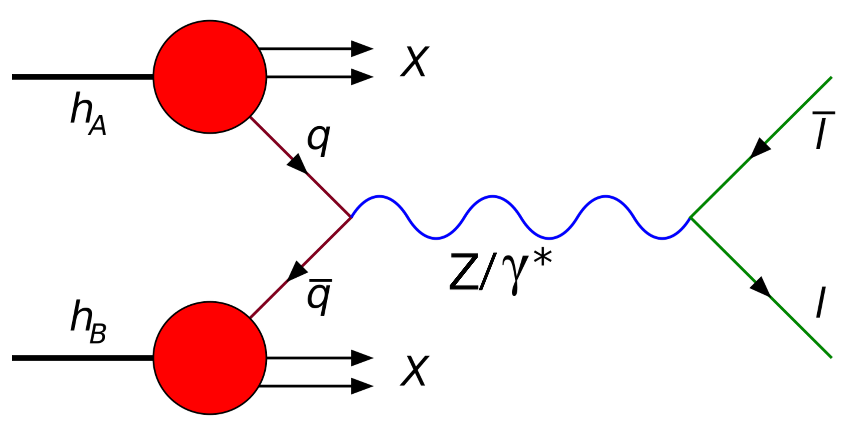
Drell-Yan Differential Cross Section Measurement at 13TeV with the CMS Detector

Kyeongpil Lee *on behalf of the CMS collaboration*

Physics Motivation

Drell-Yan (DY) Process

- lepton pairs are produced via γ^*/Z exchange



Motivation

- Precise test of QCD
- PDF constraints
- Major backgrounds for many BSM searches

→ **CMS has been continuously measured DY cross sections**

- 3 papers with 7-8 TeV data: already published [*]
- **This is the first measurement with 13 TeV data!**

[*] JHEP10(2011)007, JHEP12(2013)030 and Eur. Phys. J. C (2015) 75:147

Analysis Strategy

Goal: Measure the differential cross section $d\sigma/dm$ of DY process

- 2.3(2.8) fb^{-1} for e(μ) channel
- 15 < M < 3000 GeV (43 bins)

$$\sigma_i = \frac{N_i^u}{A_i \, \varepsilon_i \, L}$$

- *cross section of i-th bin*: σ_i
- *Acceptance*: A_i
- *Efficiency*: ε_i
- *Integrated Luminosity*: L
- *Observed yield* (N_i^u) with
  - ⊙ momentum/energy scale correction
  - ⊙ background subtraction
  - ⊙ unfolding correction

