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Outcome of the engineering studies for the FCC-hh cryoplants

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Based on preliminary design works from research institutes, engineering studies were performed by the world-leader industries, Linde and Air Liquide, to assess the conceptual design for the FCC-hh cryoplants with industrial solutions and/or innovative technologies. For such high performance hadron collider, the cryogenic system has to distribute very large cooling capacities all along the 100-km tunnel for the 16T superconducting magnets continuously cooled at 1.9 K and for the beam screens operated between 40 and 60 K. The required total cooling power will be produced in 10 refrigeration plants with a unit equivalent capacity of 100 kW at 4.5 K, up to 4 times larger than the present state-of-the-art. Half of the entropic refrigeration load is due to the synchrotron radiation produced by the high-energy proton beams and deposited on beam screens actively cooled around 50 K. This non-conventional thermal load distribution is an additional challenge for the FCC-hh cryogenic system. Furthermore the cryogenic system has also to cool down the cold mass of the FCC-hh machine in less than 20 days with controlled thermal gradients in the cryo-magnets and beam screens. The presentation presents the main outcome of the engineering studies performed by Linde and Air Liquide to develop reliable and efficient FCC cryogenic systems.

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