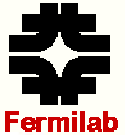


Status of NML Test Facility

Jerry Leibfritz
February 2, 2009

NML Project Overview



- **Overall Plan**
 - **Build an RF Unit Test Facility at 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- μ m 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), Cooldown, and RF Test
- **Phase-2 (FY10 - FY11)**
 - **Prepare for First Beam**
 - Install Gun, Injector, Test Beamlines, Second Cryomodule (CM2)
 - Generate First Beam
- **Phase-3 (FY11 - FY13)**
 - **Complete RF Unit**
 - Upgrade RF System to 10 MW, Install Third Cryomodule (CM3)
 - Operate Full RF Unit with Beam

Exterior of NML



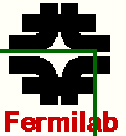
Revised NML Technical Plan

(Results of FY08 Omnibus Budget Cuts)

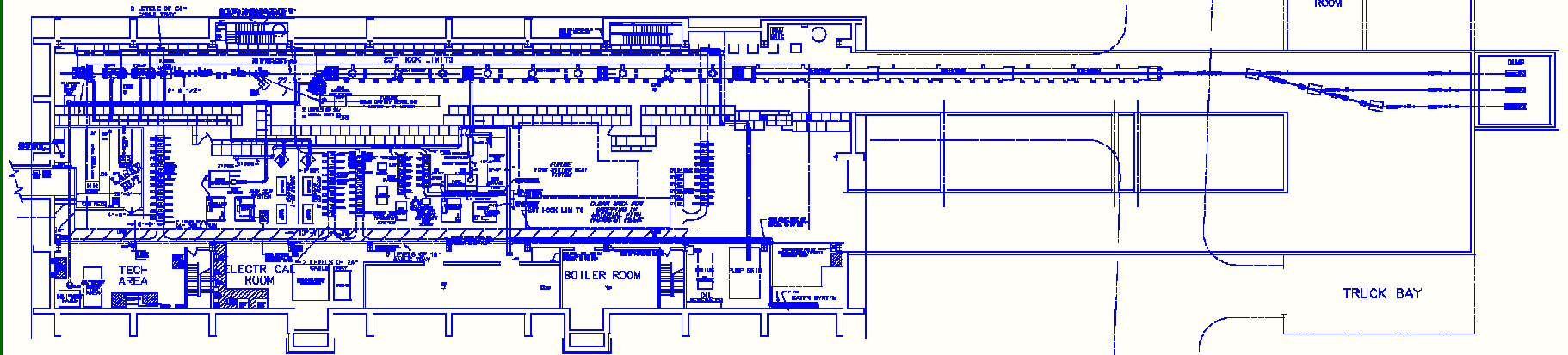


- **Budget Reduction**
 - FY08 Funding Cuts, Manpower Reduction, Uncertain Funding Profile
 - Changed Overall Scope/Plans of Project
- **New Goals/Scope**
 - Meet RF Test Requirements for one RF Unit for ILC & Project-X
 - Fit Everything Within Existing Building
 - Cryomodules shifted upstream approximately 8 meters
 - Space for Injector and Test Beamline reduced
 - **Capability to Expand to our Original Plan was Maintained**
- **Large Overall Cost Reduction**
 - Elimination of Building Extension (~\$5M)
 - Elimination of Cryoplant (~\$13M)
 - New Injector design does not include Laser Hut, Laser System, CC1, 3.9 GHz Cavities and associated RF systems and Cryogenic connections.
 - Simpler Injector Design (Does not require moving Photoinjector)

