Jefferson Lab Alignment Group

Data Transmittal

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DETAILS: M:\align\DATA\Inspection\HallB\Torus12G\151214A

Below are the results of the Torus magnet survey carried out on December 11th, 2015. The coordinate system was established using a best fit transformation to the coil fiducials. Values are in mm.

Hub locations relative to various solutions are shown below. The 1st solution is the least squared fit of found to ideal fiducial locations. A hub line at 0,0 was transformed in this analysis. The 2nd system is the found spit relative to the floor control, and thereby the straight ahead beam. Z origin for the 1st 2 systems is relative to the coil case design zero point (ref. dwg. B00000-04-01-1101). The 3rd system is relative to the CEBAF metric system.

	Relative to Best Fit			Relative to straight ahead beam			CEBAF System [meters]		
	X	Y	Z	X	Y	Z	X	Y	Z
HUB_US	-0.07	0.98	450.72	-1.54	-5.90	460.49	-80.59846	103.34936	-401.64901
HUB_DS	-0.18	0.73	2501.02	-0.54	0.41	2510.78	-80.59946	103.35567	-403.69930

The found fiducial coordinates relative to the hub line are below. A circle was formed to the found upstream and downstream data. The Radial error is to the 'fit' data.

Upstream Points Found				Ideals			Deltas			plane fit results	Planar Error	Radial Error
Coil	x	y	z	x	y	z	x	y	z			
A	0.88	3207.11	-506.93	0.04	3207.24	-507.04	0.84	-0.13	0.11	AUS	0.41	-0.35
B	-2776.63	1604.25	-507.66	-2777.63	1603.47	-506.82	1.00	0.78	-0.84	BUS	-0.44	0.23
C	-2778.17	-1602.05	-506.71	-2777.30	-1604.17	-506.91	-0.87	2.12	0.20	CUS	0.15	0.10
D	0.09	-3207.28	-506.44	0.77	-3207.36	-507.04	-0.68	0.07	0.60	DUS	0.17	-0.31
E	2776.85	-1603.45	-506.94	2777.59	-1603.67	-507.00	-0.74	0.22	0.06	EUS	-0.21	0.19
F	2776.95	1603.19	-507.18	2777.63	1603.66	-507.05	-0.68	-0.48	-0.13	FUS	-0.09	0.14
Downstream Points Found				**Ideals**			**Deltas**			**plane fit results**	**Planar Error**	**Radial Error**
Coil	**x**	**y**	**z**	**x**	**y**	**z**	**x**	**y**	**z**			
A	0.34	4213.47	877.92	-0.03	4213.08	878.24	0.37	0.39	-0.32	ADS	0.77	0.00
B	-3649.68	2105.94	876.71	-3648.27	2106.44	878.14	-1.41	-0.50	-1.43	BDS	-0.65	-0.09
C	-3647.92	-2108.04	877.88	-3648.72	-2106.07	878.17	0.80	-1.97	-0.29	CDS	-0.11	0.14
D	0.97	-4213.09	879.14	-0.50	-4212.87	878.31	1.47	-0.22	0.83	DDS	0.74	-0.11
E	3648.41	-2106.41	877.56	3648.57	-2106.38	878.22	-0.16	-0.03	-0.66	EDS	-0.62	0.02
F	3648.70	2106.38	877.42	3648.62	2106.64	878.22	0.08	-0.26	-0.80	FDS	-0.14	0.03

Circle Centers and Radius from above fit circles:						
	X	Y	Z		Calced Radius	Design Rad
Coil_US	-0.20	-0.10	-506.98		3206.87	3207.26
Coil_DS	-0.30	0.25	877.77		4213.22	4212.71

Using the lines formed from the found exterior tooling balls to the found hub line, the adjacent angles were calculated for each cryostat in the upstream and downstream positions. The ideal angles should be 60º.

UPSTREAM		DOWNSTREAM	
	DEGREES		DEGREES
CA TO CB	60.01490	CA TO CB	60.03047
CB TO CC	59.98845	CB TO CC	60.00956
CC TO CD	60.01457	CC TO CD	59.98031
CD TO CE	59.97751	CD TO CE	59.97522
CE TO CF	60.00201	CE TO CF	59.99648
CF TO CA	60.00256	CF TO CA	60.00795
SUM	360		360

The vectors between the outside fiducials for each coil were used to determine the roll from the +X axis.

