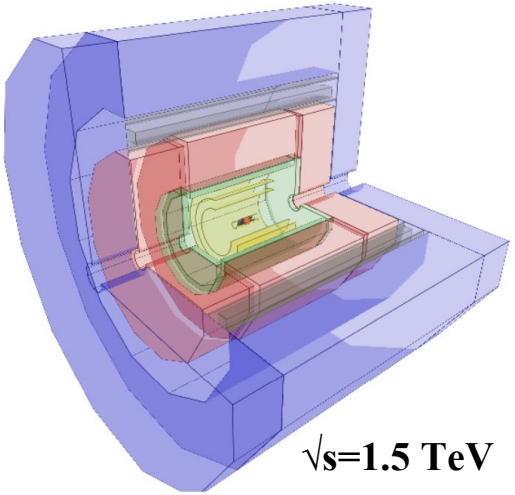
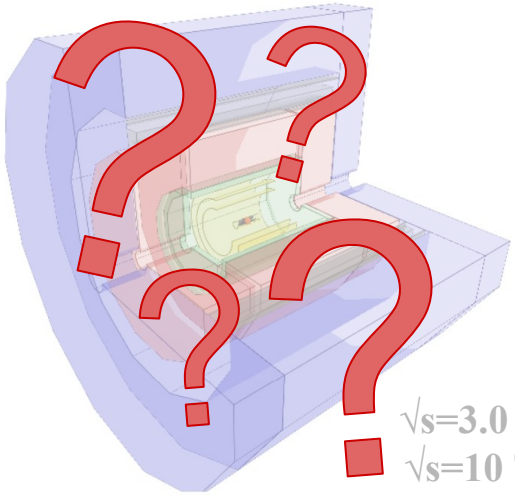




Towards Detector Design at √s=3 TeV and √s=10 TeV

Task 2.1 Design of detector configurations: detector design strategy definition

Massimo Casarsa[1], Donatella Lucchesi[2], Lorenzo Sestini[3], Davide Zuliani[2]

1) INFN-Trieste
2) University and INFN of Padova
3) INFN Padova

Detectors Requirements Determination

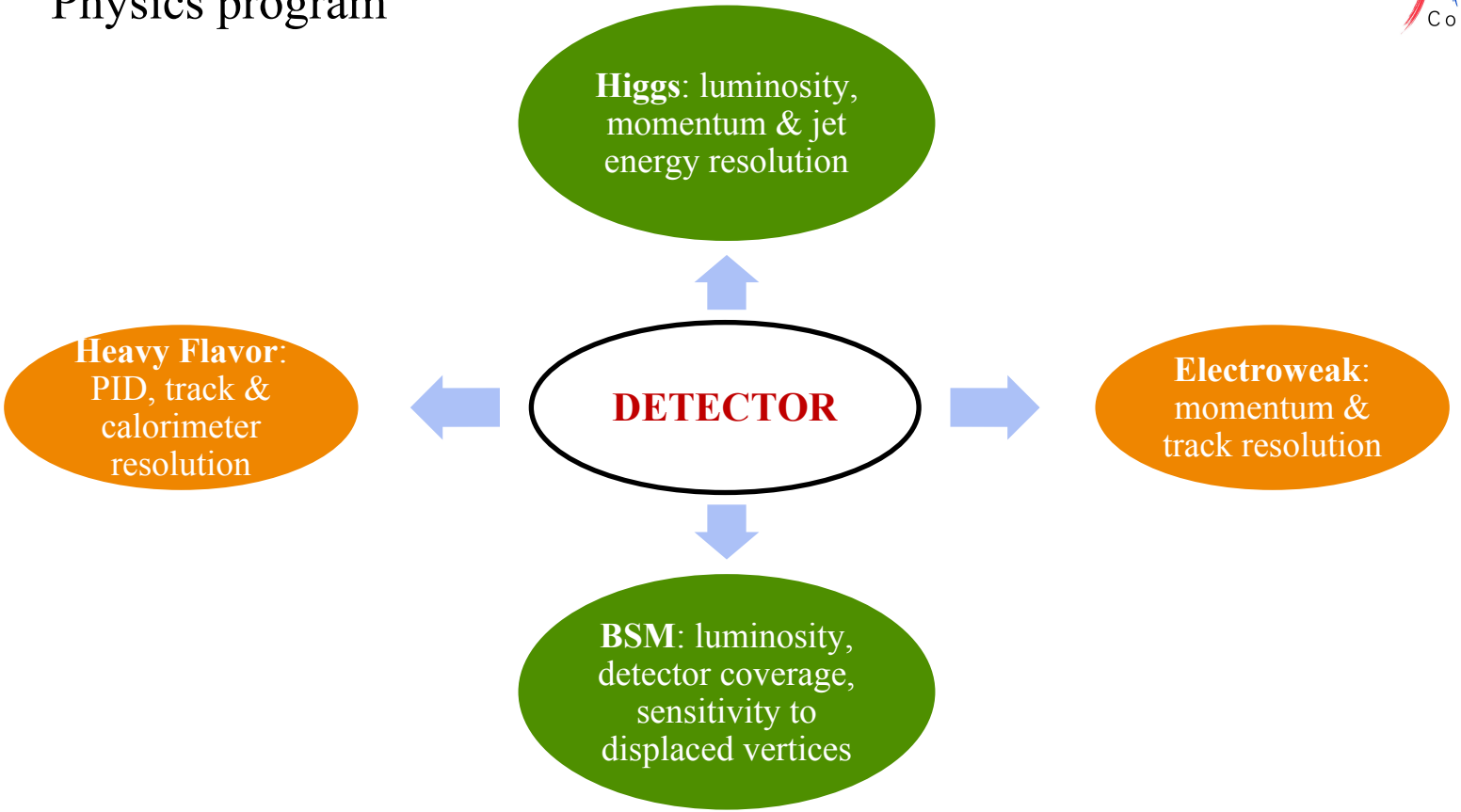
Detector results from a **interplay** of the **accelerator machine optimization** and the **wanted physics reach** due to the beam-induced background (BIB)

