Muon Collider Full Simulation Studies

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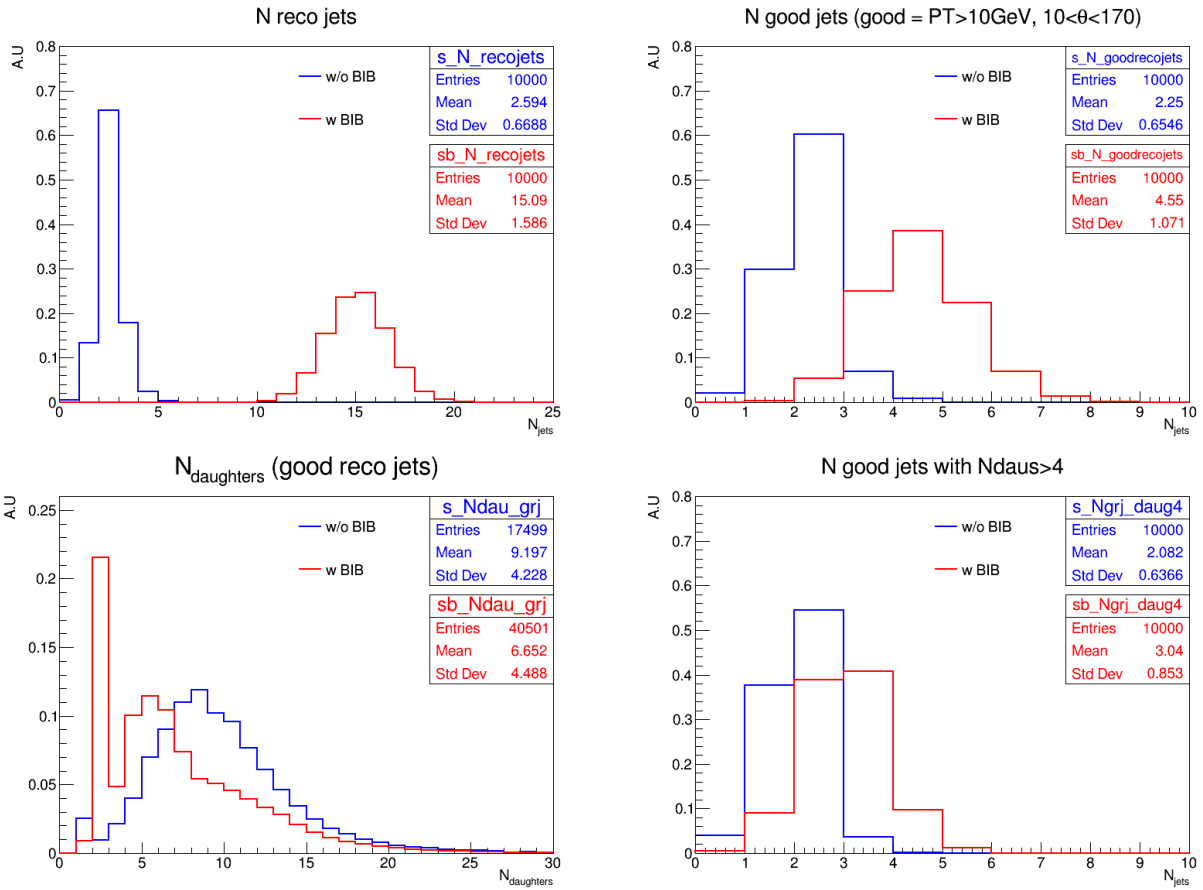
Jet reconstruction performance in presence of BIB

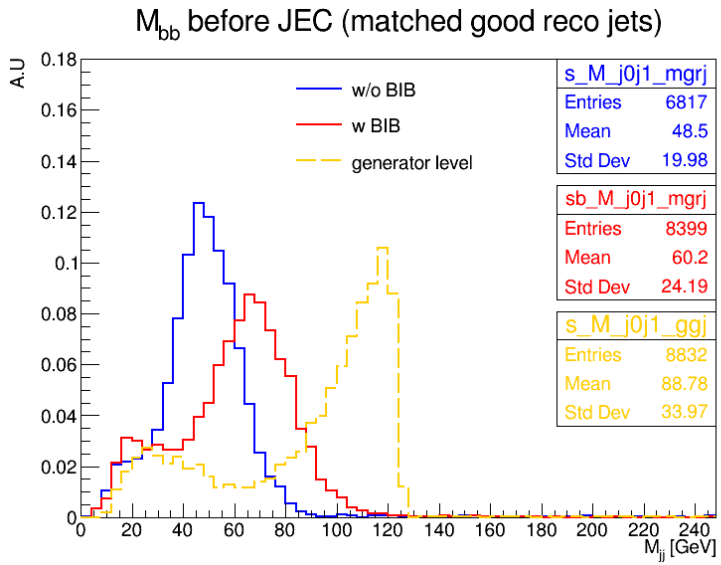
Signal Process: $\mu^+\mu^- \rightarrow \nu\bar{\nu}H, H \rightarrow b\bar{b}$ overlaid with BIB at 1.5TeV.
Anti-k_T jet with R=0.5 used.

