



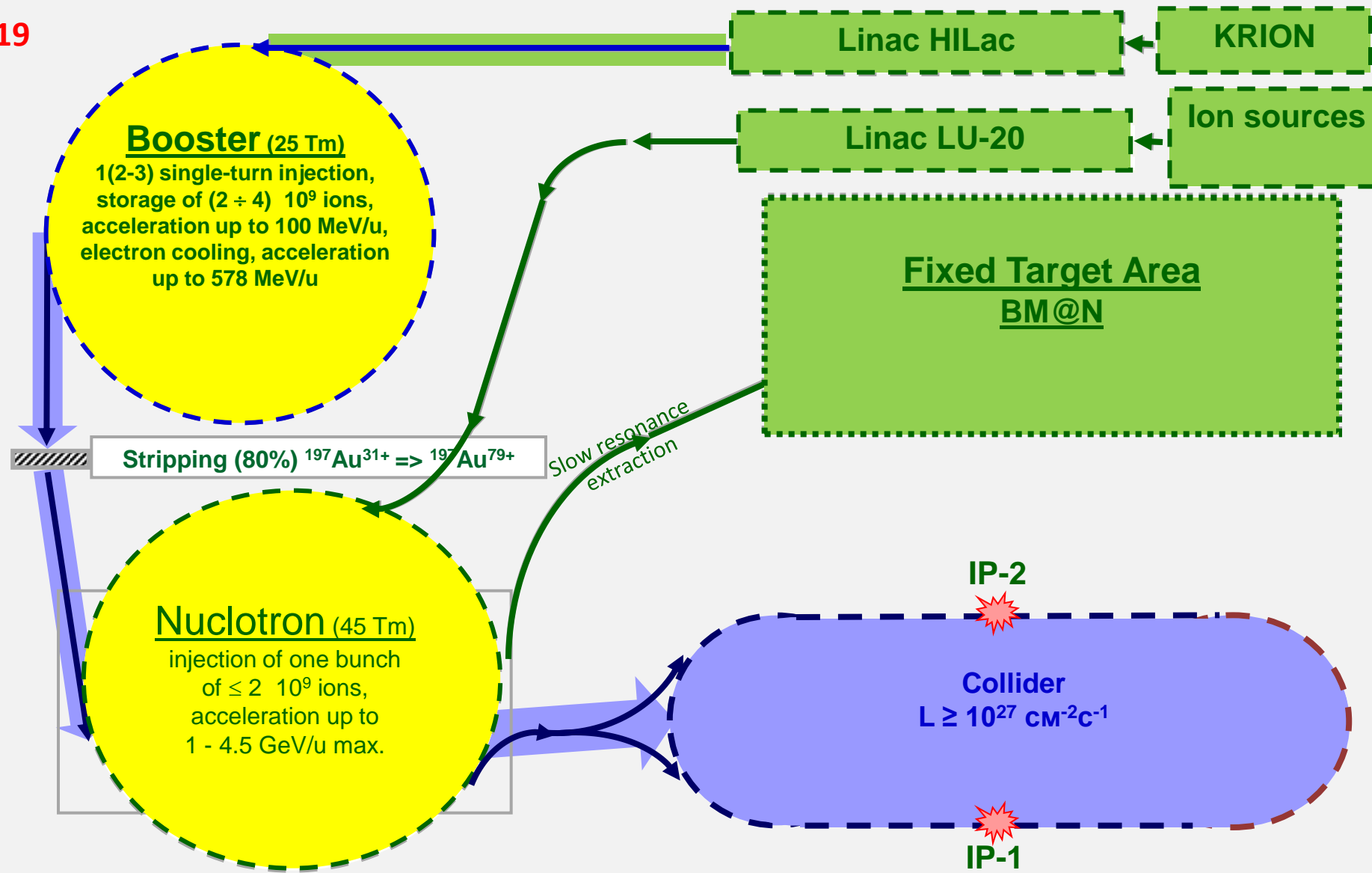
# Booster and Nuclotron: status and plans

A.Sidorin for the AD team

**4th Collaboration Meeting  
of the BM@N Experiment at the NICA Facility  
14-15 October 2019**

# Facility components' – status

2019



work in progress

assembly

commissioned / existing

# NICA Stage I (BM@N):

- KRION, HILAc
- BT Line HILAc - Booster
- Booster Synchrotron
- BT Line Booster – Nuclotron
- Nuclotron upgraded

# KRION, HILAc

## KRION:

Optimized at test bench for generation  
209Bi, 131Xe

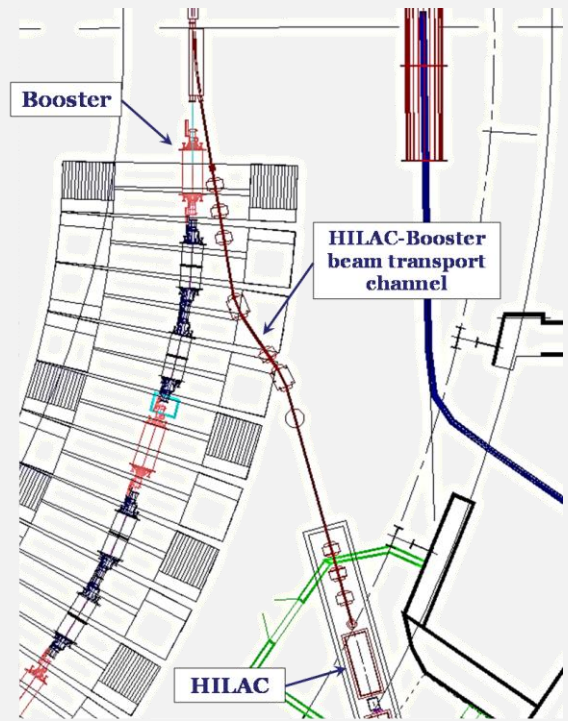
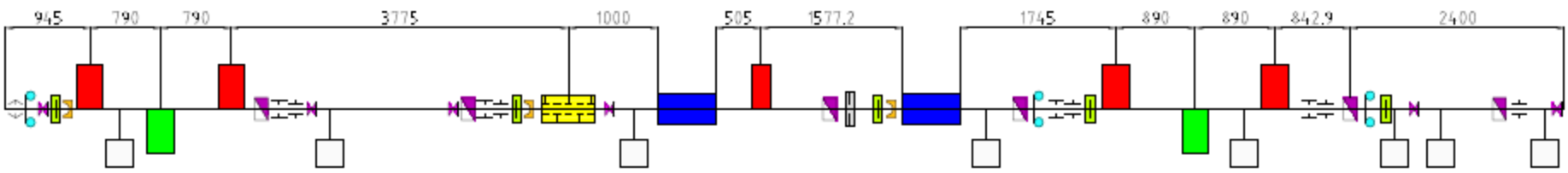
Expected intensity ~ 5E8 per pulse

## HILAc:

Commissioned 2016

Prepared for test run with laser source

# HILAc-Booster Beam Transport Line



- transport with minimal ion losses
- debunching
- matching
- Separation and adsorption of neighbor charge states of ions.
- Provide different schemes of the beam injection into the Booster.

