HF noise studies in UL

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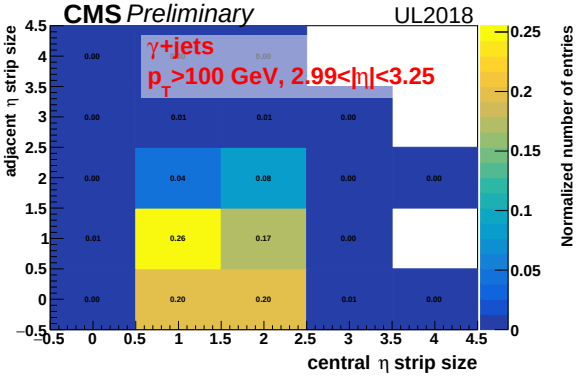
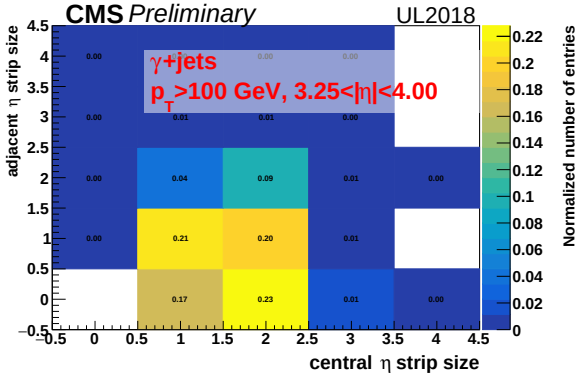
Introduction

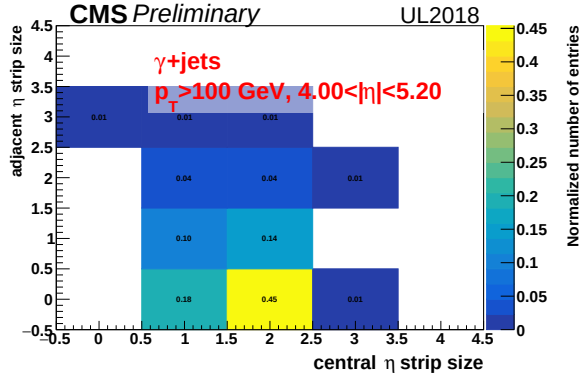
- Development of a new HF noise tagging working point, with η dependent conditions.
- Using several selections to measure the performances of HF jets. ($|\eta|$ >2.99, p_T >100 GeV, passing tight jet ID)
- Low MET Z+jets/γ+jets to measure the efficiency in data.
  - Exactly one $Z(\mu\mu)$ or a tight γ
  - $\Delta\phi(Z/\gamma, jet) > 2.7$; $0.5 < p_T(Z/\gamma)/p_T(jet) < 1.5$
  - PFMET<50 GeV
- VBF$\rightarrow H \rightarrow \gamma\gamma$ (removing jets matched to photons) for efficiency in MC.
  - Two tight γ with $|\eta| < 2.5$ and $115 < M(\gamma\gamma) < 135$
- Monojet events from the MET dataset to assess the noise passing rate.
  - PFMET>100 GeV
  - Exactly one HF jet with $p_T > 100$ GeV.
  - No extra jet with $p_T > 30$ GeV.
  - No lepton with p_T >10 GeV.
  - N.B. Assuming here that the contamination from good jets is negligible (probably true, but a bit concerned with the large passing rate at high $|\eta|$ and low p_T)

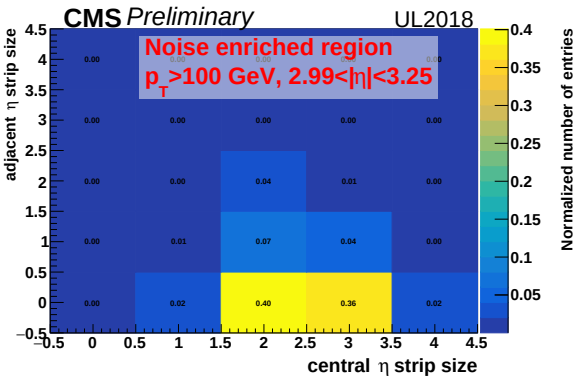
η strip size

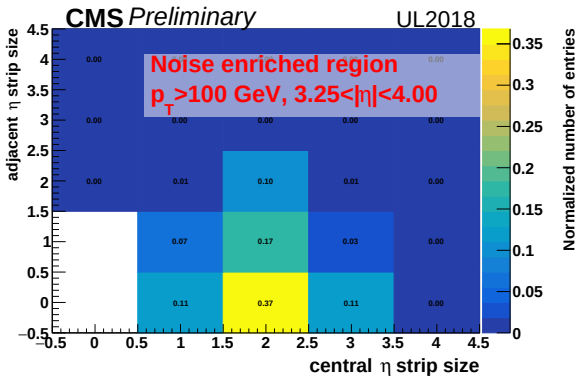
- Proposed cut: remove jets with central η strip size ≥ 3.

