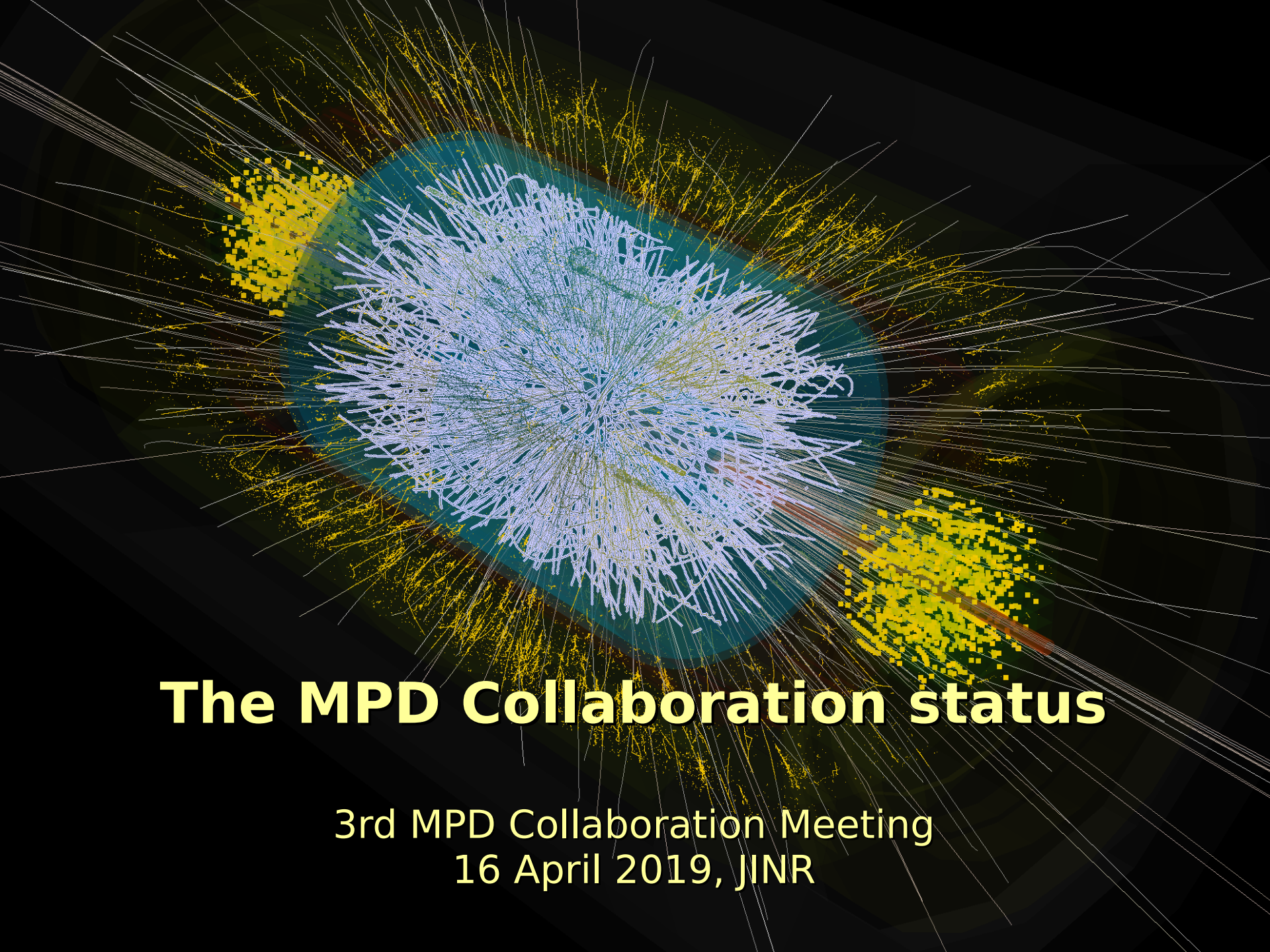
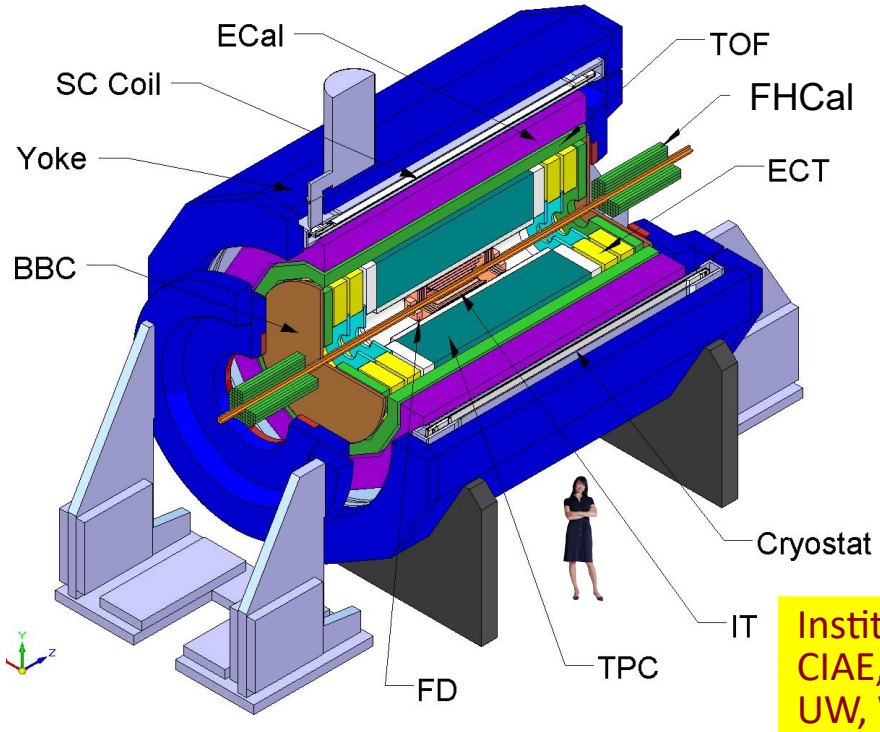


The MPD Collaboration status

3rd MPD Collaboration Meeting
16 April 2019, JINR

MultiPurpose Detector (MPD) Collaboration:



Institutes voted today:
CIAE, Beijing, China;
UW, Warsaw, Poland

*Baku State University, NNRC, **Azerbaijan**;*
*University of Plovdiv, **Bulgaria;***
*University Tecnica Federico Santa Maria, Valparaiso, **Chile**;*
*Tsinghua University, Beijing, **China**;*
*USTC, Hefei, **China**;*
*Huizhou University, Huizhou, **China**;*
*Institute of Nuclear and Applied Physics, CAS, Shanghai, **China**;*
*Central China Normal University, **China**;*
*Shandong University, Shandong, **China**;*

