VTX Track Resolution with Beam background Overlay

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Background events : types and timings

背景类型	时间参数	模式类型	物理意义
Pair(Pair production)	-2770	固定时间窗口	事件间隔 2770ns
BGB(Beam-Gas Bremsstrahlung)	4145.41	采样模式（速率）	每秒发生 4145.41 次（Hz）
BGC(Beam-Gas Coulomb)	87781.62	采样模式（速率）	每秒发生 87781.62 次（Hz）
BTH(Beam-Thermal Photon)	357.20	采样模式（速率）	每秒发生 357.20 次（Hz）
TSC(Touschek Scattering)	103.77	采样模式（速率）	每秒发生 103.77 次（Hz）

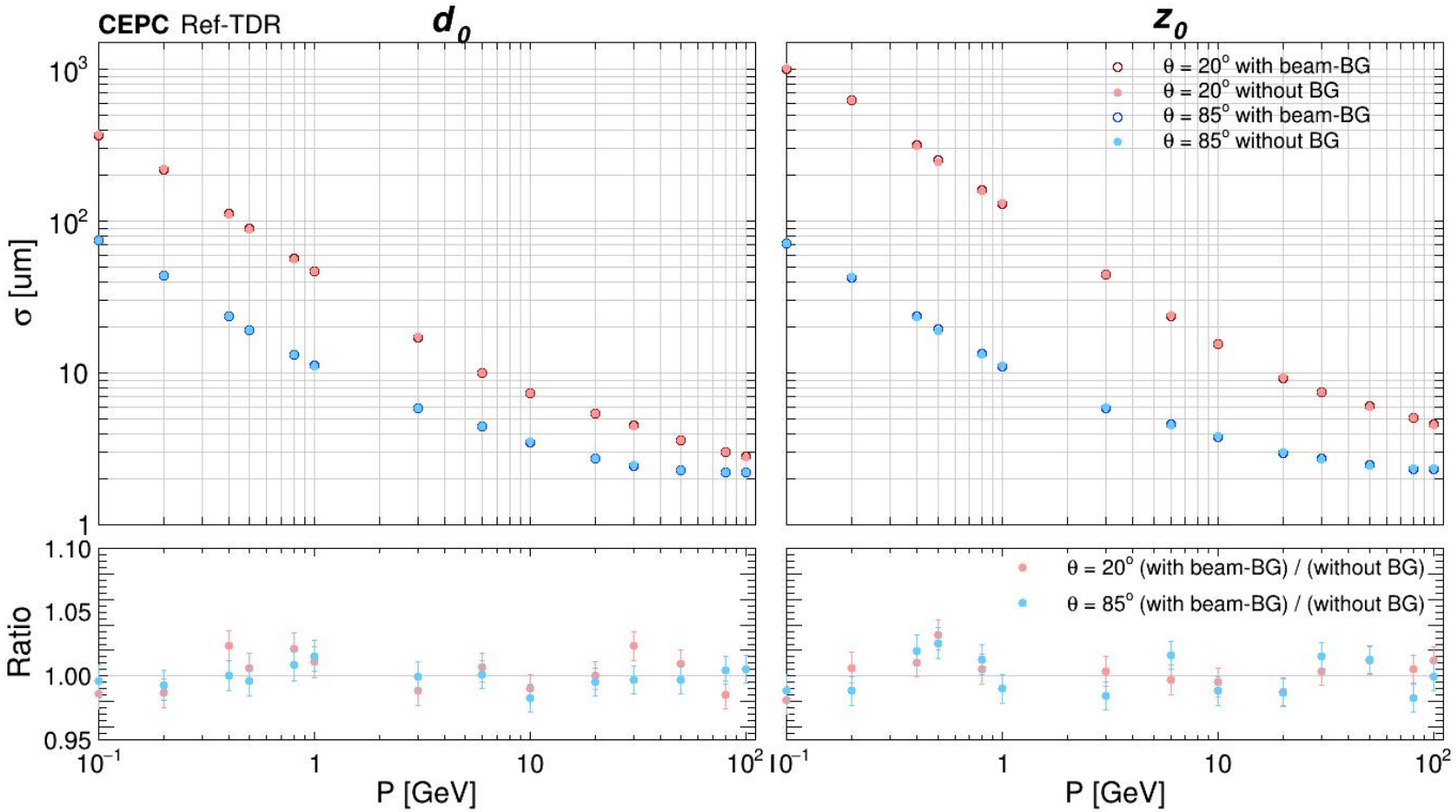
topdir : /cefs/higgs/shihy/tools/CEPCSW_TDR255/CEPCSW/Test/Higgs
version : 250515

- updated:/cefs/higgs/shihy/tools/CEPCSW_TDR258/CEPCSW/Test/Higgs/Pair_250823(cut不同)
- updated:/cefs/higgs/shihy/tools/CEPCSW_TDR258S/CEPCSW/Test/Higgs/Pair_250829

d_0 and z_0 Resolution : With vs. Without Background

- Key Metrics:
  - d_0 : Transverse impact parameter resolution.
  - z_0 : Longitudinal impact parameter resolution.
- Entries : 10000

tdr25.5 pair production:250515



- There is **no noticeable degradation** in the resolution of d_0 and z_0 at polar angles of 85° and 20° across the momentum range from 0.1 to 100 GeV.

Residual and sigma of z0 (100-200MeV)

Pair Production:0515

P/MeV	residual(μm)	error(μm)	sigma(μm)	error(μm)
100	250.1	10.1933	994.818	7.69868
110	123.615	9.81735	963.014	7.9189
120	67.0848	9.38635	920.904	7.68429
150	17.2101	7.96158	781.717	6.38922
170	14.8752	7.28191	710.832	5.88379
200	0.498564	6.36237	624.534	5.17185

