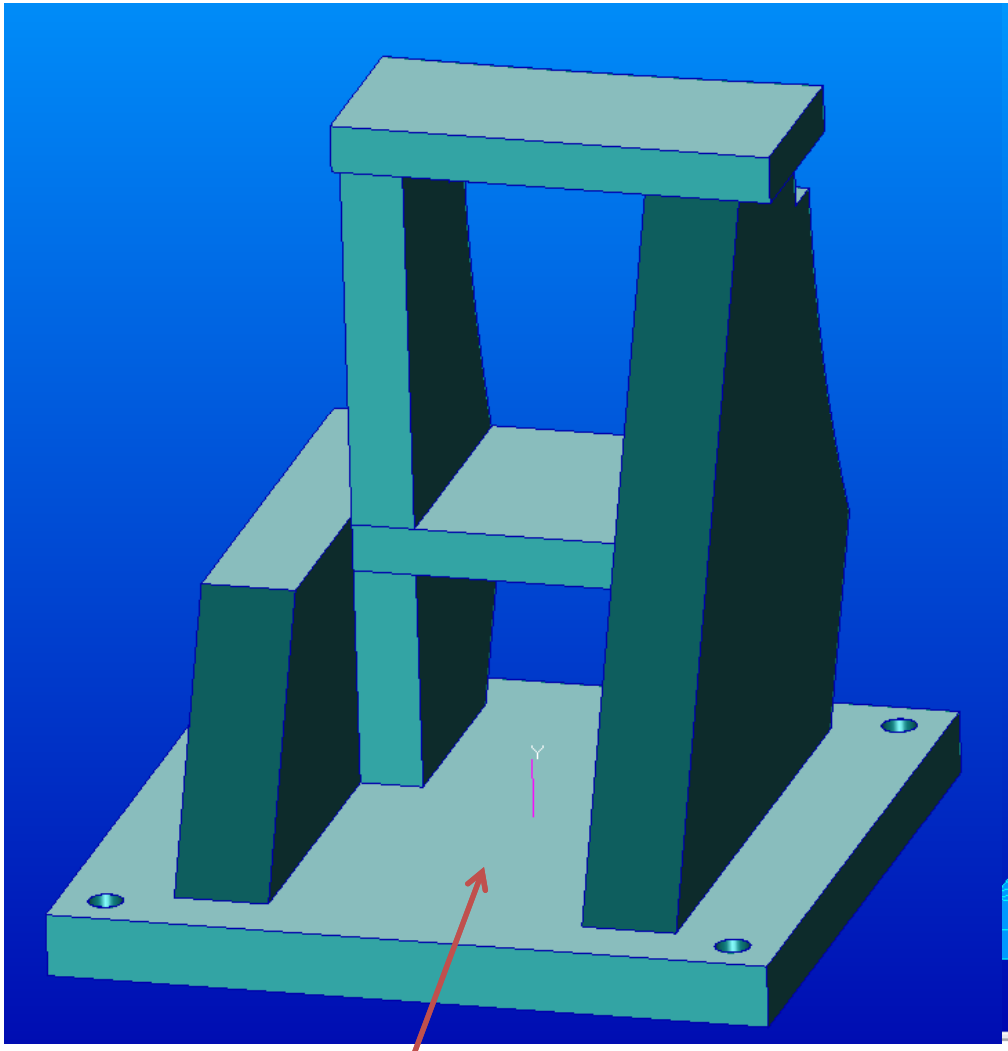
Vessel Support Leg Calculations

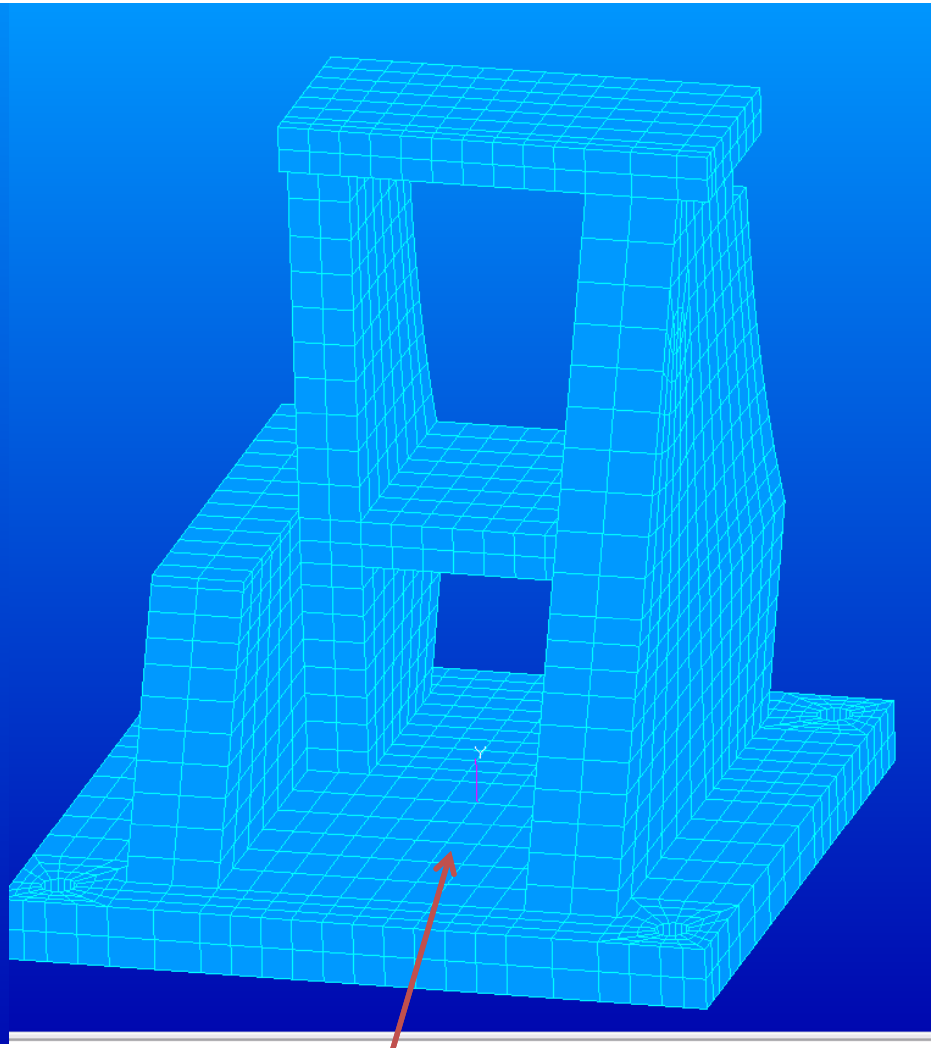
Enclosed are all the so far available calculations covering the above subject. Please note that this is preliminary presentation format and it may change as completion of the analyses progresses? I think, so far it is self explanatory.

I am following a logical analyses progression from linear to non linear methods. I hope that this will answer all necessary questions.

Also, I have not fully completed RUN #4 analyses (Non Linear static Sol 106 with GAP elements). As you can see from the enclosed slides, many GAPs are involved. But, I think it will be done soon?

Please examine the included slides!



