Overview of Magnetic Measurements

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Session MO1 – Monday 1st October 2001 – 9.00/12.30

Most of the information presented in this introductory session has been detailed in the course of the workshop. This summary is on purpose focused to recent and future trends in the field of magnetic measurement.

Annick Ropert (ESRF) has introduced the workshop with a survey of the challenges for the field quality of present accelerator magnets. The tune accuracy is dominated by the control of the integrated strength of both dipole and quadrupole magnets. Quadrupole misalignments and dispersion in strength between the dipoles create orbit distortions. High brilliance Synchrotron Light Source require active control of the quadrupole alignment and tilt to avoid detrimental emitance growth.
The allowed strength dispersion and higher order multipole content of the main dipoles are not more demanding for the new large accelerators (HERA, LHC) with respect to their aperture. This field quality is however more difficult to reach with superconducting magnets having smaller aperture sizes and wider superconducting cable dimensions. The dynamic aperture is for these accelerators smaller than the physical aperture.

Stephane Sanfilippo (CERN) presented the challenges for the field quality measurement of the LHC magnets and gave an introduction to the relevant presentations at this workshop.
These measurements become more and more difficult. The aspect ratio, increasing length or smaller aperture, induce measuring equipment at the state of the art in mechanics. Numerous innovations were needed to assess correct alignment of the magnets. Time dependent effects in superconducting cables and dispersion of magnetisation strength in permanent magnet elements require complicated measurement campaigns and heavy data analysis. New challenges are expected for magnets based on NbSn superconductors (higher persistent current effects) and high field permanent magnets where the quality will be dominated by saturated iron yokes. Progress will be needed for accelerator physicists, magnet manufacturers, and measurement specialists. The growing interactions between these fields will bring numerous challenging studies.

Animesh Jain (BNL) covered the fruitful developments that were needed for the successful RHIC collider. He stressed the important progress still required in data acquisition and analysis in order to measure future superconducting accelerator magnets. Two main difficulties are still in front of us. Both BNL and CERN equipment are limited by the data transfer rates needed for long magnets measured with numerous rotating coils. Numerical treatment needs innovative improvements to accurately measure time dependent effects varying at rates similar to coils rotation rates.

Ching Shiang Hwang (SRRC) demonstrated the numerous measuring principles and techniques used for the Synchrotron Radiation Research Centre, Taiwan. Hall plate measurement in 3 D, rotating and flip coils, stretched wire in both static and pulsed modes, alignment survey and measurement of permanent magnets are all covered. The successful and remarkable integration of all these techniques by a small team of specialist is rewarding to all the pioneering work that has been covered by larger laboratories and presented in the frame of the previous International Magnetic Measurement Workshops.