

# Modular Coil Analysis Tasks

Task ID	Objective	Basis	Results / Status	Needs Update?	Who / When
Modular Coils					
171a	Gen coil geom and elec param	m45-1231k10j	posted on web	complete	W Reiersen
171bc	Calc EM loads for worst case cond	m41-1213k9 coils, plasma offset twist	results summarized for 6 cases, indiv elem and groups	calculate running load this analysis perform magfor analysis as check	DW 3/22
174a	Est cooling system param	most recent s17e172-001 geom			F Dahlgren
171g	Est windings temp rise and cooldown	32 turns, various cooling options	~ 40-deg rise, steady state in ~16 cycles	repeat for 36 turns and present cooling configuration	HM Fan F Dahlgren
171h	Calc thermal stress in windings	case 1102, coil m1 windings + tee	B Nelson- 40-deg temp rise yields ~17-ksi in windings with local gaps forming	repeat for k10j case, coil #2 or #3	DW 3/29
172a	Calc stress in windings and structure due to gravity, EM loads	1102 shell, plasma offset twist	problems with mesh of integrated shell + tee	modify shell geom with toroidal, poloidal cuts for better mesh	DW 3/15 HMF 4/5
173ab	Est voltage drop, temp rise, cooling req for leads	most recent s17e172-001 geom			F Dahlgren
171f	Est field errors due to crossovers and leads	straight section model, 32 turns?			A. Georg.

# EM Analysis

- Element groups and running load summary is best for understanding results
- ANSYS model has some skewed elements, affects local cs for output

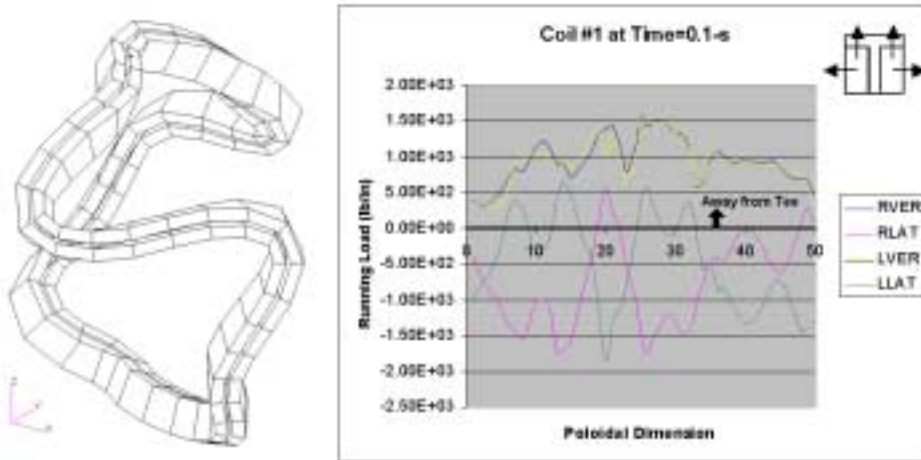
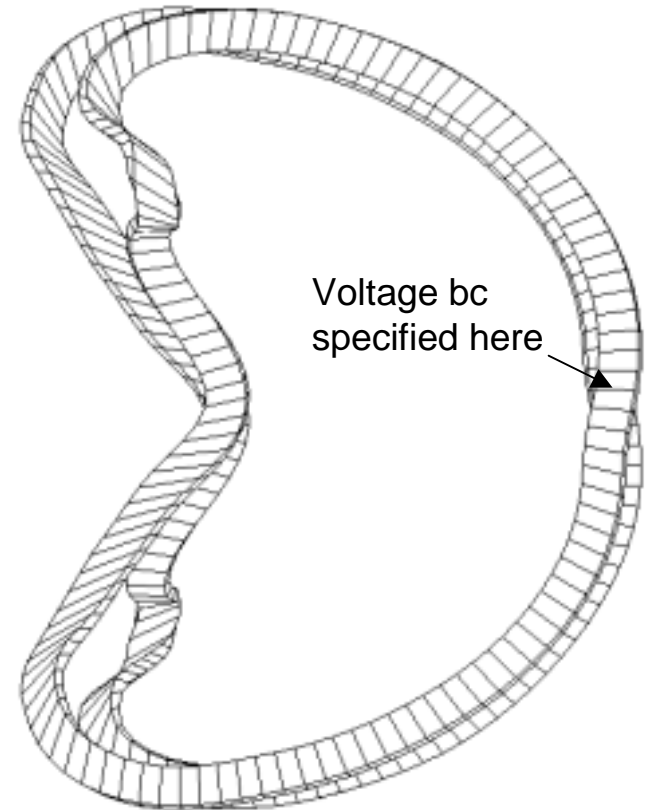


