

HOM Analysis Progress (II)

Multipole Modes of SNS $b=0.61$ cavity

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- R/Q (for the deflection) definition used here;

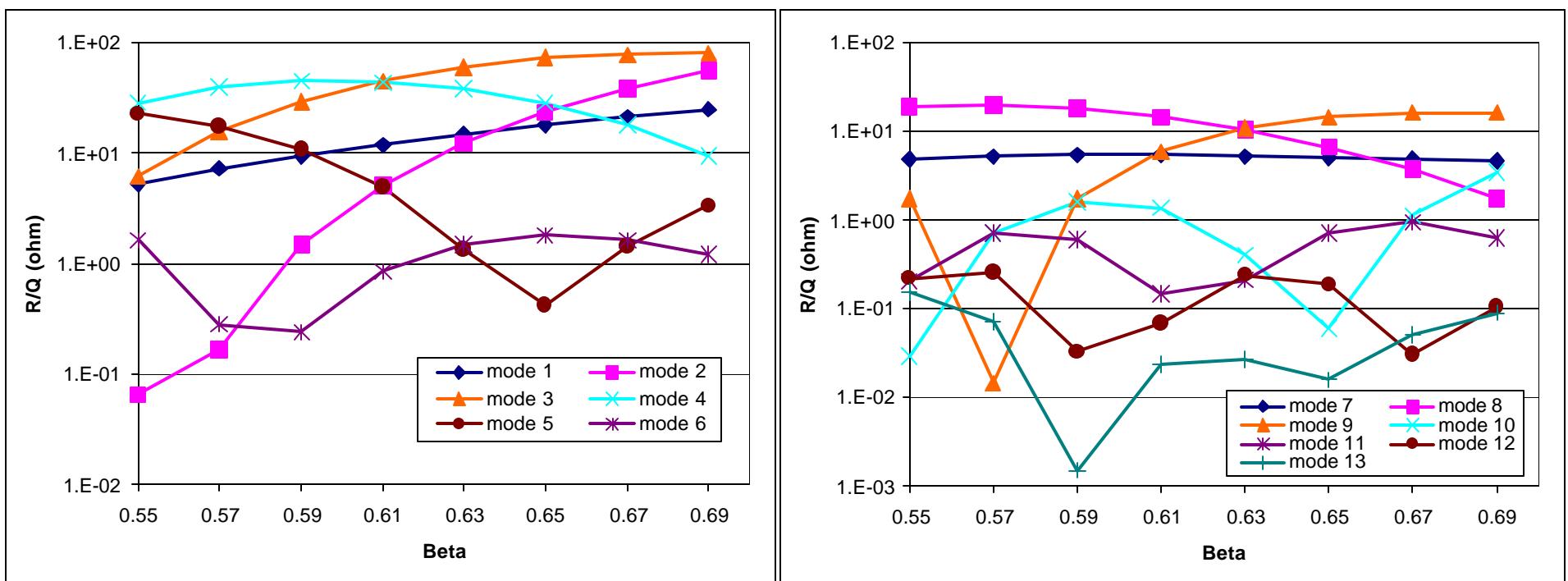
$$\frac{R}{Q} = \frac{c^2 \left| \int \nabla_r E_z \exp(i w_n z / v) dz \right|^2}{w_n^3 U} \quad (\text{ohm})$$

