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BioQantSense

Twinning for excellence of the Serbian Research Center for quantum biophotonics

Work Package 1

Development of institutional strategy

Deliverable 1.3

Catalogue of measures implemented at IPB

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1 Introduction

This deliverable is the summary of measures to be implemented during the project for improving IPB, in both scientific and organizational aspects. It develops after considerations and findings presented in deliverables, D1.1 and D1.2. It gives an overview of measures following recommendations for strategy for institutional development, given by CNR and FSU, upon their scientific and administration experts had visited IPB during the days of the project kick-off. This deliverable describes steps to be taken in order to reach project objectives, considerable improvements of scientific achievements and of management and administration capabilities, in particular those relevant for international project applications and management. The catalogue of measures that this delivery presents describes efforts and actions performed by partners during their visits to IPB and visits of IPB to partner's institutions. Based on this catalogue the plan for visits, their timing, duration, and subjects, is developed, and given in the deliverable D4.1. It identifies particular training requirements of IPB staff and students in order to improve knowledge and understanding of science and technology that has to be implemented within the exploratory project.

CATALOGUE OF MEASURES:

Key points identified to foster excellence for IPB are

- A. to enhance scientific excellence (see sec. 2)
 - consolidate IPB international scientific visibility not only at the European level;
 - stimulate greater participation of researchers, especially young ones, in dissemination at international scientific conferences;
 - acquire new knowledge and skills on experimental laboratory procedures considered preparatory to the implementation of the exploratory project focus oriented on quantum biophotonics;

- B. to enhance management and administration capabilities (see sec. 2)
 - Improve the approach and design of project proposals for obtaining a successful project
 - increase the number of project proposals submitted to the EC
 - improve the management and monitoring of projects funded by the EC and in particular by the Horizon Europe programme
 - improve aspects of cooperation with the non-scientific sector for innovation and technology transfer

2 Scientific excellence at IPB

Scientific excellence is a fundamental value of IPB, demonstrated through a wide range of activities aimed at outstanding contributions to innovative and impactful research topics. Partnerships with CNR and FSU will enhance IPB's scientific profile and reputation, particularly in the field of quantum biophotonics. Therefore, it is crucial for the organizational plan to have a specialized scientific strategy directed toward this particular scientific field. The scientific exploratory project is expected to include the development of all relevant methods and practices learned from European partners. Enhancing interaction between the Faculty of Biology at the University of Belgrade, a long-term collaborator of IPB, and the domestic partner on the European project BioQantSense is also expected. Potential areas of cooperation could include the selection, preparation, and cultivation of acceptable bio samples together with IPB's experts.

2.1 Processing of advanced photonic materials towards lab-on-the chip

The training provided by CNR at IPB to improve skills and knowledge on biophotonics will consist of a series of lectures, seminars, and discussions on various project tasks, as well as practical demonstrations in the laboratories. CNR will provide scientific-technical support on the development of MOEMS, microfluidics, and optofluidics devices fabrication coupled with advanced optical imaging and sensing systems for various fields of applications mainly including photonics applied to the biological world. Additionally, CNR will share knowledge on photocurable functional materials and composites, processed by laser-based technologies advanced laser-based fabrication processes focused on for lab-on-a-chip devices with integrated biomimetic elements for chemical and biological sensing.

During the first-year visits (visits 2, 3, 11)¹, IPB members will be introduced to the various research lines at CNR with focus on those topics that will be propaedeutic for the implementation of the exploratory project. More into details, scientific topics will span from the development of advanced novel photo-responsive polymers and composites, as well as the equipment at their disposal for characterization, and for micro- and nano-fabrication. Each visit to CNR is the opportunity to acquire hands-on experience with the available equipment, to translate knowledge to in-house materials and processes at IPB and to have lengthy discussion with their hosts on near future plans of cooperation. Whenever possible, demonstrations of experimental procedures, processes, and protocols potentially transferable to IPB laboratories, will be conducted, with a focus on biocompatible materials design (advanced photopolymers, photoresponsive, liquid crystal doped materials) and micro- nanofabrication procedures aimed at Lab-on-Chip (LoC) devices fabrication with design properly conceived for smart interfacing with optical imaging system (microscope and spectroscopic set-ups).