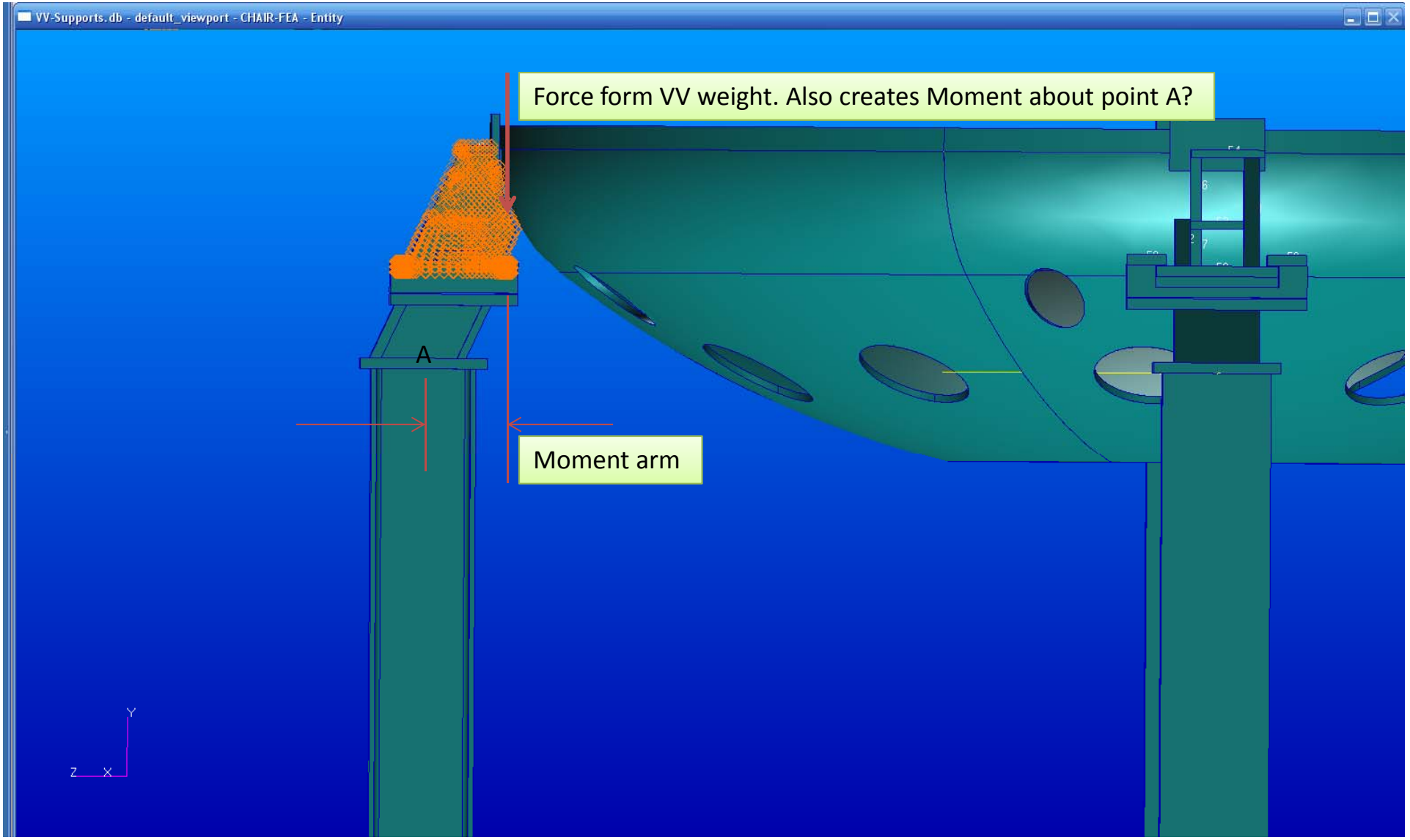


VV-support-attach-011812.igs

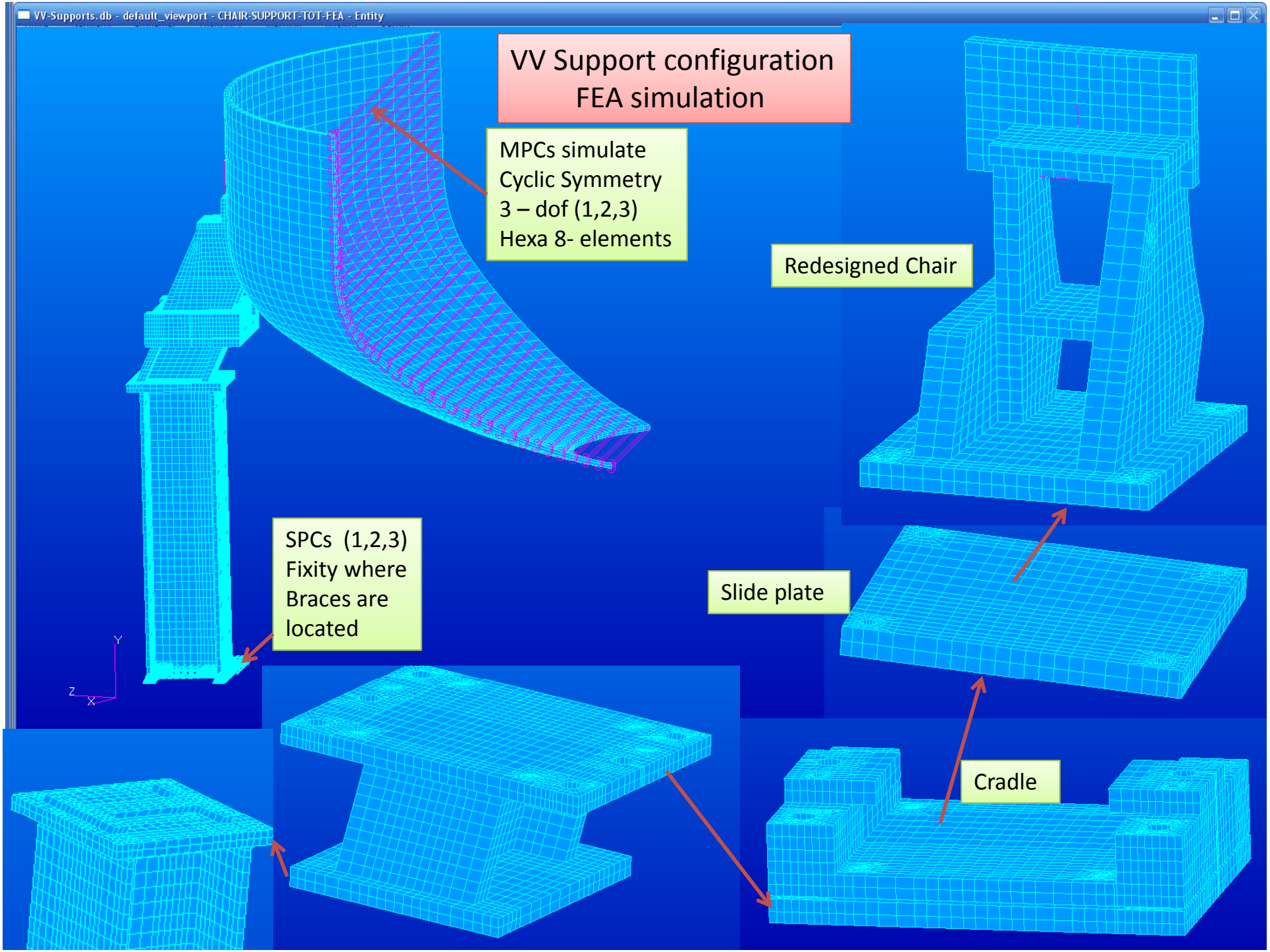
Nastran FEA all Hex8 elements

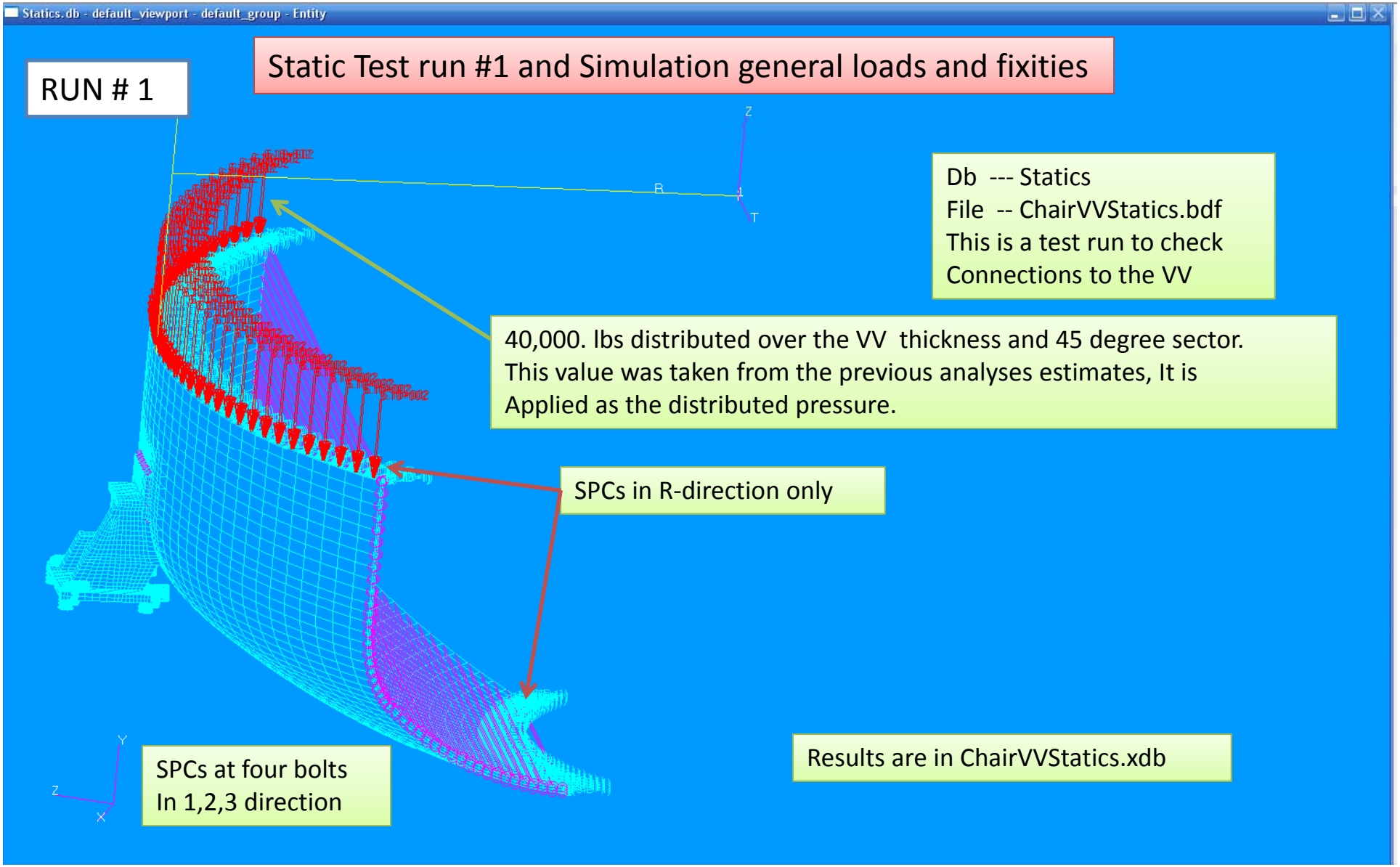
Question: How is this welded, assume weld size = 3/8 inch?

