CREMLIN Kick-off Meeting

PARALLEL SESSION October 6th 2015:

17:15 **WP3 - Science cooperation with the NICA collider facility in the field of ion beams and heavy ion physics**
V.D. Kekelidze, JINR & J. Eschke, FAIR

- **Overview WP3 and Status of FAIR** - J. Eschke (WP Leader and CBM Resource Coordinator) (20 min)
- **Status of NICA** - V.D. Kekelidze (Director of the Veksler and Baldin Laborator of High Energy Physics of JINR) (20 min)
- **Status of CBM experiment at FAIR** – P. Senger (CBM spokesperson) (20 min)
- **Status of the CBM Silicon Tracking System** – J. Heuser (CBM-STS project Technical Coordinator) (20 min)
- **Status JINR participation in the construction of Silicon Detectors for experiments at NICA and FAIR** – Y. Murin (Head of STS Department, VBLHEP JINR) (20 min)
- **Discussion**

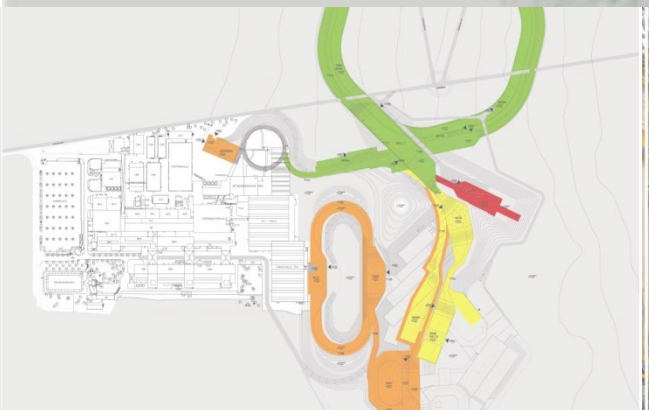
19:00 *Dinner at Art Hotel*

Connecting Russian and European Measures for Large-scale Research INfrastructures – "CREMLIN"

WP3 - Science cooperation with the NICA collider facility in the field of ion beams and heavy ion physics

Jürgen Eschke
(WP Leader)
FAIR GmbH

CREMLIN Kick-off meeting
Moscow, 06 October 2015



Overview WP3 and Status of FAIR

J. Eschke (WP Leader and CBM Resource Coordinator)

- Status Facility for Antiproton and Ion research (FAIR) in Darmstadt, Germany

- Cooperation with Joint Institute of Nuclear Research (JINR) in Dubna, Russia
  - in the field of accelerator components
  - for the Compressed Baryonic Matter experiment (CBM) at FAIR and for the BM@N and MPD experiments at JINR

- Overview WP3
  - scope
  - tasks
  - deliverables

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

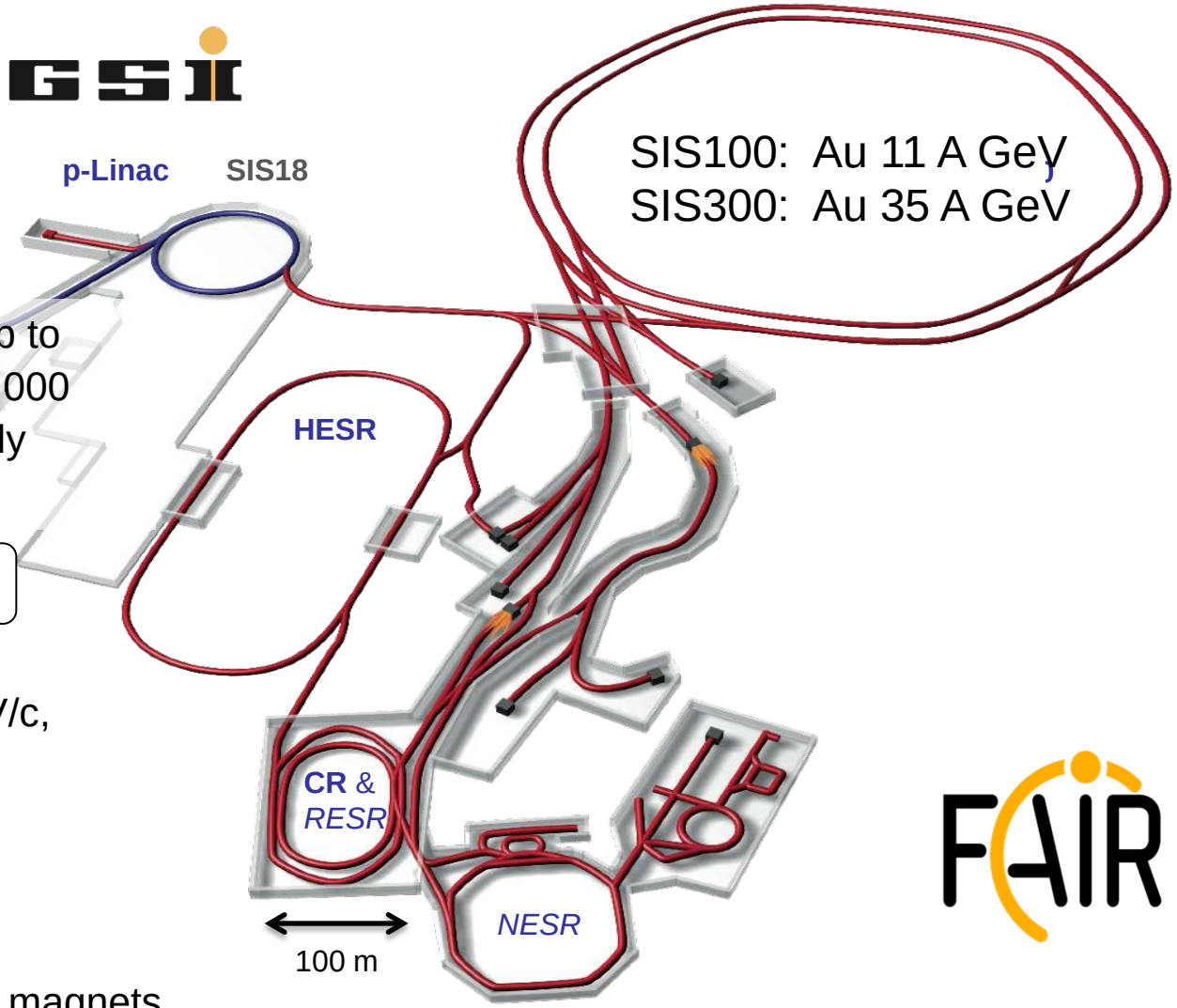
- range of radioactive beams up to 1.5 - 2 GeV/u; up to factor 10 000 higher in intensity than presently
- antiprotons 3 - 30 GeV

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
- dynamical vacuum

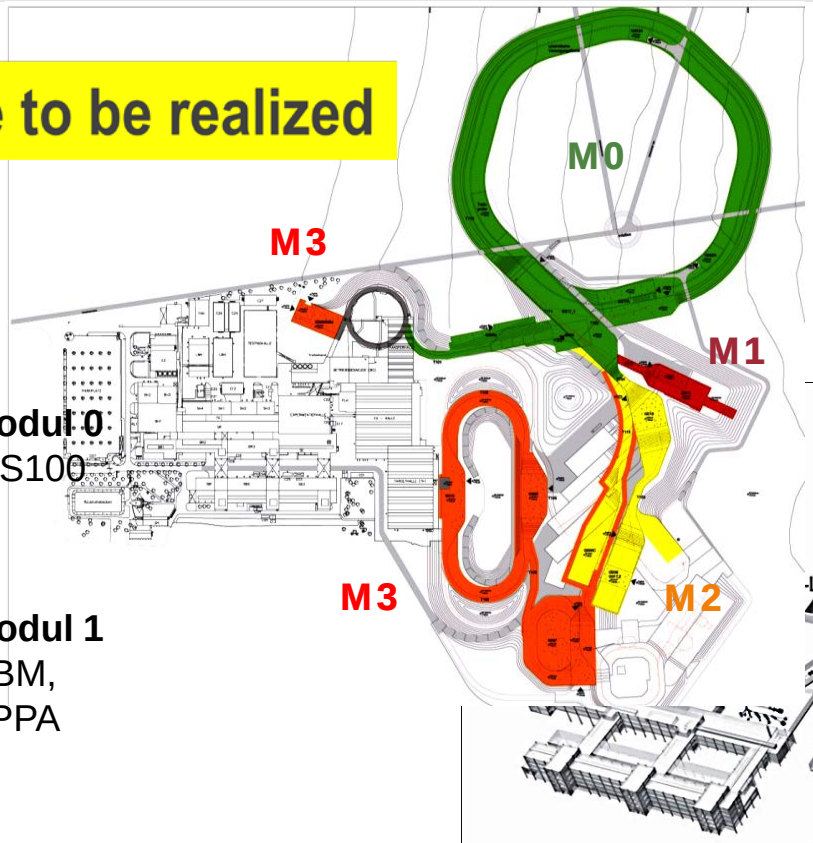


FAIR GmbH

- Steering company
- International Convention
- Partners

FAIR Modularized Start Version (MSV)