□ Mounting was finished in July

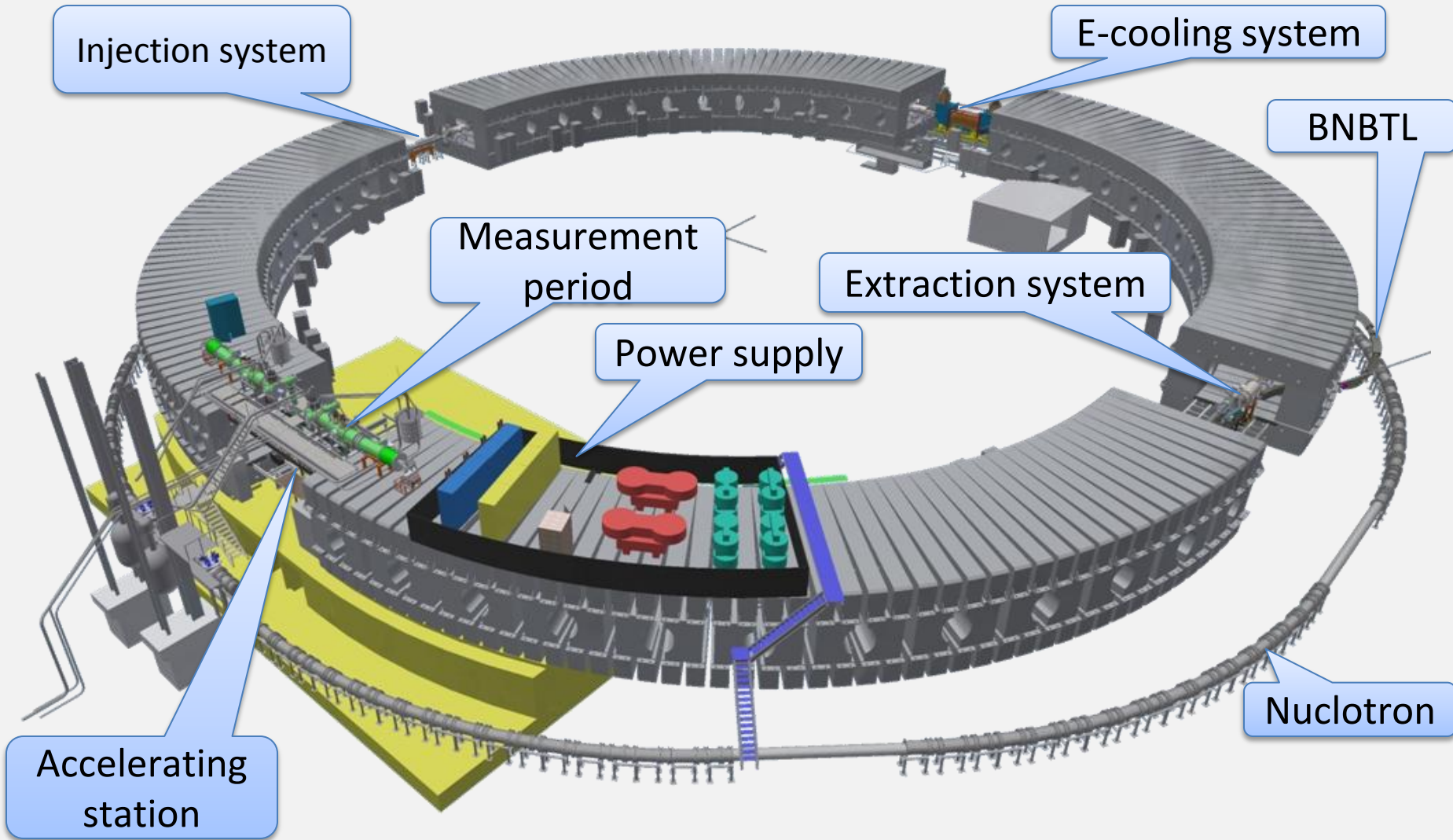


# HILAc-Booster transport channel



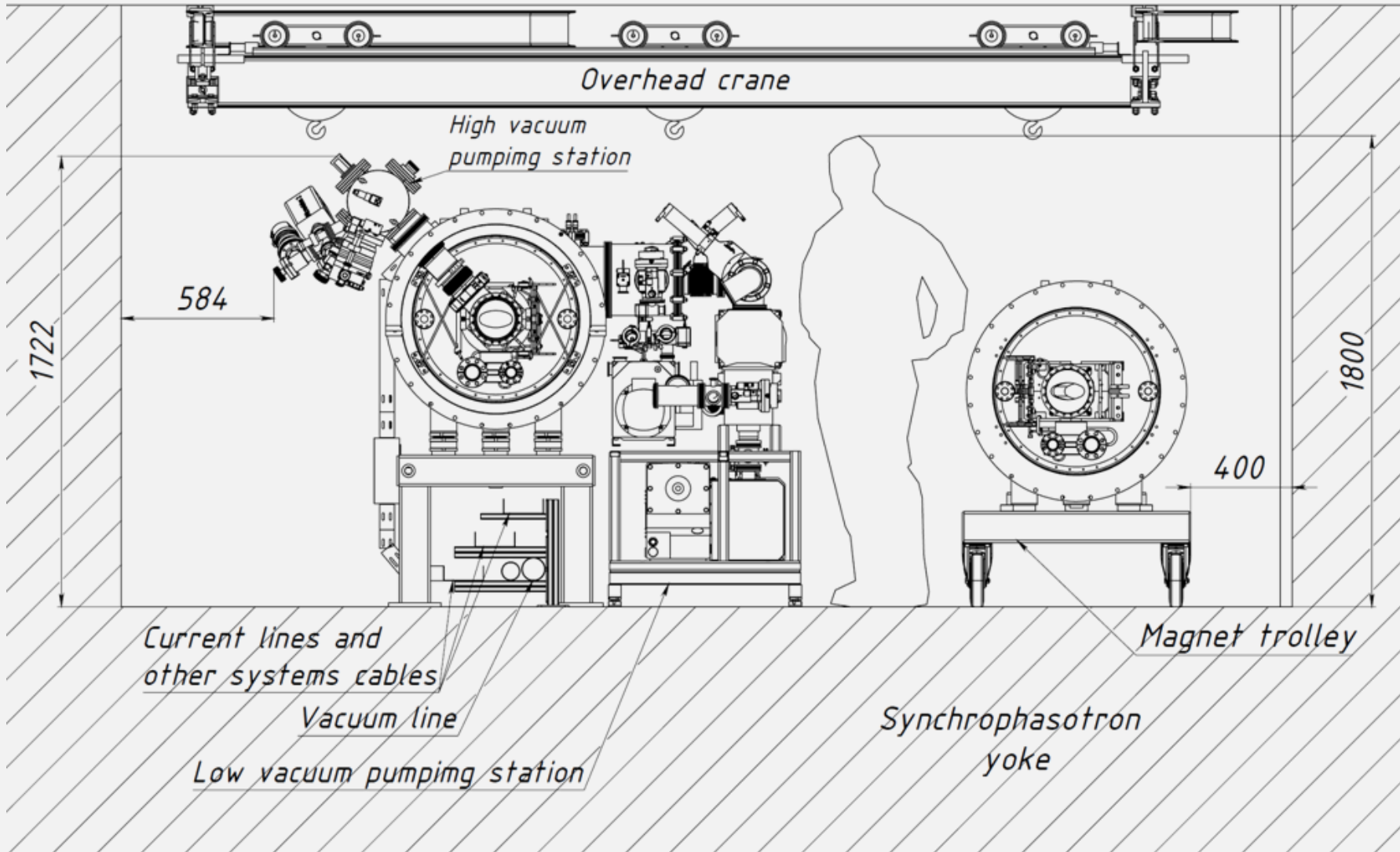
October 11,  
preparation for commissioning <sup>6</sup>

