BNL-104034-2014-TECH

AGS.SN157;BNL-104034-2014-IR

Transport of SBE Beam to the D Target

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June 1983

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U.S. Department of Energy

USDOE Office of Science (SC)

Number 157

AGS STUDIES REPORT

Date June 8-9, 1983 Time 1700 - 0800

Experimenters J.W. Glenn and J. Ryan

Reported by J.W. Glenn

Subject Transport of the SBE Beam to the D Target

OBSERVATIONS AND CONCLUSION

Introduction

Beam was extracted to the slow beam line at 24 GeV/c in Single Bunch Extraction (SBE) mode and transported to the D target. Transport efficiency vs intensity and losses were measured. Optical modeling is consistent with the observations and indicated that the full beam can be transported within the present beam line constraints.

Performance Observations

An initial estimate of an optical setup for the D line was tried without great success as the nonlinearity of field in some magnets was not considered. After lengthy tuning of a low intensity SBE beam, transmission was measured at several intensities (Figure 1). The decrease in transmission with intensity is consistent with beam size increasing with intensity. Two "COUT" printouts were generated at different stages in the tuning. A plot of efficiency vs losses (Figure 2) roughly indicates that the SEC's respond equally to beam intensity and the loss monitors read 1/3 low. The absolute calibration of these SEC's is in doubt as the first one indicated 12% extraction efficiency and only one bunch (8.3%) was extracted. The remaining 11 bunches were seen in the U line.

Beam sizes were observed on the available flags. Upstream, the sizes correlate well with sizes predicted by a later run of Ryan's beam transport modeling program, JFR (Figure 3). Also, an IPM profile from G. Smith agrees well with the emittance assumed for this model. Downstream, the measured sizes are significantly smaller than predicted, also the spot on the D215 flag shows a sharp edge on the east side. The aperture causing this cutting of the beam is not apparent. The tilts observed on the flags of the beam spots agree well with those predicted by the model from sextupole moments in the thick Lambertson magnets.

Beam losses are plotted (Figure 4) on the same distance scale as Figure 3. Long and point loss monitors correlate well. The lines are sketched to guide the eye. Beam losses along the line show peaks at the first wall and near the polarimeter in the D cave. Also, they also may indicate losses in the 21° bend area that are well shielded by the magnetic iron. These losses occur in regions where there has been aperturing indicated by the beam model and the observed sizes have become smaller than predicted.

Conclusions

Subsequent adjustment of the computer model produced a beam envelope smaller than the expected apertures (Figure 5). The matching of size at the IPM and upstream indicate a realistic emittance for the model. Misunderstanding of the orientation of the extracted beams emittance can be compensated for with the first four quads. Thus, this solution provides a strong indication that there exists a solution to "cleanly" transporting the beam. At high intensity the beam envelope should be about 10% bigger than Figure 5 shows, but would still fit the aperture.

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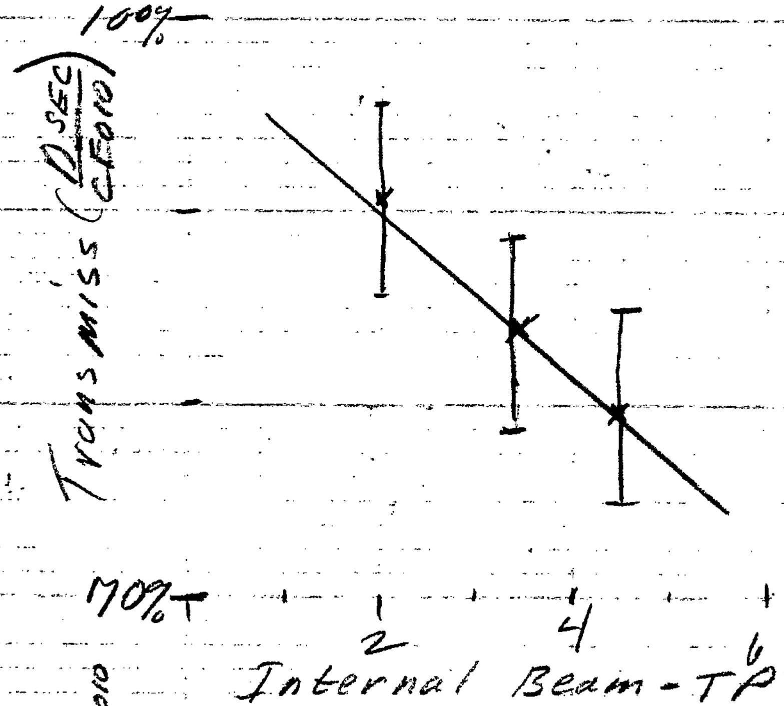


