HF noise study Run3

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HF cleaning cuts, efficiencies and SF's

Cleaning cuts for HF jets are defined as:

- $2.99 < |\eta| < 4.0$: $\sigma_{i\eta i\eta} - \sigma_{i\phi i\phi} < 0.02$ condition is required. The corner region, defined as $\sigma_{i\eta i\eta} < 0.02$ & $\sigma_{i\phi i\phi} < 0.02$ is also removed.
- $|\eta| > 4.0$: $\sigma_{i\eta i\eta} < 0.1 <$ & $\sigma_{i\phi i\phi} > 0.02$ condition is required.
- $|\eta| > 2.99$: $CSS_{HF} < 3$ is required.

$$\text{Efficiency (Data/MC)} = \frac{\text{(HF Jets with cleaning cuts) \& (PER selections)}}{\texttt{Total HF Jets with PER selections}} \quad (1)$$

$$SF = \frac{\text{Data efficiency}}{\texttt{MC efficiency}} \quad (2)$$

$$\text{Noise-tagging Efficiency} = \frac{\text{(HF Jets with inverted cleaning cuts) \& (NER selections)}}{\texttt{Total HF Jets with NER selections}} \quad (3)$$

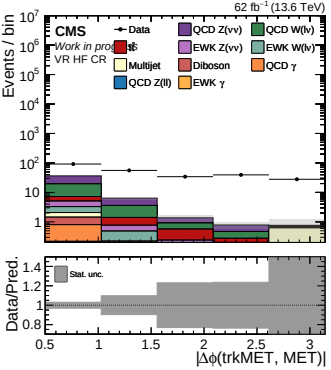
$$\text{Mistag rate} = 1 - \text{(Noise-tagging efficiency)} \quad (4)$$

HF noise estimate in SR

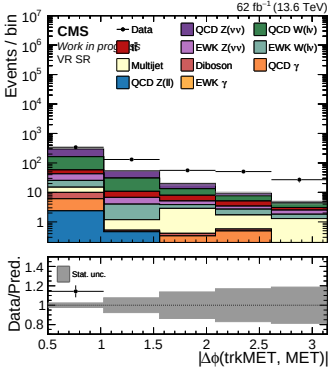
- HF CR is defined with the same selections as SR but with inverted HF-cleaning cuts. Also leading/subleading jet-$p_t > 80$ GeV & $|\eta| > 3$.
- Noise template in VBF SR is estimated from the template in HF CR using $[p_T, \eta]$ dependent transfer factors, defined as the relative probability for a noise event to pass the HF shape cuts relative to failing them.

$$N^{\text{SR}}_{\text{noise}} = \frac{P(\text{pass} \mid \text{noise})}{P(\text{fail} \mid \text{noise})} \times \left(N^{\text{CR}}_{\text{data}} - N^{\text{CR}}_{\text{MC}}\right)$$

