



Operation of 2K Cryogenic System for Superconducting RF Cavities at STF

KEKB Cryogenics Group
(presented by NAKAI Hirotaka, KEK)



Overview

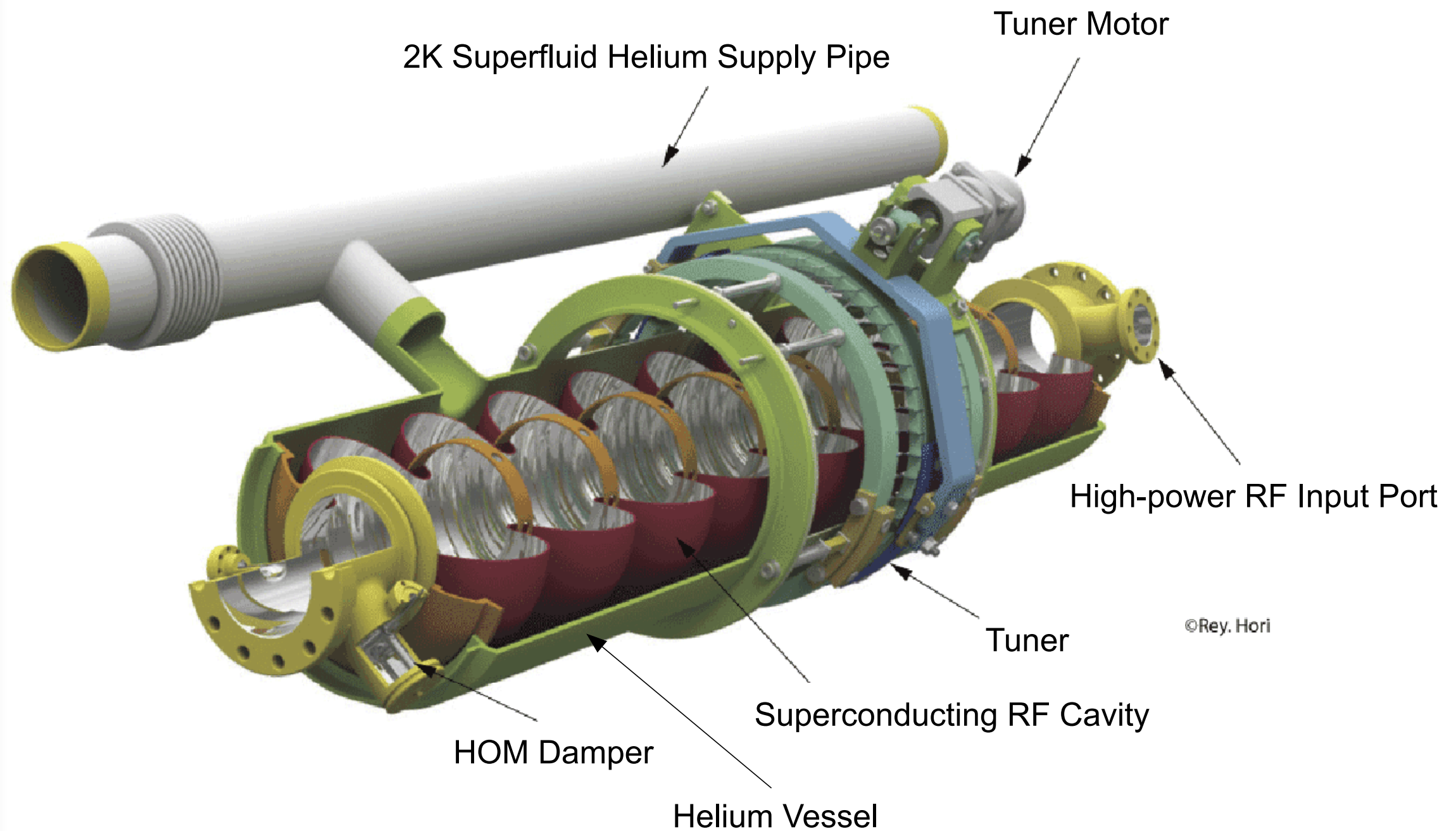
- Introduction of ILC/STF (Superconducting RF Test Facility at KEK) 2K helium cryogenic system for superconducting RF cavities and cryomodules
- Operation of ILC/STF 2K helium cryogenic system (prototype)



