# Digitization

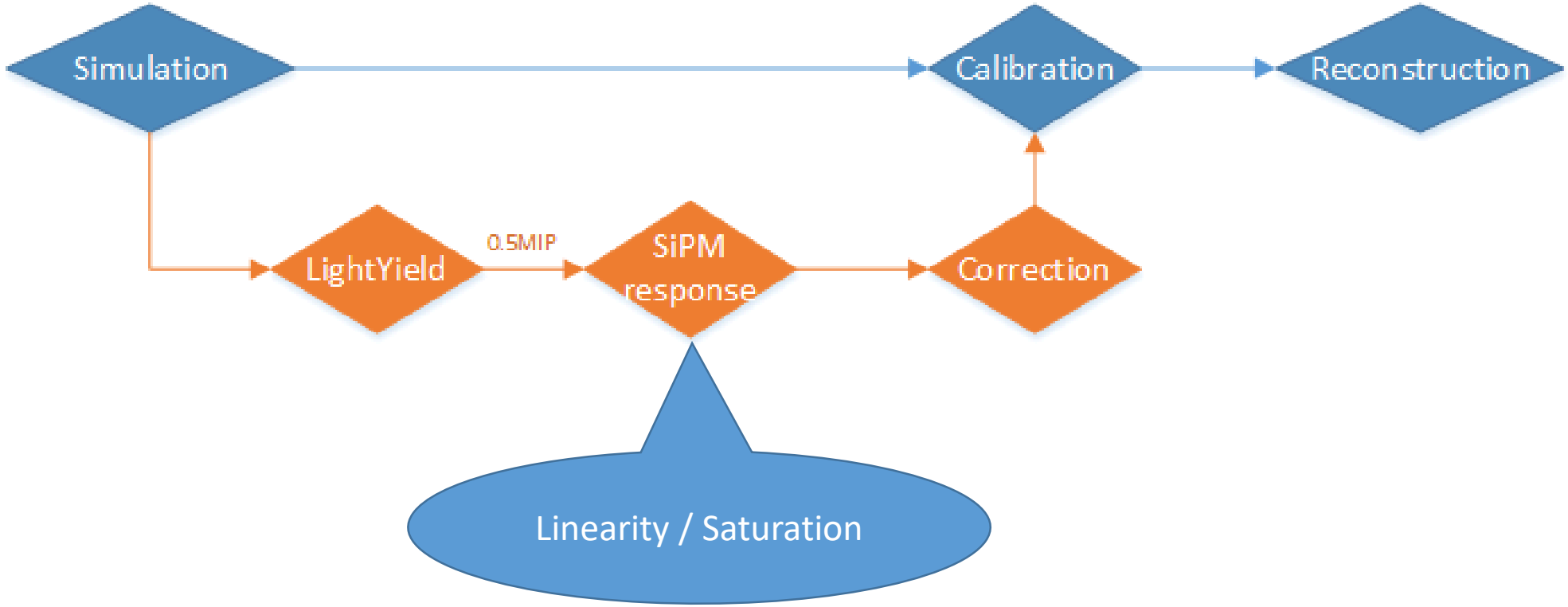
——牛亚洲

12/14/2018

# SimplifiedGeo-ScintECAL

- Layer: 30
- Geometry: Barrel + Endcap
- Scint: $5mm \times 45mm \times 2mm$
- Absorber(W): $2.8mm$
- PCB: $2mm$

# Digitization



# 模型建立——多项式分布

m个光子入射到n个探测器像素点上：

每个光子击中像素X的概率为$p_X = \frac{1}{n}\ (X = 1, \dots, n)$,

每个像素上收集到光子数为$k_1, k_2, \dots, k_n\ (k_1 + k_2 + \cdots + k_n = m)$,

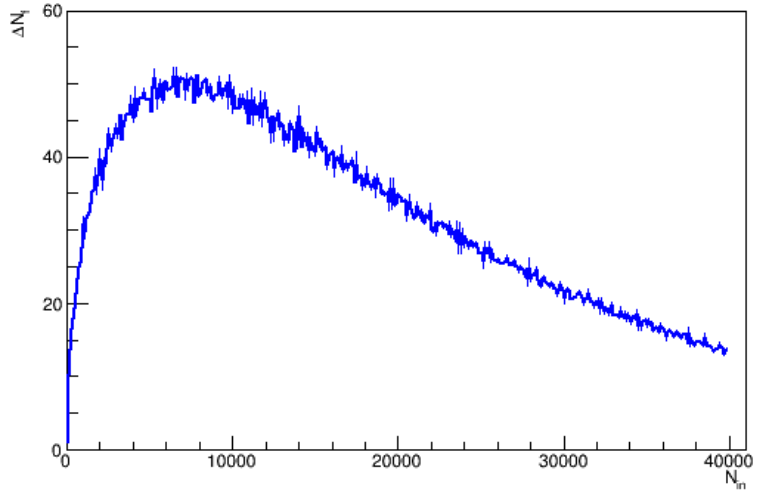
则$P(X_1 = k_1, \dots, X_n = k_n) = \frac{m!}{k_1! k_2! \dots k_n!} \cdot P_1^{k_1} \cdots P_n^{k_n}$

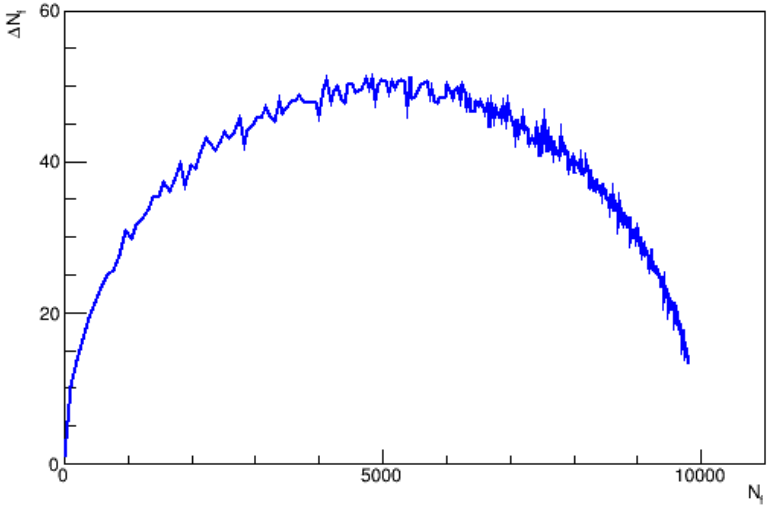
$$= \frac{m!}{k_1!\, k_2! \dots k_n!} \cdot \left(\frac{1}{n}\right)^m$$

