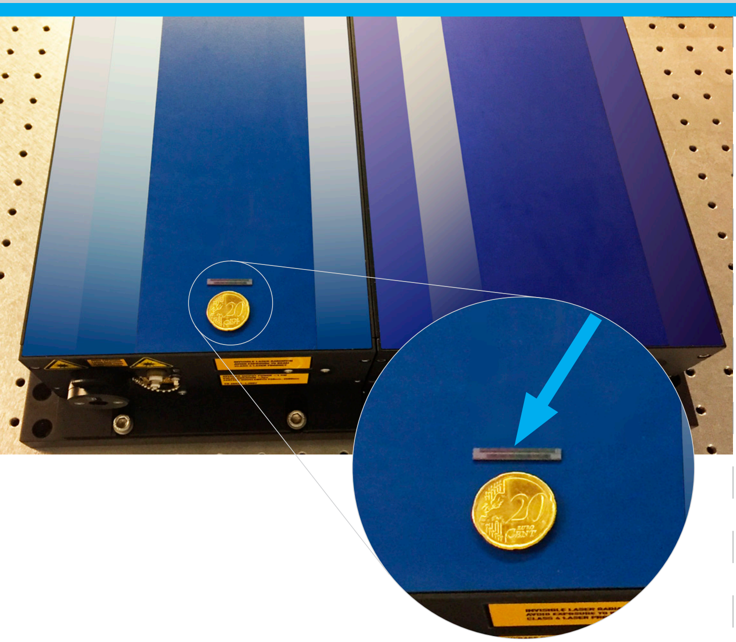

Over the last 20 years femtosecond lasers have led to a host of novel scientific and industrial instrumentation that have transformed how we measure time and frequency. They have enabled octave-spanning optical frequency combs, a Nobel Prize winning technology, enabling phase-coherently linking of optical and radio frequencies with a precision limited only by the definition of time itself.

Our vision of achieving a low-noise CMOS compatible optically pumped integrated femtosecond laser surpasses the currently existing paradigms and will enable to overcome the limitations of current miniaturized fibre, solid-state and semiconductor-based ultra-short pulse lasers.

Industrial participant:

LIGENTEC

EurA
innovation · finance · technology

Academic participants:

DESY.

UNIVERSITY OF TWENTE.

A! Aalto University

EPFL
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Because of the special composition of the consortium, we are in the rare position to design, fabricate and test integrated mode-locked lasers with application driven specifications on lowest loss fabrication platform and best-possible gain material, to ultimately achieve the FEMTOCHIP goals. The FEMTOCHIP project is designed to significantly strengthen the EUROPEAN Innovation landscape.

FEMTOCHIP A R&D Project
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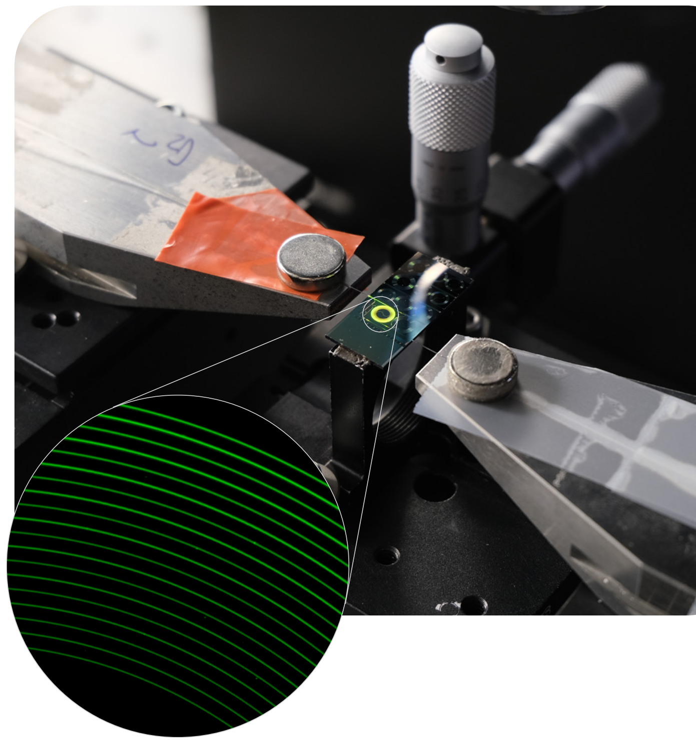
femto chip

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 965124

FEMTOSECOND LASER ON A CHIP – FEMTOCHIP



femto chip

STATE-OF-THE-ART

The demand for reducing the form factor is so dire that people working with the bulk and the fibre optics are trying ever harder to reduce the size of bulk lasers. However, such lasers are inherently limited to, at best, palm-size systems. Another technology which holds promise in terms of size is the semiconductor-based mode-locked laser. However, to date, the pulse timing jitter and peak power demonstrated is limited to several picoseconds and to a merely few 100s of mW, respectively, which cannot be used for any of the applications discussed above.

