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Analysis of non-Gaussian laser mode guidance and evolution in leaky plasma channels BLAGOJE DJORDJEVIC, Univ of California - Berkeley, CARLO BENEDETTI, CARL SCHROEDER, ERIC ESAREY, WIM LEEMANS, Lawrence Berkeley National Laboratory — The evolution and propagation of a non-Gaussian laser pulse under varying circumstances, including a typical matched parabolic channel as well as leaky channels, are investigated. It has previously been shown for a Gaussian pulse that matched guiding can be achieved using parabolic plasma channels. In the low power regime, it can be shown directly that for multi-mode pulses there is significant transverse beating. Given the adverse behavior of non-Gaussian pulses in traditional guiding designs, we examine the use of leaky channels to filter out higher modes as a means of optimizing laser conditions. The interaction between different modes can have an adverse effect on the laser pulse as it propagates through the primary channel. To improve guiding of the pulse we propose using leaky channels. Realistic plasma channel profiles are considered. Higher order mode content is lost through the leaky channel, while the fundamental mode remains well-guided. This is demonstrated using both numerical simulations as well as the source-dependent Laguerre-Gaussian modal expansion. In conclusion, an idealized plasma lens based on leaky channels is found to filter out the higher order modes and leave a near-Gaussian profile before the pulse enters the primary channel.

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