

NICA Days, WUT Warsaw, October 2019

GSI/FAIR-JINR cooperation



- Since 1980:
 Experimental collaboration in radiobiology and superheavy elements.
- Since 2000: Participation of JINR groups in the development of FAIR accelerators and experiments.

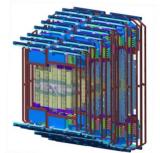




Test facility for superconducting magnets at JINR



Quadrupole Magnets for SIS100





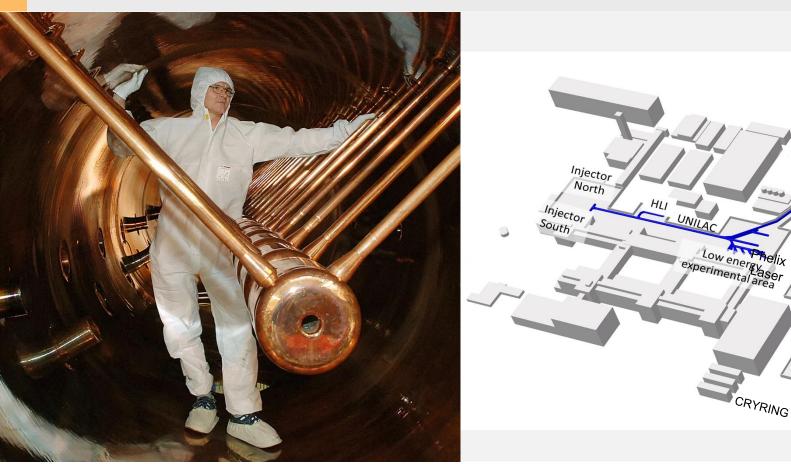
Joint development of Silicon tracking detectors

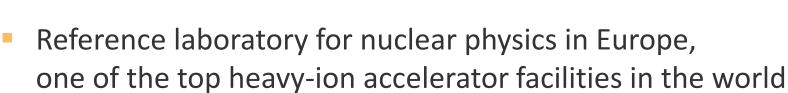
GSI –50 Years of Scientific and Technical Competence



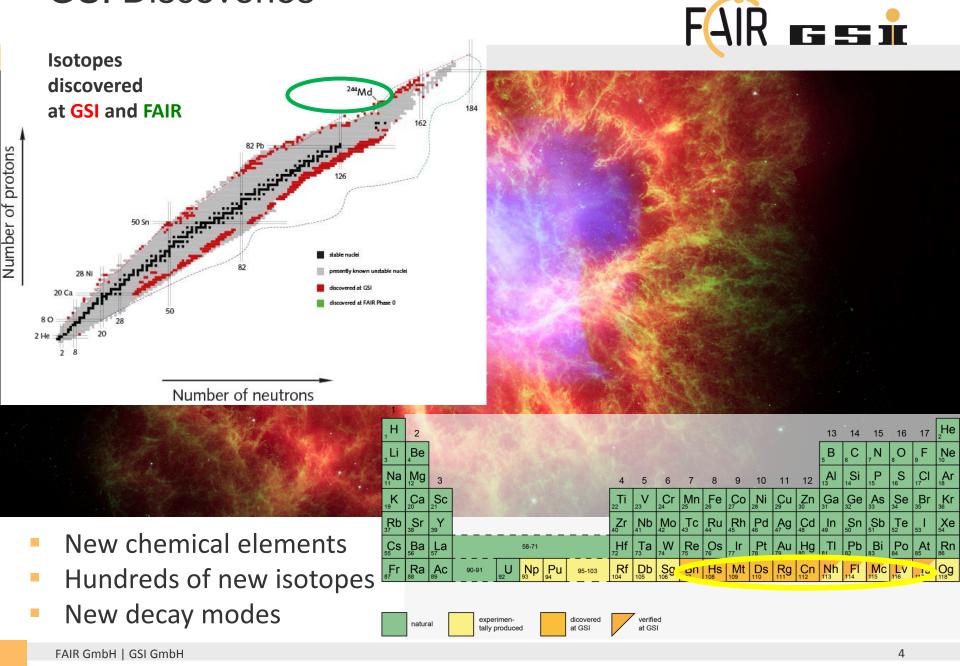
(216 m)

