

A.1: Installation and commissioning of the sixth RF cavity in Indus-2

Indus-2 RF system, having five 505.8 MHz RF cavities operational, was upgraded with installation of the sixth RF cavity during two weeks shutdown in April, 2018. Figure A.1.1 shows the sixth RF cavity installed in Indus-2.



Fig. A.1.1: A view of sixth RF cavity installed in Indus-2.

The sixth RF cavity, assembled with RF input power coupler, Higher Order Mode Frequency Shifter (HOMFS), frequency tuner system, sensing loop couplers, vacuum system comprising of 270 lps sputter ion pump, 1000 lps titanium sublimation pump, a Bayard-Alpert gauge and sputter ion pump was installed in the long straight section LS-7 of Indus-2 ring. In-situ low power RF measurements of resonance frequency, quality factor, coupling coefficient, coupling of sensing couplers etc. were performed. Coupling loop coefficient was adjusted considering with-beam operation of all the insertion devices at 2.5 GeV. The RF cavity along with fifth RF cavity was evacuated and baked by circulating hot water for about 36 hours. Heating tapes were used to heat all the CF flanges in tandem for both cavities. After cool down, vacuum level of $\sim 5 \times 10^{-10}$ mbar was achieved. Figure A.1.2 shows view of sixth RF cavity during baking.

New RF station comprising of 50 kW solid state amplifier system, RF interlock system, digital low level RF control system (DLLRF), higher order mode frequency shifter control unit, frequency tuner control system and 6-1/8 inch transmission line system was installed. Cavity water cooling and window air cooling connections were made and flow was set.

RF conditioning of the cavity was started by feeding pulsed RF power with duty factor 0.25% which was gradually

increased to 100%. RF cavity was finally tested in CW mode up to 25 kW power providing sufficient gap voltage for Indus-2 operation. Adequate precautionary measures were taken during RF conditioning and measured radiation levels were within acceptable limits. DLLRF was optimized for full RF power range and RF cavity was tested with frequency tuning loop in auto mode from low to high RF power.



Fig. A.1.2: The sixth RF cavity along with vacuum system during baking.

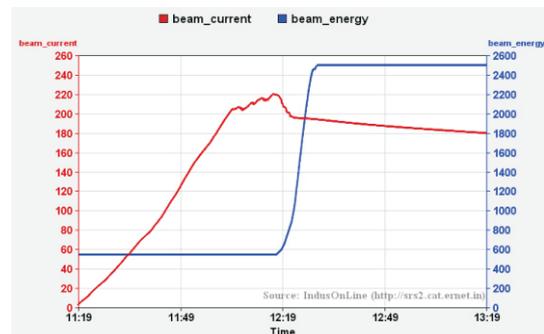


Fig. A.1.3: Indus-2 operation at 2.5 GeV with six RF cavities.

Beam trials with sixth RF cavity in operation along with previously installed five RF cavities were performed. Important parameters like cavity gap voltage, relative phases between RF cavities, vacuum level, tuning position etc. were observed and optimized. Experiments were performed to optimize RF and HOM parameters of RF cavity. During experiments, HOM signals were observed and harmful HOMs were avoided by optimizing cavity cooling water temperature and HOMFS position. At the optimized RF and HOM settings, 220 mA beam was stored at injection energy and after ramping ~ 195 mA beam current at 2.5 GeV was attained in Indus-2. Figure A.1.3 shows the snapshot of Indus-2 beam operation with six cavities. Presently, RF cavity is working satisfactorily in round-the-clock mode operation in Indus-2.

Reported by:
Mahendra Lad (ladm@rrcat.gov.in)