

# Recoil 500 GeV

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# Motivation

- Absolute  $Zh$  cross section  
(2.6% with  $Zh \rightarrow l\bar{l}h$  in 250 GeV)  
limits global fit of Higgs couplings
- Some ideas to improve  $\sigma_{Zh}$ 
  - including  $qqh$ 
    - Miyamoto-san
  - including 500 GeV
    - This talk

# lh at 500 GeV

- Cross section ( $\mu\mu h$ ) eL(0.8) pR(0.3)
  - 250 GeV: 10 fb
  - 500 GeV: 3.3 fb
  - Combining two may improve the resolution
- Recoil mass
  - Smearred in 500 GeV
- Background
  - Large t-channel diagram in 500 GeV
- Analysis
  - Almost the same as 250 GeV

# Cuts

Almost same as  $L_{ol}$

- Lepton ID
- Z mass (81.2 to 101.2 GeV)
- di-lepton  $p_T > 20$  GeV
- recoil mass (115-250  $\mu\mu$ , 100-250 ee)
- acoplanarity ( $\pi \pm 0.1$  rad vetoed)
- $p_T$  balance  
 $|\text{di-lepton } p_T - p_T \text{ of the most energetic neutral particle}| > 10$  GeV

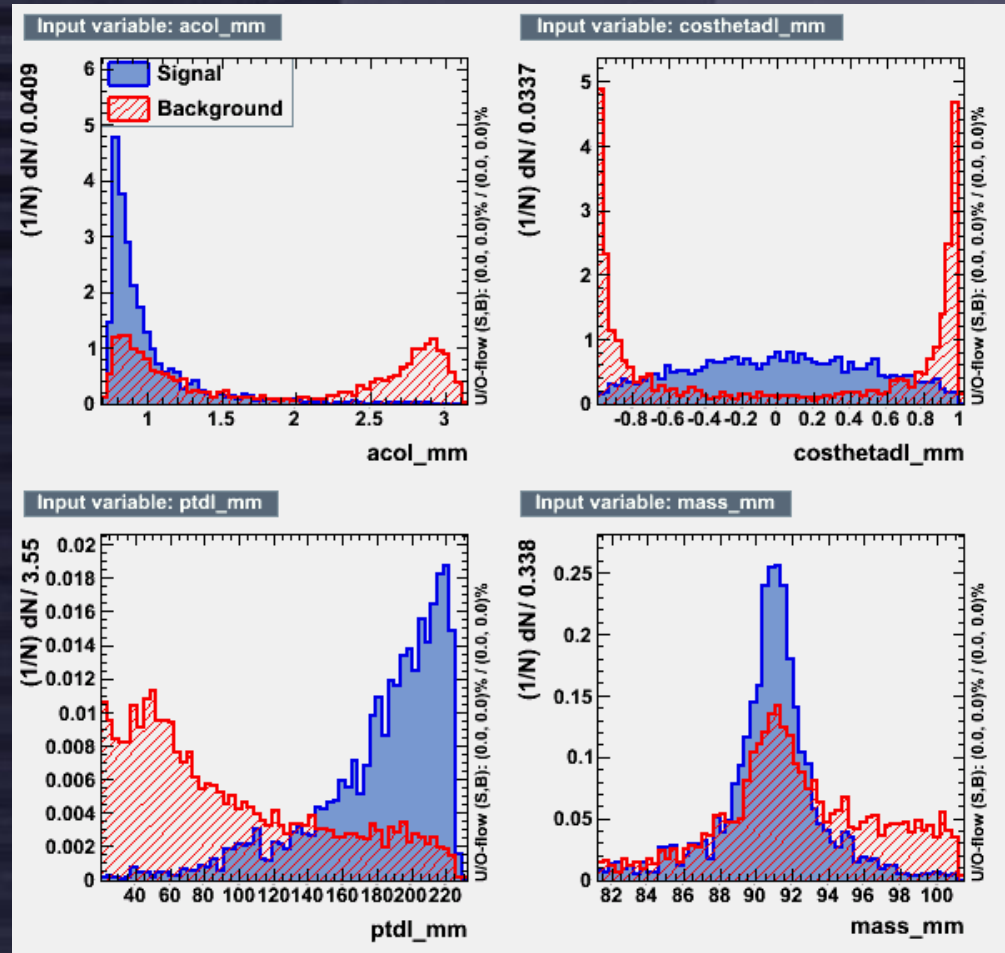
# Likelihood

Same as Lol

- di-lepton  $p_T$
- $\cos\theta$  of di-lepton
- acolinearity
- Z mass

TMVA used

- BDT & likelihood gives similar results
- Likelihood adopted



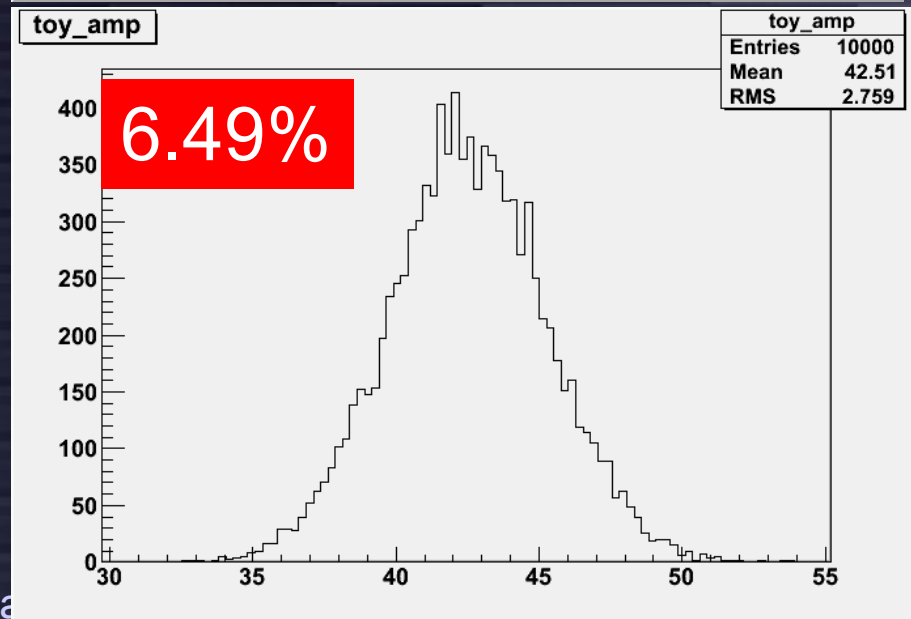
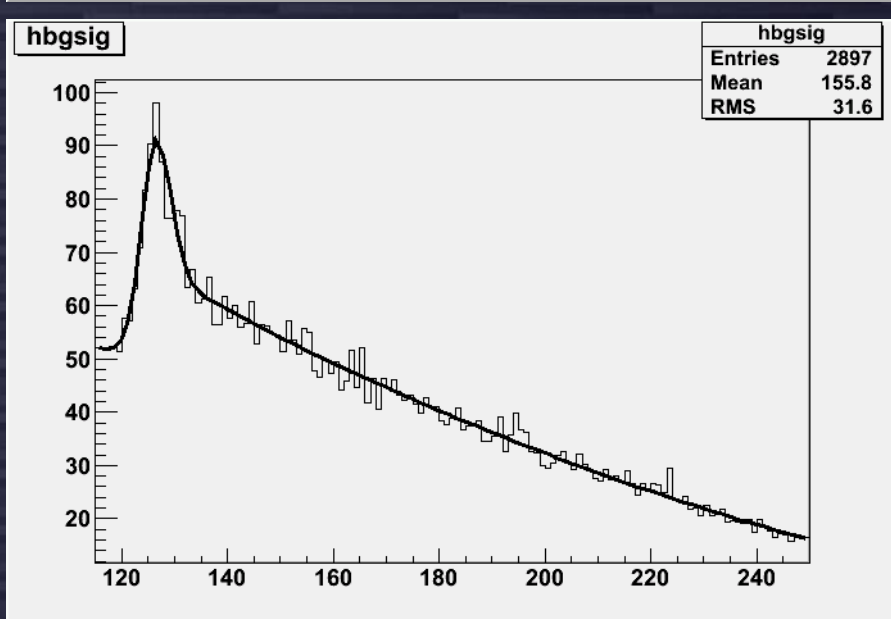
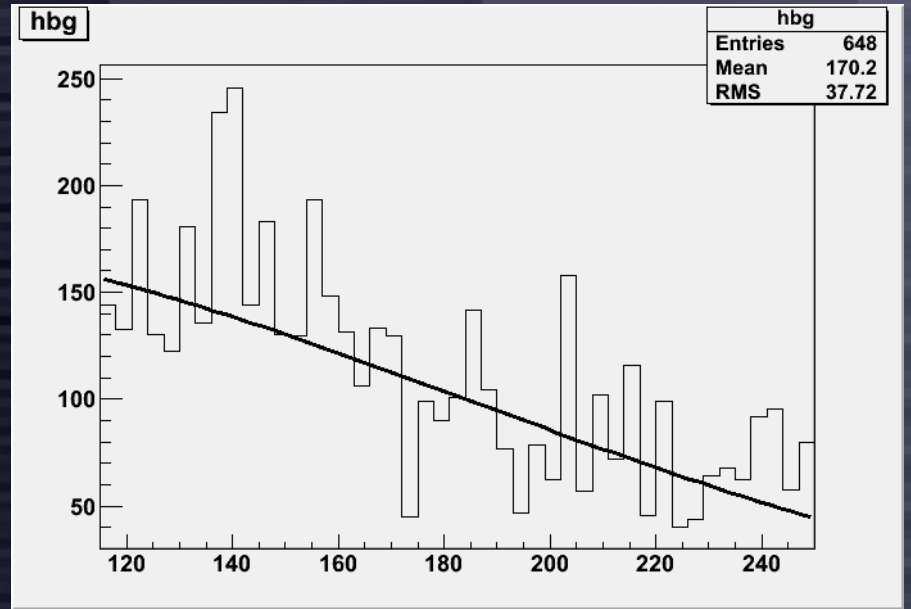
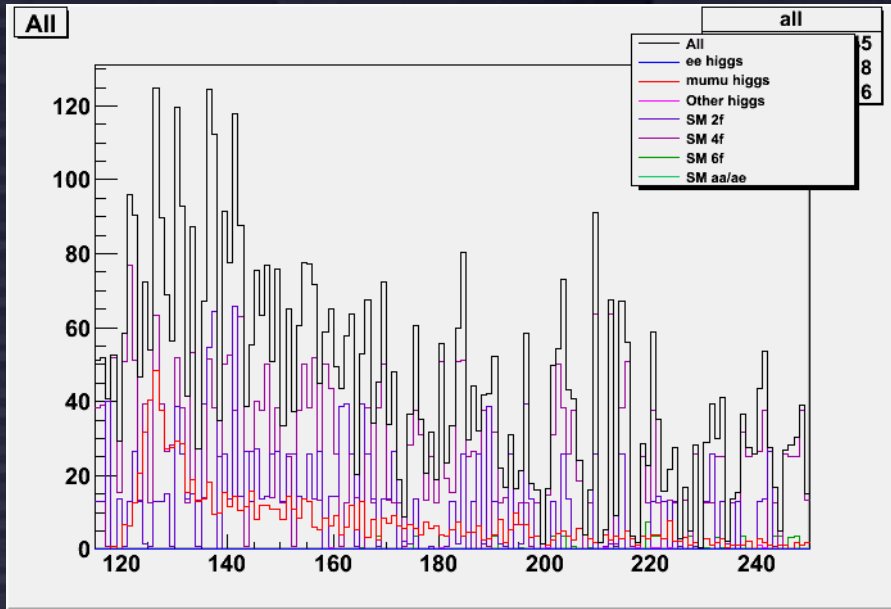
# mumu channel: cut table

