Status Report on Outer Support Frame

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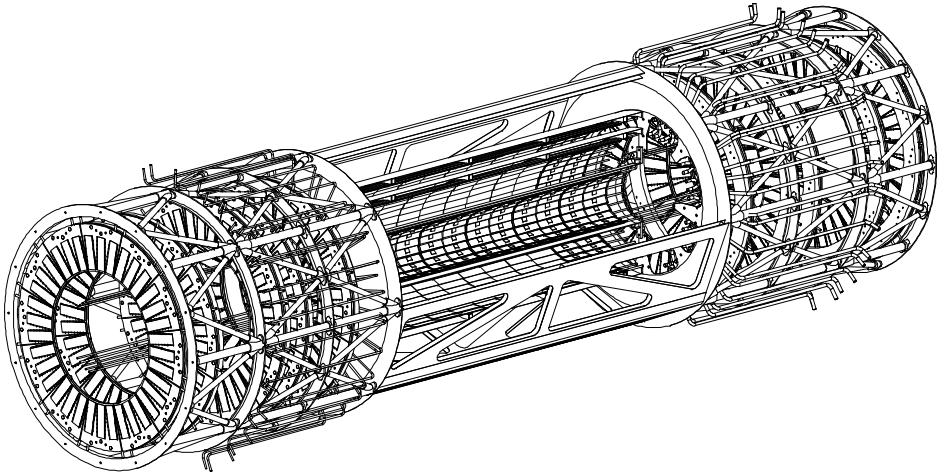
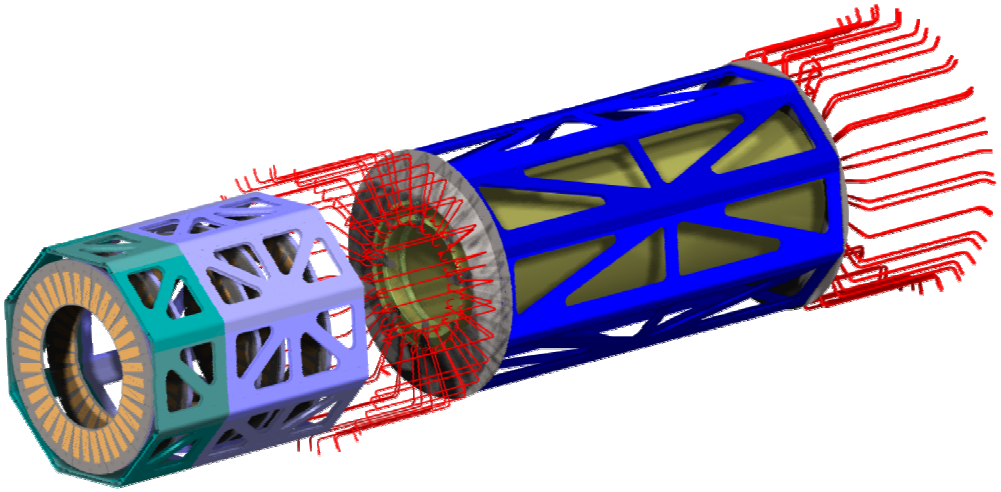
Outer Support Frame

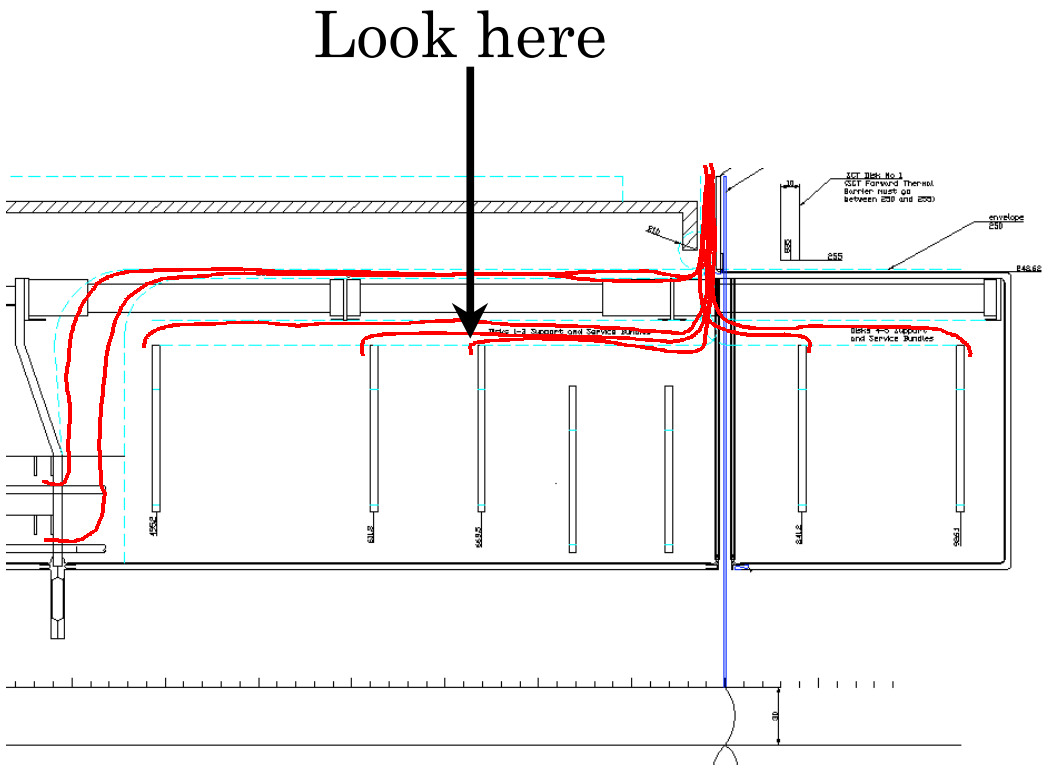
- Design presented in TDR was flat panel in barrel region and spaceframe(for maximum access) in disk region.
- Alternative is flat panel construction throughout.
- Preliminary cost comparison made(for disk region) indicates that spaceframe is significantly more expensive => flat panel preferred.
- However, some issues
  - Radial clearance in disk region
  - Tradeoff between material and stiffness





