
The European Synchrotron

# CH07 Aluminium Chamber Defect

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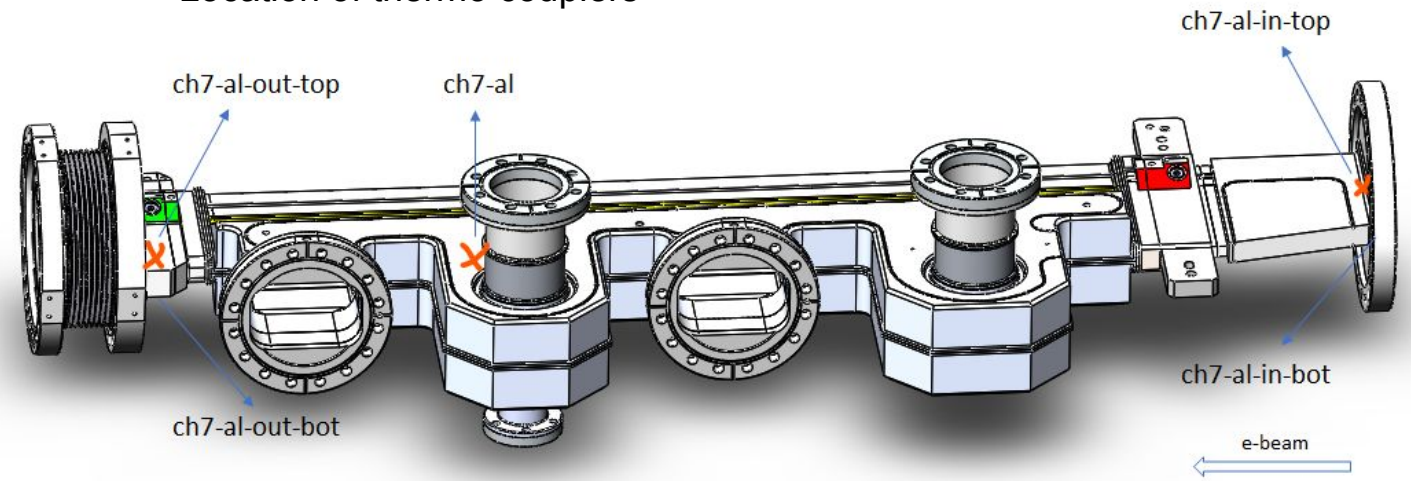
# INTRODUCTION

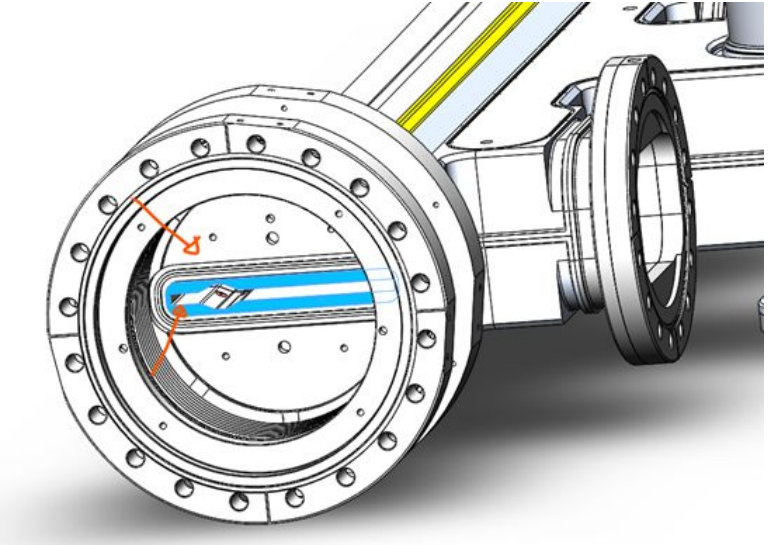
- **There is heating of the replacement CH07 chambers that were made in aluminium instead of stainless steel.**

