LINAC LUE - 200 TEST FACILITIES

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Abstract

The Intense REsonant Neutron Source (IREN) [1] with 200 MeV driver electron linac LUE-200 is being created at JINR by JINR, BINP and MEPhI. The average power of the electron beam will be 10 kW. For optional decision of a lot of problem we are planning to use a few test-installations (test-facilities). One of them is the Full Scale Test Facility (FSTF) [2] and the second one - the Electron Gun Test Facility (EGTF) at JINR. The JINR's operable installation (LUE-40 + IBR-30) [3], along its direct aim, also being used as the IREN's test-facility. The Electron Linacs of the Yerevan Physics Institute being planned to use as the IREN's test-facilities too. The description of the specified test-facilities is presented.

1 INTRODUCTION

The Intense Resonant Neutron Source (IREN) was designed and is being created at JINR by JINR, BINP and MEPhI. The IREN includes three main parts: the 200 MeV Electron Linac LUE-200 (beam average power will be 10 kW), tungsten target and plutonium booster-multiplicator [1]. On account of the IREN installation must be placed instead of the presently operating neutron source (IBR-30 and its driver - 40 MeV Electron Linac), the designed value of the accelerating gradient of the LUE-200 is chosen relatively high (35 MV/m) for providing the necessary energy and power of electron beam.

So far as the IREN must be instead of the operable facility (IBR-30 + LUE-40) it is reasonable to test, using test facilities, the most part of the IREN's equipment, and first of all the LUE-200 equipment, before its installation. For this purpose is expected to create some of those facilities at JINR and use existing facilities in BINP and YerPhI as well. The description of those facilities is given below. The program of works to be carried out at those facilities is also presented. Note that the possibility to provide the necessary accelerating gradient as well as the determination of the dark current are the principal problems for us.

2 FULL SCALE TESTING OF THE ACCELERATING SECTIONS

For full scale testing of the LUE-200 accelerating sections we are planing to use the special facility (FSTF) (see Fig. 1) at JINR (under construction [2]), as well as the BINP's available test-facilities. Since the BINP is the designer and producer of both - the accelerating sections and the SLED cavities - it is expected that the sections and cavities will be tested at the suitable BINP test-facilities in cooperation with the JINR representatives and get certificate of quality originally. At the FSTF the M-350 modulator for the 5045 klystron [4] was already installed, and klystron is being installed now. The M-350 modulator was created using of the M-250 modulator of the OLIVIN klystron station. This station was developed and created for the YerPhI linac and supplied to the JINR according to the agreement between JINR and Armenian government. All jobs on putting the modulator in operation are completed. The thermostat, cooling, monitoring and emergency systems are under construction. The vacuum system's equipment produced by the Vacuum Praha is ready for installation, and some of it is already installed.

The main problems to study at this facility are the obtaining of the expected accelerating gradient and measuring of the dark current. Along the accelerating section the scintillation detectors will be placed for measuring X-radiation induced in the section body by the dark current. Energy spectrum of the dark current and accordingly accelerating gradient will be measured in the usual way by magnet spectrometer. Moreover the RF-

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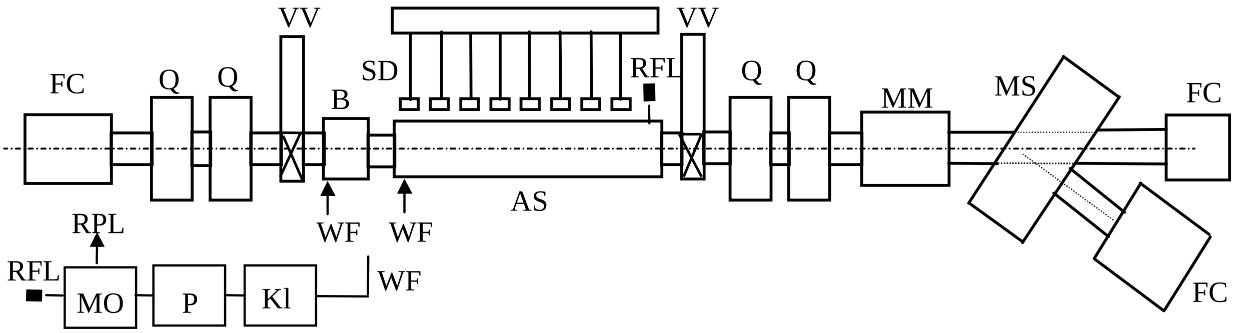

Fig. 1. Schematic layout of the full scale LUE-200 IREN test facility.
AS - accelerating section, B - buncher, Q - quadrupole lenses, FC - Faraday cup, Kl - klystron, MO - master oscillator, P - preamplifier, MS - magnetic spectrometer, RFL - RF-load, VV - vacuum valve, SD - scintillation detector, WF - waveguide feeder, MM - measuring module, RPL - reference phase line.

power multiplier system, the waveguide elements, the LUE-200 control, monitoring and protection systems are expected to test at the FSTF. Note the another no less important role of this facility. It is expected that all the LUE-200 elements will be tested and get the certificate of quality on it before installation in the standard place.

3 ELECTRON GUN (EG) TESTING AND SETTING-UP FACILITY.

In Fig. 2 the EG test - facility layout is presented. The LUE-200 electron gun is under construction at JINR now. It was designed on the basis of the prototype created earlier at BINP for the F-factory. EG products the electron beam having the parameters: 200 KeV energy; 5 A pulse current at 0.25 μsec pulse duration. At the present time most of the EG parts are produced and its assembly being carried out. In addition to the electron gun the facility includes the following equipment:

- 100 cm length beam transport channel equipped with two focusing solenoid lenses and beam position correctors (transverse magnetic field coils);
- beam current monitor;
- beam position monitor;
- beam profile monitor;
- beam emittance monitor;
- magnet analyzer;
- auxiliary technological equipment.

