

Table-top SLEDII pulse compressor

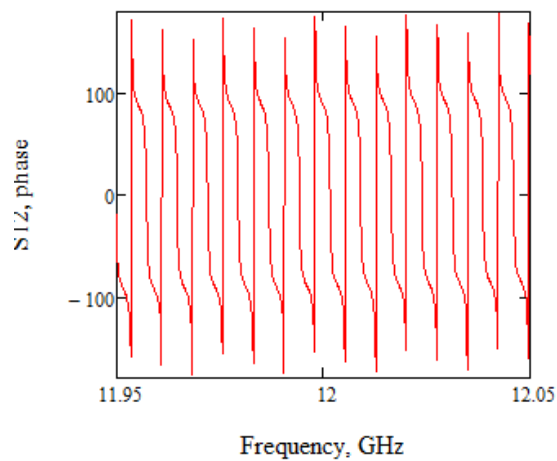
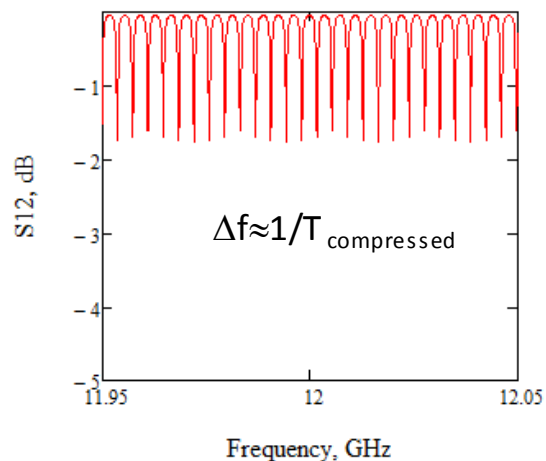
I. Syrathev, CERN





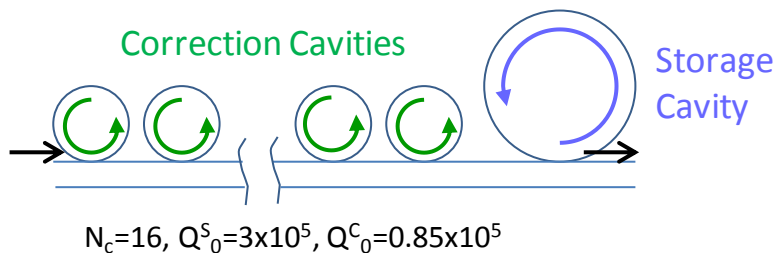
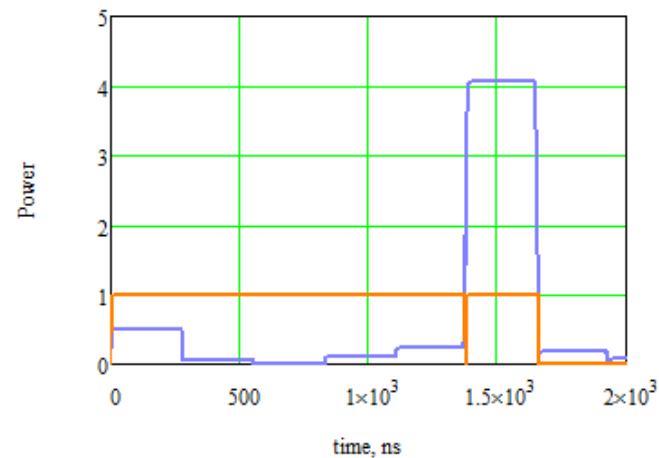
SLEDII transmission spectrum

2 x 41.5 m, Ø 77 mm

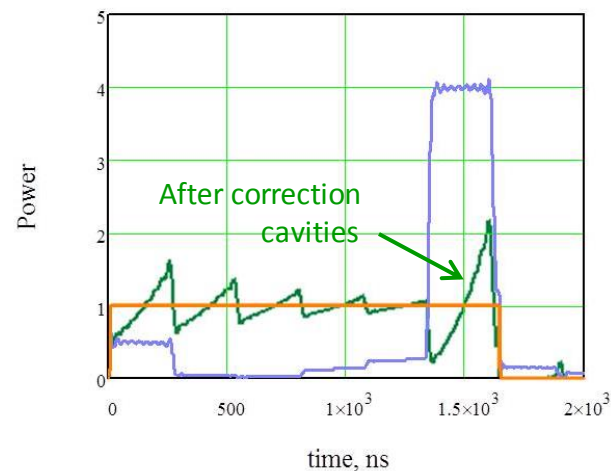
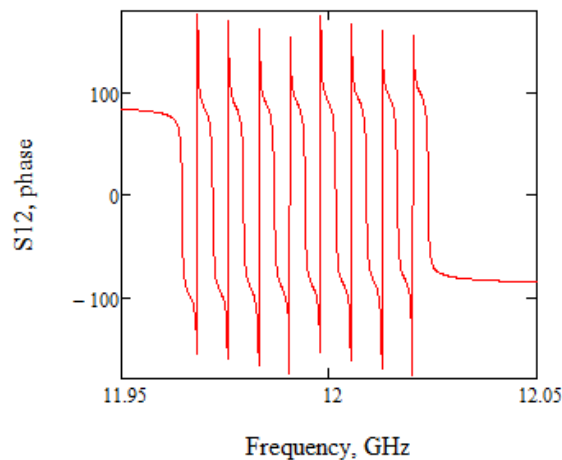
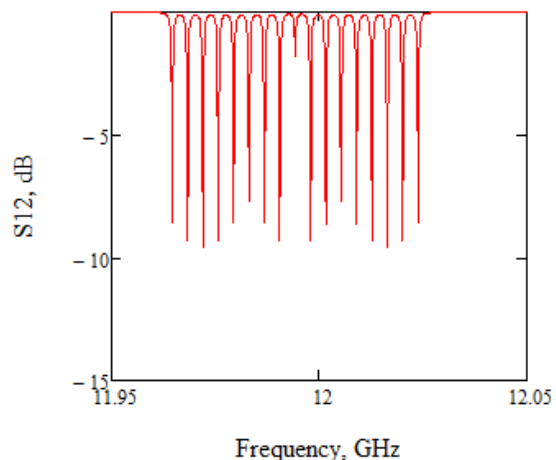


Basic principle (S. Kazakov, 1992)

