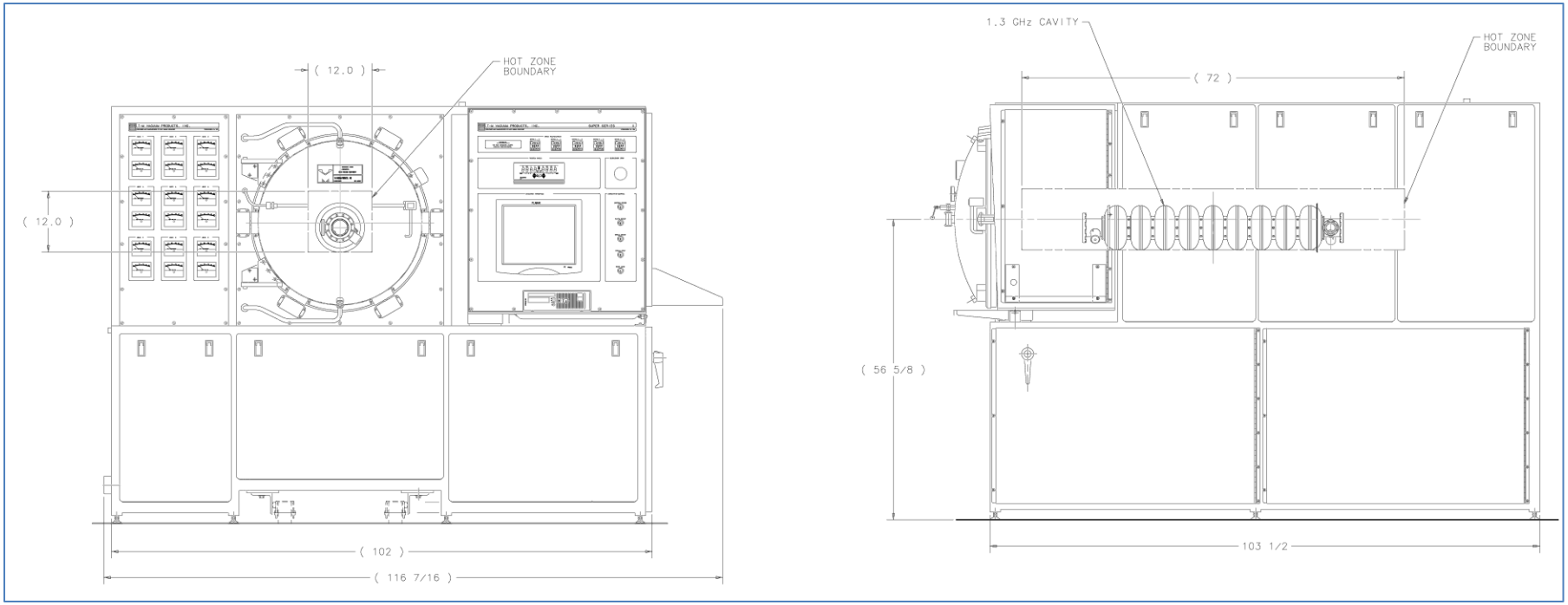
