

BigBite and Neutron detector scintillator bar positions based on the survey information.

Peter Monaghan

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Abstract

Using the information from each survey of the detectors during the experiment, the positions of the centres of each scintillator bar in both the proton and the neutron detectors, relative to the ideal centre of the target in the hall, have been calculated. Diagrams are included to illustrate where the numbers quoted in the online survey reports refer to on each detector. The (x, y, z) position of each scintillator bar is quoted in the *Hall* reference frame. It was found that the centre of the auxiliary plane is offset from the centre of the E-plane by ~ 50mm.

Introduction

Throughout this report, there are two frames of reference being used; the *hall* frame and the *detector* frame. Both are right-handed coordinate systems. The hall frame has the z-axis along the beam direction, the y-axis vertically upwards (towards the ceiling) and the x-axis is to the left of the beam direction, perpendicular to the y and z axes; see Fig. 1. The detector frame has the z-axis perpendicular to the front face/plane of the detector, in the direction of the incoming particles; the y-axis is vertically upwards towards the top of the detector and the x-axis is towards the left of the detector (looking at it from the front). For the auxiliary and trigger planes, the detector frame coordinate axes are also tilted (or pitched) at 25° , matching the tilt of these detector planes themselves. The detector coordinate system is illustrated on each figure of the detectors. The final positions of the centres of each scintillator bar are given in the **hall** reference frame.

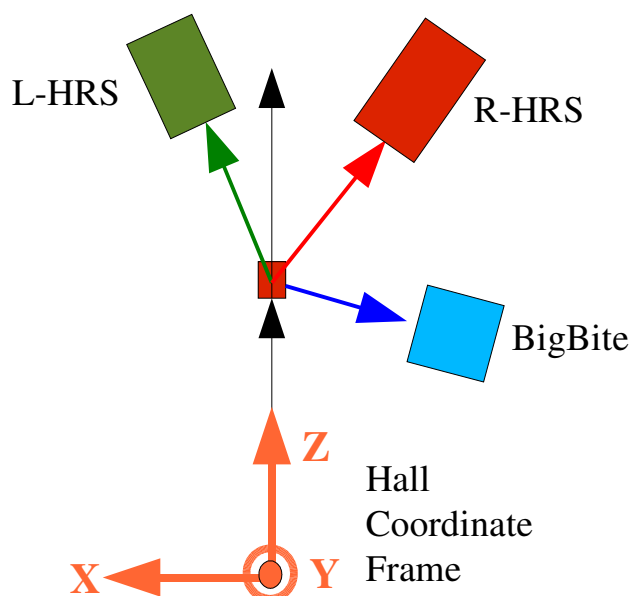


Figure 1: The orange arrows show the HALL coordinate system; Z is along the beam direction and Y is OUT of the page (vertically upwards in the hall).

The survey information also gives the heading, yaw, pitch and roll angles of each detector. The heading is the angle (in the x-z plane in the hall frame) between a line from the ideal target centre to the detector centre and the beamline. The yaw is the angle of the detector relative to the heading and is measured in the x-z plane. The pitch angle is measured relative to the y-axis. The roll angle is measured relative to the vector from the ideal target centre to the detector centre. The yaw and roll angles have been neglected in determining the scintillator bar positions.

Target Survey Information

The target ladder was surveyed on the 20th December 2004 – see survey report A970 on the hall A webpage. The location of each target centre is quoted in the hall reference frame. All of the targets were moved into the beam line and then surveyed except the straight carbon target; this target was surveyed at the same time as the beryllium target (with the beryllium target in the beamline) and hence, the y-value quoted below is -31.75 mm – exactly the distance between the centres of these two targets. There are no y-values quoted for the optics target because these values would be meaningless due to the type of sleigh and holders which the foils are placed in and the way in which it is surveyed.

<i>Target</i>	<i>x / mm</i>	<i>y / mm</i>	<i>z / mm</i>
Target Cell 1 (top): 4cm deuterium	0.00	-0.06	0.41
Target Cell 2 : 15cm deuterium	0.35	0.06	0.59
Target Cell 3 : 4cm hydrogen	0.39	0.00	0.70
Target Cell 4 (bottom): 15cm hydrogen	0.79	0.08	1.09
Optics Target			
beam left upstream side support	44.45		
beam left downstream side support	44.66		
Z position of centre of middle foil			0.49
Beryllium Target			
centreline at upstream face	-0.26	0.06	0.70
Carbon Target (straight)			
centreline at upstream face	-0.16	-31.75	0.77
Carbon Target (tilted)			
20.184° measured tilt	-0.27	0.09	1.18

Auxiliary Plane Scintillator Positions

In the detector frame of the auxiliary plane, the axes are rotated at 25° above the horizontal, matching the pitch angle of the scintillator plane. The survey group determined the centre of the auxiliary plane to be along the plane between the front and back of the scintillator bars (shown as the yellow dotted line in fig. 2) and the mid-point between the top side of the uppermost bar and the bottom side of the lowermost bar. The origin along the x-axis was determined as the mid-plane between the two vertical frame members of the detector. The numbers quoted in the survey report are the location of this centre-point relative to the ideal target centre.

