
IR beam pipe design
(for wake field calculations)

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FCC-ee MDI meeting # 9

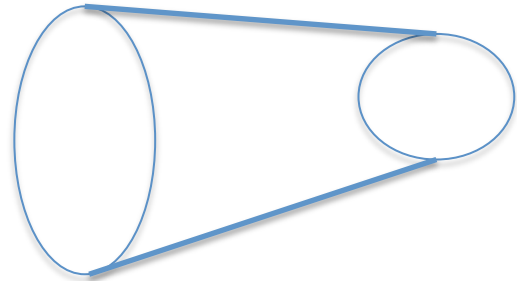
April 3, 2017

Current status of HOM analyses

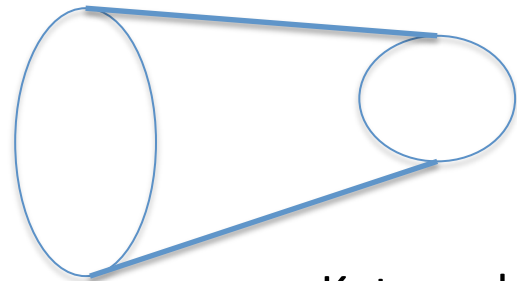
- ❖ Three different models of IR with same diameter of incoming pipes and of a central pipe
 - 1) Incoming pipes are squeezed to a half circle to merge into the central pipe with a constant diameter
 - 2) Incoming pipes are circular pipes but the central part has a sharp transition to an approximately elliptical shape of a double size in the horizontal direction.
 - 3) Full smooth geometry
- ❖ New approach for the wake field and eigen mode simulation using CAD files from “CATIA” for Interaction Region.
- ❖ Establish the file format and additional file description for better communication between “CATIA” and “CST”.



I



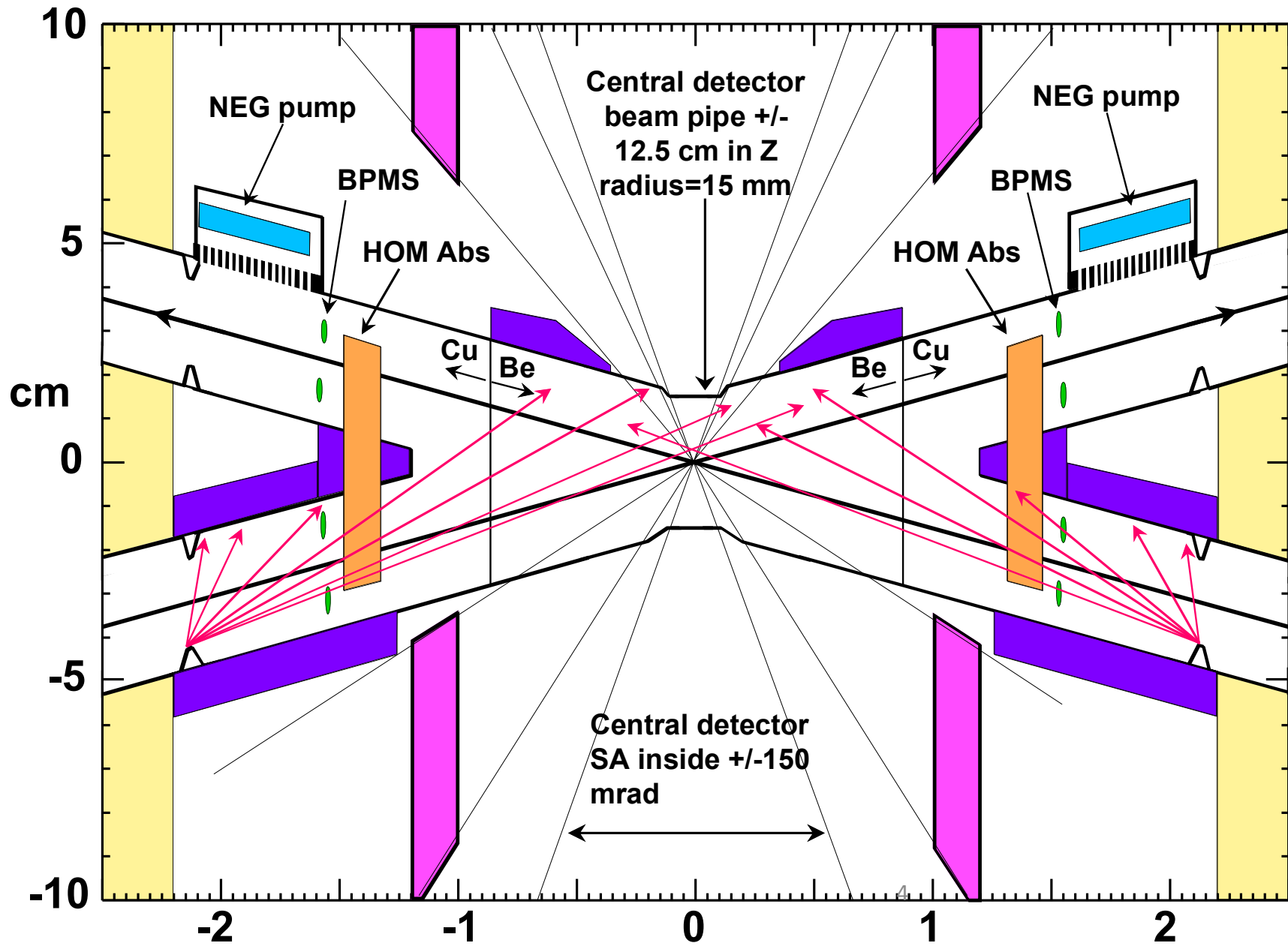
II



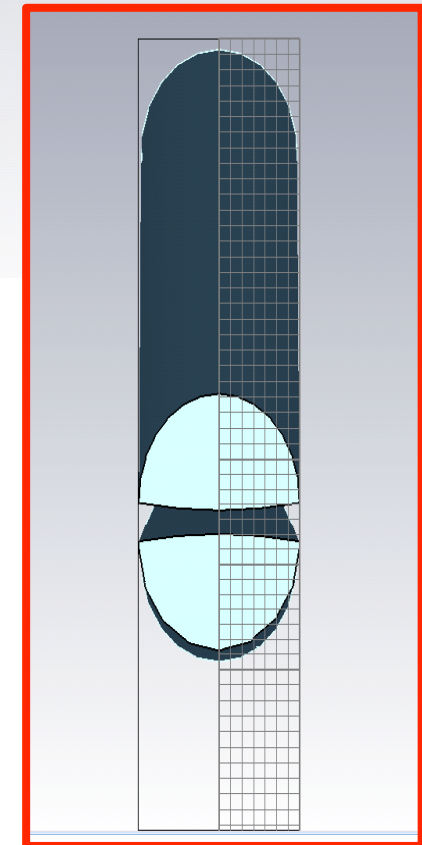
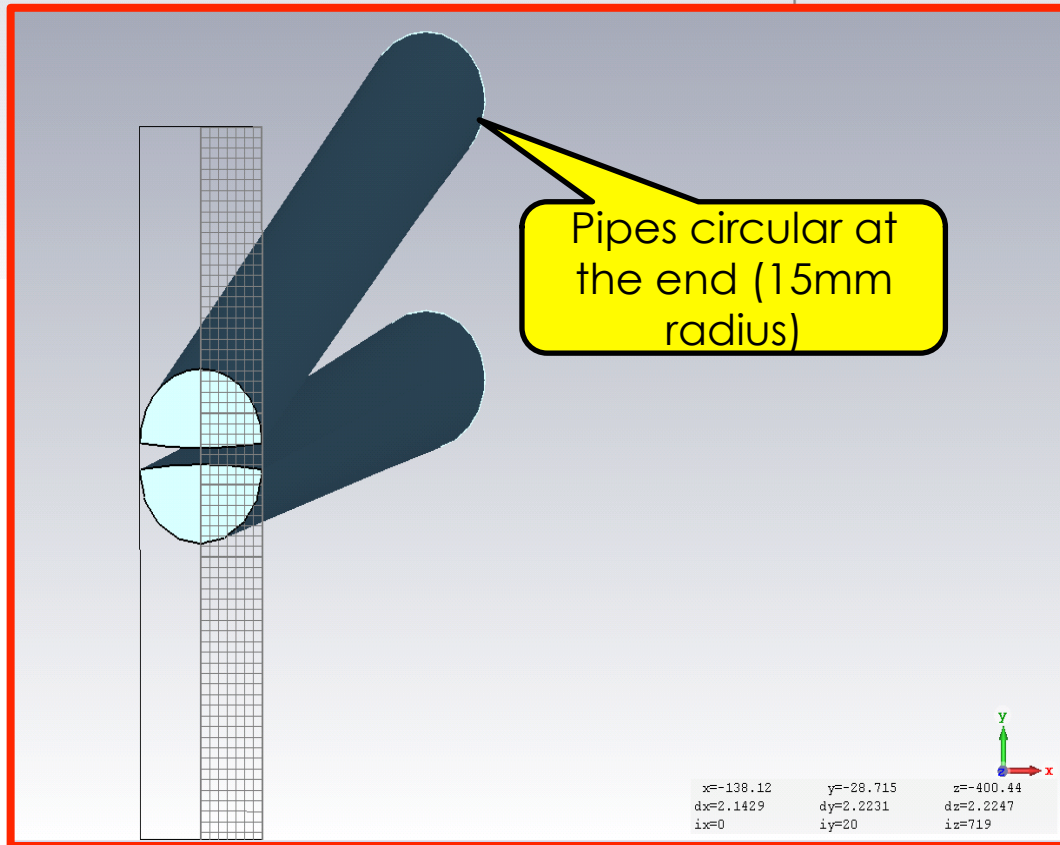
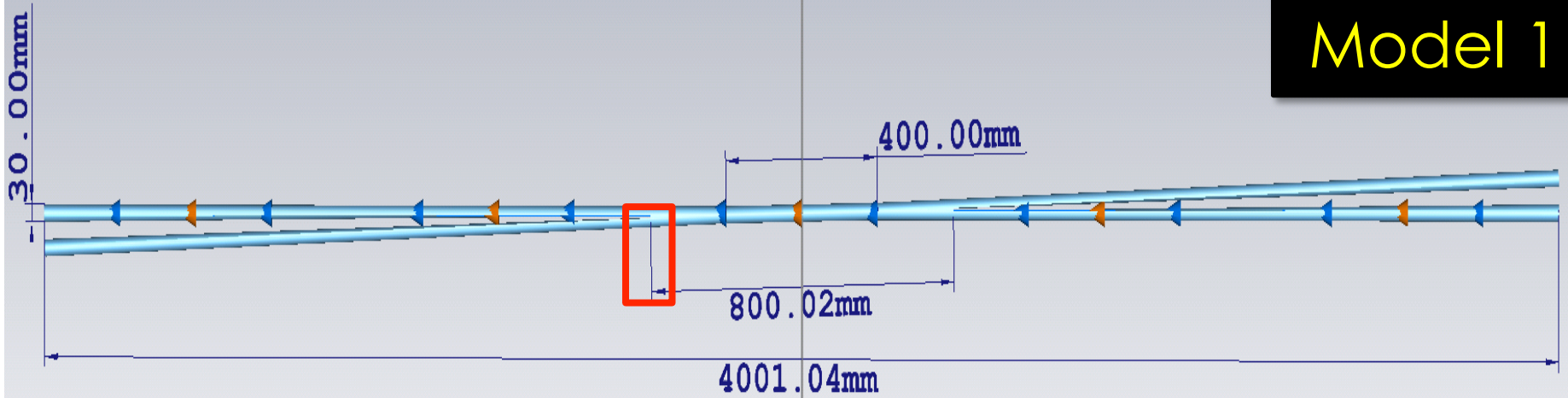
III