Redesigned VV support chair



General design

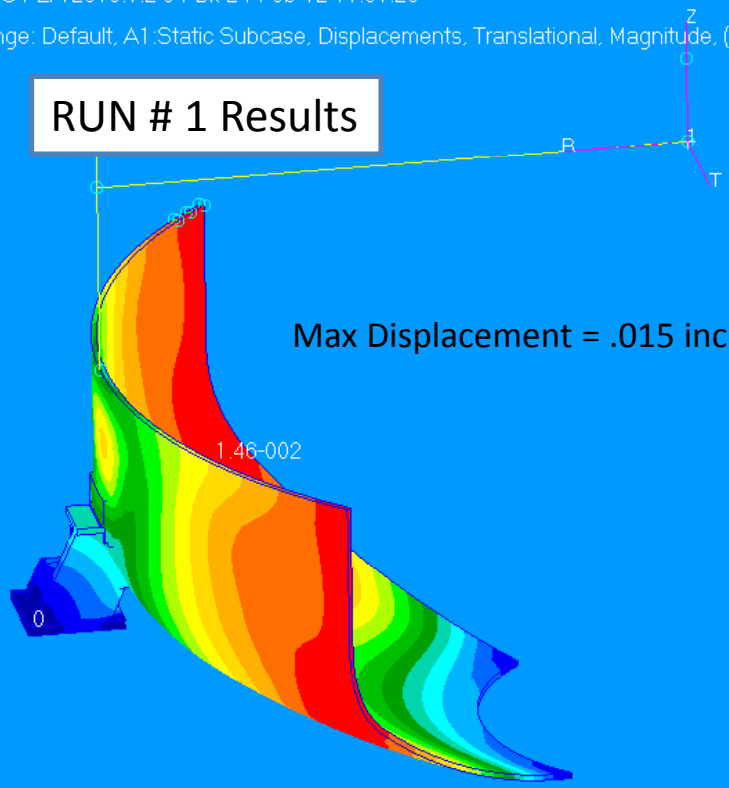

VV-Supports.db - default_viewport - CHAIR-SUPPORT-TOT-FEA - Entity
VV Support configuration
FEA simulation
MPCs simulate
Cyclic Symmetry
3 – dof (1,2,3)
Hexa 8- elements
Redesigned Chair
SPCs (1,2,3)
Fixity where
Braces are
located
Slide plate
Cradle


Statics.db - default_viewport - default_group - Entity
RUN # 1
Static Test run #1 and Simulation general loads and fixities
Db --- Statics
File -- ChairVVStatics.bdf
This is a test run to check
Connections to the VV
40,000. lbs distributed over the VV thickness and 45 degree sector.
This value was taken from the previous analyses estimates, It is
Applied as the distributed pressure.
SPCs in R-direction only
SPCs at four bolts
In 1,2,3 direction
Results are in ChairVVStatics.xdb

MSC FEA 2010.1.2 64-Bit 24-Feb-12 11:37:20

Fringe: Default, A1:Static Subcase, Displacements, Translational, Magnitude, (NON-LAYERED)

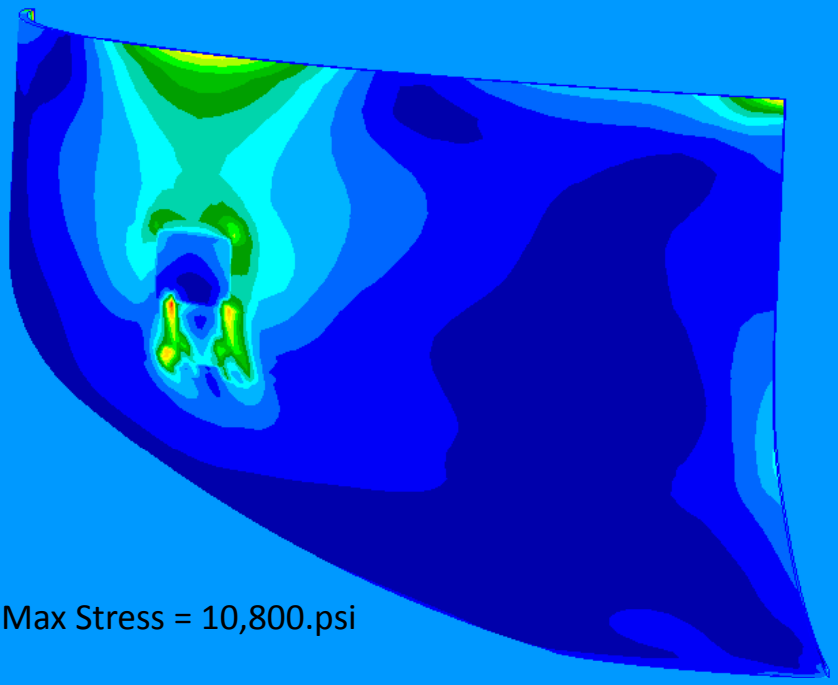
RUN # 1 Results



Max Displacement = .015 inch.

MSC FEA 2010.1.2 64-Bit 24-Feb-12 11:44:14

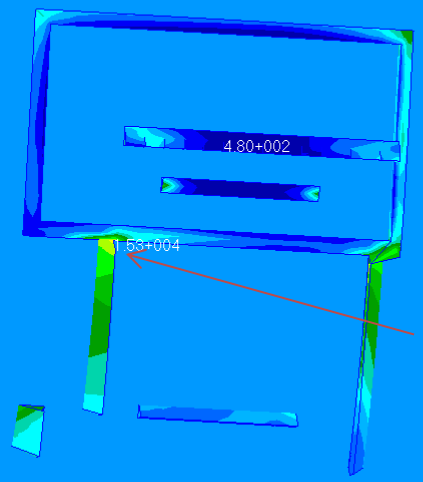
Fringe: Default, A1:Static Subcase, Stress Tensor, , von Mises, (NON-LAYERED)



Max Stress = 10,800.psi

MSC FEA 2010.1.2 64-Bit 24-Feb-12 11:47:06

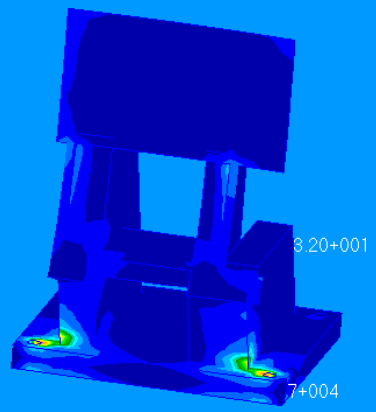
Fringe: Default, A1:Static Subcase, Stress Tensor, , von Mises, (NON-LAYERED)



