

# **CEPC HZZ Project**

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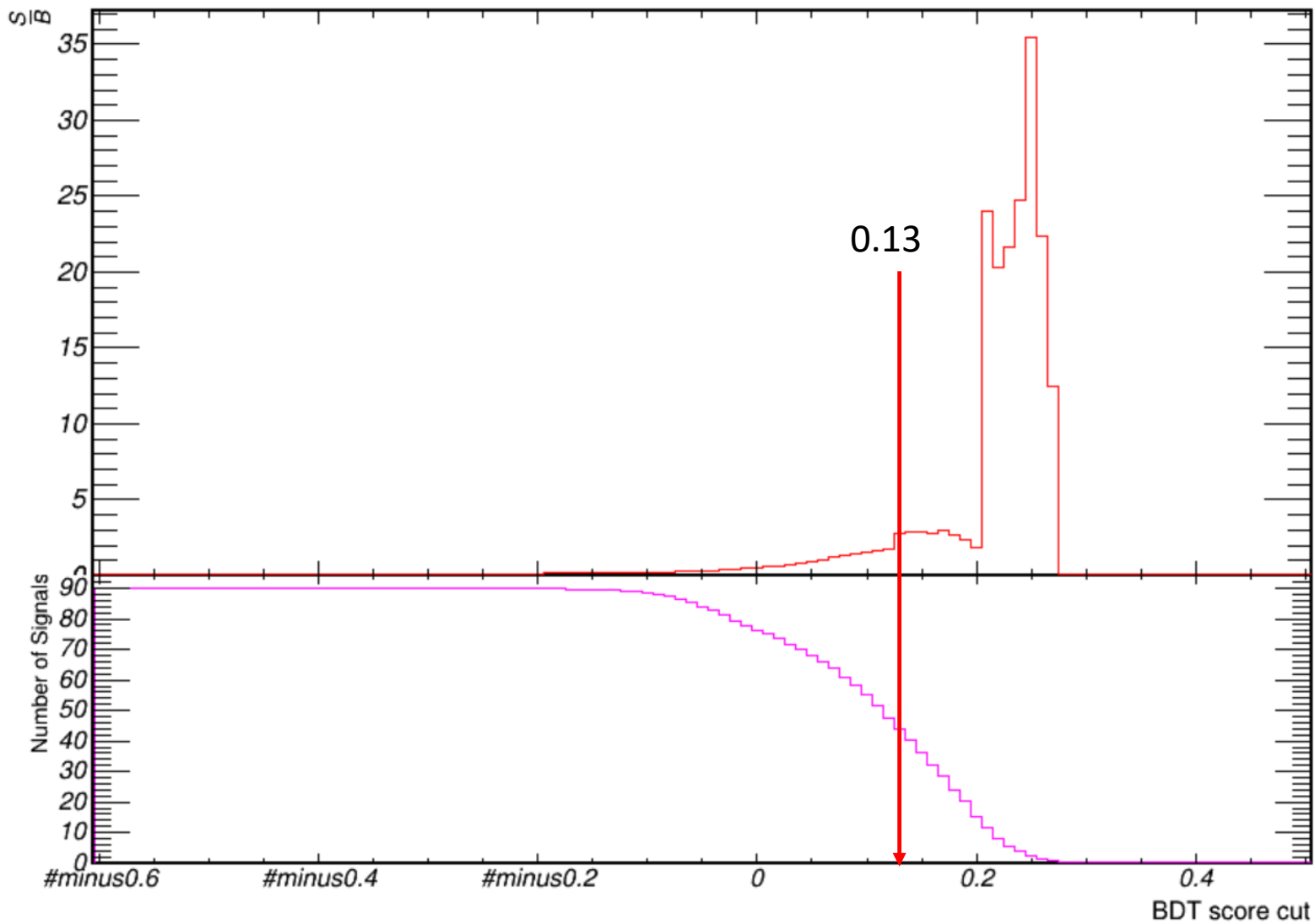
# Project Overview

	mm(vvjj)	mm(jjvv)	vvHZZ	qq(vvmm)	qq(mmvv)
Cut-based	Done	Done	Done	Done	Done
Merge into framework	Done	Done	Done	Done	Done
BDT Study	Done	Done	Done	Done	Done
Put BDT code in package	Done	On-going	On-going	On-going	On-going
Higgs width fitting in the framework	Done	Done	Done	Done	Done
Combined fitting	Done				

	Status
Table & Plot style	Done
CEPC Memo	On-going
ee channel	Awaiting
EFT	On-going (Ryuta)