scope to be realized



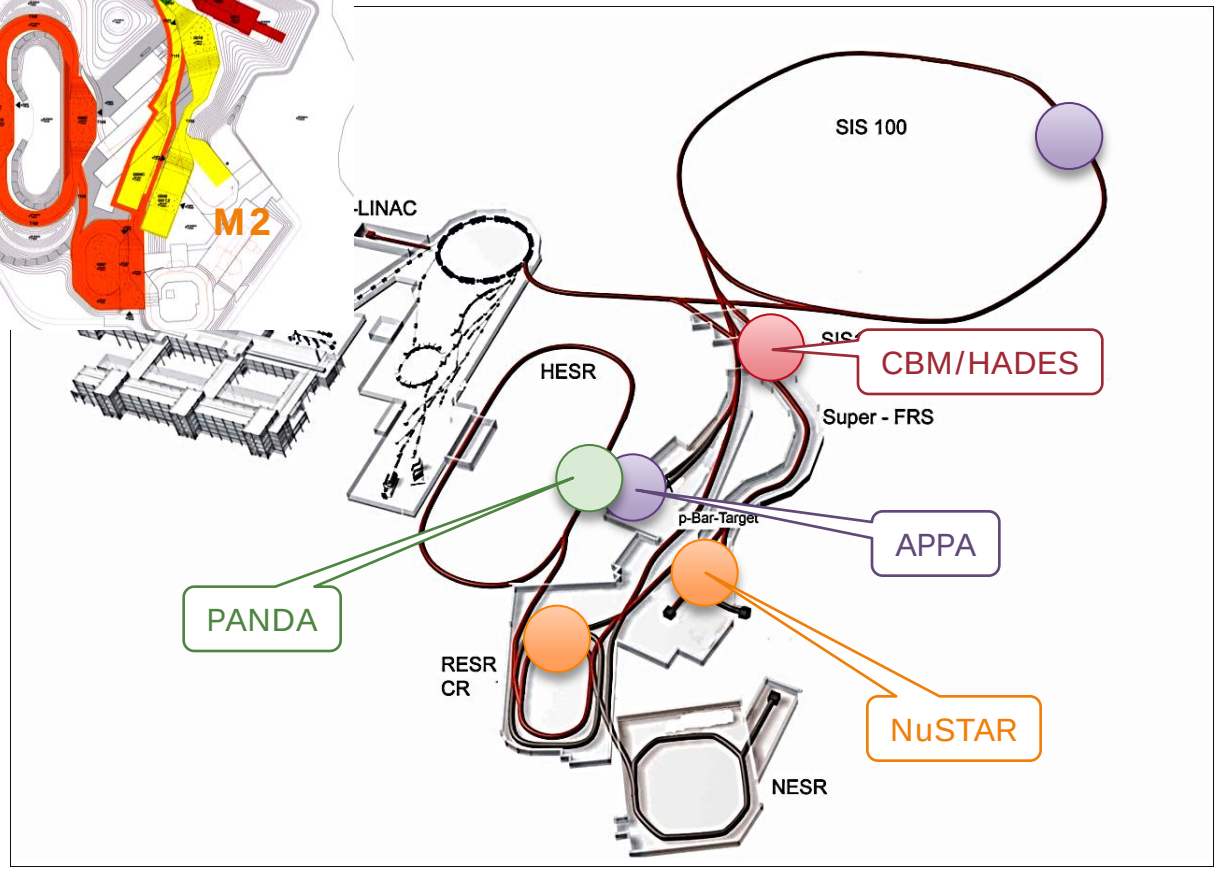
Experiments
M1: APPA
M1: CBM/HADES
M2: NuSTAR
M3: PANDA

Modul 0
SIS100

Modul 1
CBM,
APPA

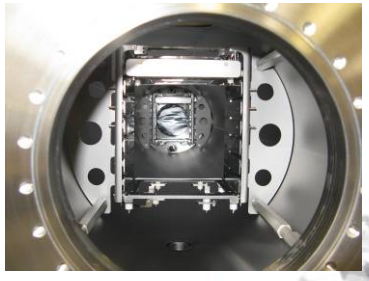
Modul 2
Super-FRS

Modul 3
Antiproton-target, CR, p-Linac, HESR

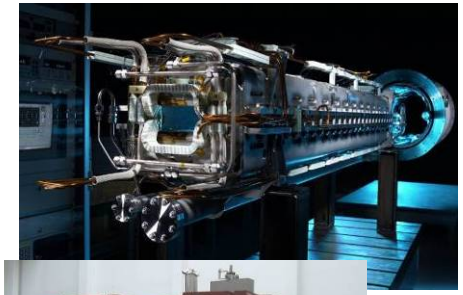


FAIR accelerator challenges

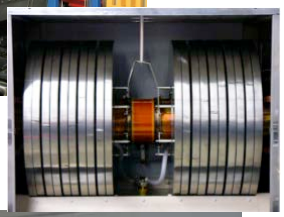
Diagnostic and XHV at highest intensities



Superconducting magnets



Rf-cavities



Beam cooling

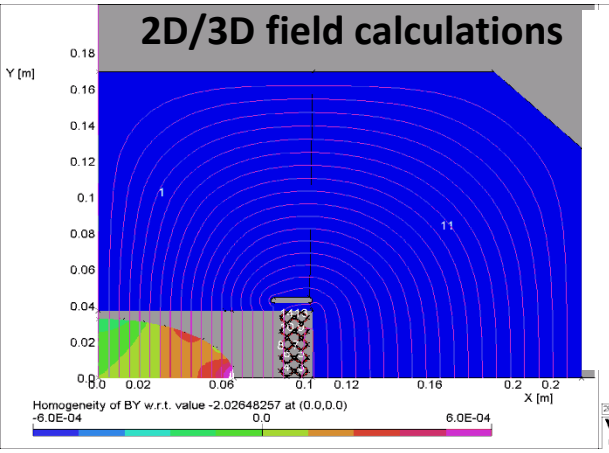
FAIR HELMHOLTZ GEMEINSCHAFT GSI

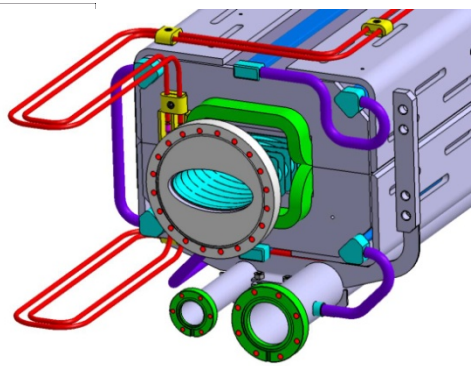
SIS 100 Main Synchrotron

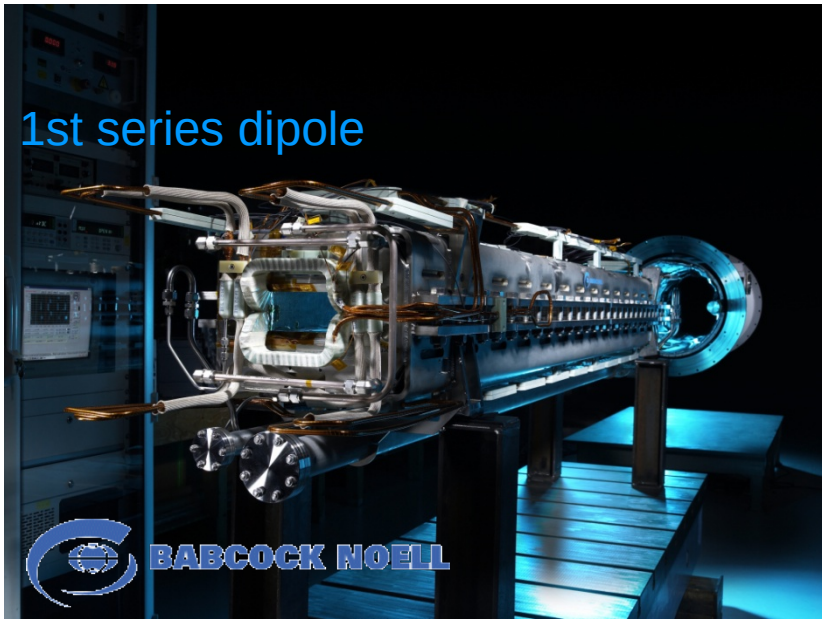
Intermediate charge state ions e.g. U^{28+}-ions up to 2.7 GeV/u
Protons up to 29 GeV