*IHEP, Beijing, **China**;*
*University of South China, **China**;*
*Palacky University, Olomouc, **Czech Republic**;*
*NPI CAS, Rez, **Czech Republic**;*
*Tbilisi State University, Tbilisi, **Georgia**;*
*Tubingen University, Tubingen, **Germany;***
*Tel Aviv University, Tel Aviv, **Israel**;*
Joint Institute for Nuclear Research;
*IPT, Almaty, **Kazakhstan**;*
*UNAM, Mexico City, **Mexico**;*
*Institute of Applied Physics, Chisinev, **Moldova**;*
*WUT, Warsaw, **Poland**;*
*NCNR, Otwock – Świerk, **Poland**;*
*UWr, Wrocław, **Poland**;*
*Jan Kochanowski University, Kielce, **Poland**;*
*INR RAS, Moscow, **Russia**;*
*MEPhI, Moscow, **Russia**;*
*PNPI, Gatchina, **Russia**;*
*INP MSU, Moscow, **Russia**;*
*SPSU - Dept. of NP, **Russia;***
*St. Petersburg, **Russia**;*
*SPSU – Dept. of HEP, St. Petersburg, **Russia**;*
*KI NRS, Moscow, **Russia**;*

Memorandum of Understanding

- Each Collaboration Institution should sign a Memorandum of Understanding.
  - Detailing the mutual obligations of the host laboratory and the institution
  - Detailing the contribution of the Institution in terms of: manpower, in-kind contribution, hardware and software involvement, physics analysis
  - Specifying the possible contribution to the Common Fund
- Template for the MoU has been prepared by JINR
- Discussion of the MoU status will be carried out during IB

MPD Deputy Spokespersons

Victor Riabov (PNPI, St Petersburg, Russia)

His extensive experience in the design, construction and maintenance of the Drift Chambers of the PHENIX experiment will be invaluable for the MPD Collaboration. He also has deep understanding of the way that large scientific collaborations work, thanks to his involvement in the PHENIX and ALICE Collaborations, which lasted more than a decade. He is an expert in the physics of light flavor production, which is a fundamental part of the physics program of MPD. Such combination of unique skills will be critical for the successful organization and execution of the MPD detector construction and its physics program.

Zebo Tang (USTC, Hefei, China)

He has large experience in the production and operation of the Time-of-Flight detector of STAR, which correlates very well with the needs of the MPD Collaboration. The Chinese contribution to the construction of the ECAL detector will also be of critical importance for the success of MPD. He has been involved in a large experimental collaboration - STAR, so MPD can benefit from the organizational and scientific expertise of both of the RHIC experiments. He is an expert in physics of heavy flavor production, so his field of interest is complementary to the other members of the executive team. He his contribution to physics, detector construction and the creation of the collaboration structure will be invaluable.

MPD Executive Council

- "The Executive Council directs the execution of the MPD project. It shall establish scientific priorities for the experiment. It shall review and act on recommendations of the Spokesperson regarding all issues of major importance to the Collaboration.
- The Executive Council may appoint review committees and task forces to provide advice on technical, scientific and technological decisions, as needed.
- The Executive Council shall be composed of the following members:
  - Spokesperson, Deputy Spokesperson(s), IB Chair and Project Manager
  - Six members elected by the Institutional Board.
  - Two members appointed by the Spokesperson that shall serve at his discretion. Appointments by the Spokesperson shall be approved by the IB. "

Executive Council elections

- The IB has held the elections for the EC members
  - 22 candidates nominated by at least one Collaboration member, 16 candidates agreed to stand for election
  - EC decided to employ the „staggered" system to ensure continuity of the EC operations
  - **Vadim Kolesnikov** and **Yi Wang** will serve for 3-year term
  - **Alejandro Ayala** and **Alexander Zinchenko** will serve for 2 year term
  - **Oleg Rogachevsky** and **Arkadiy Taranenko** will serve for 1 year term
- Two members of the EC appointed by the Spokesperson
  - **Ilya Sleyuzhenkov** (GSI/MePHI) and **Andrei Dolbilov** (JINR - LIT)
  - The IB will be asked to endorse them during the meeting on April 16th
- The inaugural EC meeting was held on March 29th

Physics Working Groups

- „The Physics Working Groups shall be the environment in which all official MPD physics results are developed, certified and readied for publication. The analysis working groups shall be the environment in which MPD software tools are developed, tested, certified and made available to any MPD member. The physics and analysis working groups conveners form the physics council that is chaired by the Spokesperson.”
- Plan to create 5 Physics Working Groups
- Every physicist in MPD is expected to join at least one PWG
  - Web and e-mail tools to manage PWG creation and operation are being tested, based on propositions from the JINR IT team
- Convenors of the respective PWGs will soon be proposed

Physics Working Groups

PWG1
Global observables

- Total event multiplicity
- Total event energy
- Centrality determination
- Total cross-section measurement
- Vertex determination
- Event plane measurement at all rapidities
- Spectator measurement

PWG2
Spectra of light flavor and hypernuclei

- Light flavor spectra
- Hyperons and hypernuclei
- Total particle yields and yield ratios
- Kinematic and chemical properties of the event
- Mapping QCD Phase diagram

PWG3
Correlations and Fluctuations

- Collective flow for hadrons
- Vorticity, Λ polarization
- E-by-E fluctuation of multiplicity, momentum and conserved quantities
- Femtoscopy
- Forward-Backward corr.
- Jet-like correlations

PWG4
Electromagnetic probes

- Electromagnetic calorimeter measurements
- Photons in ECAL and central barrel
- Low mass dilepton spectra and search for in-medium modification of resonances and intermediate mass region

PWG5
Heavy flavor

- Study of open charm production
- Charmonium with ECAL and central barrel
- Charmed meson through secondary vertices in ITS and HF electrons
- Explore production at charm threshold

RFBR Grants

- Russian Foundation for Basic Research has awarded grants for Physics analyses dedicated to NICA

1. Electromagnetic signals:
1.1 **Dielectrons, continuum and LVM (ρ,ω,ϕ)**
(V.Vasendina, A.Zinchenko, Levterova, I.Rufanov, S.Bulychev, B.Kebrikov, V.Kulikov, M.Martemianov, M.Maciuk, A.Skobliakov)
1.2. **Inclusive and direct photons**
(D.Ivanishchev, D.Kotov, E.Kryshen, M.Malaev, V.Riabov, Yu.Riabov)

