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A Bi-Periodic Undulator for SOLEIL II: The Prototype and the First Beam Tests at SOLEIL

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The recent improvements in the field of synchrotron light sources push the limits of brightness and pave the way for new scientific research. The upgrade of Synchrotron SOLEIL, called SOLEIL II, aims at optimizing photon production by reducing the natural horizontal emittance of the electron beam to less than 100 pm.rad, compared to 3.9 nm.rad currently. However, the new lattice [1] imposes a 30% reduction in the space reserved for some insertion devices. SOLEIL is presently looking for technical solutions such as compact radiation sources to take into account this space constraint.

An innovative device called "bi-periodic undulator" [2] is studied at SOLEIL. It is a compact device with special magnet arrangement, made of a vertical superimposition of magnet that permits changing the period of the magnetic field [3]. The magnetic period can be changed by its triple value using longitudinal shifting of the magnetic system. Such a capability makes possible the spectral range extension of the undulator by changing the operating mode and permits replacing two juxtaposed undulators by only one insertion device.

We will report on the design, the results of simulation of the magnetic performance, the impacts on beam dynamics and the expected emitted radiation. The construction of the bi-periodic undulator prototype will also be detailed, as well as its magnetic characterization, the applied correction methods and its limits. The installation on the present storage ring and the results from the first beam tests will be presented.

[1] A. Loulergue et al., "TDR baseline lattice for the upgrade of SOLEIL", in Proc. IPAC'22, Bangkok, Thailand, Jun. 2022. doi:10.18429/JACoW-IPAC2022-TUPOMS004

[2] O. Marcouille, A. Mary, M.-E. Couprie, and K. Tavakoli, Onduleur bi-périodique, dispositif, installation et procédé associé, Patent no. FR3125670. https://patents.google.com/patent/FR3125670A1/

[3] A. Potet et al., « bi-périodic undulator : innovative insertion device for SOLEIL II », in Proc. FLS2023, Luzern, Switzerland, Aug 2023. doi:10.18429/JACoW-FLS2023-TH1D4

I plan to submit also conference proceedings

No

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