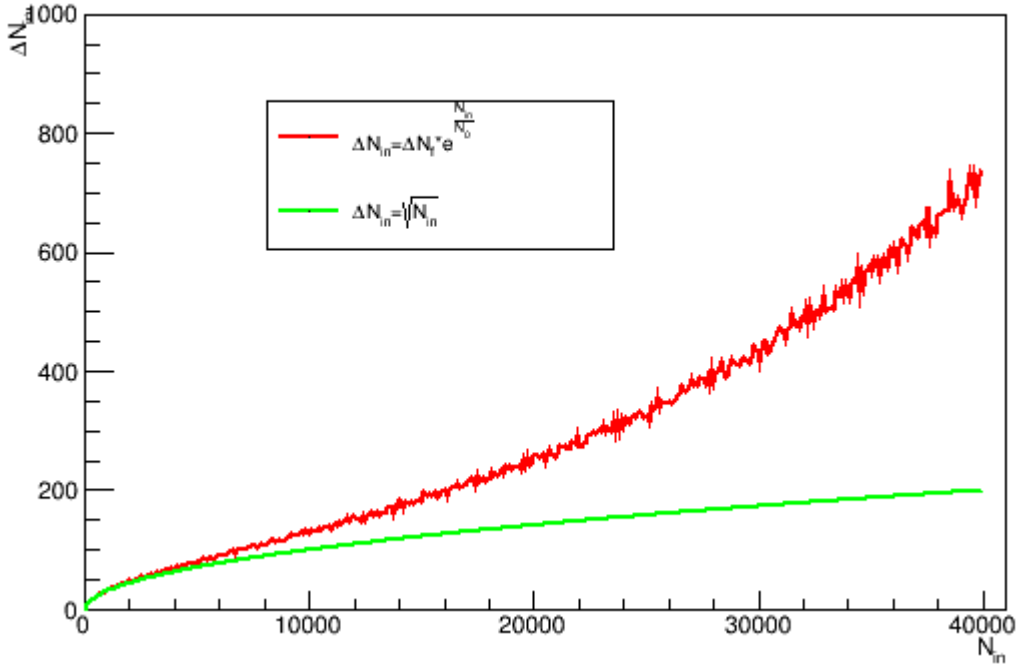
击中像素的个数为$N_f = \sum_{i=1}^{n} I(X_i > 0)$

