



UNFOLDING THE JET MASS IN $Z +$ JETS EVENTS

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- ▶ A Measurement of normalized double differential jet production cross section in $Z + \text{Jet}$ events :

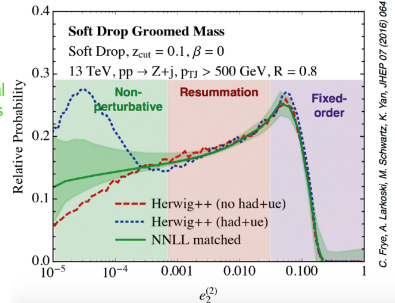
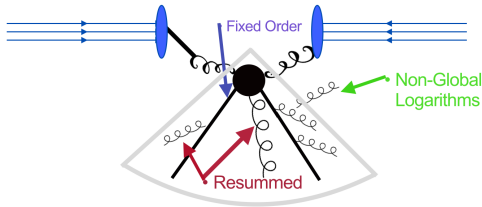
$$\frac{1}{\frac{d\sigma}{dp_T}} \frac{d^2\sigma}{dp_T dm} \left(\frac{1}{\text{GeV}} \right)$$

- ▶ We use TUnfoldDensity to perform 2D unfolding:

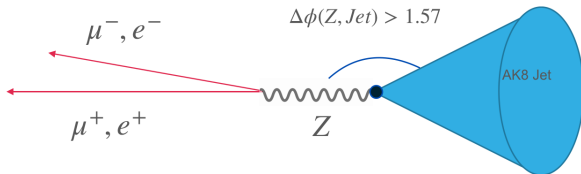
$$(p_T, [m_u || m_g])$$

- ▶ We compare the ungroomed and groomed jet masses (9 combinations of the soft-drop parameters)
- ▶ Today we show a preview of our preliminary results for 2017 data
- ▶ Plan to publish this fall with 2016/2017/2018 or some subset of that data

Jet Mass : A simple observable for testing QCD



- Understand evolution of the “jet” function in perturbative QCD
- Improve modeling of jets in Monte Carlo generators



Summary

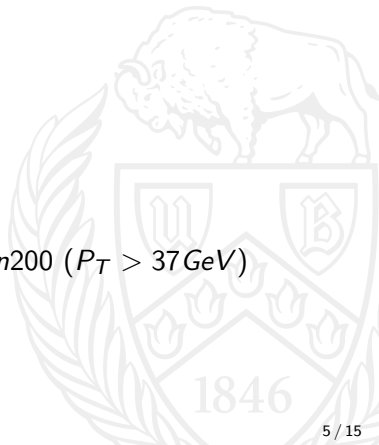
- ▶ At least 1 Anti-Kt $R = 0.8$ Jet, $P_T > 200\text{GeV}$, $|\eta| < 2.5$, $dR(\text{Jet}, \text{Lepton}) > 0.8$
- ▶ 2 opposite sign, same flavor leptons, $|\eta| < 2.4$
- ▶ Sum of the 2 leptons gives the Z candidate, $P_T > 90\text{GeV}$, $d\phi(Z, \text{Jet}) > 1.57$

Muons

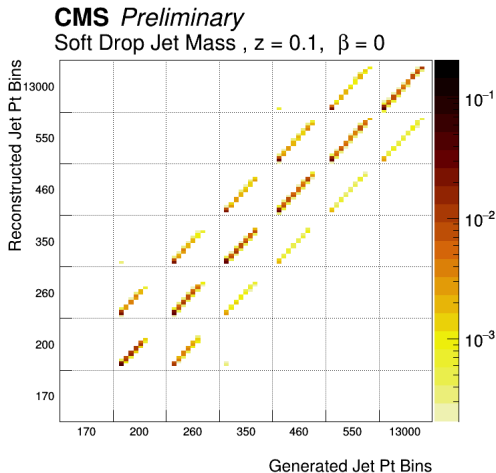
- ▶ ISO : PF relative Isolation $0.4 < 0.25$
- ▶ ID : Medium cut based ID
- ▶ Trigger : IsoMu27 ($P_T > 29\text{GeV}$)

Electrons

- ▶ ISO : None
- ▶ ID : Medium cut based ID
- ▶ Trigger : $Ele35_W PTight_GsfORPhoton200$ ($P_T > 37\text{GeV}$)

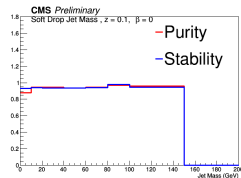
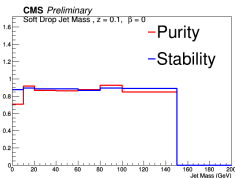
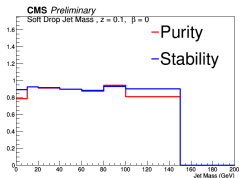
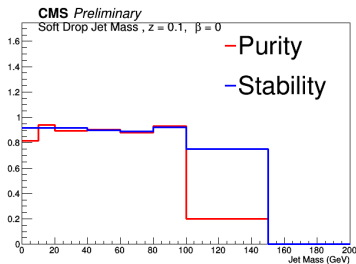
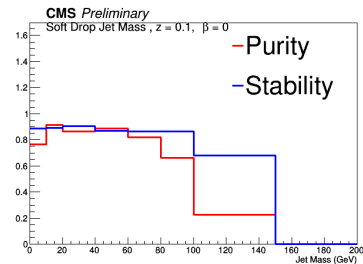


