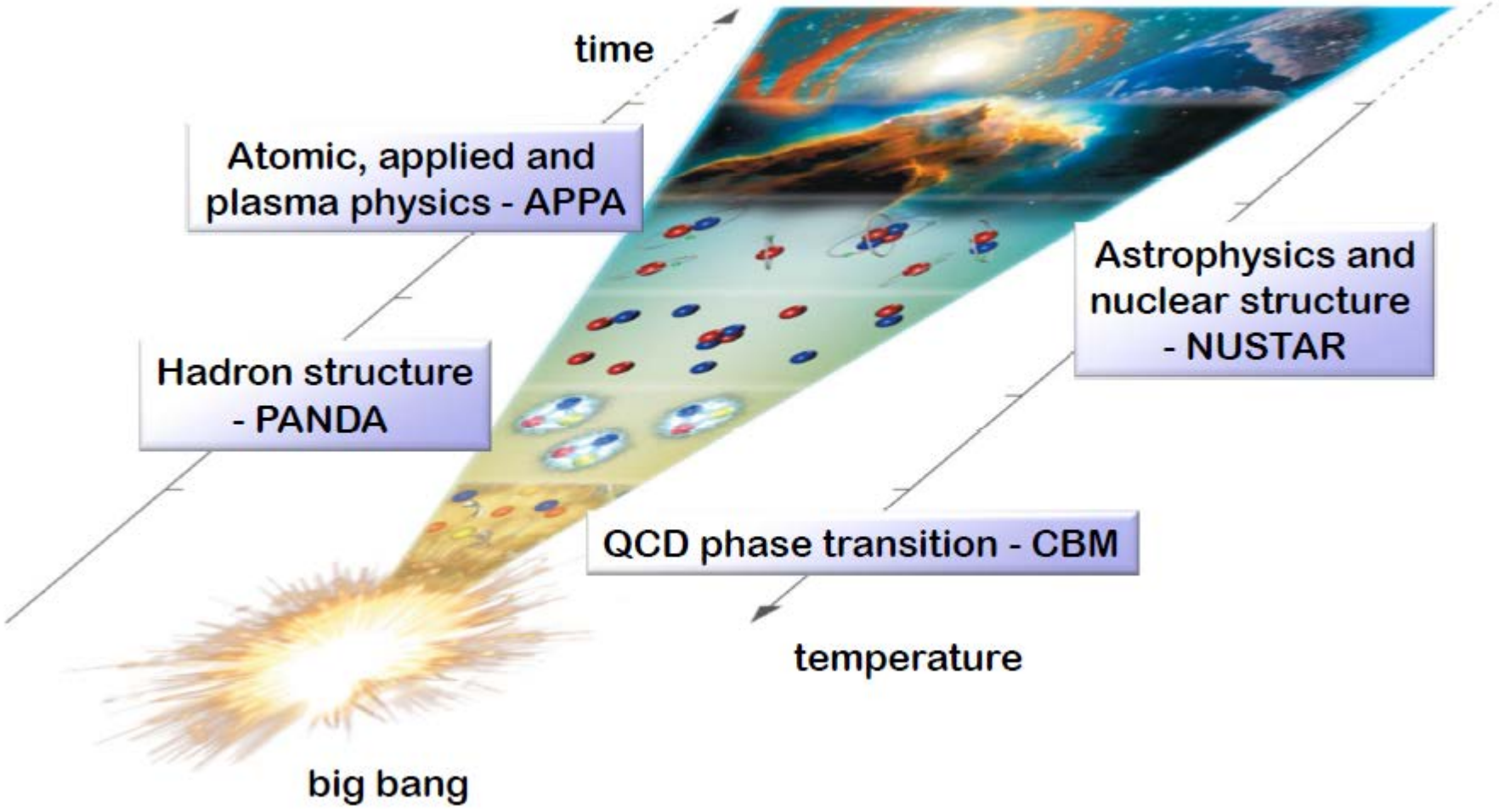
Статус проекта FAIR

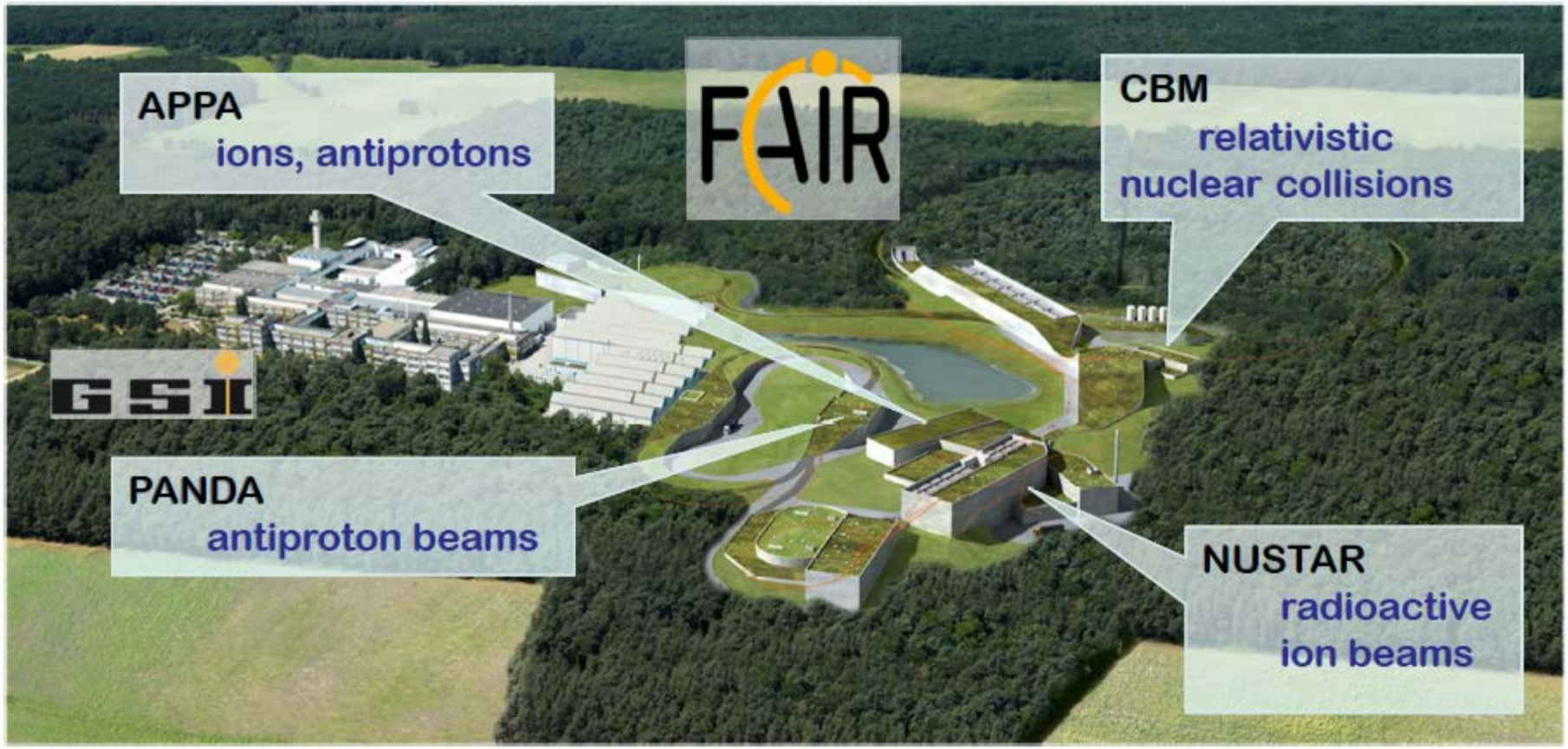
(Facility for Antiproton and Ion Research)