Location of thermo couplers



# INTRODUCTION

- **Some info from Hugo,**

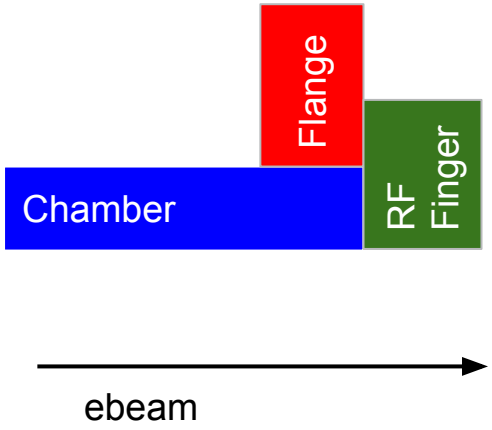


- cause of the heating could be the particular construction of the bpm block
- As it wasn't machined from a single block, the inner part is welded to the outer part, it creates the possibility that the two indicated surfaces are not in the same plane. If the inner part is slightly recessed this would create a gap and an impedance source which would explain the heating we observe. This feature is not present on the stainless steel version of these chambers, which show no heating.

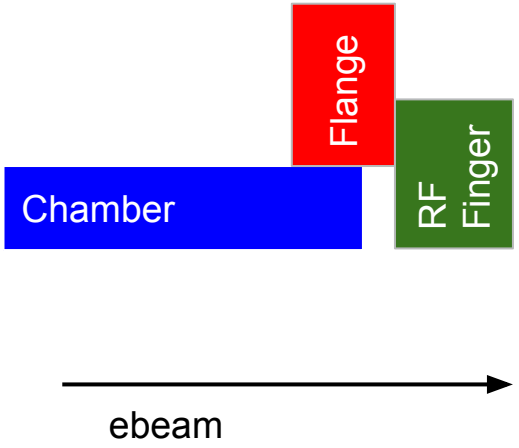
- **Heating is seen in all modes. (16b -> 70C absolute, 7/8+1 -> 50C). Vals for C14.**
- **The heating is worse in hybrid than 16b mode.**
- **Chamber could be bending but it is not know.**

# POSSIBLE GAP GEOMETRY

- According to Hugo, possible flange offset of 0.1mm to 0.2mm.

