S1 Global Status

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12 July 2010

S1-Global

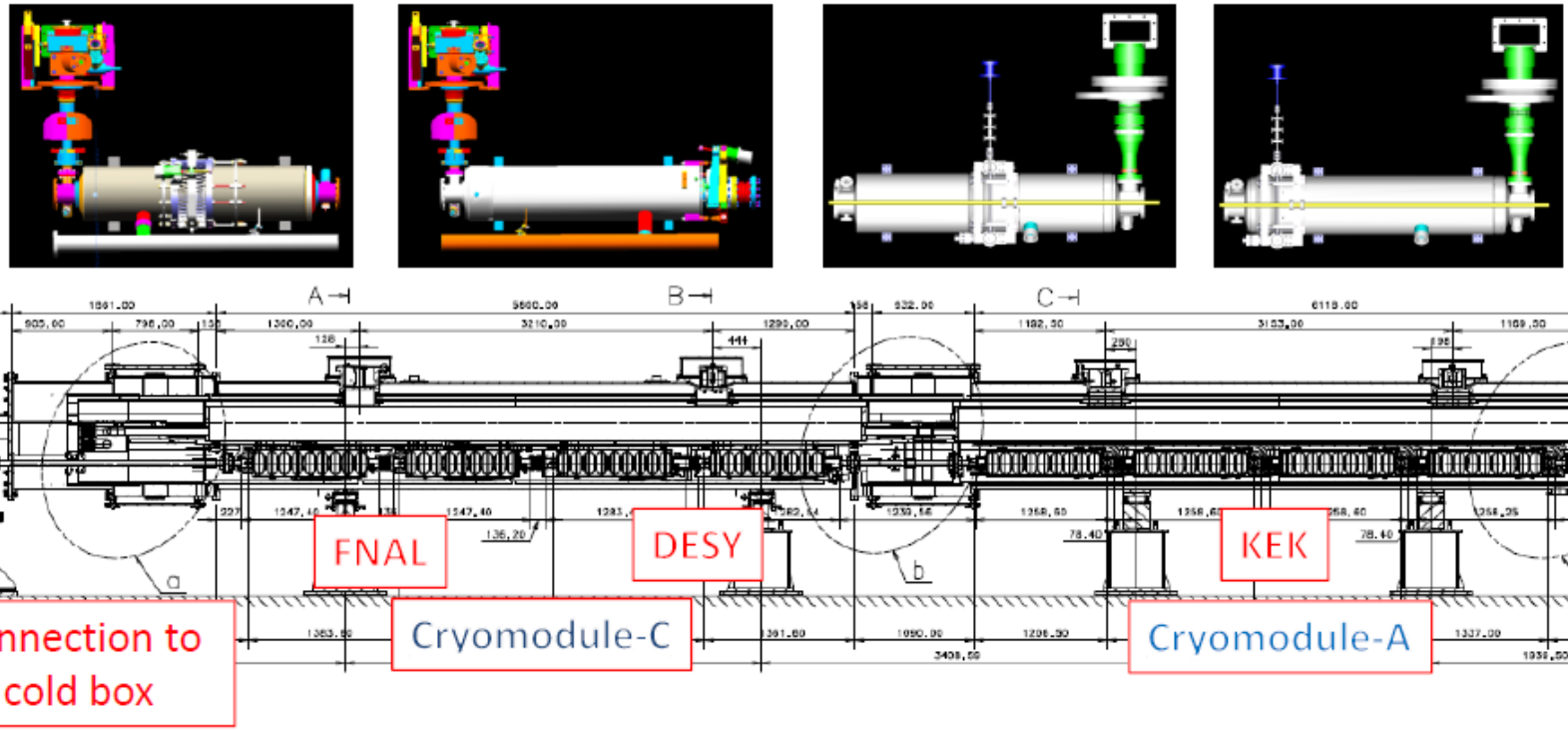
The main target of the S1-Global :

Operating a cryomodule with an average accelerating gradient of 31.5 MV/m with 8 cavities under the international research collaboration.

Included research subjects:

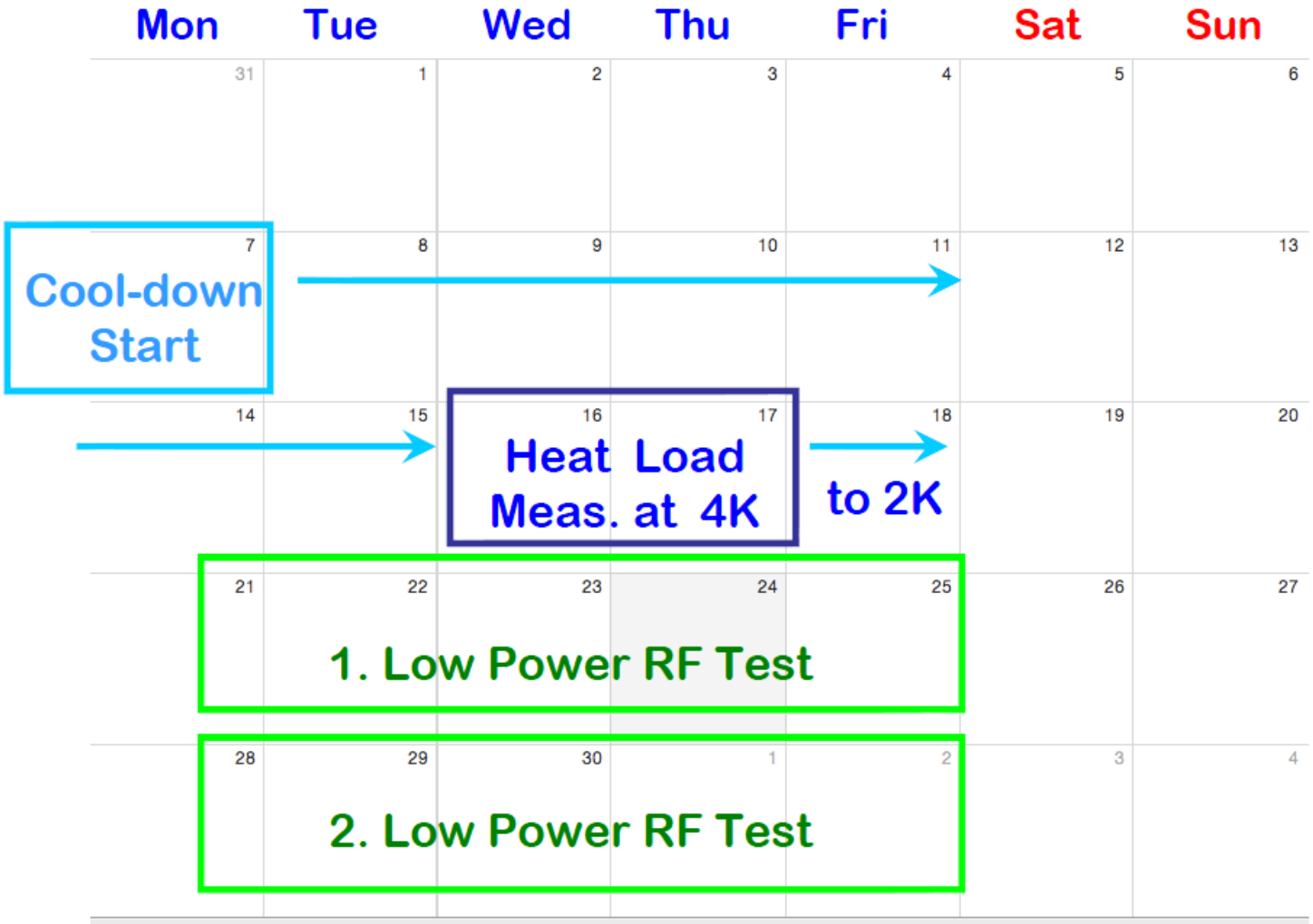
1. Experience the design, assembly and the alignment procedures for cavity packages from participating parties.
2. Measure the heat loads for the cavity packages and the cryomodule for the static and the 31.5 MV/m dynamic conditions.
3. Conduct the comparative studies of performance of cavities from the participating institutes.
4. Attempt to attain an average accelerating gradient of 31.5 MV/m in a pulsed RF operation at 5Hz with 1ms flat-top length, 0.07% rms amplitude variation and 0.35 degree rms phase variation.
5. Advance implementation of the 'plug-compatibility concept'

