400-GeV PROTON TRANSPORT TO A MODIFIED NEUTRINO AREA

R. Stefanski

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For the Tevetron, a new targeting station called the Front Hall will be built in the Neutrino area in conjunction with an extension of the G2 manhole, Also, a new primary beam line will be installed for calibration beams and beams dump experiments. This ambitious project will be carried out in stages, the first stage to be completed in FY 1980. This first stage will consist of building the extension that will connect enclosure G3 and neuhall and establishing a proton beam transport system between the front hall and enclosure 103 - the targeting station for the N3/N5 beam lines. The G2 extension, however, will not be built this year. To meet the requirements of the physics program for the fall of 1980, a transport system is required to deliver primary protons to the neutrino target tube and to the new target station in enclosure 103. This report gives the details of the design of this transport system.

The transport system to the neuhall target tube will be only slightly affected by the first phase of the Neutrino Area modifications. The beam optics will remain much the same as they are now as can be seen in Figure 1. The Lambertson magnets will move upstream from their present postion in Neuhall to the upstream end of enclosure G3. To get the beam through the 1" Lambertson aperture a horizontal waist is made in the vicinity of enclosure G2. The beam in ν-hall is then somewhat larger, but still fits well within the operatures of MV140 and the targeting quads. A large 2½ mm spot will be used for the fall run, commensurate with the targeting requirements of the horn beam that will run in the period. The beam element coordinates and operating currents are given in Table I.

Considerable change will take place in the by-pass beam, because the Neutrino iron shield installation will destroy the beam line in enclosure 101. The new beam will pass through a beam pipe that will be installed between Neuhall and enclosure 100, and, from there, to enclosure 103. The locations for magnets in this beam is given in Table II.
The Lambertson magnets that are currently located in ν-hall, and bend the beam into the by-pass line will be moved to enclosure G3. A small magnet in G2 (MVT 120) will be used to flip the beam across the Lambertson septum. The electrostatic septa now located in G3, could also be moved to G2 to split D.C. beam between ν-hall and the by-pass line. A string of bending magnets in the Front Hall (B130) and ν-hall (7BN) will match the beam into the new beam pipe. The ν-hall quads (7FN and 7DN) focus the beam into the pipe and match it into the focusing quads in enclosure 103. The bends in enclosure 100 and 103 bring the beam into line with the N3/N5 beam line. The beam optics are given in Figure 2.

The magnet locations in the Front Hall, ν-hall, and enclosure 100 are shown in Figure 3. Figure 4 shows the pre-target magnets in enclosure 103. To implement this scheme, two new B1 magnets will be required for the bend 7BN, and an additional EPB depole will be needed for B130. All other magnets will be taken from the existing NØ, by-pass or N3 beam lines. The enclosures already have sufficient power to support the new beam elements.

The design given in this report will serve as an interim solution for the proton transport at 1TeV. Many magnet locations where chosen to be identical with those required for the Tevatron solution. The beam in enclosure 103 is located near the east wall of that enclosure, because the Tevatron beams will require a bend toward the west. Most of the magnets used in this design will also be required for the Tevatron solution (see TM 934). This design also establishes the operational feasibility of constructing the front hall and installing the long beam pipe to enclosure 103 before the G2 extension is built.

TABLE I

Proton Transport to ν-hall Target Tube

Beam Element	Z (ft)	X (ft)	Y (ft)	B/g	Name	Ø rotation	Peak Power KW	I amp	x' mrad	y' mrad
3Q120	1650.	-.67	729.75	-3.212	Q110		6.2	68	0	10.128
3Q120	1695.	-.67	730.21	2.597	Q111		4.0	55	0	10.128
see note (a)	3155	-.67	744.99	11.1	V140	90°	19 x 4	1049	0	10.128
3Q120	3350	-.67	744.99	3.944	OFN1		9.3	84	0	0
3Q120	3364.5	-.67	744.99	3.944	OFN2		9.3	84	0	0
3Q120	3376	-.67	744.99	-3.446	ODN1		7.1	73	0	0
3Q120	3387.5	-.67	744 99	-3.446	ODN2		7.1	73	0	0
3Q120	3399	-.67	744.99	-3.466	ODN3		7.1	73.	0	0
TGT	3484.22	-.67	744.99				126			

a. This bend consists of four EPB dipoles. The coordinates given in the table are for the bend point.