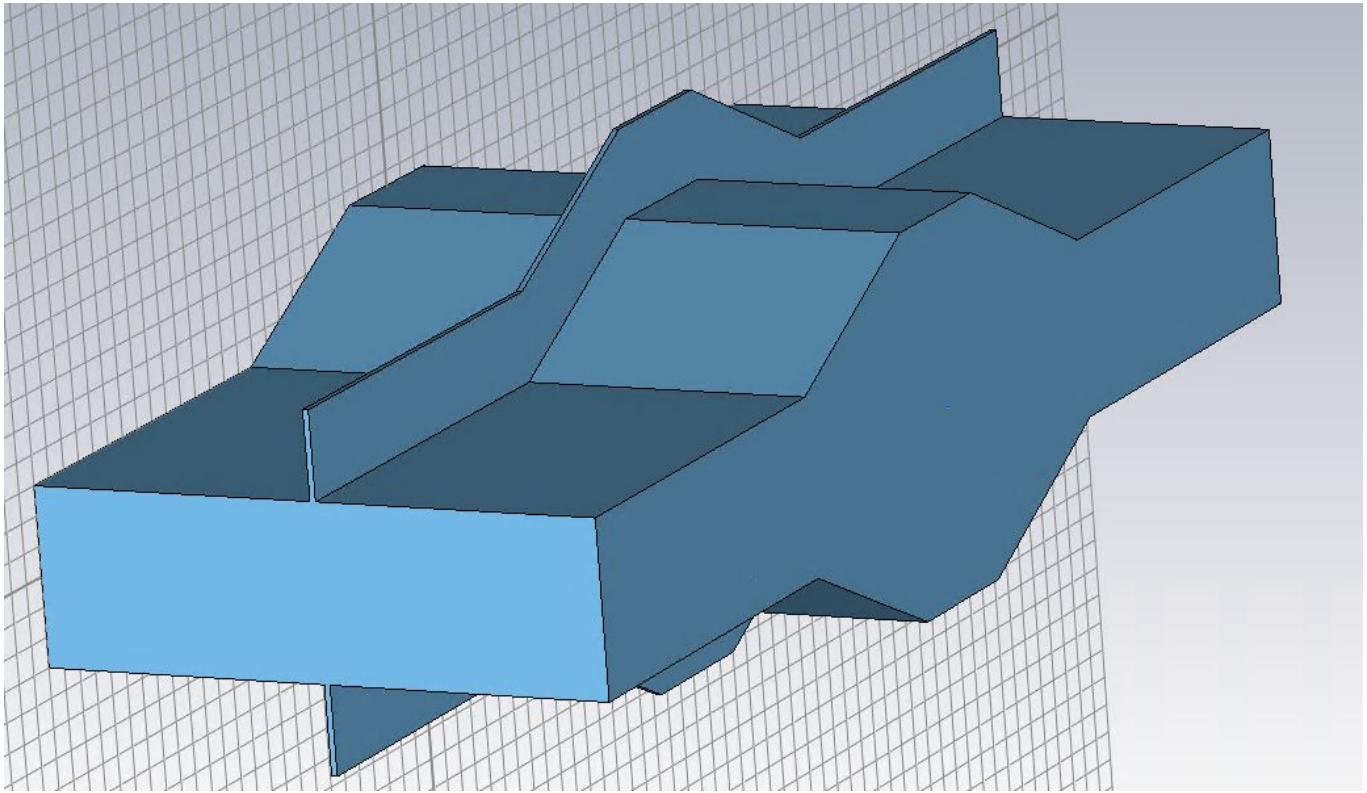



**Perfect case**




**Defect**

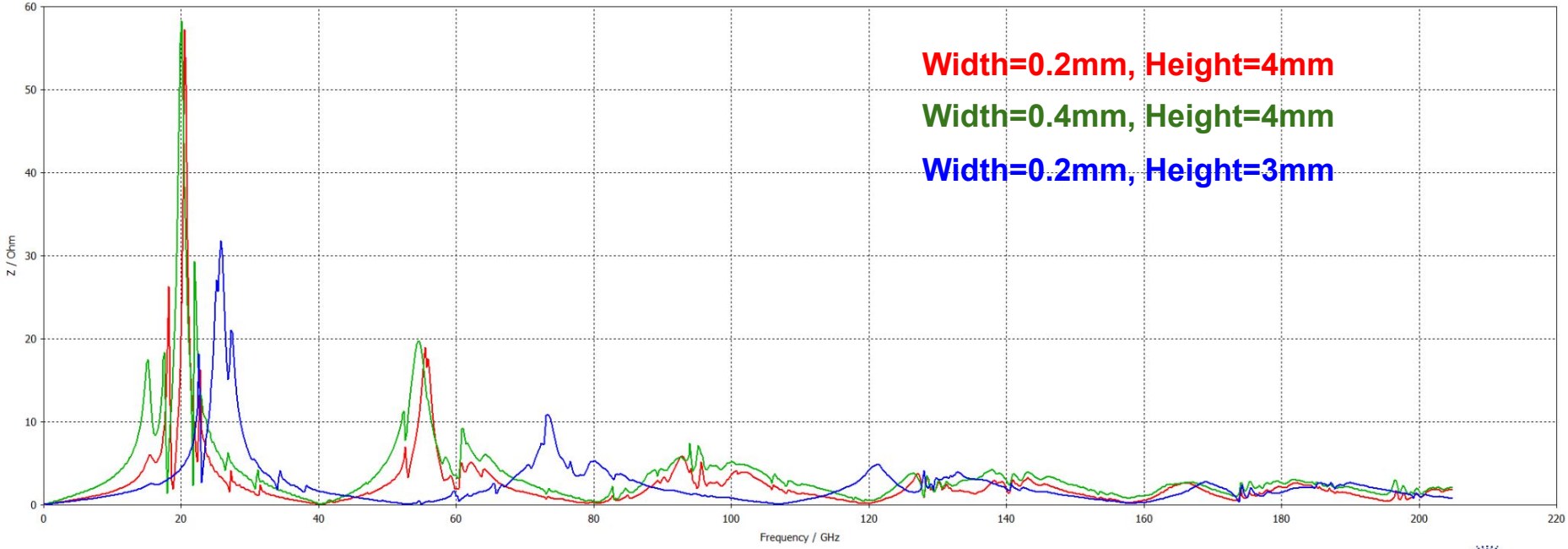
# POSSIBLE GAP GEOMETRY



- 2 free parameters:
- Defect width: ~0.1-0.2mm
- Defect height: ~3mm-4mm

