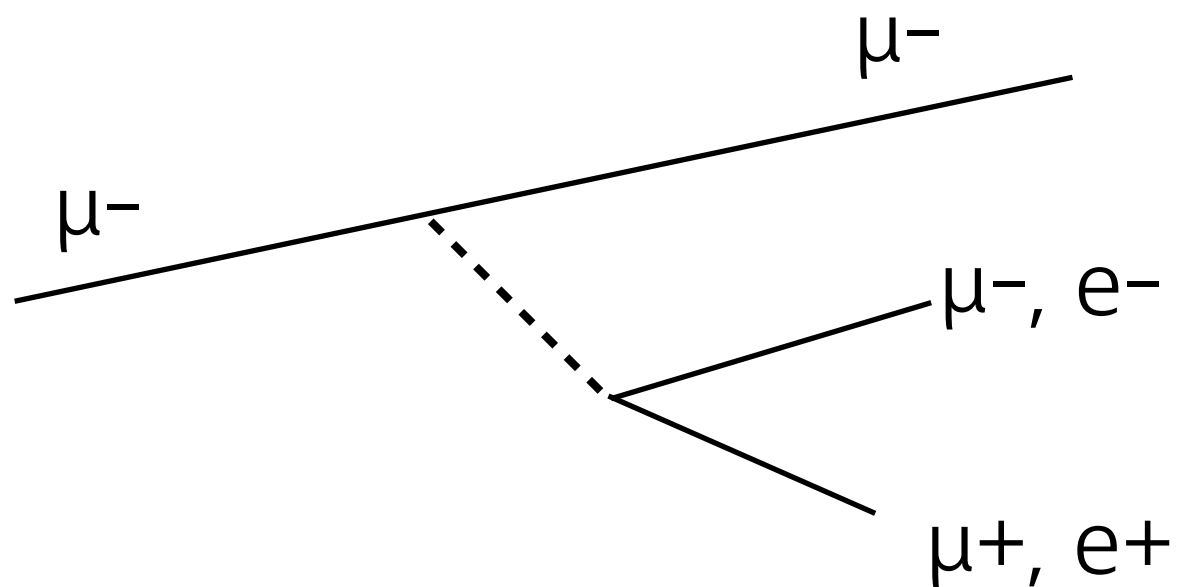# ISR Gen-Level Check
13 TeV
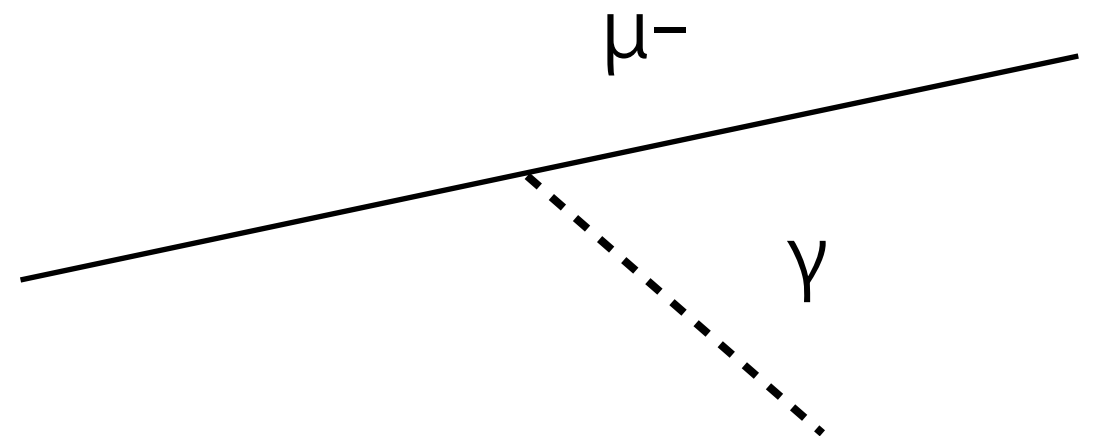# LQv7-6-6.5

2016.10.25

MG & aMC@NLO

- For 8 TeV Study, we used MG samples.

- aMC@NLO is used for 13 TeV

- NLO effect must have been considered before checking reco. level

- using StatusFlag()

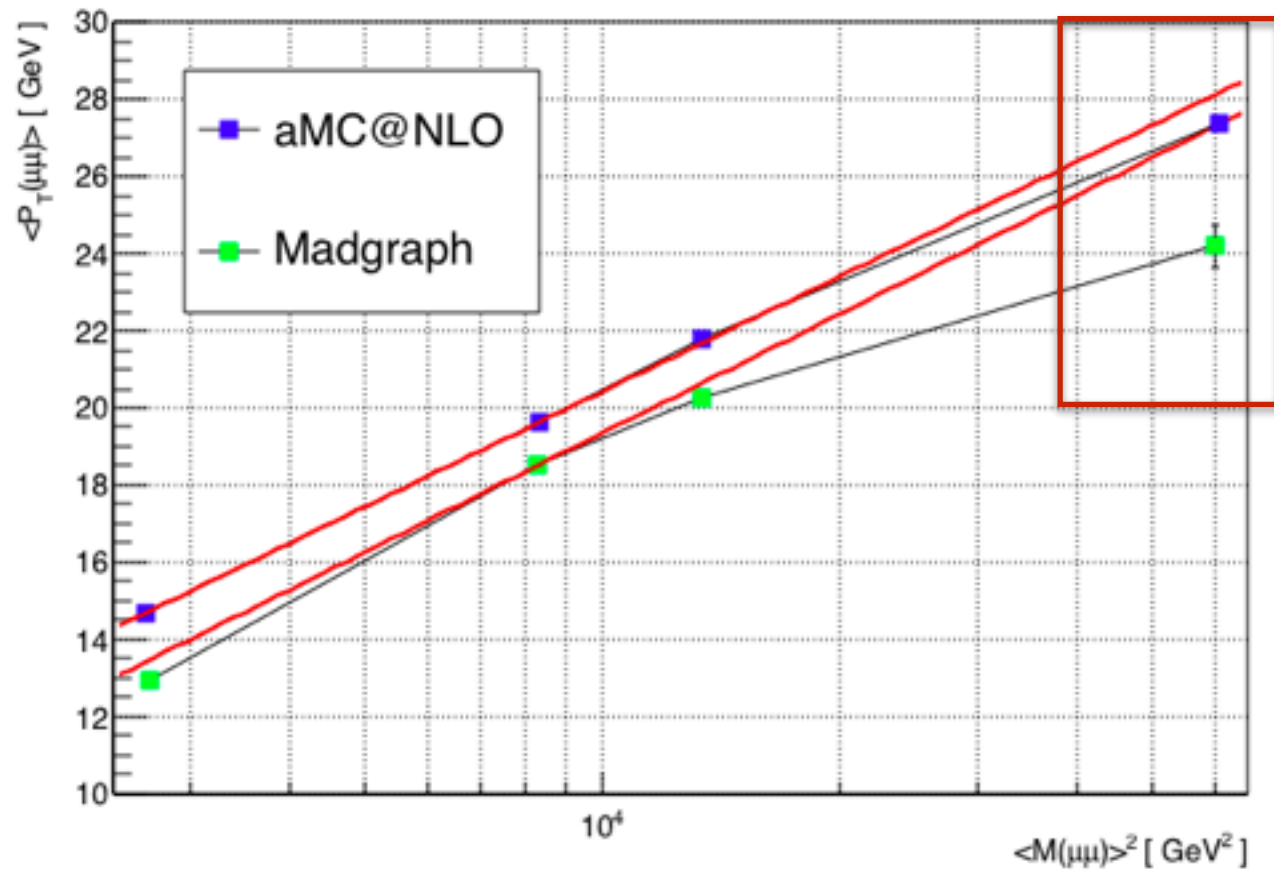# What to consider
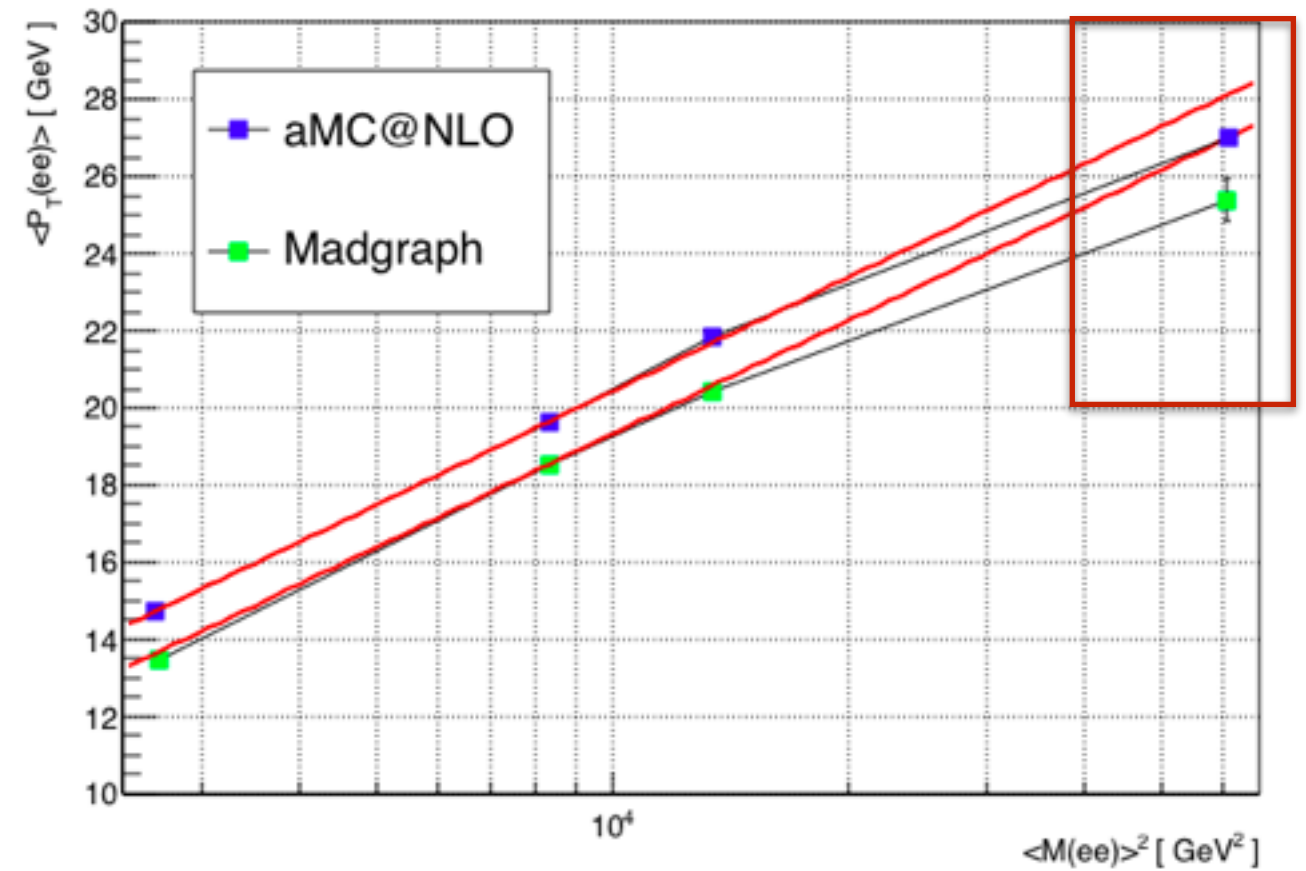
- LO vs. NLO

- include OR exclude FSR momentum

μ−

μ−

μ−, e−

μ+, e+

pair production

μ−

γ

FSR gamma radiation

Gen-Level Muon+FSR aMC@NLO & Madgraph 13TeV

Gen-Level Electron+FSR aMC@NLO & Madgraph 13TeV

μμ	MG	aMC@NLO
Slope	4.44±0.08	4.29±0.03
intercept	-21.5±0.8	-19.1±0.2

ee	MG	aMC@NLO
Slope	4.24±0.09	4.26±0.03
intercept	-19.7±0.8	-18.8±0.02

include FSR mom.