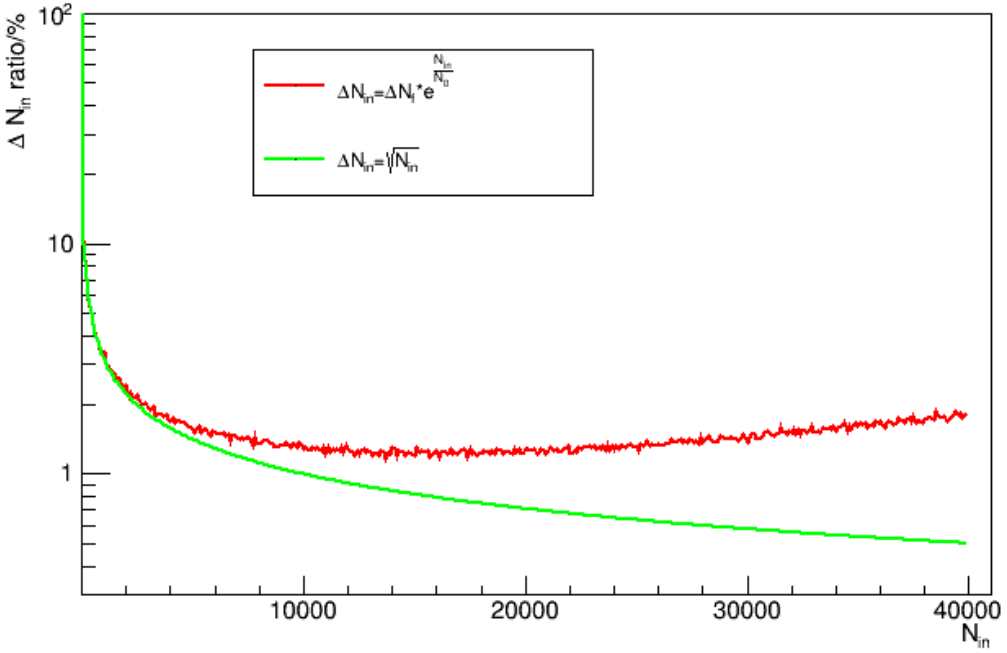
手算比较复杂，采用抽样的方式

# SiPM 10000 pixel

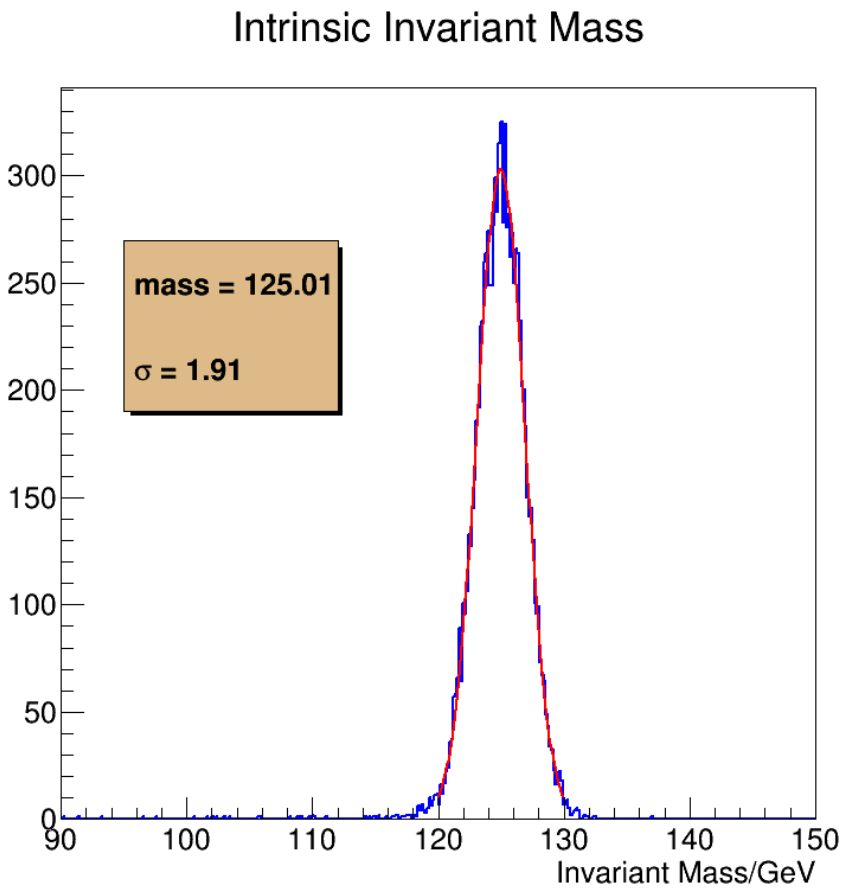


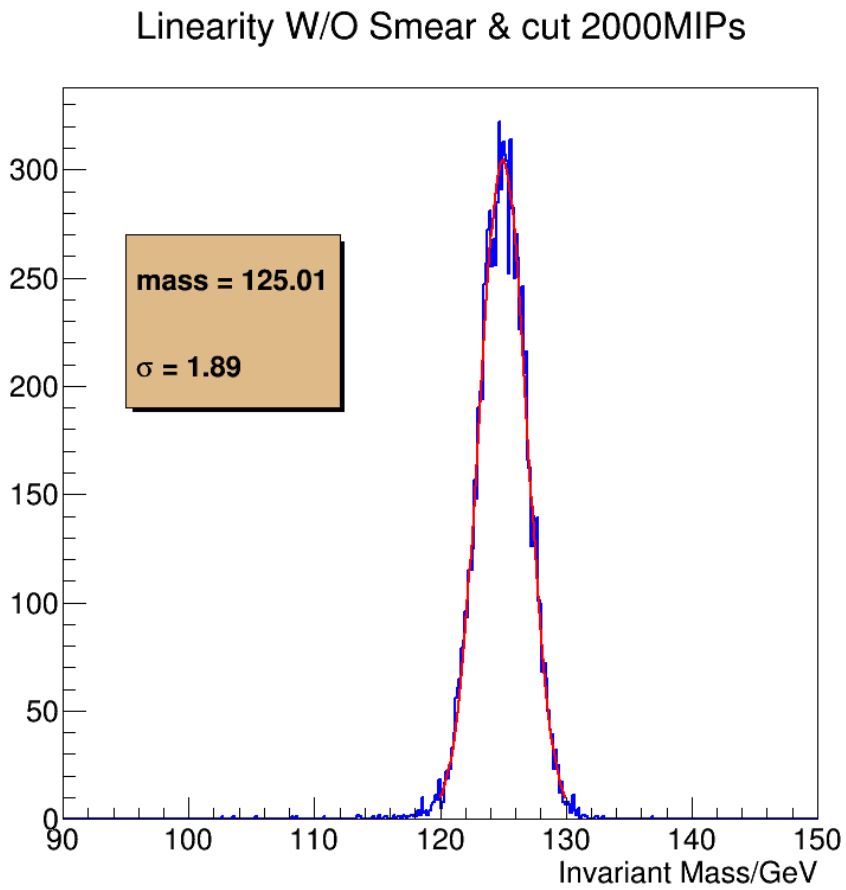



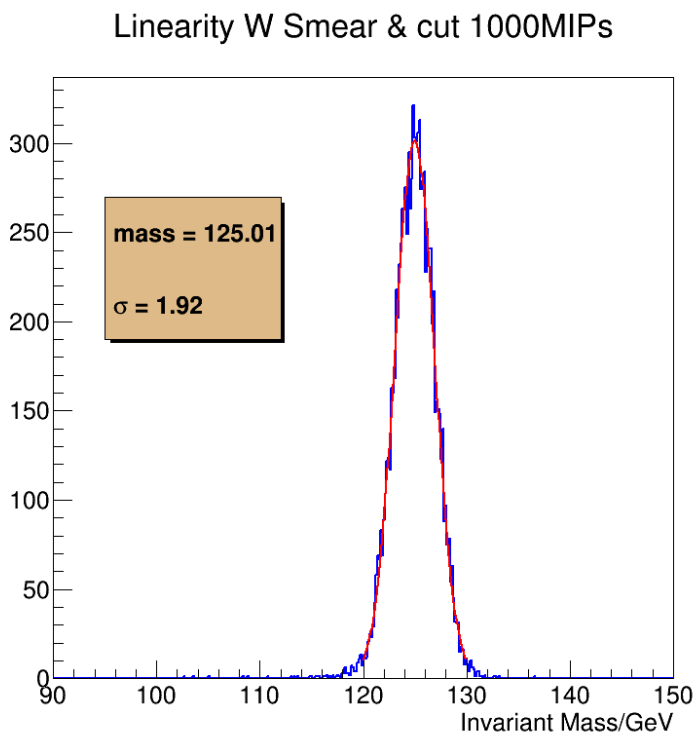



