BOOSTER SYNCHROTRON AT NICA ACCELERATOR COMPLEX

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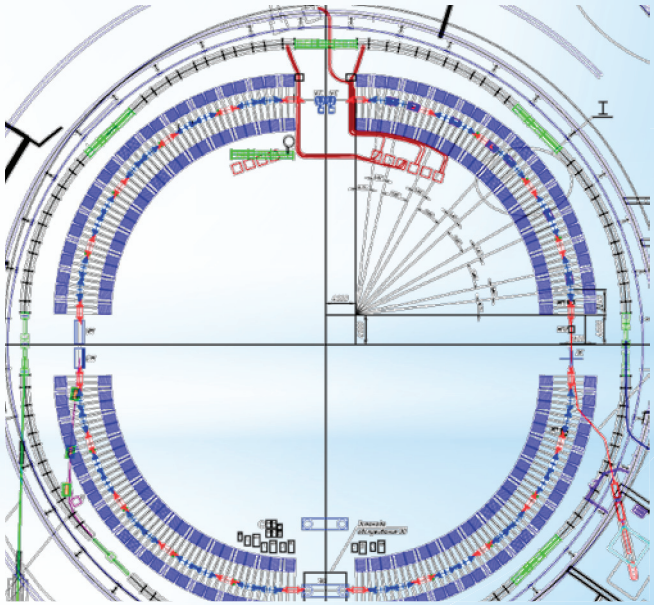
Booster

Main parameters

Ions	$^{197}Au^{31+}$
Energy at injection	3.2 MeV/amu
Maximum energy	578 MeV/amu
Magnetic rigidity: at injection maximal	1.6 T·m 25 T·m
Betatron tunes: Qx Qz	4.8 4.85
Chromaticity: ΔQx/(Δp/p) ΔQz/(Δp/p)	−5.1 −5.5
Momentum compaction	0.05
Amplitude of corrected C.O.	5 mm
Acceptance: horizontal vertical	150 π·mm·mrad 55 π·mm·mrad
Emittance: at injection $\varepsilon_{x,z}$ at extraction ε_x at extraction ε_z	15 π·mm·mrad < 3 π·mm·mrad < 1.5 π·mm·mrad
Momentum spread: at injection maximal at extraction	$\pm 10^{-3}$ $\pm 2.3 \square 10^{-3}$ $\pm 2.2 \square 10^{-4}$
Revolution period: at injection at extraction	8.5 μs 0.89 μs

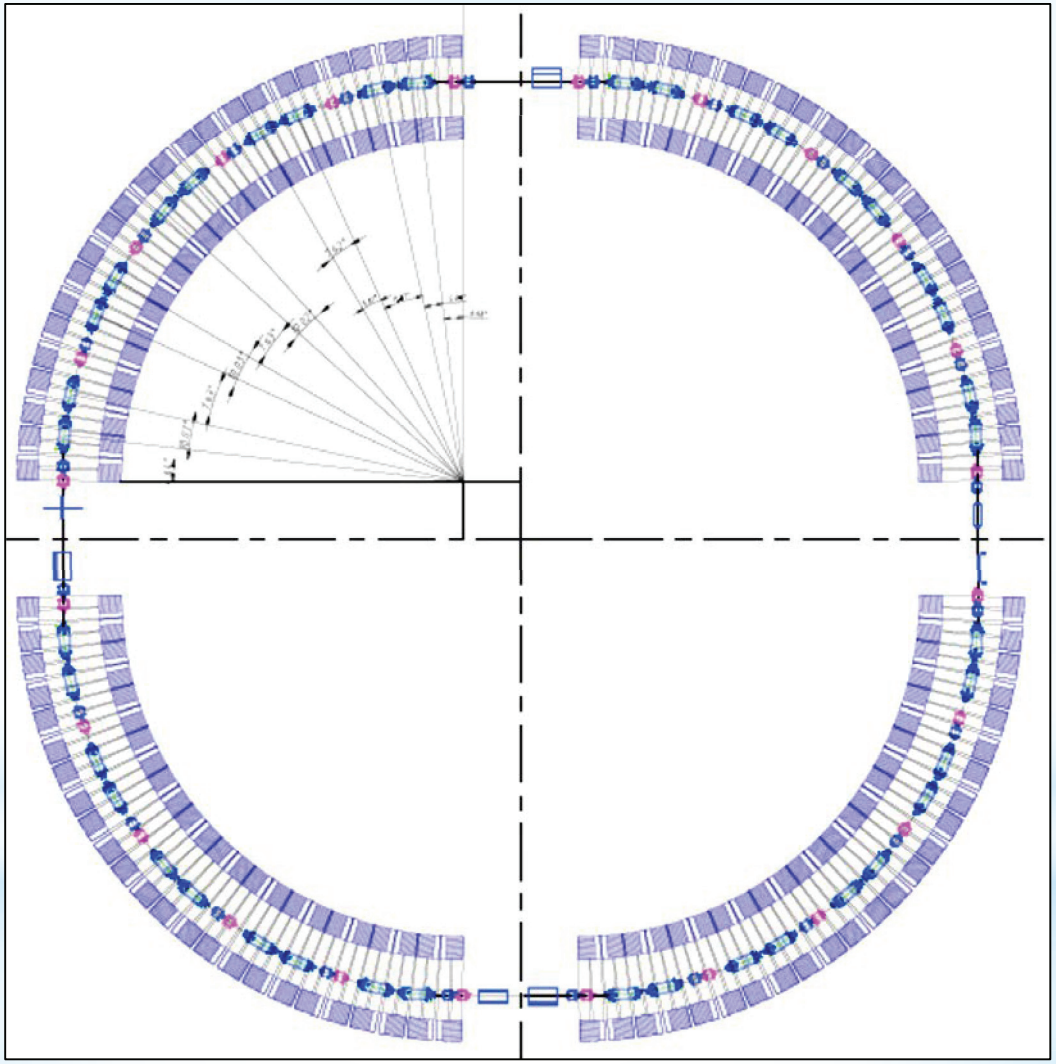
Goals

- Accumulation of required intensity of ions by means of several methods of beam injection.
- Acceleration of ions up to energy required for effective stripping.
- Forming of the required beam emittance with electron cooling system.

