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L3Res global fit status

April 20, 2020

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Results for UL17_V1 inputs vs EOY17 reference

The Z+jet results use inputs posted on the JEC agenda of March 9, 2020 (<https://indico.cern.ch/event/896070/#28-update-on-ul17-z-jet-l3resi>).

The multijet results were privately provided through Minsuk Kim's CERNbox.

Photon+jet from Lucas Torterotot (

[/afs/cern.ch/work/l/ltortero/public/JEC-task/2017UL/](https://afs.cern.ch/work/l/ltortero/public/JEC-task/2017UL/)

[combinationfiles/JEC_Summer19UL17_V1-JER_Fall17_V3b/2020-04-02/*](https://afs.cern.ch/work/l/ltortero/public/JEC-task/2017UL/combinationfiles/JEC_Summer19UL17_V1-JER_Fall17_V3b/2020-04-02/*)).

I would like to extend special thanks to

- ▶ Maximilian Horzela and Daniel Savoiu for Z+jet inputs
- ▶ Lucas Torterotot for γ +jet inputs
- ▶ Minsuk Kim for multijet inputs
- ▶ Henning Kirschenmann for maintaining global fit software in gitHub

Current to-do list:

- ▶ MPF uncertainties from FSR at high p_T should be smaller. This should increase response and pull UL17 closer to 2016, 2018. At low p_T MPF FSR uncertainty they can be larger, thus constrain L1Res bit less.
- ▶ No EM scale for Zee or *gamma*. **NB: Photon scale shifted down by 1% to match Zll**
- ▶ Need $|\eta_{e^+,e^-}| < 1.3$ break-up for Zee mass to use with γ
- ▶ Further input needed on photon scale uncertainties vs p_T
- ▶ Finish parameter pulls and correlations plots

Some notes about current global fit settings:

- ▶ Electron and muon scales are corrected with Z mass in RunBCDEF. This is measured in bins of Z p_T and fitted with quadratic logarithmic function (constant for $Z\mu\mu$). Z mass fit uncertainty is added to statistical uncertainty for each sample, and Zee and $Z\mu\mu$ are subsequently combined into Zll, which is used in global fit to avoid decorrelated k_{FSR}
- ▶ Photon scale is corrected with Zee mass at $p_{T,Z} = 2 \times p_{T,\gamma}$, and fit uncertainty is added to statistical uncertainty (**tbd**: get Zee mass with EB-EB only)
- ▶ Reference scale uncertainties are set to 0.2% for combined leptons ($l=e+\mu$), **0.5% for photons with 1.0% rescaling** (since no EM scale yet)
- ▶ MPF method is given additional 0.5% uncertainty for γ +jet and 0.2% for Zll+jet (for 40% Zee+jet) to cover for possible residual EM footprint effects
- ▶ **New**: k_{FSR} central value and uncertainties are taken for all IOVs from BCDEF to reduce uncertainties and avoid decorrelation for pTbal
- ▶ JEC parameterization is the 2-p fit previously used in 2017

- ▶ Inputs are provided for MPF and p_T balance with $\alpha < 0.1, 0.15, 0.20$ and $\alpha < 0.3$; this last one is used for global fit vs p_T
- ▶ Other inclusive α bins are used to derive custom FSR+ISR corrections, under the assumption of linear dependence versus α cut and log-quadratic dependence versus p_T
- ▶ FSR+ISR corrections are further constrained in global fit under the assumption that both MPF and p_T balance converge to same ultimate result (within constraints of their uncorrelated systematics)
- ▶ γ +jet is also used only at $p_T > 105$ GeV to avoid QCD dijet contamination
- ▶ Compared to EOY17, re-enabled Z+jet pTbal at 30–100 GeV with $\alpha_{\text{eff,max}} = 0.45$ (**tbd**: revisit pTbal FSR slope change at $p_T < 100$ GeV based on full Run 2 data, add MPF bias shape from unclustered energy)

- ▶ Multijets has both recoil p_T and leading jet p_T binning; **leading** used as current default (*plan: JER-syst. weighted average*)
- ▶ triggers:
{"jt0","jt40","jt60","jt80","jt140","jt200","jt260","jt320","jt400","jt450","jt500"}
- ▶ leading thresholds:
{ {0,64}, {64,84}, {84,114}, {114,196}, {196,272}, {272,330}, {330,395}, {395,468}, {468,592}, {592,600} }
- ▶ recoil thresholds:
{ {0,97}, {97,196}, {196,220}, {220,272}, {272,395}, {395,468}, {468,592}, {592,600} }
- ▶ **FSR** corrections applied (derived vs $p_{T,min}$), fit uncertainty added in global fit
- ▶ **JER** uncertainty included (derived for recoil and leading) in global fit (*plan: reduced with JER-syst. weighted average, derive 2nd order JER syst. e.g. from recoil vs leading*)

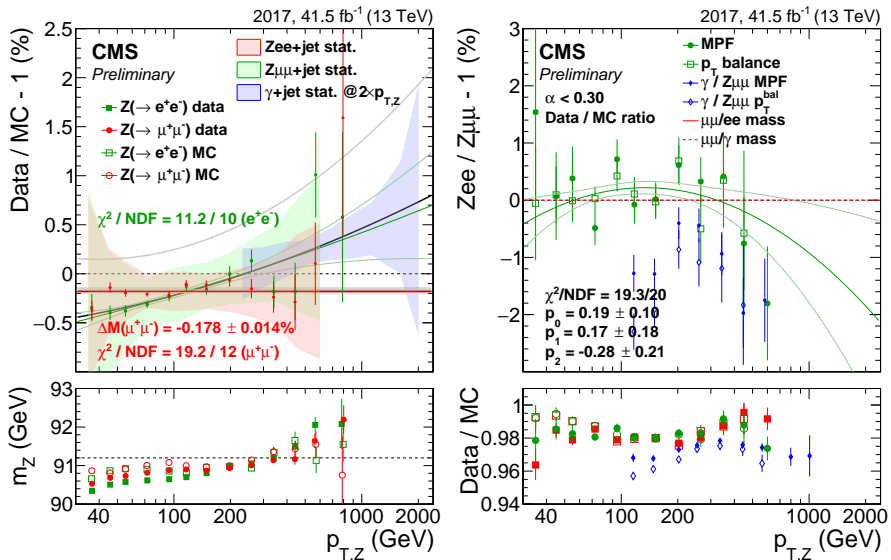
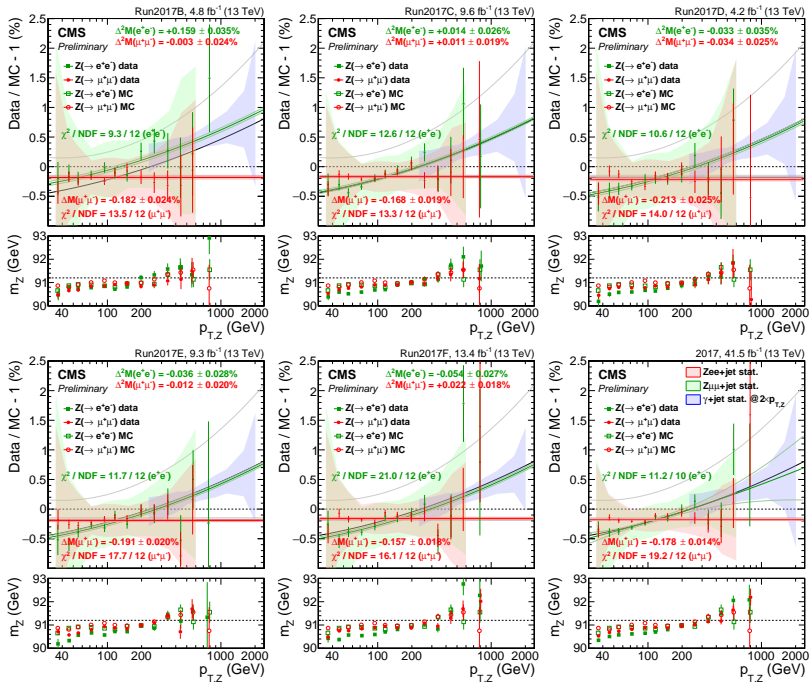
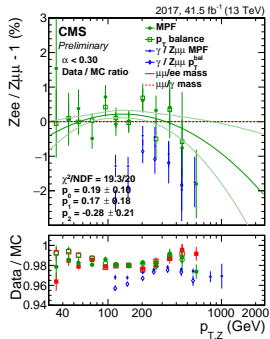
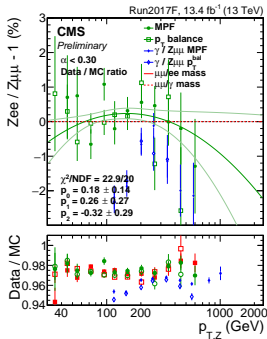
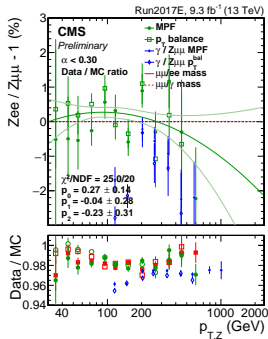
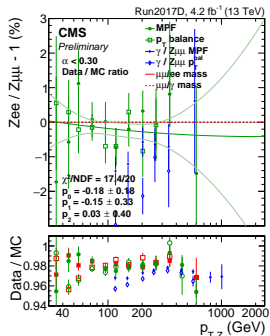
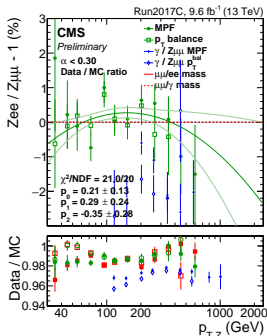
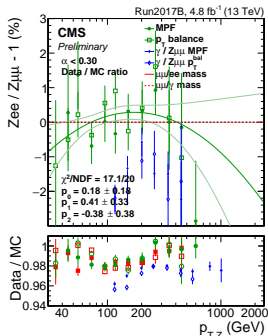


