Review of "B1" to "C1" interface Response to NCR 3735 and Deviation Request to Address Remaining B-C Coil Interfaces

12/18/07

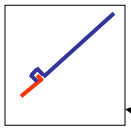
Disposition to NCR 3735

- Modify the copper cladding on B1 and C1 as shown on page 3.
  - The slides which follow this are given for reference.

RFD for Other B/C Coils:

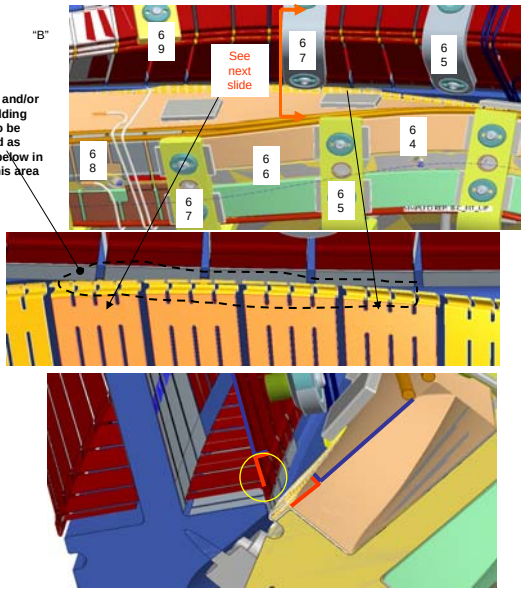
  - Coils B5,B6, and C6 are not yet VPI'd. These should be "preemptively" modified in a similar manner, with the exception being that instead of a crimp connection flat overlapped solder connections will be used (since heating due to soldering can be tolerated in a non-impregnated coil).
  - Grinding of all C and B coils will be necessary, similar to the B1 and C1 that is described in the PowerPoint slides attached. Use these as models. Refer to Slide 16.
  - The other C and B coils can be ground to roughly the same profile as B1 and C1. This is not a highly stressed area (see slides), so grinding is not critical.
- It is likely that this same copper cladding modification will be needed on coils B2, B3,B4, C2,C3,C4, and C5.

Elimination of cladding interference:

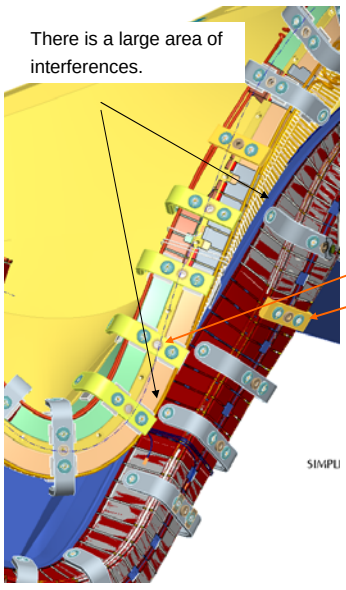


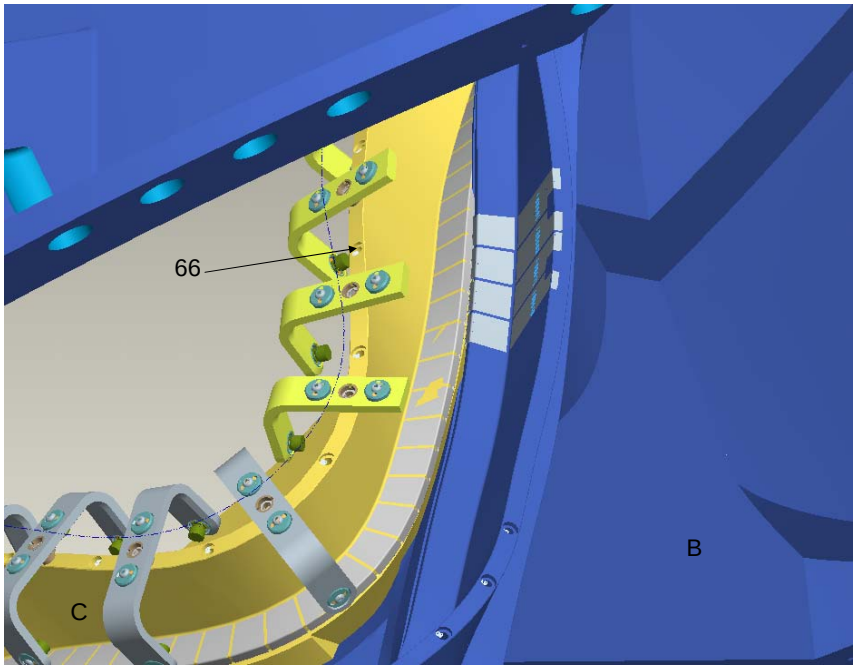
- On B coil, between clamp holes 65 & 69: and on C coil , between clamp holes 64 & 68:
  - Unbend copper crimps & straighten copper.
  - Form the copper as shown in the yellow circle. Bent out leg should be ~1/8".
  - Form the upper copper to meet the bent out leg and form a crimp U section over the lower piece.
  - Crimp the copper U.
  - Epoxy the copper to the coil and overlay the repaired region with glass – epoxy.
- *Every attempt should be made to avoid copper breakage*. However IF the copper breaks during the unbending operation, abandon that piece. Uncooled continuous lengths up to 8" are acceptable. Record the actual as repaired condition and append to the NCR.
  - For reference, slide 14 shows the reslts of a thermal analysis with every other tab set unconnected.

The "B" and/or "C" cladding needs to be modified as shown below in red in this area

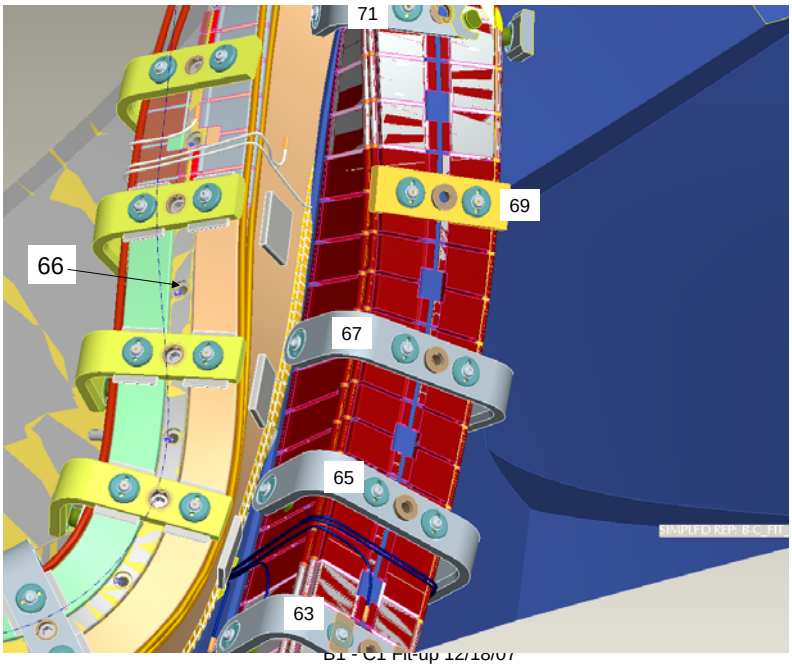


There is a large area of interferences.





