LMVM simulation with new beam pipe and shielding in SIS100 geometry

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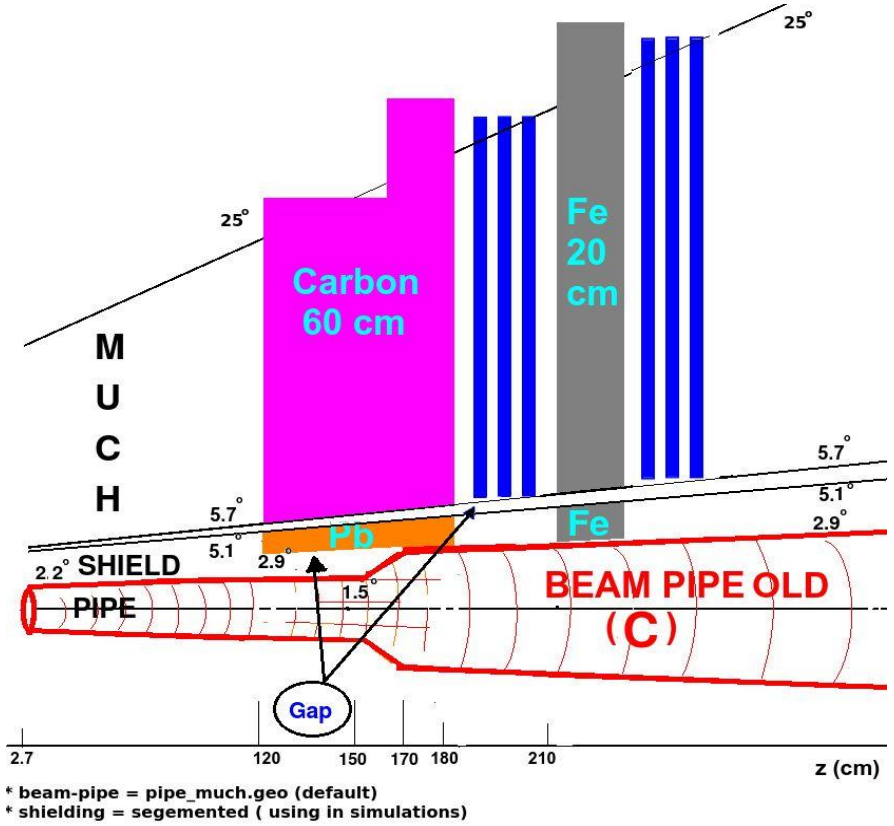
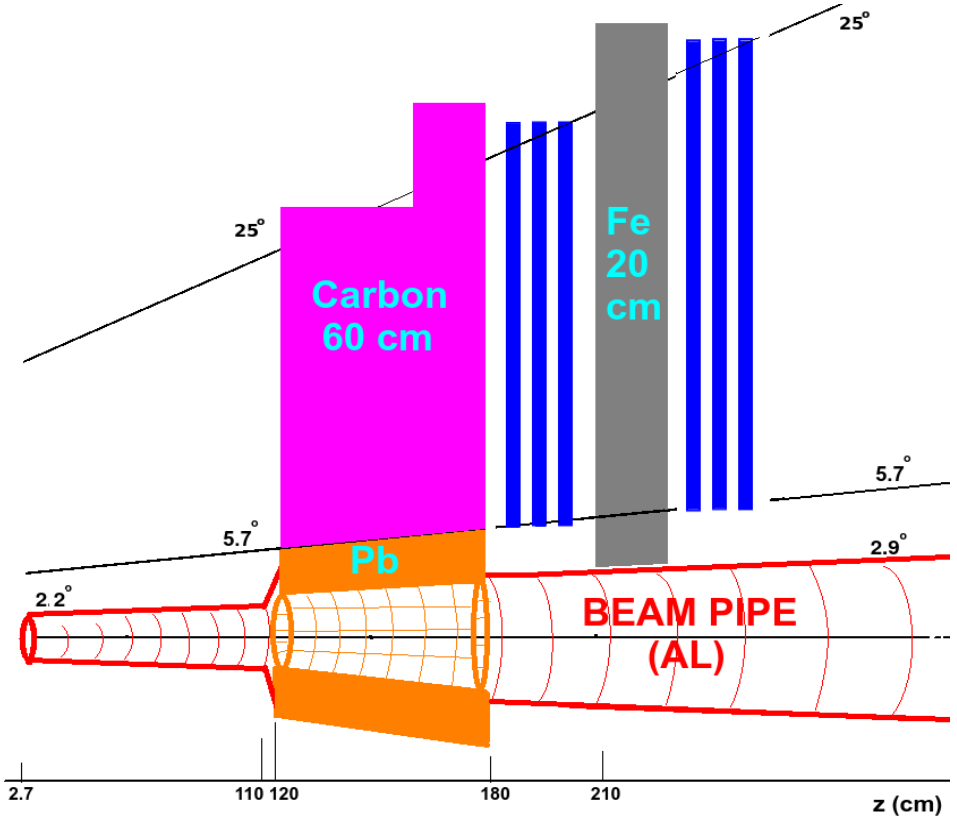
Aim

- **Performance study of SIS100-B geometry with new beam pipe and shielding**





Old configuration

New configuration
(Pb as part of beam pipe)

(From last presentation of Shabir)

Tools used

CBM Frame-Work

- **CBMROOT(environment): VERSION –JUL13p1**
- **FAIRSOFT-VERSION-dec13p1**

Event Generators

- **PLUTO: cocktail sources at 8 Agev**
- **URQMD: (version 3.3) To generate background events @8 AGeV Au + Au central collisions**

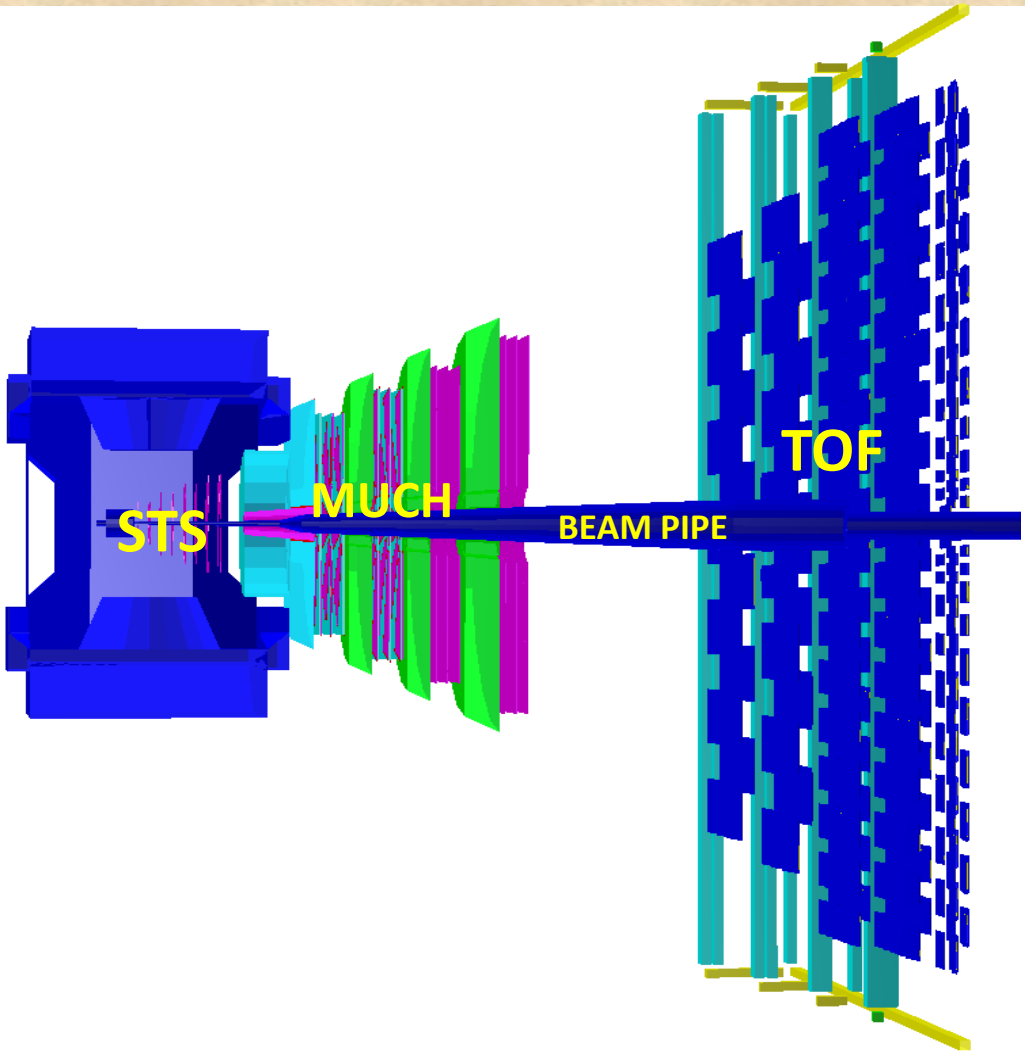
GEANT3: Transport the particles through the CBM set-up

