Weekly meeting

Xiaohu Sun

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05-01-2016

IHEP

Zy

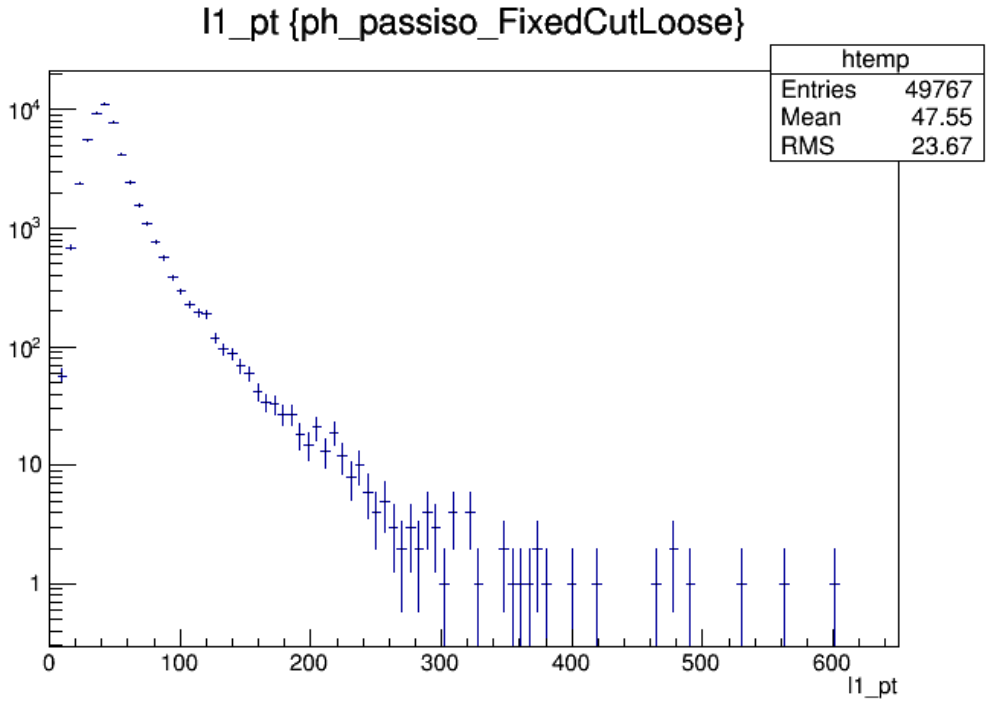
HIGG1D2 is used

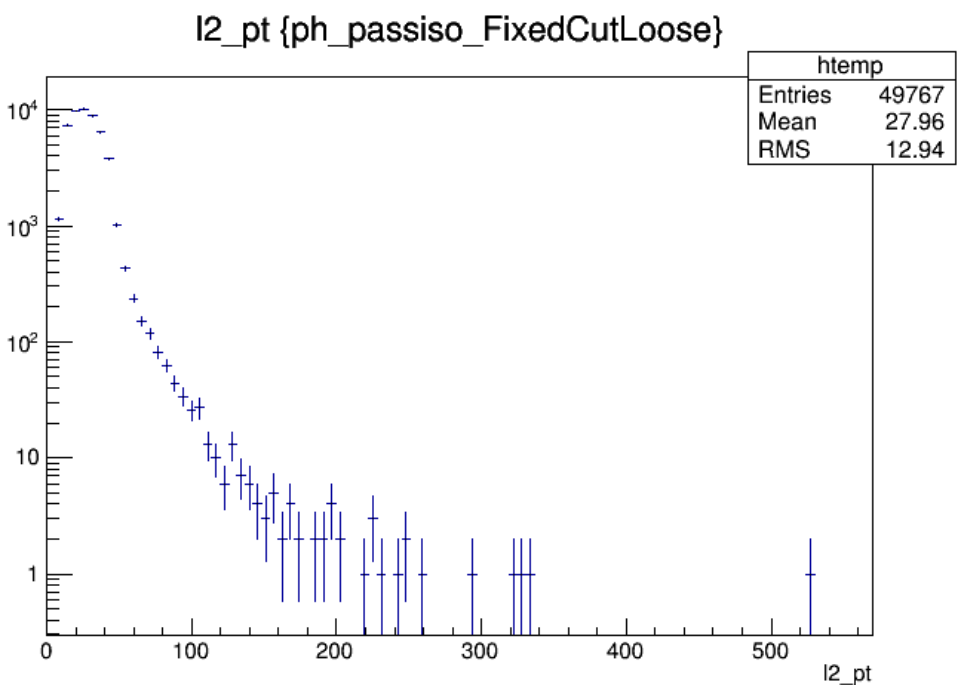
- 109300 events from mini-ntuples directly
- Assume all cuts applied
- Assume all calibration done
- The selection is the following:

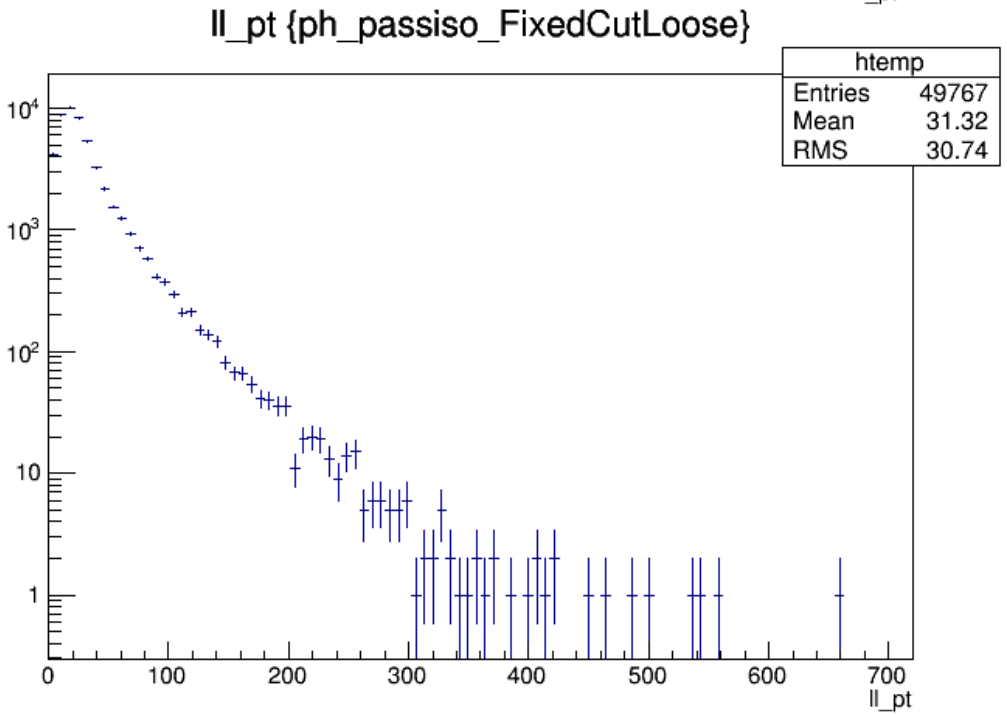
ISO (FixedCutLoose)
ETCone20 < 0.065 ET
PTCone20 < 0.05 pT

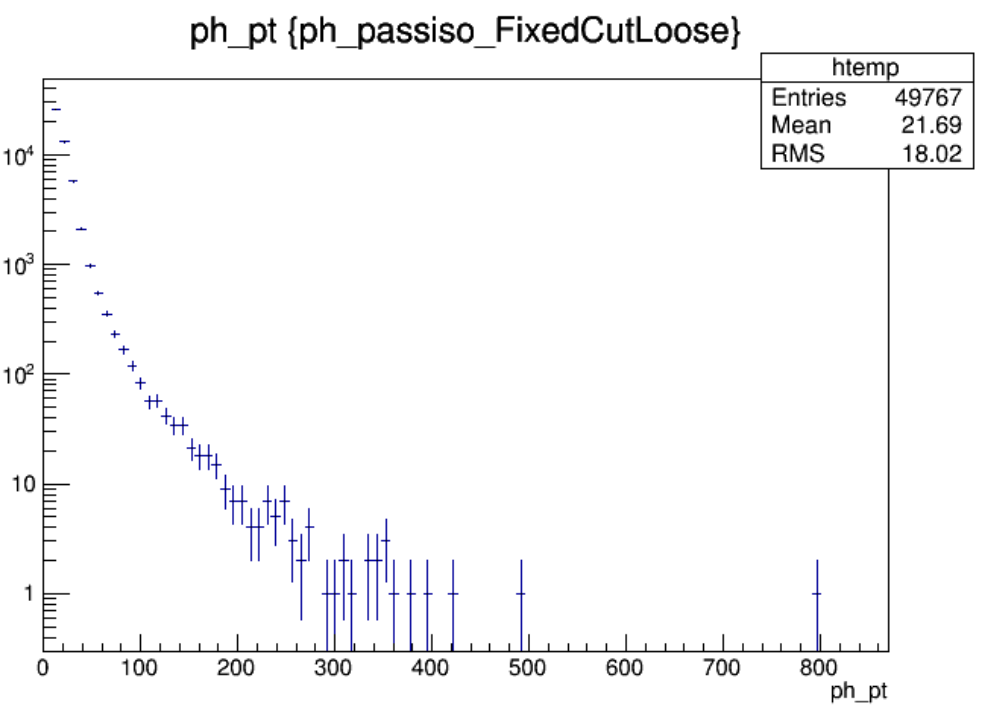
  - at least one photon with ET>9.5 GeV and |eta|<2.5 GeV
  - at least two leptons with opposite charge and invariant mass>40 GeV
  - electron selection: medium, |eta|<2.5, pT>9.5 GeV
  - muon selection: pt>9.5 GeV |eta|<2.7 && good muon (pass cuts on number of hits)

Leptons, ll and photon [FixedCutLoose]

