Long Lived Particle

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Process

$\mathbf{p\ p} > \widetilde{\boldsymbol{t}}_{\mathbf{1}}\ \widetilde{\boldsymbol{t}}_{\mathbf{1}}^{*}$ $\qquad M_{\widetilde{t}_1} = 700$ GeV

$\widetilde{\boldsymbol{t}}_{\mathbf{1}} > \boldsymbol{b}\ \boldsymbol{l}$ → **lepton universality**

- be = 1/3
- bμ = 1/3
- bτ = 1/3

- generator : PYTHIA8
- decay length : cτ = 0.1 cm, 1 cm, 10 cm, 100 cm
- benchmarks : SPS1a

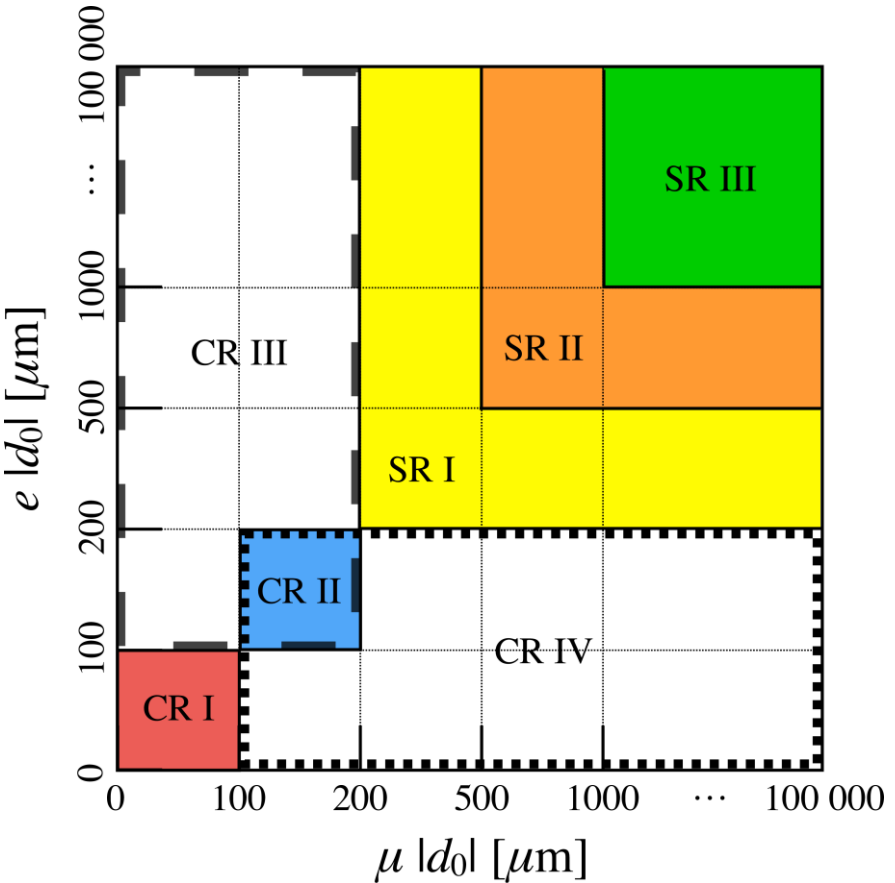
Preselection

	pT	|eta|
electron	>42 GeV	<2.4