Compression



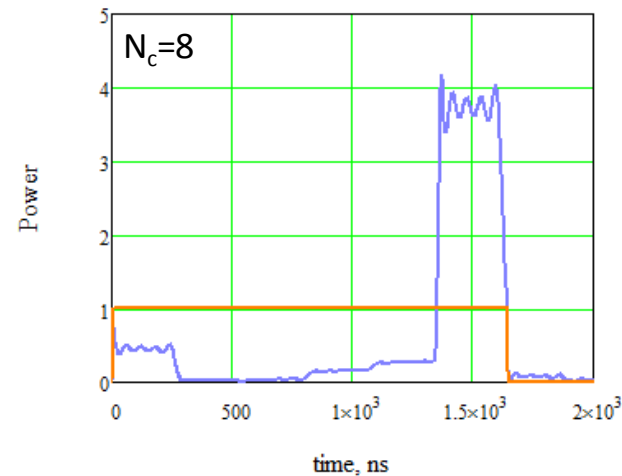
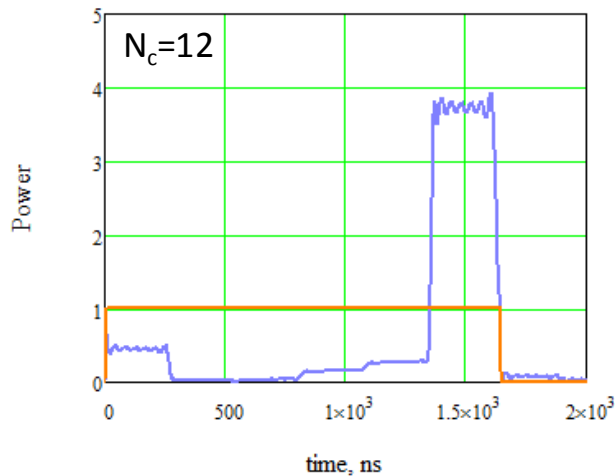
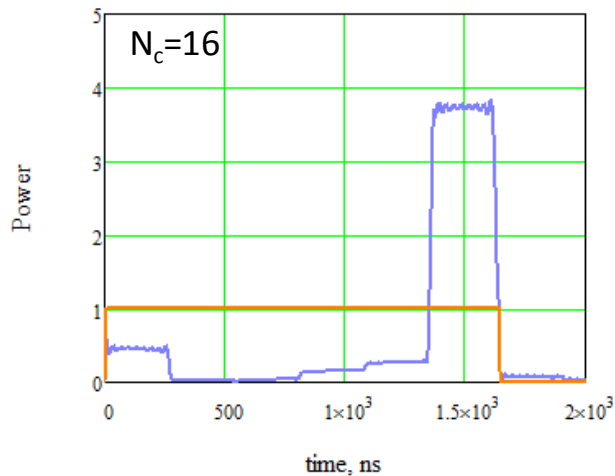
- The spectrum lines of long waveguide can be partially imitated by limited number of individual correction cavities.
- Only storage cavity should provide high Q-factor.
- Loaded Q-factor for all the cavities should be equal (flat top)



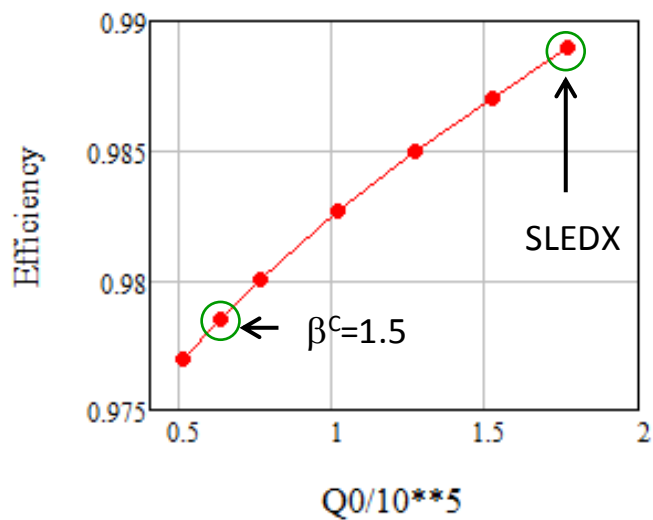


Storage cavity: $Q^S_0=1.77 \times 10^5$, $\beta^S=5.98$
 Correction cavities: $Q^C_0=0.63 \times 10^5$, $\beta^C=1.5$

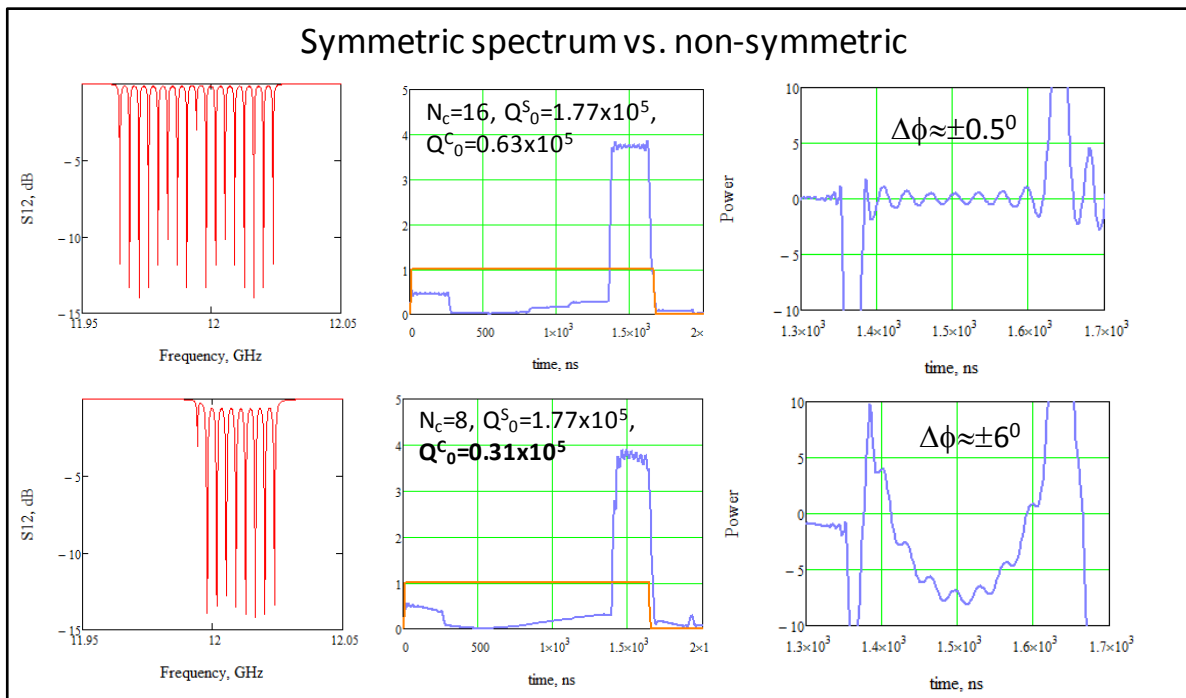
Practical systems



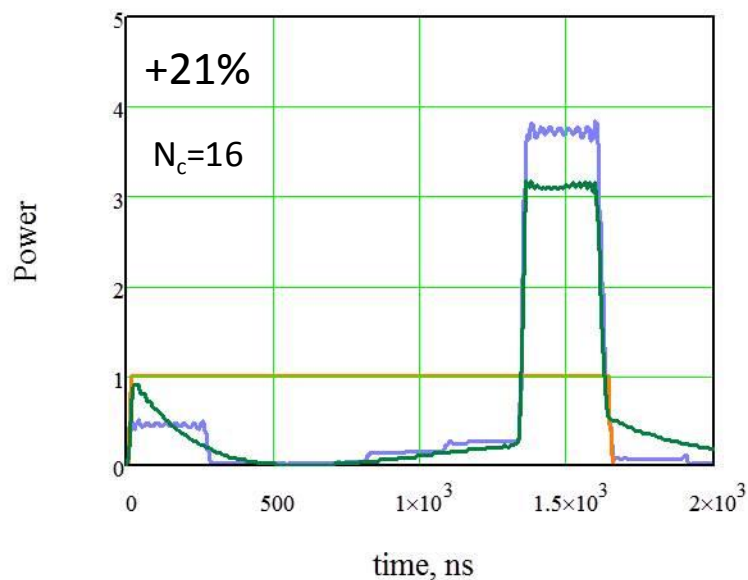
Ohmic efficiency of the correction cavities chain.



