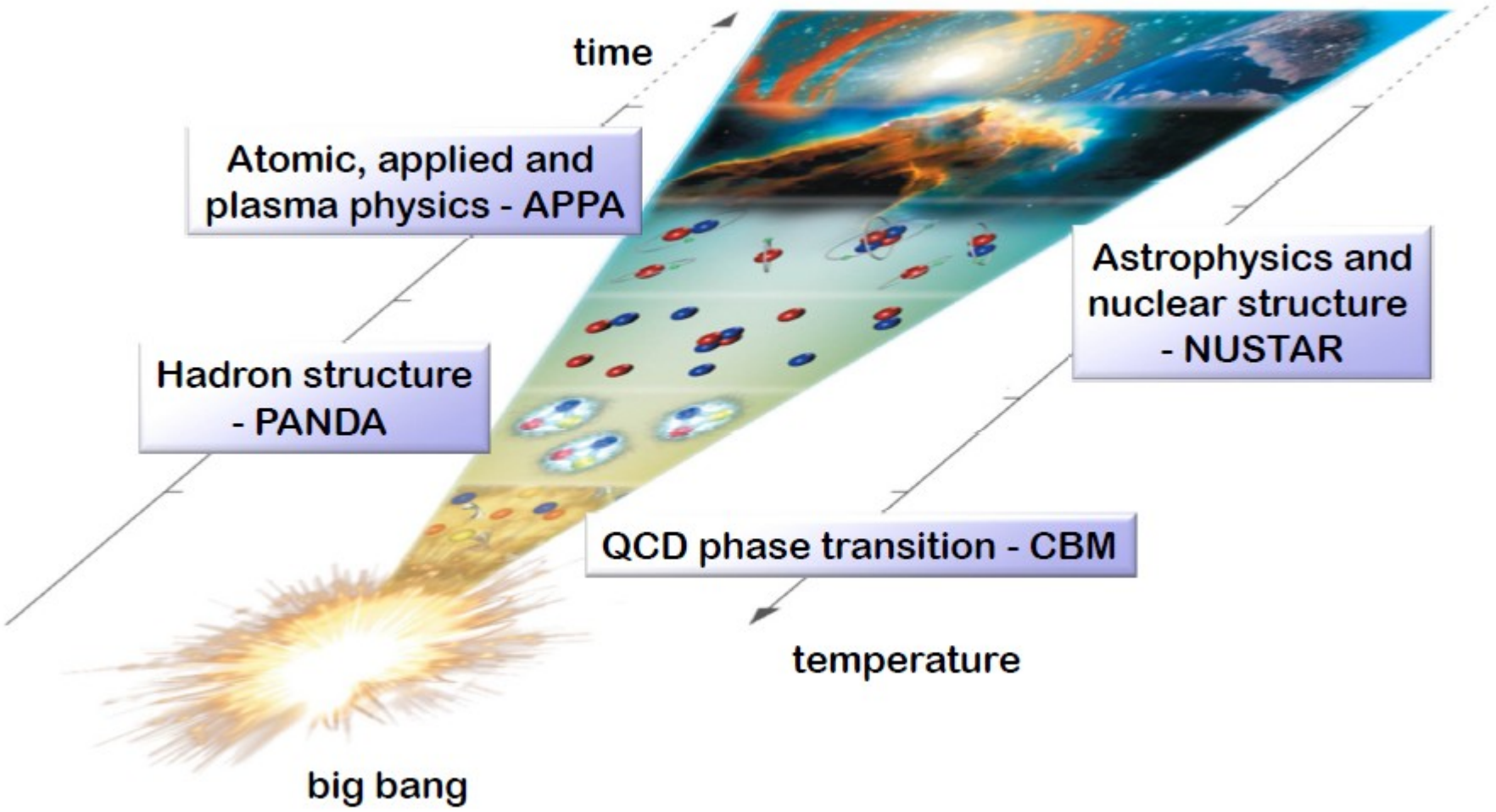
Статус проекта FAIR

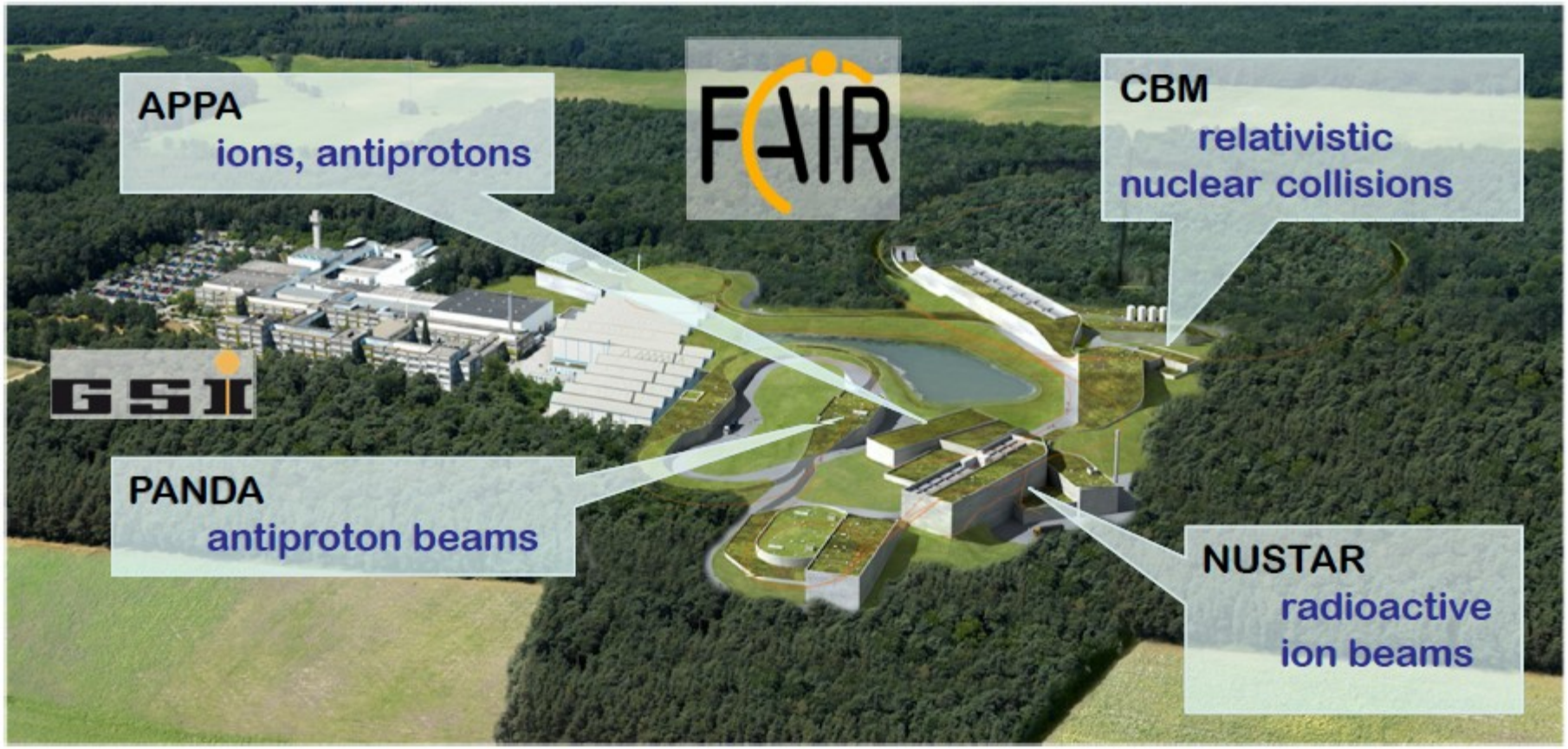
(Facility for Antiproton and Ion Research)

