ZH Branching ratio study at 350 GeV

ILC physics and software meeting
Nov. 19. 2010

H. Ono (NDU)

Current status

- llH mode analysis
  - llH lepton ID + di-jet clustering is re-applied for DST file
    - Sorry to occupy CPU nodes for a long time
  - Next : Optimize selection criteria for 350 GeV
    and apply BG reduction and evaluate BR measurement accuracy

- Compare with luminosity scaling
  - beam parameter dependence is checked for 250 and 350 GeV

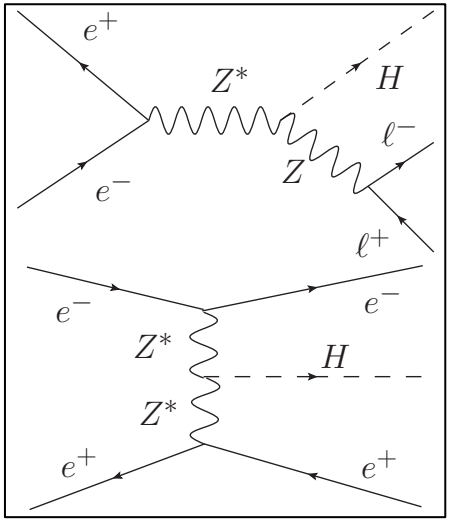
llH mode analysis

llH analysis procedure: di-lepton + di-jet reconstruction

Electron/Muon identification

1. Lepton isolation + track energy selection
2. Calorimeter energy deposit fraction information

If # of candidates > 2 :
select di-lepton mass is closest to Mz pair



BG reduction should apply after the di-lepton identification

Signal : eeH/μμH
BG : llqq, vlqq

Mode	Ecm=250GeV	Ecm=350GeV
llH (eeH/μμH/ττH)	34.60 fb (12.55/11.66/10.39 fb)	25.25 fb (10.96/7.16/7.14 fb)

t-channel diagram contribution

Peak luminosity dependence

Luminosity difference is considered with following beam parameters

Reference value : $L_{peak}=2.0\times10^{34}cm^{-2}s^{-1}$, $L_{int}=500\ fb^{-1}$ at RDR 500 GeV

	RDR (LOI)			SB2009 w/ TF			NB w/TF		
Ecm (GeV)	250	350	500	250	350	500	250	350	500
Peak L ($10^{34}\ cm^{-2}s^{-1}$)	0.75	1.2	2.0	0.27	1.0	2.0	0.8	1.0	2.0
Integrated L (fb^{-1})	187.5	300	500	67.5	250	500	200	250	500

NB : New baseline parameter

Production cross section with beam polarization (e+,e-)=(+30%, -80%)

