Status of NICA facility

Latest event

Decision of NICA Review Committee #4 from 11 Dec 2019:

Cost and Schedule Review Committee for the NICA Project

(Cost and Schedule Review Committee for the NICA Project)

24 – 26 Feb 2020 @ LHEP JINR, Dubna

1. ***Fernando Ferroni*** *(INFN, Italy) - chair**;***
2. ***Frederick Bordry (****CERN);*
3. ***Luisa Cifarelli*** *(University of Bologna, Italy);*
4. ***Joachim Mnich*** *(DESY, Germany);*
5. ***Latchezar Kostov*** *(BNRA, Bulgaria);*
6. ***Eliezer Rabinovici*** *(Racah Institute of Physics Hebrew University of Jerusalem, Israel);*
7. ***Leonid Kravshuk*** *(INR RAS, Russia)*

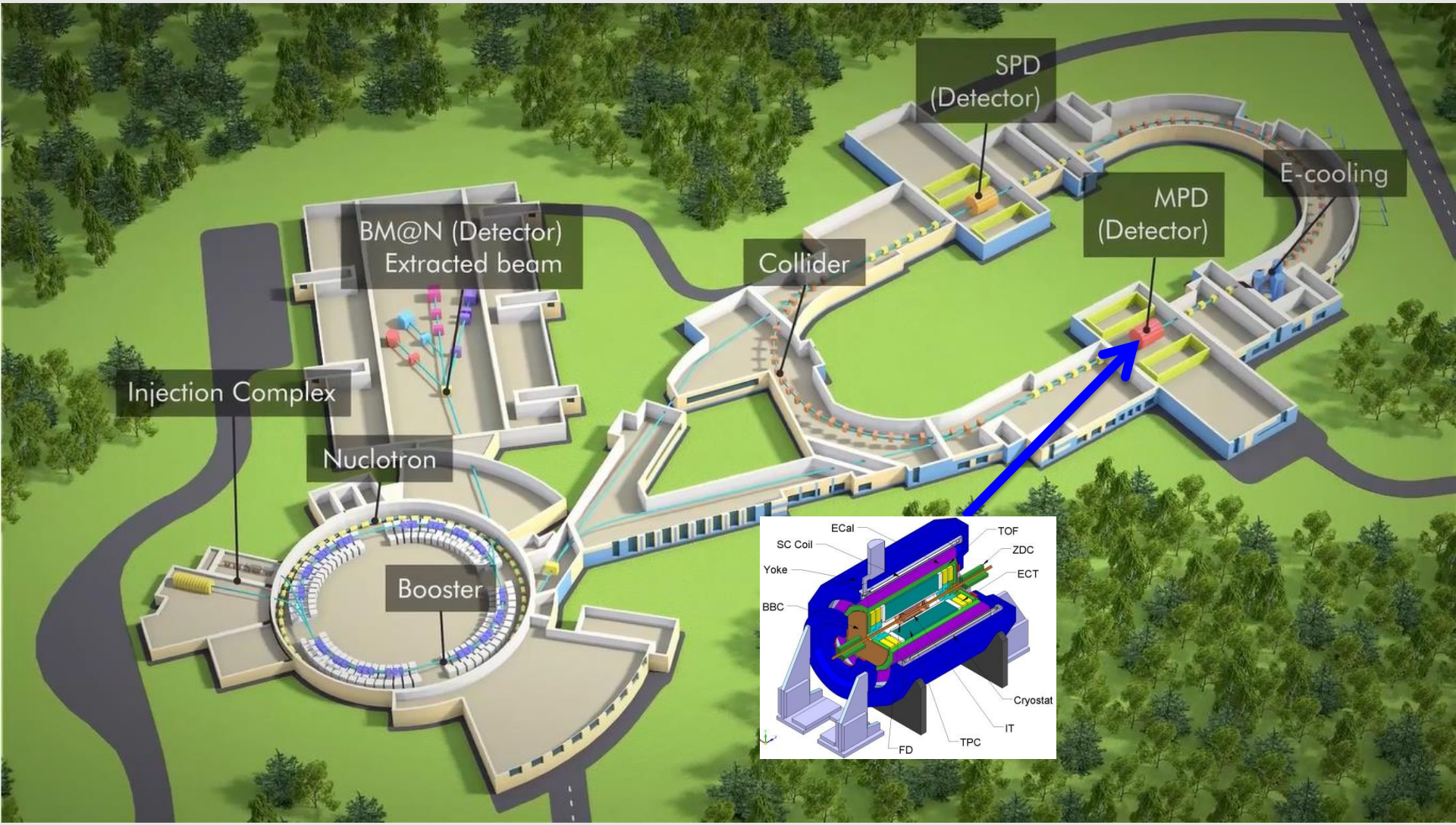
Key run-milestones

W47, 2021

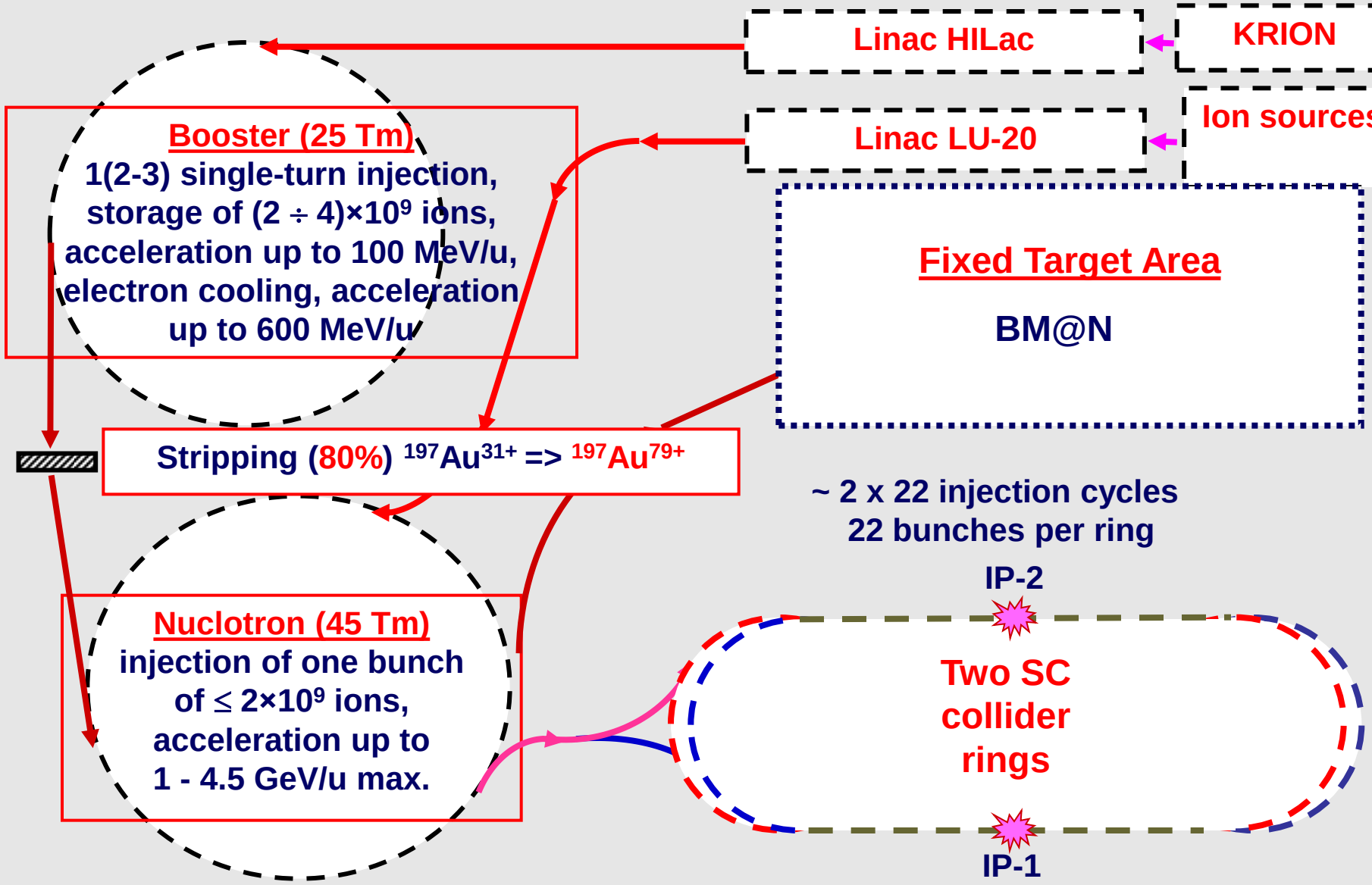
2020 ***2021*** ***2022***

Название задачи
NICA Booster
Start of Booster Cryogenic tests
Start of Booster Run#1 (with beam)
Booster Run#1
Start Booster Run#2 + B-> N channel
Booster Run#2 + B-> N channel
Start of Booster Run#3 + Nuclotron
Booster Run#3 + Nuclotron
Start Booster Run#4 + Nuclotron @ BM@N
Booster Run#4 + Nuclotron @ BM@N
NICA Collider
Start of Collider technological Run#0
Collider technological Run#0
Start of Collider Run#1
Collider Run#1
MPD
Detector comissioning
Detector ready for tests with cosmic rays

