

S1-G Cryomodule Thermal Tests (June 8 – July 16)

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1. Thermal measurements and schedule

- **Scheduled test period for thermal measurements**
 - 1 week before summer shut down
 - Preparatory measurement of the static heat load of the Module-A and C
 - 3 weeks after summer shut down
- **Heat load measurements**
 - Heat loads of the modules are mainly measured by the mass flow rate of evaporated 2K LHe.
 - Static heat load of Module A and C
 - Dynamic heat load of DESY, FNAL and KEK cavities at the average gradient of 31.5 MV/m
 - Heat loads at 4K are measured during the cool-down of modules (back-up measurement).
- **Temperature profile**
 - The temperature profiles of the components are automatically measured during all test period.
 - Cool-down and warm-up stages (two times)
 - Operating conditions of cavities.
 - Temperature measurement by Cernox, PtCo and CC.
- **Position change of cavities and GRP during cold test**
 - Positions of KEK cavities by Wire Position Monitor (WPM)
 - Positions and deformations of GRPs of Module A and C by WPM and strain gauges
 - Positions of GRP of Module A by Laser Position Monitors
 - The measurement will be performed in the first experimental term. In the second term, the holes on the vacuum vessel and 80K shield are closed for the heat load measurements.

Heat load measurements @4K

Mon	Tue	Wed	Thu	Fri	Sat	Sun
June 7	Cool-down by 90K helium gas				Cooling 80K shields down to LN2 temp.	Non-cooling cryomodule
	Cooling 80K shields with LN2 until 22:00					
June 14	Cool-down by LHe	Heat load meas. at 4K				
1. Supplying LHe to 2K dewer in the 2K Cold Box. 2. Heat loss measurement at the 2K CB. 3. After the measurement, continuing cooling Modules with LHe.	1. Cooling Modules with LHe to 4K.	1. Heat load meas. of S1-G modules at 4K. 1-A. Heat load meas. @ 4K steady condition. 1-B. HL meas. @ 4K with heater (Calibration) Heater power: • half of HL of S1G module • HL of S1G module	<u>Repeatability</u> 1. Heat load meas. of S1-G modules at 4K. 1-A. Heat load meas. @ 4K steady condition. 1-B. HL meas. @ 4K with heater (Calibration) Heater power: • half of HL of S1G module • HL of S1G module	Pumping to 2K	Cooling 80K shields down to LN2 temp.	Non-cooling cryomodule