Figure 4 - Radial and Lateral Force Components on Coil M1 (Bilin)

PVR coil running loads

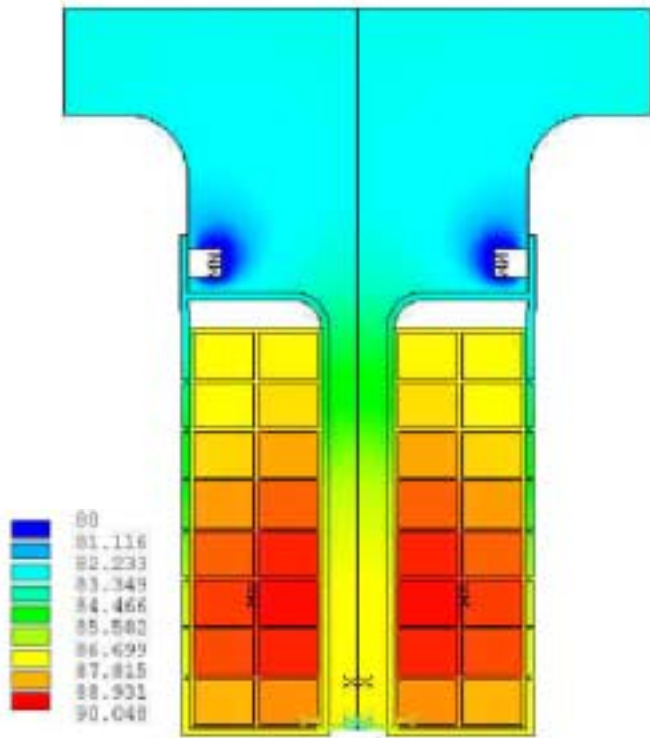


Coil M1 from ANSYS model

# 2D Thermal Analysis

- Needs to be updated for present configuration

Plate on two sides



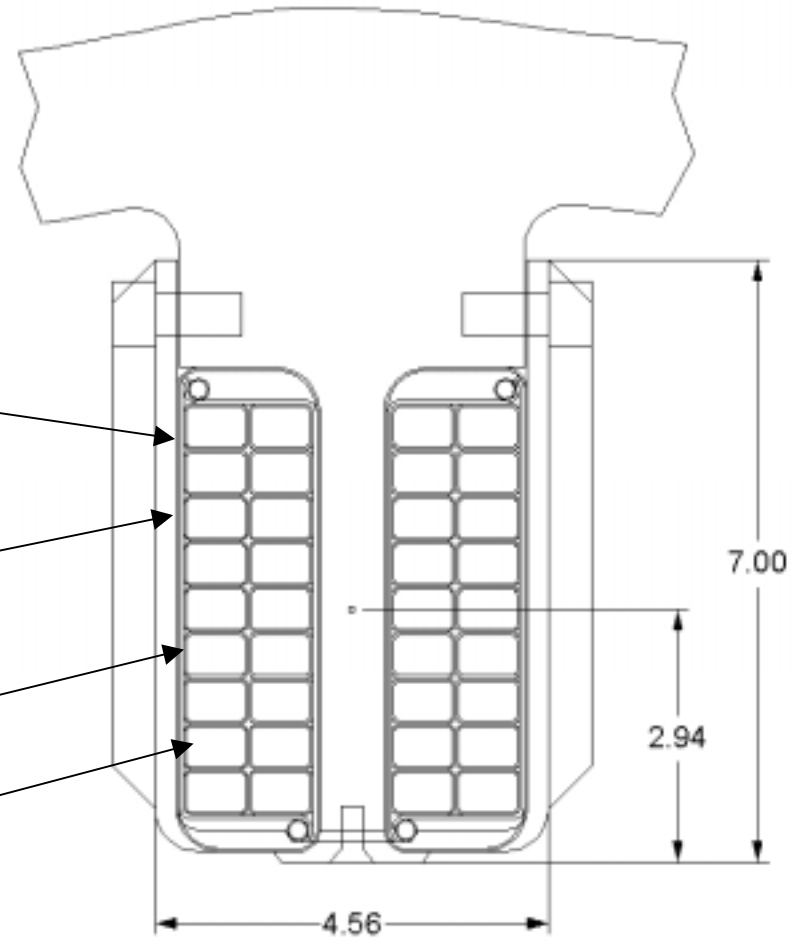
HM Fan

Ground Insulation  
0.030-in