2. Light flavor and nuclei:
2.1 **Identified hadrons and light nuclei (π, K, p, d, t, 3He, 4He)**
(V.Vasendina, V.Kireev, V.Kolesnikov, A.Mudrokh)
2.2 **Neutral mesons (π0, η, ω)**
(S.Bulychev, B.Kerbikov, V.Kulikov, M.Martemianov, M.Maciuk, A.Skoblyakov, D.Ivanishchev, D.Kotov, E.Kryshen, M.Malaev, V.Riabov, Yu.Riabov)
2.3 **Resonances : ρ, K*, ϕ, Λ(1585), Σ(1385), Ξ(1530)**
(D.Ivanishchev, D.Kotov, M.Malaev, V.Riabov, Yu.Riabov)
2.4. **Hyperons (Λ, Σ, Ω) and hyper-nuclei**
(V.Vasendina, A.Zinchenko, D.Zinchenko, Levterova, I.Rufanov, V.Kireev, V.Kolesnikov, A.Mudrokh)

3. Correlations and fluctuations
3.1 HBT
(P.Batuk, O.Kodolova, L.Malinina, I.Kokhtin, K.Mikhailov, G.Nigmatkulov, G.Romanenko)
3.2 Flow
(A.Anikeev, O.Golosov, Yu.Gornaya, D.Blau, E.Kapishin, V.Kireev, P.Parfenov, A.Taranenko, A.Trutse, D.Ivanishchev, D.Kotov, E.Kryshen, M.Malaev, V.Riabov, Yu.Riabov)
3.3 Fluctuations
(V.Vasendina, V.Kireev, V.Kolesnikov, A.Mudrokh)

4. Global signatures (forward physics, centrality, reaction plane)
(V.Golovatyuk, O.Golosov, M.Golubeva, A.Ivashkin, A.Izvestnyi, N.Karpushkin, S.Morozov, P.Parfenov, A.Strizhak, A.Timoshenko)

5. Heavy flavor (charm).
V.Vasendina, A.Zinchenko, D.Zinchenko, Levterova, I.Rufanov)

Task Forces

- Several tasks of significance to all analysis groups must also be completed. The tasks do not provide physics results directly, however they are essential for all analyses. EC will for the specific Task Forces to deal with these topics:
  - The Analysis Software Task Force
    - Deals with general purpose analysis tools, common data formats, central production of data
  - The Tracking and PID Task Force
    - Deals with data reconstruction, including tracking and particle identification combining data from all detectors
  - The Monte-Carlo Simulation Task Force
    - Central production of large simulated data samples, inclusion of new Monte-Carlo models for MPD physics into analysis software
  - The MPD Calibration Task Force
  - Example of existing group, which could become a Task Force: "ECAL Software group"

Speakers Bureau/Talks Committee

- Even distribution of conference talks opportunities for all Collaboration Members, with emphasis on giving exposure to young paricipants
- Contact point for request for talks on behalf of the collaboration
- Active effort to ensure MPD is visible at major international conferences in the field
- Establishment of rules for conference presentation preparation and approval
- Execution of talks approval process
- Candidates for the SB/TC needed - should start right away

Editorial Board

- The Editorial Board for the Collaboration should be formed. The main responsibility would be:
  - Propose to the IB rules for the MPD Author list, maintain the author list and make sure it is constantly up-to-date
  - Propose to the IB, and enforce the publication policy
  - Prepare the rules and maintain the respository of „MPD Approved" figures to be shown outside of the Collaboration
  - Ensure that MPD results presented to the outside and correct, up-to-date, and consistent between talks
  - Monitor the presentation of MPD experiment and results and make sure that only Collaboration Members can speak on behalf of the Collaboration

Electronic tools for communication

- Major concern expressed by Collaboration members is the urgent need for efficient communication tools
- Several resource exist, but need to be strongly developed and kept up to date:
  - General NICA webpage with MPD section: http://mpd.jinr.ru
  - „New" MPD-dedicated webpage: http://mpd.jinr.ru/experiment
  - General purpose mailing list: MPD_Coll_List(at)maillist.jinr.ru
- More specific tools have been proposed by the JINR IT and are being tested within the Collaboration:
  - The MPD Wiki (based on the DocuWiki platform)
  - The MPD Forum (based on the Discourse web forum platform)

Physics Summary

- Several generators used as input (UrQMD, PHSD, LAQGSM, vHLLE): up to 10^7 events
- MPD physics simulation includes TPC,TOF,ECAL, and FHCAL
- Additional research groups joined (MEPhI, MSU, ITEP, PNPI , Tsinghua)

MPD PHYSICS CASES (progress status)

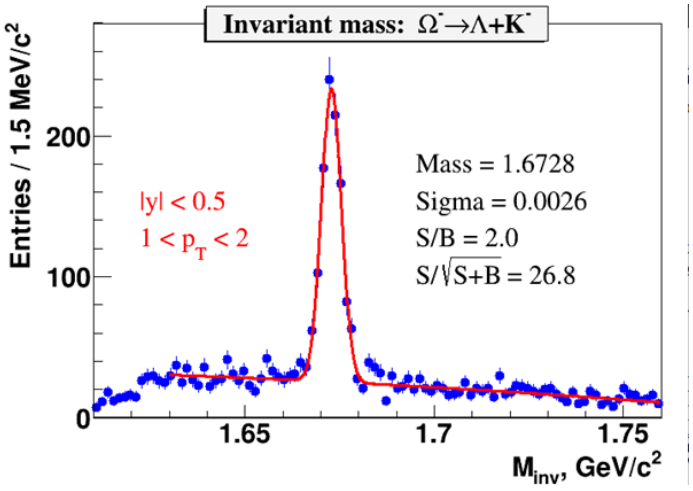
EVENT CHARACTERIZATIN, PID (MEPhI, JINR) - progressing

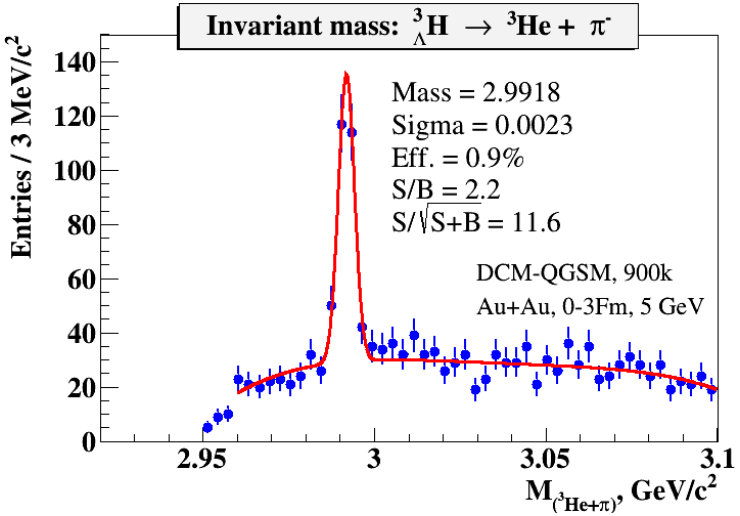
MULTISTRANGENESS PRODUCTIN (JINR) – steady progress

