Vector Boson Scattering (VBS)[1] refers to the scattering of any electroweak gauge Boson V=$W^{\pm}$, Z, γ. This definition includes diboson processes which makes it necessary to specify the final state for VBS and diboson processes. The VBS finale state $VVjj$ is characterized by the two bosons and two jets while diboson processes finale state only contains two bosons VV in the finale state. Since gauge bosons have a short half-life of $3 \cdot 10^{-25}$s one needs to include the decay of the outgoing boson leading to the full process $qq \to VVjj \to 4ljj$ shown in figure 0.1. In leading order only quark-initiated diagrams produce vector bosons. These

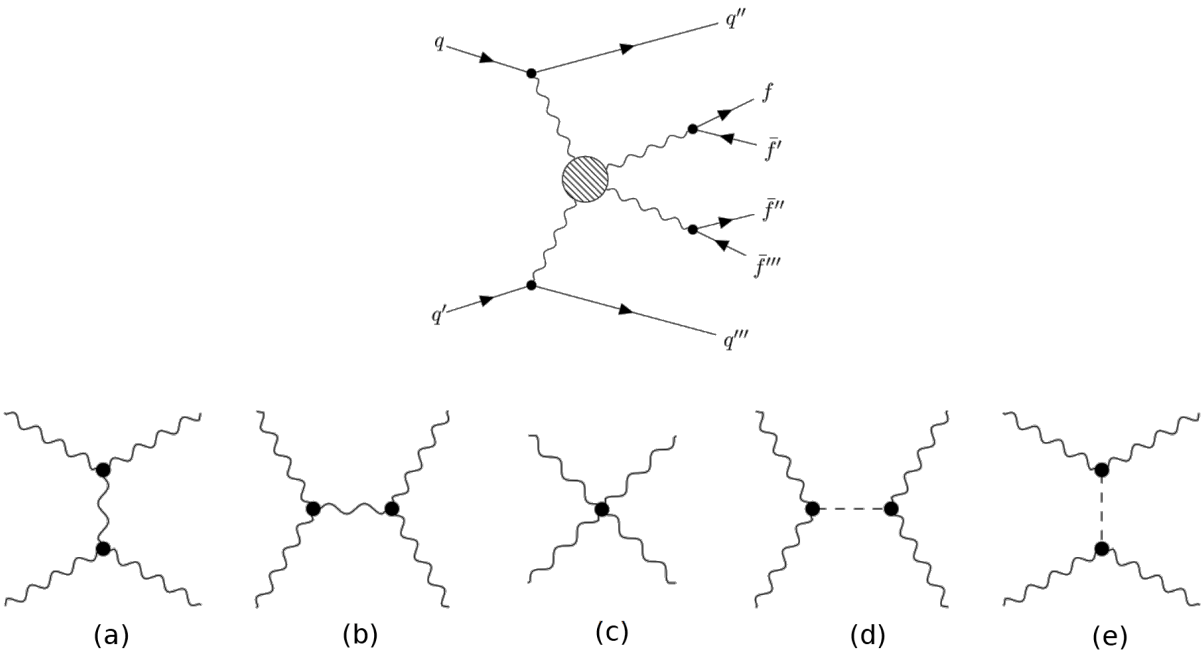

Figure 0.1: Structure of full VBS process $qq \to VVjj \to 4ljj$ with two of the four leptons having a charge. The circle stands for the processes a to e which come from the non-Albanian gauge group $SU(2)$ for weak interactions in leading order $VV \to VV$ processes.[1]

quarks are shifted by a small angle away from the beam axis resulting in the for the VBS process characteristic tagging jets. The couplings a to e in 0.1 are all electroweak interactions and based on there coupling structure produce a squared matrix element $|M^2| \propto \alpha_{EW}^6$. The α_{EW} stands for the combined coupling strength of the electroweak and electromagnetic interactions. These couplings can also be achieved by coupling structure $|M^2| \propto \alpha_{EW}^4 \alpha_S^2$, but these couplings however do not contribute to VBS processes. In the signal for VBS processes the diagrams with less than six electroweak diagrams are considered as background defining the $VVjj - EW6$ processes. Some examples for the these processes can be seen in 0.2. How these processes are selected will be discussed in the following chapter. The $W^{\pm}Z$ processes is dominated by EW and QCD interactions specifically the EFT Terms are only accounted for in the EW interactions.

Multiple factors make the study of VBS processes interesting. VBS processes are only accessible from LHC Run-II and forward making them more relevant in the future. The appearance of both TGC and QGC lead to interesting studies of polarization, gauge invariance, unitarity and Higgs physics. The distinct two jet finale state makes the selection of VBS process relatively easy leading to a small background estimation. In BSM both properties are relevant as new models often include TGC and QGC. Without knowing the underlying theory it is hard to make predictions on the impact of a BSM theory on the background. In EFT TGC are essential for analysis on dim-6 operates and QGC for studying dim-8 operators. The accessibility of a variety of couplings and the fact that no BSM theory to date fully describes anomalous couplings motivate the research on resonances in VBS using EFT.

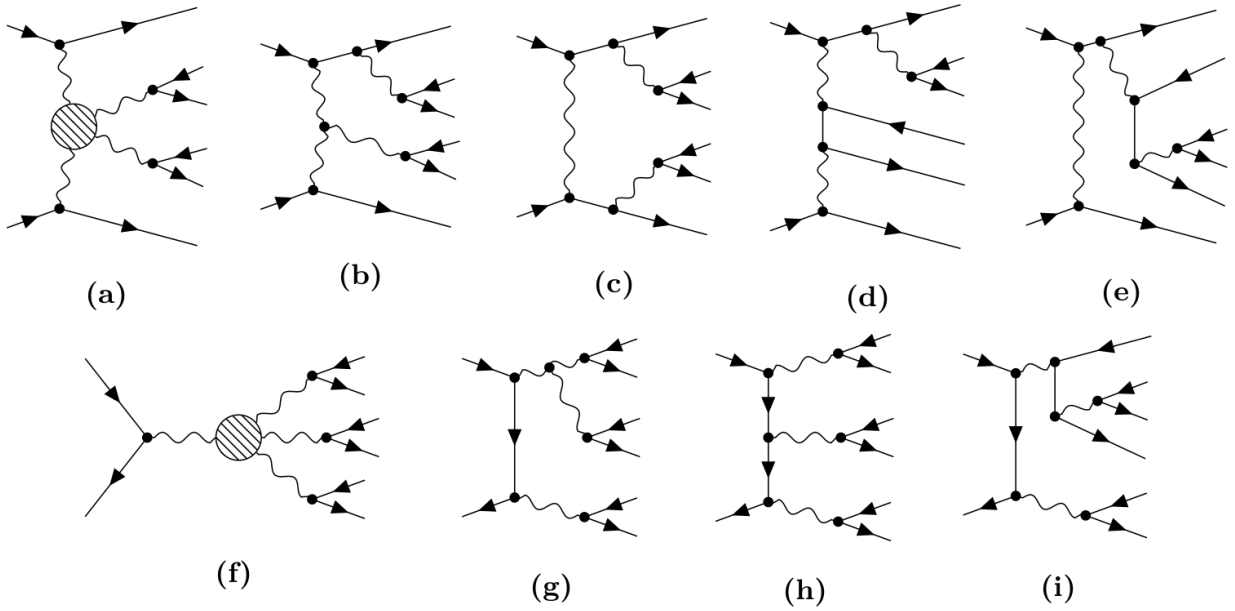

Figure 0.2: Example Feynman diagrams for VVjj-EW6 processes. The dashed circle stands for the Feynman diagrams a-e in Figure 0.1