Disk Region Radial Clearance

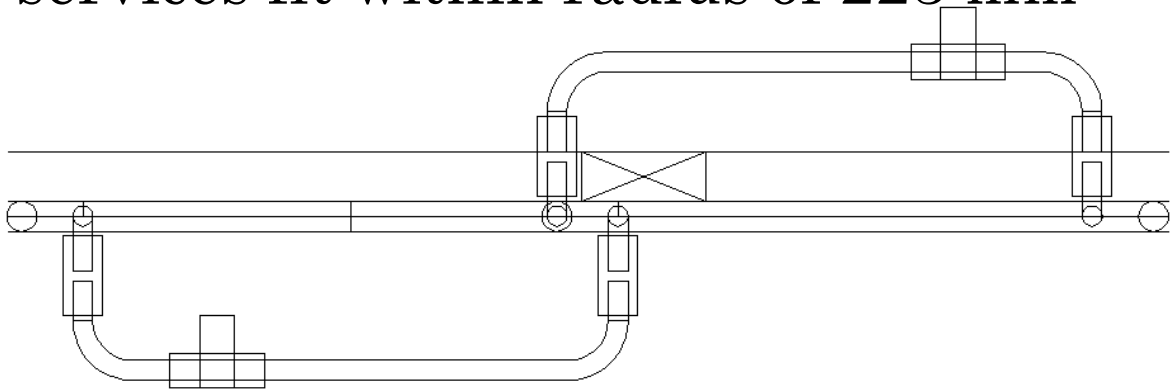
- Reminder..
  - Disk services inside frame
  - Barrel services outside frame
- Tight spot at disk 3
- Compare spaceframe, flat panel options

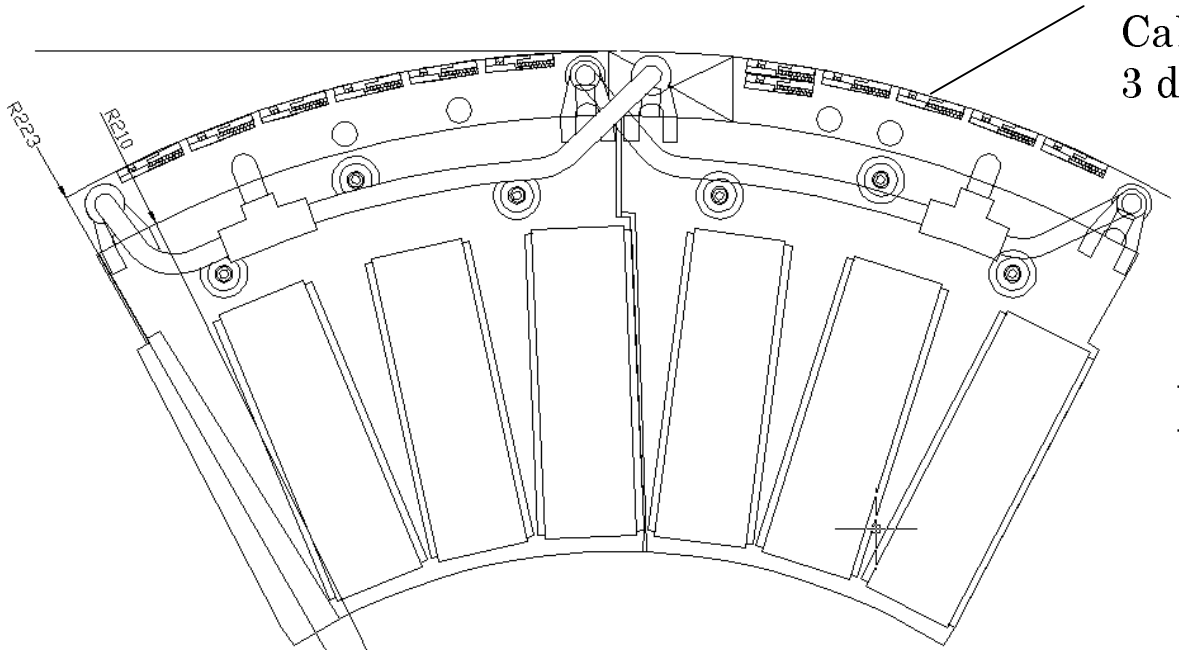


Disk Sector Services(At Disk 3)

