Heavy Ion Collision Experiments at NICA

V. Kekelidze, A.Sorin,
JINR, Dubna

NICA-FAIR Symposium,
Darmstadt, Nov. 15-17, 2016

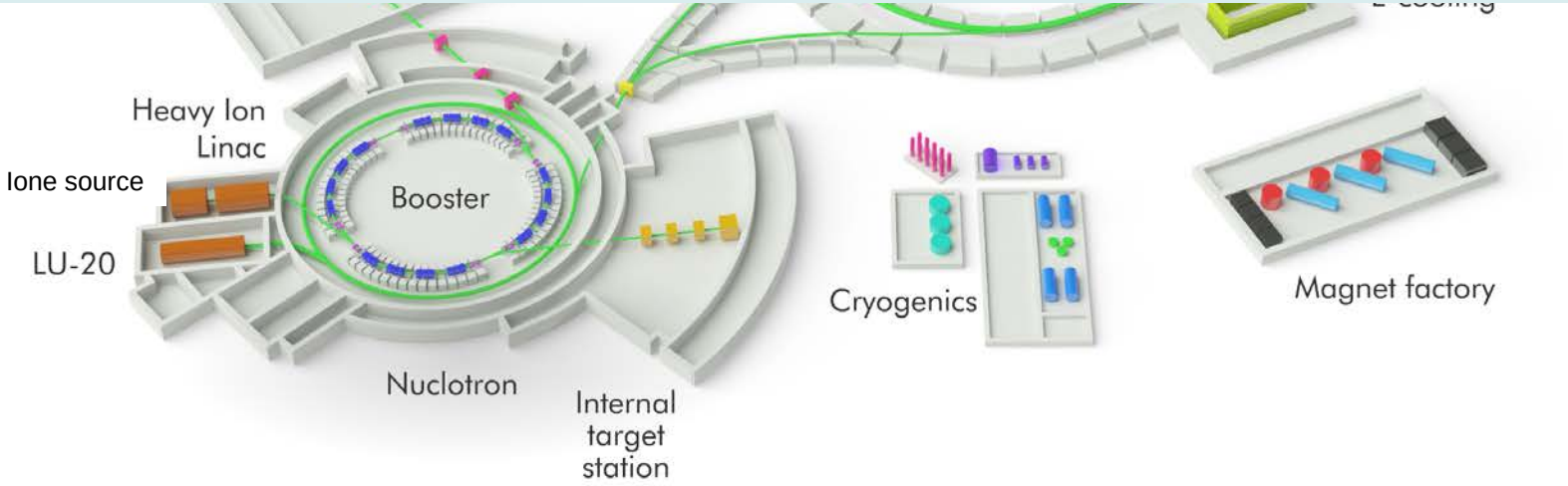
NICA (Nuclotron based Ion Colider fAcility)

Main targets:

- *study of hot and dense baryonic matter at the energy range of max baryonic density*
- *investigation of nucleon spin structure, polarization phenomena*

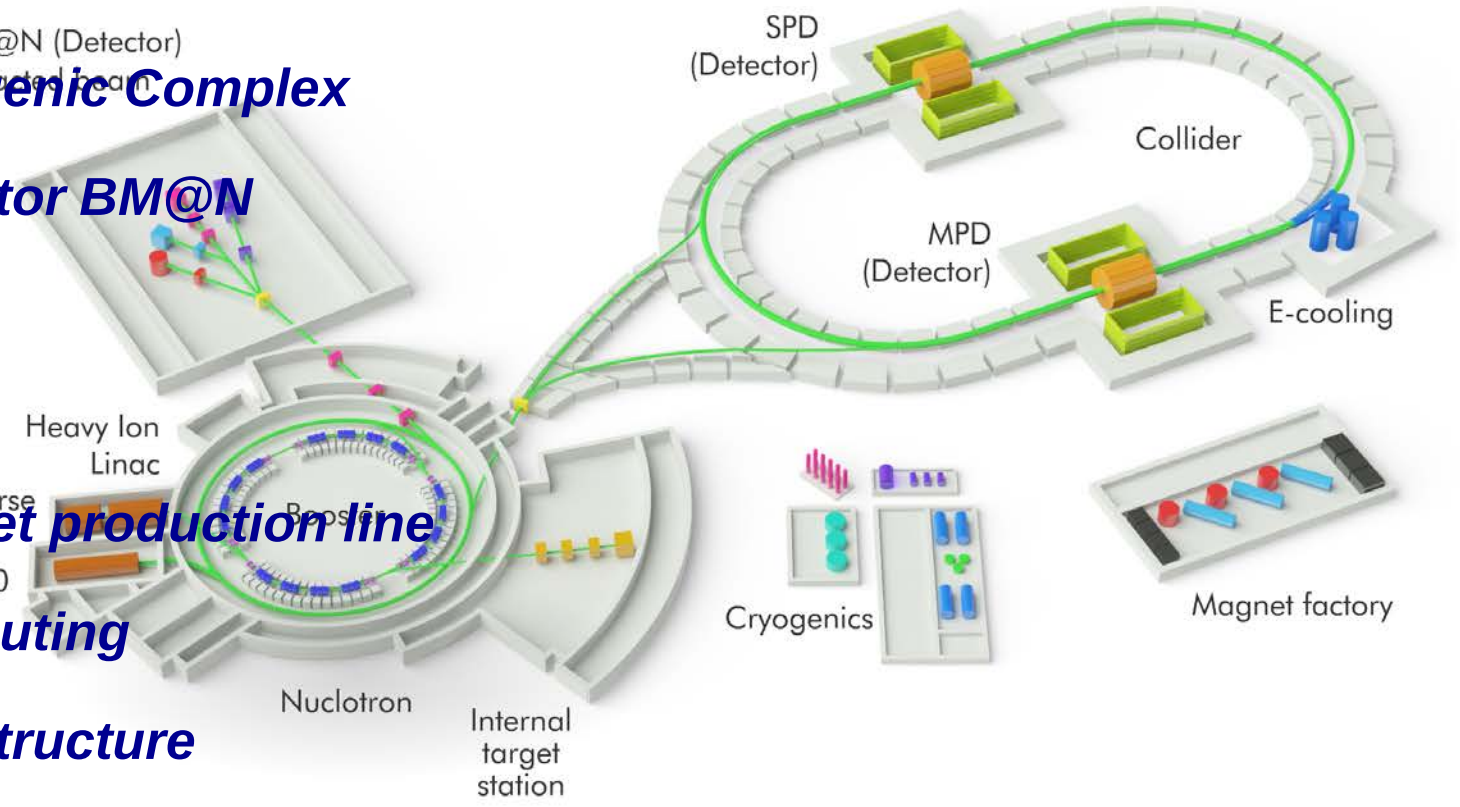
- *development of accelerator facility for HEP @ JINR*
- *construction of Collider of relativistic ions from **p** to **Au**, polarized protons and deuterons*

with max energy up to $\sqrt{S_{NN}}$ = **11** *GeV* (Au^{79+}) *and =***27** *GeV (p)*

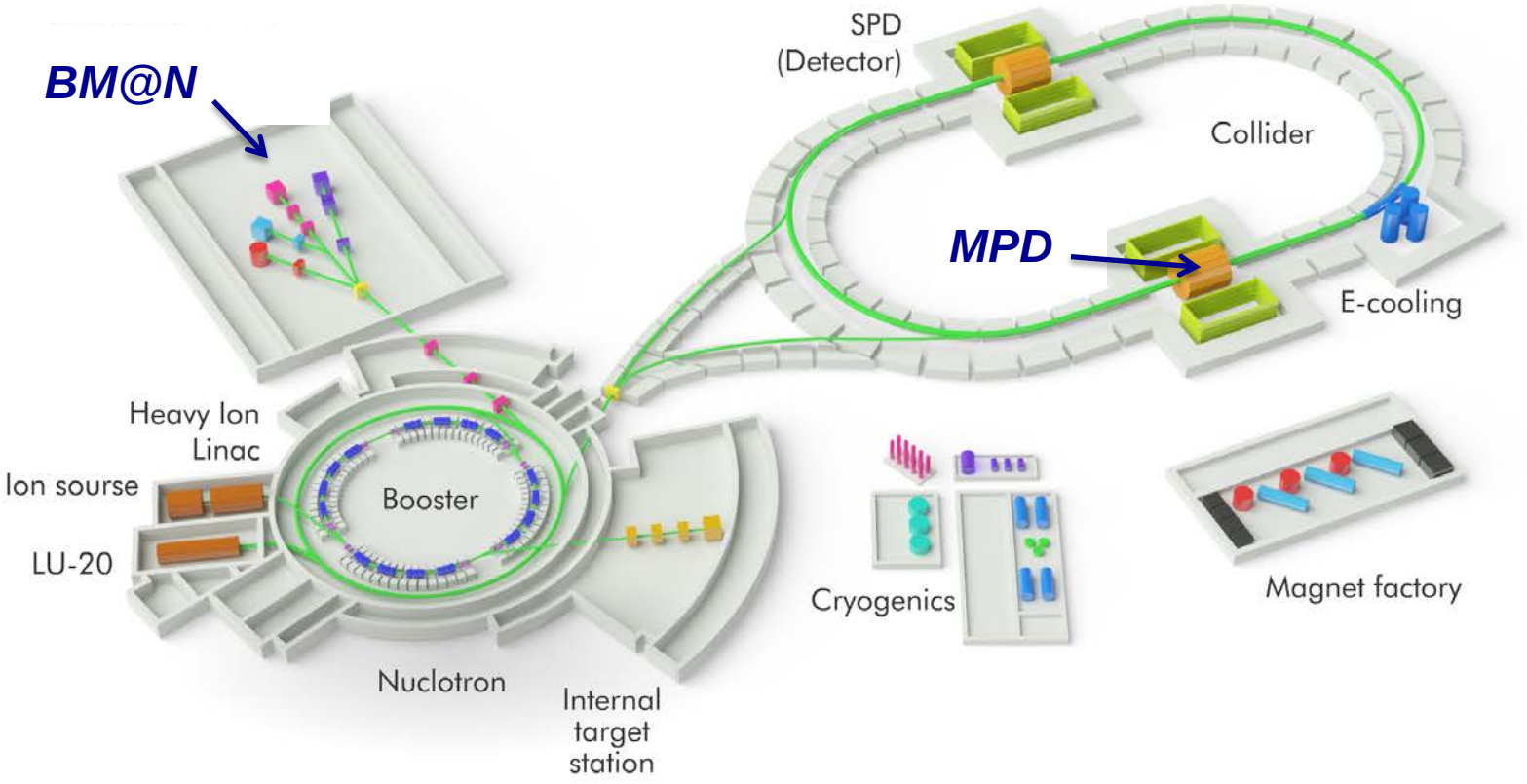


major blocks of the NICA

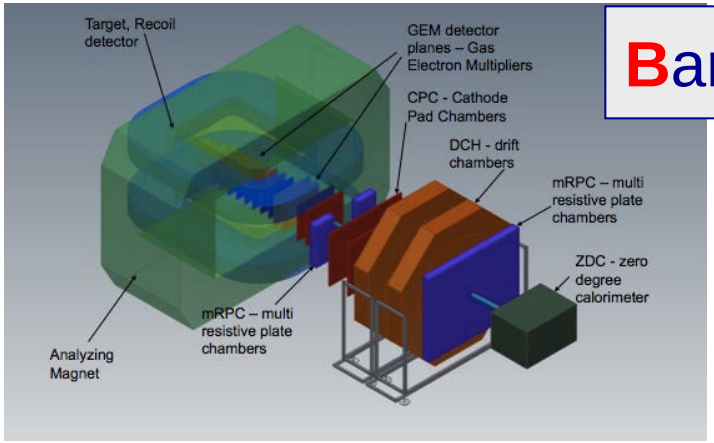
- *Injection Complex*
- *Booster*
- *Nuclotron*
- *Collider*
- *Cryogenic Complex*
- *Detector BM@N*
- *MPD*
- *SPD*
- *Magnet production line*
- *Computing*
- *Infrastructure*



major blocks of the NICA



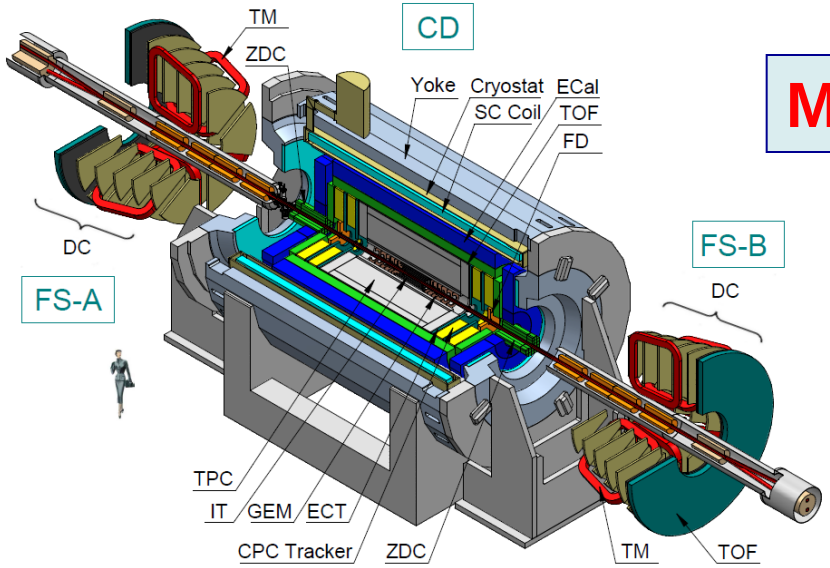
3 detectors



Baryonic **M**atter at **N**uclotron (**BM@N**)

the fixed target experiment at the Nuclotron

Stage I 2017



MultiPurpose Detector (MPD)

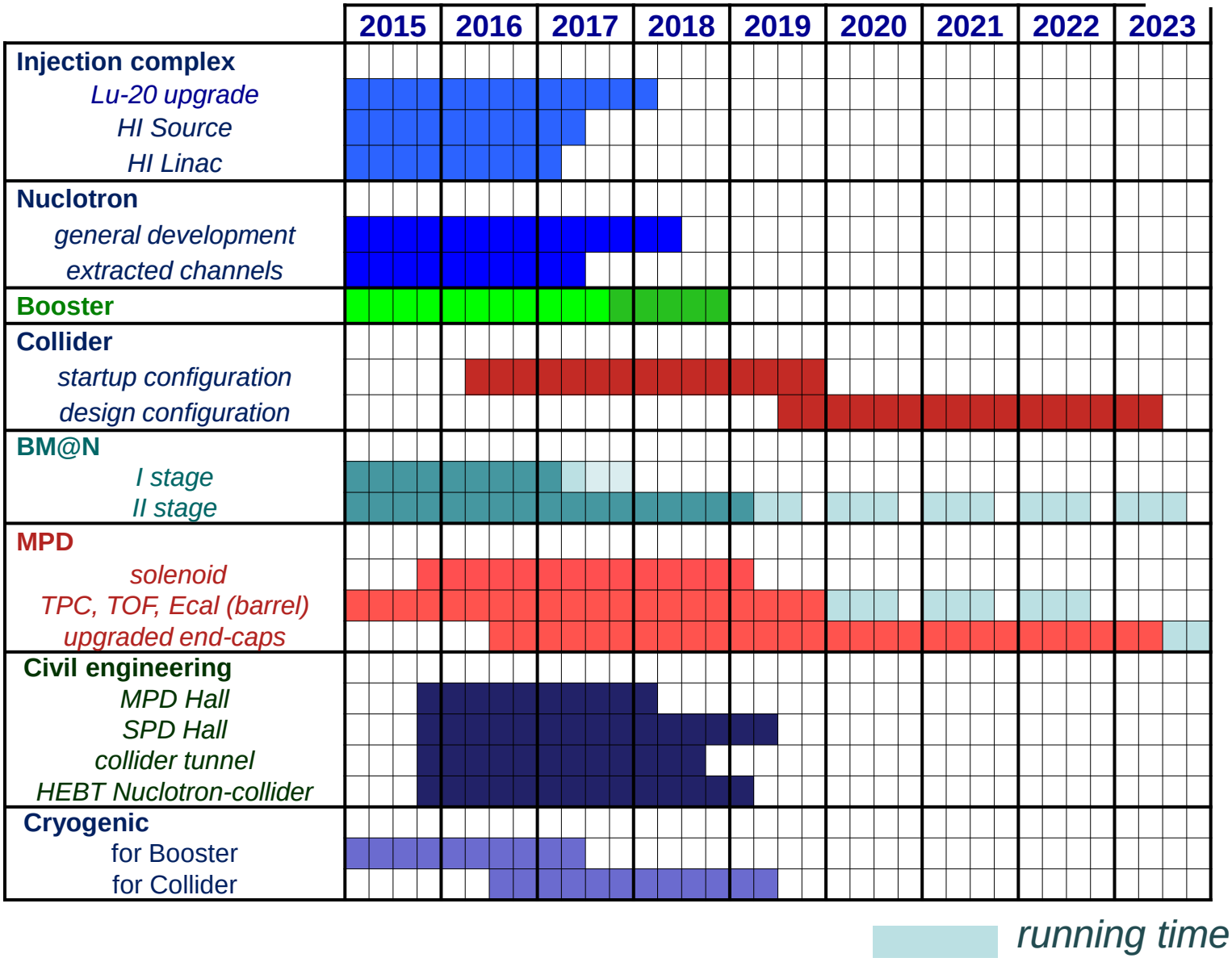
at the Collider

Stage I 2020

SPD (Spin Physics Detector) *at the Collider*

the project - in preparation

NICA schedule

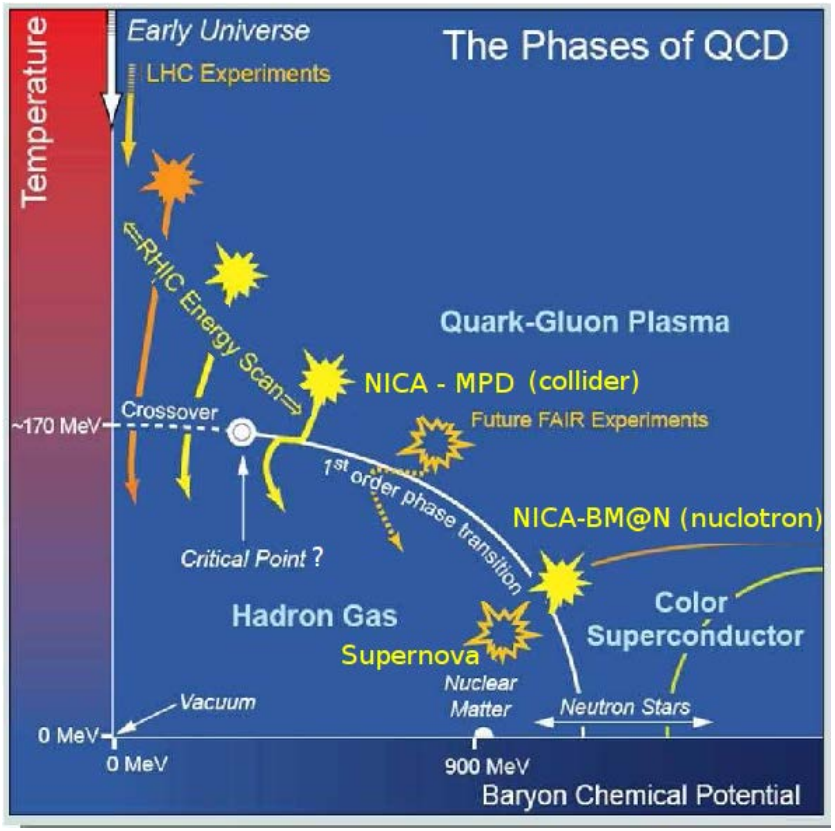


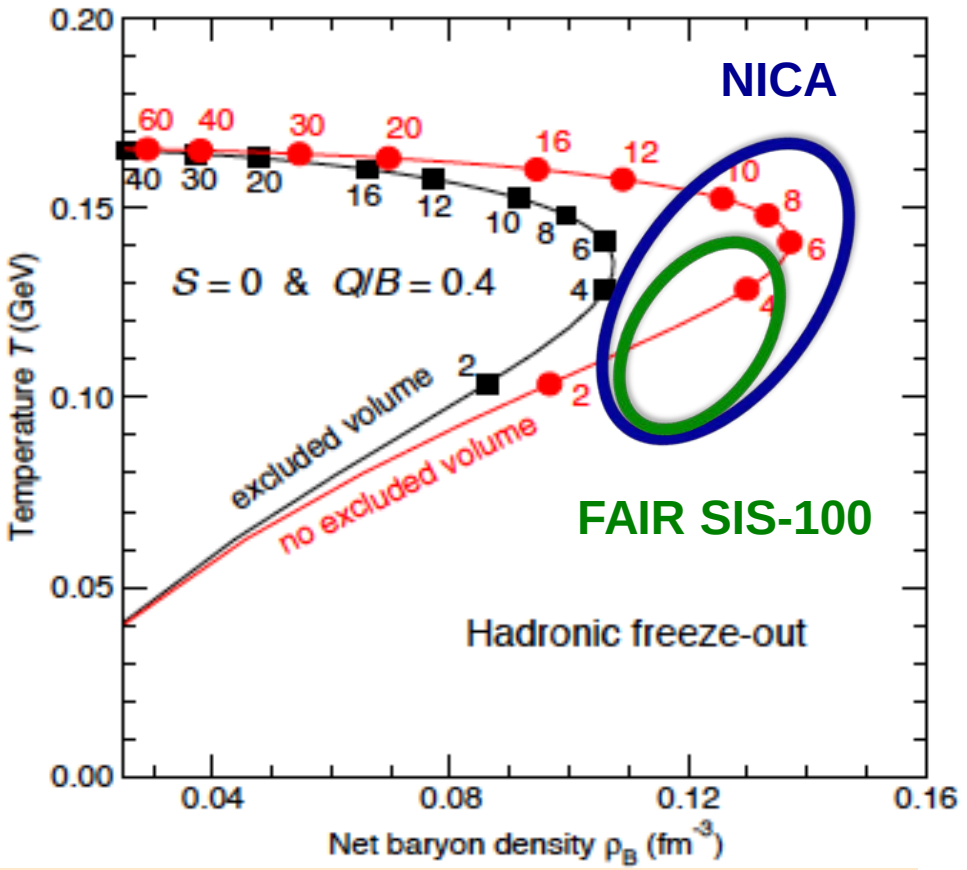
NICA program in heavy ion collisions and experimental strategy for 2017-2023