Geometry : SIS100

- **MUCH: [4 Absorbers(1st absorber 60cm of Carbon)+4stations(all GEM)]**
- **STS: Standard (stations=8)**
- **TOF geometry: tof_v13b.root**

Geometry (SIS100)

- STS+MUCH(4 absorbers+4GEM stations)+TOF
- STS: sts_v12b.geo.root
- MUCH: 60 cm (C+Pb) + (20+20+30) cm Fe, all GEMs
- ToF: tof_v13b.root



Yields at 8 AGeV

	ρ^0 (775MeV)	ω (783 MeV)	φ (1020 MeV)	η (550 MeV)	η_D (550 MeV)	ω_D (783 MeV)
Multiplicity (HSD)	9	19	0.12	16	16	19
BR($\mu\mu$ channel)	$4.55*10^{-5}$	$9*10^{-5}$	$2.87*10^{-5}$	$5.6*10^{-6}$	$3.1*10^{-4}$	$1.3*10^{-4}$
Per event yield	$4.09*10^{-4}$	$1.71*10^{-3}$	$3.44*10^{-6}$	$8.96*10^{-5}$	$4.96*10^{-3}$	$2.47*10^{-3}$

Multiplicity from HSD
Branching ratio from PDG

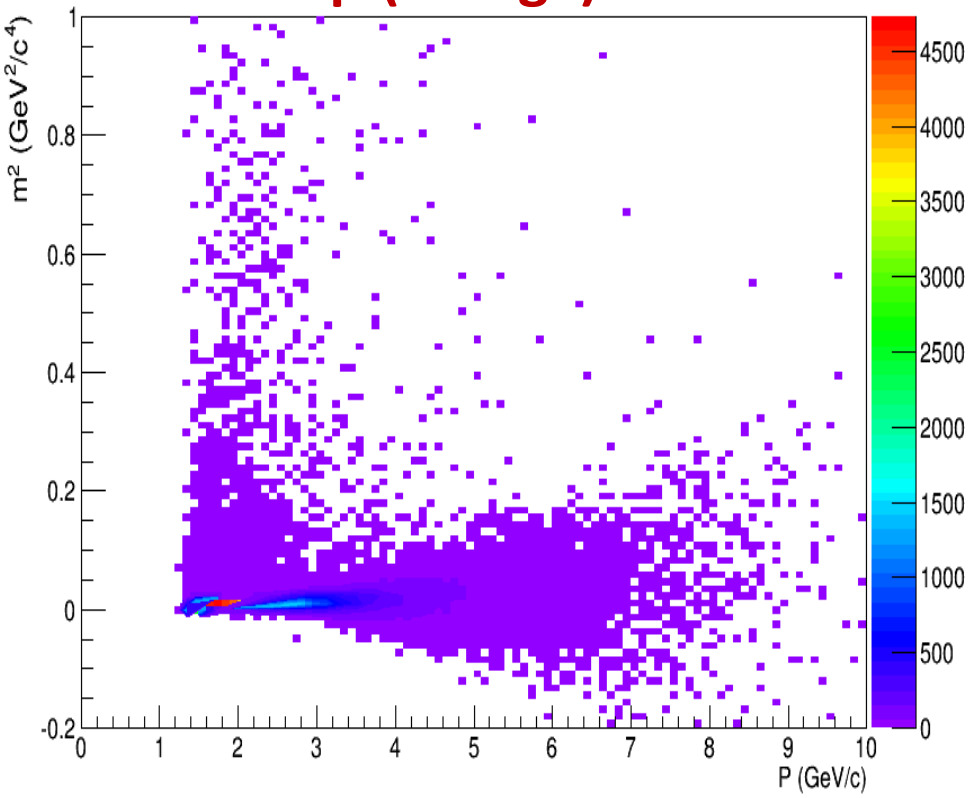
Cuts used

- MUCH hits>=11
- STS hits>=7
- χ^2_{much} <1.3
- χ^2_{vertex} <2.0
- m^2 <=0.05 GeV^2/C^4

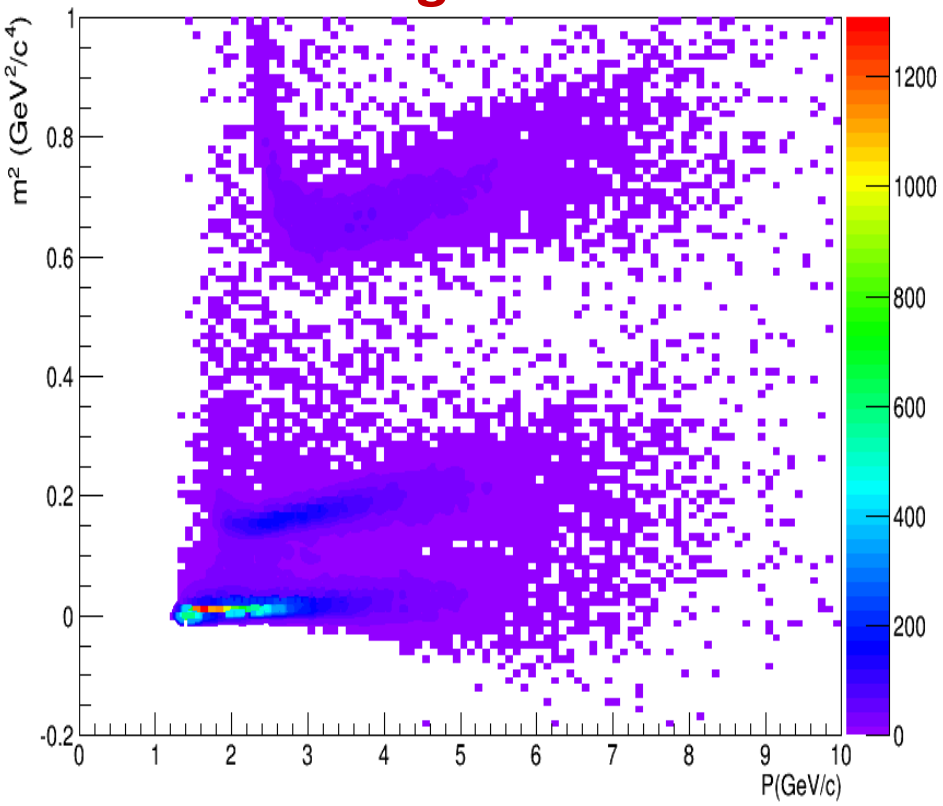
- Events analysed : 500k
- Embedded (urqmd+pluto) events are transported through CBM detector using GEANT3 transport code.
- After reconstruction invariant mass of signal is calculated.
- Whereas, unembedded background (urqmd only) is calculated after reconstruction by SE technique combining oppositely charged tracks.