Katsunobu Oide

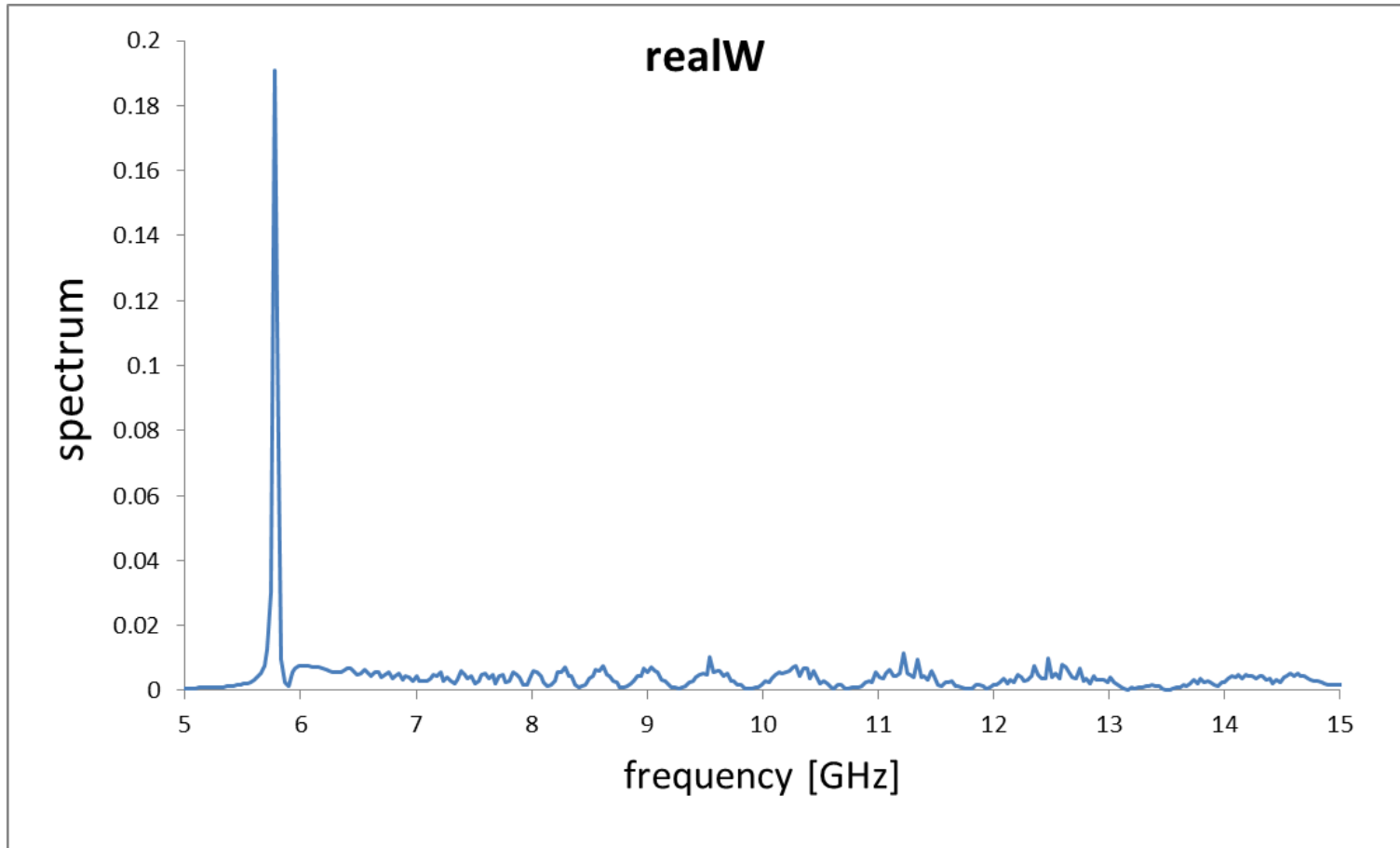
All models based on the M. Sullivan design