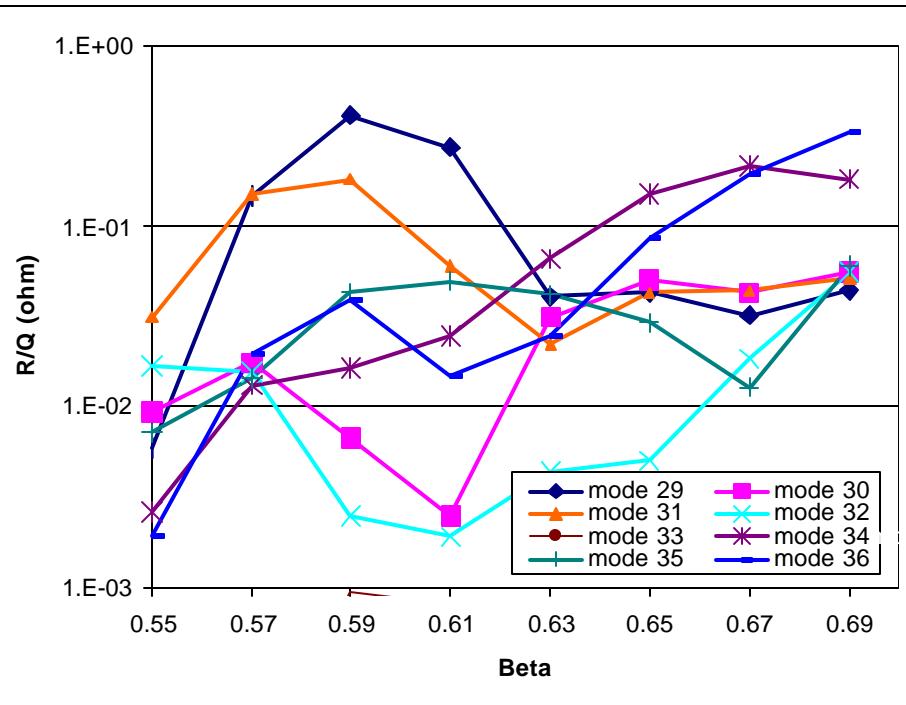
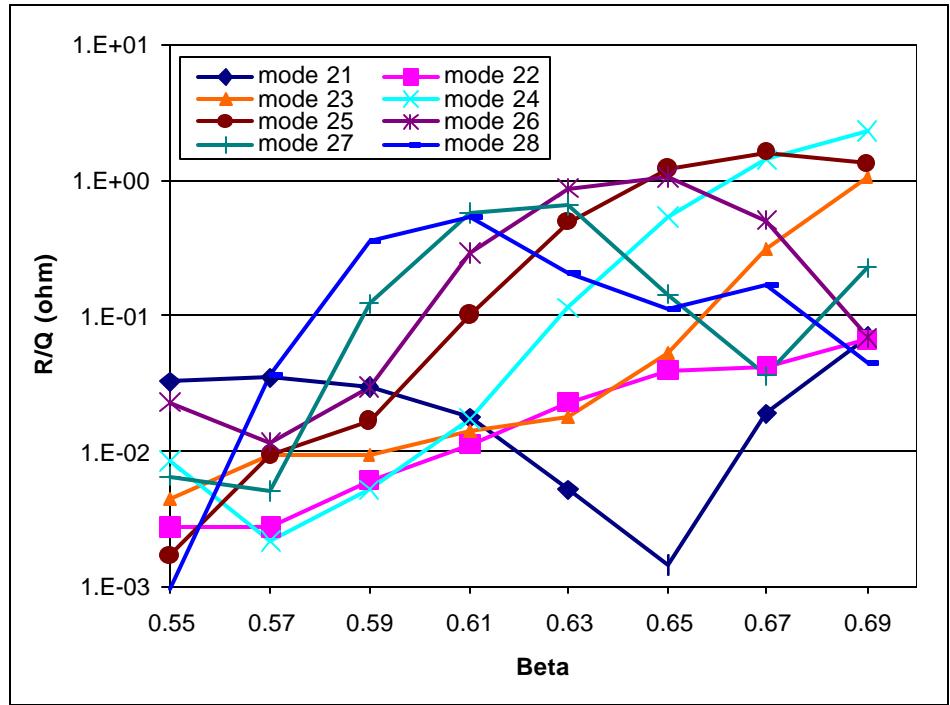
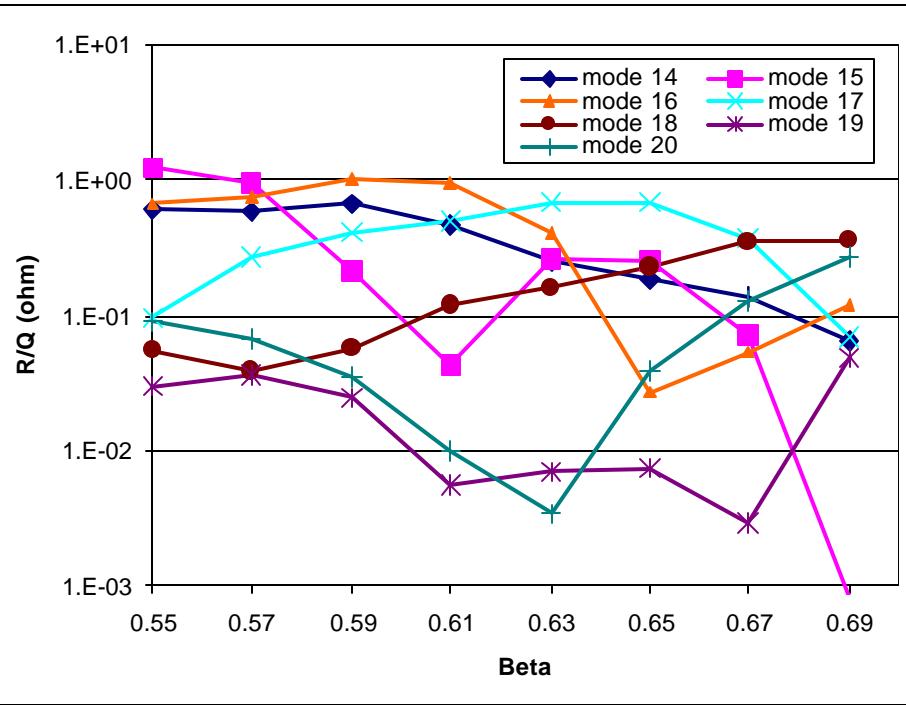
- In BBU code, usually R/Q in Ohm is used
- in addition to the particle velocity,
R/Q for deflection modes depends on the radial position of beam.
- In cylindrical pillbox cavity ;
for dipole mode $E_z \propto r$ (independent of radial position)
for quadrupole mode $E_z \propto r^2$
for sextupole mode $E_z \propto r^3$
When the SNS elliptical cavity shows similar tendency,
we can define R/Q at the reference radial position
and get R/Q easily at other radial position.