High energy experimental area



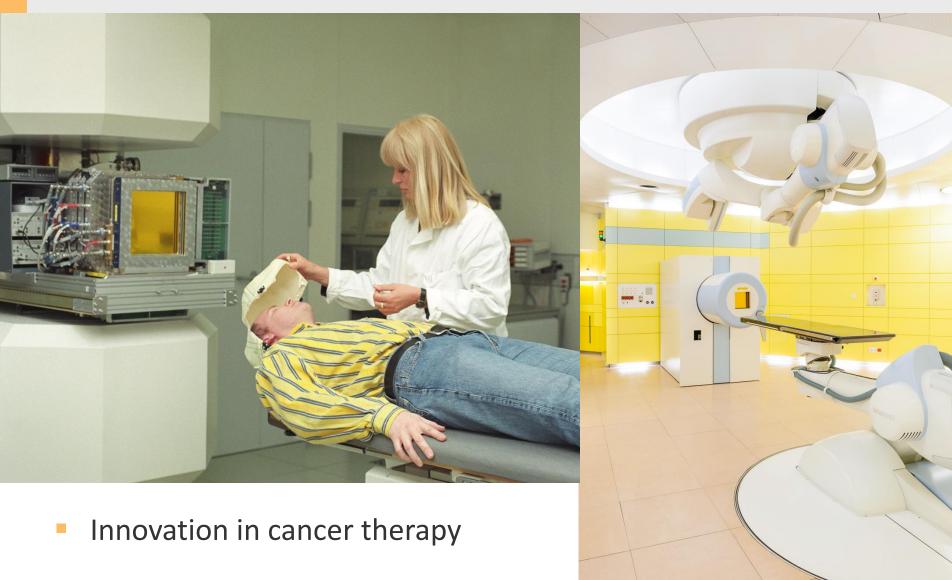


GSI Discoveries

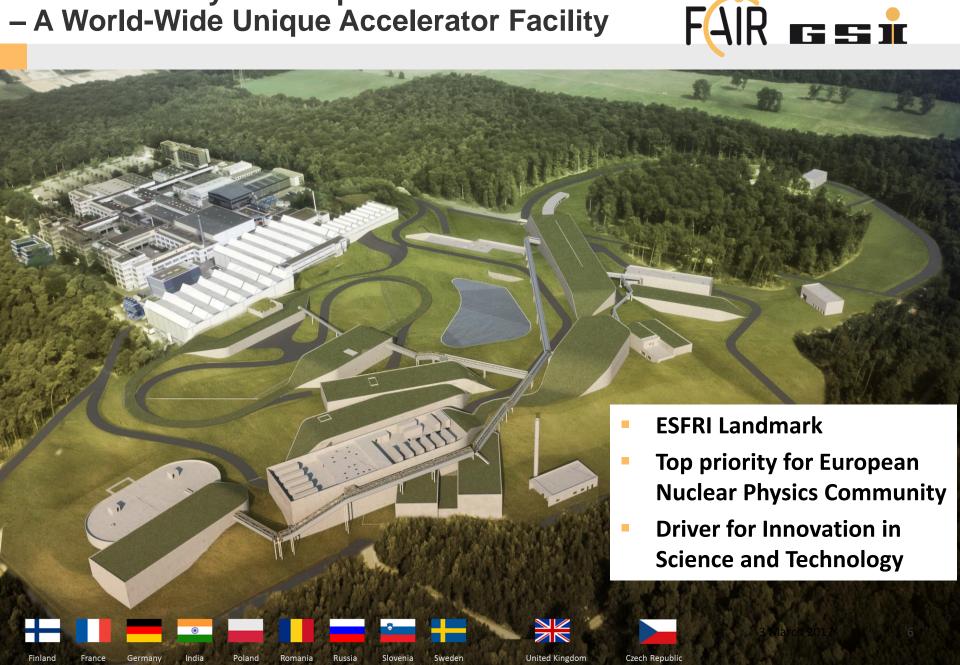


GSI Discoveries



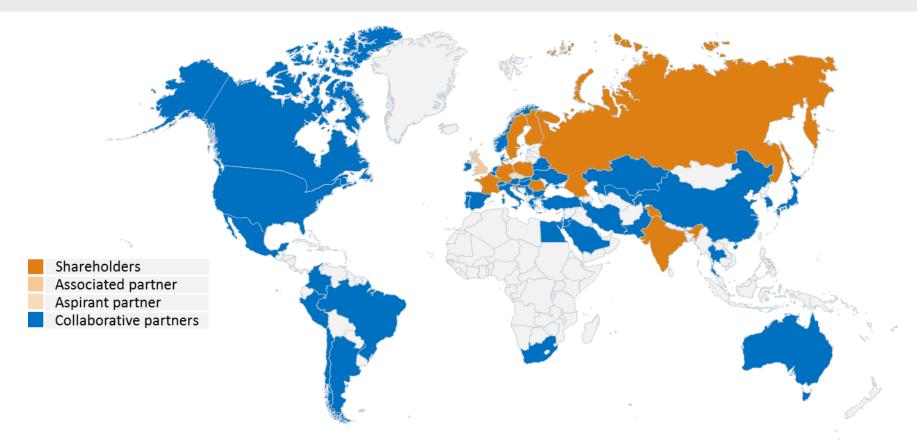


FAIR: Facility for Antiproton and Ion Research - A World-Wide Unique Accelerator Facility



FAIR: International Cooperation





- 9 international FAIR Shareholders
- 1 Associated Partner (United Kingdom)
- 1 Aspirant Partner Czech Republic (Since 2018)

Participation of **3.000 scientists from all continents**

Status of FAIR Project: Civil Construction Progress since official start on 4th of July 2017









Status of FAIR: Accelerators: construction / procurement progress



~ 60 sc dipole SIS100 modules manufactured at BNG and 55 shipped to GSI and tested



SIS100 quadrupole units shipped from JINR to BNG for integration into FOS module



All 51 HEBT vacuum chambers of batch 1 delivered (BINP, Russia)



The series production of RF – debunchers



All HESR Dipoles are produced, in Jülich and 65% are delivered to FAIR

