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Superconducting Undulators

For more than 5 years, superconducting undulators (SCUs) using NbTi as conductor have been successfully delivering X-rays in storage rings. The European X-Ray Free-Electron Laser Facility (XFEL) plans to demonstrate the operation of SCUs in X-ray free-electron lasers (FELs). For the same geometry, SCUs can reach a higher peak field on the axis with respect to all other available technologies, offering a larger photon energy tunability range. To improve the undulator's performance (peak field for the same geometry), Nb3Sn or HTS materials like rare earth barium copper oxide (ReBCO) instead of NbTi superconductors can be utilized. These materials have higher irreversibility fields, critical temperatures, and critical current densities. The field quality of an SCU is strongly determined by the mechanical accuracies reached. Although Nb3Sn requires heat treatment, which reduces the reachable mechanical accuracies, this is not the case for ReBCO tapes, making them a good candidate for undulator applications. HTS magnets are receiving a lot of interest from many laboratories in the US, Asia. and Europe, which are planning different programs to advance this technology.

For the period in which the student will be at European XFEL we plan to start to optimize the geometry of a planar HTS undulator with magnetic simulations, studies of joints and windings.

Group

XFEL

Special Qualifications

Project Category

A4. Development of experimental techniques

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