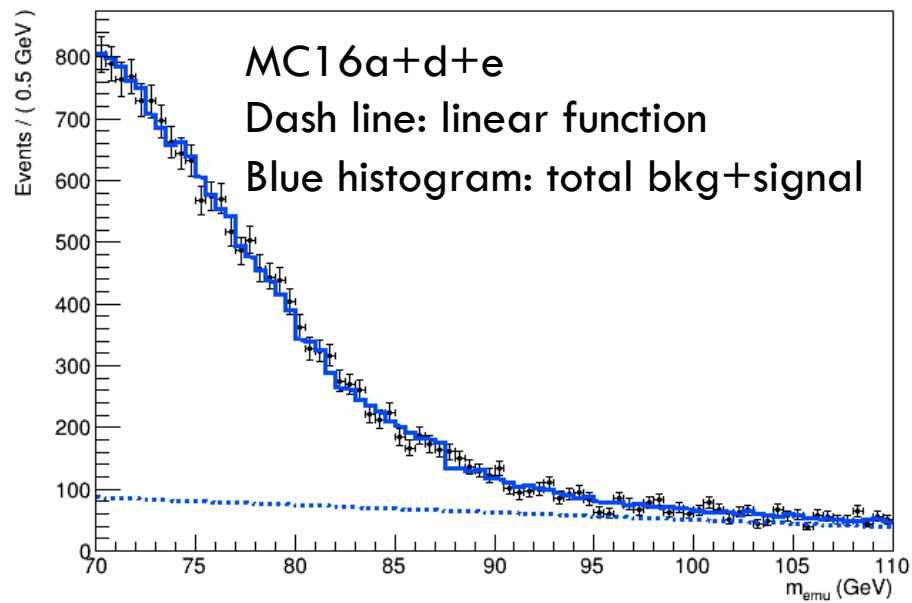
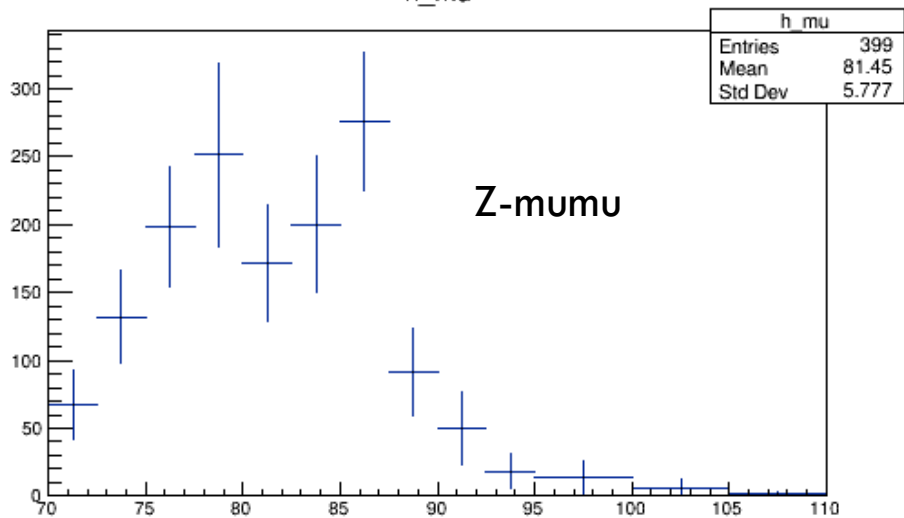
