

Status of the Super c - τ Factory project

Edict No. 642 of December 1, 2016 by the President of Russian Federation approved the Strategy for Scientific and Technological Development of Russian Federation (hereinafter referred to as the Strategy). This document of the state strategic planning determines the goal and main tasks of the scientific and technological development of the Russian Federation, establishes the principles, priorities, main directions, and measures for implementing the state policy in this area, as well as the expected results of the Strategy implementation to ensure stable, dynamic and balanced development of the Russian Federation for a long-term period.

As one of the main directions of the implementation of the state policy in the field of scientific and technological development of the Russian Federation, the Strategy mentions the development of the infrastructure and environment as well as creation of conditions for research and development that meet the modern principles of scientific, technical and innovative activities and best Russian practices, among other things by supporting the creation and development of unique scientific facilities of the "mega-science" class and large-scale research infrastructures on the territory of the Russian Federation (paragraph 32, b of the Strategy).

Russian Federation Government Order No. 1325-r of June 24, 2017 approved the plan of activities for the implementation of the first phase of the Strategy (for 2017-2019), according to which a program for the creation and development of a network of unique "mega-science" class facilities on the territory of the Russian Federation (activity 30) should be developed. Among the anticipated results of the implementation of this activity is formation of international collaborations, completion of the stage of design of the second-stage "mega-science" class facilities on the territory of the Russian Federation, including SSRS-4, XCELS, and Super C-Tau, and transition to the stage of their construction.

The Super c - τ factory is an accelerator complex designed for experiments with electron-positron colliding beams in the energy range from 2 to 5 GeV with a record luminosity of $10^{35} \text{ cm}^{-2}\text{s}^{-1}$, which is two orders of magnitude higher than that achieved today in the world in this energy range. The concept of the new collider is based on a new method to increase the luminosity, which was proposed and developed by experts from INFN (Italy) and Budker Institute. The physical program of the project is based on such fundamental issues as the study of mixing in the D meson system, search for CP-violating effects in decays of charmed particles, and search for "New Physics" in rare and Standard Model-forbidden decays of charmed particles and tau lepton. It is important to note the high complementarity of the physical tasks of the project and experimental programs of the largest modern experiments in the elementary particle physics, first of all, Belle II at Super KEKB and LHCb at LHC.

In 2011, the Super c - τ project became one of the six "mega-science" class projects selected by the Governmental Commission for implementation on the territory of the Russian Federation. The conceptual design of the new facility, which had been developed at Budker Institute with the participation of Russian and foreign partners, was highly evaluated by Russian and foreign experts, including two international assessments organized by the Ministry of Education and Science of the Russian Federation in 2012 and 2013. International scientific committees and organizations (ECFA, CERN, and JINR) and authoritative scientists (including Nobel Prize Winner

in Physics M. Perl) have expressed their support for the Super C-Tau project. Leading Russian and foreign research organizations with significant experience and competence in the relevant fields expressed interest in participating in the development and construction of the new facility and carrying out experiments with it.

Budker Institute of Nuclear Physics of SB RAS is the largest academic institute of the Russian Federation, and one of the world's leading research centers in the field of elementary particle physics, accelerator physics and technology, synchrotron radiation sources, free electron lasers, high-temperature plasma physics, and controlled thermonuclear fusion. A number of key ideas and developments that determine the current world level of accelerator science and technology were proposed and implemented at Budker Institute. It is the only laboratory in the world where for half a century since the appearance of the colliding-beam method at least one electron-positron collider has been operating. Today, two out of the six existing colliders are operating here.

Thereby, Budker Institute is unique in the world's ecosystem of high energy physics. It is characterized by established scientific schools and an effective system of training scientific and engineering personnel, modern experience, high qualifications and unique competence both in the development and creation of unique scientific equipment, engineering and technical infrastructure and in carrying out high-precision experiments, as well as by high experience of international scientific and technological cooperation.

In the last 5 – 7 years, Budker Institute has been actively preparing for the implementation of the Super c - τ project: the projects of the accelerator complex and detector as well as IT, engineering and construction infrastructures are being developed and detailed; the physical program of experiments is under development and refinement. The key elements of the accelerator and detector of the Super c - τ factory are being elaborated. At the end of 2015, a new injection complex of the Institute with a record capacity in the production of positrons was commissioned. It was integrated into the accelerator infrastructure of the Institute, which resulted in improved parameters and increased effectiveness of experiments at the VEPP-4M and VEPP-2000 colliders.

The plan of activities for the implementation of the first phase of the Strategy, which was approved in June 2017, determines the time frame and list of tasks necessary to complete preparations for the Super c - τ project. At the end of August 2017, the Russian Ministry of Education and Science and Budker Institute of Nuclear Physics SB RAS signed an agreement for an amount of about 0.25 billion rubles, which foresees the development and upgrade of the accelerator complex of Budker Institute and the creation of scientific and technical groundwork for the implementation of the new large-scale unique “mega-science” facility, the electron-positron collider Super c - τ factory. Effective implementation of such ambitious projects is impossible without the participation of leading scientific organizations and technology and manufacturing companies that specialize in developing and manufacturing equipment and systems for accelerator complexes and experiments and consolidation of ideas and competencies in the format of a full-scale international collaboration.