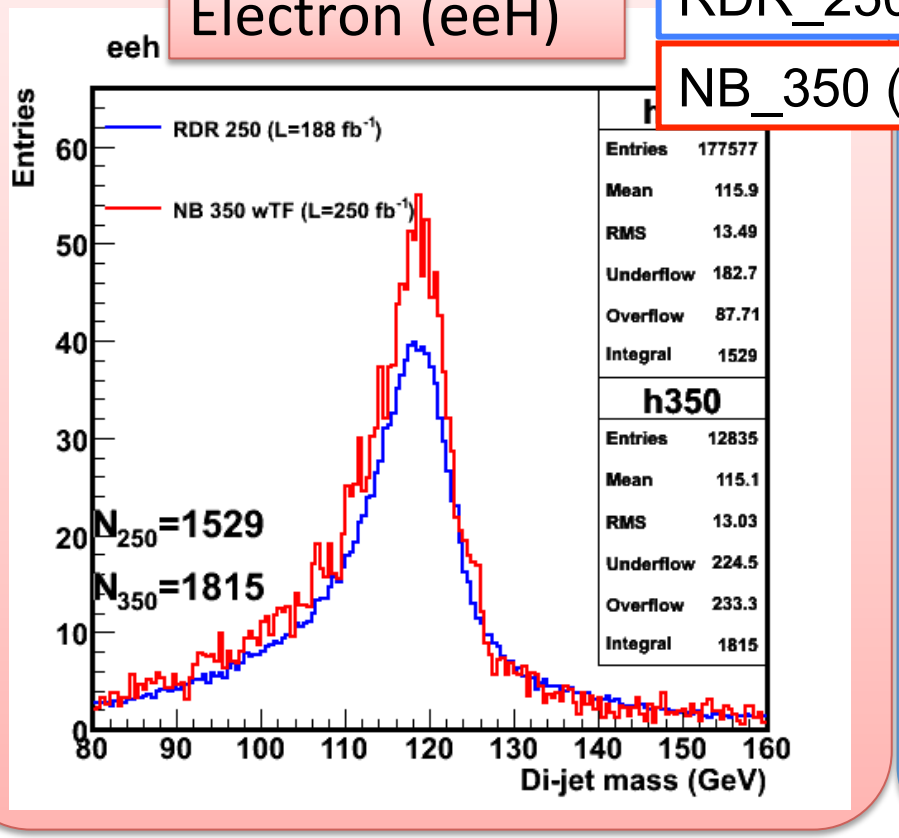
Di-jet mass (M_H) distribution

Di-jet mass reconstruction after the di-lepton identification

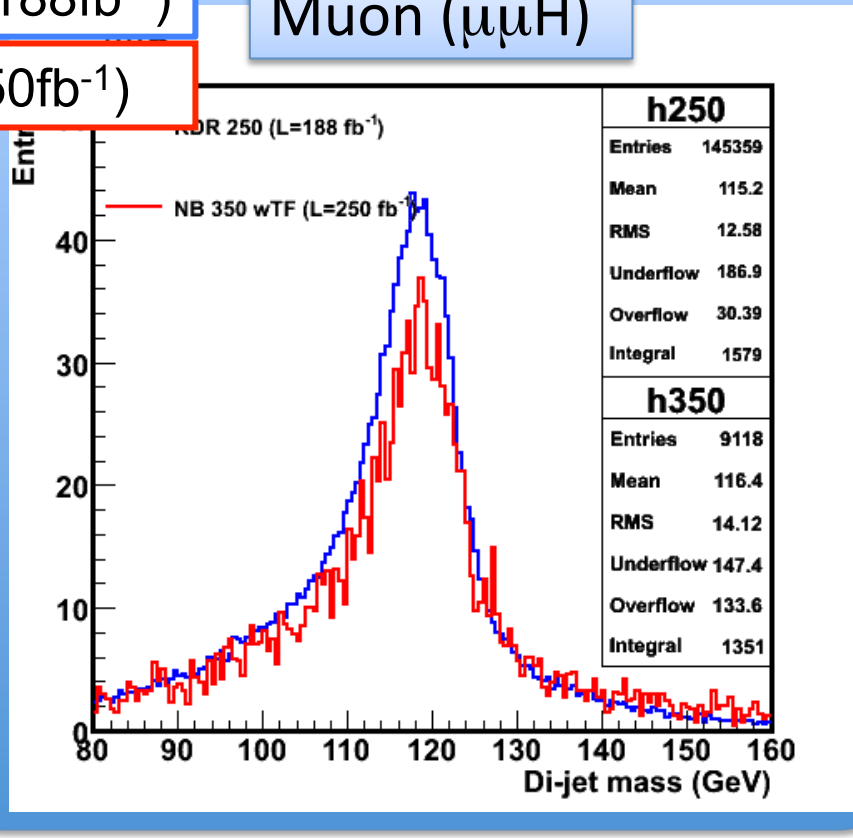
RDR_250 (188fb^{-1})

NB_350 (250fb^{-1})

Electron (eeH)



Muon ($\mu\mu$H)