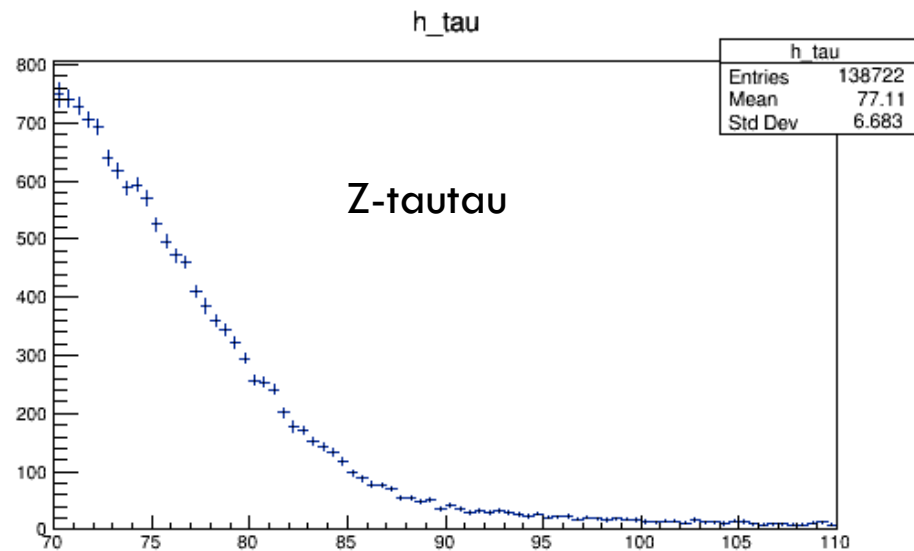
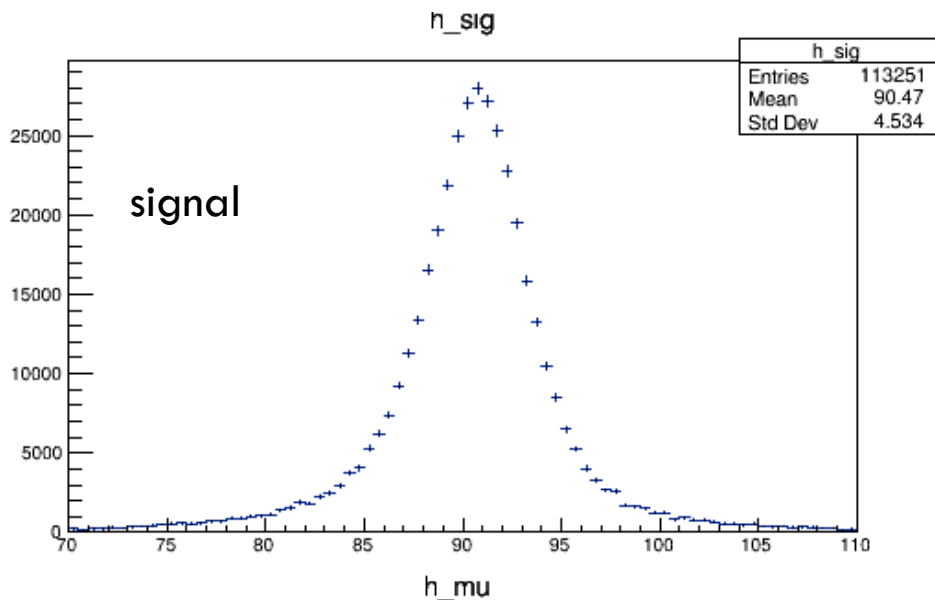