DEMONSTRATOR

Packaged chip-size low jitter sub-100 fs FEMTOCHIP laser at wavelength of 1.9 µm with peak power of ~300 W

LONG-TERM VISION

FEMTOCHIP will fundamentally and sustainably change the design, size and price of femtosecond lasers across all industries.

INTERDISCIPLINARITY

Collaboration between ultrafast laser experts, material researchers and break-through micro integrators.

NOVELTY

First chip-sized sub-100 fs laser with intracavity pulse energy > 100 pJ and pulse timing jitter < 1 fs, with 100 mW output average power.

BREAKTHROUGH & HIGH-RISK

Highest precision chip manufacturing, very low waveguide losses, grating structures for dispersion control, high rare-earth gain.

INTENSION

Within the FEMTOCHIP project, we aim at achieving an optically pumped femtosecond laser on a single microchip with performance comparable to state-of-the-art table-top laser systems.

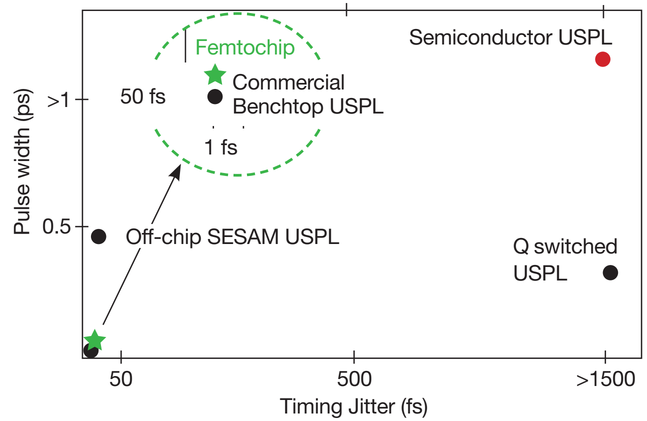
EXPECTED IMPACTS

The FEMTOCHIP project will have substantial impacts

- Scientific and technological contributions to the foundation of a new future technology
- Potential for future social or economic impact or market creation
- Building leading research and innovation capacity across Europe by involvement of key actors

Science-to-technology breakthrough that addresses this vision

Currently, purely electronic circuits hit a wall set by electronic jitter slightly below 100 fs. Low jitter mode-locked lasers once integrated together with electronics, FEMTOCHIP, have the potential to break this wall.



Timing jitter of various Ultra-Short Pulse Laser (USPL) technologies

IMPLEMENTATION

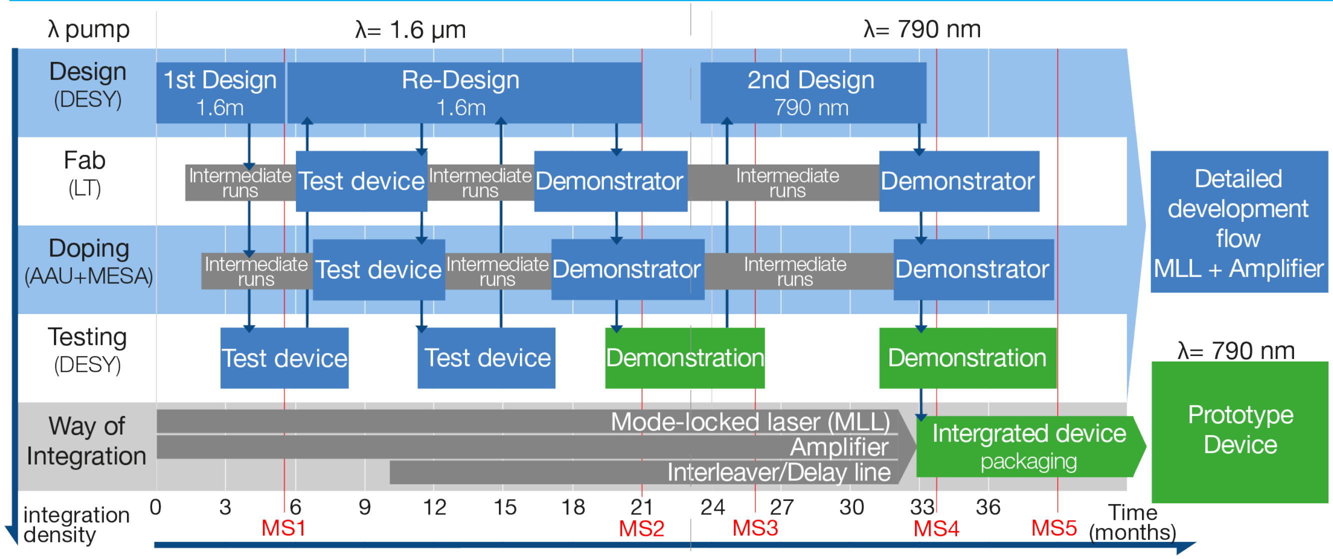


Figure 4: Graphical presentation of the work packages showing how they inter-relate