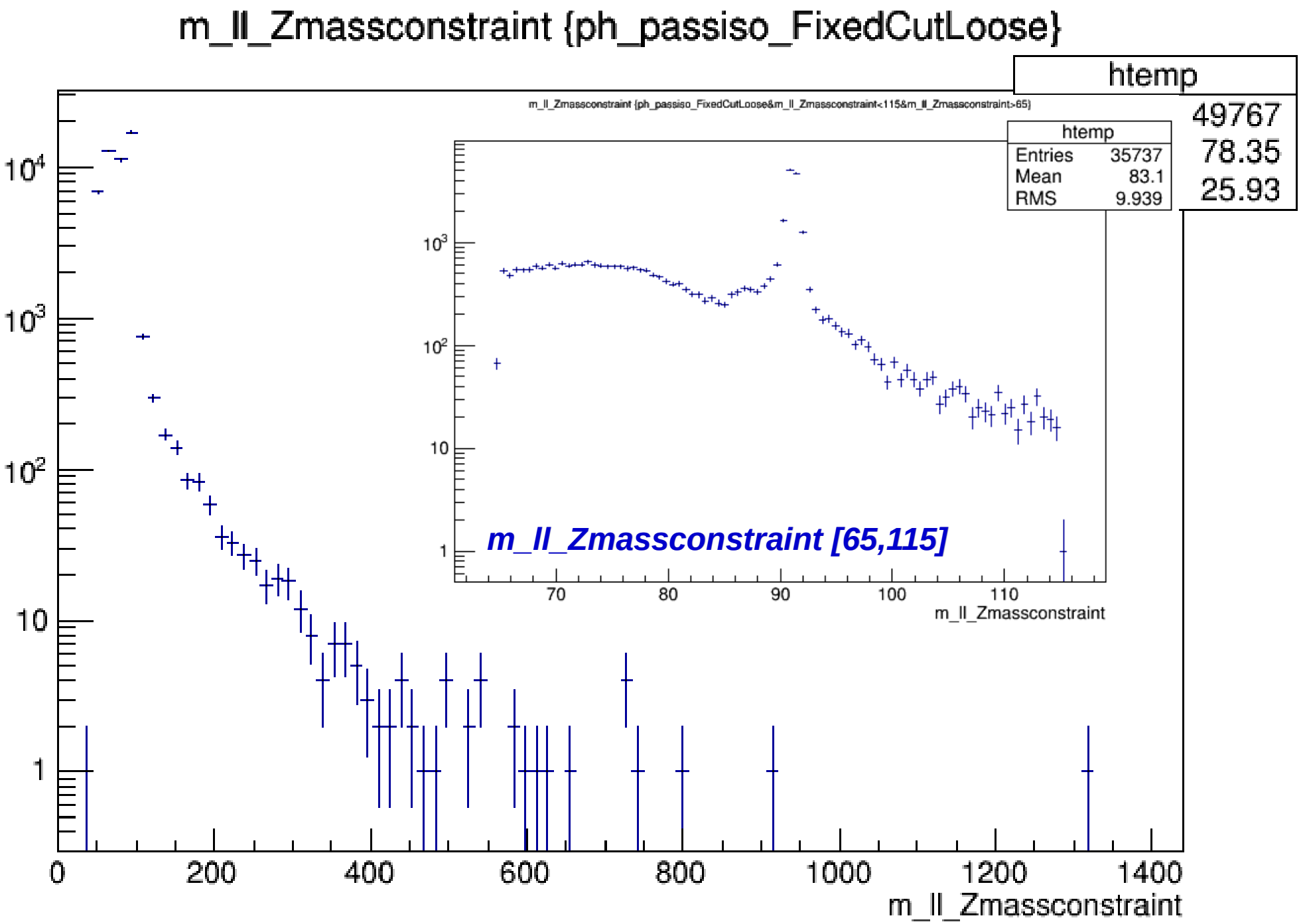








m_ll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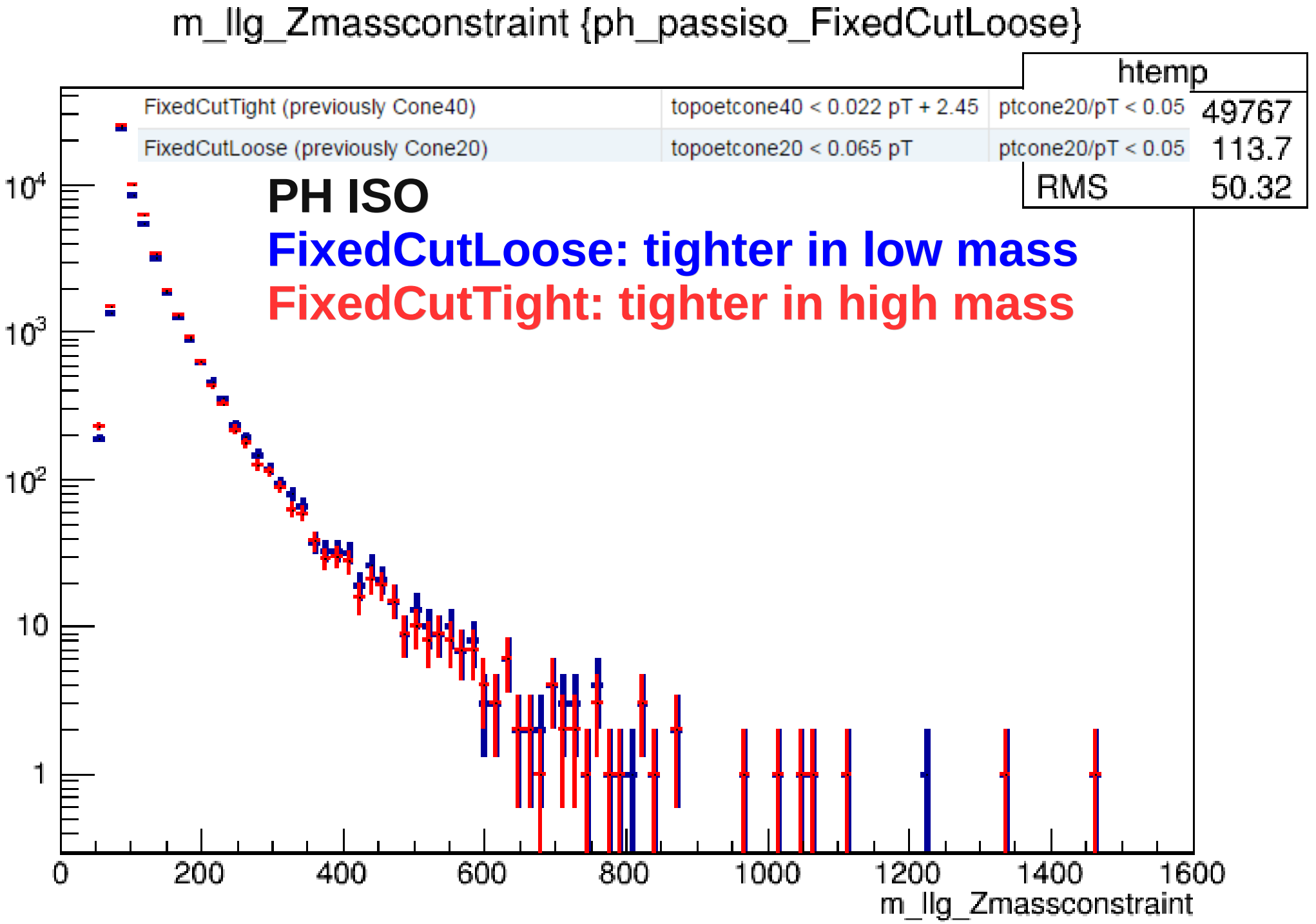
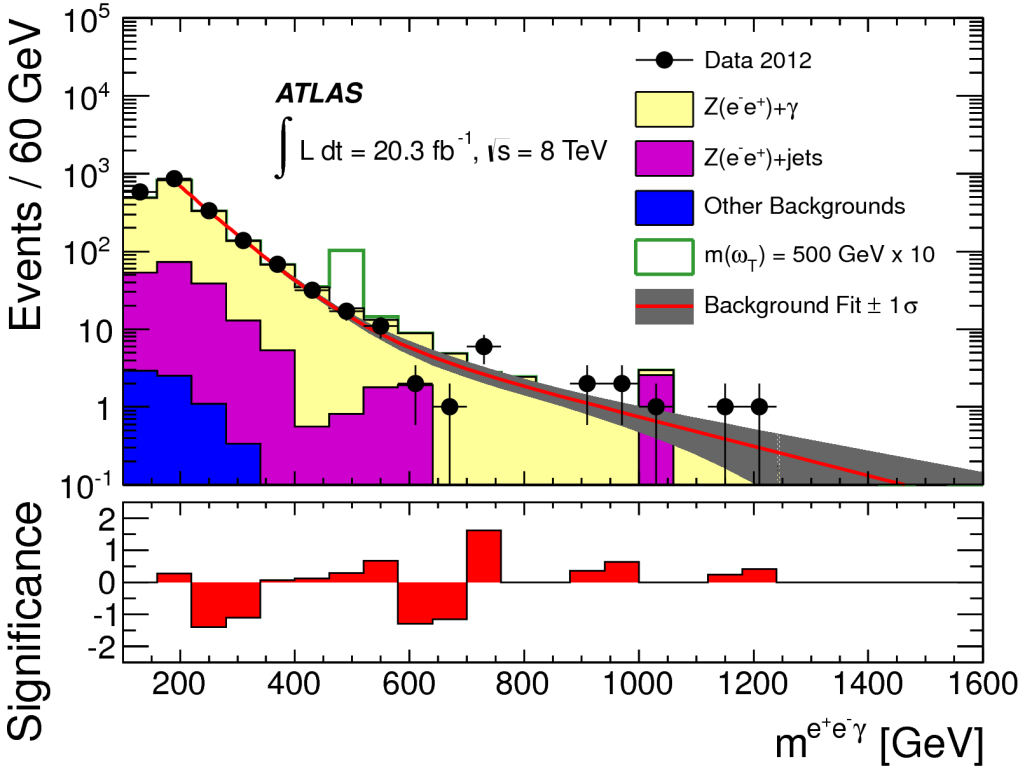
htemp
49767
78.35
25.93
m_ll_Zmassconstraint {ph_passiso_FixedCutLoose&m_ll_Zmassconstraint<115&m_ll_Zmassconstraint>65}
htemp
Entries 35737
Mean 83.1
RMS 9.939
m_ll_Zmassconstraint [65,115]
m_ll_Zmassconstraint
m_ll_Zmassconstraint

