



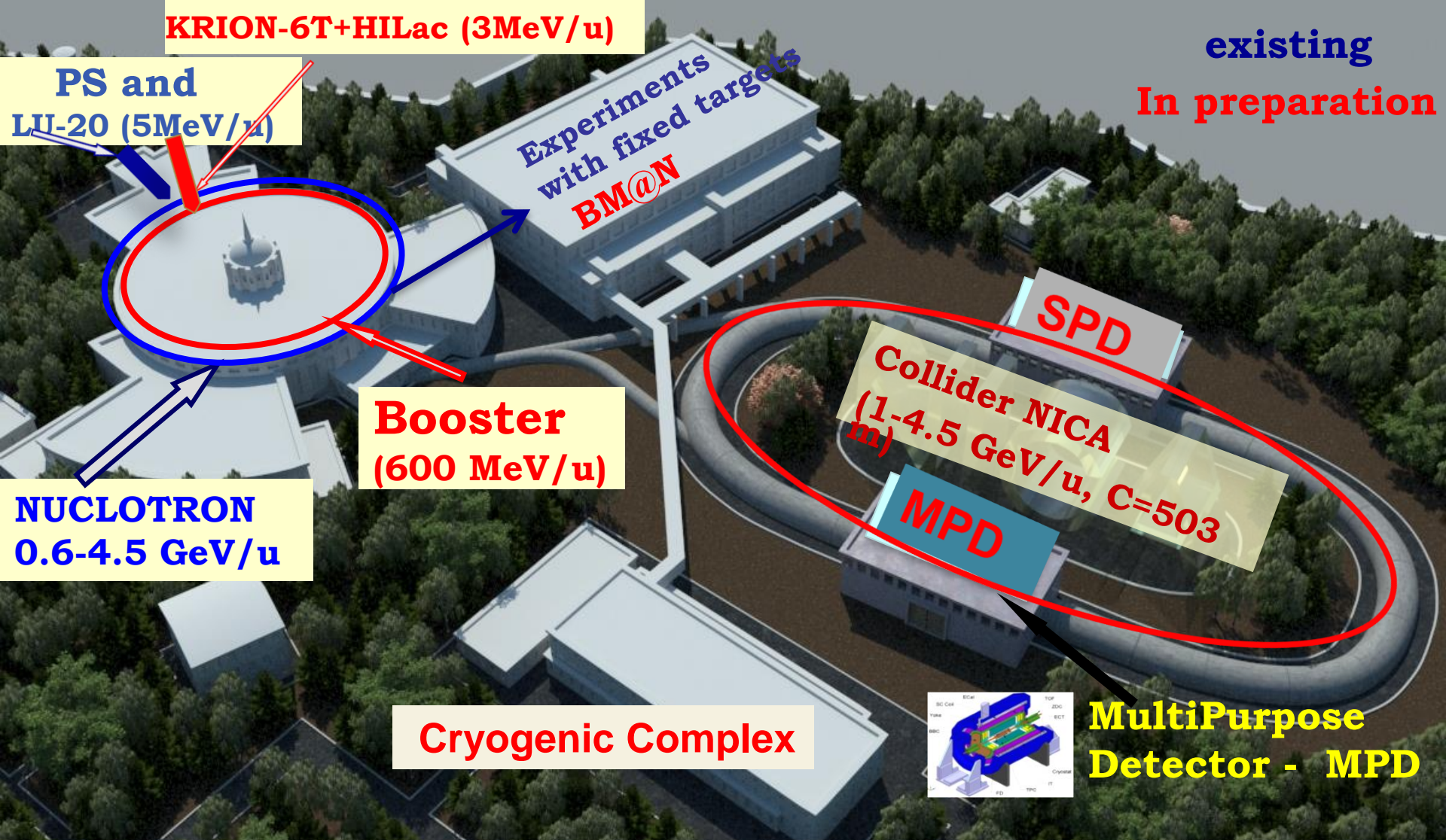
JINR (Dubna)
1956 - 2016



The JINR Scientific Program (NICA Complex)

NICA Complex: *New era in the hot dense matter science*

Collider basic parameters:
 $\sqrt{s_{NN}} = 4-11 \text{ GeV}$; beams: from p to Au; $L \sim 10^{27} \text{ cm}^{-2} \text{ c}^{-1}$ (Au), $\sim 10^{32} \text{ cm}^{-2} \text{ c}^{-1}$ (p)



