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Self and Controlled Injection in Multi-dimentional Wakefield Driven by Laser or Charged Particle Beams A. DAVIDSON, W. LU, UCLA, J. MARTINS, IST, W. AN, UCLA, S. MARTINS, J. VIEIRA, IST, C. HUANG, LANL, R. FONSECA, L.O. SILVA, IST, C. JOSHI, W.B. MORI, UCLA — In plasma based accelerators (LWFA and PWFA), the methods of injecting high quality electron bunches into the accelerating wakefield is of utmost importance for various applications. A through understanding of how the injection occurs in both self and controlled scenarios is therefore important and needed. To simplify this understanding, we start from single particle motion in an arbitrary traveling wave electromagnetic structure (e.g., wakefields driven by non-evolving drivers), and obtained the general conditions for trapping to occur. We then compare this condition with high fidelity PIC simulations through advanced particle and field tracking diagnostics. Numerous numerical convergence test were performed to ensure the correctness of the simulations. The agreement between theory and simulations clarifies the role played by driver evolution on injection, and a physical picture of injection first proposed in Ref.[1] is confirmed through simulations. Several ideas, including ionization assisted injection, for achieving high quality controlled injection were also explored and some simulation results relevant to current and future experiments will be presented. [1] W. Lu et al., PRSTAB 10, 061301, 2007

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