Fake estimation update

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outline

- Outline
  - Current status of the Fake Factor method.
  - Reproduce the fake estimation by using the Template Fit method.
  - Question & Conclusion
- Before main topics...
  - I have done a acceptance challenge perfectly.
  - data: SMWZ_p833, MC:mc11c

•BG process(mc11c)
- WW/ZW/ZZ : MC@NLO & gg2WW
- ttbar,single top: MC@NLO
- Z-->ee/μμ: ALPGEN (apply ABCD)
- Ztautau: pro09.embedding-02-39.Ztautaull_isol_mfsim

•Signal (120GeV)
- ggF,VBF: PowHeg
- W/ZH: Pythia

Fake estimation

- Now leplep sub WG has estimated the fake events by the Template Fit method.
  - Fake control samples is defined by inverting requirements of the lepton isolation.(the lepton fails at least one of those requirements)
  - The template fit is performed after m_{LL} cut.
  - There sub-leading lepton pT shapes are compared after the EW MC subtraction.
- This study's motivation is to compare the fake factor method with the template fit method.
- First, we show you a result of the fake factor method update.

Fake Factor method

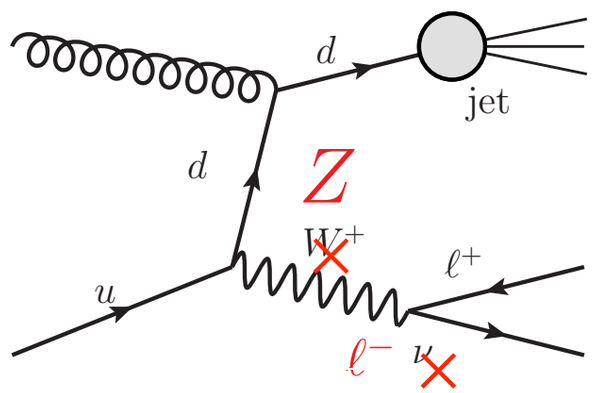
- First, choose Tight+Fakable(LNT) lepton Events in data.

$$N_{1\mathrm{Tight}+1\mathrm{Fake}} = \frac{N_{\mathrm{Tight}}}{N_{\mathrm{LNT}}} \times N_{1\mathrm{Tight}+1\mathrm{LNT}}$$

Estimated Fake BG ***Fake Factor*** ***Fakable CR***

- Extrapolate the fake events from fakable CR by using the fake factor.
- Loose Not Tight events(LNT)
- defined these events as Fakable CR

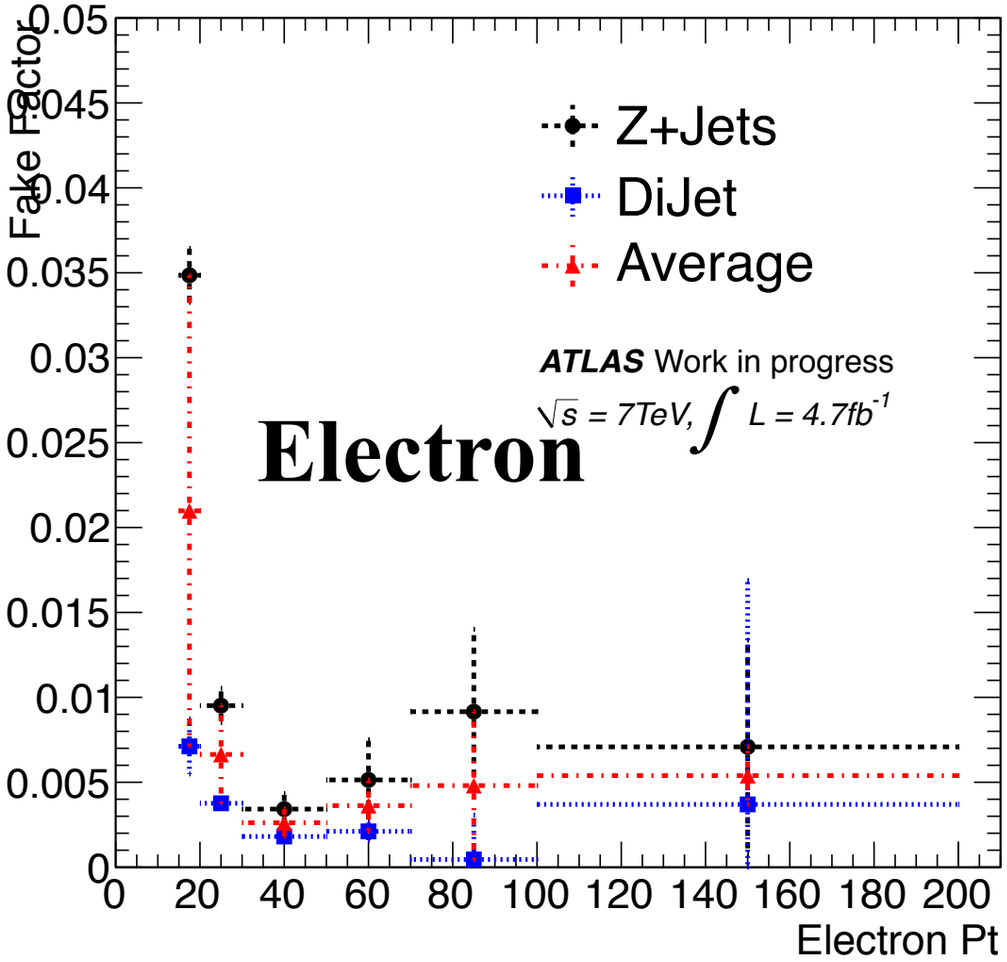
- The fake factor is evaluated by Z+Jets events in data.
  - tagging Z:two tight leptons with O.S. $|m_{LL}-m_Z|<15$GeV
  - Diboson Veto: additionally Z or W($m_T>30$GeV)
  - Counting a lepton p_T if is it Tight or LNT lepton.
  - These events are used same trigger as SR.