Gen-Level aMC@NLO & Madgraph 13TeV
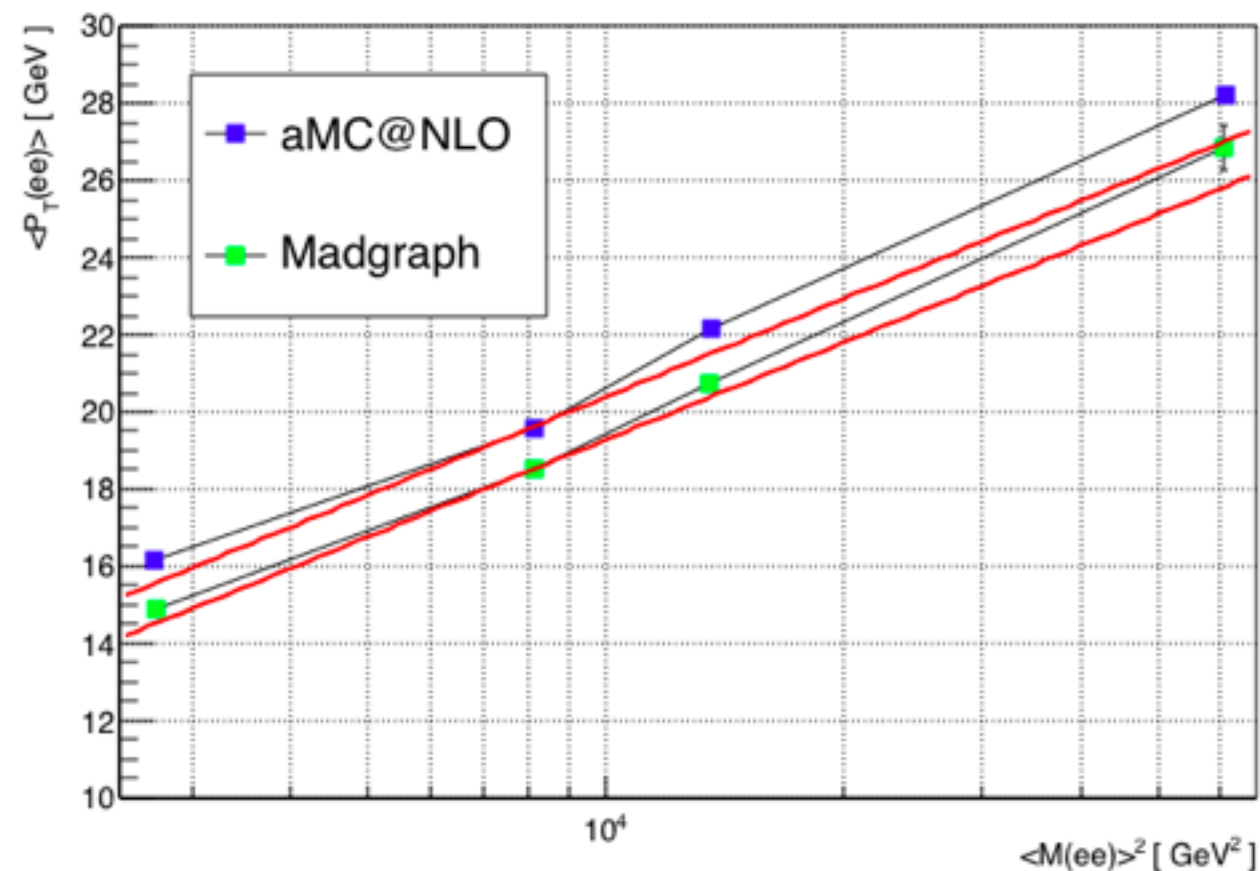
μμ	MG	aMC@NLO
Slope	3.95±0.08	3.86±0.03
intercept	−17.1±0.8	−15.1±0.2

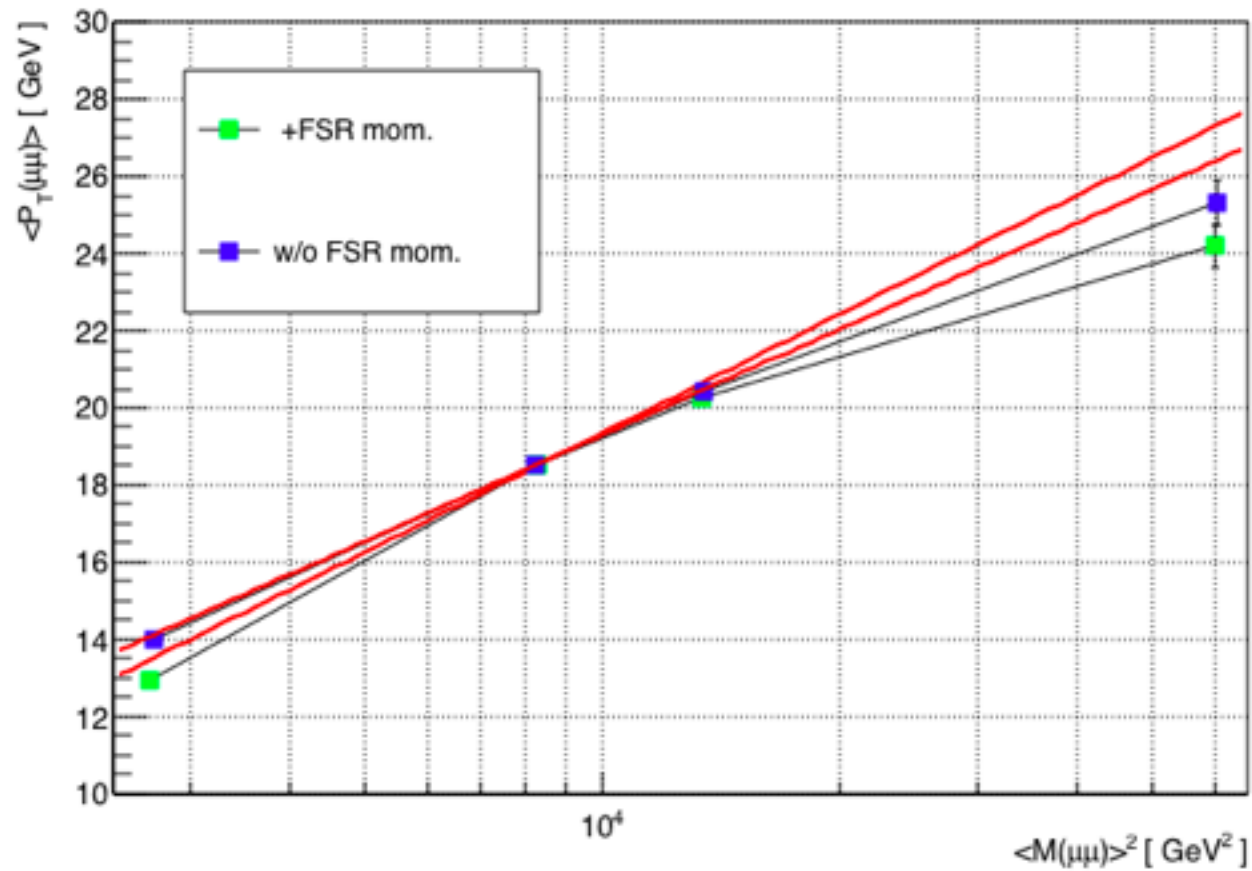| ee	MG	aMC@NLO
Slope	3.63±0.09	3.67±0.03
intercept	−14.1±0.8	−13.4±0.03

w/o FSR mom.

Gen-Level No FSR vs FSR, Madgraph 13TeV

Gen-Level No FSR vs FSR, Madgraph 13TeV
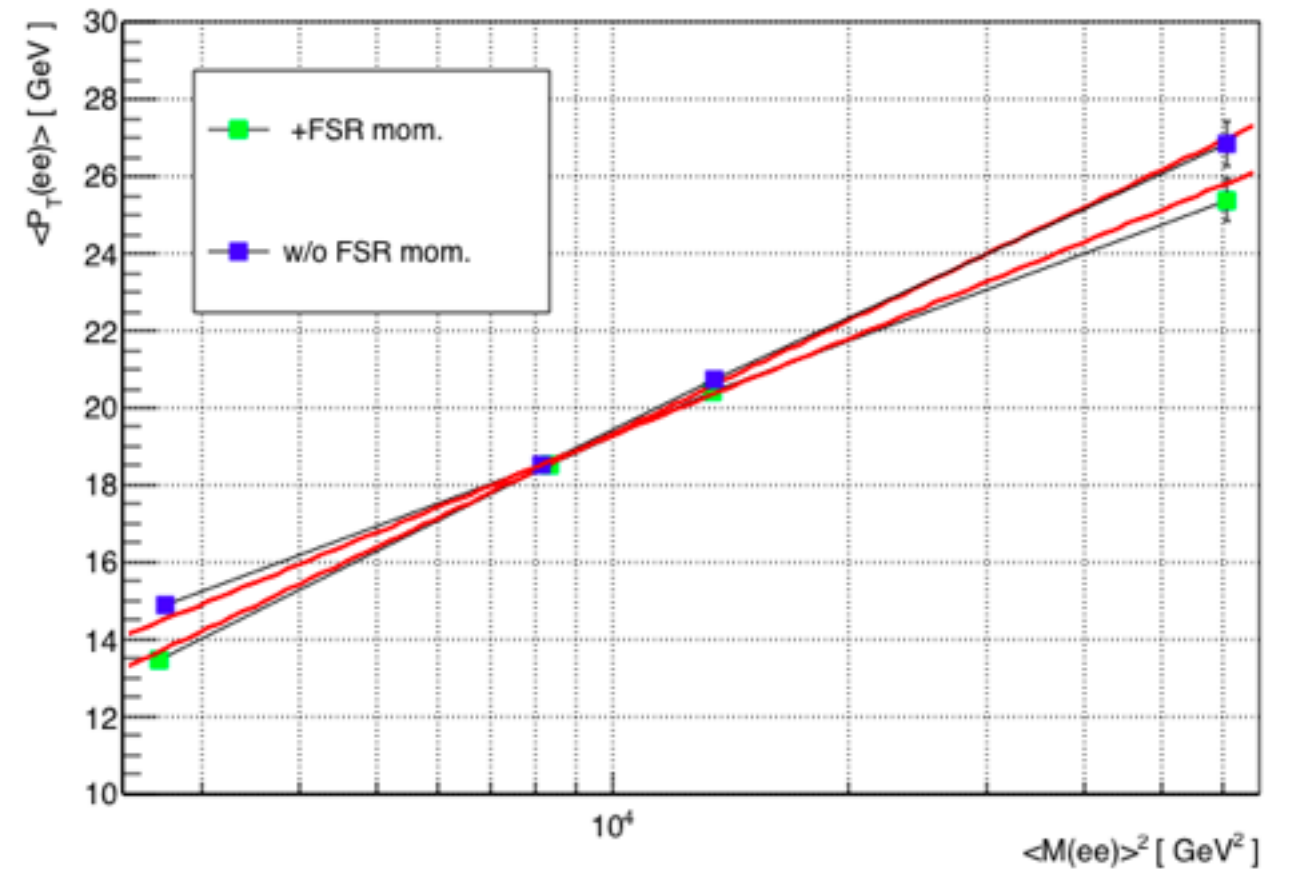
μμ	w/o FSR	+ FSR
Slope	3.95±0.08	4.44±0.08
intercept	−17.1±0.8	−21.5±0.8

ee	w/o FSR	+ FSR
Slope	3.63±0.09	4.24±0.09
intercept	−14.1±0.8	−19.7±0.8

MG

Why PT(ll+FSR) < PT(ll)??
Does it make sense?

