BE 1: Hadron Accelerators and Colliders

Time: Monday 15:00–18:00 Location: MOL 213

Group Report BE 1.1 Mon 15:00 MOL 213

Laser Cooling of Relativistic Ion Beams with Large Momentum Spreads — •Michael Bussmann[1], Danyal Winters[2], Weiqiang Wen[3], Christina Dimopoulou[2], Tino Giacomini[2], Christophor Kozhuharov[2], Thomas Kühl[2,4,5], Yuri Litvinov[2], Matthias Lochmann[2,4], Wilfried Nörtershäuser[2,6], Fritz Nolden[2], Rodolfo Sánchez[2,6], Shahab Sanjari[2], Markus Steck[2], Thomas Stöhlker[2,5,7], Johannes Ullmann[2,6], Tobias Beck[6], Gerhard Birkl[6], Benjamin Rein[6], Sascha Tichelmann[6], Thomas Walther[6], Xinwen Ma[3], Dacheng Zhang[3], Markus Löser[1], Michael Seltmann[1], Mathias Siebold[1], and Ulrich Schramm[1,8] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]GSI Darmstadt — [3]Institute of Modern Physics, Chinese Academy of Science, Lanzhou — [4]Uni Mainz — [5]HI Jena — [6]TU Darmstadt — [7]Uni Jena — [8]TU Dresden

We present new results from a recent experiment on laser cooling of relativistic bunched ion beams at the Experimental Storage Ring at GSI. Our results show laser cooling with a single solid-state cw laser system with a laser frequency scanning range larger than the bucket acceptance. This technique is of great importance for future storage ring facilities such as FAIR and HIRFL, as it allows for all-optical beam cooling of initially hot ion beams without the need for pre-electron cooling.

BE 1.2 Mon 15:30 MOL 213

Polarisation Lifetime Studies for EDM Measurements at COSY — •Marcel Rosenthal — Institut für Kernphysik, Forschungszentrum Jülich

The annihilation of matter and antimatter during the evolution of the universe requires further sources of CP violation to explain the matter-antimatter asymmetry in our galaxy. According to the CPT theorem, permanent Electric Dipole Moments (EDMs) are CP violating.

Up to now no direct EDM measurements for charged hadrons have been performed yet. The JEDI collaboration investigates the feasibility of such measurements in dedicated storage rings. The conventional storage ring in Jülich, the Cooler Synchrotron COSY, is used to first explore methods and crucial parameters of these measurements and do a first direct measurement of the proton and deuteron EDM afterwards.

Tracking simulations are a crucial part of feasibility studies of the planned experiments. The software COSY INFINITY is utilized to analyze the motion-correlated spin dynamics and create one turn transfer maps. This allows for less computational power consuming tracking in comparison to integration codes. For long-term tracking this is absolutely mandatory.

One crucial parameter for EDM measurements is the polarisation lifetime. During the last beam times a huge dataset of polarisation lifetimes utilizing different accelerator settings were recorded. These polarisation measurements at COSY are used to benchmark accelerator models and validate further predictions for EDM measurement methods.

BE 1.3 Mon 15:45 MOL 213

A RF-E-B-Dipole for Spin Manipulation at COSY — •Sebastian Mey[1], Ronald Brings[1], Ralf Gebel[1], Andreas Lehrach[2], Rudolf Maier[1], Frank Rathmann[1], and Jörg Pretz[2] — [1]Institut für Kernphysik, Forschungszentrum Jülich GmbH, Deutschland — [2]III. Physikalisches Institut B, RWTH Aachen, Deutschland

The JEDI Collaboration investigates the feasibility of EDM (Electric Dipole Moment) experiments with charged hadrons in storage rings. These incorporate measurements with horizontally polarized particles. To maximize the lifetime of the horizontal polarization, systematic studies of unwanted spin rotations utilizing a vertical RF-B field are required. To avoid simultaneously kicking the beam in the horizontal plane, the resulting Lorentz force needs to be compensated by the force of an orthogonal electric field, leading to a Wien-Filter configuration. For preliminary studies, the Cooler Synchrotron COSY is currently being supplemented with a new RF-E-B-Dipole.

The talk will incorporate the setup of the new system from the RF-Supply to the electrode and coil configuration providing the electromagnetic fields, as well as the commissioning and first measurements taken at COSY.

Group Report BE 1.4 Mon 16:00 MOL 213

Reacceleration of Ion Beams for Higher Performance in Tumor-Therapy — •Christian Schömers, Andreas Peters, and Thomas Haberer — Heidelberger Ionenstrahl-Therapiezentrum

At the Heidelberg Ion-Beam Therapy Centre (HIT) cancer patients are treated using the raster-scanning method. A synchrotron provides pencil beams in therapy quality for 255 energy steps per ion type allowing to vary the penetration depth and thus to irradiate tumors slice-by-slice. So far, changing the beam energy necessitates a new synchrotron cycle, including all phases without beam extraction.

