Jet Measurements at ECCE

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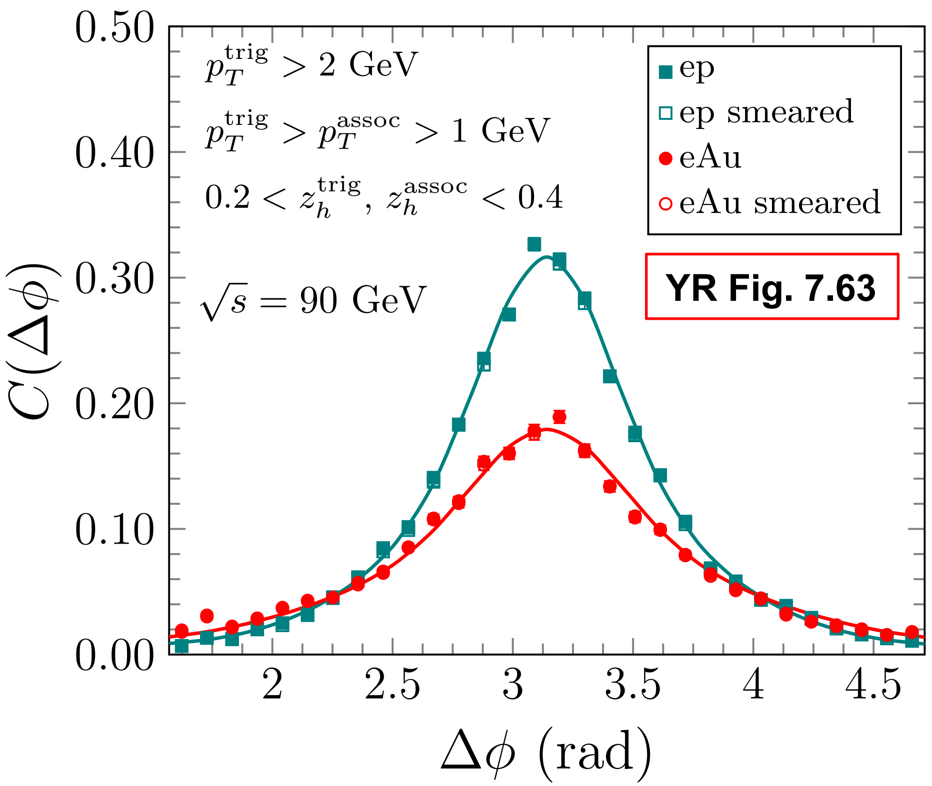
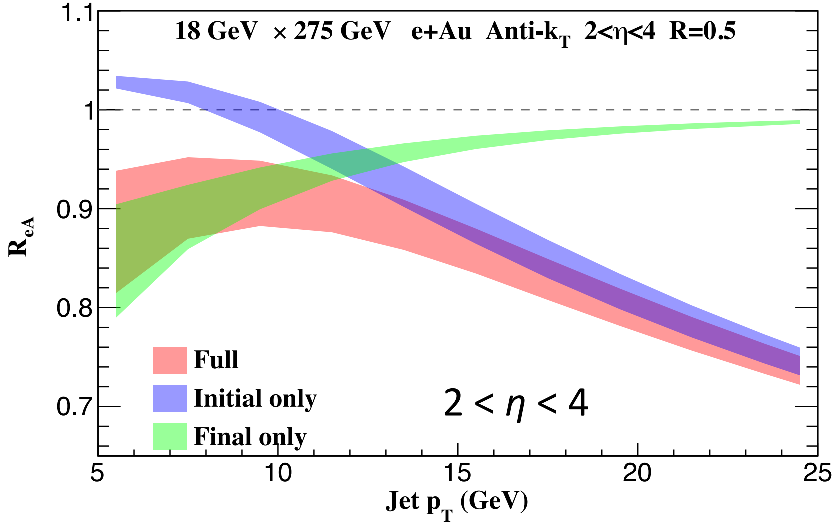
Yellow Report "Top Priority" Jet Observables (1/2)

