

Feature		Description	S1	S2	NF
Kinematic and event-level features, x_k					
Probe p_T	Transverse momentum		✓	✓	✓ _c
Probe η	Pseudorapidity		✓	✓	✓ _c
Probe ϕ	Azimuthal angle		✓	✓	✓ _c
ρ	Median energy density per unit (η, ϕ) area in the event (sensitive to pileup)		✓	✓	✓ _c
Shower shape and isolation features, x_s					
Probe R_9	Ratio of energy sum in 3×3 grid of crystals surrounding SC seed, to total SC energy.		—	✓	✓
Probe S_4	Ratio of energy sum in 2×2 grid containing most energetic crystals, to energy in 5×5 grid surrounding SC seed.		—	✓	✓
Probe η -width	Lateral spread of shower in η direction, calculated as standard deviation in crystal η values, weighted by the logarithm of the crystal energy.		—	✓	✓
Probe ϕ -width	Lateral spread of shower in ϕ direction, calculated as standard deviation in crystal ϕ values, weighted by the logarithm of the crystal energy.		—	✓	✓
Probe $\sigma_{i\eta i\eta}$	Second moment of log-weighted distribution of crystal energies in η , calculated in 5×5 matrix surrounding SC seed, rescaled to units of crystal size.		—	✓	✓
Probe $\sigma_{i\eta i\phi}$	Covariance of log-weighted distribution of crystal energies in η and ϕ , calculated in 5×5 matrix surrounding SC seed, rescaled to units of crystal size.		—	✓	✓
Probe H/E	Ratio of energy deposited in the HCAL in a cone of radius $\Delta R = \sqrt{(\Delta\eta)^2 + (\Delta\phi)^2} = 0.15$ around the SC direction, to the energy of the SC.		—	—	✓
Probe $\mathcal{I}_{\text{PF, cluster}}^{\text{HCAL}}$	Sum of transverse energy of PF clusters in the HCAL, falling inside a cone of radius $\Delta R = 0.3$ around the SC.		—	—	✓
Probe $\mathcal{I}_{\text{PF, ch}}$	Sum of transverse energy of PF charged hadrons falling inside a cone of radius $\Delta R = 0.3$ around the SC, measured with respect to the selected PV.		—	✓	✓
Probe $\mathcal{I}_{\text{PF, ch}}^{\text{WV}}$	Sum of transverse energy of PF charged hadrons falling inside a cone of radius $\Delta R = 0.3$ around the SC, measured with respect to the interaction vertex that provides the largest isolation sum. This vertex is referred to as the “worst” vertex (WV). The variable is effective in isolating misidentified photon candidates originating from jets coming from a vertex other than the PV.		—	✓	✓
Probe $\mathcal{I}_{\text{PF, cluster}}^{\text{ECAL}}$	Sum of transverse energy of PF clusters in the ECAL, falling inside a cone of radius $\Delta R = 0.3$ around the SC.		—	✓	✓
Probe $\mathcal{I}_{\text{track}}^{\text{hollow}}(\Delta R = 0.3)$	Sum of transverse energy of all tracks in a hollow cone with a smaller (larger) radius of $\Delta R = 0.04$ ($\Delta R = 0.3$) around the SC.		—	✓	✓
Probe $\mathcal{I}_{\text{track}}^{\text{solid}}(\Delta R = 0.4)$	Sum of transverse energy of all tracks in a solid cone of radius $\Delta R = 0.4$ around the SC.		—	✓	✓
Probe σ_{RR} (EE-only)	Standard deviation of the shower spread in the (x, y) plane of the preshower detector.		—	✓	✓
Probe $E_{\text{ES}}/E_{\text{raw}}$ (EE-only)	Energy deposited in the preshower detector divided by the total energy of the SC.		—	✓	✓