Indeed, integrated photonics and spectroscopy applied to the study of living matter will be considered as a necessary propaedeutic part of the exploratory project for interfacing the optical imaging system developed in collaboration with FSU with the MOEMS and lab-on-a-chip devices. In the second year (12, 16, 20), the results on protocols and fabrication procedures optimized during the first year and applied to various materials will be analyzed and will be the basis for the plan for future developments. Indeed, these visits will be focused on the implementation of complex manufacturing processes for the fabrication of MOEMS and lab-on-a-chip prototypes at IPB, using microdispensing, micromanipulation, and direct laser writing (DLW) and transferable to the exploratory project. Developing methods of quantum imaging with undetected photons

The FSU with its clear profile as a medium-sized, traditional European University and its excellence in photonics science will provide strong scientific-technical assistance to contribute to the success of the project. FSU will present talks and consulting on the fundamentals and principles behind quantum interferometry and quantum imaging and will share experience in integrating quantum-enhanced imaging into quantum imaging set-up to be developed at IPB, as part of the exploratory project. During the first-year visits (1, 4, 5, 7), FSU will provide tutorials in quantum optics for quantum microscopy, along with joint practical lab training. The focus of these visits will be primarily on exploring different modalities of quantum imaging with undetected photons. It is important to come to the conclusion about the scheme

¹ As given in Table 1: *Scheduling visits for BioQantSense*, in Deliverable D4.2

for quantum imaging already at an early stage of the project, preferably during the first seven months. This decision will define necessary elements for the setup, lasers and nonlinear crystals, photo detectors and cameras.

The visits during the second year (13, 14, and 17) will be focused on the design, simulation, and construction of quantum imaging and spectroscopy systems, making a final choice of the quantum microscope to be developed by the exploratory project. Also, one of the visits (17) will be devoted to the development of highly compact prototypes chosen for quantum imaging with undetected photons. In the final visit to FSU (27), the analysis of the performance of the quantum microscope used in the exploratory project will be the basis for the plan for future developments and improvements of this type of laser microscope.

3 Enhancing management and administration skills at IPB

The administrative and management training will be at IPB during two visits by respective partners' officials from CNR and FSU (10 and 22) and during two visits of IPB administration staff to partner's institutions (6 and 15). The subjects of the meetings are training sessions on how to prepare successful proposals for EU grants, and also about the aspects of innovation and technology transfer. Training on the successful management of EU projects will cover the whole cycle for management of EU-funded projects: 1. use of participant portal; 2 budget aspects.

FSU offers tutorials on selected topics of scientific management, which when implemented will be of great importance for the sustainable impact of BioQantSense beyond its funding period. Thus, during the visit to FSU (15) and at IPB (22), the IPB research and administration staff will be introduced to several topics of scientific management in which FSU has considerable expertise. Transfer and innovation are of interest to Serbian photonic society and will be tackled as aspects of insights into the optics and photonics ecosystem of Jena, one of the most visible and productive photonics high-tech clusters in Europe. Through the strategy that is behind these topics, IPB can become the center for the project- and person-oriented collaboration between research institutions, universities, and optics and photonics companies. Such a Belgrade ecosystem, organized under the Serbian Optical Society, will have an important role in the promotion of photonics science and technologies, the role we can emphasize through, for instance, the development of an optical museum, modeled on the Jena emerging Deutsches Optisches Museum. IPB is also interested in another topic of scientific management offered by FSU, namely remotely controlled labs, a trendy but very useful method of experimental and educational science. FSU is offering training on the development of an open-source toolbox for remote control of photonics training. In preparation for the visit to FSU, a simple optical experimental setup with possibilities for online control will be conceived and used for such training.

Staff management of the Institute of Optics of CNR (CNR-INO) will offer training on the whole cycle for the management of EU-funded projects. During mutual visits planned with IPB and CNR-INO (6 and 10), Grant Office staff will organize workshops, tutorials, and best practices to be transferred to IPB staff on administrative, financial, and management aspects, acquired at CNR-INO in several EU-funded projects during Horizon Europe, Horizon 2020, and FP7 framework programs. Aspects addressed on these visits

will be primarily focused on supporting IPB to successfully coordinate the BioQantSense project and EU-funded projects.

Moreover, the experience of CNR-INO in collaborative frameworks will be included in the training program. Educational and practical lessons from CNR-INO will cover at least the following topics:

- Use of EU Funding and Tenders and Sygma portals;
- Project budget aspects (plan, eligible and not eligible costs, budget flexibility, monitoring, audit)
- Financial management and reporting;
- Obligations imposed by Consortium Agreement and Grant Agreement at scientific, legal, and financial levels.