

First look at HH

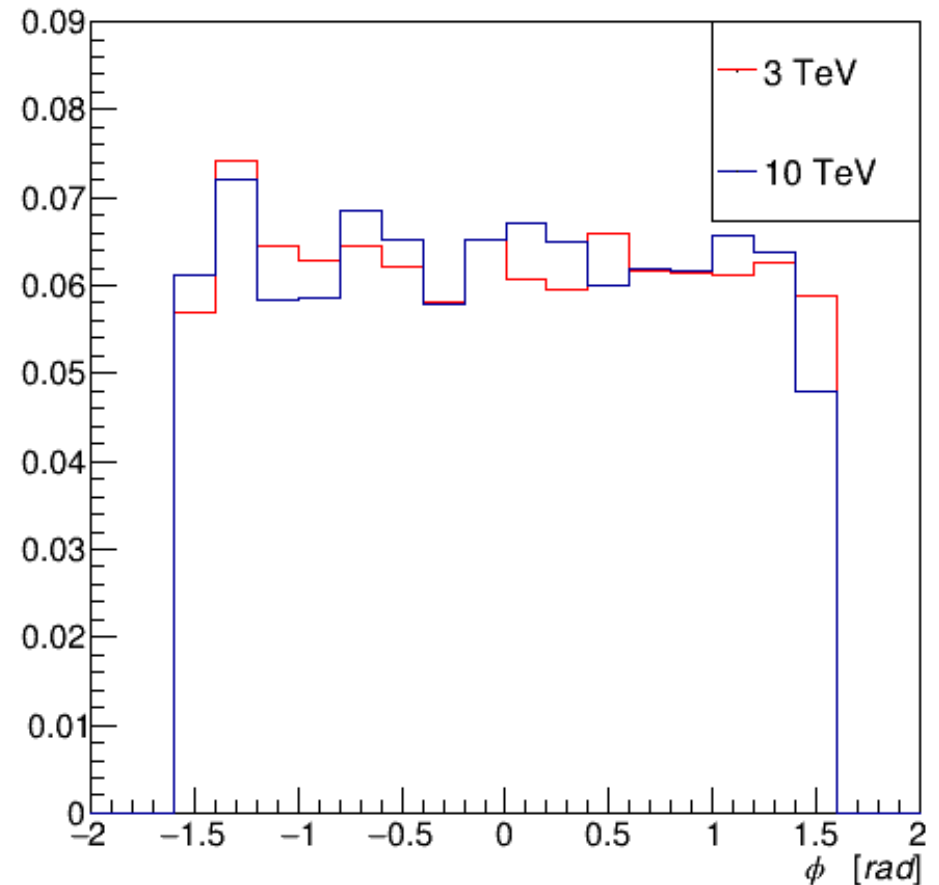
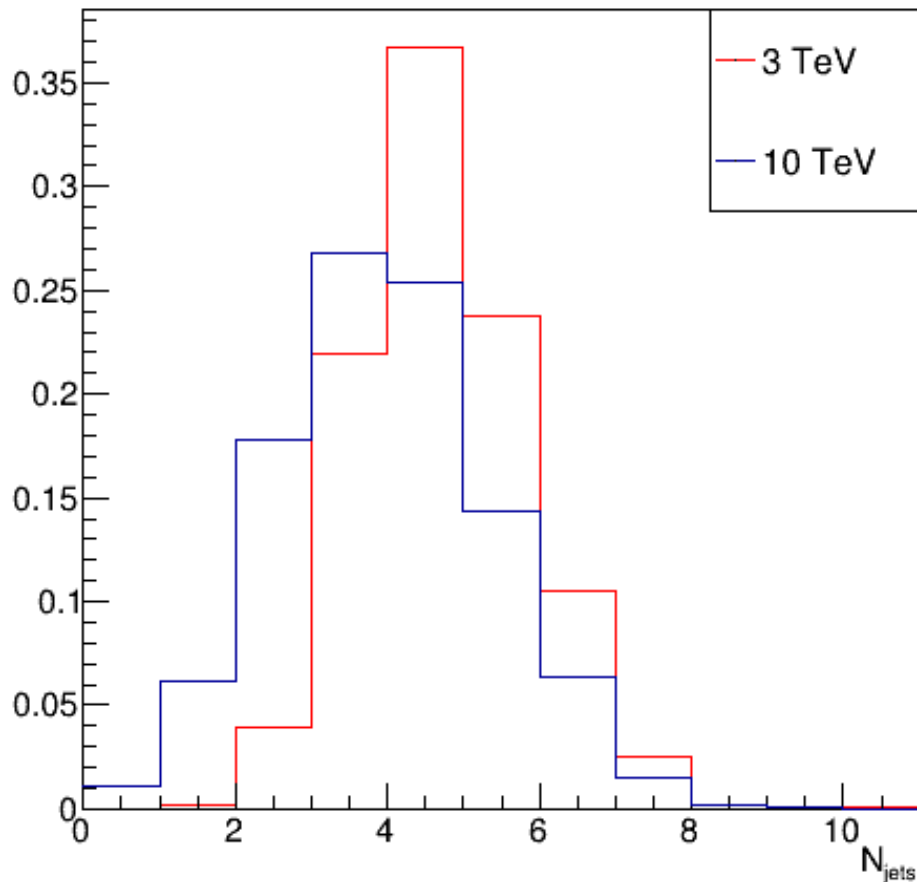
Muon Collider meeting 18/02/2020
Laura Buonincontri

