



Crab Cavity: Refrigeration System

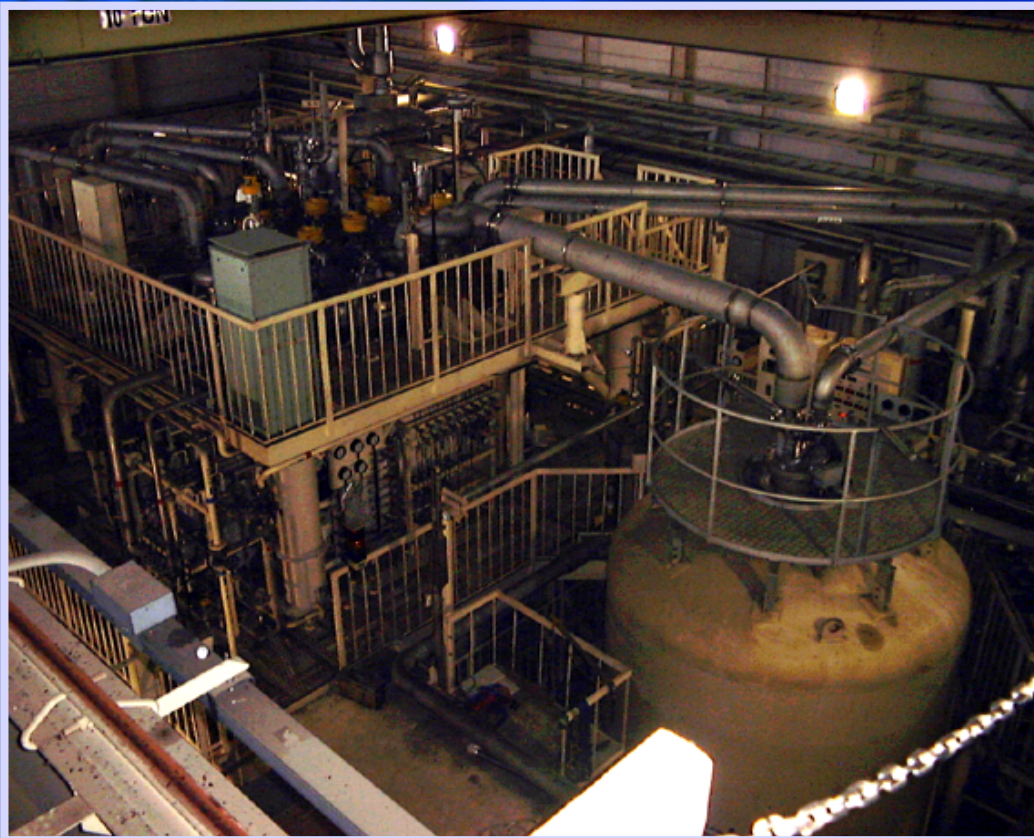
KEKB Crab Cavity R&D Group
(presented by NAKAI Hirotaka)



Overview

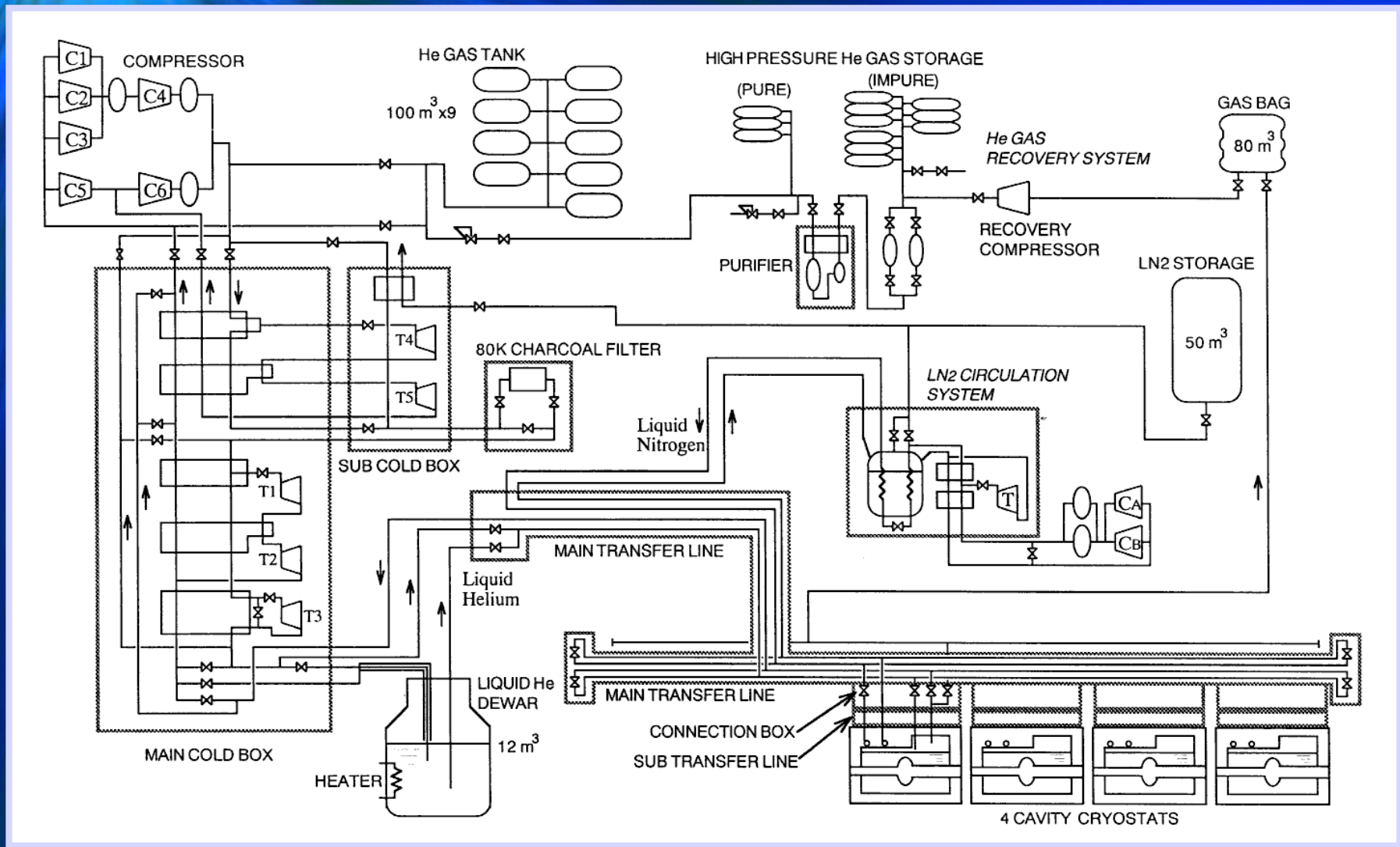
- Refrigeration system at ‘Nikko’
- Crab cavity sites in KEKB tunnel
- D10 test stand for crab cavities