Cryostat	Rotation about Z from +X axis	Angle between the vectors for adjacent cryostats	
A	89.98418	A-B	60.03079
B	150.01494	B-C	59.99319
C	210.00821	C-D	60.00080
D	270.00895	D-E	59.99192
E	330.00086	E-F	59.99108
F	29.99194	F-A	59.99224
		sum	360.00002

Measurements were taken on the bottom planes of the VJ Box Y supports.

VJ Box Y support			
	X	**Y**	**Z**
S1_US_VJ_SUP	2968.40	-746.65	-430.26
S1_DS_VJ_SUP	3815.27	-745.67	936.92
S4_US_VJ_SUP	-2963.74	-746.86	-428.24
S4_DS_VJ_SUP	-3811.93	-749.36	918.76

The following values are for the seven main supports. The coordinates given are to the centroids of the measured planes taken at the threaded rods. The current survey accounts for a 19.05mm prism offset that the previous survey did not. Results from the previous survey are shown as well.

Z & Y Supports						PREVIOUS SURVEY		
	X	**Y**	**Z**			**X**	**Y**	**Z**
COILB_Z_SUP	-3466.70	1987.09	-317.80		COILB_Z_SUP	-3467.17	1983.75	-336.84
COILD_Z_SUP	-1.25	-3996.52	-314.85		COILD_Z_SUP	-0.07	-3995.60	-334.60
COILF_Z_SUP	3465.59	1999.10	-317.06		COILF_Z_SUP	3464.00	1997.36	-336.46
S1_DS_Y_SUP	3792.18	510.78	926.22		S1_DS_Y_SUP	3797.14	530.17	926.97
S1_US_Y_SUP	2923.43	509.76	-459.84		S1_US_Y_SUP	2931.18	529.61	-459.93
S4_DS_Y_SUP	-3796.12	508.60	927.01		S4_DS_Y_SUP	-3802.00	528.35	928.15
S4_US_Y_SUP	-2925.42	509.25	-462.16		S4_US_Y_SUP	-2930.88	528.66	-462.53

The DC Supports were measured by rolling the magnet so that the each sector was down. Then a best fit transformation was established to the Torus with Coil A up.

	DC SUPPORTS							
SECTOR 1	**X**	**Y**	**Z**		**SECTOR 4**	**X**	**Y**	**Z**
R2BMEFI	539.80	-194.92	2195.16		R2BMBFI	-540.53	193.99	2194.77
R2BMEFO	772.24	-332.06	2306.71		R2BMBFO	-773.98	328.99	2305.85
R2BMFBI	539.46	195.66	2194.63		R2BMCBI	-540.58	-195.09	2194.63
R2BMFBO	772.69	331.40	2305.84		R2BMCBO	-772.43	-332.98	2306.03
SECTOR 2					**SECTOR 5**			
R2BMABI	98.90	565.67	2194.89		R2BMCFI	-438.65	-371.49	2194.30
R2BMABO	98.11	835.43	2305.79		R2BMCFO	-672.89	-505.59	2305.70
R2BMFFI	439.43	371.41	2196.05		R2BMDBI	-100.82	-565.47	2194.98
R2BMFFO	674.48	504.43	2306.86		R2BMDBO	-99.03	-835.02	2305.95
SECTOR 3					**SECTOR 6**			
R2BMAFI	-101.18	565.18	2195.41		R2BMDFI	101.29	-563.71	2195.36
R2BMAFO	-99.46	835.05	2306.58		R2BMDFO	99.20	-833.52	2307.21
R2BMBBI	-440.15	369.15	2195.08		R2BMEBI	438.12	-369.71	2195.19
R2BMBBO	-675.28	501.39	2306.15		R2BMEBO	671.34	-505.60	2306.43

Naming convention: "R2BMEFI"

R2BM = Region 2 Boss Mount
"E"= Coil designation
F= Front B= Back
I = Inner O= Outer