**Analysis of EB Support Saddles and Forces
Between Modules during Assembly**

By

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July 16, 2002

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**Victor Guarino
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1. Introduction

As the EB Tile Calorimeter is constructed, the support saddles and the modules will be subjected to different forces, stresses, and deflections than when completely assembled. The purpose of this analysis is to examine the forces, stresses, and deflections acting on the support saddles and modules at various stages of assembly.

2. Model Description

In the FE model of the saddle and back cryostat support, the Z axis ran along the beam line, the Y axis was in the vertical direction, and the X axis was horizontal.

Software used: COSMOS/M and Solid Works

Type of Elements: Solid

Number of Elements: 78,355

Material: Stainless Steel, $E = 206,000$ MPa

Code applied: Euro code 3

A complete description of how the modules, connections within and between modules, and support saddles were modeled can be found in ANL Technical Report ANL-HEP-TR-01-097, "Extended Barrel Support Saddle Design and Analysis".

3. Load Cases

There were eight load cases examined to date. All of the loads are at their nominal values. These are described below.

EB1 - 63 modules with cryostat load

EB2 - 63 modules without cryostat load

EB3 - 48 modules with cryostat load

EB4 - 48 modules without cryostat load

EB5 - 32 modules with cryostat load

EB6 - 32 modules without cryostat load

EB7 - 24 modules with cryostat load

EB8 - 24 modules without cryostat load

- EB9 - 14 modules with saddles
- EB10 - 14 modules with saddles and support cradle
- EB11 - 14 modules without saddles but with support cradle only

Load Case EB7 did not converge to a solution. It appears that this configuration is unstable without any further supports.

Figure 1 below shows an example of how modules are numbered.

Fig. 1. Module numbering scheme.

4. Stability of Assembly

There are two load cases where the EB assembly is not stable and additional supports are needed; load case EB7, which has 24 modules in place and the cryostat load first applied and, load case 9, in which there are 14 modules supported only by the saddle. The FE model in both of these load cases found a solution; however, the deflections were excessively large, because the entire structure had to deform in order to find a static solution to the problem. Also, in both of these

load cases, when a small force (100N) was applied to the back cryostat support in the X direction, the deflections and forces that were found by the FE model changed dramatically.

Both of these load cases were examined by performing some simple hand calculations and with a 2D FORTRAN program, which solved for the reaction forces on the saddle. With the constraint that the swivel bolt forces must be in compression in both of these load cases, it was found that a static solution was only possible if additional support was provided to the saddles or modules below the saddle. Each of the unstable load cases will be examined in detail below.

Fig. 2. Static Analysis of Load Case EB9 - 14 modules in place.

Figure 2, above, shows a simplified location of forces being applied to the saddle in load case EB9, in which there are 14 modules in place that are only supported by the saddle. With only 14 modules in place, only 1 swivel bolt and the key are in contact. The reaction force, F , is equal to 7 times the weight of a module. The saddle reaction forces, F_r and F_s , can be easily solved by statics as shown below.

$$\Sigma F_y \quad F_r \cos \theta + F_s \sin \theta = F$$

$$\Sigma F_x \quad F_r \sin \theta = F_s \cos \theta$$

$$F_r = F \cos \theta$$

$$F_s = F \sin \theta$$

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However, the sum of the moments about the IP must be equal to zero in order to achieve equilibrium. Therefore,

$$\Sigma M_{IP} - RF_s + XF = 0 .$$

Solving for X, we find

$$X = \frac{RF_s}{F}$$

$$X = R \sin \theta .$$

If the angle is

$$\theta \approx 34^{\circ} ,$$

then

$$X \approx .56R .$$

Using $R=4,173\text{mm}$, we find that $X=2,333\text{mm}$, which is not underneath the saddle support beam. If the support point is located at $3,000\text{mm}$ at the center of the support beam, then an additional moment, $[M=(3000\text{mm}-X)*F]$, is needed in order to achieve static equilibrium. In order to check this analysis, the saddle support beam in the FE model was restrained in load case EB9 along its edges in the vertical direction, so that it could support a reaction moment. The reaction forces were then examined and the equivalent location of the reaction force was found. This is plotted below and shows that the reaction force would have to be applied outside of the beam to achieve equilibrium. The location of the reaction force is in reasonable agreement with the location of the reaction force calculated in the simplified hand calculations discussed above.

Fig. 3. Variation of reaction force position--load case EB9.

In order to achieve equilibrium during assembly, the support cradle, which is used to initially assemble the first 12 modules, will have to be kept in place. In this case, the support cradle carries the entire load of the modules and only a minimal load is applied to the saddles. This analysis is shown in load case EB10 where there are 14 modules in place supported by a combination of the support cradle and the saddles. The forces acting on the saddles in this load case are virtually zero.

The same analysis and conclusions apply to load case EB7, in which there are 24 modules in place and the cryostat load is applied. The forces acting on the saddle in the back of this load case are shown in Fig. 4 below. Static equilibrium can be found using the following equations.

$$\Sigma F_y \quad F_1 \cos \theta + F_2 \cos \alpha + F_s \sin \theta - F_c = F$$

$$F = W + F_c$$

$$F_1 \cos \theta + F_2 \cos \alpha + F_s \sin \theta = W$$

$$\Sigma F_x \quad F_1 \sin \theta + F_2 \sin \alpha - F_s \cos \theta = 0.0$$

$$\Sigma M_o \quad -RF_s + XF - AF_c = 0.0$$

$$F_s = \frac{XF - AF_c}{R}$$

Fig. 4. Static analysis of load case EB7 - 24 modules in place with the cryostat load applied.

