ECAL Saturation Studies

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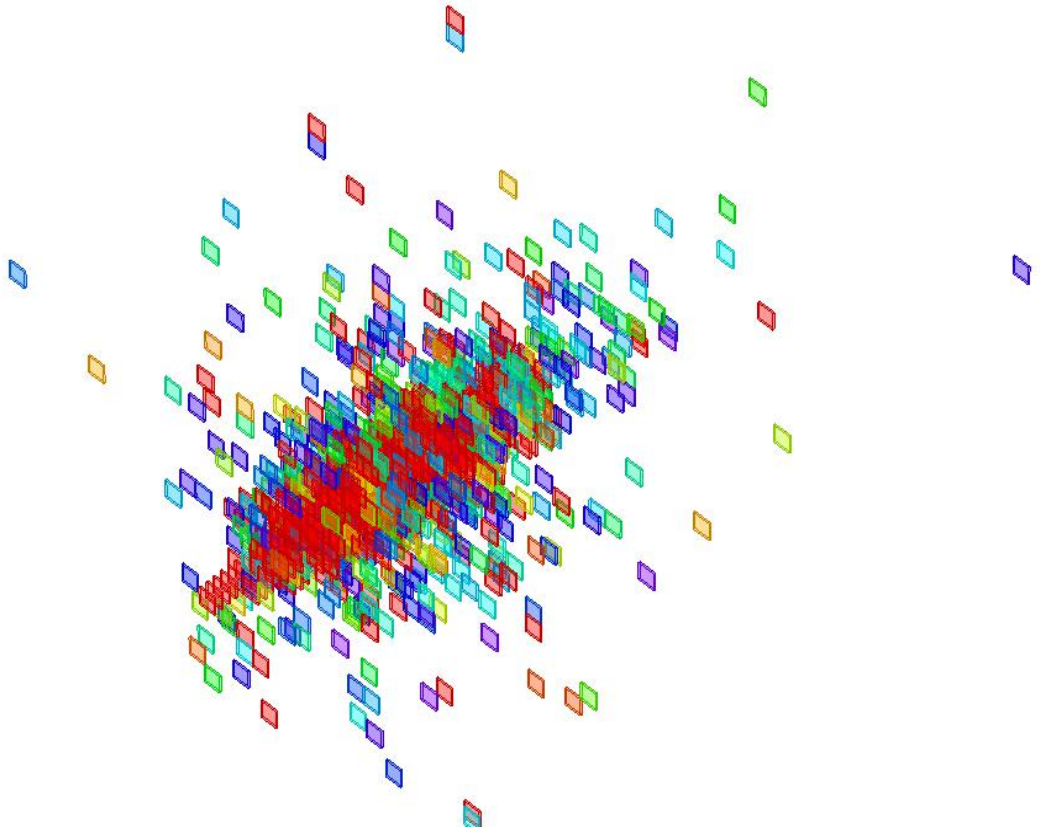
内容

- Hit level 下saturation对能量测量的影响

- Cluster level 下saturation对higgs InvMass的影响

粒子击中量能器产生的一个事例



Geometry

ILD_o2_V05
Radius = 3000 mm
HalfZ = 8000 mm
NLayer = 240
CellSize = 10 mm
Si： 0.5 mm
W： 1.4mm