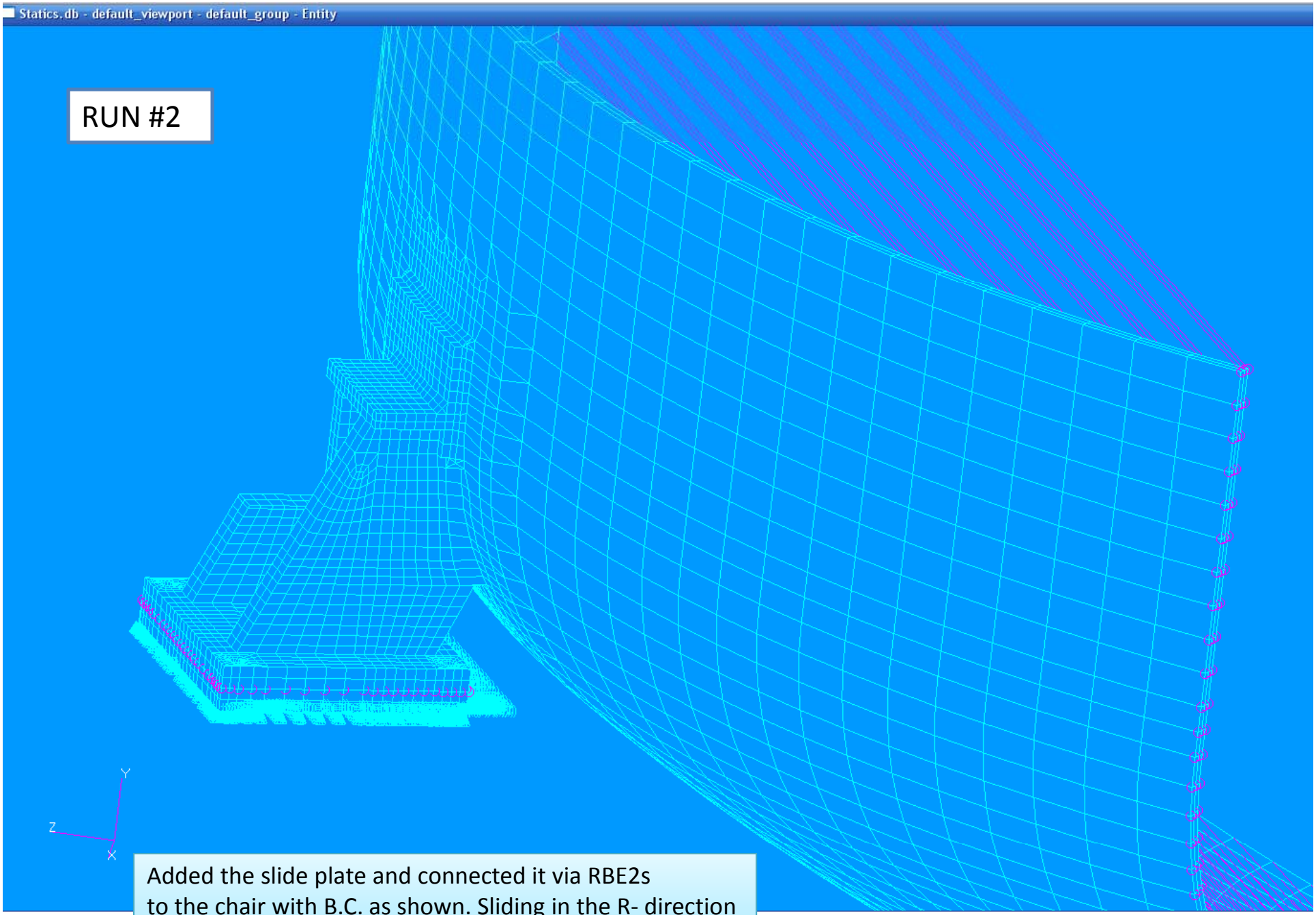
Max stress = 15,300.psi

MSC FEA 2010.1.2 64-Bit 24-Feb-12 11:52:31

Fringe: Default, A1:Static Subcase, Stress Tensor, , von Mises, (NON-LAYERED)



Max Stress = 56,700.psi
Note:(not real)

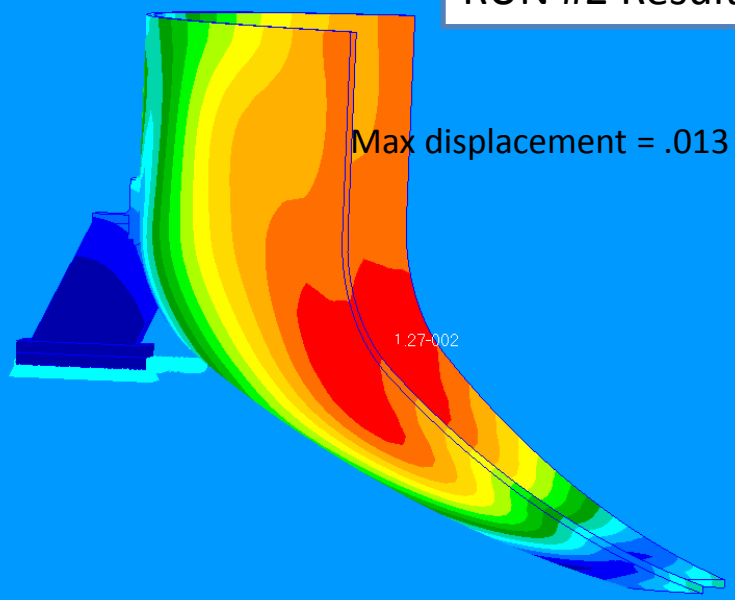


Added the slide plate and connected it via RBE2s to the chair with B.C. as shown. Sliding in the R- direction nodes at the center of the slide plate. (Y in coord1=0.)

MSC FEA 2010.1.2 64-Bit 28-Feb-12 13:46:02

Fringe: RUN2-Loads, A2:Static Subcase, Displacements, Translational, Magnitude, (NON-LAYERED)

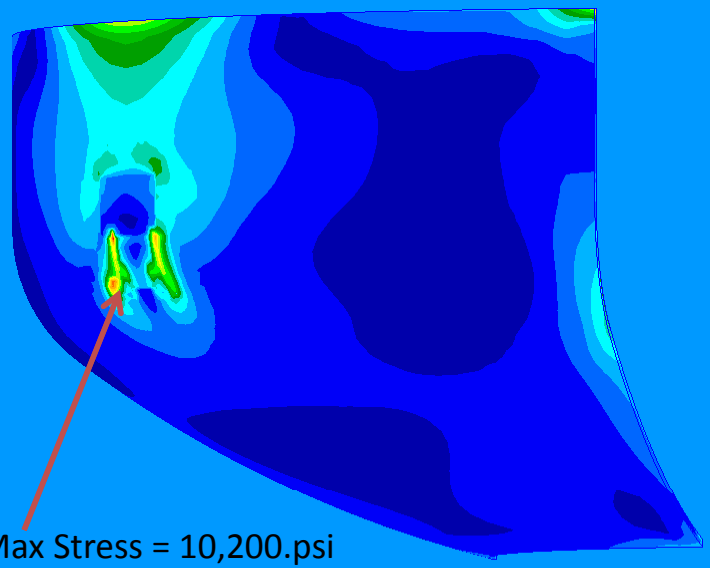
RUN #2 Results



Max displacement = .013 inch

MSC FEA 2010.1.2 64-Bit 28-Feb-12 14:03:29

Fringe: RUN2-Loads, A2:Static Subcase, Stress Tensor, , von Mises, (NON-LAYERED)

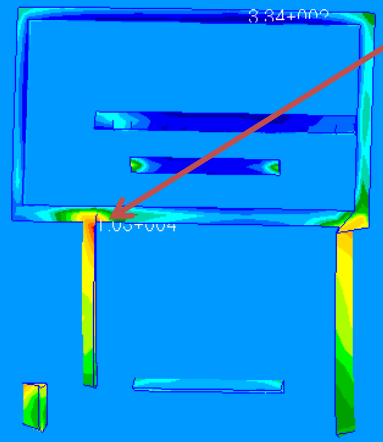


Max Stress = 10,200.psi

Weld area

MSC FEA 2010.1.2 64-Bit 28-Feb-12 14:10:36

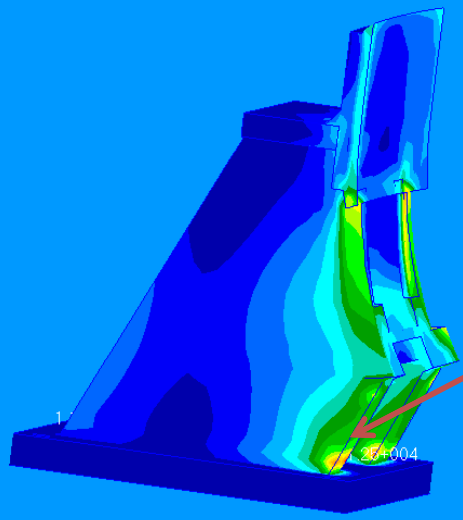
Fringe: RUN2-Loads, A2:Static Subcase, Stress Tensor, , von Mises, (NON-LAYERED)