Solving for F_{r1} , F_{r2} , and F_s results in swivel bolt forces, which are in tension. However, the swivel bolt forces must be in compression. This can only be achieved by either moving the location of the support point, X , or by adding the force, P , as shown in the figure below. The force, P , can be added by placing a compression beam between the back cryostat supports. The static equilibrium equations in this case are

$$\Sigma F_y \quad F_1 \cos \theta + F_2 \cos \alpha + F_s \sin \theta - F_c = F$$

$$F = W + F_c$$

$$F_1 \cos \theta + F_2 \cos \alpha + F_s \sin \theta = W$$

$$\Sigma F_x \quad F_1 \sin \theta + F_2 \sin \alpha - F_s \cos \theta = -P$$

$$\Sigma M_o - RF_s + XF - AF_c + BP = 0.0$$

$$F_s = \frac{XF - AF_c}{R} + \left(\frac{B}{R}\right)P.$$

If

$$P = 142 \text{ tons,}$$

then

$$F_s = 0.0.$$

Solving for P, F_{r1} , F_{r2} , and F_s results in positive value of the swivel bolt forces. These four unknowns were solved with only 3 equations by iterating the value of P from zero to a final value of 18 tons, at which point the swivel bolt forces became positive. The value of 41 tons for P is the minimum value, which is needed to have the swivel bolts in compression. The output of the FORTRAN program that solved this problem can be found in Appendix 1 and shows the forces on the back saddle for every module during the assembly. In order to check this static analysis, a truss element was placed in the FE model between the back cryostat supports. The resulting values of the forces on the saddle are compared below, between the FE model and the static analysis. The static analysis compares well with the FE model considering the large deflections of the saddle (3mm) at the top swivel bolt and that the force, F1, in the FE model is actually a sum of the forces acting on 3 different swivel bolts at 3 different module positions.

	P (tons)	F1 (tons)	F2 (tons)	Fs (tons)
Static Analysis	41	32	0	78
FE Model	34	19	0	65
% Difference	17%	40%	0%	16%

A compression member between the back cryostat supports is needed in order to generate the force, P. This compression member will have to be similar to a turnbuckle so that the value of P can be varied. In order to remove the compression member after the EB assembly is stable, it will be necessary to reduce the force on it to zero.

Finally, a static analysis identical to the one described above was carried out for the addition of every module to the assembly from 14 modules in place to 64 modules in place. This analysis shows that with 14, 15, 16 and 24, 25, 26, 27, 28 modules in place, the assembly is unstable, because an additional moment is needed at the bottom of the saddle in order to achieve stability. In all of the load cases, additional fixturing will be needed in order to provide the necessary support.

5. Forces between Modules

The charts below show the forces between the modules for the load cases that have been examined. It is clear from these charts that the forces decline with the number of modules, which are assembled and are the maximum when the entire EB has been assembled.

6. Saddle Forces

The force on the saddles from the EB also changes as the modules are assembled. These are shown in tables below. Once again, the maximum loads on the saddle occur when the entire EB has been assembled. There are three special cases. The first is load case EB7, in which there are 24 modules in place and the cryostat load is first applied. This load case, as discussed above, is unstable unless a compression member is placed between the back cryostat supports. The results below reflect an FE model, in which a truss is placed between the back cryostat supports, and the resulting compression force on this truss is XXX tons.

The results for load case 9, 14 modules supported only by the saddle, are not shown, because this case, as discussed above, is unstable. The results for load case 10, which is 14 modules in place supported by the assembly cradle and saddles, are not shown, because the forces on the saddles are nearly zero.

Load Case EB1

	Radial Forces						Key Forces M7
	M6	M8	M9	M10	M11	M12	
Z1	0.00	16,250	115,500	227,500	128,000	0	-354,600
Z2	110,500	248,300	209,500	115,700	41,490	0	-740,800
Z3	236,900	345,400	267,200	188,500	35,540	0	-996,500
Z4	114,100	216,300	194,100	188,900	88,190	0	-595,200

Load Case EB2

	Radial Forces						Key Forces M7
	M6	M8	M9	M10	M11	M12	
Z1	202,100	136,600	97,690	118,400	58,260	0	-426,700
Z2	148,800	220,800	160,700	95,170	18,520	0	-618,900
Z3	208,800	249,800	181,000	123,900	30,590	0	-653,800
Z4	139,600	155,900	102,300	84,700	27,270	0	-403,600

Load Case EB3

	Radial Forces						Key Forces M7
	M6	M8	M9	M10	M11	M12	
Z1	0	0	83,900	201,000	117,400	0	-251,300
Z2	32,700	169,000	169,000	93,580	37,500	0	-594,500
Z3	187,000	287,200	225,000	159,700	28,670	0	-841,300
Z4	85,490	181,900	169,800	169,300	82,360	0	-500,390

Load Case EB4

	Radial Forces						Key Forces M7
	M6	M8	M9	M10	M11	M12	
Z1	154,100	104,100	74,580	90,210	44,620	0	-326,500
Z2	113,800	168,700	122,900	72,340	14,140	0	-471,470
Z3	159,700	190,800	138,300	94,240	23,360	0	-498,000
Z4	106,400	118,900	78,060	64,340	20,820	0	-308,700

Load Case EB5

	Radial Forces						Key Forces M7
	M6	M8	M9	M10	M11	M12	
Z1	0	0	34,900	178,800	110,800	533	-142,900
Z2	0	13,480	123,200	77,770	35,620	1,186	-427,700
Z3	117,400	217,000	179,800	131,500	22,620	0	-680,000
Z4	60,450	149,800	146,900	152,600	78,240	0	-399,400

Load Case EB6

	Radial Forces						Key Forces M7
	M6	M8	M9	M10	M11	M12	
Z1	102,600	69,420	50,450	60,150	29,630	0	-219,700
Z2	76,030	112,300	82,520	47,940	9,137	0	-312,700
Z3	106,800	127,100	92,830	62,570	15,280	0	-330,500
Z4	70,880	79,370	52,750	42,780	13,640	0	-207,700

Load Case EB7

	Radial Forces						Key Forces M7
	M6	M8	M9	M10	M11	M12	
Z1	111,400	127,700	97,720	94,390	56,720	0	-323,700
Z2	142,800	198,000	149,800	102,600	18,110	0	-536,630
Z3	0	15,730	83,430	68,540	23,290	0	-424,500
Z4	0	0	0	0	0	0	-216,900

Load Case EB8

	Radial Forces						Key Forces M7
	M6	M8	M9	M10	M11	M12	
Z1	76,630	52,100	38,420	45,070	22,020	0	165,900
Z2	57,000	84,080	62,350	35,750	6,578	0	233,330
Z3	80,110	95,160	70,070	46,690	11,160	0	246,600
Z4	52,990	59,620	40,100	31,970	9,969	0	156,900

7. Deflections

The deflections in the vertical direction are shown below. It should be noted that in the load cases with the cryostat there are significant differences between the front and back of the EB.