KRION-6T+HILac (3MeV/u)

**PS and
LH-20 (5MeV/u)**

**Booster
(600 MeV/u)**

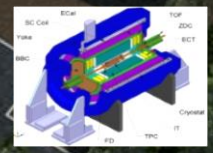
**NUCLOTRON
0.6-4.5 GeV/u**

Cryogenic Complex

**existing
In preparation**

SPD
**Collider NICA
(1-4.5 GeV/u, C=503
m)**
MPD

**MultiPurpose
Detector - MPD**



NICA International collaboration



JINR-France (IN2P3) MoU



Megaprojects: Workshop in Dubna (Italy, Germany, France, China, Egypt, SAR, RF)



February 2015 Cooperation Agreement FAIR (Darmstadt) – NICA JINR (Dubna)



Extension of the International Cooperation

NICA & FAIR became the part (Work Package 3) of **CREMLIN** project (Connecting Russian & European Measures for Large-scale Research Infrastructures) in the framework of **HORIZON 2020**

Signed by 19 European Institutes (including JINR + 5 Russian Institutes)

Project kick-off:

Moscow, Oct. 5-8, 2015

CREMLIN objectives for NICA & FAIR:

- *exchange of know-how on designing and constructing detector and accelerator components*
- *involvement in common activities to bundle resources and create additional synergies*
- *providing support in coordination, reviewing and training*

Bulgarian authorities (Nuclear Regulatory Agency, as a representative in JINR CPP and Ministry of Education) take a decision about submission of the **NICA project to ESFRI Roadmap**. Special letter of Commitment prepared and Letter of support for the submission of the NICA project.

Authorities of **Czech Republic, Romania and Slovakia** kindly considered favorably the support to this submission.



The ESFRI Roadmap identifies new Research Infrastructures (RI) of pan-European interest corresponding to the long term needs of the European research communities, covering all scientific areas, regardless of possible location.

Project descriptions highlight the manner in which they would impact on science and technology development at international level, how they would support new ways of doing science in Europe, and how they would contribute to the enhancement of the European Research Area.

