Preliminary RF design and tolerance study of the correction cavity
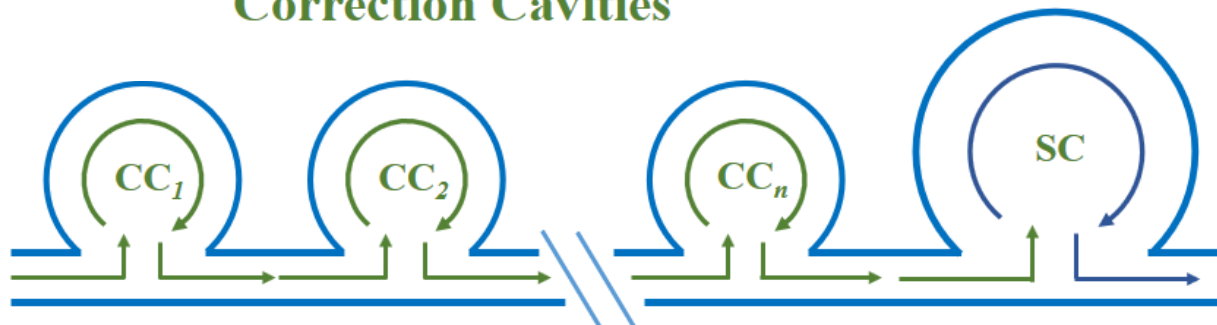
Ping Wang, Alexej Grudiev

20.07.2022

Pulse compression system for klystron-based CLIC
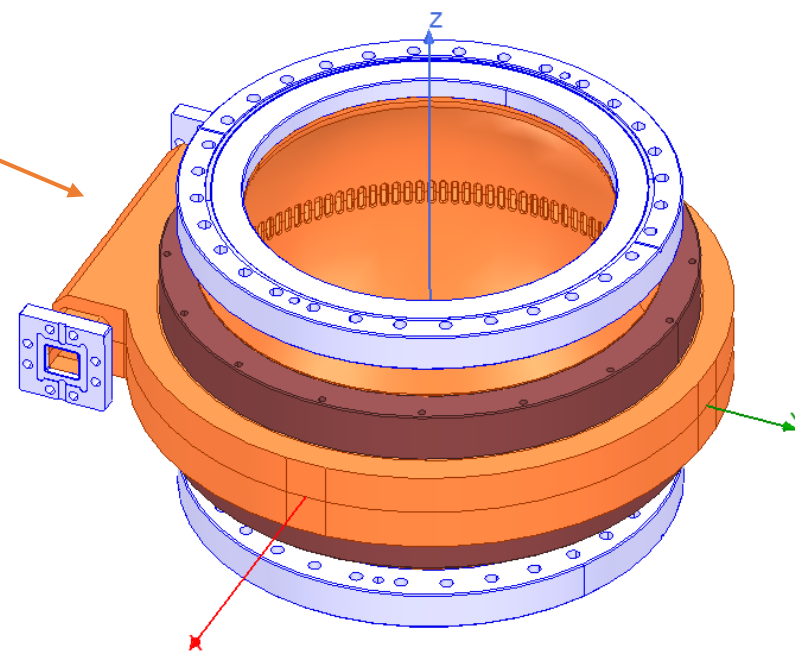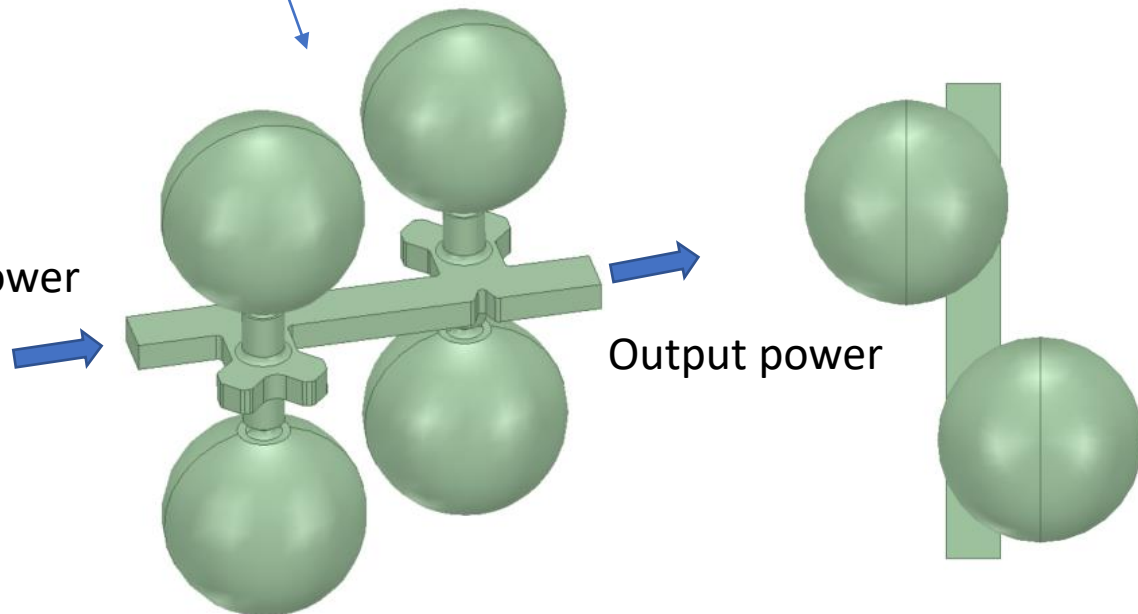
Prototype of the first correction cavity