S1-Global cryomodule overview



- S1-Global collaborative profile
  - INFN: Design and construction of the 6m Module-C for DESY and FNAL cavities
  - DESY: Two TESLA type cavities with Saclay tuner
  - FNAL: Two TESLA type cavities with blade tuner
  - SLAC: Power distribution system for Module-C and input coupler conditioning
  - KEK: 6m Module-A for KEK cavities, four TESLA-like cavities and infrastructure for completing the module tests

June, 2010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Cool-down Start
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Heat Load Meas. at 4K
to 2K
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1. Low Power RF Test
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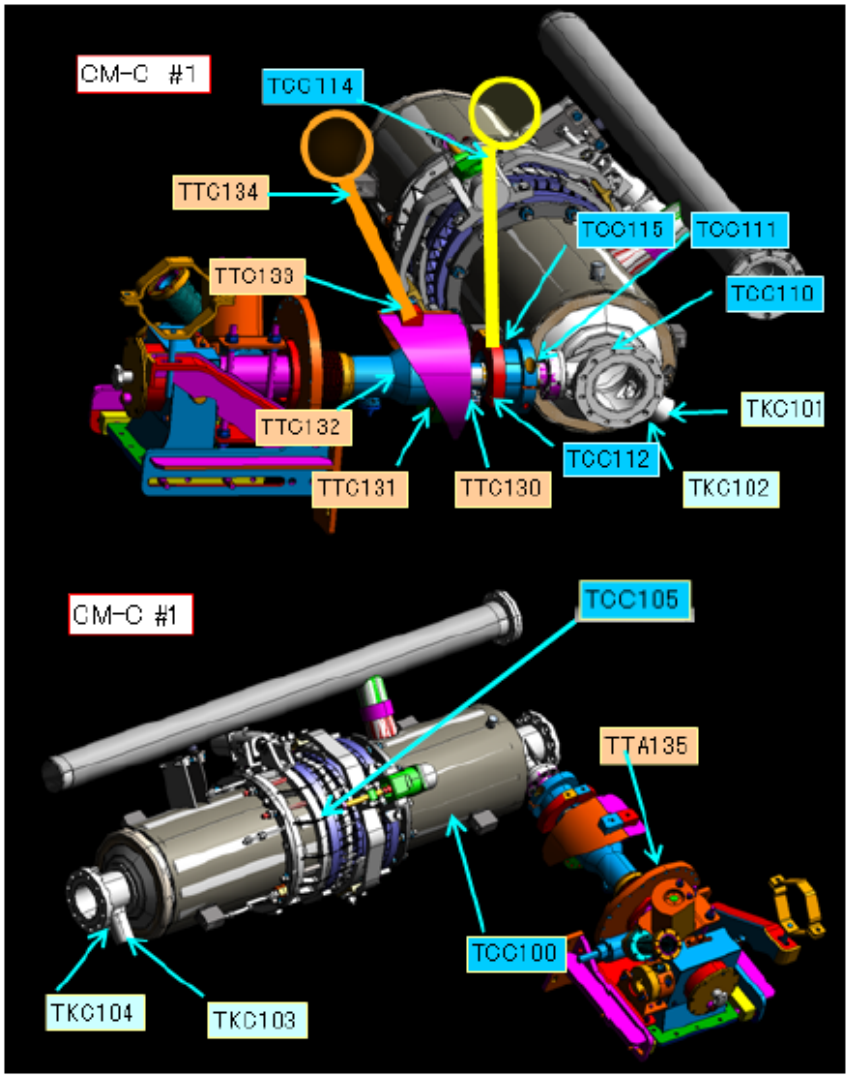
2. Low Power RF Test

Temperature sensors on cavity jacket and input coupler



Tag No	Position of measurement
TCC100	Helium Vessel
TKC101	HOM coupler in the input coupler side-top
TKC102	HOM coupler in the input coupler side-bottom
TKC103	HOM coupler in the non-input coupler side-top
TKC104	HOM coupler in the non-input coupler side-bottom
TCC105	Piezo
TCC110	Connection area of input coupler with beam pipe
TCC111	5K thermal intercept of input coupler (beam pipe side)
TCC112	5K thermal intercept of input coupler (body)
TCC114	5K thermal intercept of input coupler (cooling pipe side)
TCC115	5K thermal intercept of input coupler (intercept side)
TTC130	80K thermal intercept of input coupler (beam pipe side)
TTC131	80K thermal intercept of input coupler (body)
TTC132	80K thermal intercept of input coupler (vacuum vessel side)
TTC133	80K thermal intercept brade of input coupler (coupler side)
TTC134	80K thermal intercept brade of input coupler (cooling pipe side)
TTC135	Input coupler (room temperature and in the vacuum vessel)

Cernox:7, Carbon resistor:4, CC: 6

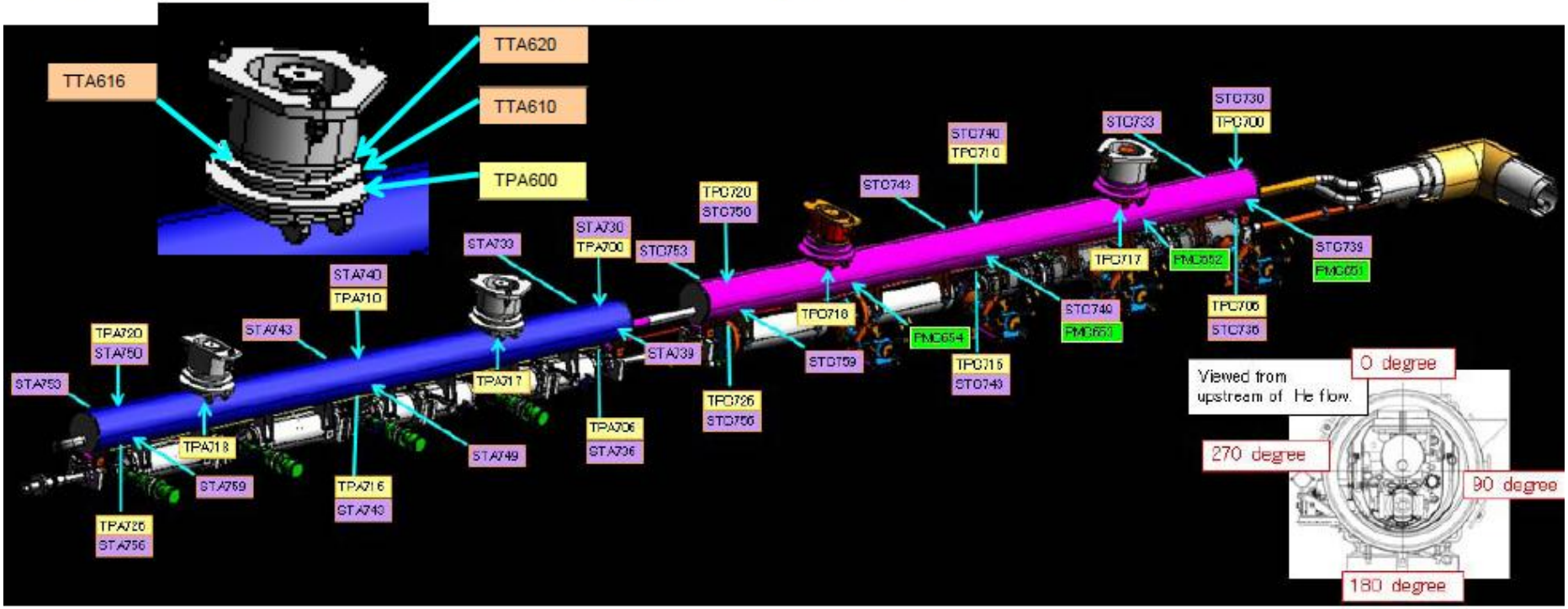
Cavity vessel= 1

Input coupler= 11 (including thermal intercepts)

