Jefferson Lab
Thomas Jefferson National Accelerator Facility

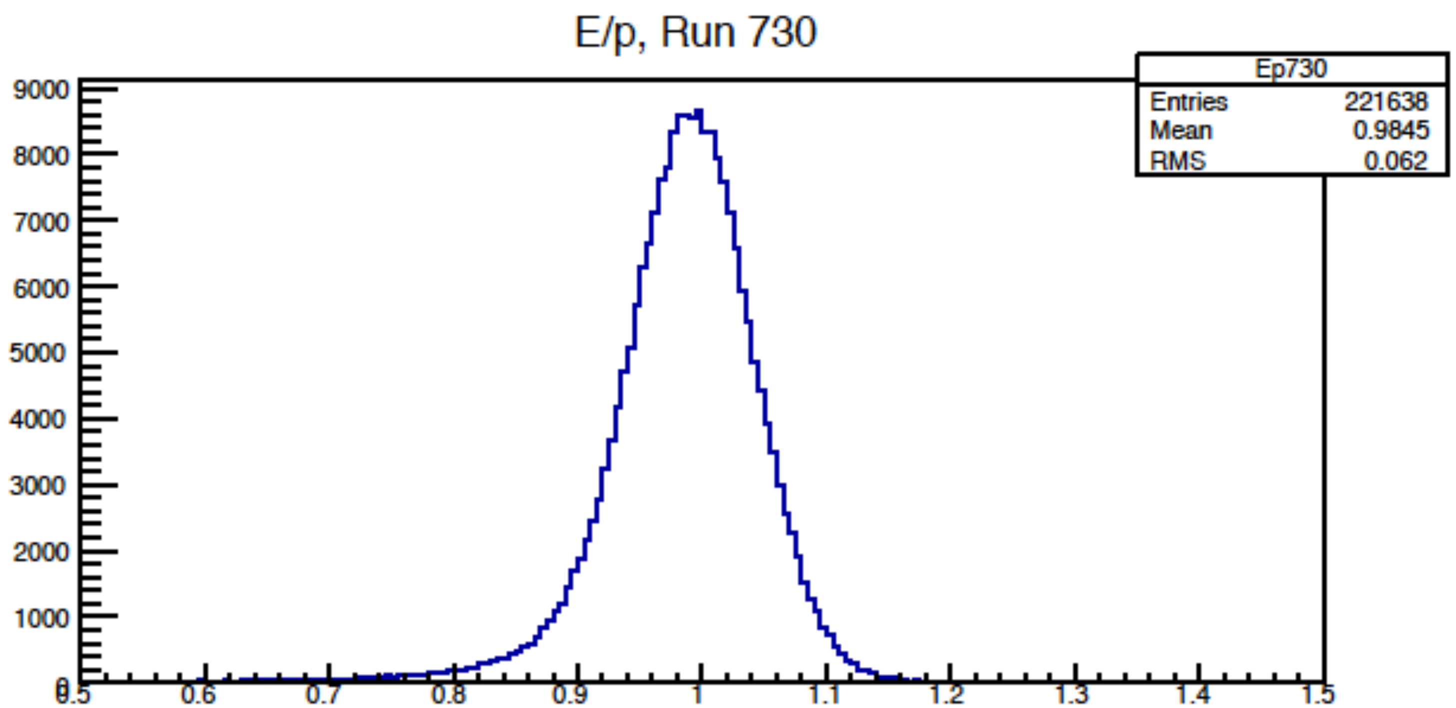
PHYSICS

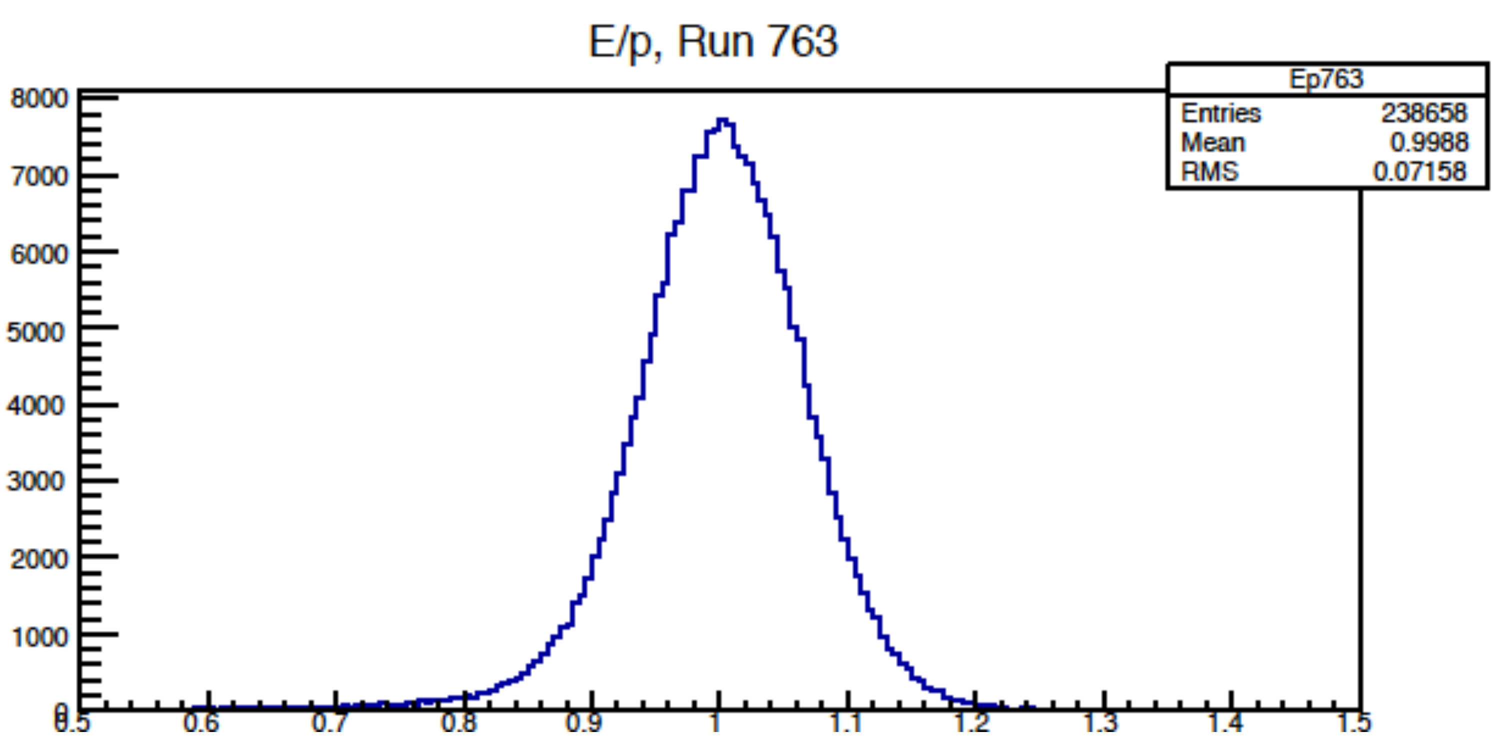