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TABLE II

Proton Transport to Hadron Beam Trageting Station

Beam Element	Z (ft)	X (ft)	Y (ft)	B/g Kg/kg/in	Name	Ø Rotation	Peak Power KW	I amp	X' mrad	Y' mrad
3Q120	1650.	-.67	729.75	-3.212	Q110		6.2	68	0	10.13
3Q120	1695	-.67	730.21	2.597	Q111		4.0	93	0	10.13
4-4-30	2238.5	-.67	735.71	2.33	VT120	90°	2.4	55	0	10.13
Lambertson	2867.1	-.67	742.00	6	L130-1		19	1152	0	10.00
"	2878.1	-.68	742.11	6	L130-2		19	1152	-1.37	10.00
"	2889.1	-.70	742.22	6	L130-3		19	1152	-2.74	10.00
"	2900-1	-.74	742.33	6	L130-4		19	1152	-4.11	10.00
5-1.5-120	3078.1	-1.71	744.10	12.13	B130-1	33.8°	23	1146	-5.48	10.00
"	3089.1	-1.78	744.21	12.13	B130-2	33.8°	23	1146	-7.80	8.48
"	3100.1	-1.88	744.29	12.13	B130-3	33.8°	23	1146	-10.13	6.99
"	3111.1	-2.01	744.36	12.13	B130-4	33.8°	23	1146	-12.45	5.46
B2	3251.5	-4.07	744.92	11.47	7BN-1	157.87°	63	2970	-14.77	3.95
B2	3272.5	-4.33	744.98	11.47	7BN-2	157.87°	63	2970	-9.91	1.97
3Q120	3315.	-4.59	745	-1.23	7DN		.9	26	-5.06	0
3Q120	3395.	-5.0	745	1.23	7FN		.9	26	-5.06	0
B2	4823.	-12.22	745	11.92	7W00		68	3086	-5.06	0
B2	6047.	-25.03	745	14.88	7H03-1		106	3853	-10.51	0
3Q60	6068.	-25.33	745	-4.16	7D03-1		5.	88	-17.30	0
3Q120	6074.	-25.43	745	-4.16	7D03-2		10	88	-17.30	0
B2	6085.	-25.62	745	14.88	7H03-2		105	3853	-17.30	0
3Q120	6107.	-26.08	745	4.09	7F03-1		10	87	-24.10	0
3Q120	6118.	-26.35	745	4.09	7F03-2		10	87	-24.10	0
3Q120	6129.	-26.61	745	4.09	7F03-3		10	87	-24.10	0
5-1.5-120	6140.	-26.88	745	14.88	7H03-3		35	1406	-24.10	0
5-1.5-120	6151.	-26.16	745	14.88	7H03-4		35	1406	-27.5	0
5-1.5-120	6162.	-27.49	745	14.88	7V03		35	1406	-30.9	0
Target	6175	-27.89	745						-30.9	-3.4

