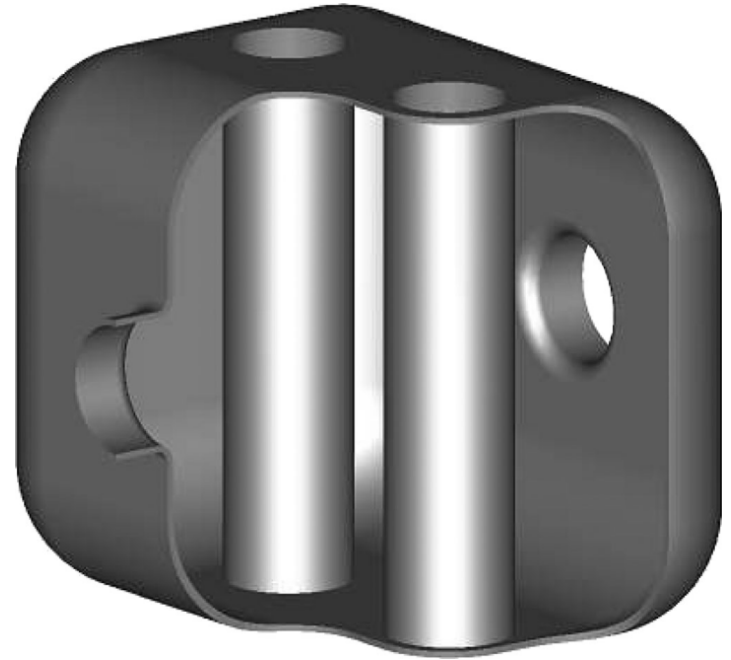
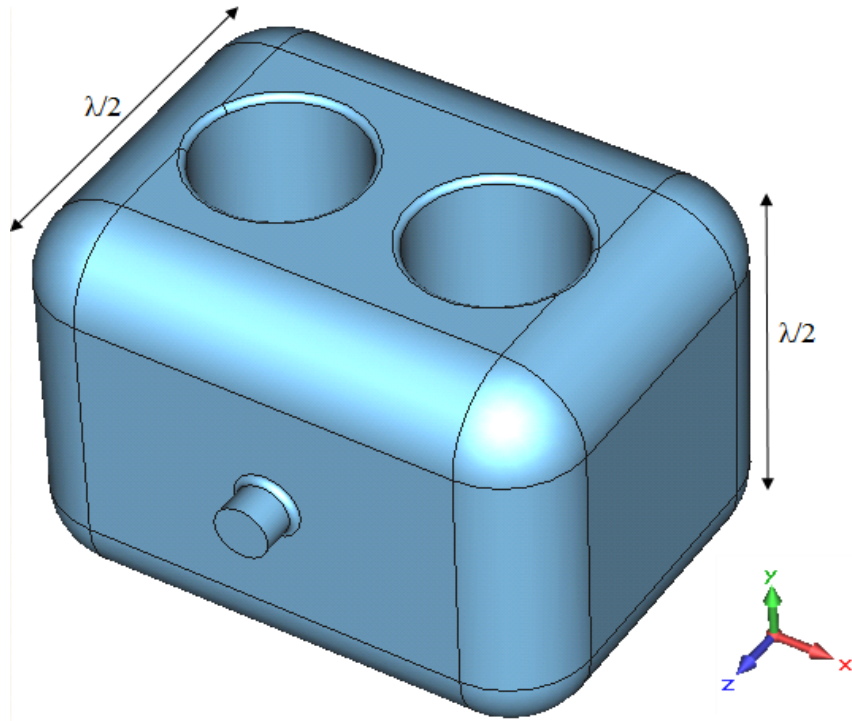