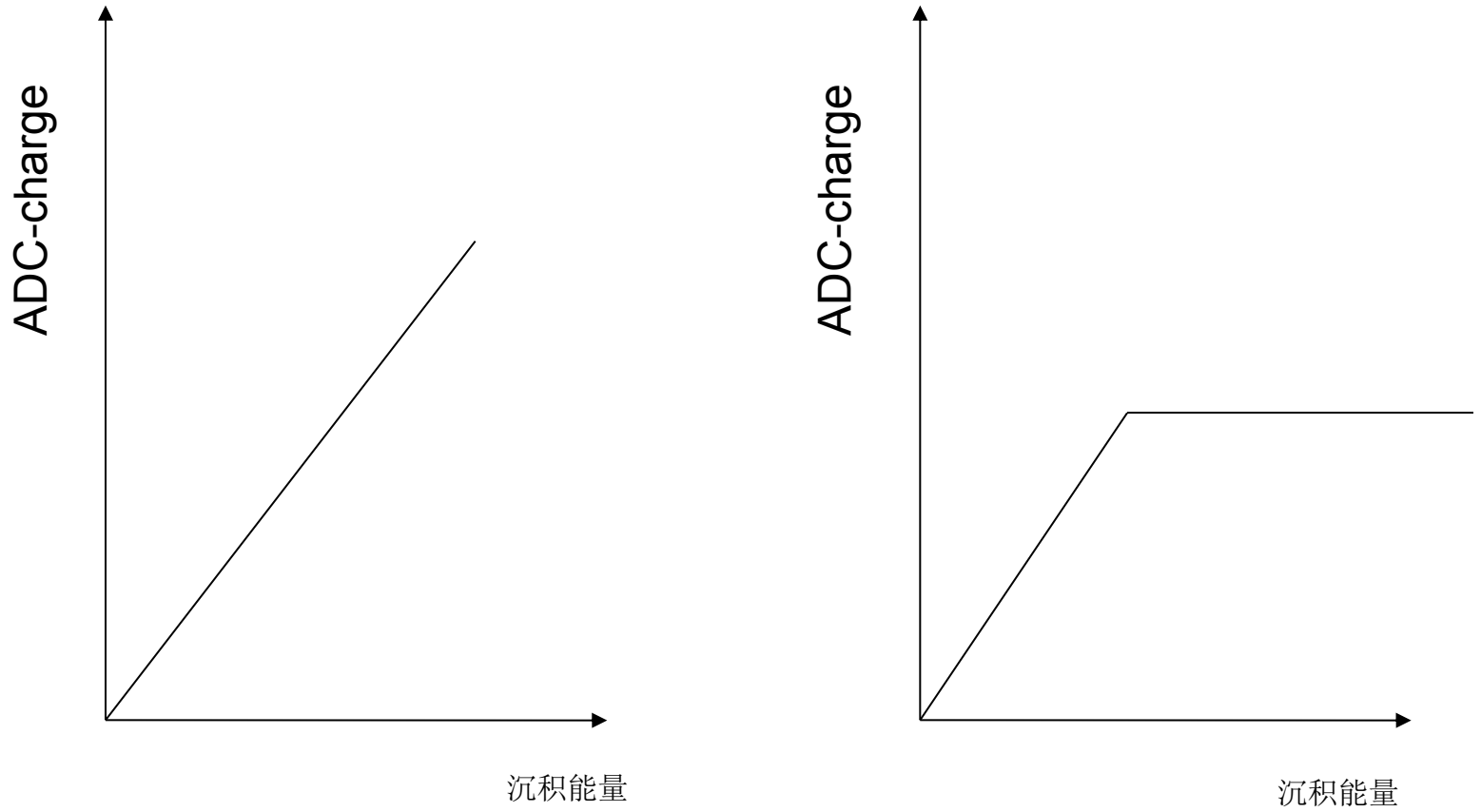
Sample

50GeV Photon

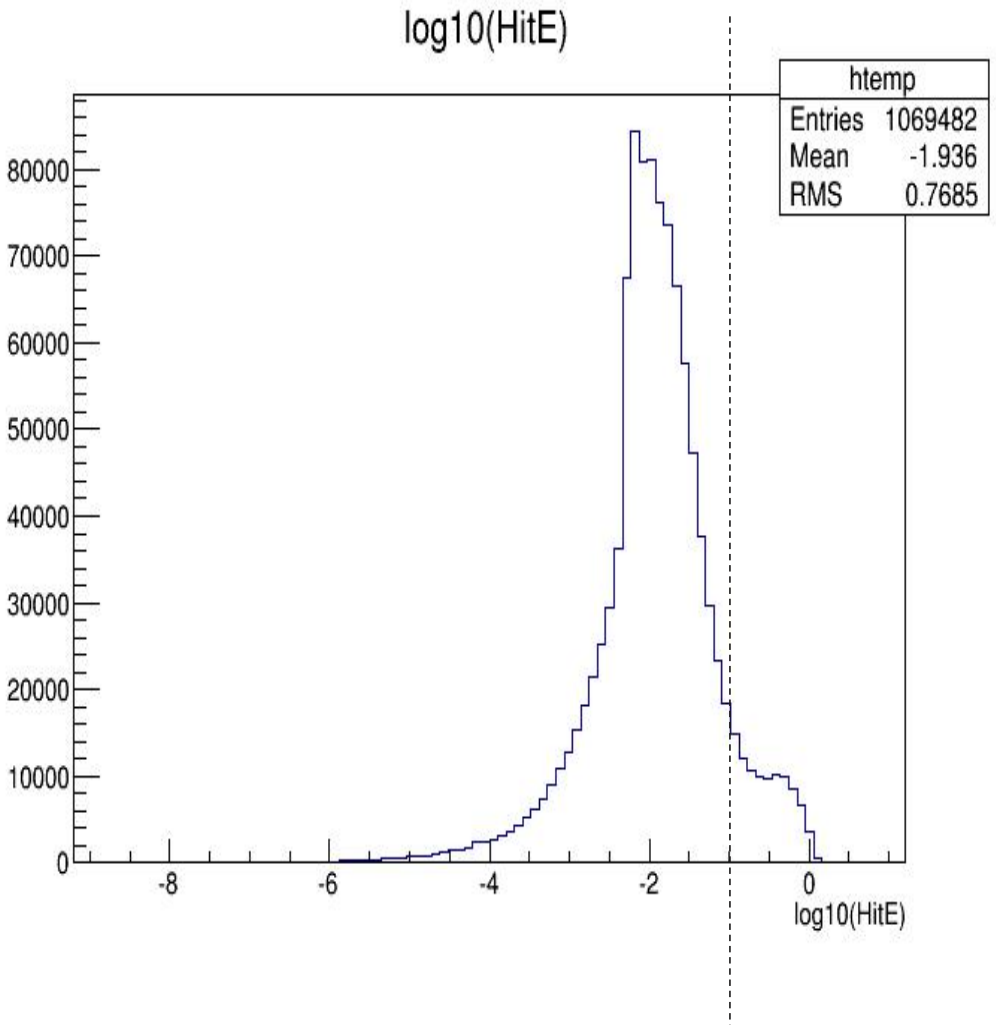
saturation：

出于对硬件制造和成本的考虑，对Hit能量读出设立一个上限，使其对物理测量的影响在可接受的情况下尽可能得小

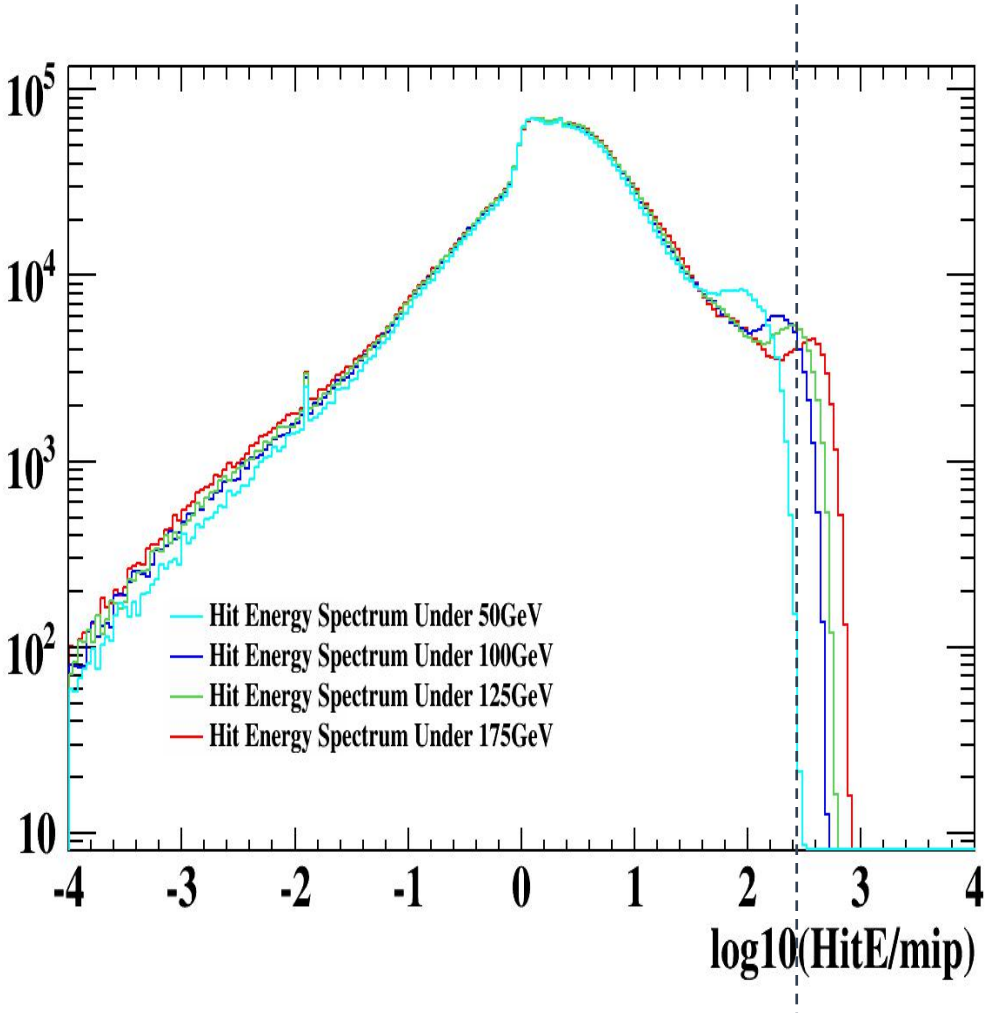
通过对Hit的读出能量添加阈值条件（将大于阈值的Hit能量设为阈值）来作为Hit点的能量输入