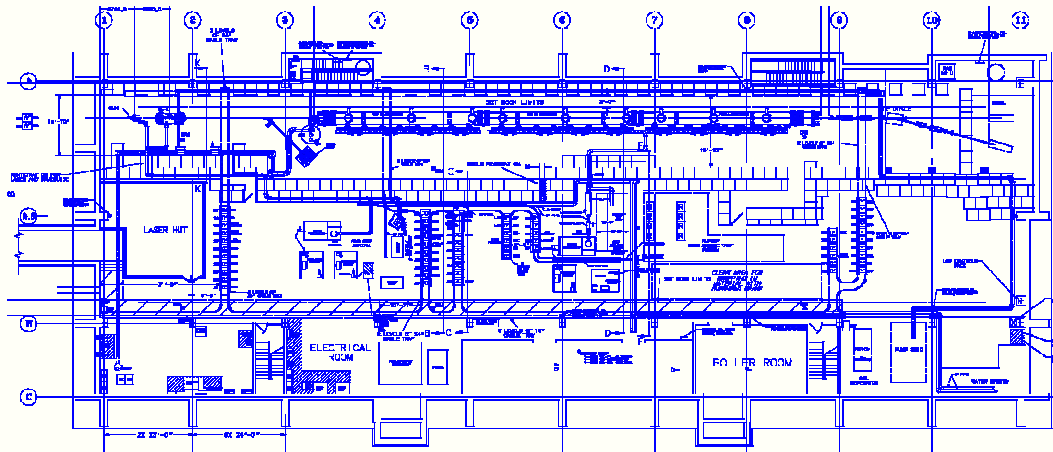
Original and Revised Layout of NML



Original NML Layout (Pre - 2008)