Facility layout

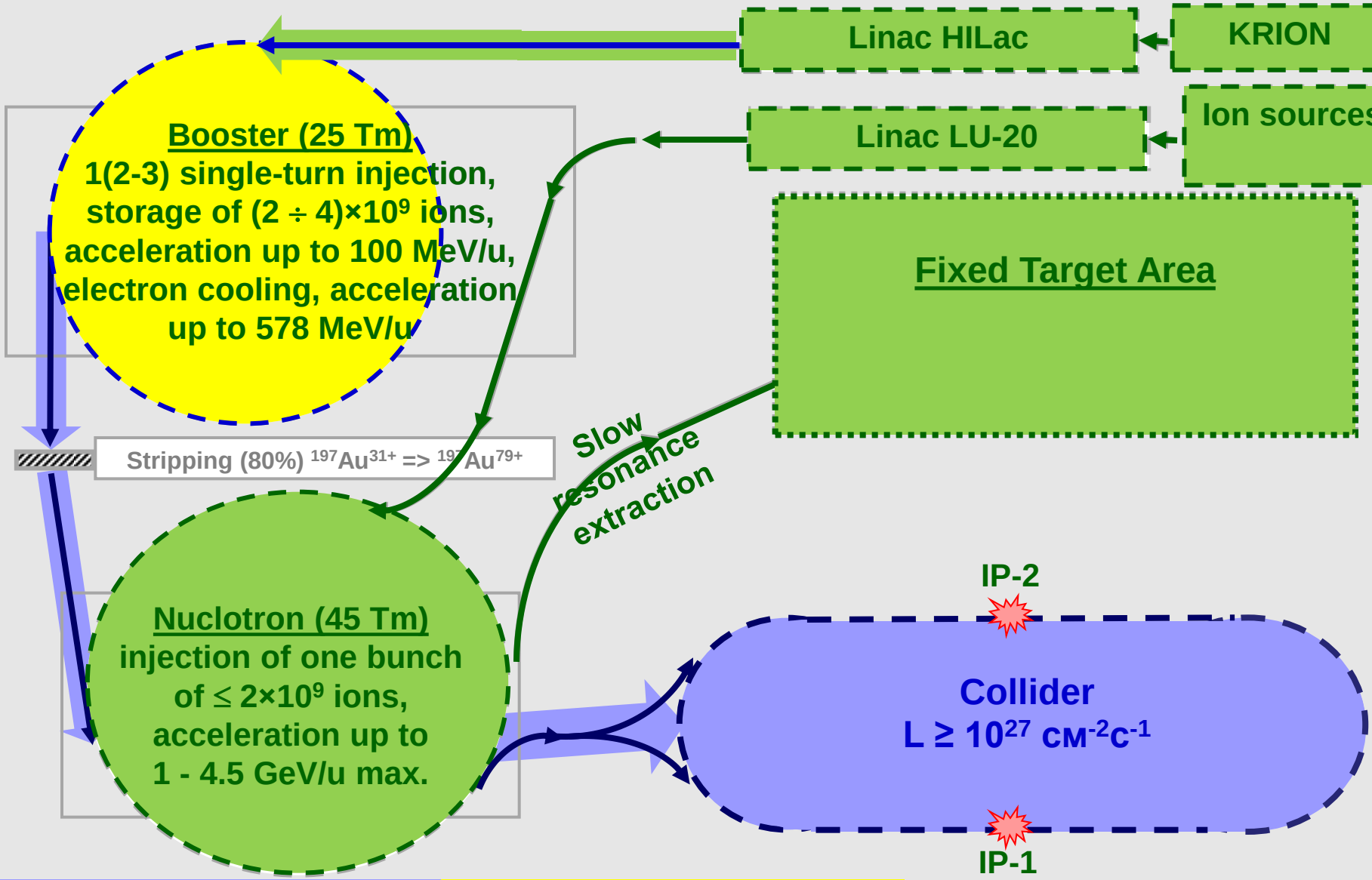


Facility operation scenario



Facility components – status

2020

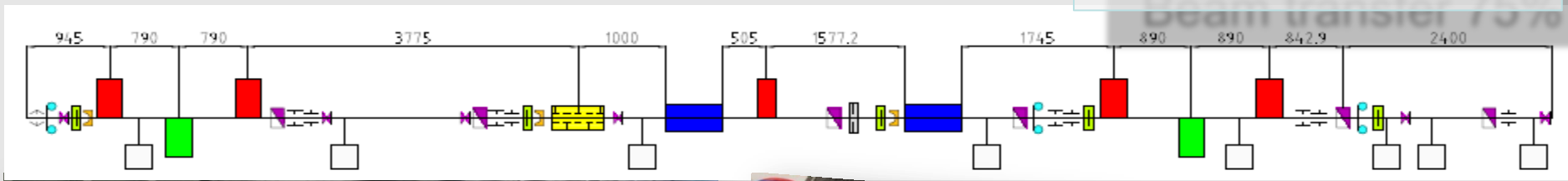


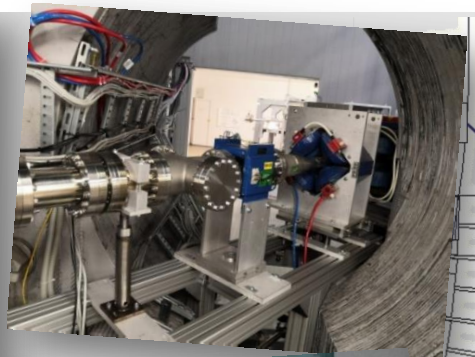
work in progress | assembly | commissioned / existing

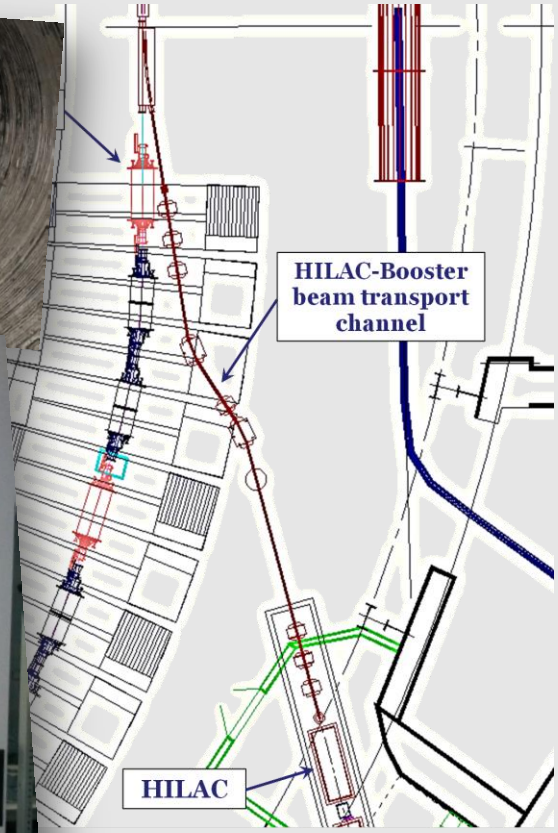
HILAC-Booster transfer channel

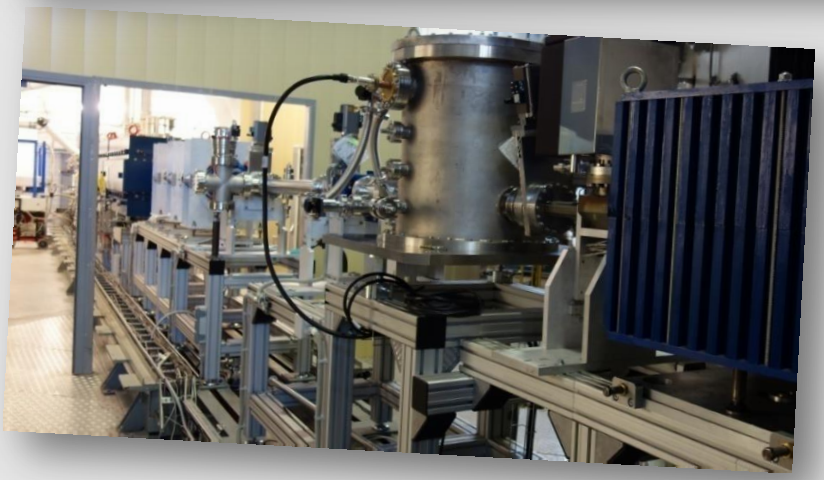
Final testing

Beam transfer 75%





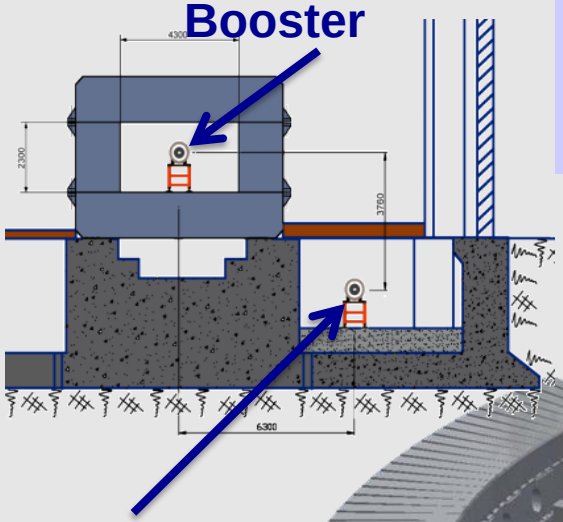


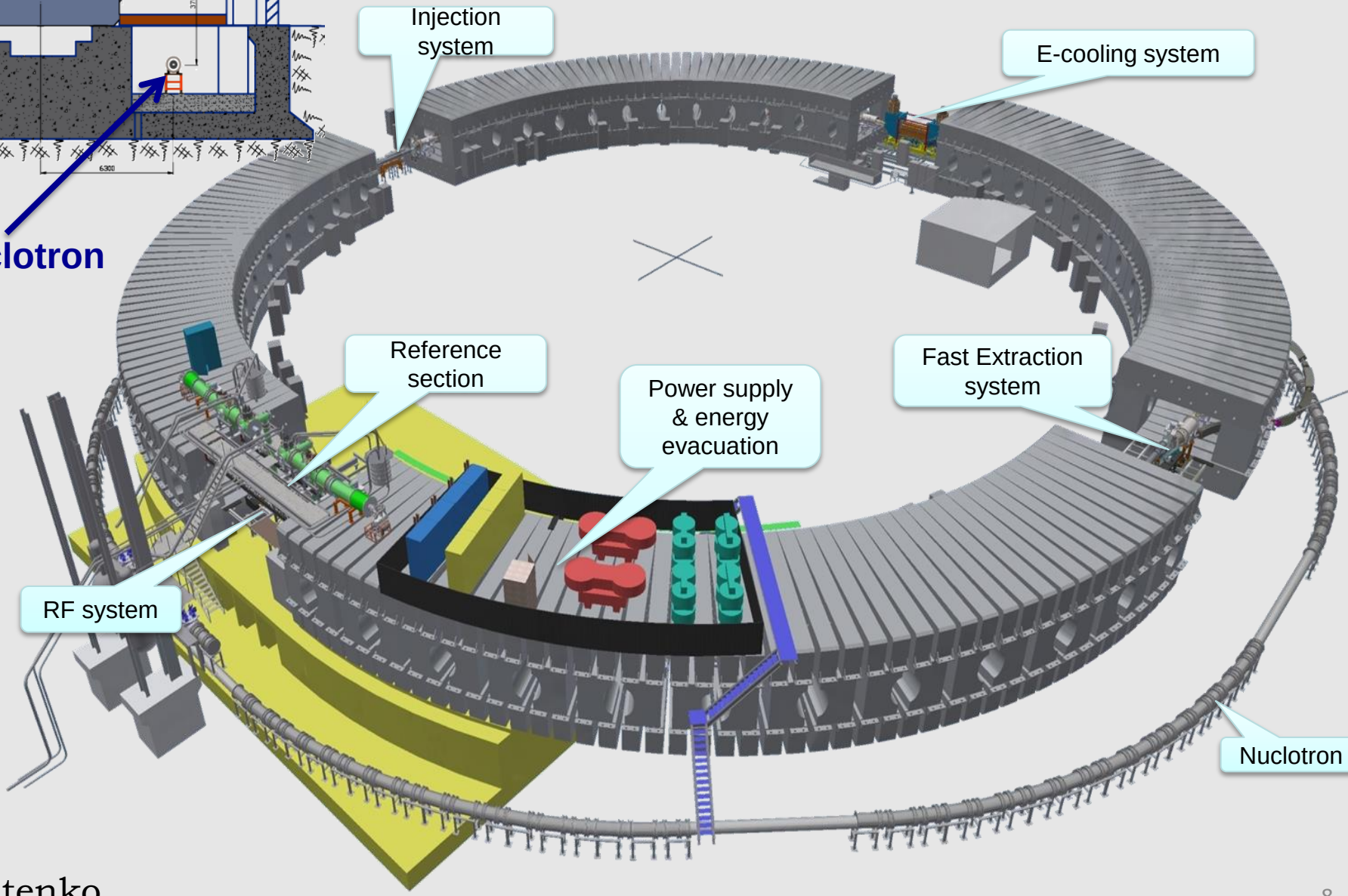


A.Butenko

NICA Booster

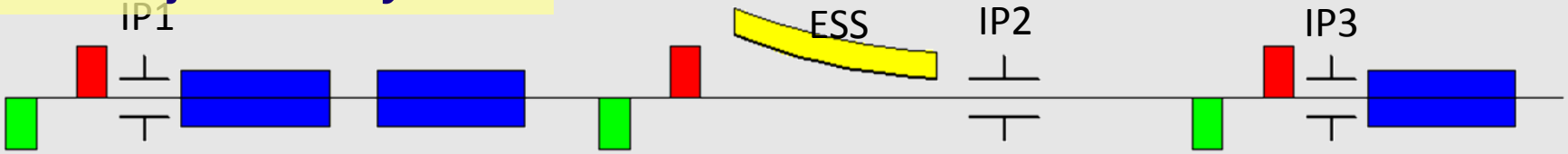
1. “Prepare” beam from KRION – HILAc for stripping (600 MeV/u)
2. Store ions at injection energy (multiple injection)
3. Cool the beam @ 60 MeV/u => small 6D emittance