Larger cross section in eeH at 350 GeV from the t-channel contribution

Smoothness difference comes from lower statistics in 350GeV sample

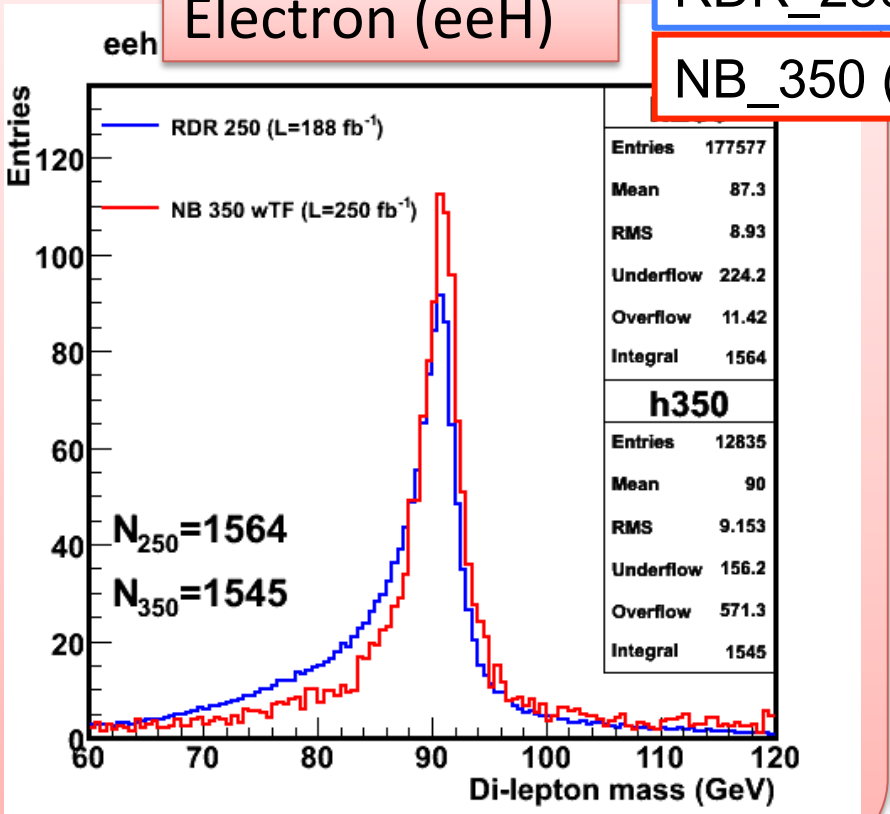
Di-lepton mass (M_Z) distribution

Di-jet mass reconstruction after the di-lepton identification

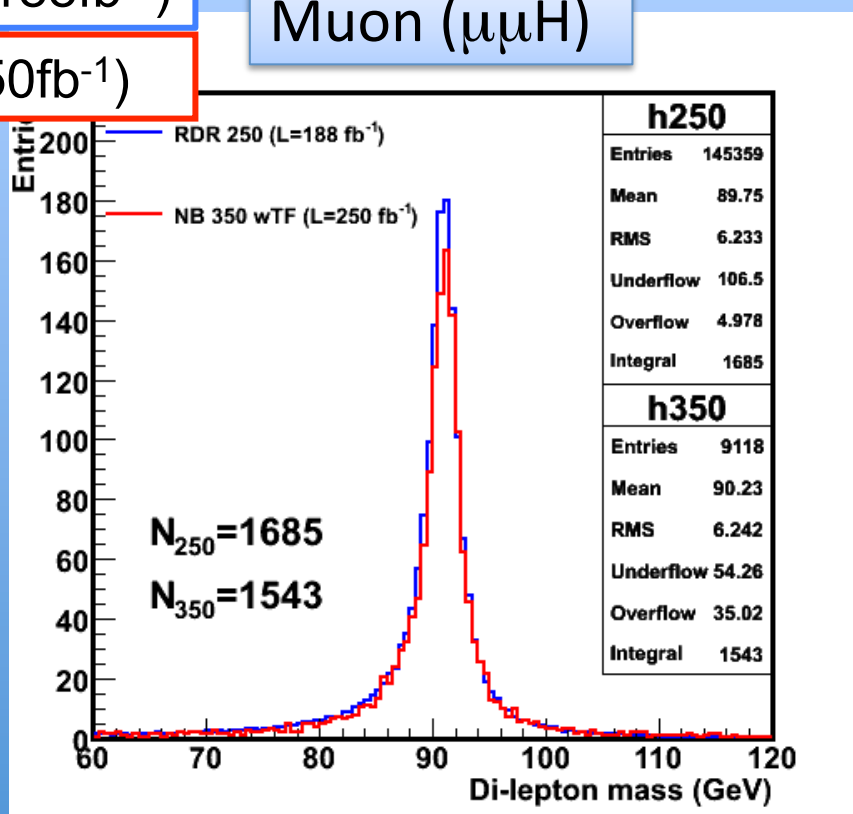
RDR_250 (188fb^{-1})

NB_350 (250fb^{-1})

Electron (eeH)



Muon ($\mu\mu$H)



Larger lower tail in 250 GeV
PFA EM track-cluster matching performance?

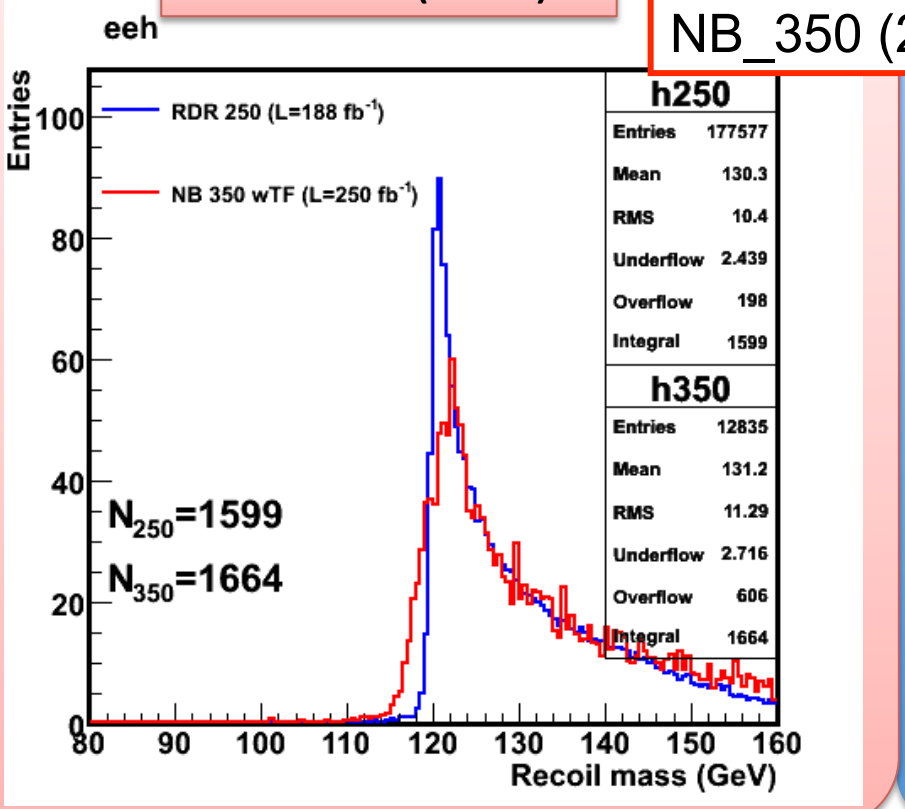
Significant difference does not observed in $\mu\mu$H mode

Recoil mass (M_H) distribution

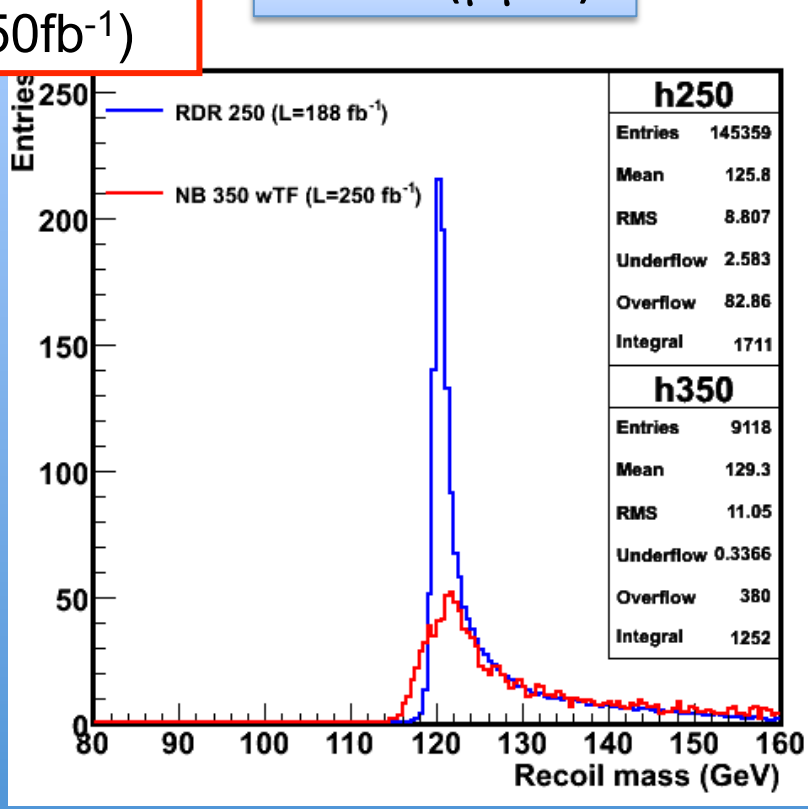
RDR_250 (188fb^{-1})