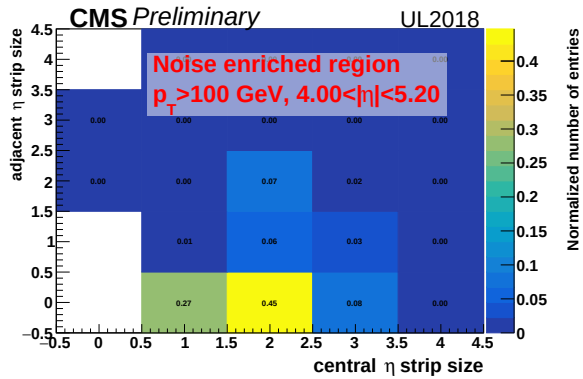






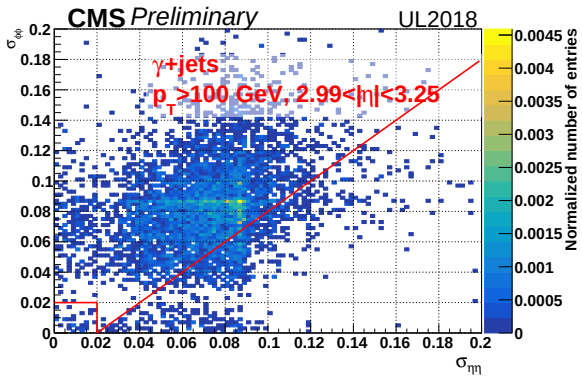


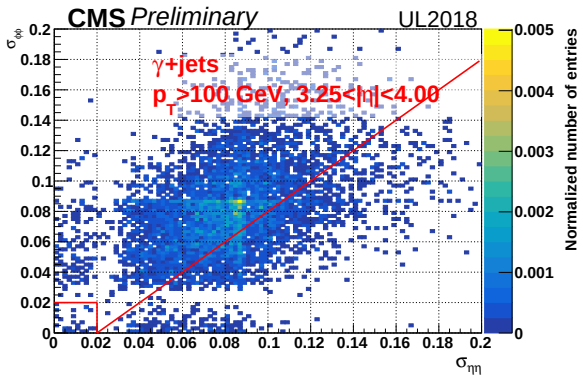


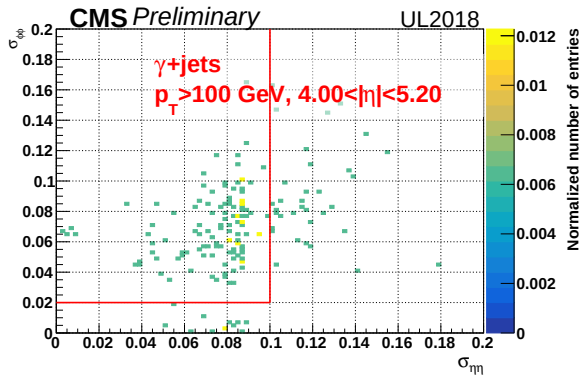


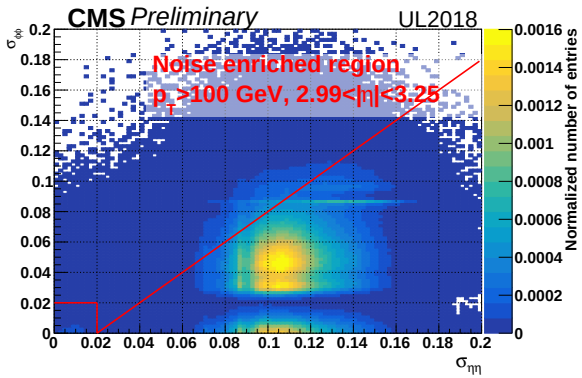
$\sigma_{\eta\eta}$ vs $\sigma_{\phi\phi}$