- fast-ramped superconducting magnets and
- strong bunch compression system

$B\rho$= 100 Tm B_{max}= 1.9 T dB/dt= 4 T/s curved magnet







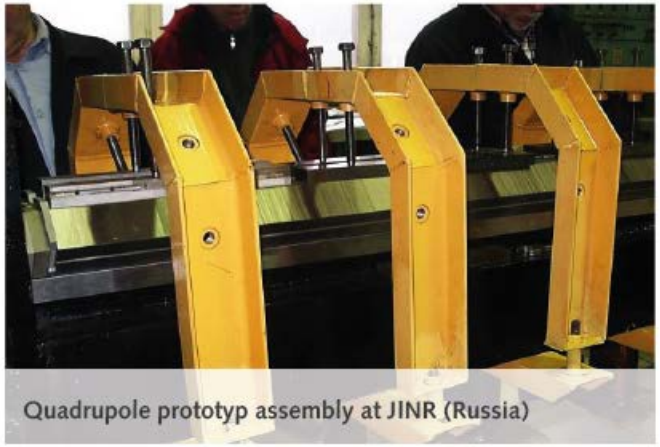
Prototype production also at BINP,JINR

R&D for Fast Ramped Superconducting Magnets

109 pieces required for SIS 100

- Before prototyping, several 1m R&D models have been build together with JINR

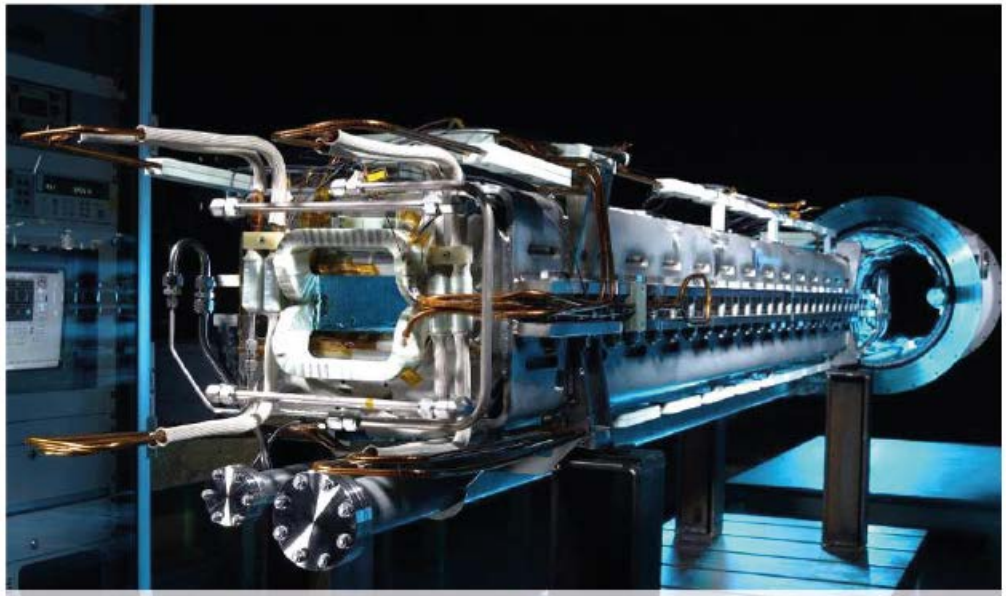
First curved SIS100 dipole manufactured at BINP (Russia)



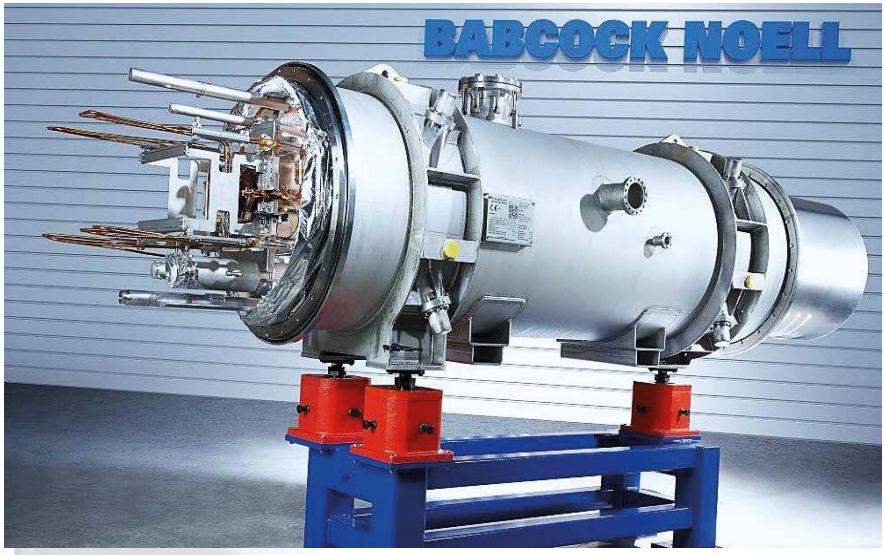
Quadrupole prototyp assembly at JINR (Russia)

Status:

- Contract signed
- Production by BNG (Germany) started
- FoS magnet delivered and succesfully tested at full ramp rate
- Manufacturing processes optimized
- Cable production released

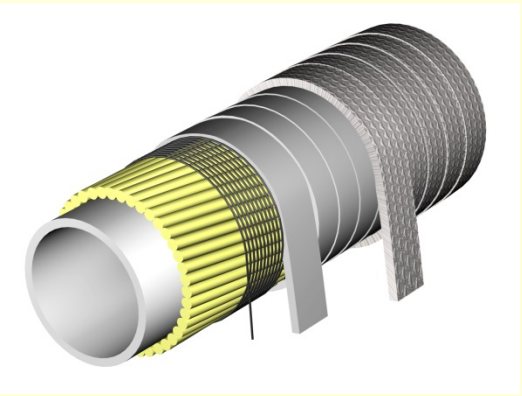


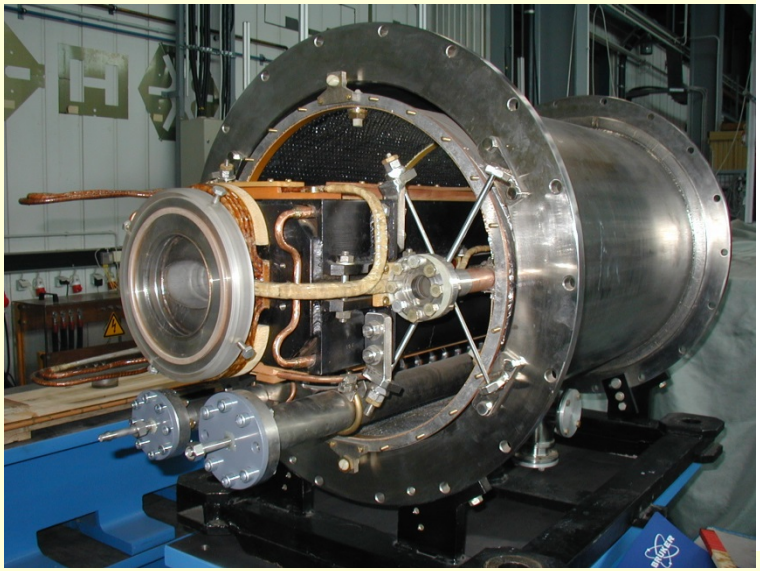
Full size SIS100 dipole with two layer coil (BNG, Germany)

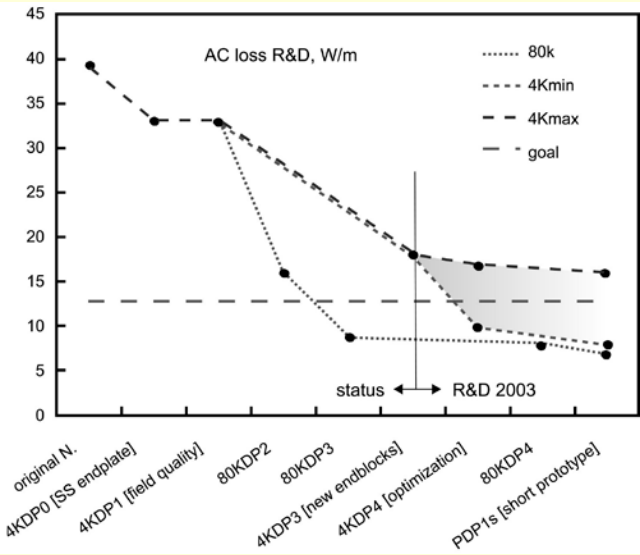


Fast Ramped Superconducting Magnets for SIS100

Window frame magnet with superconducting coil







Nuclotron Cable (developed by JINR) **Nuclotron Dipole in Cryostat**

BNG (Germany) is the only provider for Nuklotron cables beside JINR (Russia)

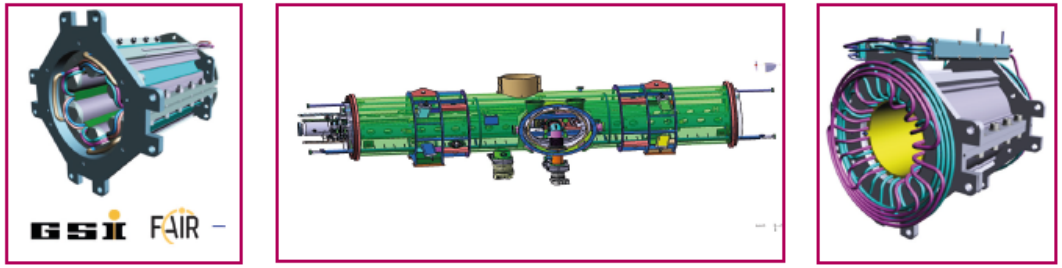
- Cable production for the dipole series and the local cryogenic system has started (almost completed)

Nuklotron cables production at BNG (Germany)

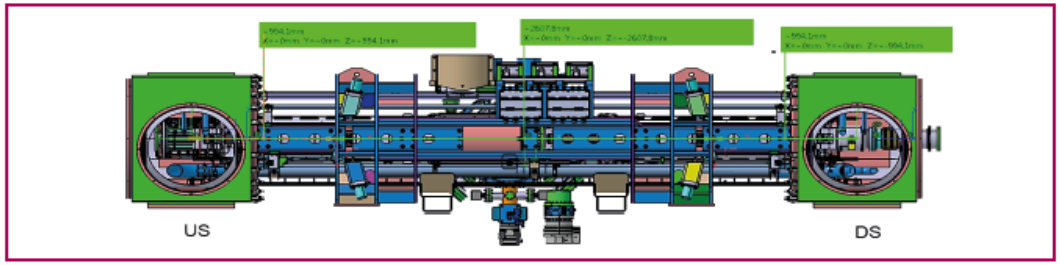
Intense Cooperation between GSI/FAIR and JINR in the joint developement and construction of components for accelerators

Cryomagnetic Quadrupole Modules for SIS100

- Manufacturing design of first of series module (FoS), completed by GSI design department, models and drawings send to JINR
- In-kind contract for production of quadrupole units with JINR (Russia) are signed
- R&D contract on QA and magnet test facilities between GSI and JINR are signed
- Production of FoS quadrupole units expected for end of 2015