Model 1

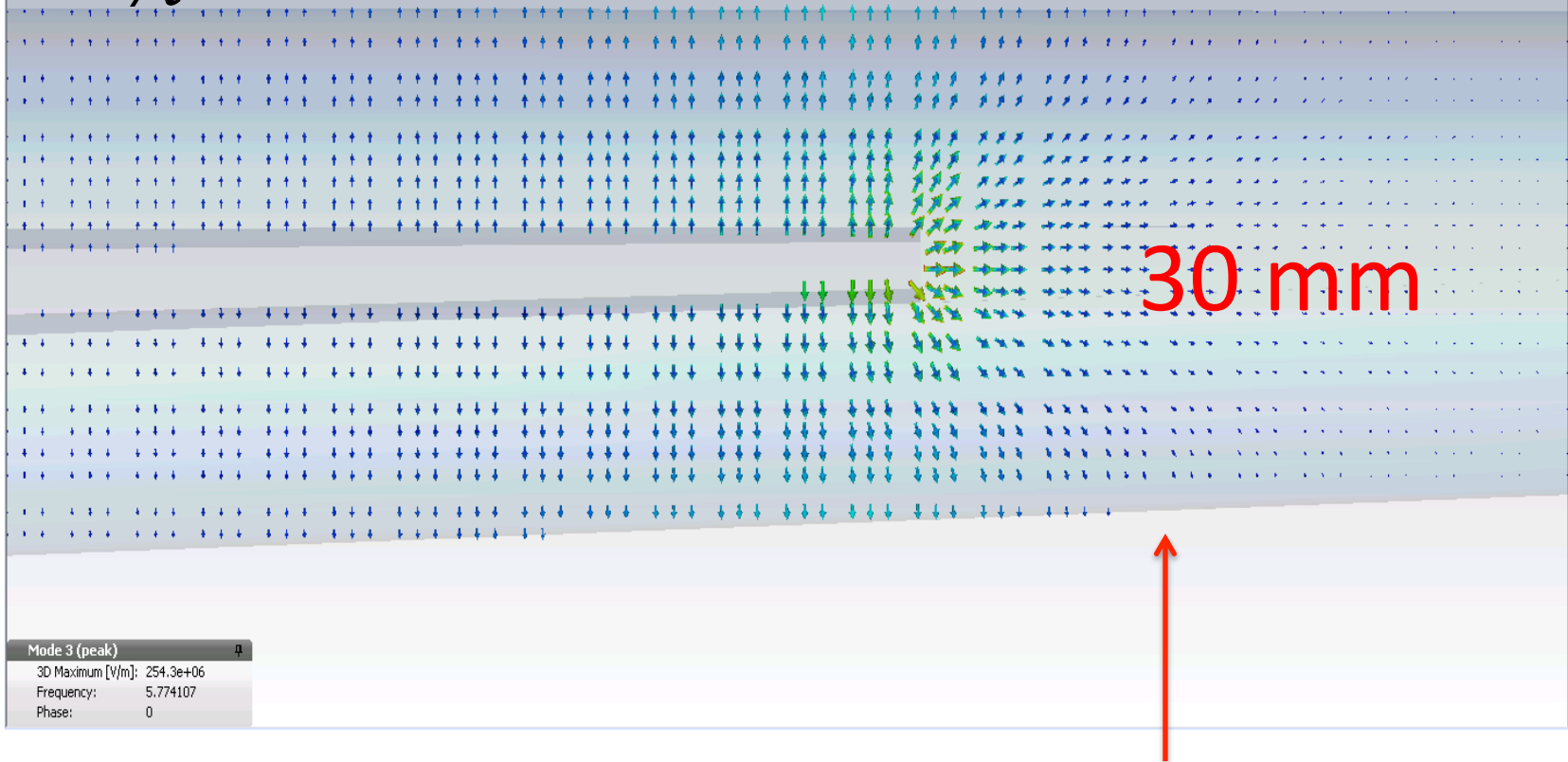


We found only one trapped mode

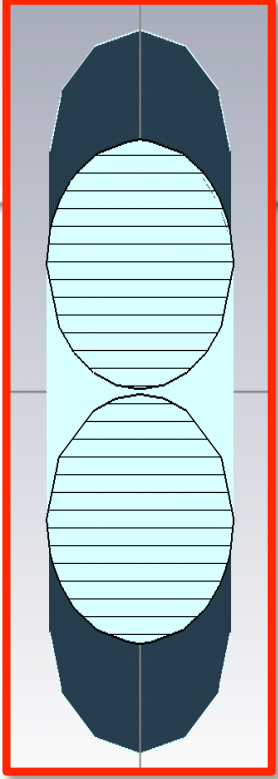
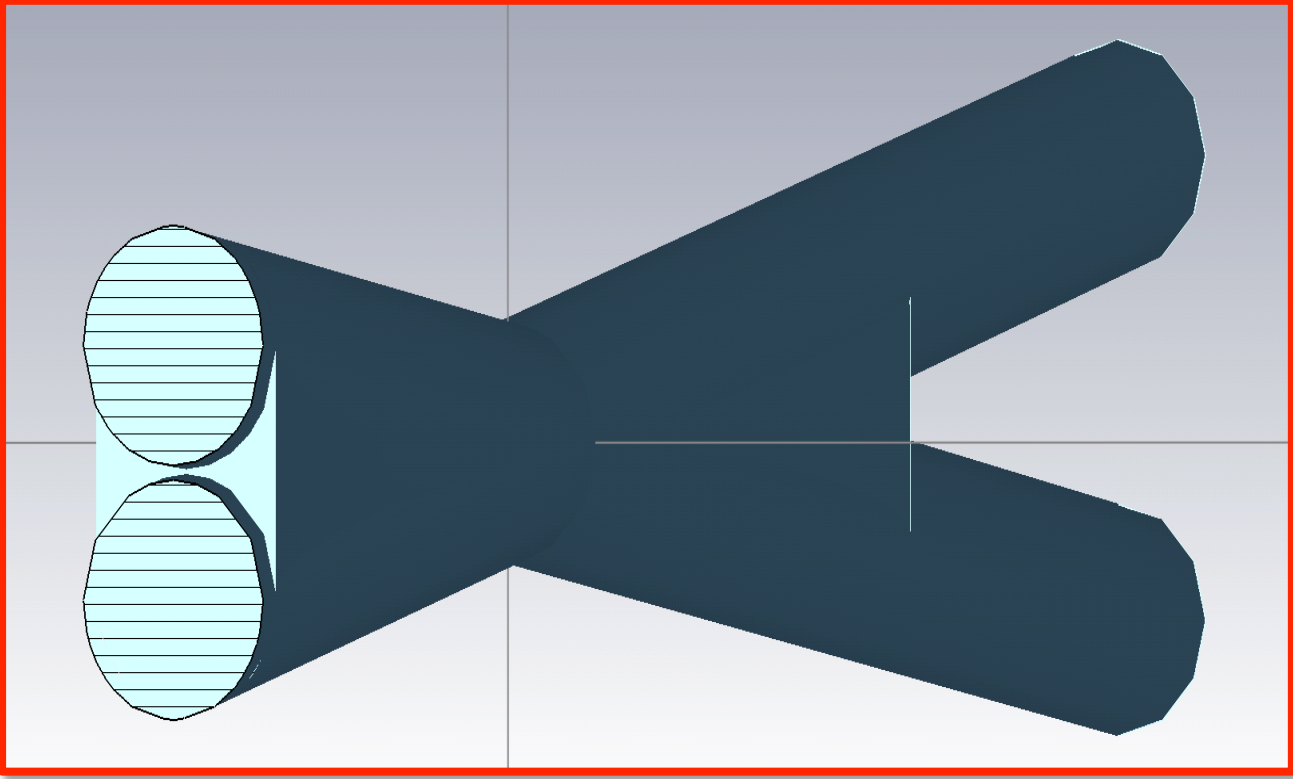
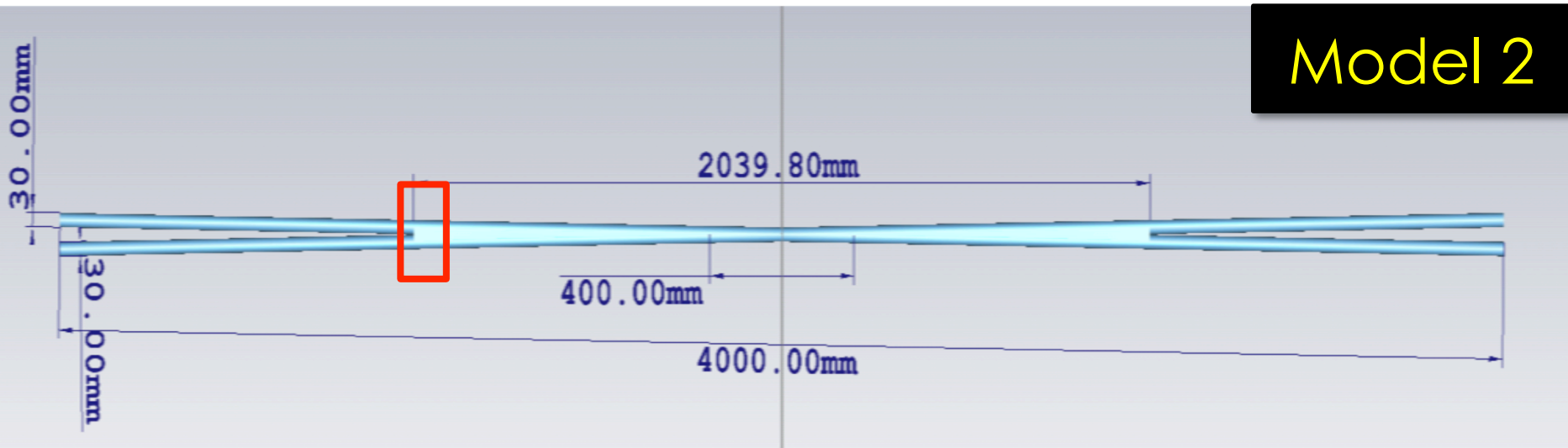


