Monte Carlo Studies

- Peter Gumplinger has written 2 separate Monte Carlo codes for E614

- T1MONTE simulates surface muon production in a carbon T1 production target, the output of this code is fed into M13GEANT as input

- M13GEANT simulates processes occurring when sending muon beam through m13 beam line, simulation ends at Q7

- M13GEANT can also be run with the output at Q7 fed back in and ran through the solenoid, results are collected and graphed at the center of the solenoid

- all 3 parts of these simulations have been performed for various inputs at high statistics run on the following TRIUMF pc's using linux, Guinevere, lin05, lin06 and E614db & THOR

Monte Carlo Studies

- studying effect of changing input parameters of T1MONTE to see how this changes muon spin polarization at center of solenoid

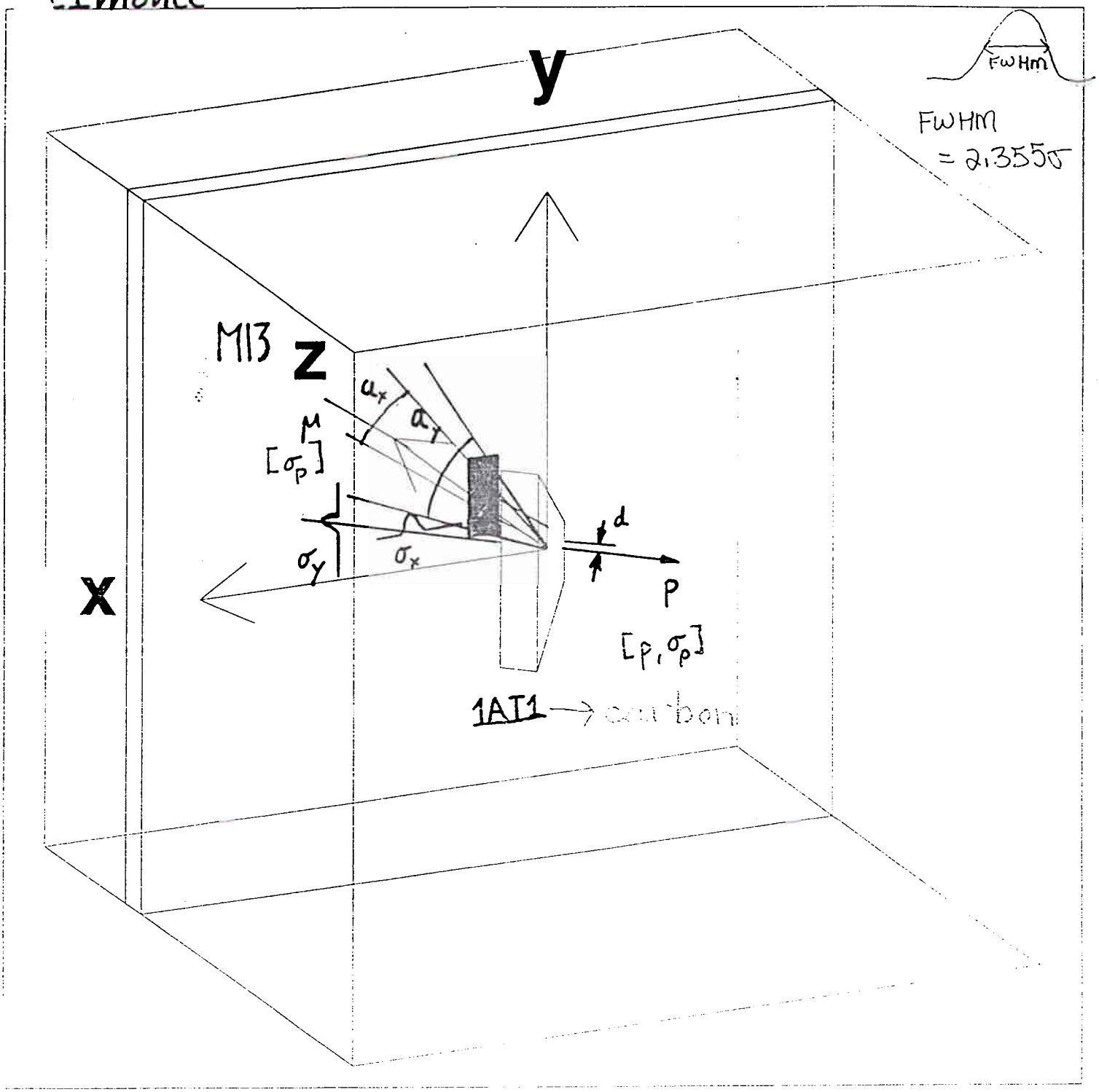
- changing horizontal position of where proton beam hits production target at positions -0.5mm, 0 nominal (T1MONTE assumes this is -1mm from edge of production target), 0.5mm, 1.0mm, 1.2mm and 1.5mm

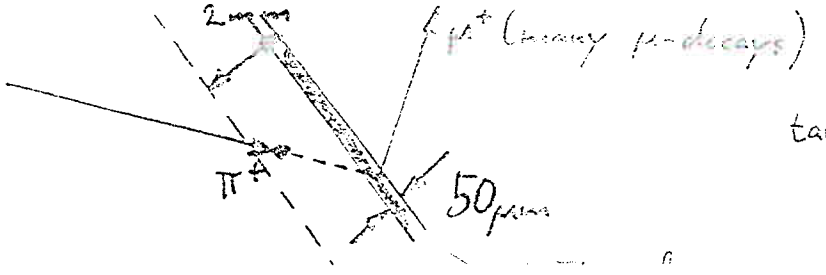
- also performed simulations with different proton beam spreads, FWHM_x(horiz)=3mm and FWHM_y(vert)=7mm nominal,
  FWHM_x=3.5mm and FWHM_y=6.5mm,
  FWHM_x=4.0mm and FWHM_y=6.0mm,
  FWHM_x=4.5mm and FWHM_y=5.5mm

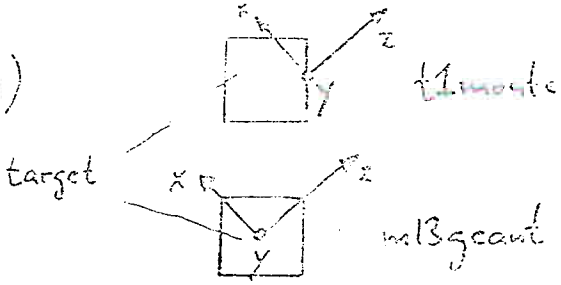
- doing these tests in order to determine and optimize monitoring of proton beam on production target

