Director's Review of the Project X RF Systems Overview

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Project X Director's Review

March 16, 2009

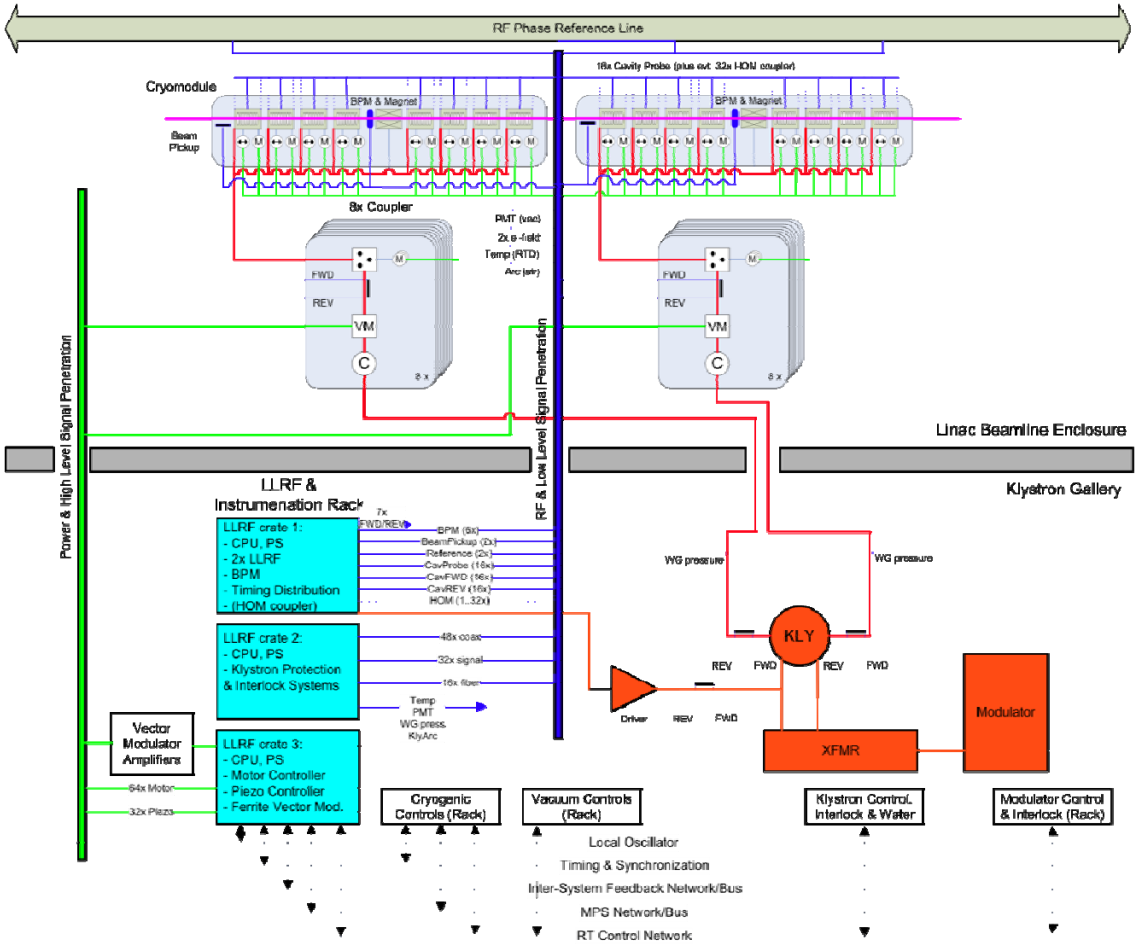
325MHz RF System

- 325MHz System
  - Cavities
    - RFQ
    - 16 room temperature cavities
    - 93 superconducting cavities
  - 8 Klystrons 325 MHz, 2.5 Mwatt
  - 4 Modulators & Charging supplies
  - ~109 Vector Modulators
- Specifications
  - Beam Current = 20 mA
  - Beam Pulse Length = 1.25 mSec
  - Repetition Rate = 5 Hz
  - Final Energy = 0.420 GeV

1300MHz RF System

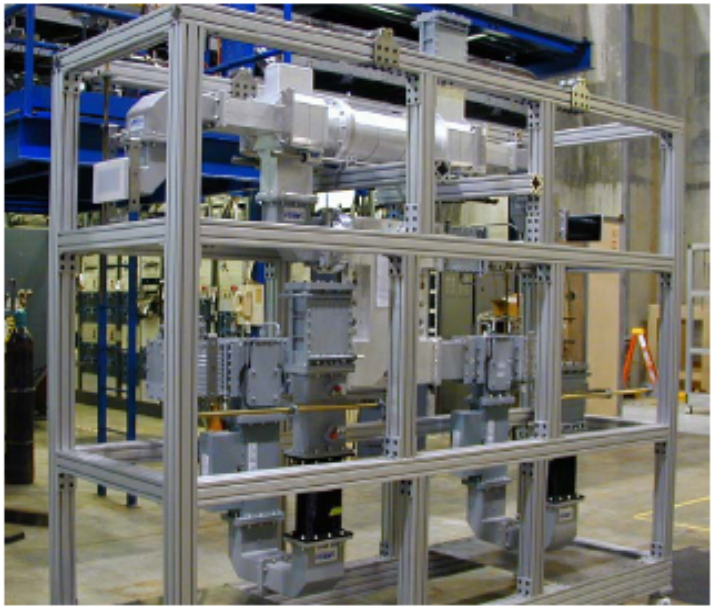
- 1300MHz System
  - 368 Cavities
  - 23 Klystrons 1300 MHz, 10 Mwatt
  - 23 Modulators
  - 23 High Power RF waveguide distribution systems
  - 96 Vector Modulators
- Specifications
  - Beam Current = 20 mA
  - Accelerating Gradient = 25MV/m
  - RF Pulse Length = 1.5 mSec
  - Beam Pulse Length = 1.25 mSec
  - Repetition Rate = 5 Hz
  - RF Power to Cavity (Pulsed) = 519 Kwatts
  - Rf Power to Cavity (Average) ~ 3.9 Kwatts