Finland France Germany India Poland Romania Russia Slovenia Sweden UK

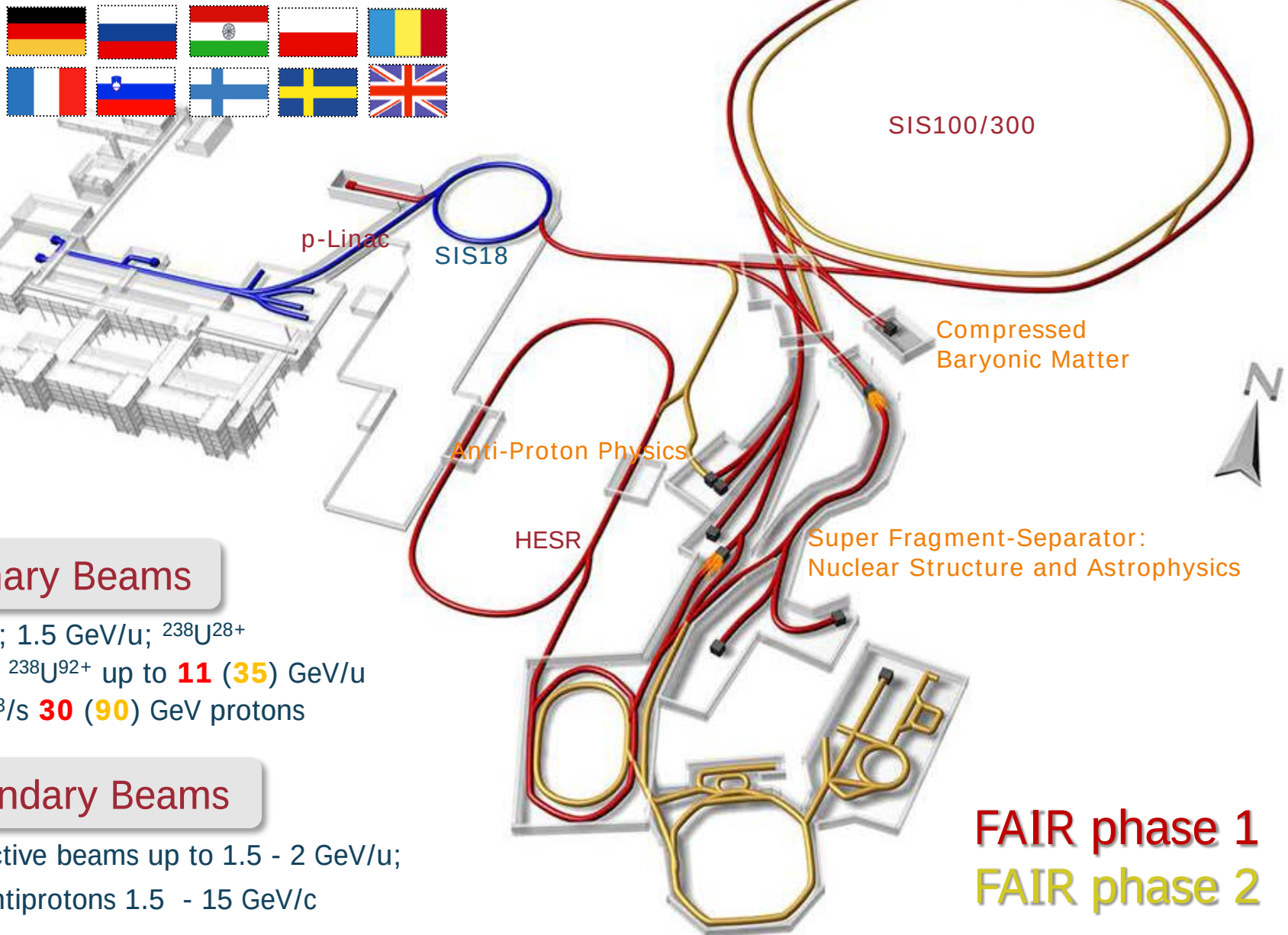
FAIR Science Sketch



The FAIR Project



FAIR – Conceptual View



Primary Beams

- 10^{12}/s; 1.5 GeV/u; $^{238}U^{28+}$
- 10^{10}/s $^{238}U^{92+}$ up to **11** (**35**) GeV/u
- 3x10^{13}/s **30** (**90**) GeV protons

