TREX: Hard X-ray science, diffraction and scattering, spectroscopy, imaging and pulse radiolysis

For the user programme in hard X-ray science we are presently seeking users to work with us on instrument commissioning and further methods development of the following systems:

a) *X-ray diffraction and/or scattering experiments in the field of protein crystallography using the complementary sealed tube X-ray source.*
Time frame: Ongoing.
Contact person: Borislav Angelov, email: Borislav.Angelov@eli-beams.eu

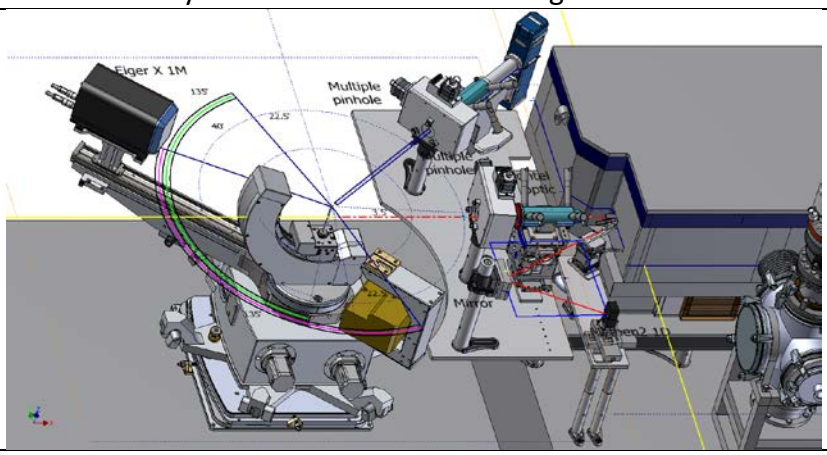
b) *X-ray diffraction and/or scattering experiments in the field of material science, using the complementary sealed tube X-ray source.*
Time frame: Quarter 2 2019.
Contact person: Borislav Angelov, email: Borislav.Angelov@eli-beams.eu

In case you are interested in working with us on the development of further functionalities on the hard X-ray instruments, please fill in the application form on the user portal.

Brief description of the available set up:

The X-ray diffractometer is based on a custom modification of a commercial STOE STADIVARI goniometer. It has the same functionality as the commercial analog plus in addition an extended range for the detector movement going up to 400 mm sample to detector distance. The main module of the diffractometer is the so called Euler cradle goniometer, which is capable of simultaneously rotating the investigated sample at 360 degree and at the same time to position the X-ray detector at desired angle and distance from the sample. It comes with a computer controlled video microscope and dimmable led light. The cryo cooling for the fragile biological sample is implemented via a commercial cryo stream cooler from Oxford Cryosystems. The recording of the diffracted and scattered X-ray photons is accomplished by a single photon counting hybrid pixel detector model Eiger X 1M from Dectris company. Another module is the X-ray microfocus sealed tube with Montel optics and JJ X-ray pinhole collimation.

The instrument for hard X-ray science is outlined in the figure below.