- $Q_0 = 70936$
- Beta = 1.95
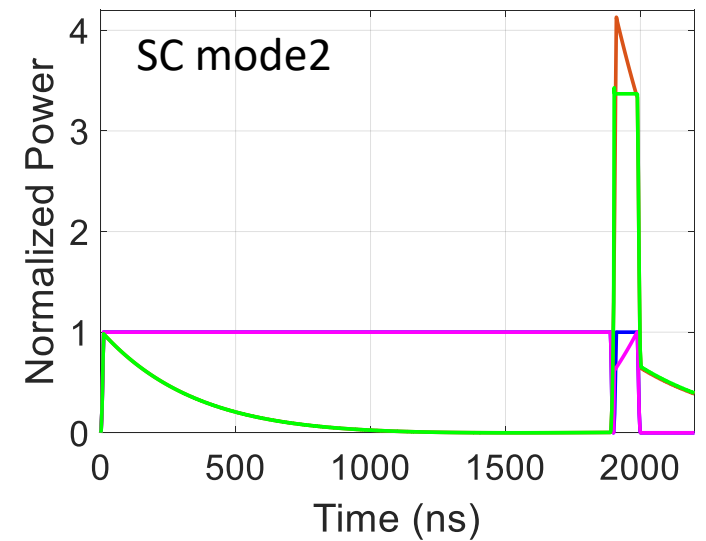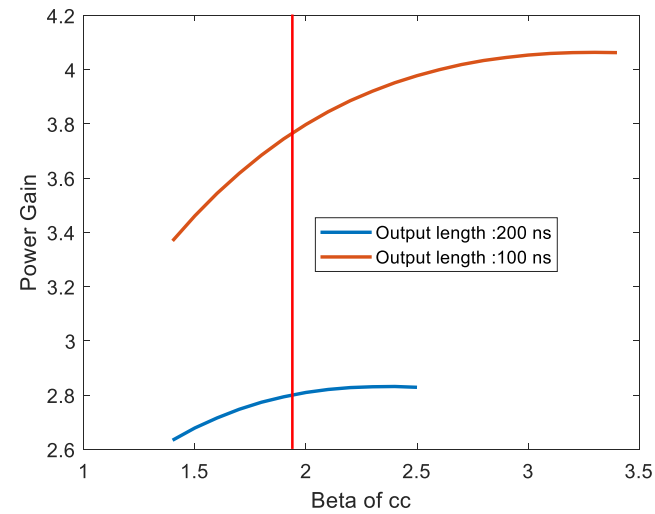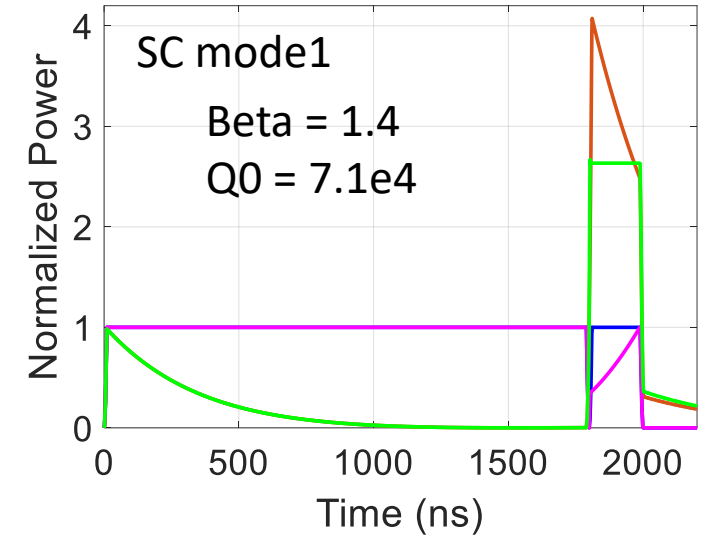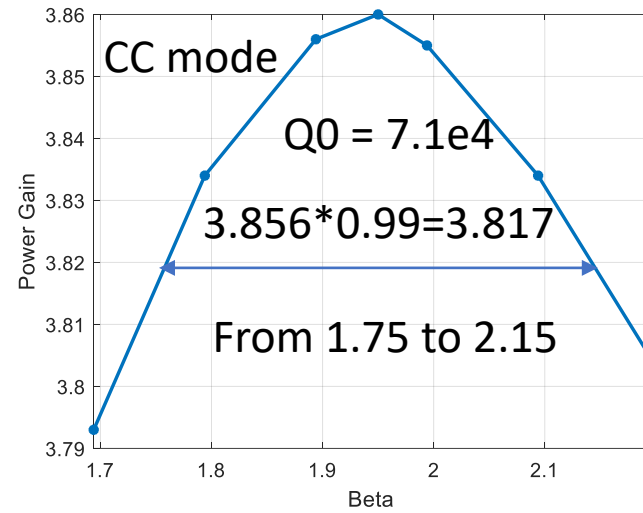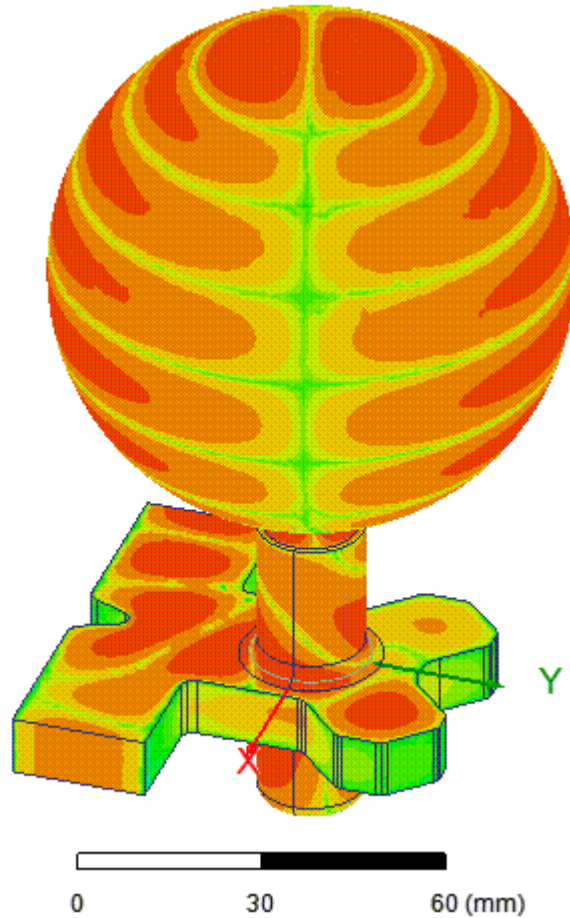
Main parameters of the spherical cavity