## Booster 3D view





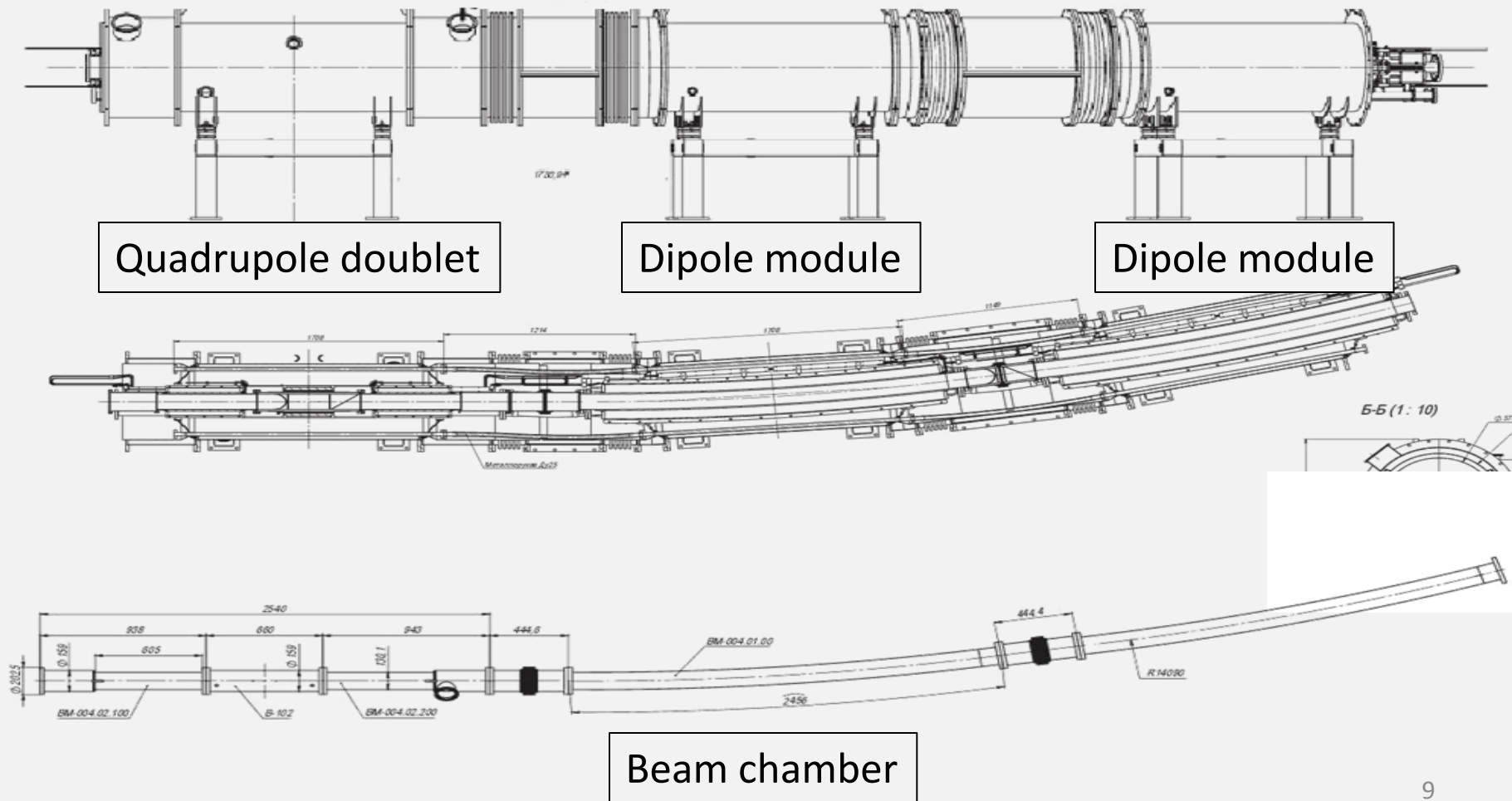
# The booster tunnel cross section





# Booster. Cryo-magnetic system

Regular periods



# Booster. Cryo-magnetic system



# Booster. Cryo-magnetic system





# Booster. Cryo-magnetic system

Alignment of magnets on position

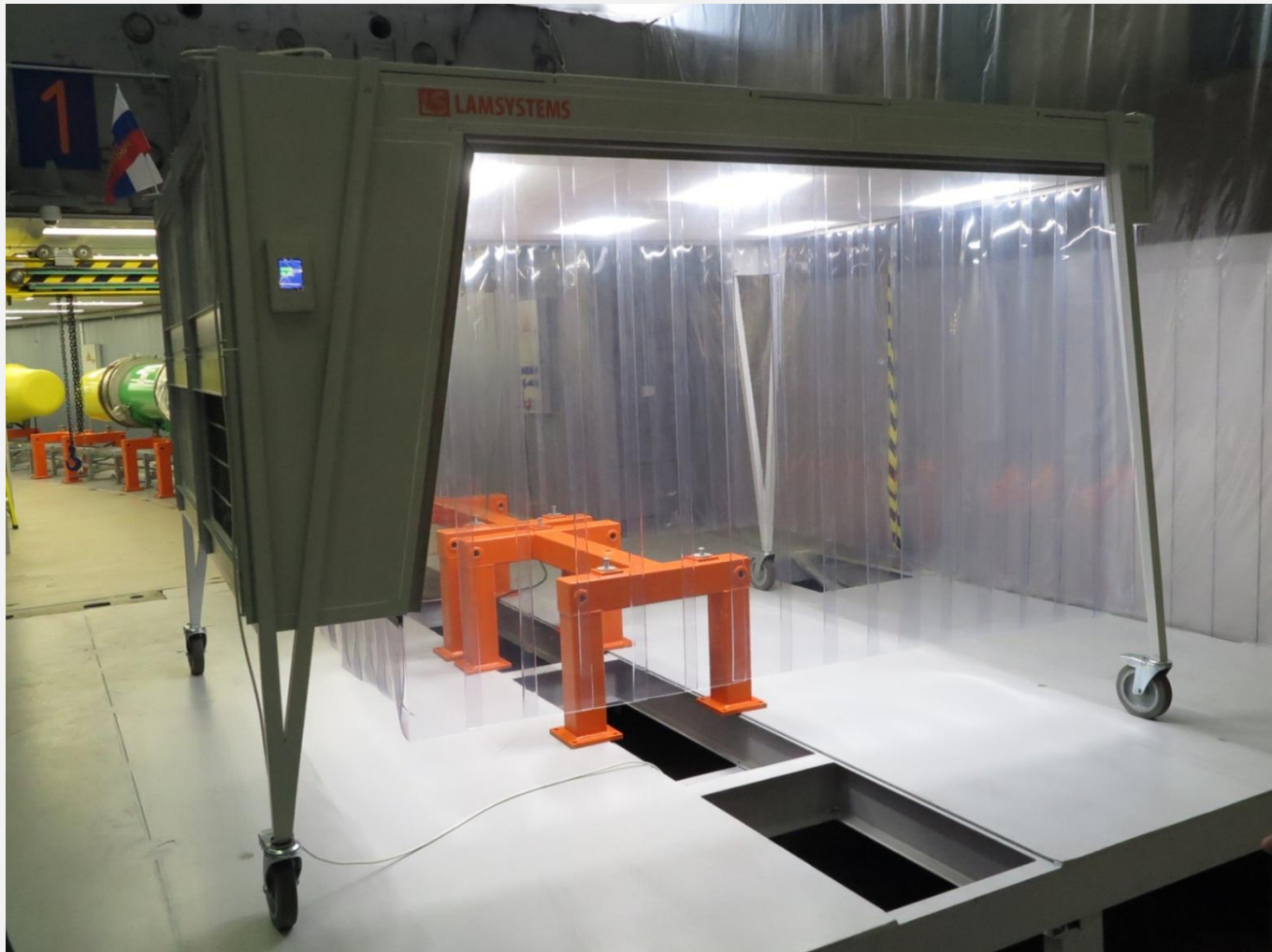
• Promizmerenia company



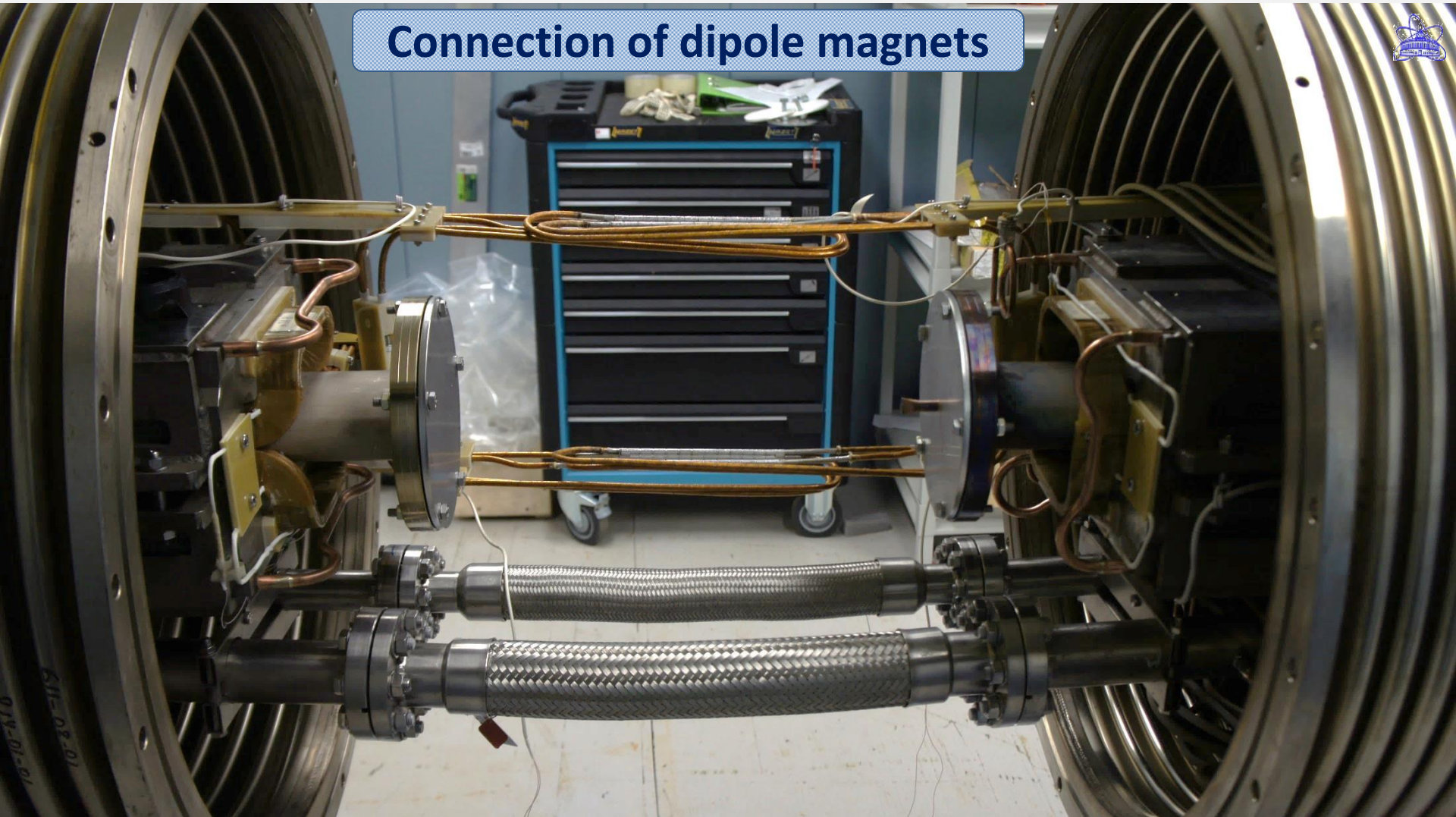


