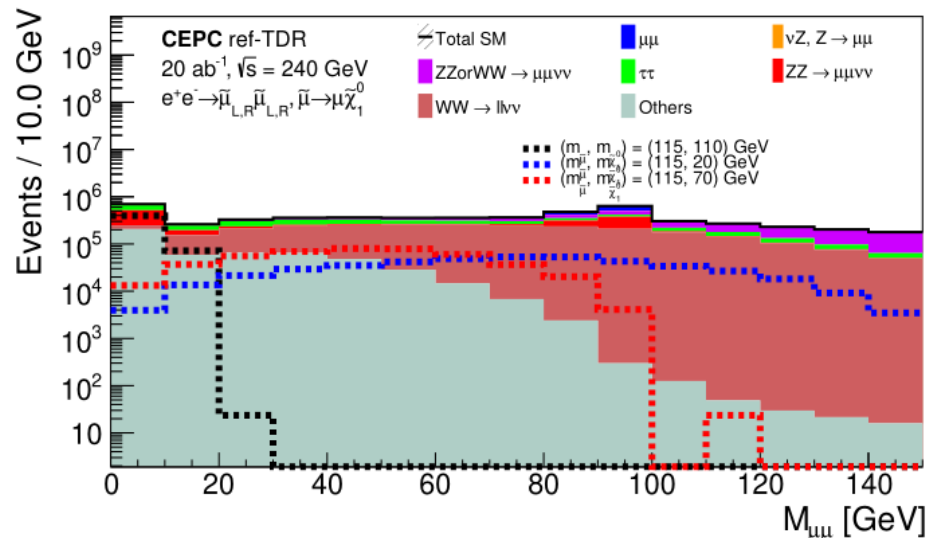
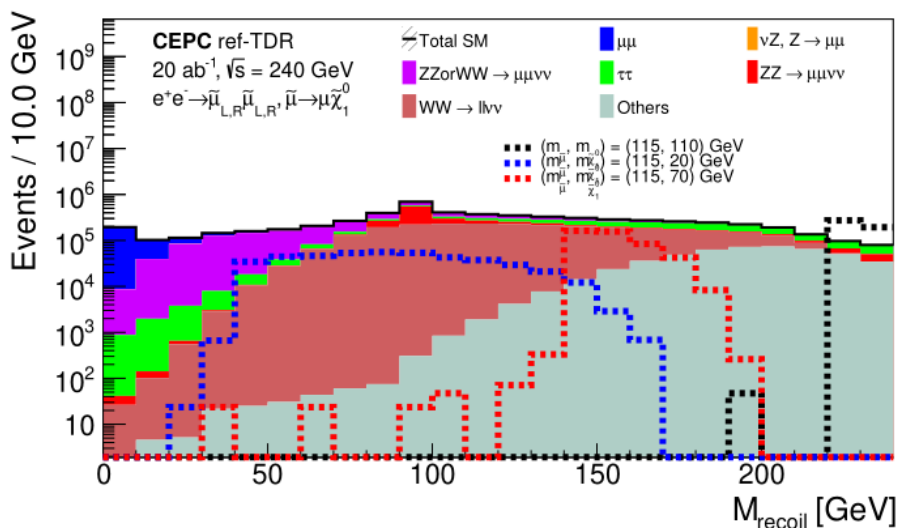
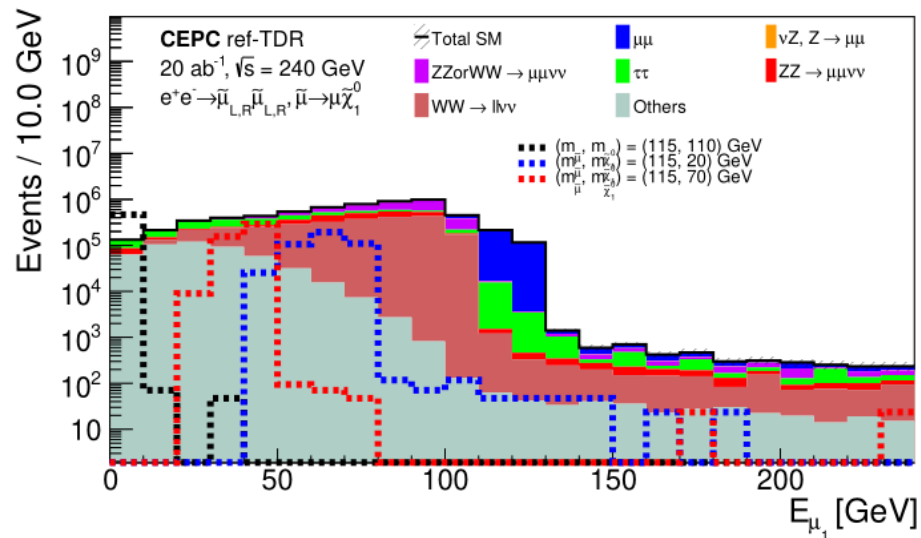
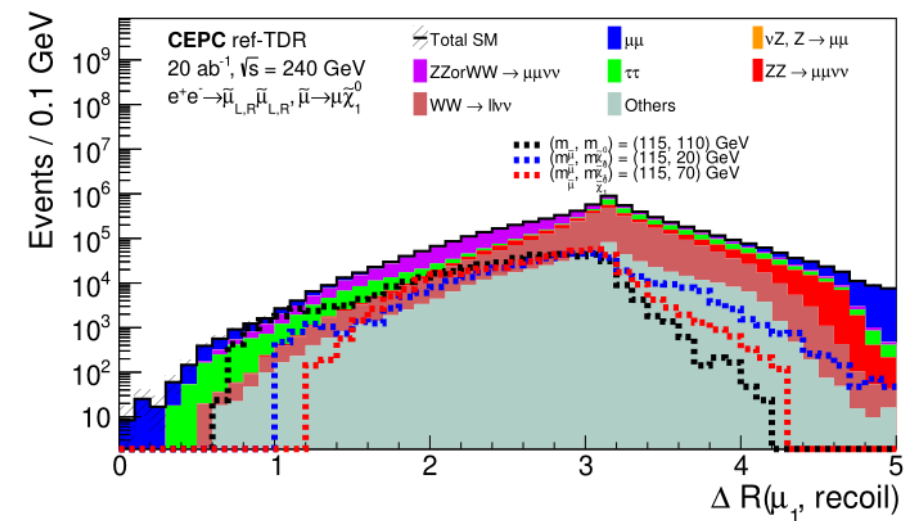