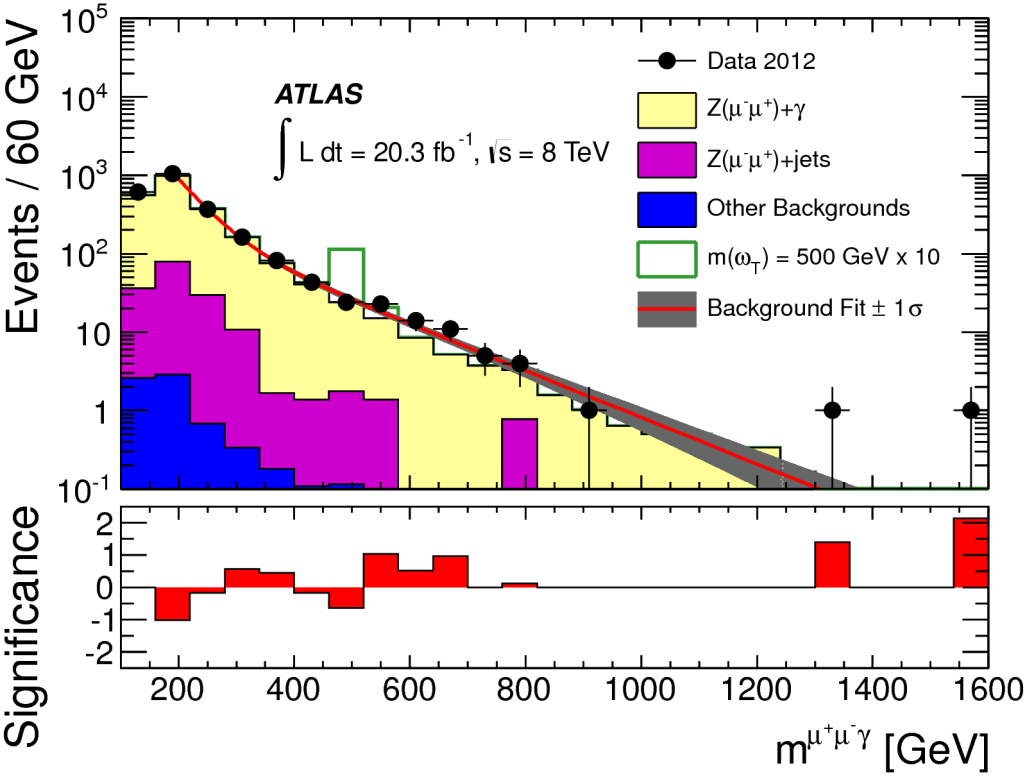
m_llg


m_llg_Zmassconstraint {ph_passiso_FixedCutLoose}
htemp
FixedCutTight (previously Cone40) topoetcone40 < 0.022 pT + 2.45 ptcone20/pT < 0.05 49767
FixedCutLoose (previously Cone20) topoetcone20 < 0.065 pT ptcone20/pT < 0.05 113.7
RMS 50.32
PH ISO
FixedCutLoose: tighter in low mass
FixedCutTight: tighter in high mass
10^4
10^3
10^2
10
1
0
200
400
600
800
1000
1200
1400
1600
m_llg_Zmassconstraint

8TeV high mass searches

- https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/EXOT-2013-09/



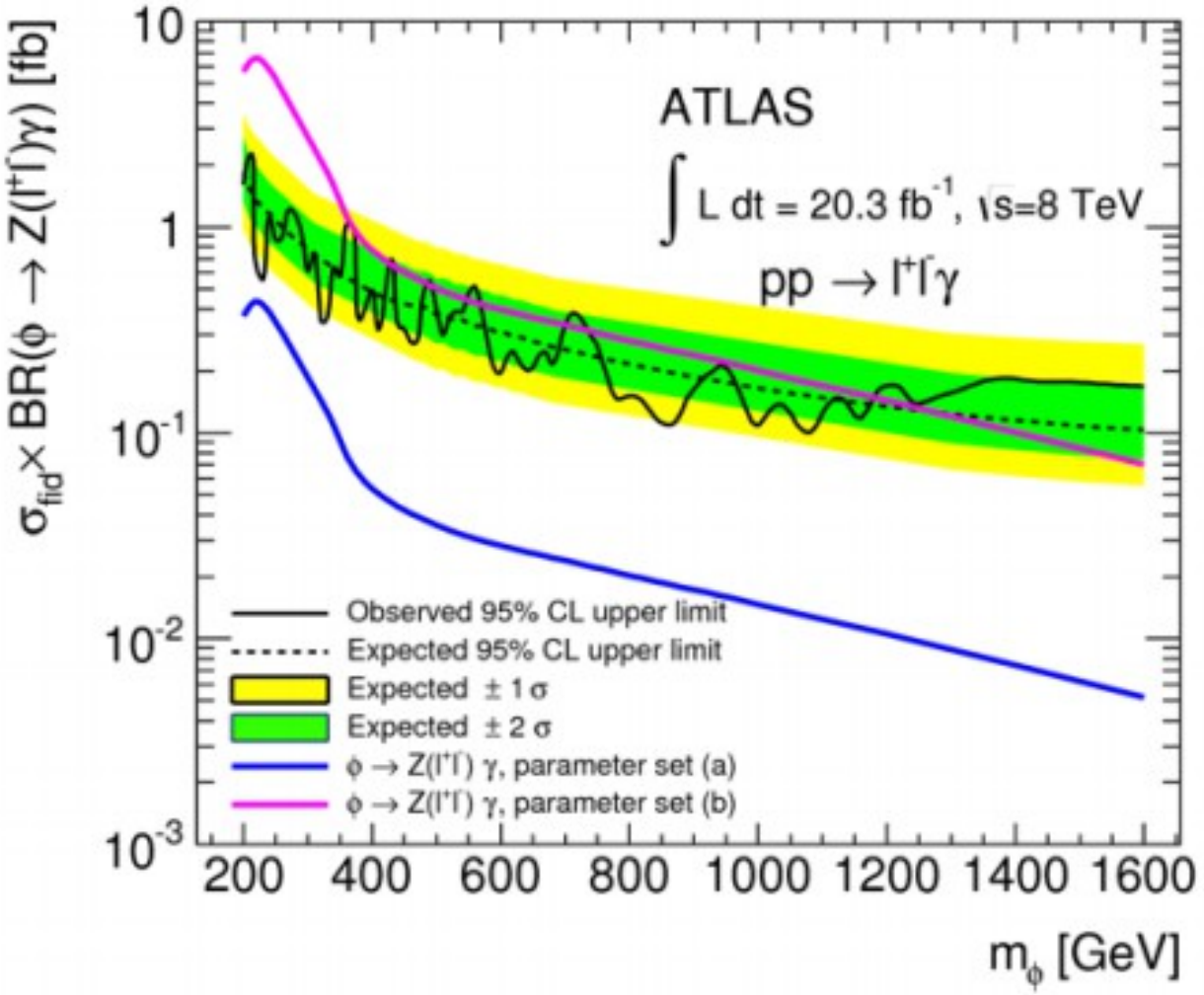


A small excess in ***electron*** channel only

Run1 result

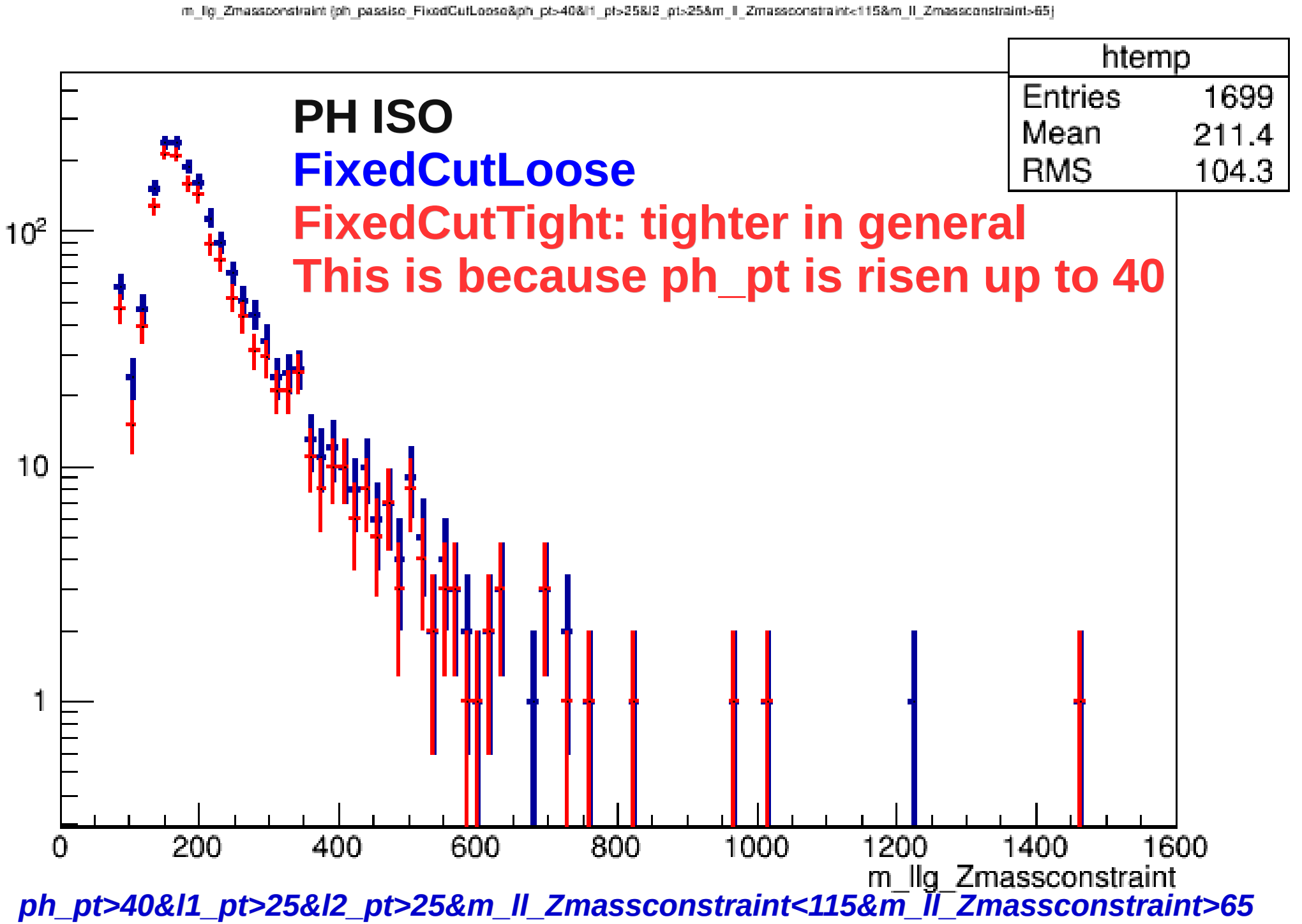
- On 8 TeV dataset (PLB 738 (2014) 428-447)
  - $p_T(l)>25$ GeV, $p_T(\gamma)>40$ GeV, $\Delta R(l,\gamma)>0.7$, m_{ll} in 65-115 GeV
  - 1σ local excess at ~700 GeV, down to 0σ at ~750 GeV