The deflections at the cryostat support points are shown for each load case in the table below:

Load Case	Front Cryostat Support		Back Cryostat Support	
	X(mm)	Y (mm)	X (mm)	Y (mm)
EB1	-1.7	-3.3	2.2	-2.1
EB2	-0.8	-2.0	-0.4	-0.4
EB3	-1.5	-2.7	2.8	-2.1
EB4	-0.5	-1.4	-0.2	-0.3
EB5	-0.8	-2.1	3.6	-2.2
EB6	0	-0.8	0.3	-0.4
EB7	-0.6	-1.7	1.1	-1.3
EB8	0.4	-0.5	0.5	-0.4

* positive X values are deflections toward the center of the EB.

Deflections at the Top of the Saddle

Load Case	Z1		Z2		Z3		Z4	
	X (mm)	Y (mm)	X (mm)	Y (mm)	X (mm)	Y (mm)	X (mm)	Y (mm)
EB1	-1.9	-2.5	-1.4	-2.0	-0.2	-1.0	1.1	-0.7
EB2	-0.9	-1.6	-1.0	-1.4	-0.9	-1.2	-0.8	-1.1
EB3	-1.5	-2.1	-1.0	-1.6	0.6	-0.7	-1.5	-0.4
EB4	-0.6	-1.1	-0.6	-1.0	-0.6	-0.9	-0.5	-0.8
EB5	-0.9	-1.6	-0.3	-1.1	1.3	-0.2	2.2	-0.1
EB6	0.0	-0.6	0.0	-0.5	0.0	-0.4	0.0	-0.4
EB7	-0.7	-1.2	-0.4	-0.9	0.7	-0.3	0.9	-0.4
EB8	0.3	-0.3	0.2	-0.3	0.3	-0.2	0.3	-0.2

Deflections at the Bottom of the Saddle

Load Case	Z1		Z2		Z3		Z4	
	X (mm)	Y (mm)	X (mm)	Y (mm)	X (mm)	Y (mm)	X (mm)	Y (mm)
EB1	0.0	-1.3	0.0	-1.2	0.2	-1.3	0.2	-1.7
EB2	0.0	-1.0	0.0	-0.8	-0.1	-0.6	0.0	-0.4
EB3	0.0	-1.1	0.0	-1.0	0.3	-1.2	0.3	-1.7
EB4	0.0	-0.8	0.0	-0.6	0.0	-0.5	0.0	-0.4
EB5	0.0	-1.0	0.2	-0.9	0.4	-1.2	0.3	-1.8
EB6	0.0	-0.6	0.0	-0.5	0.0	-0.5	0.1	-0.4
EB7	0.0	-0.9	0.0	-0.7	0.2	-0.8	0.2	-1.1
EB8	0.1	-0.6	0.1	-0.5	0.1	-0.4	0.1	-0.4

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Vertical Deflections (mm)
Load Case EB1

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Vertical Deflections (mm)
Load Case EB2

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Vertical Deflections (mm)
Load Case EB3

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Vertical Deflections (mm)
Load Case EB4

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Vertical Deflections (mm)
Load Case EB5

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Vertical Deflections (mm)
Load Case EB6

**Vertical Deflections (mm)
Load Case EB8**

8. Conclusions

The forces acting on the modules and support saddle during assembly for the load cases examined are all less than those found in the completed EB and far less than those used to design the EB.

- The EB assembly is not stable when there are 24 modules in place and the cryostat load is first applied. In order to stabilize the assembly, a stiffening beam is needed between the back cryostat supports. This stiffening beam is subjected to 34 tons. A static analysis shows that up to module 28, the stiffening beam will be needed.
- The EB assembly is not stable when there are 14 modules and the saddle is first put in place. The assembly support cradle will have to remain in place until all of the modules have been placed on the saddle in order to insure stability.
- All of the forces between modules and acting on the saddles are less than the design forces that have been used to design the EB.
- Finally, a static analysis, identical to the one described above, was carried out for the addition of every module to the assembly from 14 modules in place to 64 modules in

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place. This analysis shows that with 14, 15, 16 and 24, 25, 26, 27, 28 modules in place, the assembly is unstable, because an additional moment is needed at the bottom of the saddle in order to achieve stability. The support from the assembly cradle for modules 14, 15, 16 is enough to provide stability, while a compression member between the back cryostat supports will be needed to provide stability for the top modules.

Appendix 1

SADDLE FORCES AT THE BACK OF THE EB (TONS)
 87 TON LOAD FROM THE BACK CRYOSTAT SUPPORT
 IT IS ASSUMED THAT HALF OF THE MODULE WEIGHT
 (5 TONS) IS SUPPORTED BY THE BACK SADDLE

=====

TOP SADDLE SUPPORT AT MODULE # 7
 BOTTOM SADDLE SUPPORT AT MODULE # 6
 #MODULES= 7

REACTION FORCES AT SADDLE

F1	F2	FS
30.123	0.041	20.950

LOCATION OF SADDLE REACTION POINT, LS = 2499.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 8
 BOTTOM SADDLE SUPPORT AT MODULE # 6
 #MODULES= 8

REACTION FORCES AT SADDLE

F1	F2	FS
34.977	0.002	27.392

LOCATION OF SADDLE REACTION POINT, LS = 2859.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 9
 BOTTOM SADDLE SUPPORT AT MODULE # 6
 #MODULES= 9

REACTION FORCES AT SADDLE

F1	F2	FS
31.680	8.278	32.335

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

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TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=10

REACTION FORCES AT SADDLE

F1	F2	FS
26.701	18.214	35.928

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=11

REACTION FORCES AT SADDLE

F1	F2	FS
29.371	20.036	39.521

LOCATION OF SADDLE REACTION POINT, LS= 3000.000

TRUSS REACTION FORCE, F1= 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=12

