

Cavity Test Plan in S1-G Cryomodule

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E. KAKO (KEK) 2010' Mar. 29 S1-G @ GDE Beijing Global Design Effort

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Outline

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

Schedule of S1-Global in 2010

	Symbol	EP1 EP2 VT Ins Tune Ani HPR MHI									
Year	Year						1	2010			
Month	Month	1		2	3	4	5 6	7	8	9 10	11 12
Date	Date	4 11 18	3 25 1 8	15 22	1 8 15 22	29 5 12 19 2	6 <u>3</u> 10 17 24 31 7 14 21	28 5 12 19 26 2	9 16 23 30 6	5 <mark>13</mark> 20 27 4 11 18	25 1 8 15 22 29 6 13 20 27
Cavity	Comments				GD	E TTC	G.W. IPAC	Kaso ku	ki Summer	LINAC10	
					Bei	jing Ferm	i Kyoto	Hime ji	Vacation	Tsukuba	2010 Eeb 08
MHI-08	for S1–G		EP:	VT Ins	No Liq He			New Acid			
MHI-09	for S1-G							Clean Room R	leconstruction	•	
MHI-10	for SO			C In	ns EP <mark>1</mark> Anl	Ins Tur	EP2VT Ins Tur EP2VT Ins	Tur <mark>EP2VT Ins</mark> Tune t	o <mark>JLa</mark> b		noquie
MHI-11	for SO	EP	<mark>1 Anl Ins</mark> Tu	ne		Tur <mark>EP2VT</mark>	Ins Tur <mark>EP2VT</mark> Ins Tur <mark>EP2</mark>	VT Ins Tune t	o <mark>Jla</mark> b		
MHI-12	for Quantum Beam								une <mark>EP1</mark> AnI <mark>Ins</mark>	s Tur <mark>EP2VT</mark> Ins Tur <mark>EP</mark>	2 VT Ins Tur EP2 VT MHI
MHI-13	for Quantum Beam								ns Tur <mark>EP1</mark> Ar	n <mark>l Ins Tur<mark>EP2 VT</mark> Ins</mark>	s Tur <mark>EP2 VT</mark> MHI
IHP-01	for R & D						?? HPIVT Ins				
HIT-01	for R & D					Ir	s Tur <mark>EP1 Anl Ins</mark> Tur <mark>EP2 VT</mark>	Ins			
TOS-01	for R & D						Ins Tur EPI Ani Ins Tur	rEP2VT Inc			
											Ini-2cell
ERL2 cell-#1	2007' for R & D		EP2VT Ins								
ERL2 cell-#2	2008' for R & D			EP2V	T Ins	EP2VT Ins					
ERL2 cell-#3	for ERL-Injector Cryomodule										Ins EP1 Anl Ins
ERL2 cell-#4	for ERL-Injector Cryomodule										Ins EP1 Anl Ins
ERL2 cell-#5	for ERL-Injector Cryomodule										Ins EP1 Anl
								-down	2nd	cool-do	own
Cryomodule-A (KEK)	Preparation			Pre paratic	on						
	Class 10			010							
	Class 1000			C	1000						
	Outside of C.R.				Outside						
	Under the GRP					u-GRP					
Cryomodule-C (FNAL, DESY)	Preparation	Prepar	ation								
	Class 10	C10							<u></u>		
	Class 1000	C1	000					v howe			
	Outside of C.R.		Outside								
	Under the GRP			u-GRP							
								PSIS			
Cryomodule- A & C	Installation of Warm Coupler				Warm C	oupler	Warm Coupler				
	Cooling Down						Cool dovin			Cool do vn	
	Experiment at 2 K						Low Power	r RF Exp		High Powe	er RF Exp
	Warming Up						╶╢═╝╾┼╌╴═╝╾╴┼╹┪┝╌┝╌┥	Warm up			Warm u
	Coupler Aging								Coupler A	ging	
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RF Source [Network Analyzer]

- Stroke of mechanical tuner ; hysteresis
- Setting of drive frequency ; fo = 1300.00 MHz
- Meas. of variable input coupling $(\mathbf{Q}_{\mathrm{IN}})$ by bandwidth
- Adjustment of input coupling to Q_{IN} = 2.(3)x10⁶ Calibration of monitor coupling (Q_t) HOM filter (fundamental Q_{HOM-1}, Q_{HOM-2})
- Static stroke of piezo tuner;

hysteresis and reproducibility

• HOM Q_{ext} ; TE111, TM110, TM011

• Frequency stability : A fo / A P (Hz/Pa) 2010' Mar. 29 Global Design Effort

Low Power RF Tests (2)

RF Source [50W RF Amplifier] → Eacc ~ 0.2 MV/m

- Measurement of input coupling (Q_{IN}) by decay time Calibration monitor coupling (Q_t)
- Measurement of mechanical vibration modes driven by a piezo tuner
- Single-pulse response by piezo tuner as a function of Voltage, Frequency, Load
- Double-pulse response by piezo tuner as a function of Voltage, Frequency, Load
- Multi-pulse response by piezo tuner

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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 μs, 50 μs, 100 μs, 200 μs, 400 μs, 500 μs, **800 μs, 1.0 ms, 1.5 ms** 5 Hz (1 Hz) at least, Pin = 350 kW



RF Source [2 MW / 5 MW Klystron]

- One cavity individual operation (one by one)
- Measurement of input coupling (Q_{IN}) by decay time Calibration of monitor coupling (Q_t)
- Cavity processing at higher fields in a 1.5 ms pulse operation ; Eacc,max
- Cavity processing at higher fields in a 0.6 ms pulse operation ; Eacc,max
- Mechanical vibration modes at high fields, 5 Hz by piezo sensor (tuner)
- <u>Comparison between Vert. Tests and Cryo. Tests</u>

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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;
 Optimization off-set detuning and parameters of piezo drive pulse
 RF feedback / OFF
- Dynamic RF loss measurement in each cavity ; ON / OFF resonance, (one by one)

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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 (Cryomodule- A, C)
- 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 ?

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KEK waits for your participation in the experiments of the S1-Global cryomodule at KEK-STF.



Thank you for your attention ...

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