Gen-Level No FSR vs FSR, aMC@NLO 13TeV
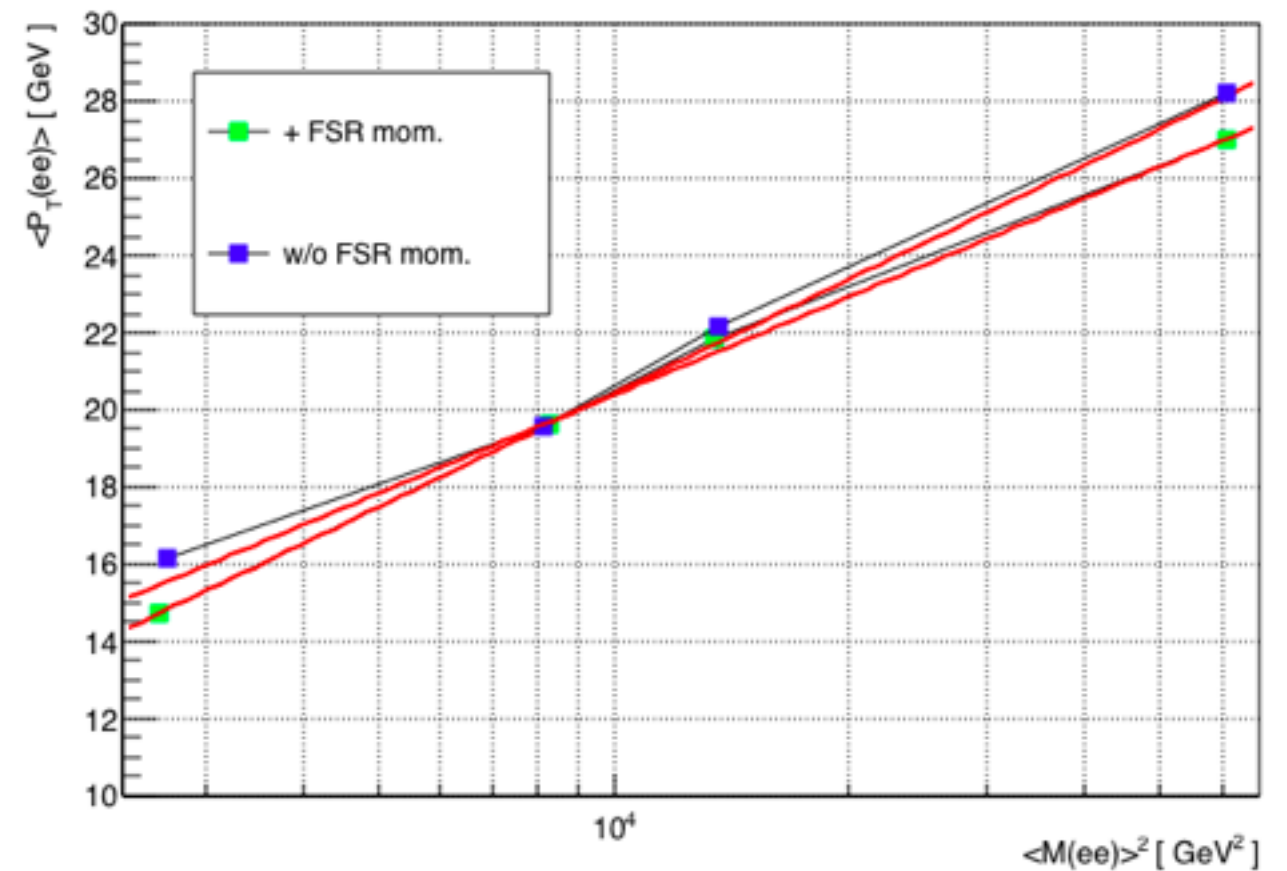
μμ	w/o FSR	+ FSR
Slope	3.86±0.03	4.29±0.03
intercept	−15.1±0.2	−19.1±0.2

ee	w/o FSR	+FSR
Slope	3.67±0.03	4.26±0.03
intercept	−13.4±0.03	−18.8±0.02

aMC@NLO

Why PT(ll+FSR) < PT(ll)??
Does it make sense?
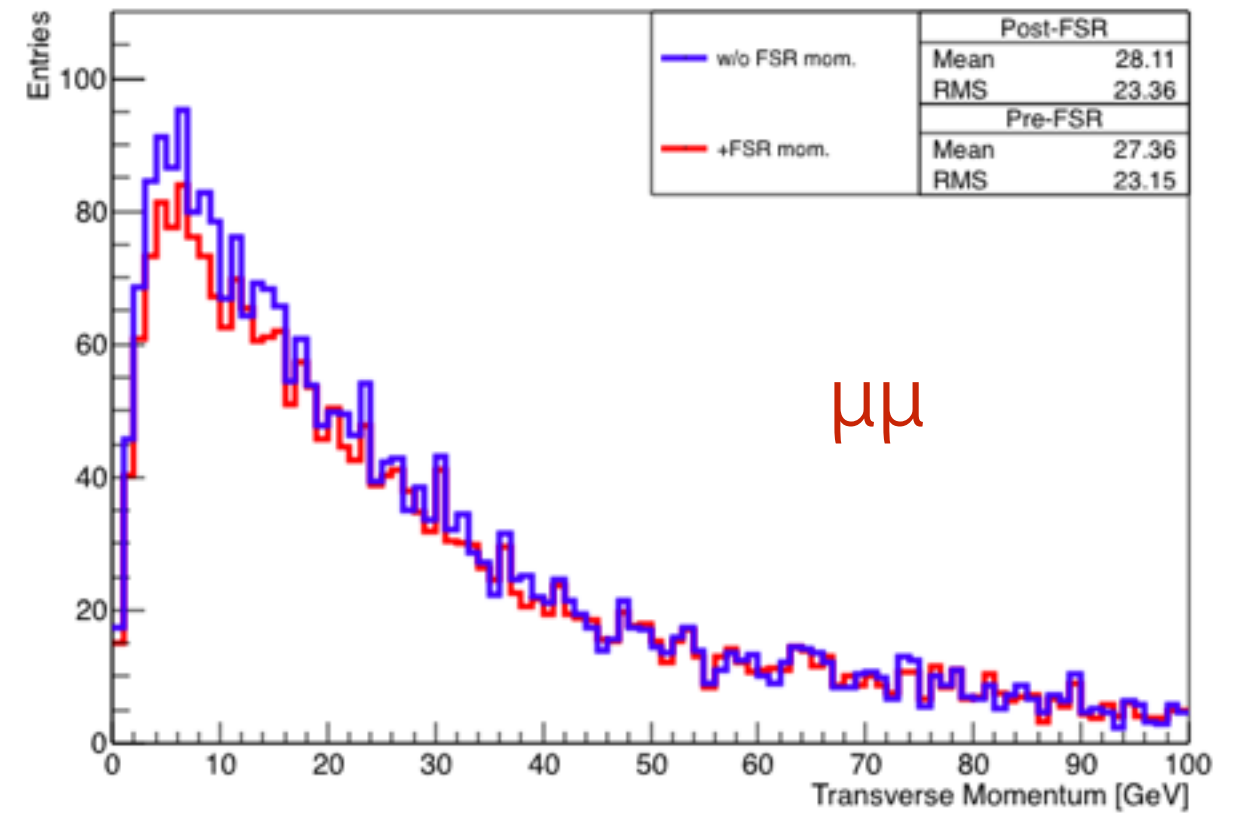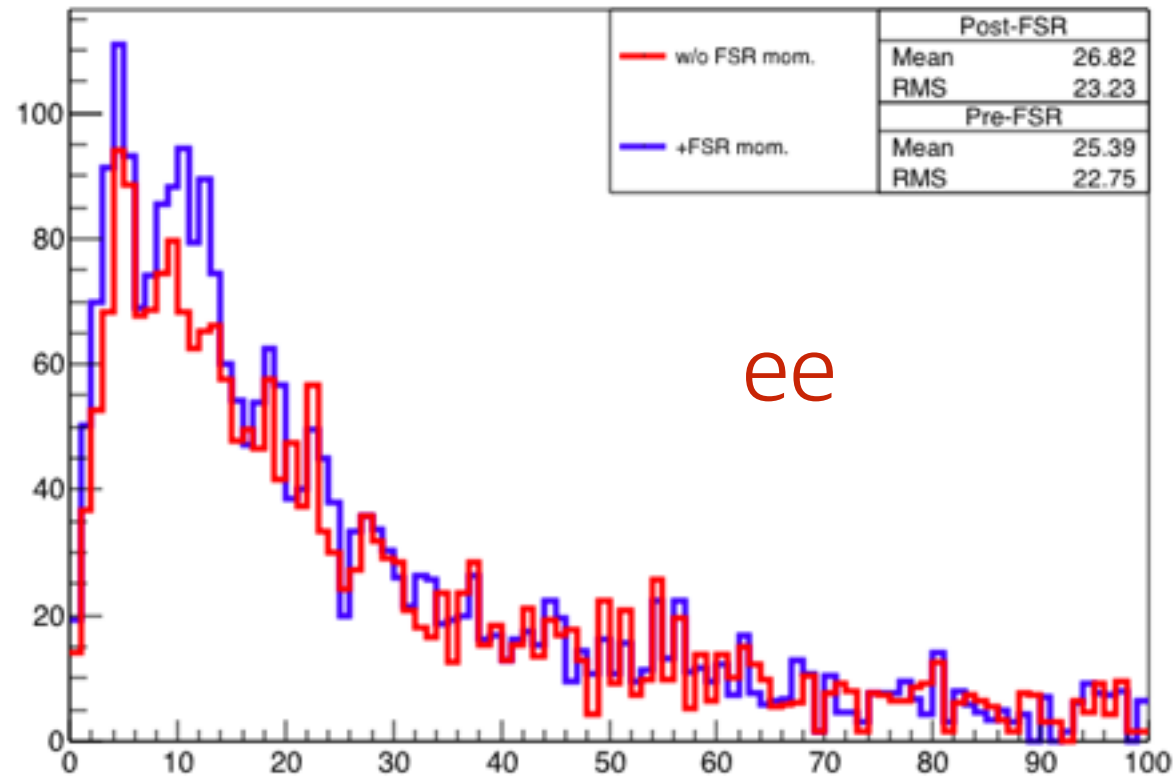
MG   aMC@NLO