Parallel Bar Deflecting and Crabbing Cavities

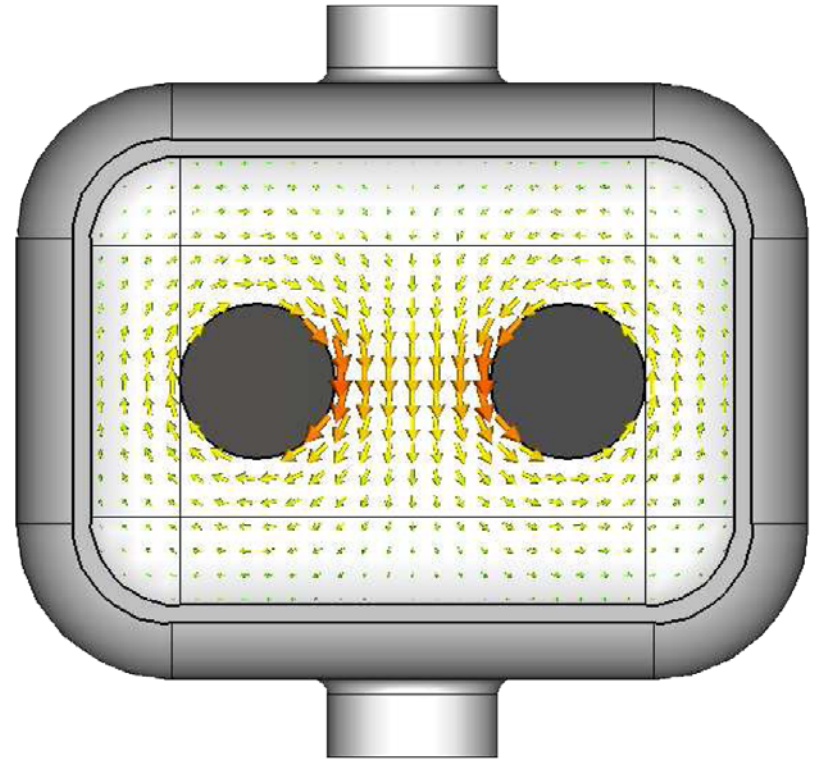
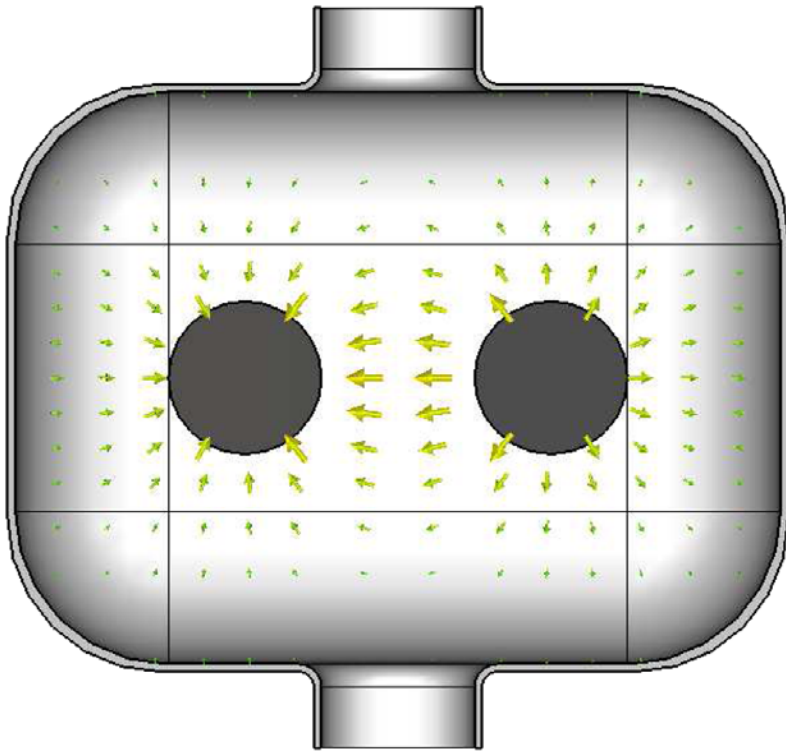
Jean Delayen
Subashini De Silva

Center for Accelerator Science
Old Dominion University
and
Thomas Jefferson National Accelerator Facility

Parallel Bar Cavity Concept



Parallel Bar Cavity Concept



JLab 499 MHz Deflecting Cavity

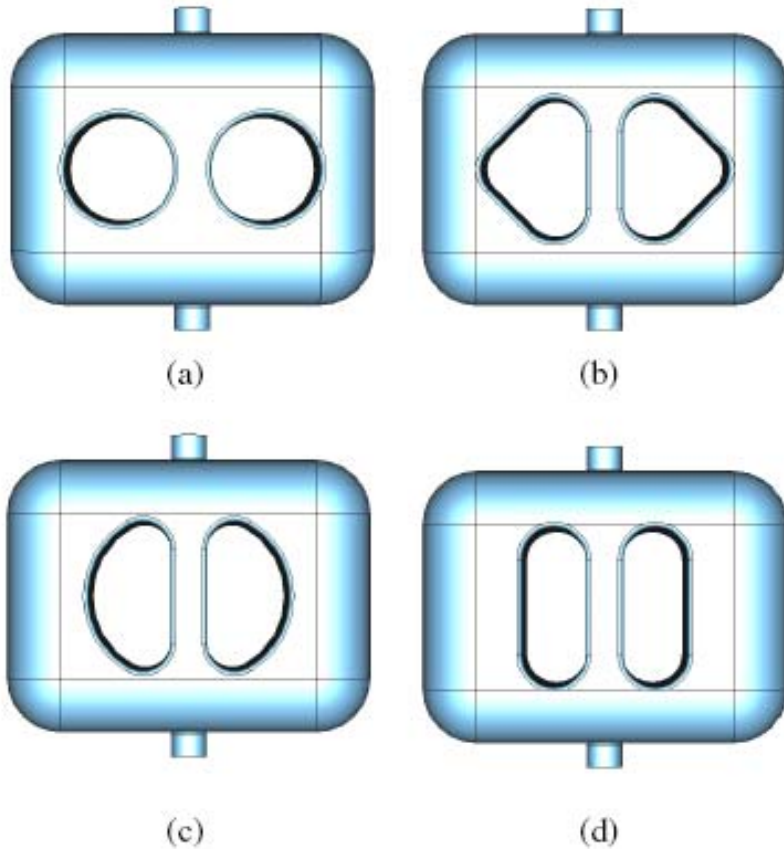


Figure 2: Design structures for CEBAF 499 MHz deflecting cavity with (a) circular, (b) triangular, (c) half circular and (d) race track shaped parallel bars.