DIPOLES (I)

mode no.	frequency	mode no.	frequency
mode 1	1.11712E+09	mode 21	2.19634E+09
mode 2	1.13793E+09	mode 22	2.24083E+09
mode 3	1.14359E+09	mode 23	2.24965E+09
mode 4	1.15214E+09	mode 24	2.26555E+09
mode 5	1.16179E+09	mode 25	2.28785E+09
mode 6	1.16955E+09	mode 26	2.31482E+09
mode 7	1.34599E+09	mode 27	2.34074E+09
mode 8	1.45814E+09	mode 28	2.36812E+09
mode 9	1.50250E+09	mode 29	2.41053E+09
mode 10	1.56286E+09	mode 30	2.42991E+09
mode 11	1.62394E+09	mode 31	2.45469E+09
mode 12	1.66988E+09	mode 32	2.46507E+09
mode 13	1.71948E+09	mode 33	2.46669E+09
mode 14	1.93725E+09	mode 34	2.47234E+09
mode 15	1.97603E+09	mode 35	2.47574E+09
mode 16	2.02147E+09	mode 36	2.48555E+09
mode 17	2.06218E+09	mode 37	2.52833E+09
mode 18	2.09318E+09	mode 38	2.57639E+09
mode 19	2.11337E+09	mode 39	2.63383E+09
mode 20	2.12418E+09	mode 40	2.69575E+09

