LCWS15/20151105

Current Status of Japanese Cryo Design

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in collaboration with

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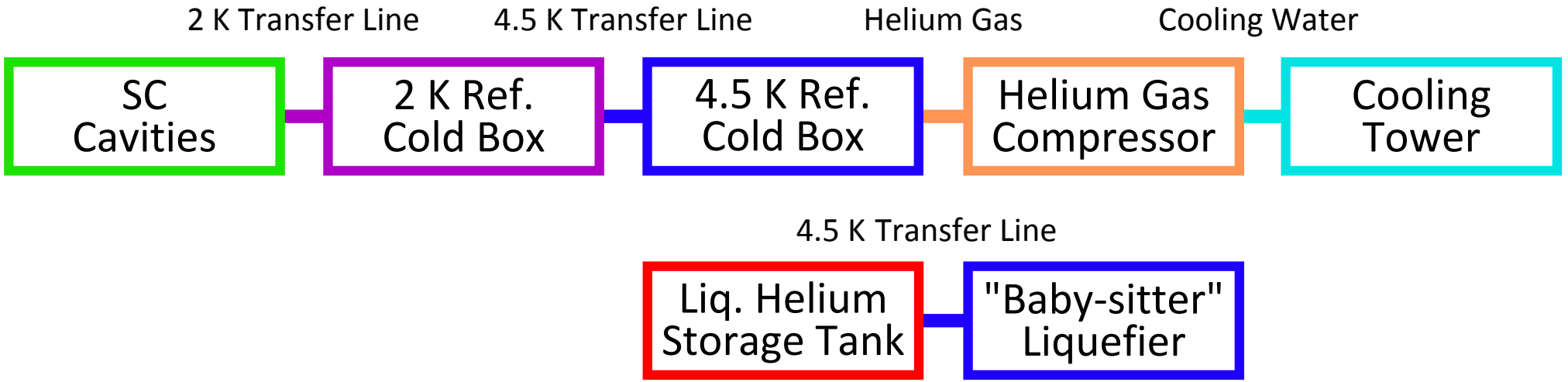
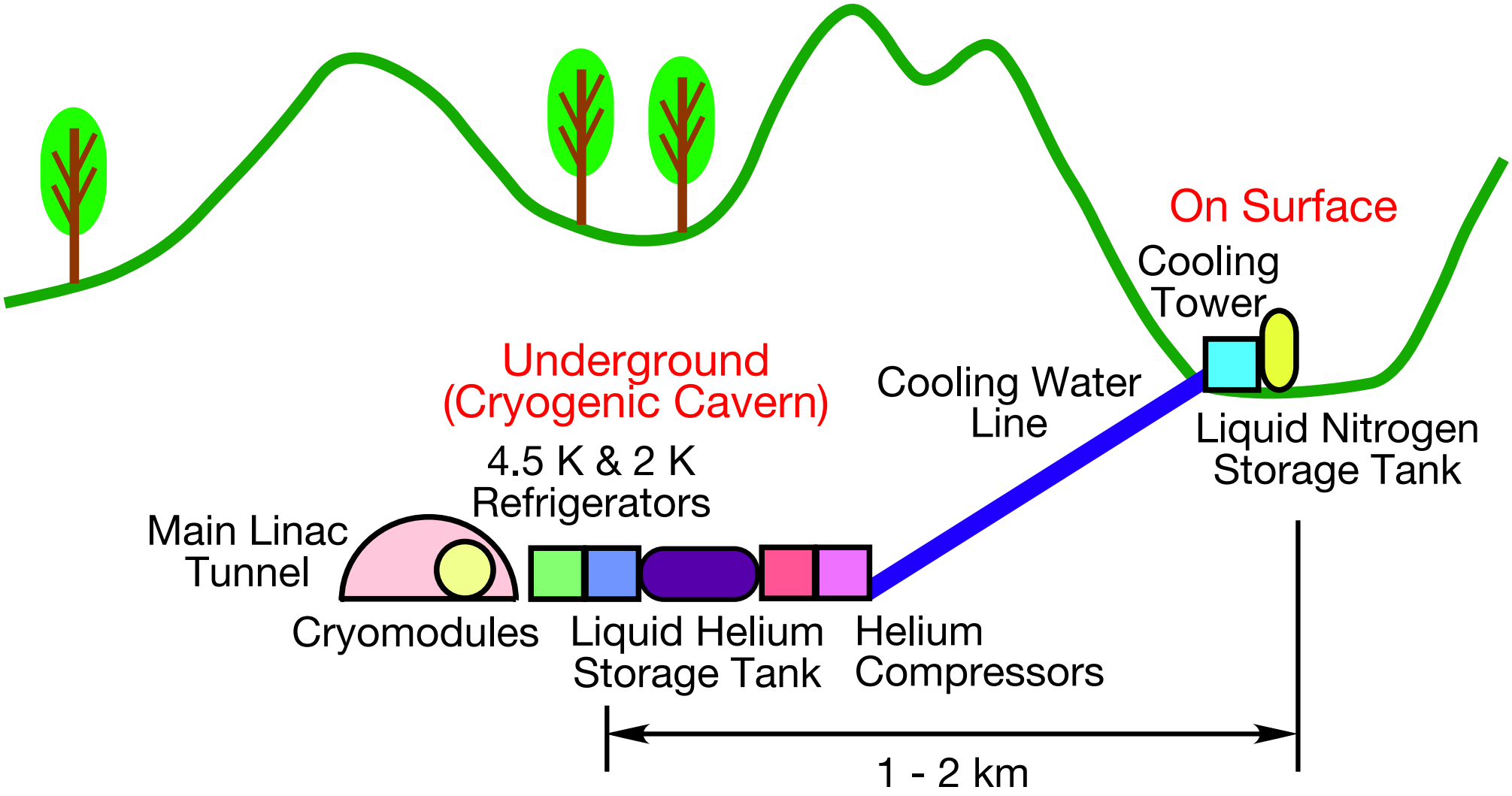
Thomas PETERSON, FNAL

