

WH selection

$p_T^{\tau_h} > 20 \text{ GeV}, |\eta^{\tau_h}| < 2.3, I^e < 0.1, I^\mu < 0.15, \text{b veto}$

Channel	Trigger ($p_T/ \eta $)	Lepton selection: p_T (GeV)	τ_h selection: isolation
$e\mu\tau_h$	$\mu(22/2.1)$ or $e(25/2.1)$	$p_T^e > 15$ or $26, p_T^\mu > 23$ or 15	MVA τ_h (60% eff.)
$\mu\mu\tau_h$	$\mu(22/2.1)$	$p_T^\mu > 23, p_T^\mu > 15$	MVA τ_h (60% eff.)
$e\tau_h\tau_h$	$e(25/2.1)$	$p_T^e > 26$	MVA τ_h (55 or 65% eff.)
$\mu\tau_h\tau_h$	$\mu(22/2.1)$	$p_T^\mu > 23$	MVA τ_h (55 or 65% eff.)

ZH selection

Z boson reconstructed from opposite charge, same-flavor light leptons, $60 < m_{\ell\ell} < 120 \text{ GeV}, \text{b veto}$

τ_h baseline requirements: $p_T^{\tau_h} > 20, |\eta^{\tau_h}| < 2.3, \text{MVA } \tau_h$ (65% efficiency)

e baseline requirements: $p_T^e > 10, |\eta^e| < 2.5, \text{MVA ID}$ (90% efficiency)

μ baseline requirements: $p_T^\mu > 10, |\eta^\mu| < 2.4, \mu \text{ ID}$ (> 99% efficiency), $I^\mu < 0.25$

Channel	Trigger ($p_T/ \eta $)	Lepton selection: p_T (GeV)	Lepton selection: isolation
$ee\mu\tau_h$			$I^\mu < 0.15$
$eee\tau_h$	$[e_1(23/2.5) \& e_2(12/2.5)]$	$[p_T^{e1} > 24 \& p_T^{e2} > 13]$	e ID (80% eff.), $I^e < 0.15$
$ee\tau_h\tau_h$	or $e_1(27/2.5)$	or $p_T^{e1} > 28$	baseline selection listed above
$eee\mu$			e ID (80% eff.), $I^e < 0.15, I^\mu < 0.15$
$\mu\mu\mu\tau_h$			$I^\mu < 0.15$
$\mu\mu e\tau_h$	$[\mu_1(17/2.4) \& \mu_2(8/2.4)]$	$[p_T^{\mu1} > 18 \& p_T^{\mu2} > 10]$	e ID (80% eff.), $I^e < 0.15$
$\mu\mu\tau_h\tau_h$	or $\mu_1(24/2.4)$	or $p_T^{\mu1} > 25$	baseline selection listed above
$\mu\mu e\mu$			e ID (80% eff.), $I^e < 0.15, I^\mu < 0.15$