ISO
ETCone20<0.2ET
PTCone20<0.3PT



Apply RUN I cuts to RUN II data

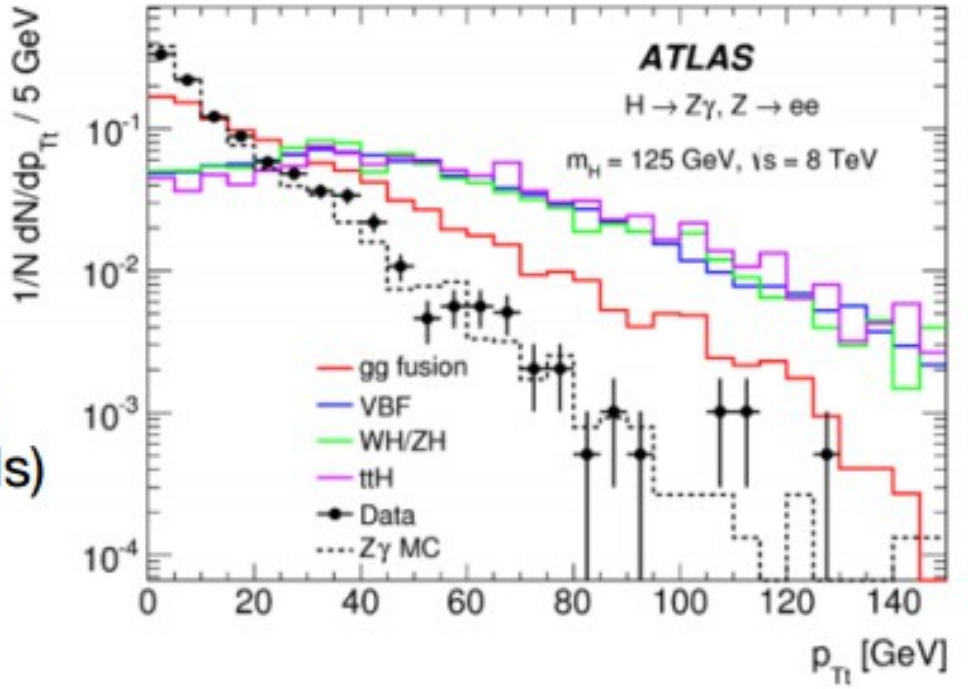
High mass searches

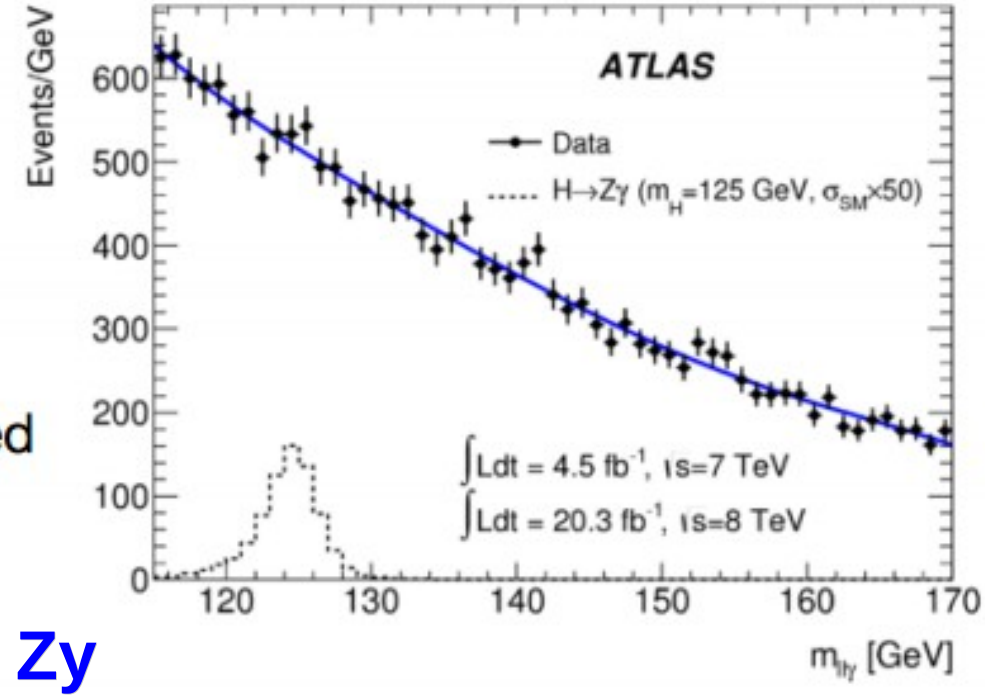


ph_pt>40&l1_pt>25&l2_pt>25&m_ll_Zmassconstraint<115&m_ll_Zmassconstraint>65

Run1 analysis in a nutshell

- Selection (effs~30%): PH ISO ETCone40<4GeV
  - lepton triggers
  - lepton and γ selection similar to H→4l and H→γγ (except kinematic thresholds)
    - p_T^l>10 GeV, p_T^γ>15 GeV
  - invariant mass cut on ll system
- Event classification
  - categories based on Z-γ pseudo rapidity difference and Higgs pTt
- Signal extraction:
  - fit to llγ invariant mass, bkg model fixed from spurious signal studies, bkg parameters floating in fit



