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Approval

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I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that any work or result described therein is either genuinely a result of the APPOLO project or that any other sources are properly referenced.

Name of scientific representative of the Coordinator: Gediminas Raciukaitis

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Glossary

1. Introduction

The APPOLO project is seeking to establish and coordinate the Hub of (laser) application laboratories with extended knowledge in laser processing technologies. The Hub will make connections between the end-users, which have demand on laser technologies for (micro) fabrication and the laser equipment manufacturers in order to accelerate 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.

This is achieved by applying innovative laser technologies and transferring the knowledge accumulated by the research staff to the value chains of manufacturing industry, as well as laser and laser equipment suppliers. In order to understand the requirements of value chains for innovative laser products, a Questionnaire is prepared and will be distributed between laser-based equipment suppliers and potential users of laser technologies. The questionnaire is made to inquire companies about their needs for laser technologies, their specific interests in laser processing and their challenges for accessing and using laser based manufacturing tools.

2. Questionnaire to laser-based equipment suppliers and potential users of laser technologies

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

By filling out this questionnaire you will help us (APPOLO project members) to understand the needs and value of lasers for your company or industry. We will then analyse your demands and improve the APPOLO Hub to provide suitable tools and information.

APPOLO project focuses on emerging innovative laser technologies and processes, which need to be customised, tested and validated. APPOLO aims to exploit the unique combination of distributed knowledge in academic application labs, equipment producers, system integrators, end-users to enable the development of innovative processes, products and machineries for industrial laser material processing applications. To achieve this APPOLO establishes and coordinates the Hub of Laser Application Laboratories to provide the high-quality integrated services.

All answers will be treated with the maximum of confidentiality. Participating companies and individuals will not be identified in publications of the network and only aggregated statistics gathered from all participants of this survey will be published.

A. YOUR INVOLVEMENT WITH LASER PROCESSES AND TECHNOLOGIES

1. How do you currently make use of lasers technologies in your company? (Tick all that apply)

- ☐ We manufacture lasers or laser systems;
- ☐ We make laser components;
- ☐ We test lasers or laser components;
- ☐ We integrate laser systems into processing lines;
- ☐ We use laser technologies in our production;
- ☐ We outsource laser fabrication processes;
- ☐ We characterize materials and components, processed with laser technologies;
- ☐ We use laser technologies in our prototyping or product development;
- ☐ Other (please specify): _____

2. How would you like to use laser technologies in the future? (Tick all that apply)

- ☐ We would like to use laser technologies in our prototyping or product development;
- ☐ We would like to manufacture components, materials or coatings in our own laser facilities
- ☐ We would like to outsource laser based manufacturing;
- ☐ We would like to characterize materials and components, processed with laser technologies;
- ☐ We would like to develop new lasers and laser systems;
- ☐ We would like to integrate laser technologies into our or customer process lines;
- ☐ Other (please specify): _____

3. What prevents your company from adopting or expanding the use of laser technologies? (Tick all that apply)

- ☐ We are currently using laser technologies;
- ☐ Lack of knowledge or skills;
- ☐ Lack of equipment or facilities;
- ☐ Concern about possible high costs to adopt the technology;
- ☐ Doubts regarding applicability to our business;
- ☐ Other (please specify): _____

a. Can you describe your difficulties with the use of laser technologies (optional)?

B. YOUR NEEDS FOR LASER PROCESSES AND TECHNOLOGIES

4. Do you expect / plan / like to introduce laser technologies in future?

☐ Yes

☐ No

5. Do you need discussion regarding laser application in future product /technology development?

☐ Yes

☐ No

6. Which specific areas of laser processing are you interested in? (Tick all that apply)

☐ Laser development

☐ Fine cutting

☐ Laser optics development

☐ Ablation/Cleaning

☐ Semiconductor processing

☐ Deposition

☐ Nanomaterials

☐ Laser writing

☐ Engraving

☐ Laser writing on 3D surfaces

☐ Functional surfaces

☐ Micro-milling

☐ Sensors

☐ Drilling

☐ Solar cells

☐ Laser Induced Forward Transfer (LIFT)

☐ Polymers

☐ Efficient large scale surface treatment

☐ Welding

☐ Other (please specify): _____

7. Are you interested in? (Tick all that apply)

☐ Validation & assessment service for your products for industrial processes?

☐ Verification of laser and components specifications for your applications?

☐ Assessment of technical specifications of the equipment?

☐ Validation of new laser technologies in industrial environment?

☐ Assessment of its interaction with any complementary equipment?

☐ Consultancy?

☐ Assessment of the equipment in dedicated laser processes?

☐ Other (please specify): _____

8. Are there any limitations in laser technologies preventing their adoption in your industry?

☐ Yes. (Please specify): _____

☐ I do not know

☐ Not applicable

9. Are there any aspects of laser technologies that must be improved for their adoption in your industry?

- ☐ Yes. (Please specify): _____
- ☐ I do not know
- ☐ Not applicable

10. How important is for you that the laser system specifications comply with an officially certified standard, i.e. ISO?

- ☐ Essential, (Please specify why): _____
- ☐ Important,
- ☐ Not important,
- ☐ Not applicable

11. Do you see benefits of independent validation of specifications of lasers and other equipment?

- ☐ Yes (Please specify): _____
- ☐ No
- ☐ Other (Please specify): _____

12. How useful can be service of independent and competent third party (like laser application laboratories of APPOLO HUB) to assess your laser fabrication technologies?

