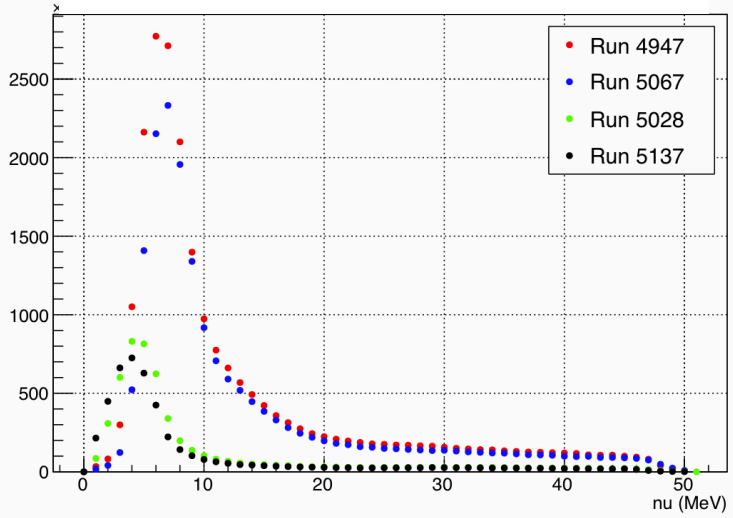
Packing Fraction

M. Cummings

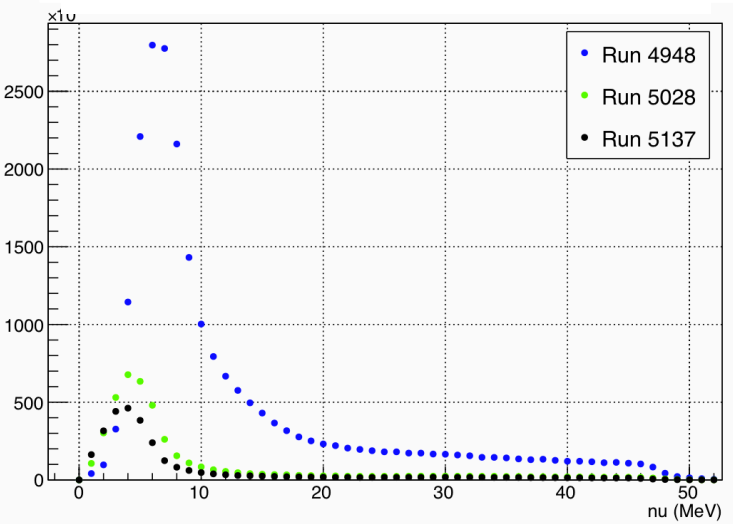
4/29/15

1.1 GeV, 2.5T, Transverse

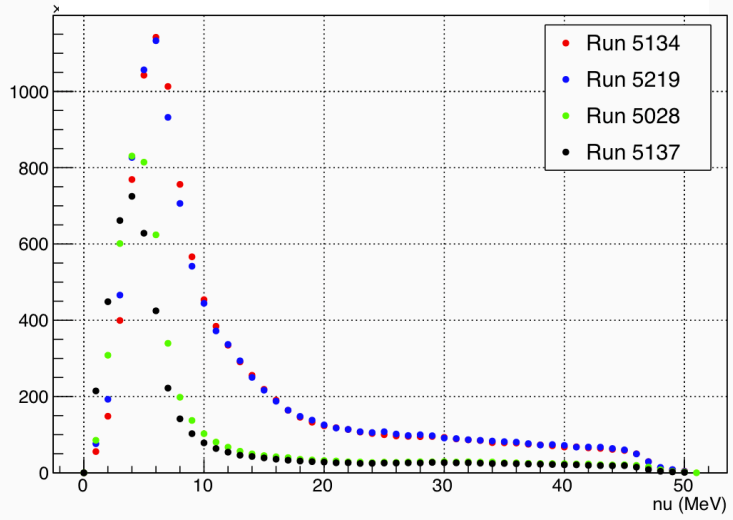
Material 11



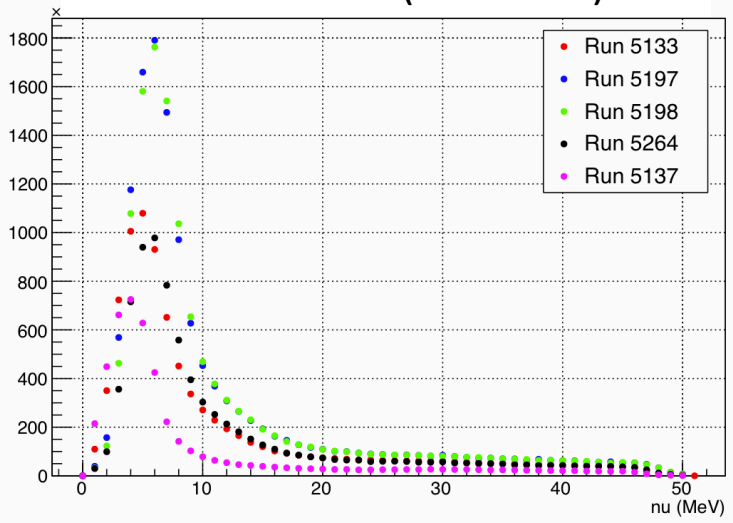
Material 12



Material 13

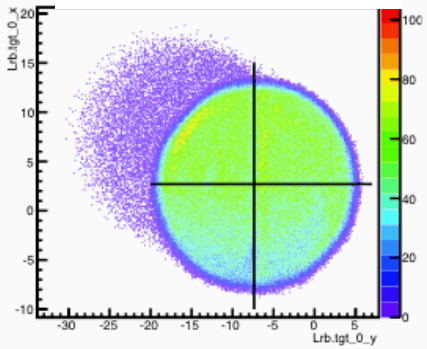


Material 14 (short cell)