Figure : (a) Shift in Zee and Zμμ masses versus Z p_T. (b) MPF and p_T balance for Zee+jet and γ+jet versus Zμμ+jet after mass (and FSR) corrections. γ+jet is EOY17.





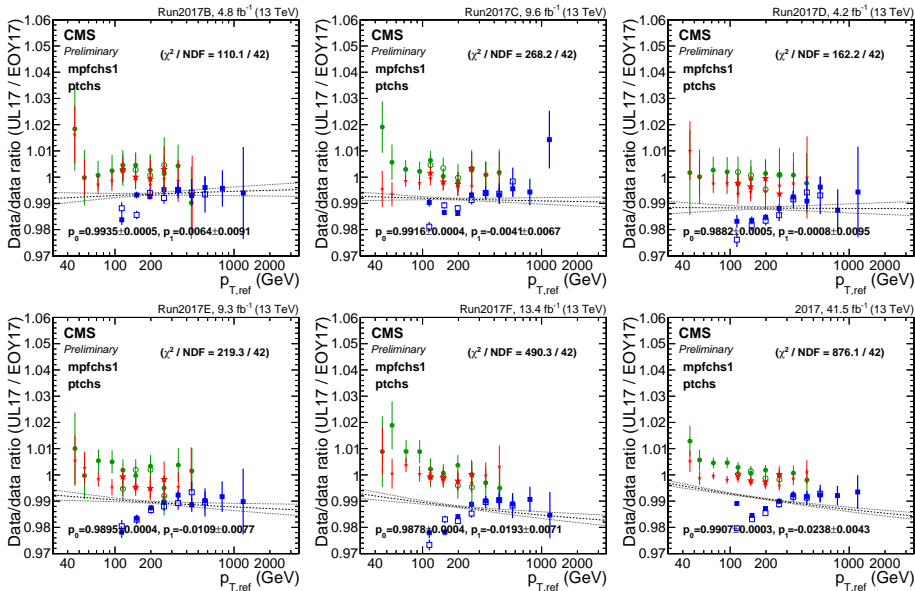


Figure : Data (UL17) vs data (EOY17)

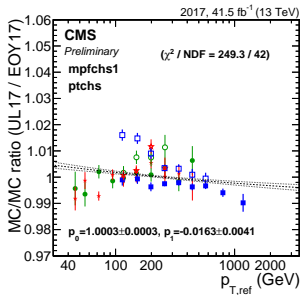


Figure : MC (UL17) vs MC (EOY17)

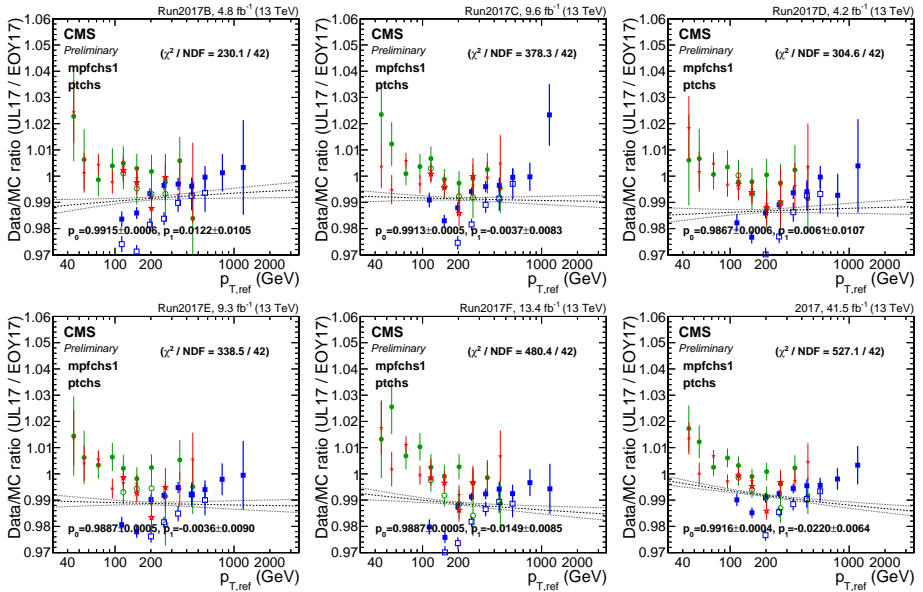


Figure : Data/MC ratio (UL17) vs Data/MC ratio (EOY17)

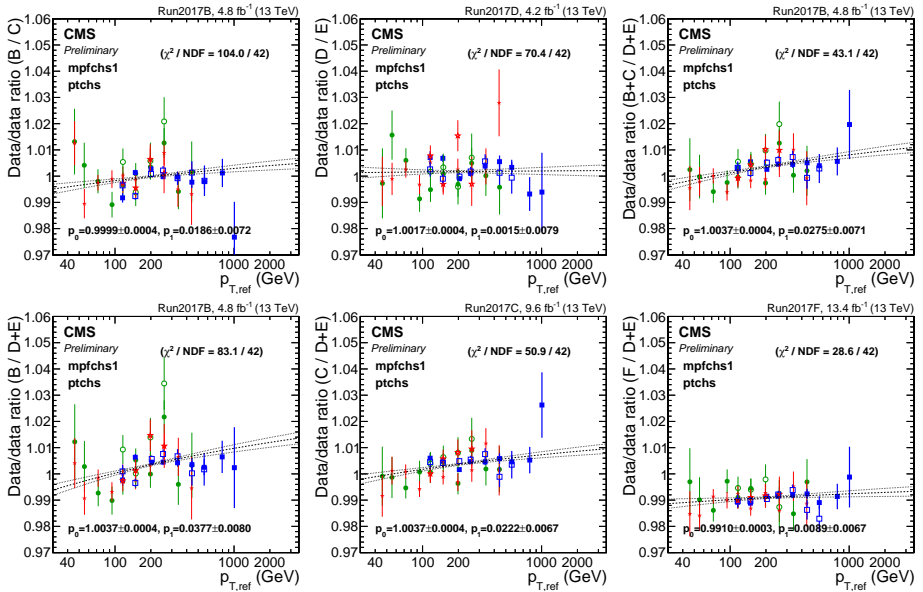


Figure : Stability checks between data IOVs.