# Z-emu

- Signal model: histogram pdf from MC
- Background model:
  - ▣ Z-tau: histogram pdf from MC
  - ▣ Z-mumu: histogram pdf from MC
  - ▣ Others: analytical function(linear function)
- Systematic uncertainty for signal model
- Statistic uncertainty for background model

# Pdf



# Fitting result

- $nZ_{\tau\tau} = 13191.6 \pm 264.478$
- $nZ_{\mu\mu} = 1040.02 \pm 193.967$
- $nC_{mb} = 5018.39 \pm 397.262$
- $nSignal = 128.518 \pm 88.0363$

# For limit

- Fit the MC with  $n_{\text{Signal}} = 0$ , generate asimov data, export the workspace, run `AsymptoticsCLs` with the workspace:

## Correct bands

+2sigma: 333.23

+1sigma: 247.826

-1sigma: 128.225

-2sigma: 95.512

Median: 177.953

Observed: 184.884

# Systematic for signal

```
chenboping — bochen@lxplus767:/afs/cern.ch/user/f/fean/public — ssh -Y bochen@lxplus.cern.ch — 204x51
~ — bochen@lxplus726:/afs/cern.ch/work/b/bochen/zemu/VgHadronicStatisticalAna — ssh -Y bochen@lxplus.cern.ch
[bochen@lxplus767 public]$ root -l TMVApp_total_Zemu.root
root [0]
Attaching file TMVApp_total_Zemu.root as _file0...
(TFile *) 0x210e730
[root [1] .ls
TFile**      TMVApp_total_Zemu.root
TFile*      TMVApp_total_Zemu.root
KEY: TTree   Nominal;5      Nominal
KEY: TTree   Nominal;4      Nominal
KEY: TTree   EL_EFF_ID_TOTAL_INPCOR_PLUS_UNCOR__1down;3  EL_EFF_ID_TOTAL_INPCOR_PLUS_UNCOR__1down
KEY: TTree   EL_EFF_ID_TOTAL_INPCOR_PLUS_UNCOR__1down;2  EL_EFF_ID_TOTAL_INPCOR_PLUS_UNCOR__1down
KEY: TTree   EL_EFF_ID_TOTAL_INPCOR_PLUS_UNCOR__1up;3      EL_EFF_ID_TOTAL_INPCOR_PLUS_UNCOR__1up
KEY: TTree   EL_EFF_ID_TOTAL_INPCOR_PLUS_UNCOR__1up;2      EL_EFF_ID_TOTAL_INPCOR_PLUS_UNCOR__1up
KEY: TTree   EL_EFF_Iso_TOTAL_INPCOR_PLUS_UNCOR__1down;3  EL_EFF_Iso_TOTAL_INPCOR_PLUS_UNCOR__1down
KEY: TTree   EL_EFF_Iso_TOTAL_INPCOR_PLUS_UNCOR__1down;2  EL_EFF_Iso_TOTAL_INPCOR_PLUS_UNCOR__1down
KEY: TTree   EL_EFF_Iso_TOTAL_INPCOR_PLUS_UNCOR__1up;3      EL_EFF_Iso_TOTAL_INPCOR_PLUS_UNCOR__1up
KEY: TTree   EL_EFF_Iso_TOTAL_INPCOR_PLUS_UNCOR__1up;2      EL_EFF_Iso_TOTAL_INPCOR_PLUS_UNCOR__1up
KEY: TTree   EL_EFF_Reco_TOTAL_INPCOR_PLUS_UNCOR__1down;3  EL_EFF_Reco_TOTAL_INPCOR_PLUS_UNCOR__1down
KEY: TTree   EL_EFF_Reco_TOTAL_INPCOR_PLUS_UNCOR__1down;2  EL_EFF_Reco_TOTAL_INPCOR_PLUS_UNCOR__1down
KEY: TTree   EL_EFF_Reco_TOTAL_INPCOR_PLUS_UNCOR__1up;3      EL_EFF_Reco_TOTAL_INPCOR_PLUS_UNCOR__1up
