DELPHES Tutorial

Michele Selvaggi

CERN

TUTORIAL

Make sure your have properly installed ROOT, Pythia8 and Delphes and compiled Delphes with Pythia8 as showed here:

https://cp3.irmp.ucl.ac.be/projects/delphes/wiki/WorkBook/Pythia8

Tutorial:

https://cp3.irmp.ucl.ac.be/projects/delphes/wiki/WorkBook/Tutorials/Hefei

Pythia8 to Delphes

- You have already installed Pythia8 during the MG5 tutorial

- Locate the installation inside [MGDIR]/HEPTools/pythia8

- Type:

  - export PYTHIA8=[MGDIR]/HEPTools/pythia8

- Go back to the Delphes directory, and type:

  - make HAS_PYTHIA8=true DelphesPythia8

Outline

In this tutorial you will learn how to:

- interface Delphes with the Pythia8 event generator
- configure and generate events with Pythia8 + Delphes
- navigate through the Delphes output
- analyse the Delphes events with an analysis macro
- configure a detector card

Higgs recoil measurement

In this tutorial we will study the Higgs recoil measurement at CEPC
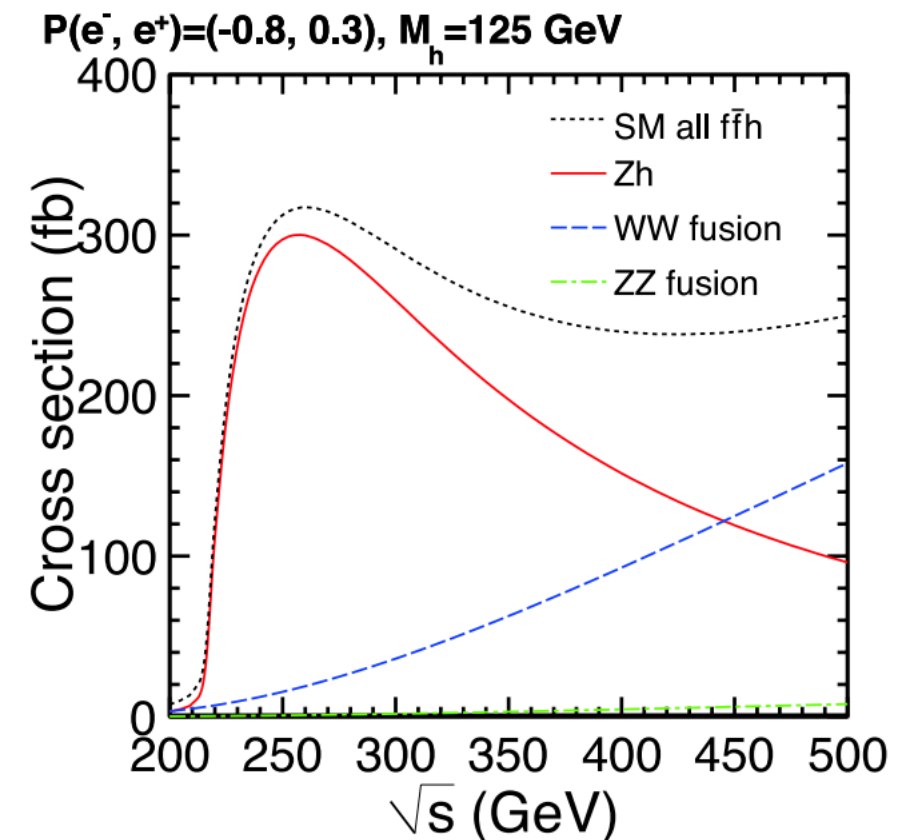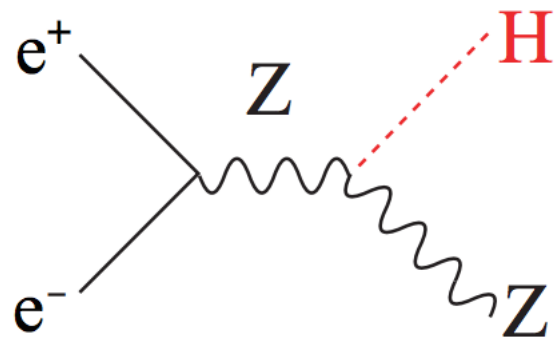
- At e+e- colliders, (at threshold) Higgs is produced mainly via ee→ZH (Higgs Strahlung)

Higgs recoil measurement

- Higgs mass can be reconstructed without using ANY information of the Higgs decay product

- Reconstruct μμ final state and construct the Recoil mass variable

- Write $p_H = p_{e+e-} - p_Z$ (4-vectors)

