Cool-down and warm-up studies of a FCC sector

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The development of FCC poses great challenges in cryogenic process equipment and to future cryogenic facilities. Specifically, as compared to the Large Hadron Collider (LHC), cooling a magnet lattice of about 186000 tons over an equivalent period of time, requires three times of the current available cooling power. Hence, exploring the potential impact of the cooling power on the cooling and warmup timescales of a FCC sector is of utmost importance.

A mathematical formulation based on the preliminary magnet design was used to estimate the cooldown and warmup timescales of the arrangement of quadrupole and dipole magnets that occurs periodically along the magnetic lattice, i.e. magnet string. The results show: 1) it is possible to cooldown a FCC sector within 11.9 days in normal operation and, 2) warmup a FCC sector in about 12.1 days. Additionally, for a cooling power of 2.5 MW, the nitrogen quantity needed is of about 60 Ml (equivalent to 6 CERN Globes). The results give a relevant input for simplification of the future cryogenic facilities and, respective, modular cryogenic distribution line elements.

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