Contribution ID: **4** Type: **not specified**

Mechanical design of the suspension system of superconducting elements subject to variable loads

This research outlines the recent progresses on the mechanical design and integration of the suspension system of superconducting elements subject to variable loads, with focus on the supports of superconducting dipoles for the rotating transfer line of a carbon ion therapy machine, the so-called gantry.

When designing suspension systems for superconducting elements subject to constant loads, the primary challenge is to strike a balance between limiting the heat load to the cold mass and ensuring proper mechanical resistance and/or stiffness of the system. This trade-off often leads engineers to choose from a limited set of materials and supporting architectures. In this presentation an overview of the different overall designs is presented.

The comprehensive design of a system that is able to withstand variable loads is of key importance for this application. Two suspension systems are proposed as viable solutions, the first being an adaptation of the eight-support architecture to rotating gantries, while the second is a novel architecture based on robotics. The methodology for the comparison of the two suspension systems is outlined. First results related to the heat-load, mechanical resistance and buckling are presented. The optimization of each of the two solutions by mean of genetic algorithm is explained and results with respect to initial manually optimized structures are shown. The performance against errors due to stiffness of components is compared as well as other advantages of one solution with respect to the other.

Type of contribution

Poster

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