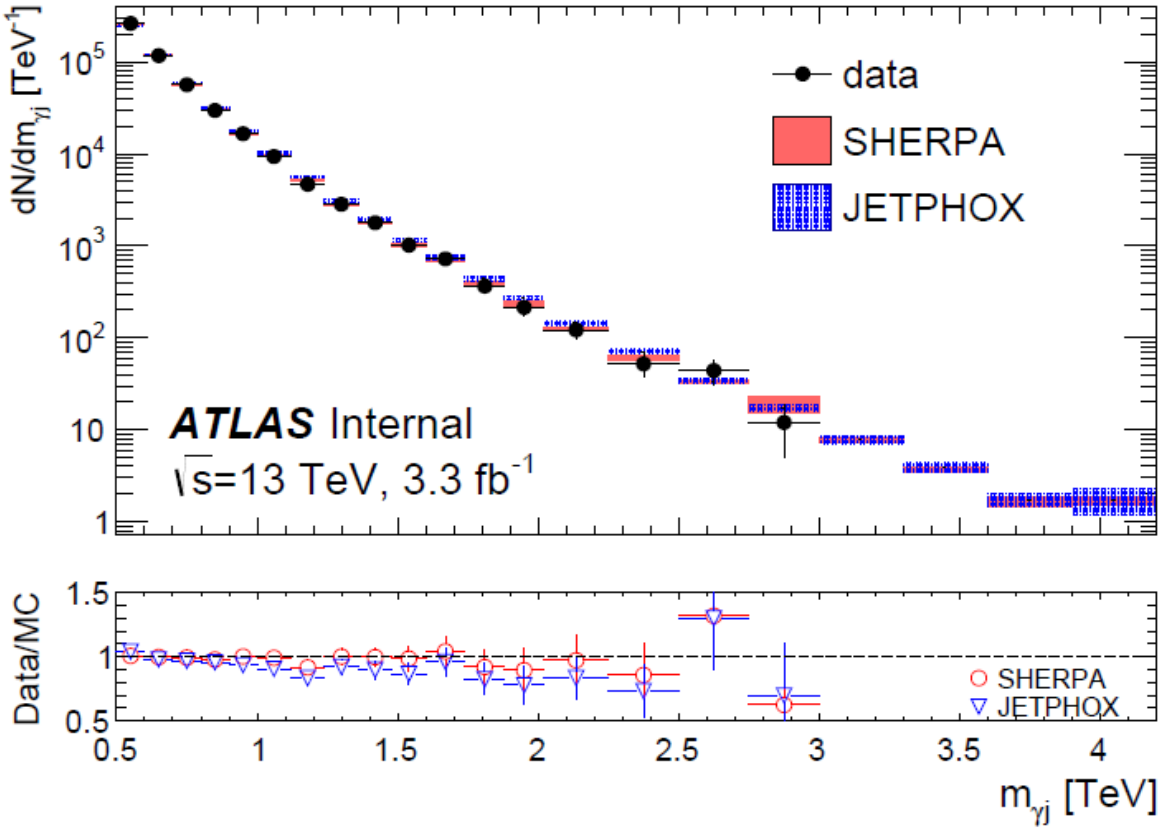


NOT high mass, only SM Higgs Zy
Phys. Lett. B 732C (2014), pp. 8-27

y+jets

Look at y+jets events

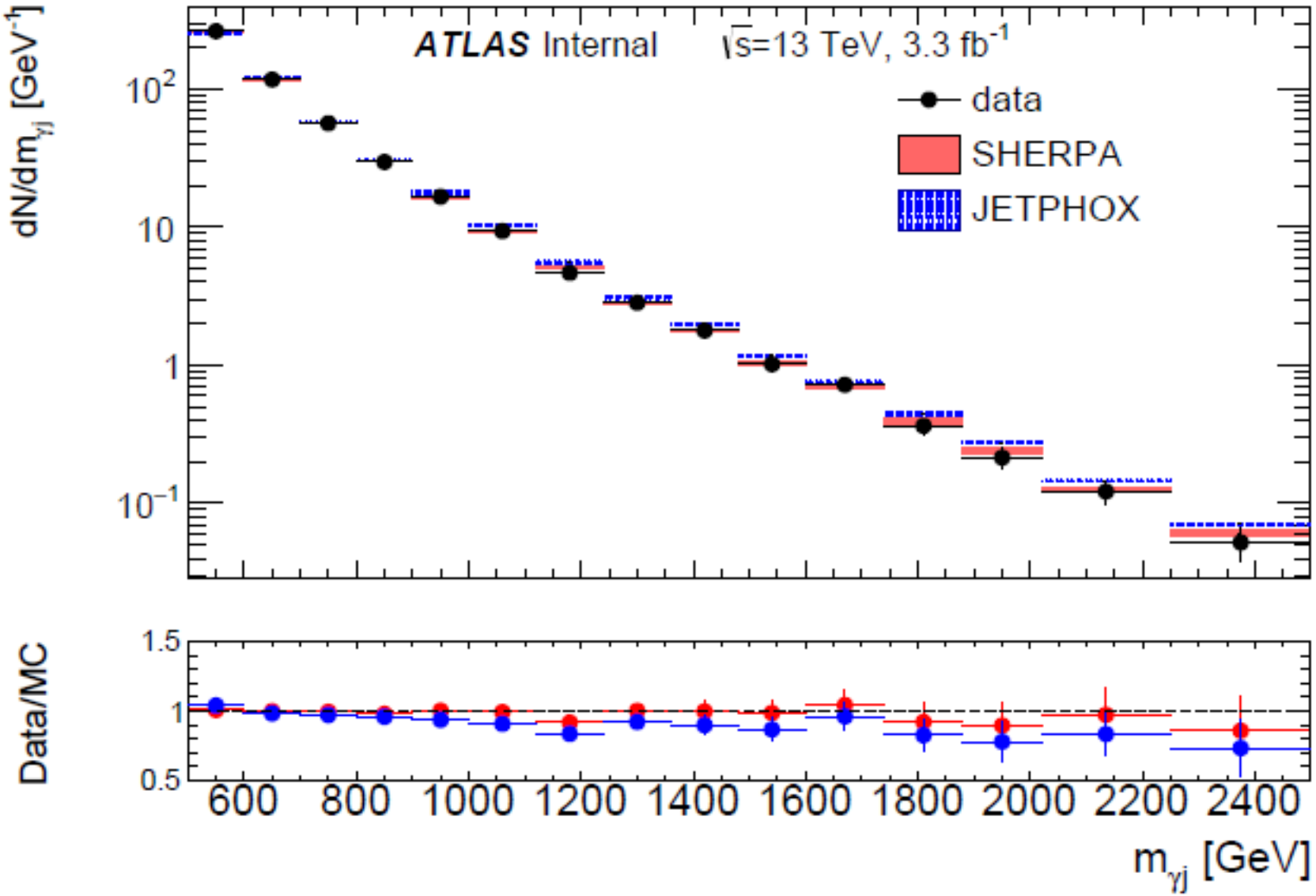
- Iso: $2.45\ \mathrm{GeV} + 0.022 \times E_{\mathrm{T}}^{\gamma}$ transverse isolation energy $E_{\mathrm{T,iso}}^{\gamma}$ $\Delta R = 0.4$
- Jet is from anti-kt 4.0
- Trigger HLT_g120_loose, HLT_g140_loose or HLT_xe100
- **>= 1 y**
- **>= 1 jet**
- pT(y)>150GeV
- pT(jet)>150GeV
- eta(y)<1.37
- DeltaEta(yj)<1.6



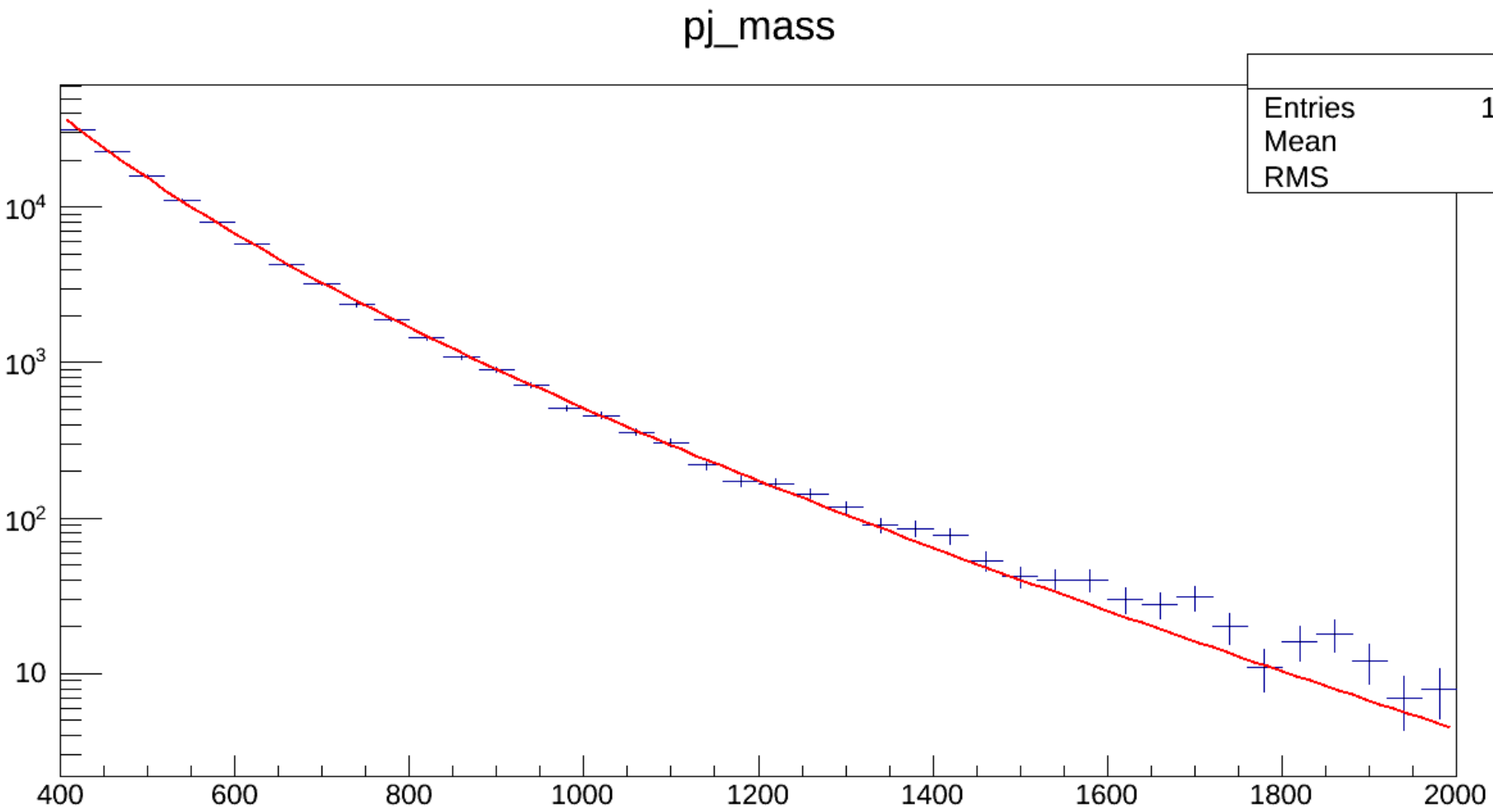
While, from **diphoton res** ⇒

– FixedCutTight Isolation
- topoetcone40 < 0.022* E_T^{γ} + 2.45 GeV
- ptcone20 < 0.05* pT