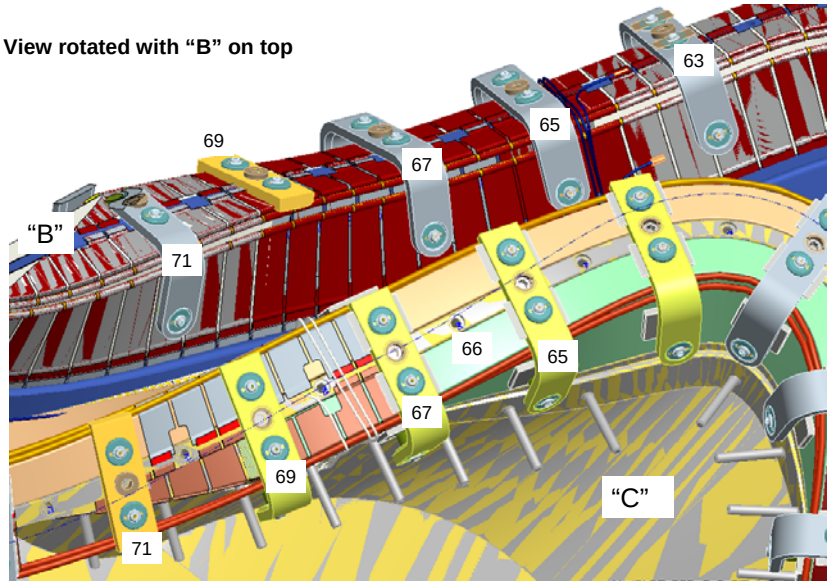
5



B1 - C1 Fit-up 12/18/07

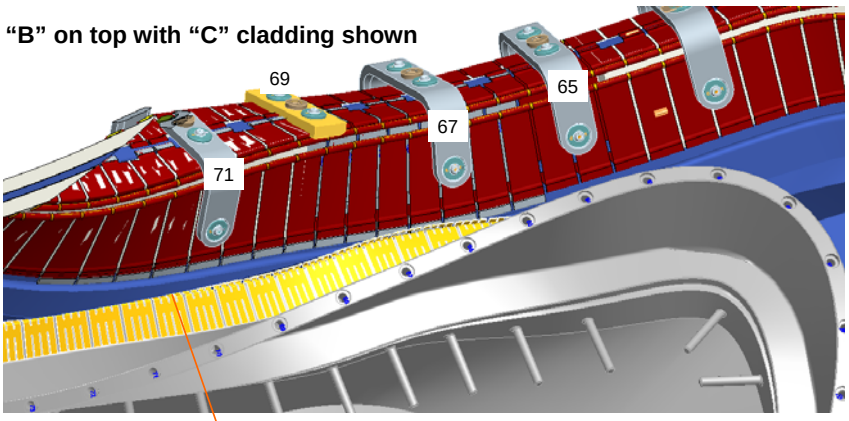
6

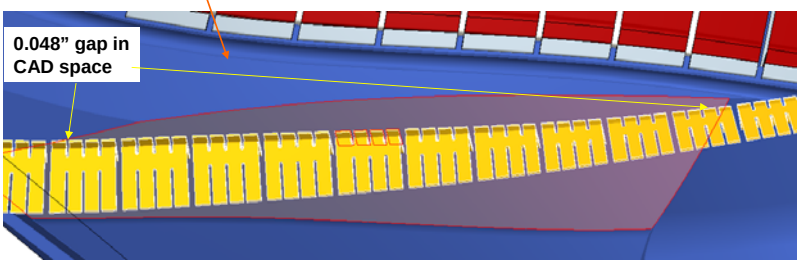
View rotated with “B” on top



B1 - C1 Fit-up 12/18/07 7

“B” on top with “C” cladding shown





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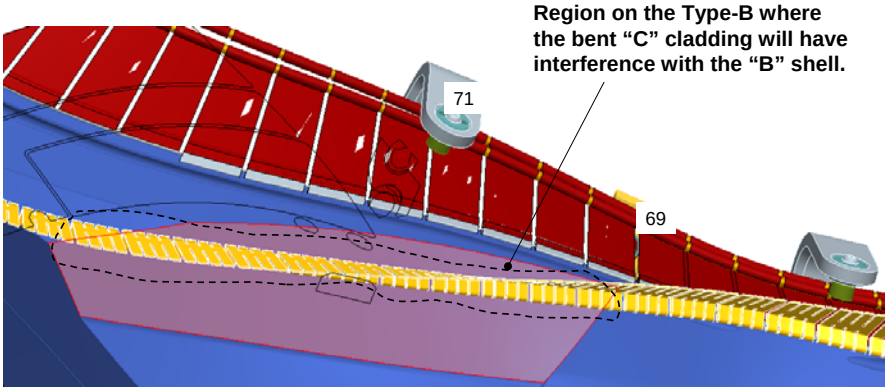
