Joint DESY and University of Hamburg Accelerator Physics Seminar

Tuesday, 03.09.2019

(16:00 in Room 459/30b)

Long-Range and Short-Range Wakefield Effects on Electron-Beam Dynamics in TESLA-type Superconducting RF Cavities

Alex H. Lumpkin

FNAL

Abstract

The Fermilab Accelerator Science and Technology (FAST) facility has a unique configuration of a photocathode RF gun beam injecting two TESLA-type single cavities (CC1 and CC2) in series prior to the cryomodule. Beam propagation off axis in these cavities can result in both long-range and short-range transverse wakefields which can lead to emittance dilution within the macropulses and micropulses, respectively. Two configurations of a Hamamatsu C5680 streak camera viewing a downstream OTR screen were utilized to track centroid shifts during the macropulse (framing mode) for the long-range case and during the micropulse for the short-range case ($\sim 10\ \mu$m spatial resolution and 2 ps temporal resolution). Steering off axis before CC1, resulted in a 100 kHz bunch centroid oscillation within the macropulse that was detected by the downstream RF BPMs and the streak camera[1]. At 500 pC/bunch, 50 bunches, and 4 mrad off-axis vertical steering into CC2, we recently observed an $\sim 100\ \mu$m head-tail centroid shift in the streak camera image $y(t)$ profiles which we attributed to a short-range wakefield effect. Additional results for kick-angle compensations and model results will be presented.

W.Hillert, (Univ. HH), I.Agapov (MPY) and M.Vogt (MFL).

Visit our web site at `http://www-mpy.desy.de/AccPhySemDESY/index.html`

[1] A.H. Lumpkin et al., "Submacropusle electron-beam dynamics correlated with higher-order modes in Tesla-type superconducting rf Cavities", *Phys. Rev. Accel. and Beams*, **21**, 064401 (2018)