FIRST LASING OF FERMI FEL-2

E. Allaria[1], D. Castronovo[1], P. Cinquegrana[1], M.B. Danailov[1], G. D'Auria[1], A. Demidovich[1], S. Di Mitri[1], B. Diviacco[1], W.M. Fawley[1], M. Ferianis[1], L. Froehlich[1], G. Gaio[1], R. Ivanov[1], N. Mahne[1], I. Nikolov[1], G. Penco[1], L. Raimondi[1], C. Serpico[1], P. Sigalotti[1], C. Spezzani[1], M. Svandrlik[1], C. Svetina[1], M. Trovo[1], M. Veronese[1], D. Zangrando[1], Benoît Mahieu[1,2], M. Dal Forno[3,1], L. Giannessi[4,1*], M. Zangrando[5,1], G. De Ninno [7,1], E. Ferrari[8,1], F. Parmigiani[8,1], D. Gauthier [7]

[1]Elettra-Sincrotrone Trieste S.C.p.A., Basovizza, Italy
[2]CEA/DSM/DRECAM/SPAM, Gif-sur-Yvette, France
[3]DEEI, Trieste, Italy
[4]ENEA C.R. Frascati, Frascati (Roma), Italy
[5]IOM-CNR, Trieste, Italy
[6]PSI, Villigen, Switzerland
[7]University of Nova Gorica, Nova Gorica, Slovenia
[8]Università degli Studi di Trieste, Trieste, Italy

Abstract

The FERMI@Elettra seeded Free Electron Laser (FEL) is based on two separate FEL lines, FEL-1 and FEL-2. FEL-1 is a single stage cascaded FEL delivering light in the 65-20nm wavelength range, while FEL-2 is a double stage cascaded FEL where the additional stage extends the frequency up-conversion process to the spectral range of 20-4nm.

The FEL-1 beam line has been in operation since the end of 2010, with user experiments carried on in 2011-2013 and user beam time allocated until the first half of 2014. Fermi FEL-2 is a seeded FEL operating with a double stage cascade in the "fresh bunch injection" mode [1]. The two stages are two high gain harmonic generation FELs where the first stage is seeded by the 3rd harmonic of a Ti:Sa laser system, which is up converted to the 4th-12th harmonic. The output of the first stage is then used to seed the second stage. A final wavelength of 10.8 nm was obtained (the 24th harmonic of the seed wavelength) during the first commissioning in October 2012. The experiment demonstrated that the FEL is capable of producing single mode narrow bandwidth pulses with energy of several tens of microjoules. The commissioning of FEL-2 continued in March and June 2013, where the wavelength of operation was extended down to 4nm and below, demonstrating that an externally seeded FEL is capable of reaching the soft X-ray range of the spectrum.

*Corresponding author: luca.giannessi@elettra.eu. This work has been supported in part by the Italian Ministry of University and Research under grants FIRB-RBAP045JF2 and FIRB-RBAP06AWK3

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We have addressed the FERMI FEL-2 First lasing experience elsewhere in these proceedings. We address therefore the reader to Ref. [2-4] for a general overview of FERMI, and to Ref. [5, 6] for a detailed description of FEL-2 first lasing details.

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