Fake estimation by using fake factor method.

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Introduction

- I estimated fake lepton events by fake factor method.
- Procedure of fake factor method is an extrapolation from fakable control region to fake events in SR.
- I measured F.F. in 2012 data.
  - F.F. is ratio that evaluated from Z+jets events.
  - F.F. using multi-jet evaluation is ongoing now.
  - In this talk, I talk to focus on F.F. using Z+jets events.
  - I used default non skim `SMWZ_NTUP` samples.

$$N^{Est.}_{Bkg.} = N_{Tight+LNT} \times F.F.$$

$$F.F = \frac{N_{Tight}}{N_{LNT}}$$

Objects definitions

Numerator

Denominator

Electrons

1) author is 1or 3
2) E_T >15GeV
3) medium++
4) $|\eta|<1.37$, $1.52< |\eta|<2.47$
5) $E_T$cone30/E_T<0.14
6) $p_T$cone30/E_T<0.13

Muons

1) staco tight
2) $|\eta| < 2.5$
3) $p_T > 10$GeV
4) MCP Hits, $|Z_0| < 10$mm
5) $E_T$cone30/p_T < 0.14
6) $p_T$cone30/p_T < 0.13

Loose Electrons

1) **No ID requirement**
2) author is 1or 3
3) E_T >15GeV,crack eta
4) **$E_T$cone30/E_T<0.25**
5) **$p_T$cone30/E_T<0.25**
6) **!Tight electron(signal)**

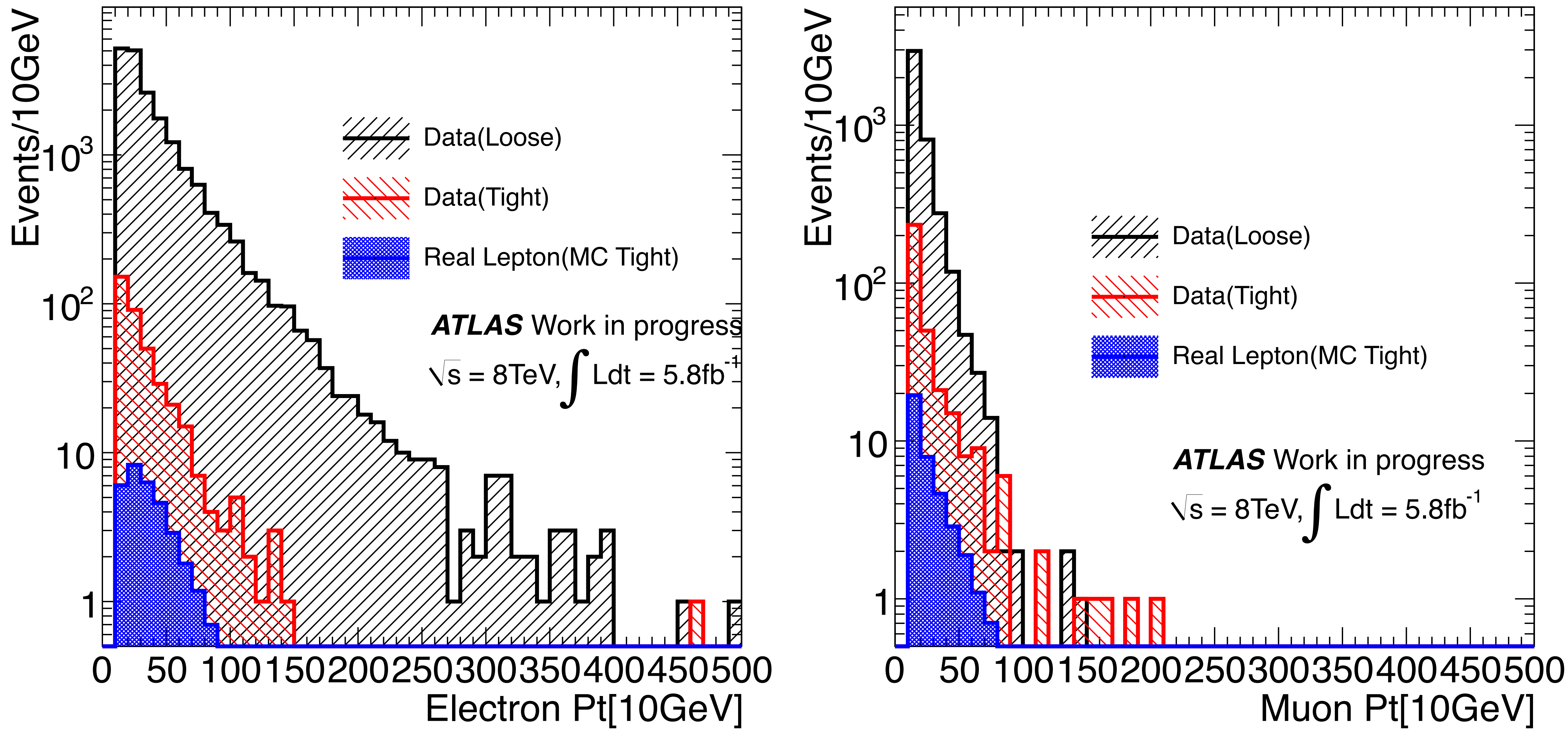
Loose Muons

1) **No ID requirement**
2) $|\eta| < 2.5$
3) $p_T > 10$GeV
4) MCP Hits, $|Z_0| < 10$mm
5) **$E_T$cone30/E_T<0.25**
6) **! Tight muon(signal)**

F.F. measurement

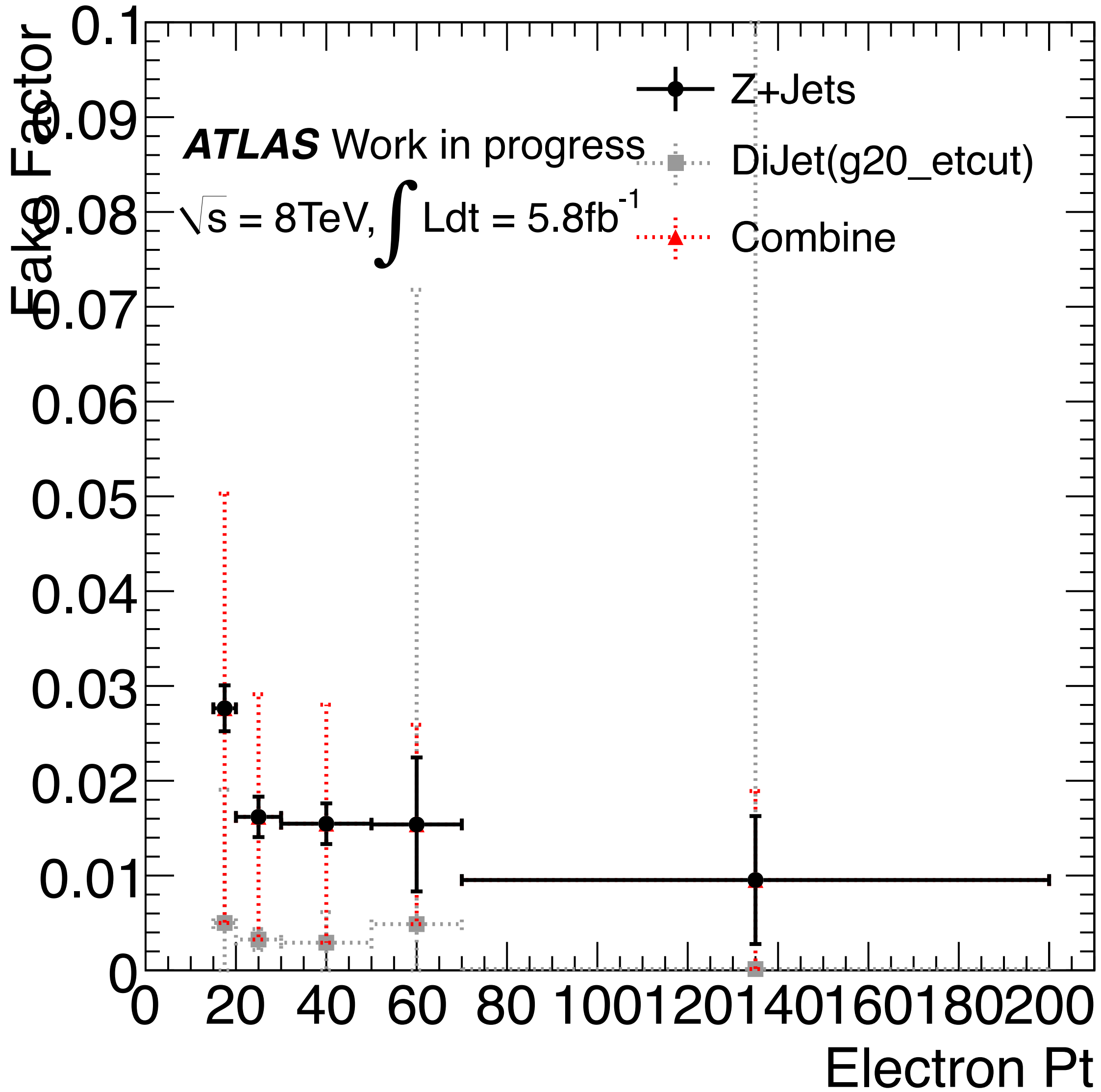
- Z+jets:Select exactly one Z event.
  - Same flavour two OS leptons with $|m_Z - m_{LL}| < 15$GeV.
  - Veto additional Z/W candidate.($|m_Z - m_{LL}| < 15$GeV, $m_T > 30$GeV)
  - Evaluate EW contamination from MC diboson events.
- di-jet:Select exactly two jets event.
  - Events fired `EF_g20_etcut` and single muon triggers.
  - Veto Z/W candidate.($|m_Z - m_{LL}| < 15$GeV, $m_T > 30$GeV)
  - Evaluate EW contamination from EW MC events.
- Fake factor as a function of lepton p_T is evaluated by counting numerator and denominator candidates.

