



FSUE "D.V. Efremov Scientific Research Institute of Electrophysical Apparatus"

Scientific and Production Complex of Linear Accelerators and Cyclotrons

NPK "LUTS" NIEFA

CC-18/9 MEDICAL COMPACT CYCLOTRON

The D.V. Efremov Scientific Research Institute of Electrophysical Apparatus has designed most of the large scale cyclic accelerators of charged particles installed in Russia and abroad. These accelerators are used both for research in fundamental properties of matter and for applied purposes: isotope production, activation analysis and for biomedical research.

The CC-18/9 cyclotron is a compact isochronous machine of novel design intended for accelerating of negative hydrogen or deuterium ions up to 18 or 9 MeV energy, respectively, with 100% efficiency of extraction by stripping to positive ions. The cyclotron is especially suitable for the production of both single-photon emitters (Ga-67, In-111, I-123, Rb-81) for SPECT and positron emitters (F-18, O-15, N-13, C-11) for PET.



Two CC-18/9 cyclotrons have been put into operation: one machine is now operated in the PET center of Turku, Finland and the other is functioning in the medical center in Pesochny, St.Petersburg, Russia. The cyclotrons differ in the beam transport systems, namely, the first machine uses four remote targets and the second machine employs three remote targets.

SPECIFICATIONS

BEAM

Type of ions		
- accelerated	H ⁻	D ⁻
- extracted	H ⁺	D ⁺
Energy (max), MeV	18	9
Beam current, mA	100	50
Number of targets		3 - 6

POWER CONSUMPTION, kW

90

OPERATING MODE

long-term

MAGNETIC STRUCTURE

Type of magnet	«shielding»
Pole diameter, cm	115
Gap(valley/hill), mm	118/27
Average induction, T	1.26
DC power in coil, kW	7
Weight, t	20

RADIO-FREQUENCY SYSTEM

Number of dees	2
Dee angle	42°
Harmonic mode	2 and 4
Frequency, MHz	38.2
Dee voltage, kV	35
RF oscillator output power, kW	25
Dissipated RF power per dee, kW	7

ION SOURCE

Type of source	CUSP
Location	external
Beam current H ⁻ /D ⁻ , mA	1/0.5
Beam energy H ⁻ /D ⁻ , keV	18.4/9.2

BEAM EXTRACTION

Beam is extracted by the charge-exchange of respective negative ions by stripping foils. There are three strippers in the cyclotron: one is intended to extract the beam to remote targets (three or four in number) placed in the beam lines and two others are used to extract the beam to the targets installed immediately on the vacuum chamber.

BEAM TRANSPORT SYSTEM

The cyclotron is equipped with a transport system to extract the beam to remote targets. This transport system consists of: an ion tube, a deflecting magnet, two correcting magnets, a doublet of quadrupole lenses and a switching magnet. When targets are located at a large distance from switching magnet, focusing lenses are additionally installed in corresponding beam lines.

DIAGNOSTICS

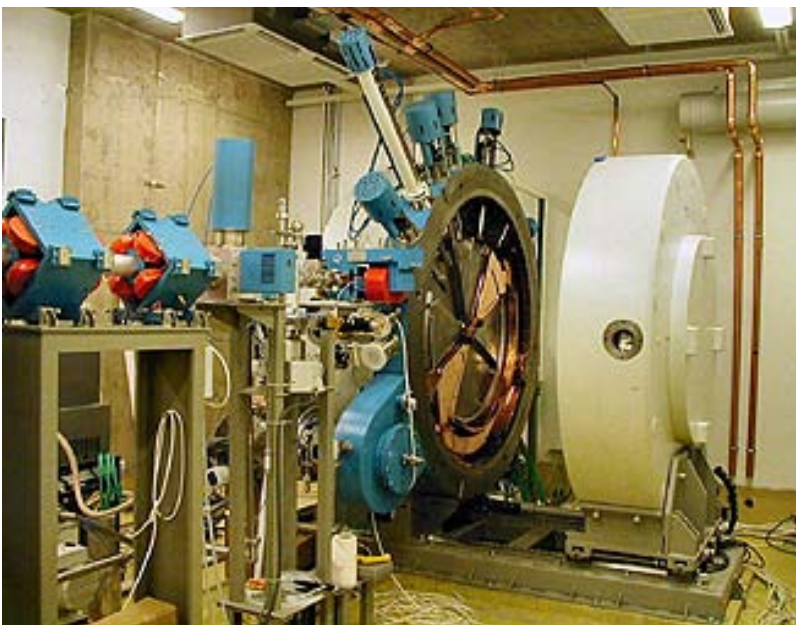
A probe is used for the beam diagnostics in the cyclotron chamber; scanners and Faraday cups are employed for beam diagnostics in the beam transport system. The semi-yoke of the electromagnet combined with the chamber cover is moved to 800 mm away from the chamber casing to provide an access to the equipment located inside the vacuum chamber.