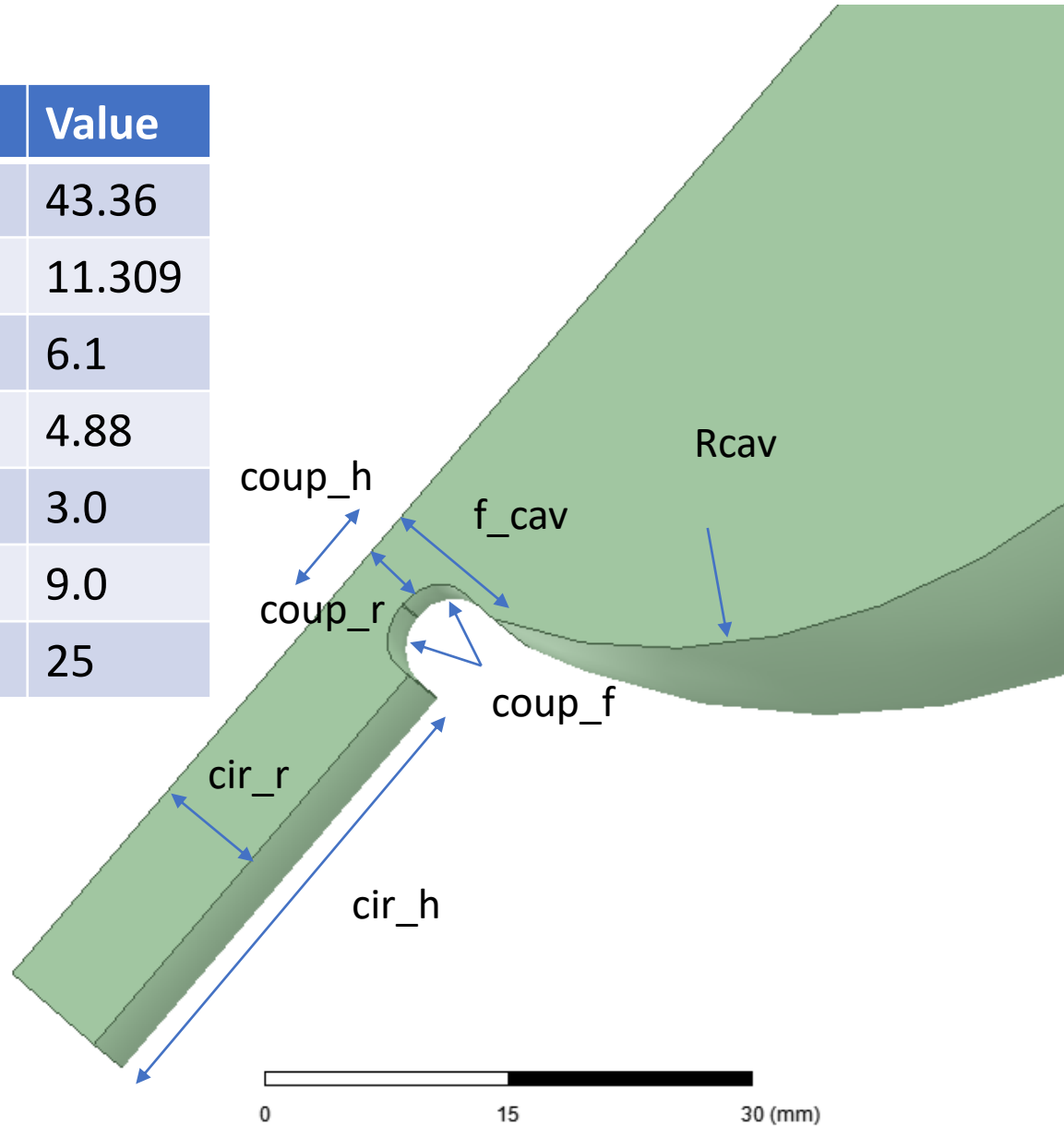| Parameters	Value
Rcav [mm]	43.36
f_cav [mm]	11.309
coup_h [mm]	6.1
coup_r [mm]	4.88
coup_f [mm]	3.0
cir_r [mm]	9.0
cir_h [mm]	25
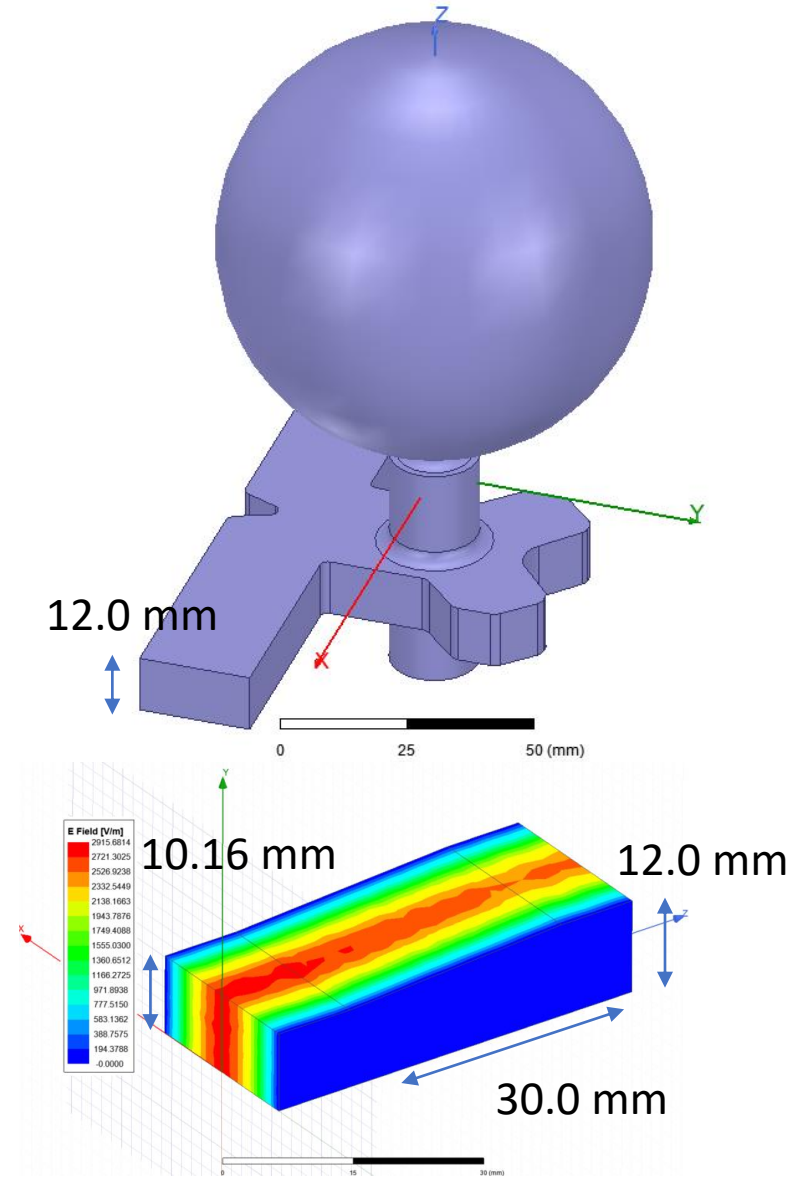
Tolerance study of the spherical cavity

