Status and Plans of NML Test Facility at Fermilab

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NML Project Overview

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- **Overall Goal**
  - **Build an RF Unit Test Facility at the New Muon Lab Building (NML)**
    - **One RF Unit (3 ILC-like Cryomodules)**
    - **10-MW RF System**
    - **Beam with ILC/Project-X parameters (3.2 nC/bunch @3 MHz, Up to 3000 bunches @ 5Hz, 300-μm rms bunch length)**
- **Phase-1 (FY07 - FY09)**
  - **Prepare Facility for Testing First Cryomodule (CM1) without Beam**
    - **Infrastructure, RF Power, Cryogenics (Refrigerator #1)**
    - **Install First Cryomodule (CM1) and Capture Cavity-2 (CC2), Cooldown, and RF Test**

NML Project Overview

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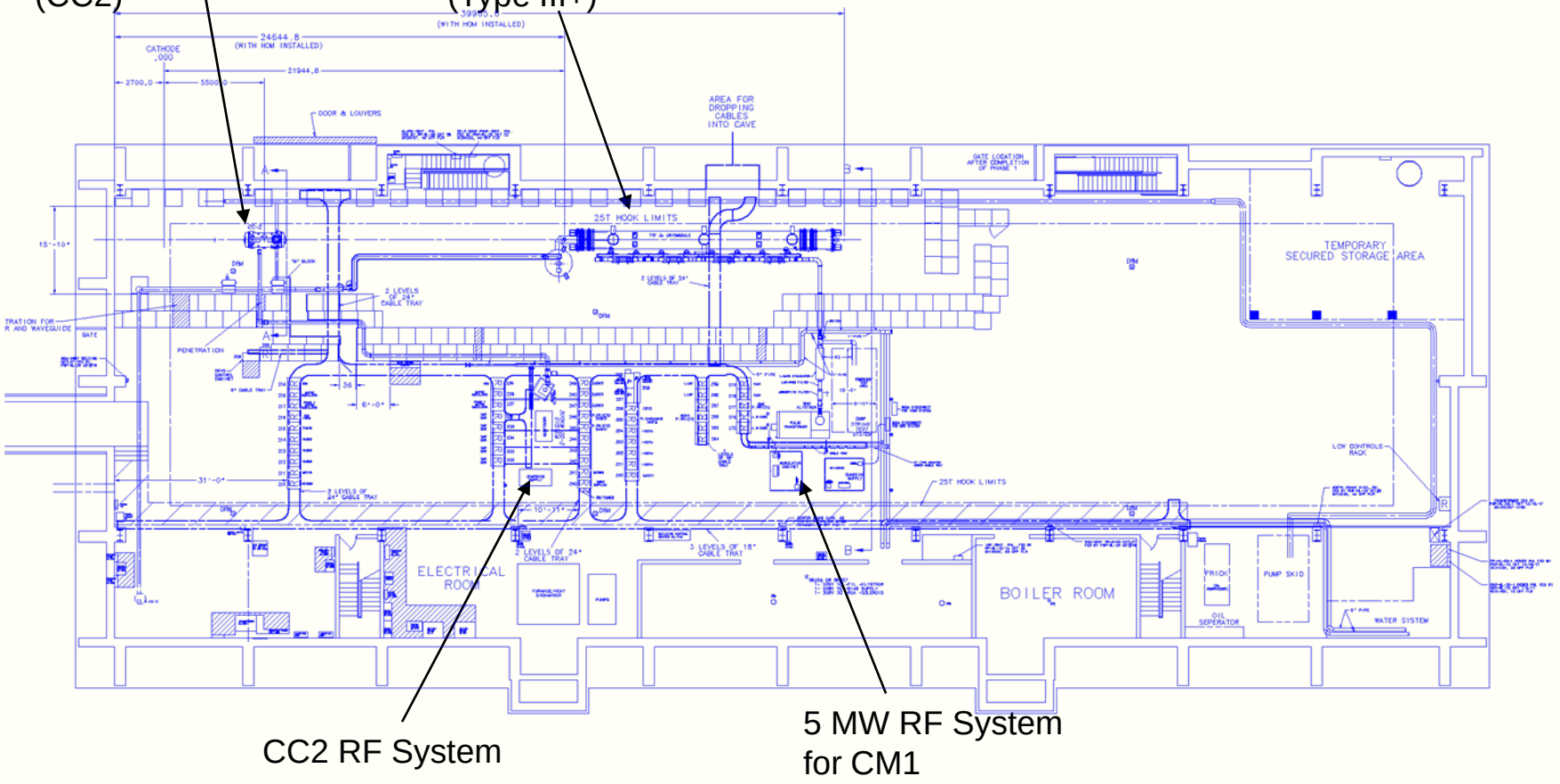
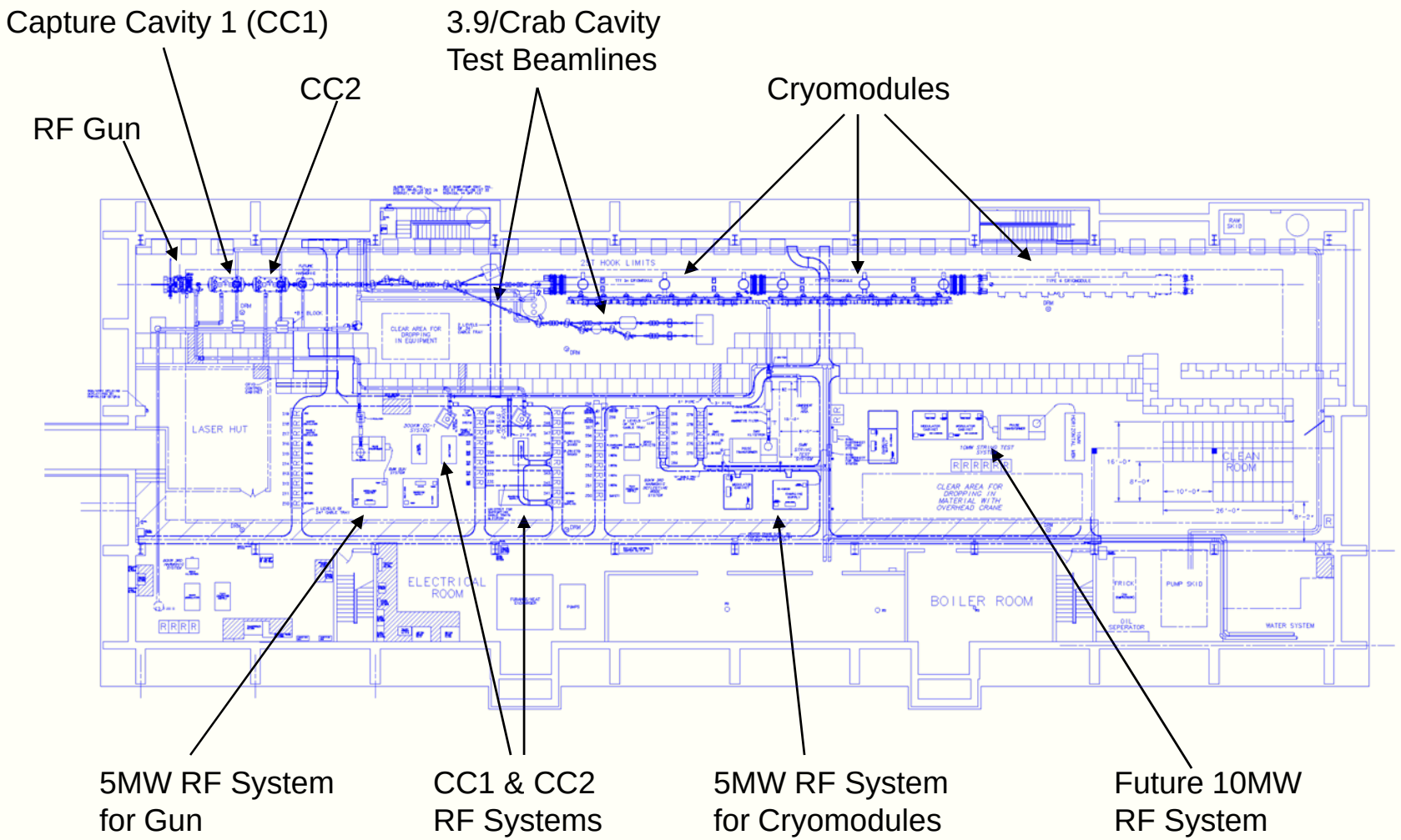
- **Phase-2 (FY10 - FY11)**
  - **Prepare for First Beam**
    - Civil Construction to Expand Facility (Capability for 2 RF Units)
    - Install Gun, Injector, Test Beamlines, Beam Dump, Second Cryomodule (CM2)
- **Phase-3 (FY11 - FY13)**
  - **Complete RF Unit**
    - Upgrade RF System to 10 MW, Install Third Cryomodule (CM3)
    - Operate Full RF Unit with Beam
    - Commission New Cryogenic Plant
    - Begin Installation of 2nd RF Unit

