ID contributo: **139** Tipo: **poster**

Relativistic charged-particle beam dynamics via the generation of wake field

lunedì 3 giugno 2013 19:30 (30 minuti)

A new theoretical approach to describe the dynamics of the relativistic charged-particle beam propagation via
the generation of wake field is provided. The wake field is derived starting from the Lagrangian of a relativistic test charged particle. The beam dynamics is described using the appropriate Hamiltonian for the beam particle
and a quantum description is provided using a recently developed theory. The eective Hamiltonian shows a new
additional slow response eect to the longitudinal dynamics due to the relativistic propagation of the beam in a
longer time scale. Using such approach, further study of the eects of both the transverse (focusing/defocusing) and the longitudinal (acceleration/deceleration) components of the wake field in the self-consistent PWF excitation
is proposed.

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