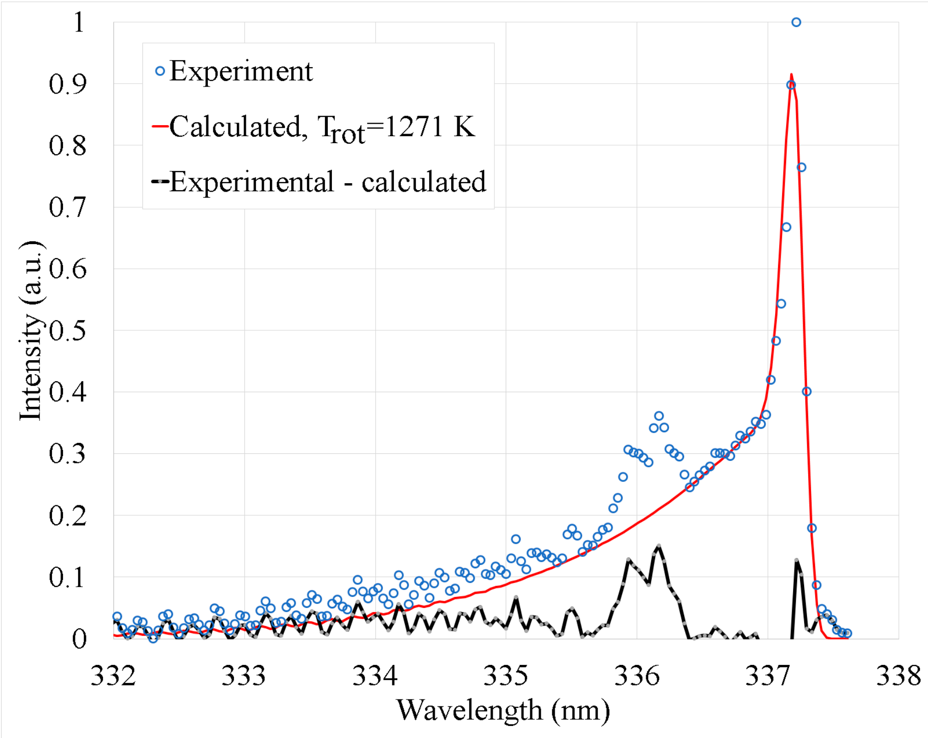

Figure S1. NH(A-X,0-0) band spectrum.

Registered and calculated N_2(C-B, 0-0) spectra, and their difference revealing the NH(A-X,0-0) band spectrum. Distance $x = 0$. The N_2(C,0) rotational temperature, $T_{rot} = 1271$ K, was determined on the basis transition N_2(C-B,0-2) spectrum as described in the paper. The registered and calculated spectra were fitted at 336.6–337 nm where the NH(A-X,0-0) intensity is low [1].

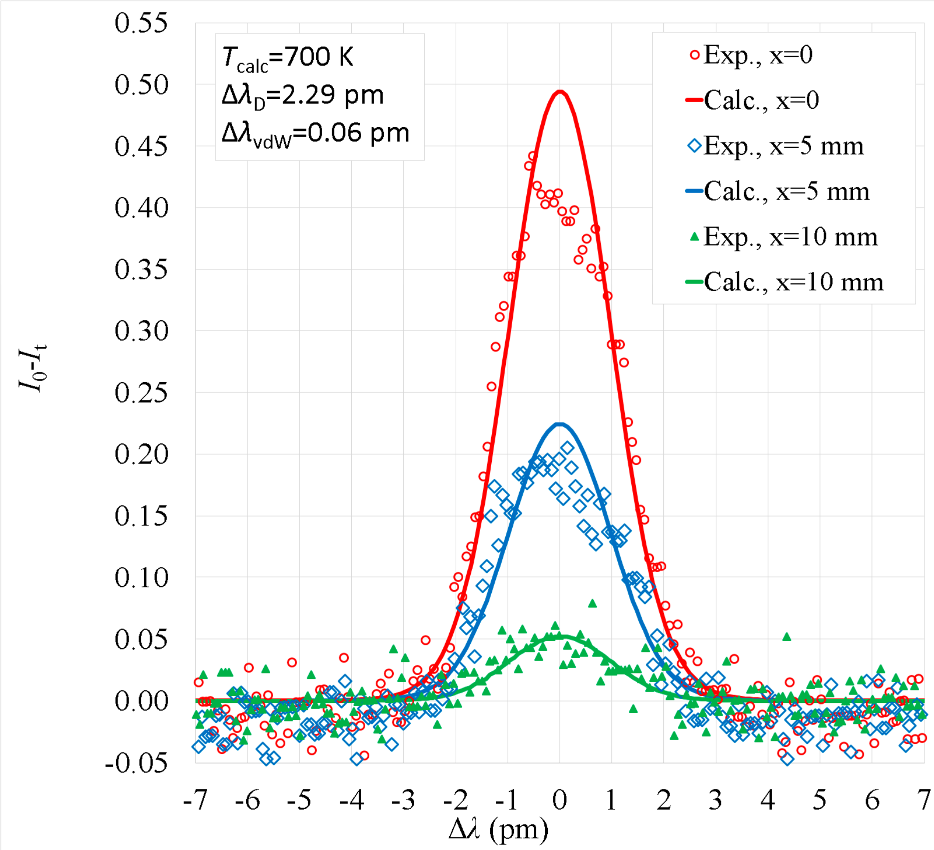

Figure S2. Temperature estimation from Ar ($1s_5 \rightarrow 2p_6$) line shape analysis. I_0- the incident light intensity, I_t- the transmitted light intensity.