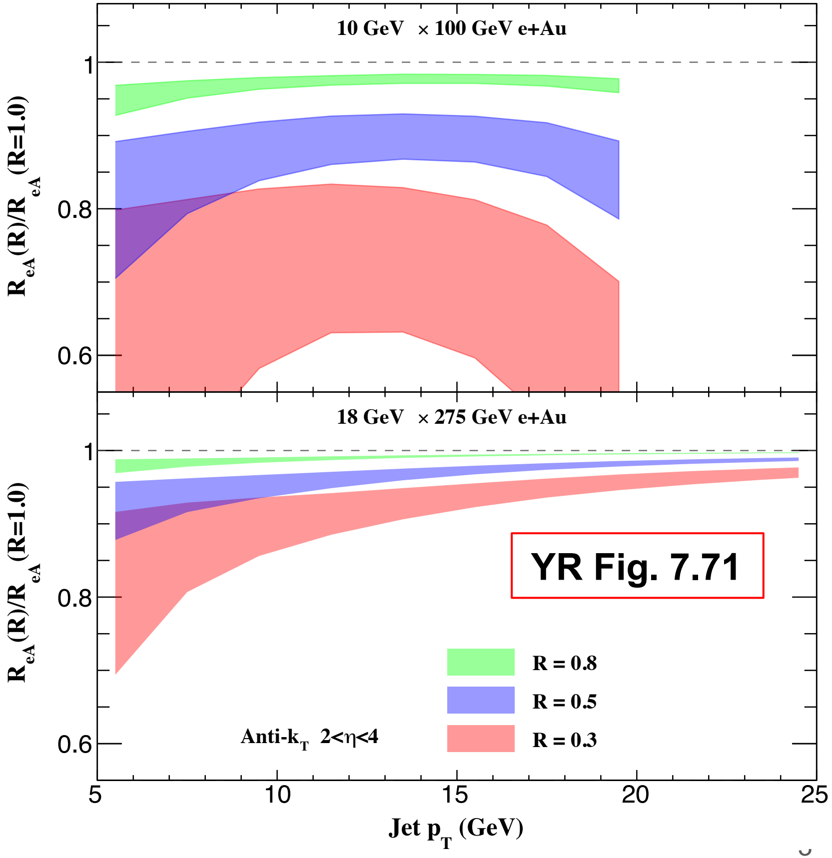


- Dihadron azimuthal angle correlation in *e*+Au and *e* + *p* collisions
- Linked to saturation physics
- Propose to do jet-hadron correlations instead
  - Jets have better correlation with parton kinematics
  - Jet resolution is better than tracking resolution

Yellow Report "Top Priority" Jet Observables (2/2)

$$R_{eA}(R) = \frac{1}{A} \frac{\int_{\eta 1}^{\eta 2} d\sigma / d\eta dp_T |_{e+A}}{\int_{\eta 1}^{\eta 2} d\sigma / d\eta dp_T |_{e+p}}$$