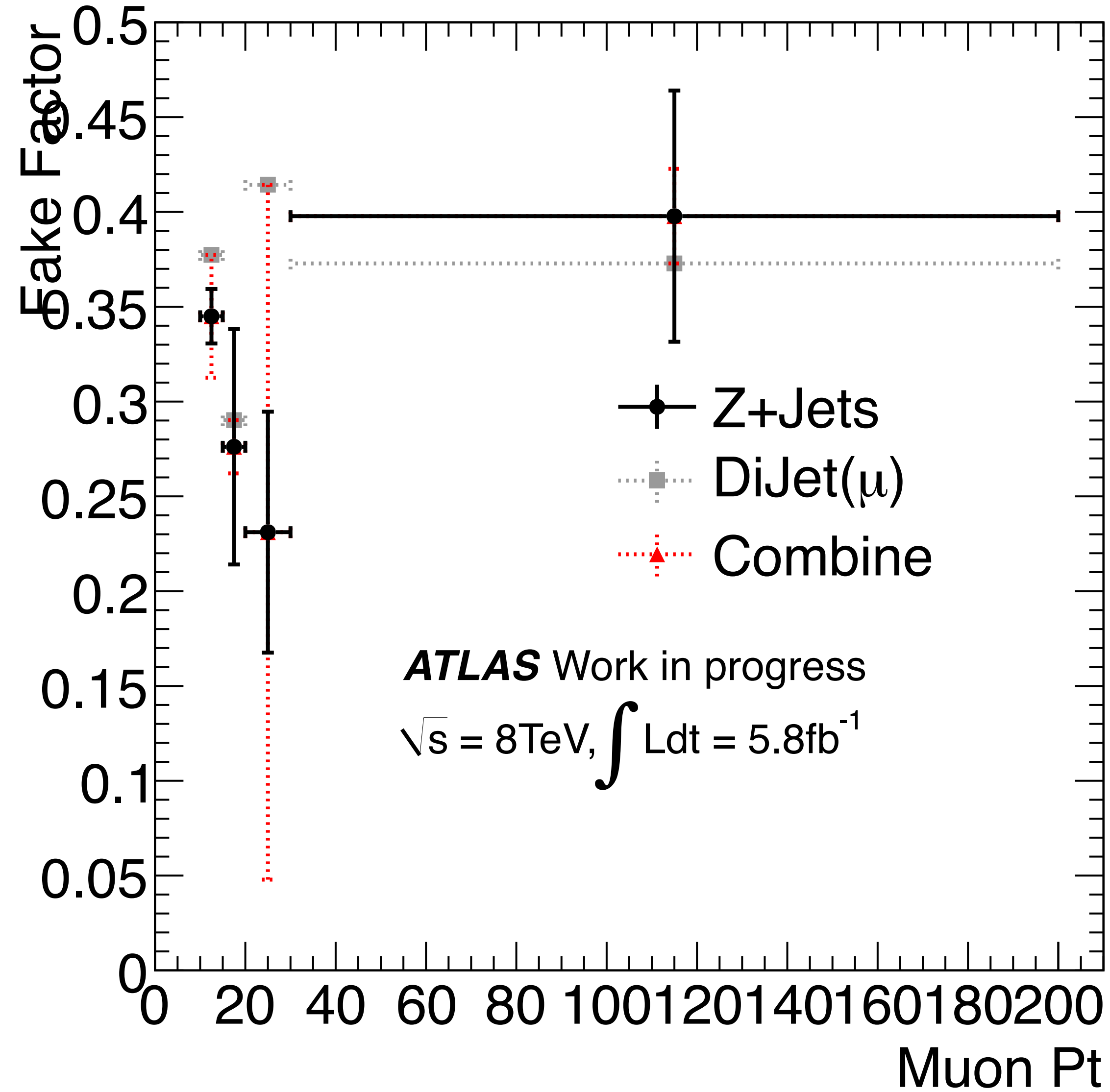
Fakable p_T distribution



- Fakable candidate lepton p_T distributions in Z+jets.
  - EW contamination is low level about ~10%.