Exploration of the QCD Phase Diagram

Exploring high-density baryonic matter: maximun freeze-out density

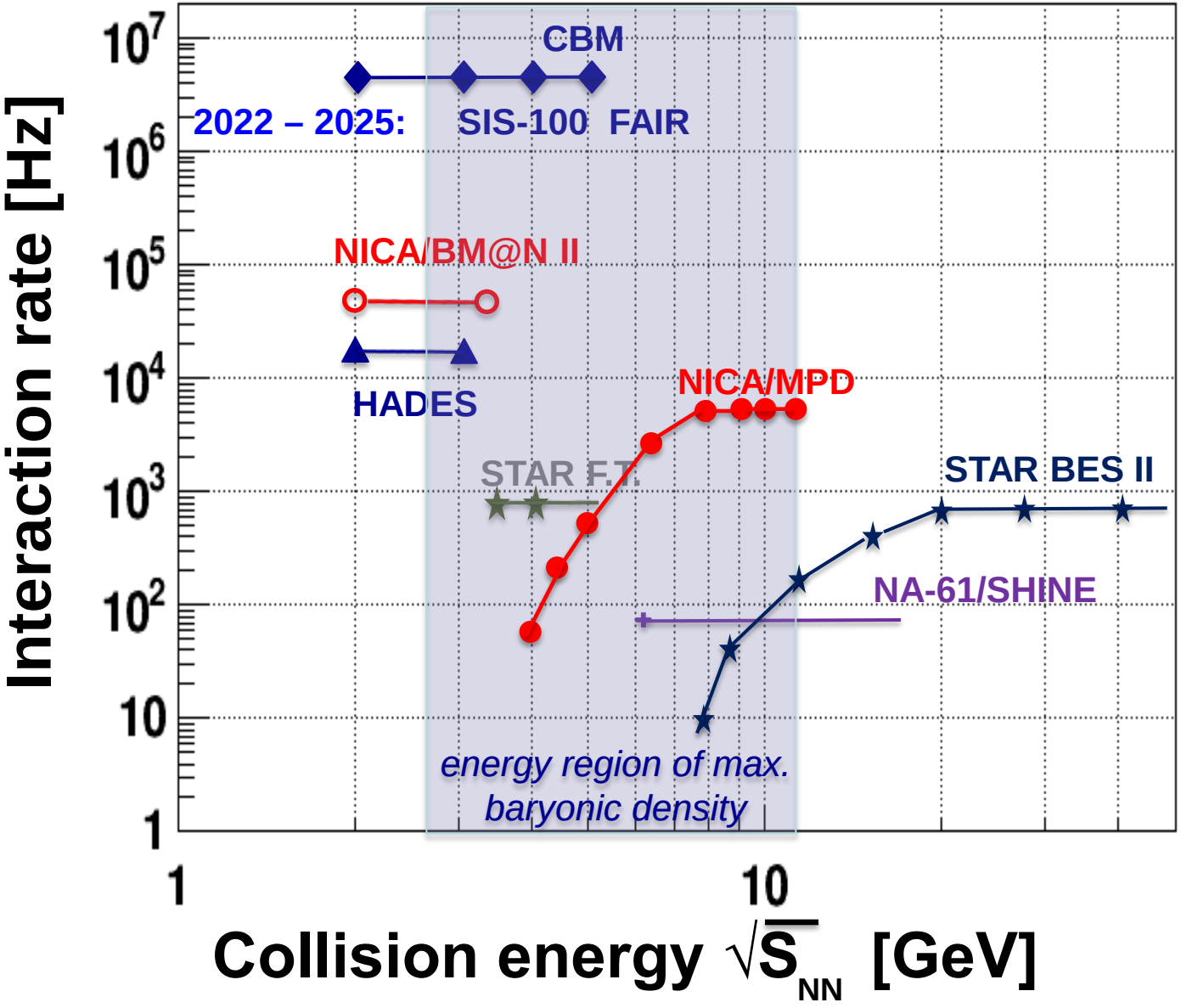
Jurgen Randrup, Jean Cleymans





NICA is well suited for exploring the transition between the hadronic phase and the new plasma phase. This exploration is the top priority of the NICA program

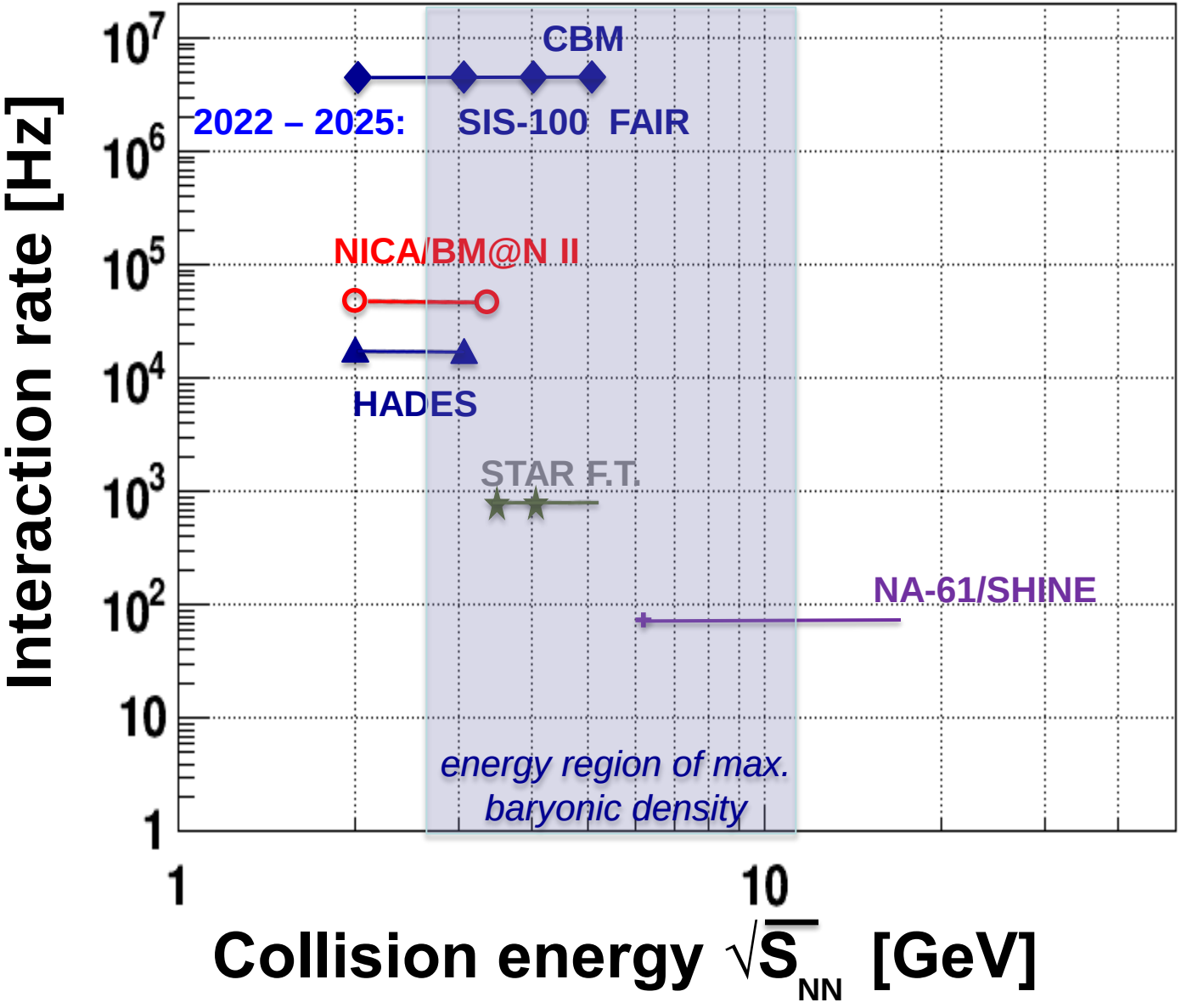
Present and future HI experiments



Both, collider and fixed target approaches,
are complementary and necessary
for approval of potential discovery

In this view the **NICA** and **FAIR** projects are complementary and their joined efforts have aimed to discovering and to studying new forms of baryonic matter

Present and future HI F.T. experiments



Baryonic Matter at Nuclotron (BM@N)

Leader: *M. Kapishin*

Detector Advisory Committee:

Hans Rudolf Schmidt, Tubingen Uni. - chairman

Hans Gutbrod, GSI

Itzhak Tserruya, Weitzmann Istitute

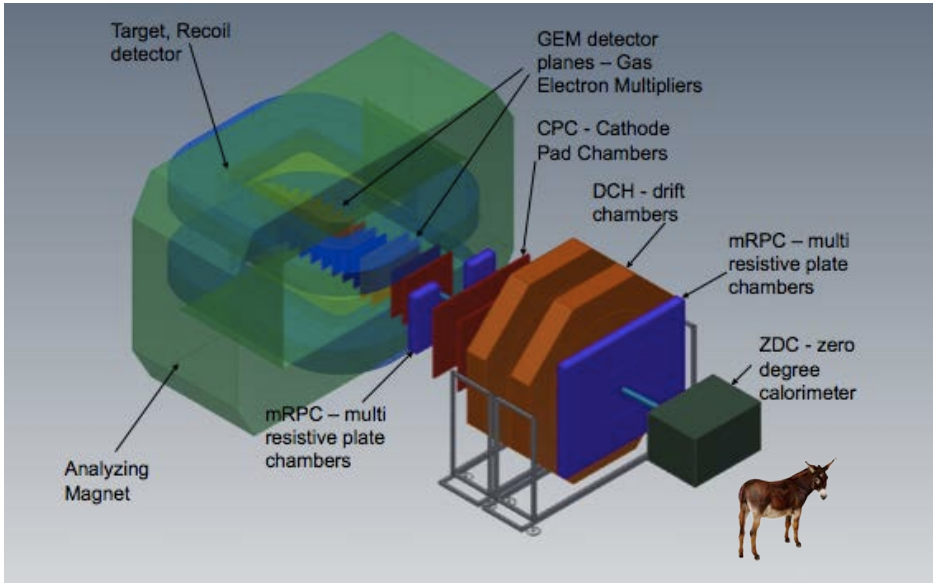
Peter Hristov, CERN

Karlheinz Hiller, DESY

BM@N: *the 1st stage*

Participants from:

Russia: *INR, MEPhi, SINP, MSU, IHEP, S-Ptr Radium Inst.*
Bulgaria: *Plovdiv University;*
China: *Tsinghua University, Beijin;*
Poland: *Warsaw Tech.Uni.*
Israel: *Tel Aviv Uni.*
Germany: *Frankfurt Uni.*
+ CBM/FAIR

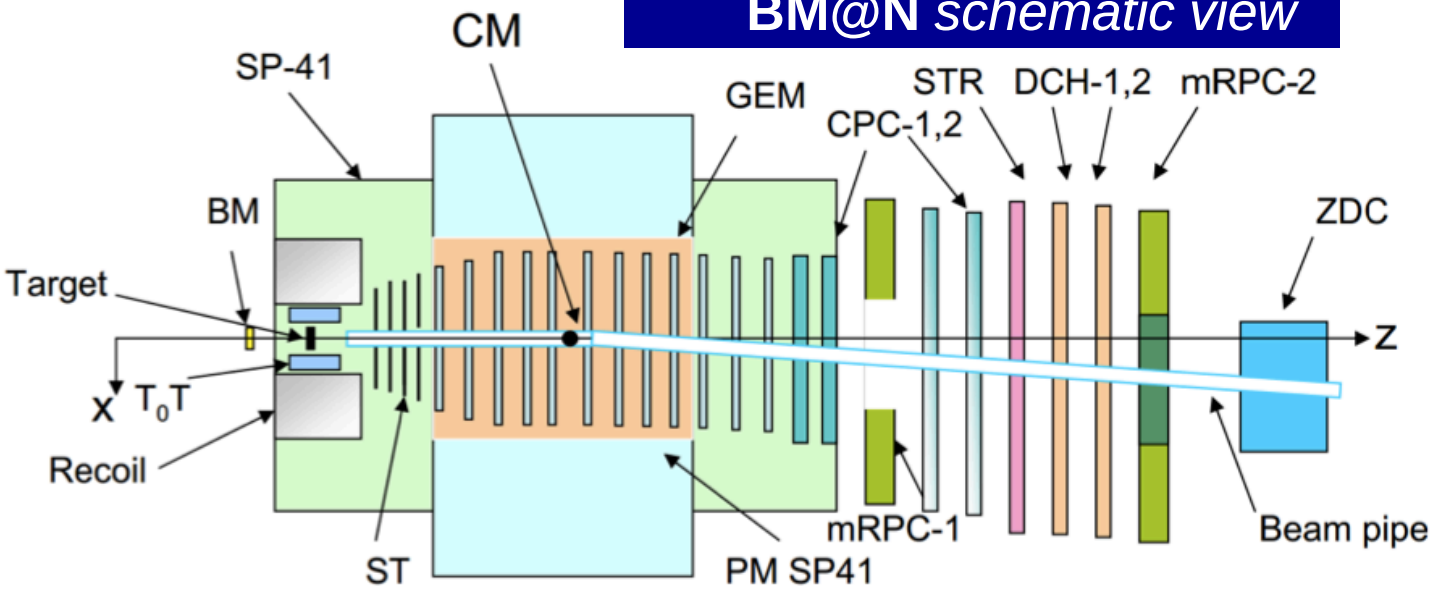


Physics:

- ✓ *strange / multi-strange hyperon and hypernuclei production at the threshold*
- ✓ *hadron femtoscopy*
- ✓ *event-by event fluctuations*
- ✓ *in-medium modifications of strange & vector mesons in dense nuclear matter*
- ✓ *electromagnetic probes, states decaying into γ, e (with ECAL)*

BM@N status and milestones

BM@N *schematic view*

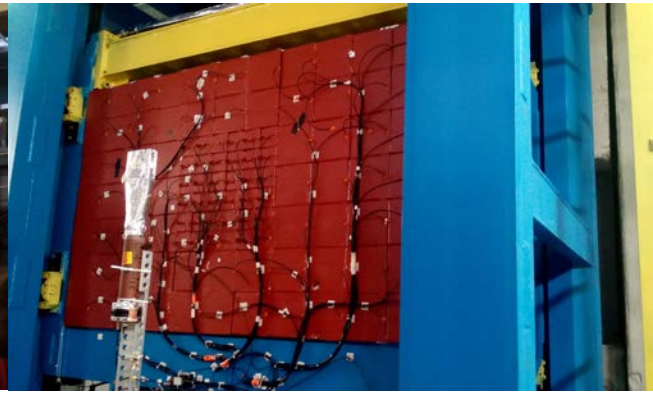


BM@N configuration

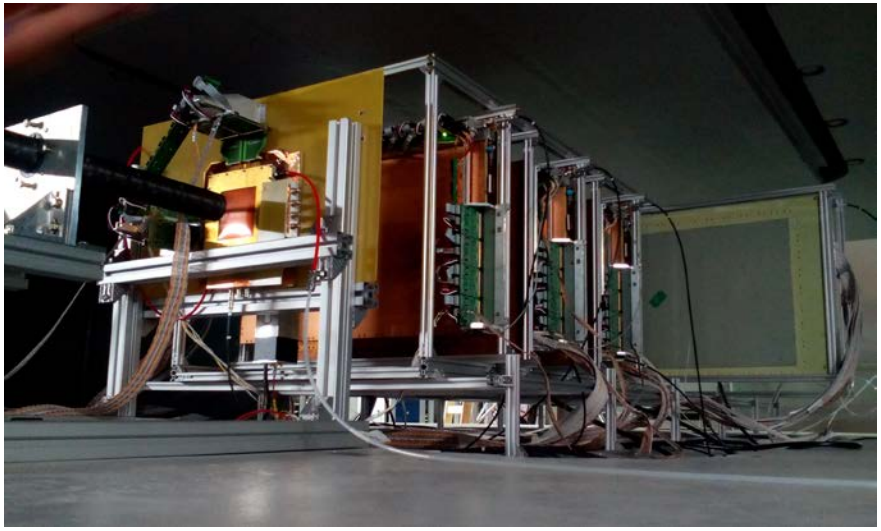
	DAQ	GEM *(CERN)*	ST	TOF	Outer tracker
• **2016, IV**:	*basic config.*	*6 half planes*	*1 small plane*	*half config.*	*DCH*
• **2017, III:**	complete	*10 h/pl.*	*2 s/pl.*	*basic*	*DCH*
• **2019, I:**	**-"-**	*8-10 full pl.*	*2 s.,2 large pl.*	*complete*	*Straw+DCH*