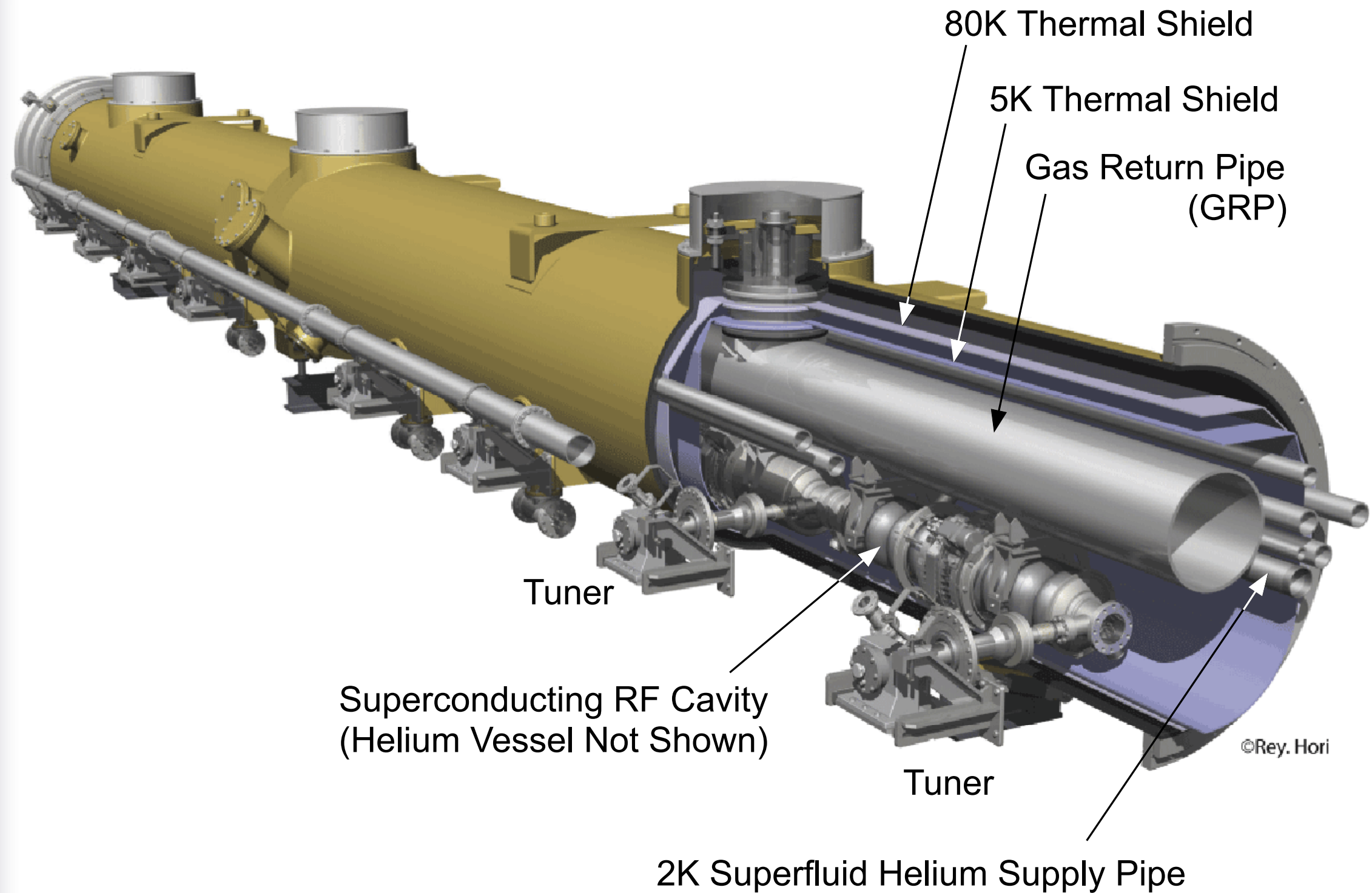
STF Phase1-Global (S1-G)

- Experimental demonstration of international collaboration (“plug-compatibility”)
- 1.3GHz 9-cell RF cavities made of niobium
- 8 cavities in 2 cryomodules
 - Cryomodule A: 4 KEK cavities
 - Cryomodule C: 2 FNAL cavities + 2 DESY cavities
- Cryogenic tests from June 2010 to Feb. 2011