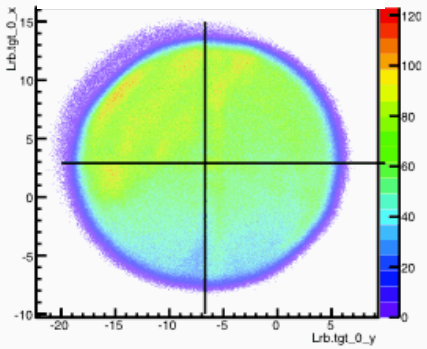


1.1 GeV, 2.5T, Transverse

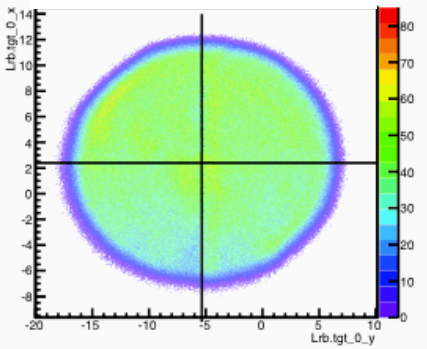
Run 4946– mat 11



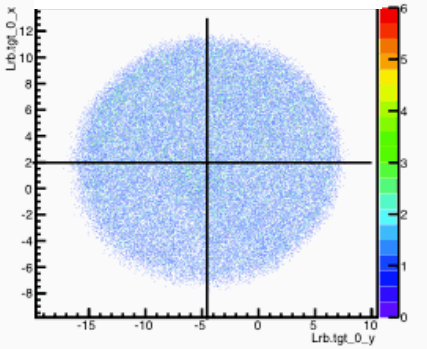
Run 4949– mat 12



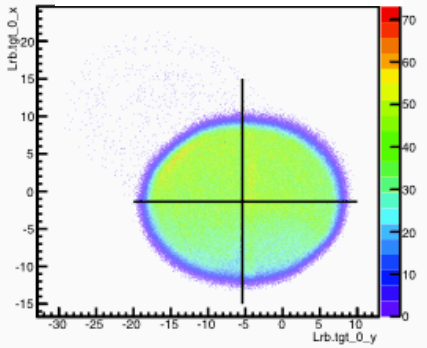
Run 5066– mat 11



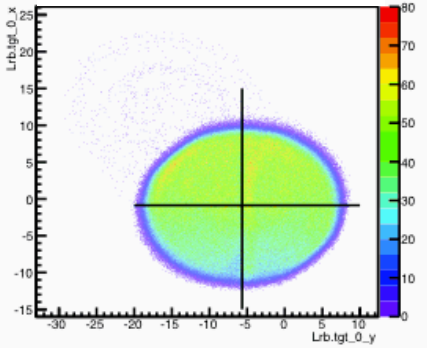
Run 5069– mat 11



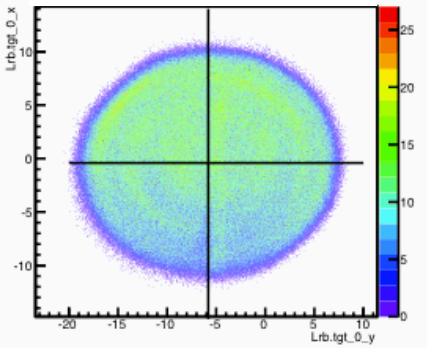
Run 5133– mat 11



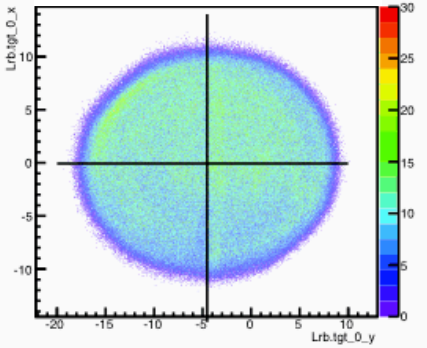
Run 5134– mat 12



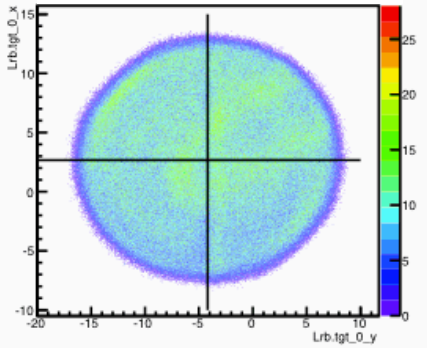
Run 5219– mat 11



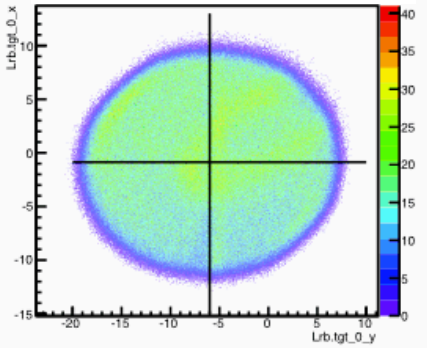
Run 5264– mat 11