By design, services fit within radius of 223 mm

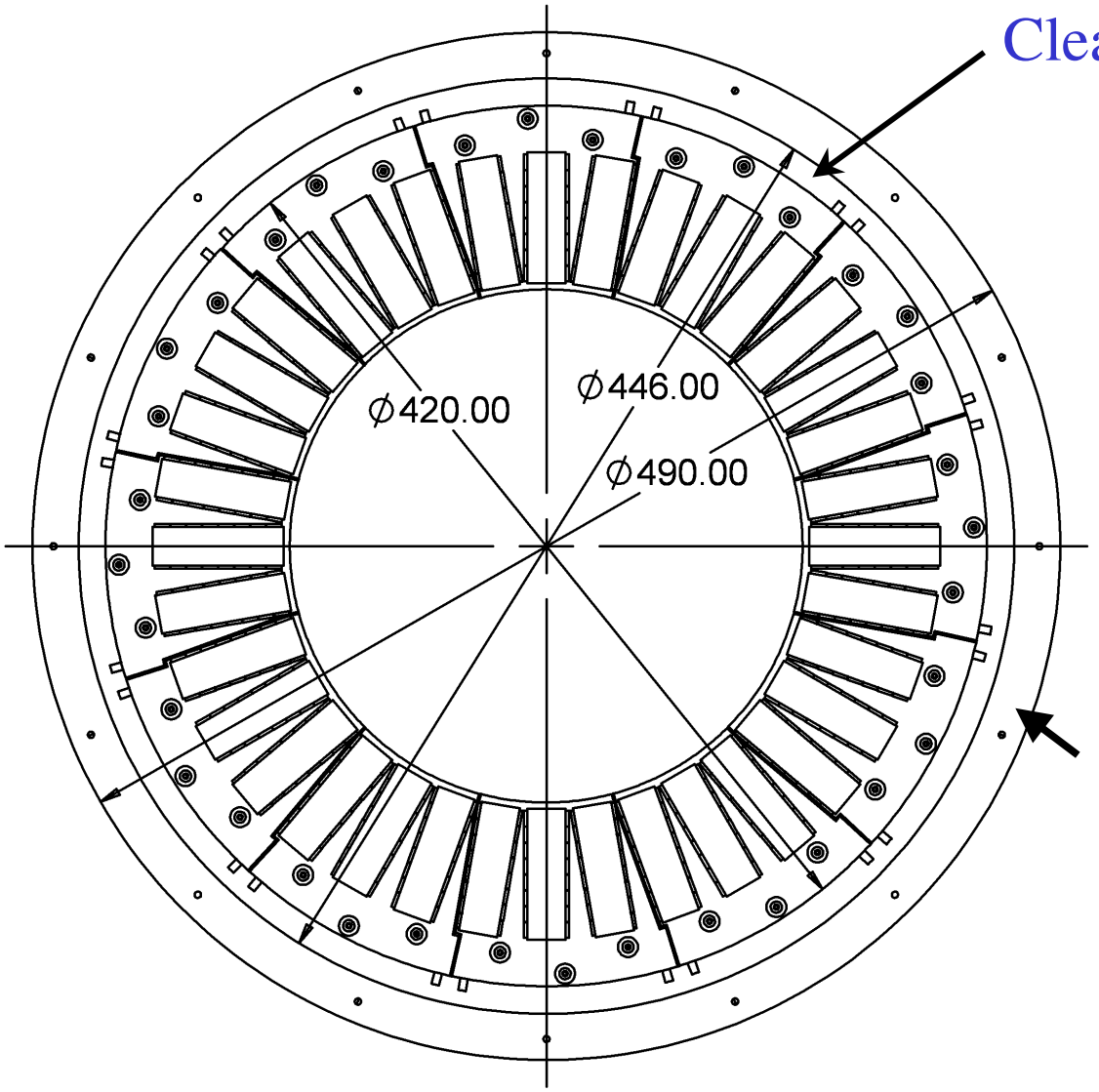
Top View





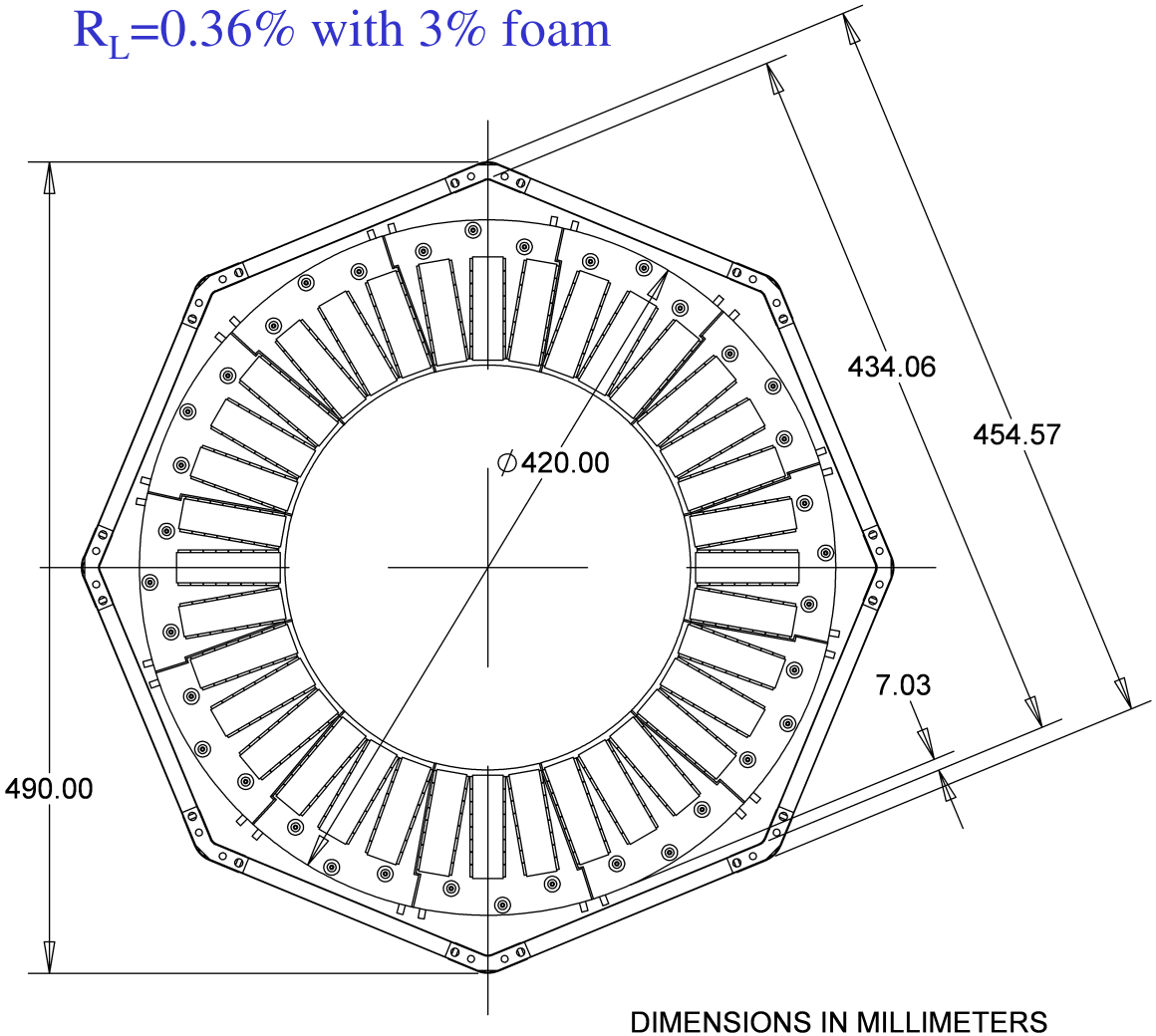
End View

TDR Spaceframe