Post Omnibus NML Layout (2008)



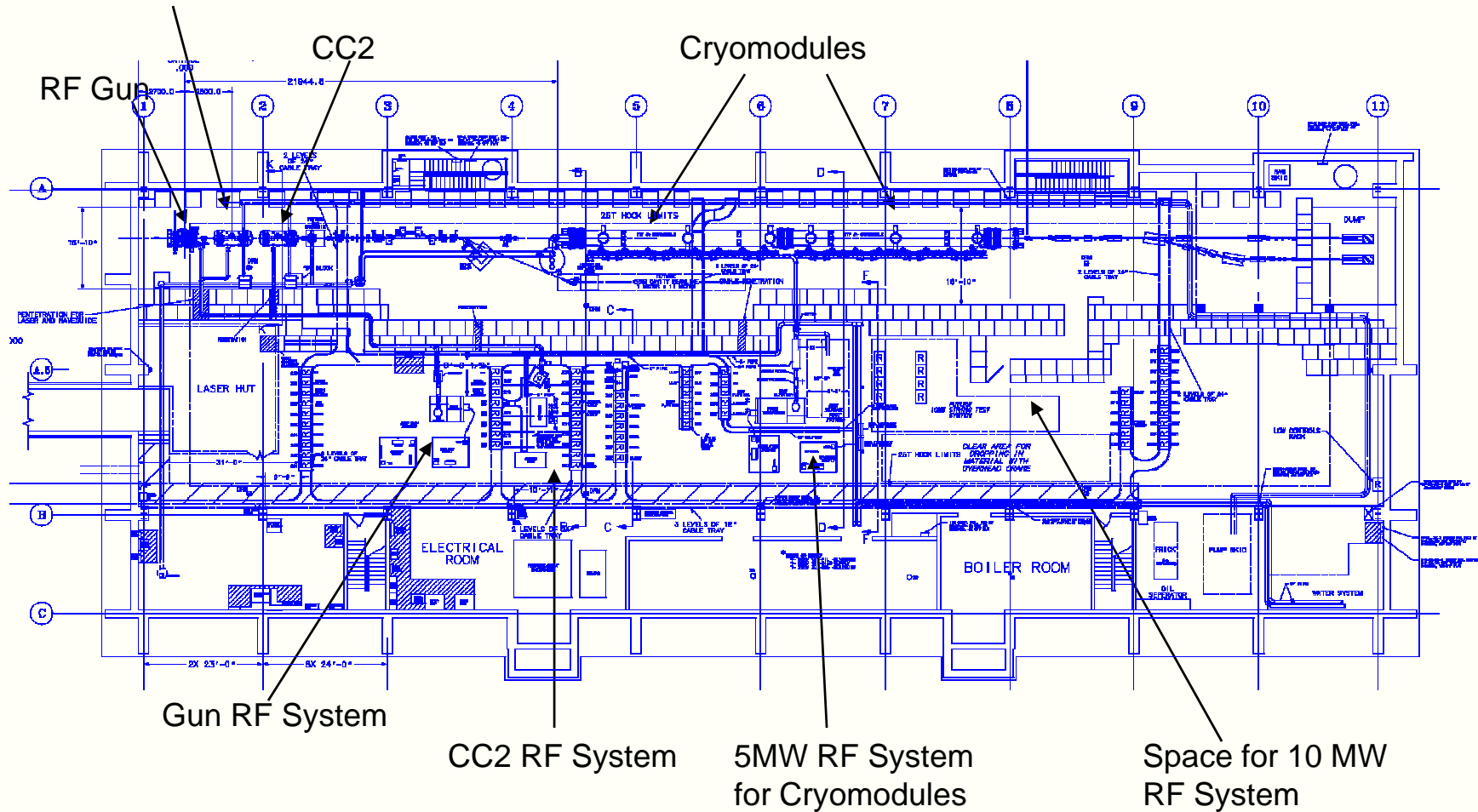
Revised NML Technical Plan - Again!