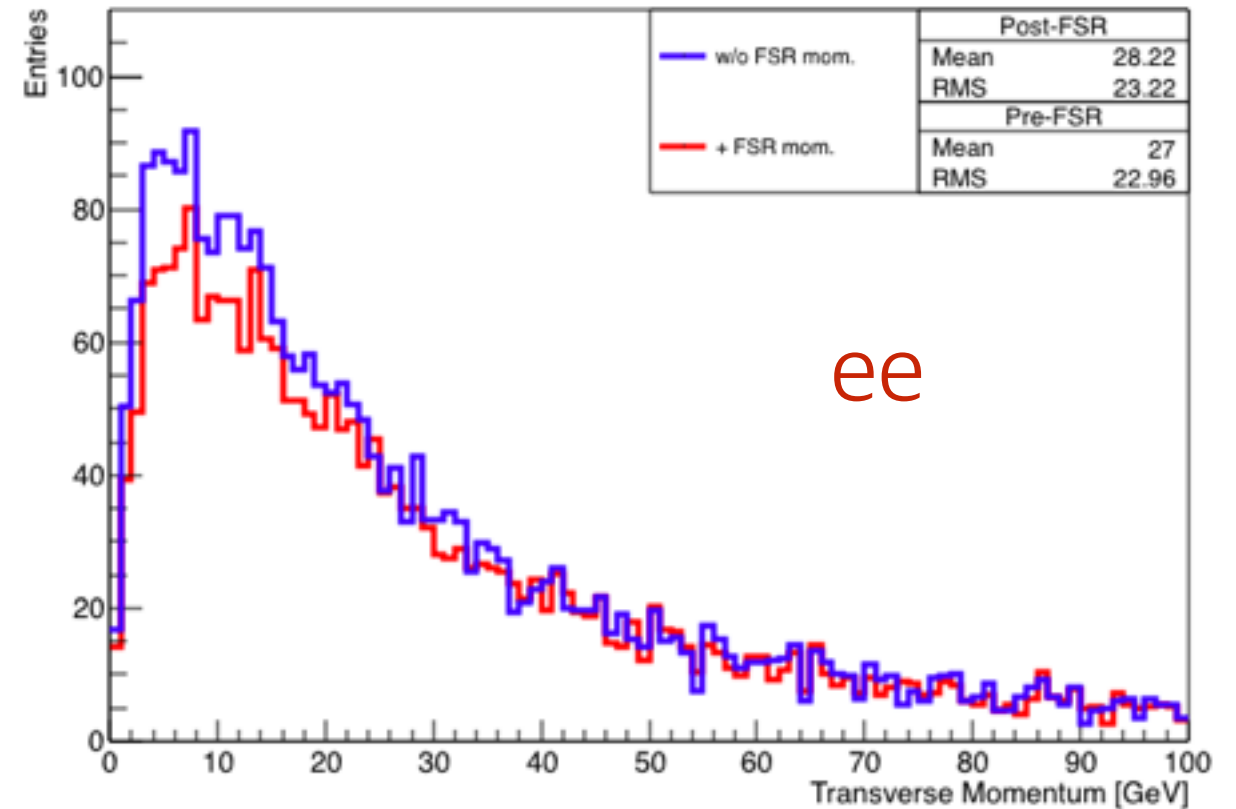

$P_T(\mu\mu)$ pre-FSR vs post-FSR, $200 < M[GeV] < 350$

μμ

$P_T(\mu\mu)$ pre-FSR vs post-FSR, $200 < M[GeV] < 350$

μμ

$P_T(ee)$ pre-FSR vs post-FSR, $200 < M[GeV] < 350$
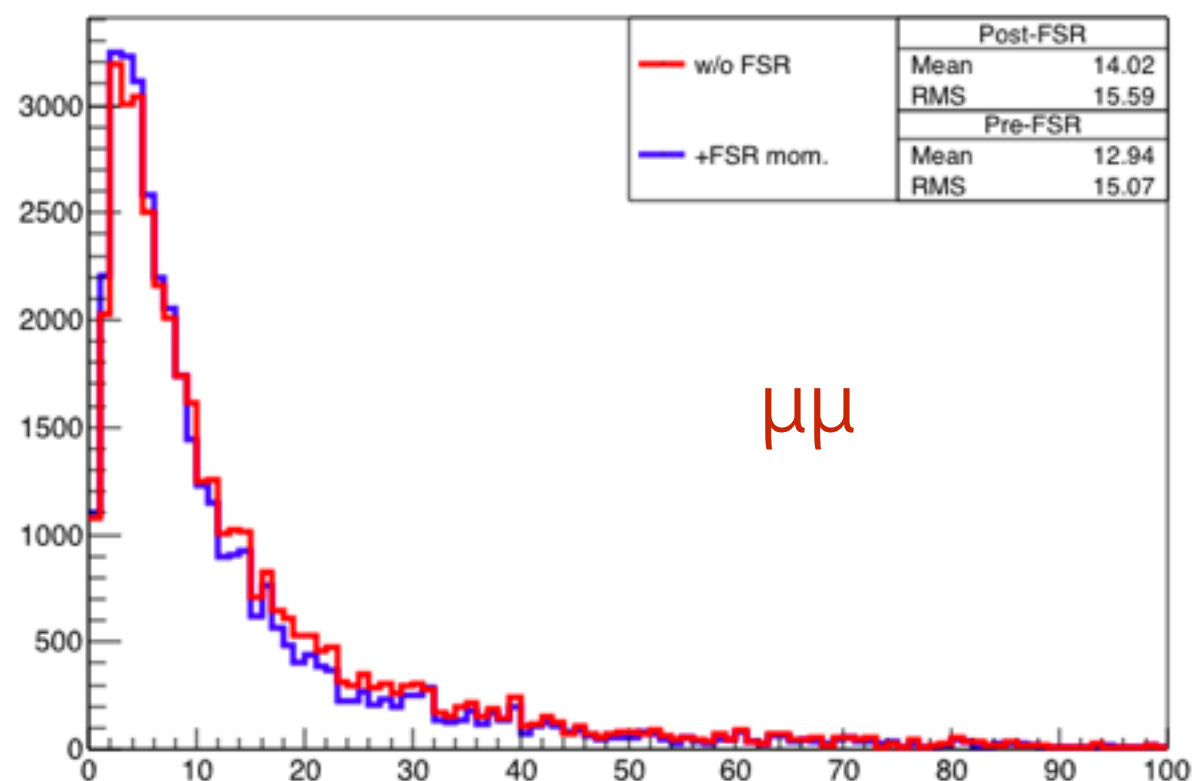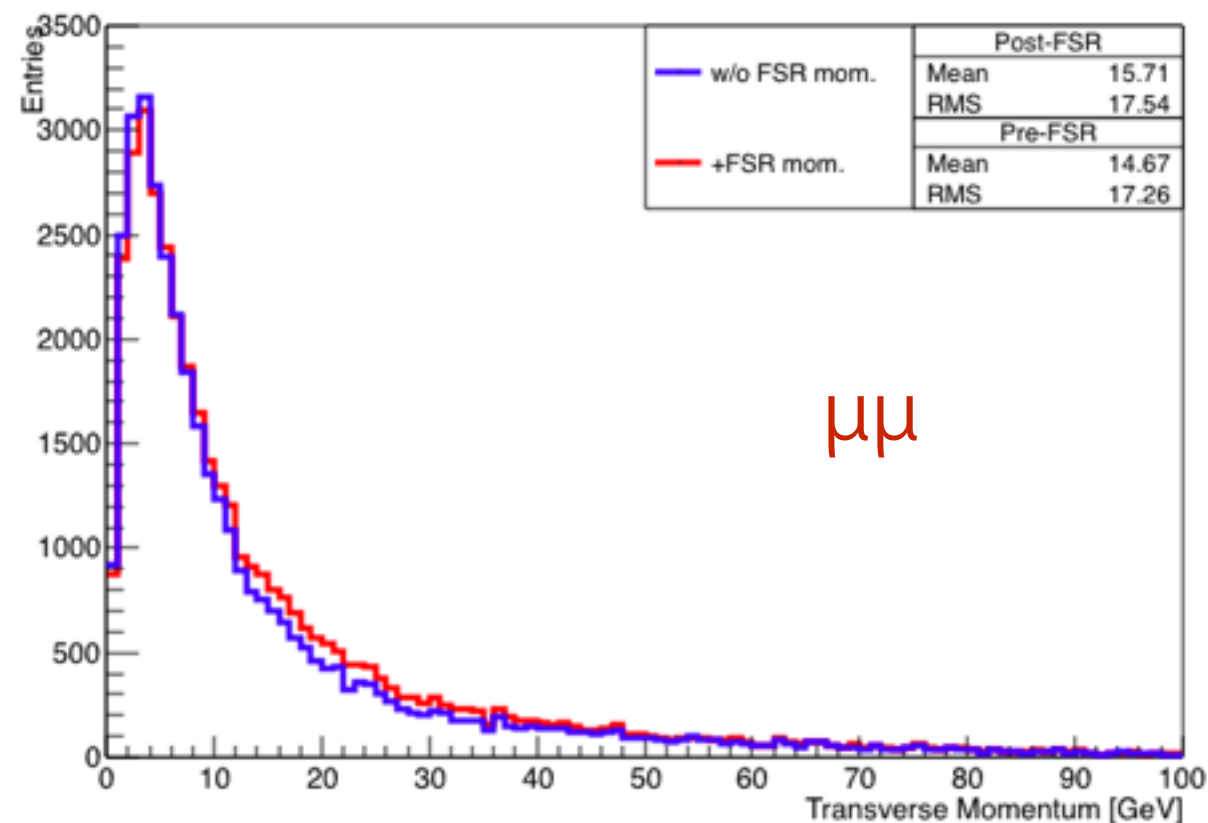
ee

$P_T(ee)$ pre-FSR vs post-FSR, $200 < M[GeV] < 350$
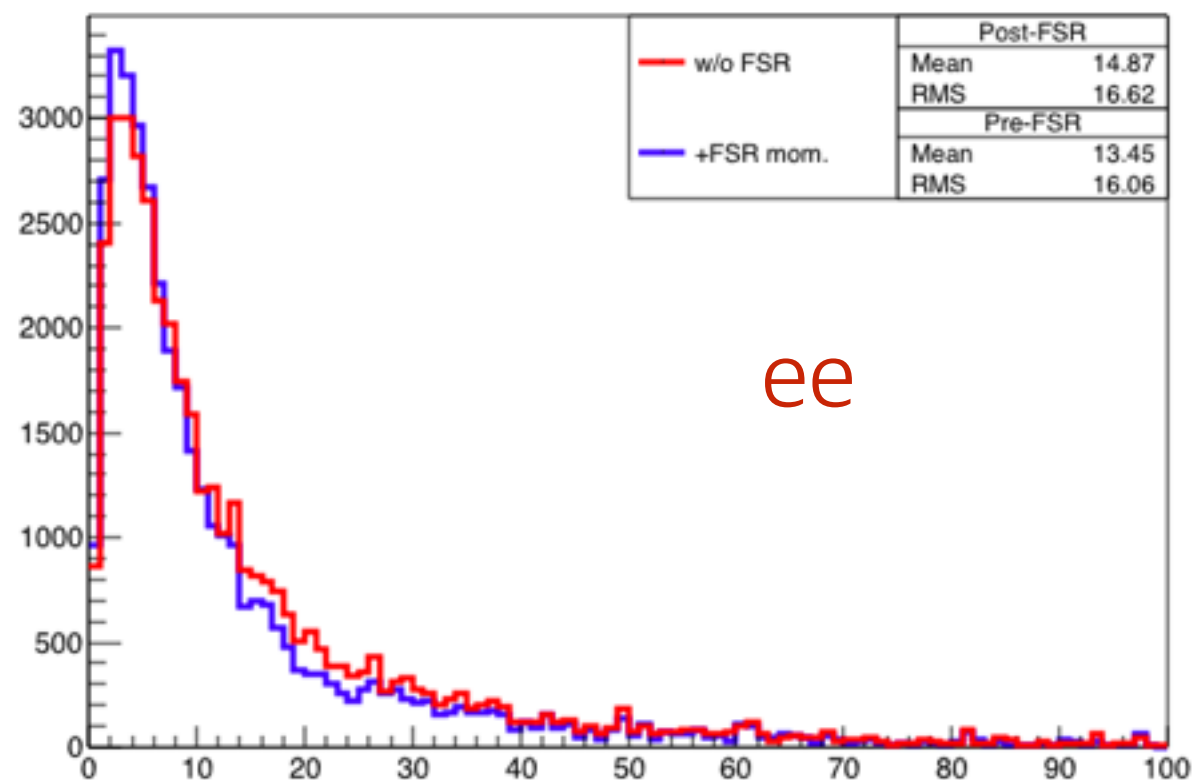
ee

