Abstract
IHEP has started the “1.3 GHz SCRF Accelerating Unit and Horizontal Test Stand Project” since early 2009. The SCRF Accelerating Unit contains a 9-cell 1.3 GHz superconducting cavity, a short cryomodule, a high power input coupler, a tuner, a low level RF system and a high power RF source, etc. This unit will also serve as a Horizontal Test Stand (HTS) for new components R&D. Recent progress of the components R&D is presented, as well as the key SCRF facilities design and commissioning, i.e. the CBP machine, pre-tuning machine and BCP facility for 9-cell cavities.

INTRODUCTION

In order to develop and demonstrate the key technology for China’s future XFEL and ERL projects as well as the ILC, IHEP has started the “1.3 GHz SCRF Accelerating Unit and Horizontal Test Stand Project” since early 2009 [1].

The “SCRF Accelerating Unit” is a 2-meter-long short cryomodule containing one 9-cell cavity, one high power coupler, one tuner, and the corresponding low level RF (LLRF), high level RF (HLRF) and cryogenic systems (Fig. 1). The components will be designed, fabricated and commissioned with reference to the existing designs worldwide which meet the ILC RDR specifications. This unit will also serve as a Horizontal Test Stand (HTS) for new components R&D (e.g. cavity packages, input couplers, tuners, LLRF systems, cryomodule cold mass structures, etc.).

Constructing and commissioning SCRF infrastructures and facilities is an important part of this program, which will allow sustainable SCRF technology development in IHEP and China.

R&D PROGRESS

Large Grain 9-cell Cavity
A low-loss shape bare tube 9-cell cavity using Ningxia large grain niobium is being fabricated at IHEP. EBW of 13 dumbbells with stiffening rings was finished. We are now tuning the dumbbells by reshaping and trimming. For details, refer to [2].

High Power Input Coupler and Tuner
The high power input coupler is designed with reference to the KEK STF-baseline input coupler. RF design [1], thermal and multipacting simulation and mechanical design (Fig. 3) are ongoing. We will fabricate two input couplers in 2010.

We chose the KEK slide jack tuner as the baseline design (Fig. 4). Fabrication and low temperature test will be done next year.

Figure 2: Half cells and dumbells of the IHEP large grain 9-cell cavity

The low-loss 9-cell cavity with full end groups is also under development. The end cell shape, the HOM couplers and the end plate will be optimized to damp higher order modes and reduce high field Lorentz force detuning according to ILC requirements.

Figure 3: Structure design of the warm and cold coaxial parts of the high power input coupler

Figure 4: KEK slide jack tuner as the baseline design
Cryomodule

The structure design (Fig. 5), thermal and mechanical simulation of the short cryomodule containing one 9-cell cavity has been finished. The short cryomodule will be fabricated next year.

IHEP fabricated the first prototype cryomodule for Euro-XFEL (PXFEL1) in 2009 (Fig. 6 & 7). This cryomodule was successfully tested at CMTB of DESY and will be installed in FLASH to increase the energy to 1.2 GeV.

Marx Modulator

The solid-state Marx modulator (Fig. 8) is under development at IHEP with ILC baseline specifications, supported by innovation funds of the Chinese Academy of Sciences. The key component 12 kV solid switch has been developed and one 12 kV cell module was demonstrated successfully.

SCRF Facilities

The 1.3 GHz SCRF program will significantly improve the IHEP SCRF infrastructures and facilities to meet the 9-cell cavity requirement for surface preparation and vertical tests. Several SCRF facilities have been fabricated or installed and will be commissioned soon:

- CBP (tumbling) machine for 9-cell cavities (Fig. 9)
- BCP facility for 9-cell cavities (Fig. 10)
- Pretuning machine (Fig. 11)
- Manually vertical pretuning device (Fig. 12)

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A closed loop cryogenic system for vertical and horizontal test is also designed and proposed (Fig. 13).

**SUMMARY**

IHEP 1.3 GHz SCRF R&D is ongoing well including the SCRF facilities upgrade. Most of the components will be fabricated next year. The whole accelerating unit will be integrated and horizontally tested in 2011.

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**REFERENCES**