NICA White Paper – International Efforts



Draft v 8.03
January 24, 2013

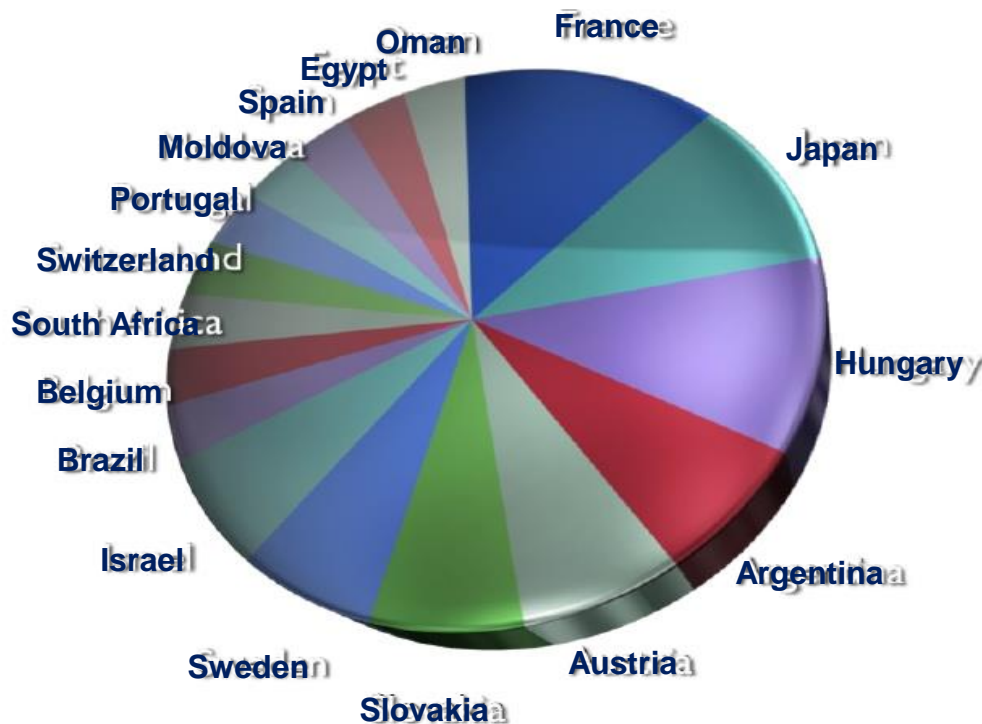
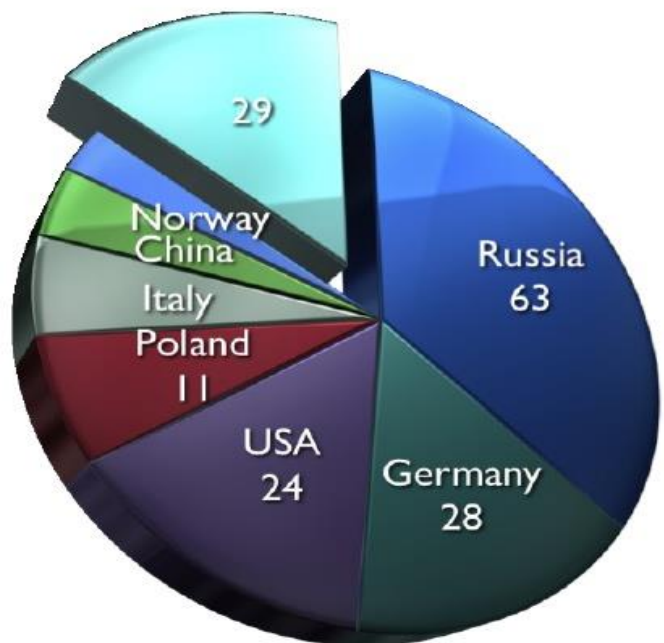
SEARCHING for a QCD MIXED PHASE at the
NUCLOTRON-BASED ION COLLIDER FACILITY
(NICA White Paper)

Statistics of White Paper Contributions

111 contributions:

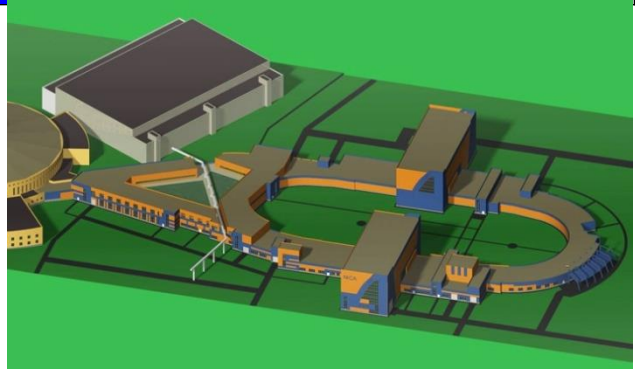
188 authors from **70** centers in **24** countries

*Indicates wide international interest
to the physics at MPD & BM@N*





	2014				2015				2016				2017				2018				2019			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Injection complex																								
Nuclotron upgrade stage II																								
Booster																								
Collider																								
BM@N I stage																								
MPD:																								
<i>solenoid</i>																								
<i>TPC, TOF, Ecal (barrel)</i>																								
Collider civil engineering:																								
<i>MPD Hall</i>																								
<i>SPD Hall</i>																								
<i>Collider tunnel</i>																								
<i>HEBT Nuclotron-collider</i>																								
Cryogenic full scale (collider & MPD)																								