Fig. 1

Transport efficency vs Internal Beam Intensity

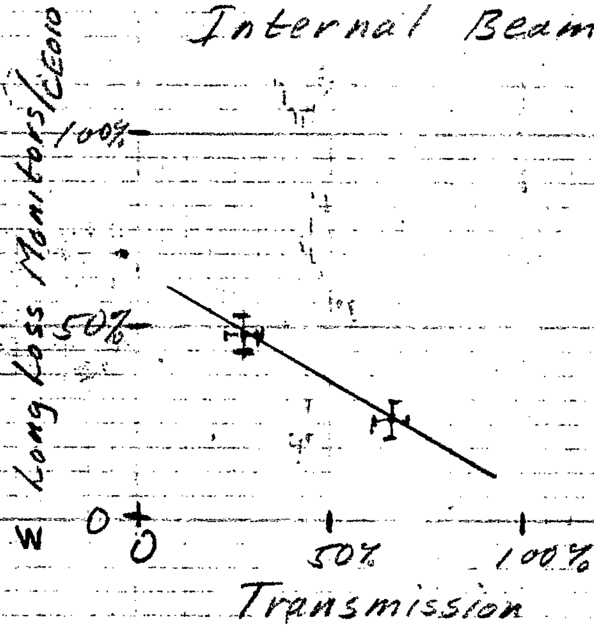


Fig. 2

Sum of Long Loss Monitors times arbertrary constant and normulized to Extracted Beam vs Transmission Efficency

