ESRF	**Experiment title:** Optical X-ray pump-probe study of the vibrational and electronic relaxation of I_2 in liquid solvents	**Experiment number:** SC364
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Report:

Our approach **towards** time resolved laser-SR pump-probe experiments at ID09 follows a step-wise **increase** in complexity, which thus allows us to address experimental difficulties in a controlled manner, before we perform the envisioned studies on chemical and biological systems. For measuring time-resolved EXAFS on I_2 at ID09 we have to:

a) perform static EXAFS on optimized I_2 solutions with the standard setup (I_0 and I_t),
b) perform static EXAFS on optimized I_2 solutions with reduced intensity (ca. 10^{-3} smaller via the installed X-ray chopper) and recorded via Lock-In detection using the X-ray chopper frequency (900 Hz) as the Lock-In reference,
c) perform static EXAFS on the diluted system optimized for highest S/N ratio, and recorded via Lock-In detection at 900 Hz,
d) perform a laser-pump SR-probe experiment on the diluted system via Lock-In amplification of the laser-induced X-ray transmission (thus referencing the Lock-In with an additional laser chopper **at** around 100 Hz).

During a 2 day test run in the 32 bunch mode this June we have performed a series of measurements to evaluate the static EXAFS capability of ID09. We have worked with a Si (111) monochromator in Bragg-Bragg configuration in combination with the U46 undulator source in the 30-35 keV region. The first sample was an I_2/benzene solution optimized for the iodine K edge absorption, and two fluorescence diodes were used to detect the incoming and transmitted X-ray intensity. Hereby the X-ray flux was converted to isotropic fluorescence by Nb-foils. With this setup we have gained EXAFS spectra with equal quality to those derived at BM29 (Fig. 1 right).

Our energy resolution has not been determined yet, but inspection of the edge in our spectra and in that of BM29 with a resolution around 1 eV allows us to assume ours to be in the 20-30 eV range, which is sufficient for the EXAFS analysis. A long term drift in photon energy was observed, when keeping the monochromator at a fixed wavelength, but successive spectra nicely reproduced the edge at the same energy, so that averaging several EXAFS spectra is possible.

After this step we introduced the X-ray chopper into the monochromatic beam thus reducing the incoming photon flux by a factor of 1000. The detector signals were fed into the input of two Lock-In amplifiers, which were referenced with the chopper frequency of 900 Hz. The acquired spectrum (Fig. 1 left) already exhibits some EXAFS modulations, but the noise is still too large to clearly resolve these features. However, the weak detector signals were transmitted via 10 m long BNC-cabels, to the Lock-In, which introduces a significant noise-source. This will be solved in the next run. Also the beamline was not tuned to peak performance, but was operated with 10-100 less intensity, which will also be improved. Initial experiments on a highly diluted I_2/CCl_4 (1 : 270) sample clearly resolved the iodine edge. With the optimized concentration (ca. 5 times more concentrated) and increased photon flux we should be able to collect static EXAFS spectra on dilute systems. After this step it seems easy to introduce the laser pump beam and collect our first time-resolved EXAFS spectra.

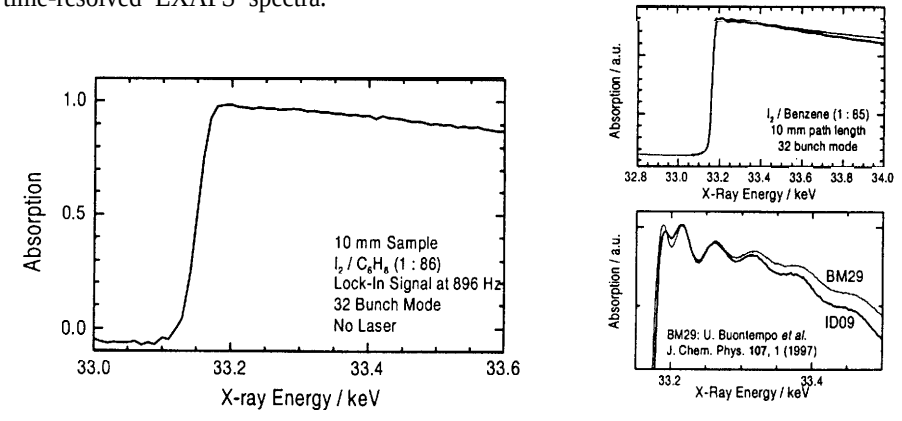

Fig. 1: Static EXAFS spectra on I_2 solution acquired with different methods. Left: With ca. 10^4 times less intensity via Lock-In than Right