Run 5028 – dummy

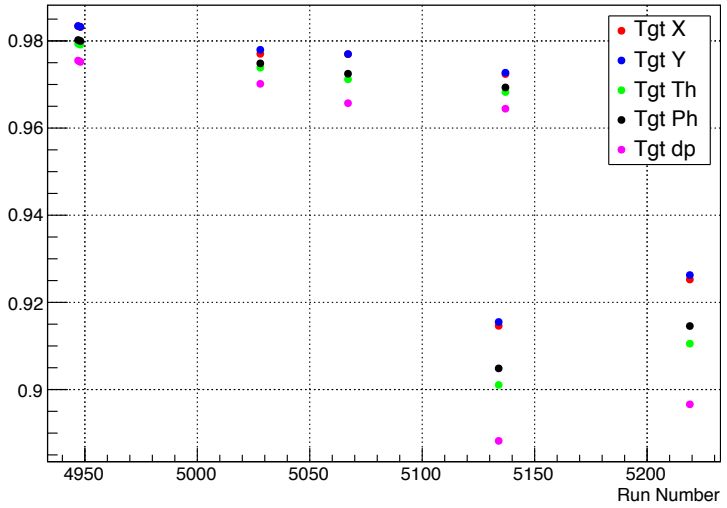


Run 5137 – dummy

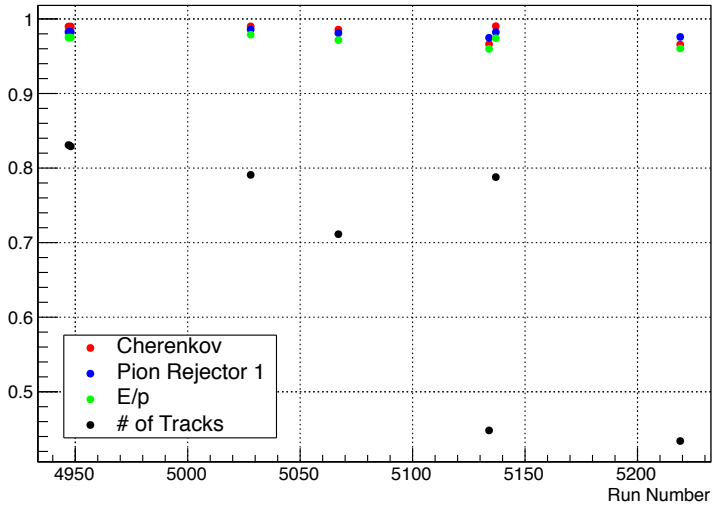


Effect of Cuts

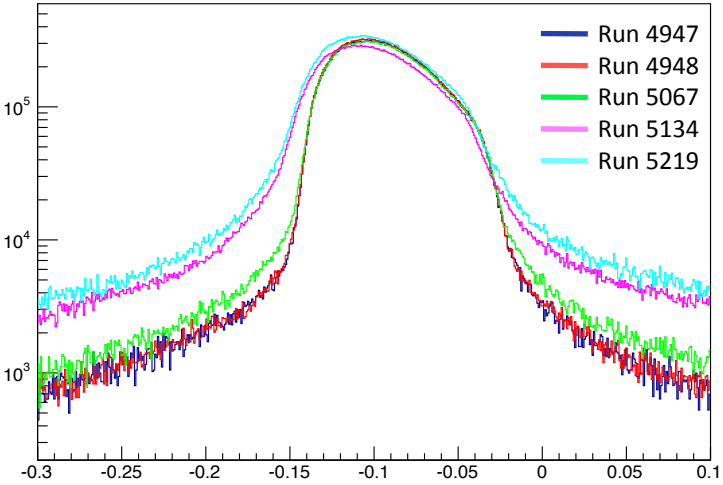
Target Plane Cuts



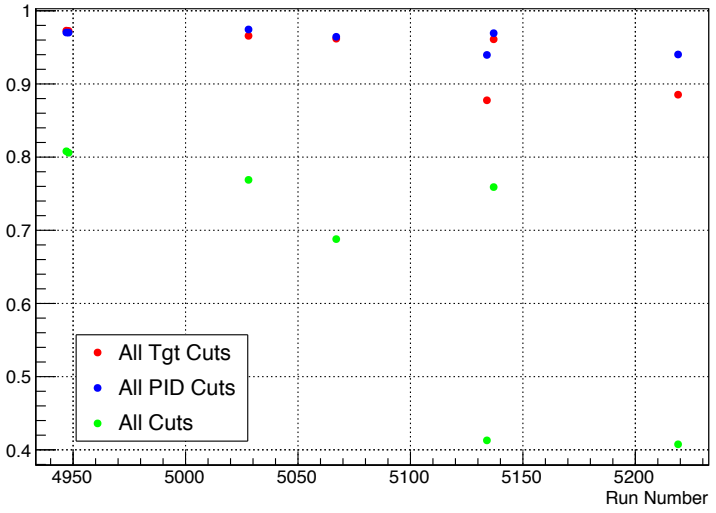
PID & # of Track Cuts



L.rec.th

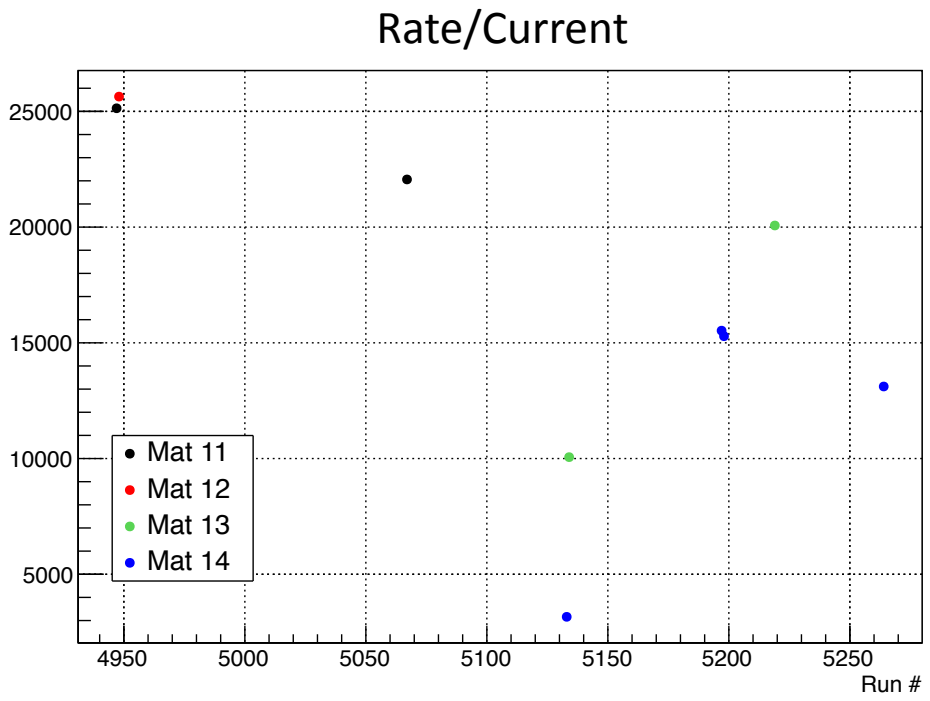


Combined cuts



Rate/Current Info

Run	Current	T3 Rate
4947	8.28	208115
4948	8.14	208702
5067	17.81	392877
→ 5134	43.66	439254
→ 5219	44.87	900538
→ 5133	43.93	138830
5197	19.47	302298
5198	19.99	305566
→ 5264	51.04	669297



1.1 GeV, 2.5T, Transverse