MG
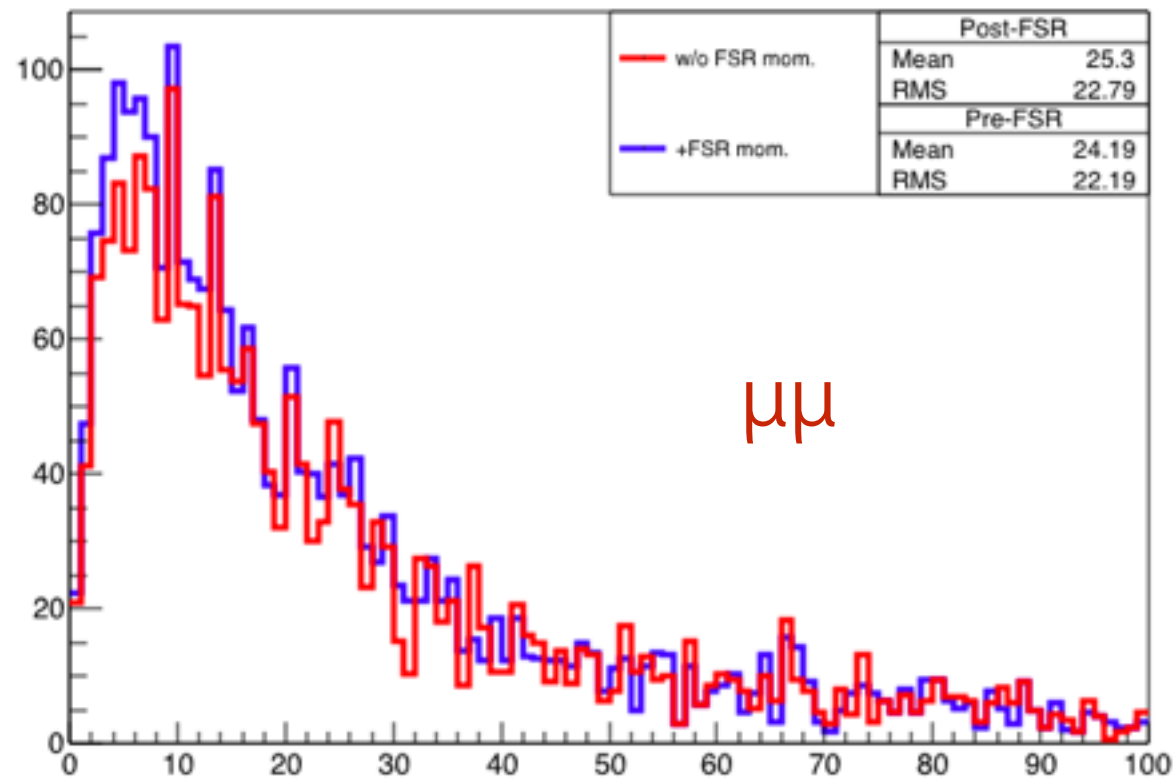
aMC@NLO

$P_T(\mu\mu)$ pre-FSR vs post-FSR, 40 < M[GeV] < 60
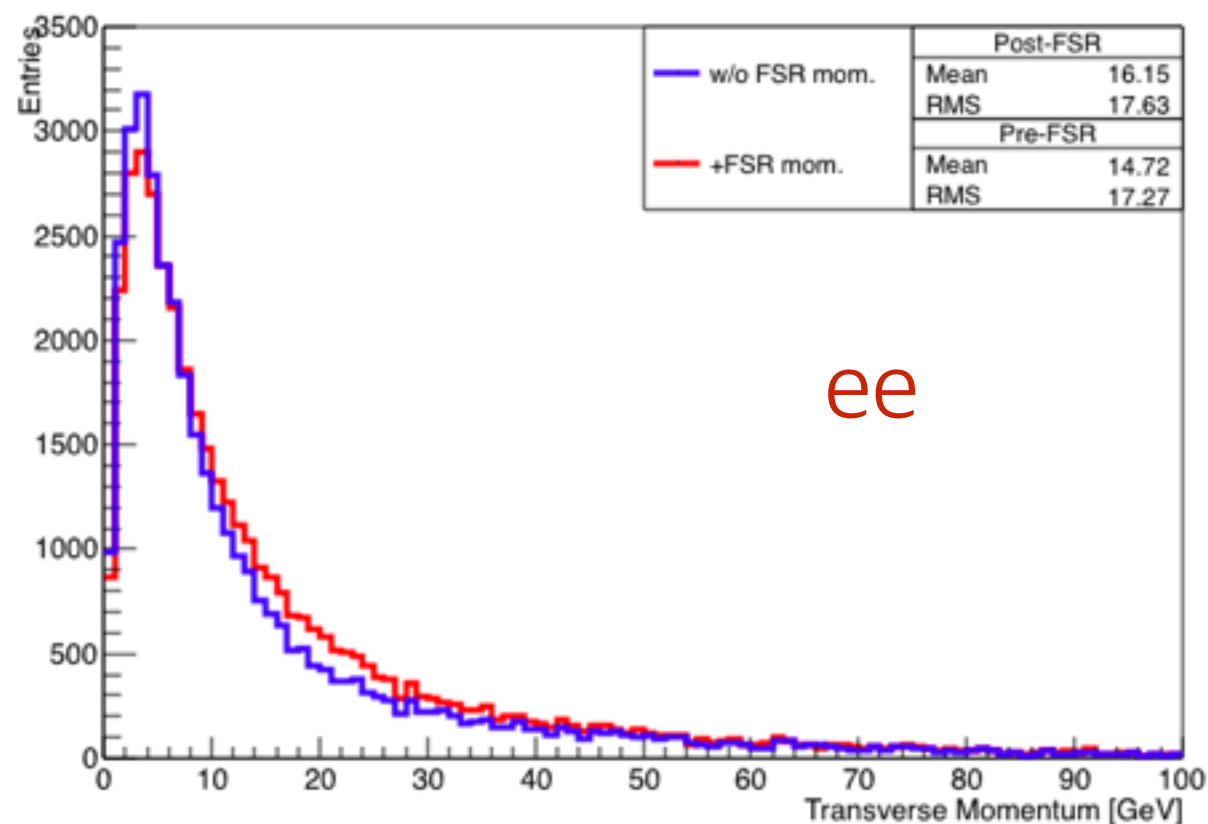
$P_T(ee)$ pre-FSR vs post-FSR, 40 < M[GeV] < 60

MG

aMC@NLO

100~200 GeV MG

aMC@NLO

$P_T(\mu\mu)$ pre-FSR vs post-FSR, $100 < M[GeV] < 200$
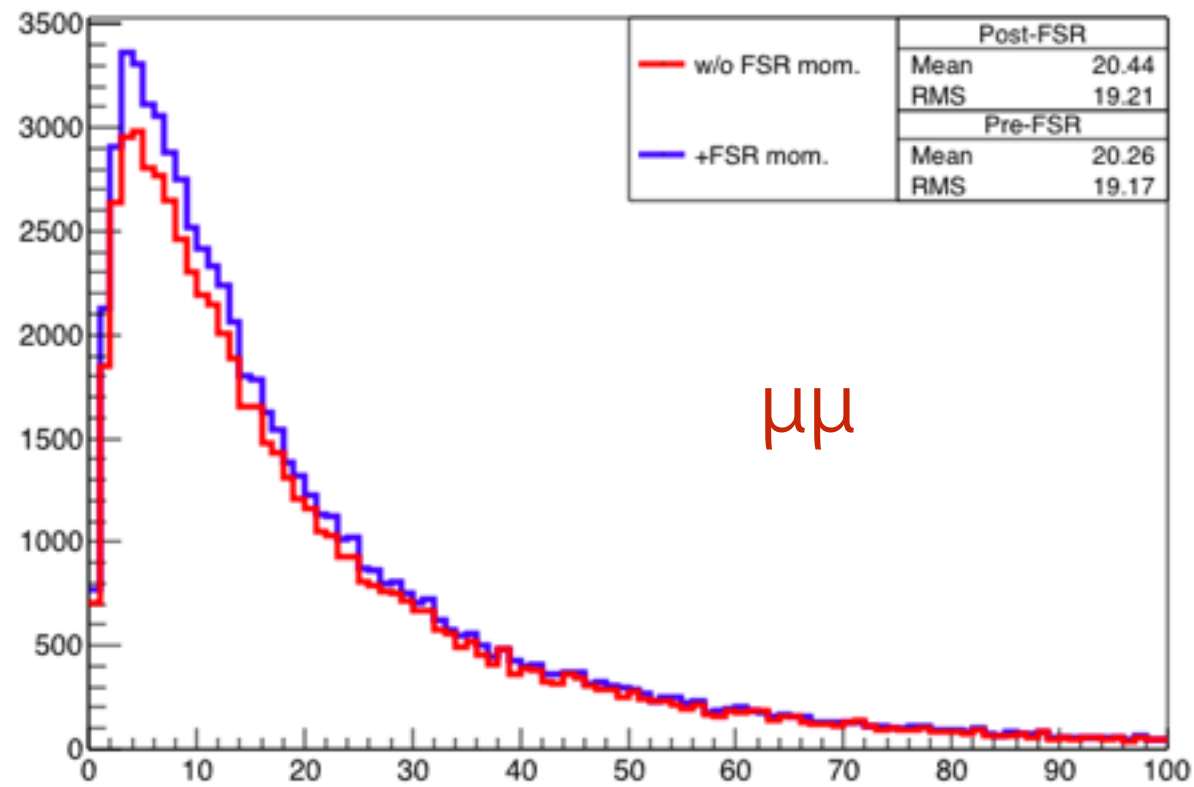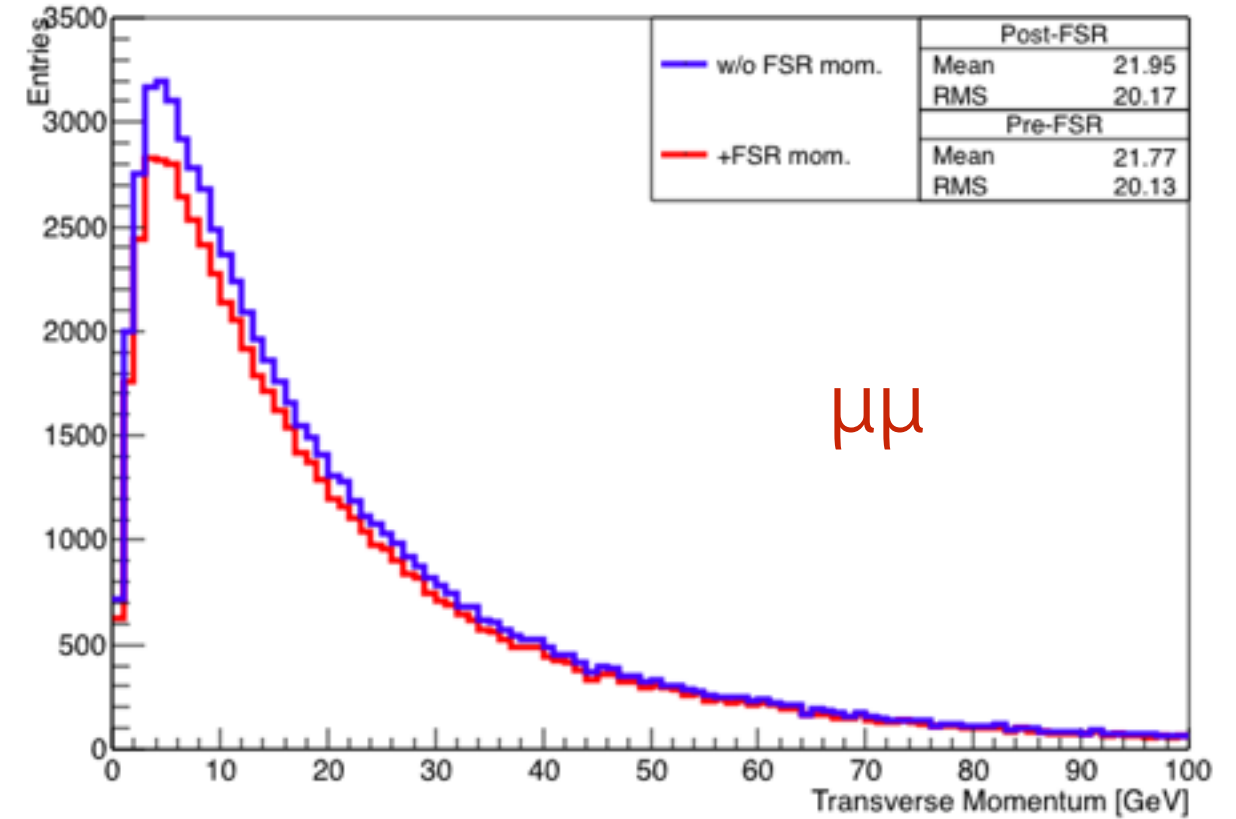
	Post-FSR	
w/o FSR mom.	Mean	20.44
	RMS	19.21
	Pre-FSR	
+FSR mom.	Mean	20.26
	RMS	19.17

$\mu\mu$

$P_T(\mu\mu)$ pre-FSR vs post-FSR, $100 < M[GeV] < 200$

	Post-FSR	
w/o FSR mom.	Mean	21.95
	RMS	20.17
	Pre-FSR	
+FSR mom.	Mean	21.77
	RMS	20.13

