Operation of the COXINEL line at HZDR

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The COXINEL line enables to control, transport and manipulate a highly divergent electron beam generated from laser plasma accelerator (LPA). The beamline consists of high gradient permanent magnet-based quadrupoles to mitigate the emittance growth, a chicane to reduce the slice energy spread and a set of quadrupoles before the undulator for chromatic matching. In combination with the HZDR DRACO 100 TW ultra-short pulse laser capable of producing high quality electron beams with 0.7 mrad divergence, around 5% energy spread and 5 pC/MeV charge density, free electron laser (FEL) has been successively achieved in the seeded configuration [1]. We report here on the electron beam transport methods and optimization with the use of five imaging systems installed along the line, a UV spectrometer to characterize undulator radiation by measuring the spatio-spectral distribution, alongside other diagnostics such as ICT, streak camera and UV camera, that enabled for FEL amplification.

References

[1] M. Labat, J.P. Couperus Cabadağ, A. Ghaith, A. Irman, et al. "Seeded free-electron laser drive by a compact laser plasma accelerator" Nature Photonics (2022), https://doi.org/10.1038/s41566-022-01104-w