

## **MODES OF A LAMELLAR GRATING FOR SMITH-PURCELL EXPERIMENTS**

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If an electron beam propagates just above a grating, it produces diffraction radiation which was observed for the first time by Smith and Purcell (SP) in 1953. If the beam current is high enough, a strong interaction with the fundamental evanescent mode of the grating occurs. The beam bunches and coherent emitted radiation is expected at specific observation angles which are given by the SP relationship for the harmonics of the grating mode frequency. For small grating periods ( $< 1\text{mm}$ ), the Terahertz range can be reached, in principle.

In this presentation, we give a complete study of the modes of a finite lamellar grating, the one we used in a recent experiment at CEA/CESTA<sup>1</sup>. Measurements of grating excitation with a network analyzer and 3D simulations are reported along with a new 3D theory. Excellent agreement between the theory and the simulations, as well as between the simulations and the measurements, is found. The 3D theory turns out to be a simple extension of the Andrews & Brau 2D model<sup>2</sup> where the transverse horizontal dimension was ignored.

1. J. Gardelle, L. Courtois, P. Modin and J.T. Donohue, Phys. Rev. ST Accel. Beams 12, 110701 (2009).

2. H. L. Andrews and C. A. Brau, Phys. Rev. ST Accel. Beams 7, 070701 (2004).