Abstract: The paper presents the Gamma-4 four-module electrophysical facility project developed for radiation physics research. For this facility, we have developed and tested a typical module which, with a matched load, generates an electrical pulse with voltage and current amplitudes of up to 2 MV and 750 kA, respectively, and with a half-height duration of 60 ns. 700 shots were performed which conformed the operating parameters and reliability of the module. Layouts of the facility for the modes of synchronous (with accuracy of ±3 ns) operation of the modules with vacuum electron diodes and with a current summator to generate soft x-ray pulses have been developed.

Keywords: pulsed electron accelerator, bremsstrahlung, soft x-ray pulses, magnetically insulated transmission line, accelerating tube.

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INTRODUCTION

The Gamma-4 four-module electrophysical facility for research and tests in the field of radiation physics has been developed. The facility consists of four typical modules based on the Gamma-1 high-current pulsed accelerator of electrons and spaced uniformly on a circle [1–4]. Figure 1 presents a general view of the typical modules of the facility located in the experimental hall. This arrangement provides the mode of synchronous (with an error of ±3 ns) operation of the typical modules with vacuum electron diodes with the array of diodes located in a vacuum chamber.
1. TYPICAL MODULE OF GAMMA-4 FACILITY

The experimentally tested typical module includes a system of high-voltage pulse shaping (HVPS) and an energy transmission system (ETS) to the load unit. With the matched load, the module generates an electrical pulse with voltage and current amplitudes of up to 2 MV and 750 kA, respectively, and with a half-height duration equal to 60 ns. The general view of the Gamma-4 typical module is presented in Fig. 2.

1.1. System of High-Voltage Pulse Shaping

Figure 3 shows a schematic of the HVPS consisting of a double stepped forming line (DSFL) with a multichannel switch unit built into a transformer of the shaped pulse duration and a prepulse switch.

The layout of the HVPS takes into account the conditions of location of the Gamma-4 facility in the experimental hall. The main components of the HVPS are DSFL and two GIN-1000 pulsed voltage generators, which are placed on wheeled platforms providing their travel along the rail track during installation and repair.

The DSFL is designed to store the electrical energy transmitted from two GIN-1000 pulsed voltage generators to shape a high-voltage pulse with the aid of a multichannel switch and to half the duration of the output pulse with the aid of the duration converter built into DSFL. As the internal volume of the DSFL is filled with de-ionized