



**Particle Physics Division
Mechanical Department Engineering Note**

Number: MD-ENG-181

Date: 25 March 2009

Project Internal Reference:

Project: NOvA Full Height Engineering Prototype (FHEP)

Title: NOvA Full Height Engineering Prototype (FHEP) at CDF
Layout – Wall Loads

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Reviewer(s):

Key Words: NOvA, Assembly and Installation, Block Pivot Table

Abstract Summary:

Wall Loads documented submitted to FESS per Director's Policy 18.

Applicable Codes: n/a

Reference Drawings: 2563.100-ME-339148, 2563.100-ME-339149, and 2563.100-ME-339985 (all three of these drawings are un-dimensioned and therefore, require field measurements).

Solid Model File:

PPD_IDM_PPD91059\DRP_NOVA_FHEP_CDR_12-2-08.MF1

Discussion:

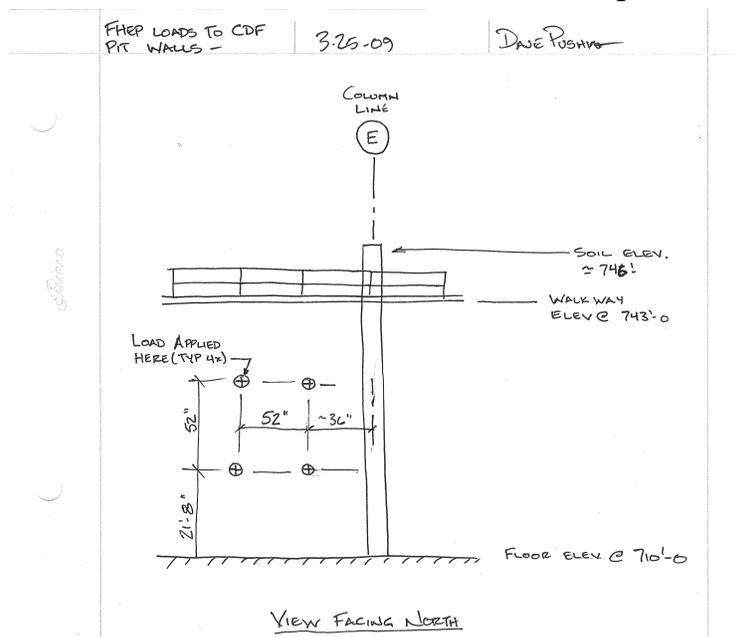
FHEP consists of a painted steel weldment, bolted to the floor and braced off the wall. Bracing is used to transfer seismic loads between the weldment and the building.

FHEP bookend weighs approximately 13,900 pounds. Center of gravity is located approximately 292 inches above the floor and on the vertical centerline. FHEP detector, filled with liquid, weighs approximately 42,000 pounds. Block Pivot Table weighs approximately 25,300 pounds.

Seismic loads from the combined FHEP Bookend, FHEP detector, and Pivoter table may get transferred into the wall at CDF. Hydrostatic loads (assume FHEP extrusions have no stiffness and swell until contacting the bookend and pivot table) will be taken by tying FHEP bookend and the Pivot table together at the edges. This is a very conservative scenario.

The load will be applied to the wall at a total of four locations: two vertical locations (one above and one below the FHEP C.G. - Elevations are 260 and 312 inches above floor) and two horizontal locations (east-west) direction, 52 inches apart. Loads will include a component normal to the wall and a component parallel to the wall. Load magnitude will be $0.06 * \text{weight}$. Total load will be $0.06 * (13,900 + 42,000 + 25,300) = 4872$ pounds. Applied at four locations, the load at each location is 1220 pounds.

The following sketch shows the seismic load locations:



Key dimensions taken at CDF using the group's laser distance device are:

Floor to bottom of crane:	612 inches
Floor to bottom of north walkway structural steel:	386.7 inches
Width of north walkway (cement wall to handrail):	69.5 inches
Width of wall btw column lines D and E:	285.2 inches
Width of electrical clear area at col. line D:	48 inches
Ladder cage projection east of col. Line D:	36 inches
Length of assy pit floor btw col. Lines 1 and 4:	824 inches

Images of NOvA FHEP at CDF:

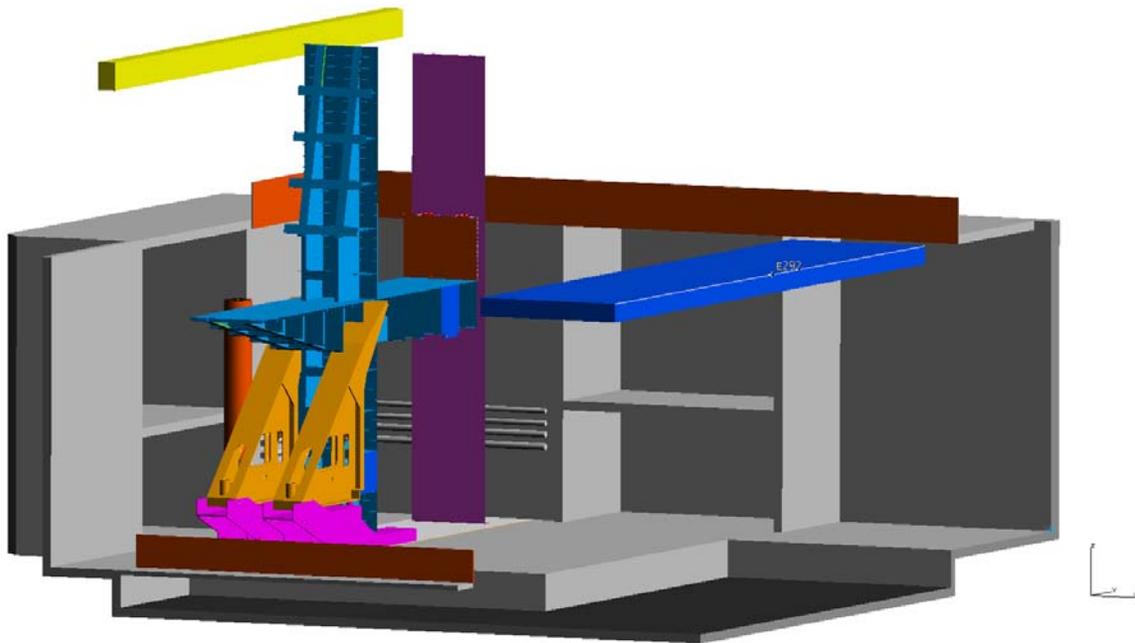


Image 1: NOvA FHEP at CDF Assembly Pit Looking to the Northwest.

