Fermilab

REPORT ON A DESIGN STUDY FOR SIMULTANEOUS OPERATION OF THE NØ DICHROMATIC TRAIN AND THE N7 BYPASS BEAM

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Introduction

Within the current physical layout of the neutrino area, it is impossible to place the NØ dichromatic train in the target tube and transport the N7 proton beam along side it. The extension of the target tube to roughly double its length coupled with an increased width allows one to consider simultaneous operation of these two beams.

New Design

The proposed scheme is drawn up in Figure 1, which shows Neuhall, the current target tube, the proposed target tube extension and a portion of the decay pipe. Bend points and bend angles are indicated on the figure. The lambertson magnets (7EN) would have to run 12.7% more than their nominal value (5.5 mr) for N7 running with other neutrino train loads. The 7WN magnets run at a substantially smaller current than usual and, in addition, are displaced by about 40' downstream. Five additional EPB dipoles are needed in the target tube extension to match this beam into the existing path (3 for 7WT, 2 for 7ET). The 7ET magnets could be offset to avoid interference with the NØ beam. The only modification necessary to the train itself would be notching the optical survey marker stands which the beam passes near (Fig. 2A, B) and, perhaps, the installation of some rectangular vacuum pipe.

Problems

Major modifications are necessary, however, to the flux monitoring apparatus for the dichromatic train. When these monitors were first designed, beams to feed the N7 and N1 beam lines were only possible from a common point; the last magnet on the dichromatic train. Monitor sizes and apertures were selected accordingly (Fig. 3).

The proposed design intersects the two monitoring stations (expansion port and target manhole) at sensitive positions. Figure 4 details the original

placement of the fixed monitors at the expansion port. These monitors (a SWIC and an ion chamber) have subsequently been relocated in the downstream "tophat" of the expansion port. The transverse dimensions are the same, however. The proposed N7 beam is seen to intersect these monitors in a region where leakage currents could easily be induced. Figure 5 shows these monitors in their present location and details some of the materials used.

The center, movable part of the expansion port monitoring station, also poses some problems with regard to this new N7 beam position. There are three possible configurations for this center section (shown in Fig. 6). These are 1) Empty, 2) C Counter, 3) RF Cavity. Only the Cerenkov Counter position offers a clear path for the N7 beam.

With the exception of the RF cavity, all of the above monitors could be moved to the Ƶ location immediately downstream of the dichromatic train. New monitors, smaller in size, and therefore less costly and easier to maintain could also be built for installation in the target tube extension.

The other monitoring station, the target manhole, shares the same problems as the expansion port (Fig. 7). Here the monitor sizes were made larger than necessary in order to accommodate the diverging N1 and N7 beams of Fig. 3. These devices could conceivably be made smaller so that the N7 beam does bypass them. This should be no problem for the SWIC, which is needed primarily as a beam steering device. The ion chamber might lose a few percent containment of the beam from a reduction in size, but this could be corrected in later analysis.

Conclusion

A proposal for simultaneous operation of the NØ dichromatic train and the N7 bypass beam has been made, contingent on the completion of the target tube extension and a re-working of the dichromatic flux monitoring devices.

