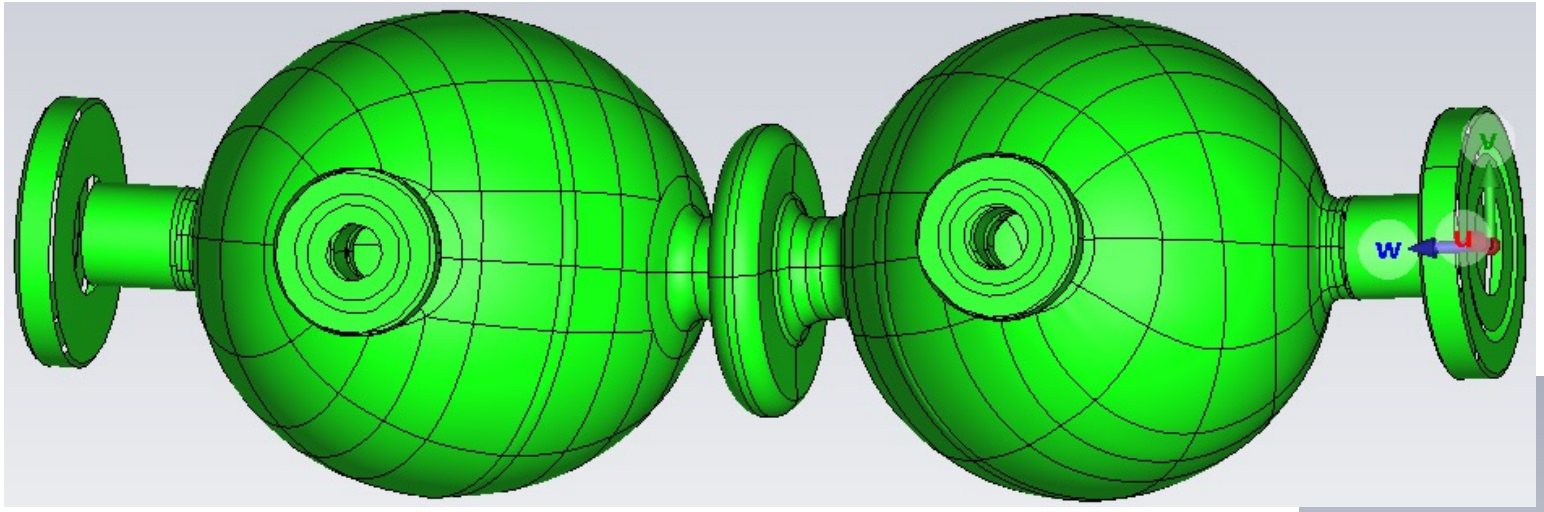
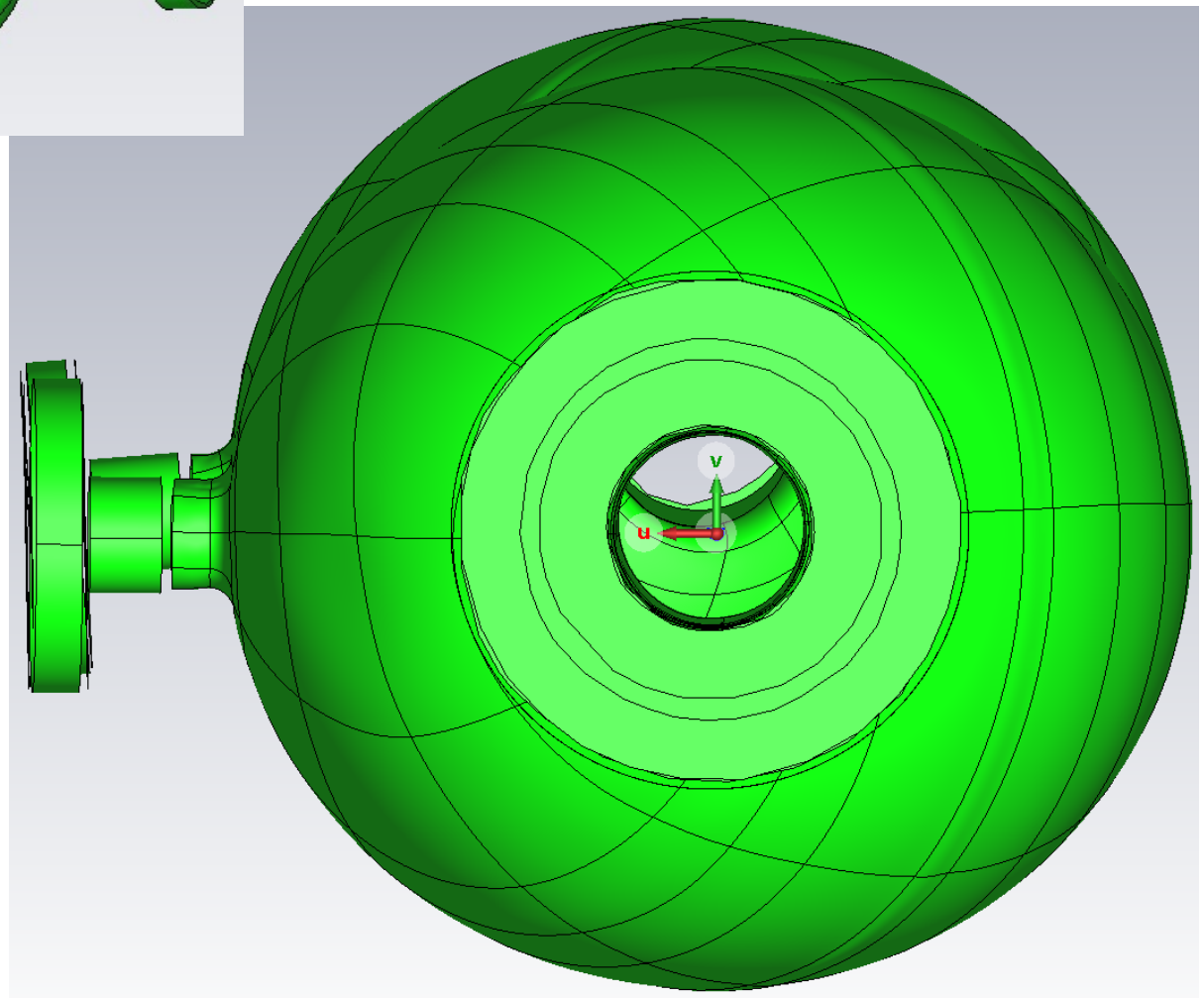
Simulations with Real Cavity geometry (assuming uniform 2mm thickness)

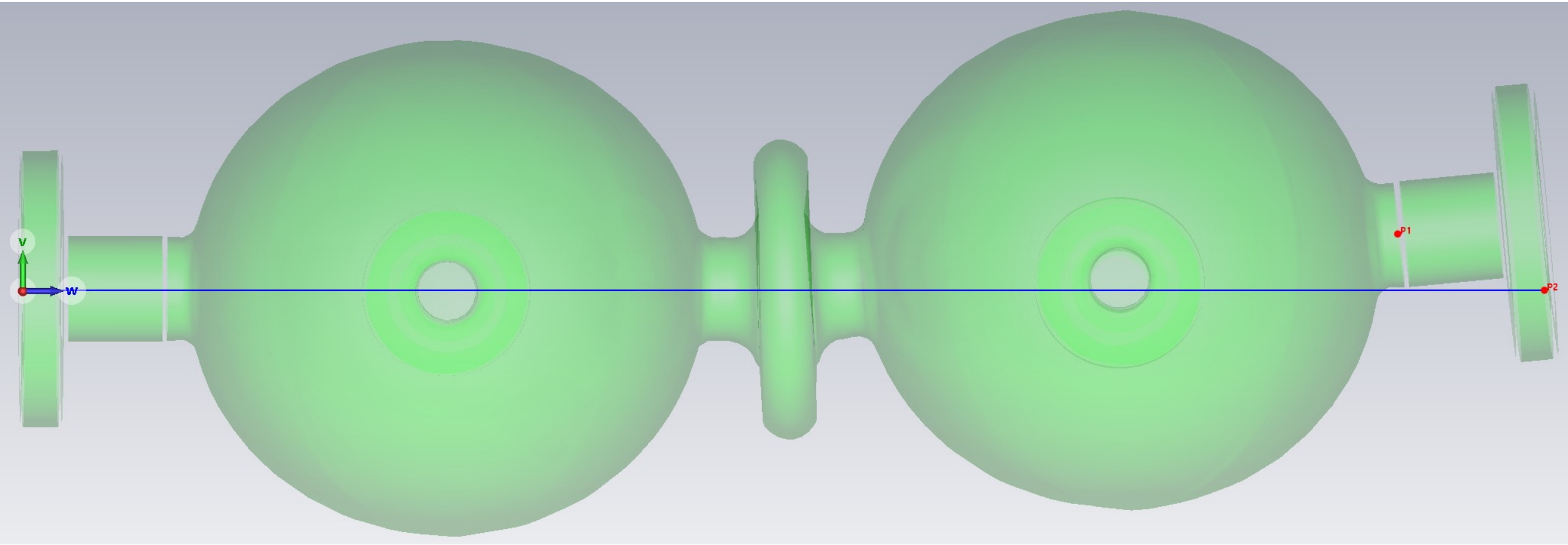
Performed by Ivan Gonin and Timergali Khabiboulline