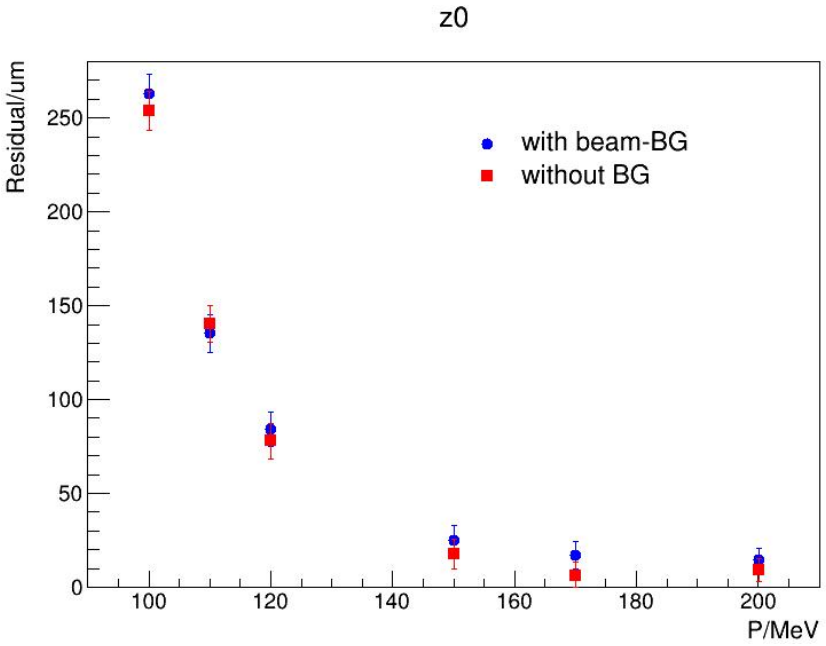
Pair Production:0823

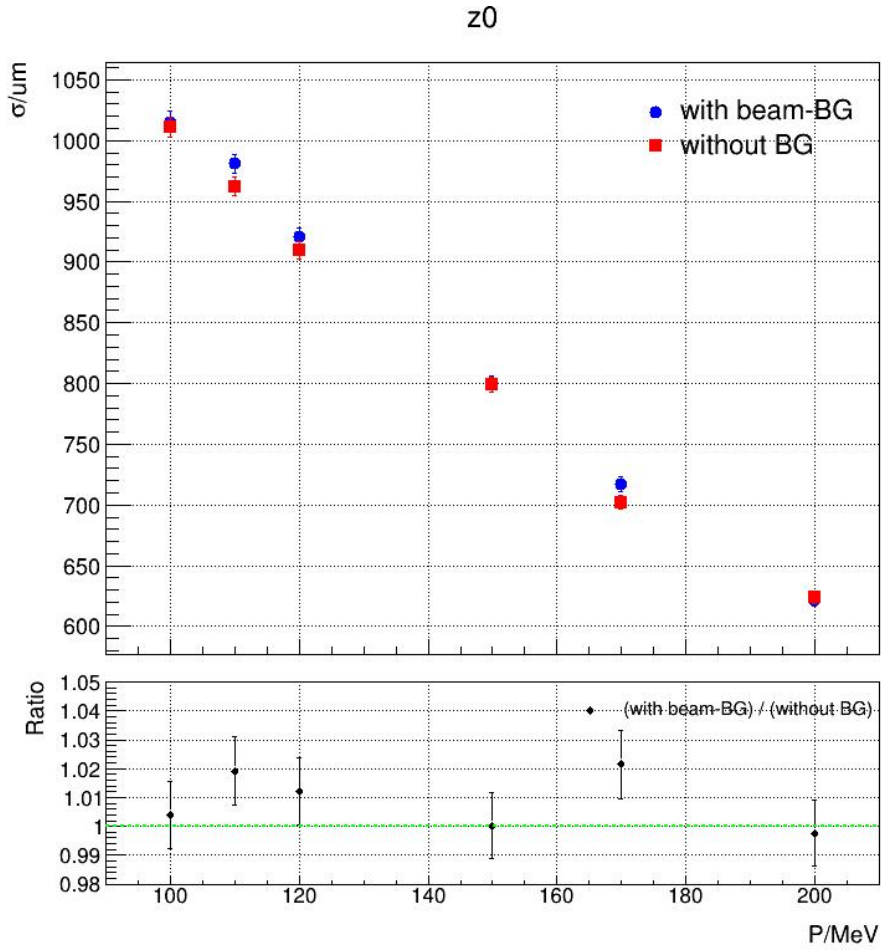
	θ=20°				θ=160°			
P/MeV	residual(μm)	error(μm)	sigma(μm)	error(μm)	residual(μm)	error(μm)	sigma(μm)	error(μm)
100	262.61	10.6498	1015.46	8.42591	-246.164	10.3266	1011.34	8.11497
110	135.195	10.0085	980.796	8.07265	-133.284	9.79003	962.32	8.07326
120	84.3152	9.3419	920.602	7.30881	-74.9706	9.28504	909.591	7.4908
150	24.9261	8.12948	799.22	6.53018	-31.7615	8.1727	798.989	6.33108
170	17.0865	7.28427	717.251	5.9301	-44.0336	7.15484	702.159	5.5975
200	14.479	6.36759	622.221	5.15145	-20.4603	6.33632	623.663	4.93058

No background

	θ=20°				θ=160°			
P/MeV	residual(μm)	error(μm)	sigma(μm)	error(μm)	residual(μm)	error(μm)	sigma(μm)	error(μm)
100	253.852	10.4011	1015.37	8.01231	-271.181	10.1747	999.505	7.97047
110	140.499	9.80041	961.078	7.81041	-145.672	9.84936	969.353	7.89635
120	77.87	9.5101	933.602	7.63063	-74.9586	9.4607	928.584	7.67269
150	17.9085	7.95925	782.192	6.34349	-35.5974	8.1491	801.495	6.79528
170	6.28874	7.31143	718.253	5.79888	-4.8261	7.20792	707.321	5.91877
200	9.2829	6.3058	623.39	5.15279	-3.40903	6.24324	616.405	5.05256

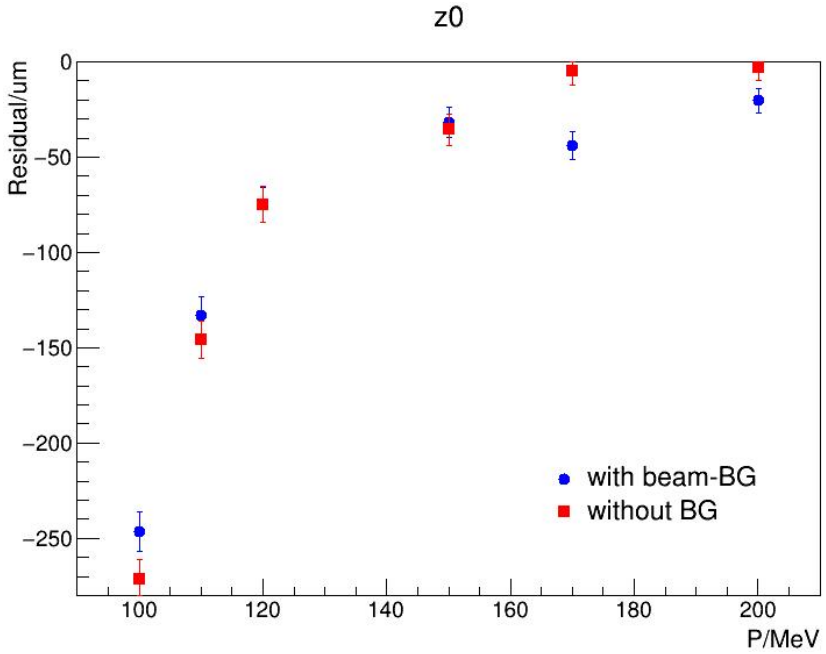
Residual and sigma of z0 at 20°（100-200MeV)

