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Status of ARIADNA Collaboration for applied research at NICA facility

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NICA (**N**uclotron-based **I**on **C**ollider f**A**cility) is a new accelerator complex designed at the Joint Institute for Nuclear Research to study properties of dense baryonic matter. Besides the fundamental physics issues, the NICA team is also constructed special beamlines for applied research, including biomedical applications, space research, radiation materials science, radiation testing of microelectronics and novel developments for ADS. The **A**pplied **R**esearch **I**nfrastructure for **A**dvanced **D**evelopments at **N**ICA f**A**cility, recently named ARIADNA, includes (1) beamlines with magnetic optics, power supplies, beam diagnostics systems, cooling systems, etc., (2) several experimental zones equipped with target stations for users (detectors, sample holders, irradiation control and monitoring system, etc.) and (3) supporting user infrastructure (areas for deployment of user equipment, for sample preparation and post-irradiation express analyses).

Overall scope of applied research be performed using ARIADNA beamlines includes but limited to radiation protection in space, radiation testing of microelectronics, materials research with ion beams and novel technology for radiation waste processing.

Zone 1 and its experimental station is designed for studying radiation damage to decapsulated microcircuits with low-energy ion beams extracted from the HILAC at the energy of 3.2 MeV/nucleon. The spectra of available particles will include protons and ions with Z = 2 to 92, which enables simulating certain aspects of exposure of non-biological samples to low-energy component of space radiation. Zone 2 will provide an opportunity for irradiation of different samples with intermediate-energy ion beams of 150–1000 MeV/nucleon. Zone 2 includes two target stations designed for space radiobiology studies, radiation materials science and investigating the radiation damage to capsulated microelectronics. At both target stations the following ions are expected to be available: $^{12}C^{6+}$, $^{40}Ar^{18+}$, $^{56}Fe^{26+}$, $^{84}Kr^{36+}$, $^{131}Xe^{54+}$, $^{197}Au^{79}$. Considering the recent trends and multiple requests raised by potential users, there is an intent to extend acceleration techniques towards realistic simulation of galactic cosmic rays with NICA beams, including implementation of the specific acceleration regime with rapid switching of ions and energies. Zone 3 is designed for development of novel nuclear power technologies, including development of ADS. The beams of $^{1}H^{1+}$, $^{2}D^{1+}$, $^{12}C^{6+}$, $^{40}Ar^{18+}$ and $^{7}Li^{3}$ with energies of 0.3-4 GeV/nucleon are planned to be available at the target station of this zone. Zone 4 is intended for long-term exposure of materials science and biological samples to heavy ions with energies of 1-4 GeV/nucleon. The recent test experiments in this zone were performed with 3.8 GeV/nucleon $^{124}Xe^{54+}$ ions.

There are the ARIADNA collaboration is established in 2022 on research topics, which constructed zones are designed for. At present, this collaboration involves 202 participants from 30 organizations of 7 countries. Both academic and industrial teams are eligible to access the ARIADNA infrastructure. A corresponding user policy at NICA is under development, which will include regulations on equipment use, bioethics, access to beamlines and to supportive user infrastructure, etc. There are several ways of joining ARIADNA. First, as a member of ARIADNA collaboration via signing of an MoU to become a member of the collaboration. Second, as an individual user: via preparation and submitting a proposal for an experiment. Third, as an ARIADNA partner via contacting the ARIADNA responsible person and discussing a specific was on how a research team or a company can contribute to ARIADNA.

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