Plan

- Documented parameters for Case J (8/25 strawman) for inclusion in "Design Book"
- Clear up issues and provide write-up on TF design in December

Issues

Thermal siphon

- 10cm provided in CP
- Need to show that it will work and that enough space is provided (Sze?)

Design stresses in CP

- Low relative to ductile allowables but material is not ductile with T_{in}~30C (53MPa max VM versus 330MPa TYS)
- Insufficient data for material in embrittled, irradiated condition to make assessment of stresses relative to allowables (Billone concurs? OK to bet on success?)

Aluminum for outer shell

- Low stresses
- Good resistivity required for low losses (3.7 micro-ohm cm)
- Boeing to recommend alloy based on fabricability?

Bus connections

- PPPL layout featured 20 connections covering about 80% of the perimeter at the midplane
- UCSD layout reduced the number of bus connections to 8 covering about 28% of the perimeter of the midplane
- Concerns are non-uniform J (higher losses) in outer shell and ripple
- J is .07kA/cm^2 in aluminum shell, 0.12kA/cm^2 at bus connection
- Resulting ripple is TBD

TF System Parameters	Units	Value	Comments
CENTERPOST PARAMETERS			
Major radius	m	3.2	
Toroidal field at major radius	T	2.14	
Centerpost radius at midplane	m	0.899	
Toroidal field at centerpost	T	7.63	
TF current	MA	34.3	Single turn conductor
Centerpost radius at flared section	m	1.60	
Centerpost height between flared sections	m	13.6	
Centerpost height overall	m	28.2	
Cooling holes		400	
Mean cooling hole diameter	m	.027	
Mean spacing between cooling holes	m	.089	
Total cooling hole area	m^2	0.237	
Diameter of thermal siphon	m	0.2	Closed volume provided for removal of afterheat
Area of thermal siphon	m^2	0.031	
Conductor area at midplane	m^2	2.27	
Centerpost area at midplane	m^2	2.539	
Packing fractions			
Packing fractions			
- Coolant	%	9.3	
- Conductor	%	89.4	
- Thermal	%	1.2	
Mean conductor current density at midplane	kA/cm^2	1.51	
Centerpost conductor material		AL15	DS copper alloy AL15 is the nominal conductor choice. However, there are other high conductivity (greater than 85% IACS) alloys such as CuCrZr which are also candidates.
Conductor resistivity at 20ºC	μΩ-cm	1.89	89% IACS
Coolant		Water	
Inlet temperature	ºC	30	
Outlet temperature	ºC	72	
Mean coolant temperature	ºC	51	
Flow velocity	m/s	10	
Mass flow in centerpost	kg/s	2338	
Heat removed from centerpost			
- Joule	MW	248	
- Nuclear	MW	164	
- Total	MW	412	
Inlet pressure	MPa	1.30	
Outlet pressure	MPa	0.15	
Centerpost stress intensity			Not corrected for packing fraction
- Maximum axial	MPa	17	
- Maximum VonMises	MPa	53	
OUTER SHELL PARAMETERS			
Shell material		5000 series Aluminum	
Conductor resistivity at 20ºC	μΩ-cm	3.7	
Coolant fraction	%	15	Governed by shielding requirements
Shell thickness at midplane	m	0.7	

Current density	kA/cm^2	0.07	
Heat removed from outer shell			21MW of nuclear heating deposited in collar
- Joule	MW	31	
- Nuclear	MW	39	
- Total	MW	70	
SLIDING JOINT PARAMETERS			
Radius of joint	m	1.6	
Toroidal field at joint	T	4.3	
Height of joint	m	3.6	
Average current density	kA/cm^2	.095	Normal to plane of joint
Peak current density	kA/cm^2	.40	Normal to plane of joint
Number of joints		200	
Feltmetal pads per joint		2	
Width of Feltmetal pads	m	.015	
Peak current density in Feltmetal	kA/cm^2	0.7	
Peak current density in conductor	kA/cm^2	0.8	
BUS PARAMETERS			
Bus connections		8	
Distance from outer shell to power supplies	m	15	
Bus cross sectional area	m	3.46	
Bus material		C102	High conductivity copper (100% IACS) assumed to minimize cross-sectional area
Bus resistivity at 20ºC	μΩ-cm	1.7	
Joule dissipation in bus	MW	22	
ELECTRICAL PARAMETERS			
TF stored energy	GJ	6.2	
Voltage drop across TF	V	8.7	
Voltage drop across power supply	V	1	High current diode rectifiers assumed
Recirculating power			
- Centerpost	MW	248	
- Outer shell	MW	31	
- Bus	MW	22	
- Power supplies	MW	34	
- Total	MW	335	