***Form of renewal for Project***

**APPROVED**

**JINR DIRECTOR**

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**MPD PROJECT PROPOSAL FORM**

1. **General information on the research project of the theme**

**1.1 Theme code:** (for extended projects) *–* **02-1-1065-2007/2026**

NICA Complex: Design and Construction of the Complex of Accelerators, Collider and Physics Experimental Facilities at Extracted and Colliding Ion Beams Aimed at Studying Dense Baryonic Matter and the Spin Structure of Nucleons and Light Ions, and at Carrying out Applied and Innovation Projects.

**1.2 Project code: 02-1-1065-3-2011/2025**

**1.3 Laboratory: VBLHEP**

**1.4 Scientific field: Large JINR Research Infrastructure**

**1.5 Title of the project: MultiPurpose Detector MPD**

**1.6 Project leaders: V.Golovatyuk, V.Kekelidze, V.Riabov**

**2. Scientific case and project organization**

**2.1 Annotation**

The main goal of the MPD project is to design and build a universal detector for studying the properties of strongly interacting nuclear matter at extreme baryon densities. The first concept of MPD was presented in a Letter of Intent issued in February 2008, the first version of the Conceptual Design Project was released in December 2009 [1].

**2.2 Scientific case** (aim, relevance and scientific novelty, methods and approaches, techniques, expected results, risks)

The main scientific goal of the MPD project is to search for new phenomena in the baryon-rich region of the QCD phase diagram using colliding heavy-ion beams in the energy range 4 GeV ≤ √(s\_NN ) ≤ 11 GeV and/or fixed-target collisions in the energy range 2.3 GeV ≤ √(s\_NN ) ≤ 3.5 GeV.

Over the past 20 years, an extensive research program has been carried out in the field of heavy-ion collisions and a number of new phenomena have been discovered. There is strong evidence for a deconfinement phase transition in central heavy-ion collisions at SPS energies [2]. Extensive experimental data collected during the RHIC experiments [3] suggest the formation of a new state of dense partonic matter - strongly interacting quark-gluon plasma (sQGP). However, it is generally accepted that a much more sensitive and detailed study of the QCD phase diagram in the region of large baryochemical potential μB requires the next generation of heavy ion experiments [4]. Several accelerator centers have recently started new heavy ion programs: SPS at CERN [5], RHIC at BNL [6] and CBM at FAIR [7] can be considered as additional programs aimed at studying the relevant physical problems of hot and dense baryonic matter.

The main advantages of the NICA/MPD project are that the NICA accelerator facility will provide a wide choice of beams (from protons to gold ions) in the energy range that covers the onset of deconfinement (center-of-mass energy from 4 to 11 GeV). The high luminosity of NICA (L = 1027 cm-2 s-1) allows for fairly small energy steps when scanning through the collision energies, ensuring a high rate of statistics collection.

**The key features of the proposed MPD design that enable high-precision nuclear collision studies are:**

• High collision frequency (up to 6 kHz) enables very fine measurements of the energy dependence and centrality of any phenomenon of interest

• MPD has full azimuthal coverage and will measure most of the momentum range in the pseudorapidity range of -2 < η < 2.

• Particle identification uses tracking information from TPC in magnetic field to reconstruct particle momentum, ionization loss TPC information, and TOF measurements of particle time-of-flight. Electromagnetic calorimeter data are also used to reconstruct photons and electrons with good time and energy resolution.

The existing international collaboration for the project involves about 450 scientists from 16 institutes in Russia and abroad.

The following processes are planned to be studied:

* the yield of strange particles, baryons and antibaryons;
* event-by-event fluctuation of multiple particle production, transverse momentum, particle yield ratio;
* anisotropic and collective flows;
* momentum correlations (femtoscopy);
* production of lepton pairs and soft photons;
* polarization phenomena.

To conduct the specified studies, the detectors of the setup must ensure effective identification of nuclear collision products and measurement of their parameters at high loads in a wide range of phase space.

**General design of the setup**

The setup must include:

- a system for measuring particle momentum in the range p = 0.1 – 2 GeV;

- a particle identification system for separating protons, π-mesons, K-mesons and electrons in the momentum range of 0.1 – 3 GeV/c;

- a system for reconstructing the primary interaction vertex with an accuracy of 100-200 μm and secondary decay vertices with an accuracy of 10-20 μm;

- the ability to register gamma rays in the energy range of 50 - 2000 MeV;

The setup should cover a geometry close to 4π. For accurate measurement of the particle momentum, the tracking system should operate in a uniform magnetic field with a strength of 0.2 - 0.5 T. Obviously, to obtain such a field in the specified volume, it is preferable to use a superconducting solenoid magnet.

The MPD setup that meets these requirements is shown in Fig. 1. The detector should consist of a cylindrical part and two end-cup parts. All of them are located in a magnetic field. The cylindrical part consists of various types of detectors located around the beam collision region, which include a tracking system, a time-of-flight system, and an electromagnetic calorimeter.

