

Higgs to Tau(μ) Tau(μ)

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Motivation:

Will lowering the single-muon and dimuon trigger thresholds increase the acceptance in the mu-mu channel?

Dataset Used:

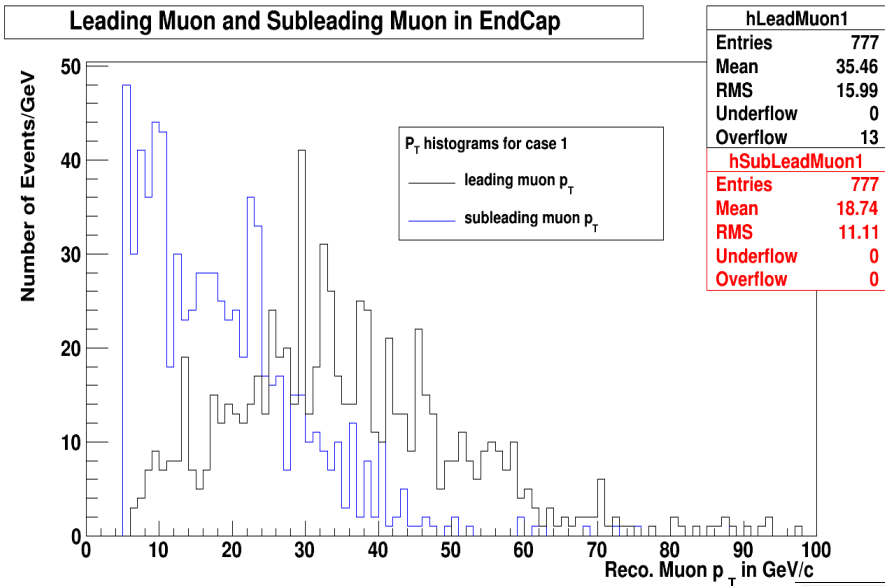
S/B	Physics channel	# of Events	Pile-Up	GEMs Used		# of dimuon Events
Signal	Glu Glu To Higgs (All Taus decaying to Muons)	50K	0	Yes	Private	18K
	Glu Glu To Higgs	500K	Yes	No	Official (2012)	6K
Background	DY Tau Tau	800K	Yes	Yes	Official	---

Cuts Applied

- η : EndCap- $\rightarrow 1.6 < |\eta| < 2.1$; Barrel- $\rightarrow |\eta| < 1.5$
- p_T : No Cuts
- Run-1 Cuts: Shown in the acceptance plots

p_T distributions

Case-1

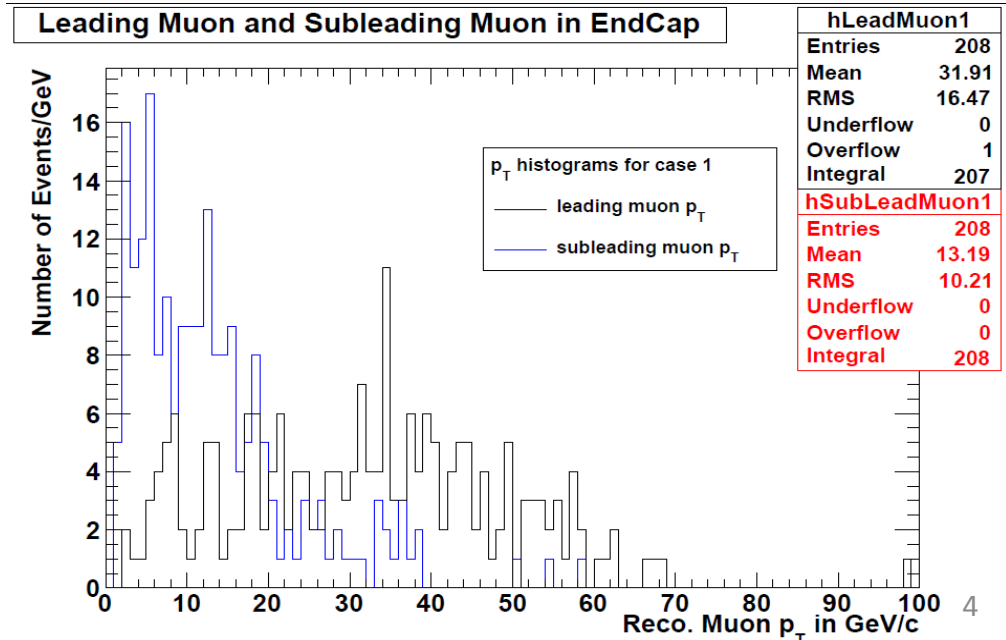


Without GEM



With GEM

Not sure why the p_T distribution in case of the samples with GEMs starts at 5 GeV/c !



Leading Muon in Endcap, subleading muon in barrel

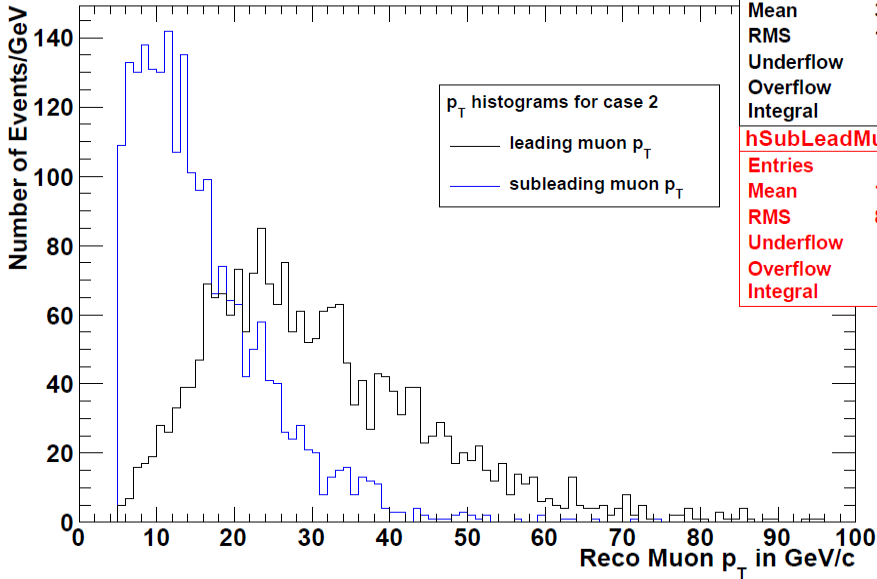
hLeadMuon2	
Entries	2202
Mean	30.85
RMS	14.63
Underflow	0
Overflow	18
Integral	2184
hSubLeadMuon2	
Entries	2202
Mean	15.74
RMS	8.774
Underflow	0
Overflow	1
Integral	2201