Gran Sasso

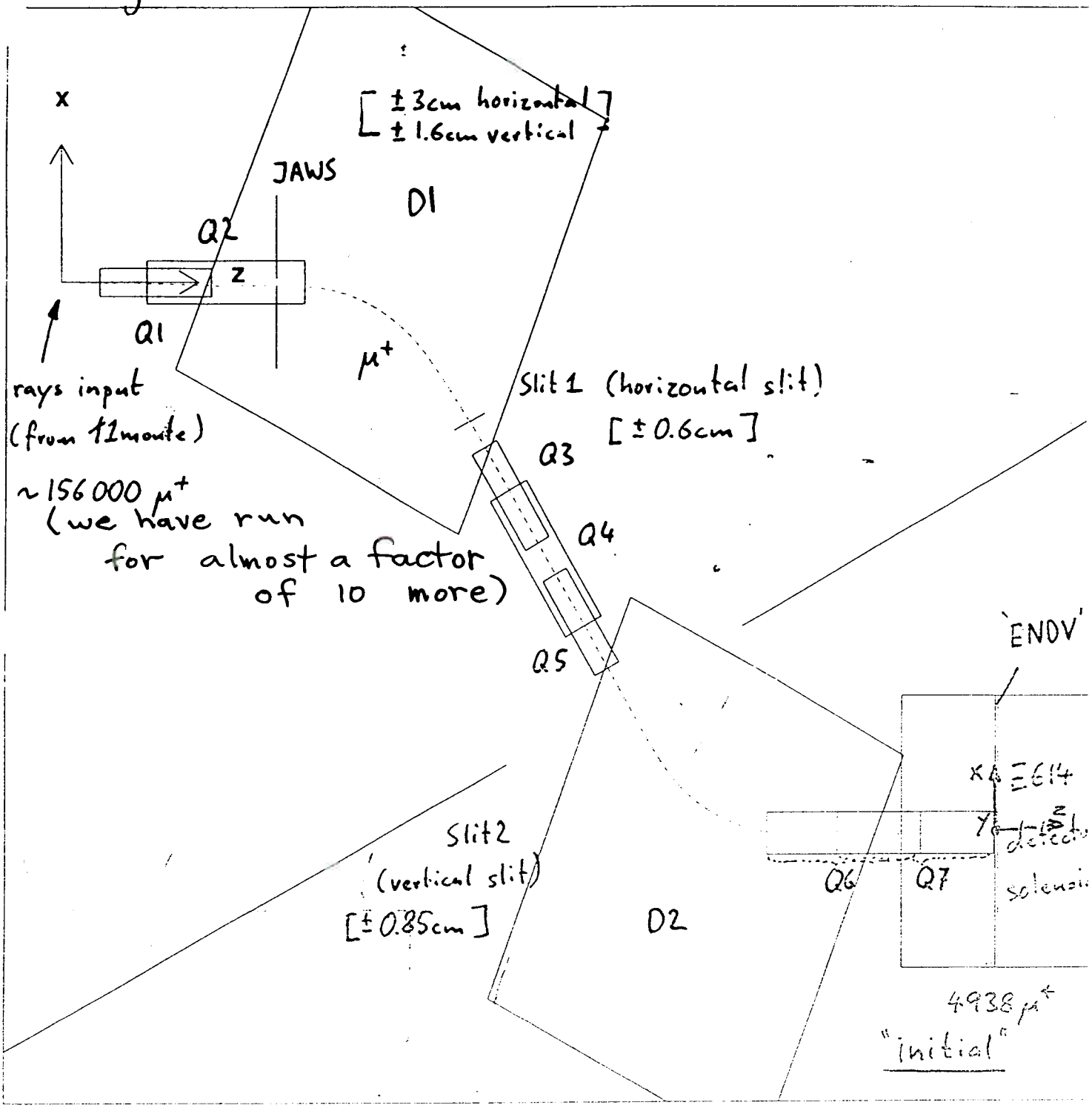
t1monte







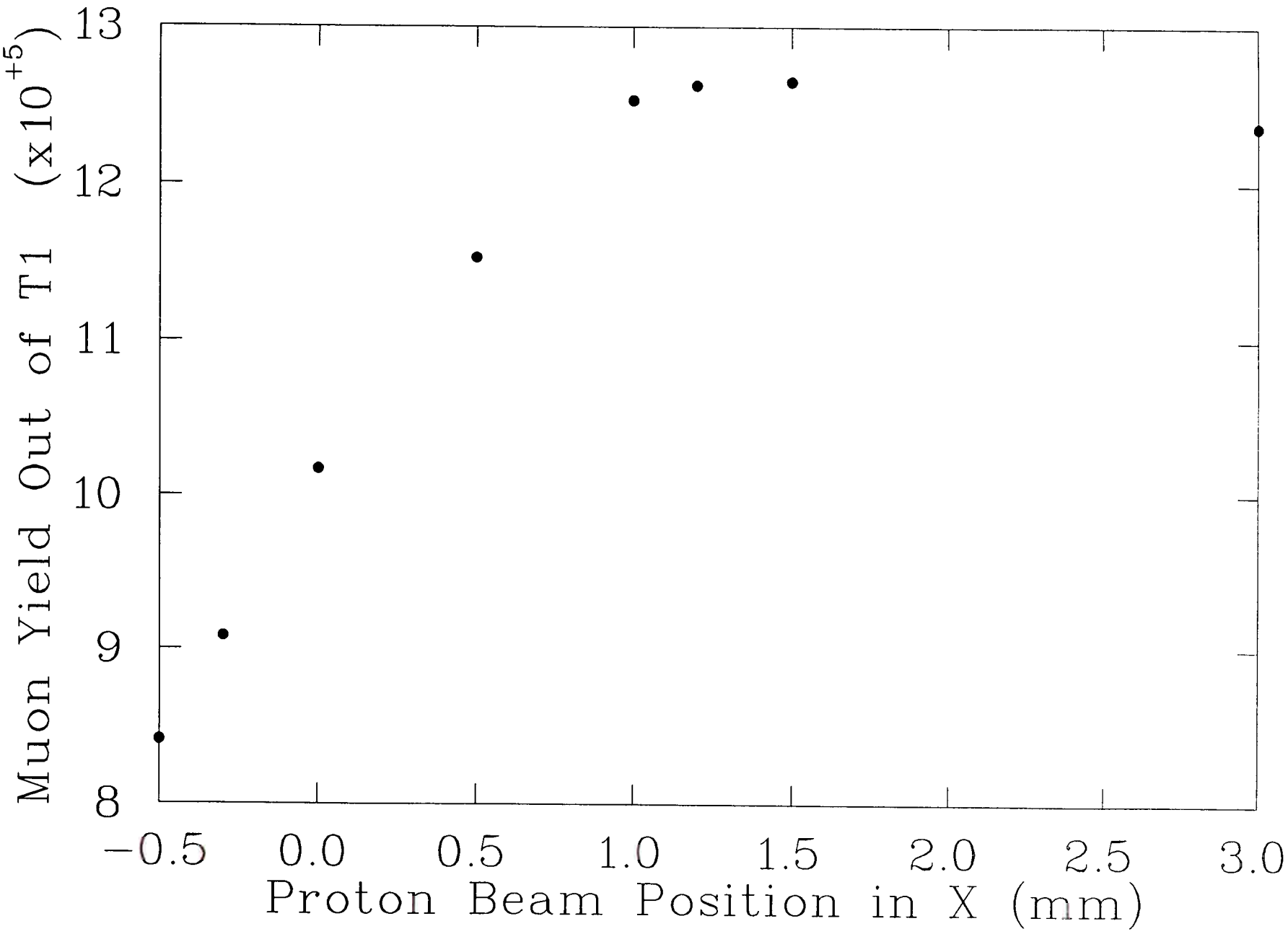
m13geant



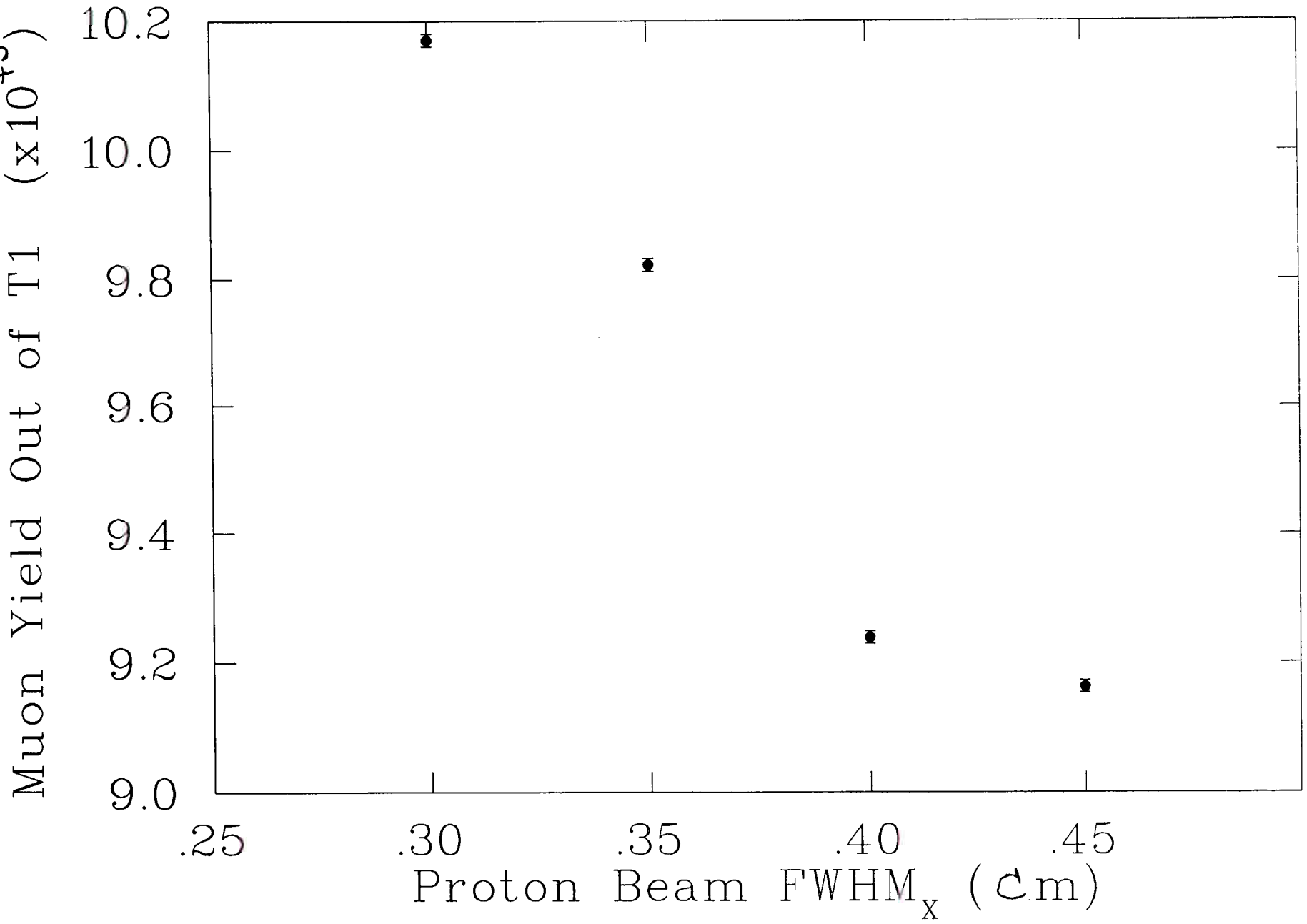
μ+ rate: ~ 15k/s