HOM coupler= 4

Piezo= 1

Sensors on GRP and support posts



PtCo : 20, CC thermocouples : 12
GRP= 16
Support Post= 20

For measuring the GRP deformation
Strain gauge: 24 positions
(3 positions along the GRP axis, and 4 azimuthal positions for one GRP)

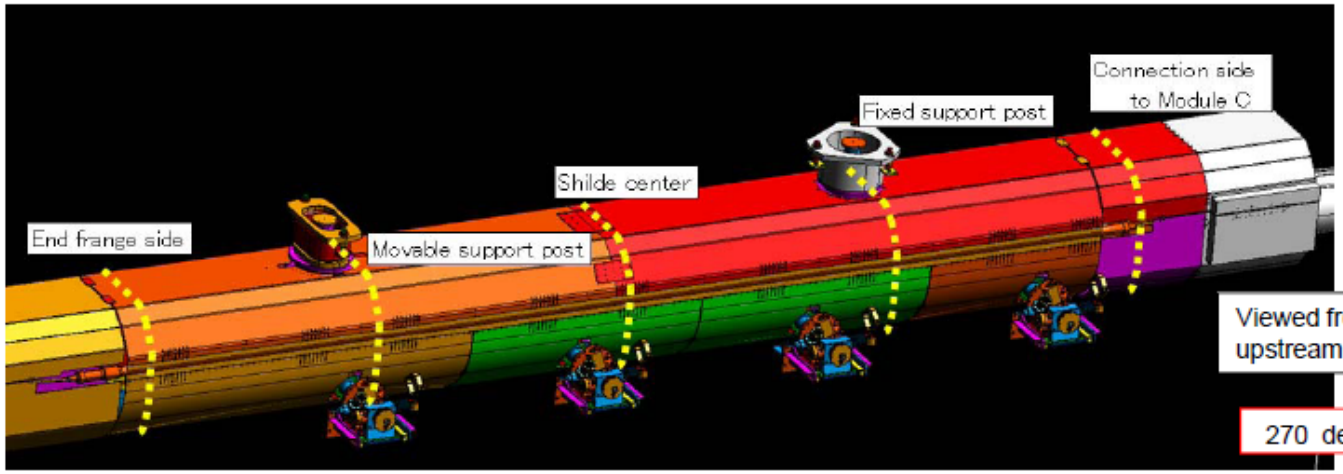
Module-A GRP

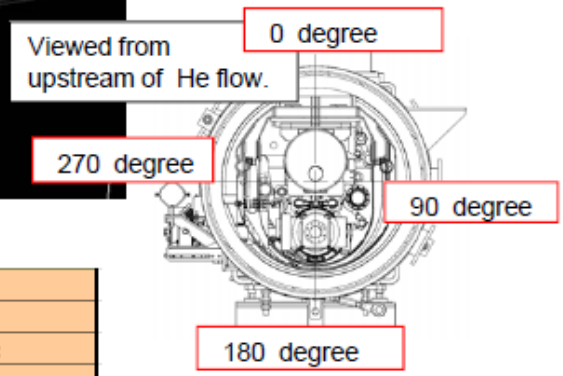
Tag No	Position of measurement
TPA700	Upstream-top (Module-A connection side)
TPA706	Upstream-bottom
TPA710	Center-top
TPA716	Center-bottom
TPA717	Connection area between S.P and GRP(F)
TPA718	Connection area between S.P and GRP(M)
TPA720	Downstream-top (end flange side)
TPA726	Downstream-bottom
STA730	0 degree in the side of Upstream
STA733	90 degree in the side of Upstream
STA736	180 degree in the side of Upstream
STA739	270 degree in the side of Upstream
STA740	0 degree in the center
STA743	90 degree in the center
STA746	180 degree in the center
STA749	270 degree in the center
STA750	0 degree in the side of end flange
STA753	90 degree in the side of end flange
STA756	180 degree in the side of end flange
STA759	270 degree in the side of end flange

Module-C GRP

Tag No	Position of measurement
TPC700	Upstream-top (Module-C connection side)
TPC706	Upstream-bottom
TPC710	Center-top
TPC716	Center-bottom
TPC717	Connection area between S.P and GRP(F)
TPC718	Connection area between S.P and GRP(F)
TPC720	Downstream-top (end flange side)
TPC726	Downstream-bottom
STC730	0 degree in the side of Upstream
STC733	90 degree in the side of Upstream
STC736	180 degree in the side of Upstream
STC739	270 degree in the side of Upstream
STC740	0 degree in the center
STC743	90 degree in the center
STC746	180 degree in the center
STC749	270 degree in the center
STC750	0 degree in the side of end flange
STC753	90 degree in the side of end flange
STC756	180 degree in the side of end flange
STC759	270 degree in the side of end flange

Temperature sensors on thermal shields





Tag No	Position of measurement
TPC510	0 degree in the side of module-C
TPC513	90 degree in the side of module-C
TPC516	180 degree in the side of module-C
TPC519	270 degree in the side of module-C
TPC529	90 degree at fixed support post
TPC533	90 degree at shield center
TPC536	180 degree at shield center
TPC539	270 degree at shield center
TPC549	270 degree at movable support post
TPC550	0 degree in the side of end flange
TPC553	90 degree in the side of end flange
TPC556	180 degree in the side of end flange
TPC559	270 degree in the side of end flange

Module-C:
PtCo 13

TTC810	0 degree in the side of module-C
TTC813	90 degree in the side of module-C
TTC816	180 degree in the side of module-C
TTC819	270 degree in the side of module-C
TTC830	0 degree in the center
TTC833	90 degree in the center
TTC836	180 degree in the center
TTC839	270 degree in the center
TTC850	0 degree in the side of end flange
TTC853	90 degree in the side of end flange
TTC856	180 degree in the side of end flange
TTC859	270 degree in the side of end flange

