appolo

Hub of Application Laboratories for Equipment Assessment in Laser Based Manufacturing

Supported by the European Commission

COOPERATION

APPOLO Workshop: High Throughput and High Precision Laser Micro Machining with Ultra Short Pulses @ BUAS, Burgdorf, 04 Nov. 2015

www.appolo-fp7.eu

FP7 project No 609355

Bern University of Applied Sciences

CENTER FOR PHYSICAL SCIENCES AND TECHNOLOGY

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General official information

- Collaborative project of 7th Framework Programme (large integrated project)
- Call: FP7-2013-NMP-ICT-FOF “Factories of the Future”
- Objective: FoF-ICT-2013.7.2 Equipment assessment for sensor and laser based applications

- **APPOLO**
- **Hub of Application Laboratories for Equipment Assessment in Laser Based Manufacturing**

- **EC Grant Agreement N° 609355**
- **Start: 01 September, 2013;** **End: 31 August, 2017**
- **48 months**
- **Our efforts:** **1112 PMs**
- **Total estimated budget:** **14’007’330 €**
- **EC contribution:** **10’999’954 €**

- **We are 22 partners from 9 countries (LT, BE, CH, DE, ES, FI, IS, IT, NL):**
  - **Public research & universities** **6**
  - **Industrial research** **1**
  - **SMEs** **12**
  - **Large** **3**
- New partner selection is in process after **the Open Competitive Call in 2015**

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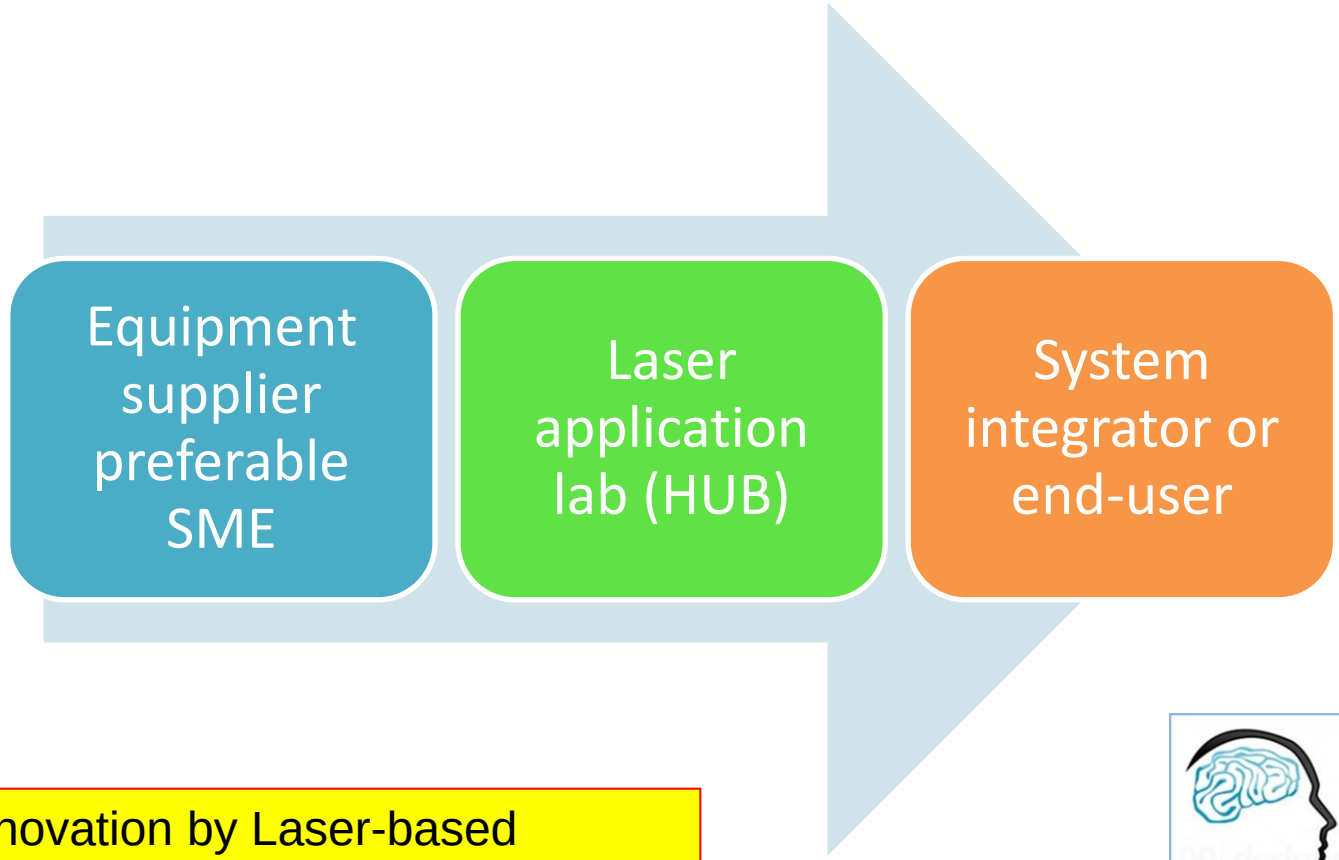
Goal of a ICT call and APPOLO