TOF information

μ (omega)

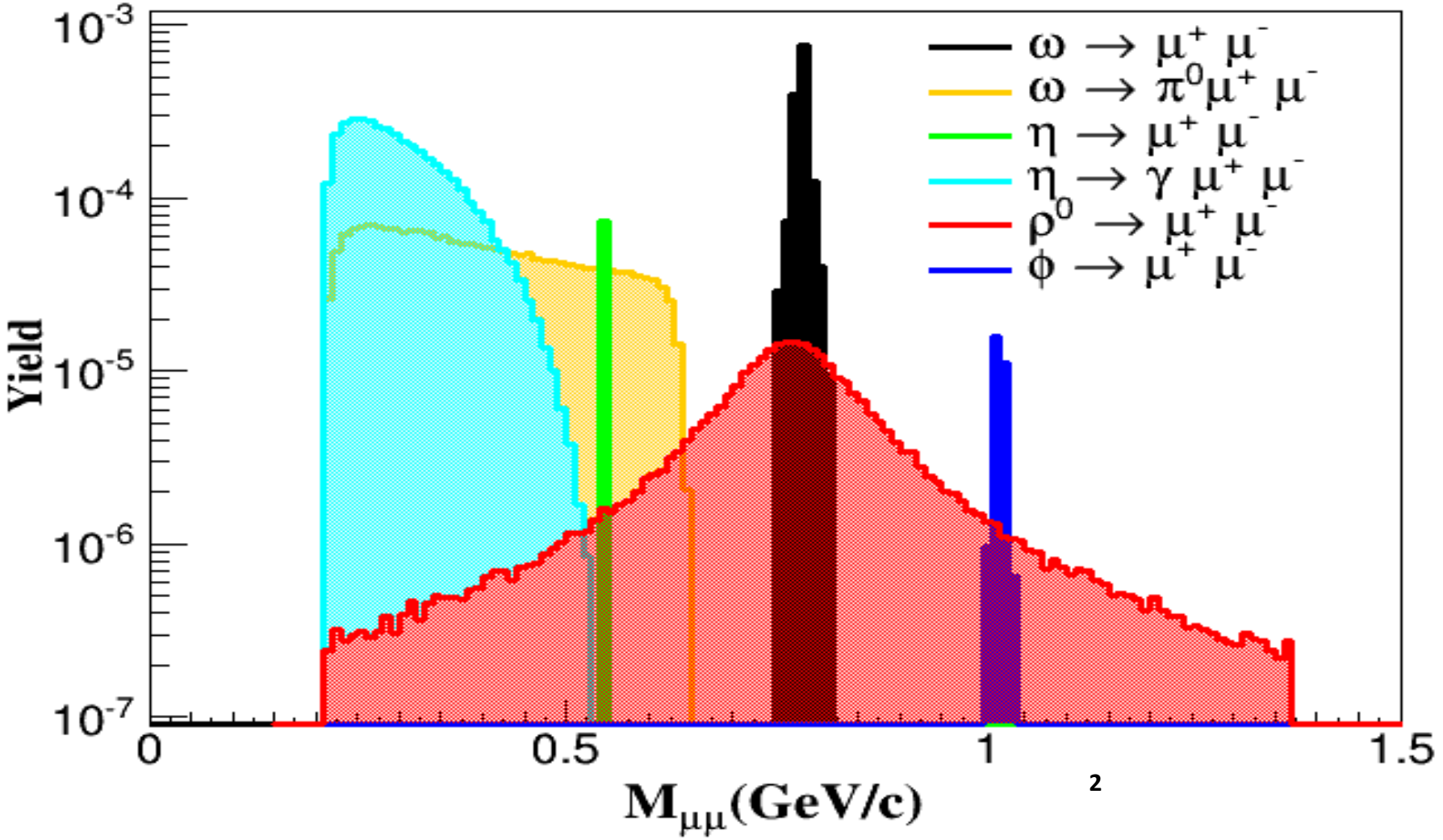


Background

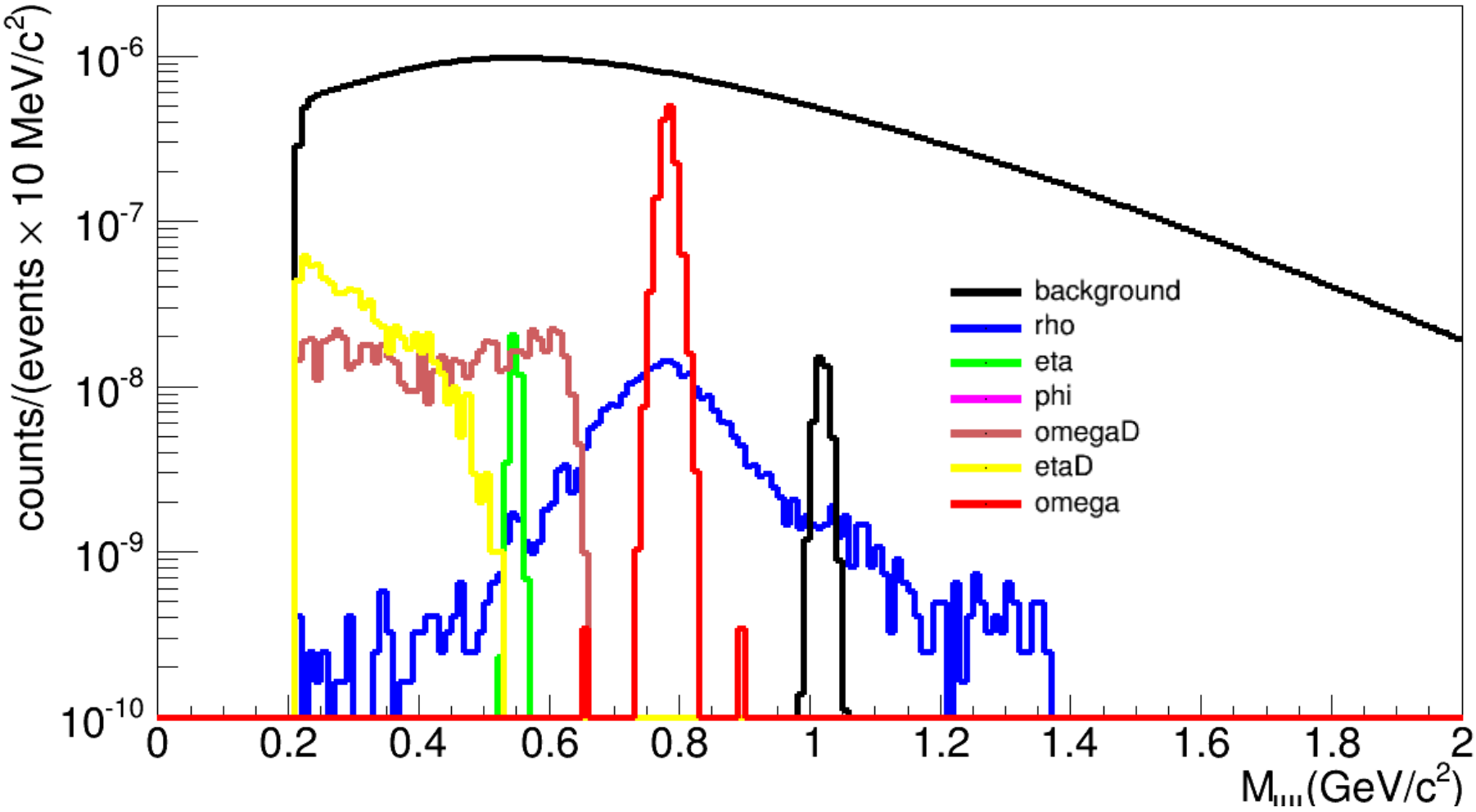


TOF is used to reduce background (m^2 >=0.05 GeV^2/C^4)