- ☐ Essential (Please specify why): _____
- ☐ Useful (Please specify why): _____
- ☐ Not useful
- ☐ Not applicable

13. Where do you see benefits of such laser technology assessment for your business?

Please rate 1 to 5 (with 5 being the most important)

	1	2	3	4	5		1	2	3	4	5
Independent comparison of competitive laser products						Information about reliability of laser system					
Minimization of purchase risk						Independent experts to choose suitable laser products					
Standardisation of purchase						Other (please specify):					
Quality information of laser processed parts						_____					

C. YOUR CHALLENGES WITH LASER PROCESSES AND TECHNOLOGIES

14. What laser parameters are the most important for your application?

Please rate 1 to 5 (with 5 being the most important)

	1	2	3	4	5		1	2	3	4	5
Output power	○	○	○	○	○	Pulse duration	○	○	○	○	○
Pulse energy	○	○	○	○	○	Pulse timing jitter	○	○	○	○	○
Pulse energy stability	○	○	○	○	○	Synchronisation accuracy	○	○	○	○	○
Wavelength	○	○	○	○	○	Operating temperature /humidity	○	○	○	○	○
Repetition Rate	○	○	○	○	○	Power consumption	○	○	○	○	○
Beam quality	○	○	○	○	○	Absolute tolerance of output parameters between products	○	○	○	○	○
Beam spot size	○	○	○	○	○	Other (please specify):					
Beam pointing stability	○	○	○	○	○						

15. Which laser process parameters are the most important for your application?

Please rate 1 to 5 (with 5 being the most important)

	1	2	3	4	5		1	2	3	4	5
Process throughput	○	○	○	○	○	Precision	○	○	○	○	○
Process speed	○	○	○	○	○	Repeatability	○	○	○	○	○
Tolerance to laser parameter variation	○	○	○	○	○	Debris-free	○	○	○	○	○
Tolerance to work piece properties variation	○	○	○	○	○	24/7 regime	○	○	○	○	○
Maintenance free	○	○	○	○	○	I do not know	○	○	○	○	○
Roll-to-roll	○	○	○	○	○	Other (please specify):					
Sheet to sheet	○	○	○	○	○						

16. What has the strongest influence to your decision to apply laser technology against other alternative technologies? Please rate 1 to 5 (with 5 being the most important)

	1	2	3	4	5		1	2	3	4	5
Investment cost	○	○	○	○	○	Safety requirements	○	○	○	○	○
Processing quality	○	○	○	○	○	Personnel requirements	○	○	○	○	○
Flexibility	○	○	○	○	○	Range of materials	○	○	○	○	○
Running costs	○	○	○	○	○	Reliable suppliers	○	○	○	○	○
						Other (please specify):	○	○	○	○	○

17. Where are you looking for consultancy and support in selecting lasers and laser technologies for your needs?

- ☐ We ask our suppliers for their expertise;
- ☐ We ask person or institutions, which we know personally;
- ☐ We ask local research institutions;
- ☐ We ask well-known (in EU) research institutions;
- ☐ We ask well-known (outside EU) research institutions.

D. GENERAL COMPANY INFORMATION

Principal industry sector: _____

Core business: ☐ Consulting ☐ Production ☐ R&D ☐ Other

Legal form: ☐ Private company ☐ Public company ☐ Public institution ☐ Other

Number of employees: _____

When was your company established: _____

E. ABOUT YOU (OPTIONAL)

Your name: _____

Your role within the company: _____

Do you have responsibility or influence for laser procurement/use in your company?

☐ Yes

☐ No

Would you be interested in a detailed consultation about your laser fabrication needs? Tick “Yes”, if you are willing to have us contact you directly in the future.

☐ Yes

☐ No

If interested in a detailed consultation, please provide contact information:

3. Conclusions

The questionnaire is designed to obtain information about the needs of laser technology existing and potential users. These are the target groups for laser assessment HUB.

The questionnaire is used to collect general information about potential clients, their exposure to laser technologies and their challenges with accessing and using laser based processing. The analysis of the collected data will be done, separating initially two target groups – existing users and potential users. Existing users are viewed as a primary source of clients of the HUB, as they have experienced difficulties with laser technology adoption and implementation in their environment. It is therefore important to address their challenges, collected via questionnaire, and transfer that knowledge to APPOLO industrial partners via Industrial Advisory Board.

The second group of clients, who have a little or no exposure to laser processing technologies, is expected to be much larger than an existing user base. Many of them probably will not use laser technologies, as better alternatives might be available in the market for their application. However it is important to understand their decision making processes for choosing manufacturing technologies. This information is also collected by the questionnaire and will be analysed for the benefit of the HUB. The HUB will transfer this information to research laboratories and industrial partners, who will build new assessment experiments, directed to provide relevant information to new potential users. Such expansion is already devised in the project as the Open Call for assessment experiments; therefore analysis of potential users needs will direct the project towards the most promising open call topics.

The questionnaire was distributed at key conferences and exhibitions (Photonics west 2014, LPM2014) and is accessible via APPOLO project website (<http://www.appolo-fp7.eu/questionary.html>) and flyers in conferences, where APPOLO project partners are attending.