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Development of short period High field cryogenic undulator at SOLEIL

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Short period high field undulators are required for compact Free Electron Lasers. Permanent magnet based hybrid undulators, well understood from a technological point of view, are still very competing when temperature is decreased, enabling both the coercivity and the remanence to be enhanced. At SOLEIL, the used PrFeB magnets enable to avoid the spin transition reorientation phenomenon occurring with NdFeB magnets enabling to cool down directly at 77 K. A 2 m long cryogenic undulator of period 18 mm was first built in house, with a specific Hall probe bench directly installed in the final vacuum chamber. This first cryogenic undulator is in operation on the storage ring since three years. A second U18 cryo-ready undulator using a slightly different magnet grade with a higher coercivity and modules with magnets surrounded by two half poles for easier swapping is under construction. A third 3 m long cryo-ready undulator U15 with a period of 15 mm is under development. It will be first used for the LUNEX5 FEL project (COXINEL demonstration of FEL amplification with a laser wakefield acceleration).

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