Case-2

Without GEM



p_T histograms for case 2
— leading muon p_T
— subleading muon p_T

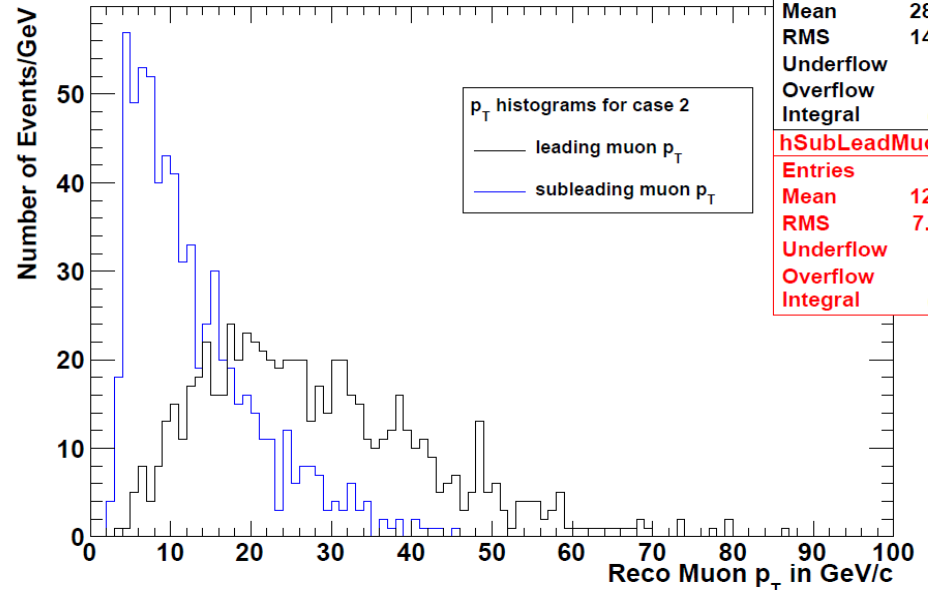


With GEM

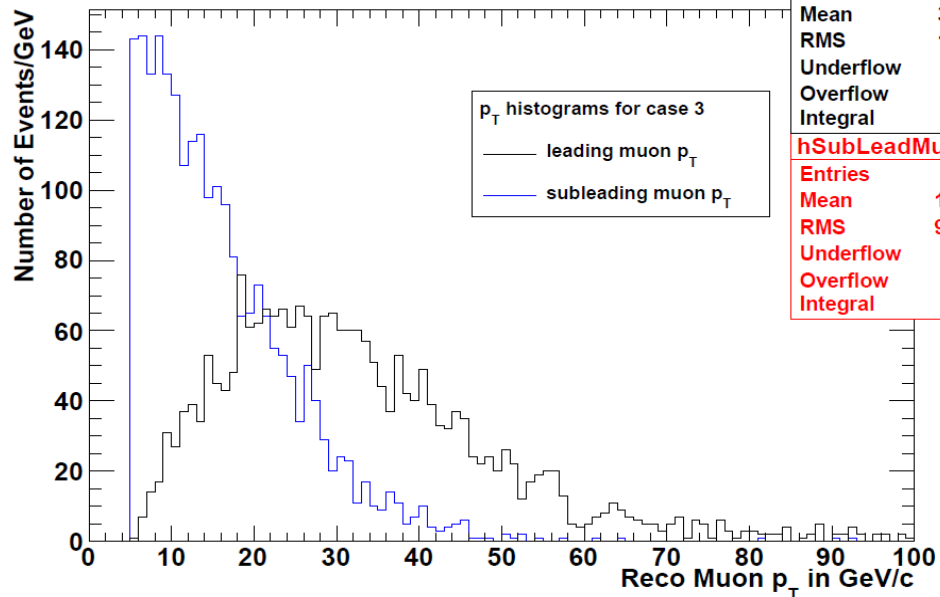


Leading Muon in Endcap, subleading muon in barrel

hLeadMuon2	
Entries	678
Mean	28.06
RMS	14.03
Underflow	0
Overflow	3
Integral	675
hSubLeadMuon2	
Entries	678
Mean	12.83
RMS	7.981
Underflow	0
Overflow	0
Integral	678



Leading Muon in Barrel, subleading muon in endcap



hLeadMuon3	
Entries	2309
Mean	32.41
RMS	16.21
Underflow	0
Overflow	29
Integral	2280

hSubLeadMuon3	
Entries	2309
Mean	16.07
RMS	9.178
Underflow	0
Overflow	0
Integral	2309