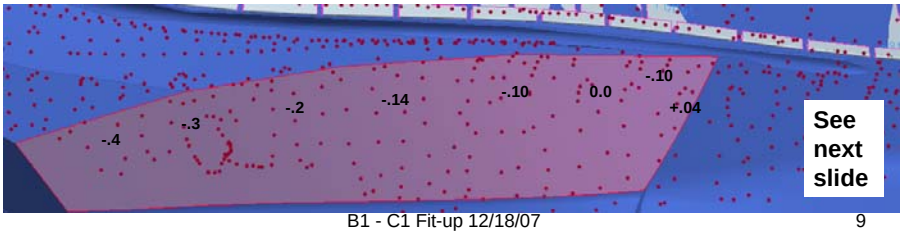
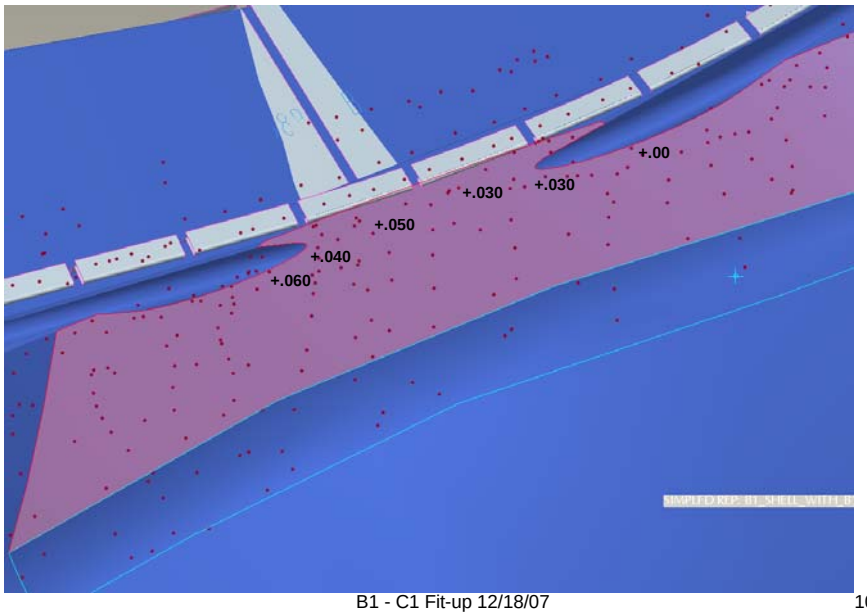
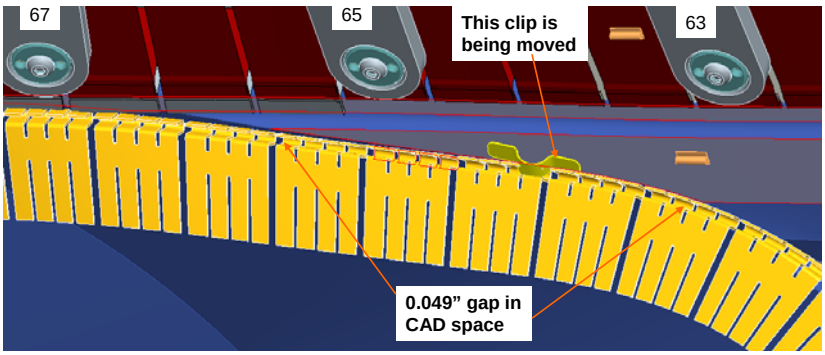


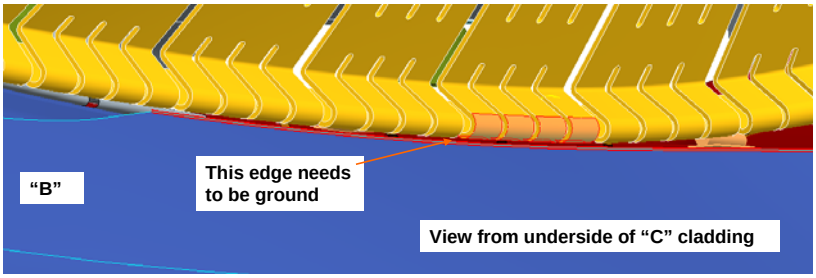


B1 - C1 Fit-up 12/18/07 9



B1 - C1 Fit-up 12/18/07 10





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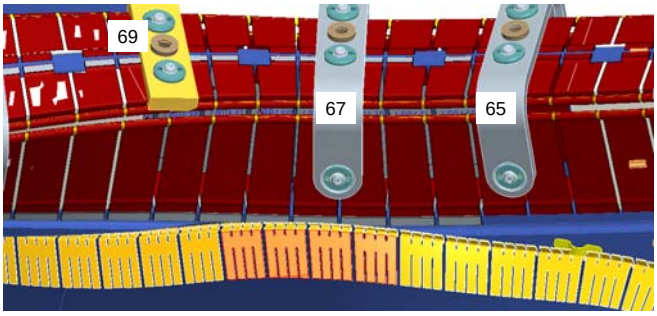
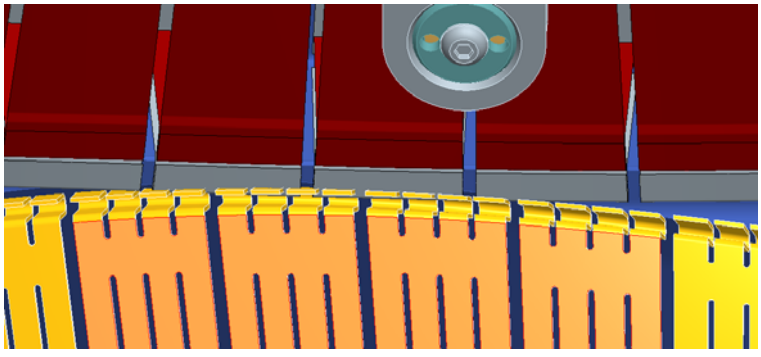


“B”

“C” cladding

“B”