Smuon update & MET Study

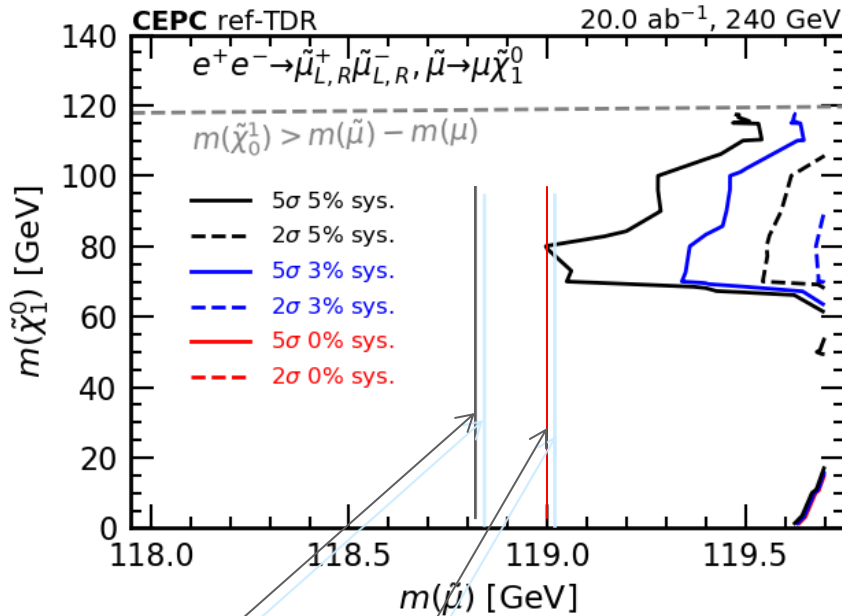
Feng LYU, LIANG Shiyi, ZHUANG Xuai, WU Minlin

09/June/2025/

Smuon performance plots format update (Wu Minlin)

