A.4: Development, installation and commissioning of vertical pinger magnet power supply in Indus-2

To study linear and non-linear beam dynamics, a set of pinger magnets will be required. These magnets will excite the beam either in vertical or horizontal plane and the beam response will be measured by beam position monitors. In the first phase, vertical pinger magnet (report A.3 of this Newsletter) along with its power supply is commissioned in Indus-2. Half-sinusoidal current pulse with peak current of 5.5 kA and pulse width of nearly 1 μs was required to generate a deflection angle of 2 mrad. To achieve these specifications, a low inductance, high voltage compliant pulser unit, with thyratron as a switch, was developed. To reduce the working voltage to a minimum value, the obvious choice was to reduce the path inductance. To achieve this objective, all efforts were made to reduce the stray inductance in pulse power circuit. Pulse power circuit were designed with capacitors having low equivalent series inductance and coaxial thyratron assembly. Pulse-forming network was placed in the vicinity of the pinger magnet. Contemplating the designed working voltage and high *di/dt* load current, it was decided to use thyratron as a high voltage switch for this application. Special design efforts were made to achieve low jitter, handle high *di/dt* of load current and to deal with the problems of slow recovery and reverse arcing associated with the thyratron switch. The schematic of pulse power circuit is shown in Figure A.4.1.

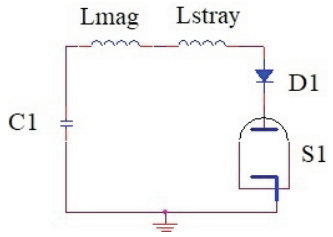

Fig. A.4.1: Pulse power circuit.

The capacitor C1 is charged via command resonant charging scheme to 14 kV. In command resonant charging scheme, a low voltage capacitor is discharged into the primary winding of high voltage pulse transformer and high voltage is generated across the secondary capacitor. The low voltage capacitor is charged by resistive charging scheme. The voltage across this capacitor is maintained by feedback loop. The voltage of the capacitor can be varied by control reference from remote to change the amplitude of current pulse in the pinger magnet. The peak current and pulse width are functions of C1 and total path inductance ($L_{mag} + L_{stray}$). Firing thyratron switch S1 results in generation of half-sinusoidal current pulse in the highly underdamped circuit. The current is measured with Pearson make current monitor. The supply was assembled in 36 U rack and tested for full specifications with actual pinger magnet housed on coated ceramic chamber. After magnetic field mapping, the supply was installed and commissioned in Indus-2. Power supply was operated with its remote interface from Indus-2 control room and load current was transmitted to oscilloscope in Indus-2 control room for monitoring and experimentation. Figure A.4.2 shows the waveforms of current and magnetic field measured at vertical pinger kicker magnet. Figure A.4.3 shows the installed pulse power circuit near to vertical pinger magnet. Figure A.4.4 shows a photograph of the power supply.

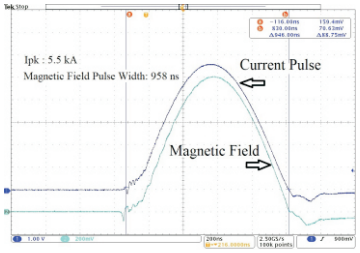

Fig. A.4.2: Current (1 kA/div) and magnetic field (108 gauss/div) waveforms.

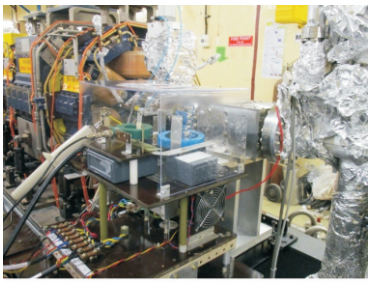

Fig. A.4.3: Photograph of pulse forming network.

Fig. A.4.4: Photograph of the power supply commissioned in Indus-2.

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