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Optical Characterization of a PWFA Plasma Source[1] VALENTINA LEE, CHRISTOPHER DOSS, KATHRYN WOLFINGER, ROBERT ARINIELLO, KEENAN HUNT-STONE, JOHN CARY, MICHAEL LITOS, University of Colorado, Boulder — The performance of an electron beam-driven plasma wakefield accelerator (PWFA) depends critically on the density profile of the plasma source. Often, it is advantageous to preform the plasma source ahead of the arrival of the beam (e.g. by laser ionization of a gas) in order to better control the plasma density profile. Due to the geometry and density range of a PWFA plasma source, which comprises a filament less than 1 mm in diameter and up to 1 m in length with a typical core density of 10^{16-17} cm^{-3}, it is challenging to accurately diagnose. Shadowgraphy techniques deployed with laser-driven plasma WFA that have much shorter plasma sources with much higher density cannot easily provide a complete picture of the PWFA plasma source. The most robust diagnostics for the PWFA plasma source rely on the optical properties of the plasma recombination light. However, in order to correctly interpret such signals, the temporal evolution of the plasma filament decay process must be well understood. We present experimental results of a method that combines the signals from shadowgraphy and plasma recombination light to diagnose the density profile of a PWFA plasma source supported by models and simulations describing the PWFA plasma source decay process.

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