- $m_H^2 = m_{Recoil}^2 = (\sqrt{s} - E_{\mu\mu})^2 - p_{\mu\mu}^2$
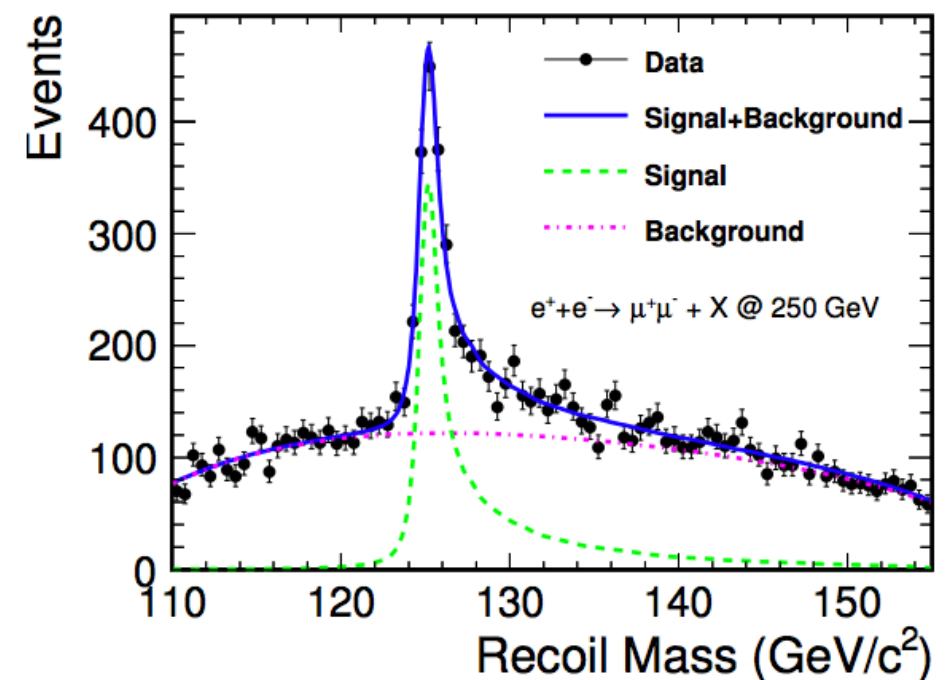
Only use Z decay information to reconstruct the Higgs (magic of e+e-)!

Gives model independent measurement of the Higgs width!

