

Medical Solutions

For the daily and trade press

Erlangen, 2005

Background Information: Particle Therapy

Method

Particle therapy is a highly precise as well as biologically very effective therapy in the treatment of cancer. During clinical application, protons or carbon ions are accelerated to very high speeds by a linear accelerator and applied to the tumor where they destroy tumor cells. The range can be precisely calculated and the pencil beam targets the tumor with millimeter precision, fully protecting the surrounding healthy tissue. Only exceptional cases warrant hospital stays. As GSI reports, treatments so far have resulted in not more than a slight reddening of the skin and in rare instances, some other minor side-effects were experienced. Today, it is possible to successfully treat tumors whose location or vicinity to organs at risk made therapy difficult or impossible – truly a milestone in cancer therapy. For some types of cancer, the possibility of a cure – for example, malignant tumors sited at the cartilage at the base of the skull– may increase by as much as 90 percent as confirmed by clinical studies performed by GSI and the University of Heidelberg.

Business development

As early as October 2003, Siemens Medical Solutions (Med) laid the cornerstone for the company's entry into the particle therapy market by signing agreements with its new strategic partner, the Gesellschaft für Schwerionenforschung (GSI), a German government-funded, heavy ion research center. The exchange of know-how between research and industry will provide a much larger number of patients with access to the method developed by GSI. Since then, Med has reinforced its commitment to particle therapy: a cooperation contract with Danfysik, a leading manufacturer of particle accelerators, includes the exclusive delivery of accelerator systems to Siemens and their

installation for medical applications. Danfysik will manufacture the accelerator systems jointly developed by both companies (proton and carbon sources, synchrotron accelerators as well as beam delivery systems to medical treatment rooms). Siemens will integrate these into its particle therapy systems and market them worldwide.

“Treatments with proton and carbon ions represent a therapy with a highly promising future. As a single solution provider for diagnostic and treatment solutions, we are incorporating particle therapy in our product spectrum to further expand our position in oncology,” explained Dr. Hermann Requardt, member of the board at Siemens Medical Solutions.

Facts and numbers

A standardized combination system for proton and ion therapy is being developed that will be marketed by Siemens. Depending on the configuration, the customer will spend between 100 to 120 million Euro for a system. This includes the costs for a separate building, which amount to 20-30 percent of the overall price. In developed countries, one system will cover the requirements of a populace ranging between eight to ten million inhabitants. Current assumptions are – based on the configuration used– that Siemens systems will treat more than 2500 patients per year. Reimbursement per patient will range between 17 000 to 20 000 Euro.

In November 2003, the Heidelberg University Clinic started to build a Particle Therapy Center on approx. 5000 square meters (approx. 45000 sq.ft.). The budget for the project, the costs of which are carried at equal amounts by the State and the University Clinic, is approximately 78 million Euro. Siemens Medical Solutions will begin by providing the complete medical equipment for the treatment rooms as well as supply a further development of the state-of-the-art radiation technology by GSI.

Ions – Protons–X-rays

Ions are electrically charged atoms that can be accelerated to high energies due to their charge. In clinical applications, protons and carbon ions are being used. As compared to conventional radiation with photons (radiation therapy), therapy with ions provides a number of advantages among them, for example, a more favorable dose profile: during conventional radiation the dose, after a steep initial rise, decreases steadily as

penetration increases. The reverse is true with carbon ions and/or protons. The dose increases steeply in the target volume and is greatly reduced in the tissue in front of the tumor. After a maximum dose in the tumor, the so-called Bragg's peak, the location of which can be accurately defined, the tissue situated after the peak receives almost none. Protons and carbon ions are ideally suited for this therapy and provide for an optimal dose distribution. In addition, carbon ions are characterized by a higher biological effectiveness than provided by conventional radiation therapy. The disadvantage is the limited field of application due to lack of clinical experience: up to now mainly patients with inoperable tumors at the base of the skull or brain tumors (ion therapy), soft tissue sarcomas, and prostate cancer (proton therapy) as well as lung cancer have been treated.