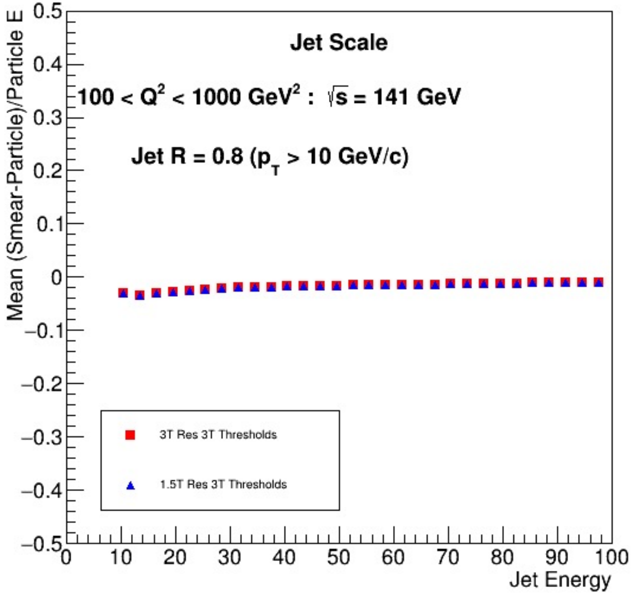


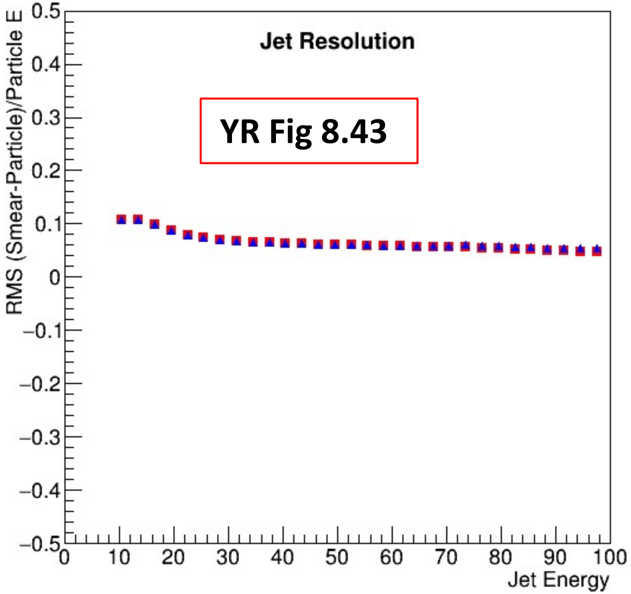
YR Fig. 7.71

Jet Performance Plots

- For supporting documentation we will need to generate Jet Energy Scale (JES) and Resolution (JER)

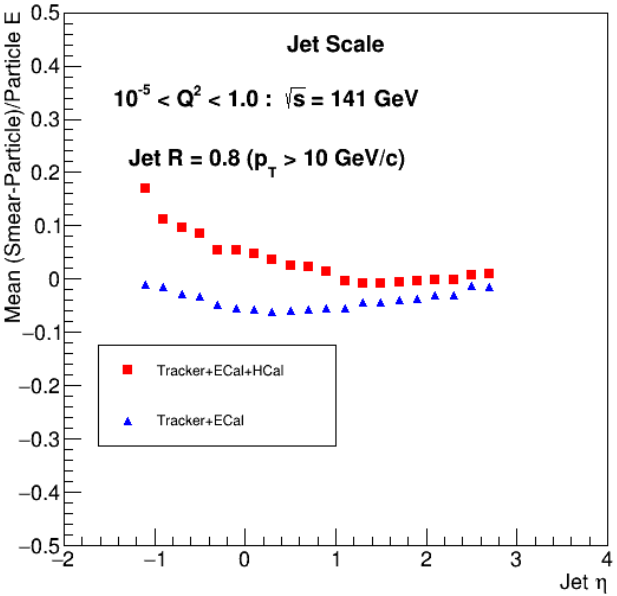
Pseudorapidity Range	Handbook ($\sigma P/P\%$)	3 T ($\sigma P/P\%$)	1.5 T ($\sigma P/P\%$)
$-3.5 < \eta < -2.5$	$0.1\% * P \oplus 2\%$	$0.1\% * P \oplus 2\%$	$0.2\% * P \oplus 5\%$
$-2.5 < \eta < -1.0$	$0.05\% * P \oplus 1\%$	$0.02\% * P \oplus 1\%$	$0.04\% * P \oplus 2\%$
$-1.0 < \eta < 1.0$	$0.05\% * P \oplus 0.5\%$	$0.02\% * P \oplus 0.5\%$	$0.04\% * P \oplus 1\%$
$1.0 < \eta < 2.5$	$0.05\% * P \oplus 1\%$	$0.02\% * P \oplus 1\%$	$0.04\% * P \oplus 2\%$
$2.5 < \eta < 3.5$	$0.1\% * P \oplus 2.0\%$	$0.1\% * P \oplus 2\%$	$0.2\% * P \oplus 5\%$