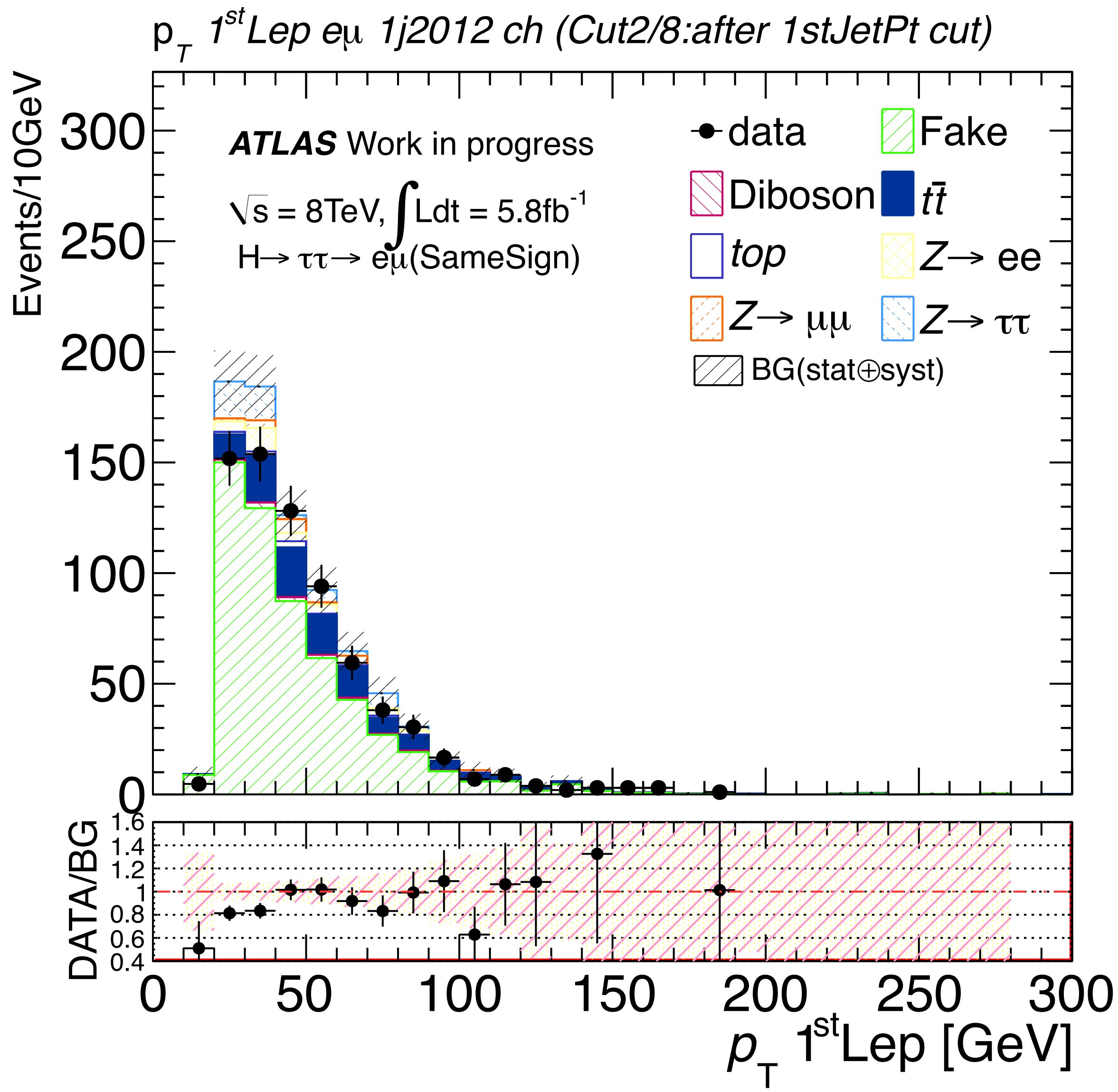
Fake Factor

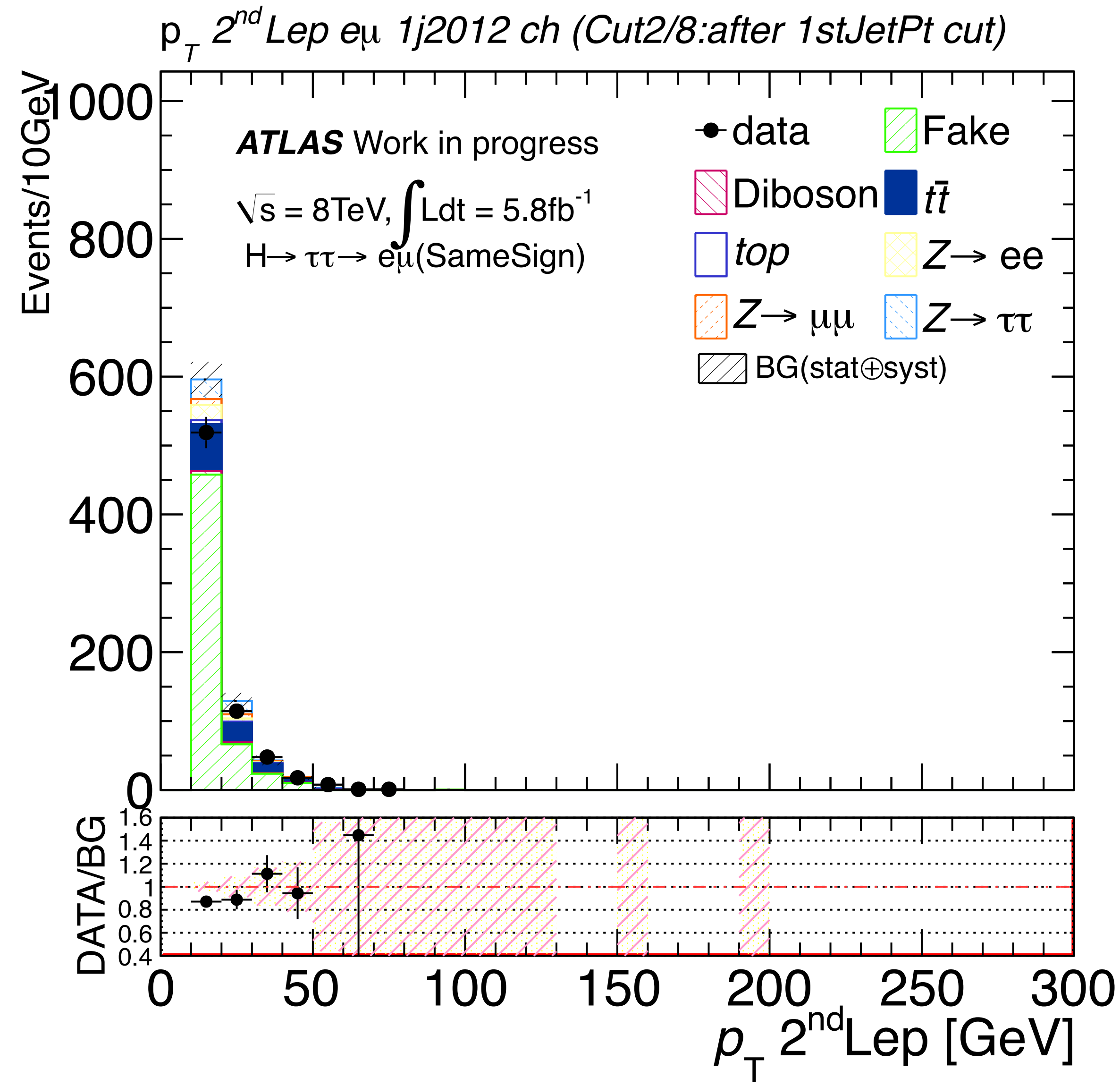




- Fake factor was evaluated as Z+jets center values.
  - Systematics uncertainty is mainly stat. and sample dependence.
  - This is assigned as difference of Z+jets/di-jet F.F.
  - Combine point are includes stat. and sample dependence.

