

# Tiger (Littman / Metcalf)

Tunable External Cavity Diode Laser  
Tapered Amplifier Technology  
Littman/Metcalf Configuration

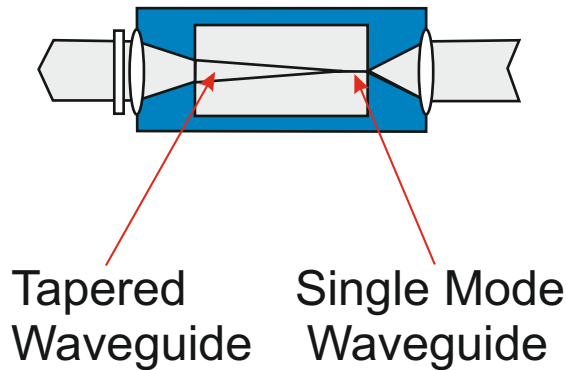
Scientific Lasers



# Tapered Laser Diode

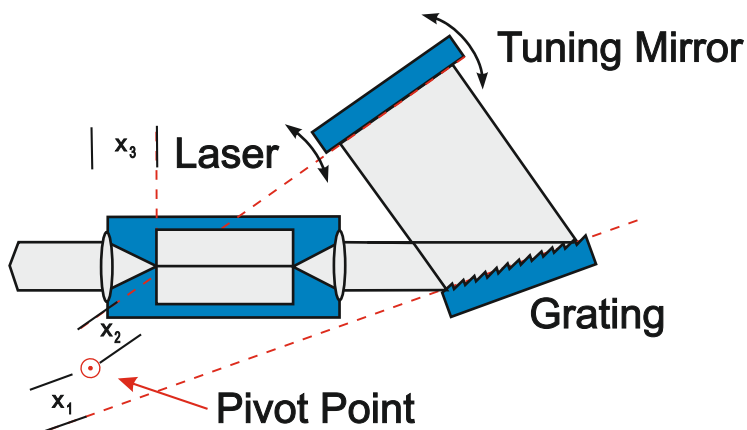
## Concepts, an Overview

### Tapered Laser



The maximum output power of diode lasers is limited by the mirror facets of the laser chip. A very successful concept for improving the output power of diode lasers is the tapered laser diode. A tapered laser consists of two segments. The right hand segment is realized by a single mode waveguide for achieving proper single mode emission. The left hand side is a tapered waveguide for boosting the maximum output power from typically 200mW up to more than 1000mW.

### Littman/Metcalf Design



Sacher Lasertechnik realized an external cavity diode laser basing on tapered lasers. The laser system bases on more than 10 years of experience in manufacturing external cavity laser diodes. The external cavity is realized with class D anti-reflection coated tapered diode lasers and with a high efficiency diffraction grating. The output power is coupled out via the rear facet. This results in the best performance for an external cavity diode laser system in Littman/Metcalf configuration. Several patent applications are pending. Typical power values range between 500mW and 1000mW, depending on the wavelength. This laser design is available by model no. TEC-320.

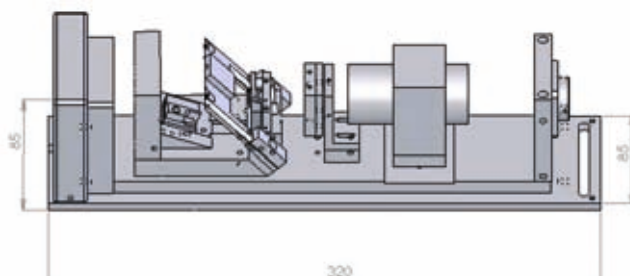
**Tiger**  
TEC-320

### Technical Realization

### Dimensions

The drawing on the left hand side show the technical realization and the dimensions of the TEC-320 external cavity diode laser system. It includes an 35dB optical isolator by default.

**Tiger**  
TEC-320



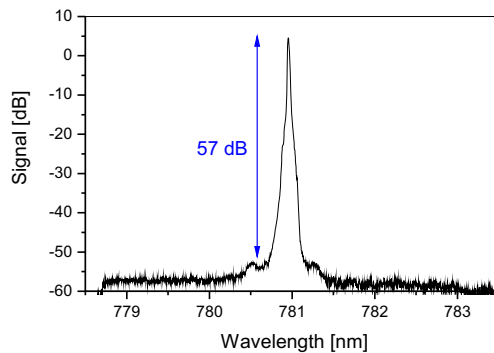
### Literature

We offer reprints on several publications which have been published by Sacher Lasertechnik on this concept:

<http://www.sacher-laser.com/pubdocs2.php>

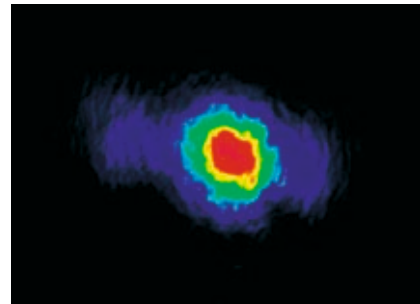
# Key Features of our Tapered Littrow Laser System

## Side Mode Supression



Typical Values:  
Power: > 1000 mW  
 $M^2 = 1.4$  in both directions

## Beam Quality



## High passive stability

Realizing the pivot axis of the tuning grating and the cavity adjustment via flex-mounts ensures the highest passive stability of our Littrow laser system. As a result, we achieve a robust and highly stable external cavity diode laser system with excellent values for the long term laser linewidth.