Design of pre-series modul and components by GSI Design Office



Design of QM module including end boxes (link to local cryogenics)

Prototypes and Pre-Series Components for Quadrupole Magnets

Prototype Cryogenic Beam Position Monitor

FoS and Series Cryogenic Beam Position Monitor
- Tendering planned for Q3/2015

Prototype Cryocatcher

FoS and Series Cryocatcher
- Tendering ongoing. Offers received

Magnet testing facilities GSI / Dubna / CERN

SIS100 Quadrupole Magnet Testing at JINR Dubna

Preparation for tests at JINR

1600 m² main hall, 700 m² auxiliary facilities

- R&D contract on magnet facility signed
- Set-up of test stands started

- Testing of SIS100 Dipoles and prototypes at GSI
- Testing of SIS100 quadrupole units at Dubna
- Testing of Super-FRS magnets at CERN

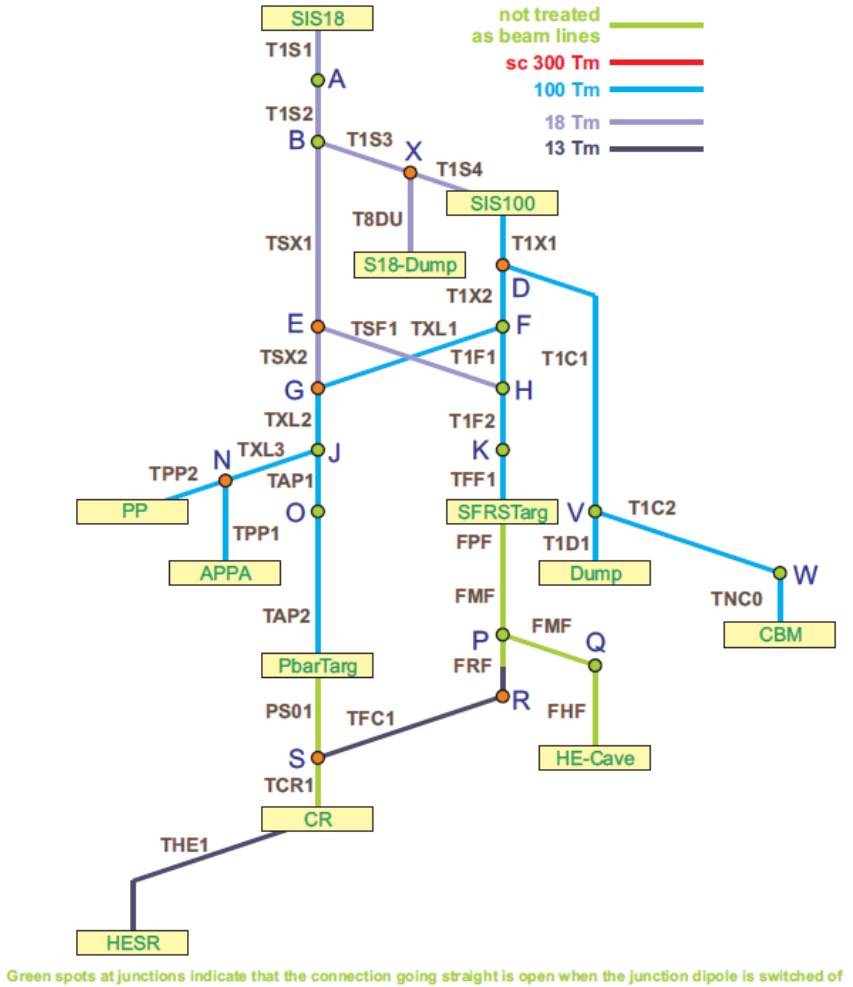
New series test facility at GSI

→ 2 kW cryo plant, new building

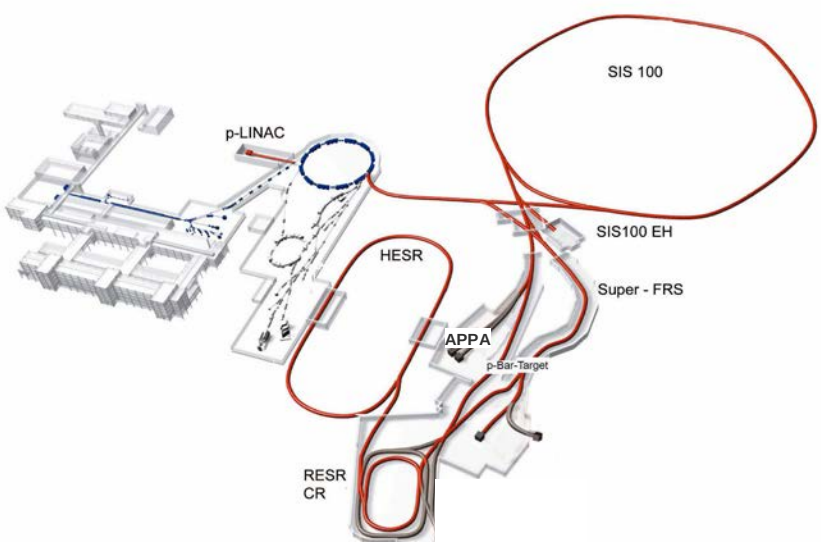
upgrade of test facility with a 20 kA power converter

preparation of string test area

HEBT – MSV (Module 0-3)

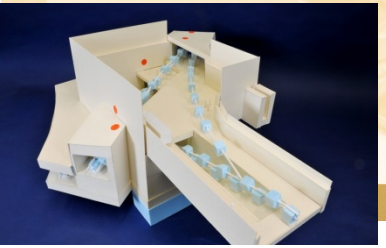


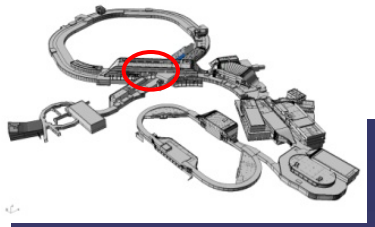
Green spots at junctions indicate that the connection going straight is open when the junction dipole is switched of

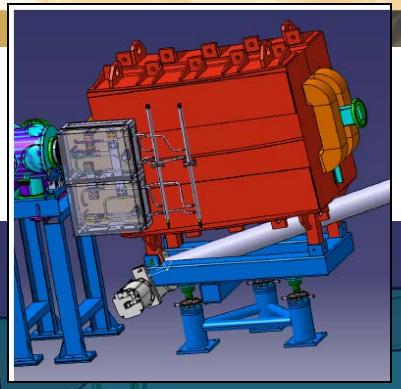


- 27 sections (11 connections/beam lines)
- Total length (HEBT) ca. 1.5 km
- All beam lines normal conducting
- Nominal magnetic rigidity:
  100Tm, 18Tm, 13Tm
- Parallel operation
- Full version has to be taken into account for building planning of the MSV