Nikko Large Helium Ref. System



- Built in 1988
- 8 kW at 4.4 K (refrigeration mode)
- 1 420 L/h (liquefaction mode)

Nikko Large Helium Ref. System



Specifications

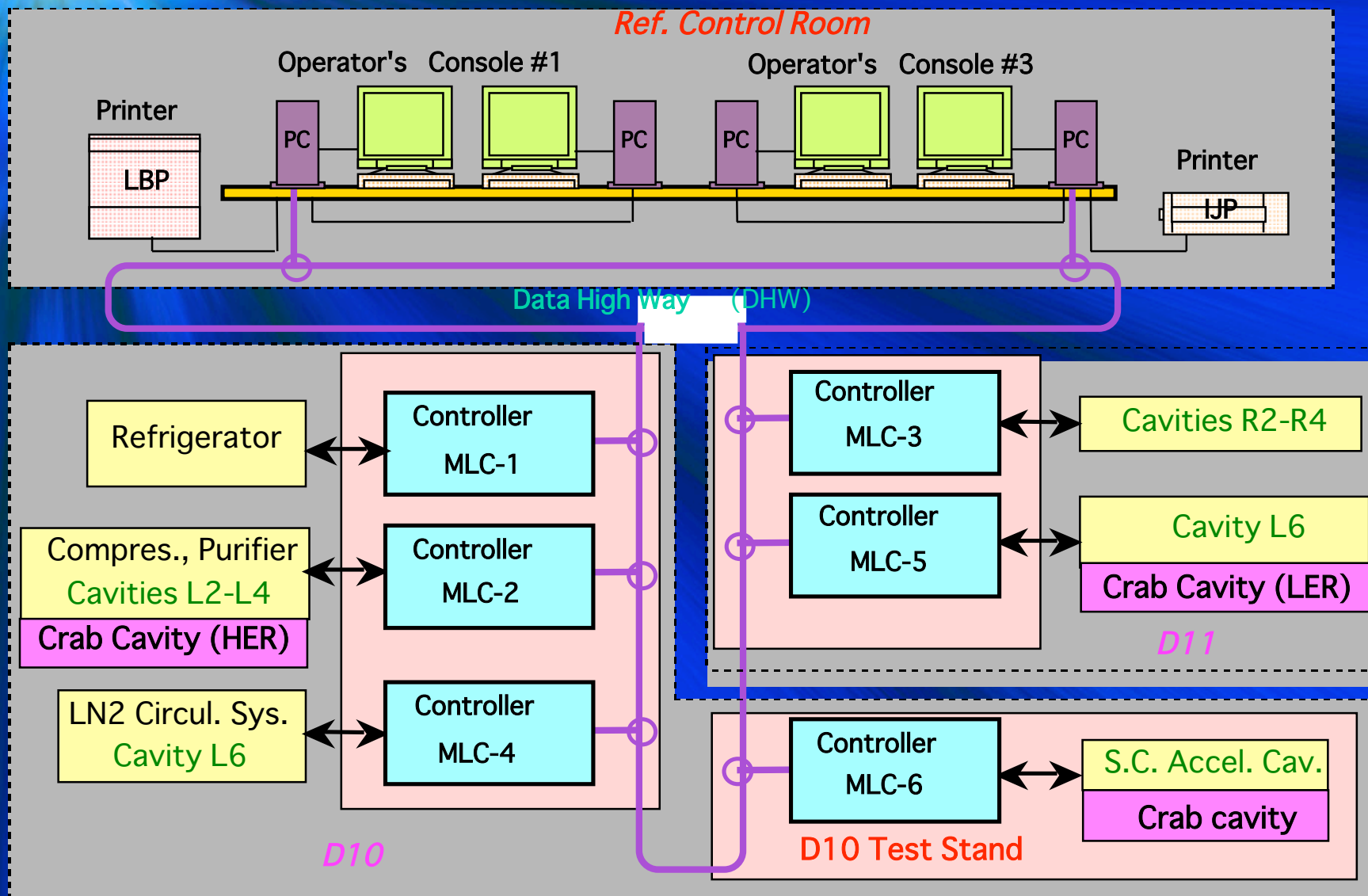
- Cold box: 8 kW at 4.4 K with 5 turbo-expanders
- Helium compressors: 10 820 + 3 825 Nm³/h
- Liquid helium storage vessel: 12 000 L
- Medium pressure gas storage: 100 m³ x 9 vessels
- Liquid nitrogen storage vessel: 50 000 L