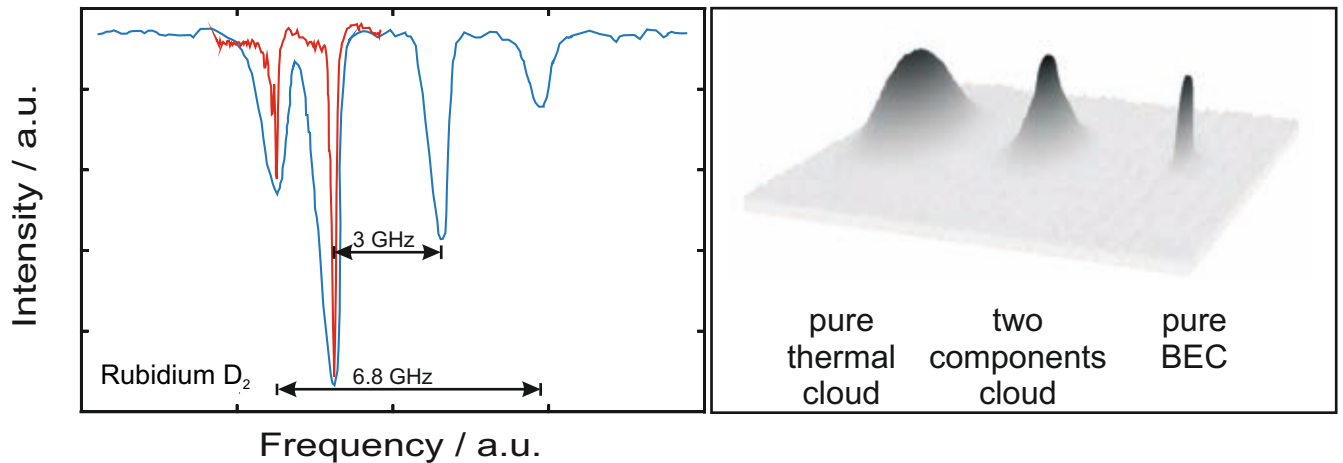
## Option: Single-mode fiber coupling

Due to the excellent mechanical stability of our Littrow laser system, we are able to perform high efficiency fiber coupling with coupling efficiencies between 40% and 70% into single-mode polarization maintaining optical fibers. 60 dB Optical isolators and angled fiber connectors (FC/APC couplers) are available upon request.

## Specifications:

Output Power	500 .. 1000 mW *
Wavelength	765, 780, 785, 795, 850, 970, 1060 nm or Customer Specified
Wavelength Precision	0.05 nm or Customer Specified
Piezo Fine Tuning	100 GHz .. 150 GHz @ 100 V Piezo Voltage *
Mode-hop Free Tuning	up to 30 GHz
Piezo Fine Tuning Speed	> 0.5 kHz Modulation Frequency @ 10 GHz Amplitude
Linewidth	1 MHz @ 1 ms
Side Mode Supression	> 50 dB
Beam Waist ( $2 w_0$ )	3 mm x 1.5 mm .. 1.5 mm x 1.5 mm *
Beam Divergence	< 2 mrad
Beam Quality $M^2$	< 1.7
Output Polarization	P - Polarized or S - Polarized *
Power Monitor	Photo Diode
Weight	Laser Head: 0.6 kg, Power Supply: 4.5 kg
Laser Head Dimension (width x heigh x length)	83 mm x 81 mm x 320 mm

\* the actual value depends on the chosen wavelength



## Application Example

### Optical Cooling and Trapping: Formation of BEC

Optical cooling and trapping requires highly stable, narrow linewidth, high power, tunable laser systems. Our TIGER external cavity laser diode system was specially designed for fulfilling these requirements. The left hand side of the graphic shows the  $D_2$  absorption lines of Rubidium. The blue curve represents the Doppler enhanced signal, the red curve represents the saturated absorption signal. The right hand side of the graphic shows the temporal development of BEC within a magneto-optical trap (MOT). The signal the left hand side indicates the pure thermal Rubidium cloud within the MOT, the middle signal is an intermediate state, the signal at the right hand side indicates the formation of Bose-Einstein-Condensate (BEC). For more details of this experiment, please review the literature section of our website: <http://www.sacher-laser.com/PubDocs2.php>. We gratefully acknowledge the AMOLF for providing us the BEC data, detected with the TIGER laser system.

## About Sacher Lasertechnik

### Company Profile

Sacher Lasertechnik is leading manufacturer of tunable external cavity diode lasers (ECDLs) with more than 15 years of experience. The product range includes anti-reflection coated diode lasers, ECDLs in Littrow and in Littman/Metcalf configuration as well as driver electronics for the LD and sophisticated measuring electronics. Please contact us with your measurement requirements. We would be proud to support you with our competence.

### Please contact us

Sacher Lasertechnik GmbH Rudolf-Breitscheid Str. 1-5 D-35037 Marburg/Lahn Germany Tel.: +49 6421 305 - 0 Fax: +49 6421 305299	Sacher Lasertechnik LLC 5765 Equador Way Buena Park, CA90620 U. S. A. Tel.: 1-800-352-3639 Fax: 1-714-670-7662
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Email: [contact@sacher-laser.com](mailto:contact@sacher-laser.com)  
Web: <http://www.sacher-laser.com>

