反质子能谱分析

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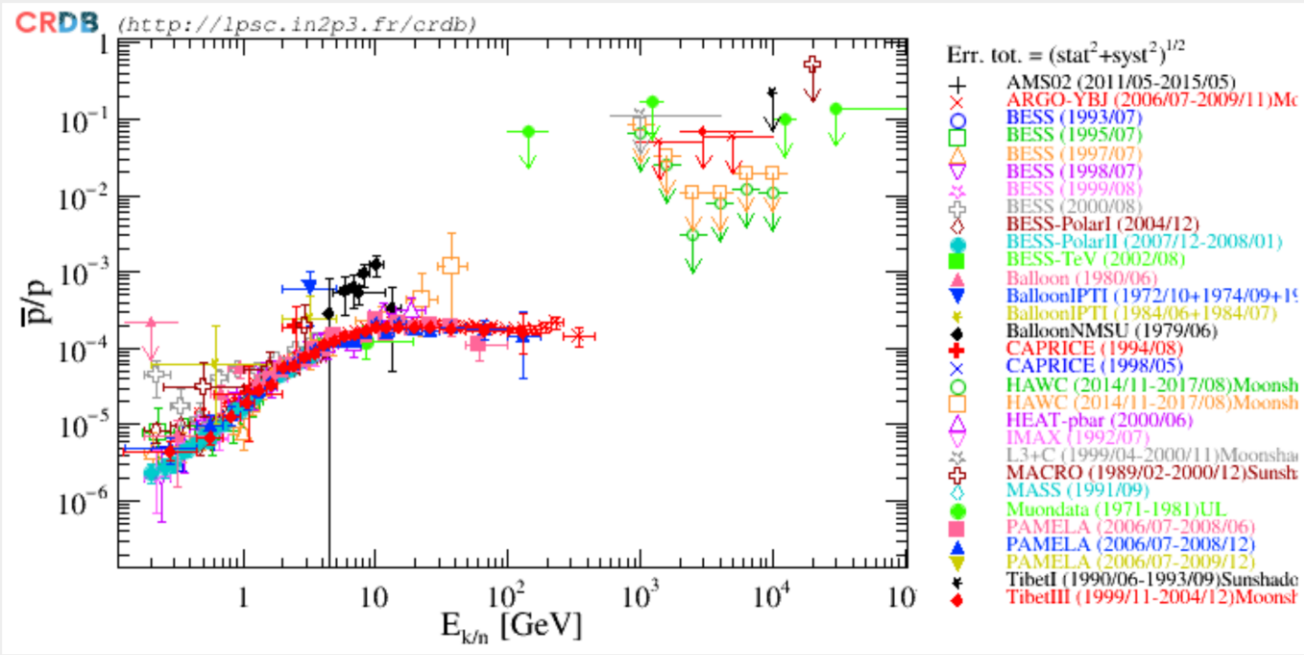
2025-01-16

本底排除率

本底排除率： 每留下一个信号，要扔掉多少个污染。



Electrons and protons in cosmic rays

Φ_p(1 TeV) ~ 10^{-4} (m² sr s GeV)$^{-1}$
Φ_e(1 TeV) ~ 10^{-7} (m² sr s GeV)$^{-1}$

If only 1 proton over 1000 is misinterpreted as an electron, we would end up with a 100% contamination in electron flux!!

The requirement for CALET is to be able to select electron and proton events such that proton contamination in electron sample is ~ %

$$10^2 = \frac{N_e^{sel}}{N_p^{sel}} = \frac{N_e \epsilon_e}{N_p \epsilon_p} = 10^{-3}\frac{\epsilon_e}{\epsilon_p} \longrightarrow \frac{\epsilon_e}{\epsilon_p} = 10^5$$