# Booster. Cryo-magnetic system

## Movable clean zone

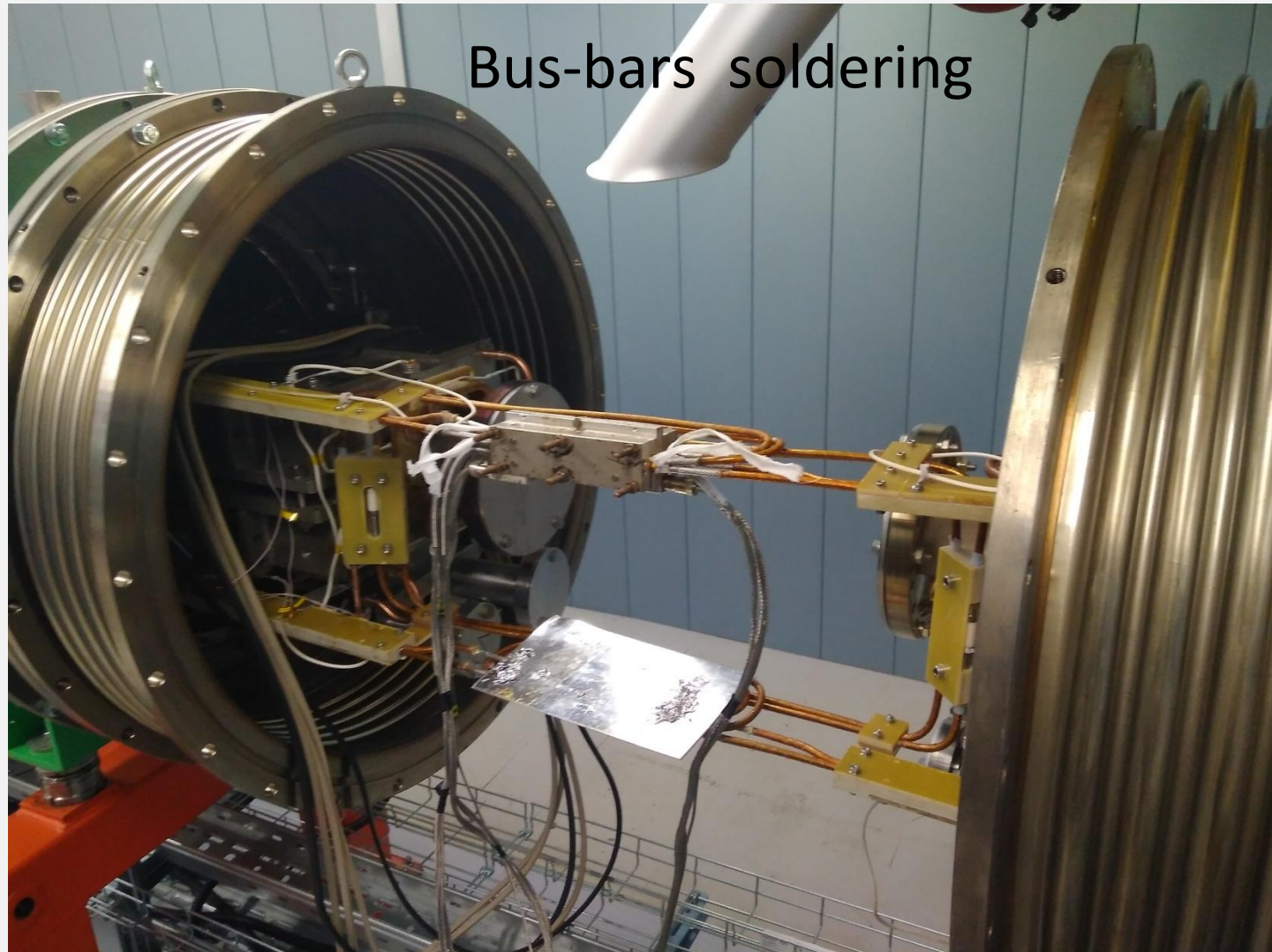


Connection of dipole magnets



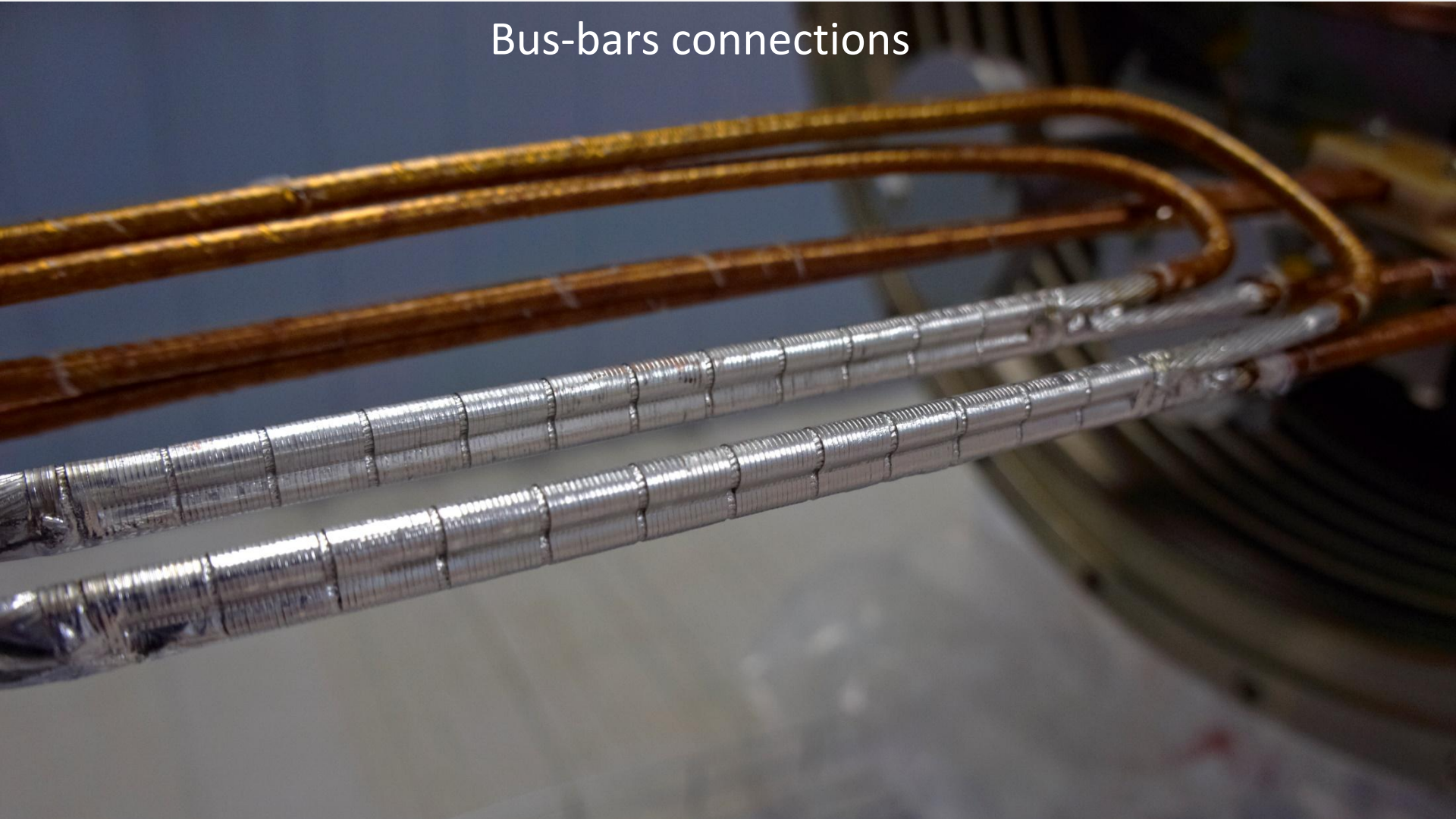


# Booster. Cryo-magnetic system



# Booster. Cryo-magnetic system

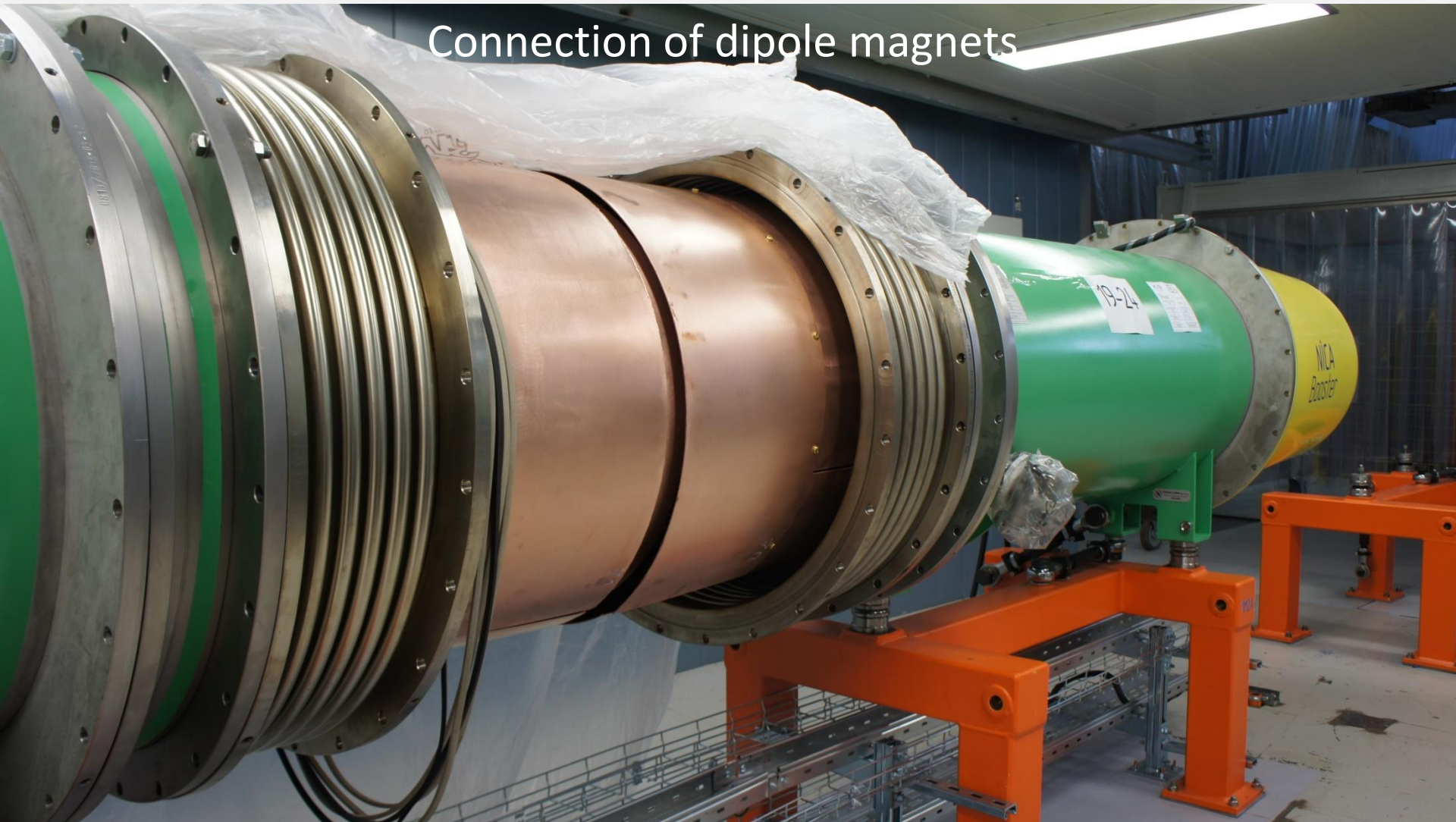
Bus-bars connections





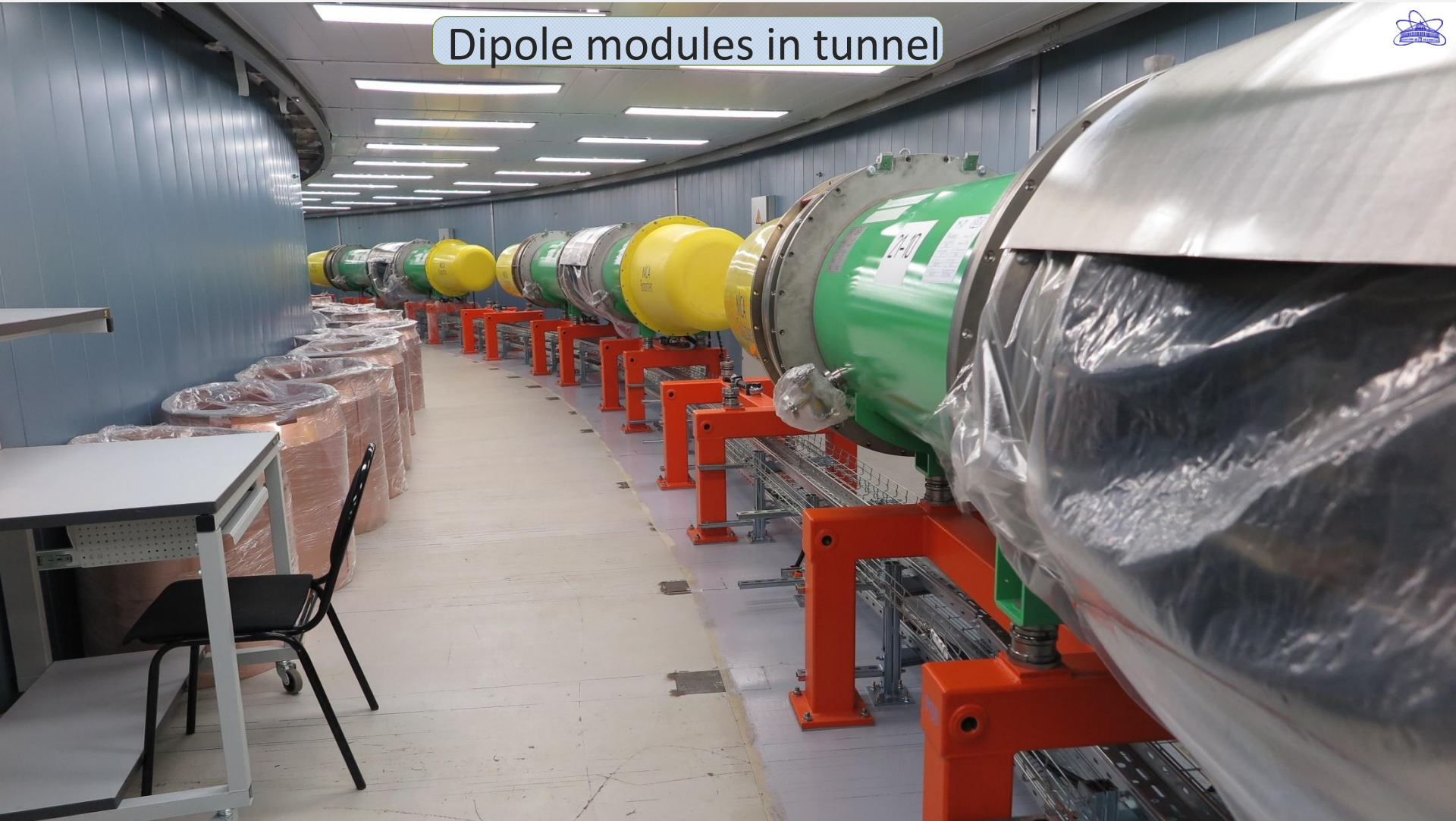
# Booster. Cryo-magnetic system

Connection of dipole magnets