— # input protons for each point = 376 MILLION!

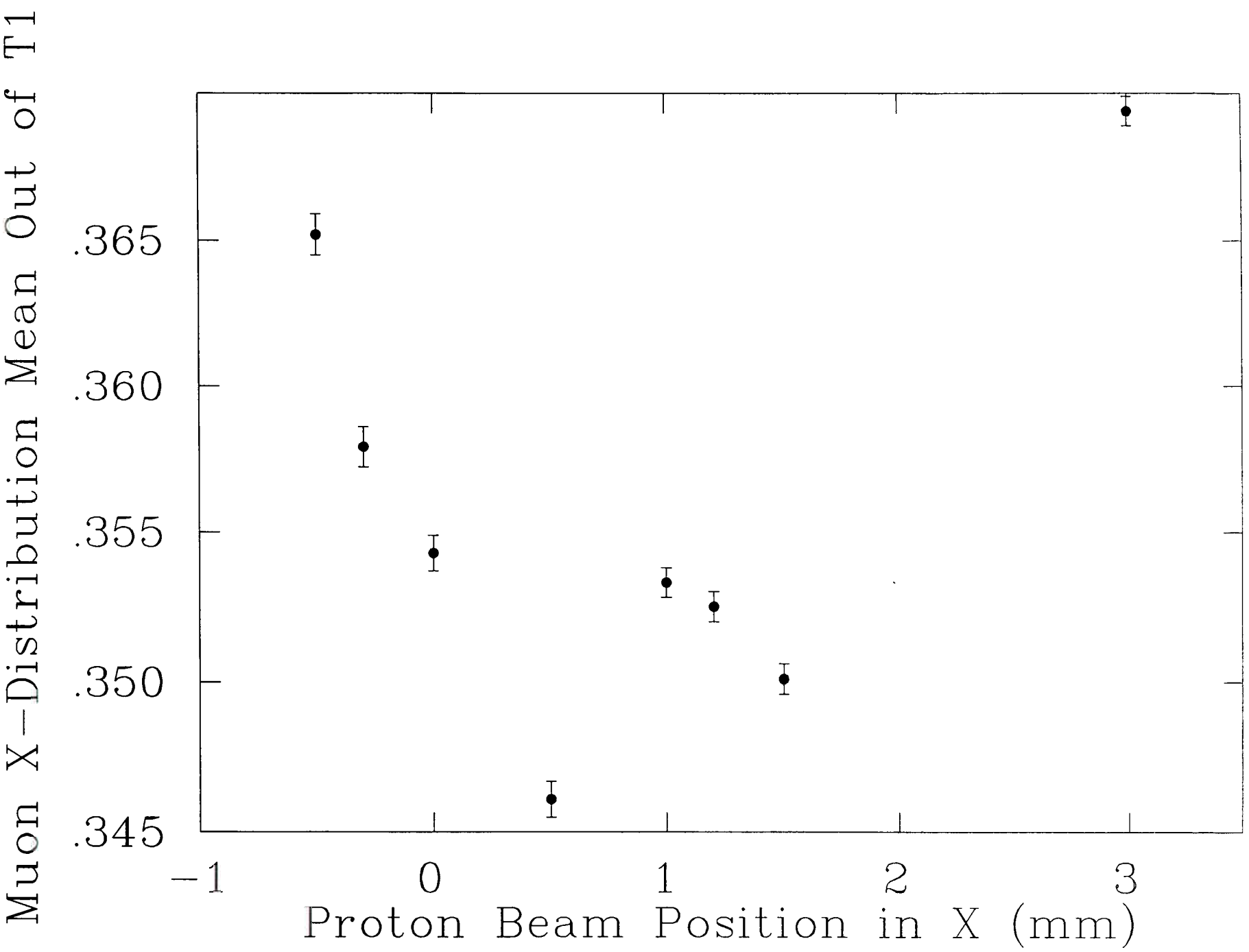
— nominal tune



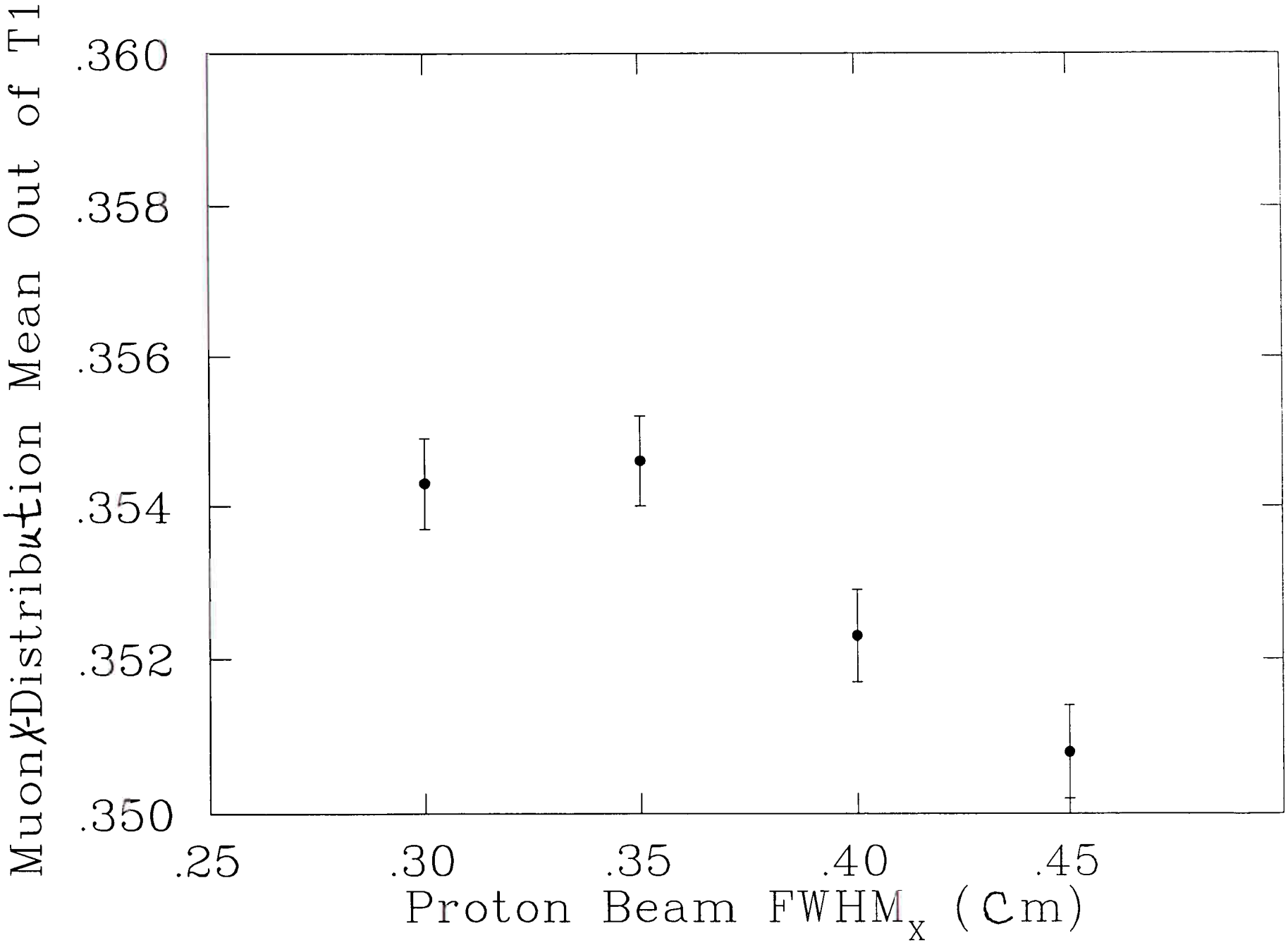
- # protons for each point = 376 MILLION
- nominal position