FIGURE CAPTIONS

1. Proposed Layout: Dichromatic Train and New N7 Beam.

2. Optical Survey Marker Stands
   A. Bedplates 1-8
   B. Bedplates 9-10

3. Original Flux Monitor Constraints

4. Upstream Tophat: Expansion Port

5. Current Layout: Expansion Port

6. Center Section: Expansion Port

7. Target Manhole Layout

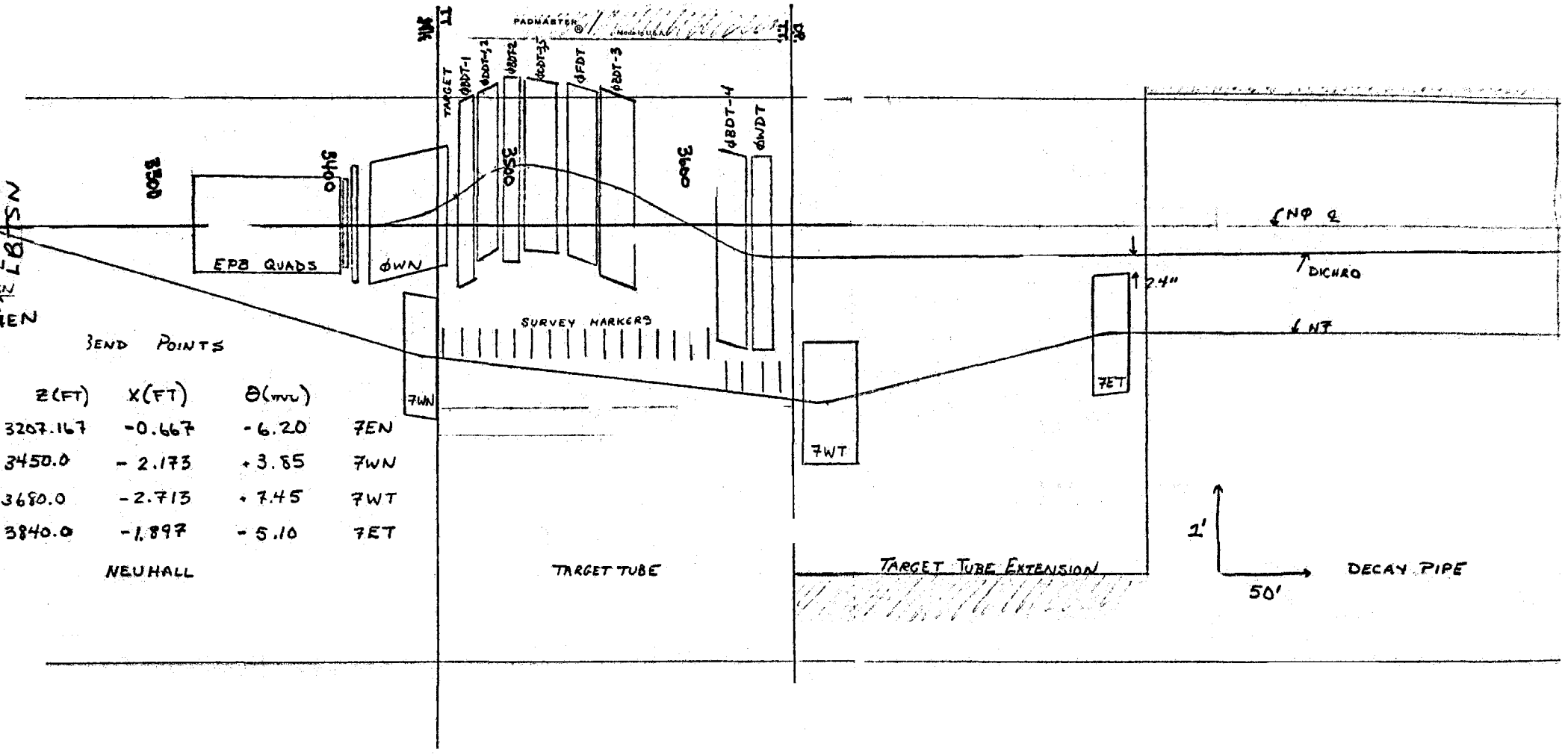

PADMASTER
TARGET
ΦBDT-1
ΦBDT-2
ΦBDT2
ΦBDT-3
ΦFDT
ΦBDT-3
ΦBDT-4
ΦWDT
3500
3450
3400
EPB QUADS
ΦWN
SURVEY MARKERS
7WN
7WT
7ET
℄NΦ ℄
DICHRO
2.4"
℄ NT
BEND POINTS
Z(FT) X(FT) Θ(mrl)
3207.167 -0.667 -6.20 7EN
3450.0 -2.173 +3.85 7WN
3680.0 -2.713 +7.45 7WT
3840.0 -1.897 -5.10 7ET
NEUHALL
TARGET TUBE
TARGET TUBE EXTENSION
1'
50'
DECAY PIPE