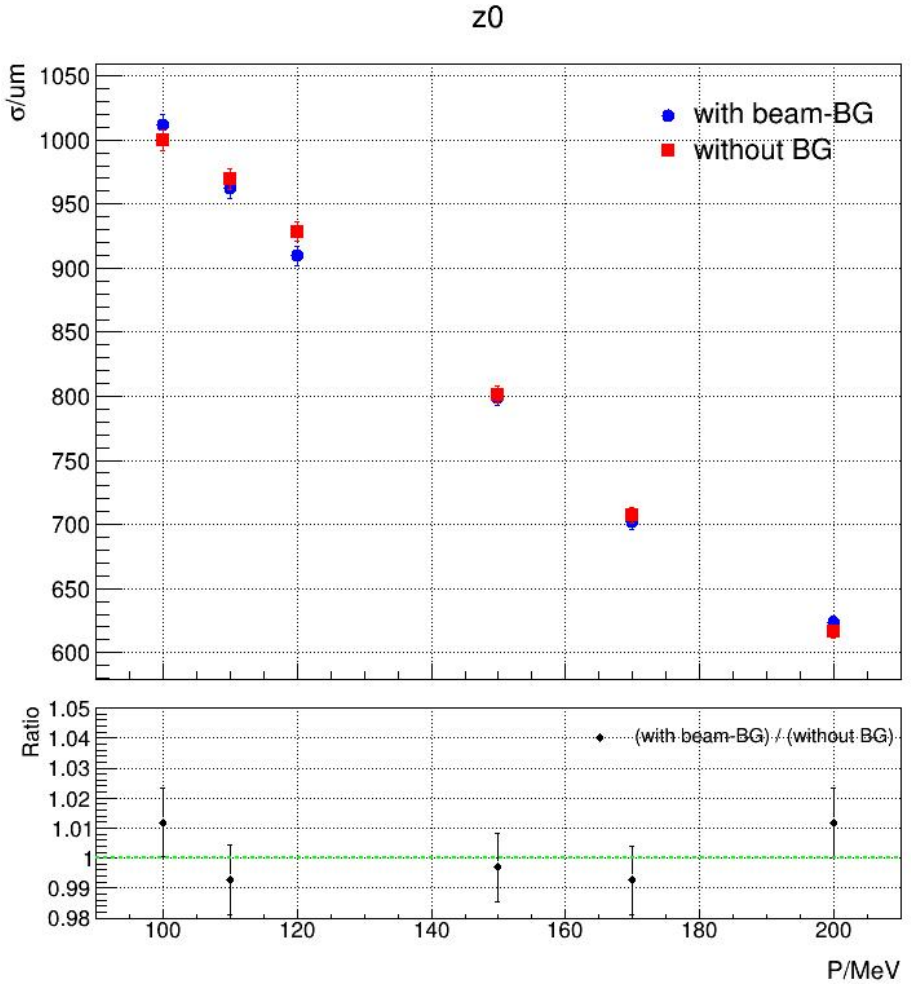




- Residuals are significantly larger in the 100-120 MeV region.
- In the 100 - 120 MeV region of the sigma, the difference is relatively obvious.

Residual and sigma of z0 at 160°（100-200MeV)

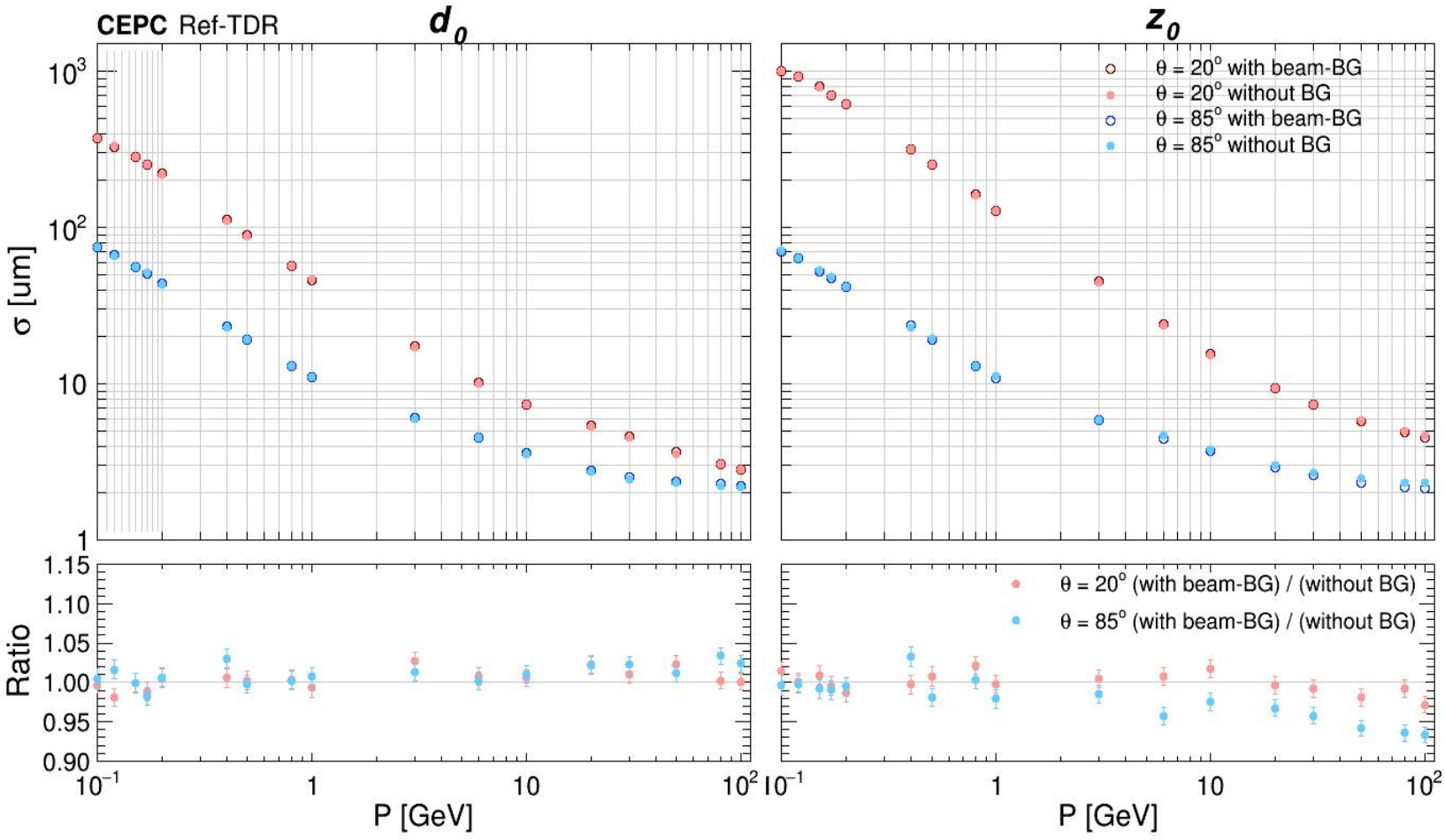




Beam background has a significant impact on the low-momentum region.

