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PHYSICS

Ar (e,$e'p$) Analysis Meeting

Detector Efficiency Analysis
Results & Questions

Dan Abrams

8/10/2017

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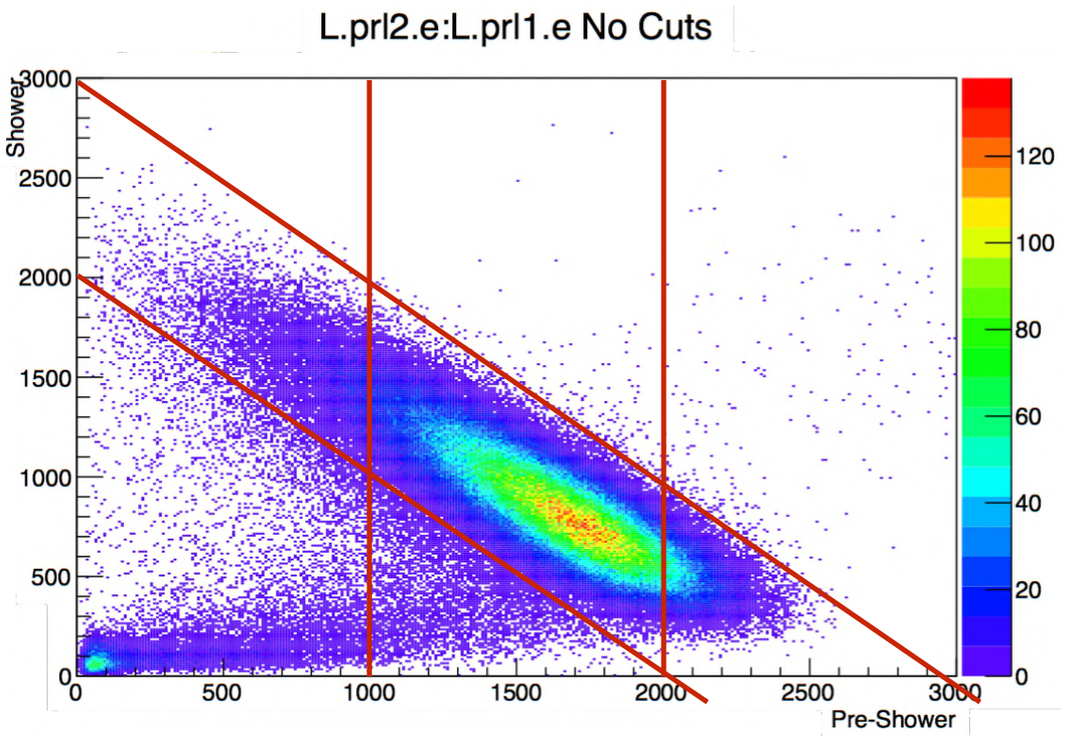
PHYSICS

Cherenkov Cut Efficiency



Acceptance Cuts:

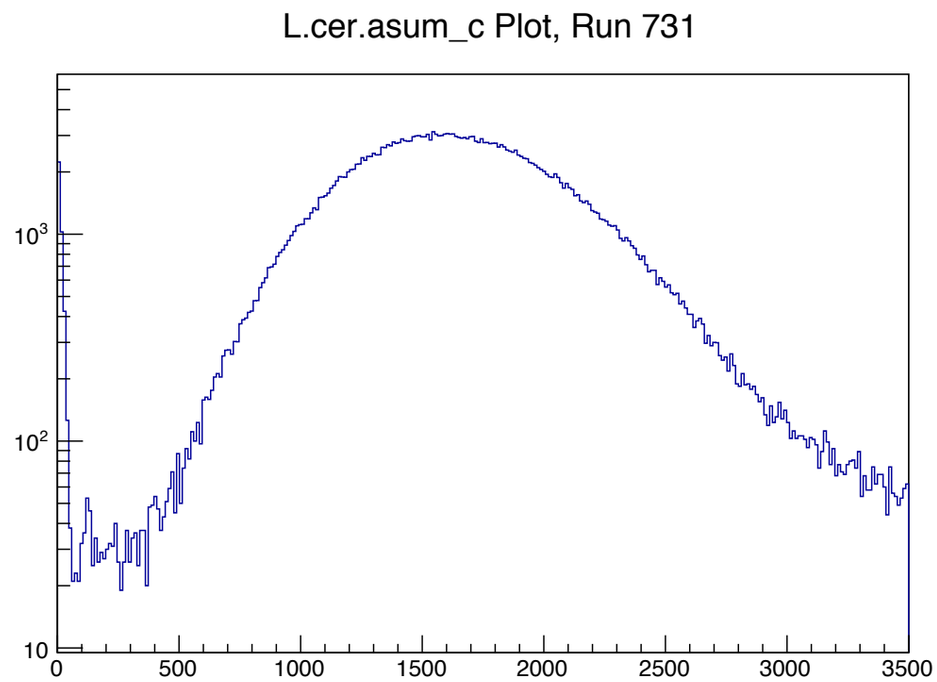
- `abs(L.tr.tg_th)<=0.07`
- `abs(L.tr.tg_ph)<=0.04`
- `abs(L.tr.tg_dp)<=0.04`