Figure 1

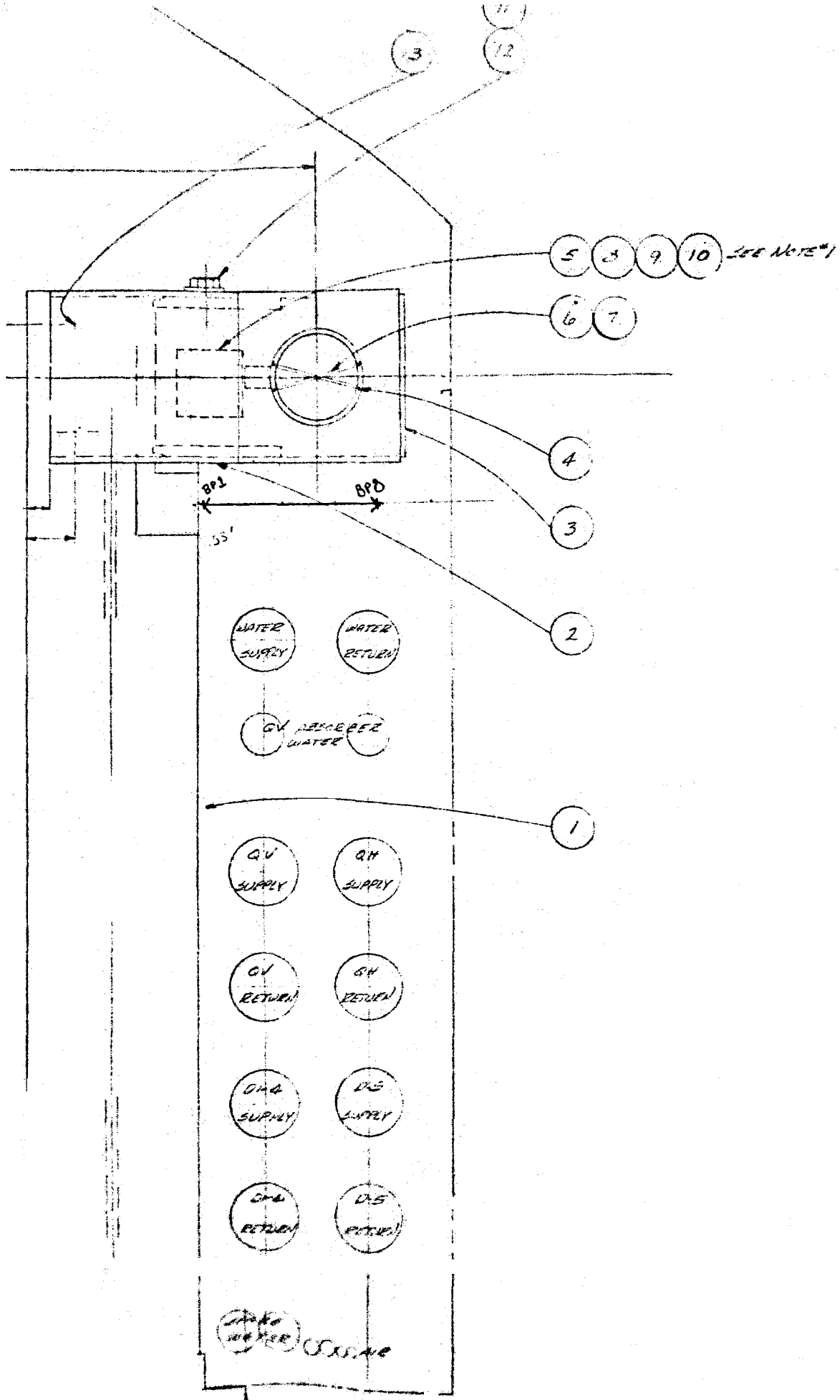
