**Abstract**

The RF gun with RF control is discussed. It is based on the cathode-grid cavity and grid-cavity cascade; beam energy is required for the beam acceleration. The features of the grid are the following: bunches are emitted at the grid of the injector. The cathode-grid cavity is a coaxial cavity with anode-cathode gap. The main advantages of this system are the following: Firstly, the beam is immediately formed to the bunches that follow the cavity frequency. Secondly, the particles can become relativistic at the output of the injector. The beam can be directly injected to the linear accelerators for high-energy physics experiments. The main advantage of this system is the ability to control the beam current and to feed the regular accelerating structures is transmitted to the cathode. The beam dynamics is unconsidered in the paper.

**INTRODUCTION**

The RF gun with a thermionic cathode can be used as the injector. It is based on the cathode joint with the cathode-grid assembly. The electrons are accelerated by the cathode electric field. The main advantages of this system are the following: Firstly, the beam is immediately formed to the bunches that follow the cavity frequency. Secondly, the particles can become relativistic at the output of the injector. The beam can be directly injected to the linear accelerators for high-energy physics experiments. The main advantage of this system is the ability to control the beam current and to feed the regular accelerating structures is transmitted to the cathode. The beam dynamics is unconsidered in the paper.

**SCHEME OF THE INJECTOR**

General scheme of the controlled RF gun is presented in Figure 1. RF power is obtained from the klystron which can also be used to feed the regular accelerating structures in the injector. The cathode-grid cavity is a coaxial cavity with anode-cathode gap. The main advantage of this system is the ability to control the beam current and to feed the regular accelerating structures is transmitted to the cathode. The beam dynamics is unconsidered in the paper.

**PARTICLE DYNAMICS**

Particle dynamics simulations were also carried out with help of CST Studio. Because of computer ability limitation the accelerating cavity and the exciting one were considered to be independent in terms of the electromagnetic field. The grid was considered to be completely transparent for the beam. Plasma shift between the control voltage in the coaxial cavity and the voltage in the accelerating cavities equalled about 120°. Field amplitudes are shown in Figure 4 and 5. The cathode emission current was chosen 10 A.

**CONCLUSION**

The detailed simulations show that RF gun with the RF control allows obtaining electron bunches with an operating frequency of the accelerator, relativistic velocity and small energy spread in a bunch. Besides, in this model, high-energy particles that go back to the cathode are absent. The proper chosen profile of the cathode electrode is capable of focusing enough high charges without using an additional external magnetic field. The simulation of the RF power penetrating from the accelerating cavities to the grid in the exciting cavity did not show the significant voltages in the cathode-grid gap and this value can be compensated by bias voltage. Proposed injector can be used in the complex, when the good emittance of the electron beam is not important, for example, for accelerators with conversion systems. Also this system can be applied for 5-band industrial accelerators.

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