JINR Computing Infrastructure



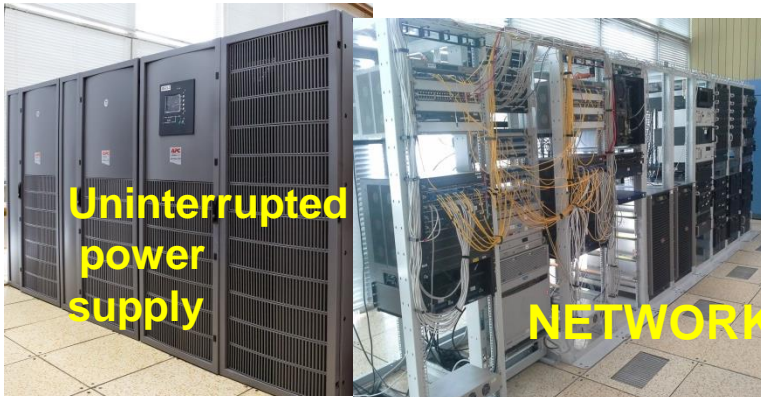
Tape Robot



Computing elements

LHCOPN – 10Gbps, 3400 cores (~ 50 kHS06),
5 PB tapes (IBM TS3500), 3.4 PB disk
Close-coupled, chilled water cooling InRow
Hot and cold air containment system
MGE Galaxy 7000 – 2x300 kW

March 2015 – CMS Tier1 Inauguration



Uninterrupted power supply

NETWORK



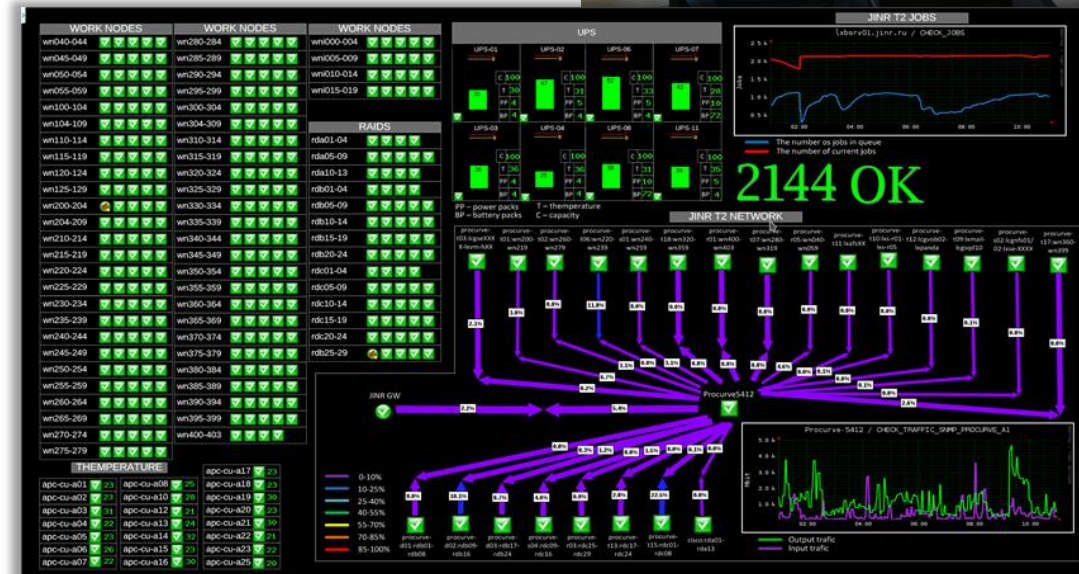
Cooling system





Monitoring and Control room Tier1/Tier2

For a robust performance of a complex it is necessary to monitor the state of all nodes and services- from the supply system to the robotized tape library