# Booster. Cryo-magnetic system

Dipole modules in tunnel





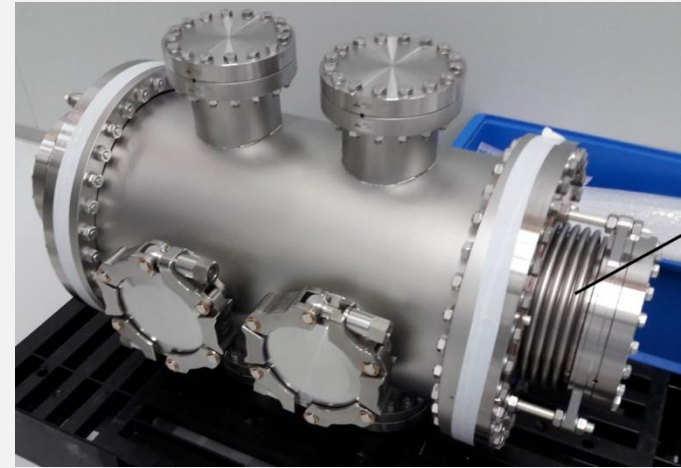
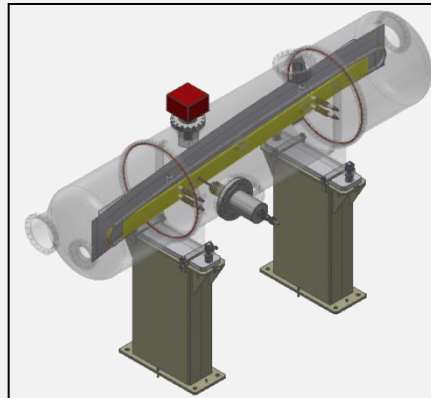
# Booster injection system



ESS + IP2 delivery  
June 2019  
CryoSystems

IP3 delivery  
 July 2019  
 Bevatech + Pink

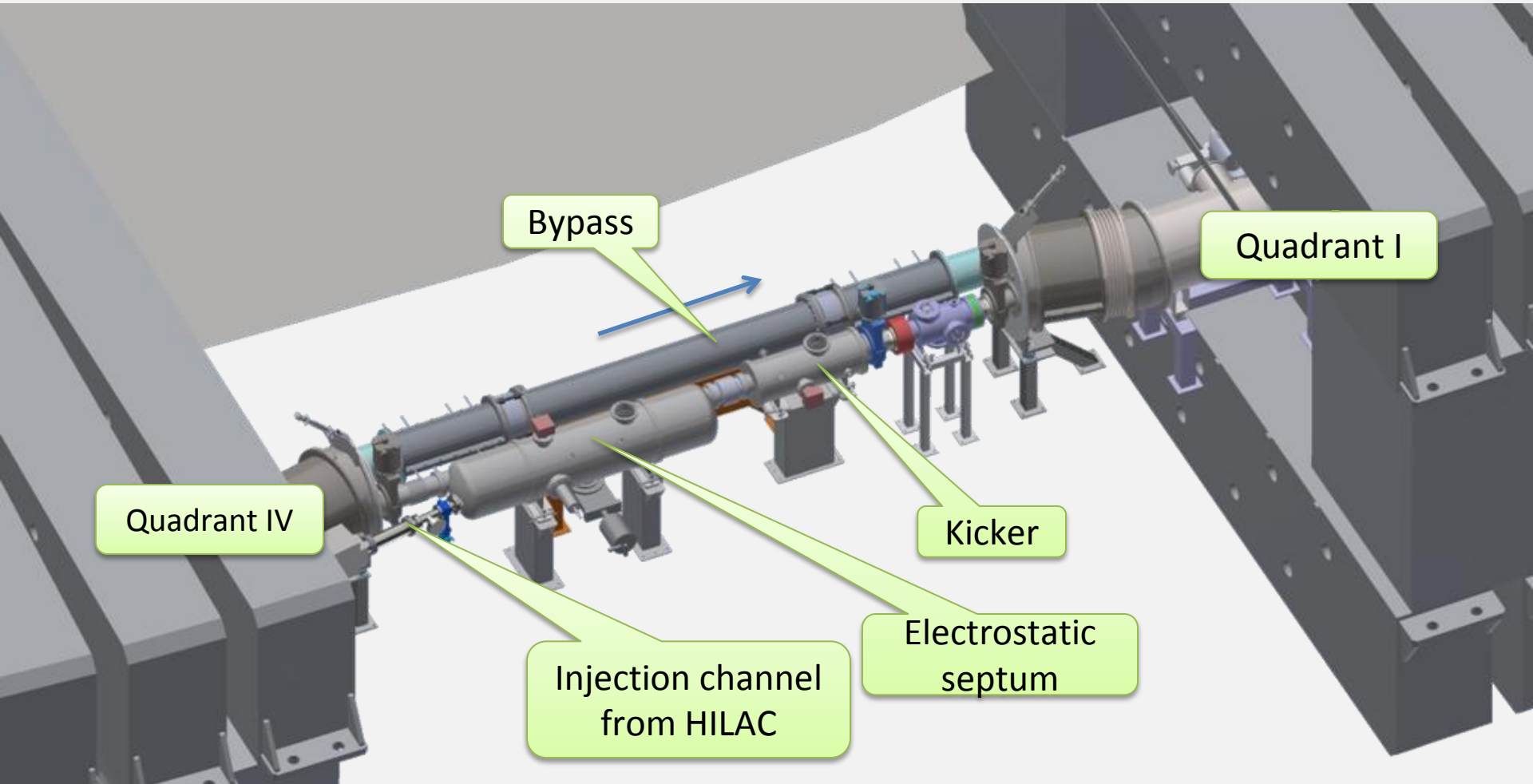
IP1 – ordering in  
 Aug 2019



- injection with minimal ion losses
- single-turn injection, multiturn injection, multiple injection.