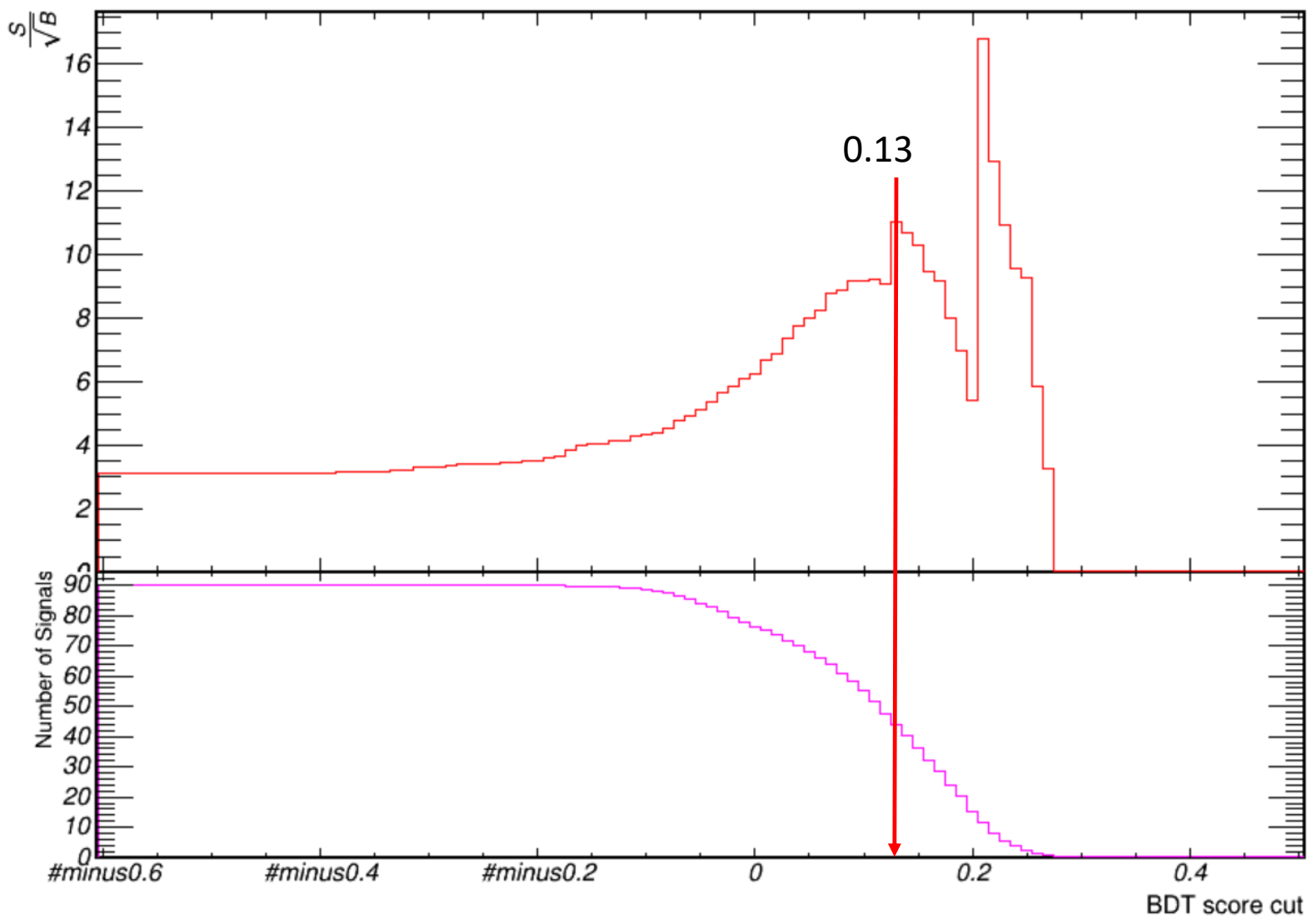
# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

$\frac{S}{B}$



# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

$\triangleright \frac{S}{\sqrt{B}}$



# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

Cut-based

Cut	Signal	ZH background	2f background	4f background
Expected	1000	1140511	801811977	107203890
<i>Pre – selection</i>	616	30524	481301	515955
<i>Signal or not</i>	211	30307	481301	515955
$M_{missing} > M_{dijet}$	107	1605	115175	28838
$M_{dimuon}$	95	726	73813	6836
$M_{dimuon}^{rec}$	95	707	7894	1360
$N(pfo)$	94	336	3271	574
$Pt_{visible}$	89	312	342	168
$Angle_{min}$	85	298	283	139
$M_{missing}$ and $M_{dijet}$	62	80	254	46
<i>Single Jet</i>	54	67	0	9

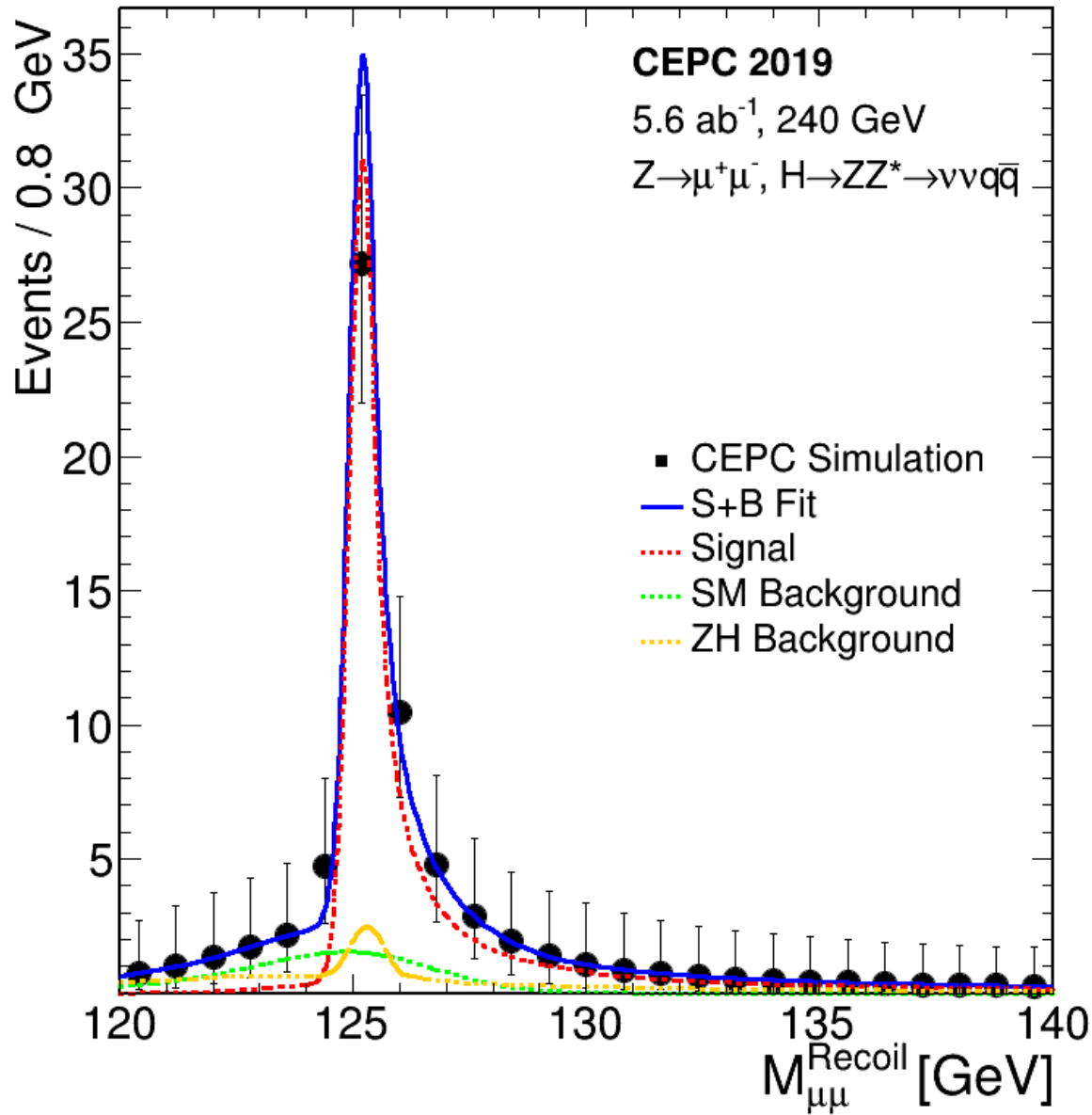
BDT

Cut	Signal	ZH background	2f background	4f background
<i>Expected</i>	1000	1140511	801811977	107203890
<i>Pre – selection</i>	616	30494	480828	515424
<i>Signal or not</i>	211	30282	480828	515424
$M_{missing} > M_{dijet}$	107	1608	115062	28811
$M_{dimuon}$	95	725	73741	6833
$M_{dimuon}^{rec}$	95	706	7886	1359
$N(pfo)$	94	336	3268	574
$Pt_{visible}$	89	312	342	168
<i>BDT score</i>	47	10	14	2

# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

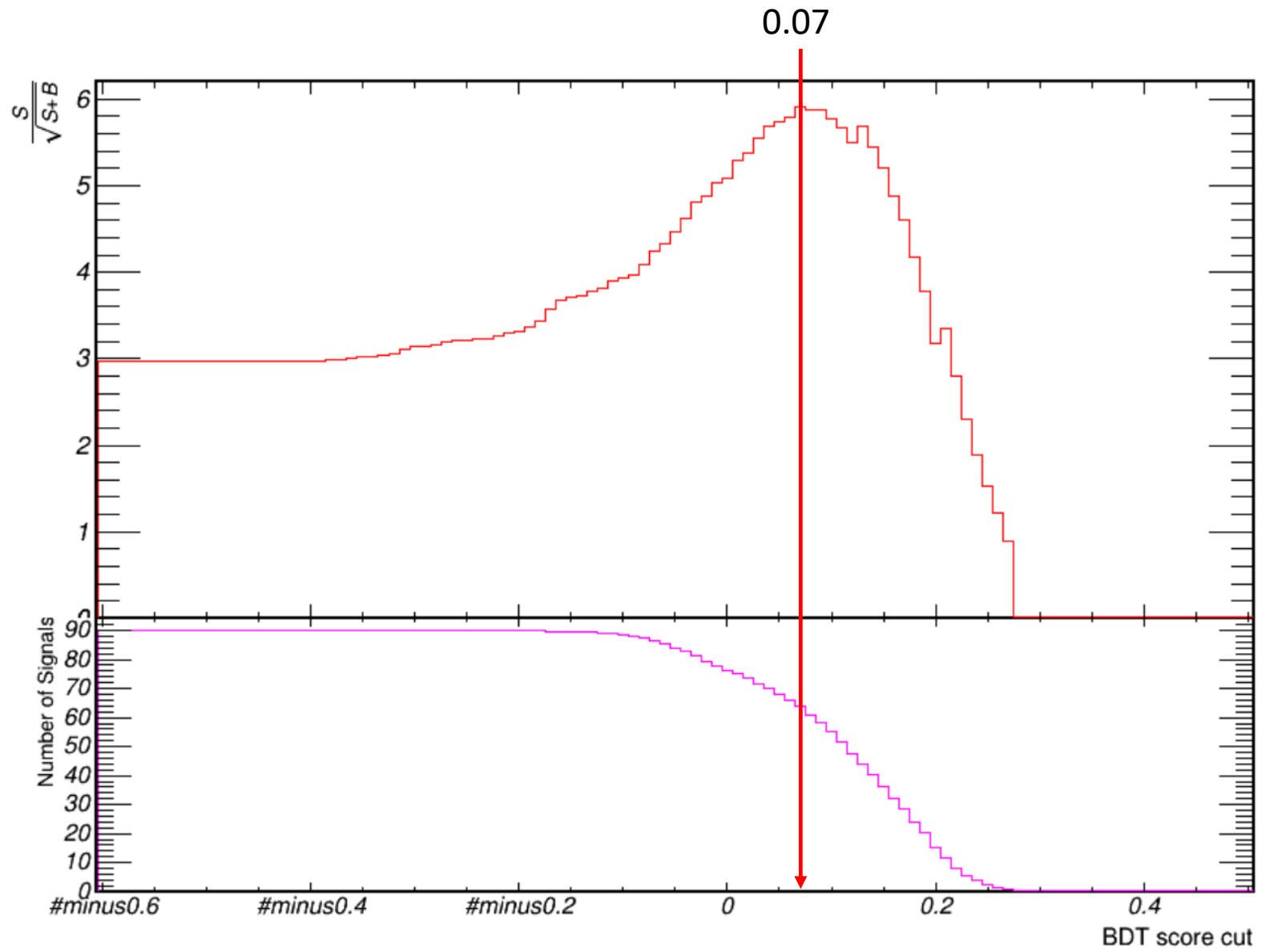
## ➤ Fitting Result

$$\frac{\Delta (\sigma (ZH) * BR(H \rightarrow ZZ^*))}{\sigma (ZH) * BR(H \rightarrow ZZ^*)} = 16.35\%$$



# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

$$\frac{S}{\sqrt{S+B}}$$



# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

Cut-based

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BDT

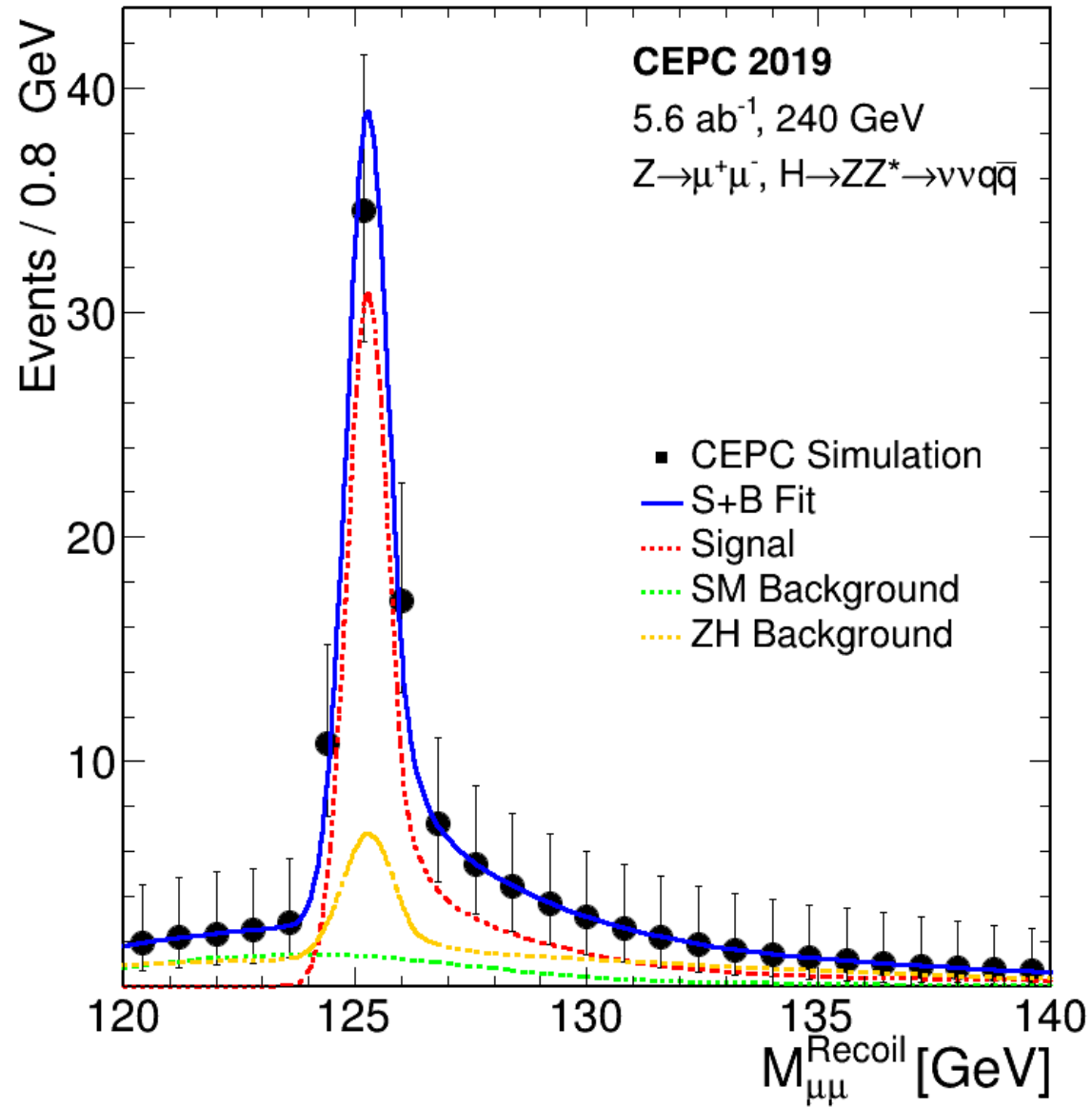
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$N(pfo)$	94	336	3268	574
$Pt_{visible}$	89	312	342	168
<i>BDT score</i>	66	36	14	11



# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

## ➤ Fitting Result

$$\frac{\Delta (\sigma (ZH) * BR(H \rightarrow ZZ^*))}{\sigma (ZH) * BR(H \rightarrow ZZ^*)} = 15.22\%$$



# Summary

- **Finished the fitting code for each channel in the framework**
- **Combined fitting done**
- **Determined the best BDT score cut reference:  $\frac{S}{\sqrt{S+B}}$**
- **Compiled CEPC memo successfully**

# Next to do

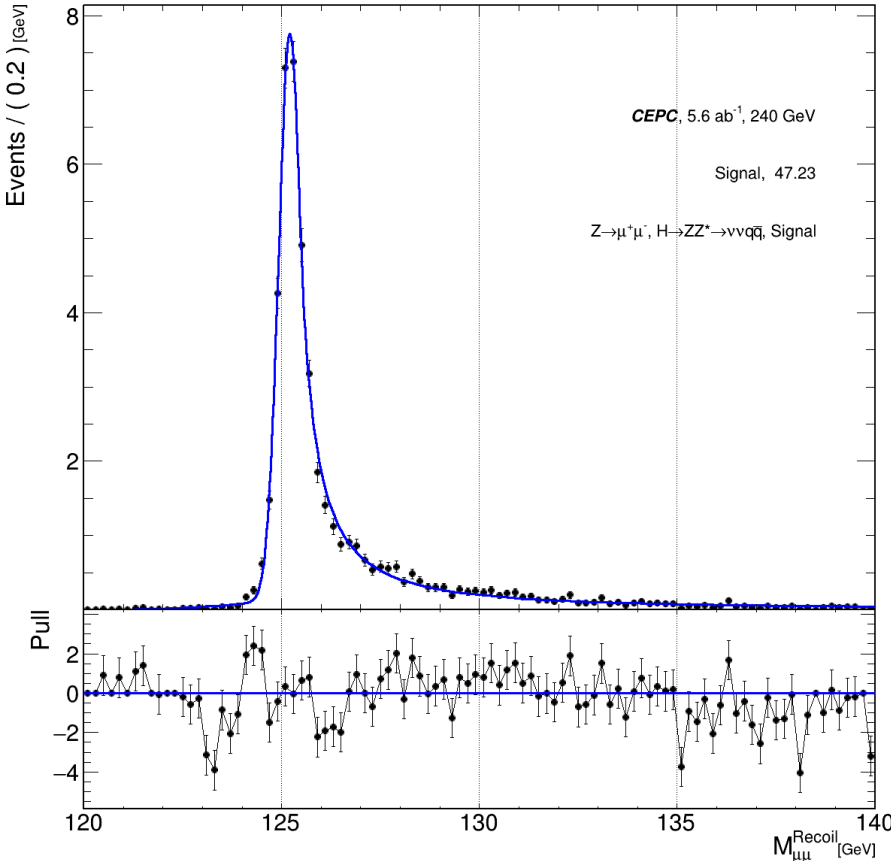
- **Complete BDT study for the other 4 channels**
- **Optimize the cuts for all 5 channels**
- **First look at ee HZZ channel (maybe?)**