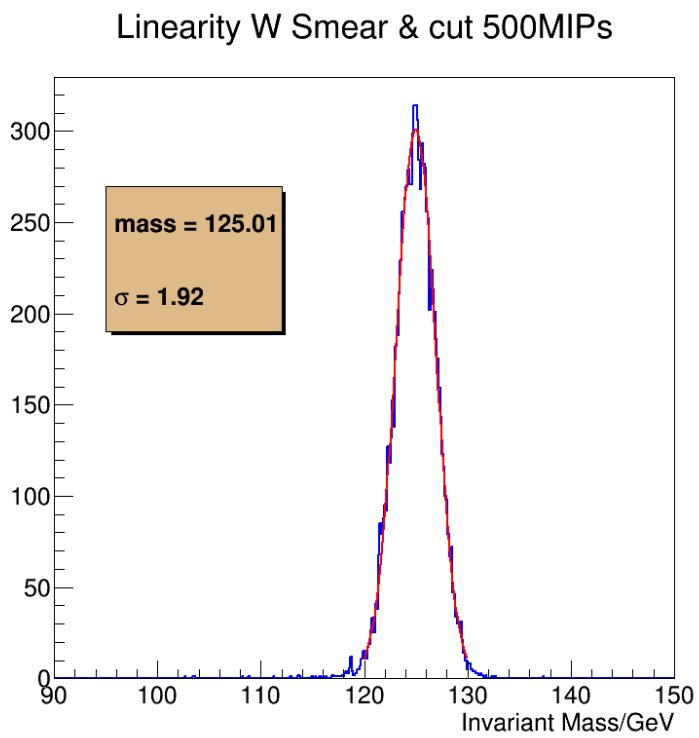
# Intrinsic and set range cut

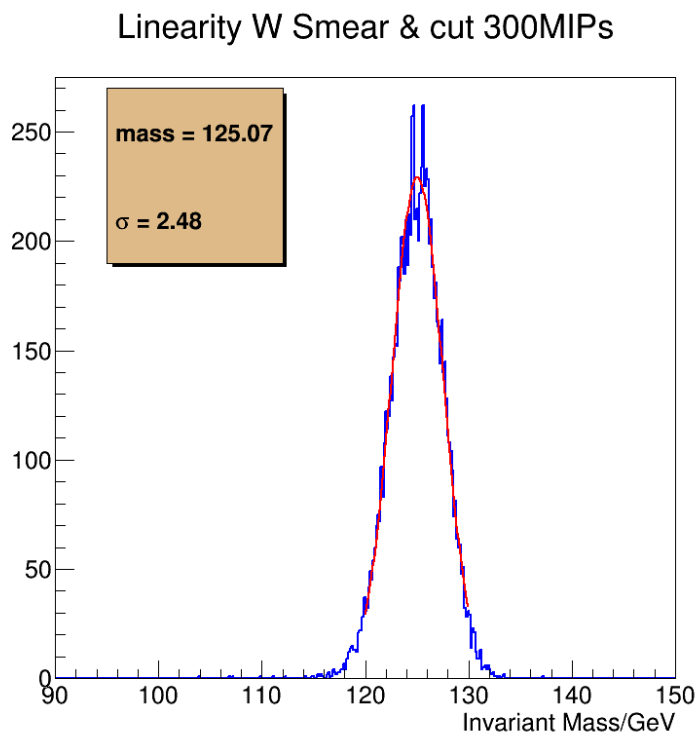


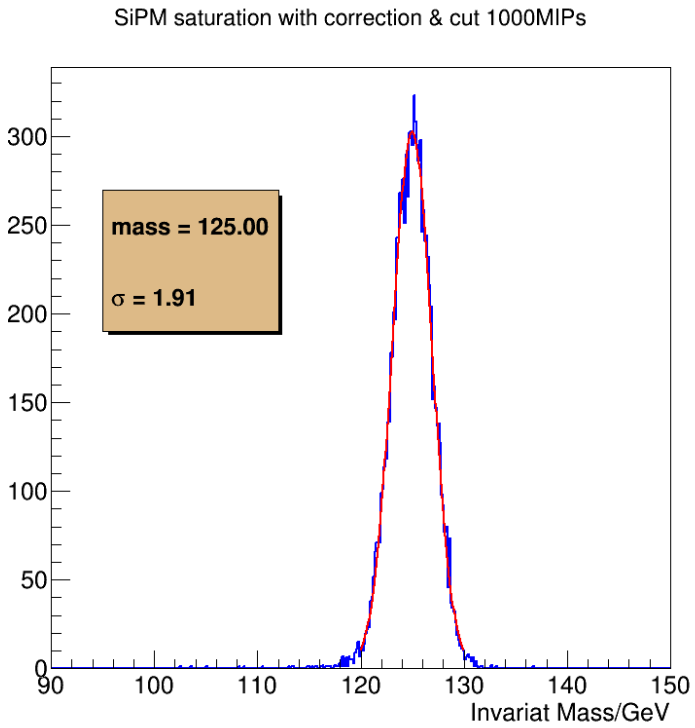