Tracking Cut: `L.tr.n==1`

$N_{e,tot}$ = Number of electrons within box

Cherenkov Cut: `L.cer.asum_c` >= #

$N_{e,cut}$ = Number of electrons that survive Cherenkov Cut



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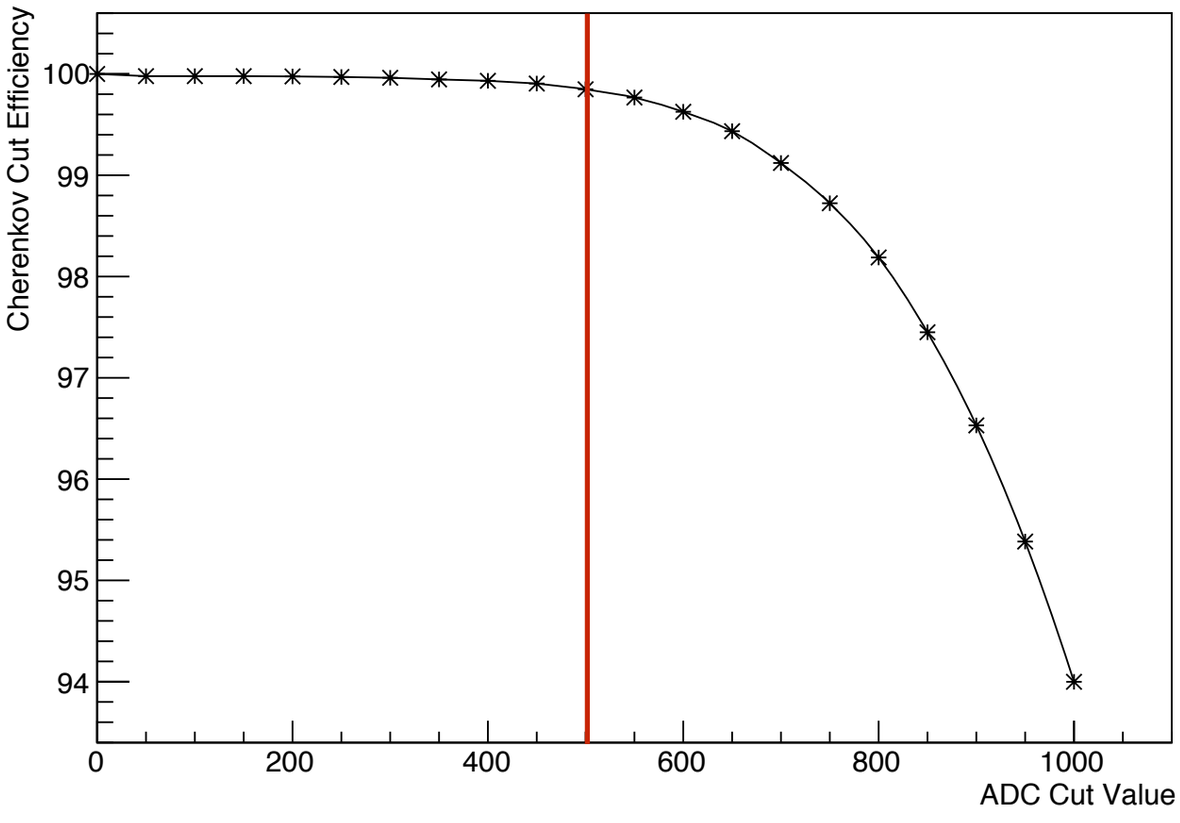
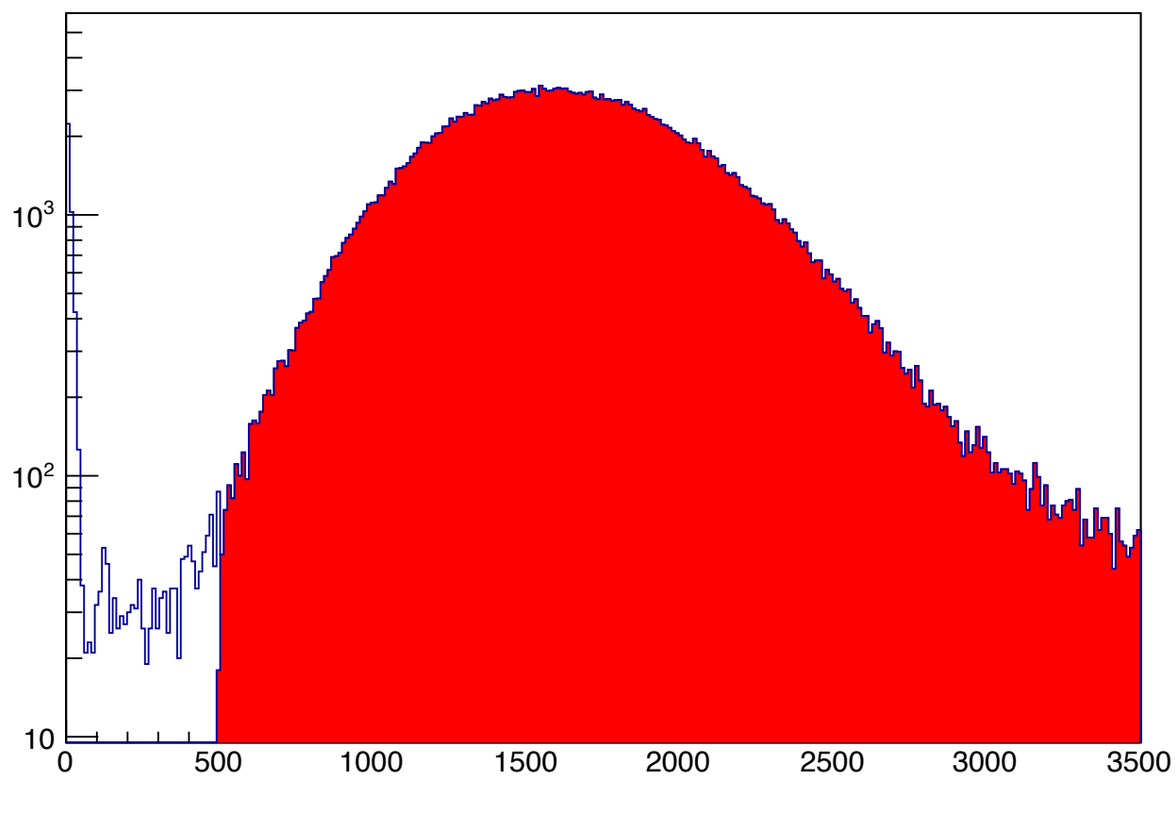
Cherenkov Cut Efficiency