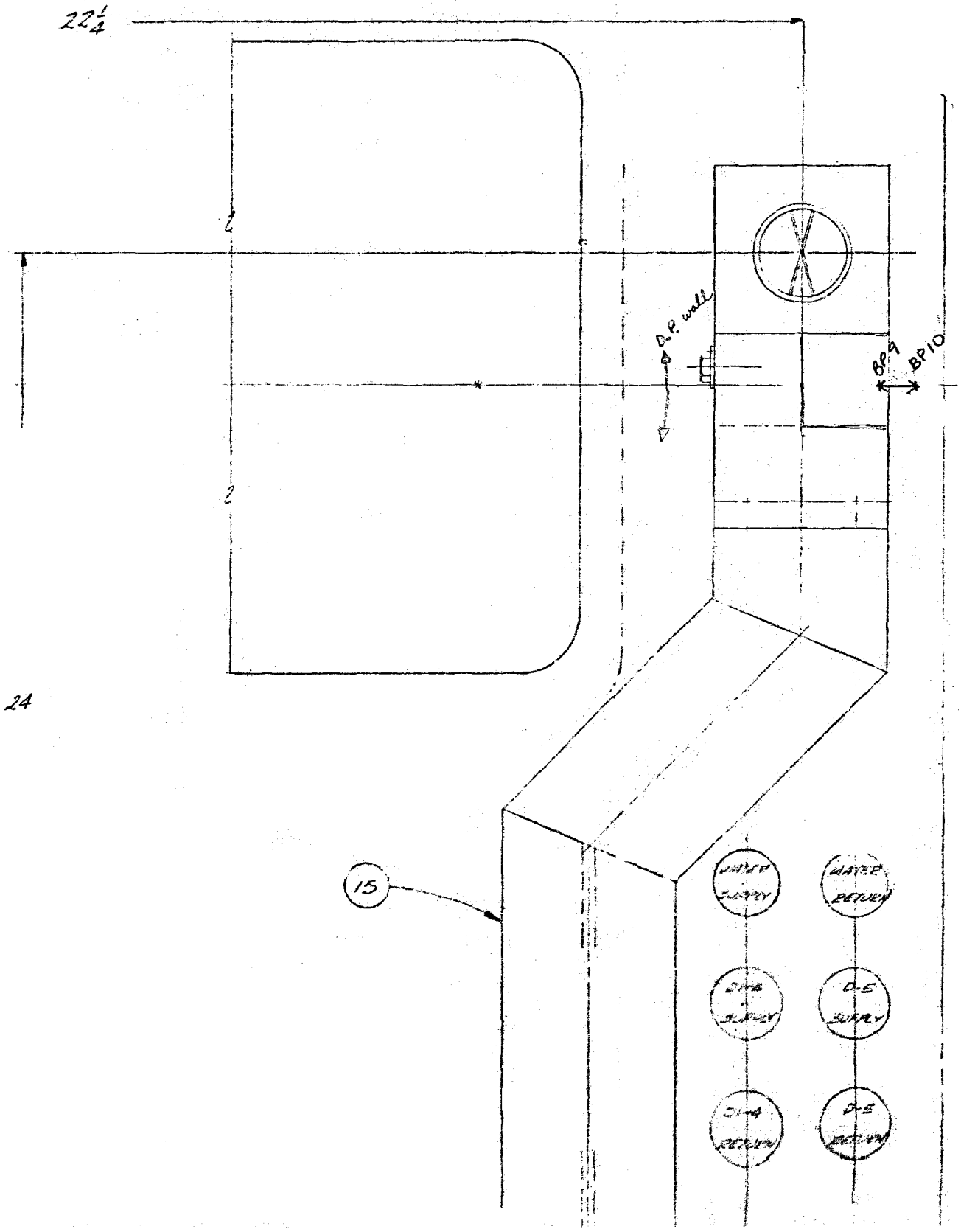