Phase-1 Layout of NML



Overall Layout of NML Building



Future Expansion of NML Facility

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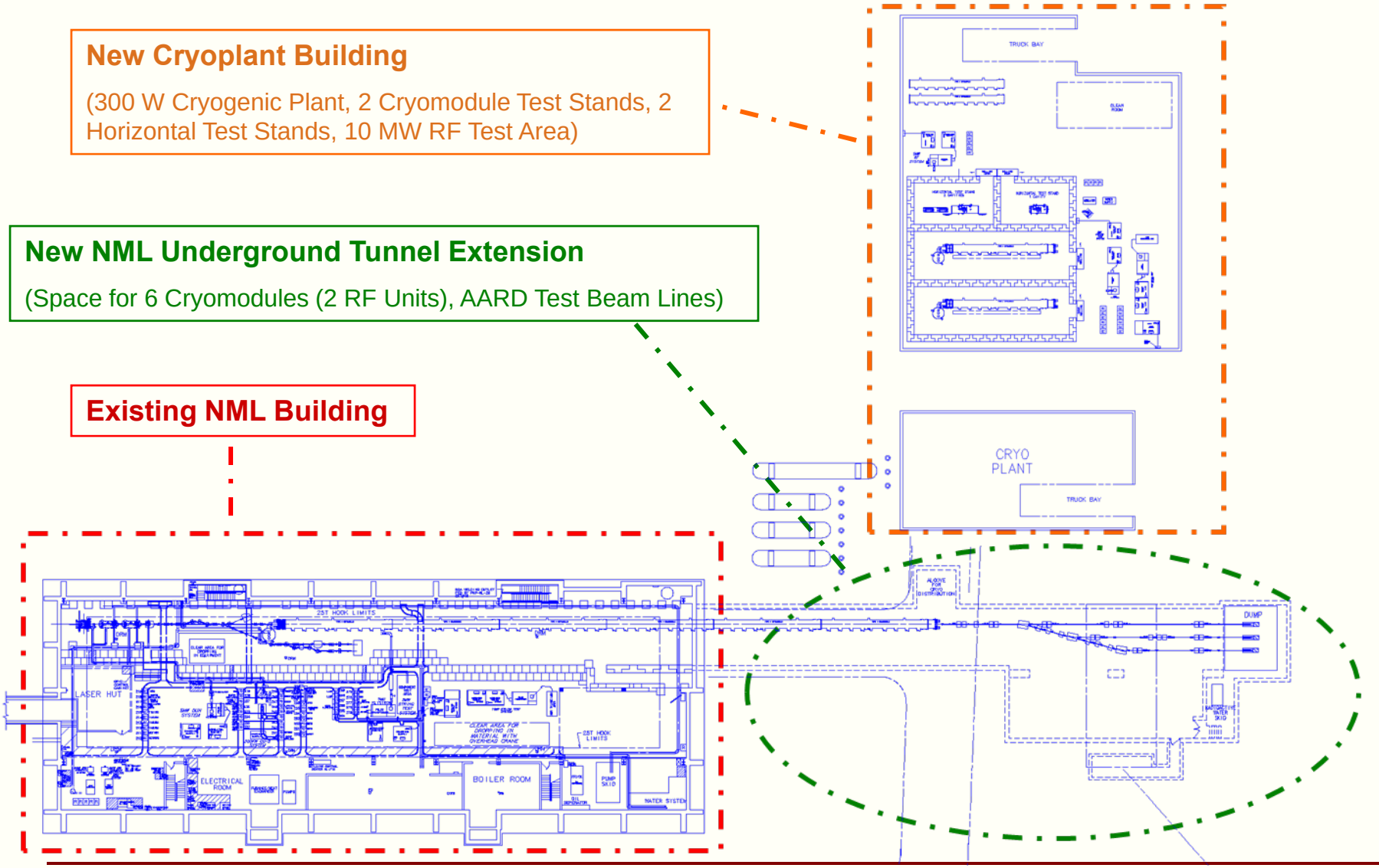
New Cryoplant Building

