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# Characterization of Longitudinal electron beam dynamics in a compact S-band Standing Wave (SW) Radio-Frequency (RF) Photoinjector (1.5 cell design)

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Nowadays, charged particle accelerators play an important role as powerful engines that speed up tiny charged particles to incredibly high speeds close to the speed of light. These machines are essential in many scientific areas: Understanding the Universe, many medical applications, nuclear Studies, Astrophysics, and Industrial Uses. This research highlights on the longitudinal electron beam dynamics in a compact S-band standing wave radio-frequency photoinjector of 1.5 cell, focusing on the generation and acceleration characteristics of the electron beam under the RF fields. This research clearly examines the intricate interplay between electric fields and their profound impact on the extraction and acceleration mechanisms governing electron beams within accelerator cavities. Through meticulous analysis,
we are able to know how variations in electric field strength, under various conditions within the photoinjector setup such as the RF phase, directly affect the efficiency of beam generation, extraction and the subsequent acceleration processes within these specialized cavities. This is carried out with a support of analytical models and simulation program (MATLAB).
This study is also unique in the country and provides scientific access and resources for accelerator physicists, experts and researchers.

## Technical Track

Nuclear Applications and Radiation Processing

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