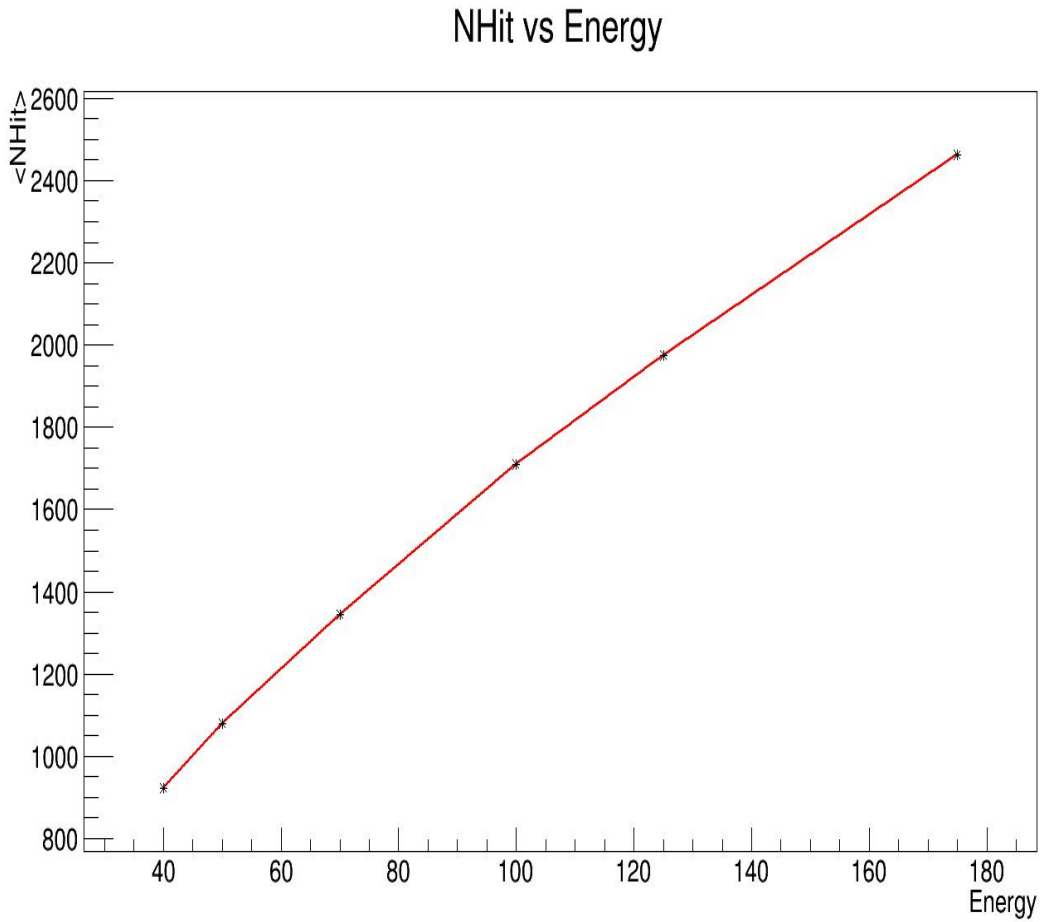


Hit的能谱图



不同入射能量下的Hit能谱图

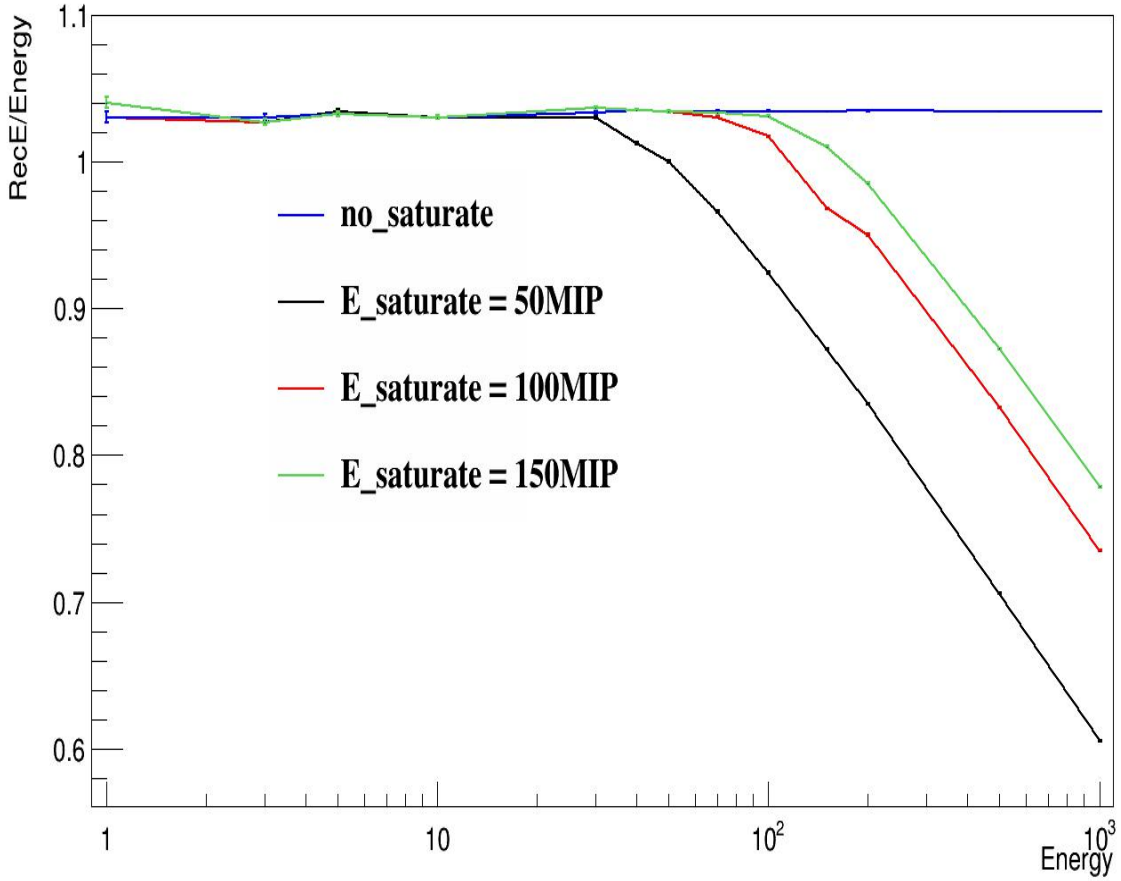


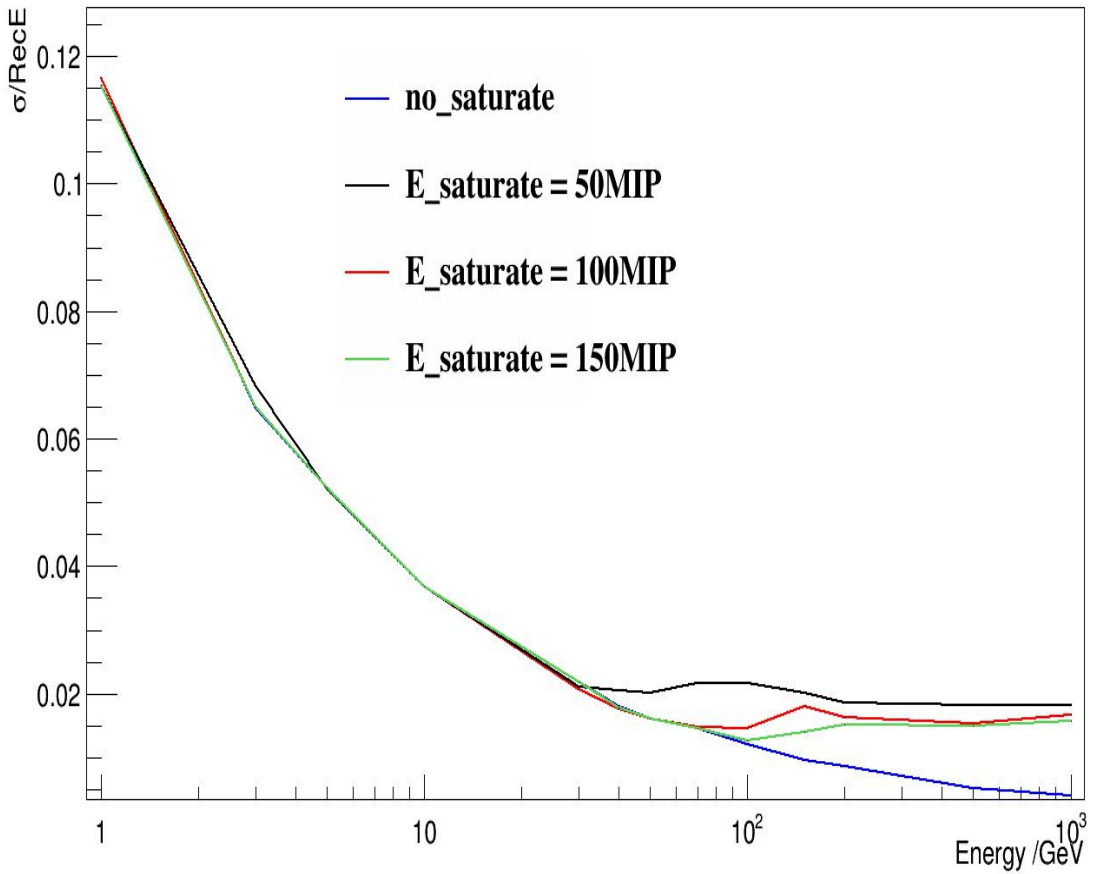


不同能量下单光子所产生的
(平均)Hit数目

Saturation

- 模拟数字饱和，观察重建能量的线性性和分辨率

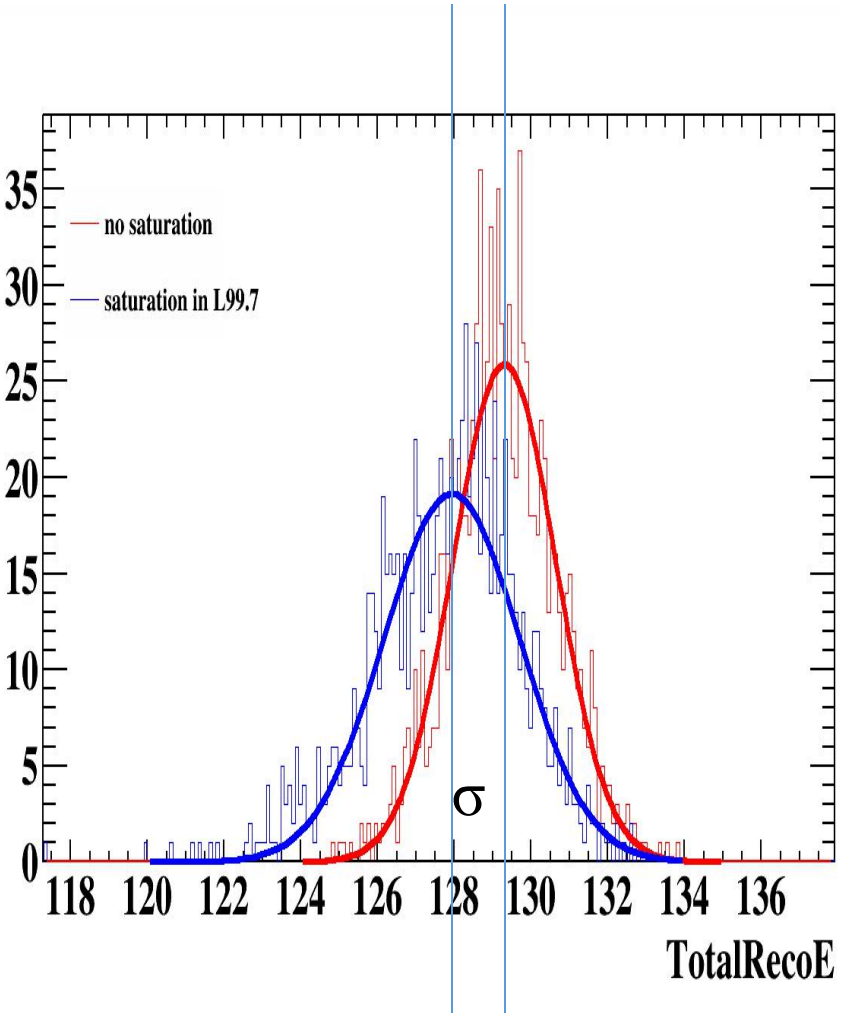