Features

- High efficiency with supercritical turbo-expander
- High temperature turbo-expander to save liquid nitrogen
- Liquid nitrogen circulation system for 80 K thermal shield
- Inner 80 K charcoal filter for continuous & stable operation

Refrigeration Control System

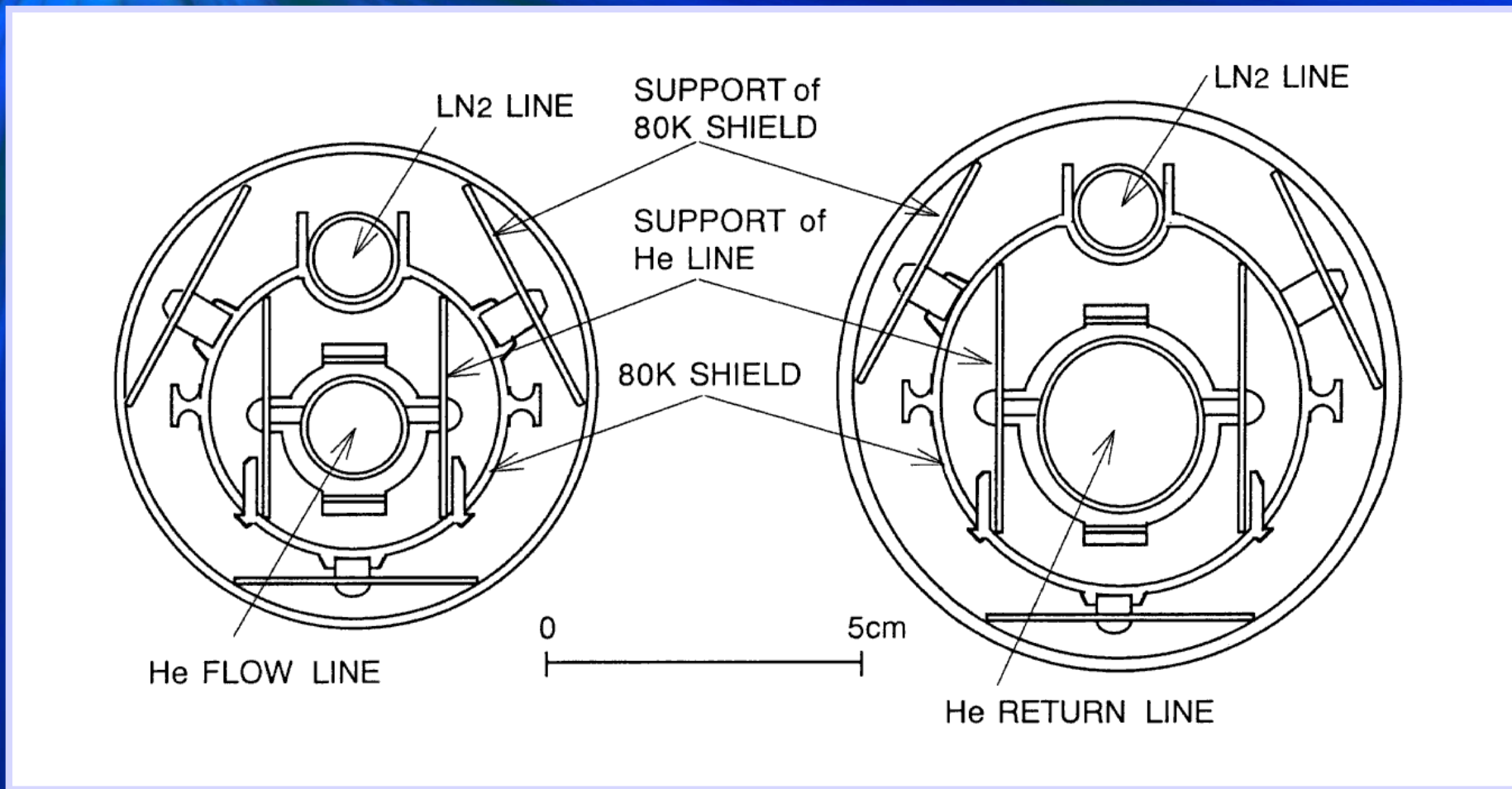