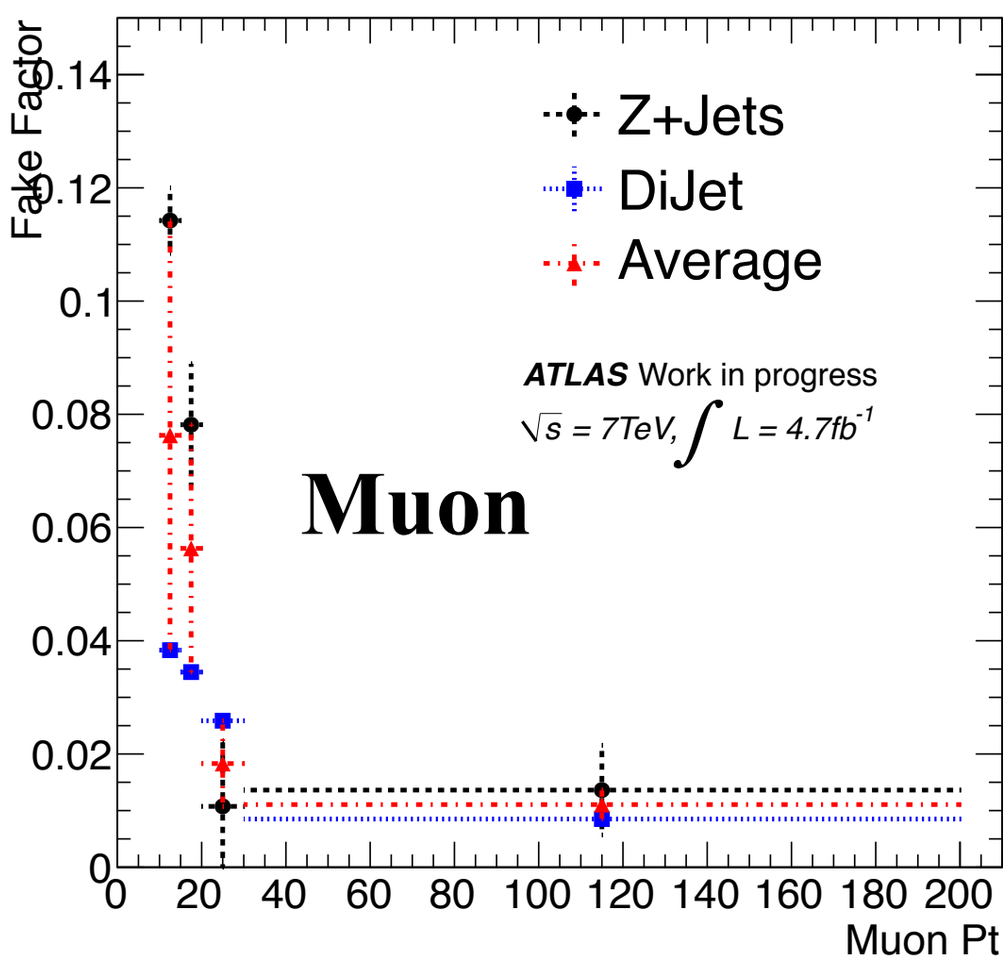


✓LNT Muon (!Tight Muon)
- STACO muon
- ID hit requirement
- |eta| < 2.5, pT > 10GeV, |Z0| < 10mm
- EtCone20/pT< 0.10
- PtCone20/pT < 0.25

✓LNT Electron (!Tight Electron)
- Author 1 or 3,medium++
- N_{hit}(SCT + Pixel) >= 4
- |eta| < 2.47 ,Et > 15GeV
- EtCone20/pT < 0.25
- PtCone20/pT < 0.10