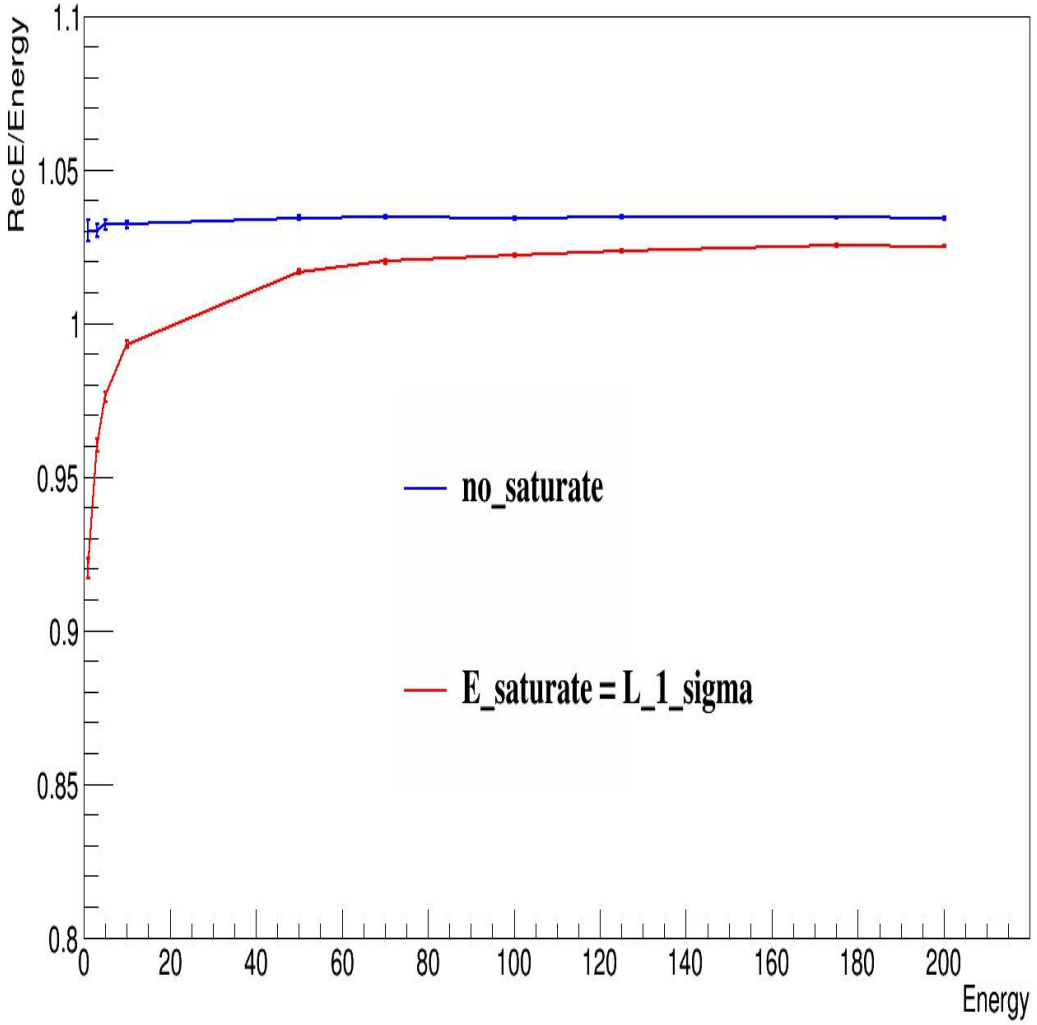
重建能量

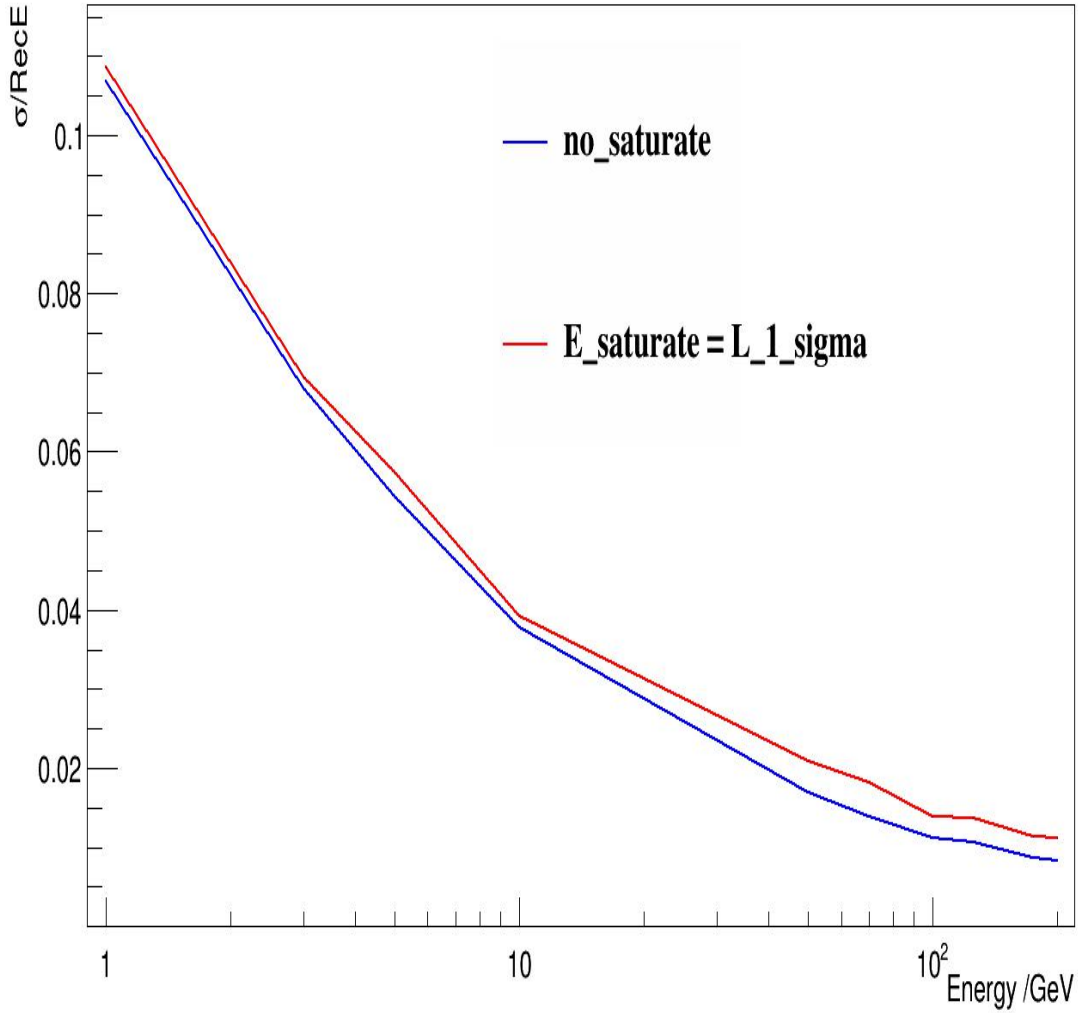
重建能量 & saturation后的重建能量

选取一个特定的阈值L_1σ：重建后的能量与saturation之前的峰位相差一个σ，使得saturation造成的影响较小



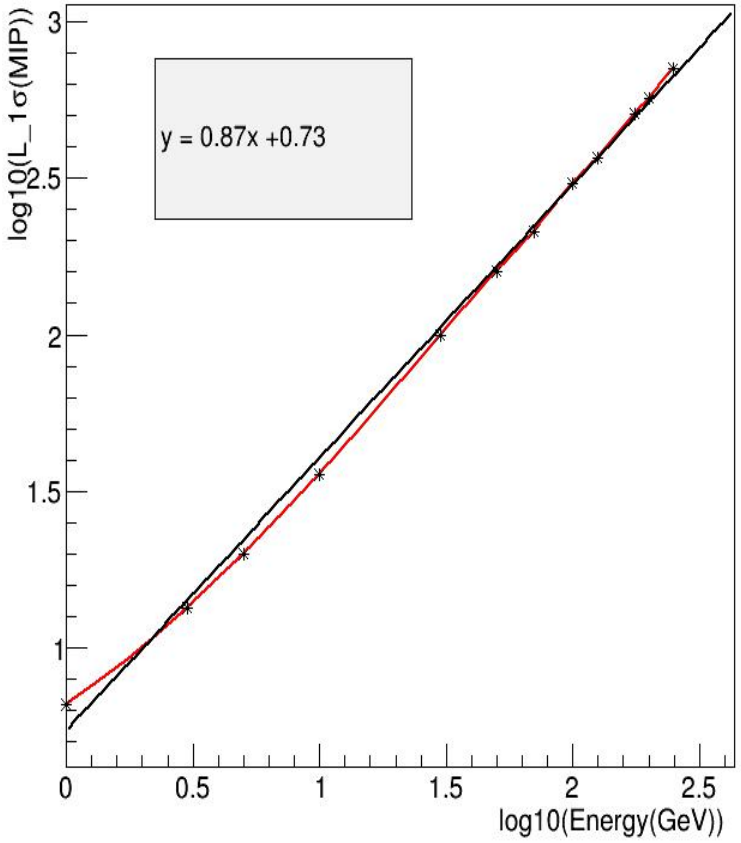
L_1σ下的重建能量线性性和分辨率



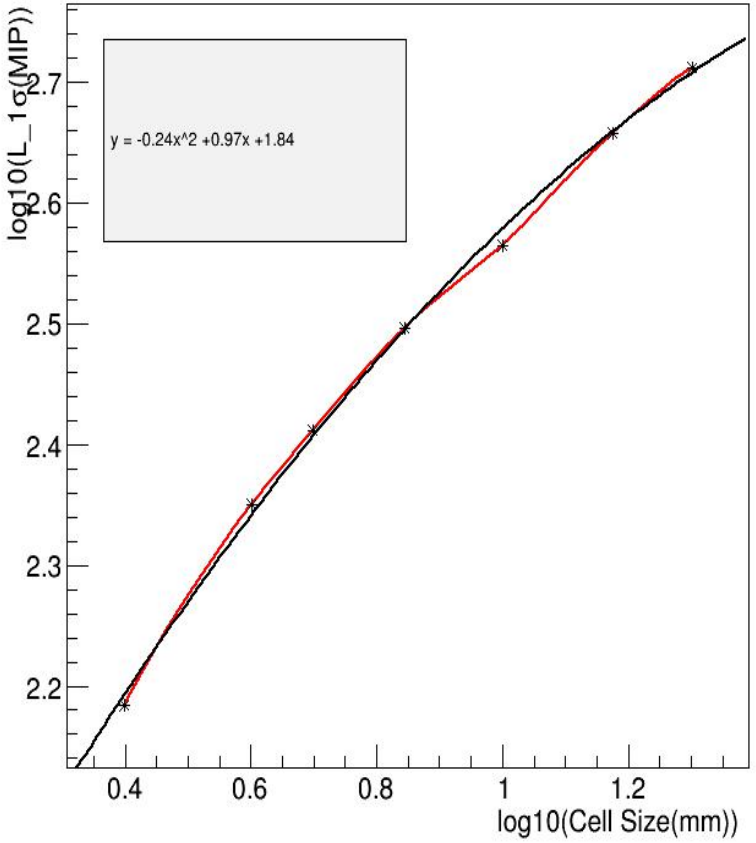