The no. of ions that can be accelerated in the synchrotron usually exceeds the required no. of ions for one energy slice. An intensity upgrade of the injector system will be investigated, to increase the no. of accelerated particles even more. The treatment time could be significantly reduced by reaccelerating or decelerating the remaining ions to the next energy level. By alternating acceleration and extraction phases several slices could be irradiated with only short interruptions.

Therefore the reacceleration of a transversally blown up beam * due to RF-knockout extraction * must be investigated, beam losses have to be minimized. To estimate the benefit of this operation mode, treatment time has been simulated and compared to the time achieved in the past. A reduction of up to 65 percent is possible and more patients can be treated! Simulations and first tests of a reaccelerated and extracted beam are presented.

15 min. break

Group Report BE 1.5 Mon 16:45 MOL 213

Challenges and current status of the TLEP lattice design — •Bastian Härer[1,2], Bernhard Holzer[1], and Anke-Susanne Müller[2,3,4] — [1]CERN, Geneva — [2]LAS, KIT, Karlsruhe — [3]ANKA, KIT, Karlsruhe — [4]IPS, KIT, Karlsruhe

Following the recommendations of the European Strategy Group for High Energy Physics, several new projects are studied as possible future accelerators for the high energy physics research at CERN. One of these accelerators is TLEP, a new 80 km e+/e- storage ring collider with an energy up to 175 GeV per beam. TLEP will have at least two mini beta insertions to house high energy detectors and several straight sections dedicated for rf installation, injection/extraction, machine safety and beam collimation.

This talk will point out the current status of the TLEP lattice design, which is challenging, because the beam emittance is depending on energy squared and experiments in the energy range from 45 GeV to 175 GeV are foreseen.

BE 1.6 Mon 17:15 MOL 213

Origins of Transverse Emittance Blow-up during the LHC Energy Ramp — •Maria Kuhn[1,2], Gianluigi Arduini[1], Verena Kain[1], Andy Langner[1,2], Yannis Papaphilippou[1], Michaela Schaumann[1], and Rogelio Tomas[1] — [1]CERN, Geneva, Switzerland — [2]University of Hamburg, Hamburg, Germany

During LHC Run 1 about 30 % of the potential peak performance was lost due to transverse emittance blow-up through the LHC cycle. Measurements indicated that the majority of the blow-up occurred during the energy ramp. Until the end of LHC Run 1 this emittance blow-up could not be eliminated. In this presentation the measurements and observations of emittance growth through the ramp are summarized. Simulation results for growth due to Intra Beam Scattering will be shown and compared to measurements. A summary of investigations of other possible sources will be given and backed up with simulations where possible. Requirements for commissioning the LHC with beam in 2015 after Long Shutdown 1 to understand and control emittance blow-up will be listed.

BE 1.7 Mon 17:30 MOL 213

Impact of Quadrupolar Errors (b2) on the Optics Measurement Resolution in the LHC — •Andy Langner[1,2], Per Hagen[2], Ewen Hamish Maclean[2], Viktor Maier[2], and Rogelio Tomás[2] — [1]Universitaet Hamburg — [2]CERN

With respect to the operation of the LHC in 2015 with an increased

collision energy, an accurate measurement and correction of the optics will be crucial. The algorithm to determine LHC beta-functions uses the measured turn-by-turn data at the beam position monitors (BPMs) from an excited betatron oscillation. From the phase advances between three adjacent BPMs the beta functions are computed. An important prerequisite for this method is the precise knowledge of the optics model. It was studied whether introducing measured values of the systematic quadrupolar errors (b2) to the model will further increase the measurement resolution.

BE 1.8 Mon 17:45 MOL 213

A hydrodynamic tunneling experiment in CERN's HiRadMat facility - Comparison of experimental results and simulations. — •Florian Burkart[1,2], Daniel Wollmann[1], Rüdiger Schmidt[1], and Naeem Tahir[3] — [1]CERN, Genf, Schweiz — [2]Goethe Universität, Frankfurt, Deutschland — [3]GSI, Darmstadt, Deutschland

In 2012, a novel experiment has been performed at the CERN HiRadMat facility to study the impact of a 440 GeV proton beam generated by CERN's Super Proton Synchrotron (SPS), on extended solid copper cylindrical targets. Substantial hydrodynamic tunneling of the protons in the target material has been observed. In this contribution a comparison of the experimental results to predictions, achieved with iterative FLUKA and BIG2 simulations will be presented. Furthermore, the plan and status of simulations for future upgrades of the LHC their implication on the machine protection design will be discussed.