Technical note

Presenting the auto-alignment module

The auto-alignment module is a complementary tool for stabilizing and optimizing the emission from Lytid's multi-QCL (Quantum Cascade Laser) source, TeraCascade1000.

The latter is an ultra-compact THz source allowing for integration of up to six QCLs for narrow band tunable emission in the THz range. Each QCL's emission is centered at a specific frequency within 2 and 5 THz.

Figure 1 TeraCascade1000 : multi-QCL THz source

Each QCL being manufactured on a dedicated chip, these integrated on a 3*2 matrix support, the laser emission occurs at different position for different QCLs within the same source. Note that emission from different QCLs is not simultaneous. Moreover, the emission from a QCL is naturally divergent.

The source is a powerful tool of multi-band THz emission. However, its intrinsic multi-laser architecture imposes an added complexity to those experimental setups requiring simple and fast switching between the different frequencies offered by the source.

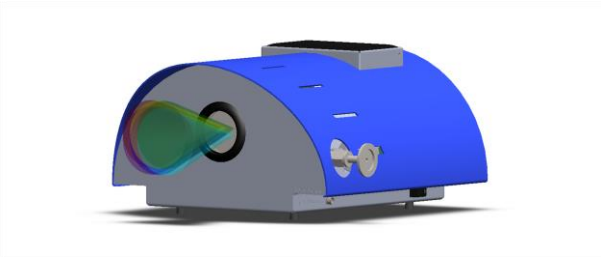

Figure 2 Shifted and divergent emission at six different frequencies of TeraCascade1000

In order to spatially stabilize and collimate the laser emission and thus fully exploit the potential of TeraCascade1000, Lytid designed the auto-alignment module.

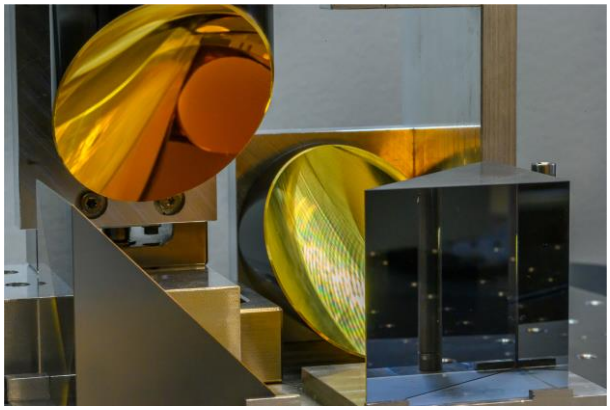

Figure 3 Detail of auto-alignment module

This system provides collimation and stabilization of THz emission from different QCLs. No realignment is required when sweeping frequencies: thanks to the auto-alignment module, alignment is maintained for different QLCs emission.

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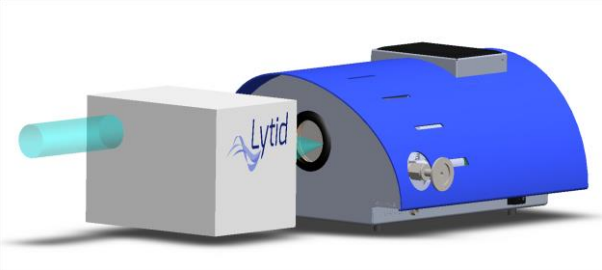

Figure 4 Emission of TeraCascade1000 with the auto-alignment module integrated at the output of the source

The auto-alignment module is remotely controlled by a dedicated software. The user chooses the desired emission frequency through the TeraCascade1000 touch screen. The same value is entered to the driving software of the auto-alignment module. The latter would ensure collimated and stabilized output, whatever frequency the user might choose.

As a result, alignment and beam shaping are preserved when sweeping frequencies.

Figure 5 Measurement of the beam profile for three different frequencies, after the auto-alignment modules and a focusing lens

Figure 5 shows different frequency's beam profiles after transmission through the auto-alignment module and a focusing lens. As expected, the beams are aligned at the same output position.

Given the focal length of the focusing lens, for increasing frequency the beam size decreases, being proportional to the wavelength.

The auto-alignment module allows to speed up applications where multi-frequency emission is required and relieves the user from time-consuming re-alignment procedures.

In addition, integration compactness (only 125 x 133 mm) of the auto-alignment module and full automation grant a simplified user experience.

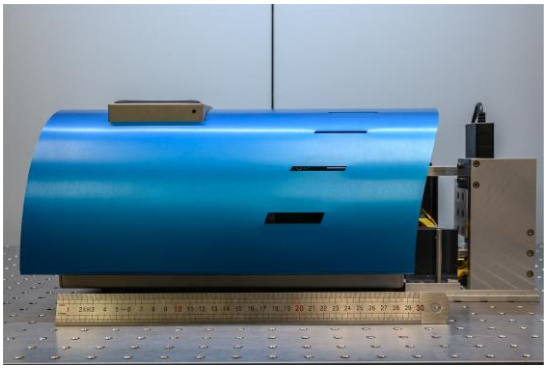

Figure 6 TeraCascade1000 with integrated auto-alignment module at its output.

Beside the TeraCascade1000 optical handling simplification, the versatility of this module is ensured by the broadband design for multi-frequency uses and its customizable output components. The modular beam collimator allows for different output profiles dimensions thanks to 1/2" up to 3" diameter beam shaping optics.

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