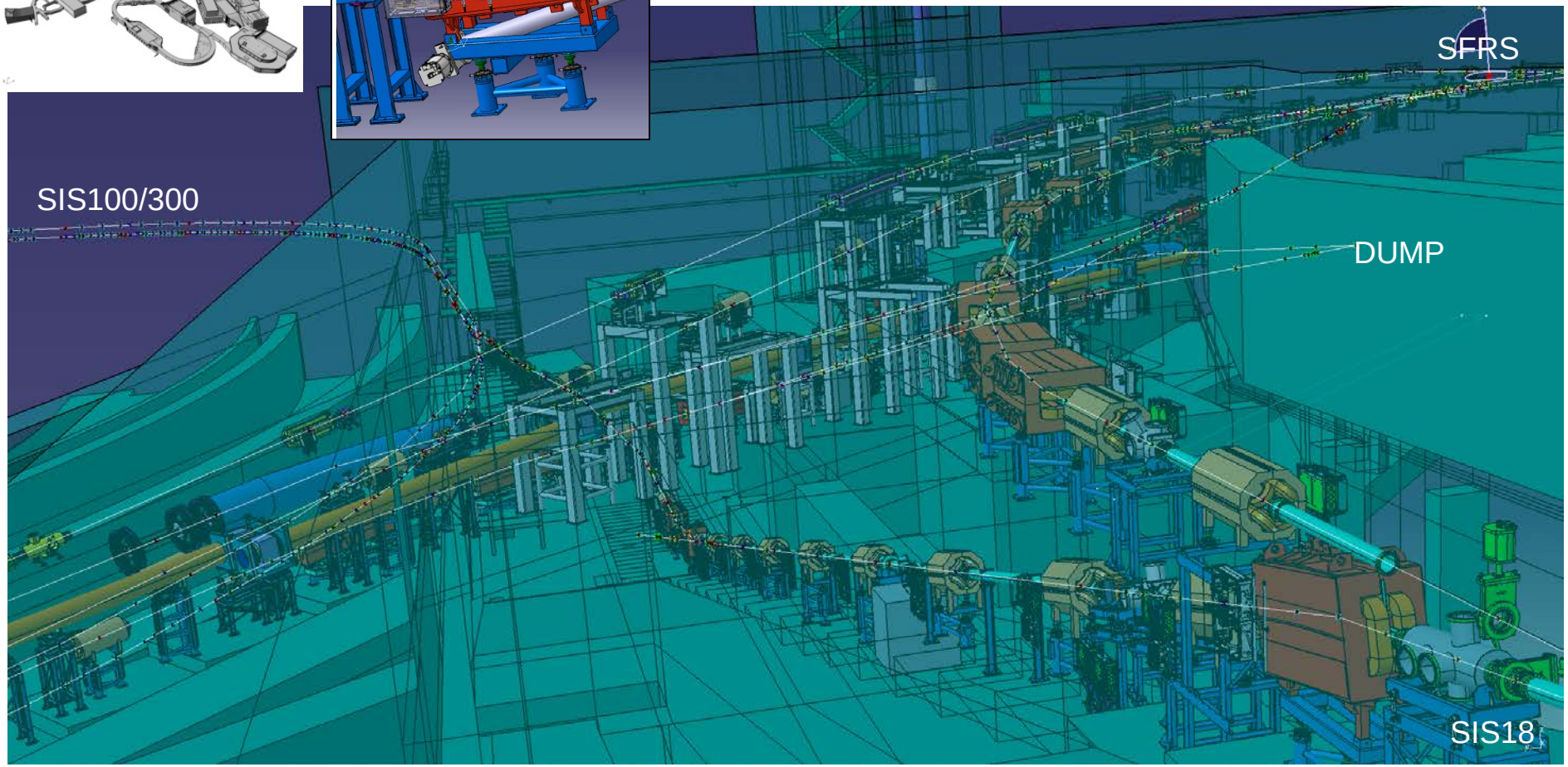
HEBT system lay-out of transfer lines



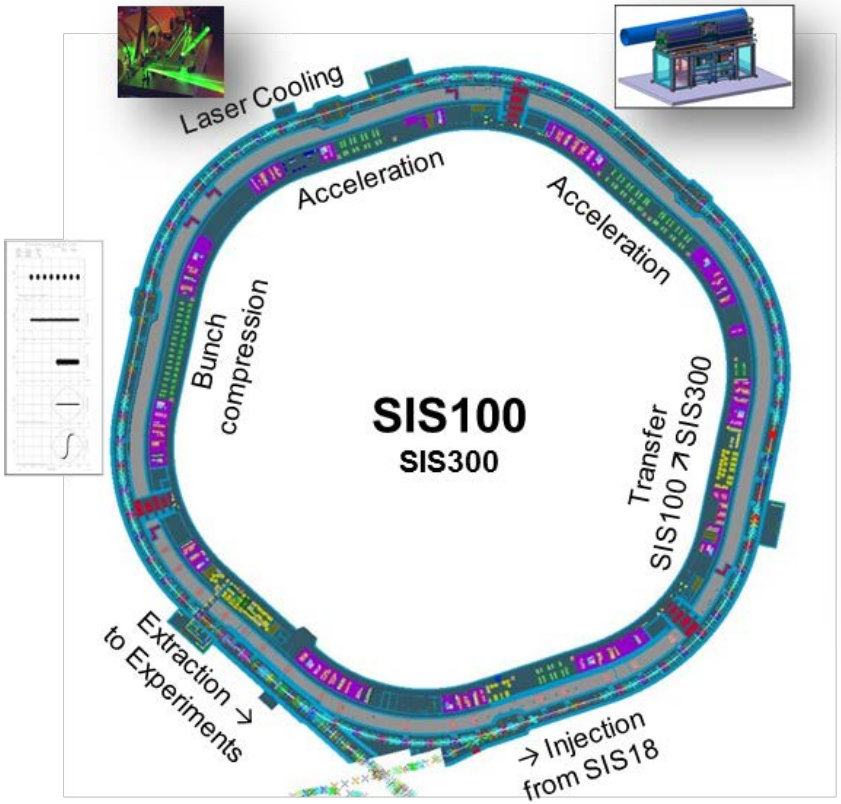




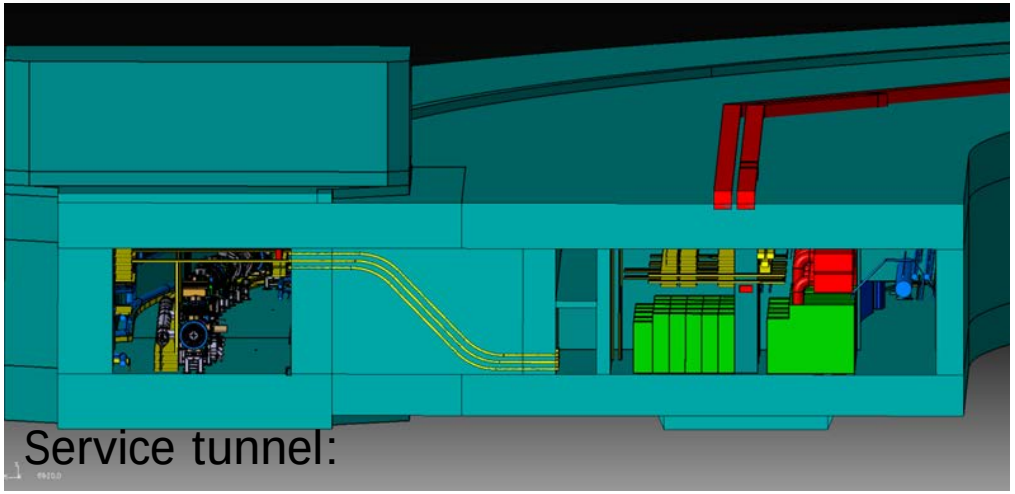
Production of HEBT magnets → Efremov St. Petersburg



SIS100/300 tunnel



Images courtesy of M. Konradt / J. Falenski



Service tunnel:

SIS300 - preparations

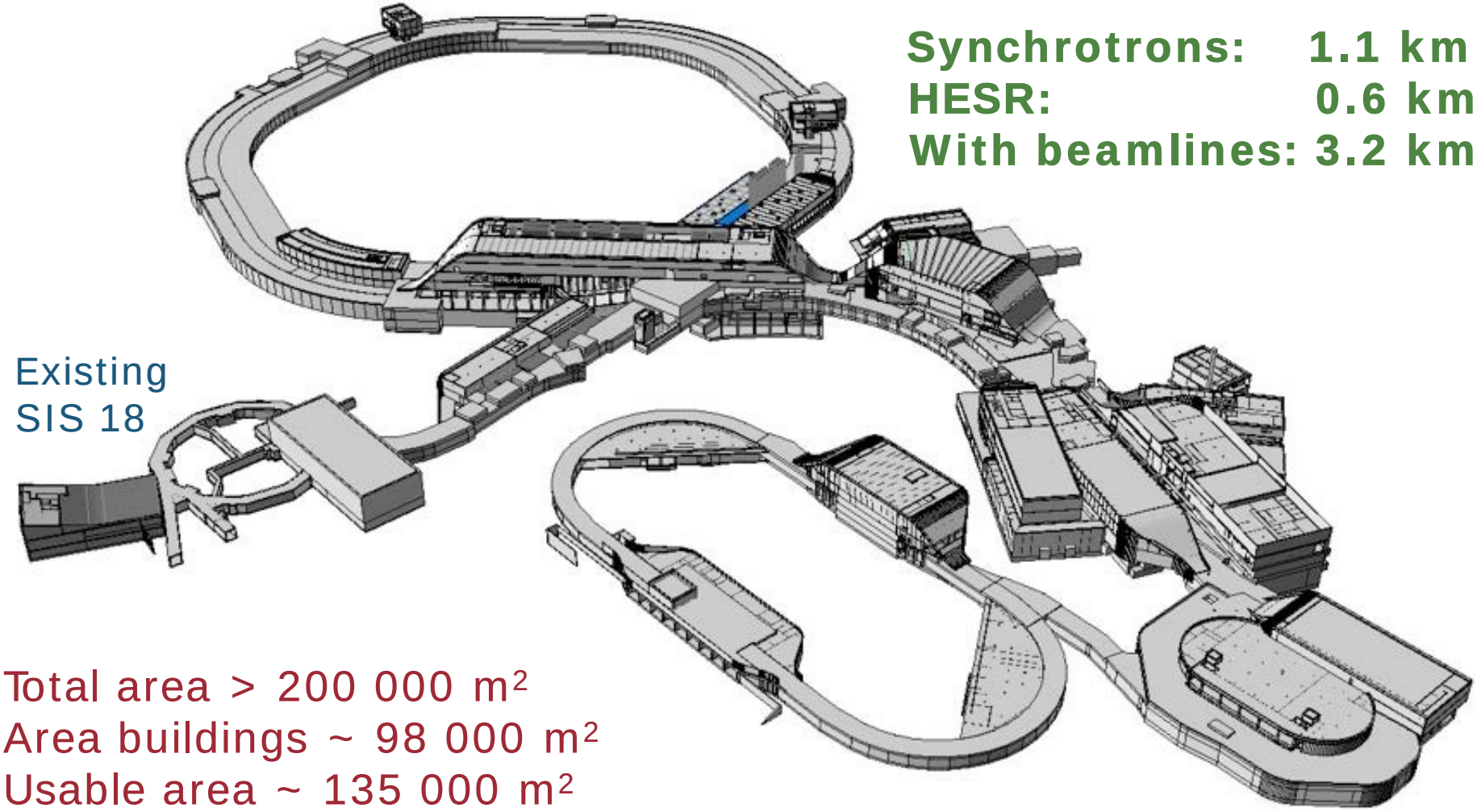
Full length curved, fast ramped s.c. SIS300 dipole magnet delivery: October 2013

- Within the scope of SIS300 R&D, GSI / FAIR has developed the fastest super-conducting accelerator magnets worldwide.
- Cos-theta configuration
  Bmax = 6 T ; dB/dt = 1 T/s
- Preparation of civil construction for SIS300

SIS300 quadrupole magnet prototype(IHEP, *Russia*)