MAGO activities – Fermilab
Update Jan 2024



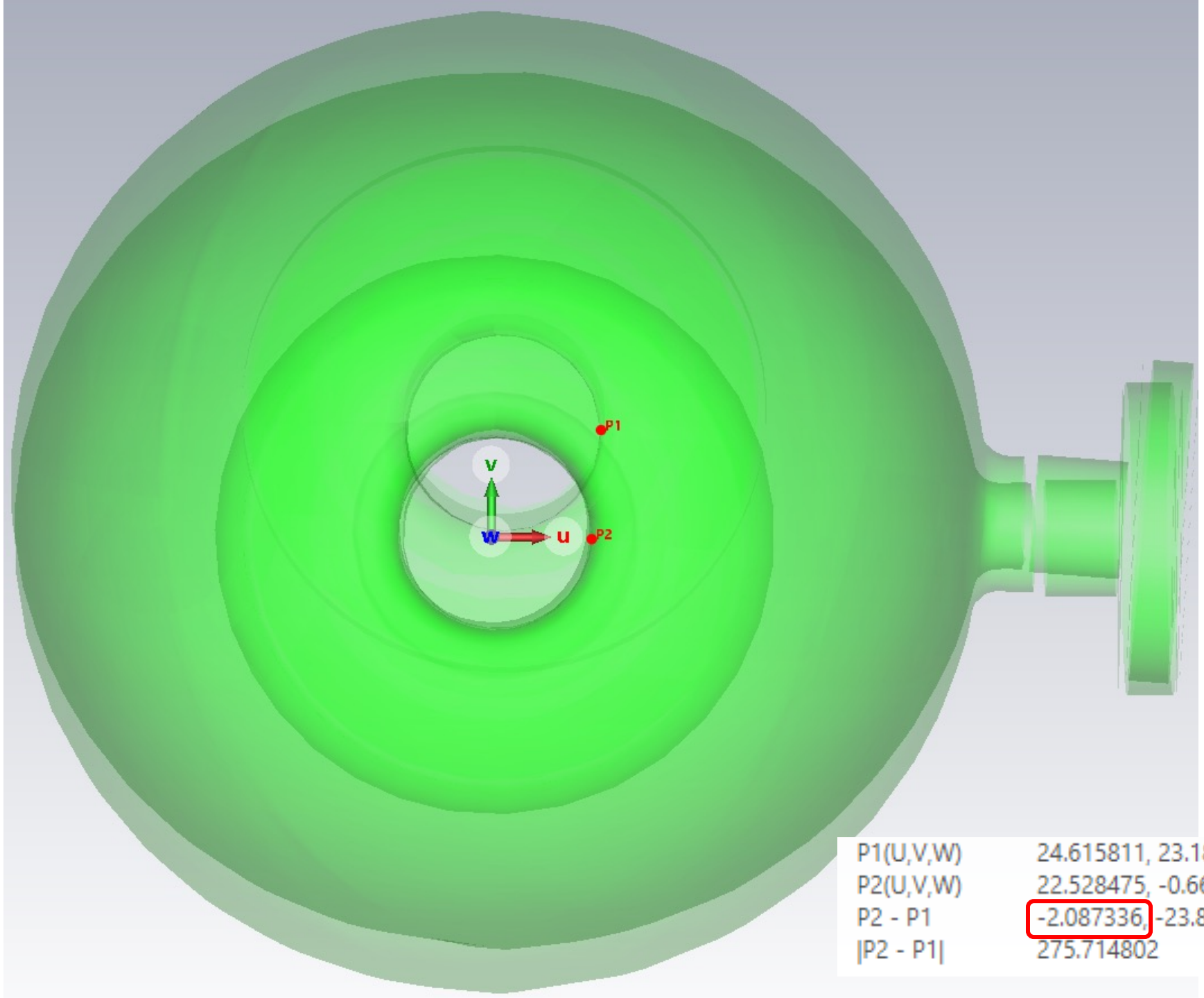
Set of areas from DESY measurements



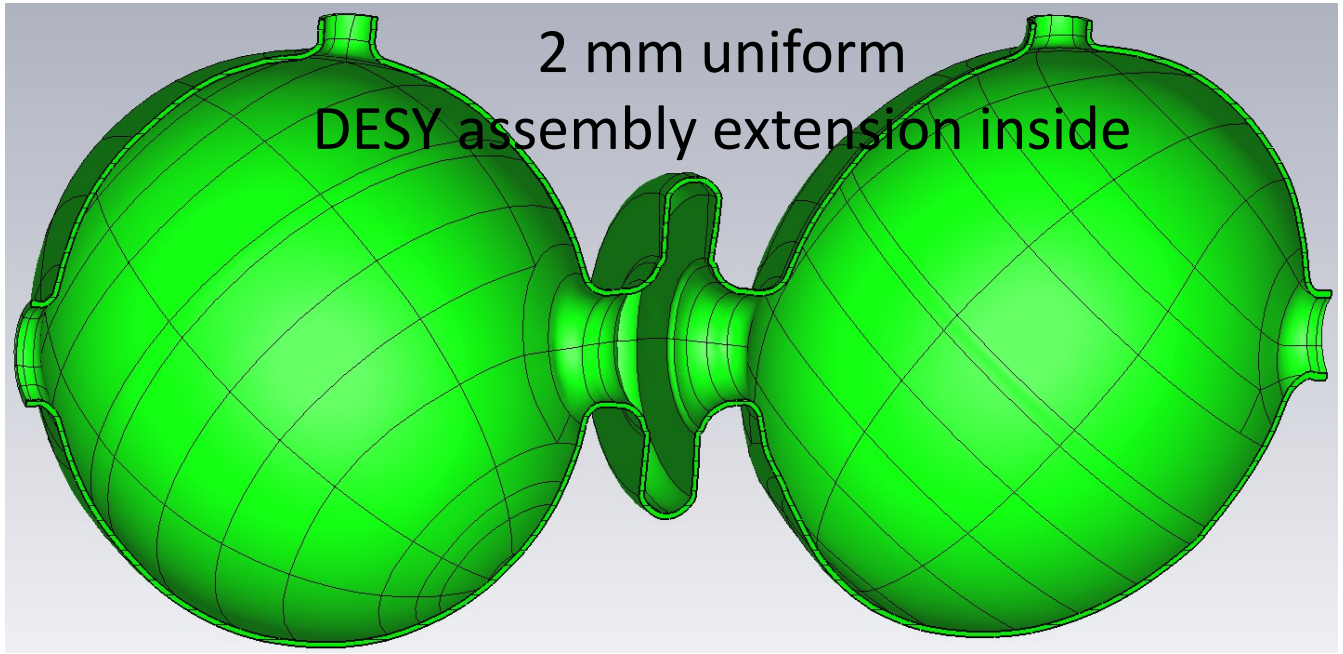


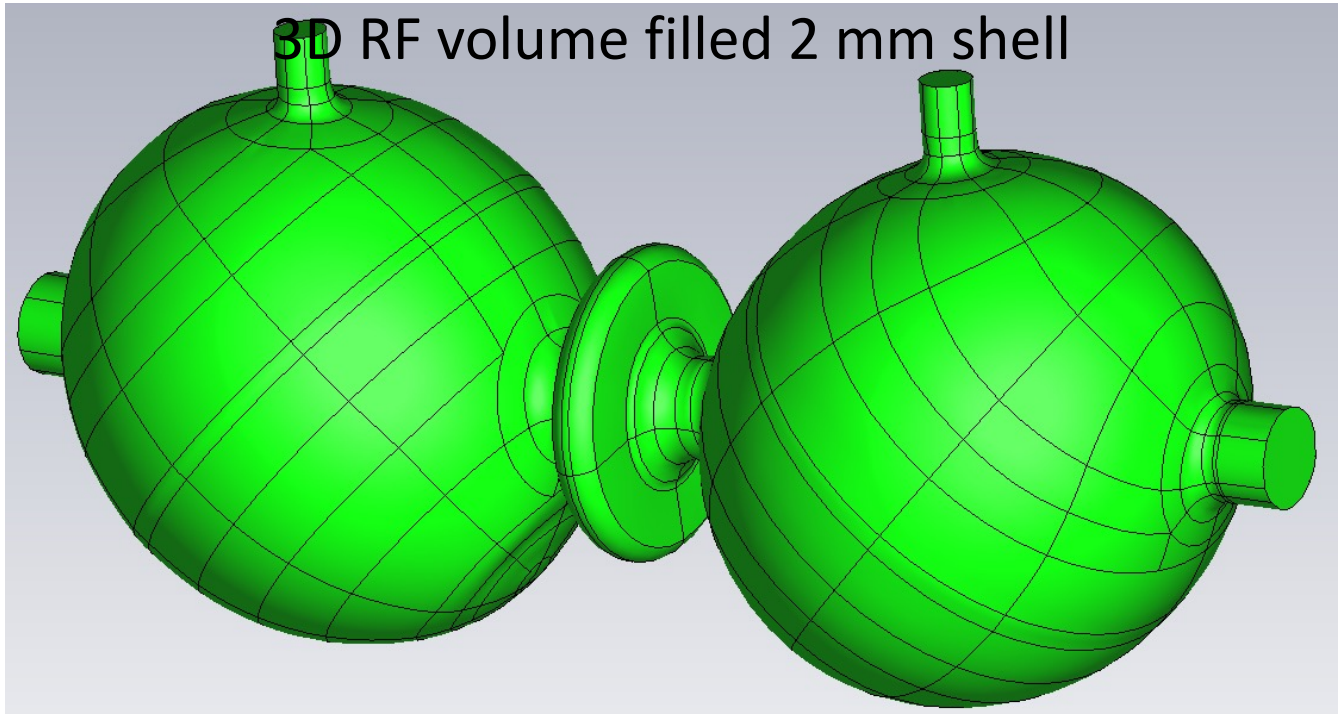
Picked elements

P1(U,V,W)	24.615811, 23.180903, 566.777999
P2(U,V,W)	0, 0, 627
P2 - P1	-24.615811, -23.180903, 60.222001
|P2 - P1|	69.065055



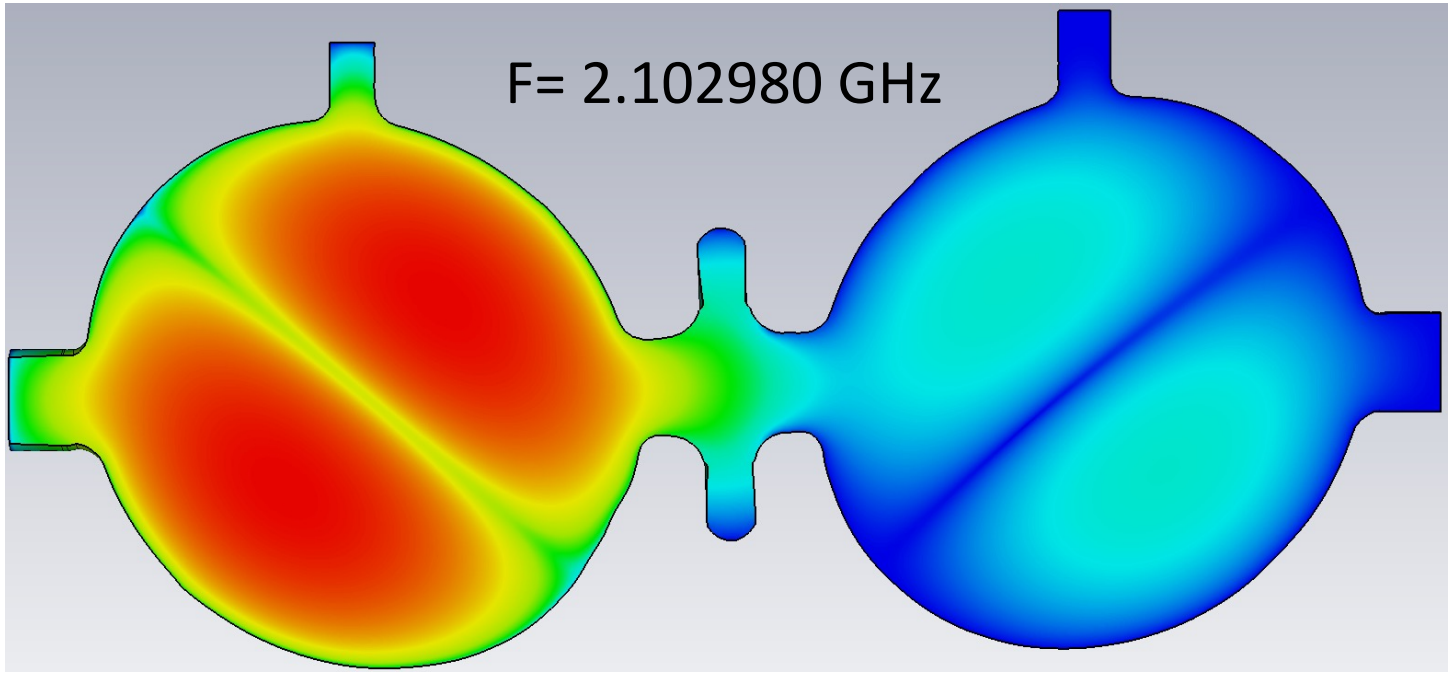
P1(U,V,W)	24.615811, 23.180903, 566.777999
P2(U,V,W)	22.528475, -0.666472, 292.104378
P2 - P1	-2.087336, -23.847375, -274.673621
|P2 - P1|	275.714802


2 mm uniform
DESY assembly extension inside


3D RF volume filled 2 mm shell

6 modes in constructed RF volume

1	2.074270 GHz	ΔF ~ 0.65 MHz
2	2.074927 GHz	
3	2.075943 GHz	ΔF ~ 1.560 MHz
4	2.077506 GHz	
5	2.102980 GHz	ΔF ~ 2.69 MHz
6	2.105671 GHz	

