

SC Cavity System for ERL-injector At KEK

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Abstract

Development of a SC Cavity Injector Cryomodule for the compact ERL (Energy-Recovery Linac) is being continued at KEK since 2006. An injector for cERL is required to accelerate a CW electron beam of 100mA to 10MeV. In this application, critical hardware components are not cavities but RF input couplers and HOM dampers. Several combinations of number of cavity and cells per cavity were examined, and a three 2-cell cavity system was chosen for cERL. Each cavity is drove by two input couplers to reduce required power handling capacity and also to compensate coupler kick. HOM coupler scheme was chosen for HOM damping, and 4 or 5 HOM couplers are put on beam pipes of each cavity. Because of simplicity cavities are cooled by jacket scheme. Two prototype 2-cell cavities (#01 and #02) and two input couplers for compact ERL were fabricated in 2007 and 2008. The vertical test of #01 cavity with HOM pickup probe was carried out at April 2009. The result of vertical test and schedule will be reported.

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Frequency Beam Current Energy Beam Power :



Table. Basic parameter of cERL at KEK

Input coupler: coaxial-type coupler

HOM damper: coaxial-type HOM coupler

Measurement of Proto-type 2-cell cavity #01

Progress of Work for cavity testing,

- (a) Inspection of inner surface of cavity at "As received",
- (b) Measurement of the accelerating mode and HOMs,
- (c) Measurement of the Qin by using dummy couplers,
- (d) CP process (20 μ m) at Nomura plating company,
- (e) Anneal process,
- (f) Inspection of inner surface of cavity after anneal process,
- (g) Final EP process (100 μ m), H₂O₂ rinsing, hot bath rinsing, HPR, assembly and mild baking at STF in KEK,
- (h) HOM coupler tuning for accelerating mode in vertical test stand,









Summary and Future Plan

Two fully equipped proto-type 2-cell cavities (#01 and #02) and two input couplers were fabricated at 2007 and 2008. The low power and vertical test of proto-type 2-cell cavity #01 was carried out until April 2009. The cavity #01 was achieved the operation gradient (14.5 MV/m) in vertical test (CW, long run operation). The Max: field was achieved over 30 MV/m at short time. The field was limited by one HOM pick-up probe. The 2nd vertical test of #01will be equipped the thermal anchor to obtain a good cooling for HOM pick-up probe to assume the cryomodule operation.

At present, the initial surface treatment and low power test of proto-type 2-cell cavity #02 is carried out. The 1st vertical test of this cavity will be done December 2009. The high power test of the input couplers will be done from November 2009.

Target of Injector System 1.3 GHz 100 mA cW 10 MeV 1 MW



(i) Vertical test with regular HOM pick-up antennae and T-mapping (temperature mapping), * High field processing and Long run operation to assume the cryomodule test



Proto-type 2-cell cavity #2 (Five loop type HOM couplers)



Proto-type 2-cell cavity #01 (Four HOM couplers)