



## Introduction

This whitepaper introduces a novel neoMOS laser system, which delivers ultrashort laser pulses with a duration  $< 50$  fs and energies  $> 150$   $\mu$ J at repetition rates up to 400 kHz.

## The SMA(A)RT idea

High energy and high average power laser systems are the key technology for a wide range of industrial machining processes such as drilling, cutting and ablating or for fundamental scientific applications. Spectroscopy, microscopy or imaging applications require laser-driven XUV or soft-x-ray sources enabled by high harmonic generation and high peak power laser systems.

The neoMOS concept fully covers the ns to sub-ps pulse regime with flexible energy output up to mJ level and repetition rates between single shot and 10 MHz at a wavelength of 1030 nm. Equipped with a non-linear pulse compression module, the system can provide pulse durations below 50 fs. This allows further extending the concept of modular short to ultrashort pulsed lasers. The users will be enabled to perform several applications with different pulse parameter sets 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. By 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 about 700 fs. Recent developments in external pulse compression technology however show a simple and efficient way to broaden the spectral bandwidth to allow sub-50 fs pulses while maintaining over 90 % of the pulse energy with excellent beam profile.

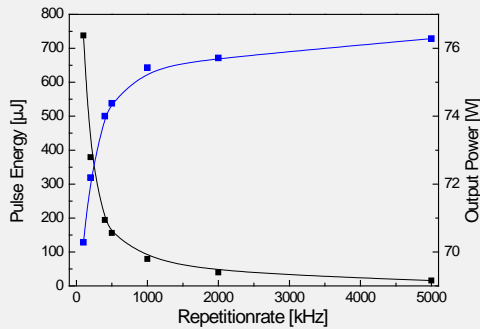
n2-Photonics has developed industry-ready, compact compression modules that are based on a patented multi-pass cell. Especially in the high energy range this technology offers perfect performance, even at pulse energy levels of several mJ.





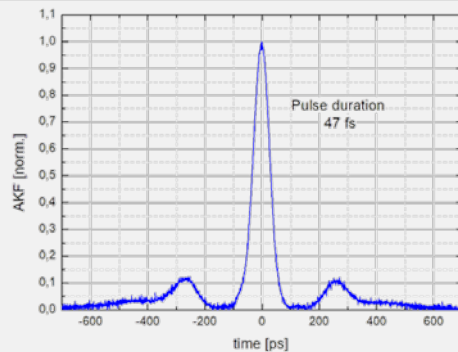
## Performance

In the presented configuration, a SMAART series laser head with > 75 W average output power, up to 700  $\mu\text{J}$  pulse energy and a pulse duration of 850 fs was injected into a two stage n2-Photonics compression module. The used pulse energy was limited by the module design to about 200  $\mu\text{J}$ . After the first stage the pulse duration was reduced down to about 170 fs and after the second stage 47 fs were achieved. The output pulse energy was > 150  $\mu\text{J}$  up to repetition rates of 400 kHz. This leads to an average power > 60 W and a pulse peak power of 4 GW. Therefore, the



laser source enables high photon flux for harmonic generation applications. The beam quality  $M^2$  was measured < 1.2 in both axis and the RMS noise remains below 0.5 % over 15 h, identical to the driving laser RMS noise. The system performance is scalable to higher energy regimes by adapting the compression module. A second version with 400  $\mu\text{J}$  pulse energy and 100 fs pulse duration as well as a 200 W system is currently under construction.

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## Summary

The neoMOS 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-50 fs regime.

In accordance with the modular neolASE system architecture, the add-on compression module can be simply docked to the neoMOS 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).