muon	>40 GeV	<2.4
ΔR(e,mu) > 0.5		

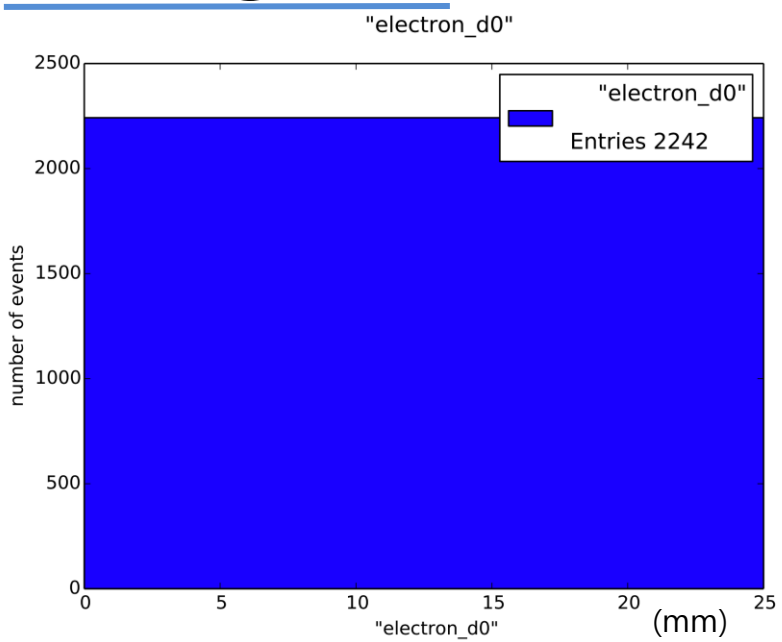
The isolation sum is required to be less than 3.5% (6.5%) of the electron's pT for electrons in the barrel (endcap) region. Muon need to be less than 15% of the muon's pT (in ΔR < 0.4 cone).

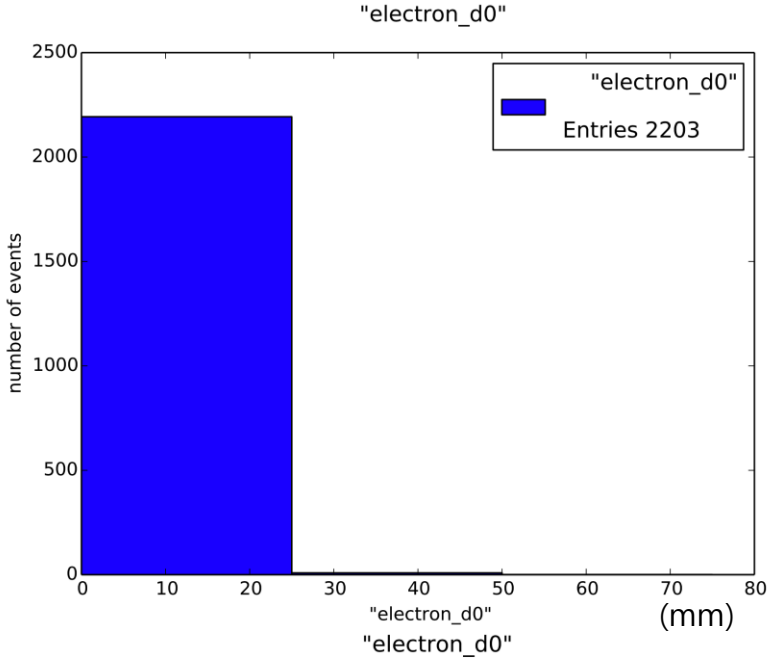
- limit of track : 10 cm
- No overlapping in 3 regions

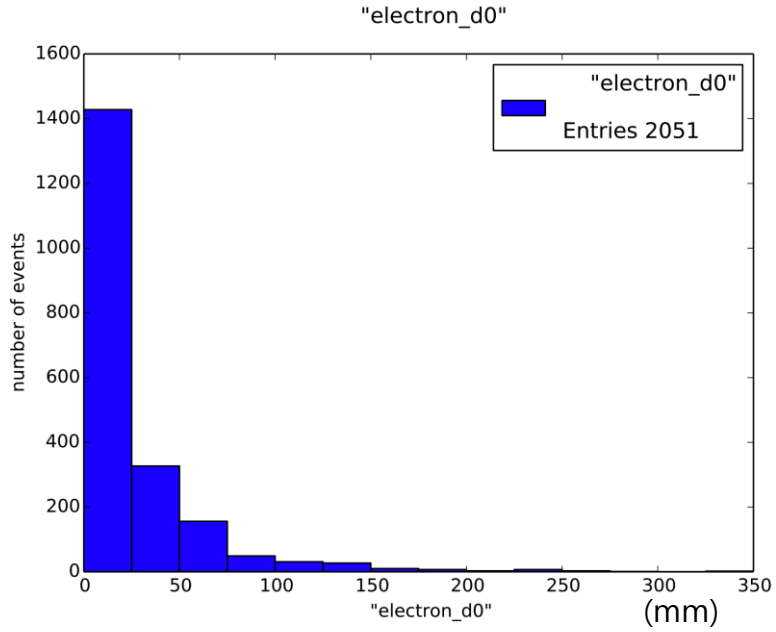
- **SR I** : 200 ~ 100000 μm (loose)
- **SR II** : 500 ~ 100000 μm (intermediate)
- **SR III** : 1000 ~ 100000 μm (tight)