Basic Components of Cryogenic Systems

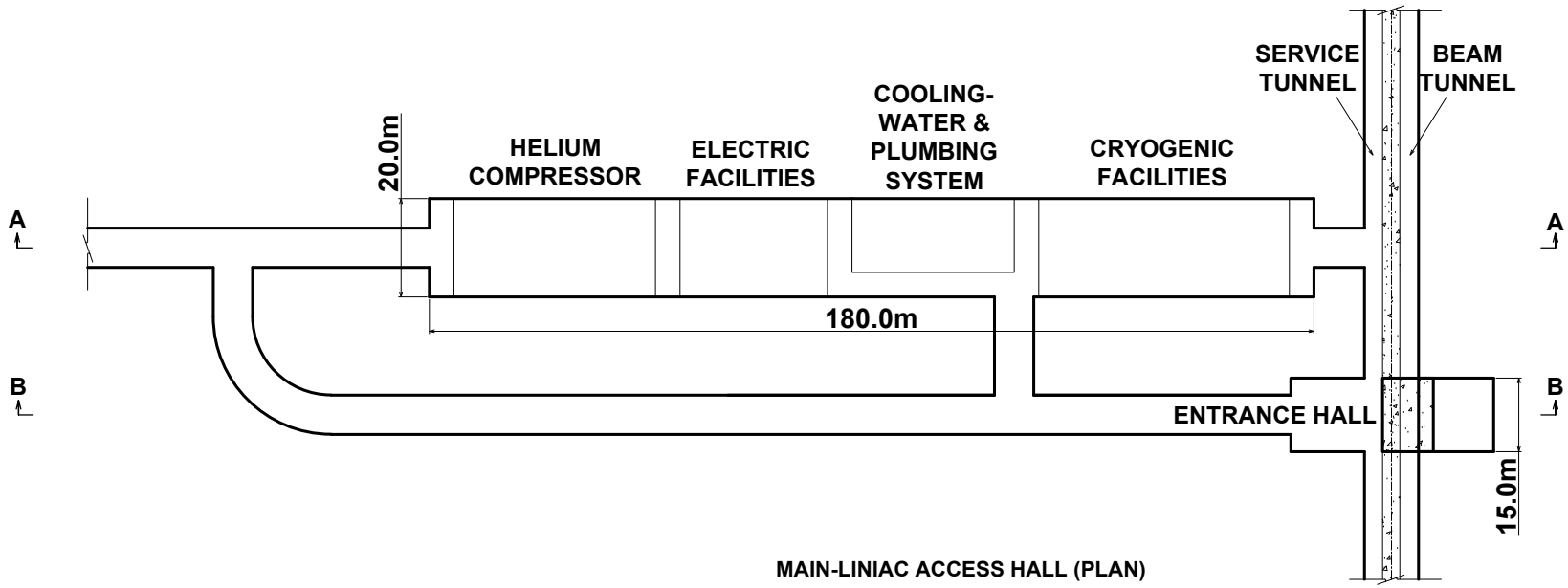


- Shorter cryogenic transfer lines preferred for less heat loads and lower costs
- Heat removal necessary for heat generation at helium compressors as much as consumed electric power (cooling water, cooling towers)
