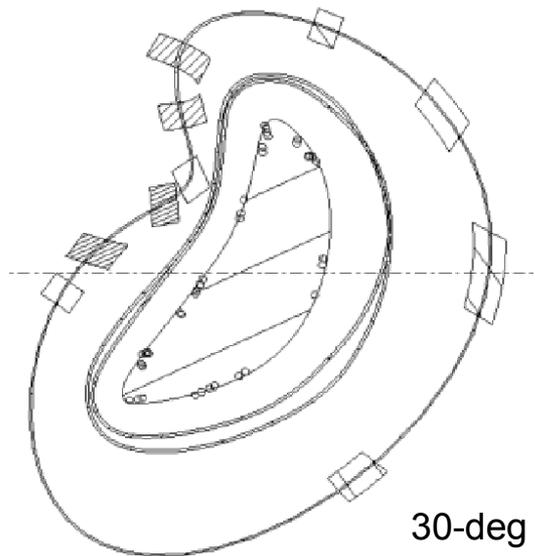
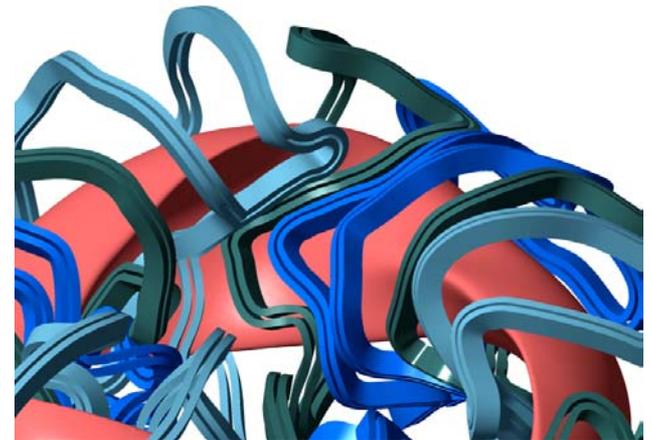


# Status of Modular Coil Design

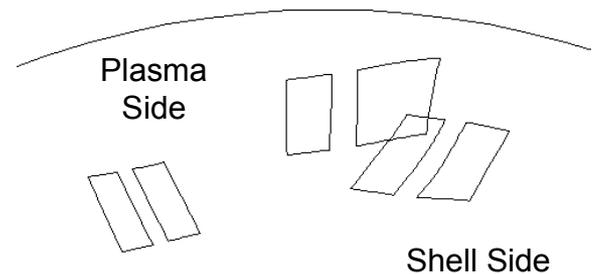
David Williamson  
NCSX Project Meeting  
10/16/01

# Last Project Meeting -

- Coil case 0813a1 was presented as best 18-coil solution
- Parameters:
  - Min coil-plasma distance = 19.7-cm
  - Min coil-coil distance = 11-cm
  - Min bend radius = 9.1-cm
- Design issues:
  - Coil twist and bend radius
  - Interference with vacuum vessel
  - Coil overlap and structural shell complexity



30-deg (v=.25)



## Design Approach -

- Modify targets to improve coil feasibility:

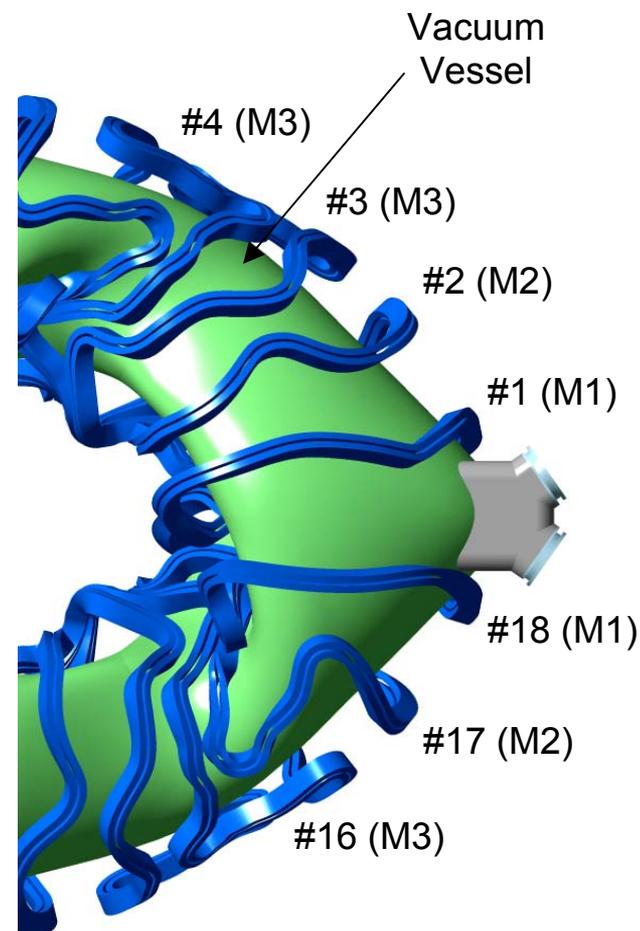
Min coil-coil spacing = ~16-cm  
- allows twist flexibility

