Multivariate Sensitivity Analysis of Jet Substructure Observables to Quenching

Looking at 2D correlations and how they change

- Which correlations are sensitive to medium modification?
- Which correlations are robust to uncorrelated background?

Kullback–Leibler Divergence

Expectation value of Difference Log Likelihood:

$$KL = \sum \ p(x_i) \ log\left[\frac{p(x_i)}{q(x_i)}\right]$$

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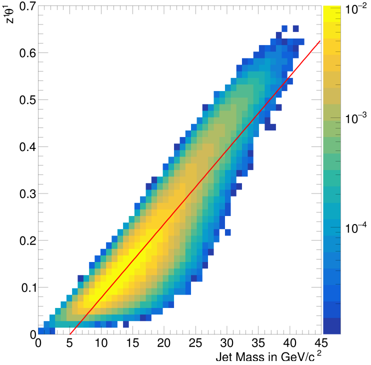
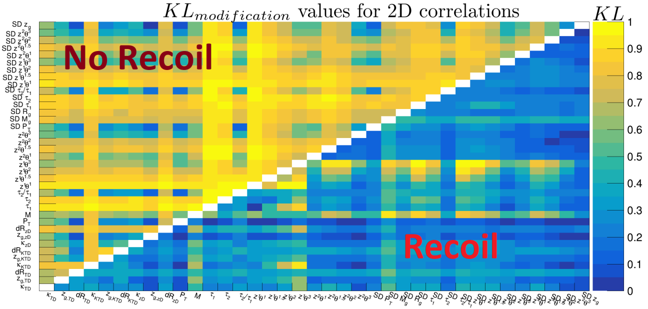


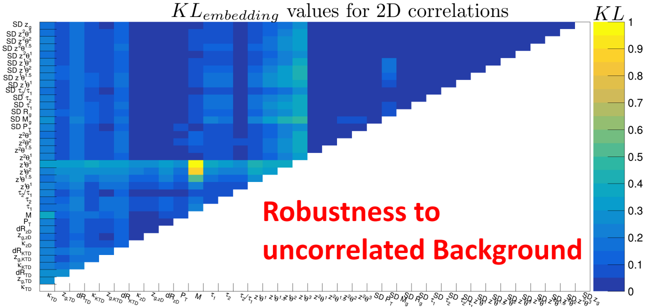
Correlation Modification: Quenching & Background

How do our 2D correlations change?

- **Jewel vacuum vs. with quenching**
  - More yellow $\rightarrow$ more modified

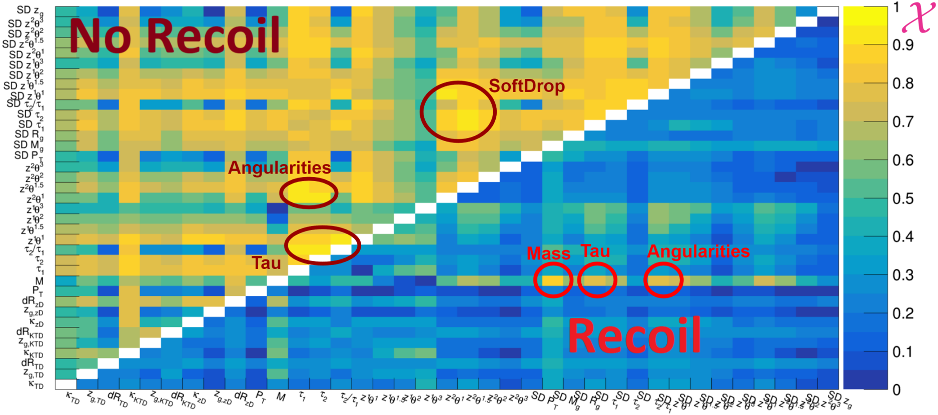


- **Jewel vacuum vs. embedded**
  - Signal embedded into a LHC-like uncorrelated background
  - More blue $\rightarrow$ more robust



Selecting Best 2D Correlations

Select variables with: $\mathcal{X} = KL_{Modification} * (1 - KL_{Embedding})$



Quenching

Robust and sensitive to quenching with Nsubjettines τ and Angularities

Recoil

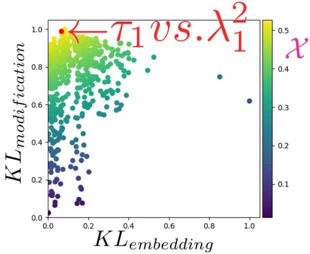
Additionally Mass and SoftDrop Mass very sensitive to recoil

Example of Selected Correlation: τ_1 vs. Angularity

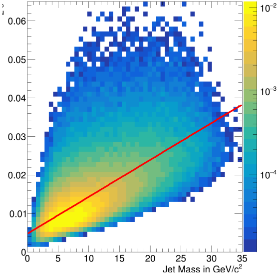
- Robust to uncorrelated background
- Sensitive even when correlation coefficient similar

Click here for all correlations

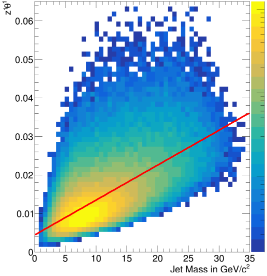
and choose observables from drop down menu



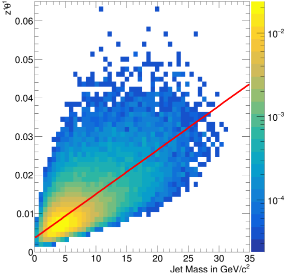
Vacuum



Vacuum Embedded



Quenching No recoil



Towards Various Implementations

Versatile method

- Probing physics effect (e.g. recoil, resolution length, ...)
- Differentiating between models
- Comparing models to data
- Fully data driven study of jet quenching using pp and PbPb data

Probing medium recoil: Mass vs. SoftDrop Mass →