Define the working hypotheses!

1. Recent preliminary studies have shown that the BIB characteristics are dominated by the nozzle. This is under study in the MDI group. We will keep iterate with them. In order to proceed it is assumed the BIB effects on detector at $\sqrt{s}$=3 TeV and $\sqrt{s}$=10 TeV are the same studied at $\sqrt{s}$=1.5 TeV

Detectors Requirements Determination - 2

2. Physics program

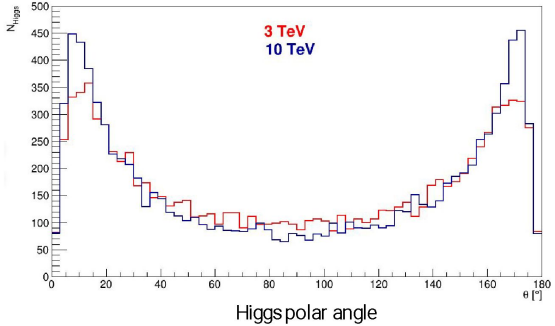


Detectors Requirements Determination - 2

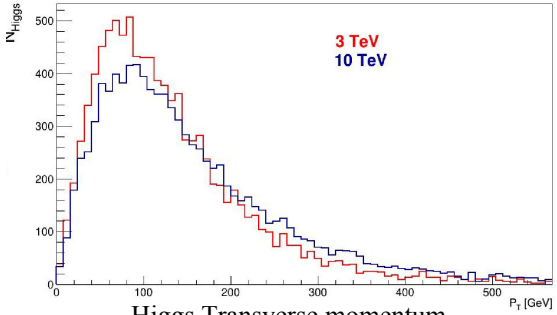
1. **Detector coverage**: agree with IR design experts on nozzle occupancy and available volume
2. By using the **available results** with the **full simulation**, we can determine the desidered:
   a. track parameters resolution
   b. energy resolution and jet energy resolution
   c. muon parameter resolution
3. **PID** to be done **from scratch**

Higgs: tracks and muons

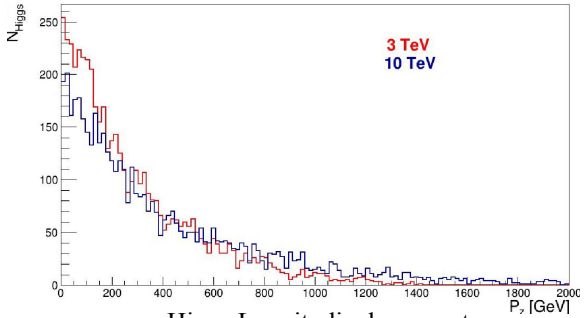
Generator level study for H → μμ for several kinematic variables