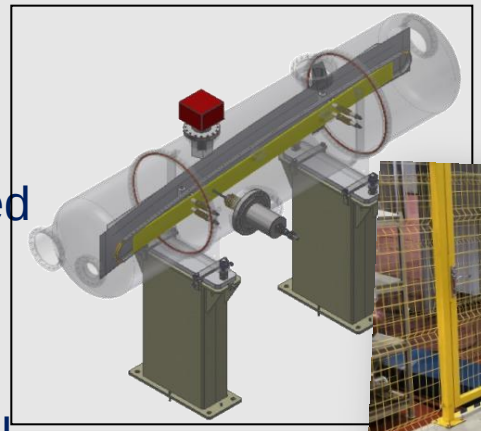


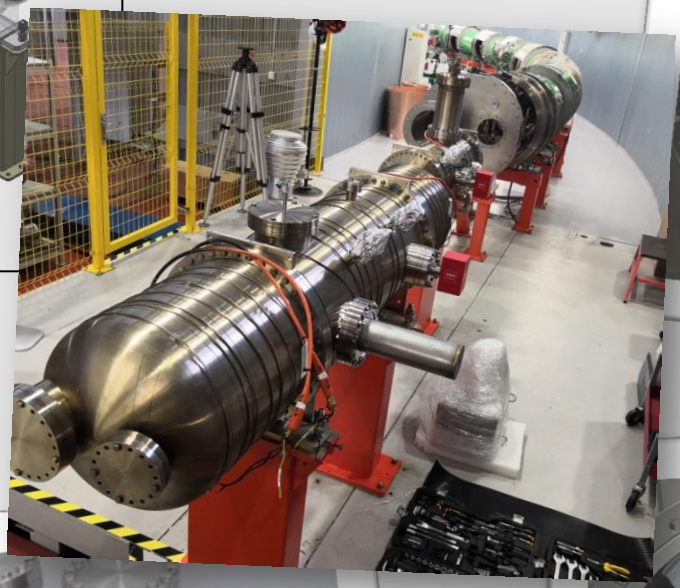
Launch of technological tests

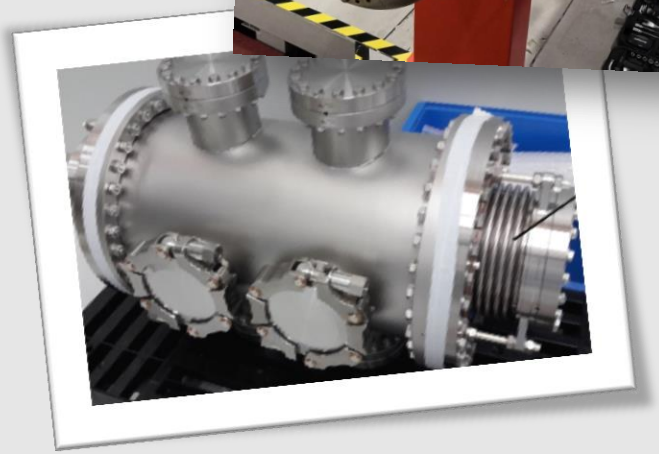
Booster injection system

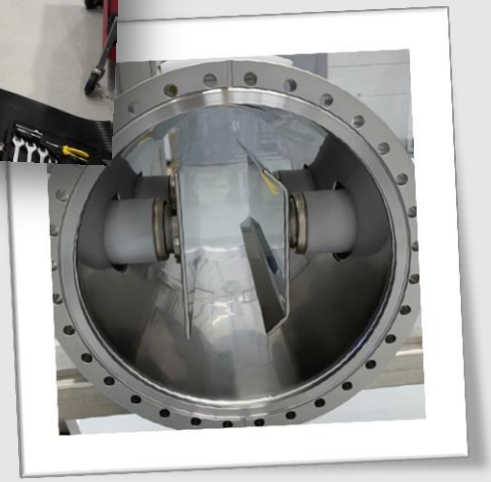


- ESS + IP2
  assembled, tested
- IP3
  tested, vac. shell
  expect delivery
- IP1 – for injection
  additional options

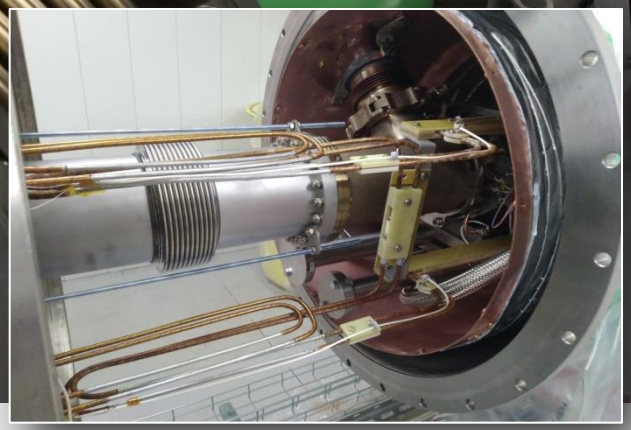








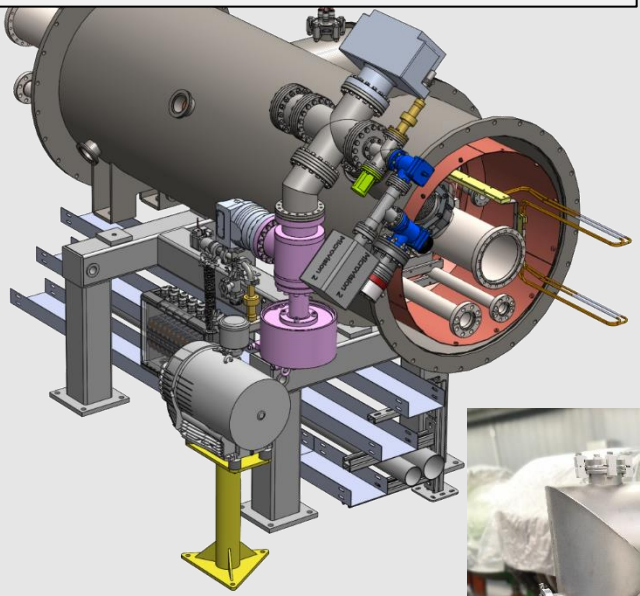
Booster sc-magnets system



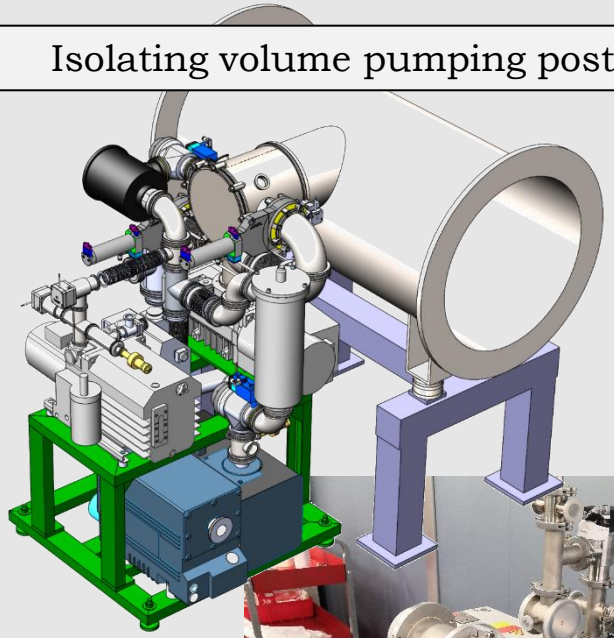
- ✓ ***all magnets in the tunel***
- ✓ ***90% connected***
- ✓ ***ring He-system*** assembled 90%, tested 50%
- ✓ ***beam pipe 25%***

Booster vacuum system

Beam pipe pumping post



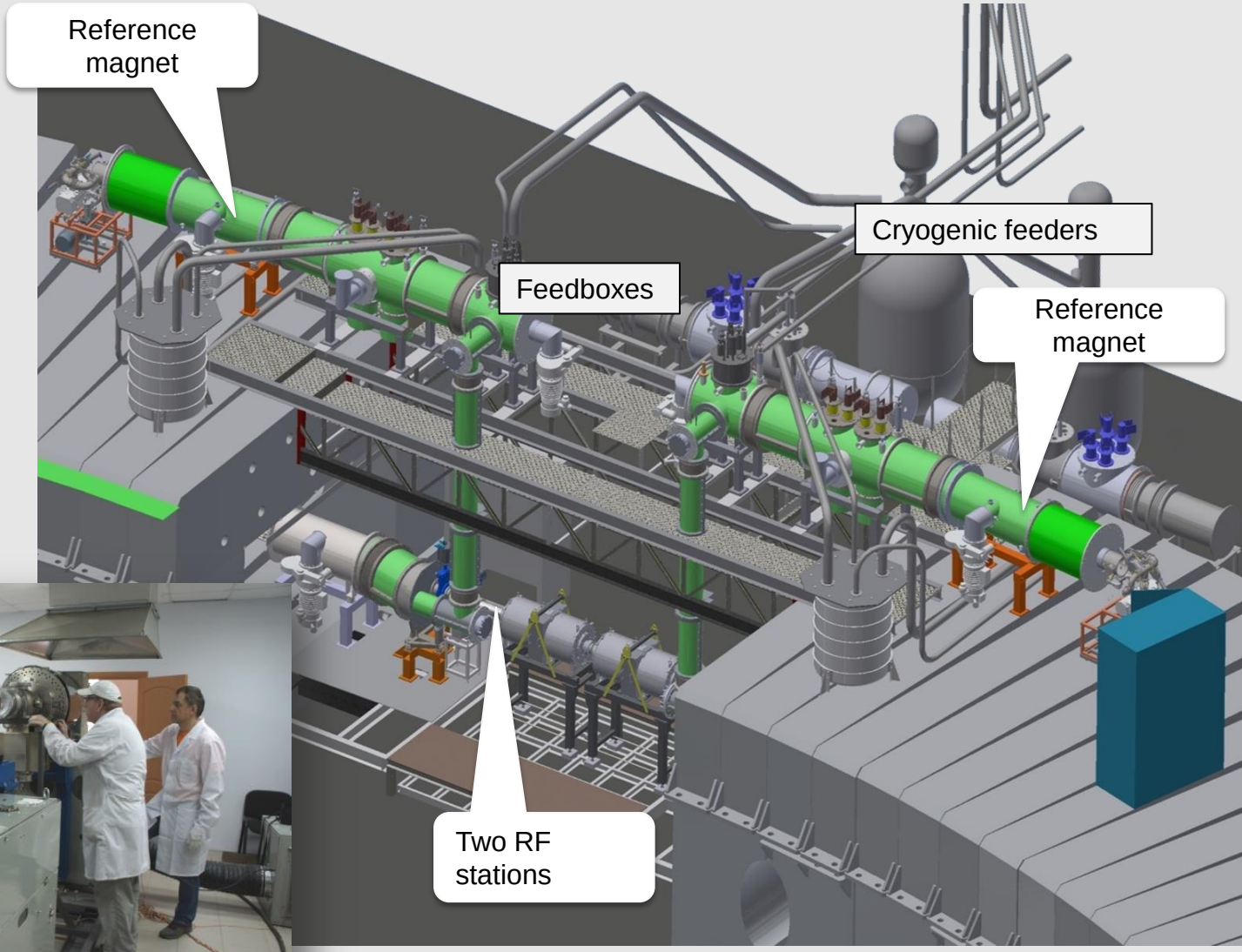
Isolating volume pumping post



- under assembly

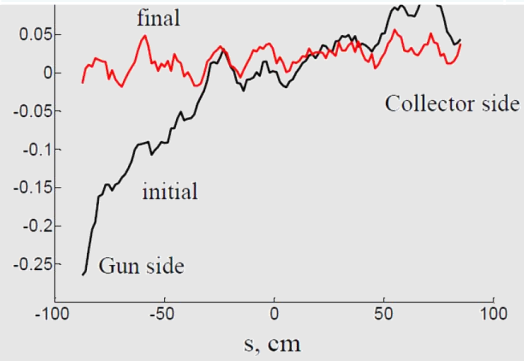
RF-stations and reference magnets' unit

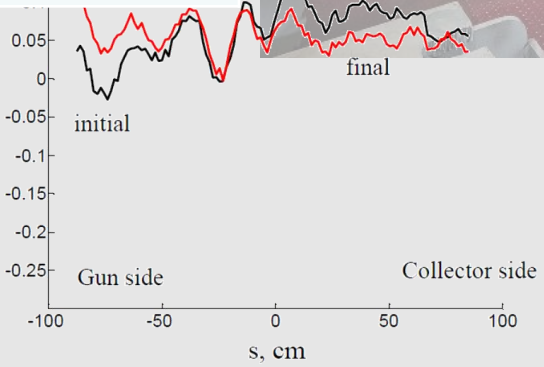
- RF- stations assembled and tested
- Ref. magnets' unit under production
  Delays occurred
  Completeness 70%