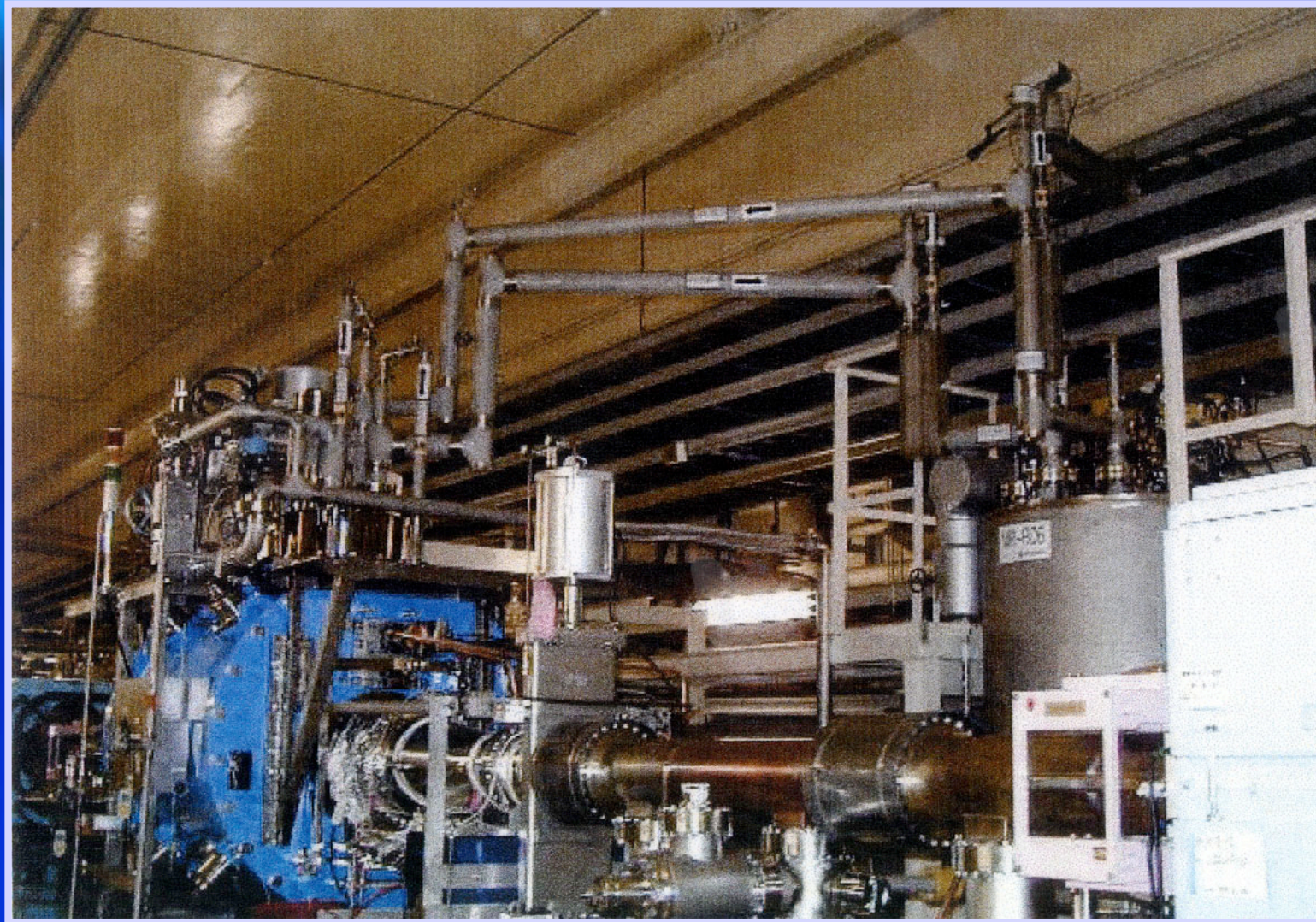
Configuration of TRISTAN

- 32 superconducting accelerating cavities in 16 cryostats (2 cavities in 1 cryostat)
- 8 cryostats at D10 tunnel (L1-L8) and 8 at D11 tunnel (R1-R8)
- Cryogenics (liquid helium and liquid nitrogen) distributed from “connection ports” to cryostats by transfer lines

