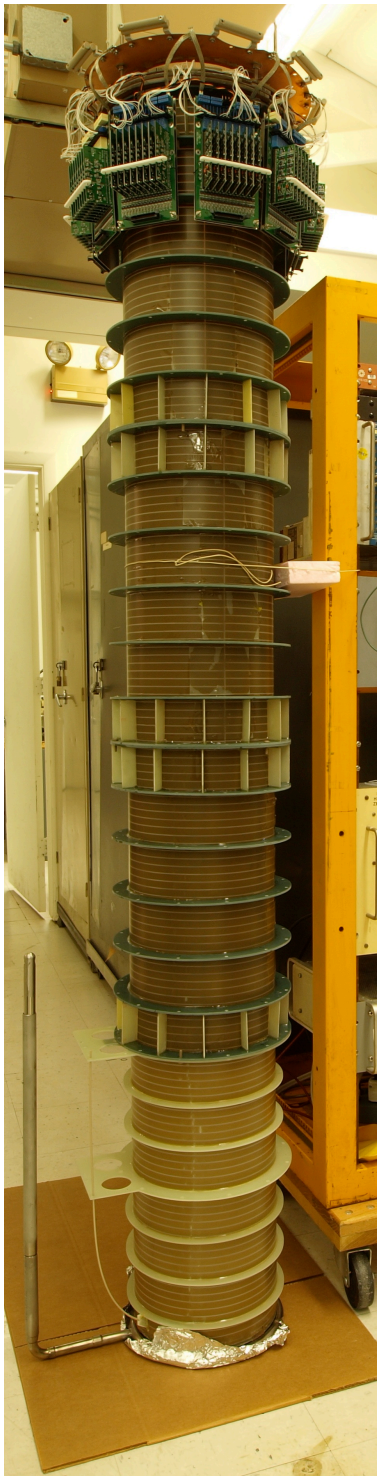
LAPD Tank Center Flange for Run 2 With Long Bo TPC

A new tank center flange and sub-flange have been fabricated for the 2nd run of LAPD. The sub-flange carries a TPC detector known as Long Bo. Both large flanges are populated with various sizes of smaller conflat flanges. Both flanges are sealed using an indium wire in a groove. The main flange is 1 inch thick and the sub-flange is 3/4 inch thick, both made from 304L stainless steel. The flange assembly is shown in drawing #489768 and included in this document.

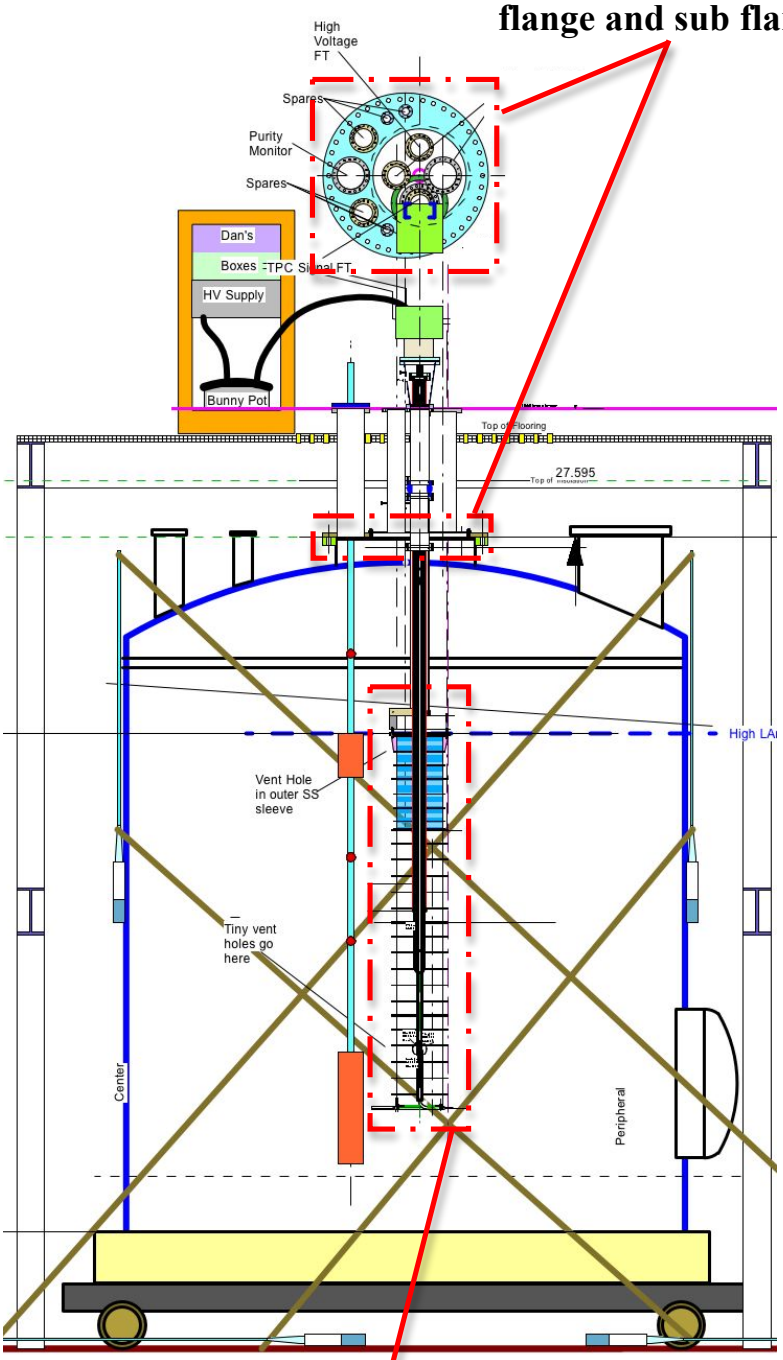
The TPC chamber is shown in the following figure. The chamber itself weighs less than 50 pounds such that its not a significant flange load.

