

Intrinsic solvent response as a tool for alignment and diagnostic for pump-probe X-ray scattering experiments on liquid samples

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X-ray pump / Laser probe experiments provide novel fundamental insight into a number of photo-induced processes. Such pump/probe experiments require reliable tools to ensure spatio-temporal overlap of the incident pulses. The ultra-short X-ray pulses available at X-ray free electron lasers (XFELs) provide access to even higher time-resolution, but also increase the requirements for stability, diagnostics and fast robust methods for achieving the best experimental conditions¹. The development of X-ray/optical arrival time diagnostics² as well as fast online analysis tools³ are crucial for the successful operation of such large scale facilities.

Here we present methods for aligning, diagnosing and optimizing liquid phase pump/probe X-ray scattering experiments. The tools rely on the intrinsic scattering signals associated with the deposit of energy in solvents^{4,5} and therefore, do not require the use of additional targets, detectors or reference compounds. The introduction of such tools has increased the fidelity of the resulting measurements and reduced the time required for alignment and optimization for optical pump / X-ray probe experiments on liquid samples. The continued development of XFEL diagnostics and methods is crucial in the future scientific output and utilisation of the limited availability of such facilities.

References

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