Parameters	Value	Sensitivity			Recommended range
		Freq [MHz/mm]	Q0 [/mm]	Beta [/mm]	
Rcav [mm]	43.36	-276.2	1003	-0.39	< ± 0.003 mm
coup_h [mm]	6.0	0.009	-714	-1.00	< ± 0.1 mm
coup_r [mm]	4.88	-3.71	-2694	4.20	< ± 0.02mm
coup_f [mm]	3.0	-1.25	-673	1.17	< ± 0.08mm
cir_r [mm]	9.0	-0.021	-1512	-0.07	> ± 0.1mm
cir_h [mm]	25	-0.014	-759	-0.06	> ± 0.1mm
Criterions		Δf0 < ± 1.0 MHz	ΔQ0 > -1000	ΔBeta < ± 0.1	
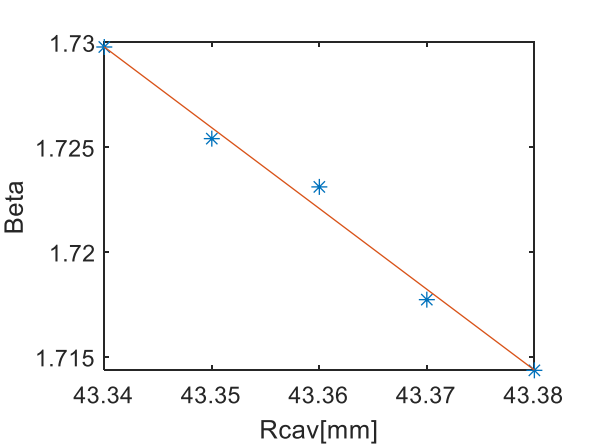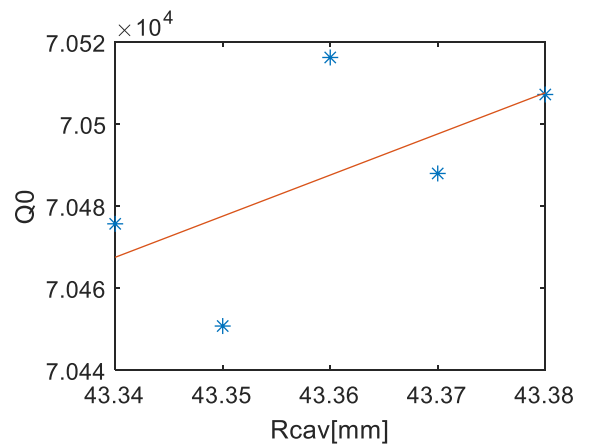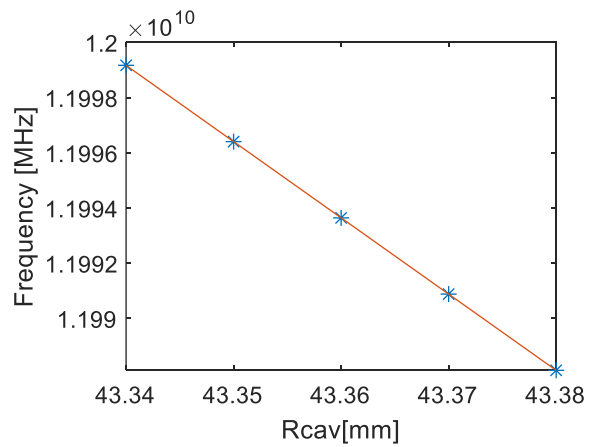
Alignment of the two hemispheres

