

Location of NCD Attachment Anchors

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Rob Komar
Dept. of Physics, 6224 Agricultural Rd.
Vancouver, BC V6T 1Z1

Peter Doe
Dept. of Physics, PO. Box 351560
Seattle, WA 98195-1560

Summary: 96 acrylic blocks, used to anchor the Neutral Current Detectors (NCD's) have been bonded to the inner shell of the SNO acrylic vessel and subsequently surveyed to determine their exact position. The results of this survey are given. The uncertainty in the position of the NCD anchors is ± 3.0 mm.

Description of the NCD Anchor Array: The "ideal" location of the 96 NCD anchors is shown in figure 1a. It is a square array, one meter lattice spacing, centered on the Z-axis of the acrylic vessel. The actual location of the anchors deviates from the ideal array since anchors may not be located closer than 2" to a bond in the shell of the acrylic vessel. From figures 1a and 1b it can be seen that anchors A1 thru A8, H1 thru H4 and I1 thru I8 all fall on a horizontal bond and have been moved downwards to provide the 2" bond clearance. In addition, anchor A6 was moved further from its ideal location due to a repair plug in the 103-105 horizontal bond.

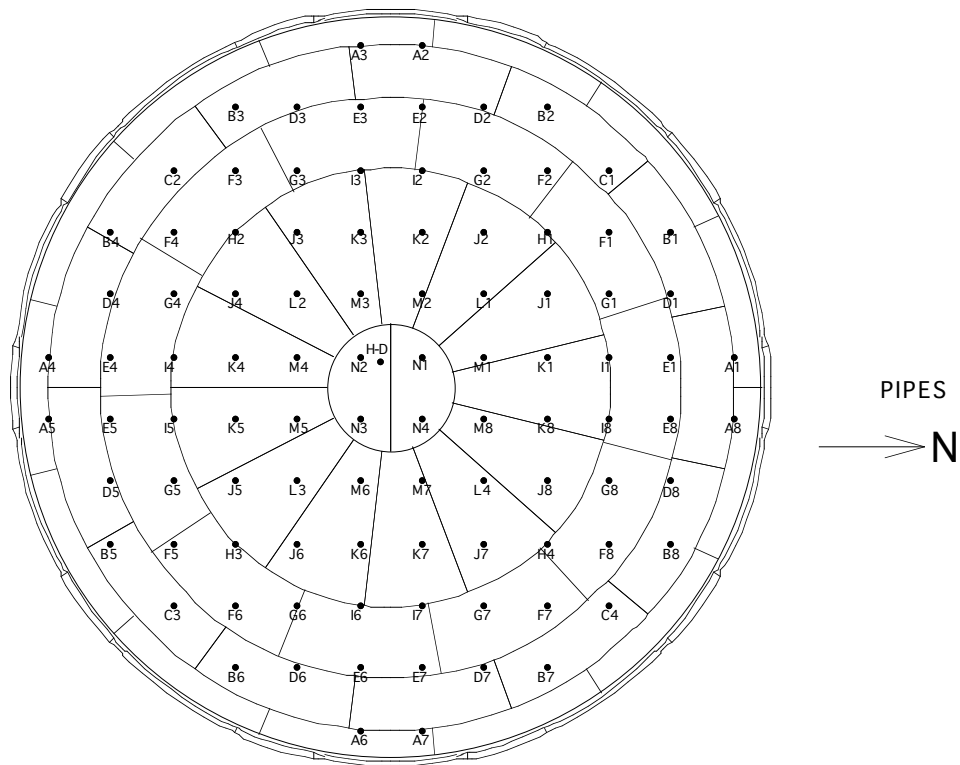
Survey Technique: Figure 2 shows a NCD anchor. In order to determine its position it was fitted with a nylon "cap" which has a cross scribed at its exact center, as shown in figure 3. When correctly fitted to the anchor, the cross on the cap is located exactly 6.1 cm above the surface of the acrylic vessel shell.