**Purpose and description of the detectors of the setup**

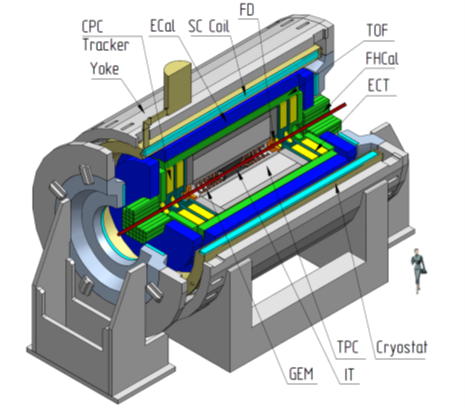


Fig. 1 Layout of the MPD, complete stage.

A time-projection drift chamber (TPC) was chosen as the main tracking system. It should be supplemented by an internal tracking system based on silicon semiconductor detectors (IT) surrounding the beam collision region. Both detectors will provide accurate reconstruction of particle tracks and their momenta, as well as determination of particle decay vertices. The inner detector should have at least 5 layers surrounding the beam interaction region to reconstruct secondary vertices of short-lived particles such as heavy hyperons.

To identify particles, in addition to the TPC, a precision time-of-flight (TOF) system is needed, which should ensure the identification of charged particles with momenta up to 2 GeV/c in a wide pseudorapidity region. The TOF system will need a fast forward detector (FD), which provides a start signal for the time-of-flight system and a time resolution of at least 30 ps.

An electromagnetic calorimeter (EMC) is required to identify electrons and photons and measure their energy. High granularity of the calorimeter along with good energy and time resolution will significantly improve the particle identification capabilities of the MPD detector. The optimal design and cost of the calorimeter is based on a multilayer absorber-detector assembly of the “shashlyk” type.

In order to expand the particle detection area in the forward region (the pseudorapidity region |η| > 2, where the TPC tracking efficiency decreases), end-face tracking systems (ECT) based on proportional straw tubes, proportional chambers with cathode readout, or detectors based on GEM structures should be provided. Tracking systems (ECT) should be located at both ends of the MPD directly behind the TRS reading chambers. To identify particles in the angle range |η| > 1.2, it is also proposed to use a time-of-flight system and electromagnetic calorimeters similar in type to such systems in the cylindrical part of the MPD.

To detect particles emitted at very small angles 1.2 < |η| < 2, fast forward detectors (FD) and hadronic calorimeters (FHCal) are used. The listed detectors are used in the trigger to determine the centrality of the collision and reconstruct the interaction point of nuclei in the beam.

Thus, in the structure under consideration MPD can be divided into three regions with a characteristic measurement method and accuracy: the central part |η| < 1.2, the forward region 1.2 < |η| < 2, in which the particle momentum is measured rather roughly (dp/P ~ 4 - 10%) and the region 2 < |η| < 3, where the integral parameters of the event are measured.

In order to optimize the time of construction and commissioning of the facility, it is advisable to create it in stages. At the first stage, the **basic configuration** is assembled, which should include such subsystems as TPC, the cylindrical part of the TOF, FD, FHCal and the cylindrical part of the ECal. The internal tracking system ITS, the forward tracking system, including Straw and CPC, as well as the end TOFs can be attributed to the complete configuration and manufactured at the second stage.

In the basic configuration, the facility can effectively identify secondary particles and measure their momentum in the pseudorapidity range | η | < 1.2. The consolidated volume of the technical description of the MPD installation is located at: <http://mpd.jinr.ru/doc/mpd-tdr>.

**References**

[1] The MultiPurpose Detector (MPD). Conceptual Design Report, v1.0.

http://nica.jinr.ru/

[2] C.Alt et al.Phys.Rev.C 77, 2008, 024903.

[3] Nucl.Phys. A757 (2005), 1-283

[4] Searching for a QCD mixed phase at the NICA (NICA White paper). Draft v2.01,

30 September 2009. http://nica.jinr.ru/

[5] NA61 experiment. CPOD07 (2007),023. Eprint=0709.1646.

[6] G.S.F. Stephans, J. Phys., G32 (2006), S447-S454.

[7] P.Senger, J. Phys. G30 (2004), S1087-S1090.

**Main Assembly Stages**

**Table 1.**

|  |  |
| --- | --- |
| Stage | Assembly stage time |
| Preparation for solenoid magnet turn-on (cryogenics, power supply, etc.) | December 2024 – January 2025 |
| Magnetic field measurements | February - April 2025 |
| Preparation for detector subsystem installation | May 2025 |
| Installation of TOF, ECal, TPC, platform with electronics, cables. | May - October 2025 |
| Mounting the FHCal | November - December 2025 |
| Commissioning | December 2025 |
| The firs run on the collider beams | December 2025 |

**SWOT analysis for the MPD - project**

**Strengths:** The strong points of the MPD- project are the unique physics related with the studies of the structure of the phase diagram of the state of strongly interacting matter in the region of moderate temperatures and large baryon densities exceeding the density in ordinary nuclear matter by 5-8 times.

**Weaknesses:** Detector has a very high complexity. There is the firs experiment of such scale built in JINR. It requires a new organization of institute administrative departments and universities collaboration.

