Nate Rodning - 2 June 2, 1999

As I understand it, there are approximately three ways to tune the muon beam to get particles across the fringe field.

1) parallel rays incident upon the fringe field
2) rays focused to a point at the fringe field
3) rays which come in at a tangent to the fringe field lines.

I am able only to look at the first two of the above using Transport and Revmoc. I'm not an expert on either, but I believe that I have a code which includes the a fringing of the entrance field, but which has no fringe field at the exit. This allows for the consideration of rays which stop inside of the solenoid.

The basic conclusions (which can be gleaned from the following figures) are that:

1) M13 can be tuned to give parallel rays, at the expense of making the beam very large. This is shown with the solenoid off in the first figure.
2) When the solenoid is turned on, these parallel rays diverge due to the interaction with the fringe field. This is shown in Figure 2.
3) A focused beam, with no solenoid, is shown in Figure 3.
4) These rays can be brought nearly parallel by tweaking the focus and turning the solenoid on. This is shown in Figure 4.
5) Figures 5 - 11 refer to the tune of figure 4, and are results of Revmoc simulations. Figure 5 shows the spatial distributions and the divergence for muons at the axis of the detector. The "trigger" refers to a sweet spot 1cm square at the center of the detector.
6) In figures 6-7 I try to find the origination of the good muons upstream of the detector. The distributions at the JAWS don't really help.
7) Divergence at JAWS.
8) There is some spatial (vertical) discrimination at the TEC, as shown in figure 8.
9) Divergence at TEC.
10) Divergence at the Trigger
11) Figures 11-13 show similar distributions for parallel rays tracked across the fringe field.

My conclusions:

The above distributions look similar for either the focused or the parallel tune brought across the fringe field. The flux appears to be slightly better for parallel rays incident upon the fringe field.

This does not argue against the possibility of an "adiabatic transition" across the fringe field.

The rates are:

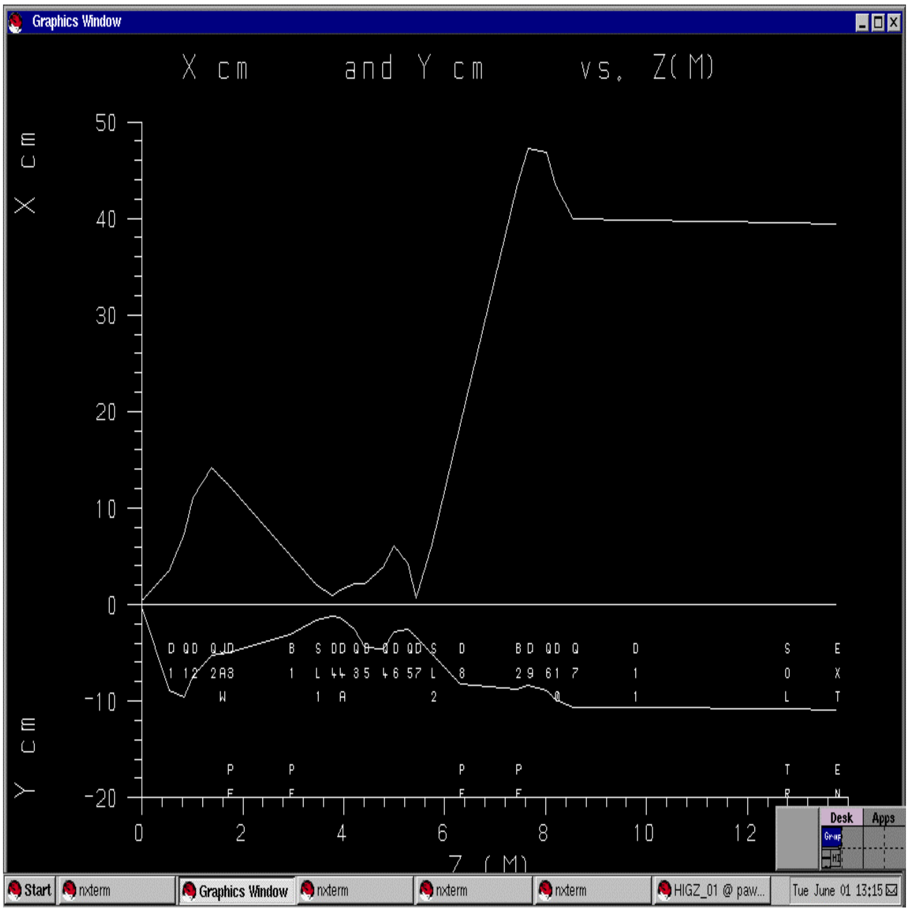
Focused tune: 1.6x10^-4 = (806 Good Muons) / (5 x 10^6 Generated Muons)
Parallel tune: 1.93x10^-4 = (694 Good Muons) / (3.6 x 10^6 Generated Muons)