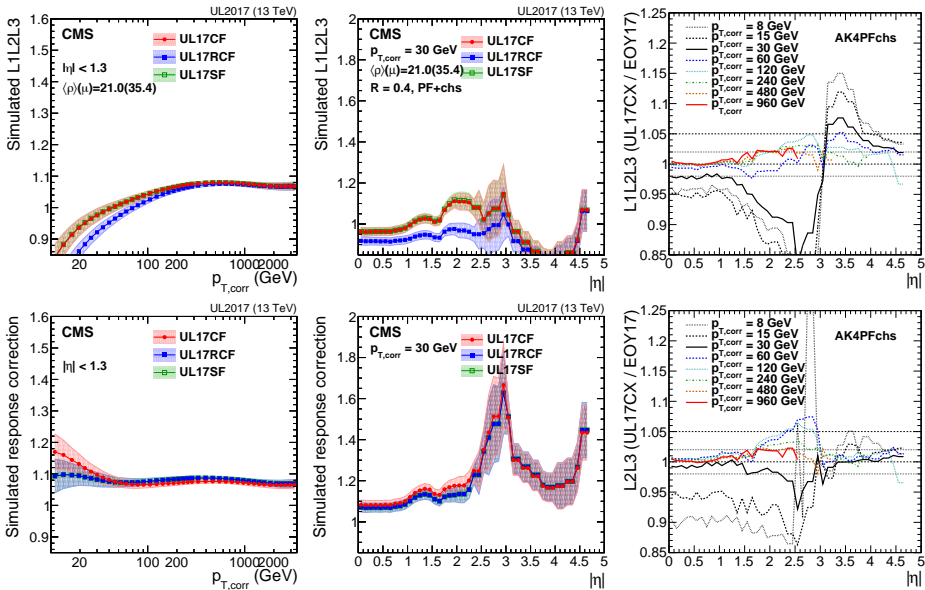


Figure : MC JEC UL17 V1 vs EOY17 V32 (CX=ComplexL1, S=SimpleL1).

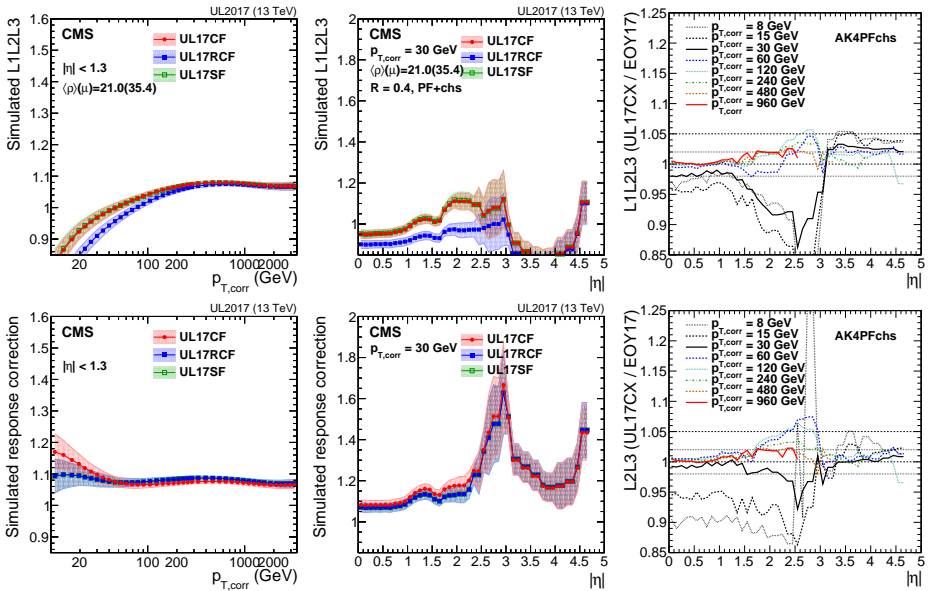


Figure : Data JEC UL17 V1 vs EOY17 V32 (CX=ComplexL1, S=SimpleL1).

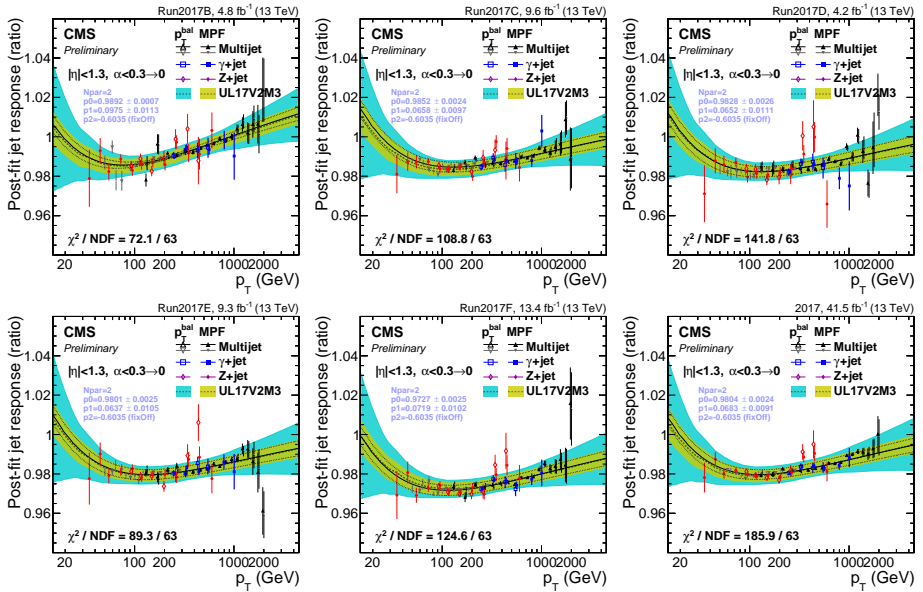


Figure : Final fit results.

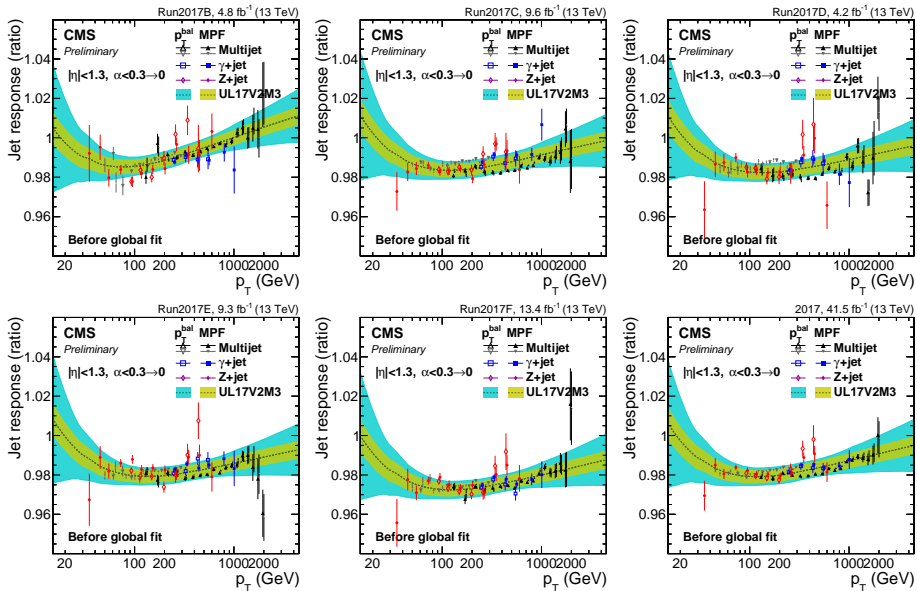


Figure : Pre-fit (post-FSR) results.

