



Particle Physics Division

Mechanical Department Engineering Note

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Project: FLARE

Project Internal Reference:

Title: FLARE LArTPC Work Platform Remote Valve Support

Author(s): Ingrid Fang, R. J. Woods

Reviewer(s):

Key Words: FLARE LAr TPC Tank Work Platform, Remote Valve, Valve Support

Abstract/Summary:

The exact details of the Remote Valve were unknown when structure of the Work Platform was originally designed. This valve was assumed to be positioned close to its support; however, the valve was attached to the end of a pipe that cantilevered approximately 40 inches from the support. This cantilever caused the support to rotate during valve actuation and when the valve was subjected to a manually applied horizontal load.

In order to reduce this rotation, the support was modified by welding a second angle to the original support angle to form a more torsionally stiff box section. This note contains the results of a finite element analysis performed on the new box section that proves the modification is safe.

Applicable Codes:

Manual of Steel Construction, ASD, Ninth Edition, American Institute of Steel Construction, Inc. 1989

Engineering Manual, Fermilab, 07/09 Edition.

FLARE LAR TANK

CRYO PIPING
SUPPORT

R. J. WOODS
MAR. 1, 2011

CHECK SUPPORT FOR TOP REMOTE VALVE =

VALVE WEIGHT = 185 #

THE FOLLOWING DIMENSIONS WERE TAKEN FROM THE
IDMAY MODEL:

X DIRECTION:
FROM CENTER OF VALVE TO SUPPORT = 26.98"

Z DIRECTION:
FROM CENTER OF VALVE TO SUPPORT = 31.15"

$$M_x = 185 (26.98) = 4991 \# \text{-IN}$$

$$M_z = 185 (31.15) = 5763 \# \text{-IN}$$

DUE TO COMPOUND ANGLE, ANALYZE USING
FINITE ELEMENT METHOD:

Flare LAR TPC Work Platform Analysis

By Ingrid Fang

March 8, 2011

The purpose of this analysis is to investigate the support for a cryogenic valve attached to the work platform.

The support originally consisted of a 4x4 structural steel angle, vertically orientated and welded to the platform top floor support beam. It was found that the mass of the valve caused excessive deflection in this angle. In order to bring the deflection to more tolerable limits, another angle was welded to the original support angle to form a box shaped section, thus increasing the torsional resistance of the member.

The results shown below indicated that this proposed addition met the design requirements.