-Nominal tune

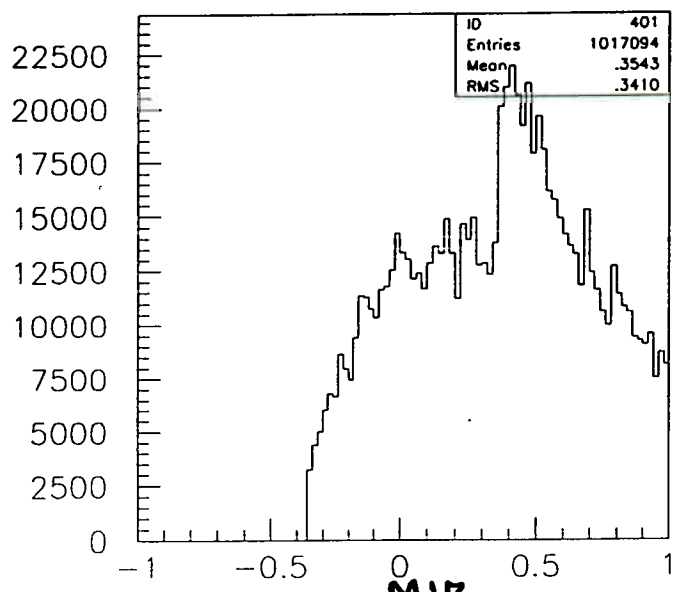


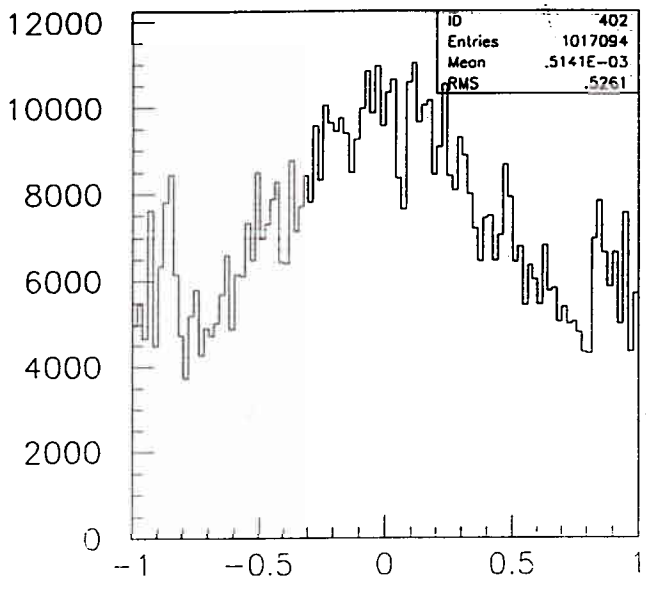
-nominal position



nominal position
nominal tune

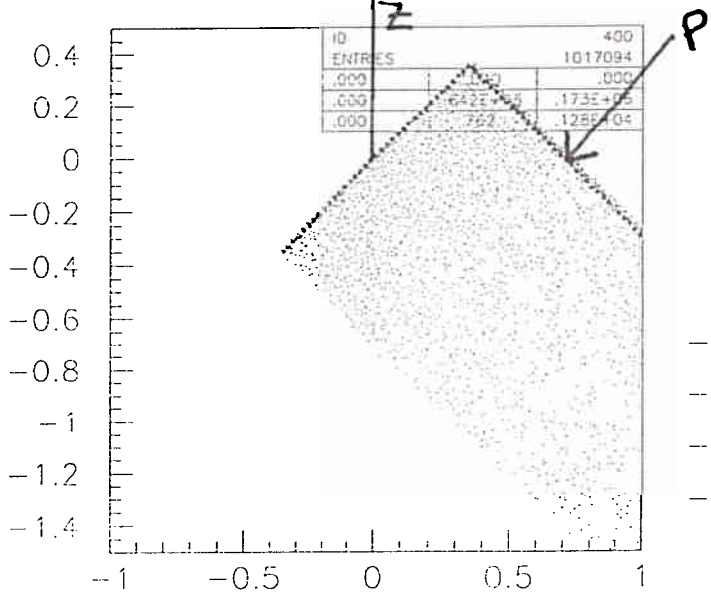
gunntest3 t/monte

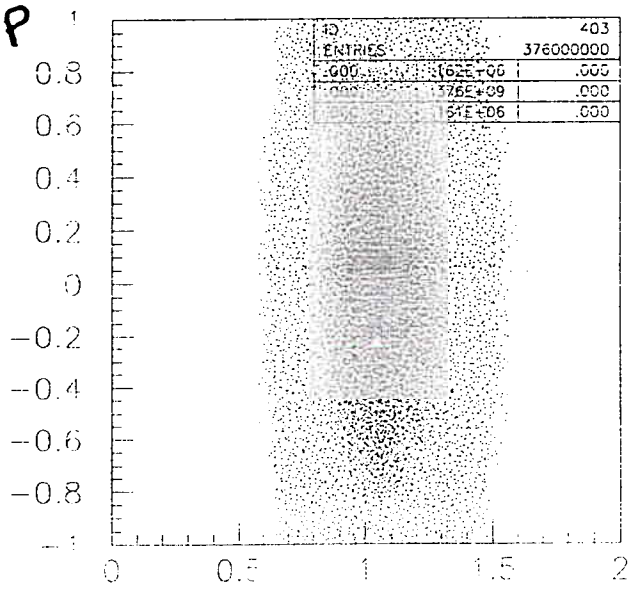




Muon origin distribution in X

Muon origin distribution in Y



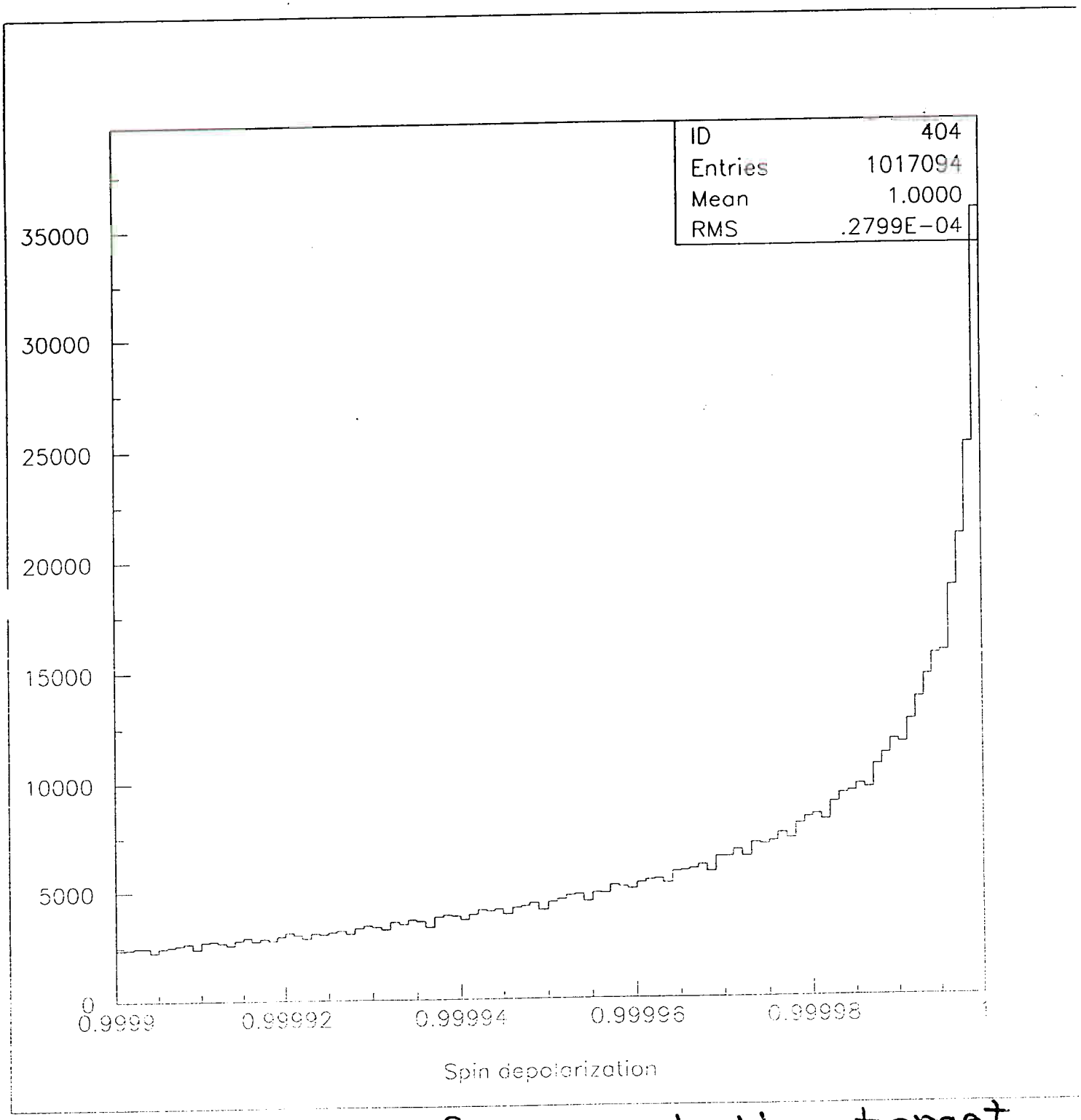