- Liquid helium storage tanks with “baby-sitter liquefiers for long-term shutdowns or at blackouts

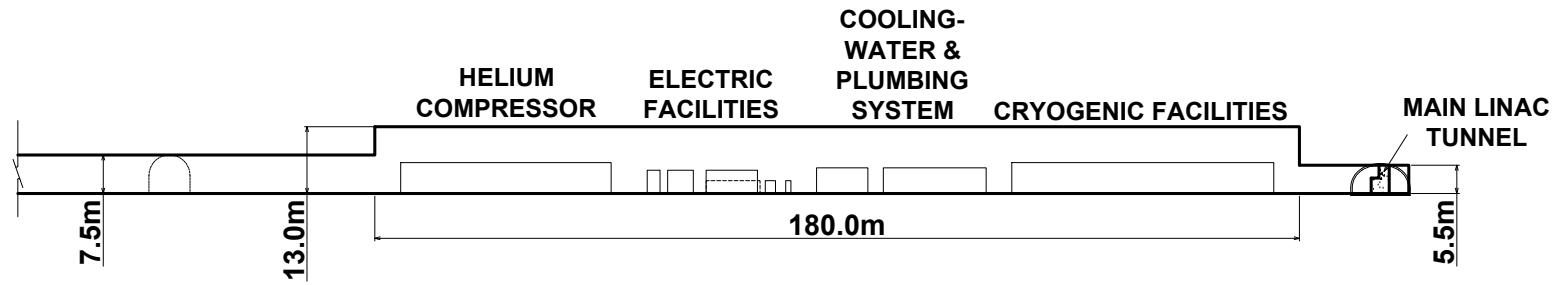
Cryogenic Component Configuration in TDR



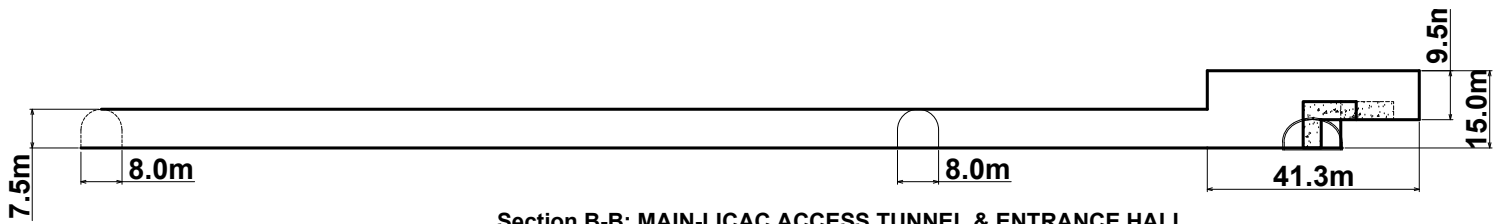
Typical Access Hall (Cryogenic Cavern)



MAIN-LINIAC ACCESS HALL (PLAN)



