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Off-axis cavity enhanced absorption spectrometer based on a mid-infrared continuous wave quantum cascade laser YUNJIE XU, Department of Chemistry, University of Alberta, Edmonton, Canada, RAVIRAJ KULKARNI, WAISHUN TAM, ZHENG SU, IGOR LEONOV, University of Alberta, Canada —
We present the design and construction of a mid-infrared off-axis cavity enhanced absorption (OA-CEAS) spectrometer based on a cw quantum cascade laser in combination with a pulsed slit jet molecular beam expansion. A computer program was developed to automate and to synchronize the timing of the CEAS experiments with the pulsed molecular beam. The dominant source of noise in CEAS experiments arises from incomplete averaging of the cavity mode structures. The suppression of noise was accomplished by implementing the following procedures: (1) Optimize off-axis alignment to excite as many higher order transverse modes as possible. (2) Modulate the cavity length using a piezoelectric actuator mounted on one of the cavity mirrors. (3) Introduce mechanical perturbation in the optical cavity to randomize the residual mode structures. (4) Optimize laser frequency speed to even cavity mode intensities. (5) Apply wavelength modulation to the laser. The CEAS experimental result measured with a static NH_3 gas and with jet-cooled larger organic molecules will also be presented.

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