Annex 4.
Project report form

APPROVED

Director of Laboratory

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REPORT ON PROJECT (INFRUSTRUCTURE PROJECT*)*
IN FIELD OF RESEARCH WITHIN
THE TOPICAL PLAN FOR JINR RESEARCH

1. General information on the Project
1.1. Scientific field
Particle physics
1.2. Name of the Project
AMBER (NA66)
1.3. Project code
02-2-1085-2-2024/2029
1.4. Theme code
02-0-1085-2009/2029
1.5. Actual duration of the Project
2024-2026
1.6. Project Leader(s)
A. Guskov

2. Scientific report
2.1. Annotation
During the reporting period, the JINR group was active in several areas: development of the physics program for the second phase of the experiment; R&D for the production of Micromegas detectors with a low material budget in the active area; development of triggerless electronics for the MDT detectors of MW1, as well as routine maintenance and repair of this subsystem; participation in the development and operation of the triggerless data acquisition system, as well as participation in the analysis of experimental data from 2023.

2.2. A detailed scientific report
2.2.3. A description of the scientific work undertaken and the results obtained.

In collaboration with Samara University, a proposal for the second phase of the experiment was prepared and submitted to the collaboration to study the partonic structure of the kaon using direct photons as a probe. A system of three electromagnetic calorimeters is expected to provide a measurement accuracy of the differential cross section at the level of 15% and 20% per year of data taking for positive and negative kaons, respectively. A proposal was also made to study the chiral anomaly in the vertex KγKπ with a kaon beam.

A realistic description of large-area Micromegas chambers has been implemented in the GARFIELD package, and signal modeling has been performed. The results obtained are being used in the development of new readout electronics for the Micromegas chambers. In collaboration with the Torin group, the first prototype of Micromegas chambers for the AMBER experiment was fabricated and tested. The feasibility of manufacturing large-area chambers at the Micromegas production site of DLNP JINR, has been demonstrated. A design Micromegas chambers with minimal material budget has been proposed for the small-angle detector. At JINR, test assemblies of mechanical prototypes have been carried out to select the manufacturing technology. A working prototype of a chamber with two signal planes, an active area of 10.5×10.5 cm², and a total material budget of less than 0.6% of radiation length has been fabricated. Preparations for testing the prototype are currently underway.

Recuperation of the MDT muon detectors (Muon Wall 1) after 20 years running and designing a new digital VME unit suitable for new AMBER readout for triggerless data acquisition system are started. MDT's recuperation was performed at CERN for one (out of two) station. It includes: testing of all detectors (528 units comprising 4224 wires), replacement of broken detectors/wires, recovery of gas tightness. A new digital 192-channel module (FDM-192A, FPGA-based Digital Module) is being designed for replacement of present trigger-based DAQ by the triggerless version. The prototype units should be ready by September, 2026 for tests and tuning with DAQ test stand at CERN.

The JINR group is participating in the processing and analysis of data from the 2023 run on antiproton yield measurements, specifically in antiproton identification in the RICH detector. It has also made a significant contribution to the development and operation of the new triggerless DAQ. The group has fully fulfilled its shift obligations at the detector.

2.2.4. A list of the main publications of JINR authors, including associated personnel on the results of the project work (list of bibliographical references).

1) Alice C. et al, "Development of the new large area Micromegas detector and its readout electronics for the AMBER experiment at CERN", NIM A 1079 (2025) 170611
2) Guskov A., Maltsev A., Olshevskiy A., "Study of low-energy QCD in meson reactions with the Coulomb field of atomic nuclei", Natural Sci.Rev. 3 (2026) 6, 200602
3) Gridin A., "Study of the kaon partonic structure with high-pT prompt photon production process at the AMBER experiment at CERN", accepted to Moscow University Physics Bulletin, 2026

4. Plan/actual analysis of resources used: human (including associated personnel), financial, IT, infrastructure

4.1. Human resources (actual at the time of reporting, total number of participants)
(total number of participants)

№№ п/а	Category employee	Core staff Amount of FTE	Associated personnel Amount of FTE
1.	scientific staff	7	
2.	engineers	1.5	
3.	professionals	~~0~~	
	Total:	**8.5**	

Theme Leader

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Project Leader

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Laboratory Economist

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