Rejection power

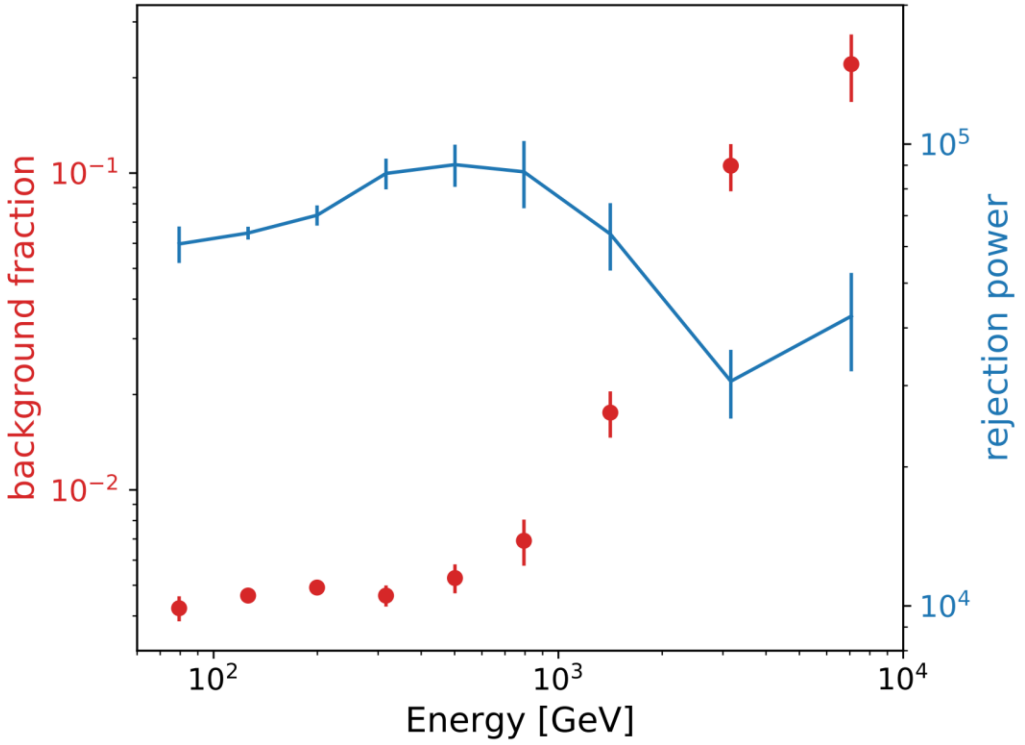
Selection efficiency

$$10\% = \frac{N_p sel}{N_{pbar} sel} = \frac{Np \times \varepsilon p}{Npbar \times \epsilon Pbar} = 1e5 \times \frac{\epsilon p}{\epsilon pbar}$$