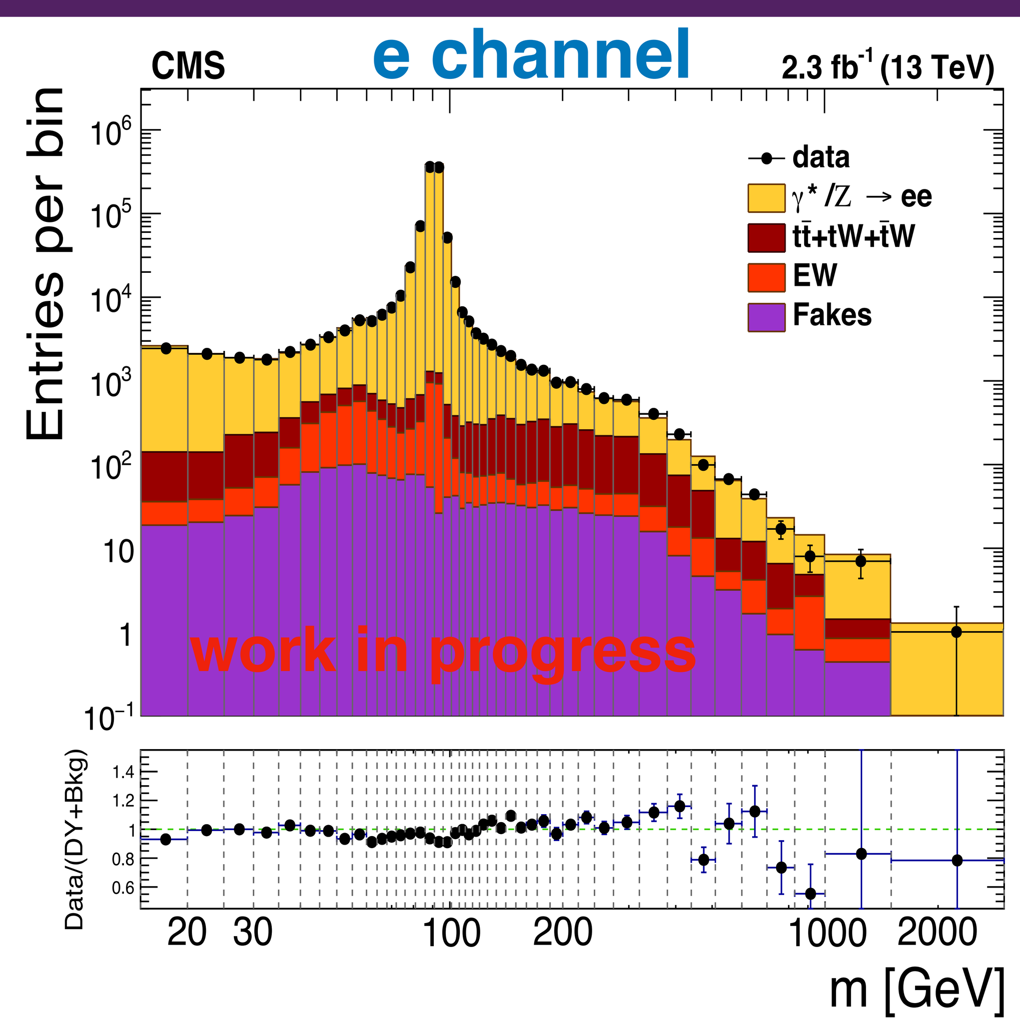
Event Selection & Background Estimation

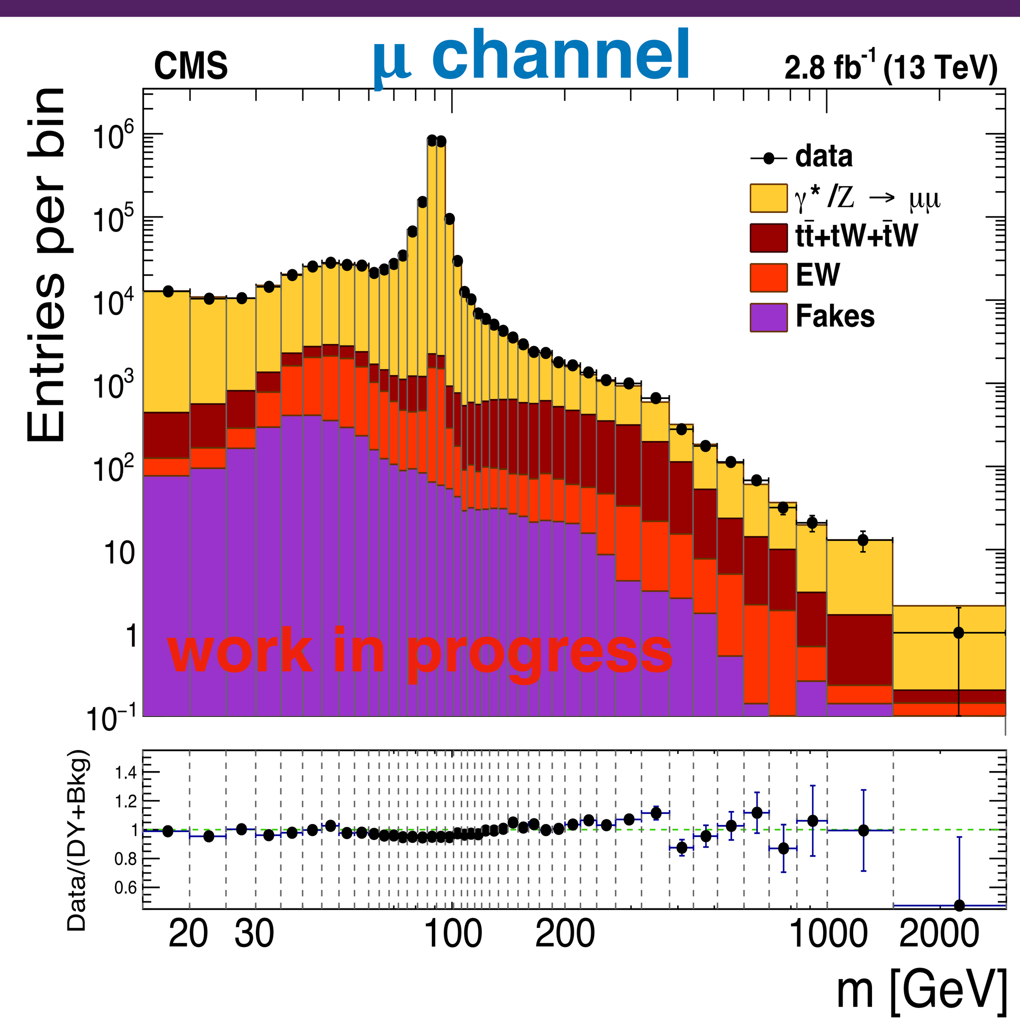
Event selection

Requirement	e channel	μ channel
Trigger	Isolated single e trigger with P_T > 23 GeV	Isolated single μ trigger with P_T > 20 GeV
Kinematic cuts	P_T > (30, 10) GeV, $\lvert\eta\rvert$ < 2.5	P_T > (22, 10) GeV, $\lvert\eta\rvert$ < 2.4
ID	CMS standard selection	

Background estimation

- **Fakes (QCD, W+jets)**: fake rate method (data-driven)
- **top events** & **WW**: eμ method (data-driven)
- **WZ & ZZ**: MC prediction





Corrections

Step 1: Unfolding correction for the detector resolution

- To remove the bin migration effects
- generated post-FSR mass vs. reconstructed mass

Step 2: Acceptance & efficiency corrections

- To compensate the lost events by kinematic limit & ID procedure
- Difference of efficiency between data and MC is also taken into account