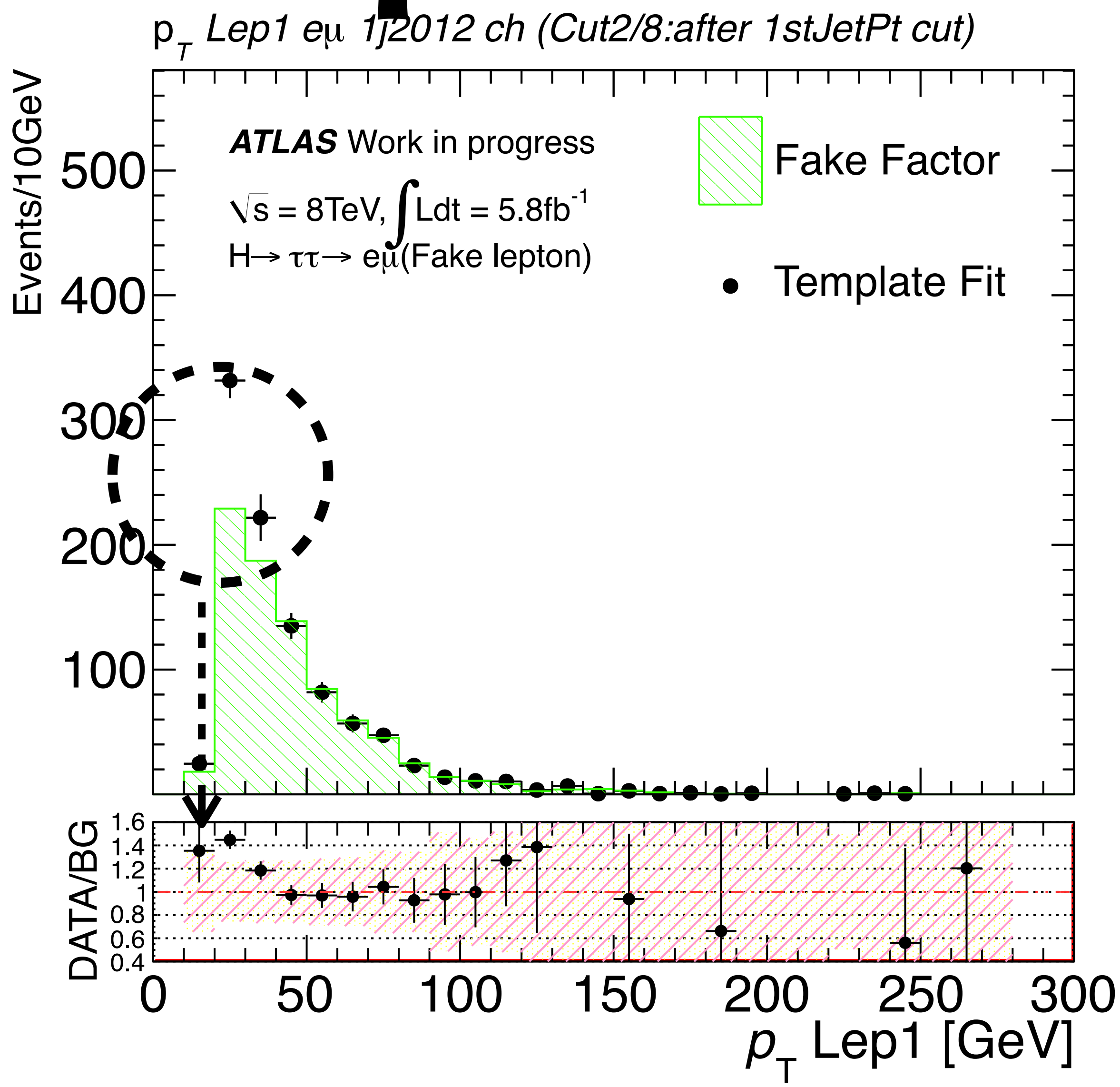
SS Control Plots

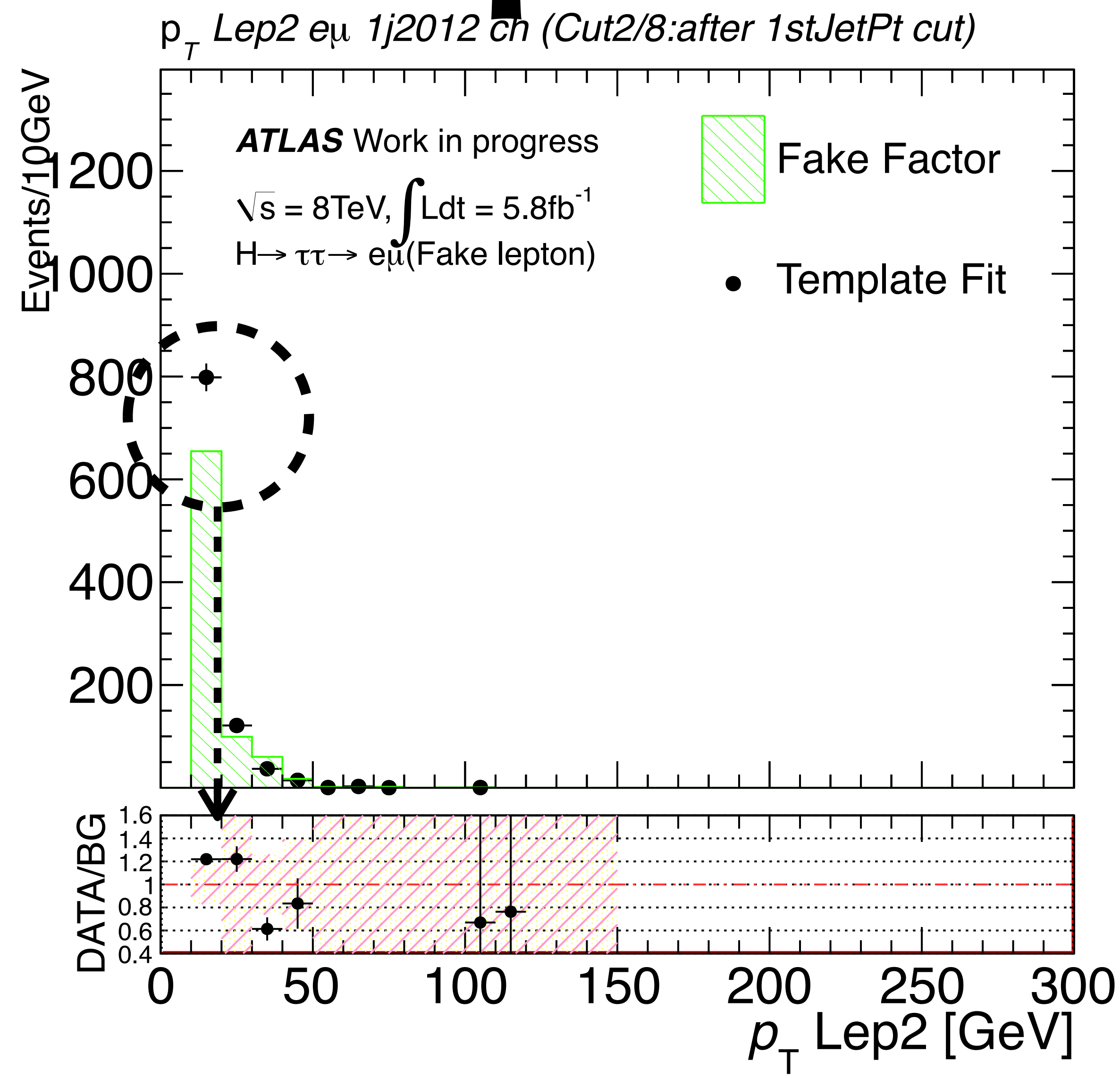




- Lepton p_T distribution after 1st jet $p_T > 40$ GeV in eμ channel.
  - left: leading electron p_T
  - right: sub-leading muon p_T