$$\frac{\varepsilon p}{\varepsilon pbar} = 1e-6$$

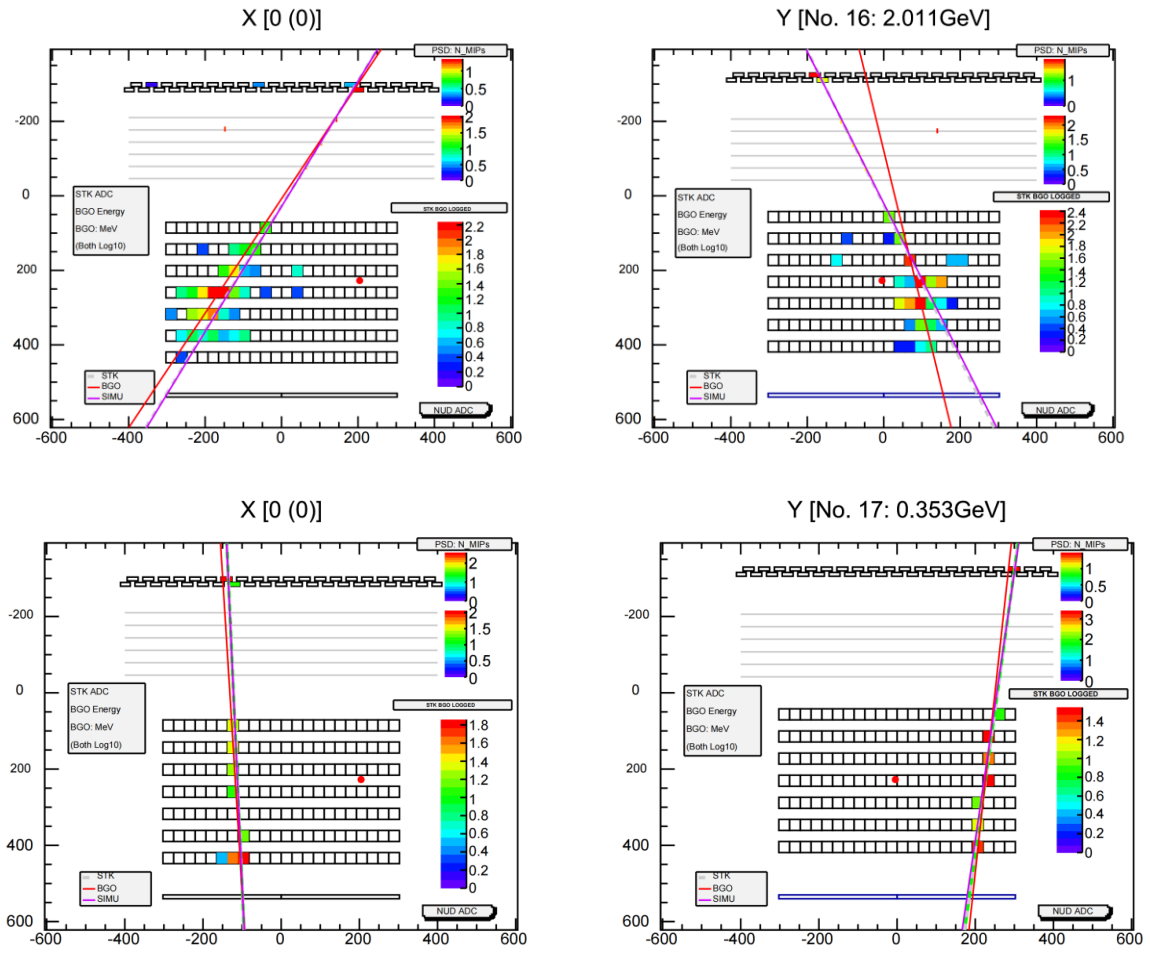
DAMPE ep鉴别能力

目标本底排除能力 $\frac{\varepsilon p}{\varepsilon pbar} = 1e-6$ ，
反质子误判率低于百万分之一。