**Threats**

The main risks are:

When creating the MPD detector in the basic configuration in the period 2020 - 2025, the main risks include:

1. Complexity of the detector design, the institute had no experience in creating such large detectors and collaborations;

2. Lack of qualified personnel of engineers, specialists and researchers;

3. Difficulties in accessing technologies developed by Western companies;

4. Termination of contracts by Western companies and institutes after February 2022;

5. Delays in the delivery of construction projects (in particular, the cooling system of building 17);

6. For the creation of second-stage detectors (full configuration) - the period 2026-2030;

a) ITS – vertex detector – alternative detector and electronics technologies are being developed in China, there is no certainty when production of working components will begin and how accessible they will be to us, despite our financial and intellectual participation in the developments;

b) Forward tracking system – difficulties in acquiring modern microcircuits, materials and devices.

**2.3 Estimated completion date in basic configuration - 2025**

**in full configuration – 2030**

**2.4 Participating JINR laboratories VBLHEP, LIT, LNP**

**MICC resource requirements**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Computing resources** | **Distribution by year** | | | | |
| 2026 | 2027 | 2028 год | 2029 | 2030 |
| Data storage (TB)  - EOS  - Tapes | 3 000  6 000 | 6 000  12 000 | 8 000  16 000 | 10 000  20 000 | 12 000  24 000 |
| Tier 1 (CPU core hours) | 3 500 000 | 5 000 000 | 9 000 000 | 9 000 000 | 9 000 000 |
| Tier 2 (CPU core hours) | 3 000 000 | 4 000 000 | 7 500 000 | 8 000 000 | 8 000 000 |
| SC Govorun (CPU core hours)  - CPU  - GPU | 800 000  - | 1 000 000  - | 3 000 000  - | 1 000 000  - | 3 000 000  - |
| Clouds (CPU cores) | 0 | 0 | 0 | 0 | 0 |

