PULSED MAGNET SYSTEM FOR THE SIMULTANEOUS INJECTION OF KEK-PF AND KEKB RING

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Abstract

The KEK Linac provides the four different energy beams to the four storage rings. The 3.5 GeV positron and 8 GeV electron beams are injected into KEKB. The 2.5 GeV and 3 GeV electron beams are delivered to the Photon factory ring (PF) and the Photon factory advanced ring (PF-AR). To deliver the beam to the KEK-photon factory and KEKB ring simultaneously, the pulsed bending magnet was installed at the end of KEKB Linac. It makes possible the top up operation of PF ring.

Introduction

In KEKB, electron and positron beams are injected sequentially. It takes 30 seconds to switch the beam mode. Since the luminosity tuning has been sensitive to the beam condition of each ring, there is an increased demand to ensure the simultaneous injection of beams into KEKB rings. In addition to this demand, the top-up operation of the PF ring also required to obtain high-quality experimental data. In order to satisfy these requirements, three ring simultaneous injection was planed. The installed pulsed bending magnet is one of the hardware components of this upgrade project.

Parameters	Value
Deflection angle	114 mrad
Max. magnetic field	1.36 T
Magnet Gap (W x H)	157 x 30
Coil	One Turn
Magnet Core	1m
Max. Repetition rate	25 (12.5) Hz
Max. Current	27 (32) kA
Output current wave form	Half sinusoid
Pulse Width	200 μsec

The specification of the pulsed bending magnet.

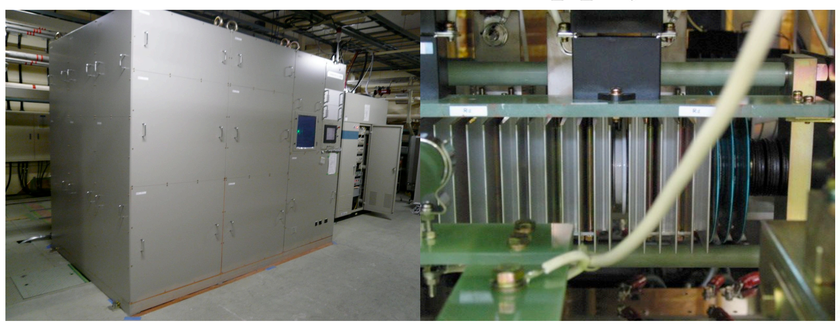
Pulsed Magnet System

Magnet

Photograph of the pulsed bending magnet.

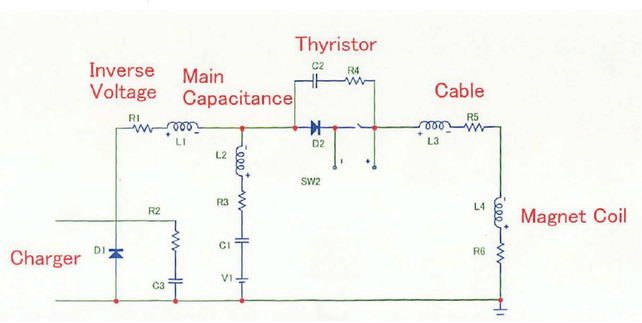
For the 2.5 GeV electron beam, the magnetic field strength is about 1.22T and the maximum repetition rate is 25Hz. The magnet system was designed for the beam operation up to 3GeV. The magnet is a wind frame type magnet. Laminated core was used for the magnet. Thickness of the plate is 0.35mm. The core length is 1m, and the gap height is 30mm. The single turn coil is used.

Power supply and Control System



Picture of the power supply at the Linac Klystron gallery

Switching thyristor of the power supply

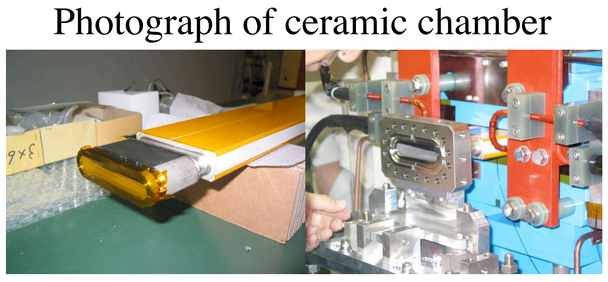


The schematic diagram of the power supply

The power supply is located in the klystron gallery at the end of lineac and connected with 7m long 40 coaxial cables to the magnet. To reduce the noise, the exclusive earth ground is prepared. The trigger signal is sent through the optical fibre cable. Mitsubishi FT1000A-50A thyristor was selected for the energy discharge switch. Total 24 thyristors, 6 series and 4 parallels, were used. The power supply is controlled from the remote sight through the Programmable Logic Controller (PLC) supervised by the EPICS system. The local control of the power supply can be done through the touch panel.

Ceramic Chamber

Photograph of ceramic chamber

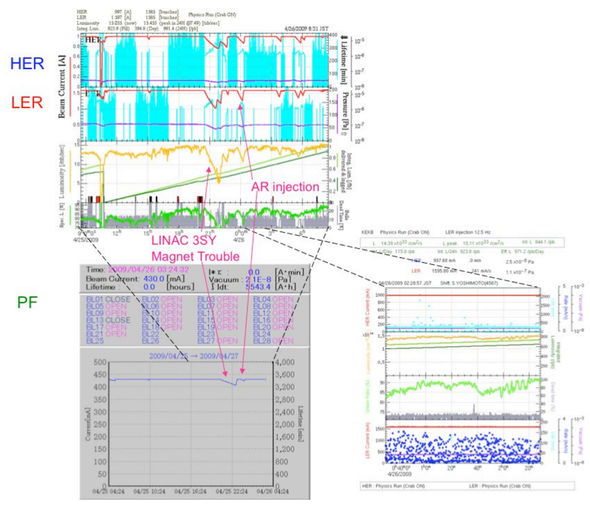


Special removable flange of the ceramic chamber

The ceramic chamber has racetrack type inner wall coated with Ti-Mo. The surface resistance is around 100Ω/ □. The special removable flange is used for one side of the chamber so that the chamber can be inserted from one side to the other.

Parameter	Value
Ceramic chamber length	1316.95mm
Ceramic size (inside)	86x16x1200 mm
Ceramic size (Outside)	99x27x1200 mm
Ti coating surface resistance	100Ω/□

Ceramic chamber parameters



Operation Status

The three ring simultaneous injection has been succeeded since April 2009. The beam is injected into KEKB HER/KEKB LER/PF ring in the 12.5 Hz/12.5Hz/1Hz or 12.5Hz/25Hz/0.5Hz. The storage beams in the three rings are kept constant and top-up operations of three rings have been succeeded. The pulsed bending magnet extracts the beam to the PF on 1 Hz or 0.5 Hz at the top-up mode, and 25Hz to storage the beam from 0.

Summary

The three rings (KEKB LER, HER and PF rings) pulse-to-pulse simultaneous injection started successfully from April 2009. PF top-up operation improves the data quality. KEKB luminosity tuning has been performed at the constant beam current. The pulsed magnet selectively extracts the beam to the PF beam transport line.