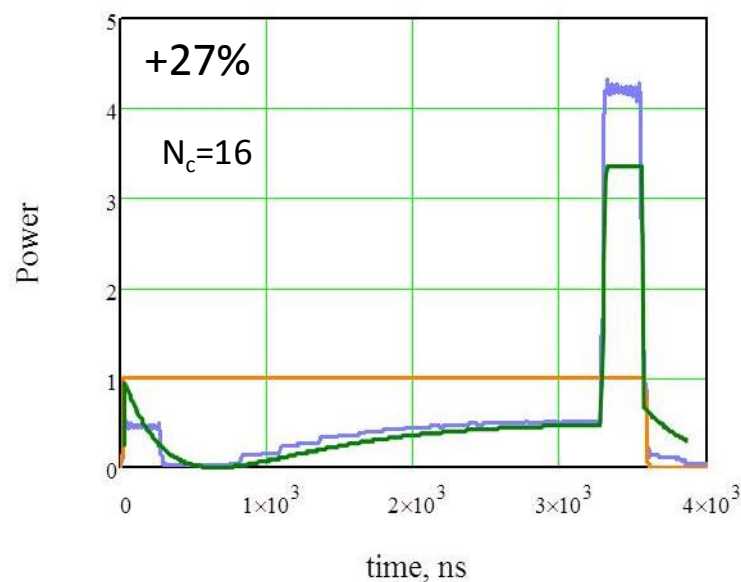
Symmetric spectrum vs. non-symmetric



XBOX#1,2. 50 MW, 1.5 μ s
Phase modulation



XBOX#3. 4x6 MW, 3.5 μ s
Phase-to-amplitude modulation

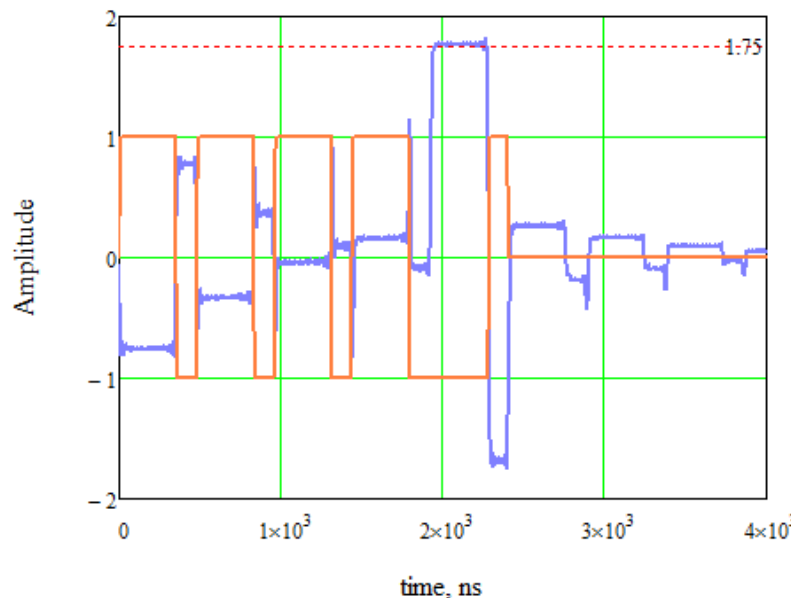


- The use of CC chain allows to increase by 20-25% power gain of existing SLEDX.
- Compared to standard the SLEDII, such a system is $\sim 6\%$ less efficient.
- Volume (Q_0) of correction cavity is few time smaller than volume of Storage cavity.

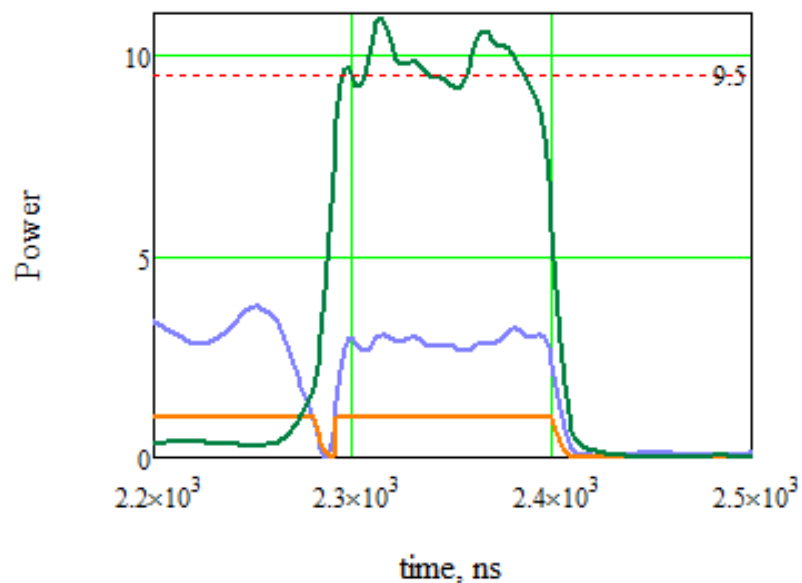
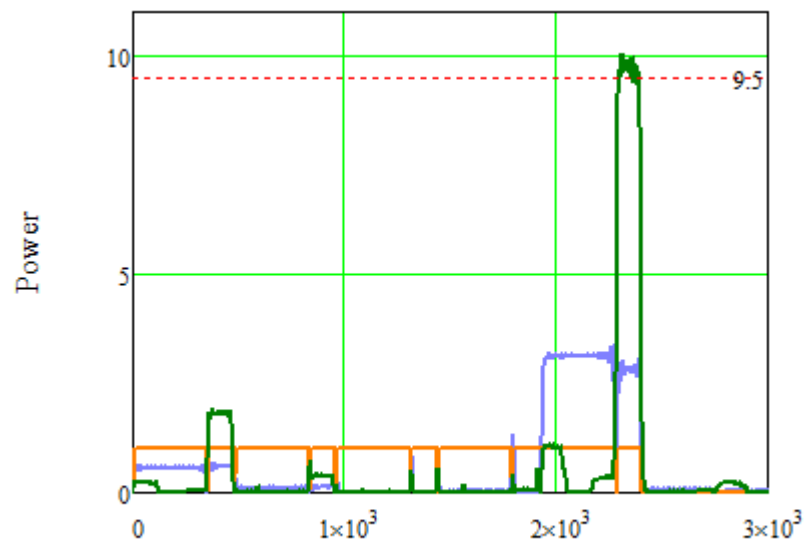


Two stages of pulse compression

After stage #1



After stage #2



Compression: 2400 ns to 100 ns
Efficiency: 40%



Whispering Gallery Pulse Compressor

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2004

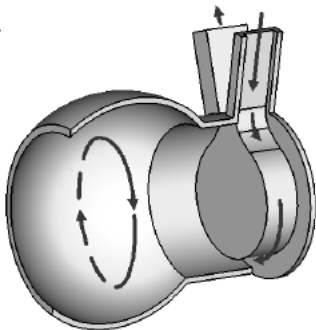
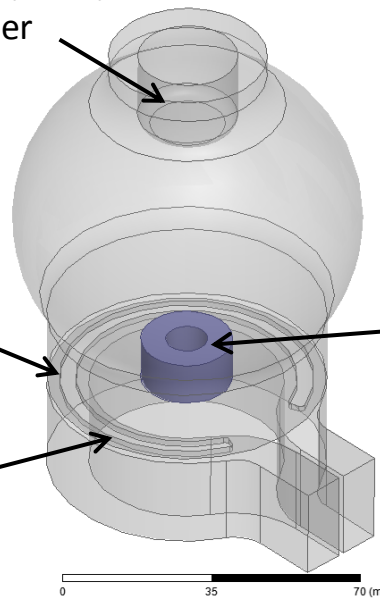


FIGURE 1. Tunnel-feed whispering-gallery pulse compressor.