A FEA analysis of the two flanges is included after the figures and drawings. The FEA analysis assumes a ¾ inch thick center flange when in fact the flange is 1 inch thick such that the FEA analysis is conservative. The FEA analysis shows a maximum stress due to internal pressure of 2,000 psi which is far below the allowable for 304L stainless steel.



Long Bo TPC

New LAPD tank center flange and sub flange



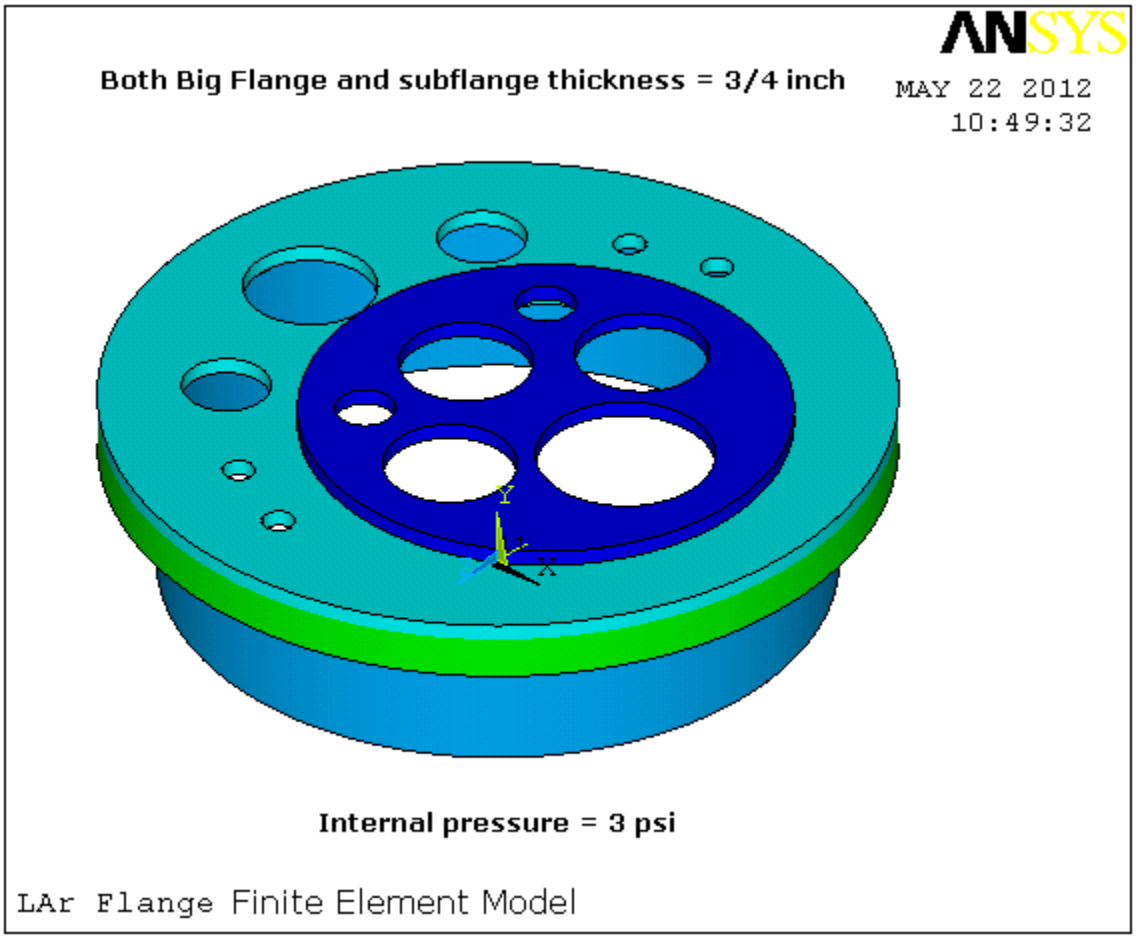
Long Bo TPC position in LAPD tank

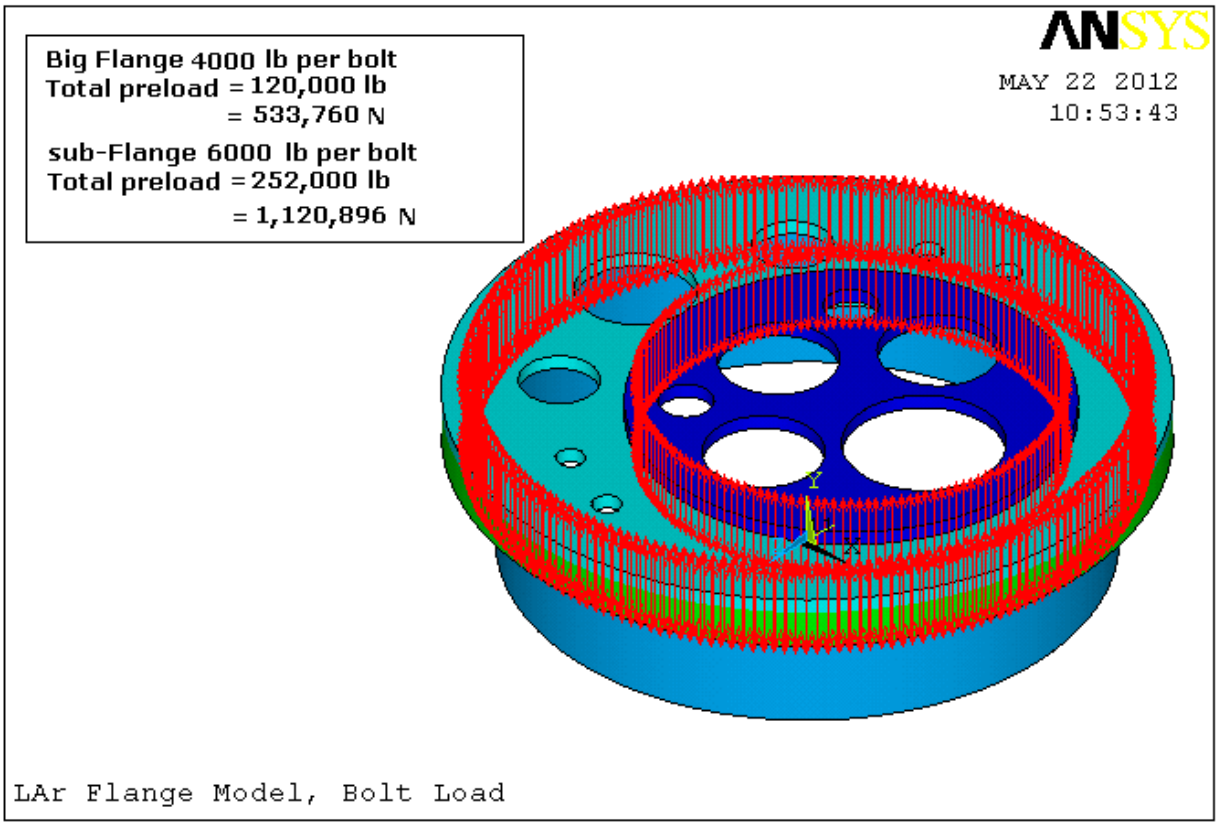
