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Title: End Multipoles for the 32 mm SSC Dipoles

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End Multipoles for the 32 mm SSC Dipoles

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Now that the cross section of the new 40 mm SSC dipoles (SSC-C5) has been agreed upon, we are looking more seriously at the end design. At this time we have results for four 32-mm dipoles with the SSC-P11 cross section. In this note we compare the measurements with the results of calculations for the end harmonics using the program MAG3.

The program calculates the contribution of coil segments only (no iron). The iron stops at the end of the straight section, and the program calculates the integrated multipoles from that point outwards. The measured values are simply the difference of long and short coil measurements.

The comparison of the measured and calculated values in Table 1 shows that the calculations can predict the quadrupole and sextupole terms within several prime units. This ability could be used in principle to design an end configuration with no sextupole contribution. The program does not appear reliable for higher multipoles. Unfortunately, even this limited predictive power will probably be lost if the iron is extended part way along the end region. If the iron completely covers the end, the quadrupole term would be reduced naturally and it might possible to predict and thereby control the sextupole. However, such a design must also reduce the field enhancement in the saddle region, or else the ends will limit the magnet's performance.

Table 1 SSC-P11 End Multipoles, $b_n \times 10^4$@ 1 cm

Magnet	b_1	b_2	b_3	b_4
N1	6.9	25.4	1.1	-7.1
S1	7.7	28.6	0.8	-8.9
N2	9.9	29.1	1.6	-7.3
S2	8.9	25.6	2.7	-5.5
Measured	8.4±1.4	27.2±2.0	1.6±0.9	-7.2±1.4
Calculated	10.4	25.9	0.1	-0.8