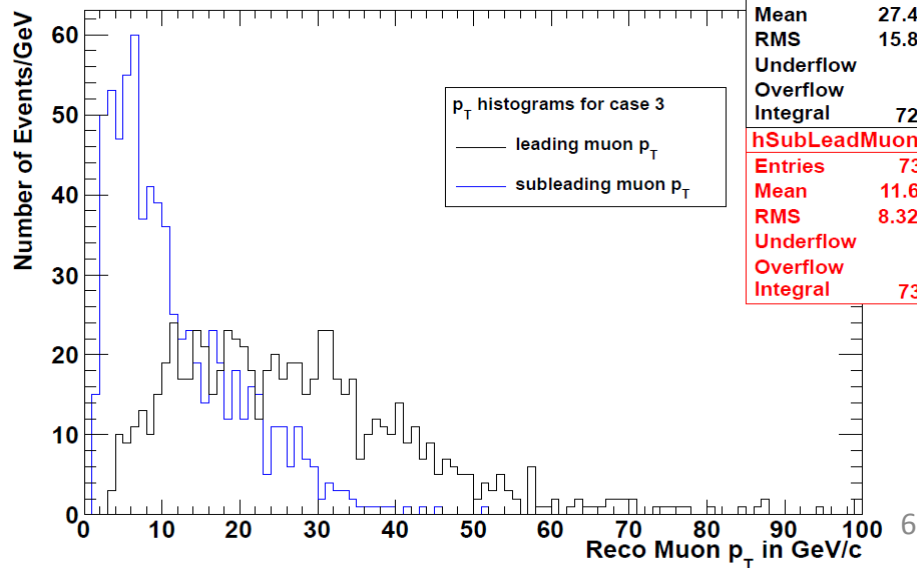
Case-3

Without GEM



With GEM

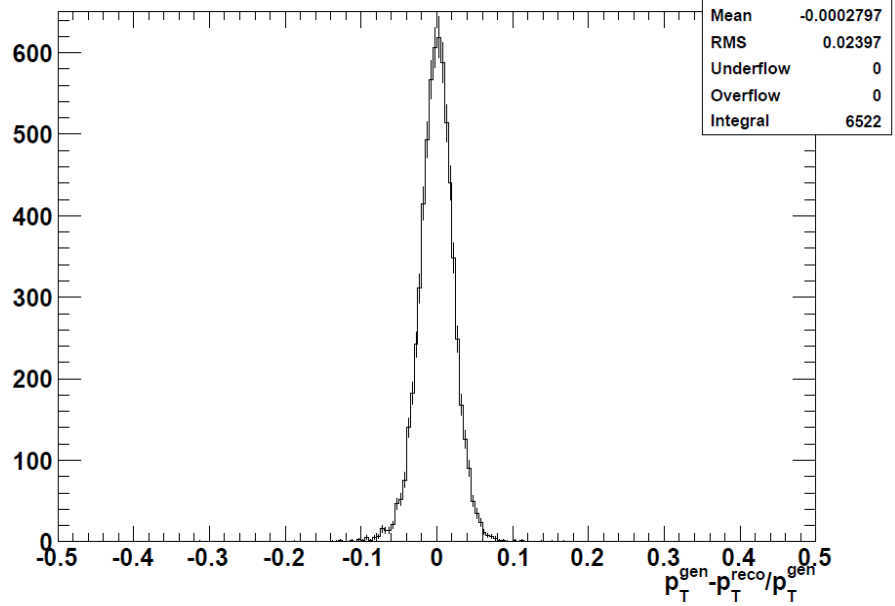
Leading Muon in Barrel, subleading muon in endcap



hLeadMuon3	
Entries	731
Mean	27.44
RMS	15.83
Underflow	0
Overflow	6
Integral	725

hSubLeadMuon3	
Entries	731
Mean	11.66
RMS	8.329
Underflow	0
Overflow	0
Integral	731