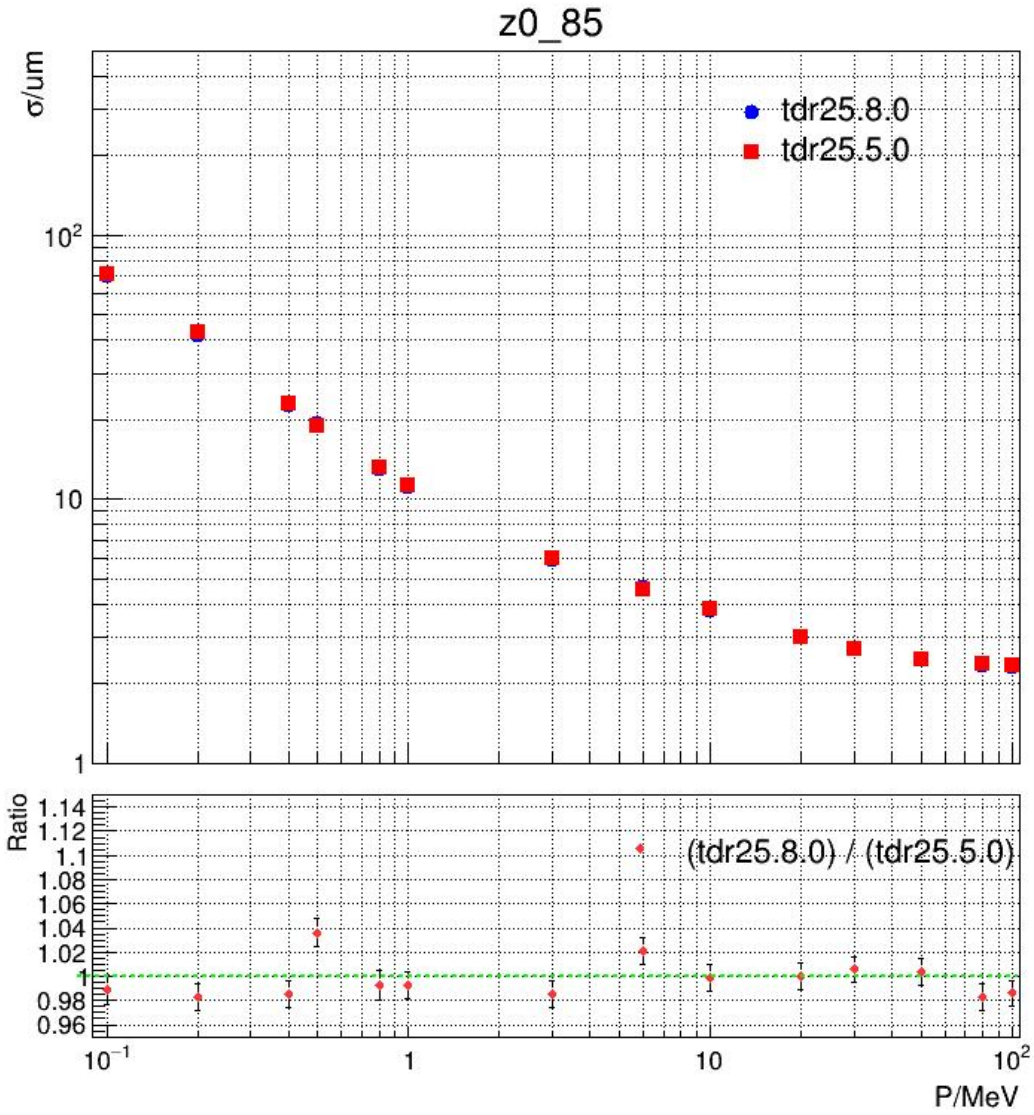
d_0 and z_0 Resolution : With vs. Without Background

tdr25.8 pair production:250829



- Above 3 GeV, under the condition of mixed beam background, the resolution of z_0 deteriorates, with a maximum degradation of approximately 7% at 85° .

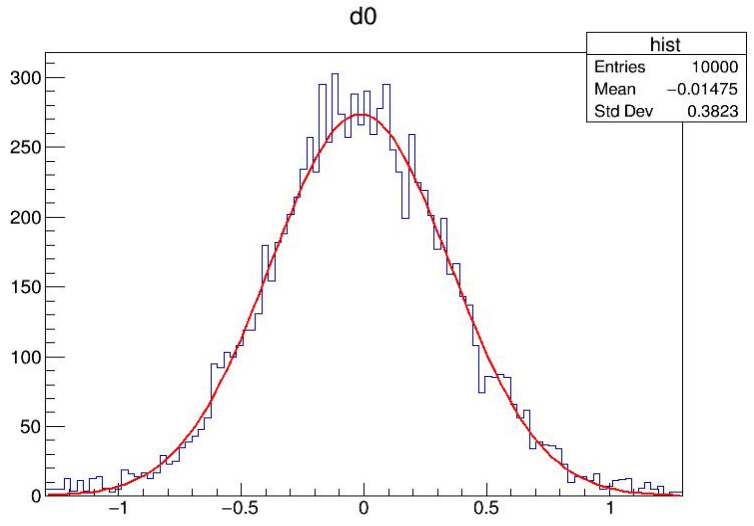
TDR25.8 vs TDR25.5(without BG)

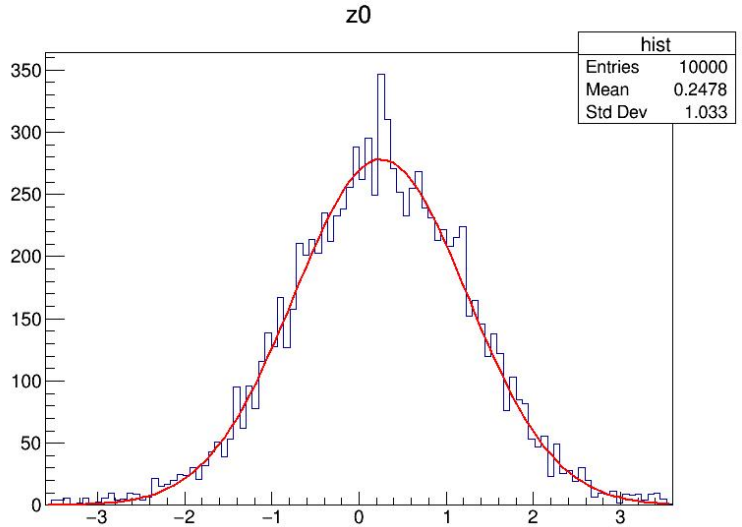


- There is no significant difference within the acceptable error range.