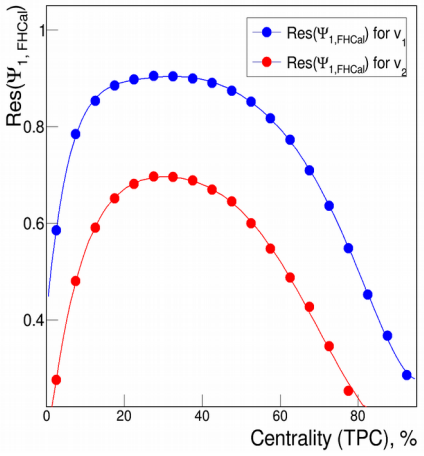
HYPERNUCLEI (JINR) – slow progressing due to low statistics of simulated events

FLOW, INCLUDING HYPERONS (MEPhI, JINR) – steady progress

Au+Au @ 11 GeV (PHSD)







Physics Summary (2)

MPD PHYSICS CASES (progress status)

FEMTOSCOPY and CORRELATIONS (MSU, JINR) – steady progressing

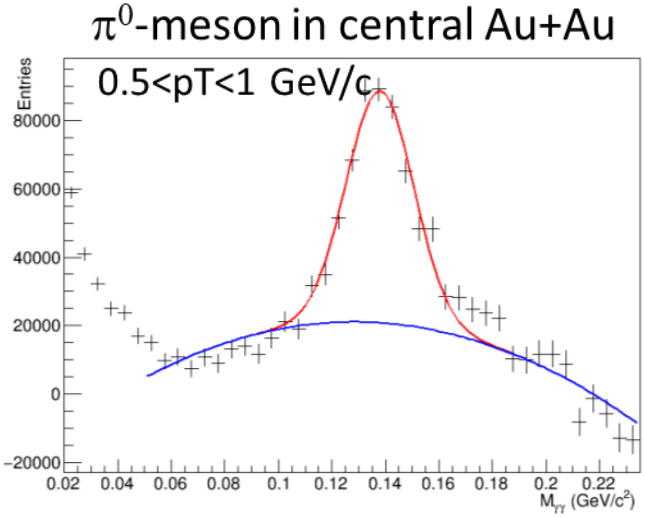
Ev-by-Ev FLUCTUATIONS (JINR) – slow progress due to lack of manpower

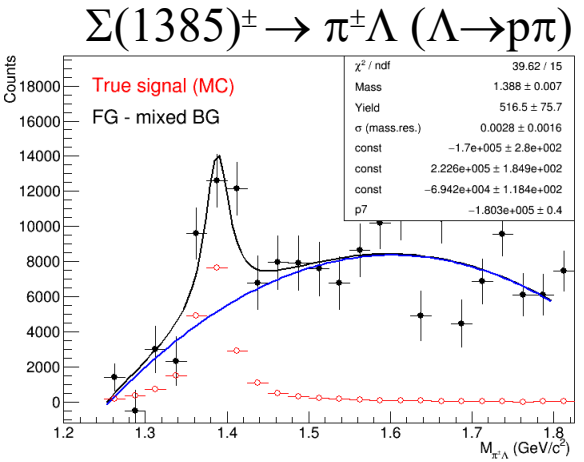
ECAL RECONSTRUCTION (JINR,PNPI,Tsinghua) – steady progress

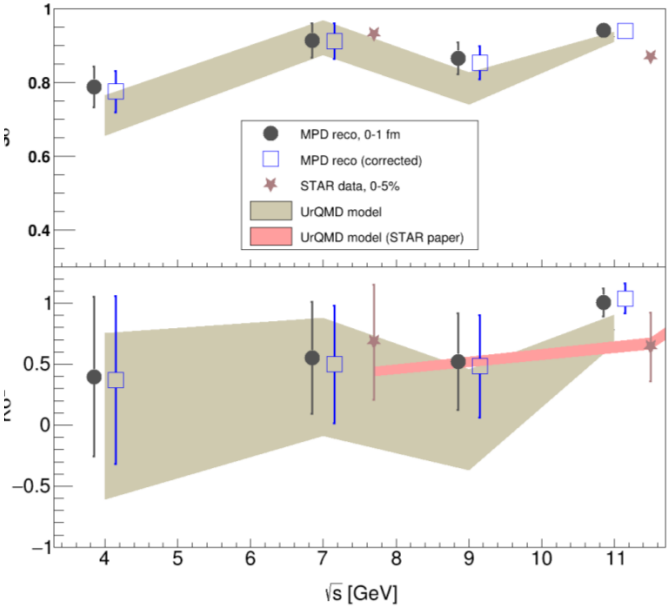
RESONANCES (PNPI) – steady progress

DILEPTONS (JINR) – frozen due to lack of manpower

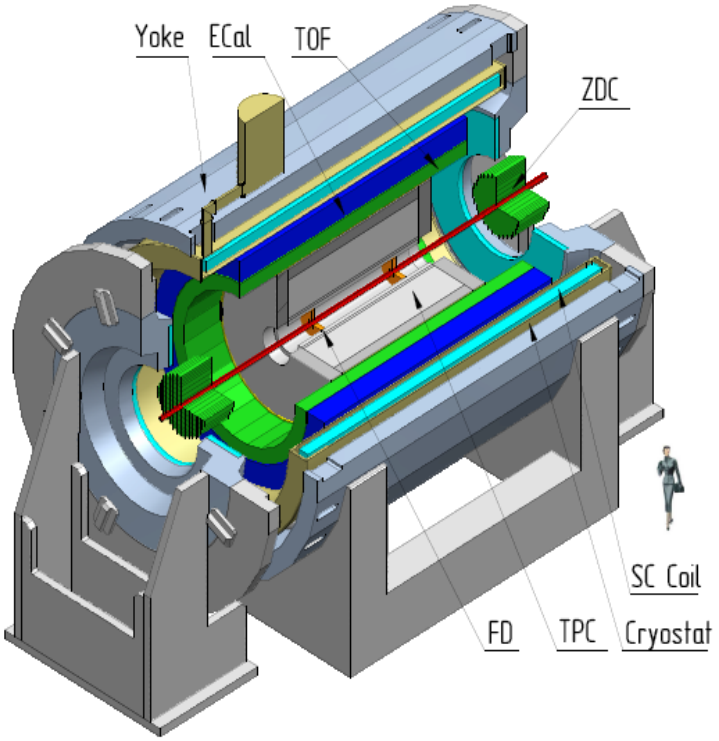
Growing of the contribution from other groups is expected after signing all MoU and success of the RFBR grant program