BM@N Run 52 (June 2016): *tests & commissioning of GEM CT located inside analyzing magnet*

d beam (~5·10^5 /cycle) with 2.94 GeV/n



*5 GEM detectors 66 x 41cm^2 + 1 detector **163 x 45** cm^2*



GEM detectors for central tracker

Tests of GEM detector 163 x 45 cm^2

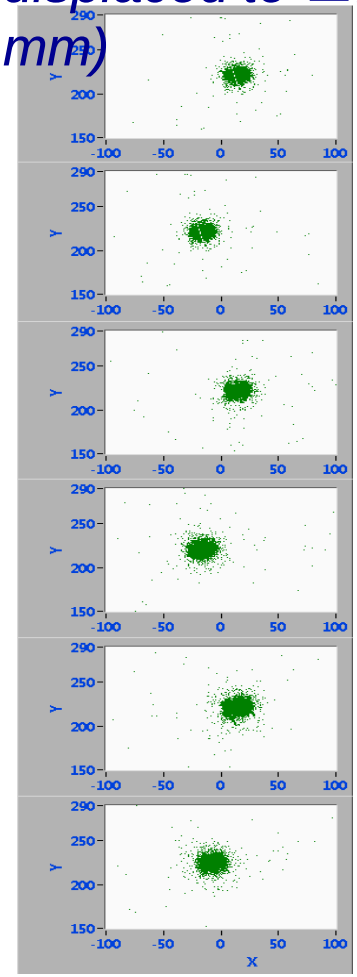
Set of 5 GEM detectors 66 x 41 cm^2 prepared for cosmic tests, June 2016

- *GEM design and production at CERN workshop is going slower than expected*
- *5 detectors 66 x 41 cm^2 and 2 detectors 163 x 45 cm^2 are foreseen to use in technical run at the end 2016*
- *6-8 more detectors 163 x 45 cm^2 should be commissioned in autumn 2017 plan to produce*

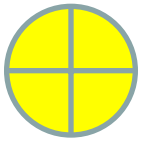
Performance of GEM tracker in séance 52, June 2016

5 middle size + 1 big GEM detectors

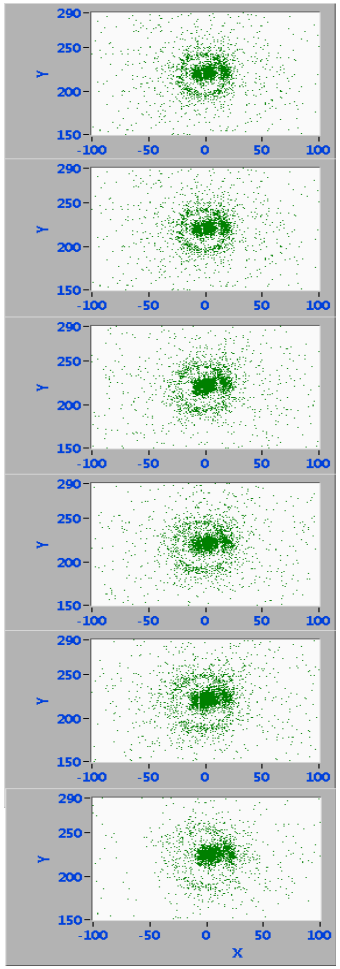
Beam spot (detectors are displaced to ±15 mm)

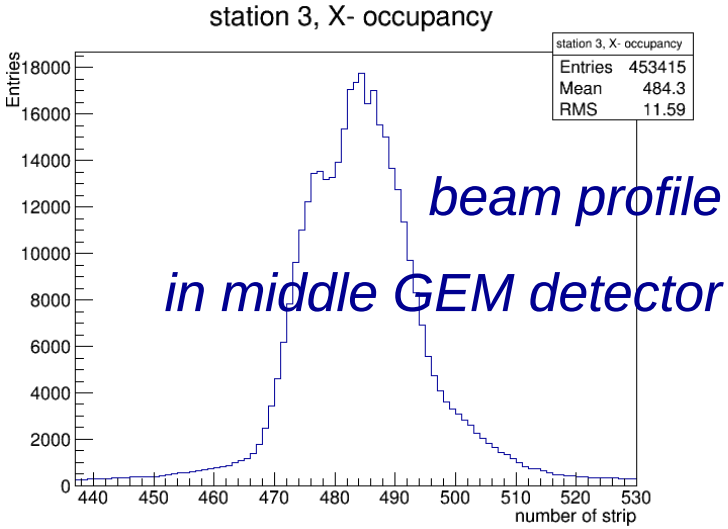


beam

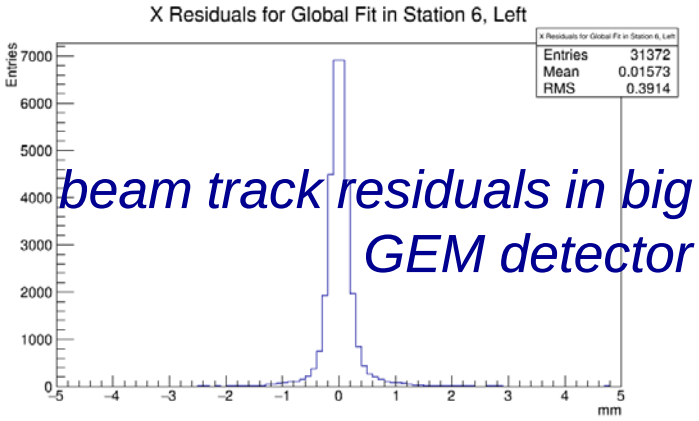


Products of interaction with target & proton spectators / pile-up events in center





beam profile in middle GEM detector



beam track residuals in big GEM detector

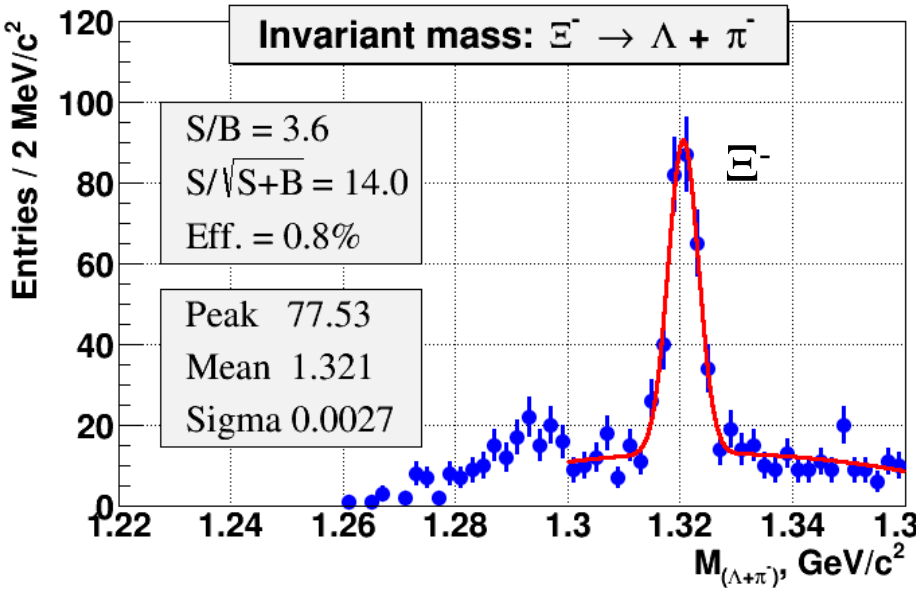
BM@N *feasibility study*

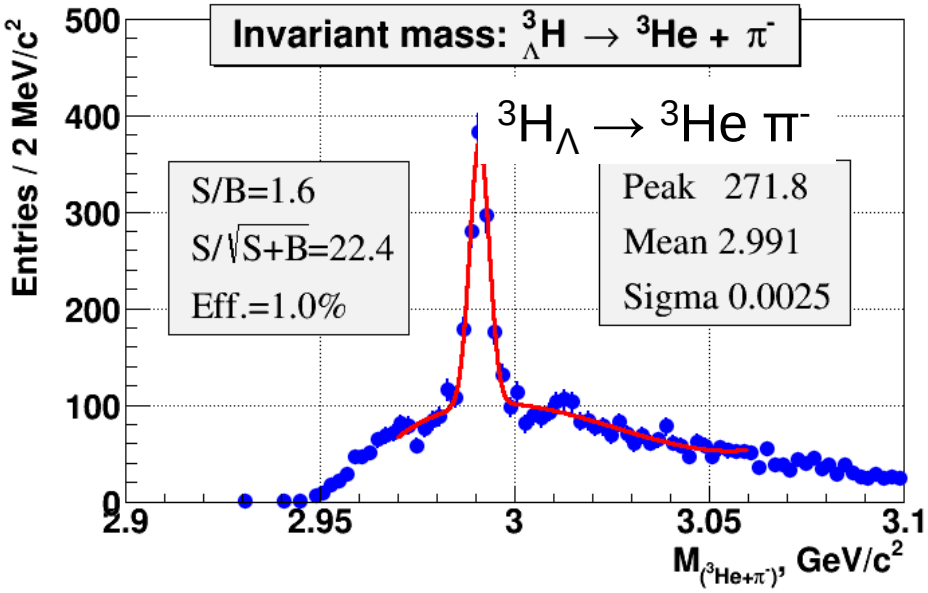
A.Zinchenko, V.Vasendina

Simulation: *UrQMD & DCM-QGSM, Au+Au 4,5 AGeV*

900 k central events
7,5M Ξ^- in 1 m, 20 kHz trigger

2,6M central events
8,5M $^3H_\Lambda$ in 1 m, 20 kHz trigger





BM@N plans

year	2016	2017 spring	2017 autumn	2019	2020 + ..
beam	**d (↑)**	**C, Ar**	**Kr**	**Au**	**Au, p**
maximum intensity, Hz	**1M**	**1M**	**1M**	**1M**	**10M**
trig. rate, Hz	**10k**	**10k**	**20k**	**20k**	**50k**
central tracker	**6 GEM half pl.**	**8 GEM half pl.**	**10 GEM half pl.**	**8 GEM full pl.**	**12 GEM or 8+2Si**
expiment status	**techn. run**	**techn. run**	**physics run**	**physics stage 1**	**physics stage 2**

MultiPurpose Detector (MPD)

Coordinator: *V. Golovatyuk*

Detector Advisory Committee:

Hans Gutbrod, GSI - chairman

Itzhak Tserruya, Weizmann Institute

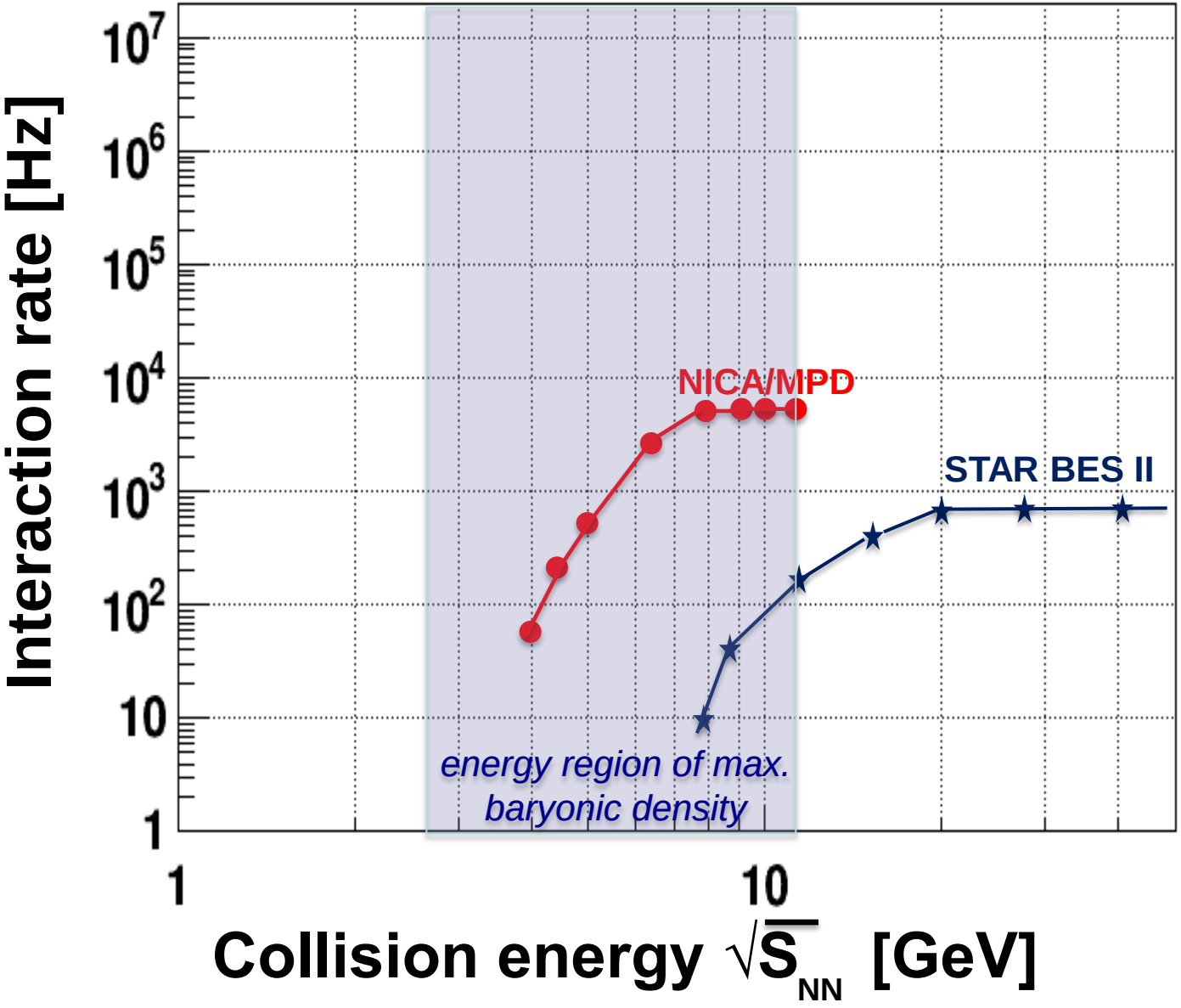
Hans Rudolf Scmidt, Tubingen Uni.

Jean Cleymans, Cape Town Uni.

Nu Xu, BNL

TDRs for most sub-detectors have been prepared and now are under evaluation by **DAC**

Present and future HI collider experiments



MPD experimental strategy

measure a variety of observables systematically changing collision conditions: ***energy, centrality, system size****;*
reference data (i.e. ***p+p****) will be taken at the same conditions*

Observables:

- *Bulk observables (hadrons): spectra,yields (**OD, EOS**) from p to Ω*
  (charm is under evaluation)
- *Event-by-event fluctuation in hadron productions (**CEP**)*
- *Femtoscopy: correlations involving π, K, p, Λ □ (**OD**)*
- *Directed & elliptic flows for identified hadron species (**EOS, OD**)*
- *Multi-strange hyperon production : yields & spectra (**OD, EOS**)*
- *Electromagnetic probes (**CSR, OD**) – limited specifications in 2019*
- *Hypernuclei*

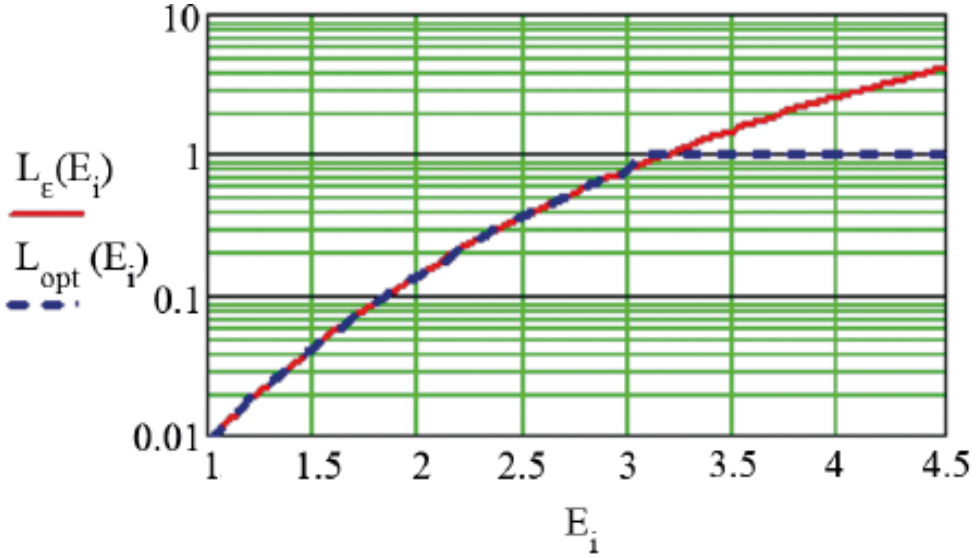
OD – Onset of Deconfinement **CEP** – Critical End Point
CSR – Chiral Symmetry Restoration **EOS** – Equation Of State

NICA parameters at very beginning (*from 2020*)

Eur. Phys. J. A (2016) **52**: 211
DOI 10.1140/epja/i2016-16211-2

Three stages of the NICA accelerator complex*

V.D. Kekelidze[1], R. Lednicky[1], V.A. Matveev[1,2], I.N. Meshkov[1,3,a], A.S. Sorin[1,2], and G.V. Trubnikov[1,3]



Start-up version (2020)

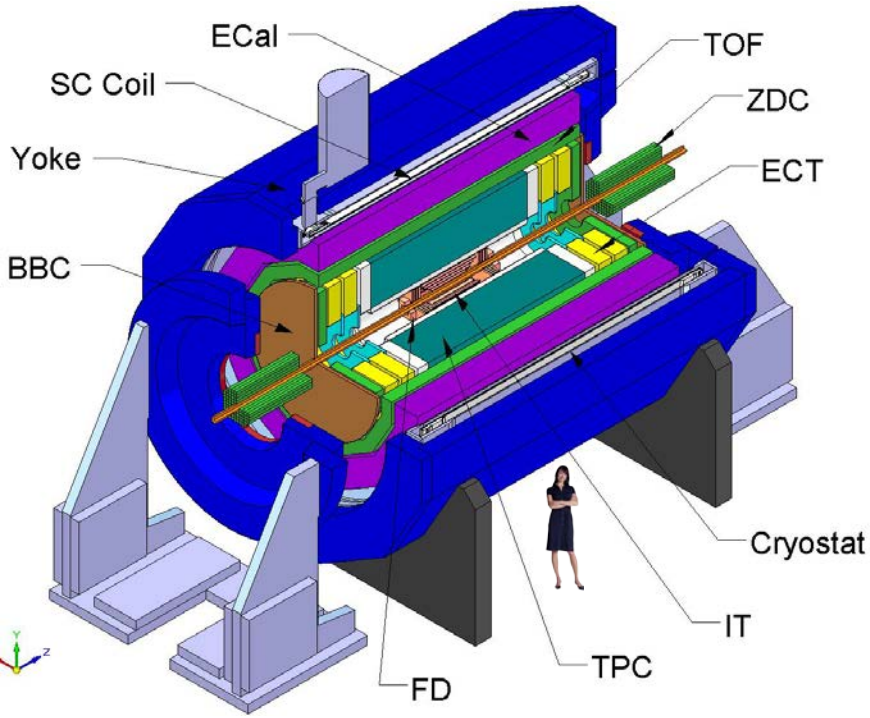
- *reduced luminosity*: **5 ·10^{25} at 11 GeV/A**
- *enlarged beam diamond:* **s =0.6 m**