**2.5. Participating countries, scientific and educational organizations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Organization** | **Country** | **City** | **Participants** | **Type**  **of agreement** |
| A.I.Alikhanyan National Science Laboratory | ARMENIA | Yerevan | H.Grigorian, V.Abgaryan, A.Ayriyan, N.Gevorgyan, I.Kadochnikov, V.Papoyan, A.Piloyan | MoU of 29/10/2020 |
| State Scientific Institution “Joint Institute for Energy and Nuclear Research – Sosny” of the National Academy of Sciences of Belarus | BELARUS | Minsk | L.Babichev, Yu.Rusak | MoU in the process of signing |
| Plovdiv University Paisii Hilendarski | BULGARIA | Plovdiv | M.F.Shopova, B.Dabrowska, P.Dulov, N.Geraksiev, M.Ilieva, D.Suvarieva, L.Yordanova | MoU of 16/11/2020 |
| Tbilisi State University | GEORGIA | Tbilisi | R.Shanidze, T.Babutsidze, G.Kachlishvili, V.Kikvadze, A.Machavariani, M.Nioradze | No MoU |
| Institute of Physics and Technology (IPT) | KAZAKHSTAN | Almaty | I.Lebedev, E.Bondar, A.Fedosimova, S.Ibraimova, T.Idrissova, B.Iskakov, D.Myktybekov, Zh.Sadykov, A.Serikkanov | MoU in the process of signing |
| Three Gorges University | CHINA | **Yíchāng** | S.Li,  S.Feng,  K.Wu,  X.Yuan | MoU of 26/11/2021 |
| Institute of Modern Physics of the Chinese Academy of Sciences | CHINA | Lanzhou | X.Li,  Z.Li,  X.Niu,  Y.Wang,  N.Xu,  H.Yang,  Yapeng Zhang, Yuezhao Zhang, C.X.Zhao,  W.Zhou | No MoU |
| Tsinghua University | CHINA | Beijing | Y.Wang,  Z.Deng,  D.Han,  Y.Huang,  L.Li,  Y.Li,  C.Shen,  Z.Xiao,  Z.Xu,  X.Zhu,  P.Zhuang | MoU of 16/03/2021 |
| School of Nuclear Science and Technology, University of Chinese Academy of Sciences | CHINA | Lanzhou | G.Xie,  M.Huang,  Y.Shen,  Z.Yuan | MoU of 21/04/2021 |
| Institute of Particle Physics, Central China Normal University | CHINA | Wuhan | Y.Wang,  F.Liu,  S.Shi,  X.Sun | MoU of 14/05/2021 |
| Huzhou University | CHINA | Huzhou | J.-S.Wang,  Y.Gu,  P.Li,  X.Sun,  F.Wang,  H.Xu,  X.Zhu | MoU of 26/11/2021 |
| University of South China | CHINA | Héngyáng | X.Wang,  X.Li,  T.Yu,  X.Zhao,  B.Zheng | MoU of 21/07/2021 |
| University of Science and Technology of China | CHINA | Héféi | Z.Tang,  X.Chen,  K.Jiang,  X.Li,  Z.Li,  P.Lu,  M.Shao,  Y.Sun,  Y.Wang,  W.Zha,  Y.Zhang | MoU of 14/05/2021 |
| Shandong University | CHINA | Jinan | C.Yang,  Z.Chen,  C.Feng,  J.Jiao,  D.Liu,  Y.Wang,  Y.Wang,  Q.Xu, Q.Yang | MoU of 27/05/2021 |
| Shanghai Institute of Nuclear and Applied Physics of the Chinese Academy of Sciences | CHINA | Shanghai | D.Fang,  X.Cao,  L.Liu,  F.Lu | MoU of 27/04/2021 |
| Centro de Investigación y de Estudios Avanzados | MEXICO | Mexico City | M.A.Ayala Torres, L.M.Montaño Zetina, M.A.Fontaine Sánchez | Mexican consortium, MoU of 11/10/2019 |
| Instituto de Ciencias Nucleares de la Universidad Nacional Autónoma de México | MEXICO | Mexico City | M.Alvarado, A.Ayala, W.Bietenholz, E.Cuautle, R. García,  R. Guzman, M.E.Patiño | Mexican consortium, MoU of 11/10/2019 |
| Universidad Autónoma Metropolitana | MEXICO | Mexico City | I.Gaspar, L.A.Hernandez Rosas,  A.S.Juan López, J.C.Marquéz Ramirez | Mexican consortium, MoU of 11/10/2019 |
| Benemérita Universidad Autónoma de Puebla | MEXICO | Puebla | L.G.Espinoza Beltran, E.M.Barbosa, M.R.Cahuantzi, C.H.Zepeda Fernández | Mexican consortium, MoU of 11/10/2019 |
| Universidad de Colima | MEXICO | Colima | M.Herrera , M.E.Tejeda-Yeomans | Mexican consortium, MoU of 11/10/2019 |
| Universidad Autónoma de Sinaloa | MEXICO | Sinaloa | I.D.Jiménez | Mexican consortium, MoU of 11/10/2019 |