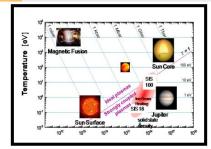


Delivery of 1st 6 series Power Converter from India, (ECIL, India)



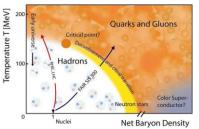
The FAIR science: four pillars





atomic physics, biophysics, plasma physics, material research





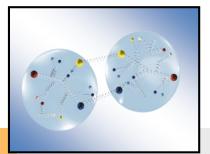
nuclear- and quark-matter





nuclear structure and nuclear astrophysics





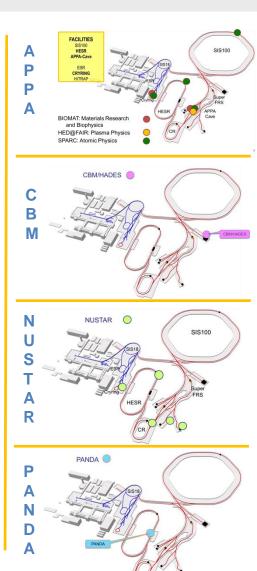
hadron structure and dynamics



Schedule for FAIR Science



- Working towards the completion of FAIR by 2025
- Major thrust is on construction of FAIR accelerators and experiments.
- At the same time staged approach to FAIR science and progressive commissioning of accelerators and detectors:
 - FAIR phase 0 : start in 2018/2019
 - FAIR day 1 configurations/ phase 1 experiments with FAIR accelerators progressively approaching design parameters → 2024/25 ...
 - Full FAIR operation 2025+



Russian partner institutes at FAIR leading players, with JINR in the frontline!