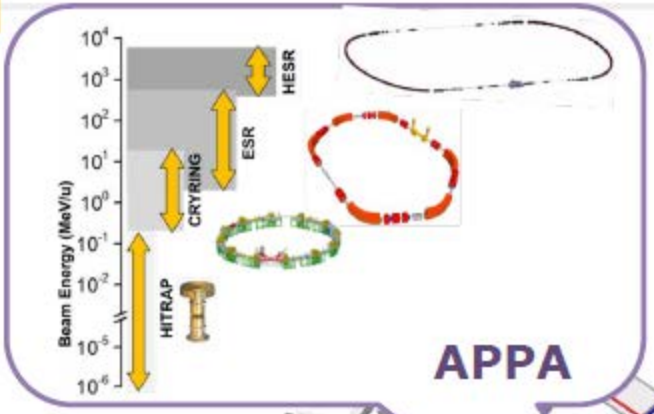
Secondary Beams

- radioactive beams up to 1.5 - 2 GeV/u;
- 10^{11} antiprotons 1.5 - 15 GeV/c

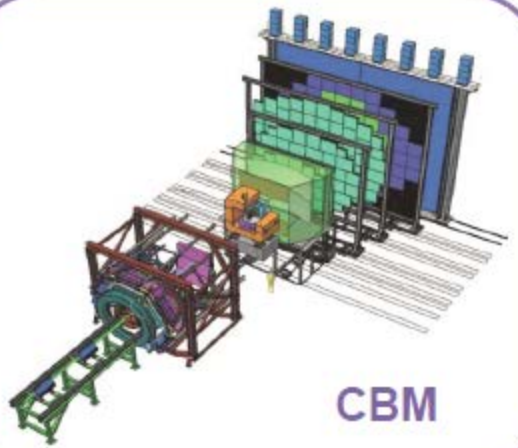
FAIR phase 1

FAIR phase 2

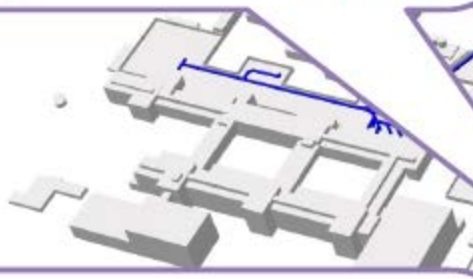
FAIR – four research pillars



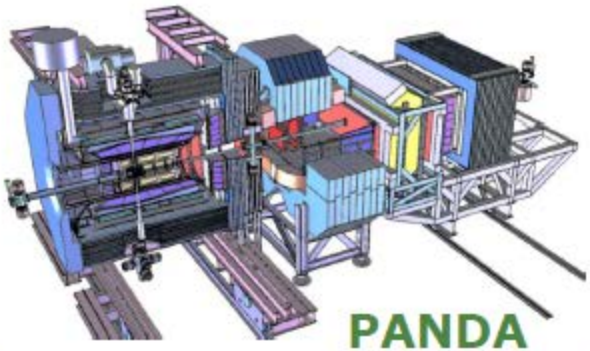
APPA



CBM



HESR



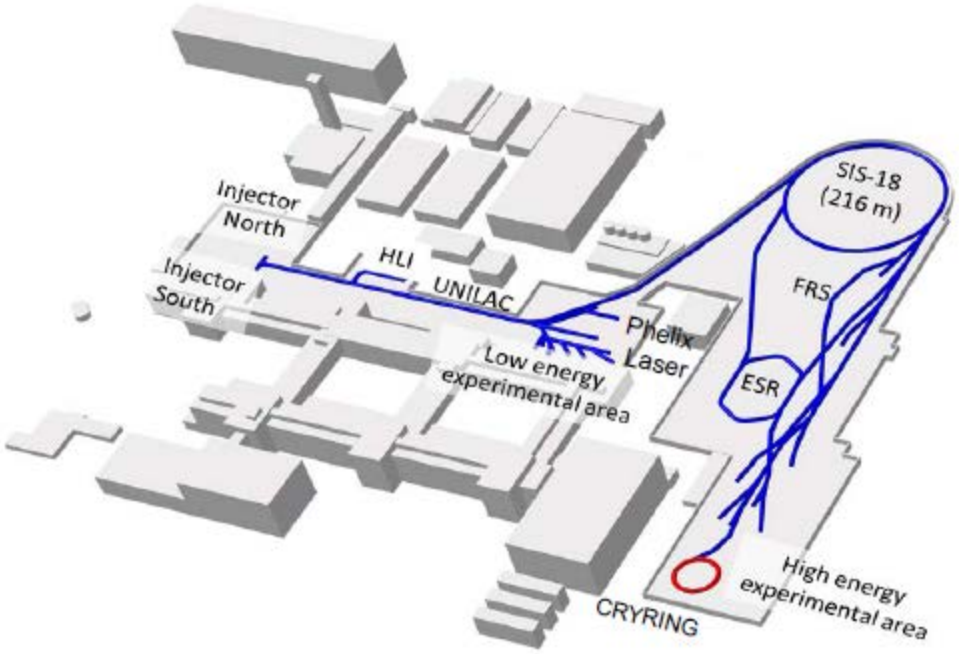
PANDA

NUSTAR

International Participation in FAIR

- FAIR governed by international convention
  - 9 shareholders + 1 assoc. partner (orange)
- **3000** scientists from all over the world are engaged
  - More than **200** institutions from **53** countries are involved with their scientists (orange + blue) → FAIR community growing

GSI – Almost 50 Years of Scientific and Technical Competence



- Existing accelerator facility has been upgraded to serve as injector for FAIR and – in the meantime – for FAIR phase 0

Research Infrastructures available at GSI
- open to external users, in particular from univ.

