

APPOLO Workshop

Lappeenranta University of Technology

2015



*APPOLO Workshop
Online Monitoring in Laser Processing
Fifth of June 2015
LUT Laser, Future Factory- Lappeenranta, Finland*

LUT

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APPOLO in Brief

During more than 50 years of the existence, lasers have been proved as the unique tool for diverse material processing application. New application ideas, coming from universities and research institutions, are implemented usually by spin-off companies with limited resources for market penetration. Research laboratories are using universal tools (laser machines), while the effective and low-cost production requires adaptation of the processes and equipment during the technology assessment phase by the end-user. The process and equipment go jointly.

APPOLO concept

The APPOLO project seeks to establish and coordinate connections between the end-users, which have demand on laser technologies for (micro)fabrication, knowledge accumulated in the application laboratories of research institutes and universities and the laser equipment manufacturers (preferable SMEs: for integration, lasers, beam control and guiding, software, etc.) in order to facilitate faster validation of the process feasibility and adaptation or customization of the technology (equipment) for manufacturing conditions, including reliability of components and their interaction as well as assessment of the dedicated production processes in terms of the process speed, quality and repeatability.

APPOLO Activities

- CIGS scribing cluster: Assessment of new equipment & reliable laser scribing processes
- Texture cluster 1: Fast structuring for printing & decoration
- Texture cluster 2: Surface functionalization
- Laser Direct Writing cluster 1: 3D interconnections on plastics
- Laser Direct Writing cluster 2: LIFT for Photovoltaic Applications
- On-line monitoring tools

Online Monitoring in Laser Processing

Laser micro machining and laser surface structuring are innovative manufacturing technologies, and useful with a wide range of machinable materials. They both offer high levels of flexibility. During the last few years, these technologies experienced a strong increase in their industrial application. New process requirements involving precise monitoring and quality assurance play crucial roles.

Process monitoring in laser micro machining control, not only an indirect acquisition of the focus position or processed material removal depth, but also a direct recording of the melting pool are possible. However, these techniques struggle with inherent disadvantages such as a relatively high uncertainty, the high material dependency, low lateral accuracy (capacitive sensors), or an indirect acquisition of process parameters (systems based on process related phenomena). In particular, for the processing of non-metals, only a few of these monitoring techniques are applicable. In addition, the large number of influencing parameters in laser processes leads to a time consuming process set-up and configuration, especially in setting the laser process parameters for new materials and new laser devices. In this context, there is a strong industrial demand on automated solutions suited for micro machining.

Topics of the workshop

- Development and validation of on-line laser processing monitoring and beam control systems
- On-line process control during the assessment experiments
- Tool assessment and tool integration into laser processing monitoring.
- Real-Time control and control algorithms development in laser Processing

Lappeenranta University of Technology

Ever since its foundation in 1969, Lappeenranta University of Technology, LUT, has brought together technology and economics in a pioneering spirit. LUT's strategic focus areas are green energy and technology, the creation of sustainable competitiveness and operation as a hub of international Russian relations. Our international scientific community consists of 7 000 students and experts.

LUT Laser

Laboratory of Laser Materials Processing – is a part of Lappeenranta Laser Processing Centre (LPC), which is a joint institute between LUT and VTT (Technical Research Centre of Finland). The research facilities are located in the city of Lappeenranta in southeastern Finland. LUT Laser has a significant influence to laser processing in Finland, and most of the laser related businesses in Finland today have history with LUT Laser.

Workshop info

Workshop is organized by LUT

Workshop title: "Online Monitoring in Laser Processing"

E-Mail: info@lut.fi

Internet

<http://www.appolo-fp7.eu/workshops.html>

<http://www.lut.fi/web/en/school-of-energy-systems/research/laser-processing>

Sponsored by:



Venue: LUT Laser, Future Factory, Tuotantokatu 2, Lappeenranta, Finland, Lappeenranta University of Technology

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Workshop program Friday, 05.06.2015

