

Muon Collider Full Simulation Studies

Tutorial

Shivani Lomte

June 10, 2021

Tutorial instructions

<https://confluence.infn.it/display/muoncollider/Tutorial>

<https://github.com/MuonColliderSoft/MuC-Tutorial.git>

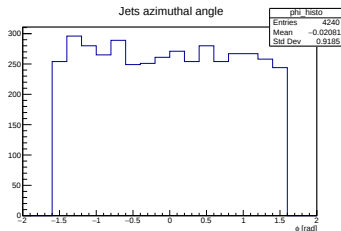
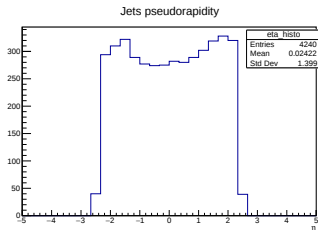
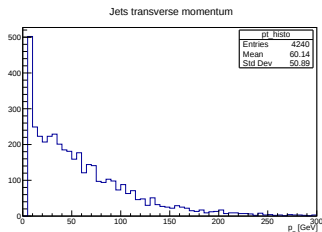
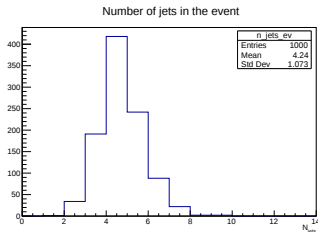
Detailed set of instructions/documentation for simulation and reconstruction setup for new users (Slack).

Tutorial-1: signal

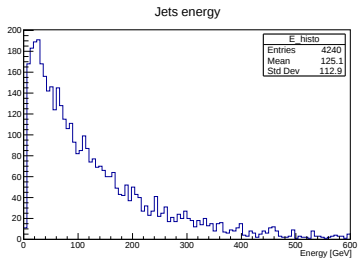
At 1.5 TeV COM energy for signal process

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

Reco jets: k_T with $R=0.7$, $p_T > 5$ GeV and $|\eta| < 2.5$

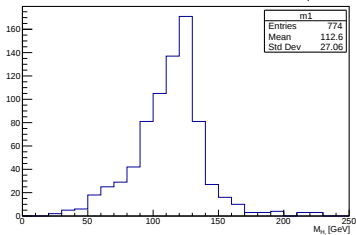


Tutorial-1: signal

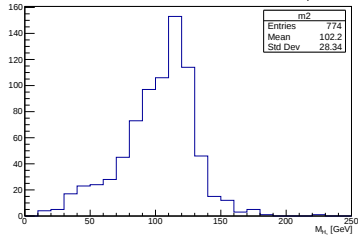


For events with 4 jets or higher:

Invariant mass of jet pair with highest p_T

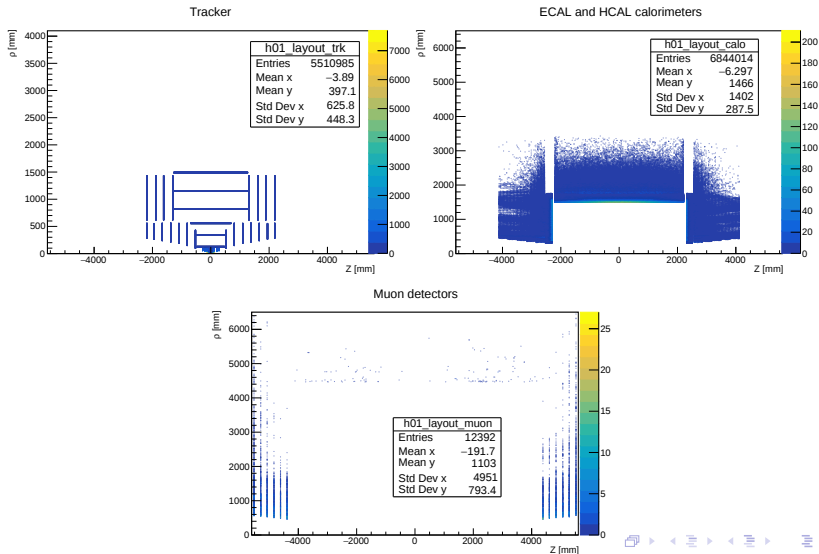


Invariant mass of jet pair with lowest p_T



Tutorial-2: BIB

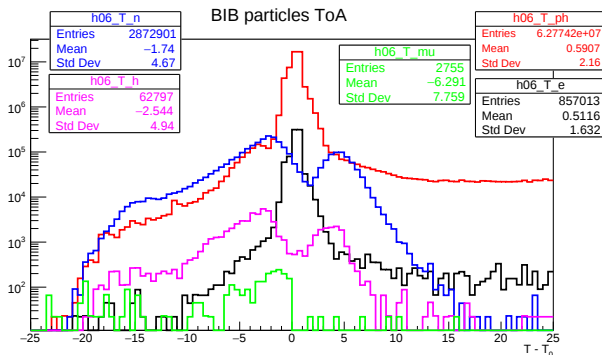
Tracker, Calorimeter and Muon Detector Layout:



Tutorial-2: BIB

MC truth particles time of arrival (ToA) at detector entry point w.r.t bunch crossing.

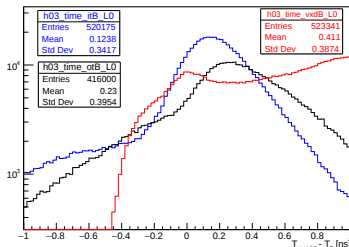
Note: **neutrons** and **hadrons** have negative $T - T_0$ values.



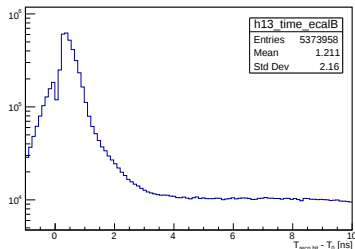
Tutorial-2: BIB

Reconstructed hit time in Tracker and Calorimeter:

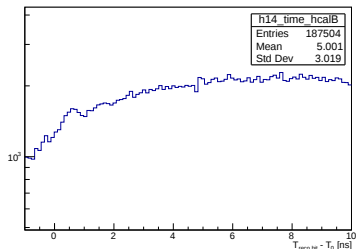
hit Time (Tracker)



hit Time (ECAL Barrel)



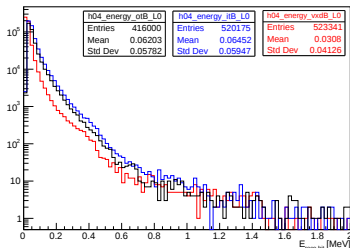
hit Time (HCAL Barrel)



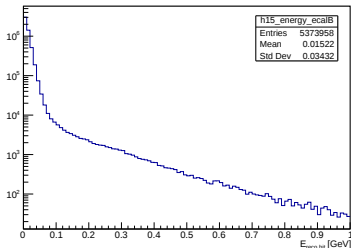
Tutorial-2: BIB

Reconstructed hit energy in Tracker and Calorimeter:

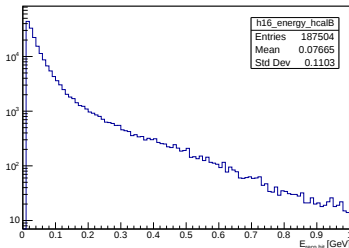
Hit energy (VXD Barrel L0)



Hit energy (ECAL Barrel)

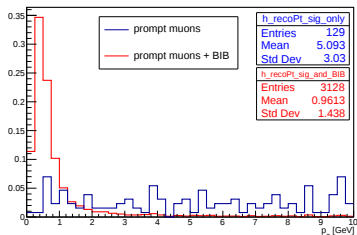
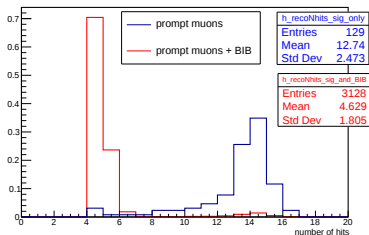


Hit energy (HCAL Barrel)



Tutorial-3: signal and BIB (yet to analyze in detail)

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



Tutorial-3: signal and BIB