Liquid Argon Tank Flange FEA Model

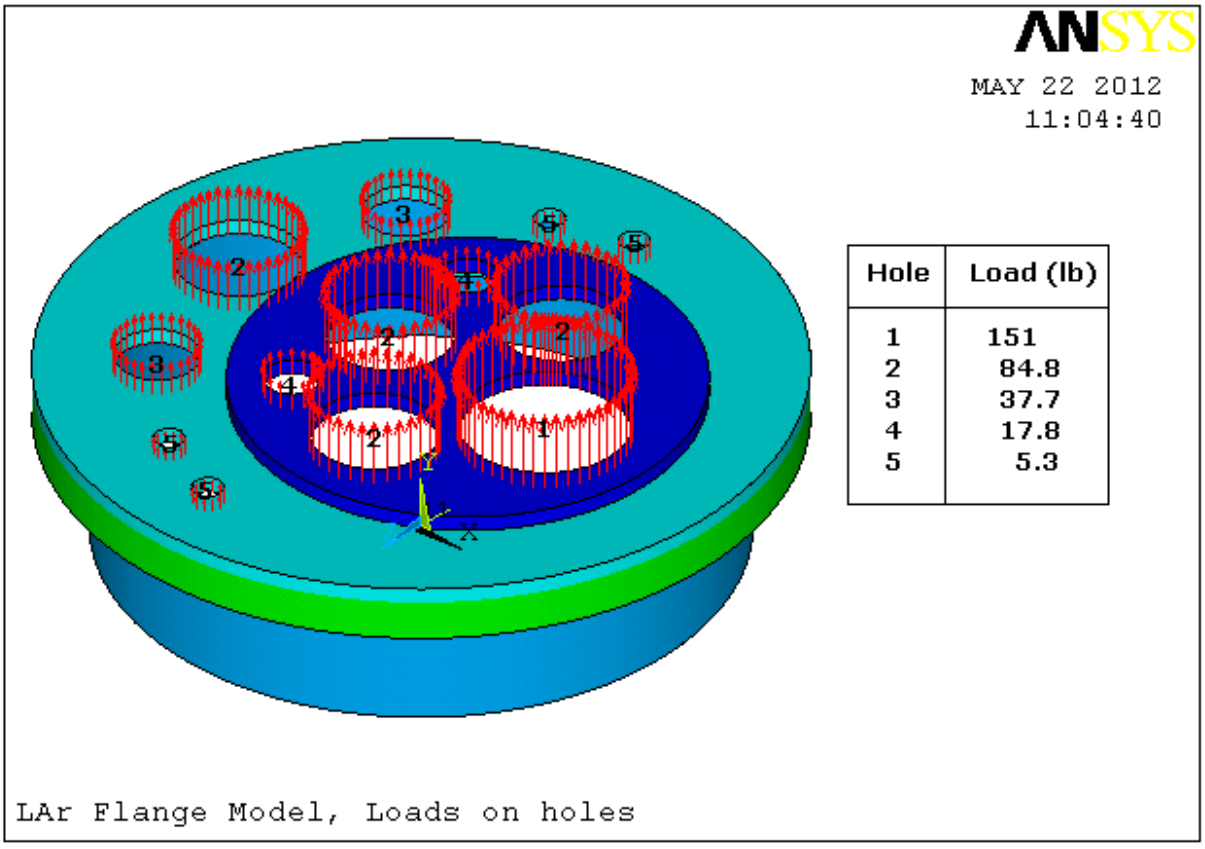
Zhijing Tang

May 22, 2012

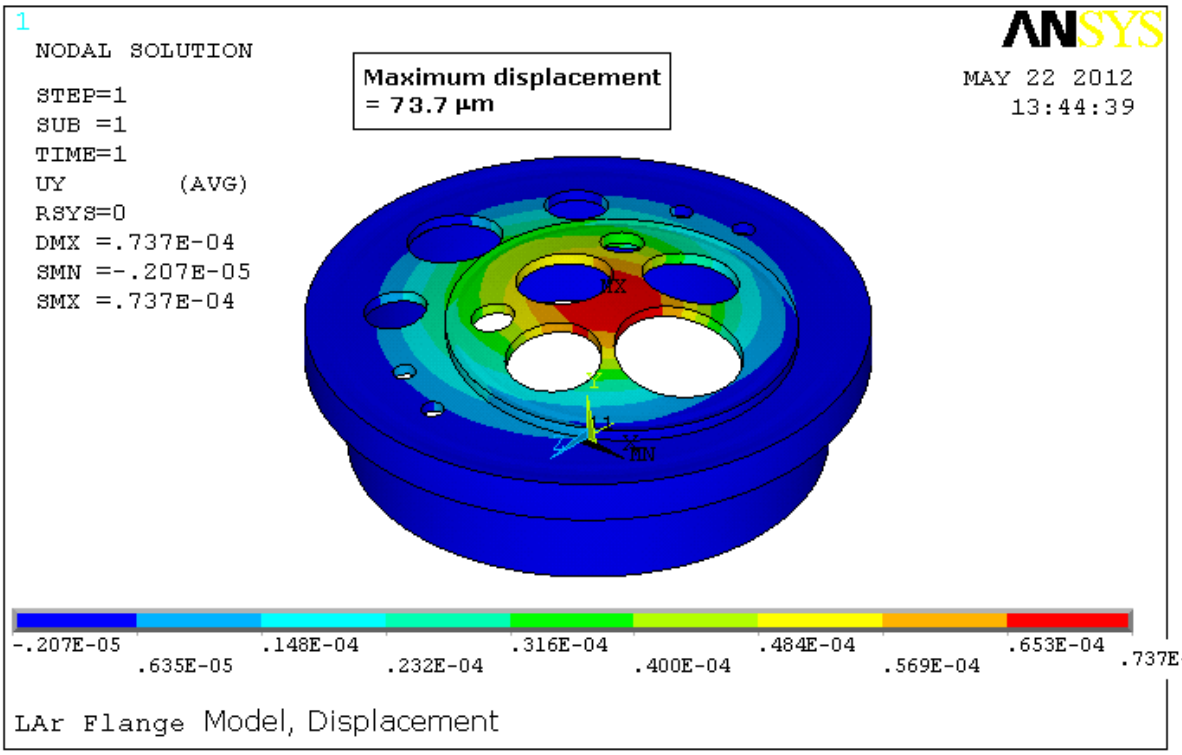
In large liquid argon tank, there is an opening about 30 inch diameter. The flange cover the opening is 3/4 inch thick. Modification is proposed to add a sub-flange. This finite element analysis is to calculate the stress and displacement of the flanges. The model is shown in Fig.1. Both flanges are 3/4 inch thick. Model is supported at the low-end of the opening. Internal pressure is 3 psi. Fig.2 shows the bolt preloads. Fig.3 shows the loads on the circumference of the holes. Fig.4 is the calculated displacement. The maximum displacement is 0.074 mm. Fig.5 is the calculated equivalent stress. The maximum stress is about 5000 psi, and it is due to the bolt preload. If this is excluded, the maximum stress due to internal pressure is about 2000 psi. Figs. 6 and 7 show that the contact area has negative stress. Therefore there should be no leak.