Min bend radius = ~14-cm  
- 5x conductor dim +  $\frac{1}{2}$  coil width

- Use vacuum vessel as fixed boundary  
Min coil-vessel spacing = ~10-cm
- Simplify winding surface / structural shell  
Manually or by CoilOpt surface modification
- Evaluate CoilOpt-generated and manually adjusted cases

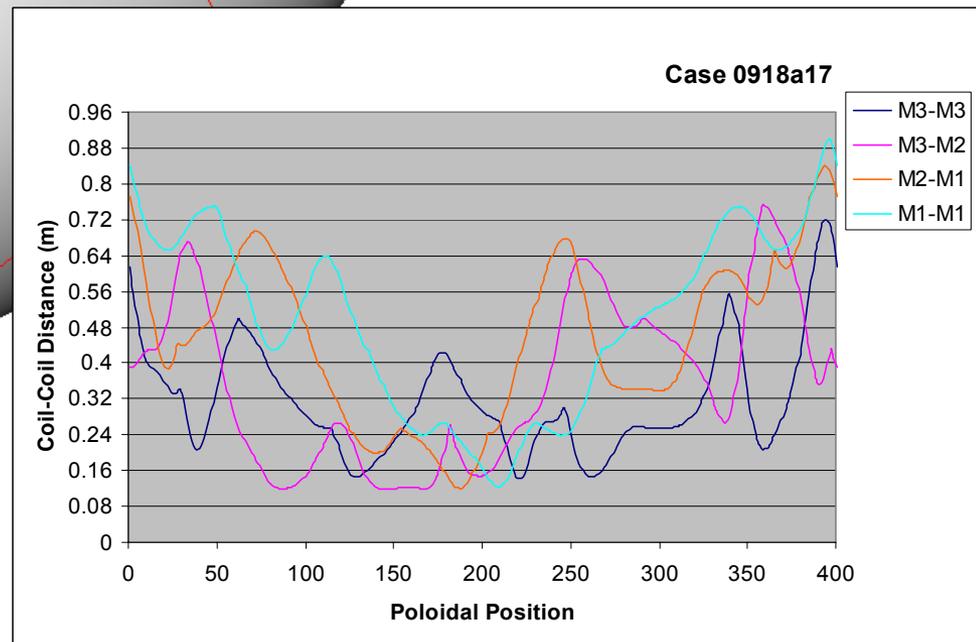
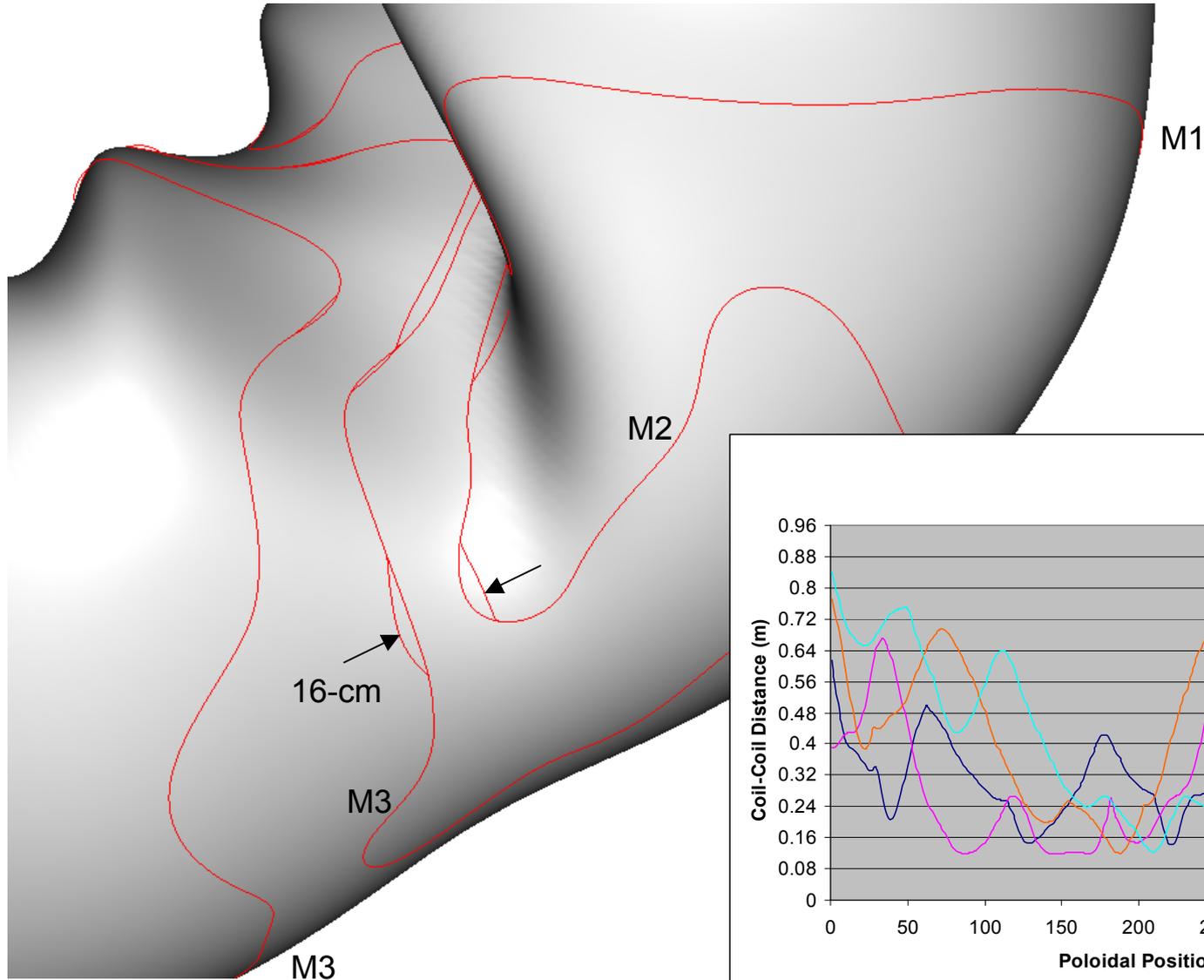
# Status -