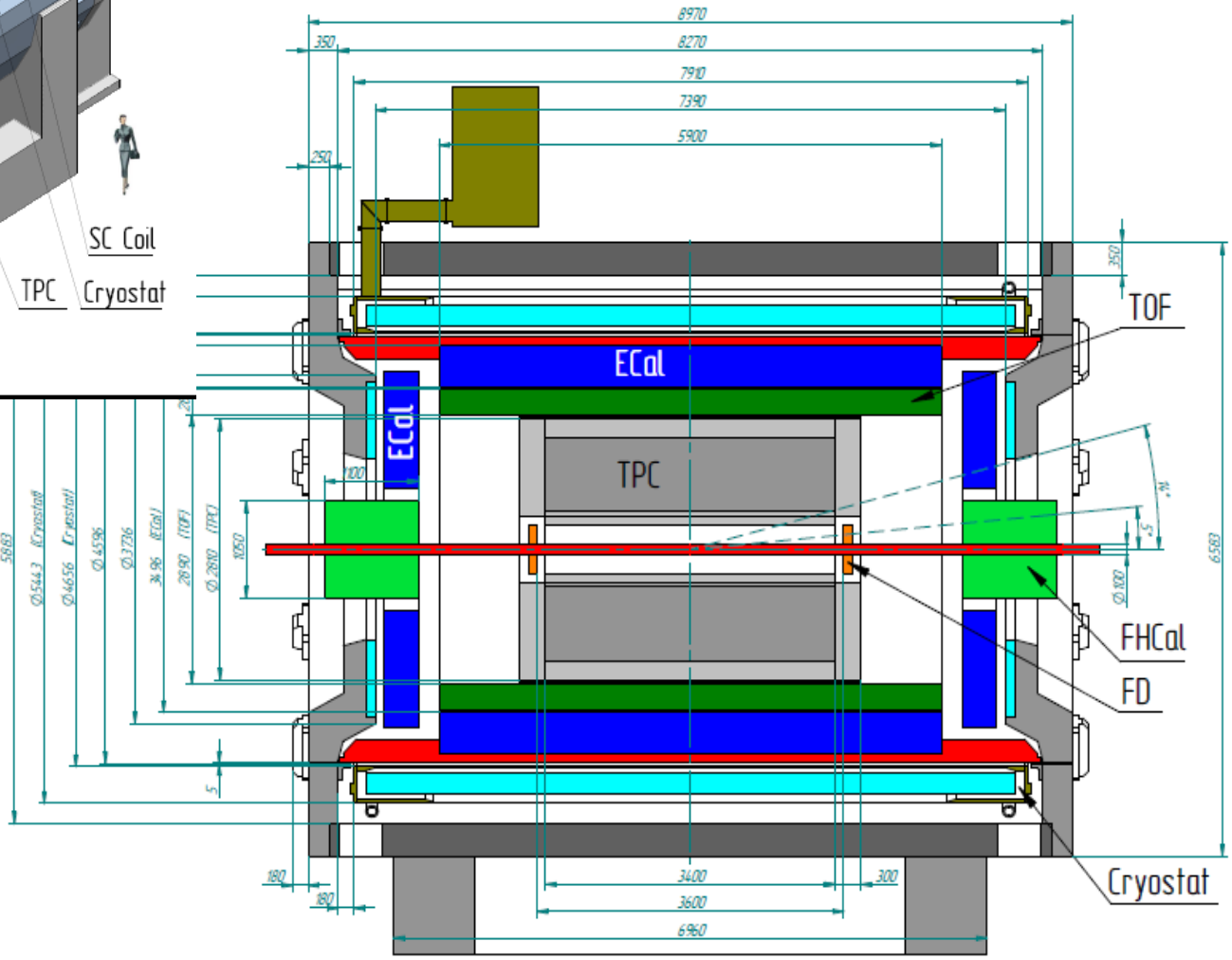




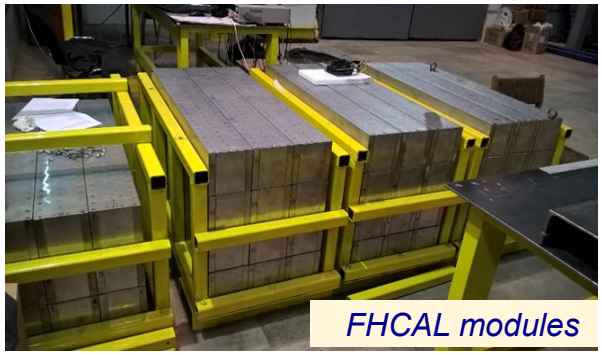


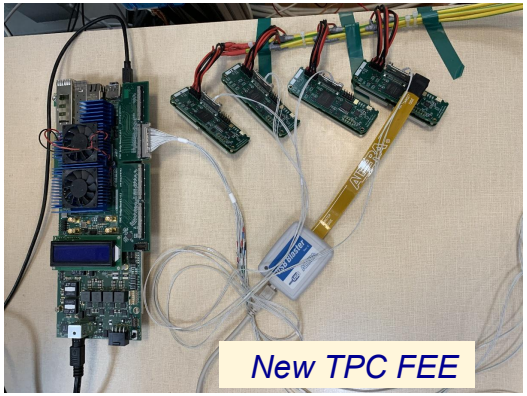
MPD 1st stage status

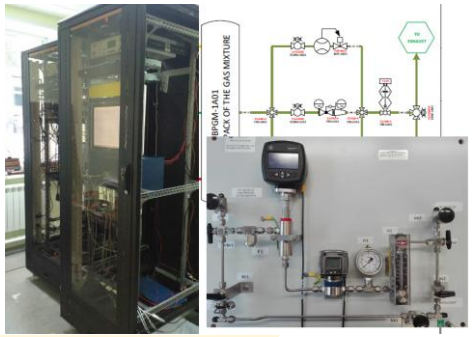




Components being ready

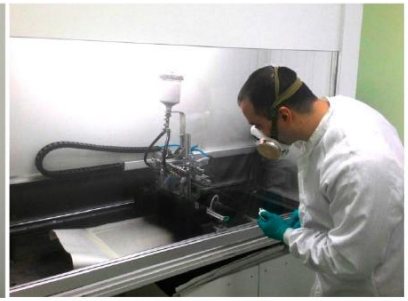

FHCAL modules


New TPC FEE


TOF Gas System


Support rings


Ultrasonic wave glass cleaning

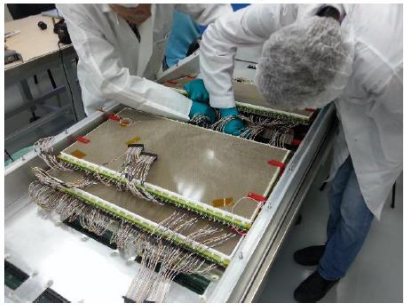

Painting of the HV conductive layer


MRPC assembling

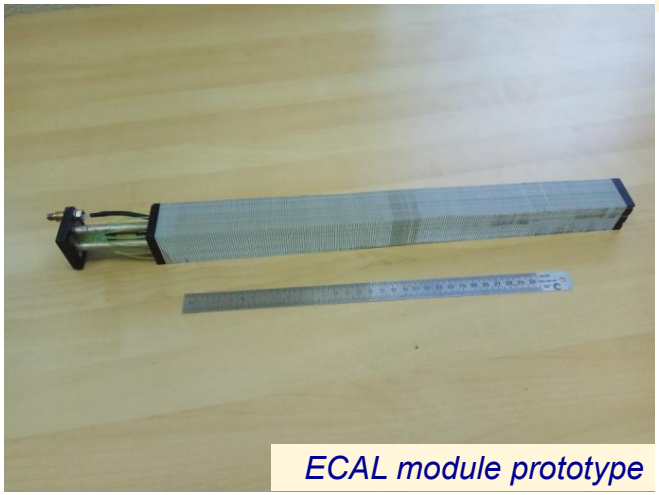

Solenoid assembling


Optical quality control


Cables and connectors soldering

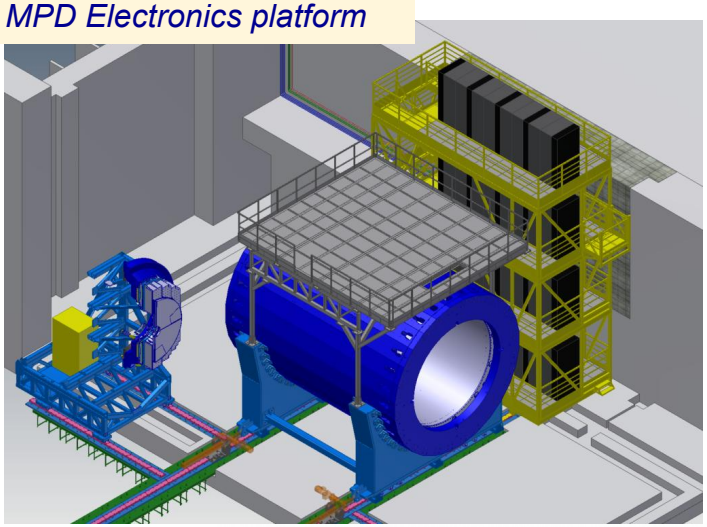

Detectors installation to the TOF box

Detector production

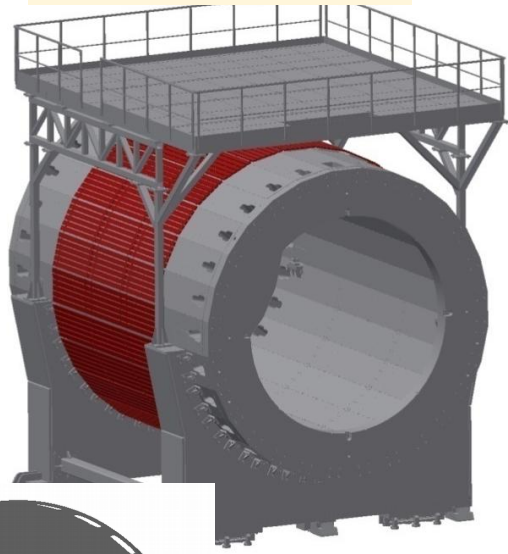


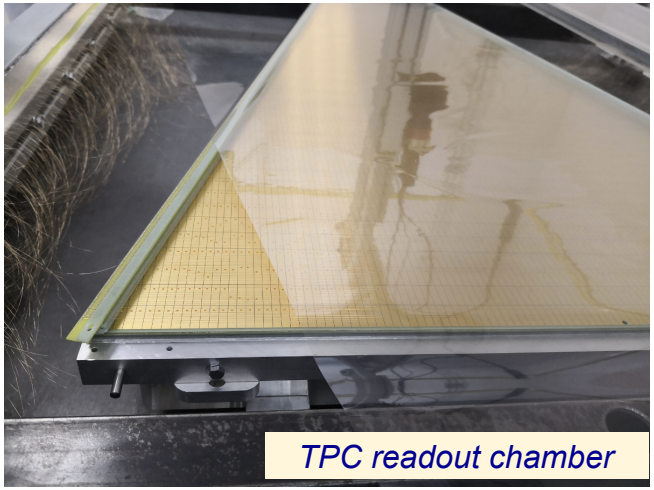