REACTION FORCES AT SADDLE

F1	F2	FS
32.638	0.018	78.849

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 41.39994

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=13

REACTION FORCES AT SADDLE

F1	F2	FS
39.240	0.007	80.945

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 37.89999

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TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=14

REACTION FORCES AT SADDLE

F1	F2	FS
45.729	0.048	83.083

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 34.50005

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=15

REACTION FORCES AT SADDLE

F1	F2	FS
52.331	0.036	85.179

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 31.00008

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=16

REACTION FORCES AT SADDLE

F1	F2	FS
58.933	0.025	87.274

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 27.50007

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=17

REACTION FORCES AT SADDLE

F1	F2	FS
65.535	0.013	89.370

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 24.00006

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TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=18

REACTION FORCES AT SADDLE

F1	F2	FS
72.137	0.002	91.465

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 20.50004

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=19

REACTION FORCES AT SADDLE

F1	F2	FS
78.627	0.043	93.604

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 17.10003

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=20

REACTION FORCES AT SADDLE

F1	F2	FS
85.229	0.031	95.699

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 13.60002

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=21

REACTION FORCES AT SADDLE

F1	F2	FS
91.831	0.020	97.795

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 10.10000

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TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=22

REACTION FORCES AT SADDLE

F1	F2	FS
98.433	0.009	99.890

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 6.599996

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=23

REACTION FORCES AT SADDLE

F1	F2	FS
104.922	0.050	102.029

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 3.199999

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=24

REACTION FORCES AT SADDLE

F1	F2	FS
111.187	0.195	104.253

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=25

REACTION FORCES AT SADDLE

F1	F2	FS
113.858	2.017	107.846

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

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TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=26

REACTION FORCES AT SADDLE

F1	F2	FS
116.528	3.838	111.438

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=27

REACTION FORCES AT SADDLE

F1	F2	FS
119.198	5.659	115.031

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=28

REACTION FORCES AT SADDLE

F1	F2	FS
121.868	7.481	118.624

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=29

REACTION FORCES AT SADDLE

F1	F2	FS
124.538	9.302	122.217

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

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TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=30

REACTION FORCES AT SADDLE

F1	F2	FS
127.208	11.124	125.810

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=31

REACTION FORCES AT SADDLE

F1	F2	FS
129.878	12.945	129.402

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

TOP SADDLE SUPPORT AT MODULE # 10
BOTTOM SADDLE SUPPORT AT MODULE # 6
#MODULES=32

REACTION FORCES AT SADDLE

F1	F2	FS
132.548	14.767	132.995

LOCATION OF SADDLE REACTION POINT, LS = 3000.000

TRUSS REACTION FORCE, F1 = 0.0000000E+00

Appendix 2

Inner Radius Module Deflections Front of the EB

Module #	Load Case EB1		
	X	Y	Z
1	0.28	-2.09	-0.07
2	0.27	-2.02	-0.09
3	0.25	-1.93	-0.11
4	0.20	-1.80	-0.12
5	0.13	-1.65	-0.14
6	0.03	-1.46	-0.16
7	0.06	-1.51	-0.05
8	0.09	-1.55	0.07
9	0.41	-1.88	0.33
10	0.94	-2.33	0.64
11	1.59	-2.77	0.90
12	2.22	-3.14	1.12
13	2.42	-3.19	1.07
14	2.57	-3.24	1.04
15	2.67	-3.26	1.00
16	2.71	-3.27	0.95
17	2.69	-3.27	0.90
18	2.62	-3.28	0.83
19	2.52	-3.31	0.75
20	2.38	-3.35	0.67
21	2.23	-3.42	0.58
22	2.06	-3.51	0.49
23	1.90	-3.62	0.39
24	1.75	-3.75	0.28
25	1.61	-3.89	0.18
26	1.49	-4.03	0.07
27	1.40	-4.17	-0.04
28	1.33	-4.31	-0.15
29	1.29	-4.42	-0.25
30	1.26	-4.51	-0.36
31	1.25	-4.57	-0.46

Module #	Load Case EB2		
	X	Y	Z
1	0.07	-1.69	0.11
2	0.07	-1.63	0.11
3	0.05	-1.54	0.10
4	0.01	-1.42	0.10
5	-0.06	-1.28	0.09
6	-0.15	-1.10	0.08
7	-0.16	-1.09	0.06
8	-0.17	-1.08	0.04
9	-0.02	-1.23	0.05
10	0.24	-1.44	0.07
11	0.55	-1.66	0.07
12	0.84	-1.81	0.07
13	1.07	-1.91	0.06
14	1.24	-1.96	0.05
15	1.35	-1.99	0.04
16	1.40	-2.00	0.03
17	1.39	-2.00	0.02
18	1.34	-2.01	0.01
19	1.25	-2.03	0.00
20	1.12	-2.07	-0.01
21	0.98	-2.13	-0.02
22	0.83	-2.21	-0.03
23	0.68	-2.32	-0.04
24	0.54	-2.43	-0.05
25	0.41	-2.56	-0.05
26	0.30	-2.70	-0.06
27	0.22	-2.83	-0.07
28	0.15	-2.95	-0.08
29	0.11	-3.05	-0.08
30	0.09	-3.12	-0.09
31	0.08	-3.17	-0.09

Load Case EB3			
Module			
#	X	Y	Z
1	0.15	-1.81	-0.08
2	0.14	-1.76	-0.09
3	0.13	-1.68	-0.11
4	0.09	-1.57	-0.13
5	0.03	-1.43	-0.14
6	-0.07	-1.26	-0.16
7	-0.06	-1.28	-0.07
8	-0.05	-1.30	0.05
9	0.21	-1.57	0.31
10	0.66	-1.94	0.61
11	1.21	-2.32	0.87
12	1.75	-2.63	1.09
13	1.87	-2.64	1.04
14	1.97	-2.68	1.01
15	2.04	-2.69	0.97
16	2.07	-2.69	0.92
17	2.06	-2.69	0.86
18	2.04	-2.70	0.80
19	2.00	-2.70	0.72
20	1.95	-2.72	0.64
21	1.91	-2.74	0.56
22	1.86	-2.76	0.46
23	1.83	-2.78	0.37