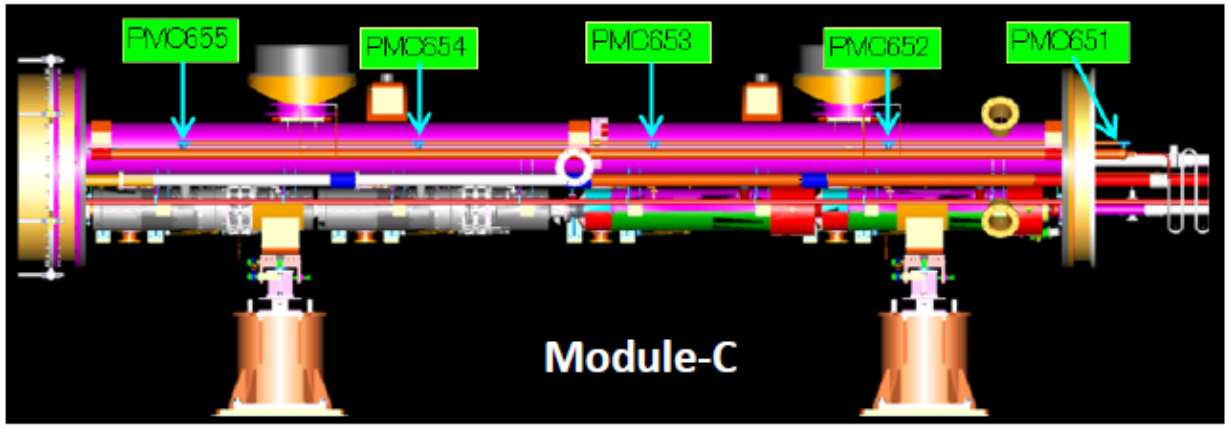
Module-C:
Cu-Constantan thermocouple 12

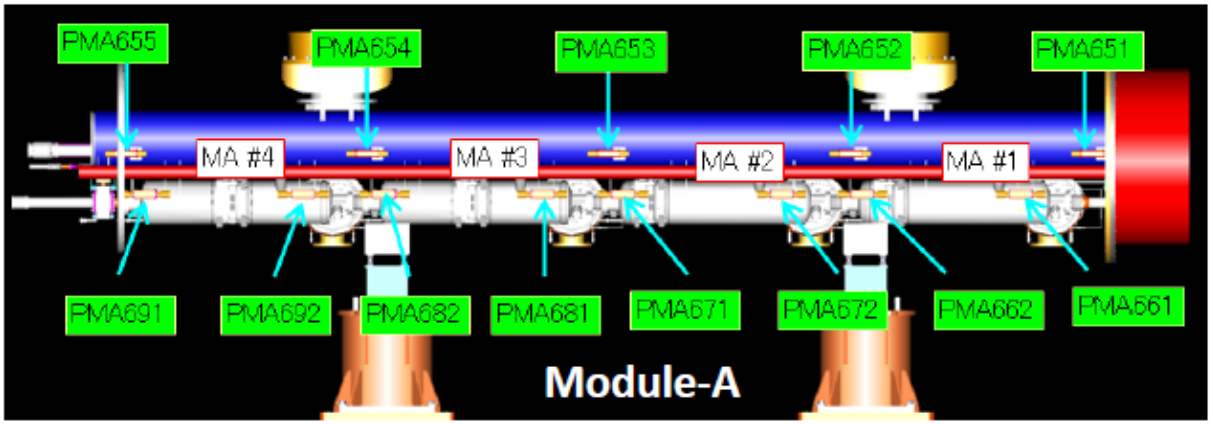
For Module-A and -C
5K shield
PtCo : 27
80K shield
CC : 24

Position measurement of cavities and GRP

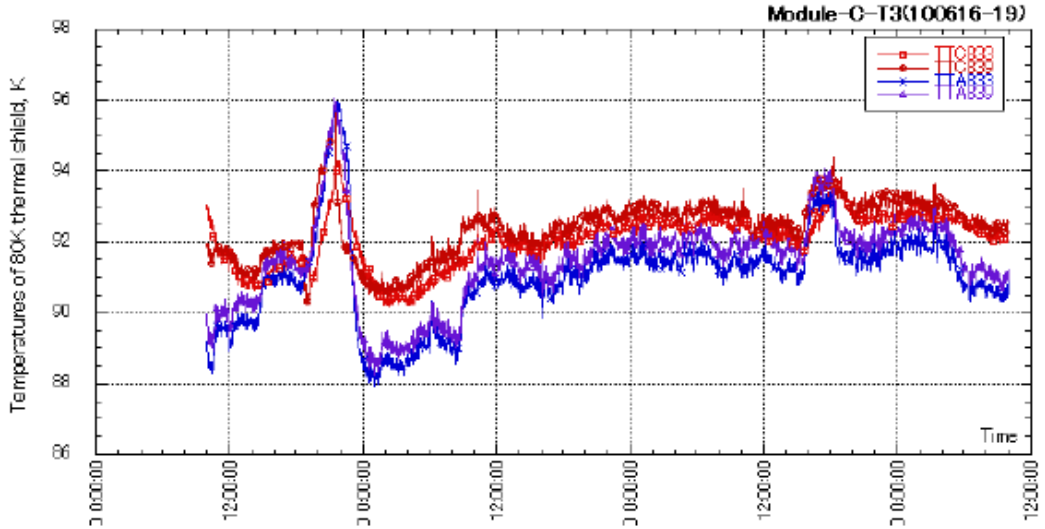
Measurement of position of cavities and GRP by WPM

- Module-C
  - 5 WPMs are assembled on the GRP.
- Module-A
  - 5 WPMs on the GRP and 2 WPMs for each cavity are assembled. In total, 13 WPMs.

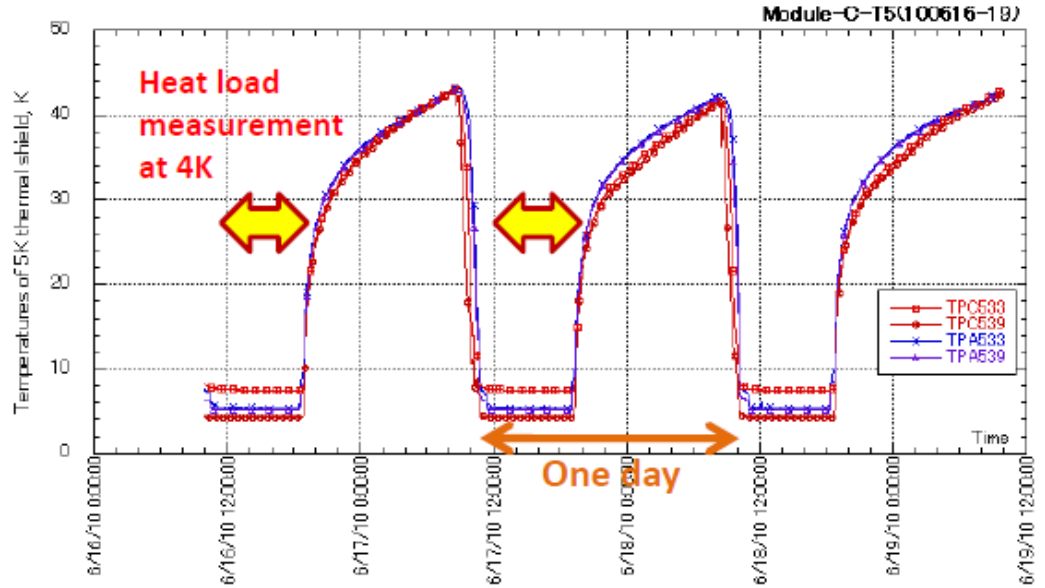




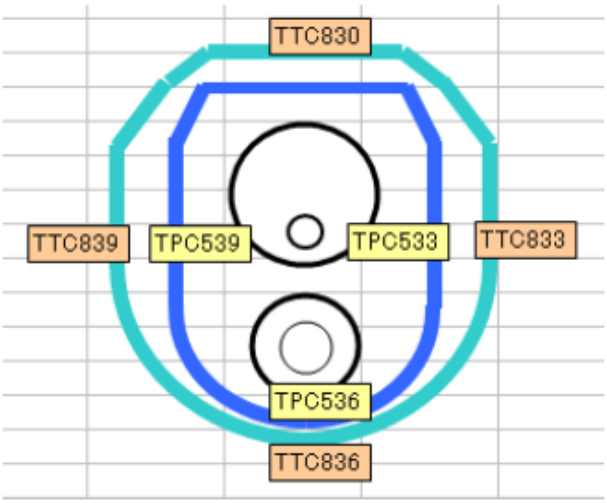
Thermal conditions at heat load measurement at 4K (June 16 – 17)

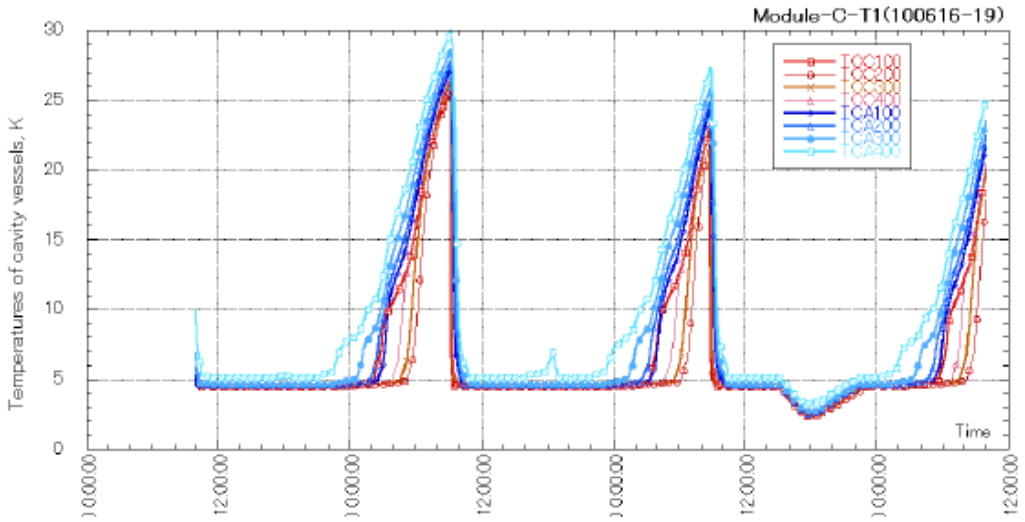


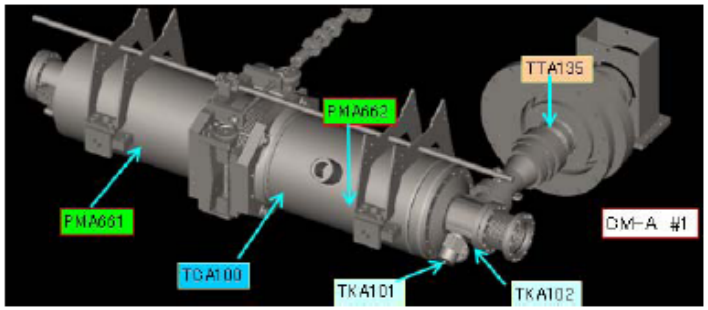
80K thermal shield
TTC833, TTC839:Module-C center pos.
TTA833, TTA839:Module-A center pos.