Where the normalization is to the total particles generated into the REVMOC phase space (darn… I'll need to check on the momentum distribution which was used if anyone wants to try to convert this into a real fllux) which is defined by

XSIZE .84 130.0
YSIZE .5 330.0

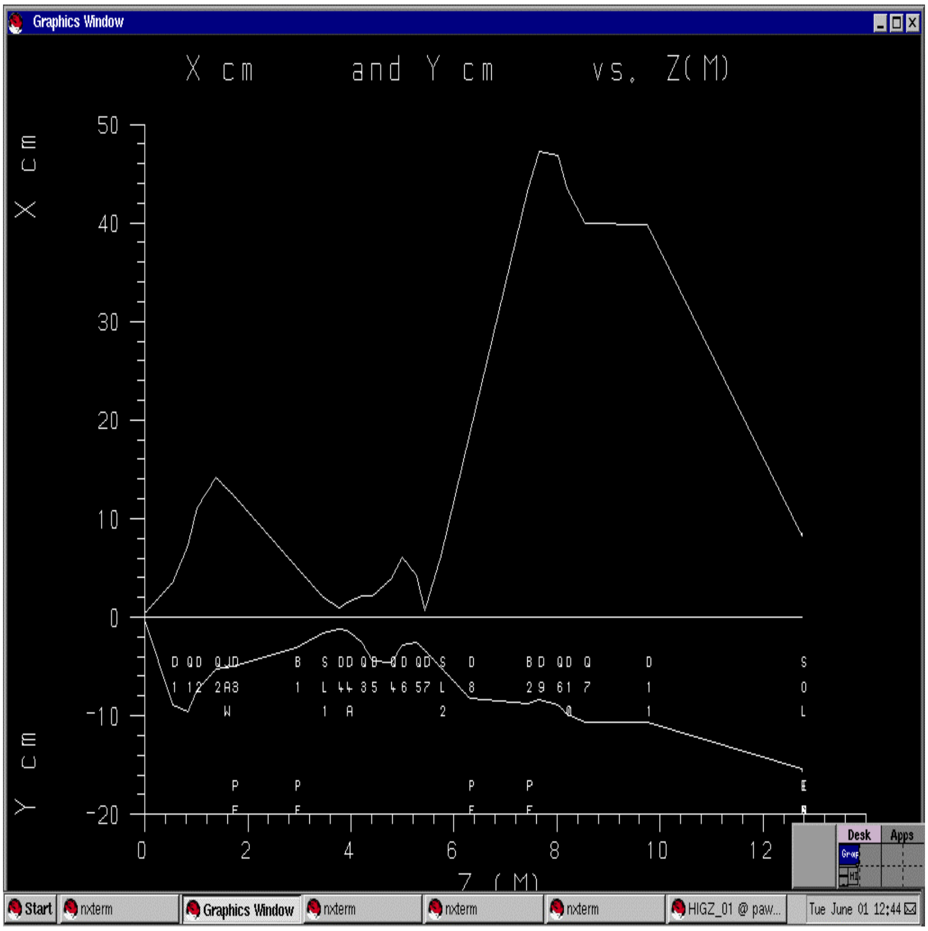
Basic Starting Point - parallel rays with no solenoid

Q1	QUAD	-1.0056	-112	-54.95
Q2	QUAD	0.8269	92	45.19
B1	BEND	0.8569	65061	65.58
Q3	QUAD	1.2260	137	66.99
Q4	QUAD	-1.4157	-158	-77.36
Q5	QUAD	1.9981	223	109.18
B2	BEND	0.9249		
Q6	QUAD	0.3331	37	18.20
Q7	QUAD	-0.2055	-23	-11.23
SOL	SOLE	0.0000		