# Linearity with Gaussian smear

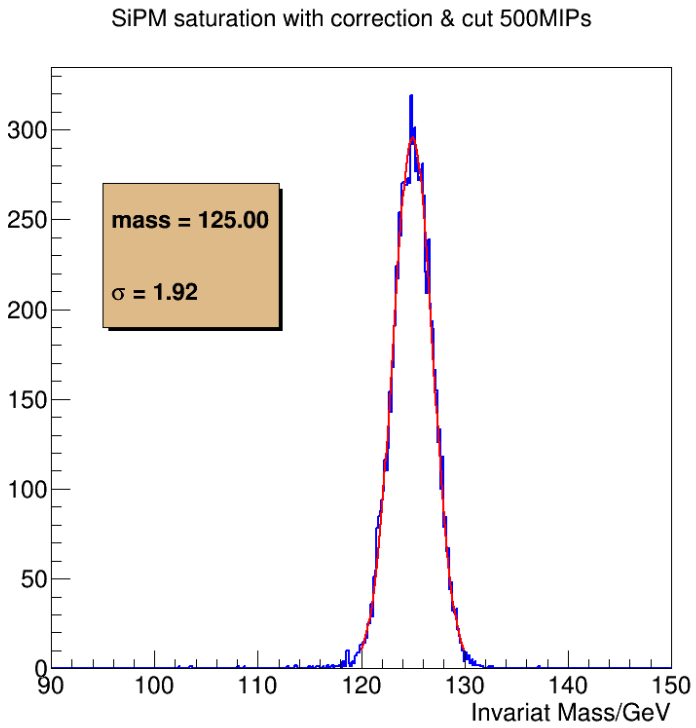


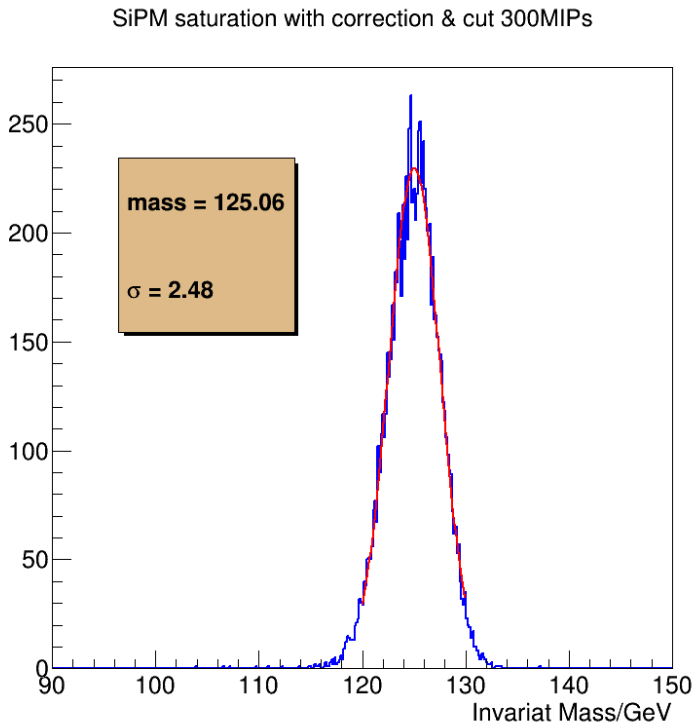



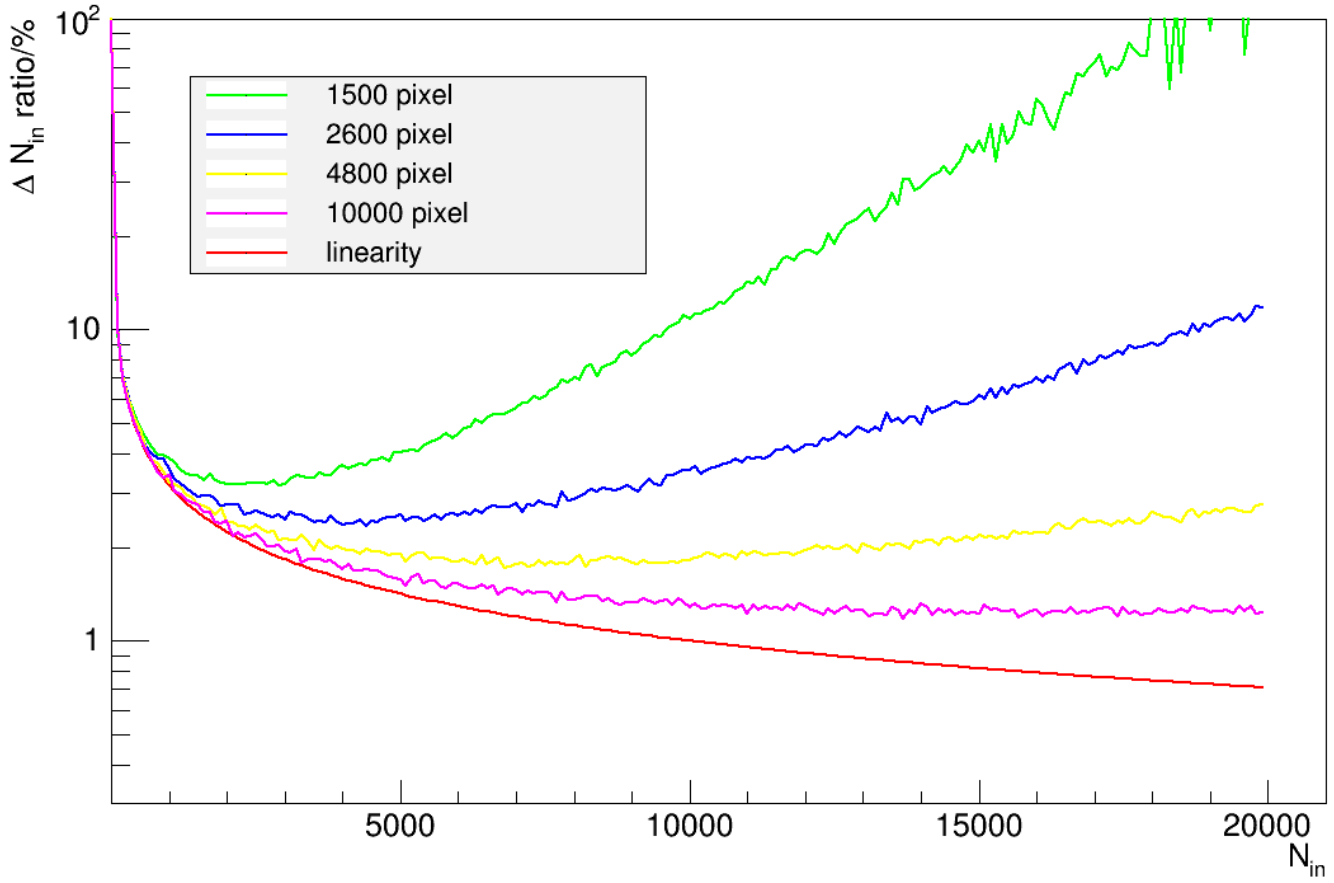
# 10000pixel SiPM saturation with correction