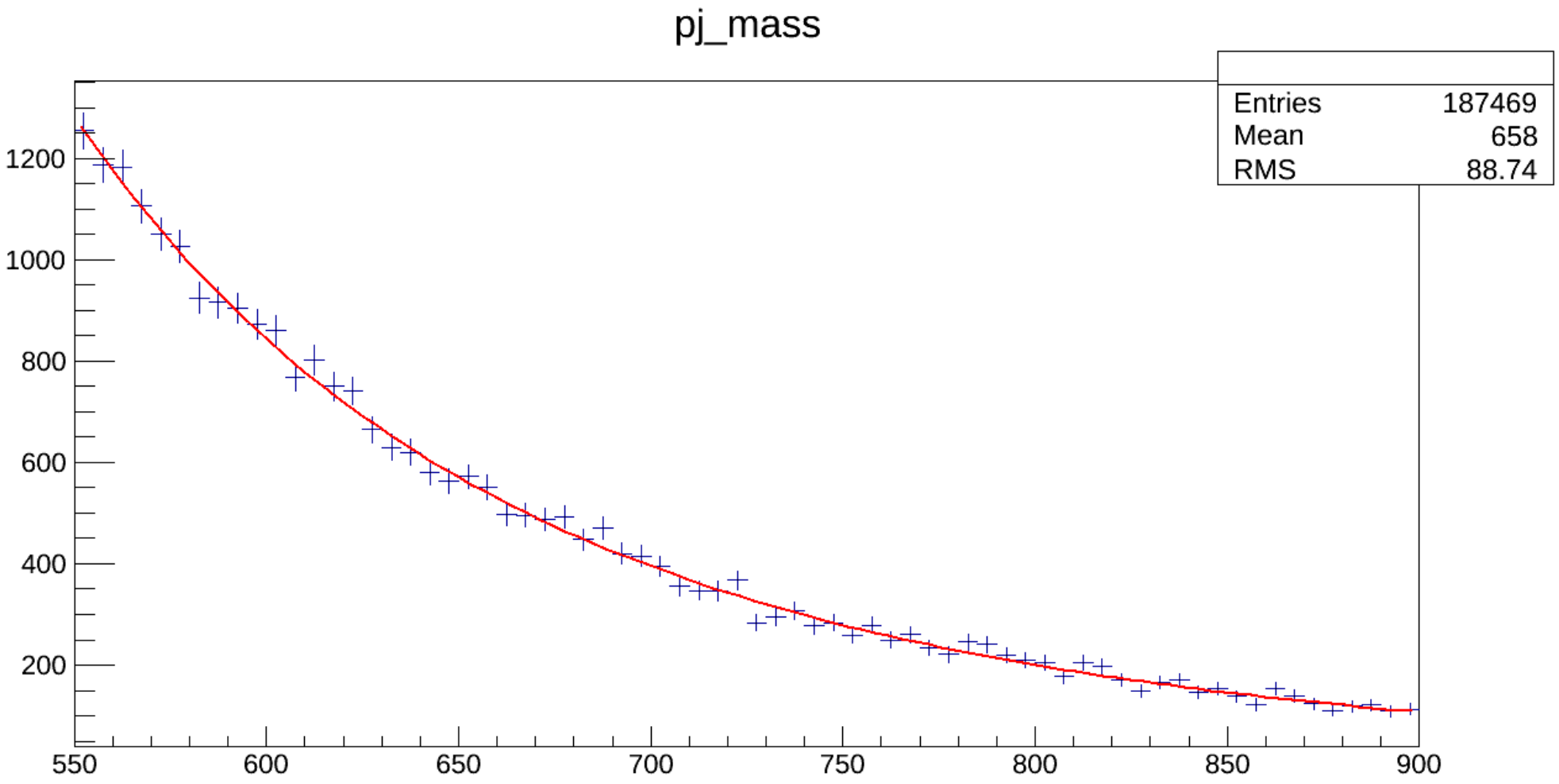
M(y+jet) from NOTE



M(y+jet) from Ruggero with finer bins

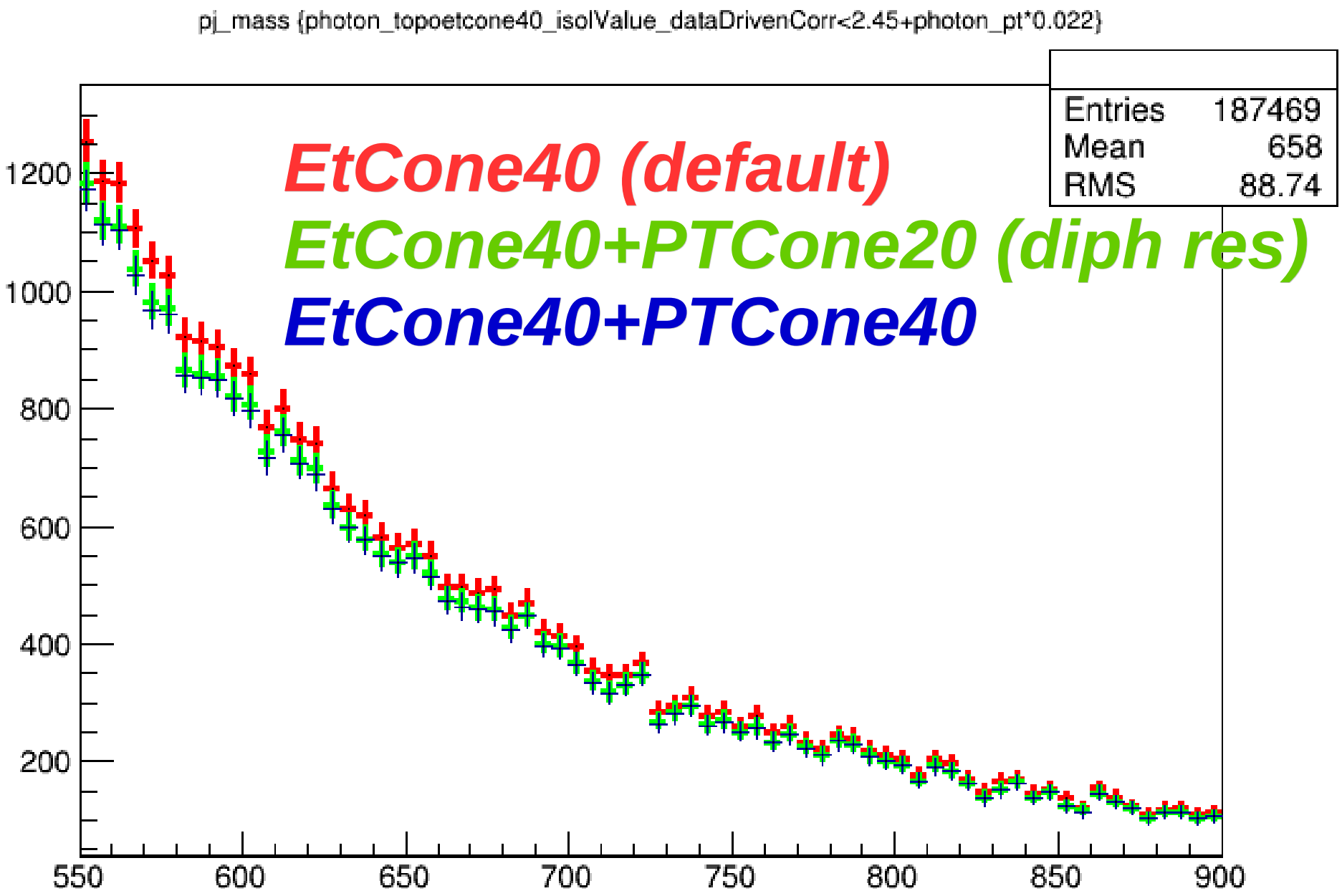


M(y+jet) from Ruggero with finer bins

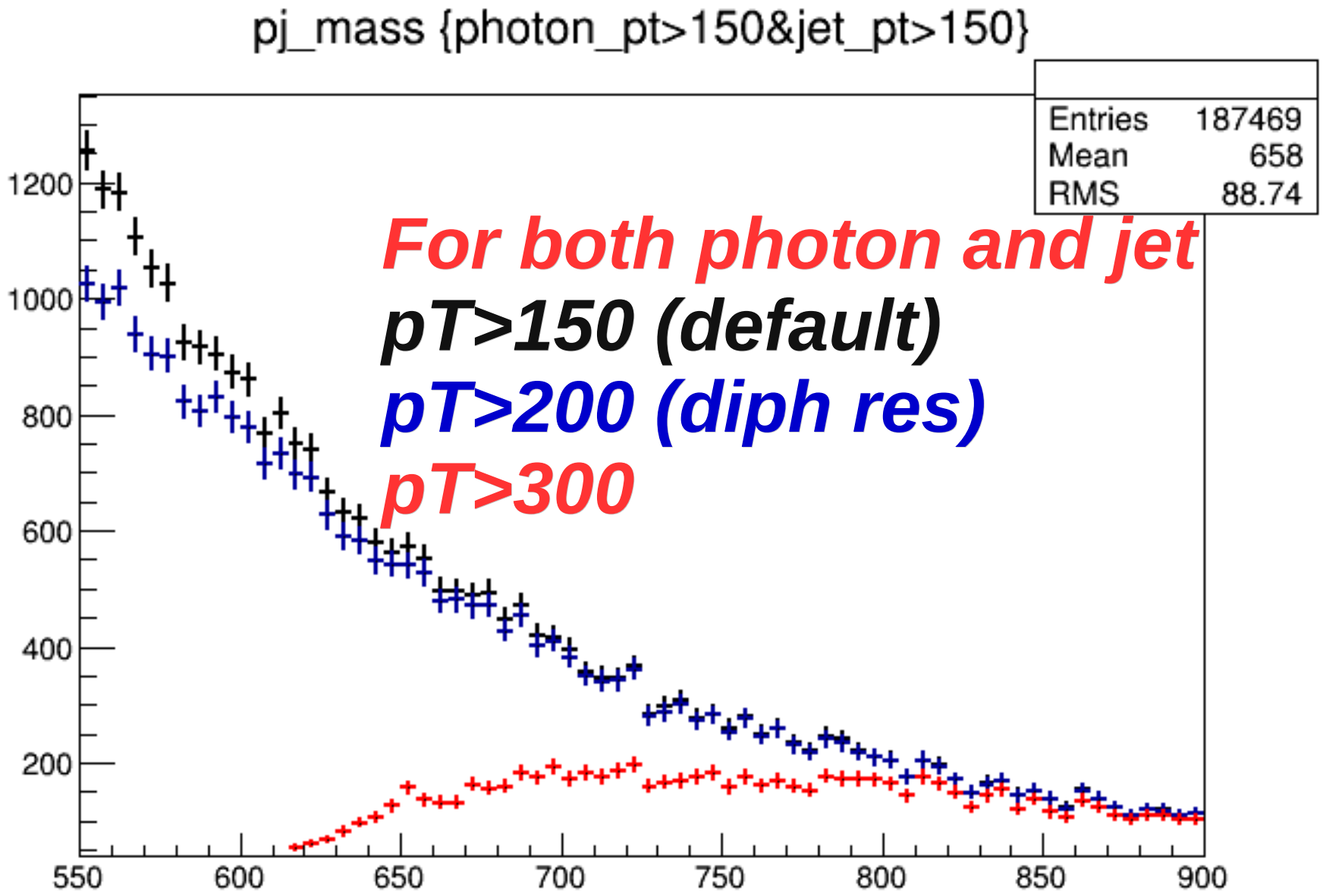


$$f_{\mathrm{bkg}}(x \equiv m_{\gamma \mathrm{j}}/\sqrt{s}) = p_0(1-x)^{p_1} x^{-p_2-p_3 \log x}$$