Muon Pt resolution in End cap region

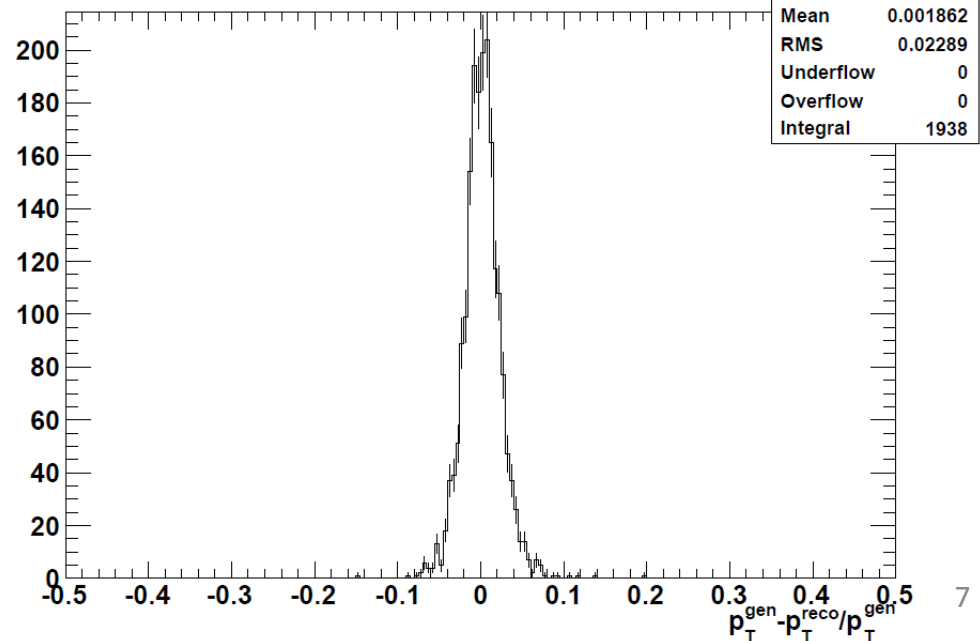


p_T resolution

Without GEM



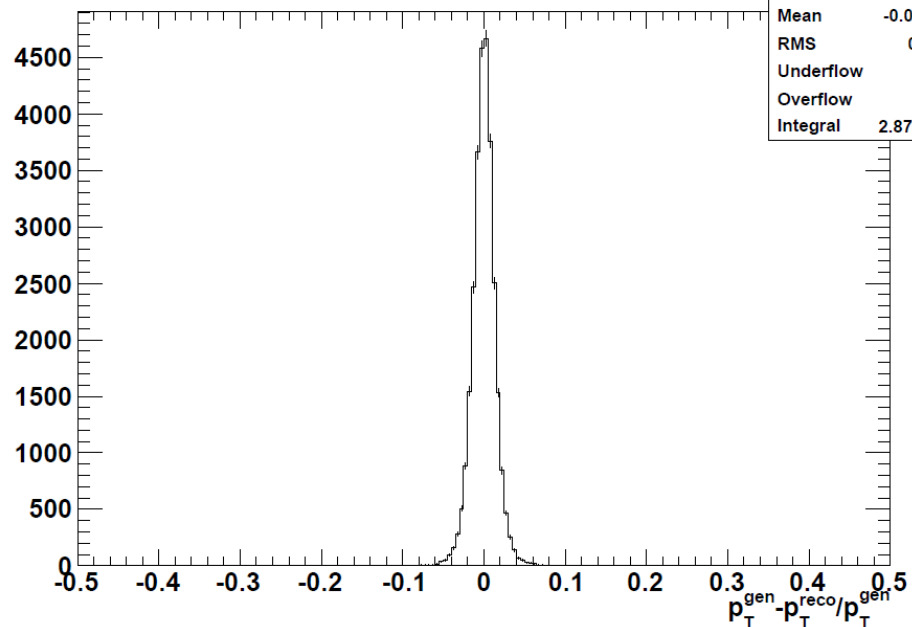
Muon Pt resolution in End cap region



With GEM

Mean Values:
GEMs: -0.0002797
w/o GEMs: 0.001862

Muon Pt resolution in barrel region



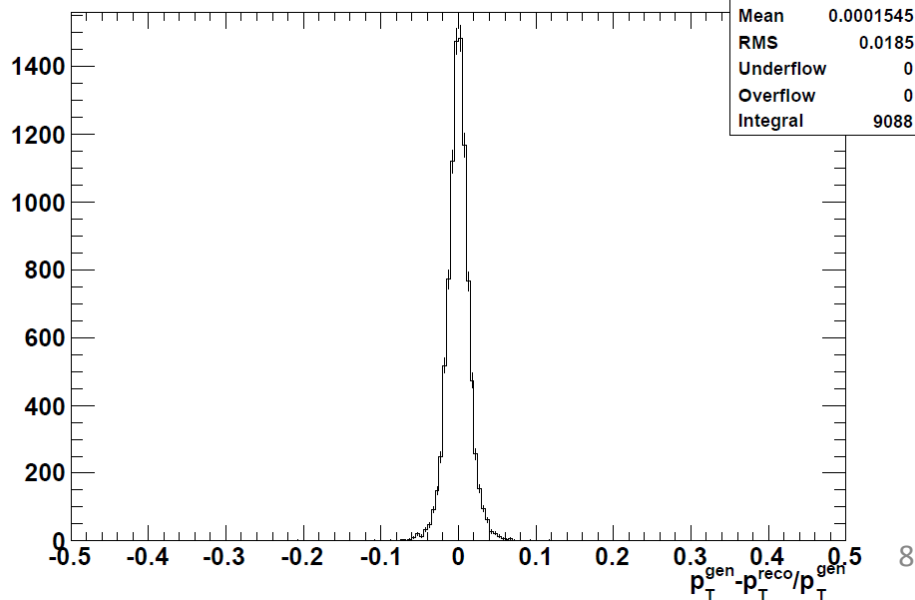
Without GEM