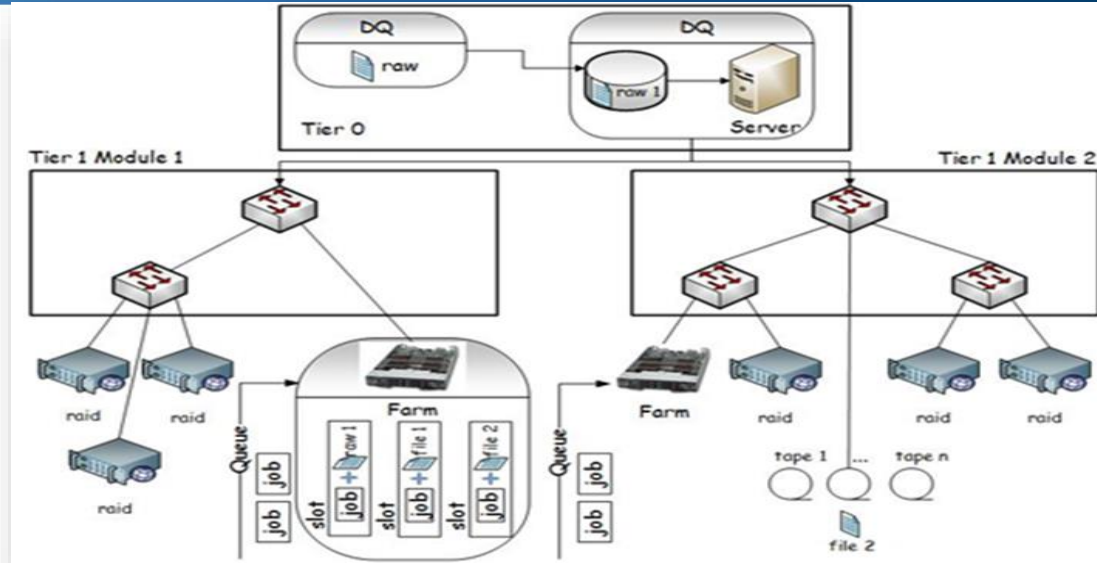


System allows one, in a real time mode, to observe the whole computing complex state and send the system alerts to users via e-mail, SMS, etc. 690 elements are under observation 3497 checks in real time

Simulation of NICA-MPD-SPD Tier0-Tier1 computing acilities

Working at TB scale the NICA MPD-SPD experiments will face with great challenges in distributed computing:

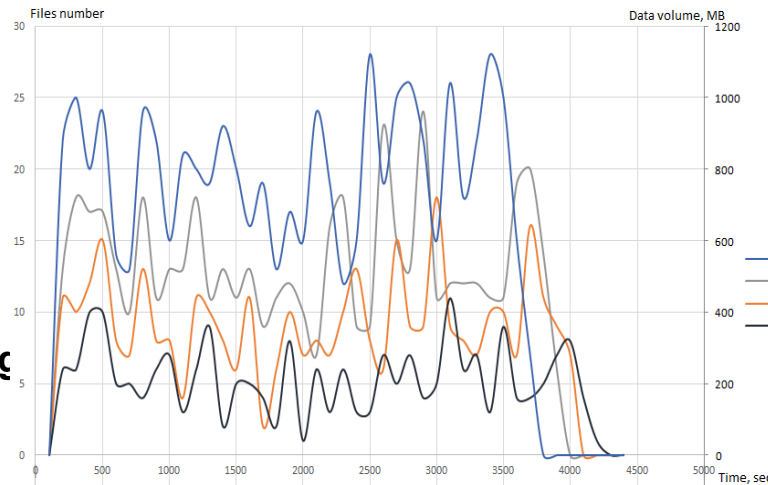
- large increase of CPU and network resources;
- combined grid and cloud access;
- Intelligent dynamic data placement
- distributed parallel computing;
- renewal most of simulation and analysis software codes.



Data storage and processing scheme of Tier0-Tier1 level

The program SyMSim (Synthesis of Monitoring and SIMulation) for simulation of grid-cloud structures is developed.

The **originality** consists in **combining a simulation program with a real monitoring system** of the grid/cloud service in frame of the same program.



Number of DAQ data files stored on output disk buffer for growing data volumes

Estimated rate of NICA-MPD experimental data from Tier0 to be transferred to Tier 1 is about 24 PB by one month. Simulation result shows what happened in the grid/cloud system if the data volumes are grow up to 1,5 times for example. Simulation result allows one to **understand how the intensity of the input stream determines the reserves of the system capacity**

*Data analysis tool for the NICA experiments
is developed by MPD software group on the basis
of the ROOT framework (CERN)
and FAIRroot packages (GSI, Germany).
This framework was developed together with
the software group from the CBM/FAIR experiment.*

*It is updated regularly with including the local changes
in the code and when external packages like GEANT
or ROOT are needed to be updated.*

*This framework is tested by the users
from the local experiments (MPD, BM@N)
and from the CBM experiment as well.*

GRID 2016



July 4 - 9 2016

7th International Conference "Distributed Computing and Grid-technologies in Science and Education" will be held at the Laboratory of Information Technologies (LIT) of the Joint Institute for Nuclear Research (JINR) on 4 - 9 July 2016 in Dubna (grid2016.jinr.ru)
This year Conference is dedicated to the 60th anniversary of JINR and 50th anniversary of LCTA/LIT.



Thank you and welcome to Dubna!