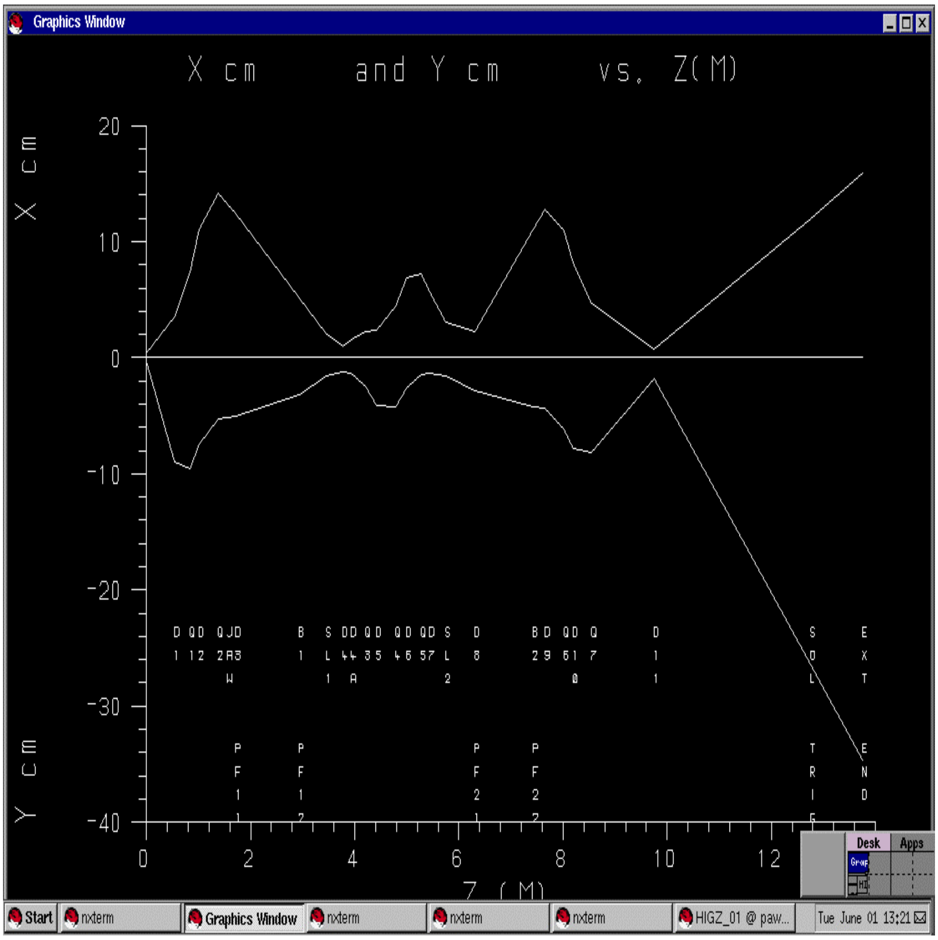
Focusing Effect of the Solenoid, Quads left unchanged

Q1	QUAD	-1.0056	-112	-54.95
Q2	QUAD	0.8269	92	45.19
B1	BEND	0.8569	65061	65.58
Q3	QUAD	1.2260	137	66.99
Q4	QUAD	-1.4157	-158	-77.36
Q5	QUAD	1.9981	223	109.18
B2	BEND	0.9249		
Q6	QUAD	0.3331	37	18.20
Q7	QUAD	-0.2055	-23	-11.23
SOL	SOLE	20.0000		



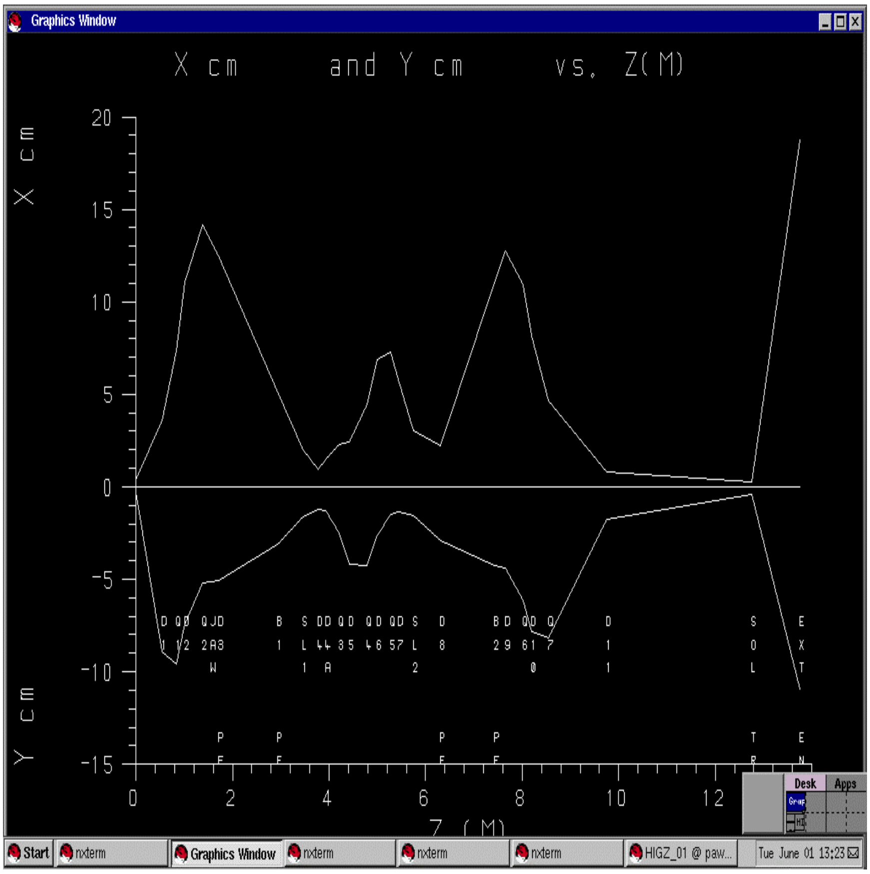
A more traditional tune. Focus 1.2 m from Q7