Offset = 4 µm

E face: P2

H face: P1
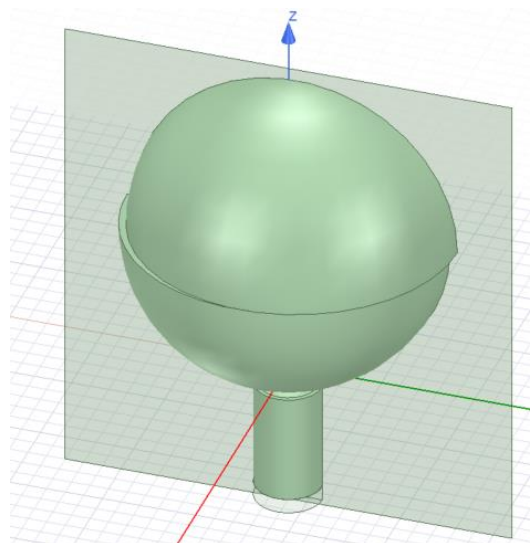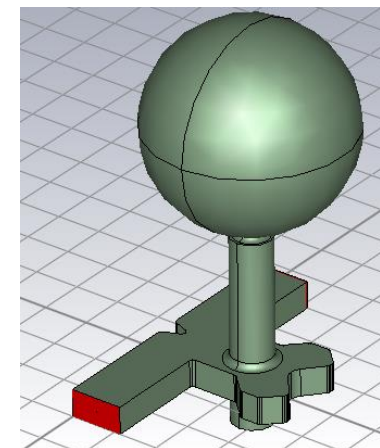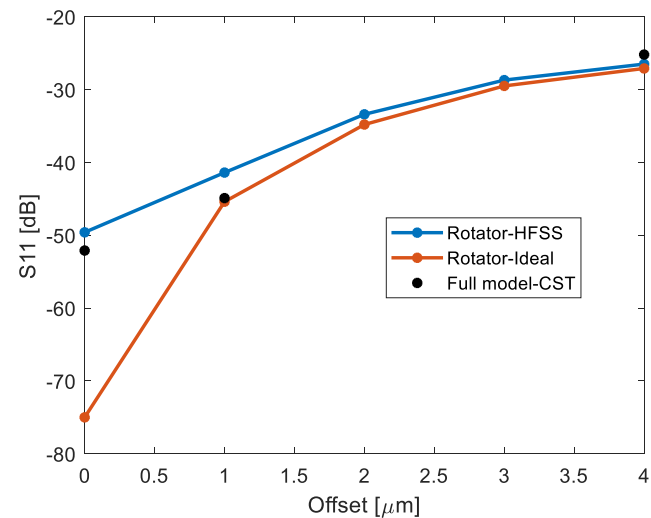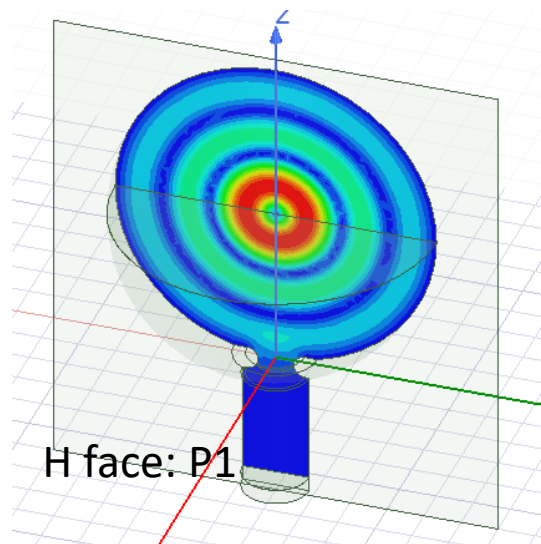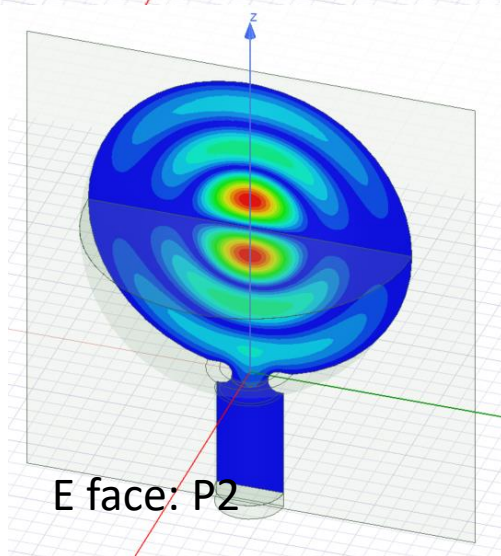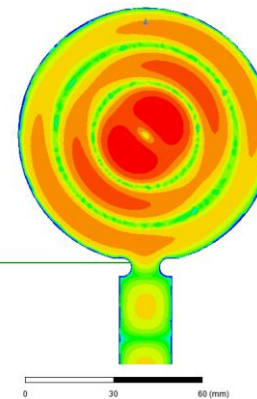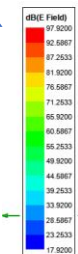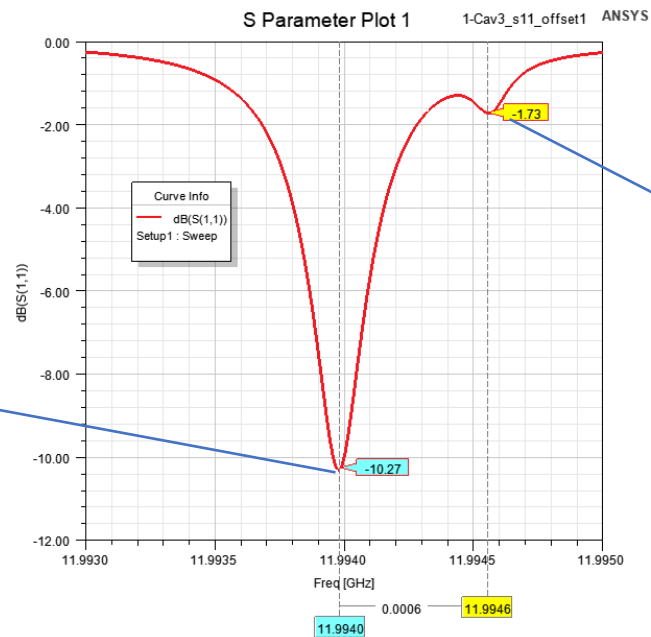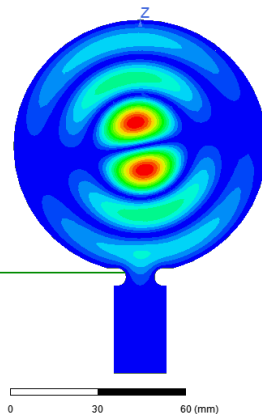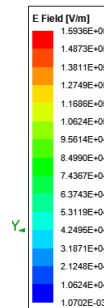
Tuning of the CC cavity