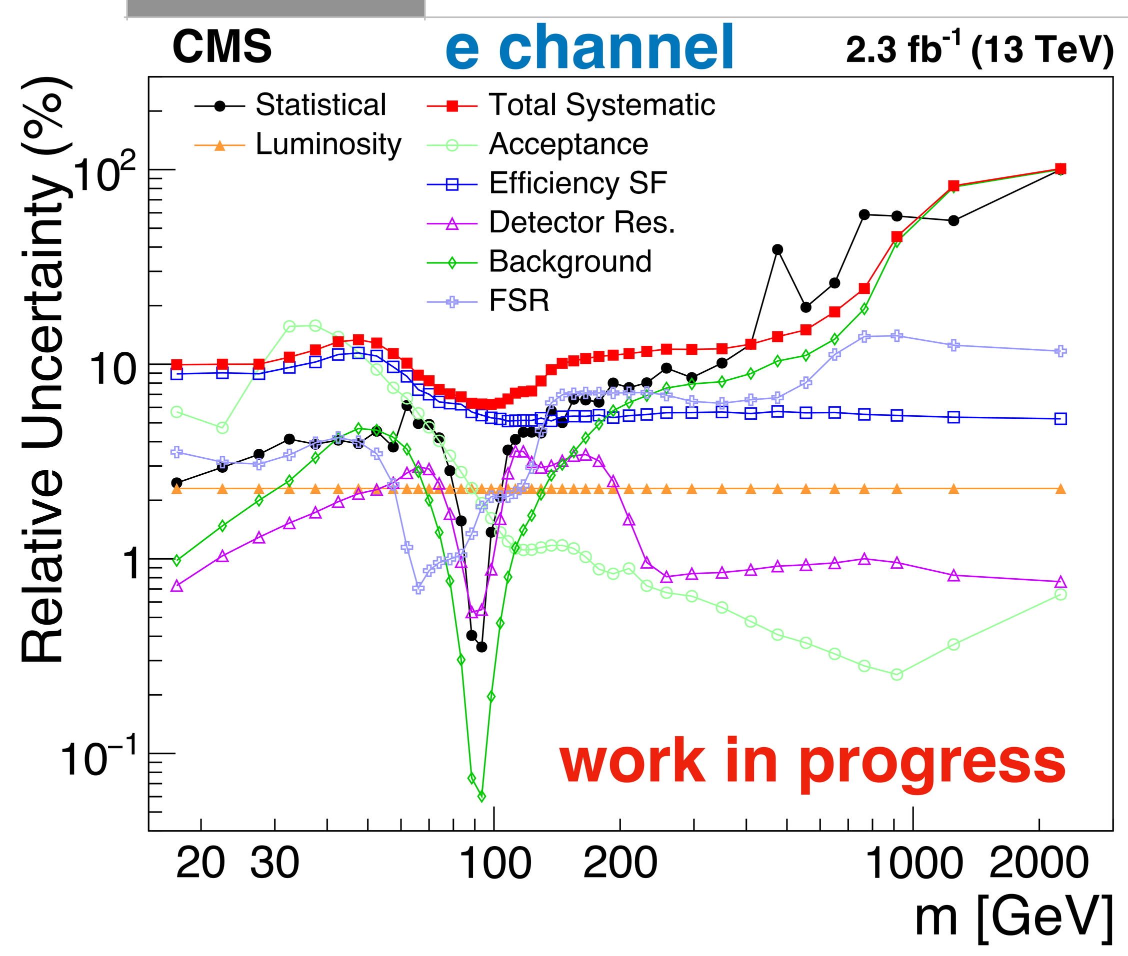
Step 3: Unfolding correction for FSR

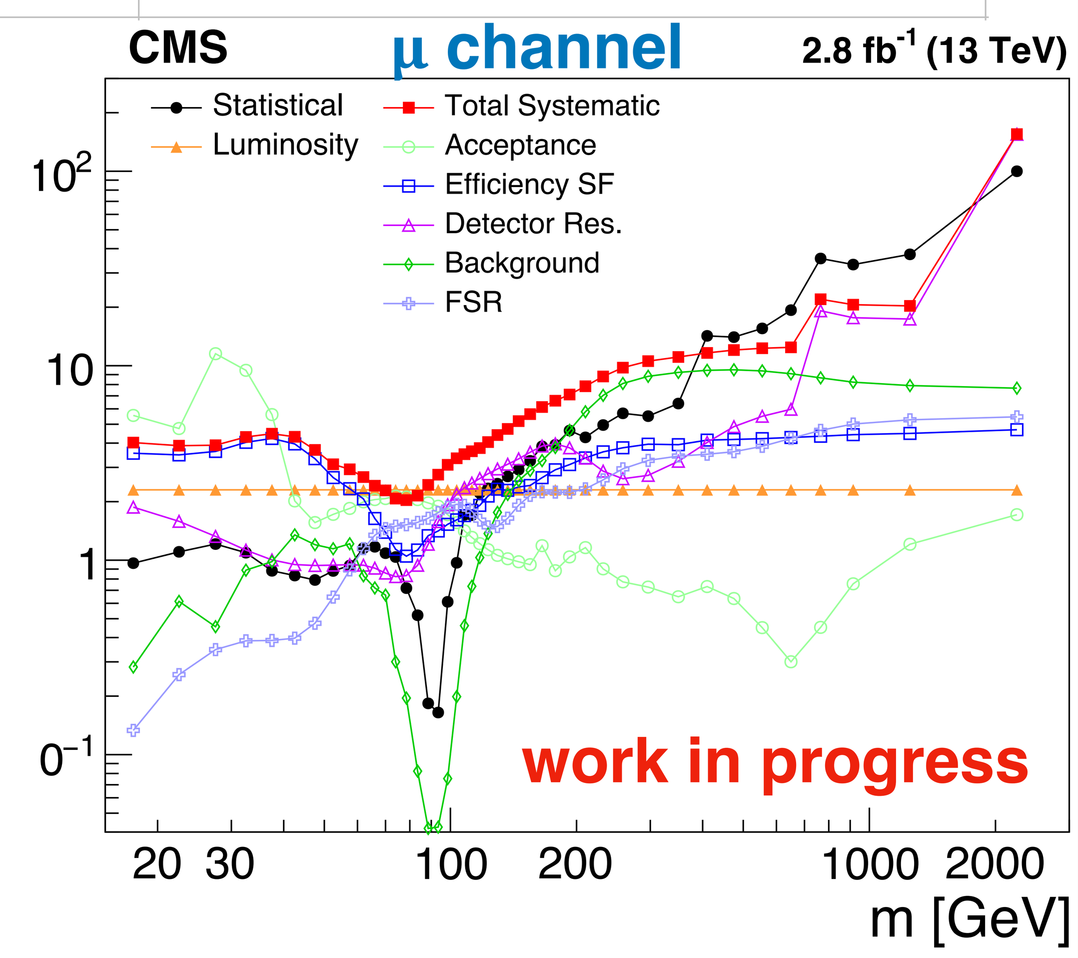
- To remove the bin migration effects by FSR
- post-FSR mass vs. dressed mass

$$\vec{P}^{\mu}_{\text{dressed}} = \vec{P}^{\mu}_{\text{post-FSR}} + \sum_{\Delta R(\mu,\gamma)<0.1} \vec{P}^{\gamma}$$

