Optical spectroscopy: Stimulated Raman Scattering, transient absorption, IR spectroscopy (1 and 2D) and pulse shaping

For the user programme in optical spectroscopy we are presently seeking users to work with on the final instrument commissioning and further methods development of the following systems:

a) *femtosecond Stimulated Raman Scattering.*
   Time frame: Ongoing.
Contact person: Miroslav Kloz, email: Miroslav.Kloz@eli-beams.eu

b) *Transient optical absorption spectroscopy.*
   Time frame: Ongoing
Contact person: Miroslav Kloz, email: Miroslav.Kloz@eli-beams.eu

c) *IR spectroscopy (1 and 2D).*
   Time frame: March 2019
Contact person: Miroslav Kloz, email: Miroslav.Kloz@eli-beams.eu

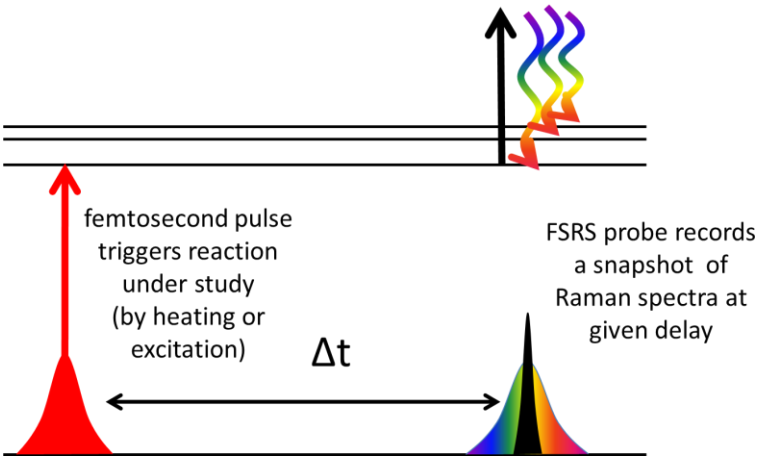
d) *Pulse shaping and coherent control*
   Time frame: Ongoing
Contact person: Miroslav Kloz, email: Miroslav.Kloz@eli-beams.eu

In case you are interested in working with us on the development of further functionalities of the optical spectroscopy stations, or in conducting experiments on the existing set ups, please fill in the application form on the user portal.

Brief description of the available set ups:

-**Femtosecond Stimulated Raman scattering (FSRS)**

Femtosecond stimulated Raman spectroscopy is an experiment that allows monitoring Raman vibration spectra of molecules with sub-ps time resolution. When used with reactions that can be triggered, ideally photo-triggered, it is powerful tool to follow reaction dynamics and structural changes with high time resolution and high acquisition speed.



Stimulated Raman probe:

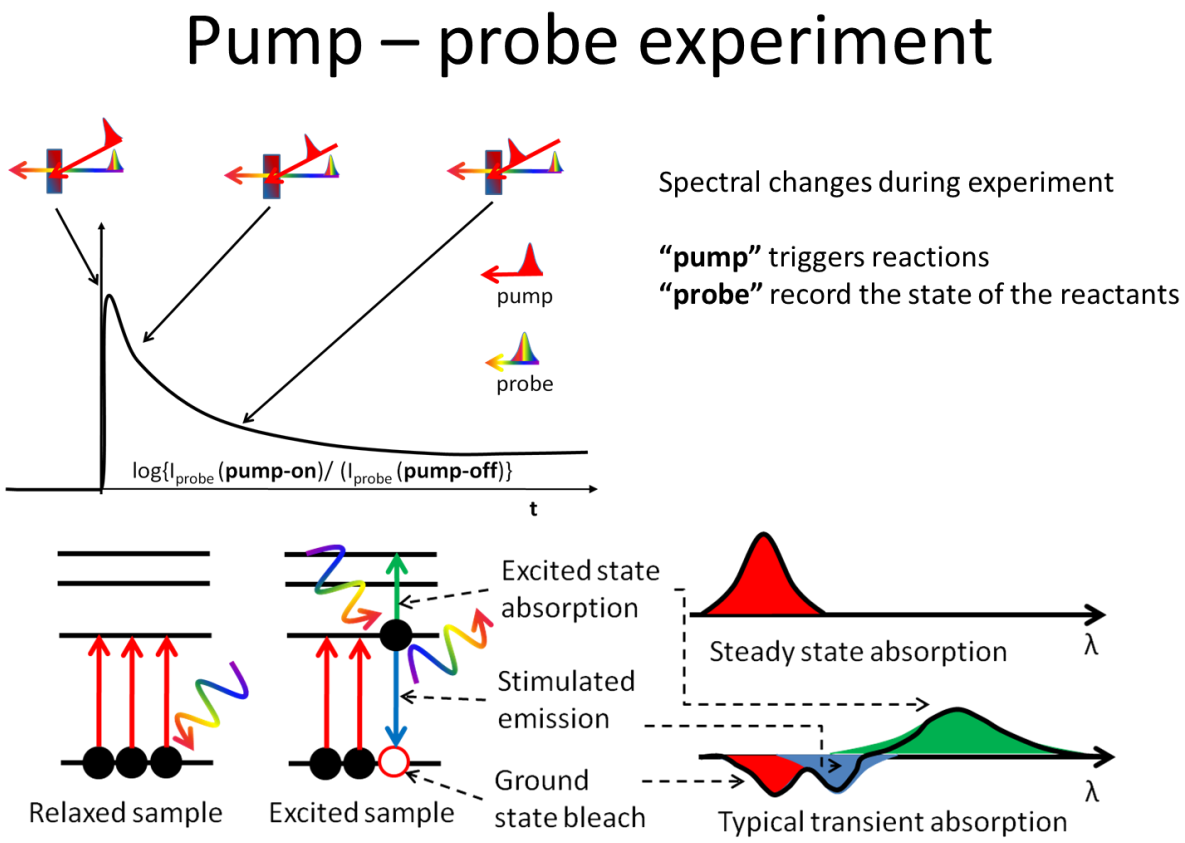
Time resolution	~100fs
Spectral resolution	~1 cm^{-1}
Observed spectral window	30 - 4000 cm^{-1}
Raman pulse wavelength	760-840 nm

Triggering pulse pump:

Time resolutions	~ 30fs
Spectrum	~ 50 nm
Available wavelengths	266 nm, 400 nm, 800 nm (being extended to 230-2600 nm)
Pump-probe delay	0 – 6 ns, 10 fs resolution

-Optical transient absorption

Optical transient absorption is an experiment where changes in the sample absorbance are recorded with high time resolutions. It is very robust technique for characterization of excited and transient states of molecules, atoms and materials.



Probe pulse:

Time resolution	~20fs
Spectral resolution	~1 nm
Observed spectral window	266 – 2500 nm