Q1	QUAD	-1.0056	-112	-54.95
Q2	QUAD	0.8269	92	45.19
B1	BEND	0.8569	65061	65.58
Q3	QUAD	1.0771	120	58.85
Q4	QUAD	-1.3930	-156	-76.12
Q5	QUAD	0.9981	112	54.54
B2	BEND	0.9249		
Q6	QUAD	0.8111	91	44.32
Q7	QUAD	-0.9026	-101	-49.32
SOL	SOLE	0.0000		

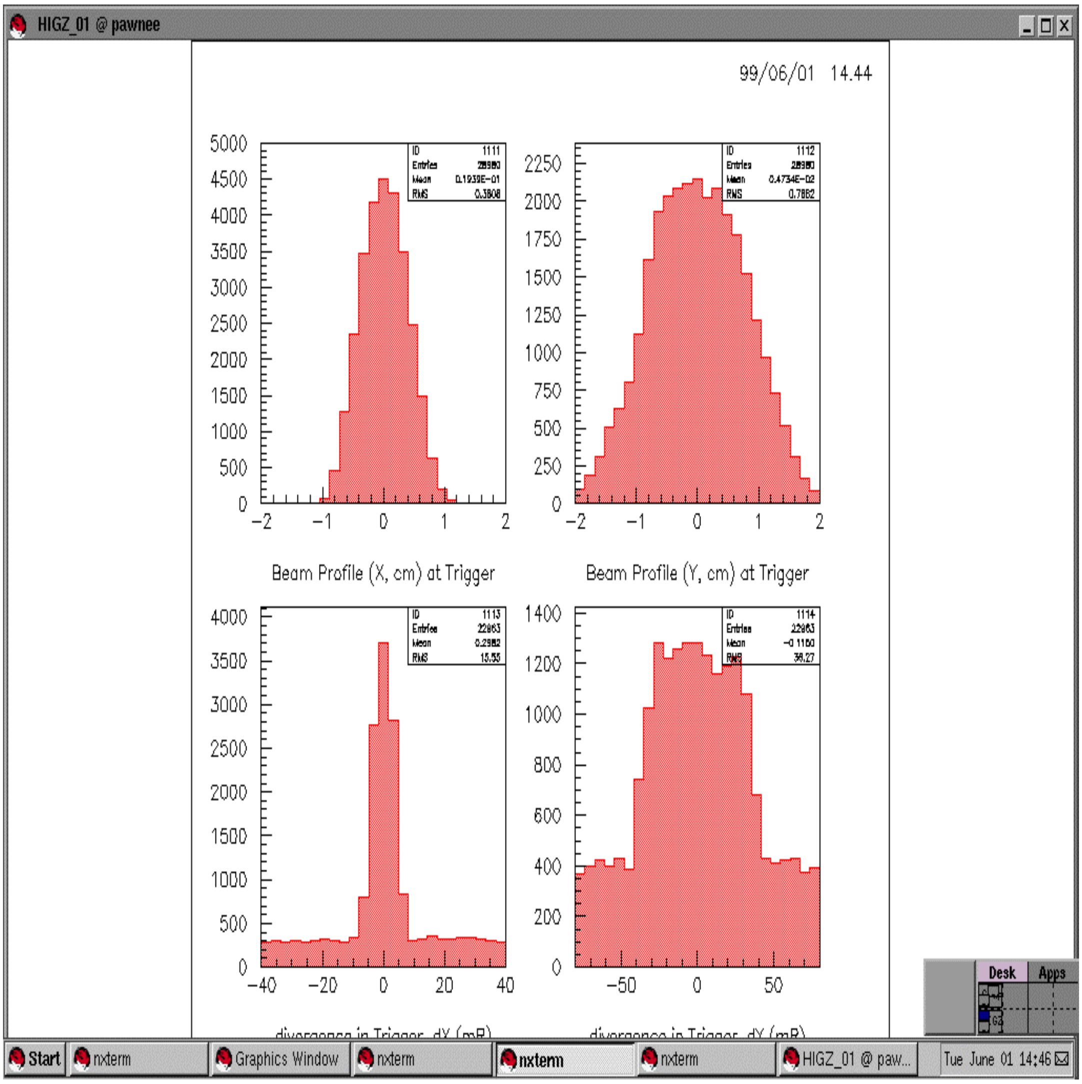


Focused as in the above, but with solenoid on.