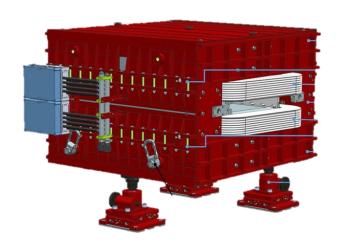
Collector ring being constructed at BINP



- 90 % of CR specifications has been released
- The series production of RF debunchers is ongoing
- CR Rest Contract with BINP (Russia) has been signed in June 2018.
- Power amplifier prototype for Stochastic Cooling system has been produced and SAT successfully tested



FoS RF-debuncher



CR dipole design

FAIR Accelerator – Commons ...



- All 51 HEBT vacuum chambers of batch 1 delivered (BINP, Russia)
- 21 of 51 HEBT Dipoles from serial production delivered (Efremov)





First of Series of SIS100 Quadrupole Magnets successfully cold-tested at JINR...

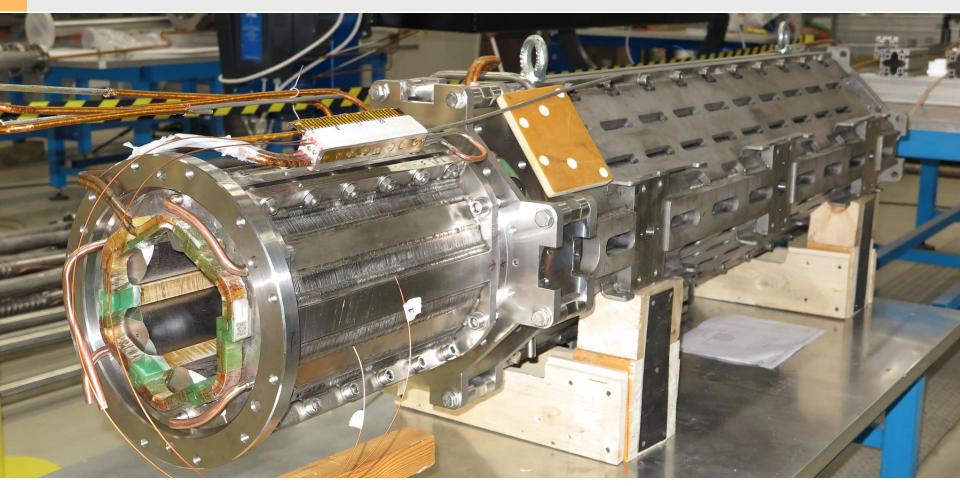


SIS100 quadrupole unit mounted in the test cryostat (blue) at JINR, Dubna

Cold-Test Facility at JINR, Dubna

Co-Operation with JINR in Forefront Technologies



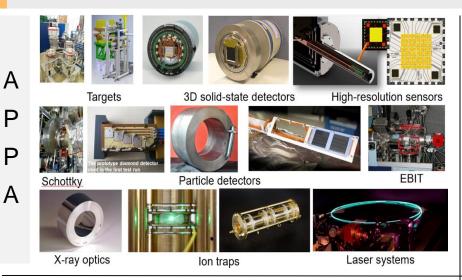


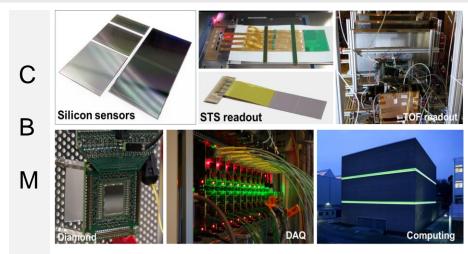
Cutting edge development of sophisicated super-conducting magnet technologies

FAIR experiments:

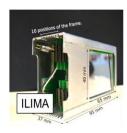
detector R&D and construction well on track ...