Coil Position	Type	Length (m)	Min Rad (cm)	C-C Dist (cm)	C-V Dist (cm)	C-P Dist (cm)	Current (kA)	Avg Error (%)	Max Error (%)
Case 0918a17								0.6	2.5
18	M1			12.4					
01	M1	7.2	9.6	12.0	0.5	20.2	625.0		
02	M2	7.2	9.4	12.0	5.8	19.4	595.0		
03	M3	7.2	9.6	14.2	9.9	23.1	565.0		
04	M3								
Case 0918a17r2 (modified)								0.9	8.1
18	M1			16.3					
01	M1	7.3	11.8	15.9	9.8	20.0	-		
02	M2	7.1	10.2	14.6	9.7	19.9	-		
03	M3	7.1	10.0	14.9	9.6	21.4	-		
04	M3								
Case 1011b3								2.7	12.6
18	M1			20.1					
01	M1	6.2	11.4	14.0	0.9	20.4	799		
02	M2	5.4	12.4	14.0	7.2	20.5	583		
03	M3	4.9	12.5	14.6	6.1	21.0	418		
04	M3								
Notes:									
Dimensions at room temperature (scale factor = 1.003435)									



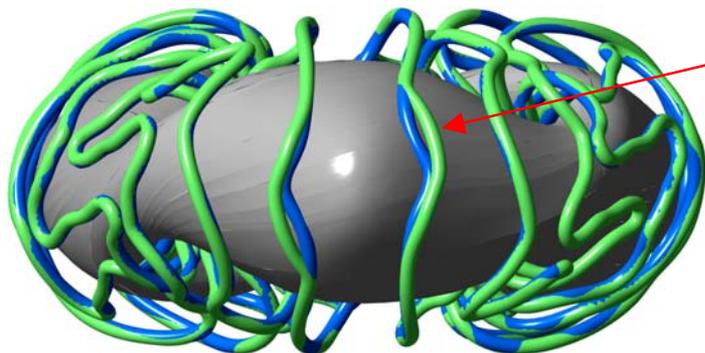
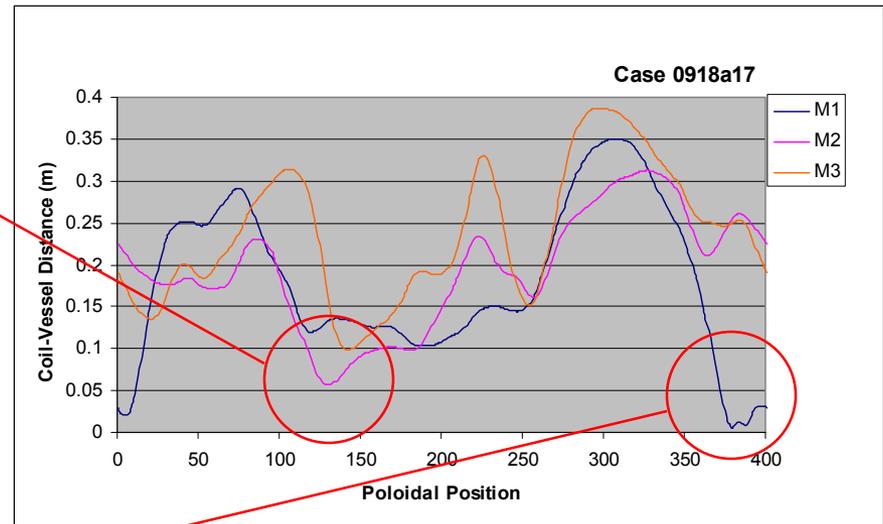
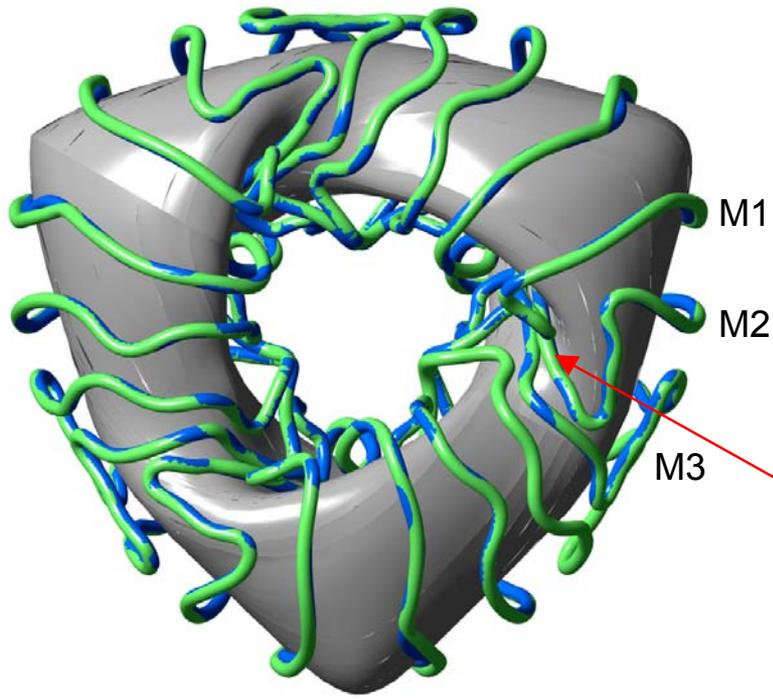
# Case 0918a17 Coil-Coil Spacing -

