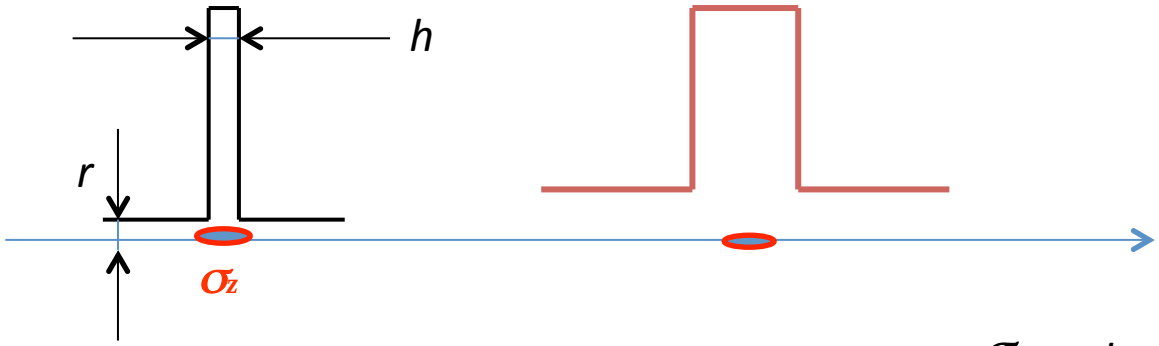
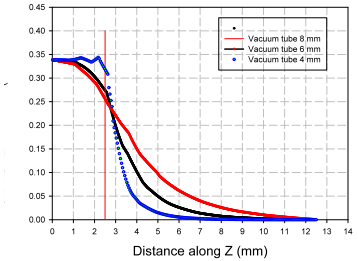


$\sigma_z \sim h$, or $\sigma_z > h$

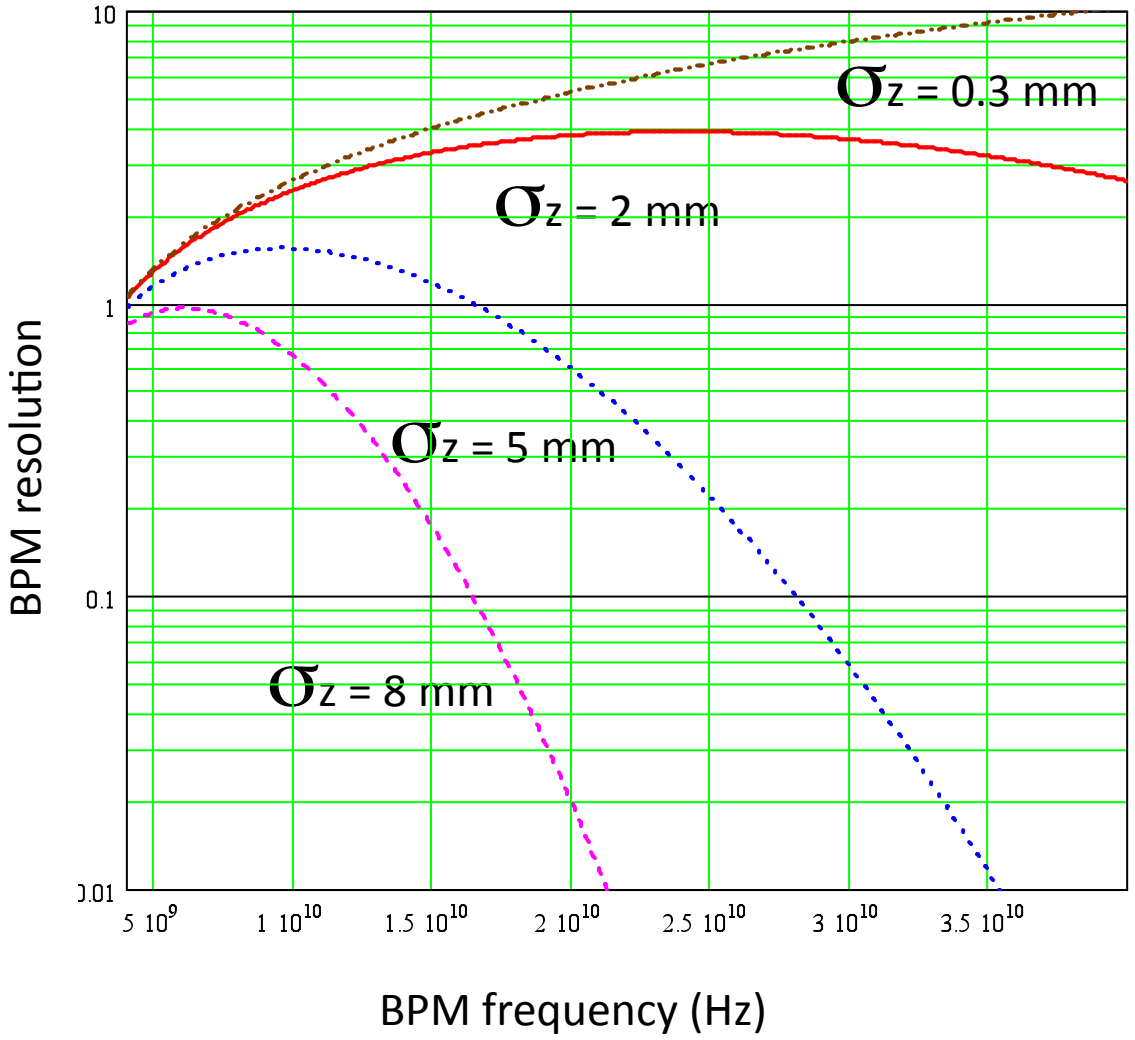
$Q \sim h$



$$V = \pi * 10.8 * \delta * q * f^2 * (\tfrac{R}{Q})^{0.5} * T(\theta/2) * S(\omega, \sigma_z) * \left(\frac{\beta * Z_{load}}{(1+\beta) * 2 * Q_{load}} \right)^{0.5}$$

$$S(\omega, \sigma_z) = \frac{\sin(\omega * \sigma_Z / 2 * c)}{\omega * \sigma_Z / 2 * c}, \ldots\ldots S(\omega, \sigma_z) = \exp(\omega^2 * \sigma_z^2 / 2 * c^2)$$

$$T(\theta) = \frac{\sin(\frac{\pi * Leff}{\lambda * 2})}{\frac{\pi * Leff}{\lambda * 2}}$$