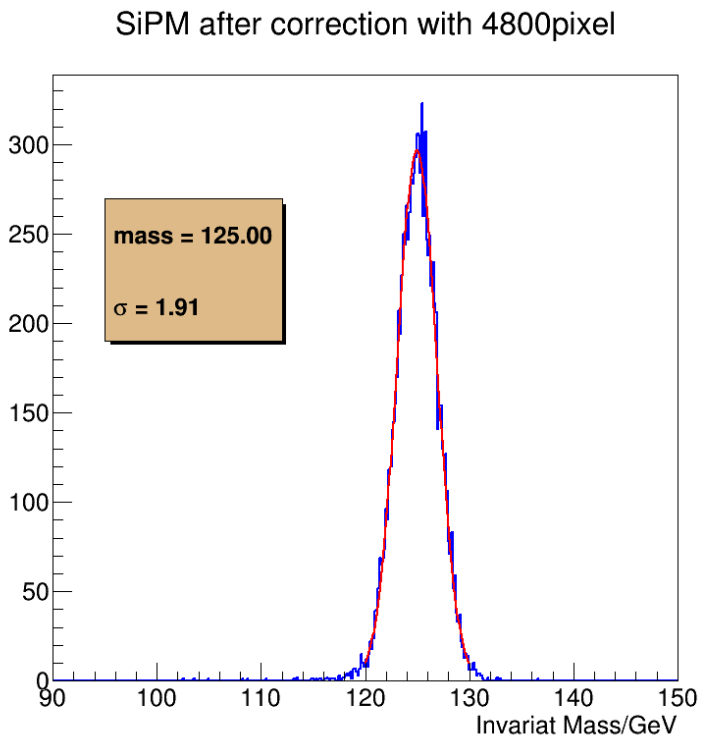



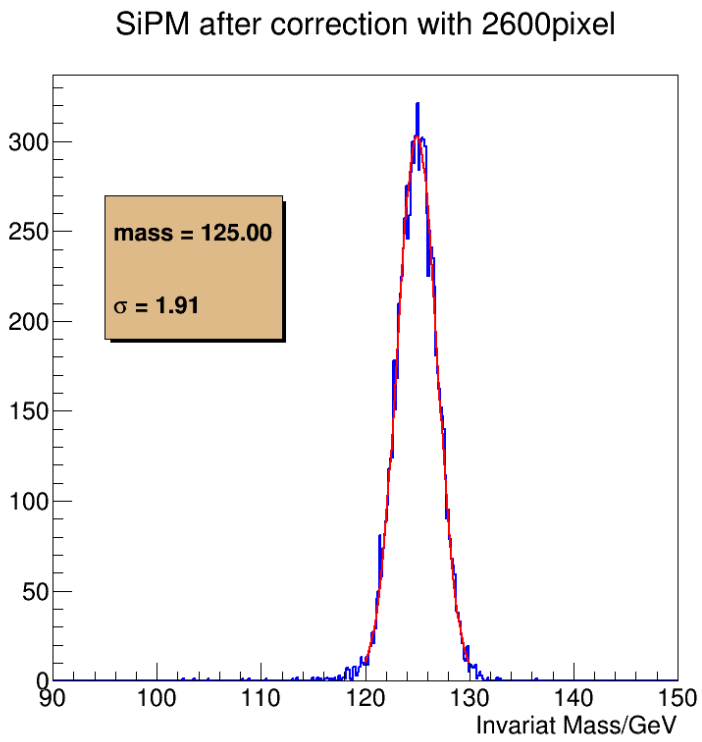



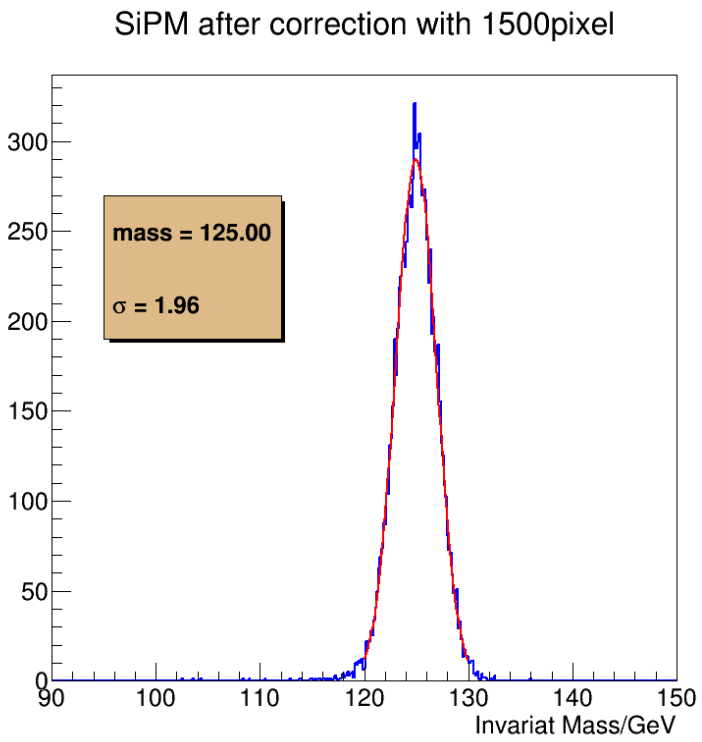
# How about decrease the SiPM pixels



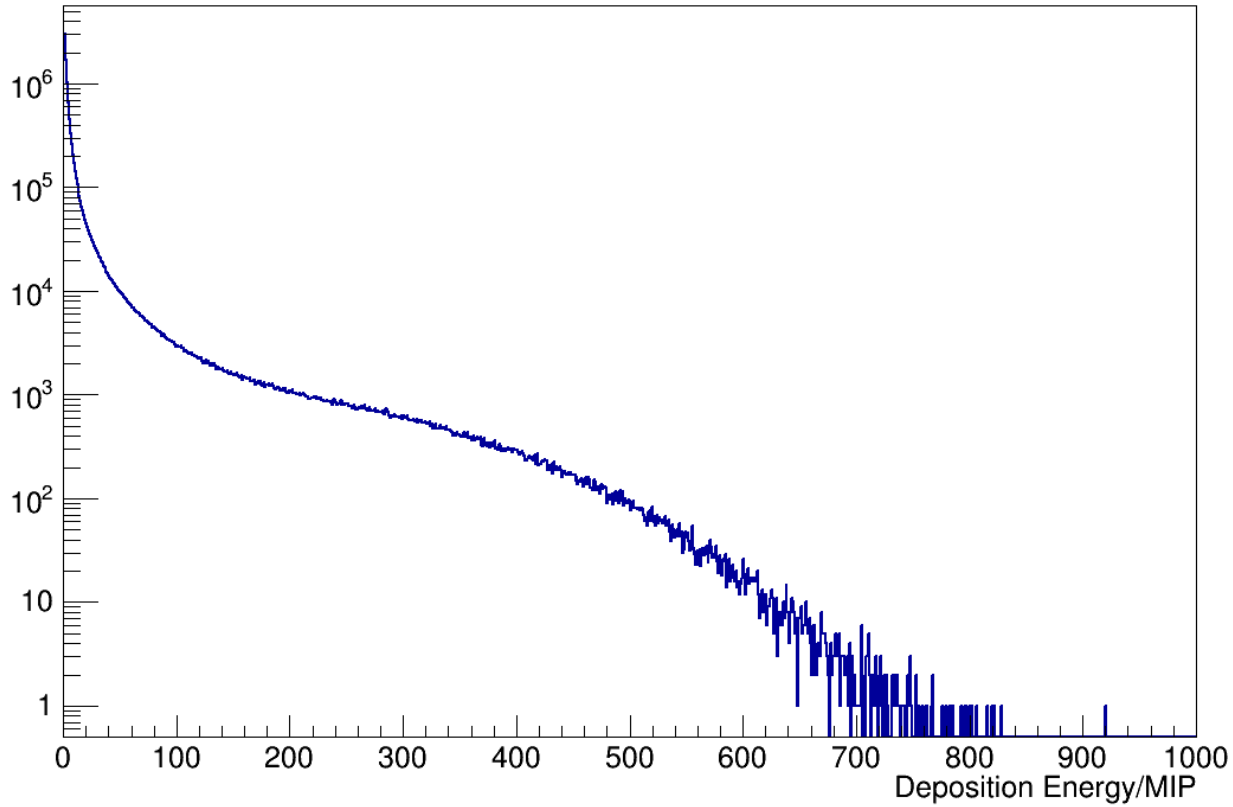
# How about decrease the SiPM pixels



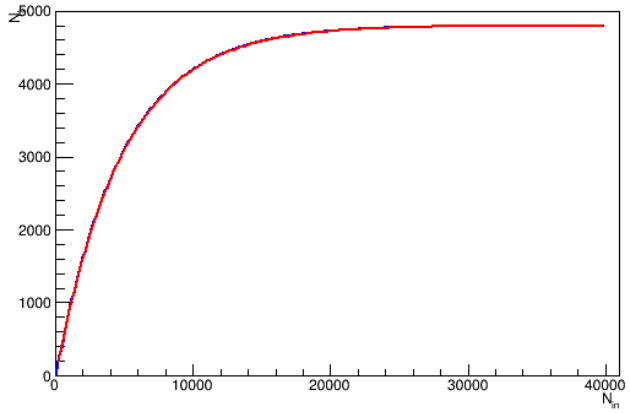



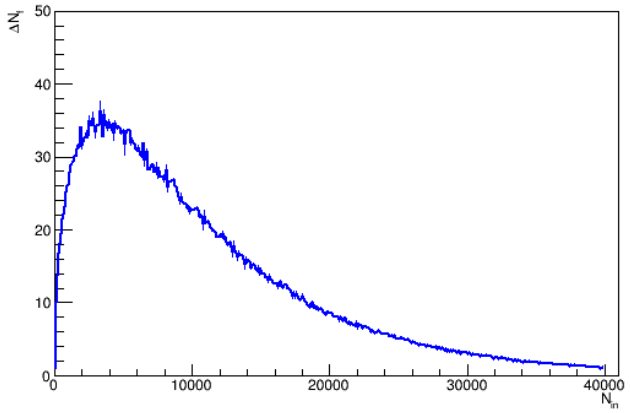
# Back Up

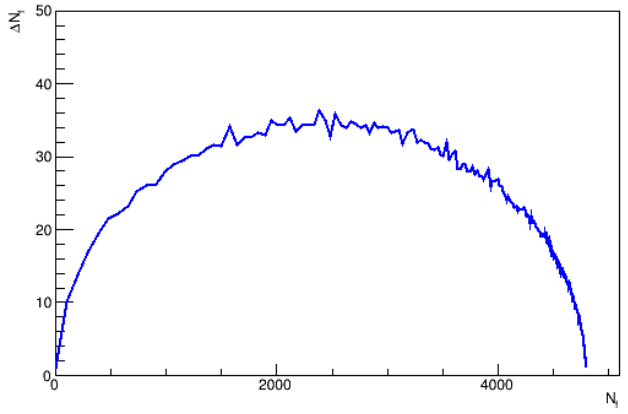


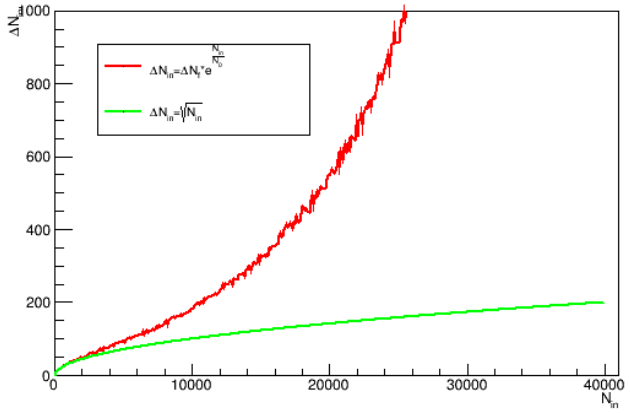

| Energy Dep/MIPs | 100 | 200 | 300 | 500 | 1000 |
|---|---|---|---|---|---|
| Hits Ratio / % | 97.40 | 98.81 | 99.47 | 99.96 | 100 |
| Energy Ratio / % | 52.61 | 69.29 | 82.87 | 98.02 | 100 |