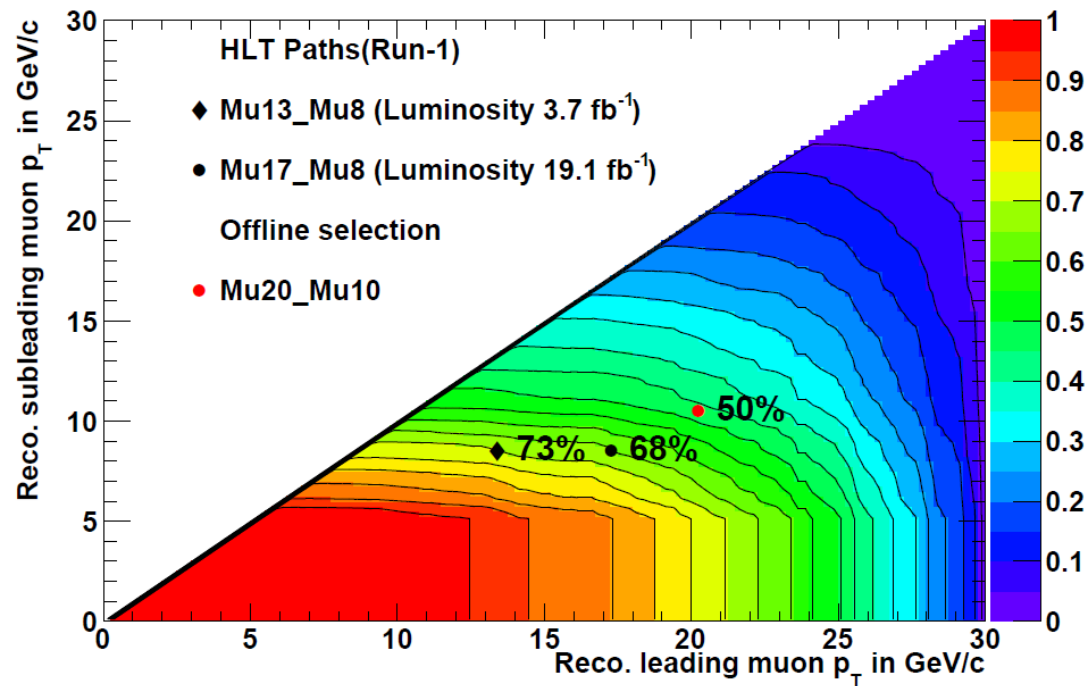
With GEM

Mean Values:
GEMs: -0.000128
w/o GEMs: 0.0001545

Muon Pt resolution in barrel region



Leading Muon and Subleading Muon in EndCap



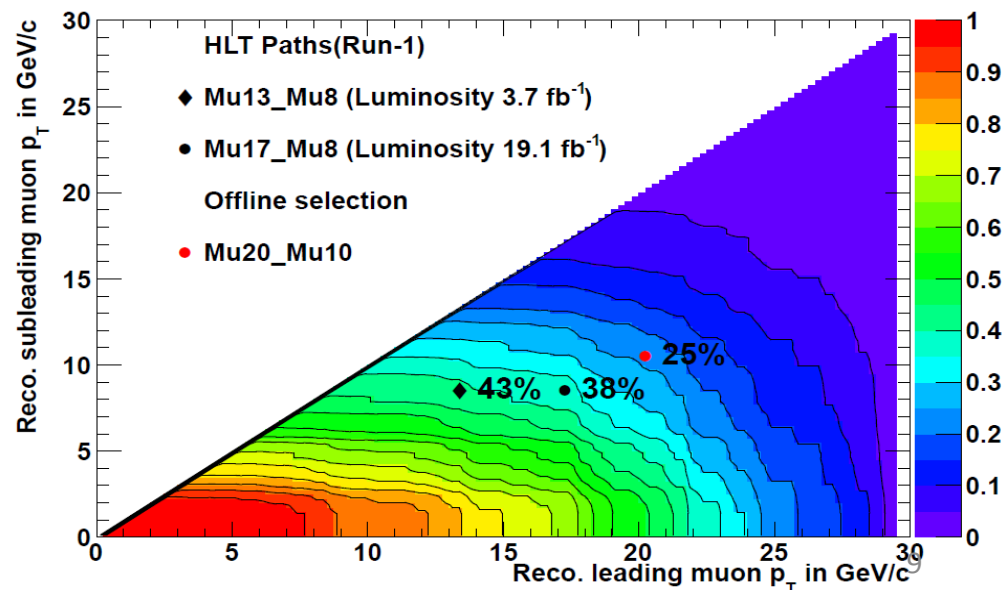
Acceptance plots

Case-1

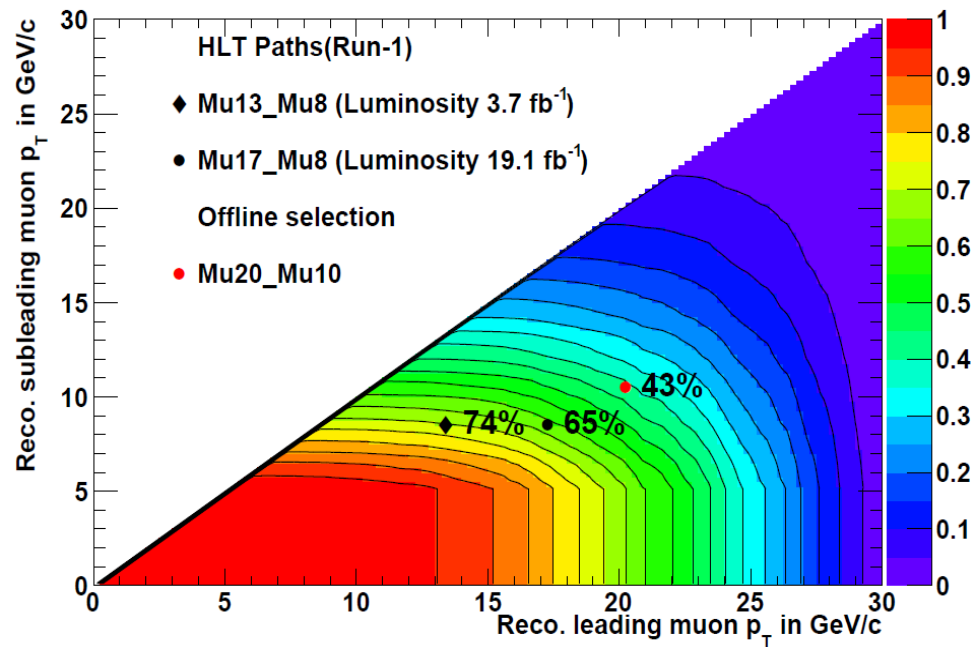
With GEM

Much lower values of acceptance!