Reducing barrier to enter into market with new product (equipment for laser-based manufacturing)



Driving Innovation by Laser-based Manufacturing to the Regions of Europe

THINK INDUSTRY

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Hub of Application Laboratories for Equipment Assessment in Laser Based Manufacturing

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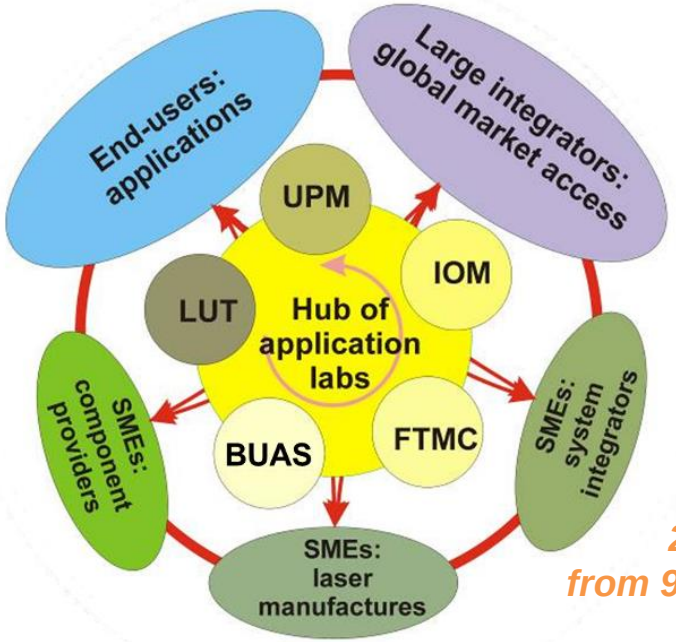


22 partner from 9 countries

Goal of APPOLO: validation of laser based equipment for industrial applications

Core of the consortium – **laser application laboratories:**

- around Europe;
- connected to a virtual hub,

in order to

- accumulate knowledge and infrastructure
- promote the easy-to-access environment
- develop and validate of laser-based technologies in

8+ equipment assessment value chains

36 partner
10 countries

15 sub-projects

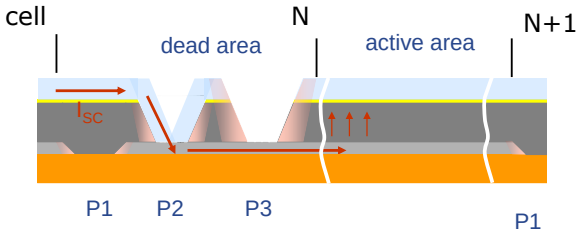
Industrial Advisory Board

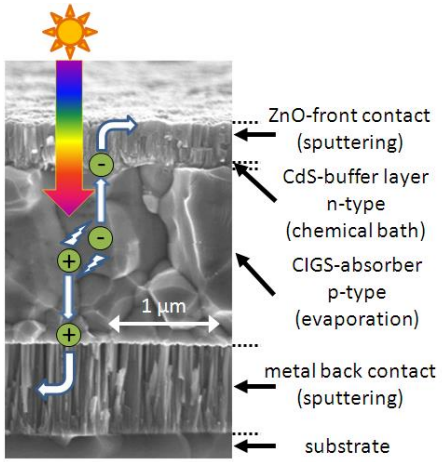
Input from other assessment chains

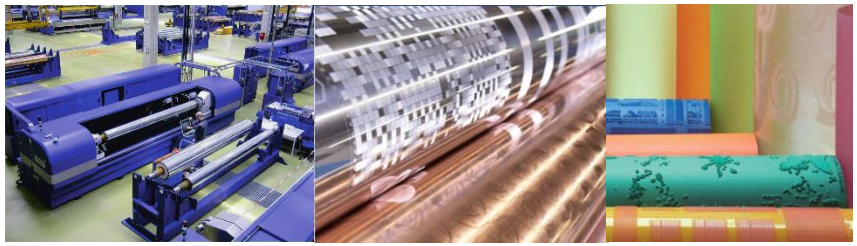
Assessment procedures → **Equipment assessment** → **Integration for process validation** → **Equipment in processing** → **Validation with end-user**