ECAL module prototype

MPD Electronics platform



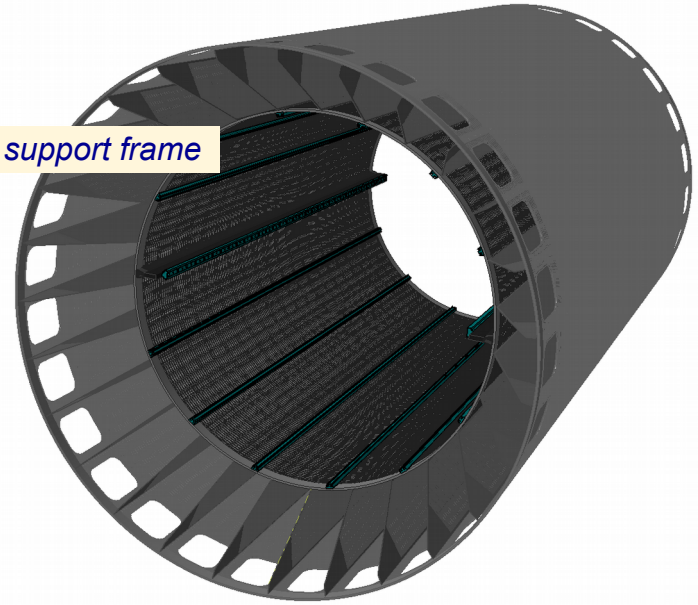
MCORD cosmic detector





TPC readout chamber

ECAL support frame



Preparation for commisioning and data

- A detailed plan for detector construction and commissioning has been prepared by the Project Manager
- First installations in the MPD hall will begin already in 2019 and will continue through 2020, with the aim of being ready for detector turn-on at the end of 2020
- Major help from the Collaboration will be necessary for successful completion of this tasks
- According to this schedule, MPD will be potentially ready to take data (cosmic rays) at the beginning of 2021. This will require setting up the shift schedule at that time