Ar(e,e'p) Analysis Presentation

10/5/2017

Daniel Abrams

Calorimeter Cut Efficiency



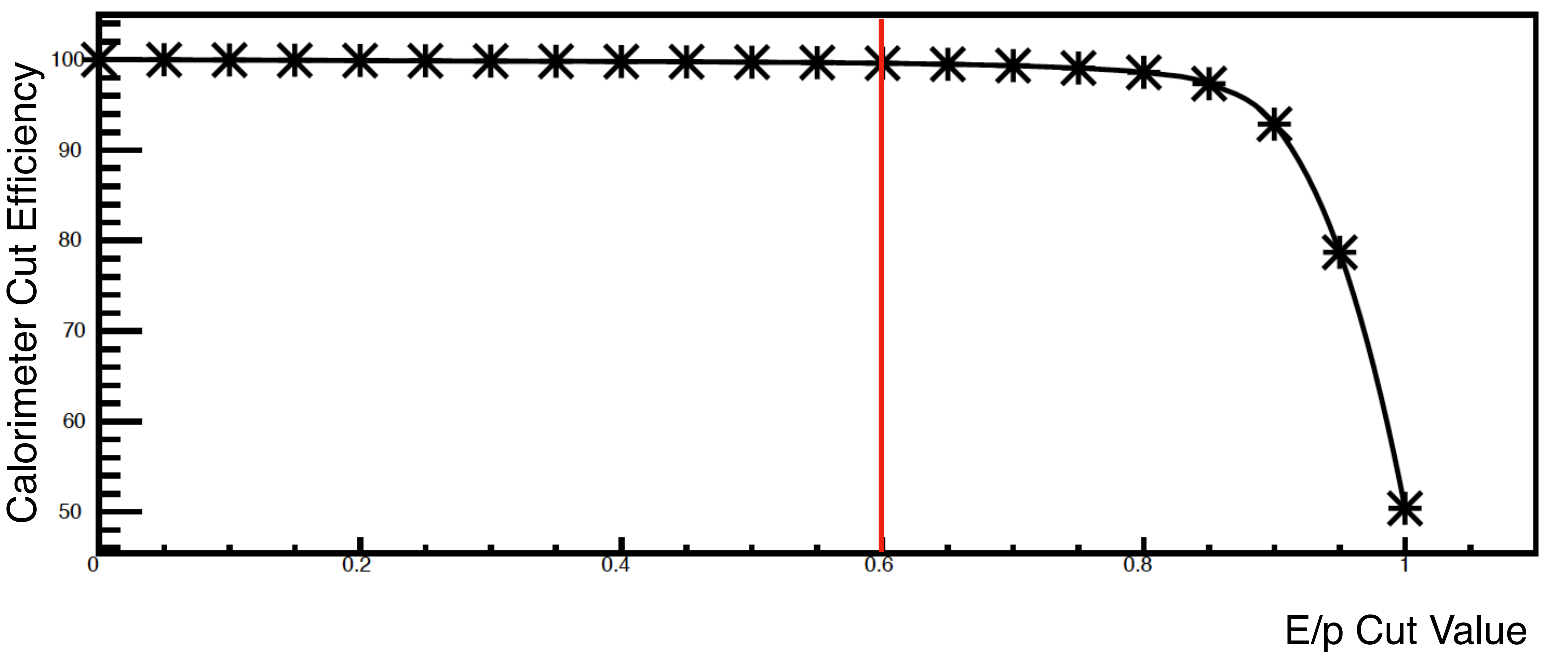


$$\epsilon_{cal} = \frac{N_{survive}}{N_{tot}}$$