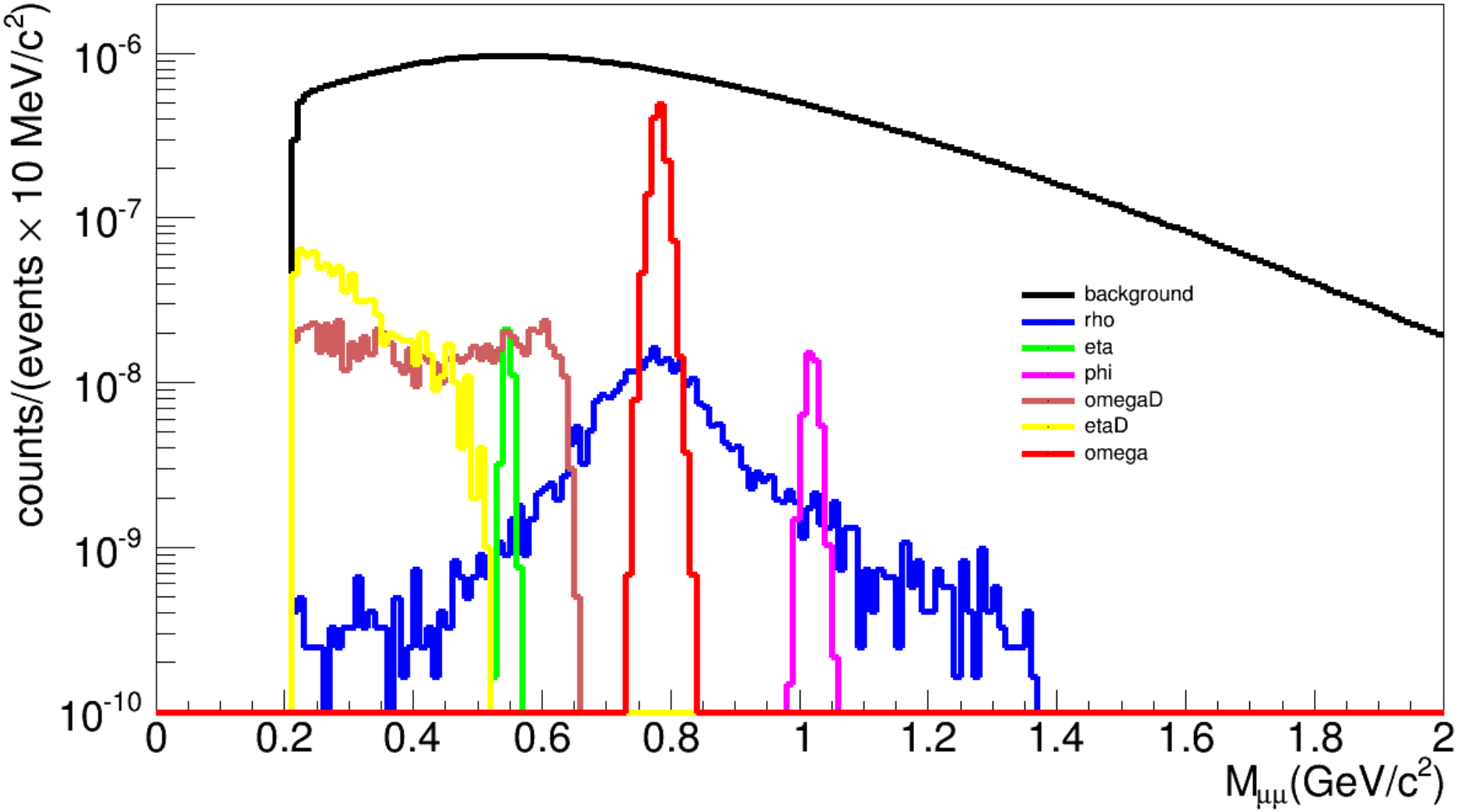
Input cocktail from PLUTO @8 AGeV



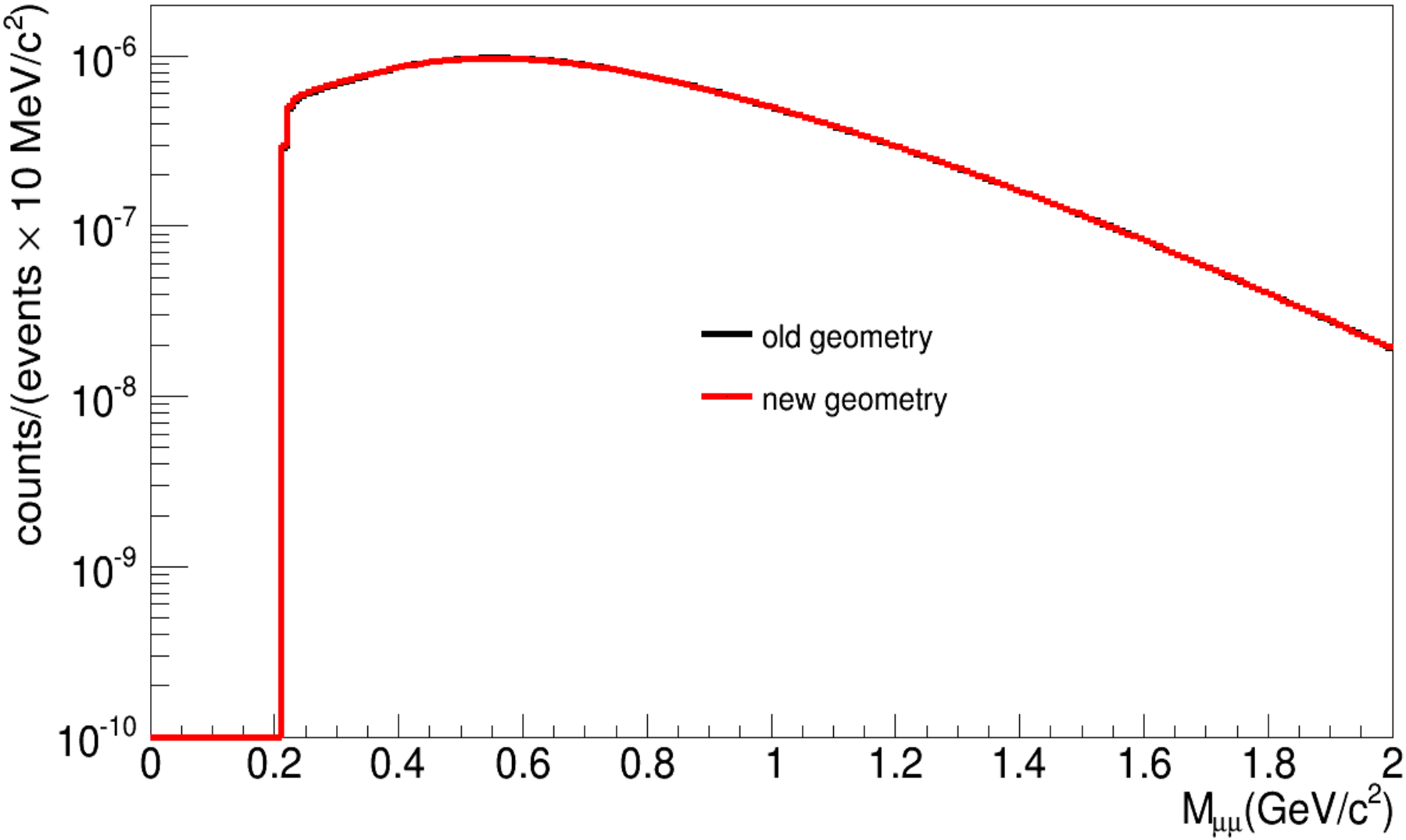
Reconstructed Cocktail from old geometry