Spectrum $f_{\text{trapped}}=5.77$ GHz

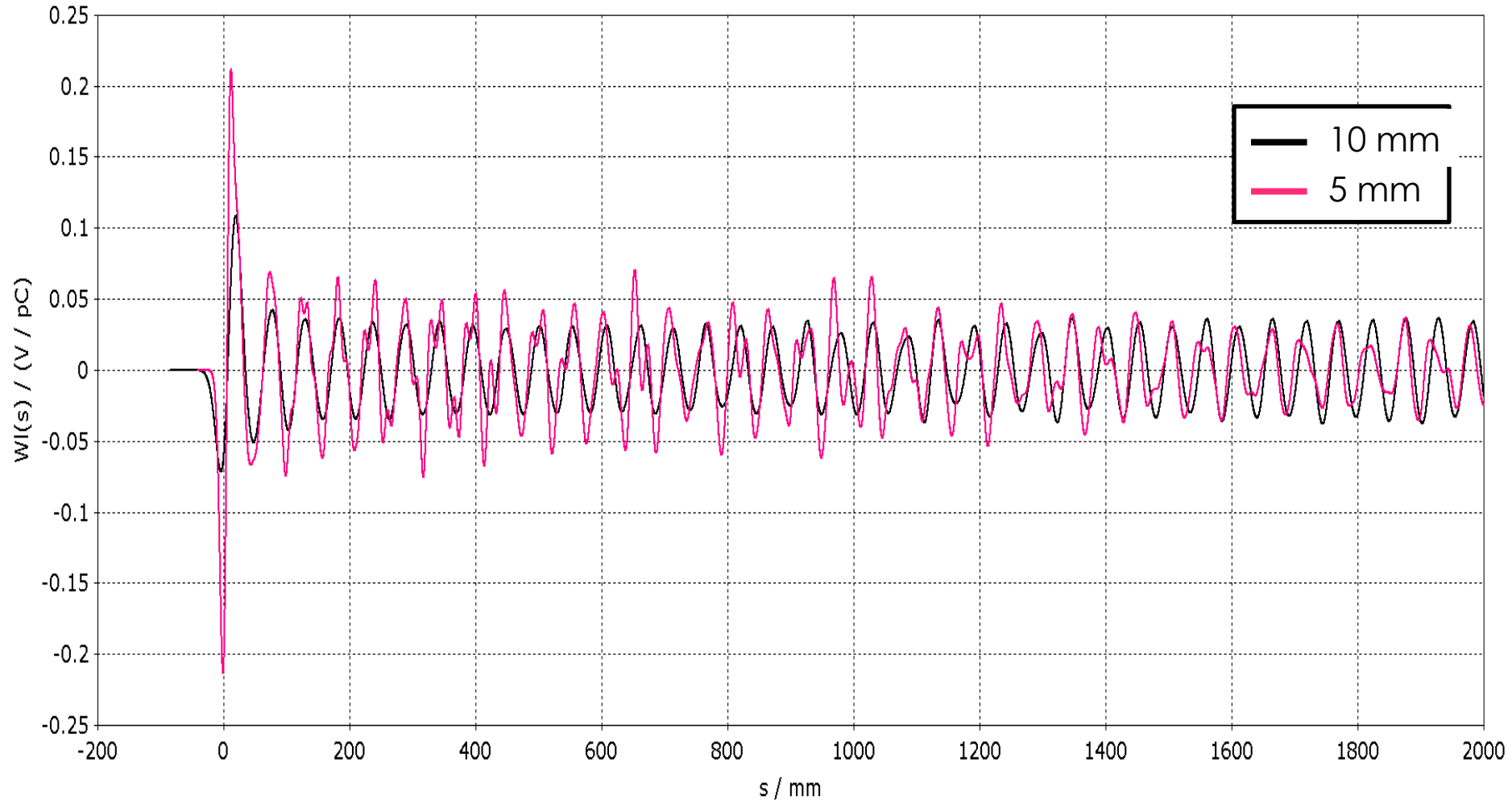
- Quality factor $Q = 8558$
- Shunt impedance $R_{shunt} = 210$
k Ω
- $R/Q = 25$



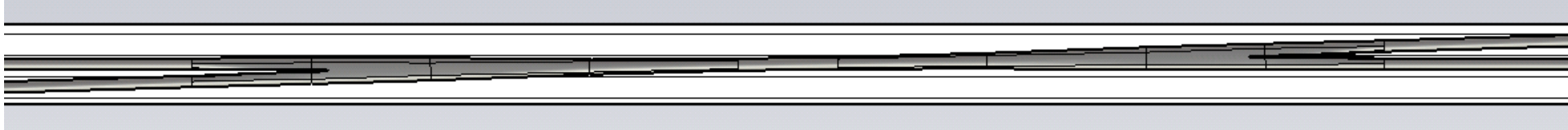
Model 2



We managed to do only wake field simulation,
but failed to do eigen mode simulations.



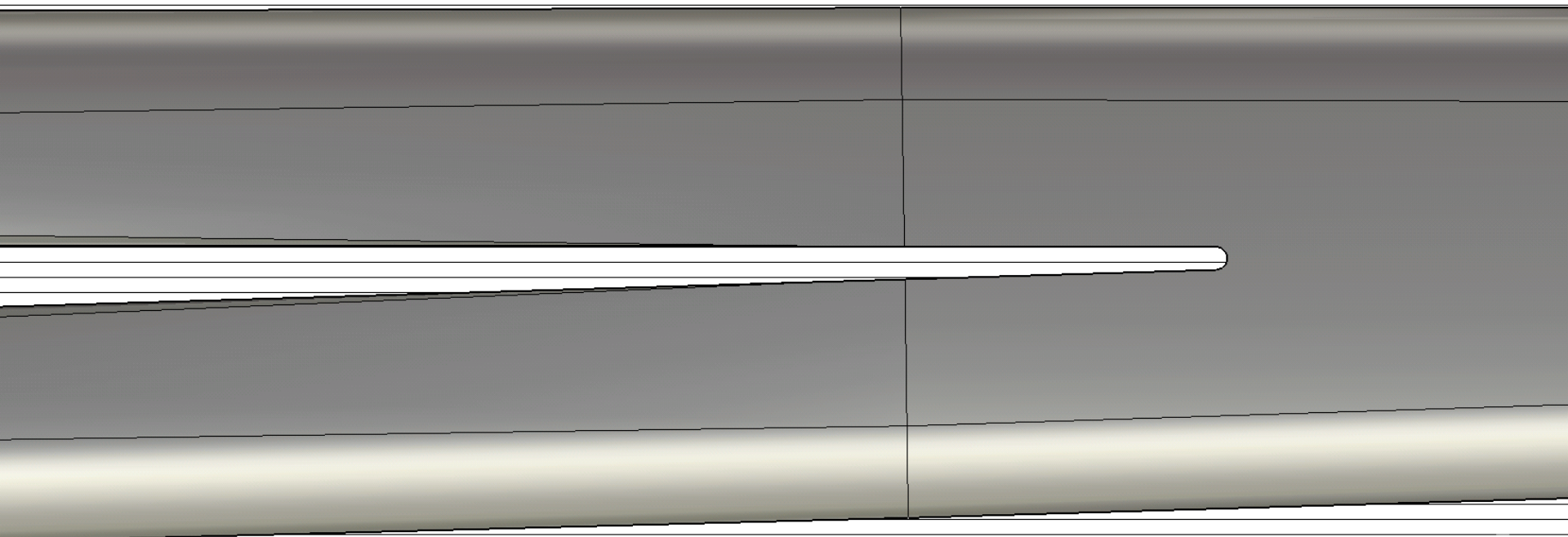
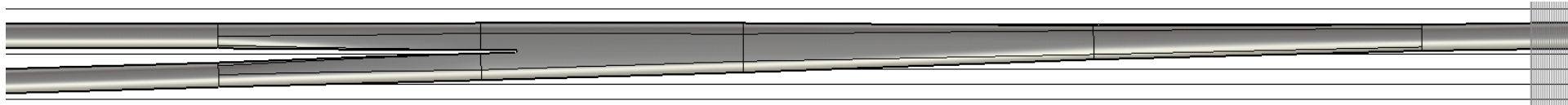
Using CAD files from “CATIA”
Great, fantastic work of Miguel Gil Costa