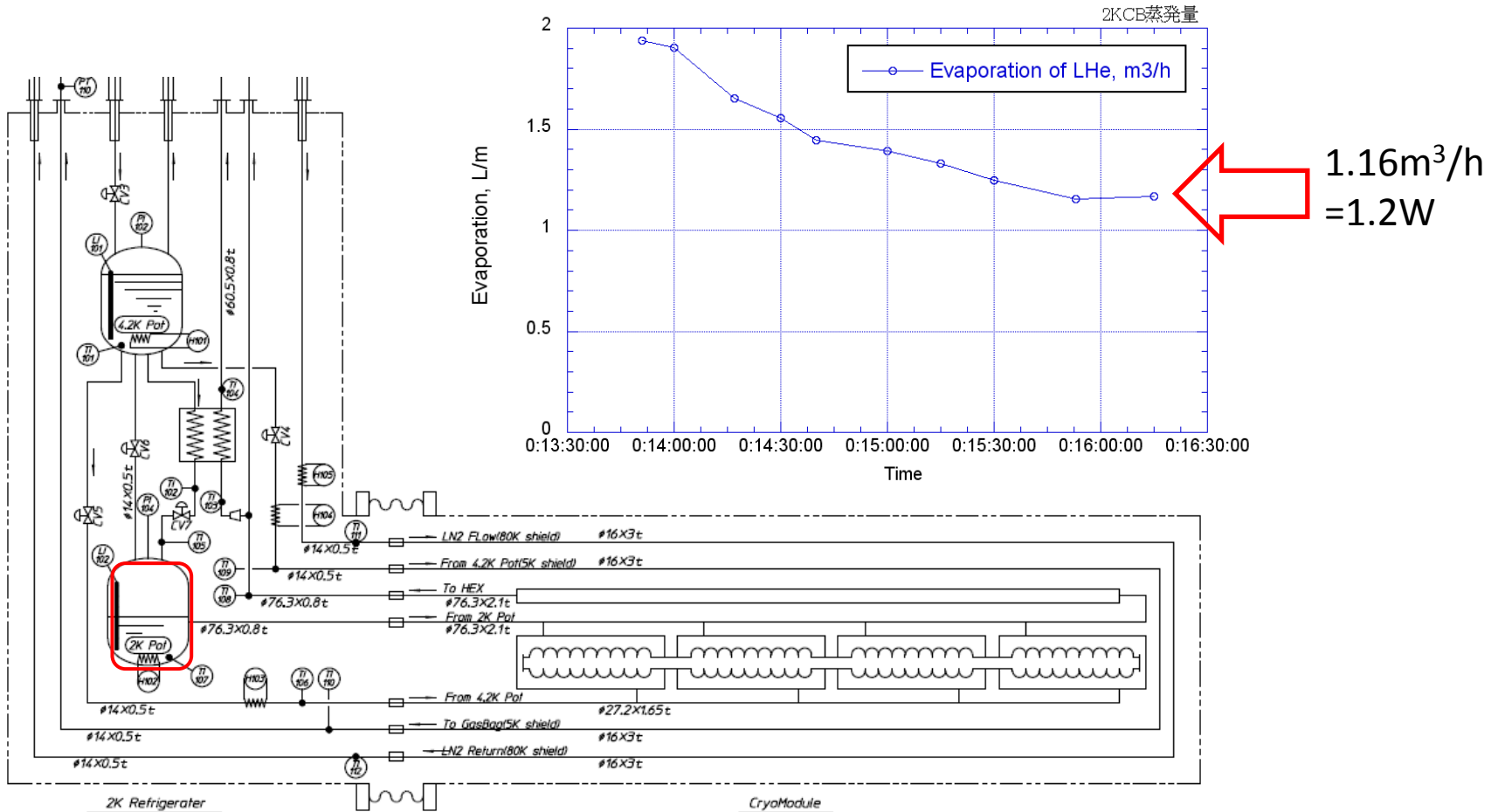
Heat load measurements @2K

Mon	Tue	Wed	Thu	Fri	Sat	Sun
<p>July 12</p> <p>Re-cooling to 2K</p> <p>1. Supplying LHe and cooling down to 2K. 2. Heat loss meas. of S1G module at 2.5 K while cooling down to 2K . 3. After the HL meas., cooling S1G module to 2K</p>	<p>Heat load meas. at 2K</p> <p>1. Cooling S1G module to 2.5K. 2. Heat loss meas. of S1G module at 2.5 K while cooling down to 2K . 3. After 2.5K HL meas., cooling S1G module to 2K. 4. HL meas. @ 2K. 5. Evaporating LHe in 2K dewer of 2K CB. Measuring HL of GRP. 6. HL meas. of S1G module. 7. Supplying LHe and cooling to 2K.</p>	<p>Calibration meas. at 2K by heater</p> <p>1. Cooling S1G module to 2.5K. 2. Heat loss meas. of S1G module at 2.5 K. 3. After 2.5K HL meas., cooling S1G module to 2K. Calibration meas. 3-A. Heat load meas. @ 2K steady condition. 3-B. HL meas. @ 2K with heater (Calibration) Heater power: • half of HL of S1G module • HL of S1G module 4. Supplying LHe and cooling to 2K.</p>	<p>Heat load meas. at 2K</p> <p>1. HL meas. @ 2K. 2. Evaporating LHe in 2K dewer of 2K CB. Measuring HL of GRP. 3. HL meas. of S1G module. 4. Supplying LHe and cooling to 2K.</p>	<p>Heat load meas. at 2K</p> <p>1. HL meas. @ 2K.</p>	<p>Pumping to 2K</p> <p>Cooling 80K shields down to LN2 temp.</p>	<p>Non-cooling cryomodule</p>


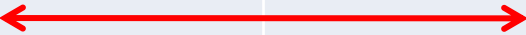
Heat Load Measurements at 4K

Heat load at 2K Pot in the 2K Cold Box: $Q = 1.2 \text{ W}$

Heat load of S1G cryomodule, 2K Pot and connection pipe: $Q = 8.7 \text{ W}$ (June 17)



Static heat load measurements at 2 K

	July 12	July 13	July 14	July 15	July 16
Cooling 80K shield by LN2	Cooling stopped at 10 pm	Cooling continued from 8 am 	Cooling all day long	Cooling continued till 17 pm	Cooling started from 8 am
Cooling 5Kshield and cavities by LHe	Cooling stopped 6:30 pm	Cooling stopped at 7:30 pm	Cooling continued from 8 am 	Cooling stopped at 5 pm	Cooling started from 3 pm
Heat load at 2.5K	13.1 W	12.2 W	11.8 W		
Heat load at 2.0K		12.8 W	12.4 W	11.4 W 11.9 W (Once refilling LHe)	12.5 W
Heat load of S1-G cryomodule at 2.0K				7.5 W	
Calibration by heater at 2.0 K			Heat input:10.1 W Measured:10.7 W		

The cavities and 5K shield were re-cooled at July 12.
The 80 K shield was cooled continuously till July 12.