**Status of the accelerator facility U-400M**

In frame of development of accelerated complex of Flerov Lab, project DRIBS-III, the modernization of facility U-400M was started in June 2020. The main goal was to replace broken and outmoded equipment: replacing the excitation coils of the main magnetic system, updating the vacuum system, the water-cooling system and the power supply system, creating a new control system and replacing the radiation safety system. The high-energy beam extraction systems and accelerated beam transportation channels were also modernized.

The most complicated part of the work was replacing the excitation coils of the main magnet of the U-400M cyclotron. This work was started after disassembling of cyclotron equipment and work square preparing. The specialists from research and production company GKNP (Bryansk) together with FLNR specialists have perform it during one year. Old broken coils were uninstalled and change to new. The pair of excitation coils from 11 section with full mass 55 ton each was mounted.

After completion of installation, connection to the power supply and water-cooling system of the main magnet excitation coils, magnetic measurements began. Based on the measurement results, the magnetic field was corrected using shims. The first harmonic of the magnetic field was compensated to a level less 3 Gauss. The average field at the outer radius was increased by placing additional shims in the valleys of the magnetic structure, thereby increasing the extraction radius by 10-17 mm, as a result, the energy of the extracted beam increased by 1-1.5%.

In parallel with this, modernize the output system was carried out. Based on the results of magnetic measurements, as well as based on the results of an analysis of the operation of the old high energy output system, a new focusing magnetic channel MK-1 was calculated and manufactured. The new magnetic channel will significantly increase the radial focusing of the beam, and also compensate for the vertical refocusing of the beam that existed previously.

After the end of the magnetic measured and modification of magnetic field, the reinstallation of the equipment began. All cyclotron components were check before installation. If necessary, the elements were repaired and modified in accordance with the new layout of the cyclotron equipment. If it was impossible to modify or restore old components, new ones were manufactured. As part of the installation, the layout of the vacuum chamber equipment was changed.

After installing the vacuum chamber and successful vacuum tests, work began on installing the accelerating system resonators. The resonators received a new drive system for the hardening plate, a new design of contact groups, as well as a new AFT trimmer system (automatic frequency trimming system). After installation work, measurements and calibrations of resonators were carried out. And when the operating vacuum level in the cyclotron chamber is reached, training of the RF system begins.

The axial injection system has also been modernized. The DECRIS-2 ion source has been replaced by the DECRIS-2M, with higher intensity. In the vertical part of the axial injection, additional elements included in the Blocking and Alarm system were installed. The all elements of the system has been adjusted.

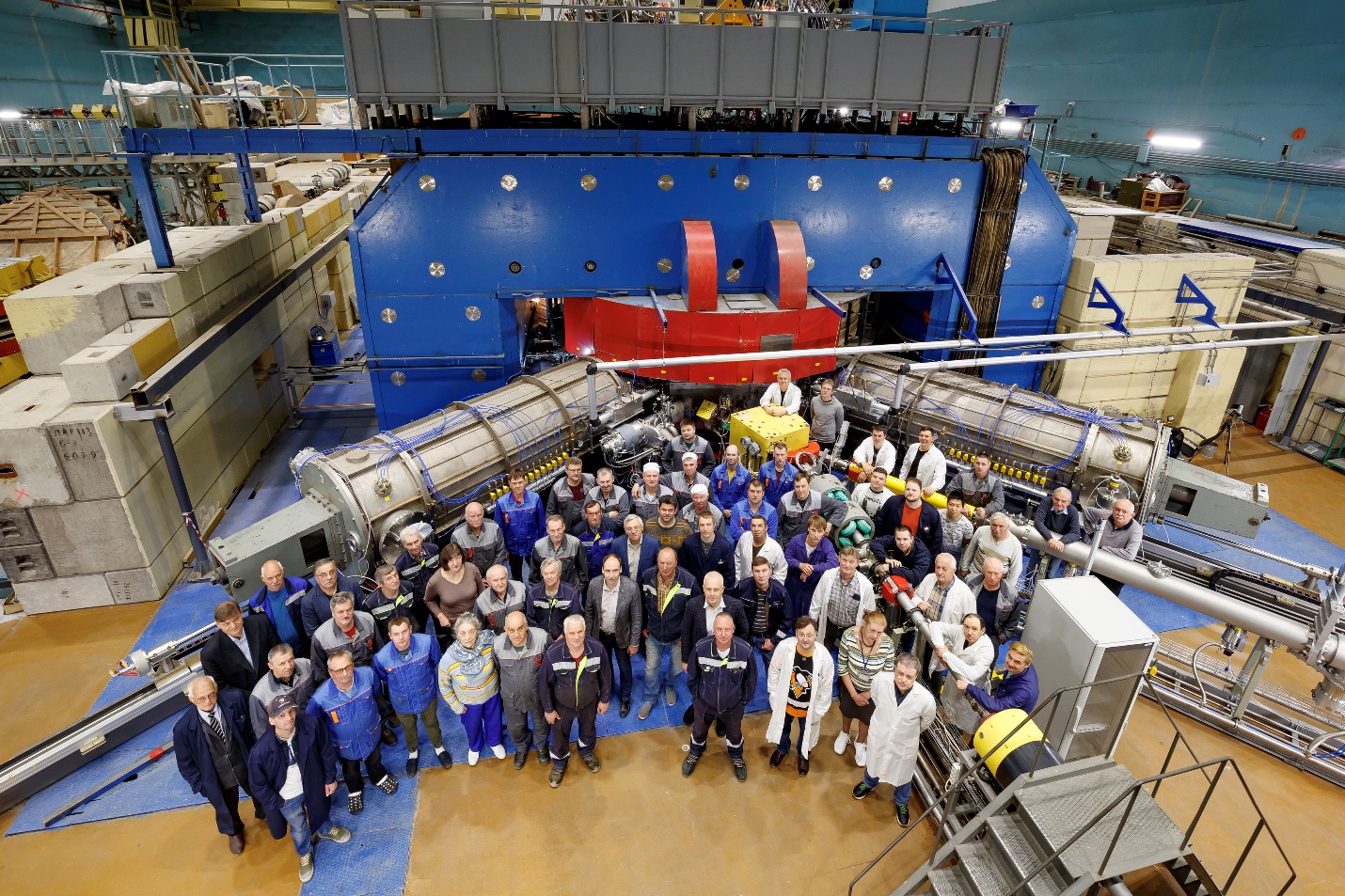
At the final stage, the accelerated beam transportation channels and experimental installations located in the accelerator hall were installed. Preparations for experiments have begun.

Work was carried out not only in the accelerator hall. The water-cooling system was improved, new power supplies, forevacuum equipment, vacuum cryopump compressors, control servers were installed, and RF power amplifiers were modified. New power and control cable lines, forevacuum and helium lines for the vacuum system, RF power transmission feeder lines, water cooling and compressed air supply lines were laid.

The control system has been completely updated. New control schemes and software were developed and implemented by FLNR specialists. New control racks and new power supply have been assembled. The control system combined both old and new equipment. The system is fully operational and put into operation.

Separately, it should be noted the work on creating new Blockings and Alarm systems for the U400M accelerator facility and Auto Radiation Monitoring System for the building. During the modernization, the systems were developed, mounted, inspected, tested and commissioned.

At the beginning of May 2024, all accelerator facilities systems were mounted, commissioning and tested. After this, comprehensive tests with accelerated beams were began. The first results have been received. After a full range of tests, the U-400M accelerator facility will be commissioned. The first experiments are planned for the 2nd half of 2024.

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