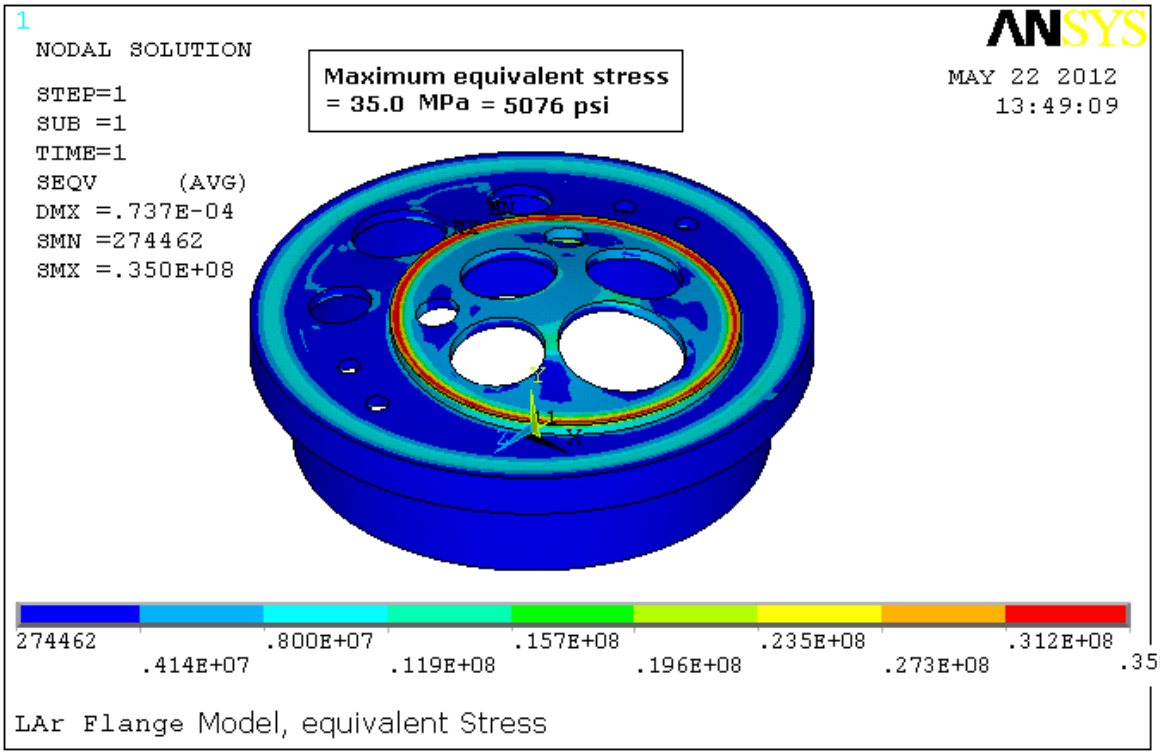




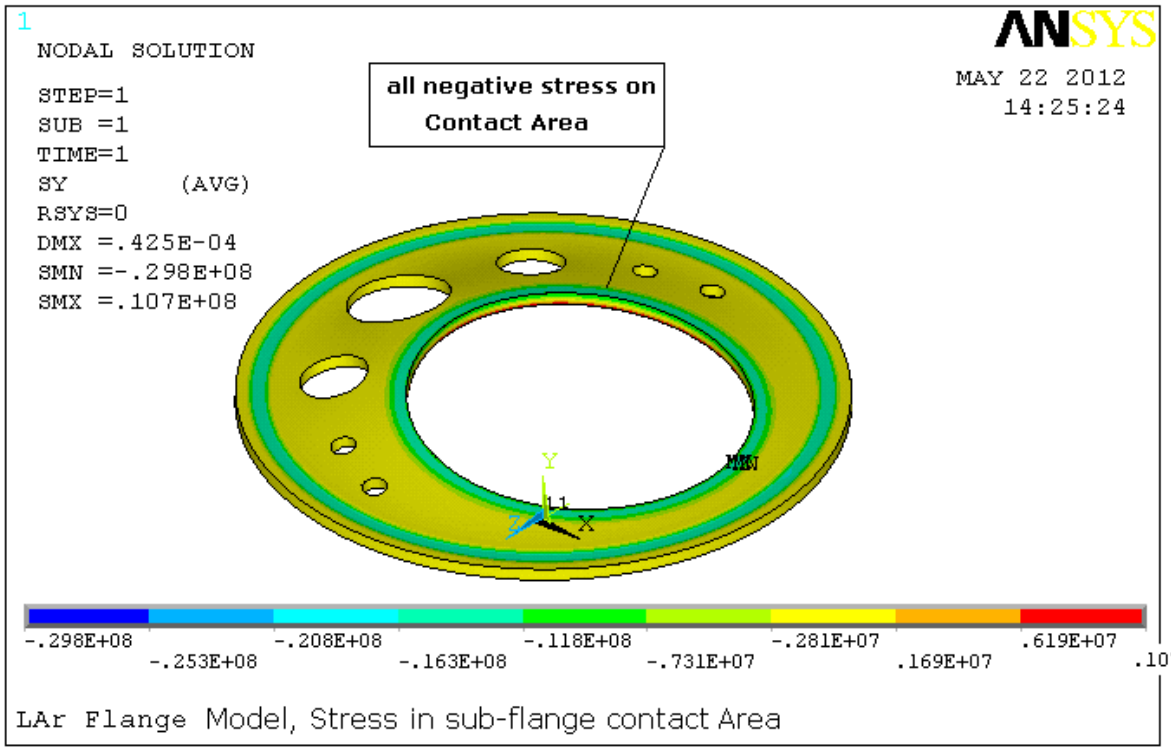
Hole	Load (lb)
1	151
2	84.8
3	37.7
4	17.8
5	5.3