Electron Retention Efficiency: $\epsilon_e = \dfrac{N_{e,cut}}{N_{e,tot}}$

Cherenkov Cut Efficiency VS ADC Cut Value, Run 731



L.cer.asum_c Plot, Run 731



Most effective Cherenkov cut: `L.cer.asum_c >= 500`

$$\Longrightarrow \quad \epsilon_e = 99.85\%$$

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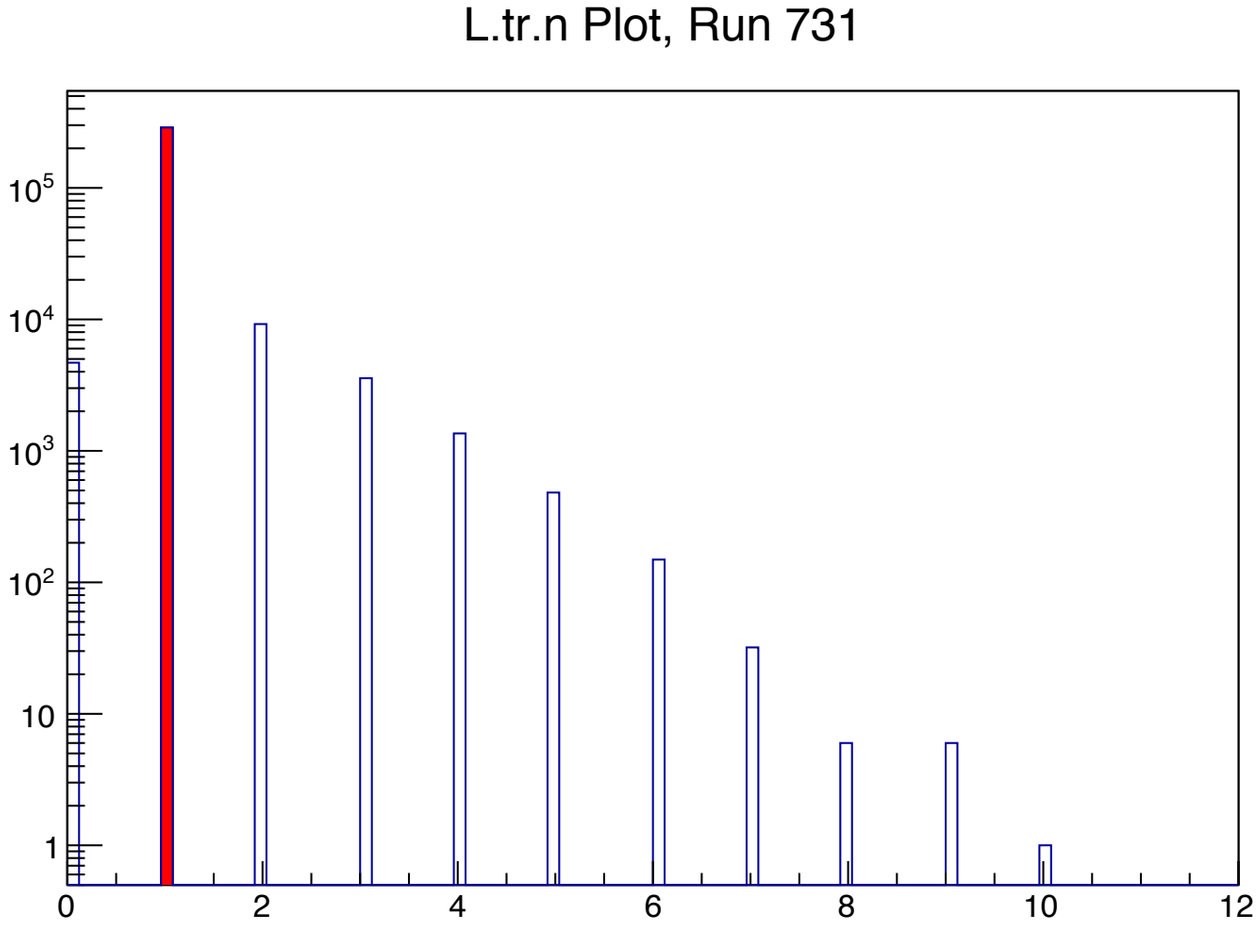
VDC Tracking Efficiency



Acceptance Cuts:

- `abs(L.tr.tg_th)<=0.07`
- `abs(L.tr.tg_ph)<=0.04`
- `abs(L.tr.tg_dp)<=0.04`

Trigger Cut: `T3`

Cherenkov Cut:

`L.cer.asum_c>=500`

Count the total number of events: N_{tot}

Count the number of single-track events: N_{st}

(`L.tr.n==1`)

VDC Tracking Efficiency:

$$\epsilon = \frac{N_{st}}{N_{tot}}$$

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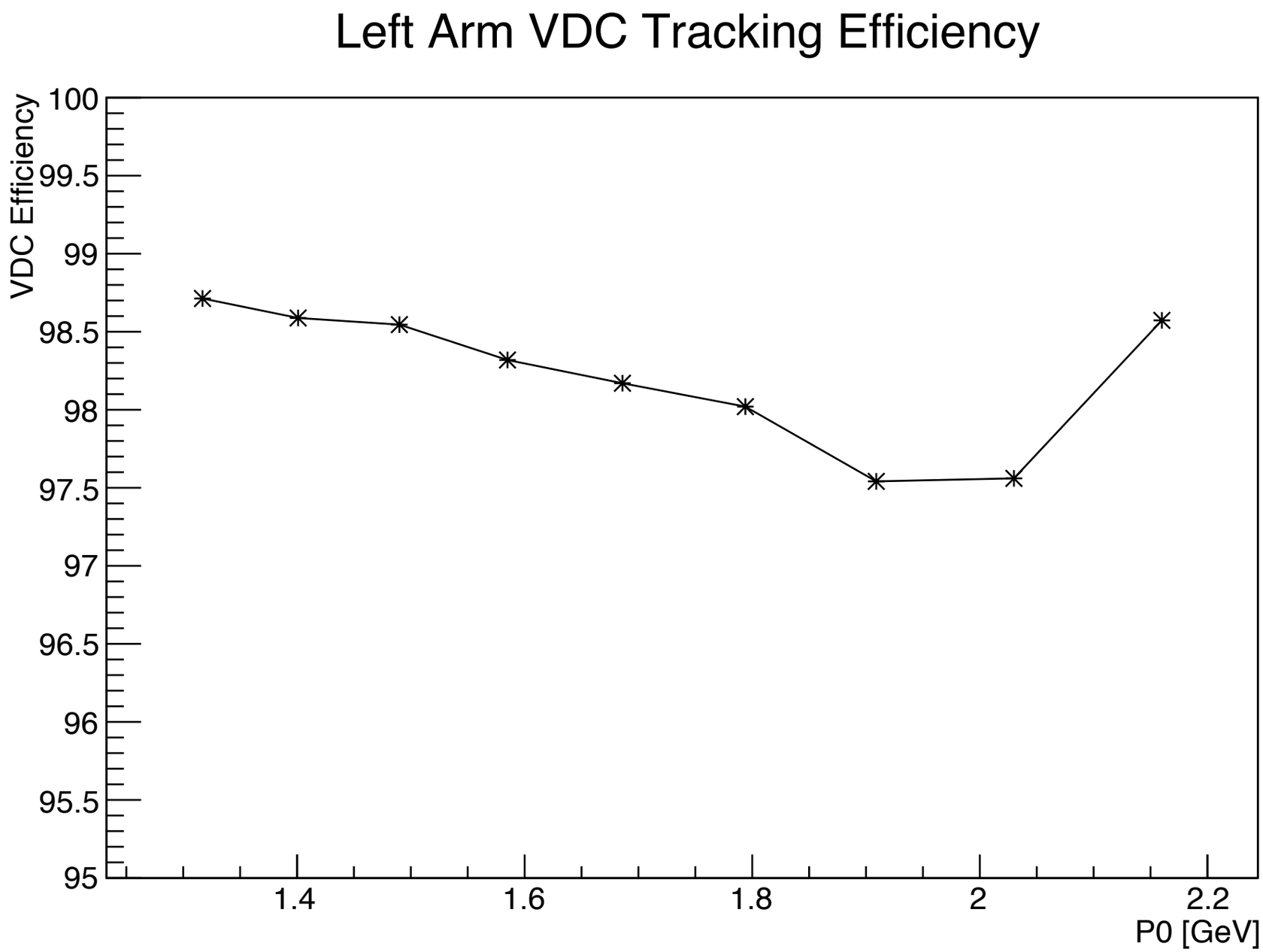
VDC Tracking Efficiency

$$\epsilon = \frac{N_{st}}{N_{tot}}$$

δ-scan runs:

Run	P0 [GeV]
730	2.16
731	2.03
739	1.91
740	1.80
747	1.69
748	1.59
755	1.49
756	1.40
763	1.32



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VDC Tracking Efficiency

How to calculate N_{st} and N_{tot} ?

Difference between number of events and number of particles?

`BaseCut` = Acceptance Cuts & Cherenkov Cut & T3 trigger cut

`ncut:  L.tr.n==1`

```
Ntot = T->Draw("L.tr.n",BaseCut)

Nst = T->Draw("L.tr.n",BaseCut&&ncut)

Ntot = T->GetEntries(BaseCut)

Nst = T->GetEntries(BaseCut&&ncut)
```

