



## Introduction

This whitepaper introduces the novel sub-100 fs neoMOS laser system, which delivers ultrashort laser pulses with a duration  $< 100$  fs and energies  $> 150$   $\mu$ J. The system is a unique combination of the robust and compact SMAART<sup>1</sup> series laser with an efficient pulse compression module from n2-Photonics. The technology allows combining the best of two worlds: industry-proven laser technology and state-of-the-art broad-bandwidth, high transmission compression.

## The SMA(A)RT idea

High energy laser systems are the key technology for a wide range of industrial machining processes such as drilling, cutting and ablating or for scientific applications. Every application and material has its own ideal parameter set for optimal process speed and precision. The neoLASE SMAART concept fully covers the ns to sub-ps pulse regime with flexible energy output up to several hundred  $\mu$ J and repetition rates between 100 kHz and 10 MHz. Equipped with the compression module by n2-Photonics, the SMAART laser can provide shorter pulses below 100 fs and beyond. This allows further extending the variability concept of modular short to ultrashort pulsed lasers. The users will be enabled to perform several applications with their own respective ideal parameter set on one single laser system.

## The technology

The neoLASE philosophy is focused on providing lasers that are based on industrially proven technology, individually tailored for the specific user application. Using proven neoLASE amplifier units, the systems are compact, robust and reliable while maintaining excellent beam profile even at high average powers. Due to the intrinsic bandwidth limitations, the pulse duration of the neoYb amplifiers is restricted to  $> 700$  fs. The recent developments in external pulse compression technology however show a simple and efficient way to broaden the bandwidth to allow sub-100 fs pulses while maintaining over 90 % of the pulse energy with excellent beam profile.

n2-Photonics has developed industry-ready, compact compression modules that are based on a patented multi-pass cell. This technology is intrinsically insensitive to alignment issues. Especially in the high energy range, so relevant for scientific and industrial applications, the technology offers perfect performance, even over the mJ energy level.

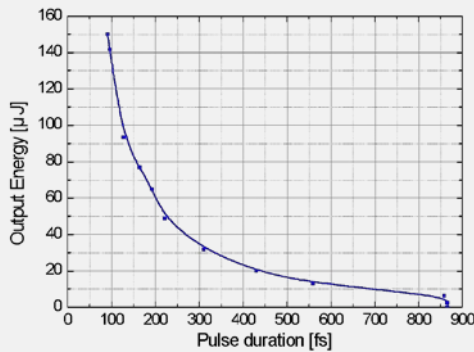


1) 04/21 Whitepaper: SMAART Ultrashort Pulsed Laser



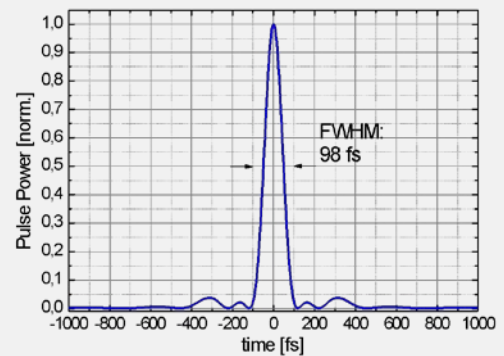
## Performance

The combination of neoLASE and n2-Photonics technology enables high energy, sub-100 fs pulses while maintaining a high system robustness and low complexity. In the presented configuration, a SMAART series laser head with a repetition rate



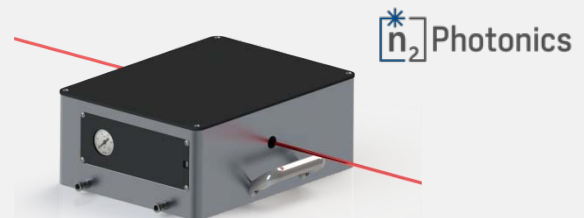
of 300 kHz with > 50 W average output power and a pulse duration of 900 fs was injected into a n2-Photonics compression module with a footprint of only 36 x 36 cm<sup>2</sup>. With approx. 90 % transmission through the multi-pass cell and compressor unit, a compression factor > 9 has been achieved resulting in a spectral bandwidth of 30 nm (@-10 dB level) and measured pulse duration of 100 fs. The beam quality M2 was measured < 1.2 in both axis and the rms noise remains below 0.3 % over 1 h, identical to

the driving laser RMS noise. The system performance is easily scalable to the mJ regime by adding another amplifier stage in the laser head and adapting the n2-Photonics compression module. By adapting either energy or chirp, the actual output pulse duration can be flexibly set to any value between 900 -100 fs. Further compression to below 30 fs is also feasible by adding a second compression module.



## Summary

The neoYb laser series offers a wide range of laser parameters starting from cw-single frequency, high energy pulses up to short pulse femtosecond radiation based on a universal, industry-proven platform and is now extended to the sub-100 fs regime.



In accordance with the modular neoLASE system architecture, the add-on compression module can be simply docked to our laser head. Additional ps, sub-ps or SHG outputs are optionally possible. True to our motto "brilliance in customized laser solutions", we look forward to your inquiry on [www.neolase.com](http://www.neolase.com) or [info@neolase.com](mailto:info@neolase.com).