

Proton Therapy and Research at the Bronowice Cyclotron Centre IFJ PAN

Pawel Olko



National Consortium of Hadron Radiotherapy, NCRH

Application for funding

Poland joined European Union on May 1, 2004.

In 2007 -2013 **1.3 billion €** for infrastructure in science and technology from Structural Funds of EU

National Consortium of Hadron Radiotherapy

15 institutions (universities, oncology clinics, medical universities) since 2006

IFJ PAN proposal :

- Modern 230-250 MeV cyclotron
- New eye treatment room
- Experimental room for physics and radiobiology
- Gantries with active Pencil Beam Scanning (PBS)

International consultations:

- H. Nystrom (Uppsala)
- J. Farr (Essen)
- A. Mazal (Orsay)



Time schedule of the NCRH-CCB project and Gantry project



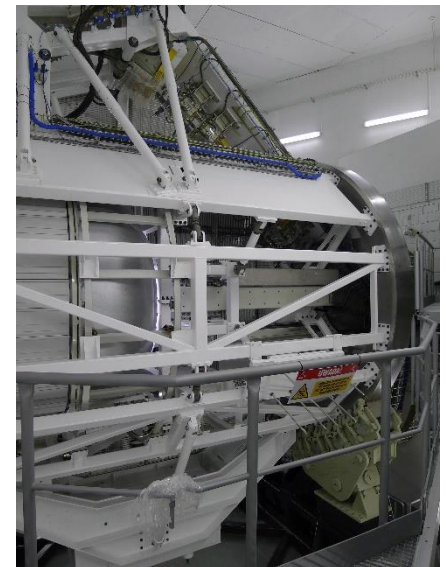
Cyclotron project: 30 M€

- signing the contract 08.2010
- start of the construction 03.2011
- installation of the cyclotron 05.2012
- starts of experiments 01.2013

