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Protection of the European XFEL Undulators from the Additional Beam Losses Caused by the Insertion of a Slotted Foil

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The undulators in the European XFEL are made of permanent magnets that need to be protected from beam losses that could cause demagnetisation. Under current operating conditions, beam losses in the undulators are prevented by a collimation section downstream of the main Linac and upstream of the switchyard. In the future, a slotted foil may be installed in the European XFEL to reduce the X-ray pulse length; however, the insertion of the foil will spoil the emittance of most of the bunch which increases the probability of particles scraping the collimator and continuing to be transported to the undulator section. In this paper, we report a study to assess the level of the beam losses in the undulators in the European XFEL that would be caused by a slotted foil, and to determine the optimal apertures to use in the collimators to minimise the losses. We also assess whether shielding or an additional collimator in front of the undulator could be added to the beamline to prevent the losses.

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