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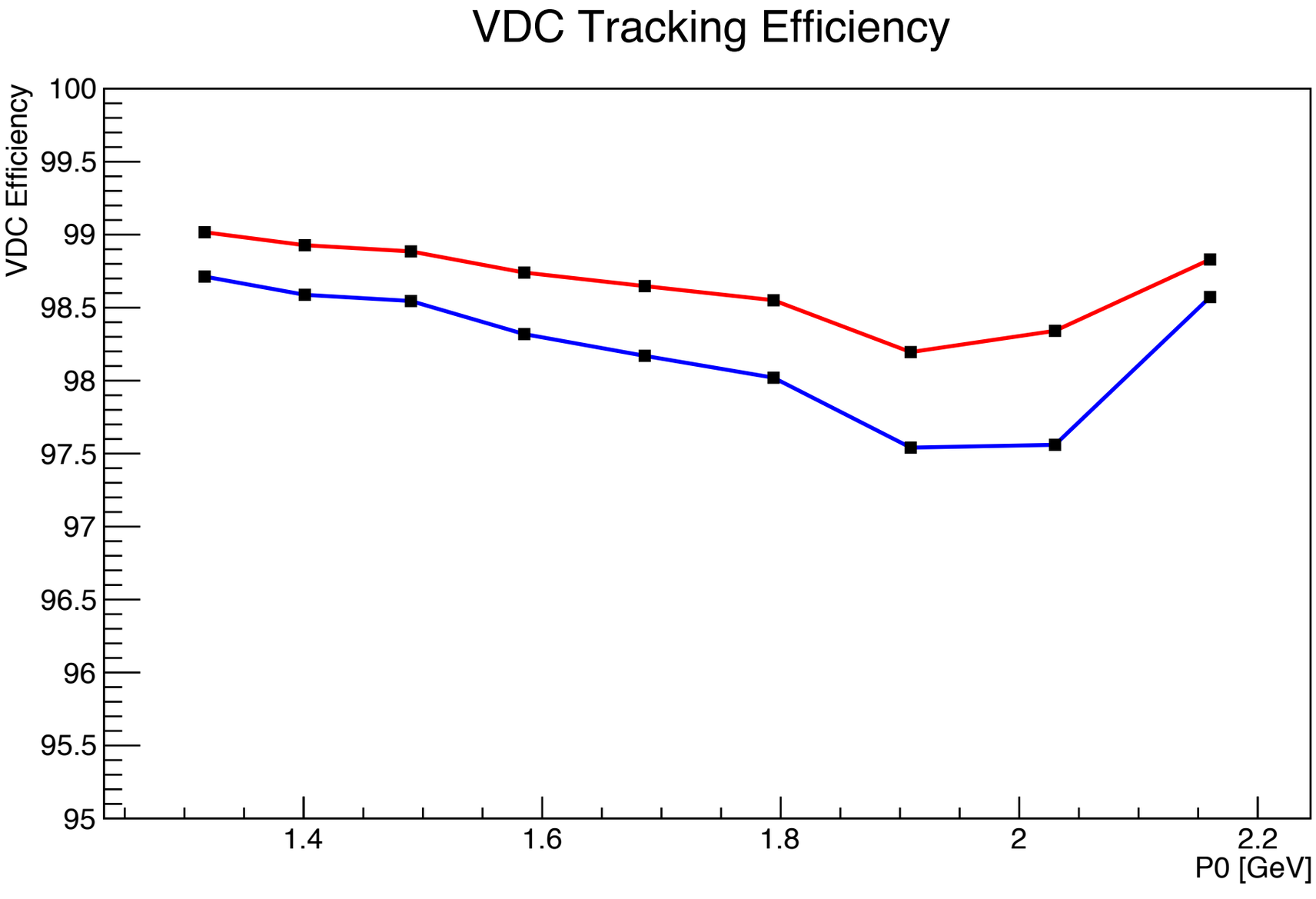
VDC Tracking Efficiency

Comparing results from 2 methods:



Red: `GetEntries` method
Blue: `Draw` method

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Trigger (Scintillator) Efficiency

Main Trigger: `T3 = (S0&&S2)&&(GC||PR)`

Efficiency Trigger: `T5 = (S0||S2)&&(GC||PR)`

How to define the efficiency?

$$\epsilon_{\text{trig}} = \frac{T_{\text{main}}}{T_{\text{main}} + T_{\text{eff}}}$$

$$\epsilon_{\text{trig}} = \frac{T^3_{corr}}{T^5_{corr}} \qquad T^i_{corr} = \frac{T_i ps_i}{1 - DT_i}$$