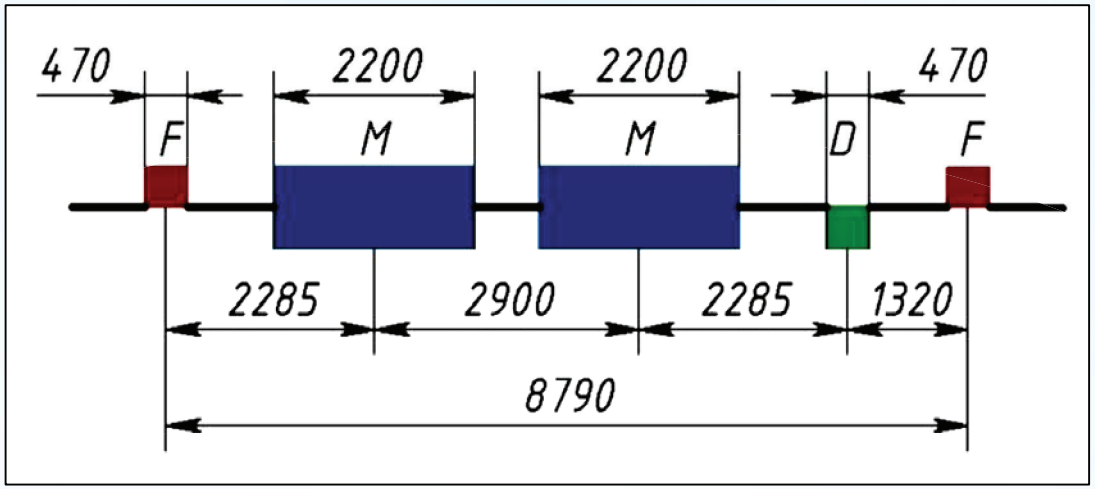


Booster

Booster layout inside Synchrophasotron yoke



DFO cell

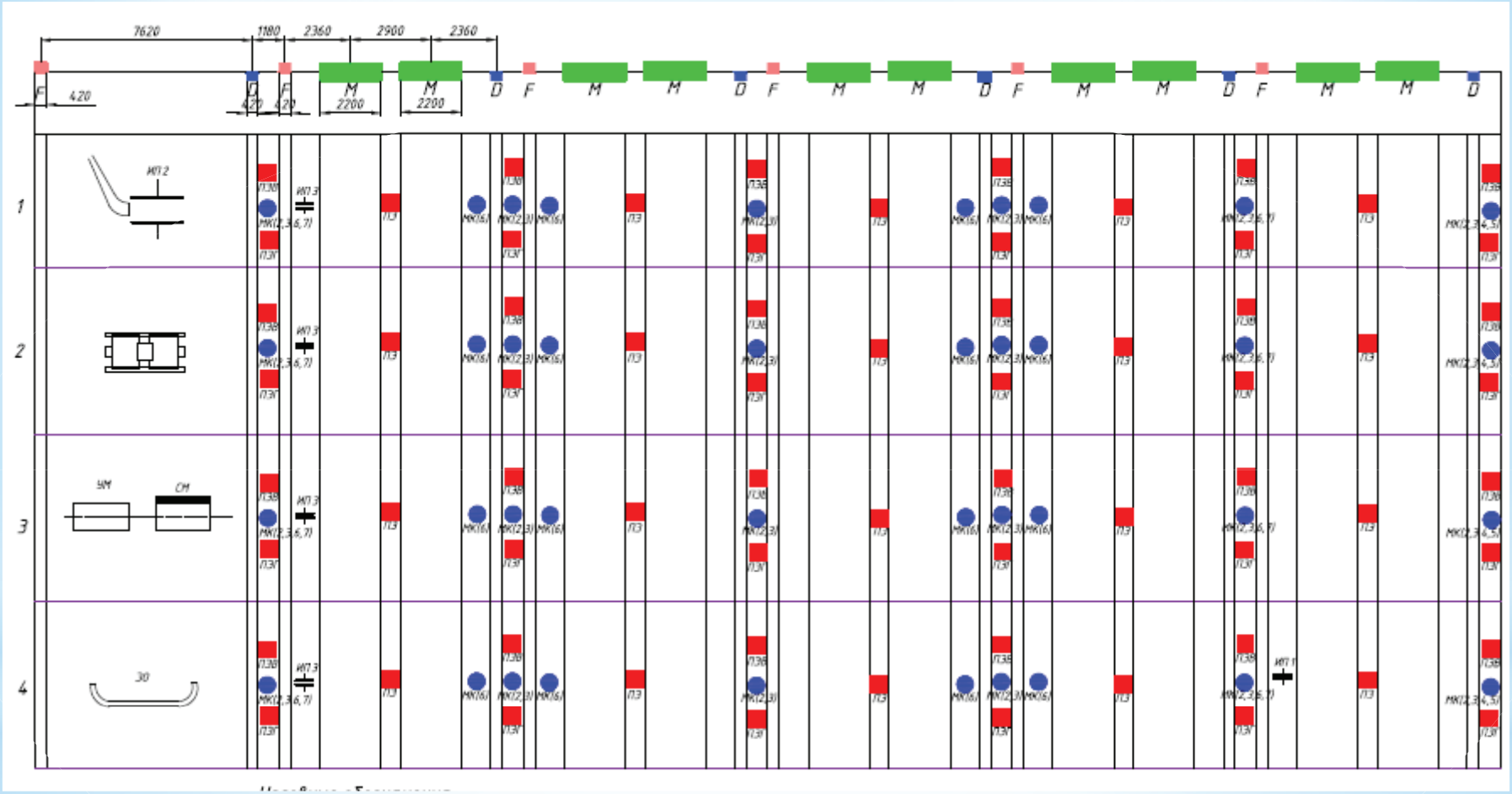


4 large straight sections

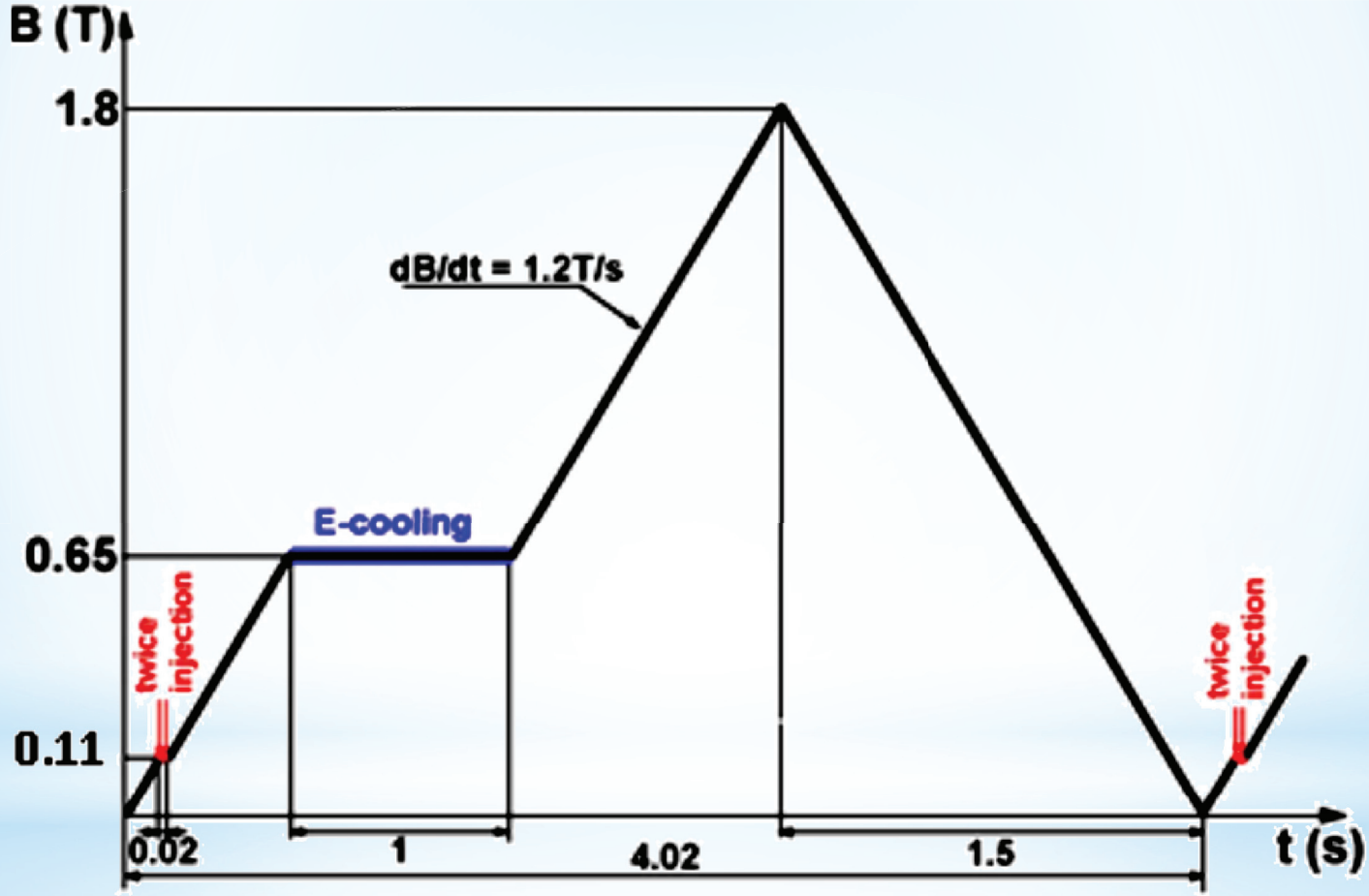
1. **Injection system**
2. **Two RF cavities**
3. **Single-turn extraction system**
4. **E-cooler**