Calorimeter Cut Efficiency

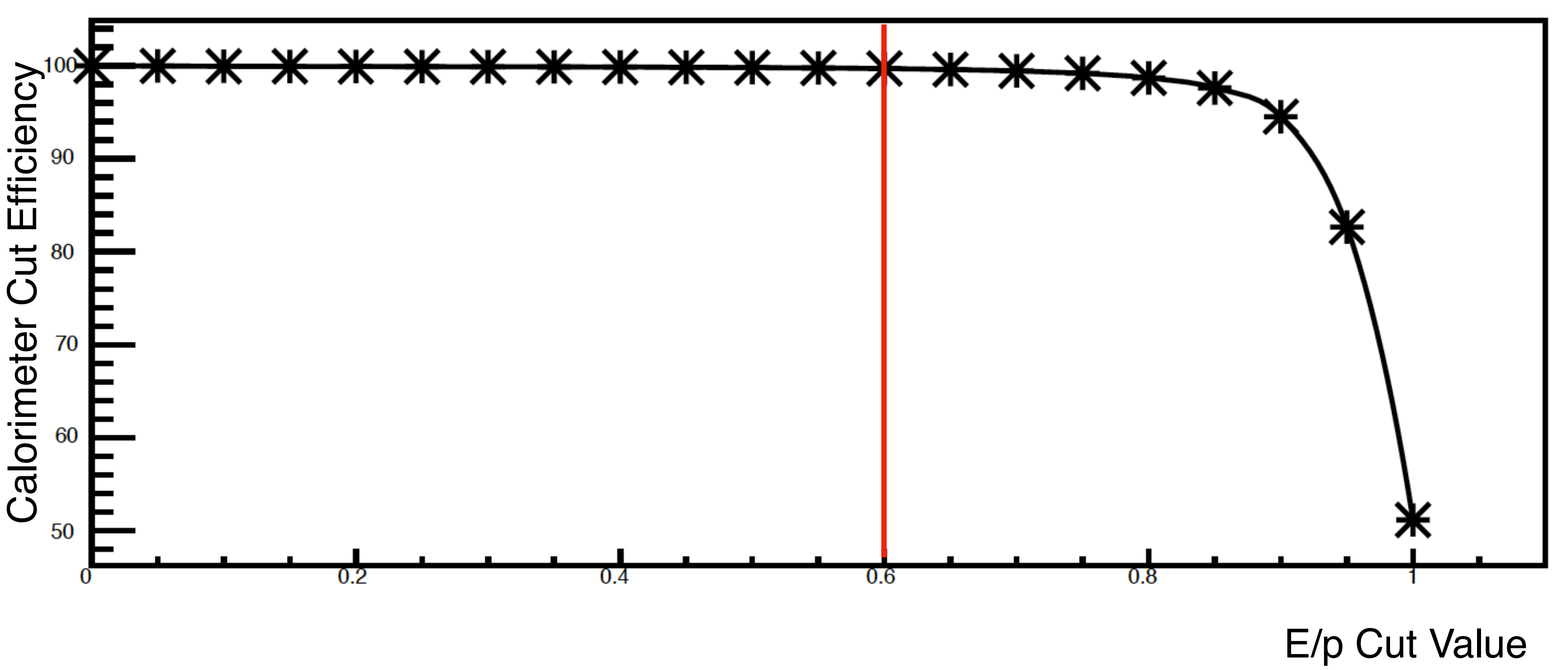
$$\text{Cut:}\quad E/p \geq 0.6$$

Run 763, P_0 = 1.32 GeV



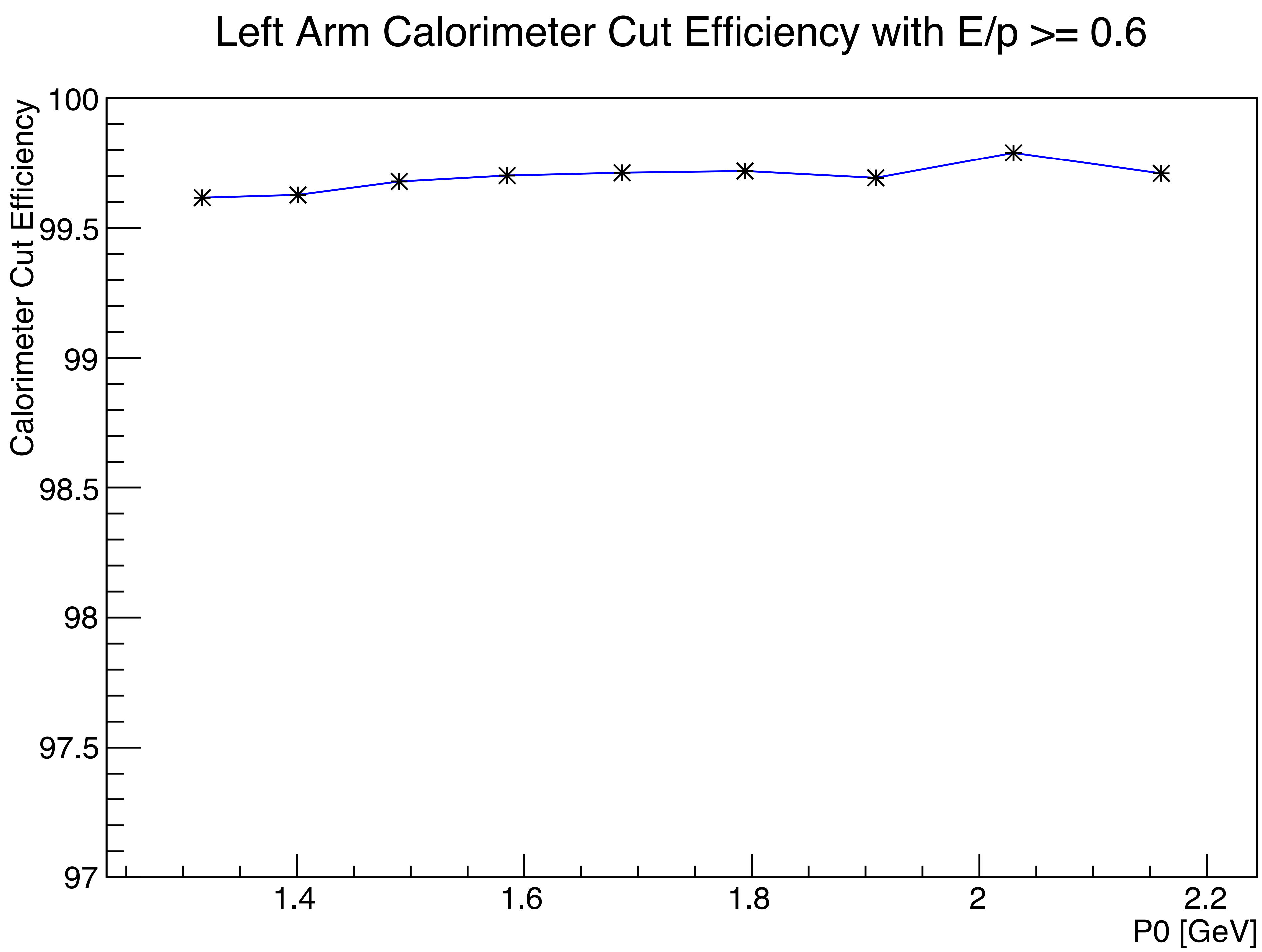