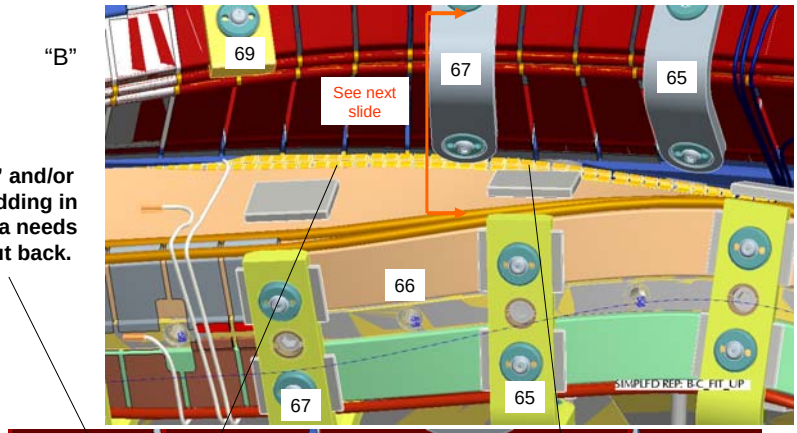


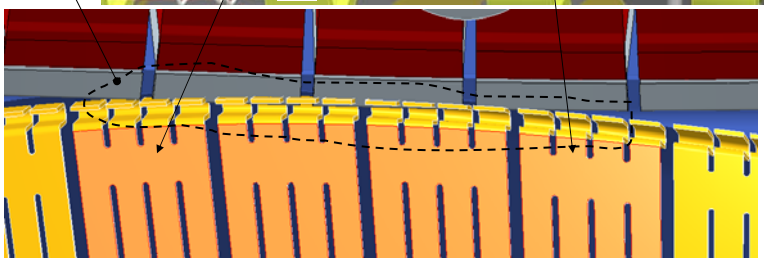
“C” cladding

12

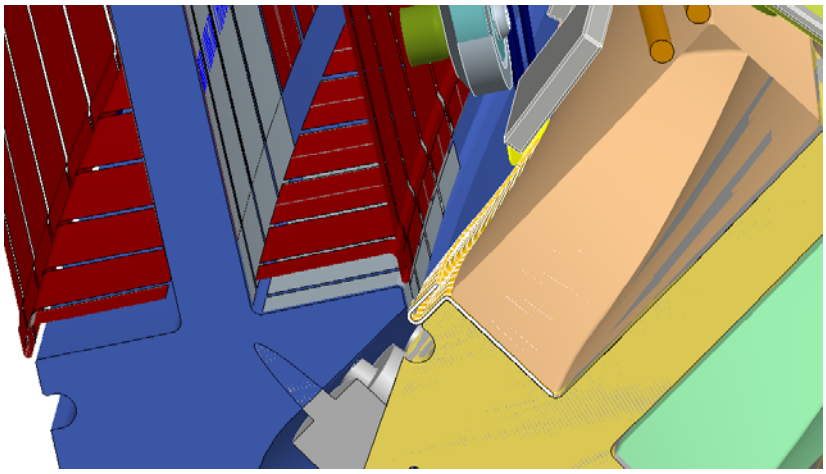
“B”

The “B” and/or “C” cladding in this area needs to be cut back.

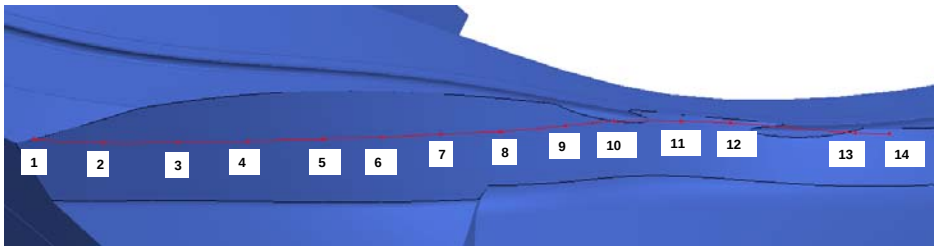


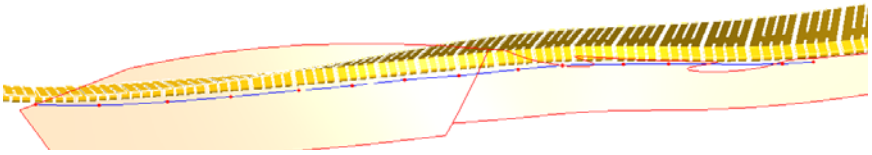


13



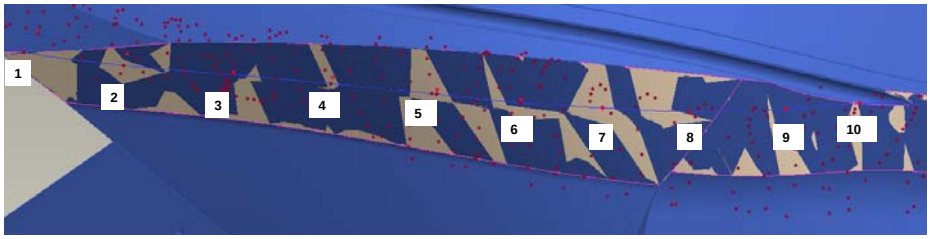
Local section view





Point data relative to the "B' default coordinate system

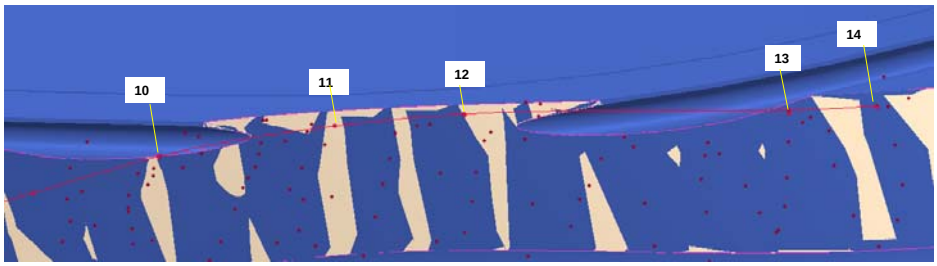
	X	Y	Z
1	34.087	-27.853	-41.520
2	34.532	-26.814	-39.870
3	34.997	-25.567	-38.164
4	35.353	-24.380	-36.598
5	35.686	-23.086	-34.925
6	35.952	-22.079	-33.603
7	36.251	-21.049	-32.331
8	36.651	-20.010	-31.011
9	37.241	-18.809	-29.617
10	37.769	-17.908	-28.587
11	38.350	-16.817	-27.066
12	38.650	-16.047	-25.906
13	39.070	-14.208	-22.898
14	39.163	-13.659	-22.105



Point data relative to the "B' default coordinate system

	FOR B1 AND C1							
				"B" surf to	Currt. Ground Dist. from	Currt "B" surf to	Additional grinding depth for	Added fractional grinding
	X	Y	Z	"C" cladding	Met. Pts	"C" cladding	1/4" gap	depth
1	34.087	-27.853	-41.520	0.046	0.649	0.695		none
2	34.532	-26.814	-39.870	0.046	0.361	0.407		none
3	34.997	-25.567	-38.164	0.046	0.092	0.138	0.112	1/8
4	35.353	-24.380	-36.598	0.046	0.162	0.208	0.042	1/8
5	35.686	-23.086	-34.925	0.046	0.128	0.174	0.076	1/8
6	35.952	-22.079	-33.603	0.046	0.094	0.140	0.110	1/8
7	36.251	-21.049	-32.331	0.046	0.020	0.066	0.184	3/16
8	36.651	-20.010	-31.011	0.046	-0.014	0.032	0.218	1/4
9	37.241	-18.809	-29.617	0.046	0.009	0.055	0.195	1/4
10	37.769	-17.908	-28.587	0.046	0.048	0.094	0.156	3/16
11	38.350	-16.817	-27.066	0.046	0.022	0.068	0.182	3/16
12	38.650	-16.047	-25.906	0.046	0.058	0.104	0.146	3/16
13	39.070	-14.208	-22.898	0.046	0.093	0.139	0.111	3/16
14	39.163	-13.659	-22.105	0.046	0.063	0.109	0.141	3/16