**Back up**

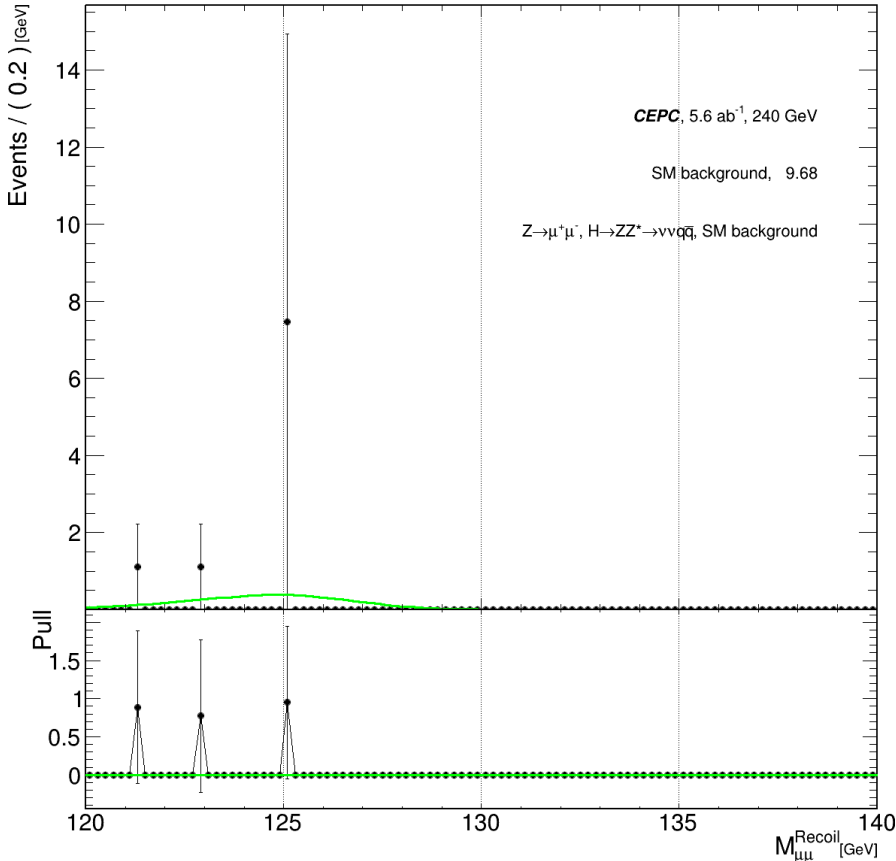
# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

## ➤ Fitting Results (BDT score cut 0.13)

### Signal



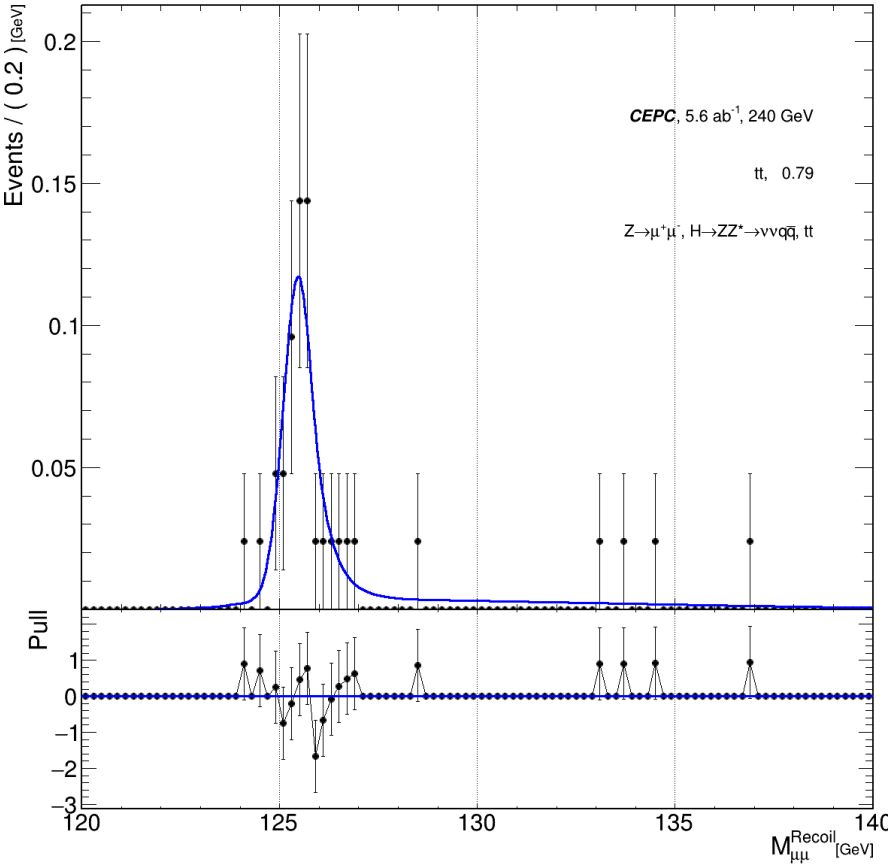
### SM Background



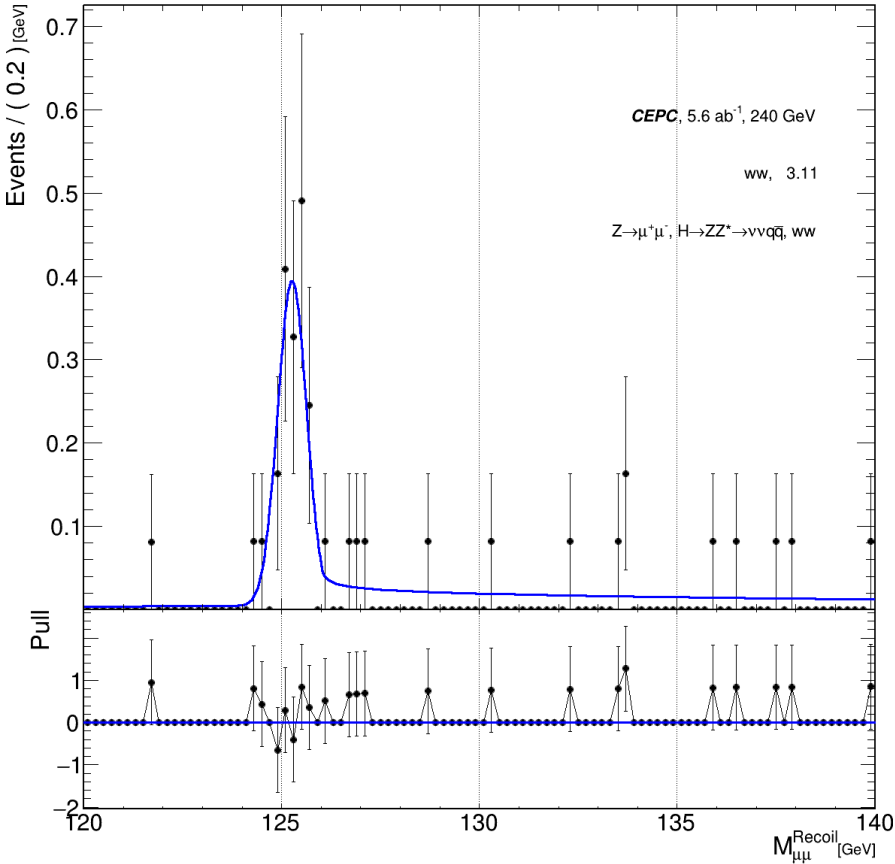
# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