Muon origin distribution ZX−Plane

Proton Beam YX−Profile

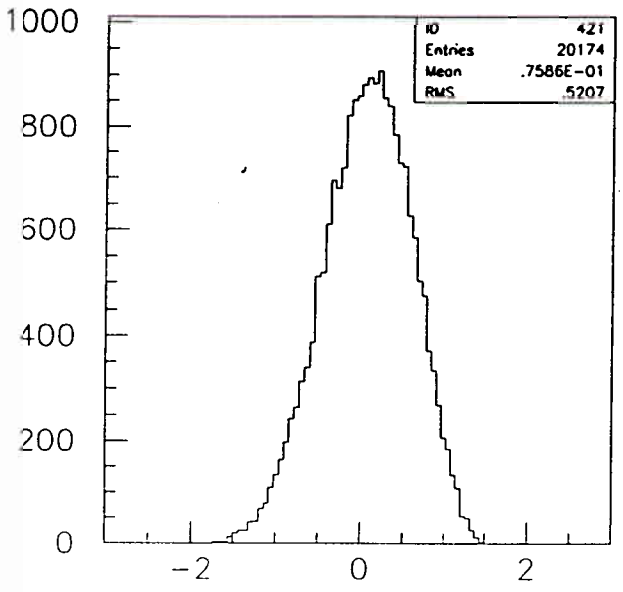
scale is in cm

nominal position
nominal tune

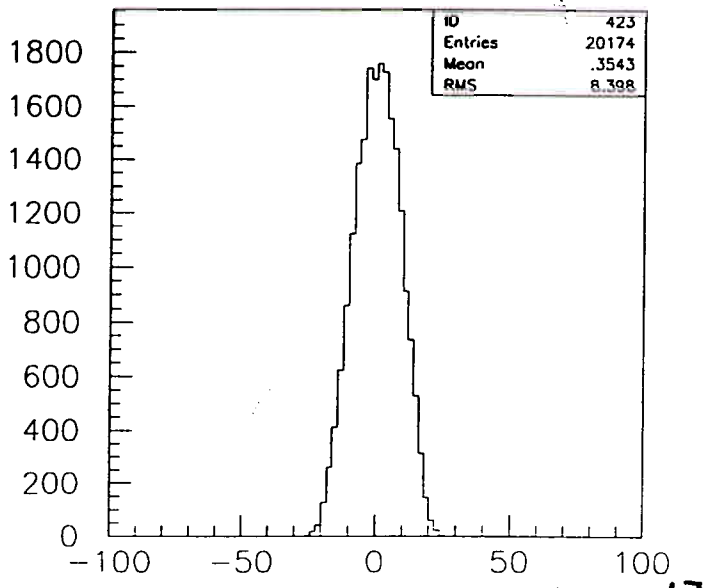


on exit from production target

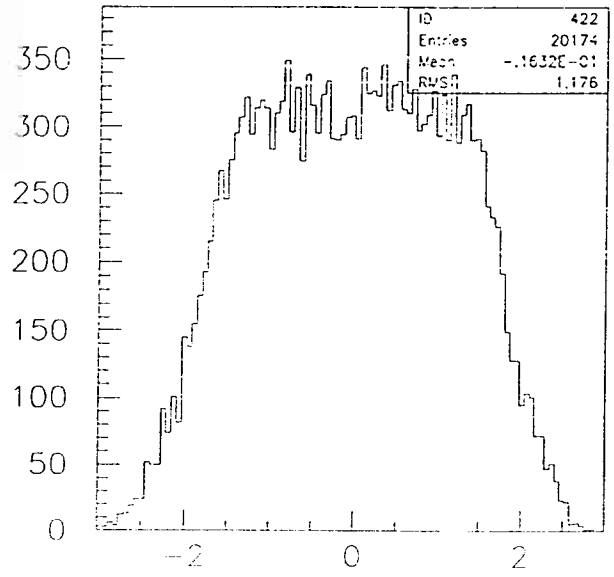
nominal input



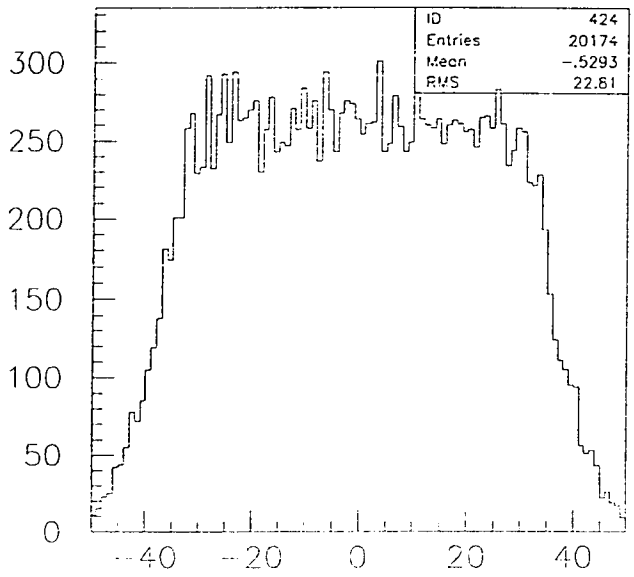
Final – x – [cm]



Final – dx –



Final – y – [cm]