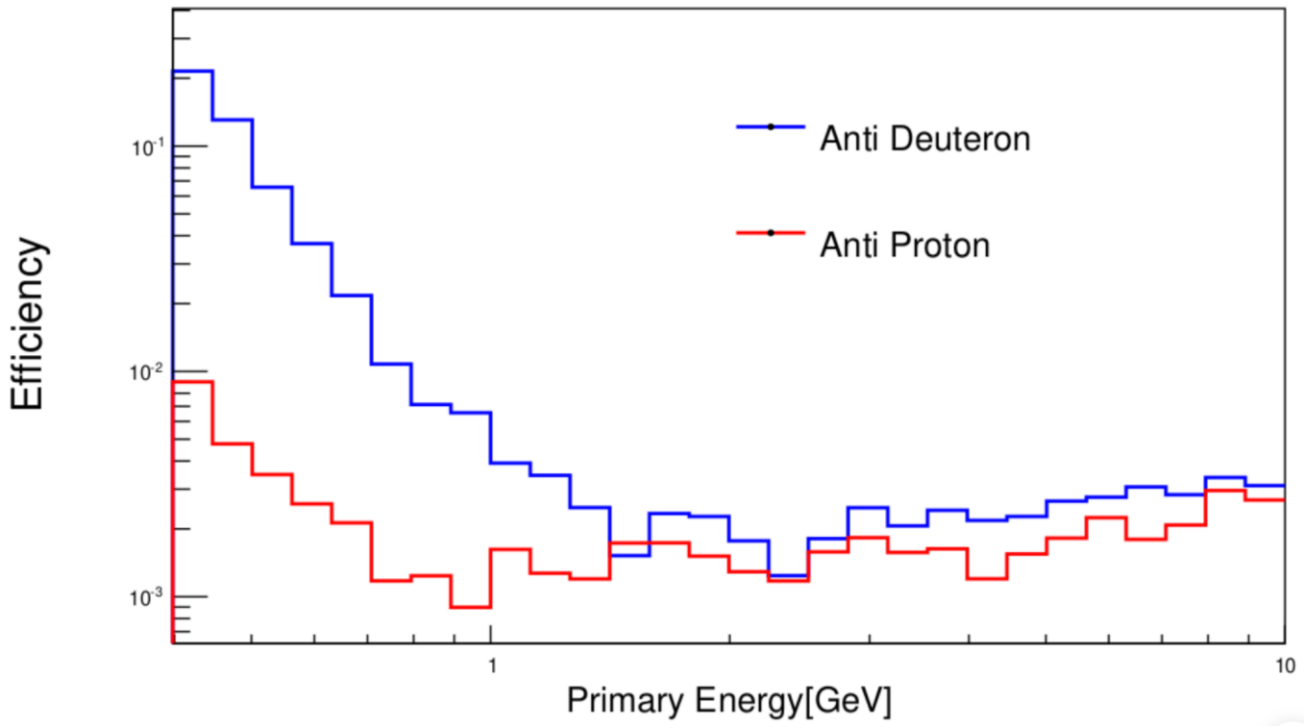
1e4 < rejection power < 1e5

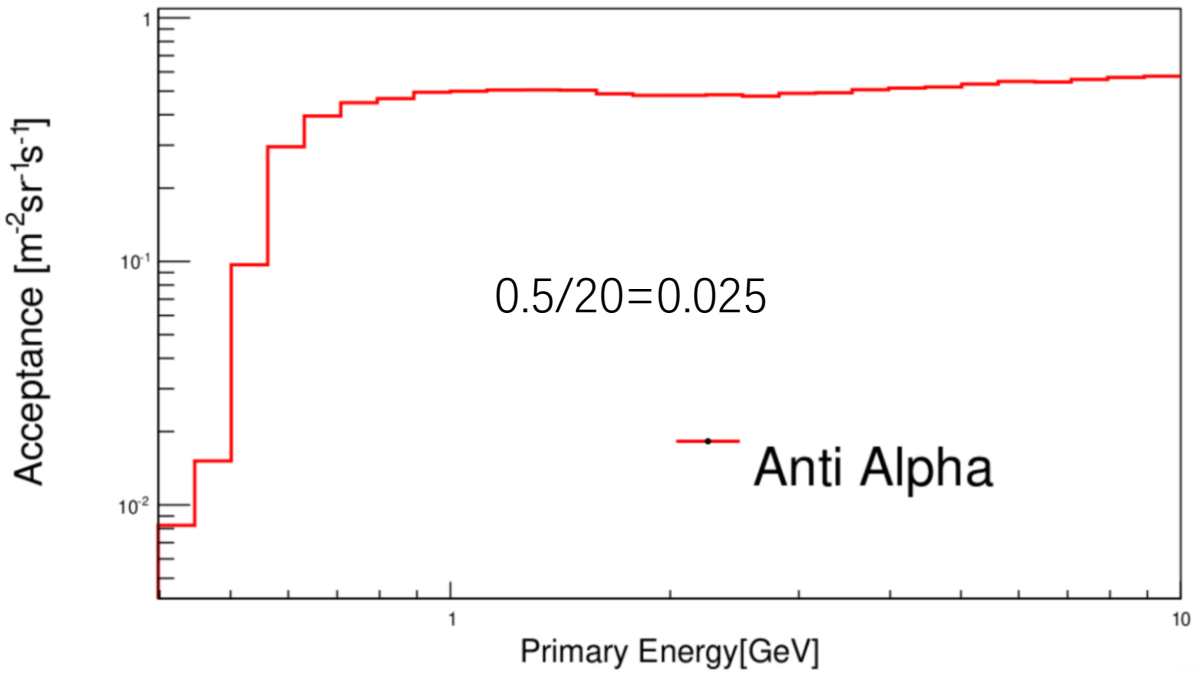
32 个辐射长度，电子误判率可以做到几万分之一。



反质子的信号微弱，2GeV的信号难以有效发现。电子的BGO track即为真实track，信号充足的情况依旧做不到1e5次方的本底排除率。

