

Muon Collider Full Simulation Studies

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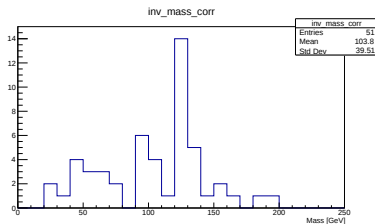
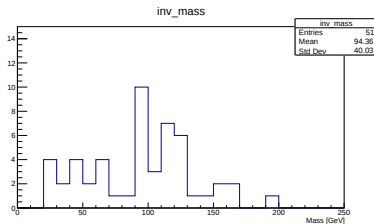
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Jet correction

Signal: $\mu^+\mu^- \rightarrow \nu\bar{\nu}H \rightarrow \nu\bar{\nu}b\bar{b}$

Applying MC correction to good matched reco jets.

$$p_{\mu}^{corr} = C_{MC} \times p_{\mu}^{raw} \text{ where } C_{MC} = \frac{p_T^{truth}}{p_T^{reco}}$$



Peak shifts from 90 GeV to 125 GeV after correction. Need more statistics.

Jet correction in presence of background

Next, study the jet reconstruction in presence of bib. For this generate Hbb signal overlaid with bib. Starting with 10% bib, modified the reco_steel.xml file. However, error in Marlin step. The root file is corrupted.

I started with a simpler example: prompt muon signal from interaction point and bib overlaid (part of Tutorial).

Useful resource:

<https://indico.fnal.gov/event/45187/timetable/?view=standard>

Beam Induced Background

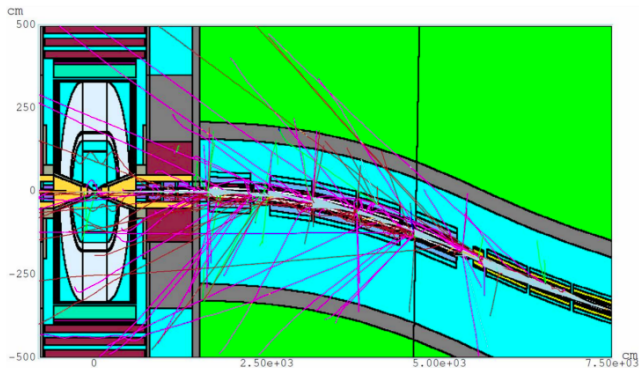
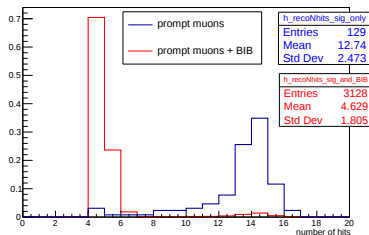
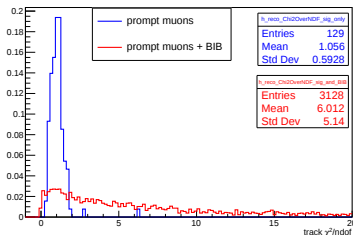


Figure: MARS15 simulation of Muon Collider machine and machine-detector interface. Ref: [arXiv:2001.04431](https://arxiv.org/abs/2001.04431)

Tutorial-3: signal and BIB

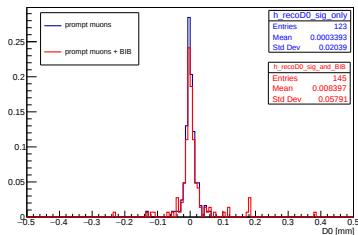
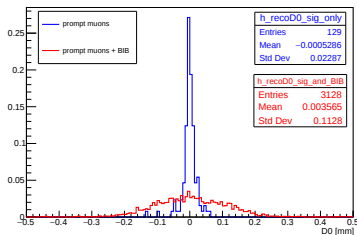
Signal is an event with 1000 prompt muons from interaction region (IR) with uniform p_T between 0 and 100 GeV. We study the differences between signal **with** and **without** the background (BIB).

Considering 1% of total bib: **N=129** and **N=3128**



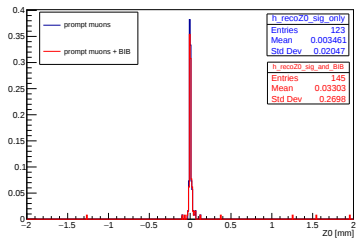
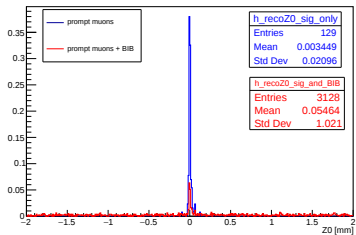
Left: $\chi^2/\text{ndof} < 20$ and $N_{\text{hits}} > 1$

Right: $\chi^2/\text{ndof} < 5$ and $N_{\text{hits}} > 6$

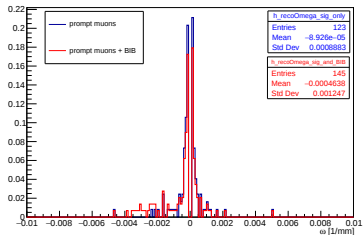
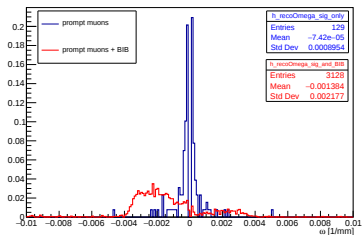
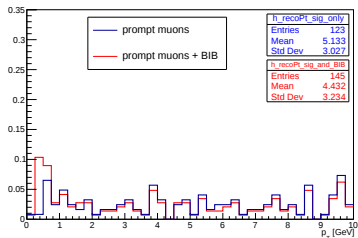
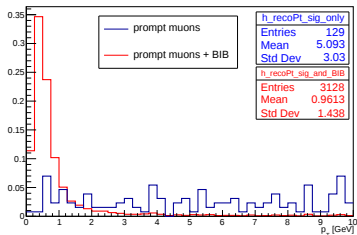


Before: $N=129$ and $N=3128$

After: $N=123$ and $N=145$



hit p_T and curvature ω



Takeaway and next steps

Cuts exist to reduce bib significantly. Check for Hbb signal in presence of bib (working on generating the sample).

For more statistics, working on job submission. Histogram file missing! Looking into that.