Simulation and reconstruction

- Simulation of the process $\mu^+\mu^- \rightarrow \nu\bar{\nu}HH \rightarrow \nu\bar{\nu}b\bar{b}b\bar{b}$ with Whizard at 3 TeV and 10 TeV (1000 events)
- GEANT4 detector simulation with *ddsim* (physics list: QGSP_BERT_HP)
- Jet reconstructed by the Fastjet package of Marlin

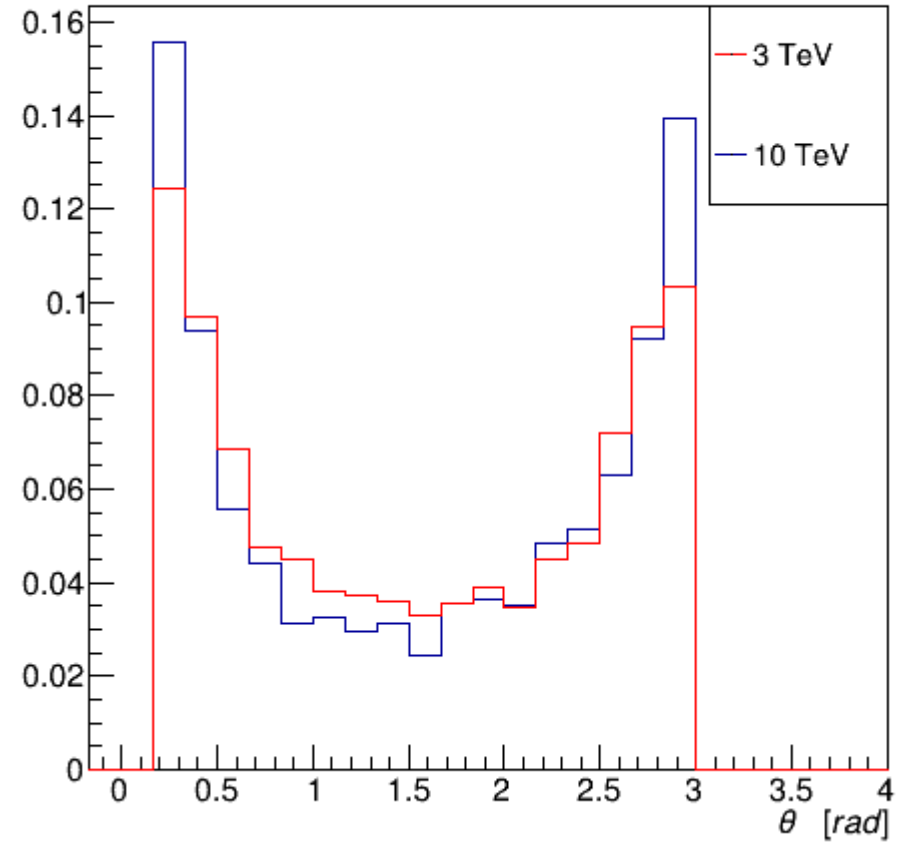
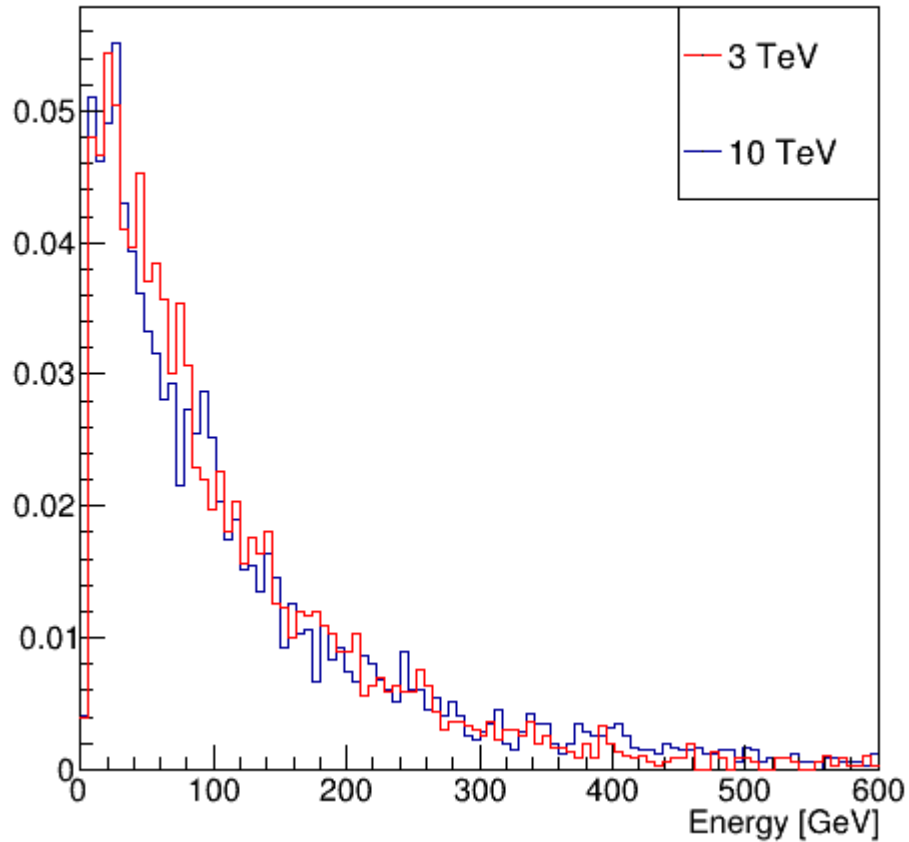
Properties of jets I

- Comparison between 3 and 10 TeV: number of jets and azimuthal angle



Properties of jets II

- Comparison between 3 and 10 TeV: energy and polar angle



Study of the invariant masses

- Selection of events with $N_{\text{jets}} > 3$
- For each event, only the four jets with highest P_T are considered
- Jets are combined in pairs and for each combination the invariant mass is calculated

$$(m_{12}, m_{34}) \quad (m_{13}, m_{24}) \quad (m_{14}, m_{23})$$

- The following relations are calculated:

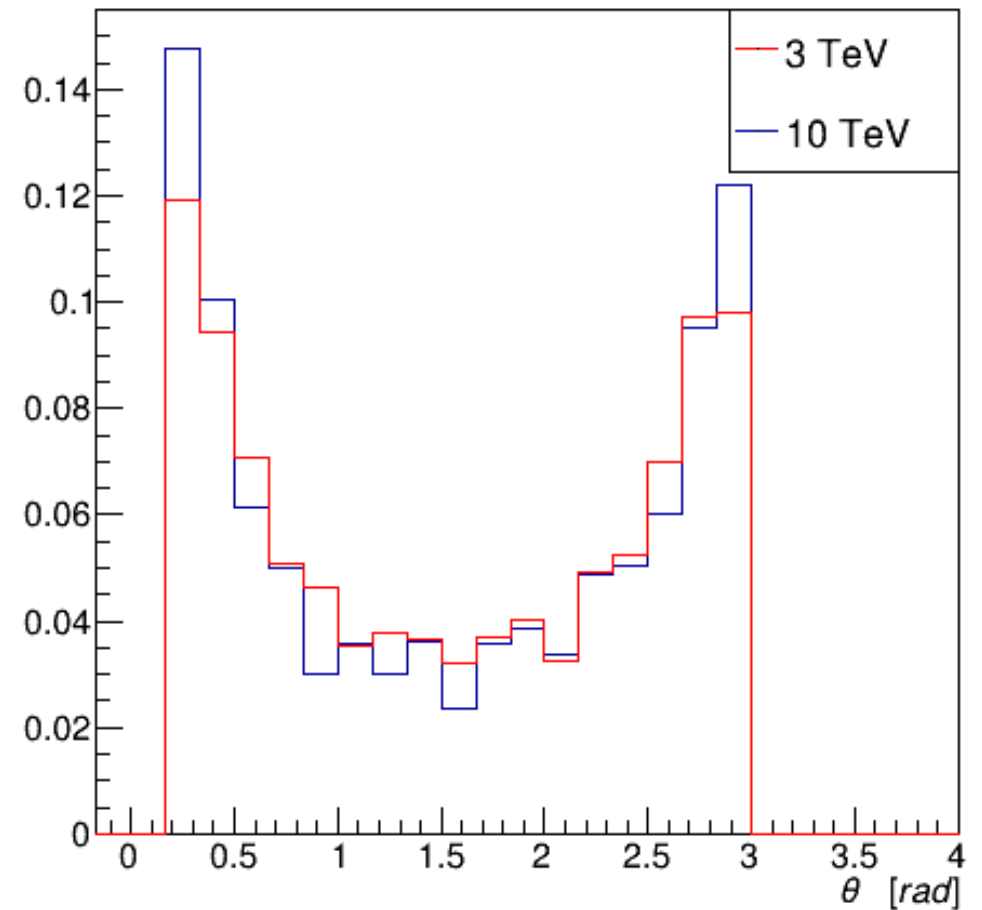
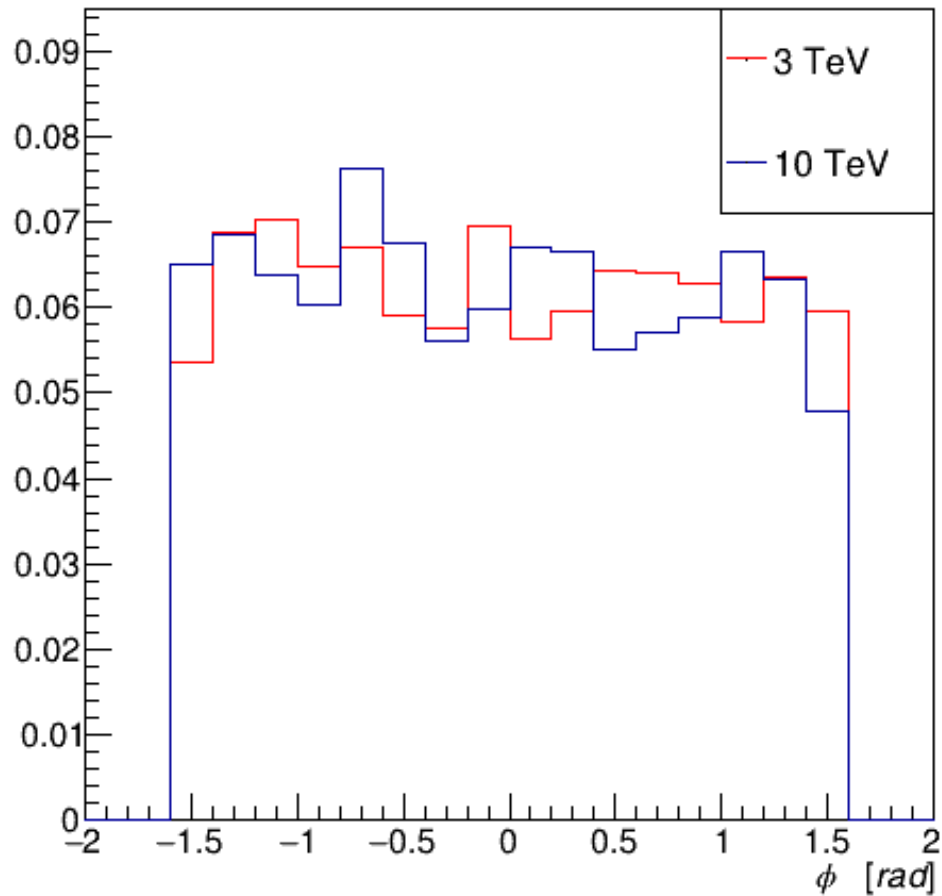
$$|m_h - m_{12}| + |m_h - m_{34}|$$