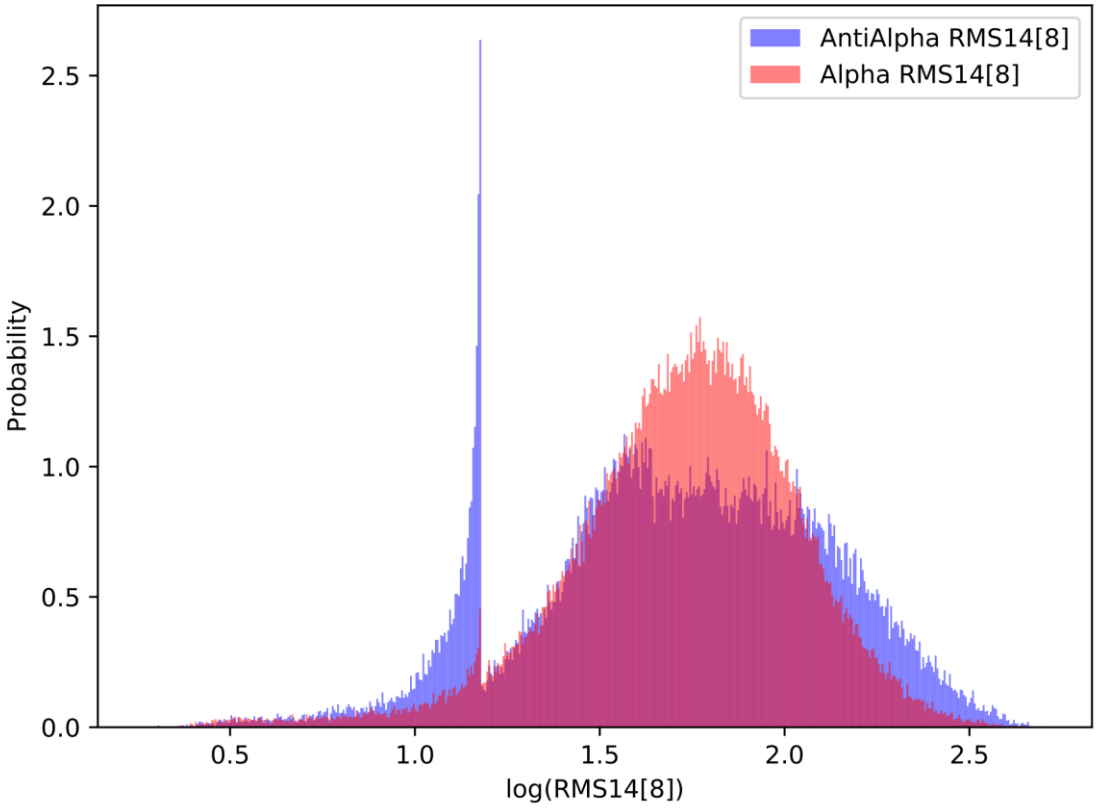
触发效率

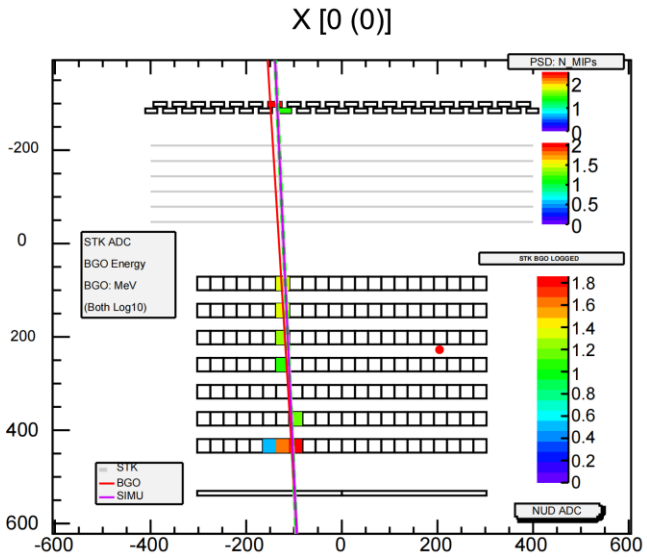


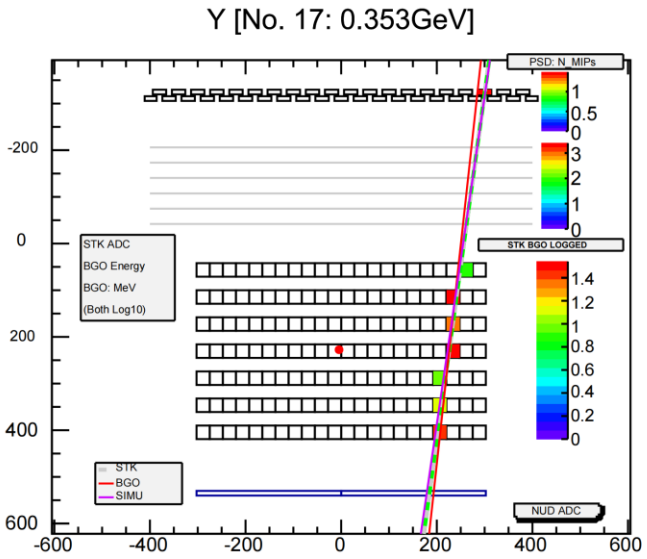


Acceptance = Efficiency * 19.74