Flat Panel(8 Sides)

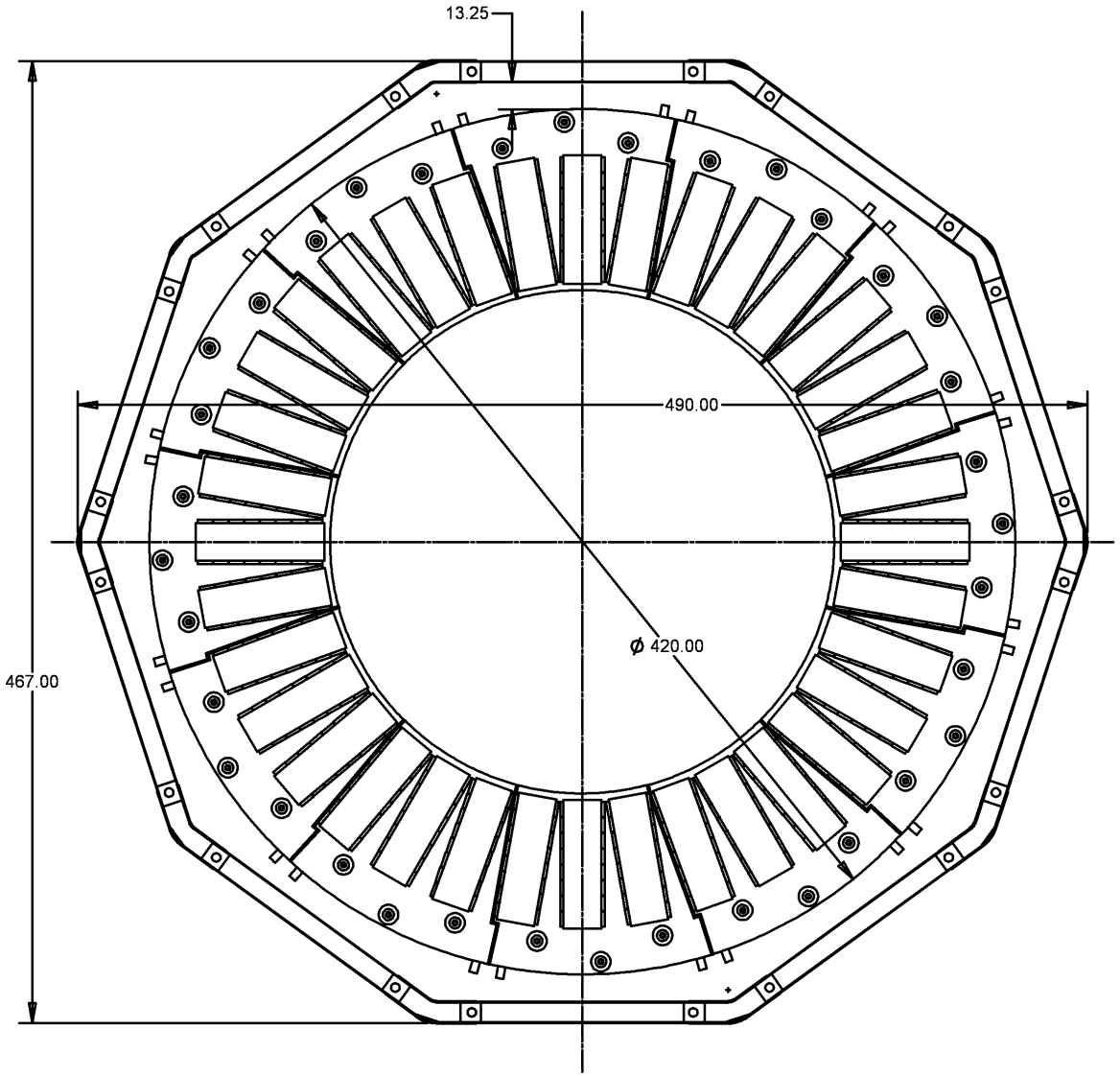
R_L=0.36% with 3% foam



Clearance is only 7mm if outer radius of 245 mm is kept. Not enough.