$$|m_h - m_{13}| + |m_h - m_{24}|$$

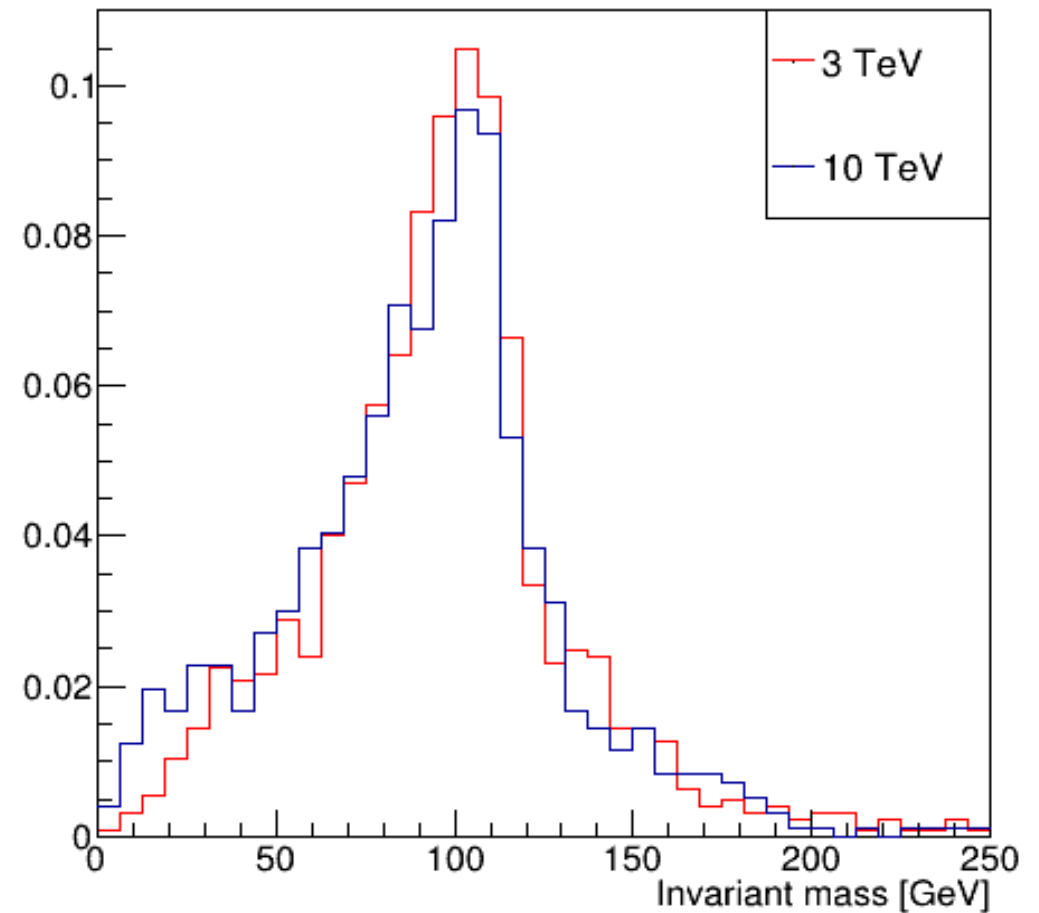