# Booster injection system

## First warm gap



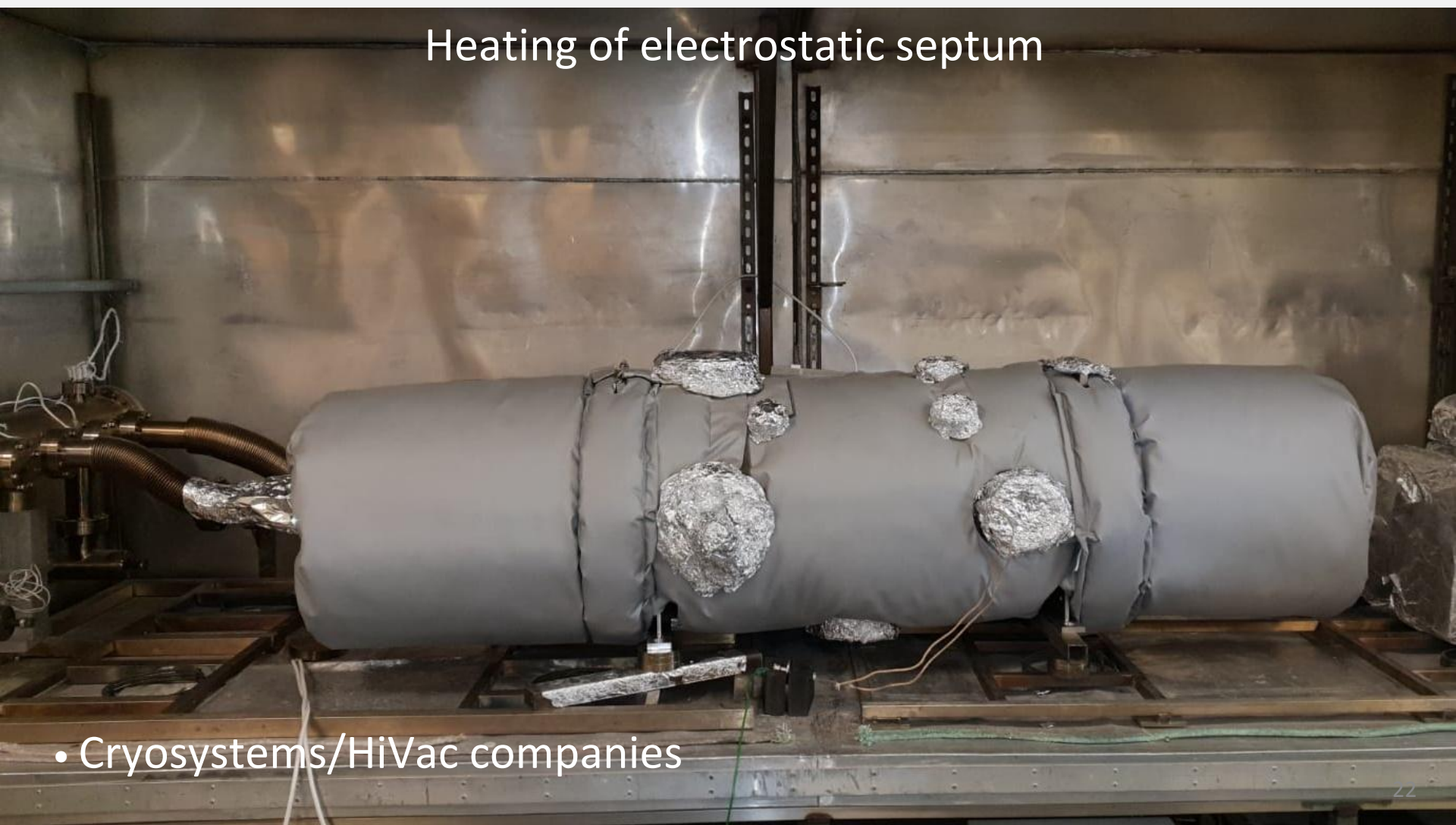


# Booster injection system

Production of electrostatic septum

- Cryosystems/HiVac companies

Heating of electrostatic septum



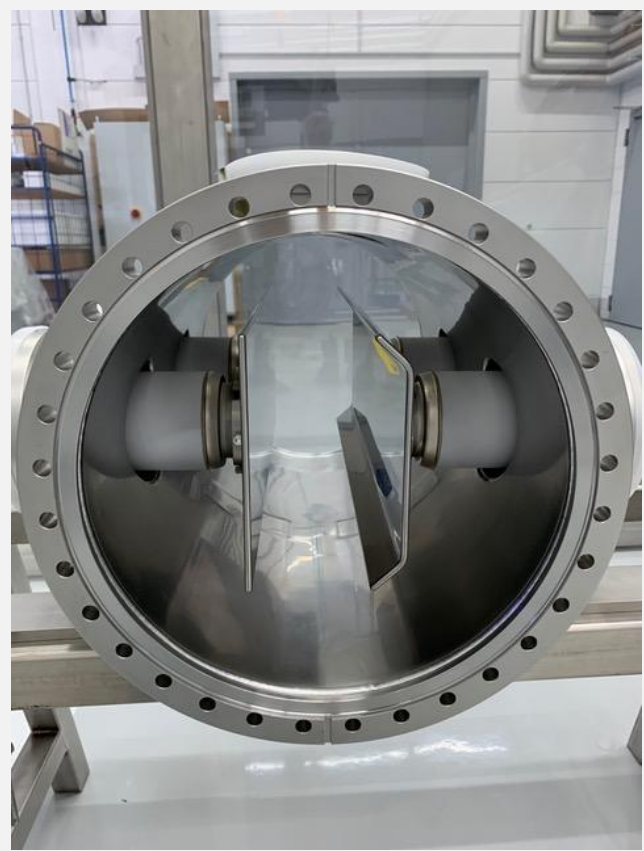
- Cryosystems/HiVac companies



# Electrostatic kicker (cold)

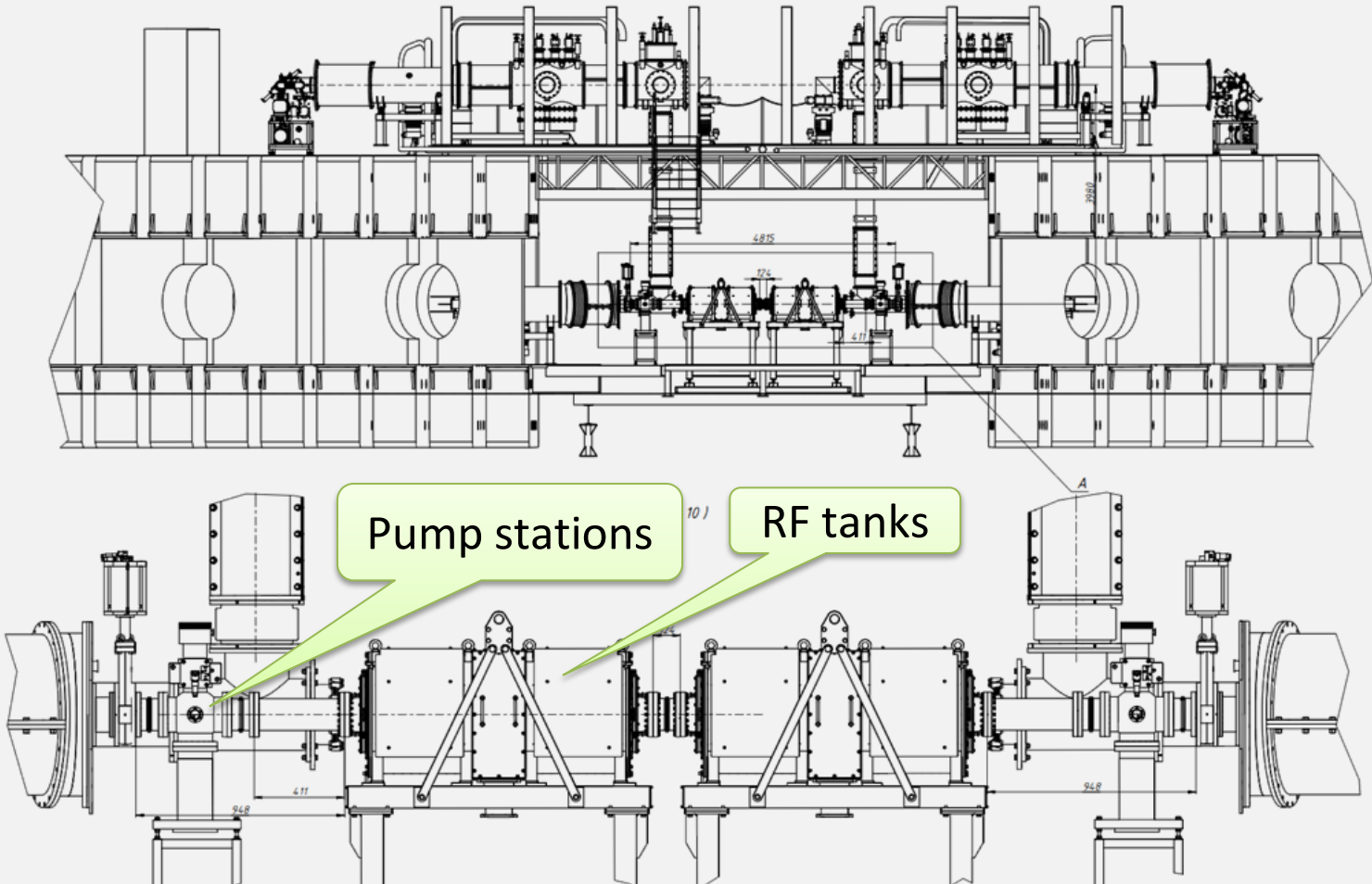


• BEVATECH/PINK companies





## Second warm gap



# Second warm gap



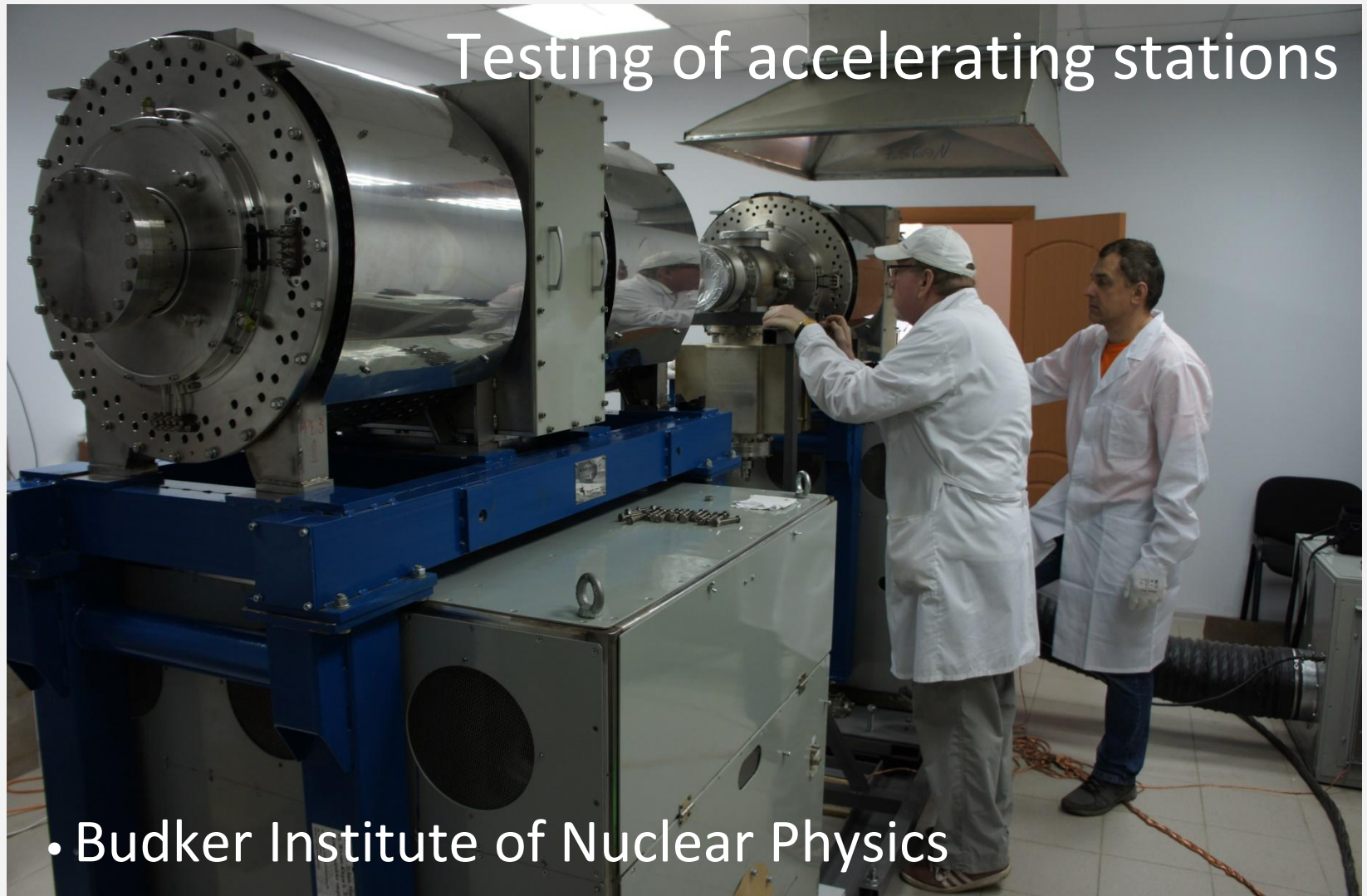


# Second warm gap





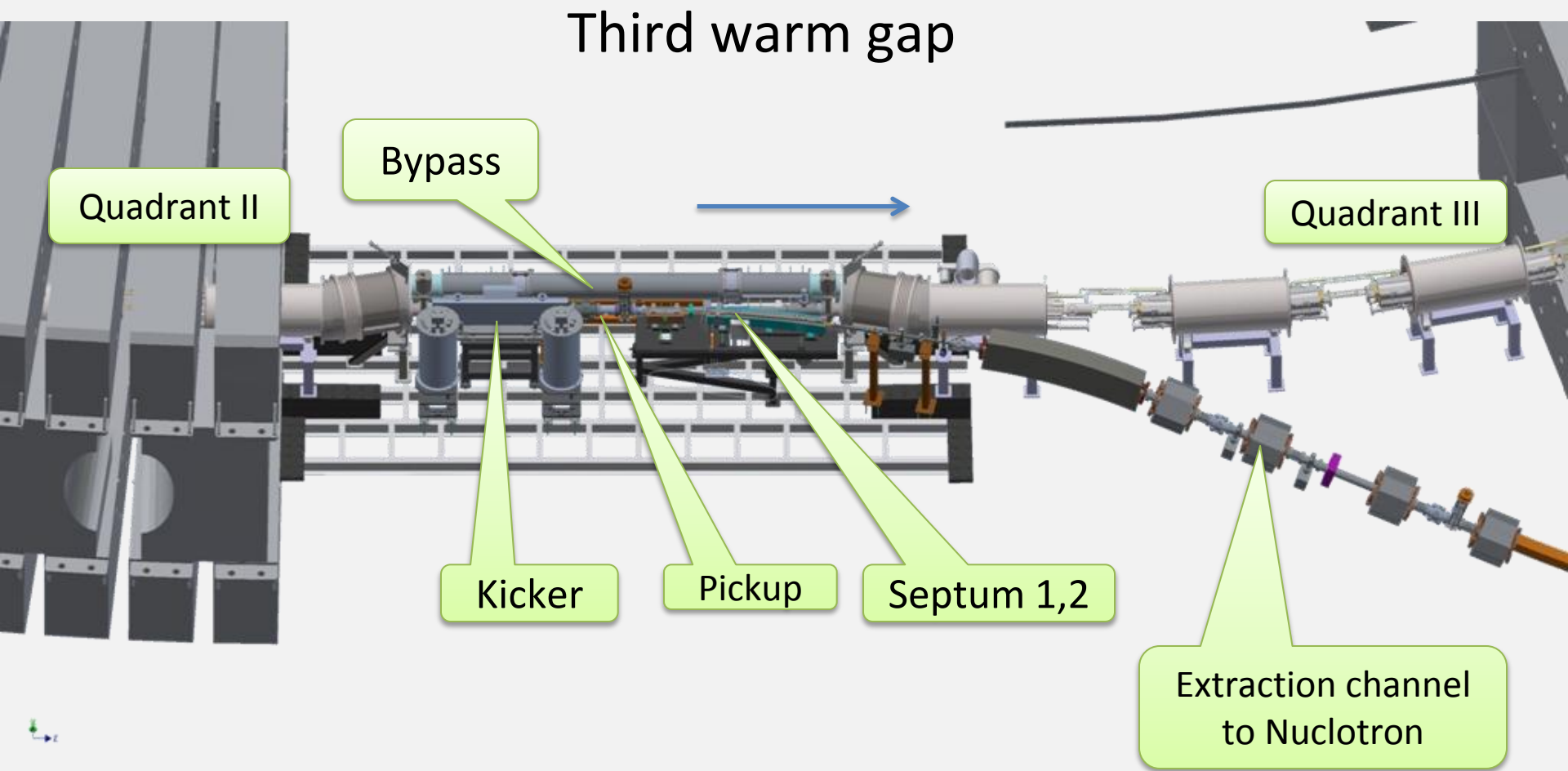
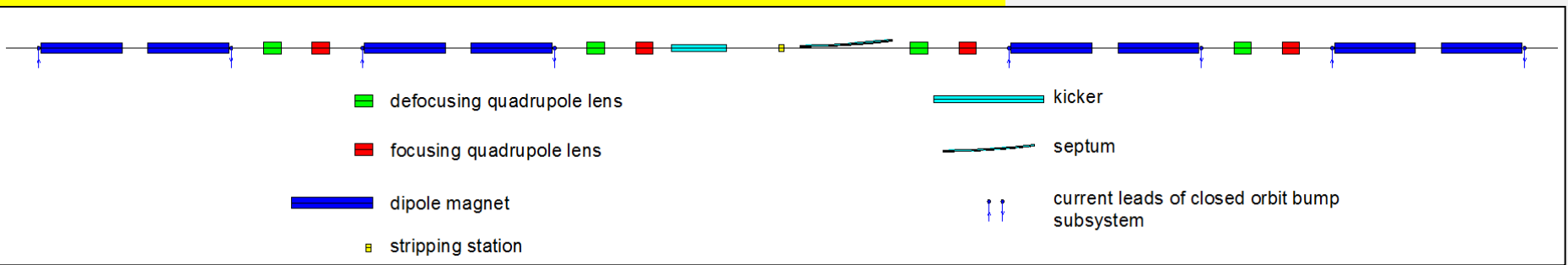
# Booster acceleration stations