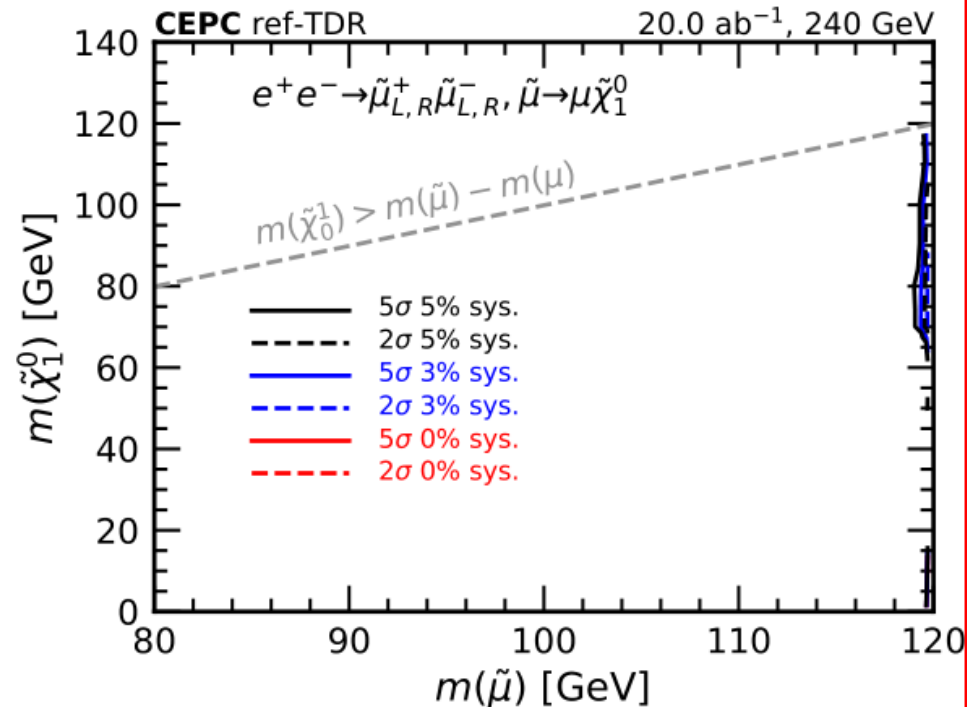


Zn plot re-drawing with correct weights for smuon mass >119 GeV



Old limit: **118.8 GeV** by wrong use
20k events for 119 GeV+ samples,
while in fact they are 15k, 5K LOST!

New limit :**119.0 GeV** by 119 GeV +
samples have got back the lost 5k
events and now 20k



Final Zn plot with correct Zn
values in 119 GeV + and re-
updated plot format



Ref TDR feedback

- P24 **Missing energy reconstruction** should be further investigated, particularly in b- and c-jet events with tagged leptons and in **BSM channels with large ETmiss.**
- - *Physics-related performance* — to demonstrate baseline detector capabilities for physics analyses (e.g., particle identification, global variables like **ETmiss**), and to present the physics analyses themselves. This should be the main focus of the performance chapter.

Basic Information

- **CEPC@240GeV smuon pair samples under CEPCSW 25.3.6 are produced by LIANG Shiyi:**
`/lustrefs/atlas/SUSY/users/liangsy/CEPC/cepcsampleproduction/smuonRec/Reco/HADD/rec*.root`
Msmu: 80, 90, 100, 115, 118 119 119.2 119.4 119.7 GeV
MLSP : 1, 10, 20, ..., Msmu-10, Msmu-5, Msmu-2 GeV
- **Preselection:** Two energetic tracks $>0.5\text{GeV}$, NoPID, energetic two tracks, Rec/Truth MATCH:
OS && Rec. /Truth match: $\Delta R < 0.1$

- **MET Variables:**

== -pT: the muon pair system total transverse momentum

The two muons' rec & truth matched TLorentzVector:

Rec : v1, v2

Truth: T1, T2

rec & truth muons system total TLorentzVector :