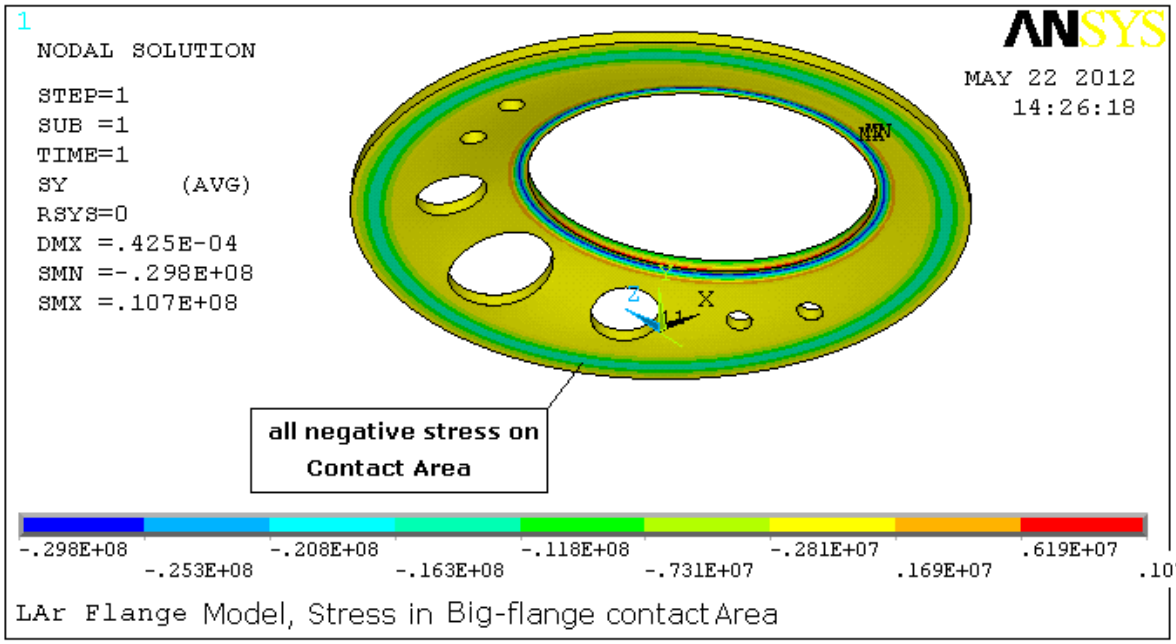
LAr Flange Model, Displacement



LAr Flange Model, equivalent Stress

