AKBP 5: Modern Proton Accelerators - Challenges and Perspektives

Zeit: Dienstag 11:00–13:00 Raum: HS 7

Hauptvortrag AKBP 5.1 Di 11:00 HS 7

New Developments in Cyclotrons and Gantries for Proton Therapy — •Marco Schippers — Paul Scherrer Institut, Villigen, Switzerland

After an introduction to proton therapy and the basic characteristics of cyclotrons for this application, the special role of the cyclotron in proton therapy will be discussed. It will be shown how modern technology like e.g. superconductivity is applied to make the cyclotron more compact and cheaper after its initial simplification from an accelerator for physics research into a medical device. However, it will also be shown how several of these developments could be a limitation in currently available successful treatment techniques.

To irradiate the tumor from different directions a gantry is used. This is a beam transport system mounted on a mechanical structure that can rotate around the patient. Due to the masses and sizes of the magnets for the beam transport, such a gantry has a typical diameter of 10-12 m and a mass of 100-200 tons. To reduce the associated costs of such gantries several groups are working on various new designs. The development of smaller and/or less heavy gantries requires the application of special techniques in the transport of charged particle beams.

In addition to a possible cost reduction, new technologies also enable possibilities to apply new irradiation techniques to achieve an often beneficially much faster irradiation treatment of a patient. Recent developments in this field will be discussed.

Hauptvortrag AKBP 5.2 Di 11:30 HS 7

Non-destructive Beam Diagnostics for high Current Proton LINACs — •Peter Forck — GSI

To achieve an efficient acceleration, high current hadron LINACs are operated close to their technical limits and in many cases a non-standard beam dynamics is chosen. Beam parameters have to be well controlled calling for a precise beam measurement. Non-invasive beam instrumentation is preferred to enable the simultaneous observation along the entire LINAC and to prevent for the destruction of any intersecting material.

For pulsed LINACs the beam current and transmission measurements with current transformers is standard, but an extended principle suited for cw-LINACs had recently been established. Non-invasive profile measurements are based on the detection of residual gas ionization products by an Ionization Profile Monitor or the detection of beam induced fluorescence photons. Such systems were recently developed. For H^--beams photo-detachment by a scanning laser beam can be applied for profile and emittance determination. The capability of methods for bunch shape determination will be addressed. Examples from different accelerators illustrate the applicability. Perspectives for the instrumentation will be discussed in this overview talk.

Hauptvortrag AKBP 5.3 Di 12:00 HS 7

The High Brillance Neutron Source (HBS) - Challenges of a Modern Proton Accelerator — •Holger Podlech[1], Martin Droba[1], Klaus Kümpel[1], Sarah Lamprecht[1], Oliver Meusel[1], Nils Petry[1], Philipp Schneider[1], Malte Schwarz[1], Chao Li[2], Chuan Zhang[3], Johannes Baggemann[2], Thomas Brückel[2], Tobias Cronert[2], Paul Doege[2], Thomas Gutberlet[2], Eric Mauerhofer[2], Ulrich Rücker[2], Paul Zakalek[2], and Sarah Böhm[4] — [1]Goethe Universität Frankfurt (IAP) — [2]Forschungszentrum Jülich GmbH — [3]GSI Helmholtzzentrum — [4]RWTH Aachen

Due to the decommissioning of several research reactors there will be a severe drop in available neutrons for research in Europe in the next decade despite the commissioning of the European Spallation Source (ESS). The High Brilliance Neutron Source (HBS) currently under development at Forschungszentrum Jülich is scalable in terms of beam energy and power due to its modular design. The driver Linac for HBS at will accelerate a 100 mA proton beam to 70 MeV. The Linac is operated with a beam duty cycle of up to 6% (11% RF duty cycle) and can simultaneously deliver three proton pulse lengths (384 Hz at 52 μ s, 96 Hz at 208 μ s and 24 Hz at 832 μ s) for three neutron production targets. The front end of the HBS Linac consists of an ECR source, LEBT and a 2.5 MeV RFQ followed by a CH-DTL with 35 room temperature CH-cavities. The presentation describes the conceptual design and the challenges of such a modern high power proton accelerator with high reliability and availability.

Hauptvortrag AKBP 5.4 Di 12:30 HS 7

The High Brilliance Neutron Source (HBS) Project — Thomas Gutberlet[1], Ulrich Rücker[1], Paul Zakalek[1], Eric Mauerhofer[1], Tobias Cronert[1], Johannes Baggemann[1], Paul Doege[1], Marius Rimmler[1], Sarah Böhm[2], Jinjing Li[1], Olaf Felden[1], Ralf Gebel[1], Holger Podlech[3], Oliver Meusel[3], and •Thomas Brückel[1] — [1]Forschungszentrum Jülich GmbH — [2]RWTH Aachen University — [3]Goethe University Frankfurt

Neutron scattering has proven to be one of the most powerful methods for studying structure and dynamics of condensed matter on atomic length and time scales. It is essential to understand processes, phenomena and functionalities in a wide range of materials. Accelerator driven neutron sources with high brilliance neutron provision are an attractive option as older research reactors are fading out. The Juelich Centre for Neutron Science is developing a compact accelerator driven high-brilliance neutron source to offer access for science and industry to neutrons in form of a medium-flux, but high-brilliance neutron facility. The High-Brilliance Neutron Source (HBS) will consist of a high current proton accelerator, compact neutron production and moderator system and optimized neutron extraction and transport for thermal and cold neutrons. The project will allow construction of a scalable neutron source ranging from a university-based neutron laboratory to a full-fledged user facility with open access and service. We will describe the currents status of the project, the requirements for the accelerator, the next steps, milestones and the vision for the future use of neutrons at universities and research institutes.