Austria China Finnland France Germany Greece India Italy Poland Slovakia Slovenia Spain Sweden Romania Russia UK

FAIR Science Sketch



The FAIR Project



Facility for Antiproton and Ion Research

Primary Beams

- 10^{12}/s; 1.5 GeV/u; $^{238}U^{28+}$
- 10^{10}/s $^{238}U^{73+}$ up to 35 GeV/u
- 3x10^{13}/s 30 GeV protons

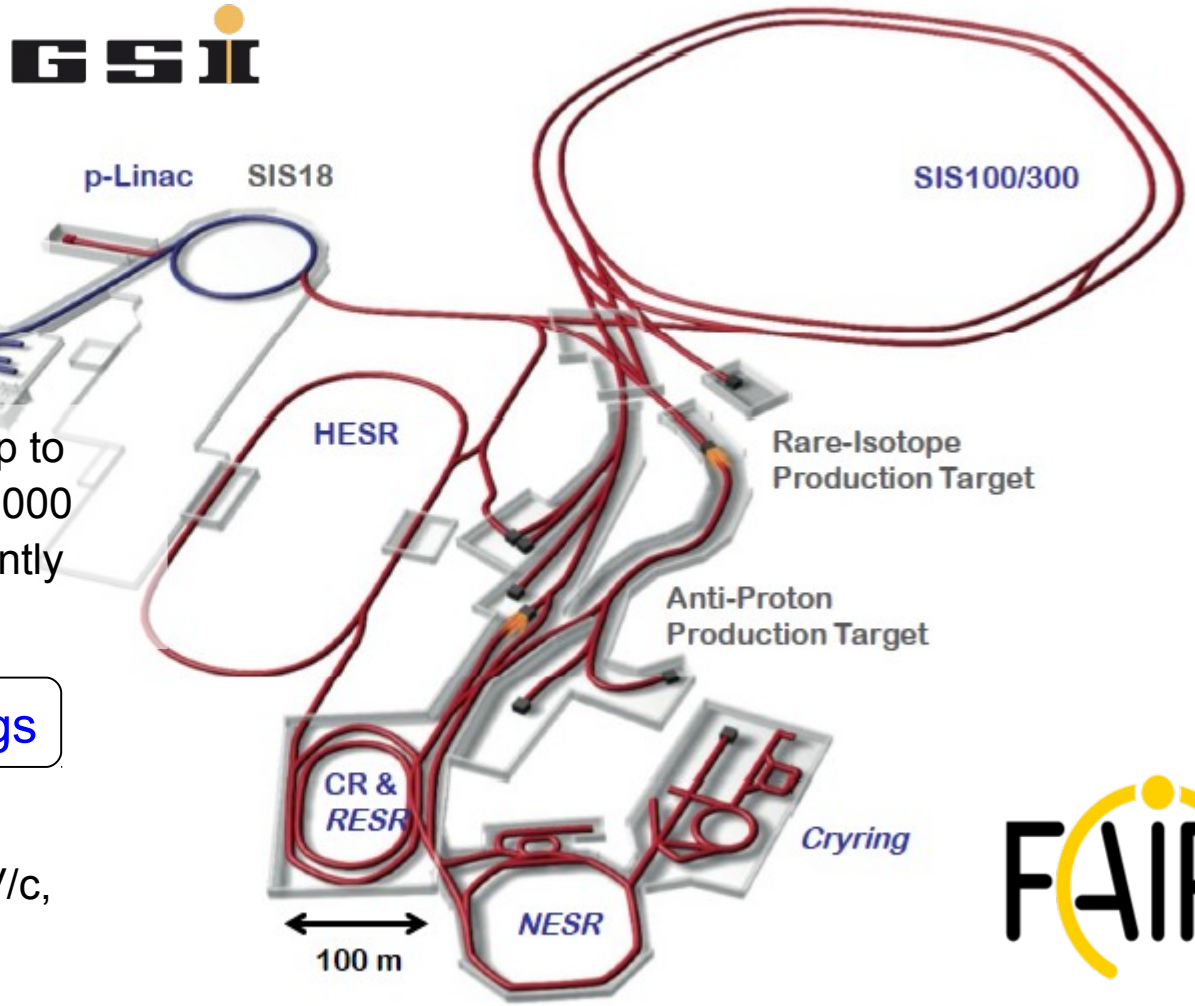
Secondary Beams

- range of radioactive beams up to 1.5 - 2 GeV/u; up to factor 10 000 higher in intensity than presently
- antiprotons 3 - 30 GeV

Storage and Cooler Rings

- radioactive beams
- 10^{11} antiprotons 1.5 - 15 GeV/c,

stored and cooled



Technical Challenges

- cooled beams, rapid cycling superconducting magnets

Немецкой стороной начат процесс слияния ФАИР и ГСИ. В июле 2013 г. создана международная рабочая группа, которая подготовила перечень юридических и практических вопросов по слиянию, ответы на которые должна дать рабочая группа по слиянию, созданная Германией и администрации ФАИР и ГСИ.

В начале 2014 г., по результату финансового аудита проекта FAIR, FAIR Council сообщил, что стоимость проекта FAIR существенно увеличилась в части civil construction (примерно на 250 Мевро).

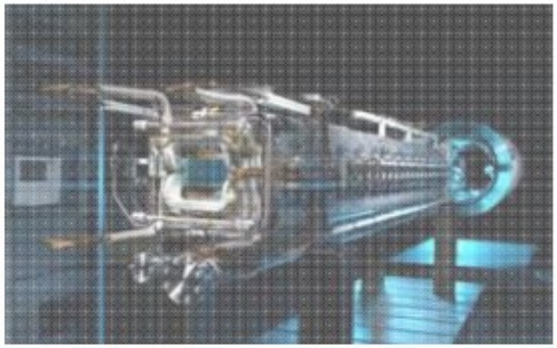
В связи с этим Staatssekretär Georg Schütte инициировал рассмотрение всего проекта FAIR специально созданным International Review Committee (chaired by Rolf-Dieter Heuer)

Review meeting from 16-18 February in Darmstadt – главные итоги:

- Провести критический анализ эффективности организационной структуры проекта и менеджерской структуры;
- Провести пересмотр всех научных программ FAIR вплоть до 2025 года и позже и сделать ранжирование научных направлений;
- Создать "Strategy Board" для выработки стратегических рекомендаций для Директората на переходный период и представить их Council meeting on 30th June/1st July 2015;
- Создать Administrative and Management Advisory Panel для выработки рекомендаций Administrative Managing Director;
- Создать Advisory Committee for civil construction для выработки рекомендаций руководству ФАИР и ГСИ.