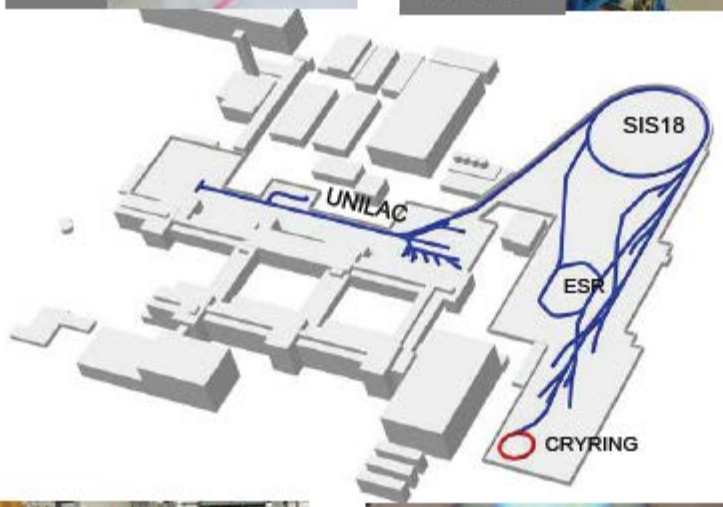

FRS


ESR

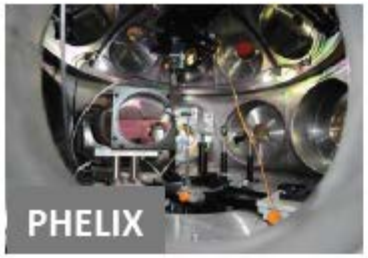

HITRAP


Cryring

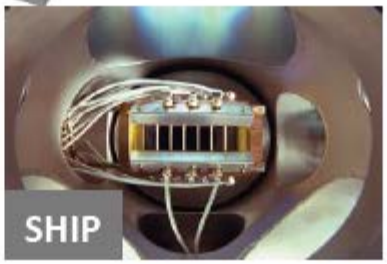

UNILAC / SIS18




R3B

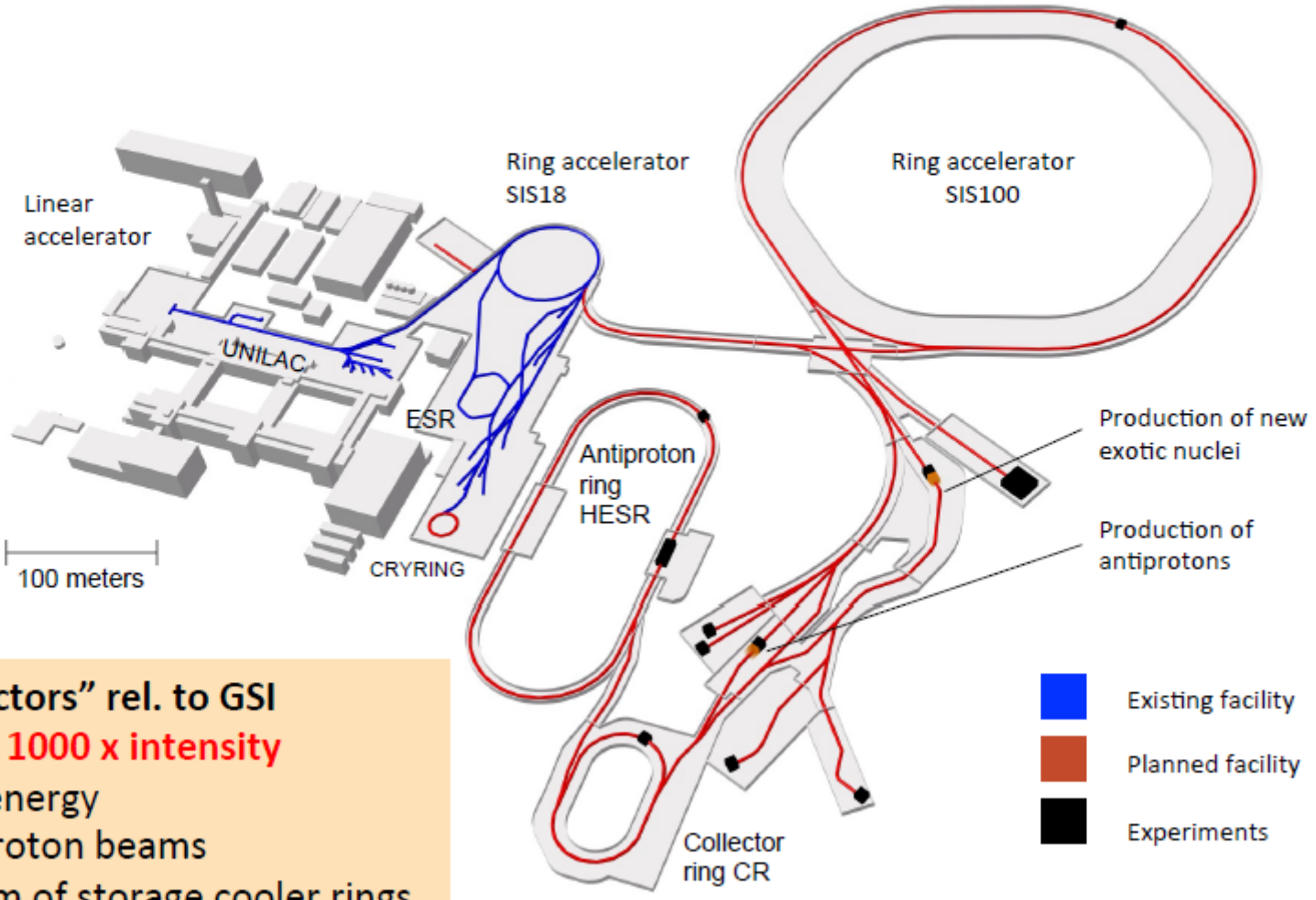

PHELIX


TASCA


SHIP


HADES

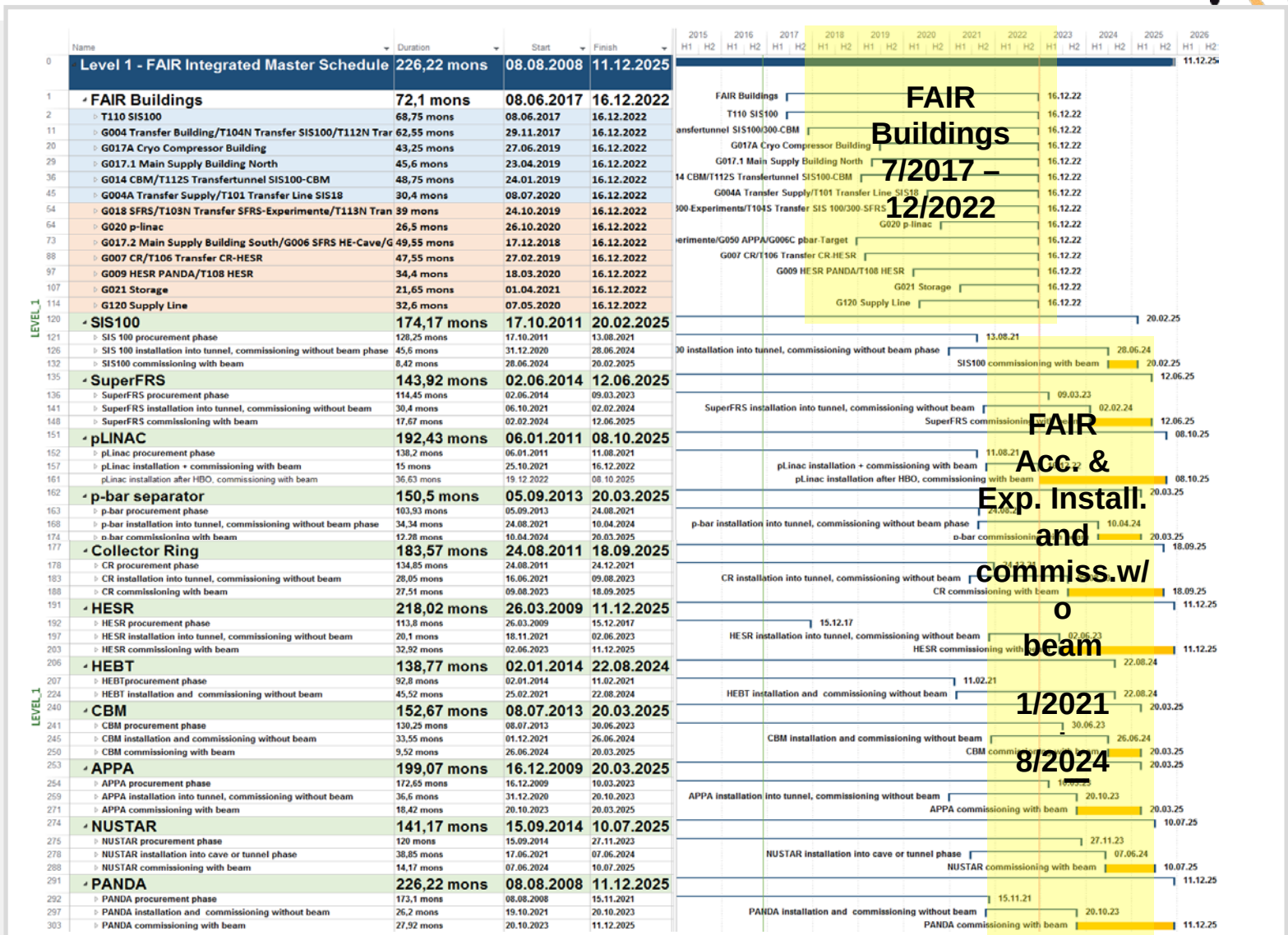
FAIR – The Facility



"Gain factors" rel. to GSI

- **100 – 1000 x intensity**
- 10 x energy
- antiproton beams
- system of storage cooler rings