Run	Material	Prod/Dummy Ratio	Pf	Uncertainty
4947	11	3.38	0.464	6.6%
5067	11	2.77	0.347	3.5%
4948	12	3.44	0.452	6.6%
5134	13	1.88	0.140	3.3%
5219	13	1.94	0.150	4.8%
5133	14	1.68	0.210	4.0%
5197	14	2.55	0.487	4.4%
5198	14	2.50	0.471	4.7%
5264	14	1.49	0.150	5.4%

To Do

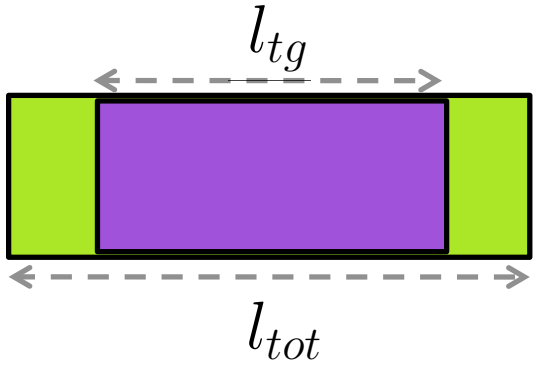
- Uncertainty:
  - XS ratio *very* dependent on beam position
  - change in tgtx of 1mm -> ~6-8% change in pf
  - change in tgty of 1mm -> ~3-4% change in pf

- Working on technote

Backup

Reminder – Method

$$Y_{prod} = Y_{He}^{out} + (1 - p_f) Y_{He}^{full} + p_f Y_{NH_3}^{full}$$



$$\left[\begin{array}{l} Y_{He}^{out} = \left(\dfrac{l_{tot} - l_{tg}}{l_{tot}} \right) Y_{dummy} \\ \\ Y_{He}^{full} = \left(\dfrac{l_{tg}}{l_{tot}} \right) Y_{dummy} \end{array} \right]$$

$$p_f = \left(\frac{l_{tot}}{l_{tg}} \right) \left(\frac{Y_{prod}}{Y_{dummy}} - 1 \right) \left(\frac{Y_{NH_3}^{full}}{Y_{He}^{full}} - 1 \right)^{-1}$$

Reminder – Method

$$p_f = \left(\frac{l_{tot}}{l_{tg}}\right)\left(\frac{Y_{prod}}{Y_{dummy}} - 1\right)\left(\frac{Y^{full}_{NH_3}}{Y^{full}_{He}} - 1\right)^{-1}$$