| Universidad de Sonora | MEXICO | **Hermosillo** | A.G.Garcia, L.Rebolledo | Mexican consortium, MoU of 11/10/2019 |
| Universidad Michoacana de San Nicolás de Hidalgo | MEXICO | **Morelia** | **J.Anzúrez,  I.Luna,  P.Martínez, S.H.Ortiz,  A.Raya,  M.Reyes,  U.Sáenz,  G.Tinoco** | Mexican consortium, MoU of 11/10/2019 |
| Institute of Applied Physics | MOLDOVA | Chisinev | M.Baznat, D.Baznat | No MoU |
| Institute of Physics and Technology, Mongolian Academy of Sciences | MONGOLIA | Ulaanbaatar | Ts. Baatar | No MoU |
| Belgorod National Research University | RUSSIA | Belgorod | K.Vokhmyanina, V.Dronik, A.Kubankin, A.Pyatigor | MoU of 13/11/2020 |
| D.V. Skobeltsyn Institute of Nuclear Physics (SINP) of the Moscow State University | RUSSIA | Moscow | M.Merkin, N.Baranova, G.Bogdanova, E.Boos, M.Cheremnova, A.Chernyshov, G.Eyyubova, D.Karmanov, P.Kharlamov, O.Kodolova, M.Korolev, V.Korotkikh, A.Kryukov, V.Kukulin, V.Kuzmin D.Lanskoy, I.Lokhtin, D.Melikov, M.Platonova, G.Romanenko, L.Shcheglova, S.Shushkevich, A.Snigirev, A.Solomin, T.Tretyakova, V.Volkov, E.Zabrodin | MoU of03/11/2020 |
| High School of Economics University | RUSSIA | Moscow | F.Ratnikov, D.Derkach, F.Ghazzawi | MoU in the process of signing |
| Institute for Nuclear Research of the Russian Academy of Sciences | RUSSIA | Moscow | A.Ivashkin, A.Baranov, A.Botvina, U.Dmitrieva , M.Golubeva, F.Guber, A.Izvestnyy, N.Karpushkin, A.Kurepin, S.Morozov, S.Musin, V.Popov, I.Pshenichnov, S.Savenkov, A.Strizhak, A.Svetlichnyi, V.Volkov, L.Yakobnyuk | MoU of 29/01/2020 |
| Moscow Institute of Physics and Technology | RUSSIA | Moscow | T.Aushev,  A.Nozik | MoU of 03/11/2020 |
| National Research Nuclear University MEPhI (Moscow Engineering Physics Institute) | RUSSIA | Moscow | A.Taranenko, A.Anikeev, E.Atkin, N.Barbashina, A.Demanov, M.Mamaev, G.Nigmatkulov, P.Parfenov, M.Strikhanov, V.Troshin, A.Trutse | MoU of 11/06/2021 |
| National Research Center "Kurchatov Institute" | RUSSIA | Moscow | V.Kulikov, D.Blau, S.Bulychjov, O.Golosov, M.Martemianov, M.Matsyuk, K.Mikhaylov, E.Nekrasova, D.Peresunko | MoU of 09/11/2020 |
| Plekhanov Russian University of Economics |  | Moscow | A.Kamkin, M.Chupilko, M.Lebedev, S.Smolov | MoU in the process of signing |
| North Ossetian State University | RUSSIA | Vladikavkaz | N.Pukhaeva, A.Eremina, R.Esenov, Y.Kasumov , D.Kibizov, A.Korsunov, Z.Persaeva | No MoU |
| Peter the Great St. Petersburg Polytechnic University (SPbPU) | RUSSIA | Saint Petersburg | Ya.Berdnikov, A.Berdnikov, D.Kotov, D.Larionova, A.Lobanov, D.Shapaev, D.Trushkov | MoU of 11/07/2023 |
| Saint Petersburg State University | RUSSIA | Saint Petersburg | G.Feofilov, E.Andronov, A.Anufriev, S.Belokurova, V.Chulikov, K.Galaktionov, S.Igolkin,  V.Il’in, V.Kondratev, V.Kovalenko, N.Makarov, N.Maltsev, D.Prokhorova, N.Prokofiev, A.Puchkov, K.Sevastianova, S.Simak, S.Torilov, F.Valiev, V.Vechernin, S.Yurchenko, V.Zherebchevsky, A.Zviaygina | MoU of 06/02/2023 |
| Petersburg Nuclear Physics Institute (PNPI) | RUSSIA | Gatchina | Y.Riabov, R.Abdulin, N.Burmasov, A.Dyachenko, A.Ezhilov, O.Fedin, D.Ivanishchev, A.Khanzadeev, L.Kochenda, D.Kotov, P.Kravchov, E.Kryshen, A.Kyrianova, M.Maksimov, M.Malayev, V.Maleev, Y.Naryshkin, M.Pokidova, D.Pudzha, A.Riabov, V.Samsonov, A.Vasilyev, M.Vznuzdaev, G.Zalite, M.Zhalov, V.Riabov | MoU of 27/09/2021 |
| Vinča Institute of Nuclear Sciences, | SERBIA | Belgrade | J.Milosevic, D.Manic, L.Nadderd, V.Rekovic | MoU of 26/11/2021 |
| Pavol Jozef Šafárik University | SLOVAKIA | Košice | J.Vrlakova, V.Barbasová, A.Kravcakova, M.Vala | MoU of 14/12/2021 |