DIPOLES (III)





QUADRUPOLES (I)

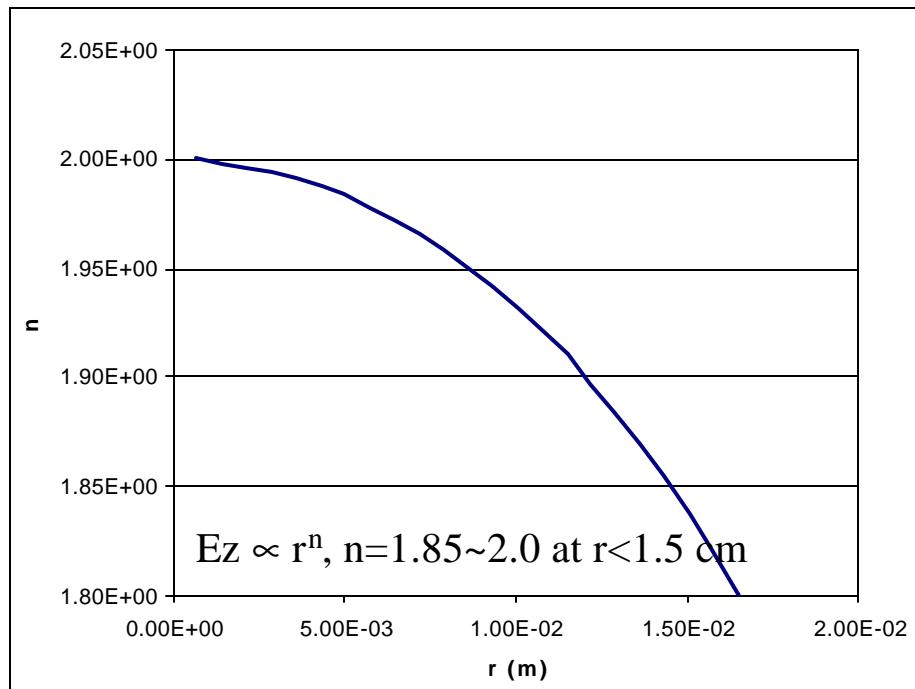
mode no.	frequency	mode no.	frequency	mode no.	frequency
mode 1	1.51744E+09	mode 11	2.09736E+09	mode 21	2.56694E+09
mode 2	1.55603E+09	mode 12	2.10317E+09	mode 22	2.58399E+09
mode 3	1.55720E+09	mode 13	2.32915E+09	mode 23	2.60272E+09
mode 4	1.55878E+09	mode 14	2.46636E+09	mode 24	2.61892E+09
mode 5	1.56026E+09	mode 15	2.47653E+09	mode 25	2.62850E+09
mode 6	1.56122E+09	mode 16	2.48333E+09	mode 26	2.71646E+09
mode 7	1.94871E+09	mode 17	2.49272E+09	mode 27	2.76014E+09
mode 8	2.07281E+09	mode 18	2.50333E+09	mode 28	2.76229E+09
mode 9	2.07960E+09	mode 19	2.51293E+09	mode 29	2.76571E+09
mode 10	2.08869E+09	mode 20	2.54108E+09	mode 30	2.77015E+09

QUADRUPOLES (II)

