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Wed-Af-Po3.16-12 [29]: Magnetic and thermomechanical study of a variable gap superconducting undulator

Wednesday 25 September 2019 14:00 (2 hours)

A 3D thermo-magneto-mechanical study of a variable gap, 14 mm - 10 period superconducting undulator has been conducted based on a preliminary magnetic design carried out in RADIA. The choice of the conductor is made on the basis of a safe operating margin of the superconducting winding. This margin is determined via a coupled thermal, magnetic and mechanical analysis. Thus, the studies include the impact of the Lorentz forces and the heat input from the electron beam during energization and nominal operation of the undulator as well as the minimum pre-loading of the coils to achieve a tolerable peak stress on the conductor to achieve 1 T on axis at a variable gap ranging from 5 mm to 11 mm. To account for the thermo-mechanical effects on the winding, a refined study coupling thermal and mechanical models relying on contact elements has been implemented to get a more accurate response of the system under load. Those contacts elements model the contact between the coils and the carbon steel core making the two poles of the undulator.

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