As of April, 7, 2015, **Dr.-Ing. Jürgen Henschel** was assigned as **overall project leader for the FAIR Project** in his role **as Technical Director of FAIR and GSI GmbH**.





16th Council Meeting – June 30 / July 1, 2015

Future Strategy for FAIR

FAIR Management

Finland France Germany India Poland Romania Russia Slovenia Sweden UK

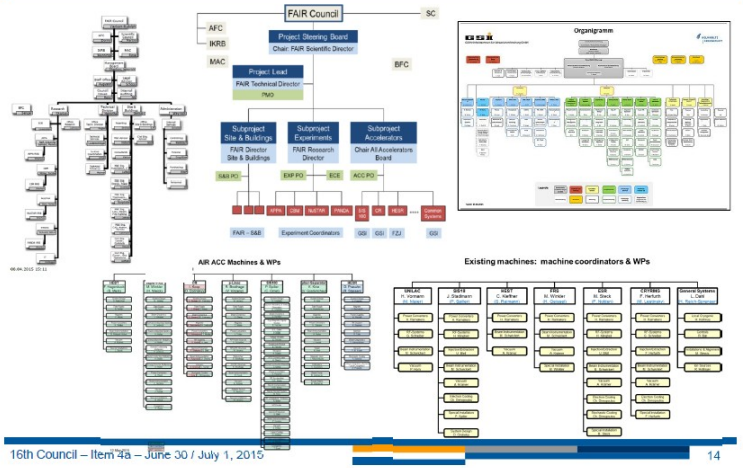
FAIR

Future Strategy for FAIR

Project organization and management

Jürgen Henschel

Project organization and management



Future organizational structure in five main units

- **Project Team**
  - capture and run the project in all aspects
  - full responsibility for scope control
  - management of dedicated resources and schedule improvements
  - direct reporting line to management
  - structure t.b.d. – preferably strong matrix setup
- **Research Division**
  - physics case
  - host lab tasks, communication to external user community
  - setup and execution of the experiments
  - experiment schedule until first data acquisition and construction of necessary equipment to do so
- **Operations Division**
  - running of all existing machines on site
- **Infrastructure Division**
  - enabling of the facility
- **Administrative Division**
  - builds legal and financial framework for the organization
  - provides administrative services

Next steps

- Conversion of existing structures into a suitable joint project management structure for FAIR GmbH and GSI GmbH
- Establishment of a joint Project Management Office (PMO)
  - *from Technical Division (FAIR) and Project Coordination (FAIR@GSI)*
- Operational integration of FAIR GmbH and GSI GmbH staff, e.g.
  - *Controlling (done)*
  - *Purchasing (done)*
  - *Human Resources*
  - *Finances*

FAIR Modularized Start Version (MSV) analysis

Scenarios (Part 1)

Scenario 1: **Without CBM (Module 1)**

- Scientific consequence: omission of experiments HADES and CBM
- Re-planning effort: small
- Saving potential: ca. 50 M€

Scenario 2: **Without Module 2 (Super-FRS, R3B, ILIMA, HISPEC/DESPEC, MATS, LASPEC, EXL)**

- Scientific consequence: omission of the full NUSTAR program
- Re-planning effort: significant replanning required
- Saving potential: ca. 312 M€

Scenario 5: **Like Scenario 3 but keeping both CR and HESR (--> 11 @ 22)**

- Scientific consequence:
  preservation of the full scientific instrumentation for APPA (SPARC) and NUSTAR (ILIMA, EXL), adding of physics programs with antiprotons including PANDA is possible since the HESR is included in this scenario
- Re-planning effort: moderate
- Saving potential: ca. 103 Mio. €.

Cost and schedule for 11 @ 22

Cost estimate:

- Saving potential compared to FAIR MSV: about 103 M€ (2022 prices)
  - Building for p-linac and PANDA experimentation hall
  - Accelerator systems for p-linac, pbar target, beam lines and related Common Systems
  - PANDA detector (only partially included in FAIR Project funding)

Schedule:

- Schedule for realization of 11 @ 22 is essentially the same as for FAIR MSV
- Critical path is the production and assembly of the Super FRS which is a key system in both the MSV and 11 @ 22

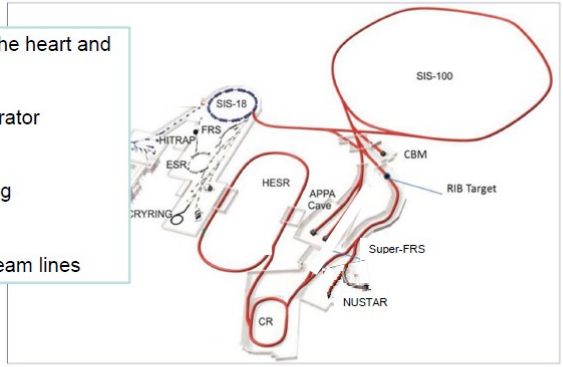
11 @ 22 Strategy: Accelerators

Synchrotron SIS100, the heart and „workhorse“ of FAIR

Super Fragment Separator

Cooler-storage rings
CR, HESR, and Cryring

Reduced number of beam lines



11 @ 22 Strategy: Experiments

APPA

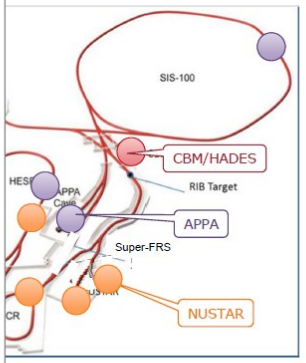
- SPARC: atomic physics in strong fields
- WDM+Hedgehob: dense plasma physics
- BIOMAT: biomedical and materials research

CBM

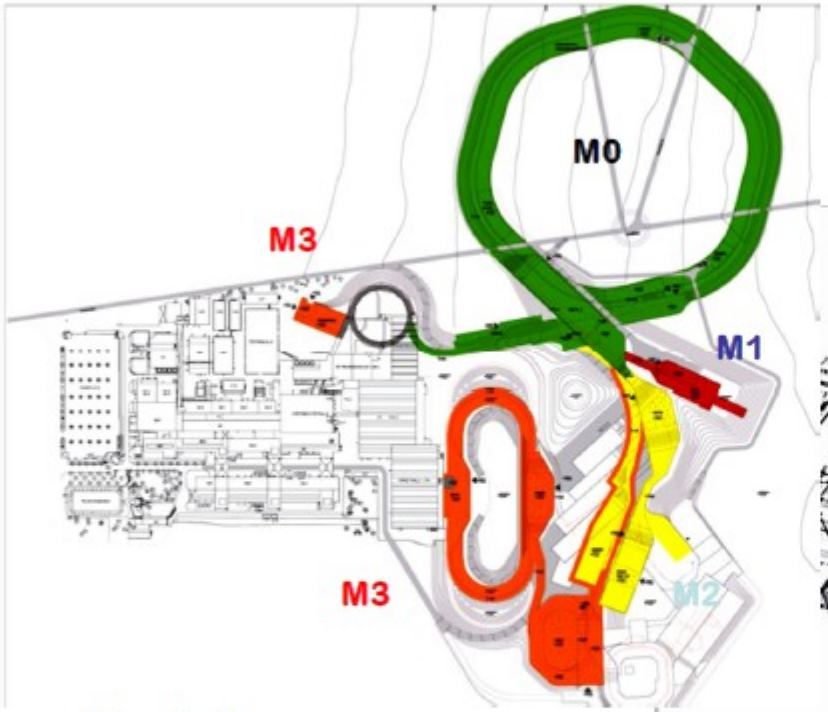
- HADES : hadrons in dense nuclear matter
- CBM: compressed baryonic matter