Booster

Booster composition

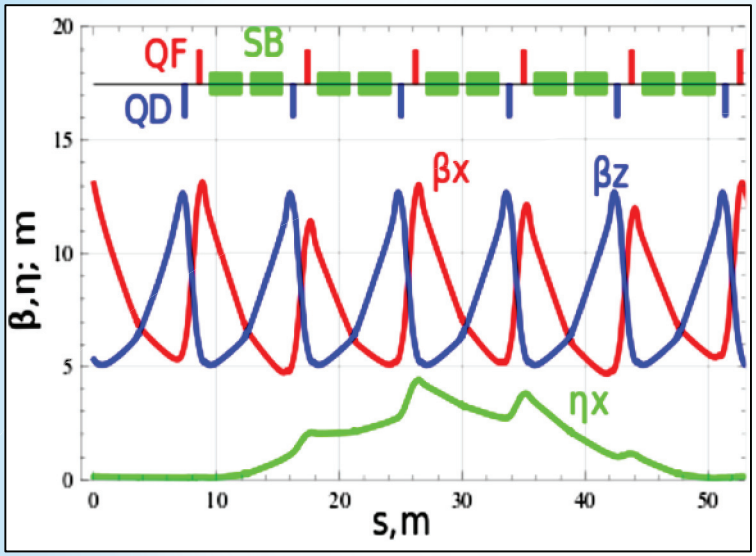


Working cycle

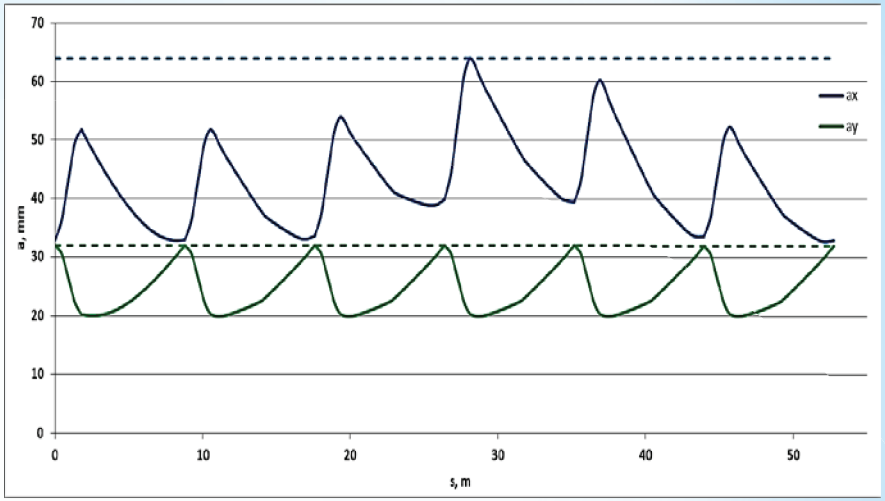


Beam dynamics

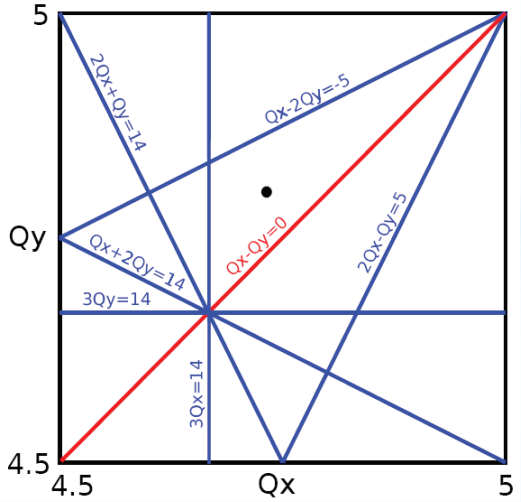
Lattice functions



Beam envelopes

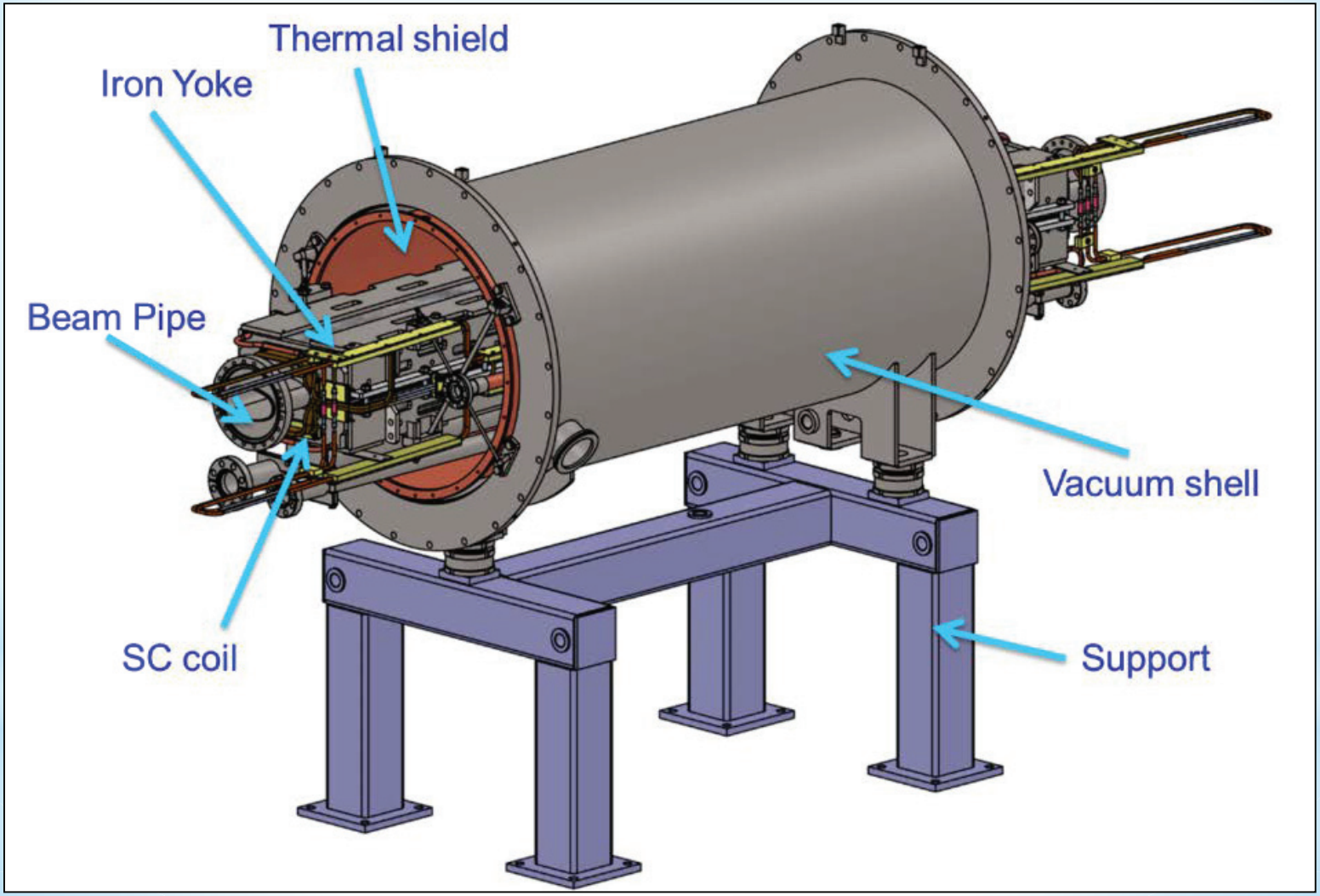


Betatron tunes