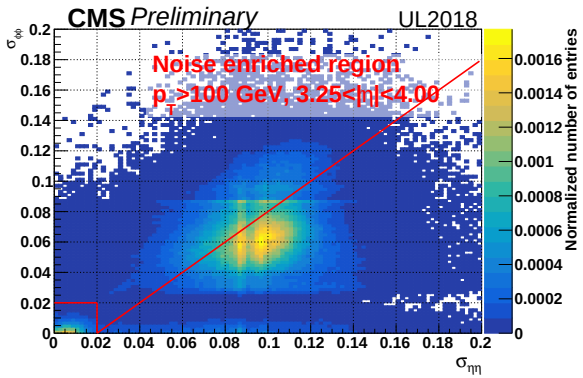
- Some hot spots in noise enriched region at low $\sigma_{\eta\eta}$, $\sigma_{\phi\phi}$, more visible at high η. Beam halos? (see next slide)
- Testing customized cut at very high $|\eta|(> 4)$ as the noise seems to shift to higher $\sigma_{\eta\eta}$ values (maybe not really needed?)

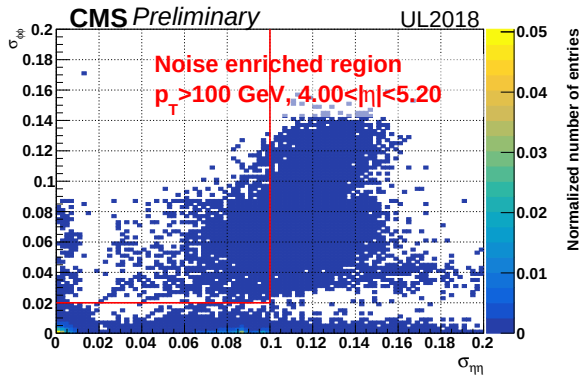






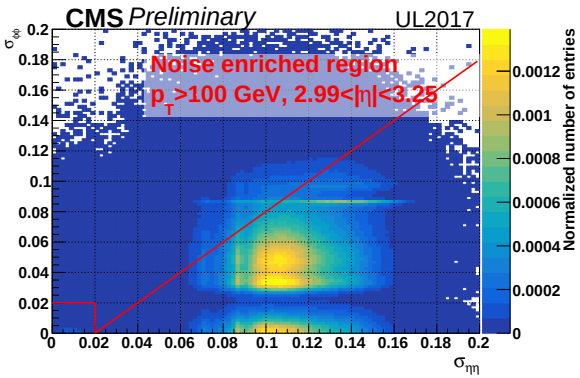


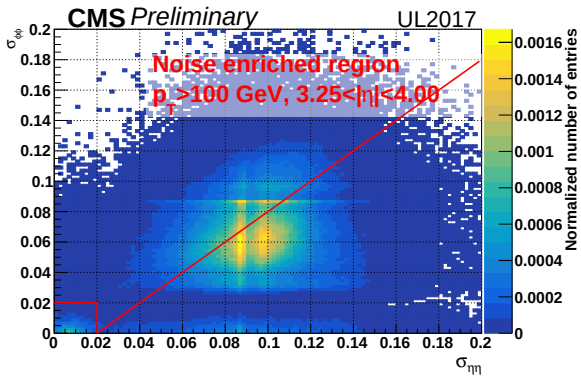


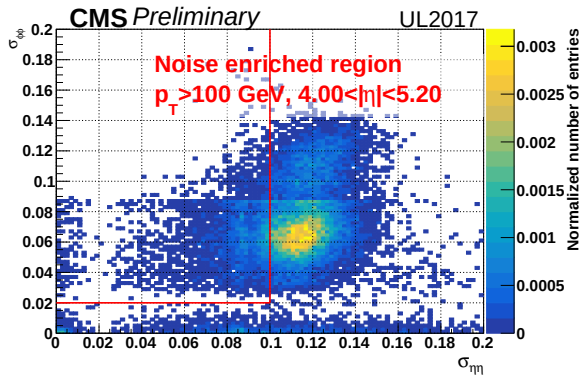


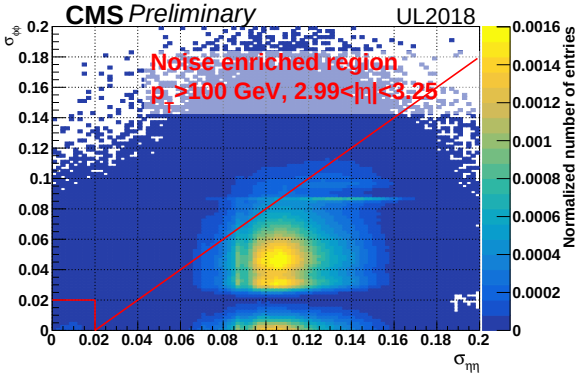
$\sigma_{\eta\eta}$ vs $\sigma_{\phi\phi}$: 2017 vs 2018