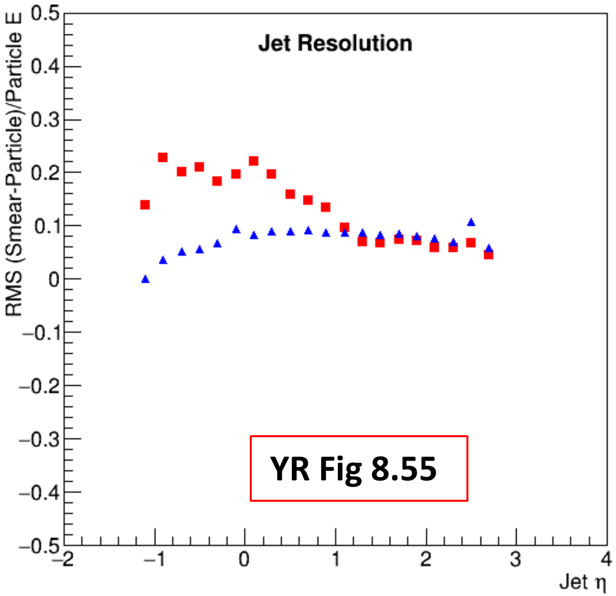




- For the YR the JES was calculated as the mean of the smeared jet energy minus the true jet energy divided by the true jet energy
- JER is the RMS.

Calorimeter Performance?

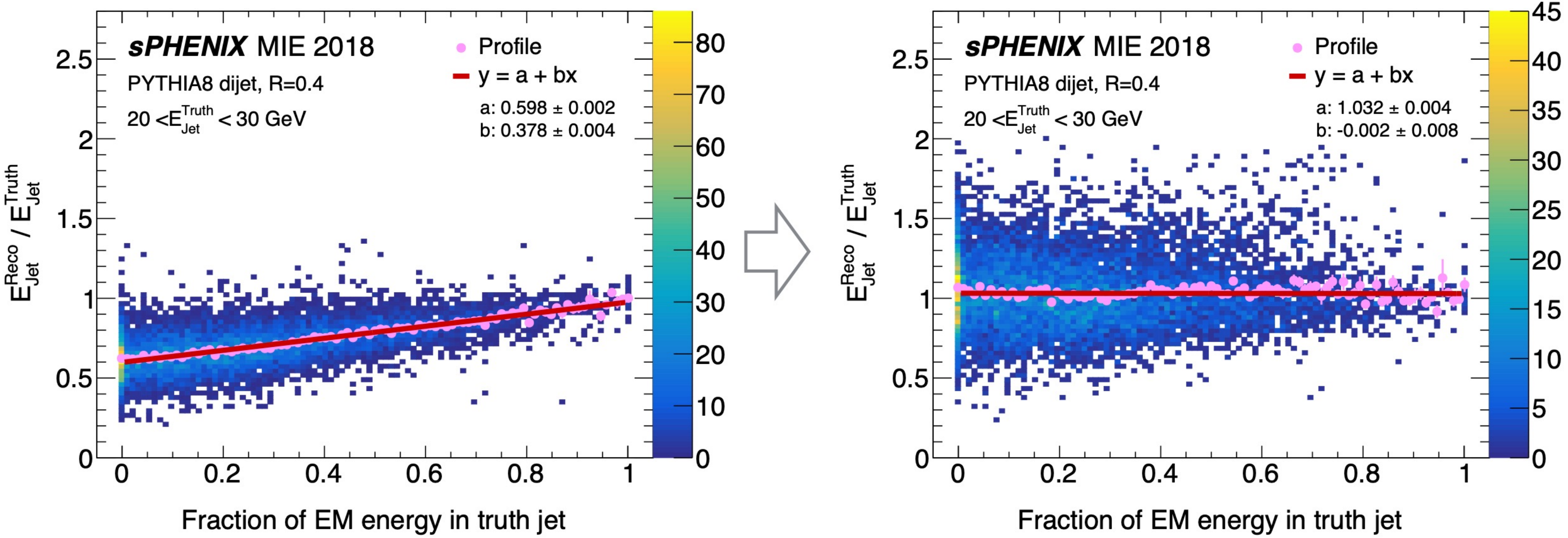




- Matching on this plot was from Reco→Truth (compared to the previous)
  - Due to low energy hadrons which fluctuated to much higher energy in the Hcal due to resolution

- Reading the YR it is not clear what calorimeter calibration was done prior to the jet finding