The absorption profile of the Ar spectral line λ_0= 763.5106 nm (transition $1s_5 \rightarrow 2p_6$) [2], determined by TDLAS measurements, was fitted with a Voigt profile. Satisfactory fitting was found using the same temperature, 700 K, in the case of all experimental profiles. Two spectral line broadening mechanisms were considered: Doppler (Gaussian profile) and van der Waals (Lorentzian profile) broadening. The full width at half maximum (FWHM) of the Doppler broadening was calculated as $\Delta\lambda_D = \sqrt{\frac{8 \cdot k_B \cdot T_g \cdot \ln(2)}{m_{Ar} \cdot c^2}} \cdot \lambda_0$, where k_B is Boltzmann's constant, T_g- the gas temperature, m_{Ar}- the mass of Ar atom, c- the speed of light. The FWHM of van der Waals broadening was calculated as $\Delta\lambda_{vdW} = 8.18 \cdot 10^{-26} \cdot {\lambda_0}^2 \cdot \left(\alpha \cdot \langle \overline{R}^2 \rangle\right)^{2/5} \cdot \left(\frac{T_g}{\mu}\right)^{3/10} \cdot N$ [3]. Here, λ_0 is in nm, α - the atomic polarizability of the neutral perturber ($16.54 \cdot 10^{-25}$ cm^3), T_g is in K, N- the concentration of atoms in cm^{-3}, μ- reduced mass of the colliding atoms in AMU (for Ar $\mu \approx 20$). $\langle \overline{R}^2 \rangle = \langle \overline{R}_U^2 \rangle - \langle \overline{R}_L^2 \rangle$, with $\langle \overline{R}_U^2 \rangle$ and $\langle \overline{R}_L^2 \rangle$ been the mean square radiuses (in Bohr radius units) of the atom in upper and lower levels and $\langle \overline{R}_{U|L}^2 \rangle = \frac{1}{2} \cdot n^{*2}[5n^{*2} + 1 - 3l_{U|L}(l_{U|L} + 1)]$. In this formula l_U=1 and l_L=0 are the orbital angular momentum quantum numbers and $n^{*2} = \frac{E_H^i}{E_{Ar}^i - E_{2p6}}$ is the effective quantum number with ionization potentials E_H^i=13.60 eV and E_{Ar}^i=15.76 eV of hydrogen and argon atoms and E_{2p6}=13.17 eV is the energy of Ar($2p_6$) atom [2].

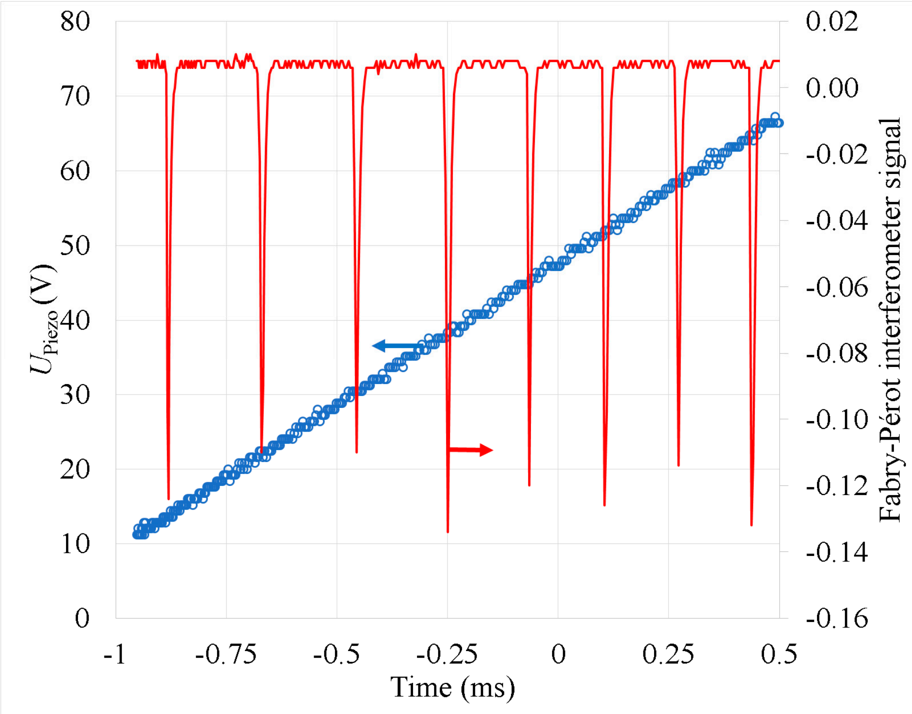

Figure S3. TDLAS laser stability on the basis of Fabry-Pérot interferometer signal.

Example of Fabry-Pérot interferometer signal in response to the linear increase in the voltage on the piezoelectric element (U_{Piezo}) that changed the laser resonator length. The dependence of the Fabry-Pérot interferometer signal on time was used to determine the laser wavelength change and check the laser operation stability.

Reference

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