NUSTAR incl. LEB Building, Super-FRS

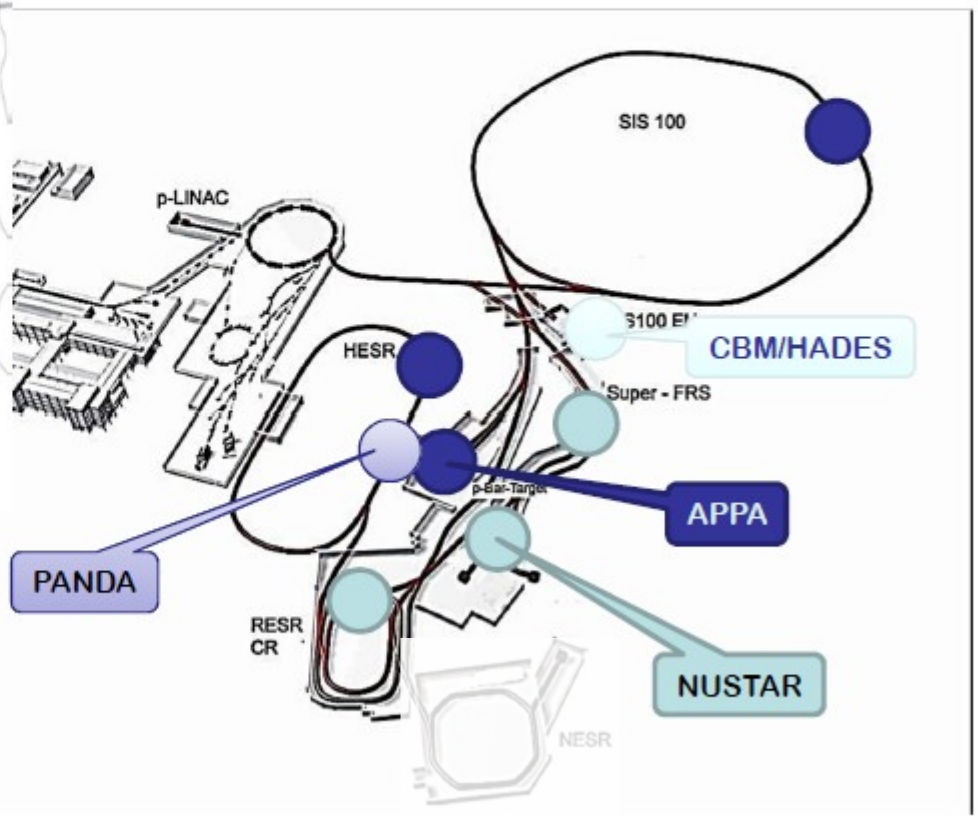
- R3B: kinematically complete reaction studies with relativistic radioactive ion beams
- ILIMA: In ring lifetime and mass spectroscopy
- HISPEC/DESPEC: In beam and stopped beam γ spectroscopy of exotic nuclei
- MATS: Mass and lifetime spectroscopy in traps
- LASPEC: laser spectroscopy of exotic nuclei
- EXL: In-ring reaction studies with exotic nuclei



Modularised Start Version (MSV)



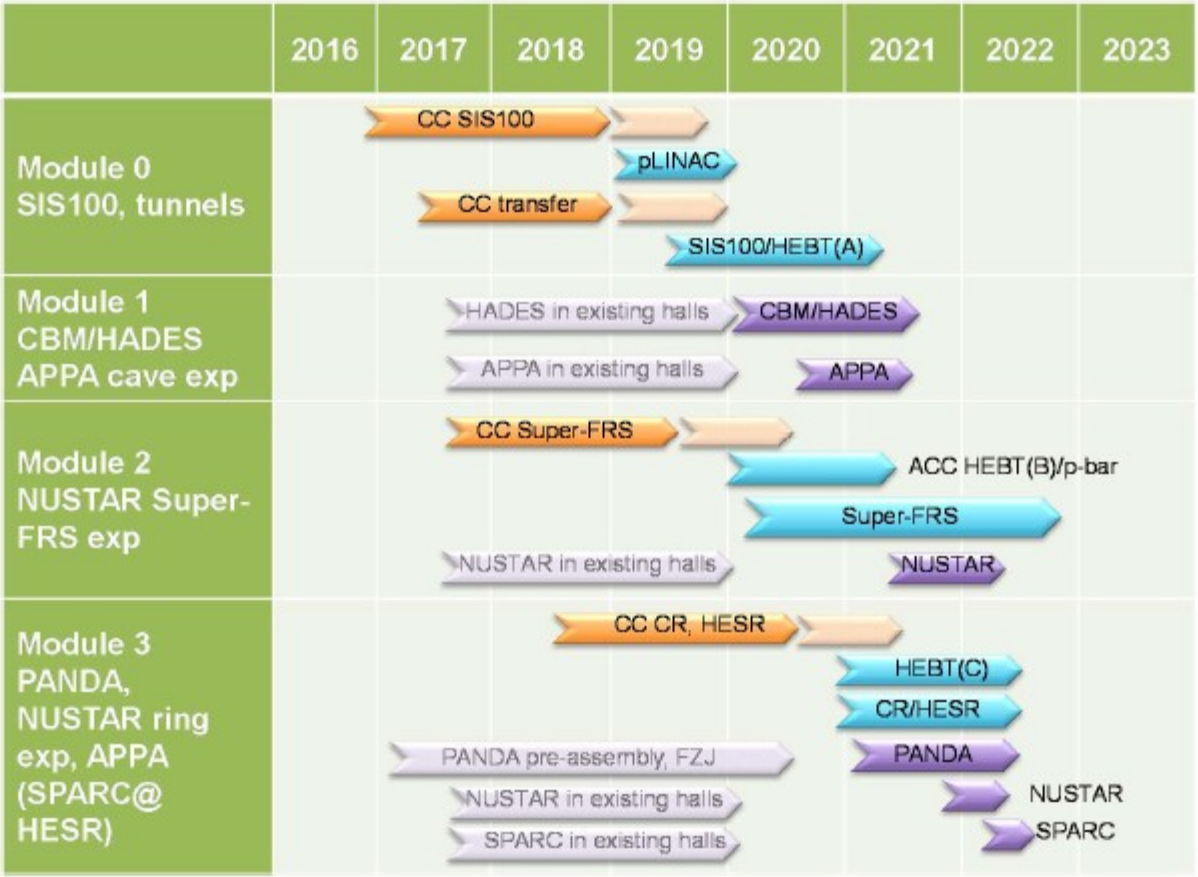
Cost about 1.6 billion by 2018
(1 billion 2005 Euros)