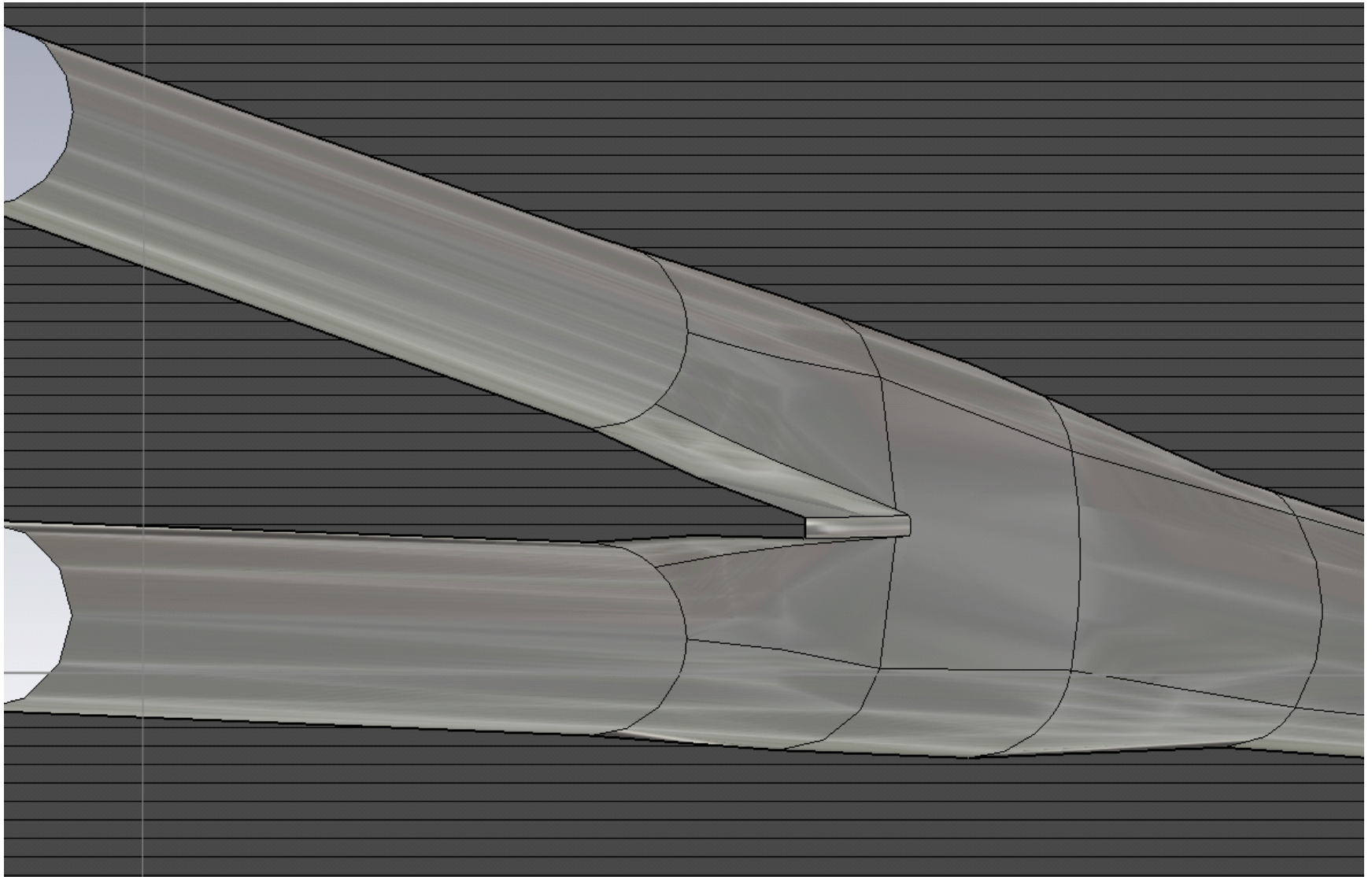
Here are results from 2 ½ days
of intense work

More details of the model

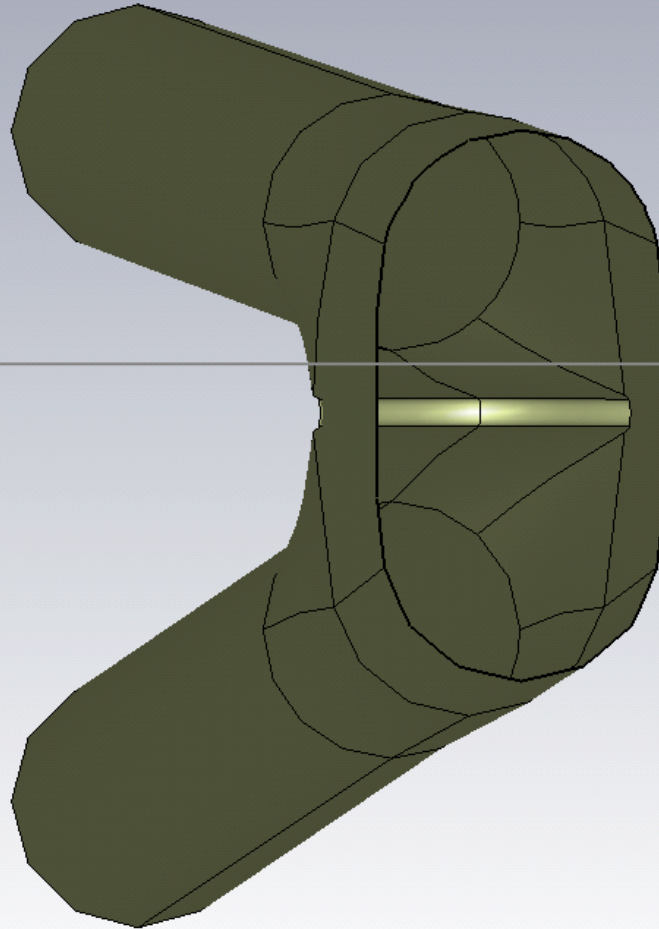
Model 3



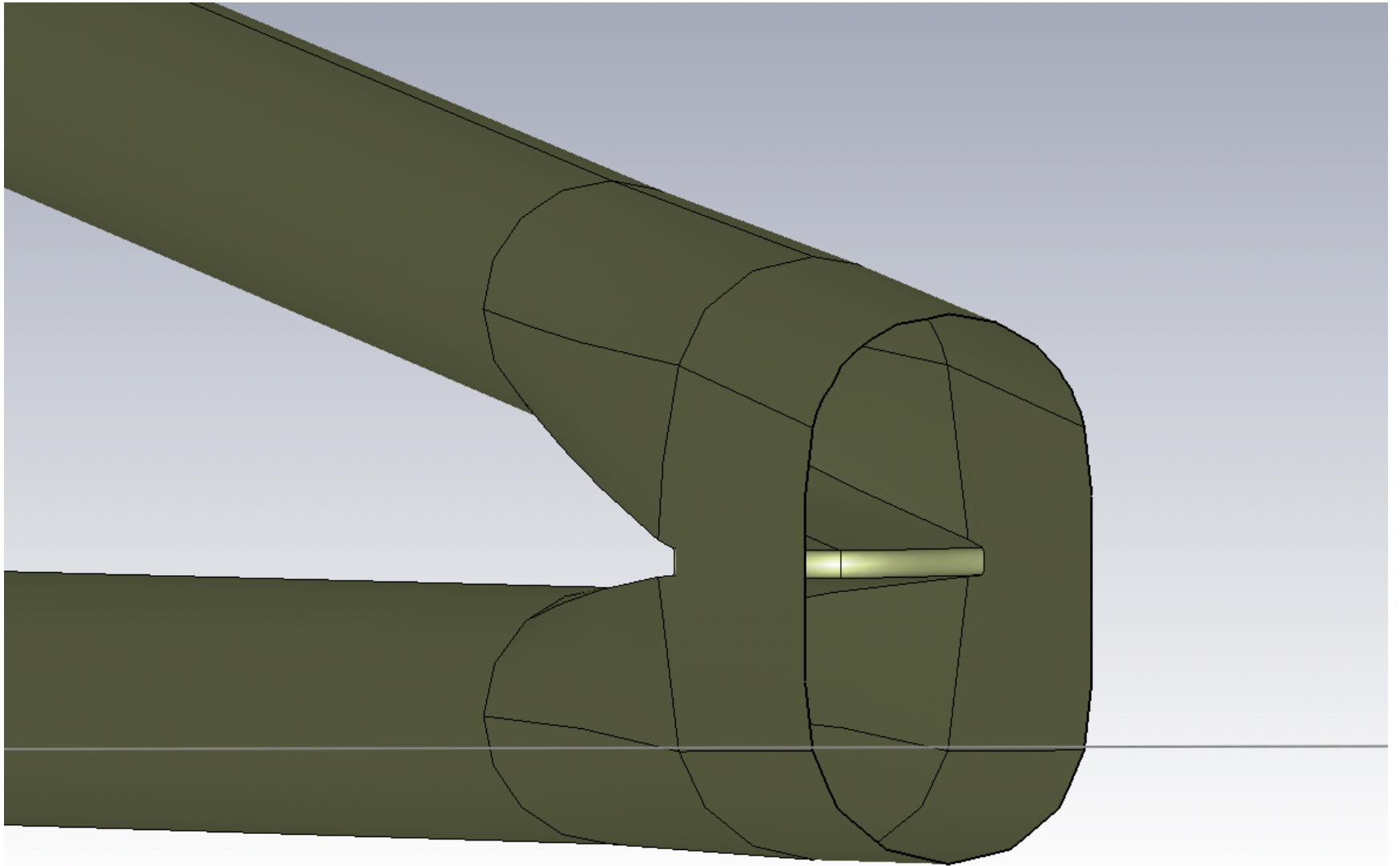
More details. All smooth geometrical transitions.