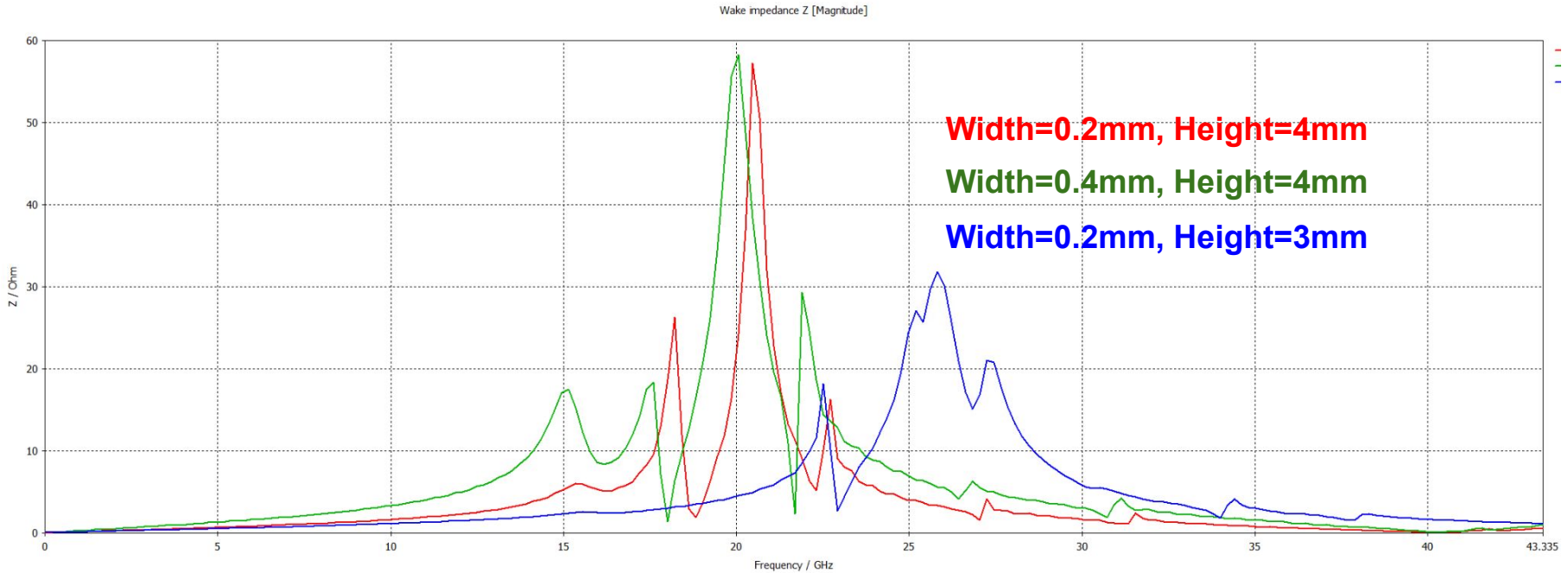
# IMPEDANCE RESULTS

- Sigmaz=0.5mm. Wake length = 1m.



# IMPEDANCE RESULTS

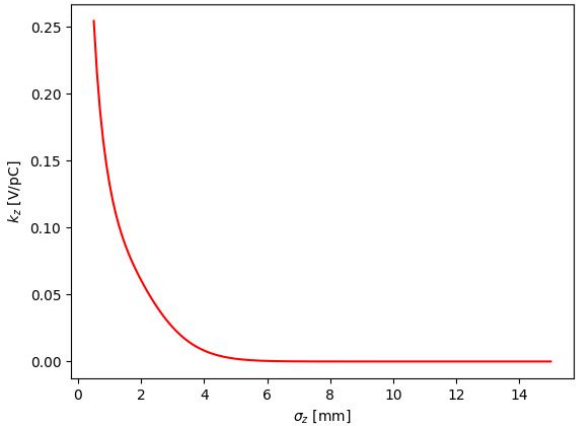
- Sigmaz=0.5mm. Wake length = 1m.

