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HIPERDIAS

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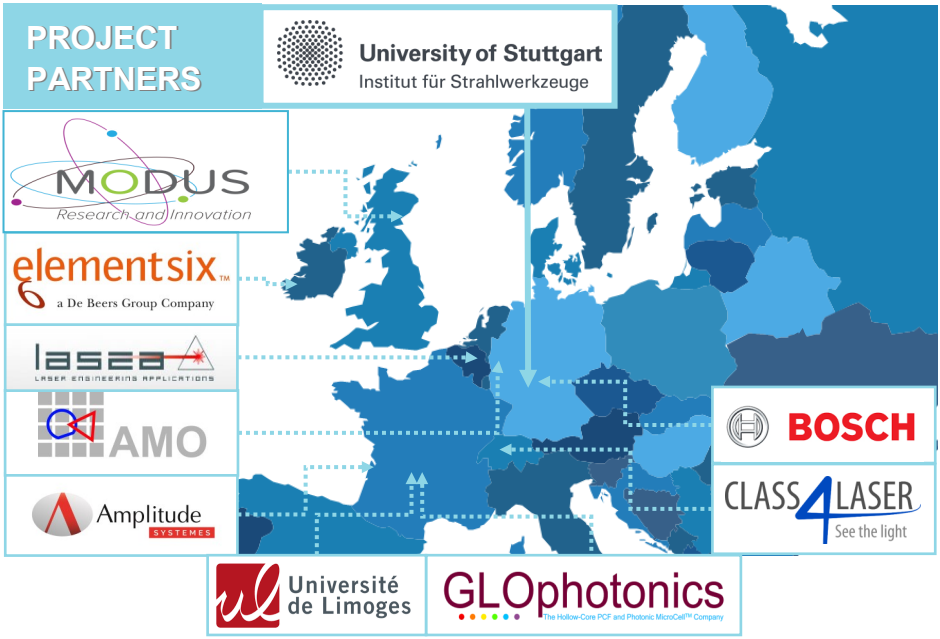
PHOTONICS 21

HIgh throughPut LasER processing of DIAmond & Silicon

Driven by the end-users requirements and needs, the main objective of the HIPERDIAS project is to demonstrate high throughput laser-based manufacturing using high-power, high-repetition rate sub-1 ps laser. Although the laser system to be developed within HIPERDIAS can address other material processing applications, the focus here will be 3D structuring of silicon at high speed, precision processing of diamond material and fine cutting of metal for the watch and the medical industry.

OBJECTIVES

- Highly flexible high-power and high-efficiency femtosecond laser source with average output power of up to 1000 W at the megahertz (MHz) including flexible fiber beam delivery.
- Cost-efficient solutions (power scaling, pulse compression & fiber transport) for a broad range of applications.
- Optimisation of demanding high-volume applications regarding efficiency as well as quality.



TECHNOLOGY & FINAL TARGETS

Chirped Pulse Amplification (CPA) approach based on highly efficient compressors gratings will be implemented in order to minimise the overall losses of the laser system. The final targets of the project are to demonstrate:

- a 10-times increase of ablation rate and productivity of large area 3D structuring of silicon
- a 10 times increase of speed in fine cutting of metals
- an increase of process speed (6-10 times) at a low processing tools cost of diamond machining.

Therefore, the laser parameters, as well as the beam shaping, beam guiding (based on Kagomé fibers) and machine systems will be developed and optimised to fulfill the above manufacturing targets. The laser architecture will be based on fully passive amplifier stages combining hybrid (fiber-bulk) amplifier and thin-disk multipass amplifiers to achieve sub-500 fs at an average output power of 500 W and sub-1 ps at an average output of 1 kW, at a repetition rate of 1-2 MHz. Furthermore, second harmonic generation (SHG, 515 nm) and third harmonic generation (THG, 343 nm) will be implemented to allow processing investigation at these wavelengths. At 515 nm (respectively 343 nm) an average power of >=250 W (respectively>=100 W) shall be demonstrated.

Get In Touch:
Universität Stuttgart (USTUTT) | Institut für Strahlwerkzeuge (IFSW)
Pfaffenwaldring, 43 | D-70569 Stuttgart | Germany | **www.hiperdias.eu**
Emails: marwan.abdou-ahmed@ifsw.uni-stuttgart.de | hiperdias@modus.ltd