中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences

International Review of the IHEP PAPS SRF Facility

Mandate and Charges

Objectives

Several large scientific projects based on superconducting RF (SRF) accelerators are in construction preparation phase or have been proposed in China. A 6 GeV synchrotron light source (HEPS) is to be constructed in Beijing from 2018 to 2024, which plans to use four 166 MHz SRF cavities and two 500 MHz SRF cavities. The CIADS project in Guangdong province for nuclear waste treatment is proposed for the next five years, which plans to use multiple low beta cavities to accelerate proton to about 600 MeV. The XFEL light source in Shanghai is approved to complete construction in seven years, which plans to use more than 600 1.3 GHz TESLA cavities to reach 8 GeV beam energy. The 100 km circumference, 240 GeV center-of-mass energy circular electron-positron collider (CEPC) as a Higgs factory is proposed to use 160 1.3 GHz TESLA cavities and 336 650 MHz 2-cell cavities. The Institute of High Energy Physics (IHEP) has been or will be involved in all these large accelerator projects, and more than 400 SRF cavities are expected to be tested in the following years.

To realize these projects, as well as many other future large superconducting accelerator projects in China and worldwide, it is mandatory to build a large-scale and well-functioned production and SRF R&D facility in an early stage; such a facility would also help to train the new generation of scientists, as well as to serve as a link between industry and project management. Recently the Beijing local government funded IHEP to build a large SRF facility (4500 m^2) as part of the PAPS (Platform of Advanced Photon Source technology R&D) project. The construction of the PAPS SRF facility has just started, and it is planned to complete before June 2020.

The PAPS SRF facility is aimed at processing and testing of several hundreds of SRF cavities and couplers, and assembly and testing of about 20 cryomodules per year for different users. It is also planned to cover the requirement of new SRF material and technology development. The layout and the function of the PAPS SRF facility need to be carefully defined, designed and reviewed.

The scope of this upcoming review is to examine:

- Design of the Overall SRF Facility layout, function, workflow and interfaces (cryogenics, electrical, hydraulic, mechanical …)
- Design of the Vertical Test Facility, with the specified choice of components for LLRF, power supply, and various measurement and diagnostics (magnetic field, T-mapping, quench detection …)
- Design of the Cryomodule Test Facility, with the function and design of the test cryomodule, the specified choice of components for LLRF, power supply, and various measurement (magnetic field, mechanical vibration …)
- Design of the Coupler Conditioning Facility, with the workflow for mass production, the layout of the dedicated rooms for couplers, and the specified choice of components for incoming qualification, baking, power supply, and so on.
- Design of the Cleanroom and Cryomodule Assembly Facility, with the workflow for mass-cleaning and clean assembly of cavities and strings, the layout of the cleanroom, and the specified choice of components for parts-washing, ultrasonic cleaning, HPR, gas supply, and so on.
- Design of the Vacuum System, with the specified choice of components for slow venting and pumping, leak check for single components and cavity-string, vacuum system for vertical test and horizontal test, the remote RGA analysis unit, etc.

- Cavity R&D and RF Facilities, including optical inspection and defects repairing, RF measurement and pre-tuning, and equipment for development of technologies like Nb-Cu sputtering, Nb_3Sn thin film, N_2 doping and infusion, etc. Note that it is not possible to have chemical plant on site, so alternatively an EP facility will be built elsewhere and it is not within this review.

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The review committee is invited to assess the functional and operational design of the facilities and the technical choices and specifications of various systems and components, and comment on the following charge questions:

- Are the SRF facility design goals well defined and credible for the future large projects and R&D requirement and the PAPS construction schedule?
- Are the designs of the systems and devices feasible and effective to achieve the mass-production and R&D goals?
- What are the technical risks and potential impacts? What mitigation measures should be taken?
- Are the designs presented ready for procurement or fabrication? If not, what is recommended before the construction phase?
- Is there any opportunity or proposal of collaboration between IHEP PAPS Project and your institute or projects on the development of advanced SRF devices or systems?

The committee is required to compile a short report with findings, comments and recommendations within one month after the review meeting. The report will be delivered to Prof. Weimin PAN, the PAPS Project Leader.

Members of the International Review Committee

Name	**Institute**
Carlo Pagani (Chair)	INFN
Stephane Berry	CEA
Hitoshi Hayano	KEK
Yoshihisa Iwashita	Kyoto Univ.
Walid Kaabi	LAL
Eiji Kako	KEK
Takayuki Kubo	KEK
Catherine Madec	CEA
Paolo Michelato	INFN
Shinichiro Michizono	KEK
Hiroshi Sakai	KEK
Kensei Umemori	KEK
Kirk Yamamoto	KEK
Masashi Yamanaka	KEK

Date and Place

14th July 2017 at IHEP