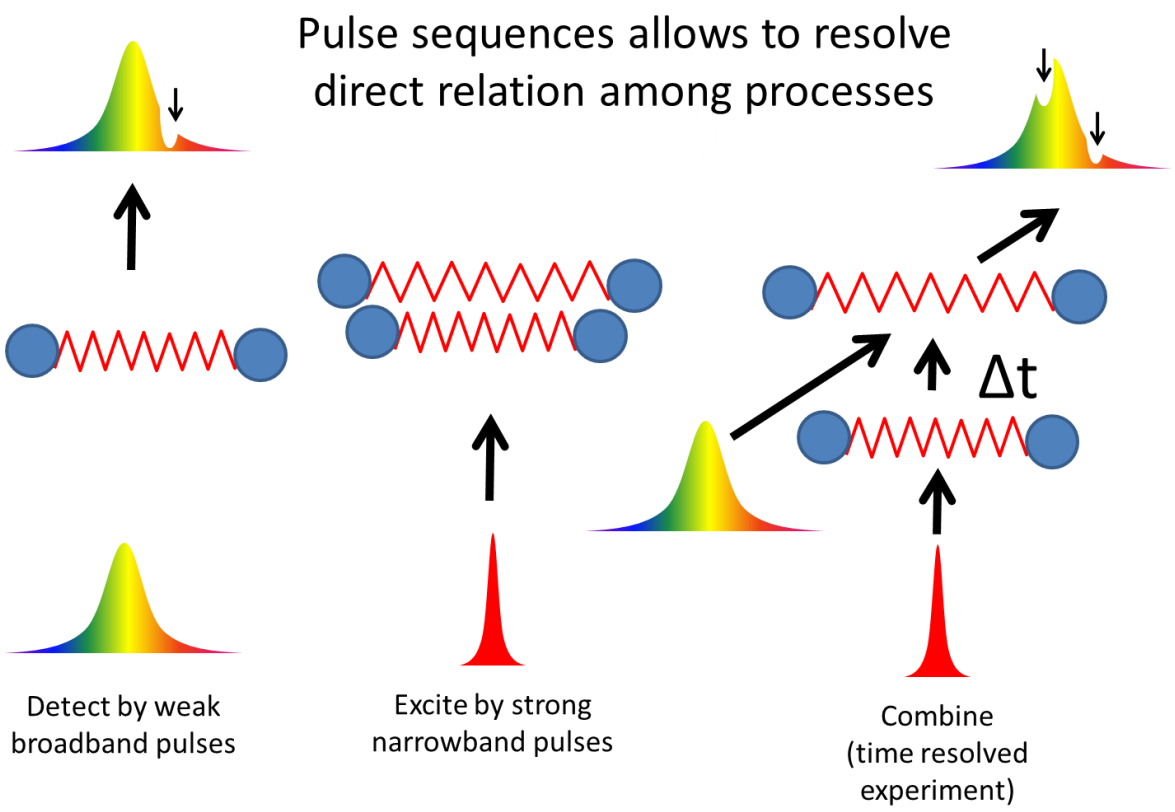
Triggering pulse pump:

Time resolutions	~ 30fs
Spectrum	~ 50 nm
Available wavelengths	266 nm, 400 nm, 800 nm (being extended to 230-2600 nm)
Pump-probe delay	0 – 6 ns, 10 fs resolution

-IR spectroscopy (1 and 2D)

Femtosecond mid IR spectroscopy is a tool for study of bond structure of molecular and solid state systems. Vibrations spectra are recorded with fs time resolutions. That allows following conformational changes such as isomerization, bond braking, bond formation, solvent dynamics etc.…

2D IR spectroscopy is technique for observing cross-talk between individual bonds. Such experiment is analogue of 2D NMR experiments. In the same way it produces data that are more rich in structure-related information, but with possibility to record them with femtosecond time resolution.



Probe pulse:

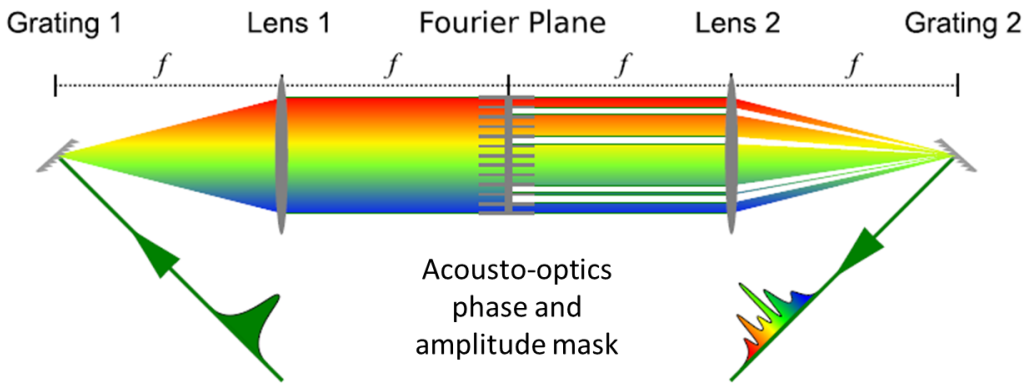
Time resolution	~100fs
Spectral resolution	~0.1 cm^{-1}
Observed spectral window	2600 nm – 10000 nm

Triggering pulse pump:

Time resolutions	~ 30fs
Spectrum	~ 50 nm
Available wavelengths	266 nm, 400 nm, 800 nm (being extended to 230-2600 nm)
Pump-probe delay	0 – 6 ns, 10 fs resolution

-Pulse shaping and coherent control

Pulse shaping is a technique that allows to model spectral and temporal profile of the pulse. This has versatile applications the fields such as multidimensional spectroscopy, coherent control, and spatial and temporal signal encoding atc.