Integrated Project Time Schedule – Level 1: FAIR Buildings, Accelerators & Experiments



	Name	Duration	Start	Finish
0	Level 1 - FAIR Integrated Master Schedule	226,22 mons	08.08.2008	11.12.2025
1	FAIR Buildings	72,1 mons	08.06.2017	16.12.2022
2	T110 SIS100	68,75 mons	08.06.2017	16.12.2022
11	G004 Transfer Building/T104N Transfer SIS100/T112N Trar	62,55 mons	29.11.2017	16.12.2022
20	G017A Cryo Compressor Building	43,25 mons	27.06.2019	16.12.2022
29	G017.1 Main Supply Building North	45,6 mons	23.04.2019	16.12.2022
36	G014 CBM/T112S Transfertunnel SIS100-CBM	48,75 mons	24.01.2019	16.12.2022
45	G004A Transfer Supply/T101 Transfer Line SIS18	30,4 mons	08.07.2020	16.12.2022
54	G018 SFRS/T103N Transfer SFRS-Experimente/T113N Tran	39 mons	24.10.2019	16.12.2022
64	G020 p-linac	26,5 mons	26.10.2020	16.12.2022
73	G017.2 Main Supply Building South/G006 SFRS HE-Cave/G	49,55 mons	17.12.2018	16.12.2022
88	G007 CR/T106 Transfer CR-HESR	47,55 mons	27.02.2019	16.12.2022
97	G009 HESR PANDA/T108 HESR	34,4 mons	18.03.2020	16.12.2022
107	G021 Storage	21,65 mons	01.04.2021	16.12.2022
114	G120 Supply Line	32,6 mons	07.05.2020	16.12.2022
120	SIS100	174,17 mons	17.10.2011	20.02.2025
121	SIS 100 procurement phase	128,25 mons	17.10.2011	13.08.2021
126	SIS 100 installation into tunnel, commissioning without beam phase	45,6 mons	31.12.2020	28.06.2024
132	SIS100 commissioning with beam	8,42 mons	28.06.2024	20.02.2025
135	SuperFRS	143,92 mons	02.06.2014	12.06.2025
136	SuperFRS procurement phase	114,45 mons	02.06.2014	09.03.2023
141	SuperFRS installation into tunnel, commissioning without beam	30,4 mons	06.10.2021	02.02.2024
148	SuperFRS commissioning with beam	17,67 mons	02.02.2024	12.06.2025
151	pLINAC	192,43 mons	06.01.2011	08.10.2025
152	pLinac procurement phase	138,2 mons	06.01.2011	11.08.2021
157	pLinac installation + commissioning with beam	15 mons	25.10.2021	16.12.2022
161	pLinac installation after HBO, commissioning with beam	36,63 mons	19.12.2022	08.10.2025
162	p-bar separator	150,5 mons	05.09.2013	20.03.2025
163	p-bar procurement phase	103,93 mons	05.09.2013	24.08.2021
168	p-bar installation into tunnel, commissioning without beam phase	34,34 mons	24.08.2021	10.04.2024
174	p-bar commissioning with beam	12,28 mons	10.04.2024	20.03.2025
177	Collector Ring	183,57 mons	24.08.2011	18.09.2025
178	CR procurement phase	134,85 mons	24.08.2011	24.12.2021
183	CR installation into tunnel, commissioning without beam	28,05 mons	16.06.2021	09.08.2023
188	CR commissioning with beam	27,51 mons	09.08.2023	18.09.2025
191	HESR	218,02 mons	26.03.2009	11.12.2025
192	HESR procurement phase	113,8 mons	26.03.2009	15.12.2017
197	HESR installation into tunnel, commissioning without beam	20,1 mons	18.11.2021	02.06.2023
203	HESR commissioning with beam	32,92 mons	02.06.2023	11.12.2025
206	HEBT	138,77 mons	02.01.2014	22.08.2024
207	HEBTprocurement phase	92,8 mons	02.01.2014	11.02.2021
224	HEBT installation and commissioning without beam	45,52 mons	25.02.2021	22.08.2024
240	CBM	152,67 mons	08.07.2013	20.03.2025
241	CBM procurement phase	130,25 mons	08.07.2013	30.06.2023
245	CBM installation and commissioning without beam	33,55 mons	01.12.2021	26.06.2024
250	CBM commissioning with beam	9,52 mons	26.06.2024	20.03.2025
253	APPA	199,07 mons	16.12.2009	20.03.2025
254	APPA procurement phase	172,65 mons	16.12.2009	10.03.2023
259	APPA installation into tunnel, commissioning without beam	36,6 mons	31.12.2020	20.10.2023
271	APPA commissioning with beam	18,42 mons	20.10.2023	20.03.2025
274	NUSTAR	141,17 mons	15.09.2014	10.07.2025
275	NUSTAR procurement phase	120 mons	15.09.2014	27.11.2023
278	NUSTAR installation into cave or tunnel phase	38,85 mons	17.06.2021	07.06.2024
288	NUSTAR commissioning with beam	14,17 mons	07.06.2024	10.07.2025
291	PANDA	226,22 mons	08.08.2008	11.12.2025
292	PANDA procurement phase	173,1 mons	08.08.2008	15.11.2021
297	PANDA installation and commissioning without beam	26,2 mons	19.10.2021	20.10.2023
303	PANDA commissioning with beam	27,92 mons	20.10.2023	11.12.2025

Progress achieved in the FAIR Accelerator and Experimental Projects

Status of FAIR: Civil Construction

rapid progress since official start on 4th of July 2017

Excavation SIS100 tunnel

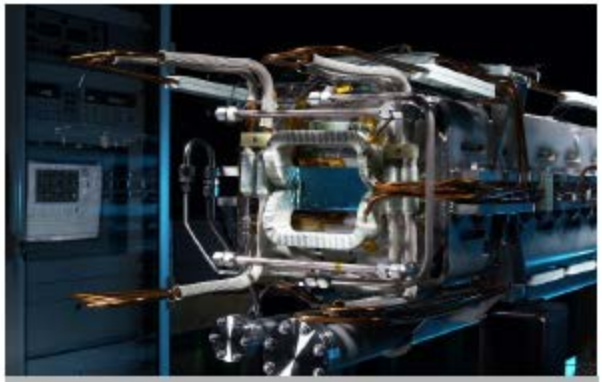
eted ready for FAIR and FAIR phase 0

Excavation transfer building & CBM cave

Start of concrete shell works for SIS100

Status of FAIR: accelerators:
construction / procurement progresses well

- Serial production for major components for SIS 100 is progressing with one quarter of the dipole magnets already manufactured.