Leading Muon and Subleading Muon in EndCap



Leading Muon in Endcap, subleading muon in barrel



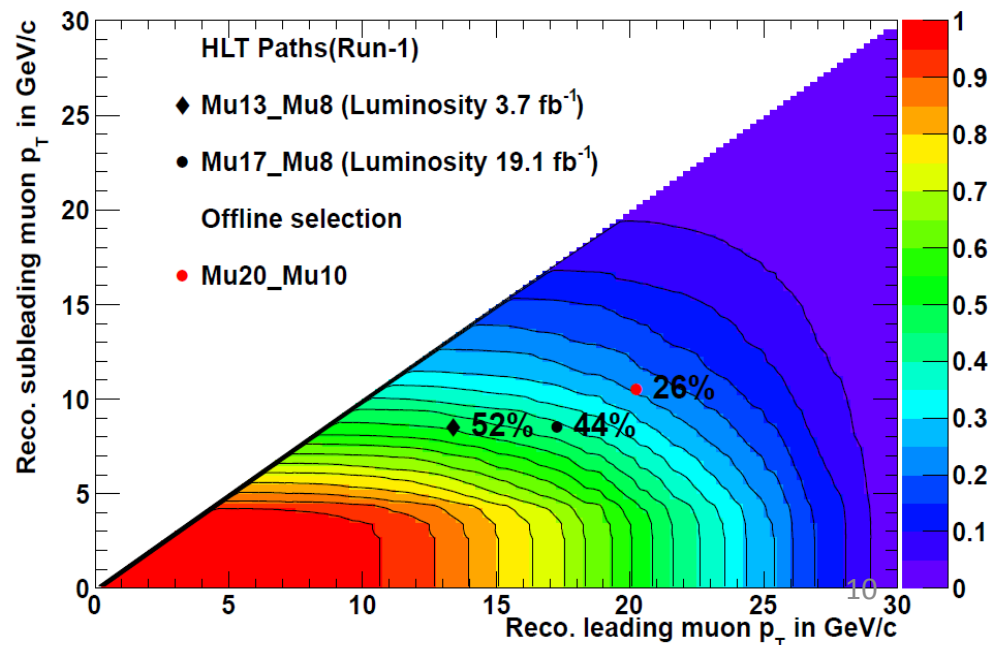
With GEM

Acceptance plots

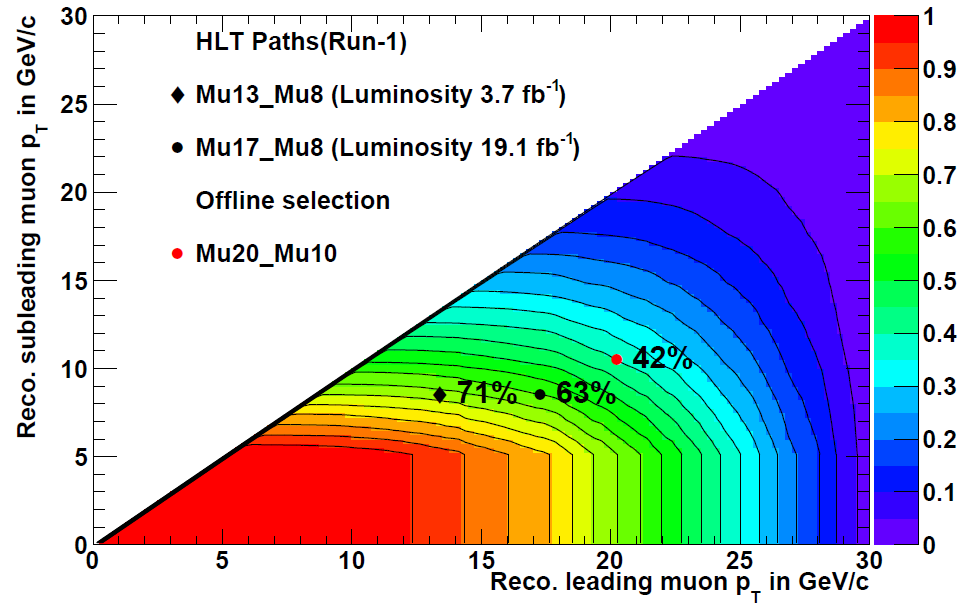
Case-2

Without GEM

Leading Muon in Endcap, subleading muon in barrel



Leading Muon in Barrel, subleading muon in endcap



With GEM

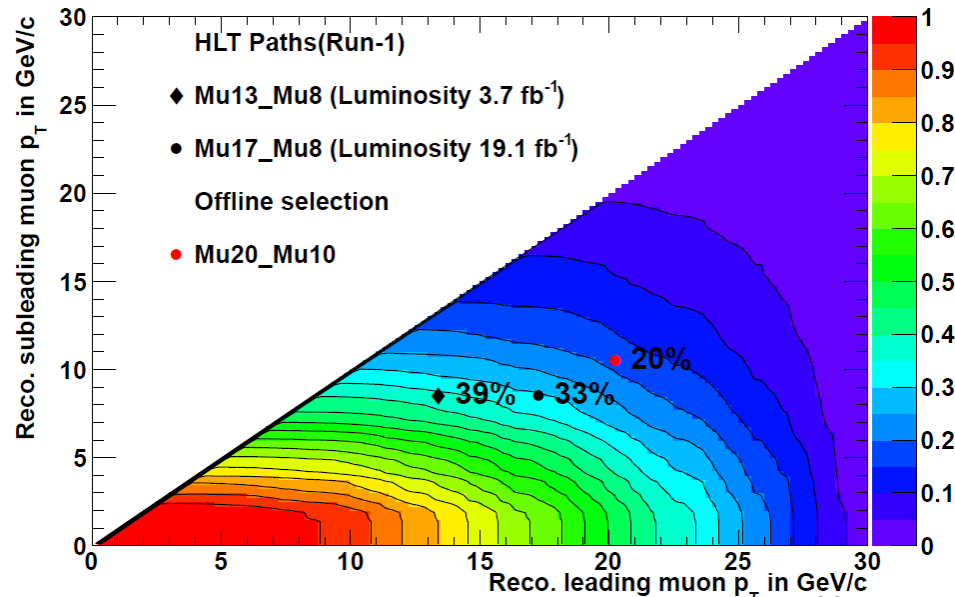
Acceptance much more sensitive to change in subleading muon p_T