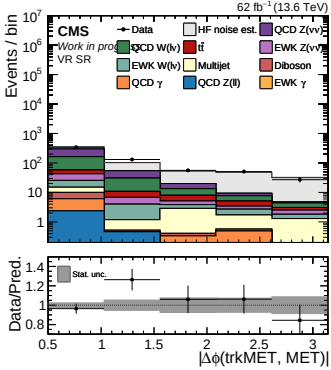
Run3 (2022 + 2023): Validation region



VR HF CR

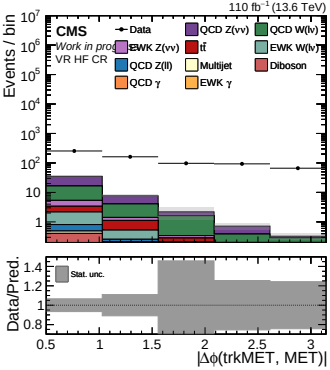


VR SR

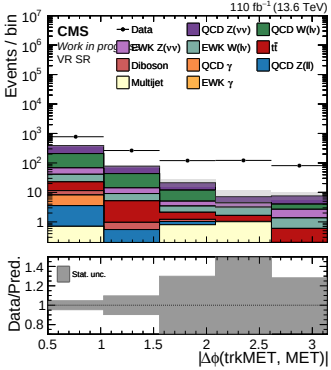


VR SR with HF estimate

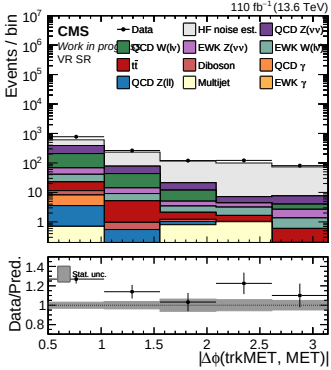
2024: Validation region



VR HF CR

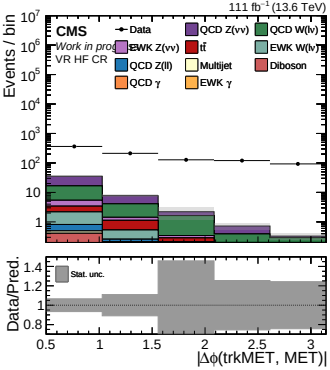


VR SR

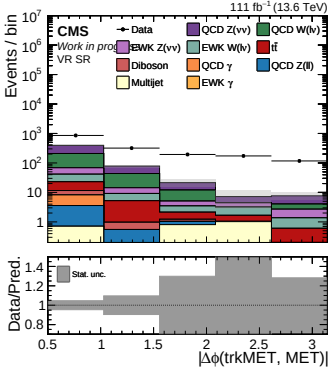


VR SR with HF estimate

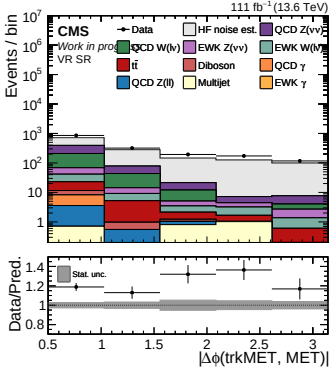
2025: Validation region



VR HF CR

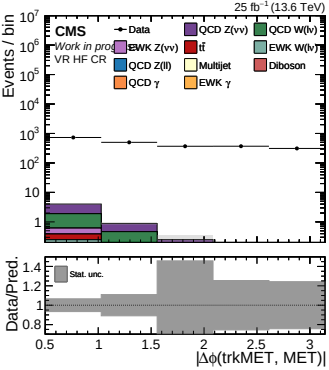


VR SR

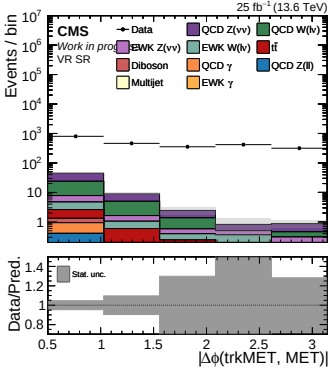


VR SR with HF estimate

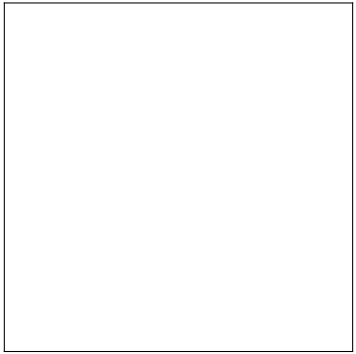
2026: Validation region