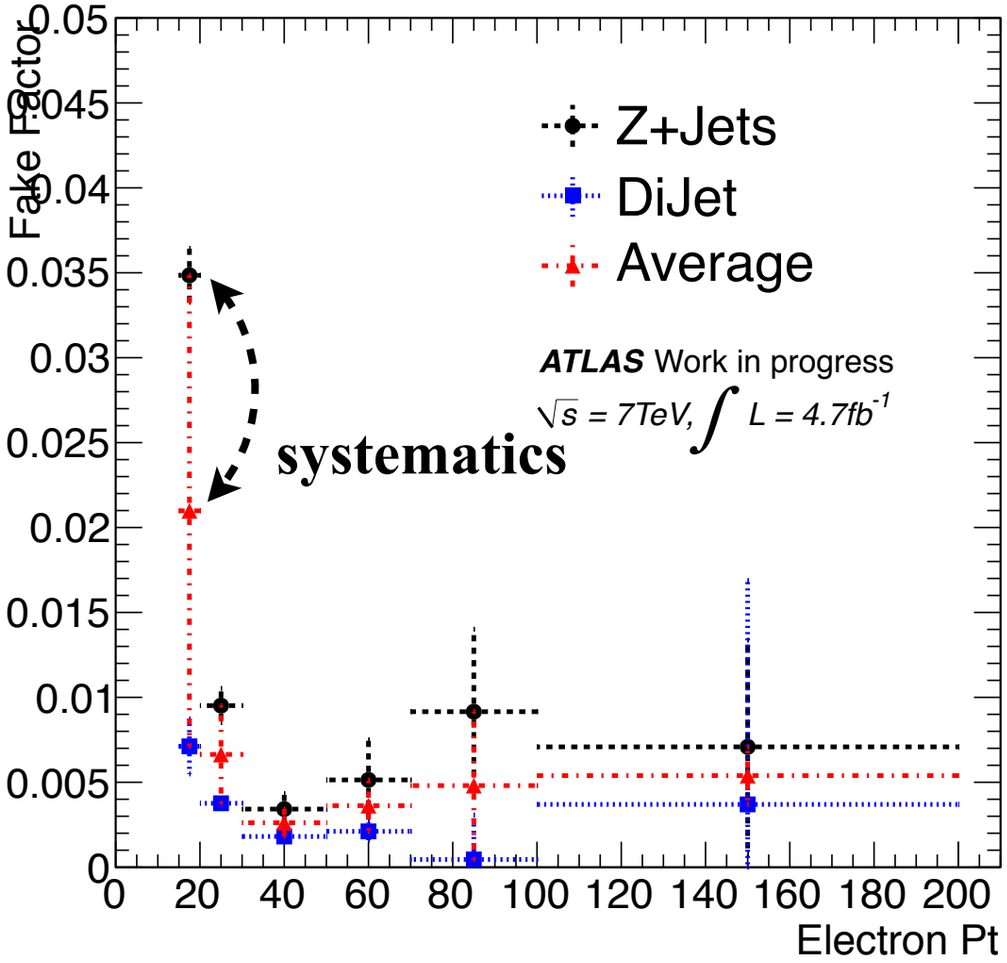
Fake Factor measurement

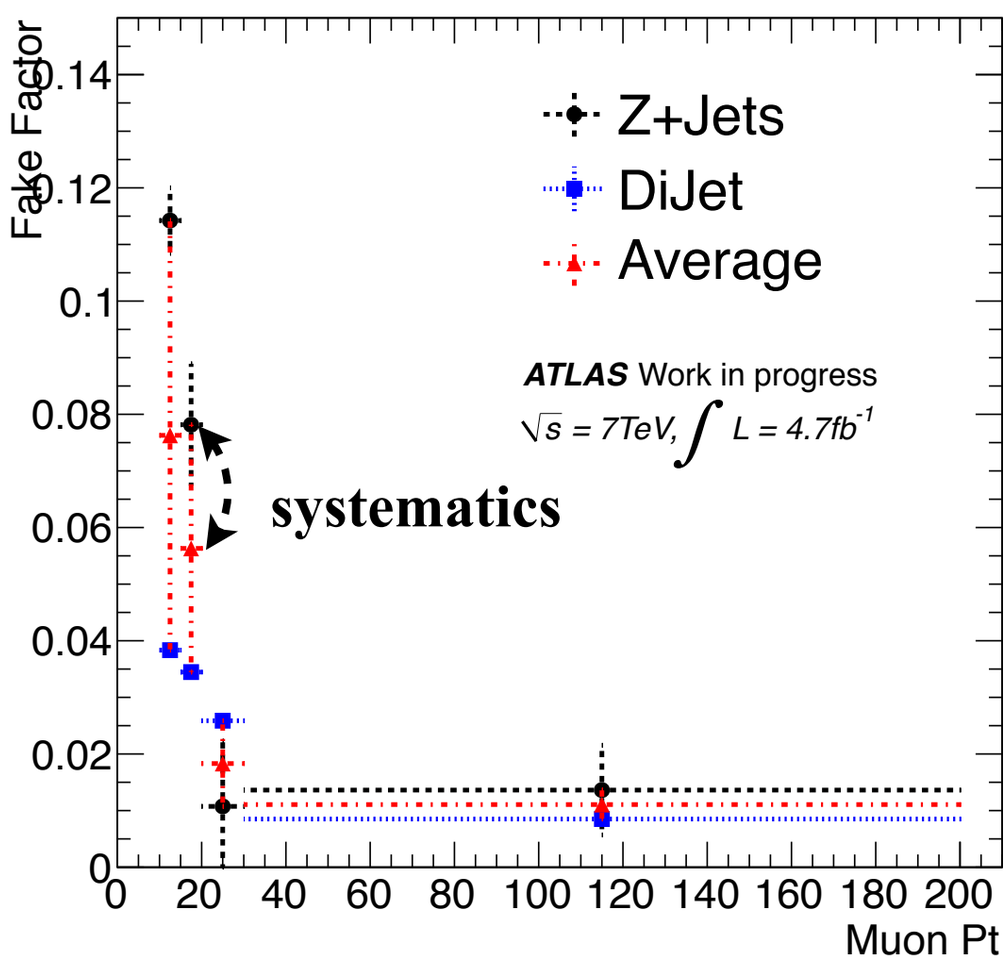




- Current fake factor is shown above figure.
  - We change mainly how to choose the tag-Z boson.
  - The fake factor has been more smaller than my previous talk.
  - We estimate the factor from Z+Jets and DiJet events.
  - In oder to evaluate a difference of the ratio of quark/gluon jet, We take account of a ratio of QCD/W+Jets events.