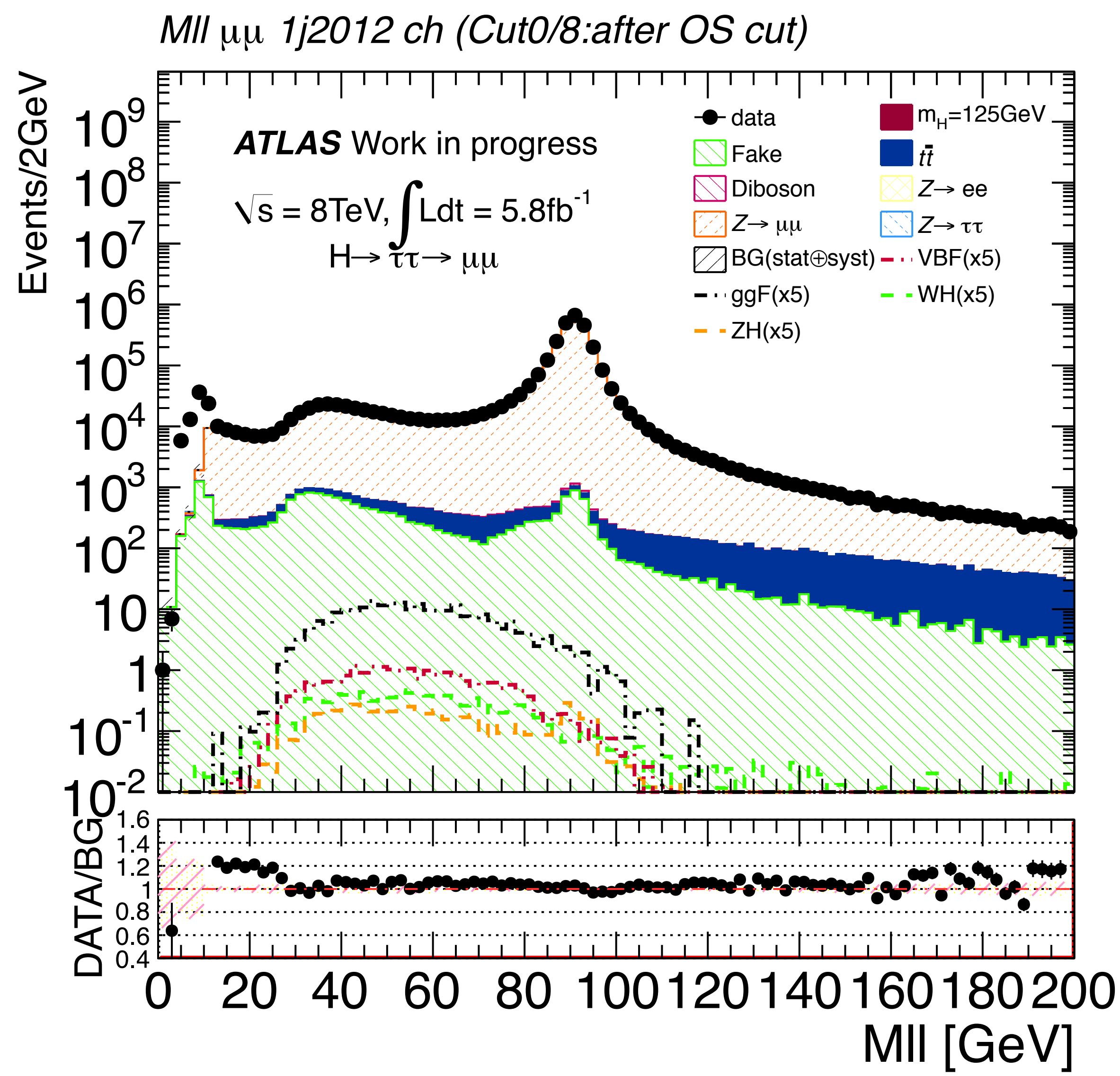
Compare with Template Fit

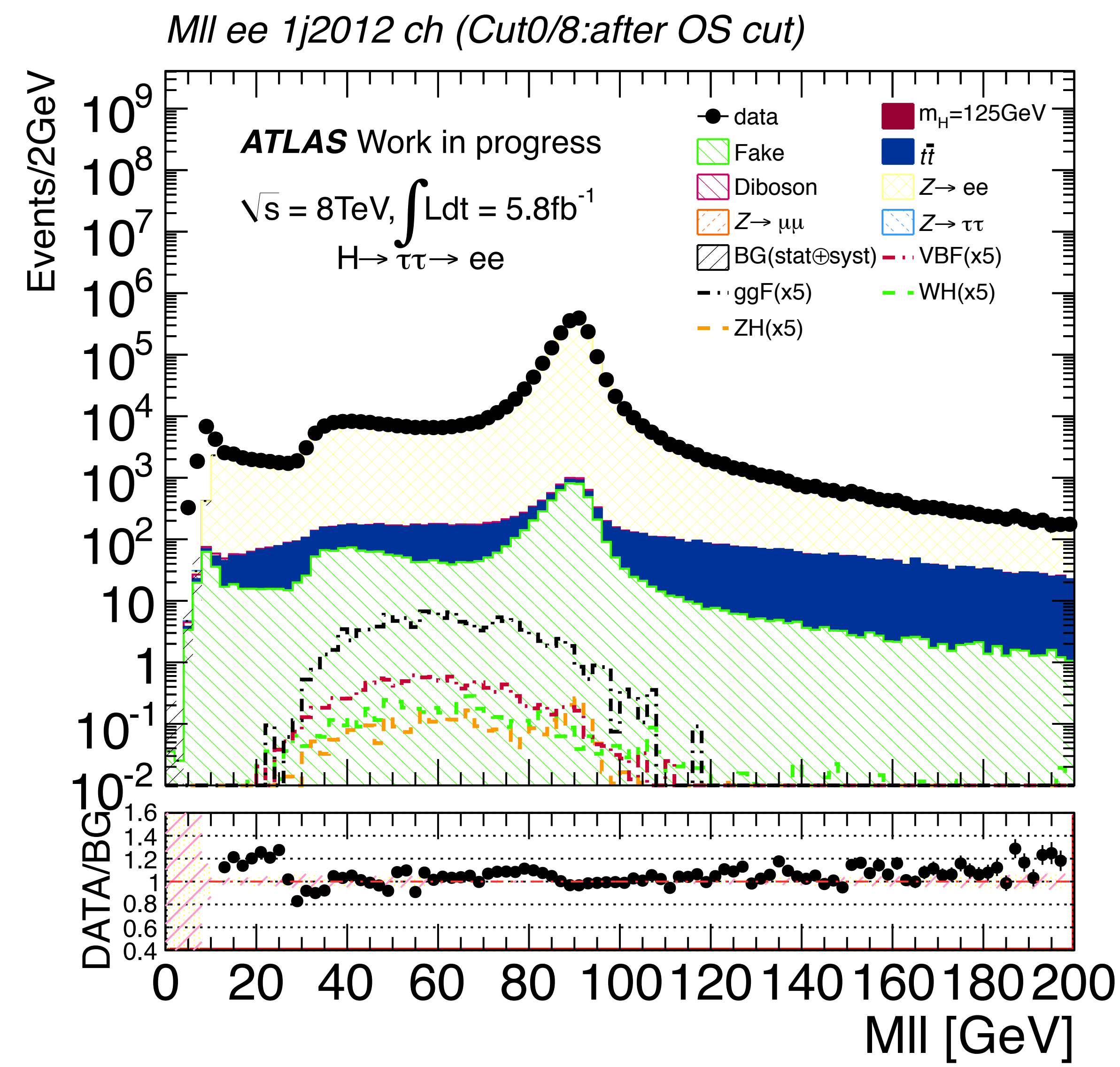




- Lepton p_T distribution after 1st jet $p_T > 40$ GeV in eμ channel.
  - left: leading electron p_T
  - right: sub-leading muon p_T
- Low p_T region has large systematics uncertainties.