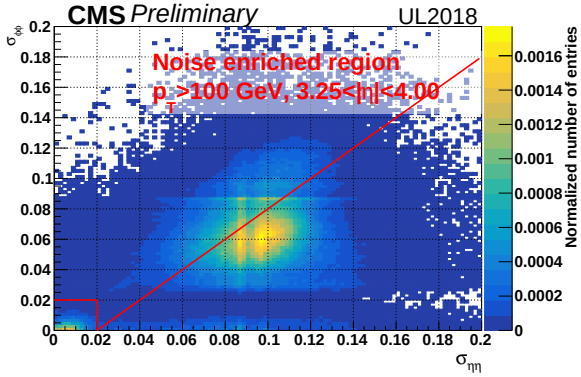
- Similar trend for $|\eta| < 4$
- Low $\sigma_{\phi\phi}$ spots much more pronounced in 2018 for $|\eta| > 4$

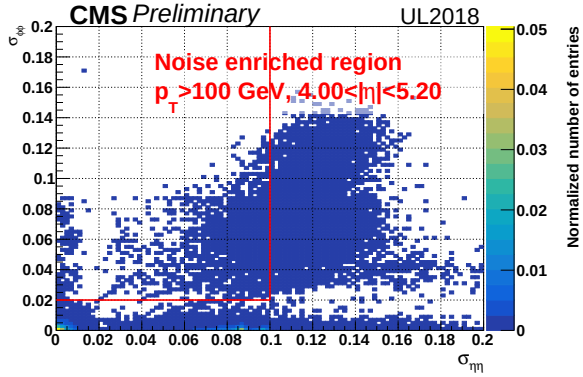




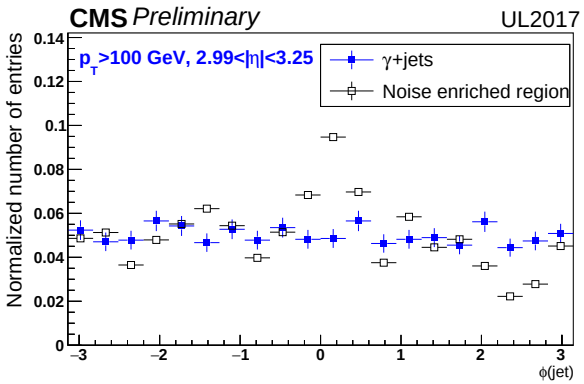