SIS100 Dipole Magnets

Cryo Catcher

Cryo-Bypass Line

Bunch Compressor

Quadrupole Unit

RF Cavity System

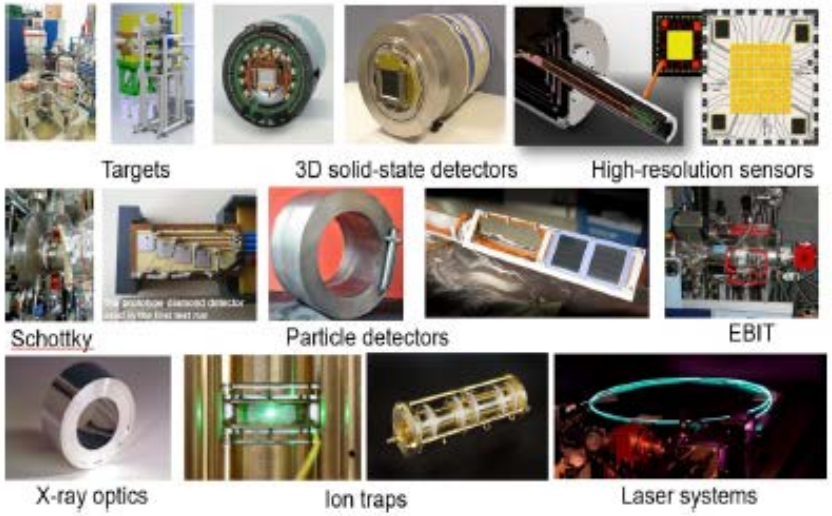
24 SIS100 (of 120) dipole magnets have been delivered and are being cold-tested …

Status of FAIR: experiments

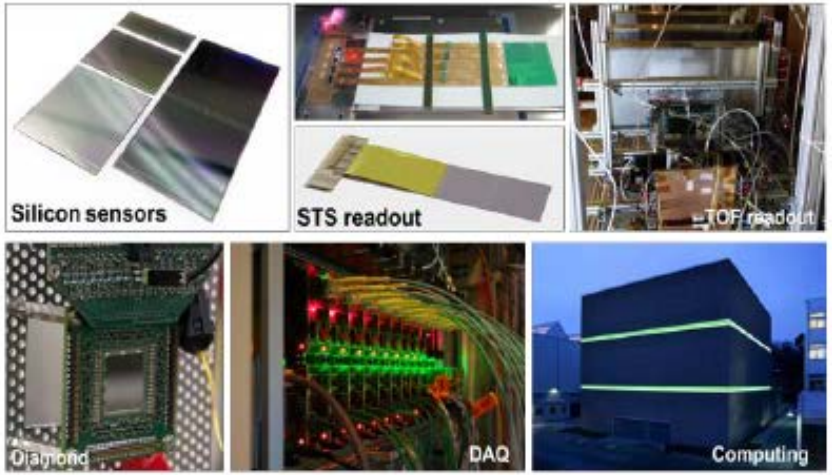
detector R&D and construction well on track …

FAIR GSI

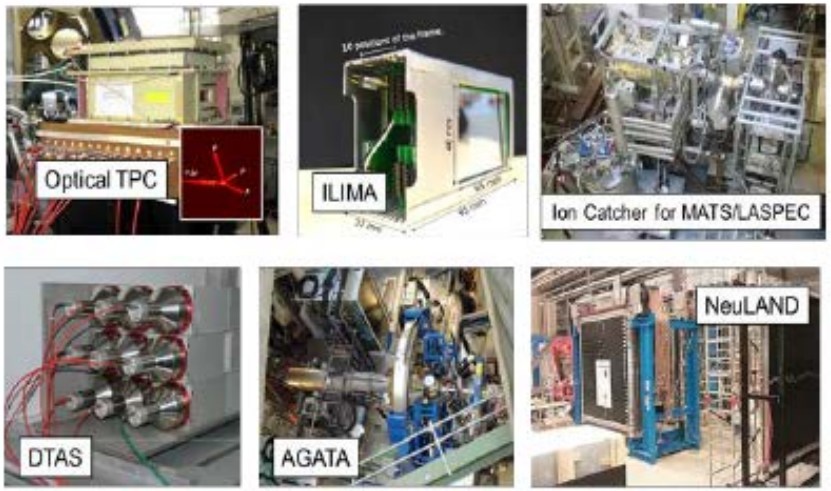
APPA



CBM



NUSTAR



PANDA

Russia

Status of this sheet: *after 25th Council meeting, 6 Dec. 2018*

Commitment (all figures Jan. 2005 prices):(Convention, signed)	**178.050 M€**
Cash, including:	178.050 M€
Cash (beyond contributions to ACC. & EXP.:	44.500 M€
Accountable contribution to accelerators:	66.314 M€
Of which assigned and partly contracted: 65.236 M€	
of which manpower *(not acc. cost book): 6.314 M€*	
Accountable contribution to experiments:	24.270 M€
(of which assigned: 24.270 M€ + Priority 2 components = 30.975 M€)	
Planned additional contribution to experiments acc. to Russian EoIs:	29.290 M€
Planned but not specified cash contribution to accelerators:	13.676 M€
Required additional commitment in cash (XVII.6.3):	**43.100 M€**
By June 2016	27.500 M€
Status of Commitment: Confirmed (Statement 25th Council Meeting).	
By 2019	15.600 M€
Status of Commitment: Confirmed (Statement 25th Council Meeting).	

Experiments:

FAIR

Russia

Status of this sheet: *after 25th Council meeting, 6 Dec. 2018*

Contracted:		**23.327 M€**
IHEP: PANDA PWO crystals (1981 pcs.), (II.19.1):		1.006 M€
IHEP: PANDA Barrel base materials, 1.4.1.10.1.8.1 (XX.13.24):		0.680 M€
IHEP: PANDA mechanical structure of EM calorimeter, (VI.11.2):		2.844 M€
IHEP: HEDgeHOB for high-gradient quadrupoles, (XI.19.3):		2.800 M€
Budker: PANDA - yoke for SC solenoid, (VI.11.3):		1.000 M€
Budker: PANDA SC. solenoid (besides yoke), (XI.19.4):		4.420 M€
Budker: CBM- SC. dipole, contract negotiations, (XI.19.5):		3.758 M€
JINR: CBM -Ladders for STS tracking system, (IX.18.4):		2.115 M€
PNPI NUSTAR HV distribution system NeuLAND, (VIII.19.5):		0.415 M€
PNPI: Mech. structure of CBM RICH detector, (XI.19.6): (0.250 M€ more in Priority 2, total price: 1.450 M€)		1.200 M€
PNPI: Components for CBM-MUCH, (XVI.12.4): (1.200 M€ more in Priority 2, total price: 3.022 M€)		1.822 M€
PNPI: NUSTAR – Tracking Detectors, 1.2.5.1.2.1.4 (XXI.6.9):		0.489 M€
INR- Modules for CBM – PSD, (XVI.12.3):		0.778 M€
Assignments: (this also includes the Priority 2 components)		**7.648 M€**
IHEP: PANDA Forward Shashlyk Calorimeter, 1.4.1.11.1 (XXI.6.10)	(Priority 2)	1.352 M€
JINR: PANDA – Muon System, 1.4.1.13.5 (XXI.6.11)	(Priority 2)	2.318 M€
JINR: NUSTAR – R3B, 1.2.5.1.2.3.2.2 (XXII.13.4)		0.300 M€
PNPI: NUSTAR – Sci. bars & Read-out Elec. NeuLAND, (VIII.19.4):	(Priority 2)	0.585 M€
PNPI: Components for CBM-RICH, 1.1.1.3.1.2.2 (XI.19.6)	(Priority 2 part)	0.250 M€
PNPI: Components for CBM – MUCH, 1.1.1.3.2.3.2 (XVI.12.4):	(Priority 2 part)	1.200 M€
PNPI NUSTAR ACTAF-2 small chamber work packageCo1, (XXIII.12.8)		0.175 M€
ITEP: TOF detector for CBM, 1.1.1.5.4 (XXI.6.8)		0.468 M€
ITEP: APPA Wobbler, 1.3.2.1.4.1 (XXI.6.12):	(Priority 2)	1.000 M€

