

A.4: Cold testing of X-link tuner with 650 MHz single-cell RF cavity at LN₂ temperature

A new type of X-link tuner has been developed indigenously and patent is applied in 4 countries. Japan has recently granted patent for this tuner (Figure A.4.1). The X-link tuning system is capable to tune single-cell and multi-cell SCRF cavities for precise slow and fast tuning with low hysteresis. RRCAT has embarked on development of tuners required for high beta (HB) 650 MHz SCRF cavities for the superconducting linac for proposed ISNS. A prototype X-link tuner for 650 MHz cavity is developed.

The 650 MHz single-cell niobium cavity is assembled with X-link tuner for testing at LN₂ temperature. The whole system is hanged vertically, similar to VTS assembly, on a supporting structure.

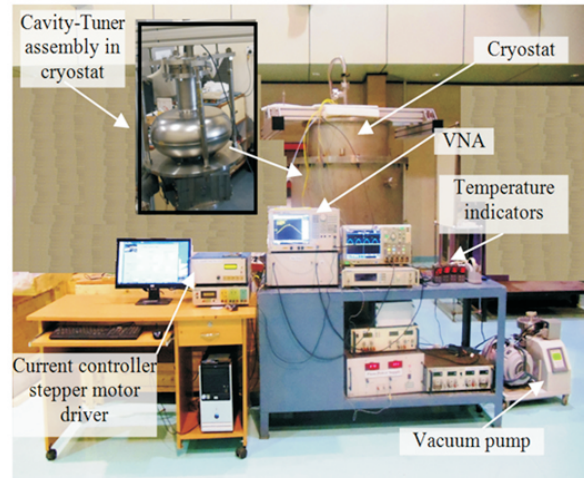


Fig. A.4.2: LN₂ test setup for X-link tuner.

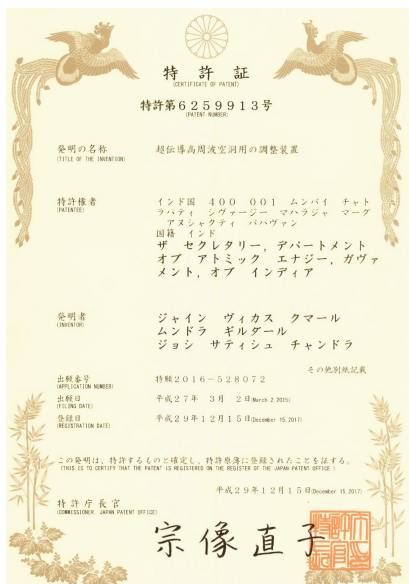
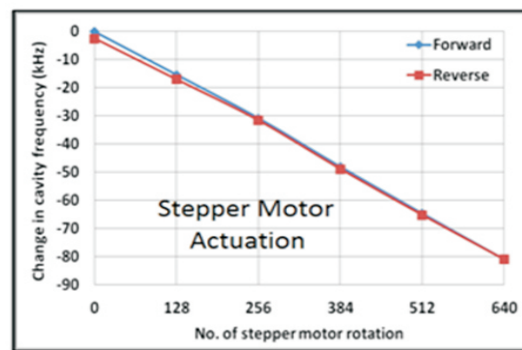
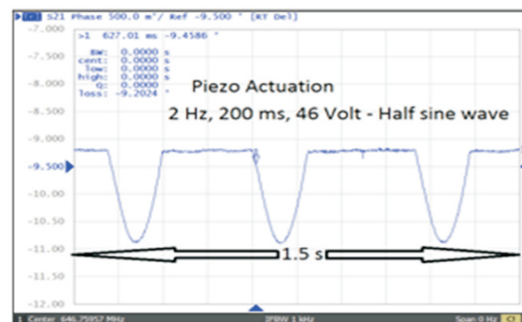


Fig. A.4.1: Japanese patent on "Device for tuning SCRF cavities" received in December 2017.

Testing of the X-link tuner was carried out at 300 K and at 77 K (Figure A.4.2) during Nov.-Dec. 2017. In slow tuning operation, stepper motor has been rotated for compression (forward) and expansion (reverse) of the cavity. Change in cavity frequency of 82 kHz for 2.5 turns of power screw (640 rotation of stepper motor) has been recorded (Figure A.4.3(a)). For fast tuning operation, piezos are excited with a half sign wave of various pulse widths ranging from 50 ms to 400 ms at variable repetition rates and change in cavity frequency was observed in terms of change in phase. The plot of change in phase due to piezo actuation at 2 Hz repetition rate, 200 ms pulse width and 46 volt excitation is shown in Figure A.4.3 (b).



(a)



(b)

Fig. A.4.3: (a) Slow tuning with stepper motor actuation. (b) Fast tuning with piezo actuation.

The testing of tuner upto LN₂ temperature with 650 MHz single RF cavity is an important exercise in validating the tuner performance. This tuner will be further tested for its performance under superconducting state of the SCRF cavity at 2 K in VTS.

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