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Design of support structure for nozzle components in heavy ion therapy gantry

Hadron therapy is a form of radiation therapy for cancer treatment. This cancer treatment approach shows multiple advantages to conventional radiotherapy such as higher precision, better effectiveness, minimal healthy tissue damage. Unfortunately, currently hadron therapy is hardly accessible due to complexity and high cost of infrastructure needed to accelerate and direct the beam of heavy particles. One of the most mechanically complex parts of this infrastructure, that may allow cost improvement, is machine called gantry. It allows tumor irradiation from multiple desired angles by supporting part of beam transfer line that rotates around patient. "HITRI plus"is a project with an aim to create hadron therapy more accessible. As a part of this project, this work proposes, the mechanical design of a gantry component called gantry nozzle. Topology optimization is used for an initial design followed by iterative manual optimization for final design proposals. Two possible solutions of nozzle design are developed and compared. The total of supported mass by the nozzle structure is estimated to be around 1.2t and the achieved mass of both proposals is lower than 1t while keeping transfer line component displacements within estimated required linear and angular tolerance of ± 0.2 mm and ±1 mrad respectively. In addition to that, a design workflow is developed that may be used to update nozzle structure designs due to ongoing development of the whole system.

Type of contribution

Poster

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