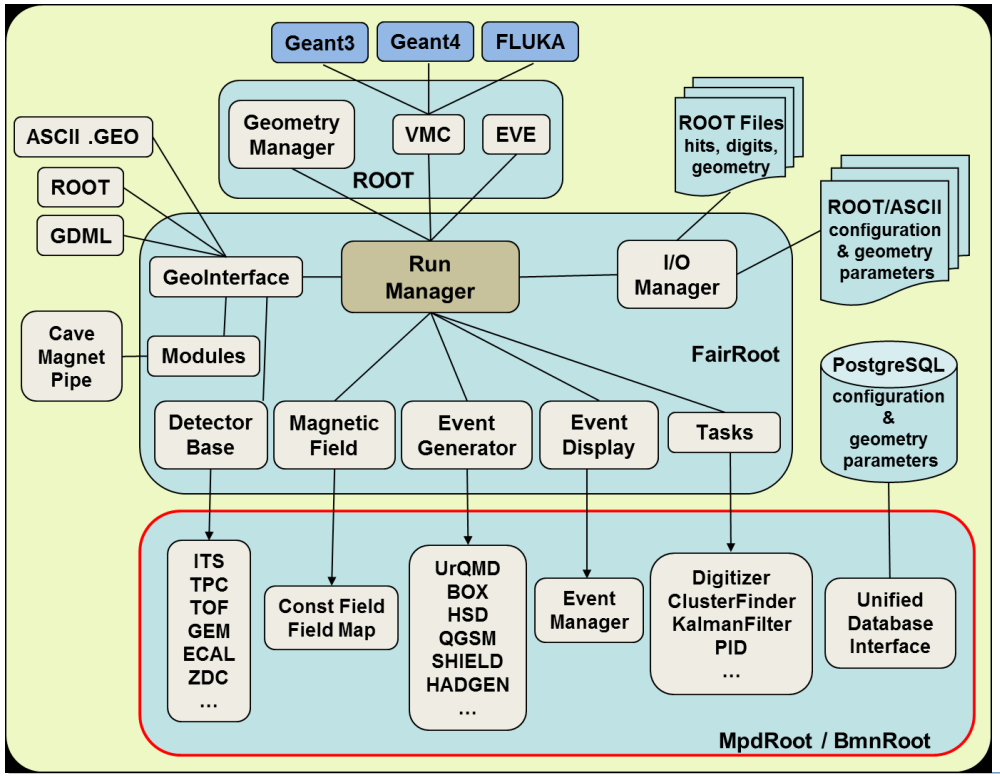
Software status

NICA > mpdroot > **Details**

mpdroot
Project ID: 24

Add license · 366 Commits · 6 Branches · 3 Tags · 24.1 MB Files

Simulation and Analysis Framework for NICA/MPD Detectors

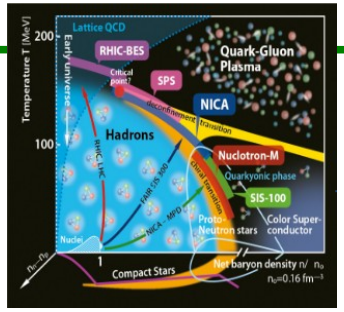


Plans and future tasks:

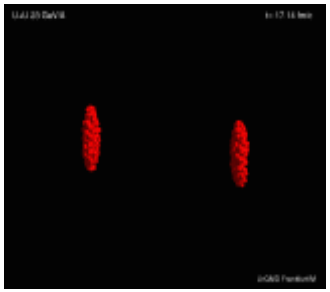
- Manpower
- Boost clustering
- Boost tracking
- Detector alignment and calibration
- Cloud computing for the MPD
- Virtual organization for MPD in GRID
- Physics Analyses

Detector	MC Geometry	Hits/digits
TPC	Ver. 8 (2018)	hitproducer
TOF	Ver. 7 (2016)	hitproducer
ECAL	Ver. 8 (2018)	hitproducer
FHCal	Ver. 2 (2018)	hitproducer
ITS	Ver. 3 (2015)	hitproducer
FFD	Ver. 0 (2016)	hitproducer
BBC	Ver. 2 (2019)	MC points

Computing for the NICA Megaproject

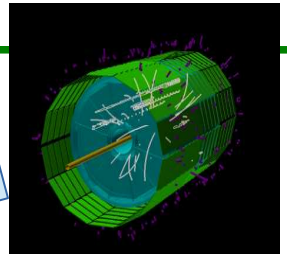


QCD phase diagram

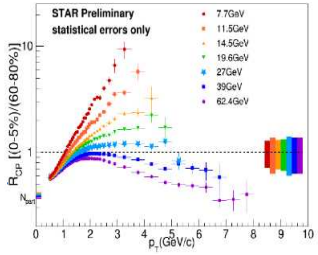


Simulations

GOVORUN



Events reconstruction



Physics analysis

Computing for the NICA megaproject:

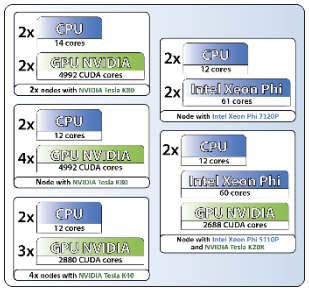
- data acquisition from detectors
- data transmission for processing and analysis.

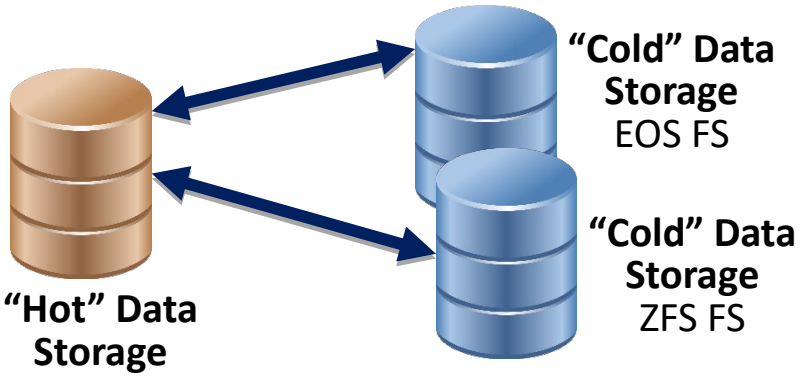
Requirements for the network infrastructure, computing architectures, storage systems as well as appropriate software for data processing and analysis. Developed computing models should take into account the trends in the development of network solutions, computing architectures and IT-solutions, which allow combining supercomputer (heterogeneous), grid and cloud technologies and creating distributed, software-configured HPC platforms on its basis. The use of such solutions for data processing and analysis requires the creation of software environments, which provide a necessary code abstraction enabling to implement the required functionality for a wide range of computing tools.