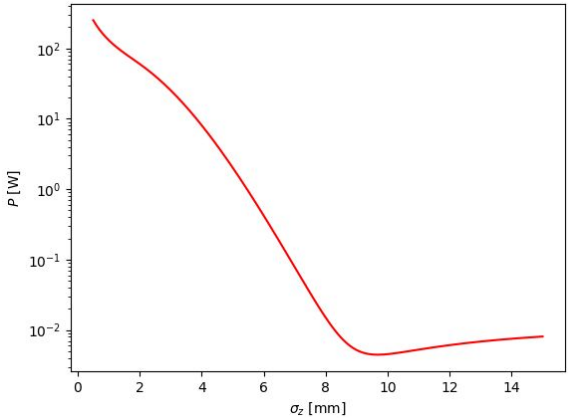


# IMPEDANCE RESULTS

- Taking the first case, we can take the impedance and recompute for different bunch lengths (assuming gaussian bunch).

**Width=0.2mm, Height=4mm**



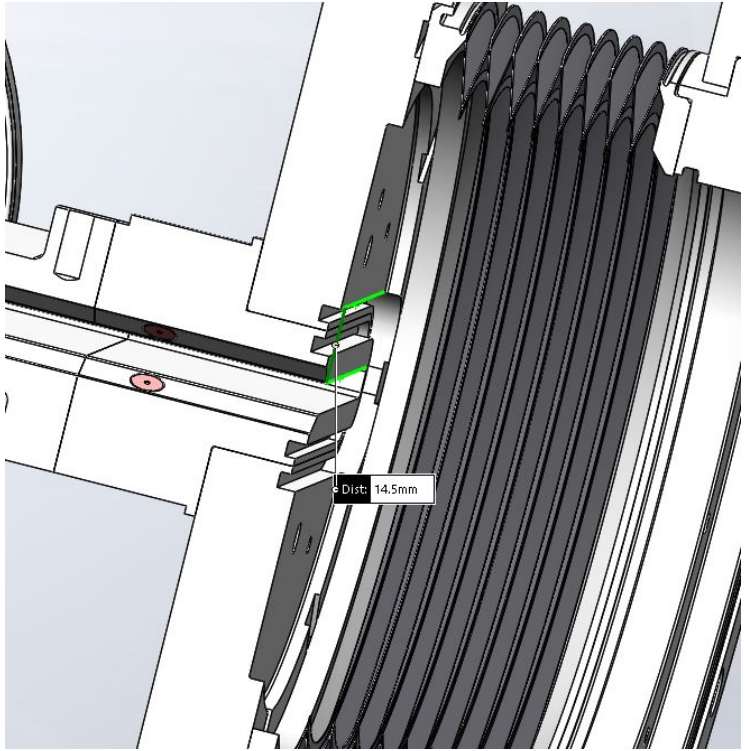

- Most of the impedance is around 20GHz, longer bunches do not excite higher frequencies. To observe heating, the peaks need to be much lower.
- Ib=0mA, sigz=3mm, sigf = 15.9GHz
- Ib=5.75mA, sigz=9.5mm***, **sigf=5GHz**. *** asymmetric - not gaussian