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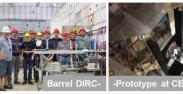
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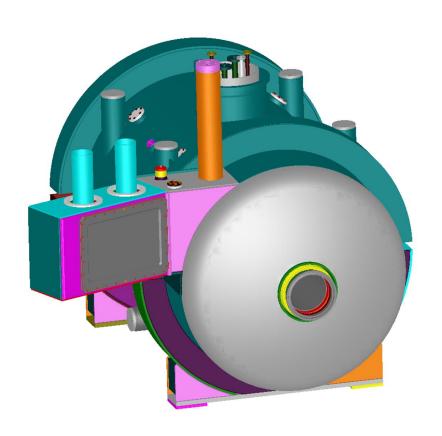




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IHEP Protvino: APPA, HED@FAIR





Design fixed for 4 supracond. magnets by IHEP Protvino

INR, Moscow: CBM PSD

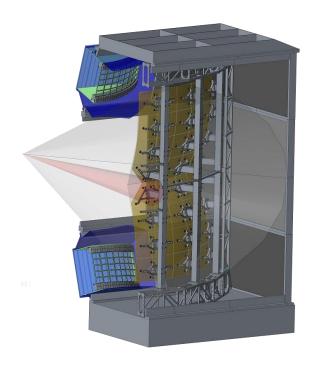




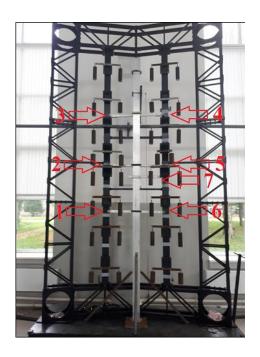
CBM Calorimeter modules setup for usage at BM@N

PNPI, Gatchina: CBM MUCH and RICH





CAD design of RICH mirror mount



Prototype of RICH mirror mount

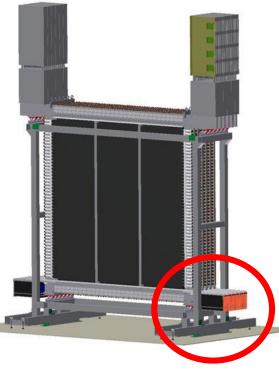
PNPI, Gatchina: HV distribution system NeuLAND