Obtained from Data

Require input from cross section models

$$Y_x \sim \sigma_x \cdot \rho_x \cdot A_x$$

$$\rho_x = \frac{\rho_{mass-x} \cdot l_x \cdot A_v}{M_x}$$

$$p_f = \left(\frac{l_{tot}}{l_{tg}}\right)\left(\frac{Y_{prod}}{Y_{dummy}} - 1\right)\left(\frac{\rho_{mass,N}\frac{\sigma_N \cdot A_N}{M_N} + \rho_{mass,H}\frac{\sigma_H \cdot A_H}{M_H}}{\rho_{mass,He}\frac{\sigma_{He} \cdot A_{He}}{M_{He}}} - 1\right)^{-1}$$

σ_x = cross section

ρ_x = target number density

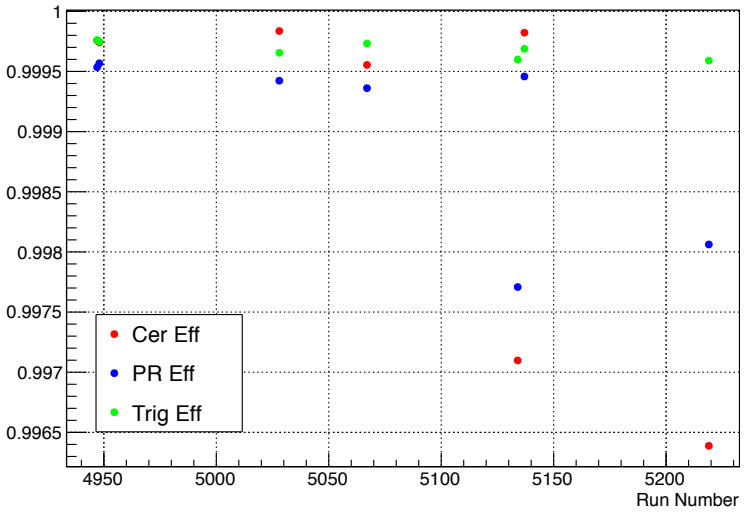
$\rho_{mass,x}$ = mass density

l_x = length of material

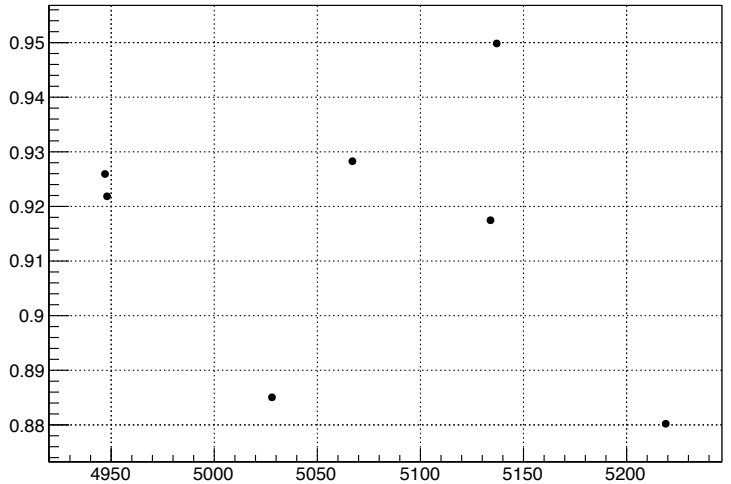
$A_x = \frac{\#\text{ of counts in cut}}{\text{total }\#\text{ of counts in fit}}$