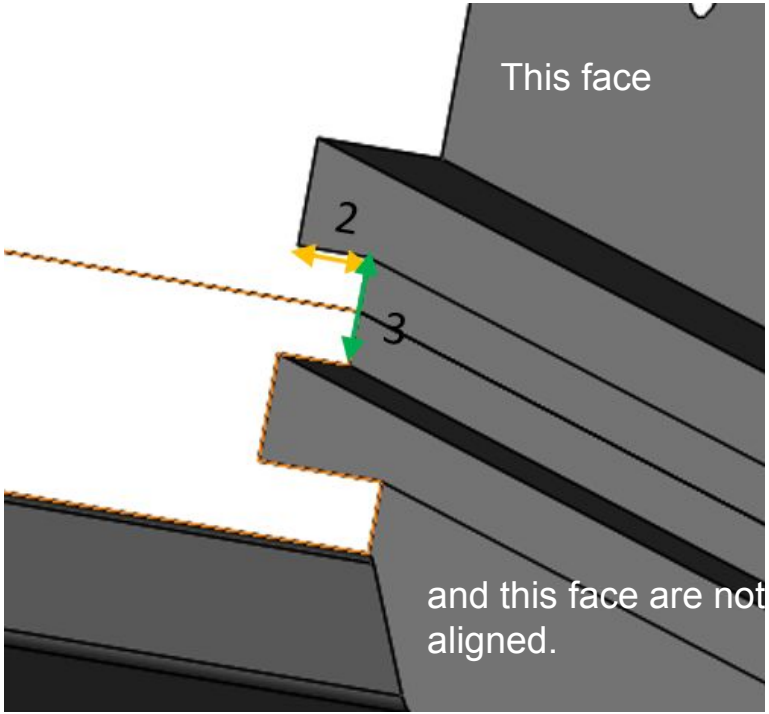
# IMPEDANCE RESULTS

- 6mm height puts first peak at 12GHz. Not low enough.
- 8mm height puts first peak at 10GHz.
- 10mm heights puts first peak at 8GHz.
- For peaks below 5 GHz, this needs to be a height of approximately 13mm. That's very large, is it realistic?

# CONTINUED

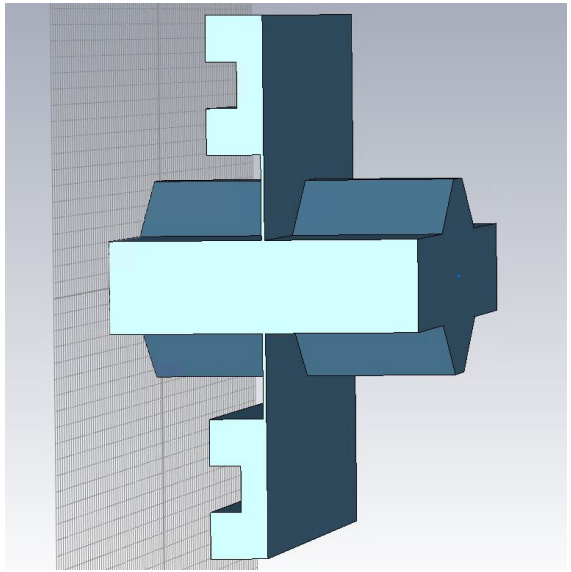
- **After checking with Hugo, yes it is realistic, and in fact, the real geometry is worse than originally simulated.**

