to V_1V_1$+jet which are presented in Fig(1)

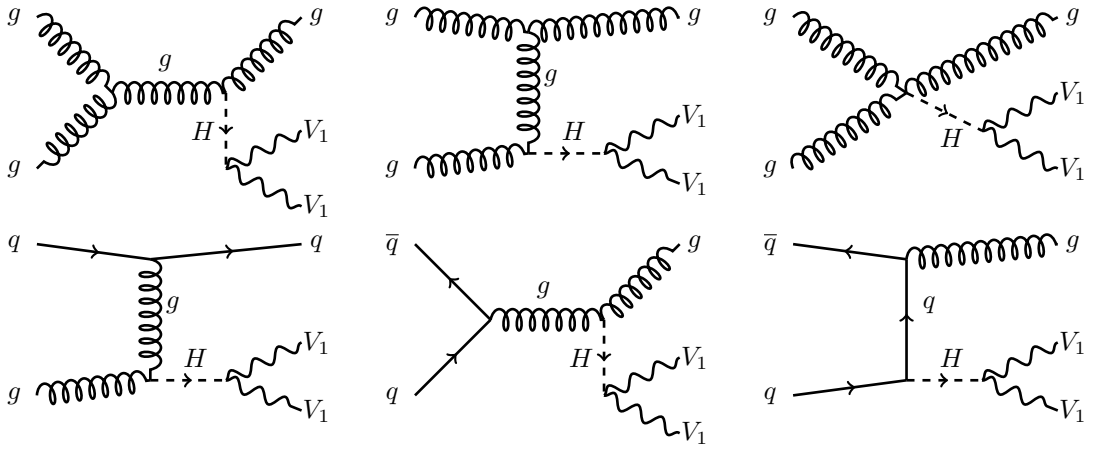

Figure 1: Feynman diagrams for $gg \to V_1V_1$+jet, $gq \to V_1V_1$+jet and $q\overline{q} \to V_1V_1$+jet process contributing to mono-jet signature.

For this signature, the relevant non-trivial parameter space is two dimensional, in which the DM mass M_{V_1} and the λ_L parameter contribute to the cross section, however since the second parameter just scales the production cross section which is proportional to λ_L^2, we can consider the process like one dimensional parameter space.

There is one more process which contributes to mono-jet signature from DVDM, namely $q\bar{q} \to V_1V_2 + g$ and $gq \to V_1V_2 + q$ process diagrams for which are presented in Fig.(2).

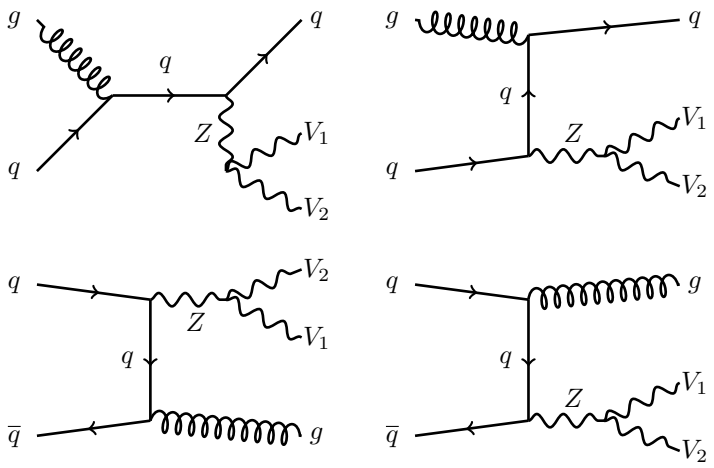

Figure 2: Feynman diagrams for $q\bar{q} \to V_1V_2 + g$ and $gq \to V_1V_2 + q$ process contributing to mono-jet signature.

