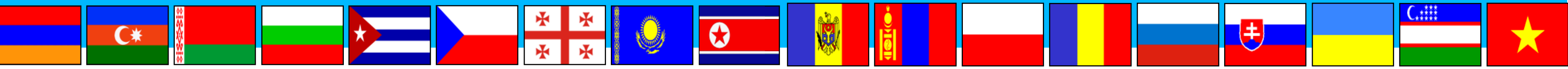
Joint Institute for Nuclear Research
International Intergovernmental Organization



# Status of the NICA project at JINR

V. Kekelidze, A. Kovalenko, R. Lednicky, V. Matveev,
I. Meshkov, A. Sorin, G. Trubnikov
(for the NICA/MPD collaboration)

BRAZIL-JINR FORUM
“Frontiers in Nuclear, Elementary Particle,
and Condensed Matter Physics”
JINR, Dubna, June 15, 2015


NICA
Volga
river

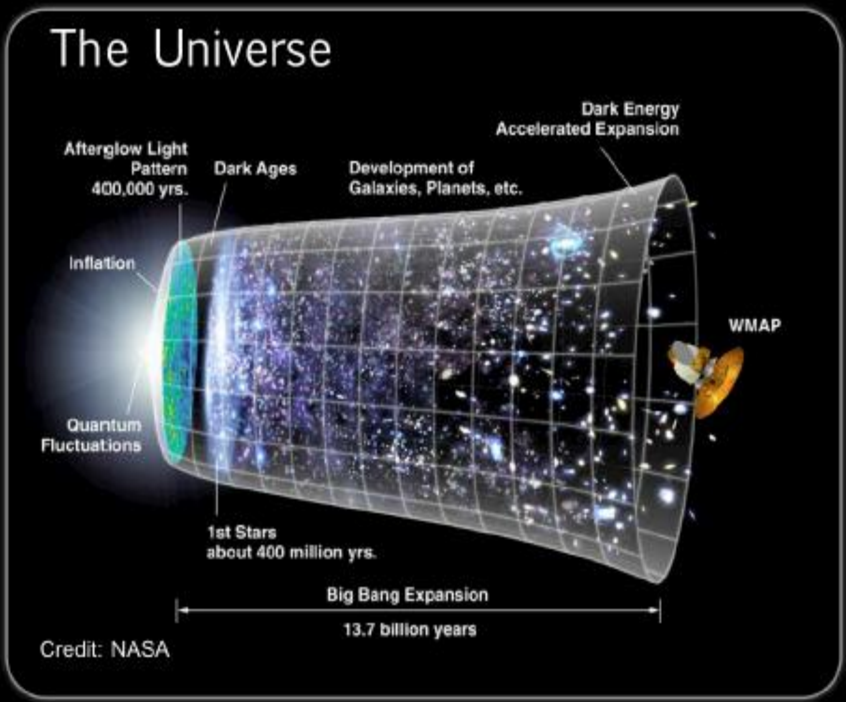
## ***NICA (Nuclotron based Ion Colider fAcility) – the flagship project in HEP of Joint Institute for Nuclear Research (JINR)***

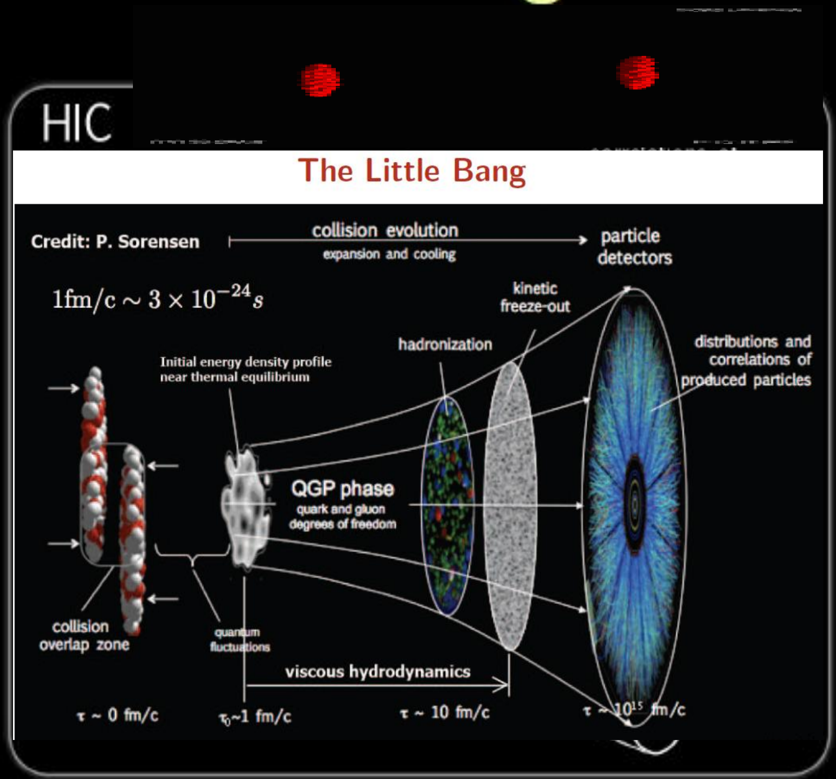
Main targets of "NICA Complex":

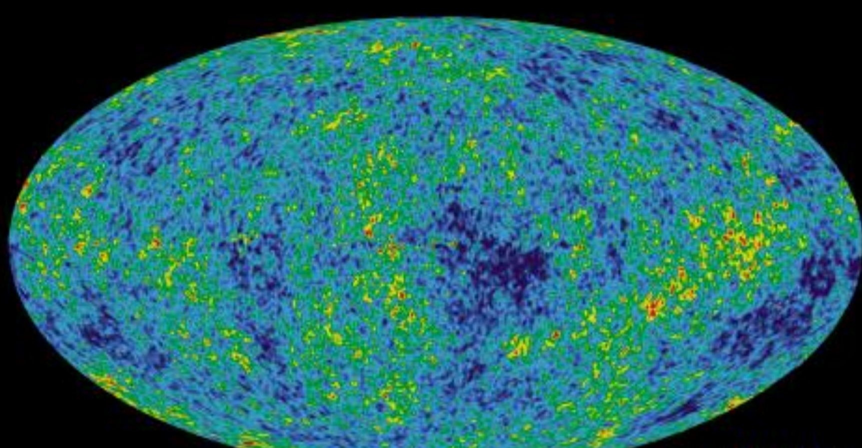
- ***study of hot and dense baryonic matter***
- *investigation of nucleon spin structure, polarization phenomena*

- *development of accelerator facility for HEP @ JINR providing intensive beams of relativistic ions from p to Au polarized protons and deuterons with energy up to* $\sqrt{S_{NN}}$ = *11 GeV ($Au^{79+}$) and =27 GeV (p)*

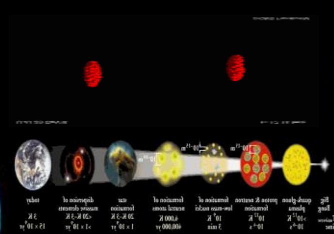
# The Big Bang vs the Little Bangs

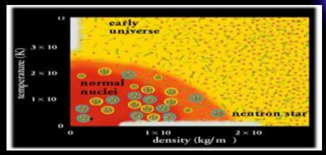


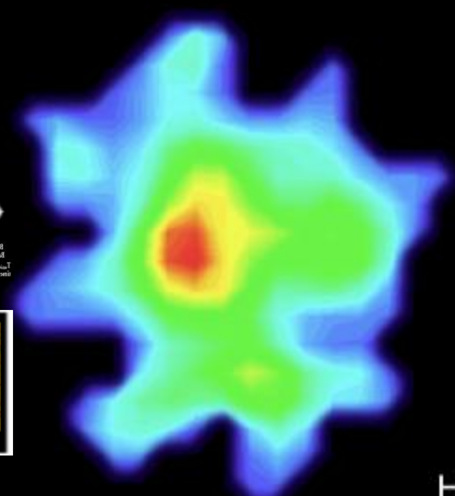



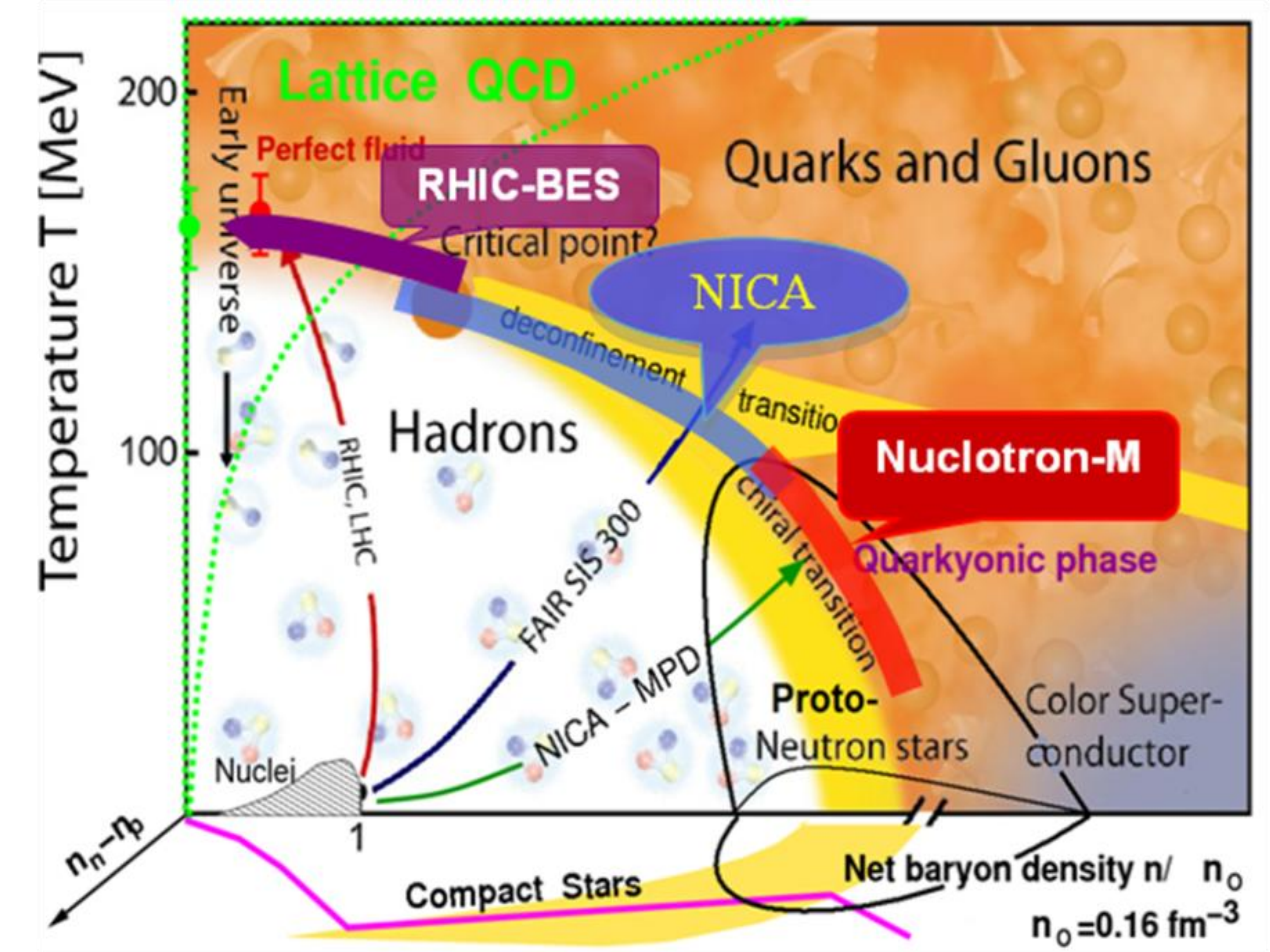
WMAP





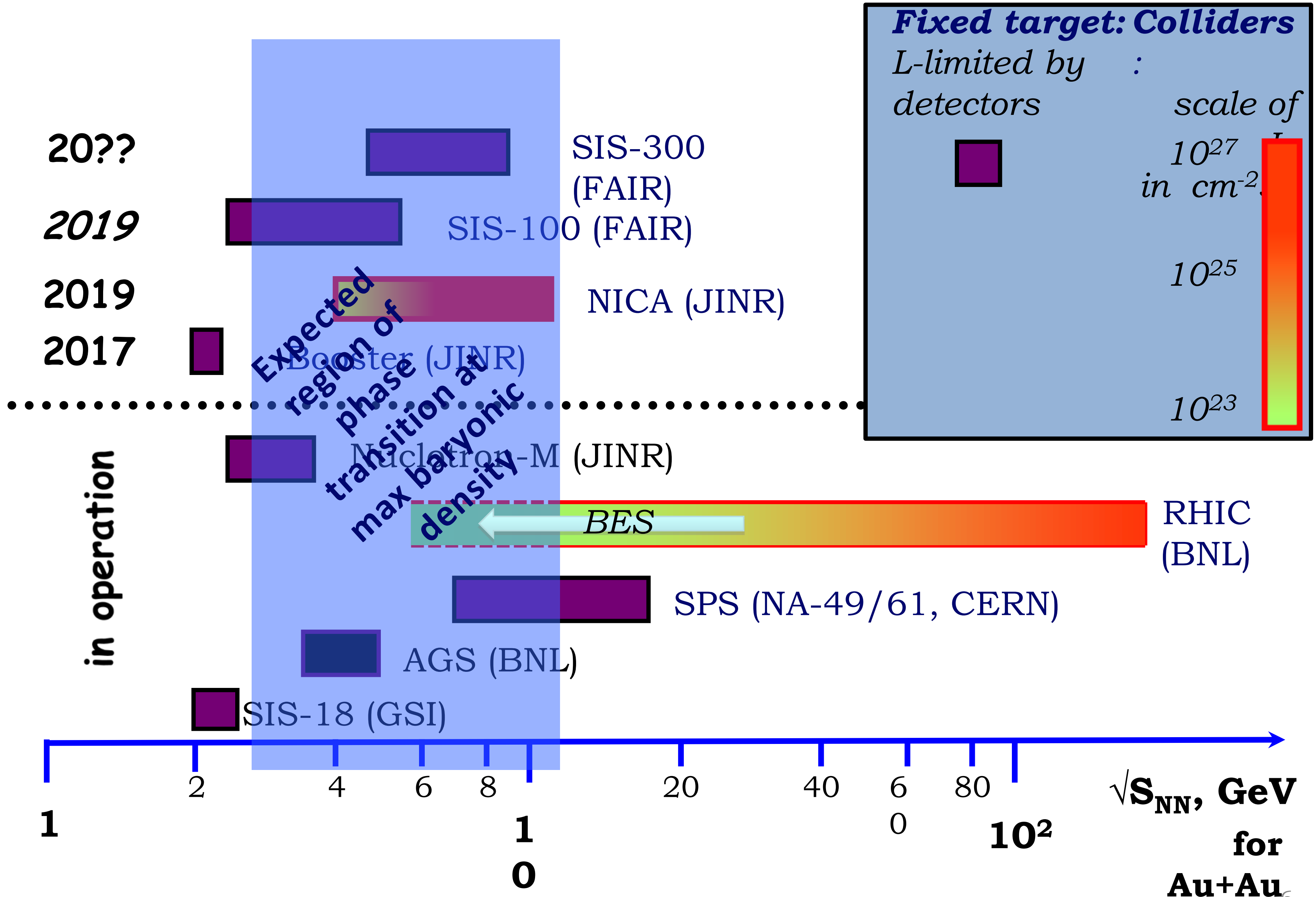


HIC

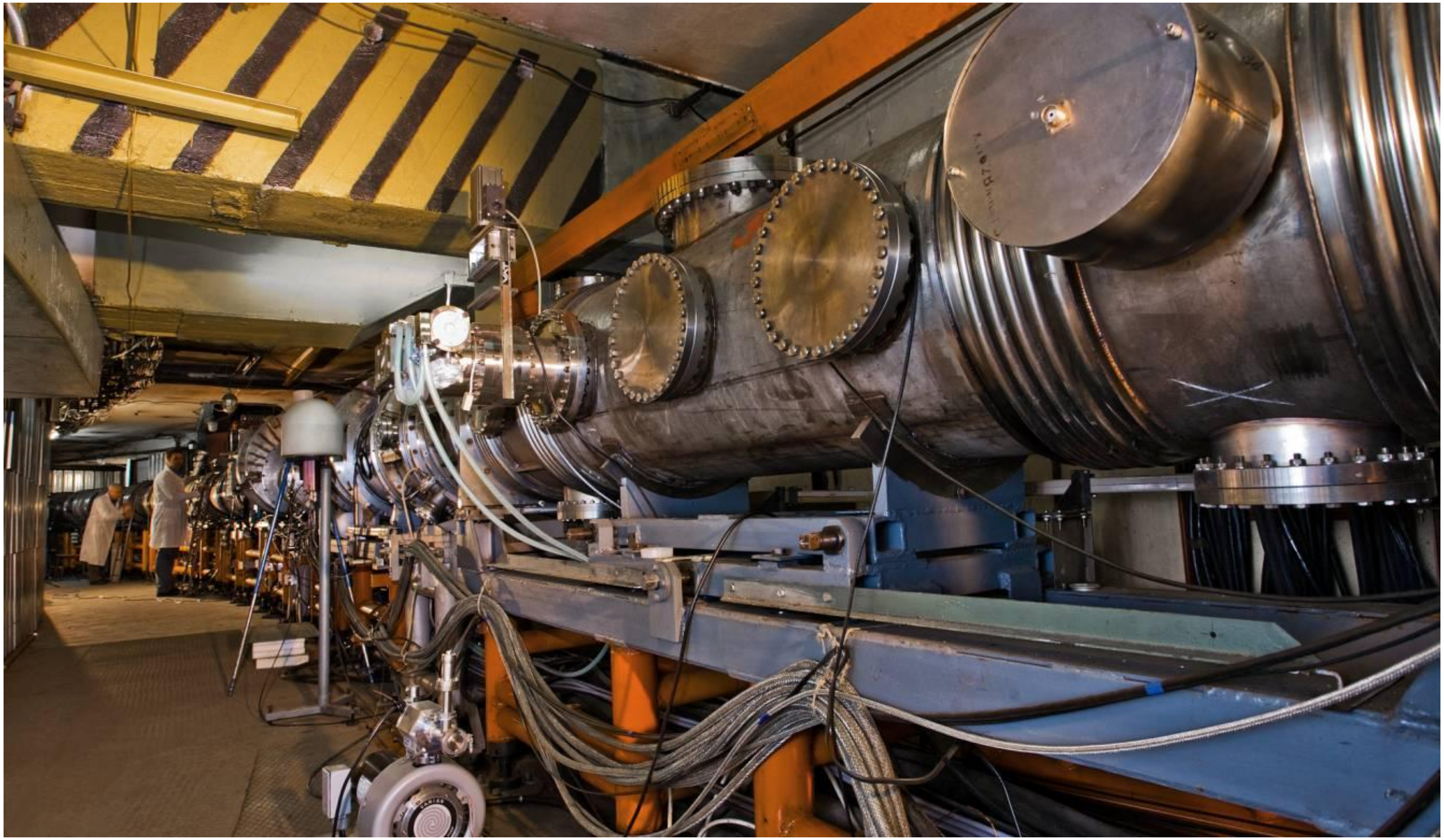


Lattice QCD
Temperature T [MeV]
200
100
Early universe
Perfect fluid
RHIC-BES
Critical point?
Quarks and Gluons
NICA
deconfinement
transition
Nuclotron-M
Hadrons
RHIC, LHC
FAIR SIS 300
chiral transition
Quarkyonic phase
NICA – MPD
Proto-
Neutron stars
Color Super-
conductor
Nuclei
1
$n_n - n_p$
Compact Stars
Net baryon density n/ $n_0$
$n_0$ =0.16 fm$^{-3}$