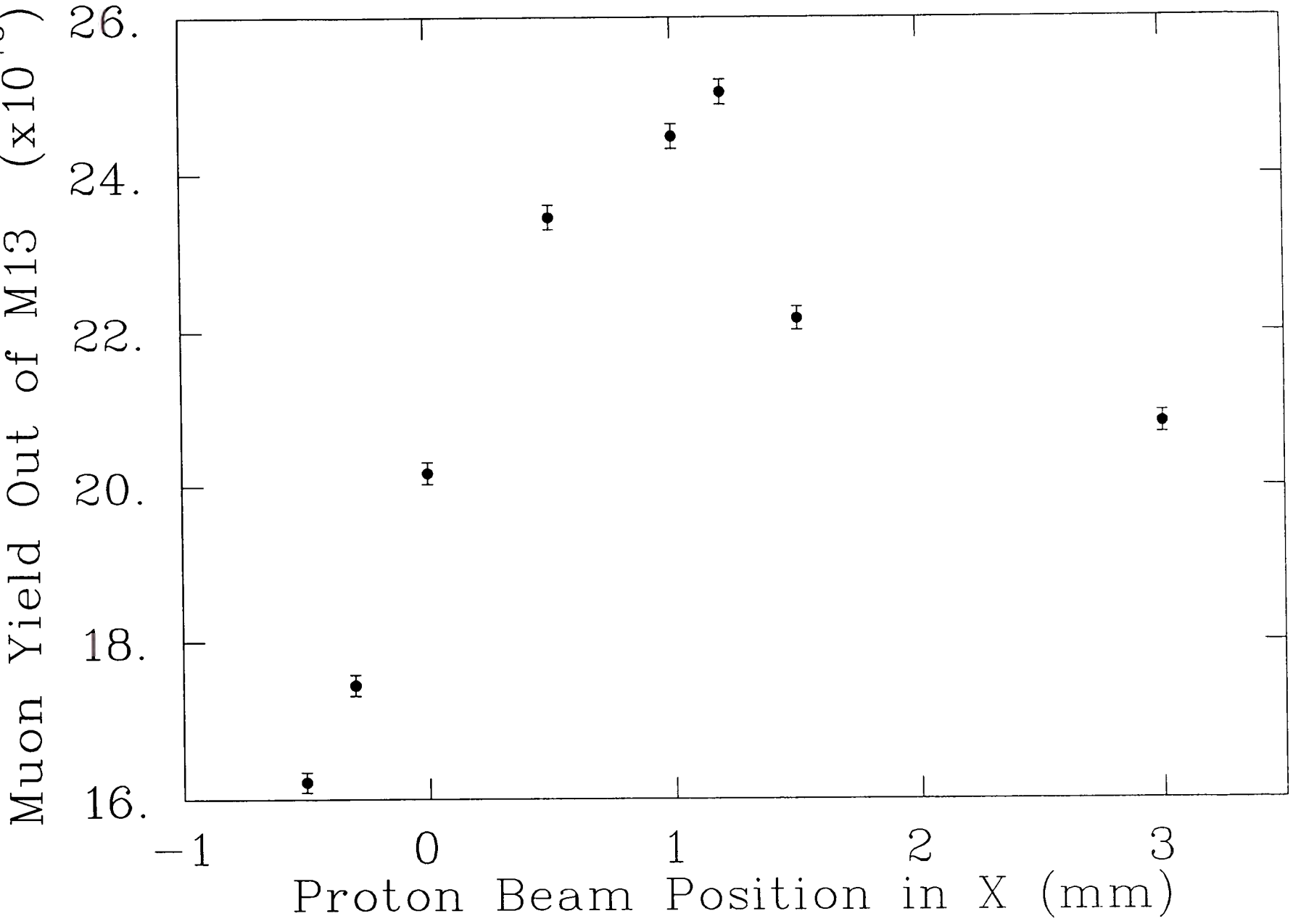


Final – dy – [mrad]

- rays at Q7
- used for input to solenoid

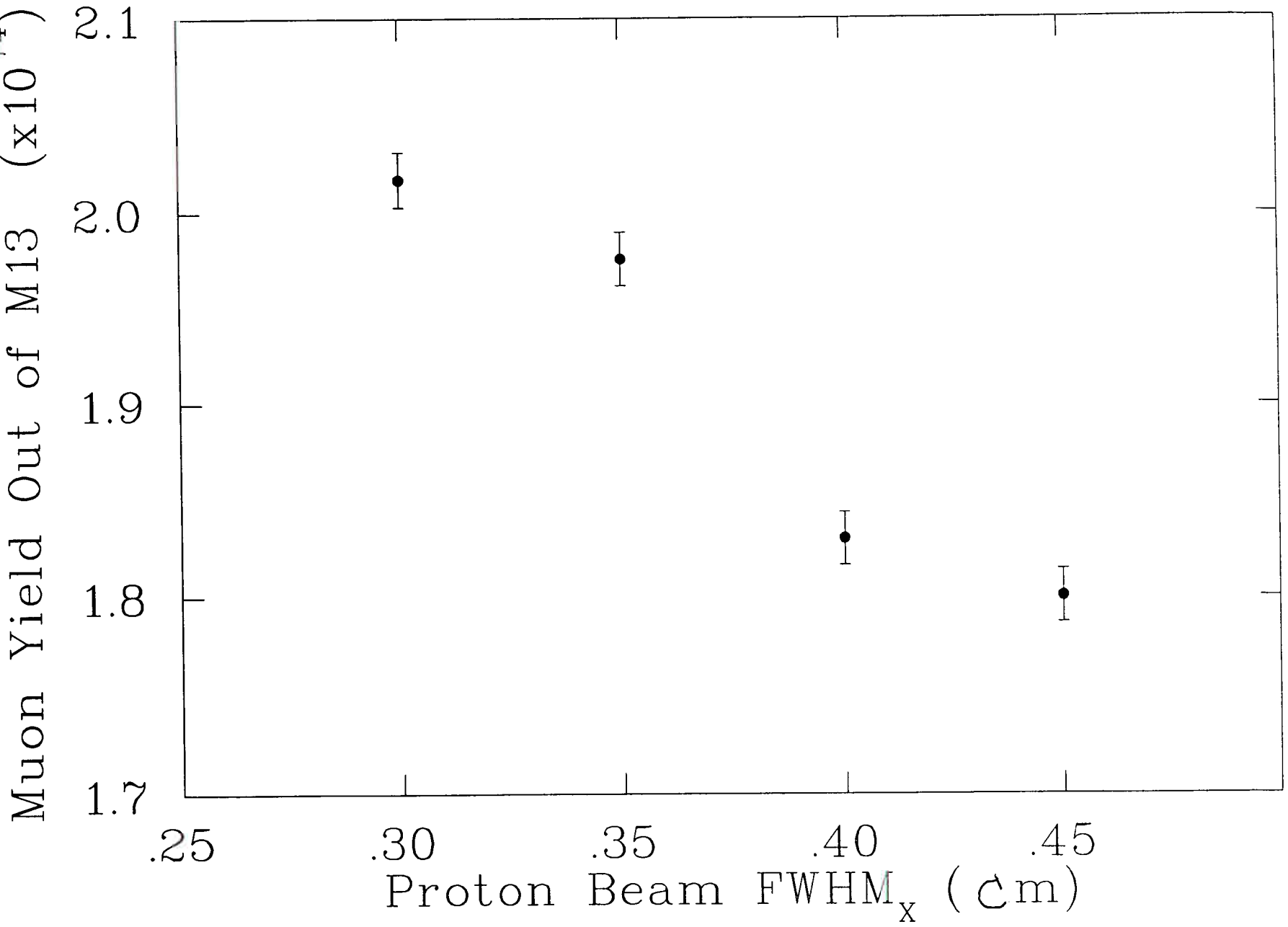
3.76×10^6 protons into T1 $\Rightarrow \sim 9 \times 10^5$ muons out

$\sim 9 \times 10^5$ muons into M13



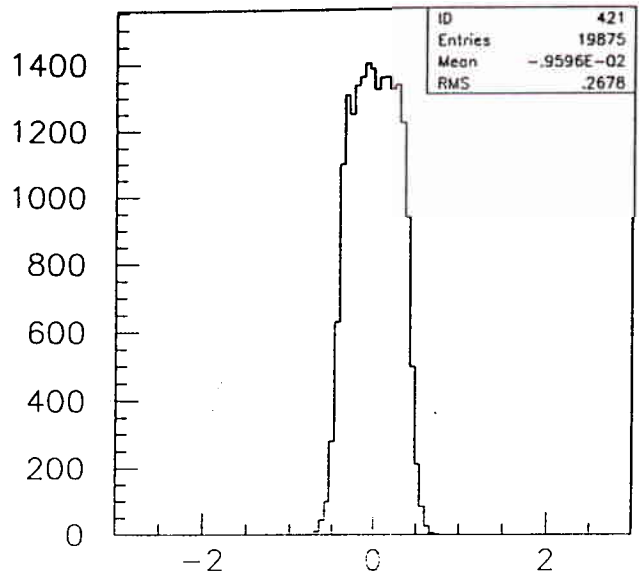
376×10^6 protons into T1 $\Rightarrow \sim 9 \times 10^5$ muons out