Load Case EB4			
Module			
#	X	Y	Z
1	-0.05	-1.39	0.09
2	-0.06	-1.35	0.08
3	-0.07	-1.27	0.08
4	-0.10	-1.17	0.07
5	-0.16	-1.04	0.07
6	-0.24	-0.89	0.06
7	-0.27	-0.85	0.05
8	-0.29	-0.82	0.03
9	-0.20	-0.91	0.04
10	-0.03	-1.05	0.05
11	0.19	-1.20	0.06
12	0.38	-1.30	0.05
13	0.54	-1.37	0.04
14	0.65	-1.40	0.04
15	0.73	-1.42	0.03
16	0.77	-1.42	0.02
17	0.78	-1.42	0.02
18	0.77	-1.42	0.01
19	0.75	-1.43	0.00
20	0.71	-1.44	-0.01
21	0.68	-1.45	-0.01
22	0.65	-1.47	-0.02
23	0.63	-1.48	-0.03

Load Case EB5				
Module				
#	X	Y	Z	
1	0.22	-1.73	-0.02	
2	0.21	-1.68	-0.04	
3	0.19	-1.60	-0.07	
4	0.15	-1.49	-0.09	
5	0.09	-1.35	-0.11	
6	0.00	-1.19	-0.14	
7	-0.03	-1.14	-0.08	
8	-0.08	-1.09	0.00	
9	0.08	-1.27	0.24	
10	0.41	-1.54	0.53	
11	0.83	-1.84	0.79	
12	1.25	-2.09	1.00	
13	1.27	-2.04	0.94	
14	1.28	-2.05	0.91	
15	1.28	-2.05	0.86	
16	1.27	-2.05	0.81	

Load Case EB6				
Module				
#	X	Y	Z	
1	0.01	-1.24	0.06	
2	0.01	-1.20	0.06	
3	-0.01	-1.13	0.05	
4	-0.04	-1.02	0.05	
5	-0.10	-0.89	0.05	
6	-0.18	-0.74	0.04	
7	-0.23	-0.67	0.03	
8	-0.29	-0.59	0.02	
9	-0.28	-0.60	0.03	
10	-0.22	-0.65	0.03	
11	-0.14	-0.71	0.04	
12	-0.07	-0.75	0.03	
13	-0.02	-0.77	0.03	
14	0.01	-0.77	0.03	
15	0.02	-0.78	0.02	
16	0.02	-0.78	0.02	

Load Case EB7			
Module #	X	Y	Z
1	-0.06	-1.90	0.46
2	-0.07	-1.83	0.40
3	-0.10	-1.71	0.32
4	-0.16	-1.54	0.20
5	-0.25	-1.32	0.06
6	-0.39	-1.06	-0.11
7	-0.45	-0.99	-0.17
8	-0.52	-0.92	-0.22
9	-0.41	-1.04	-0.14
10	-0.17	-1.25	0.01
11	0.16	-1.48	0.19
12	0.52	-1.70	0.39

Load Case EB8			
Module #	X	Y	Z
1	0.05	-1.18	0.04
2	0.39	-0.49	0.04
3	0.41	-0.47	0.04
4	0.41	-0.48	0.03
5	0.38	-0.51	0.03
6	0.30	-0.60	0.04
7	0.24	-0.70	0.04
8	0.16	-0.84	0.04
9	0.11	-0.97	0.04
10	0.07	-1.07	0.05
11	0.06	-1.14	0.04
12	0.05	-1.17	0.04

Appendix 3

Inner Radius Module Deflections Back of the EB

Module #	Load Case EB1		
	X	Y	Z
1	0.61	-2.31	-0.07
2	0.60	-2.26	-0.09
3	0.58	-2.18	-0.11
4	0.54	-2.07	-0.12
5	0.48	-1.92	-0.14
6	0.39	-1.76	-0.16
7	0.26	-1.57	-0.05
8	0.07	-1.34	0.07
9	-0.12	-1.15	0.33
10	-0.23	-1.07	0.63
11	-0.18	-1.10	0.90
12	-0.08	-1.16	1.11
13	0.15	-1.26	1.07
14	0.31	-1.31	1.04
15	0.40	-1.33	1.00
16	0.44	-1.33	0.95
17	0.42	-1.34	0.89
18	0.35	-1.35	0.83
19	0.25	-1.37	0.75
20	0.11	-1.42	0.67
21	-0.04	-1.48	0.58
22	-0.20	-1.57	0.48
23	-0.37	-1.69	0.38
24	-0.52	-1.81	0.28
25	-0.66	-1.95	0.17
26	-0.77	-2.10	0.07
27	-0.87	-2.24	-0.04
28	-0.94	-2.37	-0.15
29	-0.98	-2.49	-0.25
30	-1.01	-2.57	-0.36
31	-1.02	-2.63	-0.46

Load Case EB2			
Module #	X	Y	Z
1	0.08	-1.38	0.11
2	0.07	-1.34	0.11
3	0.05	-1.26	0.10
4	0.02	-1.15	0.10
5	-0.04	-1.01	0.09
6	-0.13	-0.85	0.08
7	-0.12	-0.87	0.06
8	-0.11	-0.89	0.04
9	0.02	-1.02	0.05
10	0.23	-1.19	0.07
11	0.52	-1.38	0.07
12	0.80	-1.54	0.06
13	1.03	-1.64	0.06
14	1.20	-1.69	0.05
15	1.31	-1.72	0.04
16	1.36	-1.72	0.03
17	1.36	-1.73	0.02
18	1.30	-1.74	0.01
19	1.21	-1.76	0.00
20	1.09	-1.80	-0.01
21	0.95	-1.86	-0.02
22	0.80	-1.94	-0.03
23	0.65	-2.04	-0.04
24	0.50	-2.16	-0.05
25	0.38	-2.29	-0.06
26	0.27	-2.43	-0.06
27	0.18	-2.56	-0.07
28	0.12	-2.67	-0.08
29	0.08	-2.77	-0.08
30	0.06	-2.85	-0.09
31	0.05	-2.89	-0.09