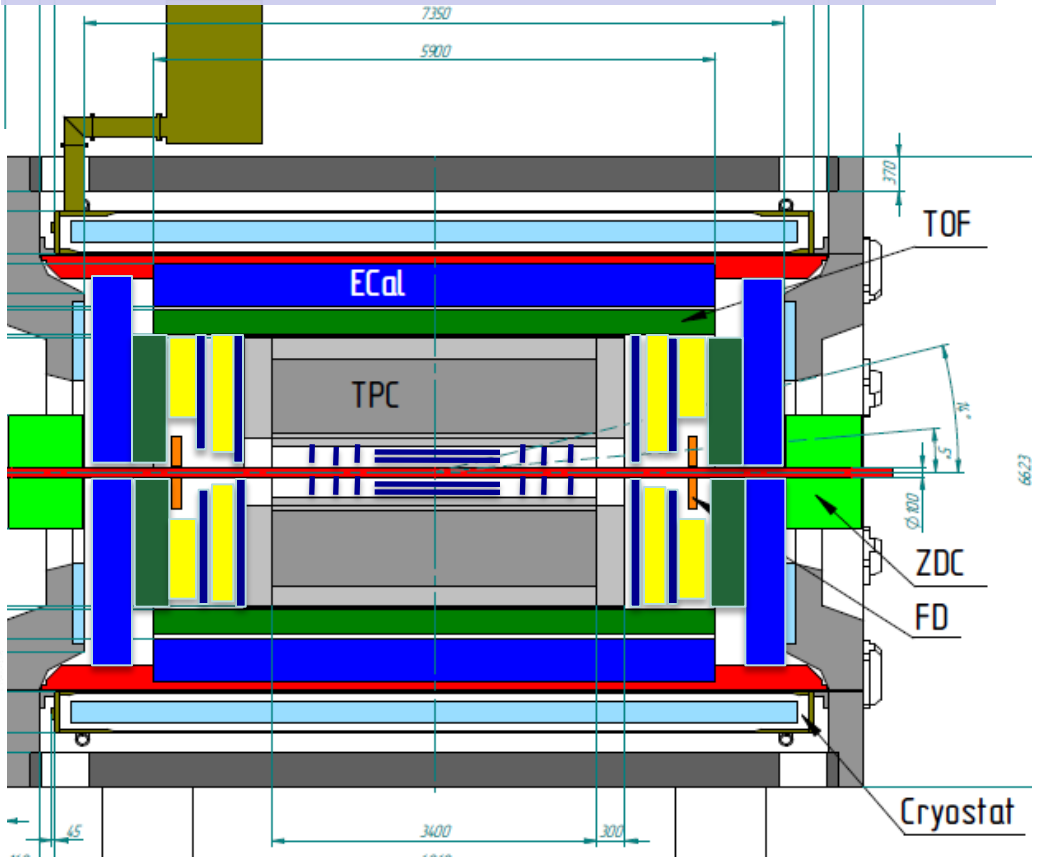
MPD detector for Heavy-Ion Collisions @ NICA

Tracking: up to |η|<1.8 (TPC)
PID: hadrons, e, γ (TOF, TPC, ECAL)
Event characterization:
centrality & event plane (ZDC)

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

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





Status: *technical design and detector R&D – completed;*
Preparation for the mass production

strategy in 2020-2023

energy and system size scan from 4 to 11 GeV in steps of 1-2 GeV

limitation by the accelerator:

- *lower luminosity*
- *extra reduction by 40% because of a larger beam diamond*

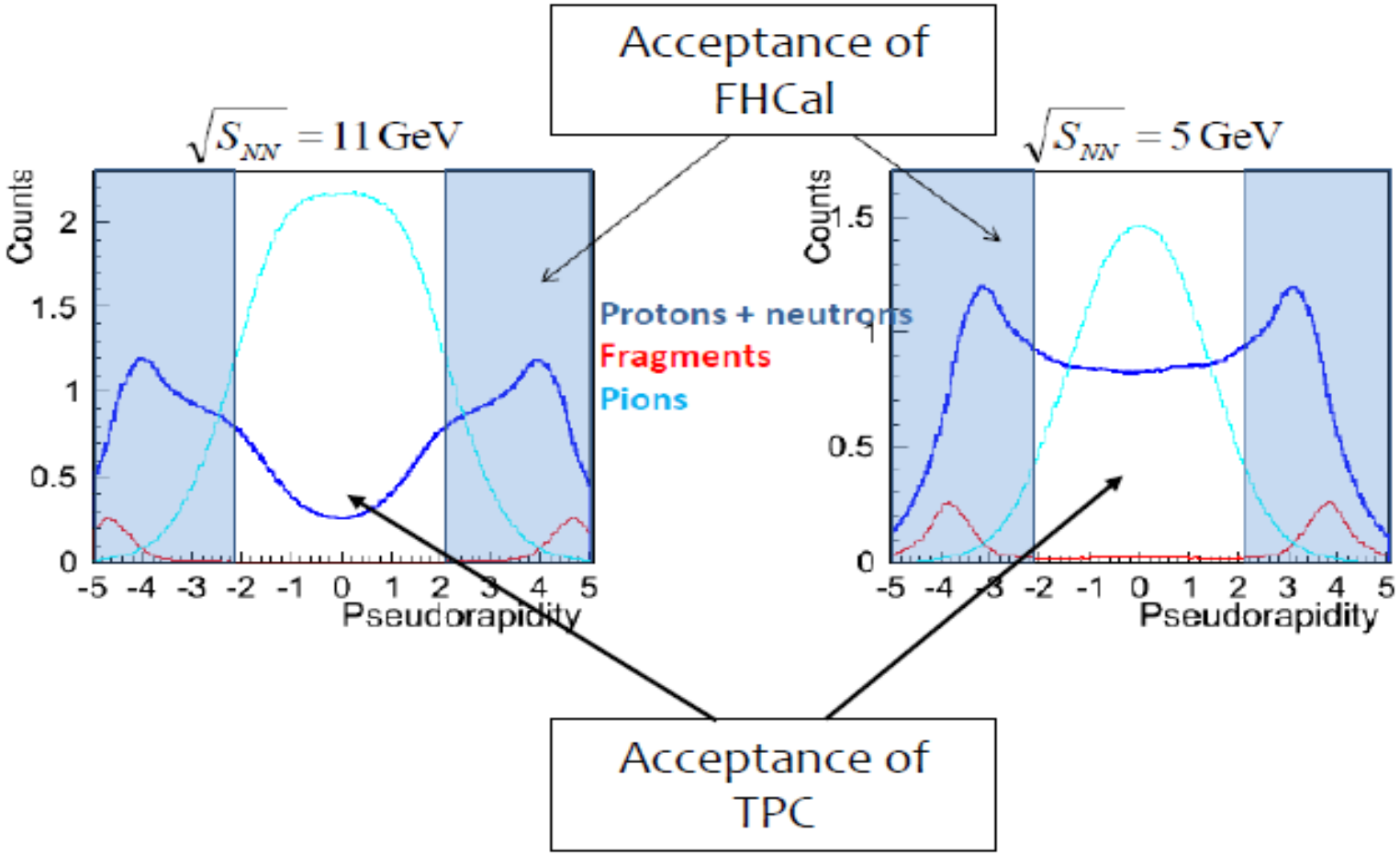
Detector limitation

- ***TPC** tracking: $|\eta|<1.8$ (N points>10)*
- ***TOF** coverage: $|\eta|<1.2$*
- ***PID**: combined $|\eta|<1.2$, 0.1<pT<4 GeV/c,*

  limited in $1.2 < |\eta| > 1.8$ (only dE/dx)
- ***ECAL** coverage : $|\eta|<2.5$*
- ***FHCAL** coverage: $2.2<|\eta|<4.8$*
- ***FD** inside the TPC inner pipe*

Acceptance on η

MEPhI: *P. Parfenov, I. Svintsov, I. Selyuzhenkov, A. Taranenko*



data rates

possible scenario:
*to take data at **8** energies **4, 5, 6, 7, 8, 9, 10, 11** GeV*
*for beam/target combinations: **Au+Au**, **Xe+Xe**, **C+C, p+p***

*In total: **32** data sets (**1** week for each of the top-half energies and **2** weeks for lower energies).*
*In **48** weeks (~**1,5** year) of data taking the **statistics equal to one at RHIC** will be accumulated (duty factor 0.5 is used)*

Beam	Luminosity ($cm^{-2} c^{-1}$)		Data sample per 1 week at $\sqrt{s}$ = 4 GeV	Data sample per 1 week at $\sqrt{s}$ = 11 GeV
	$\sqrt{s}$=4 GeV	$\sqrt{s}$=11 GeV		
^{197}Au	$7 \cdot 10^{24}$	$5 \cdot 10^{25}$	$9.1 \cdot 10^{6}$	$6.3 \cdot 10^{7}$

Particle yields in Au+Au collisions @ $\sqrt{s_{NN}}$ = 8 GeV (*central collisions*)

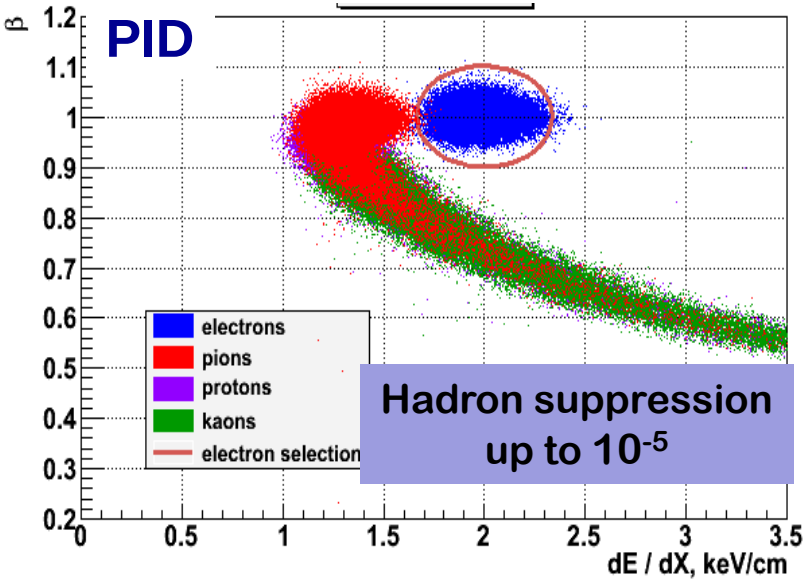
one week of running at **L = 5 10^{25}cm^{-2}s^{-1}** *(duty factor = 0,5)*

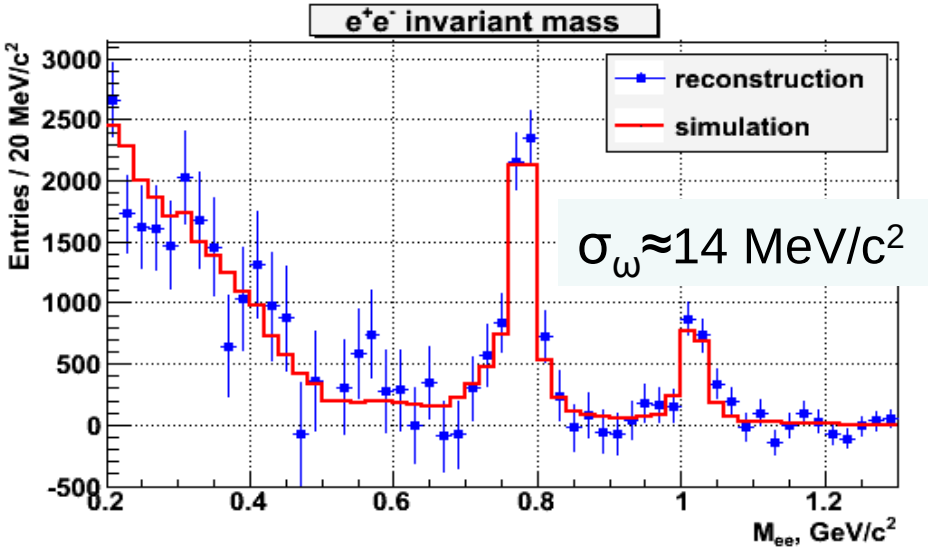
Particle	Multiplicity	Decay mode	BR	*Efficiency %	Yield /1 w
π^+	293	----	---	61	$7.7 \cdot 10^8$
K^+	59	---	----	50	$1.5 \cdot 10^8$
p	140	---	----	60	$4.2 \cdot 10^8$
Λ	~35	$p+\pi^-$	64%	~10%	$\sim 1 \cdot 10^7$
Ξ^-	~2	$\Lambda+\pi^-$	~100%	1.6%	$1.0 \cdot 10^5$
ρ	31	e+e-	$4.7 \cdot 10^{-5}$	35	$2.5 \cdot 10^3$
ω	20	e+e-	$7.1 \cdot 10^{-5}$	35	$2.5 \cdot 10^3$
φ	2.6	e+e-	$3 \cdot 10^{-4}$	5	$2.0 \cdot 10^2$
Ω	0.14	Λ+K	0.68	2	$9.5 \cdot 10^3$

MPD performance for dileptons

A. Zinchenko, at SQM-2015

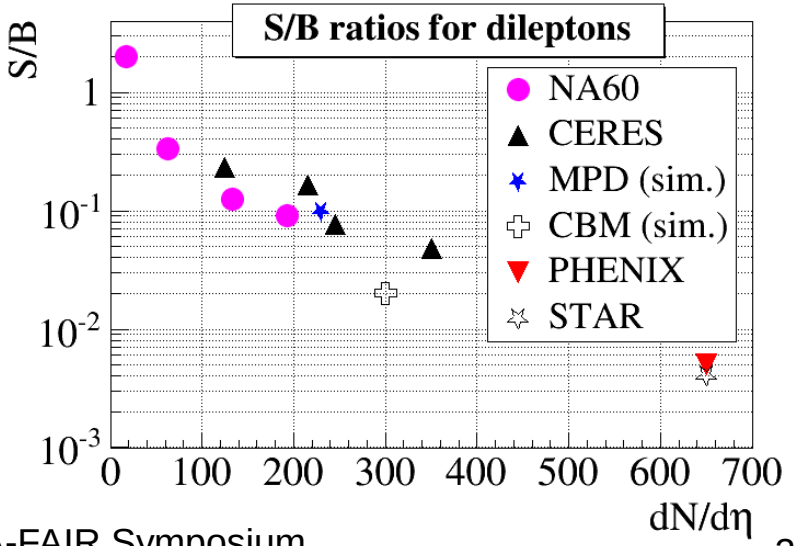
Good probes to indicate medium modifications of spectral functions due to chiral symmetry restoration in A+A collisions; effect is proportional to baryon density





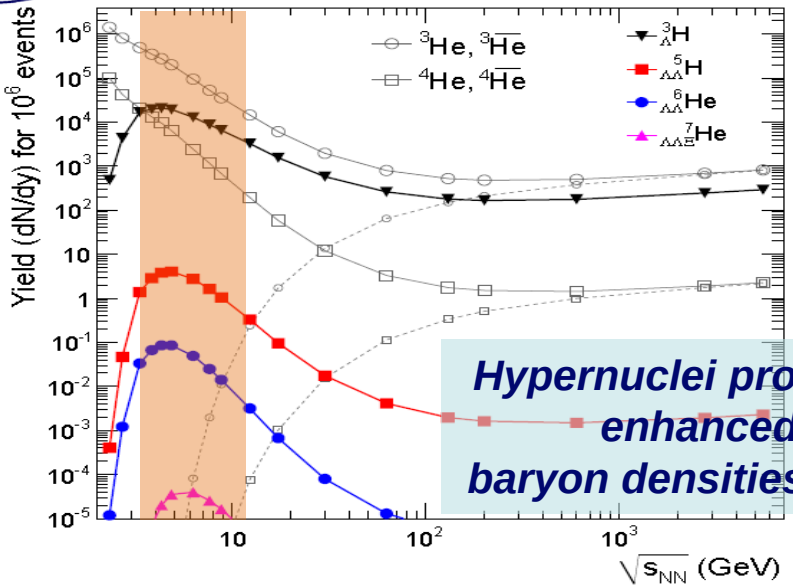
Yields, central Au+Au st $\sqrt{s_{NN}}$ = 8.8 GeV/u

meson	Yields		Yield / 1 w
	4π	y=0	
ρ	31	17	$7 \cdot 10^4$
ω	20	11	$7 \cdot 10^4$
φ	2.6	1.2	$1.7 \cdot 10^4$

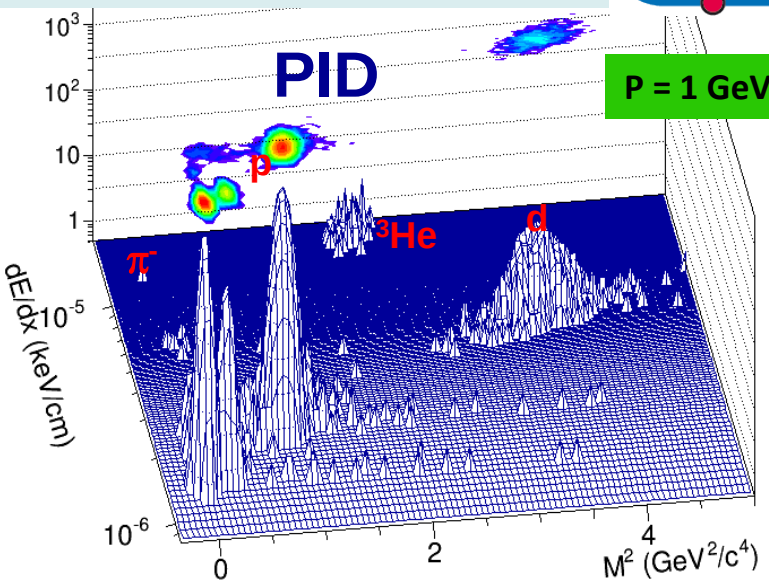


Hypernuclei @ MPD

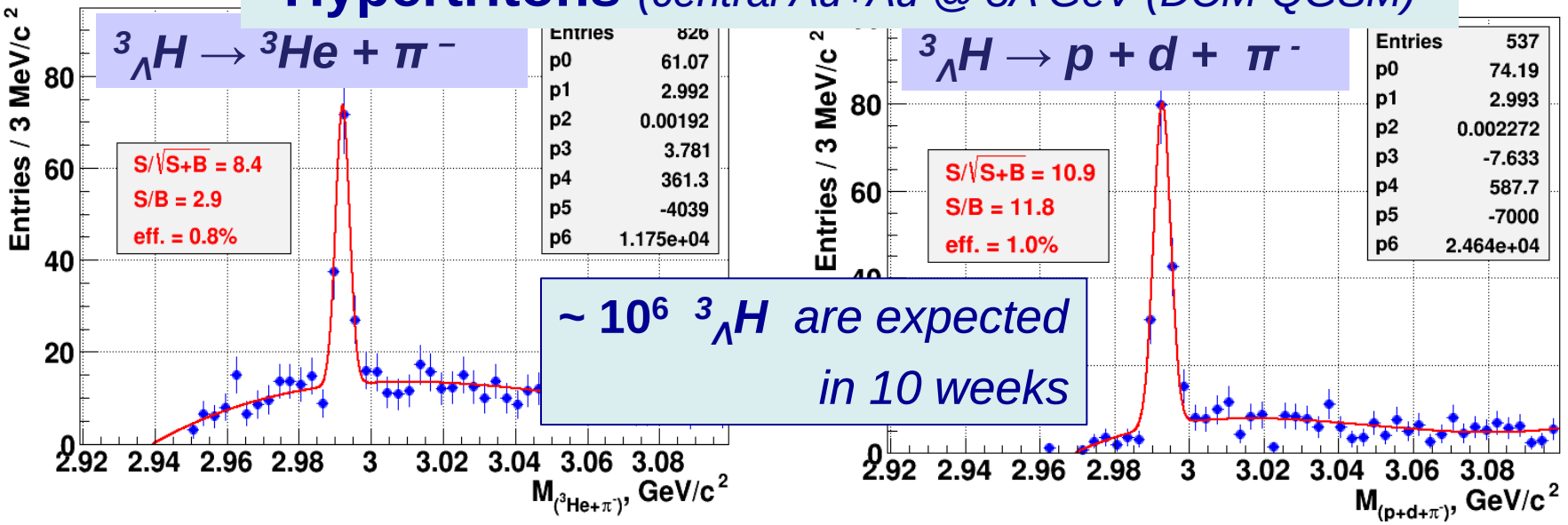
M. Ilieva, at "SQM-2015"



Hypernuclei production enhanced at high baryon densities (NICA)



