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Wakefield and skin depth issues in the kicker at the SHINE

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The Shanghai high-repetition-rate XFEL and extreme light facility (SHINE) is designed to be one of the most advanced free electron laser user facilities around the world. The repetition is aiming at 1 MHz and the high-repetition-rate electron beams are delivered into three undulator lines through the beam delivery section. The main functional elements are kickers. The vacuum chamber in the kicker is a dielectric pipe made of ceramic. The wakefield of a dielectric pipe is much stronger than that of a metal pipe and the accumulation of static charges in the ceramic wall is undesired. Thus a metal layer should be applied to the inside of the chamber wall. In order to limit eddy currents which could lead to losses of the applied magnetic field when penetrating through the chamber, the layer should be as thin as possible. On the other hand, the thickness of the layer should not be smaller than the skin depth in order to avoid new problems. We simulate the motion of electrons in a metal layer to find the “effective skin depth” and calculate the wakefield of our kicker. Based on the results, we give suggestions to the design scheme of kickers.

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