Electron cooler

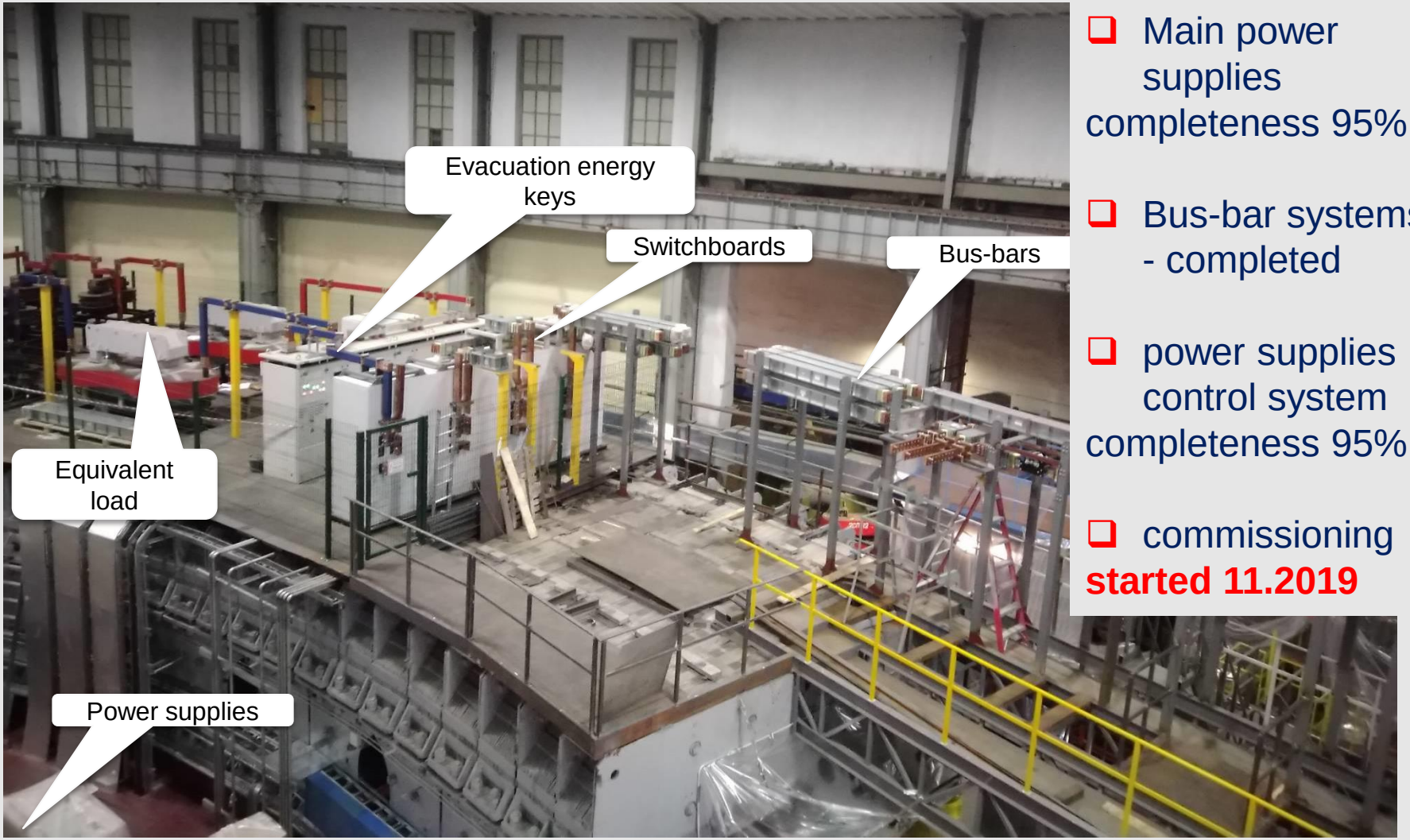
Achieved parameters	Value
Electron energy, keV	2
Electron current, mA	170
Magnetic field, kGs	1
Filed homogeneity	2×10^{-5}
Vacuum pressure, Pa	3×10^{-9}
Total power, kW	120





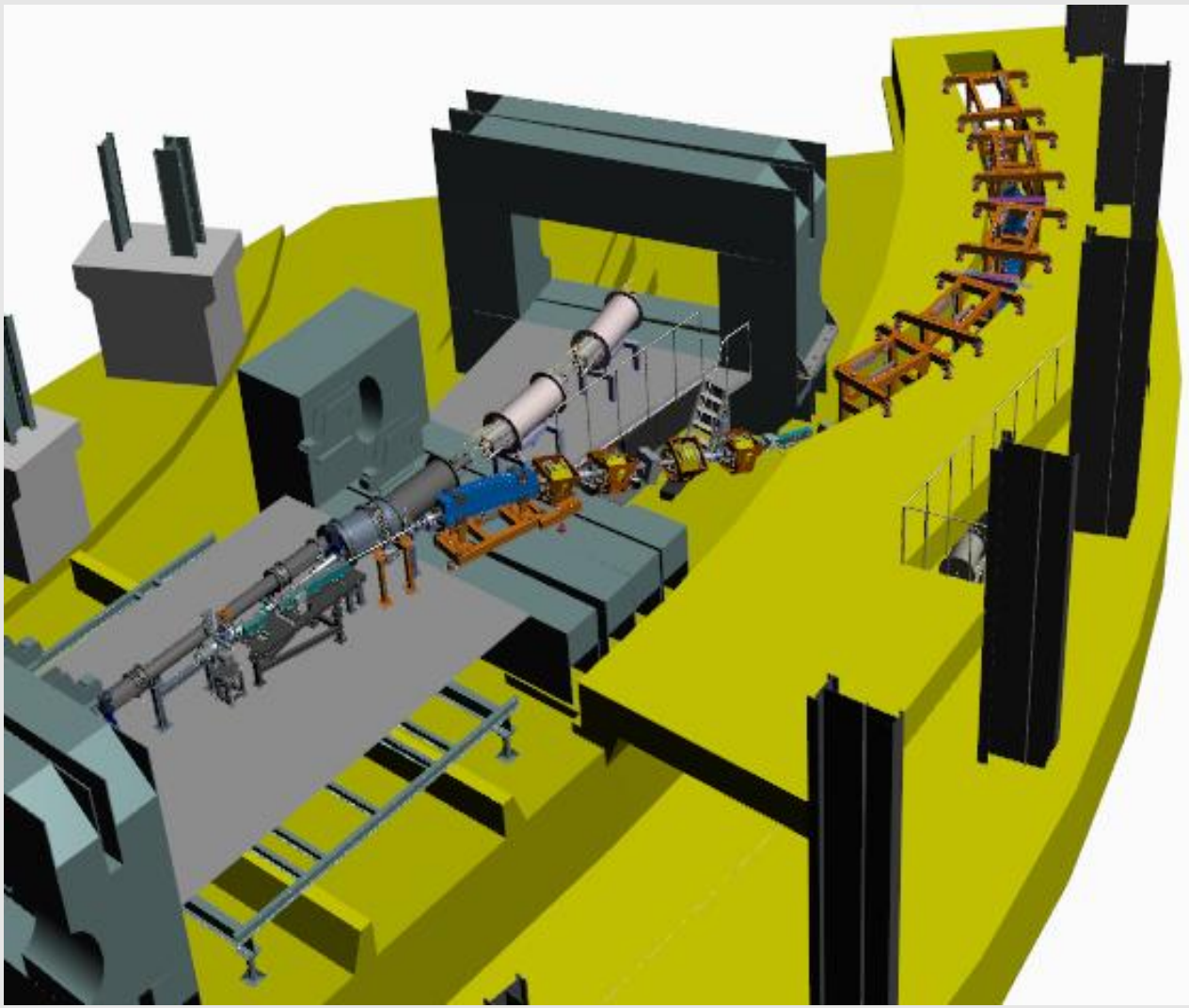
Ready for Booster Comissioning

Power supply and energy evacuation system



- Main power supplies completeness 95%
- Bus-bar systems - completed
- power supplies control system completeness 95%
- commissioning **started 11.2019**

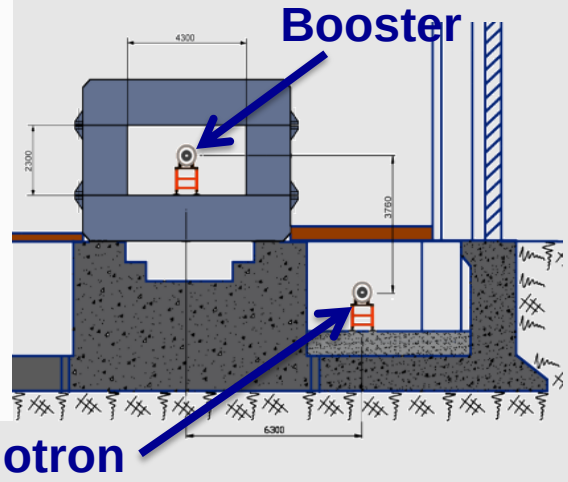
Booster-Nuclotron transfer channel



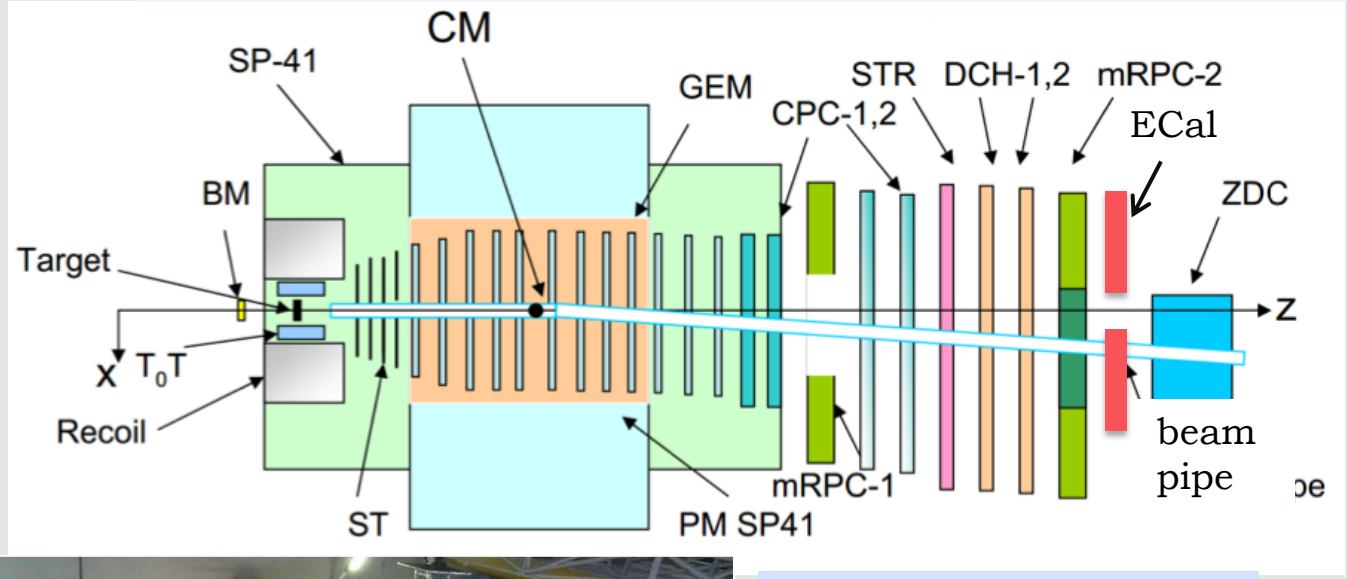
production @ BINP

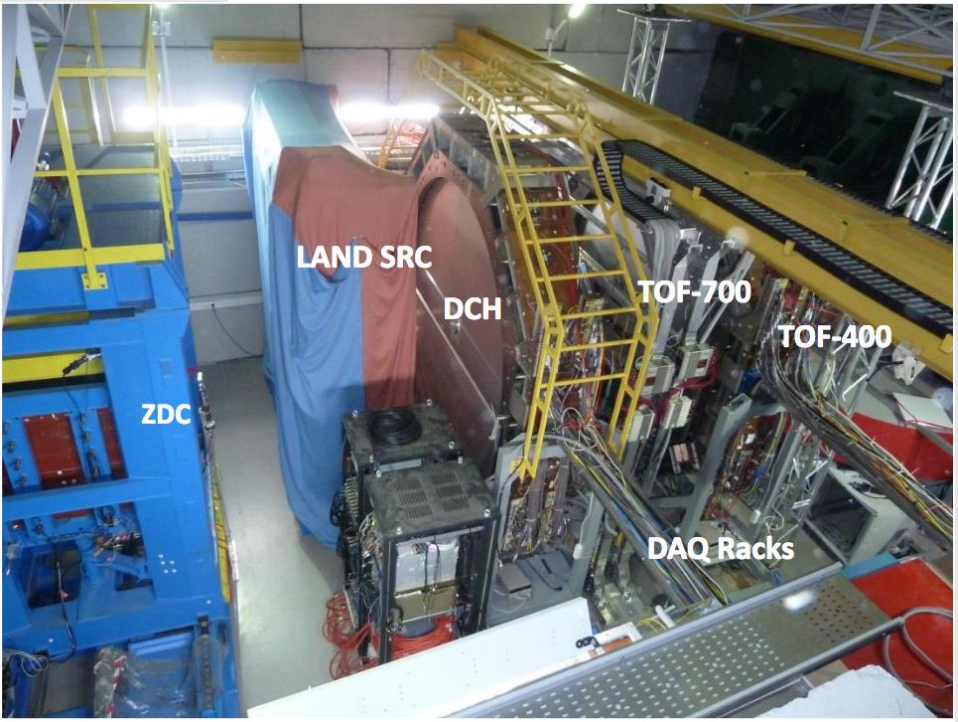
- extraction elements - in the tunnel
- channel elements 03.2020 > 10.2020
- Assembly and testing