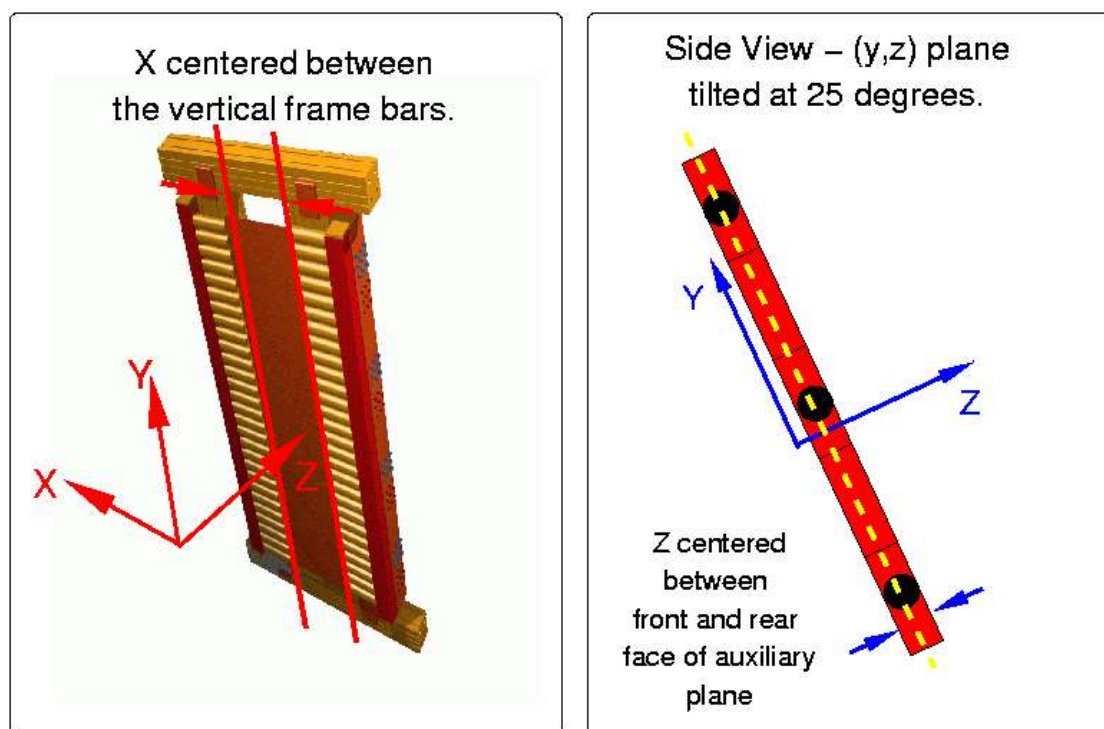


Figure 2: The detector coordinate frame for the auxiliary plane is indicated by the red axes. The centre point of the detector is the mid-plane of the scintillator bars (yellow dotted line in the side view diagram) and the mid-point between the top of the first bar and the bottom of the last bar.

Auxiliary at 70°

The first survey of the detectors was done on 3rd January 2005 and the details are given in survey report number A969. The survey information in the **hall frame** places the centre of the auxiliary plane as defined above (relative to the idea target centre) at,

z / mm	x / mm	y / mm	heading / deg	yaw / deg	pitch / deg	roll / deg
728.8	-2004.2	376.2	-70.02	-0.06	25.31	-0.05

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-1725.8	1002.7	627.5
2	-1735.9	979.9	631.2
3	-1746.1	957.1	634.9
4	-1756.2	934.3	638.6
5	-1766.3	911.5	642.3
6	-1776.4	888.7	646.0
7	-1786.6	865.9	649.6
8	-1796.7	843.1	653.3
9	-1806.8	820.4	657.0
10	-1817.0	797.6	660.7
11	-1827.1	774.8	664.4
12	-1837.2	752.0	668.1
13	-1847.4	729.2	671.7
14	-1857.5	706.4	675.4
15	-1867.6	683.6	679.1
16	-1877.7	660.8	682.8
17	-1887.9	638.0	686.5
18	-1898.0	615.2	690.2
19	-1908.1	592.4	693.8
20	-1918.3	569.6	697.5
21	-1928.4	546.8	701.2
22	-1938.5	524.0	704.9
23	-1948.7	501.2	708.6
24	-1958.8	478.4	712.3
25	-1968.9	455.6	715.9
26	-1979.0	432.8	719.6
27	-1989.2	410.0	723.3
28	-1999.3	387.2	727.0
29	-2009.4	364.4	730.7
30	-2019.6	341.6	734.4
31	-2029.7	318.8	738.0
32	-2039.8	296.0	741.7
33	-2050.0	273.2	745.4
34	-2060.1	250.5	749.1
35	-2070.2	227.7	752.8
36	-2080.3	204.9	756.5
37	-2090.5	182.1	760.1
38	-2100.6	159.3	763.8
39	-2110.7	136.5	767.5
40	-2120.9	113.7	771.2
41	-2131.0	90.9	774.9
42	-2141.1	68.1	778.6
43	-2151.3	45.3	782.2
44	-2161.4	22.5	785.9
45	-2171.5	-0.3	789.6
46	-2181.6	-23.1	793.3
47	-2191.8	-45.9	797.0
48	-2201.9	-68.7	800.7
49	-2212.0	-91.5	804.3
50	-2222.2	-114.3	808.0
51	-2232.3	-137.1	811.7
52	-2242.4	-159.9	815.4
53	-2252.6	-182.7	819.1
54	-2262.7	-205.5	822.8
55	-2272.8	-228.3	826.5
56	-2282.9	-251.1	830.1