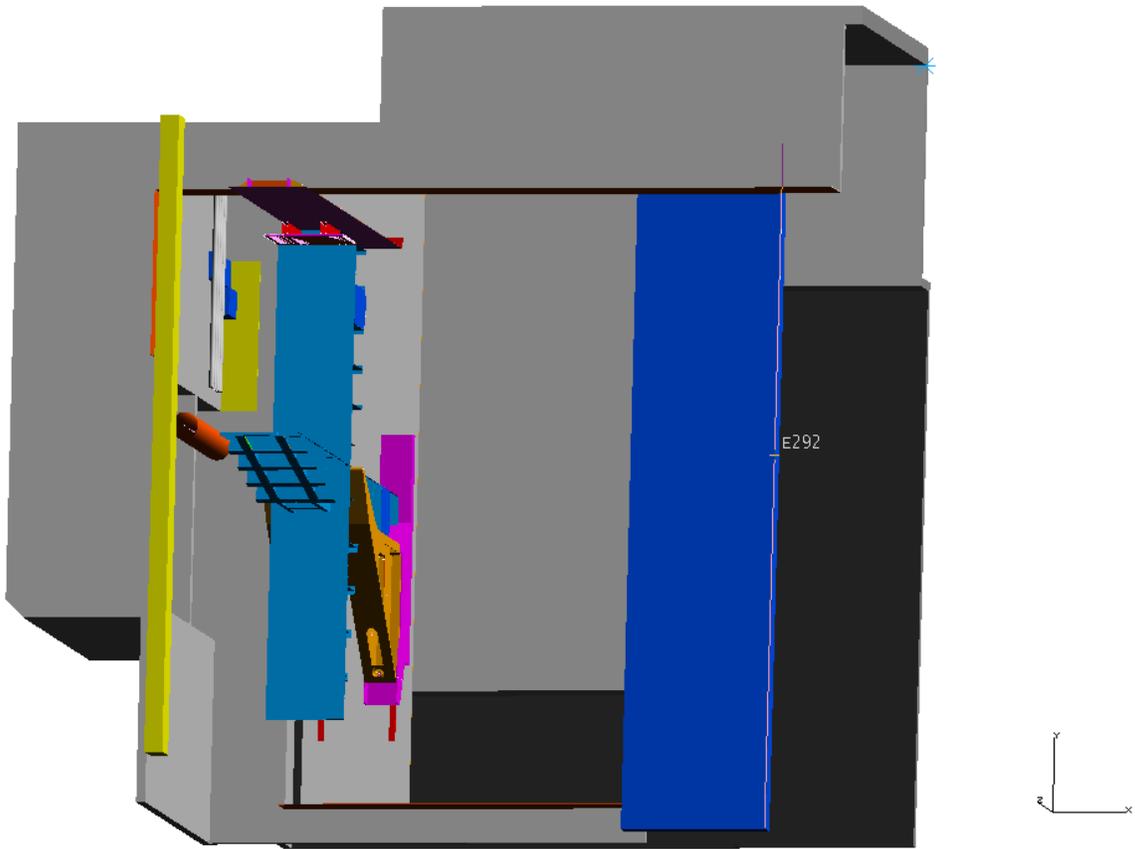


Image 2: Semi Plan View (Looking Down from Above) of the NOvA FHEP Pivoter in the CDF Detector Pit.

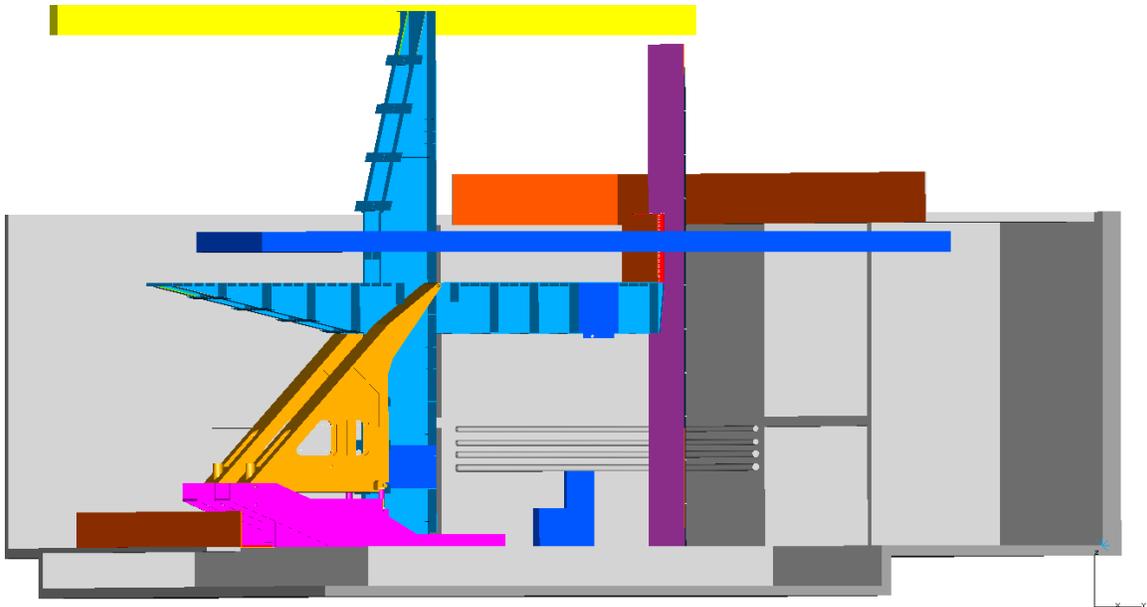


Image 3: Elevation View

Notes about the Images shown:

- 1) CDF Crane Rail is shown in Yellow. Bottom of Crane Rail is 612 inches above the assembly elevation.
- 2) CDF Transport Cart is not shown in its normal parking space.
- 3) The Pivoter shown the table in both the vertical and horizontal positions (it can only be in one position at any one time). As shown, the pivoter table will need to be shortened to avoid conflict with the crane.
- 4) The FHEP “Bookend” is shown in purple on the north wall of the assembly area.
- 5) The CDF Cable Bridge is shown as a blue rectangle. Elevation and horizontal position of the lower edge are accurate. Size is not.
- 6) Hand rails around the pit are shown as solid orange walls.
- 7) Light gray area on the floor in image 2 represents an area twelve feet wide, located 10 feet east of the west wall. Actual distance from the wall will be about 12 feet. Refer to item 4 below from the discussion with the CDF staff. This will be changed to 12 feet from the west wall in the actual installation.