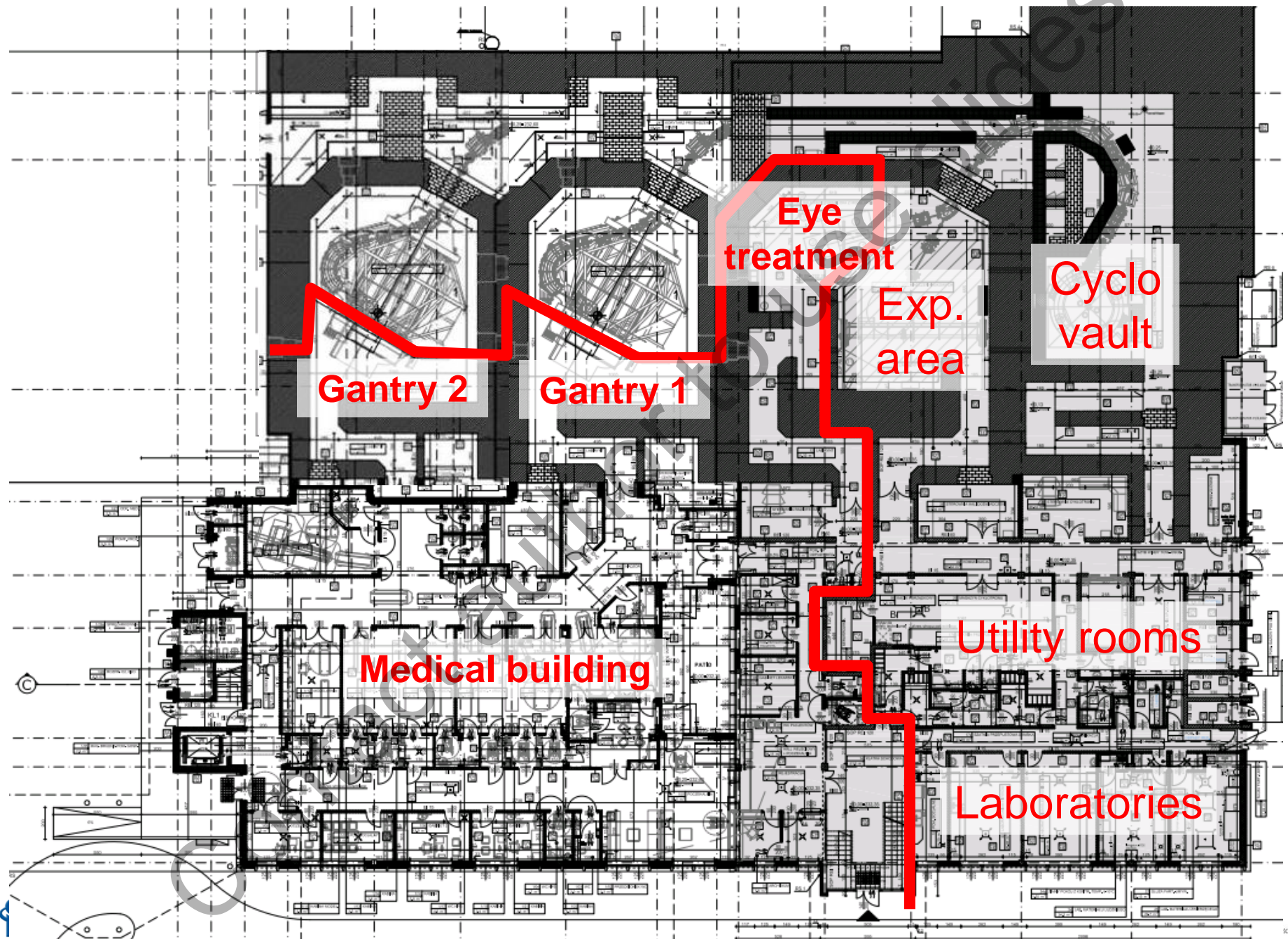


Gantry project: 30 M€

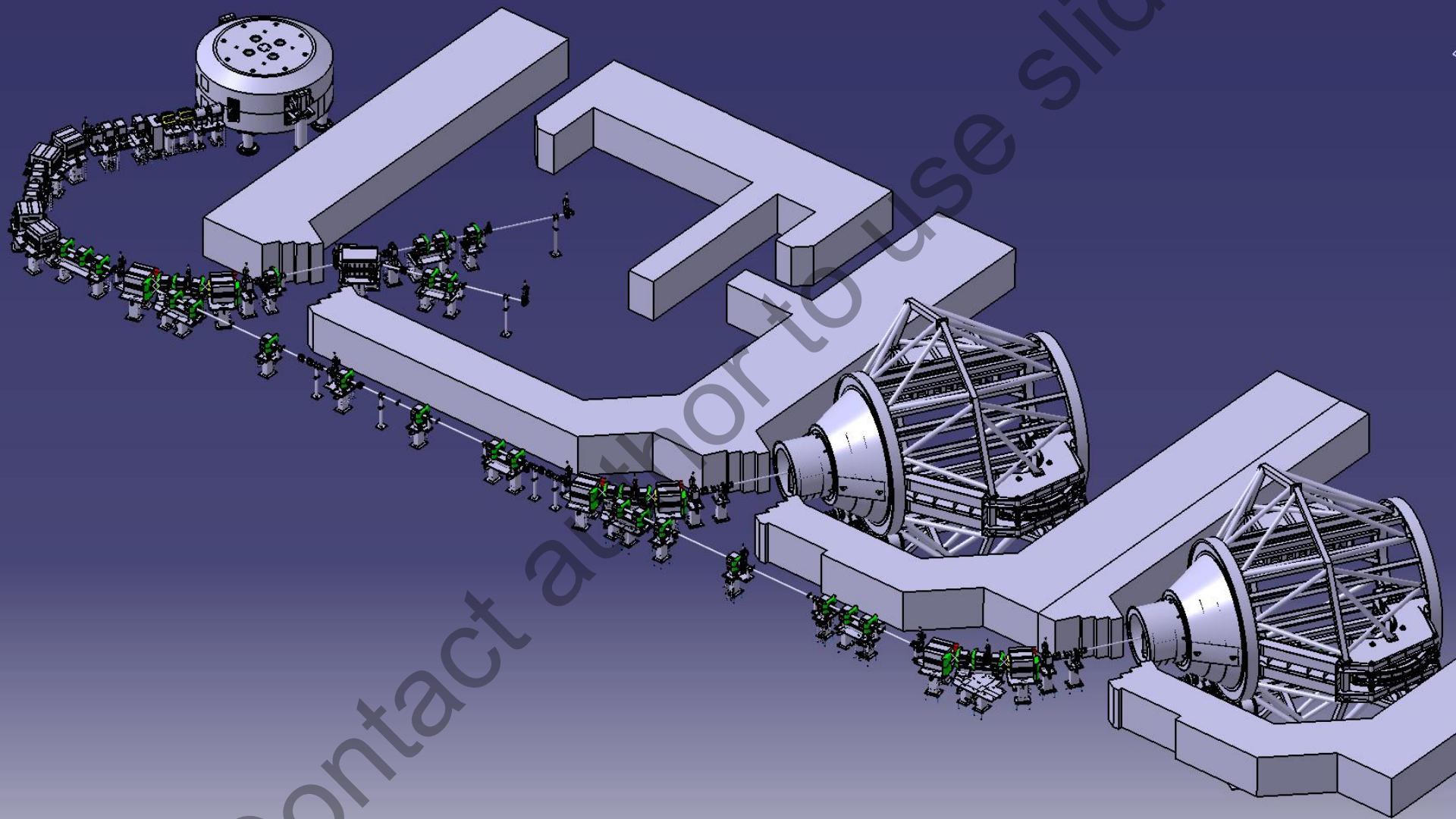
- gantry 1 operational 06.2014
- gantry 2 operational 06.2015
- end of the contract 09.2015