The GOVORUN supercomputer can become a tool for computing modeling, as it contains the latest computing and data storage resources including the ultrafast data storage system, which ensures a high speed of data acquisition up to hundreds of gigabytes per second with the possibility of a linear extension of performance and capacity of the system up to 1000 times.

Computing for the NICA Megaproject on the GOVORUN

GOVORUN





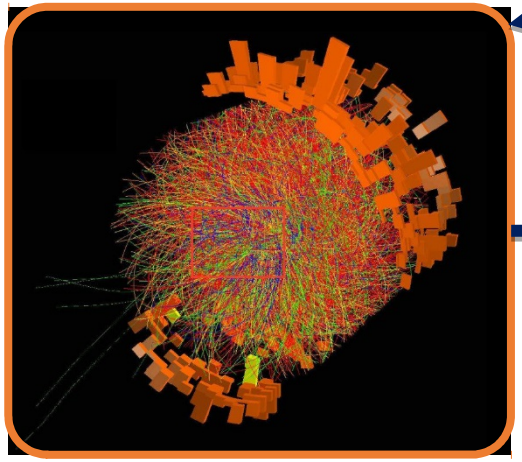
"Hot" Data Storage
Lustre FS

"Cold" Data Storage
EOS FS

"Cold" Data Storage
ZFS FS

- Modeling:
  - physical events;
  - receiving data from detectors.
- Data storage organization.

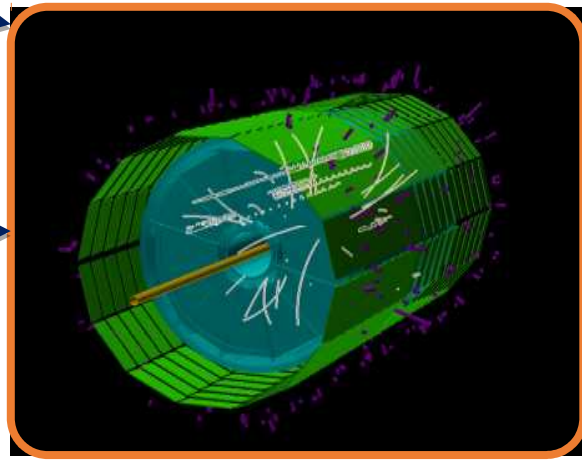
MpdRoot



Particles Generator
- internal
- external

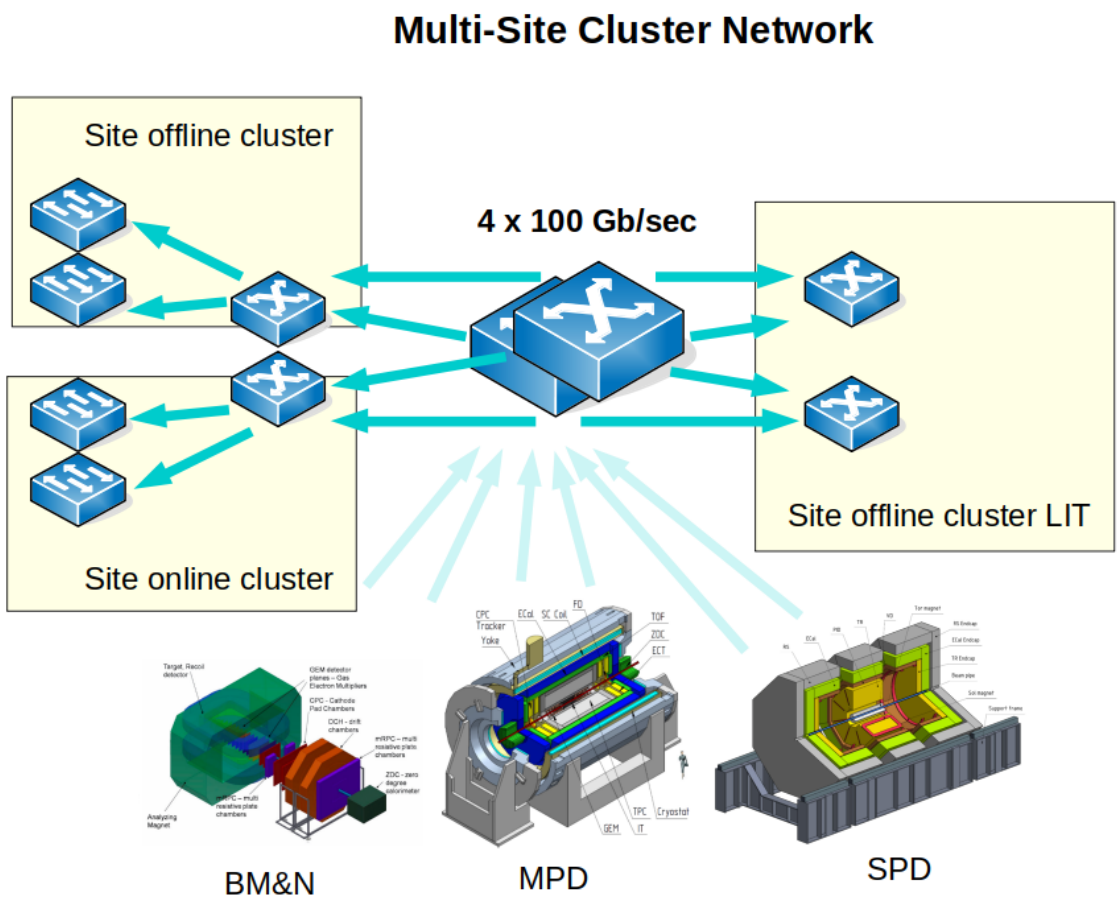
Geant4
A simulation toolkit

DIRAC
THE INTERWARE



Events reconstruction

Multi-Site Cluster Network



Collaboration organization – next steps

- Signing of the MoU with each Institution
- Establishment of the Physics Analysis Groups
  - Designation of PWG Convenors
  - Request to all Collaboration Members to join their PWG(s) of interest and actively participate in their work
- Establishment of Talks Committee/Speakers Bureau
  - Propositions for candidates welcoe
- Establishment of effective communication channels
  - Major update of the MPD webpage
  - Test and deployment of the MPD Wiki and MPD Forum