Sum = 738KW

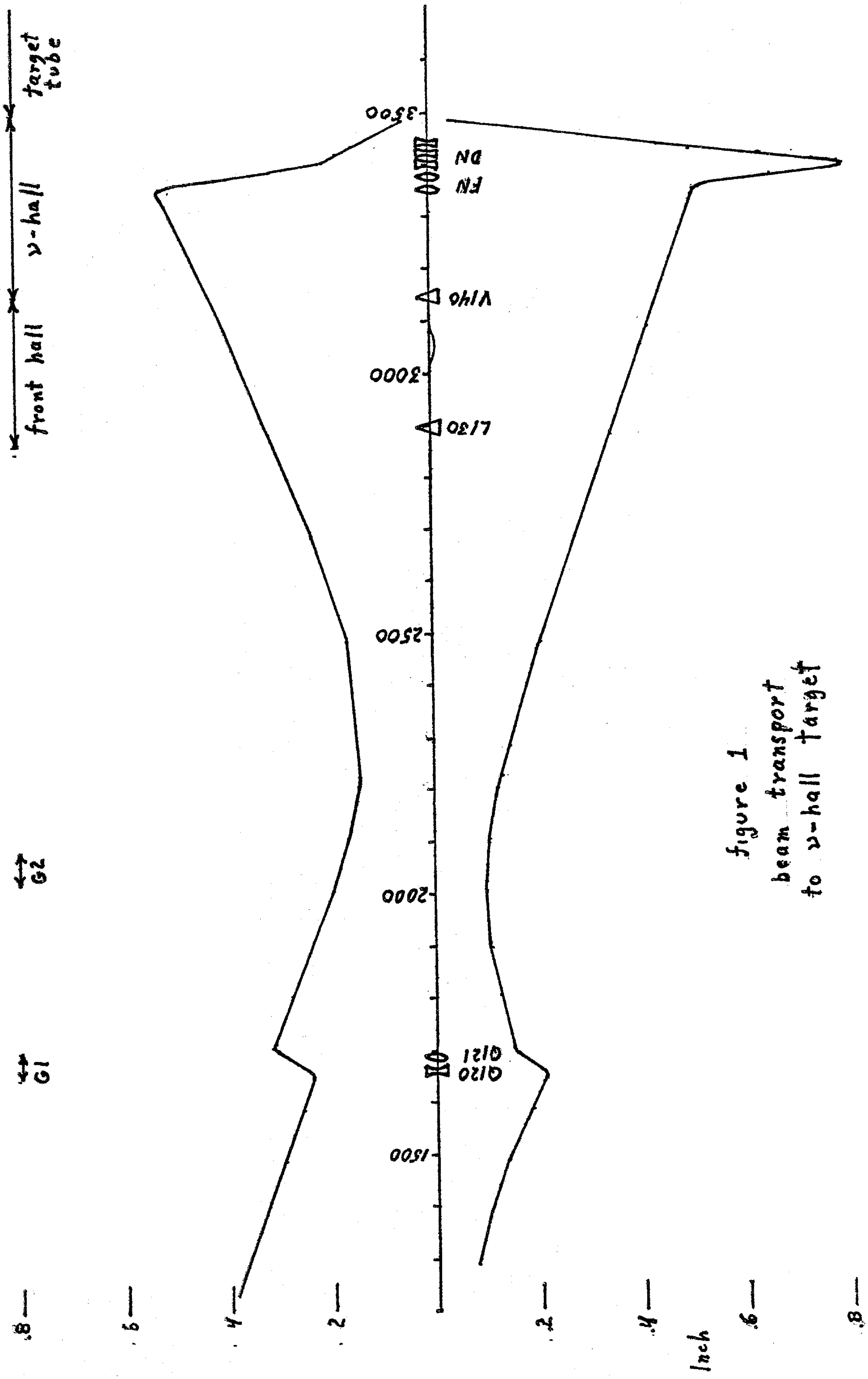


figure 1
beam transport
to ν-hall target