5K thermal shield
TTC533, TTC539:Module-C center pos.
TTA533, TTA539:Module-A center pos.

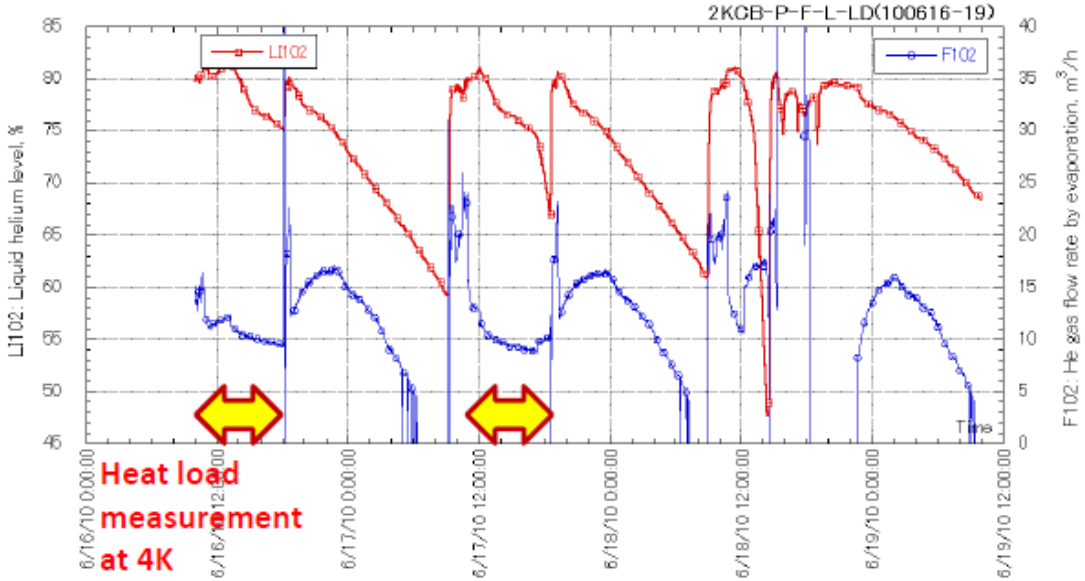






TCC100, 200, 300, 400:Module-C vessels
TCA100, 200, 300, 400:Module-A vessels

Clearly, the starting time of temperature rises of Module-A cavity vessels are earlier than the time for Module-C cavity vessels.



He gas flow by evaporation

June 16

F102=9.50 m3/h @ L102=75.4%

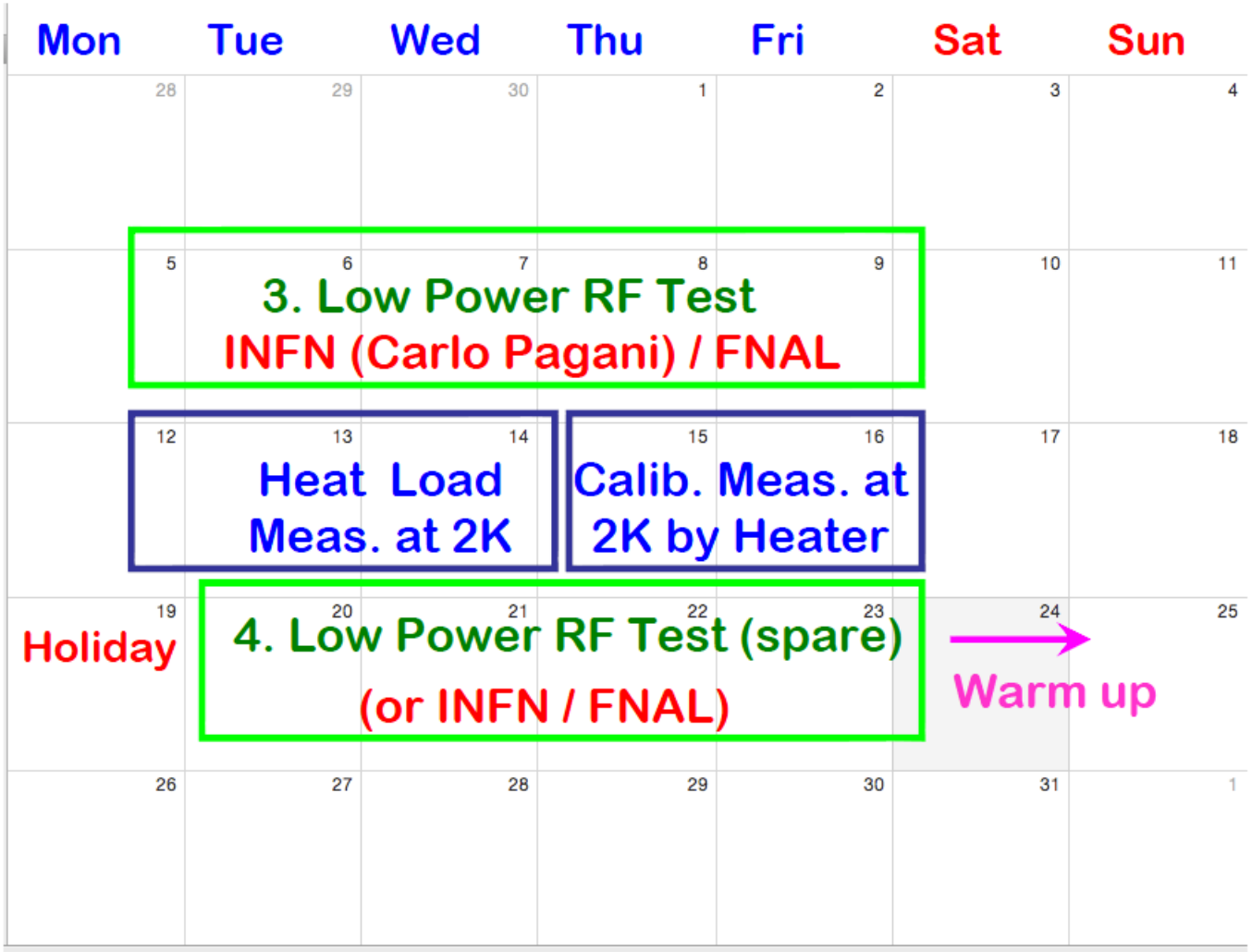
Q=9.10 W

June 17

F102=9.07 m3/h @ L102=75.4%

Q=8.69 W

July, 2010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3. Low Power RF Test
INFN (Carlo Pagani) / FNAL
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Heat Load
Meas. at 2K
Calib. Meas. at
2K by Heater
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Holiday
4. Low Power RF Test (spare)
(or INFN / FNAL)
Warm up
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S1-GLOBAL

Frequency change during cool-down

[MHz]

	Cavity	room temp.	Δ *fo*	4.2 K	Δ*fo*	2.0 K
1.	C1/AES-004	1297.989	1.959	1299.948	0.168	1299.780
2.	C2/ACC-011	1297.974	1.949	1299.922	0.157	1299.766
3.	C3/Z-108	1297.768	1.977	1299.745	0.044	1299.701
4.	C4/Z-109	1297.755	1.986	1299.741	0.045	1299.697
5.	A1/MHI-05	1297.793	1.990	1299.784	0.310	1299.473
6.	A2/MHI-06	1297.806	1.978	1299.784	0.300	1299.483
7.	A3/MHI-07	1297.664	1.977	1299.641	0.127	1299.514
8.	A4/MHI-09	1297.885	1.984	1299.869	0.184	1299.684

