

MODERNIZATION THE MODULATOR OF THE RF-GENERATOR ION LINEAR ACCELERATOR LU-20

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Abstract

The report discusses the replacement of the lamp switch the modulator semiconductor. A schematic of the modulator and a semiconductor switch scheme protection against voltage surges in the generator lamp. Replacing the lamp switch it possible to increase the output power generator.

INTRODUCTION

Modulator frequency generator ion linac LU-20 was commissioned at the beginning of 70th years. Currently modulator lamps GMI-34B used in this modulator, taken out of production and the existing stock has long worn out and due to the increase of the internal resistance of these lamps, the anode voltage on the generator lamps significantly decreased and the generator does not produce RF-power required to normal operation of the accelerator. It was therefore decided to replace the modulator lamps solid state switch HTS 501-80-LC2 firm "BEHLKE" Germany. This decision was implemented.

THE MODULATOR

RF-generator supplying linear accelerator LU-20 was



Figure 1: Modulator of the RF-generator.

launched in 1970. It provides a nominal power level in the cavity of the accelerator. Eventually all aging occurred generator elements. In the 90 years has stopped the release of modulator tubes GMI-34B used as a key modulator of the generator. I had to work on finding a used lamps. To ensure the total anodic current generator tubes 220 A key is a four connected in parallel modulator tubes GMI-34B (Fig. 1). Since the lamp old internal resistance from them several times the rated and thereon a high voltage drop is applied to the anodes generator tubes. As a result, the output power of the generator is insufficient to provide desired accelerating voltage in the resonator of the accelerator.

It was decided to replace the modulator tubes semiconductor switches. The switches were ordered us "BEHLKE" Germany. The first experience of replacement bulbs semiconductor switches proved unsuccessful. After working the switches was breakdown.

SIMULATION OF THE MODULATOR

After analyzing the causes of the breakdown of the switch modeling work was conducted modulator using Micro-cap 9. The modeling was made for the lamp and the semiconductor switch. Several schemes have been analyzed with a semiconductor switch. The modeling was assembled circuit protection semiconductor switch and then on the simulator breakdowns in generator lamps were tested semiconductor switch and perfected the technique of working as part of a key generator in normal mode and circuit protection from breakdowns in key generator lamps and from spontaneous elongation of the anode pulse. Fig.2 is a schematic diagram of the

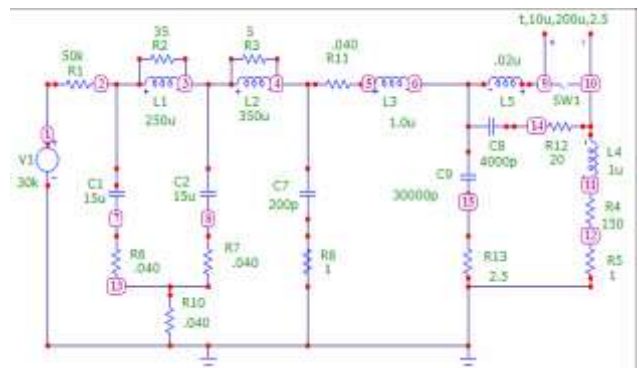


Figure 2: Scheme of the modulator.

modulator on which to carry out simulation of the modulator. Figure 3 shows the simulation results.

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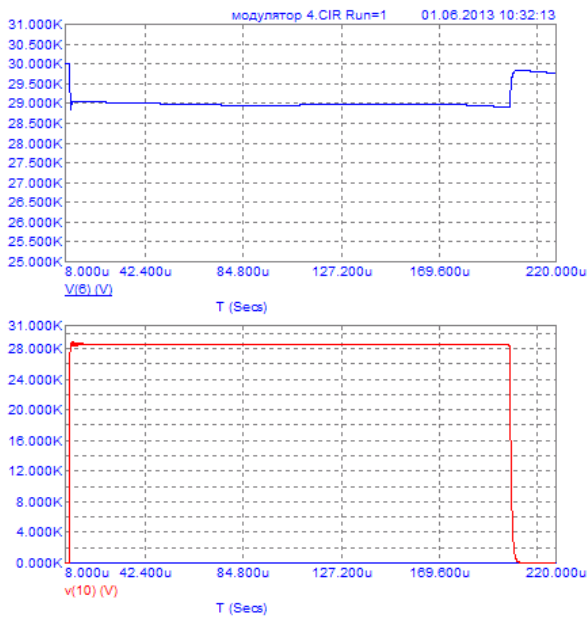


Figure 3: The results simulation of the modulator.

After testing a semiconductor switch and protection circuits (Figure 4, 5) modulator lamps were replaced by a switch (Figure 6) and has been successfully operated at the Nuclotron session.



Figure 5: The modulator with semiconductor switch.

CONCLUSION

As a result of the work done modulator tubes were replaced by semiconductor switches HTS 501-80-LC2 firm "BEHLKE" Germany, which led to a successful work session at the Nuclotron[1] and provide work of Nuclotron on the carbon the fourth charge states.

REFERENCES

[1] A.S. Averichev et al., Results of the 46th and 47th sessions Nuclotron. Posts JINR, R9-2013-140, Dubna, 2013.

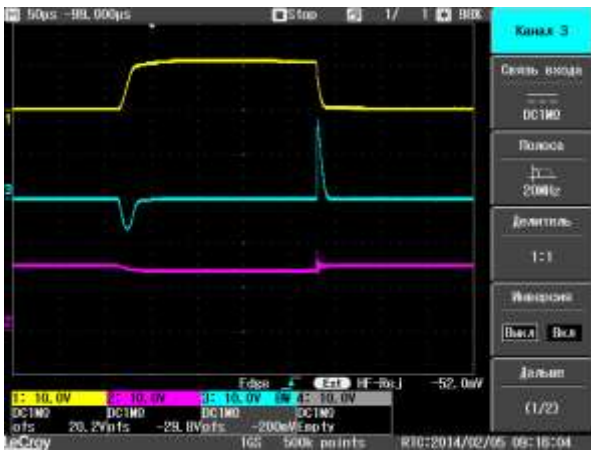


Figure 4: Oscillograms of the protection scheme.

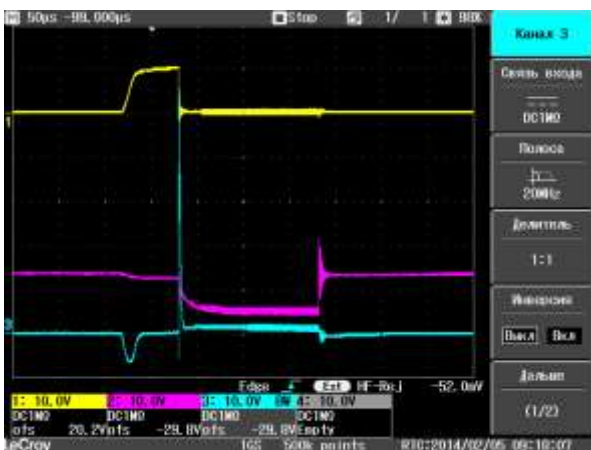


Figure 5: Oscillograms of the protection scheme.

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