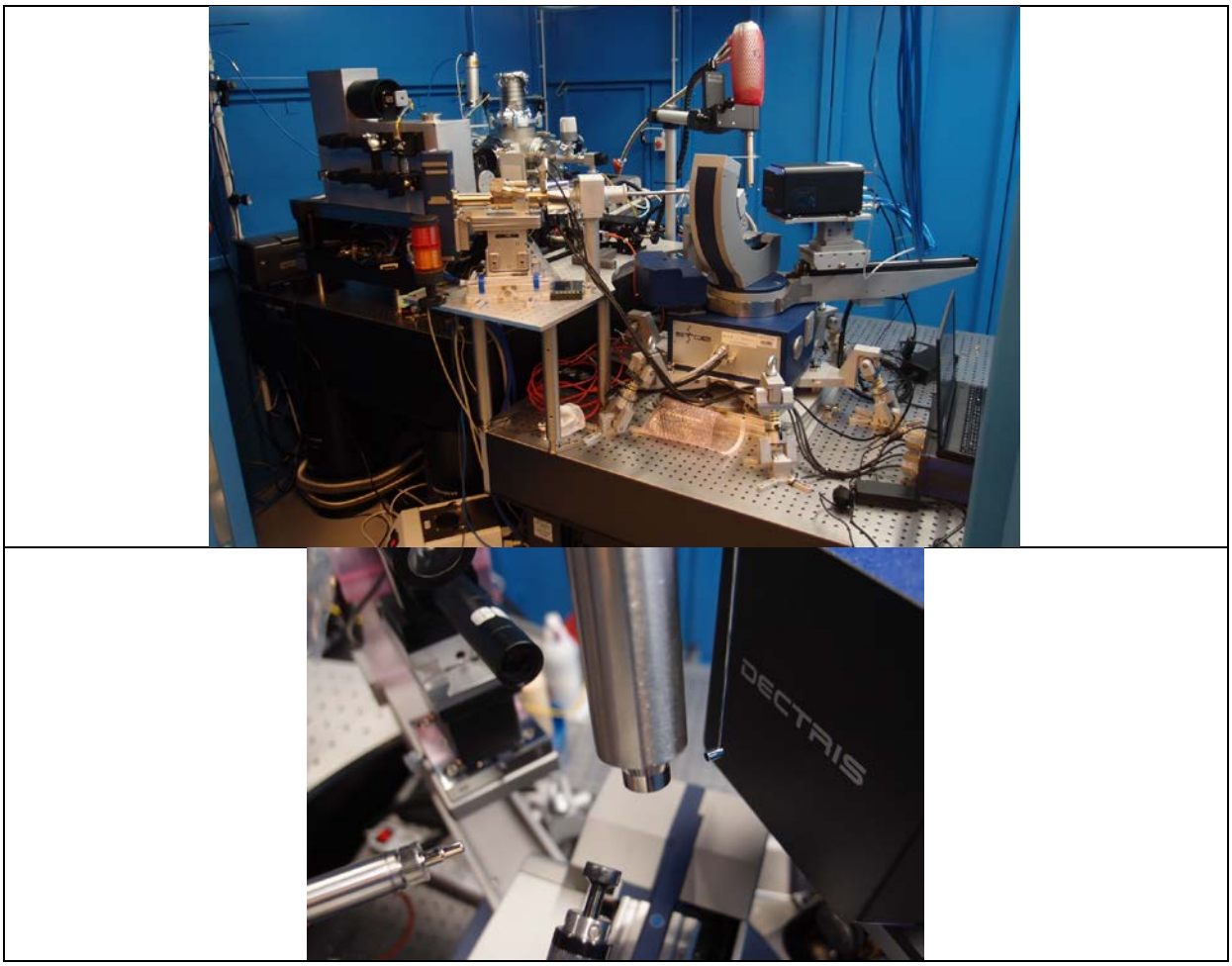


Fig. Top: Hard X-ray experimental station as designed, including the laser driven Plasma X-ray source, a complementary sealed tube Cu-anode X-ray source, diffractometer and von Hamos spectrometer for absorption spectroscopy. Middle: Diffraction station as built (presently available for users with the complementary sealed tube X-ray source). Bottom: detail of the diffractometer sample environment when optimized for protein crystallography with the cryostream cryocooler.

Technical Data

Sealed tube X-ray beam parameters	
Flux on the sample	10^8 ph/sec
Beam size	145 micrometers
Beam divergence	4.8 mrad
Beam polarization	40%
Wavelength	CuKa 1.54 Angstroms
Detector parameters	
Pixel size [µm2]	75 x 75
Sensitive area (width x height) [mm2]	77.2 x 79.9
Total number of pixels	1030 x 1065 = 1,096,950
Maximum frame rate [Hz]	3000

Frame dead time	3 µs
Point-spread function	1 pixel
Sensor thickness [µm]	450
Threshold energy [keV]	2.7-18
Maximum count rate [phts/s/mm2]	5x10^8
Counter bit depth [bit]	12
Image bit depth [bit]	16 or 32
Photon processing time per pixel	180 ns
Data format	HDF5
Sample to detector distance	40-400 mm