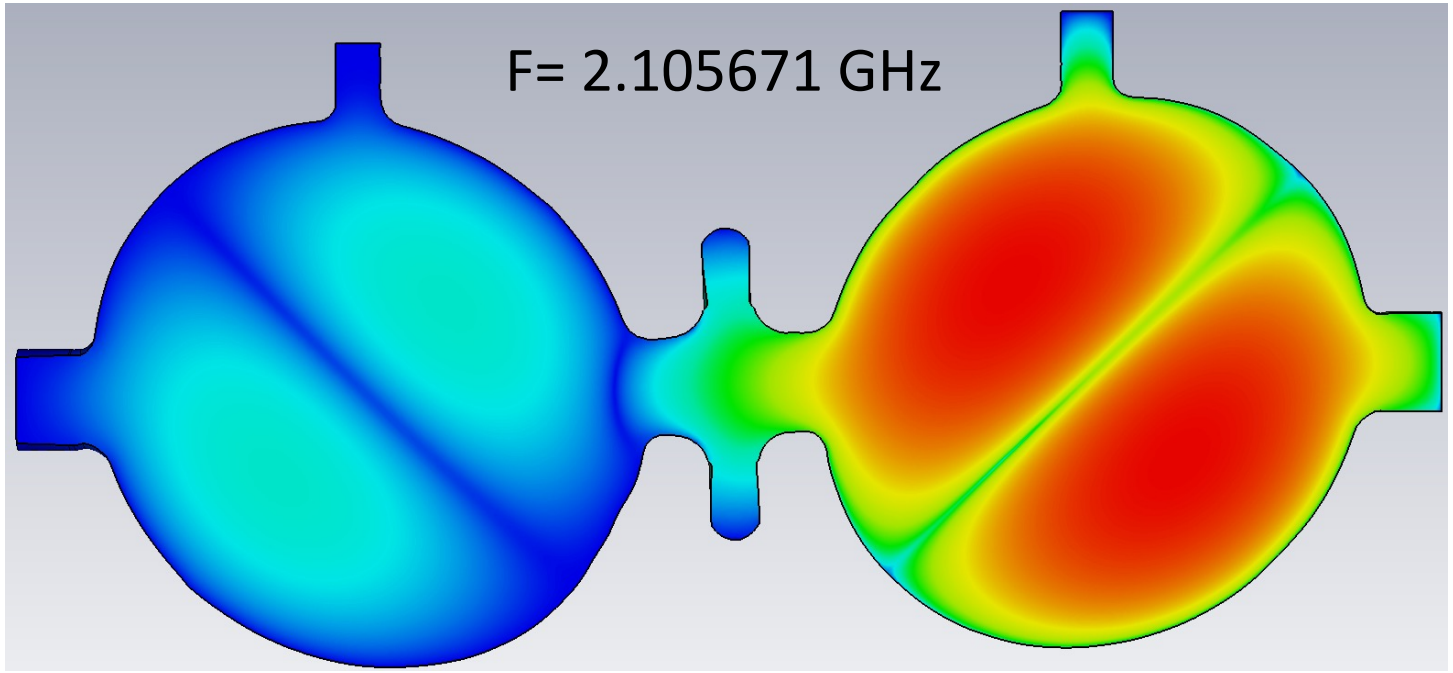


6 modes in designed RF volume

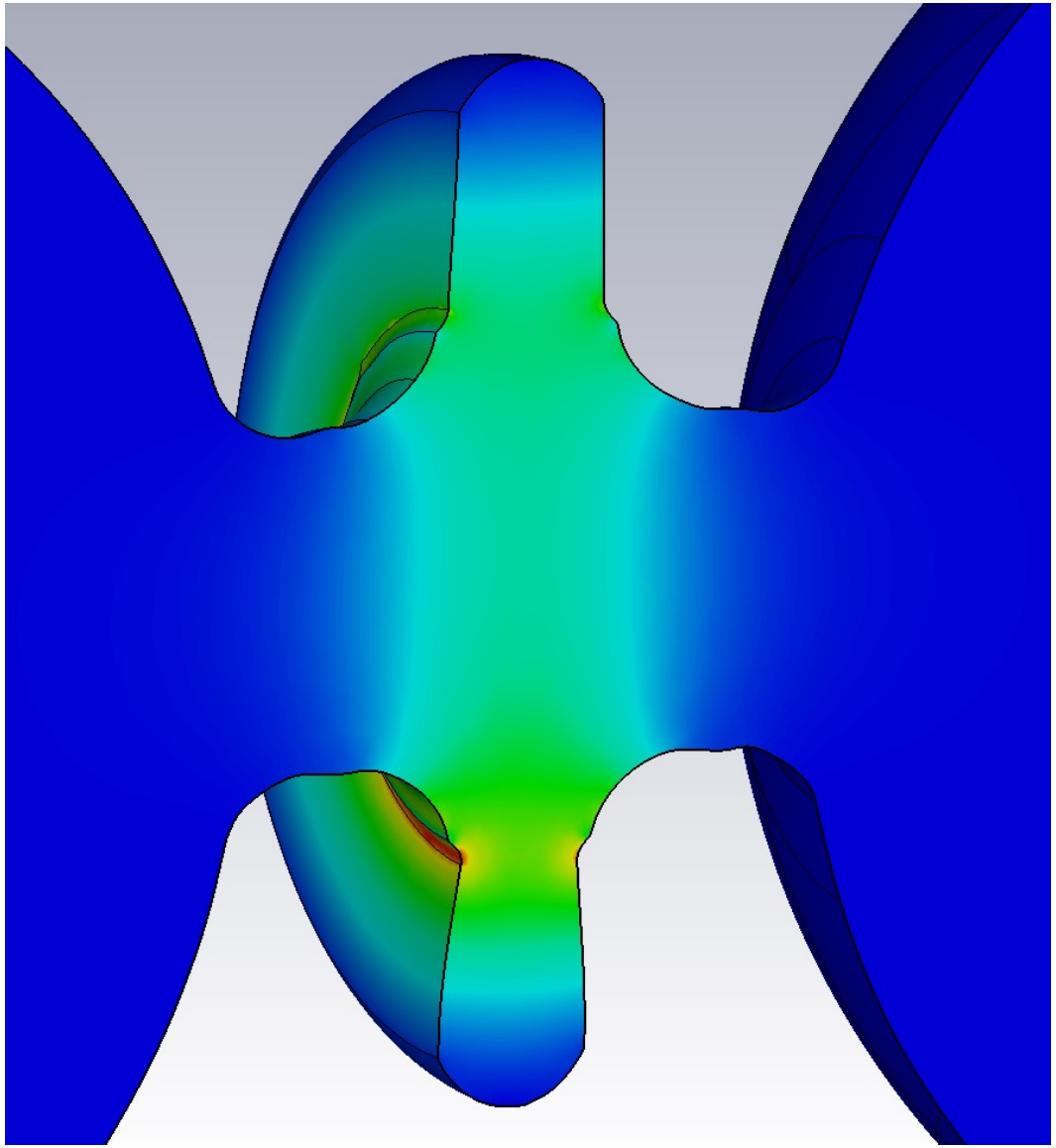
"0" mode F= 2.073450 GHz
"π" mode F= 2.073471 GHz
ΔF ~ 21 kHz

"0" mode F= 2.076753 GHz
"π" mode F= 2.076760 GHz
ΔF ~ 7 kHz

"0" mode F=2.103683 GHz
"π" mode F=2.103693 GHz
ΔF ~ 10 kHz



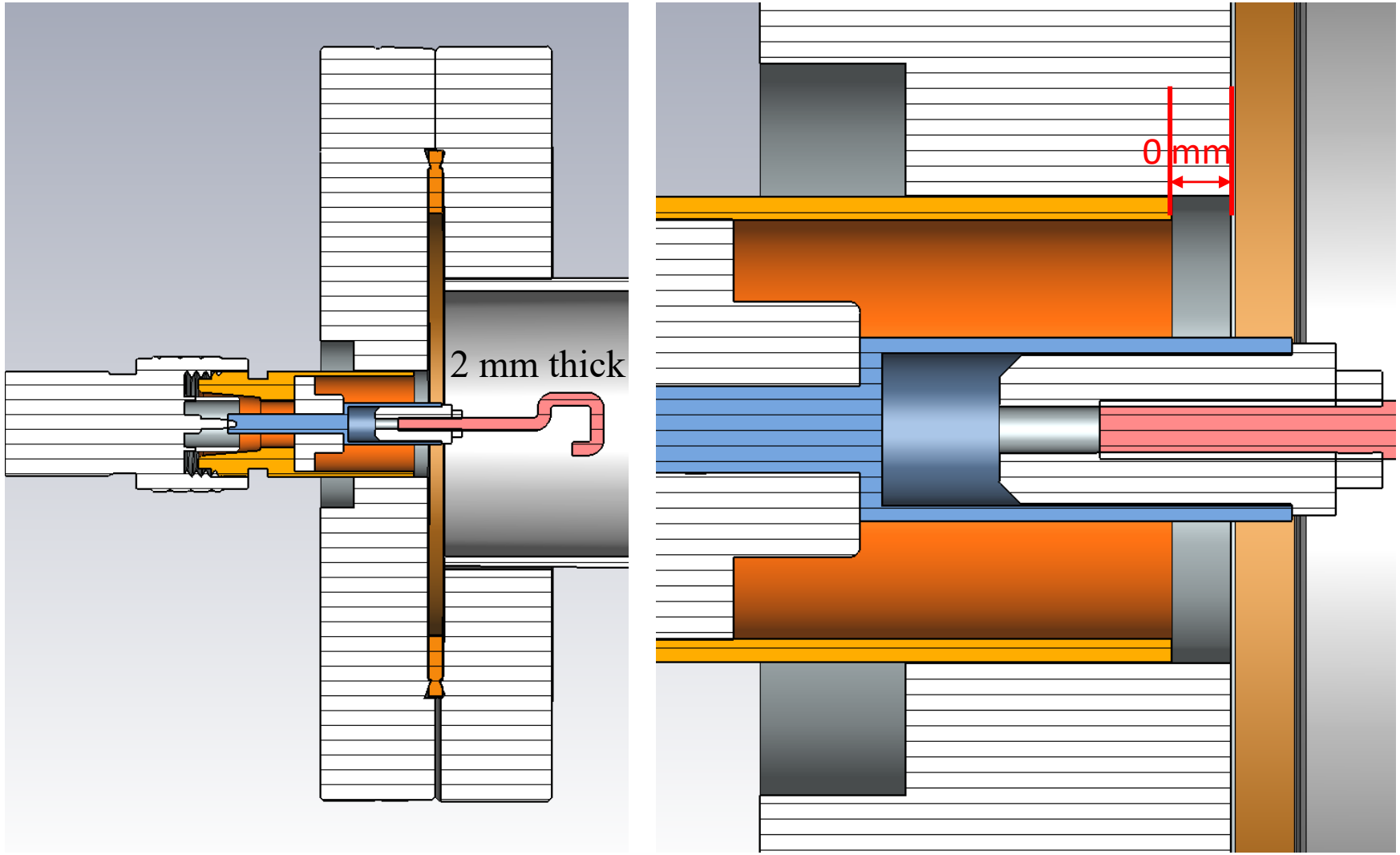
F ~ 2.217817 GHz (+114 MHz)