$$\epsilon_{cal} = 99.62\%$$

Run 730, P_0 = 2.16 GeV

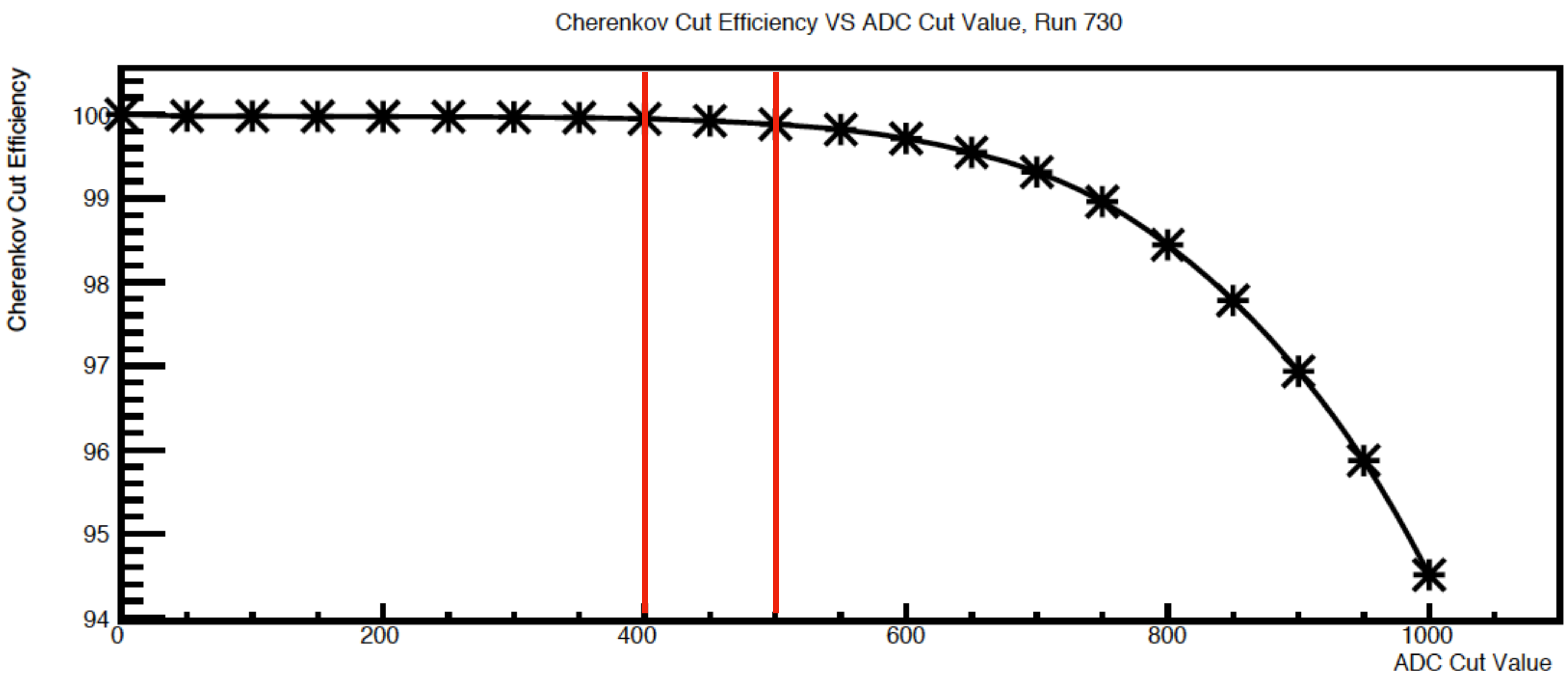


$$\epsilon_{cal} = 99.71\%$$

Calorimeter Cut Efficiency