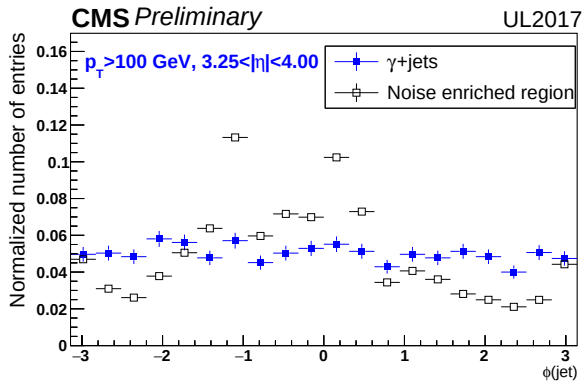


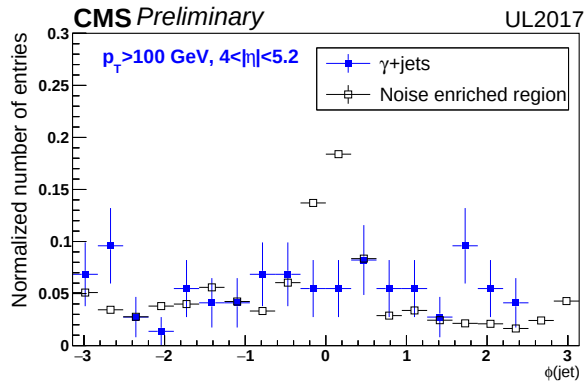


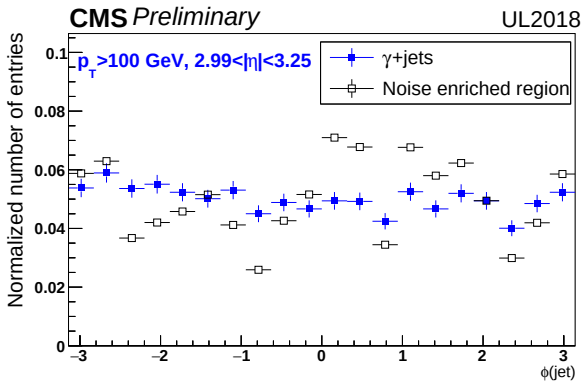


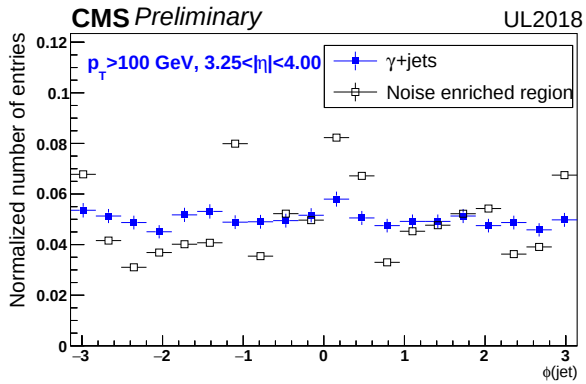
Jet phi distribution : 2017 vs 2018

