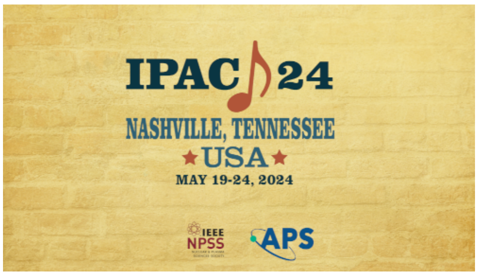


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# Topology optimization of a dipole magnet using normalized gaussian network

*Sunday, 19 May 2024 16:00 (2 hours)*

The precision of the proton therapy beam depends on maintaining high field quality in the magnet's good field region. Iron yoke is employed in magnets to increase the magnetic field and reduce the fringe field. However, when providing a high magnetic field for transporting relatively high-energy particles, the saturation effect of the yoke can distort the field quality. To mitigate this effect, tuning holes and pole shape optimization are adopted in the iron yoke to adjust the magnetic flux, which helps in maintaining a higher field quality for particles with different energies. Optimizations are often limited by human expertise. In this paper, we use a topology optimization method that employs a non-dominated sorting genetic algorithm for the prototype design of an iron yoke in a dipole magnet. To achieve a smooth distribution of material, we represent the shape of the iron yoke using a normalized Gaussian network. This method effectively mitigates the field error at different energy levels. Shape optimization is performed to compare it with topology optimization. It is suitable for the application of topology optimization in the beam line system for the proton therapy system.

## Footnotes

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