Evaluate 400 points/coil, adjust position to get min dist = 16-cm



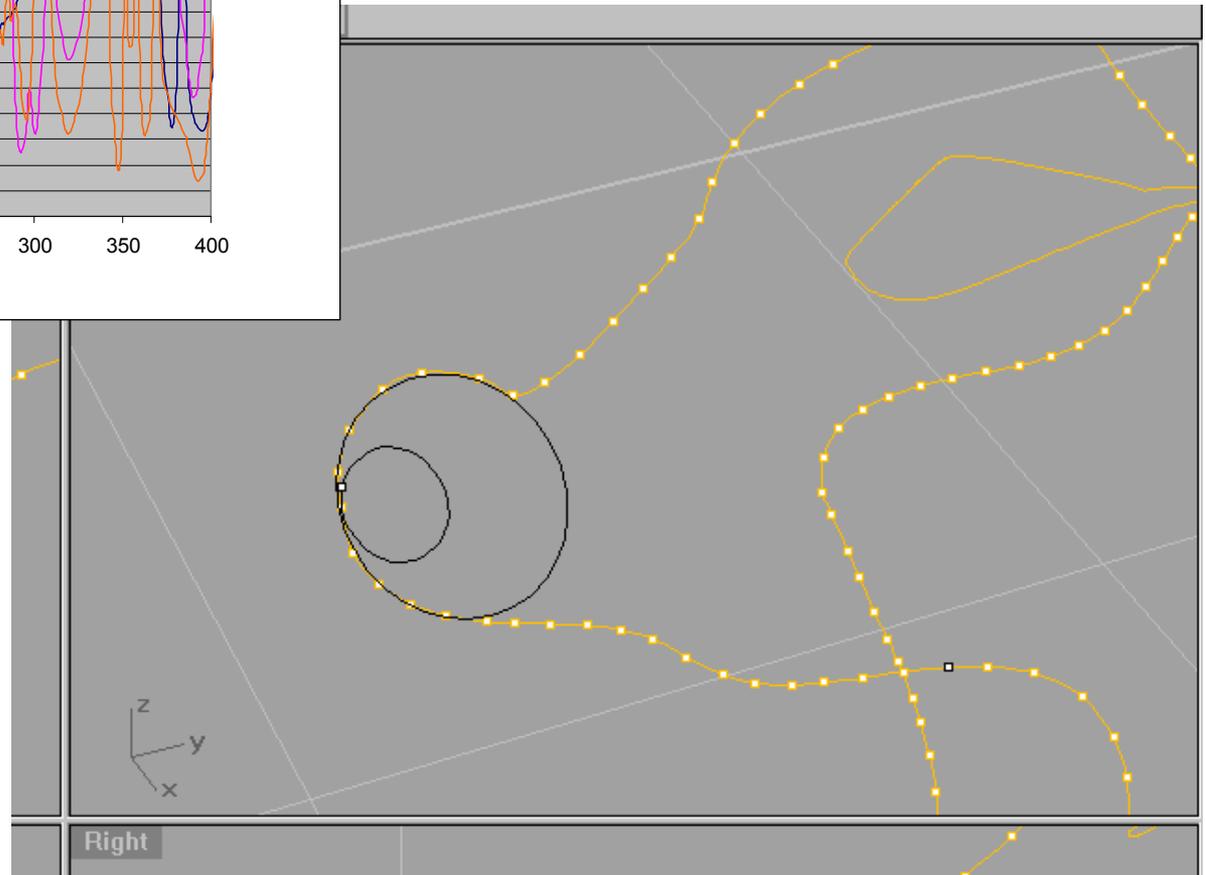
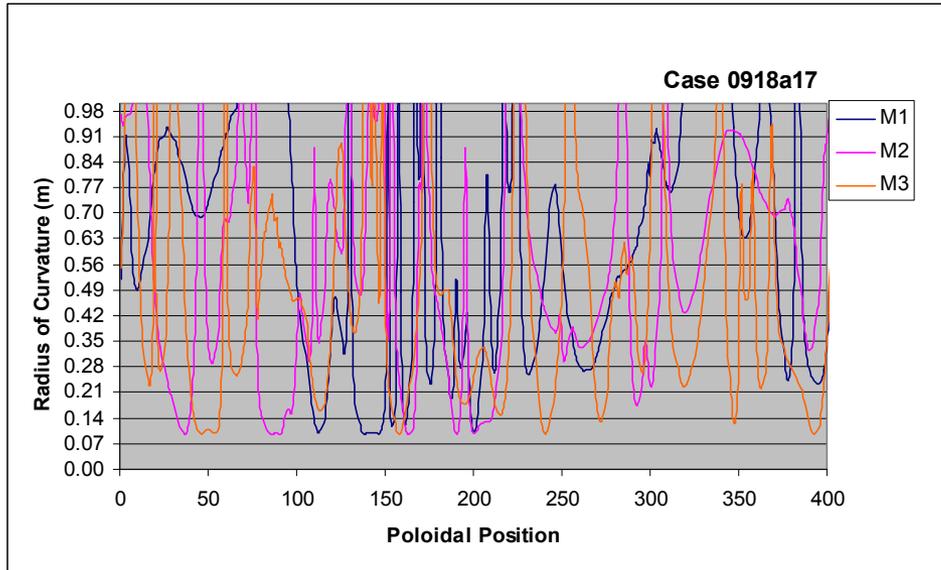
# Case 0918a17 Coil-Vessel Spacing -

