SwissFEL Beam Dump Dipole Spectrometer Simplistic Design
Backed by Accurate Magnetic Field Measurements

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The SwissFEL project at the Paul Scherrer Institute (PSI) has entered its final phase with most of the magnets having been measured and installed. The beam dump dipole in the Injector-Linac 1 section of the SwissFEL facility serves not only to dump the electron beam but also acts as a spectrometer. Optimisation of the magnet pole profiles and pole ends, in order to achieve a good field region homogeneity of 1e-04, is nowadays a common approach when designing magnets utilised at places where a high magnetic field quality is necessary. This design route leads to very compact magnets with complex pole geometries that are more expensive to manufacture than magnets of simple geometries. Regardless the magnet quality, the magnetic field measurements are the ultimate test before getting magnets into operation. At PSI, the magnetic field mapping by Hall probes has a relative accuracy of 1e-04 and below. With such an accuracy the beam dump dipole geometry optimisation could be somewhat relaxed. It is for these reasons that we have adopted a simpler design concept for this dipole. The magnet design rationale, the results of the magnetic field measurements and the beam ray-tracing analysis are presented in depth.