Frequency tuner

Coupling can be changed with the height

Coupling slot



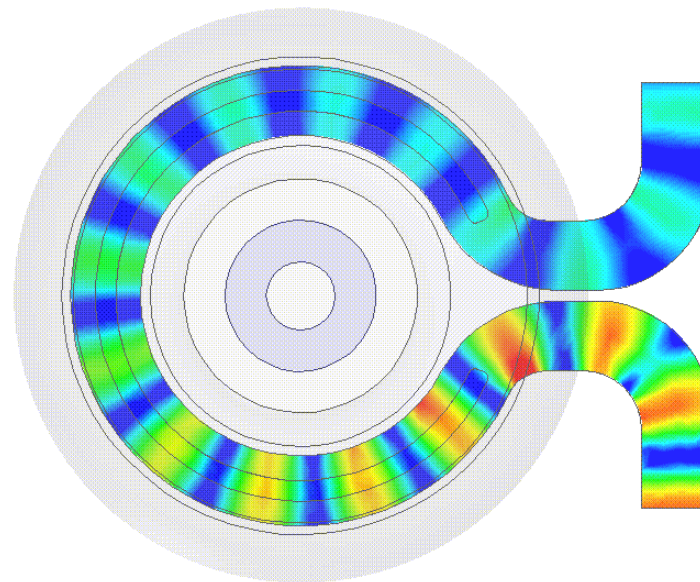
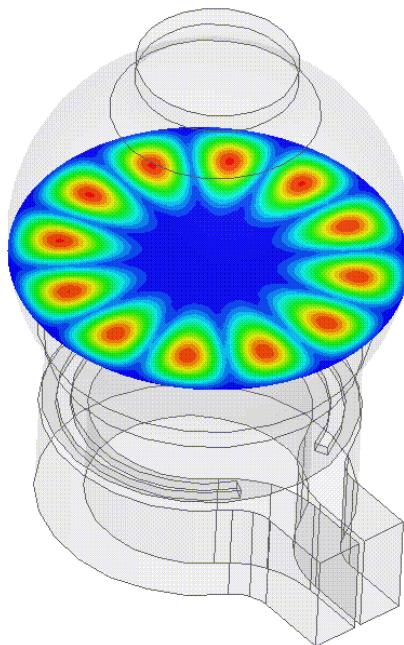
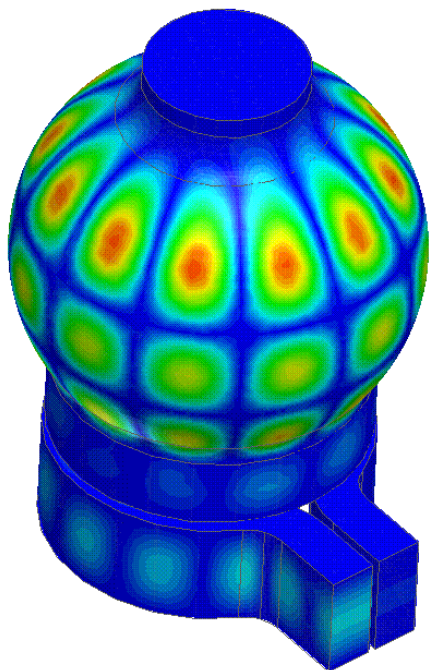
CC#1.Modified mini BOC

The Q-factor of the whispering gallery mode ($TM_{N,1,1}$):

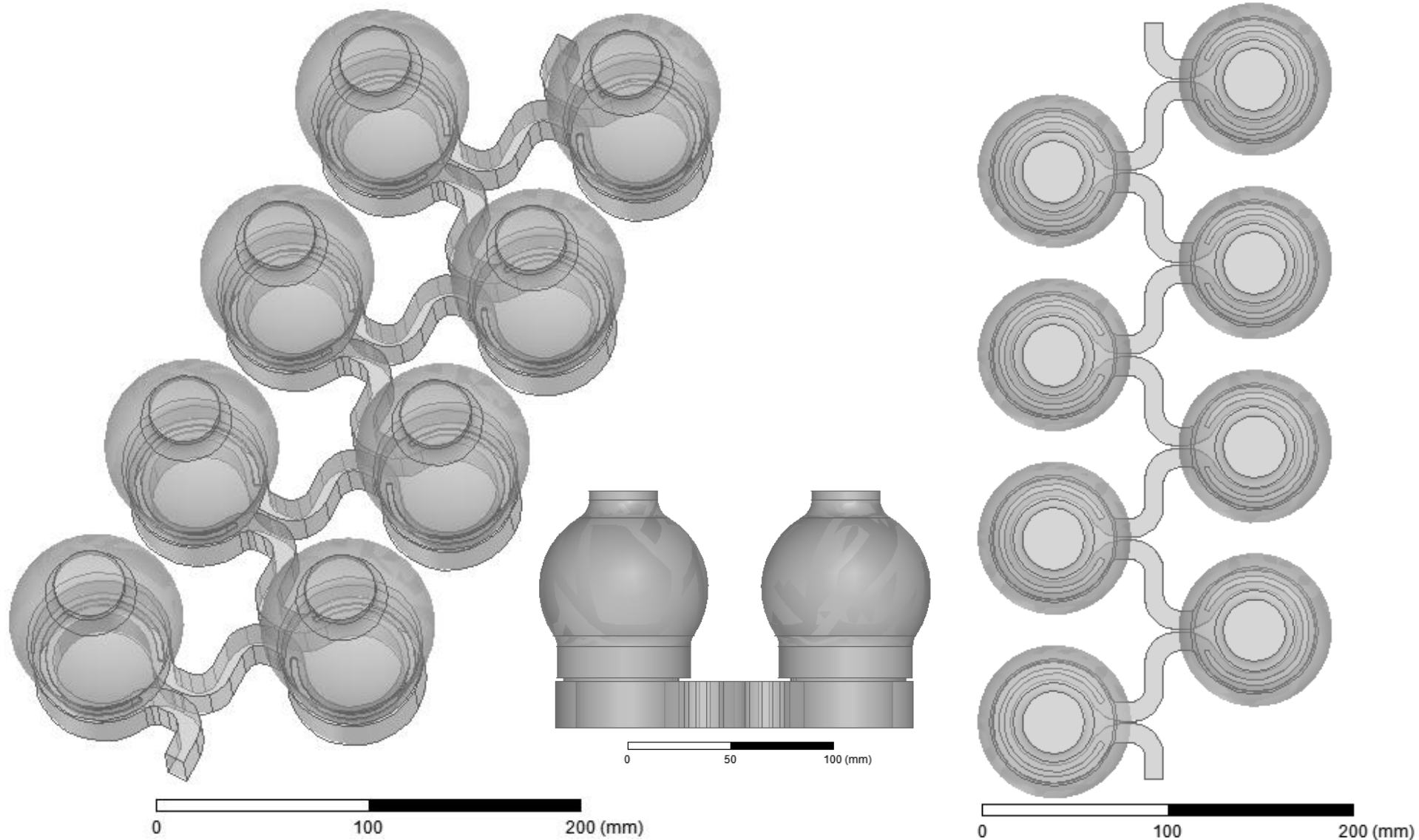
$$Q_E = \frac{a}{\sigma_s}$$

for Copper:

$$a = Q_0 \sqrt{\lambda} 4 \times 10^{-6}$$



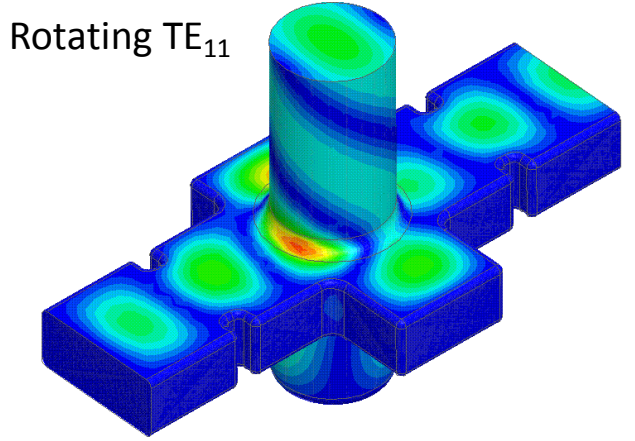
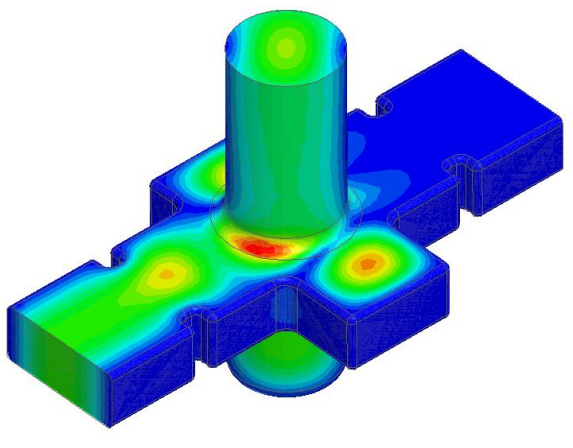
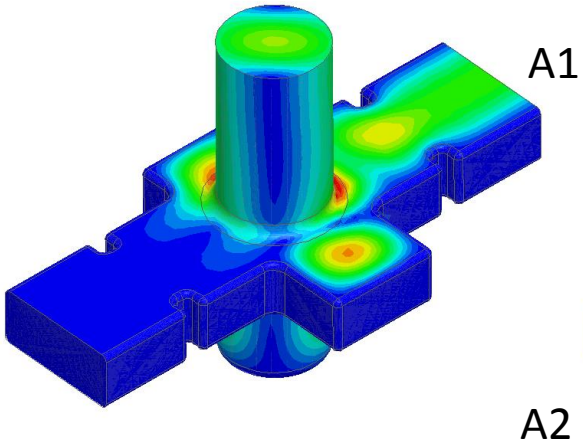
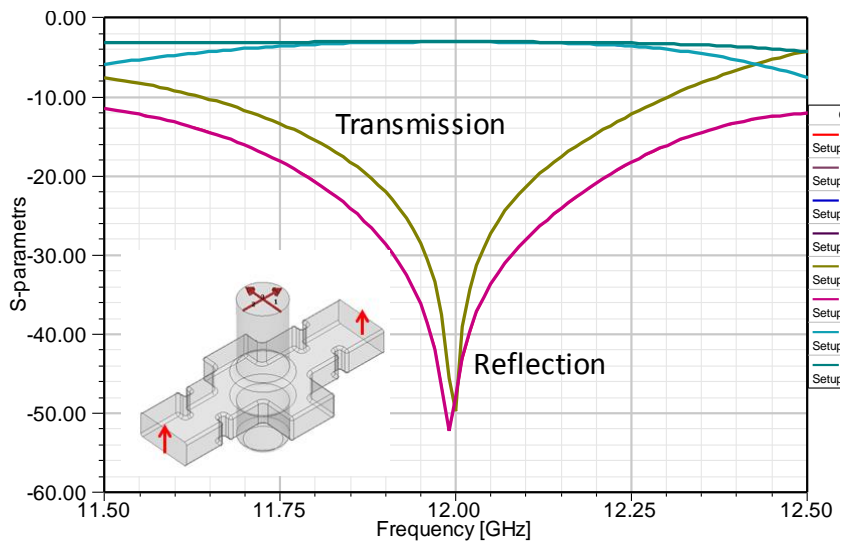
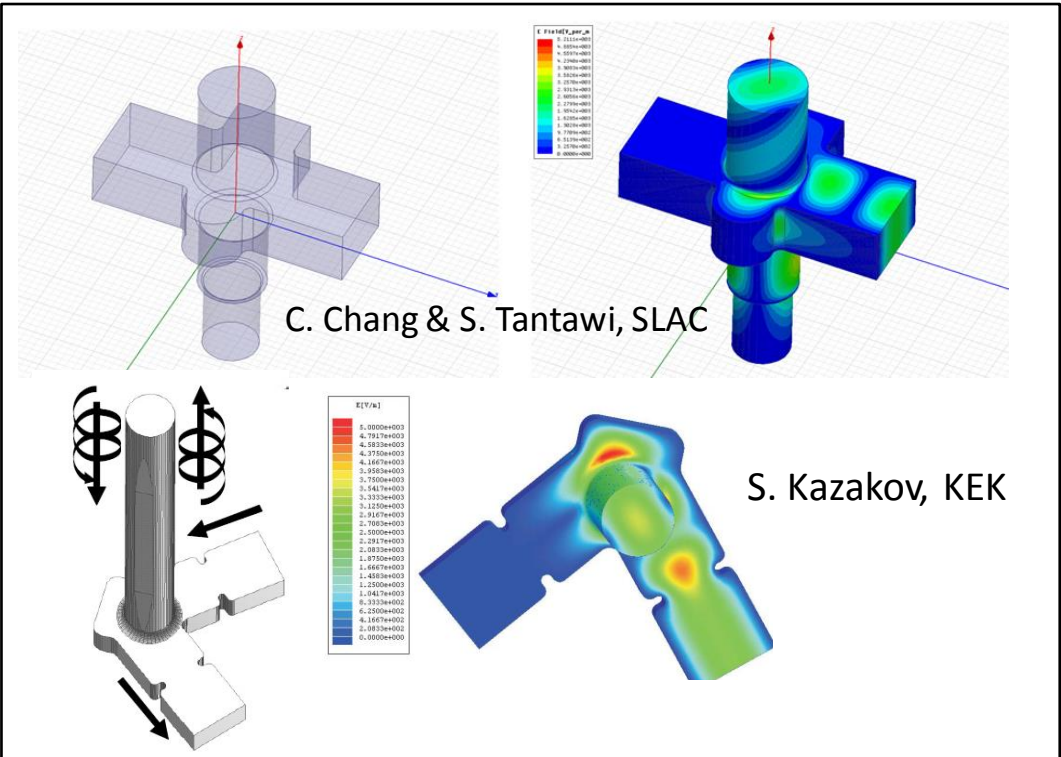
CC chain #1