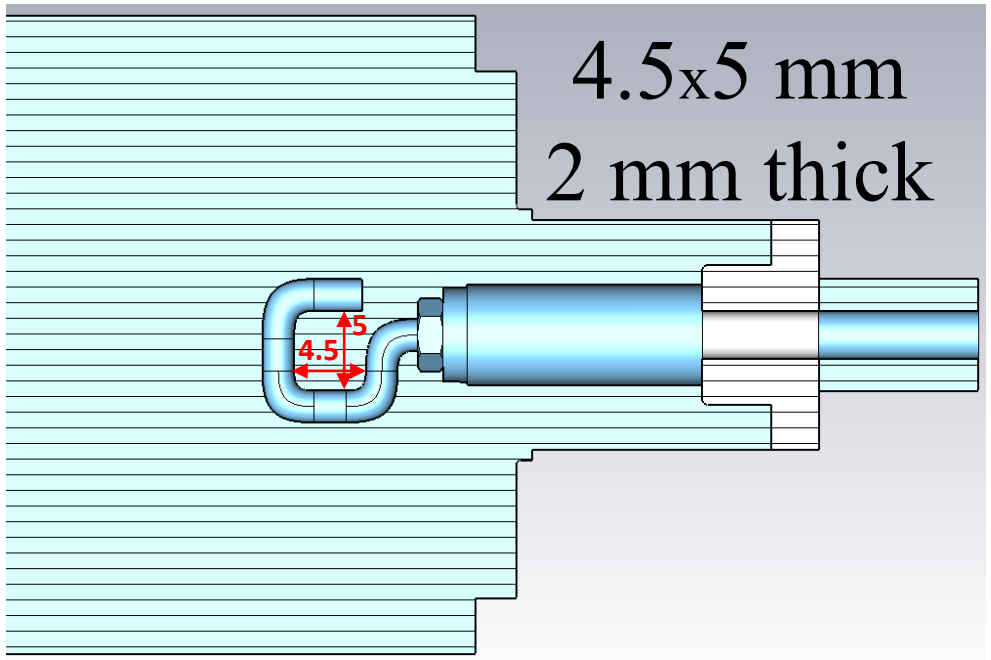


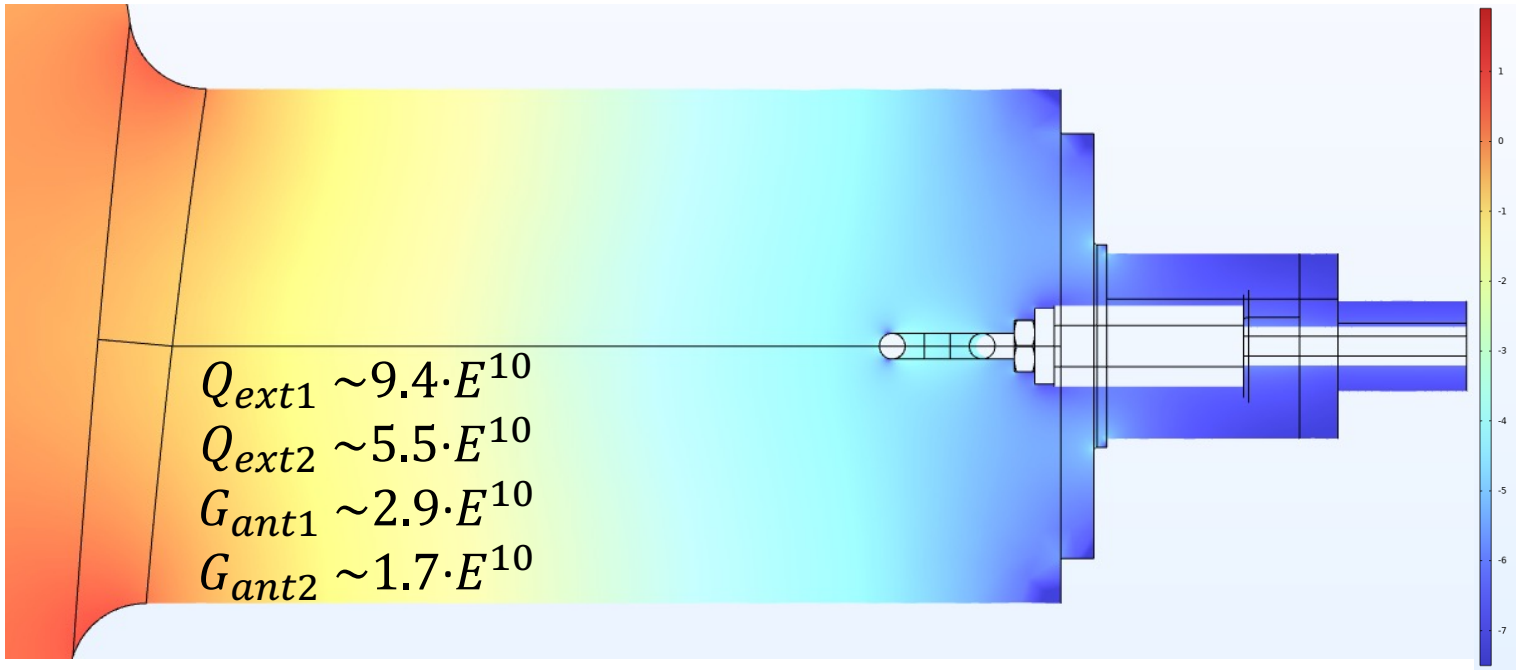
RF Antennas design

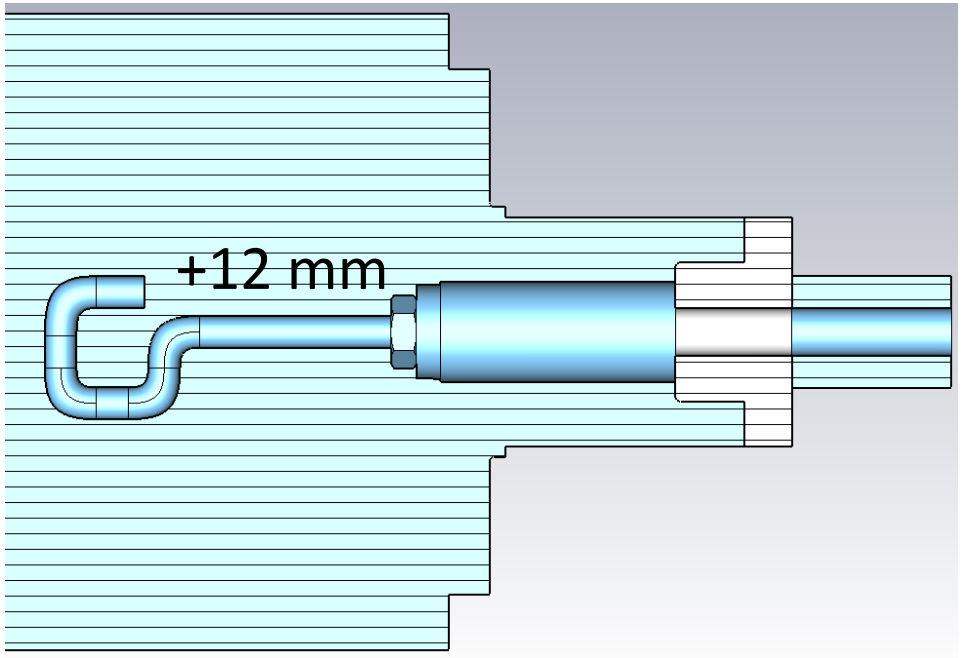
RF simulations by Ivan Gonin, Timergali Khabiboulline

