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Mechanical design and challenges of the FCCee arc radiation shielding

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The FCC-ee faces challenges in managing radiation from primary synchrotron photons, which can damage machine components and tunnel equipment due to cumulative exposure. Effective shielding is crucial to reduce equipment failure, prevent performance degradation, and limit reliance on costly radiation-hard materials.

The proposed solution involves enclosing photon stoppers with shielding inserts and plates. With 2580 dipoles, each containing 10 photon stoppers, the machine requires shielding for 25800 stoppers. A preliminary lead-based design shows promise in dose reduction, but optimization is needed to control costs, meet integration constraints, and ensure manufacturing feasibility. Current estimates suggest each stopper will require 400 kg of shielding, totaling 10320 tons of lead. Optimization focuses on refining the shielding's shape, size, and materials, while simplifying fabrication and installation to improve scalability. Goals include detailed cost estimates, spatial assessments, and a design addressing thermal management, mechanical integrity, and structural support, ensuring significant reduction of ionizing dose. This work is vital for proving the FCC's feasibility.

Footnotes

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