Rec : total_r = v1+v2

Truth: total_t = T1+T2

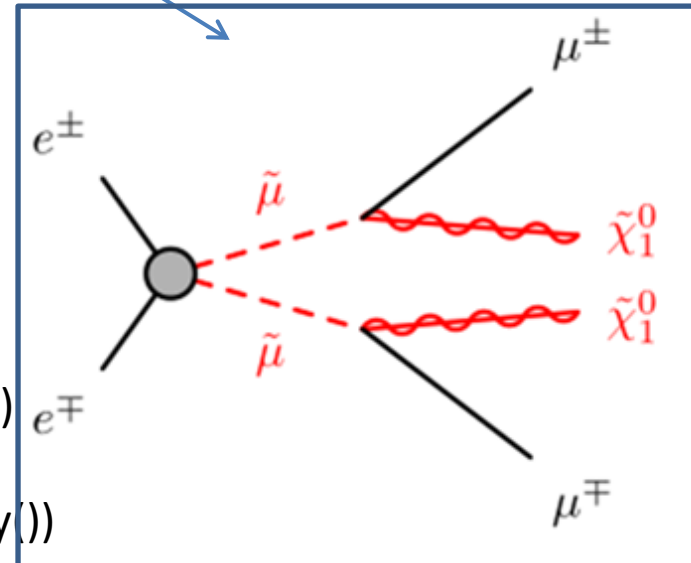
MET value getting in two ways (same value) :

Rec1 : $\sqrt{\text{total_r.Px()}\cdot\text{total_r.Px()}+\text{total_r.Py()}\cdot\text{total_r.Py()}}$

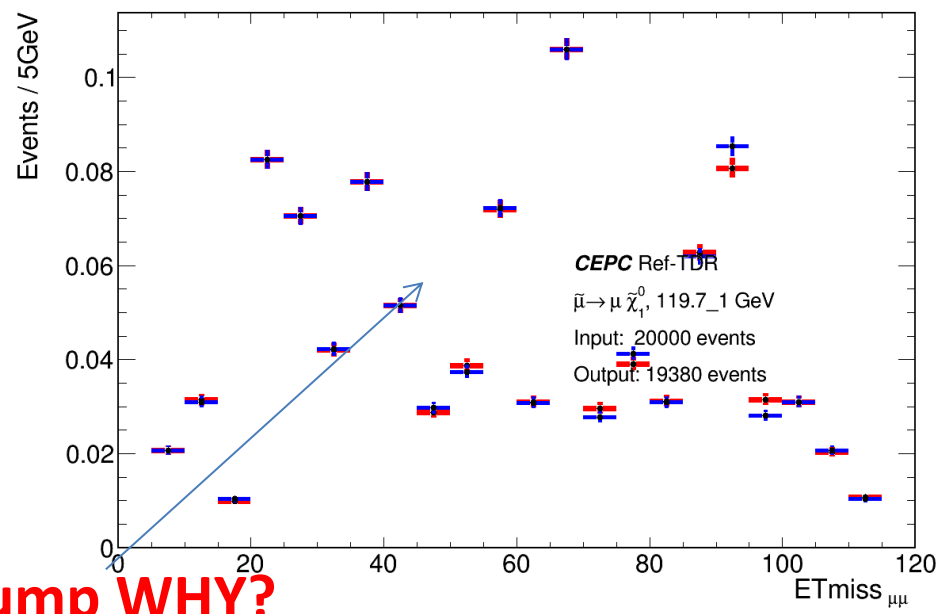
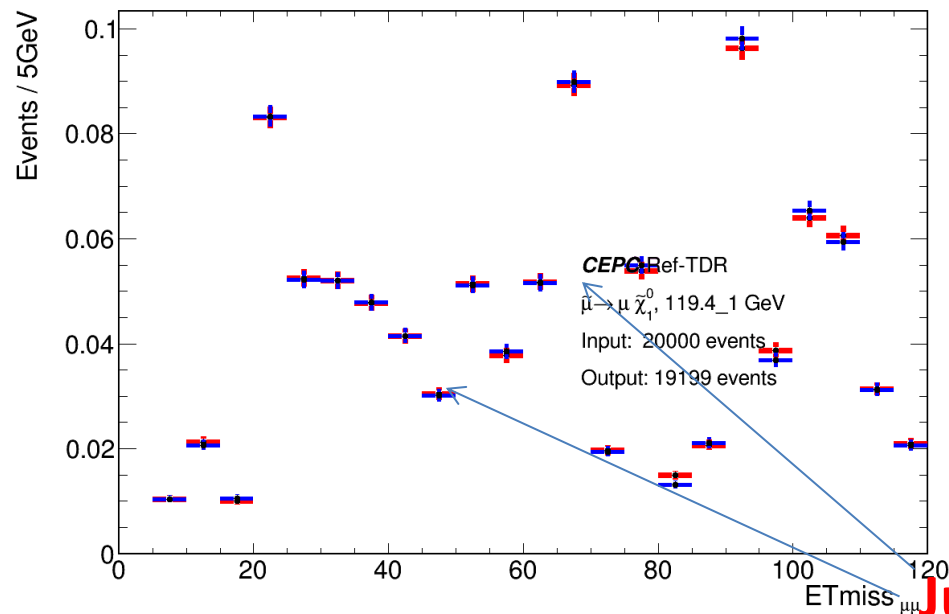
Rec2 : total_r.Pt()