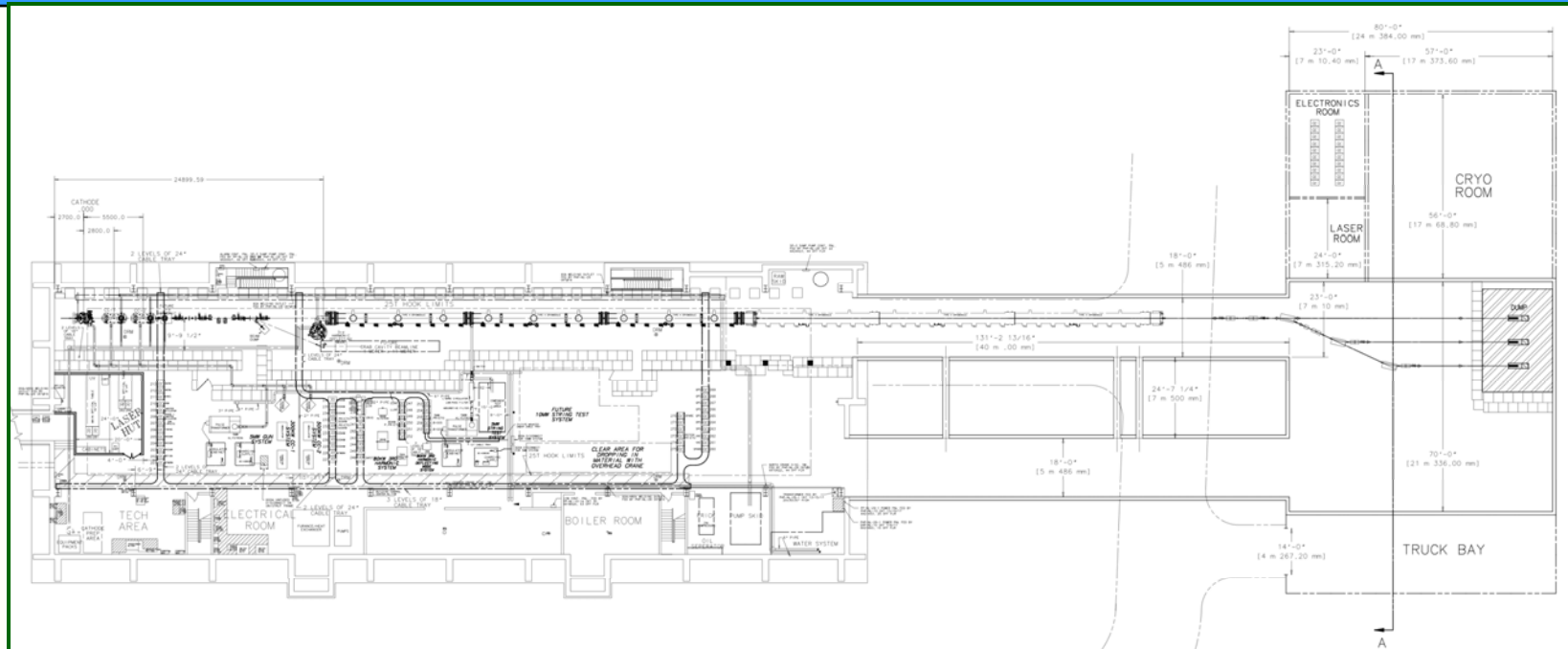
- **After Many Discussions it was Determined that the New Plan had Several Limitations**
 - **Could not Generate ILC-type Beam**
 - **AARD Program would be Minimal**
 - **A0 Photo-Injector would Cease Operation after Tev Shutdown**
- **Decision was made in Late 2008 to Return to the Original Plan**
 - **Shift Cryomodules back to Original Location**
 - **Space for Full (upgraded) Photo Injector**
 - **Full Test Beamlines (AARD)**
 - **Only 2 Cryomodules if No Funding for Building Extension**