Q1	QUAD	-1.0056	-112	-54.95
Q2	QUAD	0.8269	92	45.19
B1	BEND	0.8569	65061	65.58
Q3	QUAD	1.0771	120	58.85
Q4	QUAD	-1.3930	-156	-76.12
Q5	QUAD	0.9981	112	54.54
B2	BEND	0.9249		
Q6	QUAD	0.8209	92	44.86
Q7	QUAD	-0.9303	-104	-50.83
SOL	SOLE	20.0000		

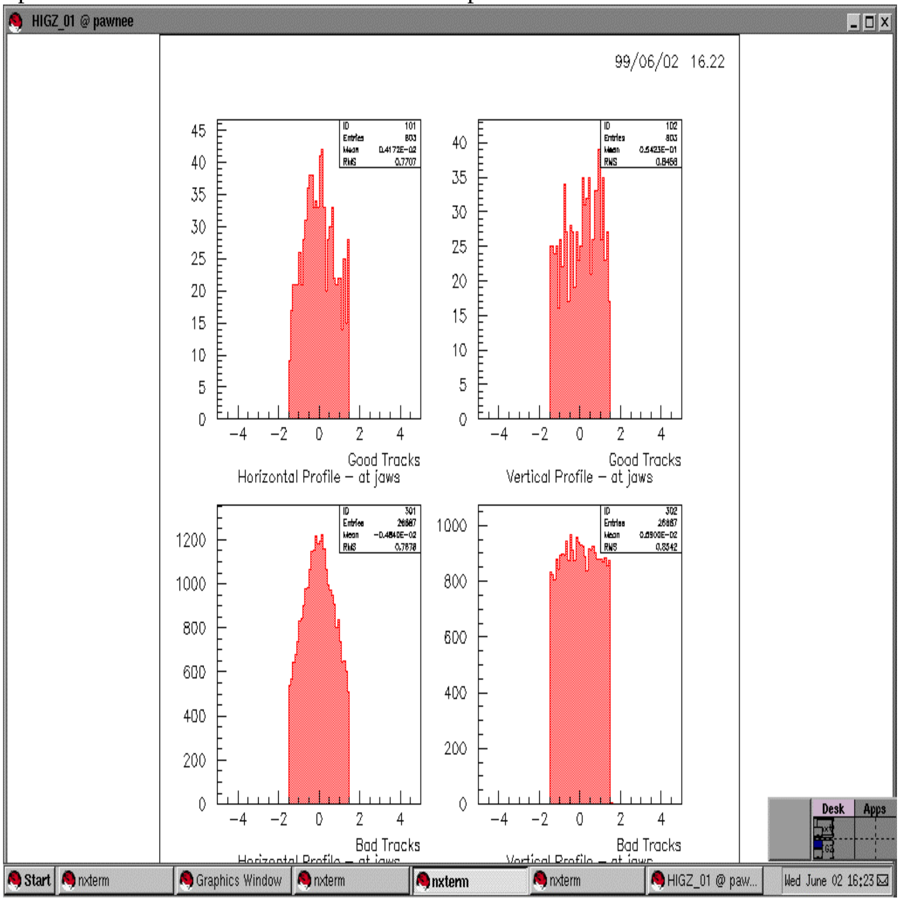


Revmoc distributions for tune in preceding page:

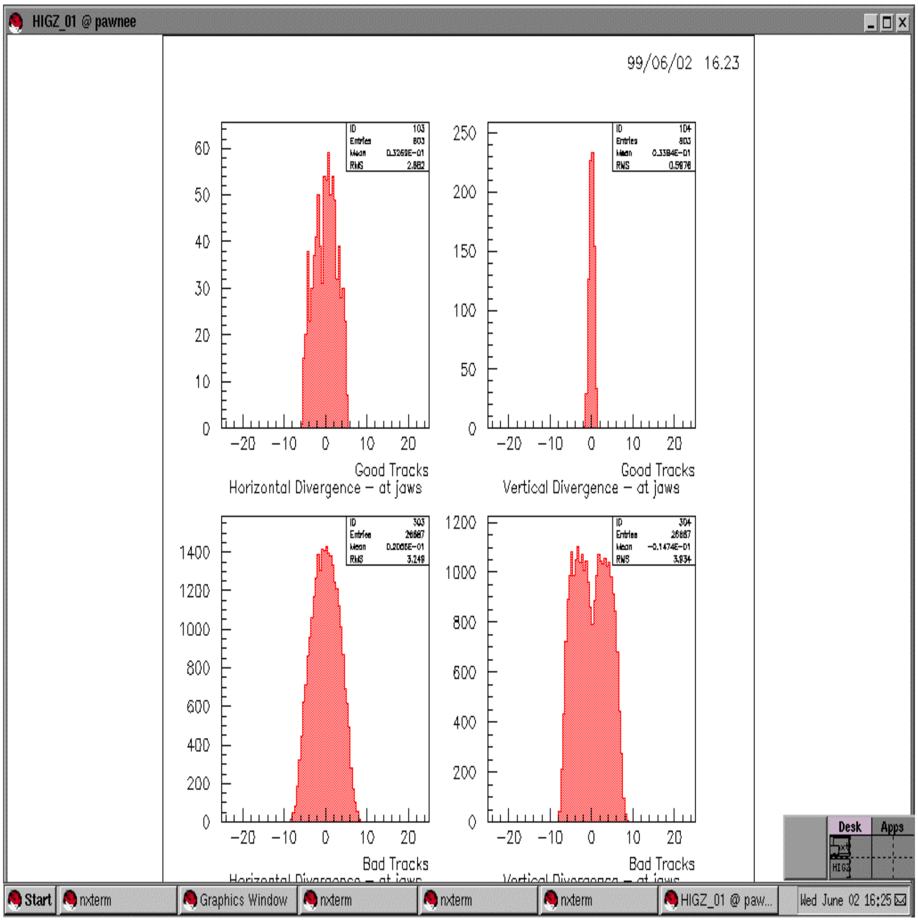


So… Can we figure out where to "find" the good rays? The following obtained by cutting on the previous distribution. Good rays are those which hit a 2cm by 2cm "trigger" (or sweet spot) at the axis of the solenoid, and which have a divergence of less than 10 mR.

Spatial distribution at the Jaws does not help:

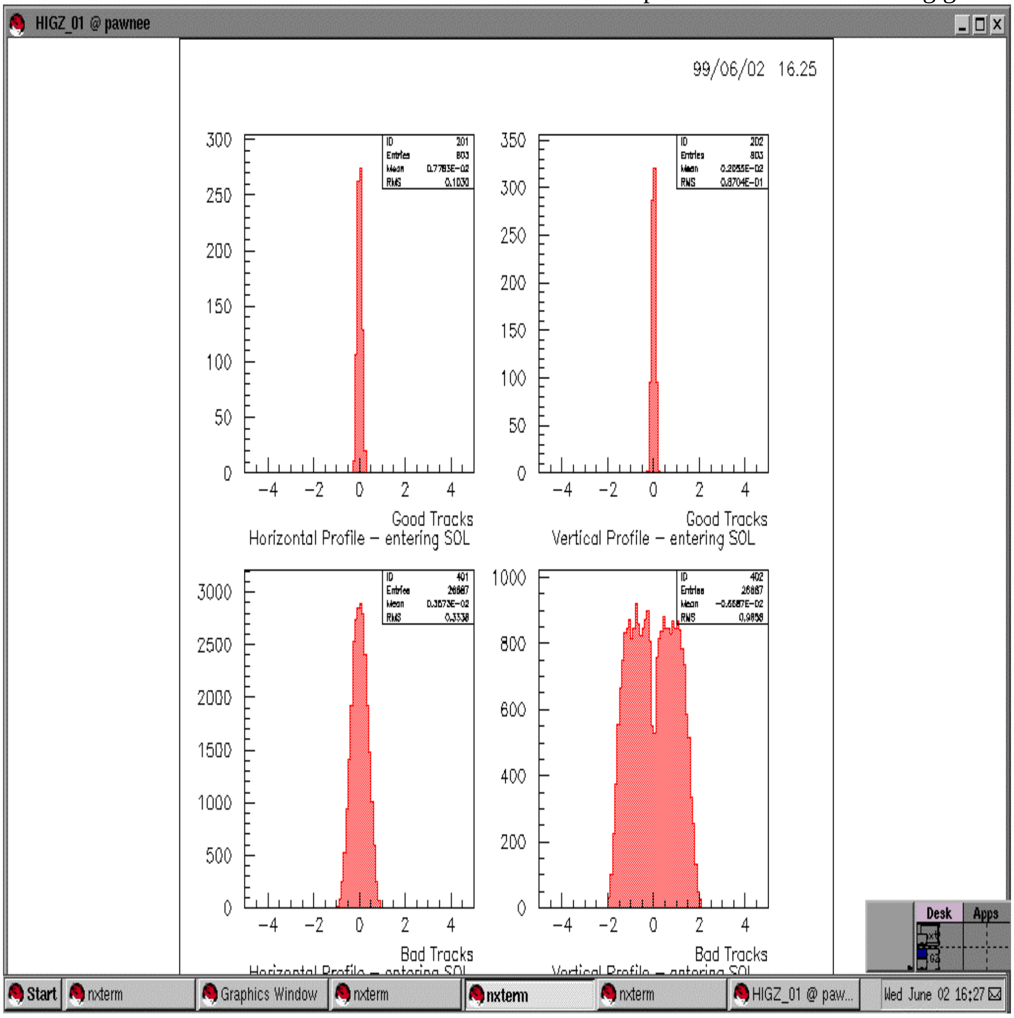


The divergence at the Jaws shows some discrimination, but I doubt it helps.