NB_350 (250fb^{-1})

Electron (eeH)



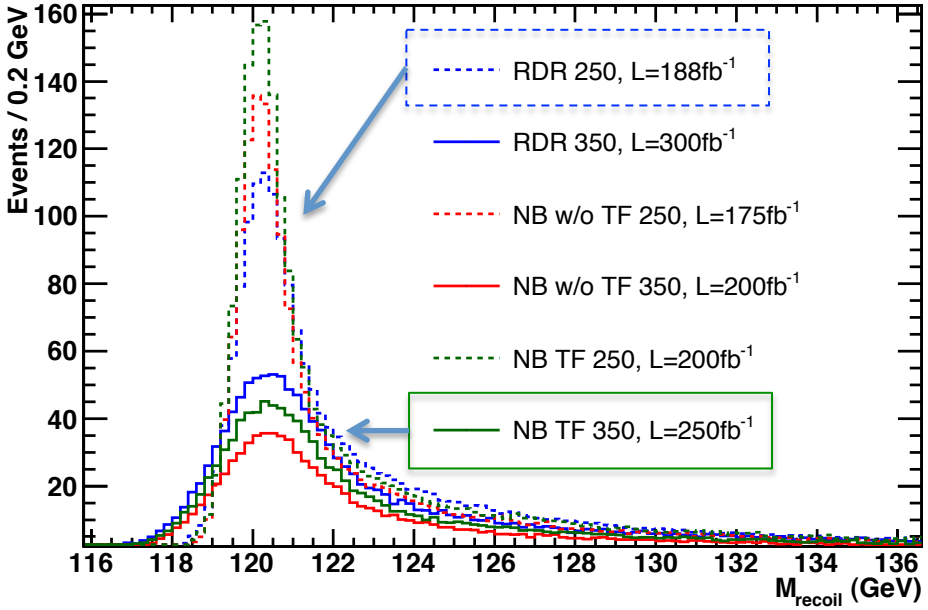
Muon ($\mu\mu$H)



No treatment for the beam energy spread and ISR/Brems. photons.
Significant advantage for the Higgs mass/x-section measurement with the recoil mass from the narrower distribution in 250 GeV

Comparison with recoil mass study

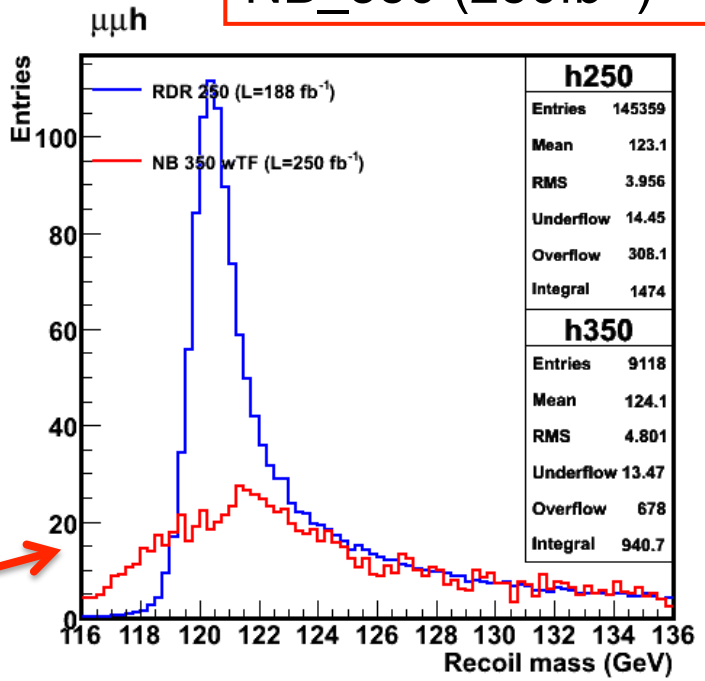
Li's recoil mass analysis in μμH with fast sim



Full simulation sample comparison

RDR_250 (188fb^{-1})

NB_350 (250fb^{-1})



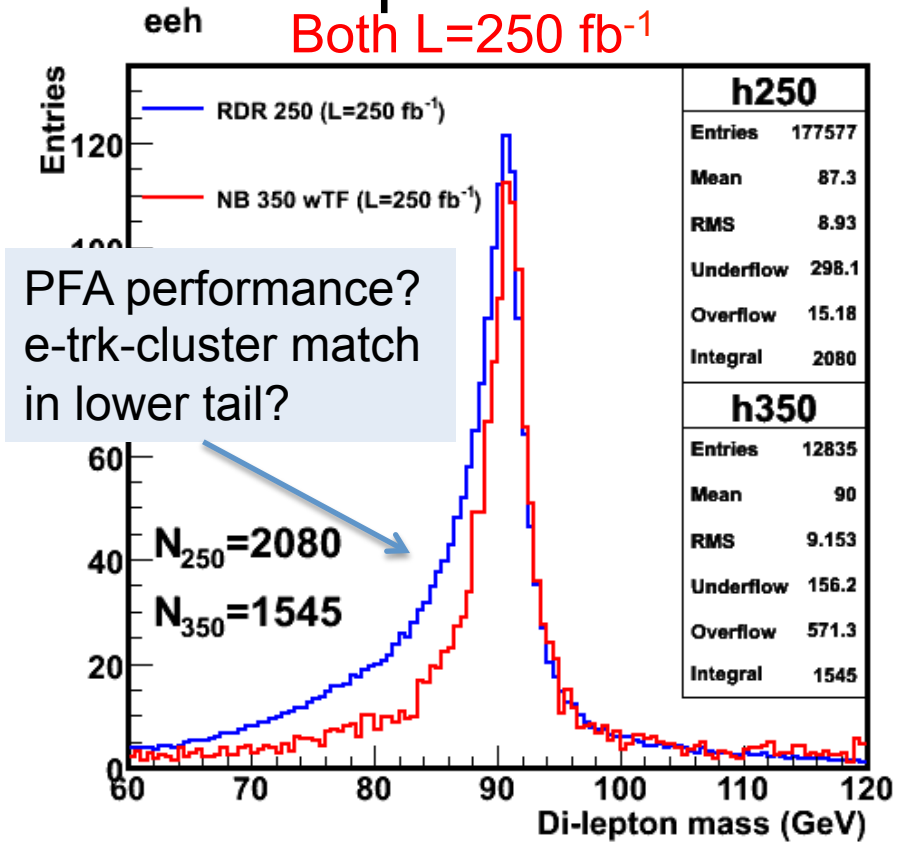
- One difference reason will comes from the low statistics of 350 GeV samples
- Other reason will comes from the different lepton identification cuts
- Beam energy spread and bremsstrahlung contribution in 350 GeV?