Calibration of Jet Energy Scale

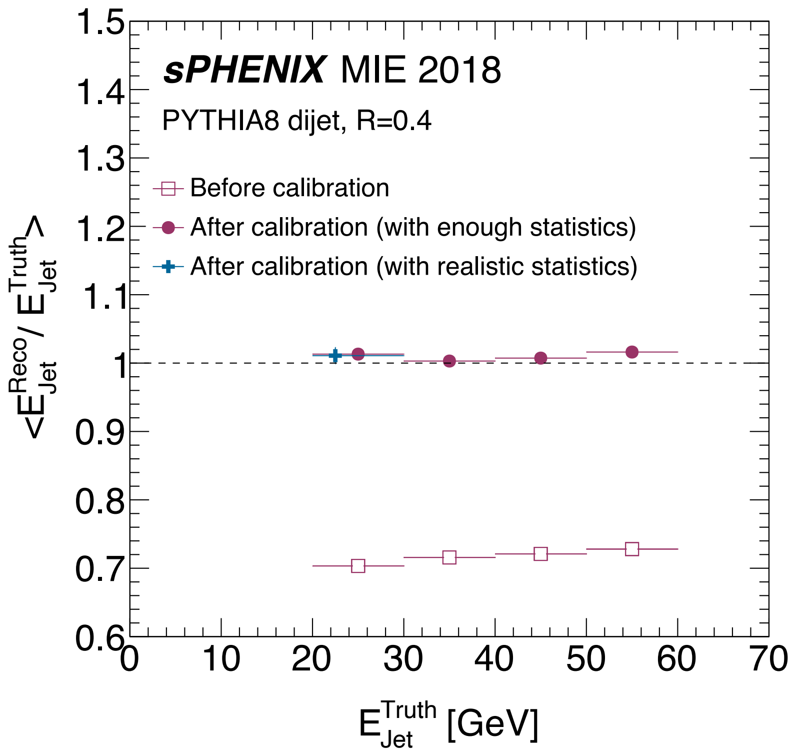


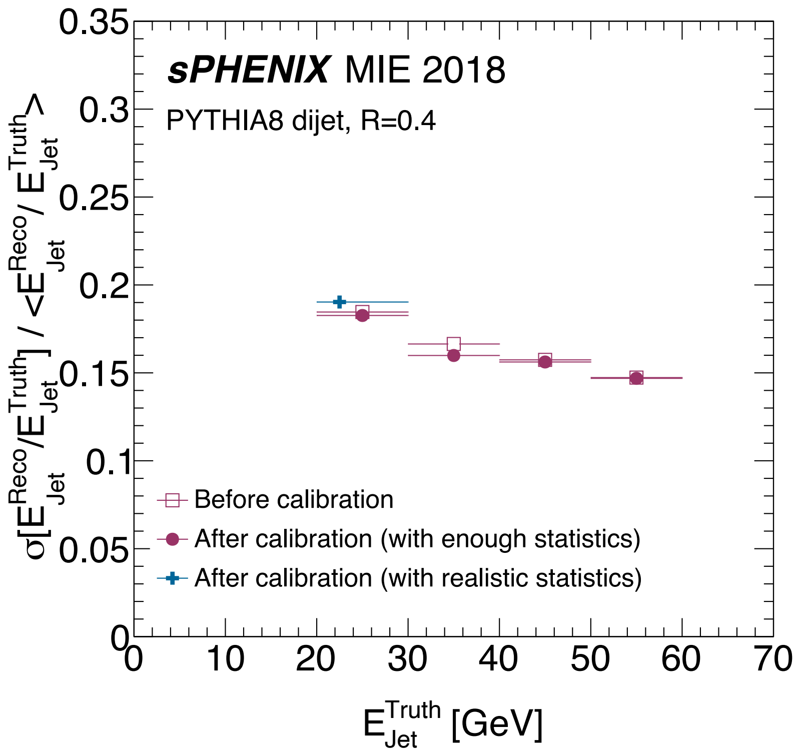
- EMCal Calibration done using γ-jet events

$$E_{\text{Jet}}^{\text{reco}} = E_{\text{EMCal}}^{\text{em}} + A(E) \cdot E_{\text{EMCal}}^{\text{had}} + B(E) \cdot E_{\text{HCal}}$$