(300 W Cryogenic Plant, 2 Cryomodule Test Stands, 2 Horizontal Test Stands, 10 MW RF Test Area)

New NML Underground Tunnel Extension

(Space for 6 Cryomodules (2 RF Units), AARD Test Beam Lines)

Existing NML Building



NML Tunnel Extension

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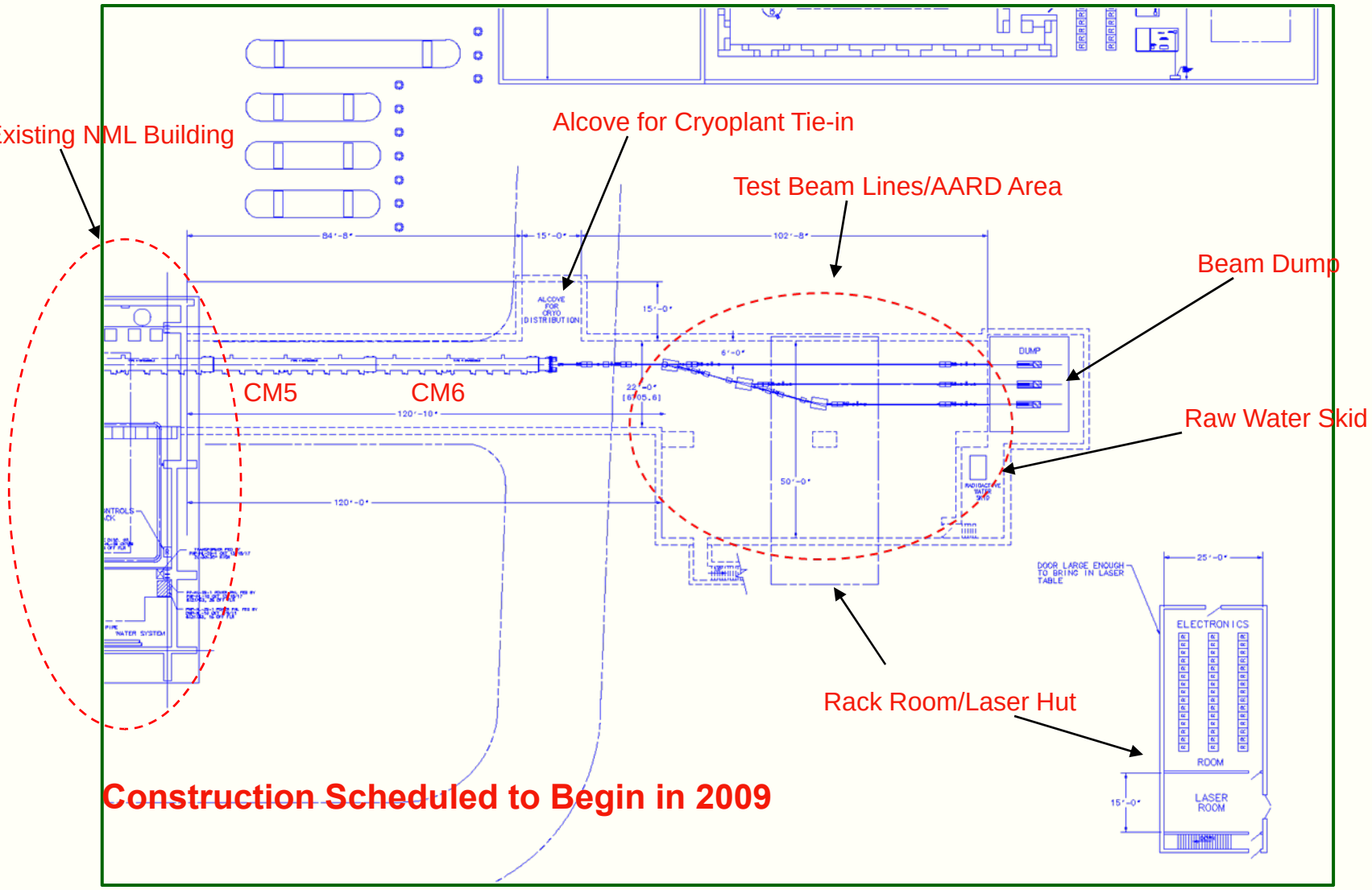

