Complex interferometry principles and its potential in case of sufficiently stable diagnostic system

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Abstract: Classical *interferometry* is one of the key methods among *active* optical diagnostics. Its more advanced version, which allows *recording* and subsequent *reconstruction* of up to *three* sets of data using just *one* data object—a *complex interferogram*—was developed in the past and became known as *complex interferometry*. Employing this diagnostics, not only the usual *phase shift*, but also the *amplitude* of the probing beam as well as the fringe *contrast* (leading directly to the phase shift *time derivative*) can be reconstructed *simultaneously* from such a complex interferogram. In this talk it will be demonstrated that even in the case of a not particularly good diagnostic beam *quality* these three quantities can be reconstructed with a high degree of *accuracy* provided both the *diagnostic beam* as well as the corresponding *optical line* feature a reasonable *stability*. Such stability requirement is important as in an ideal case *four* shots need to be gradually recorded (one by one): the *signal* complex interferogram, the *reference* interferogram as well as the *intensity* structures of the *signal* and *reference* part of the *diagnostic* beam.
Two xamples of complex interferograms obtained in experiments will be analyzed: the *laser produced plasma* (spark in the air) and the *high pressure gas jet*. Also, computer generated complex interferograms will be processed in order to demonstrate all the features of this technique.
A general *ray-tracing* based *iterative* algorithm will be outlined in order to increase a *precision* of the *index of refraction spatial profile* taking into account *refraction* effects (omitted in the *Abel inversion*) and employing the *original* reconstructed *phase shift* and *amplitude*.