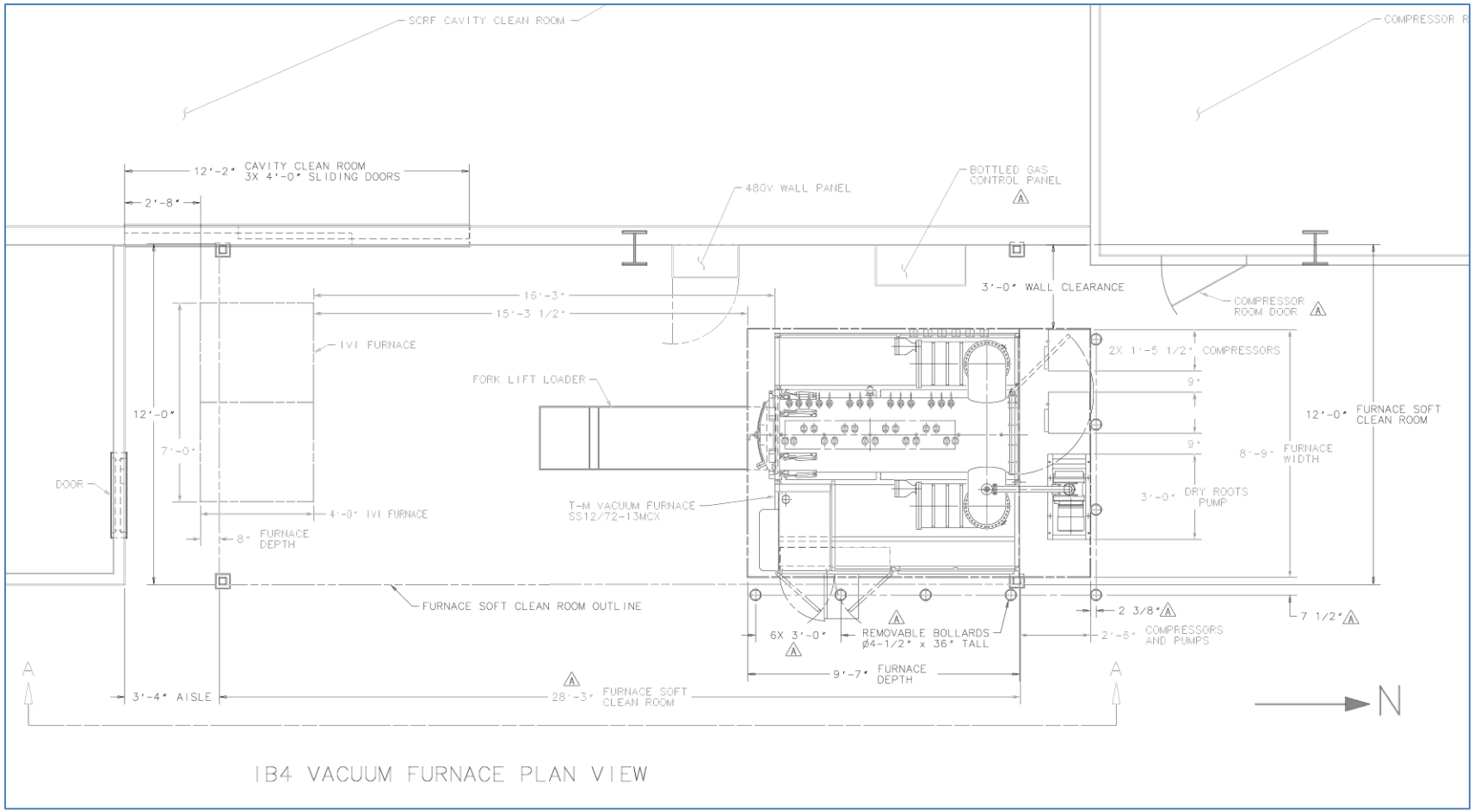
1.3-GHz Cavity Vacuum Furnace at IB4