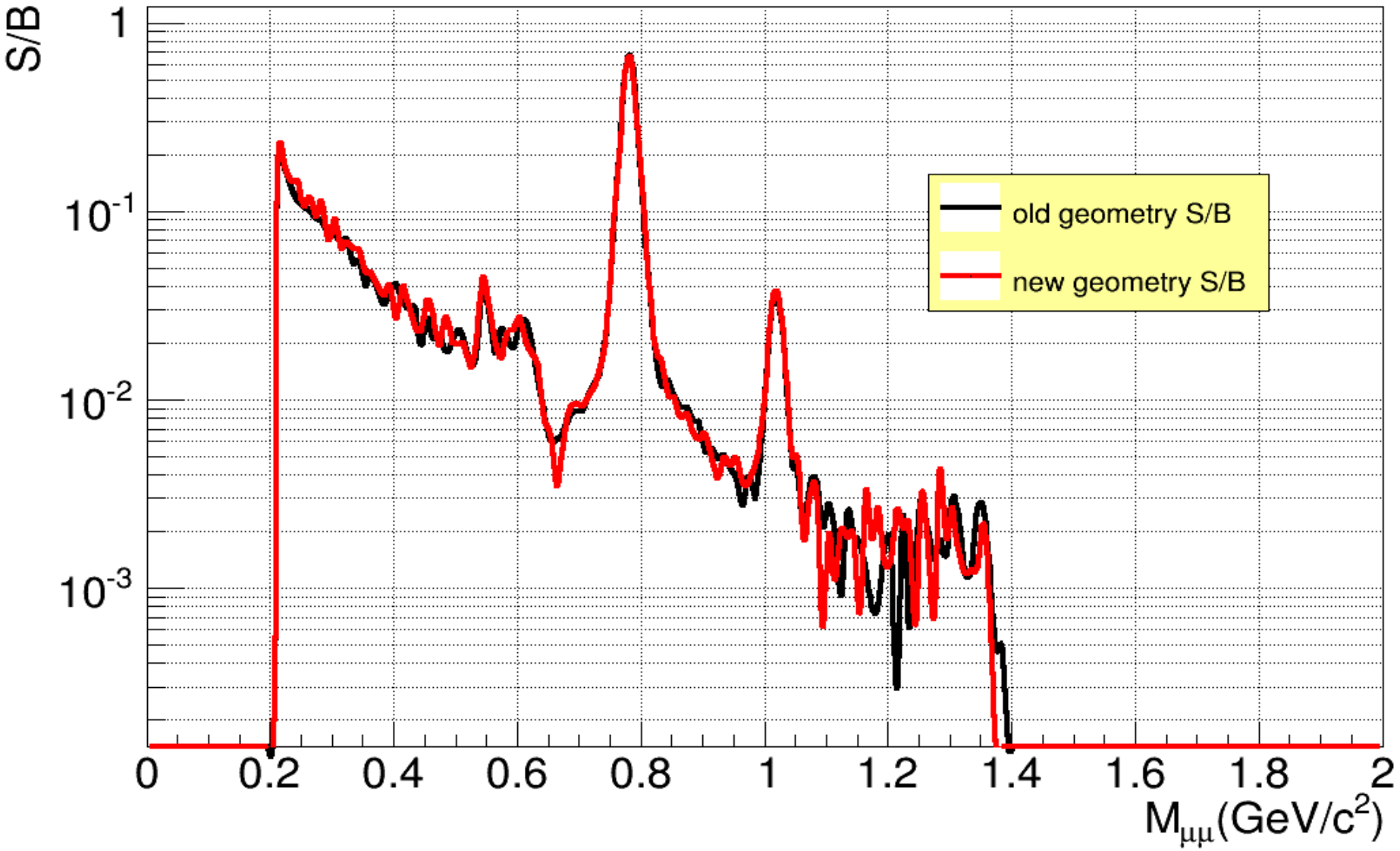
Reconstructed Cocktail from new configuration



Background


counts/(events × 10 MeV/c²)
10⁻⁶
10⁻⁷
10⁻⁸
10⁻⁹
10⁻¹⁰
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
M_μμ(GeV/c²)
old geometry
new geometry

S/B

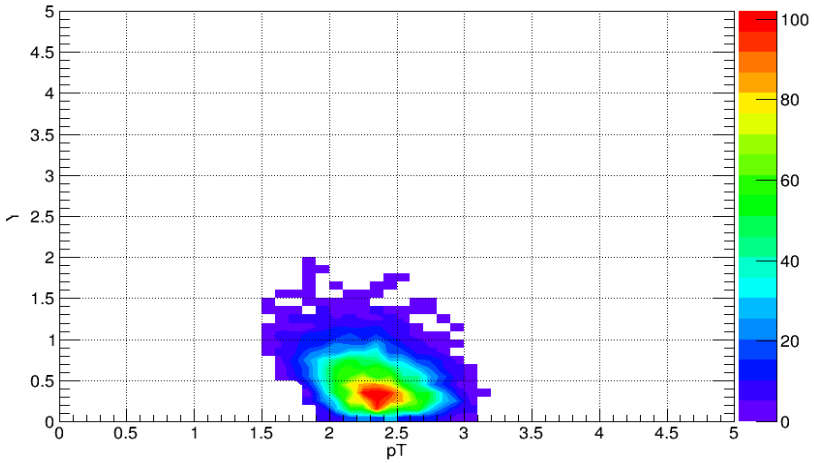

S/B
1
10^{-1}
10^{-2}
10^{-3}
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
$M_{\mu\mu}(GeV/c^2)$
old geometry S/B
new geometry S/B

Efficiency of different particles from simulation

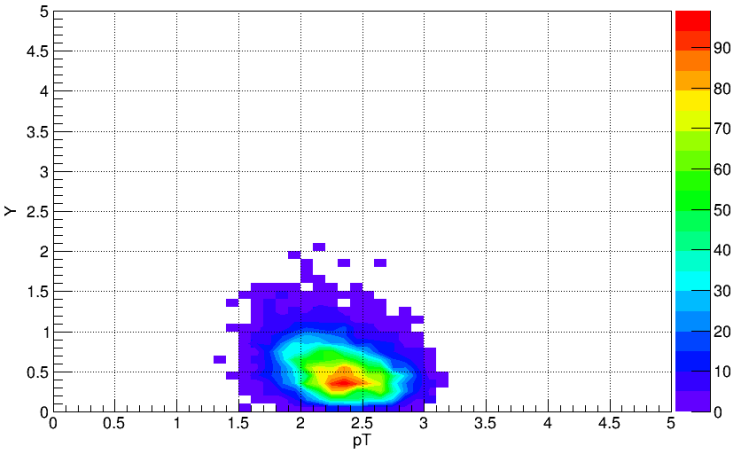
		ρ^0	ω	φ	η	η_D	ω_D
Efficiency(%)	New geometry	0.78	0.81	1.26	0.41	0.17	0.29
	Old geometry	0.76	0.82	1.21	0.41	0.15	0.27
S/B	New Geometry	0.007	0.28	0.014	0.01	0.005	0.006
	Old geometry	0.007	0.27	0.014	0.01	0.005	0.006