Schedule for Realizing FAIR

- Working towards the completion of FAIR by 2025

➡ Major thrust is on construction of FAIR accelerators and experiments

➡ But at the same time we pursue a staged approach to FAIR science and to the progressive commissioning of accelerators and detectors:

  - ***FAIR phase 0 : start in 2018/2019***
  - FAIR day 1/ phase 1 with FAIR accelerators progressively approaching design parameters
  - Full FAIR operation

Evaluation of proposals for first FAIR Phase-0 Campaign 2018/19

Results G-PAC (overall): beamtime recommendations in 8 h-shifts

	Shifts requested			Shifts recommended (A)			Shifts extended (A and A-)		
Session	Sum main	Sum para.	Total	Sum main	Sum para.	Total	Sum main	Sum para.	Total
ESR / CRYRING	555	0	555	188	0	188	278	0	278
SIS18: HADES / CBM	183	81	191	94	81	102	134	81	142
SIS18: NUSTAR - R3B	264	20	266	85	34	88	120	34	123
SIS18: NUSTAR - S-FRS	185	69	192	62	38	66	102	59	108
SIS18: NUSTAR - DESPEC	221	40	225	58	22	60	58	40	62
UNILAC / SHE	570	261	596	294	174	311	327	174	344
Σ	1978	471	2025	781	349	816	1019	388	1058

Total requested

Total recommended

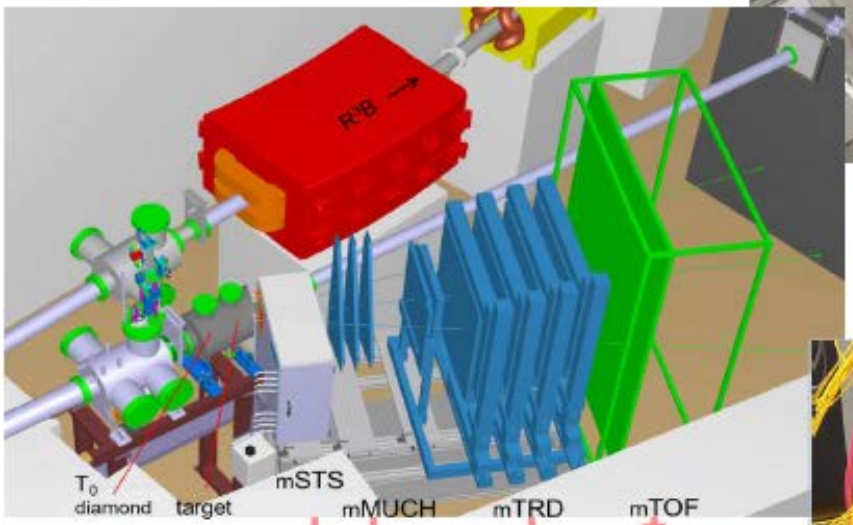
Total recomm. plus "flexible reserve"


С Новым 2019 годом!
2019

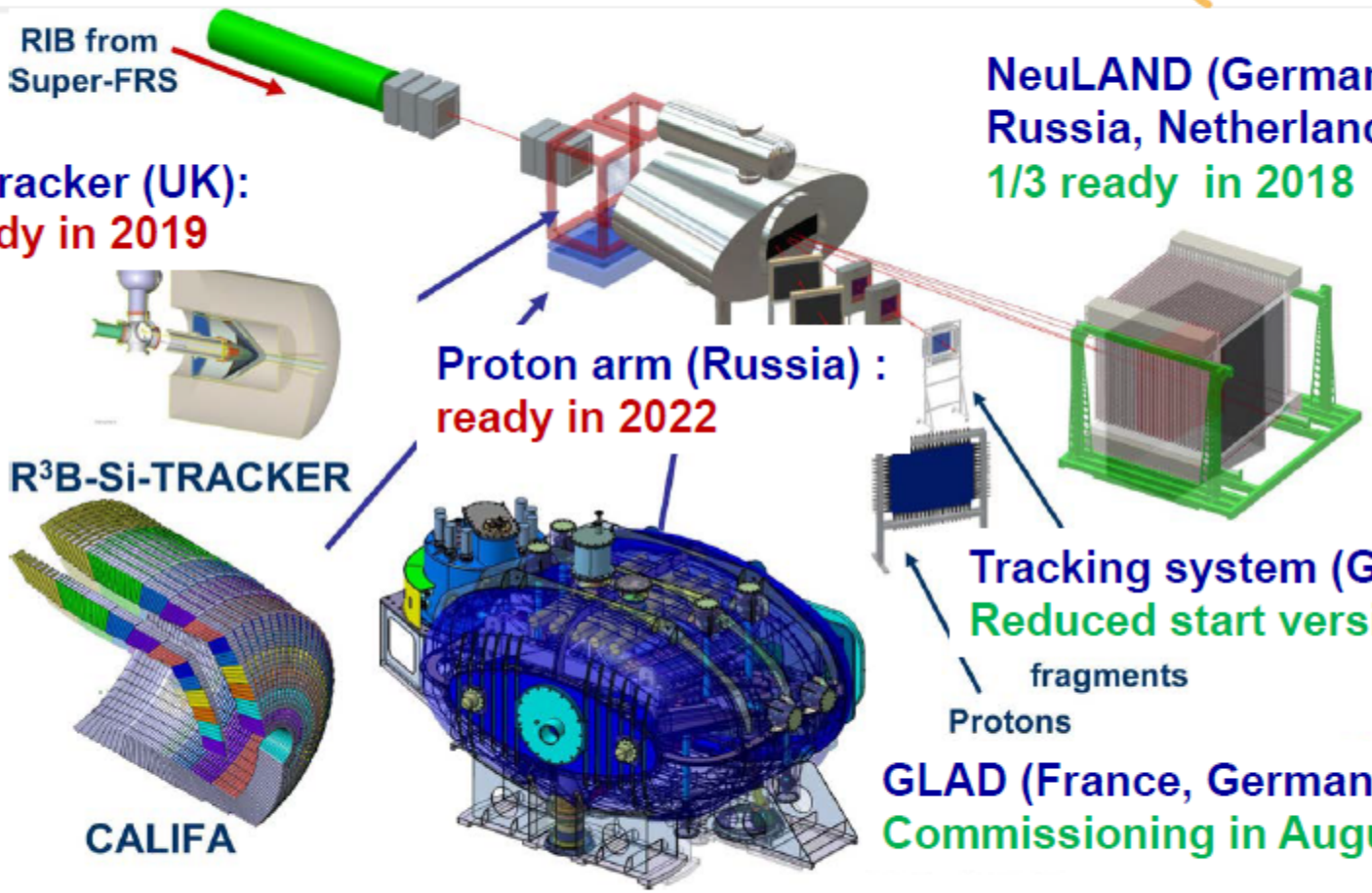
mCBM@SIS18 - a CBM full system test-setup for high-rate nucleus-nucleus collisions at GSI/FAIR