04.2020 > **12.2020 (01.21)**



Baryonic Matter at Nuclotron (BM@N)





main systems:
ST,
GEM,
mRPC,
DCH,
ZDC,
Ecal

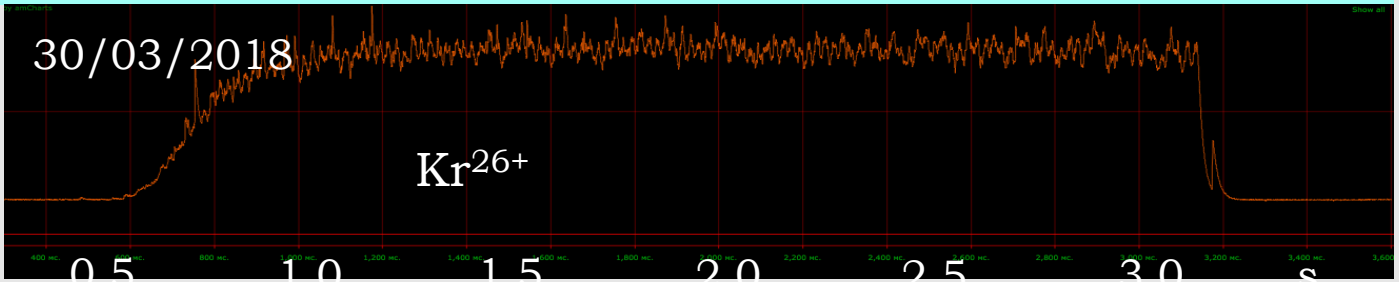
Baryonic Matter at Nuclotron (BM@N)

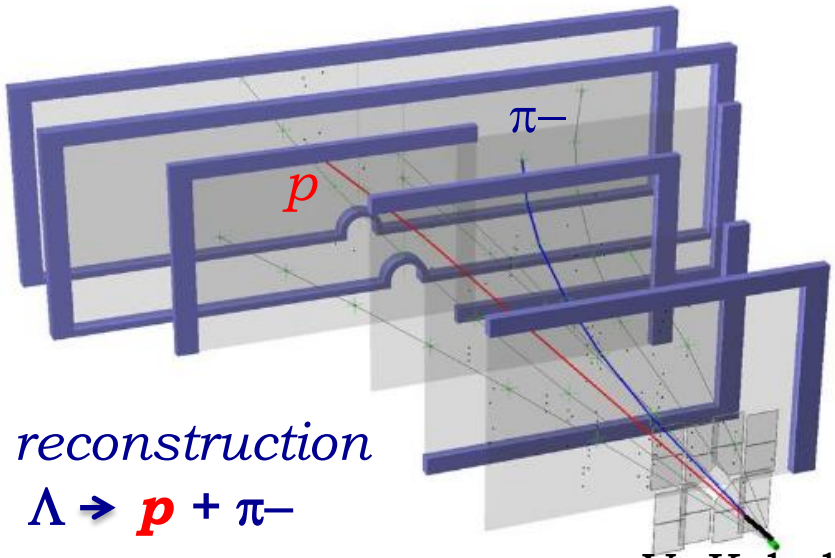
1st physics run:

***March – April 2018*:**

targets: ***C, Al, Cu, Sn, Pb;***

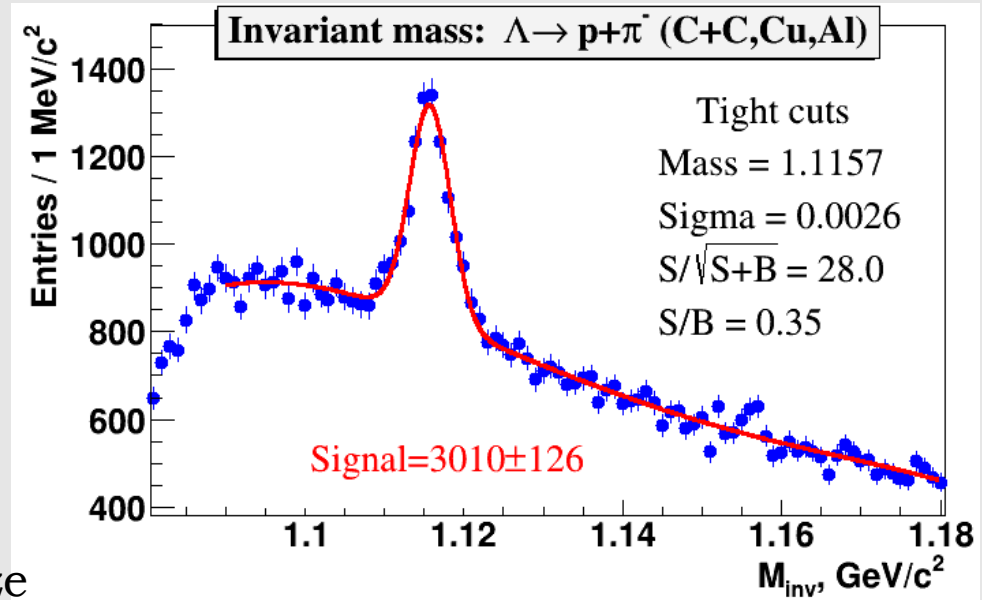
	beams	*stat*
$^{12}C^{6+}$	***4,0 -4,5 AGeV***	***20 M ev***
$^{40}Ar^{16+}$	***3,2 AGeV***	***130 M ev***
$^{84}Kr^{26+}$	***2,3 AGeV***	***50 M ev***





reconstruction

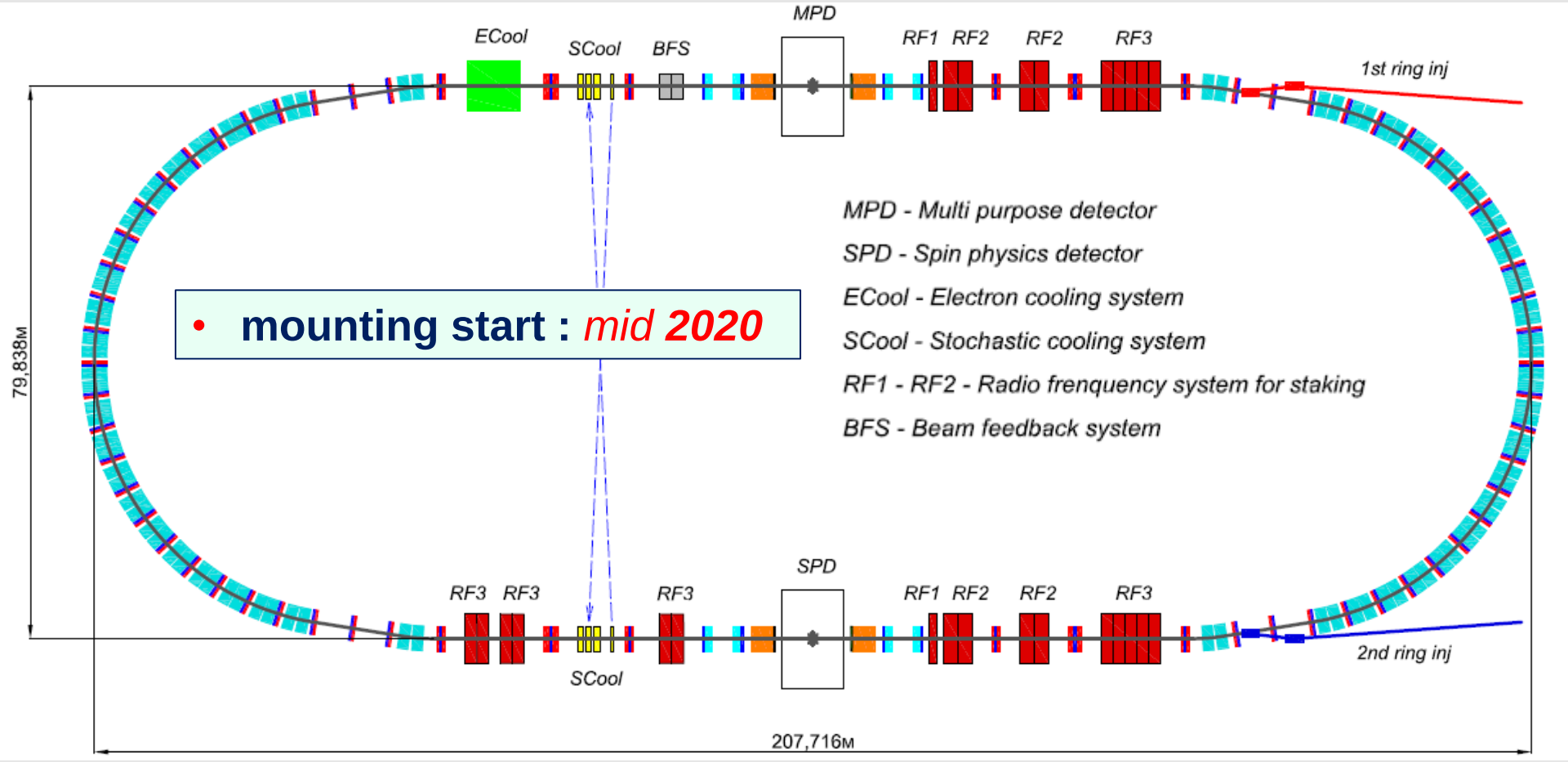
$\Lambda \rightarrow p + \pi^-$



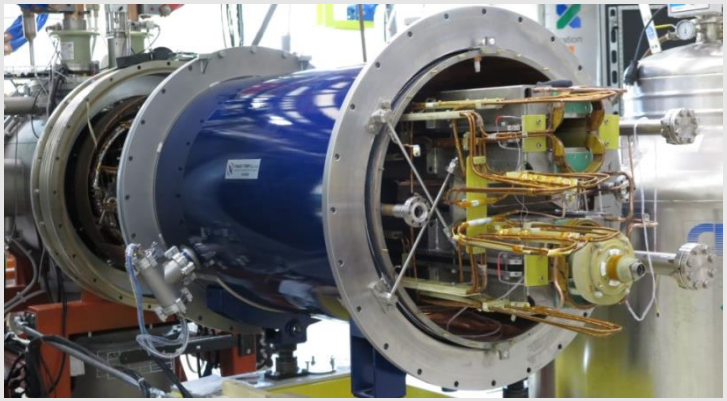
Baryonic Matter at Nuclotron (BM@N)

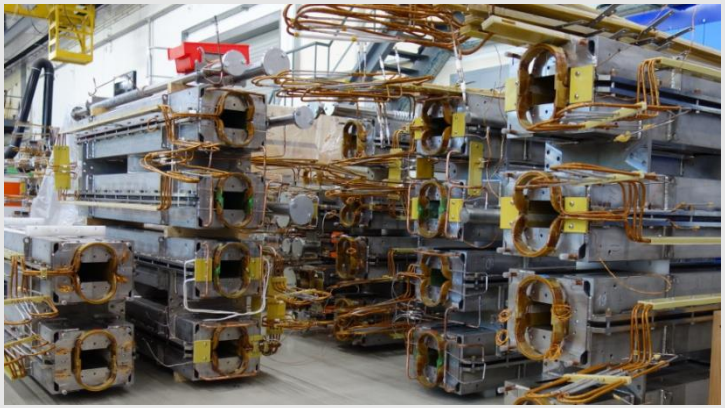
Year	2017	2018	2021	2022 +
Beam	C	Ar,Kr, C(SRC)	Kr,Xe	до Au
Intensity, Гц	0.5M	0.5M	0.5M	2-5M
Trigger rate, Гц	5k	10k	10k	20k→50k
Central tracker	6 ½ plGEM	6 ½ plGEM +3 pl. FwdSi	7 pl. GEM + 3 pl. FwdSi	7 pl. GEM + 3 pl. FwdSi + 4 pl. STS
Status	Tech. run	Tech + Phys run	Phys run, 1st stage	Phys run, 2nd stage

