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Preliminary technical design for the FCC-ee dipole shielding

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Managing radiation from primary synchrotron photons is a major design challenge for the FCC-ee, as prolonged exposure can degrade tunnel infrastructure and critical machine components. Effective shielding is therefore essential, not only to protect equipment and maintain operational reliability, but also to minimize the need for costly radiation-hardened materials.

The current shielding approach under consideration involves enclosing photon stoppers with inserts and plates. With 2840 dipoles, each housing 10 photon stoppers, the FCC-ee requires shielding for a total of 28400 units. Preliminary simulations using lead-antimony alloys have shown encouraging dose reduction performance. The initial concept estimates around 400 kg of shielding per photon stopper, leading to a total mass exceeding 11000 tons. Ongoing R&D is focused on optimizing the geometry, in view of simplifying manufacturing and assembly processes to support large-scale production. These efforts also involve detailed cost evaluations, assessments of mechanical stresses, thermal behaviour, and integration constraints in and around the dipoles . Advancing this work is essential to confirm the FCCee's overall feasibility.

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