Load Case EB3			
Module #	X	Y	Z
1	0.53	-2.05	-0.08
2	0.52	-2.01	-0.10
3	0.51	-1.94	-0.11
4	0.48	-1.84	-0.13
5	0.42	-1.71	-0.15
6	0.34	-1.57	-0.16
7	0.19	-1.35	-0.07
8	0.00	-1.11	0.05
9	-0.25	-0.87	0.31
10	-0.43	-0.72	0.60
11	-0.48	-0.68	0.87
12	-0.47	-0.69	1.07
13	-0.31	-0.76	1.04
14	-0.21	-0.79	1.01
15	-0.15	-0.80	0.97
16	-0.12	-0.80	0.92
17	-0.12	-0.81	0.86
18	-0.15	-0.81	0.80
19	-0.18	-0.82	0.72
20	-0.23	-0.83	0.64
21	-0.28	-0.85	0.56
22	-0.32	-0.87	0.46
23	-0.35	-0.89	0.37

Load Case EB4			
Module #	X	Y	Z
1	-0.05	-1.16	0.09
2	-0.05	-1.13	0.08
3	-0.07	-1.06	0.08
4	-0.10	-0.96	0.07
5	-0.15	-0.84	0.07
6	-0.23	-0.69	0.06
7	-0.23	-0.69	0.05
8	-0.24	-0.67	0.03
9	-0.17	-0.75	0.04
10	-0.03	-0.86	0.05
11	0.16	-0.99	0.06
12	0.35	-1.09	0.05
13	0.51	-1.16	0.04
14	0.62	-1.19	0.04
15	0.70	-1.21	0.03
16	0.74	-1.21	0.02
17	0.76	-1.21	0.02
18	0.75	-1.21	0.01
19	0.72	-1.22	0.00
20	0.69	-1.23	-0.01
21	0.65	-1.24	-0.01
22	0.62	-1.26	-0.02
23	0.60	-1.27	-0.03

Load Case EB5			
Module #	X	Y	Z
1	0.80	-1.83	-0.02
2	0.79	-1.79	-0.05
3	0.77	-1.72	-0.07
4	0.74	-1.61	-0.09
5	0.68	-1.48	-0.11
6	0.60	-1.33	-0.14
7	0.45	-1.12	-0.08
8	0.26	-0.88	-0.01
9	-0.06	-0.56	0.23
10	-0.37	-0.31	0.53
11	-0.55	-0.19	0.78
12	-0.66	-0.13	0.98
13	-0.62	-0.15	0.94
14	-0.61	-0.15	0.91
15	-0.61	-0.15	0.86
16	-0.62	-0.15	0.81

Load Case EB6			
Module #	X	Y	Z
1	0.02	-1.09	0.06
2	0.01	-1.05	0.05
3	0.00	-0.99	0.05
4	-0.04	-0.89	0.05
5	-0.09	-0.76	0.04
6	-0.17	-0.62	0.04
7	-0.21	-0.56	0.03
8	-0.26	-0.50	0.02
9	-0.26	-0.50	0.03
10	-0.22	-0.52	0.03
11	-0.15	-0.57	0.04
12	-0.08	-0.61	0.03
13	-0.04	-0.63	0.03
14	-0.01	-0.64	0.03
15	0.00	-0.64	0.02
16	0.00	-0.64	0.02

Load Case EB7

Module #	X	Y	Z
1	0.74	-0.73	0.45
2	0.74	-0.74	0.40
3	0.74	-0.76	0.31
4	0.75	-0.78	0.20
5	0.76	-0.82	0.06
6	0.79	-0.87	-0.11
7	0.77	-0.84	-0.17
8	0.73	-0.79	-0.23
9	0.62	-0.66	-0.14
10	0.50	-0.52	0.01
11	0.37	-0.39	0.19
12	0.21	-0.27	0.38

Load Case EB8

Module #	X	Y	Z
1	0.06	-1.07	0.04
2	0.41	-0.49	0.04
3	0.41	-0.49	0.04
4	0.38	-0.52	0.03
5	0.30	-0.62	0.04
6	0.24	-0.71	0.05
7	0.16	-0.86	0.05
8	0.11	-0.98	0.05
9	0.07	-1.08	0.05
10	0.06	-1.15	0.05
11	0.05	-1.19	0.04
12	0.05	-1.15	0.04

Appendix 4

Outer Radius Module Deflections Front of the EB

Module #	Load Case EB1		
	X	Y	Z
1	0.28	-2.04	0.03
2	0.34	-1.94	0.03
3	0.38	-1.80	0.03
4	0.39	-1.62	0.02
5	0.38	-1.38	0.01
6	0.39	-1.22	0.00
7	0.41	-1.23	-0.01
8	0.49	-1.42	-0.03
9	0.84	-1.81	-0.06
10	1.39	-2.28	-0.09
11	2.01	-2.69	-0.11
12	2.41	-2.92	-0.10
13	2.56	-3.00	-0.07
14	2.67	-3.05	-0.04
15	2.71	-3.07	-0.01
16	2.70	-3.07	0.02
17	2.64	-3.08	0.05
18	2.54	-3.10	0.07
19	2.40	-3.13	0.10
20	2.24	-3.19	0.13
21	2.06	-3.27	0.15
22	1.88	-3.38	0.18
23	1.70	-3.51	0.20
24	1.54	-3.65	0.22
25	1.40	-3.81	0.23
26	1.28	-3.97	0.25
27	1.18	-4.12	0.26
28	1.11	-4.26	0.27
29	1.07	-4.38	0.28
30	1.05	-4.48	0.28
31	1.04	-4.54	0.28