The Siemens solution

For more than 100 years, Siemens has been successfully involved in the field of radio-oncology and advanced it through numerous technical innovations. In the area of conventional radiation therapy including IMRT, Siemens counts more than 2000 installations today. For Siemens, particle therapy is a natural and logical expansion of the company's solution spectrum. It will strengthen Siemens' position in radio-oncology in general as well as an innovation leader in particular.

Particle therapy by Siemens Medical Solutions is a combined solution, adding the advantages of carbon ions to the proven technique of tumor treatments with protons. By widening the beam slightly and considering their 3-5 times higher biological effectiveness, carbon ions are proving to exert excellent effect to the tissue of certain tumors. The clinical studies conducted by Chiba/Japan also indicate that the treatment dose with carbon ions could be delivered in a smaller number of fractions, i.e. repeat sessions. The solution by Siemens Medical Solution enables the company's entry into particle therapy with protons. The possibility of applying additional types of ions leaves particle therapy open for further indications. This ensures its long-term investment in the future (of medicine) .

The background information is supplemented by a number of images located in the Internet under: <http://www.siemens.com/med-bild/partikel>

Animation is shown under: <http://www.siemens.com/Partikeltherapie>

The **Gesellschaft für Schwerionenforschung (GSI)** in Darmstadt is a research center for basic research funded by the Federal Government of Germany and the State of Hesse. GSI's approximately 850 employees are involved in constructing and operating accelerators as well as in research with heavy ions. Every year, more than 1,000 scientists are visiting GSI. The research center provides them with access to their research installations depending on the visitors area of interest. GSI is equipped with an outstanding, one-of-kind accelerator for beams of ions. The research program of GSI includes a broad spectrum ranging from nuclear physics to plasma physics and matter to tumor therapy. The most well-known results are the discovery of six new chemical elements with atomic numbers 107-112 and the development of a new tumor therapy with beams of ions. These and numerous other scientific results provide GSI with a leading international position in the research of beams of ions. By 2012, GSI plans to have a new international accelerator facility for research with ions and antiprotons. Basic, previously unsolved questions beginning with matter and the development of the universe will be addressed. For additional information, go to: www.gsi.de

Danfysik A/S is one of the leading suppliers of systems and components for particle accelerators. The company's accelerator technology is based upon more than 40 years of experience in this field and upon the continuous development activities carried out by a large team of technicians, engineers, and physicists. The competences cover development, design, production, systems integration, and installation of accelerator systems. Danfysik is known for its high quality accelerator products such as magnets, power supplies, ion sources, and beam instrumentation which are in operation in the research and industrial market all over the world. Larger system deliveries include turnkey synchrotron accelerators with energies up to 3 GeV. The company headquarters and main production site is based near Copenhagen, Denmark. Further information can be found under: <http://www.danfysik.com>

Siemens Medical Solutions is one of the world's largest suppliers to the healthcare industry. The company is known for bringing together innovative medical technologies, healthcare information systems, management consulting, and support services, to help customers achieve tangible, sustainable, clinical and financial outcomes. From imaging systems for diagnosis, to therapy equipment for treatment, to molecular medicine to hearing instruments and beyond, Siemens innovations contribute to the health and well-being of people across the globe, while improving operational efficiencies and optimizing workflow in hospitals, clinics, home health agencies, and doctors' offices. Recent acquisitions in the area of in-vitro diagnostics – such as Diagnostic Products Corporation – mark a significant milestone for Siemens as it becomes the first full service diagnostics company. Employing approximately 36,000 people worldwide and operating in more than 130 countries, Siemens Medical Solutions reported sales of 8.23 billion EUR, orders of 9.33 billion EUR and group profit of 1,06 billion EUR for fiscal 2006 (preliminary figures). Further information can be found under: <http://www.siemens.com/medical>