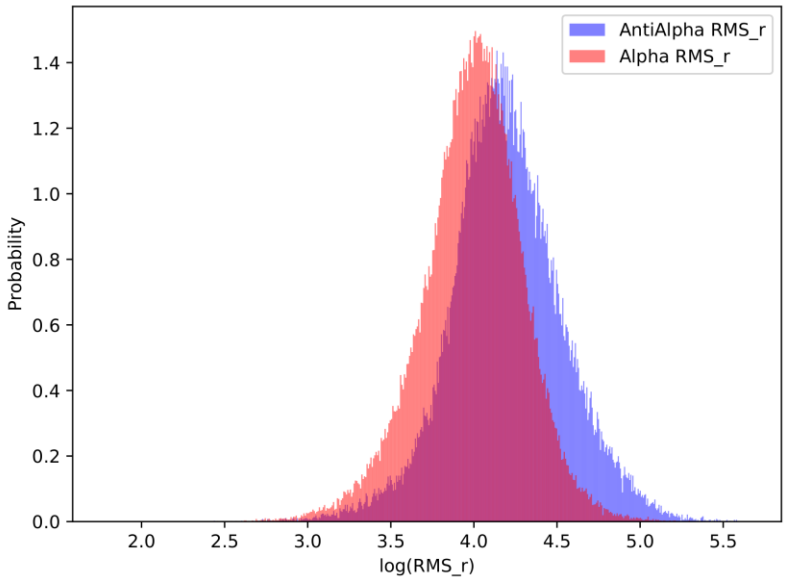
沉积信号微弱

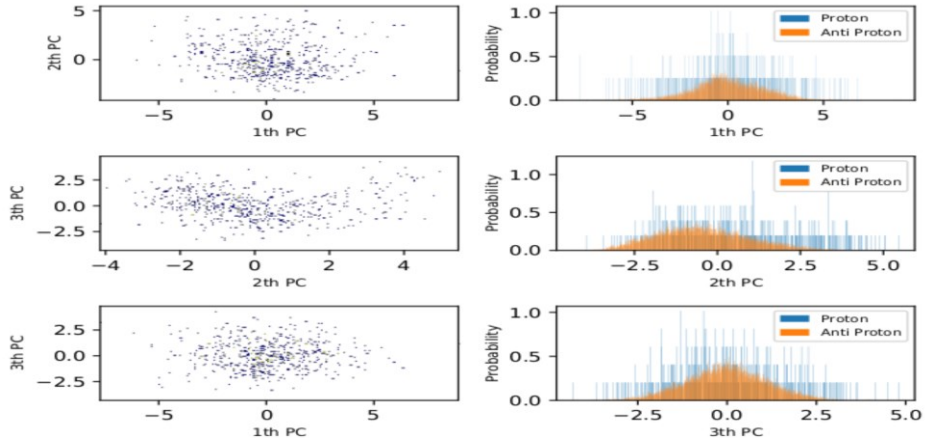

AntiAlpha RMS14[8]
Alpha RMS14[8]
Probability
log(RMS14[8])
0.0
0.5
1.0
1.5
2.0
2.5

