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## Set-up, characterization and mitigation of cross-talk between PM-based and ferrite-enforced appliances for FLASH 2020

We present the design basics, assembly procedure and the results of the characterization measurements for two magnetic appliances that are part of the current upgrade of the FLASH free electron laser at DESY Hamburg. A permanent magnet-based phase shifter will allow for a tuning of the electron trajectory between two insertion devices to provide constructive interference, while ferrite-enforced corrector coils with variable field direction will not only correct gap-dependent kicks of the undulator but will also be strong enough to serve as steerers in a slow feedback system. We have manufactured ten phase shifters and more than 30 corrector coils which have all been measured with Hall probes and stretched-wire set-ups to measure the achievable phase range and maximum kick, respectively, to correct any multipole contributions and to check for consistency within each series. A particular challenge was the introduction of significant cross-talk between the permanent magnets of the phase shifter and the ferrite core of the coils due to the close proximity of the two devices along the beam line. The ferrite would dampen the fringe field of the phase shifter leading to an unwanted kick to the electron beam. The issue was mitigated by placing a set of ferromagnetic dowels between phase shifter and coil that would compensate for the dampening. Size and position of the dowels were modelled beforehand and verified in stretched-wire measurements.

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