Auxiliary at 99 °

A second survey was done on the 5th April, with the detectors at 99° in the hall; details can be found in survey report number A987. Unfortunately, this second survey only included the trigger plane and the neutron detector. Therefore, in order to determine the positions of auxiliary plane bars in the Hall frame with the detectors at 99°, it is assumed that the relative positions of the auxiliary and trigger planes (from the previous survey information - 3rd January) have been preserved.

Now using this information and the fiducial information for the auxiliary plane itself, the position of the origin of the auxiliary plane at 99° is estimated to be at,

z / mm	x / mm	y / mm	heading / deg	yaw / deg	pitch / deg	roll / deg
-340.7	-2103.6	376	-99.2	N/A	25.31	N/A

s / mm = 2131.01

The positions of individual auxiliary plane scintillator bars relative to the ideal target centre in the hall frame are given overleaf.

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-1811.1	1002.5	-293.3
2	-1821.7	979.7	-295.1
3	-1832.4	956.9	-296.8
4	-1843.0	934.1	-298.5
5	-1853.7	911.3	-300.2
6	-1864.3	888.5	-302.0
7	-1874.9	865.7	-303.7
8	-1885.6	842.9	-305.4
9	-1896.2	820.1	-307.1
10	-1906.9	797.3	-308.8
11	-1917.5	774.5	-310.6
12	-1928.2	751.7	-312.3
13	-1938.8	728.9	-314.0
14	-1949.4	706.2	-315.7
15	-1960.1	683.4	-317.5
16	-1970.7	660.6	-319.2
17	-1981.4	637.8	-320.9
18	-1992.0	615.0	-322.6
19	-2002.7	592.2	-324.4
20	-2013.3	569.4	-326.1
21	-2023.9	546.6	-327.8
22	-2034.6	523.8	-329.5
23	-2045.2	501.0	-331.3
24	-2055.9	478.2	-333.0
25	-2066.5	455.4	-334.7
26	-2077.2	432.6	-336.4
27	-2087.8	409.8	-338.2
28	-2098.4	387.0	-339.9
29	-2109.1	364.2	-341.6
30	-2119.7	341.4	-343.3
31	-2130.4	318.6	-345.0
32	-2141.0	295.9	-346.8
33	-2151.7	273.1	-348.5
34	-2162.3	250.3	-350.2
35	-2173.0	227.5	-351.9
36	-2183.6	204.7	-353.7
37	-2194.2	181.9	-355.4
38	-2204.9	159.1	-357.1
39	-2215.5	136.3	-358.8
40	-2226.2	113.5	-360.6
41	-2236.8	90.7	-362.3
42	-2247.5	67.9	-364.0
43	-2258.1	45.1	-365.7
44	-2268.7	22.3	-367.5
45	-2279.4	-0.5	-369.2
46	-2290.0	-23.3	-370.9
47	-2300.7	-46.1	-372.6
48	-2311.3	-68.9	-374.4
49	-2322.0	-91.7	-376.1
50	-2332.6	-114.5	-377.8
51	-2343.2	-137.2	-379.5
52	-2353.9	-160.0	-381.2
53	-2364.5	-182.8	-383.0
54	-2375.2	-205.6	-384.7
55	-2385.8	-228.4	-386.4
56	-2396.5	-251.2	-388.1

Trigger Plane Scintillator Positions

Rather than determining a reference point for the E and delta-E planes individually, the survey group found a single origin for the trigger plane as a whole. It is the location of this origin point for the trigger plane relative to the ideal target centre which is quoted in the survey report.

Just as for the auxiliary plane, the coordinate system in the detector frame for the trigger plane is rotated at 25° above the horizontal. The origin is centred in the x-direction between the two vertical upright frame members as indicated. In the y-z plane, the origin is located along the mid-plane between the front face of the delta-E bars and the rear face of the E bars; this is the green dotted line shown in Fig. 3. The origin is centred in the y-z plane between the top of the uppermost E bar and the bottom of the lowermost E bar.