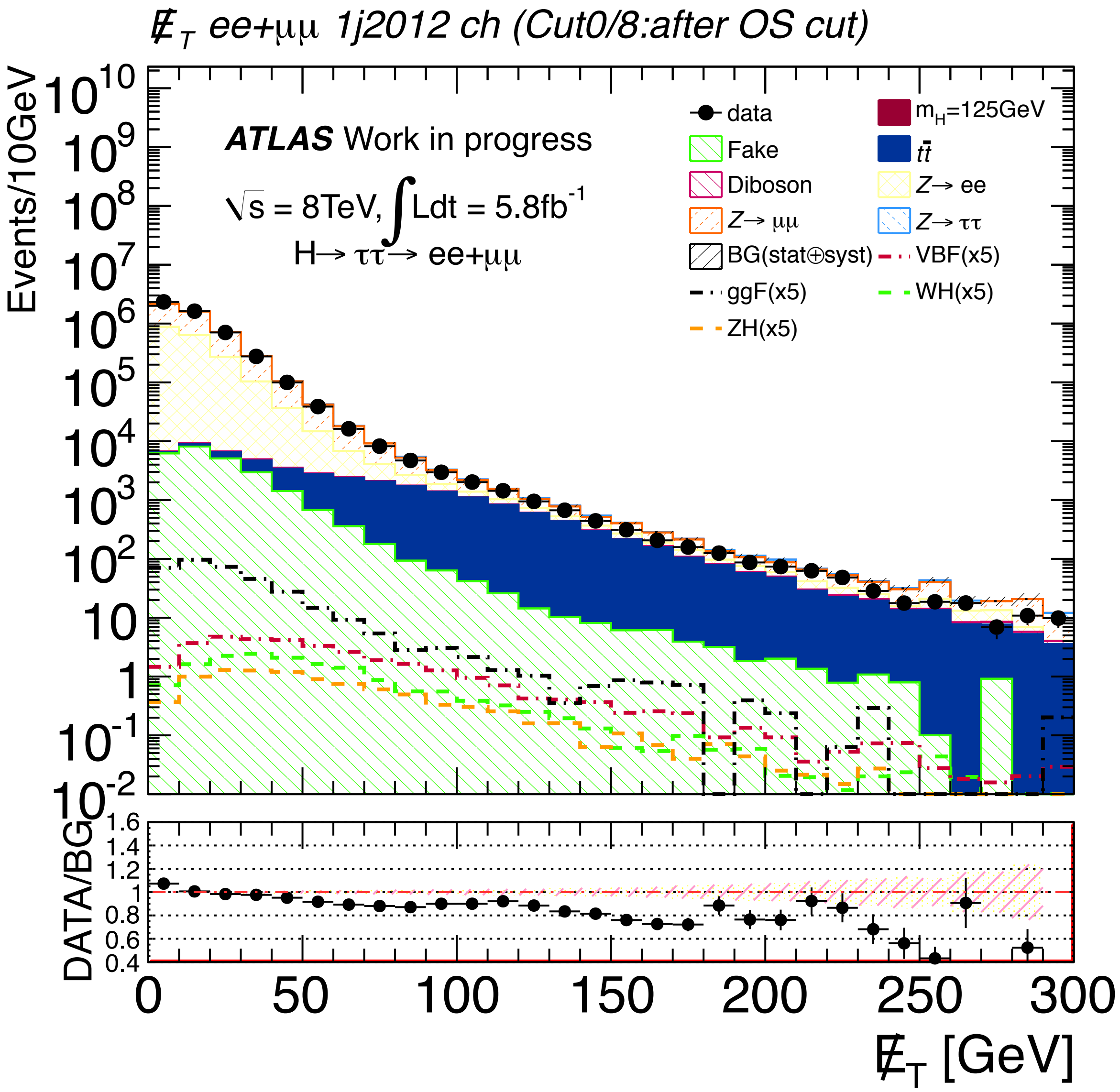
Some Control Plots in OS

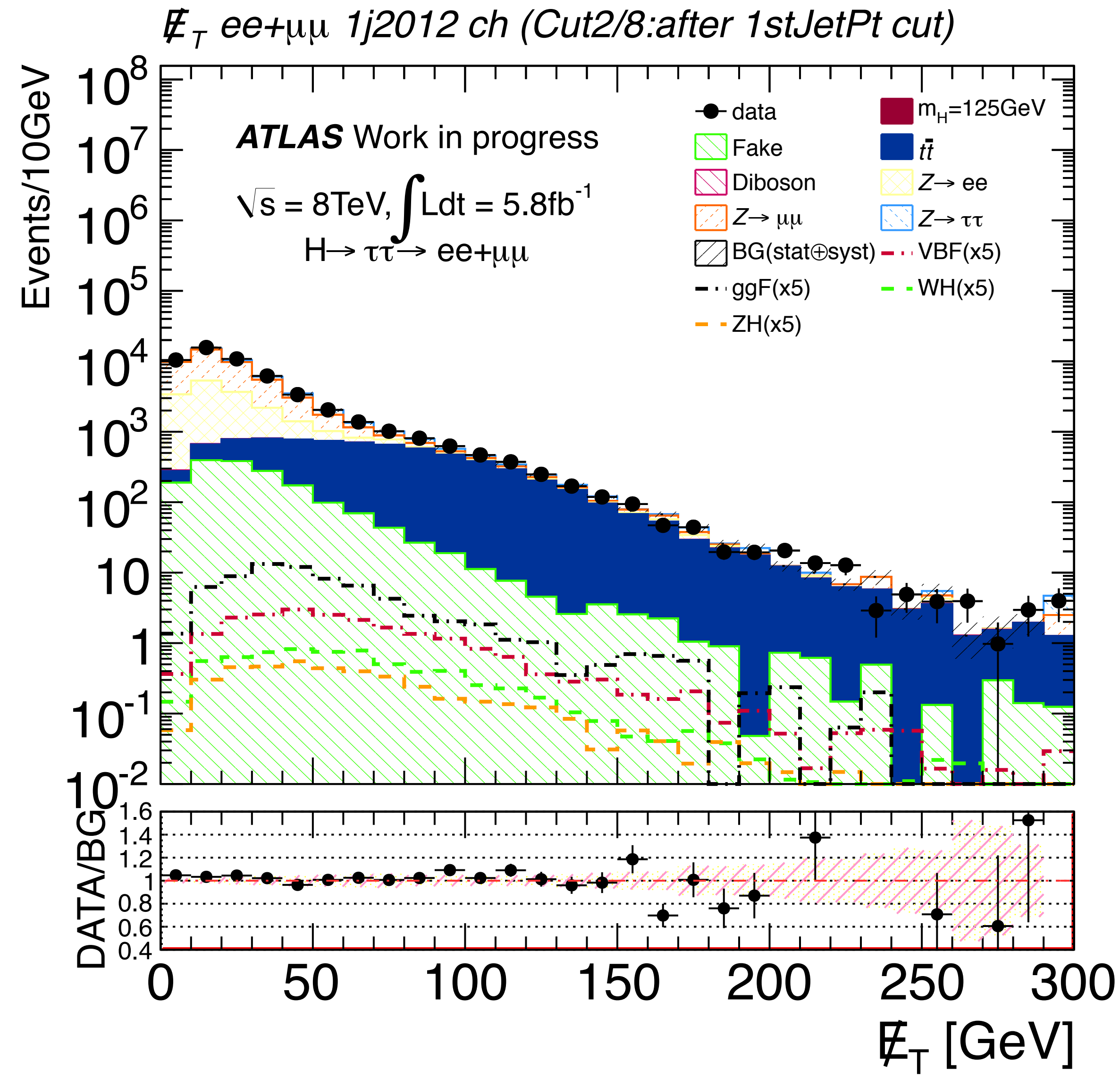




- m_{LL} distribution after OS cut in μμ,ee.
- Almost flat data/BG ratio
- m_{ee} has certain bump around 80GeV.