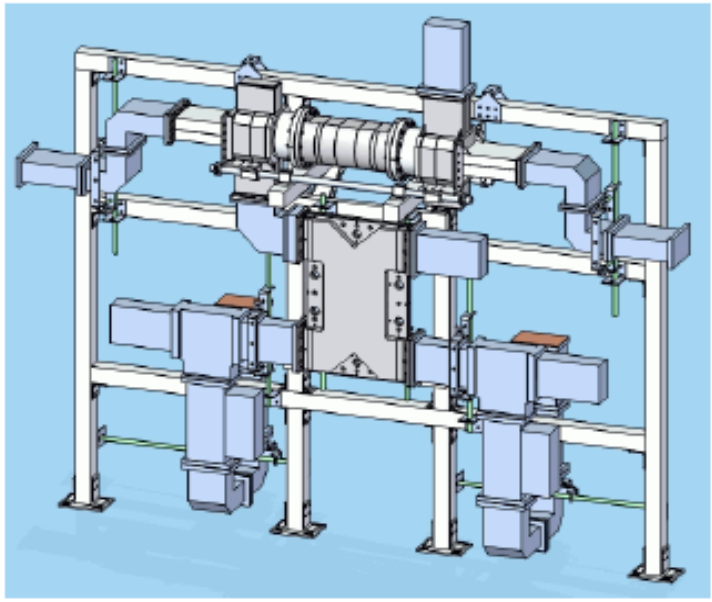
1300MHz Block Diagram



1300MHz WG Distribution

RF PDS Unit





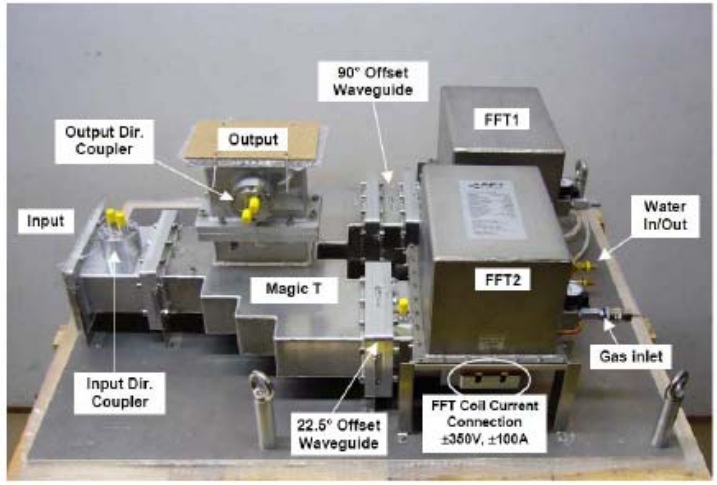
The first (of 4) 2-cavity units of our RF power distribution system for Fermilab's first NML cryomodule is delivered. The other three are complete and about to be high-power tested and shipped.

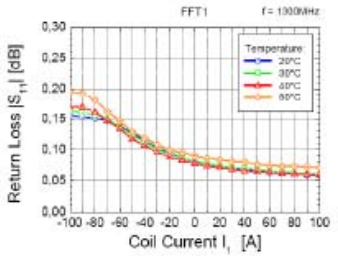
When installed, the front wall of the 80/20® frame will be removed, and the U-bends reversed to go under the remaining wall.

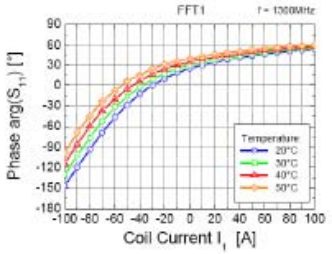
1300MHz Vector Modulator

Fast Amplitude and Phase Control

(AFT prototype for FNAL PD)







Rated for 550 kW at 1.3 GHz and has a 30 us response time

1300MHz Circulator

1300MHz Horz. Klystron

TOSHIBA TENTATIVE Technical Data TD

MULTI-BEAM KLYSTRON AMPLIFIER
E3736H

TOSHIBA E3736H is an L-band Multi-Beam Klystron (MBK) designed suitable for linear accelerators. The MBK is mounted horizontally and installed together with the solenoids and its stand.

The E3736H delivers 10-MW peak output power with 1.5-ms pulse width and a pulse repetition rate of 10 pps at a frequency of 1.3 GHz.

The MBK with several low-perveance beams in parallel through the klystron enables to operate at lower cathode voltage with higher efficiency.

The output power is extracted through two WR-650 standard waveguides. The electron beams are focused by a series-coil electromagnet.

1300MHZ Vert. Klystron

VKL-8301 Multiple Beam Klystron

CPI
Communications & Power Industries
microwave power products division

CPI Microwave Power Products (MPP) offers klystrons for particle accelerator applications. The VKL-8301 is a 1300 MHz, 10 MW peak power, 150 kW average power, long-pulse multiple beam klystron for the European X-FEL and International Linear Collider (ILC) projects.

Key Features

- Multiple beams result in lower operating voltages
- Higher-order-mode interaction results in long cathode lifetimes (>100,000 hours predicted)
- Six beam, cathode-pulsed electron gun
- Six cavity RF circuit including one second-harmonic cavity for enhanced efficiency
- Dual WR650 waveguide outputs
- Collectors capable of dissipating the entire beam power