MT 25

High Gradient Nb3Sn Quadrupole Demonstrator MKQXF Engineering Design

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Abstract

The MKQXF is the further development of the “pole-loading” concept for Nb3Sn quadrupoles. The main features of the MKQXF design are illustrated in Figure 1 as the HL-LHC IR quadrupole QXF [3], based on the bladder-and-key concept. The design optimization is described and the optimized assembly parameters and the effect of the dimensional tolerances on the maximum coil stress level are presented.

2D Model

Abstract

The mechanical design of the end region, including four tie rods, four bullets per side and a stainless steel shell assembly parameters are achievable and the stresses remain at an acceptable level at all times.

Mechanical structure

The dimensional tolerances on the coil size play the most important role in the maximum coil stress level, underlining the need for high precision mechanical of the coils to carefully determine the assembly parameters.

During the model magnet phase the shells can easily be adjusted to guarantee the required precision levels and to compensate for the field errors. These data can be used at a later stage to adjust the coil fabrication tolerances to both mechanical and magnetic requirements effectively.

The Azimuthal coil stress [MPa] and FEM model results are compared with the 2D results in Table 2. Table 1 presents the elongation of the coil’s extremities. The coil deforms by 0.44 mm during powering, which is well within the acceptable limits for all components.

REFERENCES