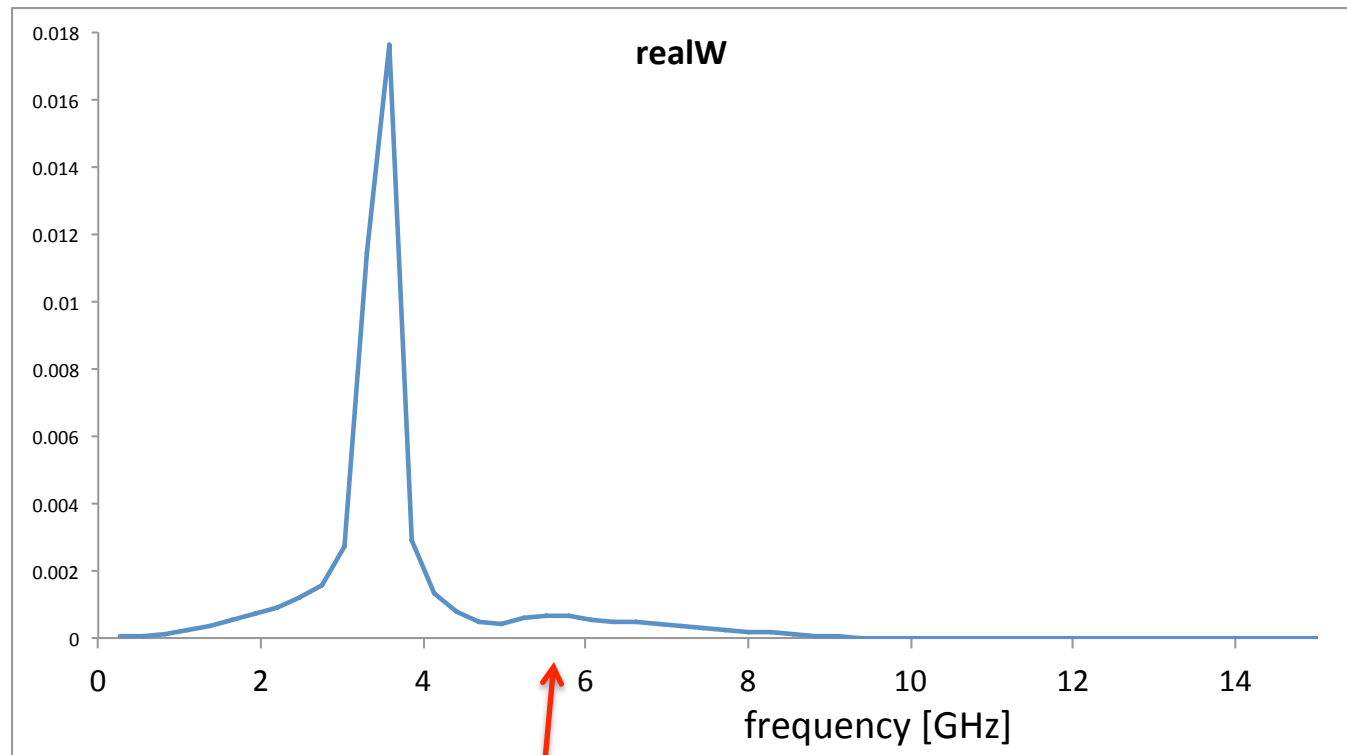
Inner view



Inner view

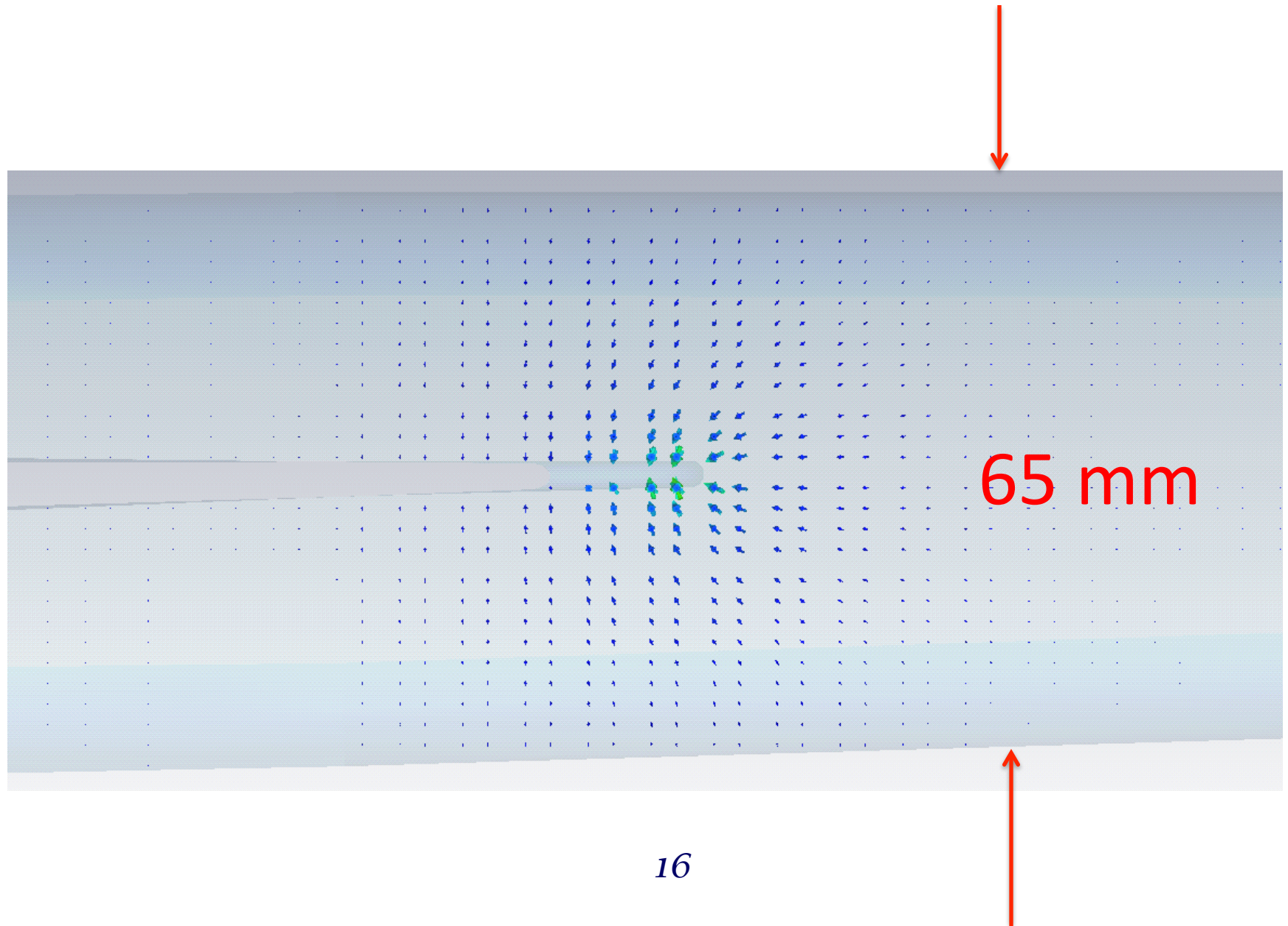


We found one mode, but less frequency 3.5 GHz

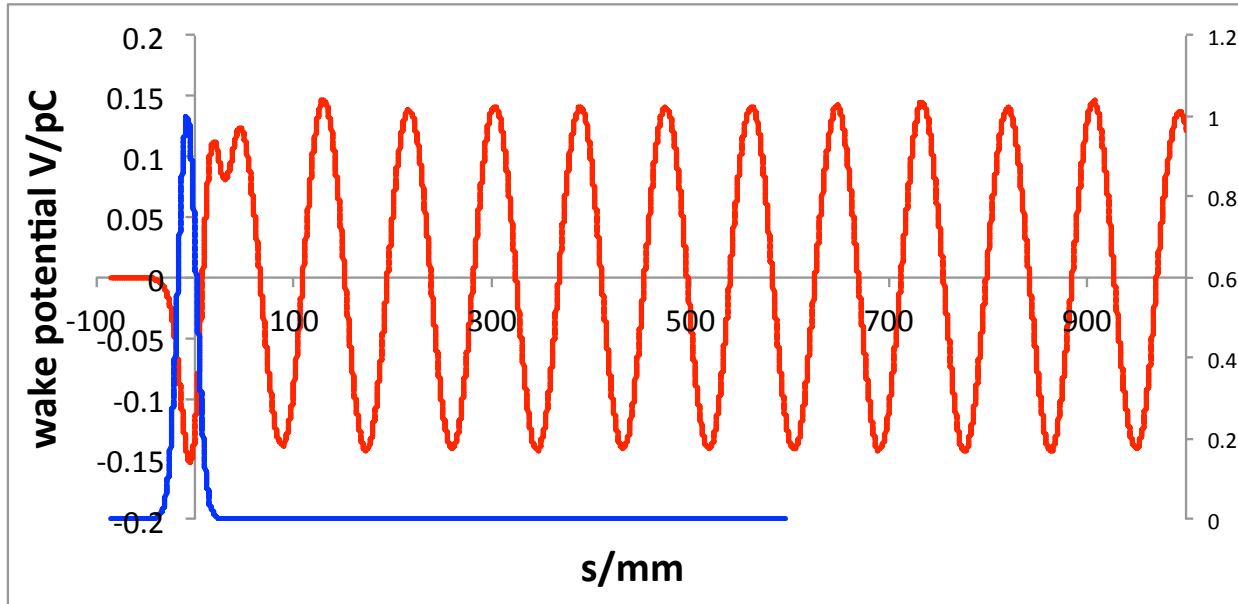


But maybe there some other modes.
Need to check with a shorter bunch

Mode frequency 3.5 GHz. Field distribution

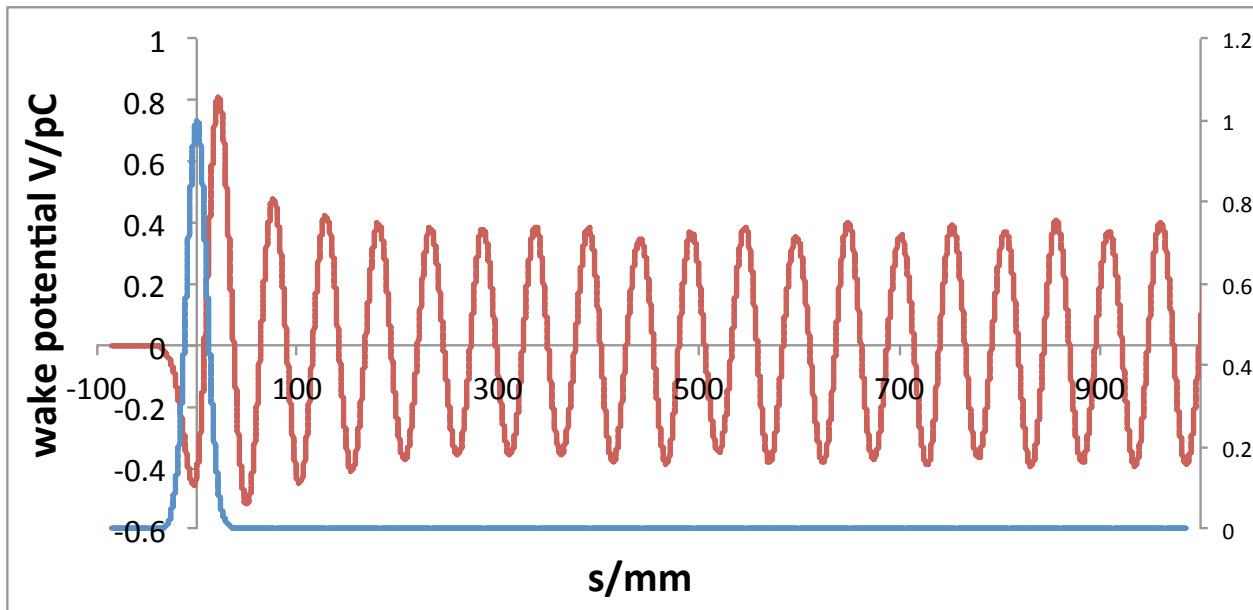


Comparison of wake potentials



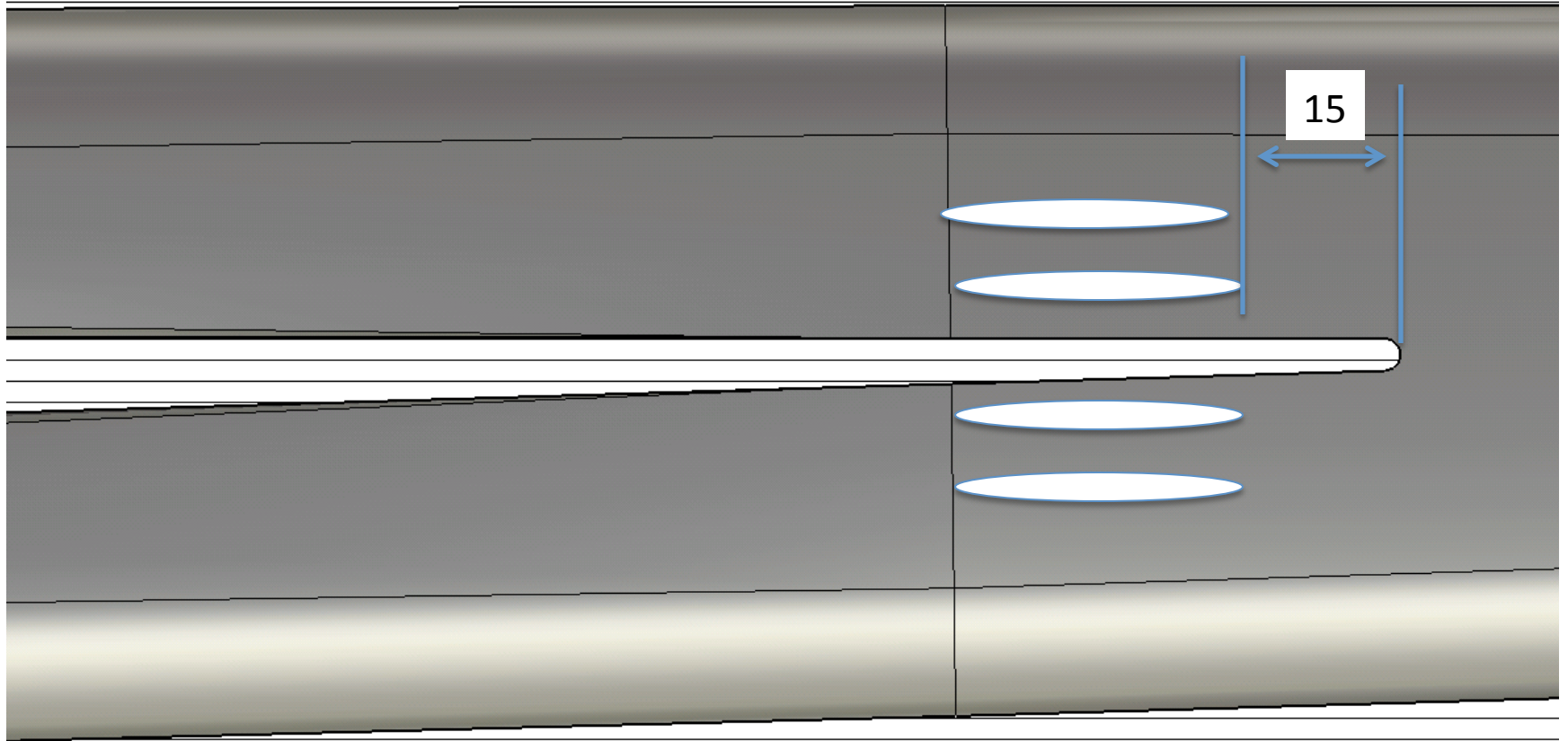
Model 3

Amplitude
3 times