APPOLO: Clusters of Activities

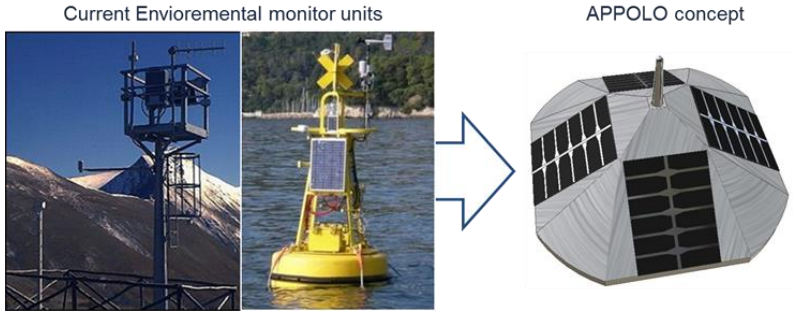
- **Thin film CIGS solar cell scribing with picosecond lasers**







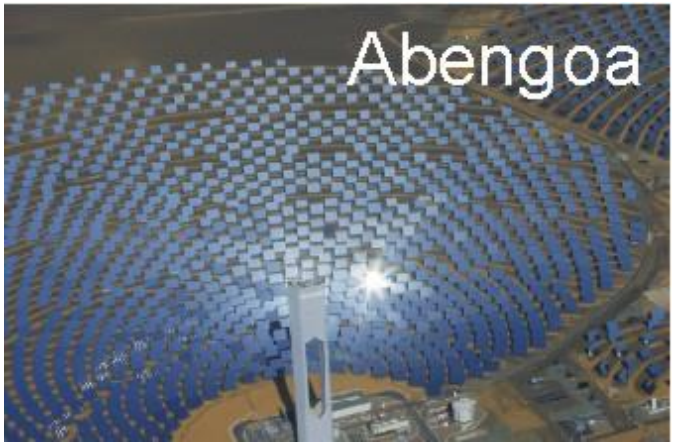
- **Laser surface texturing**



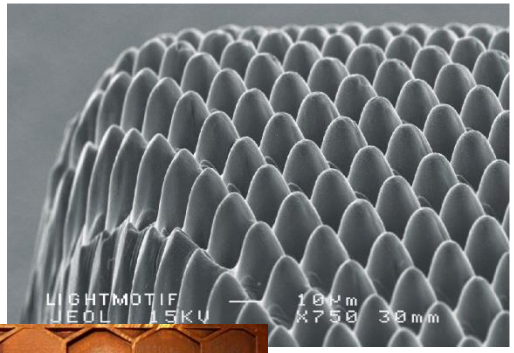
- **Laser patterning and direct writing for flexible 3D electronics**

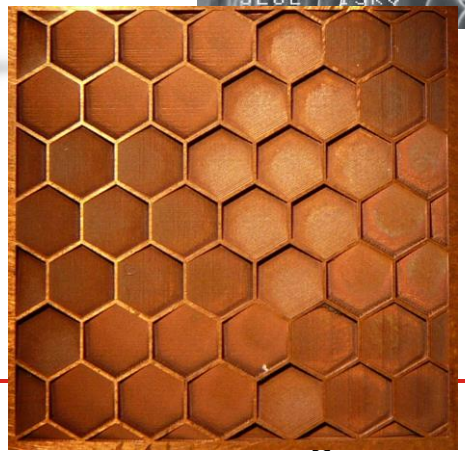
- Parallel activities on **sensing and monitoring techniques** for processing and validation

What they are for?



