

| Channel                              | VBF category selection criteria   |  |  |
|--------------------------------------|---|--|--|
| $\tau_{\text{lep}}\tau_{\text{lep}}$ | At least two jets with $p_{\text{T}}^{j_1} > 40$ GeV and $p_{\text{T}}^{j_2} > 30$ GeV<br>$ \Delta\eta_{j_1,j_2}  > 3.0$<br>$m_{j_1,j_2} > 400$ GeV<br>$b$ -jet veto for jets with $p_{\text{T}} > 25$ GeV<br>Jet veto: no additional jet with $p_{\text{T}} > 25$ GeV within $ \eta  < 2.4$  |  |  |
| $\tau_{\text{lep}}\tau_{\text{had}}$ | At least two jets with $p_{\text{T}}^{j_1} > 40$ GeV and $p_{\text{T}}^{j_2} > 30$ GeV<br>$E_{\text{T}}^{\text{miss}} > 20$ GeV<br>$ \Delta\eta_{j_1,j_2}  > 3.0$ and $\eta(j_1) \cdot \eta(j_2) < 0$ , $m_{j_1,j_2} > 300$ GeV<br>$p_{\text{T}}^{\text{Total}} =  \vec{p}_{\text{T}}^{\ell} + \vec{p}_{\text{T}}^{\tau_{\text{had}}} + \vec{p}_{\text{T}}^{j_1} + \vec{p}_{\text{T}}^{j_2} + \vec{E}_{\text{T}}^{\text{miss}}  < 30\text{GeV}$<br>$b$ -jet veto for jets with $p_{\text{T}} > 30$ GeV<br>$\min(\eta_{(j_1)}, \eta_{(j_2)}) < \eta_{(\ell)}, \eta_{(\tau_{\text{had}})} < \max(\eta_{(j_1)}, \eta_{(j_2)})$ |  |  |
|                                      | <b>VBF tight</b><br>$m_{j_1,j_2} > 500$ GeV<br>$p_{\text{T}}^H > 100$ GeV<br>$p_{\text{T}}^{\tau_{\text{had}}} > 30$ GeV<br>$m_{\text{vis}} > 40$ GeV   | <b>VBF loose</b><br>Non tight VBF  |  |
| $\tau_{\text{had}}\tau_{\text{had}}$ | At least two jets with $p_{\text{T}}^{j_1} > 50$ GeV and $p_{\text{T}}^{j_2} > 30$ GeV<br>$ \Delta\eta(\tau_1, \tau_2)  < 1.5$<br>$ \Delta\eta_{j_1,j_2}  > 2.6$ and $m_{j_1,j_2} > 250$ GeV<br>$\min(\eta_{(j_1)}, \eta_{(j_2)}) < \eta_{(\tau_1)}, \eta_{(\tau_2)} < \max(\eta_{(j_1)}, \eta_{(j_2)})$  |  |  |
|                                      | <b>VBF high <math>p_{\text{T}}^H</math></b><br>$\Delta R(\tau_1, \tau_2) < 1.5$ and<br>$p_{\text{T}}^H > 140$ GeV   | <b>VBF low <math>p_{\text{T}}^H</math>, tight</b><br>$\Delta R(\tau_1, \tau_2) > 1.5$ or<br>$p_{\text{T}}^H < 140$ GeV<br>$m_{j_1,j_2}[\text{GeV}] > (-250 \cdot  \Delta\eta_{j_1,j_2}  + 1550)$ | <b>VBF low <math>p_{\text{T}}^H</math>, loose</b><br>$\Delta R(\tau_1, \tau_2) > 1.5$ or<br>$p_{\text{T}}^H < 140$ GeV<br>$m_{j_1,j_2}[\text{GeV}] < (-250 \cdot  \Delta\eta_{j_1,j_2}  + 1550)$ |
| Channel                              | Boosted category selection criteria   |  |  |
| $\tau_{\text{lep}}\tau_{\text{lep}}$ | Exclude events passing the VBF selection<br>$p_{\text{T}}^H > 100$ GeV<br>$b$ -jet veto for jets with $p_{\text{T}} > 25$ GeV   |  |  |
| $\tau_{\text{lep}}\tau_{\text{had}}$ | Exclude events passing the VBF selection<br>$E_{\text{T}}^{\text{miss}} > 20$ GeV<br>$p_{\text{T}}^H > 100$ GeV<br>$p_{\text{T}}(\tau_{\text{had}}) > 30$ GeV<br>$b$ -jet veto for jets with $p_{\text{T}} > 30$ GeV  |  |  |
| $\tau_{\text{had}}\tau_{\text{had}}$ | Exclude events passing the VBF selection<br>$\Delta\eta(\tau_1, \tau_2) < 1.5$<br>$p_{\text{T}}^H > 100$ GeV  |  |  |
|                                      | <b>Boosted high <math>p_{\text{T}}^H</math></b><br>$\Delta R(\tau_1, \tau_2) < 1.5$ and<br>$p_{\text{T}}^H > 140$ GeV   | <b>Boosted low <math>p_{\text{T}}^H</math></b><br>$\Delta R(\tau_1, \tau_2) > 1.5$ or<br>$p_{\text{T}}^H < 140$ GeV  |  |