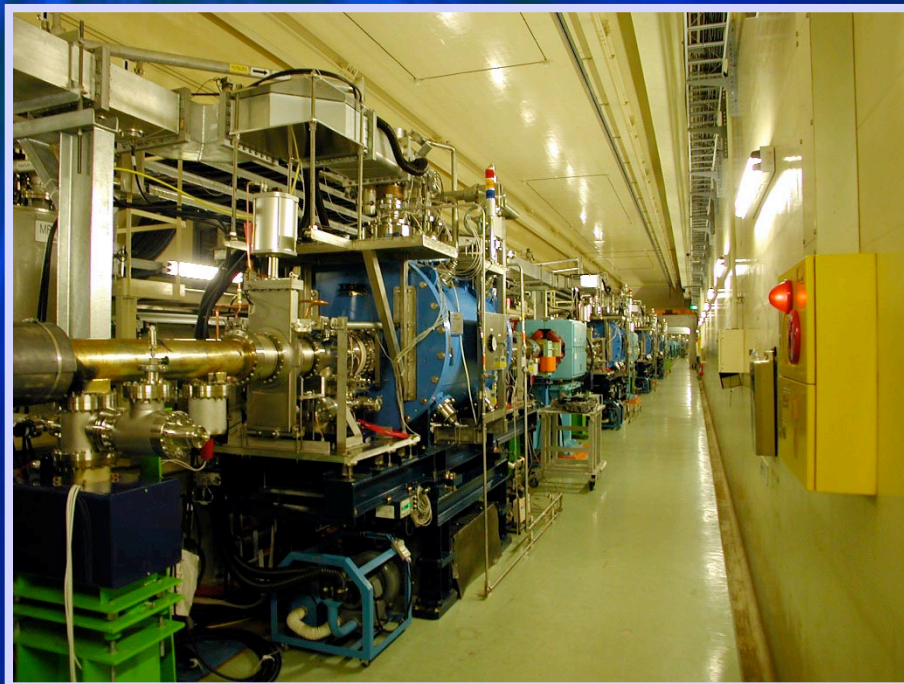
Transfer Line



Sub Transfer Lines

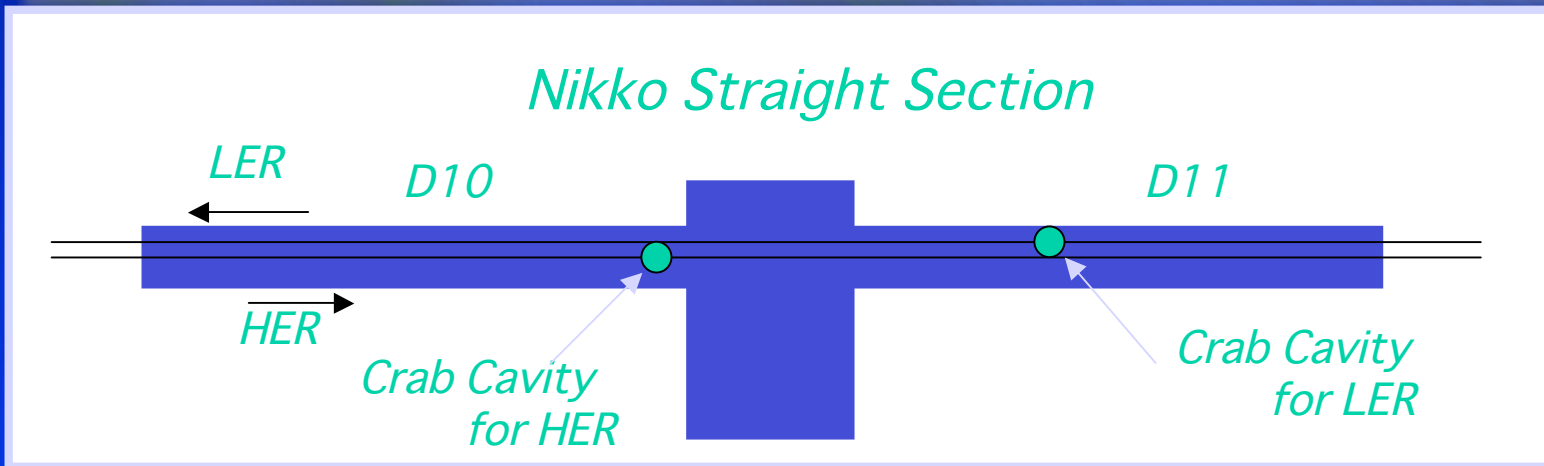
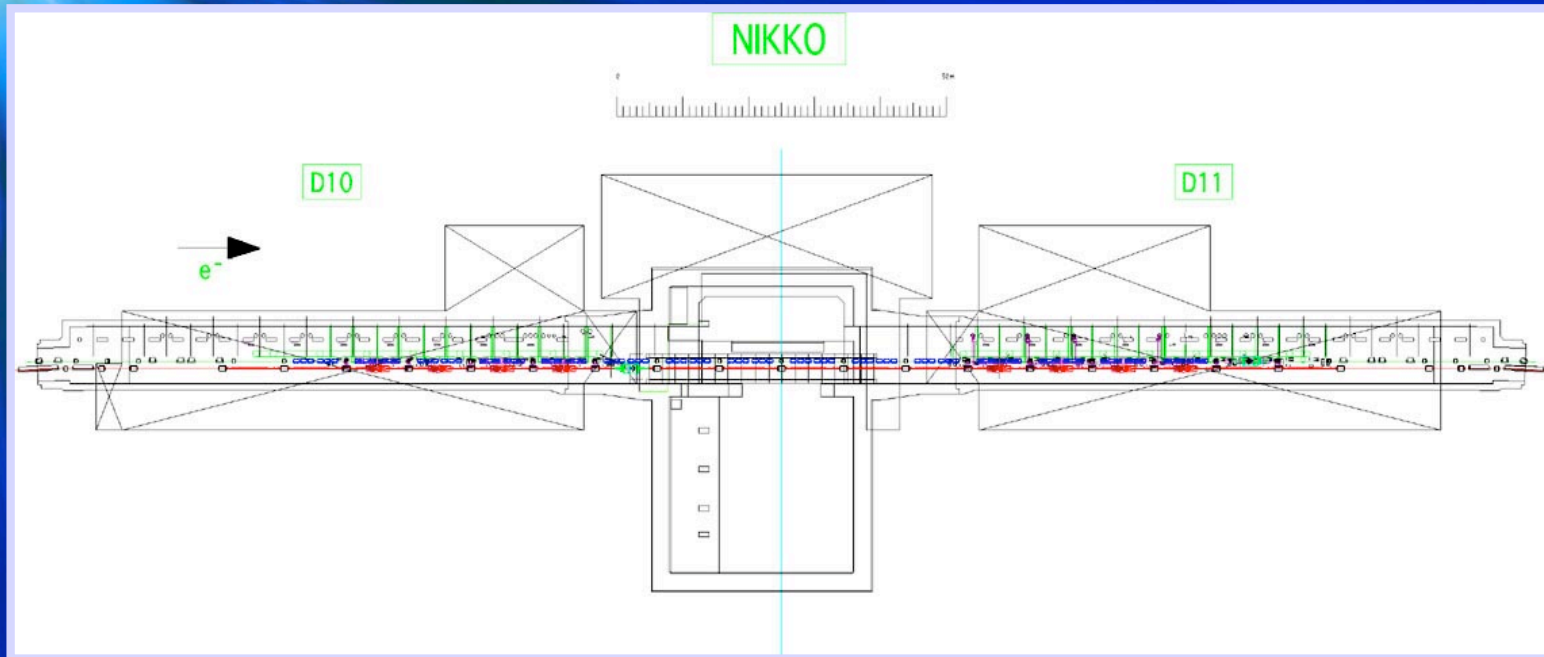


