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Overview and status of the cryogenic system for SHINE accelerators

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The Shanghai high repetition rate x-ray free electron laser (XFEL) and extreme light facility (SHINE), a quasi-continuous wave hard XFEL facility, is currently under construction. The superconducting accelerators of SHINE require cryogenic cooling at 2 K for cavities, 5 K for cold interception, and 40 K for thermal shields, respectively. In this paper we present the overview and recent progress of the SHINE cryogenics system that mainly consists of the cryoplant generating the cooling power, the cryogenic distribution system that delivers the cryogen to the accelerators, and the utility system to serve liquid nitrogen together with the helium management. With considerable safety margins, three sets of large helium cryoplants are being built in two cryo-stations at the front and end of the SHINE accelerators, respectively. Each cryoplant could provide a cooling power of 4 kW at 2 K. Up to now, all the equipment belonging to the three cryoplants has been installed. The warm compressor station, 4.5 K cold box, 2 K cold box, and the interconnecting cryogenic transfer line in between for the first set of cryoplant are being commissioned and are likely to reach the nominal performance in the coming months. This progress improves the cryogenic capability of the SHINE facility and will enable the joint commissioning and operation of the SHINE accelerators in the future.

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