Higher Harmonics Generation (HHG), brief description and expected parameters of the HHG source

HHG Beamline

High-order harmonic generation in noble gas is employed to produce a stable source of coherent femtosecond pulses in the XUV spectral range. For call1 the source is set to a 5 m focal length and is prepared to run with a number of different gases, in particular Ar, Ne, Kr and He with conversion efficiencies up to >5*10^-6. The XUV beamline is equipped with a set of diagnostics including a Flat field XUV spectrometer, an XUV diode and a wavefront sensor for characterization of the beam provided to the end-station.

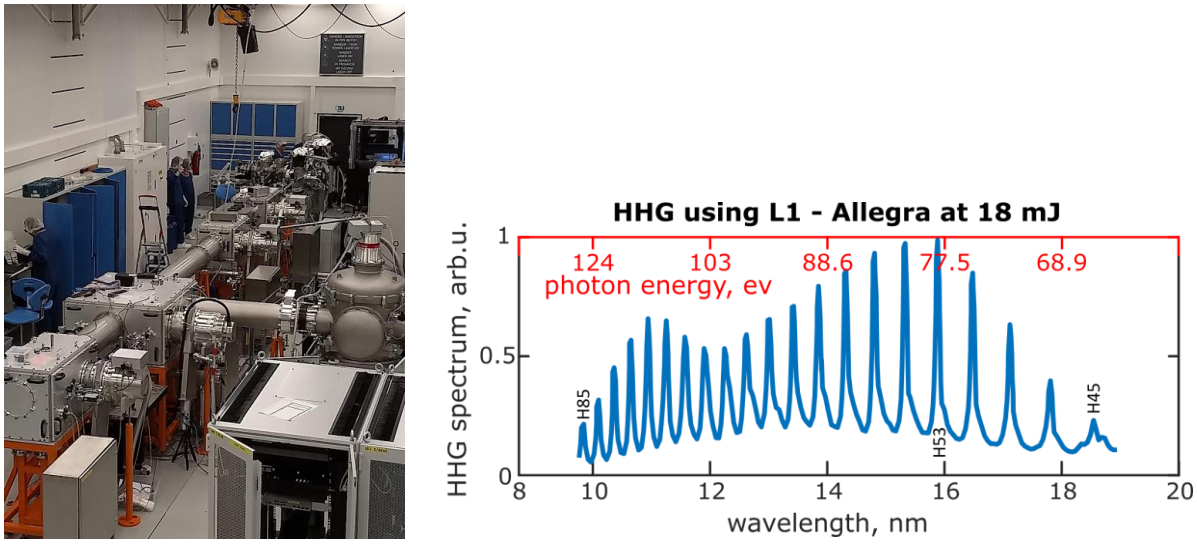

Fig 1: Left: Picture of the ELI Beamlines HHG source. Right: Harmonics generated by L1 ALLEGRA in the E1 HHG source (neon cell at 80 mbar).

XUV Monochromator and focusing

For the call 1 experiments the HHG beamline is equipped with a grating monochromator. This, in general, has an energy resolution of < 1 eV, sufficient to separate adjacent harmonics in its main region of operations (10 to 120 eV).

Tab. 2: XUV monochromator properties

Pulse duration after monochromator (simulated)	**Grating (lines/mm)/spectral region (eV)**	**Throughput**	**Refocusing**
35 to 100 fs	Flat mirror G1 (86) / 10-28 G2 (158) / 25-54 G3 (600) / 51-98 G4 (985) / 86-121	>30% between 15th and 29th harmonic	5:1 ellipsoidal mirror

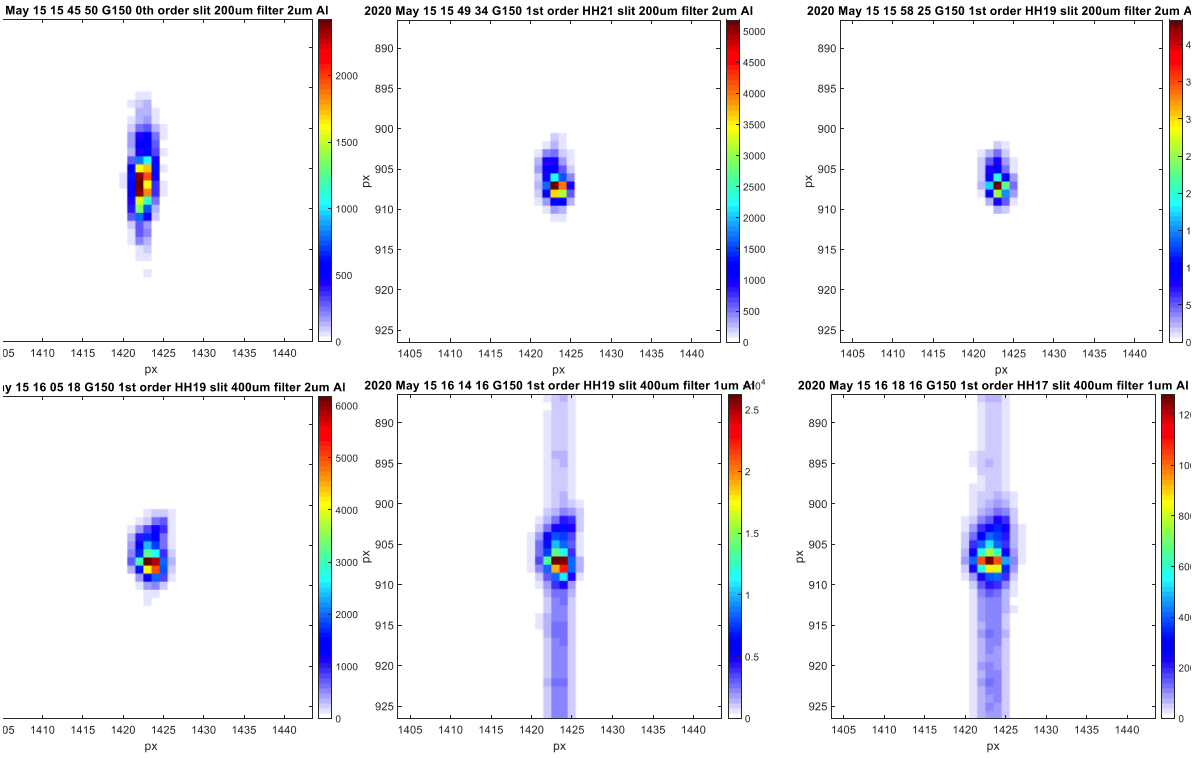

Fig. 2: Focusing of HH 17 to 21 after monochromator, using grating G150 and exit slits of 200 and 400 um. Focus imaged on a PI MTE CCD with 13.5 um pixel size.

The HHG source and monochromator are described in more detail in references [1] and [2].

References

[1] High-flux source of coherent XUV pulses for user applications
O. Hort, et al., Optics express 27 (6), 8871-8883 (2019)
[2] Single-grating monochromator for extreme-ultraviolet ultrashort pulses
F. Frassetto, et al., Opt. Express 19, 19169 (2011)