Blue - original data, Green – scaled to RT, min coil-ves spacing = 10-cm

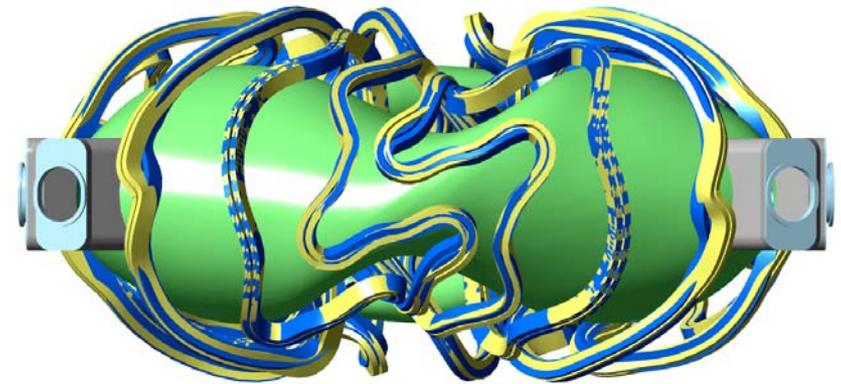
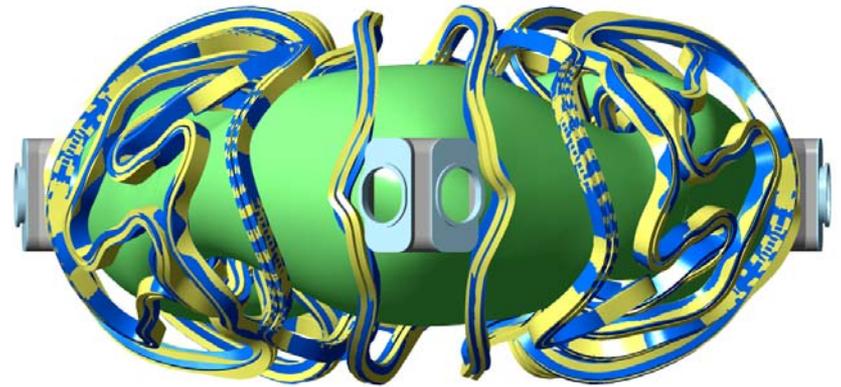
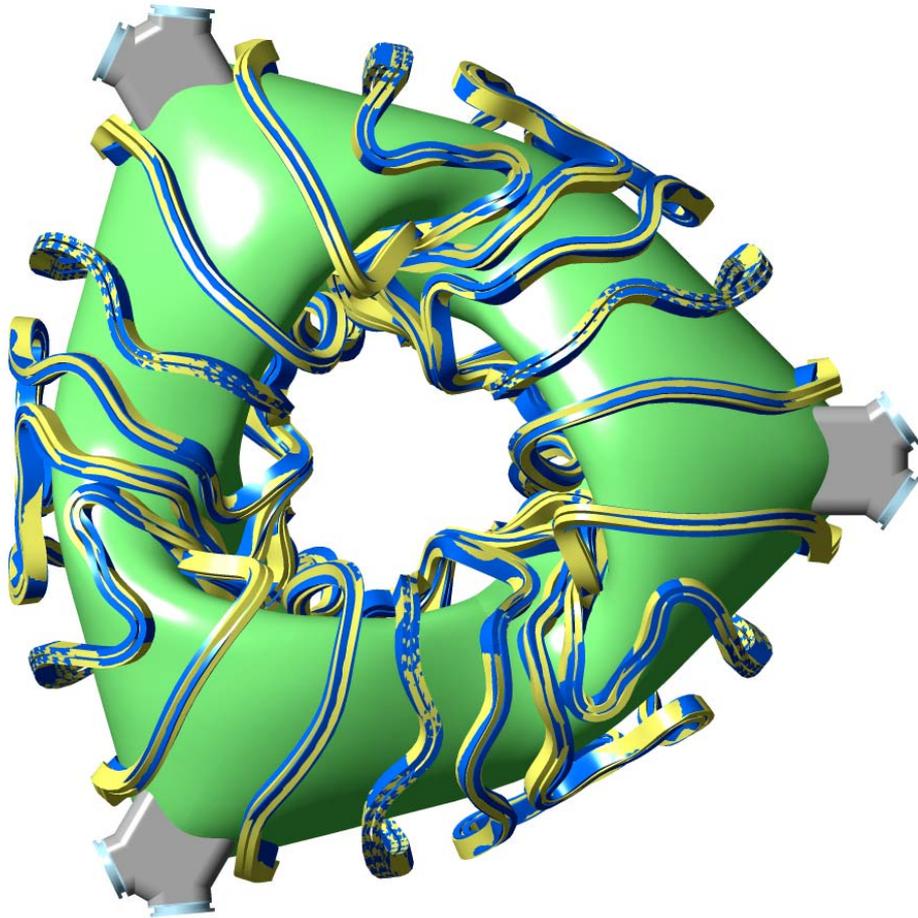