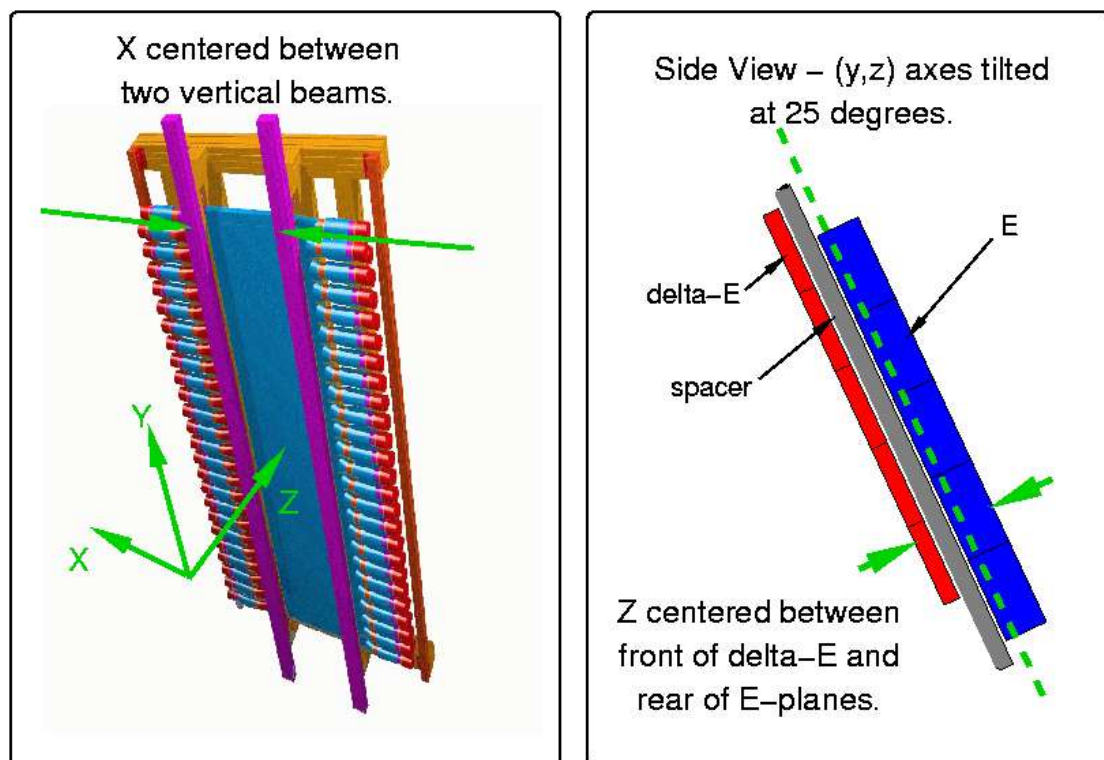


Figure 3: The green axes indicate the detector coordinate frame for the trigger plane. The origin is along the mid-plane between the front face of the delta-E bars and the rear face of the E bars (green dotted line). The origin is centred between the top of the uppermost E bar and the bottom of the lowermost E bar.

Since the survey report gives the location of the origin of the trigger plane only, the correction from the mid-plane shown in fig. 3 has been taken into account in determining the positions of the centres of each E and delta-E bar individually.

Delta-E Plane Scintillator Positions

Delta-E at 70°

The survey information from 3rd January (report A969) gives the following values for the origin of the trigger plane in the hall frame,

z / mm	x / mm	y / mm	heading / deg	yaw / deg	pitch / deg	roll / deg
1034.2	-2841.5	736.4	-70.0	0.179	25.293	0.045

Using this information and the fiducial information for the trigger plane results in the positions of the centres of individual scintillator bars for the delta-E plane at 70° as being,

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-2407.2	1669.4	876.1
2	-2442.0	1590.9	888.8
3	-2476.9	1512.5	901.5
4	-2511.7	1434.1	914.1
5	-2546.5	1355.6	926.8
6	-2581.3	1277.2	939.5
7	-2616.2	1198.8	952.2
8	-2651.0	1120.3	964.9
9	-2685.8	1041.9	977.5
10	-2720.7	963.5	990.2
11	-2755.5	885.0	1002.9
12	-2790.3	806.6	1015.6
13	-2825.1	728.2	1028.2
14	-2860.0	649.7	1040.9
15	-2894.8	571.3	1053.6
16	-2929.6	492.9	1066.3
17	-2964.5	414.4	1078.9
18	-2999.3	336.0	1091.6
19	-3034.1	257.6	1104.3
20	-3068.9	179.1	1117.0
21	-3103.8	100.7	1129.6
22	-3138.6	22.3	1142.3
23	-3173.4	-56.2	1155.0
24	-3208.3	-134.6	1167.7

Delta-E at 99°

The survey on 5th April gives the following values for the position of the trigger plane at 99° in the hall frame as,

z / mm	x / mm	y / mm	heading / deg	yaw / deg	pitch / deg	roll / deg
-474.9	-2984.9	736.2	-99.2	N/A	25.314	0.060

Again using the fiducial information for the trigger plane and this survey information, the location of the centres of individual scintillator bars were determined as,

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-2527.1	1669.0	-408.8
2	-2563.7	1590.6	-414.7
3	-2600.3	1512.2	-420.6
4	-2636.9	1433.7	-426.6
5	-2673.5	1355.3	-432.5
6	-2710.2	1276.9	-438.4
7	-2746.8	1198.5	-444.3
8	-2783.4	1120.1	-450.3
9	-2820.0	1041.6	-456.2
10	-2856.6	963.2	-462.1
11	-2893.2	884.8	-468.0
12	-2929.9	806.4	-474.0
13	-2966.5	728.0	-479.9
14	-3003.1	649.5	-485.8
15	-3039.7	571.1	-491.7
16	-3076.3	492.7	-497.6
17	-3112.9	414.3	-503.6
18	-3149.6	335.9	-509.5
19	-3186.2	257.4	-515.4
20	-3222.8	179.0	-521.3
21	-3259.4	100.6	-527.3
22	-3296.0	22.2	-533.2
23	-3332.6	-56.2	-539.1
24	-3369.2	-134.7	-545.0

