Status and Quality Assurance System of the Project on the Construction of the DC-280 Cyclotron of the Factory of Superheavy Elements

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In May–June 2018 the autonomous launching and tuning works (LTWs) of the main systems of the DC-280 cyclotron are carried out as they are completed. At present we undertake autonomous LTWs of the injection, the accelerator, and the vacuum systems in interaction with the power supply, control, water cooling and compressed air systems. More detailed information will be presented in the oral report.

The DC-280 cyclotron was constructed in compliance with the Quality Assurance System under standard GOST RISO 9001–2000. The system focuses on the project structure management and sets up a process for choosing a project supervisor, operations support service supervisors, and theme leaders (Fig. 1). Moreover, types of official documents are identified (technical reports, technical assignments, drawings, etc.). The procedures for their preparation, processing, storage, and classification are determined (Fig. 2). Further stages involve the following (Fig. 3):

- The required calculations and mathematic modelling are done. The analysis of potential engineering proposals are analyzed. Prototypes are made. Cyclotron complex is equipped. Equipment spacing layout inside the building is done.
- Engineering specifications for manufacturing the required products and systems are developed. They comprise quality assurance and on-site product acceptance requirements.
- A test programme, test protocols, product and system passports are developed and defined. Quality assurance methods employed by a specific manufacturer are used and analyzed. Post-process quality check monitoring is conducted by the Department of Technical Monitoring (DTM). DTM certificates are processed, and current on-line process quality control activities are performed.
- Following the manufacture of products and systems, FLNR representatives do the acceptance inspection, issue acceptance protocols and certificates.
- The incoming inspection of products is done prior to their installation at FLNR. Protocols are issued. The testing of products and allied equipment in conditions that correspond to the real ones under which current facilities operate can be done, if necessary. Protocols are issued.
- Products and systems of the FLNR DC-280 cyclotron are installed.
- Autonomous LTW programmes for the mounted systems are developed. These include test programmes of the installed equipment.
- Autonomous LTWs are carried out without ion acceleration. Protocols and certificates are issued. A complex LTW programme for the DC-280 cyclotron with the acceleration of testing ions is developed.
- The processed documents (programmes of autonomous and complex LTWs, workplace safety instructions when undertaking LTWs, autonomous LTW protocols and certificates, etc.) are sent to the Federal Medical and Biological Agency of Russia (FMBA) along with the project documentation for obtaining permission to undertake complex LTWs.
- Based on document processing results, the FMBA issues an expert review on the DC-280 cyclotron and grants a permission for further complex LTWs.
- The FLNR staff carry out complex LTWs with the acceleration of testing ions and issue the DC-280 cyclotron complex operability protocols and certificates. The FMBA staff carry out dosimetry measurements and epidemiological studies (microclimate, illumination, noise and vibration levels, etc.) during complex LTWs in the rooms and halls of the cyclotron, issue protocols and certificates. The DC-280 cyclotron complex operability certificate is issued.
- The FMBA issues a sanitary and epidemiological conclusion certificate on the DC-280 cyclotron for work approval at the cyclotron.
- Act of commissioning of the DC-280 cyclotron complex is issued.

The FLNR plans for 2018: to conduct autonomous LTWs of systems in May–June; to obtain the FMBA expert conclusion certificate for the DC-280 cyclotron and the permission for complex LTWs in September; to carry out complex LTWs in September–November; to obtain the FMBA sanitary and epidemiological conclusion certificate for carrying out works at the DC-280 cyclotron; and the commissioning of the cyclotron at the end of 2018.