- Depth: From -0.8 mm to 1.0 mm

- Frequency: From -0.6 MHz to 0.6 MHz

- Beta: From 1.8 to 2.1

- ΔRcav: 0.6/11994*43.38 = 2.1 µm

Unite   Subtract

Pushing

Pulling

Sphere tuning pin

Cylinder tuning pin

Unite
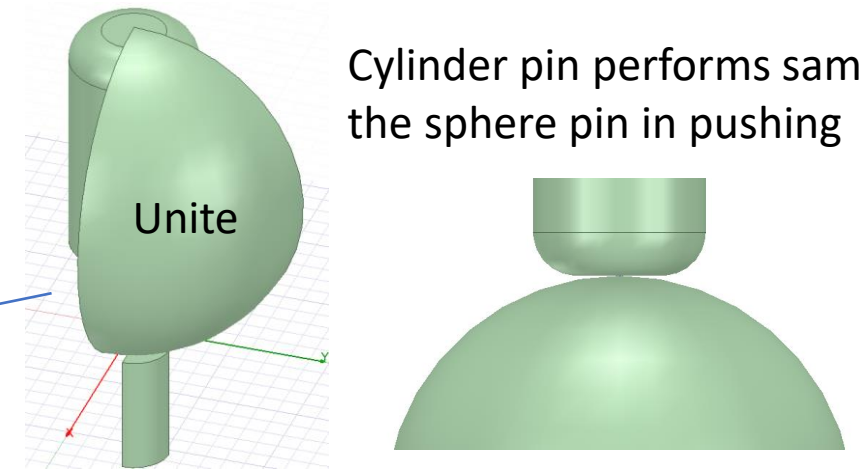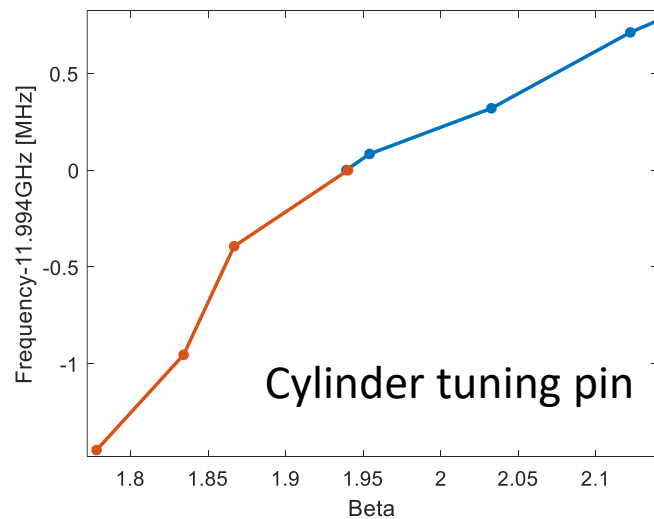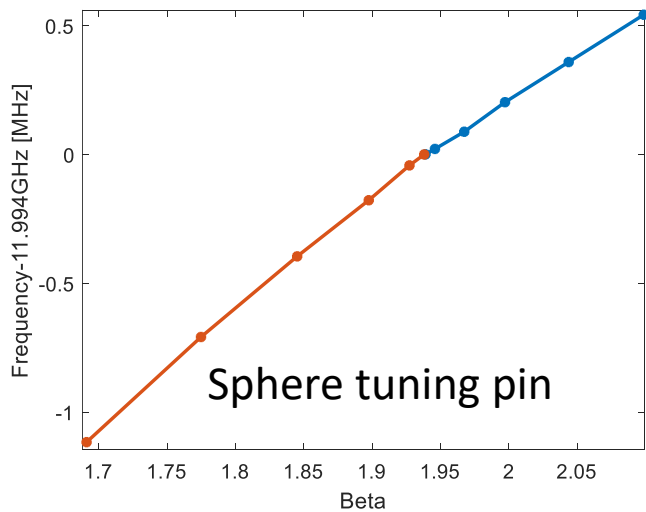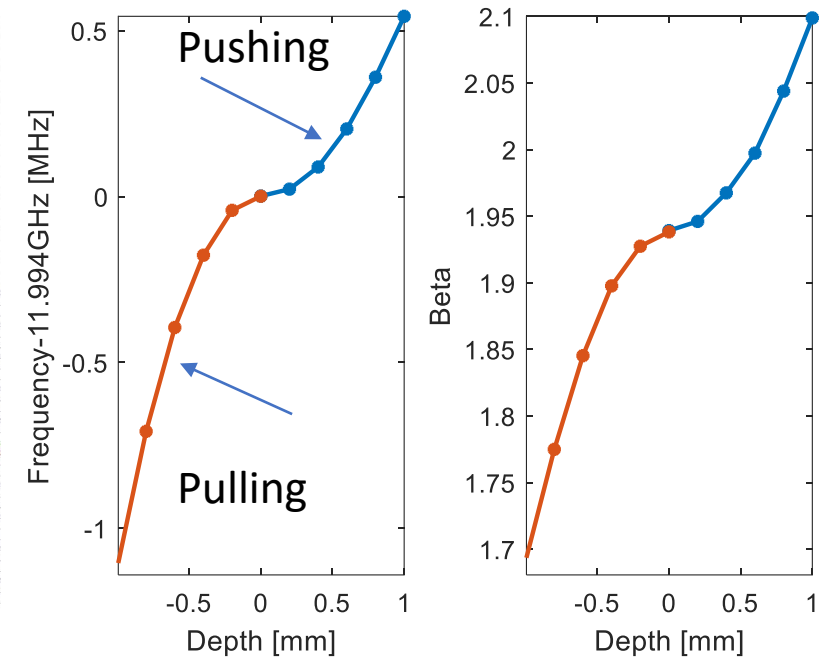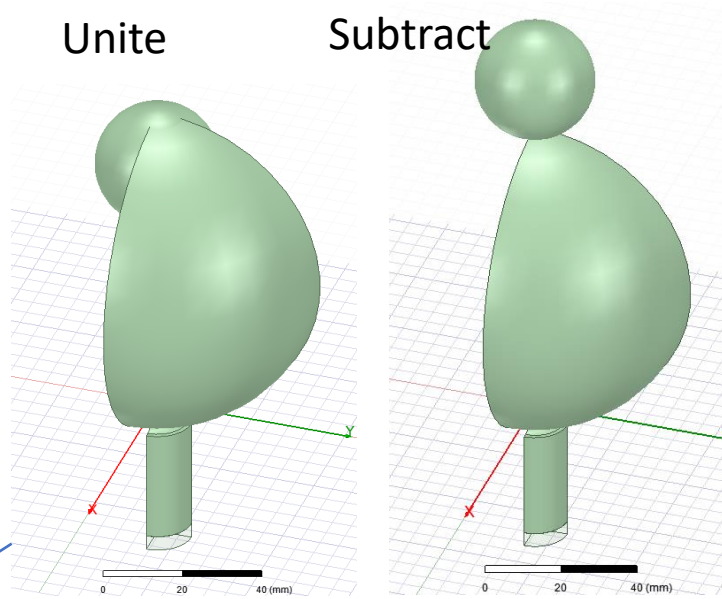
Cylinder pin performs same as the sphere pin in pushing