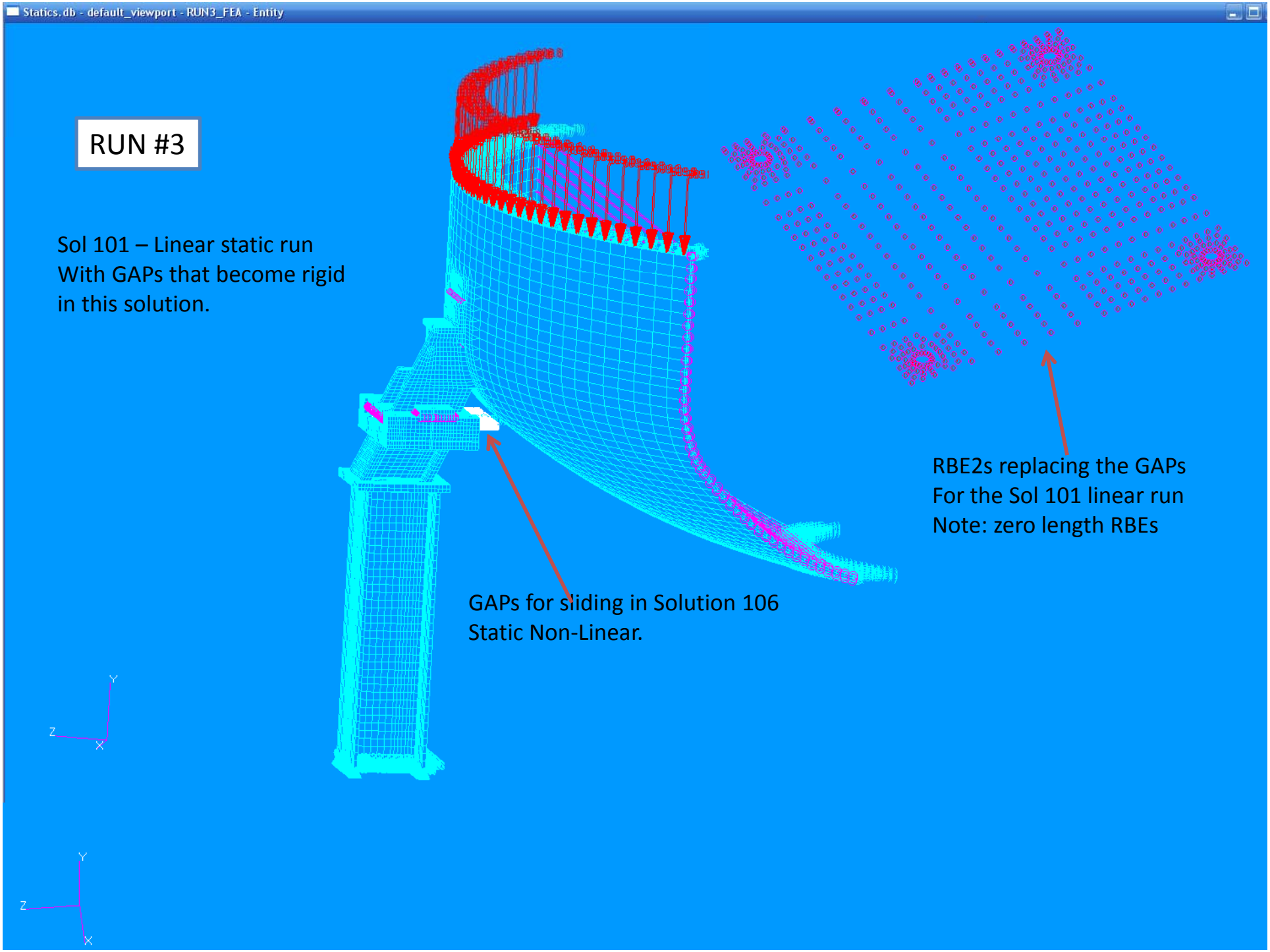
Welds between the Chair and the VV

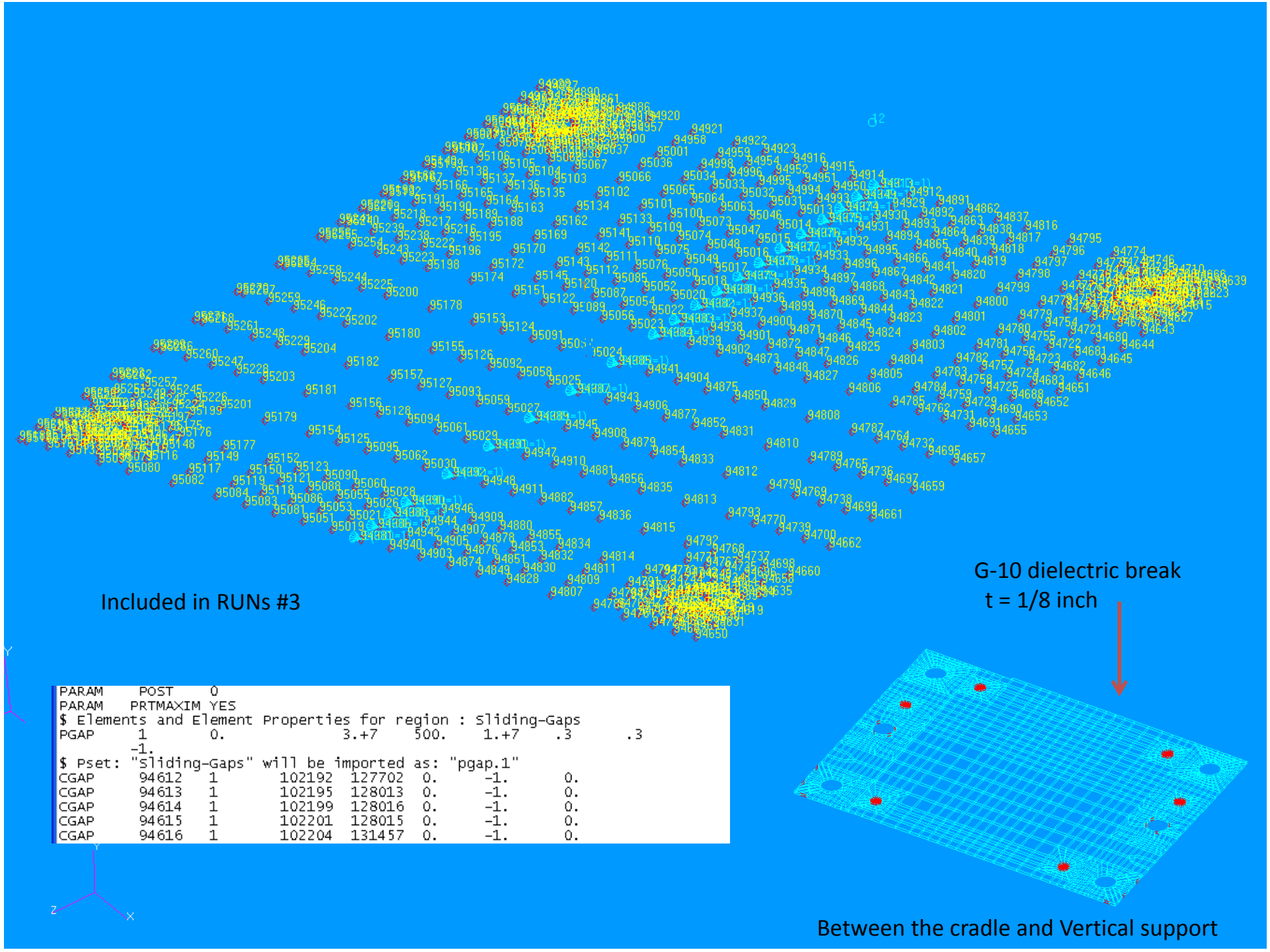
MSC FEA 2010.1.2 64-Bit 28-Feb-12 14:14:08