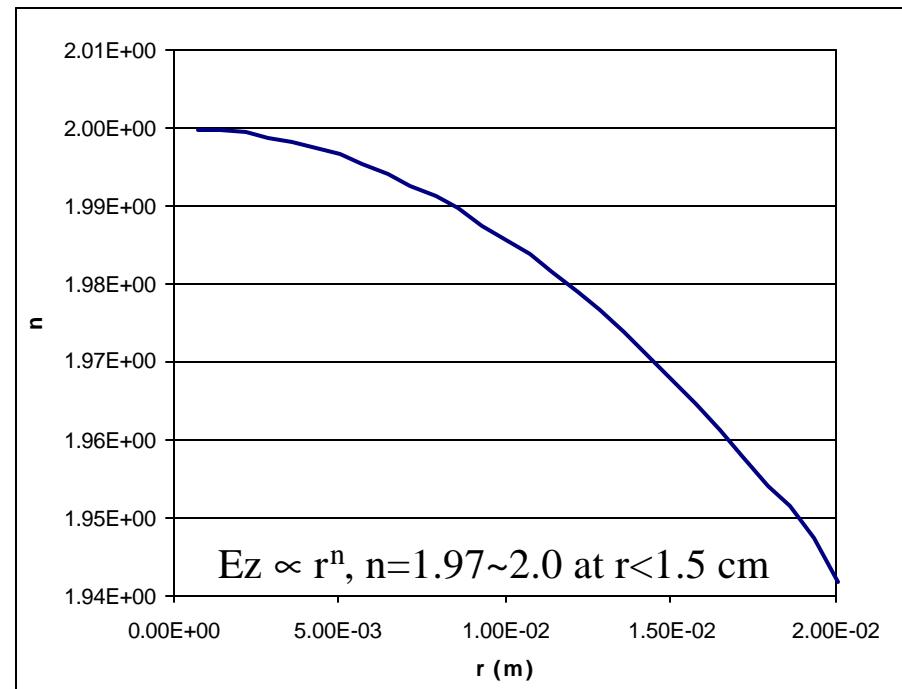
- R/Q definition used here;

$$\frac{R}{Q} = \frac{c^2 \left| \int \nabla_r E_z \exp(i\mathbf{w}_n z / v) dz \right|^2}{\mathbf{w}_n^3 U} \quad (\text{ohm})$$