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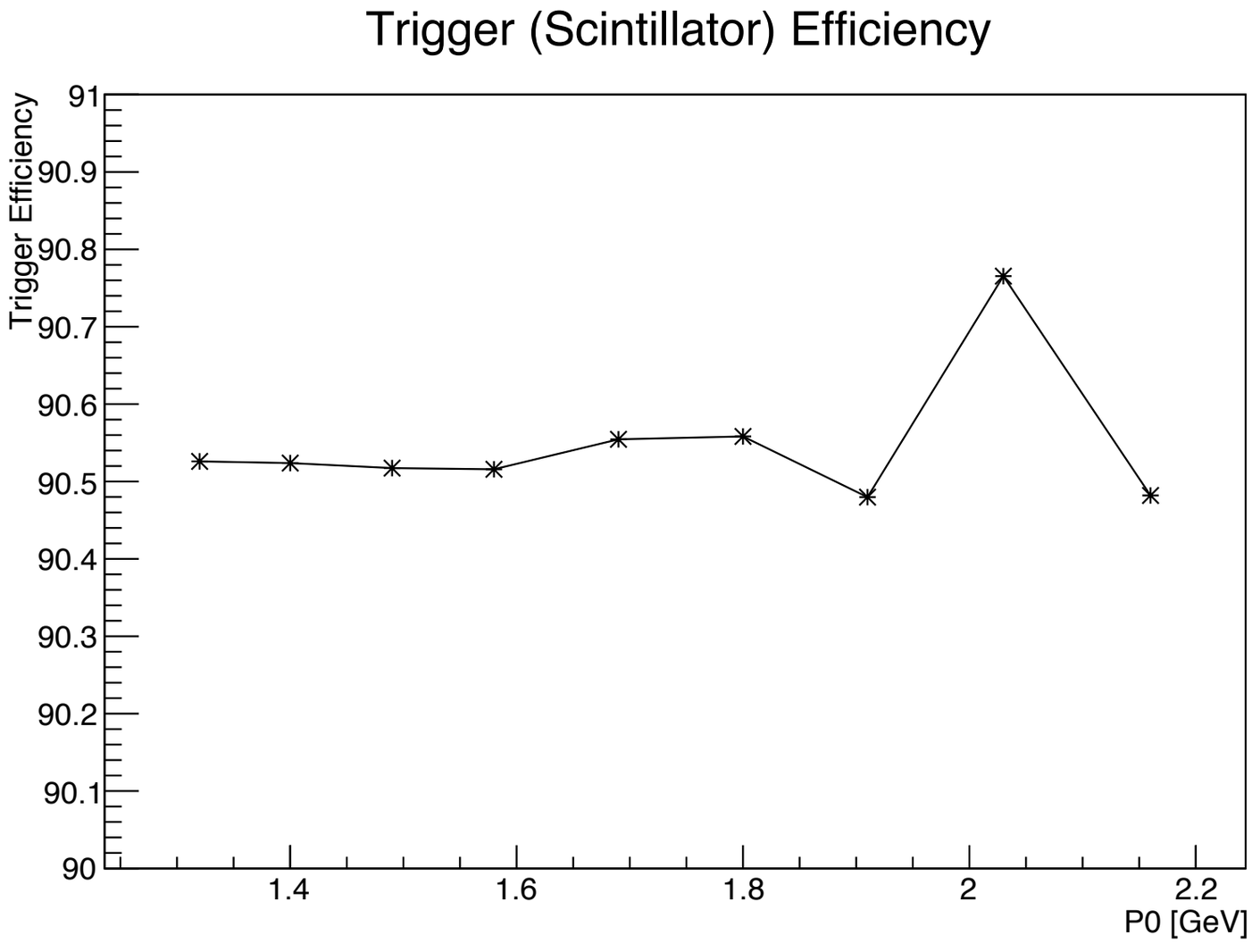
Trigger (Scintillator) Efficiency



$$\epsilon_{\text{trig}} = \frac{T_{\text{main}}}{T_{\text{main}} + T_{\text{eff}}}$$

T_{X} are the “PRES” pre-scaled trigger totals from the End_of_Run reports in Logbook