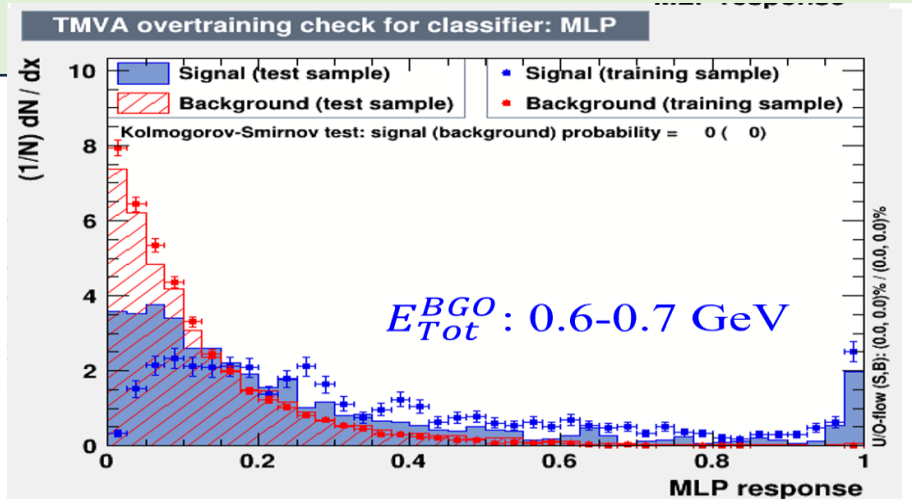

X [0 (0)]
PSD: N_MIPs
STK ADC
BGO Energy
BGO: MeV
(Both Log10)
STK BGO LOGGED
STK
BGO
SIMU
NUD ADC

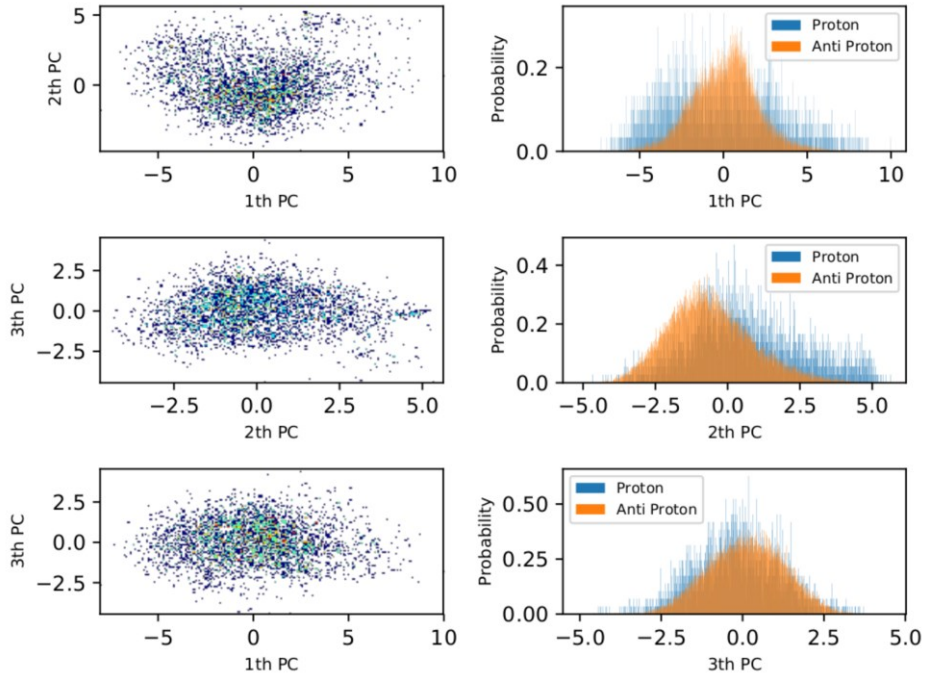

Y [No. 17: 0.353GeV]
PSD: N_MIPs
STK ADC
BGO Energy
BGO: MeV
(Both Log10)
STK BGO LOGGED
STK
BGO
SIMU
NUD ADC