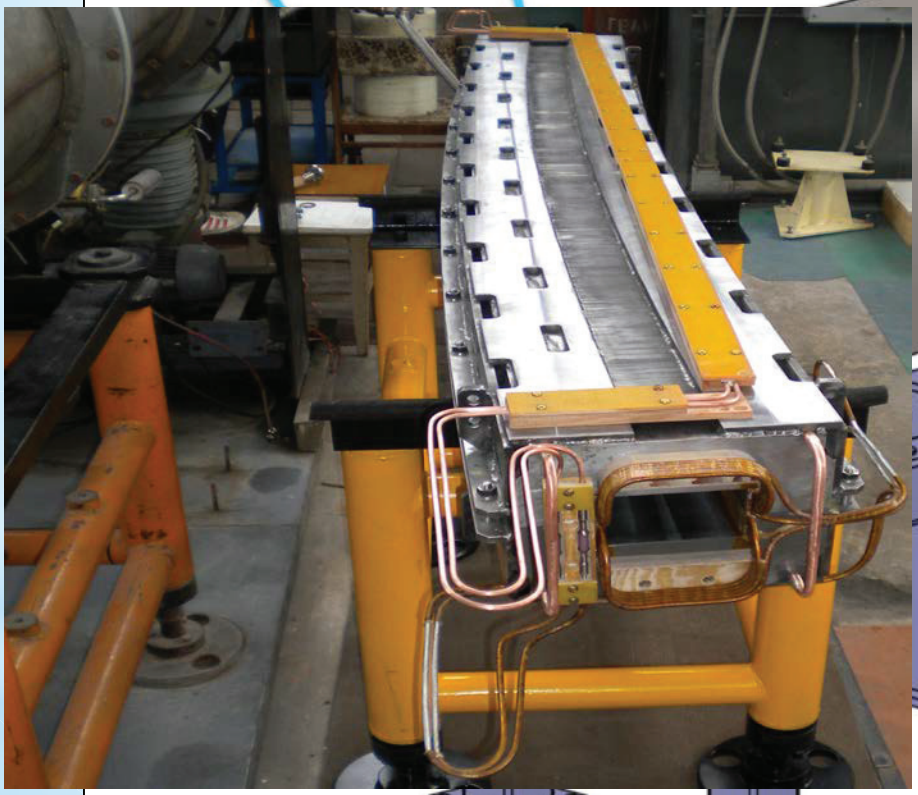
Superconducting magnets

Dipole magnets



Superconducting magnets

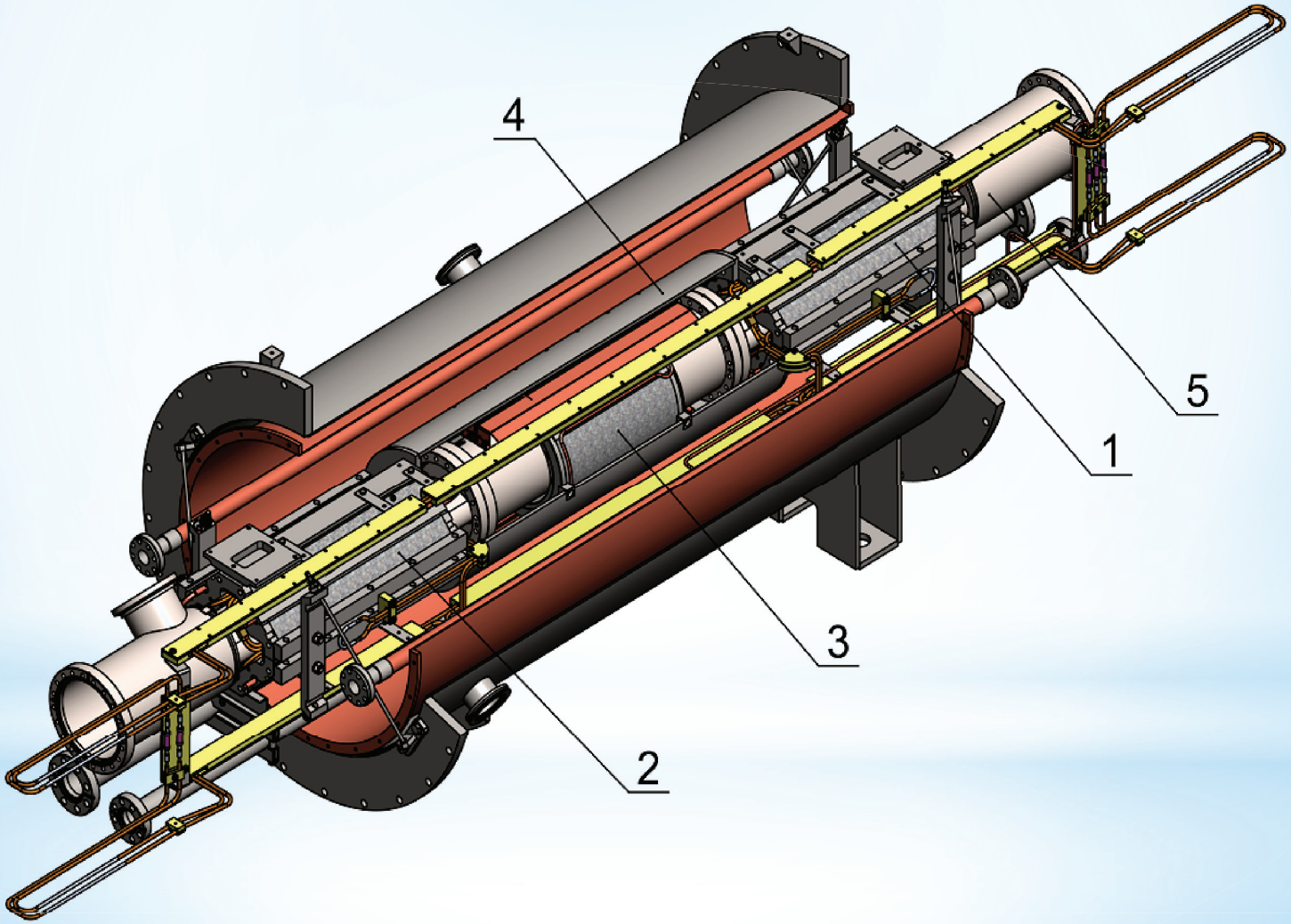
Dipole magnets



Superconducting magnets

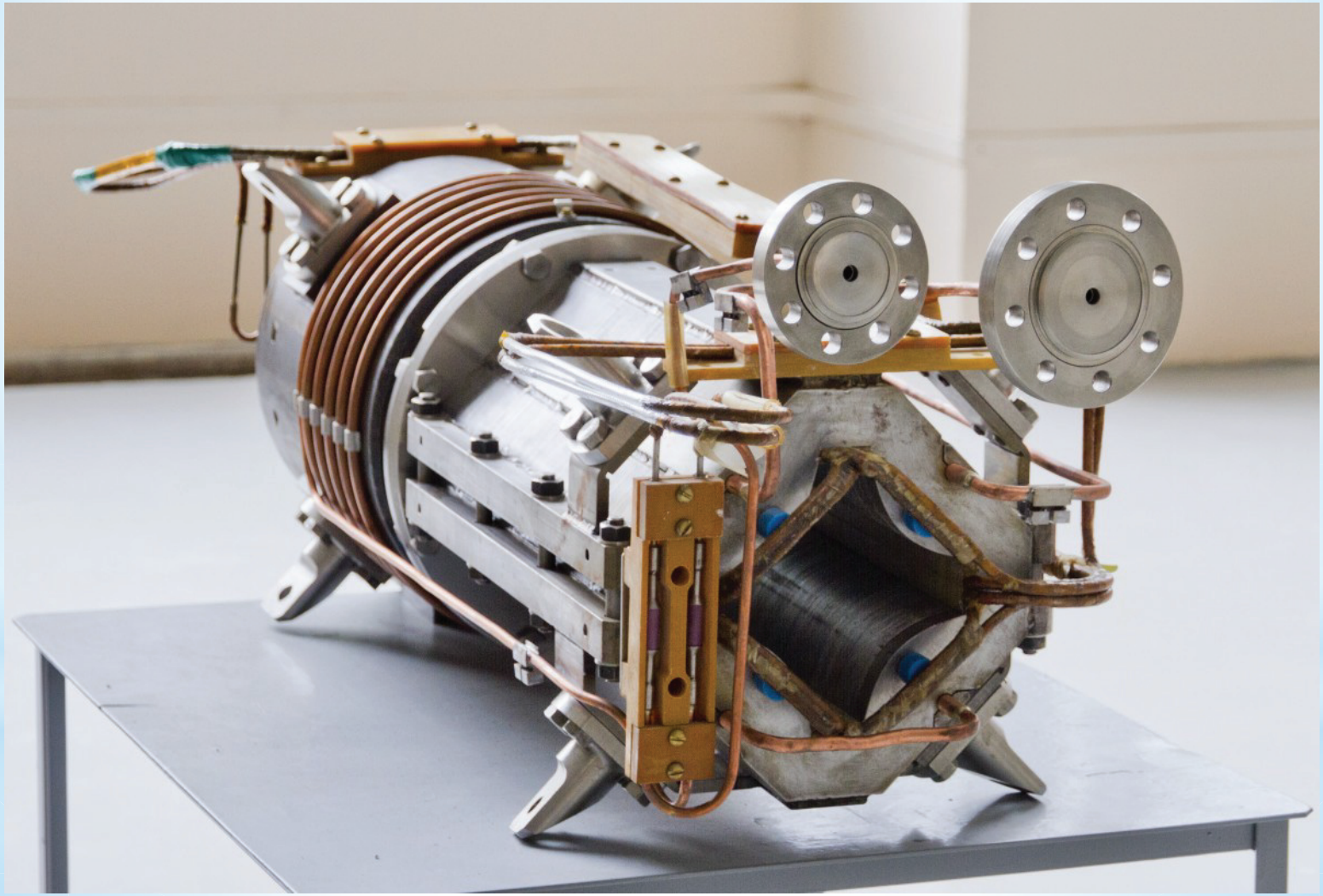
Dipole magnets

Quadrupole lenses

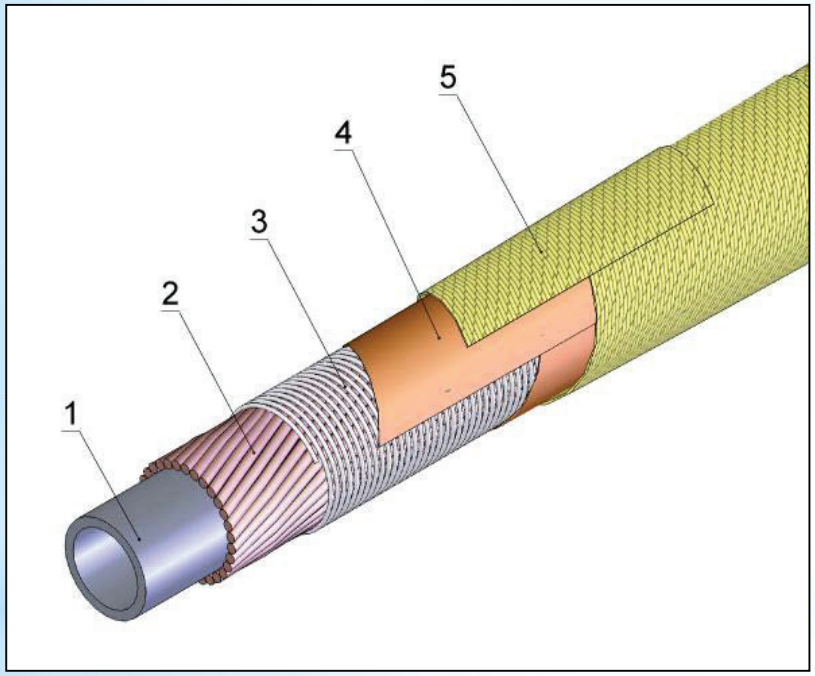


Superconducting magnets