Overall Layout of NML

Capture Cavity 1 (CC1)

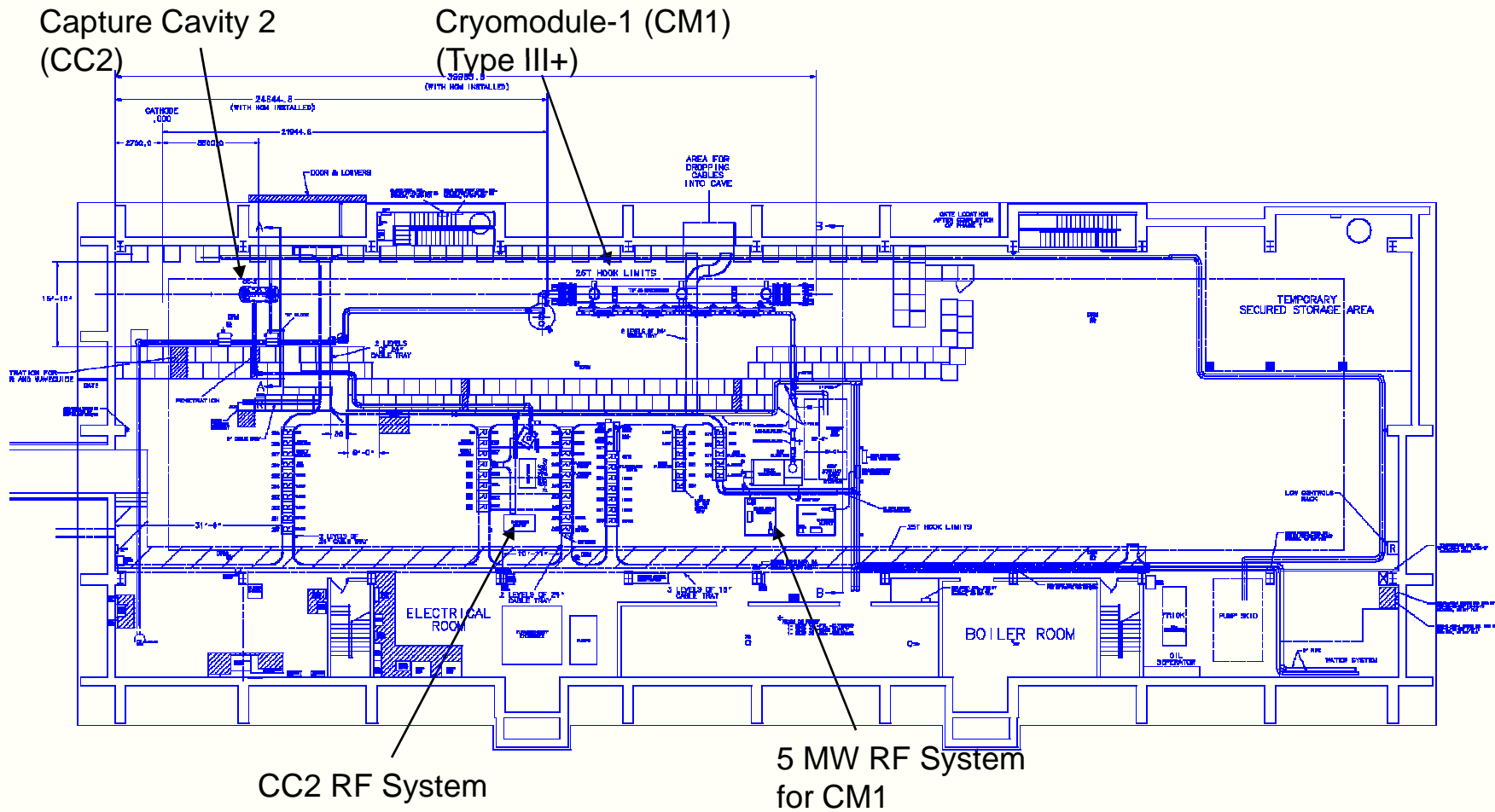


NML Layout with Building Extension



- Room for 6 Cryomodules (2 RF Units)
- Expanded Diagnostic and AARD Test Area
- Cryoplant (300W)
- Possible 2-Tunnel Design to Mock-up ILC Design

Phase-1 Layout of NML



NML Infrastructure (FY07-08)