Table 1: Transverse voltage and peak surface fields for the four design structures

Design structure	E_p / E_T^* (MV/m)	B_p / E_T^* (mT)
(a)	3.45	8.86
(b)	2.47	6.60
(c)	2.30	6.15
(d)	2.28	5.94

At $E_T^* = 1$ MV/m

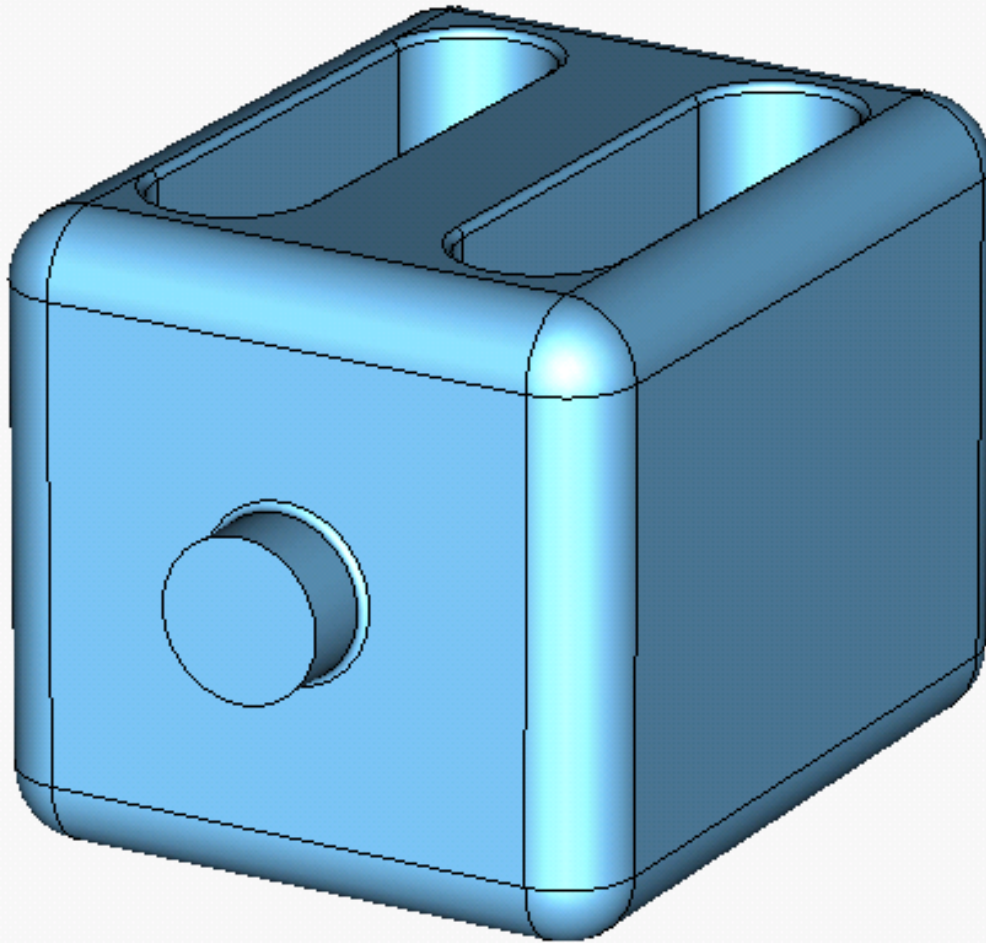
JLab 499 MHz Deflecting Cavity

Table 2: Properties of parallel-bar structure (d) of Fig. 3 and comparison with CEBAF's separator cavity

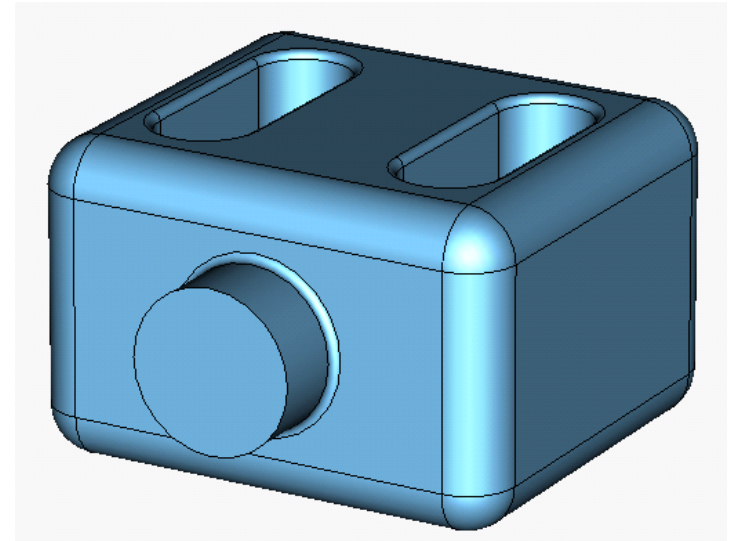
Parameter	Structure (d)	CEBAF	Units
Freq. of π mode	499	499	MHz
$\lambda/2$ of π mode	300.4	300.4	mm
Freq. of 0 mode	521.9	~537	MHz
Cavity length	420.4	~300	mm
Cavity width	320	292	mm
Bars height	305.5	20	mm
Bars width	70	20	mm
Bars length	295	135	mm
Aperture diameter	40	15	mm
Deflecting voltage (V_T^*)	0.3	0.3	MV
Peak electric field (E_p^*)	1.9	3.39	MV/m
Peak magnetic field (B_p^*)	4.9	8.87	mT
Energy content (U^*)	0.028	0.0012	J
Geometrical factor	69.4	34.9	Ω
$[R/Q]_T$	1045.3	24921	Ω