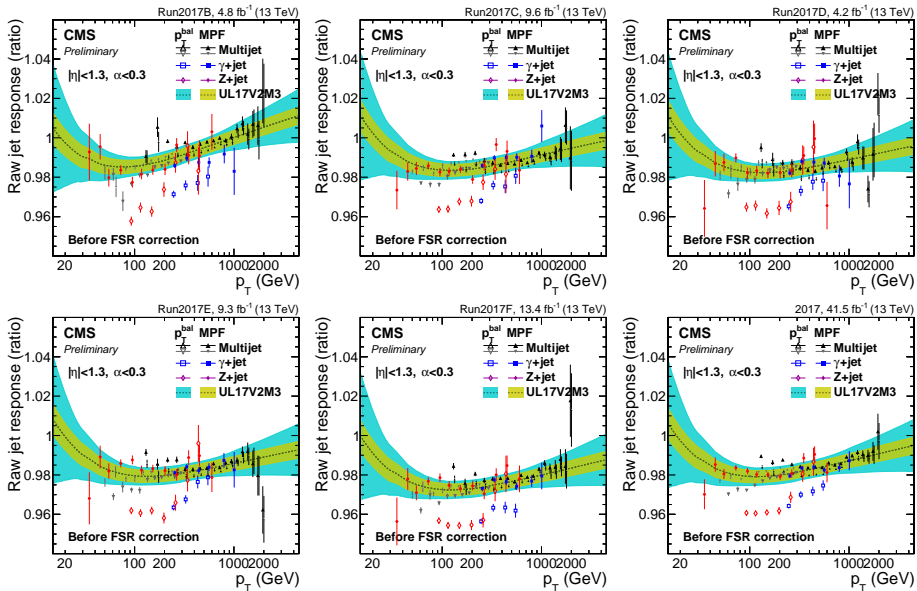
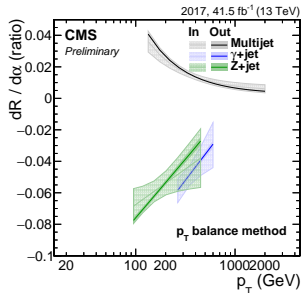
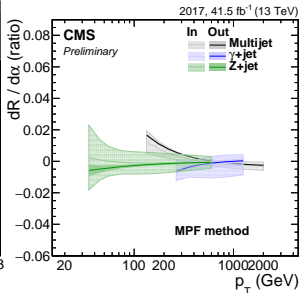
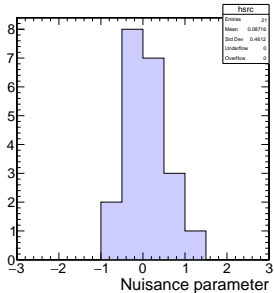
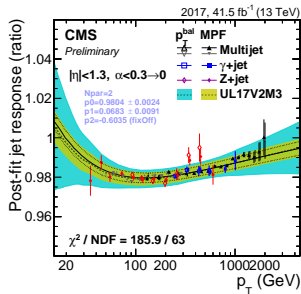
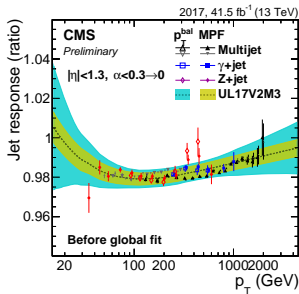
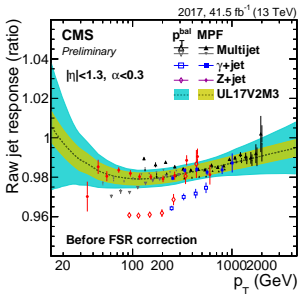
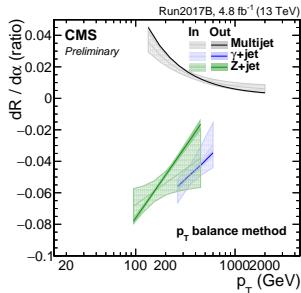
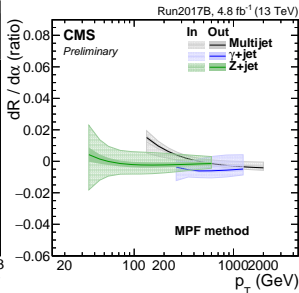
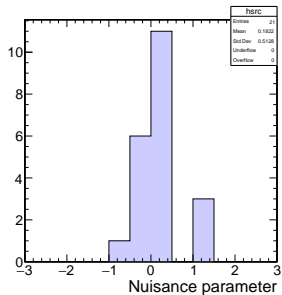
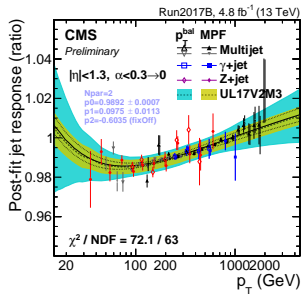
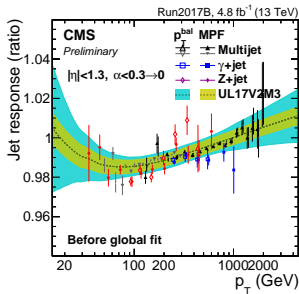
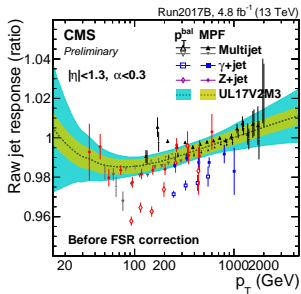
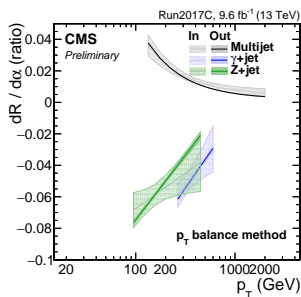
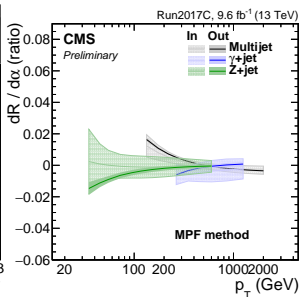
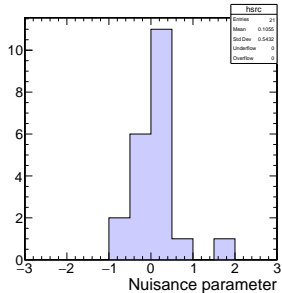
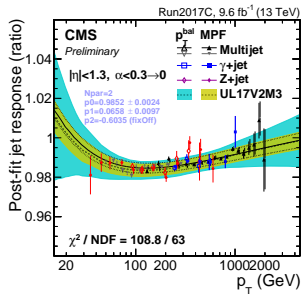
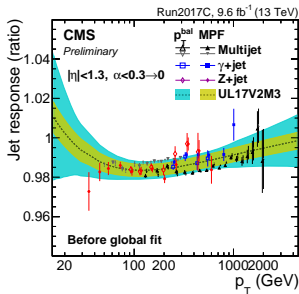
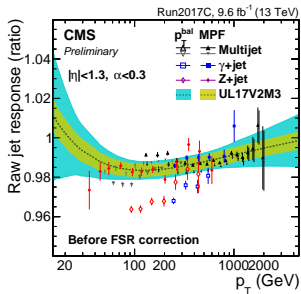
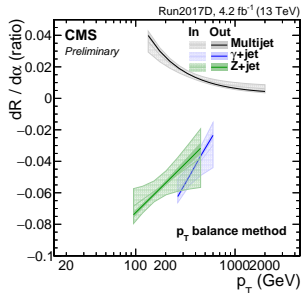
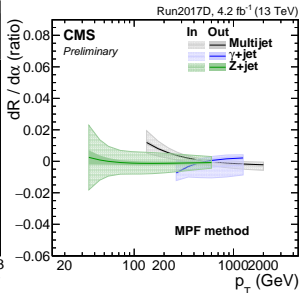
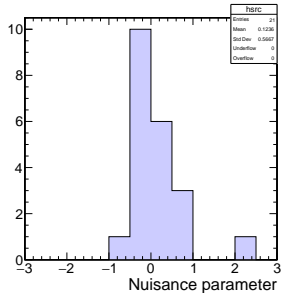
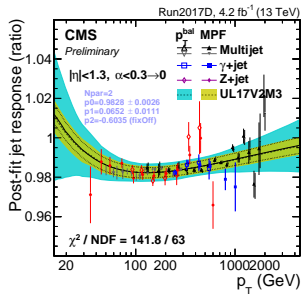
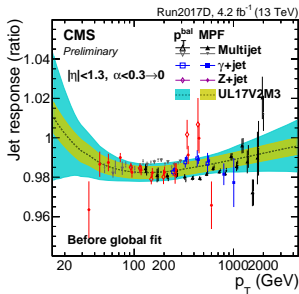
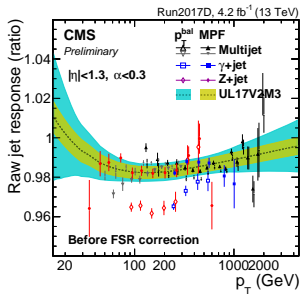


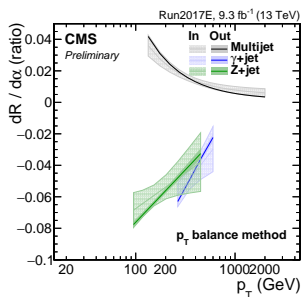
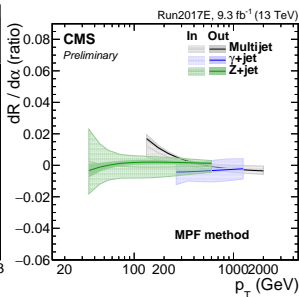
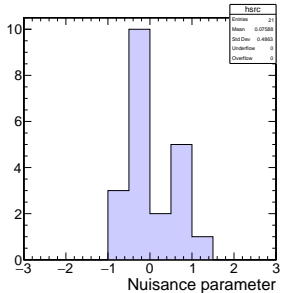
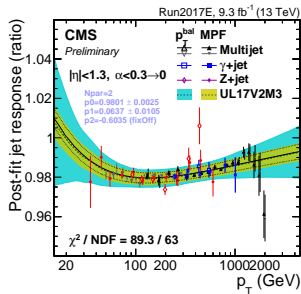
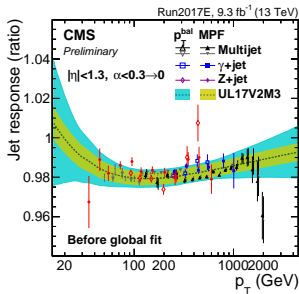
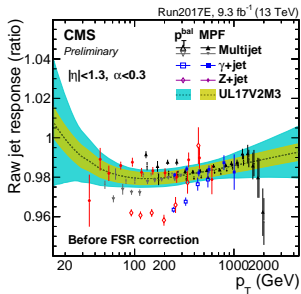
Figure : Raw (Pre-fit, pre-FSR) results.

