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Diode Laser Diagnostics for Combustion Environments

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The current state-of-the-art in hypersonic air-breathing propulsion system development relies heavily on a combination of ground tests and numerical simulations. Generally, wall measurements (e.g., pressure, temperature, and heat flux) dominate the instrumentation suite available in most ground test facilities. If in-stream information (usually pitot pressure) is available, it is usually sparse and is generally available only at the inflow and outflow planes of the test article. While valuable for various analyses, these types of information provide little or no detailed descriptions of the mean and turbulent velocity fields, the turbulence-chemistry interactions, or the local state properties within the device. Advanced laser-based techniques can provide this information but impose significant challenges on test article design which are not practical for flight systems. The aim is to develop simpler diode laser based techniques which are practical in terms of weight, power, and optical access requirements. The presentation will outline some of the key issues relating to the development and application of these techniques to plasma and combustion environments.