arXiv:1007.3008v1 [hep-ex]

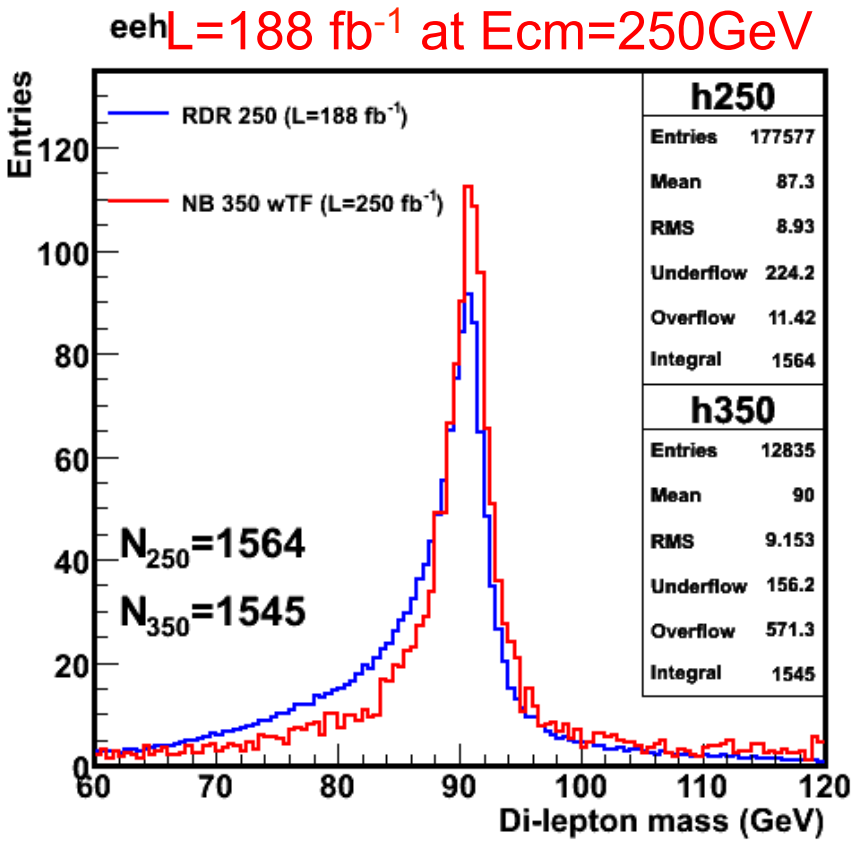
Backup

eeH mode di-lepton mass distribution

Di-lepton mass distribution after di-electron ID



PFA performance?
e-trk-cluster match
in lower tail?