Anchor locations A1 thru G8 were all surveyed using the three theodolite technique used to survey the acrylic panels during construction of the vessel. This technique typically has errors of 0.5 mm. Anchor locations H1 thru M8 were surveyed using a single theodolite located approximately on the axis of the vessel near the south pole. This is less accurate, giving errors of typically 3.0 mm. However, for all the above anchors, the uncertainty in their position is dominated by irreproducibility in positioning the survey cap. In order to reach the anchor, the cap had to be attached to the end of a 3 meter long aluminum pole. This resulted in an uncertainty in their exact location. This uncertainty is estimated to be 3 mm. Anchor locations N1 thru N4 and the haul-down anchor could not be surveyed by theodolite. The uncertainty in their location is estimated to be 3.0 mm.

Survey Results: Table 1 gives the ideal and actual locations of the NCD anchors. This actual location is defined as the location of the center of the circular footprint of the anchor on the inner surface of the acrylic vessel. The coordinate system is Cartesian, centered at the center of the sphere and referenced to construction north. The uncertainty in all measurements is assumed to be ± 3 mm. For an electronic copy of this spreadsheet contact Peter Doe, (pdoe@u.washington.edu).

FIGURE 11: LOCATION OF NCD ATTACHMENT POINTS wrt BOND LINES

NOTE: NO ATTACHMENT SHOULD BE CLOSER THAN 2" TO A BOND LINE



COORDINATE SCHEME

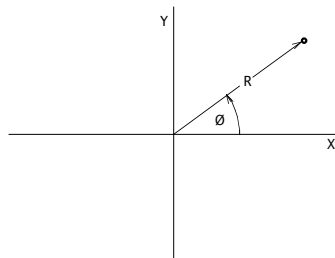


FIGURE 1b: LATTITUDE OF NCD ATTACHMENTS

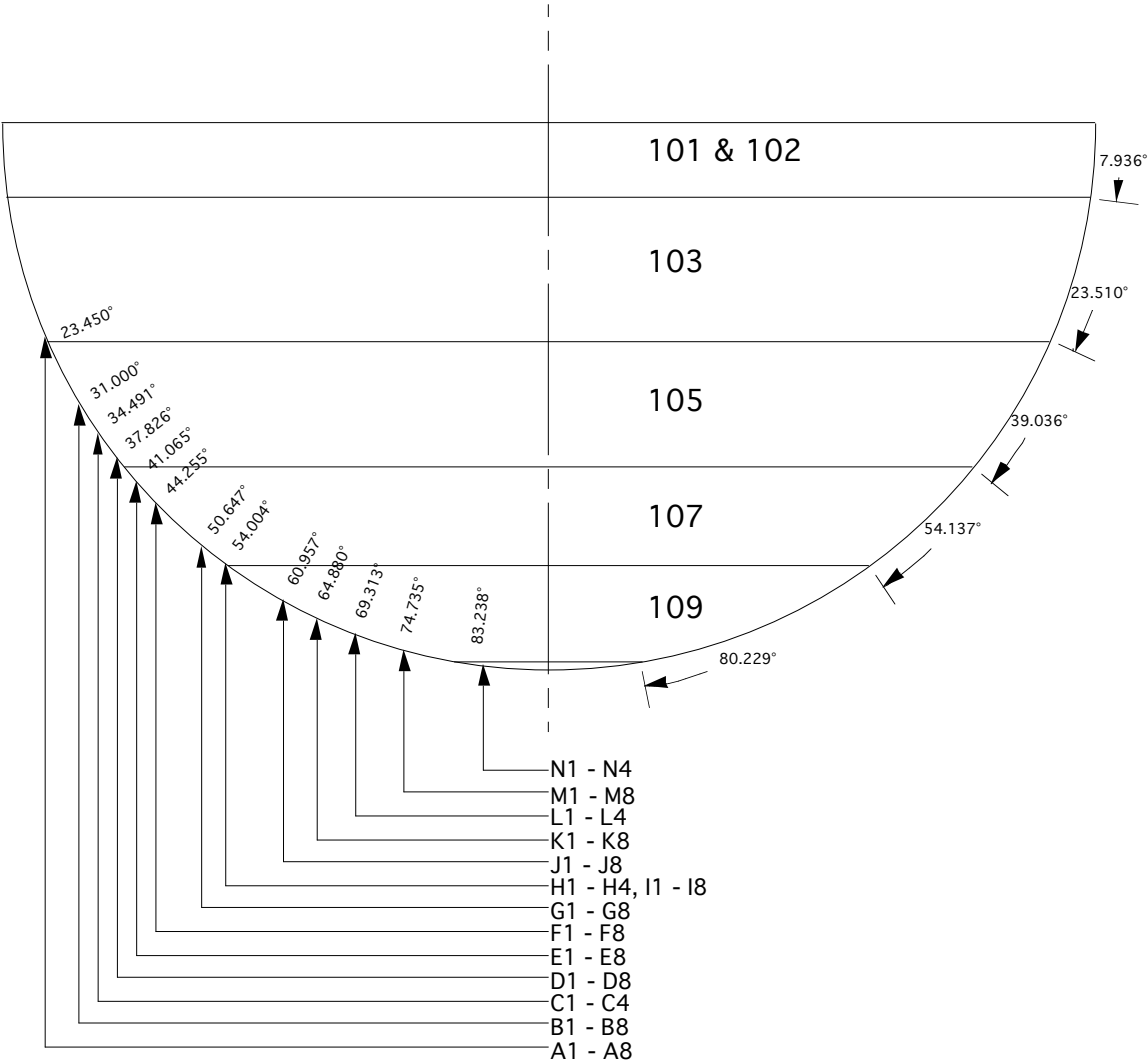
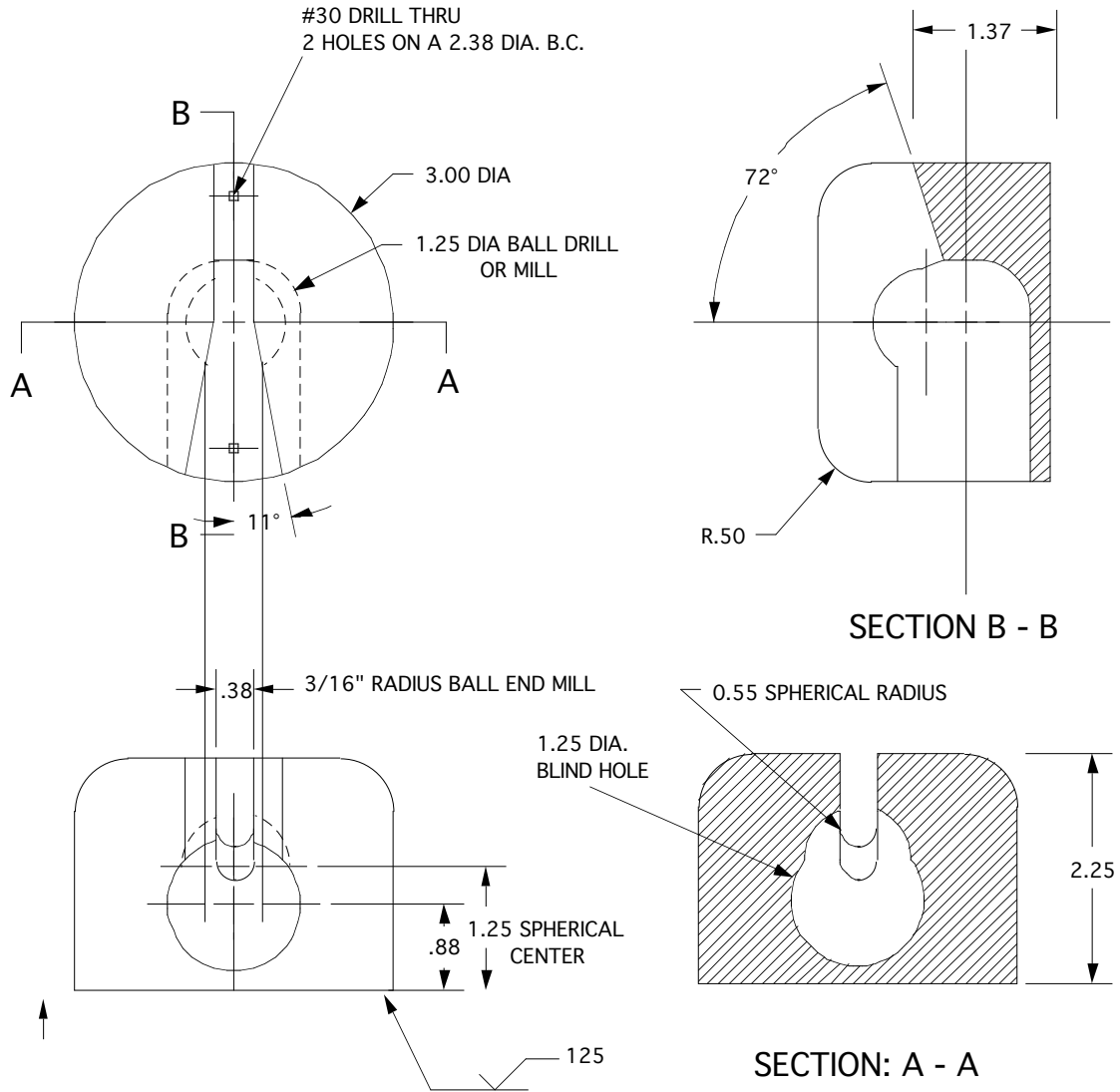