# Present and future HI machines



# Synchrotron **Nuclotron,** in operation since 1993
## – *based on superconducting magnets developed in Dubna*

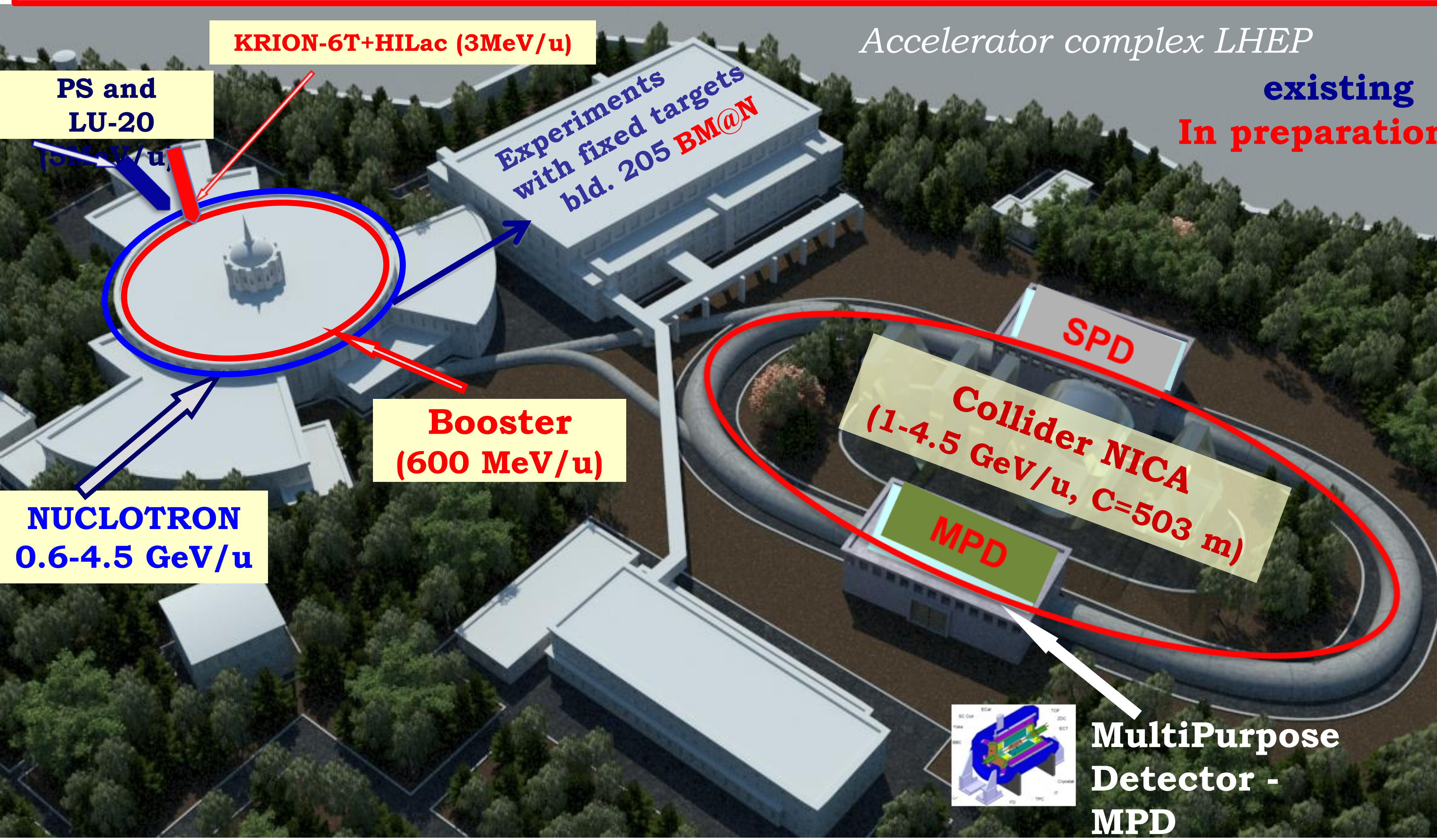


**Nuclotron provides accelerated proton and ion beams (up to *Xe42+*, *A=124*) with energies up to 6 AGeV (Z/A = 1/2)**

# Complex NICA

**Collider basic parameters:**

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



# NICA – basic milestones

- The project of **NICA complex** is approved **2010**
- The 1-st stage of **Nuclotron** modernization is completed **2010**

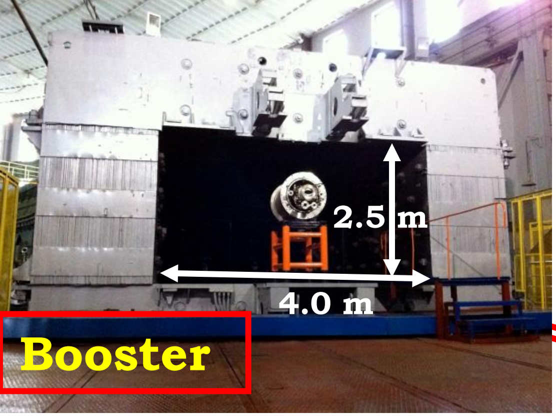
  *10 runs have been carried out are in*
  **2010 – 2014**

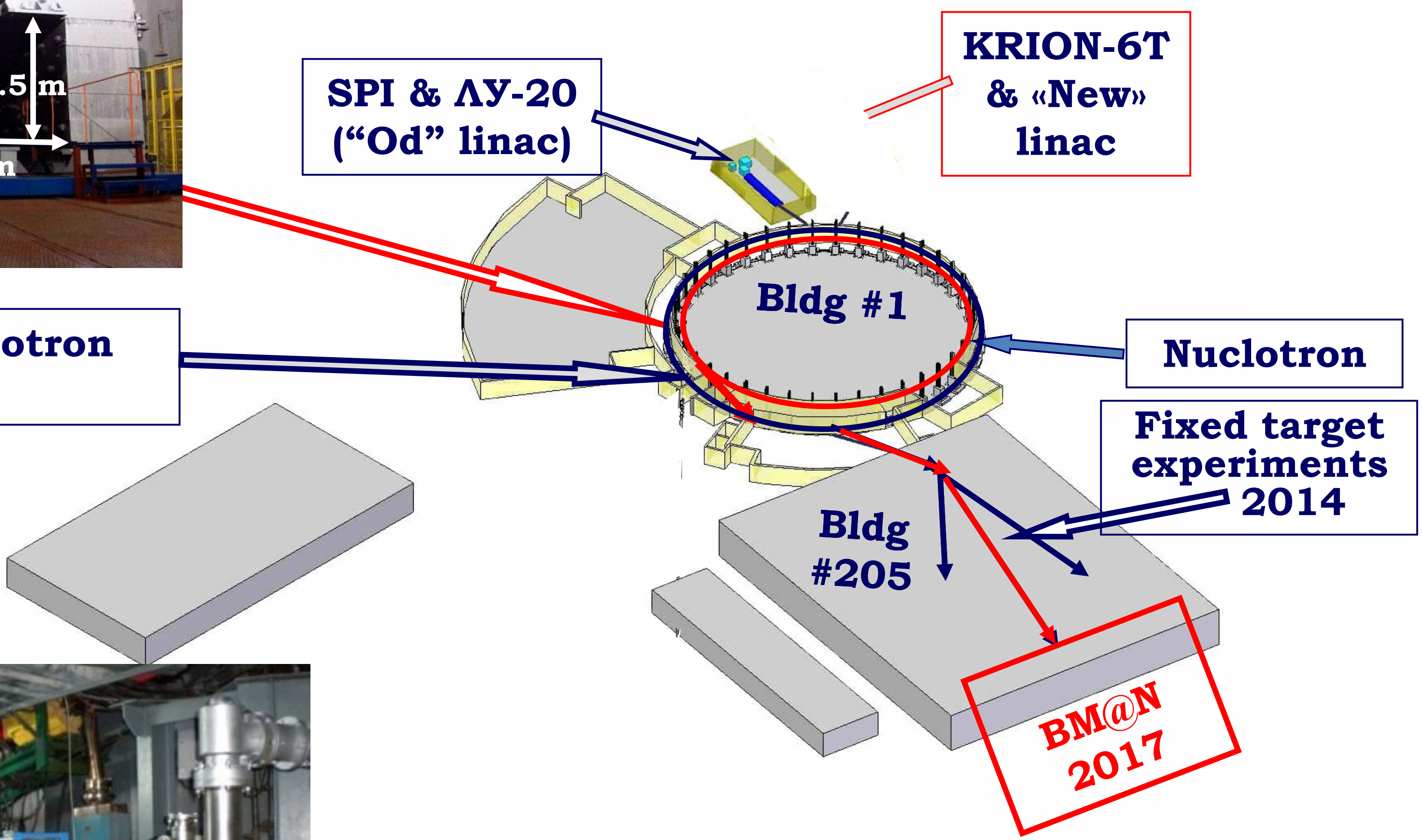
- The projects: approval – completion
  - ✓ **accelerator complex** **2010 – 2019**
  - ✓ **MPD (MultiPurpose Detector)** **2010 – 2019**
  - ✓ **experiment with fixed target BM@N (I stage)** **2012 - 2017**

- The project preparation for **Spin Physics Detector (SPD)**
  *is in progress*

# Status of the accelerator complex

# NICA – Stage I



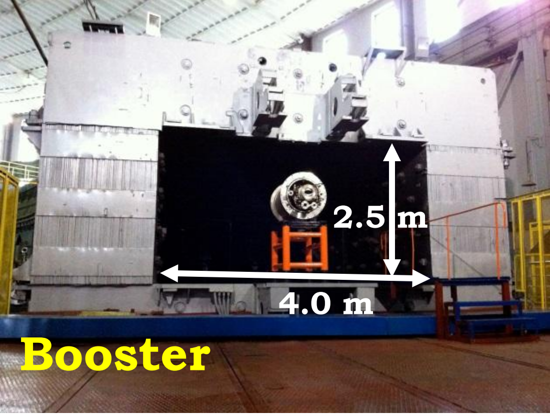

**Nuclotron facility today**

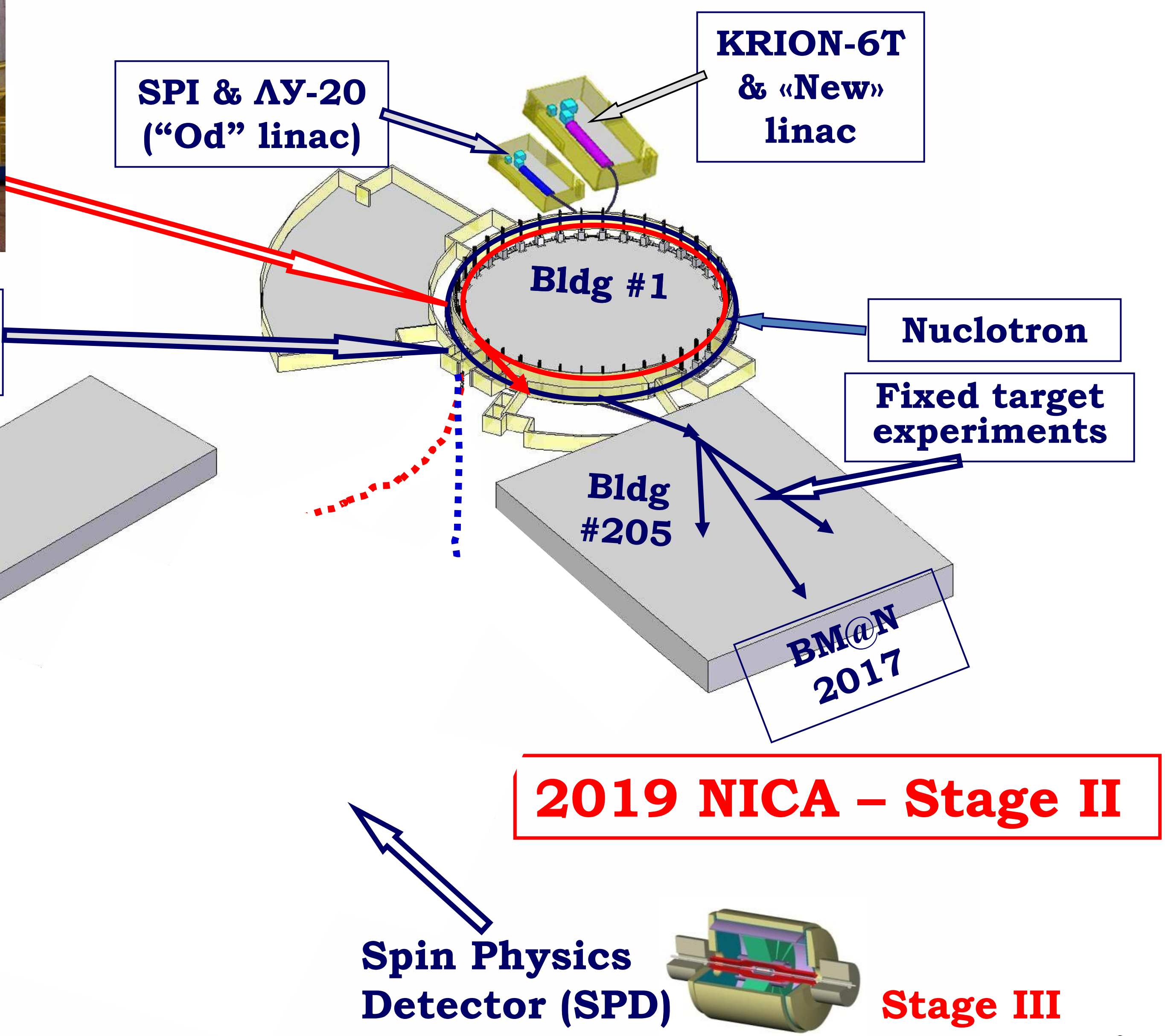
**2017 NICA – Stage I**

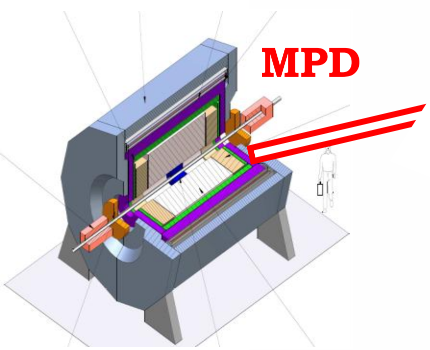
# Nuclotron Beams

| *Parameter* | *Project (2017)* | | *Achieved* | |
|---|---|---|---|---|
| Magnetic field, T | 2.0 (Bρ = 42.8 T·m) | | 2.0 | |
| Field ramp, T/s | 1.0 | | 0.8 | |
| Repetition period, s | 5.0 | | 8.0 | |
| | Energy, GeV/u | Ions/ cycle | Energy, GeV/u | Ions/ cycle |
| *Light ions* ⇒ d | 6.0 | $5 \cdot 10^{10}$ | 5.6 | $1 \cdot 10^{10}$ |
| *Heavy ions* | *With KRION-6T & Booster* | | *Without KRION-2* | |
| $^{40}Ar^{18+}$ | 4.9 | $2 \cdot 10^{10}$ | 3.5 | $5 \cdot 10^{6}$ |
| $^{56}Fe^{26+}$ | 5.4 | $1 \cdot 10^{10}$ | 2.5 | $2 \cdot 10^{6}$ |
| $^{124}Xe^{48/42+}$ | 4.0 | $2 \cdot 10^{9}$ | 1.5 | $1 \cdot 10^{3}$ |
| $^{197}Au^{79+}$ | 4.5 | $2 \cdot 10^{9}$ | --- | --- |
| *Polarized beams* | *With SPI & Siberian snake* | | *With POLARIS* | |
| p↑ | 11.9 | $1 \cdot 10^{10}$ | --- | --- |
| d↑ | 5.6 | $1 \cdot 10^{10}$ | 2.0 | $5 \cdot 10^{8}$ |