Parameterization

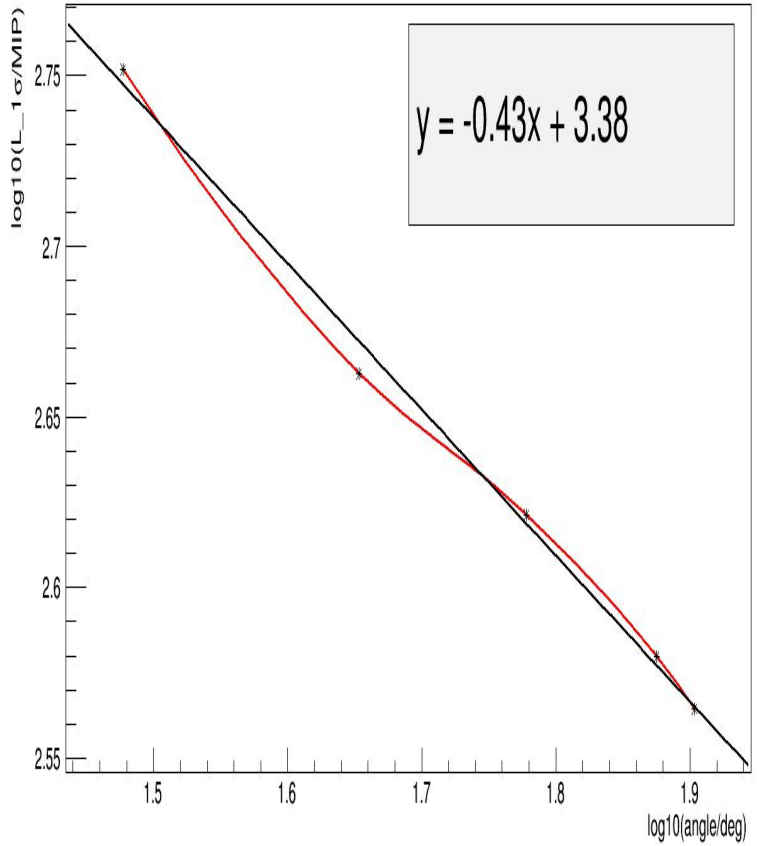
L_1_sigma vs Energy



L_1_sigma vs Cell Size



L_1_sigma vs Angle

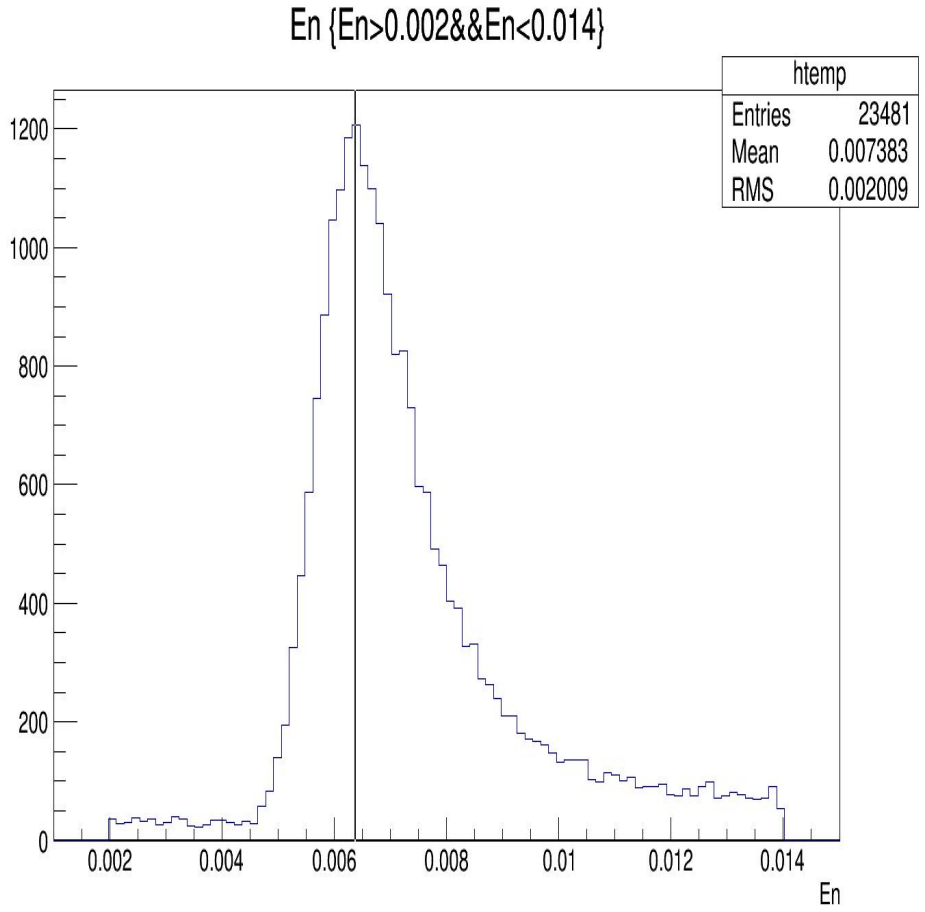


L_1_sigma = 0.87x - 0.24y^2 + 0.97y - 0.43z + 0.82 x = log(Energy) y = log(Size) z = log10(Angle)