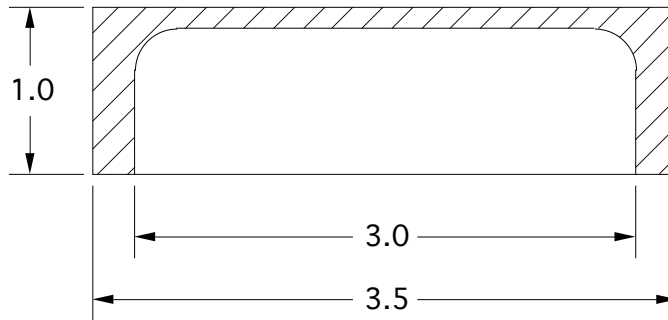
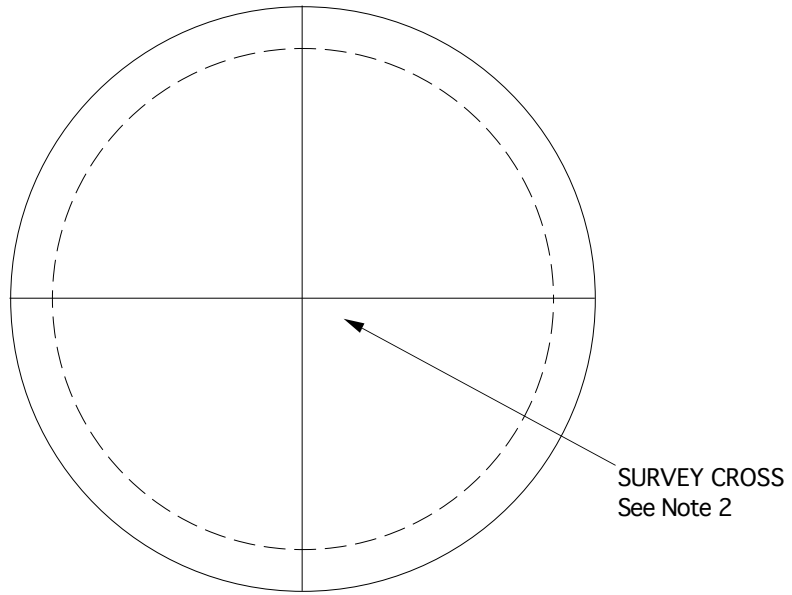
FIGURE 2: NCD ATTACHMENT



NOTE: BREAK ALL SHARP EDGES AND BURRS
 VISUAL SURFACE FINISH 125 OR BETTER
 MATERIAL 3"DIA. ACRYLIC ROD-SUPPLIED
 110 REQUIRED

FIGURE 3: NCD SURVEY CAP

MATERIAL: NYLON
3 REQUIRED



See Note 1

NOTES

1. MAKE DIAMETER A SNUG SLIP FIT TO NCD ANCHOR BLOCK
2. MAKE SURVEY CROSS BY SCRIBING WITH KNIFE AND ENHANCE WITH BLACK INK IN SCRIBE LINE.

