

BROOKHAVEN NATIONAL LABORATORY

MAGNET DIVISION NOTES

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The measured harmonics in DRG101 and DRG111 are in general agreement with the parts used in manufacturing those magnets. Except for b'_4 , all harmonics are about as good as one can expect. Though, it may be too early to iterate the cross section based on only two magnets, the data available are sufficient to plan a strategy to best optimize and control field quality in the rest of the program. The proposed plan has a minimum impact, if any, on cost & schedule and offers sufficient flexibility.

The first phase kicks in around magnet 10 and requires no change in wedges. The magnets would be assembled with 4 mil caps on the coils instead of present 6 mil. Since the field quality in this phase is estimated to be quite good, the starting point of the second phase is quite flexible, say any where between magnet 31 to 51 or so. For Phase 2, we hope that only wedge No. 2 will change and that too merely by a few mil. An attempt is made here to reduce the number of changes to a bare minimum. The estimated systematic allowed harmonics in the two phases are compared to the present values in table 1. Present values(?) are the harmonics at 1450 Amp during up-ramp in DRG101 and anticipated in DRG111 based on the warm measurements. The errors (\pm) in table 1 represent σ in *Present* column and confidence level (dbn) in *Phase 1* and *Phase 2* columns. This is a partly subjective but reasonably accurate table.

Table 1: Estimated systematic values of allowed body harmonics in *Phase 1* and *Phase 2* as compared to the "*Present*" values. There is no change in wedge in Phase 1 which starts around magnet 10. The Phase 2 requires a few mil change in wedge 2 and could begin between magnet 31 and 51.

	b'_2	b'_4	b'_6	b'_8
Present	-0.1 ± 0.2	-1.4 ± 0.2	-0.27 ± 0.1	0.28 ± 0.2
Phase 1	3 ± 2	-0.4 ± 0.3	0.0 ± 0.2	0.4 ± 0.1
Phase 2	2 ± 2	0.0 ± 0.5	-0.3 ± 0.2	0.2 ± 0.1

Given the time needed to procure the 4 mil caps for Phase 1, an order may be placed now. The final decision to use them or not could be delayed till the last minute to watch for any surprising change in the average value of b_4 harmonic based on the magnets tested in the mean time. However, since we are under-correcting and not over-correcting, in all probabilities, this adjustment will help. Moreover, the present stock of 6 mil caps will not be wasted and would be utilized in Phase 2. In addition, it would be useful to have some 4 mil caps in the stock to timely and effectively respond to a situation in which a sizable and convincing drift is observed in the field quality. The caps give a change in b'_4 harmonic by 1 unit and allowing an adjustment, if needed, virtually eliminates the need for a b_4 corrector. (There is enough capacity in sextupole corrector to deal with the above b_2). This approach may also be of interest to industry since it gives them some room to breath and since the specification on $\langle b'_4 \rangle$ is only 0.7 unit.