E Plane Scintillator Positions

E Plane at 70°

The survey on 3rd January (A969) gives the location of the centre of the trigger plane in the hall frame as,

z / mm	x / mm	y / mm	heading / deg	yaw / deg	pitch / deg	roll / deg
1034.2	-2841.5	736.4	-70.0	0.179	25.293	0.045

Using this information along with the fiducial information for the trigger plane itself, the centre of each individual scintillator bar in the E-plane was calculated to be at,

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-2446.3	1641.1	890.3
2	-2481.1	1562.6	903.0
3	-2516.0	1484.2	915.7
4	-2550.8	1405.8	928.4
5	-2585.6	1327.3	941.1
6	-2620.4	1248.9	953.7
7	-2655.3	1170.5	966.4
8	-2690.1	1092.0	979.1
9	-2724.9	1013.6	991.8
10	-2759.8	935.2	1004.4
11	-2794.6	856.7	1017.1
12	-2829.4	778.3	1029.8
13	-2864.2	699.9	1042.5
14	-2899.1	621.4	1055.1
15	-2933.9	543.0	1067.8
16	-2968.7	464.6	1080.5
17	-3003.6	386.1	1093.2
18	-3038.4	307.7	1105.8
19	-3073.2	229.3	1118.5
20	-3108.0	150.8	1131.2
21	-3142.9	72.4	1143.9
22	-3177.7	-6.0	1156.5
23	-3212.5	-84.5	1169.2
24	-3247.4	-162.9	1181.9

E Plane at 99°

For the detectors at 99°, the survey from the 5th April (A987) , gives the trigger plane location in the hall frame to be,

z / mm	x / mm	y / mm	heading / deg	yaw / deg	pitch / deg	roll / deg
-474.9	-2984.9	736.2	-99.2	N/A	25.314	0.060

Again using this survey information and the fiducial information for the trigger plane, the positions of the centres of each E-plane bar in the hall frame relative to the ideal target centre, were found to be at,

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-2568.2	1640.7	-415.4
2	-2604.8	1562.3	-421.4
3	-2641.4	1483.9	-427.3
4	-2678.0	1405.4	-433.2
5	-2714.6	1327.0	-439.1
6	-2751.2	1248.6	-445.1
7	-2787.9	1170.2	-451.0
8	-2824.5	1091.8	-456.9
9	-2861.1	1013.3	-462.8
10	-2897.7	934.9	-468.8
11	-2934.3	856.5	-474.7
12	-2970.9	778.1	-480.6
13	-3007.5	699.7	-486.5
14	-3044.2	621.2	-492.4
15	-3080.8	542.8	-498.4
16	-3117.4	464.4	-504.3
17	-3154.0	386.0	-510.2
18	-3190.6	307.6	-516.1
19	-3227.2	229.1	-522.1
20	-3263.9	150.7	-528.0
21	-3300.5	72.3	-533.9
22	-3337.1	-6.1	-539.8
23	-3373.7	-84.5	-545.8
24	-3410.3	-163.0	-551.7

Neutron Detector Scintillator Positions

The survey group again determined a single origin for the whole neutron detector rather than for individual scintillator planes. The numbers quoted in the survey report are the location of this origin relative to the ideal centre of the target in the hall.

In the neutron detector frame, the origin is centred in the x-direction between the two vertical frame bars as shown in fig. 4. The origin in the z-direction is centred between the front face of the outermost section of veto bars (the middle section) and the rear face of the scintillator bars in plane 4. The y-axis has its origin centred between the top of the uppermost veto bar and the bottom of the lowermost veto bar; the y-z plane is shown in fig. 5 and the yellow dotted line shows the origin location, near the front of the plane 2 scintillator bars.