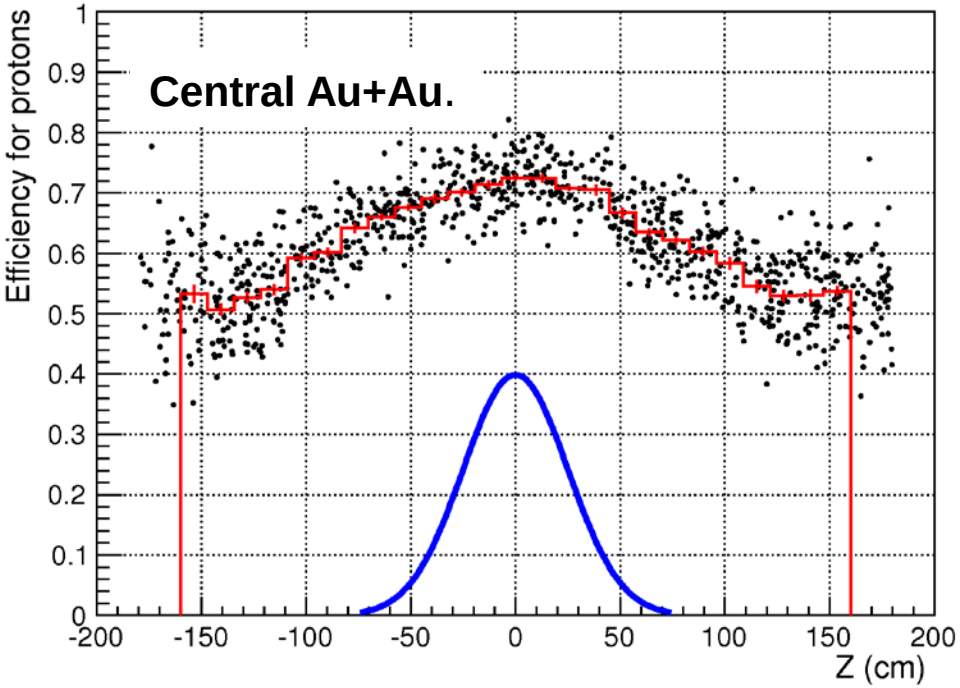
Hypertritons *(central Au+Au @ 5A GeV (DCM-QGSM)*



~ 10^6 $^3_\Lambda H$ *are expected in 10 weeks*

MPD perspectives for ev-by-ev fluctuations at Stage'1

Defined by the phase-space (barrel), PID performance
and (partially) by beam dimensions



Early study from V. Kireev

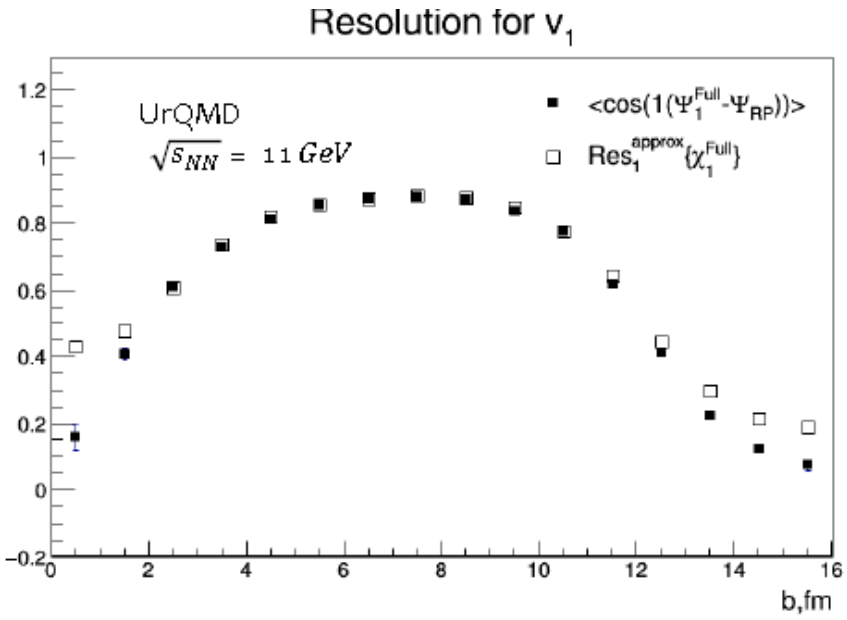
- at √s=4 GeV MPD accumulates PIDed protons (73%),
- efficiency drops to 55% at Z_{Vertex}=120cm

Maximal allowed phase-space

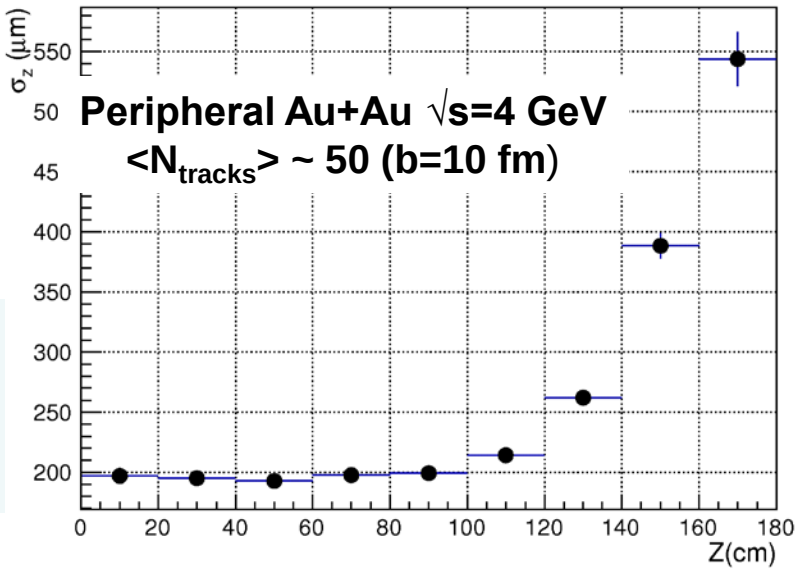
even for a limited set of MPD elements

MPD perspectives for event-by-event fluctuations at Stage'1

Is defined by the FHCAL performance, phase-space, tracking and PID performance, and (slightly) by beam dimensions



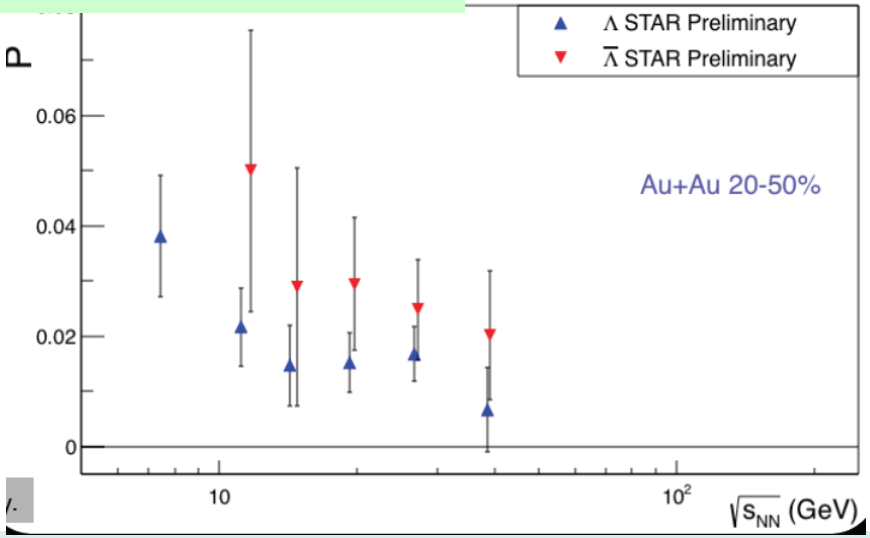
- *good v1,2 event plane resolution using FHCAL*



- *primary vertex reconstruction with TPC tracks: $\sigma_Z \sim 200$ μm is stable within |Z|<100 cm*

Spin effects in HI collisions as a complementary probe

M. Lisa, for the STAR collaboration, SQM2016, Berkeley, June 2016



O. Rogachevsky, A. Sorin, O. Teryaev, Phys. Rev. C 82, 054910, 2010.

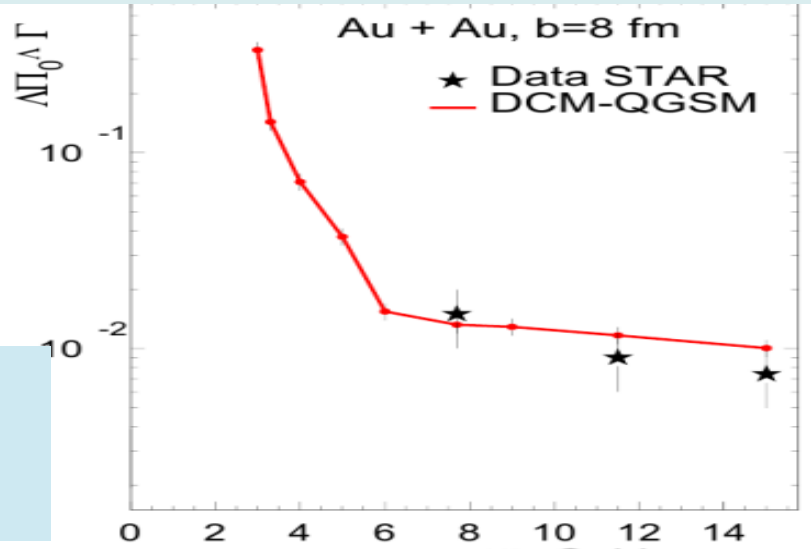
One would expect that polarization is proportional to the anomalously induced axial current [7]

$$j_A^\mu \sim \mu^2 \left(1 - \frac{2\mu n}{3(\epsilon + P)}\right) \epsilon^{\mu\nu\lambda\rho} V_\nu \partial_\lambda V_\rho, \qquad (6)$$

where n and ϵ are the corresponding charge and energy densities and P is the pressure. Therefore, the μ dependence of polarization must be stronger than that of the CVE, leading to the effect's increasing rapidly with decreasing energy.

This option may be explored in the framework of the program of polarization studies at the NICA [17] performed at collision points as well as within the low-energy scan program at the RHIC.

O.Teryaev, M.Baznat, K.Gudima, A.Sorin, XXIII Baldin Seminar,2016



M. Baznat, K. Gudima, A. Sorin, O.Teryaev Phys. Rev. C (2013); Phys. Rev C (2015); A. Sorin, O. Teryaev arXiv:1606.08398

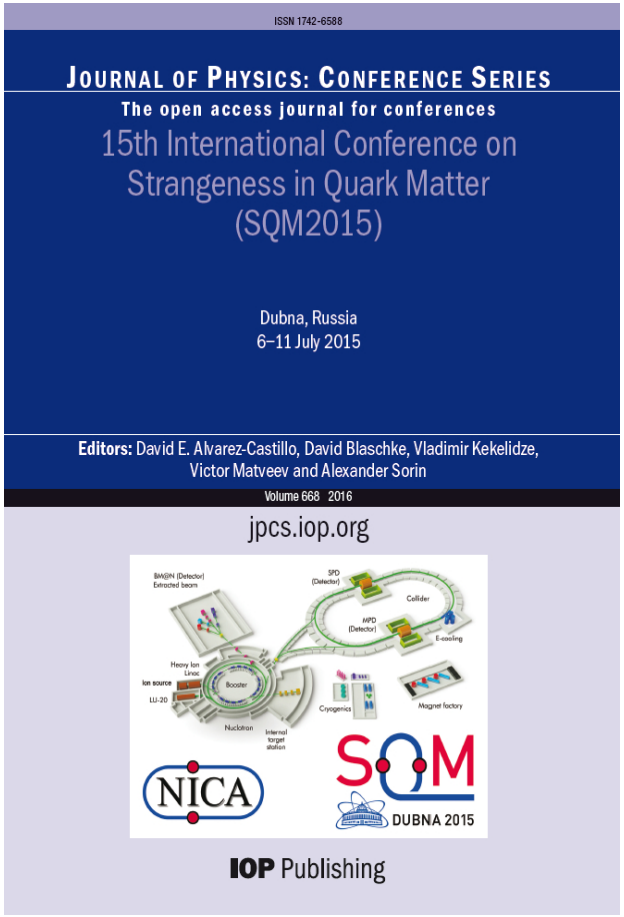
MPD physics cases (2020-2023)

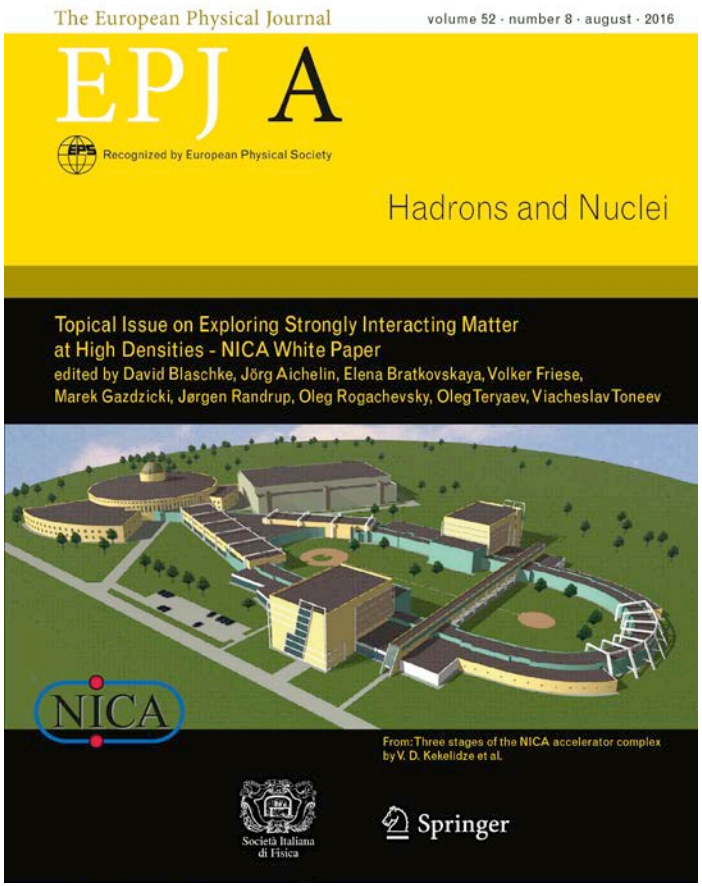
Observable	Set-up	Coverage	New insights
Hadron yields & ratios	TPC, TOF, FHCAL,ECAL	$\|\eta\| < 1.5$ pT < 4 GeV/c	Data for $4<\sqrt{s}<7$ GeV, critical assessment of y-spectra and K/π-ratio
Hyperons: yields, flow, Polarization	TPC, TOF FHCAL	$\|\eta\| < 1.5$ pT < 4 GeV/c	New data on yields, flow and polarization at $\sqrt{s} < 7$ GeV.
Dileptons	TPC, TOF ECAL, FHCAL	$\|\eta\| <$ **1.2** pT < 3 GeV/c	**low statistics data for comparison**
Fluctuations & Correlations	TPC, TOF ECAL, FHCAL	$\|\eta\| < 1.5$	New data on Ev-by-Ev fluct. for $\sqrt{s} > 4$ GeV
Chiral Magnetic & vortical effects	TPC, TOF FHCAL	$\|\eta\| < 1.5$ pT < 3 GeV/c	Data @ $\sqrt{s} < 7$GeV (CME) Vortical @ $4 < \sqrt{s} < 11$ GeV
(Hyper)Nuclei	TPC, TOF ZDC	$\|\eta\| < 1.5$ pT< 5 GeV/c	**low statistics data for comparison**

- **In stage-II one should consider efficient measurements of open-charm hadrons, di-leptons, and direct photons.**

New issues: NICA White Paper, SQM proceedings

*Physics targets for the exploration of first order phase transitions in the region of the QCD phase diagram accessible to NICA & CBM and possible observable effects of a "mixed phase culminates this year in the release of the "NICA White Paper" as a Topical Issue of the **EPJ A** (July 2016).*



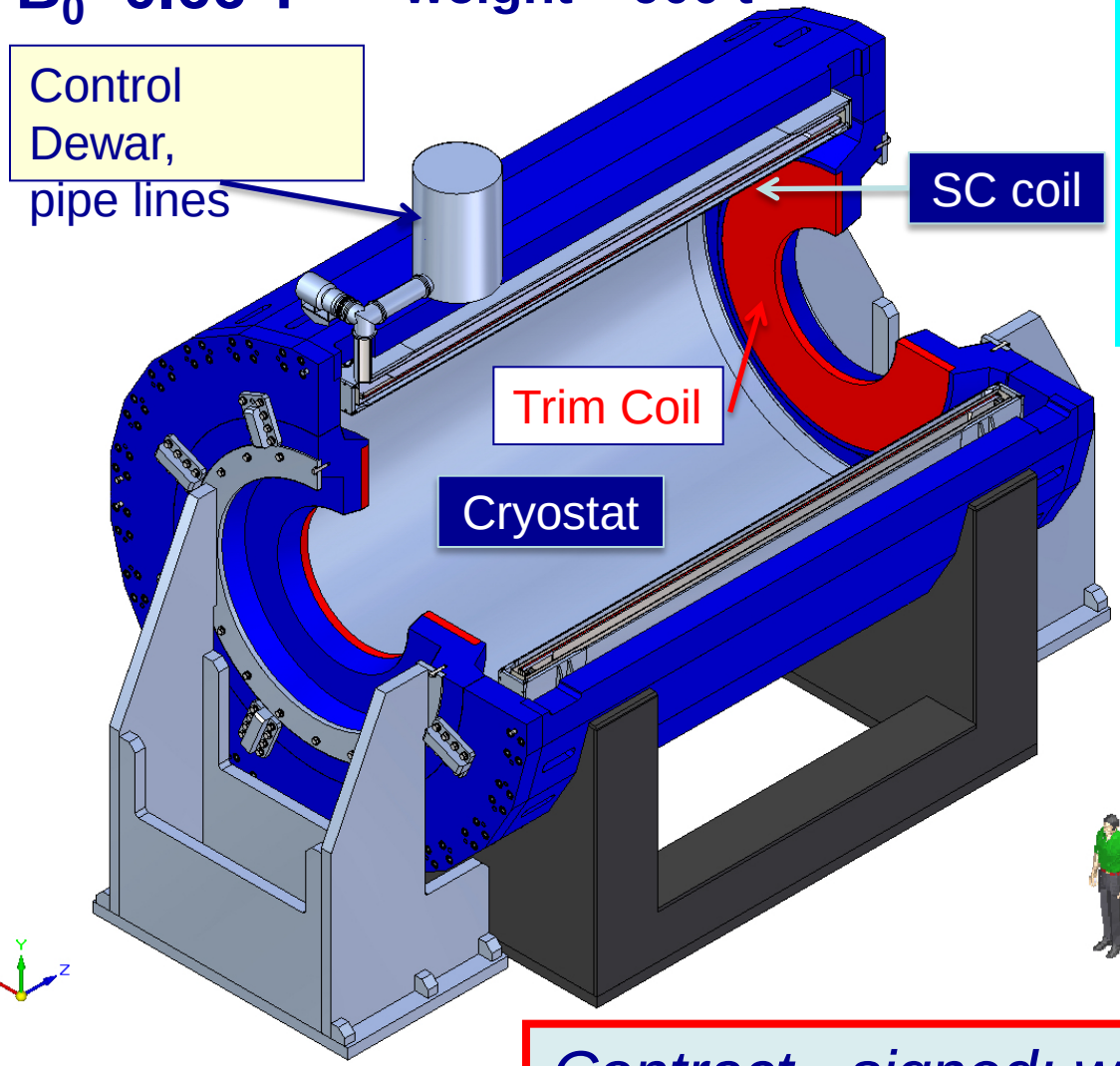


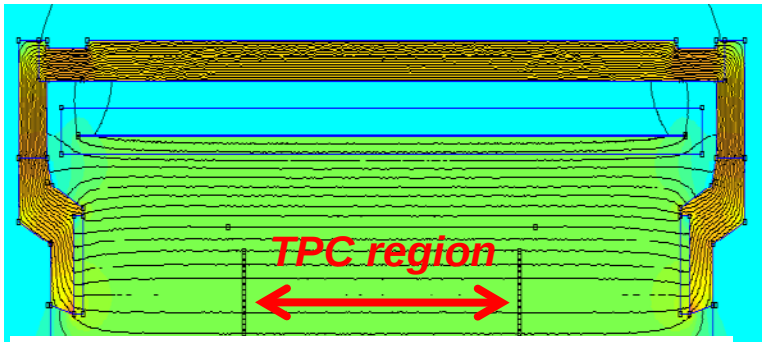
111 *contributions,*
188 *authors*
from **24** *countries*

