

Systematic study of harmonics errors in large series of quadrupoles

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MT24 - October 20 (Tue) 11:20-11:35

The harmonics content, either term by term or in some combination, is very often used as one of the criteria used to assess the quality and the acceptance or rejection of a magnet. This becomes especially important with the current trend of reduction of the bore radius of multipoles in the new generation of light sources, in which the requirement for combined function magnets makes things even worse.

Taming the unwanted harmonics throughout the entire fabrication process is of the utmost importance to manufacturers but very often proves a formidable challenge due to the numerous sources of errors and the incomplete understanding of their effect on harmonics.

As manufacturers, dealing with large numbers of magnets of many different types, with different designs and from different customers, we are in an unmatched position to perform systematic studies of harmonics contents, comparing trends in large series, comparing variations along different parameters and even comparing different designs.

This paper presents studies performed on 2 large series of 2 different types of quadrupoles as well as systematic studies of harmonics variation with different parameters. Both expected and unexpected correlations and trends are derived.