Current Status of NML

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NML Infrastructure (FY07-08)

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- Completed Removal of Chicago Cyclotron Magnet
- Prepared Building Infrastructure
  - AC Power, Network Cabling, Piping, Cable Tray, Air Ducts
  - Cleaned out Building, Epoxy Coated Floor, Alignment Network
  - Cave for Phase-1 (~3/4 of Full cave), Electrical Racks

NML During Removal of Chicago Cyclotron Magnet(CCM) (September, 2006)

NML Facility after CCM Removal and Floor Painting (February, 2007)

Current Picture of NML Facility

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View From North

NML Cryogenic System

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- Cryogenic System
  - Installed Refrigerator Room & Helium Storage Tanks
  - Refrigerator #1 (60W@1.8K) Operational - 8/07
  - Refrigerator #2 (60W@1.8K) Installation - Fall 2009
  - Distribution System
    - Feedbox, Feed Cap, End Cap Installed
  - Orbital Welder
    - Interconnect Mockup and Test Fixture Built
    - Initial Orbital Welding Tests Successful
  - Vacuum Pump and Frick Compressor
    - Commissioned - 1/09

NML Cryogenic System

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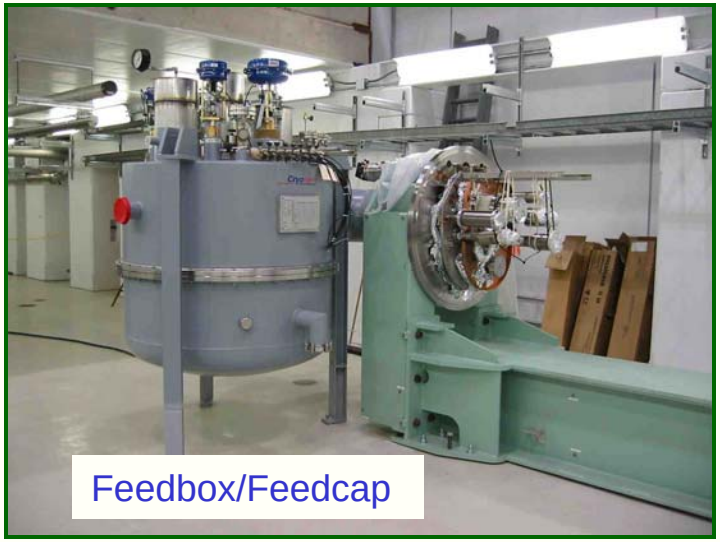
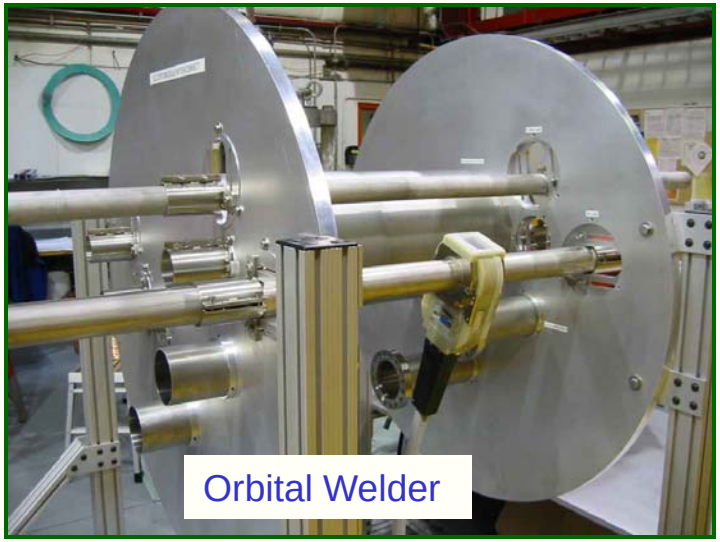
Refrigerator Room