Cooling Plate  
0.047-in / 0.25-in dia

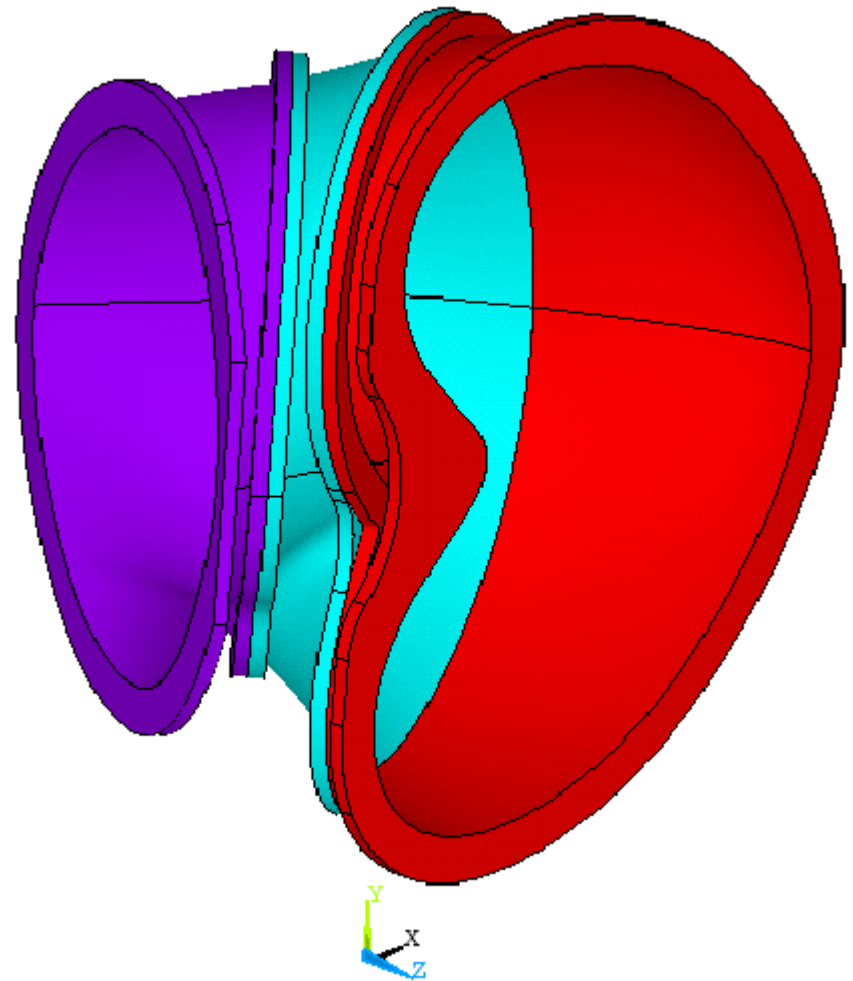
Turn Insulation  
0.030-in

Conductor  
0.688 x 0.469-in

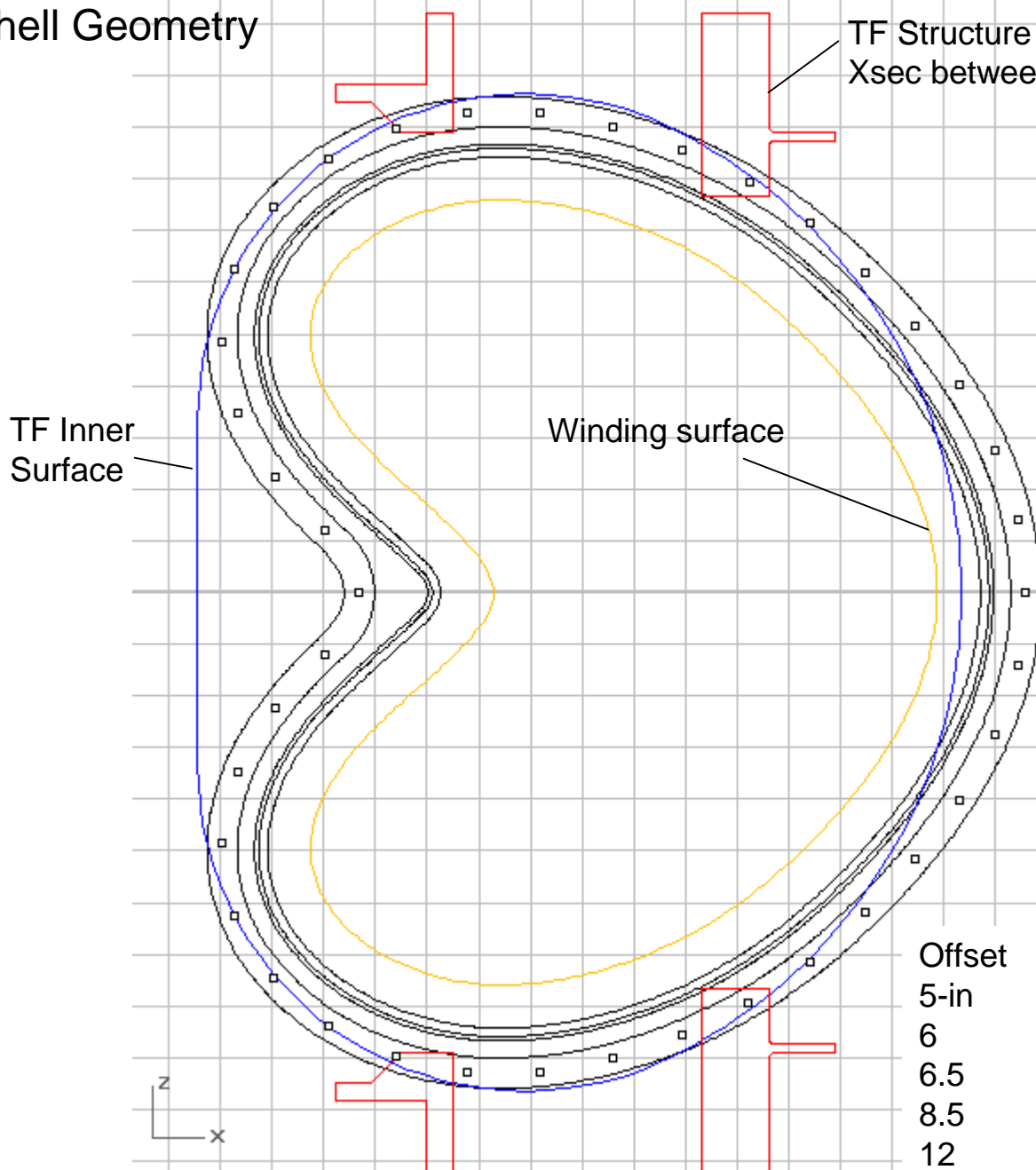


# Shell Structural Analysis

- ANSYS is challenged by small, poor aspect ratio surfaces
- Simplification or subdivision of shell geom is needed