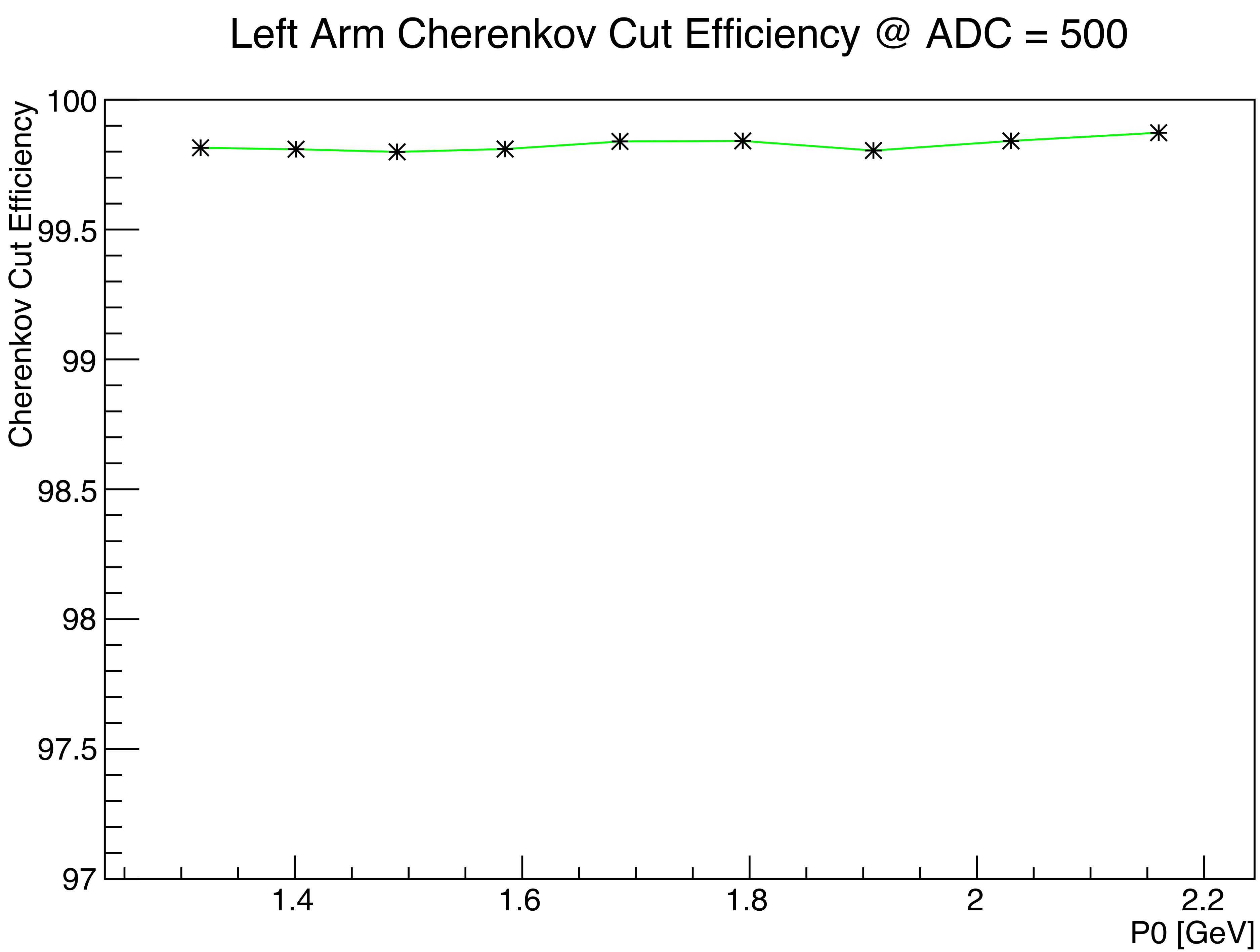
Cherenkov Cut Efficiency



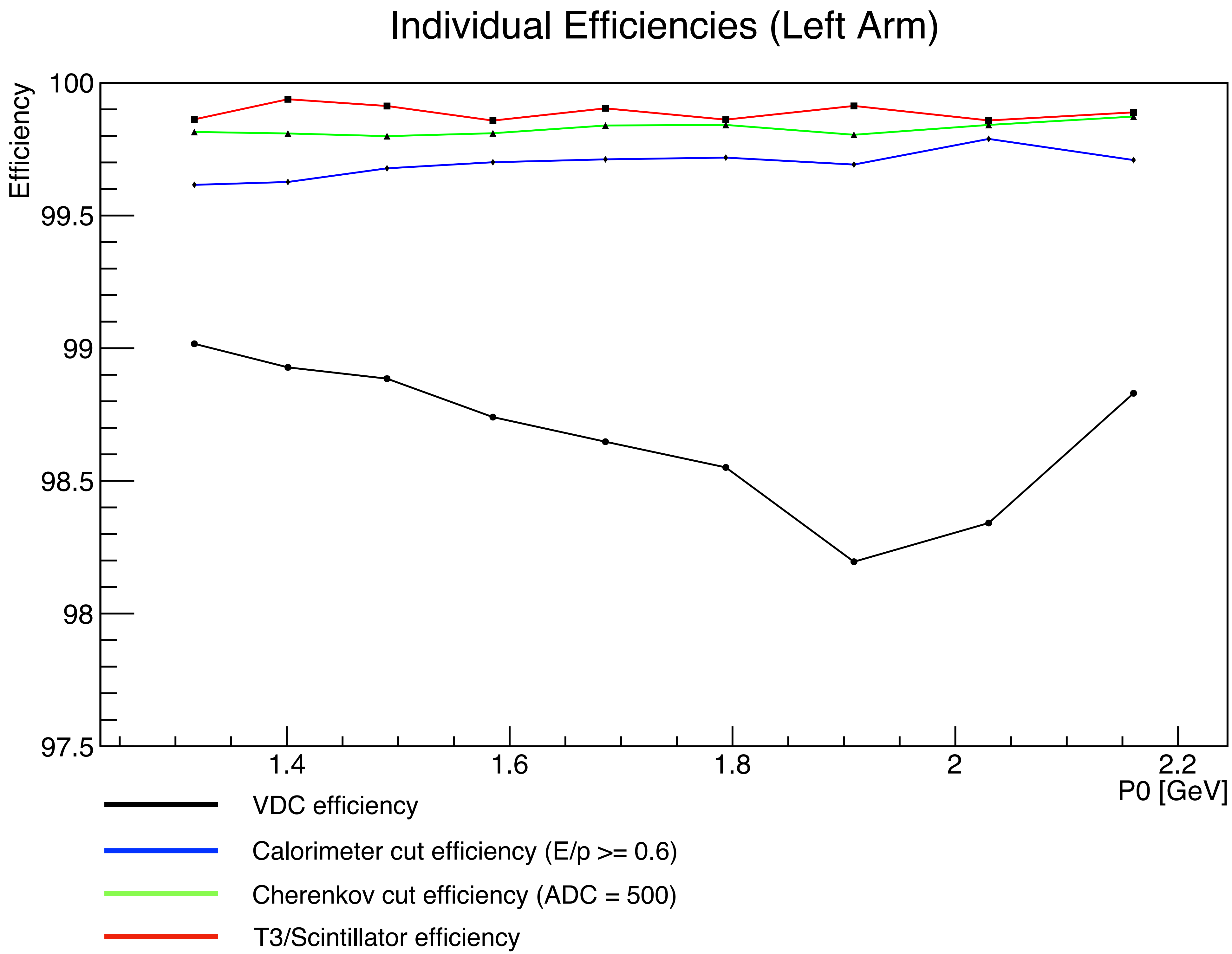
`L.cer.asum_c >= 500` $\Longrightarrow$ $\epsilon_{cer} = 99.88\%$