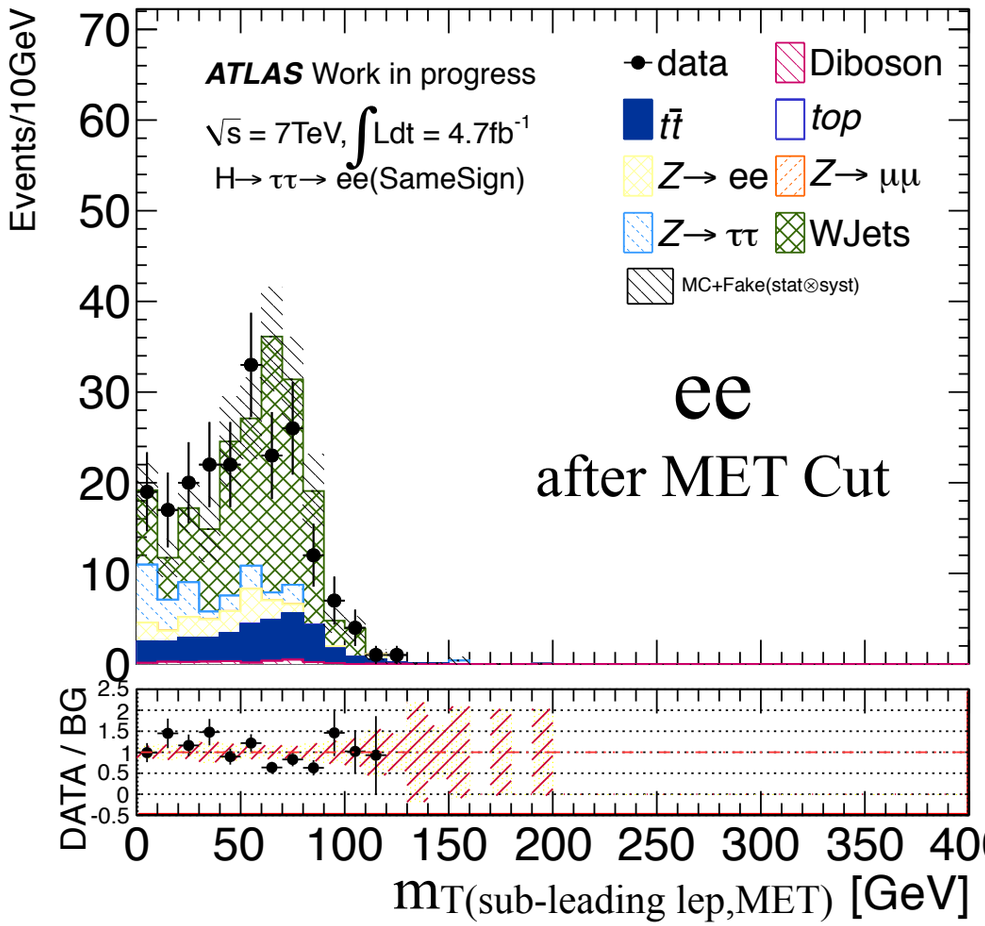
Fake Factor measurement

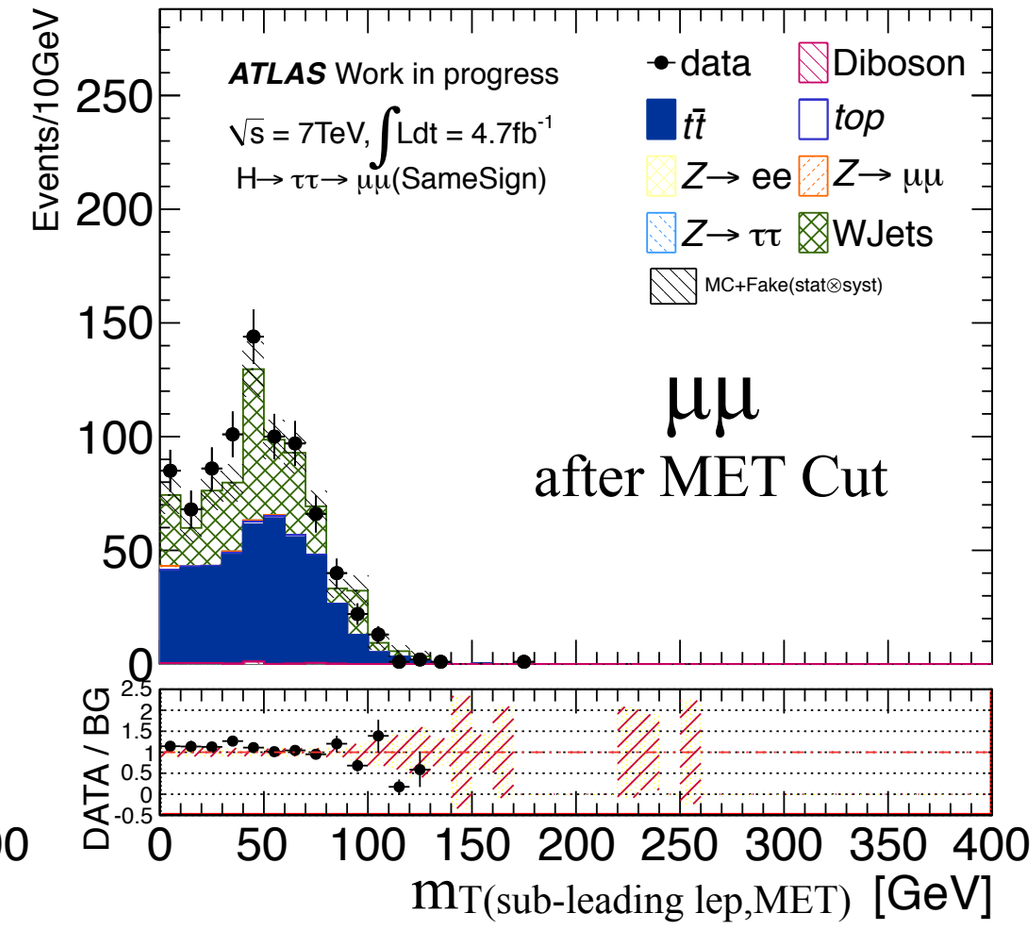




- We don't have any good idea of estimating the ratio of quark/ gluon jet.
- We have evaluated the fake factor as average value of Z+Jets and DiJets and defined systematics uncertainty as a value that cover both two factors.

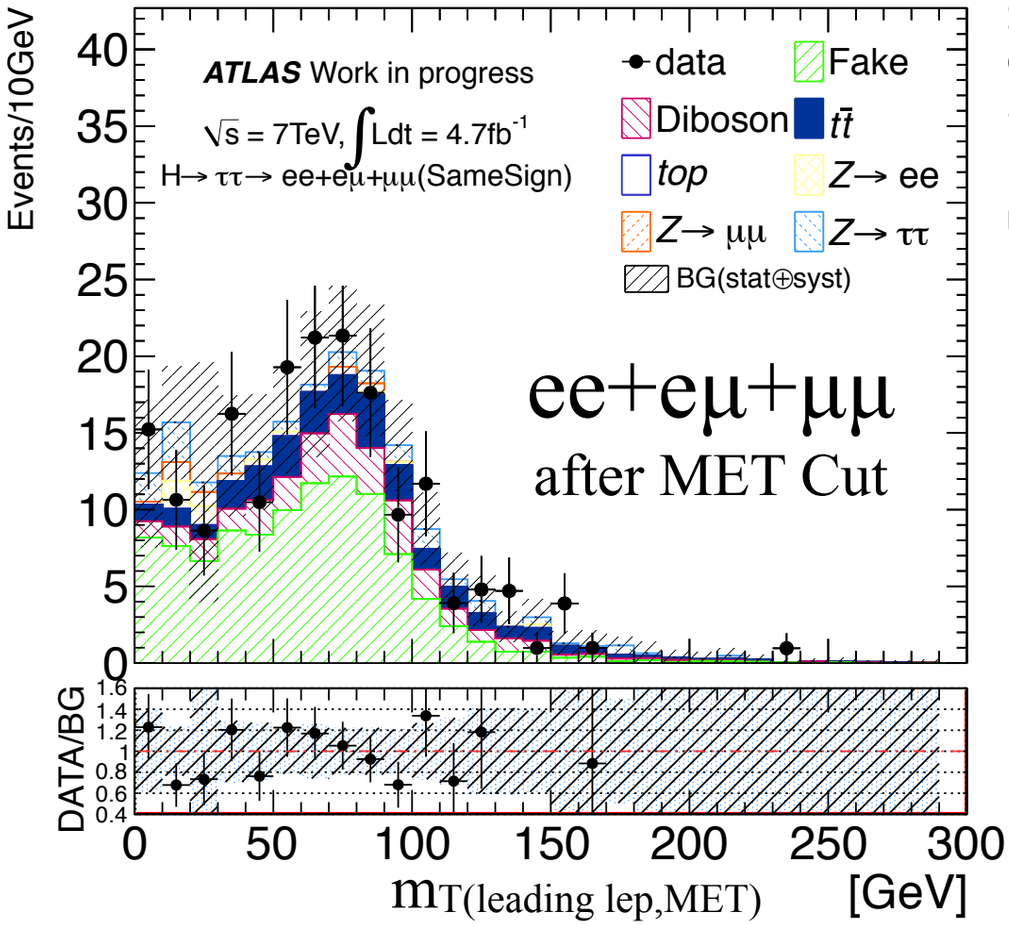
Lepton+fakable events in same sign

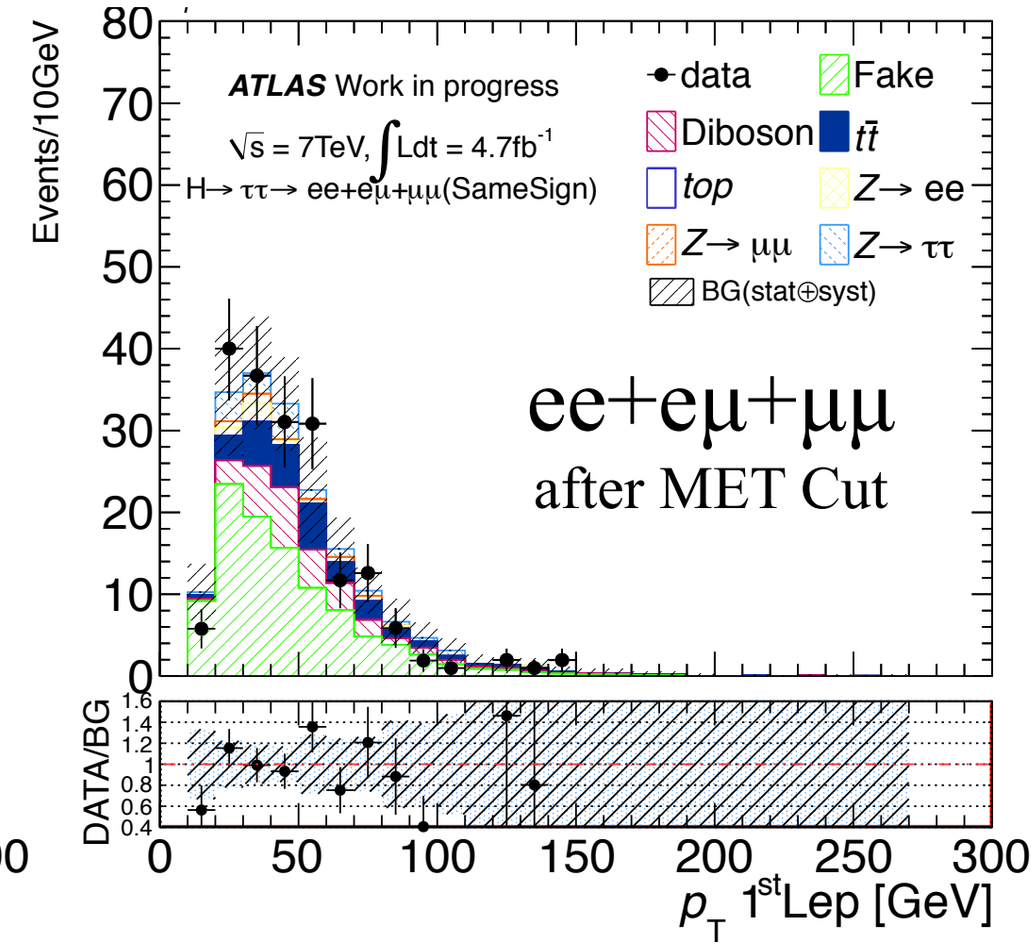




- These plots are shown $m_{T(\text{sub-leading lep,MET})}$ in same sign control region.(before apply fake factor)
  - Data points represent Tight+LNT leptons event.
  - Green histogram is W+Jets events from MC.