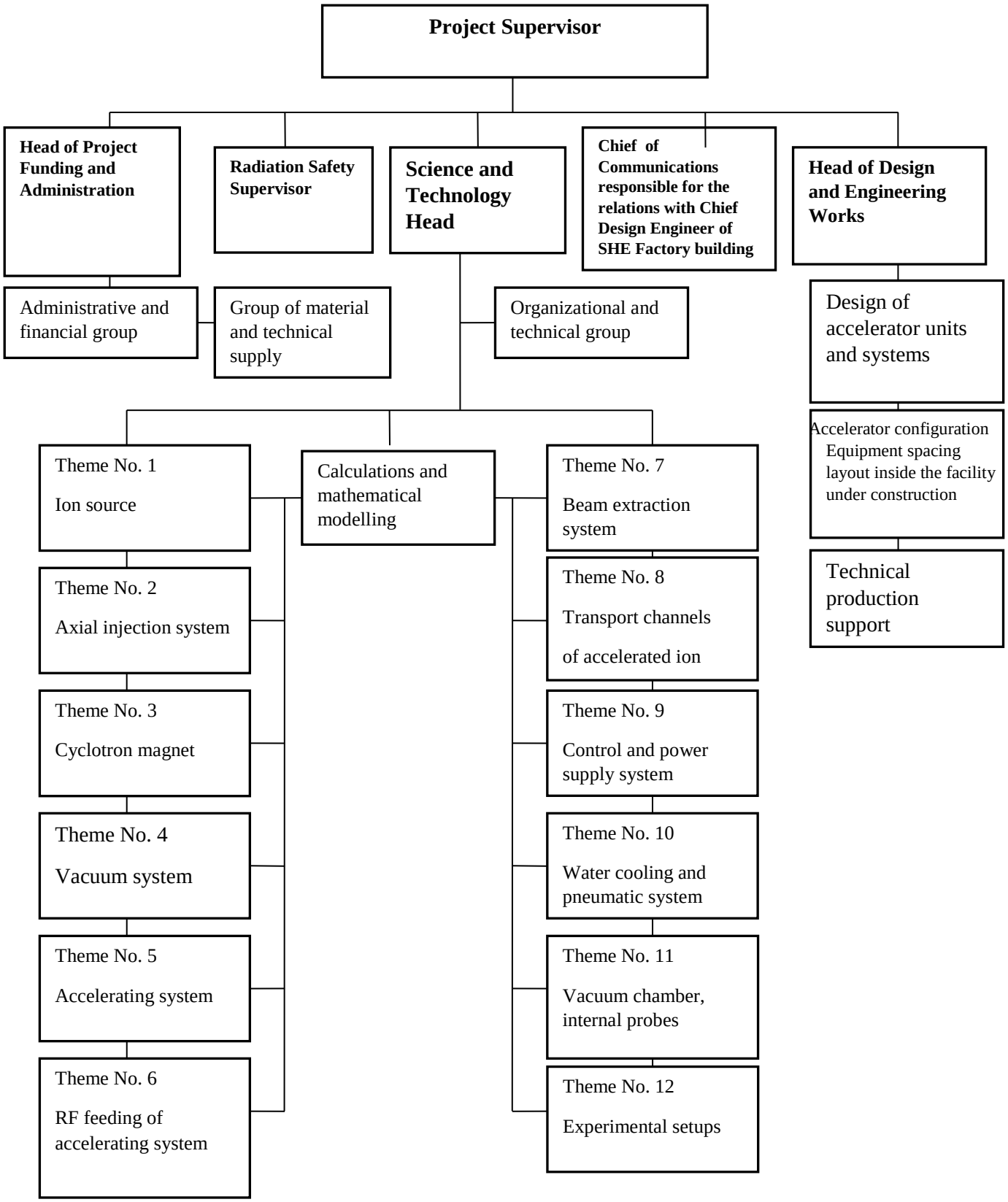

Fig. 1

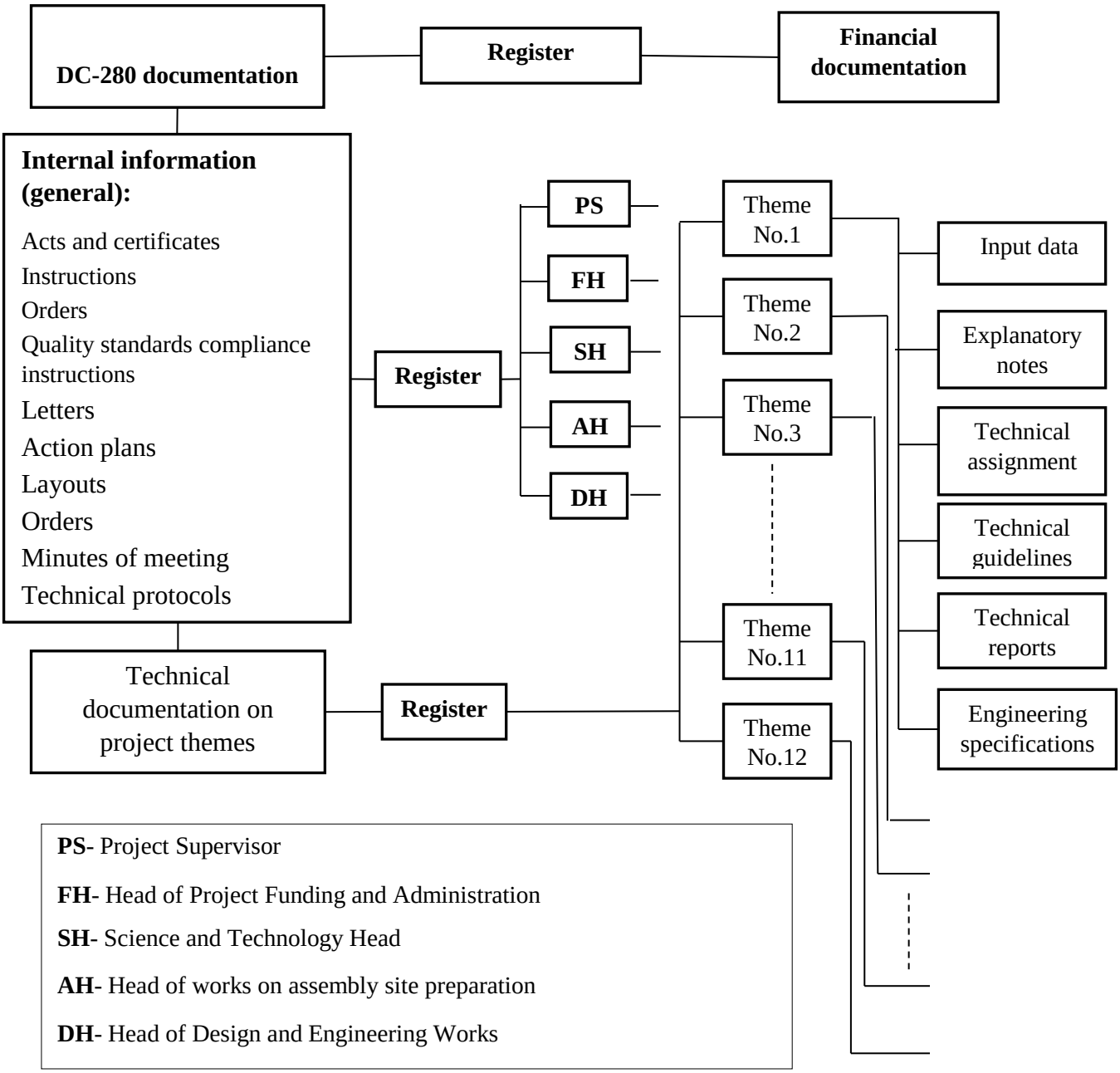

Fig. 2. The structure of the DC-280 documentation catalogue

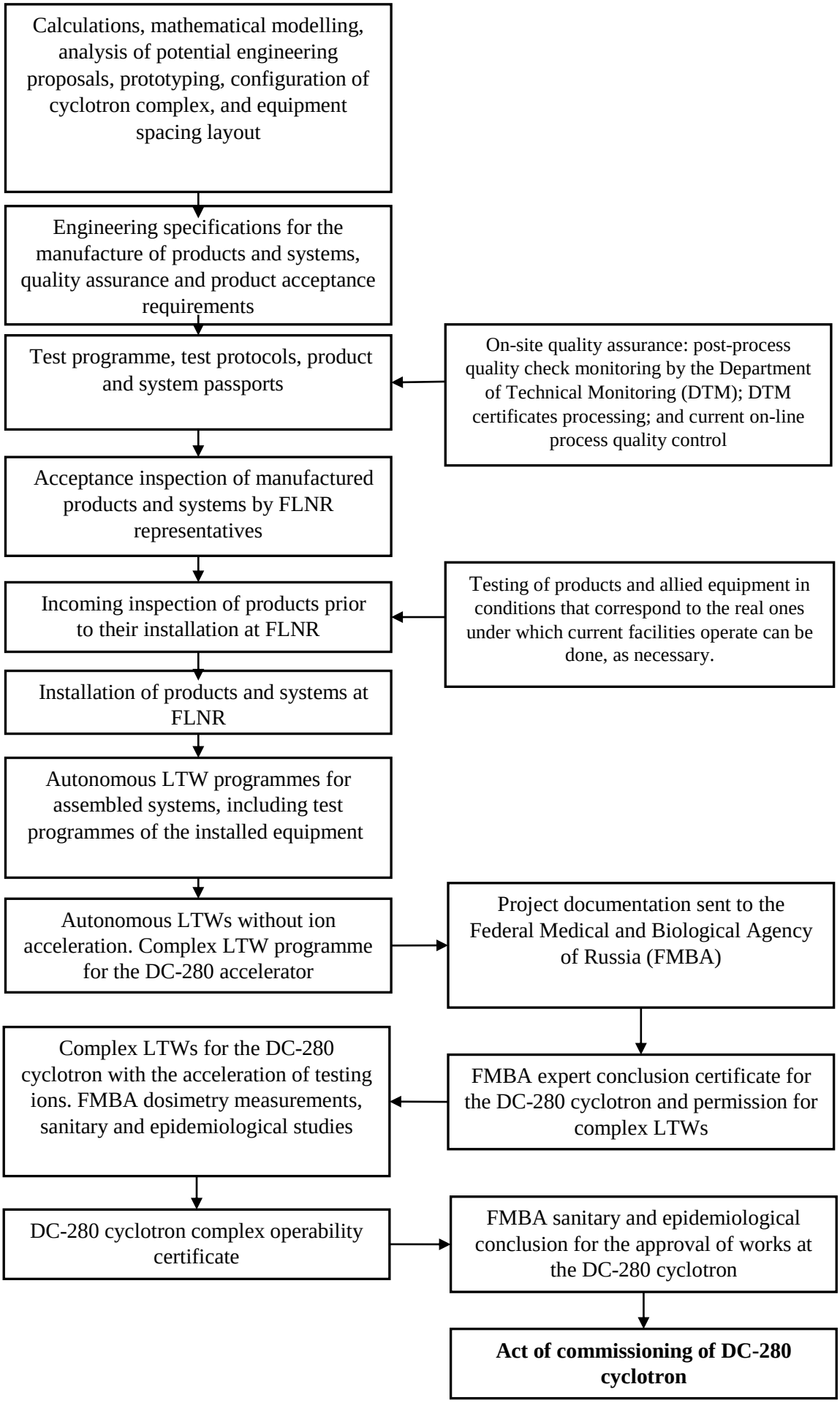
Calculations, mathematical modelling, analysis of potential engineering proposals, prototyping, configuration of cyclotron complex, and equipment spacing layout
Engineering specifications for the manufacture of products and systems, quality assurance and product acceptance requirements
Test programme, test protocols, product and system passports
On-site quality assurance: post-process quality check monitoring by the Department of Technical Monitoring (DTM); DTM certificates processing; and current on-line process quality control
Acceptance inspection of manufactured products and systems by FLNR representatives
Incoming inspection of products prior to their installation at FLNR
Testing of products and allied equipment in conditions that correspond to the real ones under which current facilities operate can be done, as necessary.
Installation of products and systems at FLNR
Autonomous LTW programmes for assembled systems, including test programmes of the installed equipment
Autonomous LTWs without ion acceleration. Complex LTW programme for the DC-280 accelerator
Project documentation sent to the Federal Medical and Biological Agency of Russia (FMBA)
Complex LTWs for the DC-280 cyclotron with the acceleration of testing ions. FMBA dosimetry measurements, sanitary and epidemiological studies
FMBA expert conclusion certificate for the DC-280 cyclotron and permission for complex LTWs
DC-280 cyclotron complex operability certificate
FMBA sanitary and epidemiological conclusion for the approval of works at the DC-280 cyclotron
Act of commissioning of DC-280 cyclotron

Fig. 3