Clearance increases to 12mm if outer radius can be 250mm and barrel services routed in flat regions. Probably OK but would need more study of barrel service routing.

Flat Panel(10 Sides)



Clearance is 13.25 mm for outer radius of 245 mm. Essentially same as spaceframe.

Openness ~64%

Radiation length- 3% foam

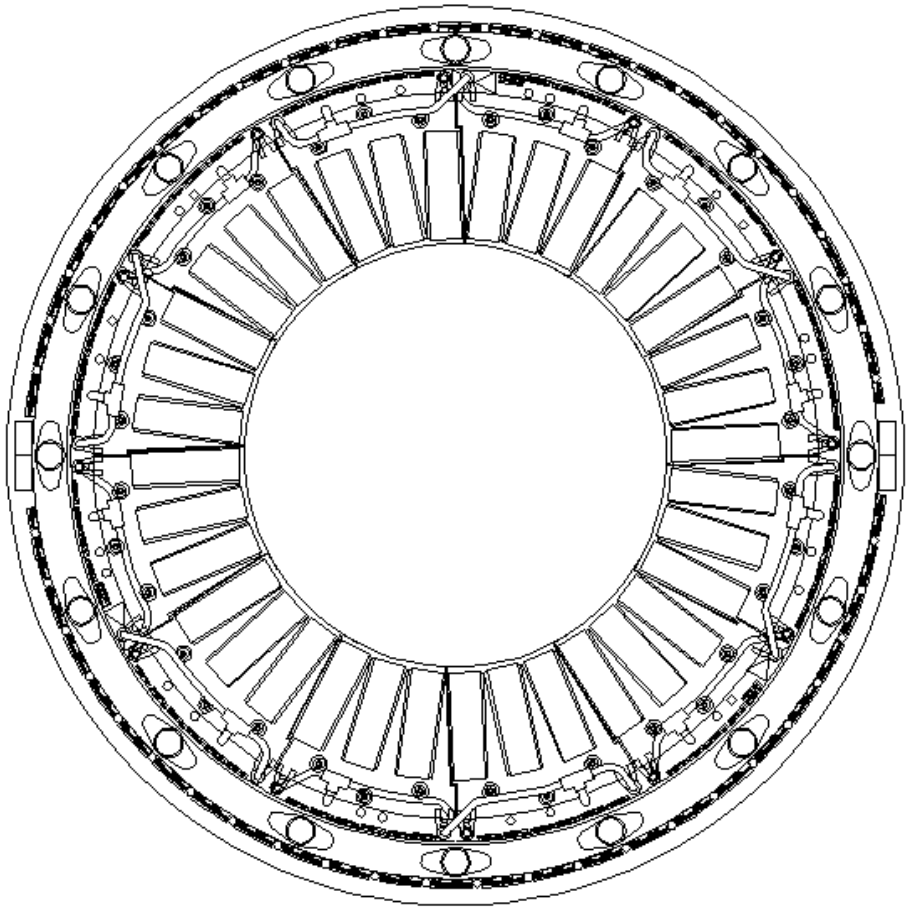
disk region 0.38%

central region 0.36%

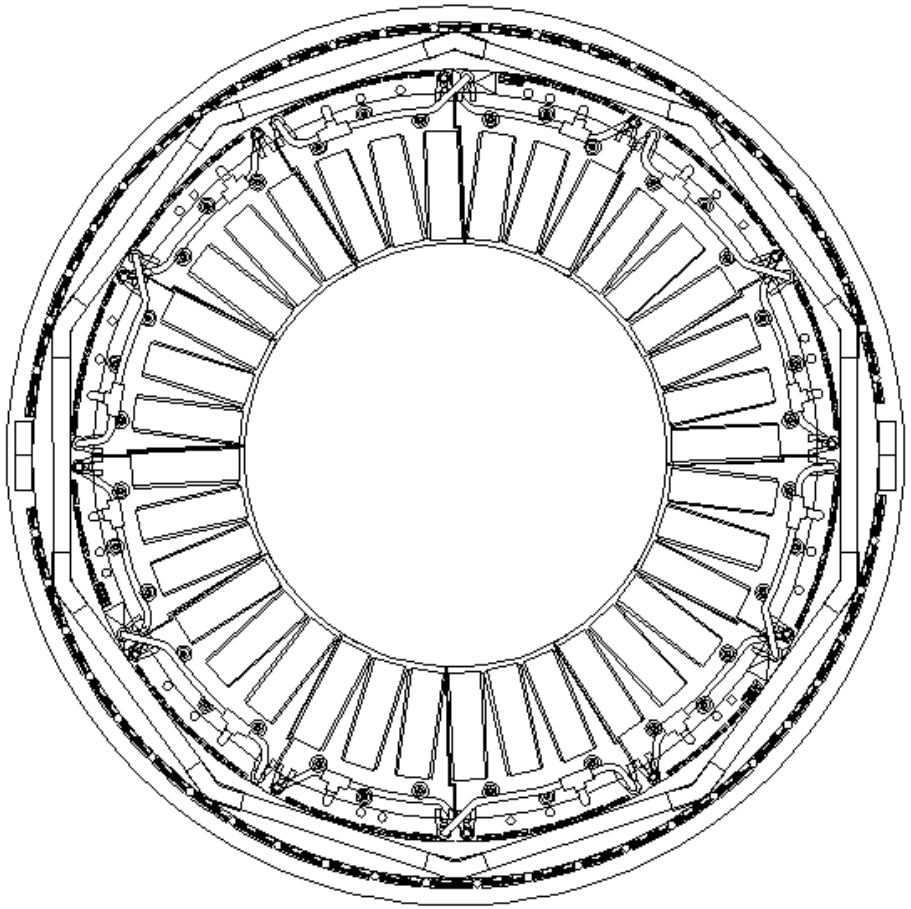
M. Gilchriese - November 12, 1998