Fringe: RUN2-Loads, A2:Static Subcase, Stress Tensor, , von Mises, (NON-LAYERED)



Max Stress = 12,500.psi


Statics.db - default_viewport - RUN3_FEA - Entity
RUN #3
Sol 101 – Linear static run
With GAPs that become rigid
in this solution.
RBE2s replacing the GAPs
For the Sol 101 linear run
Note: zero length RBEs
GAPs for sliding in Solution 106
Static Non-Linear.
Y
Z
X
Y
Z
X

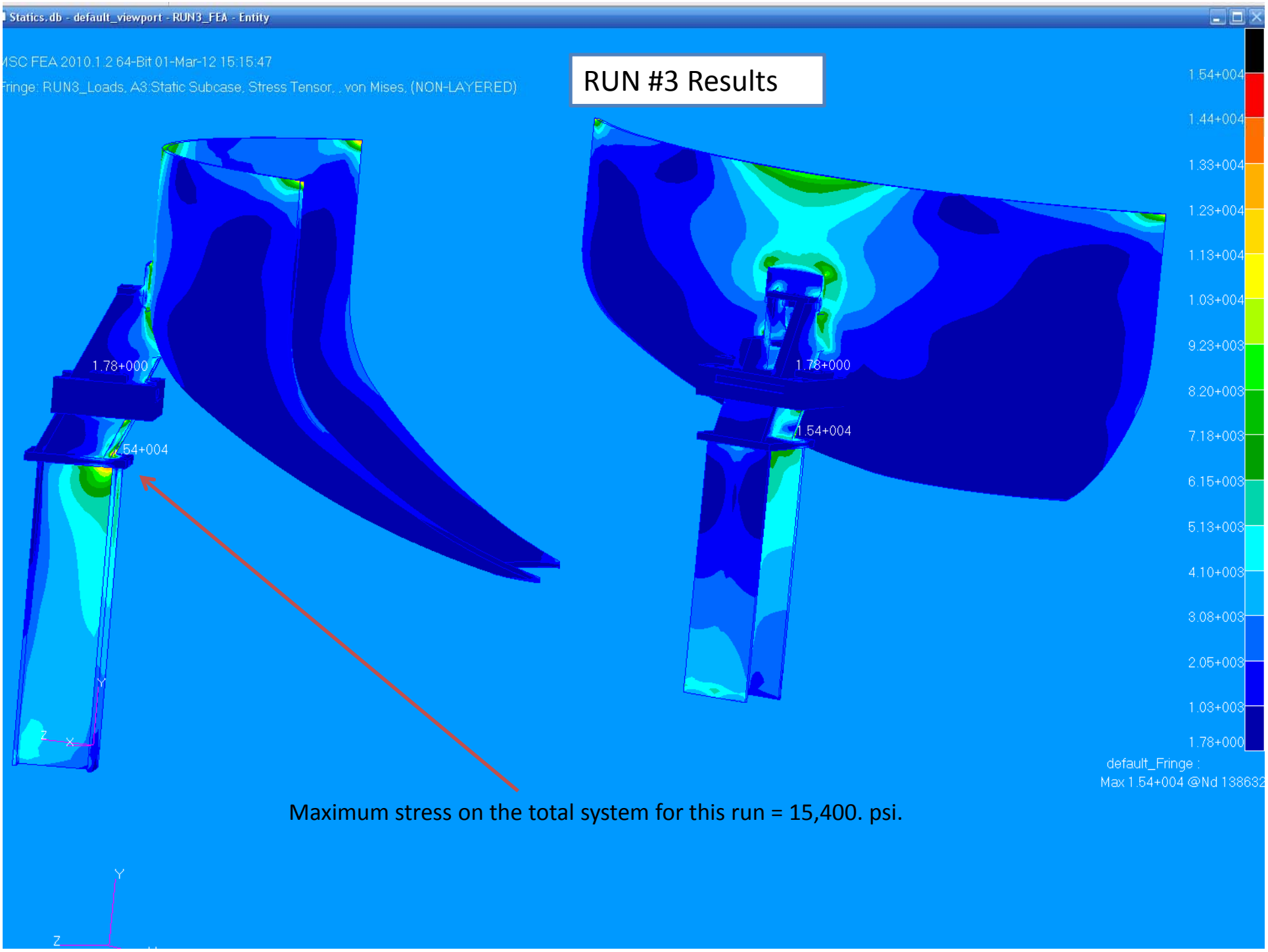


Included in RUNs #3

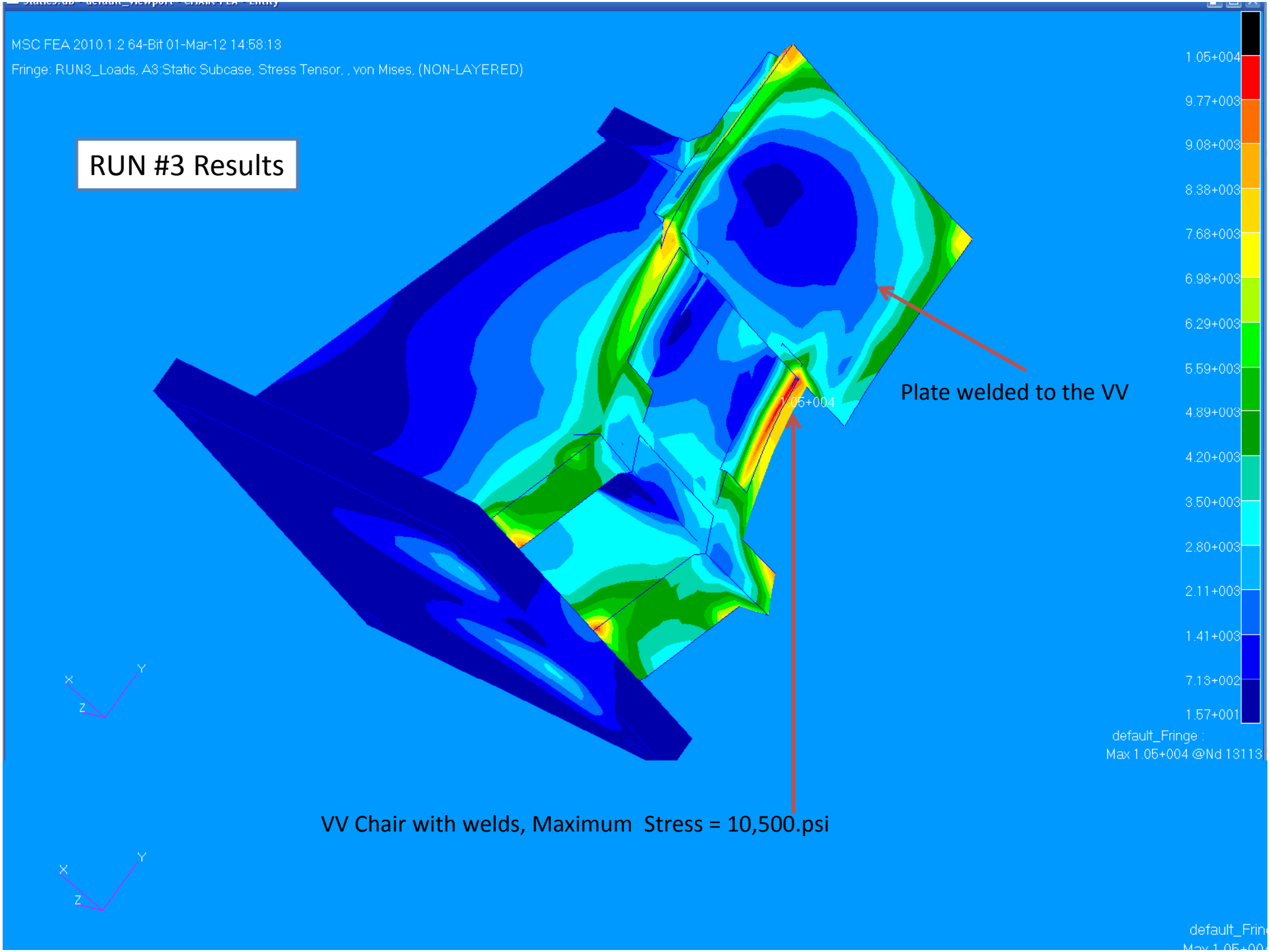
```
PARAM     POST    0
PARAM    PRTMAXIM YES
$ Elements and Element Properties for region : Sliding-Gaps
PGAP      1       0.              3.+7    500.    1.+7    .3      .3
         -1.
$ Pset: "Sliding-Gaps" will be imported as: "pgap.1"
CGAP      94612   1       102192  127702  0.      -1.     0.
CGAP      94613   1       102195  128013  0.      -1.     0.
CGAP      94614   1       102199  128016  0.      -1.     0.
CGAP      94615   1       102201  128015  0.      -1.     0.
CGAP      94616   1       102204  131457  0.      -1.     0.
```