$\mu\mu$

$P_T(ee)$ pre-FSR vs post-FSR, $100 < M[GeV] < 200$

	Post-FSR	
w/o FSR mom.	Mean	20.75
	RMS	19.49
	Pre-FSR	
+FSR mom.	Mean	20.44
	RMS	19.41

ee

$P_T(ee)$ pre-FSR vs post-FSR, $100 < M[GeV] < 200$

	Post-FSR	
w/o FSR mom.	Mean	22.13
	RMS	20.25
	Pre-FSR	
+ FSR mom.	Mean	21.82
	RMS	20.2

ee
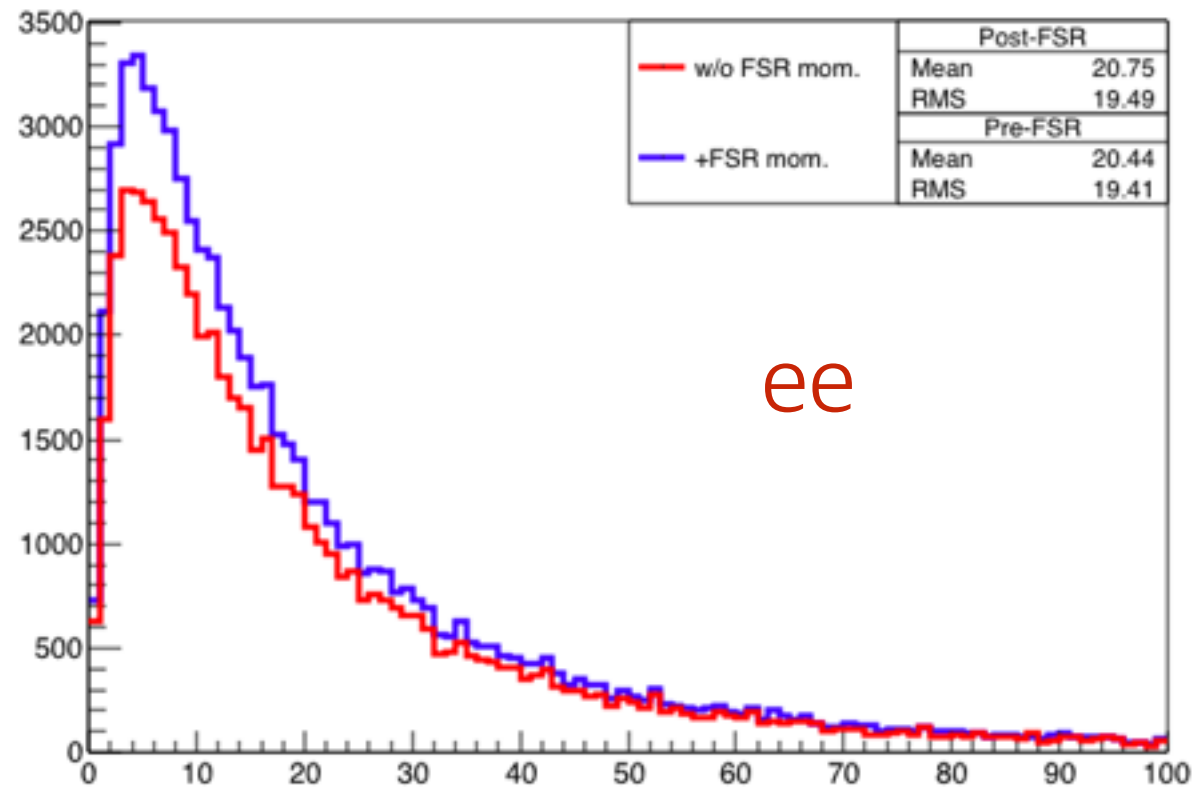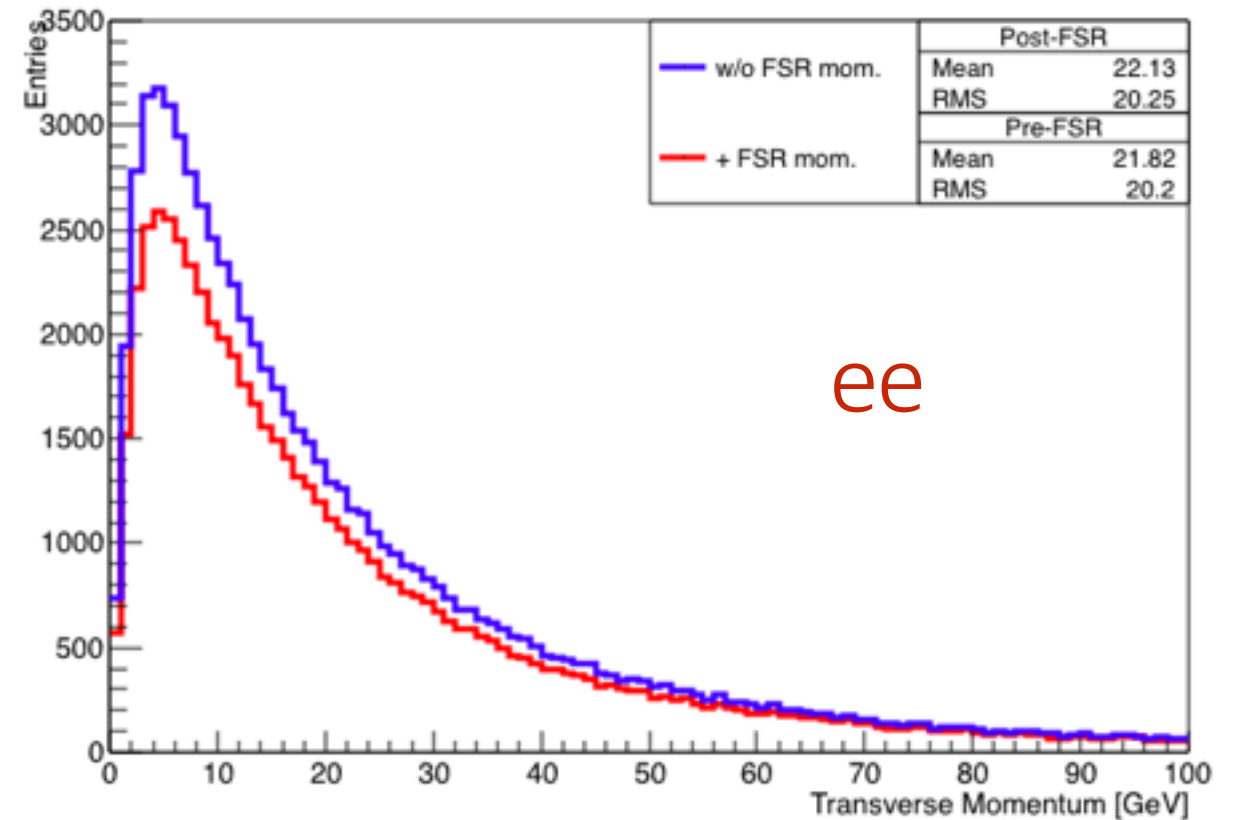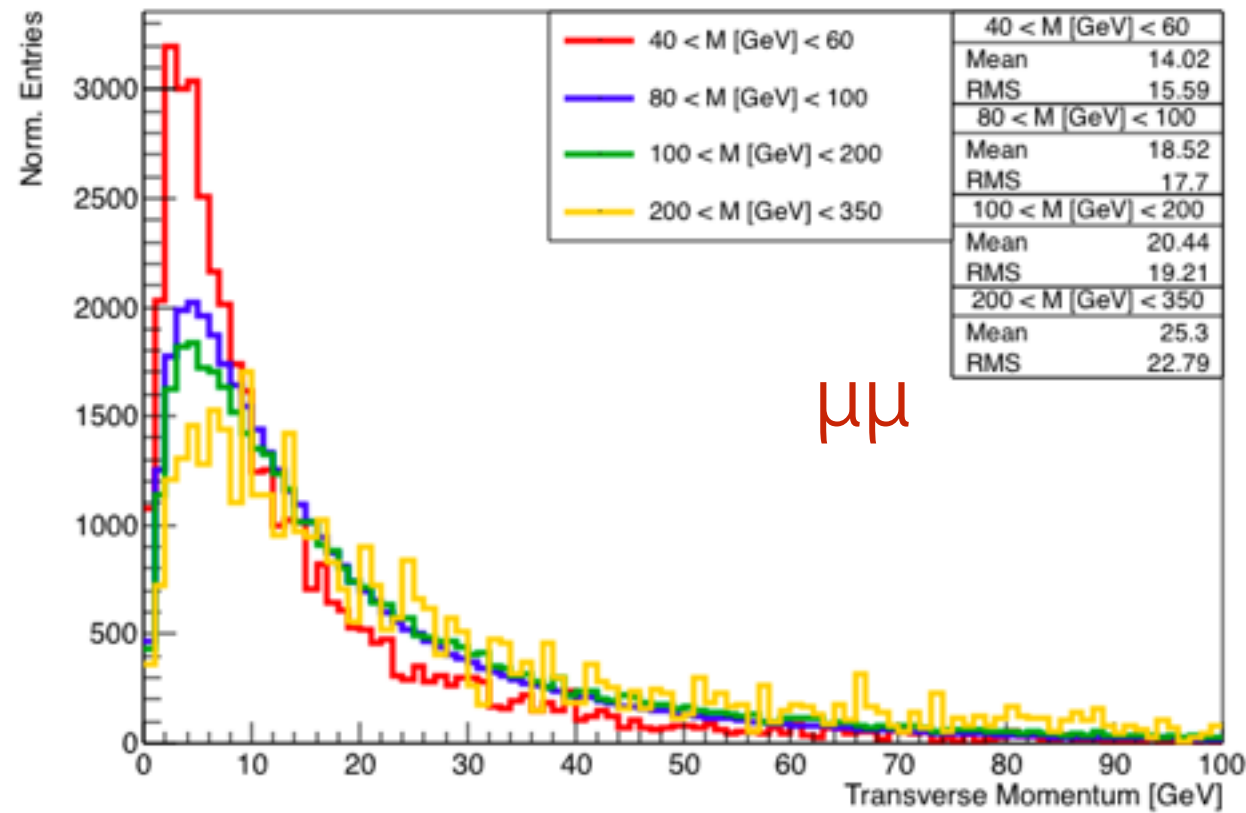
P_T(μμ) At each mass region

P_T(μμ) At each mass region
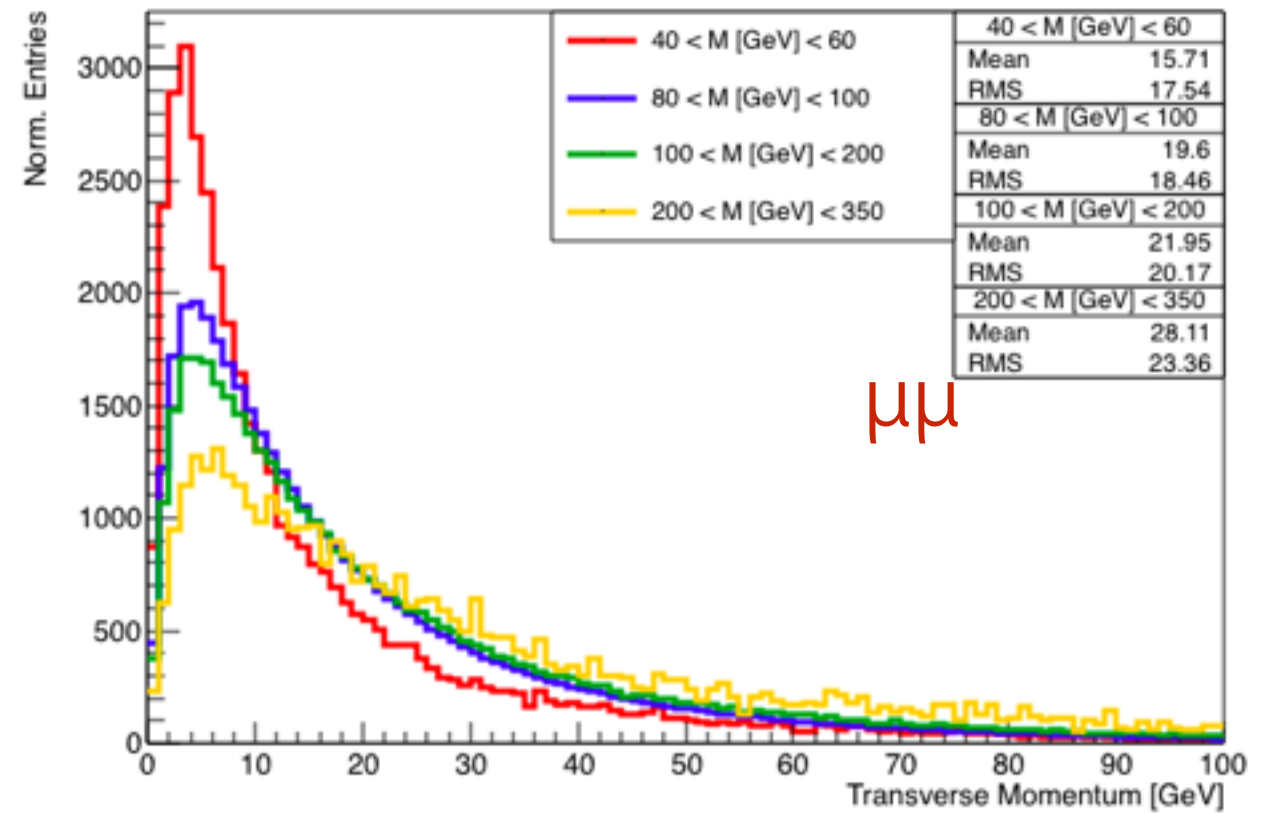
P_T(ee) At each mass region

P_T(ee) At each mass region

include FSR mom.