Cylinder pin performs better in pulling

Main parameters of RF rotator
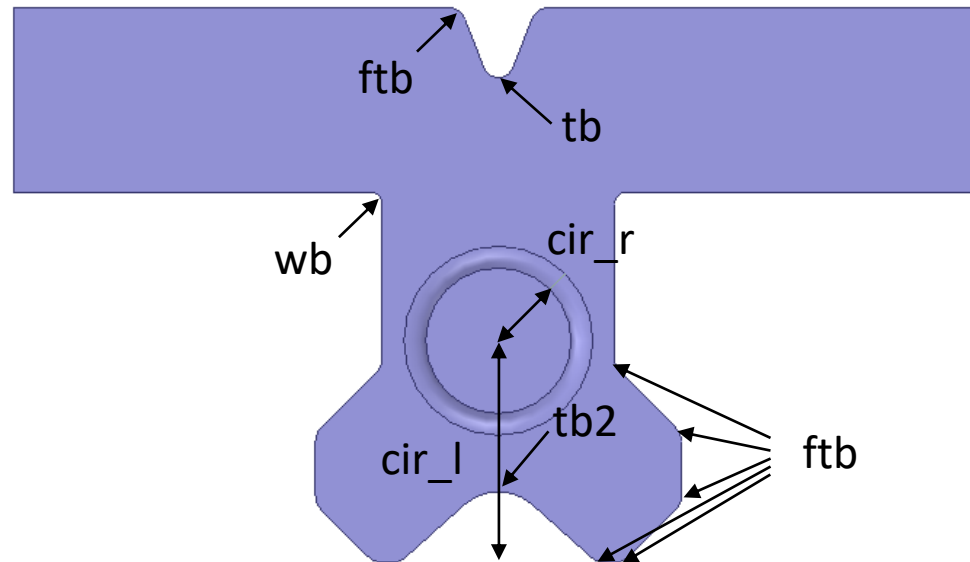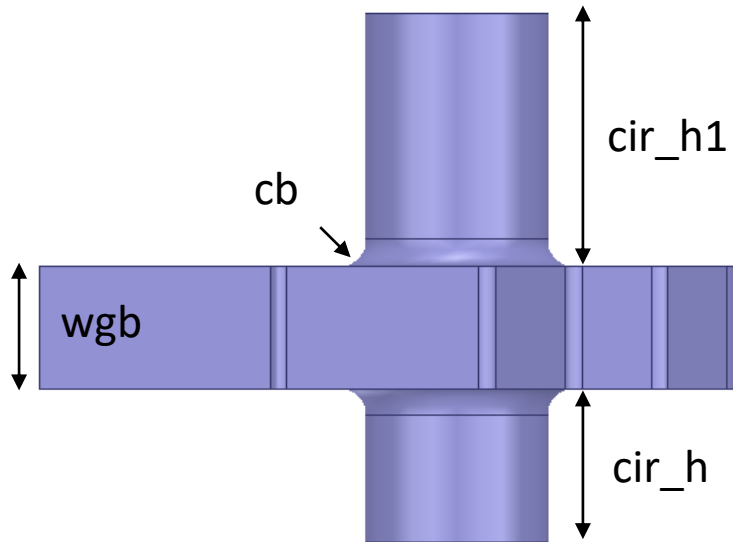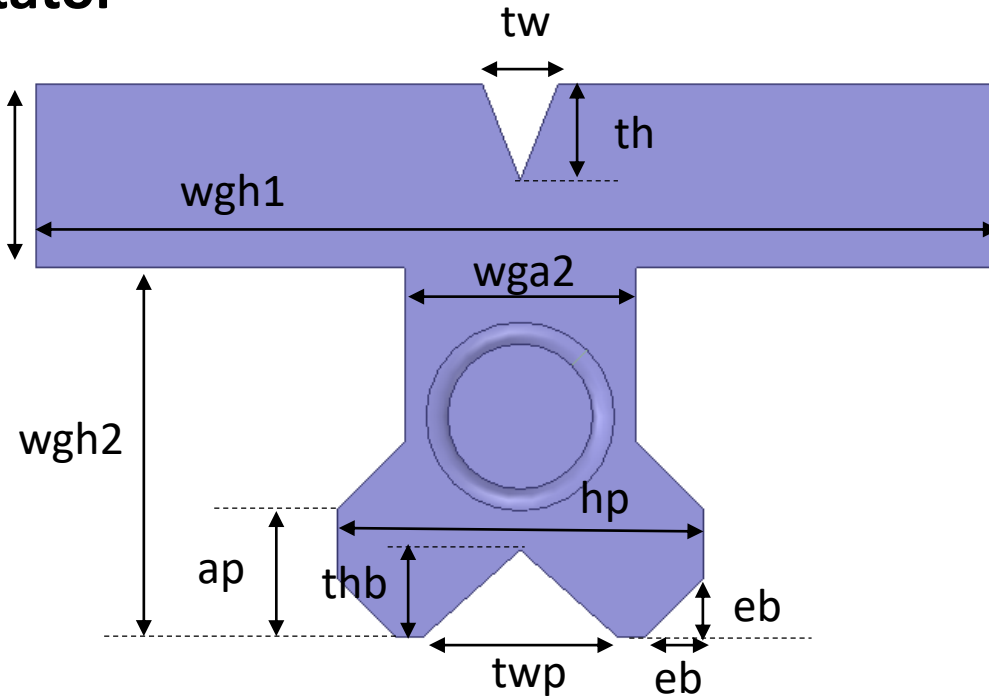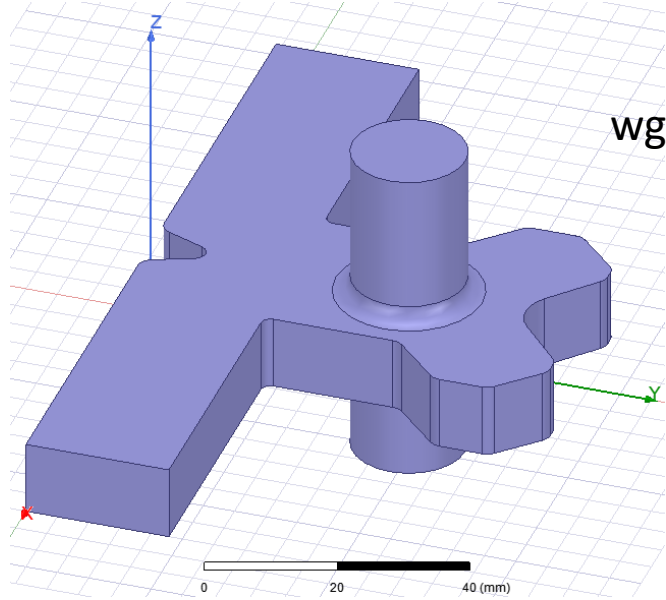
Name	Value	Unit
wgh1	120	mm
wga1	22.86	mm
wgb	12	mm
wga2	28.73	mm
wgh2	45.81	mm
cir_l	27.41	mm
cir_h	15.26	mm
cir_r	9	mm
cir_h1	25	mm
tw	9.48	mm
cb	2.7	mm
th	12	mm
wb	1.54	mm
hp	45.32	mm
ap	16.17	mm
twp	25.34	mm
thb	10.98	mm
eb	7.1	mm
tb	1.9	mm
ftb	2.38	mm
tb2	6.3	mm
dx	0	mm
dy	0	mm