Current Configuration in KEKB



- 8 s.c. acc. cavities in 8 cryostats
- 4 cryostats at D10 and 4 at D11
- 4 “connection ports” not in use at D10 and at D11 each
- Heat load of s.c. acc. cavities ~ 3 kW

KEKB Tunnel (Nikko)

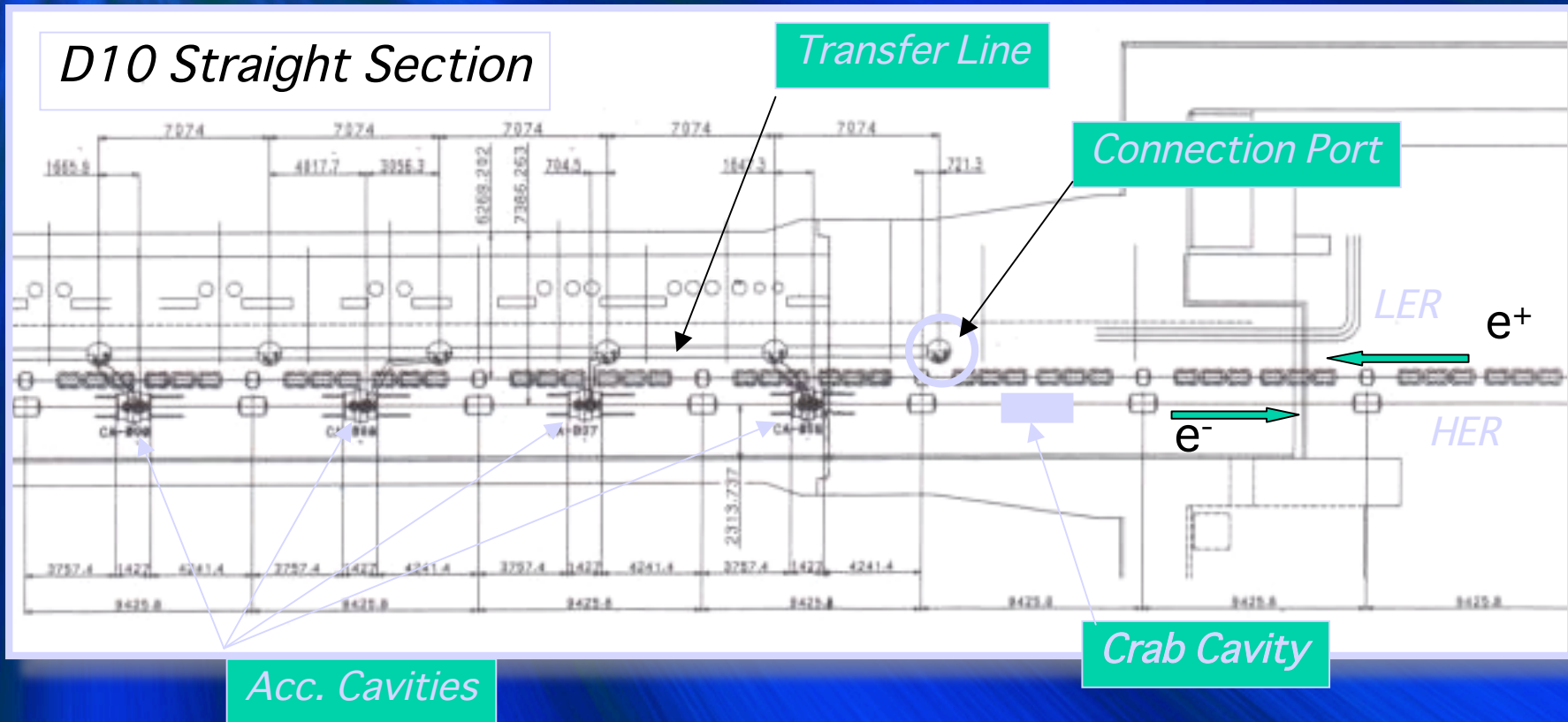


D10 Site

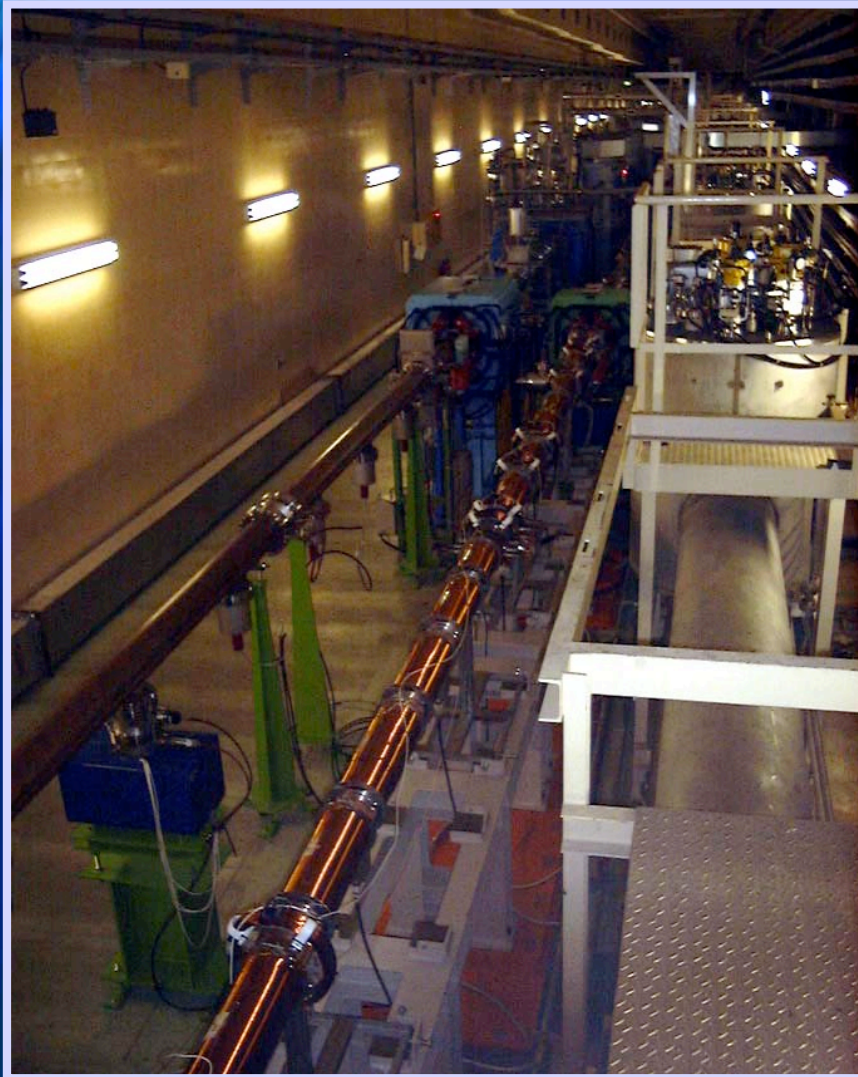


- L1 position of connection port
- Downstream of superconducting accelerating cavities