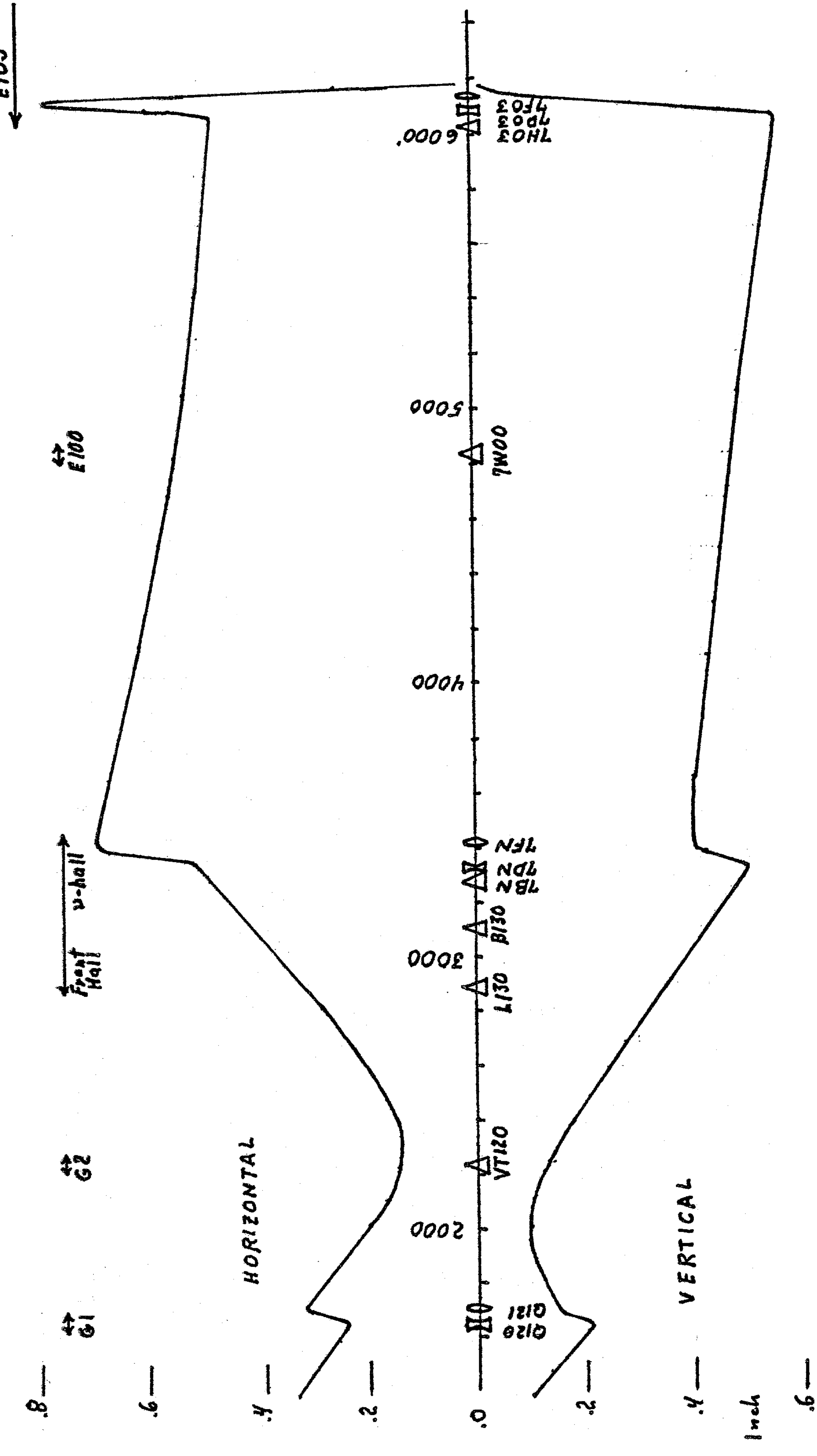
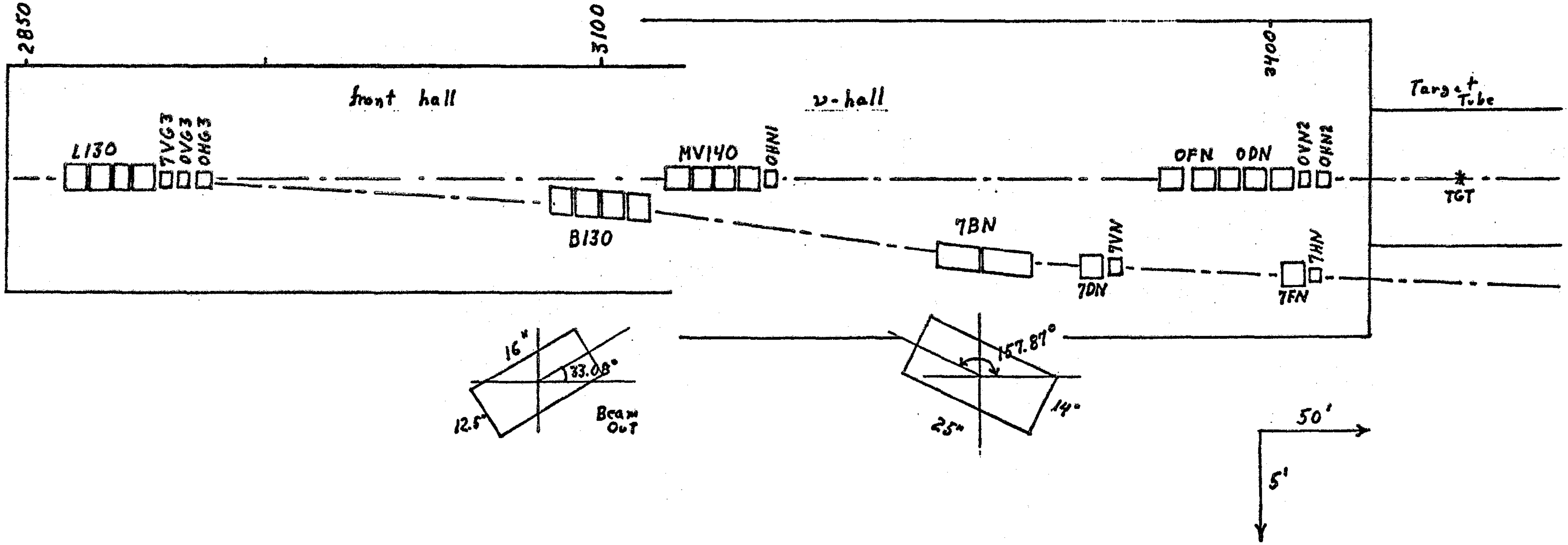


