

Sudbury Neutrino Observatory

Magnetic Field Measurements in the SNO Cavity

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SNO STR 93-051

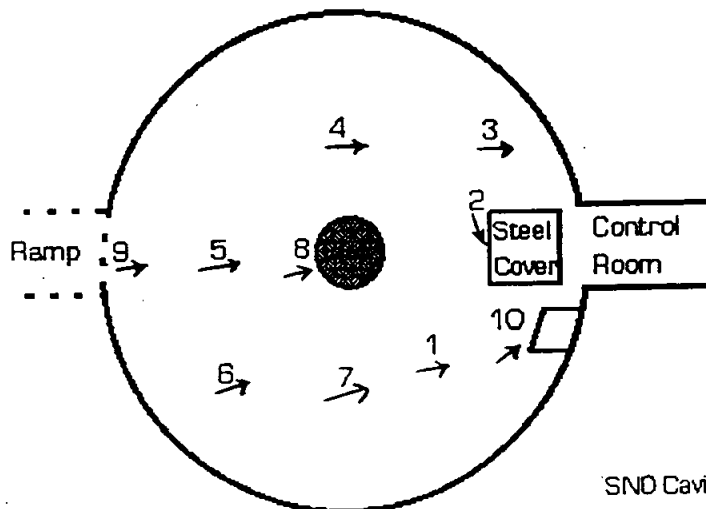
Introduction

In the past months, three separate surveys of the naturally-present earth's magnetic field have been completed in the 22 m diameter by 35 m high SNO Cavity, on the 6800 ft level of the Inco Creighton Mine. Since the photomultiplier tube light sensors for SNO are sensitive to magnetic fields, the largest component of the earth's field - the vertical component - will be greatly reduced by current-carrying circular coils in the floor and walls of the cavity. Measurements of the earth's field are important in the design and optimum operation of this compensation system. This report includes measurements made at two levels in the cavity during the excavation process. An earlier report (SNO STR 90-101) summarizes measurements in the dome area and outer laboratory sections.

Measurements

Measurements of horizontal, vertical and maximum field components were made during and after the excavation phase for the cavity. All measurements were made approximately 1 m above the floor or rock pile during excavation. A level was used with the instrument probe to obtain horizontal component values. Directions, having uncertainties of $\pm 5^\circ$, were measured with reference to the horizontal line through the cavity mid point from the cavity top entrance to the ramp entrance at the cavity base. A MEDA μ Mag Hall effect magnetometer (Model 206) was used throughout. The instrument calibration was checked by comparing the new reading set with previous underground measurements - readings are expected to be accurate to $\pm 10\%$.

Figure 1



SNO Cavity
Magnetic Fields
20 ft. below entrance level
August 5, 1992

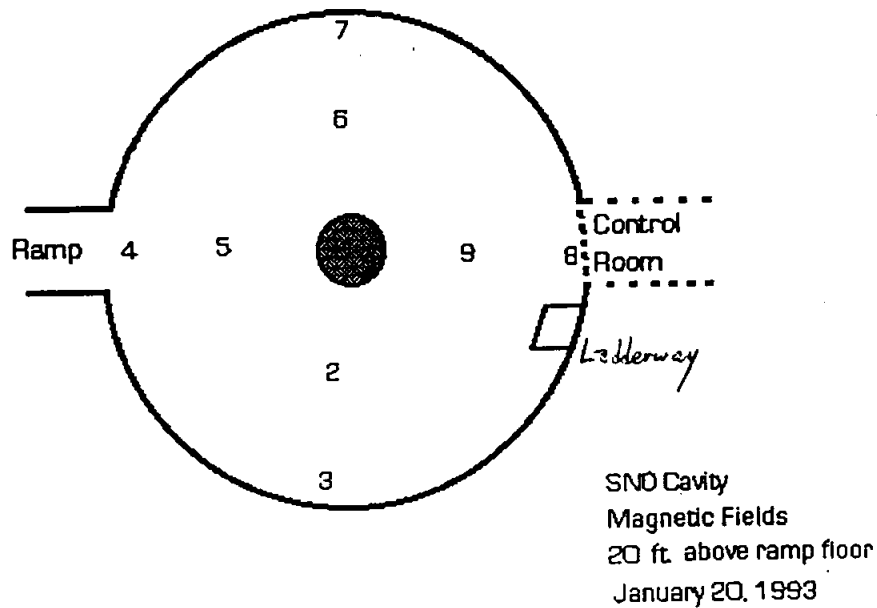
Results

- (a) Measurement set 1 - Cavity excavation depth = 20 ft. below entrance floor (7.0 m) August 5, 1992 (see Figure 1)

Location	Magnetic Field (mGauss)			
	Horizontal	(Direction)	Maximum	(Dip)
1	200 ± 20	10° W	595 ± 20	71°
2 #	185 ± 20	80° E	590 ± 20	73°
3	100 ± 20	10° W	597 ± 20	80°
4	60 ± 20	5° W	592 ± 20	84°
5	100 ± 20	5° W	593 ± 20	80°
6	130 ± 20	10° W	616 ± 20	78°
7	220 ± 20	20° W	603 ± 20	70°
8	130 ± 20	10° W	597 ± 20	78°
9	410 ± 20	20° W	760 ± 10	62°
10	165 ± 15	40° W	610 ± 20	75°
Average	170 ± 100	12° W	615 ± 50	75°

at corner of steel platform

Figure 2



(b) Measurement set 2 -Cavity excavation depth = 20 ft above ramp floor (7.0 m)
January 20, 1993 (see Figure 2)

Location	Magnetic Field (mGauss)			(Dip)
	Horizontal	(Direction)*	Maximum	
1	160 ± 10	-	545 ± 20	74°
2	145 ± 15	-	585 ± 20	76°
3 *	240 ± 20	-	615 ± 20	69°
4 *	150 ± 10	-	545 ± 20	75°
5	150 ± 10	-	585 ± 20	76°
6	150 ± 10	-	580 ± 30	75°
7 *	155 ± 10	-	585 ± 30	75°
8 *	145 ± 10	-	595 ± 20	76°
9	140 ± 10	-	565 ± 20	76°
Average	159 ± 30		578 ± 23	75° ± 2°

* 3 feet from wall (and steel screen)

Summary

Magnetic fields in the SNO cavity appear uniform to within 5 % at the locations measured. The average field has a horizontal component of 165 mG at an angle of 12° W of the line joining the cavity entrance and the ramp (magnetic north direction). The vertical field average was 596 mG, with the dip angle (below the horizontal averaging 75°. These values are quite close to the fields observed at the surface in the Sudbury region.