The research program involves: cathode emission characteristics measurement, beam energy (total energy and energy spectrum) and space-angular (profile, emittance) electron beam characteristics measurement

4 TEST RESEARCH OF THE LUE-200 ELEMENTS AND RF SYSTEM DEVICES

The LUE-200 RF-system is based on two 5045 klystrons produced by SLAC. The RF-system includes the master oscillator, reference phase line, preamplifier, SLED system, and two waveguide feeds. The each waveguide feed provides incident and reflected power monitoring, RF-pulse envelope monitoring, phase monitoring (of the buncher and the accelerating sections RF channels relative to the reference phase), control and protection (on RF breakdown and VSWR in the waveguide feeds or the sections). The LUE-200 RF

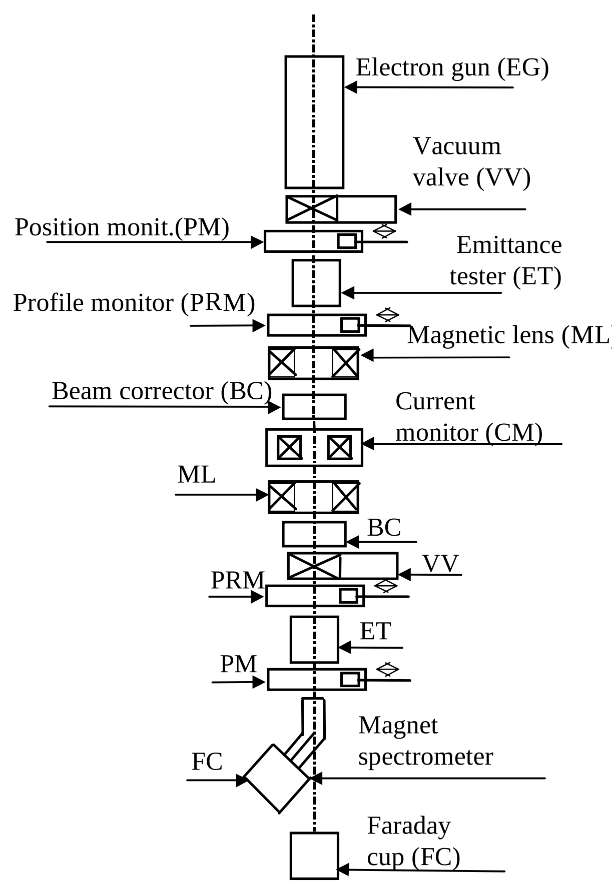

Fig. 2. Schematic layout of the EG test facility

system also includes high-power matched RF loads placed at the outputs of the sections. The RF system elements (except the SLED's cavities and the loads) were designed at MEPhI and produced by the ISTOK specialized manufacture. Some monitoring and RF-system control devices were designed at YerPhI and are being tested at the test facilities in Yerevan. When the testing will be finished that devices will be placed in own positions at the FSTF and at the LUE-200. Fig. 3 shows the layout of the IREN RF test-facility at YerPhI.

5 IREN MONITORING DEVICES

Within the project realization a number of basic principles on the IREN monitoring are being tested at the operable installation (LUE-40 + IBR-30) which is used as the IREN's test-facility. We try to build a stabile and reliable control system using free software base: FreeBSD and Linux operating system, free implementation of SQL server, HTTP server, etc. The use of the software which source codes are open gives us some advantage in comparison with commercial (and closed) software.

Such a monitoring system of the (LUE-40 + IBR-30) was created and put in experimental operation during the 1997-98. A set of pulse and continuous parameters are measured and stored with a real repetition rate 100 Hz. All the functions of the control systems (measuring, database storing, public access providing) are distributed between different UNIX workstations. Main attention is paid to provide a stability of the control system at emergency situations, such as AC power shutdown, network cable tearing, etc.

We also try to develop a software to provide an effective communication between personnel and users of the existing facility. All the information interesting for the users are available from the WWW, and WWW to SQL interface is used to access the databases.

6 CONCLUSION

The IREN project aimed to create the new JINR's base installation for fundamental research is being realized in the rigorous of the total crisis, caused by economic, political and social cataclysms of the recent years all over the territory of the Former Soviet Union. In spite of all the difficulties the IREN team does not lose hope to complete the project in the foreseeable future.

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7 REFERENCES

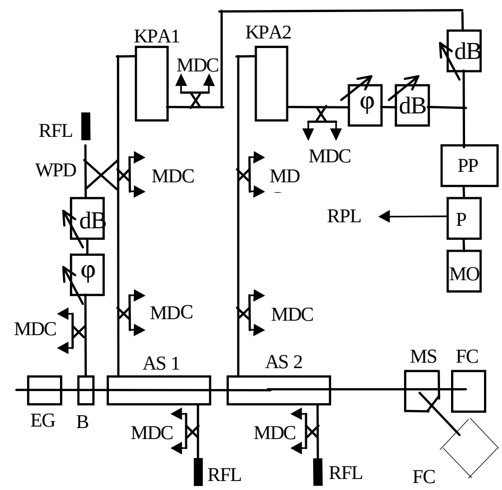

Fig. 3. The IREN test facility at YerPhI.

MO - master oscillator, P - continuous signal preamplifier, PP - pulse signal preamplifier, MDC - coupler, RPL - reference phase line, WPD - waveguide power divider, EG - electron gun, B - buncher, RFL - RF load, AS - accelerating section, KPA - klystron pulse amplifier, MS - magnetic spectrometer, FC - Faraday cup.

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