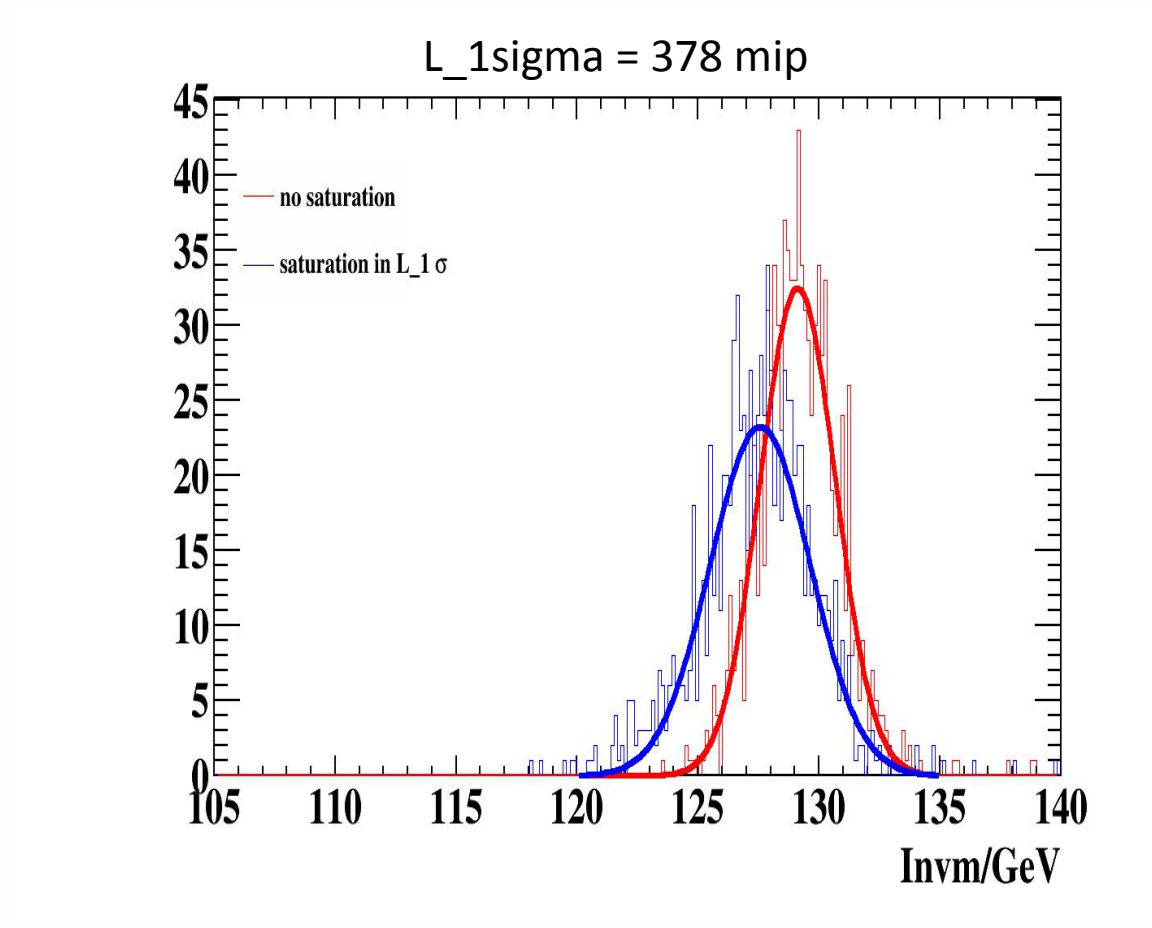
cluster level

- 在cluster level 下，研究saturation的影响，观察重建的higgs不变质量的变化。（ee—>γ γ μ μ）以及，在添加本底后，观察信号的测量精度的变化。