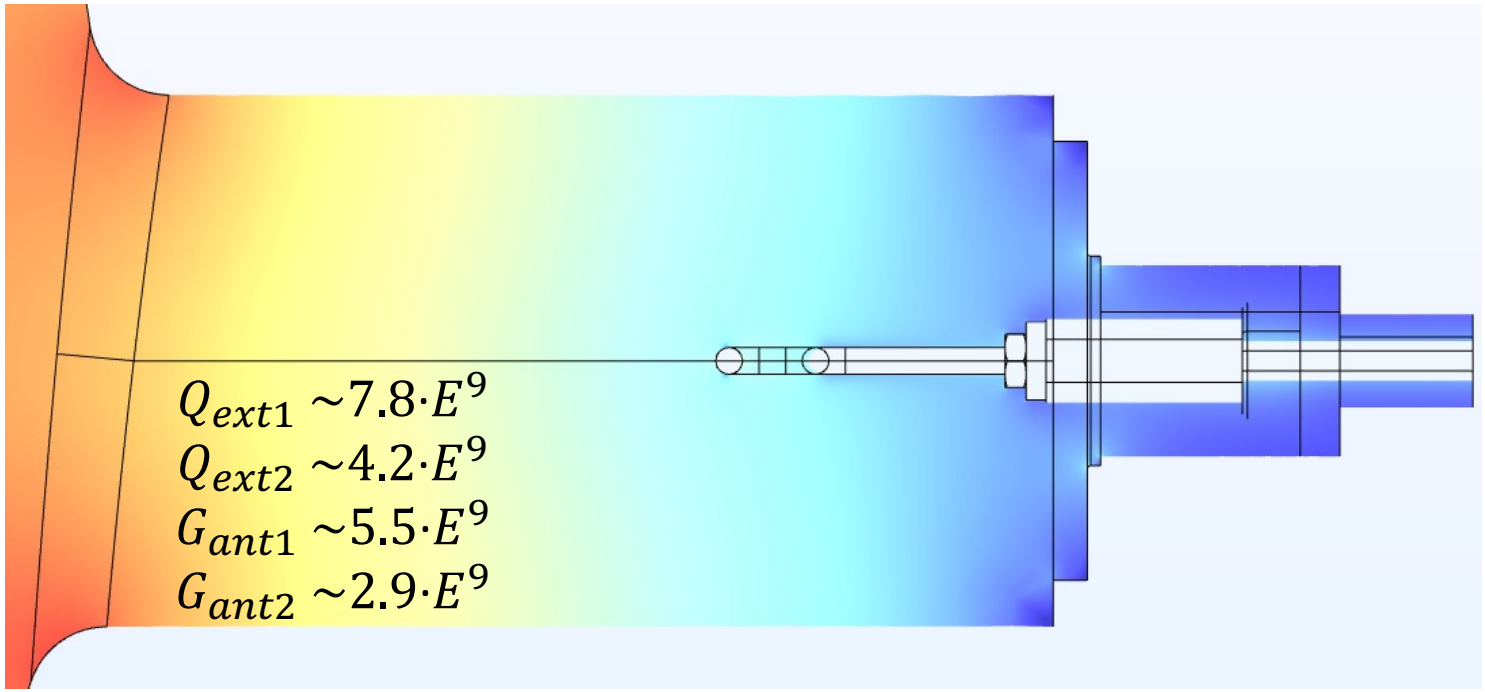
Mechanical Design by Yuriy Orlov

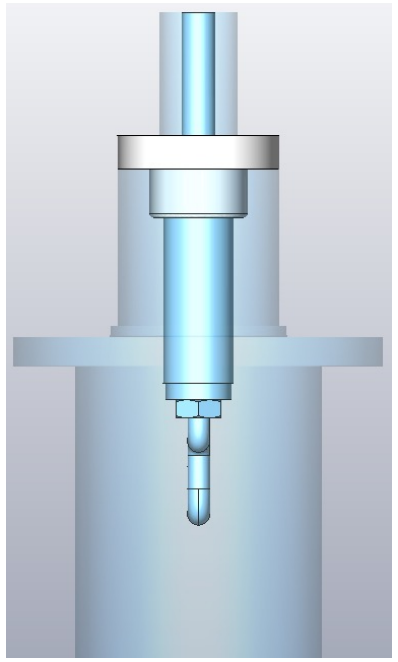

2 mm thick
0 mm


4.5x5 mm
2 mm thick
5
4.5


Q_{ext1} ~9.4·E^{10}
Q_{ext2} ~5.5·E^{10}
G_{ant1} ~2.9·E^{10}
G_{ant2} ~1.7·E^{10}

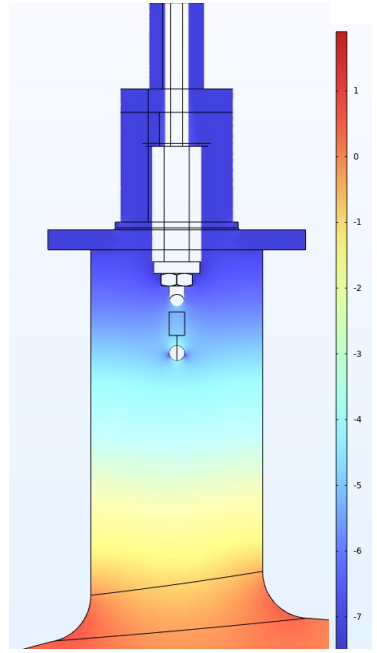

+12 mm

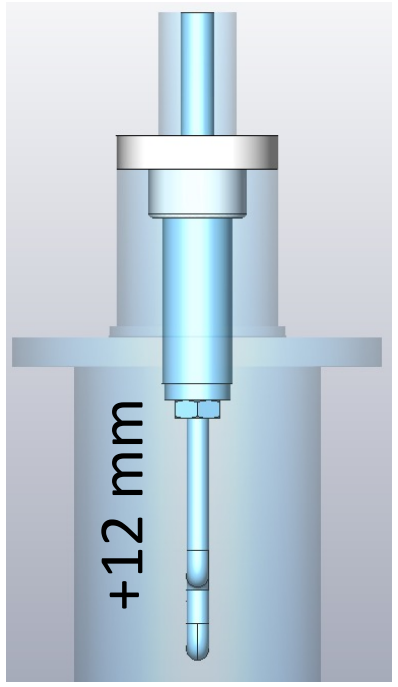

Q_{ext1} ~7.8·E^{9}
Q_{ext2} ~4.2·E^{9}
G_{ant1} ~5.5·E^{9}
G_{ant2} ~2.9·E^{9}



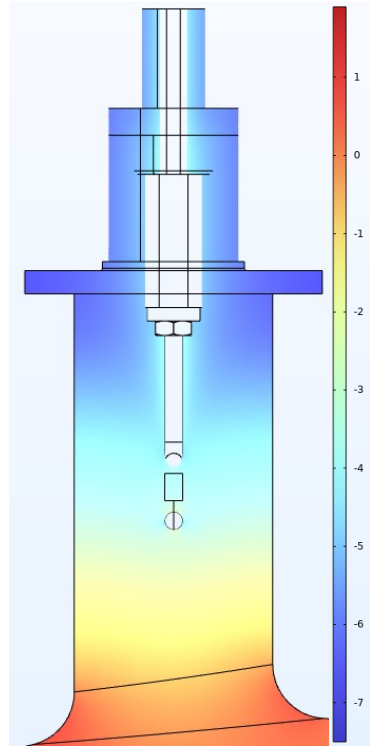
4.5x5 mm
2 mm thick

Q_{ext1} ~$1.8 \cdot E^{11}$
Q_{ext2} ~$2.1 \cdot E^{11}$
G_{ant1} ~$9.2 \cdot E^{10}$
G_{ant2} ~$1.0 \cdot E^{11}$