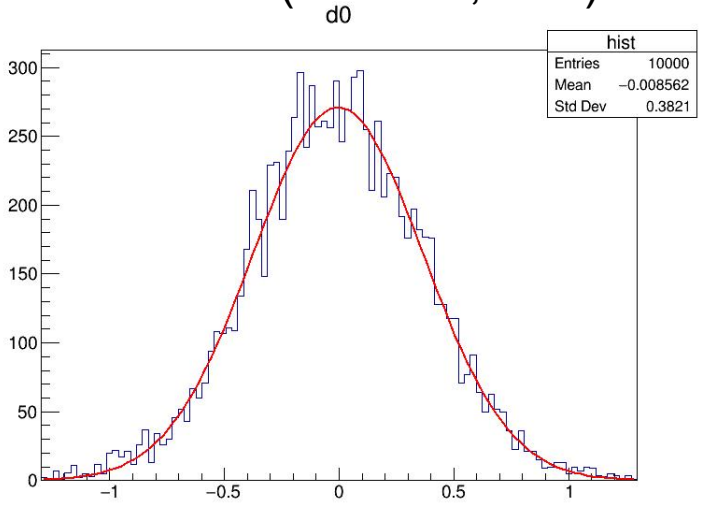
Backup

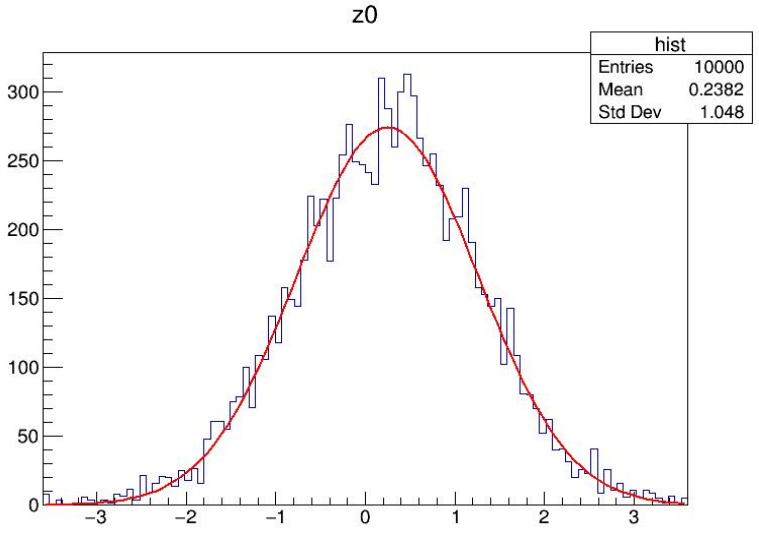
with beam-BG (Pair :250515)(100MeV,20°)





without BG (100MeV,20°)

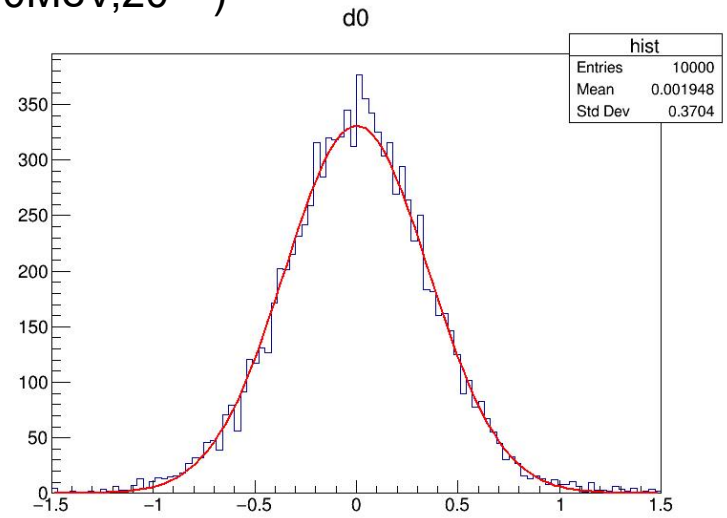


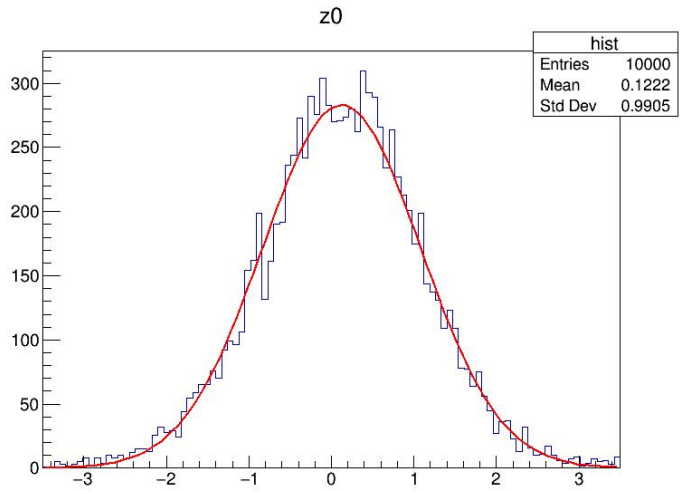


Backup

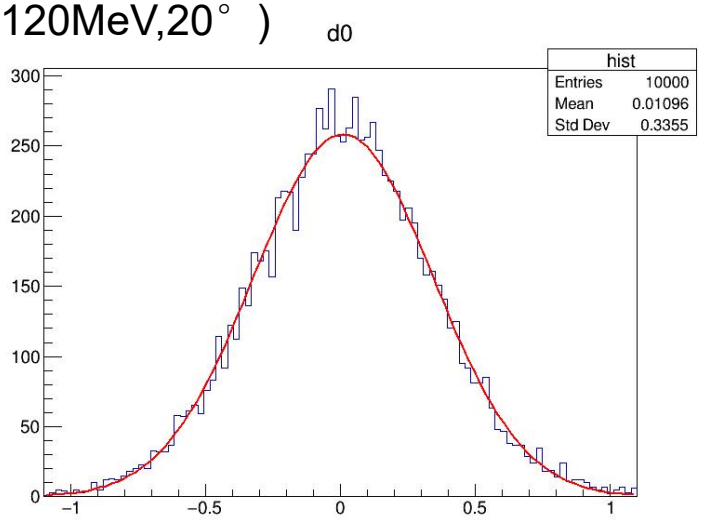
with beam-BG (Pair :250515)