Normalization Constants

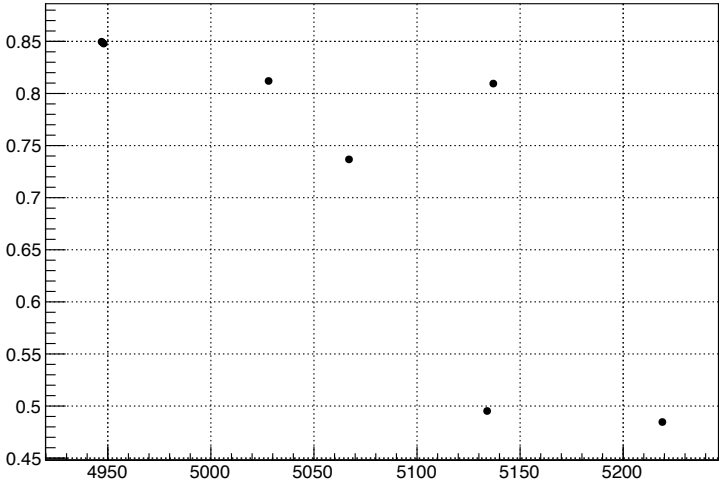
Detector Efficiencies



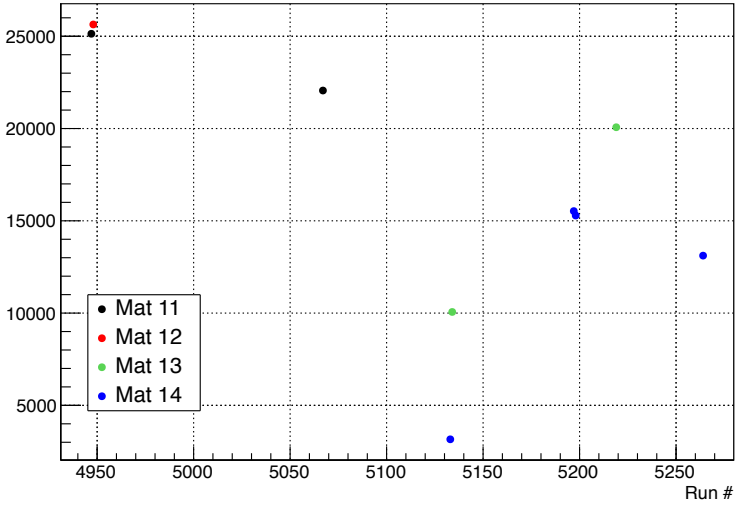
Livetime



Multi-track Efficiency

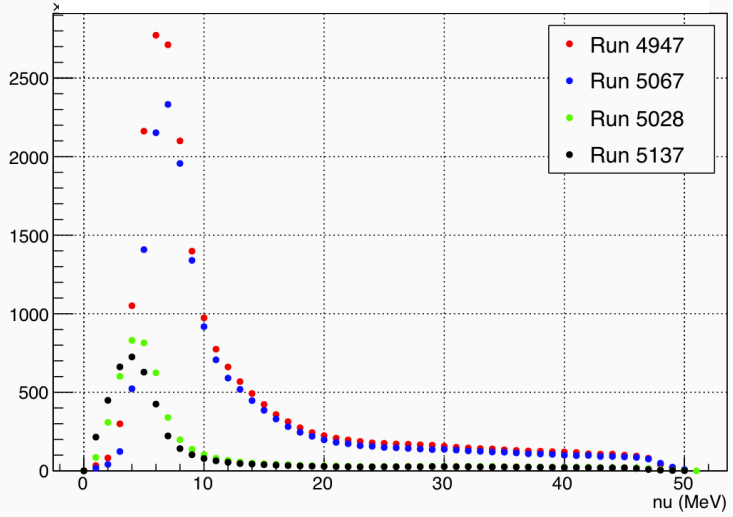


Rate/Current

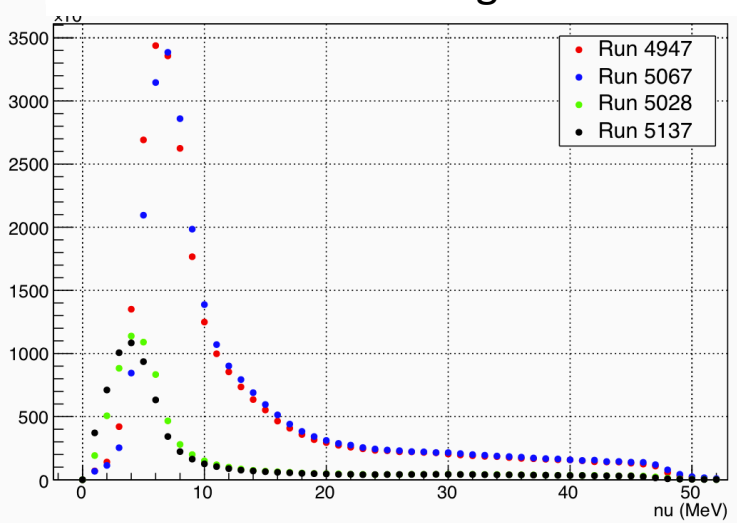


1.1 GeV, 2.5T, Transverse

Material 11 – All Cuts



Material 11 – no single track cut



Material 11 – no track cut and no MTeff