3
12
5
8
9
10
See Note #1
6
7
4
3
BP1
BPD
.55'
2
WATER SUPPLY
WATER RETURN
QV RECIRC WATER
1
QV SUPPLY
QH SUPPLY
QV RETURN
QH RETURN
QH4 SUPPLY
QH5 SUPPLY
QH4 RETURN
QH5 RETURN

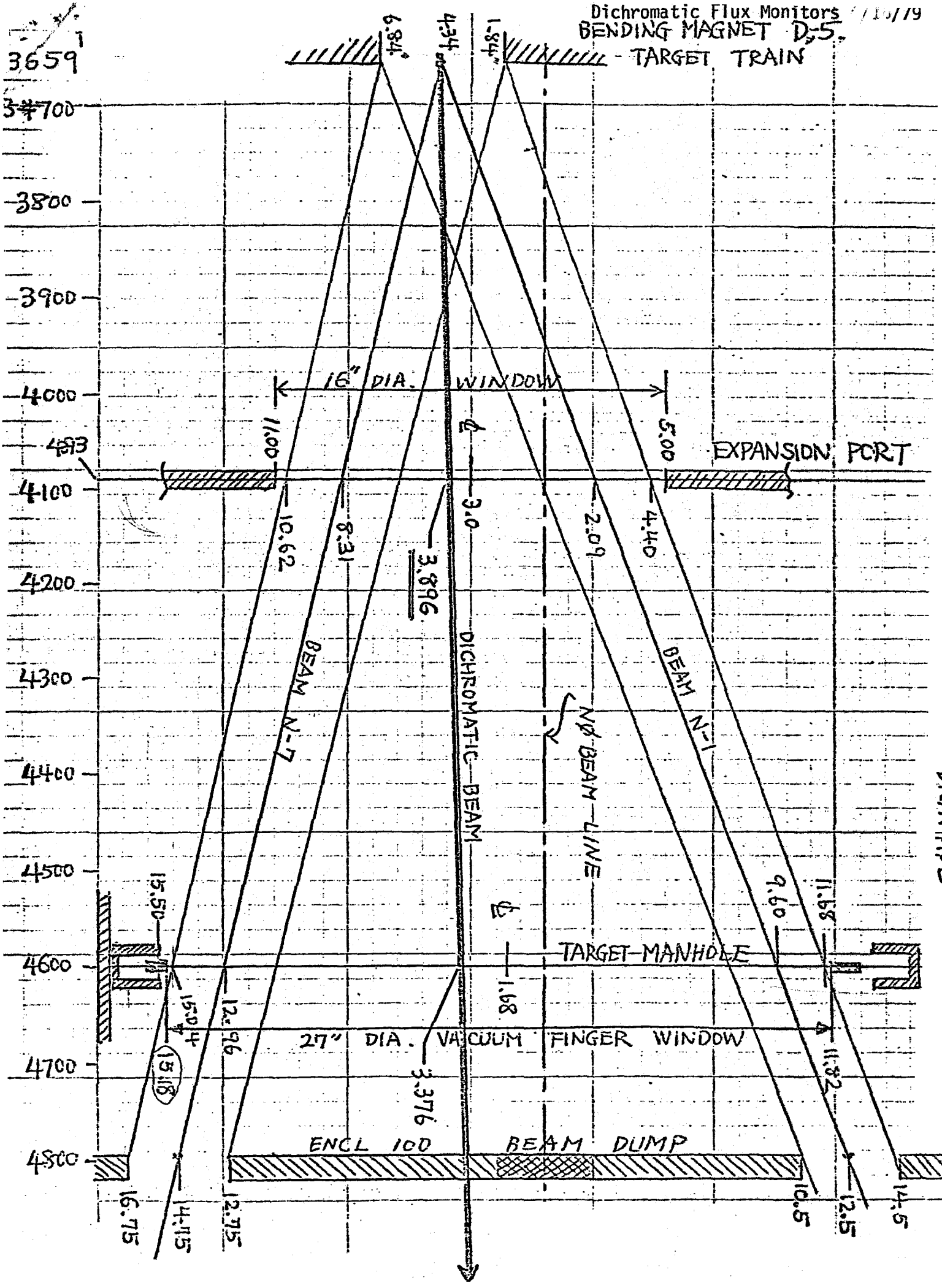
Figure 2A

Figure 2B



24

15	MC-10
14	
13	
12	
11	
10	
9	
8	
7	
6	–
5	MB-8
4	MC-8
3	MB-8
2	MC-1
1	MC-1


Dichromatic Flux Monitors 7/10/79
BENDING MAGNET D-5.
TARGET TRAIN
6.84"
4.34"
1.84"
3659
3700
3800
3900
4000
4013
4100
4200
4300
4400
4500
4600
4700
4800
16" DIA. WINDOW
EXPANSION PORT
11.00
5.00
10.62
8.31
3.896
3.0
2.09
4.40
BEAM N-7
DICHROMATIC BEAM
NØ BEAM LINE
BEAM N-1
15.50
15.04
12.96
1.68
9.60
11.68
11.32
TARGET-MANHOLE
27" DIA. VACUUM FINGER WINDOW
3.376
ENCL 100
BEAM DUMP
16.75
14.15
12.75
10.5
12.5
14.5
DISCHARGE