Figure 1. Meshing

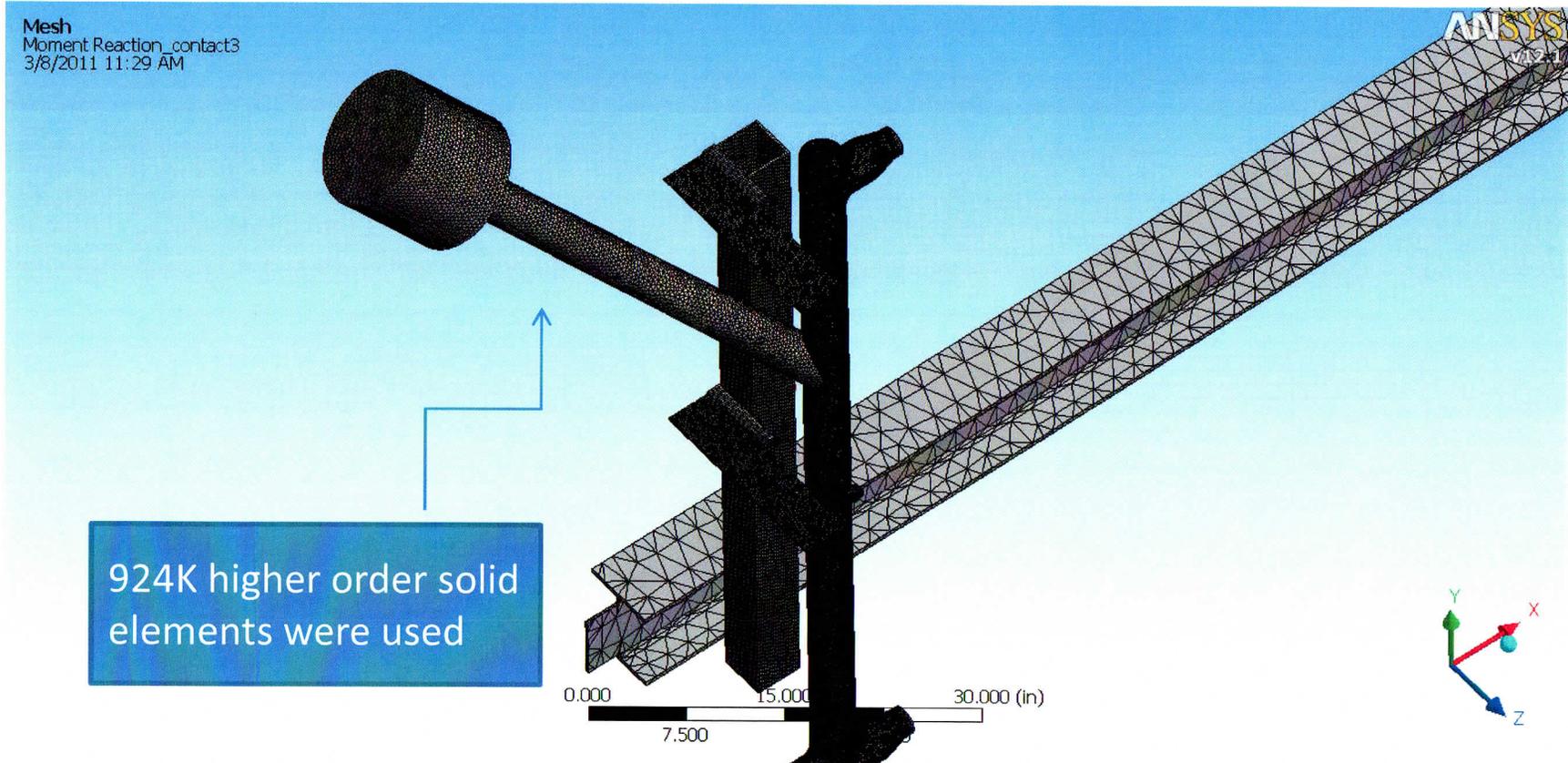


Figure 2. Loading

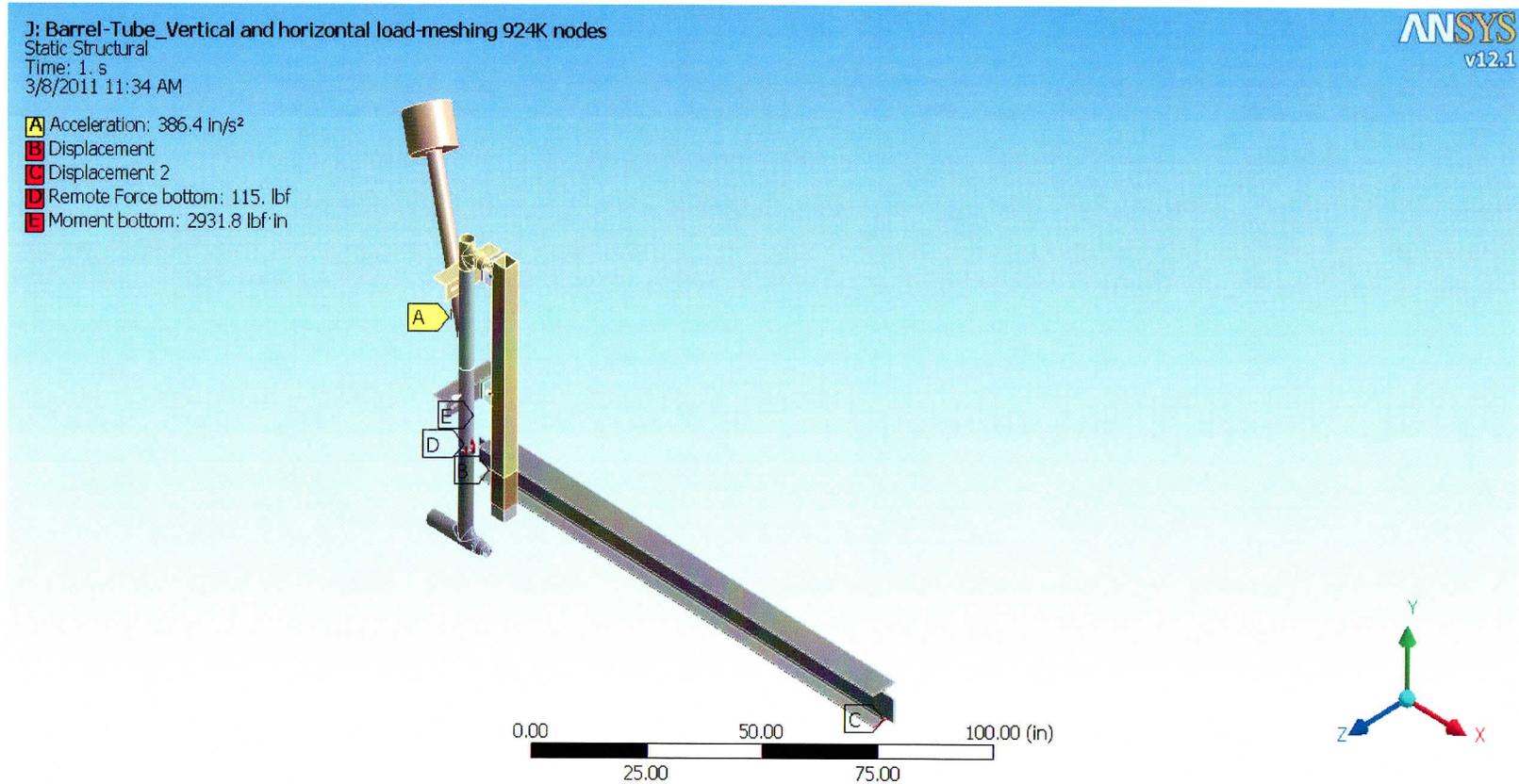


