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A cryogenic undulator for a laser-plasma driven FEL experiment

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Laser-plasma accelerators are promising candidates to drive a next generation of compact FELs. The LUX plasma accelerator, developed and operated in a collaboration of Hamburg University and DESY, recently demonstrated the generation of spontaneous undulator radiation from a laser-plasma electron beam. A future upgrade of the beamline, currently under commissioning, will include the cryogenic FEL-ready undulator FROSTY to demonstrate first FEL gain from laser-plasma electron beams following the decompression scheme. By pushing the tolerances of the mechanical components to its limits, developing new magnetic alloys which unfold their full potential within cryogenic temperatures, and fulfilling the requirements of the high vacuum standard specified at DESY, we are currently commissioning an undulator with 15 mm period length and a peak field of 2.2 T. Our calculations show, that this undulator will support the demonstration of FEL gain from a plasma-accelerator using electron beams available in the lab already today. Here, we will present the design, manufacturing and the current commissioning status of the FEL undulator.

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