Typical examples of index number via radial position



At around iris



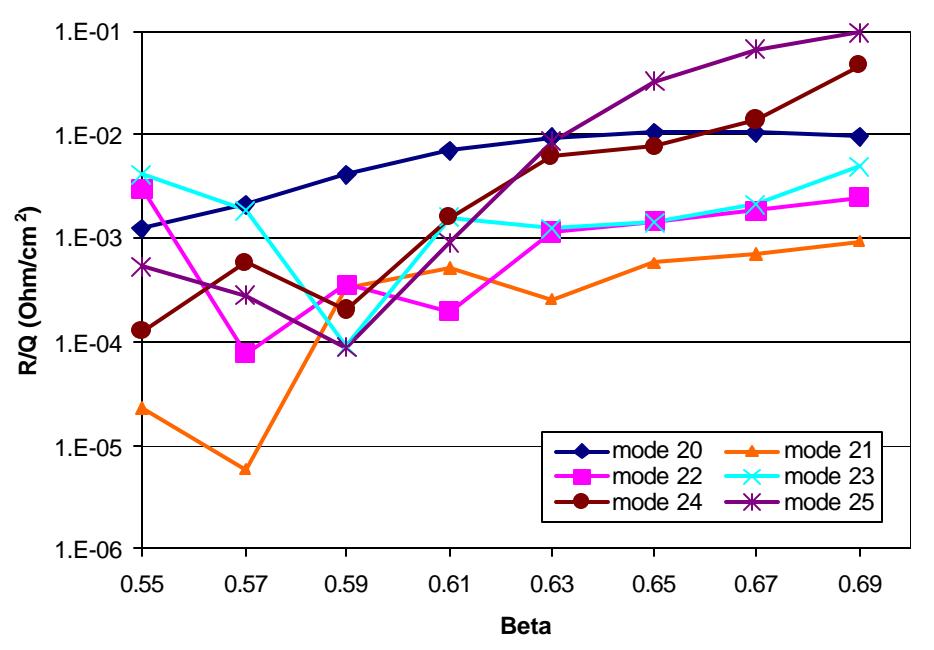
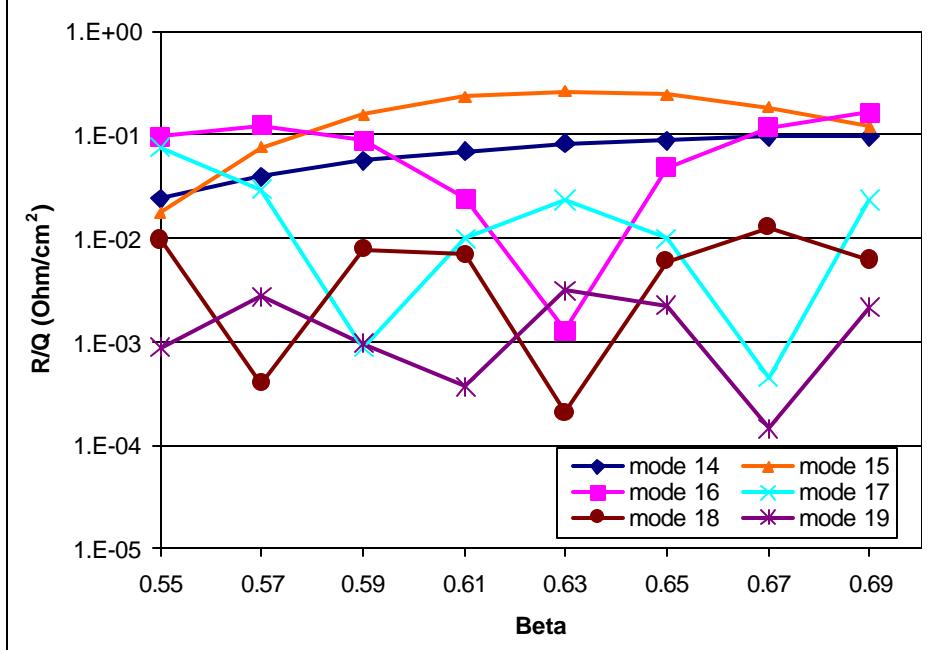
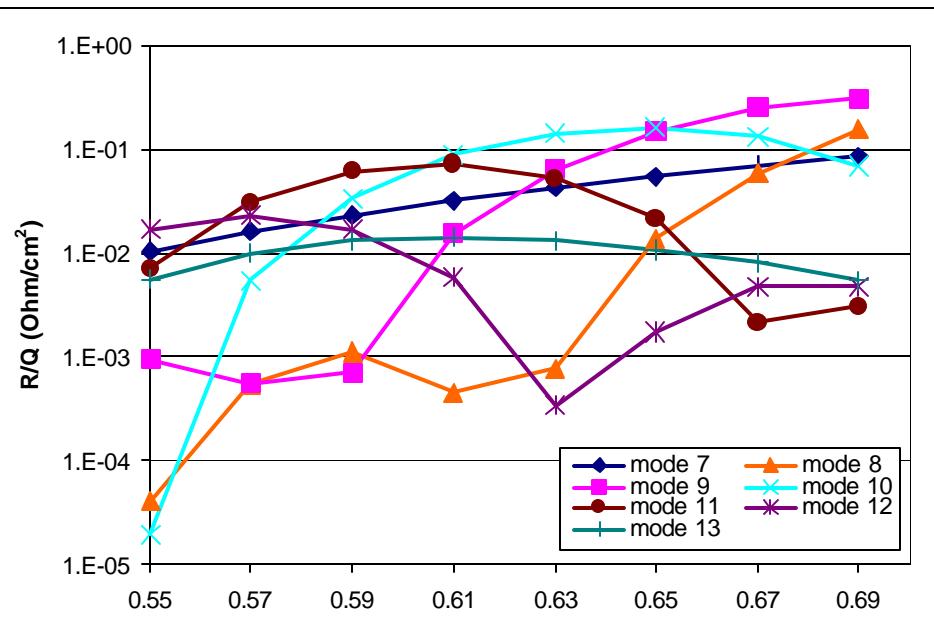
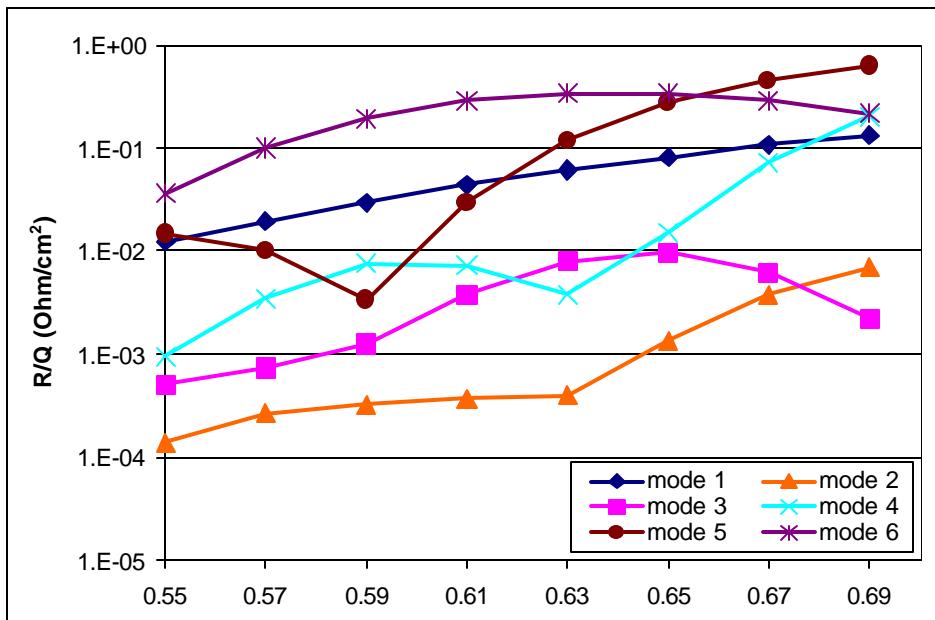
At the center of cell