`L.cer.asum_c >= 400` $\Longrightarrow$ $\epsilon_{cer} = 99.95\%$

Cherenkov Cut Efficiency

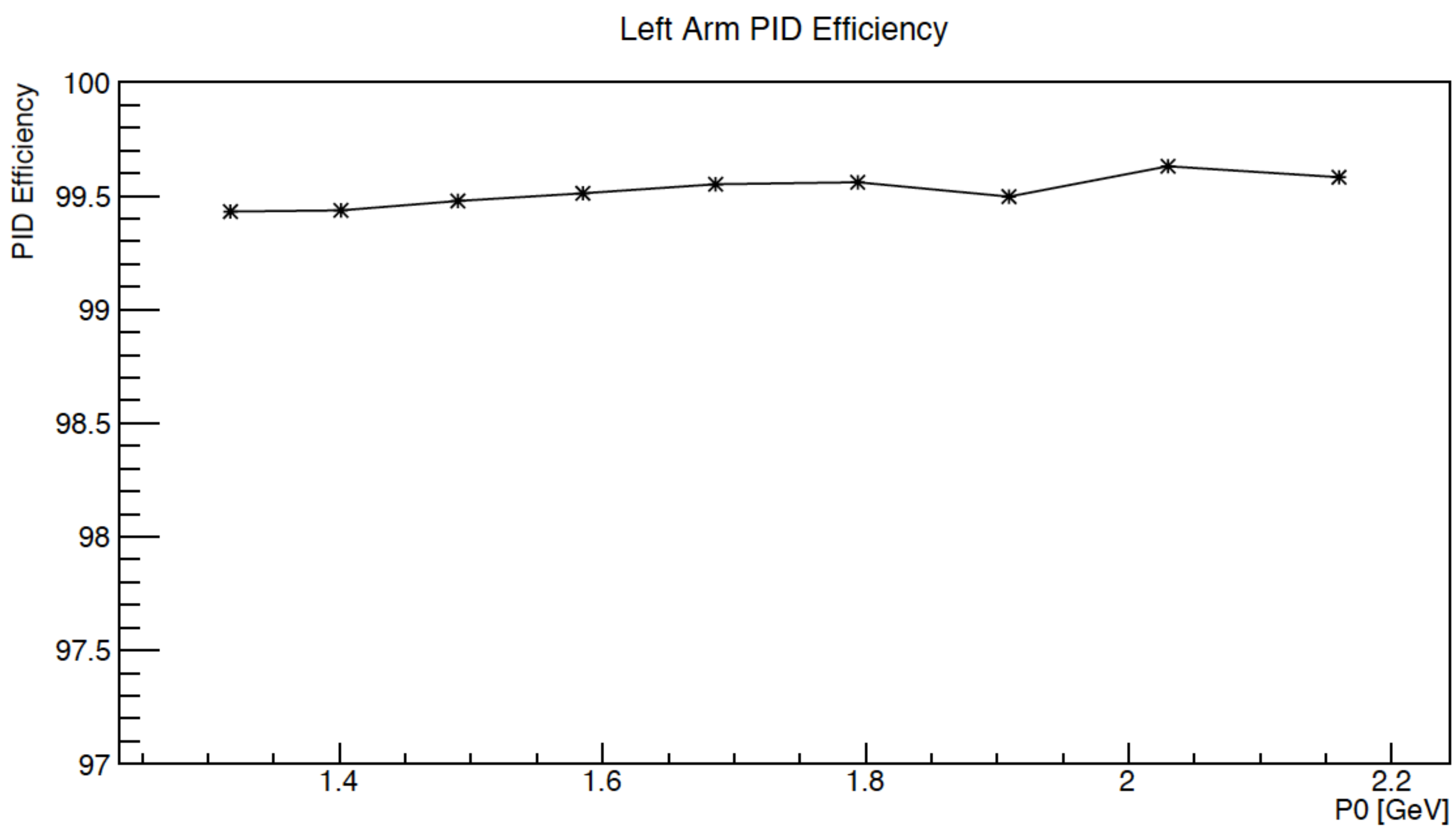


Efficiency Plot



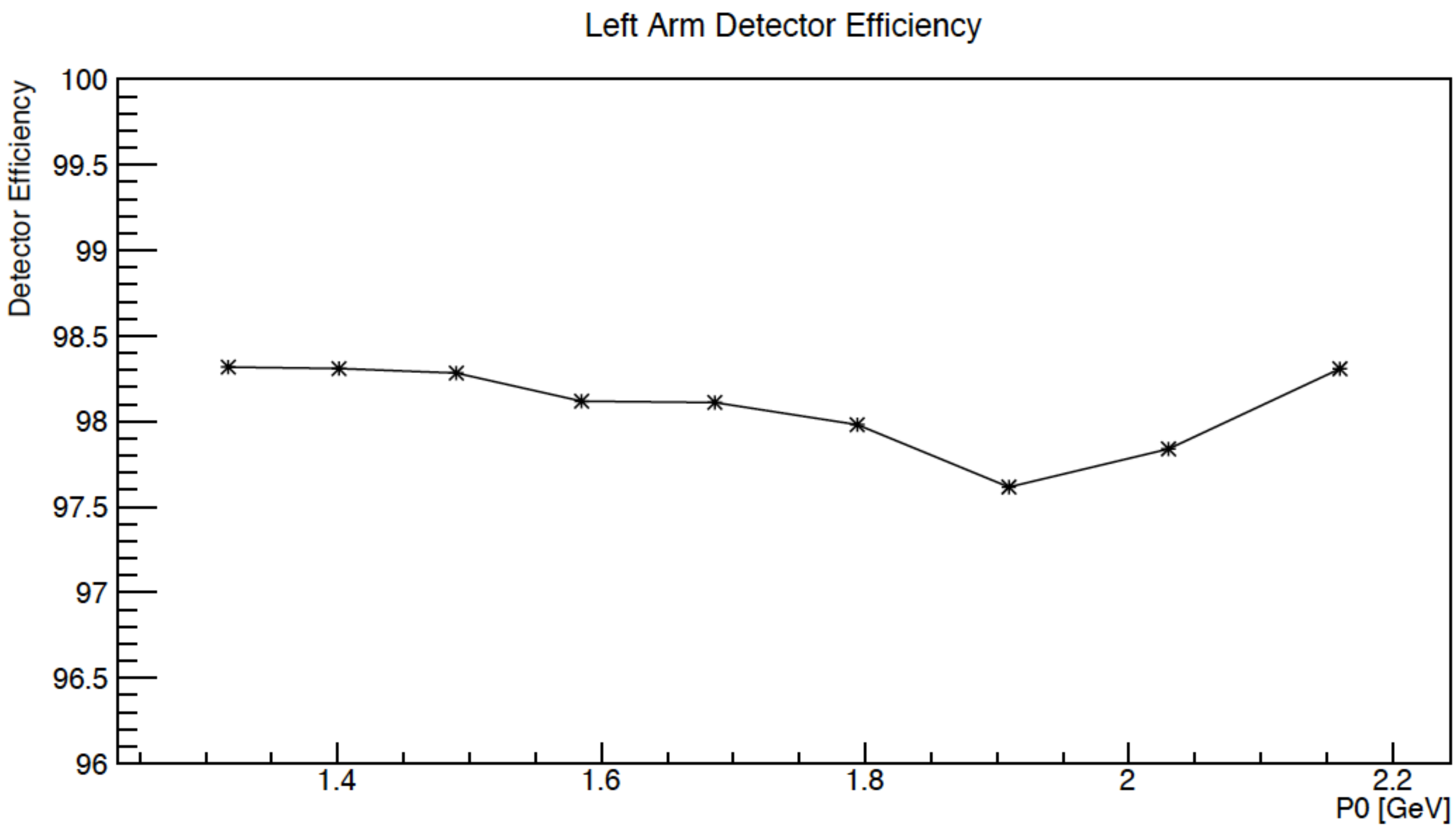
PID Efficiency

Particle identification efficiency: $\epsilon_{PID} = \epsilon_{cer}\epsilon_{cal}$



Detector Efficiency

Detector efficiency: $\epsilon_{det} = \epsilon_{car}\epsilon_{cal}\epsilon_{VDC}\epsilon_{T}$