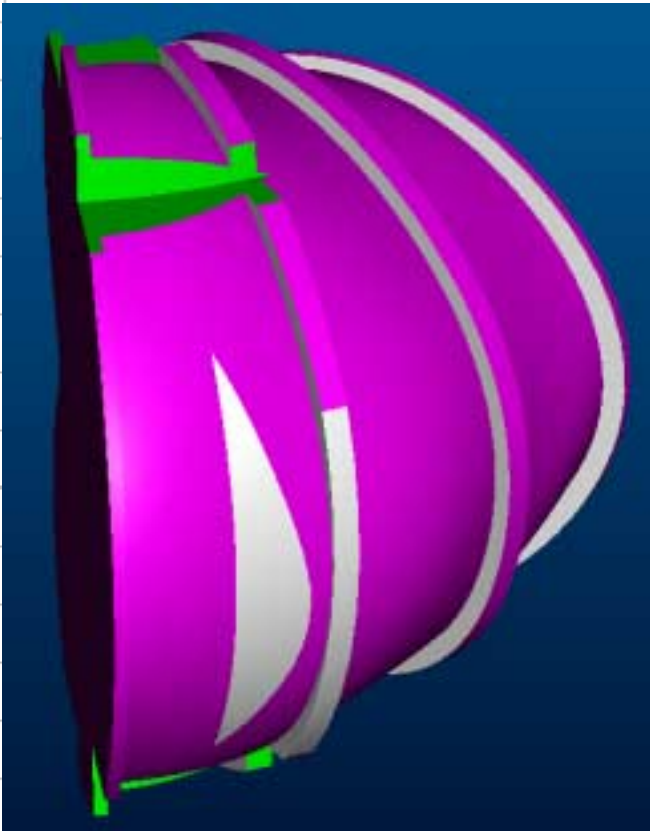
# Shell Geometry



TF Structure  
Xsec between coils