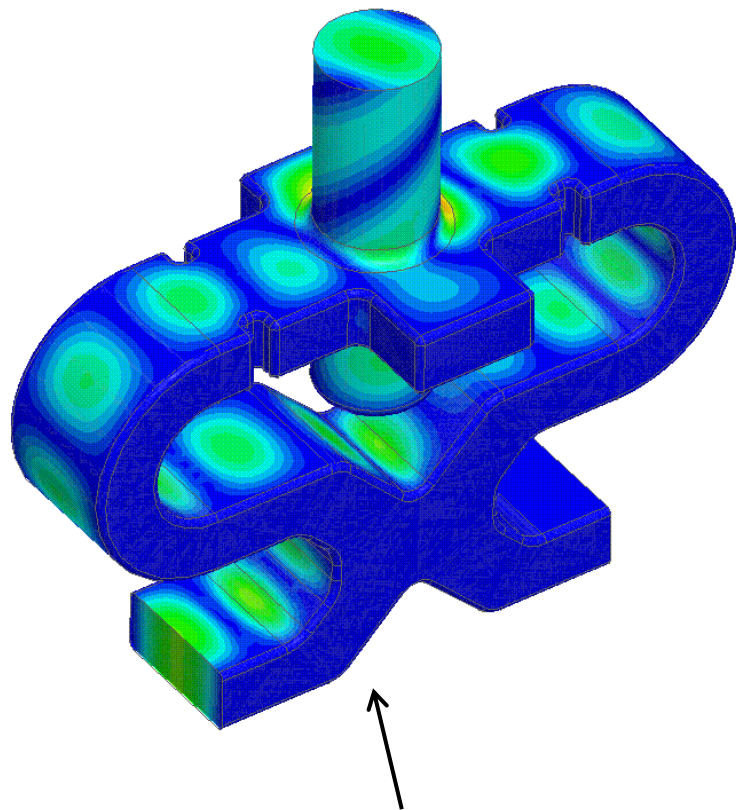
Inspired by the work done by:

3dB 'cross' hybrid. 3 ports; 4 modes

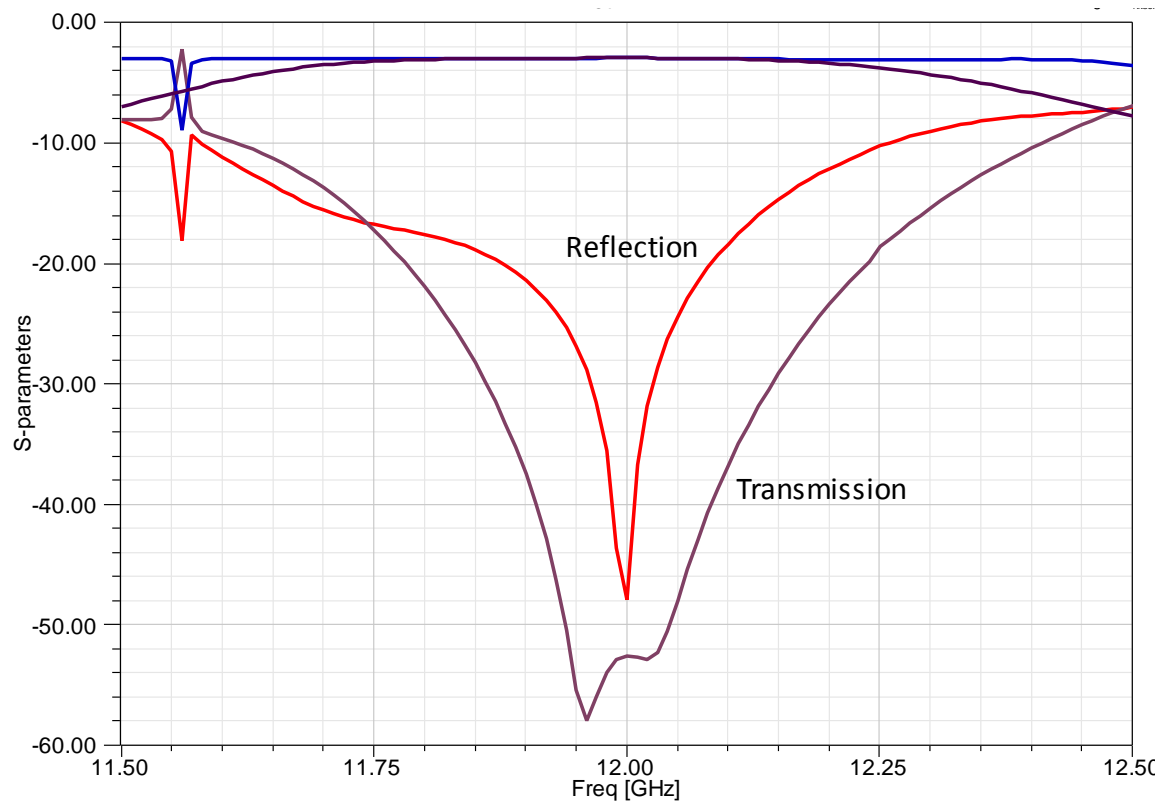




Rotating modes launcher. Practical design.

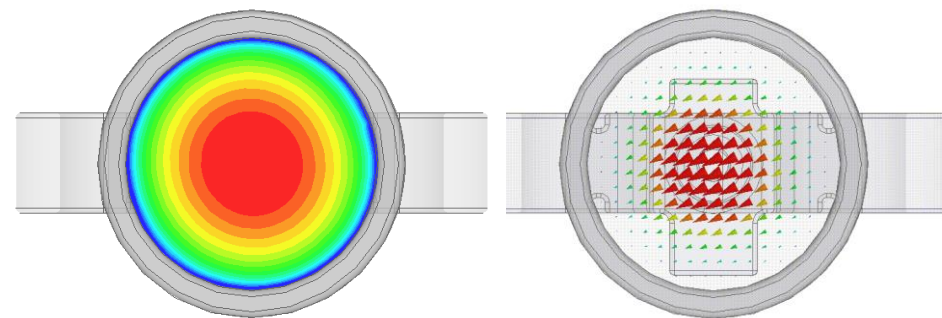
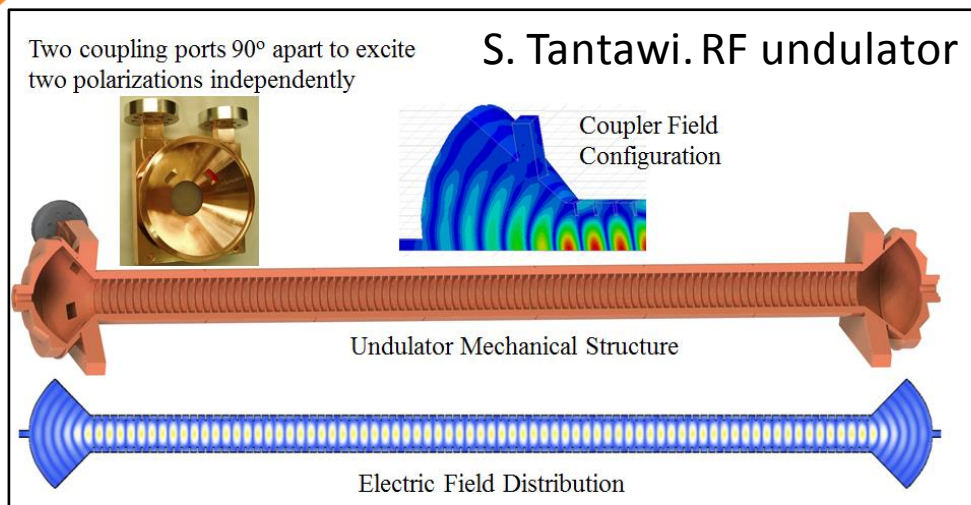


