GAS CORRELATION LIDAR FOR METHANE DETECTION

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A new type of dial system for the detection of methane in the atmosphere is being developed. The main feature of this lidar is the use of a gas correlation technique to obtain the reference signal by means of a single laser pulse, instead of two shots at different wavelengths (*). This fact is useful to make measurements on fast moving platforms.

To meet the ν_3 infrared absorption band of methane we use an optical parametric oscillator (O.P.O.) with a $LiNbO_3$ crystal as active element, and a tuning range between 1.5 ÷ 4 microns. As known (1), the major problems to overcome in parametric oscillators are the pump beam quality and the difficulty in reducing the linewidth. The first requirement is met by using, as a pump, a Nd-YAG laser based on a new type of resonator cavity, named SFUR (Self Filtering Unstable Resonator). The laser emits, with high efficiency, near diffraction limited pulsed beams (2,3,4) of about 250 mJ of energy,20 ns of duration at 10 pps of frequency repetition rate. On the other hand, the gas correlation technique allows the operation with a bandwidth as large as 1 cm^{-1}, which is obtainable using only a diffraction grating as a dispersive element in the O.P.O. cavity. Output energy from O.P.O. is expected to be some mJ, which is sufficient for methane detection on paths of several hundred meters.

Laboratory tests of the system are scheduled for June, while field trials will be carried out in the fall of the year.

The system will be also operated to detect other hydrocarbons, carbon dioxide and carbon monoxide molecules.

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*H.Edner, S.Svanberg, L.Uneus, W.Wendt, "Gas Correlation Lidar", Private Communication.

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(4) P.G.Gobbi, G.C.Reali, C.Malvicini: CLEO'85, Baltimore, May 21-24,1985.

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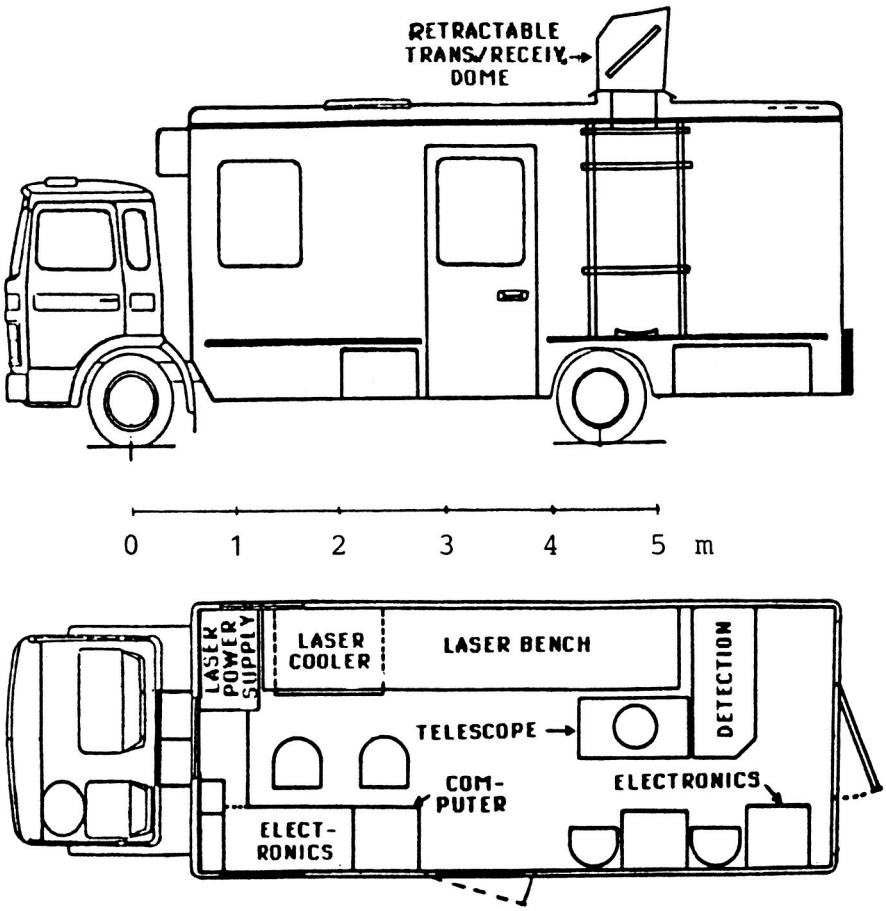

Figure 1. View of the lidar system

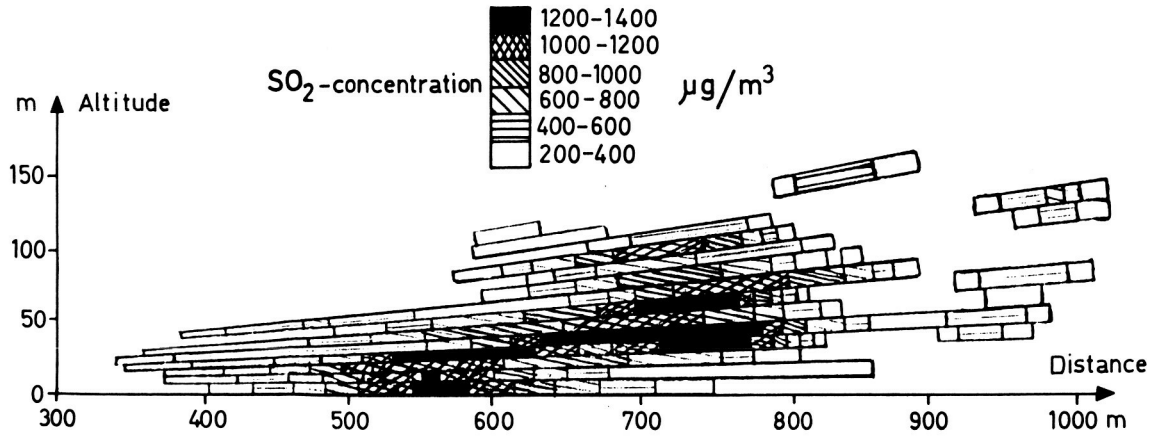

Figure 2. Vertical mapping of an SO_2 plume from a paper mill; 120 shots were averaged per wavelength and direction. The pulse energy was 2-3 mJ.