- **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



View From North

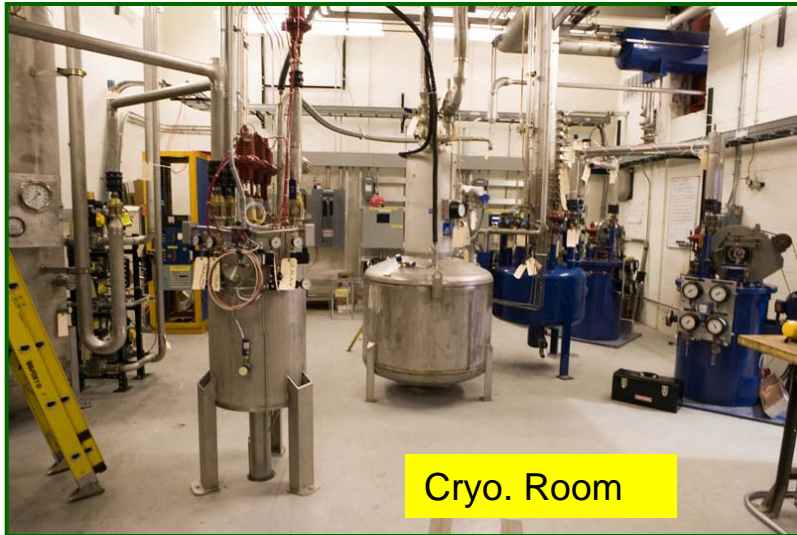


NML Cryogenic System

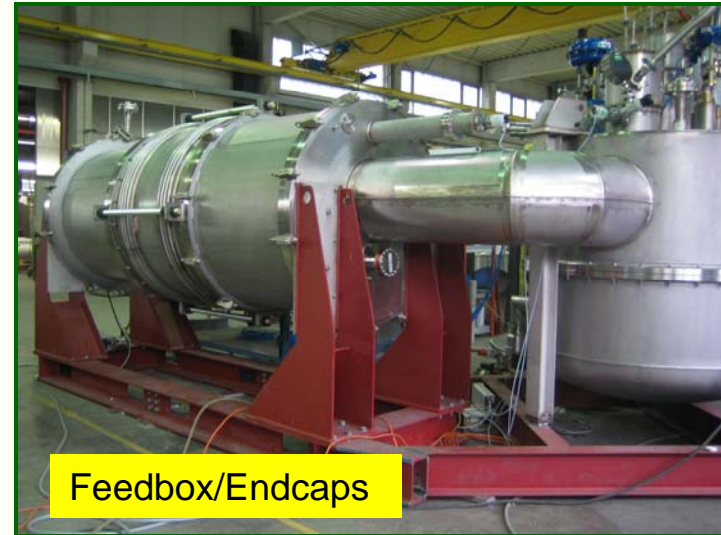


- **Cryogenic System**
 - **Installed Refrigerator Rm. & Helium Storage Tanks**
 - **Refrigerator #1 (60W@1.8K) Operational - 8/07**
 - **Refrigerator #2**
 - **Installation (3/09)**
 - **Distribution System**
 - **Feed Can, Feed Cap, End Cap Ordered (due 2/09)**
 - **Pipe Installation (90% complete)**
 - **Orbital Welder**
 - **Interconnect Mockup and Test Fixture Built**
 - **Initial Orbital Welding Tests Successful**
 - **Vacuum Pump and Frick Compressor**
 - **Commissioned (1/09)**

NML Cryogenic System



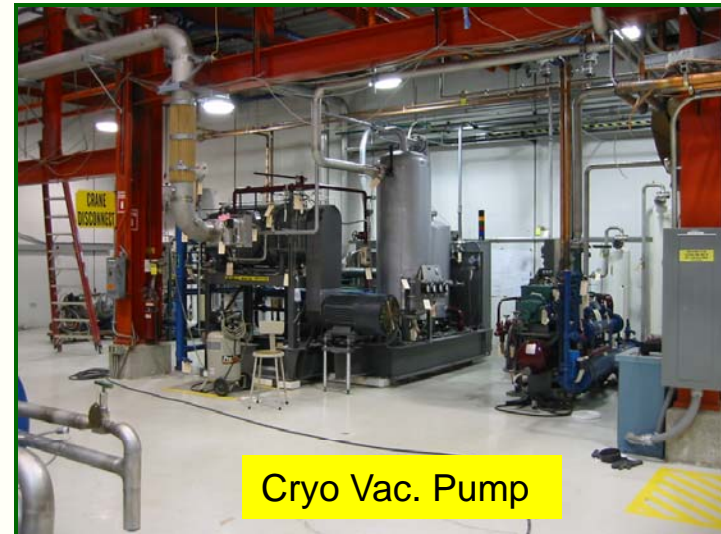
Cryo. Room



Feedbox/Endcaps



Orbital Welder



Cryo Vac. Pump

NML RF System

- **RF System**
 - **5 MW for CM1**
 - Ready for Commissioning
 - **300 KW for CC2**
 - Ready for Commissioning
 - **Distribution**
 - CM1 Distribution from SLAC
 - 1st Section at NML, Remaining due 2/09



NML Accelerator

- **Injector**
 - Lattice is Designed
 - New Gun Being Built (Will be Tested at A0)
 - CC2 Installation Scheduled for 2/09
- **Accelerator**
 - Cryo. Girder/CM Support Installed & Aligned
 - First Cryomodule Initially Installed (8/08)
- **Test Beamline**
 - Lattice Designed
 - Beam Absorber Analysis Complete