# Case 0918a17 Bend Radius -

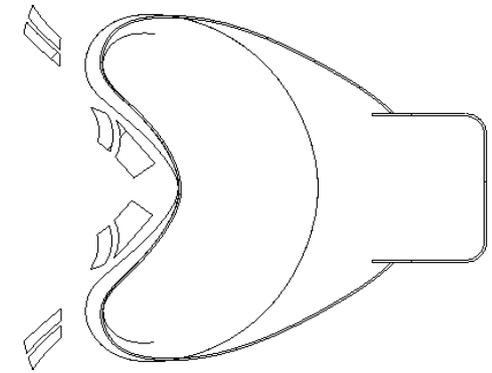
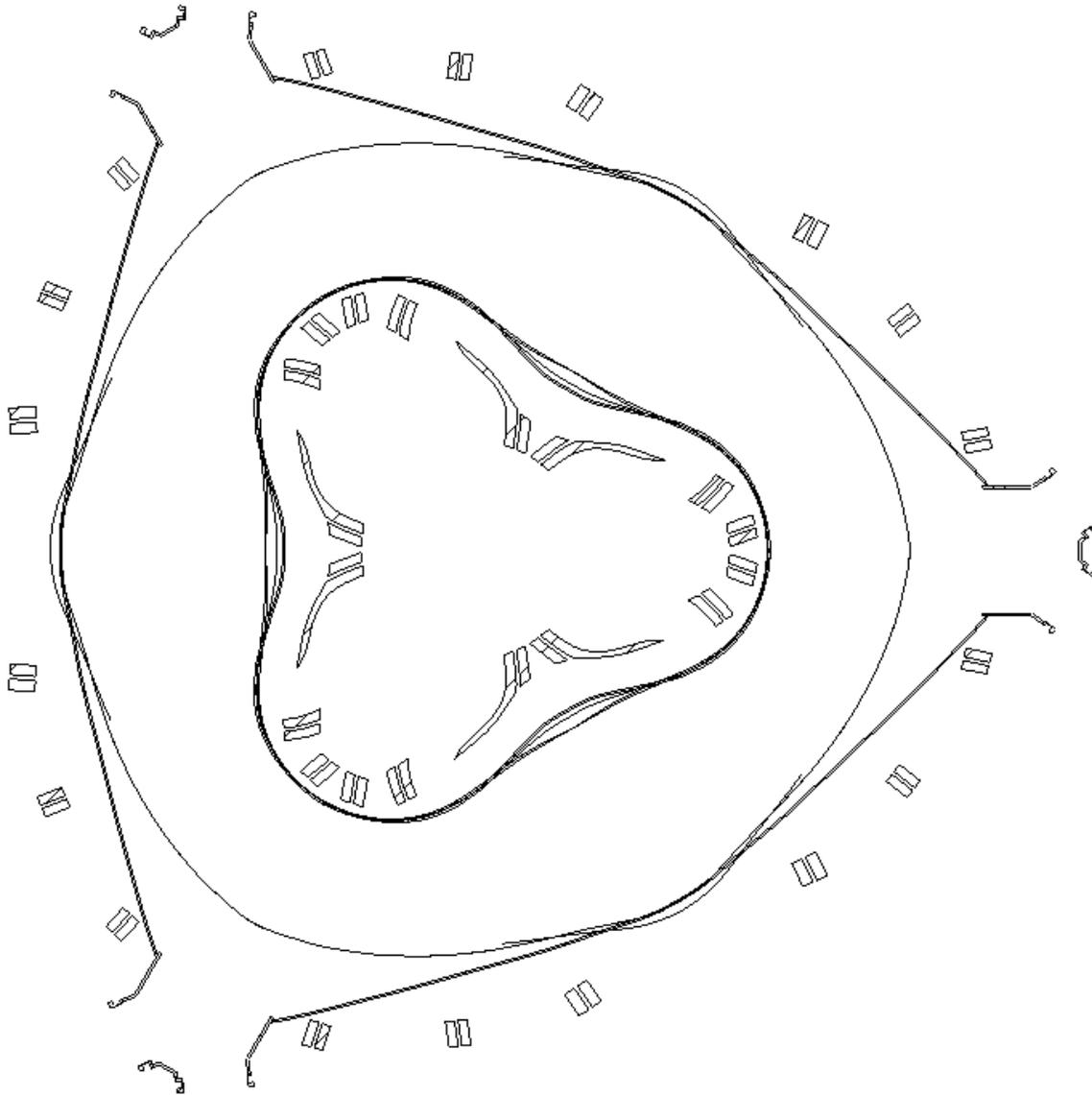
Radius of curvature target =  $5 \times 1.7\text{-cm} + 0.5 \times 9.6\text{-cm} = \sim 14\text{-cm}$