Quadrupole lenses



Superconducting NbTi cables



Superconducting magnets

Manufacturing, testing, measurements

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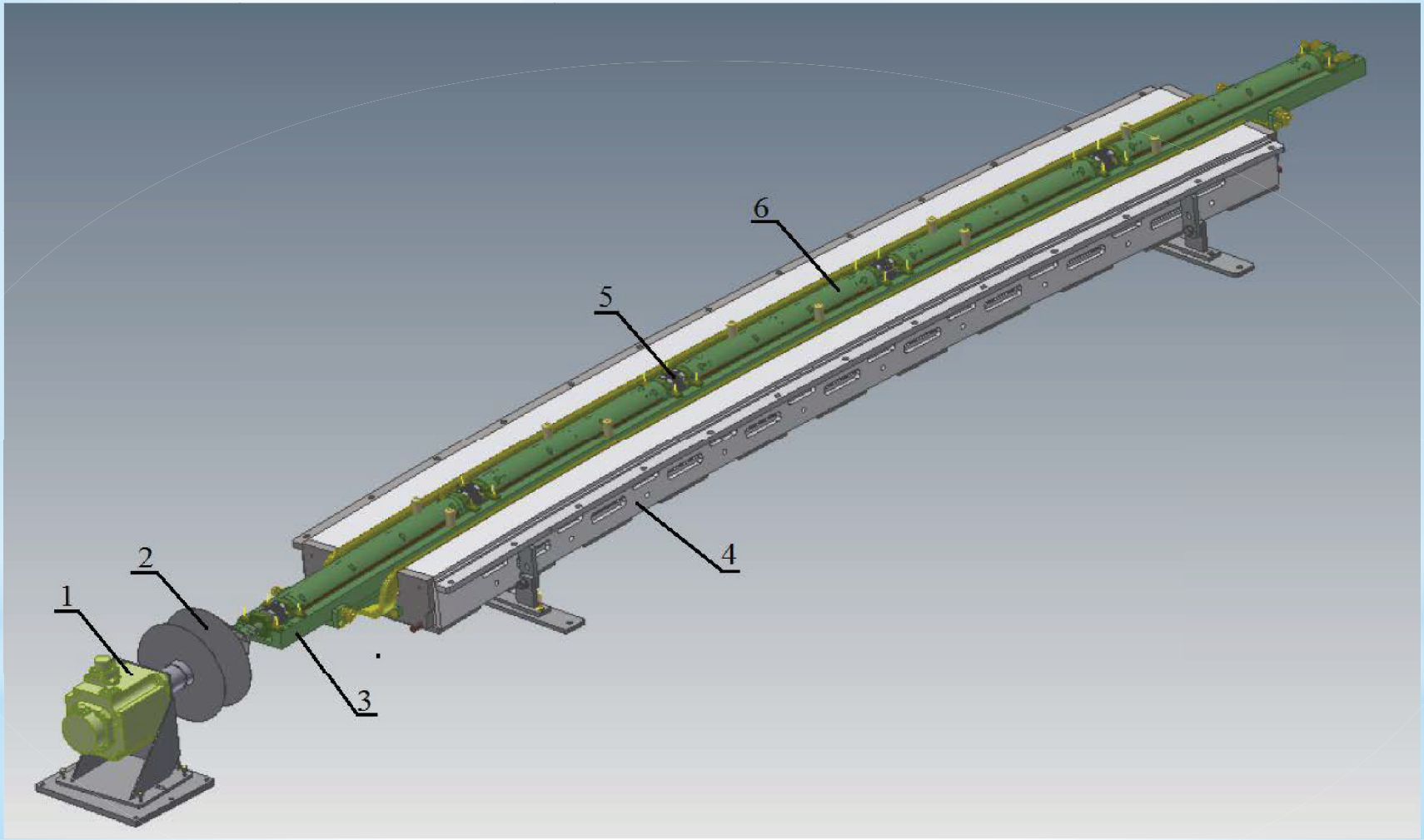
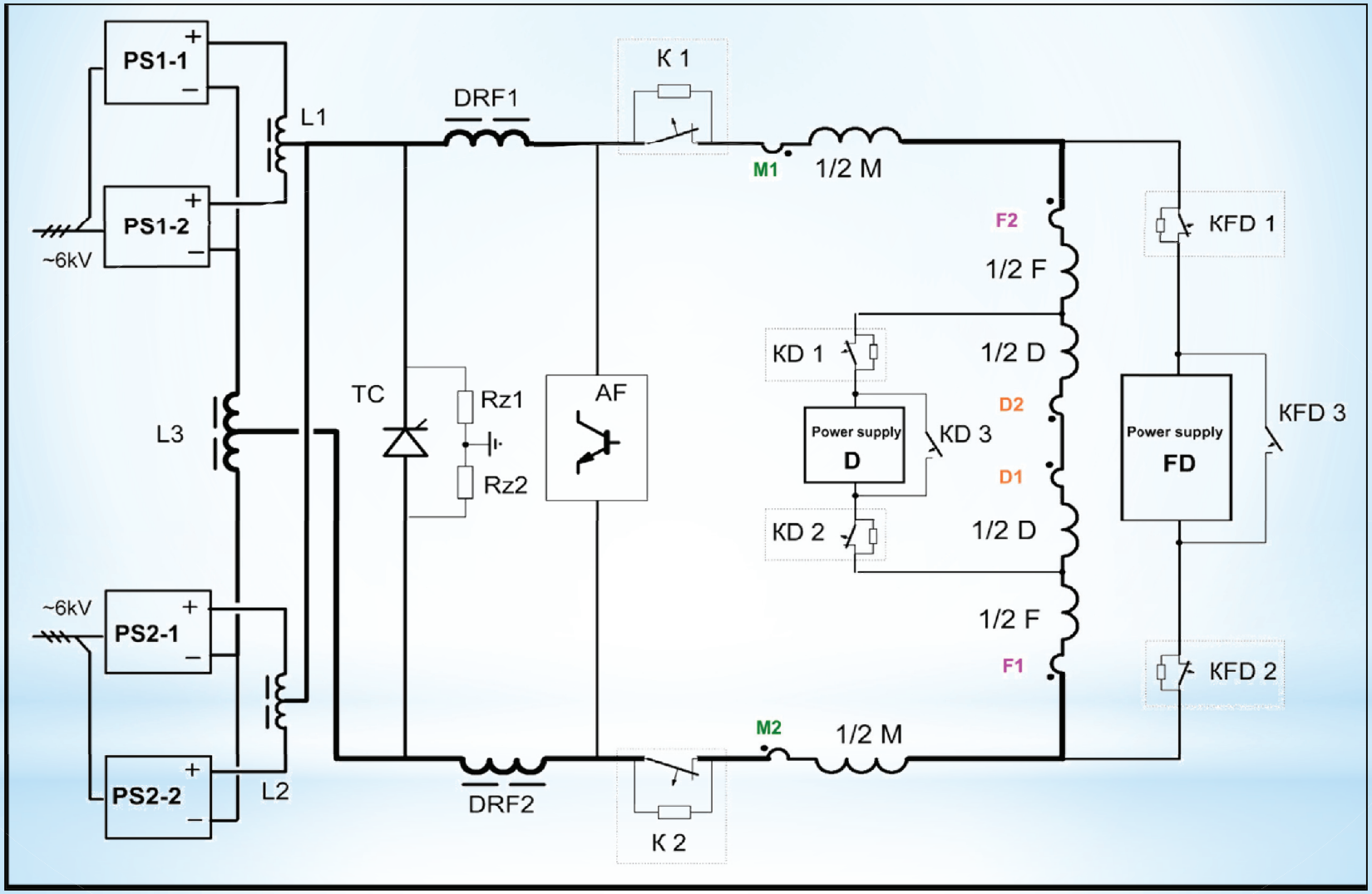
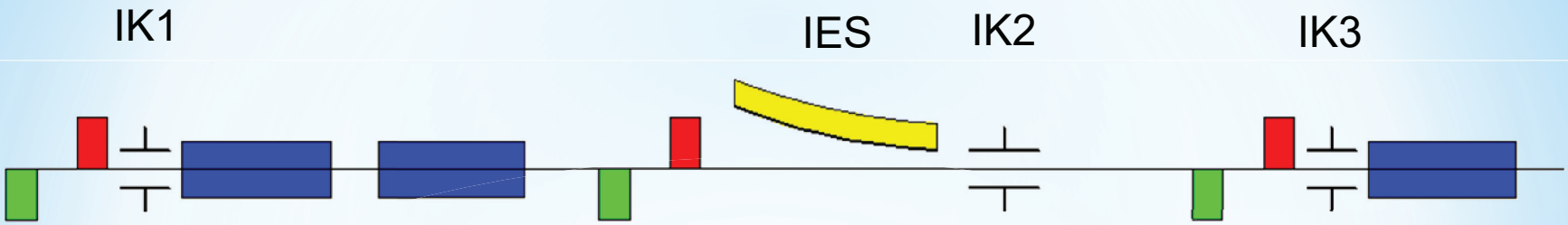


