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Segmented superconducting adjustable gap undulator (SC-AGU) prototype

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The concept of the AGU has been proposed for some time*. However, utilizing a permanent magnet-based device complicates the design due to the necessity of independent gap control for each segment and, in the case of an in-vacuum undulator, the requirement for a flexible continuity sheet to mitigate image current heating. The adoption of SC magnets eliminates these concerns.
The SC-AGU prototype will comprise three sections of magnetic arrays with a total length of 120 cm, with the central section featuring a smaller gap than the end units. To achieve this, a UHV chamber will be designed for eventual fabrication, incorporating a non-uniform aperture that conforms to the beam envelope. Furthermore, to maintain a constant fundamental photon energy and maximize on-axis spontaneous emission, each SC section will be engineered with distinct period lengths, with the central section possessing a shorter period than the end units.
This paper presents the methodology for end-field analysis, encompassing detailed simulations to characterize the magnetic field distribution at the extremities of each magnetic array. Particular emphasis is placed on the impact of field quality at junctions and its influence on radiation properties, ensuring the optimization of on-axis spontaneous emission while preserving the electron beam's 'stay-clear'area and mitigating impedance constraints imposed by the undulator magnet structure.

*O. Chubar, et al., Proc. of IPAC-2012, p. 765 (2012).

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