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The European Spallation Source RF System Design

David McGinnis

ESS-AB, david.mcginnis@esss.se

Mats Lindroos

ESS-AB, Mats.Lindroos@esss.se

Abstract

The European Spallation Source Linac reaches an energy of 2.5GeV within 350 meters. The linac delivers an average power of 5 MW with a 4% duty factor (2.9 mSec pulse at a rate of 14Hz). The peak power of the linac is over 123 MW. This averages to a peak power density that must be supplied to the beam of over 350kW/meter. Because of the large power density, 98% of the linac consists of superconducting radio frequency (RF) resonators that are used to transfer power to the beam. Before the superconducting part of the linac is a normal conducting drift-tube linac operating at 352 MHz. The normal conducting linac will be powered by four 2.0 MW power sources. There are three types of superconducting resonators. The first 28 resonators are spoke resonators operating at 352 Mhz. The remaining 184 resonators are elliptical cavities operating at 704 MHz. The peak power level covers a range from 50kW to 850 kW. The RF system for the ESS linac is defined as the system that converts AC line power to RF power at either 352 or 704 MHz to be supplied to the RF accelerating cavity couplers. This paper will give an overview of the low-level RF control, the RF power sources, and the RF distribution for the ESS RF system.