

# Investigation of material laser processing by means of multi-physics numerical modelling

## General Information

Project type:	Master Thesis, internship or combined
Lab/Group:	Intelligent manufacturing group (LAMP, <a href="http://www.empa.ch/web/s204">www.empa.ch/web/s204</a> )
Supervisor:	Dr. Elia Iseli
Location:	Empa, Feuerwerkerstrasse 39, 3602 Thun
Starting date:	ASAP
Duration:	6 month
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## Project Description

The Laboratory for advanced materials processing (LAMP) specializes in advanced 2D and 3D manufacturing processes, with research focused on innovative material designs and detection systems. Our work involves developing and applying cutting-edge process simulation tools, in-situ monitoring techniques, as well as machine learning-based modeling and process control.

In this Master's thesis, laser processes will be analyzed using advanced numerical and data-driven simulation techniques. Existing computational tools will be further developed and validated against experimental data to enhance their predictive capabilities. Due to the highly multi-physical nature of laser processes, this research involves solving a coupled set of equations that describe interactions between heat transfer, fluid dynamics, phase transitions, and other relevant phenomena.

This work will not only contribute to a deeper understanding of laser-based manufacturing but will also provide valuable experience in numerical modeling techniques applicable across various engineering and scientific domains. We invite motivated students from Materials Science, Mechanical Engineering, Computational Science, Physics, or related fields to apply. If you are interested in gaining hands-on experience in numerical simulations and high-performance computing, while contributing to cutting-edge research, please contact us for further details.

### Tasks:

- Literature research/get familiar with existing models
- Develop/expand numerical model
- Validate models by using existing experimental data
- Write report

### Skills:

- OpenFOAM, MATLAB, Python
- Multi-physics simulation / Machine learning