**2.6. Key partners** *(those collaborators whose financial, infrastructural participation is substantial for the implementation of the research program. An example is JINR's participation in the LHC experiments at CERN).*

**3. Manpower**

**3.1. Manpower needs in the first year of implementation**

|  |  |  |  |
| --- | --- | --- | --- |
| **№№**  **n/a** | **Category of personnel** | **JINR staff,**  **amount of FTE** | **JINR Associated**  **Personnel,**  **amount of FTE** |
| 1. | supervisor | 6,37 | 1,2 |
| 2. | research scientists | 47,97 | 4 |
| 3. | engineers | 56,65 |  |
| 4. | specialists | 5,36 | 0,9 |
| 5. | office workers |  |  |
| 6. | technicians | 8,6 |  |
|  | **Total:** | **124,95** | **6,1** |

**3.2. Available manpower**

**3.2.1. JINR staff**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No.** | **Category of personnel** | **Full name** | **Division** | **Position** | **Amount**  **of FTE** |
| 1. | supervisor | S.Belyaev | VBLHEP | Head of Department | 0,3 |
| D.Egorov | VBLHEP | Head of group | 0,4 |
| N.Emelianov | VBLHEP | Deputy Head of Department | 1 |
| A.Kolesnikov | VBLHEP | начальник службы | 0,1 |
| K.Mukhin | VBLHEP | Deputy Chief Engineer | 1 |
| S.Piyadin | VBLHEP | Deputy Head of Department | 0,37 |
| E.Serochkin | VBLHEP | Head of the Bureau | 0,7 |
| I.Slepnev | VBLHEP | Assistant Director for Information Technology Development | 0,7 |
| D.Tereshin | VBLHEP | Head of group | 1 |
| N.Topilin | VBLHEP | Deputy Chief Engineer | 0,8 |
|  |  |  |  |  | **6,37** |
| 2. | research scientists | S.Andreeva | VBLHEP | Leading Researcher | 0,4 |
| V.Astakhov | VBLHEP | Senior Researcher | 0,4 |
| V.Babkin | VBLHEP | Head of sector | 1,28 |
| A.Bazhazhin | VBLHEP | Researcher | 1 |
| S.Bazylev | VBLHEP | Head of sector | 0,68 |
| V.Baryshnikov | VBLHEP | Junior Researcher | 1 |
| D.Bogoslovsky | VBLHEP | Senior Researcher | 0,5 |
| I.Boguslavski | VBLHEP | Consultant | 0,1 |
| M.Bhattacharjee | VBLHEP | Junior Researcher | 1 |
| V.Vasendina | VBLHEP | Researcher | 0,6 |
| A.Vodopyanov | VBLHEP | Head of Department | 0,11 |
| V.Voronyuk | VBLHEP | Senior Researcher | 1 |
| N.Geraksiev | VBLHEP | Junior Researcher | 1,01 |
| K.Gertsenberger | VBLHEP | Head of group | 0,76 |
| V.Golovatyuk | VBLHEP | Head of Department | 0,93 |
| D.Dementiev | VBLHEP | Researcher | 0,4 |
| A.Dmitriev | VBLHEP | Researcher | 1 |
| V.Dodokhov | VBLHEP | Head of sector | 0,1 |
| V.Dronik | VBLHEP | Research assistant | 1 |
| P.Dulov | VBLHEP | Researcher | 0,8 |
| S.Zaporozhets | VBLHEP | Senior Researcher | 1,16 |
| A.Zinchenko | VBLHEP | Leading Researcher | 0,56 |
| D.Zinchenko | VBLHEP | Junior Researcher | 0,5 |
| V.Zruyev | VBLHEP | Researcher | 1,35 |
| G.Kekelidze | VBLHEP | Head of sector | 0,1 |
| D.Kereibay | VBLHEP | Junior Researcher | 0,5 |
| V.Kireyeu | VBLHEP | Senior Researcher | 0,96 |
| Y.Kiriushin | VBLHEP | Leading Researcher | 1,22 |
| M.Kozhevnikova | VBLHEP | Researcher | 1 |
| V.Kolesnikov | VBLHEP | Head of Department | 1,11 |
| N.Kolomoiets | VBLHEP | Junior Researcher | 1 |
| Y.Krechetov | VBLHEP | Senior Researcher | 1 |
| A.Krylov | VBLHEP | Junior Researcher | 1 |
| O.Kutinova | VBLHEP | Research assistant | 0,5 |
| Y.Lobanov | VBLHEP | Leading Researcher | 1 |
| S.Lobastov | VBLHEP | Senior Researcher | 1,28 |
| J.Lukstins | VBLHEP | Consultant | 0,84 |
| М.Mamaev | VBLHEP | Junior Researcher | 1 |
| S.Mertz | VBLHEP | Leading Researcher | 0,51 |
| G.Mesheryakov | VBLHEP | Senior Researcher | 1 |
| S.Movchan | VBLHEP | Head of sector | 1,01 |
| N.Molokanova | VBLHEP | Senior Researcher | 0,1 |
| Y.Murin | VBLHEP | Head of Department | 0,54 |
| D.Myktybekov | VBLHEP | Junior Researcher | 1 |
| A.Piliar | VBLHEP | Senior Researcher | 1,05 |
| O.Rogachevsky | VBLHEP | Head of sector | 0,95 |
| M.Rumyantsev | VBLHEP | Researcher | 0,9 |
| I.Rufanov | VBLHEP | Senior Researcher | 0,5 |
| V.Riabov | VBLHEP | Chief research scientist | 0,5 |
| A.Yu.Semenov | VBLHEP | Leading Researcher | 1 |
| S.Sergeev | VBLHEP | Leading Researcher | 0,5 |
| V.Serdyuk | VBLHEP | Researcher | 1 |
| V.Slepnev | VBLHEP | Head of Department | 0,4 |
| D. Suvarieva | VBLHEP | Junior Researcher | 0,88 |
| V.Tikhomirov | VBLHEP | Senior Researcher | 0,5 |
| I.Tyapkin | VBLHEP | Leading Researcher | 1,05 |
| O.Fateev | VBLHEP | Leading Researcher | 1,08 |
| A.Fedunin | VBLHEP | Head of sector | 0,5 |
| U.Filippov | VBLHEP | Head of sector | 1 |