Shaping pulse properties:

Time resolution	~5fs
Spectral resolution	Tunable down to ~0.1 cm^{-1}
Available spectra window	266 nm – 2600 nm
Maximal “pulse shaping generated delay”	10ps

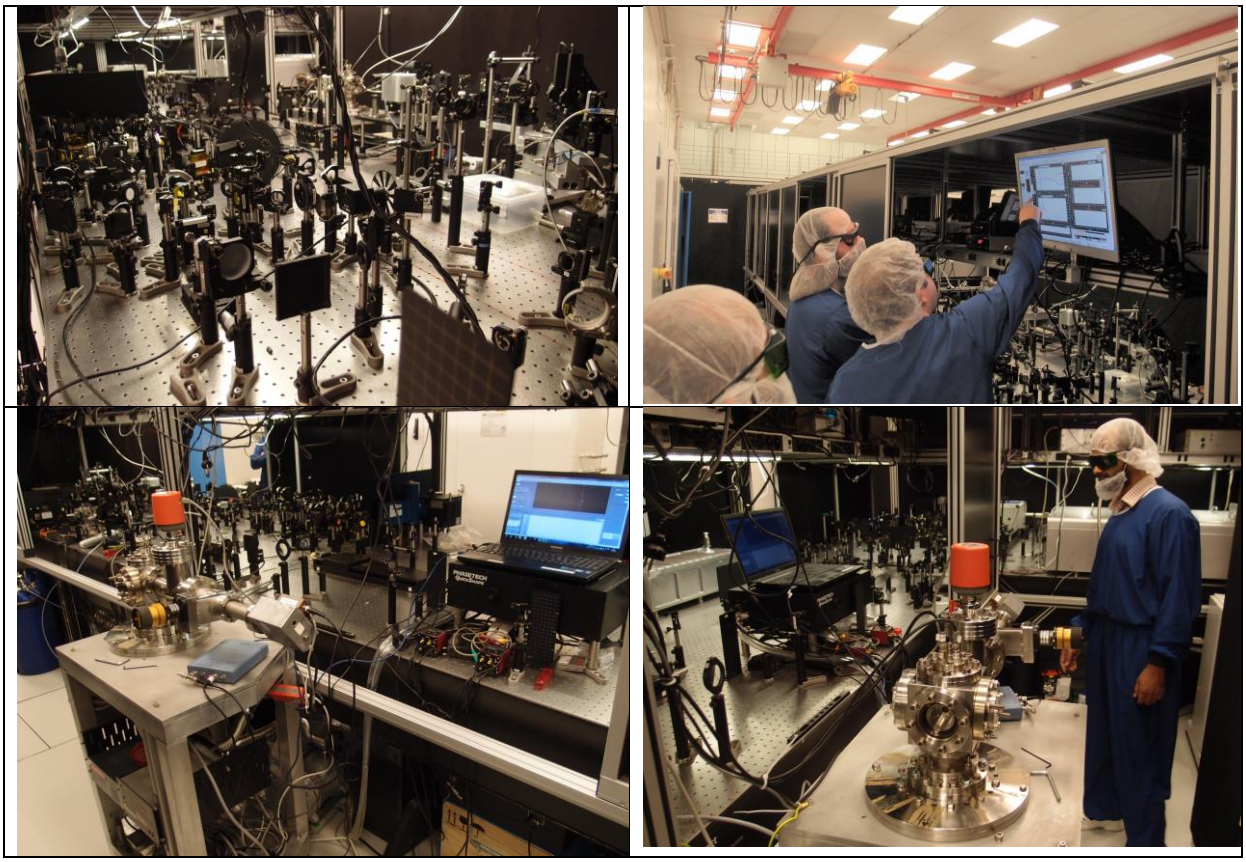


Fig: Top: Set up for fs Stimulated Raman Scattering in operation in the E1 experimental hall. Bottom: Set up for pulse shaping in operation together with a time-of-flight mass spectrometer during a user experiment where the effect of shaped pulses on catalytic reactions were investigated.