Produce ee→ZH , Z→µµ events with Pythia8:

```
Main:numberOfEvents = 10000        ! number of events to generate

Beams:idA = 11                     ! first beam, e- = -11
Beams:idB = -11                    ! second beam, e+ = 11
Beams:eCM = 240.                    ! CM energy of collision

! Higgsstrahlung process
HiggsSM:ffbar2HZ = on

! 5) Force the Z decays to muons
23:onMode = off
23:onIfAny = 13 -13
```
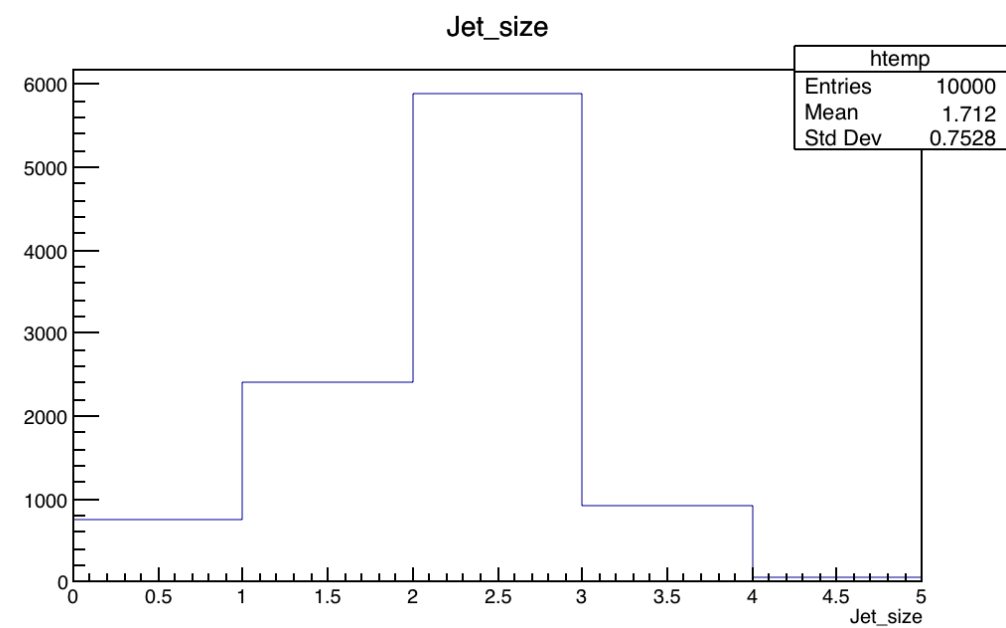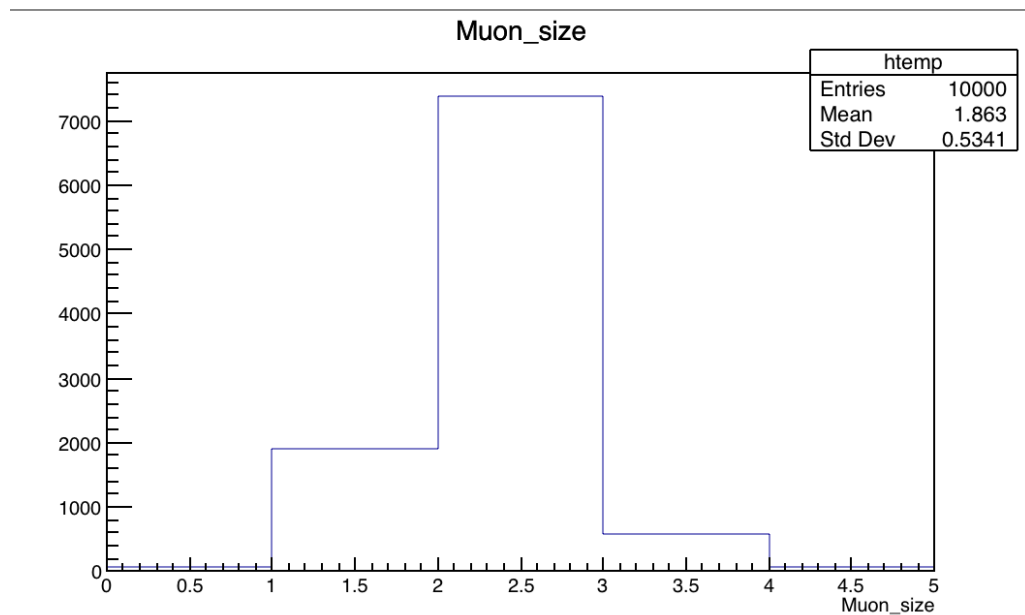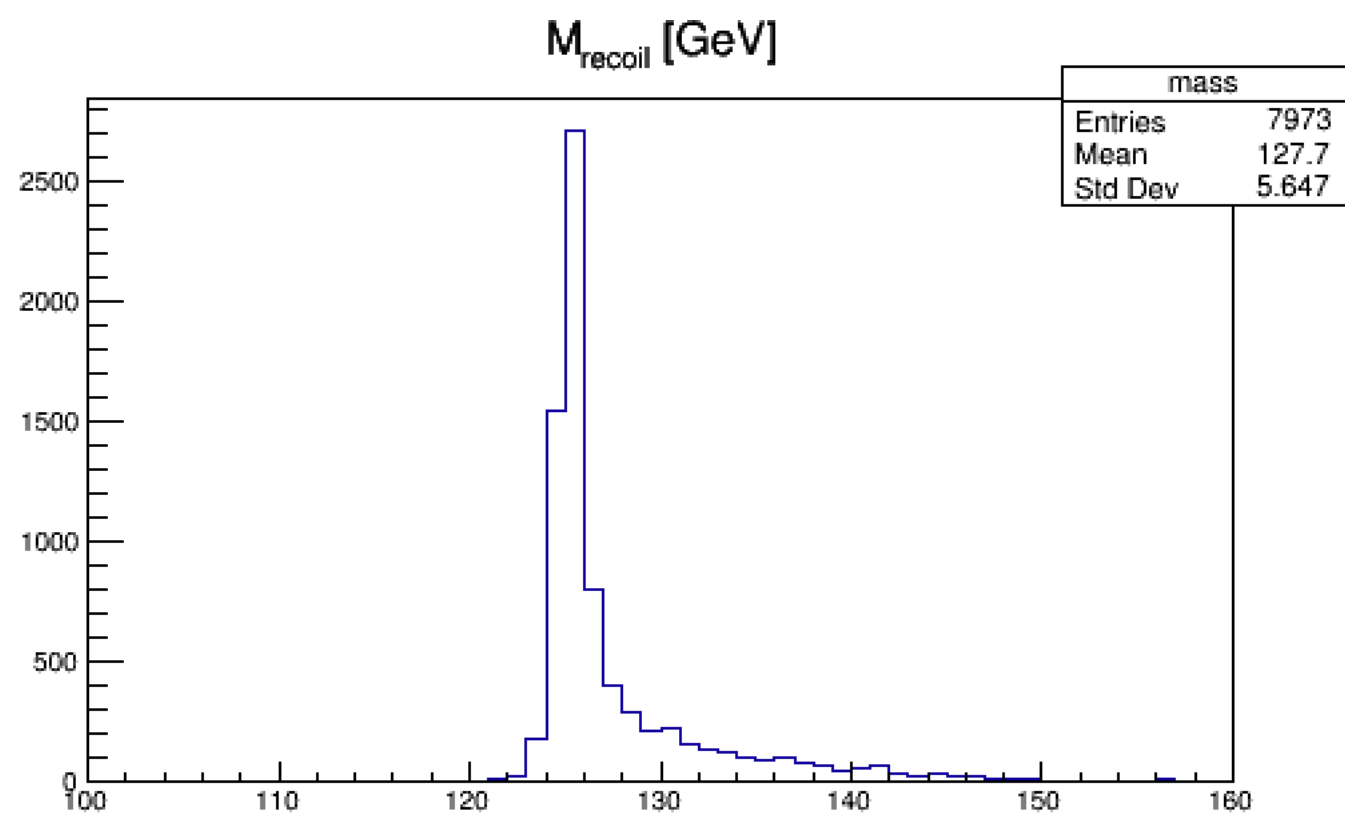
Plots (I)

Plots (II)

Plots (III)