

Cancer Treatment with Heavy Ions: Knowhow from the German Cancer Research Center Ensures Precision and Safety

On November 2, 2009, the Heidelberg Ion Therapy Center (HIT) will be opened. Very soon the first patients with malignant tumors will be treated in the new high-tech facility. Scientists of the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) have contributed substantially to the launch of this worldwide unique treatment facility, which is operated by Heidelberg University Hospitals.

To launch an ambitious technology project like HIT, a collaboration of scientists from a multitude of disciplines is needed. Ever since first plans to use the particle accelerator of the GSI Center for Heavy Ion Research in Darmstadt for cancer radiation therapy arose in the early 1990s, scientists at the German Cancer Research Center (DKFZ) have been involved in the technical, physical and medical developments that followed. At DKFZ, medical physicists from the department of Professor Wolfgang Schlegel, in particular, have made essential contributions to the fact that this effective type of treatment is now available for the benefit of many patients at the Heidelberg facility.

A heavy ion therapy is planned for each patient individually on the basis of CT scans. Specially developed software transfers information from the image data in such a way that in every point of the tumor the required radiation dose is administered. The tools for therapy planning were developed by physicists and computer scientists of DKFZ jointly with colleagues at GSI for the pilot phase of heavy ion therapy in Darmstadt. The programs now used by Siemens for operating HIT are based on this collaborative software development.

When patients are to be treated in a gigantic facility like HIT, safety comes first. Risk management has been the responsibility of DKFZ researchers who are now working at HIT. They have created binding guidelines for every process step. Quality assurance of therapy is based primarily on the developments by DKFZ for the pilot project in Darmstadt and has now been transferred to the Heidelberg facility. Thus, prior to each actual radiation treatment, a 'phantom' model of the patient is irradiated. The therapy plan is only approved if these measurements show that precisely the calculated radiation dose reaches the tumor and there is no damage to healthy tissue.

High precision dose of the radiation beam, as it is achieved by the raster scan method in heavy ion therapy, is beneficial for the patient only if the tumor is exactly in the position determined by the physicians. This is achieved by stereotactic positioning systems which were developed at DKFZ and have been optimized jointly with colleagues at HIT for heavy ion radiation therapy.

DKFZ scientists also contributed substantially to the study of the biological effect of ion radiation on tumor tissue and on normal tissue. These experiments, which were initially performed at GSI, are continued at HIT in order to further improve predictions of the radiation effect in patients.

The Deutsche Forschungsgemeinschaft (DFG) and the Helmholtz Association are both providing financial support for the collaboration of DKFZ scientists and scientists at HIT, radiotherapists of Heidelberg University Hospitals and scientists at GSI.

A picture illustrating the treatment planning with heavy ions is available at:

http://www.dkfz.de/de/presse/pressemitteilungen/2009/images/Bestrahlungsplanung_Schwerionen.jpg

The German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) is the largest biomedical research institute in Germany and is a member of the Helmholtz Association of National Research Centers. More than 2,000 staff members, including 850 scientists, are investigating the mechanisms of cancer and are working to identify cancer risk factors. They provide the foundations for developing novel approaches in the prevention, diagnosis, and treatment of cancer. In addition, the staff of the Cancer Information Service (KID) offers information about the widespread disease of cancer for patients, their families, and the general public. The Center is funded by the German Federal Ministry of Education and Research (90%) and the State of Baden-Württemberg (10%).

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