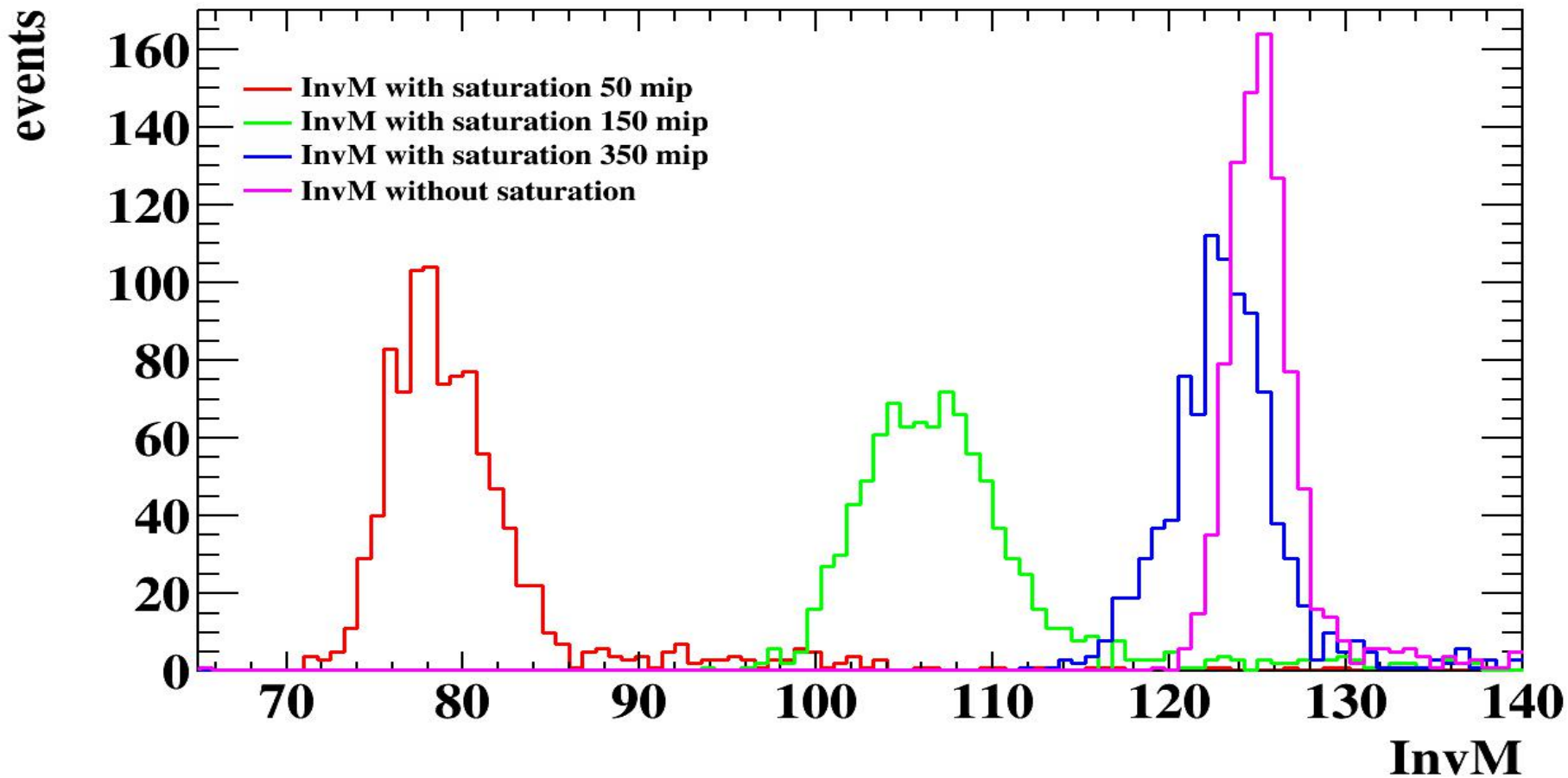
muon事例的Hit能谱图　　1mip = 0.0063GeV



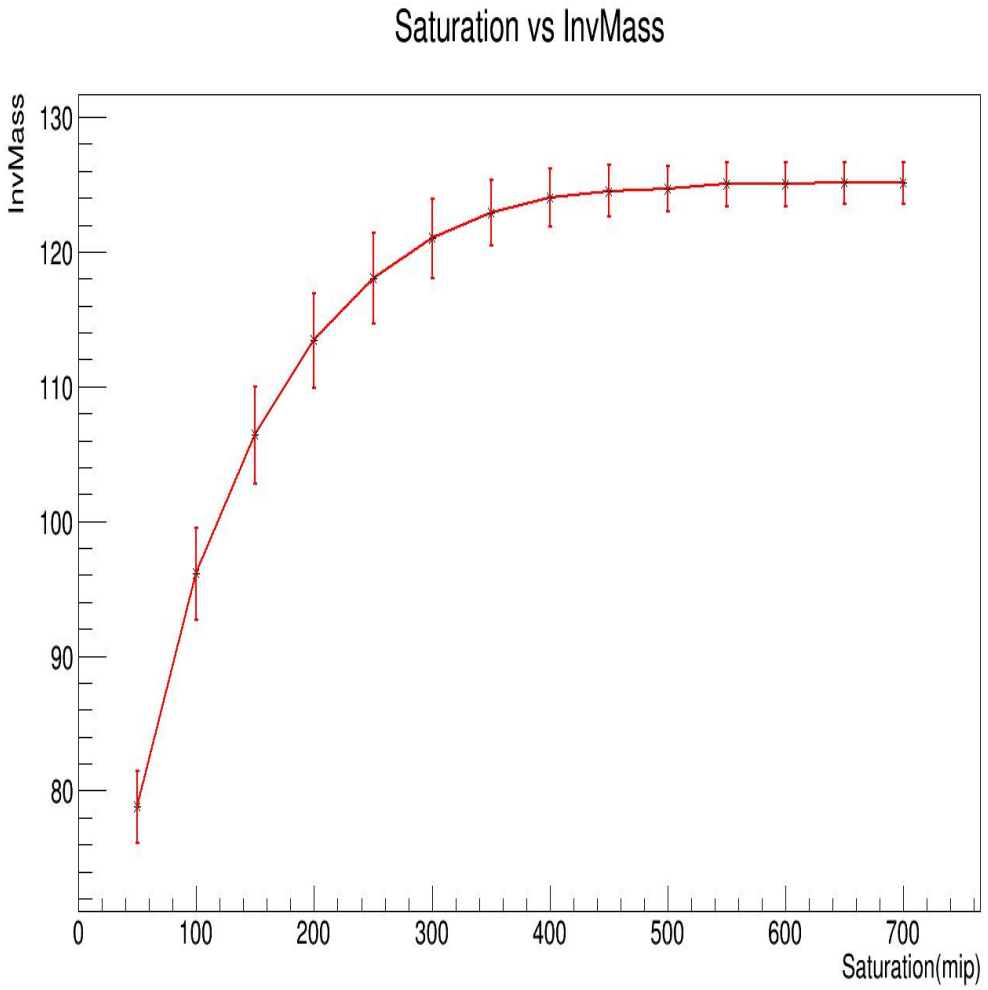
重建不变质量

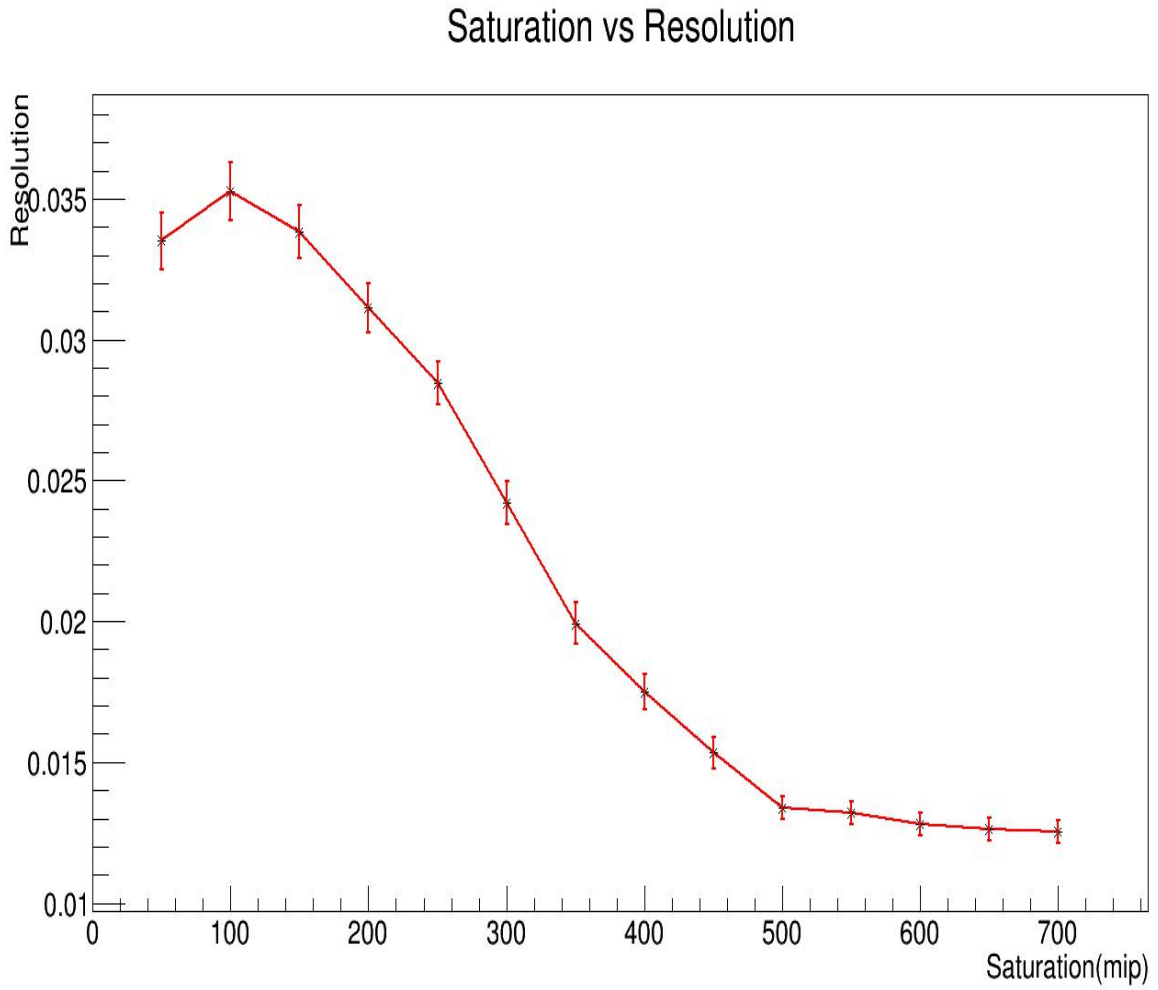


不同saturation下的Higgs不变质量谱



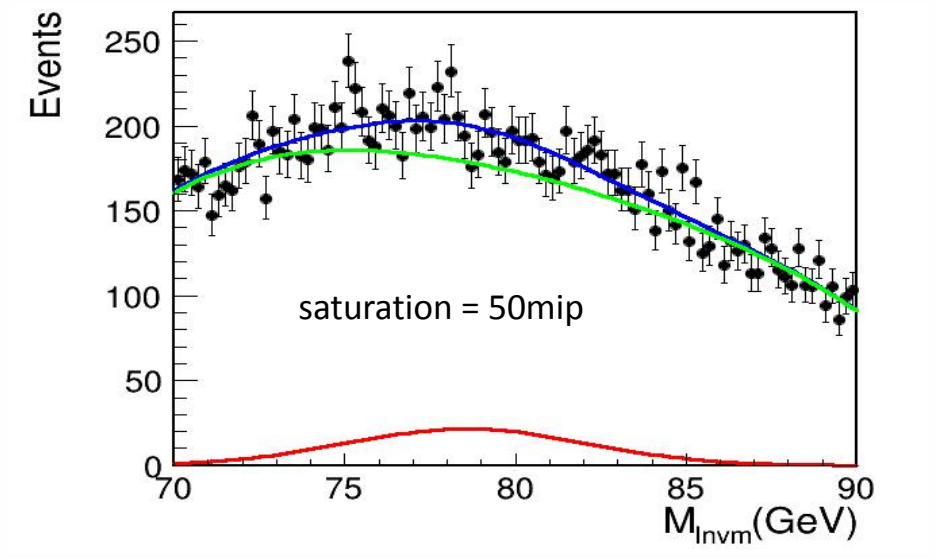
不同saturation下Higgs信号的不变质量和分辨率的变化曲线

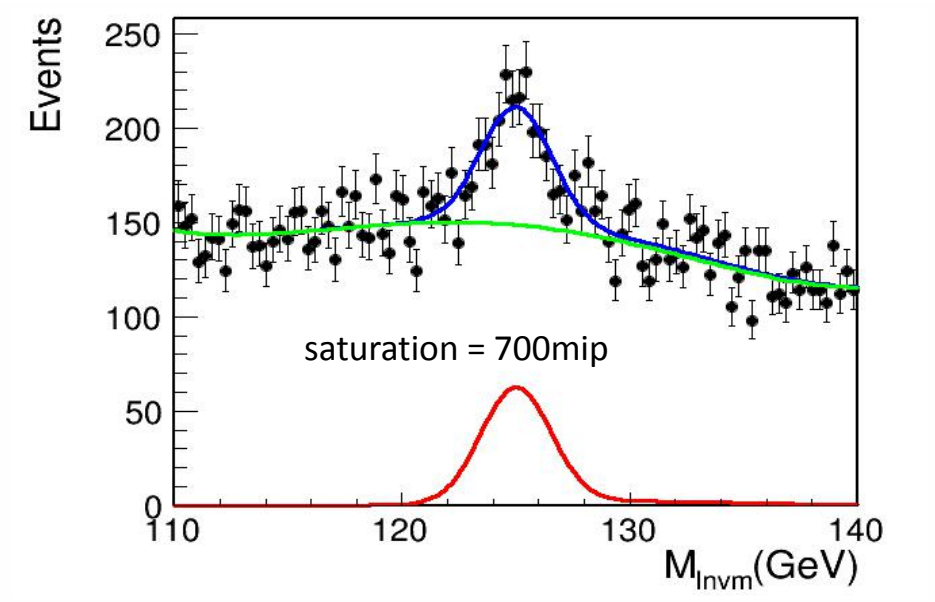


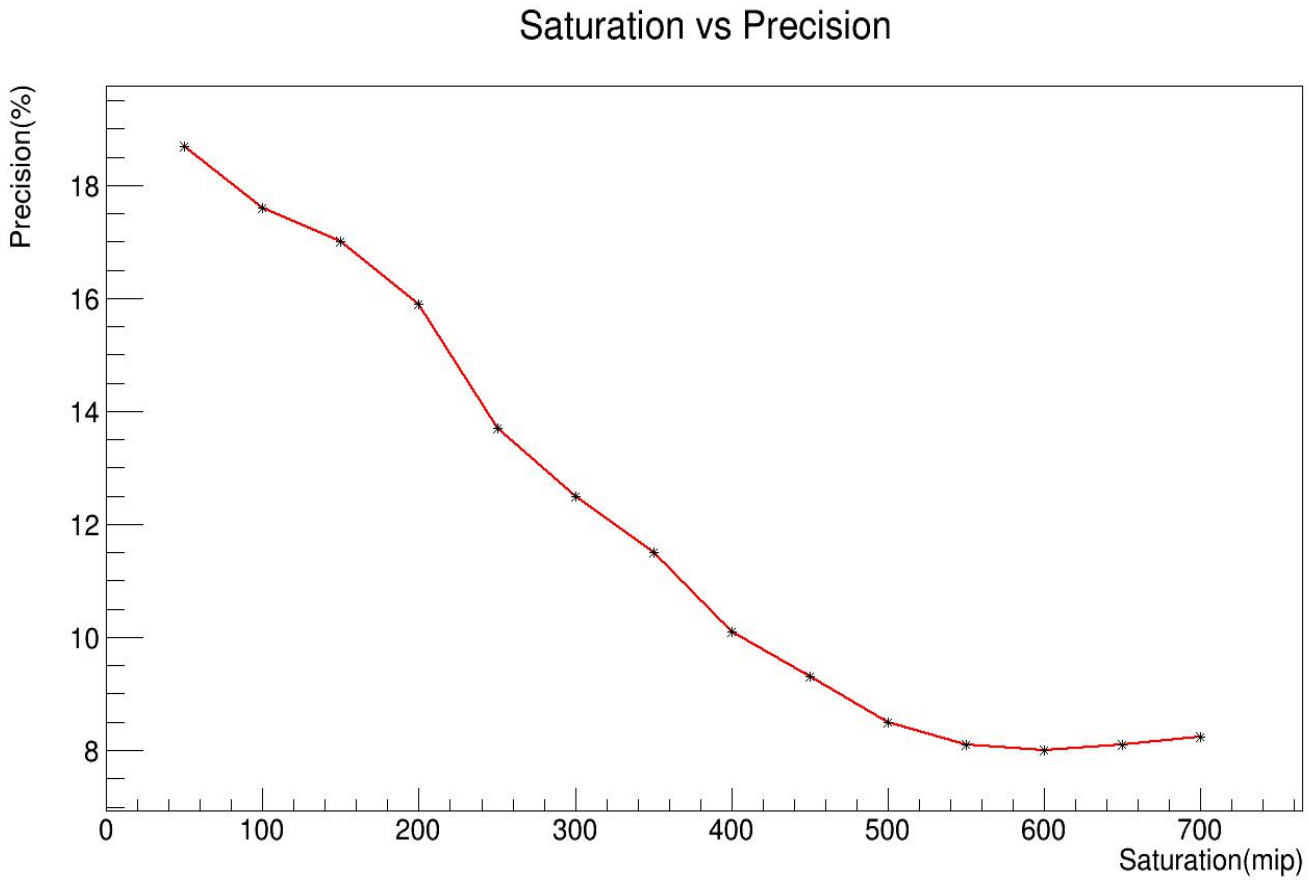