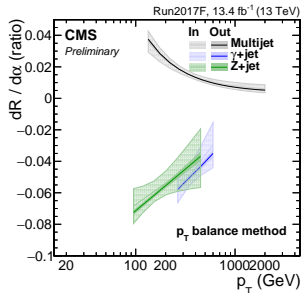
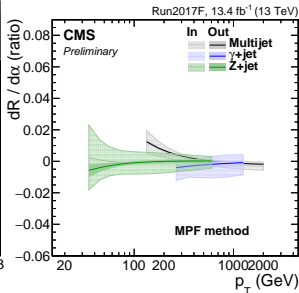
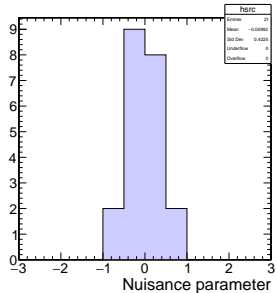
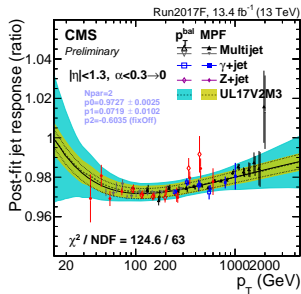
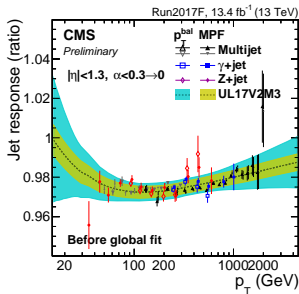
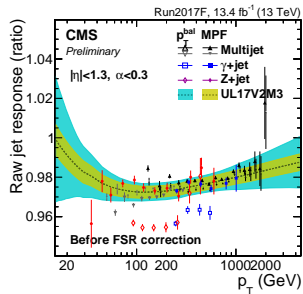


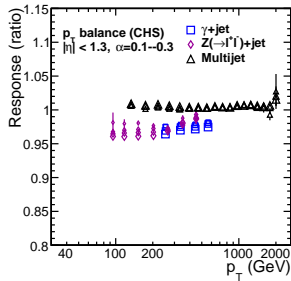
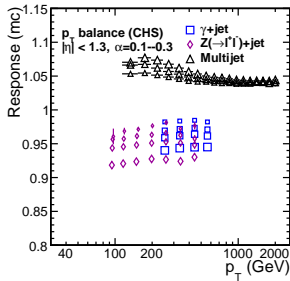
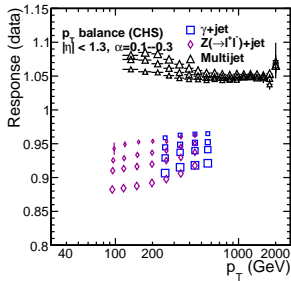
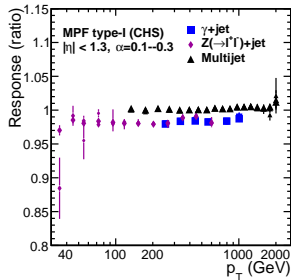
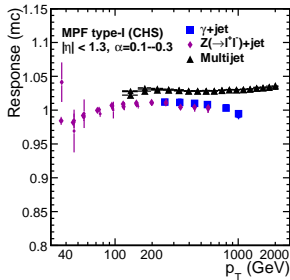
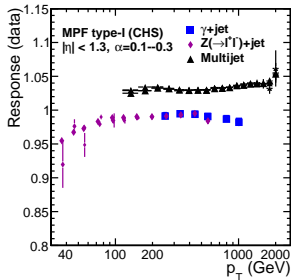


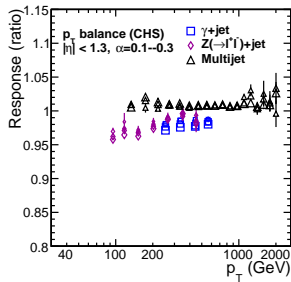
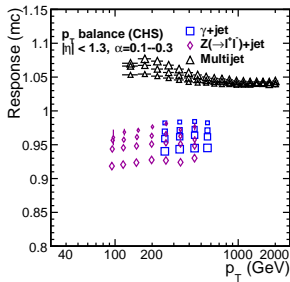
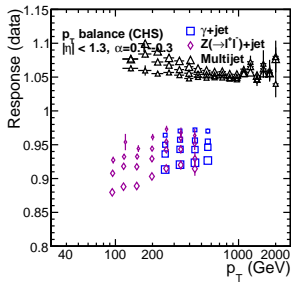
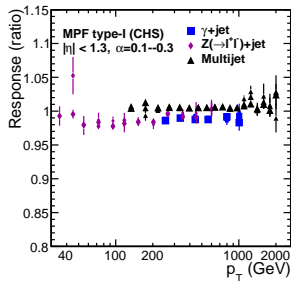
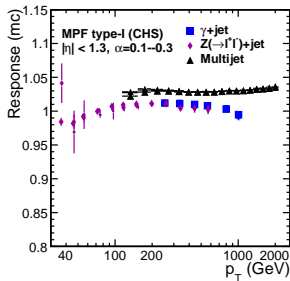
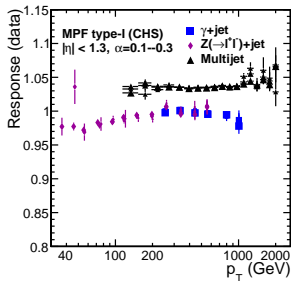


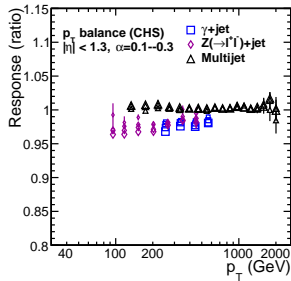
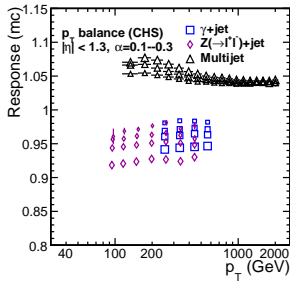
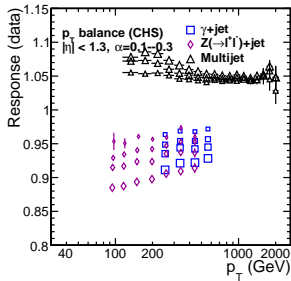
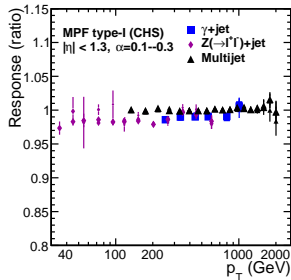
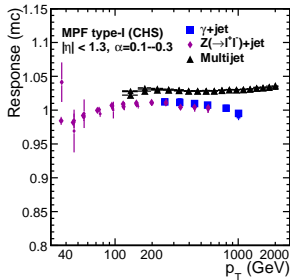
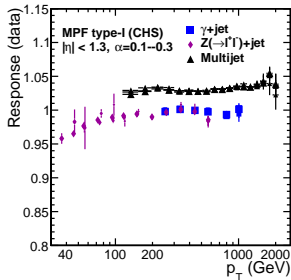


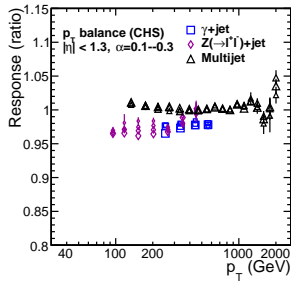
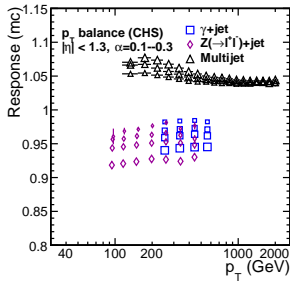
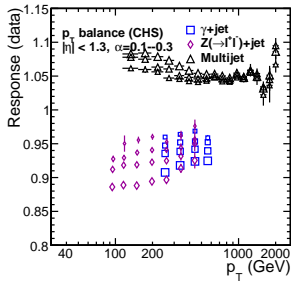
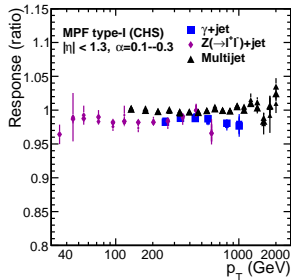
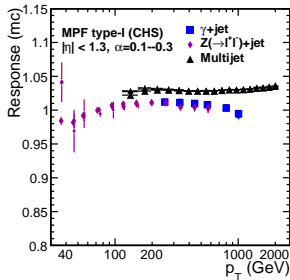
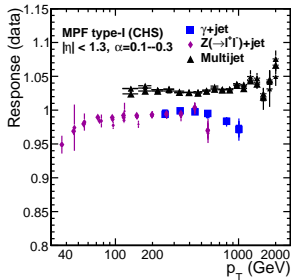