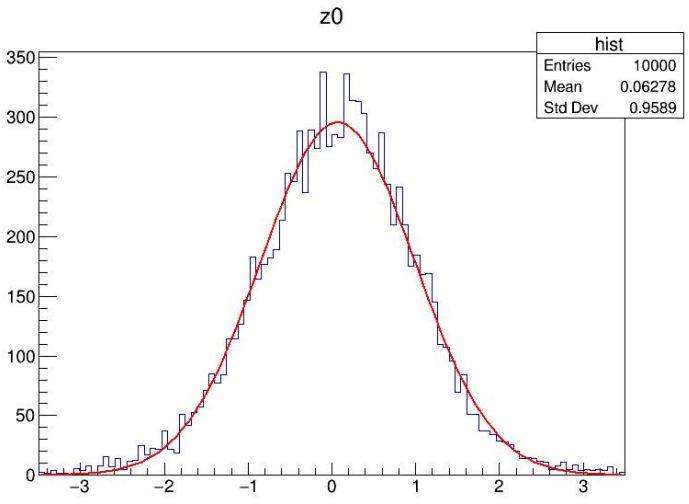
(110MeV,20°)





(120MeV,20°)

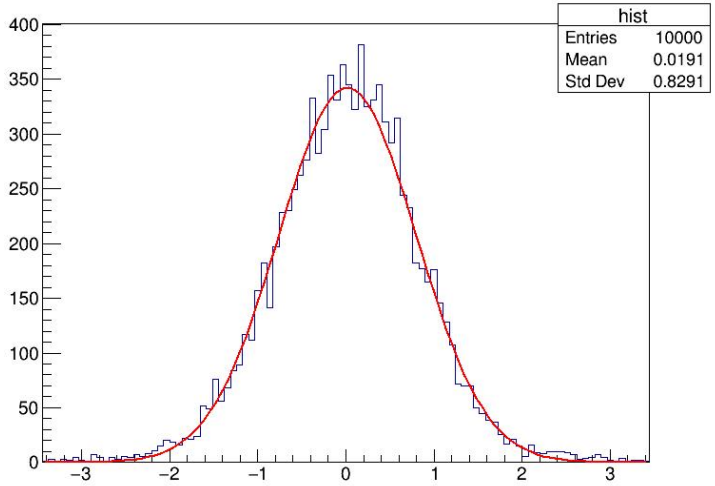




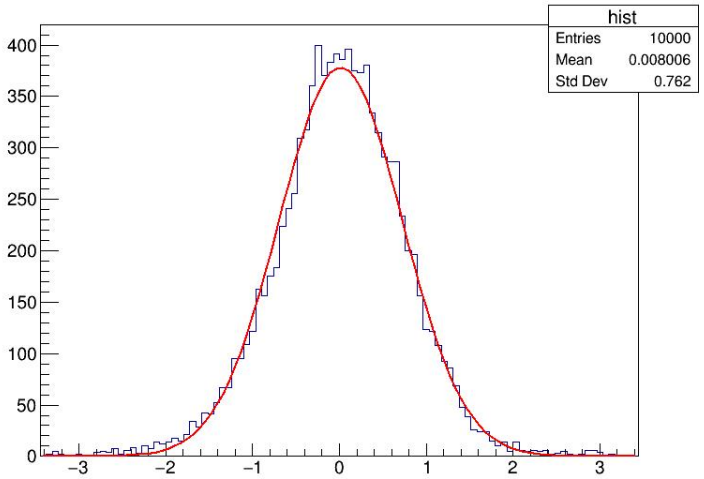
Backup

with beam-BG (Pair :250515)