## ➤ Fitting Results (BDT score cut 0.13)

### $ZH(\rightarrow \tau\tau)$ Background



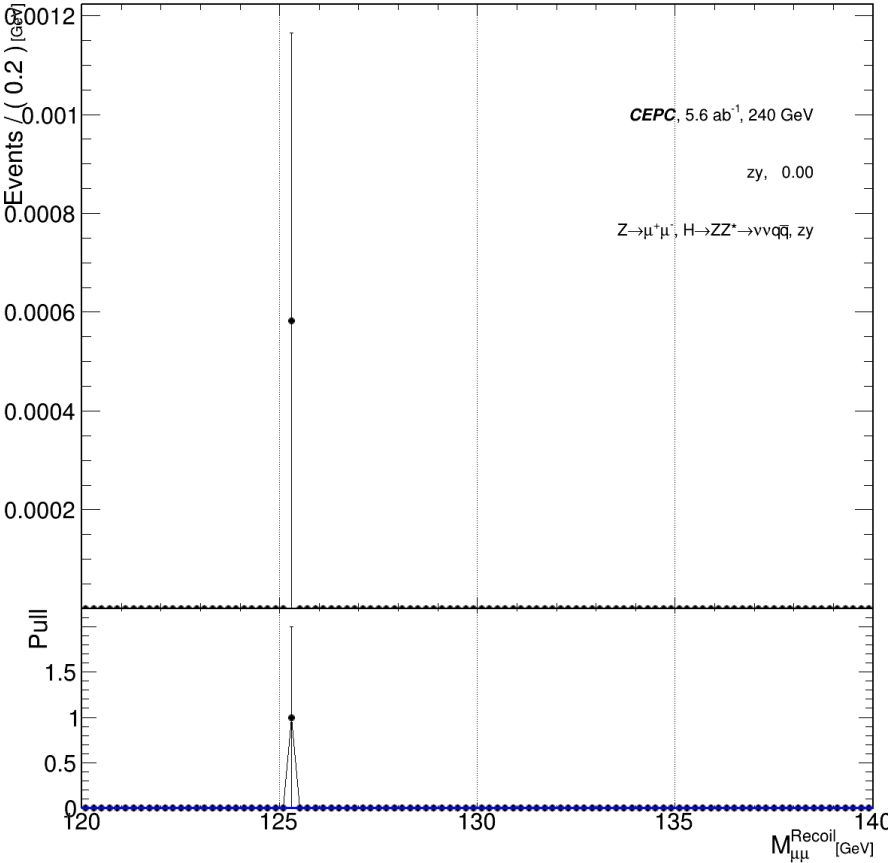
### $ZH(\rightarrow WW)$ Background



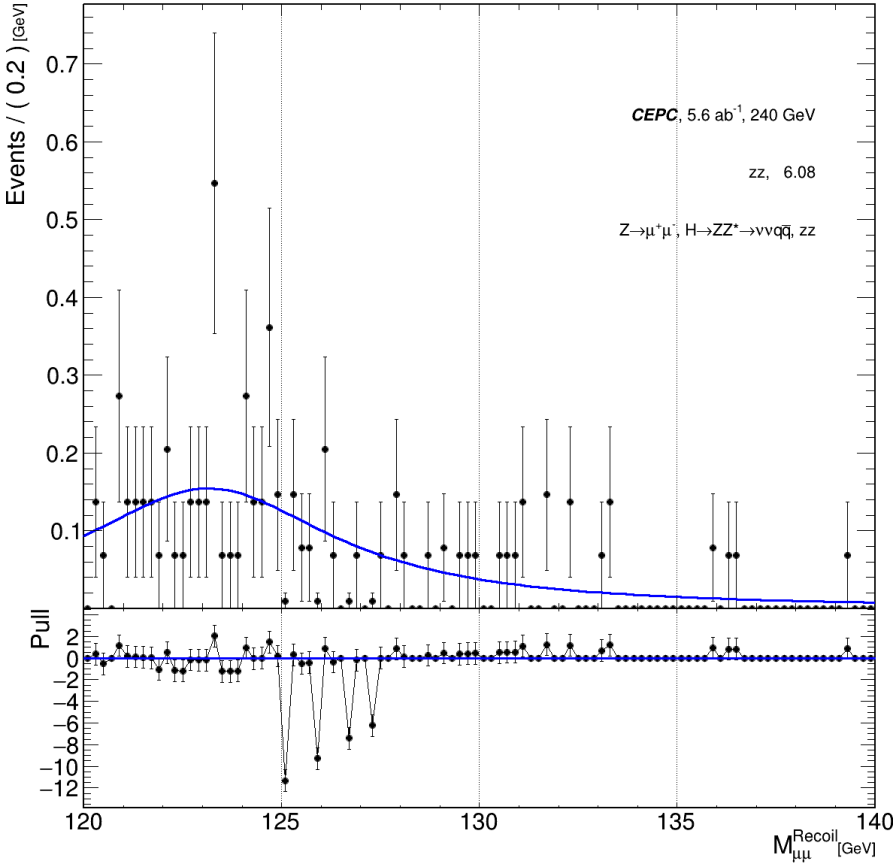
# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

