

# BROOKHAVEN NATIONAL LABORATORY

## MAGNET DIVISION NOTES

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# Upgrading QRB005 through QRB012 to Accelerator Quality Quadrupoles

R. Gupta and P. Thompson

Magnetic measurements have been performed in five of the eight identical quadrupoles built before the industry starts building magnets. These magnets have shown that except for a large  $b_3$  and a small  $b_5$ , all other harmonics are the best we can hope for with the present design philosophy. In fact, but for a significant  $a_5$  arising from the leads, all other harmonics are quite good. There is no plan for a modification in the lead configurations, which may reduce this  $a_5$ .

With this in mind, we propose what can be done to upgrade these magnets to accelerator field quality magnets. These re-built magnets will have good field quality with a 30% or more quench margin. These magnets can either be used in RHIC, or can be saved as spares. In any case we would have demonstrated an acceptable construction of eight magnets, at least from the field quality point of view before the industry starts building the magnets.

In QRB005 through QRB012, the actual shim used at all eight pole faces was 0.029". (This includes a 10 mil shim due to machining of the pole). We suggest, that these magnets be rebuilt with the new values of pole shims given here. As shown in figure 1, the four thin shims of 0.024" go on the midplane side of the four poles and the four thick shims of 0.030" go on the 90° side of the poles. The pole turns are thus effectively moved 0.003" towards the 90° side of the pole. This would bring the measured  $b_3$  close to zero. Moreover, the overall size of the coil will grow by 0.002" since the average size of the pole shim is now 0.027" instead of 0.029". This would bring the integral  $b_5$  at 1450 Amp (30GeV) close to zero in the up-ramp.

## QRB MODIFIED SHIMS

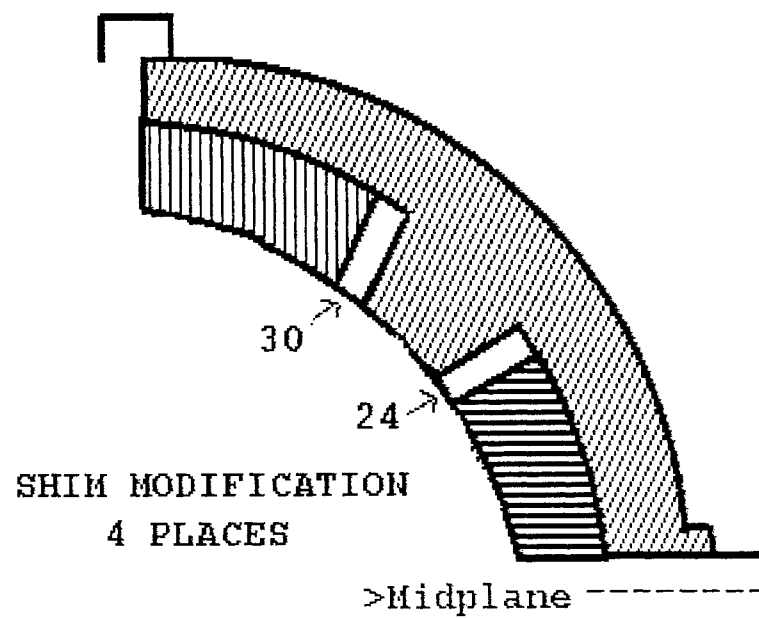


Figure 1: Shims to be used in the proposed re-built of the RHIC arc quadrupoles QRB005 through QRB012.