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## **C3Or4C-05: Cryogenic Distribution System for Polish Free Electron Laser Facility**

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Polish Free Electron Laser facility (PolFEL), presently under construction at National Center for Nuclear Research in Warsaw will consist of electron gun and four cryomodules each housing two 9-cell superconducting TESLA RF cavities. The cryomodules comprising the cavities will be supplied with superfluid helium at 2 K. Other PolFEL cooling power requirements result from the demand of the power couplers for the accelerating cryomodules (5K) and thermal shields (40 K –80 K). The machine will make use of several helium thermodynamic states like two-phase superfluid HeII, supercritical helium and low pressure helium vapors supplied to cold compressors. Cryogenic Distribution System (CDS) will provide supercritical helium to the valve-boxes where thermodynamic processing of the helium to superfluid state will take place. The paper presents the CDS architecture and discusses the possible design options like methods of the power couplers cooling, optional use and location of cold compressors. The second law of thermodynamics has been used for the optimization of the CDS configuration. Generalized approach to the design of helium distribution systems, taking into account thermomechanical aspects and the consequences of the second law of thermodynamics, is presented.

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