C2PoH

The Progress on 2K Cryogenic System for Superconducting Cavity of SSRF II

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Ⅰ. Introduction

The Shanghai Synchrotron Radiation Facility (SSRF) is an intermediate energy light source built at Zhang-Jiang Hi-Tech Park in Shanghai, China. The SSRF consists of a 432 m circumference storage ring with operating energy of 3.5 GeV and minimum emittance of 2.9 nm-rad, a full energy booster, a 150 MeV electron Linac. The RF power and voltage required for storing the electron beam are provided by means of three SC cryomodules, each containing one 499.654MHz superconducting cavity. The cavities, made of Niobium, are bath-cooled with saturated liquid helium at 4.5 K. A cryogenic plant with cooling capacity of 650 W at 4.5 K has been in operation since August of 2008 to provide cooling for the three superconducting cavities.

In order to further improve the performance of SSRF, the following SC devices will be applied as the SSRF Phase II project:

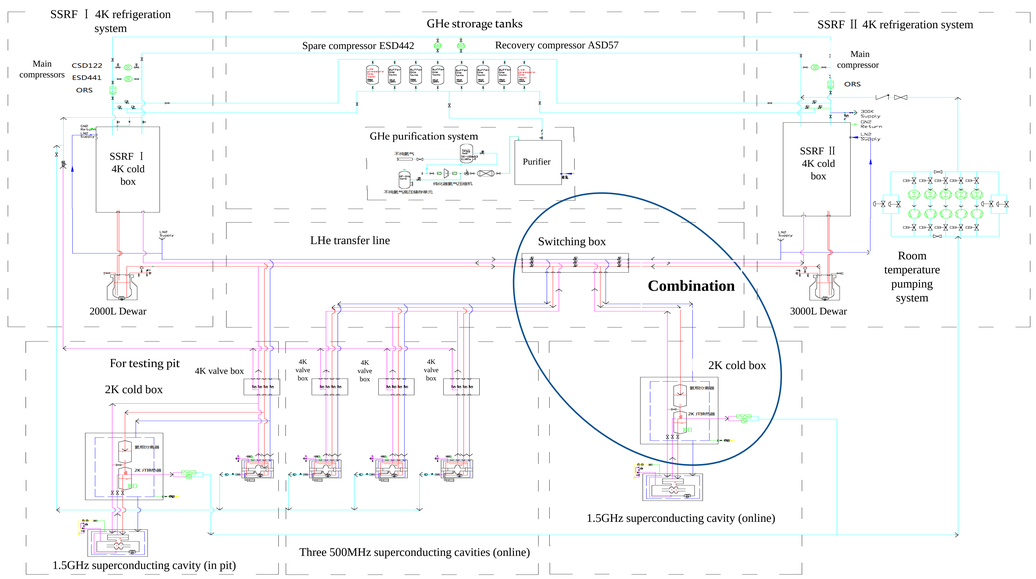
1) One third harmonic SRF cavity with 1.5 GHz，to be positioned at the SSRF storage ring, will run at 2 K (31 mbar) by bath cooling.

2) One superconducting wiggler is to be used for one of the new-built beam lines, ultra-hard multi-functional beam line. The SC wiggler will be cooled by cryocoolers at 4.2 K region by bath cooling.

For the purpose of supporting operation of the above SC devices, a new cryogenic system (SSRF-II cryoplant) with equivalent cooling capacity of at least 650 W at 4.5 K (including at least 60 W at 2 K) will be designed, fabricated, test and operated for the SSRF-II.

Additionally, the new cryoplant will be used as the back-up of current 650 W refrigeration system at 4.5 K to support normal operation of the online three 500MHz SRF cavities in case of any failure occurred to the current 4.5 K cryoplant.

Ⅱ. P & I diagram of SSRF Ⅰ & Ⅱ

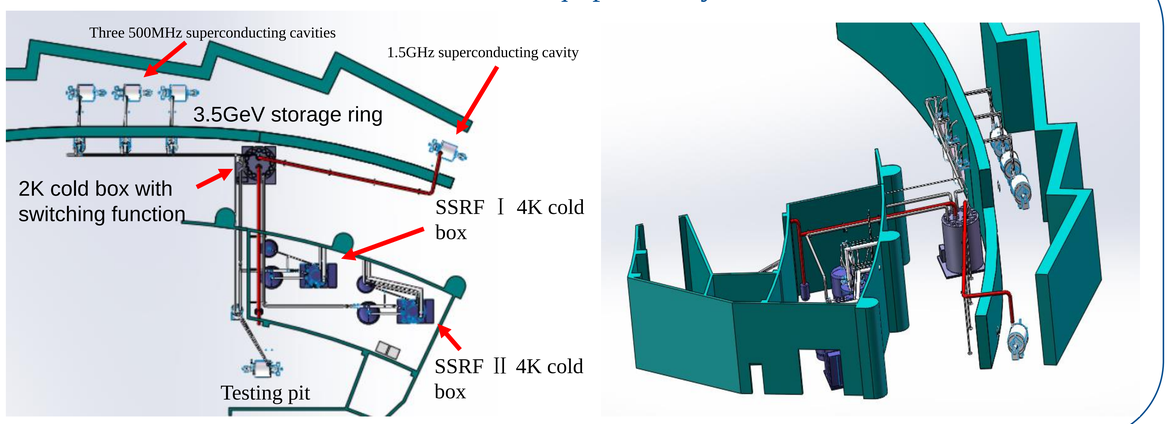


Ⅲ. Heat load estimation and operation modes

Component	Type	Detuning	Tuning
Third harmonic cavity	Static heat load	10	10
	dynamic heat load	5	180
	2K cold box（with valve box）	15	15
	2K transfer line	10	10
	total	36	211
Cryogenic transfer system	3000L dewar	0	0
	4.5K switch box	30	30
	4.5K multi channel transfer line	25	25
	total	55	55
total		91	91
total（with 50% margin）(W)		~137	~312

Switch mode		500 MHz cavity 3 sets	1.5 GHz cavity One set	Heat load (W)	
SSRF I	SSRFII			SSRF I	SSRFII
work	work	operation@4.5K	operation@2K or tuning@4.5K or detuning@4.5K	400	375 312 137
failure	work	operation@4.5K	◆operation@2K→detuning@4.5K ◆Detuning@4.5K		400+137=537
work	**failure**	operation@4.5K	◆operation@2K→detuning@4.5K ◆Detuning@4.5K	400+137=537	

Ⅳ. Main equipment layout



Ⅴ. Progress

1. Main equipment such as main compressor 4K cold box and 2K cold box with switch function have been ordered.
2. The installation of the room temperature equipment is ongoing and will be complete within October this year.
3. 4K and 2K equipment will be installed in next summer.
4. The commissioning of whole system is planned in next fall.