Manufacturing, testing, measurements

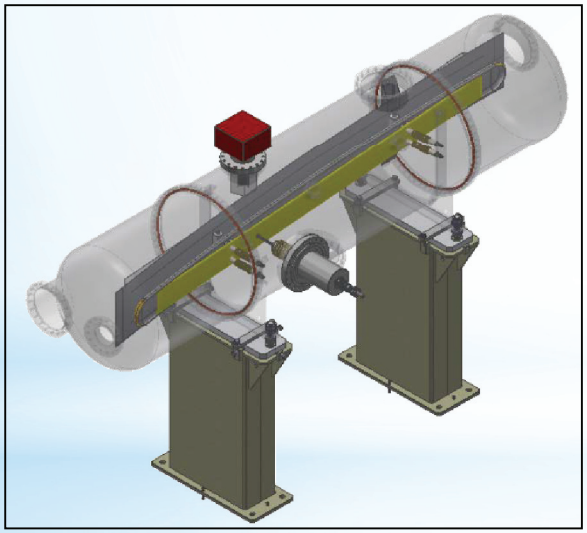
Power supplies



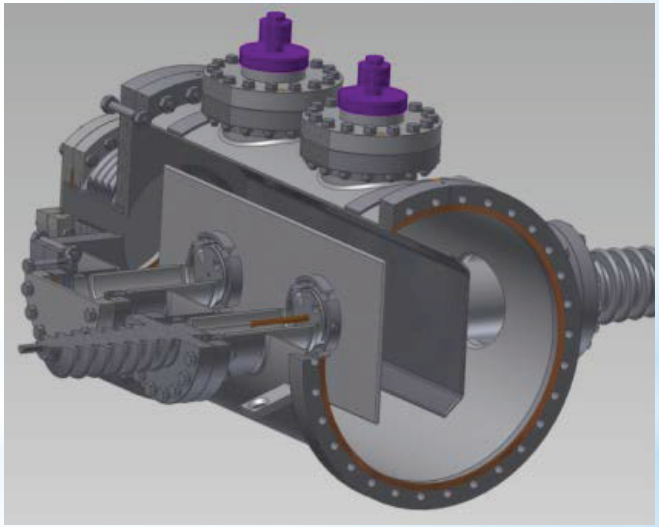
Injection system



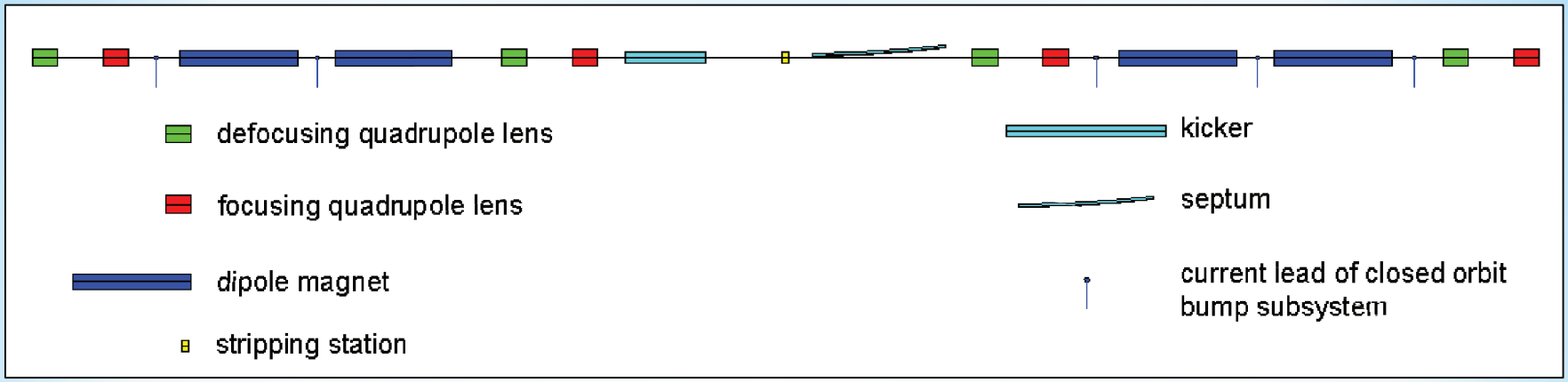
Electrostatic septum IES



Electric kicker IK1



Fast extraction system



Parameters of elements

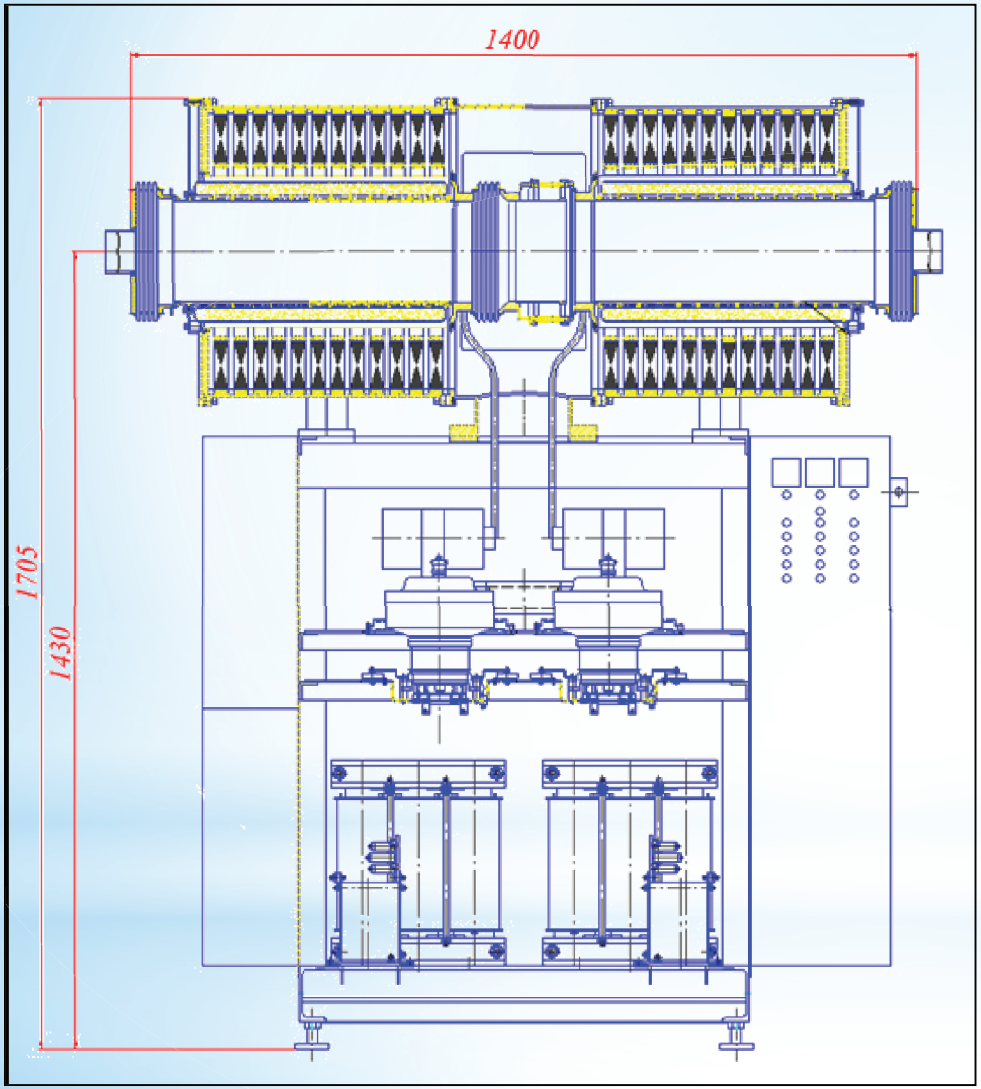
Kicker

Length, m	1.5
Max magnetic field, T	0.17
Bending angle, mrad	10
Pulse duration, μs: rise plateau	 0.5 0.5