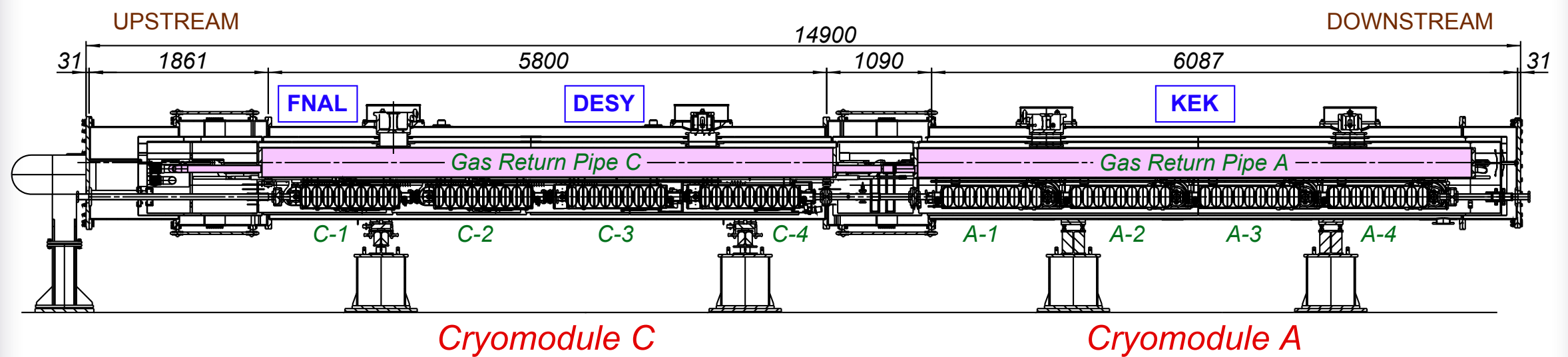
ILC/STF Superconducting RF Cavity



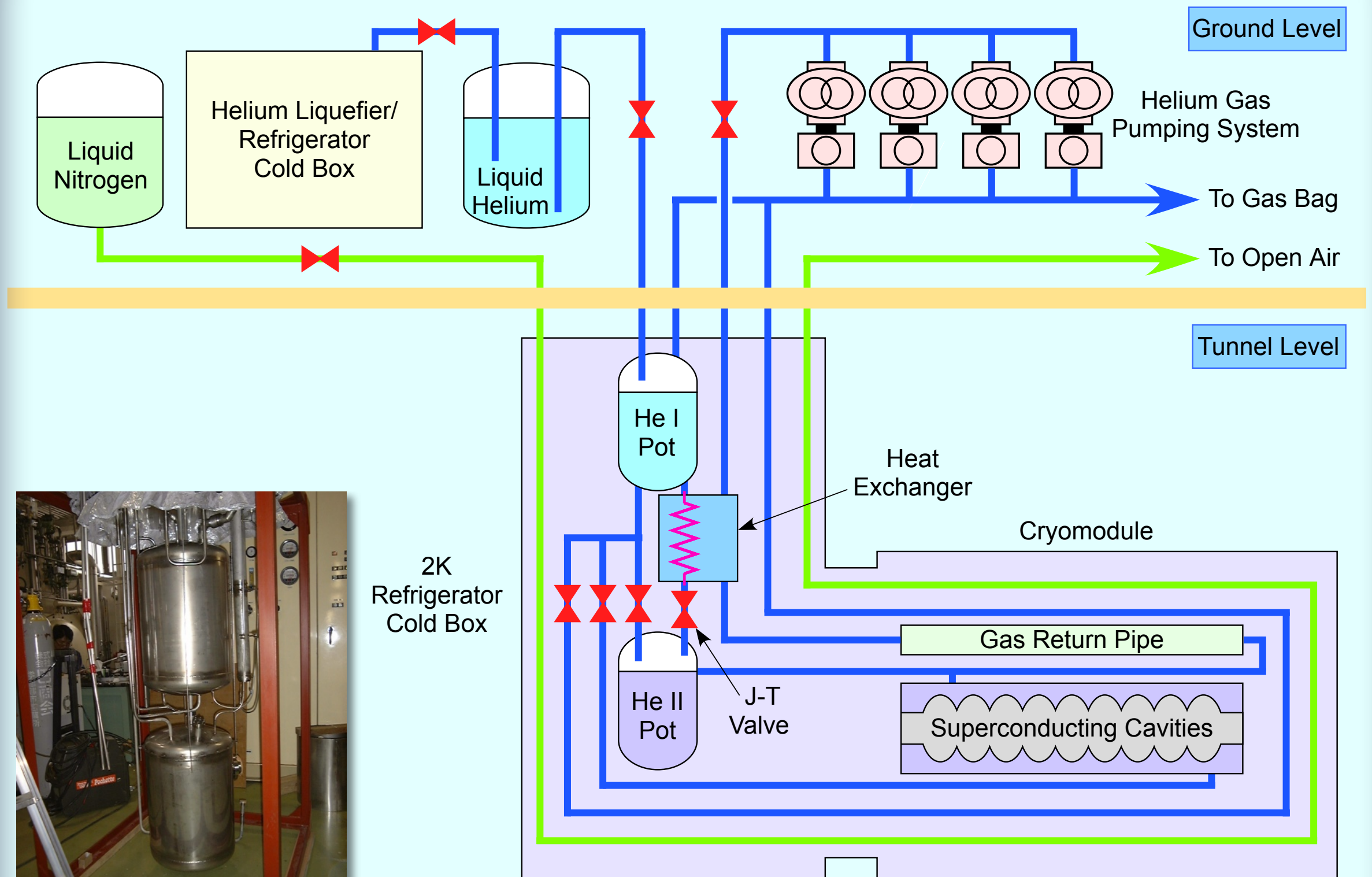
ILC/STF Cryomodule



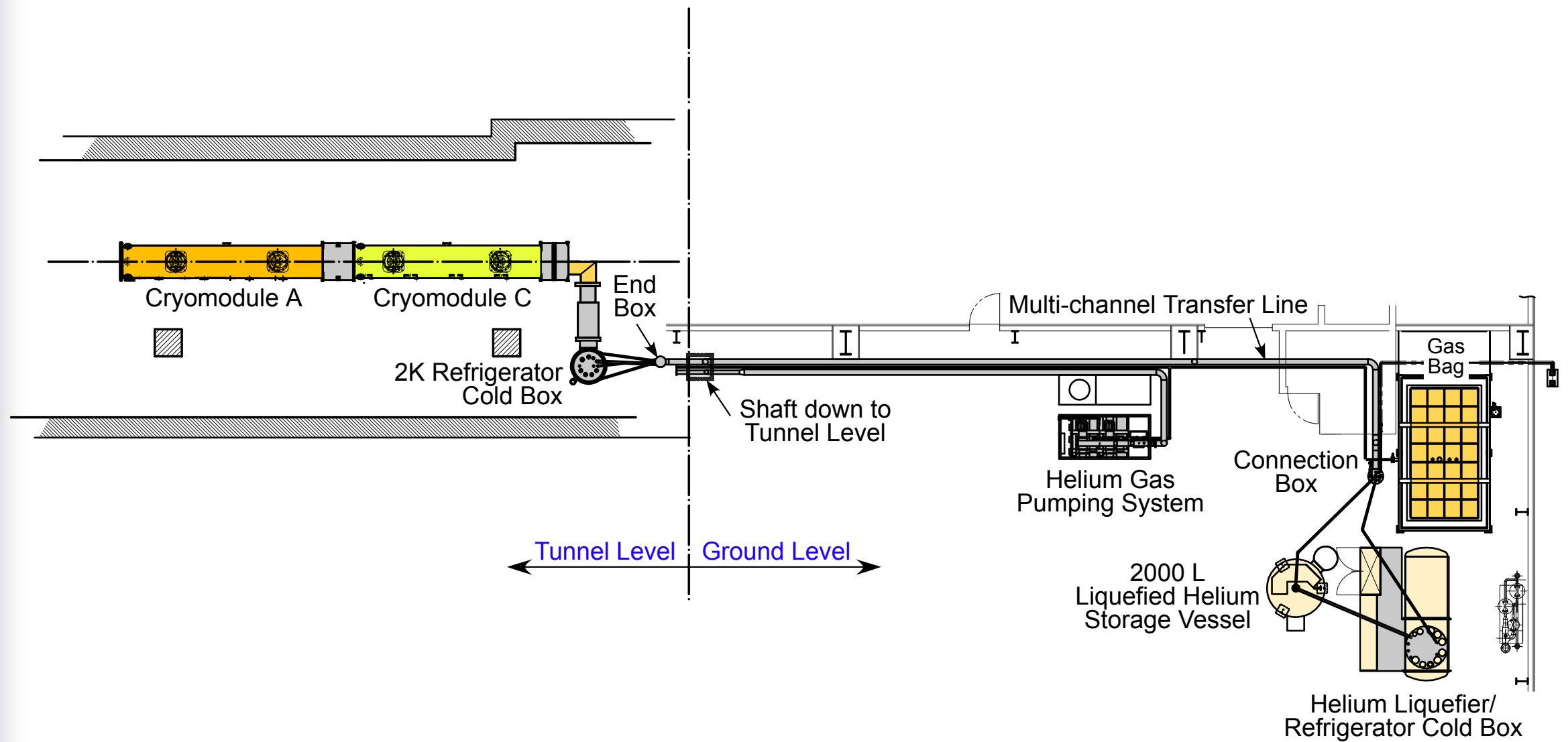
S1-G Configuration



ILC/STF 2K Helium Cryogenic System