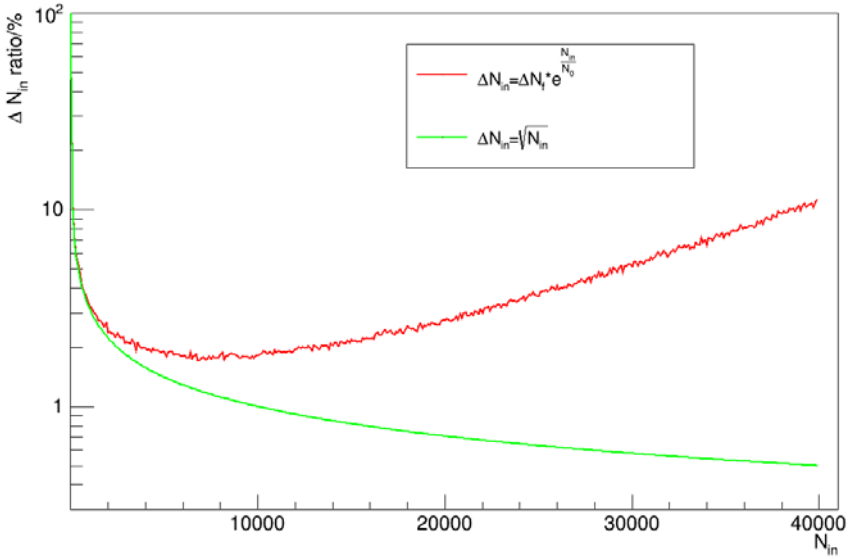
# 4800 pixel


N_f
N_in

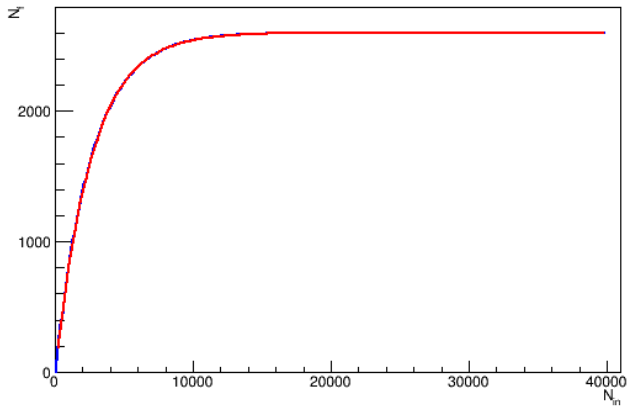

ΔN_f
N_in

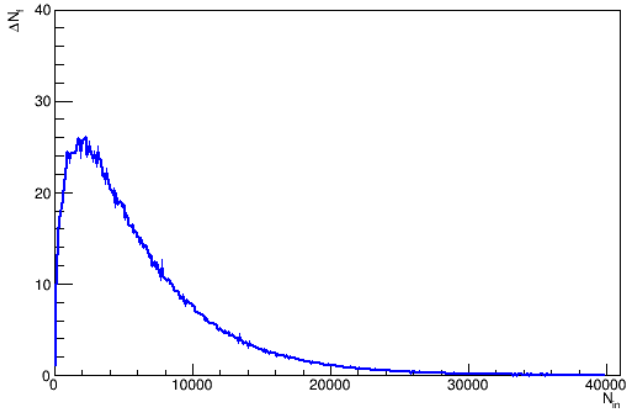

ΔN_f
N_f

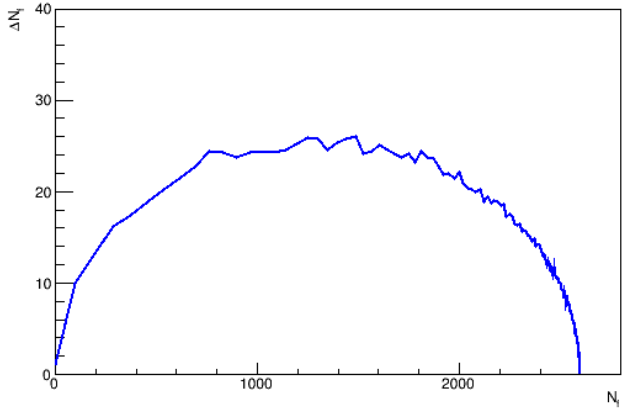

ΔN_in=ΔN_f*e^(N_in/N_0)
ΔN_in=√N_in
ΔN_in
N_in

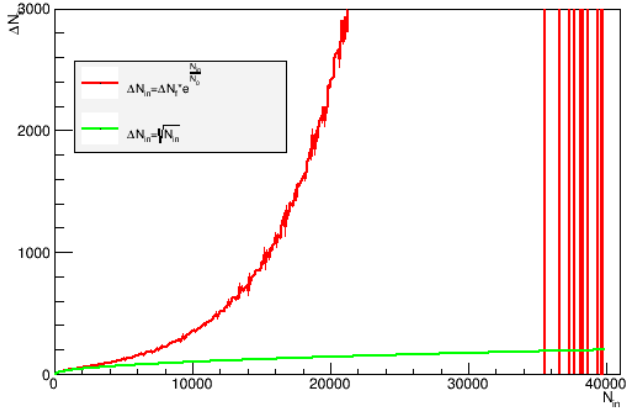

Δ N_in ratio/%
ΔN_in=ΔN_f*e^(N_in/N_0)
ΔN_in=√N_in
N_in

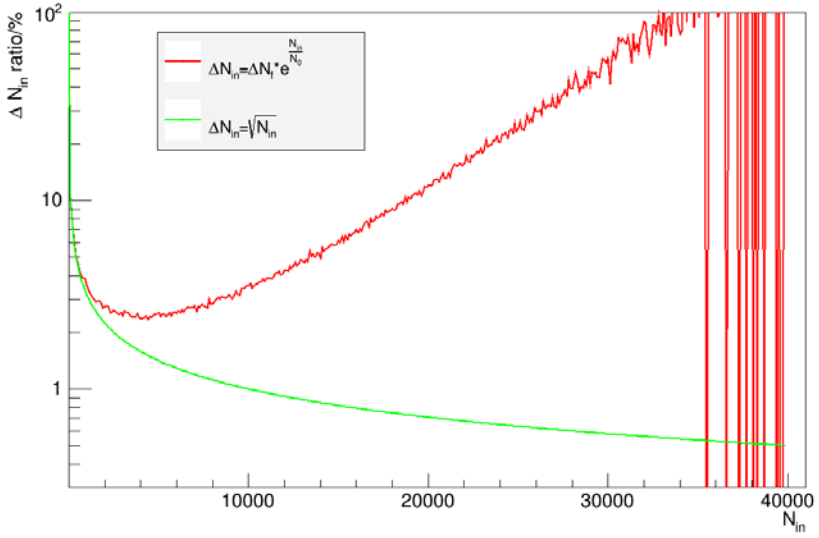
# 2600 pixel


N_f
2000
1000
0
0
10000
20000
30000
40000
N_in

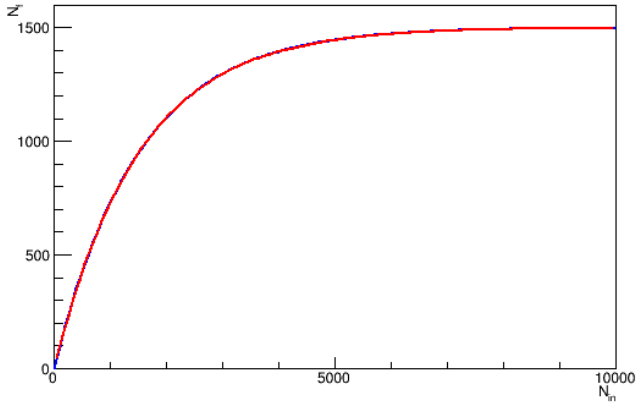

ΔN_f
40
30
20
10
0
0
10000
20000
30000
40000
N_in

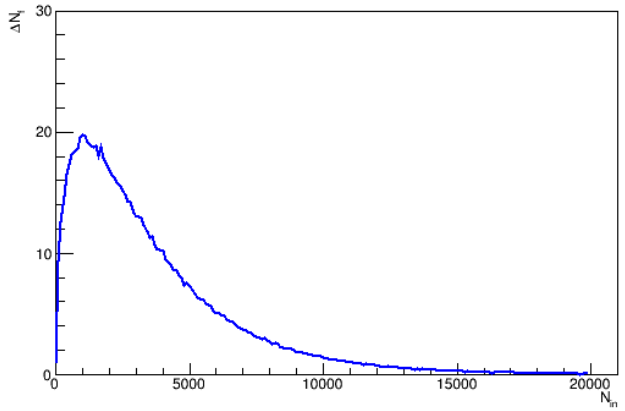

ΔN_f
40
30
20
10
0
0
1000
2000
N_f

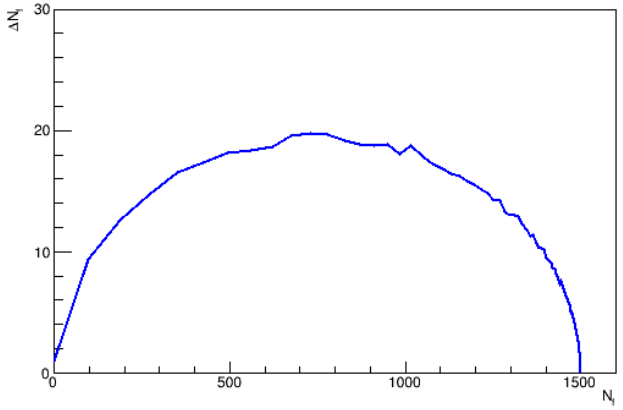

ΔN_f
3000
2000
1000
0