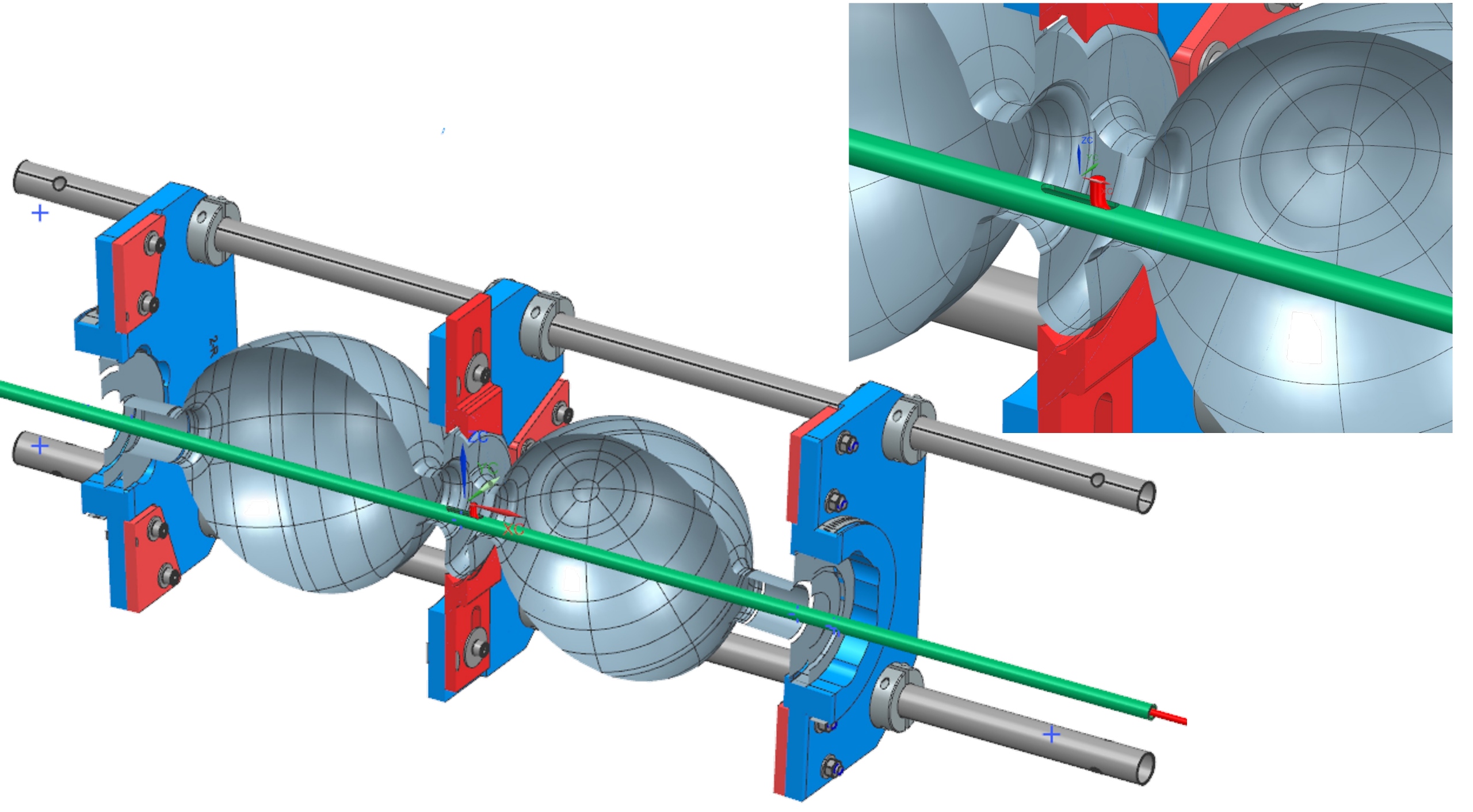




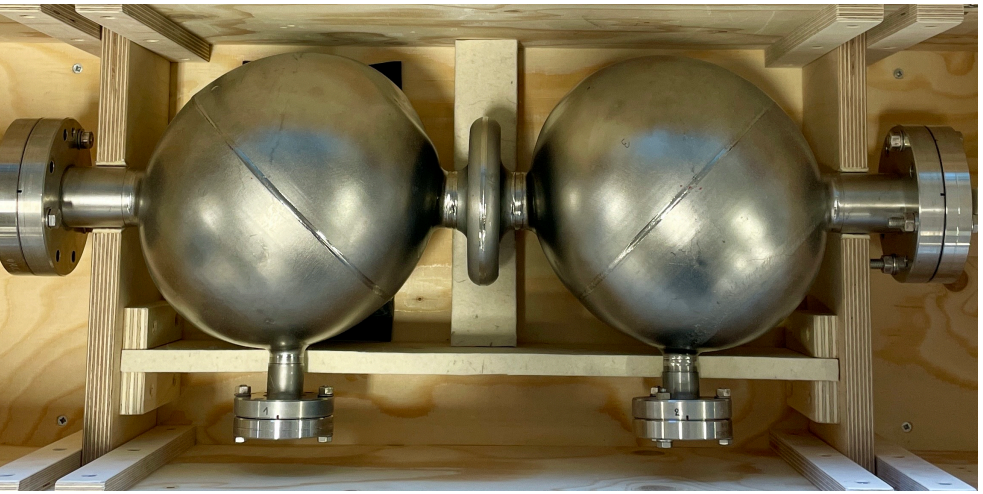
Q_{ext1} ~$1.4 \cdot E^{9}$
Q_{ext2} ~$1.6 \cdot E^{9}$
G_{ant1} ~$2.0 \cdot E^{9}$
G_{ant2} ~$2.3 \cdot E^{9}$