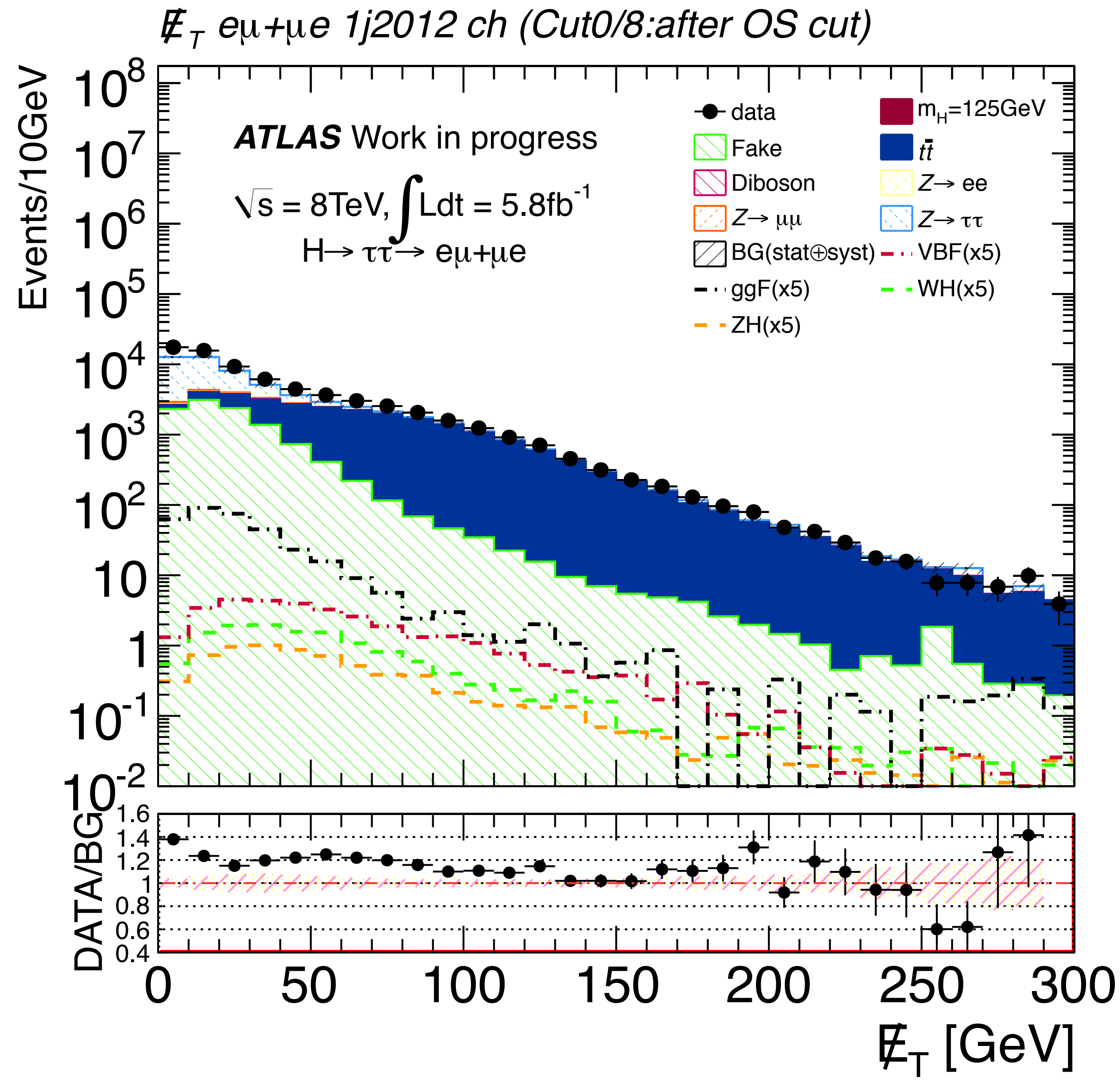
Some Control Plots in OS

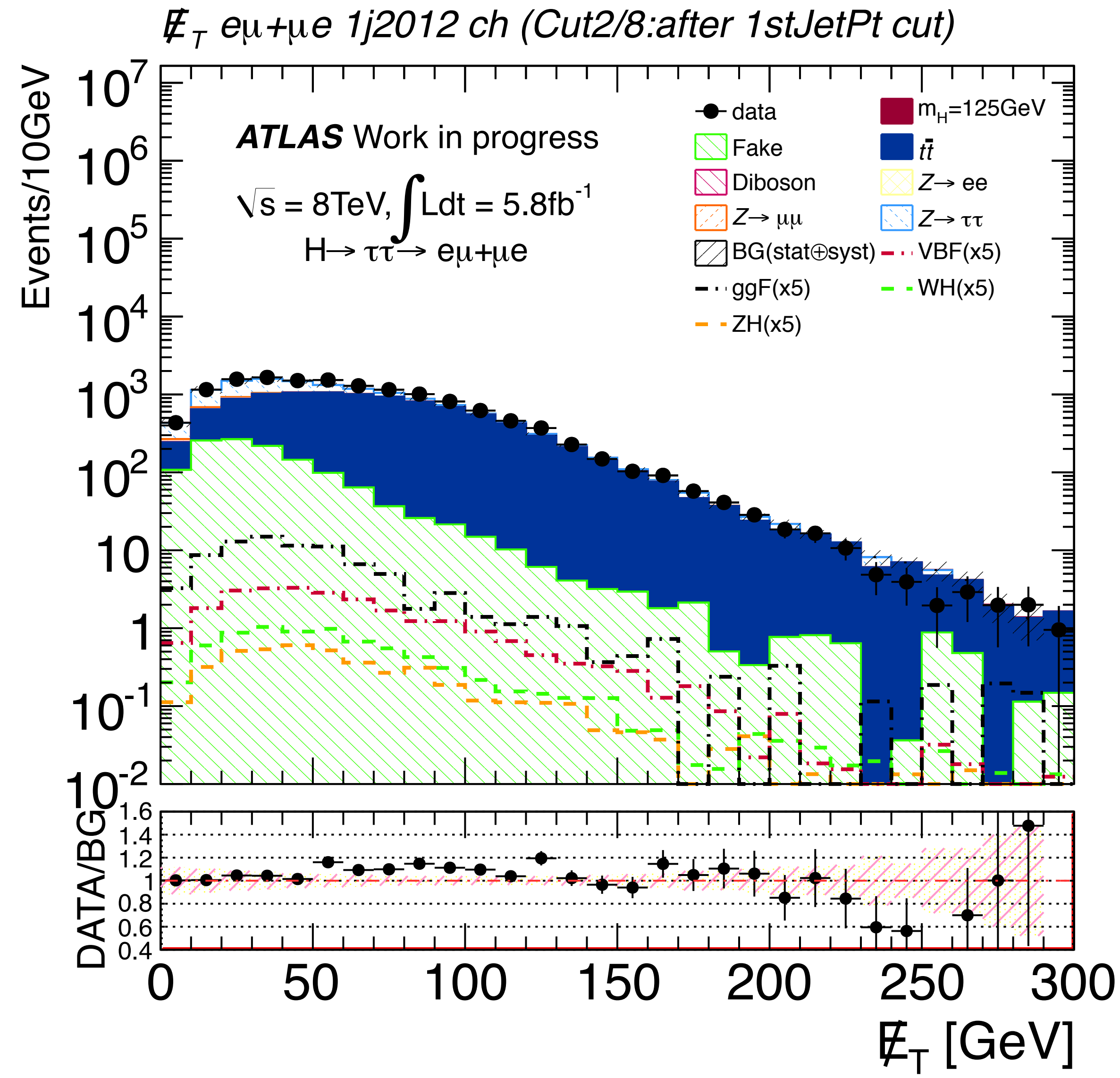




- E_T^{miss} distribution in ee+μμ channel.
  - left: OS cut
  - right: 1st jet p_T cut

