ABSOLUTE LONG DISTANCE MEASUREMENTS WITH A MODE-FILTERED FREQUENCY COMB

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A frequency comb is a very useful source of light for measuring long distances with high accuracy. Since many stable wavelengths are emitted simultaneously from the comb source, a lot of information is available for distance measurement. Our measurement scheme is based on homodyne interferometry, which requires that individual comb modes are spectrally resolved. Thus frequency combs with a low pulse repetition rate (e.g. 100 MHz) cannot be used directly with this method, since the modes are too close to be resolved. In this work we increase the repetition rate of a comb by a filter cavity and with the filtered comb we perform mode-resolved absolute distance measurement. Mode-filtering takes place with a single Fabry-Pérot cavity in a Vernier configuration, allowing to set mode spacing ranging from 10s of GHz to more than 100 GHz. Large mode-spacing significantly reduce the requirements on the resolution of the spectrometer. Here a 1 GHz comb is used, that is converted into a 56 GHz comb whose modes are then resolved by a simple array spectrometer. A trade-off between non-ambiguity range and spectral resolution needs to be made when choosing a mode spacing. In our case, a rough measurement with an accuracy of about 2.5 mm is required to overcome ambiguity. In this contribution we demonstrate absolute long distance measurement with a mode-filtered frequency comb and we show that in comparison to a conventional counting interferometer an agreement within 0.5 µm for distances up to 50 m is found.