ILC/STF 2K Helium Cryogenic System

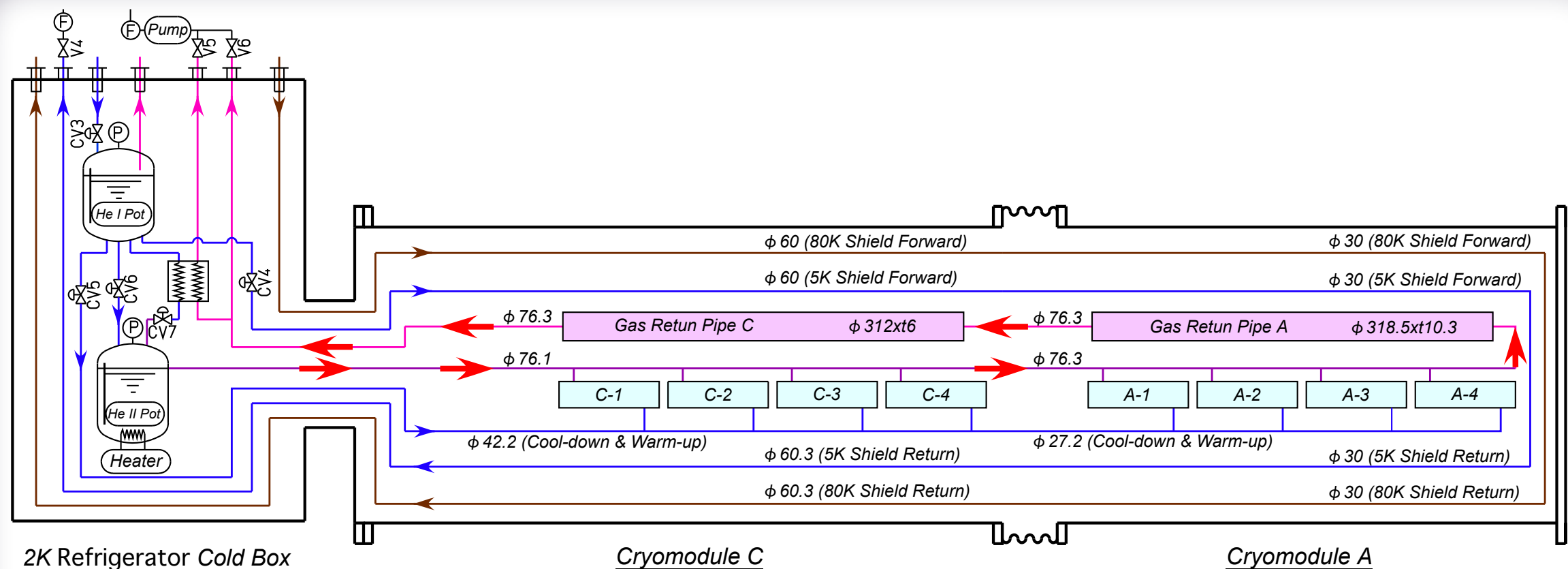




2K Helium Cryogenic System

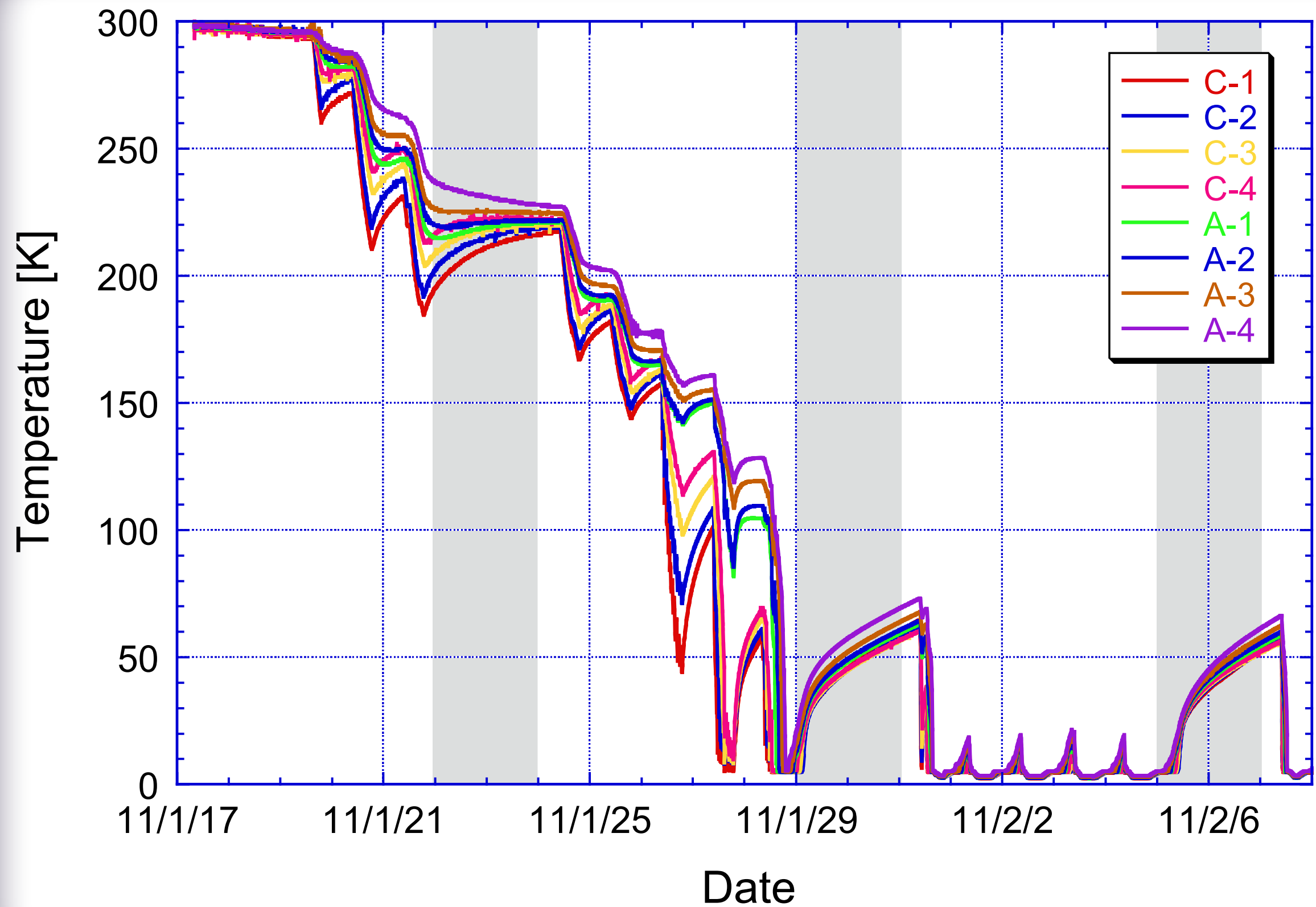
- Helium liquefier/refrigerator (TCF 200):
600 W @ 4.4 K, 250 L/h
- Measured Cooling capacity : 32 W @ 2 K
- Measured heat load @ 2 K
 - Cryogenic system: 4 W (2K cold box 1 W + transfer line 3 W)
 - Cryomodules (static): 7 W in total
 - Cryomodule A (dynamic): 7 W @ 26.9 MV/m ave.
 - Cryomodule C (dynamic): 3 W @ 20 MV/m ave.

