

## The HPRF system for PEFP 20MeV proton linac\*

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### 1. Introduction

The 100MeV, 20mA proton linear accelerator for PEFP (Proton Engineering Frontier project) is being developed [1][2]. As a low energy accelerator, 3MeV RFQ was built and 20MeV DTL consists of 4 tanks is being constructed [3]. To accelerate 20MeV proton beam, two sets of 1MW, 350MHz RF system are required for each accelerating structure. The high power RF system for 3MeV RFQ was already installed and operated to drive the RFQ. The klystron and the circulator for 20MeV DTL were installed, and the cooling system and power supply system for the klystron were also prepared.

### 2. RF system for 20MeV proton linac

In this section, the test results and performances of the RF system for PEFP 20MeV proton accelerator are described. The description of HPRF system for each accelerating structure is shown in Table 1.

Table 1. The HPRF system for 20MeV proton accelerator

Accelerating structure	RFQ	DTL
Frequency (MHz)	350	350
Energy range (MeV)	0.05~3	3~20
Beam current (mA)	20	20
Required RF power (kW)	535	900
No. of 1MW Klystron (ea.)	1	1
No. of coupler (ea.)	2	4

#### 2.1 The RF system for 3MeV RFQ

The Klystron for 3MeV RFQ was tested up to 600kW itself in pulse operation. The pulse width, repetition rate are 50μs, 10Hz respectively. And, the Klystron was operated up to 350kW routinely. The forward RF power and cavity's RF power in HPRF test for the RFQ are shown in Figure 1. All of the RF components including RF window, input coupler, klystron power supply and cooling system have the capacity of operating at 600kW average power level. Therefore RF duty can be increased for higher average power operation.

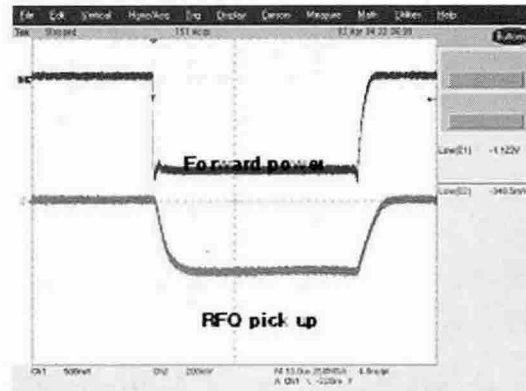


Figure 1. The measured RF signal in HPRF test for 3MeV RFQ

#### 2.2 The RF system for 20MeV DTL

The klystron and circulator for 20MeV DTL were installed, and cooling system and power supply system for the klystron were also prepared as shown in Figure 2. A TED(THALES Electron Devices) TH2089F is a slightly modified model of the 352MHz, 1.1MW klystron used at CERN was used. The klystron has a modulating anode to control the beam current and is capable of dissipating the full beam power up to 1,800kW. An AFT(Advanced Ferrite Technology) circulator which was also used for RFQ RF system was used [4]. It is a Y-junction type circulator which can deliver 1.3MW RF power for forward direction and permit 1.3MW reverse power at any phase. It uses temperature compensation system to compensate the temperature dependent ferrite saturation magnetization.



Figure 2. The installed HPRF system for 20MeV DTL

A HPRF dummy load which is cooled by the water (50%) and MEG (Mono-ethyleneglycol) with additives (DOWTHERM SR-1, 50%) mixture was used.

The klystron power supply for DTL was tested. The measured current and Mod.anode voltage in 40kV beam voltage are shown in Figure 3. The fluctuation in beam voltage was measured during test. The readjustment of the control loop gain should be necessary.

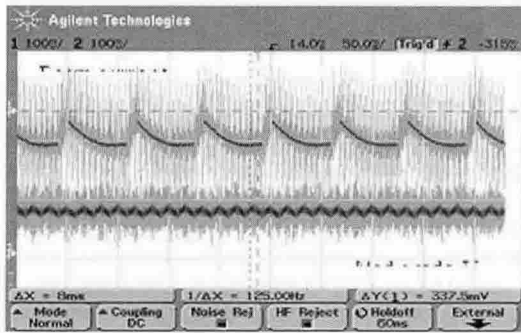


Figure 3. The measured current and Mod.anode voltage in 40kV beam voltage.

### 3. Summary

The RF system for PEFP 20MeV proton linear accelerator is described. The RF system for 3MeV RFQ was already installed and operated to drive the RFQ. The klystron was tested up to 600kW itself and operated up to 350kW routinely. The HPRF dummy load was stabilized with the change of the coolant. Preparation of 20MeV DTL HPRF test has been completed. LCP and PLC system for klystron power supply was already

prepared. Voltage fluctuation was measured during klystron test. Voltage control feedback loop seems to be re-adjusted.

### 4. Acknowledgement

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### REFERENCES

- [1] B. H. Choi, et al, "High Power Proton Linac Program in Korea", Proc. of XXI International LINAC Conference, Gyeongju, Korea, 2002
- [2] Y. S. Cho, et al, "Development of 100MeV Proton Accelerator", Proc. of XXI International LINAC Conference, Gyeongju, Korea, 2002
- [3] H. J. Kwon, et al, "The RF power delivery system design and its component characterization for PEFP DTL", Proc. of Particle Accelerator Conference, Portland, Oregon USA, 2003
- [4] H. J. Kwon, et al, "RF System for RFQ", Proc. of XXI International LINAC Conference, Gyeongju, Korea, 2002