Ultra compact 3dB hybrid. Design by A. Grudiev

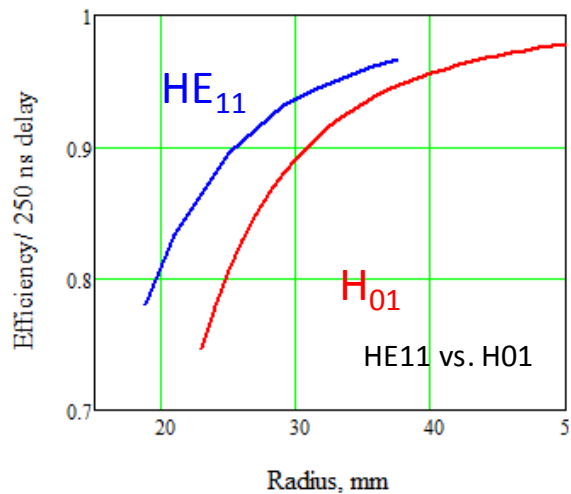




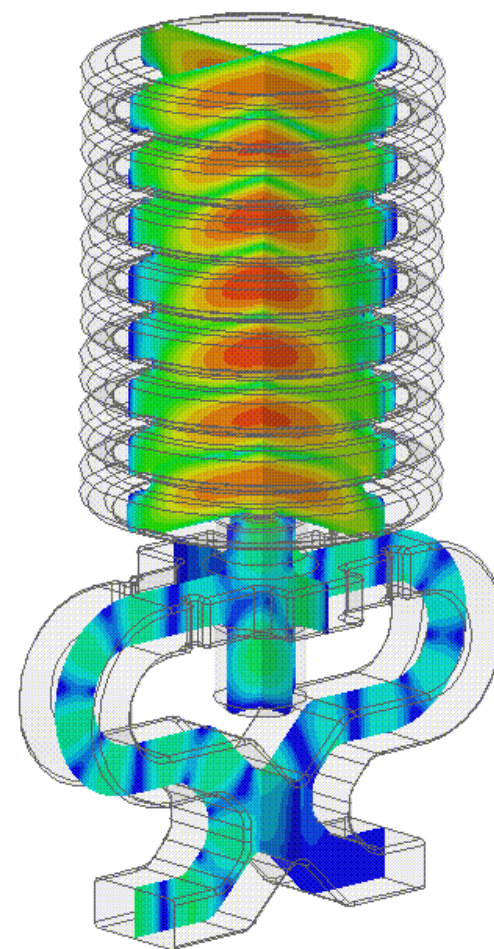
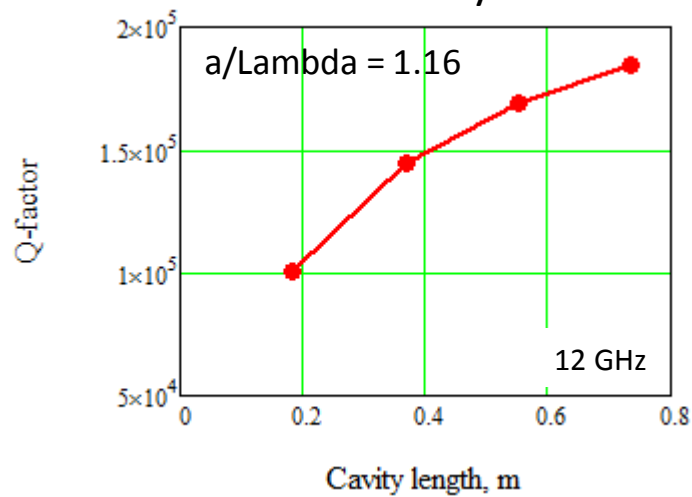
CC#2. Rotating HE11 mode