At $E_T^* = 1$ MV/m

Crab Cavity Geometry

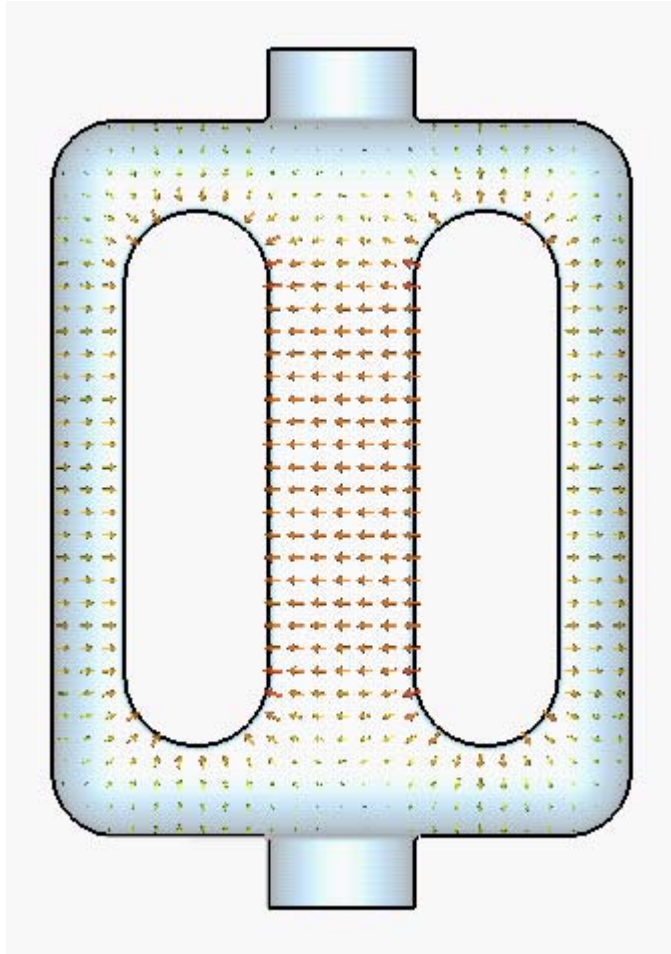


400 MHz

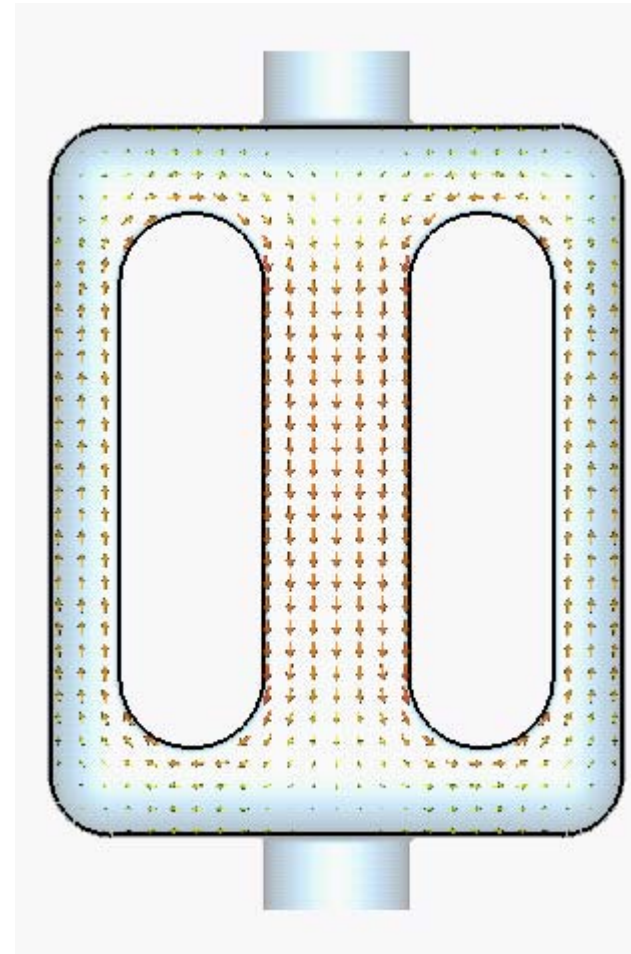


800 MHz

E and H Fields in 400 MHz Cavity

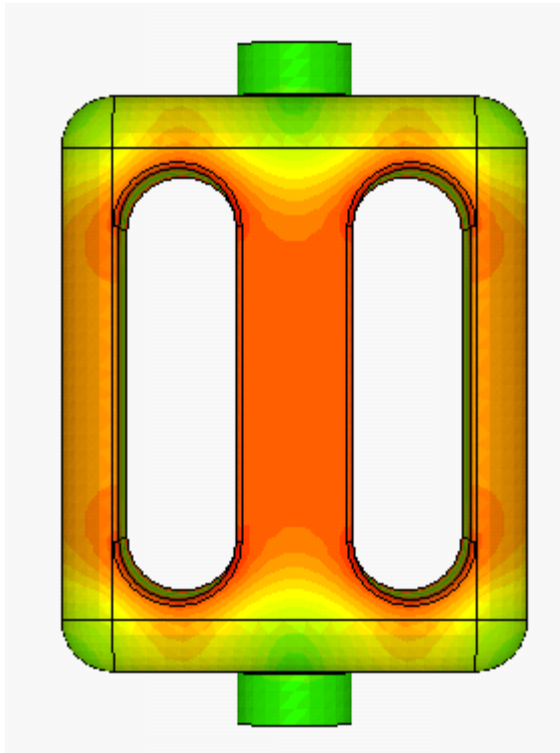


E field in the mid plane

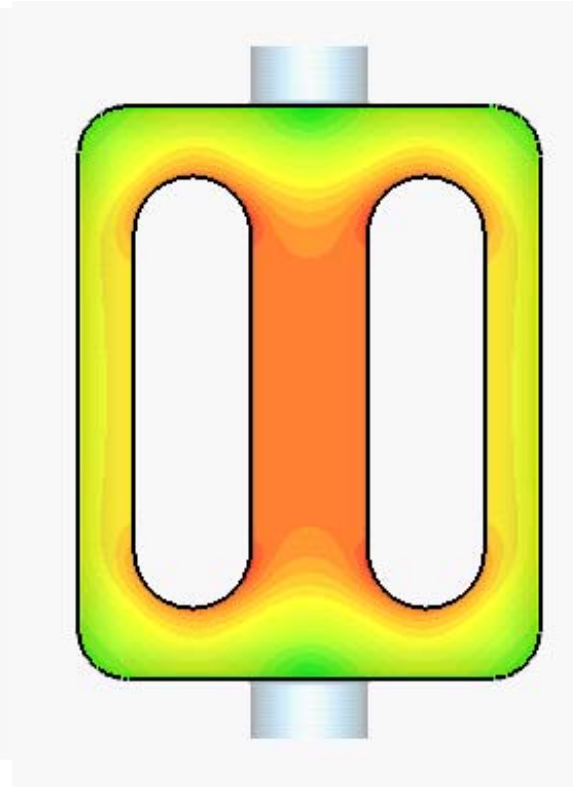


H field in the top plane

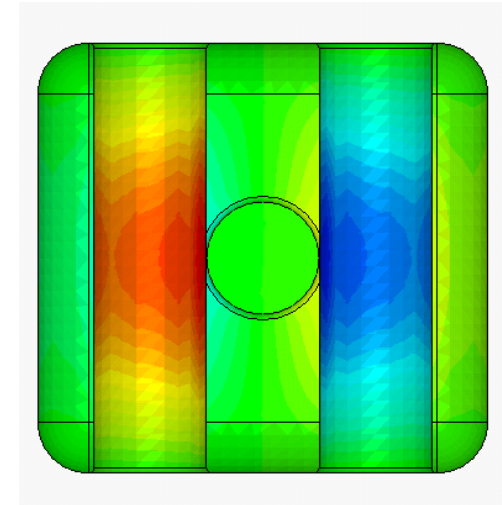