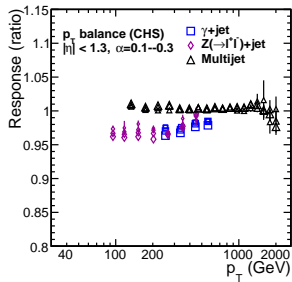
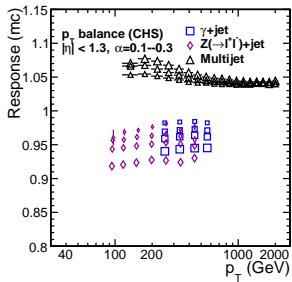
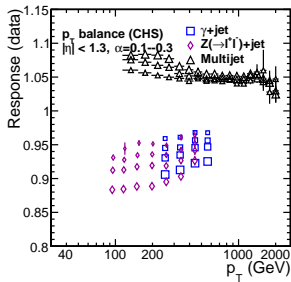
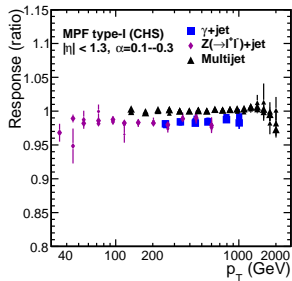
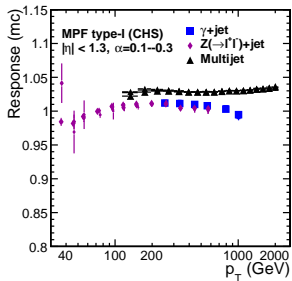
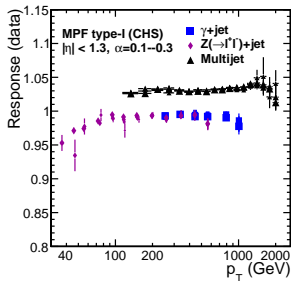


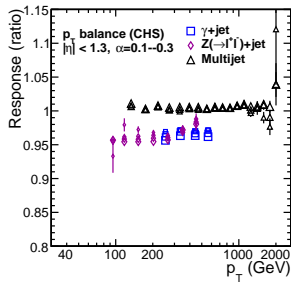
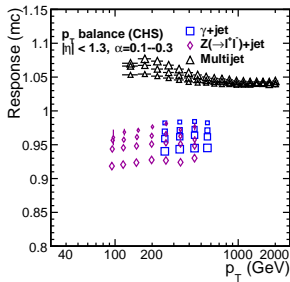
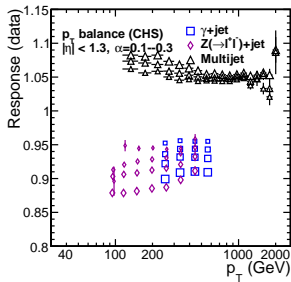
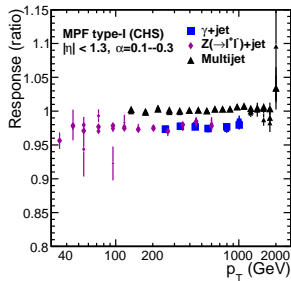
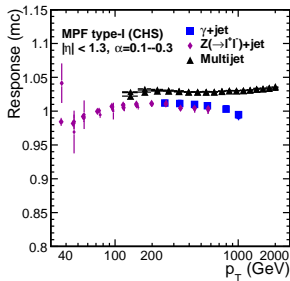
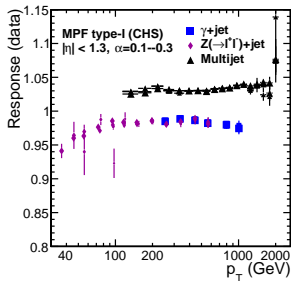


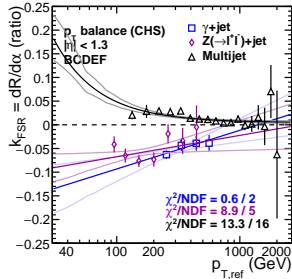
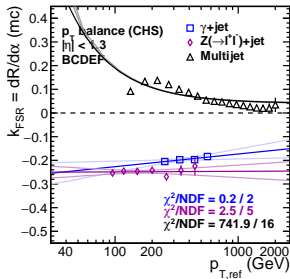
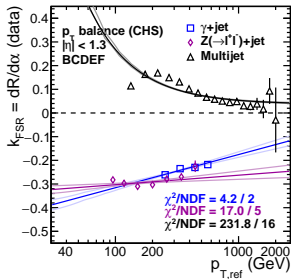
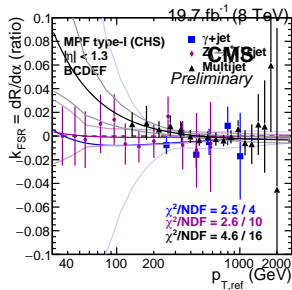
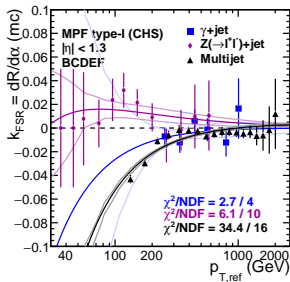
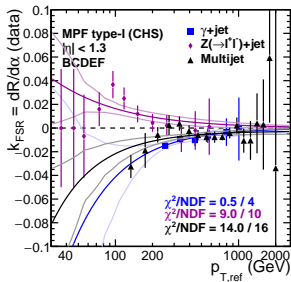


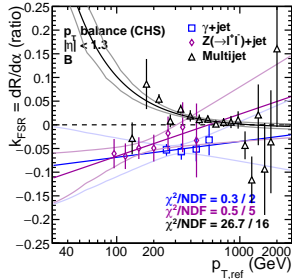
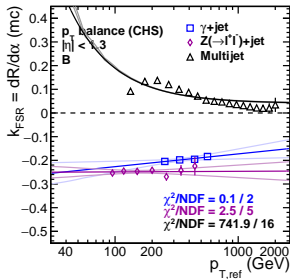
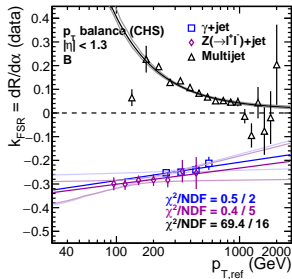
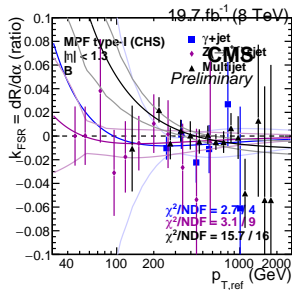
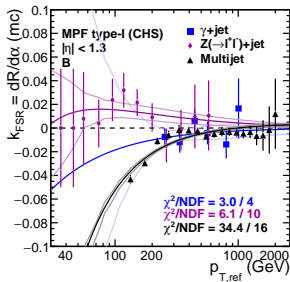
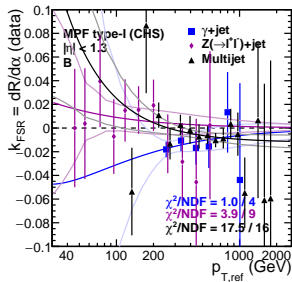