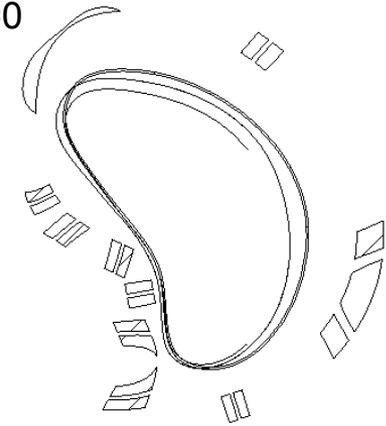
Case 0918a17 (blue) and 0918a17r2 (yellow) -



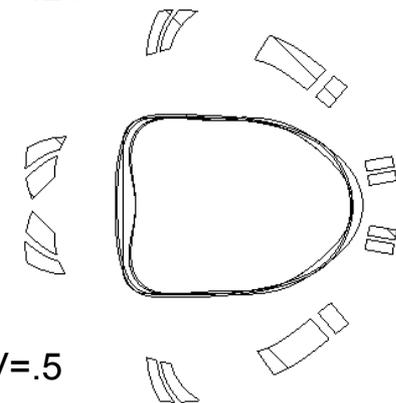
# Case 0918a17r2 -



V=0

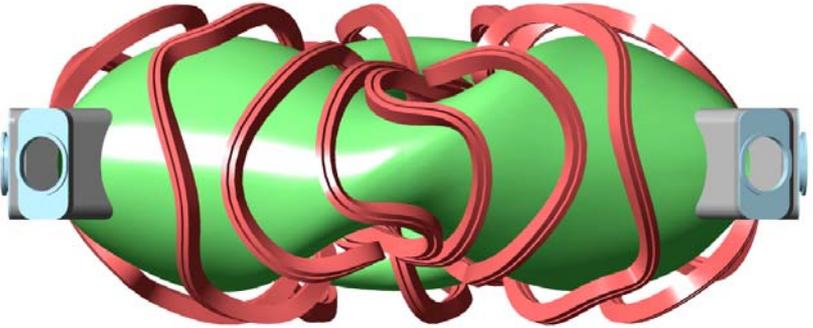
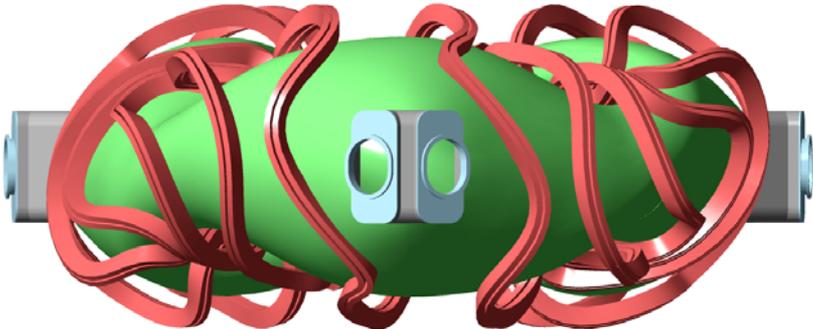
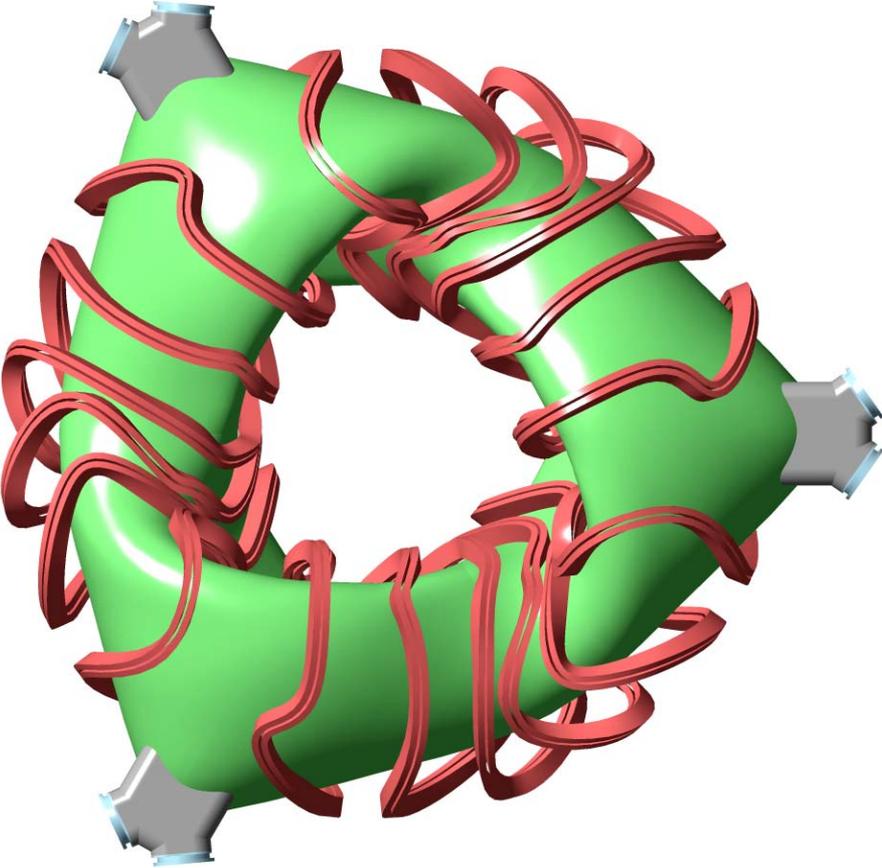