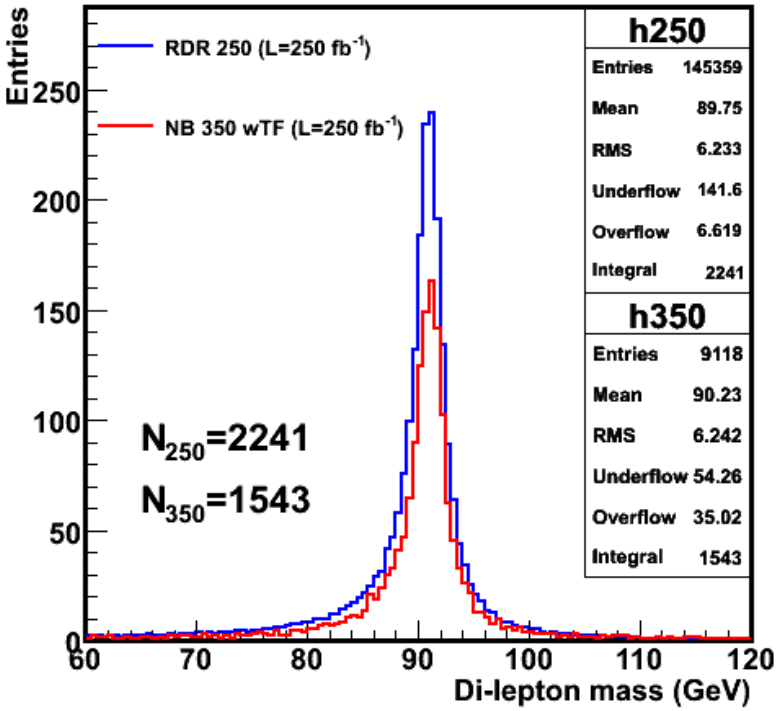


Mode	Ecm=250GeV	Ecm=350GeV
eeH/μμH/ττH	12.55/11.66/10.39 fb	10.96/7.16/7.14 fb

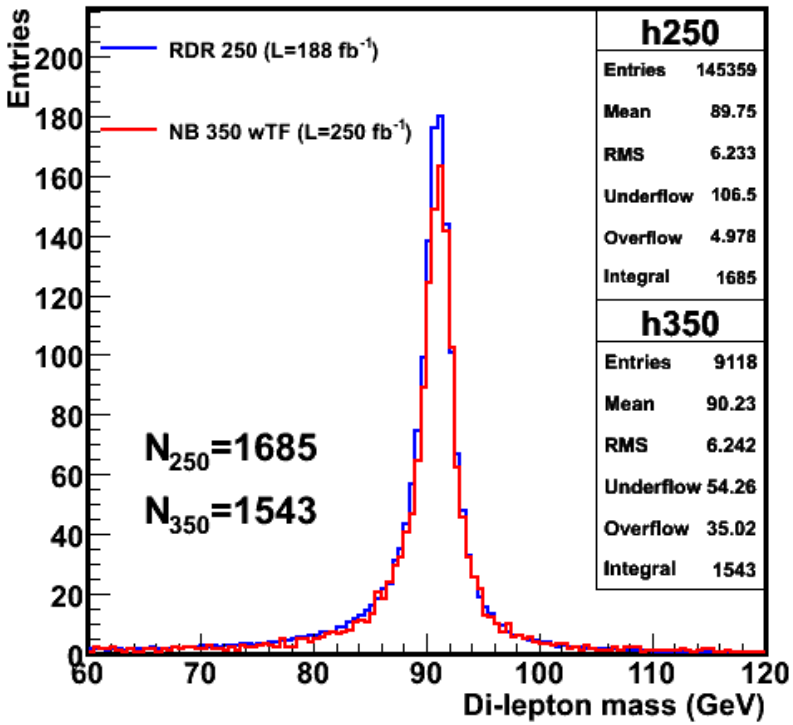
μμH mode di-lepton mass distribution

Di-lepton mass distribution after di-electron ID

μμh Both L=250 fb^{-1}



μμh L=188 fb^{-1} at Ecm=250GeV

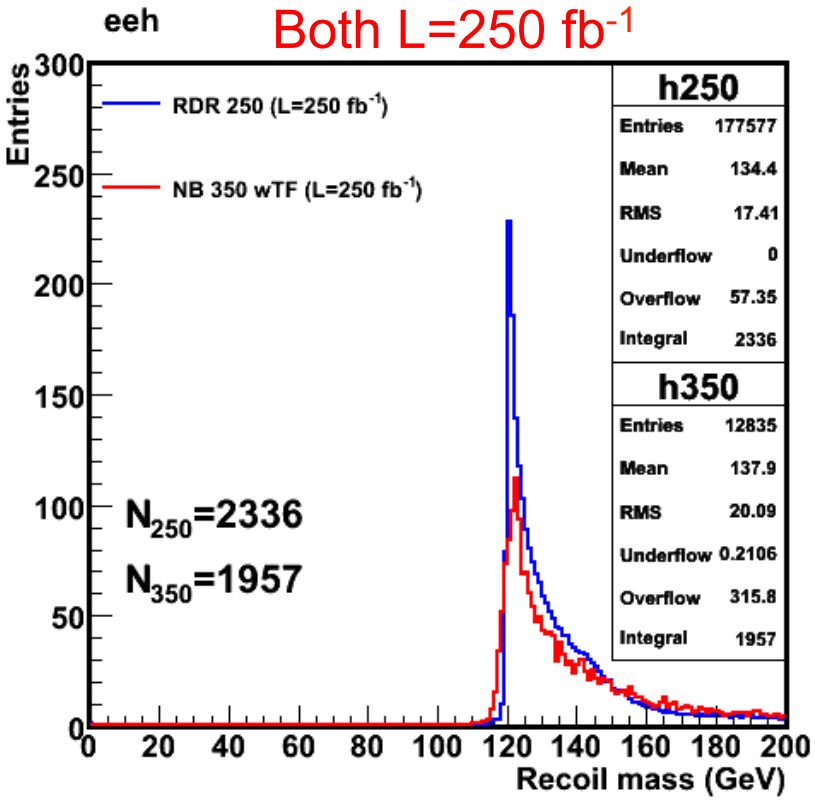


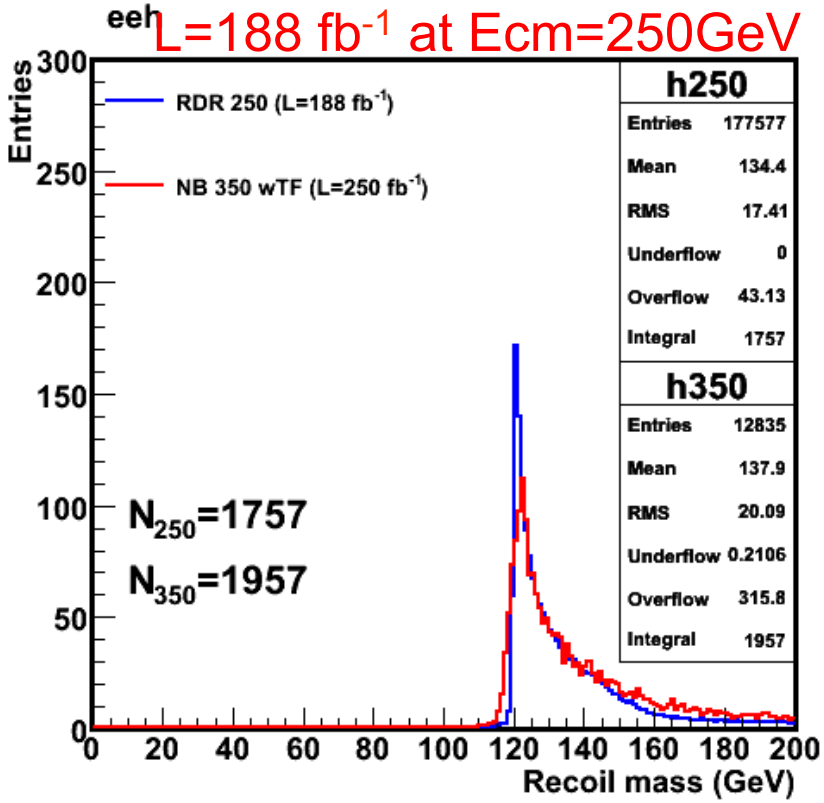
No significant difference is observed in Z→μμ distribution