Modules
M0: SIS100
M1: APPA
M1: CBM/HADES
M2: NUSTAR
M3: PANDA, NuSTAR, APPA

FAIR MSV Schedule

- Milestones:
  - SIS100 ready for beam commissioning in 2021
  - Super-FRS ready for commissioning in 2022



FAIR MSV Cost

Cost table for the FAIR MSV plus LEB building including the cost overrun estimated in 2014 for civil construction (in 2005 prices and escalated to 2022)

Total costs (MC)	2005 prices	Escalated prices*
Experiments	78,0	83,6
Accelerators	385,0	412,5
Acc. coordination personnel	110,9	113,1
Personnel FAIR GmbH	38,0	43,1
Running costs	15,4	19,8
Civil Construction original estimate	495,0	676,3
Subtotal	**1.122,3**	**1.348,4**
less site costs	1.027,3	1.220,9
Civil Construction cost increase	227,9	320,1
LEB building**	6,5	9,6
Total incl. site costs	**1.356,8**	**1.678,1**

**) Escalated from 2005 to 2022 following FAIR escalation mechanisms*

The following assumptions were made:

1) Civil Construction spending profile is preserved, but extended to the year 2022.

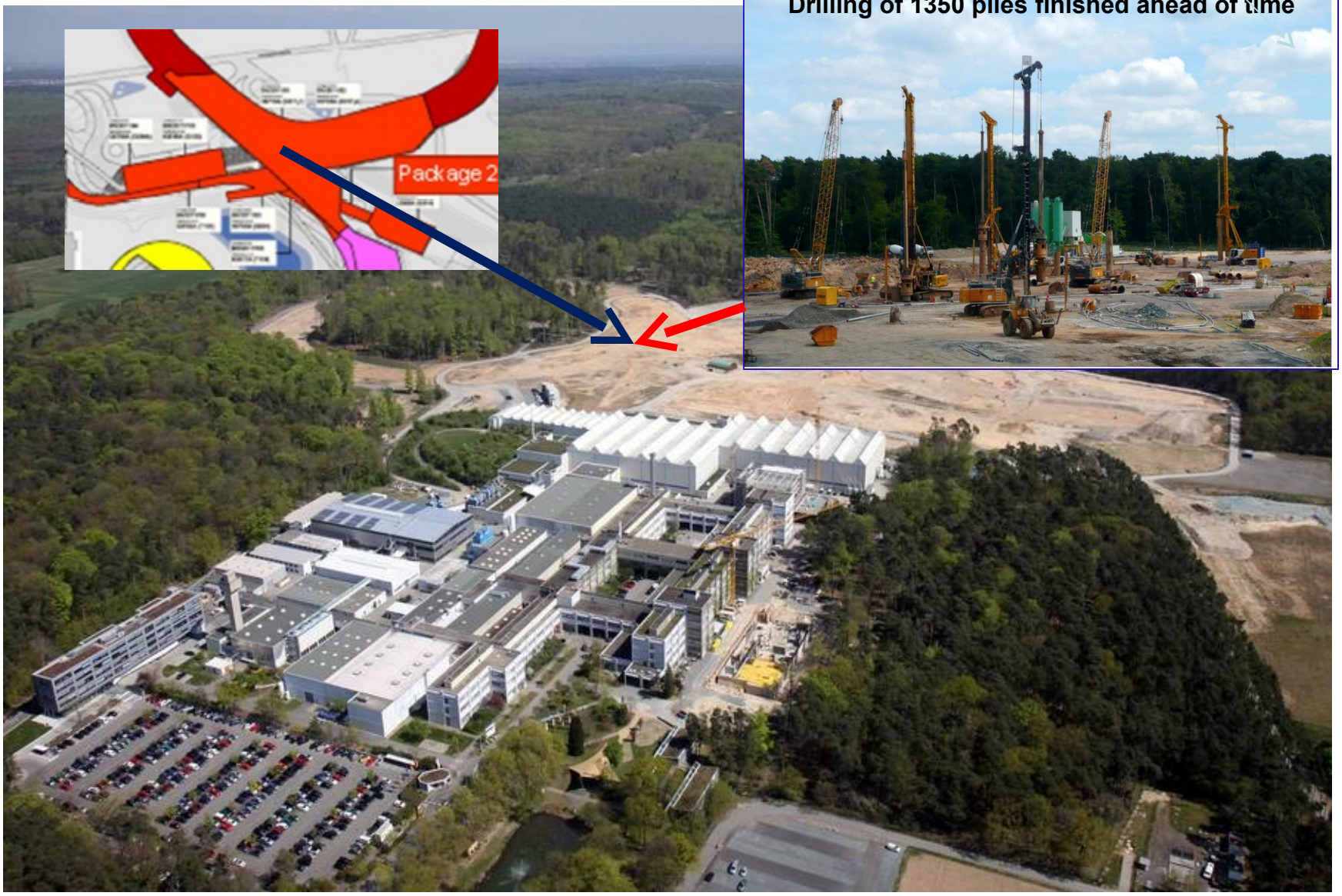
2) For the additional costs for the planners the full claim of 65,5M€ (at 2014 prices) is considered

3) In-kind contributions are not escalated

4) Concerning experiments, accelerators, and accelerator coordination personnel, only collaboration contracts and tenders are escalated.

***) The LEB building houses the NUSTAR low-energy branch. While the LEB was included in the MSV, the LEB buiding was not.*

→ Cost increase of about 320 million € (in 2022 prices)



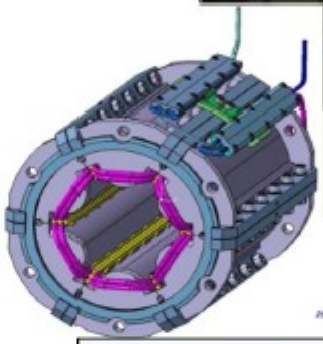
Aerial photo of the construction site taken on April 22, 2015 (photo: Till Middelhauve for FAIR)

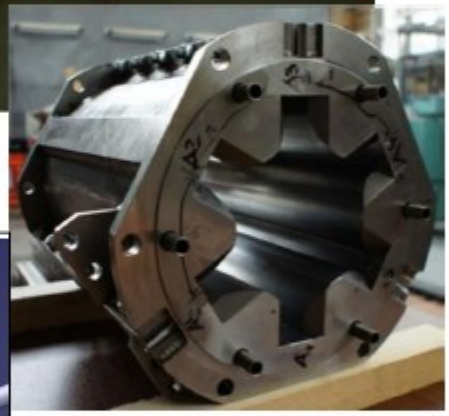
Visit of the T110 mockup

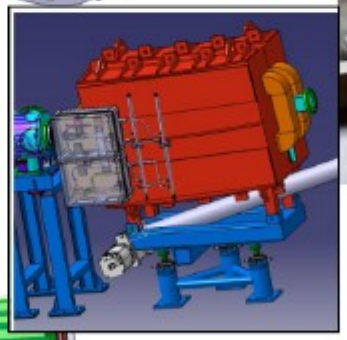
Accelerator's Status

- Progressing well

- SIS 100 dipoles
  - First series del.+tested
- SIS 100 sextopoles
  - Dubna prototype
- HEBT magnets
  - Efremov, St Petersburg
- SIS 100 quadrupoles
  - JINR, Dubna