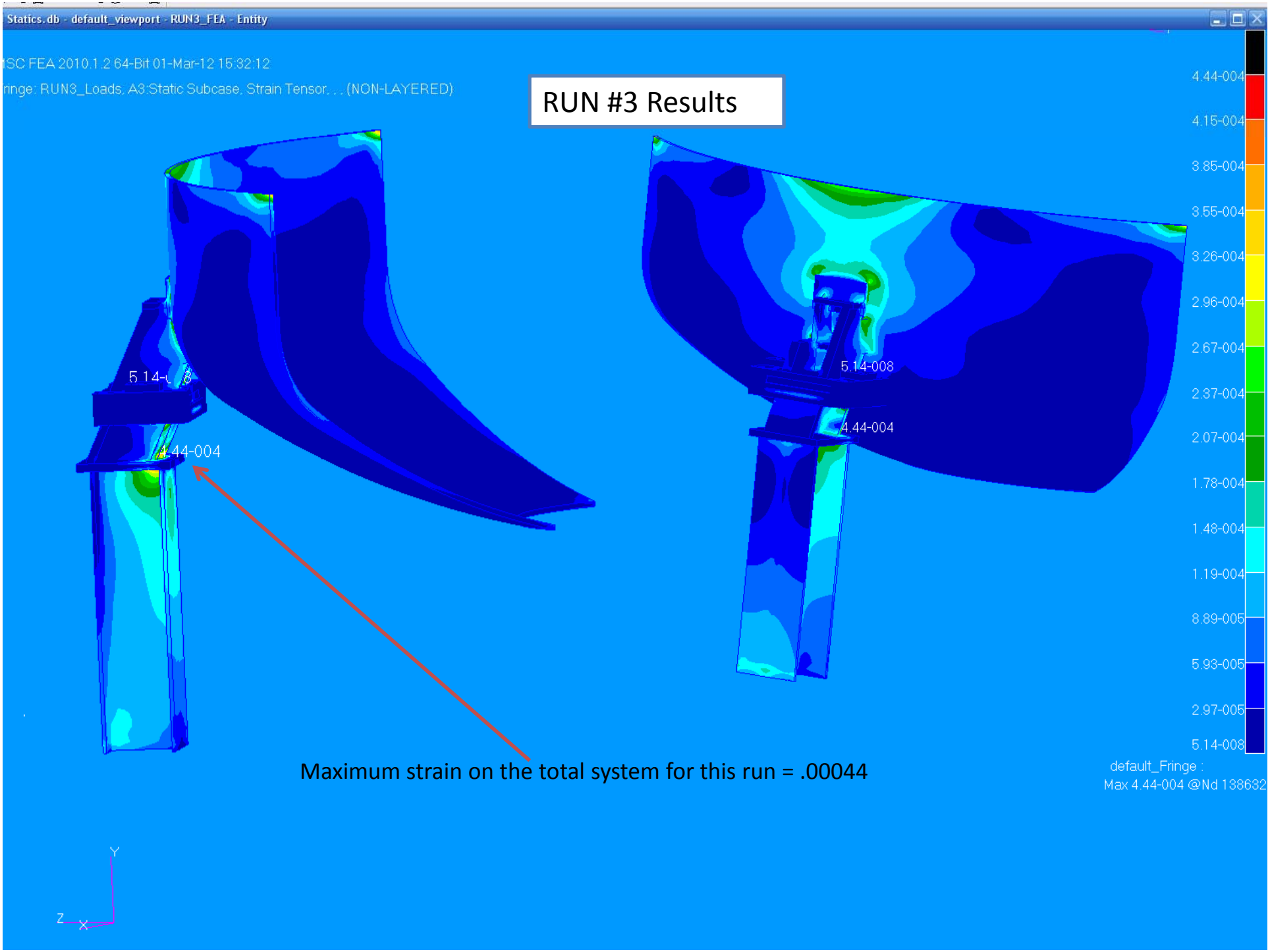
G-10 dielectric break
t = 1/8 inch

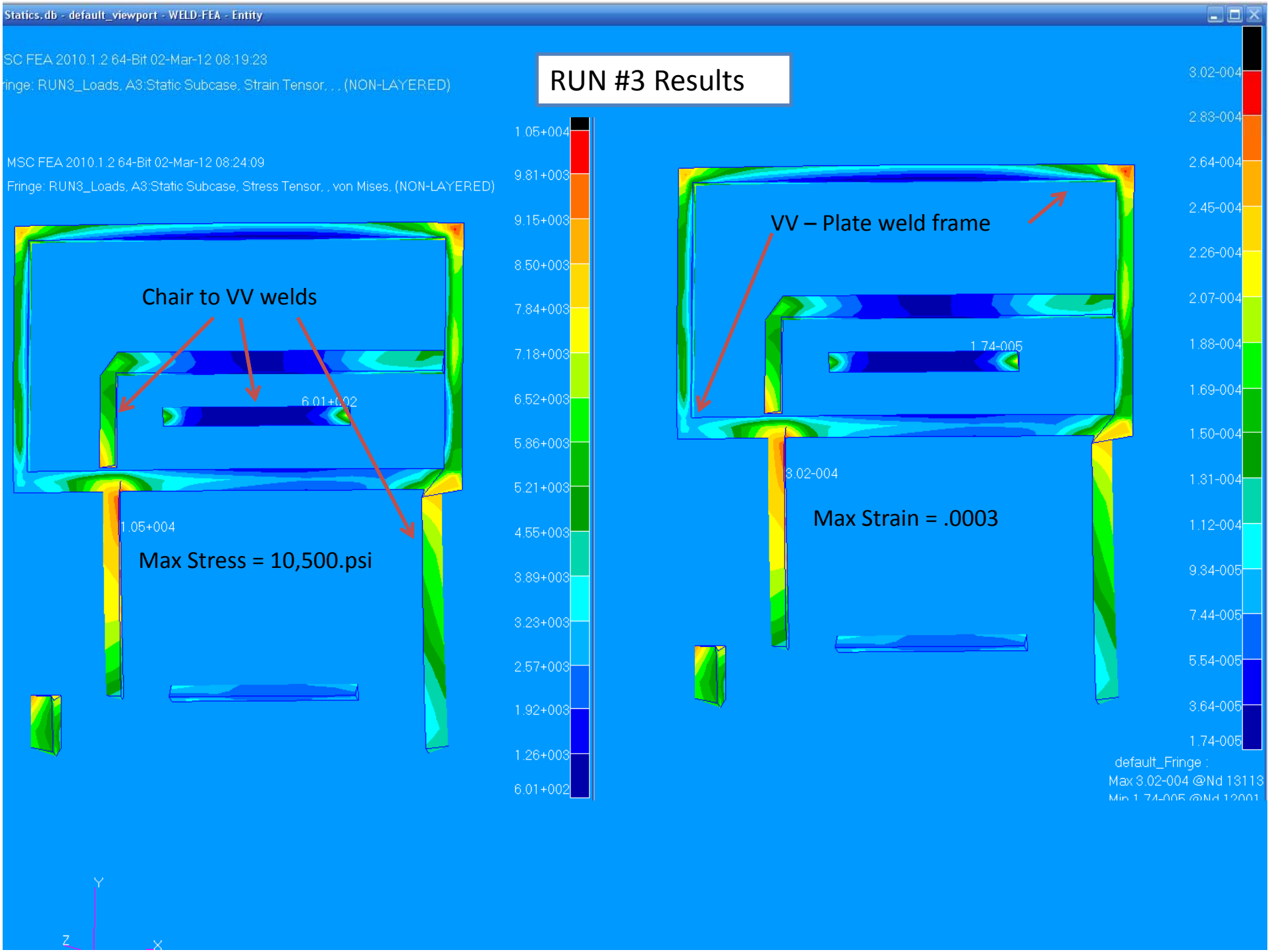
Between the cradle and Vertical support



Maximum stress on the total system for this run = 15,400. psi.