- 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

mcbm@SIS18 cave



Start version for Phase 0 (Status 2018)

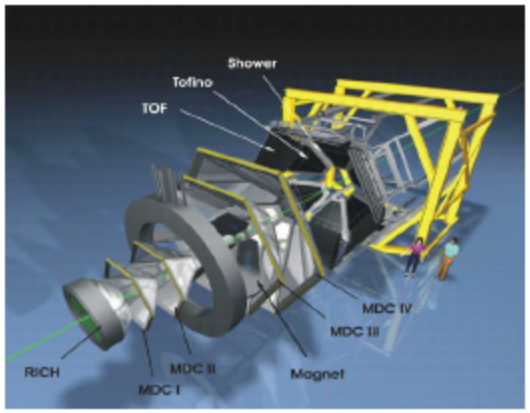


CALIFA (Sweden, Spain, Germany, Russia):
Barrel without backward part ready in 2018
+ 80% of the endcap ready in 2019

HADES

FAIR GSI

HADES Spectrometer



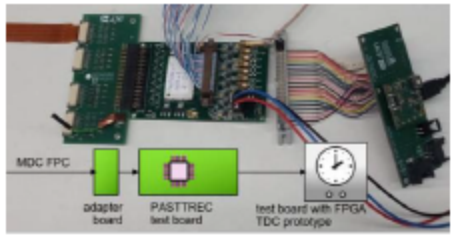
RICH Upgrade

HADES Calorimeter

- ✓ **RICH (HADES/CBM phase 0 project) – finished, ready for beam** Gain in lepton pair detection efficiency (x 3)
  - Improved background/noise rejection:
    - Better conversion pair rejection
    - Precise time information (down to 300ps precision)
  - Joint (CBM/PANDA/HADES) development of read-out system based on TRB3 platform.
- ✓ **Electromagnetic Calorimeter – 4 sectors ready for beam in 2019**
  - π0 and η decays into γγ channel
  - Electromagnetic decays of baryonic resonances
  - Improved e/π separation: important for di-electron spectroscopy
  - Proven technology: lead glass modules read out with Hamamatsu PMTs
- ✓ **MDC readout upgrade – Installation in 2020** Multi-hit TDC (TRB based) – essential for high rate experiments
  - Read-out trigger rate increase from 50 kHz to 200 kHz
- ✓ **Forward Detector (HADES/PANDA phase 0 project) – installation in 2019**
  - Enhance HADES capabilities for exclusive channels – forward region
  - Hyperon production and EM decays
  - PID via TOF, dE/dx(straw tube) – no magnetic field

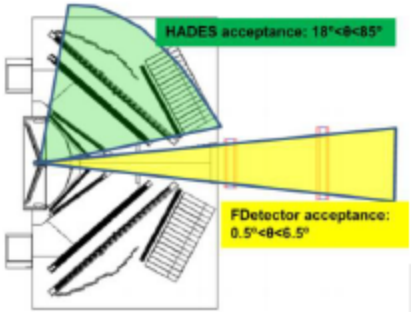
MDC readout upgrade

Installation in 2020



Forward Detector –

Installation in 2019

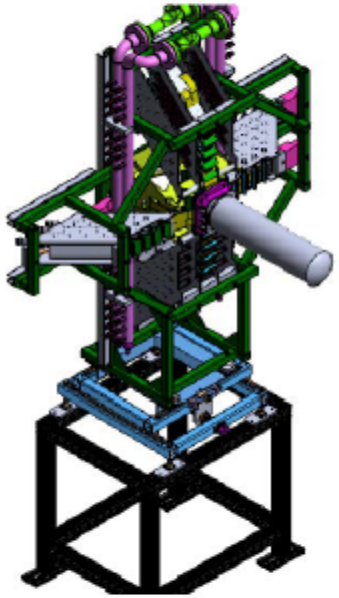


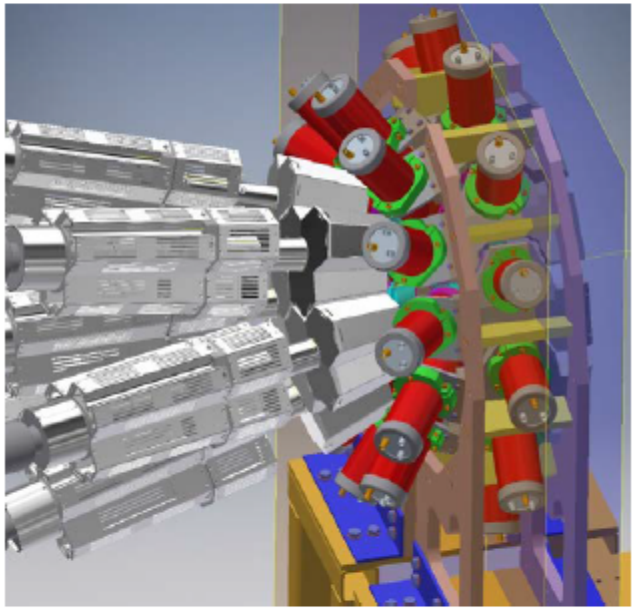
DESPEC in FAIR Phase-0 (2018/19)

Spectroscopy & lifetimes of neutron-rich nuclei close to N=126

FATIMA fast-timing array - ready for experiments (S452, S460 & S468)

FATIMA & AGATA at GANIL *AIDA* *DEGAS & FATIMA (2019)*





AIDA implantation and decay detector
(1/3 of full size available in 2018)
Commissioned in RIKEN, Japan