KEY: TTree   EL_EFF_Reco_TOTAL_INPCOR_PLUS_UNCOR__1up;2      EL_EFF_Reco_TOTAL_INPCOR_PLUS_UNCOR__1up
KEY: TTree   EL_EFF_Trigger_TOTAL_INPCOR_PLUS_UNCOR__1down;3  EL_EFF_Trigger_TOTAL_INPCOR_PLUS_UNCOR__1down
KEY: TTree   EL_EFF_Trigger_TOTAL_INPCOR_PLUS_UNCOR__1down;2  EL_EFF_Trigger_TOTAL_INPCOR_PLUS_UNCOR__1down
KEY: TTree   EL_EFF_Trigger_TOTAL_INPCOR_PLUS_UNCOR__1up;3      EL_EFF_Trigger_TOTAL_INPCOR_PLUS_UNCOR__1up
KEY: TTree   EL_EFF_Trigger_TOTAL_INPCOR_PLUS_UNCOR__1up;2      EL_EFF_Trigger_TOTAL_INPCOR_PLUS_UNCOR__1up
KEY: TTree   JET_JvtEfficiency__1down;3      JET_JvtEfficiency__1down
KEY: TTree   JET_JvtEfficiency__1down;2      JET_JvtEfficiency__1down
KEY: TTree   JET_JvtEfficiency__1up;3      JET_JvtEfficiency__1up
KEY: TTree   JET_JvtEfficiency__1up;2      JET_JvtEfficiency__1up
KEY: TTree   MUON_EFF_ISO_STAT__1down;3      MUON_EFF_ISO_STAT__1down
KEY: TTree   MUON_EFF_ISO_STAT__1down;2      MUON_EFF_ISO_STAT__1down
KEY: TTree   MUON_EFF_ISO_STAT__1up;3      MUON_EFF_ISO_STAT__1up
KEY: TTree   MUON_EFF_ISO_STAT__1up;2      MUON_EFF_ISO_STAT__1up
KEY: TTree   MUON_EFF_ISO_SYS__1down;3      MUON_EFF_ISO_SYS__1down
KEY: TTree   MUON_EFF_ISO_SYS__1down;2      MUON_EFF_ISO_SYS__1down
KEY: TTree   MUON_EFF_ISO_SYS__1up;3      MUON_EFF_ISO_SYS__1up
KEY: TTree   MUON_EFF_ISO_SYS__1up;2      MUON_EFF_ISO_SYS__1up
KEY: TTree   MUON_EFF_RECO_STAT__1down;3      MUON_EFF_RECO_STAT__1down
KEY: TTree   MUON_EFF_RECO_STAT__1down;2      MUON_EFF_RECO_STAT__1down
KEY: TTree   MUON_EFF_RECO_STAT__1up;3      MUON_EFF_RECO_STAT__1up
KEY: TTree   MUON_EFF_RECO_STAT__1up;2      MUON_EFF_RECO_STAT__1up
KEY: TTree   MUON_EFF_RECO_STAT_LOWPT__1down;3      MUON_EFF_RECO_STAT_LOWPT__1down
KEY: TTree   MUON_EFF_RECO_STAT_LOWPT__1down;2      MUON_EFF_RECO_STAT_LOWPT__1down
KEY: TTree   MUON_EFF_RECO_STAT_LOWPT__1up;3      MUON_EFF_RECO_STAT_LOWPT__1up
KEY: TTree   MUON_EFF_RECO_STAT_LOWPT__1up;2      MUON_EFF_RECO_STAT_LOWPT__1up
KEY: TTree   MUON_EFF_RECO_SYS__1down;3      MUON_EFF_RECO_SYS__1down
KEY: TTree   MUON_EFF_RECO_SYS__1down;2      MUON_EFF_RECO_SYS__1down
KEY: TTree   MUON_EFF_RECO_SYS__1up;3      MUON_EFF_RECO_SYS__1up
KEY: TTree   MUON_EFF_RECO_SYS__1up;2      MUON_EFF_RECO_SYS__1up
KEY: TTree   MUON_EFF_RECO_SYS_LOWPT__1down;3      MUON_EFF_RECO_SYS_LOWPT__1down
KEY: TTree   MUON_EFF_RECO_SYS_LOWPT__1down;2      MUON_EFF_RECO_SYS_LOWPT__1down
```

