Publishable Summary

The APPOLO project is seeking to establish and coordinate connections between the end-users, which have demand on laser technologies for (micro)fabrication, knowledge accumulated in the laser 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. Core of the consortium consist of laser application laboratories around Europe which are connected to a virtual APPOLO HUB to accumulate knowledge and infrastructure and promote the easy-to-access environment for development and validation of laser-based technologies. The APPOLO project cover activities on technical, technological and economical assessment of new equipment supplied by project partners in 8 complex assessment value chains and preparation of standardised procedures for the assessment service with can be provided for new project partners and customers beyond,

All activities of the APPOLO project during the first year of implementation were performed according to the workplan. The first year of the project covered a lot of preparation work on establishing management structures, dissemination, exploitation, quality assurance strategies and plans. RTD work was concentrated on adaptation of equipment prototypes by their suppliers: lasers, polygon scanner, on-line monitoring tools and small processing systems to the requirements of selected industrial application fields: photovoltaics, automotive and printing/decoration. Laser companies Ekspla, onefive, Time Bandwidth Products have made significant progress in development of updated versions of the selected ultra-short pulse laser sources planned for the assessment experiments in fast and precise surface structuring and thin-film scribing. Next Scan Technologies improved control of its polygon line scanner and designed updated versions with reduced focused beam spot and increase line length. AMSYS moved forward with its novel on-line monitoring tools for the process control, critically analysing existing and new approaches for optical monitoring. The tools will be integrated by ELAS in its upgraded laser machine and used in the laser technology validation at FTMC. Mondragon prepared the bench tool for UPM – a machine for laser and process assessment which are important for Abengoa. IOM spent most of the time in preparation and validation of the online monitoring tool for laser scribing, while LUT was validating their advanced monitoring equipment for laser microfabrication applications. Continuation of past collaboration of the partner's groups ONEFIVE -BUAS - EMPA, BUAS – NST - DG, UPM – Mondragon – Abengoa, Lightmotif - CRF, IOM – SWG, FTMC - CRF led to extended progress in the laser technology assessment with solid background for the use of validated equipment and technologies in industrial processes by BioAge, Flisom, Fiat, Daetwyler and Sächsische Walzengravur, as the end-users. The technology validation process started with the lasers available at application laboratories and standard demo laser and polygon, provided by the partners.

Four different routes (FTMC, BUAS, IOM, UPM) in thin-film scribing for monolithic interconnections in CIGS solar cells are running in parallel based on lasers with different pulse duration and wavelength for optimising processes based on various substrates: glass, polymer and metal foil. End-user requirements were clarified and write down as specific assessment and characterisation procedures in validation of the equipment and the scribing processes. The progress was achieved in fundamental background of the damage-less film removal, on-line characterisation techniques and technological approaches in minimising the "dead-area" width, providing a feedback to the equipment suppliers. All those activities were running during Y1 in order to prepare to the assessment of new ultra-short pulse laser sources and beam guiding technique, until they will be available for the full-scale validation experiments.

Surface texturing by lasers is in validation process for printing and polymer moulds. Three groups (BUAS, IOM, LM) are involved in the assessment experiments. The high scanning speed and high pulse repetition rate are required for cost-effective surface texturing on printing rolls. Precision of fabrication is not less important. Therefore, the activities during Y1 included new equipment development and validation as well as development strategies for efficient and precise material removal. The first embossing polymer experiment were conducted with laser engraved printing sleeves. Optimisation of the surface micro & nano texturing for moulds is running in parallel with the tests on moulded polymeric parts, validating their “consumer” properties and improving the laser texturing machine at LM.

Validation of laser structuring processes for metallisation are running at FTMC and UPM. Modification of polymer surface followed by electro-less metallisation is a way in simplification of fabrication procedures on complex 3D parts used in car production. Validation of laser source parameters and polymer materials was performed during Y1. The set-up preparation and first experiments on metal wire deposition for photovoltaics by using laser induced forward transfer (LIFT) technique has been completed in the first year.

As development and validation of laser technologies cannot be envisioned without any intelligent monitoring and on-line control, verification of the existing monitoring techniques, including spectrometers, high-speed an infra-red cameras, was performed at LUT concentrating on applicability the techniques for laser microfabrication process monitoring. New on-line methods were evaluated and designed for high-speed and precise in-line monitoring of laser scribing processes by utilizing polygon scanners and specialised autofocus & autotilt control setup for 3D processing.

Significant efforts of all partners were allocated to establish the assessment procedures based on the end-user requirements. Industrial Advisory Board (IAB) was established, which primary included representatives of all industrial partners of the consortium. Extension of IAB to external member is ongoing. Input from potential APPOLO HUB customers and partners was also accumulated by the Questionnaire, spread during the main laser related conferences and exhibitions and published on website. Dissemination and exploitations plans were prepared and are under control of engage, partner experienced in IPR management.

Two websites were launched for the project: www.appolo-fp7.eu for all project related activities and dissemination and http://appolohub.appolo-fp7.eu/ for APPOLO HUB as a single access point to consolidated infrastructure and expertise of the laser application laboratories, involved in the project.

Open Competitive Call for new partners and assessment experiments will be launched in the beginning of 2015.