Testing of accelerating stations

- Budker Institute of Nuclear Physics

# Booster fast extraction system



# Booster fast extraction system

## Kicker



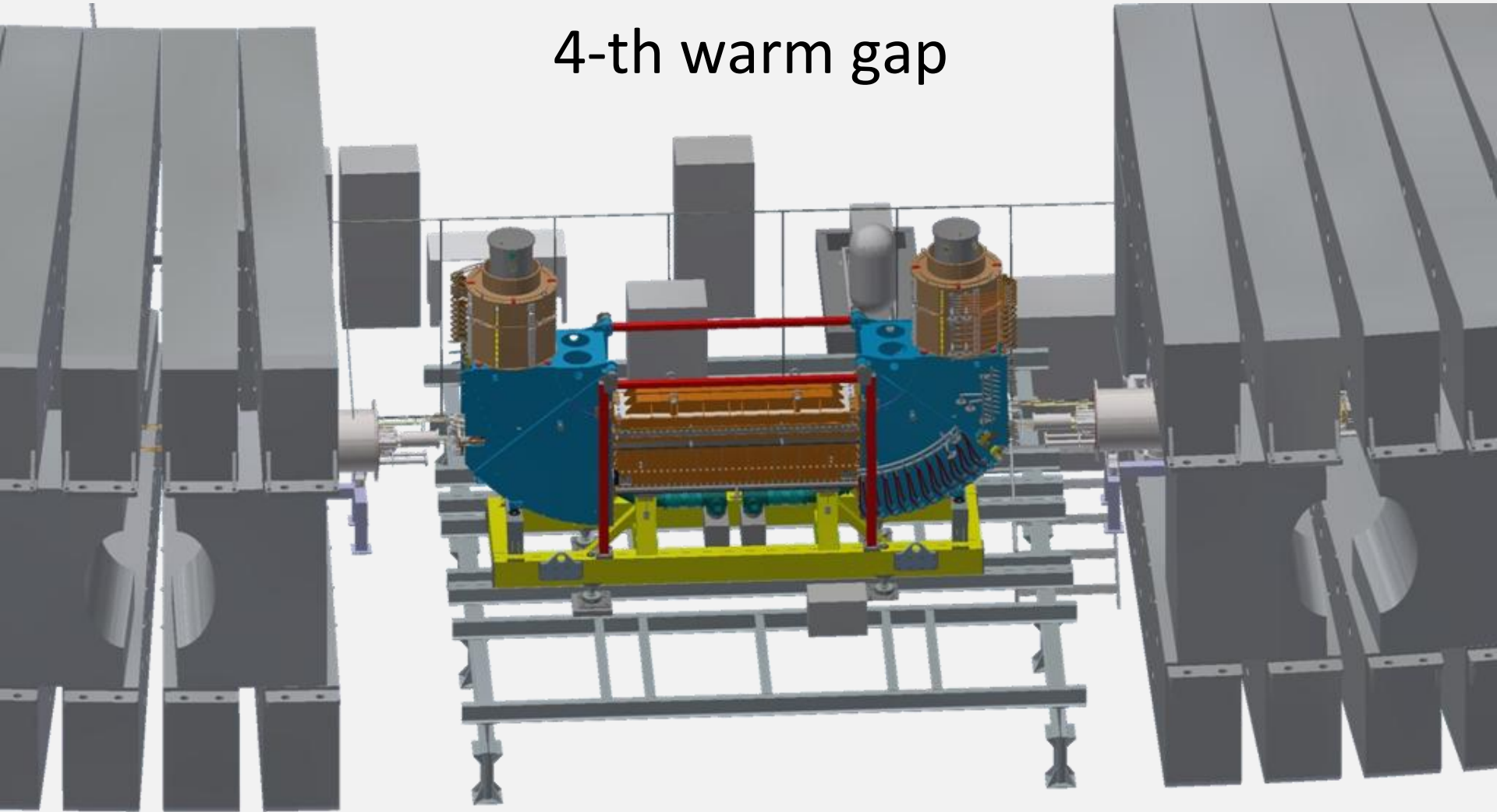
- Budker Institute of Nuclear Physics



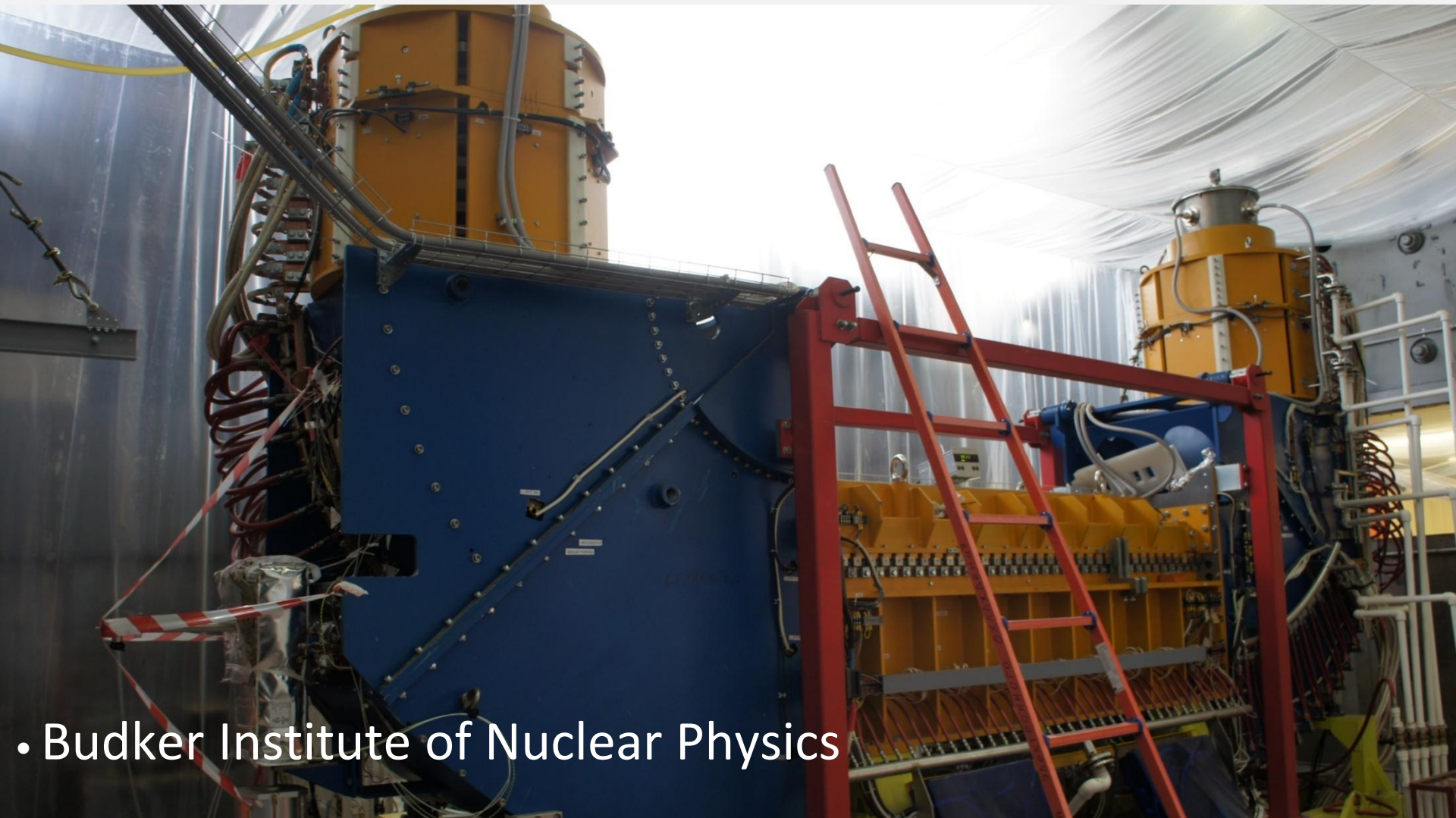


# Booster electron cooling system

4-th warm gap



# Booster electron cooling system



• Budker Institute of Nuclear Physics



# Booster Power supply system





# Booster Power supply system

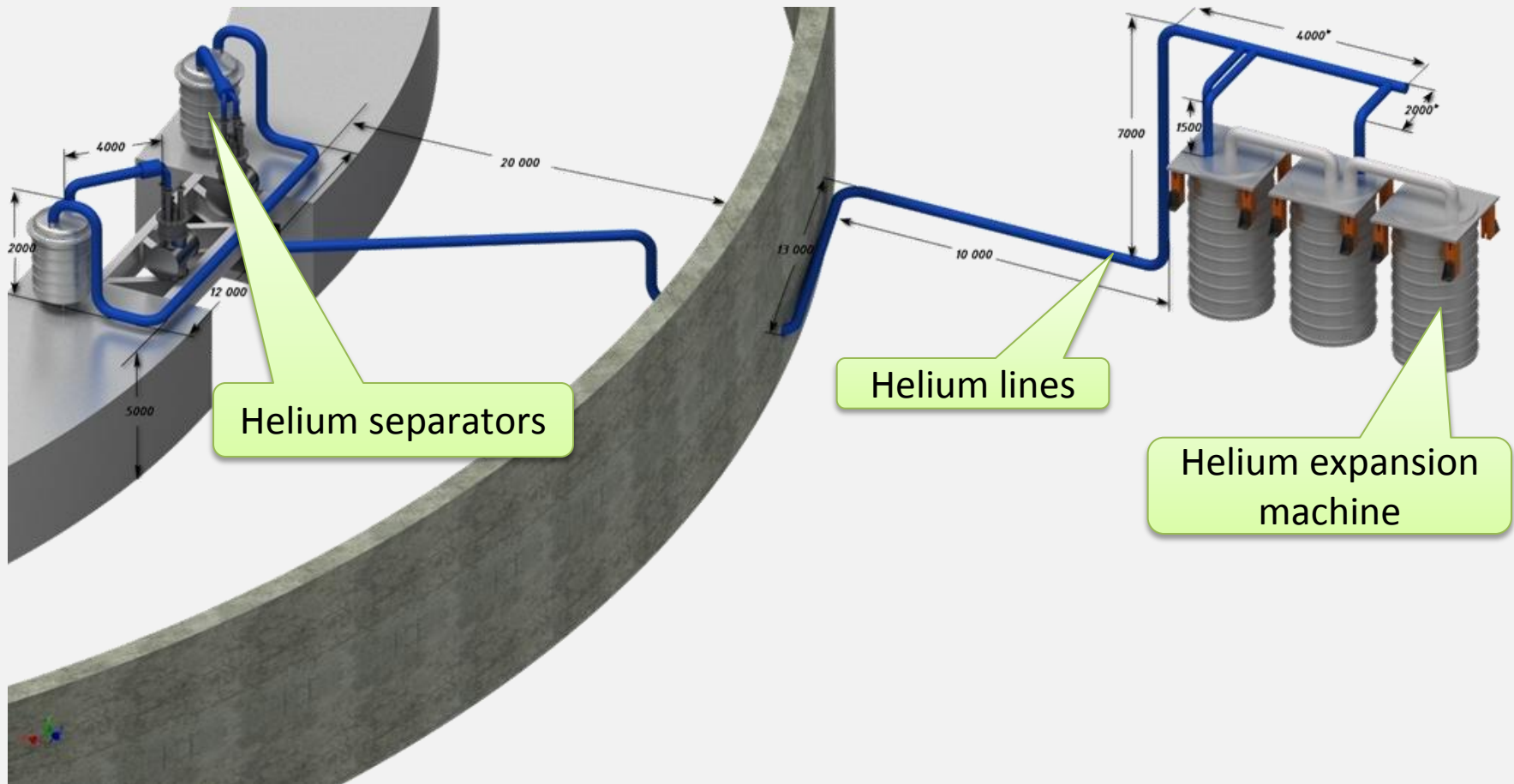


Room in the basement



Commissioning on equivalent load

# Booster Cooling system



Helium separators

Helium lines

Helium expansion machine

# Booster Cooling system



Gas control racks



Parts of expanders



# Booster Control and diagnostic systems



Control rack of correctors



Measuring rack of BPM and thermometry



Control rack of vacuum system

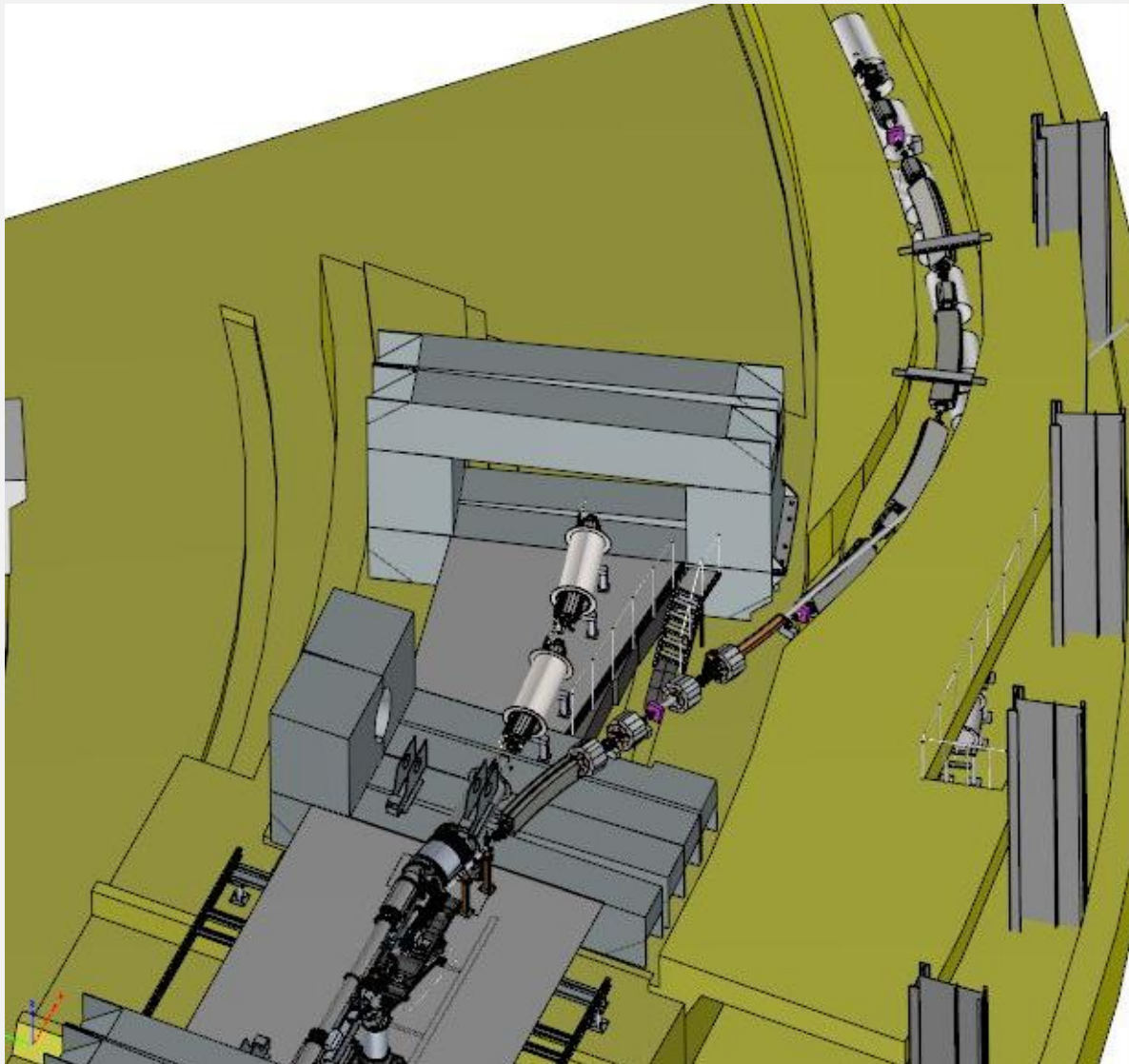
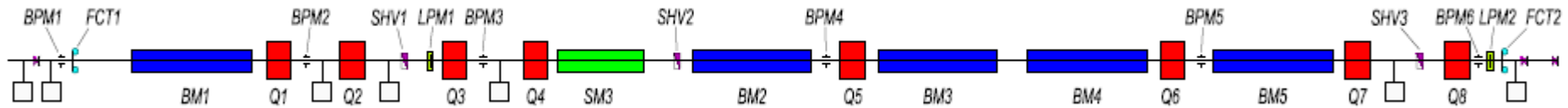
# Booster

- ❑ 90% sc-magnets passed tests
- ❑ 50% of magnets delivered to ring tunnel
- ❑ accelerator infrastructure under mounting
- ❑ technological run November 2019
- ❑ run with beam up to the end of 2019 ?