Acceptance plots

Case-3

Without GEM

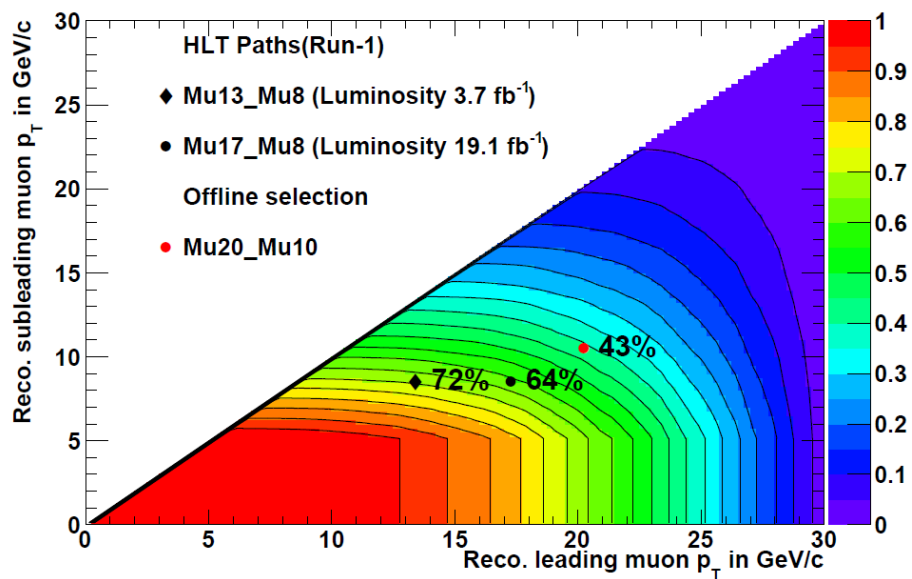
Leading Muon in Barrel, subleading muon in endcap