Acceptance plot

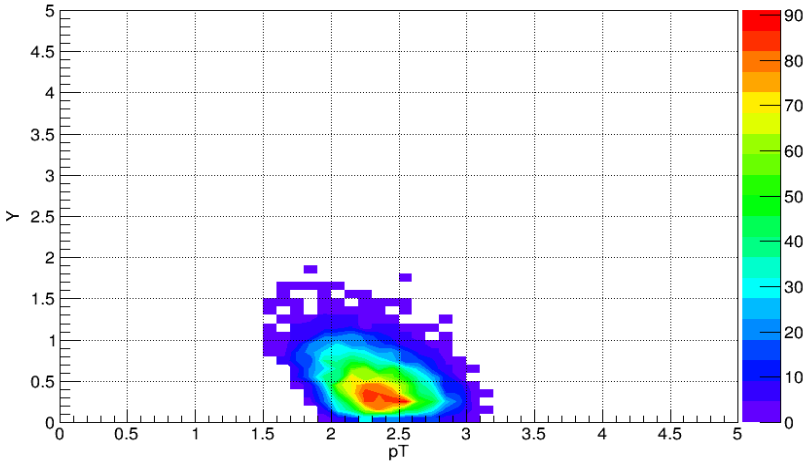
Omega without tof



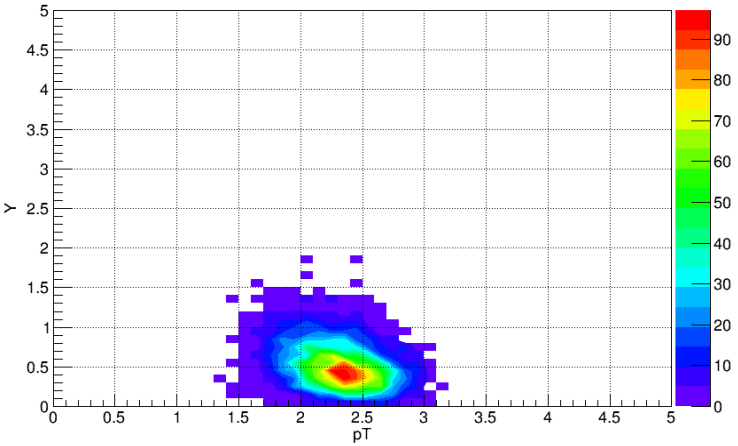
Rho without tof



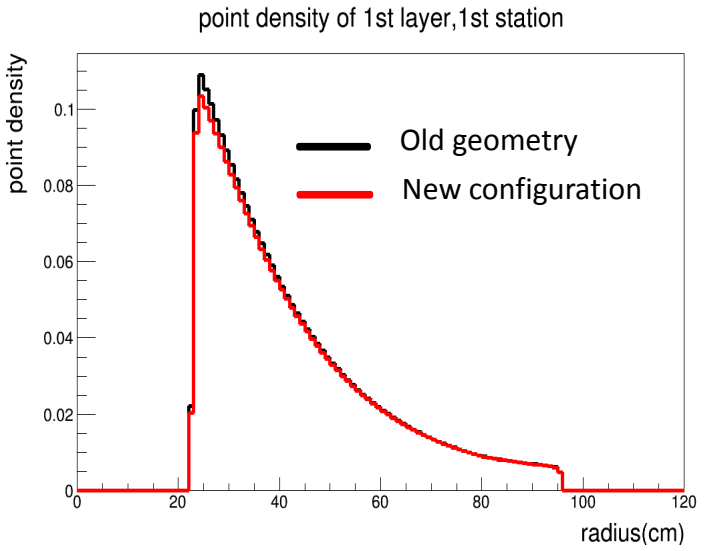
Omega with tof

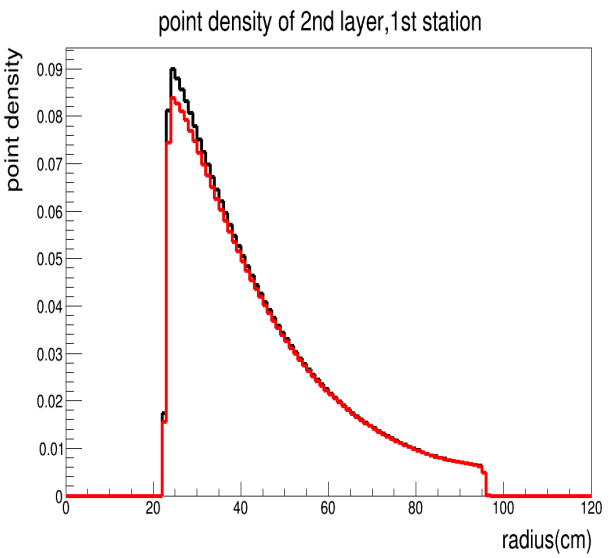


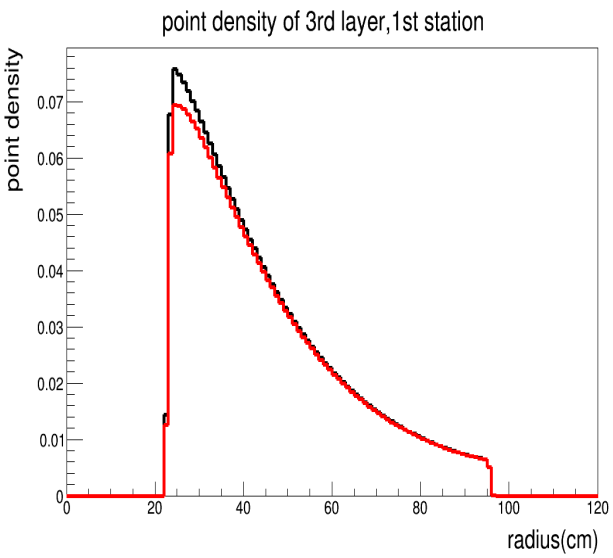
Rho with tof

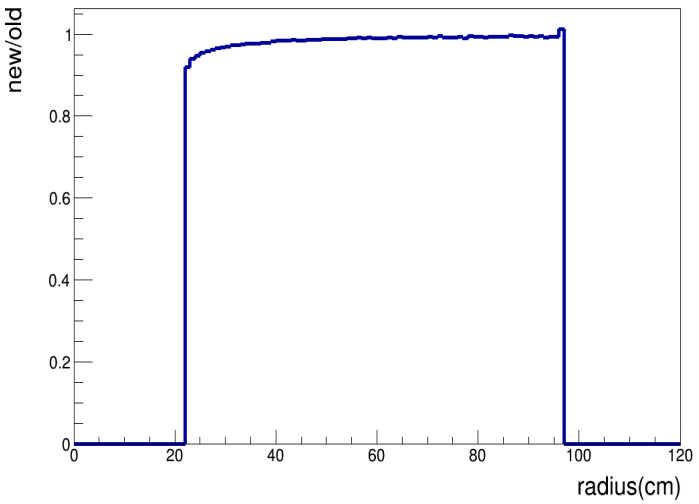


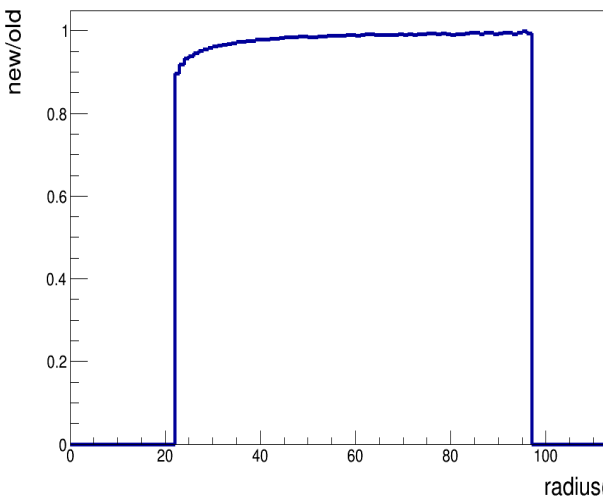
Point density (1st MUCH station)