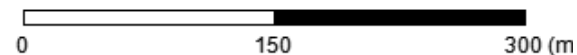
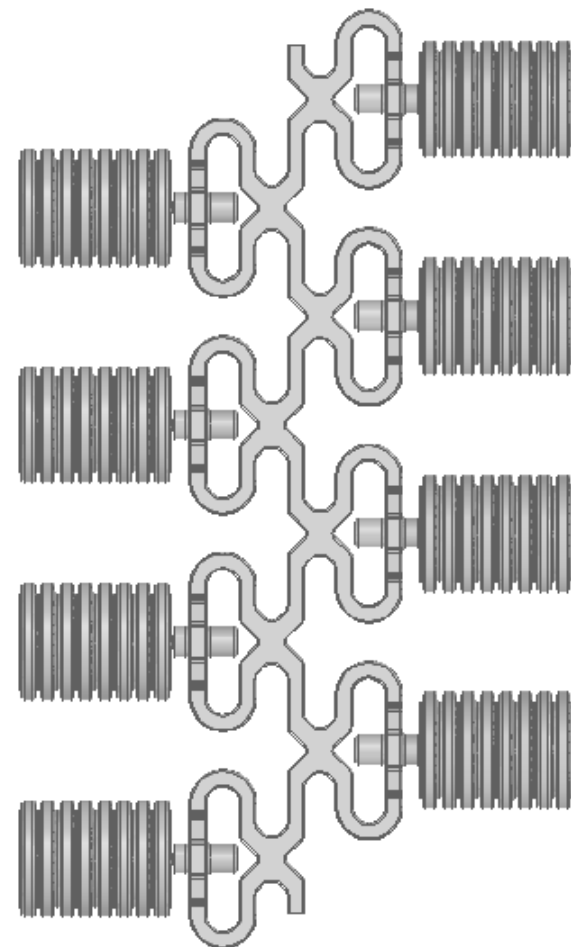
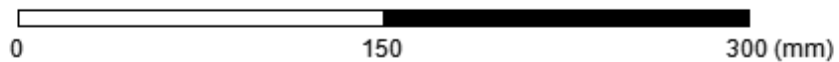
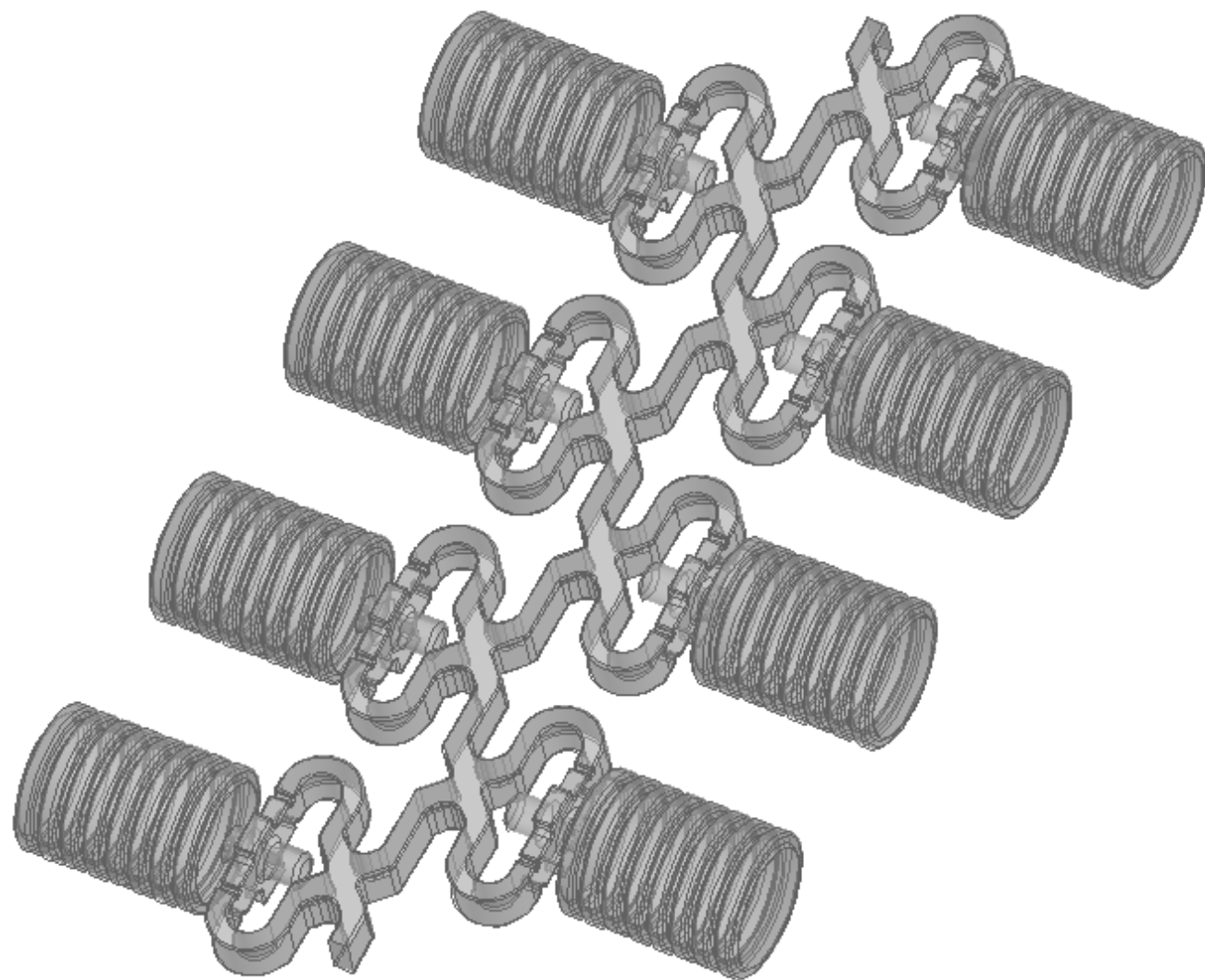
Delay line



Cavity:



CC chain #2

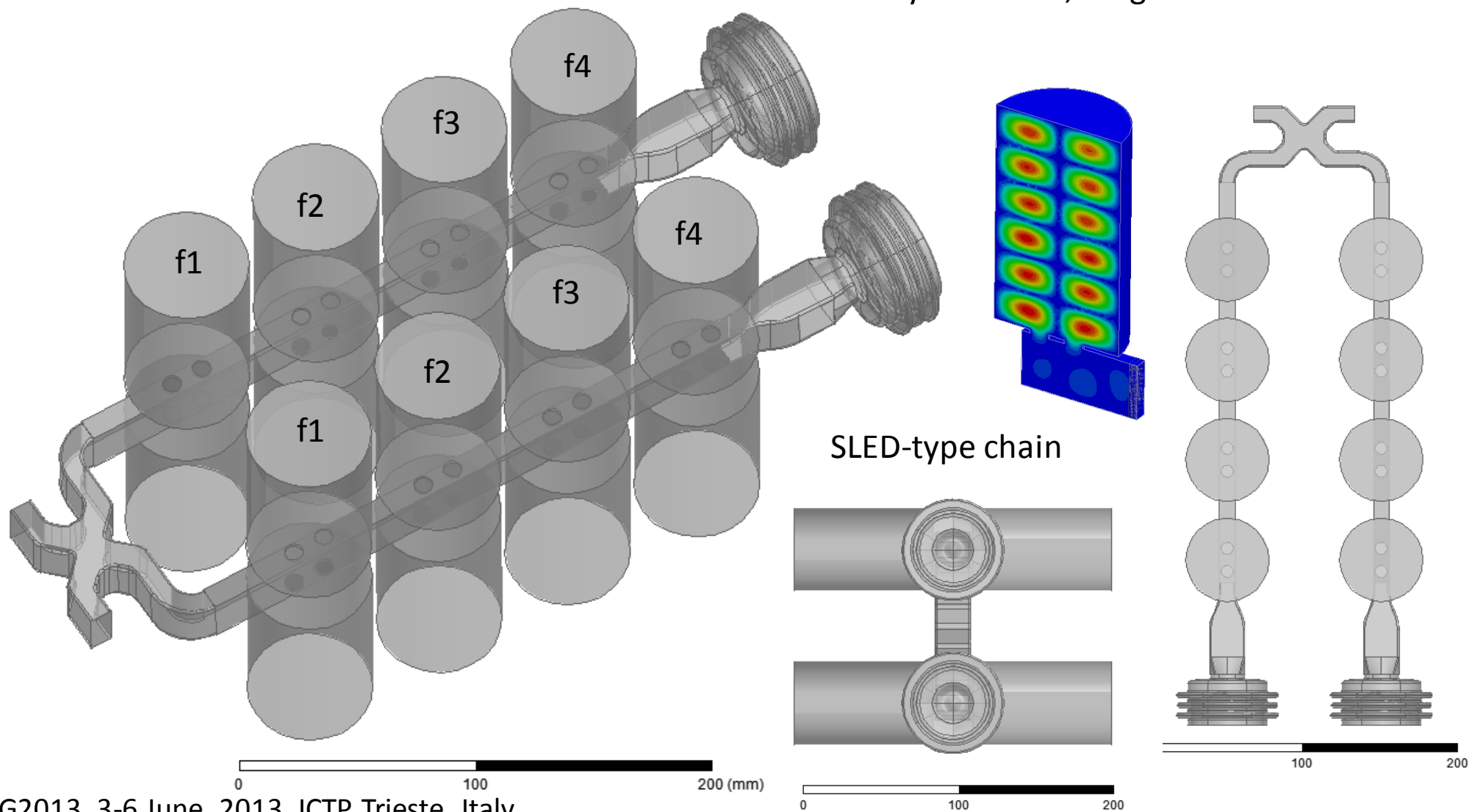




Cylindrical H_{016} cavity ($Q_0 = 6.2 \times 10^4$)

- Machined in two halves
- Individual cavity frequency tuning with pistons
- Global adjustment of the coupling using external movable short circuit

Most robust (compact) RF & mechanical solution with F and β tuning options.
Cavity: \varnothing 54mm, length ~ 90.6 mm



SLED-type chain