school, each student took a 4-1/2 hour-long final exam. Twelve students with top scores were honoured at the Award Ceremony, each receiving a certificate and a book (*Reviews of Accelerator Science and Technology*, Volume 7, Colliders, published by the World Scientific in 2014).

The 2016 school will be hosted by KEK in Japan. A Local Organizing Committee chaired by Nobuhiro Terunuma has been formed. The venue and dates will be announced in the next newsletter.

4 Recent Doctoral Theses Abstracts

4.1 Heavy-ion Performance of the LHC and Future Colliders

Michaela Schaumann
Mail to: Michaela.Schaumann@cern.ch

Graduation date: 9 October 2015
Institutions: CERN, Geneva, Switzerland,
RWTH Aachen University, Aachen, Germany
Supervisors: Prof. Dr. rer. nat. Achim Stahl (RWTH Aachen University),
Dr. John M. Jowett (CERN)

Abstract

In 2008 the Large Hadron Collider (LHC) and its experiments started operation at the European Centre of Nuclear Research (CERN) in Geneva with the main aim of finding or excluding the Higgs boson. Only four years later, on the 4th of July 2012, the

discovery of a Higgs-like particle was proven and first published by the two main experiments ATLAS and CMS. Even though proton–proton collisions are the main operation mode of the LHC, it also acts as a heavy-ion collider. Here, the term "heavy-ion collisions" refers to the collision between fully stripped nuclei. While the major hardware system of the LHC is compatible with heavy-ion operation, the beam dynamics and performance limits of ion beams are quite different from those of protons. Because of the higher mass and charge of the ions, beam dynamic effects like intra-beam scattering and radiation damping are stronger. Also the electromagnetic cross-sections in the collisions are larger, leading to significantly faster intensity decay and thus shorter luminosity lifetimes. As the production cross-sections for various physics processes under study of the experiments are still small at energies reachable with the LHC and because the heavy-ion run time is limited to a few days per year, it is essential to obtain the highest possible collision rate, i.e. maximize the instantaneous luminosity, in order to obtain enough events and therefore low statistical errors. Within this thesis, the past performance of the LHC in lead-lead (Pb-Pb) collisions, at a center-of-mass energy of 2.76 TeV per colliding nucleon pair, is analyzed and potential luminosity limitations are identified. Tools are developed to predict future performance and techniques are presented to further increase the luminosity. Finally, a perspective on the future of high energy heavy-ion colliders is given.

4.2 Study on Polarization Issues in High Energy Circular Accelerators

Zhe Duan
Mail to: zhe.duan@ihep.ac.cn

Graduation date: 29 May 2015
Institution: Institute of High Energy Physics, CAS, China
Supervisors: Prof. Qing Qin and Prof. Mei Bai

Abstract

Spin is a unique probe in accelerator-based nuclear and particle physics experimental studies. Implementation and optimization of polarized beams in in circular accelerators is a challenging endeavor and includes a lot of interesting questions to be addressed. In this thesis, several topics of stored polarized beams are studied, regarding the polarized proton beams in the Relativistic Heavy Ion Collider (RHIC), as well as polarized electron and positron beams in several electron positron storage rings.

First, a simulation framework of the spin dynamics for polarized proton beam as well as polarized electron and positron beams, is established on the basis of the Polymorphic Tracking Code (PTC). Utilizing the capability of orbital and spin normal form in PTC, the strengths of first order spin resonances can be evaluated, as well as the spin-orbit coupling function with linearized orbital and spin motion. Moreover, stroboscopic averaging is used to compute the invariant spin field in a non-perturbative manner. Finally, a Monte-Carlo simulation of the non-spin-flip synchrotron radiation induced beam depolarization is implemented, to evaluate the equilibrium beam polarization in electron positron storage rings.

RHIC is the world's only polarized proton-proton collider, which can accelerate and smash polarized proton beams with beam energy up to 255GeV, and over 50\% beam