PUMPING SYSTEM

A cryogenic pump ensures the vacuum in the accelerating chamber. Turbo pumps provide an operating vacuum in the beam transport system and ion source.

CONTROL SYSTEM

Computer is used to control the operation of the cyclotron and transport system, which can be done both from the control rack and console.

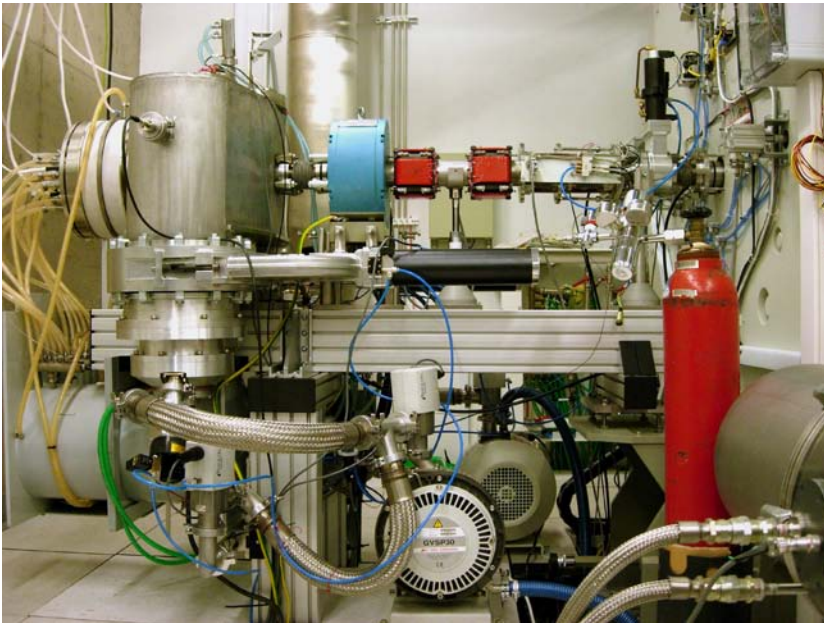


**CC-18/9 Cyclotron,
delivered to the National
Positron-emission Center,
Turku, Finland (2004)**

The movable part of the magnet is moved apart. The open vacuum chamber with the resonance system can be seen. In the left part of the photo one can see the part of the beam transport system, which is close to the magnet.

**CC-18/9 Cyclotron,
delivered to the Russian Research Center
for Radiology and Surgical Technologies,
Pesochny, St.Petersburg (2006)**





External injection system

This system consists of:

- multi-pole source of negative ions;
- vacuum chamber and two correcting magnets;
- electrostatic lens and helical inflector;
- power supply and gas supply units

Power supply and water cooling systems
are built on standard units
produced by the Bruker,
Glassman and Xantrex firms



The quality of the goods (in accordance with ISO 9001 International Standard) is in full conformity with the technical requirements for the cyclotron and is be confirmed by the Quality Certificate issued by our manufacturing plant.

Authorized Agent:
Shiva Mediums Pvt Ltd
C-99, Sector 23, Noida 201 301 INDIA
Tel: +91 120 241 4600 / 4700 Fax: +91 120 241 4500
E-mail: info@shivamediums.com Website: www.shivamediums.com