NATIONAL CENTRE FOR HADRON RADIOTHERAPY — BRONOWICE CYCLOTRON CENTRE

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Keywords: proton radiotherapy, cancer

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The basic factor which determines the success of radiotherapy is delivering the highest possible dose of ionizing radiation to the tumor volume while sparing the neighboring critical organs and healthy tissues. Protons with energies from about 60 MeV to 250 MeV are useful for cancer treatment because of the phenomenon of the Bragg peak i.e. increasing of energy deposition at the end of protons path in tissue. Therefore, the unwanted doses to healthy organs, particularly the entrance dose, are minimal as compared to MV X-rays used in conventional radiotherapy. This is of particular importance to pediatric patients in whom the probability of later radiation-induced cancer should be minimized.

In February 18, 2011 a series of proton irradiation of the first two patients has been completed at the Institute of Nuclear Physics (IFJ PAN) in Kraków, Poland. Later on, additional eleven patients suffering from eye melanoma, underwent a series of irradiation with 60 MeV proton beam using home-developed AIC-144 cyclotron. Physicists collaborated with physicians from the Clinic of Ophthalmology and Ophthalmic Oncology Collegium Medicum Jagiellonian University. The AIC-144 isochronous cyclotron was designed at IFJ PAN at the end of 80's and adapted to proton radiotherapy between 2008 and 2010. The beam delivery and the treatment room were also developed by IFJ PAN engineers, technicians and software developers. The facility, first in Poland and in the neighboring Central-Eastern European countries, is able to satisfy all national needs of ocular melanoma therapy.

60 MeV protons travel in water at the depth of about 30 mm which is sufficient to treat eyes but cannot be used to cure the deeply seated tumors. On September 13, 2006 representatives of ten major Polish scientific and medical institutions established the consortium of The National Hadron Radiotherapy Centre (Polish acronym: NCRH) coordinated by the Institute of Nuclear Physics (IFJ PAN) in Kraków. Within its long-term strategy, the Consortium foresees a two-stage development: in its first stage, a 230 – 250 MeV proton accelerator with a horizontal experimental beam for research and a treatment beam with a proton gantry, will be installed at IFJ PAN in Kraków. In the second stage, a dedicated clinical centre, with proton and C-12 beams, will be established in Warsaw.

Poland, as a new member of European Union, received in years 2007 – 2013 support for reconstruction of its infrastructure. In 2009 – 2010 IFJ PAN received about 50 M (85% from EU structural funds, 15% from Polish government) to finance the project of installation in Krakow the new Proteus C-235 230 MeV proton cyclotron from the Ion Beam Application (IBA), Belgium. On August 2, 2010 the contract between IFJ PAN and IBA has been signed for turn-key delivery of the 230 MeV Proteus C-235 proton cyclotron with a horizontal experimental beam for research and for the eye line. The energy selector will allow to use the proton beam in energy range from 70 MeV to 230 MeV. The construction of the facility at the premises of IFJ PAN at Bronowice started in March 2011 and the facility will be fully operational at the end of December 2012 (see Fig. 1).

In December 2011 the additional contract was signed for turnkey installation of the dedicated proton gantry, its housing, and the medical building. The 0 – 360° proton gantry with the 3 mm and 9 mm scanning pencil beams, Patient Positioning System with robotic arm, remote positioning will be installed and put in operation in the mid of 2014.

Figure 1: The architectural concept of the NCRH facility at IFJ PAN in Kraków. The centre will be operational in December 2012

Acknowledgments: This work was supported from the project "National Centre for Hadron Radiotherapy — Bronowice Cyclotron Centre" financed from the Operational Programme Innovative Economy.