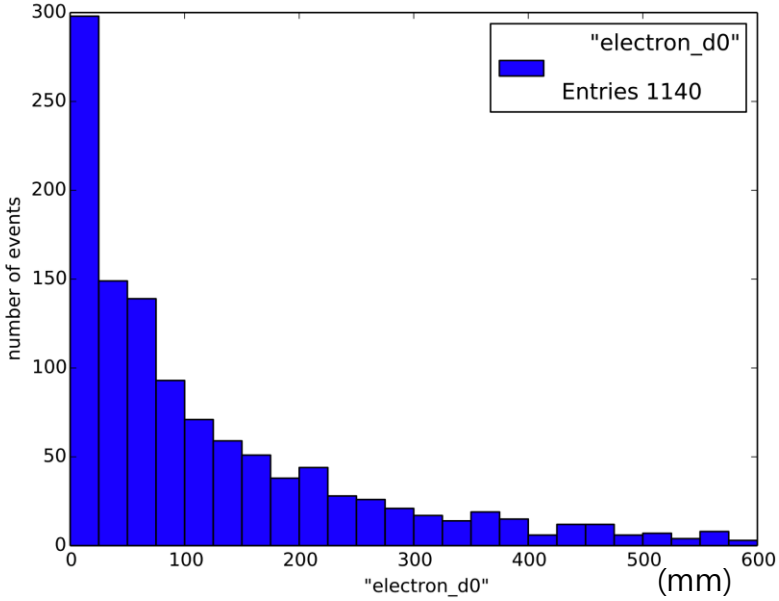


Histogram – electron d0 before cuts









Results

CMS-EXO-16-022

<Table 4>

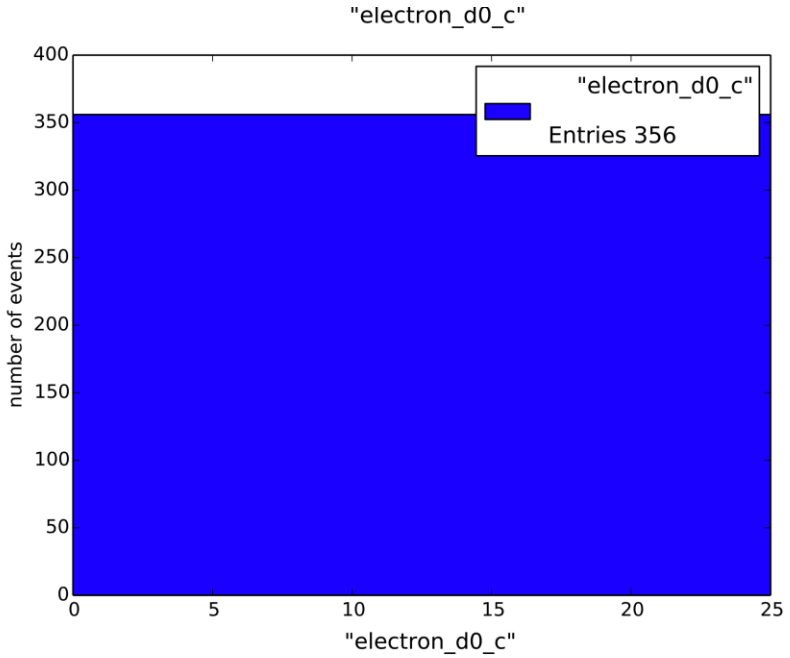
$pp \to \tilde{t}_1 \tilde{t}_1^* (M_{\tilde{t}_1} = 700\,\text{GeV})$			
$c\tau = 0.1\,\text{cm}$	3.8 ± 0.2	0.94 ± 0.06	0.16 ± 0.02
$c\tau = 1\,\text{cm}$	5.2 ± 0.4	4.1 ± 0.3	7.0 ± 0.3
$c\tau = 10\,\text{cm}$	0.8 ± 0.1	1.0 ± 0.1	5.8 ± 0.2
$c\tau = 100\,\text{cm}$	0.009 ± 0.005	0.03 ± 0.01	0.27 ± 0.03