Pts 3 thru 10

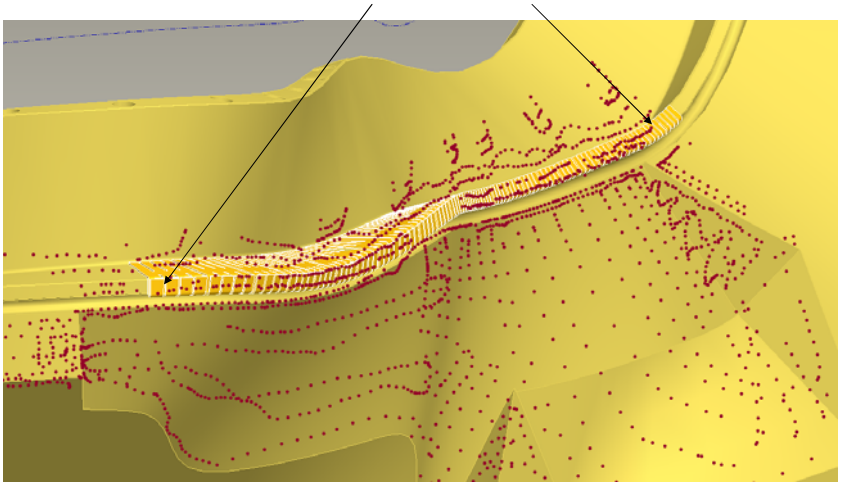


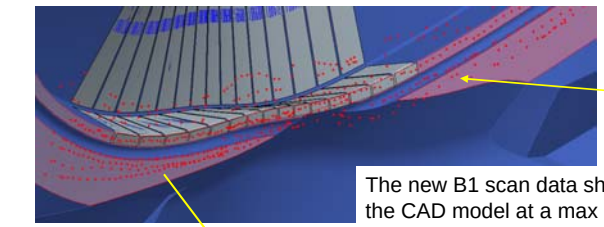
Point data relative to the "B" default coordinate system FOR B1 AND C1								
					Currt. Ground		Additional	Added
				"B" surf to	Dist. from	Currt "B" surf to	grinding depth for	fractional grinding
	X	Y	Z	"C" cladding	Met. Pts	"C" cladding	1/4" gap	depth
1	34.087	-27.853	-41.520	0.046	0.649	0.695		none
2	34.532	-26.814	-39.870	0.046	0.361	0.407		none
3	34.997	-25.567	-38.164	0.046	0.092	0.138	0.112	1/8
4	35.353	-24.380	-36.598	0.046	0.162	0.208	0.042	1/8
5	35.686	-23.086	-34.925	0.046	0.128	0.174	0.076	1/8
6	35.952	-22.079	-33.603	0.046	0.094	0.140	0.110	1/8
7	36.251	-21.049	-32.331	0.046	0.020	0.066	0.184	3/16
8	36.651	-20.010	-31.011	0.046	-0.014	0.032	0.218	1/4
9	37.241	-18.809	-29.617	0.046	0.009	0.055	0.195	1/4
10	37.769	-17.908	-28.587	0.046	0.048	0.094	0.156	3/16
11	38.350	-16.817	-27.068	0.046	0.022	0.068	0.182	3/16
12	38.650	-16.047	-25.906	0.046	0.058	0.104	0.146	3/16
13	39.070	-14.208	-22.898	0.046	0.093	0.139	0.111	3/16
14	39.163	-13.659	-22.105	0.046	0.063	0.109	0.141	3/16

Pts 10 thru 14

"C" MC is shown along with C1 scan points

All scanned points along the cladding surface are in the range of -0.006" to -0.042" below the CAD model surface of the cladding… good news.

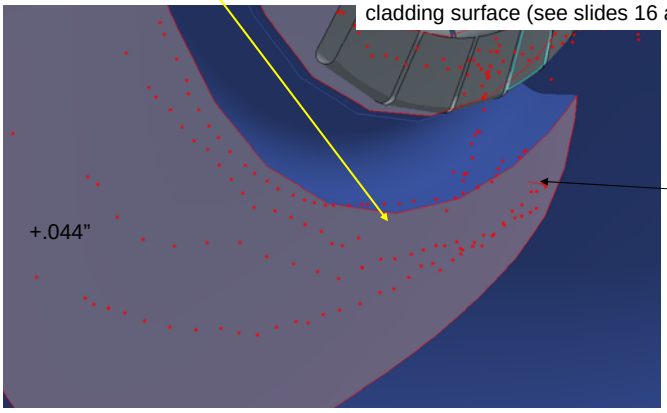




"B" MC is shown along with B1 scan points

-.050" to +.016

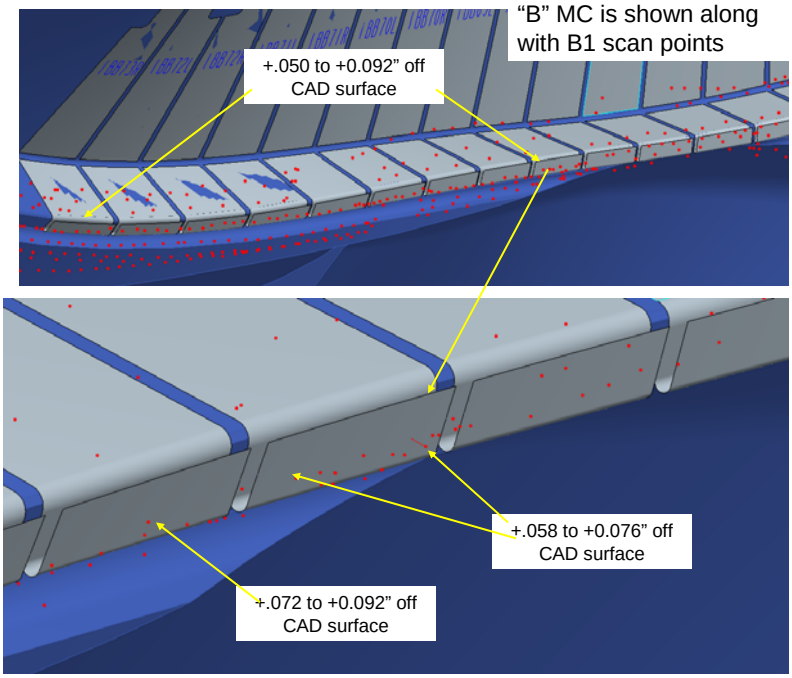
The new B1 scan data shows the surfaces are off the CAD model at a max condition on the order of +.058" and has a max value of +.092" off the cladding surface (see slides 16 and 17).