$dE_z/dr \propto \sim r \rightarrow R/Q's$ depend on the radial position

R/Q's presented hereafter are calculated with E_z 's at $r=1$ cm in Ohm/cm²

R/Q's for other radial position (Ohm) = $(R/Q)_{r=1\text{ cm}} \times r^2$ (r in cm)

QUADRUPOLES (III)



SEXTUPOLES (I)

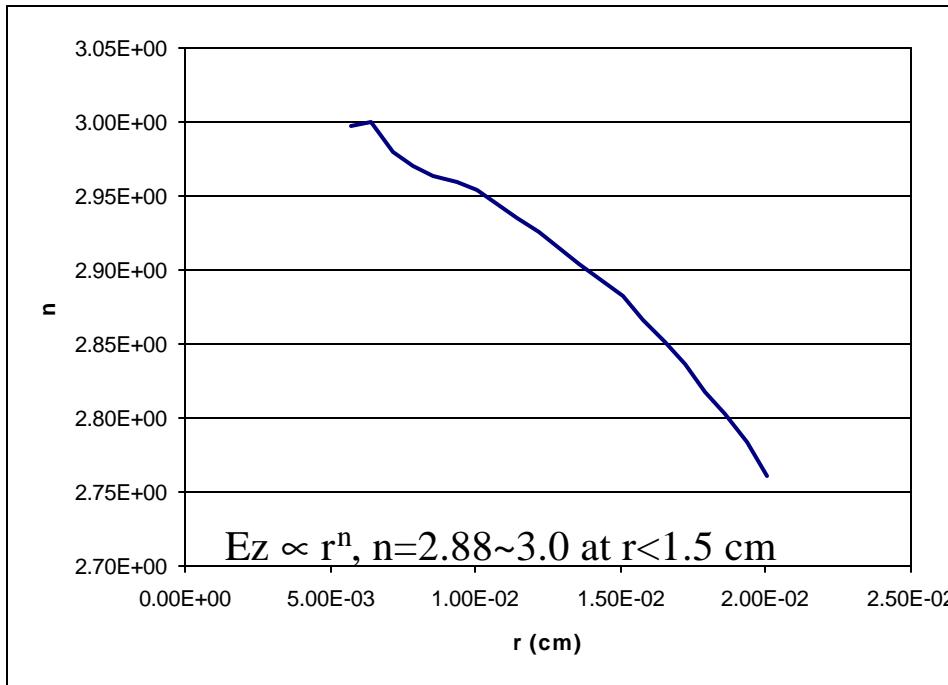
mode no.	frequency
mode 1	1.89045E+09
mode 2	1.93433E+09
mode 3	1.93453E+09
mode 4	1.93472E+09
mode 5	1.93494E+09
mode 6	1.93513E+09
mode 7	2.31760E+09
mode 8	2.38305E+09
mode 9	2.38357E+09
mode 10	2.38422E+09
mode 11	2.38476E+09
mode 12	2.39201E+09
mode 13	2.78600E+09
mode 14	2.87809E+09