Figure 3. Total Deformation

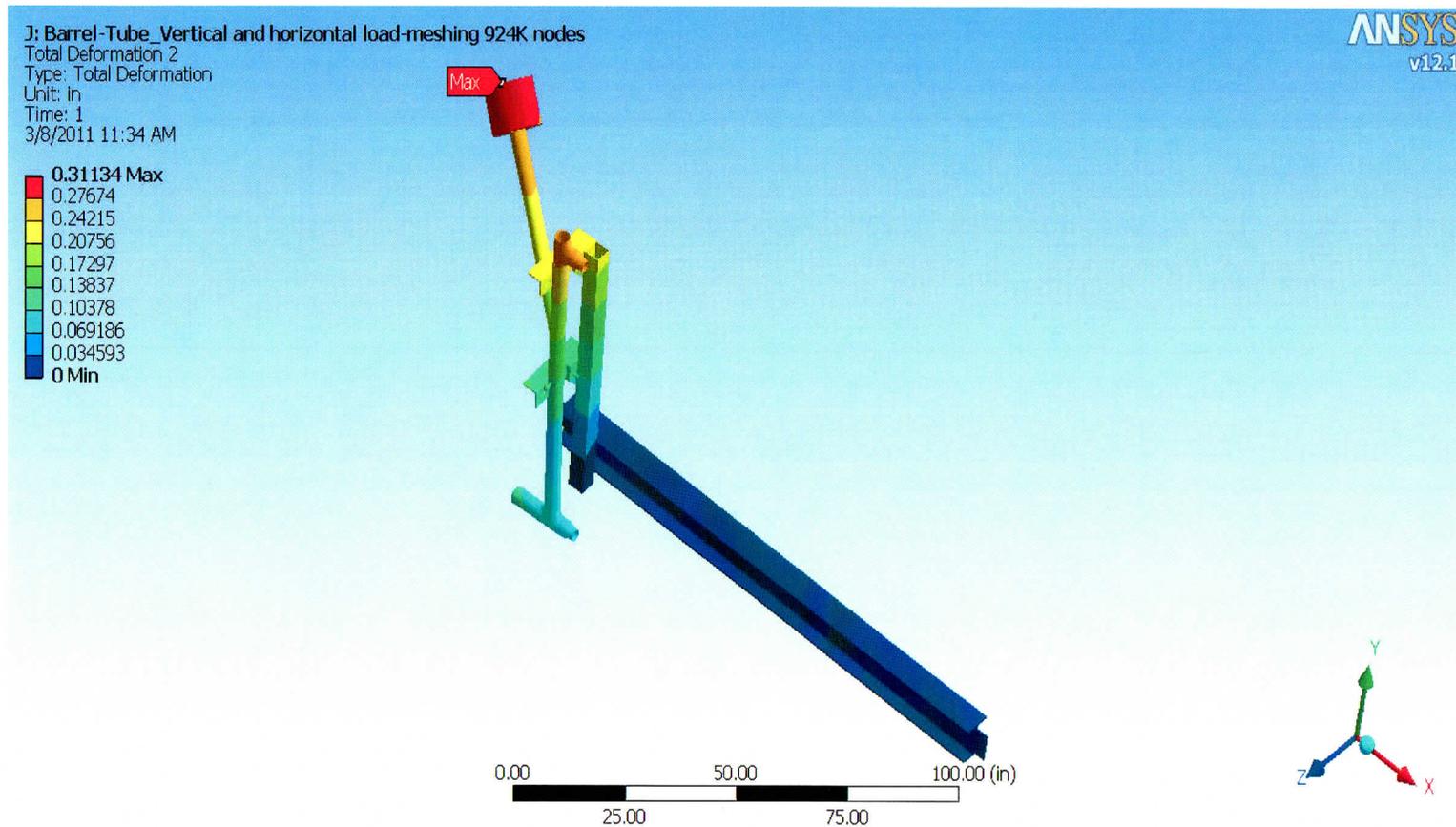


Figure 4. von-Mises Stress

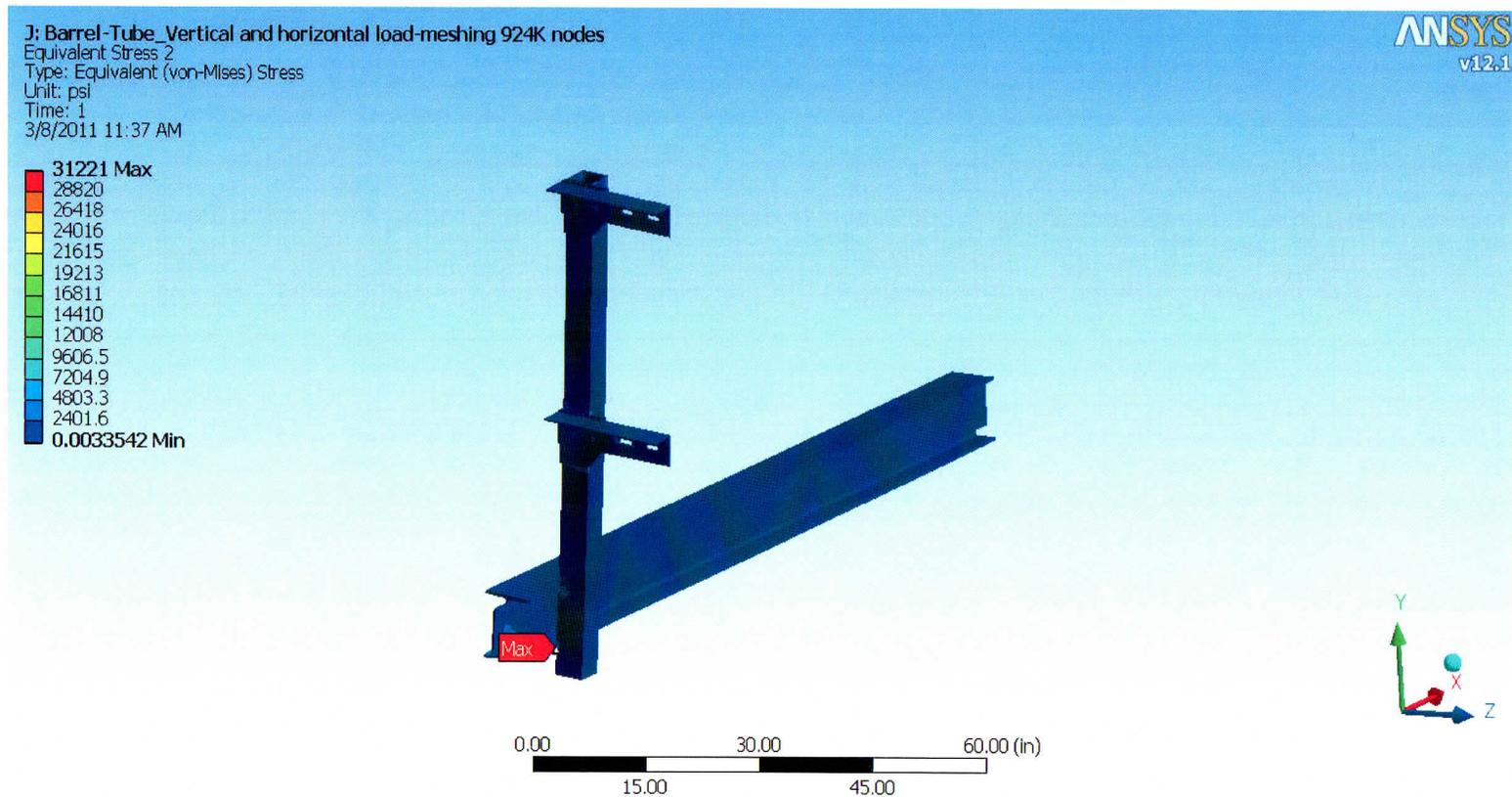