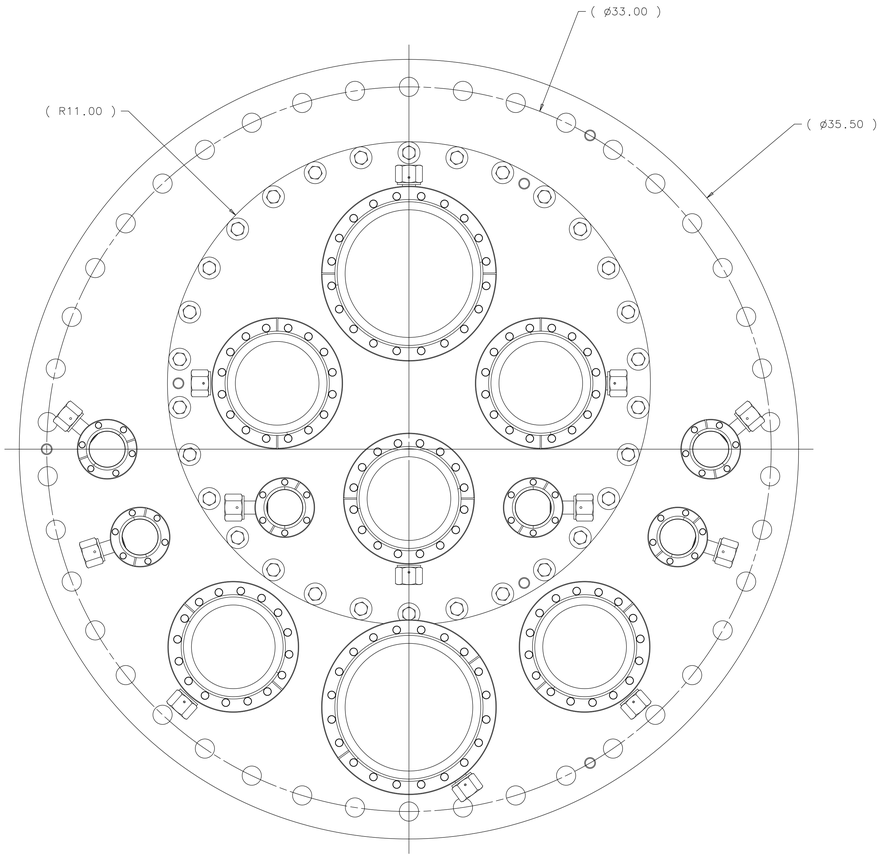


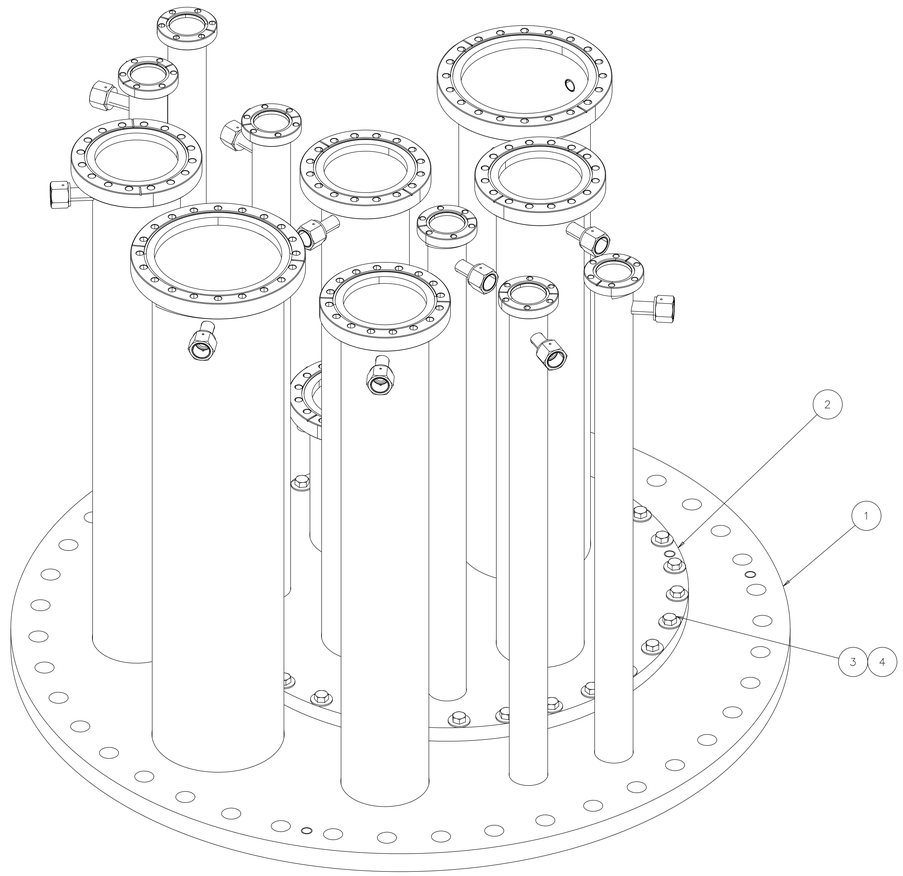
LAr Flange Model, Stress in sub-flange contact Area