smaller in
compariso
n with
model1

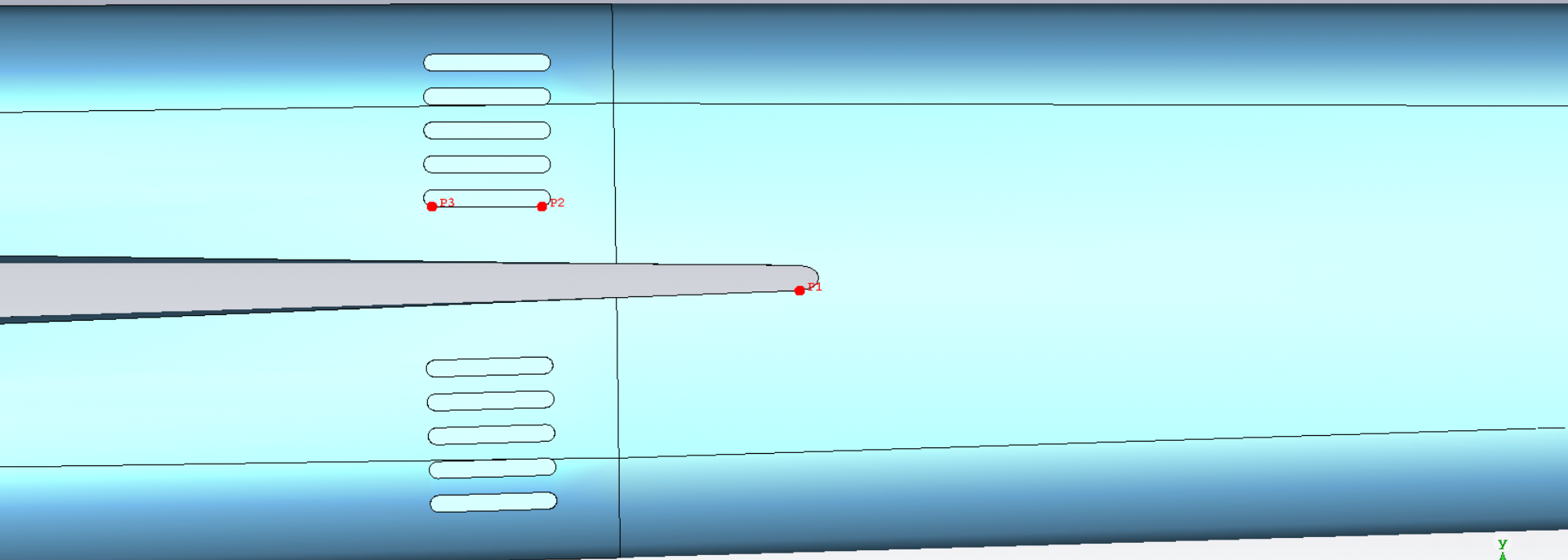


Model 1

Slots for absorber



First calculation with slots



P3 P2

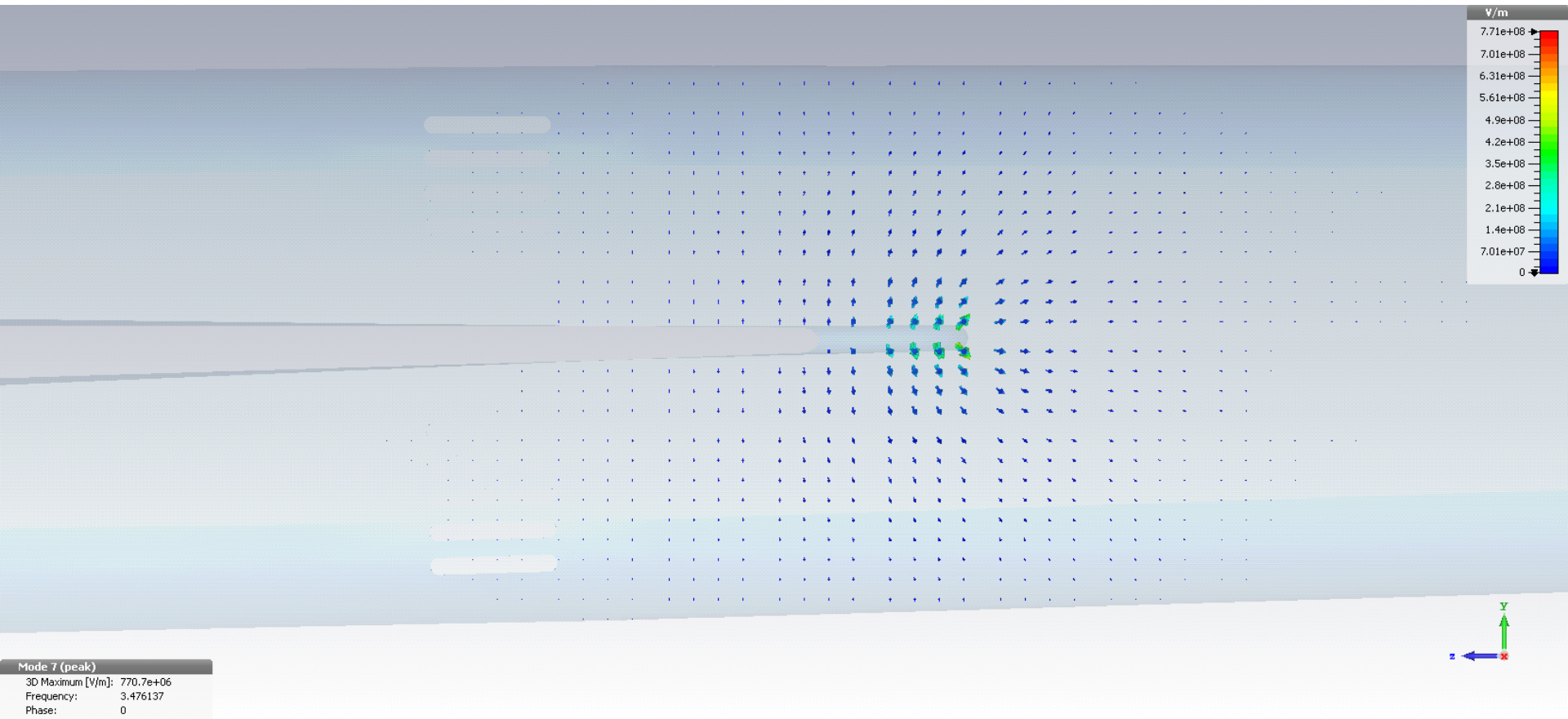
P1



x = 9981.097, y = -4542.500

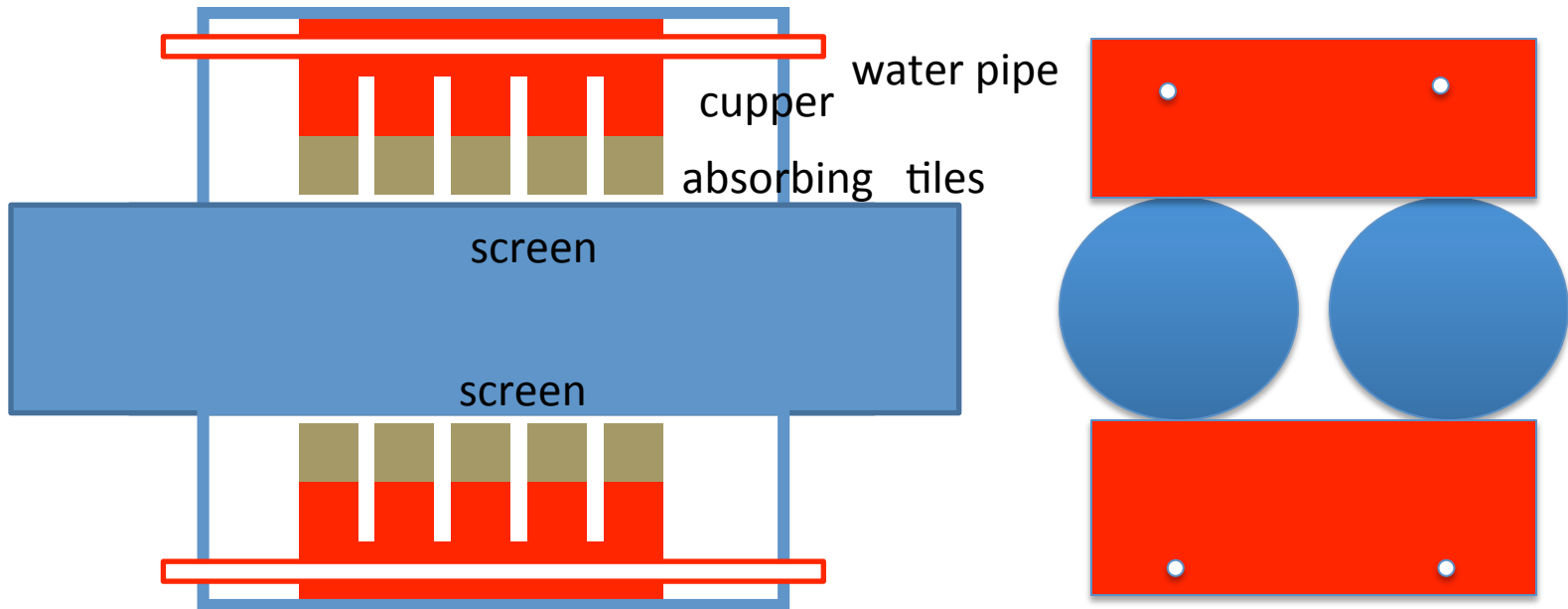
Picked Elements	
P1(X,Y,Z)	16.850494, -18.933964, 1178.169782
P2(X,Y,Z)	24, -8.996869, 1208.633060
P3(X,Y,Z)	24, -8.996869, 1221.633074
Normal(P1,P2,P3)	0.811736, -0.584025, 0

Field distribution



Slots must be moved more to right

Next step is to design a HOM absorber for FCC IR



May be during next visit.

Other tasks:

- Repeat calculations of the resonant modes with HFSS
- Check for existence of other higher modes
- Develop a procedure of preparation of the CAD files, which can be easily used in CST and HFSS calculations.
- Optimize the efficiency of the HOM absorber by using special type of calculations in CST (scattering).