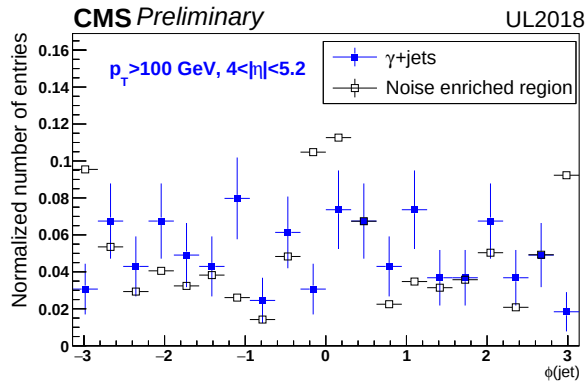




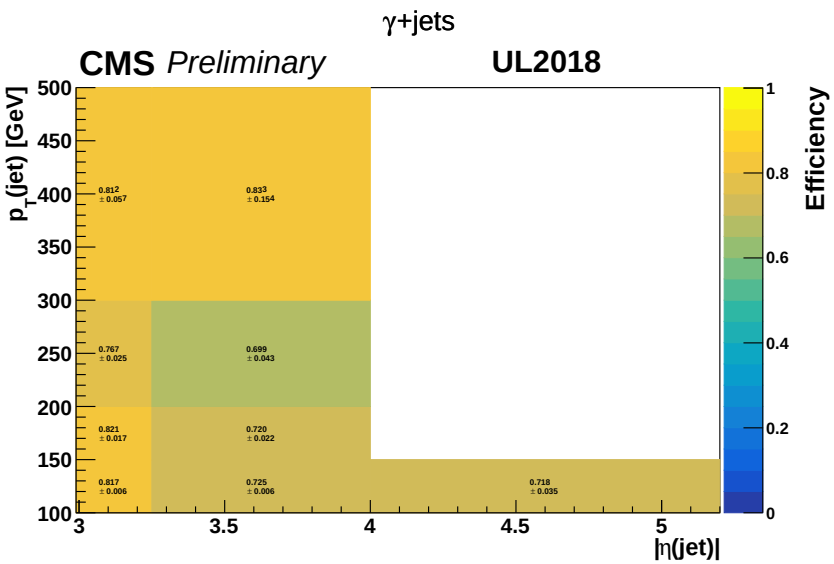


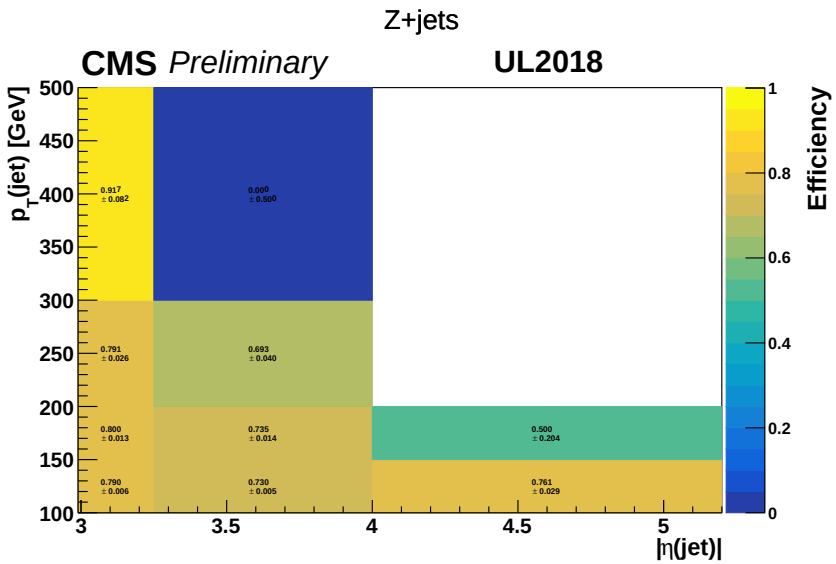


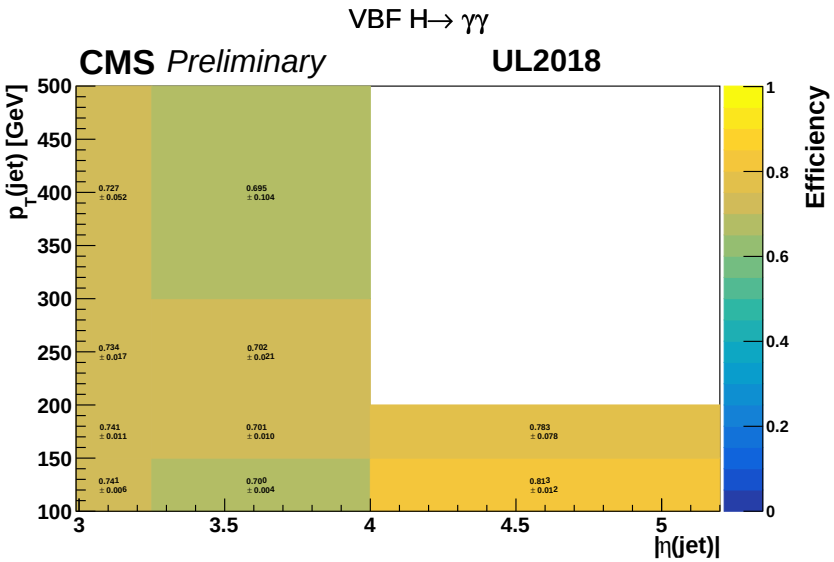


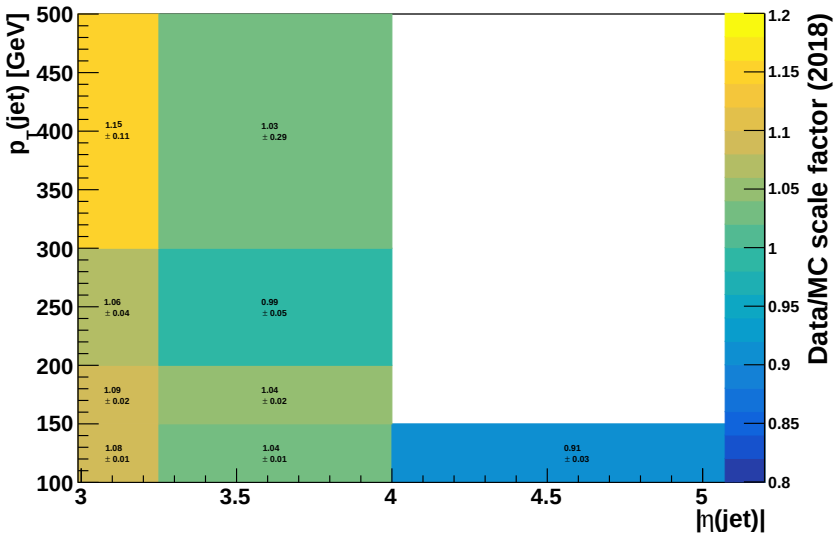


Efficiency (2018)