V=.25

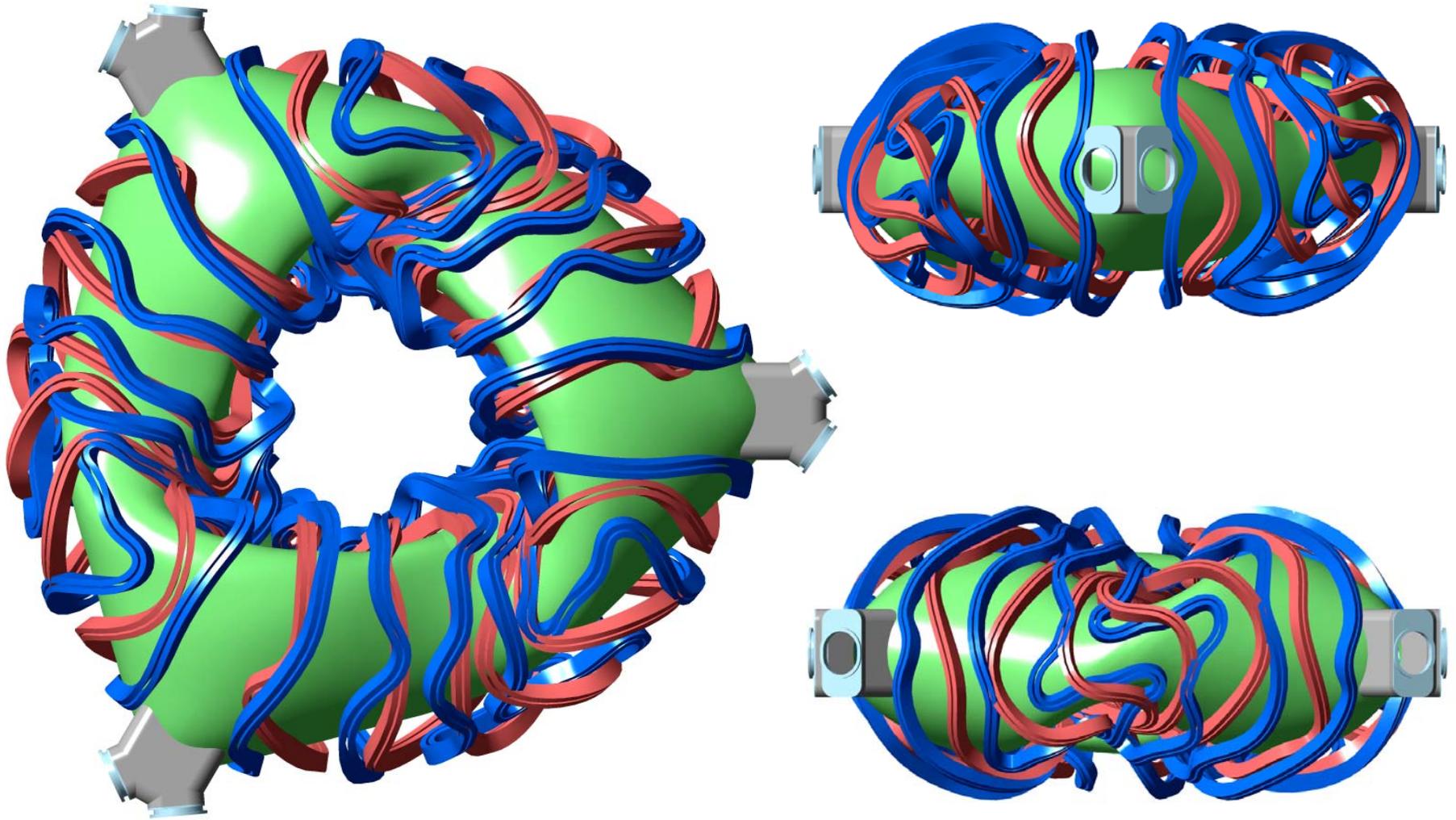


V=.5

Case 1011b3 -



Case 0918a17 (blue) and 1011b3 (red) -



## Summary / Plans -

- Case 0918a17 has been modified to improve feasibility, but field errors have increased to ~1% average, 8% max
- Case 1011b3 also has large field errors, but coil shapes are less complex
- Tasks through 10/31:

Investigate changes to 0918a17r2 to get max error <5%

Develop structural shell geometry for manufacturing studies

Layout additional CoilOpt spline-based cases