FIAT





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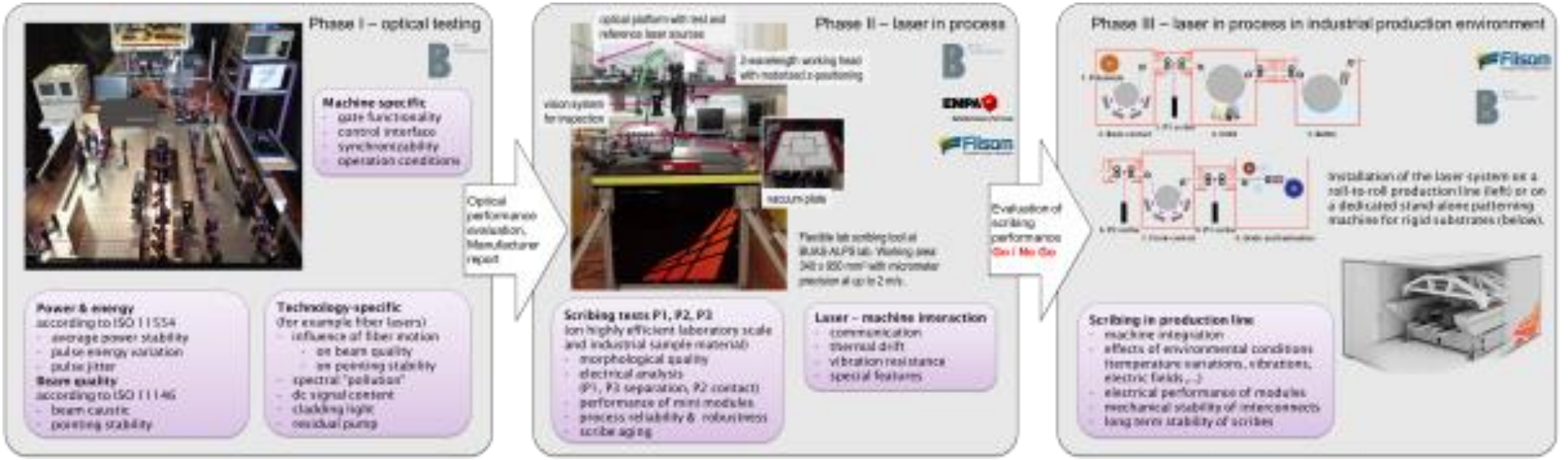
Assessment procedures

Phase I Laser testing

Phase II Laser in process

Phase III Laser in process in industrial production environment



Schematic representation of the 3-stage assessment process in CIGS solar cell scribing

Bern University of Applied Sciences

Flisom Flexible Solar Modules

EMPA Materials Science & Technology

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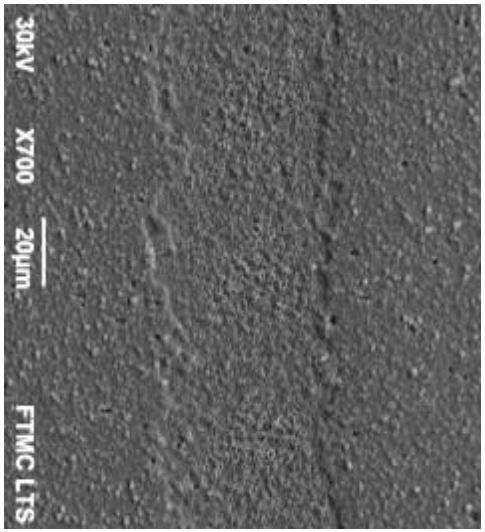
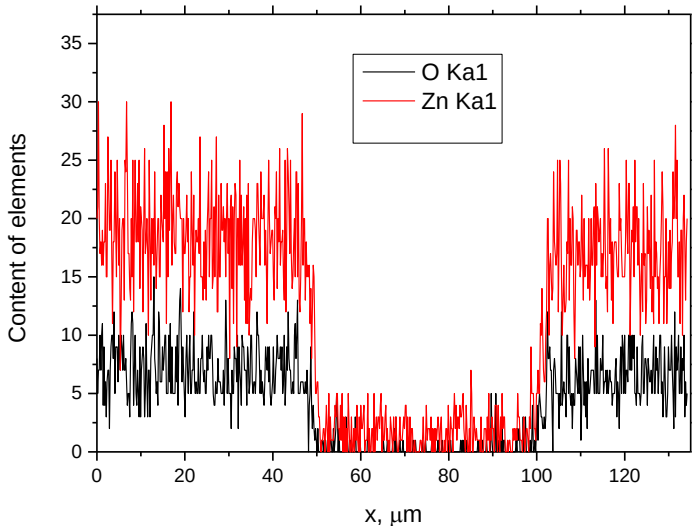
Thin film solar cell scribing

P3 type scribe is used for isolation of the adjacent cells:

- ❑ Removal only the top-contact or the full structure up to the molybdenum back-contact.
- ❑ TCO removal requires less laser power and small laser pulse overlap.