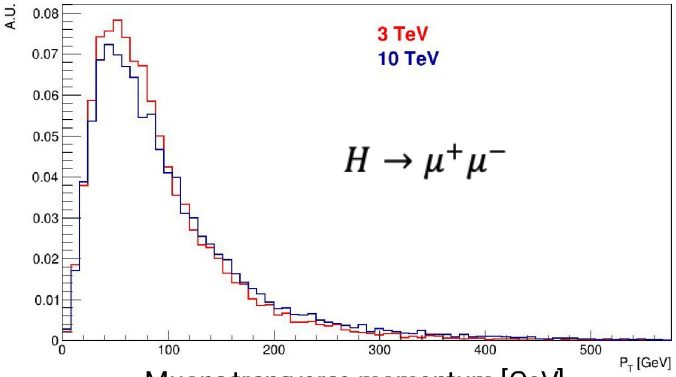
Higgs polar angle



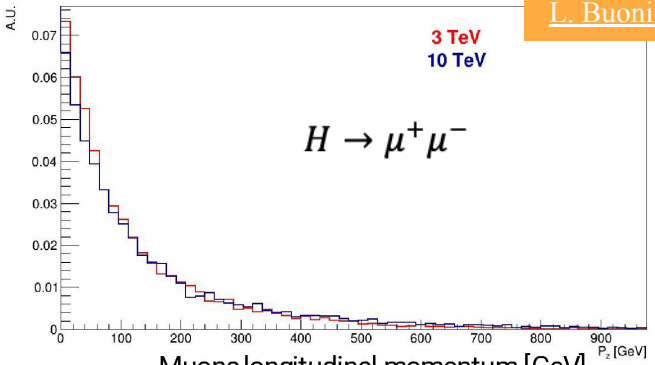
Higgs Transverse momentum



Higgs Longitudinal momentum



Muons transverse momentum [GeV]



Muons longitudinal momentum [GeV]

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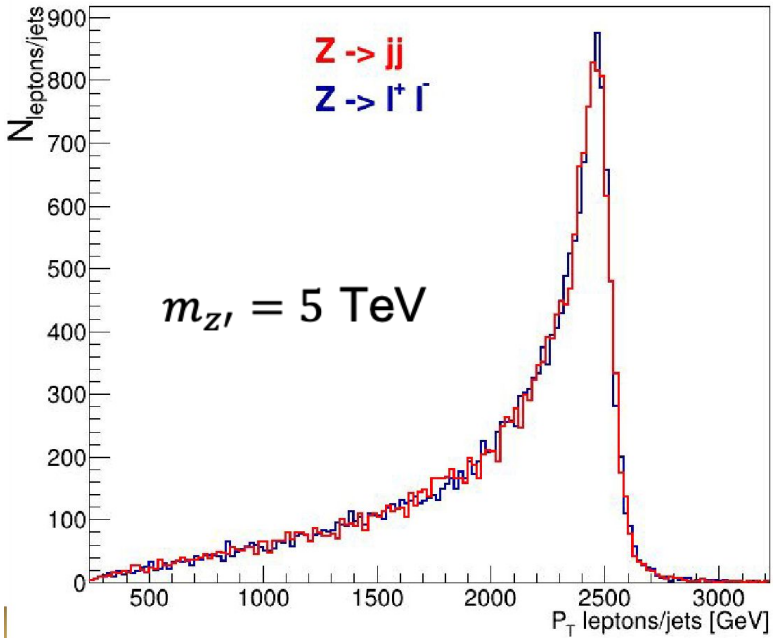
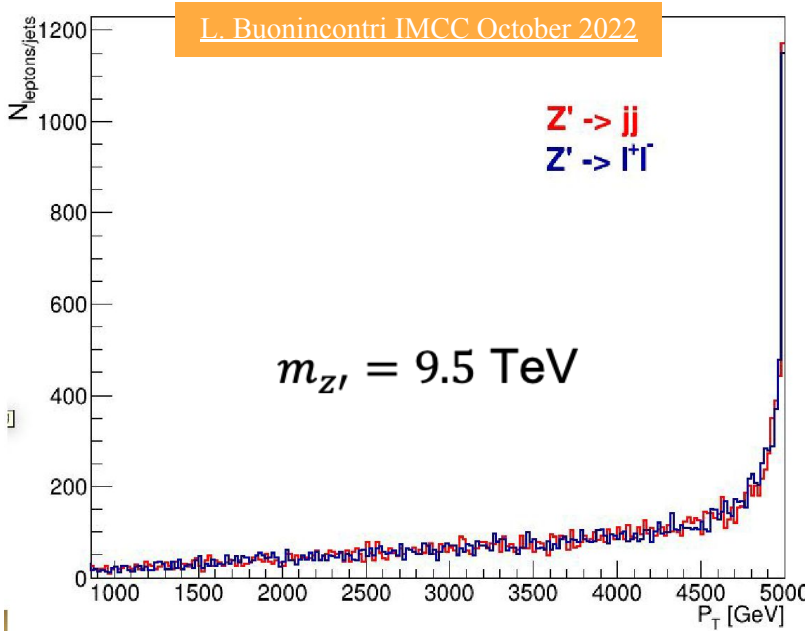
Similar momentum distributions at √s=3 TeV and √s=10 TeV

