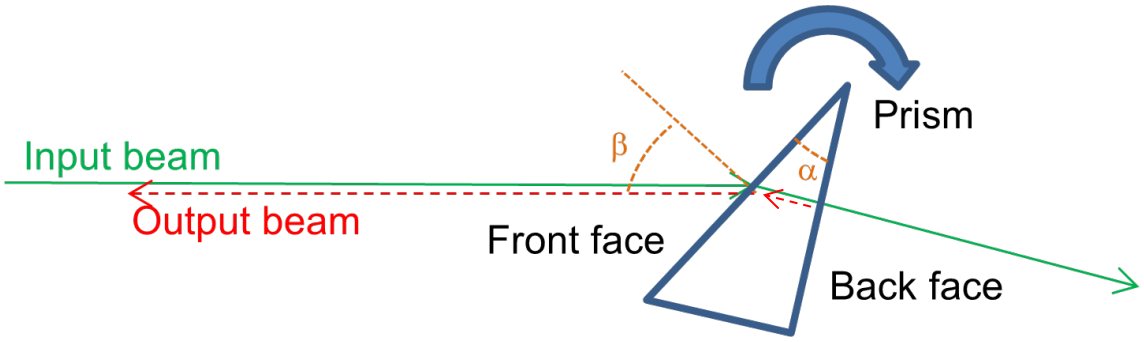
Calculating the refractive index of a transparent material with a QCL

Case study - 2023

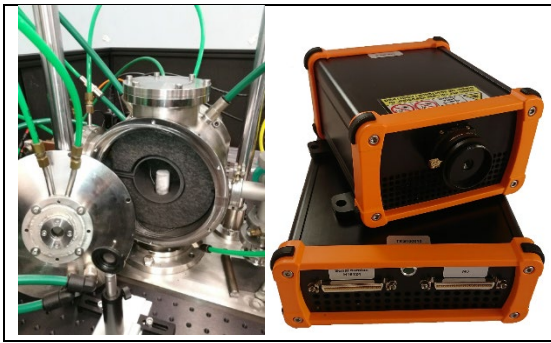
Johan Petit is a French research engineer at ONERA, the French aerospace lab, researching material characterization. In 2022, his project was to calculate the transparency and refractive index of a material using a prism for different infrared wavelengths of light from the mid-infrared (MWIR) to the long-wave infrared (LWIR) range or from approximately 3µm to 12µm. The refractive index of a material is a number that describes how fast a light beam travels through that material, and it is essential to know that number for several applications. In his setup, Johan shines a laser on a prism and rotates the prism until the reflected beam (on the back face of the prism) is collinear with the incident beam. When this is the case, Johan can easily calculate the refractive index from α and β angles (see fig. a).



Since the temperature of a material will change the refractive index of that material, Johan had to account for this in his characterization. Therefore, the setup's environment can be modified, allowing characterization to be performed up to 1000°C and beyond if the material to be tested is subject to temperature changes under intended operating conditions.

For his experiment, Johan looked for some low-cost laser sources as proposed by mir Sense.

mirSense, a manufacturer of QCLs in France, was able to provide Johan with single-wavelength QCLs for about one-fifth the cost of the tunable QCL. These compact QCLs operate at room temperature, providing efficient laser sources without the need for bulkier cooling systems. This, in combination with the plug-and-play turnkey version he chose, made the entire setup easier, cheaper, and cost significantly less real estate in the lab.



Left: Experimental setup: a cooled chamber around the furnace around the prism.

Right: mirSense turnkey system

Given the options available, it seems clear that QCLs are the ideal laser source when you want MWIR to LWIR emission, room temperature operation, and compact, turnkey usability.

- For additional contacts about the project, please contact

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