Cooling Procedure

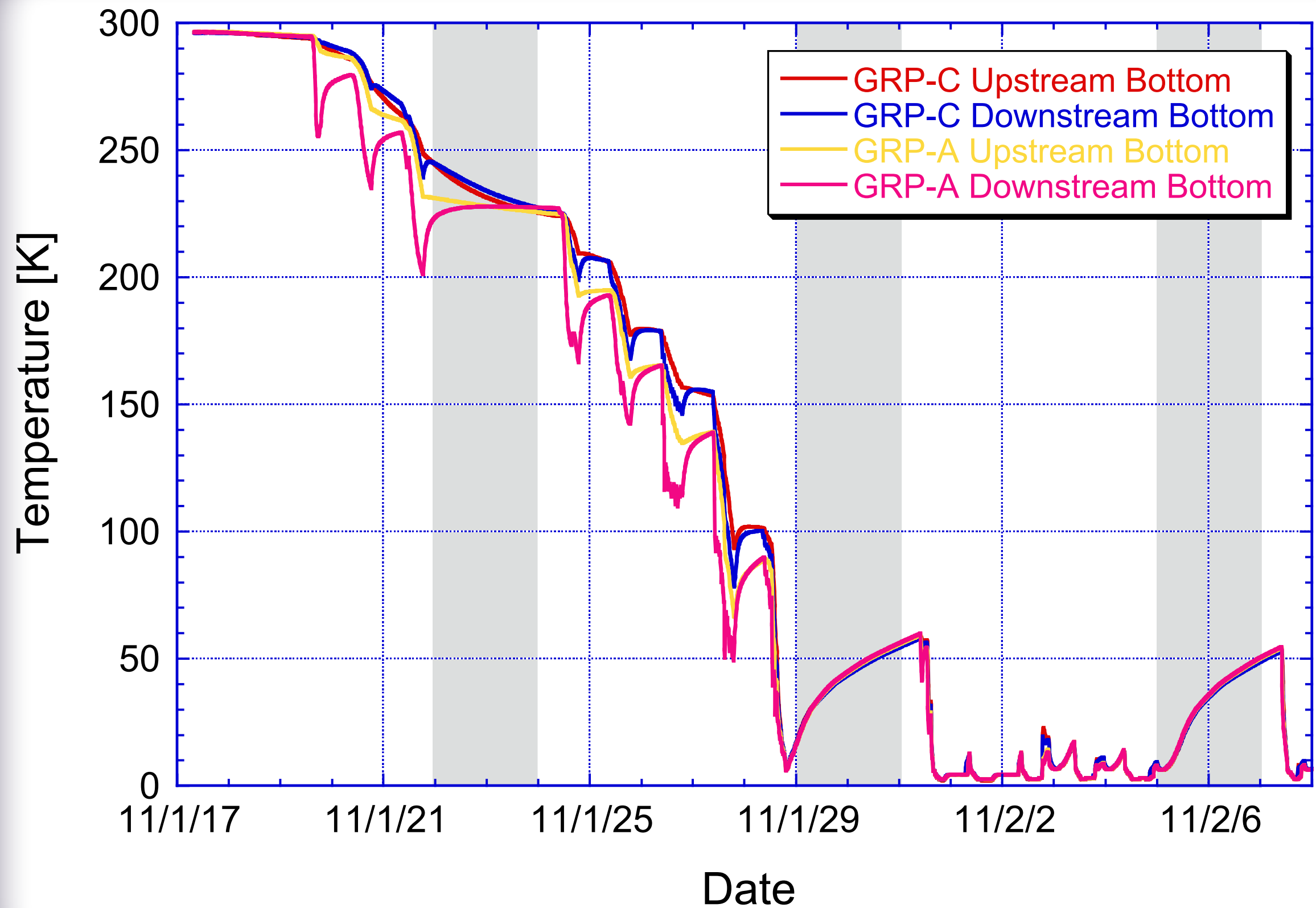


- Precooling with helium gas cooled with liquid nitrogen through precooling line down to 200 K
- Direct cooling with liquid helium through He II pot
