

# Beam Pipe --- Effects of the thickness change

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In previous analysis we assume the thickness of the beam pipe to be 8 mils, now we want to make a prototype with 10 mil thickness material, and it is desirable to know what effects this change will cause.

If the external magnetic field is the same, then the electromotive force is the same, and the eddy-current density is the same. Therefore all electromagnetic phenomena are proportional to the thickness of the beam tube.

Finite element model is used to calculate the stress and deflection of the beam pipe. For comparison, we also run a case in which the reinforce rib is 8 layers instead of 10 layers. It is seen that reduce the reinforcement is not a good approach.

Results are summarized in following tables.

1) Eddy current induced magnetic field compared with the external field  $|B^*/B|$ .

	$\omega = 30 \pi$	$\omega = 60 \pi$
$t = 8$ mils	0.613e-3	1.227e-3
$t = 10$ mils	0.766e-3	1.534e-3

2) Magnetic force compared with the vacuum pressure force  $|F_m/F_p|$ .

$t = 8$ mils	1.038e-2
$t = 10$ mils	1.359e-2

3) Power loss.

$t = 8$ mils	323 w/m
$t = 10$ mils	404 w/m

4) Stress and deflection.

	Max stress (psi)	Change of major diameter (in)	Change of minor diameter (in)
$t = 8$ mils	144539	0.110	-0.178
$t = 10$ mils	124342	0.106	-0.156
$t = 10$ mils 0.144 inch rib	239395	0.209	-0.308