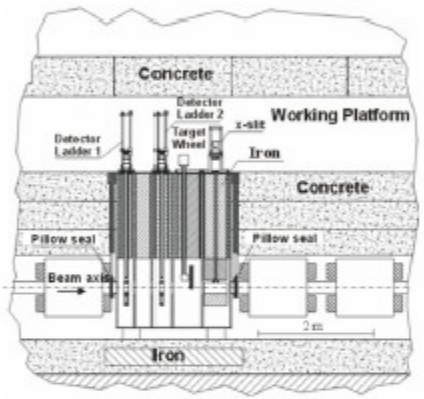




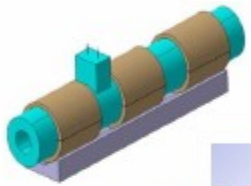
Technical Challenges: contributions by partner countries

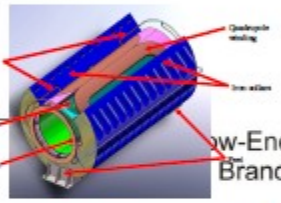
Target & Beam Catcher

Remote Handling

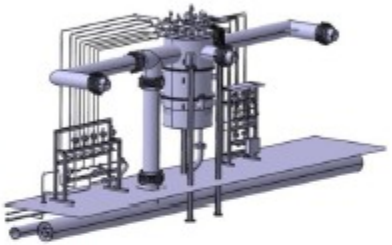


SC Multiplets





Cryogenics



Main-Separator

Hi SC Dipoles

Beam Dumps

Exit Slit Pre-Separator

Degrader 1

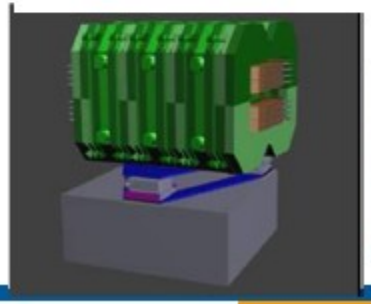
Degrader 2

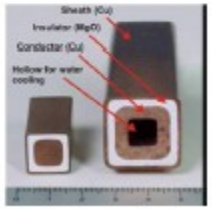
Production Target

ocusing System

Driver Accelerator

Radiation Reistant Magnets





The GLAD (GSI Large Acceptance Dipole) magnet built in France for FAIR (R3B) delivered to GSI 05.11.2015

Details on partner countries and their contributions
Russia

Commitment (all figures Jan. 2005 prices):	178.05 M€ (Convention, signed)
Cash, including:	178.05 M€
Cash (beyond contributions to acc. & exp.:	44.50 M€
Accountable contribution to accelerators:	65.76 M€
Of which assigned: 58.1429 M€	
Accountable contribution to experiments:	24.27 M€
Of which assigned: 24.270 M€	
Planned additional contribution to experiments according to Russian EoIs:	29.29 M€
Planned but not specified cash contribution to accelerators:	14.23 M€

Experiments:

All experiments intend to apply for funding in Russia, with a total sum of about 53.564 M€.
Of these the major ones are PANDA (26.124 M€), CBM (14.885 M€), NUSTAR (6.025 M€), HEDgeHOB (6.59 M€).

From the accountable contribution to Experiments:

IHEP, PANDA PWO crystals (1981 pcs.), 1.0 M€ (Council II.19.1), contract concluded
IHEP, mechanical structure of PANDA EM calorimeter, 2.844 M€ (Council VI.11.2), contract concluded
IHEP, high-gradient quadrupoles for HEDgeHOB, 2.800 M€ (Council XI.19.3), contract negotiations
JINR, yoke for PANDA SC solenoid, 1.0 M€ (Council VI.11.3), (*)
JINR, PANDA SC. solenoid (besides yoke), 4.420 M€ (Council XI.19.4), (*)
(*) contract negotiations for these two items together
JINR, Ladders for STS tracking system (CBM), 2.115 M€ (Council IX.18.4), contract concluded
JINR, CBM SC. dipole, 3.758 M€ (Council XI.19.5), contract negotiations
JINR, Straw Tube Detector, CBM – MUCH, 0.490 M€ (Council XVI.12.5)
PNPI, Sci. bars & Read-out Elec. NeuLAND (NUSTAR), 0.585 M€ (Council VIII.19.4), contract in preparation
PNPI, HV distribution system NeuLAND (NUSTAR), 0.415 M€ (Council VIII.19.5), contract concluded
PNPI, mechanical structure of CBM RICH detector, 1.450 M€ (Council XI.19.6), contract negotiations
PNPI, Components for CBM – M UCH, 3.022 M € (Council XVI.12.4)
INR, Modules for CBM – PSD, 0.778 M€ (Council XVI.12.3)

Compilation as of 14th September 2015
(Before 17th AFC Meeting)

The list of the contracted and intended contributions of the Russian Federation to the construction of the FAIR experiments

(PNPI Parts)

04.06.2015 , Revised on 07/07/2015

#	FAIR experiments	Russian Institutes, Contributions and Coordinators.	Contribution status.	Cost-book (in 2005 prices), in M Euro.	
4	NuSTAR	PNPI-Gatchina,High voltage system for NeuLAND (R3B),V. Golovtsov.	The Collaboration contract between PNPI-Gatchina and FAIR was signed on 08.07.2014.	0, 415	
5	NuSTAR	PNPI-Gatchina,Scintillator plates and read-out electronics for NeuLAND (R3B),V.Kuznetsov.	Assigned by the FAIR Council on 09.07.2013. 0, 335 M Euro – scintillator plates, 0, 250 M Euro – read-out electronics	0, 585	
9	CBM	PNPI-Gatchina,The mechanical structure of the RICH detector,V. Samsonov.	Assigned by the FAIR Council on 09.07.2014.	1, 450	
13	NuSTAR	PNPI-Gatchina,The mass calibrator and thin silicon detectors for MATS, Yuri Novikov.	TDR was approved by FAIR on 07.05.2010.	0, 191	
14	NuSTAR	PNPI-Gatchina,The remaining part of the NeuLAND detector in R3B, V. Kuznetsov.	TDR was approved by FAIR ECE in January 2013.	0, 250	
15	CBM	PNPI-Gatchina,The muon system MUCH,V.Samsonov.	Assigned by the FAIR Council on 01.07.2015.	3, 022	
22	PANDA	PNPI-Gatchina,The forward TOF detector,Stanislav Belostotski.	TDR is expected to be ready in 2015.	0, 362	
25	NuSTAR	PNPI-Gatchina,Active hydrogen target ACTAR,Evgeny Maev.	TDR is expected to be ready in 2015.	0, 955	
31	NuSTAR	PNPI-Gatchina, the tracking detectors for R3B,A. Krivchitch.	TDR is expected to be ready in 2015.	0, 480	
			TOTAL COST OF ALL CONTRIBUTIONS	**53,69**	**7,71**

Comment: all the items are approved by the managements of the four FAIR experimental pillars.