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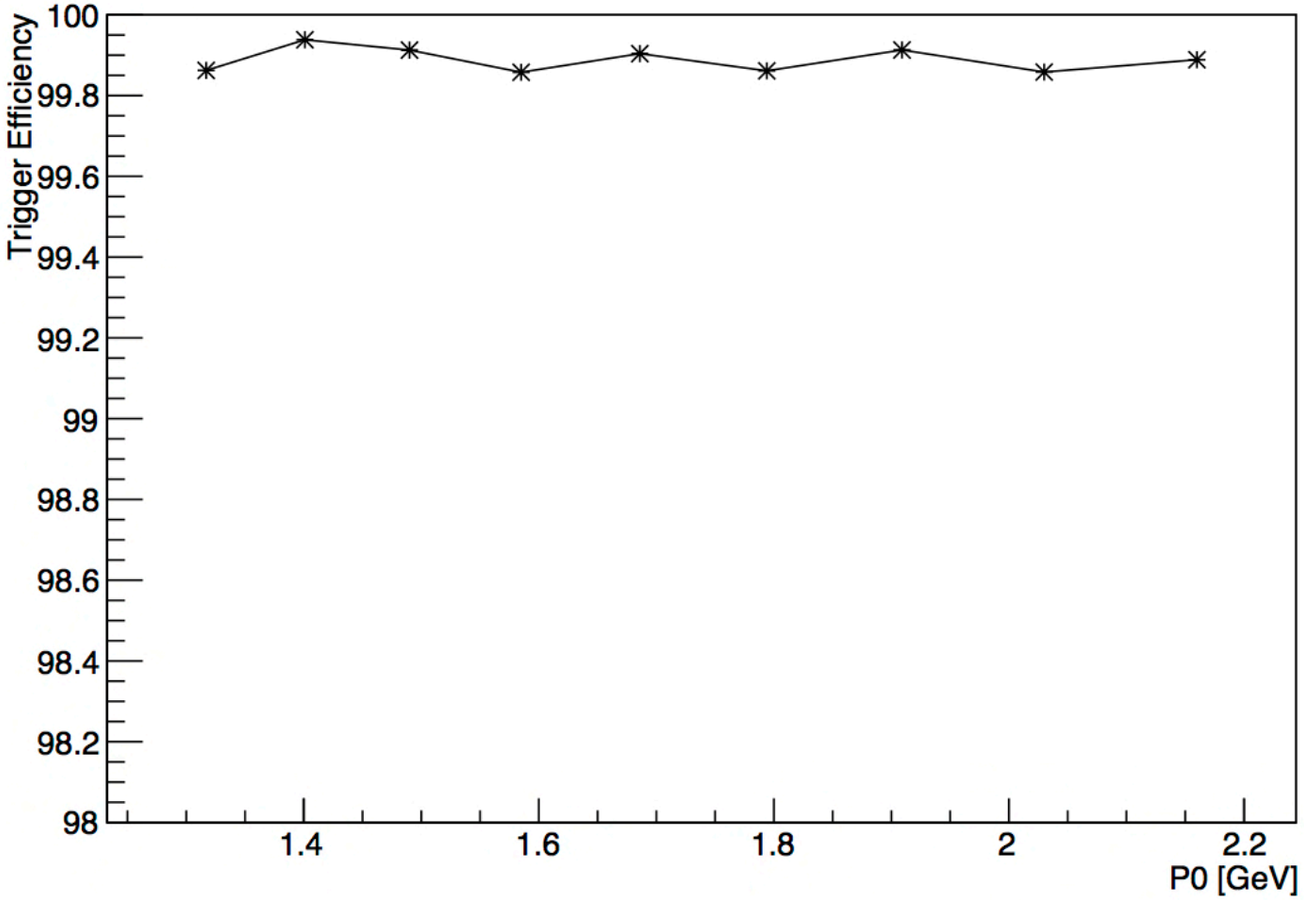
Trigger (Scintillator) Efficiency



$$\epsilon_{\text{trig}} = \frac{\texttt{T->GetEntries(cut2)}}{\texttt{T->GetEntries(cut1)}}$$

cut1:
- Acceptance Cuts
- Cherenkov Cut
- Tracking Cut
- T5 cut

cut2:
- cut1
- S0 TDC cut
- S2 TDC cut

S0 TDC cut = “L.s0.lt > 100 && L.s0.rt > 100”

S2 TDC cut = (L.s2.lt[0]>100 && L.s2.rt[0]>100)||(L.s2.lt[1]>100 && L.s2.rt[1]>100)||...

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Calorimeter Calibration Method

Shower Detector
- Pre-Shower
- Shower

VS

Pion Rejector
- `L.prl1.e`
- `L.prl2.e`

Chi Squared minimization:

$$\chi^2 = \sum_{i=1}^{N} \left[\sum_{j \in M_{ps}^i} C_j (ADC_j^i - Ped_j) + \sum_{k \in M_{sh}^i} C_k (ADC_k^i - Ped_k) - P_{kin}^i \right]^2$$

Using cosmic runs, align minimum ionization peak of each ADC spectrum to common channel number.

$$C_i = \frac{100}{(ADC_i^{muon} - ADC_i^{ped})}$$

$$C_i^{real} = C_i \times \frac{1}{M_{E/p}}$$

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