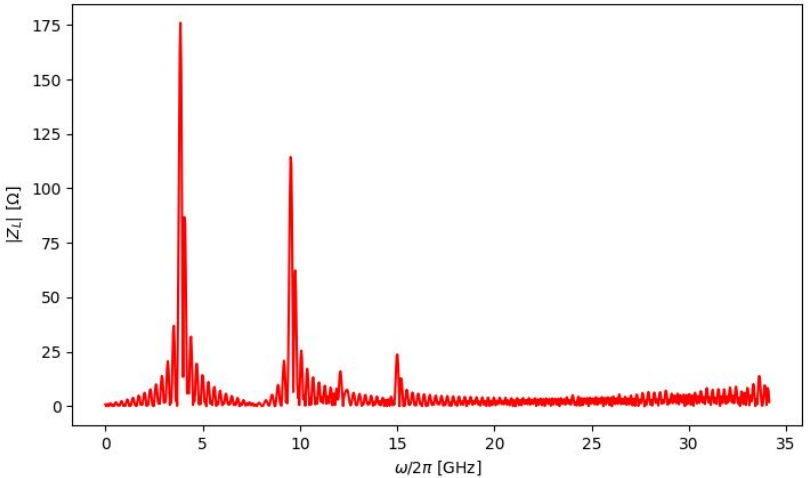


# CONTINUED

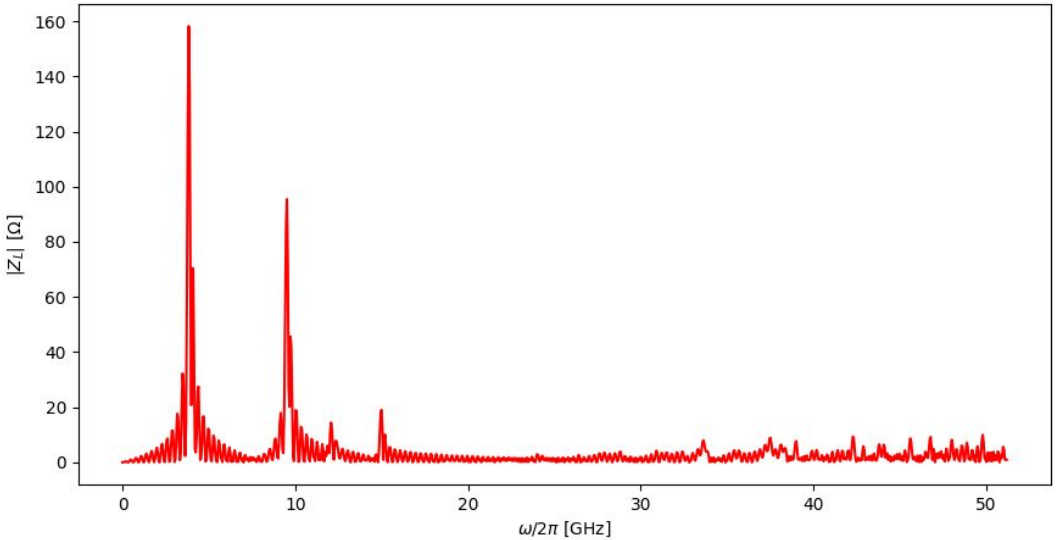
- So we put it in CST and rerun.
- Now it is a perfect resonator. We need aluminium material to give a Q.

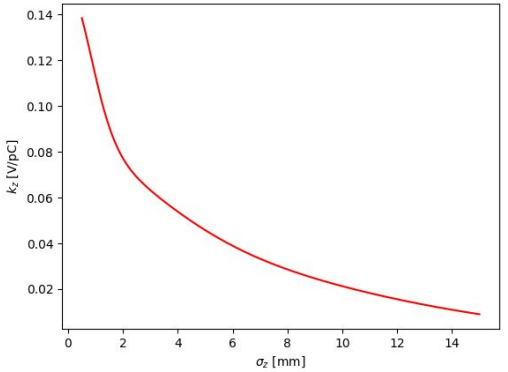


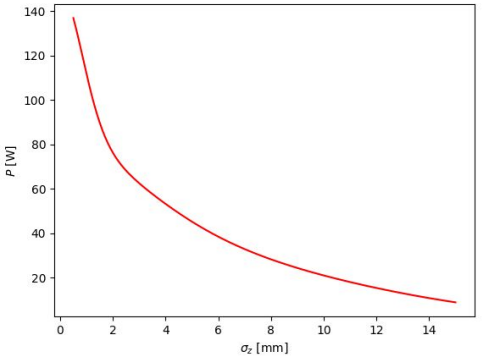


# CONTINUED

- **Below are results with aluminium and sigmaz=2mm**



# CONTINUED

- Can be compared to the welding defects plot from the paper (still not accepted)
- These defects reduced the MWT from 3.4mA to 2.6mA.
- Could be significant.

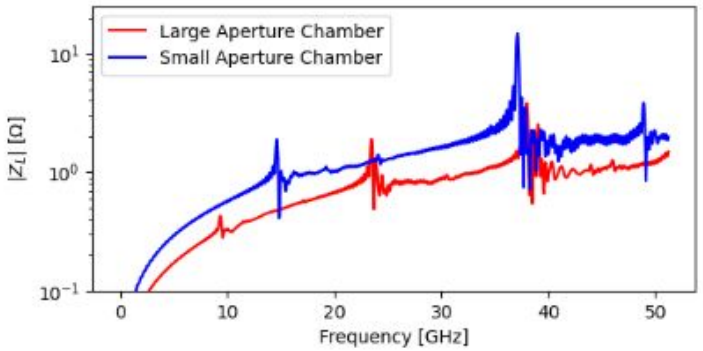



FIG. 7. Longitudinal impedance from a $\sigma_z = 2$ mm Gaussian beam and a block defect of $h_d = 0.3$ mm and $L_d = 2.5$ mm for small and large aperture vacuum chambers.