- 5K shield with liquid helium from He I pot and 80K shield with liquid nitrogen

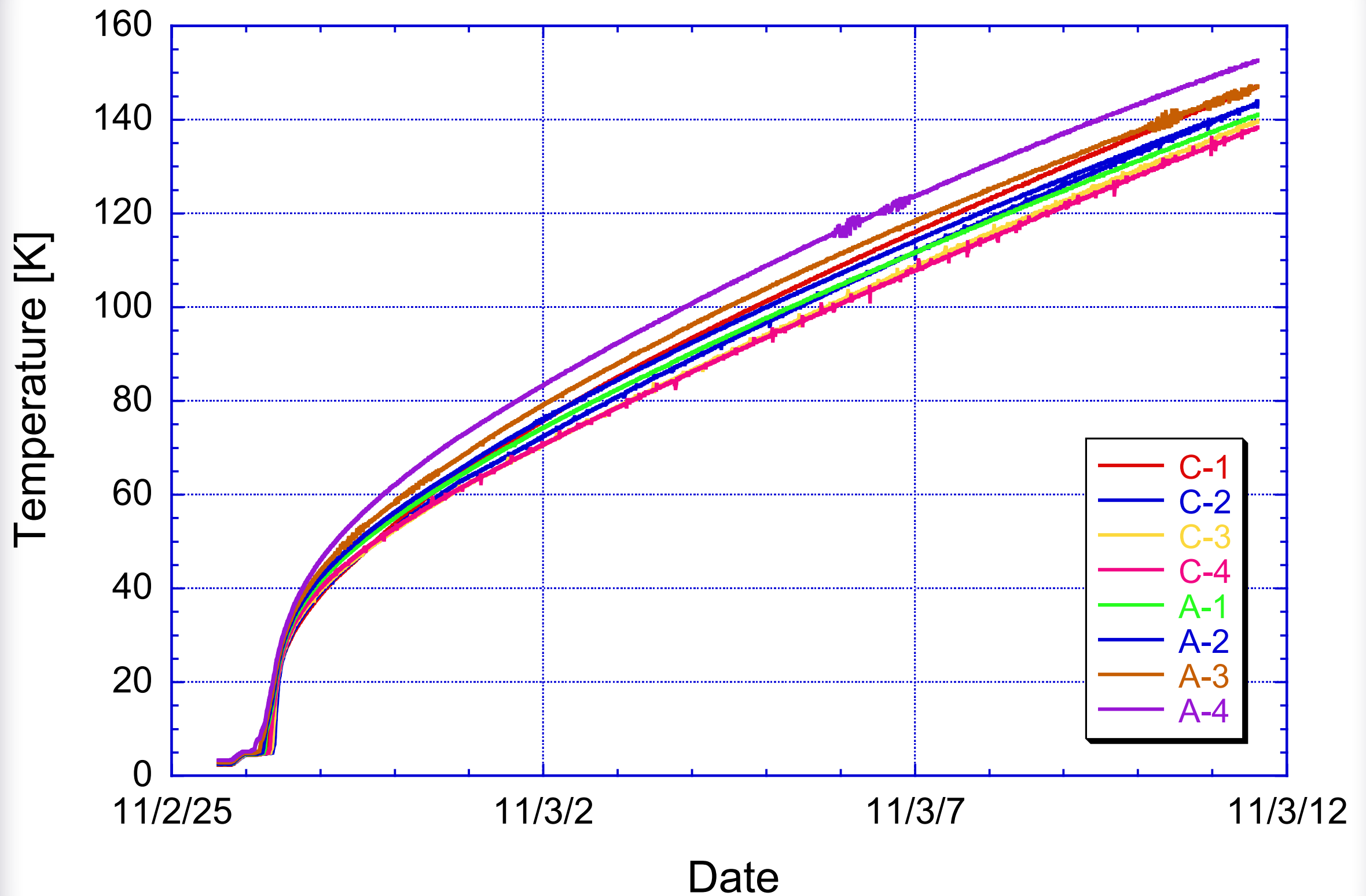
Cool-down (Liquid Helium Vessels)