Acceptance plots

Overall

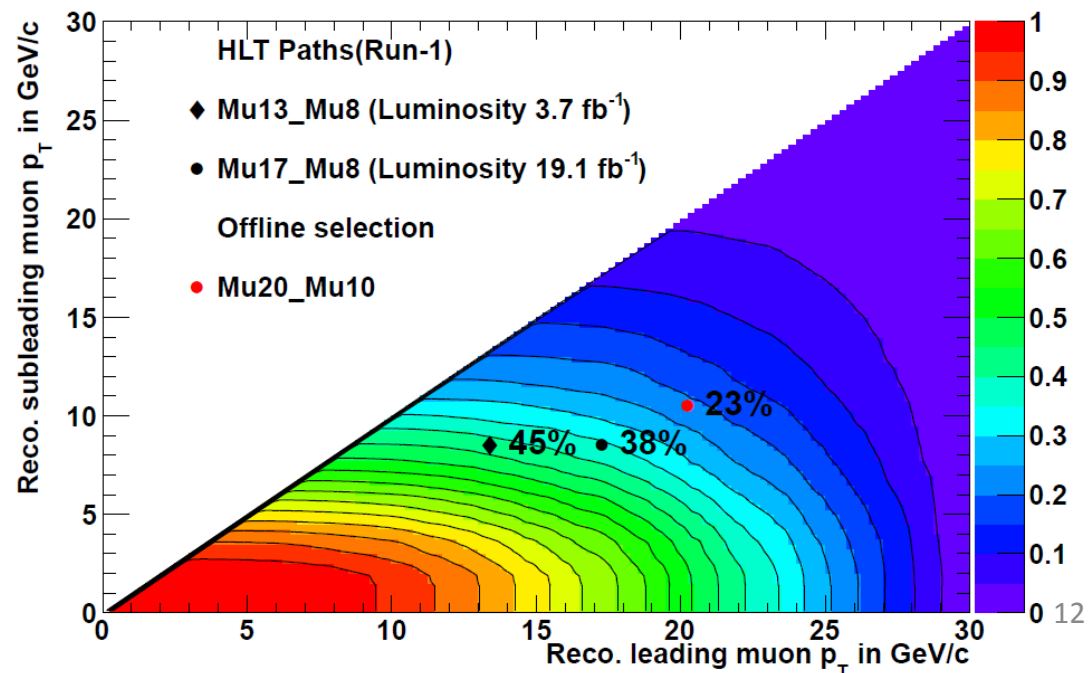
Overall acceptance plot



Without GEM



Overall acceptance plot



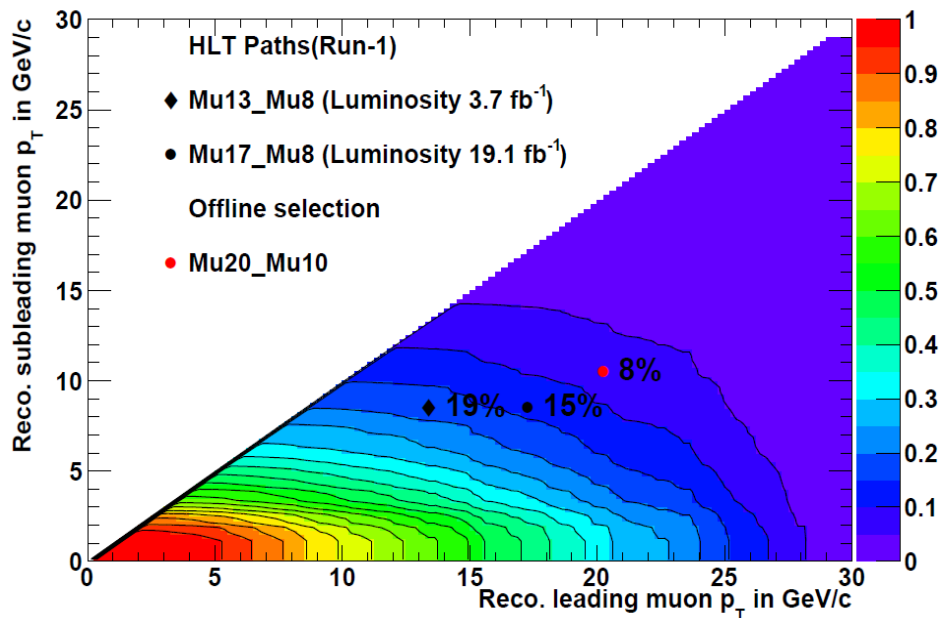
With GEM



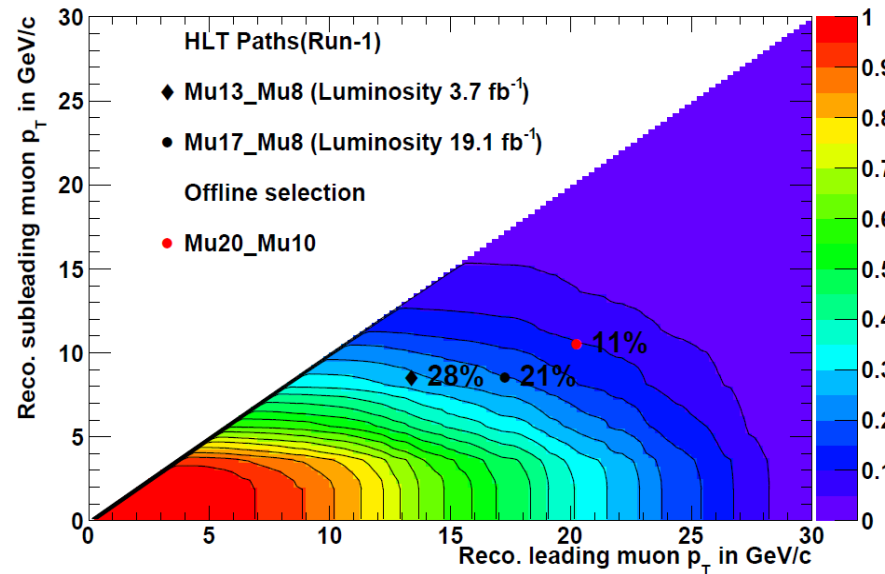
Background sample

- Only Drell Yan to Tau Tau
- Acceptance plots for all the 3 cases
- Trying to make the ratio plot of the signal to background acceptance, should shed more light on the choice of working points

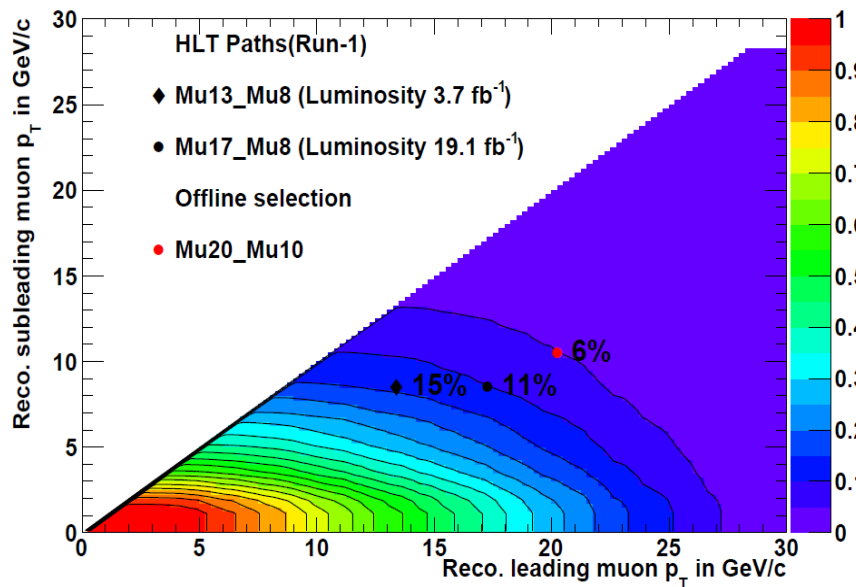
Leading Muon and Subleading Muon in EndCap



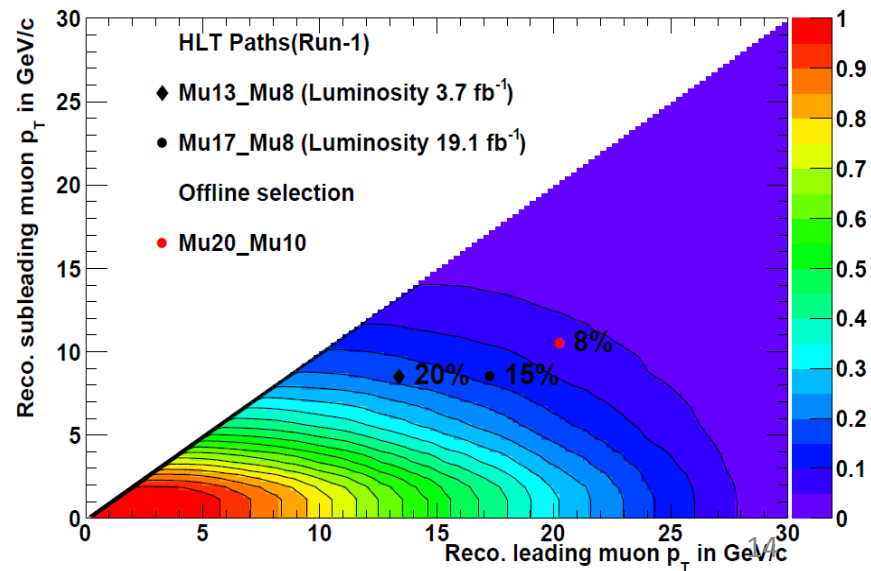
Leading Muon in Endcap, subleading muon in barrel



Leading Muon in Barrel, subleading muon in endcap



Overall acceptance plot



Conclusions and Future work

- Seems like there is improvement in the Muon p_T resolution, but that could also be due to other (tracker) upgrades
- Need to understand why the private samples start at 5 GeV/c
- GEM samples seem to have higher acceptance values for the same working values.
- Look at the Run-1 analysis and see if the Discriminator (BDT) value improves with the GEM samples