TABLE 1: COORDINATES OF INDIVIDUAL NCD ATTACHEMENT

ATTACHMENT ID	IDEAL LOCATION			AS-BUILT LOCATION		
	X COORD (meters)	Y COORD (meters)	Z COORD (meters)	X COORD (cm)	Y COORD (cm)	Z COORD (cm)
A1	5.5	0.5	-2.35	543.88	48.61	-247.99
A2	0.5	5.5	-2.35	50.54	544.66	-247.61
A3	-0.5	5.5	-2.35	-49.41	544.58	-247.75
A4	-5.5	0.5	-2.35	-543.4	50.21	-248.16
A5	-5.5	-0.5	-2.35	-543.95	-49.52	-248.01
A6	-0.5	-5.5	-2.35	-49.3	-540.84	-254.72
A7	0.5	-5.5	-2.35	49.24	-544.37	-247.73
A8	5.5	-0.5	-2.35	543.82	-49.58	-248.23
B1	4.5	2.5	-3.08	449.01	249.26	-309.87
B2	2.5	4.5	-3.08	250.26	449.85	-309.41
B3	-2.5	4.5	-3.08	-248.88	450.59	-309.83
B4	-4.5	2.5	-3.08	-449.12	249.98	-310.28
B5	-4.5	-2.5	-3.08	-450.03	-249.16	-310.02
B6	-2.5	-4.5	-3.08	-249.8	-449.79	-309.98
B7	2.5	-4.5	-3.08	250.84	-448.91	-309.51
B8	4.5	-2.5	-3.08	449.54	-250.16	-309.65
C1	3.5	3.5	-3.39	350	350	-339.62
C2	-3.5	3.5	-3.39	-349.54	350.42	-339.81
C3	-3.5	-3.5	-3.39	-350.35	-349.61	-339.71
C4	3.5	-3.5	-3.39	350.04	-350.77	-339.79
D1	4.5	1.5	-3.67	450.06	149.67	-367.84
D2	1.5	4.5	-3.67	150.71	450.27	-367.97
D3	-1.5	4.5	-3.67	-149.16	-368.32	-368.32
D4	-4.5	1.5	-3.67	-449.86	150.31	-368.22
D5	-4.5	-1.5	-3.67	-449.96	-149.04	-368.67
D6	-1.5	-4.5	-3.67	-151.57	-449.54	-368.28
D7	1.5	-4.5	-3.67	149.51	-450.55	-368.34
D8	4.5	-1.5	-3.67	449.77	-150.46	-368.29
E1	4.5	0.5	-3.94	449.61	49.54	-394.48
E2	0.5	4.5	-3.94	46.07	450.71	-394.27
E3	-0.5	4.5	-3.94	-49.66	450.41	-394.39
E4	-4.5	0.5	-3.94	-449.24	50.21	-394.9
E5	-4.5	-0.5	-3.94	-449.38	-49.23	-394.76
E6	-0.5	-4.5	-3.94	-50.91	-449.85	-394.28
E7	0.5	-4.5	-3.94	49.99	-450.3	-393.94
E8	4.5	-0.5	-3.94	449.46	-50.42	-394.59