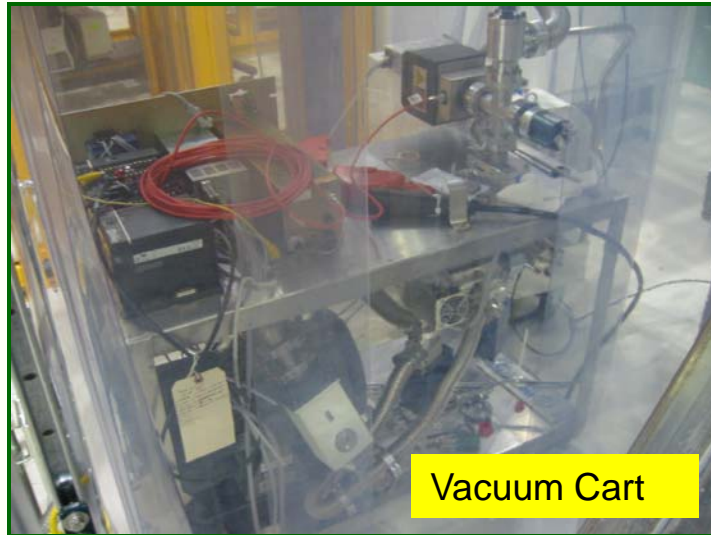


NML Auxiliary Systems



- **Vacuum System**
 - (2) Particle Free Vacuum Carts Being Assembled (1 complete)
 - Leak Detectors, RGA's, Pumps, Gages, Controls
 - Equipment for Insulating, Beamline, and Warm Coupler Vacuum Systems In-House
 - Designs for CM1 Vacuum Spools from Cold Beam Valve to Warm Beam Valve are Complete and being Fabricated
 - (3) Portable Cleanrooms Built (Capable of achieving Class-10)
- **Water Cooling System**
 - System Design Complete
 - New Pumps and Heat Exchanger Installed
 - Piping Installation 95% Complete
 - Temporary Skid (for Phase-1) Operational
- **Safety Systems**
 - Radiation, ODH, Safety Assessment, etc. Documentation Being Prepared

NML Auxiliary Systems



Vacuum Cart



Portable Cleanrooms



Water System



Inside Cave

NML Controls/Instrumentation

- **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

FY09 Plans



- **Complete Phase-1 Goals**
 - Move CC2 to NML
 - Commission RF systems for CM1 & CC2
 - Commission Cryogenic System using CC2
 - Cooldown CM1
 - Install RF Power Distribution for CM1
 - Complete Infrastructure to Cooldown, RF Power, and operate CC2 & CM1
 - Vacuum, RF, Cryo, Interlocks, LLRF, Controls, etc.
 - Begin Operation of CC2
 - Begin Cold RF Testing of CM1

- **Begin Work Towards Phase-2 (Budget Permitting)**
 - Begin Procurement of Injector (gun, magnets, etc.) and Test Beamline (dumps, magnets, etc.)
 - Begin Building Extension Construction???

Schedule Milestones



- Refrigerator #1 Operational (8/07)
- Begin Civil Design of Build. Extension (8/07)
- Commission Refrig. #1 (Liquify Helium) (9/07)
- Move RF Systems to NML (5MW & CC2) (10/07)
- Install CM Support Girders (4/08)
- 1st Cryomodule Delivery to NML (8/08)
- Delivery of 1st Waveguide from SLAC (9/08)
- 300 kW RF System Operational (11/08)
- Commission Vac. Pump & Frick (12/08)
- Cryo System Component Delivery (2/09)
- Delivery of Remaining WG from SLAC (2/09)
- 5 kW RF System Operational (2/09)
- Move CC2 to NML (2/09)
- CM1 Safety Documentation Complete (3/09)

Schedule Milestones (Cont.)



- **Begin 1st Cryomodule RF Tests (Warm) (3/09)**
- **Commission Cryo Distrib. Sys. (CC2) (3/09)**
- **CM1 Ready for Cooldown (5/09)**
- **CC2 Operational (5/09)**
- **Cold RF Testing of CM1 (8/09)**
- **2nd Cryomodule Delivery to NML (11/09)**
- **Install Gun and move A0 photo-injector (2010)**
- **First Beam (2011)**
- **3rd Cryomodule Delivery to NML (2011)**
- **Beam Through Full RF Unit (2012)**
- **Full RF Unit Operations (2012)**
- **Begin Construction of Build. Exten. (on-hold)**
- **Order Cryoplant (on-hold)**
- **Building Extension Complete (on-hold)**