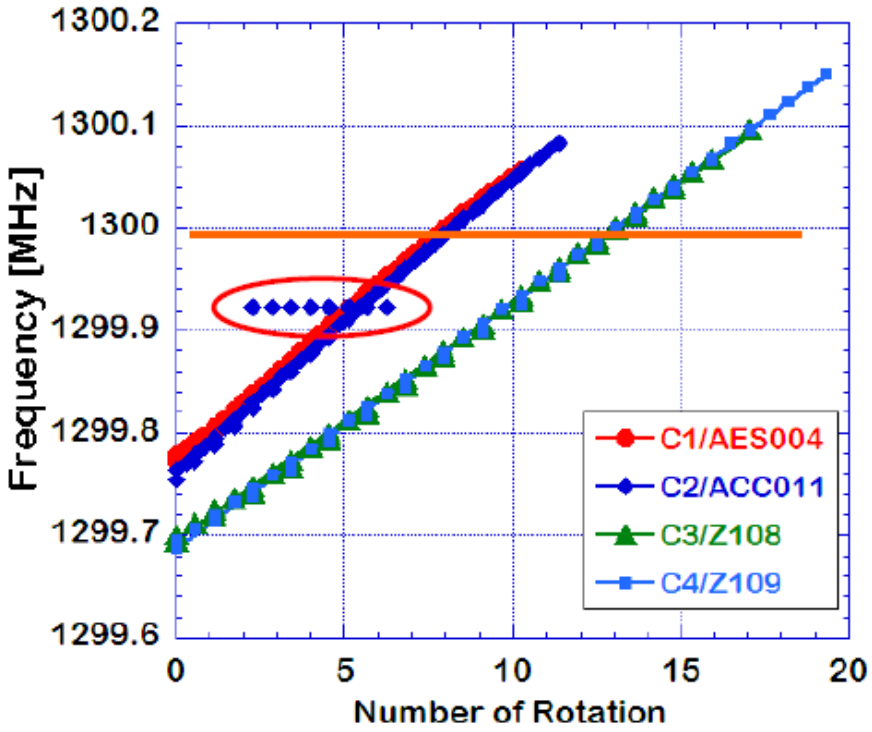
Δ *fo* (300K - 4.2K) = 1.95 ~ 1.99 MHz

Δ*fo* (4.2K – 2.0K) = -160 kHz (blade) , -45 kHz (Saclay)

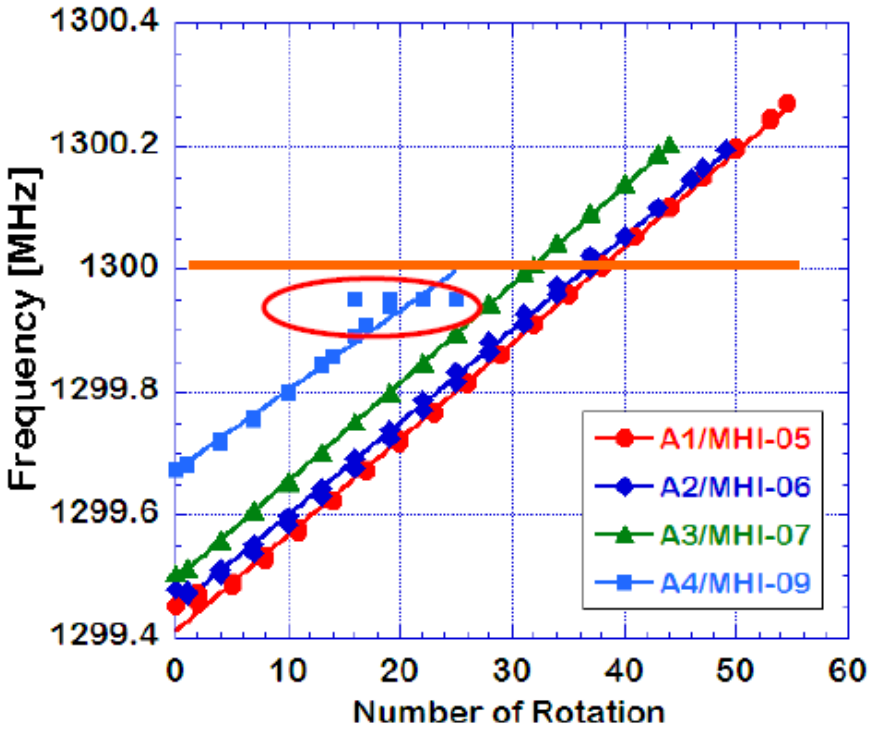
-305 kHz (Slide-jack/center) , -155 kHz (Slide-jack/end)

Stroke of Motor Tuner

Cryomodule - C



Cryomodule - A



Trouble of two motor tuners occurred in C2/ACC011 (Blade) and A4/MHI-09 (Slide-Jack/end) !!

Summary (from Y. Pischalnikov)

FNAL Cavities (AES04 &ACC11)

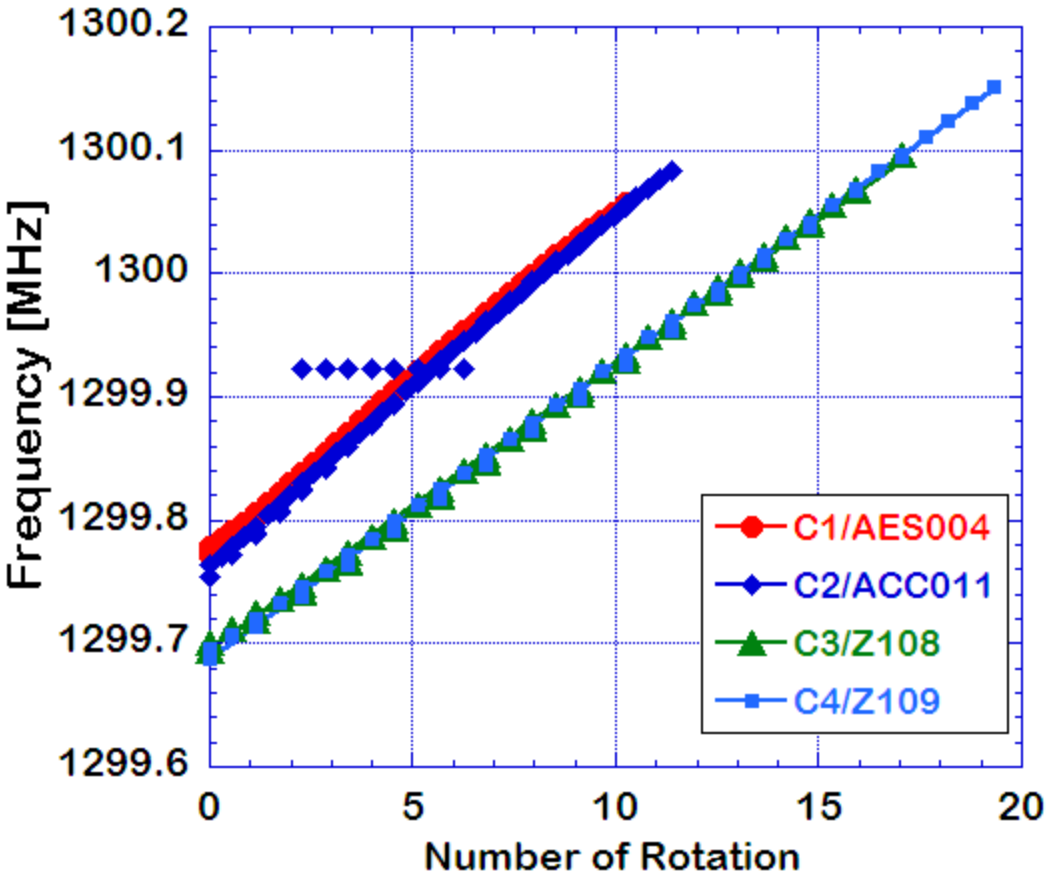
C1/AES04 –OK

C2/ACC11:

Slow Tuner after several cycles stuck at Frequency 1299.92MHz

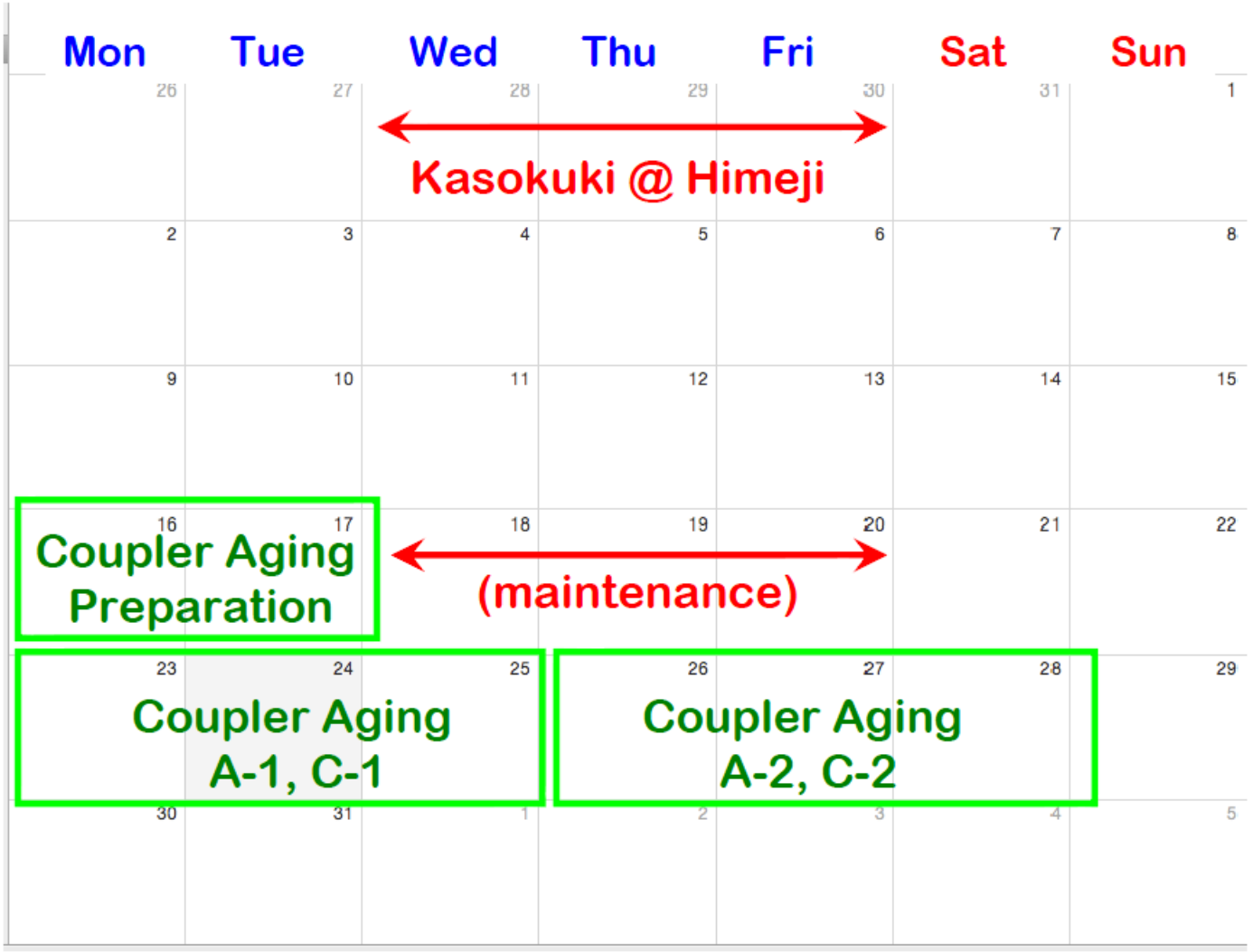
One piezo –limit NV=100V →

DF=530Hz (this maybe not enough for Eacc~30MV/m)