# NICA – Stage II



# NICA – Stage II
# (Heavy Ion Mode)

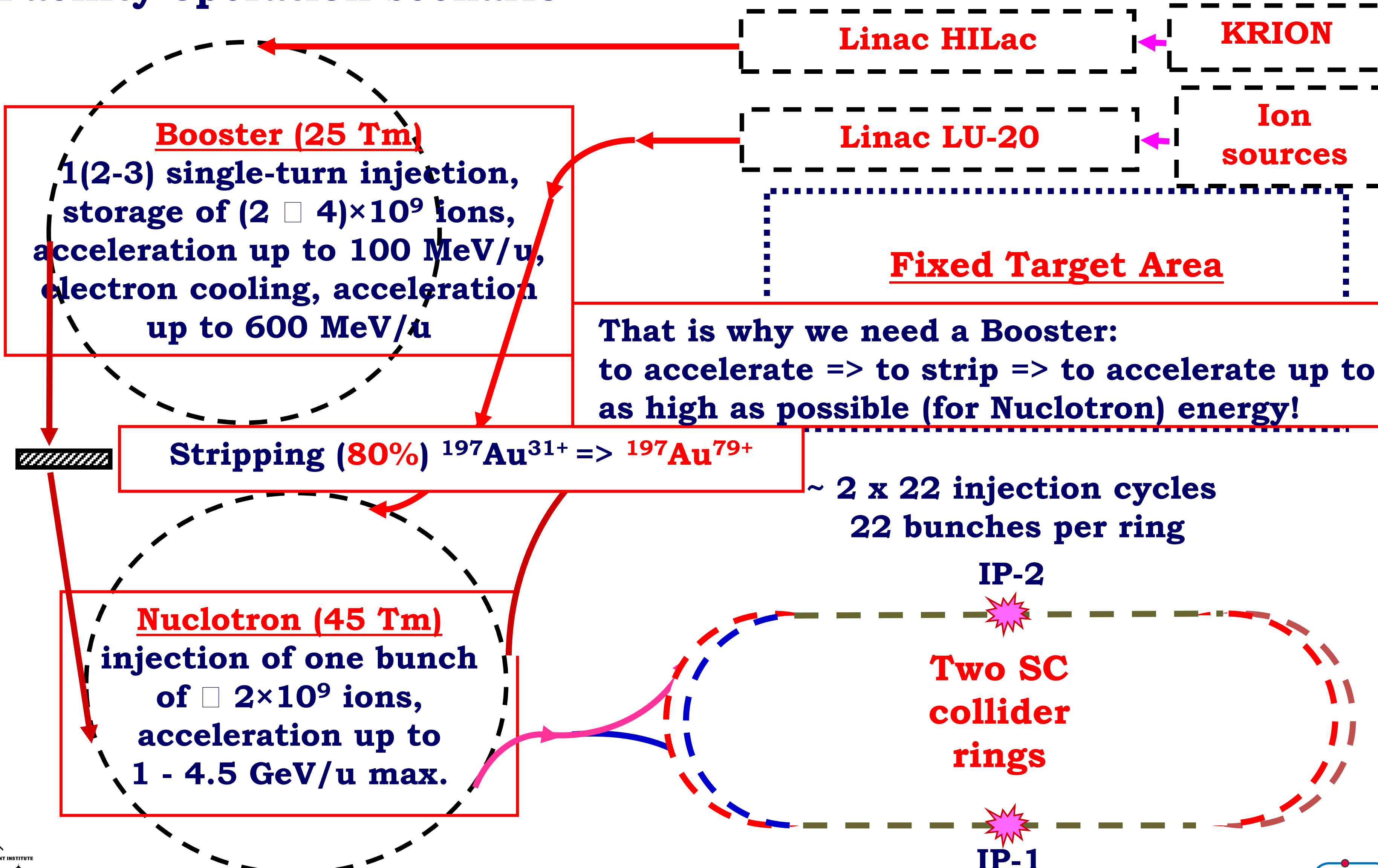
## Key Parameters of The NICA Collider

**Collider lattice: FODO, 12 cells x $90^0$ each arc,**

| | | | |
|---|---|---|---|
| Ring circumference, m | 503,04 | | |
| Number of bunches | 22 | | |
| R.m.s. bunch length, m | 0.6 | | |
| Ring acceptance, π·mm·mrad | 40.0 | | |
| Long. Acceptance, Δp/p | ≤ 0.01 | | |
| $\gamma_{transition}$ ($E_{transition}$, GeV/u) | 7.091 (5.72) | | |
| β*, m | 0.35 | | |
| Ion Energy, GeV/u | 1.0 | 3.0 | 4.5 |
| Ion number/bunch, 1e9 | 0.275 | 2.4 | 2.2 |
| R.m.s. emittance, h/v π·mm·mrad | 1.1/1.0 | 1.1/0.9 | 1.1/0.76 |
| R.m.s. Δp/p, 1e-3 | 0.62 | 1.25 | 1.65 |
| IBS growth time, s | 190 | 700 | 2500 |
| Peak luminosity, $cm^{-2}\cdot s^{-1}$ | 1.1e25 | 1e27 | 1e27 |

# NICA – Stage II: Structure and Operation Regimes (Heavy Ion Mode)

## Facility operation scenario



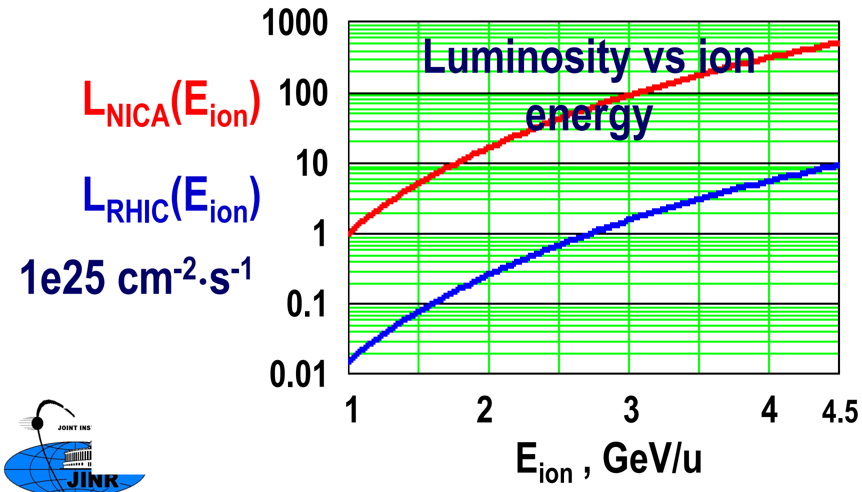
# NICA – Stage II: Structure and Operation Regimes (Heavy Ion Mode)

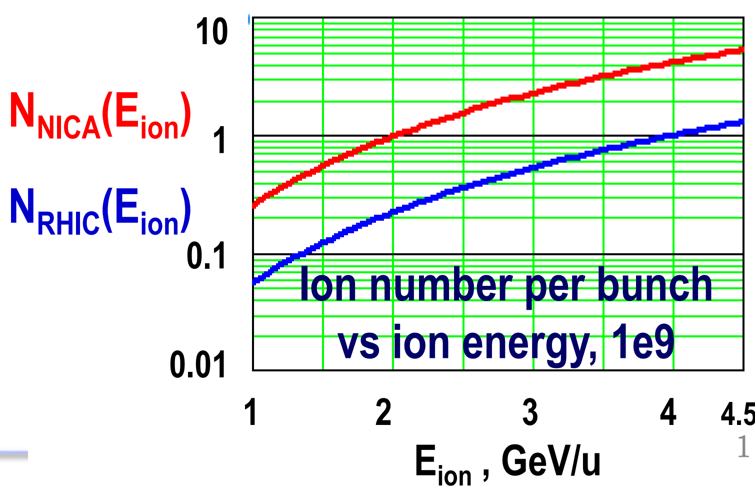
**Why RHIC has low luminosity at the energy where luminosity of NICA is relatively high? The reason is the beam space charge:**

$$N_{bunch} \propto 1/C_{ring}\,, \quad L \propto (N_{bunch})^2 \propto 1/(C_{ring})^2 \; !$$

$$C_{RHIC}/C_{NICA} = 7.62\,, \quad L_{NICA} / L_{RHIC} = (C_{RHIC}/C_{NICA})^2 \leq 58.1$$

| Parameter | RHIC | NICA |
|---|---|---|
| $C_{Ring}$, m | 3834 | 503 |
| Bunch length, m | 1.0 | 0.6 |
| Beam emittance, π·mm·mrad | 1.0 | 1.0 |
| Number of intersections | 6 | 2 |
| β*, m | 1.0 | 0.35 |
| Hour-glass factor | 0.8 | 0.6 |



# NICA – Stage III : Collider of polarized beams

1st concept of the collider beams has been developed

It assumes acceleration of polarized protons and deuterons in Nuclotron avoiding the Booster.

Concept of polarized protons in Nuclotron has been developed, but its realization requires significant upgrade of Nuclotron.

New concept with polarized particles acceleration in the Booster and storage in the Collider rings is under preliminary consideration.

Analysis of depolarization effects in the Collider is in progress.

# NICA – Stage III : Collider of polarized beams

# Source of Polarized p↑ & d↑ Ions SPI

**Collaboration of INR (Troitsk) & JINR**

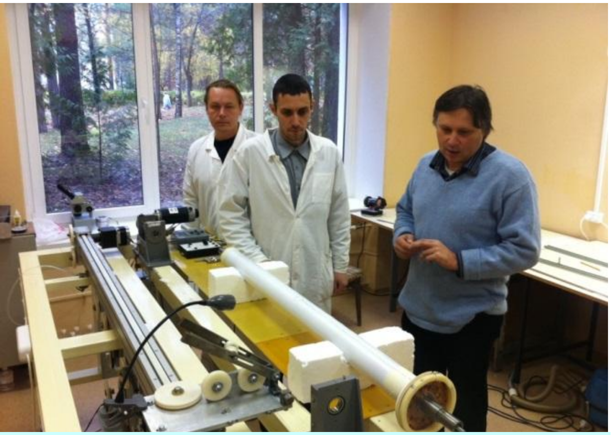
SPI at JINR, May 2013

**SPI test at Nuclotron with d↑ is planned for winter 2015.**

**It will be beginning of new stage of experiments with polarized beams at Nuclotron.**

# NICA Elements Fabrication

## Heavy Ion Source KRION-6T/ESIS
## (Electron String Ion Source modification)



**6T solenoid fabrication (2012)**

**KRION-6T/ESIS has been assembled and being tested (March 2014)**

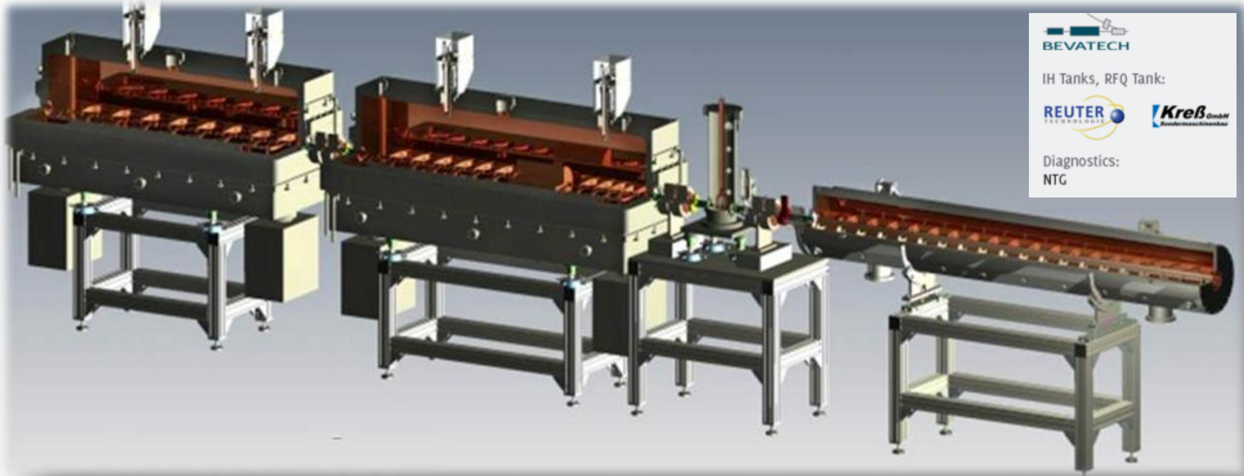
**Test results (April 2014) : B= 5.4T magnetic field reached in a working regime.**

**Test of gold ion beams has been produced:**

- **$Au^{30+}$ ÷ $Au32^{32+}$, $6{\cdot}10^8$, $T_{ioniz}$= 20 ms for**
- **$Au^{32+}$ -> repetition rate 50 Hz.**
- **ion beams $Au^{51+}$÷ $Au^{54+}$ are produced.**

# NICA Elements Fabrication

**Heavy Ion Linear Accelerator (HILAC, 3 MeV/u)**
**-under construction at BEVATECH (Frankfurt)**
**- first section delivery - October 2014**
**- final delivery - June 2015**




# SC Magnets for Booster, Collider & SIS-100 (FAIR)

June 2014

# Magnet assembly workshop at LHEP JINR

*~ 450 SC magnets will be assembled & tested in the workshop for* ***NICA*** *& SIS-100* ***FAIR***

**Starts production in 2015**

the cable machine

area for SC coil fabrication

# NICA Elements Fabrication

## SC Magnets for Booster, Collider & SIS-100 (FAIR)

## The Booster Magnets

Booster dipole and quadrupole lens

UH vacuum beam chamber (curved)

HTSC current leads 17 kA

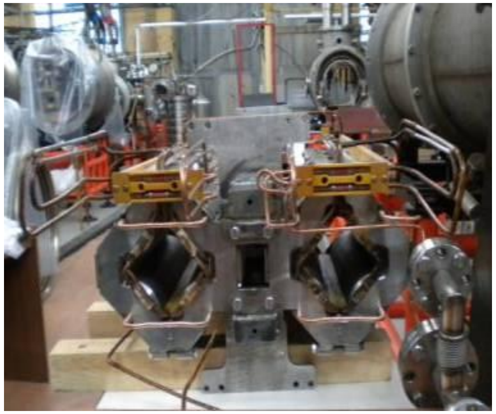
## The Collider "twin" dipole

Full-scale Nuclotron–type superconducting prototypes of dipole and quadrupole magnets for the NICA Booster and Collider were manufactured at LHEP JINR, have successfully passed the cryogenic test on the bench. Serial production of the magnets for the Booster will be started in December 2014.

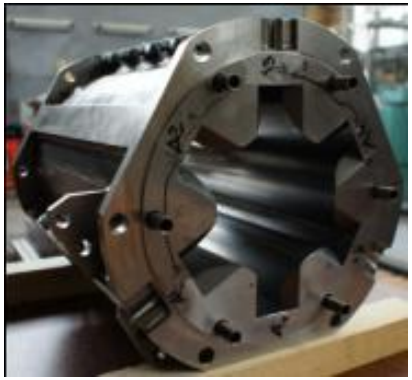
## SC Magnets for Booster, Collider & SIS-100 (FAIR)

# The SIS 100 & NICA Magnets

Dipole & quadrupole prototypes for SIS100 (FAIR)



The Collider quadrupole lens



Sextupole corrector prototype for SIS100 and NICA Booster and its assembly

# Budker INP (Novosibirsk) - design and fabrication

## RF acceleration systems for Booster

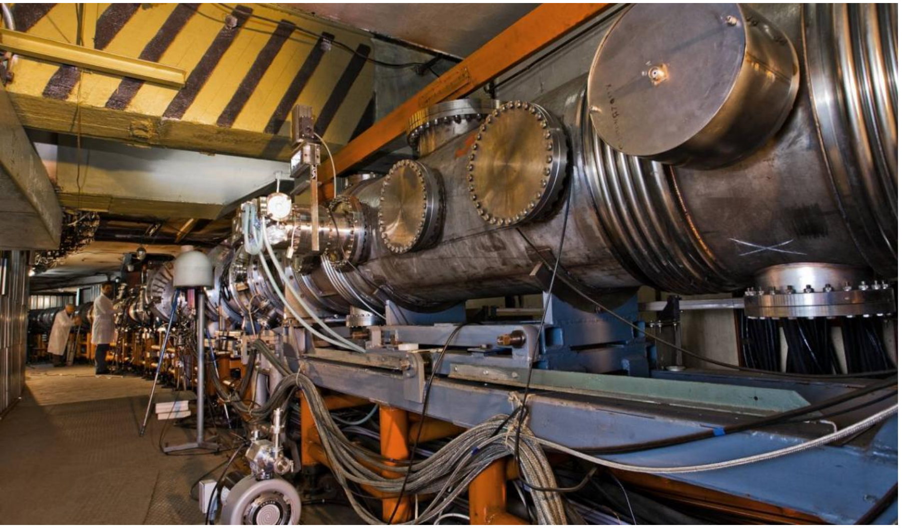
## Electron cooler for Booster

**(stage of working design)**

**Electron cooler for Booster (prototype)**

# Booster Synchrotron Construction

# Nuclotron Upgrade



Nuclotron is SC synchrotron accelerating ions and delivering presently ion beams:

deuterons $E_{max}$ = 4.8 GeV/u (B = 1.7 T)

$^{124}Xe^{42+}$ $E_{max}$ = 3.0 GeV/u (B = 1.7 T).

