

Event-Based Vision Sensor-Enabled Single-Particle Tracking

Type of position: PhD or Postdoc (possibility of M2 internship before starting the PhD project)

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Project Overview:

We invite applications for an M2 internship and fully funded PhD to work on an innovative interdisciplinary project integrating event-based sensors (EBS) into single-molecule localization microscopy (SMLM) [1] and single-particle tracking (SPT). This research aims to drive new insights into molecular processes, focusing on the dynamic behavior of proteins, particularly poly-ADP-ribose polymerase 1 (PARP1), in response to DNA damage [2].

EBS technology offers an asynchronous response to changes in light intensity, making it uniquely suited to capture fast, multiscale biological processes. The project will explore how EBS can provide insights into molecular mechanisms, focusing on real-time tracking of individual PARP1 molecules within the nucleus of living cells, and their trapping on DNA lesions upon treatment with clinically relevant inhibitors.

This project is a collaboration between the Single-Molecule Biophotonics Lab at the Institut Langevin, ESPCI Paris, and the Sébastien Huet Lab at the Institut de Génétique & Développement de Rennes (IGDR), Université de Rennes.

Role and Responsibilities:

- Develop and optimize data treatment and analysis algorithms for EBS-based single-molecule localization microscopy and EBS-based single-particle tracking (EveSMLM/EveSPT)
- Study PARP1 diffusion and trapping in live cells using EveSPT
- Develop methods for analyzing protein mobility based on the event-based data produced by molecular movement
- Explore PARP1-DNA interactions using EBS temporal signatures
- Implement dual-modality experiments combining EveSMLM with EveSPT
- Work closely with academic and industrial partners and contribute to the development of protocols and software that democratize the use of EveSMLM and EveSPT in bioimaging facilities and other research labs.

Requirements:

- A Master's degree in Physics, Biophysics, Bioengineering or a related field.
- Experience with optical microscopy, image analysis, or computational modeling is preferred.
- Interest in interdisciplinary research combining biology and technology.

How to Apply:

Please submit your application including: 1) a cover letter explaining your motivation and how your background fits the position, 2) a detailed CV including publications and contact information for two referees.

Send your application to ignacio.izeddin@espci.fr and clement.cabriel@espci.fr. Feel free to contact us for more information about the project or the position.

[1] C. Cabriel, T. Monfort, C.G. Specht, and I. Izeddin. Event-based vision sensor for fast and dense single-molecule localization microscopy. *Nat. Photon.* 17, 1105–1113 (2023). <https://doi.org/10.1038/s41566-023-01308-8>

[2] Rose M, Burgess JT, O'Byrne K, Richard DJ, Bolderson E. PARP Inhibitors: Clinical Relevance, Mechanisms of Action and Tumor Resistance. *Front Cell Dev Biol.* 2020 Sep 9;8:564601. doi: 10.3389/fcell.2020.564601. PMID: 33015058; PMCID: PMC7509090.