Civil construction is presently the lead process

FAIR accelerator complex



Synchrotrons: 1.1 km
HESR: 0.6 km
With beamlines: 3.2 km

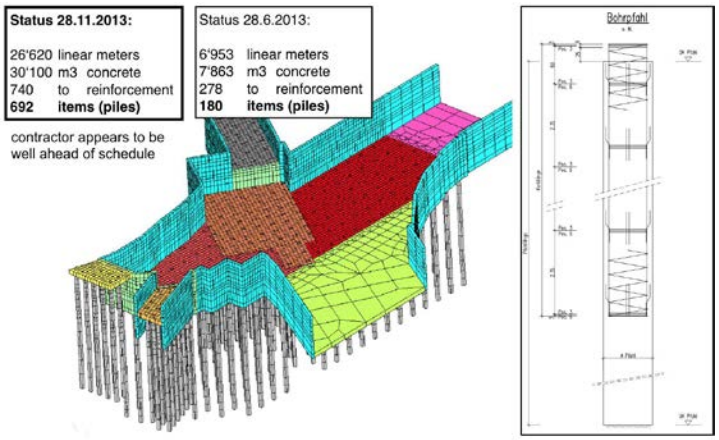
Total area > 200 000 m²
Area buildings ~ 98 000 m²
Usable area ~ 135 000 m²
Volume of buildings ~ 1 049 000 m³
Substructure: ~ 1500 pillars, up to 65 m deep

Important Milestones

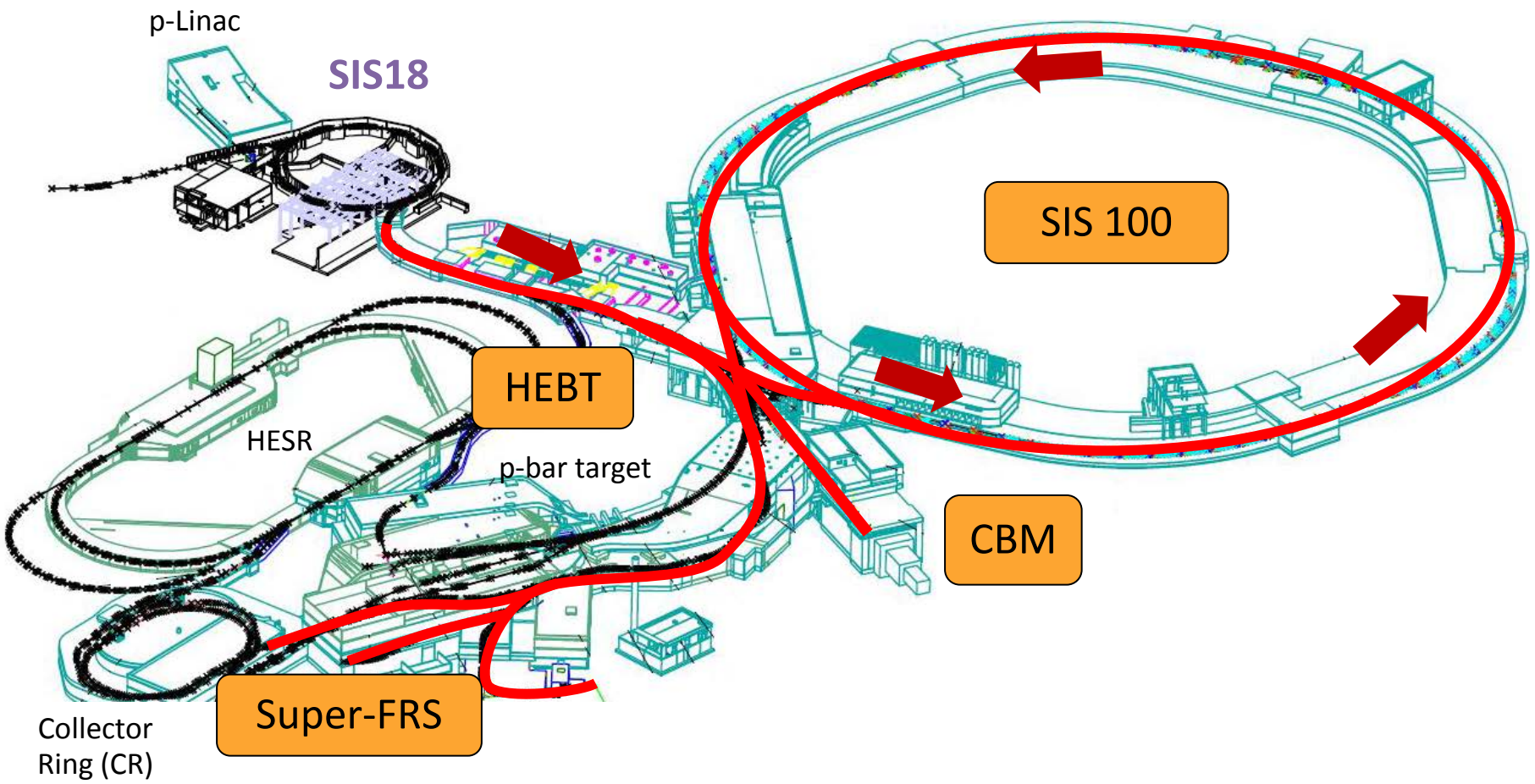
- Last construction license (radiation protection) received

Ceremonial handover on **May 22nd, 2014** of last (11th) partial construction approval regarding radiation protection. Representatives of the hessian ministry of HMUKLV took part in the celebration.