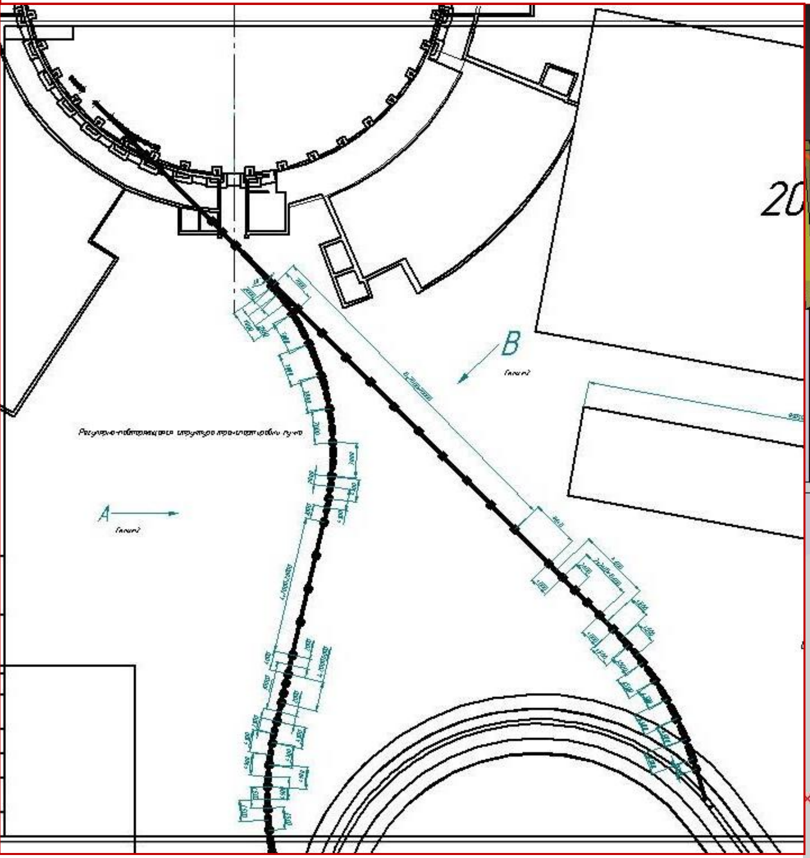
## The Nuclotron upgrade tasks for collider mode:

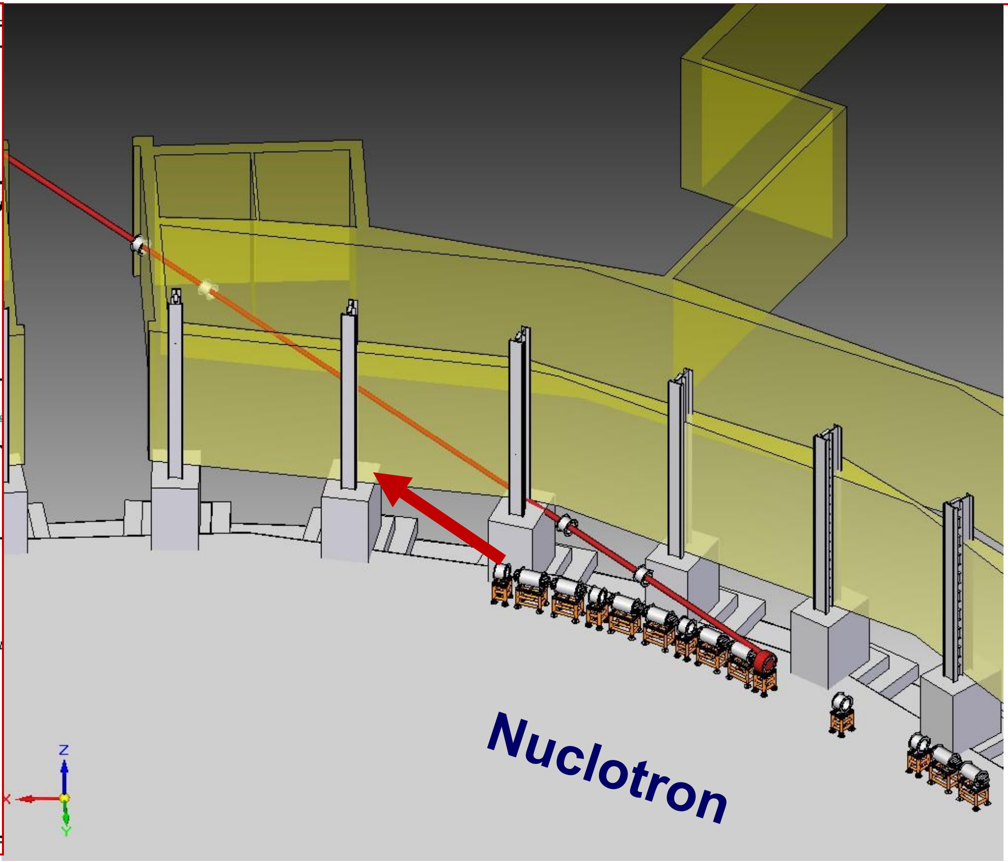
- Acceleration of $^{197}Au^{79+}$ up to 4.5 GeV/u
- Injection system for 197Au79+ at 600 MeV/u
- Upgrade of RF system
- Extraction system for 197Au79+ at 1 ÷ 4.5 GeV/u
- Upgrade of control system (synchronization)

**The work is in steady progress**

# NICA Elements Fabrication

## JINR + BINP Beam transfer channel Nuclotron - Collider
## (stage of working design)





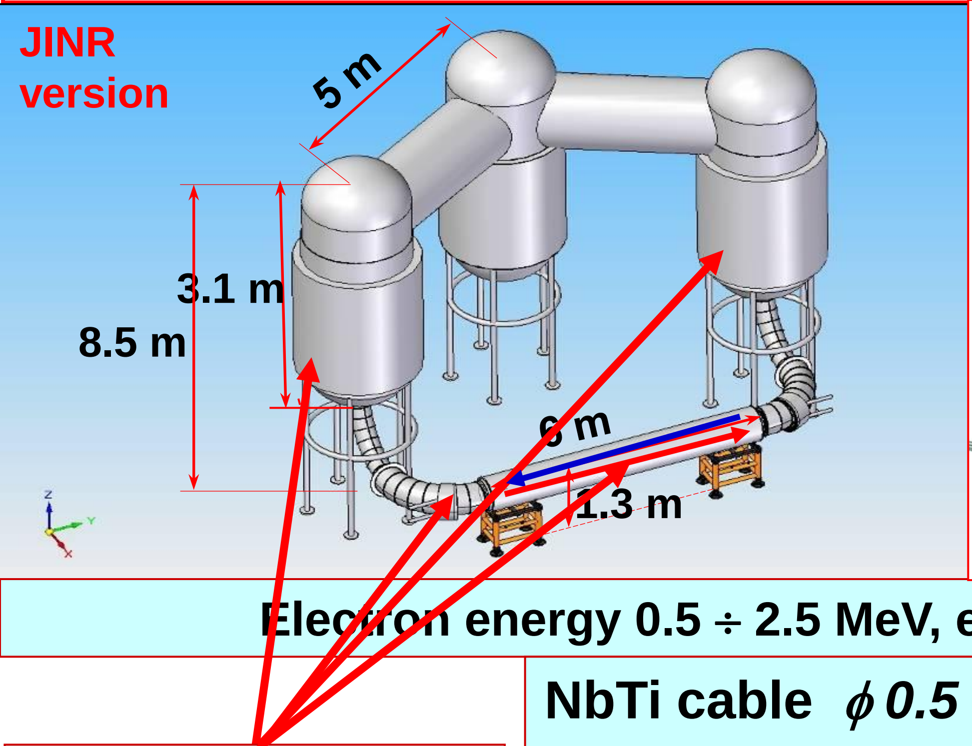

**Channel lattice:**

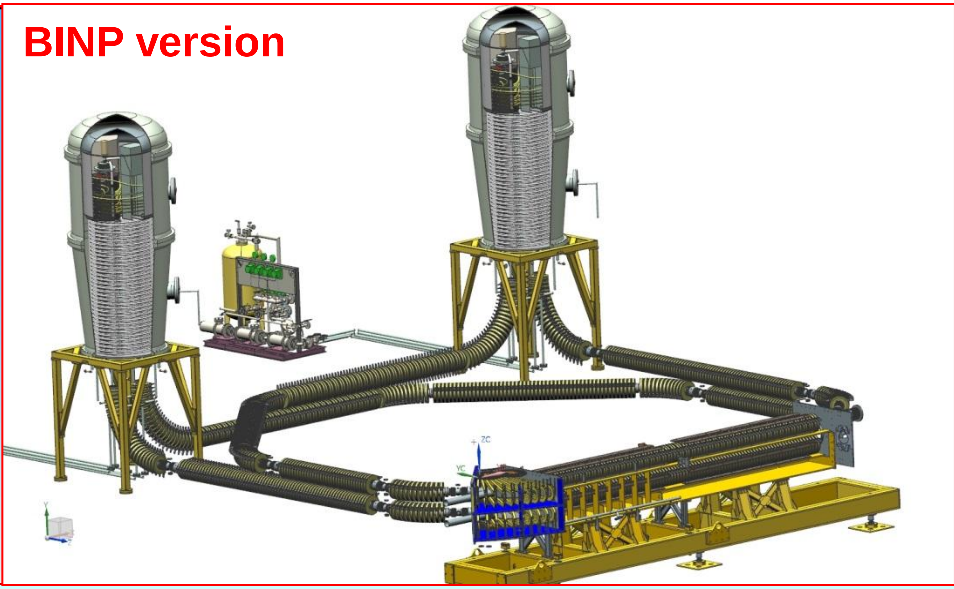
**pulsed magnets, 35 dipoles, 56 quadrupoles, $P_{average}$ ~ 200 kW**

# NICA Elements Fabrication

**JINR + BINP + AREI + Fermilab + NEC + Geliymash (Moscow)**

## Electron Cooler for NICA Collider – Two Versions




**Electron energy 0.5 ÷ 2.5 MeV, electron beam current 0.1 ÷ 1 A**

**SC solenoids**

**(JINR version)**

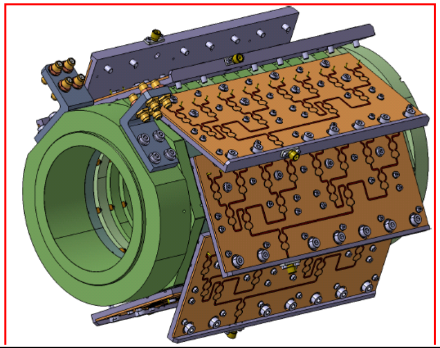
| | | |
|---|---|---|
| NbTi cable $\phi$ *0.5* мм | L = 275 km | $ 250,000 |
| HTSC band 12 x 0.5 мм$^2$ | L = 11.5 km | $ 350,000 |

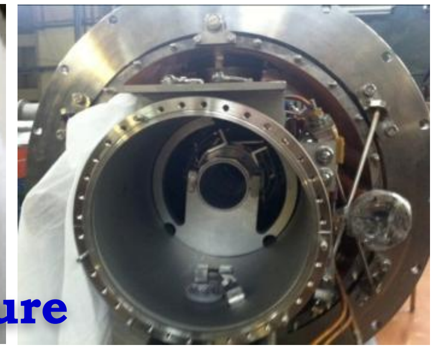
| | |
|---|---|
| Maximum electron energy, MeV | 2.5 |
| Electron beam current, A | 0.1 – 1.0 |
| Solenoids' magnetic field, T | 0.2 |

# NICA Elements Fabrication

## JINR + FZ Jülich Stochastic Cooling for NICA Collider

### Pick-Up/Kicker Station (FZJ)

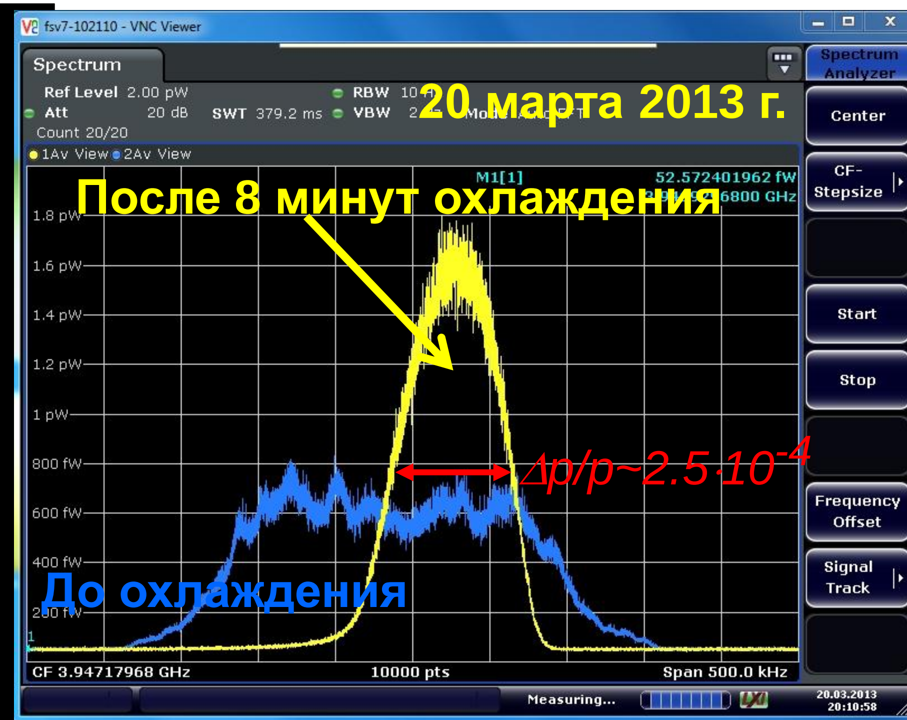


***Stochastic Cooling***
***Test experiment at Nuclotron***

March 2013 Schottky-signal spectrum
Before (blue) and after (yellow) cooling
Deuterons, 3 GeV/u, h = 3500, $N_{ion}$ = 2e9

December 2013 Carbon ions $^{12}C^{6+}$
3 GeV/u, $N_{ion}$ = 5e8
Coasting beam $\tau_{cool}$ = 27 sec (h = 2500)
Bunched beam $\tau_{cool}$ = 50 sec (h =2000)



# Summary: The NICA Beams

*Heavy ion colliding beams up to $^{197}Au^{79+}$ + $^{197}Au^{79+}$*

*at $\sqrt{s_{NN}} = 4 \div 11$ GeV , $L_{average} = 1x10^{27}\ cm^{-2} \cdot s^{-1}$*

*Light-Heavy ion colliding beams of the same $\sqrt{s_{NN}}$ and the same or higher $L_{average}$*

*Polarized beams of protons and deuterons in collider mode:*

*$p\uparrow p\uparrow$ $\sqrt{s_{pp}} = 12 \div 26$ GeV $L_{max} \approx 1x10^{32}\ cm^{-2} \cdot s^{-1}$*

*$d\uparrow d\uparrow$ $\sqrt{s_{NN}} = 4 \div 13.8$ GeV*

*Extracted beams of light ions and polarized protons and deuterons for fixed target experiments:*