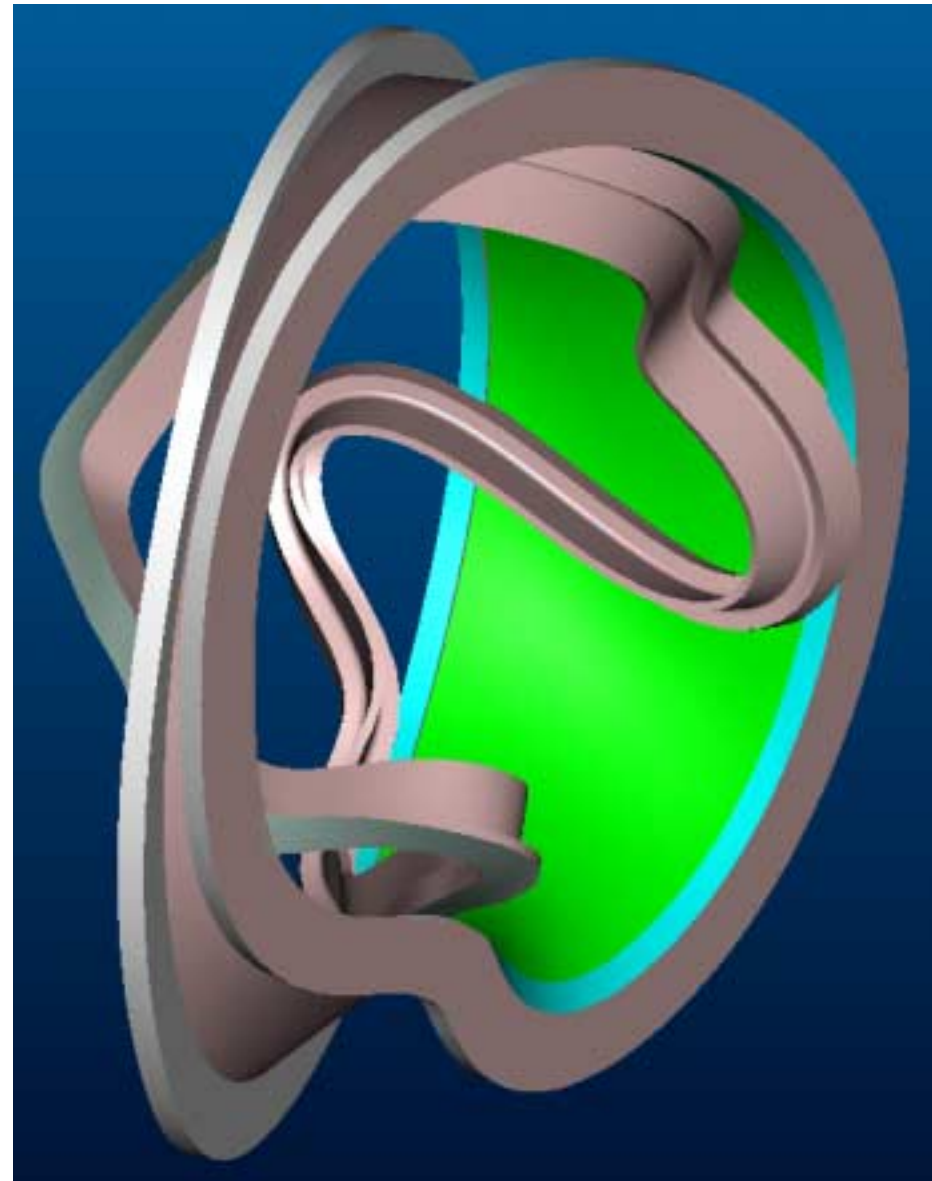
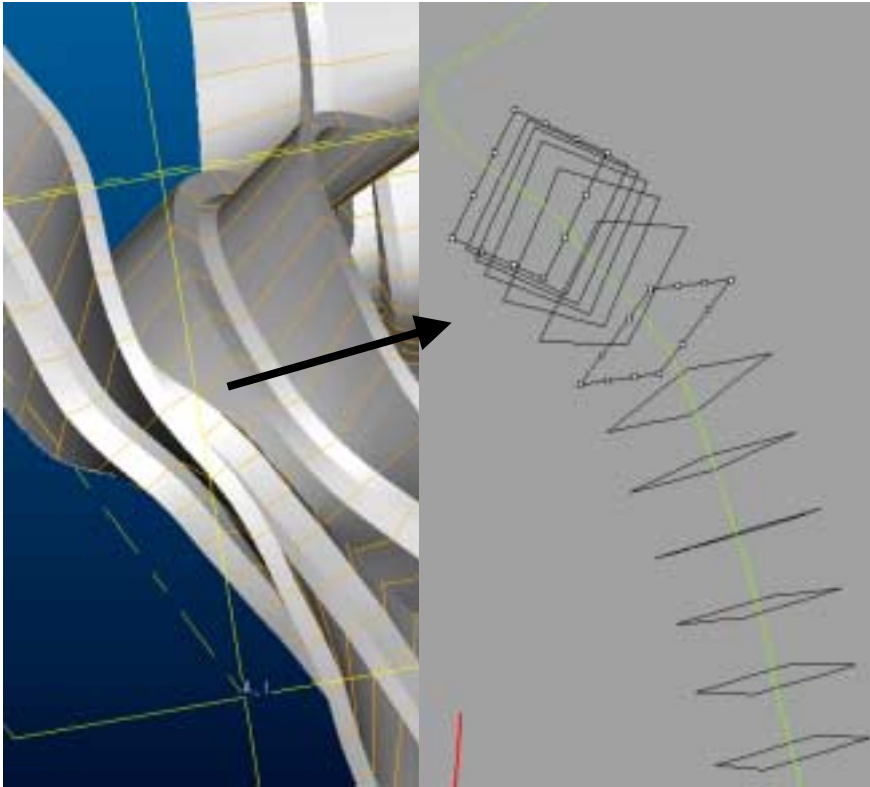
TF Inner  
Surface