NeuLAND@GSI

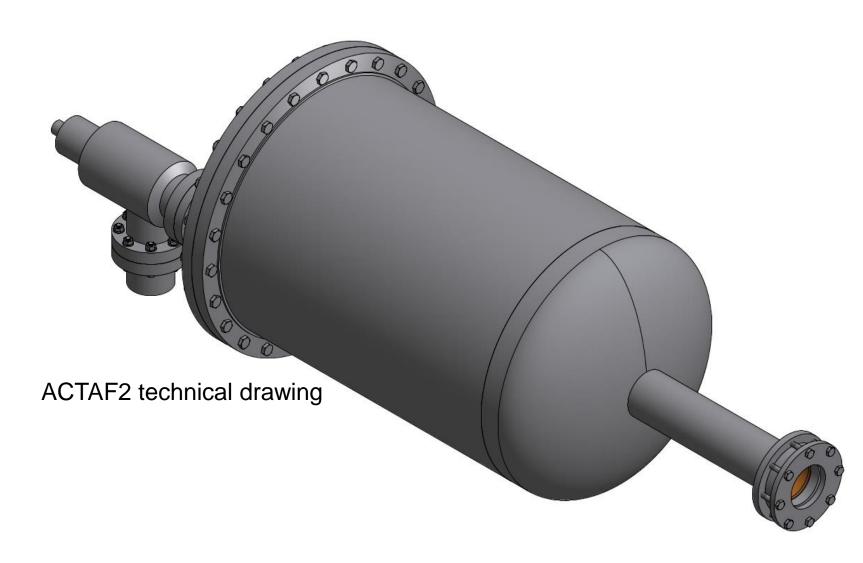


HV power supply module (distribution board)
About 60 out of 120 delivered



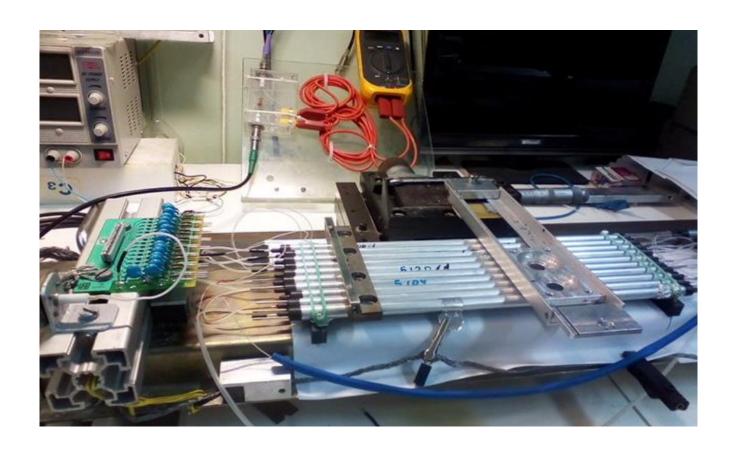
PNPI, Gatchina: : ACTAF2





PNPI, Gatchina: : Proton arm spectrometer

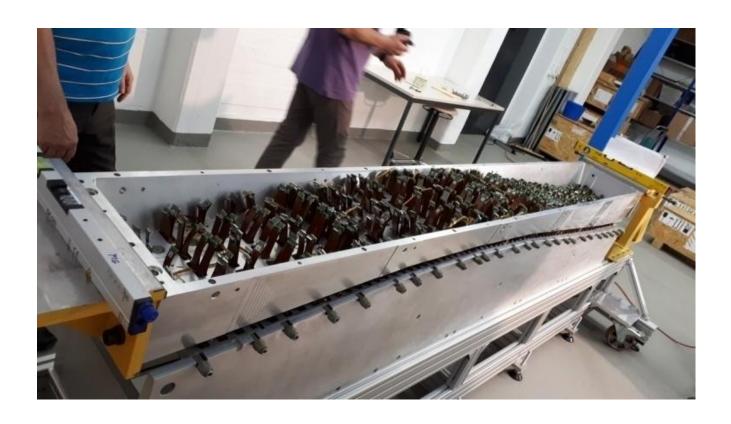




HV Test of straw tubes @ PNPI Series production in progress

IHEP Protvino: PANDA EMC





Carbon fibre alveoles for EMC by IHEP Protvino

BINP, Novosibirsk: PANDA Solenoid



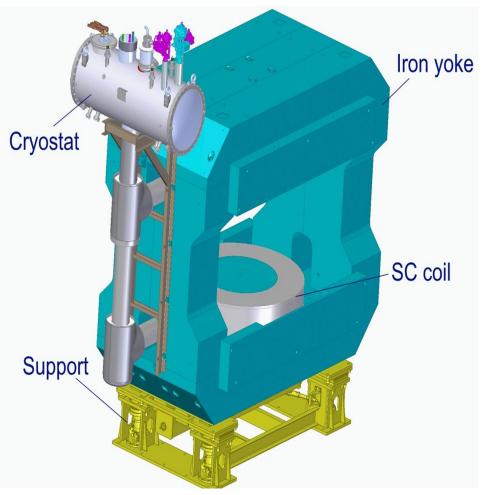


Extrusion test for SC cable prototype

Yoke production: 2 of the fully completed octants

BINP, Novosibirsk: CBM SC dipole magnet







Six cables for 3 coils were manufactured in December 2018 by Bochvar Institute,



Photo of the cross section of the superconducting cable

Machining of yoke will start in November 2019.