cut	eeh	mmh	ooh	2f	4f	6f	o
m>=2	128	1691	3490	1.03e+6	966334	56719	361231
z mass	7.2	1499	141	225706	111908	4203	2765
ptdl>20	6.2	1492	124	64342	95766	3861	1573
recoil	1.6	1211	11	15198	30594	232	68
acop	1.3	1208	11	14598	28447	227	56
ptbal	1.2	1206	10	4544	27618	217	35
like>0.8	0	997	6.5	1632	3345	63	1.3

# Recoil fit

- BG fit (Gaus \* 2<sup>nd</sup> pol for mm, linear for ee)
- Fit will all parameters free
  - GPET with 5 parameters
    - Gaus (left side)
    - Gaus + expo (right side)
  - background distribution from fit function
    - to avoid large fluctuation due to the small stat
- Toy-MC – 10000 times
  - Poisson from data (sig), func (bg)
  - Fit with fixing shape parameters (mean and amplitude free)

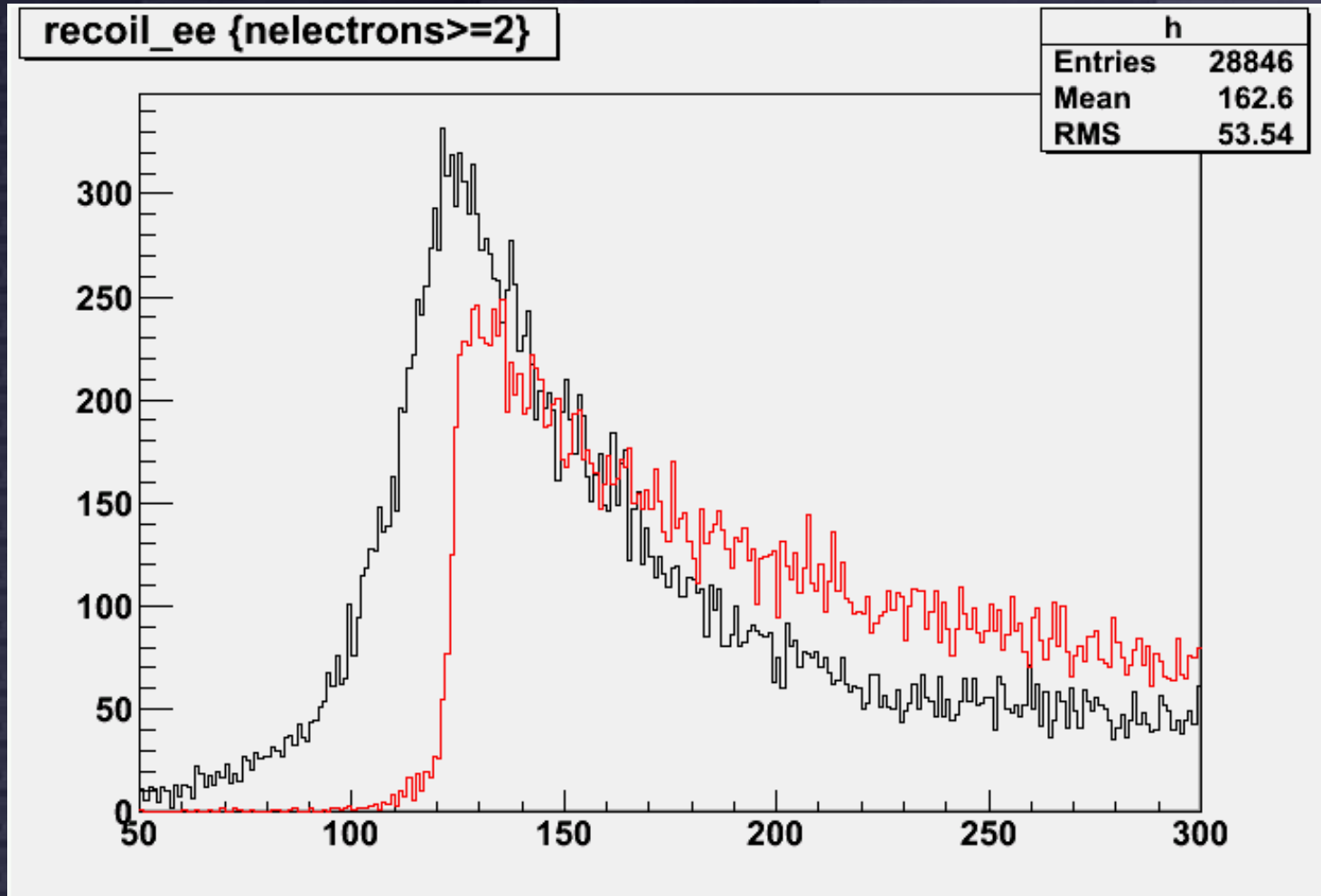
# mumu: recoil fit





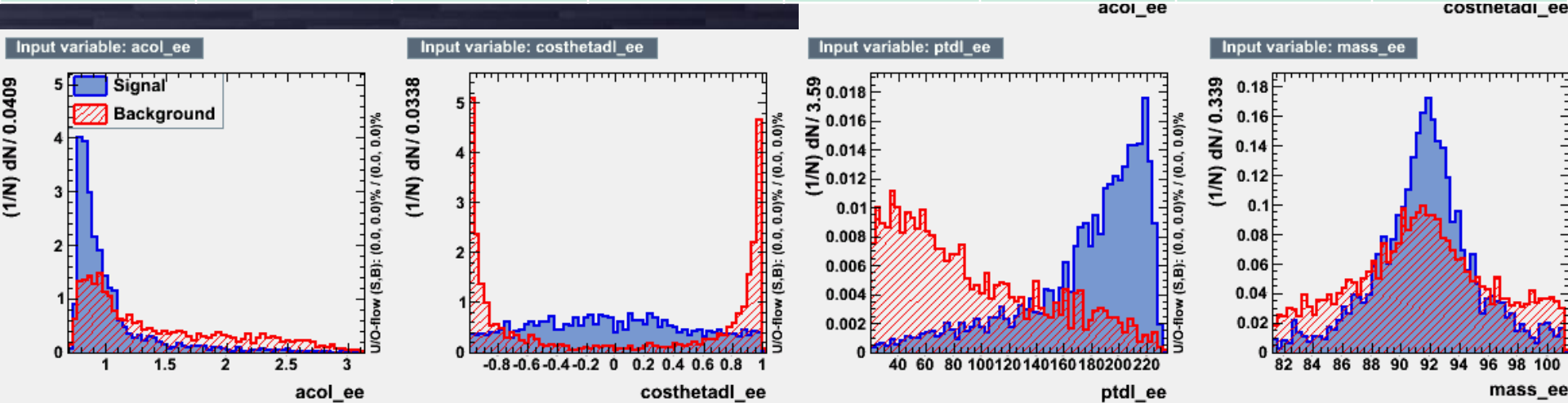