MPD status

MPD superconducting Solenoid

B_0=0.66 T **weight ~ 900 t**





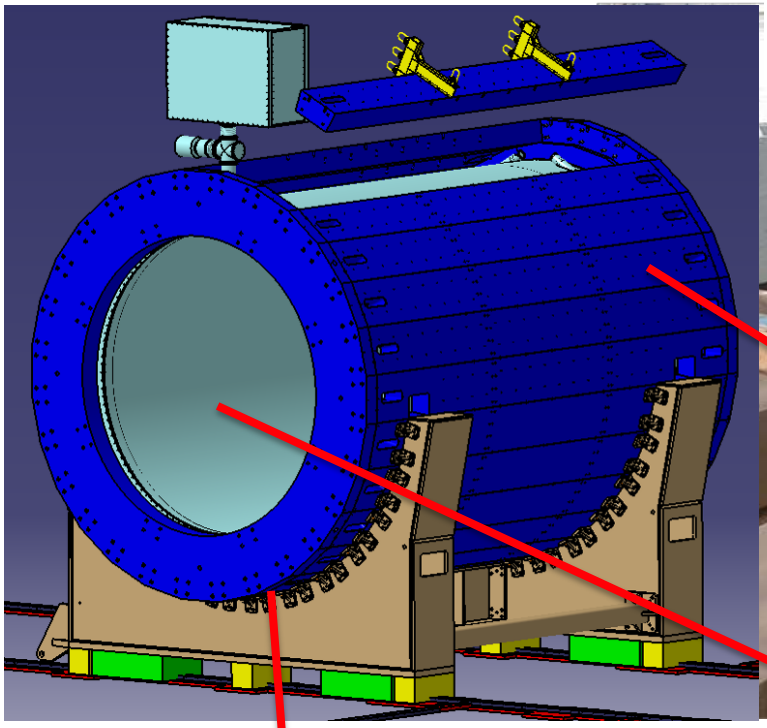
high level (~ 3x10^{-4}) of magnetic field homogeneity

ASG superconducting (Genova, Italy)**:**

- *Cold Mass + Cryostat*
- *Vacuum System*
- *Trim Coils*
- *Control System*
- *PS*
- ***General responsibility***

Contract - signed; works – in progress

Yoke production: *all packages are at Vitkovice HM*

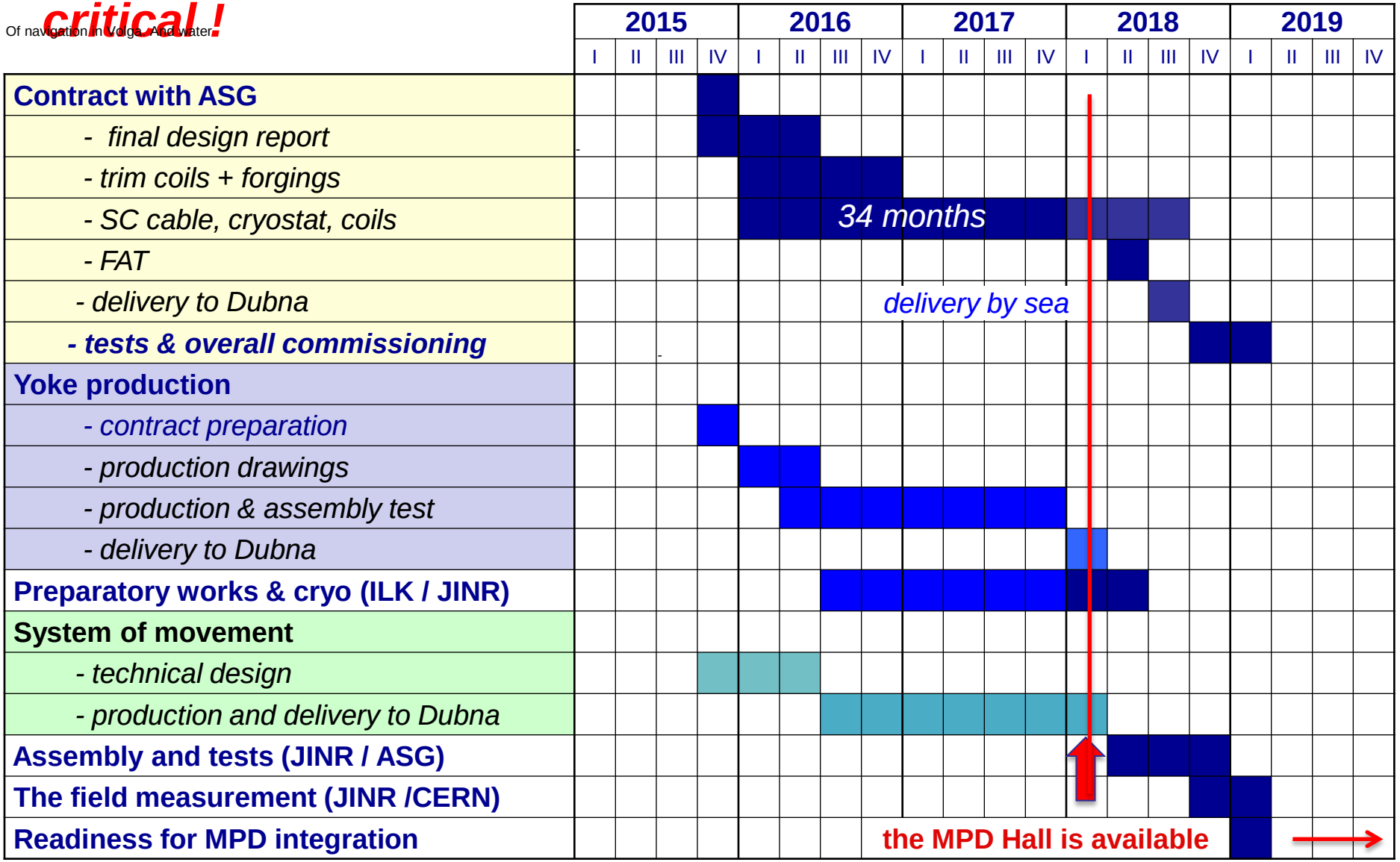


VITKOVICE Heavy Machinery, Sept. 5, 2016

Schedule for MPD Magnet fabrication & commissioning

critical !

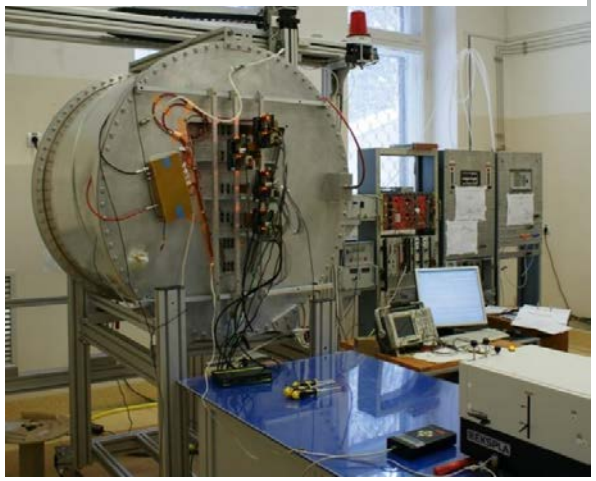
Of navigation in Volga And water



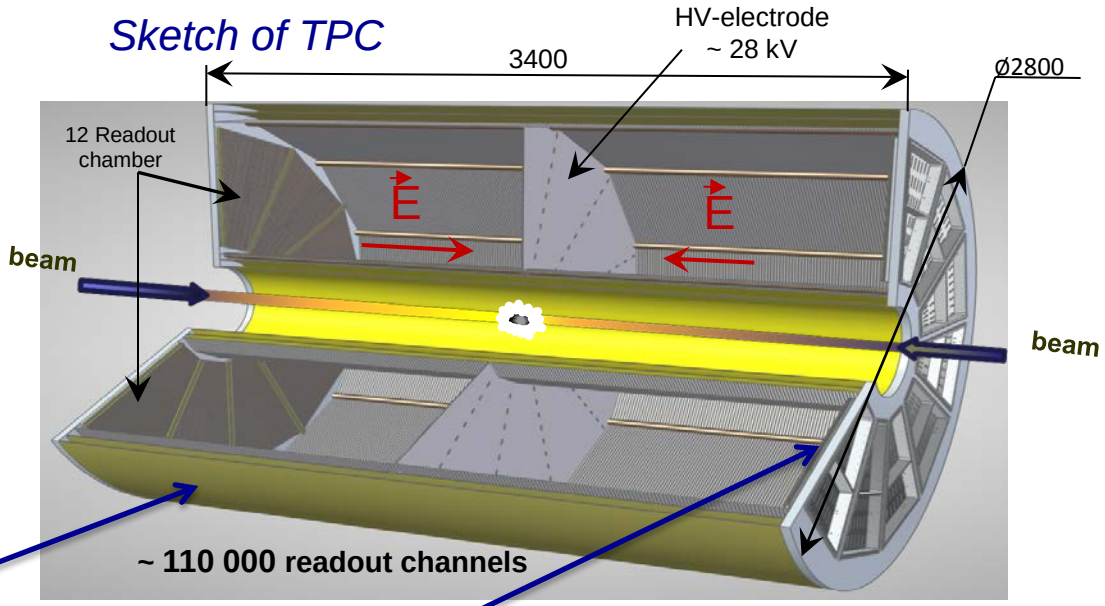
Time Projection Chamber

Leaders: *S. Movchan,* *Yu. Zanevsky*

TPC Prototype

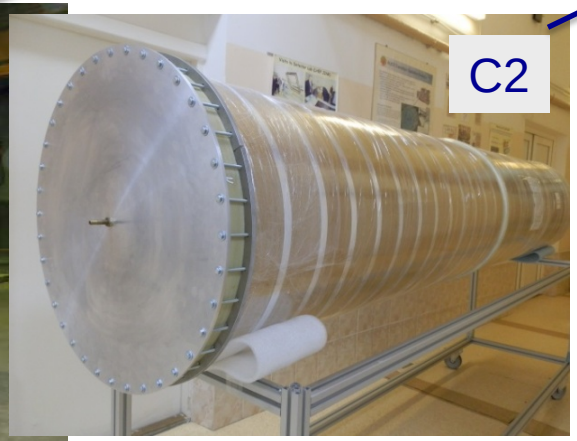


Sketch of TPC



C3

C2



Project status:

- *basic R&D finished, (cont. alternative RO Ch.);*
- *assembly workshop in preparation (readiness – IIq., **2016**)*

Works are going in accordance with the schedule

Time Projection Chamber

Leaders: *S. Movchan,* *Yu. Zanevsky*

clean room input gate

climate control

Project status:

- *basic R&D finished, (cont. alternative RO Ch.);*
- *assembly workshop clean room is completed (Sept., **2016**)*

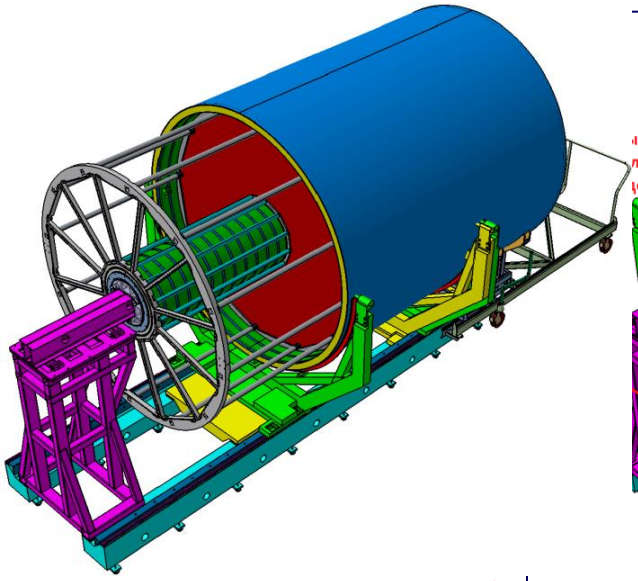
gas system: delivery to JINR in I 2017

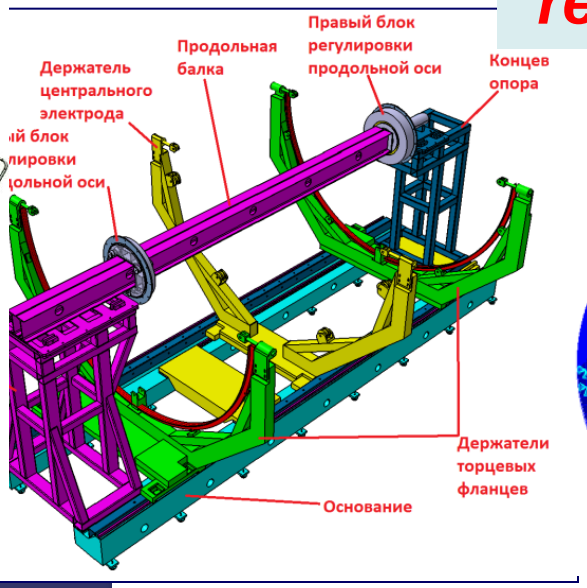
RoC chambers preparation

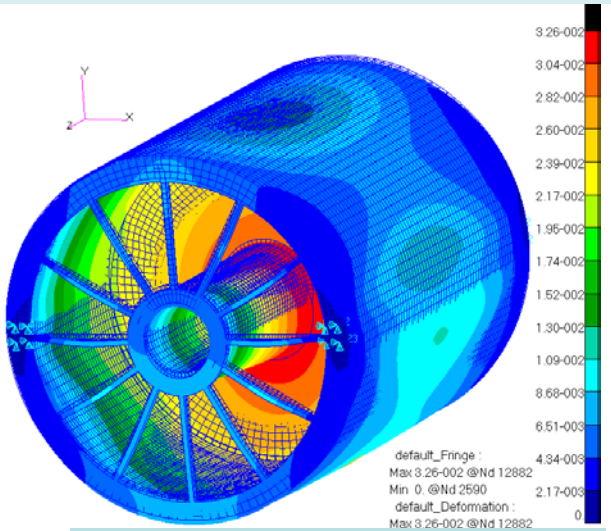
Works are going in accordance with the schedule

TPC assembly tools, cooling & laser calibration system:

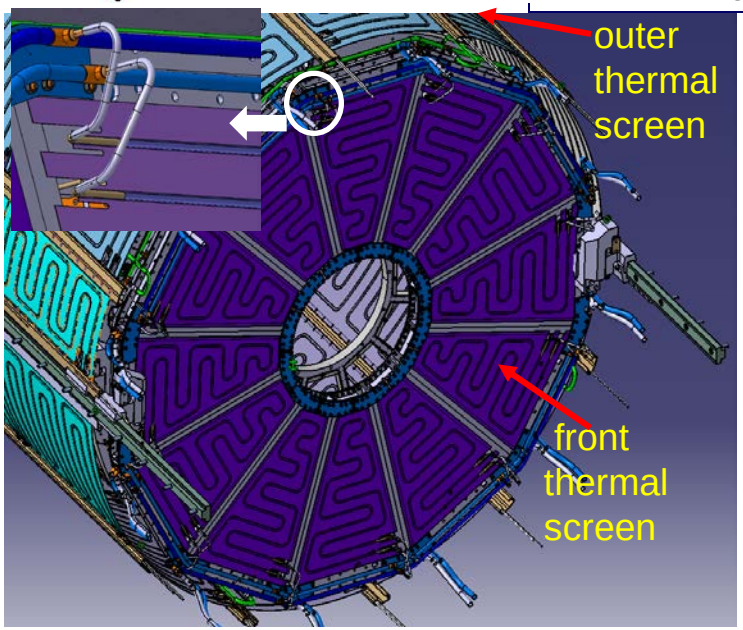
ready for production

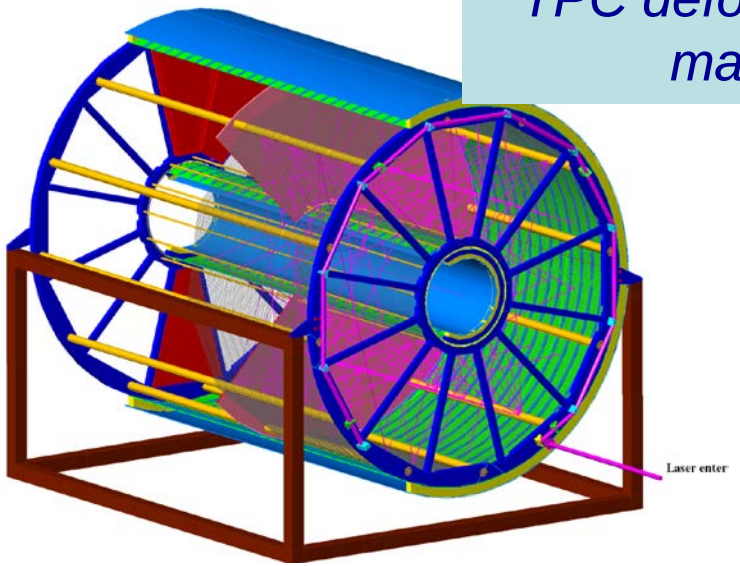






TPC deformation:
max = 32 μm





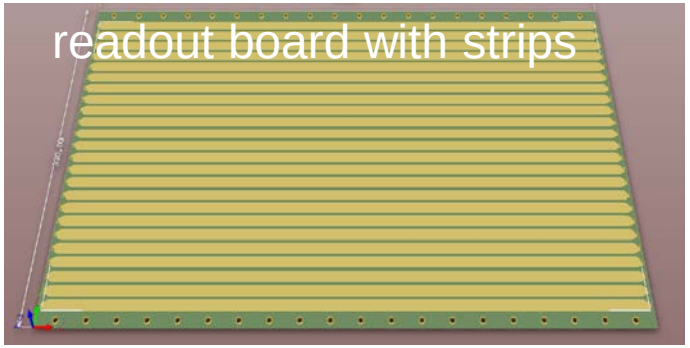
TOF Barrel

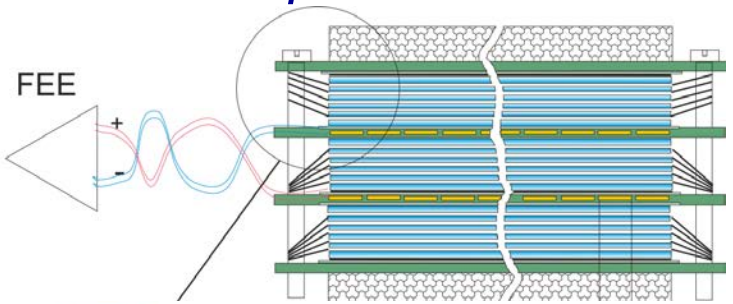
Leader: *V. Golovatyuk*

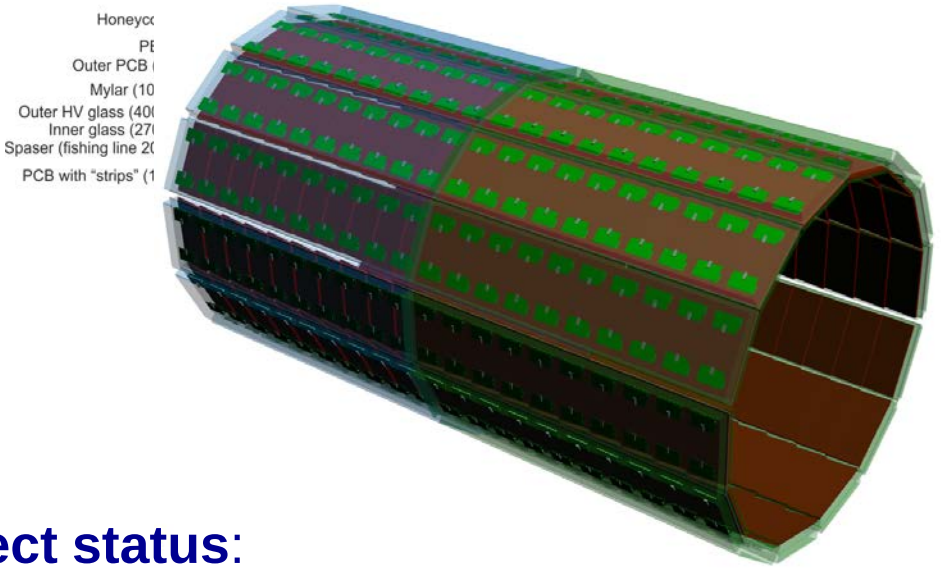
The barrel consist of 12 super-modules (*two modules connected together*)