E and H Fields in 400 MHz Cavity



H field at top plane

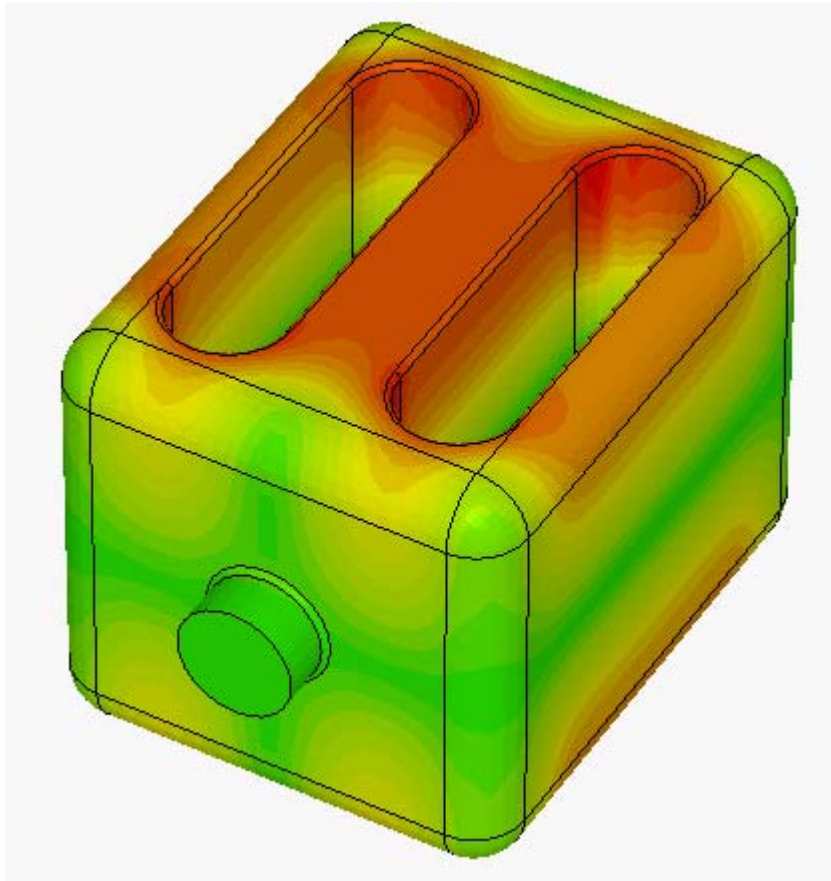


E field at mid plane

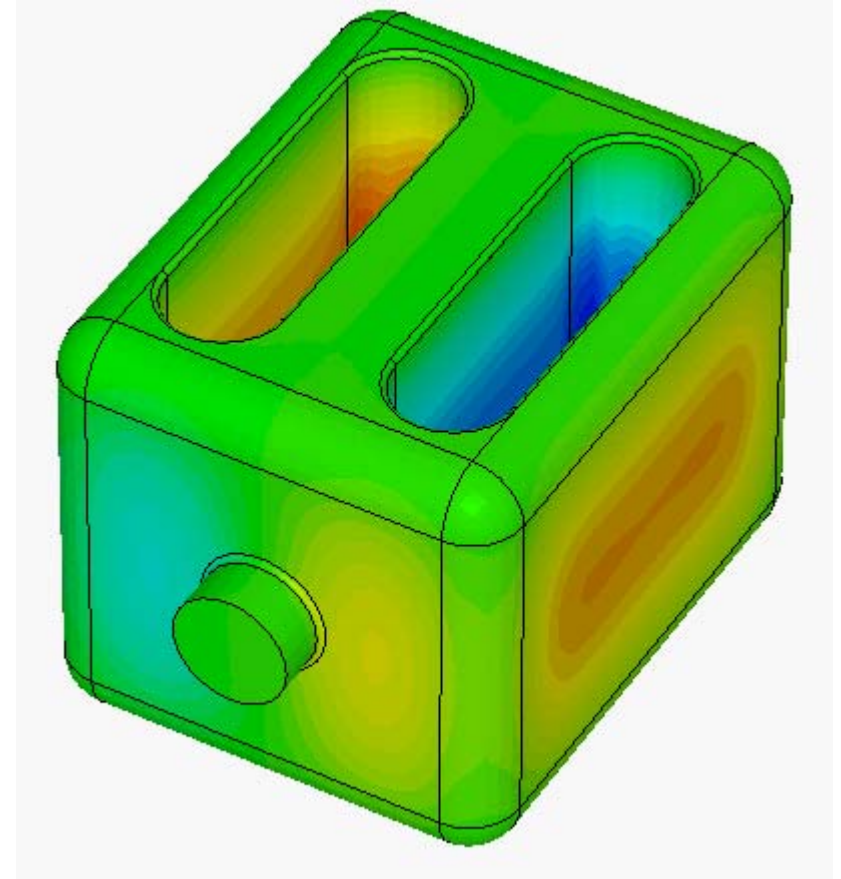


Surface E field on parallel bars

E and H Fields in 400 MHz Cavity

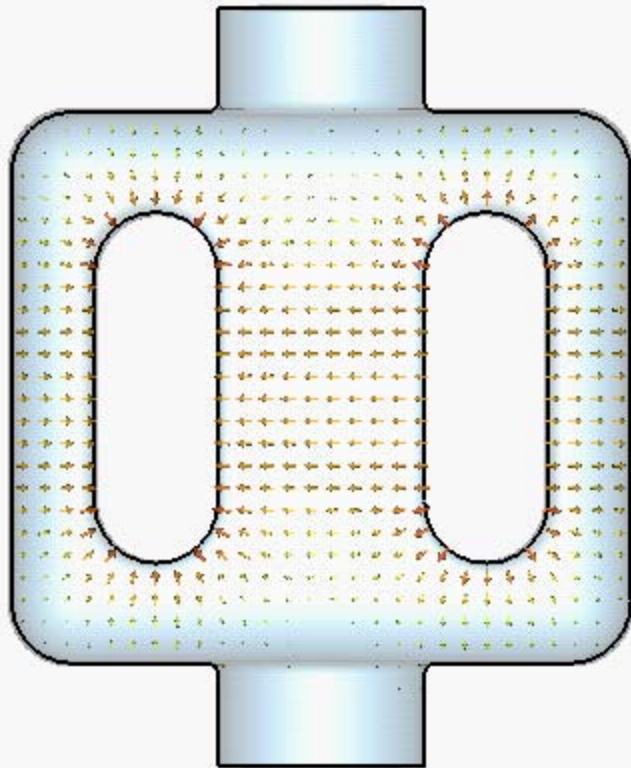


Surface H field

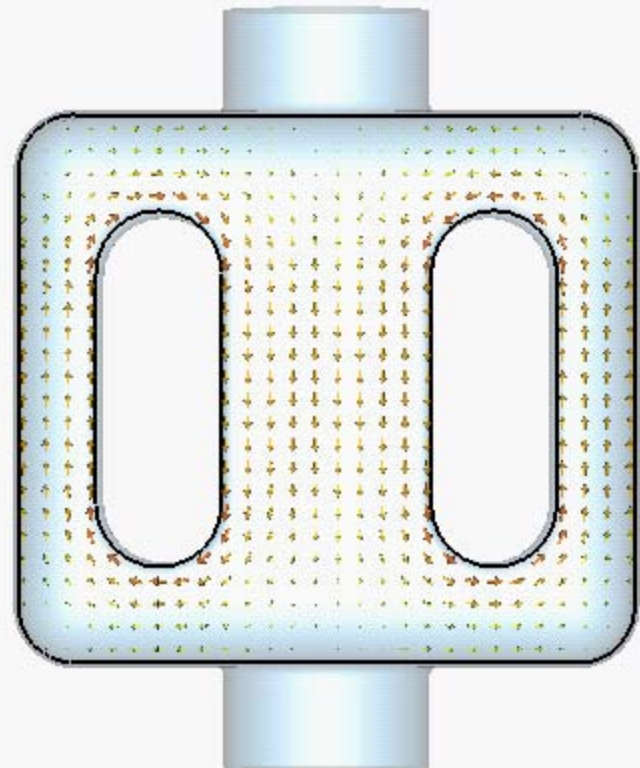


Surface E field

E and H Fields in 800 MHz Cavity