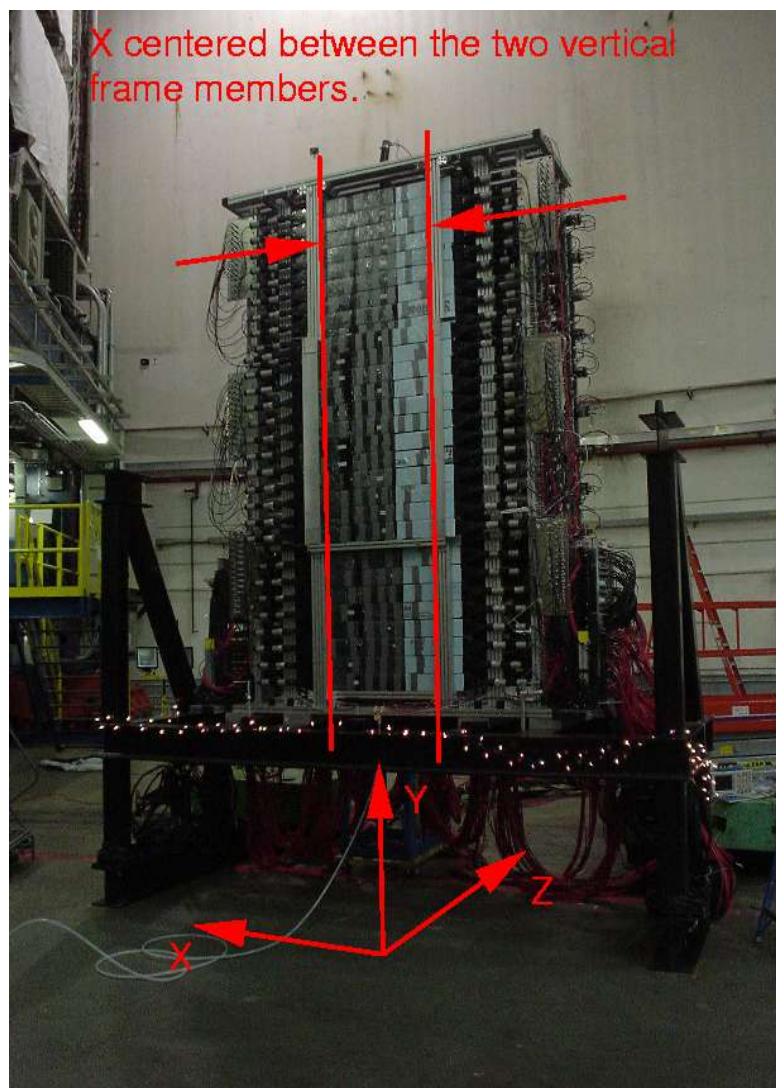


Figure 4: The coordinate system for the neutron detector is shown; the x-axis is centred between the two vertical frame bars as indicated by the red lines. (See fig. 5 for the location of the origin in the y-z plane.)

Neutron Detector – Side View
(y , z) plane

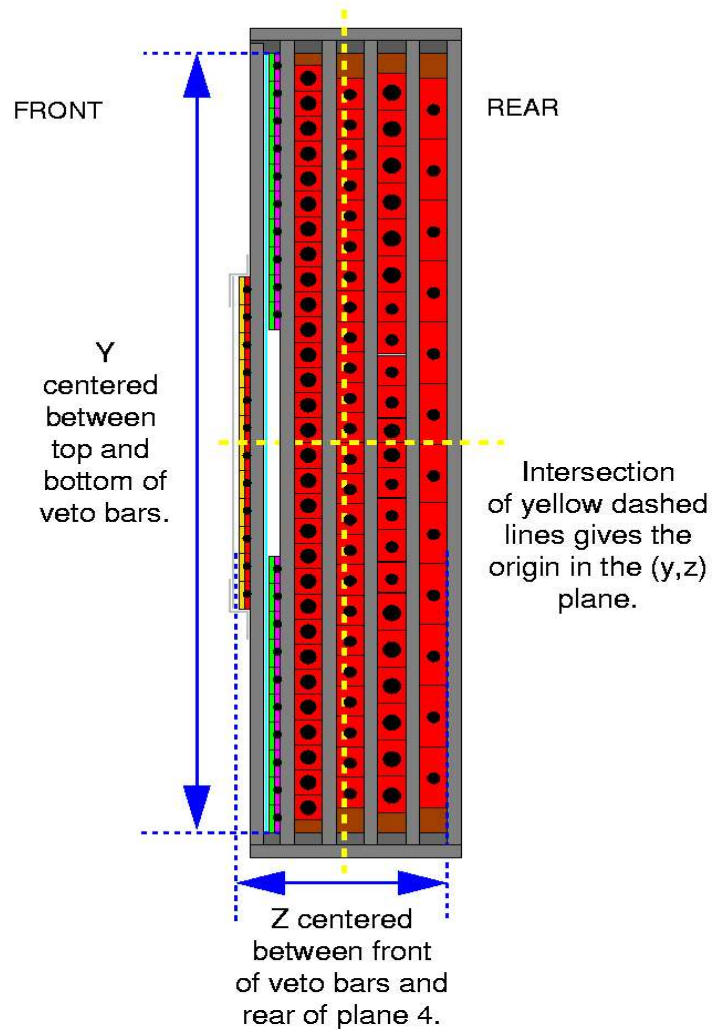


Figure 5: The origin of the y-axis is centered between the top of the uppermost VETO bar and the bottom of the lowermost VETO bar. The z-axis is centered between the front face of the veto layer and the rear frame of the plane 4 scintillator bars. Note the three overlapping regions of veto bars as well.

The side view of the neutron detector shown in fig. 5 also illustrates the three regions of veto bars and how they were arranged to overlap.

The information that follows for each plane in the neutron detector gives the position of the centre of each scintillator bar relative to the ideal target centre. This location was determined using the survey information and the fiducial information for the neutron detector.