*Li ÷ Au = 1 ÷ 4.5 GeV /u ion kinetic energy*

*$p\uparrow$, $p\uparrow$ = 5 ÷ 12.6 GeV kinetic energy*

*$d\uparrow$, $d\uparrow$ = 2 ÷ 5.9 GeV/u ion kinetic energy*

**The set of NICA beams provides unique possibility both for basic and applied researches in the forthcoming decades**

# Experiments at NICA:

**MultiPurpose Detector (MPD)**

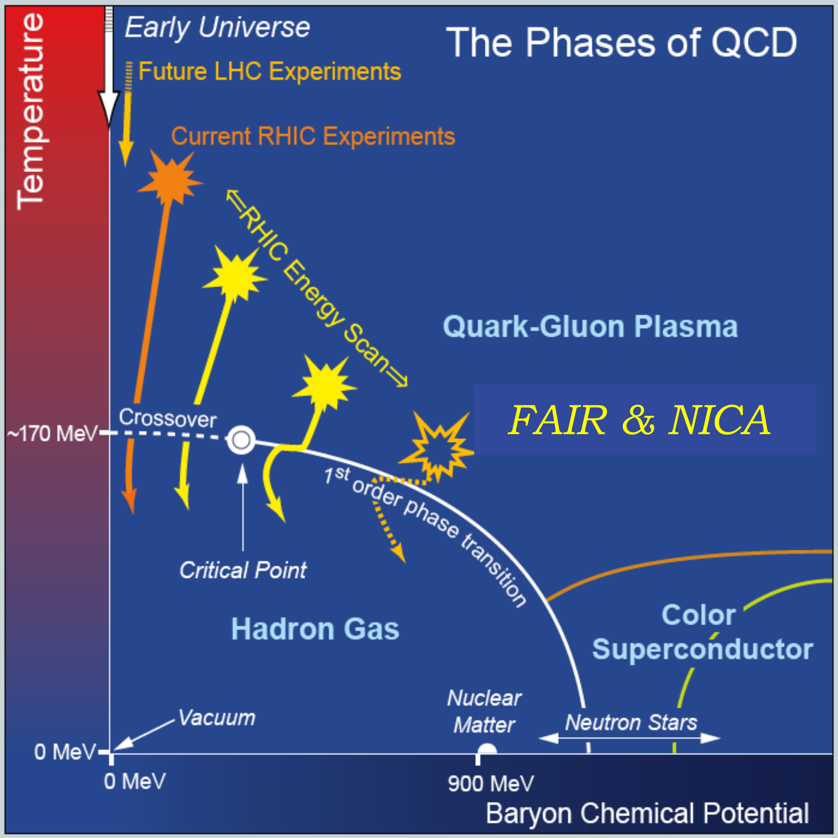
*at the Collider*

*and*

**Baryonic Matter at Nuclotron (BM@N)**

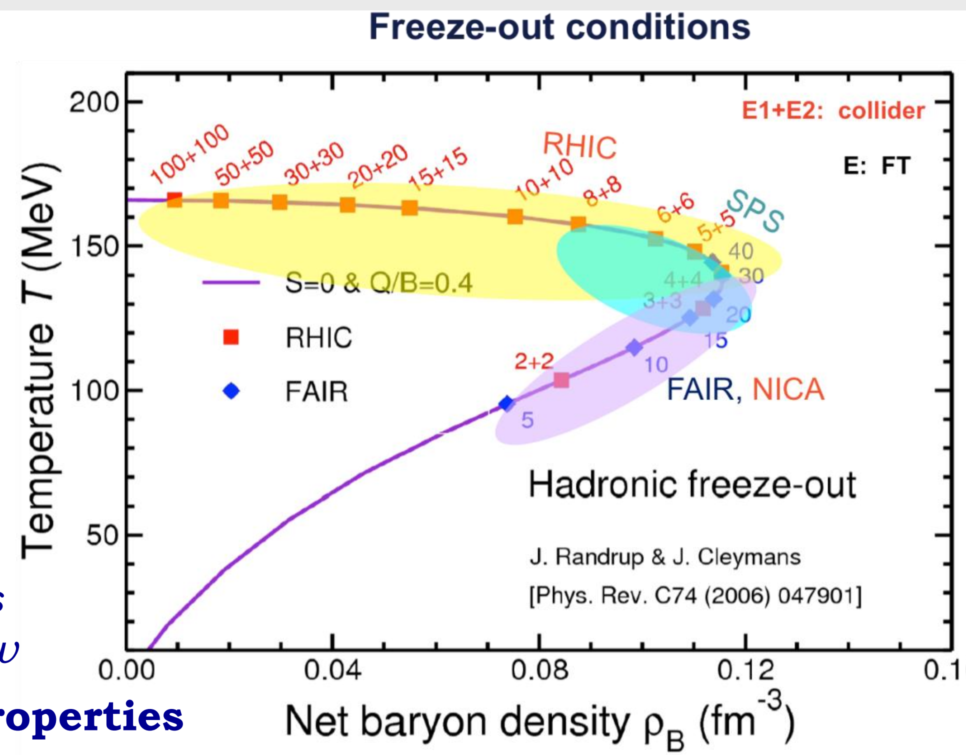
*at extracted Nuclotron beam*

# Physics



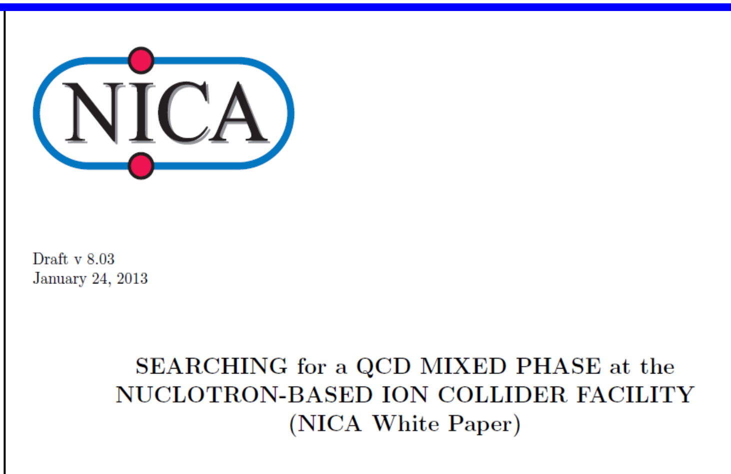

## QCD matter at NICA :

- *Highest net baryon density*
- *Energy range covers onset of deconfinement*
- *Complementary to the RHIC/BES, FAIR and CERN experimental programs*



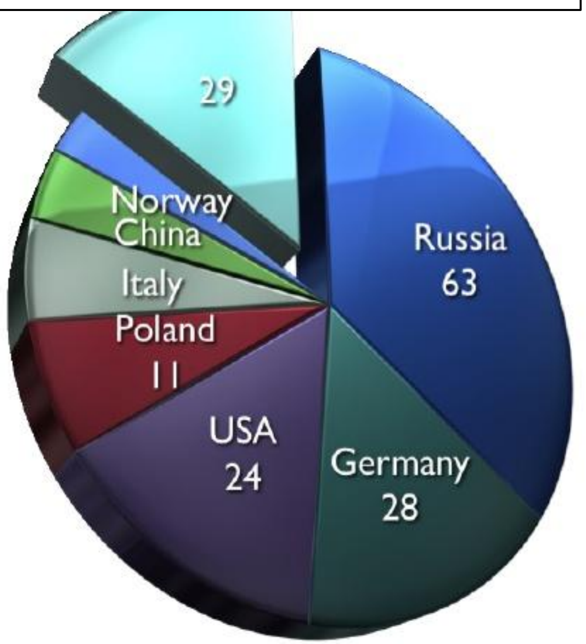

- **Bulk properties, EOS** - *particle yields & spectra, ratios, femtoscopy, flow*
- **In-Medium modification of hadron properties**
- **Deconfinement (chiral), phase transition at high $\rho_B$** *- enhanced strangeness production*
- **QCD Critical Point -** *event-by-event fluctuations & correlations*
- **Strangeness in nuclear matter** - *hypernuclei*

# NICA White Paper


NICA

Draft v 8.03
January 24, 2013

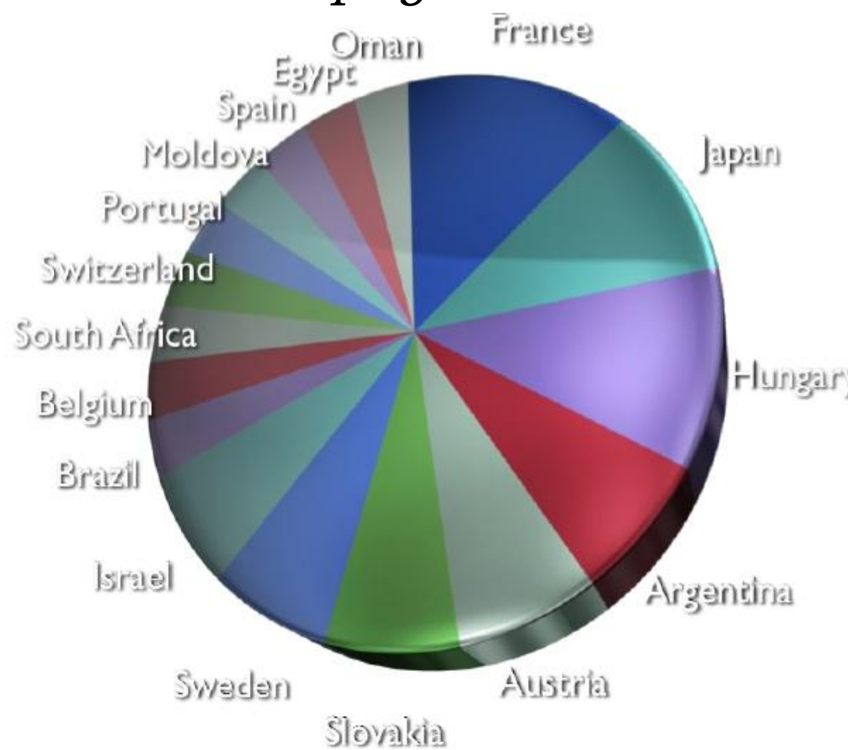
SEARCHING for a QCD MIXED PHASE at the
NUCLOTRON-BASED ION COLLIDER FACILITY
(NICA White Paper)




*Statistics of White Paper Contributions*

**111** *contributions:*
**188** *authors from* **70** *centers in* **24**

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

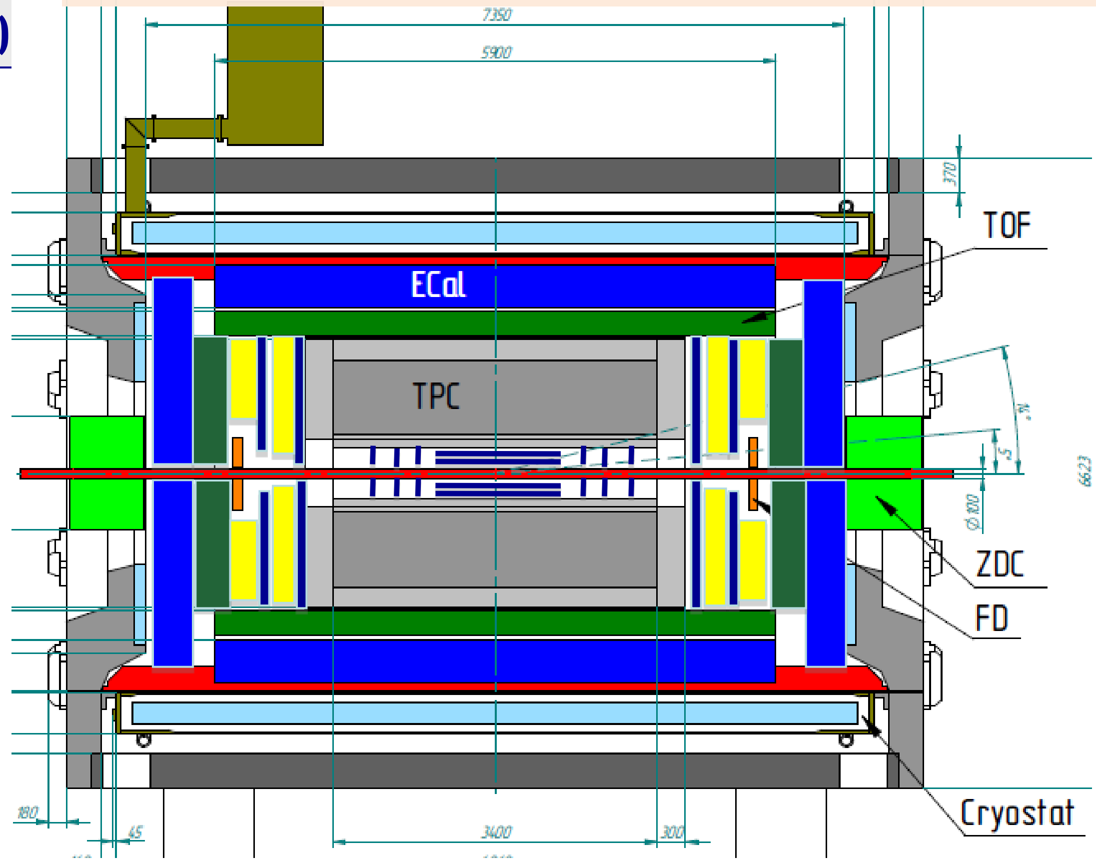


# MPD detector for Heavy-Ion Collisions @ NICA

**Tracking: up to $|\eta|<2$ (TPC)**
**PID: hadrons, e, $\gamma$ (TOF, TPC, ECAL)**
**Event characterization:**
**centrality & event plane (ZDC)**

**Stage 1: TPC, TOF, ECAL, ZDC, FD** FFD

**Stage 2: IT + Endcaps (tracker, TOF, ECAL)**

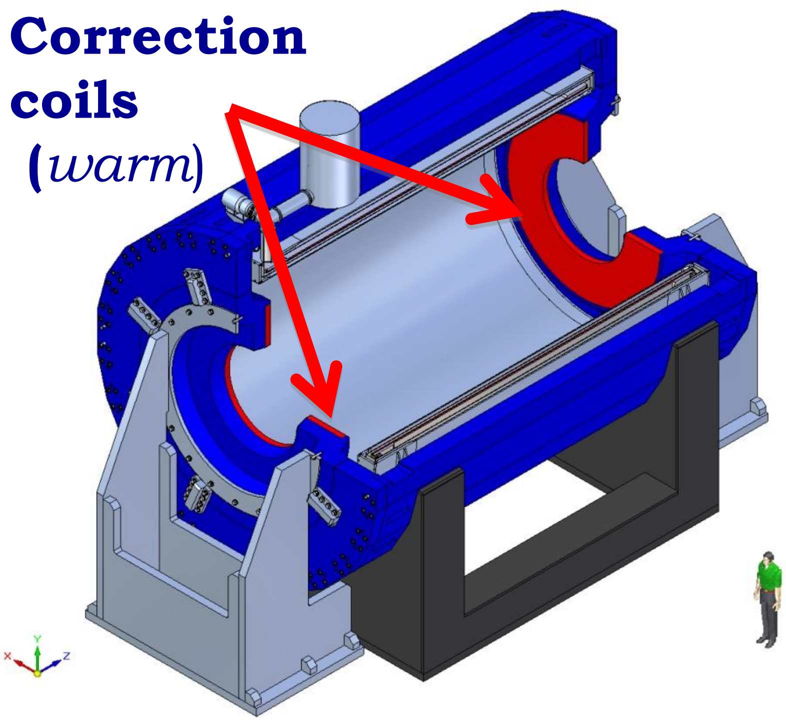



## Superconducting solenoid:

*high level (~ $10^{-4}$) of magnetic field homogeneity*

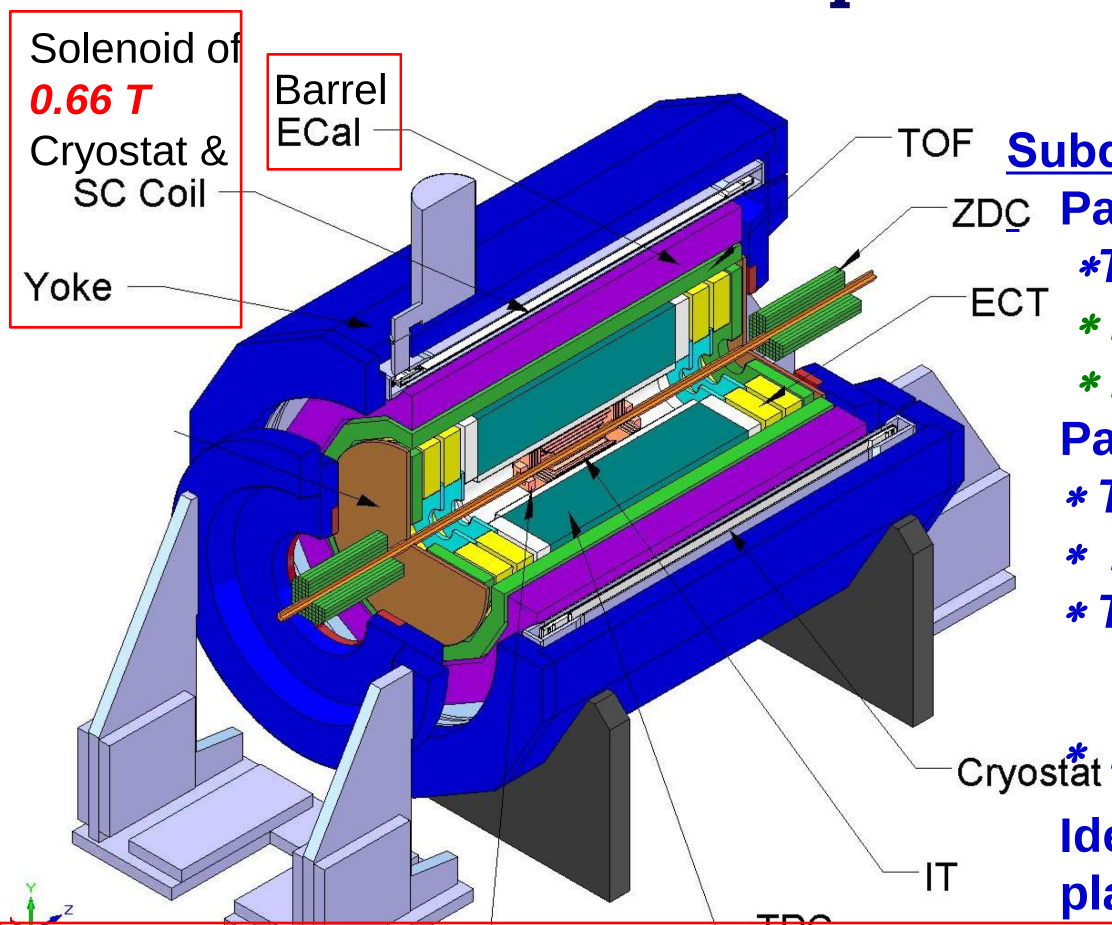
$B_0=0.66$ T

**Correction coils** (*warm*)



**Status:**
*technical design – completed; survey for producers*

# MultiPurpose Detector (MPD)




## Subdetectors & probes' identification:

**Particle Tracking:**

- *Time projection chamber (TPC)*
- *Inner tracker (IT)*
- *End Cap Tracker (ECT)*

**Particle identification:**

- *Time-of-flight detector (TOF)*
- *Electromagnetic calorimeter (Ecal)*
- *Time projection chamber (TPC)*

