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Design study of a compact superconducting undulator based on laser-structured HTS tapes

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Undulators are X-ray sources which are widely used in synchrotron storage rings or in future light sources such as free-electron lasers. Due to sustainability and energy efficiency the development envisages small-scale high-field and compact undulators with short period lengths (<10 mm) and narrow magnetic gaps (<4 mm). Therefore, high-temperature superconducting (HTS) tapes, which can provide both large critical current densities and high critical magnetic fields, are widely used and investigated at KIT. A new concept of superconducting undulators (SCUs) was introduced and further developed by laser-scribing a meander pattern into the superconducting layer to achieve quasi-sinusoidal current path through the tape.

In this contribution, we present our results from the design study in respect of the cooling concept for a compact SCU. The foreseen cooling is based on the one hand on calculations of the different heat loads through synchrotron radiation, impedance, and current supplies and on the other hand on the design of the liner including the tapering.

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Primary author: Dr KRASCH, Bennet (Karlsruhe Institute of Technology)

Co-authors: ABUSAIF, Falastine (Karlsruhe Institute of Technology);   GRAU, Andreas (Karlsruhe Institute of Technology);   GLAMANN, Nicole (Karlsruhe Institute of Technology);   NAST, Rainer (Karlsruhe Institute of Technology);   SAEZ DE JAUREGUI, David (Karlsruhe Institute of Technology)

Presenter: GRAU, Andreas (Karlsruhe Institute of Technology)

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