+.058" to +.044

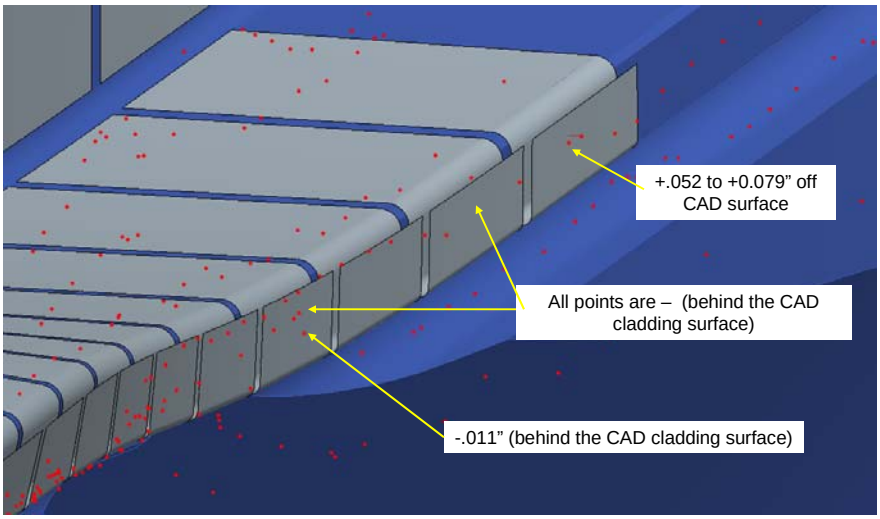
19

"B" MC is shown along with B1 scan points

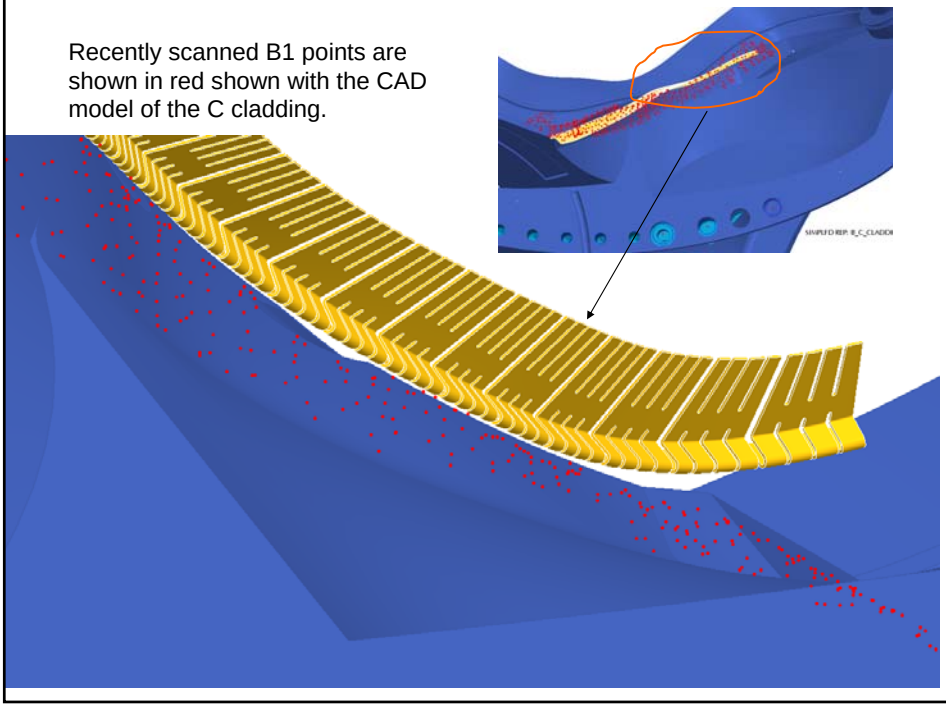


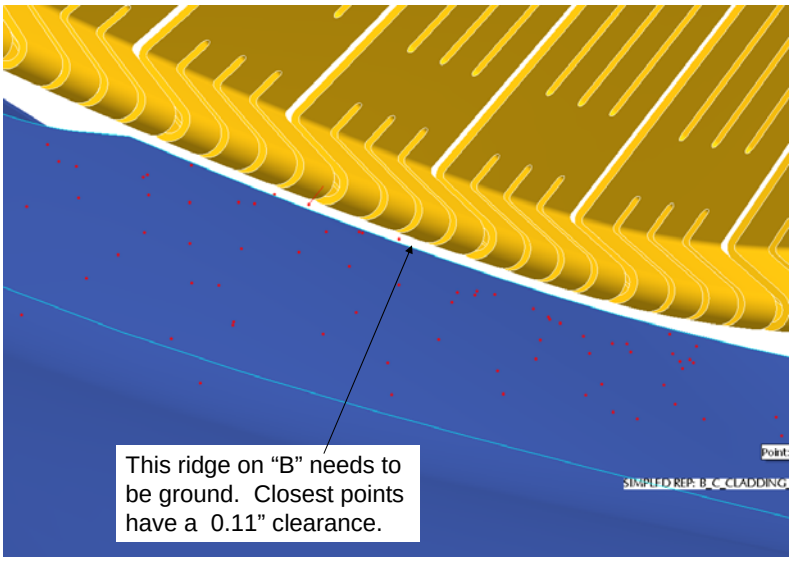
20

"B" MC is shown along with B1 scan points

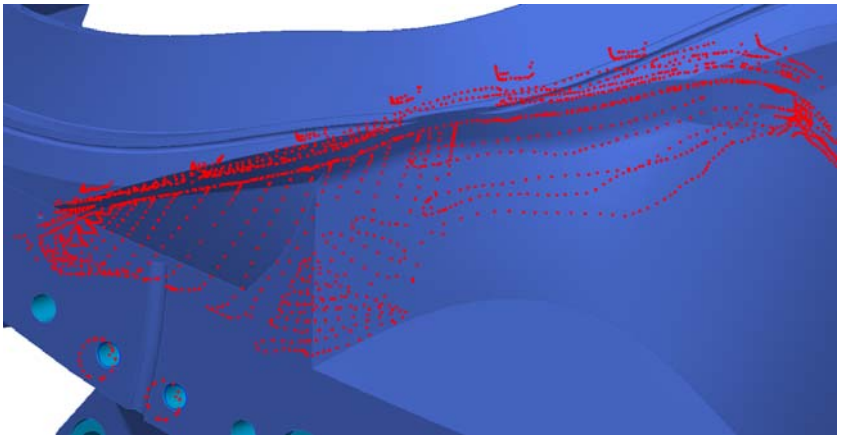


Recently scanned B1 points are shown in red shown with the CAD model of the C cladding.