$\sim 9 \times 10^5$ muons into M13

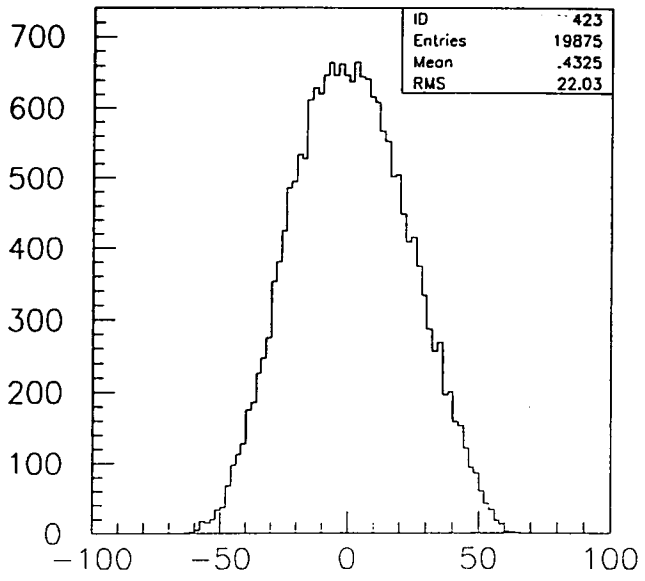


nominal input

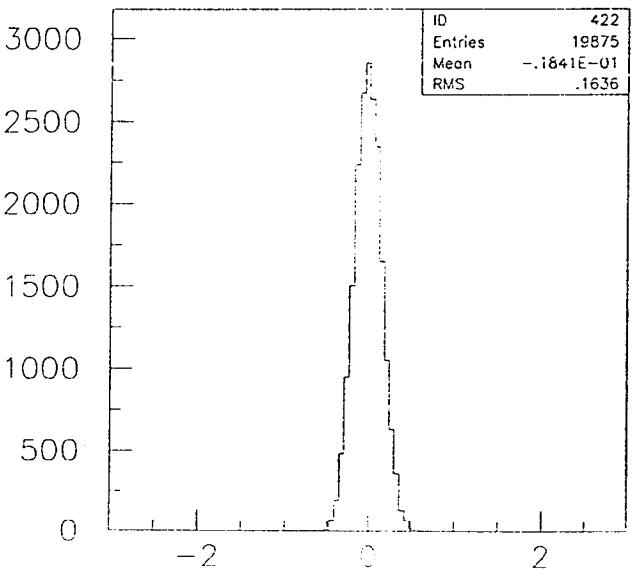
gumtest3 solenoi



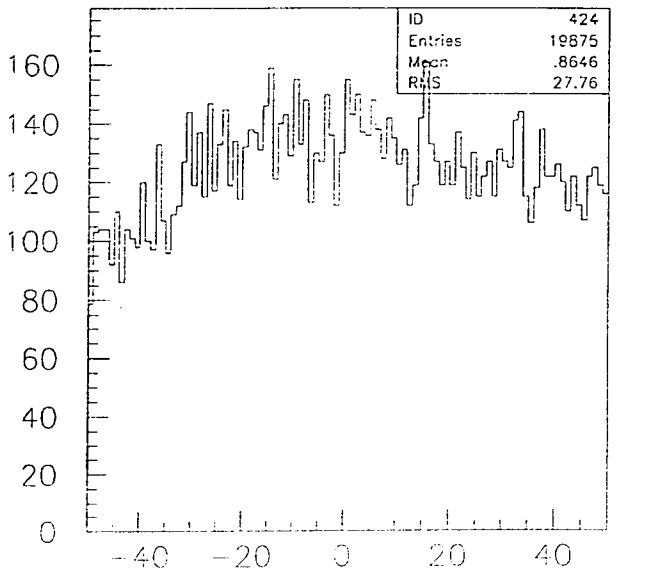
Final – x – [cm]



Final – dx – [mrad]



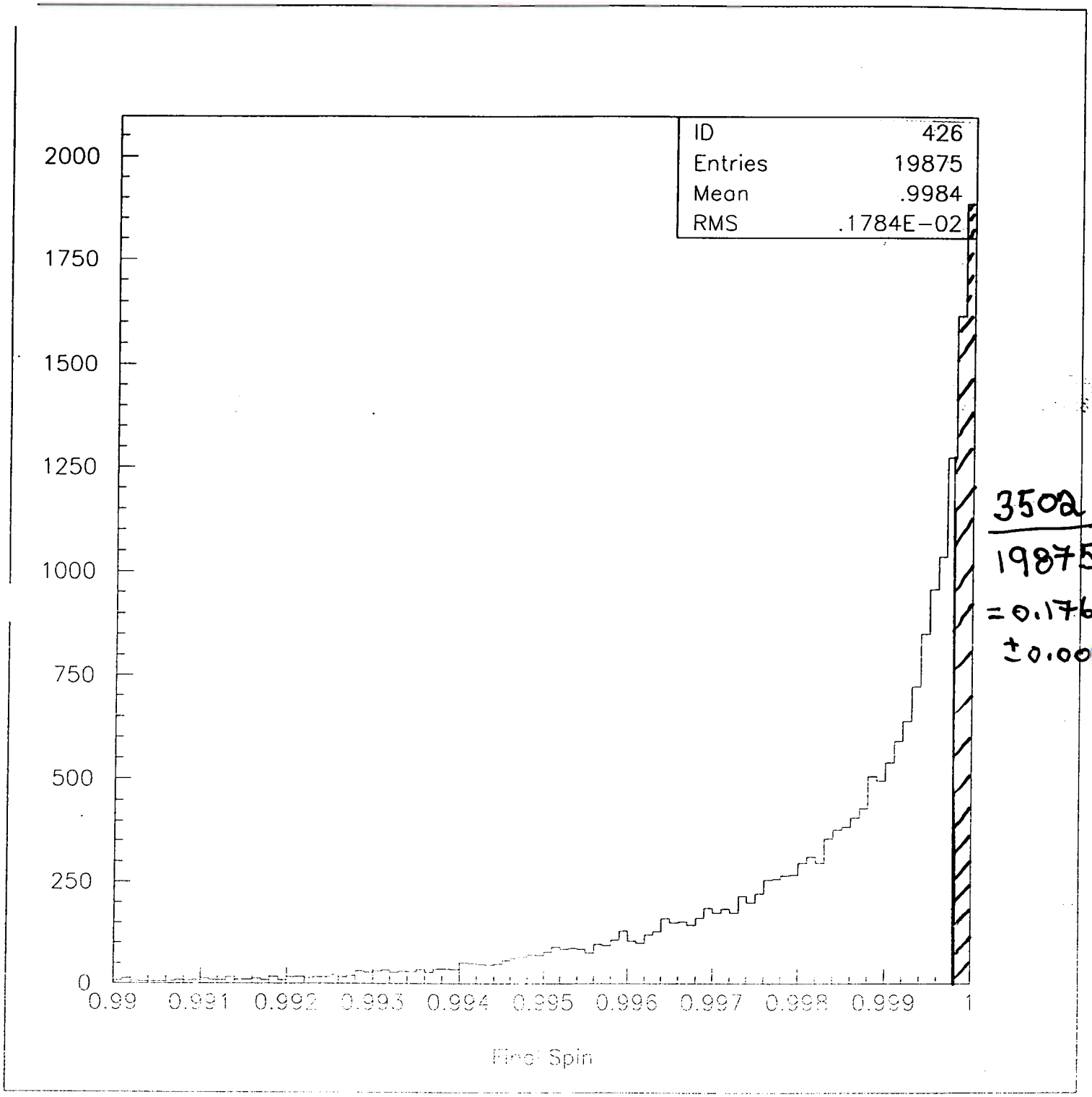
Final – y – [cm]



Final – dy – [mrad]