Section A-A: ELECTRICAL & MECHANICAL SERVICE HALL



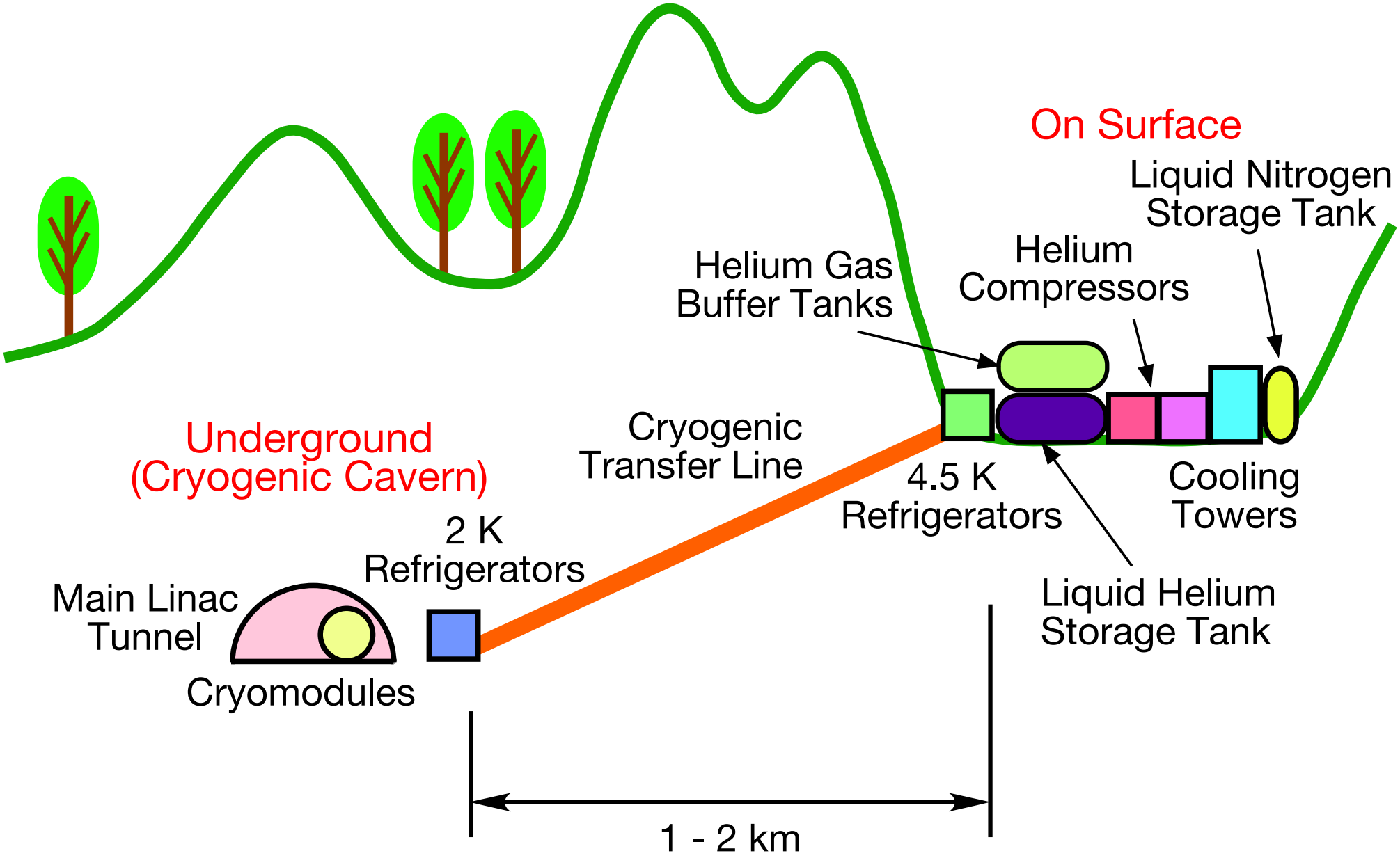
Section B-B: MAIN-LICAC ACCESS TUNNEL & ENTRANCE HALL