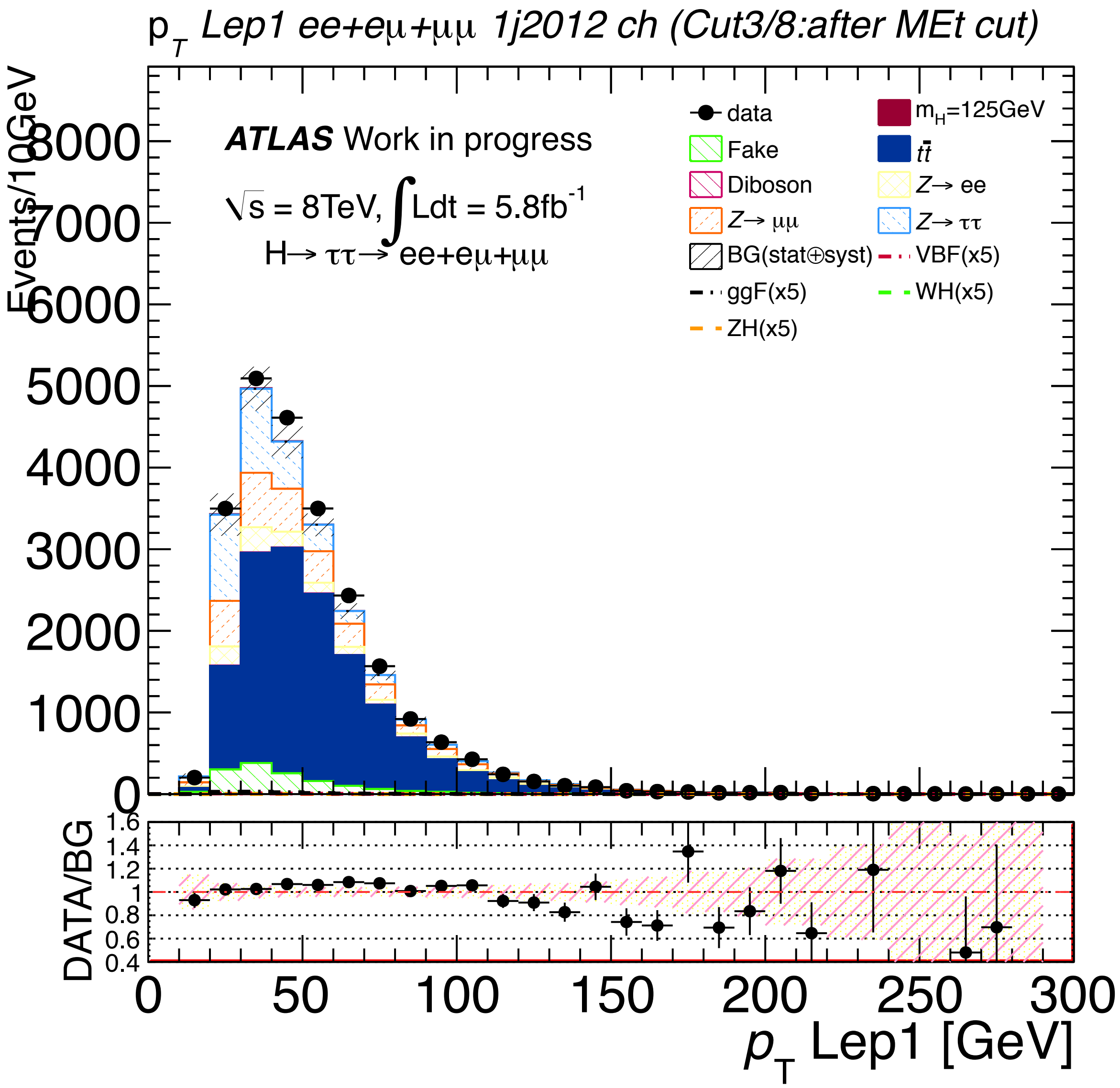
Some Control Plots in OS

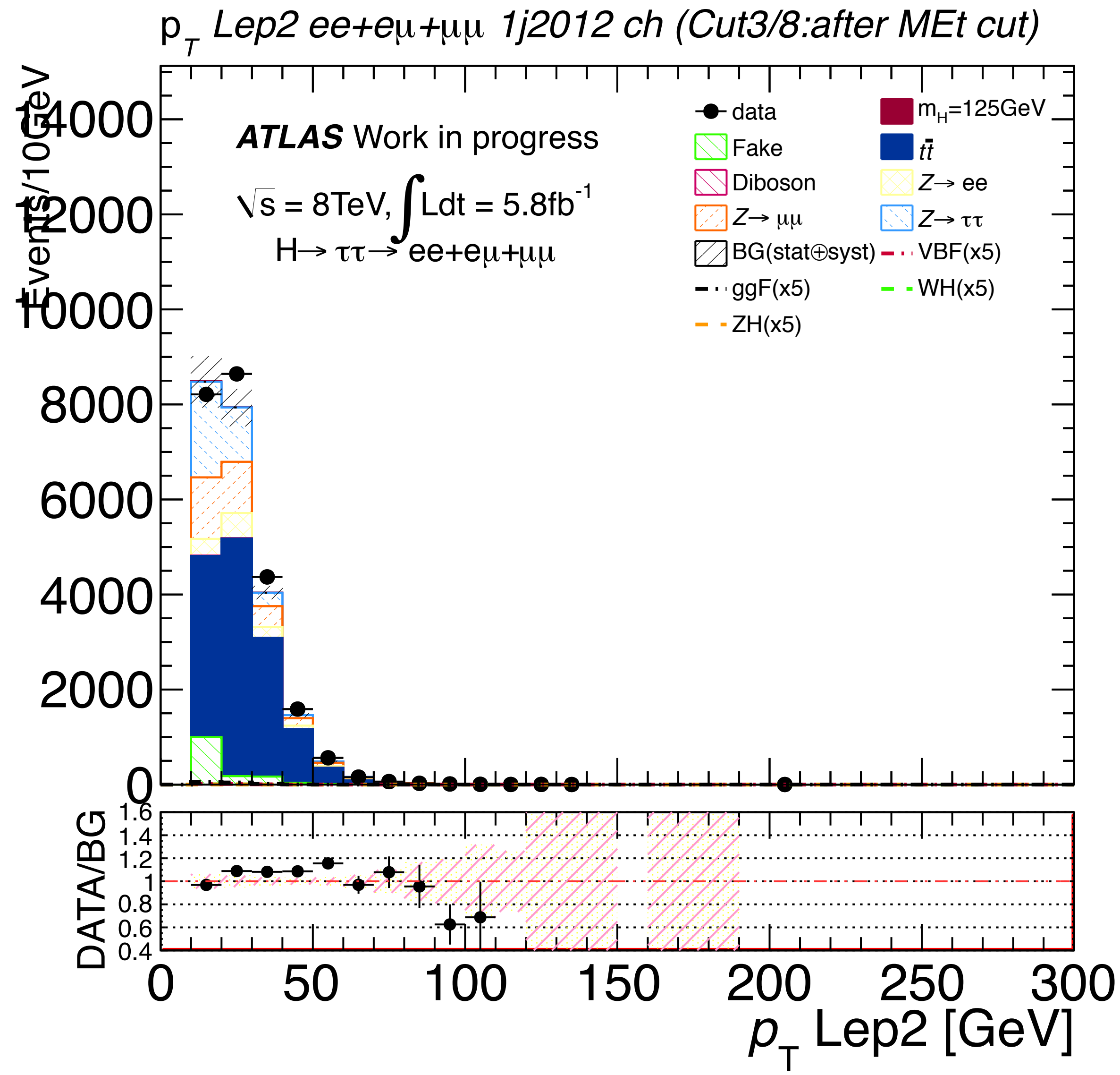




- E_T^{miss} distribution in eμ+μe channel.
  - left: OS cut
  - right: 1^{st} jet p_T cut

Some Control Plots in OS





- Lepton p_T distribution in all channel.
  - left: leading lepton
  - right: sub-leading lepton

Conclusion and Plans

- I estimated fake lepton events by fake factor method.
- This method almost work well in same sign control region.
- But low pT region has some difference between this method and template fit method.
- This region has large systematics uncertainty.
- I will finalize to study fake factors systematics.


Back Up!

Categorization

1) Preselection, and exactly two leptons with OS and veto tau leptons
2) $30 < m_{LL} < 75(100)$ for SF(DF) and $p_T^{L1} + p_T^{L2} > 35$GeV
3) At least 1 jet with $p_T > 40$GeV ($|JVF| > 0.5$ if $|\eta| < 2.4$)
4) MET > 40(20)GeV for SF(DF)
5) $0.1 < X_{1,2} < 1.0$
6) $0.5 < \Delta\varphi_{LL} < 2.5$

0jet(eμ only)

2) $30 < m_{LL} < 100$, $p_T^{L1} + p_T^{L2} > 35$
3) No jet with $p_T > 40$GeV
4) $\Delta\varphi_{LL} > 2.5$

2jet VBF

7) $p_T^{j2} > 25$GeV
8) $\Delta\eta_{JJ} > 3.0$
9) $m_{JJ} > 400$GeV
10) b-tag veto
11) CJV
12) Lep Centr.

Boosted

7) excl. VBF
8) $p_T^H > 130$GeV
9) b-tag veto

2jet VH

7) excl. VBF,Bst
8) $p_T^{j2} > 25$GeV
9) $\Delta\eta_{JJ} < 2.0$
10) $30 < m_{JJ} < 160$
11) b-tag veto

1jet

7) excl. 2jet,Bst
8) $m_{HJ} > 225$GeV
9) b-tag veto

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Jets

1) Anti k_T 40 EMTopo
2) $p_T > 20$GeV
3) $|\eta| < 4.5$
4) $|JVF| > 0.5$ (if $|\eta| < 2.4$)

Taus

1) author is 1or 3
2) $E_T > 20$GeV
3) $|\eta| < 2.5$
4) JetBDTMedium is 1
5) EleBDTMedium id 0
6) muonVeto is 0

Missing E_T

1) MET RefFinal STVF