Layout of Crab Cavities at Nikko

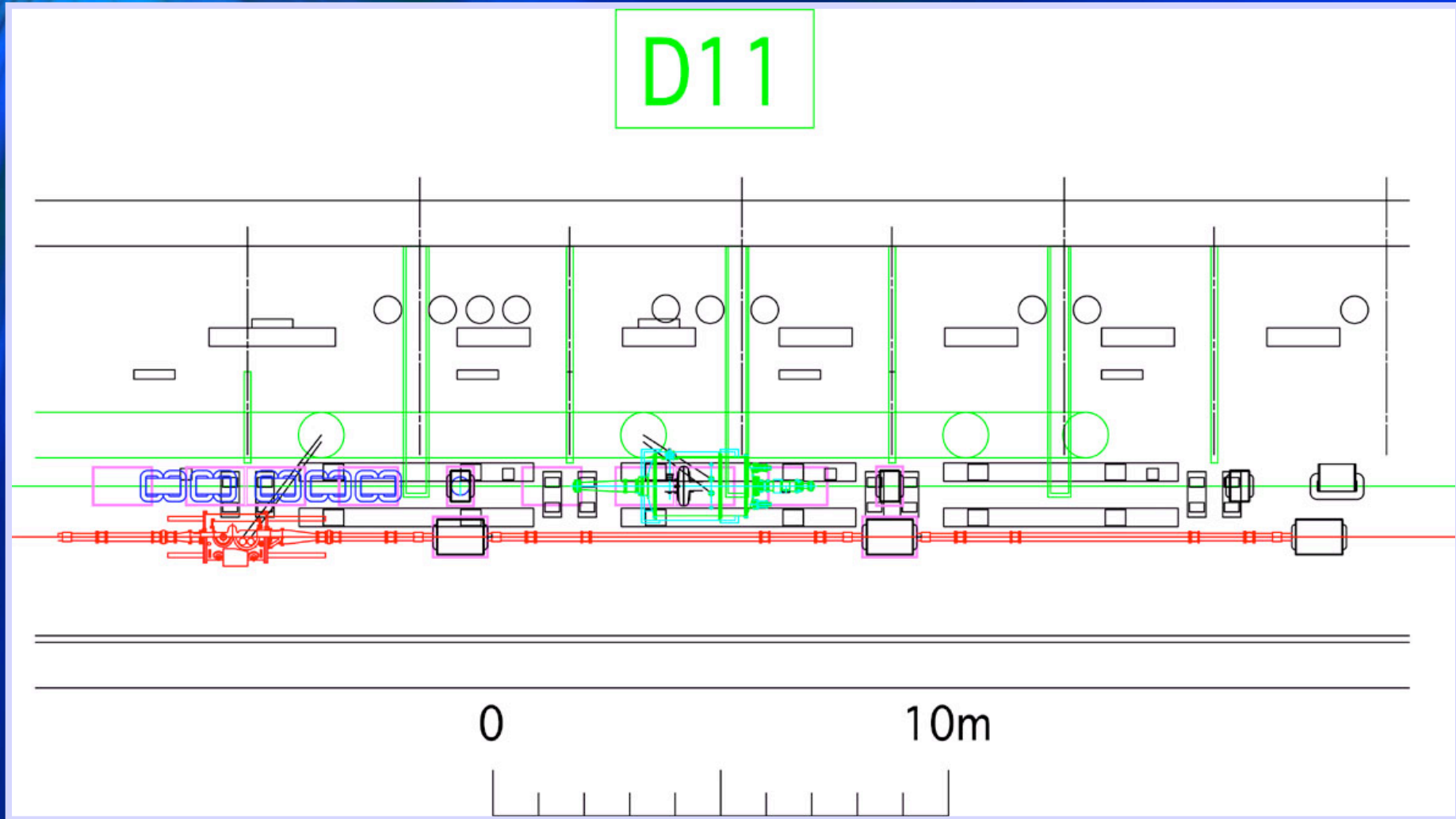


D11 Site



- R7 position of connection port
- Upstream of wiggler magnets

Crab Cavity at D11 Site

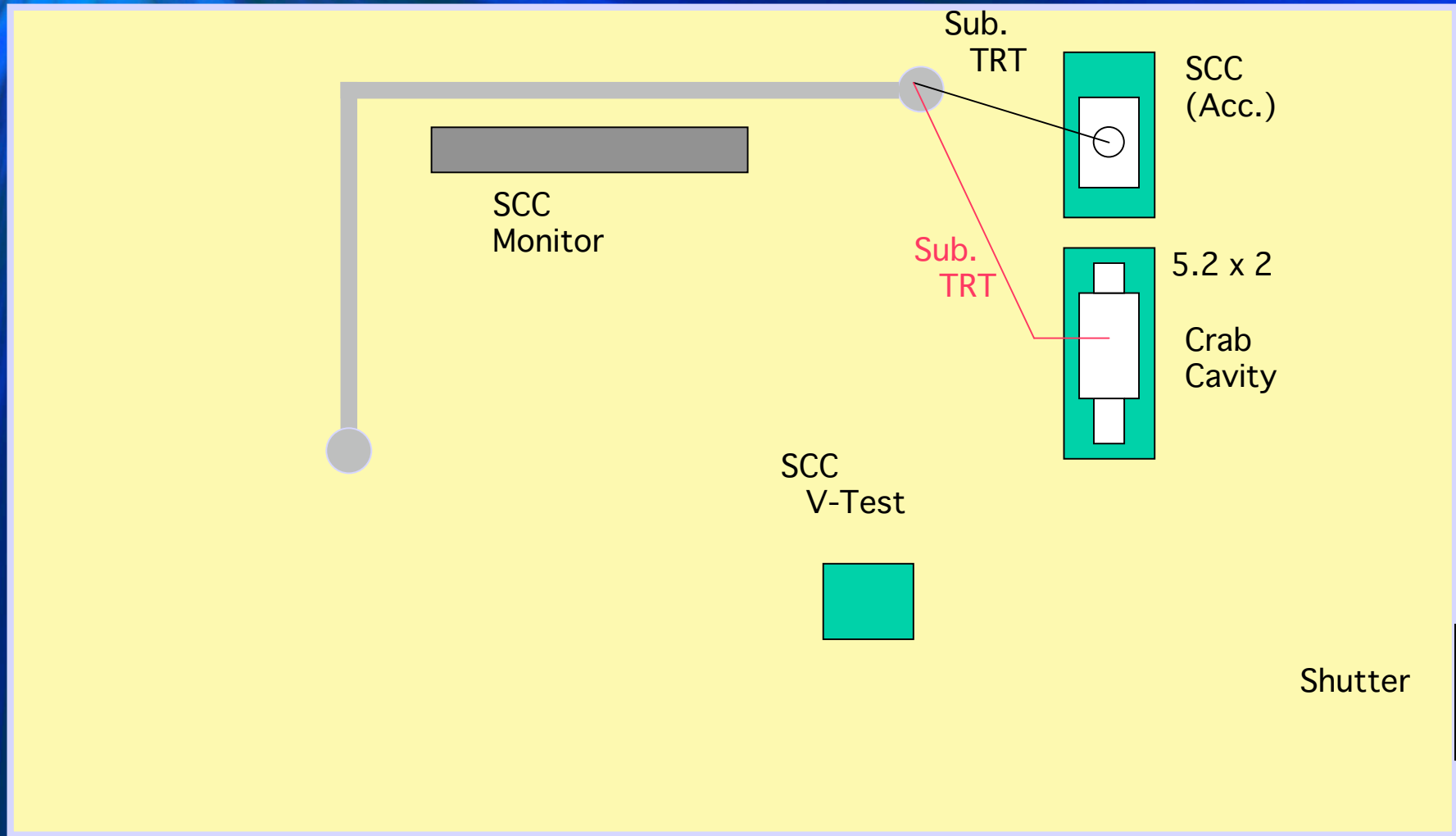




D10 Test Stand

- Horizontal measurement of crab cavities
- Final cold test of crab cavities and cryostats
- Measurement system for s.c. acc. cavities can be used also for crab cavity measurement
- New pit for crab cavities because of different dimensions

D10 Test Stand Schematic





Summary

- Refrigeration system has enough cooling power to operate 2 crab cavities in addition to 8 s.c. acc. cavities
- Positions of crab cavities for HER and LER in KEKB tunnel have been determined
- Testing site of crab cavity in preparation at D10 Test Stand