Cited from ILC-TDR

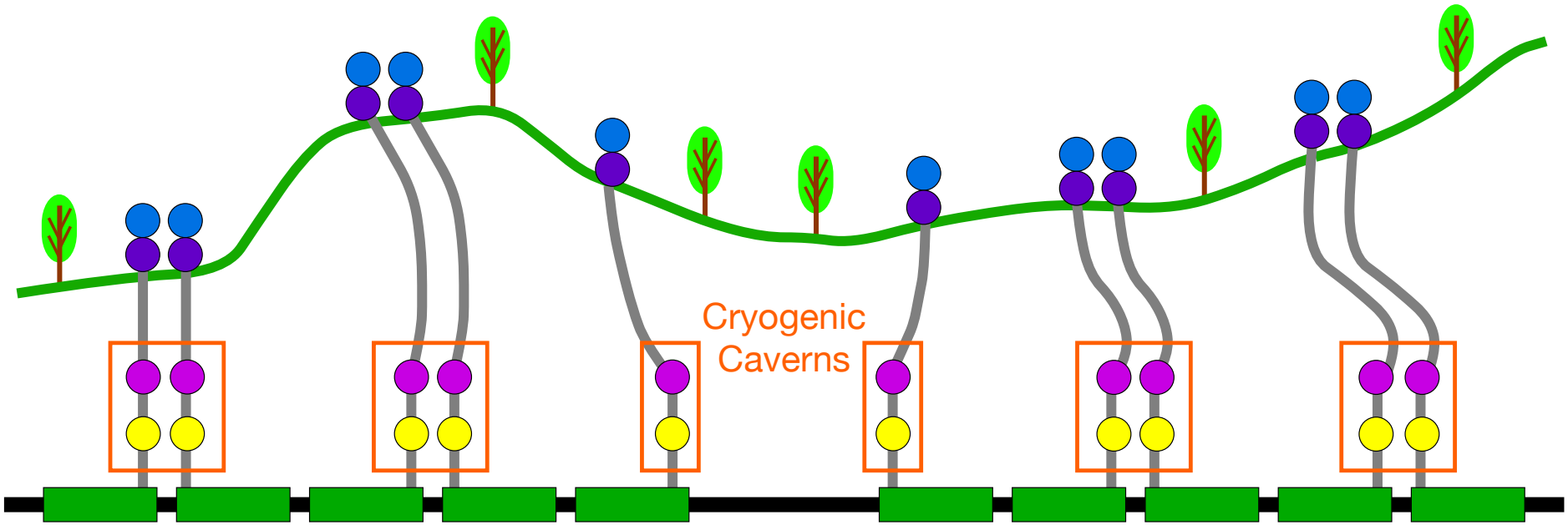
Points of Consideration

- Scenic conservation and environment protection (noise and mechanical vibration)
- Construction costs
- Storage of liquefied gases underground restricted (CERN and FNAL)
- Mechanical vibration of helium compressors affects beams
- Heat removal from helium compressors (cooling towers)
- Radioactivation of helium can be ignored (from past measurements at CERN and FNAL)
- Shorter 2 K transfer lines preferred
- Accessibility for daily checks and accidents response
- Helium buffer tanks required for stable operation of cryogenic systems (liquid helium storage tanks close to 4.5 K helium refrigerators)

Current Cryogenic Component Configuration



Current Cryogenic Plant Configuration



- Helium compressors
- 4.5 K helium refrigerators (cold boxes) ← Final location pending
- 2 K helium refrigerators (cold boxes)
- Cryogenic distribution boxes
- Cryogenic transfer lines
- Cryo units

Discussions

- Long cryogenic transfer lines up to about 2 km required in current configuration
- Location of 4.5 K refrigerators still under discussion
- Quantitative discussions on cryogenic configuration suggested
  - Cryogenics - T. Okamura
  - Civil engineering - M. Miyahara
- Operation procedures
  - Procedures before and after long-term shutdowns
  - Recovery procedure at sudden blackouts
- Safety policies
  - Who establishes?
  - How do we establish?
  - Cost for safety

Summary

- No question about compressors (+ cooling towers) and storage tanks (+ “baby-sitter” liquefiers) on surface
- For change request, compressors (+ cooling towers) and storage tanks (+ “baby-sitter” liquefiers) on surface can be proposed at this stage
- Location of 4.5 K refrigerators kept pending for further study (their location underground in the figure for the change request at this stage)

Cryogenic Component Configuration for CR