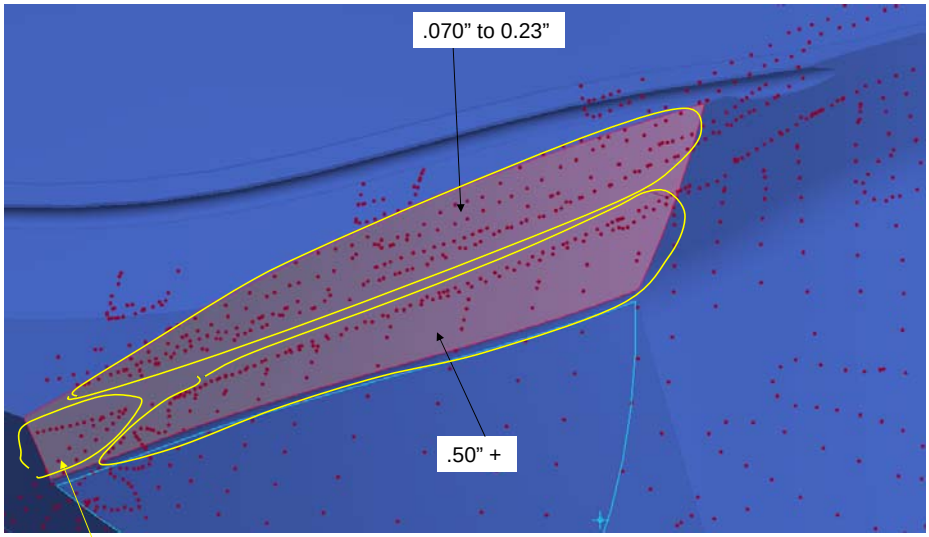




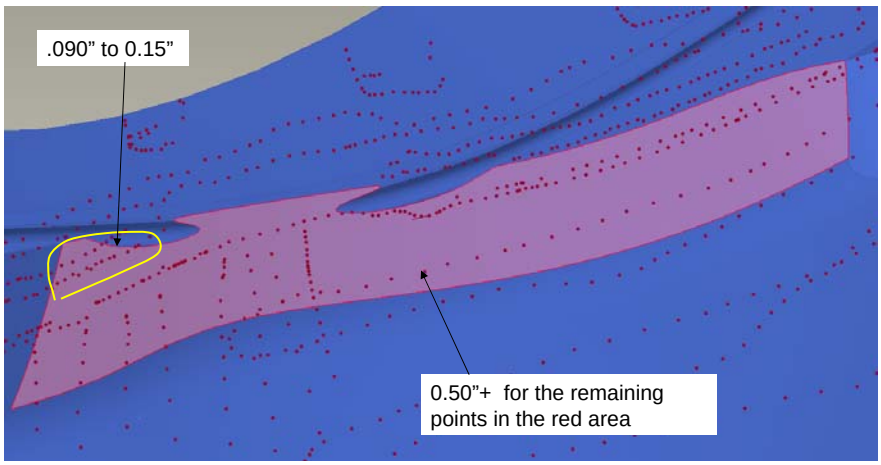
The “B” MC is the blue part shown with the recent scanned points of the “C1” MC.

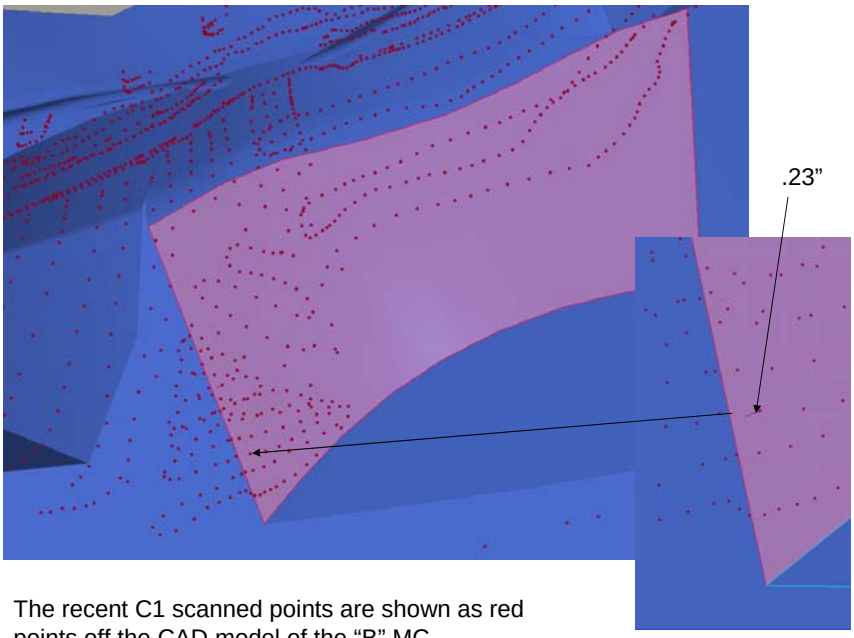


The recent C1 scanned points are shown as red points off the CAD model of the “B” MC.