JINR, Dubna: CBM STS

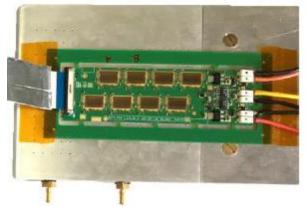




150 m² clean rooms, Solid State Section



Jig for sensor bonding



Mounted bare-die ASICs

JINR FLNR, Dubna: CALIFA forward endcap crystals



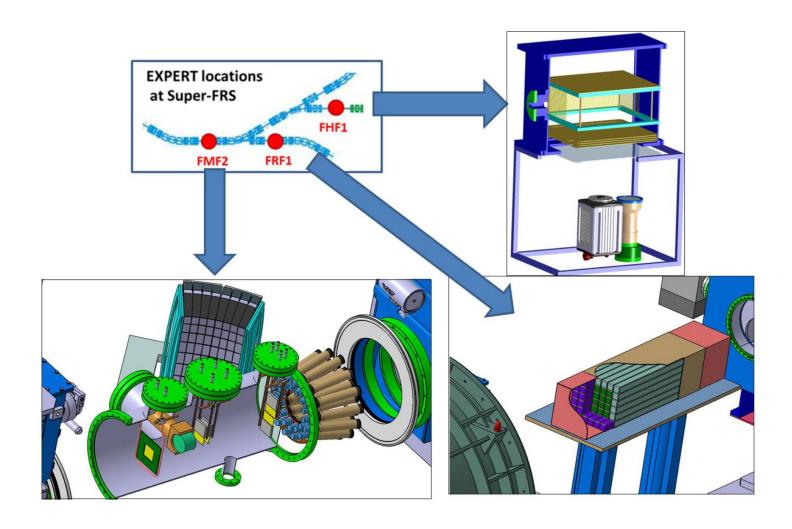
Csl Crystals



First batch delivered in June 2019

FLNR – JINR, Dubna: EXPERT

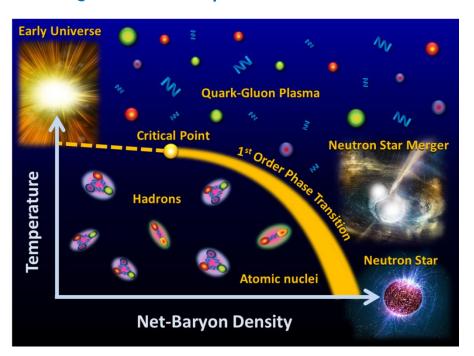




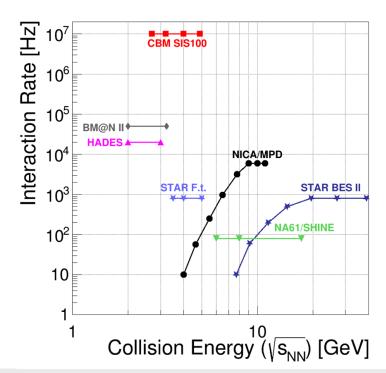
NICA and CBM@FAIR



Common physics program
Production and investigation of
nuclear matter with densities like
in the core of neutron stars.
Search for phase transitions and
the QCD critical point



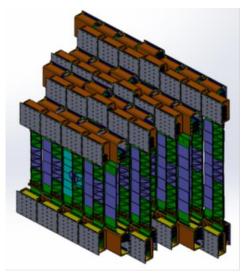
Complementary approach
NICA Collider:
high collision energies
CBM experiment at FAIR:
high interaction rates



Silicon tracking systems and high-speed readout electronics



Silicon tracker for NICA



Prototype detector modules with micro-cables and readout electronics



Detector assembly in clean rooms at GSI and JINR

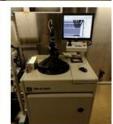












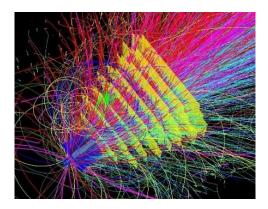


EU project CREMLINplus



Science Cooperation between European Research Infrastructures and the Russian megascience projects (NICA, PIK, USSR, SCT and EXCELS)