08:30 - 09:00	Registration	
09:00 - 09:30	Opening remarks	Antti Salminen, LUT Laser
09:30 - 10:00	APPOLO project within FP7 framework	Gediminas Račiukaitis, FTMC, Vilnius, Lithuania
10:00 - 10:30	APPOLO project – LUT monitoring system	Hamid Roozbahani, LUT Laser
10:30 - 11:00	Coffee break	
11:00 - 11:30		
11:30 - 12:00		
12:00 - 12:30		
12:30 - 13:30	Lunch	
13:30 - 14:00	Coffee & Discussion	
14:00 – 15:00	LUT Laser-Lab tour	
15:00 – 15:30		
15:30 – 16:00		
16:00 – 16:30	Coffee break	
17:00 – 17:30		
17:30 – 18:00		
18:00 - 19:30	Round table discussion @ Coffee break	
19:30 – 21:00	Evening event	

How to Reach Us

Lappeenranta is easy to reach from all over Finland. Highways 6 and 13 cross the city and there are good train connections. Lappeenranta University of Technology is located in the Skinnarila district, seven kilometers from the city Centre, at [Skinnarilankatu 34](#), 53850 Lappeenranta.

1 By bus

Local bus number 5 goes to the university from the central bus station (matkakeskus) via the city Centre. Bus numbers 1 and 3 also run between the university and the city Centre. Bus number 5 leaves from the city Centre for the university at 10 and 40 minutes past the hour. Bus number 1 leaves at 15 and 45 minutes past the hour. From the university to the city Centre, bus number 5 leaves on the hour and 30 minutes past the hour. Bus number 1 leaves at 15 and 45 minutes past the hour.

2 By train

VR trains travelling in the direction of Joensuu stop at Lappeenranta. There are plenty of trains, and the journey from Helsinki takes about 2 hours and 15 minutes. Lappeenranta railway station is located 8 kilometers from the university. [Directions from the railway station to the university](#).

3 By car

From the direction of Helsinki or Joensuu

When driving from Helsinki or Joensuu on Highway 6, turn at the university-marked sign onto the Helsingintie road. Drive along Helsingintie until you reach the traffic lights. At the traffic lights, turn left in the direction of the university, onto the Skinnarilankatu street.

There is a sign indicating the university on the left side of the street on Skinnarilankatu.

[Directions when coming from Helsinki.](#)

[Directions when coming from Joensuu.](#)

From the direction of Mikkeli

When driving on Highway 13 from Mikkeli, turn left towards Uus-Lavola onto Salpausselänkatu street, about 600 meters before the junction of Highway 6. Drive for about 3.2 kilometers along Salpausselänkatu, and turn left onto Helsingintie road. Drive along Helsingintie for about 1.2 kilometers. Turn at the first traffic lights onto Skinnarilankatu street in the direction of the university. There is a sign to the university along Skinnarilankatu.

[Directions when coming from Mikkeli.](#)

From the airport

[Lappeenranta Airport](#) is located 8 kilometers from the university.

There is a taxi stand at the airport, tel. +358 20 060 400. [Directions from the airport](#).

4 Parking

Guest parking is located in front of the main building of the university. A parking ticket is required for the parking row nearest the building. The parking ticket can be obtained from the information desk in the main building. Otherwise, customer parking is free if not otherwise stated.

[Map of the parking areas.](#)

Accommodation



Scandic Patria

[Kauppakatu 21, Lappeenranta](#)

Scandic Patria is a quarter mile from the 17th-century Lappeenranta Fortress and just over one mile from Lappeenranta Train Station. Its air-conditioned rooms have a 32-inch TV.

<http://www.scandichotels.fi/>



Original Sokos Hotel Lappee

[Brahenkatu 1, Lappeenranta](#)

This hotel is in Lappeenranta city centre, 500 metres from Lake Saimaa. It offers free WiFi, parking and sauna access.

<https://www.sokoshotels.fi/en/lappeenranta>



Kotimaailma Apartments Lappeenranta

[Oksasenkatu 1, Lappeenranta](#)

Kotimaailma Apartments Lappeenranta features self-catering accommodation in the central city area, within easy reach of shops and services.

<http://www.kotimaailma.com/en/home>



Lappeenranta Spa

[Ainonkatu 17, Lappeenranta](#)

This central Lappeenranta spa hotel is on the shore of Lake Saimaa. It provides free pool and sauna access, plus free private parking. All rooms have free internet.

<http://www.kylpyla.info/>

www.greencampus.fi