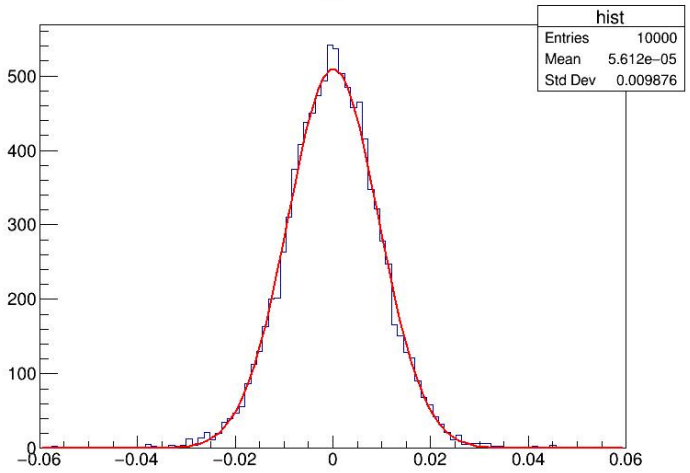
(150MeV,20°) z0



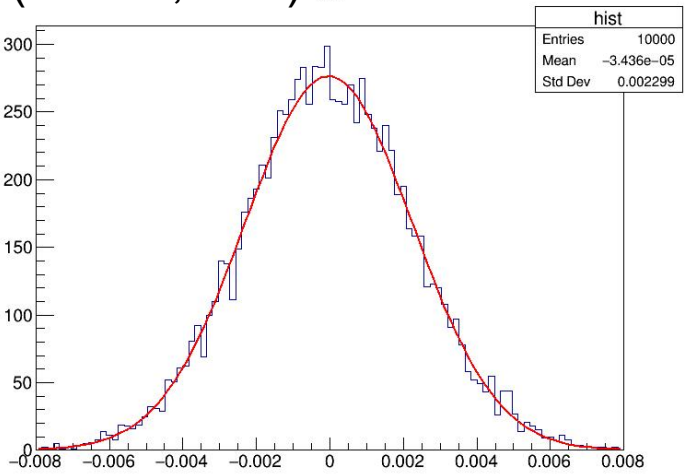
(170MeV,20°) z0



(20GeV,20°) z0

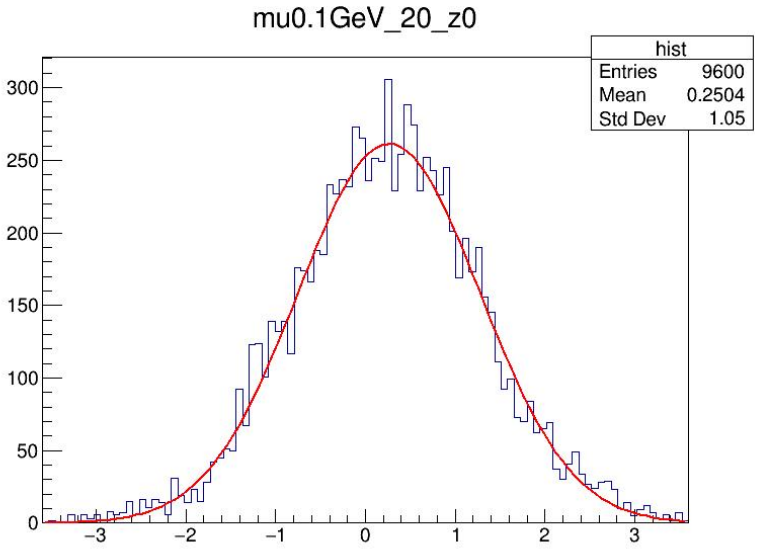


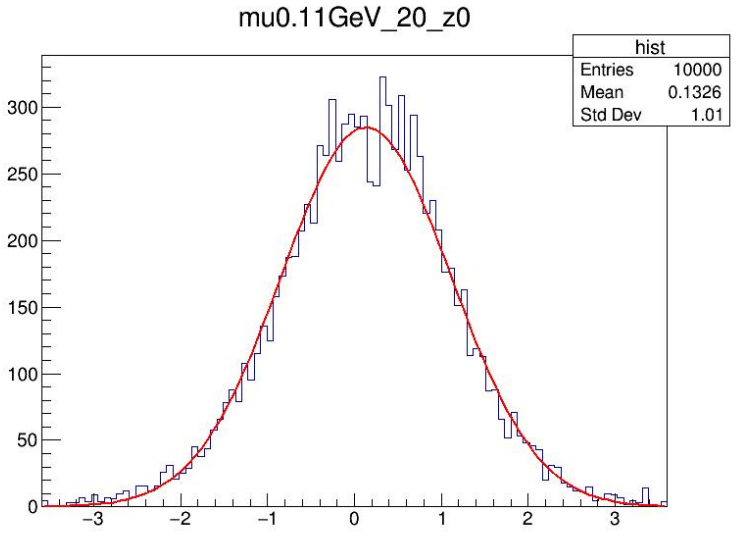
(50GeV,85°) d0

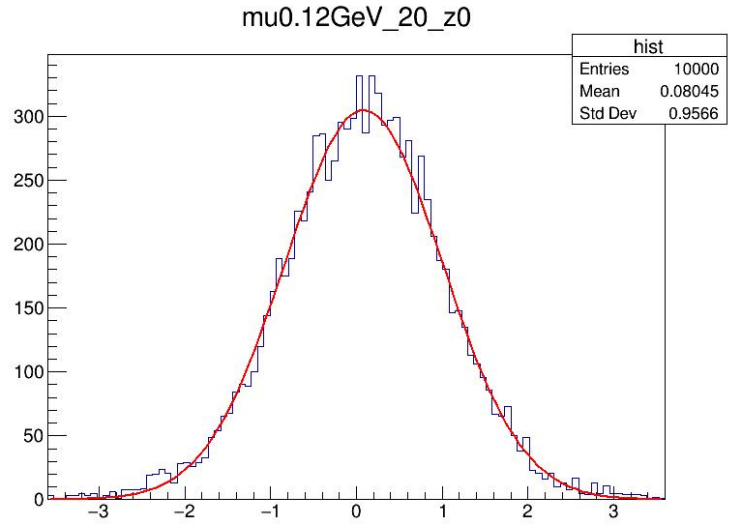


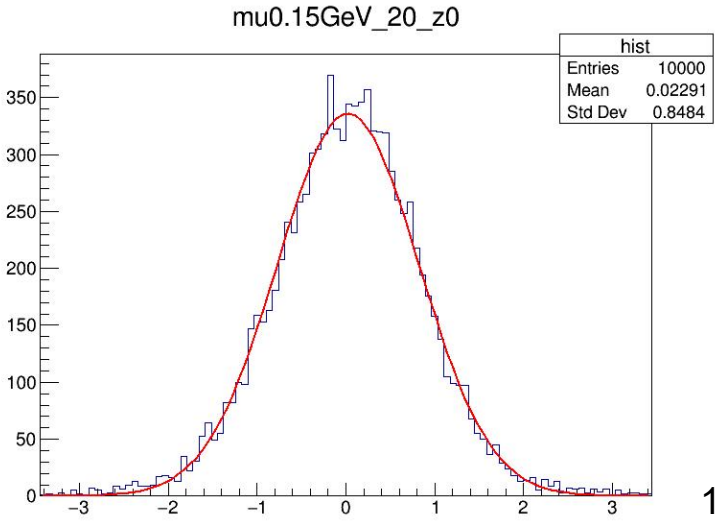
Backup

- with beam-BG (Pair:250823)