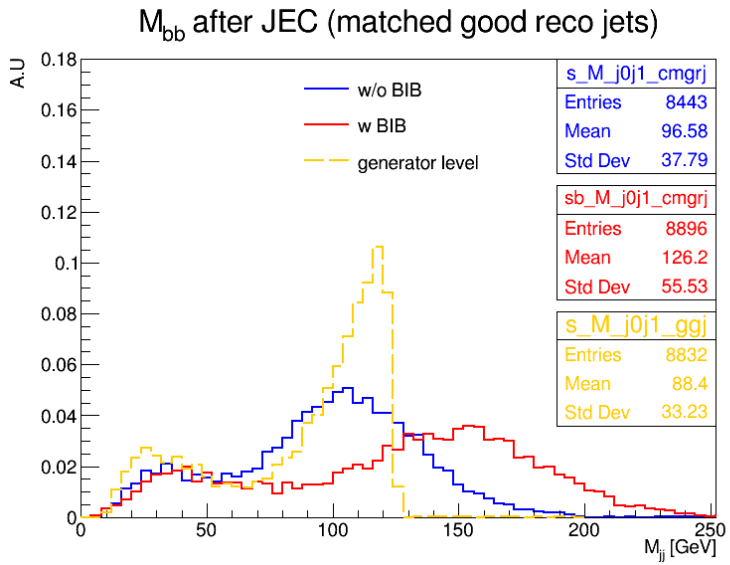


- Number of daughter particles further reduces fake jets (few high energy deposits).

Higgs reconstruction performance in presence of BIB

Two leading AK5 jets used to reconstruct Higgs invariant mass.
Jet energy correction (JEC) applied to account for lost energy due to tight E_{th}=2MeV cut on reco hits in ECal, along with timing cut of 250ps.

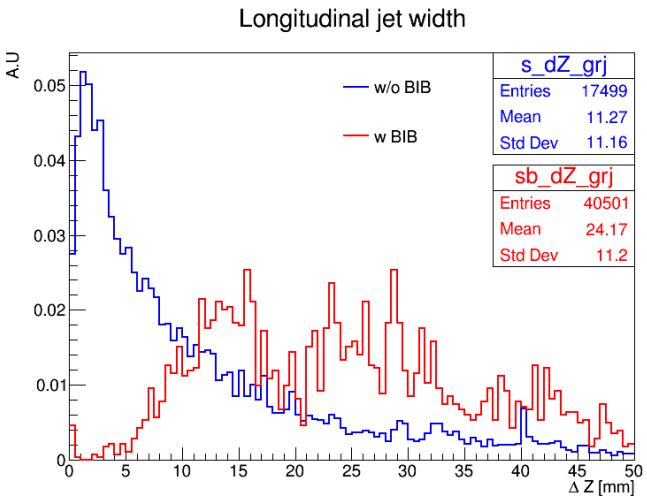




- BIB hits increase energy of b-jets, need BIB mitigation.
- Need a jet cleaning strategy to improve mass resolution.

Using jet substructure to mitigate BIB: trial variables

Longitudinal width $\Delta Z = |Z_{max} - Z_{min}|$ of jet daughter particles.



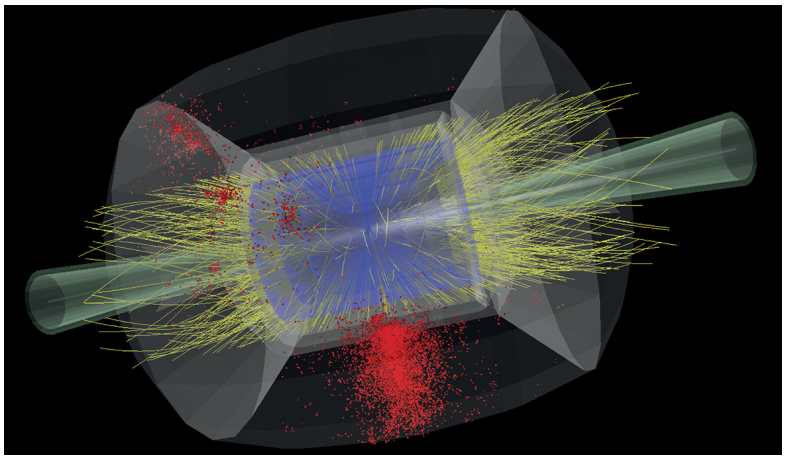
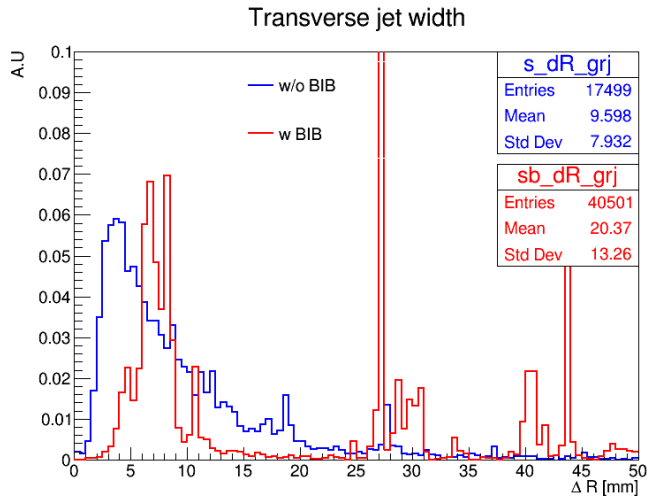


Figure: Right: Simulation of $H \rightarrow b\bar{b}$ in presence of BIB. Credit: D Lucchesi et al.

- Fake jets from BIB hits have higher longitudinal width.
- Develop a jet cleaning strategy using variables constructed from daughter particles information.

Using jet substructure to mitigate BIB: trial variables

Transverse width $\Delta R = |R_{max} - R_{min}|$, where $R = \sqrt{X^2 + Y^2}$ of jet daughter particles.



- b-jets without BIB seem to penetrate further into detector.
- Repeated use of rotated BIB particles leads to bizarre distributions.
- Need more bunch crossing event statistics to understand these patterns better.

Conclusions

- We wish to use jet substructure variables to develop a jet cleaning algorithm which improves the mass resolution.
- Need multiple BIB simulation events to capture the relevant features.