

## Analysis of RICH Mirror Measurements

Mary Ann Antonioli, Tyler Lemon, Sahin Arslan, Peter Bonneau, Pablo Campero, Brian Eng, Amanda Hoebel,  
George Jacobs, Mindy Leffel, Marc McMullen, and Amrit Yegneswaran

*Physics Division, Thomas Jefferson National Accelerator Facility, Newport News, VA 23606*

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CAD programs and Python were used to calculate linear dimensions of the ten RICH mirrors. CAD and Python results were compared to the ideal model. Based on the results, it was determined that all ten mirrors meet specifications.

To determine dimensions of the ten concave RICH detector mirrors (Fig. 1), calculations using Python programming and CAD (to cross-check Python results) were made on data taken with a coordinate measuring machine (CMM).

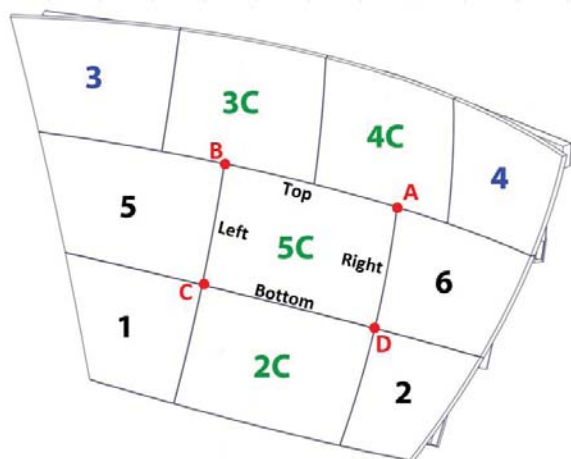


FIG. 1. Drawing of RICH mirror assembly, labeled with mirror identification numbers and side identifications.

The  $x$ ,  $y$ ,  $z$  coordinates from the CMM measurements of each mirror’s corner points were copied into an AutoCAD drawing and the distances measured from corner point to corner point. Additionally, the side lengths of the total assembly, Fig. 2, and the lengths of the top and bottom of each row of mirrors were determined.

To measure arc radius and arc length of each mirror side, the solid modelling program NX was used. CMM coordinates were imported into NX for each mirror’s corner points and three additional points for each side. Using three points for an arc, three arcs—corner 1 to corner 2, corner 1 to mid-point, and mid-point to corner 2—were drawn for each side. The three radii were averaged to determine arc radius for that side. The arc length was measured using the corner points and mid-point of that side.

Arc lengths were also calculated using the CMM points with Python software. Python added the measurements from point to point, using all CMM points.

Arc lengths of the ideal design were calculated using trigonometry, and were compared to the NX and Python calculations to assess the mirrors’ conformity to the ideal design. Table I is a sample of arc length measurements. Colored rows

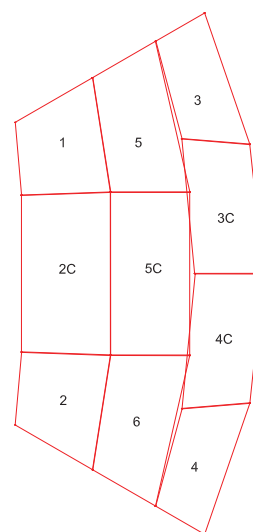


FIG. 2. AutoCAD drawing of mirror assembly, made using CMM corner points.

indicate mirror sides that are adjacent, and therefore should be close in measurement.

After reviewing all measurement data, it was determined that the RICH mirrors meet specifications.

Mirror	Side	Ideal	Python	NX
1	top	611.42	609.44	617.58
	left	554.68	551.84	560.30
	bottom	383.83	380.49	387.99
	right	522.61	519.50	527.45
2C	top	840.98	834.86	834.83
	left	522.70	520.57	520.55
	bottom	808.73	804.34	804.29
	right	522.70	520.73	519.81
2	top	611.43	606.82	616.88
	left	522.61	519.48	527.73
	bottom	383.83	378.54	386.82
	right	554.68	553.22	560.14

TABLE I. Arc lengths in millimeters of the four sides of mirrors 1, 2C, and 2, measured using Python software and NX. Colors indicate adjacent sides.