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The SXL project: Towards a sub-fs soft X-ray FEL at MAX IV

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The SXL project gathered the needs of a broad science case coming mainly from Swedish users and aims to build a soft X-ray FEL targeting the range from 5 to 1 nm. Given the energy (3 GeV) of the already existing linac at the MAX IV laboratory, which serves as injector for two storage rings and the short pulse facility, it was proposed to work on a conceptual design that builds-up on that. Short electron bunches needed to drive the FEL process can be obtained by tuning the two double-achromat bunch compressors and even shorter (sub-fs) are foreseen with low charge operation of the photocathode gun. Two color two pulses modes are foreseen with the split undulator scheme, in which a big chicane can control the delay between the two pulses/colors. The current design relies also on very compact undulators that allow variable polarization. Although already equipped with the basic features to drive an FEL in the soft X-ray range, some developments and improvements are needed to reach the desired performance, both in terms of additional diagnostics and further advanced operation schemes. In particular, contrary to conventional chicanes compressors, the double-achromat system impinges the longitudinal phase space with an energy chirp and with a strongly not flat current profile. Current studies are aiming for manipulating the longitudinal phase space in order to accommodate other FEL schemes than SASE (fresh slice, chic, echo, seeding).

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