**Triggering (T0)**

- *Fast Forward Detector (FFD)*

**Identification of centrality and event plane:**

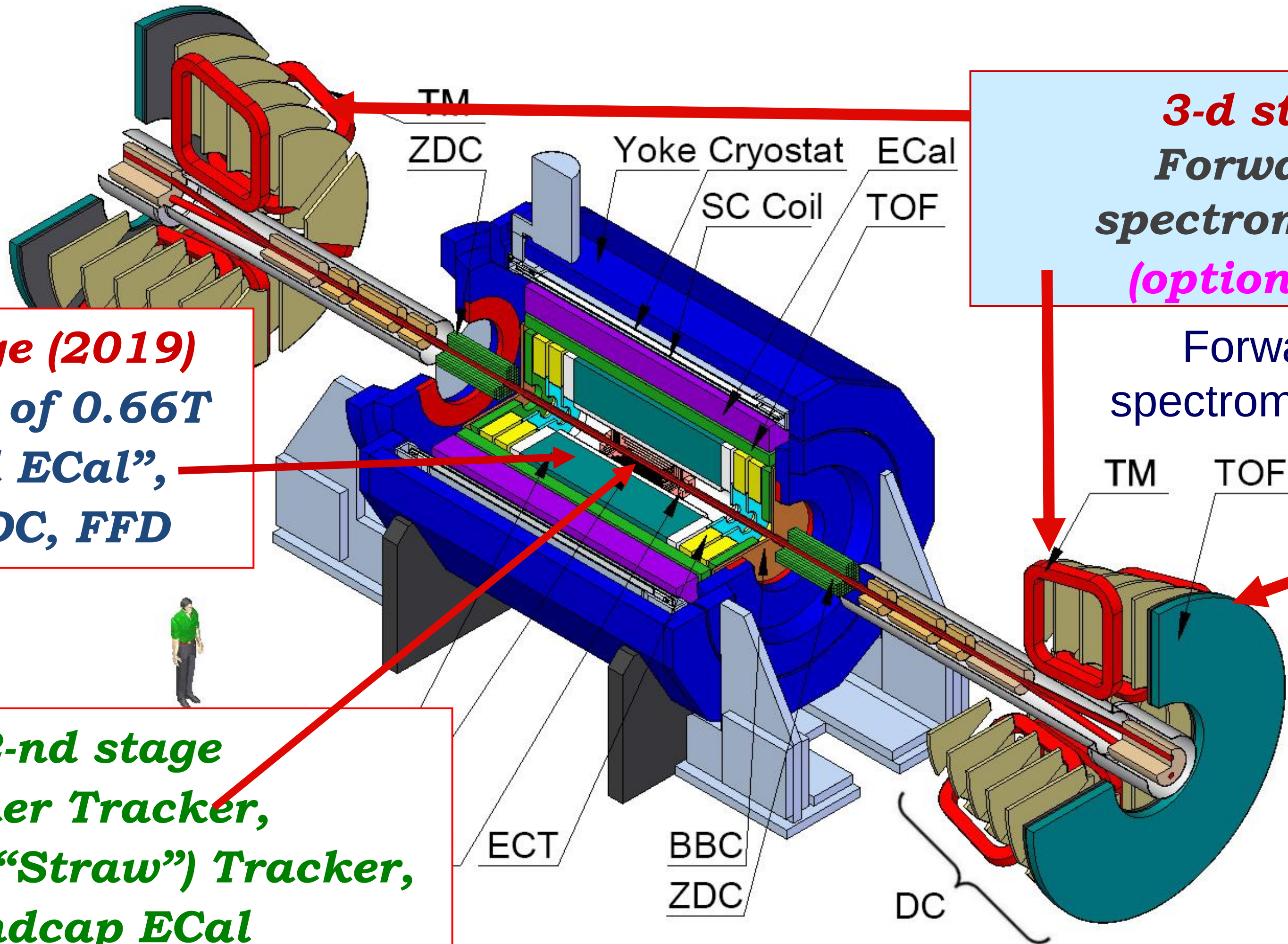
## MPD advantages:

**Disadvantage: weight ≈ 1200 tons**

- ✓ *maximum and homogeneous detection efficiency (2$\pi$ symmetry),*
- ✓ *high "transparency" for particles (small amount of matter;*
- ✓ *high quality of trajectories' reconstruction and particle identification*
- ✓ *high detection rate (~ 7 kHz)*

# MultiPurpose Detector (MPD)

## 3 stages of MPD commissioning




**3-d stage**
**Forward-spectrometers**
**(optional ?)**

**1-st stage (2019)**
**Solenoid of 0.66T**
**"Barrel ECal",**
**TPC, ZDC, FFD**

**2-nd stage**
**Inner Tracker,**
**EndCap ("Straw") Tracker,**
**Endcap ECal**

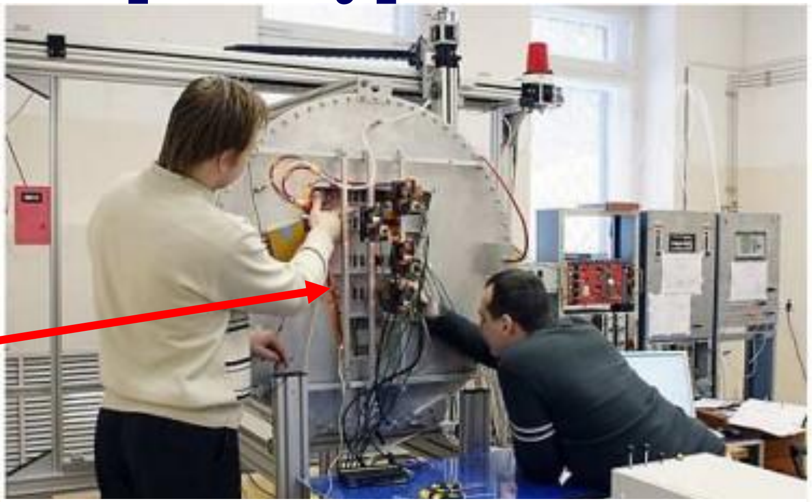
# MultiPurpose Detector (MPD)

## MPD Subdetectors' Development

### Time Projection Chamber - prototype 1

Field Cage prototype

The general view of the TPC Prototype-1

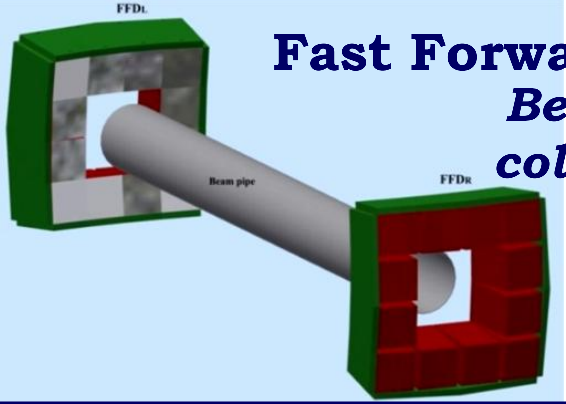


Preparation for test with UV laser.

Cylinder C3 (Dec. 2013) (carbon-filled plastic)

# MultiPurpose Detector (MPD)

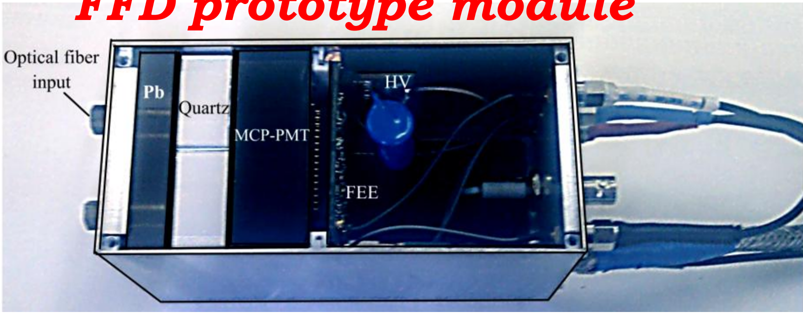
## MPD Subdetectors' Development



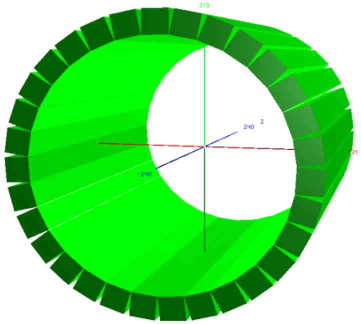

### Fast Forward Detector (FFD)

*Beam adjustment and collision trigger (30 ps)*

***FFD prototype module***




**JINR (VBLHEP) + Radium Institute (St.Petersburg).)**



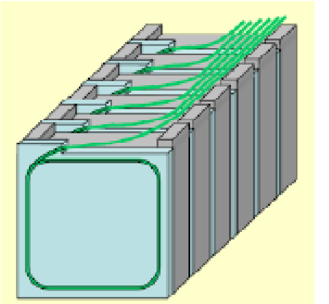
### Electromagnetic Calorimeter (ECAL "Shashlyk")

**JINR (VBLHEP & DLNP) + ISM (Kharkov)**

### Zero Degree Calorimeter (ZDC)

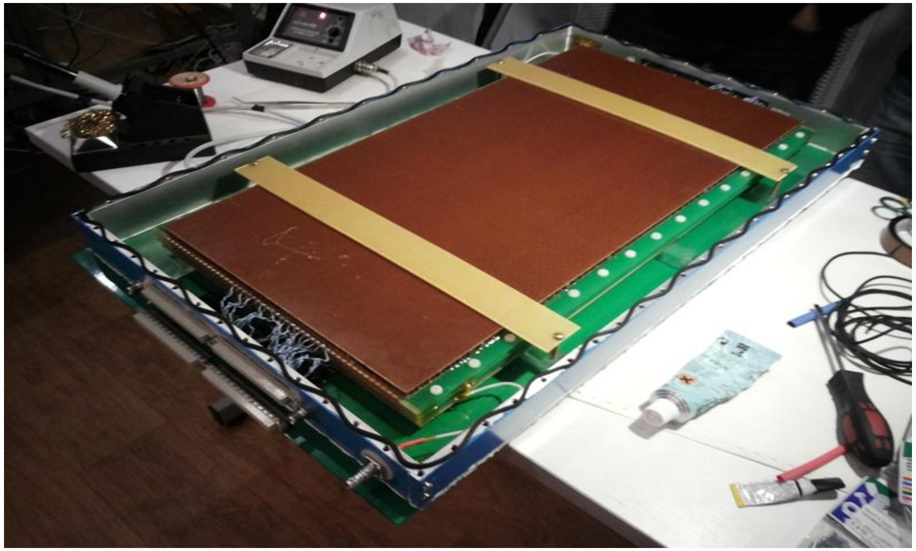

**INR (Troisk) + JINR (VBLHEP)**

**Pb + scintillator sampling (51)**
**Read-out: fibers+ Avalanche PDs**
**ZDC coverage: 2.2<|h|<4.8**



# MultiPurpose Detector (MPD)

## MPD Subdetectors’ Development

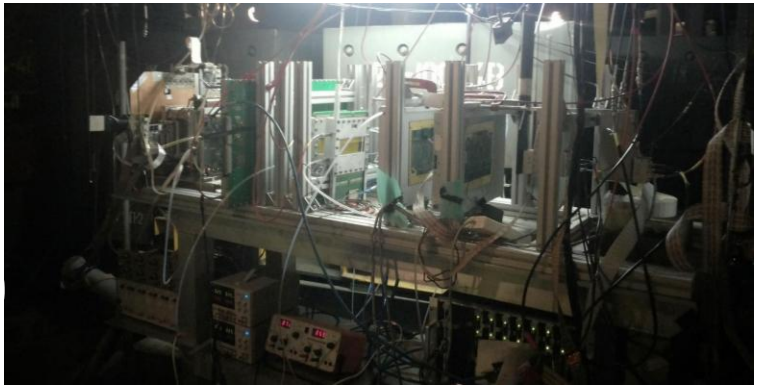


**MultiResistive Plate Counter (mRPC)**

**JINR (VBLHEP) + Hefei, Beijing (China)**

**A full-scale double-stack mRPC prototype**

**Experimental setup for mRPC tests at Nuclotron (March 2013)**



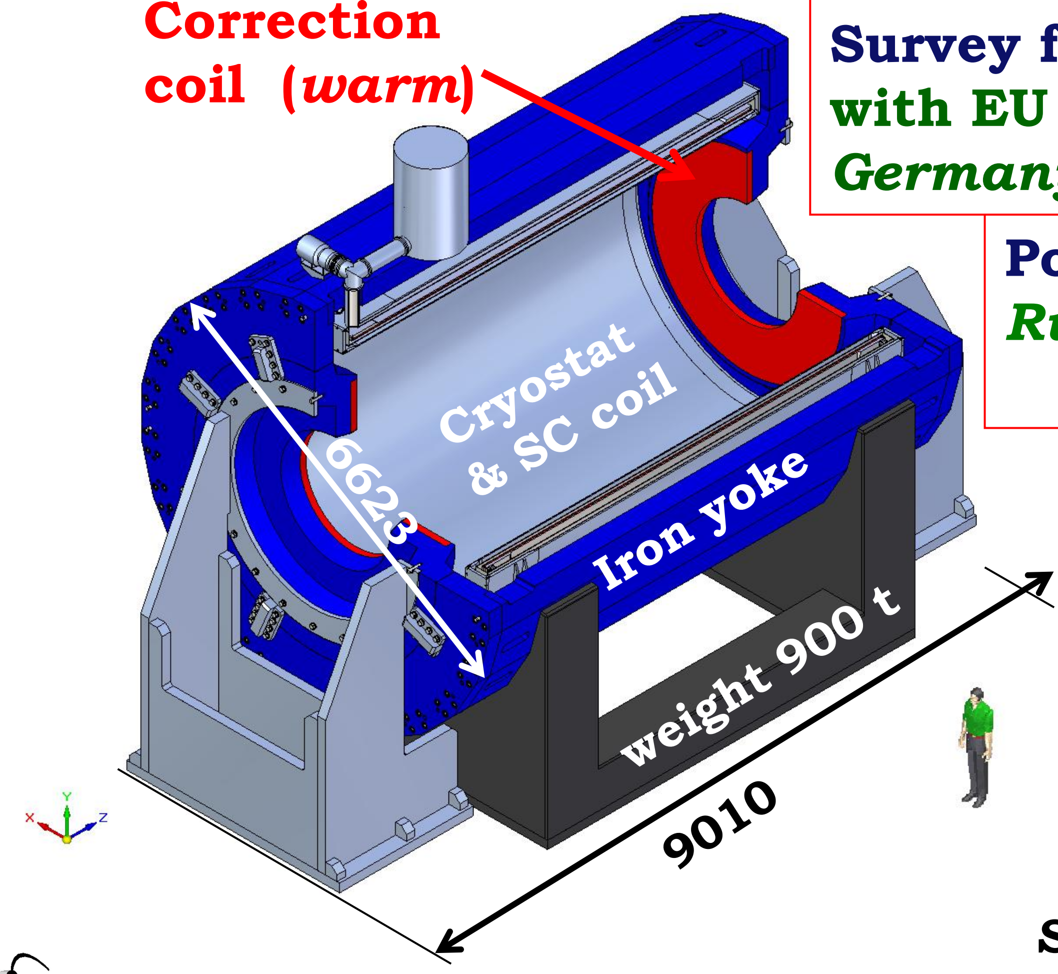
# MultiPurpose Detector (MPD)

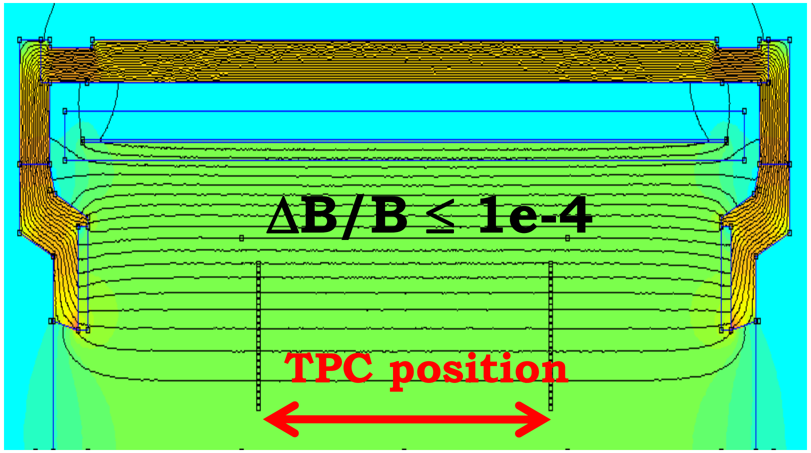
## MPD SC solenoid, $B_0$=0.66 T

**Design: Scientific Prodctn Association "Neva - Magnet" (St.Petersburg)**

**The design – close to completion;**
**Survey for contractors – negotiations with EU companies *(ASG, Genova, Germany)* & *Toshiba (Japan)***

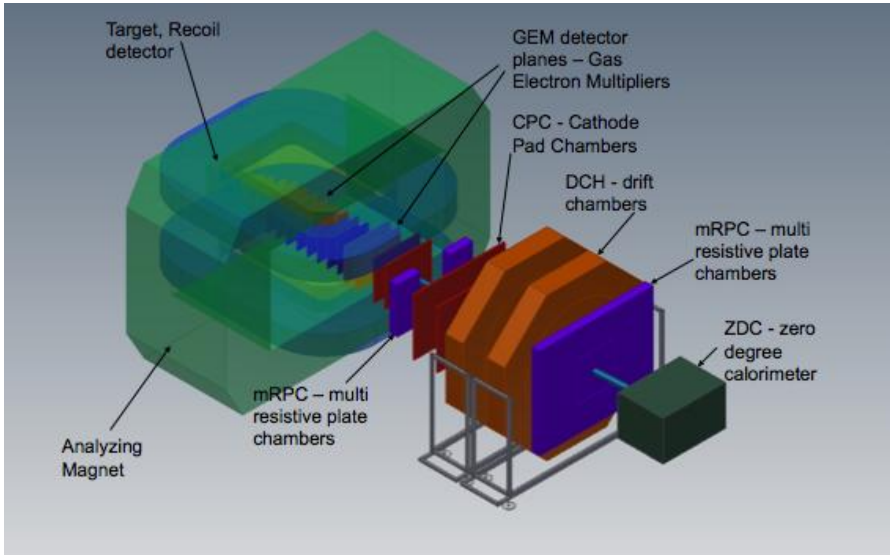
**Possible subcontractors:**
***Russian & Ukrainian* companies**



