

Technical Note No. 370

ASYMMETRIC COMBINED-FUNCTION COIL CROSS SECTION

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The potential benefits from adopting combined-function quadrupoles were discussed in a previous Technical Note.<sup>1</sup> The specific example given in this Note was based on the use of a symmetrical two-layer configuration in which the inner layer produced a pure quadrupole and the outer a dipole field. Further studies revealed problems with this solution due to an undesirable inward-directed force distribution. An asymmetric true combined-function coil, on the other hand, has a force distribution which resembles that of a dipole coil and, presumably, can be constructed with the techniques already developed.

In the present note a specific solution of an asymmetric combined-function coil is presented. This coil was obtained after a long iterative optimization procedure in which the dipole transfer function was maximized while keeping the gradient constant. It is believed that the particular configuration is satisfactory with respect to quench propagation and that the coil winding can be done with existing tooling.

The cross section of the proposed combined function coil (internally known as 7 Block-H2) is shown in Fig. 1. There are 77 turns per half coil resulting in the theoretical transfer functions, infinite- $\mu$  and warm dimensions, of

$$\begin{aligned} B/I &= 10.423 \text{ G/A} \\ G/I &= 0.628 \text{ Gcm}^{-1}/\text{A} \end{aligned}$$

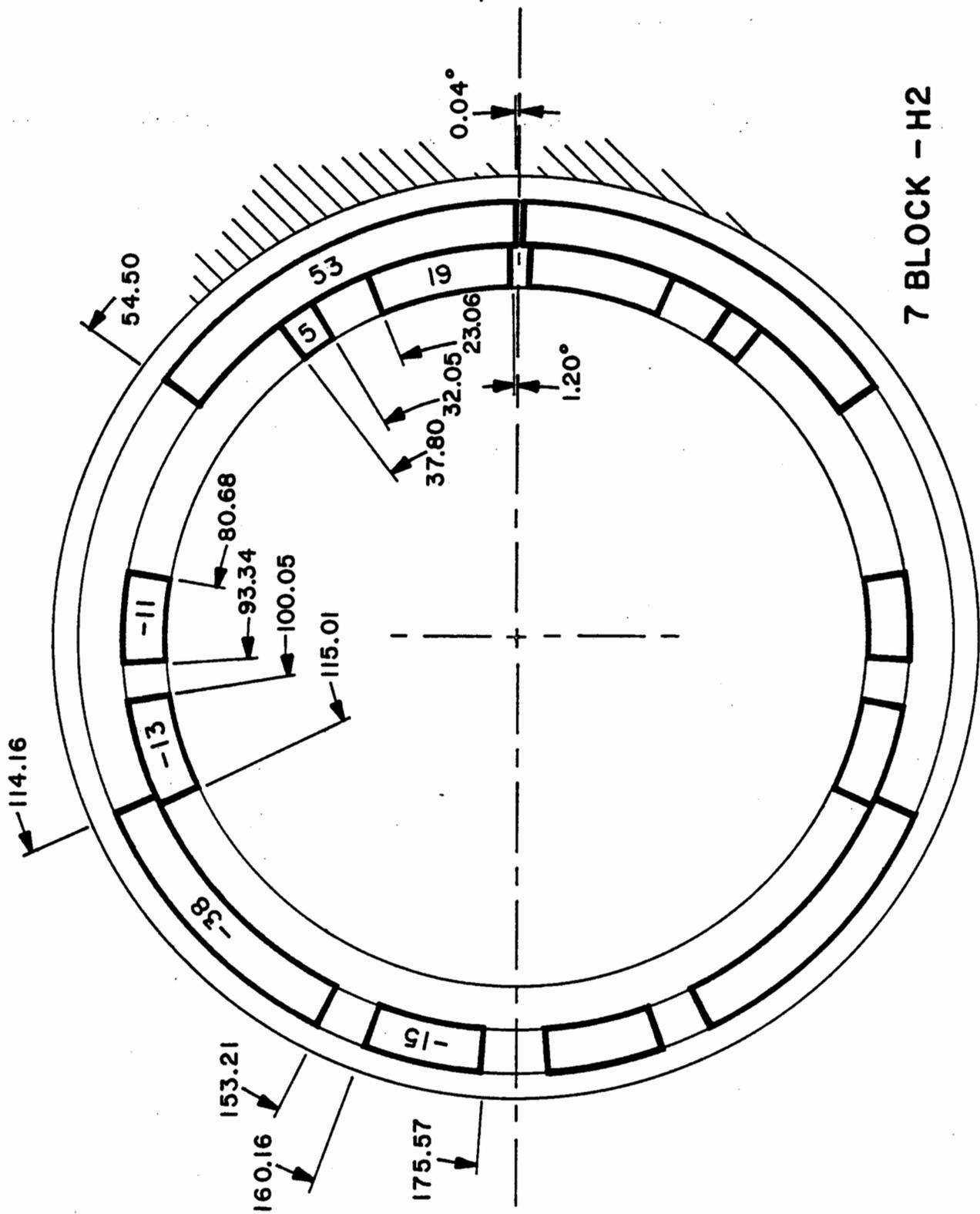
For reference the standard dipole produces 15.69 G/A with 105 turns.<sup>2</sup> The design harmonics are consistent with the parameter list tolerances for systematic errors and are listed in Table I.

Table 1. Design Field Harmonics at 4.4 cm

Harmonic n	local dipole	standard dipole
n	$b_n^1 \times 10^4$	
2	-31.6	-21.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	- 0.4	- 0.3
10	2.2	1.5
11	- 1.2	- 0.8
12	- 4.1	- 2.7
13	- 0.2	- 0.1

1. H. Hahn, ISABELLE Technical Note No. 362 (1982)

2. H. Hahn and R. C. Fernow, ISABELLE Technical Note. 337 (1981)



7 BLOCK - H2