NICA Collider



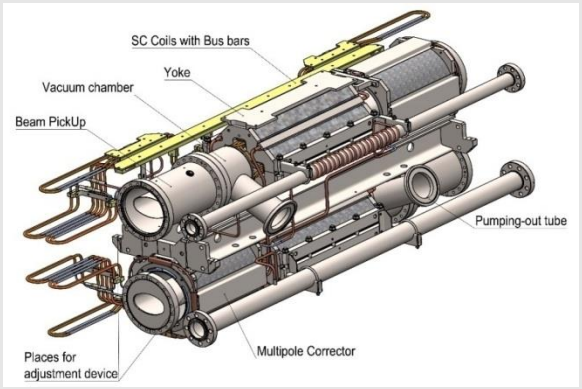
Magnetic system

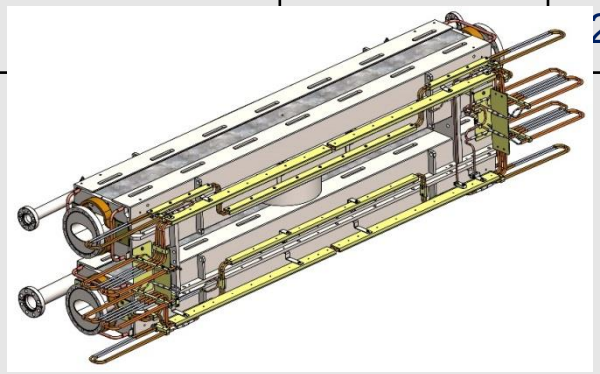




- *Dipoles - production, testing* *progress **35%***
- *Quads- production, testing* *progress **5%***
- *FF quads* *progress **5%***
- *assembly :* ***07.2020 - 07.2021***

	dipoles	**quads**
Amount	**80+8***	**70+12****
Max. field/ gradient	1.8 T	23.1 T/m
weight		240 kg





Collider systems

- *Spec. completed (basing on Booster and test facility experience)*
- *Power supplies contracted*

PS for BM@N magnet

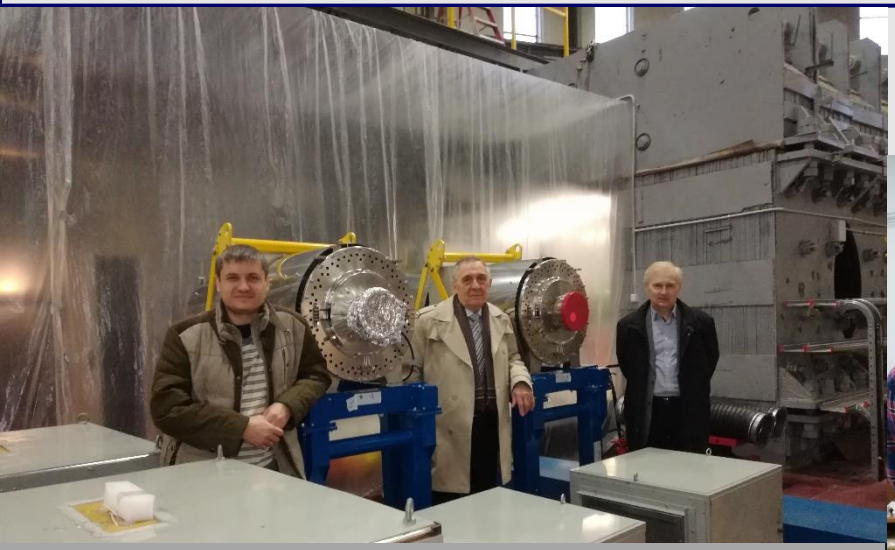
Booster PS placed on the top of the Synchrophasotron yoke

Room in the basement

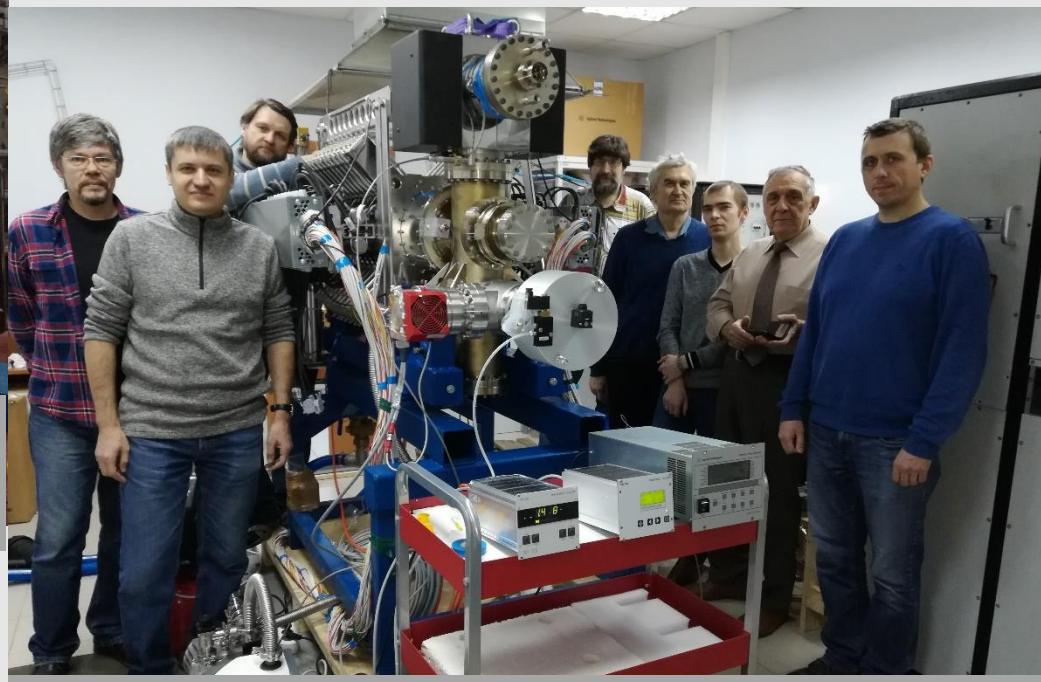
Remote control system

Booster PS system placed in the “cellar” under the Bldg No 1.

RF Acceleration Systems for the Booster and the Collider: Development by Budker INP - the main NICA collaborator



Two RF stations for the Booster are ready for mounting (25.12.2019).



The RF barrier voltage station for the Collider at the test bench in LHEP JINR after tests by BINP and NICA teams (20.12.2019).

Harmonic systems RF2 and RF3 for

23.09.2019 RF-2 and all the Team

24.09.2019 RF-2
Visit of the NICA MAC members

RF-2 at friendly inspection
21.03.2019

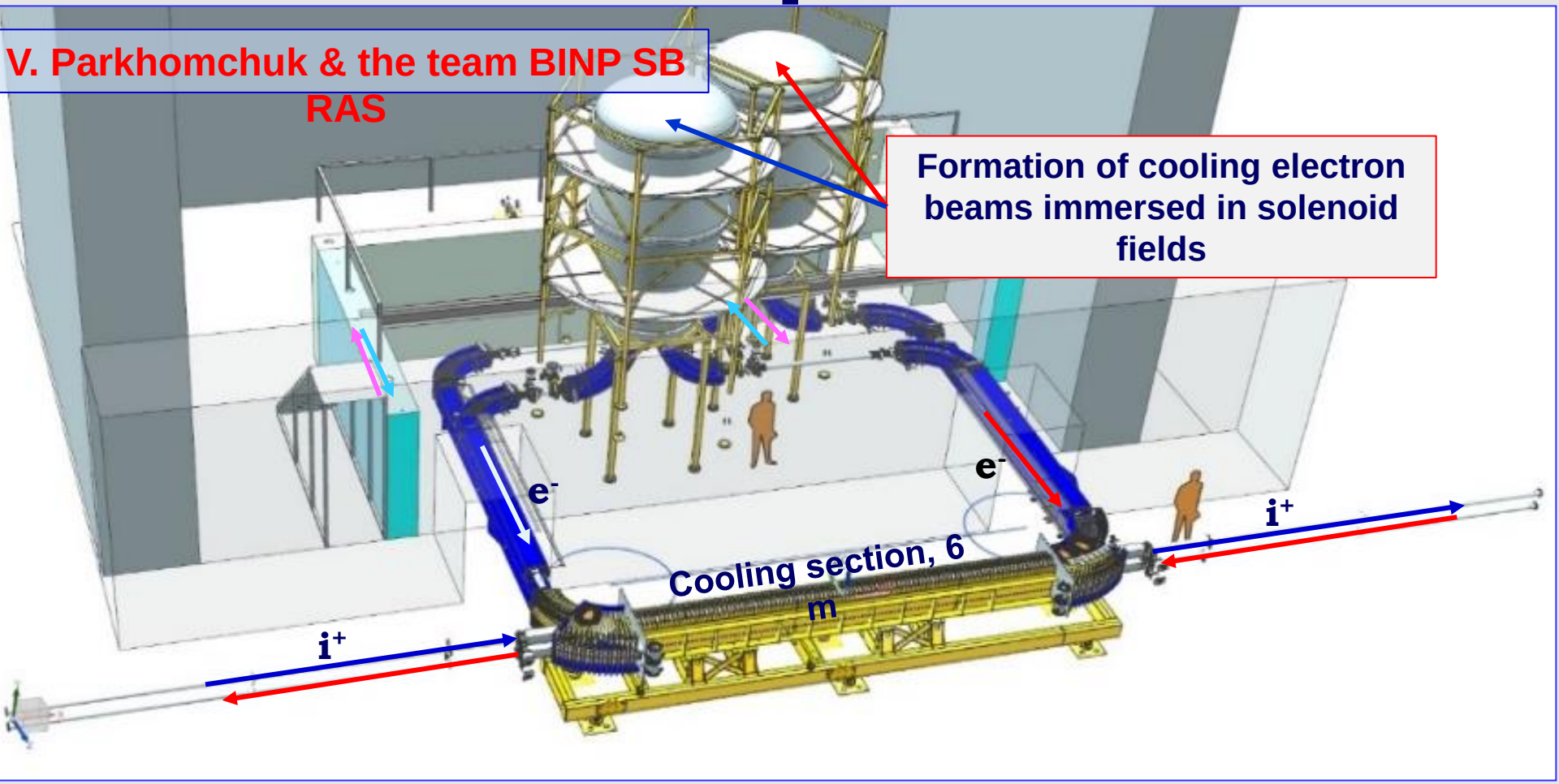
24.09.2019 The same and RF-3

I. Meshkov

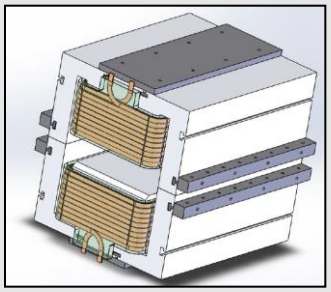
High Voltage Electron Cooler (HV ECS) for the Collider

Under development at BINP

V. Parkhomchuk & the team BINP SB RAS



Nuclotron – Collider channel (Sigma-Phi)



- *magnets- completeness 95%*
  delivery 07.2020
- *beam pipes and diagnostics*
  - completeness 70%
  delivery 07.2020
- *power supplies- completeness 10%*
  delivery 08.2020
- *assembly and testing-* ***08.2020 > 02.2021***

Magnetic element	Number	Effective length, m	Max. magnetic field (gradient), T (T/m)
Long dipole	21	2	1.5
Short dipole	6	1.2	1.5
Quadrupole Q10	22	0.353	31
Quadrupole Q15	6	0.519	31
Steerer	33	0.466	0.114