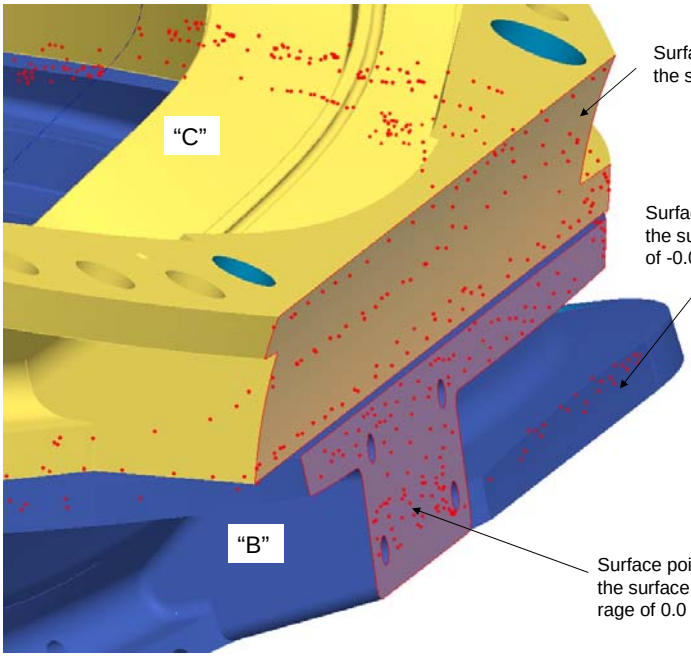


The recent C1 scanned points are shown as red points off the CAD model of the “B” MC.





The recent C1 scanned points are shown as red points off the CAD model of the “B” MC.

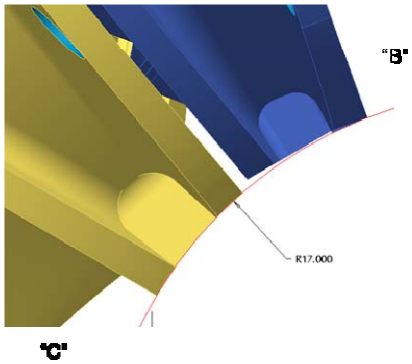


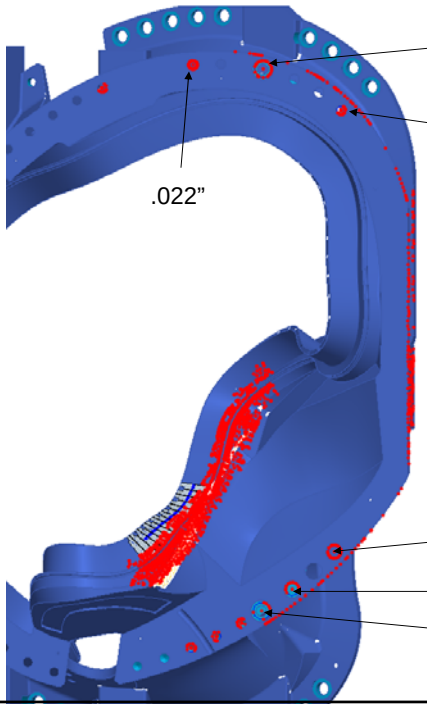
Surface points are off the surface by -0.050”

Surface points are off the surface in the rage of -0.050” to - .075”

Surface points are off the surface in the rage of 0.0 to + .029”

C – to – B interface along nose region





The values show the extent that the hole CL are out of tolerances.

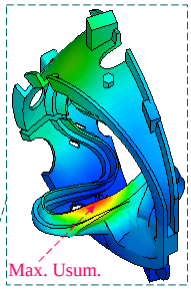
Nonlinear Analyses of Modular Coils and Shell structure for Coil Cool-down and EM Loads

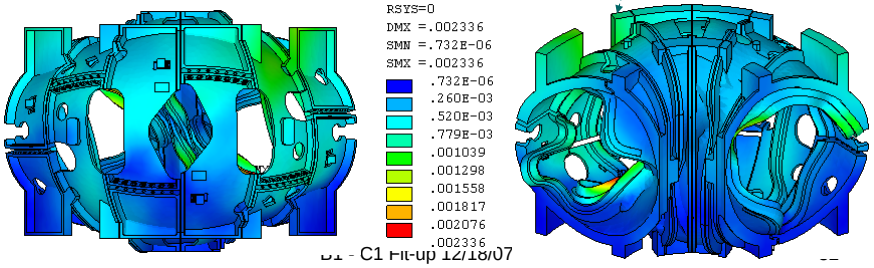
Part 1 – Results of Shell Structure and Modular Coils

H.M. Fan
PPPL
Sept. 28, 2005

Total Displacements of Shell - Usum

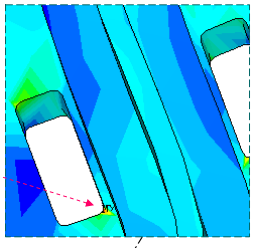
- The maximum displacement, 2.336 mm, occurs on tee in shell type B due to lateral deformation of web caused by the lateral force of the modular coil.
- Because of net vertical forces are equal and opposite with respect to the mid-span, the deformation at bottom of the mid-span is small.
- The smaller deformation at the inboard than the outboard is the result of higher shell stiffness in the inboard.
- The unit of the displacement is in meter

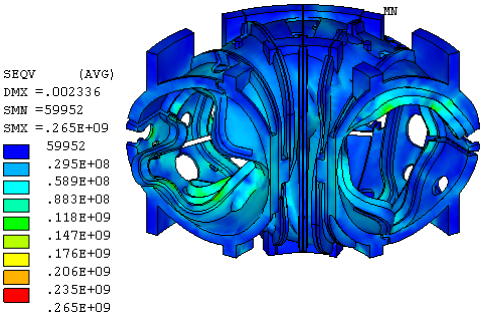


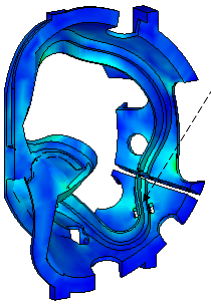


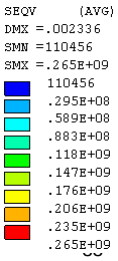
Von Mises Stress of Shell Structure

- The maximum local von Mises stress, Seqv, occurs at the corner of lead opening in shell type B.
- The model was built without chamfers at the lead openings. With chamfer, the local stress will be greatly reduced.
- The next slides will display some high stress areas









Unit of stress in pascal

B1 - C1 Fit-up 12/18/07

Upper shell type B