

RAPID TUNABLE DIODE LASER SYSTEM FOR ABSORPTION MEASUREMENTS NEAR $1.6\mu\text{m}$

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A high-speed scanning absorption system was developed and tested for investigating CO_2 spectroscopic features near $1.6\mu\text{m}$. The need of such diagnostics capabilities stems from the fact that high enthalpy and hypervelocity facilities have issues in accurately measuring facility flow conditions in the free stream or near a model (in high Mach number facilities, isentropic free stream calculations begin to break down and using transducers can be highly intrusive). This system must also be able to probe in the short run durations of impulse facilities such as Longshot ($\sim 20\text{ms}$). An external cavity diode laser (ECDL) was chosen as the light source as it is capable of tuning frequencies that easily allow it to be used for Longshot investigations.

First, absorption cell tests were done to build confidence in the spectral model as well as to verify the capabilities of the system. Longshot investigations were then performed to analyze the free-stream as well as Kheops (EXPERT program) near model absorption characteristics. Figure 2 is an illustration of the experimental set-up for the Longshot experiments. Results show (as predicted by the developed model) that detecting absorption in such facilities where number density and path length products are really low (several orders of magnitude less than that of the atmospheric absorption cell tests) can be quite challenging. However, small absorption features have been detected and investigations into techniques to further the sensitivity of the system to better resolve these features for future experiments have been documented.

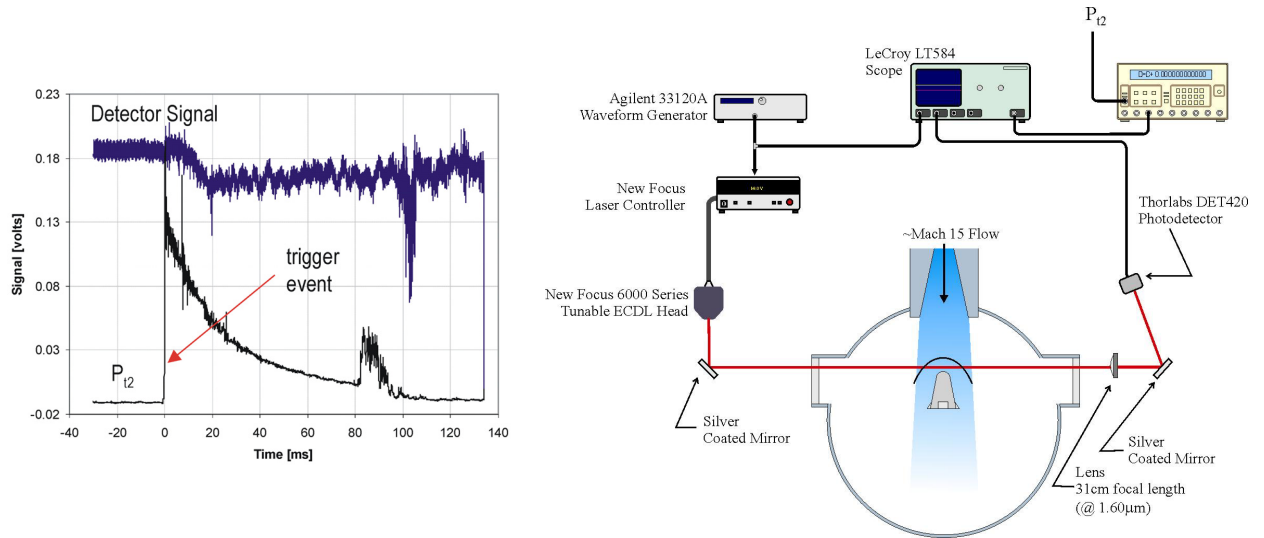


Figure 1: Longshot detector trace with total pressure measurement

Figure 2: Experimental set-up for Longshot investigations