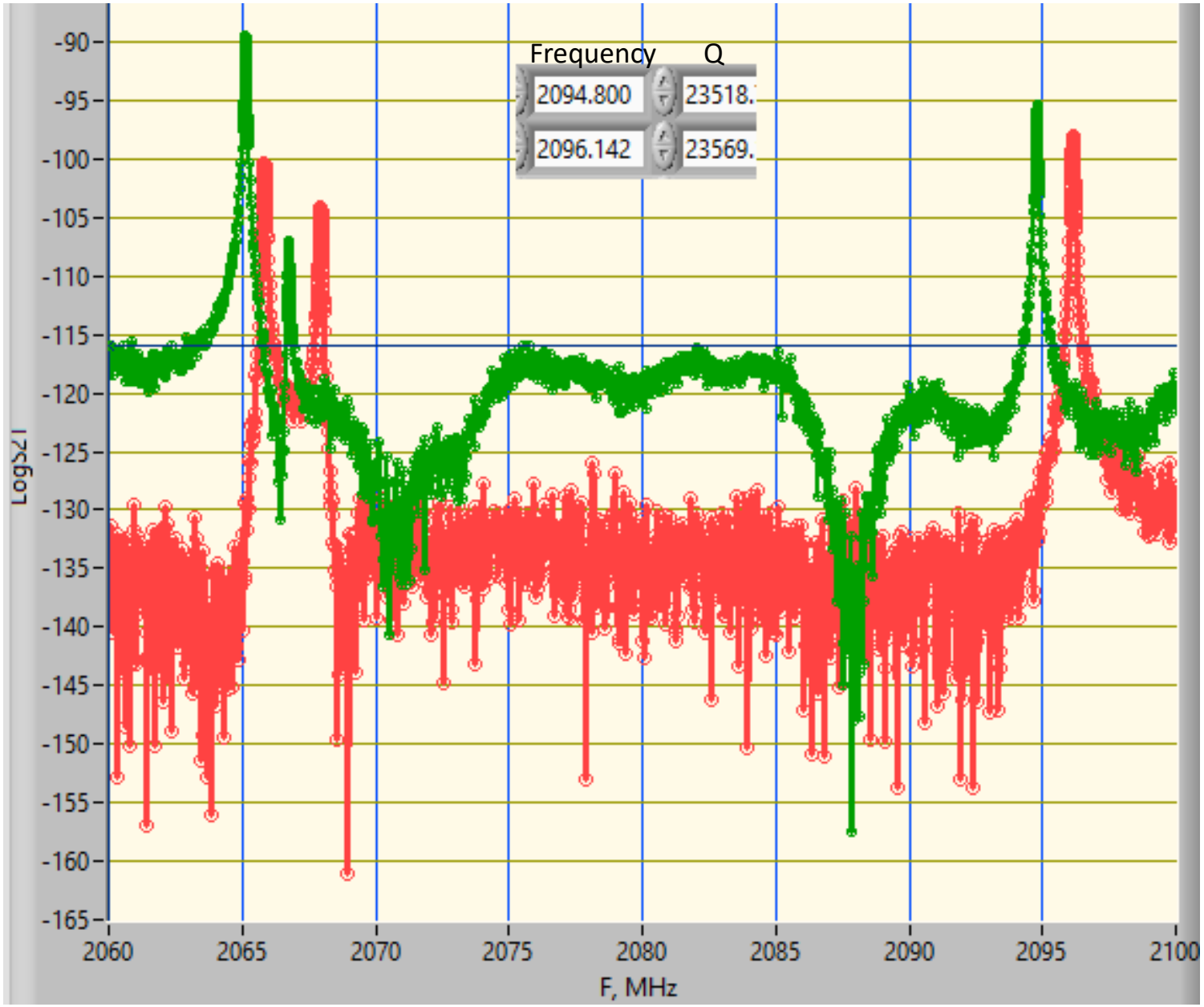
Boroscope setup for internal inspection


ZC
YC
XC

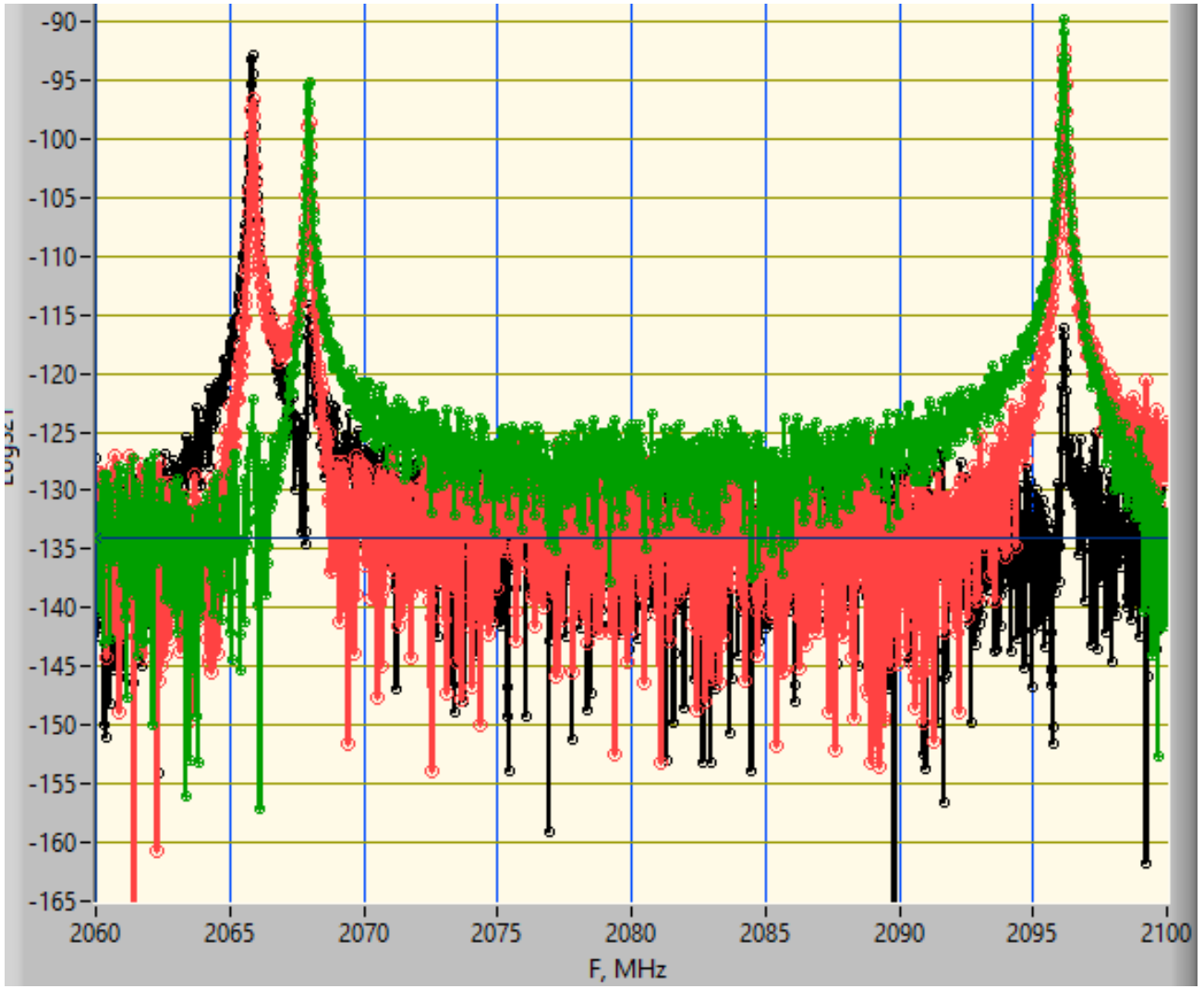
RF Measurements upon arrival



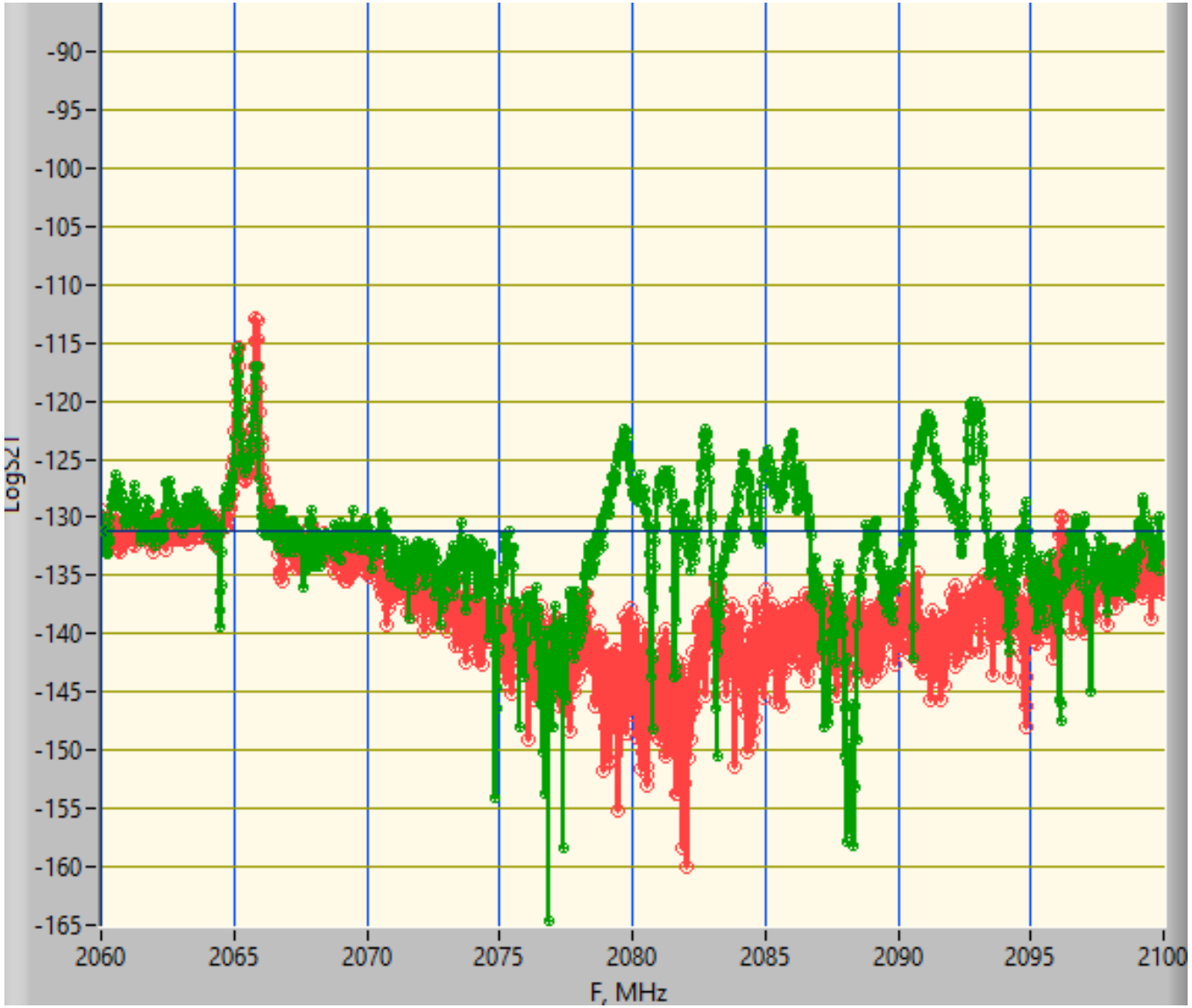
- Cell 1: cell with donut dent
- Cell 2: less dented cell



S21 measurements of each cell separately. Green – cell #1, red Cell #2



Cell #2 measurements for different rotation of 1st antenna installed on bigger port. Green 00 deg, red 45 deg and black 90 deg. 2nd antenna on small port at 45 degree.



Coupling between cells. Cell #1 45 deg to cell #2 45 deg in larger ports
Red with 3.9 GHz lowpass filter.