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End field design and tuning methods for insertion devices

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Insertion devices for synchrotron light sources have stringent requirements on field quality to yield high brightness and gap-independent steering. Correct end termination yields a large number of ''effective poles'' and helps achieve gap-independent steering. Measurements on the APS Undulator A at periods of 33 mm and 27 mm and Wiggler A with a period of 85 mm vs. gap and end-field configuration show good agreement with finite element analysis (FEA) design predictions of trajectories and field shape. We will show brightness calculations using a more realistic ''ideal'' device composed of FEA end fields and FEA central fields and compare these against the calculated brightness from delivered devices. We will show the number of effective poles for different ideal end-field geometries. Experimental entrance steering shows a large variation between different devices having the same end field configurations, necessitating empirical tuning. A review of end-field tuning methods, signatures of magnet strength changes, reduced height poles, shims and end pole shaping vs. gap and wavelength employed for APS devices will be presented.

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