10
1
0.1
0.01
BPM resolution
σz = 0.3 mm
σz = 2 mm
σz = 5 mm
σz = 8 mm
5 10^9
1 10^10
1.5 10^10
2 10^10
2.5 10^10
3 10^10
3.5 10^10
BPM frequency (Hz)

*F =1*10^10,*

*Z load=50 Ohm, δ=1*10^-9 m,*

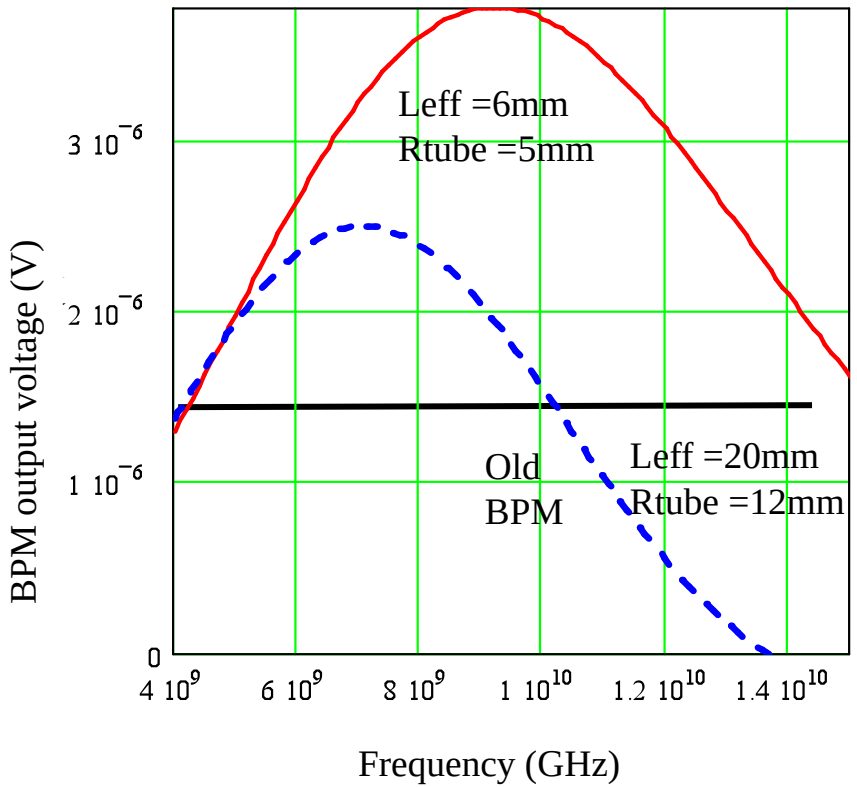
σ_z = 8 mm

Thermal noise

(dF=3 MHz, T = 300K) 1.57 μV

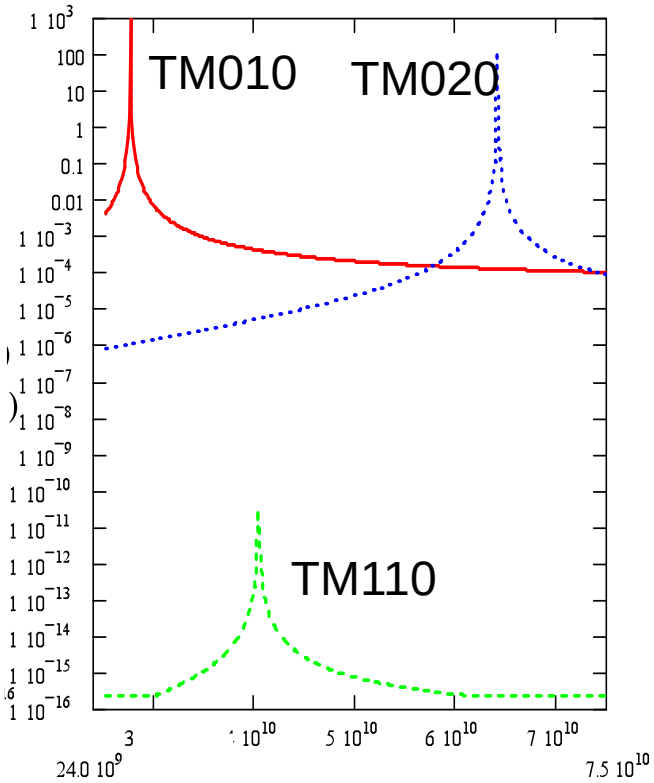
Q load=1500

β = 2.0



Cavity BPM, 6426 MHz

F010=4.4GHz, Qex=2.600,
F110=6.426GHz, Qload=3300,
F020=10.2 GHz, Qex=5800



For 1 nm resolution

$$P_{010}^{\max} / P_{110} = 135db$$

$$P_{020}^{\max} / P_{110} = 125db$$

Frequency difference:
TM010 - 60 db
TM020 - 65 db
Space mode selection:
For TM010 - 40 db(?)
For TM020 - 25 db(?)

Sum:
TM010 - 35 db, δ ~ +60 nm
TM020 - 25 db, δ ~ -17 nm