- Drilling of 1350 piles finished ahead of time

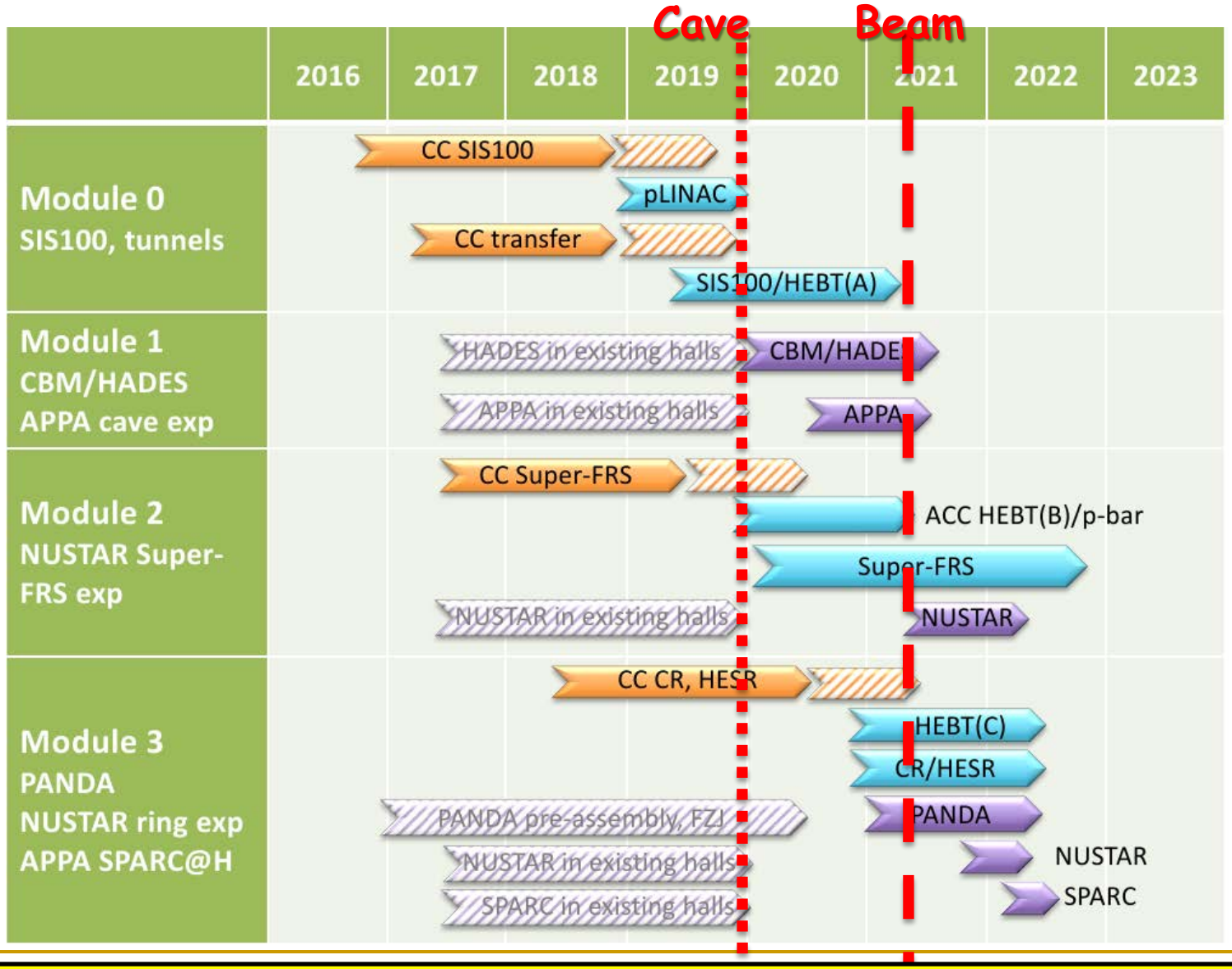


Staged realization along the beam towards MSV

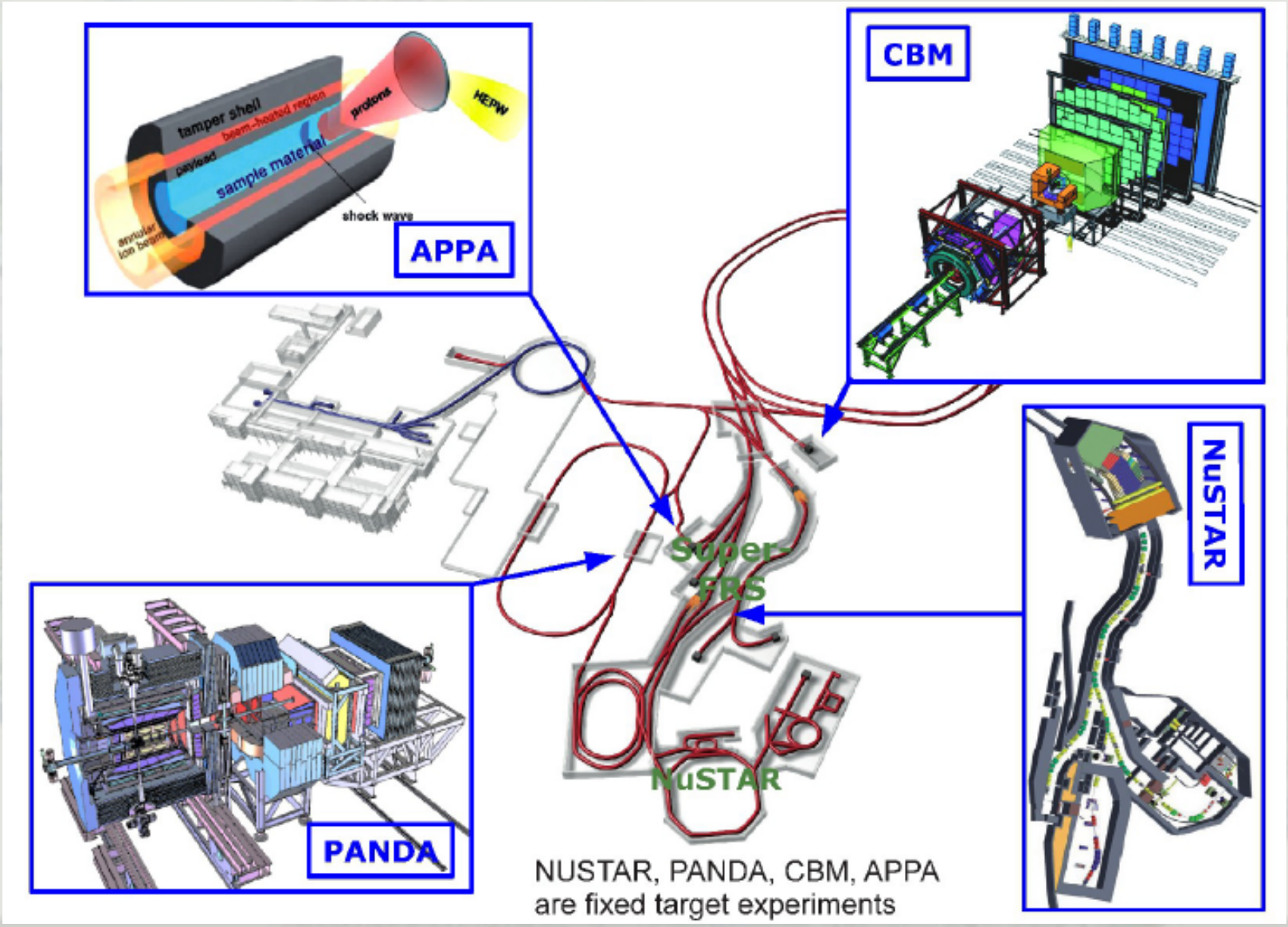


FAIR scope is MSV
updated timeline in the near future

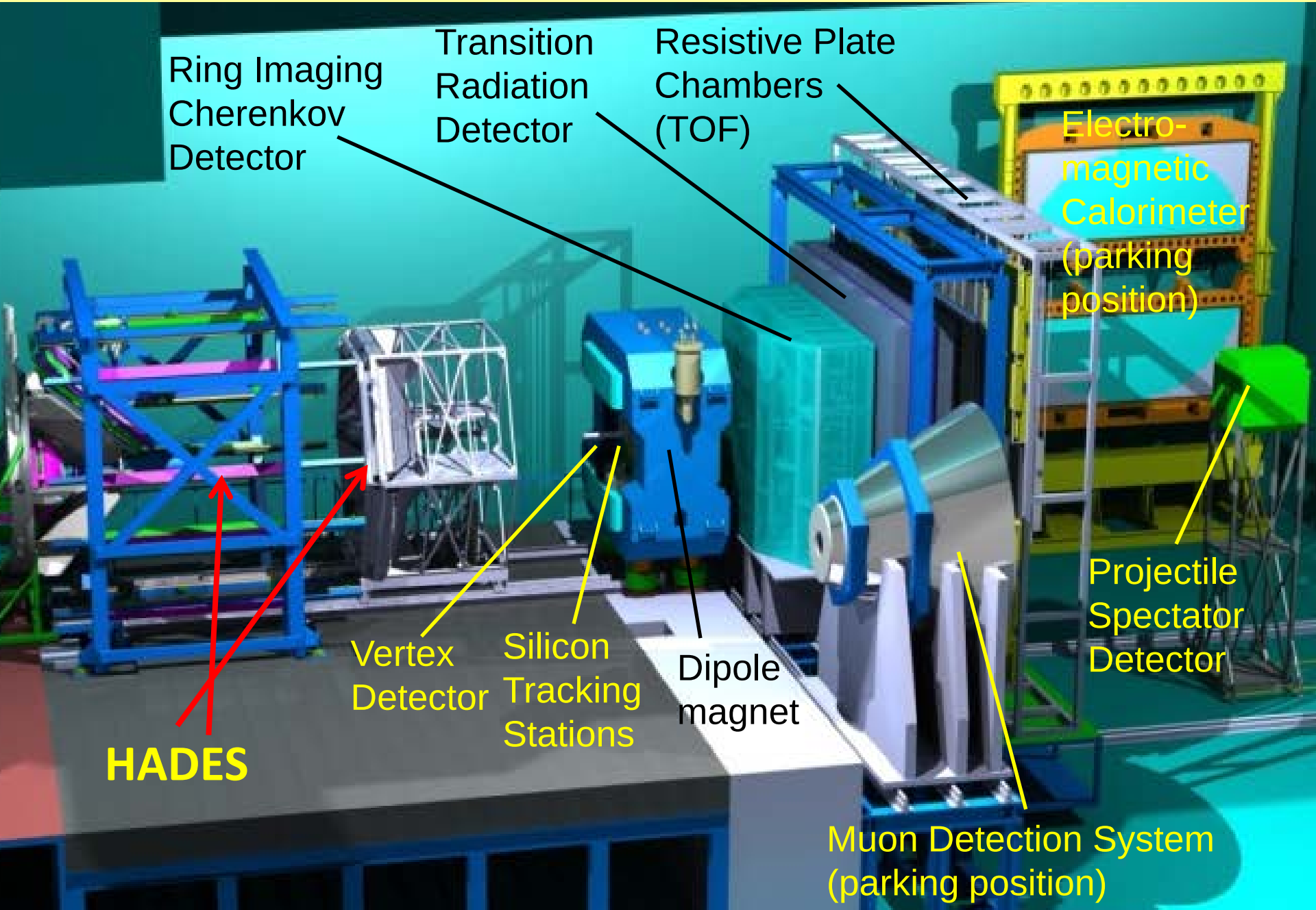
FAIR Time Lines (as shown to Council June 2015)



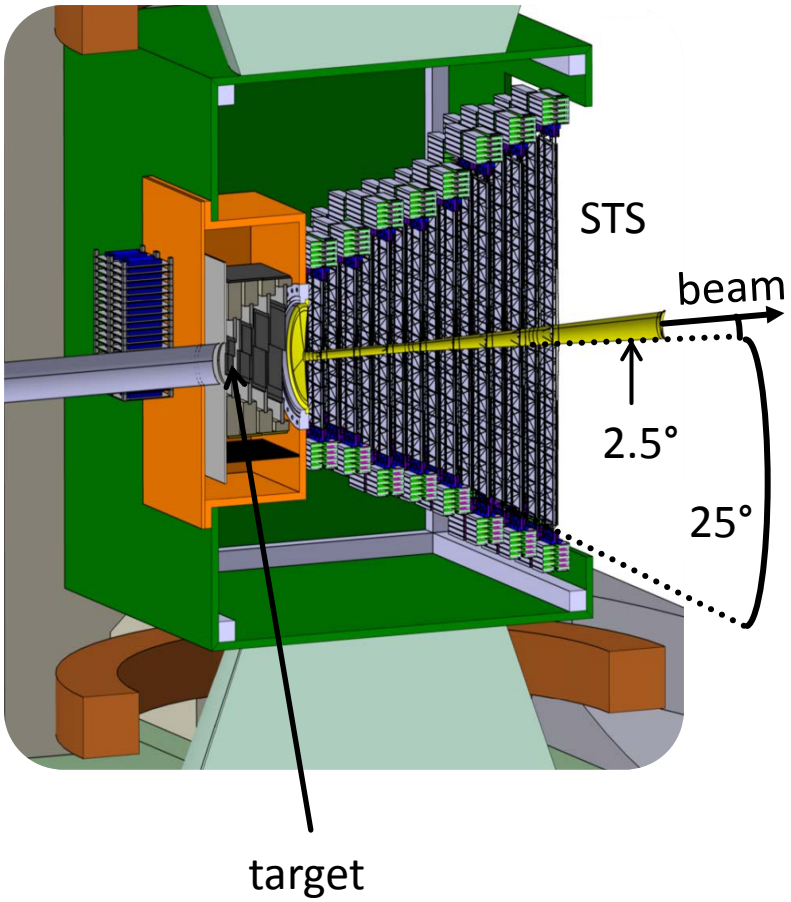
FAIR experiment collaborations more than 2100 scientist