Mode	Ecm=250GeV	Ecm=350GeV
eeH/μμH/ττH	12.55/11.66/10.39 fb	10.96/7.16/7.14 fb

eeH mode

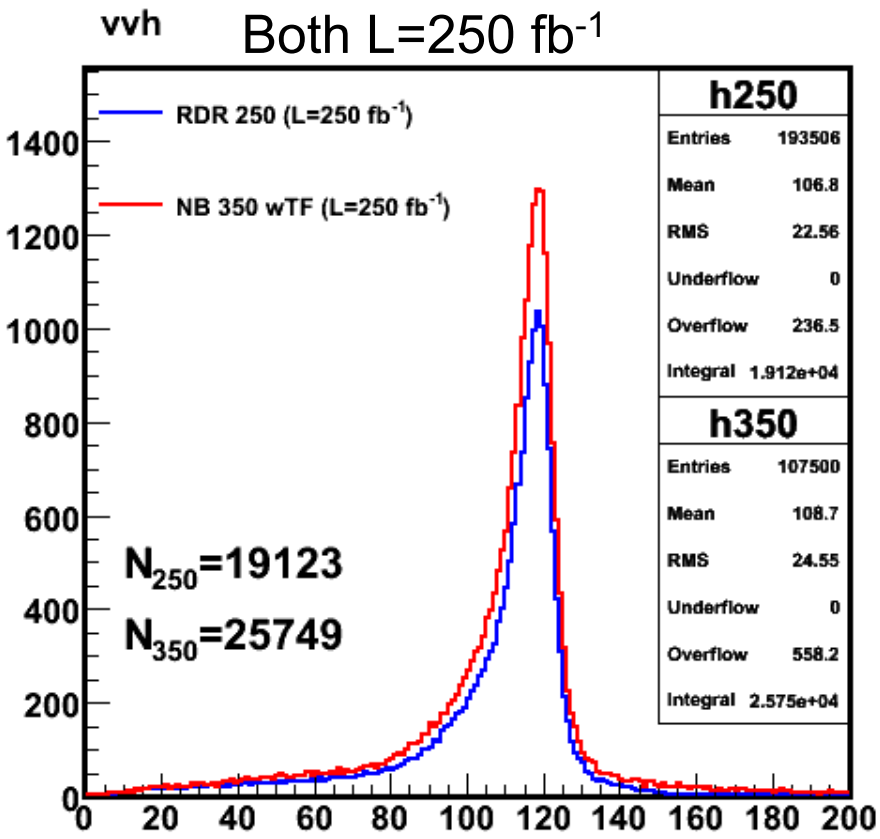
Recoil mass distribution after di-electron ID