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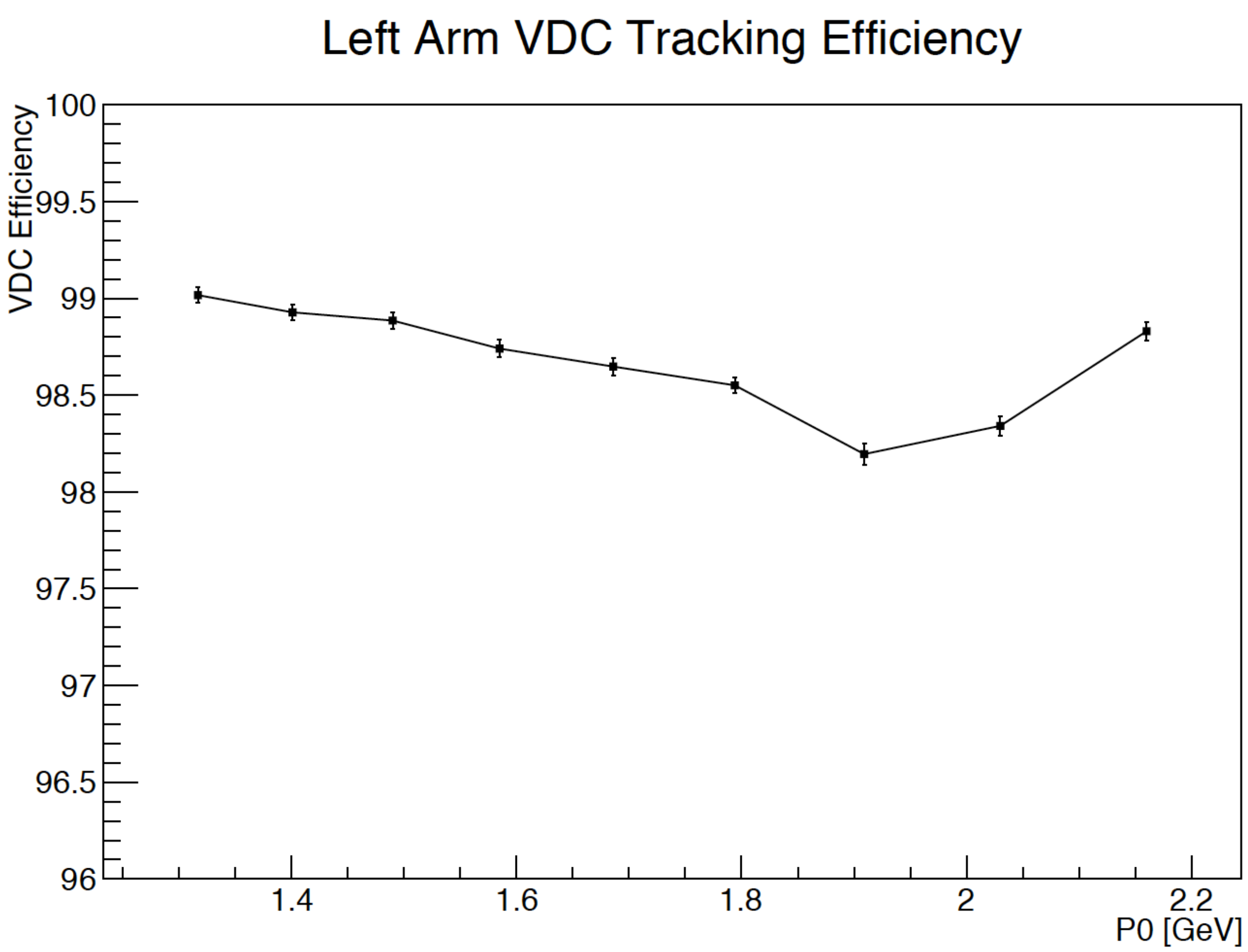
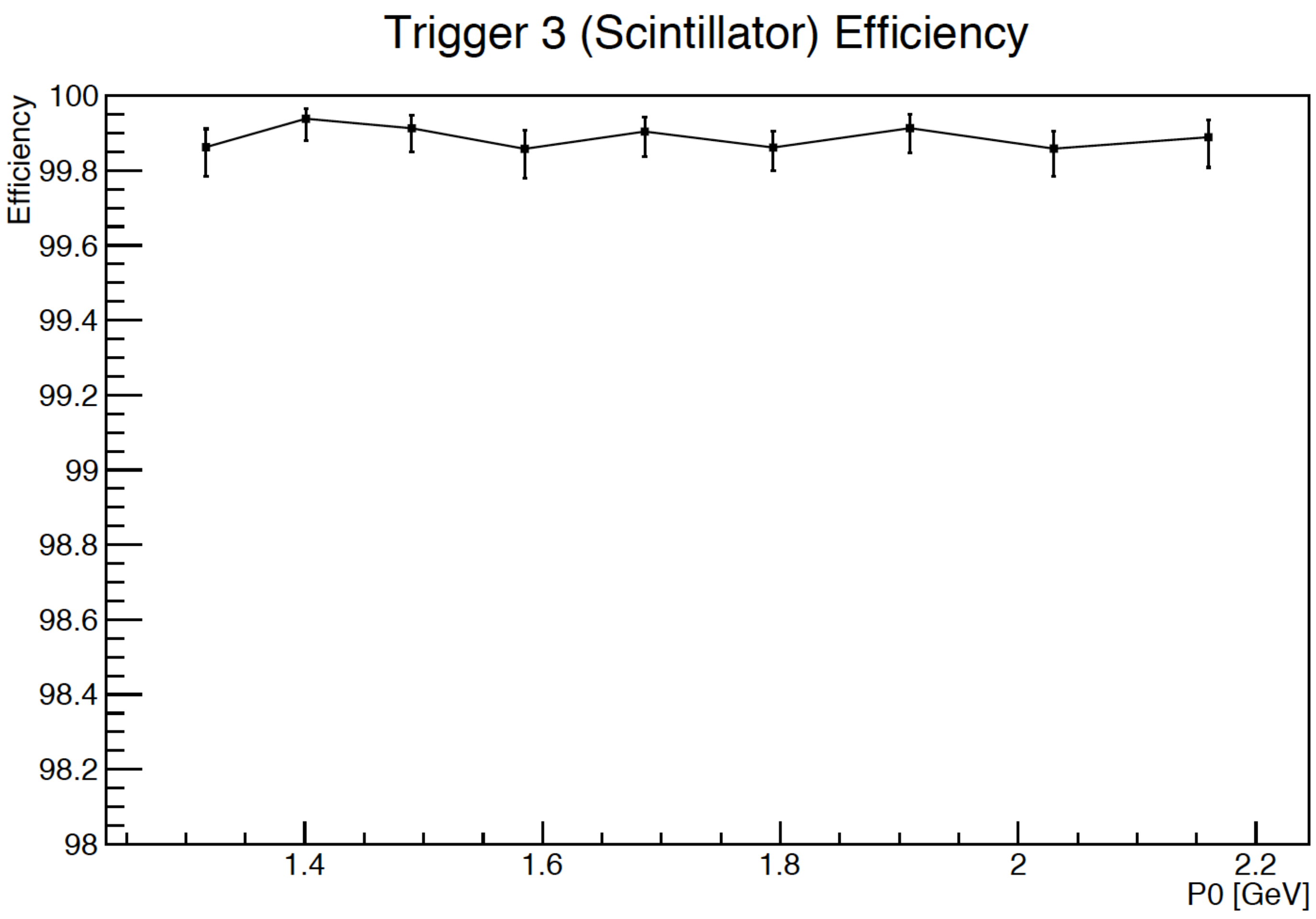
Error/Uncertainty Analysis