# ee: brems recovery

all neutral particle at  $\cos\theta > 0.99$  are added

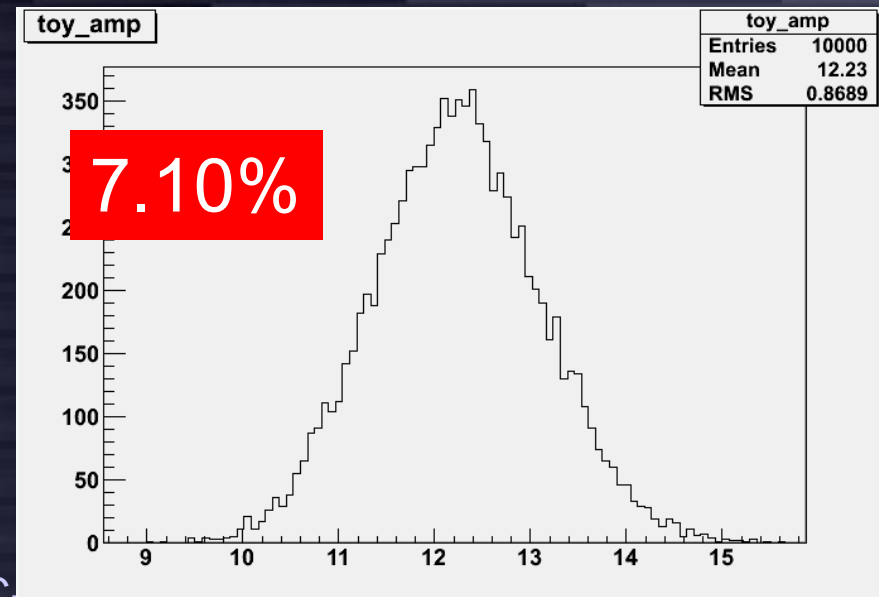
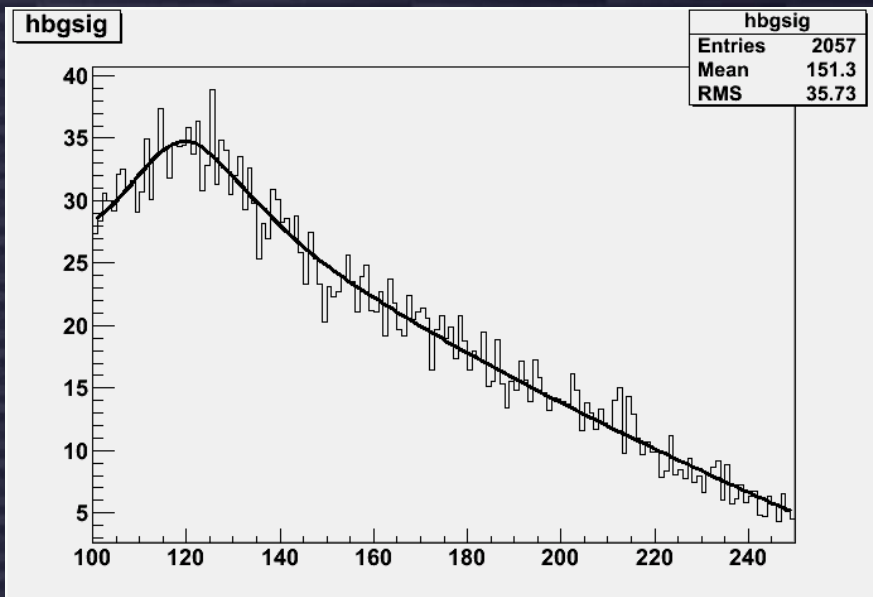
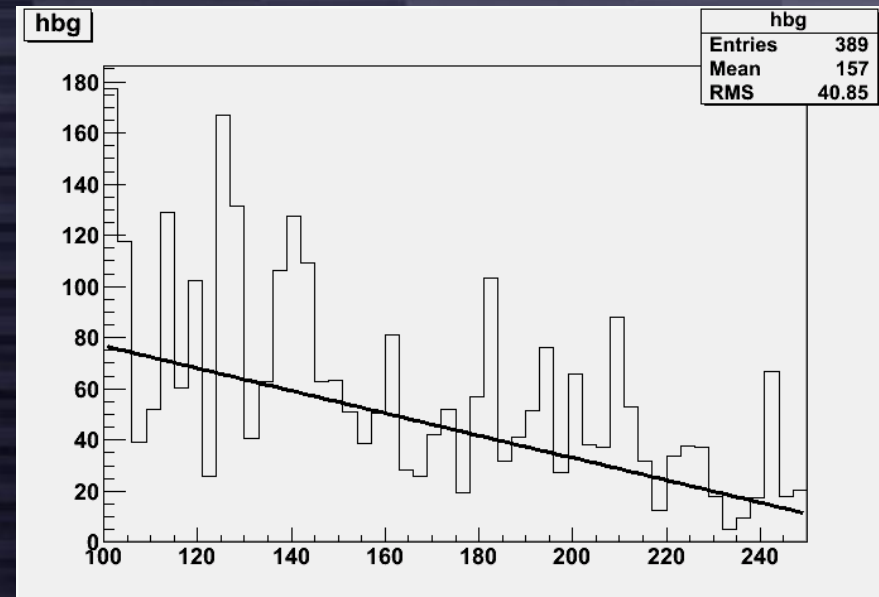
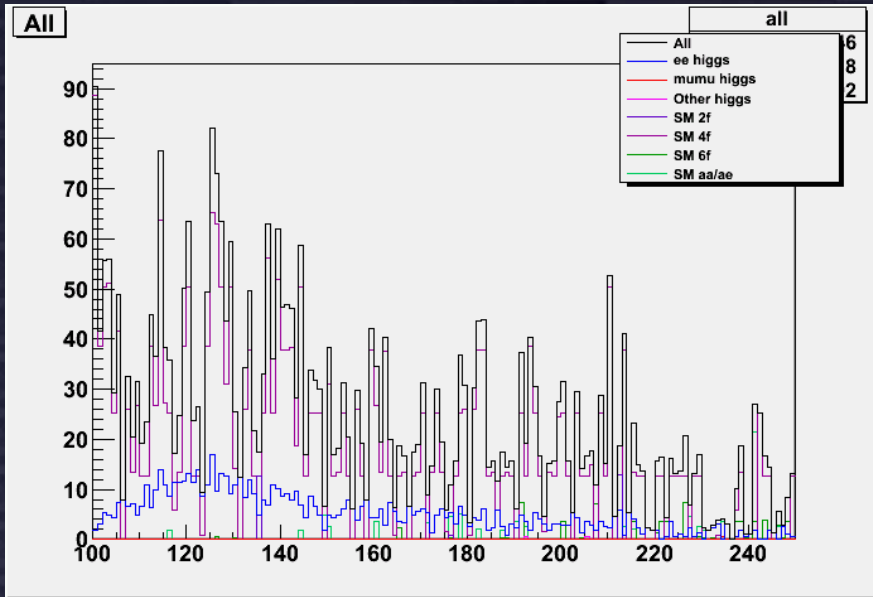


# ee: cut table

cut	eeh	mmh	ooh	2f	4f	6f	o
e>=2	4582	76	6241	500994	1.6e+4	94156	413309
z mass	1654	2.3	559	18976	151032	14827	15562
ptdl>20	1627	2.0	459	12987	115384	12983	11496
recoil	1126	0.6	14	478	31324	443	1278
acop	1118	0.6	14	426	30123	429	1193
ptbal	1113	0.6	14	388	28417	417	1154
l>0.9	757	0.6	1.4	26	2763	66	84



# ee: recoil fit



# Summary

- mmh: 6.49%
- eeh: 7.10%
  
- combined: 4.8%
  
- Have to improve statistics
  - signal (Miyamoto-san)
  - 2f, 4f (SGV: not prepared)
  - 1f\_3f (SGV: prepared)