Truth1: $\sqrt{\text{total_t.Px()}\cdot\text{total_t.Px()}+\text{total_t.Py()}\cdot\text{total_t.Py()}}$

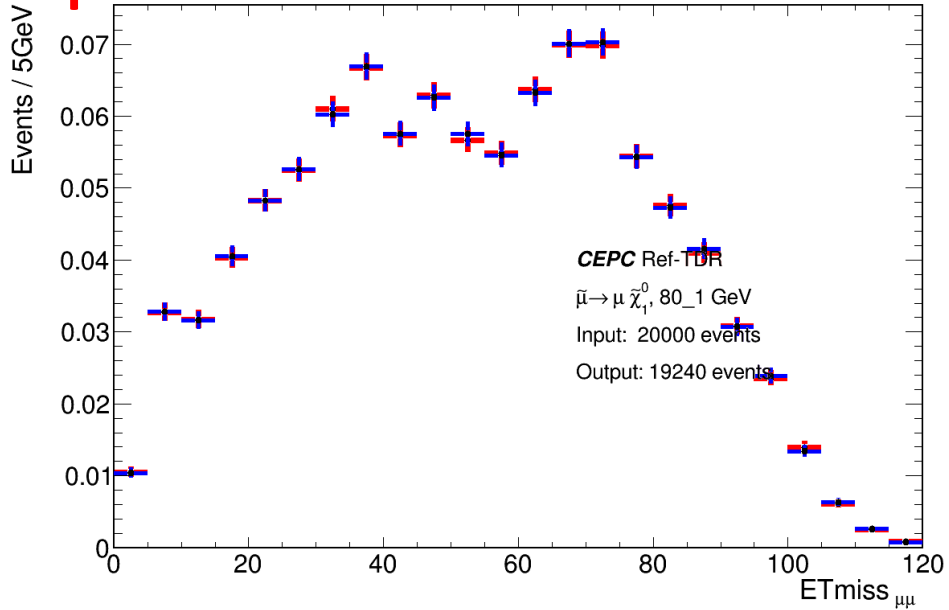
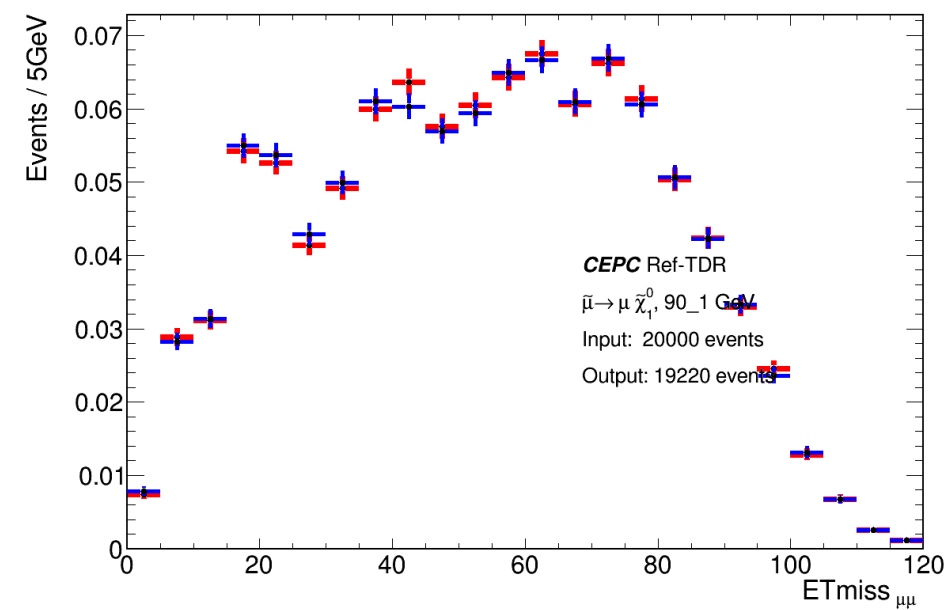
Truth2: total_t.Pt()



MET = -pT: Rec: **red** Truth: **blue**



Jump WHY?



