

## Design of Nb<sub>3</sub>Sn Wiggler Magnets for the Compact Linear Collider and Manufacturing of a Five-Coil Prototype

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**Abstract** — To achieve the luminosity requirements of CLIC at the collision point, damping rings equipped with superconducting wiggler magnets should be used to produce ultra-low emittance with high bunch charge. Although Nb-Ti wigglers meet the specifications for CLIC damping rings, the more challenging Nb<sub>3</sub>Sn technology could be used to increase the magnetic flux density amplitude in the gap and reduce the total length of wigglers in the damping rings. To test the Nb<sub>3</sub>Sn technology, a small wiggler prototype is under design and will be built and tested at CERN. Magnetic calculations concerning the selection of the main wiggler's parameters are presented in this paper, which include the optimization of the main coils dimensions and the period length in order to fulfil the normalized emittance and Intra-Beam Scattering effect constraints while decreasing the amount of wigglers in the damping rings. Another advantage of using Nb<sub>3</sub>Sn instead of Nb-Ti as superconducting material is the possibility of increasing the working margin. Several scenarios well suited for CLIC damping wigglers in which the working point is less than 80% of the magnet's current limit, are addressed in this work. In addition, the description of the manufacturing process and the current status of the Nb<sub>3</sub>Sn prototype fabrication are presented.

**Keywords (Index Terms)** — Wiggler, wiggler magnet, Nb-Ti wiggler magnet, Nb<sub>3</sub>Sn wiggler magnet.