Load Case EB2			
Module #	X	Y	Z
1	0.05	-1.65	-0.02
2	0.08	-1.57	-0.01
3	0.10	-1.45	-0.01
4	0.09	-1.30	-0.01
5	0.05	-1.10	-0.02
6	0.02	-0.94	-0.02
7	0.01	-0.92	-0.01
8	0.02	-1.00	-0.01
9	0.18	-1.21	-0.01
10	0.45	-1.44	-0.01
11	0.73	-1.65	0.00
12	0.97	-1.78	0.00
13	1.16	-1.87	0.01
14	1.30	-1.91	0.01
15	1.37	-1.93	0.01
16	1.39	-1.94	0.02
17	1.36	-1.94	0.02
18	1.28	-1.95	0.02
19	1.17	-1.98	0.03
20	1.03	-2.03	0.03
21	0.88	-2.10	0.03
22	0.72	-2.19	0.03
23	0.56	-2.30	0.03
24	0.42	-2.43	0.03
25	0.29	-2.56	0.03
26	0.19	-2.70	0.03
27	0.11	-2.83	0.03
28	0.05	-2.95	0.03
29	0.01	-3.05	0.02
30	-0.01	-3.12	0.02
31	-0.01	-3.16	0.02

Load Case EB3			
Module #	X	Y	Z
1	0.20	-1.77	0.04
2	0.24	-1.69	0.04
3	0.26	-1.57	0.03
4	0.26	-1.41	0.03
5	0.24	-1.20	0.02
6	0.23	-1.06	0.01
7	0.22	-1.05	0.00
8	0.27	-1.19	-0.02
9	0.55	-1.53	-0.05
10	1.01	-1.93	-0.08
11	1.53	-2.29	-0.10
12	1.86	-2.49	-0.10
13	1.95	-2.56	-0.07
14	2.02	-2.60	-0.04
15	2.06	-2.63	-0.01
16	2.07	-2.64	0.02
17	2.05	-2.66	0.05
18	2.02	-2.67	0.07
19	1.97	-2.69	0.10
20	1.93	-2.72	0.12
21	1.88	-2.74	0.15
22	1.85	-2.77	0.17
23	1.83	-2.79	0.19
24	1.82	-2.79	0.21

Load Case EB4			
Module #	X	Y	Z
1	-0.03	-1.37	-0.01
2	-0.01	-1.30	-0.01
3	-0.02	-1.20	-0.01
4	-0.04	-1.06	-0.01
5	-0.08	-0.90	-0.01
6	-0.13	-0.76	-0.01
7	-0.16	-0.73	-0.01
8	-0.18	-0.78	0.00
9	-0.09	-0.92	0.00
10	0.08	-1.09	0.00
11	0.28	-1.24	0.00
12	0.44	-1.35	0.00
13	0.57	-1.42	0.01
14	0.67	-1.46	0.01
15	0.74	-1.49	0.01
16	0.77	-1.50	0.01
17	0.78	-1.51	0.02
18	0.77	-1.52	0.02
19	0.76	-1.54	0.02
20	0.73	-1.55	0.02
21	0.71	-1.56	0.02
22	0.70	-1.58	0.02
23	0.70	-1.58	0.02
24	0.71	-1.57	0.02

Load Case EB5			
Module #	X	Y	Z
1	0.26	-1.69	0.05
2	0.30	-1.61	0.05
3	0.33	-1.49	0.05
4	0.33	-1.33	0.04
5	0.30	-1.13	0.04
6	0.27	-0.96	0.04
7	0.22	-0.88	0.03
8	0.21	-0.93	0.01
9	0.40	-1.15	-0.02
10	0.75	-1.45	-0.05
11	1.14	-1.72	-0.07
12	1.35	-1.84	-0.07
13	1.34	-1.86	-0.04
14	1.33	-1.86	-0.02
15	1.30	-1.87	0.01
16	1.27	-1.87	0.03

Load Case EB6			
Module #	X	Y	Z
1	0.04	-1.22	-0.01
2	0.05	-1.15	-0.01
3	0.05	-1.05	-0.01
4	0.02	-0.92	-0.01
5	-0.03	-0.76	-0.01
6	-0.08	-0.61	-0.01
7	-0.14	-0.53	0.00
8	-0.20	-0.50	0.00
9	-0.19	-0.54	0.00
10	-0.13	-0.61	0.00
11	-0.07	-0.67	0.00
12	-0.02	-0.70	0.00
13	0.01	-0.72	0.00
14	0.02	-0.73	0.01
15	0.02	-0.74	0.01
16	0.02	-0.74	0.01

Load Case EB7			
Module #	X	Y	Z
1	-0.01	-1.86	0.01
2	0.01	-1.75	0.02
3	0.01	-1.58	0.04
4	-0.02	-1.36	0.06
5	-0.10	-1.08	0.08
6	-0.18	-0.84	0.10
7	-0.23	-0.75	0.10
8	-0.26	-0.76	0.10
9	-0.13	-0.91	0.09
10	0.13	-1.13	0.07
11	0.45	-1.34	0.04
12	0.60	-1.42	0.03

Load Case EB8			
Module #	X	Y	Z
1	0.08	-1.15	-0.01
2	0.34	-0.38	-0.01
3	0.35	-0.38	-0.01
4	0.32	-0.39	-0.01
5	0.25	-0.45	0.00
6	0.17	-0.55	0.00
7	0.10	-0.69	0.00
8	0.05	-0.85	-0.01
9	0.02	-0.98	-0.01
10	0.02	-1.08	-0.01
11	0.04	-1.14	-0.01
12	0.06	-1.16	-0.01

Appendix 5

Outer Radius Module Deflections Back of the EB

Load Case EB1			
Module			
#	X	Y	Z
1	0.61	-2.27	0.04
2	0.65	-2.20	0.04
3	0.67	-2.09	0.04
4	0.67	-1.93	0.04
5	0.65	-1.73	0.05
6	0.58	-1.51	0.05
7	0.42	-1.28	0.03
8	0.17	-1.06	0.00
9	-0.05	-0.91	-0.03
10	-0.11	-0.90	-0.07
11	-0.04	-0.97	-0.08
12	0.10	-1.05	-0.09
13	0.28	-1.12	-0.06
14	0.39	-1.16	-0.03
15	0.44	-1.17	-0.01
16	0.43	-1.17	0.02
17	0.38	-1.17	0.05
18	0.28	-1.18	0.07
19	0.14	-1.22	0.10
20	-0.02	-1.27	0.12
21	-0.20	-1.35	0.15
22	-0.38	-1.45	0.17
23	-0.56	-1.58	0.19
24	-0.72	-1.72	0.21
25	-0.87	-1.88	0.22
26	-0.99	-2.04	0.24
27	-1.08	-2.19	0.25
28	-1.15	-2.33	0.26
29	-1.19	-2.45	0.27
30	-1.22	-2.55	0.28
31	-1.23	-2.61	0.28