| A.Sheremetiev | VBLHEP | Junior Researcher | 0,5 |
| A.Shutov | VBLHEP | Senior Researcher | 0,65 |
| V.Shutov | VBLHEP | Senior Researcher | 0,2 |
| V.Yurevich | VBLHEP | Head of sector | 0,5 |
|  |  |  |  |  | **47,97** |
| 3. | engineers | A.Antonova | VBLHEP | Engineer | 1 |
| I.Balashov | VBLHEP | Engineer | 1 |
| R.Baratov | VBLHEP | Technical engineer (Category 1) | 1 |
| A.Baskakov | VBLHEP | Electronic engineer (Category 2) | 0,6 |
| E.Belyaeva | VBLHEP | Leading designer | 1 |
| A.Borisov | VBLHEP | Assistant | 1 |
| A.Bochkova | VBLHEP | Assistant | 1 |
| S.Buzin | VBLHEP | Engineer | 0,75 |
| M.Buryakov | VBLHEP | Leading Engineer | 0,82 |
| A.Bychkov | VBLHEP | Software engineer (Category 2) | 1 |
| S.Vereshagin | VBLHEP | Leading Engineer | 1,36 |
| A.Voronin | VBLHEP | Engineer | 0,5 |
| S.Gerasimov | VBLHEP | Design engineer (Category 1) | 1,11 |
| A.Yu.Dubrovin | VBLHEP | Engineer | 1 |
| A. Egorov | VBLHEP | Engineer | 0,6 |
| A.Efremov | VBLHEP | Leading engineer | 1 |
| A.Ivanov | VBLHEP | Engineer | 1 |
| Y.Kambar | VBLHEP | Engineer | 0,5 |
| V.Komarov | VBLHEP | Technician | 1,32 |
| A.I.Kostylev | VBLHEP | Engineer | 1 |
| V.Krylov | VBLHEP | Leading engineer | 1 |
| S.Kukarnicov | VBLHEP | Leading designer | 1 |
| S.Kukulin | VBLHEP | Software engineer (Category 1) | 0,6 |
| V.Lobanov | VBLHEP | Leading engineer | 0,8 |
| A.Makarov | VBLHEP | Design engineer (Category 1) | 0,7 |
| I.Malikov | VBLHEP | Engineer | 1 |
| A.Moshkin | VBLHEP | Software engineer | 1 |
| E.Muravkin | VBLHEP | Technician | 1 |
| R.Nagdasev | VBLHEP | Software engineer | 1 |
| V.Novoselov | VBLHEP | Assistant | 1 |
| V.Petrov | VBLHEP | Leading engineer | 1,27 |
| D.Potapov | VBLHEP | Engineer | 1 |
| N.Ridinger | VBLHEP | Senior technician | 1,29 |
| V.Rogov | VBLHEP | Leading electronic engineer | 0,5 |
| S. Romakhov | VBLHEP | Engineer | 0,5 |
| A.Rybakov | VBLHEP | Senior engineer | 1,2 |
| A.Rimshina | VBLHEP | Engineer | 1 |
| V.Samsonov | VBLHEP | Leading engineer | 1,35 |
| M.Samuilov | VBLHEP | Assistant | 1 |
| I.Semenova | VBLHEP | Senior engineer | 1 |
| N. Sergeeva | VBLHEP | Engineer | 0,5 |
| I.Smelyanskiy | VBLHEP | Technical engineer (Category 2) | 1 |
| T.Smolyanin | VBLHEP | Engineer | 1 |
| L.Yu.Stolypina | VBLHEP | Leading engineer | 1 |
| S.Sukhovarov | VBLHEP | Leading designer | 1,53 |
| N.Tarasov | VBLHEP | Electronic engineer | 0,6 |
| A.Terletskiy | VBLHEP | Leading engineer | 0,6 |
| S.Timofeev | VBLHEP | Assistant | 1 |
| A.Timofeeva | VBLHEP | Assistant | 0,4 |
| A.Timoshenko | VBLHEP | Engineer | 0,5 |
| G.Tkachev | VBLHEP | Engineer | 1 |
| Y.Fedotov | VBLHEP | Senior engineer | 0,99 |
| I.Filippov | VBLHEP | Software engineer (Category 1) | 0,6 |
| Y. Filippov | VBLHEP | Assistant | 1 |
| T.Tsagaankhuu | VBLHEP | Senior engineer | 0,4 |
| V.Chepurnov | VBLHEP | Leading technologist | 1,33 |
| V.V.Chepurnov | VBLHEP | Engineer | 1,09 |
| I.Shmyrev | VBLHEP | Senior engineer | 1 |
| A.Shunko | VBLHEP | Design engineer (Category 1) | 0,1 |
| N.Shutova | VBLHEP | Software engineer (Category 1) | 0,2 |
| D.Shchegolev | VBLHEP | Engineer | 1 |
| A.Shcherbakov | VBLHEP | Engineer | 1 |
| A.Shchipunov | VBLHEP | Electronic engineer | 0,7 |
| G.Yarygin | VBLHEP | Leading Electronic engineer | 0,34 |
|  |  |  |  |  | **56,65** |
| 4. | specialists | S.Andreeva | VBLHEP | Leading specialist | 0,95 |
| O.Volodina | VBLHEP | Senior specialist | 0,88 |
| L.Dodonova | VBLHEP | Specialist | 1 |
| S.Kakurin | VBLHEP | Chief Technical specialist | 1,43 |
| Y.Minaev | VBLHEP | Chief Technical specialist | 0,1 |
| E.Moscovka | VBLHEP | Document Specialist | 1 |
|  |  |  | **5,36** |
| 5. | technicians | A.Butorin | VBLHEP | Mechanic of experimental benches and setups | 1,5 |
| I.Vasiliev | VBLHEP | Mechanic of experimental benches and setups | 1 |
| M.Zaiceva | VBLHEP | Assembler of radio-electronic equipment and devices | 1,3 |
| V.Maksimenkova | VBLHEP | Assembler of radio-electronic equipment and devices | 0,6 |
| A.Moskovsky | VBLHEP | Mechanic of experimental benches and setups | 1,5 |
| O.Orlov | VBLHEP | Assembler of radio-electronic equipment and devices | 0,6 |
| V.Svalov | VBLHEP | Assembler of radio-electronic equipment and devices | 0,1 |
| Y.Solnyshkin | VBLHEP | Mechanic of experimental benches and setups | 1 |
| A.Shvedov | VBLHEP | Mechanic of experimental benches and setups | 1 |
|  |  |  |  |  | **8,6** |
|  | **Total:** |  |  |  | **124,95** |

