# UPGRADE OF THE RF SYSTEM ON THE LUE-200

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*Abstract*

In the report works on upgrade of RF system of the LUE-200 (IREN) electron linac are provided. The main attention is paid to system of preliminary excitement of klystrons. After work on installation of the second accelerating section RF system of Installation it was considerably remade that allowed to carry out start-up of the second stage of the IREN installation successfully. Methods, features and problems in case of a training of two accelerating sections are discussed. Influence of the temperature and frequency modes on joint operation of accelerating sections. Results of setup of the RF system and a training of sections, and also results of posting of a bunch are given.

## INTRODUCTION

Created at the Laboratory of Neutron Physics, JINR linac LUE-200 electron on the particle energy of 200 MeV for resonance neutron source (IREN) [1,2] it is based on the best world achievements in the field of accelerator technology. The pace set energy of the particles in the LUE must be 35 MeV / m, the pulse repetition frequency - 150 Hz.

The project was implemented in two stages. First it was installed and launched the first stage of the accelerator, consisting of one section of the accelerating energy of 100 MeV. Currently it implemented the second stage of the accelerator - produced by the installation of the second accelerating section and the physical start-up of accelerator. The report presents the results of the physical start-up accelerator LUE-200 of IREN.

## RF SYSTEM OF THE LUE-200

Scheme of the RF system of the accelerator LUE-200 is shown in Fig. 1. The main components of the system are: two-channel sets the high-frequency generator with the ability to shift the phase of the oscillation between the channels in the $360^0$ revolution and the rapid phase of both channels simultaneously vibrations $180^0$, two pulse amplifier RF power for driving high-power klystron, two multiplying power system supply waveguide path RF power to the accelerating section and grouper from the powerful klystron, a directional coupler, power regulator, shifter and measuring directional couplers.

Continuous RF signal power up to 10 mW and a frequency of 2856 MHz master oscillator to the input pulse pre-amplifier driving the first and second klystron over coaxial feeders. The required phase shift between the excitation signals is carried out phase shifter.

The output klystron RF oscillation power up to 50 MW in the first pulse klystron and up to 20 MW of output from the second klystron in a rectangular waveguide evacuated arrive at 3 dB bridges. The two arms of each bridge are located high-Q resonators cumulative power of multiplication (SLED), and the fourth arm of the bridge through the waveguide and the wave type transformer is connected to the input of the accelerating section. Increasing the pulse power supplied to accelerator sections is carried out by accumulating energy in the resonator with its subsequent reradiation in going to the waveguide section when turned phase signal supplied to the resonators $180^0$. Required for this switching phase of the RF oscillations carries excitation system and synchronization of the klystron at a low level RF power.

Before entering the accelerating section of the waveguide directional couplers installed H01 and H02, which signals are used to control the incident and reflected waves. Signal attenuation in the taps is about 60 dB. The output of accelerating sections unused portion of the RF power supplied to the load. Between loads and output sections mounted directional couplers (similar H01 and H02). Waveguides made of rectangular cross-section waveguides evacuated 72X34 mm. Pumping waveguides made by ion pumps in the output window of klystron and 3 dB bridges.