Found few events in each smuon signal samples has wrong MET which above 120GeV WHY?

119.7_1: 19380/20000, -620 evt, 3.1%

charge not corrent! : -296 evts ss

failed Dr 0.1 match. : -2 evts

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth): 267.73, 22.8505, 11.7166 3 evts

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth): 246.793, 59.4822, 4.14903

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 325.047, 39.4346, 8.24269 :

119.4_1: 19199/20000, -801 evt, 4%

charge not corrent! : -379 evts

failed Dr 0.1 match. : -9 evts

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 915.125, 35.399, 25.8517 : 3 evts

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 143.327, 104.033, 1.3777

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 165.682, 88.4529, 1.87311

118_1: 18666/20000, -1334, 6.67%

charge not corrent! : -1115 evts

failed Dr 0.1 match. : -12 evts

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 263.204, 89.7627, 2.93222 : 5 evts

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 314.923, 76.781, 4.10157

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 162.266, 92.5632, 1.75303

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 173.63, 33.2598, 5.2204

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 343.074, 92.9393, 3.69138

80_1: 19240/20000: -760, 3.8%

charge not corrent! : -597evts

failed Dr 0.1 match. : -11 evts

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 477.703, 90.1272, 5.30032 : 6 evts

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 153.049, 42.3969, 3.60992

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 194.514, 33.143, 5.86893

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 498.823, 13.8399, 36.0423

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 1721.55, 85.8411, 20.055

Etmiss_Rec, Etmiss_Truth, Etmiss(Rec/Truth) : 174.675, 2.64823, 65.959

Smu pair Rec. 终选 240GeV

SR-highDeltaM	SR-midDeltaM	SR-lowDeltaM
	== 2 muons(OS, both energy > 0.5 GeV)	
$E_\mu > 40 \text{ GeV}$	$9\text{GeV} < E_\mu < 48 \text{ GeV}$	-----
$\Delta R(\mu, \text{recoil}) < 2.9$	$1.5 < \Delta R(\mu, \text{recoil}) < 2.8$	$1.5 < \Delta R(\mu, \text{recoil}) < 2.8$
$M_{\mu\mu} < 60 \text{ GeV}$	$M_{\mu\mu} < 80 \text{ GeV}$	-----
$M_{\text{recoil}} > 60 \text{ GeV}$	-----	$M_{\text{recoil}} > 220 \text{ GeV}$

Smuon NOT use MET IN events selection

Smu pair 终选 360GeV

Table 4 Summary of selection requirements for the direct smuon production signal region. ΔM means difference of mass between $\tilde{\mu}$ and LSP

SR- ΔM^h	SR- ΔM^m	SR- ΔM^l
$E_{\mu 1,2} > 60 \text{ GeV}$	$E_{\mu 1,2} < 80 \text{ GeV}$	—
$E_{\mu 1,2} \in (60 - 70, > 70) \text{ GeV}$	$E_{\mu 1,2} \in (< 35, 35 - 80) \text{ GeV}$	—
$\Delta R(\mu, \text{recoil}) < 2.8$	$1.9 < \Delta R(\mu, \text{recoil}) < 2.9$	—
$M_{\mu\mu} < 87 \text{ GeV} \parallel 95 < M_{\mu\mu} < 130 \text{ GeV}$	$M_{\mu\mu} < 80 \text{ GeV}$	—
$M_{\text{recoil}} > 100 \text{ GeV}$	—	$M_{\text{recoil}} > 340 \text{ GeV}$
$M_{\text{extra}} < 15 \text{ GeV}$	$M_{\text{extra}} < 10 \text{ GeV}$	$M_{\text{extra}} < 10 \text{ GeV}$