MG

aMC@NLO

$P_T(\mu\mu + \text{QED FSR})$ At each mass region

$P_T(\mu\mu + \text{QED FSR})$ At each mass region

$\mu\mu$

$\mu\mu$

40 < M [GeV] < 60	
Mean	12.94
RMS	15.07
80 < M [GeV] < 100	
Mean	18.55
RMS	17.78
100 < M [GeV] < 200	
Mean	20.26
RMS	19.17
200 < M [GeV] < 350	
Mean	24.19
RMS	22.19

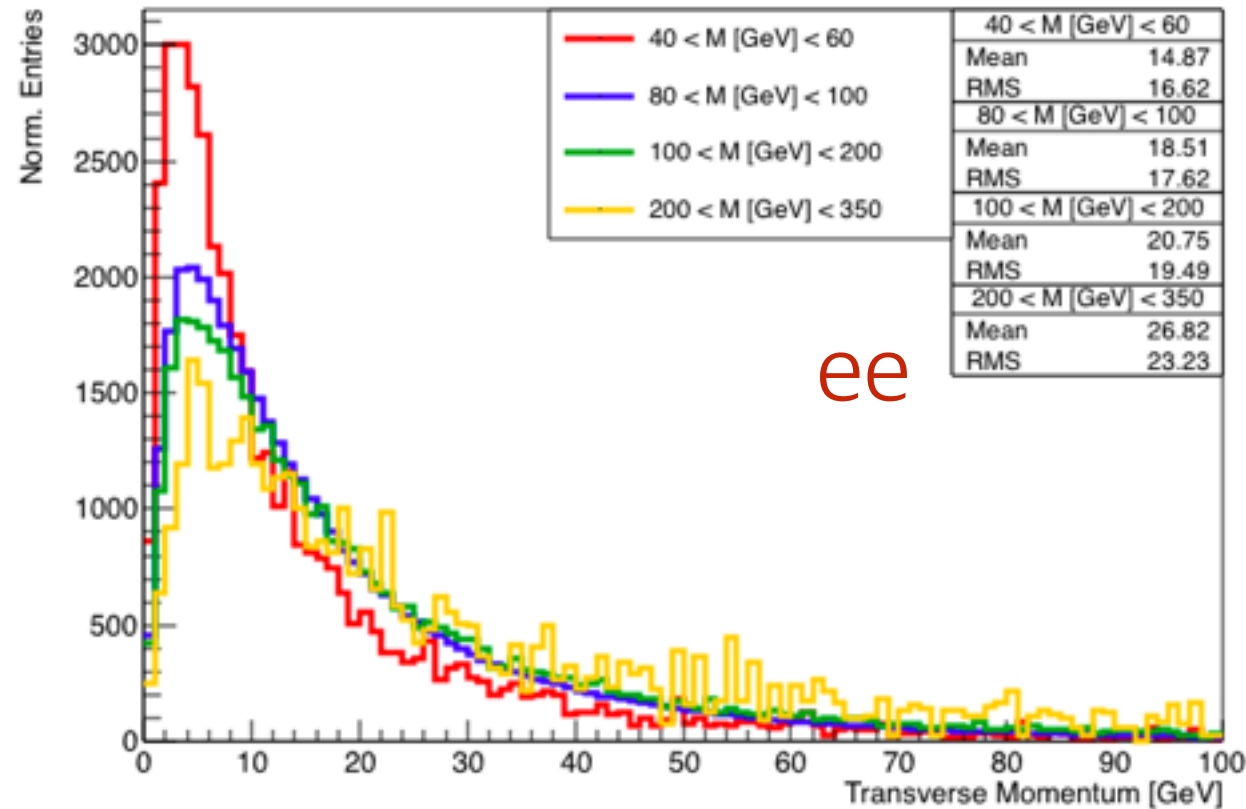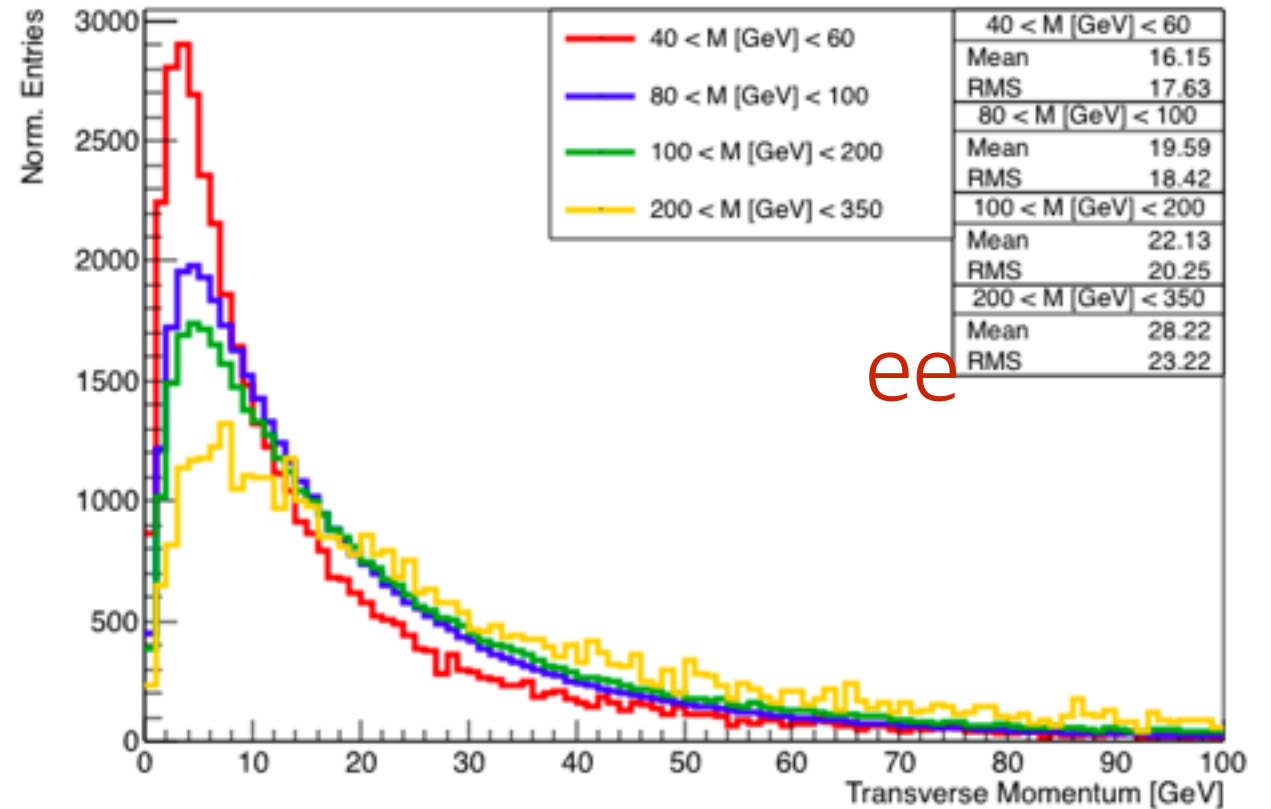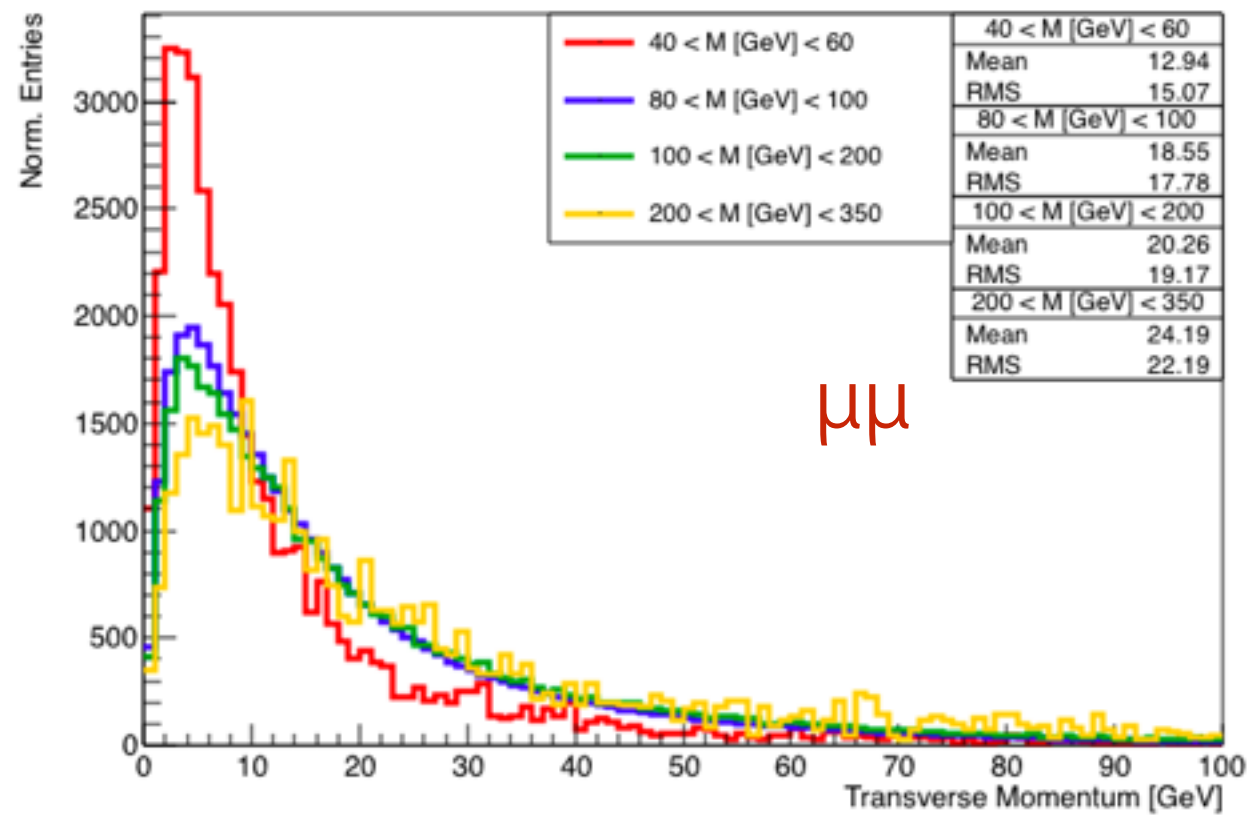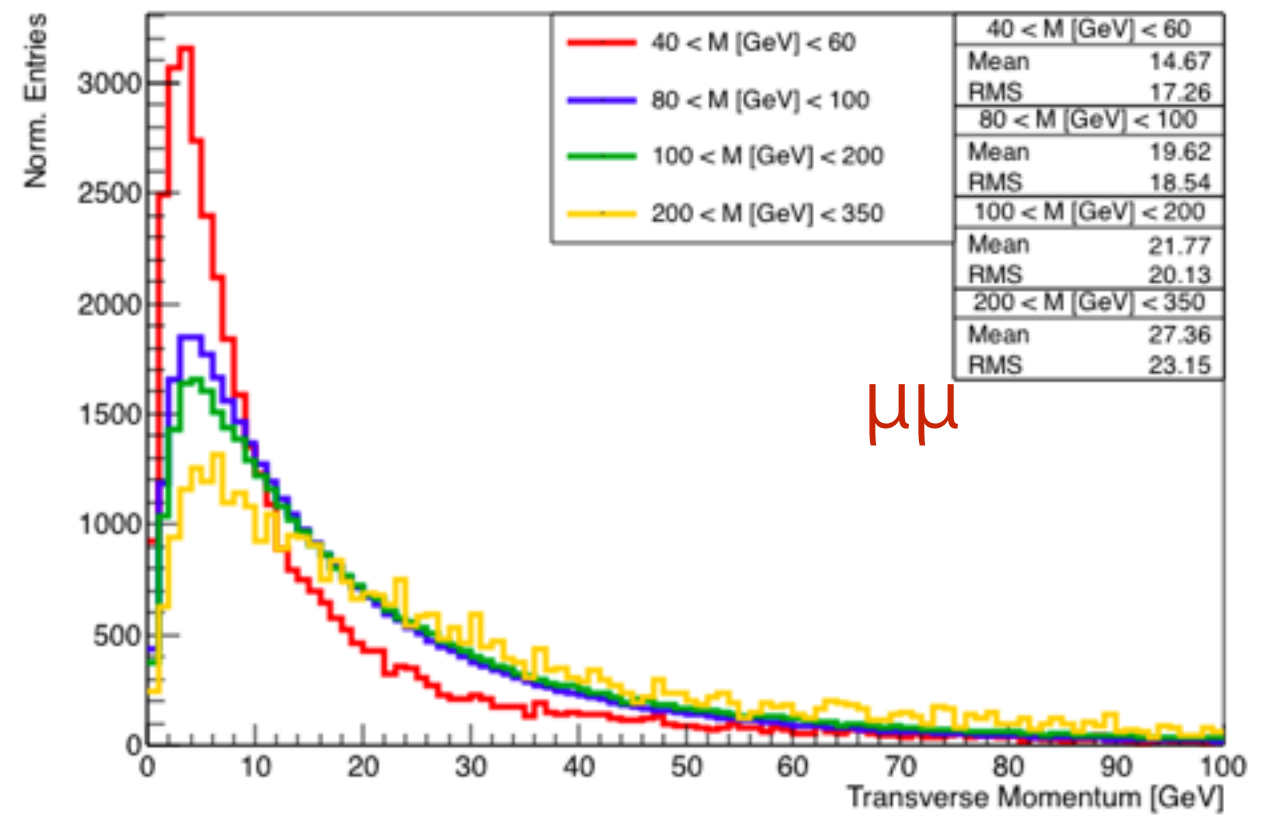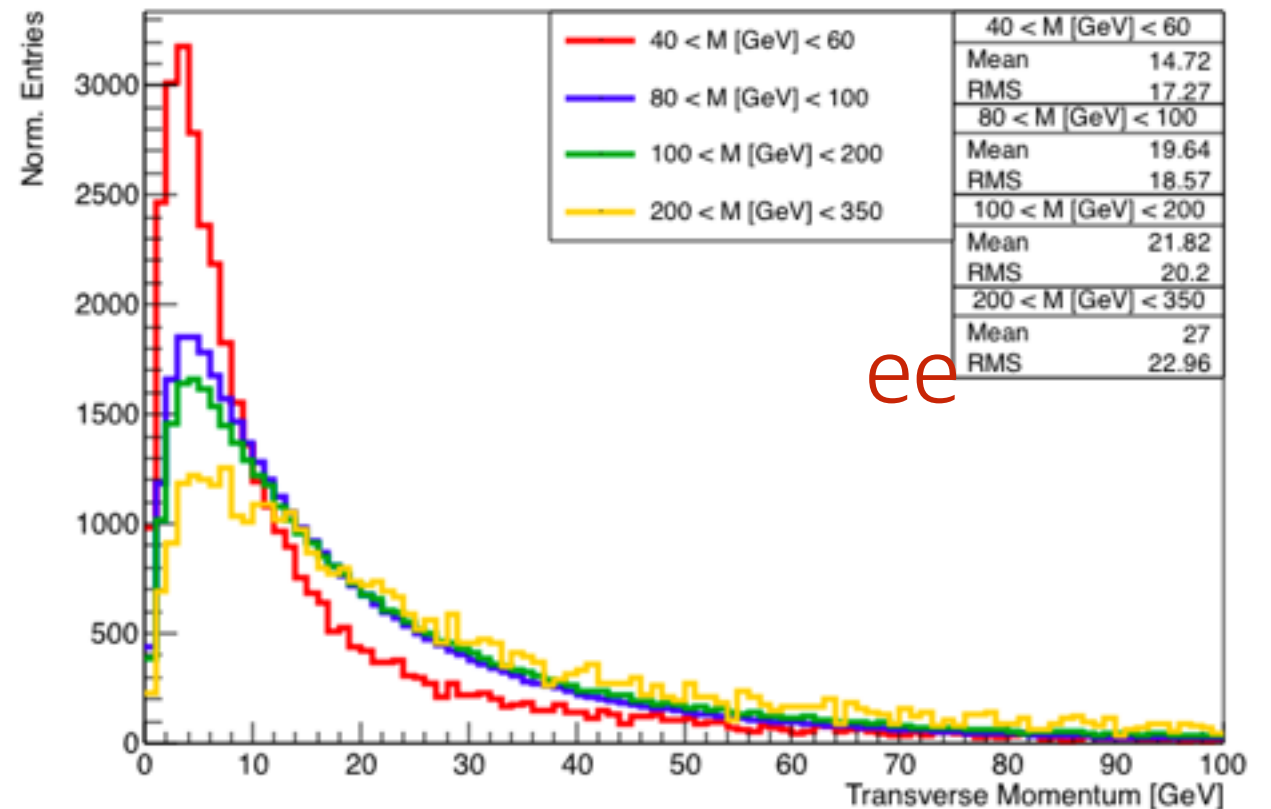| 40 < M [GeV] < 60	
Mean	14.67
RMS	17.26
80 < M [GeV] < 100	
Mean	19.62
RMS	18.54
100 < M [GeV] < 200	
Mean	21.77
RMS	20.13
200 < M [GeV] < 350	
Mean	27.36
RMS	23.15