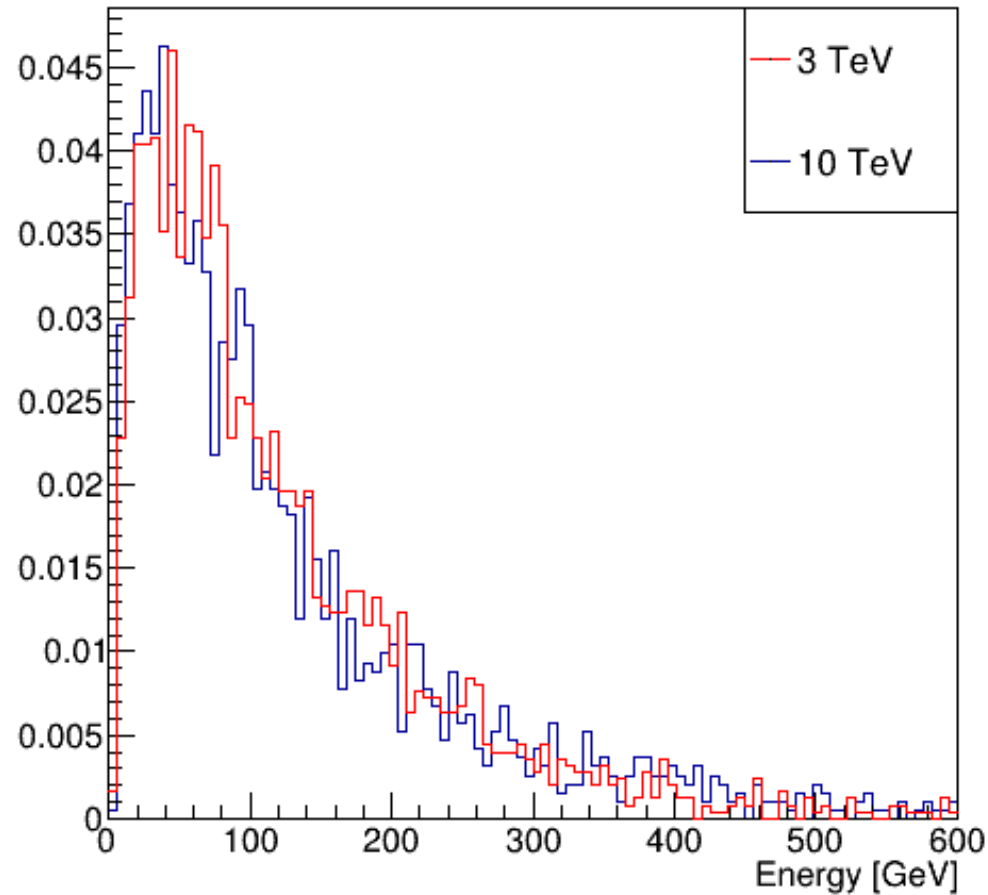
$$|m_h - m_{14}| + |m_h - m_{23}|$$