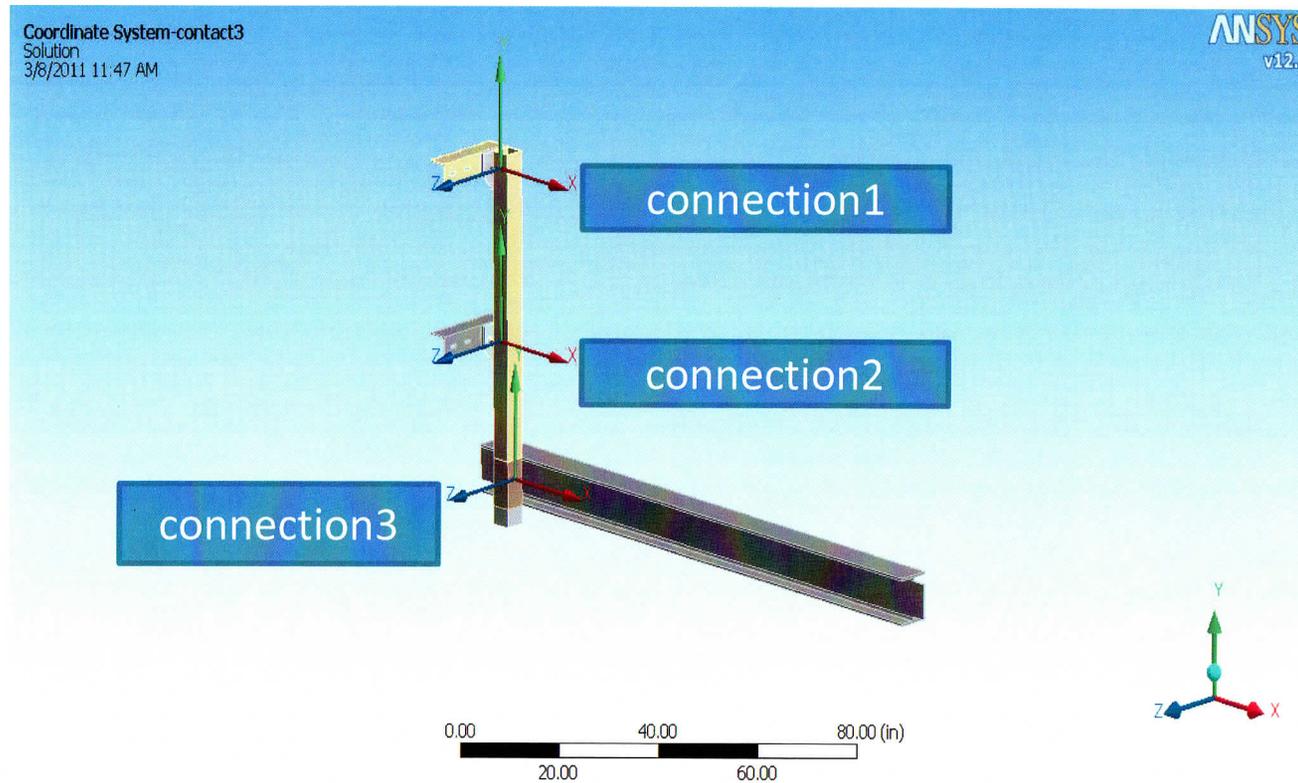


Figure 5. Forces at connections



	Fx (lbs)	Fy (lbs)	Fz (lbs)	Mx(lbs-in)	My(lbs-in)	Mz(lbs-in)
connection1	10	96	384	505	1851	488
connection2	54	285	341	2956	1957	127
connection3	35	117	63	1003	26	6505