

Time-resolved structural dynamics at the ESRF

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One of the five scientific drivers at the ESRF is “Pump-and-probe experiments and time-resolved science” [1]. The ID09 beamline is fully dedicated to this scientific mission and leads time-resolved research at the ESRF. Experiments performed at ID09 span through different scientific domains including chemistry, solid-state physics, soft condensed matter and structural biology [2-6]. Two key characteristics of ID09 are the polychromatic (pink) beam option and the possibility of selecting single (100 ps) X-ray pulses or “macro” pulses of variable duration (300 ns, 1-30 μ s, ≥ 1.5 ms). This allows to investigate phenomena over a wide range of time scales: from ultrafast relaxations in chemical compounds [2] or solid-state samples [4] to slow (up to hundreds of milliseconds) conformational changes of biological macromolecules [5]. In my talk I will briefly present: (a) the current status of the beamline and its expected performances in light of the EBS upgrade, (b) our plans for possible future upgrades, and (c) an overview of the research typically performed at ID09.

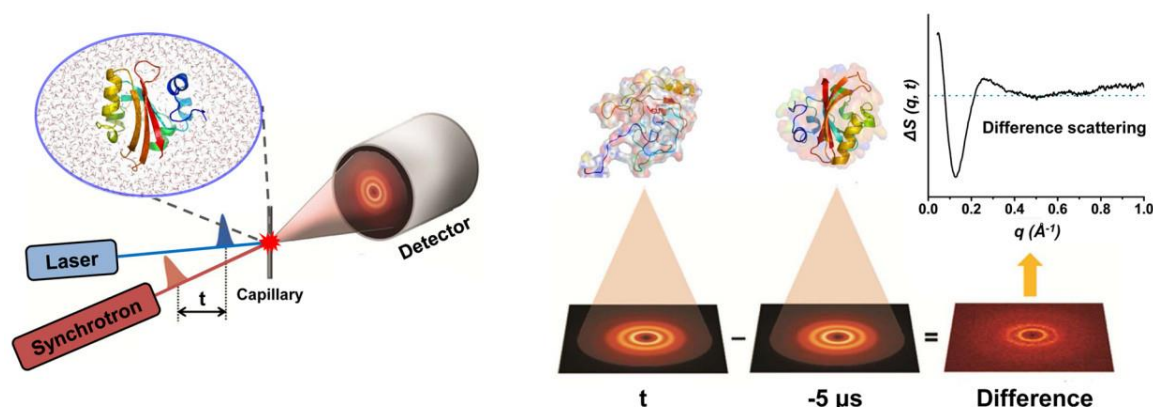


Figure 1: Example of research routinely performed at ID09 - A structural change in a protein solution is triggered by a short (ps) laser pulse and then followed as a function of time (100 ps – 100 ms) with time-resolved X-ray solution scattering (figure adapted from: Kim et al., *Acc. Chem. Res.* 2015).

References

- [1] - ESRF Upgrade Programme Phase II (2015-2019) – White Paper
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- [3] - H.T. Lemke, D.W. Breiby, T. Ejdrup, P. Hammershoj, M. Cammarata, D. Khakhulin et al., *Tuning and tracking of coherent shear waves in molecular films*, *ACS Omega*, 3, 9929-9933 (2018)
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- [5] - I. Josts, S. Niebling, Y. Gao, M. Levantino, H. Tidow, D. Monteiro, *Photocage-initiated time-resolved solution X-ray scattering investigation of protein dimerization*, *IUCrJ*, 5, 667-672 (2018)
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