MPD-magnet

produced by *ASG (Genova) and Vitkovice HM*

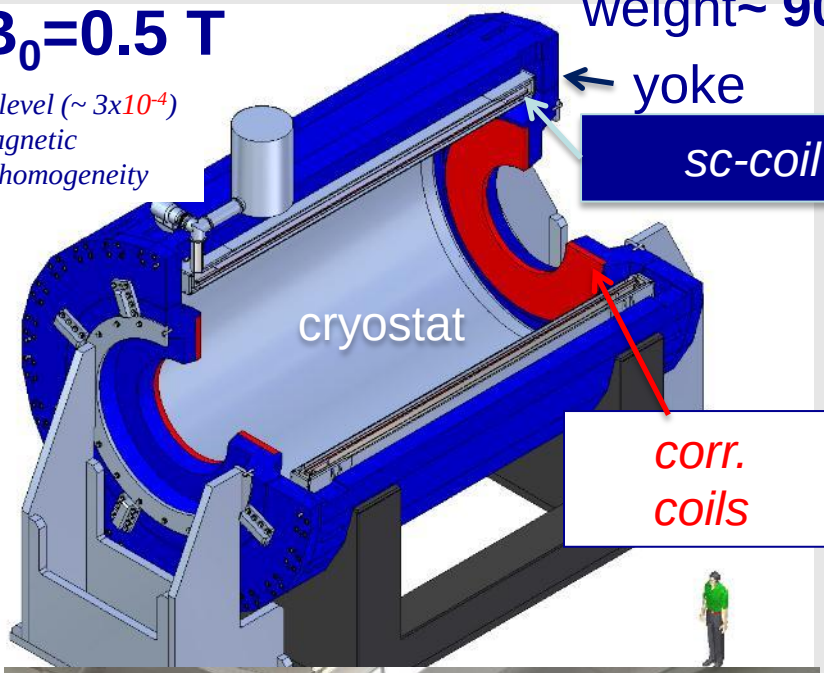
B_0=0.5 T

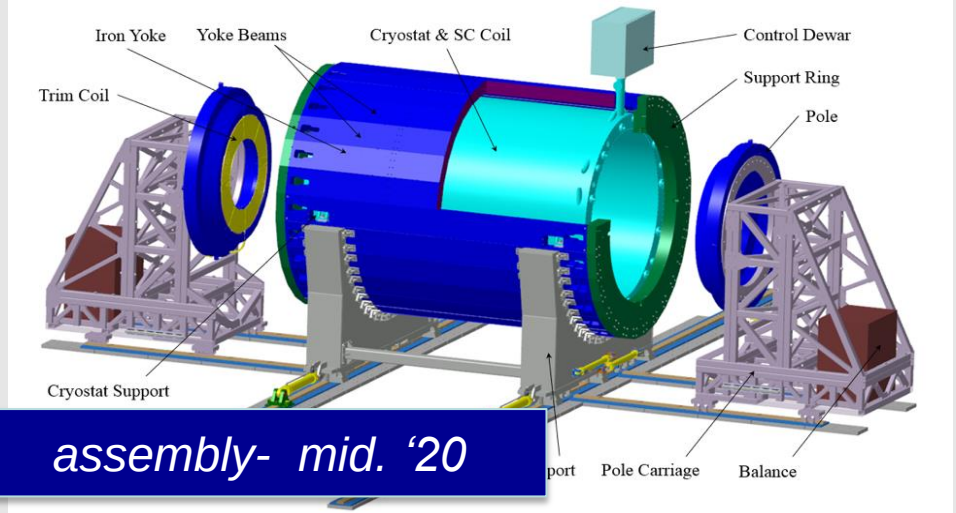
high level (~ $3x10^{-4}$) of magnetic field homogeneity

weight~ **900 t**

operation current: ***1790 A***

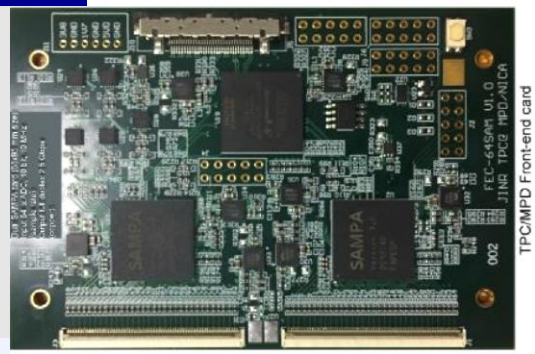
stored energy: ***14.6 Мдж***





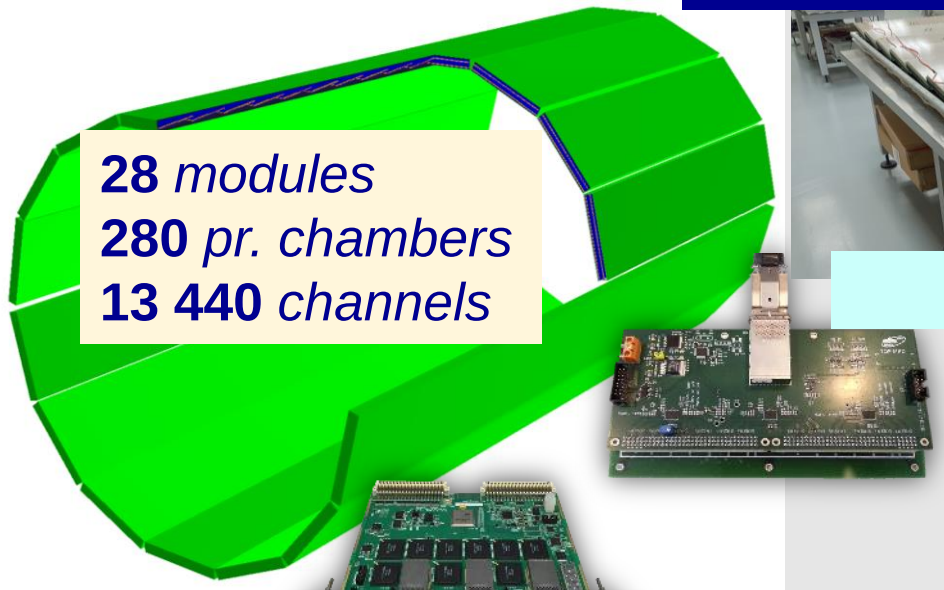
TPC – main tracker

length	*340 sm*
Radius 4	*140 sm*
Radius 1	*27 sm*
Gas	*0,9Ar+0,1CH_4*
Drift	*5.45 sm/μs;*
Drift time	*< 30 ms;*
N R/O chambers	*12 + 12*
channels	***95 232***
max. rate	*~ 7 kGz*

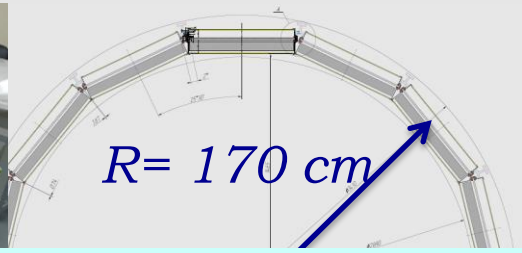


FEC64SAM:
4500 *SAMPA V4*
– delivered from ***ЦЕРН***

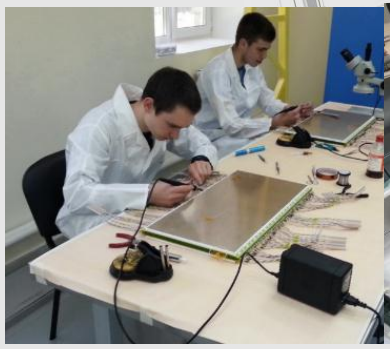
(TOF)

