BNL-104039-2014-TECH
AGS.SN162;BNL-104039-2014-IR

Measurement of Tune Conditions for HEBT Achromatic Bend

M. Q. Barton

March 1984

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy
USDOE Office of Science (SC)

DISCLAIMER

Number 162

AGS Studies Report

Date March 26, 1984 Time 1100-1330

Experimenters D. Barton, K. Reece

Reported by D. Barton

Subject Measurement of Tune Conditions for HEBT Achromatic Bend

Observations and Conclusion

A potential problem area in the operation of the HEBT line is the tuning of the three quadrupoles in the achromatic bend. These three quads, which, in the absence of a small correction for space charge, are run as a symmetric triplet, are required to provide a point-to-point focus in the horizontal (bend) plane between the centers of the two bending magnets. This tune recombines off-momentum rays to give the proper dispersion-free conditions at the beginning of the matching section of the line. The three control parameters (DACADS settings) presently available for these quads should actually be reduced to a single parameter which selects, through these constraints, a set of currents which satisfy the proper conditions. The single parameter would provide the means for matching the desired vertical tune in this section of the line.

The method used in this measurement consisted of using the magnetic-loop position monitor downstream of the second bending magnet (Y352H) to measure horizontal displacement of the beam. The bending magnet current was set successively to values chosen to represent substantial off-momentum settings of the beam. The outer pair of quadrupoles (NQ280, NQ317) were then held at a fixed setting while the central quad (NQ299) was varied to produce a sweep of the beam at the position monitor. The procedure was then repeated for two more fixed settings of the outer quads. The data are shown in Fig. 1. The reading accuracy of the position monitor on the scope was approximately 0.01 V which has been indicated on the ploted points. Straight lines have been drawn by eye to the data in order to determine the points for which the position is independent of bending magnet setting. These three measurements each yield a point on the locus of allowed settings for these quads which should be a straight line. These data are plotted in Fig. 2 and are in good agreement with linearity. The equation of the straight line is:

$$X = (1.935)\ Y - 775.1$$

where X = DACADS (NQ280,NQ317) and Y = DACADS (NQ299)

Also shown in Fig. 2 is the prediction for this line based on a TRANSPORT calculation of the tune and DACADS calibration constants from LeMaire* with zero offsets. The open circle on the measured line corresponds to the running conditions found at the start of the study, which at least demonstrates that underconstrained controls can sometimes give serendipitous results. Finally, Fig. 3 is a plot of the calculated TRANSPORT tuning line for these quads in actual magnetic gradient.

*LeMaire, J-L, "A Study of HEBT Optics and Instrumentation", BNL 22498 (1977)

mvh

Distribution: Dept. S&P

FIG 1. HERT BEND DISPERSION DATA (USING PM 352V)

D. BARTON 3/27/84

ND 249
x 495 (DACADS)
o 465
△ 475

NQ280, NQ317 = 250

PM 352H (V)

.24
.20
.16
.12
.08
.04
.0

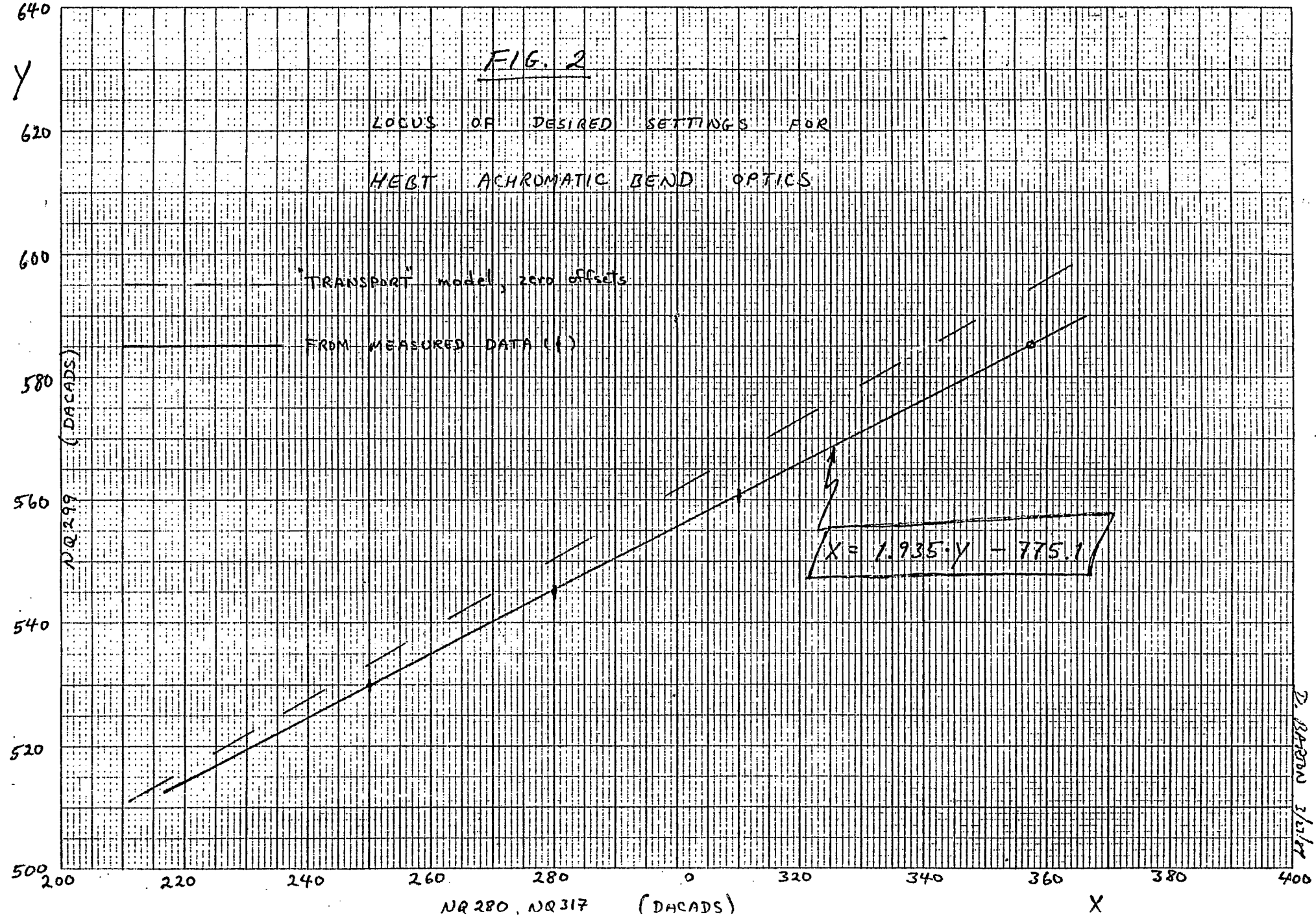
510 520 530 540 550
NQ299 (DACADS)

NQ280, NQ317 = 280

530 540 550 560 570
NQ299 (DACADS)

NQ280, NQ317 = 310

540 550 560 570 580
NQ299 (DACADS)



D. RAYDON 3/27/67

D. Barton 8-FEB-84