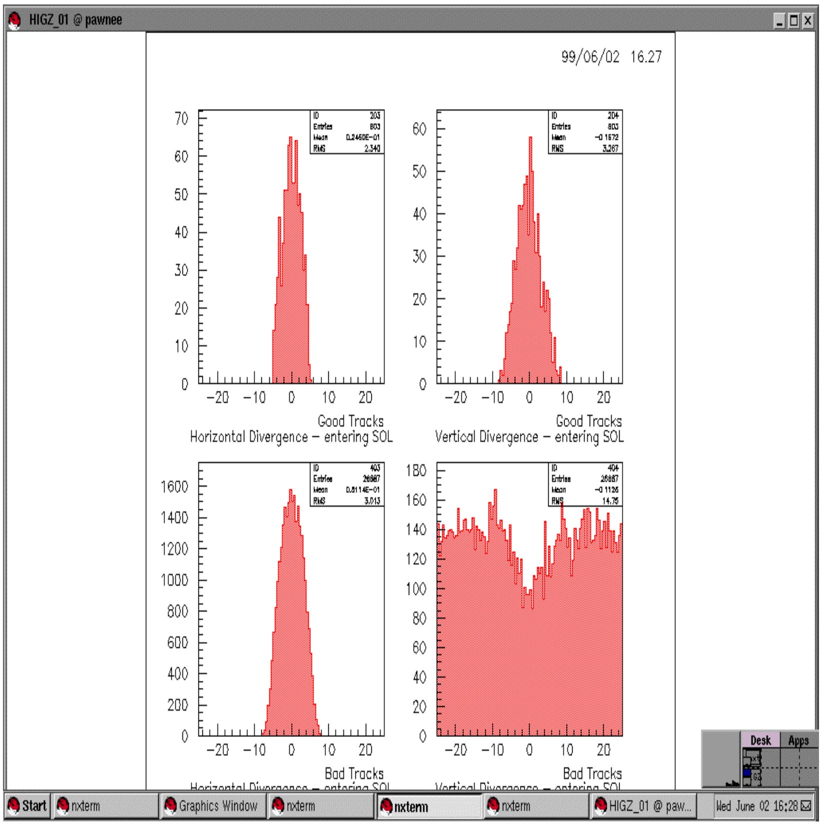


Distributions at the entrance of the solenoid:

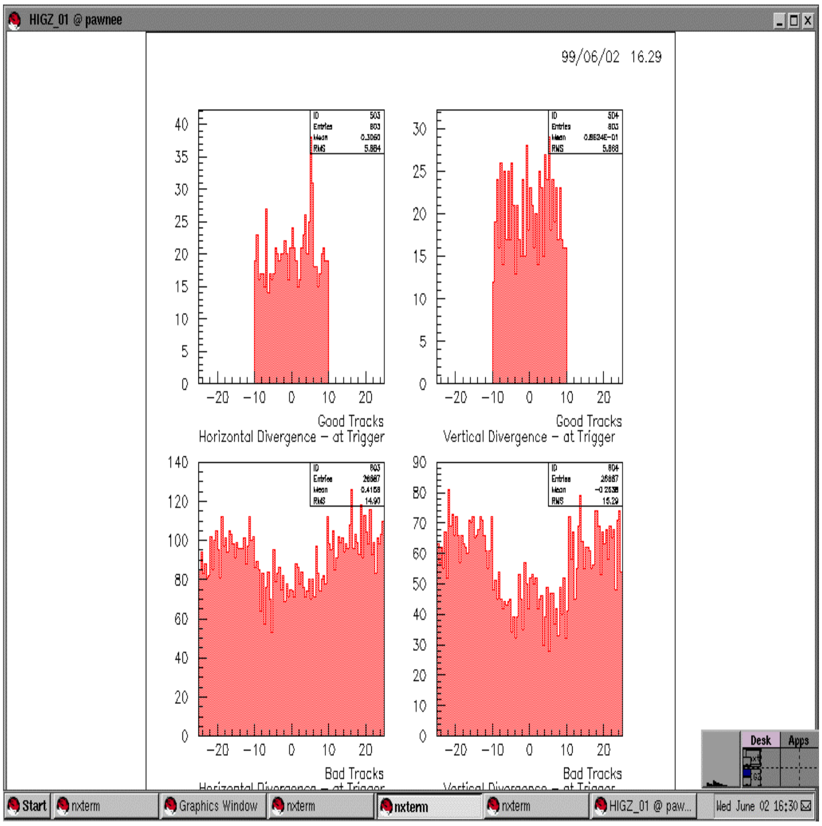
The Vertical distribution at the entrance of the solenoid has potential for discriminating good tracks:



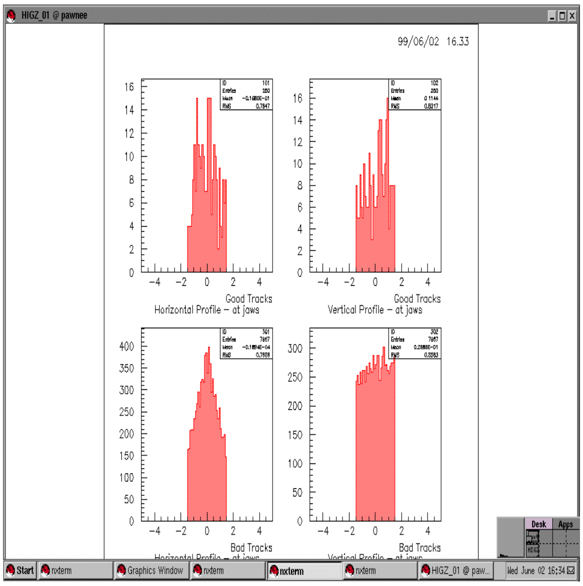
The bad tracks clearly trace to bad divergence entering the solenoid:

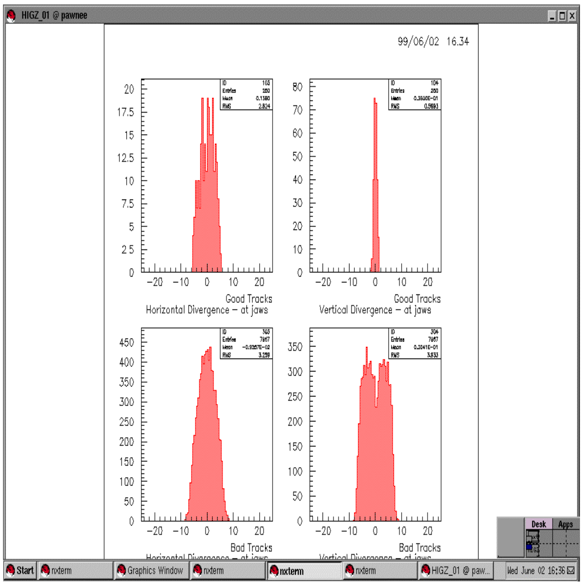


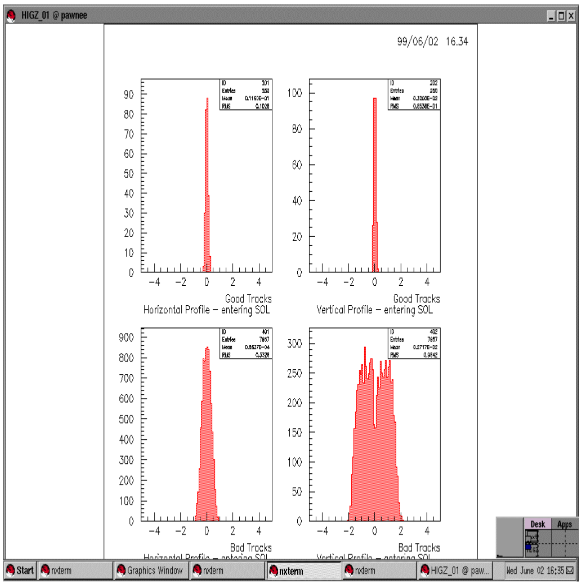
Notice that there is no peak in the divergence distribution at the trigger:

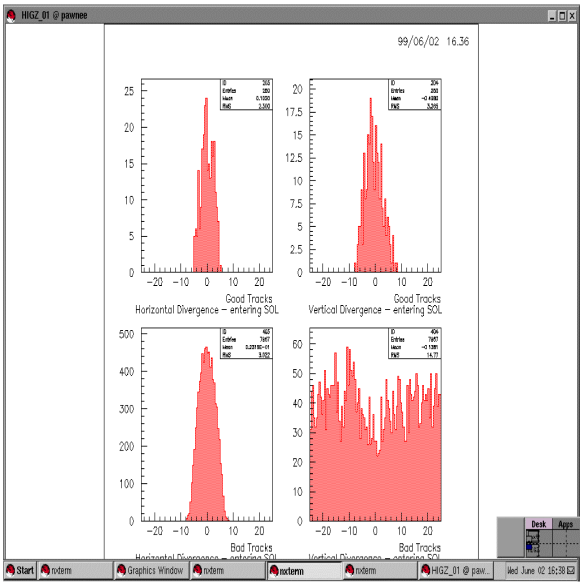


Perhaps we should compare a beam which is parallel as it enters the fringe field.






HIGZ_01 @ pawnee
99/06/02 16.34
Good Tracks
Horizontal Profile – entering SOL
Good Tracks
Vertical Profile – entering SOL
Bad Tracks
Bad Tracks


HIGZ_01 @ pawnee
99/06/02 16.36
Good Tracks
Horizontal Divergence – entering SOL
Good Tracks
Vertical Divergence – entering SOL
Bad Tracks
Bad Tracks