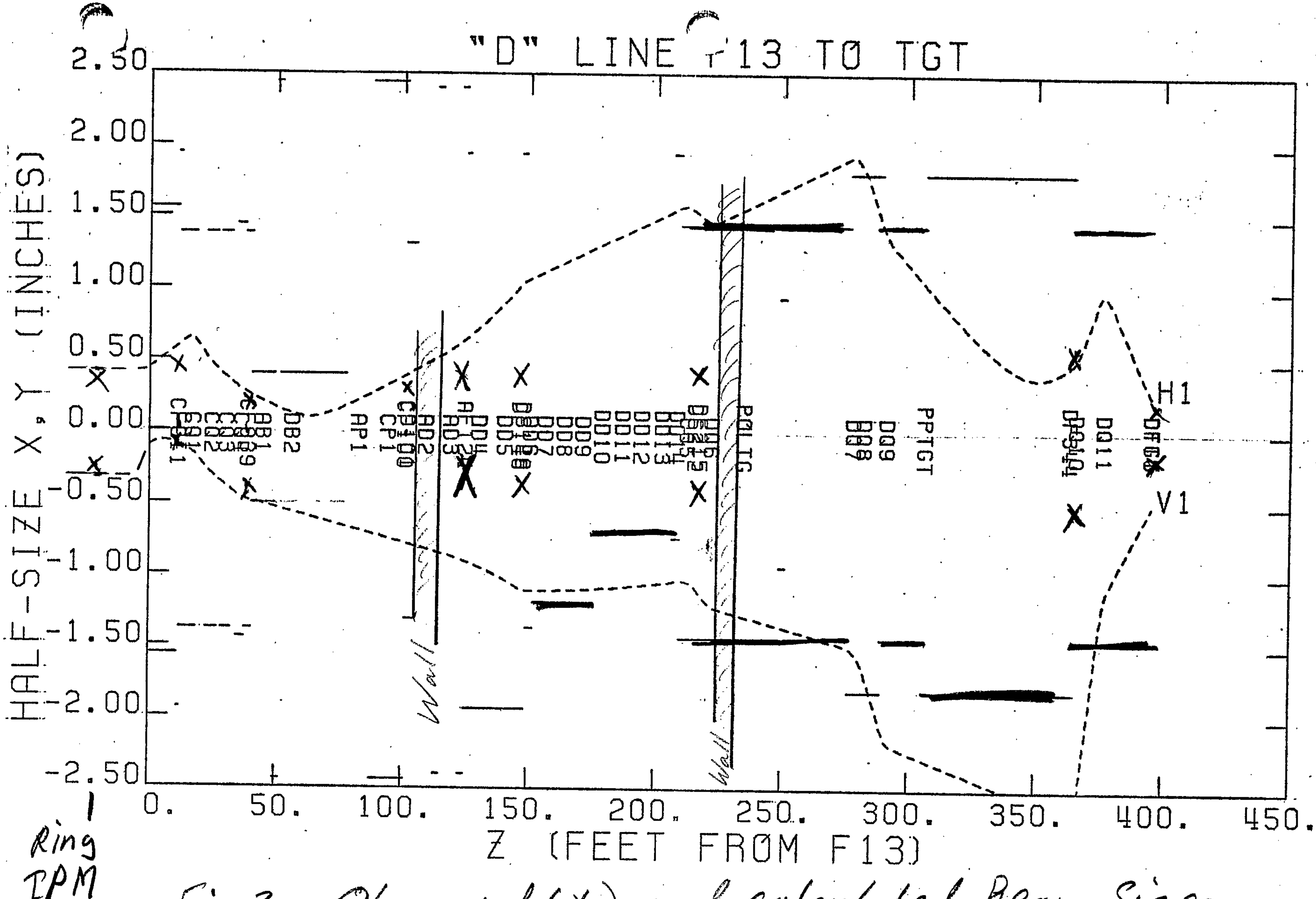
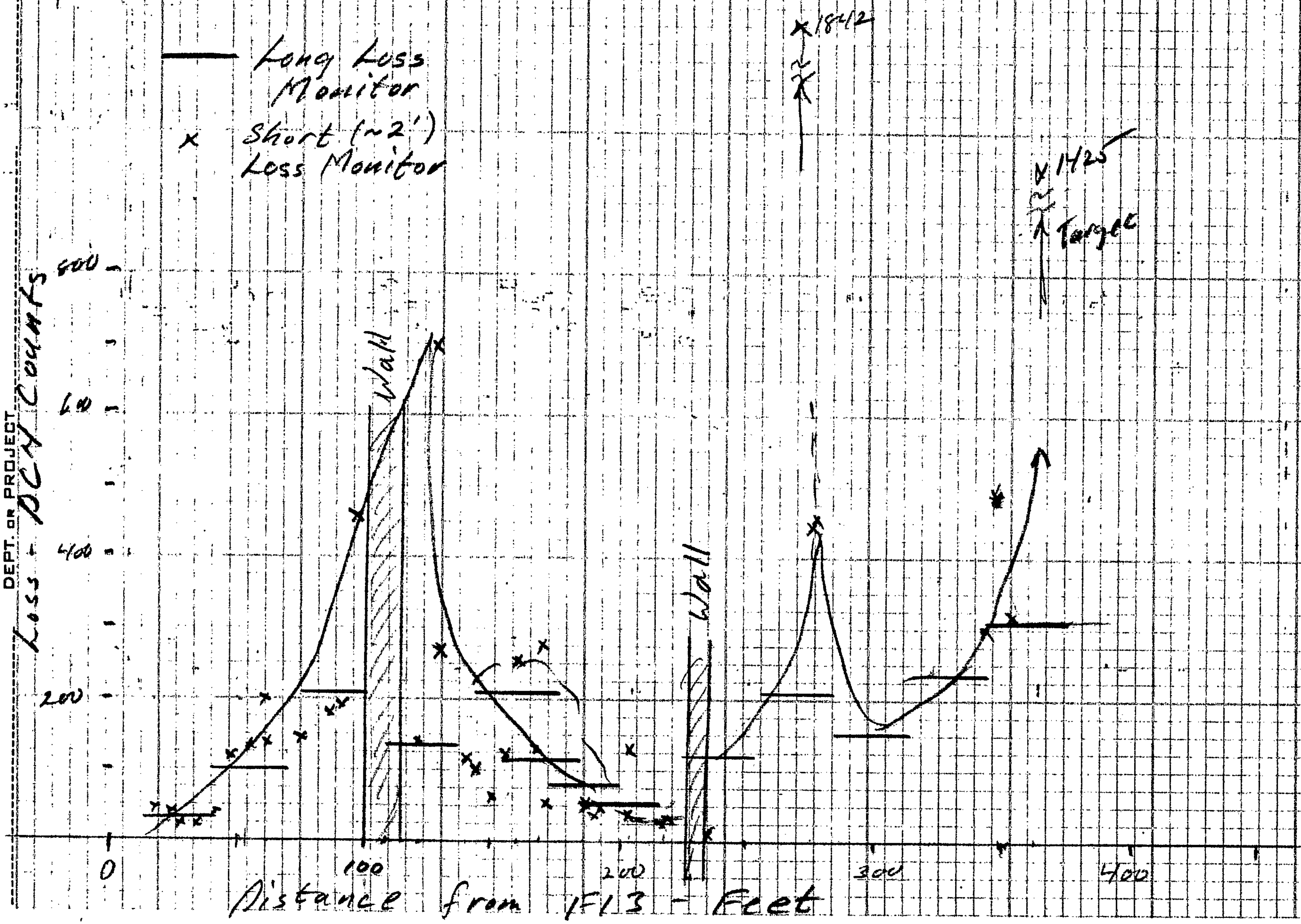


Fig 3 - Observed (X) and calculated Beam Sizes in the Transport to D Target

Fig 4 Beam Loss along the Transport to D Target.