Feedbox/Feedcap


Orbital Welder


Cryo Vacuum Pump

NML RF System

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- RF System
  - 5 MW for CM1
    - Ready for Commissioning
  - 300 KW for CC2
    - Commissioning in Progress
  - Distribution
    - CM1 Distribution from SLAC (in-house)

NML Accelerator

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- Injector
  - Detailed Lattice Designed
  - New Gun Being Built (will be Tested at A0 Photoinjector)
  - CC2 (single 9-cell cavity) Installed - 3/09
- Accelerator
  - CM Support Girders Installed & Aligned
  - First Cryomodule Test Installation - 8/08
- Test Beamline
  - Lattice Designed
  - Beam Absorber Analysis Complete

NML Auxiliary Systems

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- **Vacuum System**
  - Particle Free Vacuum Carts Built and Tested
    - Leak Detectors, RGA's, Pumps, Gages, Controls
  - Equipment for Insulating, Beamline, and Warm Coupler Vacuum Systems In-House
  - (3) Portable Cleanrooms Built (Capable of achieving Class-10)
    - Tested during CC2 vacuum installation
- **Water Cooling System**
  - System Design Complete
  - New Pumps and Heat Exchanger Installed
  - Temporary Skid (for Phase-1) Operational
- **Safety Systems**
  - Radiation, ODH, Interlock, and Safety Assessment Documentation Being Prepared

NML Auxiliary Systems

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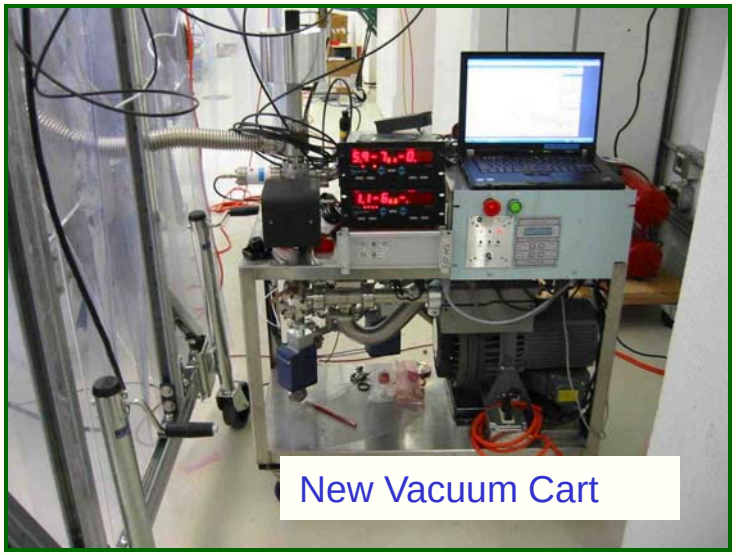
CC2 Installed

Cleanroom Work on CC2



New Vacuum Cart

Water System

NML Controls/Instrumentation

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- Controls
  - Control Room Finished and Operational
  - Wireless Network Installed Throughout Building
- Instrumentation
  - Wire Position Monitors for CM1 Tested and Installed in Endcaps
  - Faraday Cup Assembled
  - RF Protection/Interlock System Complete

Before

After

NML Facility Milestones & Goals

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- Cryogenic System Operational (Aug. 2007)
- Delivery of First Cryomodule to NML (Aug. 2008)

- Cryomodule Ready for Cooldown* (Summer 2009)
- Cold RF Testing of Cryomodule* (Fall 2009)
- Delivery of 2nd Cryomodule to NML (S1) (2010)
- Install Gun and Injector (2011)
- First Beam (2012)
- Full RF Unit Testing (3 Cryomodules) (S2) (2012)

*Significant project delays occurred due to funding cuts in 2008 and a five month delay in the delivery of cryogenic feedbox & endcaps