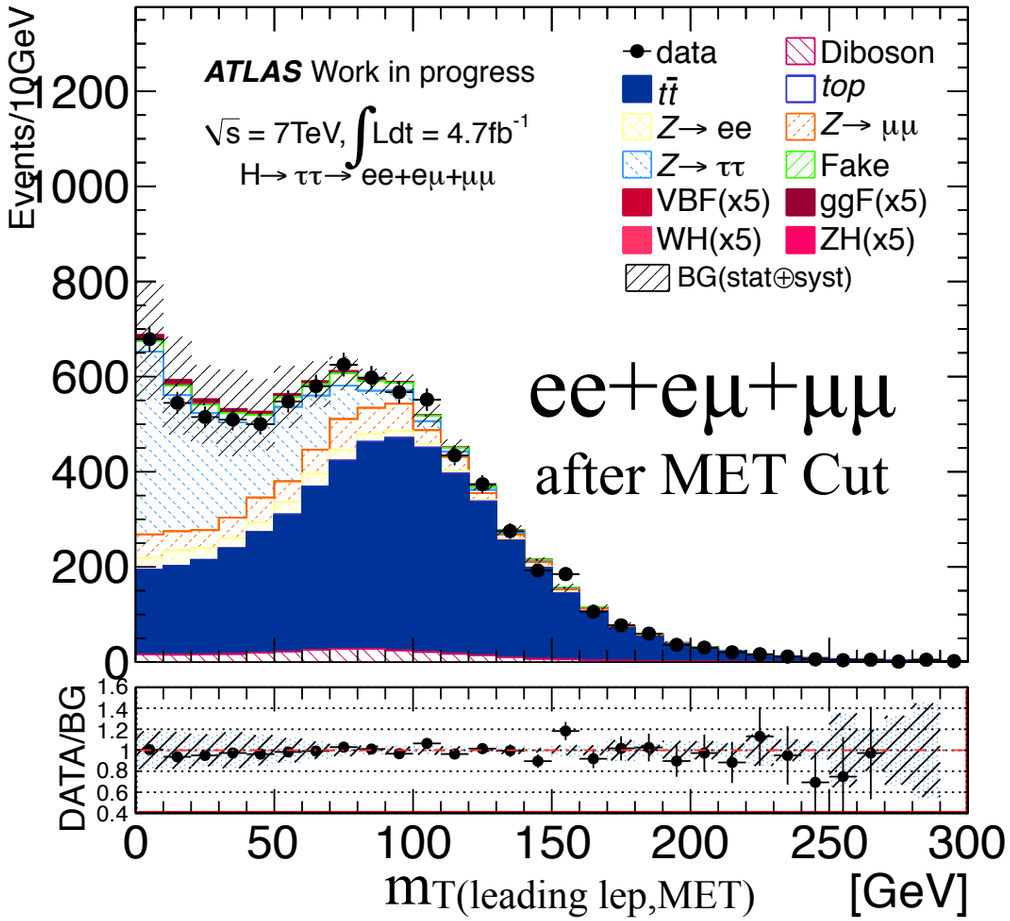
Cross check in same sign





- These plots are shown in same sign after apply fake factor.
  - Data points represent Tight+Tight leptons event.
  - The fake events are shown by light green histogram.
- The fake factor method works well in the same sign CR.

Fake estimation in SR



Fake events Result		
	Official(Template)	Fake Factor
VBF	$1.3 \pm 0.8 \pm 0.6$	$0.95 \pm 0.14 \pm 0.7$
VH	$13 \pm 2 \pm 5$	$11 \pm 1 \pm 7$
1jet	$30 \pm 4 \pm 12$	Not Estimate
0jet	$1183 \pm 12 \pm 473$	$1251 \pm 9 \pm 660$

- This method has over 50% systematics uncertainty for the fake BG component.
  - These are dominated by flavour difference of the fake factor.
- We have obtained nearly values with official ones.
- Next we reproduce the template fit method.

Procedure of Template Fit method

- I tried the template fit method by using `TFractionFitter` .
  1. Choose iso+non-iso lepton events in data.(→non-iso sample)
  2. Subtract MC(top,ttbar,Z->ll,Diboson) events from non-iso sample.(→fake sample)
  3. Perform fitting to data sub-leading pT distribution with MC and the fake sample after m_{LL} cut.(input: EW BG&fake sample)
  4. Scale the fake sample as the fake events.

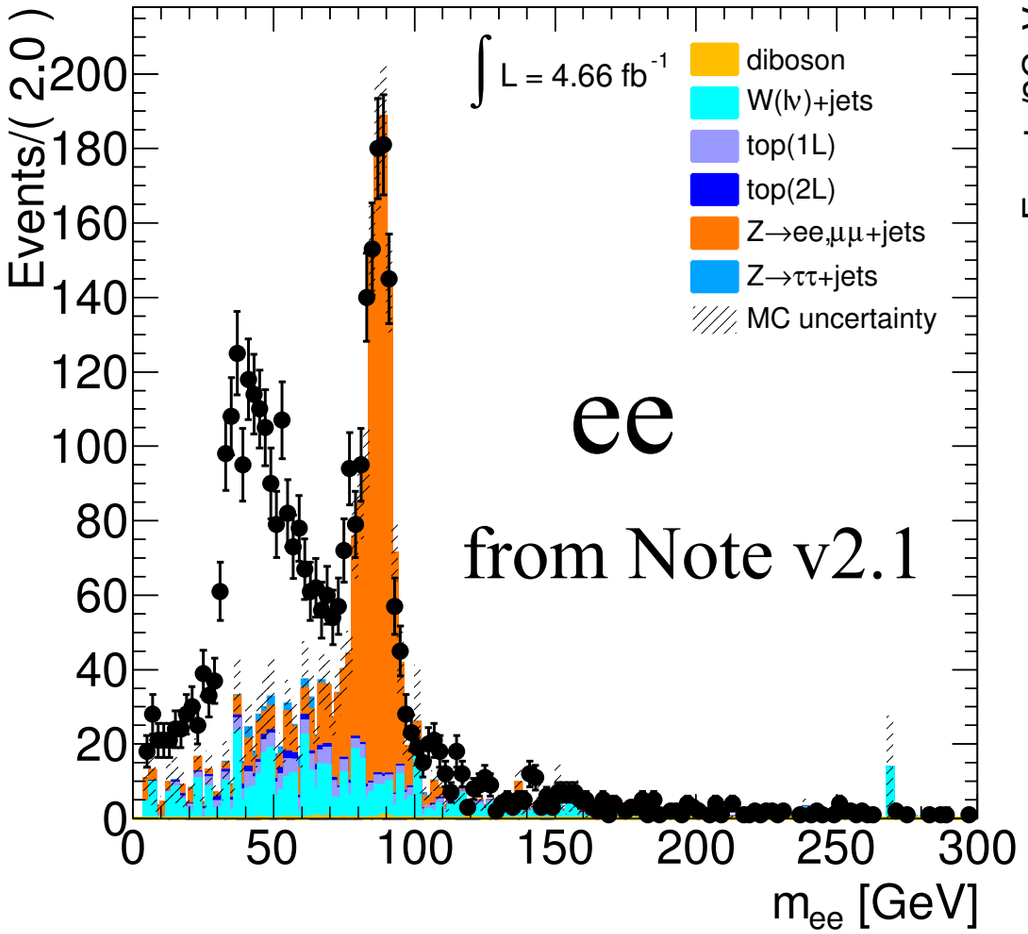
$$\mathrm{data} = f * \mathrm{fake} + (1 - f) * \mathrm{MC}$$

