Jefferson Lab Alignment Group

Data Transmittal

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Details:

Following the gyro-theodolite survey (Data Transmittal L625), and beamline transfer surveys (DTM L634 & L643) carried out in 2000, a tie to linac elements was recently made. Two quadrupoles in the north linac and two in the south were measured with optical tooling equipment. The south linac tie repeated the theodolite survey from October, 2000. This allowed for a check on the stability of the linac elements as well as the consistency of the survey methods. The results are shown below.

The azimuth between the elements was calculated using survey monuments consistent with the gyro survey ("T/fer Az"). An estimate has been made for the errors associated with the optical tooling transfers from these monuments to the quadrupoles. These estimates are shown in millimeters for the upstream and downstream components of the line ("U/s / "D/s"), and are equivalent to the transverse error ellipse component used in the previous data transmittals. The distance between the elements is again given for reference ("Dist"), and is used with the upstream / downstream errors in the determination of the azimuth error between the elements. This is given in degrees ("Az. error").

As before, these surveys are to fiducials on each element. The accuracy of fiducialization is typically in the order of 0.05mm. An angular error has been computed ("Fid error") using this and the distance between elements. The accuracy of the original gyro measurements was estimated at 3 seconds. This has been included in the final error estimate which is the RMS combination of the Gyro instrumental error, the azimuth error and the fiducialization errors.

It can be seen, therefore, that the transfer azimuth for both linacs are within the total error bar associated with the survey. These and the previous results have proved that there are no significant systematic errors associated with the survey network which was used to align the elements in the accelerator. Rather than take the small sample surveyed here, it is reasonable, then, to assume that the ideal values for the azimuths in the accelerator are the "best values" to characterize the beamline, and to attach an error consistent with those indicated below.

	Line	T/fer Az. (deg)	U/s / D/s (mm)	Dist (m)	Az. error (deg)	Fid error (deg)	TOTAL error (deg)
SL'00	**QB2L16-20**	**270.0005**	**0.04 / 0.04**	**38.40**	**0.0001**	**0.0001**	**0.0009**
SL'03	**QB2L16-20**	**270.0004**	**0.12 / 0.12**	**38.40**	**0.0004**	**0.0001**	**0.0009**
NL	**QB1L16-20**	**90.0009**	**0.12 / 0.12**	**38.40**	**0.0004**	**0.0001**	**0.0009**