$P_T(ee + \text{QED FSR})$ At each mass region

$P_T(ee + \text{QED FSR})$ At each mass region

ee

ee

40 < M [GeV] < 60	
Mean	13.45
RMS	16.06
80 < M [GeV] < 100	
Mean	18.55
RMS	17.77
100 < M [GeV] < 200	
Mean	20.44
RMS	19.41
200 < M [GeV] < 350	
Mean	25.39
RMS	22.75

40 < M [GeV] < 60	
Mean	14.72
RMS	17.27
80 < M [GeV] < 100	
Mean	19.64
RMS	18.57
100 < M [GeV] < 200	
Mean	21.82
RMS	20.2
200 < M [GeV] < 350	
Mean	27
RMS	22.96

Legend (all plots):
- 40 < M [GeV] < 60
- 80 < M [GeV] < 100
- 100 < M [GeV] < 200
- 200 < M [GeV] < 350

Axis labels: Norm. Entries (y), Transverse Momentum [GeV] (x)
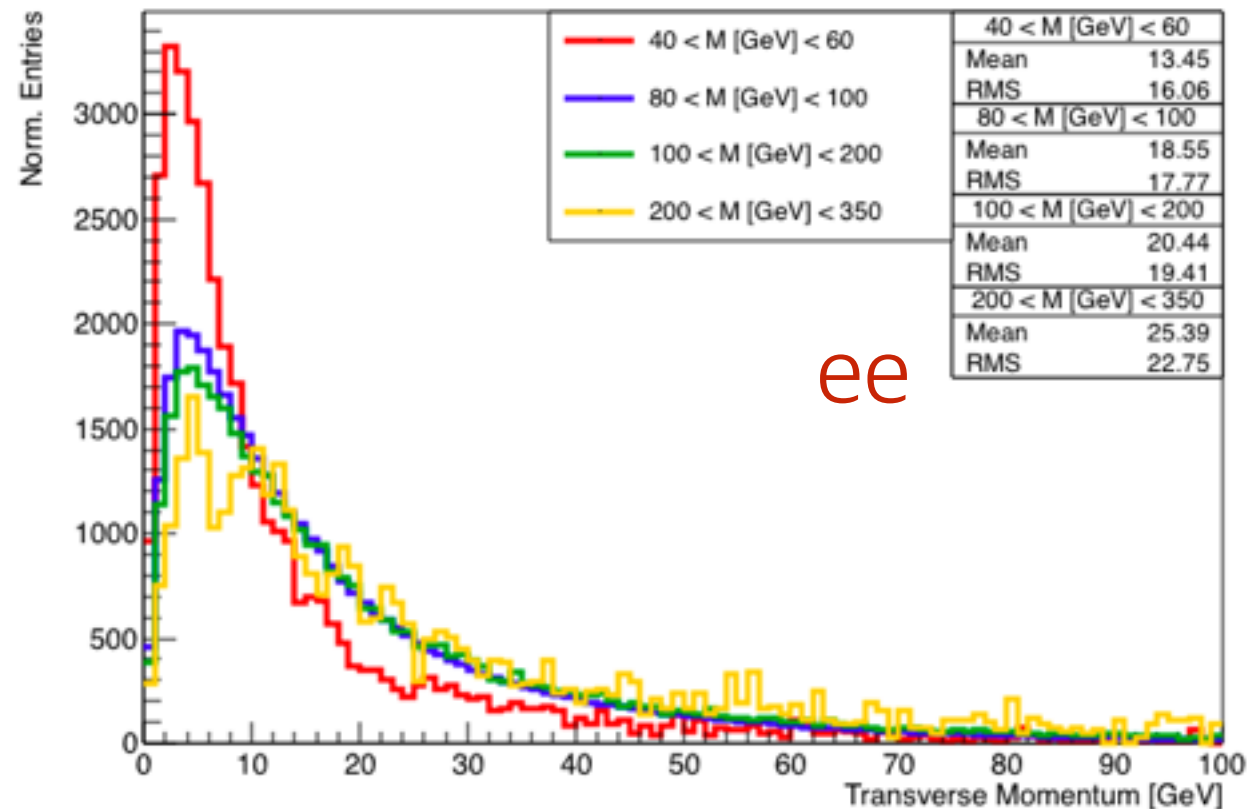
- MG mumu channel seems weird a little

- Generally slope values are similar between ee & mum

- Need to check 8 TeV gen-level

Why PT(ll+FSR) < PT(ll)??

- Considering

- ΔR(μ−, FSR from μ−)

- ΔR(μ+, FSR from μ+)
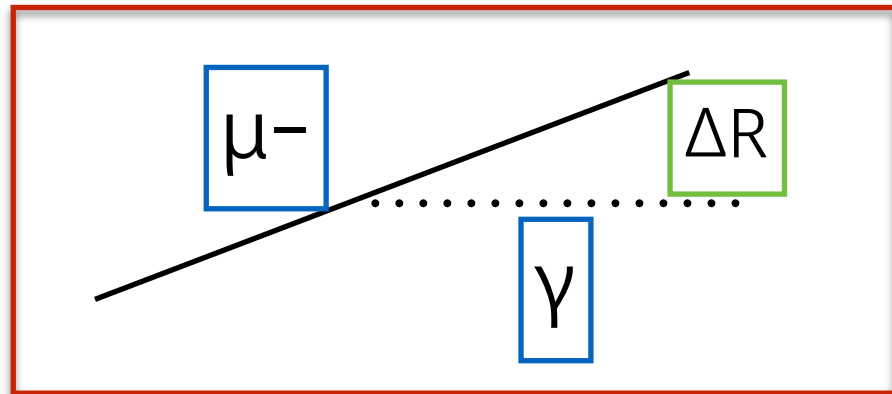
- Most of them should be ~zero?

- But most FSR vectors have ΔR with