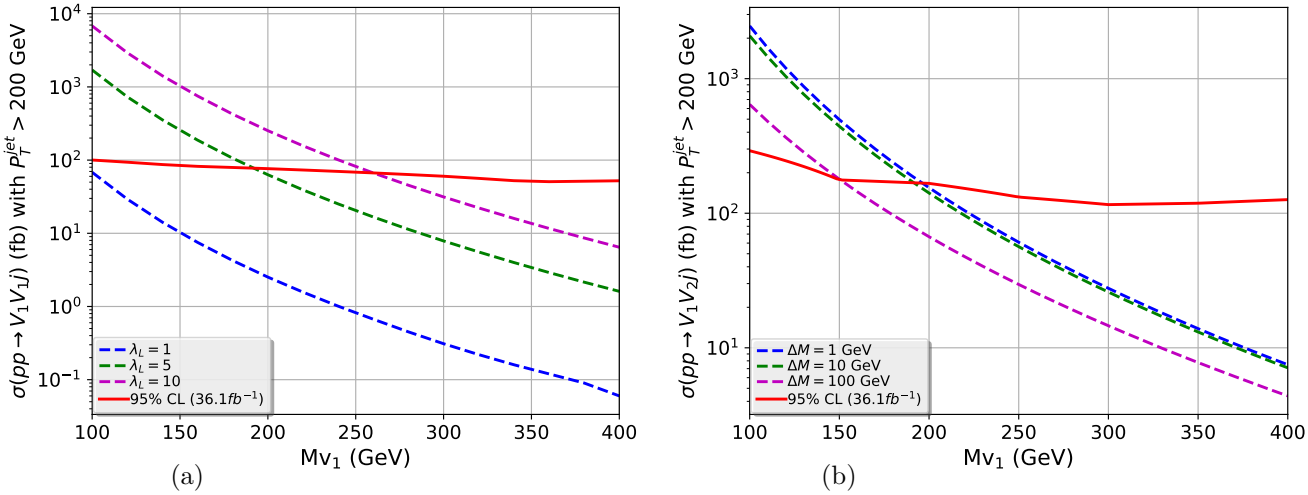

Figure 3: Cross sections and 95% CLs for $pp \to V_1V_1+$ jet versus M_{V_1} at 13 TeV in figure a) and $pp \to V_1V_2+$ jet versus M_{V_1} in figure b). In Fig a), the cross sections are shown for 3 different values of λ_L: (i) $\lambda_L = 1$ (**blue** dashed), (ii) $\lambda_L = 5$ (**green** dashed), (iii) $\lambda_L = 10$ (**magenta** dashed). In Fig b), the cross sections are shown for 3 different values of $\Delta M = M_{V_2} - M_{V_1}$: (i) $\Delta M = 1$ GeV (**blue** dashed), (ii) $\Delta M = 10$ GeV (**green** dashed), (iii) $\Delta M = 100$ GeV (**magenta** dashed). (a) Results for 13 TeV, with limits (solid **red**) calculated using the ATLAS analysis from CheckMATE.

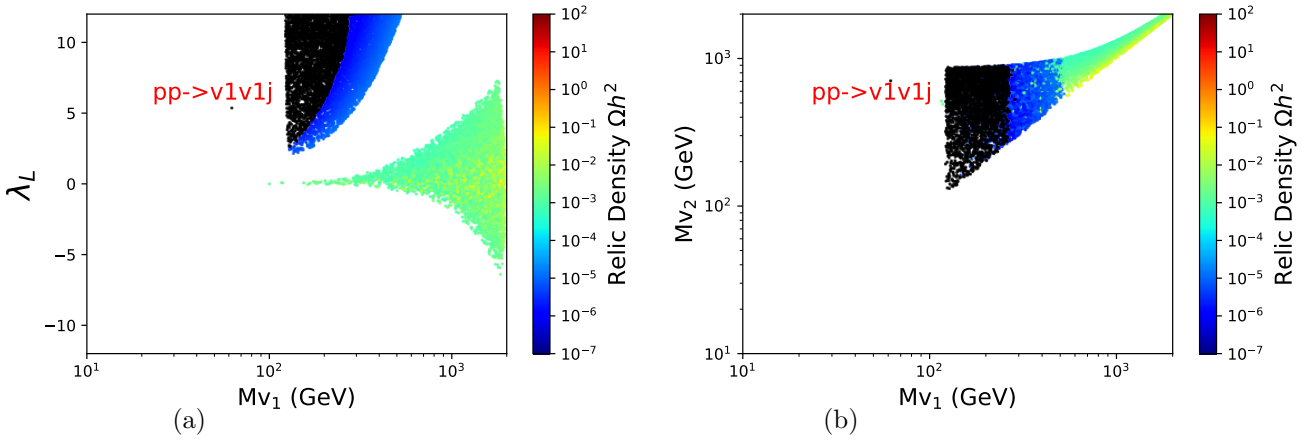

Figure 4: Projection of the 5D random scan of the DVDM into the (M_{V_1}, λ_L) plane and the excluded region at the LHC@13 TeV with 36.1 fb^{-1} of integrated luminosity using V_1V_1j channel

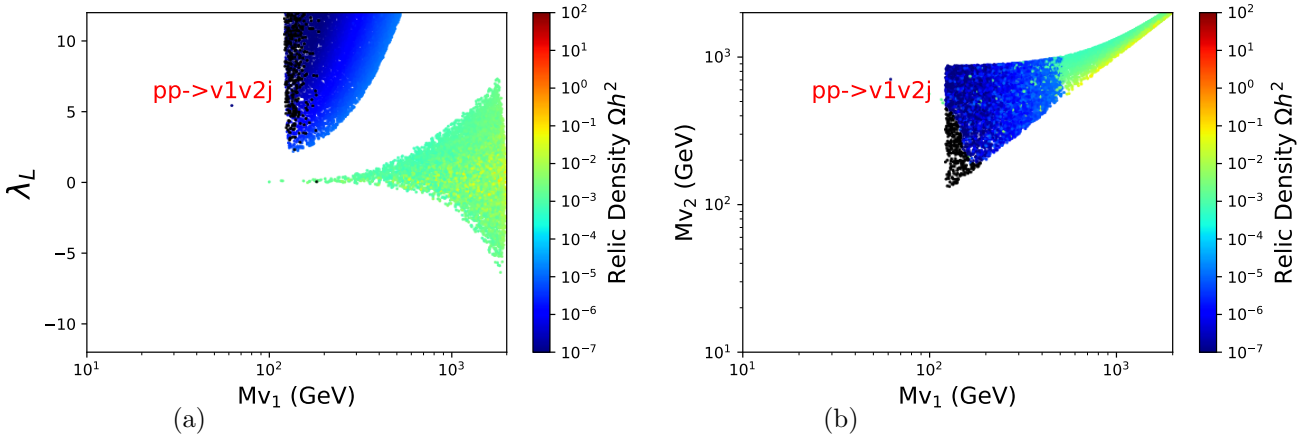

Figure 5: Projection of the 5D random scan of the DVDM into the (M_{V_1}, λ_L) plane and the excluded region at the LHC@13 TeV with 36.1 fb^{-1} of integrated luminosity using V_1V_2j channel