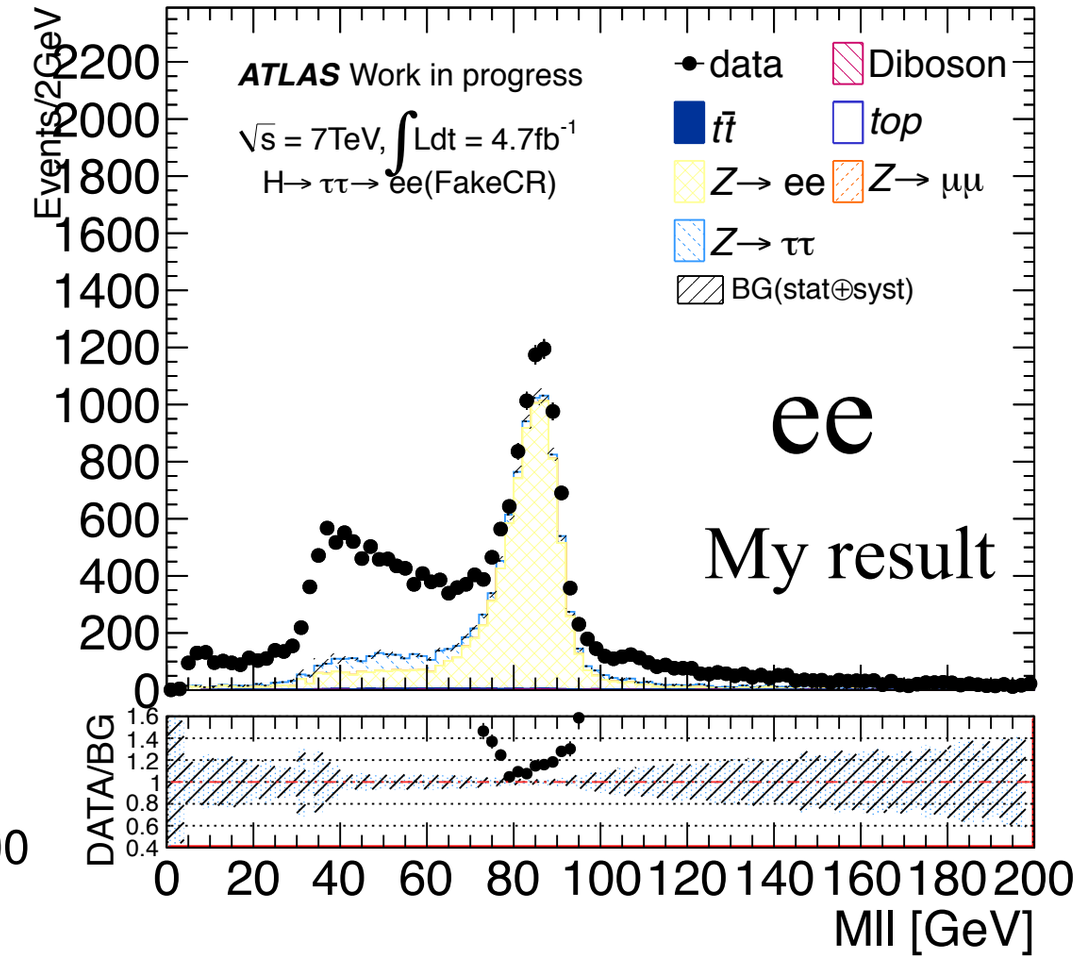
- Then I have one question,
  - How is the scale factor of the fake events defined?
  - I defined it like this equation,

$$\mathrm{SF}_{\mathrm{TFraction}} = f_{\mathrm{TFraction}} \times \frac{\#\mathrm{of\ data}}{\#\mathrm{of\ fake\ sample}}$$

  - But a scale factor of MC is fixed by theoretical S.F.(cross section*lumi/events).