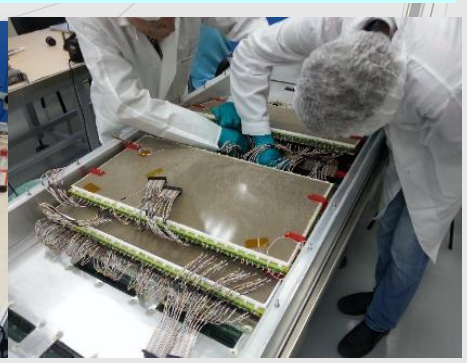


28 *modules*
280 *pr. chambers*
13 440 *channels*



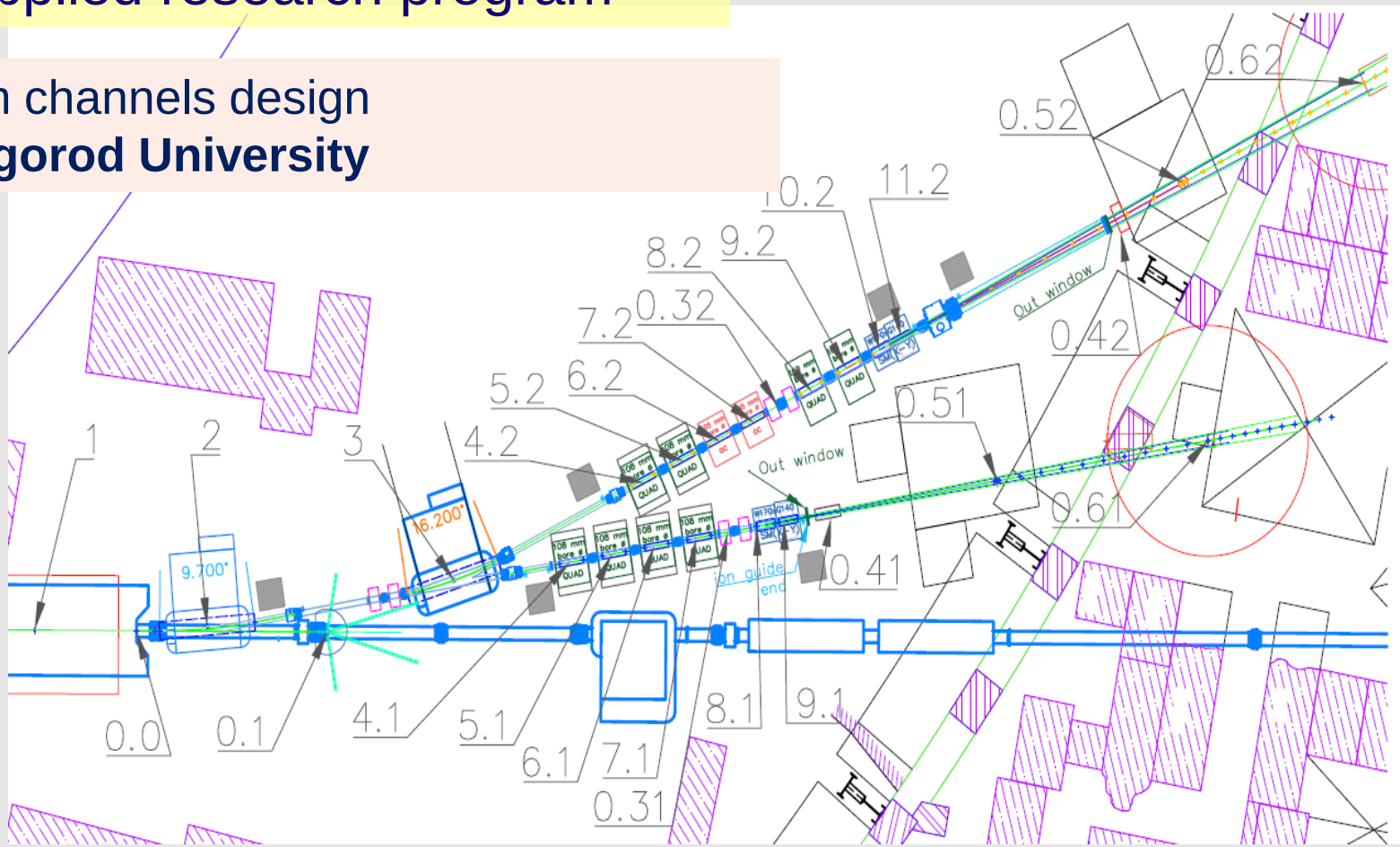
20*% modules assembled and tested*





Applied research program

Beam channels design
- **Belgorod University**



Extracted beams

tender for equpment production: ***ITEP, IHEP, BINP, Sigma-phi****.*

Collider building

*to be completed –**2021***

Aug2019

BM@N

SPD

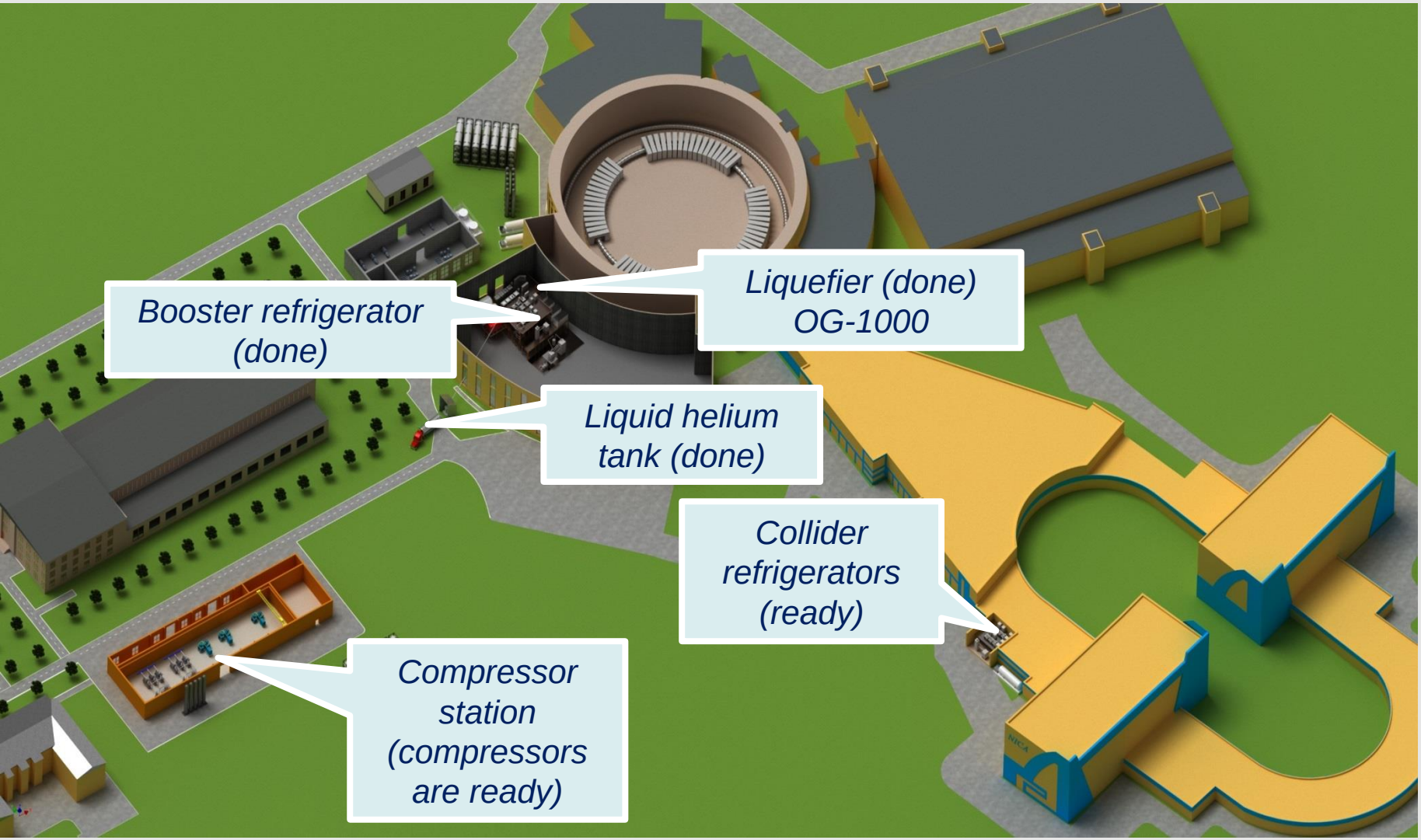
MPD

tunnel arc

comissioning of builing =>
sub stages:

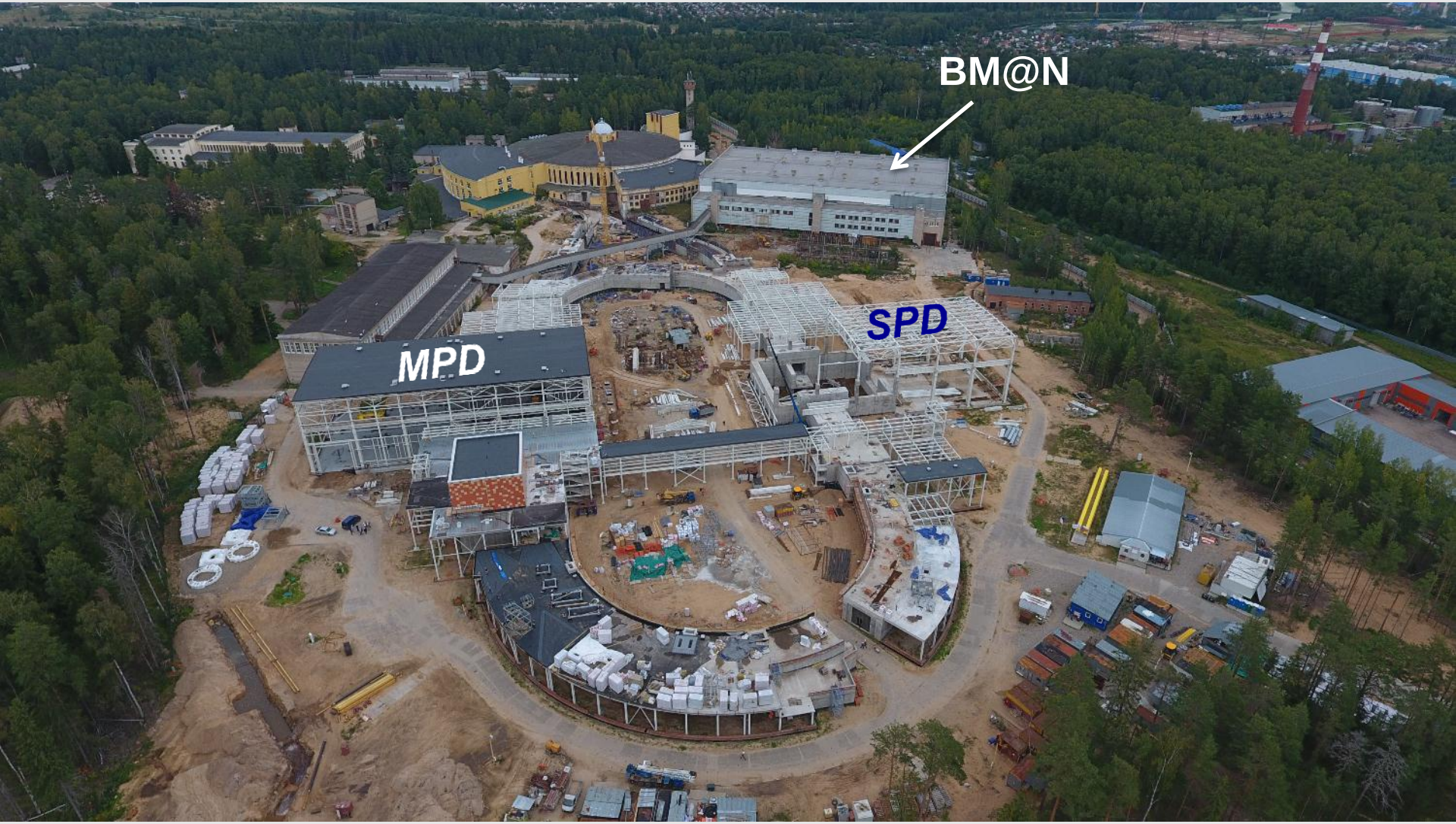
- ***MPD*** *- mid'**20***
- ***collider magnets**– mid'**20**;*

NICA cryogenic complex



LHEP electrical consumption should be increased more than2 times

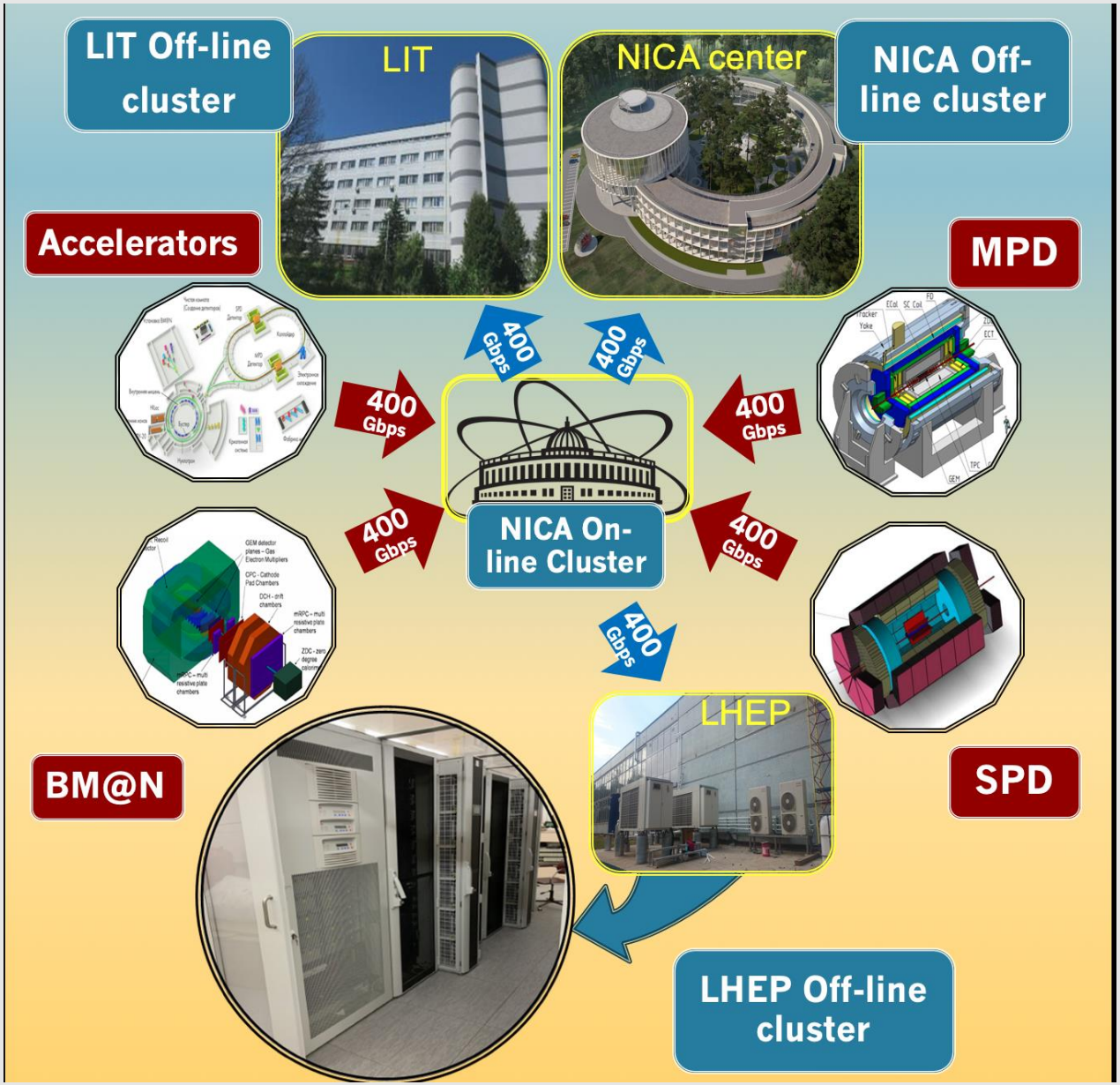
- JINR – 13 866 kW → - JINR– 32 270 kW



Center NICA: *bld. project contracted ООО ПИ «Арена»*

Plan:
get State expertize
2020

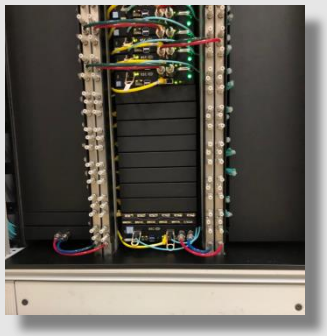
Network and computing NICA



ЛИТ

Data storage:

- 2017: 1 PB RAW /year
- plan: 10 PB RAW /year



fast disk storage in supercomputer ***«Govorun»***

Thank you