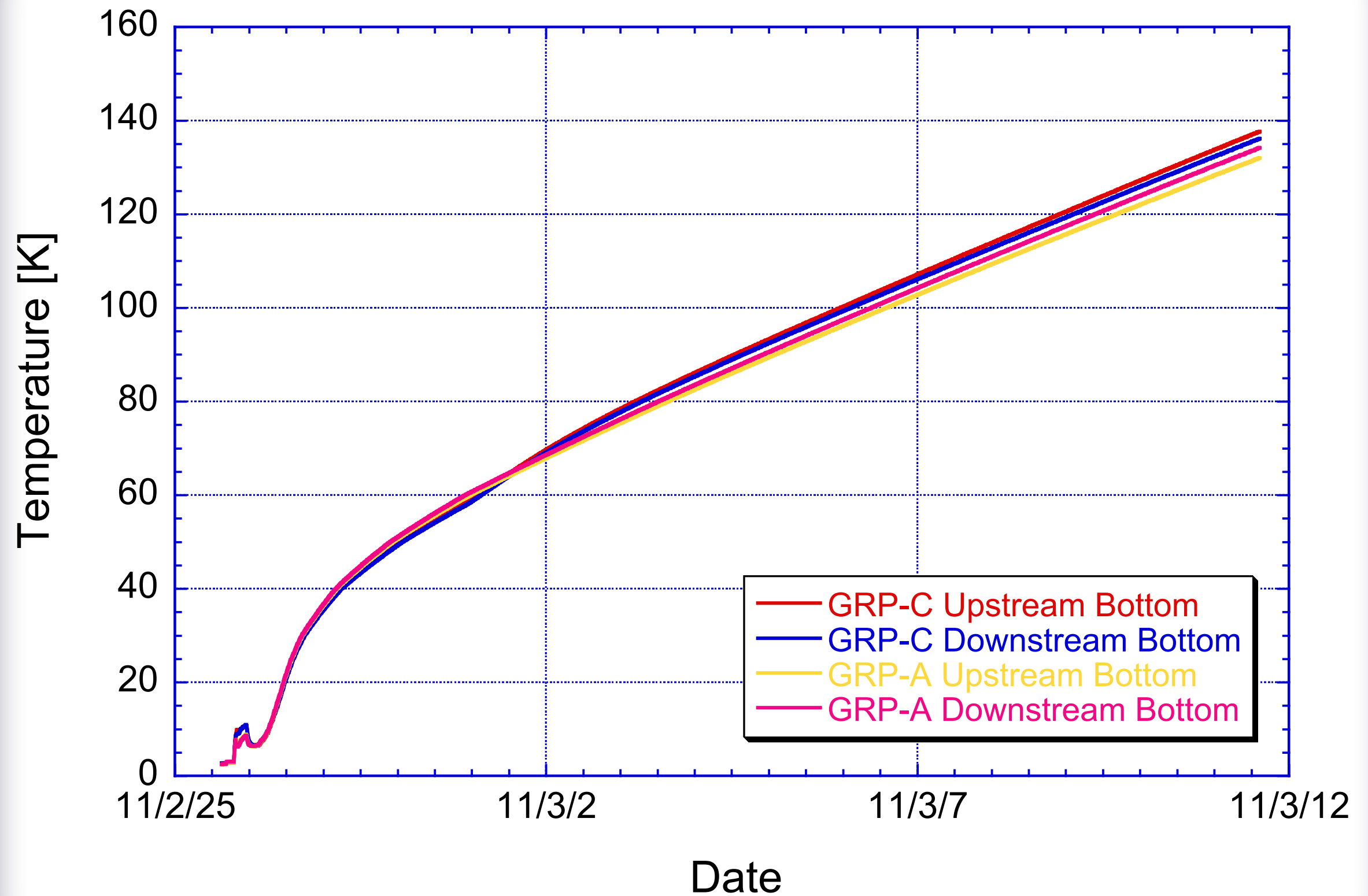
Cool-down (GRPs)



Warm-up (Liquid Helium Vessels)



Warm-up (GRPs)





Summary

- Stable long-term (but intermittent) operation of 2K helium cryogenic system at STF
- Specification of 2K cooling capacity (30 W) achieved (measured: 32 W)
- STF cavities operated with pulsed RF power, while ERL cavities with continuous wave RF power (CW): much heavier heat load to cryogenic system in ERL