Big Science Business Forum 2024
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1 – 4 OCTOBER 2024

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Construction of a short period cryogenic permanent magnet undulator CPMU12

In the framework of the LEAPS-INNOV project, this development aims to push the limits of current insertion device (ID) technology for the benefit of synchrotrons and free electron lasers.

To explore the behavior of short period undulators with unprecedented combinations of short periods and high magnetic fields, a cryogenic permanent magnet undulator (CPMU) has been designed. This innovative CPMU with a 12 mm-period is under construction at SOLEIL.

The CPMU design has been advanced to a more mature stage with respect to conventional CPMUs, addressing the challenges associated with such a short period while proposing strategies to enhance the magnetic field. The improvements over more conventional CPMUs have been thoroughly assessed. This includes optimizing the magnetic materials and cooling techniques to achieve higher performance and reliability.

The project's focus on short period undulators is driven by the need for higher brilliance and more compact radiation sources. By reducing the period length and increasing the magnetic field strength, the CPMU can generate higher harmonics, which are essential for various scientific applications, including materials science, biology, and chemistry.

Short period undulator also means an increased number of periods for the same undulator length. The second objective of this project is to industrialize the way to build and optimize insertion devices to be more efficient. To fulfill this objective, a robotic arm is employed, and the mechanical design of the modules has been adapted to benefit from this arm. Two dedicated tools have been developed to be embedded on the robot.

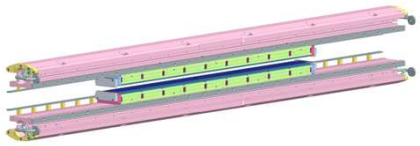
The first tool consists in 4 laser sensors and a screwdriver. The sensors are used to measure the altitude of the two magnets surrounding a pole. The screwdriver then adjust the screw so that the pole reaches the same altitude as the magnets. Measurements have shown that poles can be adjusted within 5 µm and that there is a very good agreement with a Leica 3D arm and standard dial gauges.

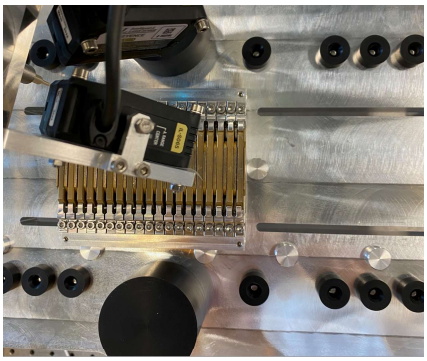
The second tool consists in a Senis Hall probe that scans the module to measure the magnetic field profiles on the fly. After analysis of the measured data, the first tool is used again to adjust the poles altitude so that, phase errors can be reduced.

The prototype's delivery marks a significant milestone in the LEAPS-INNOV project, paving the way for future enhancements and applications in advanced synchrotron light sources.

In conclusion, the development of the CPMU within the LEAPS-INNOV project represents a significant leap forward in ID technology, offering new possibilities for synchrotron and free electron laser facilities. This achievement underscores the importance of international collaboration and continuous innovation in pushing the boundaries of scientific research and technology.

This project has received funding from the European Union´s Horizon 2020 research and in novation programme under grant agreement No. 101004728.





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