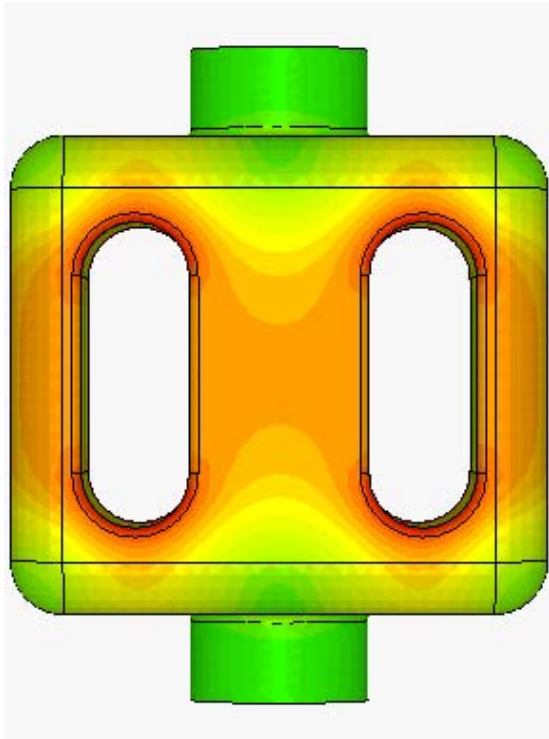


E field in the mid plane

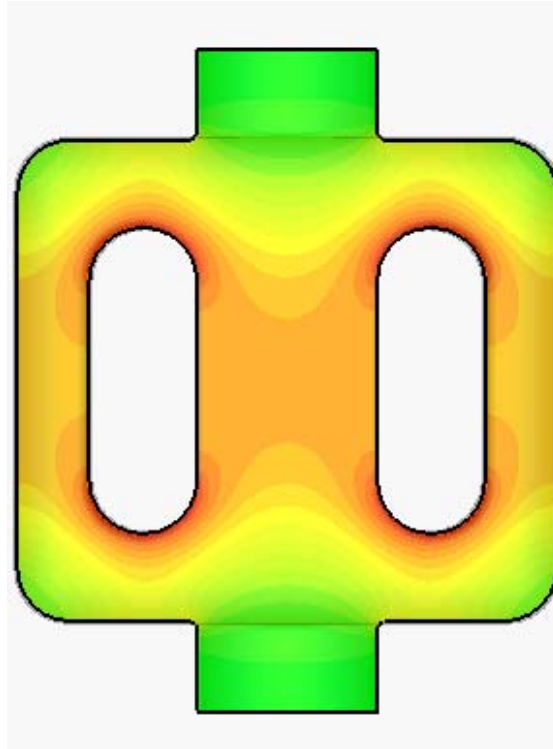


H field in the top plane

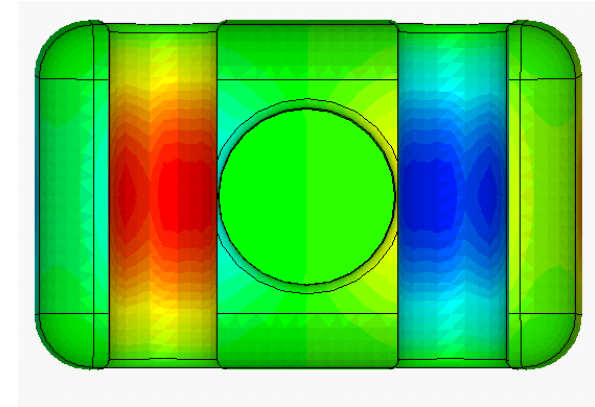
E and H Fields in 800 MHz Cavity



H field at top plane

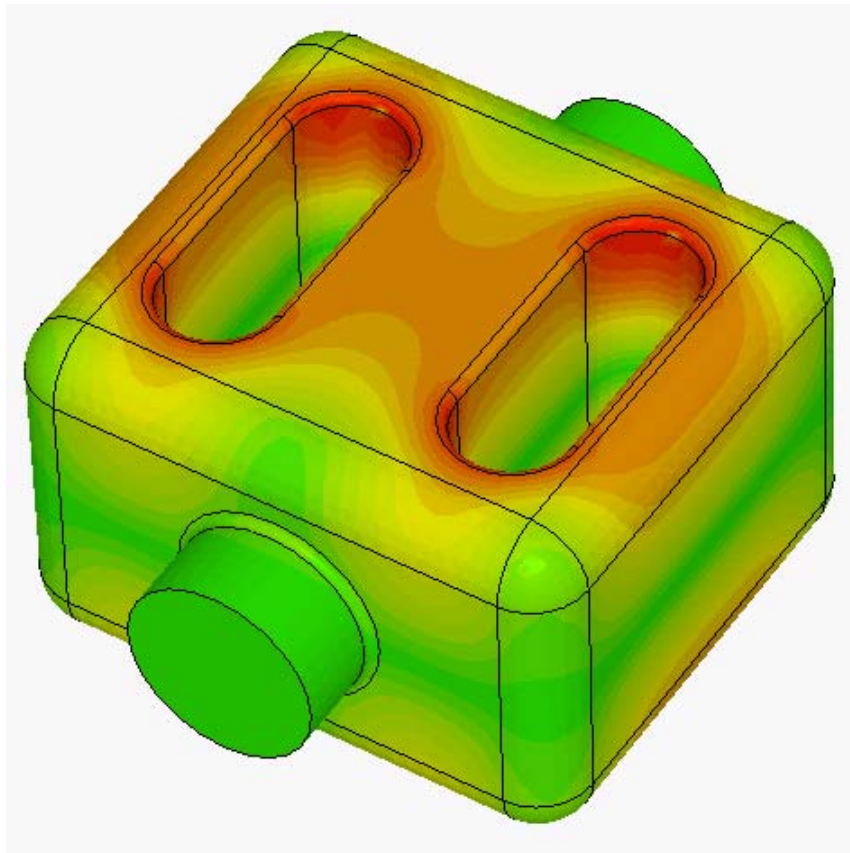


E field at mid plane

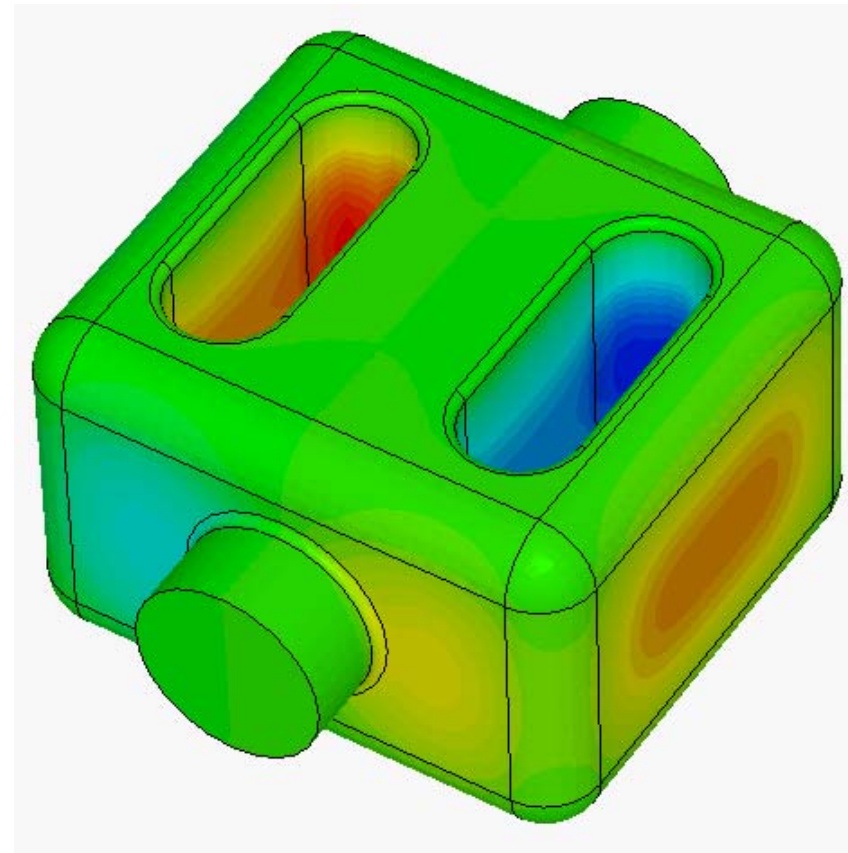


Surface E field on parallel bars

E and H Fields in 800 MHz Cavity

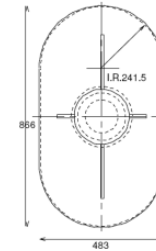


Surface H field



Surface E field

Cavity Properties



Parameter	Fig. 7	Fig. 8	Units	
Freq. of π mode	400	800	MHz	400
$\lambda/2$ of π mode	374.7	187.4	mm	
Freq. of 0 mode	407.1	815.3	MHz	
Cavity length	494.7	267.4	mm	
Cavity width	400	300	mm	615
Bars height	382.2	191.8	mm	1101
Bars width	100	60	mm	
Bars length	370	170	mm	
Aperture diameter	100	100	mm	305
Deflecting voltage (V_T^*)	0.375	0.187	MV	0.375
Peak electric field (E_p^*)	2.16	2.79	MV/m	4.25
Peak magnetic field (B_p^*)	7.05	9.78	mT	12.24
Energy content (U^*)	0.175	0.062	J	
Geometrical factor	81.37	112.3	Ω	220
$[R/Q]_T$	319.13	113.55	Ω	46.7
$R_T R_S$	2.6×10^4	1.3×10^4	Ω^2	10274

At $E_T^* = 1$ MV/m