# Booster-Nuclotron transport channel



- beam transport with minimal ion losses
- Separation of neighbor charge states.

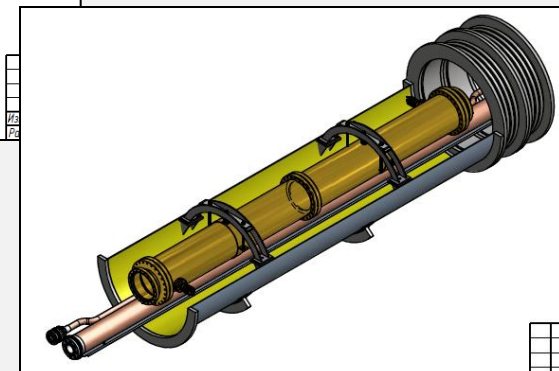
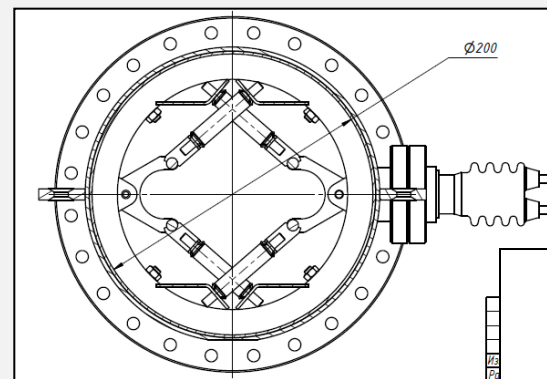
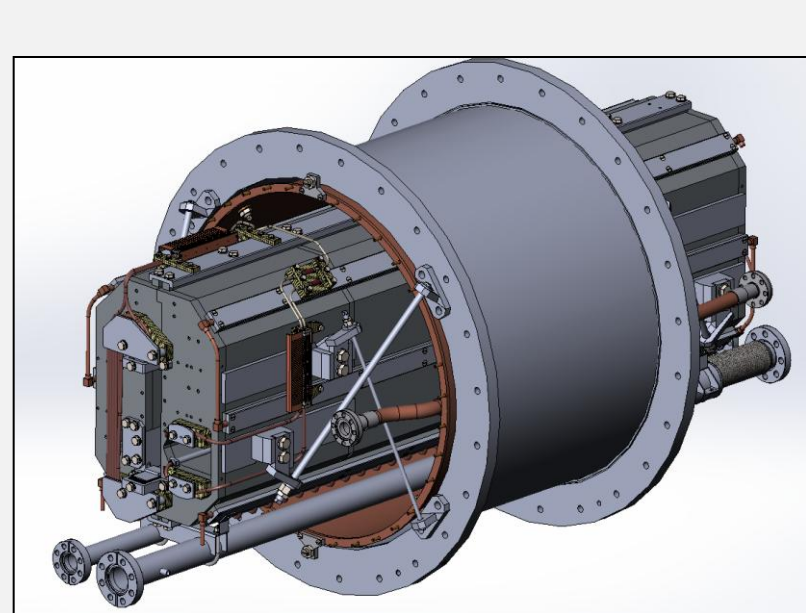
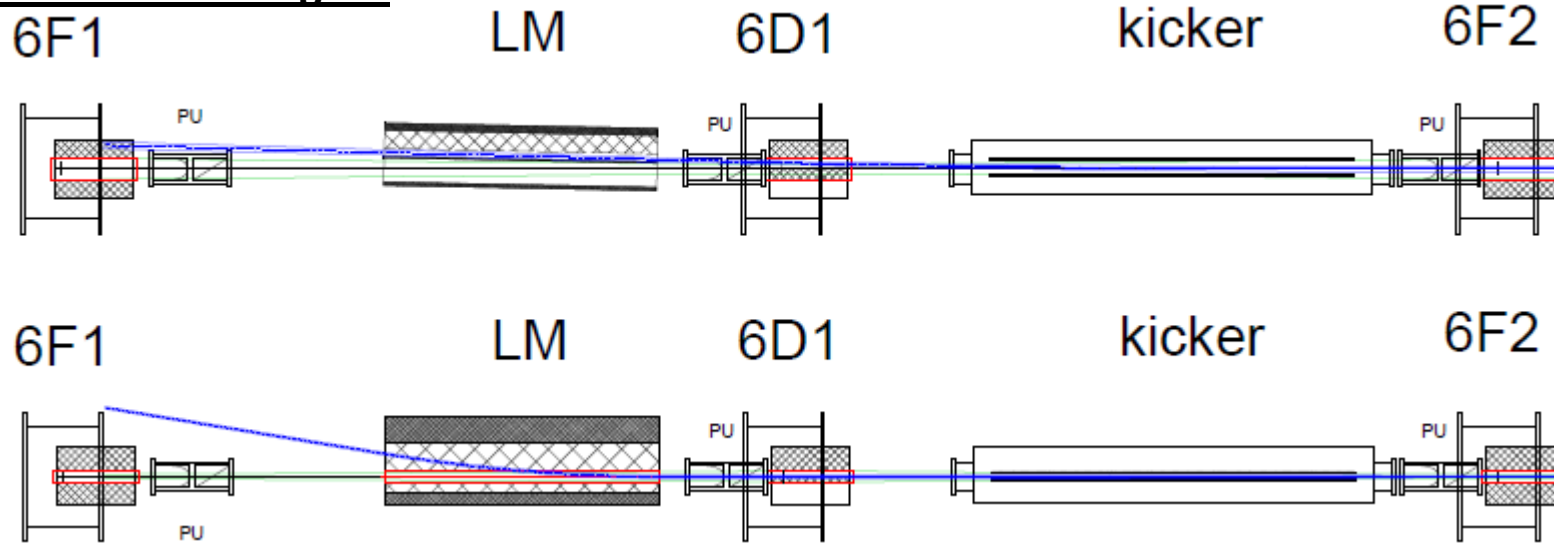
- under contract with BINP
- Channel delivery March 2020
- ...April 2020 start mounting



# Nuclotron high energy beam injection system

Kicker

## Lambertson magnet



# Cryogenics

Delivered

Delivery in 2019

Delivery in 2020

1000 l/h helium liquefier  
OG-1000

draining and oil-  
purification units MO-  
800

500 kg/h nitrogen re-  
condenser RA-0.5 of the  
Nuclotron and booster

satellite refrigerators  
RSG-2000/4.5  
of the collider

40 m<sup>3</sup> liquid helium tank

satellite refrigerator  
RSG-2000/4.5  
of the booster

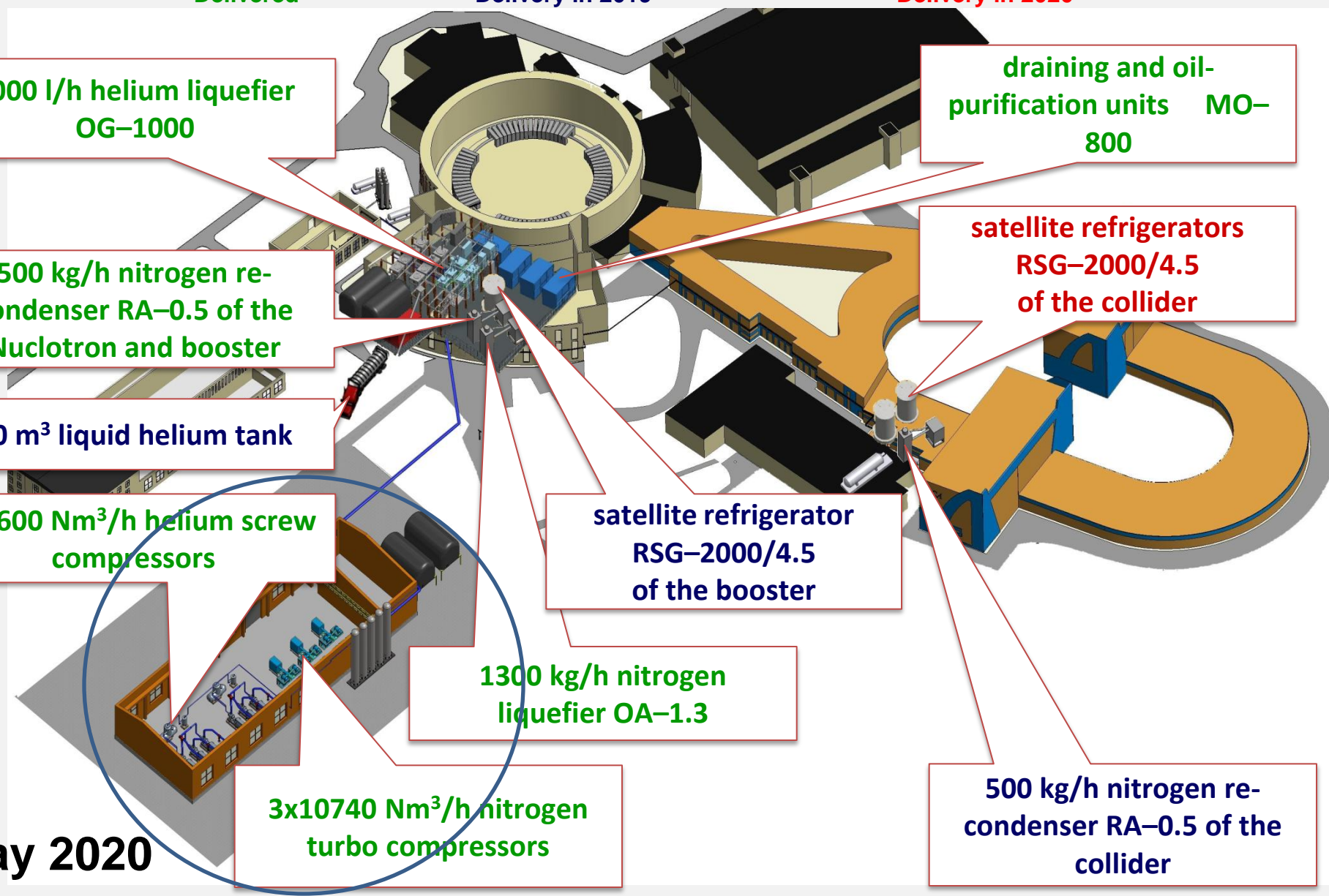
2x6600 Nm<sup>3</sup>/h helium screw  
compressors

1300 kg/h nitrogen  
liquefier OA-1.3

500 kg/h nitrogen re-  
condenser RA-0.5 of the  
collider

3x10740 Nm<sup>3</sup>/h nitrogen  
turbo compressors

May 2020



# Plans for NICA Stage I commissioning

November – December 2019  
Booster technological run

Before March 2020  
Booster run with C beam

April – October 2020  
KRION installation at HILAc  
Assembly of Booster-Nuclotron BTL  
Installation of Beam injection system at Nuclotron

May – November 2020  
Put in operation new compressors

December 2020  
First run



**Thank you for attention**