active area of TOF barrel	~56 m^2
number of channels	13 824

triple-stack MRPC



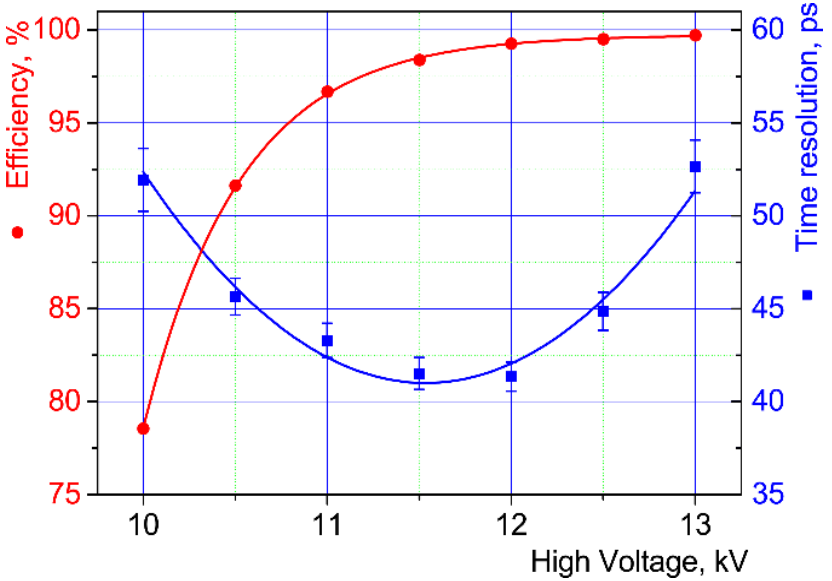




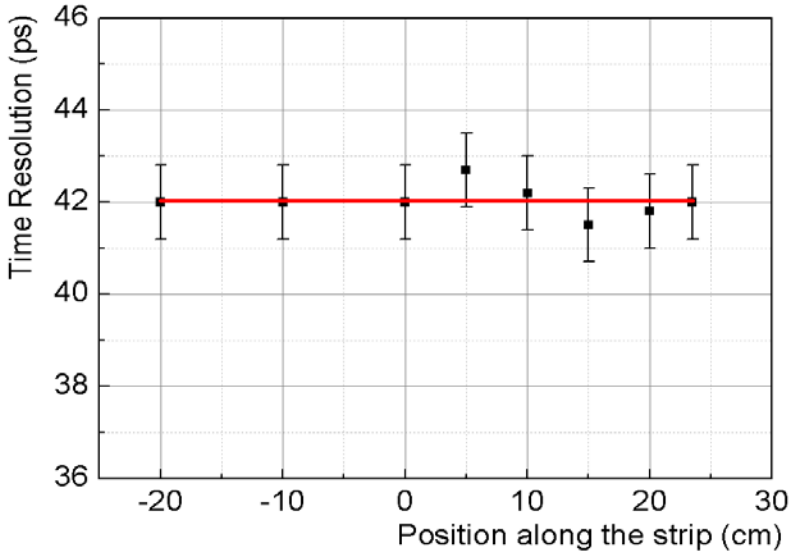
Project status:

- 90% readiness for the mass production

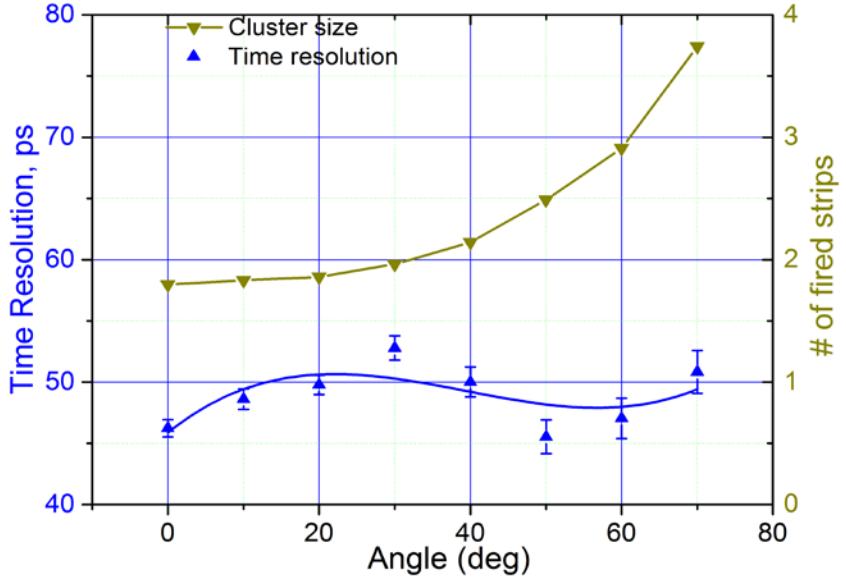
beam test results



Efficiency and time resolution of the MRPC versus HV



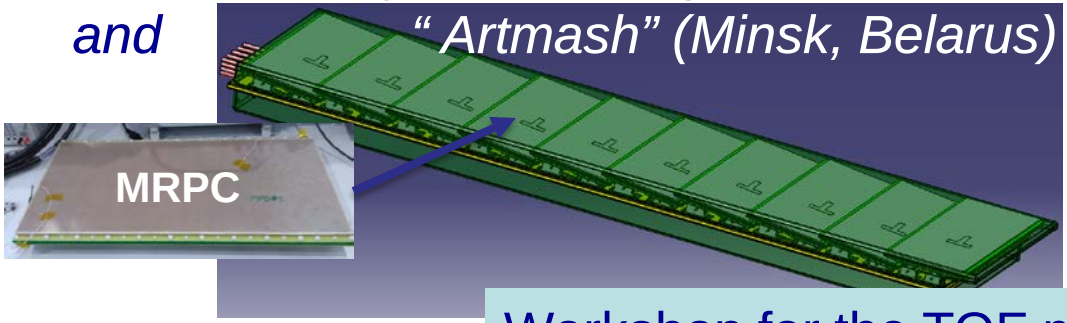
Time resolution in dependence from the position along strip



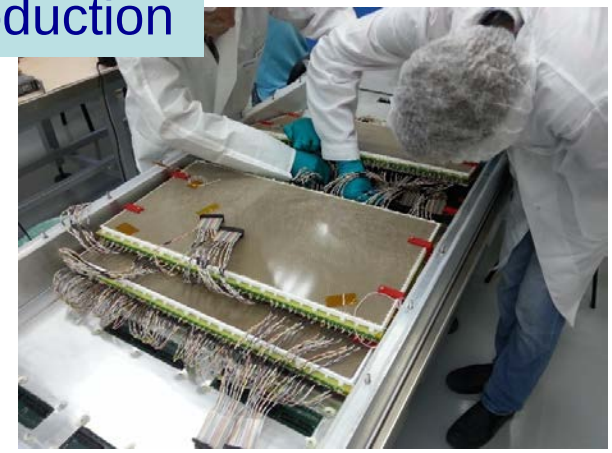
Time resolution in dependence of rotation in surface YZ

TOF Barrel: mass production preparation status

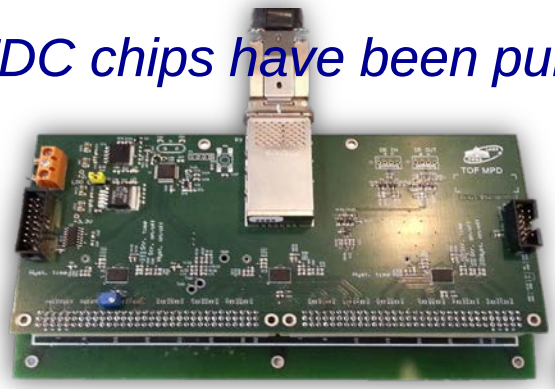
module housing was developed in close cooperation with NC PHEP BSU and "Artmash" (Minsk, Belarus)



Workshop for the TOF mass-production



basic elements - NINO & HPTDC chips have been purchased sufficient to produce read-out electronics for the TOF + reserve (~24000 channels).

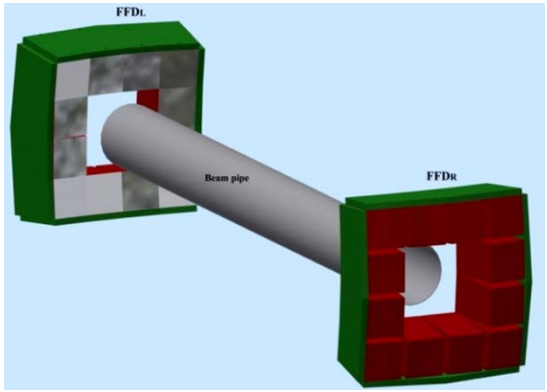


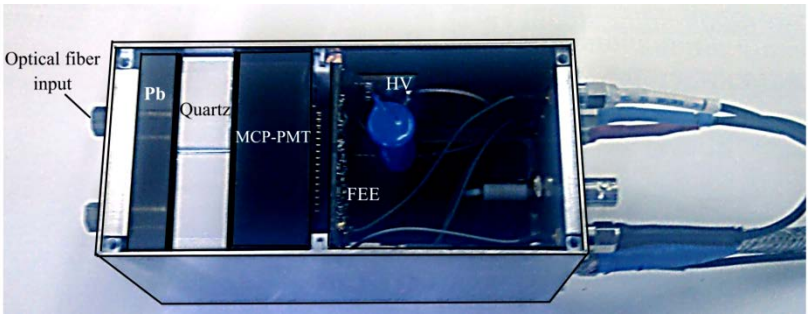
Fast Forward Detector (FFD)

Leader: *V. Yurevich*

JINR + Radium Institute (St.Petersburg).

Provides:
T0 for TOF, beam adjustment & collision L0-trigger





FFD prototype module

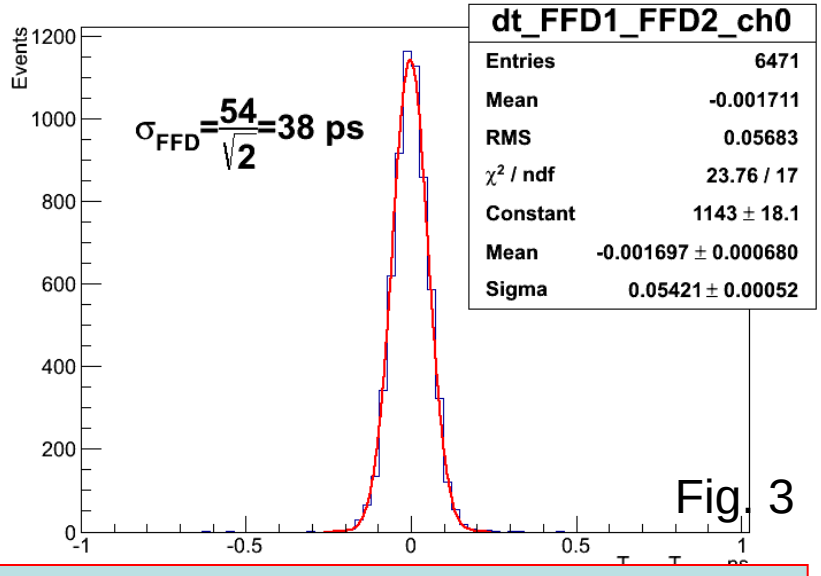


Fig. 3

the achieved time resolution fits the requirement

Status:
- *procurement of necessary elements;*
- *production in accordance with the schedule.*

Ecal (*shashlyk type*):

***TDR** - in preparation*

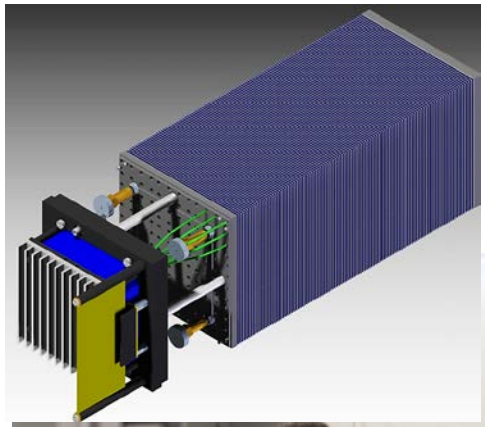
Leaders: *I. Tyapkin, A. Ol'shevsky*

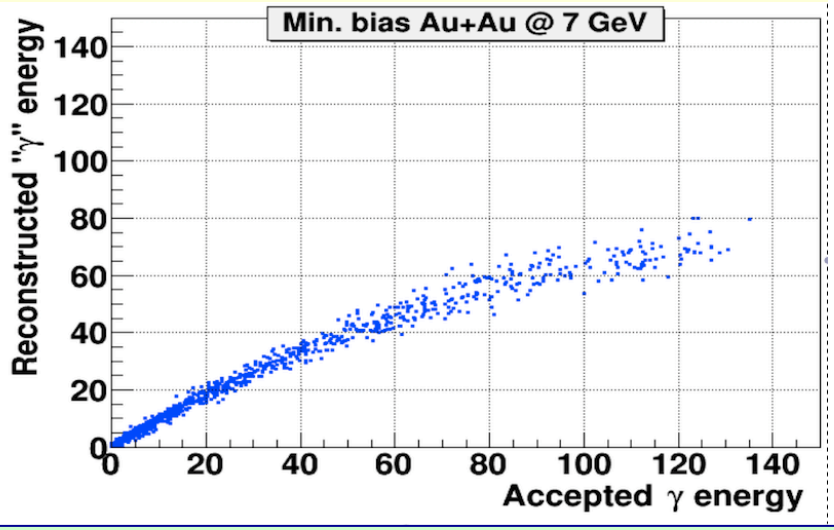
L ~35 cm (~ 14 X_0), Pb+Scint. (4x4 cm^2) read-out: WLS fibers + MAPD

integration with the MPD - design is completed

Agreement between **JINR** and **Tsinghua University** has been signed on:

- *participation in the MPD experiment;*
- *mass production of Ecal modules in China;*
- *production first 10 test modules*



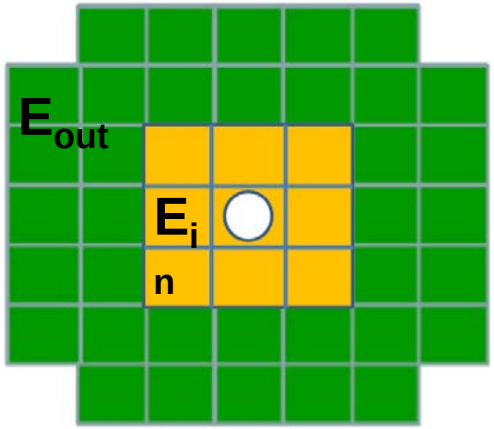


performance fits the requirements
the time scale without redundancy

FHCAL: for determination of reaction plane and centrality

Institute for Nuclear Research RAS **Leader**: *A. Ivashkin*

In cooperation with MEPhI



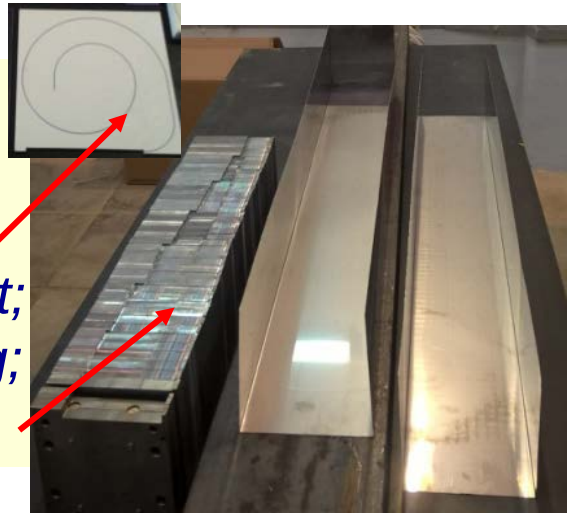
- 2-arm (left/right) calorimeter (at ~3.2 m from the IP)
- each arm consists of 45 modules.

Transverse granularity allows to measure:

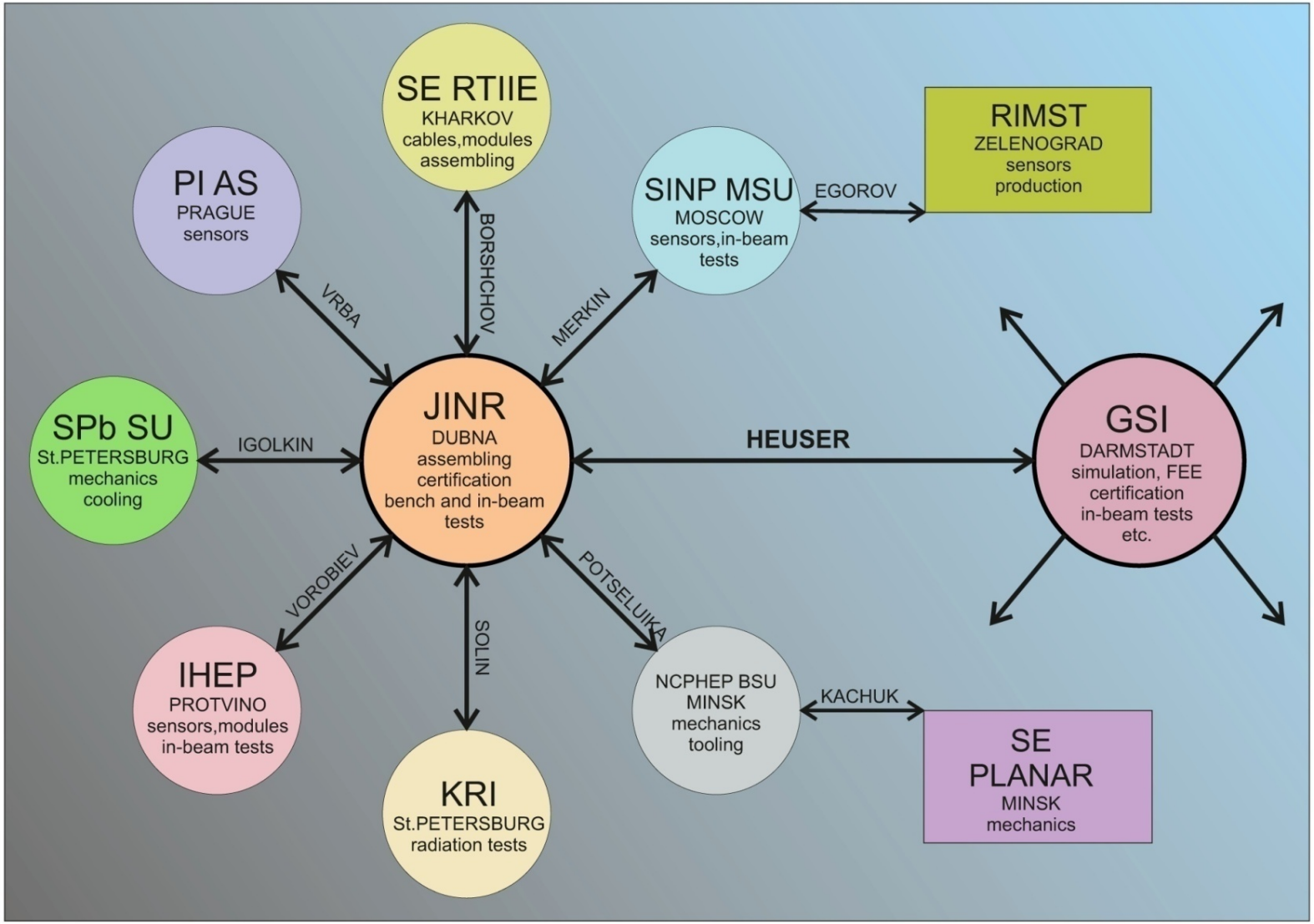
- *the reaction plane with the accuracy* **~ 20^0-30^0**
- *the centrality with accuracy below* **10%.**

module preproduction:

- *agreement on production of 90 mod for the whole FHCal has been signed;*
- *scintillator tiles are under production at Vladimir plant;*
- *lead absorber & mechanics are ready for assembling;*
- *first 9 FHCAL modules are under construction now.*



CBM-MPD consortium structure
for R&D and production of IT modules (since 2008)



IT: workshop for microstrip detector assembly & test

CBM-MPD consortium *for R&D and production of **IT** modules manifests efficient cooperation since **2008***

CERN** & **JINR** have signed **MoU** for manufacturing the STS carbon fiber space frames for **NICA** (BM@N & MPD) and **FAIR

the Probe-station automat for DSSD QA

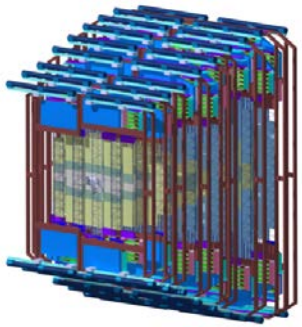
- put in operation

the clean room workshop has started operation in 2015.