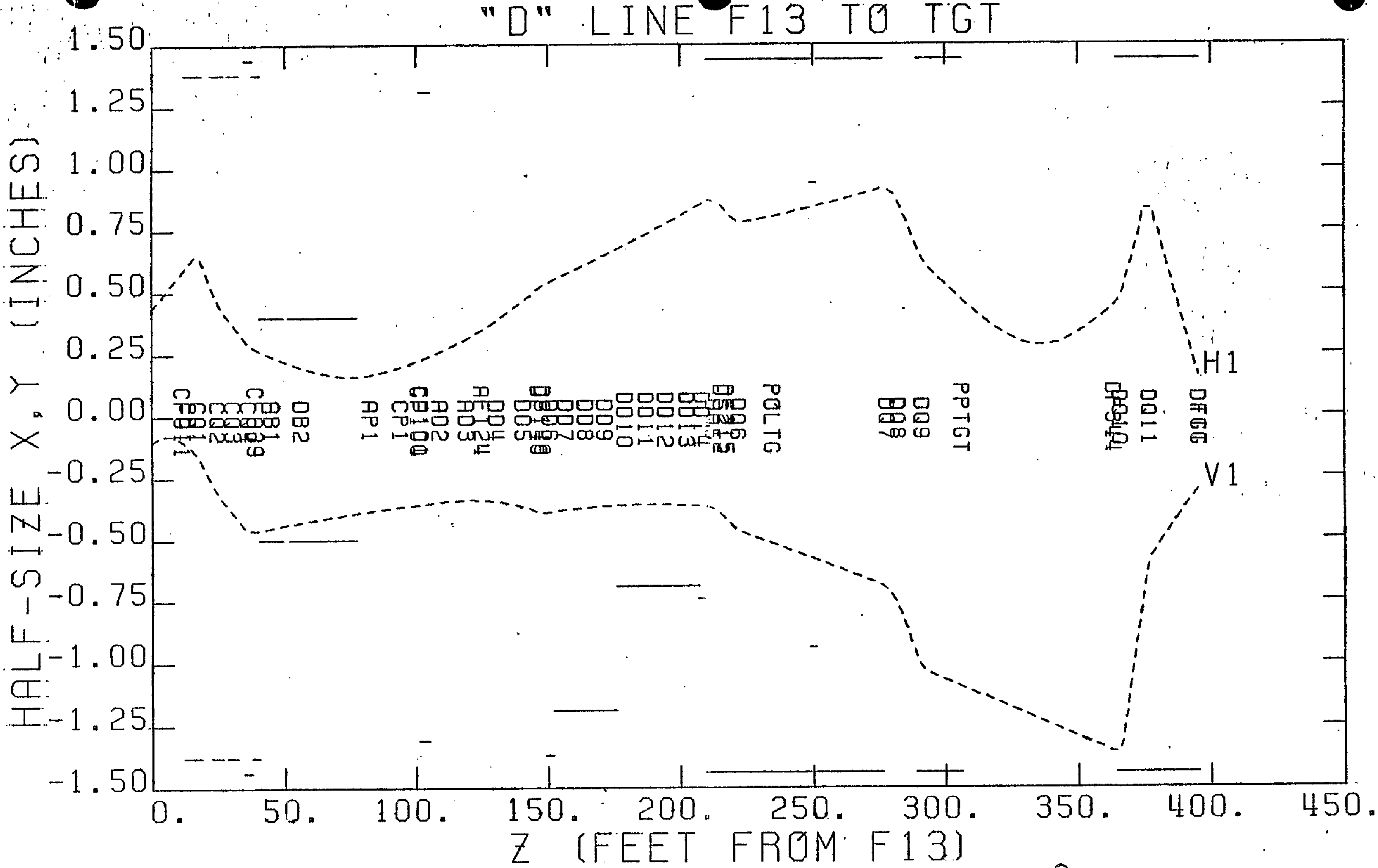


Fig. 5 Modeled "Clean" Transport of SBE Beam to D Target.