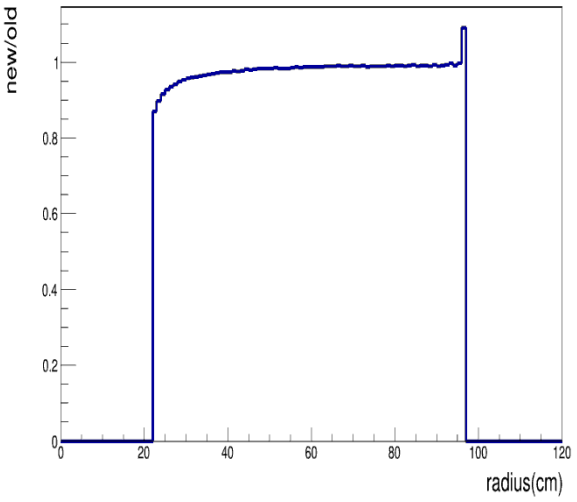




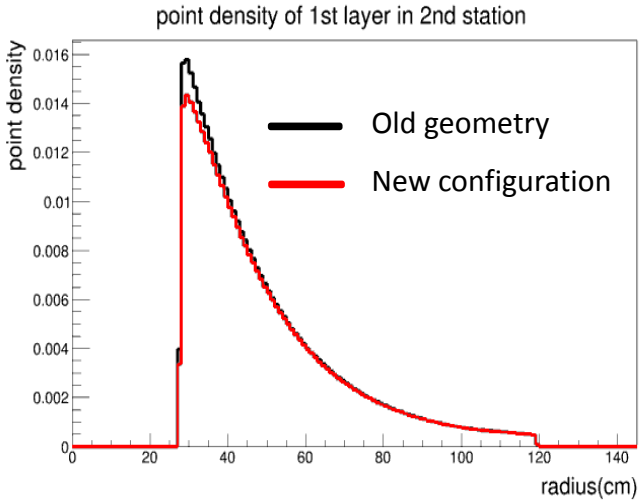


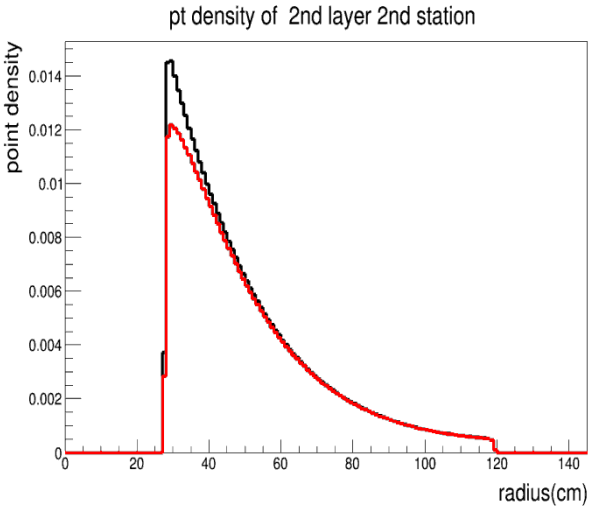


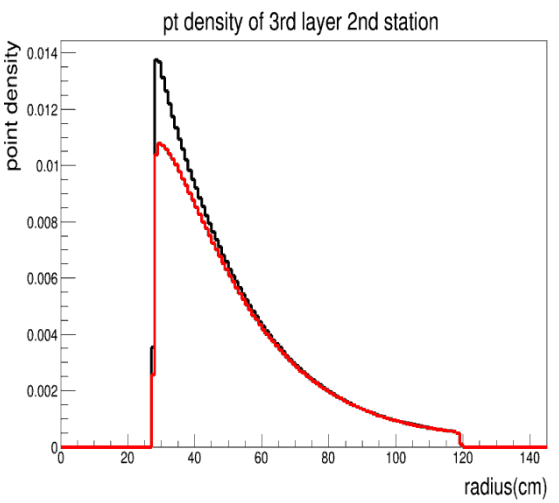


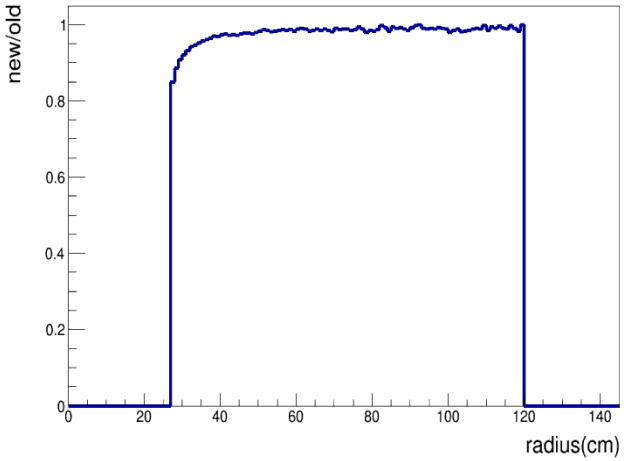


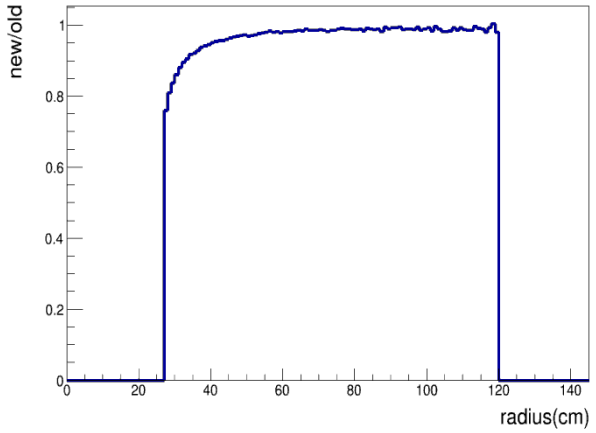
Point density (2nd MUCH station)