- The combination of invariant masses relative to the minimum relation is selected

Properties of the selected four jets



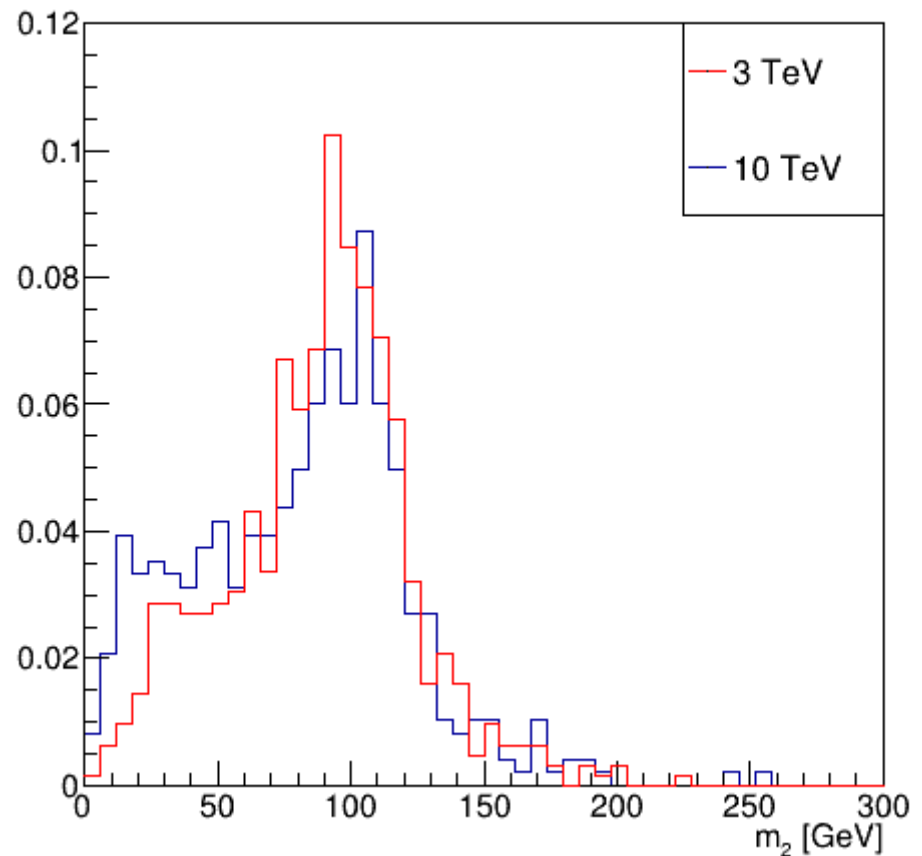
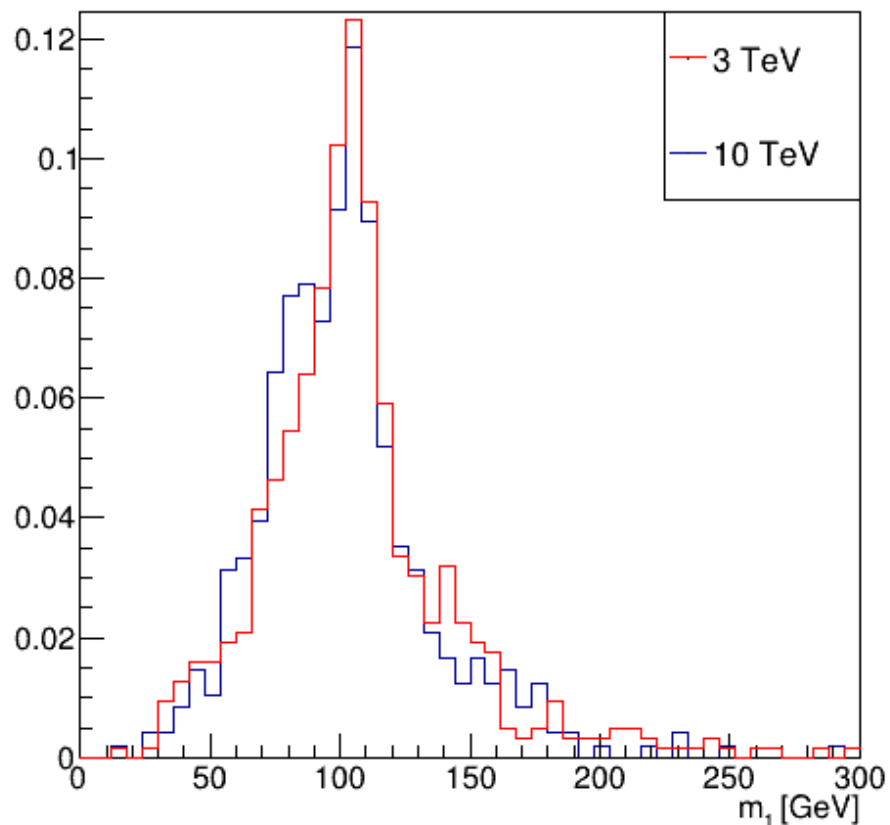
Energy and invariant mass



Plot of the invariant masses of selected pairs of high P_T jets (put together)

Invariant mass

- Plots of the invariant masses for the two combination of jets separately ($m_1 = m_{12} \ m_{13} \ m_{14}$, $m_2 = m_{34} \ m_{23} \ m_{24}$)



Next steps

This has been a first study, several things must be understood

- A more sophisticated method to select and pair the four jets which comes from the two higgs have to be developed
- The Monte Carlo truth has to be studied and all these jets properties have to be compared with the Monte Carlo truth (TrueMCIntoRecoForJets)