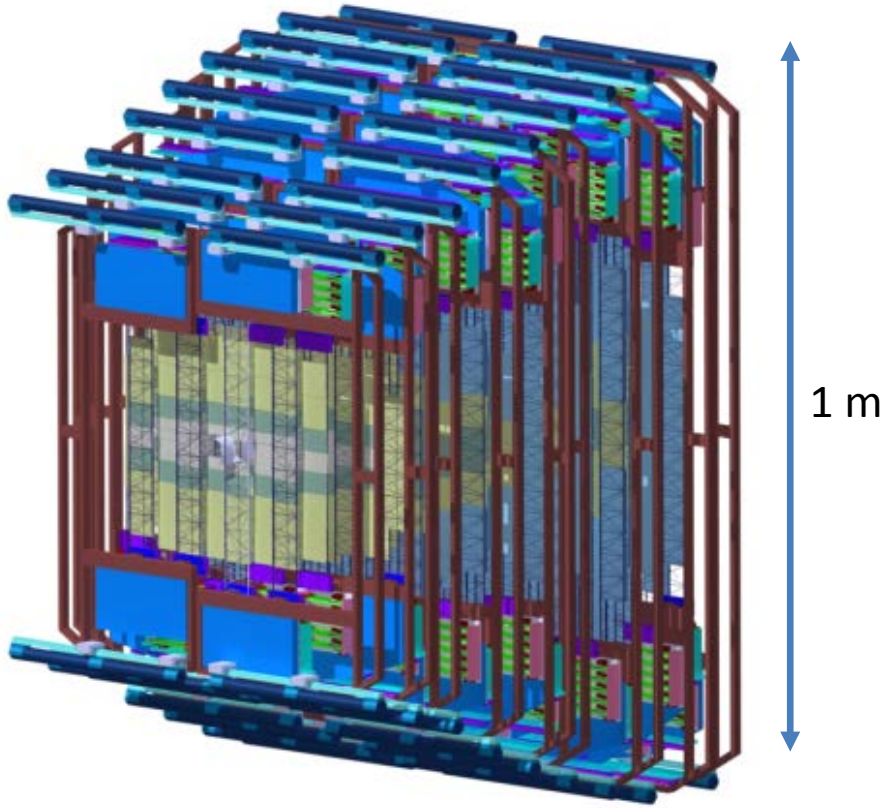


Compressed Baryonic Matter Experiment (CBM)



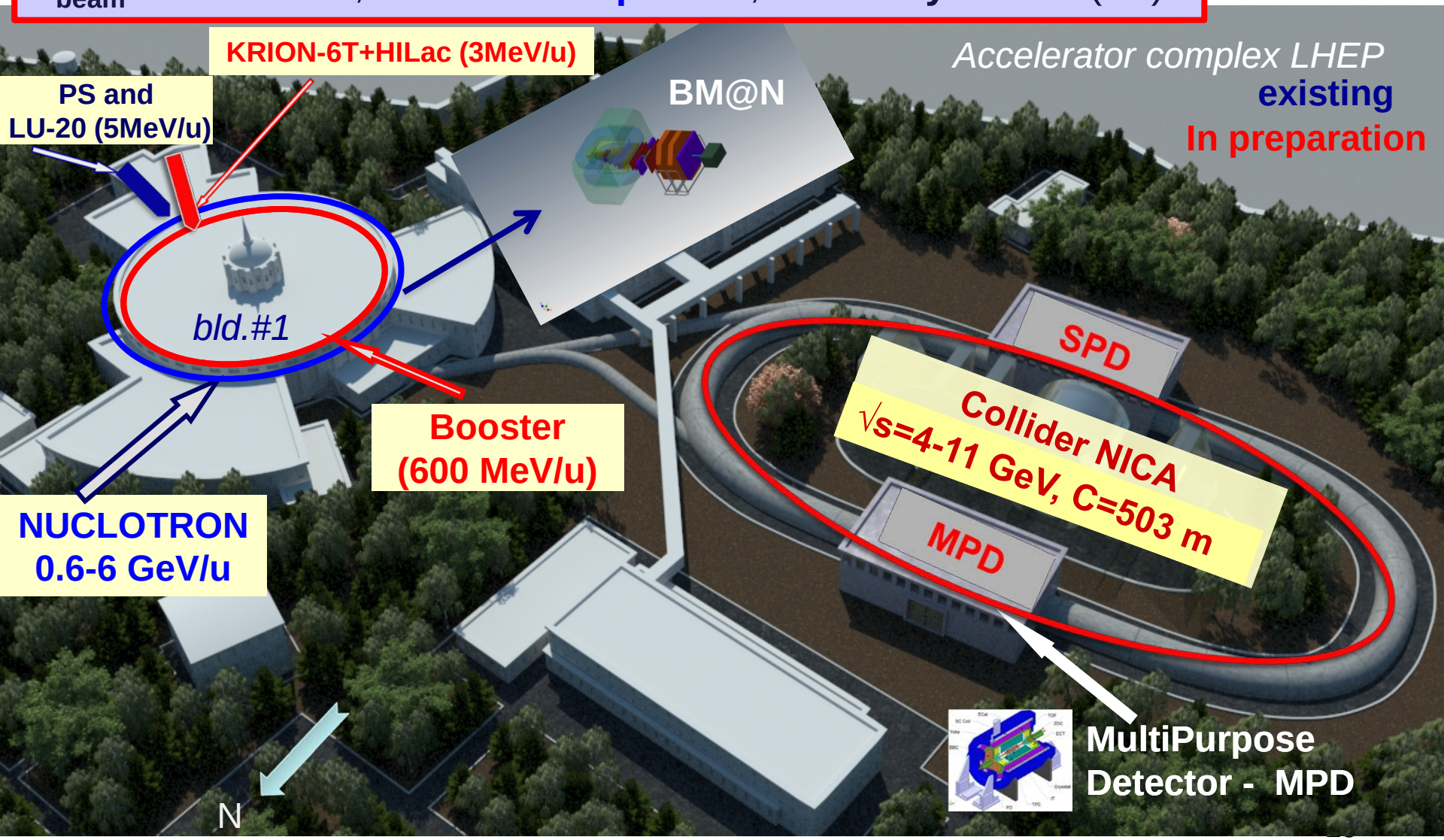
CBM Silicon Tracking System





Complex NICA

Parameters of Nuclotron for BM@N experiment:
E_{beam} = 1-6 GeV/u; *beams: from* p to Au; Intensity~10^7 c^{-1} (Au)



Tasks WP3

3.1: Coordination of joint developments of main components of the Silicon Tracking System

3.1.1: Technical management - development of STS modules/ladders

3.1.2: Organization of technical review meetings for each component and final Production Readiness Review

3.1.3: Initiation of expert training for the assembly of the components to modules and ladders

3.1.4: Organization of workshops for the joint development of experiment and accelerator components for NICA and FAIR

3.2: Lesson learned and internationalization of the NICA experiment collaborations

Tasks WP3

3.1: Coordination of joint developments of main components of the Silicon Tracking System

3.1.1: Technical management - develop… s/ladders

3.1.2: Organization of … nponent

Main objective of this WP in CREMLIN is the joint development of silicon tracking detectors

3.1.3: … pert training for the assembly of the components to modules and ladders

3.1.4: Organization of workshops for the joint development of experiment and accelerator components for NICA and FAIR

3.2: Lesson learned and internationalization of the NICA experiment collaborations

Deliverables WP3:

- D 3.1 Report on production of prototype silicon detector ladder (M24 - FAIR)
- D 3.2 Report on knowledge exchange for the joint development of components for the silicon detector and for components for the low energy heavy ion collider NICA (M36 - FAIR)
- D 3.3 Report on lesson learned and development of strategy regarding the internationalization of the NICA collaborations (M36 - JINR)

Who will be responsible for the milestones and deliverables; workshops and meetings?

Manpower in WP3

for main objective: joint development of silicon tracking detectors

<u>Personnel effort</u>

FAIR: 48 person months

- 24 person months own contribution (J. Eschke)
- 24 person months paid by EC funds (M. Teklishyn)

JINR: 48 person months

- 24 person months own contribution (Y. Murin ?)
- 24 person months paid by EC funds (NN)

Connecting **R**ussian and **E**uropean **M**easures for **L**arge-scale Research **IN**frastructures

“CREMLIN”

WP3 - Science cooperation with the NICA collider facility in the field of ion beams and heavy ion physics

Thank you very much
for your attention!

CREMLIN WP3

Tasks related to the STS:

3.1: Coordination of joint developments of main components of the Silicon Tracking System
3.1.1: Technical management - development of STS modules/ladders
3.1.2: Organization of technical review meetings for each component and final Production Readiness Review
3.1.3: Initiation of expert training for the assembly of the components to modules and ladders
3.1.4: Organization of workshops for the joint development of experiment and accelerator components for NICA and FAIR
3.2: Lesson learned and internationalization of the NICA experiment collaborations

Organizational aspects:

- Which are the concrete objectives of the WP?
  - development of CBM-STS module and ladder assembly
  - preparation and passing of the CBM-STS Production Readiness Review
  - start of module and ladder production at the assembly centers GSI and JINR-VBLHEP
- Who will be responsible for the milestones and deliverables; workshops and meetings?
  - milestones and deliverables: GSI and JINR
  - meetings and workshops: weekly CBM-STS workgroups (GSI) , (semi)-annual workshops (GSI + JINR)
- What is the current status of the EU-Russian cooperation in the scientific field of the WP?
  - very active, years of cooperation embedded in CBM Collaboration and other FAIR-NICA contacts