Barrel Services - Spaceframe vs 10 Sided Flat Panel

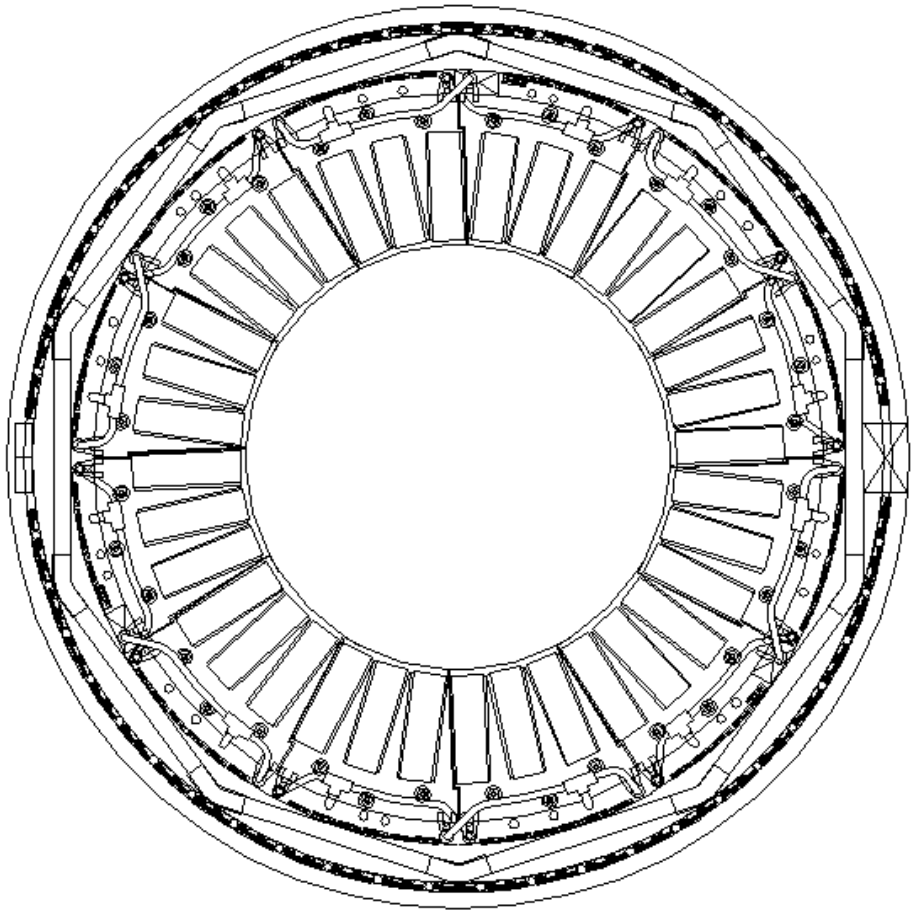
Spaceframe

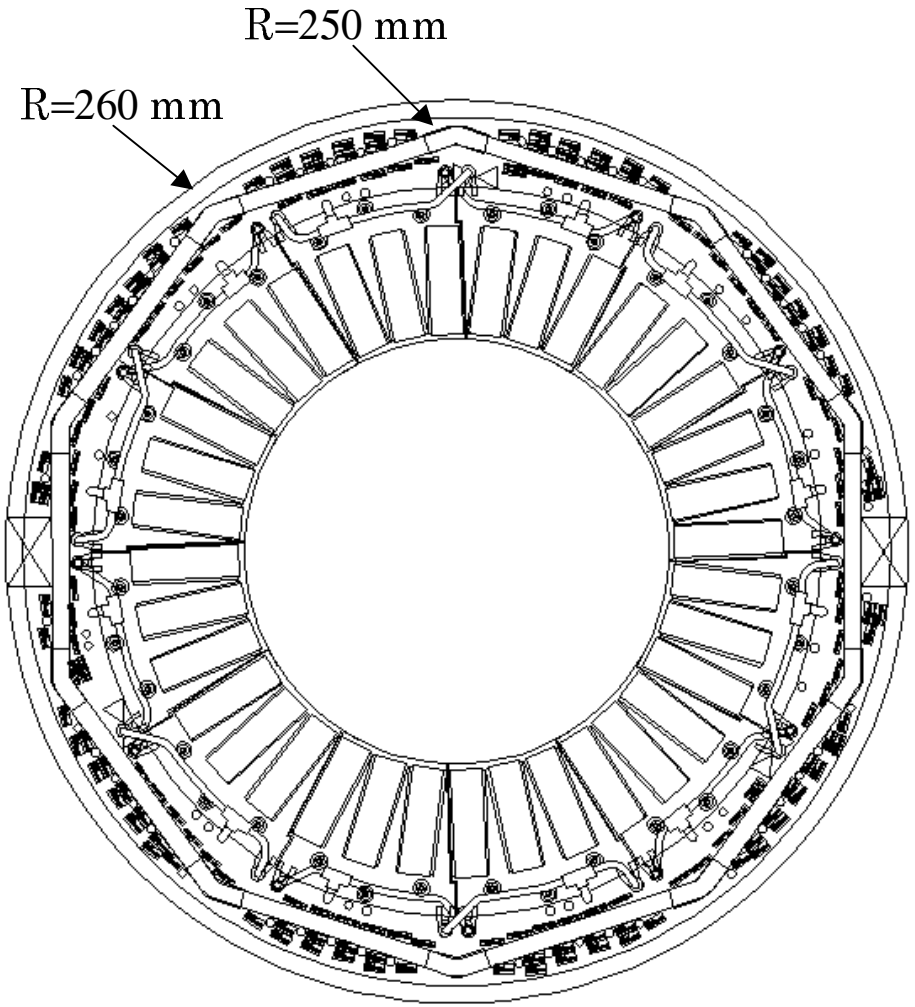


Flat Panel - no rearrangement



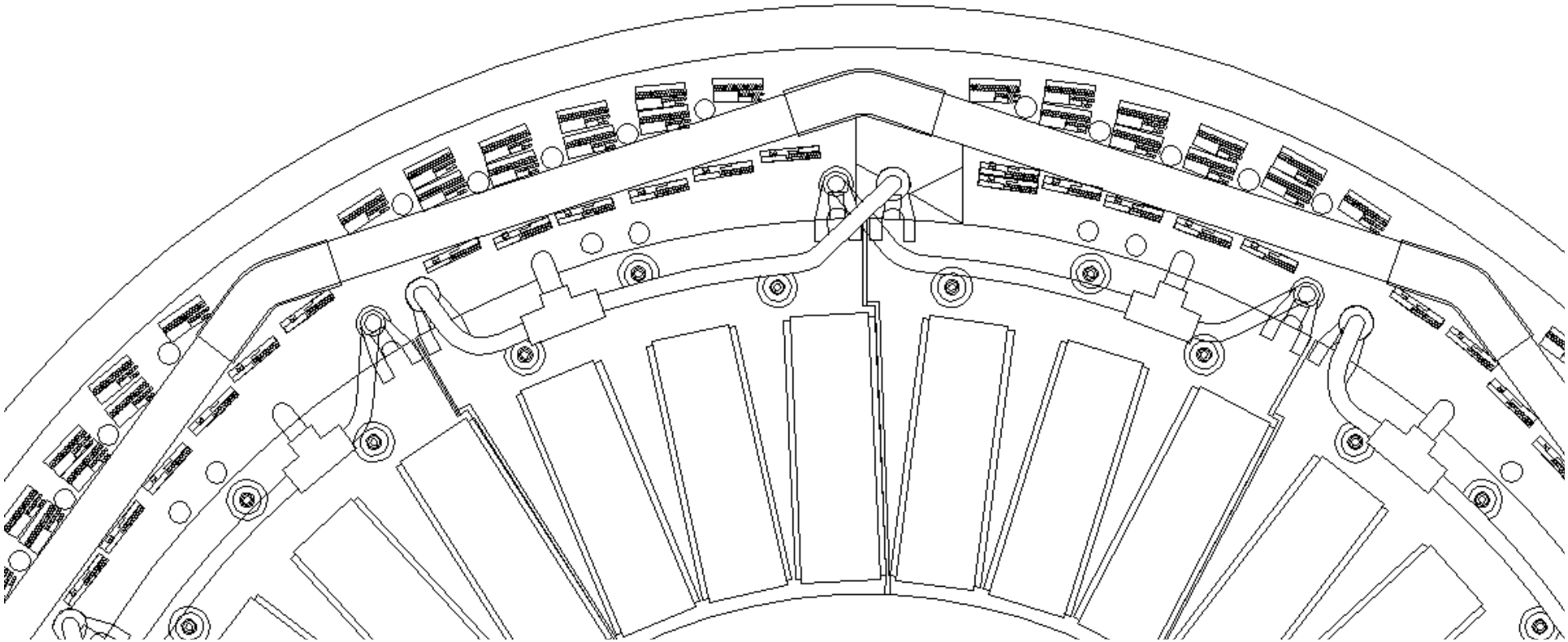
Flat Panel(10 sides) - Barrel Services Packed