- ▶ Normalized by Reconstructed (Y axis) P_T bin
- ▶ Mass binning on X axis (Coarse/Output) :
- ▶ [0.0, 10.0, 20.0, 40.0, 60.0, 80.0, 100.0, 150.0, 200.0, 13000.0]



Pt 200-260 GeV

260-350 GeV

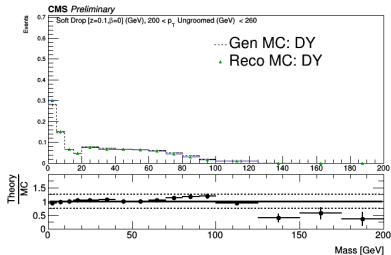


350-460 GeV

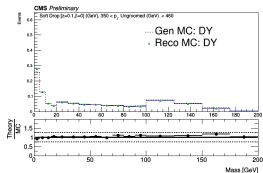
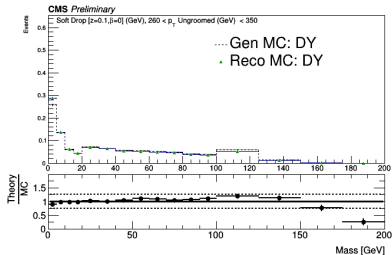
460-550 GeV

550-13000 GeV

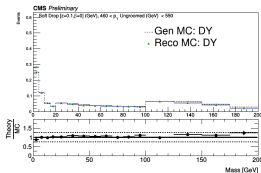
Pt 200-260 GeV



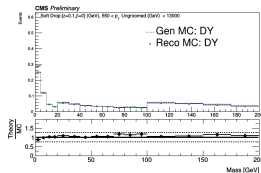
260-350 GeV



350-460 GeV

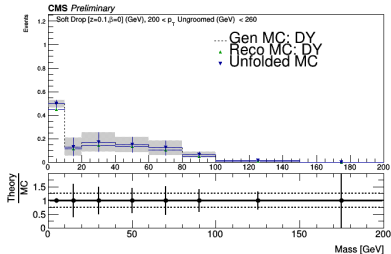


460-550 GeV

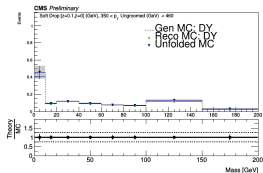
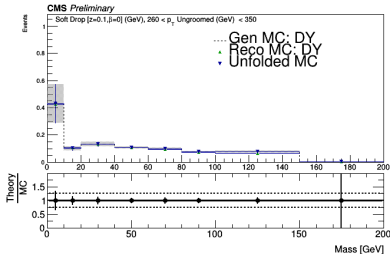