BSM heavy object: tracks and muons

Heavy Z' produced via VBF $\mu^+\mu^- \rightarrow Z'\nu_\mu\overline{\nu_\mu} \rightarrow \ell^+\ell^-$(jj)





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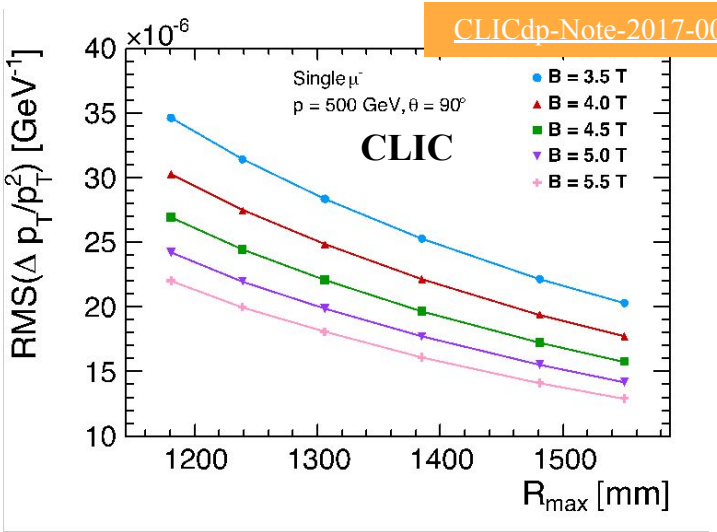
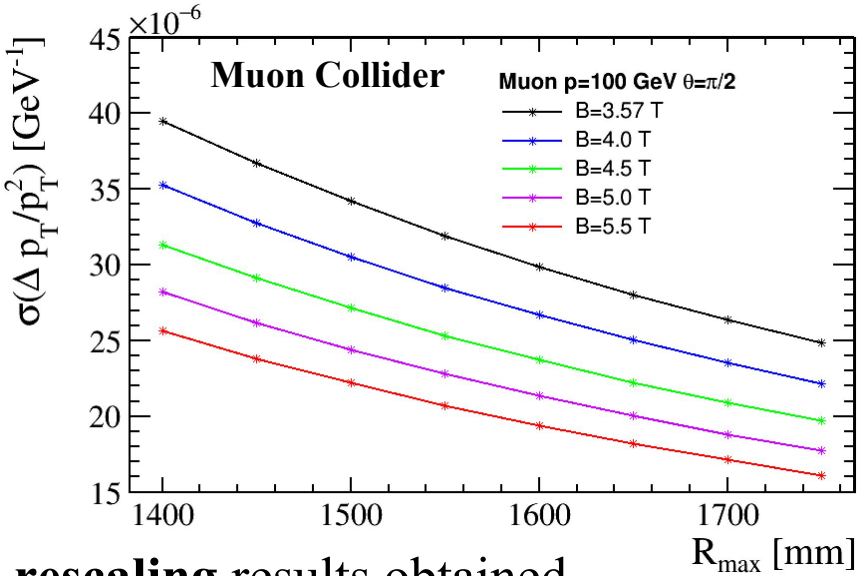
Tracks with momentum up to ~5 TeV have to be reconstructed

Magnetic Field and tracking system dimension

An example study from CLIC: **track resolution** as a function of **magnetic field** and **maximum radius of tracking system**

