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Opto-acoustic measurements of the plasma density within a gas-filled capillary plasma source

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Plasma density represents a very important parameter for both laser wakefield acceleration and plasma wakefield acceleration, which use a gas-filled capillary plasma source. Several techniques can be used to measure the plasma density within a capillary discharge, which are mainly based on optical diagnostic methods, as an example the well-known spectroscopic method using the Stark broadening effect. In this work, we want to introduce a preliminary study about an alternative way to detect the plasma density, based on the shock waves produced by gas discharge in a capillary plasma source. Firstly, the measurements of the acoustic spectral content relative to the laser-induced plasmas by a solid target allowed us to understand the main properties of the acoustic waves produced during this kind of plasma generation; afterwards, we have extended such acoustic technique to the capillary plasma source in order to calibrate it by comparison with the stark broadening method.

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