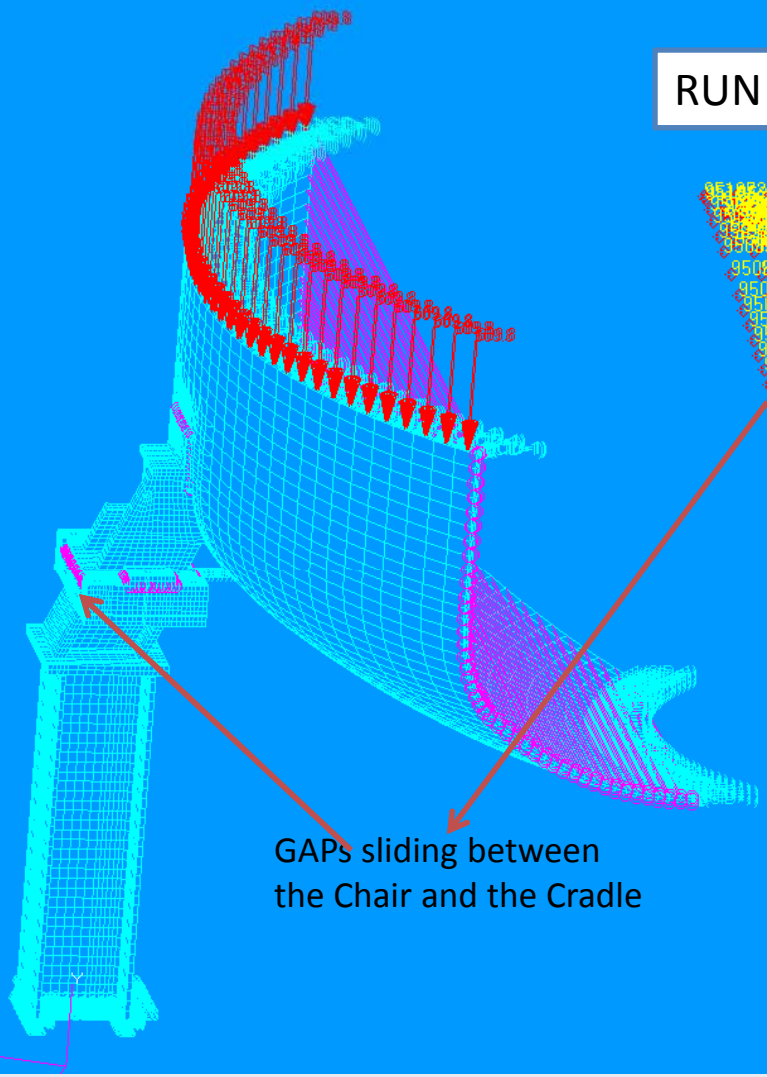

MSC FEA 2010.1.2 64-Bit 01-Mar-12 14:58:13
Fringe: RUN3_Loads, A8:Static Subcase, Stress Tensor, , von Mises, (NON-LAYERED)
RUN #3 Results
1.05+004
9.77+003
9.08+003
8.38+003
7.68+003
6.98+003
6.29+003
5.59+003
4.89+003
4.20+003
3.50+003
2.80+003
2.11+003
1.41+003
7.13+002
1.57+001
default_Fringe :
Max 1.05+004 @Nd 13113
Plate welded to the VV
1.05+004
VV Chair with welds, Maximum Stress = 10,500.psi
X
Y
Z


Statics.db - default_viewport - RUN3_FEA - Entity
ISC FEA 2010.1.2 64-Bit 01-Mar-12 15:32:12
ringe: RUN3_Loads, A3:Static Subcase, Strain Tensor, . . . (NON-LAYERED)
RUN #3 Results
4.44-004
4.15-004
3.85-004
3.55-004
3.26-004
2.96-004
2.67-004
2.37-004
2.07-004
1.78-004
1.48-004
1.19-004
8.89-005
5.93-005
2.97-005
5.14-008
default_Fringe :
Max 4.44-004 @Nd 138632
5.14-008
4.44-004
4.44-004
Maximum strain on the total system for this run = .00044
Y
Z
X

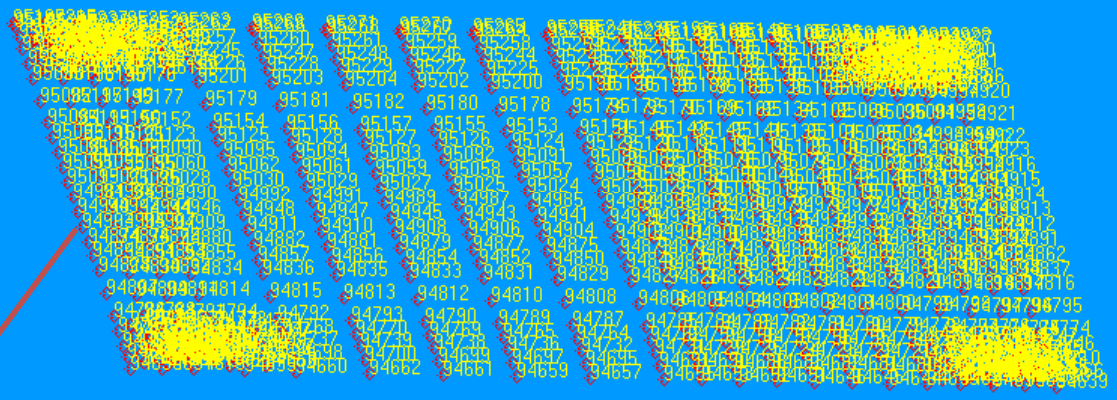

Statics.db - default_viewport - WELD-FEA - Entity
SC FEA 2010.1.2 64-Bit 02-Mar-12 08:19:23
inge: RUN3_Loads, A3:Static Subcase, Strain Tensor, , , (NON-LAYERED)
RUN #3 Results
MSC FEA 2010.1.2 64-Bit 02-Mar-12 08:24:09
Fringe: RUN3_Loads, A3:Static Subcase, Stress Tensor, , von Mises, (NON-LAYERED)
Chair to VV welds
6.01+002
1.05+004
Max Stress = 10,500.psi
1.05+004
9.81+003
9.15+003
8.50+003
7.84+003
7.18+003
6.52+003
5.86+003
5.21+003
4.55+003
3.89+003
3.23+003
2.57+003
1.92+003
1.26+003
6.01+002
VV – Plate weld frame
1.74-005
3.02-004
Max Strain = .0003
3.02-004
2.83-004
2.64-004
2.45-004
2.26-004
2.07-004
1.88-004
1.69-004
1.50-004
1.31-004
1.12-004
9.34-005
7.44-005
5.54-005
3.64-005
1.74-005
default_Fringe :
Max 3.02-004 @Nd 13113
Y
Z
X

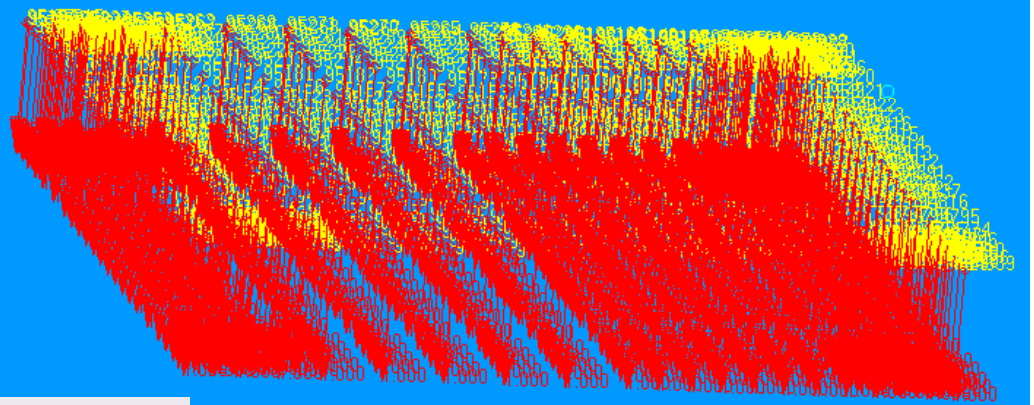
Statics.db - default_viewport - RUN4-106NL-FEA - Entity

RUN #4 Non Linear static Sol 106



GAPs sliding between
the Chair and the Cradle





GAPs orientation in the -Y direction

	Type	Scale Factor	Priority
Slide_Fic_cen	Displacement	1.	Add
Support_Bot	Displacement	1.	Add
VV-Fixity	Displacement	1.	Add
VV-Fixity-Bot	Displacement	1.	Add
Pres40000	Pressure	1.	Add

Load Case “RUN4-Loads”

This is continuing with the non linear evaluation ?

P.R. 03/02/2012