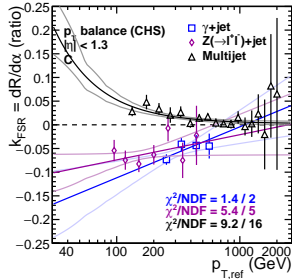
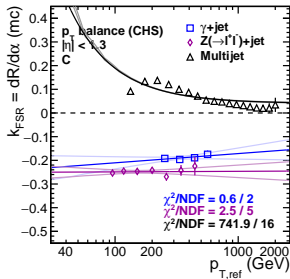
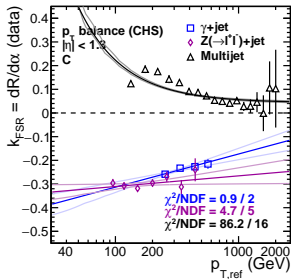
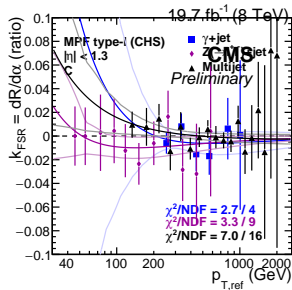
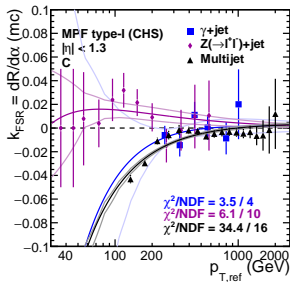
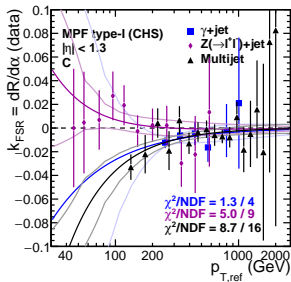


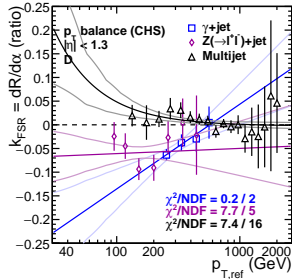
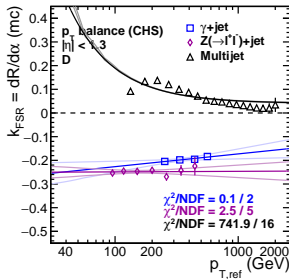
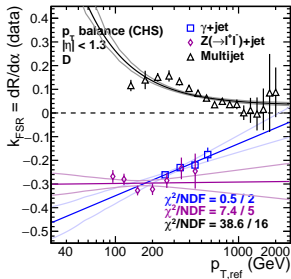
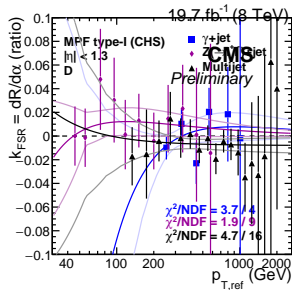
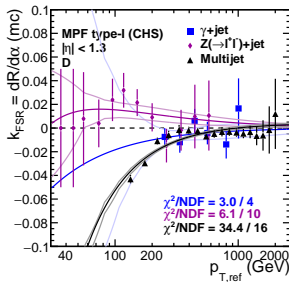
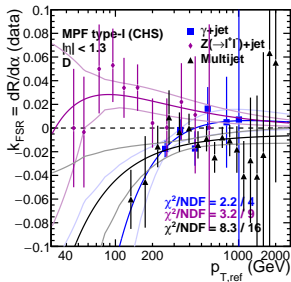


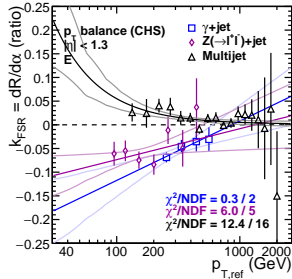
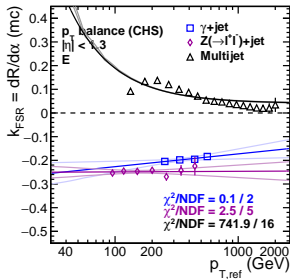
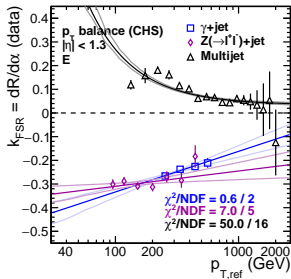
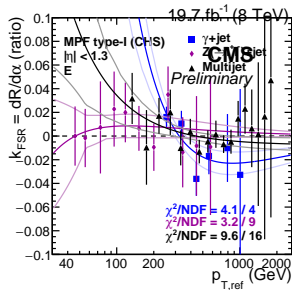
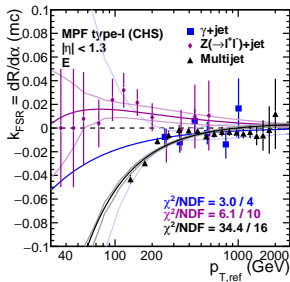
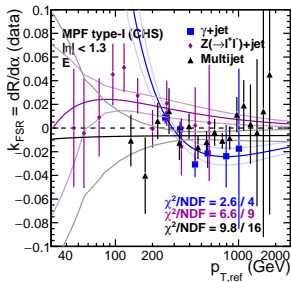


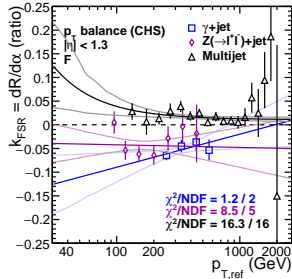
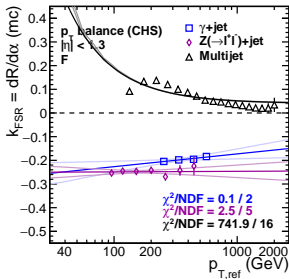
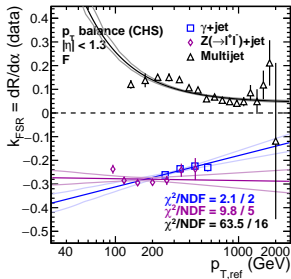
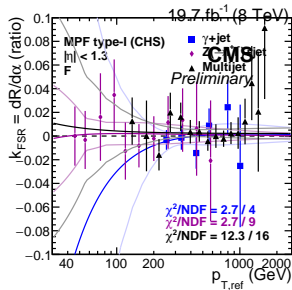
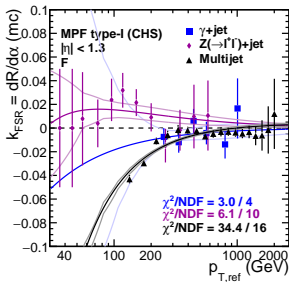
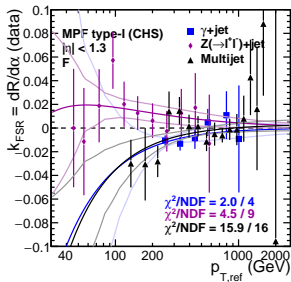


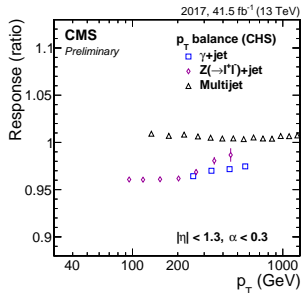
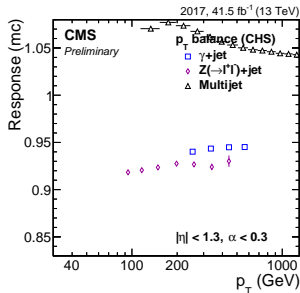
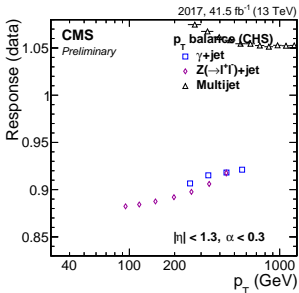
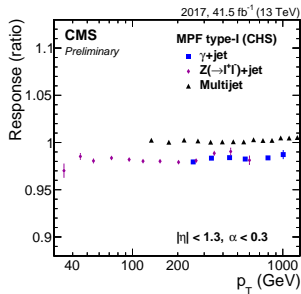
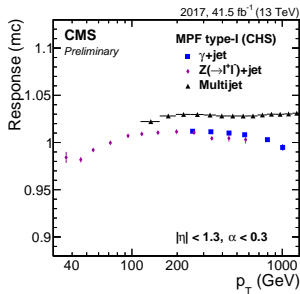
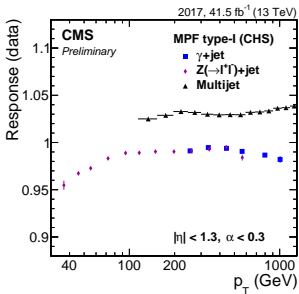