ΔN_in=ΔN_f*e^(N_in/N_f)
ΔN_in=√N_in
0
10000
20000
30000
40000
N_in

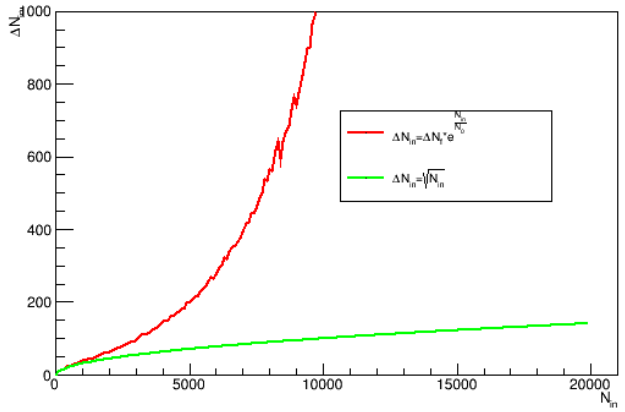

Δ N_in ratio/%
10^2
10
1
ΔN_in=ΔN_f*e^(N_in/N_f)
ΔN_in=√N_in
10000
20000
30000
40000
N_in

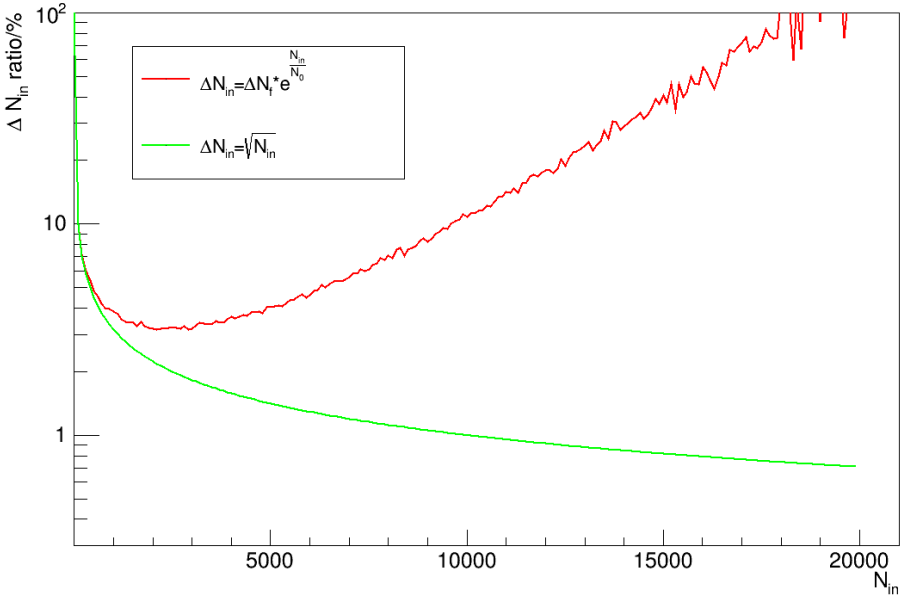
# 1500 pixel


$N_f$
1500
1000
500
0
0
5000
10000
$N_{in}$


$\Delta N_f$
30
20
10
0
0
5000
10000
15000
20000
$N_{in}$


$\Delta N_f$
30
20
10
0
0
500
1000
1500
$N_f$


$\Delta N_{in}$
1000
800
600
400
200
0
$\Delta N_{in}=\Delta N_f * e^{\frac{N_{in}}{N_0}}$
$\Delta N_{in}=\sqrt{N_{in}}$
0
5000
10000
15000
20000
$N_{in}$


$\Delta N_{in}$ ratio/%
$10^2$
10
1
$\Delta N_{in}=\Delta N_f * e^{\frac{N_{in}}{N_0}}$
$\Delta N_{in}=\sqrt{N_{in}}$
5000
10000
15000
20000
$N_{in}$