## ➤ Fitting Results (BDT score cut 0.13)

### $ZH(\rightarrow az)$ Background



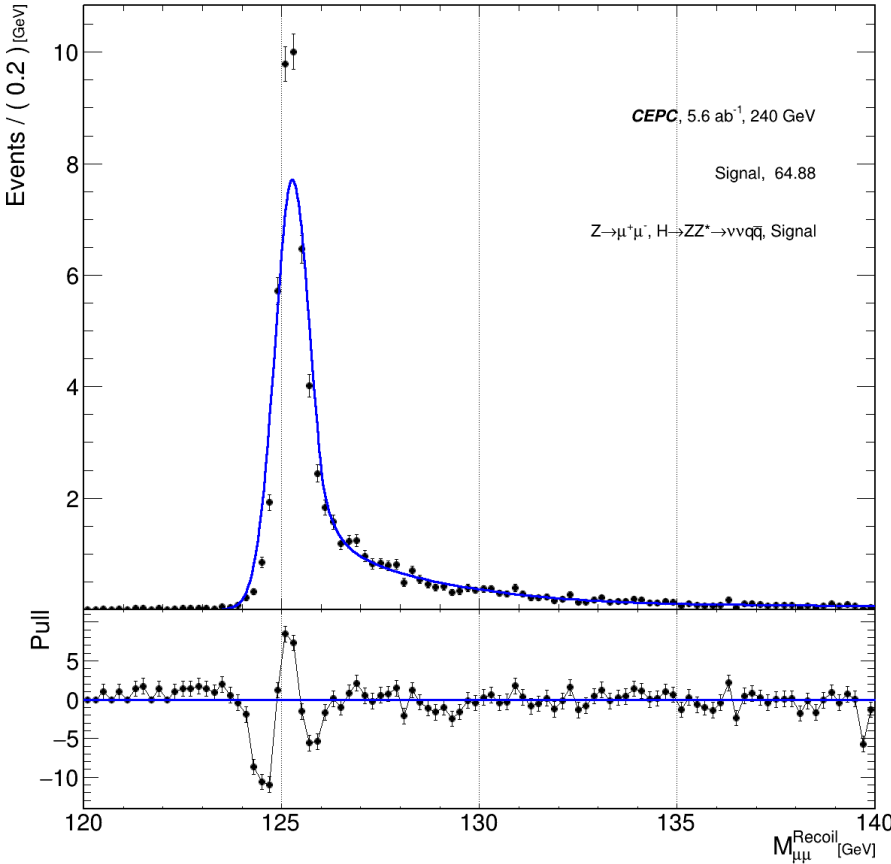
### $ZH(\rightarrow ZZ^*)$ Background



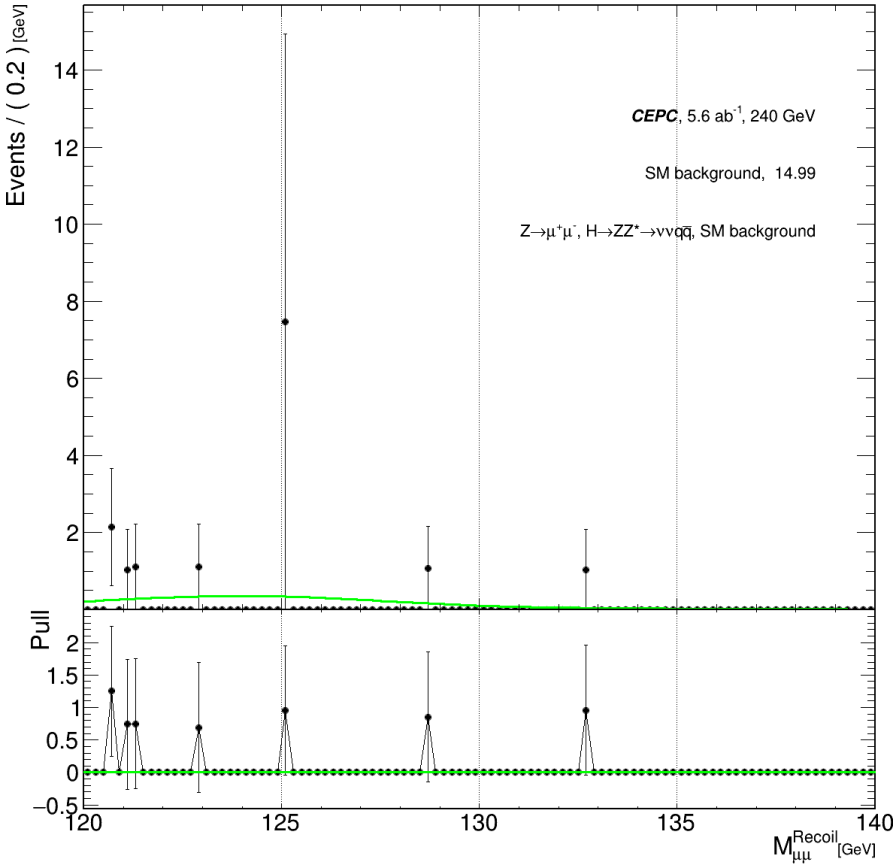
# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