С НОВЫМ 2016 ГОДОМ

The list of the contracted and intended contributions of the Russian Federation to the construction of the FAIR experiments

04.06.2015 , Revised on 07/07/2015

#	FAIR experiments	Russian Institutes, Contributions and Coordinators.	Contribution status.	Cost-book (in 2005 prices), in M Euro.
1	PANDA	IHEP-Protvino,1981 PWO crystals for the barrel calorimeter,A. Vasiliev.	The contract has been implemented.	1, 000
2	PANDA	IHEP-Protvino,The mechanical structure of the barrel calorimeter,A.Vasiliev.	The Collaboration contract between IHEP-Protvino and FAIR was signed on 26.11.2013.	2, 844
3	CBM	Consortium of Institutes:JINR-Dubna, ITEP-Moscow,SINP-Moscow, IHEP-Protvino, Sankt-Petersburg State University,Part of the Silicon Tracker System (STS),Yuri Murin (JINR-Dubna).	The Collaboration contract between JINR-Dubna and FAIR was signed on 27.06.2014.	2, 115
4	NuSTAR	PNPI-Gatchina,High voltage system for NeuLAND (R3B),V. Golovtsov.	The Collaboration contract between PNPI-Gatchina and FAIR was signed on 08.07.2014.	0, 415
5	NuSTAR	PNPI-Gatchina,Scintillator plates and read-out electronics for NeuLAND (R3B),V.Kuznetsov.	Assigned by the FAIR Council on 09.07.2013. 0, 335 M Euro – scintillator plates, 0, 250 M Euro – read-out electronics	0, 585
6	PANDA	JINR-Dubna,The whole superconducting solenoid,A. Vodopyanov.	Assigned by the FAIR Council on 27.06.2012 for the yoke and on 09.07.2014 for the rest, including coils, cryostat etc.	5, 420
7	CBM	JINR-Dubna,The dipole magnet,A. Malakhov.	Assigned by the FAIR Council on 09.07.2014.	3, 758
8	HEDgeHOB	IHEP-Protvino,Four strong-focusing quadrupoles,S. Kozub	Assigned by the FAIR Council on 09.07.2014.	2, 800
9	CBM	PNPI-Gatchina,The mechanical structure of the RICH detector,V. Samsonov.	Assigned by the FAIR Council on 09.07.2014.	1, 450
10	PANDA	JINR-Dubna,The muon system,Gennady Alexeev.	TDR was approved by FAIR ECE on 14.09.2014.	2, 318
11	PANDA	IHEP-Protvino,The remaining 8,358 PWO crystals for the barrel calorimeter, Alexander Vasiliev	TDR was approved by FAIR in 2008.	5, 705
12	PANDA	The Budker INP -Novosibirsk,The dipole magnet,Yuri Tikhonov.	TDR was approved by FAIR in 2009.	2, 052
13	NuSTAR	PNPI-Gatchina,The mass calibrator and thin silicon detectors for MATS, Yuri Novikov.	TDR was approved by FAIR on 07.05.2010.	0, 191
14	NuSTAR	PNPI-Gatchina,The remaining part of the NeuLAND detector in R3B, V. Kuznetsov.	TDR was approved by FAIR ECE in January 2013.	0, 250
15	CBM	PNPI-Gatchina,The muon system MUCH,V.Samsonov.	Assigned by the FAIR Council on 01.07.2015.	3, 022

16	CBM	INR-Troitsk,Forward PSD detector,Alexei Kurepin.	Assigned by the FAIR Council on 01.07.2015.	0, 778	
17	CBM	JINR-Dubna,The tracker based on drift tubes for the muon system (STT for MUCH),Vladimir Peshekhonov.	Assigned by the FAIR Council on 01.07.2015.	0, 490	
18	HEDgeHOB	ITEP-Moscow,Two RF-resonators (wobbler),Alexander Golubev.	TDR is prepared and is being considered within the Collaboration.	1, 000	
19	HEDgeHOB	IPCP RAS-Chernogolovka,Two vacuum chambers for HEDgeHOB (HIHEX and LAPLAS), Victor Mintsev.	TDR is prepared and is being considered within the Collaboration.	1, 770	
20	PANDA	IHEP-Protvino,Forward electromagnetic calorimeter of the "shashlyk" type, Pavel Semenov	TDR was approved by the Collaboration and submitted to FAIR ECE on June 17, 2015	1, 352	
21	NuSTAR	JINR-Dubna,Part of the CALIFA gamma-spectrometer,Andrey Fomichev.	TDR for the barrel part was approved by FAIR in November 2012, TDR for the forward part is expected to be ready in 2015.	0, 960	
22	PANDA	PNPI-Gatchina,The forward TOF detector,Stanislav Belostotski.	TDR is expected to be ready in 2015.	0, 362	
23	CBM	ITEP-Moscow,The first part of the electromagnetic calorimeter of the "shashlyk" type,Yuri Zaitsev.	TDR is expected to be ready in 2015.	2, 805	
24	CBM	ITEP-Moscow,TOF detector,Alexander Akindinov.	TDR is expected to be ready in 2015.	0, 468	
25	NuSTAR	PNPI-Gatchina,Active hydrogen target ACTAR,Evgeny Maev.	TDR is expected to be ready in 2015.	0, 955	
26	PANDA	The Budker INP -Novosibirsk,50% of the forward DISC DIRC,Yu. Tikhonov.	TDR is expected to be ready in 2015.	1, 471	
27	PANDA	ITEP- Moscow,Pellet target,Alexander Gerasimov.	TDR is expected to be ready in 2015.	0, 700	
28	HEDgeHOB	ITEP-Moscow,The ion-proton radiography system,Alexander Golubev.	TDR is expected to be ready in 2015.	0, 420	
29	HEDgeHOB	The Lebedev Physical Institute RAS, Moscow,Cryogenic target,E. Koresheva.	TDR is expected to be ready in 2015.	0, 350	
30	NuSTAR	Consortium of institutes:JINR-Dubna, SIC Kurchatov Institute - Moscow, the Ioffe PTI – Sankt-Petersburg, SINP-Moscow.The EXPERT project for the "first day" experiments at Super-FRS,I. Mukha (SIC Kurchatov Institute – Moscow) andA. Fomichev (JINR-Dubna).	TDR is expected to be ready in 2015.	2, 500	
31	NuSTAR	PNPI-Gatchina, the tracking detectors for R3B,A. Krivchitch.	TDR is expected to be ready in 2015.	0, 480	
32	PANDA	The Budker INP -Novosibirsk,Forward RICH,Yuri Tikhonov.	TDR is expected to be ready in 2017.	2, 900	
			TOTAL COST OF ALL CONTRIBUTIONS	**53,69**	**7,71**

Comment: all the items are approved by the managements of the four FAIR experimental pillars.

