

APPROVED BY

JINR Vice Director

“ ____ “ _____ 2020

SCIENTIFIC AND TECHNICAL JUSTIFICATION FOR EXTENDING THEME

to be included in the

TOPICAL PLAN FOR JINR RESEARCH FOR 2021

Theme code 02-0-1108-2011/2021

Laboratory DLNP

Department Hadron Physics

Research area Elementary Particle Physics and Relativistic Nuclear Physics

Theme title PANDA Experiment at FAIR

Theme leader G.D. Alexeev

Deputy: A.N. Skachkova

Abstract

FAIR complex, which is being constructed at GSI (Darmstadt), will provide unique possibilities for studying physics in a wide domain including atomic and plasma physics, heavy ion collisions and nuclear matter physics, nuclear structure and physics with antiprotons. The PANDA experiment planned at FAIR High Energy Storage Ring (HESR) is devoted to the investigation of possible exotic states (hybrids, glue-balls, etc.) and structure of nucleons performed with antiproton beam of high intensity and homogeneity. The information obtained in this experiment will complement the knowledge from analyses of heavy ion collisions about nuclear matter features and phase transitions, which will be obtained in the fixed target experiment CBM, also at FAIR, and collider experiments MPD and SPD at NICA (JINR, Dubna).

The main JINR contribution to the PANDA experiment now is construction of the Muon System by instrumenting the layers of steel absorber with active detectors (Mini Drift Tubes). At present we expect that initial funding from FAIR may be possible, which should cover the most urgent needs in constructing the PANDA setup – equipping the Barrel part of Target Spectrometer with muon detectors.

In the case of positive decision on this funding, the JINR will have the possibility to contribute significantly to the construction of the detector and, later – to the physics of the PANDA experiment. This will provide a unique possibility for JINR physicists to study in details the antiproton-proton and antiproton-nuclei interactions at PANDA energies, make the measurement of different interaction parameters and test different models. In particular, the structure functions, charm resonances and general behavior of nuclear matter, including new states and phase transitions, are of great interest.

List of activities

- 1) Preparation of FAIR-JINR contract on construction of the Muon System ... 2020-21
- 2) Preparation of production workshop for MDT detectors 2020-21
- 3) R&D on electronics 2020-21
- 4) Beam tests with the prototype at CERN2021
- 5) Software and physics development 2020-21

Results expected upon completion of the theme

- 1) Signing of FAIR-JINR contract on construction of the Muon System
- 2) Readiness of mass production workshop for MDT detectors
- 3) Start of MDT detectors production
- 4) Finalizing of electronics design
- 5) Calibration of the prototype at CERN to all types of particles in energy range 0.5-10 GeV
- 6) Particle identification algorithms (PID) tuned on beam test results

Participants from JINR

Dzhelepov Laboratory of Nuclear Problems (DLNP)

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Veksler and Baldin Laboratory of High Energy Physics (VBLHEP)

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Bogolyubov Laboratory of Theoretical Physics (BLTP)

A.V. Efremov, A.S. Sorin, O.V. Teryaev

Laboratory of Information Technologies (LIT)

V.V. Uzhinsky

Participating countries, institutes and organizations

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	IP NASB
CERN	Geneva	CERN
Germany	Darmstadt	GSI
Russia	Protvino	IHEP
	Novosibirsk	BINP SB RAS
	Omsk	OB IM SB RAS

Time frame of the theme 2020-2021**Total estimated cost of the theme** (in thousand €)

№.№	Activities	Total cost	Costs per years		
			1st year	2nd year	3rd year
1 (*)	Construction of detectors for the PANDA Muon System (Barrel part)	830	830		
2	R&D	80	80		
3	International scientific and technical cooperation	50	50		
Total		960	960		

Other financing sources

(*) – in framework of BMBF-JINR contract (external source to JINR budget)

Cost estimates for the theme (in thousand €)

№№ of items	Budget items	Total 2021	Including 2021
1 (*)	BMBF-JINR contract	830	830
2	Contribution of Germany (BMBF) to JINR budget	110	110
3	JINR/DLNP budget	20	20
Total		960	960

AGREED:

JINR Chief Scientific Secretary

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 “ ____ “ _____ **2020**

Laboratory Director

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Head of Planning and Finance Department

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Laboratory Scientific Secretary

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 “ ____ “ _____ **2020**

Head of Science Organization Department

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 “ ____ “ _____ **2020**

Laboratory Economist

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 “ ____ “ _____ **2020**

Theme leader

G.D. Alexeev 

“ **18** “ **06** **2020**