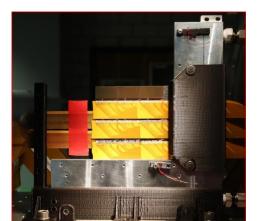
Proposal (under evaluation): 4-year-project – starting end 2019, **Total Budget: 25 M€ Consortium:** 35 participants from 12 countries - 25 European laboratories 10 Russian laboratories 10 working packages (WPs), GSI/FAIR involvement in WP2 and WP7



WP2: Collaboration with NICA - Development of instrumentation for NICA and FAIR/CBM

Engineering and construction of fast detectors,
Development of high rate data acquisition chain and software packages for simulation and data analysis
Budget 4.61 M€

Participants: JINR (9 FTE), FAIR (8.5 FTE), U Tübingen (1 FTE), WUT Warsaw (2 FTE), Wigner Budapest (2 FTE), MEPhI (4 FTE), INR Moscow (1 FTE), NPI Prague (2 FTE)



FAIR GmbH | GSI GmbH

WP7: Joint development of detector technologies

Develop a beyond state of the art CMOS pixel sensors (MAPS) for high-rate Silicon trackers for several particle physics and heavy-ion research communities in Europe and Russia for the potential upgrade of many experimental setups

Development of neutron detectors, detector school at BINP Budget 1.8 M€

Participants: JINR (1 FTE), FAIR (1 FTE), DESY (1 FTE), U Frankfurt (1 FTE), IPHC Strasbourg (1 FTE), KINR Kiev (1 FTE), ESS (1FTE), PNPI (1 FTE), BINP

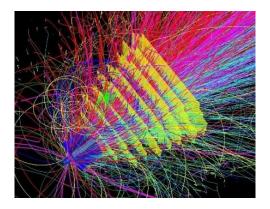


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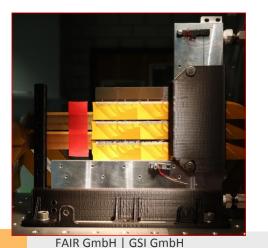
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German Russian scientific cooperation agreement (Roadmap) Intended Workpackages for NICA

Implementation of the German-Russian 10 year roadmap with respect to NICA German Contributions to JINR in the pillar I — Cooperation in the area of large research infrastructure development s

WP	Topic	Value M€
0	Coordination and technical follow-up	0.4
1	Stochastic cooling for the NICA Collider	2.3
2	Beam diagnostics and LLRF electronics for linear accelerators	1.8
3	Silicon tracking system for the NICA BM@N experiment	9.8
4	Readout electronics and data acquisition for the NICA BM@N experiment	4.5
5	R&D for superconducting high intensity ion injector Linacs@JINR	1.2

TOTAL: value 20.0 M€
All numbers are full cost estimates

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Looking forward to many more years of intense cooperation between FAIR and JINR!



Accelerator and Experimental Facilities available for FAIR phase-0



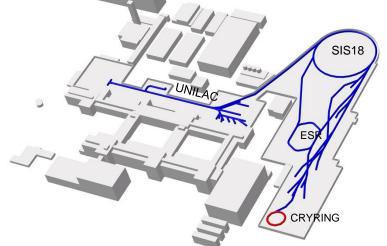




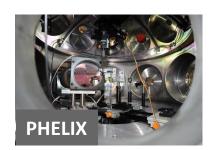


















First beam on miniCBM@SIS18

A glimpse of actual beam-ready miniCBM setup which received beam on target.

Data from individual read-out chains of the subsystems mSTS, mMUCH and mTOF is possible.



mMUCH

mTRD

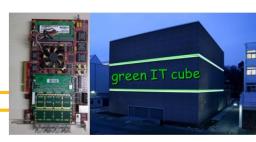




A CBM full system test-setup for high-rate nucleus-nucleus collisions at GSI/FAIR

- > CBM prototype detector systems
- free streaming read-out and data transport to the mFLES
- up to 10 MHz collision rate
- > first commissioning beam in December 2018





FAIR IS IS I



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mTOF