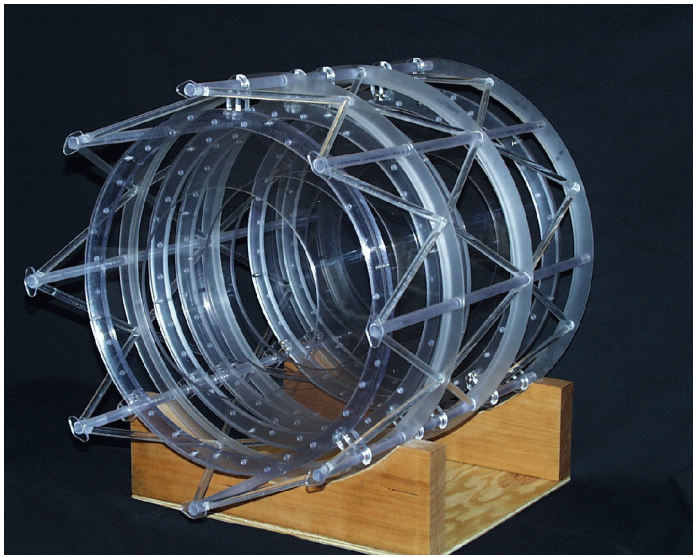
Flat Panel(10 sided) - Closeup

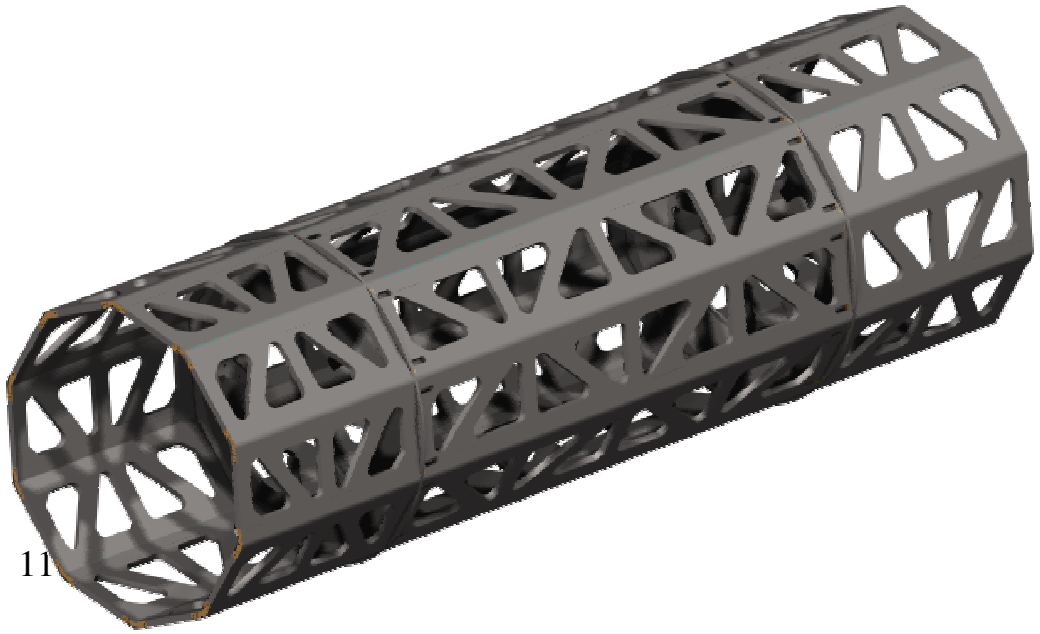
- Barrel service routing is preliminary - need more work
- But looks OK with flat panel, in fact better for cooling tubes



Conclusion

- Clearance of flat panel(10 sides) is same as spaceframe.
- Currently believe access with flat panel is OK but this remains to be shown by studies with full scale model. In any case, considerable tooling will be needed to insert disks with services into any frame.
- Proposal:accept flat panel concept and move on to more detailed design and prototypes.





Although model is spaceframe, since clearance is about same => still useful. Need to add support cone model and later barrel services.

Selection of Core Material

- Skins are assumed to be 0.3mm of XN50 or M55J fiber with Cyanate-Ester Resin. X0 assumed=250mm => 0.12% per skin or 0.24% total.
- Glue joint to core assumed to be 100 microns with X0=250mm or 0.08%
- Options for core
  - Graphite-fiber honeycomb(1/4 inch vented honeycomb)
  - Carbon foam of density 3 - 6%
- Simple comparison(10 mm thick)

	X0(mm)	Minimum Order Cost($)	Availability	Shear Moduli(N/mm^2) L-dir	W-dir
Graphite/fiber	0.15%	15-30K	4 months	669	214
Foam(3%)	0.11%	few $100s	1 month	15	15
Foam(6%)	0.21%	few $100s	1 month	60	60

- Joints are not designed but rough guess is that they add 0.02%
- % openness not fixed but 1st cut is 64%; total material would be about 0.38-0.44%(TDR value was 0.36%) for 3-6% foam *for 10 sided disk frame*.
- Clearly, the primary issue is relative shear strength of two and impact on stiffness; construction approach slightly different for each.

Proposed Prototype Program

- Accept flat panel
- Provisionally accept foam but do detailed comparison calculation with graphite-fiber by end of January 1999.
- Fabricate small specimens for tests of properties(including after cutting)
  - Order foam(lead time for 10 mm not known yet)
  - Order skins(lead time for thin with cyanate ester could be >2 months)
  - Realistic timescale for these prototypes under study but not less than 3 months
- After specimen tests, build small panels with joints and test joints
  - joints need to be evaluated using FEA comparison to measurements
- Scope of partial prototype to be decided at February ATLAS week
  - Two panels joined is minimum
  - Half of barrel region or complete disk region would be desirable but
  - Need estimate of cost before deciding => get bids before February ATLAS week.