- **A plan is being developed to assemble 1.3 GHz Elliptical cryomodules at Fermilab. Current plan involves two 1.3 GHz (β=1) cryomodules to be assembled in 2006 and 2007.**
- **MP9 building will be used to setup the infrastructure to assemble these cryomodules.**
- **3~4 FTEs are needed to assemble the strings in the cavity string assembly clean rooms. 6~8 FTEs are needed for string to cold mass and vacuum vessel assembly outside of the clean rooms.**

Cryomodule Assembly Workflow Plans in FY06 & FY07

Assumptions for the assembly of two 1.3 GHz Elliptical cryomodules in FY06 & FY07: *(R&D production rate)*

- SRF bare cavities are fabricated in industry. (Form/machine parts, electron beam welding)
- Cavities are processed (tuned for field flatness, baked, chemical etched {BCP and/or electro-polished}, high pressure water rinsed and vertical dewar tested).
- Cavities are outfitted with helium vessel and input power coupler and further dressed (tuner, magnetic shielding) for the horizontal dewar test.
- It is assumed that these steps (processing & dressing) are carried out elsewhere (collaborating laboratories, universities).
- After passing horizontal dewar test at Fermilab, the cavity with helium vessel and cold part of the input coupler is shipped sealed to the MP9 facility.
- The sealed cavities with cold input coupler are received at the MP9 facility for incorporation into cryomodules. 8 dressed cavities are assembled into a string at MP9 facility clean rooms. The cavity string is then assembled into cold mass. Cold mass is then inserted into vacuum vessel and the cryomodule assembly is complete.

Work Flow for R&D Production Rate

Receive dressed Cavities

Receive peripheral (vacuum vessel, cryogenic pipes, super-insulation etc.) Cryomodule Parts

Assemble dressed Cavities to form a String in the **Cavity String Assembly Area** (Clean Room)

Install String Assembly to Cold Mass in the **Cold Mass Assembly Area**

Install the String assembly with the cold mass into the Vacuum vessel in the **Vacuum Vessel Assembly Area**

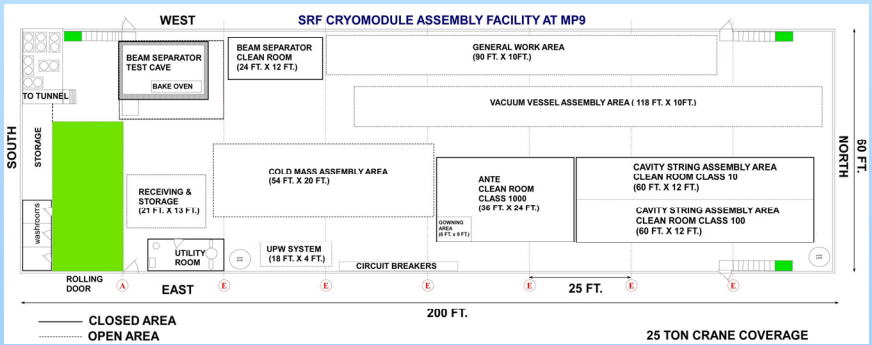
Ship completed cryomodules to **HPTF**

Cryomodule Testing at **HPTF**

Fail → Send the Cryomodule back for repair

Pass → Cyomodule production is successful

Infrastructure Layout at MP9



Cryomodule Assembly Workflow Plans for Small Scale Mass Production Rate

Assumptions for a production rate of 1~2 cryomodules per month: ***(small scale mass production rate)***

- ❑SRF bare cavities are fabricated in industry. (Form/machine parts, electron beam welding). The bare cavities arrive to FNAL.
- ❑Cavities are processed (tuned for field flatness, baked, chemical etched {BCP and/or electro-polished}, high pressure water rinsed and vertical dewar tested) at Fermilab.
- ❑Cavities are outfitted with helium vessel and input power coupler and further dressed (tuner, magnetic shielding) for the horizontal dewar test at Fermilab.
- ❑After passing the horizontal dewar test at Fermilab, the cavity with helium vessel and cold part of the input coupler is shipped sealed to the MP9 facility.
- ❑The sealed cavities with cold input coupler are received at the MP9 facility for incorporation into strings. 8 dressed cavities are assembled into a string at MP9 facility clean rooms.
- ❑The cavity string is then transported to another assembly facility to be assembled into cold mass. Cold mass is then inserted into vacuum vessel and the cryomodule assembly will be completed. (1~2 cryomodules per month in two ~ three cold mass and vacuum vessel assembly lines.
- ❑This production rate will require ~50 FTEs to work in multiple production assembly lines.

Work Flow for Small Scale Mass Production Rate

Receive bare Cavities

Receive peripheral parts

Chemical Etch Cavity (BCP and/or Electropolish)

High Pressure Water Rinse (HPWR) Cavity

Vertical Dewar Test Processed Cavity

Pass

Dress cavity:
-Weld Helium vessel
-Install input power coupler
-Assemble Tuner,
-Assemble magnetic shielding

Fail

Horizontal Dewar Test Dressed Cavity

Pass

Assemble Dressed Cavities to form a String in the **Cavity String Assembly Area** (Clean Room)

Transport String Assembly to another Facility

Receive String Assembly

Receive peripheral Cryomodule Parts

Install String Assembly to Cold Mass in the **Cold Mass Assembly Area**

Install the String assembly with the cold mass to the Vacuum vessel in the **Vacuum Vessel Assembly Area**

Ship completed cryomodules to **HPTF**

Cryomodule Testing at **HPTF**

Pass

Cyomodule production is successful

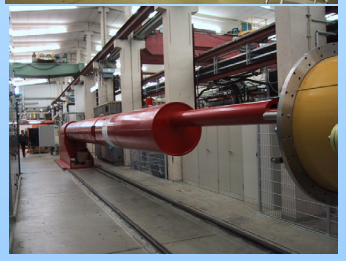
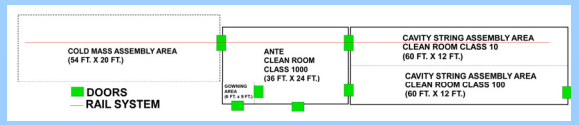
Fail

Send the Cryomodule back for repair

Procurement Plans

FY05:

- ❑Elliptical cavity string assembly clean rooms
- ❑1.3 GHz elliptical cryomodules cold mass and vacuum vessel assembly fixtures

FY06:

- ❑Elliptical cavities string assembly fixtures
- ❑Clean room equipment
- ❑Portable clean rooms
- ❑Miscellaneous fixtures