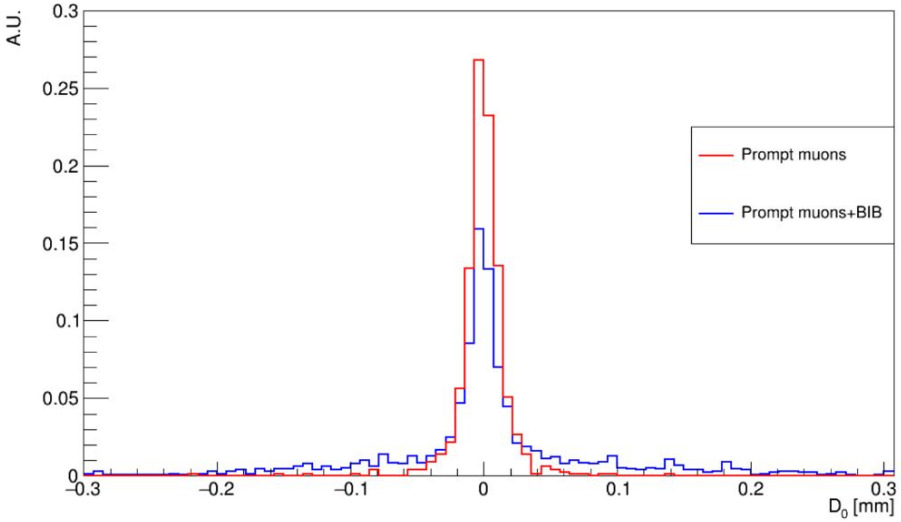




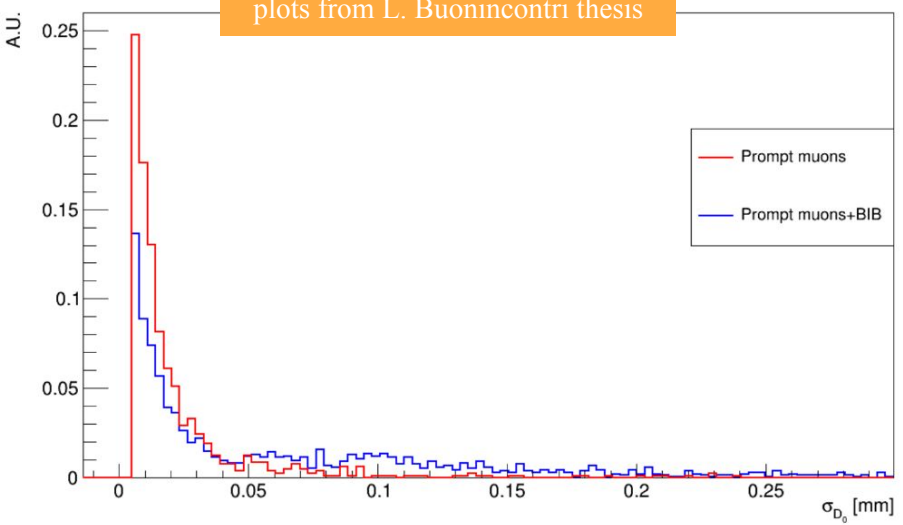
- Preliminary study done by Lorenzo by **rescaling** results obtained with **full simulation (BIB included)**
- This study can be in principle done with **fast simulation**

Impact parameter resolution

No studies yet..



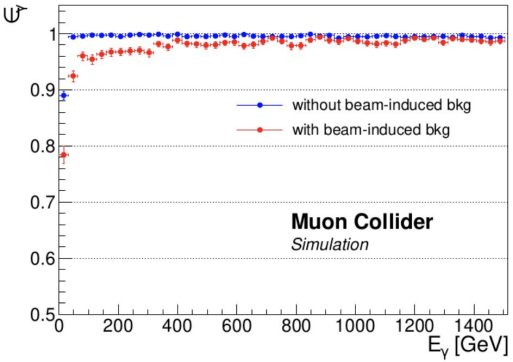
plots from L. Buonincontri thesis

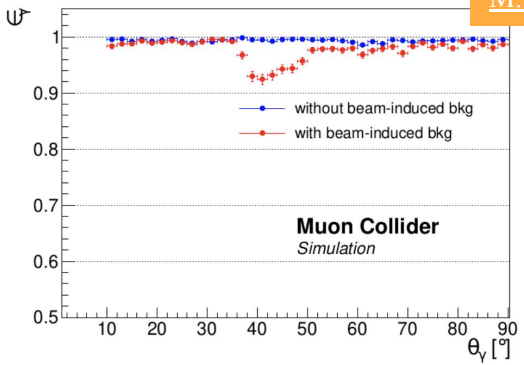


In principle, studies with **fast simulation** can be done, looking at the **dependence** with respect to the **minimum radius** of tracking system