figure 2
beam transport
to encl. 103 target



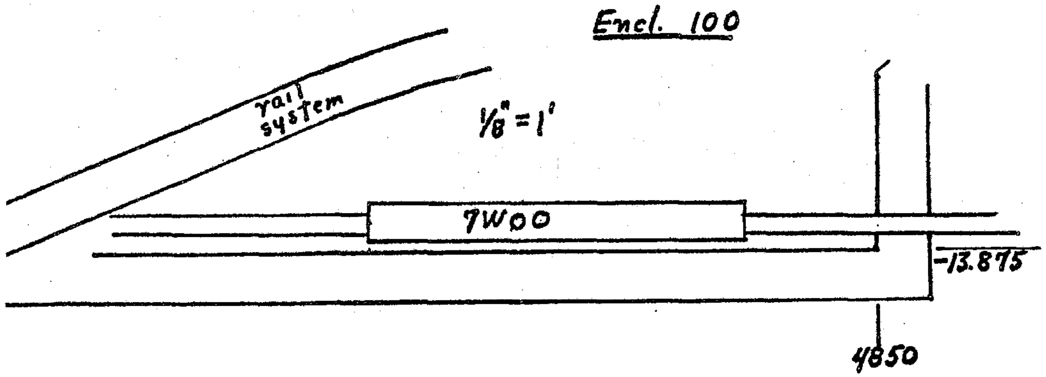


figure 3
magnet locations in front-hall, ν-hall and enclosure 100.

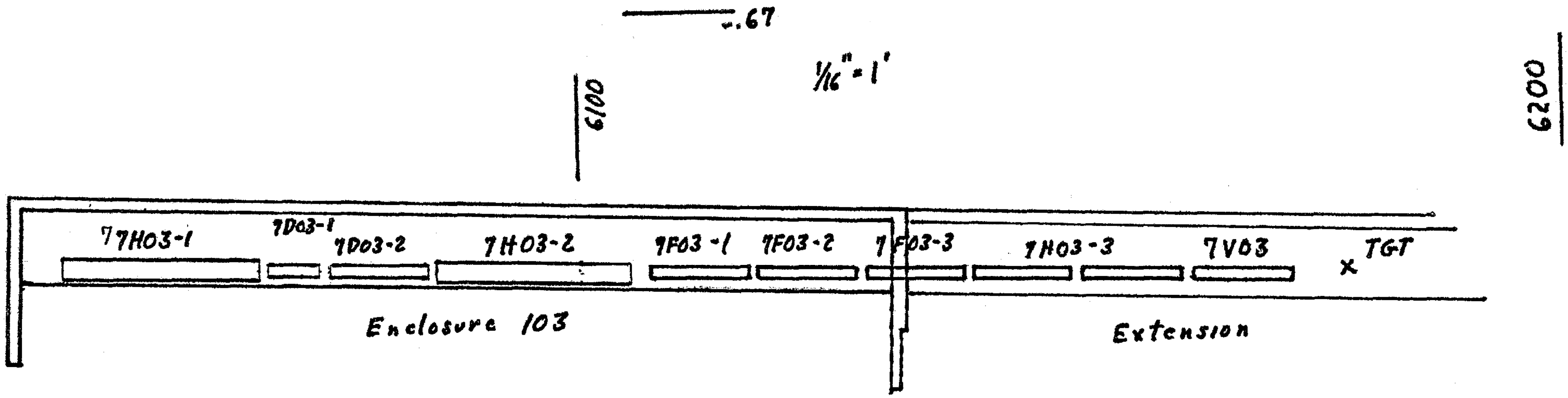


figure 4
pre-target magnet
locations in enclosure 103