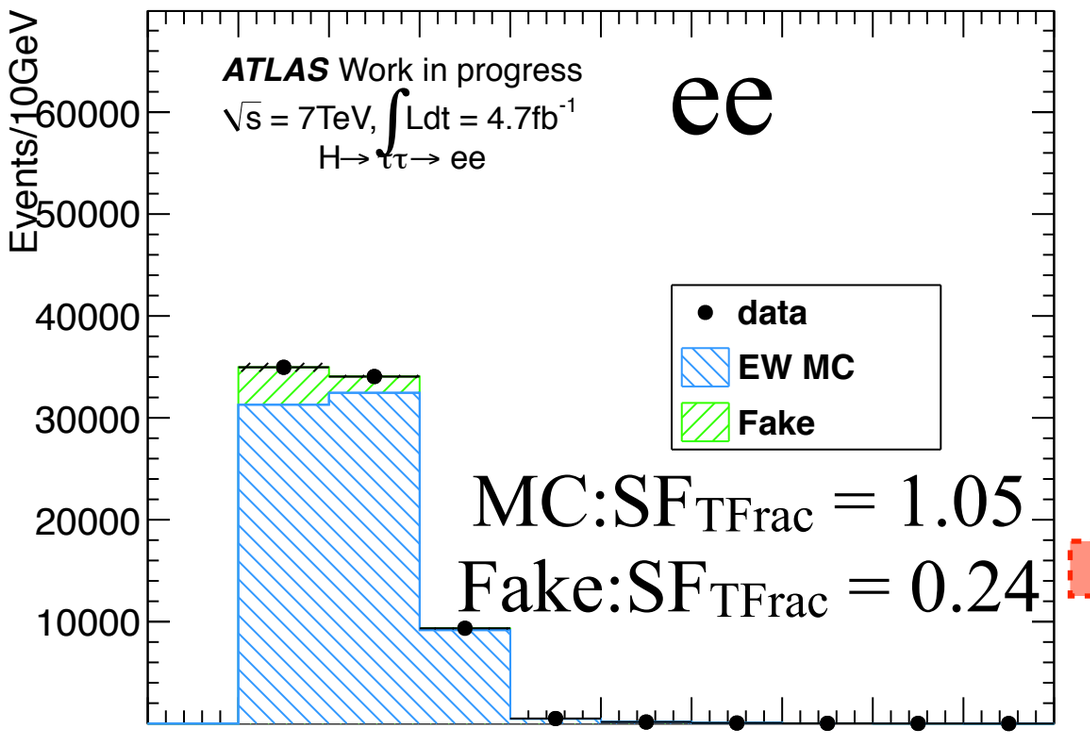
Template Fit method

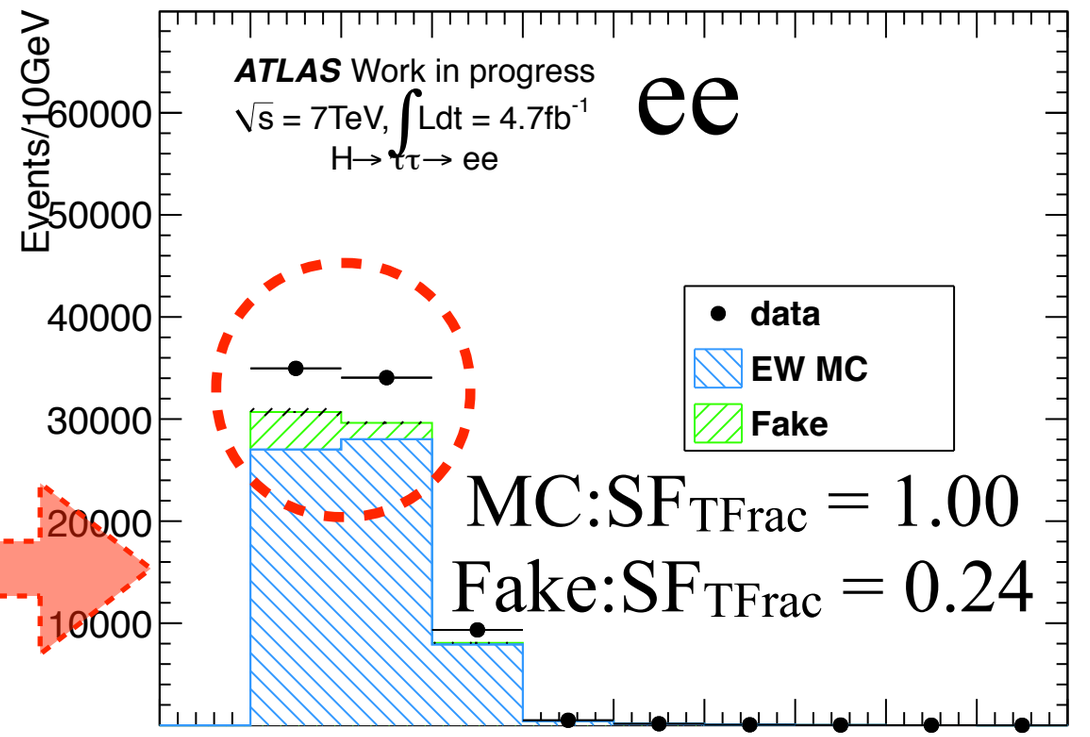




- Non-iso control sample in same sign,
  - We don't execute an overlap removal between fake electrons and fake muons.(So my result's plot is larger than Note v2.1's?)
  - or cut level is different? (before m_{LL} cut)
- How do you execute overlap removal non-iso and non-iso events?