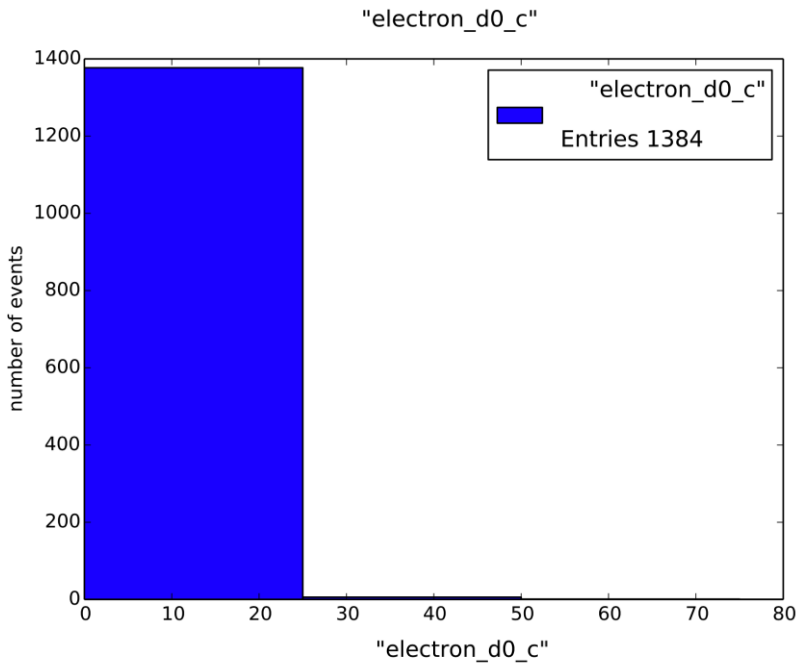
<Our Results>

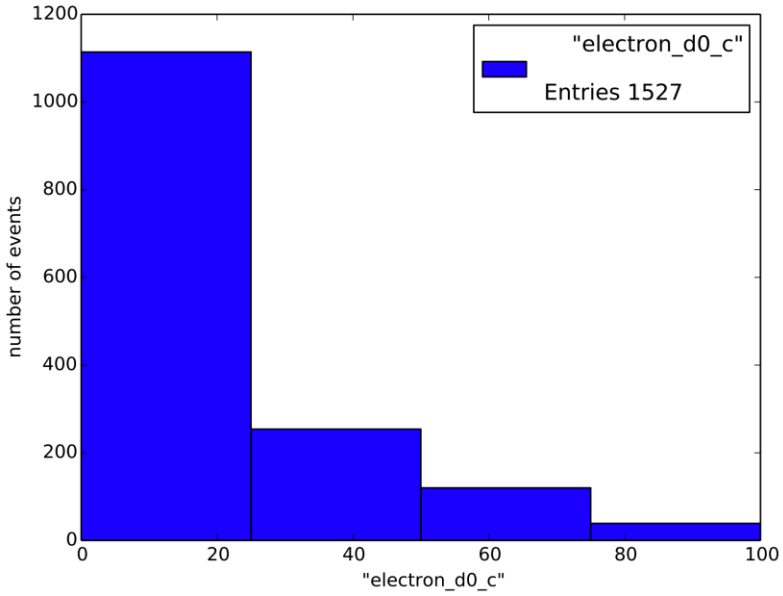
m_stop = 700	**0.0670476 pb**	**at LHC 13 TeV**	**L=2.6 fb^-1**
# of events	SR1	SR2	SR3
0.1cm	4.85	1.20	0.16
1cm	6.76	6.38	10.98
10cm	1.66	2.41	22.56
100cm	0.19	0.21	5.72