General layout NCRH



Beam lines at NCRH-CCB



Facility and equipment

- 230 MeV cyclotron
- 2 gantries with PBS
- TPS/OIS
- Computer Tomography
- Dosimetry and QA
- Eye treatment room
- Experimental hall

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C-235 Proteus produced by Ion Beam Applications S.A. (IBA), Louvain-la-Neuve, Belgium

energy selector : 70 MeV – 230 MeV

Current : 500 nA

time to change energy by 10 MeV: < 1 s

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Facility and equipment

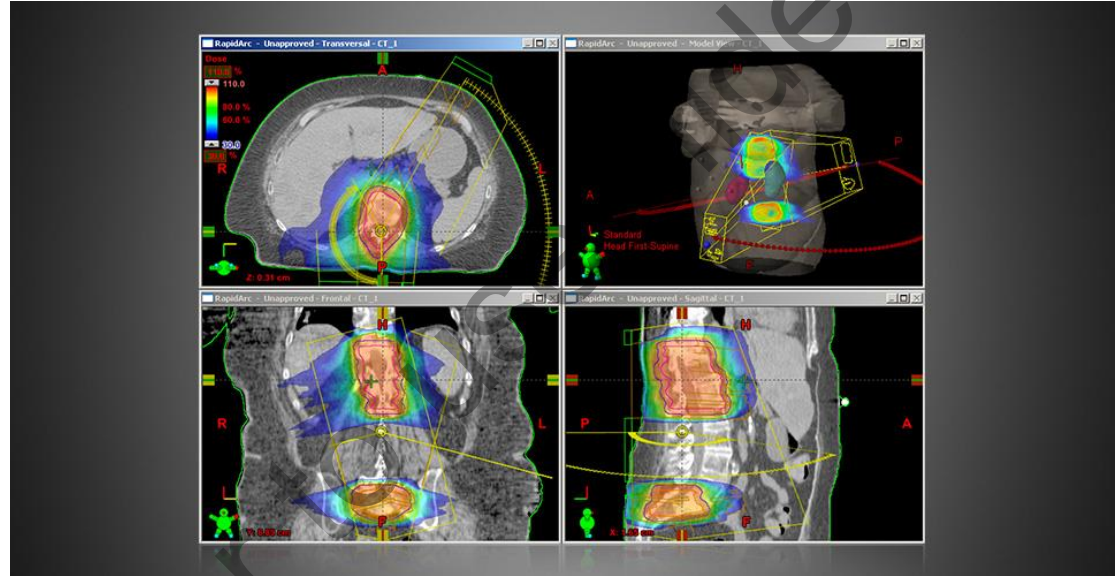
- 230 MeV cyclotron
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- dedicated IBA gantry (Pencil Beam Scanning)
- 360 degrees
- 2 spot sizes $1 \sigma = 2.7 \text{ mm}$ and 4 mm (at 230 MeV)
- irradiat. 1 liter volume to 2Gy in less than 90 s
- max. field 30 cm x 40 cm
- robotic treatment table, 6 degrees of freedom
- orthogonal kV X-rays positioning
- Vision RT optical positioning
- gating
- anesthetic arm

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- Eclipse Protons for PBS v. 13 (Varian)
- Eclipse Ocular Proton Planning EOPP v. 8.9
- ARIA Oncology Information System (Varian)
- Machine centric OIS/TPS integrated solution
- Cytrix remote access for collaborating partners

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- Siemens Somatom Definition AS Open
- Wide bore 80 cm
- 64 slices
- Qfix kVue CT overlay
- Metal Artifact Reduction
- Single Source Dual Energy
- Care Dose 4D

Facility and equipment

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- Computer Tomography
- **Dosimetry and QA**
- Eye treatment room
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Tools dedicated to proton therapy:

- Blue Phantom
- MatriXX Ion Chamber Array (2-D dosimetry)
- DigiPhant PT
- Lynx scintillation system (2-D dosimetry)
- Giraffe (Bragg peak measurement)