Neutron Detector at 50°

The survey report from the 3rd January (A969) gives the centre of the neutron detector (as defined above) to be at,

z / mm	x / mm	y / mm	heading / deg	yaw / deg	pitch / deg	roll / deg
9918.6	-11815.6	-26.5	-49.99	-0.27	0.27	-0.01

Veto Layer

Bar Number	HALL FRAME				
	x / mm		y / mm	z / mm	
	LEFT	RIGHT		LEFT	RIGHT
1	-11591	-11606	1543.3	9730	9743
2	-11591	-11606	1431.3	9730	9743
3	-11591	-11606	1319.3	9730	9743
4	-11591	-11606	1207.3	9730	9743
5	-11591	-11606	1095.3	9730	9743
6	-11591	-11606	983.3	9730	9743
7	-11591	-11606	871.3	9730	9743
8	-11591	-11606	759.3	9730	9743
9	-11591	-11606	647.3	9730	9743
10	-11591	-11606	535.3	9730	9743
11	-11515	-11530	590.2	9666	9679
12	-11515	-11530	478.2	9666	9679
13	-11515	-11530	366.2	9666	9679
14	-11515	-11530	254.2	9666	9679
15	-11515	-11530	142.2	9666	9679
16	-11515	-11530	30.2	9666	9679
17	-11515	-11530	-81.8	9666	9679
18	-11515	-11530	-193.8	9666	9679
19	-11515	-11530	-305.8	9666	9679
20	-11515	-11530	-417.8	9666	9679
21	-11515	-11530	-529.8	9666	9679
22	-11515	-11530	-641.8	9666	9679
23	-11591	-11606	-585.8	9730	9743
24	-11591	-11606	-697.8	9730	9743
25	-11591	-11606	-809.8	9730	9743
26	-11591	-11606	-921.8	9730	9743
27	-11591	-11606	-1033.8	9730	9743
28	-11591	-11606	-1145.8	9730	9743
29	-11591	-11606	-1257.8	9730	9743
30	-11591	-11606	-1369.8	9730	9743
31	-11591	-11606	-1481.8	9730	9743
32	-11591	-11606	-1593.8	9730	9743

Plane 1

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-11711	1518.4	9831
2	-11711	1412.6	9831
3	-11711	1306.8	9831
4	-11711	1201.0	9831
5	-11711	1095.2	9831
6	-11711	989.4	9831
7	-11711	883.6	9831
8	-11711	777.8	9831
9	-11711	672.0	9831
10	-11711	566.2	9831
11	-11711	460.4	9831
12	-11711	354.6	9831
13	-11711	248.8	9831
14	-11711	143.0	9831
15	-11711	37.1	9831
16	-11711	-68.7	9831
17	-11711	-174.5	9831
18	-11711	-280.3	9831
19	-11711	-386.1	9831
20	-11711	-491.9	9831
21	-11711	-597.7	9831
22	-11711	-703.5	9831
23	-11711	-809.3	9831
24	-11711	-915.1	9831
25	-11711	-1020.9	9831
26	-11711	-1126.7	9831
27	-11711	-1232.5	9831
28	-11711	-1338.3	9831
29	-11711	-1444.1	9831
30	-11711	-1549.9	9831

Plane 2

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-11836	1515.5	9936
2	-11836	1384.7	9936
3	-11836	1253.9	9936
4	-11836	1123.1	9936
5	-11836	992.3	9936
6	-11836	861.5	9936
7	-11836	730.7	9936
8	-11836	599.9	9936
9	-11836	469.1	9936
10	-11836	338.3	9936
11	-11836	207.5	9936
12	-11836	76.7	9936
13	-11836	-54.1	9936
14	-11836	-184.9	9936
15	-11836	-315.7	9936
16	-11836	-446.5	9936
17	-11836	-577.3	9936
18	-11836	-708.1	9936
19	-11836	-838.9	9936
20	-11836	-969.7	9936
21	-11836	-1100.5	9936
22	-11836	-1231.3	9936
23	-11836	-1362.1	9936
24	-11836	-1492.9	9936

Plane 3

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-11961	1469.3	10040
2	-11961	1313.5	10040
3	-11961	1157.7	10040
4	-11961	1001.9	10040
5	-11961	846.1	10040
6	-11961	690.3	10040
7	-11961	547.0	10040
8	-11961	416.2	10040
9	-11961	285.4	10040
10	-11961	154.6	10040
11	-11961	36.3	10040
12	-11961	-69.5	10040
13	-11961	-187.8	10040
14	-11961	-318.6	10040
15	-11961	-449.4	10040
16	-11961	-580.2	10040
17	-11961	-723.5	10040
18	-11961	-879.3	10040
19	-11961	-1035.1	10040
20	-11961	-1190.9	10040
21	-11961	-1346.7	10040
22	-11961	-1502.5	10040

Plane 4

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-12085	1430.0	10145
2	-12085	1170.8	10145
3	-12085	911.6	10145
4	-12085	652.3	10145
5	-12085	393.1	10145
6	-12085	133.8	10145
7	-12085	-125.4	10145
8	-12085	-384.7	10145
9	-12085	-643.9	10145
10	-12085	-903.1	10145
11	-12085	-1162.4	10145
12	-12085	-1421.6	10145

Neutron Detector at 99°

The survey report from 5th April (A987) gives the location of the origin of the neutron detector (as defined above) in the hall frame relative to the ideal target centre to be at,

z / mm	x / mm	y / mm	heading / deg	yaw / deg	pitch / deg	roll / deg
-966.5	-6100	-5.25	-99.19	N/A	-0.3	N/A