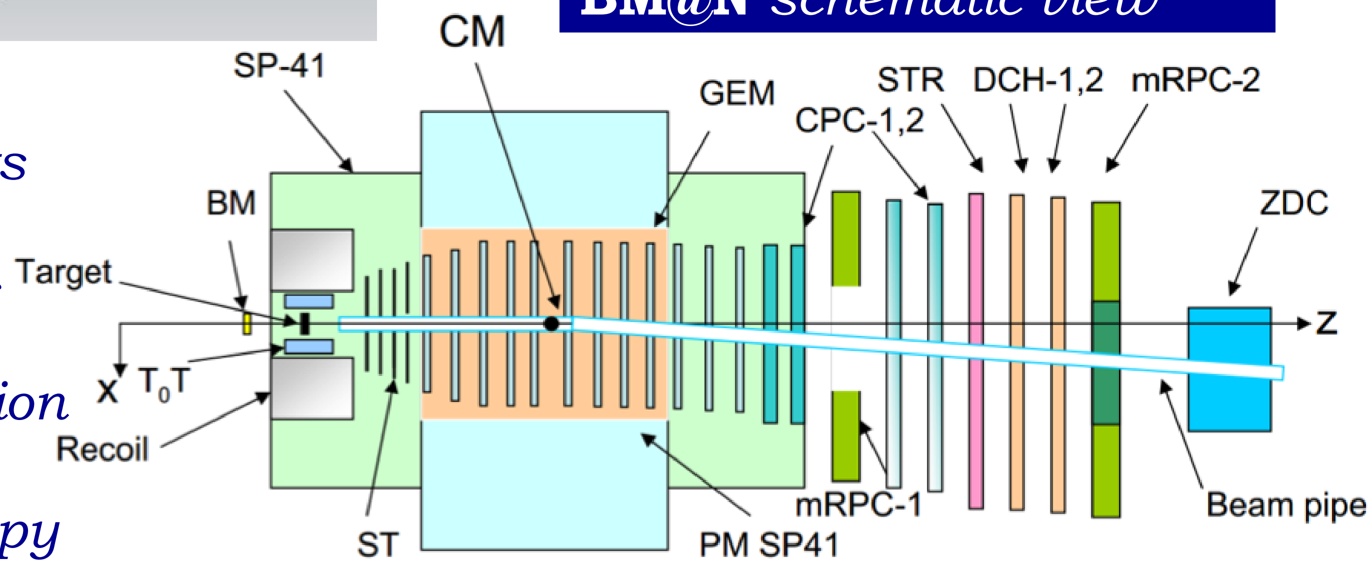

*Simulated map of magnetic field*

# BM@N (Baryonic Matter at Nuclotron): *the 1st stage*




**Collaboration of scientific centers:**
INR, SINP MSU, IHEP + S-PSUniversity (Russia);
GSI, Frankfurt U., Gissen U. (Germany):
+ CBM-MPD IT-Consortium,

**BM@N** *schematic view*

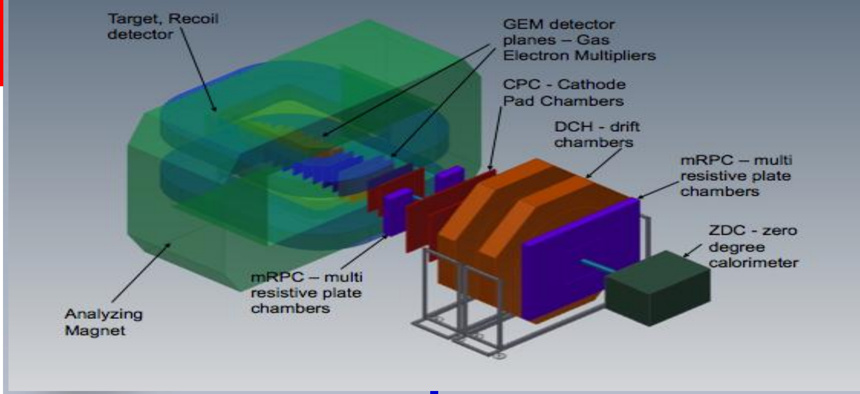


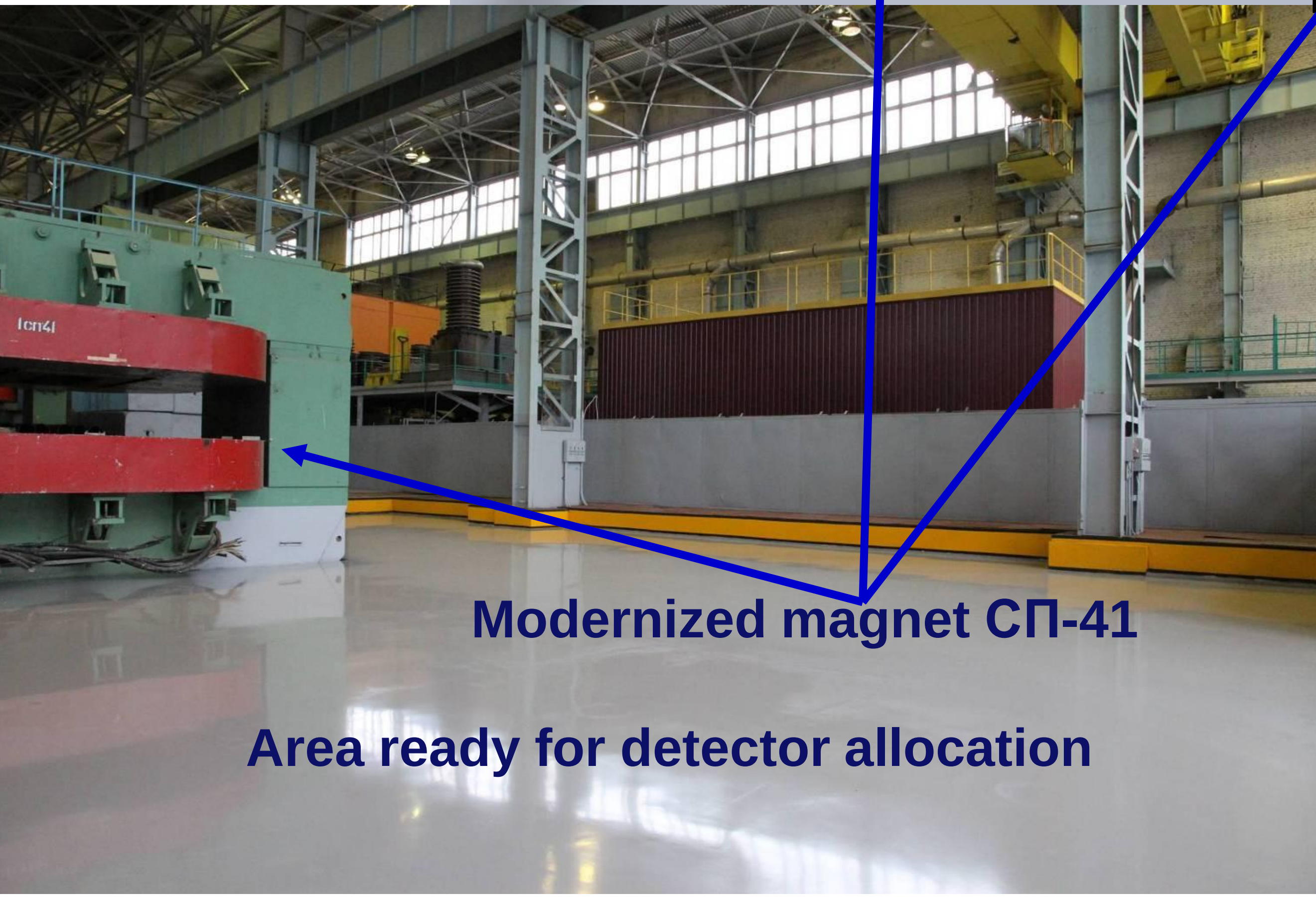

## Physics:

- ✓ *in-medium effects for strangeness & vector mesons*
- ✓ *hyperon production*
- ✓ *hadron femtoscopy*
- ✓ *electromagnetic probes (optional)*

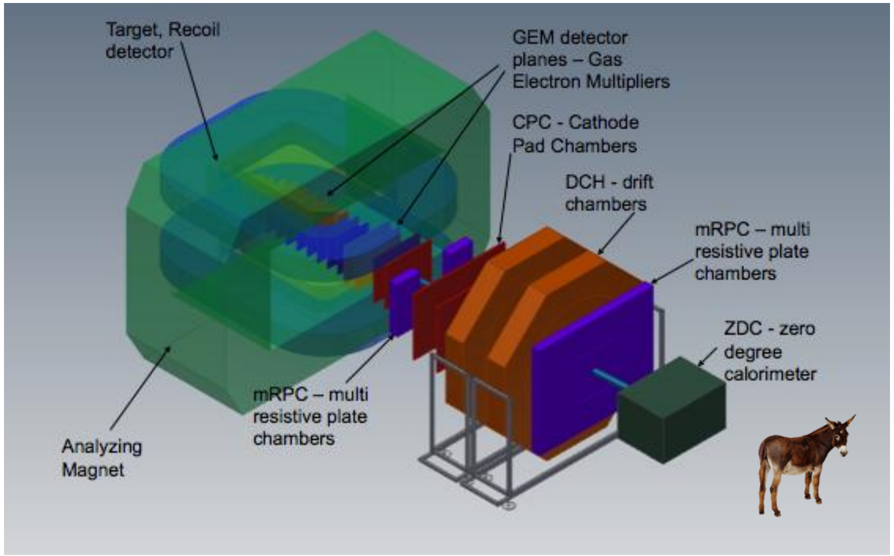
# NICA – Stage I

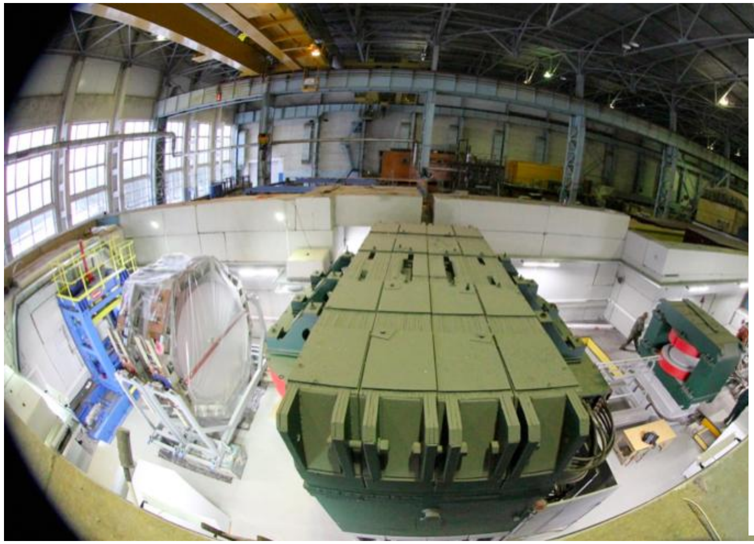
***Project BM@N, Preparation in Bld. 205***




# BM@N: *the 1st stage (2017)*



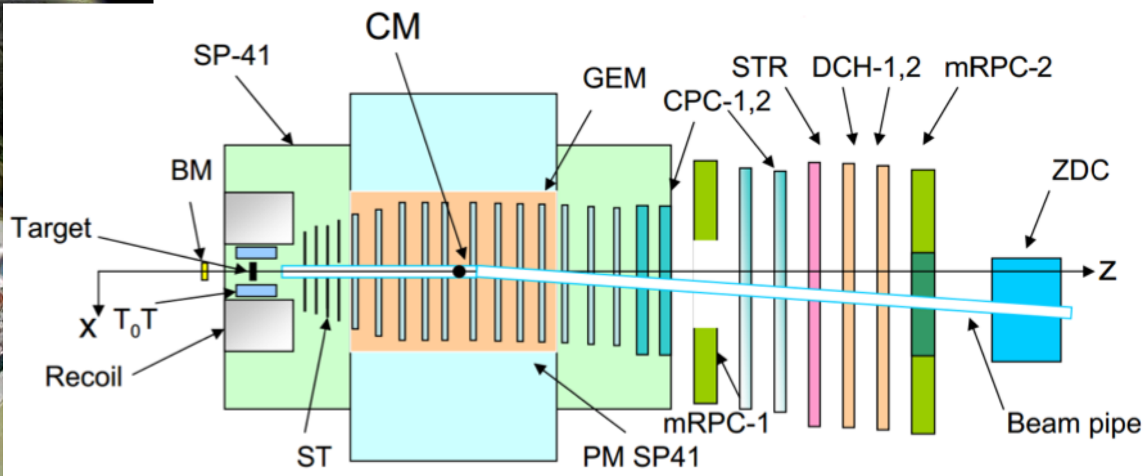



**Collaboration of scientific centers:**
IN, SINP MSU, IHEP + S-Ptr Univ. (RF);
GSI, Frankfurt U., Gissen U. (Germany):

**Physics:**

- ✓ *hyperon production*
- ✓ *hadron femtoscopy*
- ✓ *in-medium effects for strange & vector mesons*
- ✓ *electromagnetic probes (optional)*

**BM@N** *schematic view*



# SPD (Spin Physics Detector) at NICA

Collider provides both:
transversally & longitudinally
polarized ***p*** & ***d***
*with energy up to* $\sqrt{S}$ *=* ***27 GeV***

**The issues to be studied:**

- *MMT-DY processes*
- *J/Ψ production processes*
- *Spin effects in inclusive high-*$p_T$ *reactions*
- *Spin effects in one and two hadron production processes*
- *Polarization effects in heavy ion collisions*


**The Collaboration is forming**

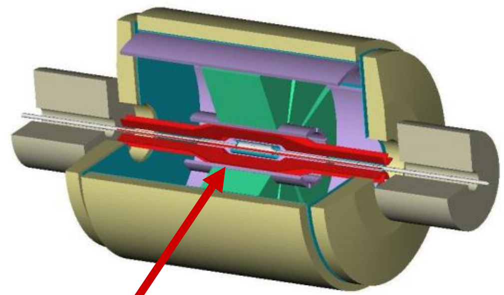
**Project is under preparation**

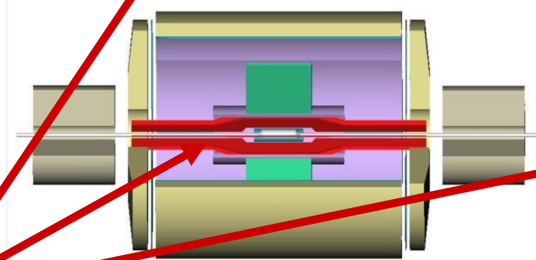
# NICA – Stage III : Collider of polarized beams

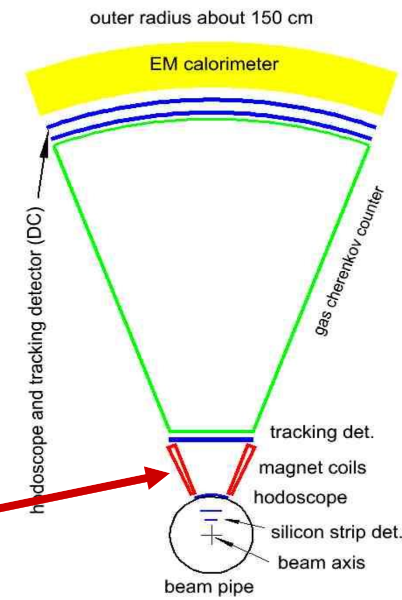
## Spin Physics Detector (SPD) – Very First Concept

**Main elements of the detector:**

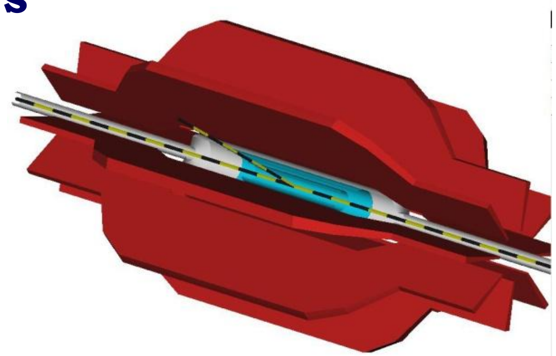
- Silicon or MicroMega (inner tracking)
- Drift chambers or straw (for tracking)
- Cherenkov counter (for PID and trigger)
- EM calorimeter
- Trigger counters
- EndCap detectors