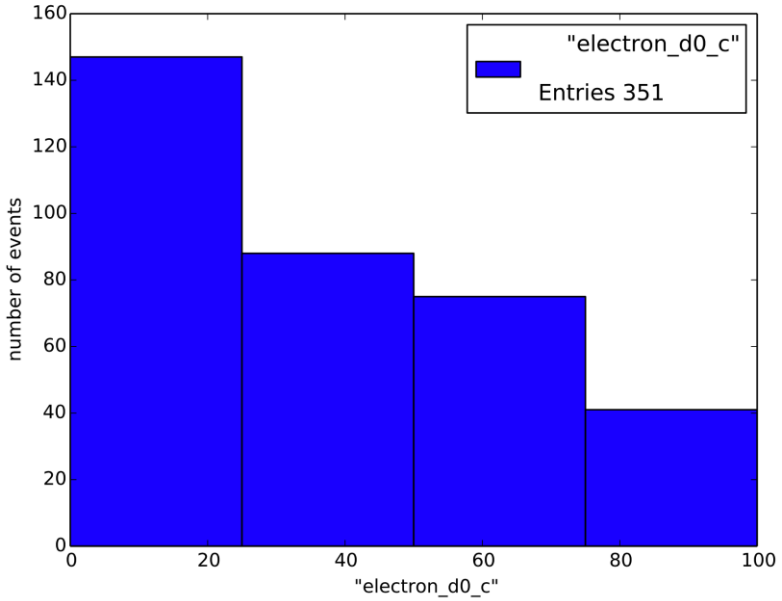
we used the cross section listed in :
https://twiki.cern.ch/twiki/bin/view/LHCPhysics/SUSYCrossSections13TeVstopsbottom

Histogram – electron d0 after cuts



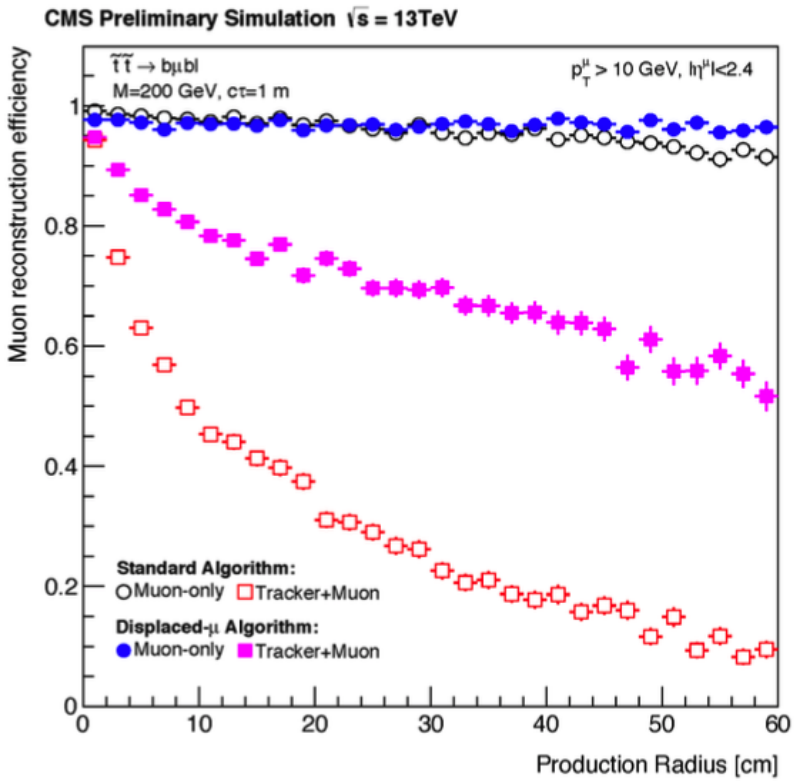






Back Up

Displaced Global Muons: Efficiency



Simulated signal process:

- PYTHIA8 stop pair production
  - M(stop) = 200 GeV, $c\tau$ = 1 m
  - Decay: stop → b + ℓ
- Flat average pileup distribution 10-50 events
- Bunch spacing: 25 nsc

- Muon reconstruction efficiency as a function of the production radius, for muons from the direct decay stop → b + μ (with muon $p_T > 10$ GeV and $|\eta| < 2.4$)
- Standard algorithms for muon-only (*black*) and tracker+muon (*red*) reconstruction, compared with the new algorithms for displaced-muon reconstruction: Displaced Standalone (*blue*) and Displaced Global (*magenta*)