Winding surface



Offset	Description	Fillet R
5-in	wing inner surf	4-in
6	wing outer surf	3
6.5	main shell inner	2.5
8.5	main shell outer	9.5
12	flange outer	6

# Coil Twist



# Stellarator Core Analysis

Task ID	Objective	Basis	Results / Status	Needs Update?	Who / When
Plasma Facing Components					
	Est temp rise in FW panels				
	Est temp rise in NB armour				
	Est heat leak between FW panels and vessel during bakeout				
	Est panel stress due to disruption loads				
	Est hydraulic parameters of cooling/bakeout lines				
	Est vacuum pumping in divertor plenum				
Vacuum Vessel					
	Est time constant of vessel				
	Est disruption loads on vessel				
	Calc stress due to gravity, vacuum, disruption, seismic loads				
	Calc stress in port region using local fea model				
	Calc stress in vessel supports				
	Est hydraulic parameters of vessel cooling / baking lines				
	Est temp distr in vessel and ports				
	Est heat leak between vessel and coils				

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PF and TF Coils					
	Gen coil geom and elec param	m45-1231k10j	posted on web	complete	
	Calc EM loads for worst case cond				
	Est hydraulic parameters				
	Est windings temp rise and cooldown				
	Calc thermal stress in windings				
	Calc stress in windings and structure due to gravity, EM loads				
	Est voltage drop, temp rise, cooling req for leads				
	Est field errors due to crossovers and leads				
Cryostat					
	Est heat leak between coils and cryostat				
	Est thermo-hydraulic param				
	Est stress due to gravity, pressure				