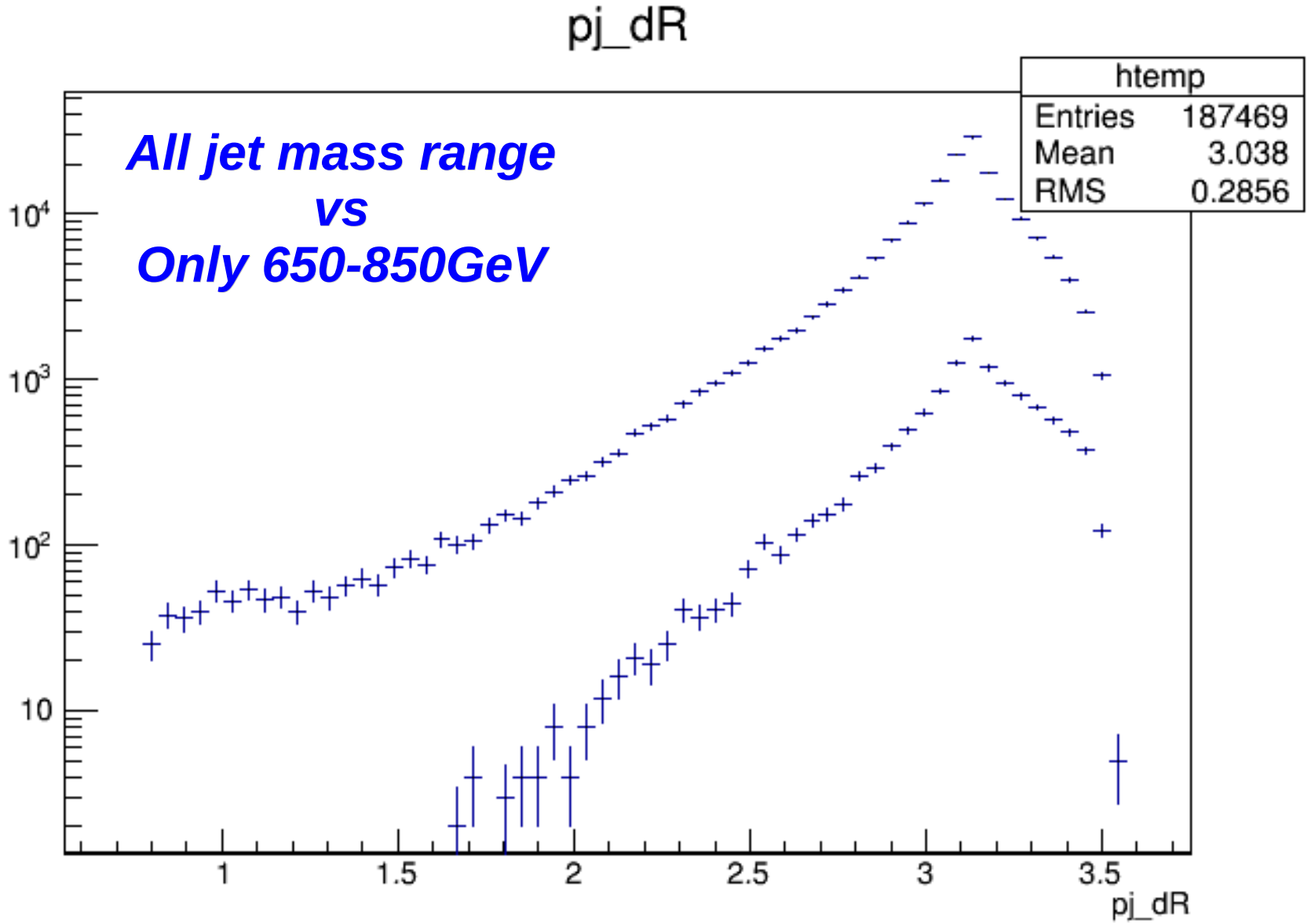
M(y+jet) with different pT ISO



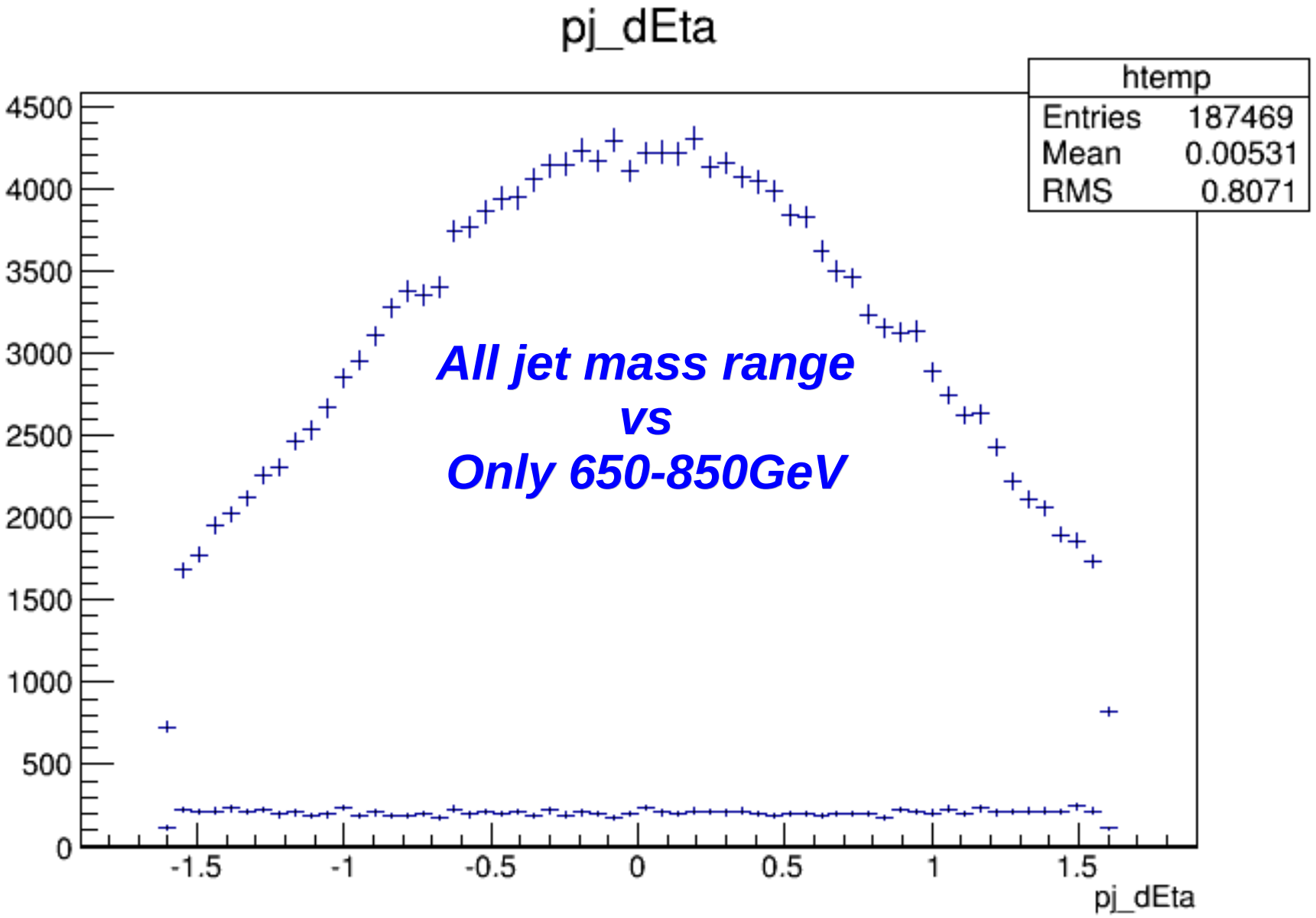
M(y+jet) with different pT cut



M(y+jet): look at 650 to 850

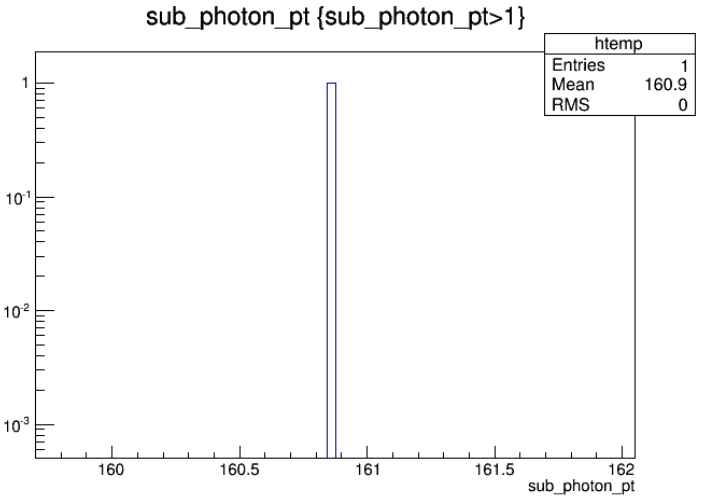


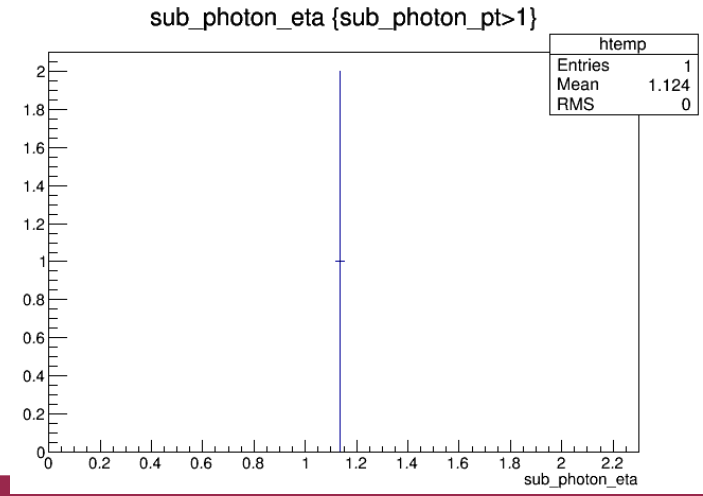
M(y+jet): look at 650 to 850

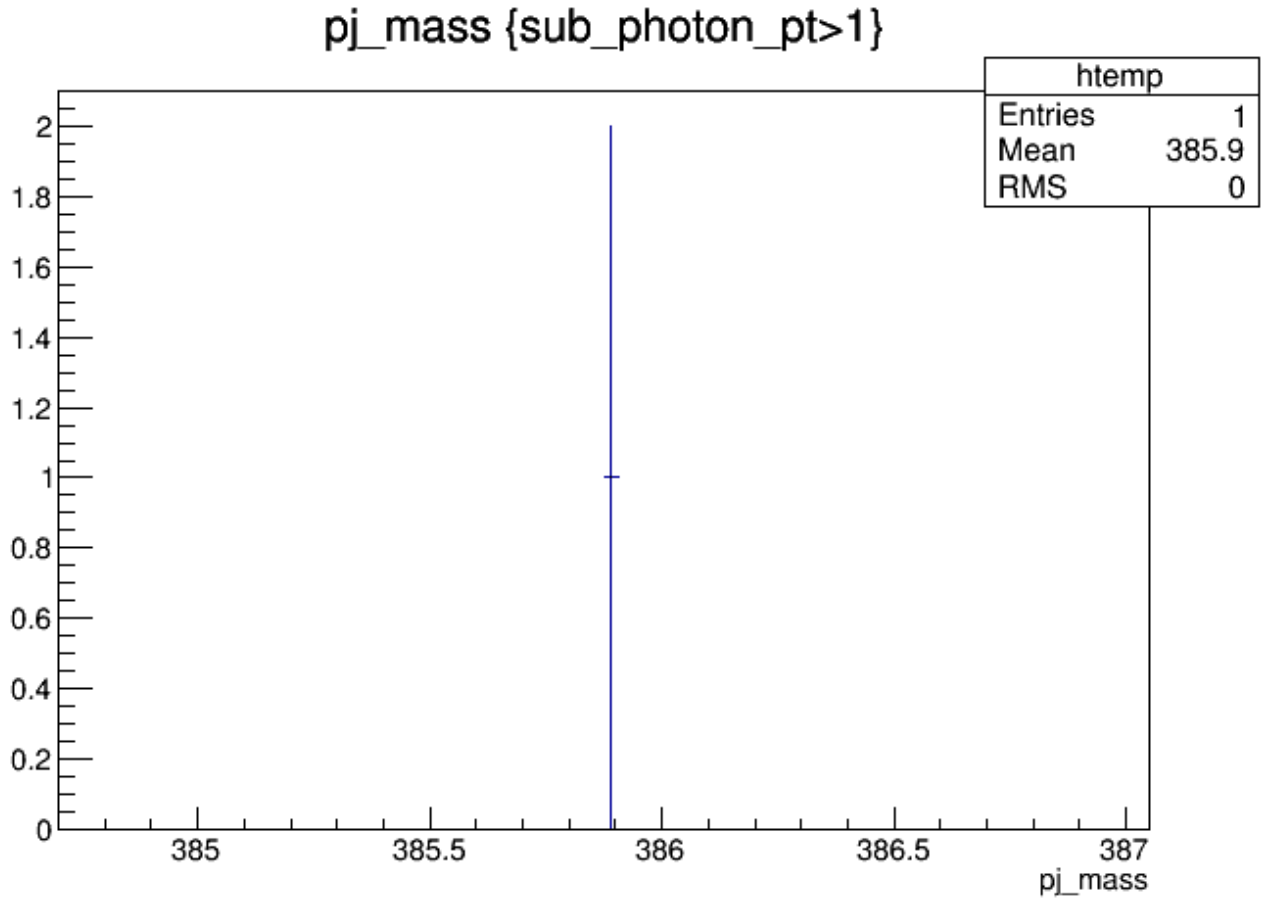


The *second* photon

- >=1 photon was asked, so there could be a second photon
- In data, actually only 1 out of 187469 event was found with a second photon: pT 161GeV, eta 1.1

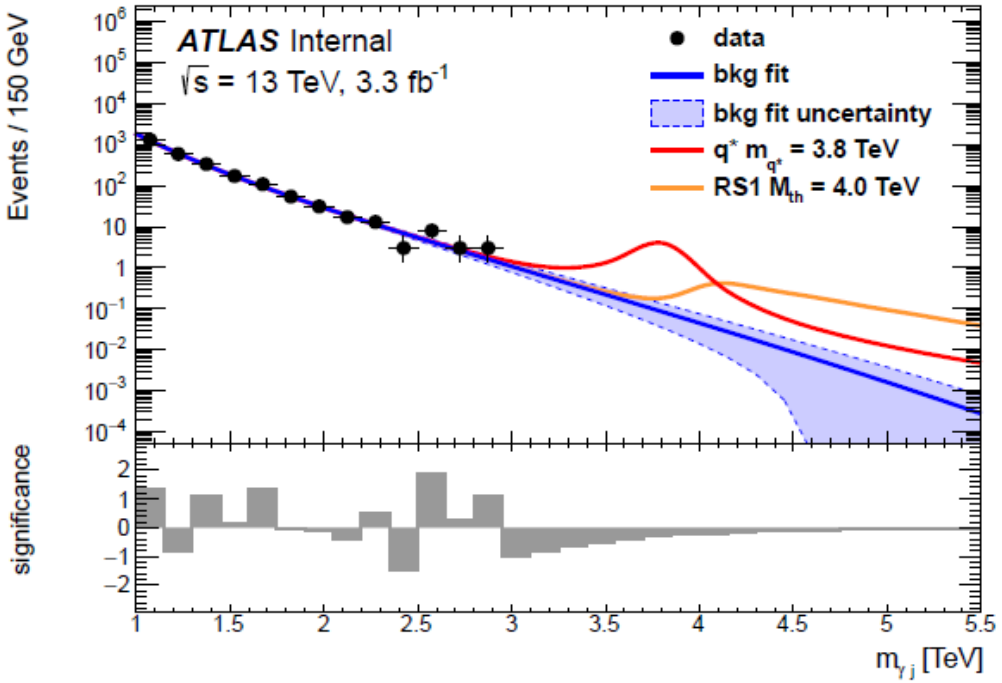


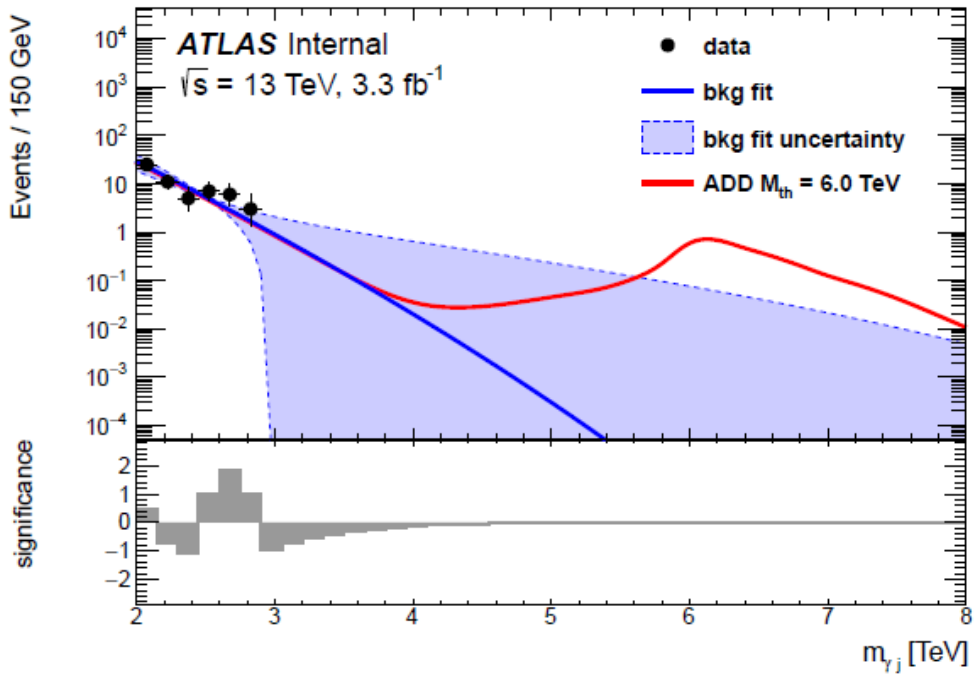




M(y+jet) s+b models on top

- 1-5.5TeV and 2-8TeV





WWWW pheno

- 1. Introduction is put in place
- 2. (empty) should come from theorists
- 3. signal and background analysis
  - Feynman diagrams
  - Preliminary table of sensitivities
  - Plots of kinematics
- 4. (empty) conclusion

Heavier Higgs searches with dihiggs decaying into WWWW

XXX*
IHEP Beijing
(Dated: December 28, 2015)

We present a perspective of heavier Higgs searches with dihiggs decaying into $WWWW$, where two W bosons decay leptonically and generate two same sign leptons, while the other two decay hadronically. The analysis intends to give an estimation of sensitivities of the $WWWW$ channel at the LHC under a center-of-mass energy 14 GeV.

1. INTRODUCTION

Since the summer of 2012 when the SM-like Higgs was discovered [?] and confirmed by further measurements from both ATLAS and CMS experiments [?], the search of BSM Higgs from various additional Higgs extensions, become more and more important.

Extensions usually construct an enlarged Higgs sector by introducing addtional Higgs doublet(s), Higgs triplet(s), or simply Higgs singlet(s). The minimal gauge extensions with extra $SU(2)$ or $U(1)$ usually invoke an additional Higgs doublets or singlets, such as MSSM (the Minimal Supersymmetric SM) that is constructed with two Higgs doublets and NMSSM (its next-to-minimal extension) that adds a Higgs singlet on the top. The minimal left-right symmetric models that includes an extra product group $SU(2)_R \times U(1)_{B-L}$ thus makes things a bit more complex with a Higgs bidoublet and two Higgs triplets. Anyway, a general framework 2HDM (two-Higgs-Double models) under the SM gauge group includes two doublets and can serve well the purpose of demonstrating our studies at the LHC in this

Backup

- P