After the initial experiments of microwave spectroscopy in the time domain \( \text{a} \) it took more than two decades before the technique was re-born. First as a steady gas-waveguide \( \text{b} \), later as a molecular beam-resonator \( \text{c} \) application, the experiment became an established spectroscopic method. During the past years a number of improvements were introduced to the technique. Namely the coaxially oriented beam-resonator arrangement (COBRA) \( \text{d} \) has dramatically improved the resolution and the sensitivity of the Fourier transform microwave (FTMW) spectrometer.

Our current efforts are aiming at an improvement of the COBRA-FTMW sensitivity by means of reduction of the thermal noise background, i.e. reducing the 300K thermal noise power of \( P_N = kTR_B \) at room temperature to the equivalent of 77K - the temperature of liquid nitrogen.

We will present a detailed theoretical background which is needed to approach the expected gain in S/N for a spectrometer operated at temperatures significantly below the thermal environment.