EDS analysis

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30 W, 1 MHz, 50 m/s, single pass

ps-laser and polygon scanner

EKSPLA

next scan technology

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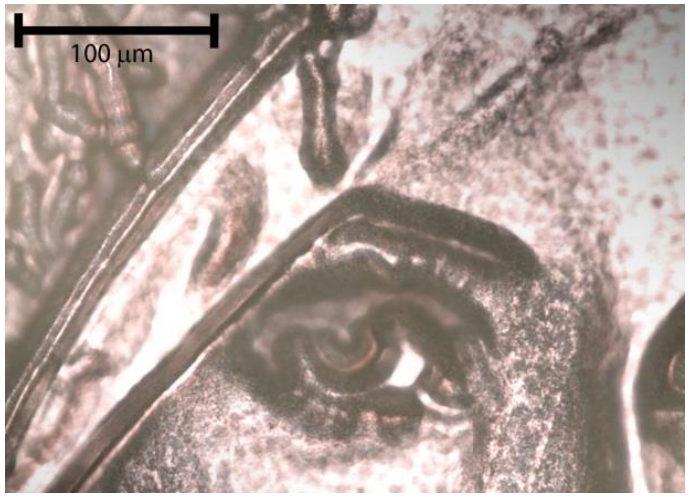
Precise machining of 3D structures

- Slicing the grayscale image into a given number of levelled black and white images.
- The black and white images are then processed one by one.

Grayscale and black and white image



Detail of machined structure

Result with 100 slices at 532 nm, 1 MHz, 1.2 W and 3 µm pitch.
Image size on target is approximately 1.5x1.5 mm^2.
Processing time of one layer is 1.2 s and the overall process time is 2 minutes.

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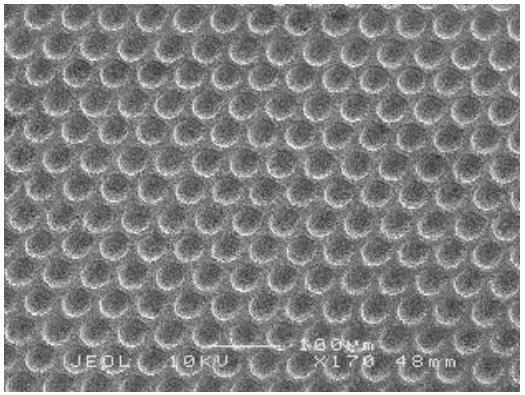
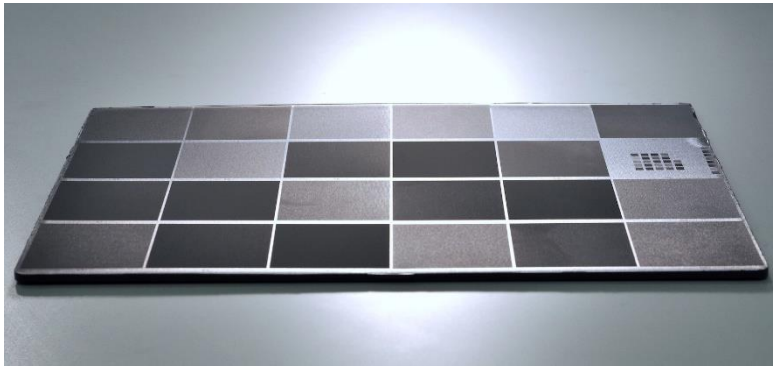
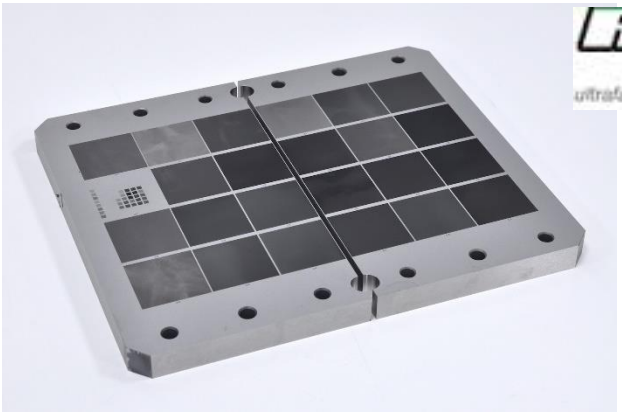
Laser texturing of moulds



