# Cavity enhanced with optical feedback using QCL lasers: Trace analysis at ppt levels in the mid-infrared range

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This work presents recent progress achieved using a cavity enhanced absorption spectroscopy (CEAS) technique which relies on optical feedback (OF) to optimize injection of a high finesse cavity by a semiconductor laser, such as a diode laser or a quantum cascade laser (QCL).

**General**

While OF-CEAS has about the same performance as Cavity Ring Down Spectroscopy when applied in the near IR region, it has the advantage of a simpler optical setup. Other advantages are the high signal levels which are recovered at cavity output, and the high precision of the spectral data points which are taken on the grid of the high finesse cavity modes.

OF-CEAS has proved to work well with QCL lasers, allowing to access stronger molecular transitions in the mid-IR region, hence improving by several decades the detection limits. On the other hand the high cavity injection efficiency becomes a real advantage at longer and longer wavelengths where optical detectors are less and less sensitive. For this reason the detection limit OFCEAS achieves in the mid-IR region results close to that obtained in the near IR.

A drawback is that the high intracavity laser power combined with the relatively low sample pressure used in order to increase spectral selectivity by absorption line narrowing, may produce saturation effects of molecular transitions, which requires special efforts to be taken into account or minimized.