Calorimeter Resolution for photons

Studies at √s=3 TeV with BIB and H → γγ





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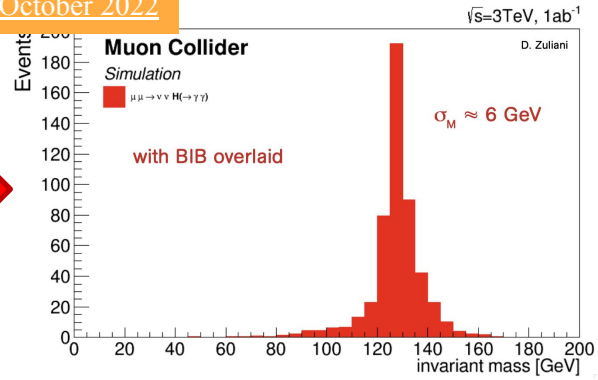
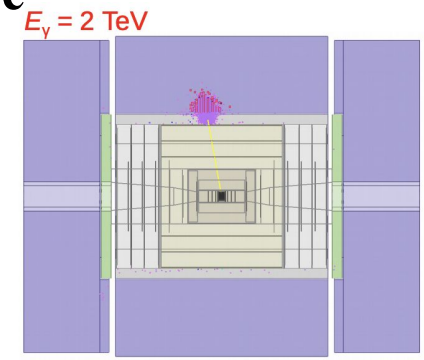


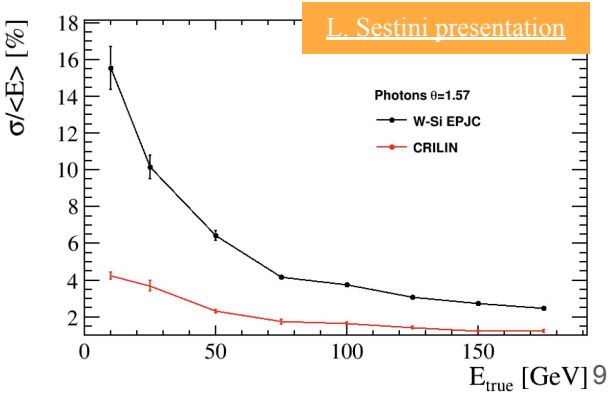
BIB in principle not so relevant here

Questions to be answered:

- Desidered energy resolution
- Shower containment for very energetic photons
- Best technology
- …

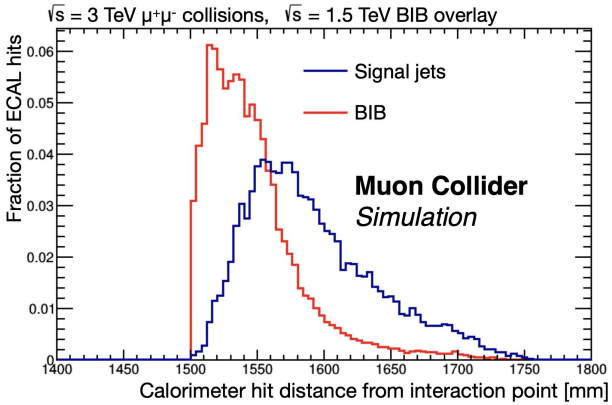


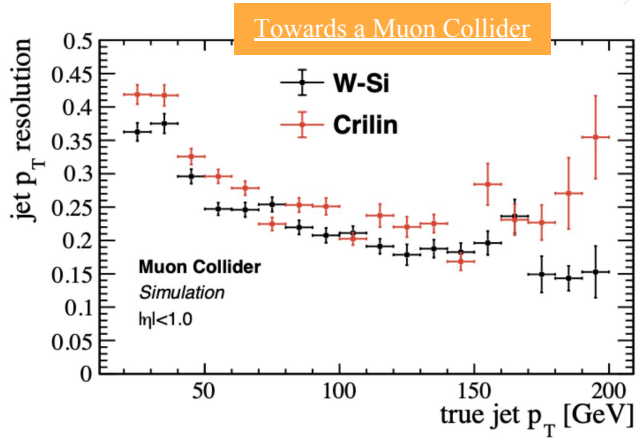
L. Sestini presentation



Jet energy Resolution

Studies at √s=3 TeV with BIB





Here impact of BIB is **relevant…**

Questions to be answered:

- Achievable jet energy resolution
- Depth of ECAL and HCAL
- Possible preshower before ECAL
- …

Conclusions

This is a **starting point** to organize the activities on detectors design study

It is important to define the **needed** and **reasonable** physics objects performance in term of **efficiency** and **resolution** at √s=3 TeV and √s=10 TeV Muon Collider

Detectors design

Experts on the different physics objects detection and identification need to work together

Thank you for your attention!