Tolerance study of the RF rotator

Name: MeritFun

Expression: db10(1-2*abs(re(S(1:1,3:1))*im(S(1:1,3:2))-im(S(1:1,3:1))*re(S(1:1,3:2))))

MeritFun < -45dB

Output Variables Plot 2

Output Variables Plot 2
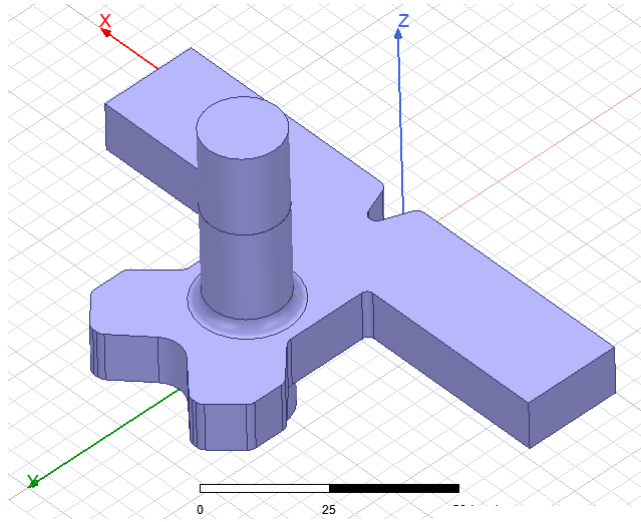
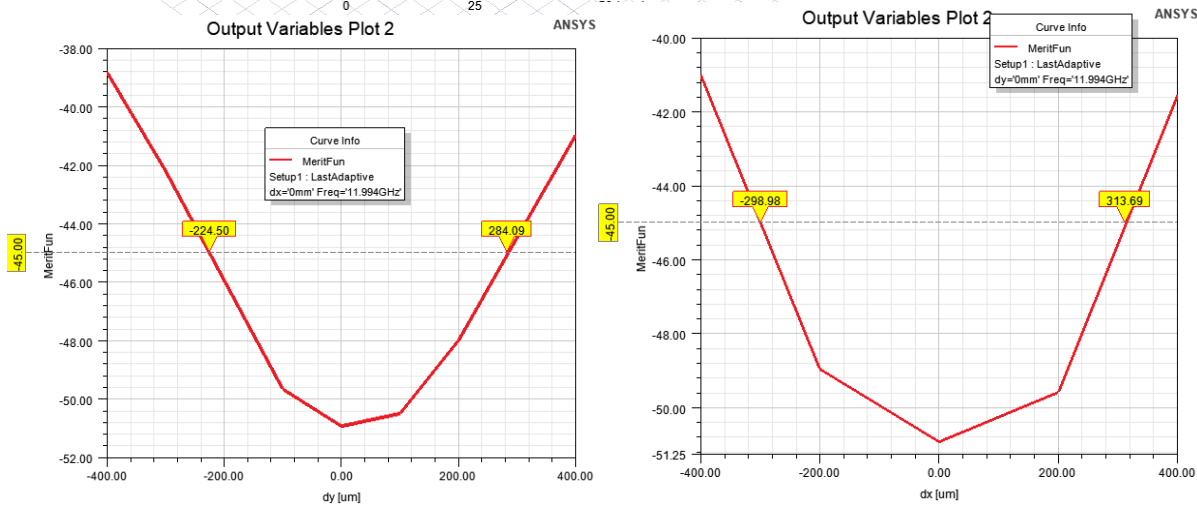| Parameters	Normal value [mm]	Acceptable range [mm]
wgh1	120	> ±1.0
wga1	22.86	-0.03, +0.04
wgb	12.00	-0.09, +0.05
wga2	28.73	-0.02, +0.03
wgh2	45.81	-0.04, +0.04
cir_l	27.41	-0.03, +0.03
cir_h	15.26	-0.06, +0.05
cir_r	9.00	-0.02, +0.02
tw	9.48	-0.06, +0.07
cb	2.70	-0.06, +0.07
th	12.00	-0.04, +0.05
wb	1.54	> ±0.1
hp	45.32	-0.05, +0.06
ap	16.17	-0.08, +0.10
twp	25.34	> ±0.1
thb	10.98	> ±0.1
eb	7.10	-0.10, +0.08
tb	1.90	-0.02, +0.02
ftb	2.38	> ±0.1
tb2	6.30	> ±0.1
dx/dy	0	> ±0.1