A and B are chosen to minimize the difference between E_γ and E_{jet}

sPHENIX Calormieter Jet performance

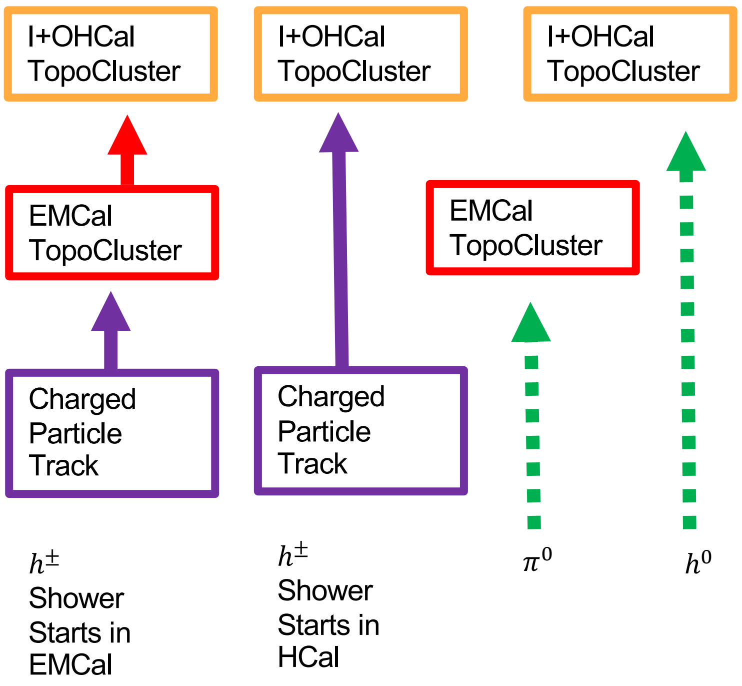




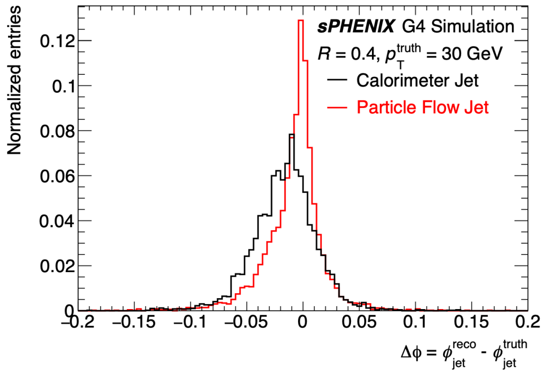
- Improvement to JES helpful for unfolding

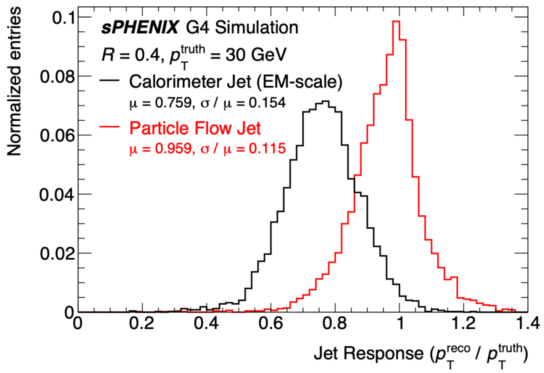
sPHENIX Particle Flow

- Implementation of **particle-flow** jet reconstruction using "best of" techniques from ATLAS/CMS
  - Charged particle tracking important for jet physics
  - Significant improvement in angular resolution and p_T response possible
- Particle-flow jets will enable the measurement of **jet sub-structure observables**



D. Perepelitsa HP2020





Conclusions

- Jet evaluators within fun4all are quite mature (jets are a key component of the sPHENIX physics program)
- A version of the PF algorithm is in fun4all already
  - I do not know how this will perform outside of mid-rapity
  - Will need further calibration as detectors change
  - This is most likely **beyond the scope** of the proposal, but could be useful
- Start with making JES/JER plots as in the YR for central, backward, forward jets
  - Check if PF gains us the ability to have track+EM+Hcal jets
- Remake dihedron correlation plot and nuclear modification plots