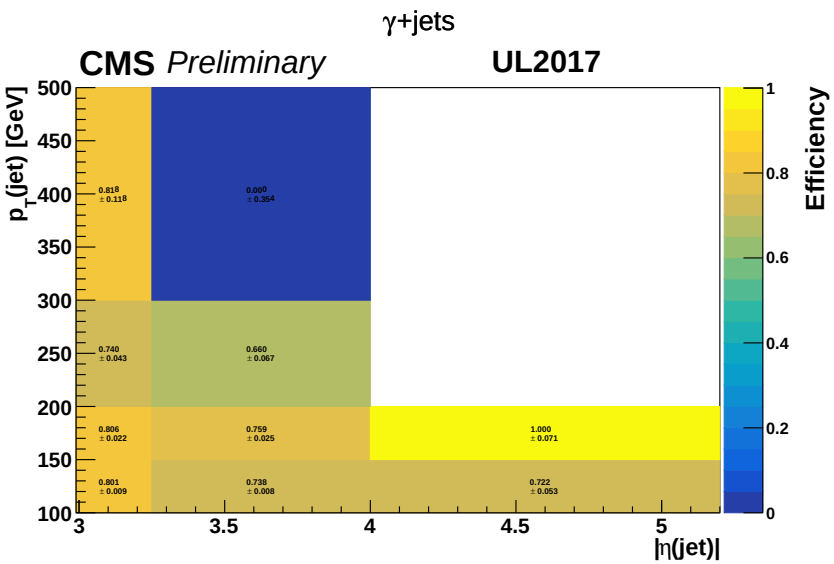


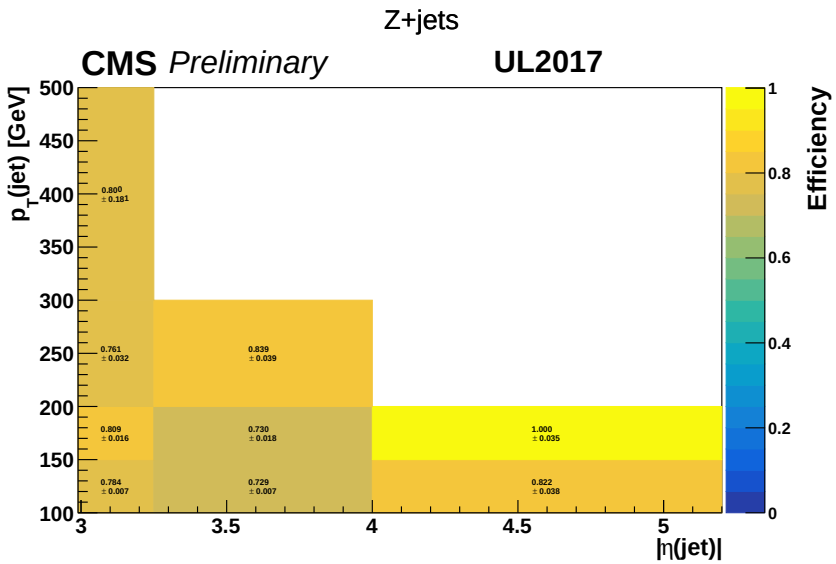


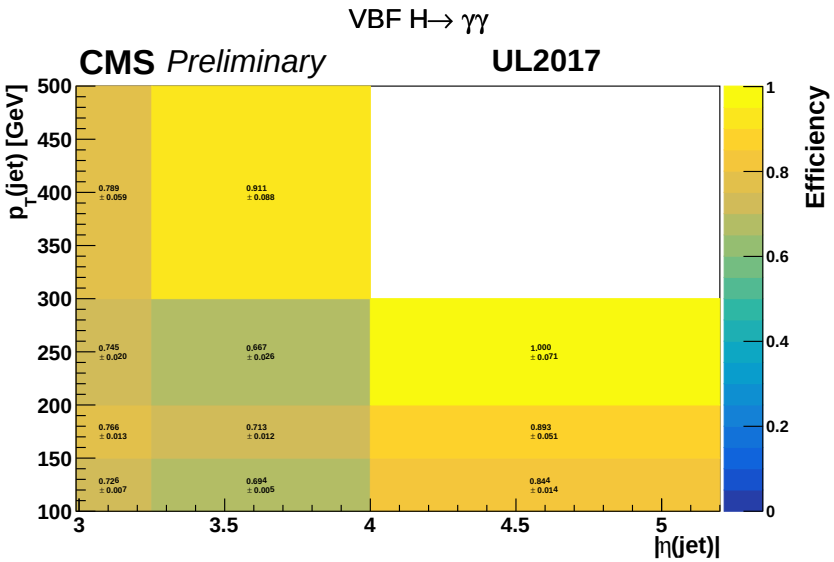


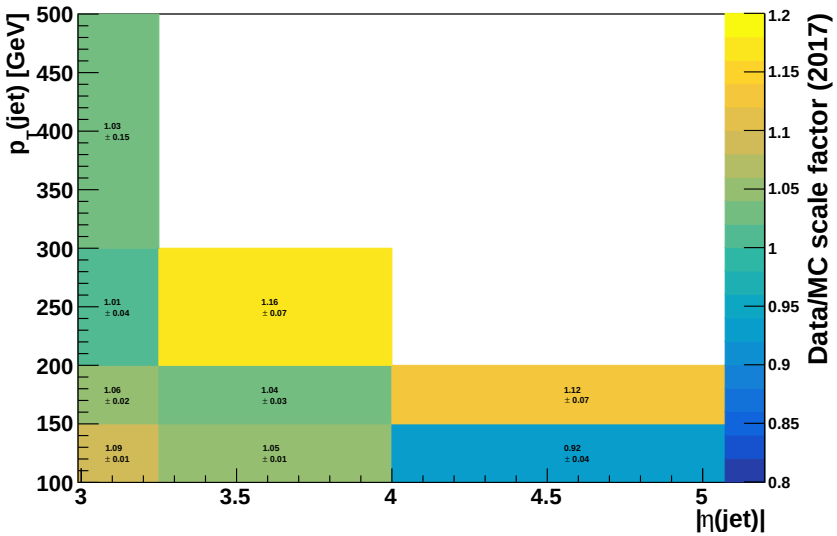


Efficiency (2017)

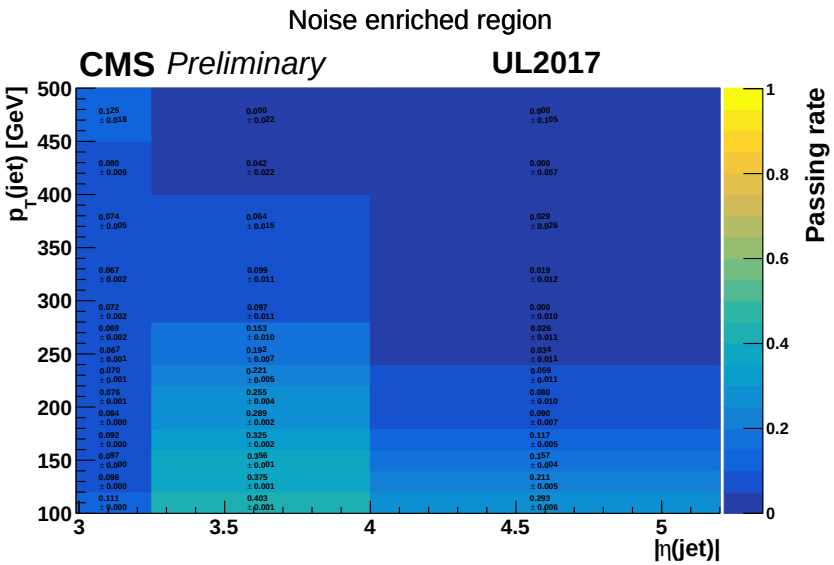


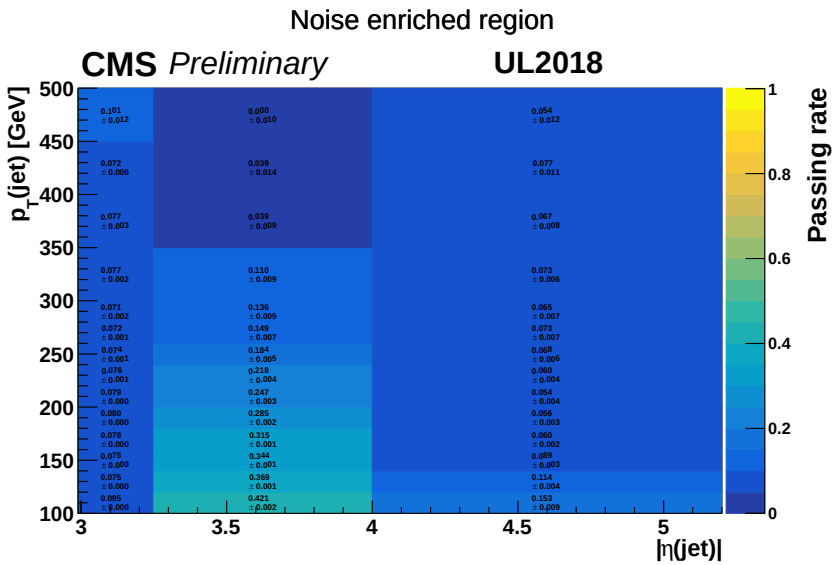






Noise tagging rate (2017/2018)





Summary

- New working point developed.
  - η dependent conditions to account for different noise source (pure HF noise vs beam halos)
- Tighter with respect to previous working point.
- **To be applied on jets back to back with MET !** (Should strongly limit the impact on signal)
- Efficiency, scale factor and noise passing rate available at:
  `https://lathomas.web.cern.ch/lathomas/JetMETStuff/HFNoiseStudy/EffcySFandNoisePassRate.root`

$\sigma_{\eta\eta}$ vs $\sigma_{\phi\phi}$: 2017 vs 2018

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