- Designed to hold a 1.3-GHz nine-cell cavity
- Bake at 600° - 800°C at $1x10^{-7}$ torr
  - Max working temperature 1000°C
- Dimensions:
  - Hot zone 12” x 12” x 72”
  - SS vacuum chamber 30”ID x 100” L
- Temperature uniformity within hot zone within ±3°C
- SRS RGA

From drawing 481188



From drawing 481301

Located at IB4

- Use existing utilities (chiller, electrical, purge gas piping)
- Extend existing clean room (Class 1000)
- 16’ clearance between IVI and new furnace to access cavity clean room

Current Status of Furnace

- Transformers, SCR, Control and power boxes are complete
- Vacuum chamber electropolished
- Next steps
  - Install power feedthroughs, thermocouples
  - Install valves, instrumentation
- Awaiting moly shields, rough and cryopumps
- Acceptance testing tentatively scheduled week of July 12

Installation at IB4 – Before delivery

- Floor repairs complete this week
- Upgrade utility lines
  - Water lines (extend along wall)
  - Air lines (extend along wall)
  - Inert gas lines (modify to supply chamber purge, partial pressure gas supply, cryopump purge)
- Scheduling, purchase parts for utility hook-ups
  - Support Dept / Facility (Gary L, Miguel, T&M)
  - Tooling Group (Rick)

Acceptance Test Plan

- A leak check based on the mass spectrometry (Helium leak detector), the acceptance criteria will be $1x10^{-9}$ TORR x liter per second Helium leak
- A control of the ultimate vacuum pressure $1x10^{-8}$ torr-L/sec (empty, clean, cold furnace)
- A leak check based on the static pressure increase method (rate of rise measurement)
- A hot test with the temperature at 600° and 1000°C with measurement of the working vacuum pressure.
  - At 600°C: Oxygen partial pressure: less than 1×10^{-8} TORR; Hydrocarbon amount: less than 1×10^{-13} mol; Hydrogen pumping speed: 500 liter / second
  - RGA measurements at room temperature, 600° and 1000°C
- A mechanical and electrical function test
- A test of the pumping sequence in automatic and manual mode
- The temperature uniformity shall also be evaluated at the process temperatures according to a procedure that will be defined by FNAL and agreed by the vendor.
  - No hot spots shall occur on the vessel or on the piping leading towards the vacuum pumps.
  - Temperature uniformity within hot zone measured with test piece (Procedure not yet defined, but will use a test piece made of 304SS pipe, electropolished and cleaned)
- After cool-down, open chamber and inspect hot zone for thermal shorts, warped heat shields or other signs of heat related failure.
- Acceptance test at T-M Vacuum and repeated at Fermilab

Training

- Training will take place at vendor site during week of acceptance testing
- Who will be trained?
  - M. Wong
  - CAF (B. Smith)
  - Cavity Processing Group
- Training procedure at Fermilab based on vendor training procedure

Installation at IB4 – After delivery

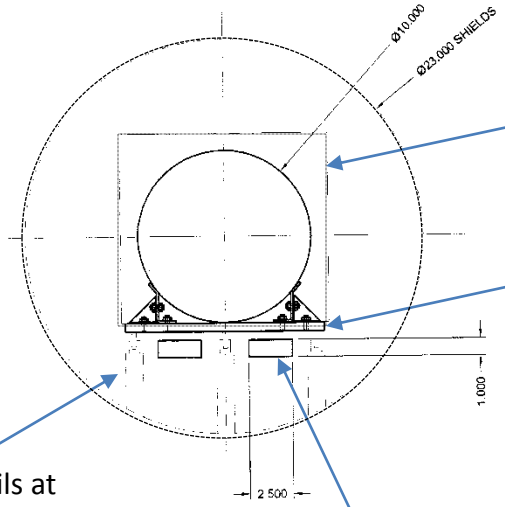
- Furnace Delivery – July 23 (tentative date)
- Installation (Support Dept/Facility, T&M, Tooling Group, CIS)
  - Utility hook-up (chilled water, electrical, air, inert gas)
  - Computer LAN connection
  - Connect rough pump and compressors to furnace system
  - Extend fire protection system
  - Install/extend softwall cleanroom
  - Install bollards
- Final acceptance test with vendor representative
- ORC Review
- End of August: Ready for cavity commissioning – Cavity Processing Group

Back-up Power

- Short power outage (<15 minutes): Computer and controls on UPS power
- Long power outage
  - Chiller and water pump on back-up generator
  - After 1 hour, estimate that hot zone at 1.3×10^{-3} to 4×10^{-3} mbar, 300°C
  - Confirm rate of pressure rise, temperature drop when system arrives
- Generator installation is decoupled from commissioning of furnace

Loading cavity into furnace

- Place cavity onto moly hearth with brackets
- Use lift truck to guide cavity/hearth into vacuum chamber
- Moly hearth rests on rails within chamber



Hot zone boundary
12” x 12”

Moly hearth with brackets

Moly rails at
Bottom of
chamber

Forks of lift truck

Lift truck is guided by rails
at the bottom of the furnace frame