将saturation放在500mip之后不变质量的测量逐渐变好

higgs信号在加入本底后的测量精度





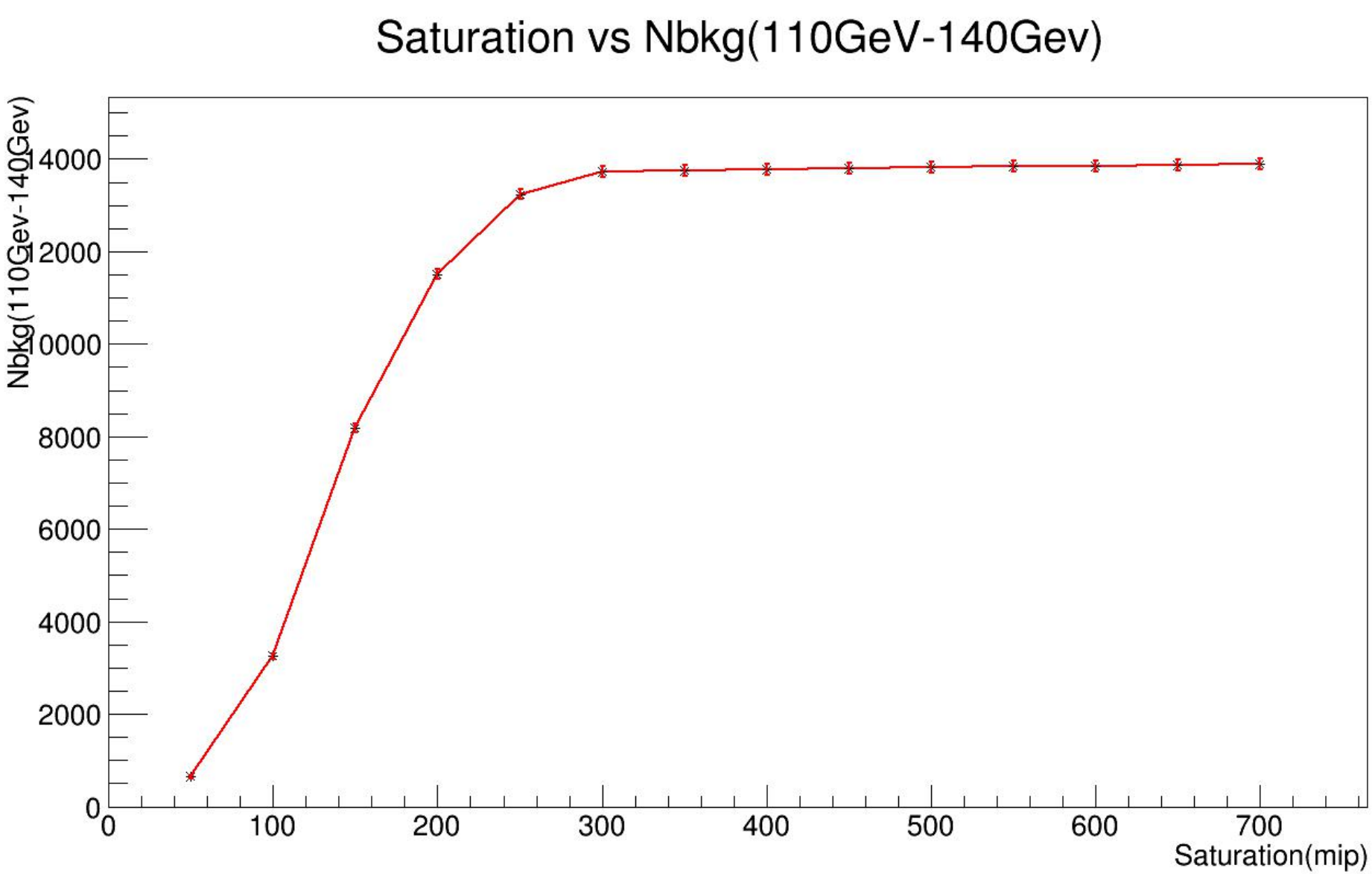


需要按照精度要求来定出saturation的具体数值

总结

- 由模拟的结果看来，在当前量能器几何结构下，选取saturation在500mip以上时，其对物理测量的影响开始逐渐变小，为安全计，选取saturation在1000mip以上是有意义的。

谢谢


Saturation vs Nbkg(110GeV-140Gev)
Nbkg(110Gev-140Gev)
0
2000
4000
6000
8000
10000
12000
14000
0
100
200
300
400
500
600
700
Saturation(mip)