Uncertainties

Region	e channel	μ channel
Low mass	**efficiency SF** (~9%)	**efficiency SF** (~3%)
Z-peak	**efficiency SF** (~5%)	**FSR** (~2%)
High mass	**Background, statistics** (10-100%)	**Background, statistics** (10-100%)

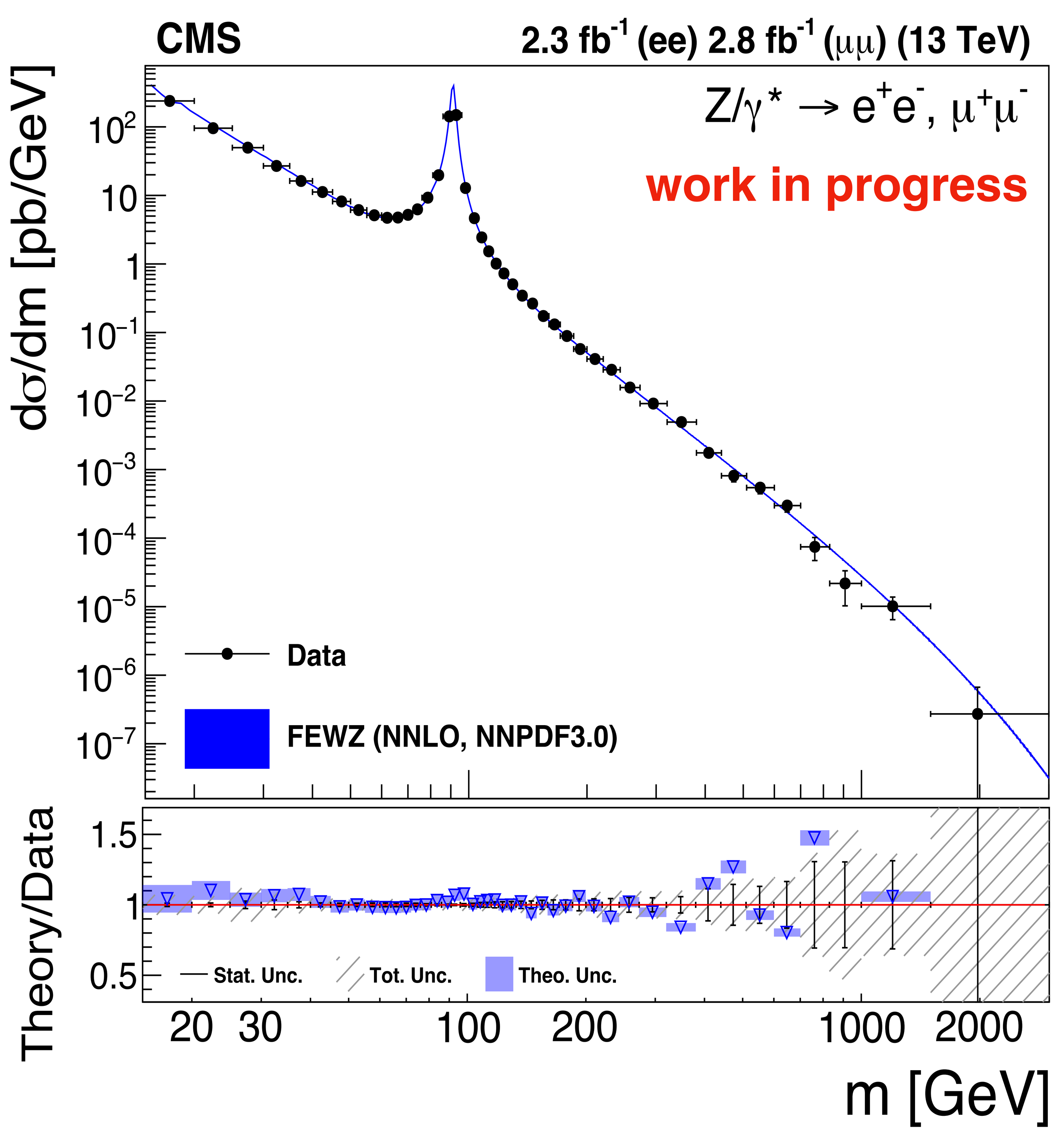




Results

Combination of two channels

- For higher precision
- BLUE method



→ **generally good agreement with theory prediction**