BGO shower 区分度





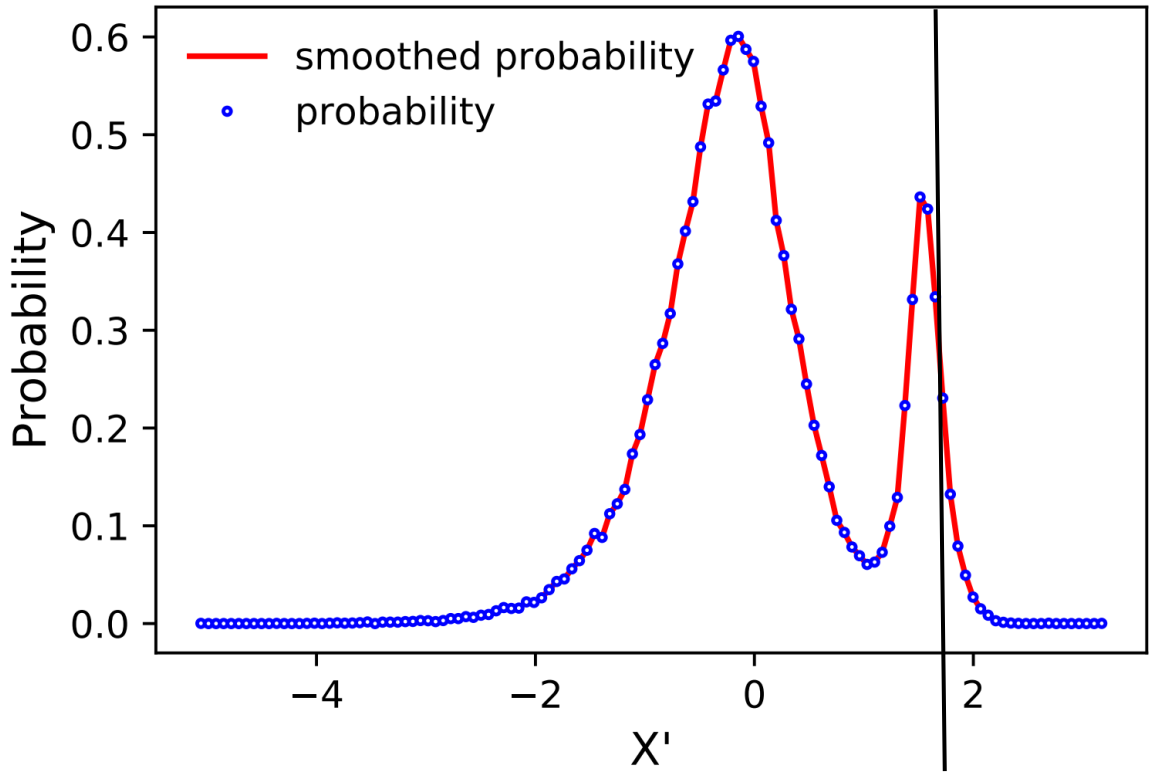




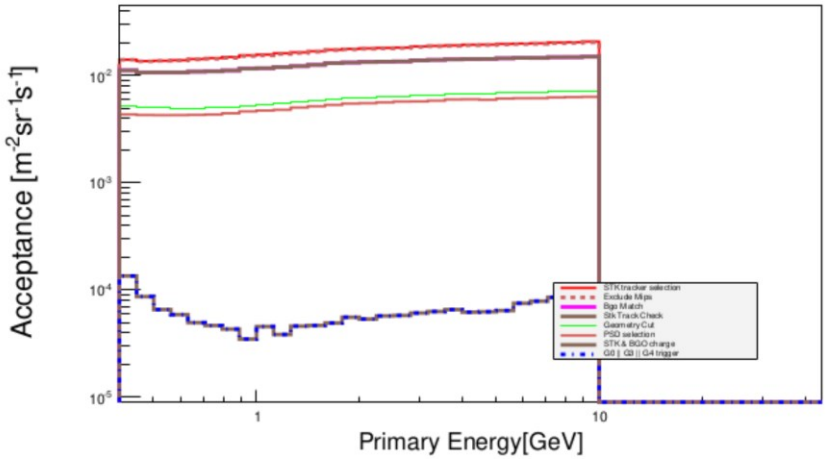
模拟需求

目标本底排除能力 $\frac{\varepsilon p}{\varepsilon pbar} = 1e-6$，
反质子误判率低于百万分之一。

有效训练反质子需要5w，%20留下的效率，剩下一万，需要10亿模拟。



preselection挑选效率0.1%。
Pid cut 20%. 0.02%。反质子的挑选效率是万分之二。



现状

- 模拟10亿，
- 分辨，本底，
- 可能的方法、东西效应、de/dx