VR HF CR

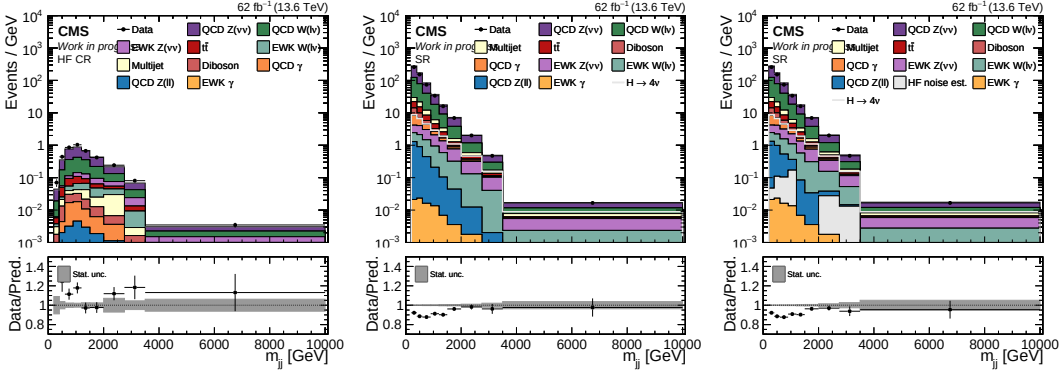


VR SR



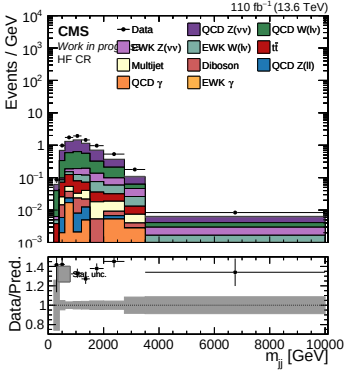
VR SR with HF estimate

Run3 (2022 + 2023): m_{jj}

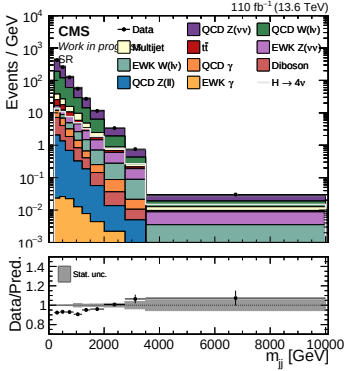


HF CR SR SR with HF estimate

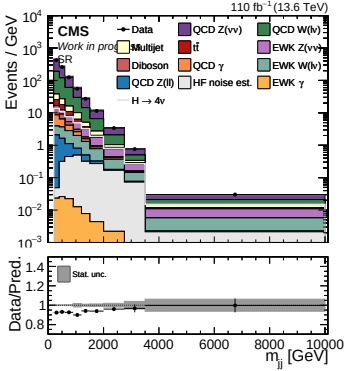
2024: m_{jj}



HF CR

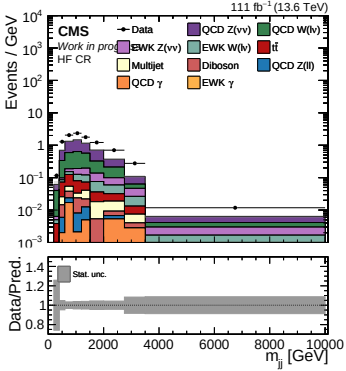


SR

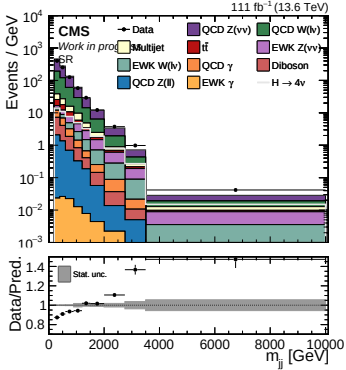


SR with HF estimate

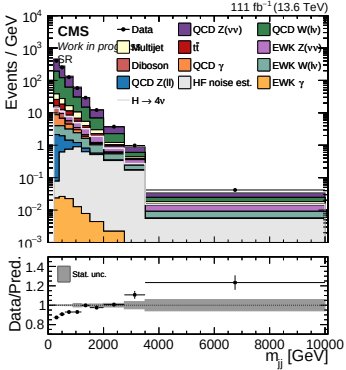
2025: m_{jj}



HF CR

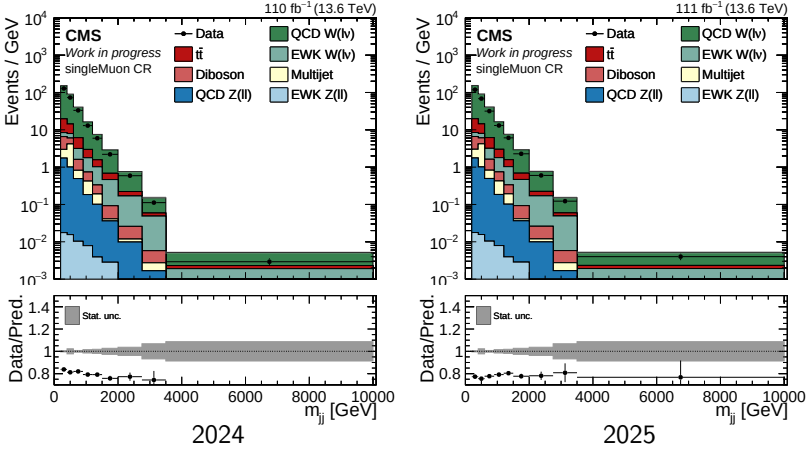


SR

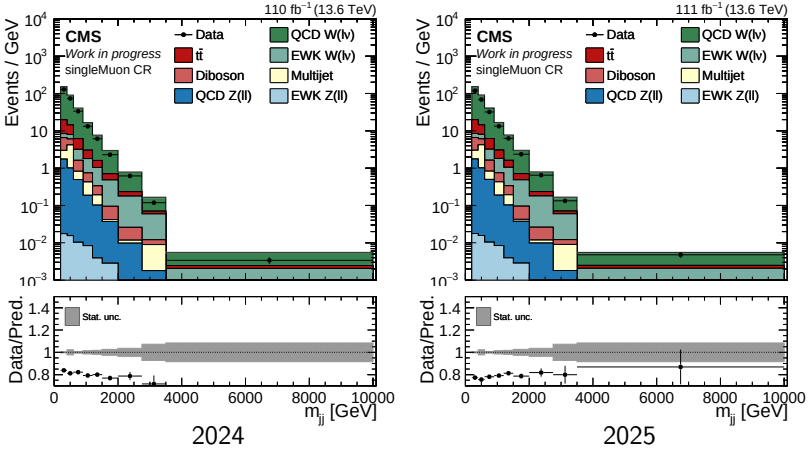


SR with HF estimate

Single Muon CR: m_{jj}



Single Muon CR: m_{jj} (without HF-veto selection)



Backup