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**Numerical Study of Low energy Electron Beam Dynamics in Over-Dense Plasma** KOOK-JIN MOON, MOSES CHUNG, Ulsan National Institute of Science and Technology, PATRIC MUGGLI, Max Planck Institute for Physics — The self-modulation of a long proton bunch, which is used for Advanced WAKefield Experiment (AWAKE)[1] at CERN, can be seeded by a sharply rising bunch front, a relativistic ionization front or a short preceding electron bunch. The electron bunch seeding scheme decouples seed wakefield parameters from those of the proton bunch. It is therefore essential to determine the evolution of the electron bunch and how it generates wakefields in the 5-10 MV/m range over meter scale propagation distances necessary for effective seeding. With a low energy bunch (20 MeV), electrons lose a large fraction of their energy. That leads to significant evolution of the bunch longitudinal distribution and thus of the wakefields' phase. This evolution makes the investigation of transverse matching condition to the linear wakefields complicated. In this context, we search for a condition for the stable generation of the seed wakefields using Particle-In-Cell code FBPIC[2]. We will present detailed simulation results and their implication for wakefields' seeding.

[1]P. Muggli et al. (AWAKE Collaboration), Plasma Phys. Controlled Fusion 60, 014046 (2018).
[2]R. Lehe et al., Comput. Phys. Comm. 203, 66-82 (2016)

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