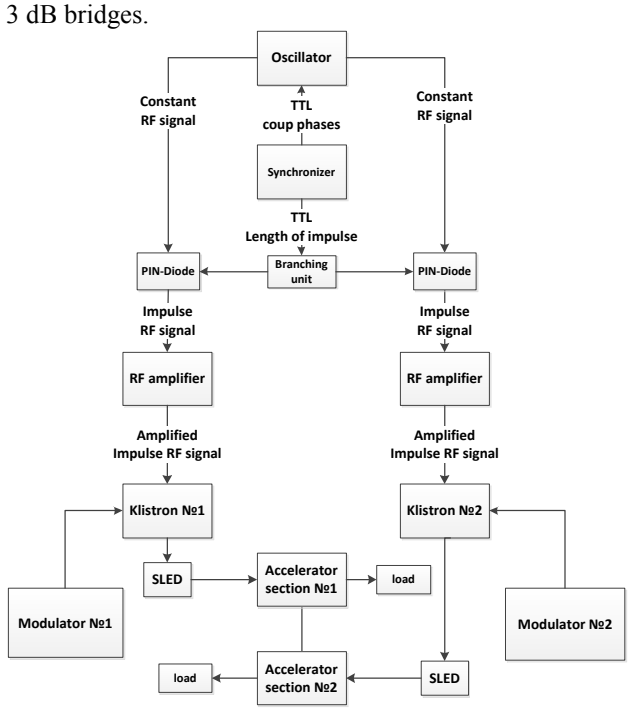


Figure 1: Scheme of the RF system of the IREN facility.



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## RF SYSTEM TRAINING

After the installation of the second accelerating section on the regular place and achievement in the two sections of the working vacuum accelerating work began on putting the RF power in the accelerating section and the high frequency training. This work continued for quite a long time. When workers have been achieved levels of RF power input into the accelerating section of the electron beam wiring has been made.

Figures 2 and 3 show the waveforms of the incident RF power, the klystron voltage and incident RF power from the accelerating section to the load for accelerating the first and second sections respectively. The oscillograms of the incident RF power to the load of the booster sections is visible loading of the accelerating field electron beam.

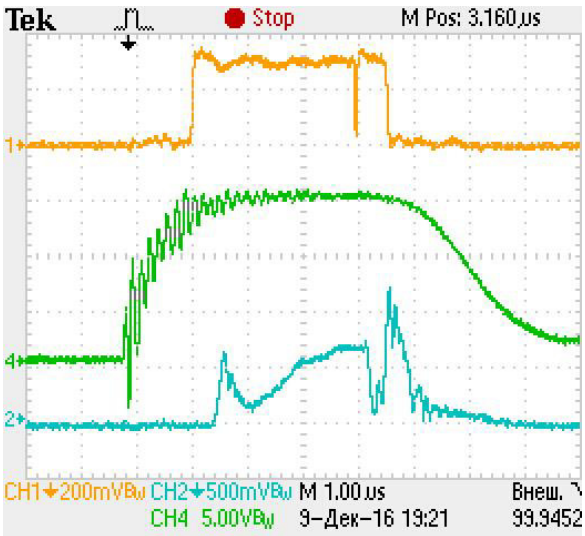


Figure 2: CH1 - the waveforms of the incident RF power, CH2 - incident RF power from the accelerating section №1 to the load, CH3 - the klystron №1 voltage.

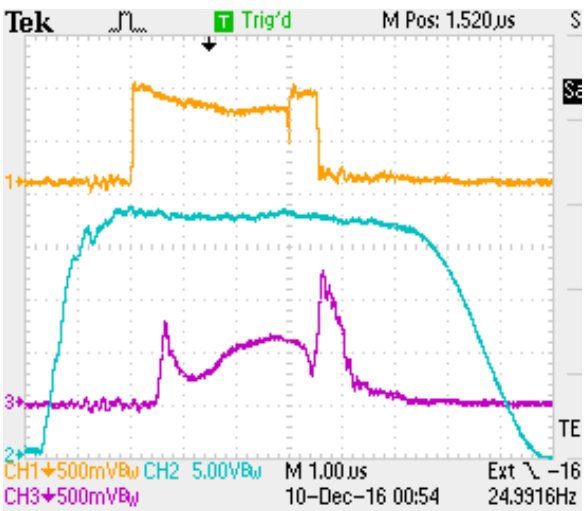


Figure 3: CH1 - the waveforms of the incident RF power, CH2 - incident RF power from the accelerating section №2 to the load, CH3 - the klystron №2 voltage.

## CONCLUSION

As a result, the work was carried out a successful start up of the second stage of the LUE-200 accelerator of the IREN facility. Spend an electron beam accelerator through both sections and at a current of the electron gun 4 A on the accelerator input received accelerated output current accelerator 2 A. Work on the conclusion of the accelerator on the design parameters continues.

## REFERENCES

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