

# Mechanical Design

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# Discussion topics

- Garnets
  - Size
  - Cooling
  - Glue the sectors
  - How to stack?
    - Glue
    - Grease
    - Compression
- Windows
  - Shape of window in the accelerating cavity
  - Shape of window in the power coupler

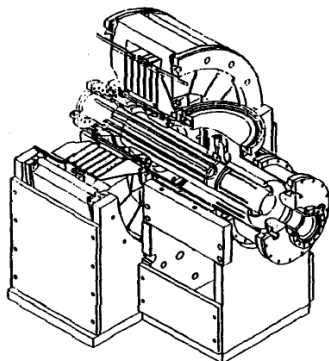
# What we need to cover (cont'd)

- Assembly (weld?)
  - 3 parts
    - Garnet section
    - Neck section
    - Power coupler section
  - Needs to be done, but not yet ...
    - HOM section
    - Solenoid section

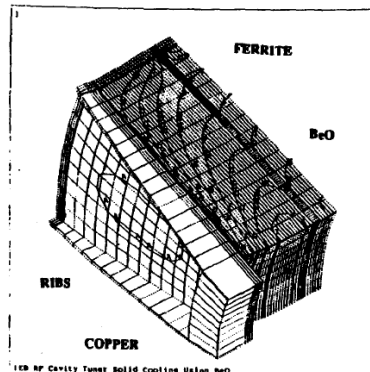
# SSC LEB uses epoxy

Table 1. Sensitivity Results.

Row	no. of AlN	no. of BeO	$t_b$	$k_b$	$T_a$	$T_b$	$T_f$	$T_e$	$S_a$	$S_b$	$S_f$
1	-	-	30	0.8	-	-	83	83	-	-	26
2	2	0	30	0.8	63	-	66	66	32	-	15
3	-	2	30	0.8	-	59	62	61	-	8	14
4	-	-	200	0.8	-	-	85	83	-	-	21
5	2	-	200	0.8	63	-	66	66	23	-	14
6	-	2	200	0.8	-	59	63	62	-	8	13
7	-	-	30	11.6	-	-	75	74	-	-	28
8	2	-	30	11.6	56	-	58	56	24	-	28
9	-	2	30	11.6	-	51	54	52	-	6	16
10	-	-	200	11.6	-	-	75	74	-	-	23
11	2	-	200	11.6	55	-	58	55	17	-	16
12	-	2	200	11.6	-	51	54	52	-	7	14
13	4	-	30	0.8	60	-	63	60	26	-	11
14	-	4	30	0.8	-	56	59	56	-	6	10
15	6	-	30	0.8	61	-	63	61	27	-	12
16	-	6	30	0.8	-	57	59	57	-	10	9



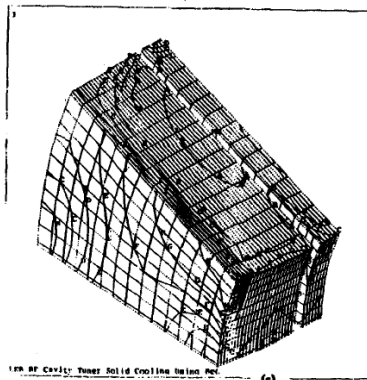
(a)



```

ANSYS 4.4A1
JUN 25 1992
13:59:51
PLAT NO. 1
POST1 STRSS8
STEP=1
ITSD=1
DMS =-39.394
SMX =-43.359
SV =-1
TV =1
DIET=-0.19116
SF =-0.218923
SF =-0.037395
SF =-0.023824
PRECISE BIDDING
A =-36.891
B =-39.805
C =-43.879
D =-48.875
E =-49.867
F =-51.866
G =-54.854
H =-55.848
I =-60.892
°C
    
```

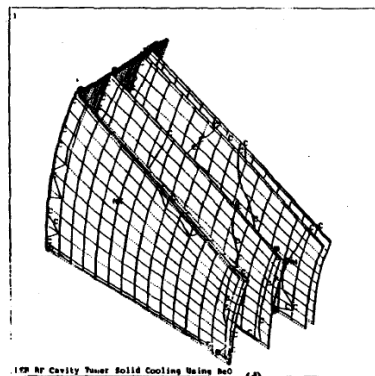
(b)



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ANSYS 4.4A1
JUN 25 1992
14:01:14
PLAT NO. 2
POST1 STRSS8
STEP=1
ITSD=1
SIZ1 (AVG)
S CLONAL:
DMS =-0.228E+04
SMX =-0.185E+07
SMIN =-0.204E+07
DMS =-0.143E+06
SMX =-0.155E+06
SV =-1
TV =1
DIET=-0.48997
SF =-0.259101
SF =-0.256458
SF =-0.441823
PRECISE BIDDING
A =-948324
B =-651218
C =-2612E+07
D =-4212E+07
E =-1200E+07
F =-1900E+07
G =-372E+07
H =-116E+06
I =-134E+06
Pa
    
```

(c)



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ANSYS 4.4A1
JUN 25 1992
14:25:37
PLAT NO. 3
POST1 STRSS8
STEP=1
ITSD=1
SIZ1 (AVG)
S CLONAL:
DMS =-0.233E+04
SMX =-177993
SMIN =-0.282E+07
DMS =-210064
SMX =-0.395E+07
SV =-1
TV =1
DIET=-0.100015
SF =-0.215601
SF =-0.056637
SF =-0.040025
PRECISE BIDDING
A =-64412
B =-4849E+07
C =-4849E+07
D =-4849E+07
E =-46057
F =-149614
G =-191316
H =-187206
I =-266245
Pa
    
```

(d)

## NOMENCLATURE AND UNITS

- $k_g$  thermal conductivity of epoxy, W/(mC)
- $S_a$  peak AlN stress (MPa)
- $S_b$  peak BeO stress (MPa)
- $S_f$  peak ferrite stress (MPa)
- $T_a$  peak AlN temperature (°C)
- $T_b$  peak BeO temperature (°C)
- $T_e$  peak epoxy temperature (°C)
- $T_f$  peak ferrite temperature (°C)
- $x_g$  thickness of the epoxy between the ferrites and BeO (or AlN), microns

Figure 1. Qualitative results for a BeO cooled tuner.

# Tuner Pros/cons

- Epoxy
  - One block, cannot fix bad garnets or alumina
  - Expansion?
  - Bubbles – caused SSC tuner to vapourize.
- Grease
  - Unknown decrease of Q
  - Unknown problems and performance in radiation area.
    - Mixed waste
- Braze cooling
  - Effect on garnet is unknown
  - Alumina is well known
- Compression stack
  - Like in Booster tuner
  - Bigger garnets (possible), but RF path?
    - Largest size is about OD 15.354 inches = 390 mm. Our garnet OD is 340 mm. Therefore we have an edge of  $(50/2 = 25 \text{ mm})$ .
  - Also longer because of thickness of copper.
  - Bigger radially also causes problems for solenoid.

# Booster cooling rings



# louris' first pass