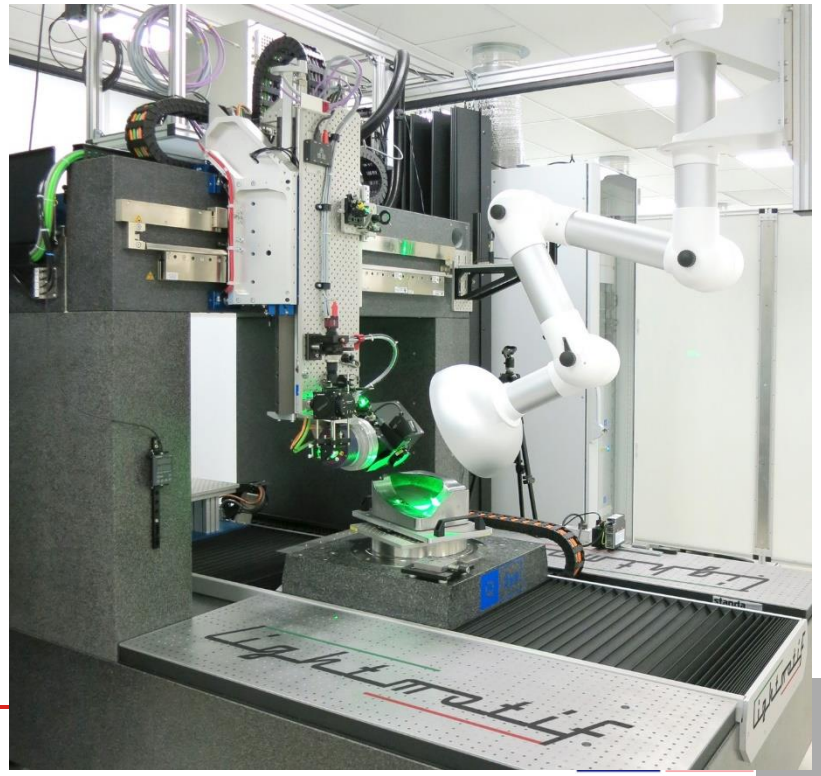
SEM measurements of one test texture



Demonstration of the anti-glare effect of the textures

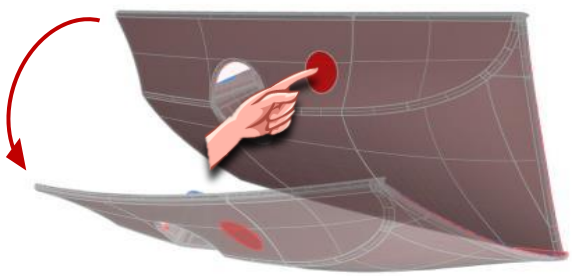


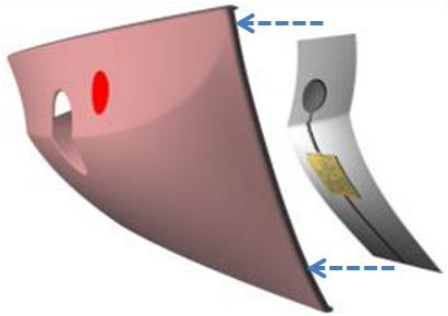
Two laser textured mould inserts



Toward integrated electronics

Dashboard Electronic Design

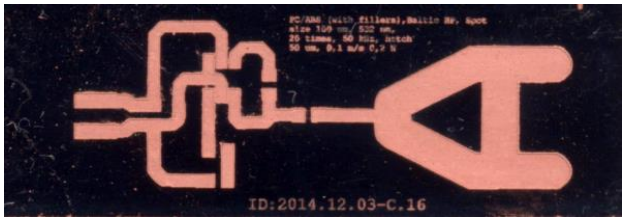


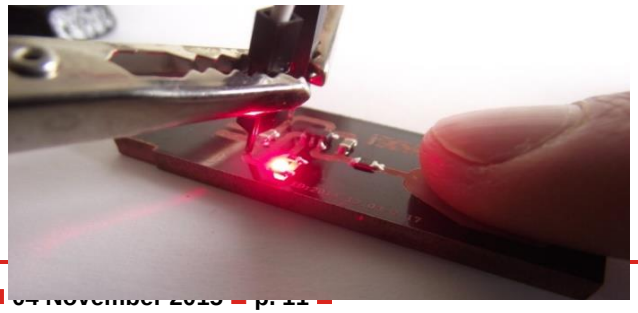


Laser surface modification
Electro-less copper plating

CRF CENTRO RICERCHE FIAT

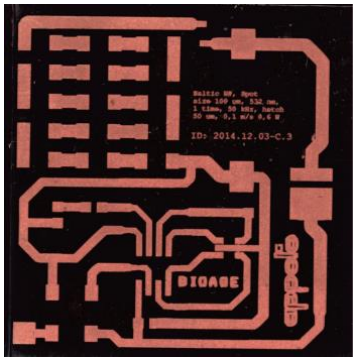
Automotive





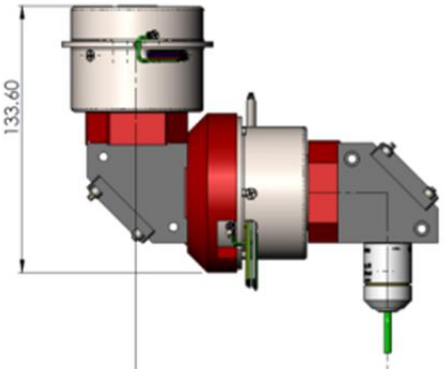
BIOAGE

Bio- & environment sensing



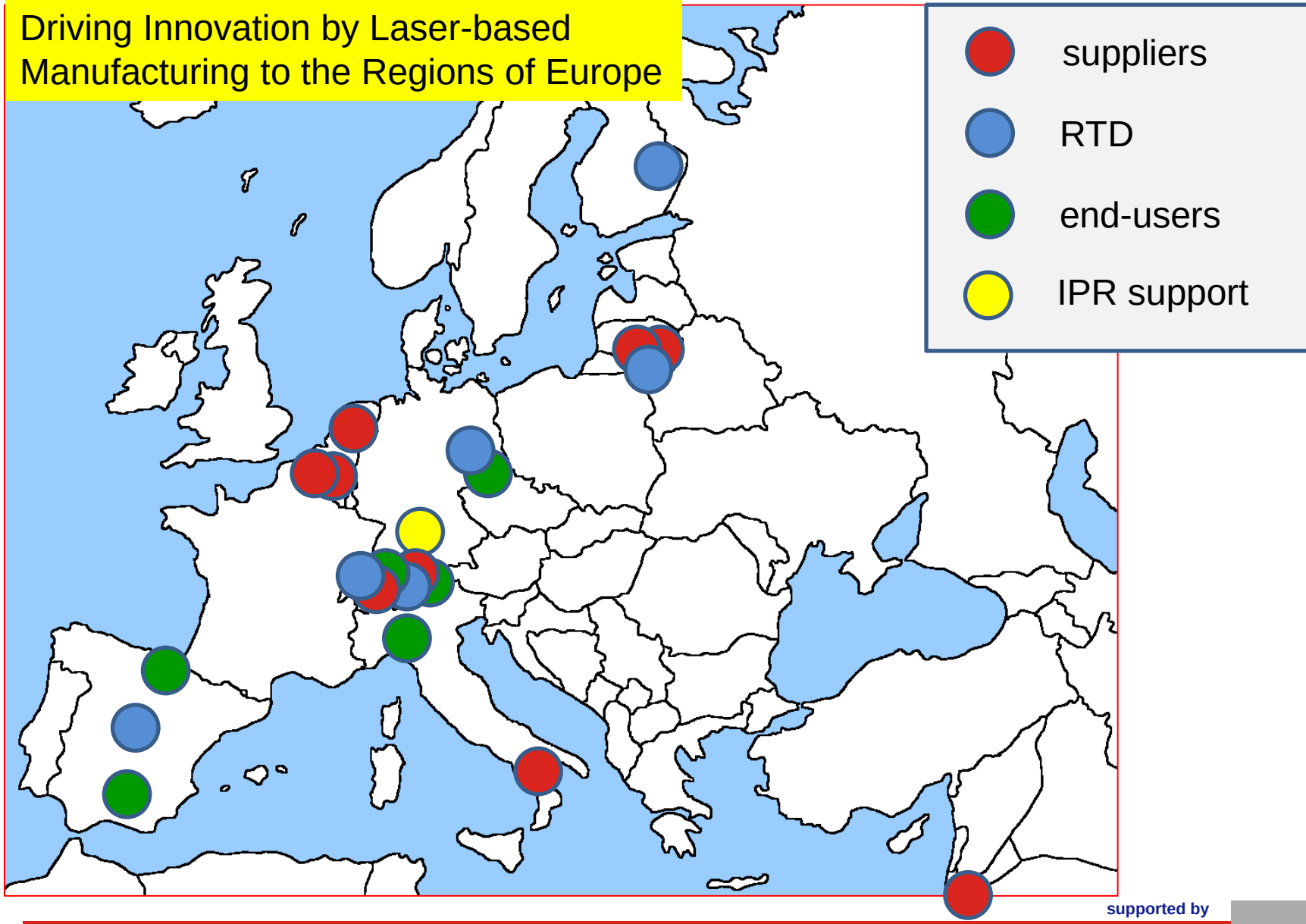
3D processing

Elas



APPOLO consortium across Europe

Driving Innovation by Laser-based Manufacturing to the Regions of Europe



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APPOLO Hub is happy to help you in validation of your equipment and processes

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BIOAGE

LUT Lappeenranta University of Technology

eElas

IOM

MONDRAGON ASSEMBLY

EMPA Materials Science & Technology

POLITÉCNICA

Flisom Flexible Solar Modules

Bern University of Applied Sciences

next scan technology

ABENGOA SOLAR

engage Key Technology Ventures

lightmotif ultrafast pulsed laser machining

onefive

AMSYS, LTD.