D. Gross in the workshop

the first test stand for the in-beam tests of the assembled boards with silicon sensors – put in operation

BM@N ST comprises four first stations of CBM STS



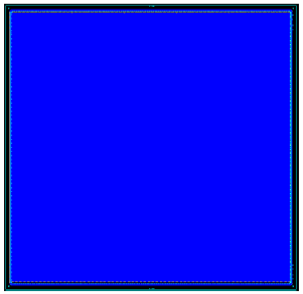
module

ladder

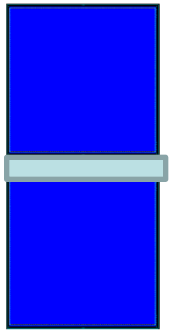
CBM STS: **8** stations
BM@N ST: **4** stations

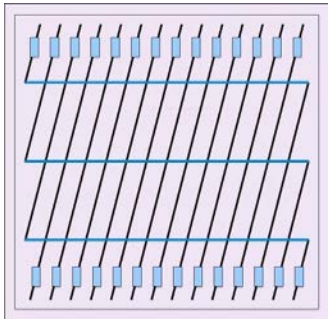
1220 sensors:
252 single /
324 daisy-pairs

900 / 220

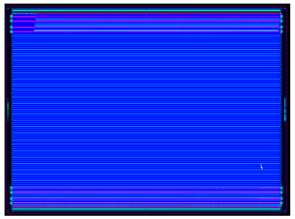


6.2 × 6.2 cm2

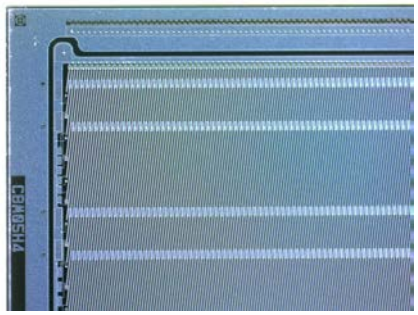




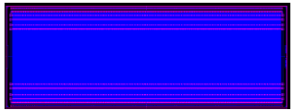
260 / 216



6.2 × 4.2 cm2



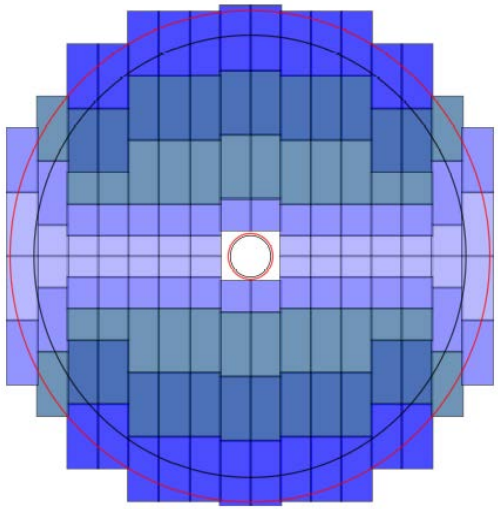
60 / 60



6.2 × 2.2 cm2

3.2 × 2.2 cm2

Double-sided-double-metalized sensors from Hamamatsu and CiS
(pitch 58 um, stereo angle 7,5 degrees)



sensor:
0.3% X_0

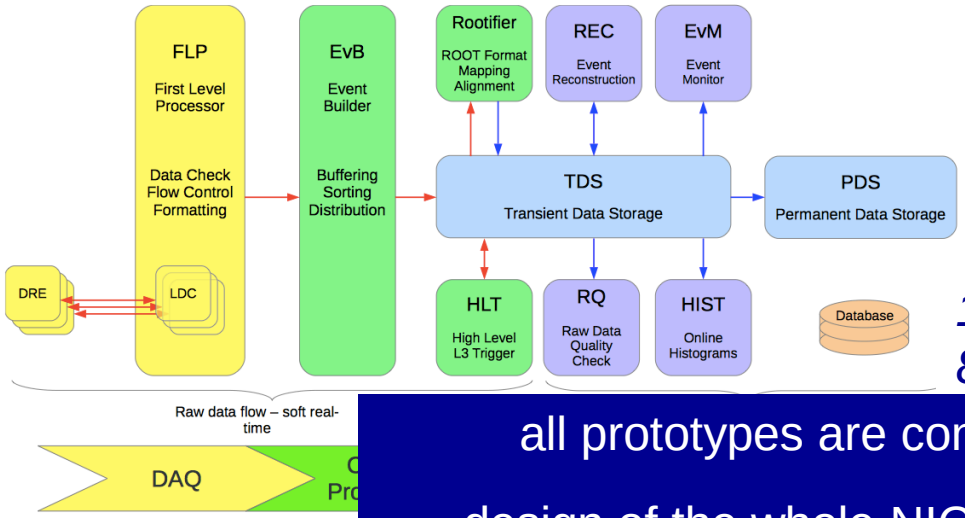
r/o cables:
2 × 0.11% X_0

+ a number of "half" sensors

Computing

Leader: *Yu. Potrebenikov*

Data processing pipeline



On-line prototype & network rack

160 × 3 GHz CPU cores, 1024 GB RAM, 8.5 TB Flash Memory, 2 ×10 Gb Ethernet les in 16U on 4 TB

all prototypes are constructed and tested;

design of the whole NICA cluster is in progress

LHEP off-line cluster (prototype)

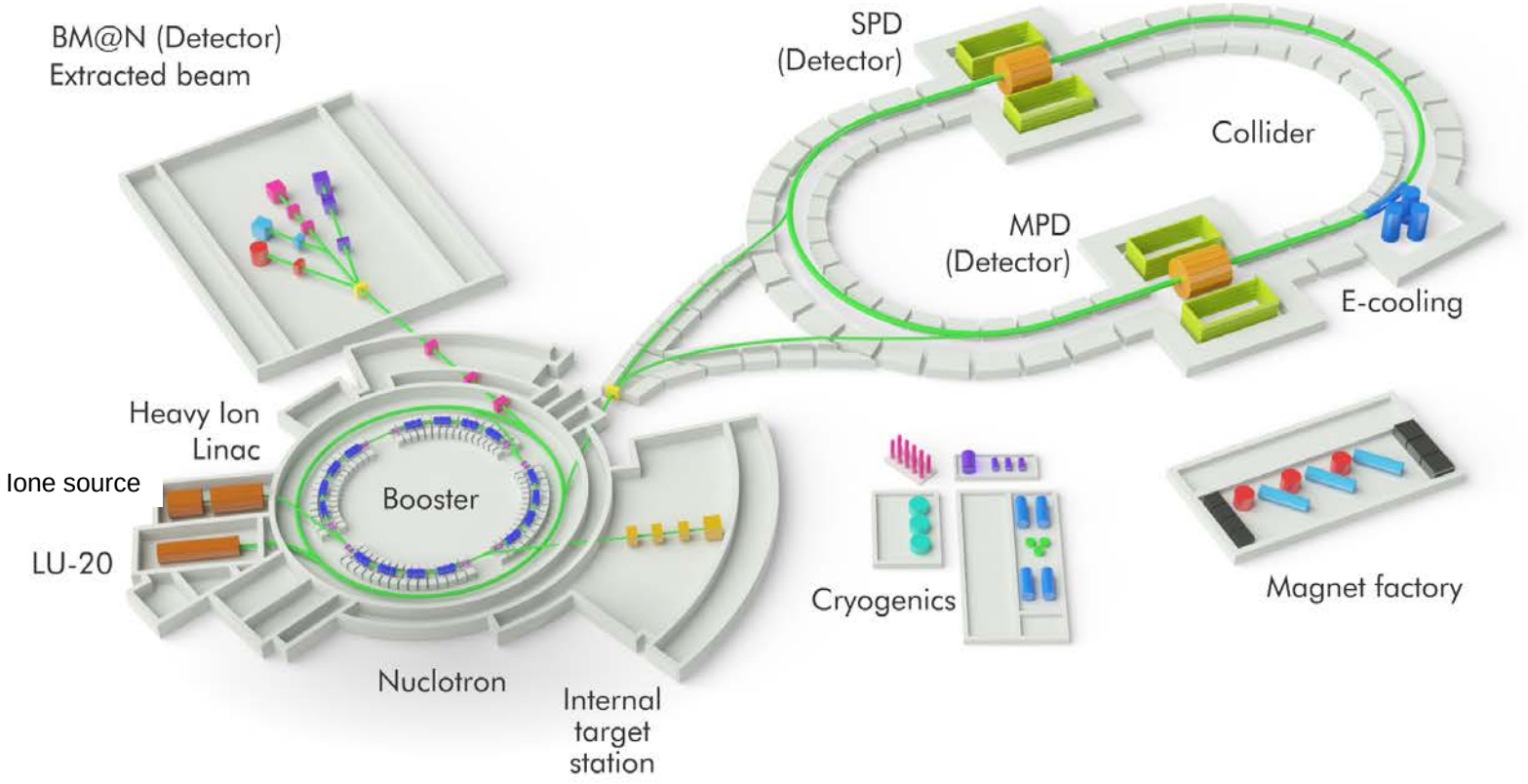
15 servers: 4 interactive,
11 batch hosts, 350 CPU cores
130TB disk space (*replicated*)

Data storage (LIT):
> 10 PB RAW data p/y
after 2020

Needs:

- Comp. CPU – 5 000 GHz
- CPU cores – 1600
- Comp. RAM – 10 000 GB
- Disc storage – 2 200 TB
- Mass storage – 20

some events


BM@N (Detector)
Extracted beam
SPD
(Detector)
Collider
MPD
(Detector)
E-cooling
Heavy Ion
Linac
Ione source
Booster
LU-20
Cryogenics
Magnet factory
Nuclotron
Internal
target
station

*In the medium-term prospect the NICA complex will be the only facility in Europe providing unique high intensity ion beams (from **p** to **Au**, **p**↑ and **d**↑) **in the energy range** from **2 – 27 GeV** (c.m.s.), which could be used for both fundamental and applied researches.*

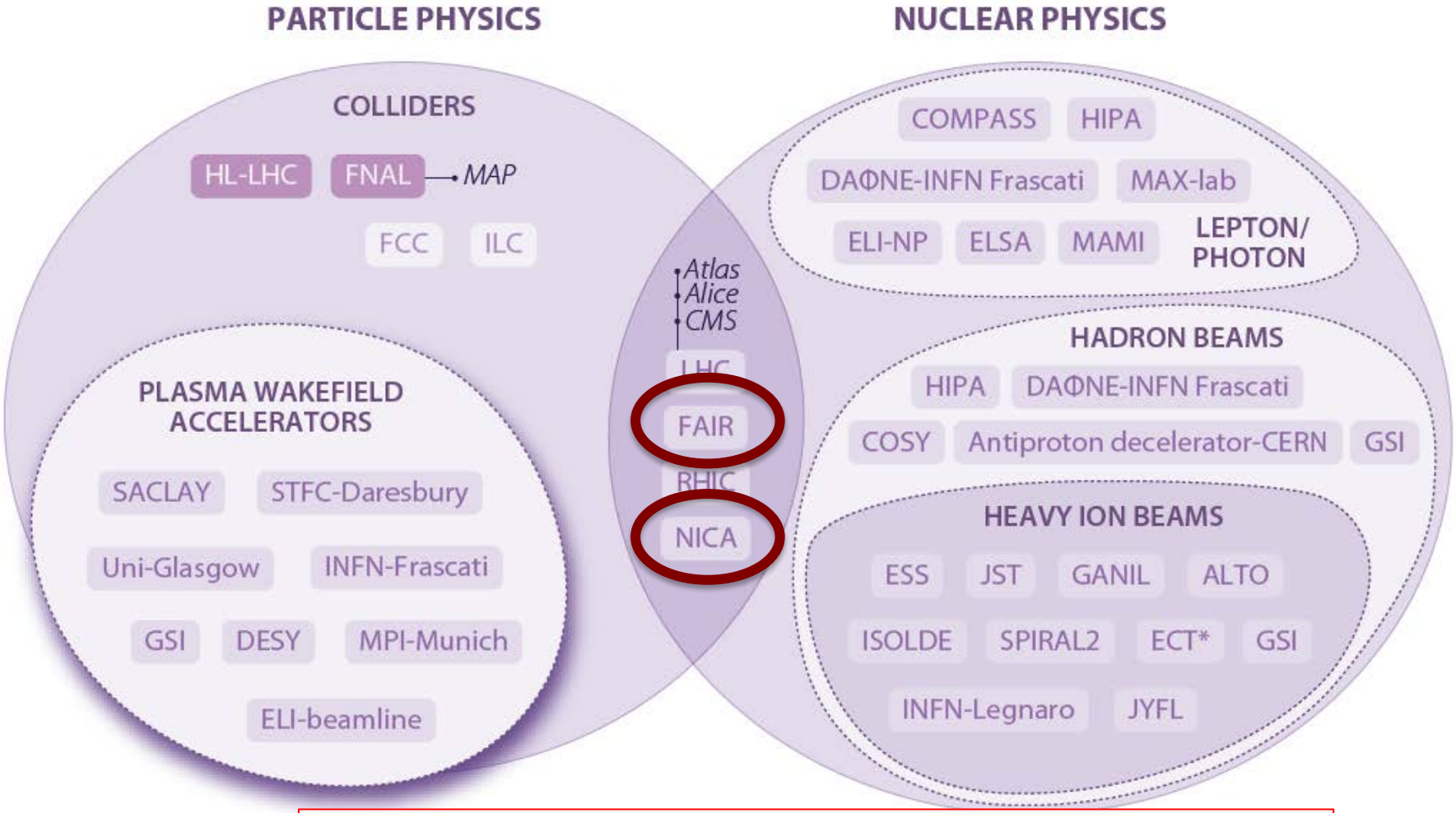
Researches at the NICA complex will contribute to

- *discovery and study of new forms of nuclear matter;*
- *comprehensive study of nucleon spin structure;*
- *applied researches, like irradiation of biological objects by heavy ion beams (space mission program) etc.*

*"It is clear that both **FAIR** and **NICA** could have an advantage in developing and extending explicitely their collaboration…."*

New issue of the ESFRI Roadmap

Main Research Infrastructure in Particle and Nuclear Physics



NICA & FAIR – Complementary Projects

RF Governmental disposal

ПРАВИТЕЛЬСТВО РОССИЙСКОЙ ФЕДЕРАЦИИ

РАСПОРЯЖЕНИЕ

от 27 апреля 2016 г. № 783-р

МОСКВА

О подписании Соглашения между Правительством Российской Федерации и международной межправительственной научно-исследовательской организацией Объединенным институтом ядерных исследований о создании и эксплуатации комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA

1. В соответствии с пунктом 1 статьи 11 Федерального закона "О международных договорах Российской Федерации" одобрить представленный Минобрнауки России согласованный с МИДом России, Минфином России, Минэкономразвития России и международной межправительственной научно-исследовательской организацией Объединенным институтом ядерных исследований проект Соглашения между Правительством Российской Федерации и международной межправительственной научно-исследовательской организацией Объединенным институтом ядерных исследований о создании и эксплуатации комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA (прилагается).

2. Поручить Минобрнауки России провести переговоры с международной межправительственной научно-исследовательской организацией Объединенным институтом ядерных исследований и по достижении договоренности подписать от имени Правительства Российской Федерации указанное в пункте 1 настоящего распоряжения Соглашение, разрешив вносить в прилагаемый проект изменения, не имеющие принципиального характера.

2947103

3. Определить вклад Российской Федерации в создание базовой конфигурации комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA до 2020 года в размере 8800 млн. рублей (в ценах 2013 года) за счет средств федерального бюджета.

4. Минобрнауки России выделить в 2016 году 4837,9 млн. рублей на уплату взноса Российской Федерации в международную межправительственную научно-исследовательскую организацию Объединенный институт ядерных исследований в целях финансового обеспечения создания комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA за счет бюджетных ассигнований, предусмотренных Минобрнауки России Федеральным законом "О федеральном бюджете на 2016 год", в том числе за 2016 год в объеме 1490 млн. рублей, за 2017 год в объеме 2340 млн. рублей, за 2018 год в объеме 1007,9 млн. рублей.

5. Минфину России, Минобрнауки России начиная с формирования проекта федерального бюджета на 2018 год и последующие периоды предусматривать ежегодно дополнительные бюджетные ассигнования федерального бюджета на увеличение объемов финансирования государственной программы Российской Федерации "Развитие науки и технологий" на 2013 - 2020 годы в целях доведения вклада Российской Федерации в создание базовой конфигурации комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA до размера, указанного в пункте 3 настоящего распоряжения.

Председатель Правительства
Российской Федерации Д.Медведев

Agreement

СОГЛАШЕНИЕ

между Правительством Российской Федерации и международной межправительственной научно-исследовательской организацией Объединенным институтом ядерных исследований о создании и эксплуатации комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA

Правительство Российской Федерации и между
межправительственная научно-исследовательская орг
Объединенный институт ядерных исследований (далее - Объед
институт ядерных исследований), в дальнейшем именуемые Стор
выражая общее желание содействовать укреплению по
Российской Федерации и Объединенного института ядерных иссл
в области проводимых научно-технических и иннова
исследований в соответствии со статьей 30 Соглашения
Правительством Российской Федерации и Объединенным ин
ядерных исследований о местопребывании и об условиях деят
Объединенного института ядерных исследований в Российской Ф
от 23 октября 1995 года,
стремясь создать комплекс сверхпроводящих колец на в
пучках тяжелых ионов NICA (Nuclotron-based Ion Collider
обладающий беспрецедентными параметрами в области иссл
физики частиц и ядер высоких энергий и обеспечивающий воз
его применения для инновационных разработок в приоритетных областях
научных знаний, техники и технологий,
согласились о нижеследующем:

Статья 1

between
the RF Government
and
the Joint Institute for Nuclear Research

has been signed

Concluding remarks

- **The construction of accelerator complex and both detectors BM@N & MPD *is going close to the schedule***
- **Physics program development is in progress; it indicates competitiveness with other experiments**
- **The NICA and FAIR projects are well recognized and accepted by the scientific community**
- **The cooperation between NICA & FAIR is well developing**

the cooperation makes us stronger!

Thank you!