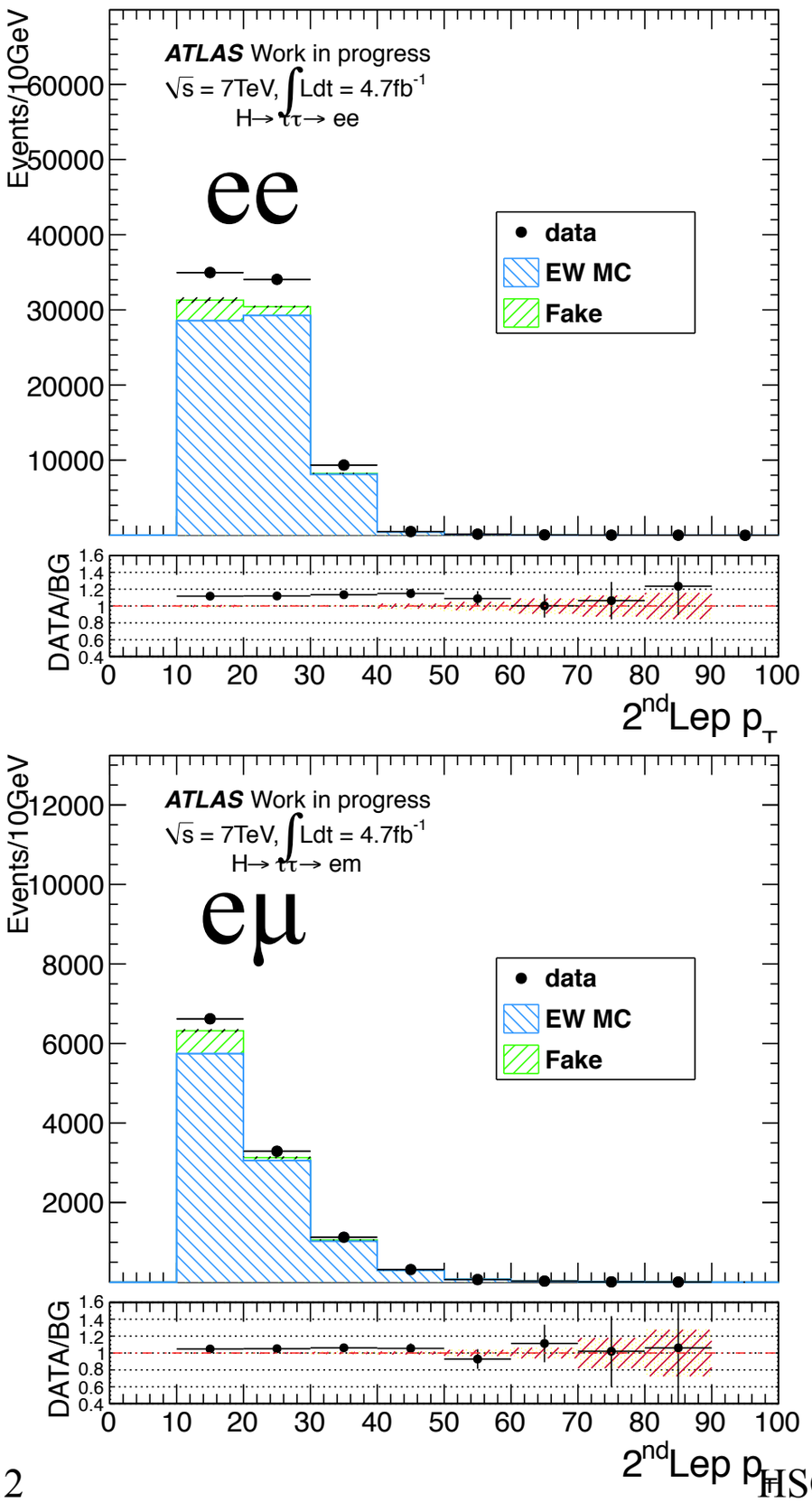
Fit Result

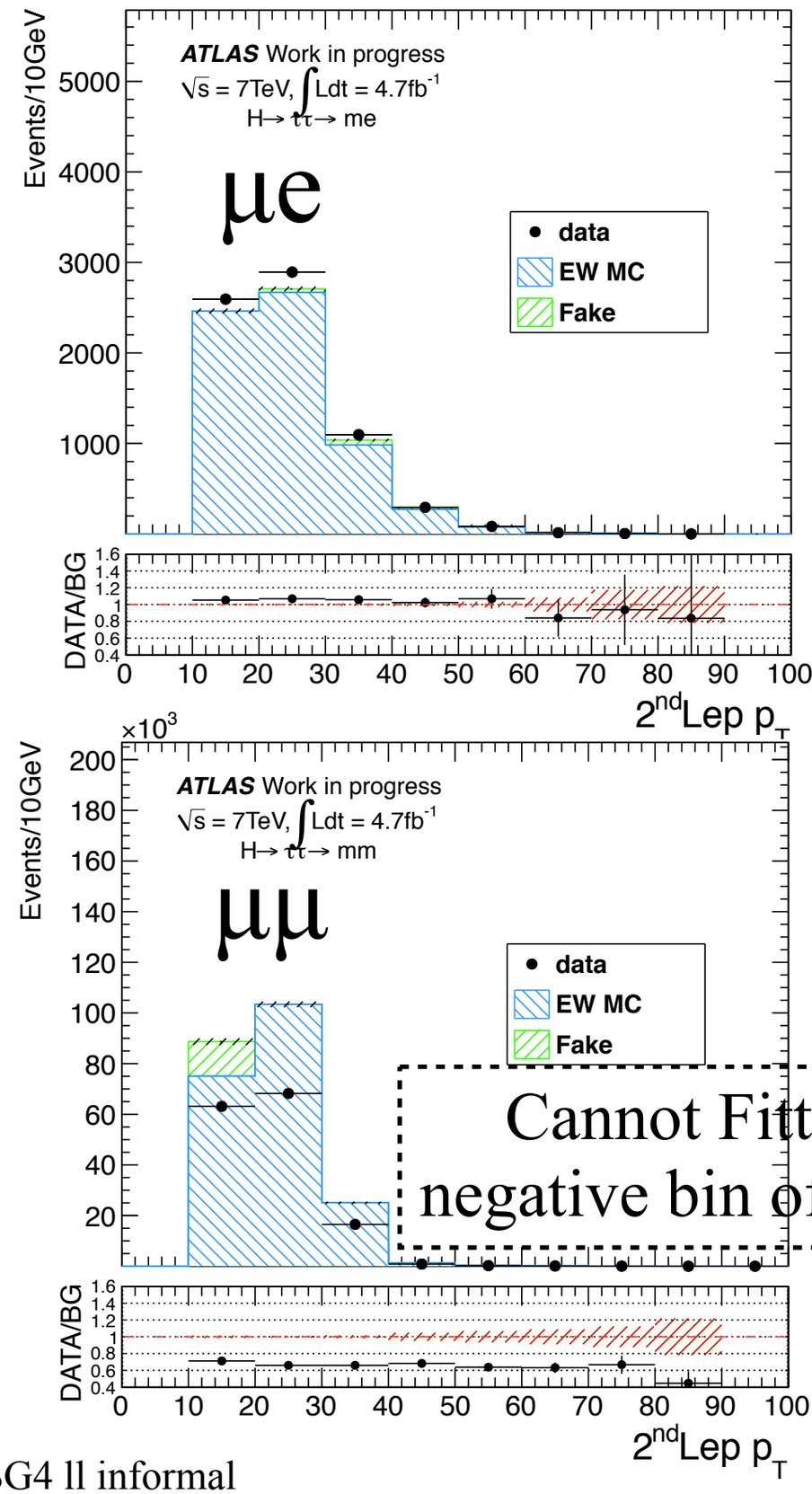




- In the case of ee channel, after cut 1(pre selection & O.S.)
  - Left: Apply SF_{TFrac} for both of EW MC and the fake events.
  - Right: Apply SF_{TFrac} for only the fake events.
- How is this difference treated?
- I don't have any idea of this problem.

Fit Result





Cannot Fitting due to negative bin of fake sample

Result of template fit

- Fitting Result is shown blow table.

Template Fit Result					
ch	Fraction		Scale Factor		
	SM EW	Fake	SM EW	Fake	χ^2
ee	0.95 ± 0.01	0.05 ± 0.01	1.05 ± 0.01	0.24 ± 0.05	$4.5/7$
$e\mu$	0.91 ± 0.02	0.09 ± 0.02	1.02 ± 0.02	0.03 ± 0.004	$2.5/7$
μe	0.90 ± 0.04	0.01 ± 0.04	0.98 ± 0.04	0.07 ± 0.03	$4.1/7$

  - Error term is only statistical components of the template fitting.
  - In the case of μμ channel, because of the level of fake leptons is very low, we cannot fit correctly.

- Systematics uncertainty estimation is now ongoing.
  - How do you change a fitting range to evaluate a systematics uncertainty of this fitting?

2012 run trigger

- 2012 trigger is applied isolation cut at trigger level.
  - single electron: `EF_e24vhi_medium1`
    - v: varying L1 threshold
    - h: L1 hadronic veto
    - i: track isolation applied at the HLT (ptCone20/Pt < 0.1)
  - single muon: `EF_mu24i_tight, EF_mu18i6_tight`
    - i: ptCone20/pt < 0.12
    - i6: tighter than “i”(cut to be finalized ptCone40<0.1 + L2 calo isolation)
- Need to check this effect for the fake estimation.
- It is easy to optimize new jet categorizations that finish evaluating a systematics uncertainty of the fake.

Question & Conclusion

- There are some questions for the template fit.
  - Do you perform to remove a overlap between fake electrons and fake muons?
  - How is deal with a scale factor after fitting?
  - How do you change a fitting range to evaluate a systematics uncertainty of this fitting?

- Conclusions
  - The fake factor method works well with systematics uncertainty over 50%.
  - There is plenty of room for improvement in quark/gluon jet ratio difference.
  - We will finalize this method regardless of using in ll analysis.
  - Nobody knows exactly what happens in this year analysis.
  - It’s better that we can cross-check between both method.

Back Up!