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## **Conversion to EEHG of the FEL-1 line at FERMI: commissioning results and first experience with user's operations**

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The conversion of the FERMI FEL-1 line to Echo Enabled Harmonic Generation (EEHG) has been successfully completed, and the new scheme is currently undergoing commissioning and testing for user operation. This achievement marks a significant milestone in the facility's upgrade process, aimed at extending the covered spectral range to include the entire water window and beyond. Thanks to this upgrade, the FEL-1 line can now deliver fully coherent ultra-short pulses with gigawatt power levels down to a wavelength of 10 nm. This enhancement is accompanied by improvements in spectral quality and stability, characteristics unique to the EEHG process.

The updated FERMI FEL-1 is the first user facility operating in the spectral range of 20-10 nm utilizing the EEHG scheme. It will also serve as an ideal test bench for conducting new machine studies in anticipation of future developments. In this report, we present the results obtained during the commissioning phase and the initial user experiments.

### **Footnotes**

### **Funding Agency**

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