# How it affect the signal pdf

□ Signal pdf(pdf) =

Nominal pdf +  $\alpha_1 * (\text{Nominal pdf} - \text{systematic 1 pdf})$

+  $\alpha_2 * (\text{Nominal pdf} - \text{systematic 2 pdf})$

+  $\alpha_3 * (\text{Nominal pdf} - \text{systematic 3 pdf})$

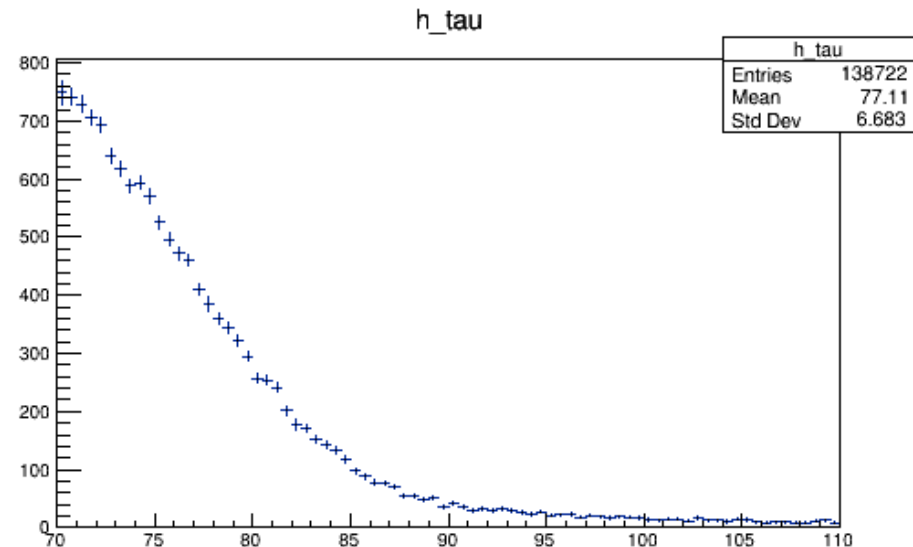
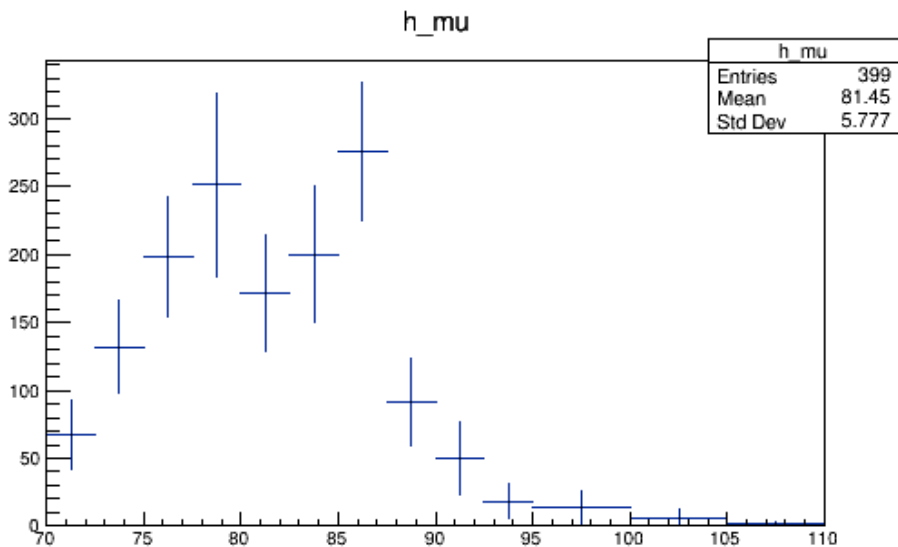
...

Constraint on alpha(nuisance parameter):

```
constraint system1_Aux = RooGaussian("mean = 0", "alpha_1", "Unit")
```

# Statistic for background

- Error bar as statistic uncertainty for the background pdf



Not sure how to add this kind of uncertainty  
Add the effect bin by bin?

# Backup: how to add signal systematic into datacard

```
[Dependents]
observable Z_m = 90 L(70 - 110) B(80)

[Models]
component Ztautau = ZemuHistoBuilder("Z_m", "h_tau")
component Zmumu = ZemuHistoBuilder("Z_m", "h_mu")
component Cmb = HggPolyPdfBuilder("Z_m", "c0")
component Signal = ZemuHistoBuilder("Z_m", "h_sig")

[Parameters]
c0 = -0.005 min=-40 max=40

nZtautau = 10000 min=0 max=28000
nZmumu = 2000 min=0 max=10000
nCmb = 5000 min=0 max=10000
nSignal = 10 min=-200 max=1000
```

- We are going to add the the histogram:  
 $\text{system1} = (\text{Nominal pdf} - \text{systematic pdf})$   
as a new component, then the  $n\text{system1}$  will be the nuisance