Veto Layer

Bar Number	HALL FRAME				
	x / mm		y / mm	z / mm	
	LEFT	RIGHT		LEFT	RIGHT
1	-5807	-5827	1564.6	-939	-942
2	-5807	-5827	1452.6	-939	-942
3	-5807	-5827	1340.6	-939	-942
4	-5807	-5827	1228.6	-939	-942
5	-5807	-5827	1116.6	-939	-942
6	-5807	-5827	1004.6	-939	-942
7	-5807	-5827	892.6	-939	-942
8	-5807	-5827	780.6	-939	-942
9	-5807	-5827	668.6	-939	-942
10	-5807	-5827	556.6	-939	-942
11	-5709	-5729	611.5	-923	-926
12	-5709	-5729	499.5	-923	-926
13	-5709	-5729	387.5	-923	-926
14	-5709	-5729	275.5	-923	-926
15	-5709	-5729	163.5	-923	-926
16	-5709	-5729	51.5	-923	-926
17	-5709	-5729	-60.6	-923	-926
18	-5709	-5729	-172.6	-923	-926
19	-5709	-5729	-284.6	-923	-926
20	-5709	-5729	-396.6	-923	-926
21	-5709	-5729	-508.6	-923	-926
22	-5709	-5729	-620.6	-923	-926
23	-5807	-5827	-564.6	-939	-942
24	-5807	-5827	-676.6	-939	-942
25	-5807	-5827	-788.6	-939	-942
26	-5807	-5827	-900.6	-939	-942
27	-5807	-5827	-1012.6	-939	-942
28	-5807	-5827	-1124.6	-939	-942
29	-5807	-5827	-1236.6	-939	-942
30	-5807	-5827	-1348.6	-939	-942
31	-5807	-5827	-1460.6	-939	-942
32	-5807	-5827	-1572.6	-939	-942

Plane 1

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-5962	1539.6	-964
2	-5962	1433.8	-964
3	-5962	1328.0	-964
4	-5962	1222.2	-964
5	-5962	1116.4	-964
6	-5962	1010.6	-964
7	-5962	904.8	-964
8	-5962	799.0	-964
9	-5962	693.2	-964
10	-5962	587.4	-964
11	-5962	481.6	-964
12	-5962	375.8	-964
13	-5962	270.0	-964
14	-5962	164.2	-964
15	-5962	58.4	-964
16	-5962	-47.4	-964
17	-5962	-153.2	-964
18	-5962	-259.0	-964
19	-5962	-364.8	-964
20	-5962	-470.6	-964
21	-5962	-576.4	-964
22	-5962	-682.2	-964
23	-5962	-788.0	-964
24	-5962	-893.8	-964
25	-5962	-999.6	-964
26	-5962	-1105.4	-964
27	-5962	-1211.2	-964
28	-5962	-1317.0	-964
29	-5962	-1422.8	-964
30	-5962	-1528.6	-964

Plane 2

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-6123	1536.8	-990
2	-6123	1406.0	-990
3	-6123	1275.2	-990
4	-6123	1144.4	-990
5	-6123	1013.6	-990
6	-6123	882.8	-990
7	-6123	752.0	-990
8	-6123	621.2	-990
9	-6123	490.4	-990
10	-6123	359.6	-990
11	-6123	228.8	-990
12	-6123	97.9	-990
13	-6123	-32.9	-990
14	-6123	-163.7	-990
15	-6123	-294.5	-990
16	-6123	-425.3	-990
17	-6123	-556.1	-990
18	-6123	-686.9	-990
19	-6123	-817.7	-990
20	-6123	-948.5	-990
21	-6123	-1079.3	-990
22	-6123	-1210.1	-990
23	-6123	-1340.9	-990
24	-6123	-1471.7	-990

Plane 3

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-6284	1490.6	-1016
2	-6284	1334.8	-1016
3	-6284	1179.0	-1016
4	-6284	1023.2	-1016
5	-6284	867.4	-1016
6	-6284	711.6	-1016
7	-6284	568.3	-1016
8	-6284	437.5	-1016
9	-6284	306.7	-1016
10	-6284	175.9	-1016
11	-6284	57.6	-1016
12	-6284	-48.2	-1016
13	-6284	-166.5	-1016
14	-6284	-297.3	-1016
15	-6284	-428.1	-1016
16	-6284	-558.9	-1016
17	-6284	-702.2	-1016
18	-6284	-858.0	-1016
19	-6284	-1013.8	-1016
20	-6284	-1169.6	-1016
21	-6284	-1325.4	-1016
22	-6284	-1481.2	-1016

Plane 4

Bar Number	HALL FRAME		
	x / mm	y / mm	z / mm
1	-6445	1451.3	-1042
2	-6445	1192.0	-1042
3	-6445	932.8	-1042
4	-6445	673.6	-1042
5	-6445	414.3	-1042
6	-6445	155.1	-1042
7	-6445	-104.2	-1042
8	-6445	-363.4	-1042
9	-6445	-622.6	-1042
10	-6445	-881.9	-1042
11	-6445	-1141.1	-1042
12	-6445	-1400.4	-1042