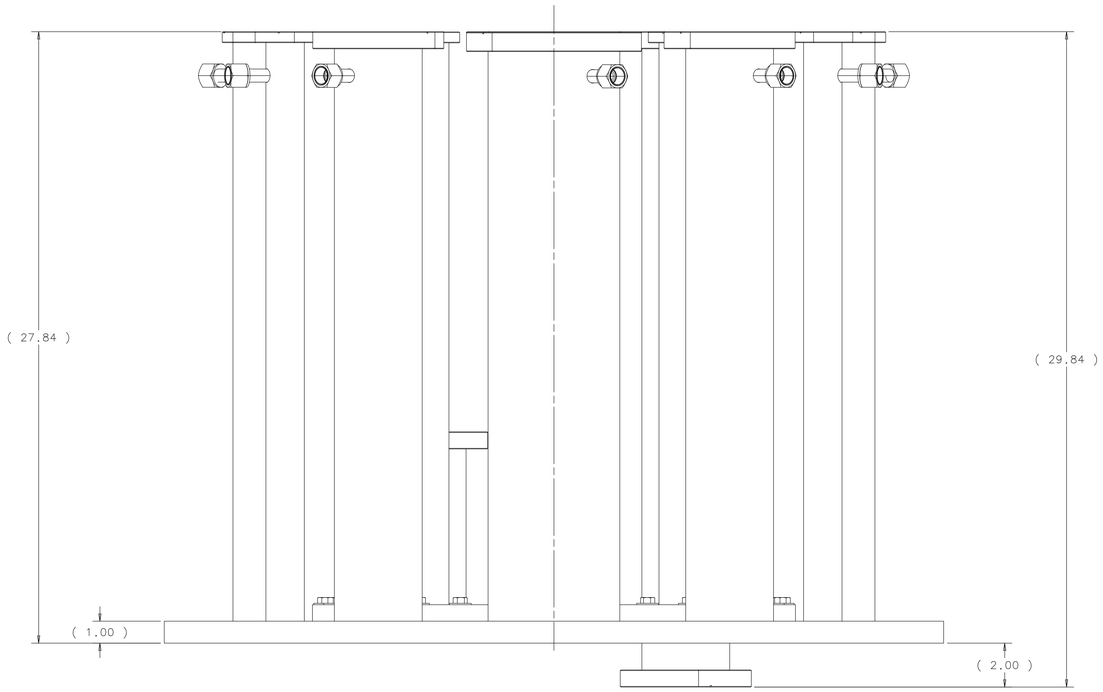


LAr Flange Model, Stress in Big-flange contact Area

REV	DESCRIPTION	DRAWN	DATE
		APPROVED	DATE







TOTAL WEIGHT = 315 LBS.

ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.
4	COML	FLAT WASHER - STL. 3/8 SCREW SIZE	30
3	COML	HEX. HD. SCREW - STL. 3/8-16 UNC-2B X 1.25 LG.	30
2	MD-489770	SUB-FLANGE WELDMENT	1
1	MD-489769	BIG-FLANGE WELDMENT	1

PARTS LIST

UNLESS OTHERWISE SPECIFIED			ORIGINATOR	T.TOPE	19-JUN-2012
.XX	.XXX	ANGLES	DRAWN	G.SMITH	19-JUN-2012
± .01	± .005	± 1°	CHECKED	G.SMITH	28-JUN-2012
			APPROVED	T.TOPE	28-JUN-2012

1. BREAK ALL SHARP EDGES .015 MAX.
2. DO NOT SCALE DRAWING.
3. DIMENSIONS BASED UPON ASME Y14.5M-1994
4. MAX. ALL MACH. SURFACES
5. DRAWING UNITS: U.S. INCH

USED ON

MATERIAL: SEE PARTS LIST ABOVE

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

FLARE - GENERAL
LAPD TANK
LAPD TANK - FLANGE ASSEMBLY

SCALE	DRAWING NUMBER	SHEET	REV
3:8	3942.010-ME-489768	1 OF 1	

CREATED WITH : Ideas12NXSeries | GROUP: PPD/MECHANICAL DEPARTMENT