

Laboratory/Institute: **Institut de Biologie Structurale**
Group: **Dynamop**

Director: **Winfried Weissenhorn**

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Title:

Serial protein crystallography: development of a sample delivery system using the Gas Dynamic Virtual Nozzle (GDVN) technology

Objectives:

The aim of the project is to set up an injection system based on the GDVN technology to deliver a thin jet (diameter ~ few μm) of protein microcrystals suitable for a serial crystallography approach.

Abstract:

The advent of a new generation of X-ray sources called X-ray free electron lasers (XFEL) paved the way in the last decade to new possibilities for structural biology. An approach called serial femtosecond crystallography (SFX) has been developed, where μm -sized protein crystals are intercepted by the bright and short (fs) XFEL pulses. The interaction of an X-ray pulse with a microcrystal produces a diffraction pattern just before the microcrystal is destroyed. A large number of such *diffraction-before-destruction* events produces a dataset which is used to obtain the protein structure. One of the crucial aspects of SFX experiments is the capability of producing a stable thin jet of microcrystals at a reasonably low flow-rate.

In this project, an injection system for SFX applications will be set up based on the GDVN technology. The apparatus will be equipped with a dual-pulse illumination system and a high-speed camera to perform measurements of the jet speed, an essential parameter for realizing time-resolved experiments at high repetition rate.

Up to 3 relevant publications of the team:

- Simple and efficient system for photoconverting light-sensitive proteins in serial crystallography experiments. *J. Appl. Crystallogr.* **50**, 932–939 (2017).
- Chromophore twisting in the excited state of a photoswitchable fluorescent protein captured by time-resolved serial femtosecond crystallography. *Nature Chem.* **10**, 31–37 (2018).
- Light-induced structural changes in a full-length cyanobacterial phytochrome probed by time-resolved X-ray scattering. *Commun Biol* **2**, 1 (2019).

Domains of expertise:

Biophysical chemistry; Experimental condensed matter physics.