LUMENTUM

CRF CENTRO RICERCHE FIAT

EKSPLA

SWG

Daetwyler Graphics

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We welcome new partners

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APPOLO consortium across Europe

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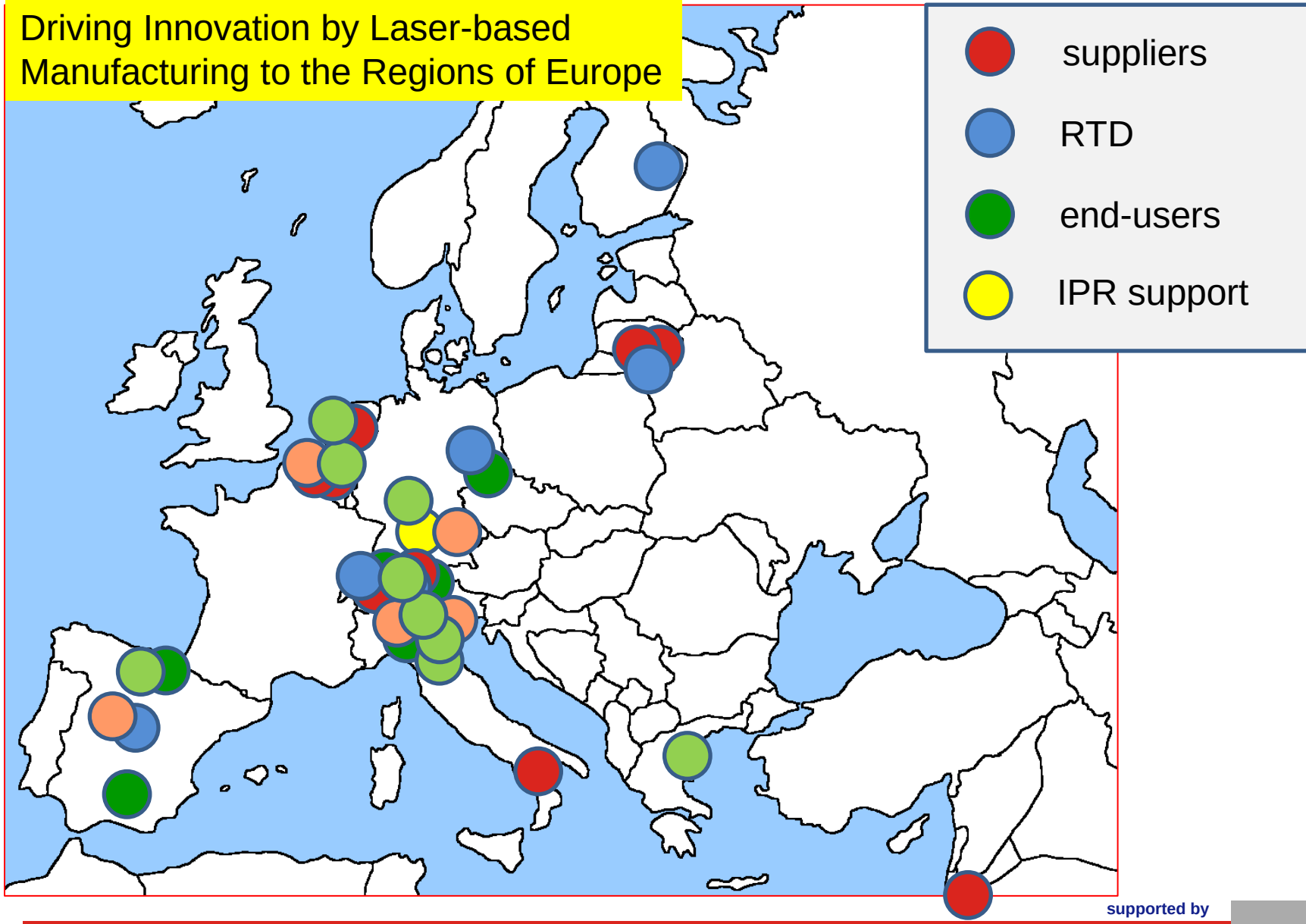

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