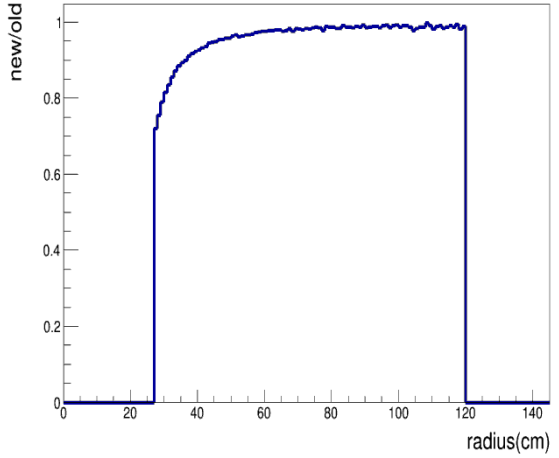




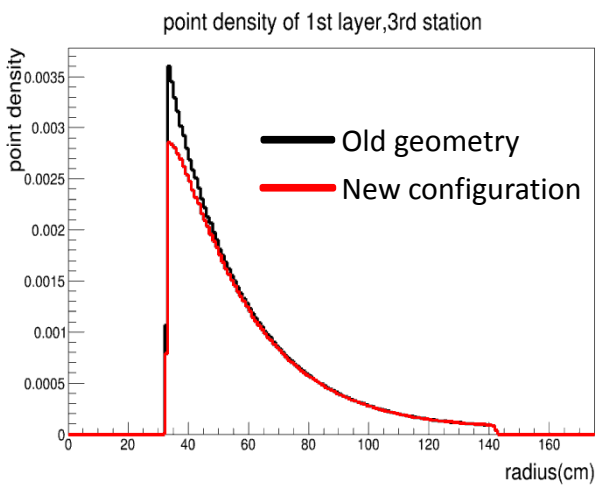


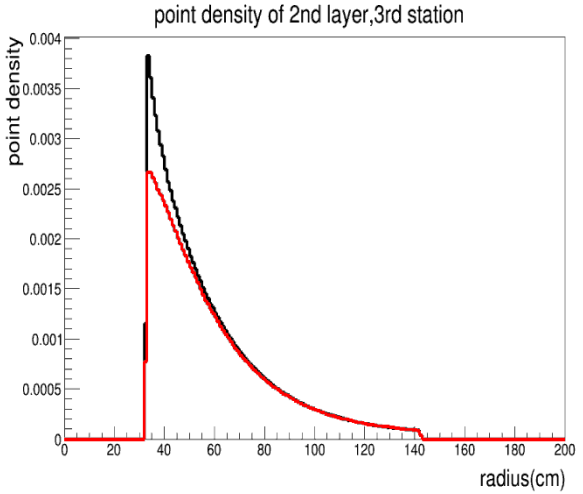


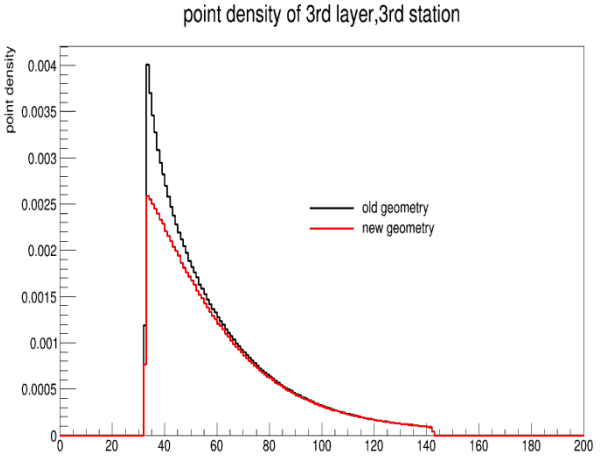


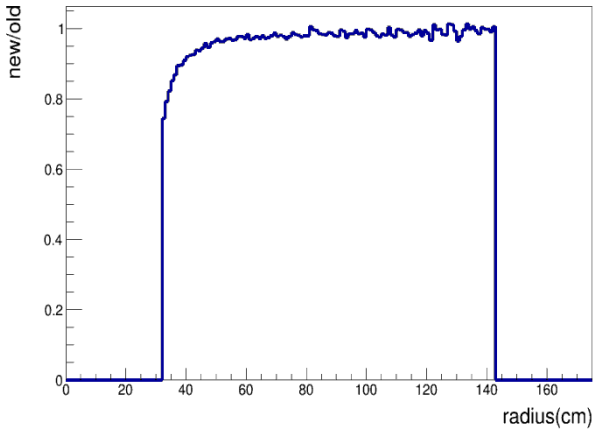


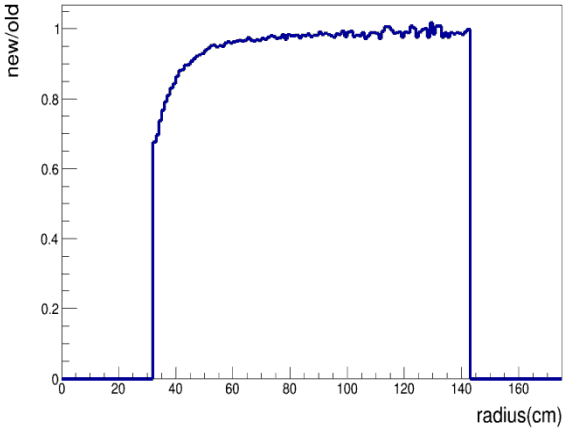
Point density(3rd MUCH station)

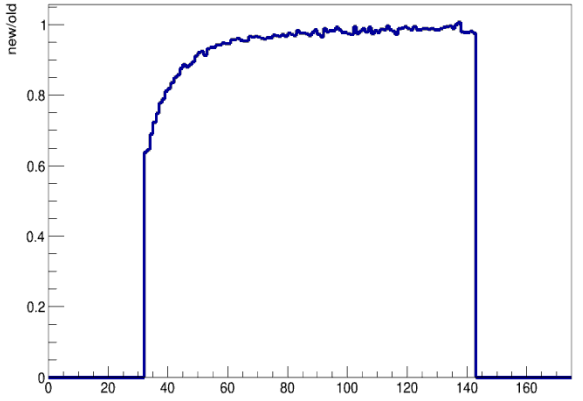




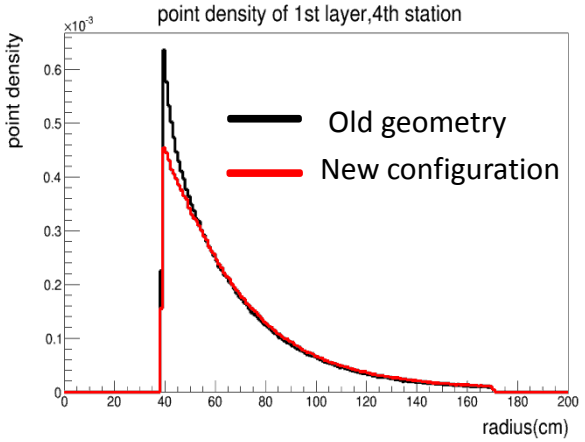


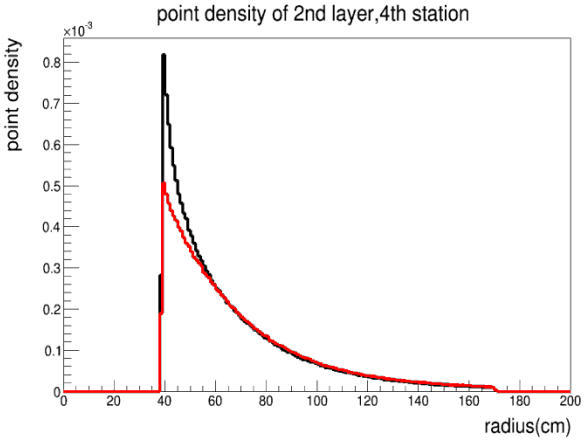


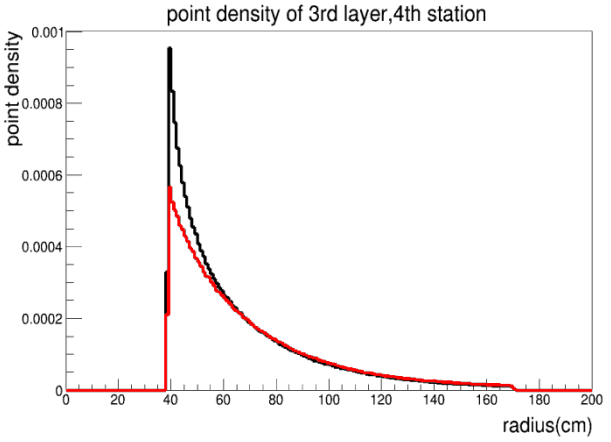


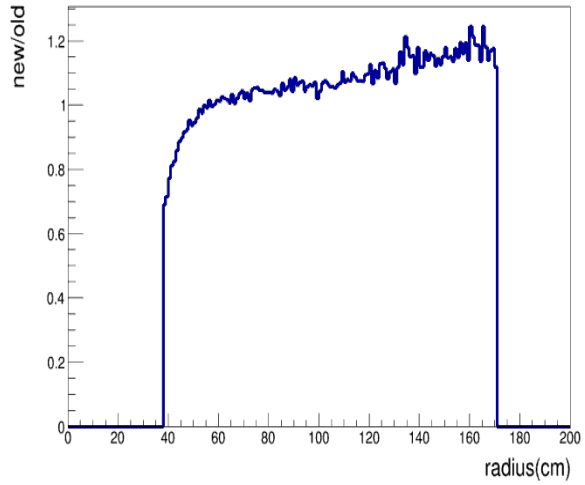


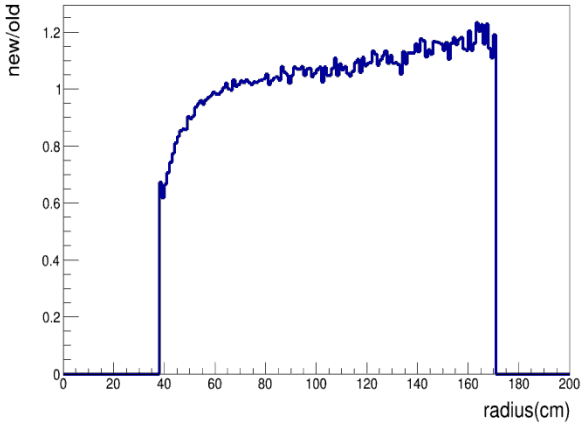
Point density (4th MUCH station)

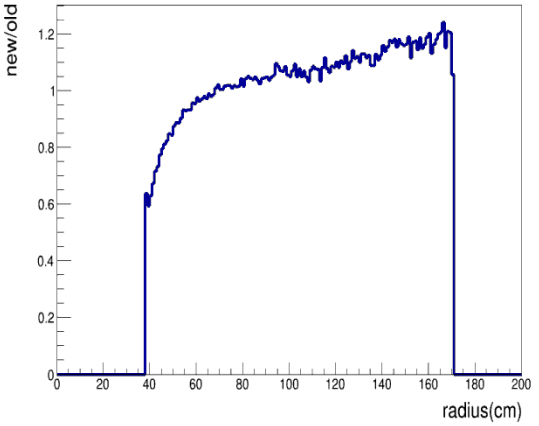












Summary

- There is almost no change in detection efficiencies of signals as well as no effect on background for two configurations (old and new).
- Point density for new configuration is less than old configuration which is expected as no gap is present in new configuration between beam pipe and Pb shielding and also between the shielding and absorber.
- MUCH shows good performance as far as cocktail (or low mass vector meson) detection is concerned at new configuration of SIS100 energies in our simulation studies.


Thank you!