

Common selections

|             |  |  |  |  |
|-------------|--|--|--|--|
|             | 2 “high-purity” tracks, opposite charge  |  |  |  |
| M selection | $ \eta^{\text{trk}}  < 2.5, p_{\text{T}}^{\text{trk1}} > 20 \text{ GeV}, p_{\text{T}}^{\text{trk2}} > 5 \text{ GeV},  \eta^{\text{M}}  < 2.1$                  |  |  |  |
|             | $0.62 < m_{\pi\pi} < 0.92 \text{ GeV} (\rho^0) / 1.008 < m_{\text{KK}} < 1.032 \text{ GeV} (\phi) / 0.84 < m_{\text{K}\pi} < 0.94 \text{ GeV} (\text{K}^{*0})$ |  |  |  |

| Category                        | ggH   | VBF High- $p_{\text{T}}^{\gamma}$  | VBF Low- $p_{\text{T}}^{\gamma}$  | VH  |
|---------------------------------|---|--|---|---|
| $\mathcal{L}$                   | $39.5 \text{ fb}^{-1}$  | $86.9 \text{ fb}^{-1}$   | $39.5 \text{ fb}^{-1}$  | $138 \text{ fb}^{-1}$   |
| Trigger                         | $\gamma +$<br>jet with $\tau$ -ID   | High- $p_{\text{T}} \gamma +$<br>VBF-like jets   | $\gamma +$<br>jet with $\tau$ -ID   | Double or single $e/\mu$  |
| $p_{\text{T}}^{\gamma}$ (GeV)   | $>38$   | $>75$  | $>38$ and $<75$   | $>40$   |
| $ \eta^{\gamma} $               | $<2.5$  | $<1.4$   | $<2.1$  | $<2.5$  |
| $\gamma$ -ID (eff.)             | 80%   | 90%  | 80%   | 90%   |
| $p_{\text{T}}^{\text{M}}$ (GeV) | $>38$   | $>30$  | $>38$   | $>40$   |
| $I^{\text{ch}}(\text{M})$       | $>0.9$  | $>0.9$   | $>0.9$  | $>0.8$  |
| $I^{\text{neu}}(\text{M})$      | $>0.8$  | —  | —   | —   |
| Event tagging                   | Meson candidate<br>within a jet with<br>$p_{\text{T}}^{\text{j}} > 40 \text{ GeV}$ , tracks<br>with $\Delta R < 0.07$ | 2 jets with<br>$p_{\text{T}}^{\text{j}} > 40 \text{ GeV}$<br>$m_{\text{jj}} > 400 \text{ GeV}$<br>$ \Delta\eta_{\text{jj}}  > 3$ | 2 jets with<br>$p_{\text{T}}^{\text{j}} > 30/20 \text{ GeV}$<br>$m_{\text{jj}} > 300 \text{ GeV}$<br>$ \Delta\eta_{\text{jj}}  > 3$ | 1 selected and<br>isolated $e/\mu$<br>or 2 selected $e/\mu$<br>$ M_{\ell\ell} - M_{\text{Z}}  < 15 \text{ GeV}$ |
| Veto                            | $e/\mu$ , VBF-like jets   | $e/\mu$  | $e/\mu$   | —   |

BDT categories

|      |                            |                           |                           |   |
|------|----------------------------|---------------------------|---------------------------|---|
| cat0 | BDT $> 0.55$               | BDT $> 0.7$               | BDT $> 0.7$               | — |
| cat1 | $-0.4 < \text{BDT} < 0.55$ | $-0.6 < \text{BDT} < 0.7$ | $-0.6 < \text{BDT} < 0.7$ | — |