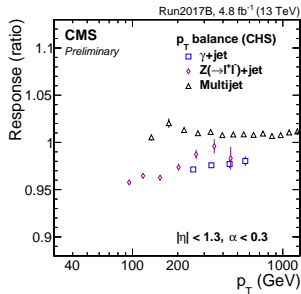
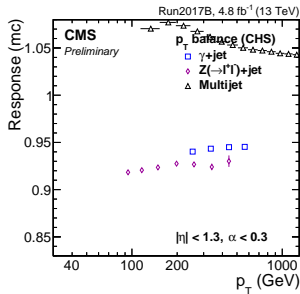
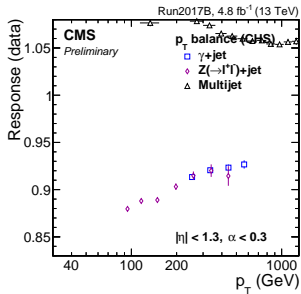
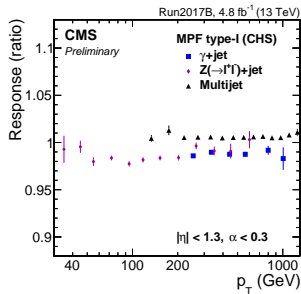
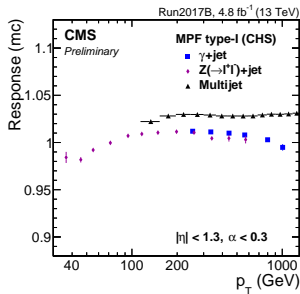
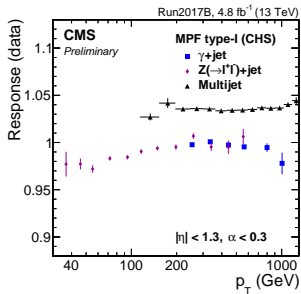


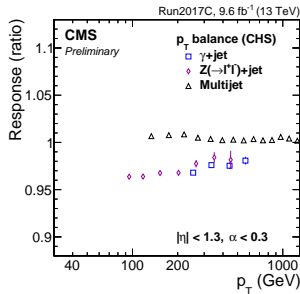
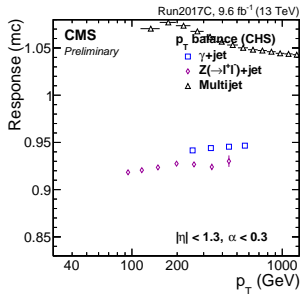
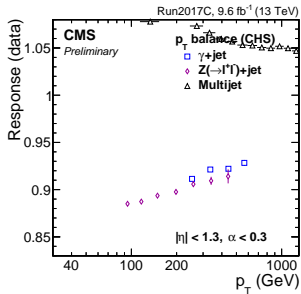
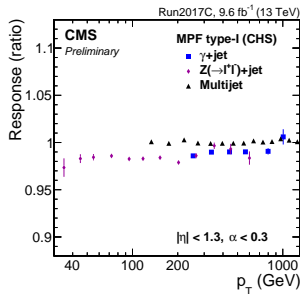
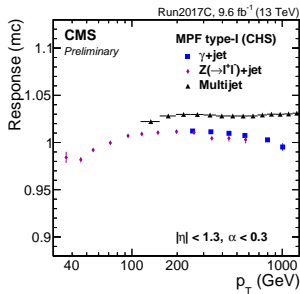
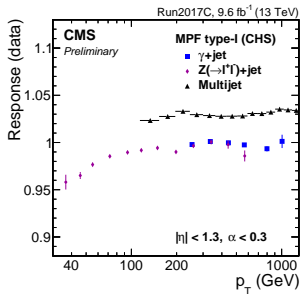


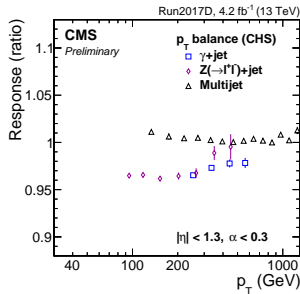
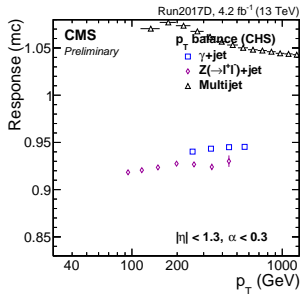
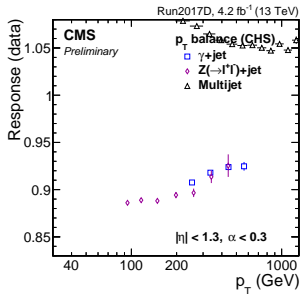
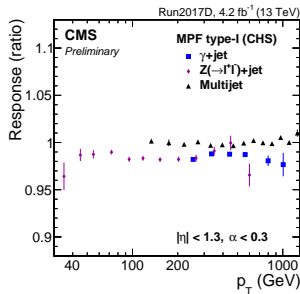
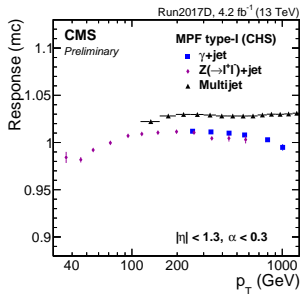
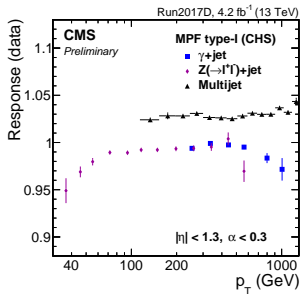


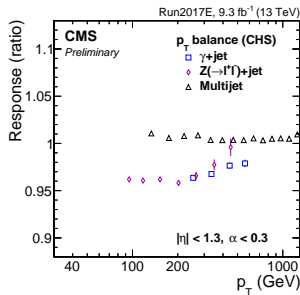
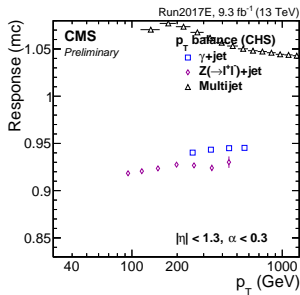
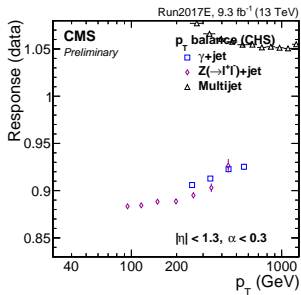
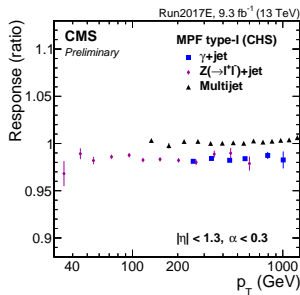
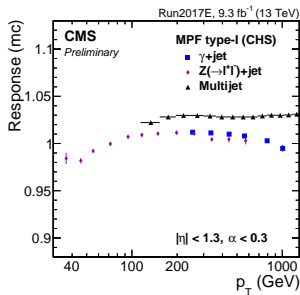
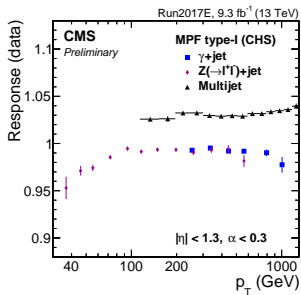


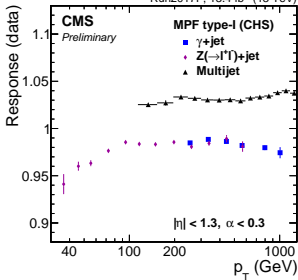
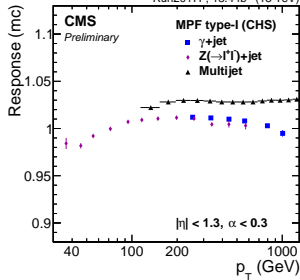
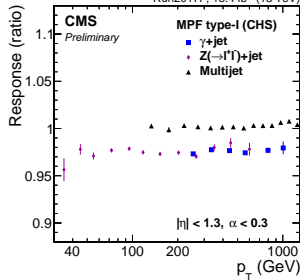
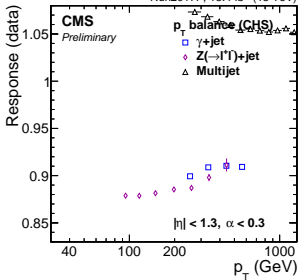
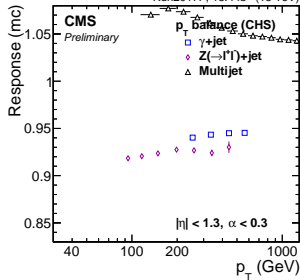










Run2017F, 13.4 fb⁻¹ (13 TeV)Run2017F, 13.4 fb⁻¹ (13 TeV)Run2017F, 13.4 fb⁻¹ (13 TeV)Run2017F, 13.4 fb⁻¹ (13 TeV)Run2017F, 13.4 fb⁻¹ (13 TeV)Run2017F, 13.4 fb⁻¹ (13 TeV)