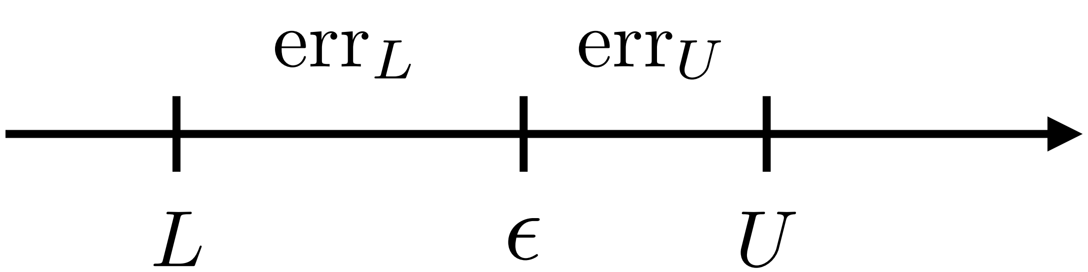


Error/Uncertainty Analysis

For Bernoulli trial type events, *i.e.* statistically independent events with only two possible outcomes (success and failure), we can use a proportion confidence interval, such as the Wilson interval:

$$\frac{1}{n+z^2}\left[n_S + \frac{z^2}{2} \pm z\sqrt{\frac{n_S n_F}{n} + \frac{z^2}{4}}\right]$$

where n is the number of trials with n_S successes and $n_F = n - n_S$ failures. The number z is the quantile, and $z = 1.96$ for a 95% confidence interval. Let U be the upper bound of the interval (the + solution) and L be the lower bound (the - solution). Thus, the Wilson interval is of the form (L,U).



$$\epsilon \in (L, U) \qquad \text{err}L \neq \text{err}_U$$

$$L + \text{err}_L = \epsilon \implies \text{err}_L = \epsilon - L$$

$$\epsilon + \text{err}_U = U \implies \text{err}_U = U - \epsilon$$

$$\implies \text{eff} = \epsilon\,{}^{+\,\text{err}_U}_{-\,\text{err}_L}$$

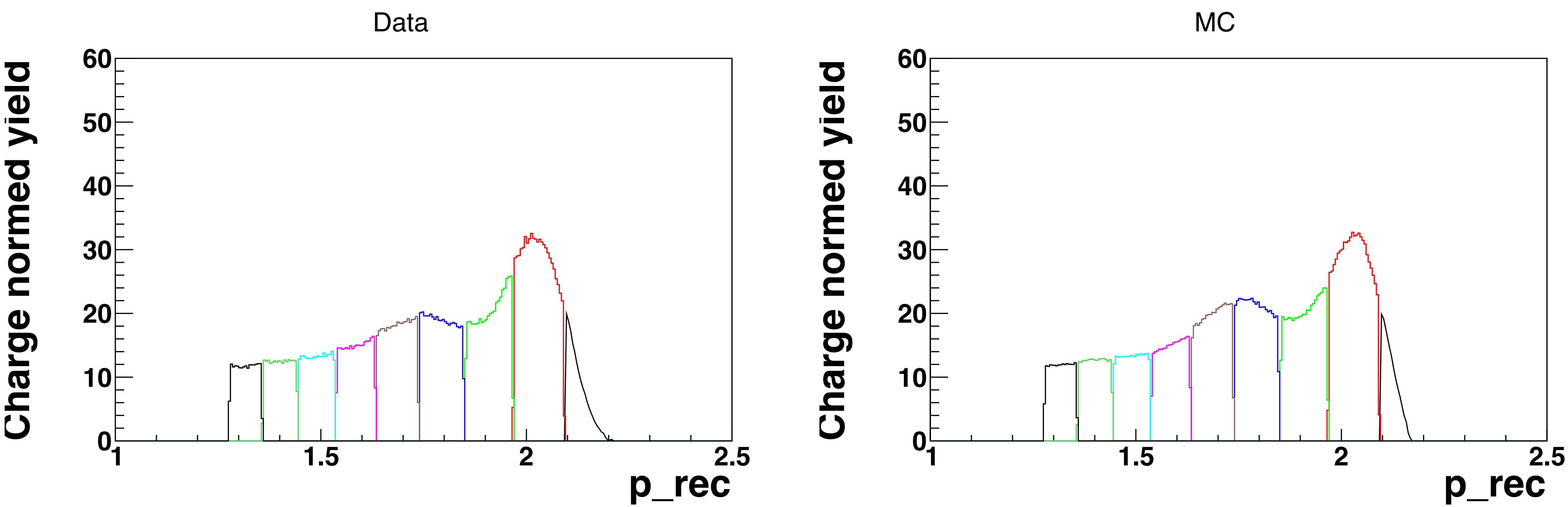
Error/Uncertainty Analysis

Main questions:

- How to propagate asymmetrical uncertainty?
- How to we calculate uncertainty for non-Bernoulli trial type events?

Yield Calculations

Reproduced results of C yield using `compare_yield.C` code



Yield Calculations