

A.3: Electronic de-gaussing system for microtron dipole magnet

A module for bipolar operation during de-gaussing of microtron dipole magnet was designed and developed in Power Converters Division, RRCAT. This module is connected with microtron dipole magnet power supply in Indus Accelerator Complex. It can reverse polarity of magnet current to facilitate de-gaussing of the magnet. A schematic block diagram is shown in in Figure A.3.1.

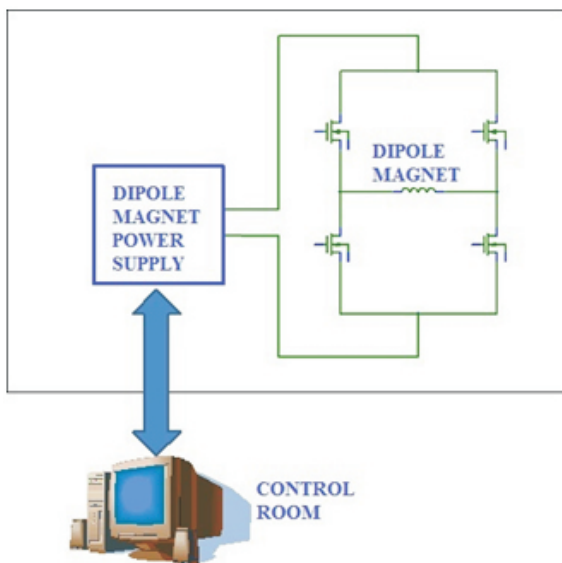


Fig. A.3.1: Magnet de-gaussing scheme.

The power supply for dipole magnet in microtron is rated for 220 A / 50 V DC. After the continuous operation of the dipole magnet the magnetic field stays at some positive value even when current of the electromagnet is reduced to zero. This is known as remnant field and its value depends on previous history of operation. It has been observed that magnetic field in microtron dipole magnet at zero current after long term operation stays at approx. 20 Gauss. De-gaussing removes this remnant field in the microtron dipole magnet and improves the electron beam quality and repeatability of the magnetic field during day to day operation. By properly de-gaussing the magnet, this remnant field can be reduced close to zero. Earlier, manual switches were used for magnet de-gaussing. Manual de-gaussing of the dipole magnet is tedious and needs continuous operator engagement for switching OFF the power supply every time the current polarity is changed and switching it ON again after changing the current polarity, using a mechanical switch. Also, when used over a long period of time, manual switches may develop problems and need periodic cleaning and maintenance. This electronic system is developed to replace the manual practice. It uses

water-cooled MOSFET switches for reversing the current polarity. A software routine controls the current polarity and amplitude without any need for human intervention. Also, this automatic system will reduce the total time required for magnet de-gaussing cycle. During normal operation of microtron, positive polarity of magnet current is selected and the magnet power supply works normally.

Magnet de-gaussing involves alternately reversing the polarity with reducing amplitude of magnet current. There is an option in the program for selecting asymmetric or symmetric de-gaussing cycle. In symmetric cycle, same value of current is applied in both polarities, while asymmetric cycle has different positive and negative values of magnet current. The magnet current is increased or decreased with a slope of 5 A/s. A typical de-gaussing cycle is completed in approximately 15 minutes and is shown in Figure A.3.2.

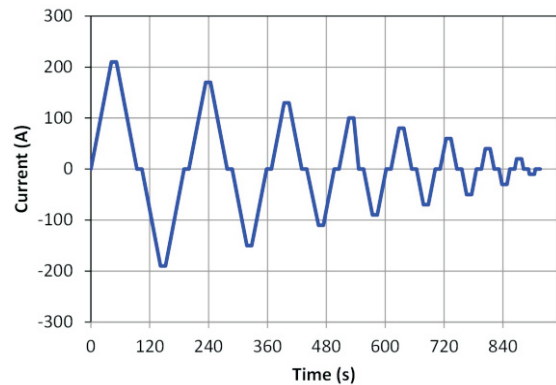


Fig. A.3.2: Magnet de-gaussing cycle.

The module will change polarity of microtron dipole magnet current only when this magnet current is zero. At non-zero current, the module will wait for current to be zero even when control room commands it to change polarity. This is very important for protection of components.

This system has been designed, developed, tested, and commissioned in microtron for regular operation. Figure A.3.3 shows this module installed in Indus Accelerator Complex.

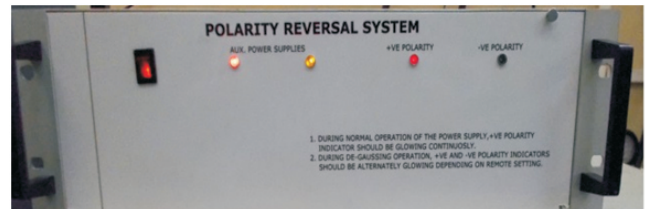


Fig. A.3.3: Microtron dipole magnet de-gaussing module.

Reported by:
Anand Pagare (apagare@rrcat.gov.in)