Cavity Test Items in S1-G Cryomodule

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Outline

1. 1\textsuperscript{st} cool-down
2. Low Power RF Tests
3. Conditioning of Couplers
4. 2\textsuperscript{nd} cool-down
5. High Power RF Tests

Reference ; STF Phase-I Activity Report
(KEK Report, 2009-3, in Japanese)
Low Power RF Tests (1)

RF Source [Network Analyzer]

- Stroke of mechanical tuner; hysteresis
- Setting of drive frequency; $f_0 = 1300.00$ MHz
- Measurement of input ($Q_L$) by bandwidth, monitor ($Q_t$) → important calibration
  HOM (fundamental $Q_{HOM-1}$, $Q_{HOM-2}$)
- Static stroke of piezo tuner; hysteresis and reproducibility
- HOM $Q_{ext}$; TE111, TM110, TM011
- Frequency stability; $\Delta f_0 / \Delta P$ (Hz/Pa)
Low Power RF Tests (2)

RF Source [50W RF Amplifier]

- Measurement of input ($Q_L$) by decay time monitor ($Q_t$) → important calibration
- Measurement of mechanical vibration modes by piezo drive oscillation
- Single-pulse response by piezo tuner as a function of Voltage, Frequency, Load
- Double-pulse response by piezo tuner
- Multi-pulse response by piezo tuner
Conditioning of Input Couplers

RF Source [2MW / 5 MW Klystron]

- in-situ baking of cold rf windows
- one coupler individually, or
two coupler simultaneously, or
four couplers simultaneously.
- 20 $\mu$s, 50 $\mu$s, 100 $\mu$s, 200 $\mu$s, 400 $\mu$s, 500 $\mu$s,
800 $\mu$s, 1.0 ms, 1.5 ms
5 Hz (1 Hz)
up to 350 kW
High Power RF Tests (1)

RF Source [2 MW / 5 MW Klystron]

• One cavity individual operation
• Measurement of input ($Q_L$) by decay time, monitor ($Q_t$) → important calibration
• Cavity processing at higher fields in a 1.5 ms pulse operation ; $E_{acc,max}$
• Cavity processing at higher fields in a 0.6 ms pulse operation ; $E_{acc,max}$
• Mechanical vibration mode at high field, 5 Hz by piezo sensor (tuner)
High Power RF Tests (2)

RF Source [2 MW / 5 MW Klystron]

- Stable operation at high fields in one cavity
- LLRF, RF feedback ON/OFF operation
- Observation of Dynamic Lorenz Detuning;
  off-set detuning, RF feedback / ON
- Compensation of Dynamic Lorenz Detuning;
  by off-set detuning and piezo tuner
  RF feedback / OFF
- Dynamic RF loss measurement in one cavity;
  ON / OFF resonance
High Power RF Tests (3)

RF Source [2 MW / 5 MW Klystron]

• Four cavity operation
• LLRF, Vector-sum operation of 4 cavities
• Dynamic RF loss measurement of 4 cavities
  ON / OFF resonance

• Eight cavity operation
• LLRF, Vector-sum operation of 8 cavities
• Dynamic RF loss measurement of 8 cavities
• Long time stable operation at ave. 31.5 MV/m ?
Thank you for your attention .....