Looks like stepper motor is rotating,
But gear box/screw is stuck

August, 2010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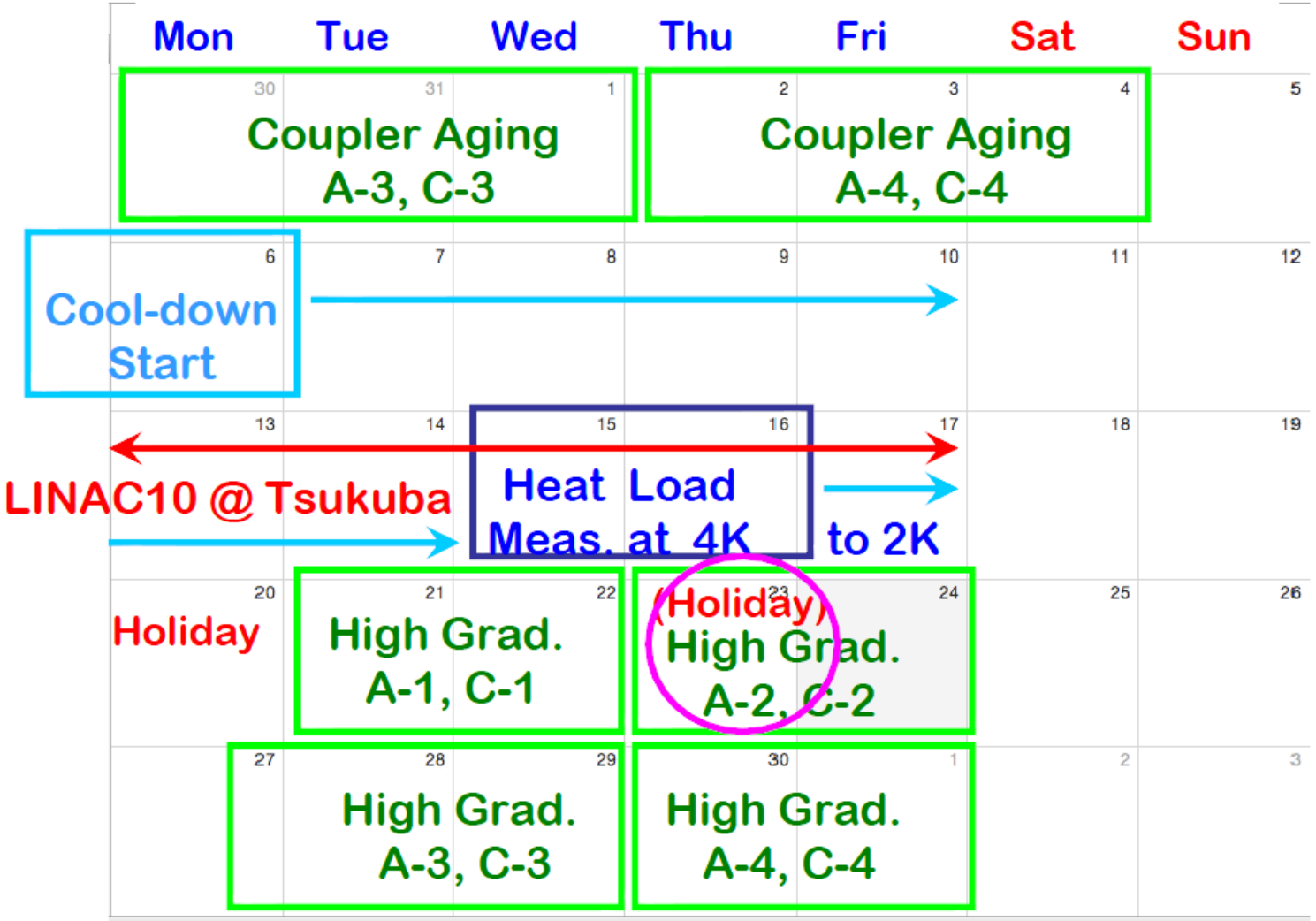
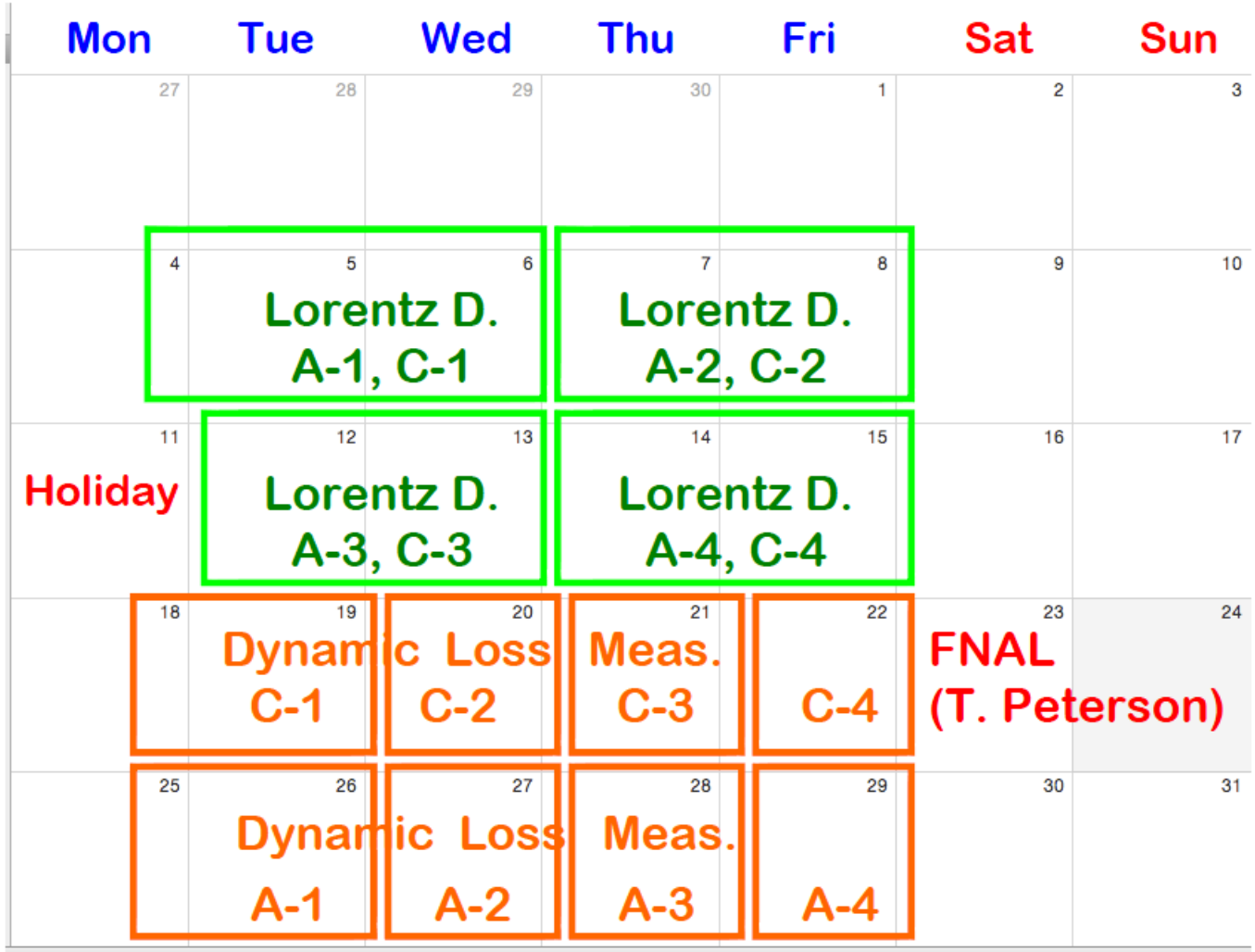
Kasokuki @ Himeji
Coupler Aging Preparation
(maintenance)
Coupler Aging A-1, C-1
Coupler Aging A-2, C-2

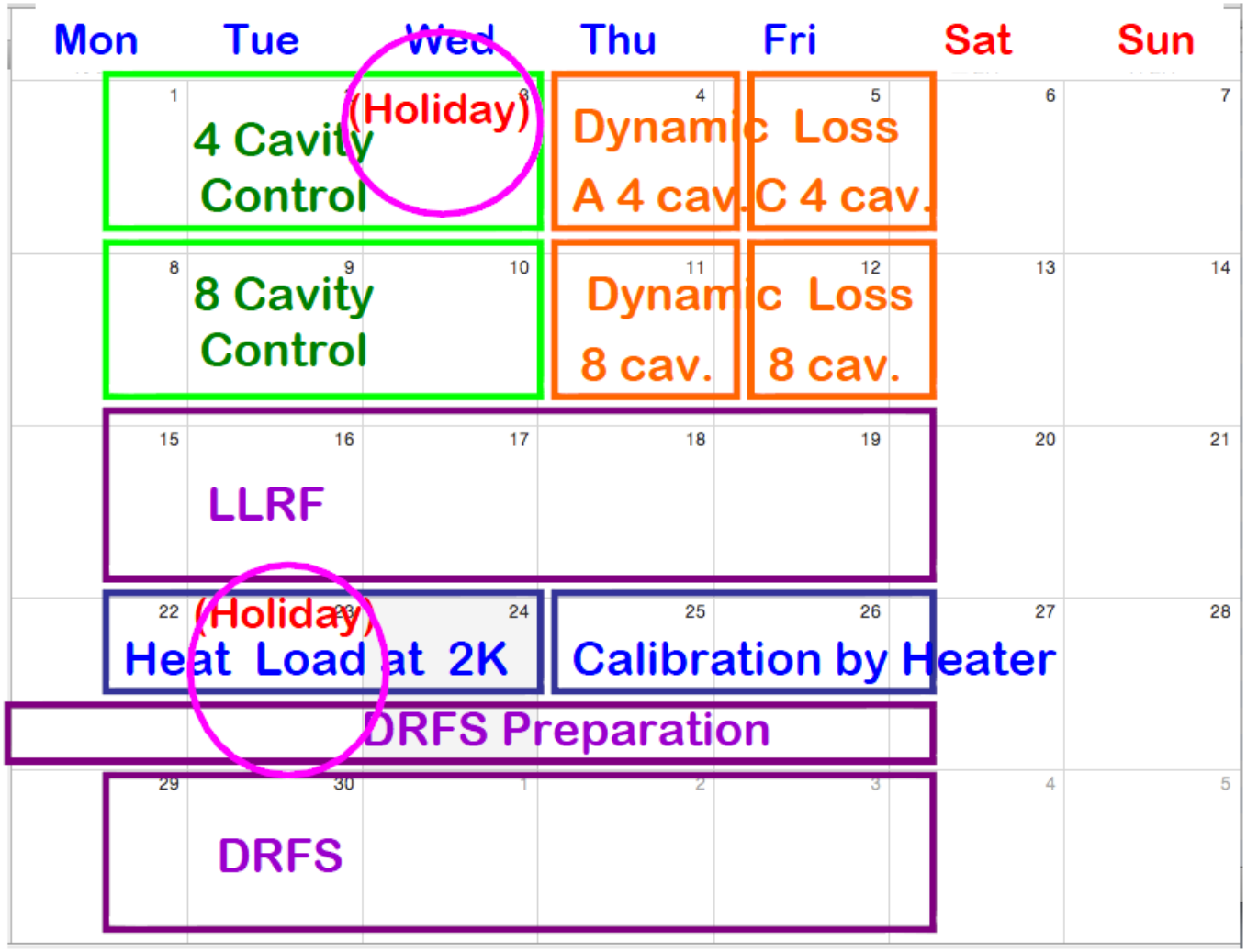
September, 2010



October, 2010



November, 2010



Summary

- S1 Global assembly and initial cooldown and tests proceeding well and according to schedule set ~7 months ago
- Though gradient goal will more than likely not be reached, components and instrumentation provide opportunities for comparisons and measurements not available on the same timescale as other tests
- ILC is supporting visits (check w/ Dept Head for conflicts, priorities, etc!)