**3.2.2. JINR associated personnel**

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Category of personnel** | **Partner organization** | **Amount of FTE** |
| 1. | supervisor | NRC KI PNPI | 4x0,3=1,2 |
| 2. | research scientists | NRC KI PNPI | 8x0,5=4 |
| 3. | engineers |  |  |
| 4. | specialists | NRC KI PNPI | 3x0,3=0,9 |
| 5. | technicians |  |  |
|  | **Total:** |  | **6,1** |

**4. Financing**

**4.1 Total estimated cost of the project - 33 M$**

The total cost estimate of the project (for the whole period, excluding salary).

The details are given in a separate table below.

**4.2 Extra funding sources**

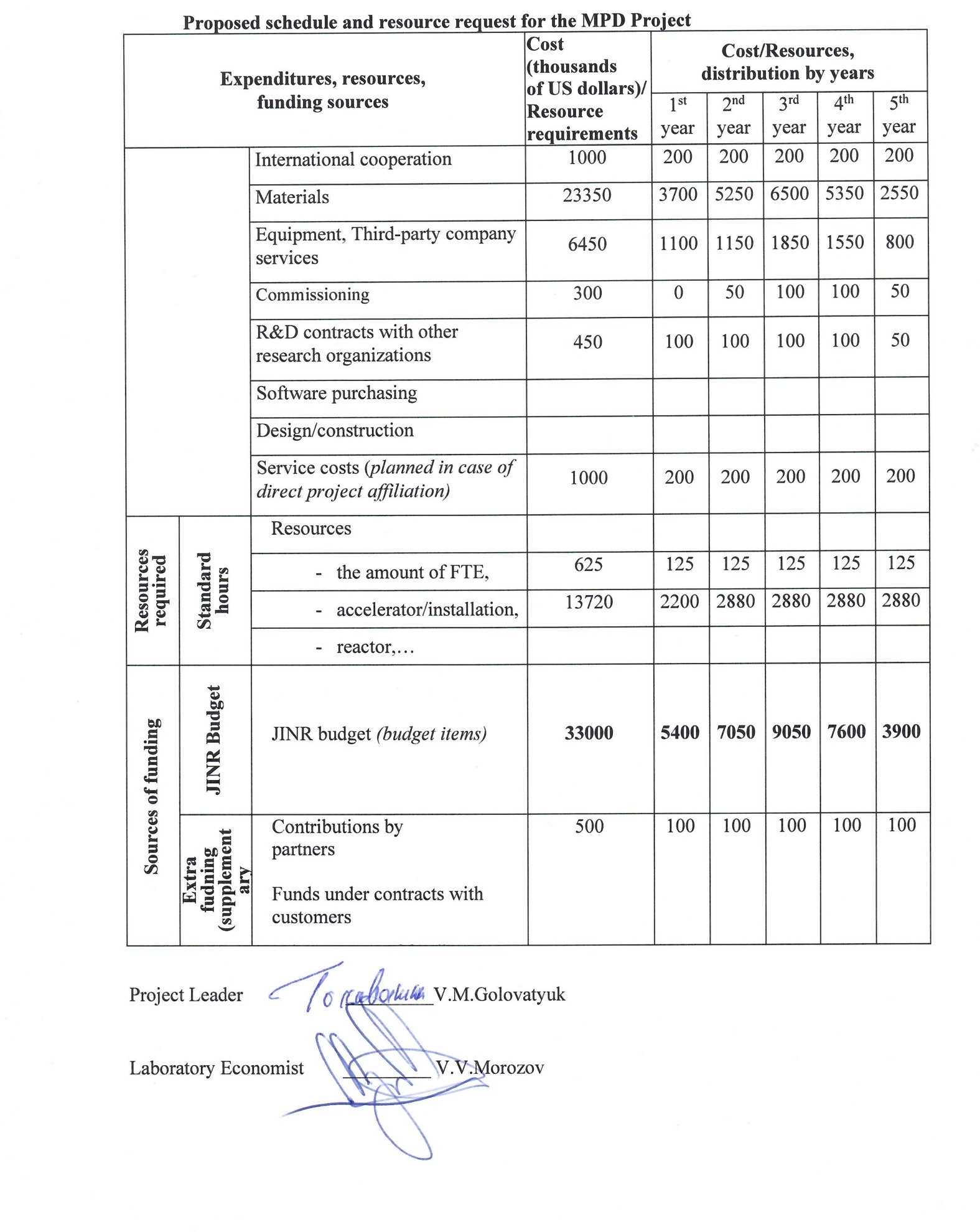
**Project Leaders:** V.Golovatyuk, V.Kekelidze

Date of submission of the project to the Chief Scientific Secretary: \_\_\_\_\_\_\_\_\_

Date of decision of the laboratory's STC: \_\_\_\_\_\_\_\_\_ document number: \_\_\_\_\_\_\_\_\_

Year of the project start: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(for extended projects) – Project start year: **2012**

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**APPROVAL SHEET FOR PROJECT**

Multipurpose detector (MPD)

PROJECT CODE02-1-1065-3-2011/2025

THEME CODE 02-1-1065-2007/2026

PROJECT LEADERS V.Golovatyuk, V.Kekelidze

*Deputy project leader: V. Ryabov*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | |
| AGREED |  |  |  | |
| JINR VICE-DIRECTOR | \_\_\_\_\_\_\_\_\_\_\_  SIGNATURE | \_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_\_\_  DATE |  |
| CHIEF SCIENTIFIC SECRETARY | \_\_\_\_\_\_\_\_\_\_\_  SIGNATURE | \_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_\_\_  DATE |  |
| CHIEF ENGINEER | \_\_\_\_\_\_\_\_\_\_\_  SIGNATURE | \_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_\_\_  DATE |  |
| LABORATORY DIRECTOR | \_\_\_\_\_\_\_\_\_\_\_  SIGNATURE | \_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_\_\_  DATE |  |
| CHIEF LABORATORY ENGINEER | \_\_\_\_\_\_\_\_\_\_\_  SIGNATURE | \_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_\_\_  DATE |  |
| LABORATORY SCIENTIFIC SECRETARY | \_\_\_\_\_\_\_\_\_\_\_  SIGNATURE | \_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_  DATE |  |
| THEME LEADER | \_\_\_\_\_\_\_\_\_\_\_ SIGNATURE | \_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_\_\_  DATE |  |
| PROJECT LEADER | \_\_\_\_\_\_\_\_\_\_  SIGNATURE | \_\_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_\_\_  DATE |  |
| APPROVED BY THE PAC | \_\_\_\_\_\_\_\_\_\_\_  SIGNATURE | \_\_\_\_\_\_\_\_\_  NAME | \_\_\_\_\_\_\_\_\_  DATE | |