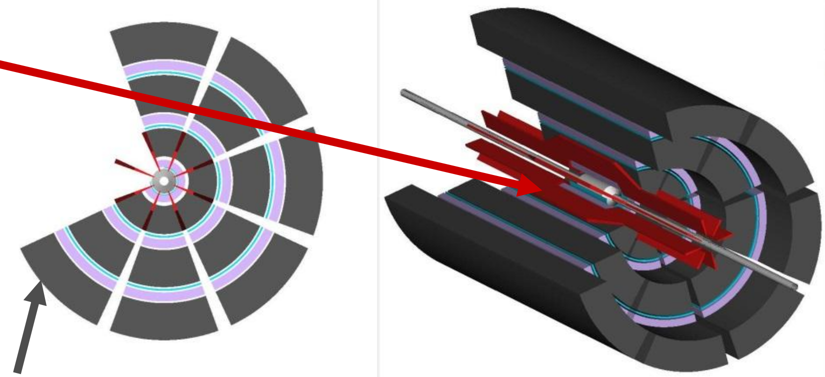







Toroidal magnet



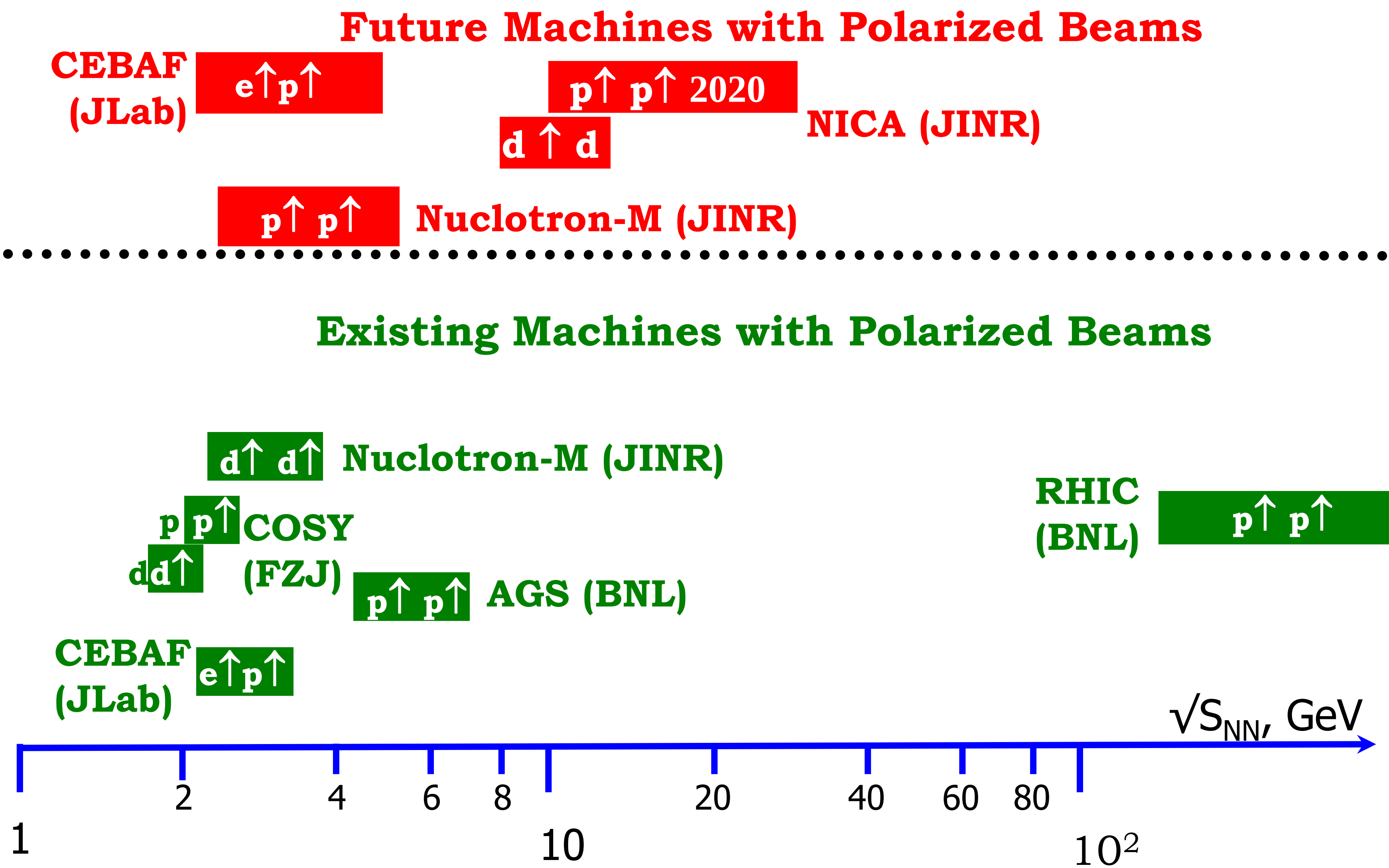


Subdetector for muon pairs

**First proposal of SPD concept is expected at the end of 2015**

Accelerators & Colliders

# NICA Research Program
## Spin Physics



# NICA Collaboration


JOINT INSTITUTE FOR NUCLEAR RESEARCH JINR



NICA

## 6 of them + JINR signed the Protocol

**PROTOCOL**

**of the International Meeting on Prospects for Collaboration in the Mega-Science Project "Complex of Superconducting Rings for Heavy Ion Colliding Beams" — the NICA Complex**

> 5. The Parties have agreed to inform their Governments about the Meeting on Prospects for Collaboration in the Mega-Science Project "Complex of Superconducting Rings for Heavy Ion Colliding Beams" – the NICA Complex and to express their interest in preparing a corresponding multilateral Agreement and in taking steps towards its approval by their countries

2. T…
and experimen…
and quality o…
NICA Com…
research, a…
scientists…

3. The … ress thei…
aimed … ruction and…

4. T… arties note the br…
co… ntries and their potenti…

5. The Parties have agreed…
Collaboration in the Mega…

Signed:

F. Krylov — for the State Committee of Science and Technology of the Republic of Belarus

L. Kostov — for the Nuclear Regulatory Agency of the Republic of Bulgaria

B. Vierkorn–Rudolph — for the Federal Ministry of Education and Research (BMBF) of the Federal Republic of Germany

N. Burtebaev — for the Atomic Energy Committee of the Ministry of Industry and New Technologies of the Republic of Kazakhstan

A. Povalko — for the Ministry of Education and Science of the Russian Federation

B. Grynyov — for the State Agency for Science, Innovation and Informatization of Ukraine

V. Matveev — for the Joint Institute for Nuclear Research

Representatives of 13 countries

**ADDENDUM to THE PROTOCOL No. 1**

of the International Meeting on Prospects for Collaboration in the Mega-science Project "Complex of Superconducting Rings for Heavy Ion Colliding Beams"

**- NICA Complex -**

Dubna, Russia, December 04, 2014

1. The sides representing:

- the Ministry of Education and Science of the Russian Federation;
- the Academy of Scientific Research and Technology of the Arab Republic of Egypt (ARE);
- the Joint Institute for Nuclear Research (JINR), an international research organization,

hereinafter in this document referred to as Parties

Discussed joining Academy of Scientific Research and Technology of the Arab Republic of Egypt (ASRT ARE) to the Protocol#1of mentioned above Meeting held on 04 December 2014 at JINR in Dubna and agreed on ASRT ARE entering the collaboration in the mega-science project "Complex of Superconducting Rings for Heavy Ion Colliding Beams" - **NICA Complex.**

2. The Parties take note of the information about the Proposal of the new accelerator and experimental complex which is under construction at JINR, possessing unique set and quality of ion beams and detectors. Being implemented as a mega-science facility NICA Complex, it will be able to make important contribution to fundamental and applied research, as well as to innovative technology development and for educational aspects.

3. The Parties express their positive opinion about the joint efforts within the Collaboration aimed at construction and use of the NICA Complex facility.

4. The Parties note the broad interest in the project under discussion from a wide range of countries and their potential involvement in the project in prospect.

5. The Parties have agreed to inform their governments about the Meeting on Prospects for Collaboration in the Mega-science Project "Complex of Superconducting Rings for Heavy Ion Colliding Beams" - the NICA Complex, and to express their support in preparing a corresponding Declaration and for accomplishment of the further steps for its approval in their countries.

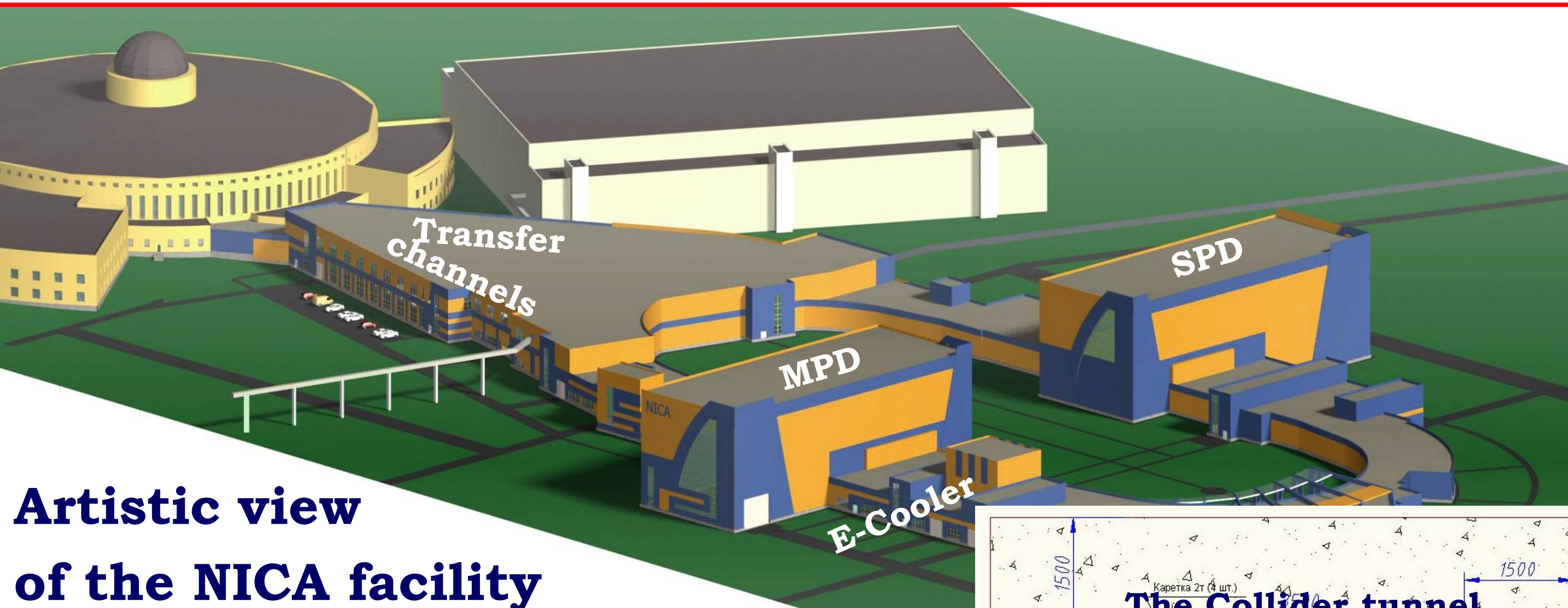
6. The Parties request that the Ministry of Education and Science of the Russian Federation, together with JINR, coordinate work on the Declaration and the development of a procedure for its approval.

____________, the Ministry of Education and Science of the Russian Federation;
*<name>*

M. SAKR ____________, the Academy of Scientific Research and Technology of the Arab Republic of Egypt;

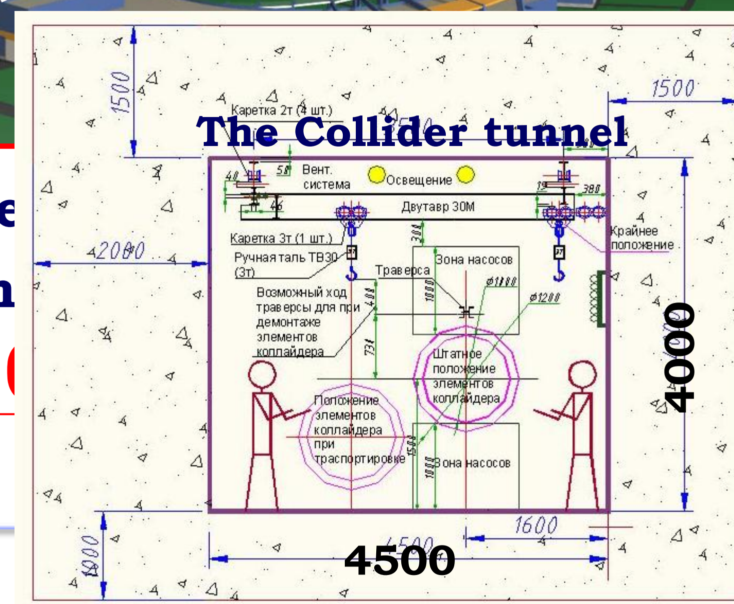
____________, the Joint Institute for Nuclear Research
*<name>*

# Civil engineering – Status and Plans




**Artistic view of the NICA facility**

***The technical project of NICA*** **(civil e**
**description and disposition) has been**
**has passed State Expertise (**

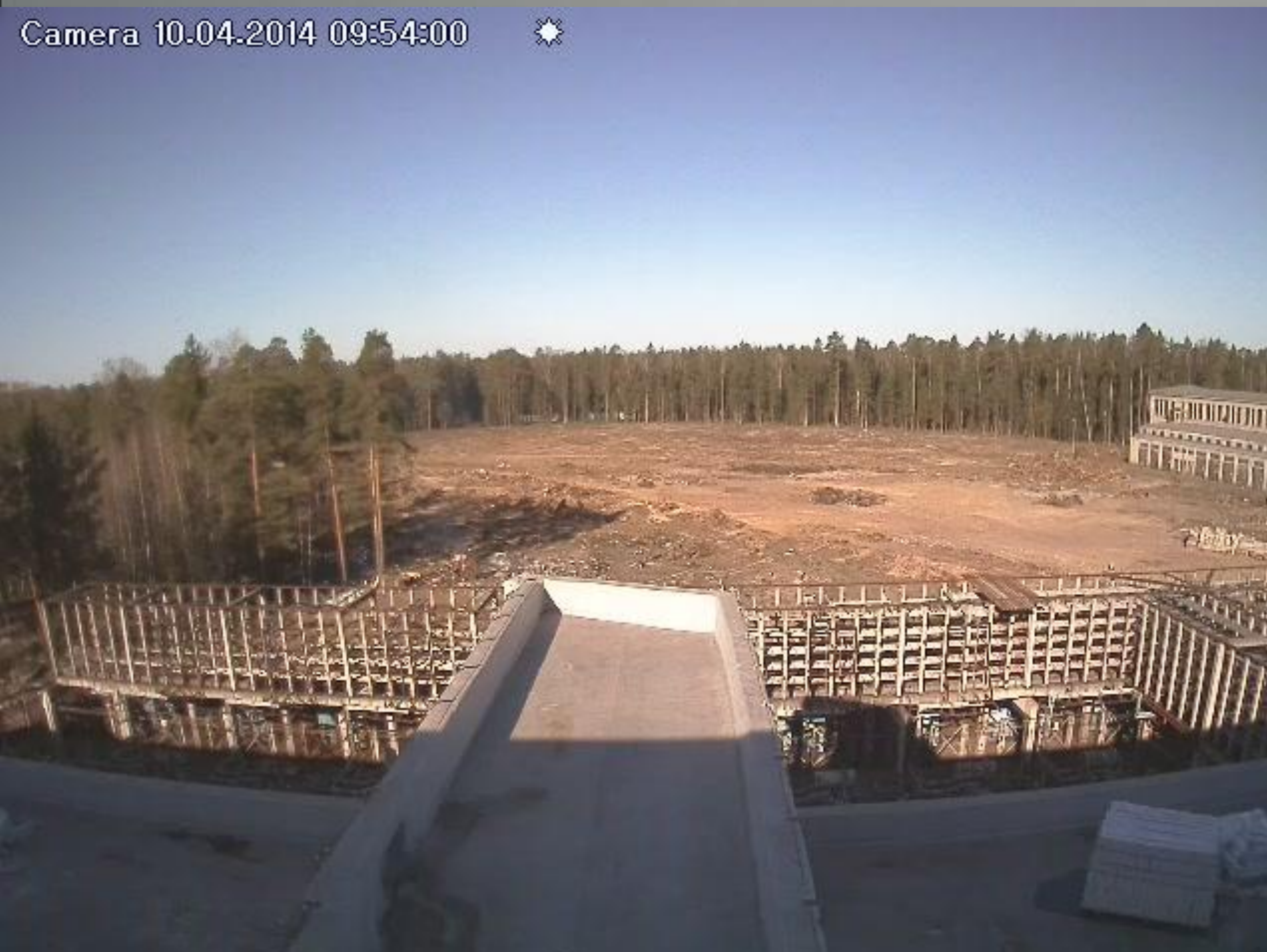


# Civil engineering – Status and Plans

***Civil construction is started***

On-line web-camera (Feb.2014)

http://nucloweb.jinr.ru/nucloserv/205corp.htm




# Civil engineering – Status and Plans


**Signing of the contract with the building company "Strabag", Austria (the winner of the tender) is close to completion.**

**Presently => stage of requirement specification based on NICA Technical Project**

**Civil construction duration is estimated as**

**48 months!**

**Beginning of Collider mounting – September 2017**

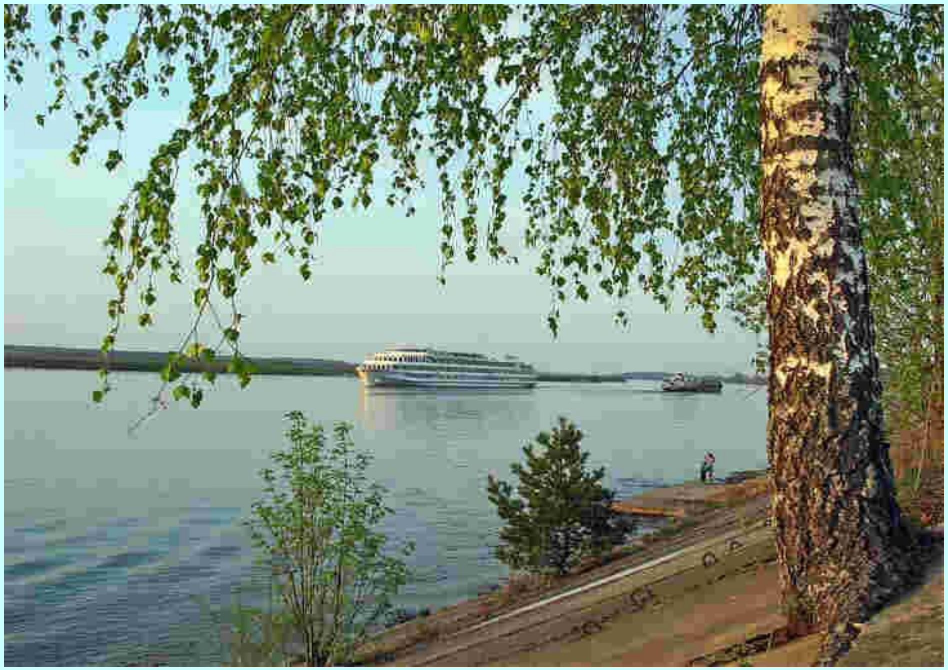
## Start up version of NICA commissioning is planned for 2019

# Concluding remarks

- **NICA complex has a potential for competitive research *in the fields of dense baryonic matter and spin physics***
- **Construction of the *accelerator complex and its elements are in progress***
- **Constructions of both detectors BM@N & MPD *are progressing as well***
- **The SPD project is in preparation**
- **The international collaboration around the NICA is growing**
- **New partners are invited to join NICA**

# Strangeness in Quark Matter 2015

Dubna, 6.-11. July 2015



Official Logo:

Email: sqm@jinr.ru

Website: http://sqm.jinr.ru

Satellite Meetings:

- Summer School “Dense Matter”, Dubna, June 29 – July 11, 2015
- Roundtable “Physics at NICA”, Dubna, 5. July 2015

# Welcome to the collaboration!

# Thank you for attention!