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## **Supervisor Expression of Interest MSCA - Marie Sklodowska Curie Action - (PF) Postdoctoral Fellowship 2024**

**Supervisor name:** Paola Saccomandi

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**Link “Pagina docente”:** <https://www.mecc.polimi.it/us/research/faculty/faculty/prof-paola-sacomandi/>  
<http://www.laseroptimal.polimi.it/>

**Department Name:** Department of Mechanical Engineering

**Research topic:**

**MSCA-PF Research Area Panels:**

- ECO\_Economic Sciences
- ENG\_Information Science and Engineering
- ENV\_Environmental and Geosciences
- LIF\_Life Sciences
- MAT\_Mathematics
- PHY\_Physics
- SOC\_Social Sciences and Humanities
- CHE\_Chemistry

**Brief description of the Department and Research Group (including URL if applicable):**

The LAMBDA Lab (“Laboratory of Measurement for Biomedical Applications”) is part of the Measurement group of the [Department of Mechanical Engineering](#), and has been created by the [ERC group LASER OPTIMAL](#). Main research interests of the Supervisor, Prof. Paola Saccomandi, and her team include quasi-distributed and distributed fiber optic sensors (FOSs) and imaging (e.g., magnetic resonance and hyperspectral imaging), and the development of light-based approaches for hyperthermal tumor treatment and monitoring. The team is also developing FOSs for antibiotics and environmental monitoring, and wearable devices embedding FOSs for physiological parameters monitoring during sport and for prosthetics. For the results of her research, in 2023 Prof. Saccomandi has been listed among the world’s top 2% scientists.

The research activities encompass several topics in the healthcare sector, including medical (CT and MRI) and multimodal (hyperspectral) imaging, fiber optic sensors for biosensing, and monitoring of physiological and environmental quantities, light-tissue interaction, thermometry.

The lab has access to up-to-date facilities and is supported by 8 funded national and international projects. The Supervisor has a successful experience with the supervision of early-stage researchers: she holds MSCA-PF and Fondazione Cariplo projects dedicated to young researchers.



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The **list of publication** of the supervisor and the latest outcome of the research are available at this [link](#).

**TITLE of the project: Novel solutions for intraoperative control and patient-specific planning of the thermal ablation therapy for cancer treatment.**

### **Brief project description:**

Electromagnetic-based thermal techniques are currently widely investigated as minimally invasive treatments for solid tumor removal. Typical advantages are: capability to deliver the therapeutic energy through small needles, safety, ability to target deep-seated organs, and compatibility with diagnostic imaging techniques for therapy guidance. Furthermore, the reduced invasiveness and pain, associated with this ablative procedure, could reduce the recovery time, and could represent an alternative to surgical resection. However, thermal techniques still hold some limitations such as the potential risk of irreversible injury to the surrounding healthy structures. Indeed, the maintenance of thermal coagulation and necrosis within the selected tissue margins, is often challenging, and patient specific treatments are needed. Also, the poor intra-operative control strategy and the lack of dedicated pre-treatment planning are the main responsible for the inaccuracy of the procedure.

In this context, key-aspects to be addressed via a specific project proposal under the MSCA-PF framework are:

- 1) the development of a numerical framework for the thermal ablation settings planning and their intra-operative adjustment (based on data assimilation) for personalized and patient-specific treatment;
- 2) the design and development of smart theranostic tools for the intraoperative control of the therapy;
- 3) the design and development of novel and innovative fiber optic sensors to monitor biological quantities related to the treatment (e.g., temperature, thermal damage, etc.);
- 4) the identification of novel biomarkers to be used as indication of treatment efficacy in real-time;
- 5) characterization of physical (thermal, mechanical, optical) properties of biological tissues undergoing thermal treatment;
- 6) nanoparticles-enhanced photothermal therapy and nanomaterial-based tumor photothermal immunotherapy.

The candidate can elaborate the proposal on one, two or all topics, considering the multidisciplinary nature of the proposed research and approach. The candidate can also propose original solutions to the addressed key-aspects or to other topics managed by the team (see “description of the Department and Research Group”). The candidate is strongly encouraged to combine these topics with her/his own knowledge on other fields, in order to make the proposal highly innovative and competitive.

One of the relevant aspects for the proposal success is the well-established network of national and international collaborations of the host research team with prestigious groups. These collaborations cover the fields of engineering, medical technology, physics, chemistry, biology, nanotechnology, and include hospitals. The MSCA-PF candidate can benefit from this network to strengthen the development of the research, training, and career development plans for the project.