Septum (two sections)

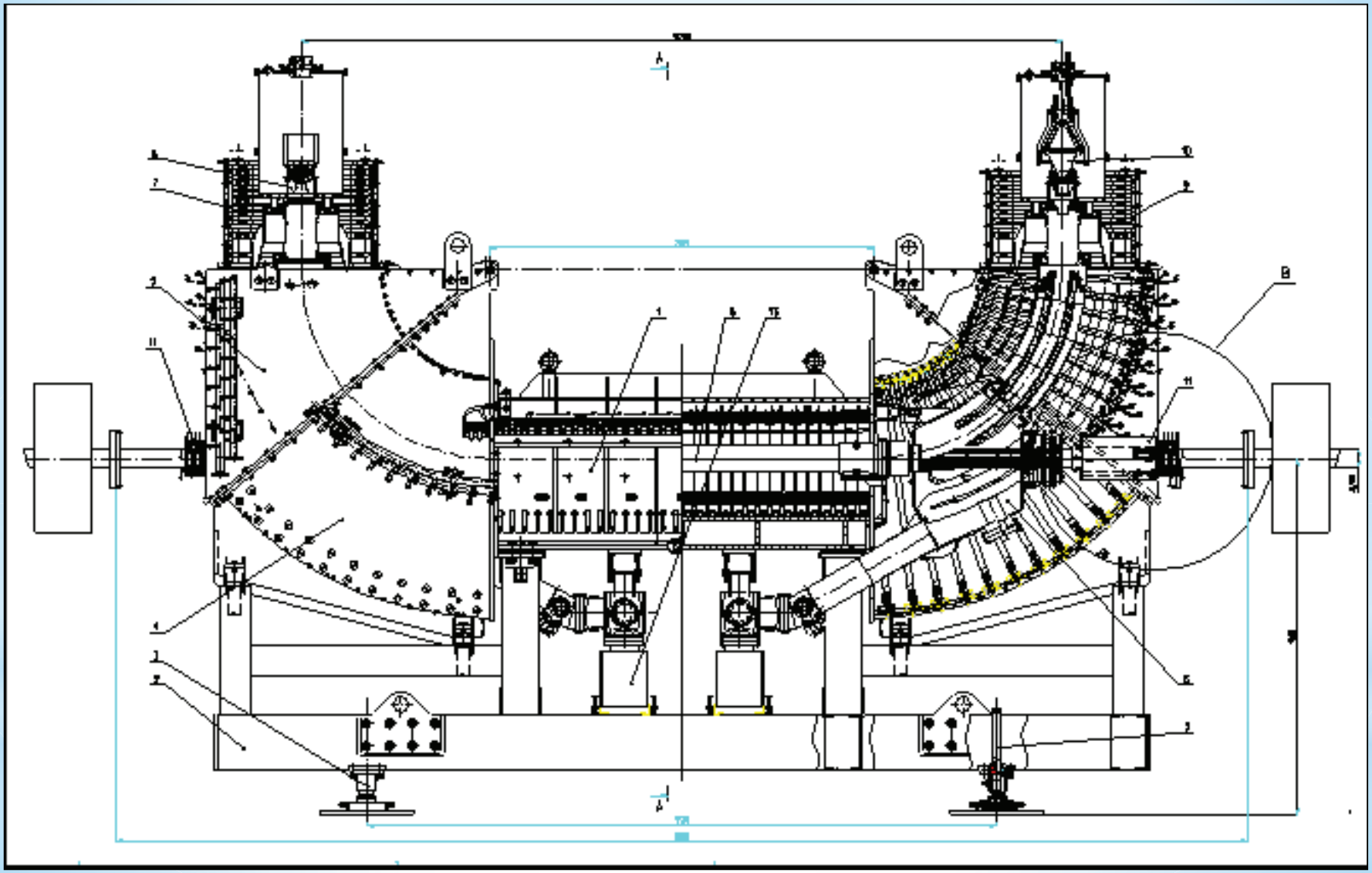
Length, m	0.4; 1.4
Max magnetic field, T	0.5; 1.3
Bending angle, mrad	20; 185
Pulse shape	semisinusoidal
Pulse duration, μs	80; 1200

RF system

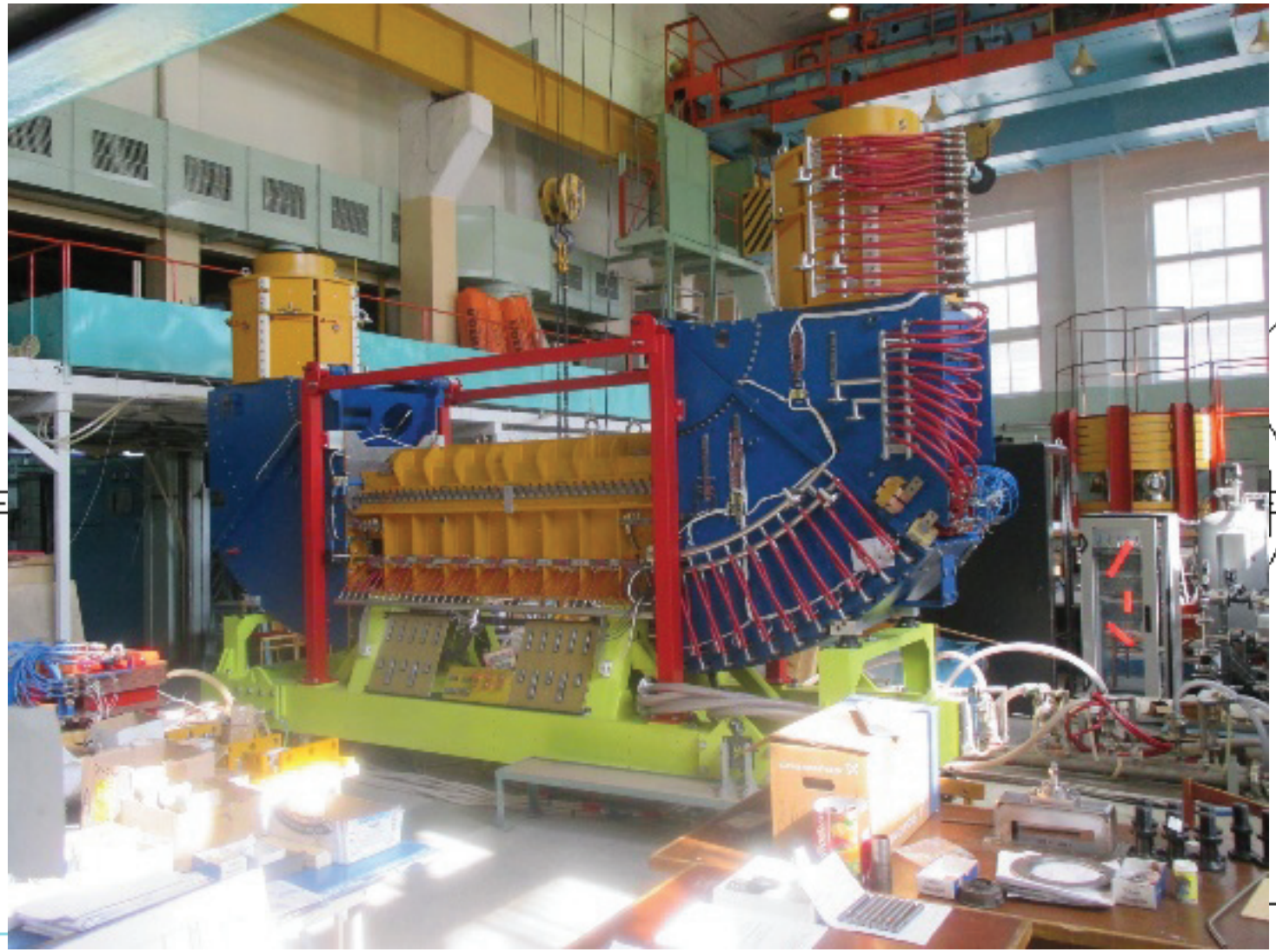


Frequency range, MHz	0.5 - 2.5
Harmonics	5 / 1
Number of cavities	2
Cavity length, m	1.4
Min/max amplitudes, kV	0.1 / 10
Max ramp, T/s	1