F1	3.5	2.5	-4.18	348.84	250.21	-418.92
F2	2.5	3.5	-4.18	250.49	350.09	-418.58
F3	-2.5	3.5	-4.18	-249.49	350.02	-419.12
F4	-3.5	2.5	-4.18	-348.91	250.51	-419.58
F5	-3.5	-2.5	-4.18	-350.13	-249.71	-419.17
F6	-2.5	-3.5	-4.18	-249.84	-349.61	-418.84
F7	2.5	-3.5	-4.18	249.73	-350.38	-419.15
F8	3.5	-2.5	-4.18	349.06	-250.83	-419.26
G1	3.5	1.5	-4.64	349.58	149.77	-464.2
G2	1.5	3.5	-4.64	150.61	350.04	-464.1
G3	-1.5	3.5	-4.64	-149.2	350.4	-464.67
G4	-3.5	1.5	-4.64	-349.29	150.18	-464.52
G5	-3.5	-1.5	-4.64	-349.65	-149.44	-464.42
G6	-1.5	-3.5	-4.64	-142.29	-353.32	-464.2
G7	1.5	-3.5	-4.64	150.11	-349.93	-464.59
G8	3.5	-1.5	-4.64	349.55	-150.26	-464.5
H1	2.5	2.5	-4.85	243.67	244.61	-491.35
H2	-2.5	2.5	-4.85	-243.07	244.94	-491.48
H3	-2.5	-2.5	-4.85	-246.47	-241.86	-491.32
H4	2.5	-2.5	-4.85	242.18	-245.48	-491.65
I1	3.5	0.5	-4.85	341.48	48.64	-491.59
I2	0.5	3.5	-4.85	49.98	341.42	-491.5
I3	-0.5	3.5	-4.85	-49.16	341.38	-491.61
I4	-3.5	0.5	-4.85	-340.82	51.97	-491.71
I5	-3.5	-0.5	-4.85	-341.46	-47.3	-491.74
I6	-0.5	-3.5	-4.85	-52.49	-341.02	-491.52
I7	0.5	-3.5	-4.85	44.84	-342.58	-491.19
I8	3.5	-0.5	-4.85	341.1	-50.94	-491.62
J1	2.5	1.5	-5.24	250.23	151.71	-524.41
J2	1.5	2.5	-5.24	151.77	250.21	-524.4
J3	-1.5	2.5	-5.24	-148.59	251.77	-524.56
J4	-2.5	1.5	-5.24	-249.05	153.56	-524.44
J5	-2.5	-1.5	-5.24	-251.65	-148.49	-524.65
J6	-1.5	-2.5	-5.24	-152.37	-249.65	-524.5
J7	1.5	-2.5	-5.24	148.59	-252.52	-524.21
J8	2.5	-1.5	-5.24	249.93	-152.52	-524.32
K1	2.5	0.5	-5.43	250.27	50.11	-543.59
K2	0.5	2.5	-5.43	52.01	251.16	-543
K3	-0.5	2.5	-5.43	-48.85	251.48	-543.15
K4	-2.5	0.5	-5.43	-250.31	51.72	-543.42
K5	-2.5	-0.5	-5.43	-250.71	-48.19	-543.56
K6	-0.5	-2.5	-5.43	-51.77	-250.46	-543.35
K7	0.5	-2.5	-5.43	48.85	-251.5	-543.14
K8	2.5	-0.5	-5.43	250.46	-50.99	-543.42

L1	1.5	1.5	-5.61	148.91	149.93	-562.13
L2	-1.5	1.5	-5.61	-149.72	151.61	-561.46
L3	-1.5	-1.5	-5.61	-151.5	-149.42	-561.57
L4	1.5	-1.5	-5.61	149.58	-152.19	-561.34
M1	1.5	0.5	-5.79	150.43	50.7	-579.17
M2	0.5	1.5	-5.79	48.21	151.75	-579.04
M3	-0.5	1.5	-5.79	-49.46	150.92	-579.15
M4	-1.5	0.5	-5.79	-150.62	50.37	-579.15
M5	-1.5	-0.5	-5.79	-150.79	-48.97	-579.23
M6	-0.5	-1.5	-5.79	-48.96	-151.34	-579.08
M7	0.5	-1.5	-5.79	47.64	-151.69	-579.1
M8	1.5	-0.5	-5.79	150.41	-51.19	-579.13
N1	0.5	0.5	-5.96	0.5	0.5	-5.96
N2	-0.5	0.5	-5.96	-0.5	0.5	-5.96
N3	-0.5	-0.5	-5.96	-0.5	-0.5	-5.96
N4	0.5	-0.5	-5.96	0.5	-0.5	-5.96