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Neon Helium Mixtures as a Refrigerant for the FCC Beam Screen Cooling: Comparison of Cycle Design Options

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In the course of the studies for the next generation particle accelerators, in this case the FCC-hh, different aspects are being investigated. One of these is the heat load on the beam tube, which results mainly from the synchrotron radiation. In case of the FCC-hh, a heat load of 500 kW is expected. The heat has to be absorbed at 40 to 60 K due to vacuum restrictions. In this range, refrigeration is possible with both helium and neon. Our investigations are focused on a mixed refrigerant of these two components, which combines the advantages of both. Especially promising is the possible substitution of the oil flooded screw compressors by more efficient turbo compressors. This paper investigates different flow schemes and mixtures compositions with respect to complexity and efficiency. Furthermore, thermodynamic aspects, e.g. whether to use cold or warm secondary cycle compressors are discussed.

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