SEXTUPOLES (II)

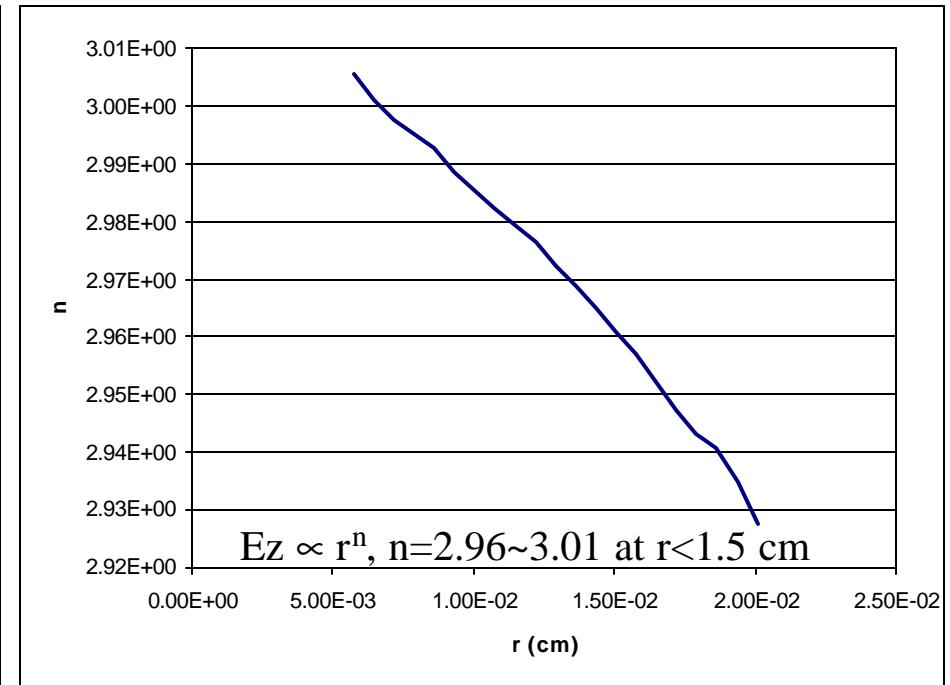
- R/Q definition used here;

$$\frac{R}{Q} = \frac{c^2 \left| \int \nabla_r E_z \exp(i\mathbf{w}_n z / v) dz \right|^2}{\mathbf{w}_n^3 U} \quad (\text{ohm})$$

Typical examples of index number variation via radial position



At around iris



At the center of cell

$dE_z/dr \propto r^2 \rightarrow R/Q$'s depend on the radial position

R/Q's presented hereafter are calculated with E_z 's at $r=1$ cm in Ohm/cm⁴

R/Q's for other radial position (Ohm) = $(R/Q)_{r=1\text{ cm}} \times r^4$ (r in cm)