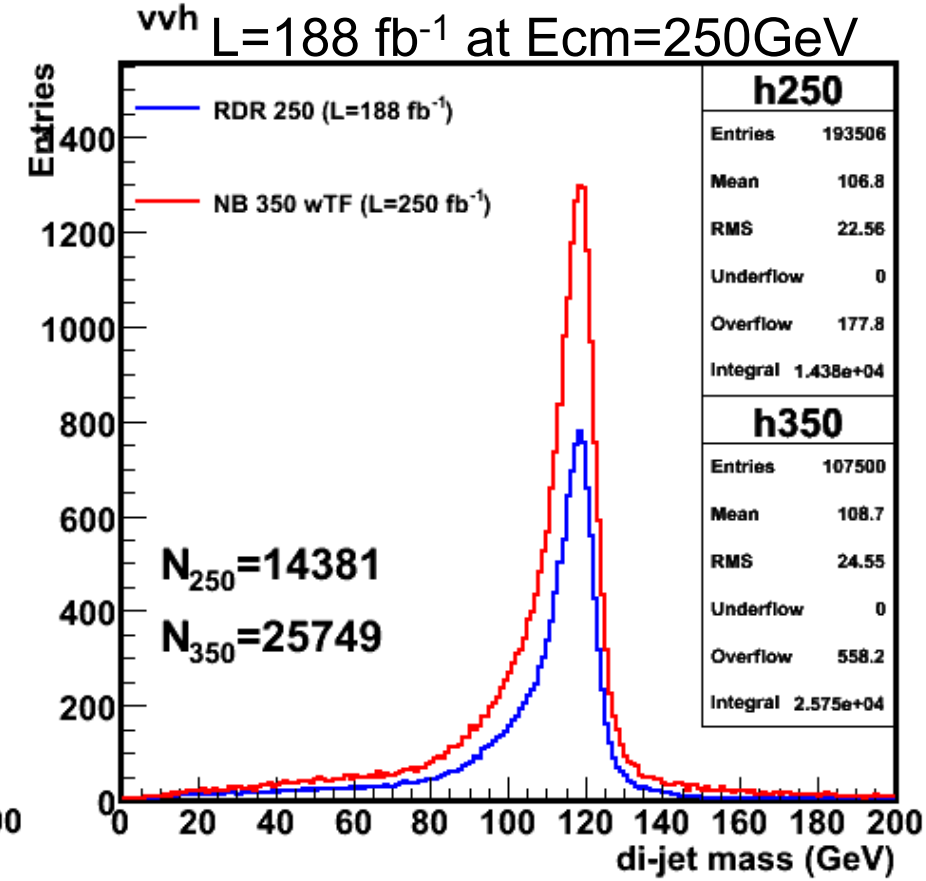




vvH sample luminosity comparison

Higgs candidate di-jet mass distribution without selection criteria

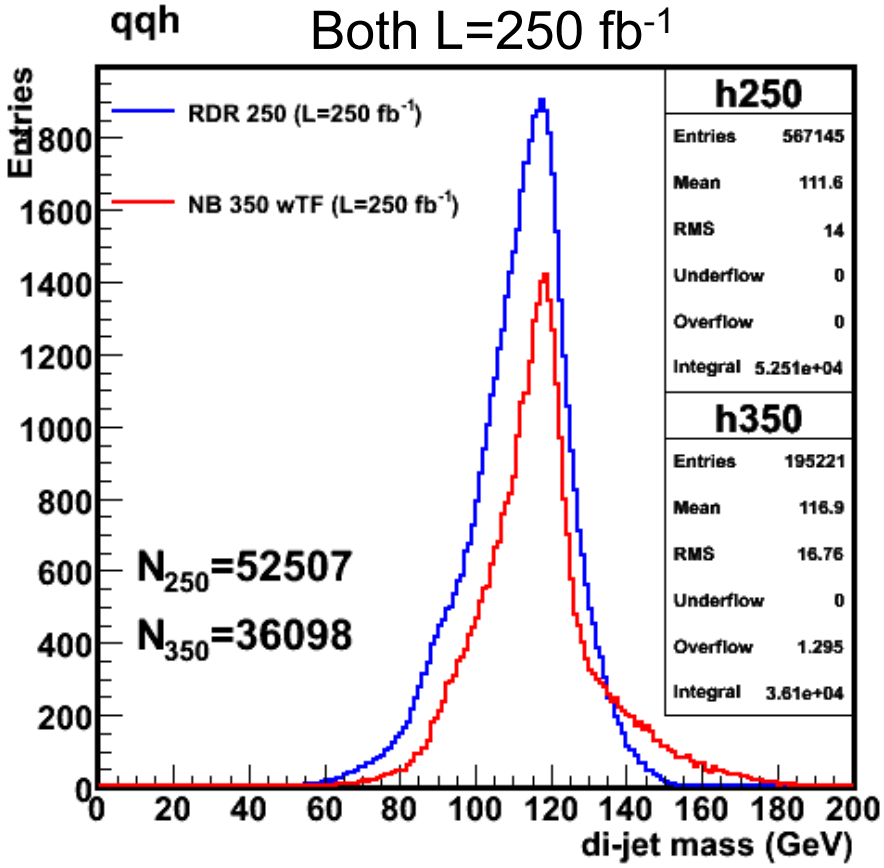


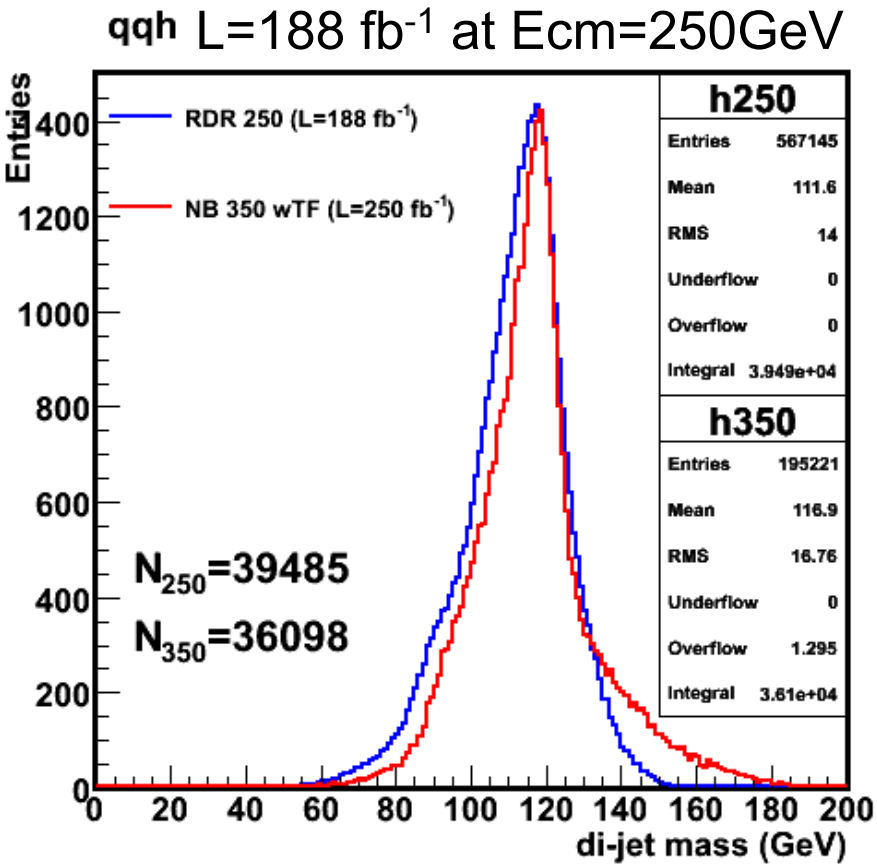


Without any selections. Difference becomes large
because of increasing the t-channel contribution at 350 GeV (Larger x-sec)

qqH sample luminosity comparison

Higgs candidate di-jet mass distribution without selection criteria





llH analysis is still on-going, next compare with recoil mass distribution