Cost Estimate Modules 0-3 (Price Basis 2005)

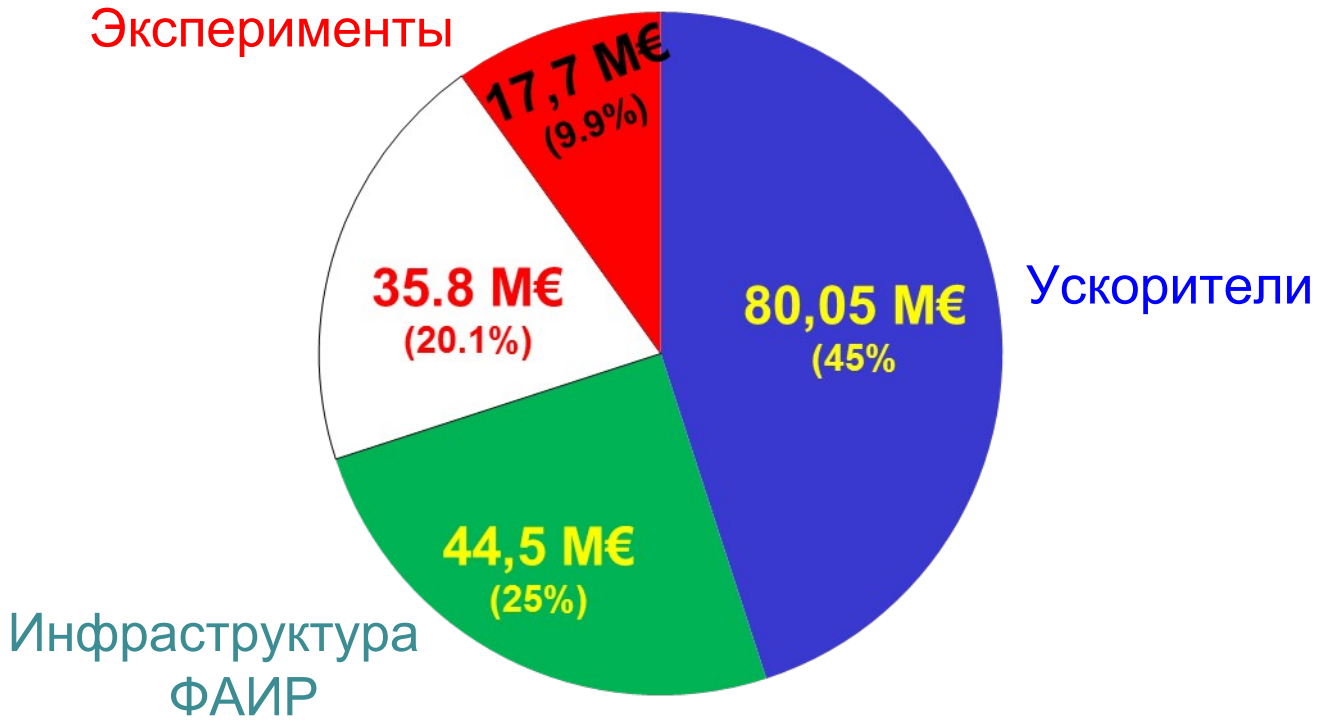
Total accelerator and personnel Modules 0 - 3	502
Total civil construction Modules 0 - 3	400
Experiment funding	78
FAIR GmbH personnel and running costs	47
Grand Total Modules 0 - 3	1027

+250

all values in M€

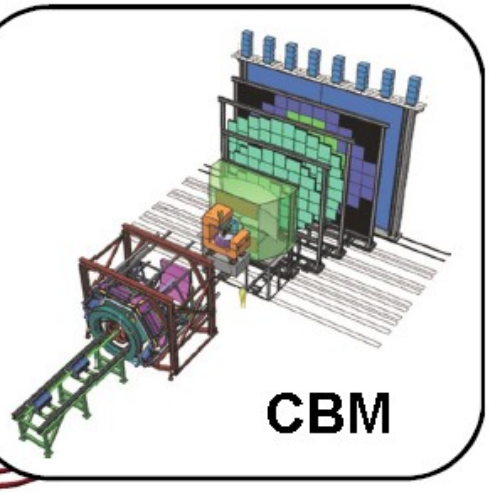
Участие России в проекте ФАИР

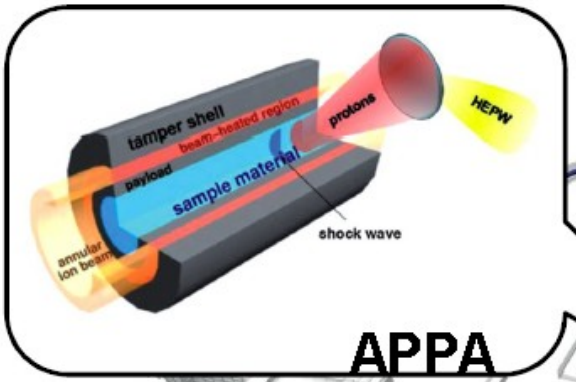
Вклад России в ценах 2005 года – 178.05 M€,
что соответствует 17.4 % от стоимости проекта ФАИР



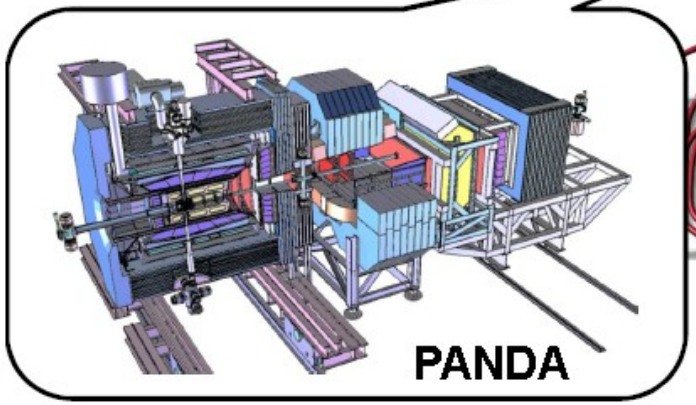
FAIR Experiments

CBM – физика адронов и кварков в плотной ядерной материи, гиперядерная материя

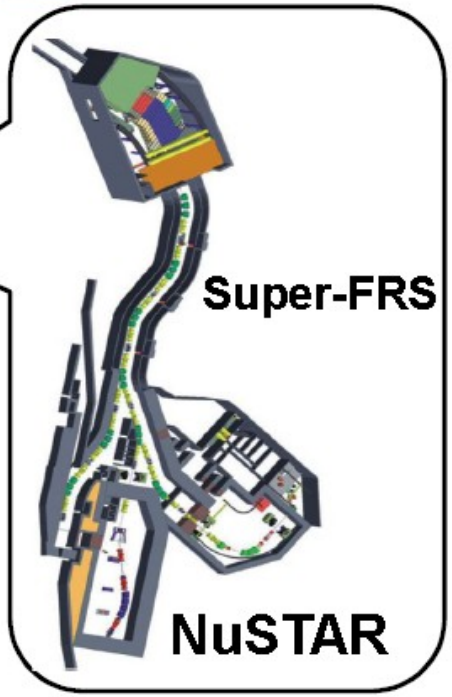




APPA – атомная физика и физика плазмы, прикладные исследования в биологии и медицине, материаловедение



PANDA – структура и спектроскопия адрона, странная и очарованная физика, гиперядерная физика на антипротонных пучках



NuSTAR – структура ядер, ядерные реакции, астрофизика, пучки радиоактивных ионов

Project organization and management