- beam in the center of solenoid

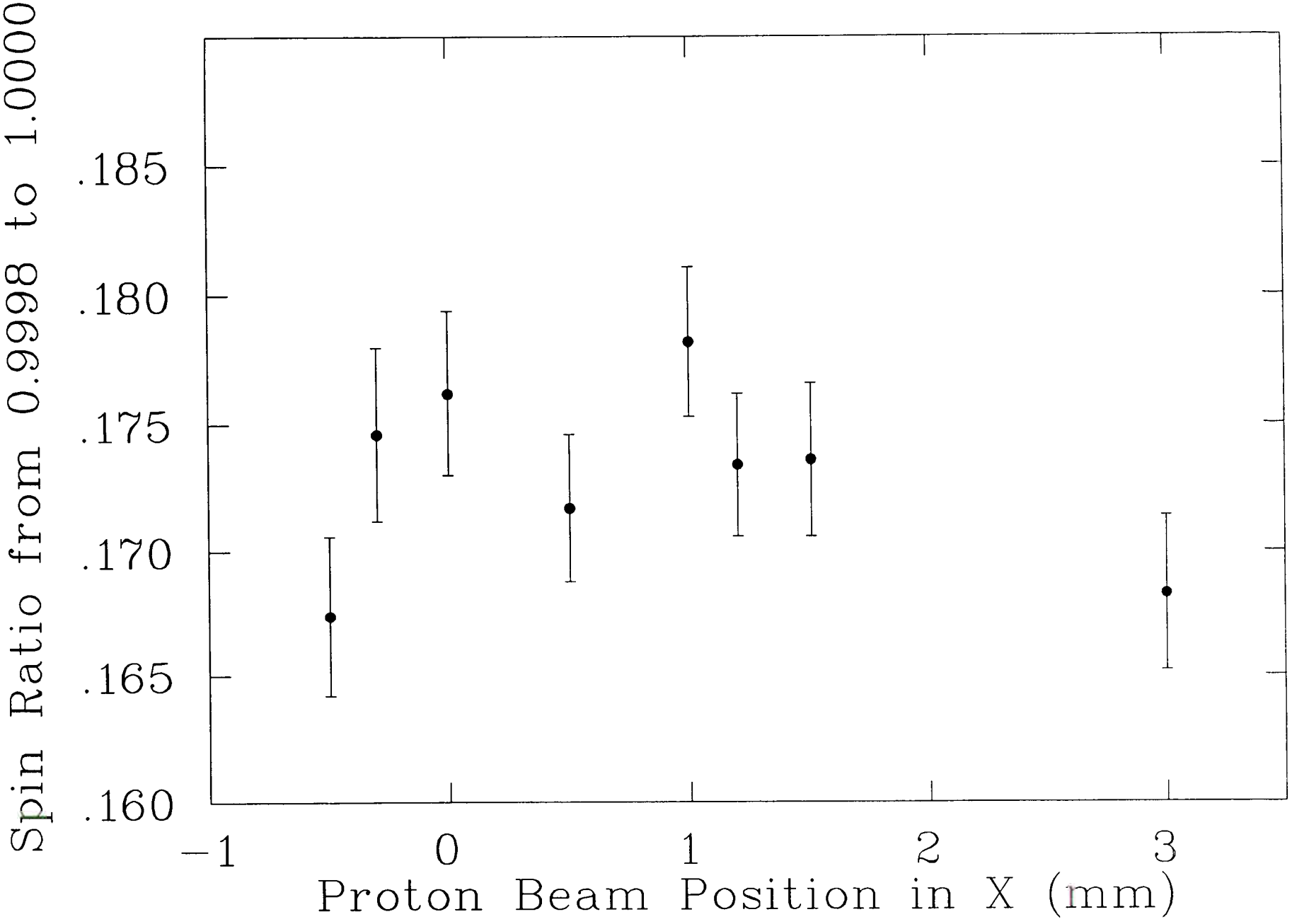
nominal input



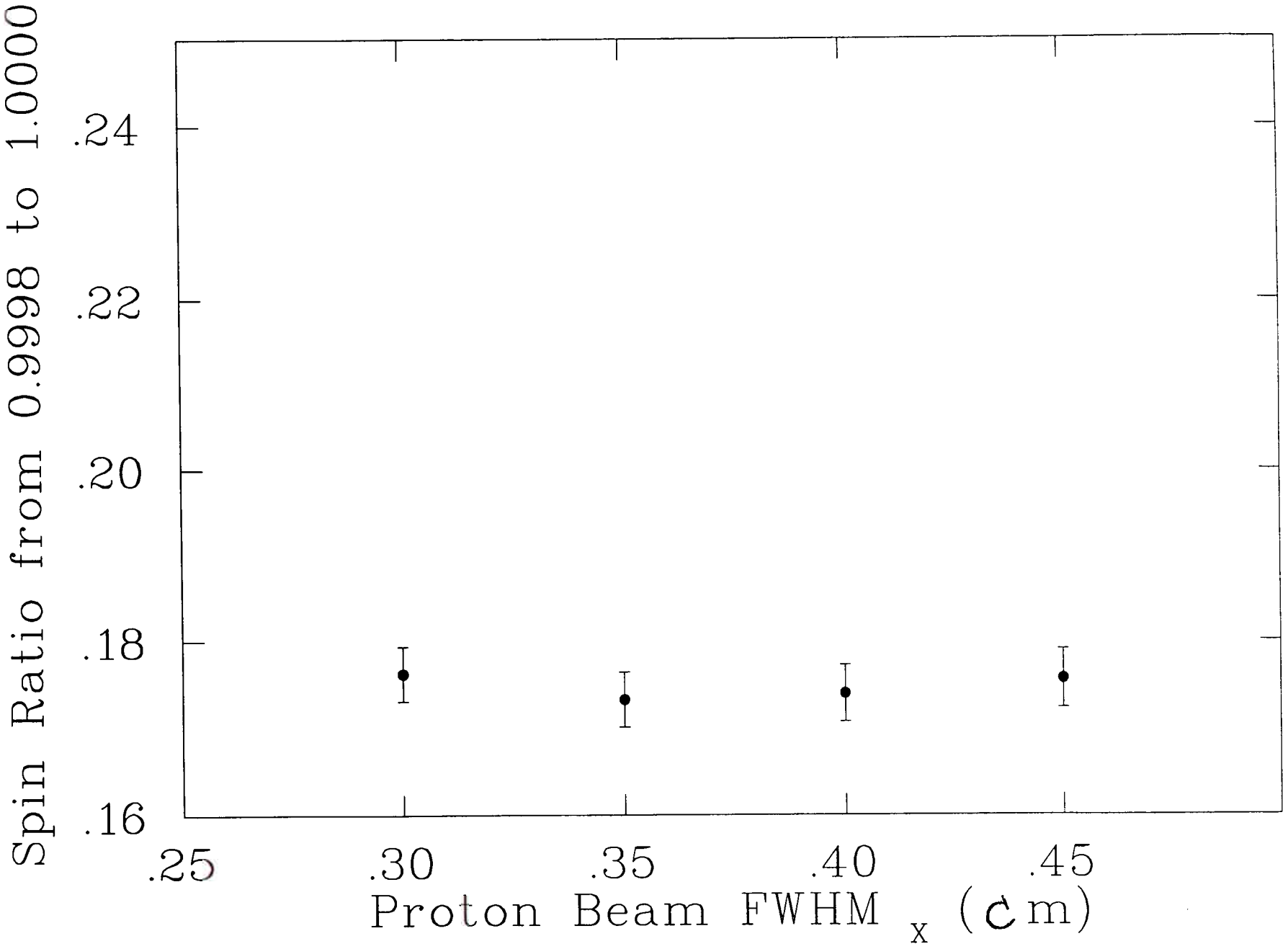
$\frac{3502}{19875} = 0.1762 \pm 0.0032$

-beam in center of solenoid

- nominal tune



-nominal position



TIME TESTS (real time)

T1MONTE: time to process one event.

Guinevere	0.0014 → 0.0021	seconds
lin ø 5	0.0018 → 0.0018	seconds
lin ø 6	0.0012 → 0.0021	seconds
E614dB	Not Available	
THOR	0.0011 → 0.0015	seconds

M13GEANT: time to process one event

Guinevere	0.4736 → 0.4801	seconds
lin ø 5	0.3568 → 0.4827	seconds
lin ø 6	0.3545 → 0.4823	seconds
E614dB	0.3520 seconds	(only 1 run)
THOR	Not Available.	

M13GEANT (SOLENOID): time to process one event

Guinevere	0.0455 → 0.0462	seconds
lin ø 5	0.0341 → 0.0450	seconds
lin ø 6	0.0333 → 0.0338	seconds
E614dB	Not Available.	
THOR:	NOT Available.	