## ➤ Fitting Results (BDT score cut 0.07)

### Signal



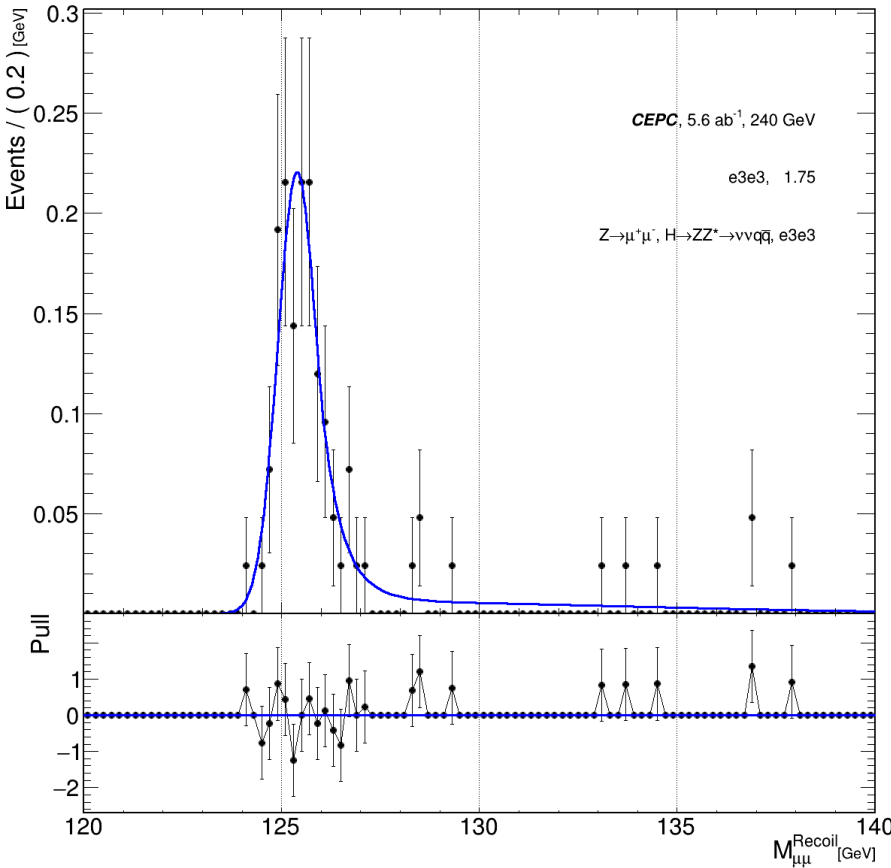
### SM Background



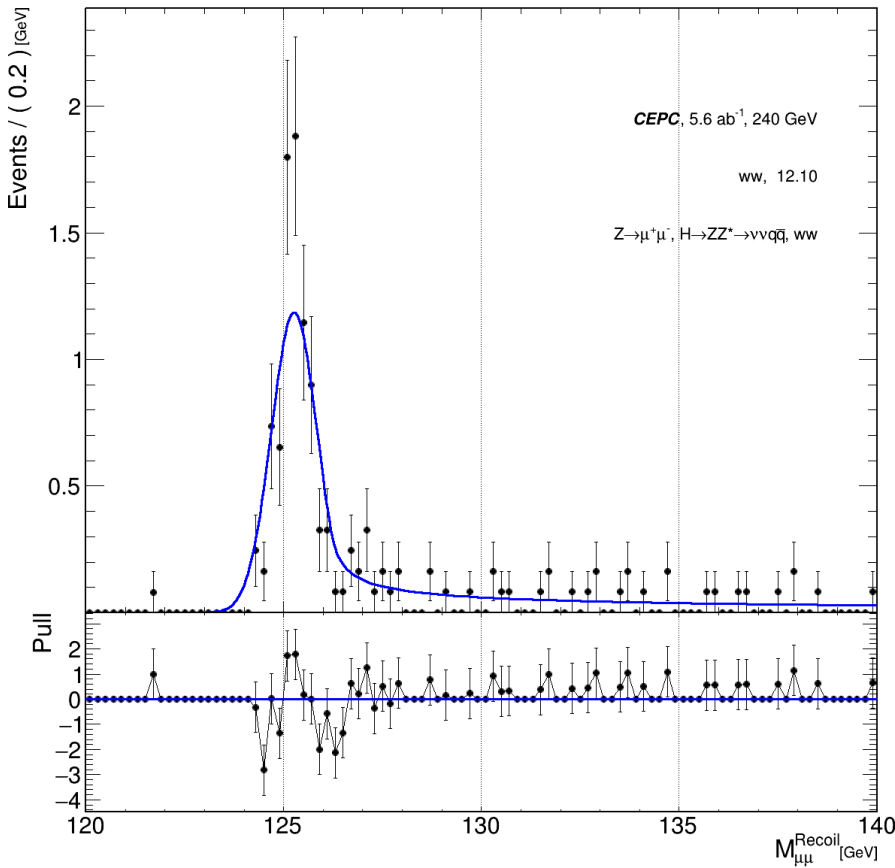
# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

## ➤ Fitting Results (BDT score cut 0.07)

### $ZH(\rightarrow \tau\tau)$ Background



### $ZH(\rightarrow WW)$ Background

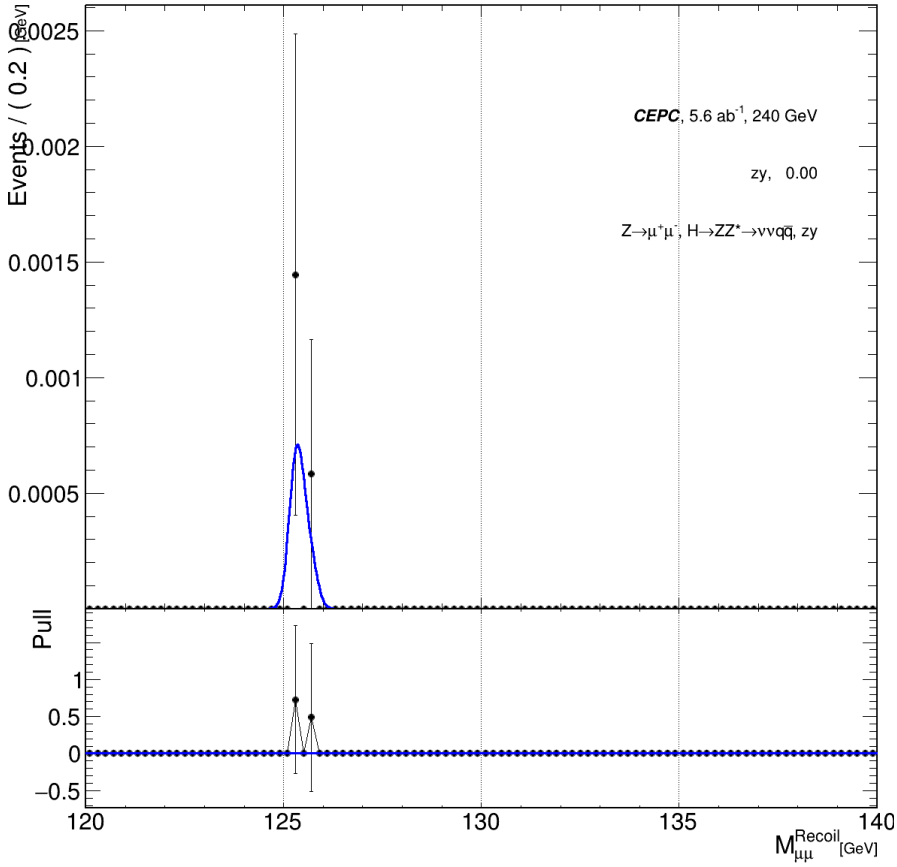




# BDT on $\mu\mu HZZ$ ( $\nu\nu jj$ )

## ➤ Fitting Results (BDT score cut 0.07)

### $ZH(\rightarrow az)$ Background



### $ZH(\rightarrow ZZ^*)$ Background