550-13000 GeV

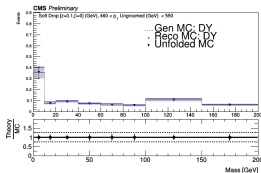
Pt 200-260 GeV



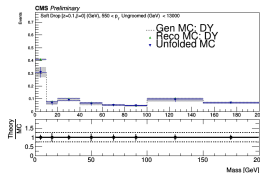
260-350 GeV



350-460 GeV



460-550 GeV

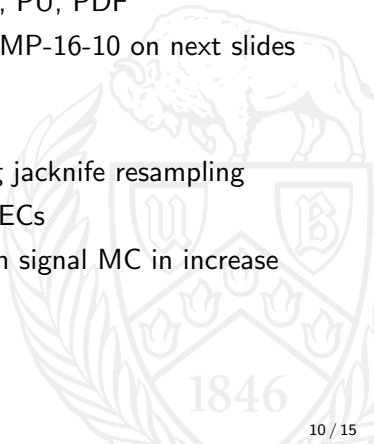


550-13000 GeV

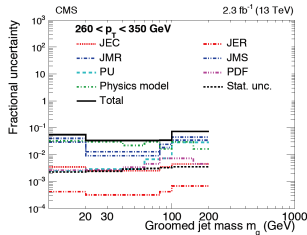
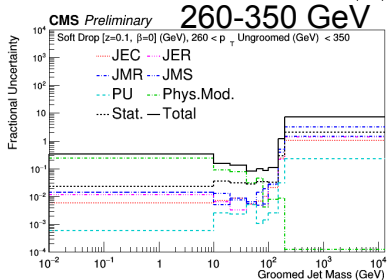
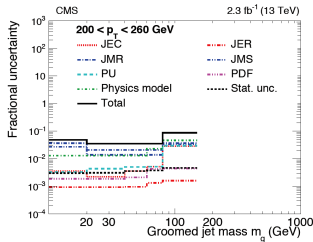
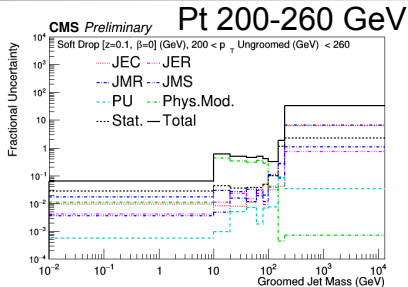
- ▶ Used TUnfoldSys to propagate uncertainties
- ▶ Input response matrices filled with observables shifted up and down 1σ from nominal
- ▶ Physics Model, JEC, JER, JMR, JMS, PU, PDF
- ▶ Compare to Dijet uncertainties from SMP-16-10 on next slides

Ongoing Work

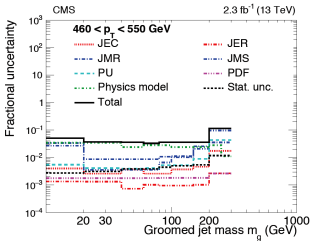
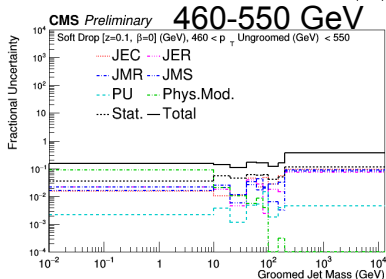
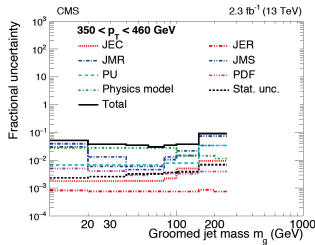
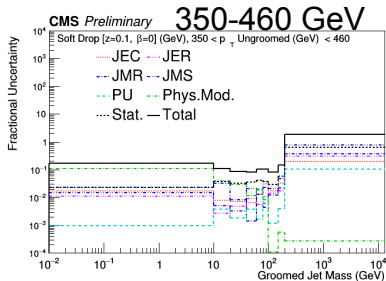
- ▶ Statistical uncertainty estimation using jackknife resampling
- ▶ Updating to Fall17_17Nov2017_V32 JECs
- ▶ Adding extension samples to Drell-Yan signal MC to increase statistics



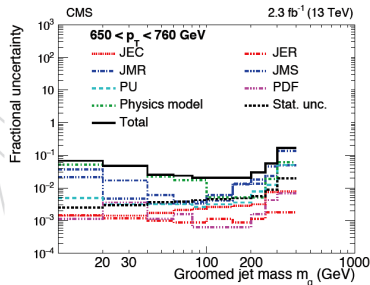
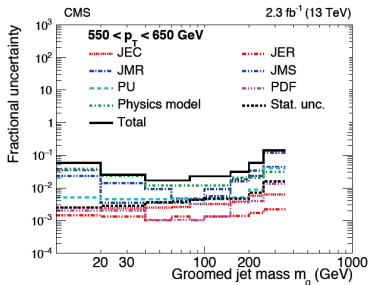
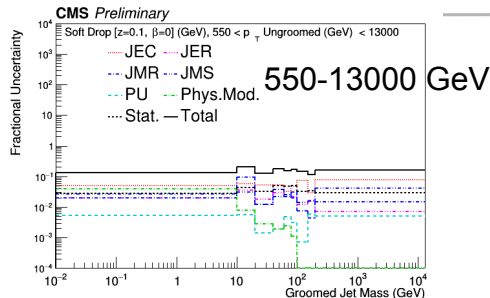
Systematic Uncertainties: Z+Jets and DiJets



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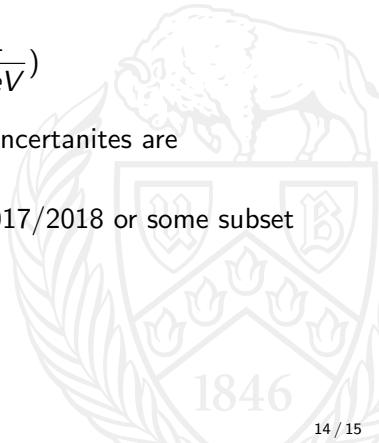
Systematic Uncertainties: Z+Jets and DiJets



- ▶ A Measurement of normalized double differential jet production cross section in $Z + \text{Jet}$ events :

$$\frac{1}{\frac{d\sigma}{dp_T}} \frac{d^2\sigma}{dp_T dm} \left(\frac{1}{\text{GeV}} \right)$$

- ▶ Method is complete and systematic uncertainties are understood
- ▶ Plan to publish this fall with 2016/2017/2018 or some subset of that data



The End



Extra Stuff