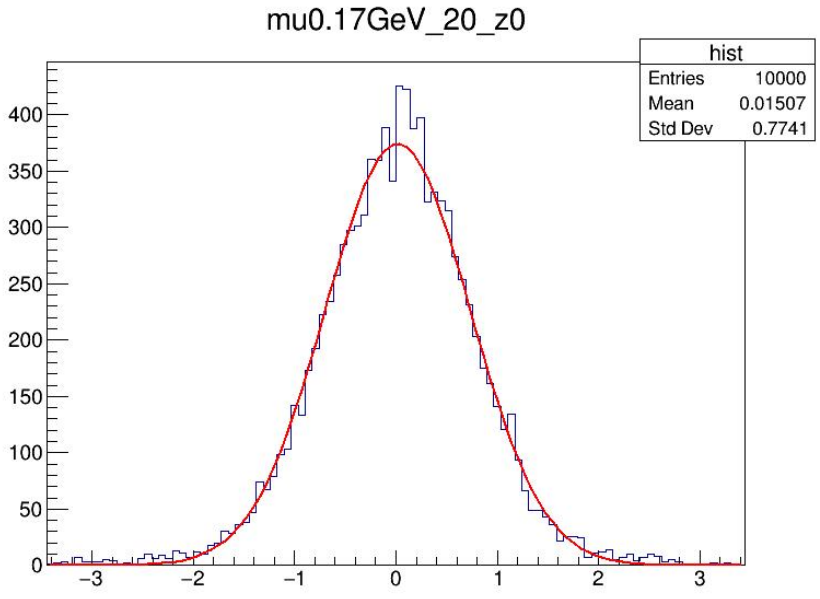


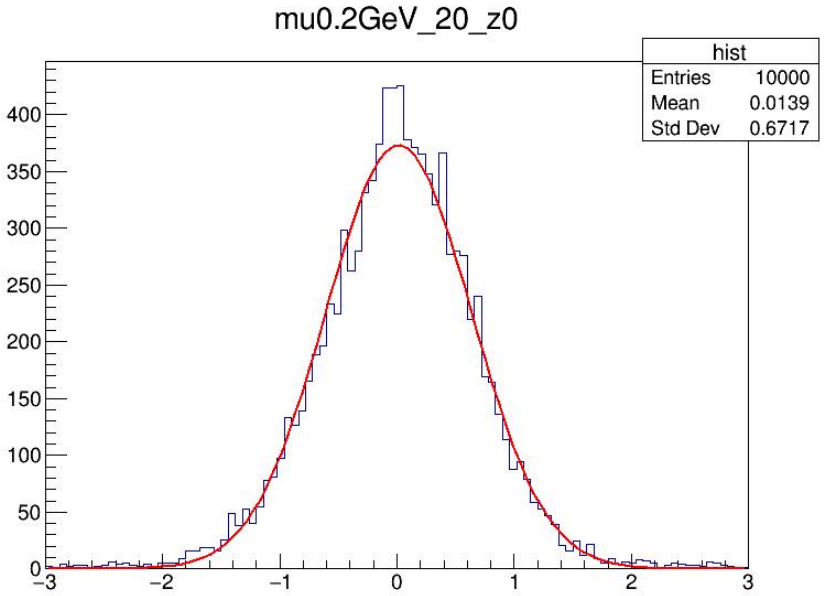




Backup

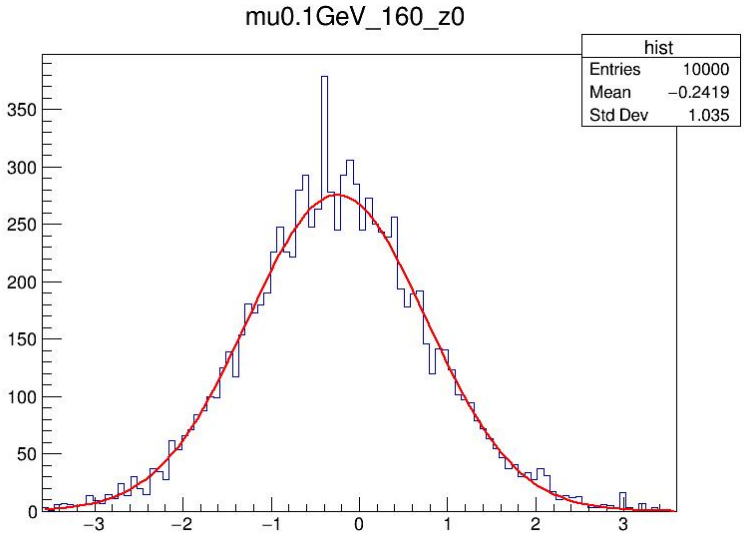
- with beam-BG (Pair :250823)

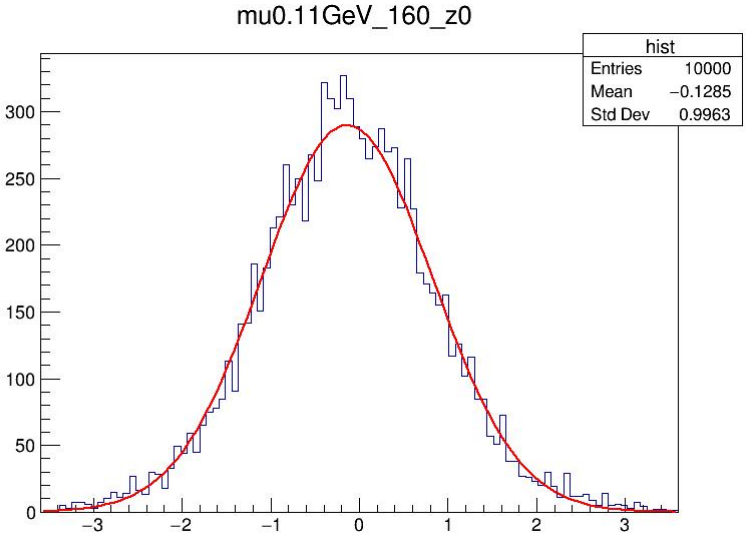


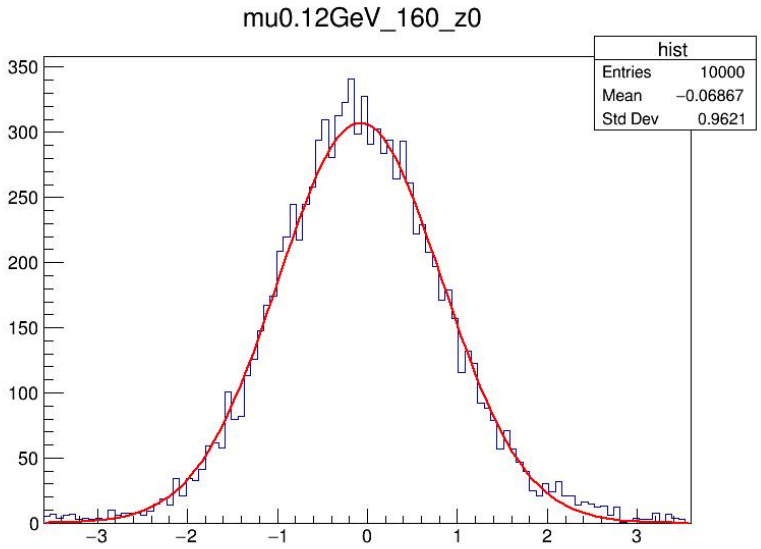


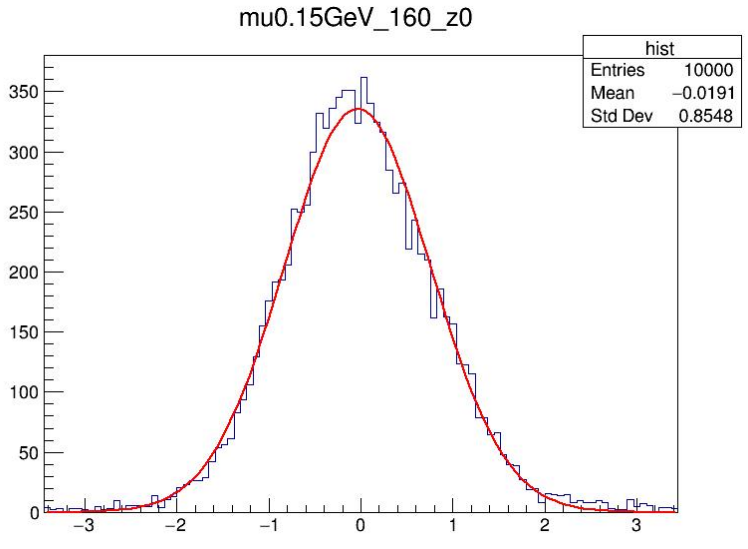
Backup

- with beam-BG (Pair:250823)









Backup

- with beam-BG (Pair :250829)