Load Case EB2				
Module				
#	X	Y	Z	
1	0.06	-1.35	-0.01	
2	0.09	-1.28	-0.01	
3	0.11	-1.18	0.00	
4	0.10	-1.03	0.00	
5	0.07	-0.84	0.01	
6	0.04	-0.69	0.02	
7	0.07	-0.71	0.02	
8	0.08	-0.80	0.02	
9	0.20	-0.97	0.02	
10	0.42	-1.18	0.02	
11	0.69	-1.37	0.02	
12	0.94	-1.51	0.02	
13	1.13	-1.60	0.02	
14	1.26	-1.64	0.02	
15	1.34	-1.66	0.02	
16	1.36	-1.66	0.02	
17	1.32	-1.67	0.02	
18	1.25	-1.68	0.02	
19	1.13	-1.71	0.02	
20	1.00	-1.75	0.02	
21	0.84	-1.82	0.02	
22	0.68	-1.92	0.02	
23	0.53	-2.03	0.02	
24	0.38	-2.15	0.02	
25	0.26	-2.29	0.02	
26	0.15	-2.43	0.02	
27	0.07	-2.56	0.02	
28	0.01	-2.68	0.02	
29	-0.02	-2.77	0.02	
30	-0.04	-2.85	0.02	
31	-0.05	-2.88	0.02	

Load Case EB3			
Module			
#	X	Y	Z
1	0.57	-2.02	0.04
2	0.59	-1.96	0.04
3	0.60	-1.86	0.04
4	0.59	-1.72	0.05
5	0.55	-1.55	0.05
6	0.47	-1.35	0.04
7	0.29	-1.11	0.02
8	0.01	-0.87	0.00
9	-0.26	-0.67	-0.03
10	-0.41	-0.60	-0.07
11	-0.43	-0.61	-0.08
12	-0.36	-0.66	-0.08
13	-0.25	-0.72	-0.06
14	-0.17	-0.76	-0.03
15	-0.13	-0.77	-0.01
16	-0.12	-0.78	0.02
17	-0.13	-0.79	0.05
18	-0.17	-0.80	0.07
19	-0.21	-0.82	0.10
20	-0.25	-0.84	0.12
21	-0.30	-0.87	0.14
22	-0.33	-0.89	0.17
23	-0.36	-0.91	0.19
24	-0.36	-0.91	0.21

Load Case EB4			
Module			
#	X	Y	Z
1	-0.02	-1.14	-0.01
2	-0.01	-1.08	-0.01
3	-0.01	-0.99	0.00
4	-0.03	-0.86	0.00
5	-0.07	-0.70	0.01
6	-0.11	-0.57	0.01
7	-0.12	-0.57	0.02
8	-0.14	-0.62	0.02
9	-0.08	-0.74	0.02
10	0.07	-0.89	0.01
11	0.25	-1.04	0.01
12	0.42	-1.14	0.01
13	0.55	-1.21	0.01
14	0.64	-1.26	0.01
15	0.71	-1.28	0.01
16	0.74	-1.30	0.01
17	0.76	-1.31	0.02
18	0.75	-1.32	0.02
19	0.73	-1.33	0.02
20	0.71	-1.34	0.02
21	0.69	-1.36	0.02
22	0.67	-1.37	0.02
23	0.67	-1.37	0.02
24	0.68	-1.36	0.02

Load Case EB5				
Module				
#	X	Y	Z	
1	0.83	-1.80	0.05	
2	0.86	-1.74	0.05	
3	0.86	-1.63	0.06	
4	0.85	-1.49	0.06	
5	0.80	-1.33	0.06	
6	0.71	-1.12	0.06	
7	0.54	-0.88	0.04	
8	0.25	-0.59	0.03	
9	-0.11	-0.29	-0.01	
10	-0.37	-0.11	-0.04	
11	-0.52	-0.03	-0.06	
12	-0.58	-0.01	-0.06	
13	-0.57	-0.02	-0.04	
14	-0.57	-0.02	-0.01	
15	-0.59	-0.02	0.01	
16	-0.62	-0.02	0.04	

Load Case EB6				
Module				
#	X	Y	Z	
1	0.04	-1.07	-0.01	
2	0.05	-1.01	0.00	
3	0.05	-0.91	0.00	
4	0.03	-0.79	0.00	
5	-0.02	-0.63	0.00	
6	-0.07	-0.48	0.01	
7	-0.11	-0.43	0.01	
8	-0.17	-0.40	0.01	
9	-0.18	-0.42	0.01	
10	-0.15	-0.47	0.01	
11	-0.09	-0.53	0.01	
12	-0.04	-0.56	0.01	
13	-0.01	-0.59	0.01	
14	0.00	-0.60	0.01	
15	0.00	-0.60	0.01	
16	0.00	-0.60	0.01	

Load Case EB7

Module #	X	Y	Z
1	0.78	-0.73	0.01
2	0.82	-0.73	0.03
3	0.86	-0.73	0.05
4	0.90	-0.73	0.07
5	0.96	-0.74	0.10
6	0.99	-0.71	0.12
7	0.97	-0.66	0.12
8	0.86	-0.56	0.12
9	0.71	-0.44	0.10
10	0.54	-0.33	0.08
11	0.37	-0.23	0.05
12	0.26	-0.18	0.04

Load Case EB8

Module #	X	Y	Z
1	0.08	-1.04	0.00
2	0.34	-0.39	-0.01
3	0.34	-0.38	-0.01
4	0.32	-0.39	-0.01
5	0.26	-0.44	-0.01
6	0.17	-0.55	-0.01
7	0.10	-0.68	-0.01
8	0.05	-0.84	-0.01
9	0.03	-0.98	-0.01
10	0.02	-1.08	-0.01
11	0.04	-1.15	-0.01
12	0.06	-1.17	-0.01