Facility and equipment

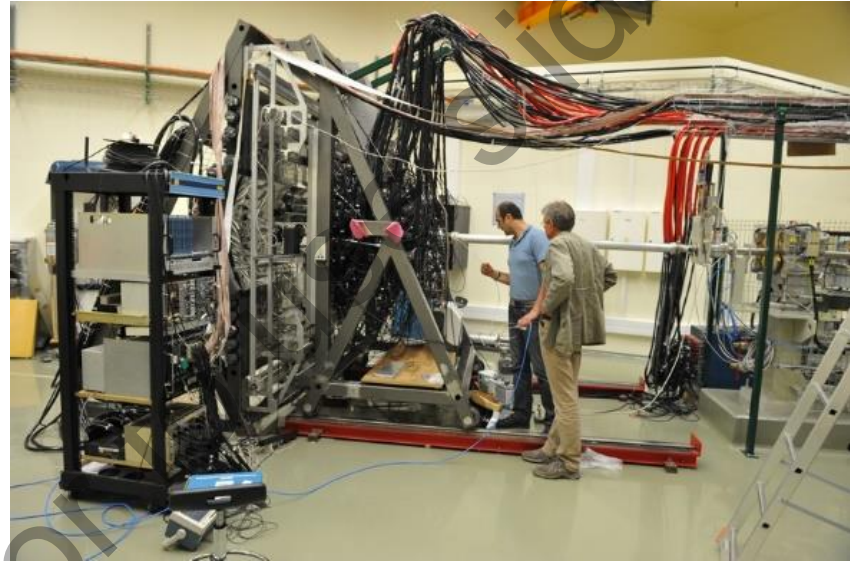
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- **Eye treatment room**
- Experimental hall



- developed by group of J. Swakon (IFJ)
- no limitation of energy (range)
- isocentric treatment chair (HEPHA BFI, France)
- CE marking in collaboration with IBA

Facility and equipment

- 230 MeV cyclotron
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- **Experimental hall**



- nuclear physics (Prof. A. Maj)
- radiobiology: RBE of protons
- tests of electronics for space flights
- detector testing

International Advisory Committee evaluates proposals for experiments

Facility and equipment

- 230 MeV cyclotron
- 2 gantries with PBS
- TPS/OIS
- Computer Tomography
- Dosimetry and QA
- Eye treatment room
- **Biology rooms**



1. **Integrated Raman-AFM system**
2. **NanoIR system**
3. **Vacuum FTIR spectrometer with microscope, FPA detector and bolometer**
4. **Independent fast imaging IR microscope**
5. **Atomic force microscope integrated with a fluorescent microscope**
6. **System for automatic analysis of chromosome aberrations**
7. **RT-PCR system for real-time testing of DNA sequence**
8. **UV-VIS Spectrometer - plate reader**

Our staff

➤ Cyclotron service and operation by our own staff

- Beam physicists
- Cyclotron engineers
- IT personel
- Medical physicists
- Dosimetrists
- QA specialists



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Slides

Our main clinical partners



Adults

Center of Oncology
Prof. B. Sas-Korczyńska
5.5 km from IFJ PAN

Eyes

University Hospital
Prof. B. Romanowska-Dixon
7 km from IFJ PAN

Children

Children University Hospital
Dr. K. Małecki
30 km by highway

Proton therapy facility

IFJ PAN – NCRH CCB

Italy- Poland – Austria - Czech – Sweden (IPACS) collaboration

In Europe many new PT centers start to treat patients using IMPT

Goal:

- harmonization of the modern proton therapy in order to rapidly increase the scientific evidence level for PT compared to modern conventional treatment techniques.



31.10.2014 The 2nd PACS meeting in Kraków

Collaboration:

- to standardize principles of treatment planning
- to develop common treatment protocols
- to perform planning exercises for different tumors

Thomas Björk-Eriksson.... Skandion Klinik
Jiri KubesPrague. PTC
Ramona Mayer.....MED Austron
Pawel Olko.....IFJ Kraków
Beata Sas-Korczyńska.....COOK Krakow

Operation of CCB-NCRH

- 230 MeV cyclotron is used for research since January 2013
- The medical part of the center will be fully operational in October 2015
- The first patient on the gantry is planned for January 2016
- After the initial learning period (1-2 years) it will be possible to treat in CCB up to 600-800 patients per year (250-350 patients per one gantry plus 100 patients in the eye treatment room)
- The procedure is still not reimbursed by the National Health Fund (NFZ).



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