E-cooler



E-cooler



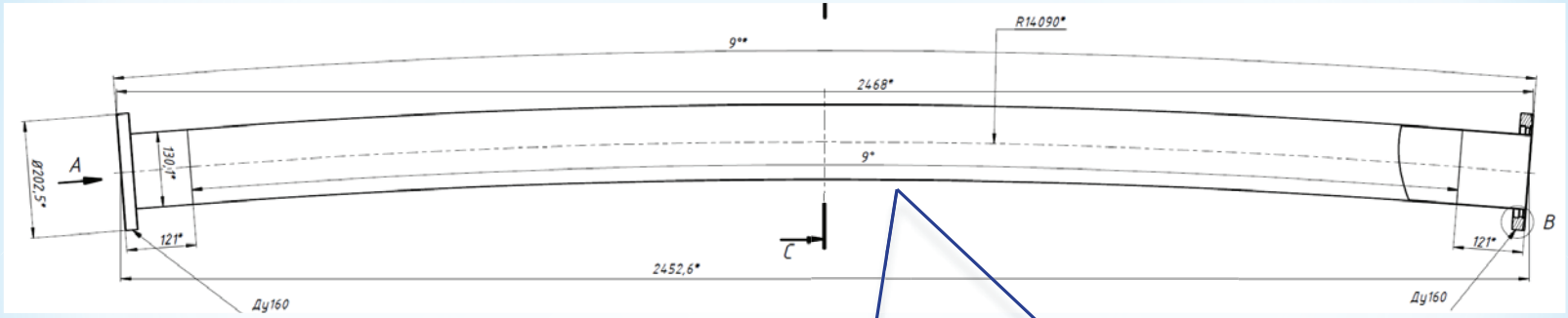
E-cooler

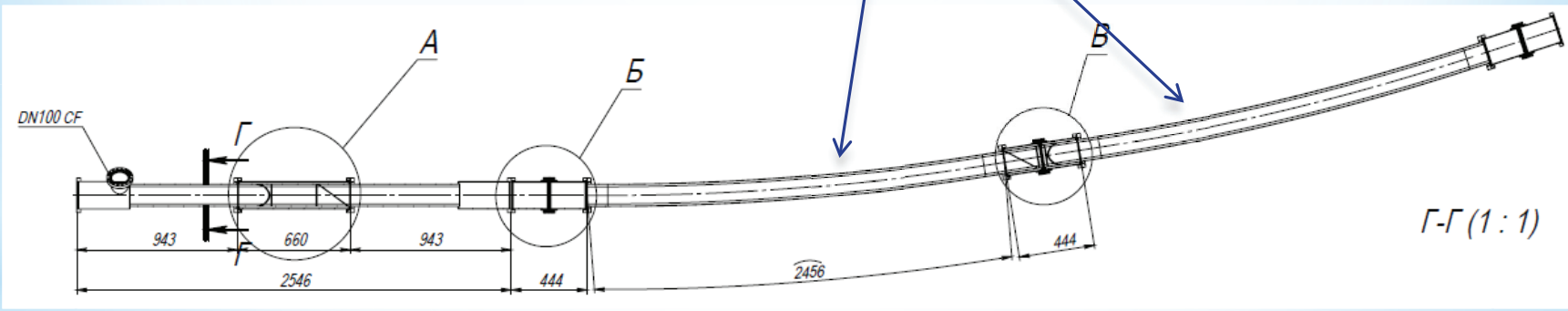
Main parameters

Ions	p^+ up to $^{197}Au^{31+}$
Electron energy	1.5 ÷ 50 keV
Electron beam current	0.2 ÷ 1.0 A
Energy stability	$\leq 1\times10^{-5}$
Electron current stability	$\leq 1\times10^{-4}$
Longitudinal magnetic field	0.1 ÷ 0.2 T
Inhomogeneity of the field	$\leq 3\times10^{-5}$
Transverse electron temperature	≤ 0.3 eV

Vacuum system

Vacuum volumes

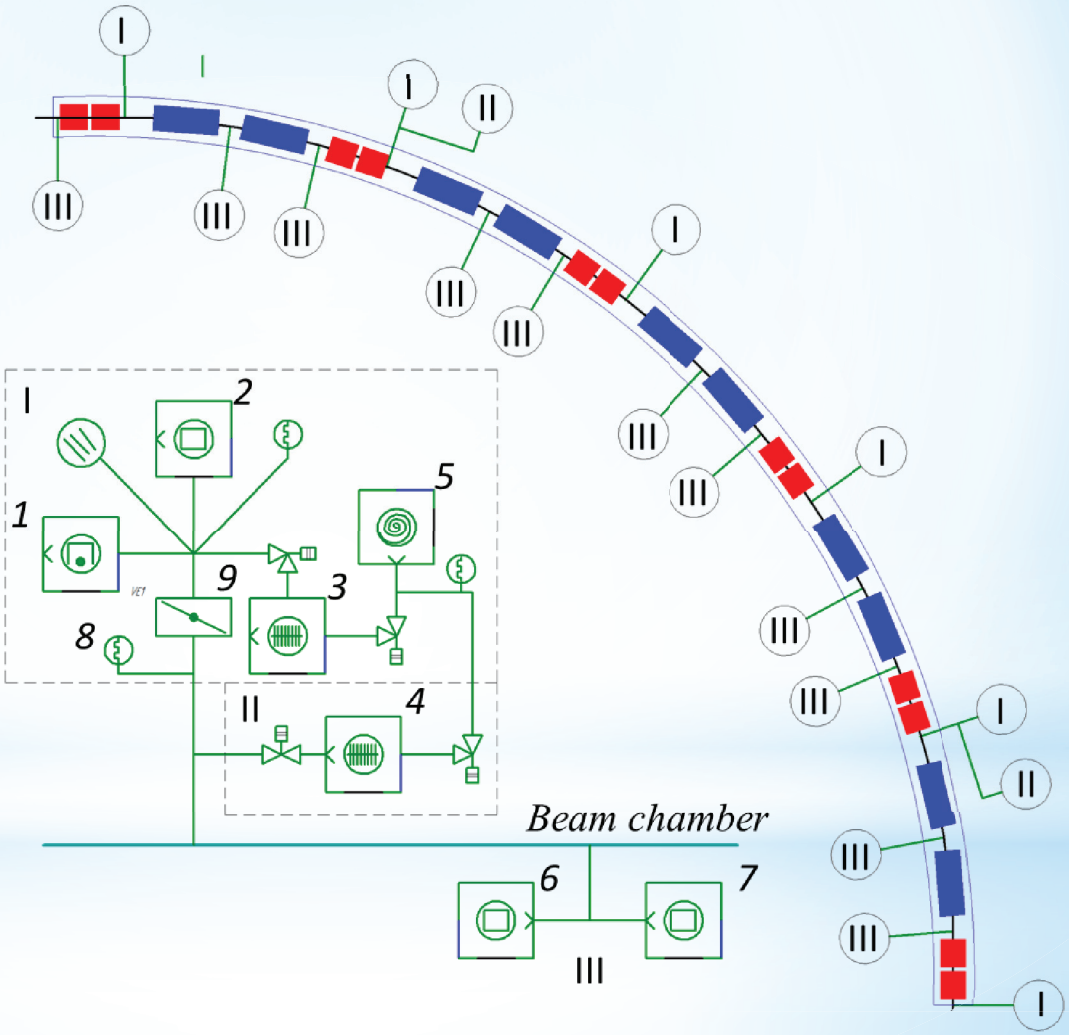




Vacuum system

Principle scheme

Pos.	Item
I	Main pump plant
II	Auxiliary pump plant
III	Titan-sublimation pumps
1	Ion pump
2	NEG pump
3	Turbomolecular pump 1
4	Turbomolecular pump 2
5	Dry scroll pump
6,7	Titan-sublimation pumps
8	UHV gauge
9	All metal gate



THANK YOU FOR ATTENTION