Micromachined filters for space applications

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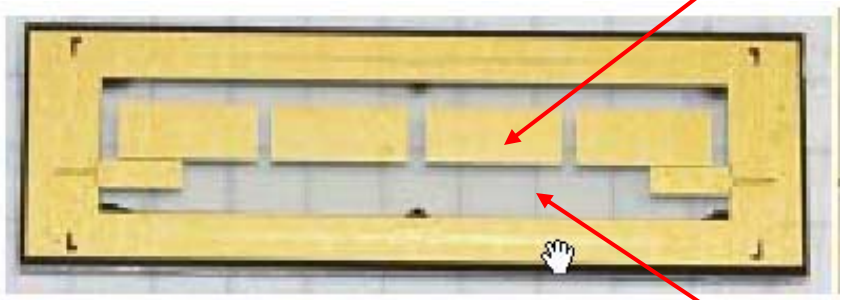
Outline

- First fabrication and measurement
- loss breakdown
- Size reduction
- 3D simulations

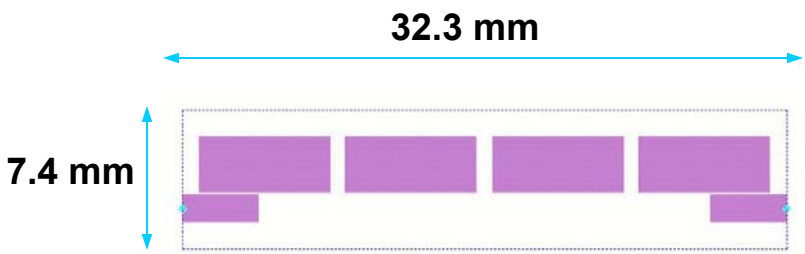
Micro-machining

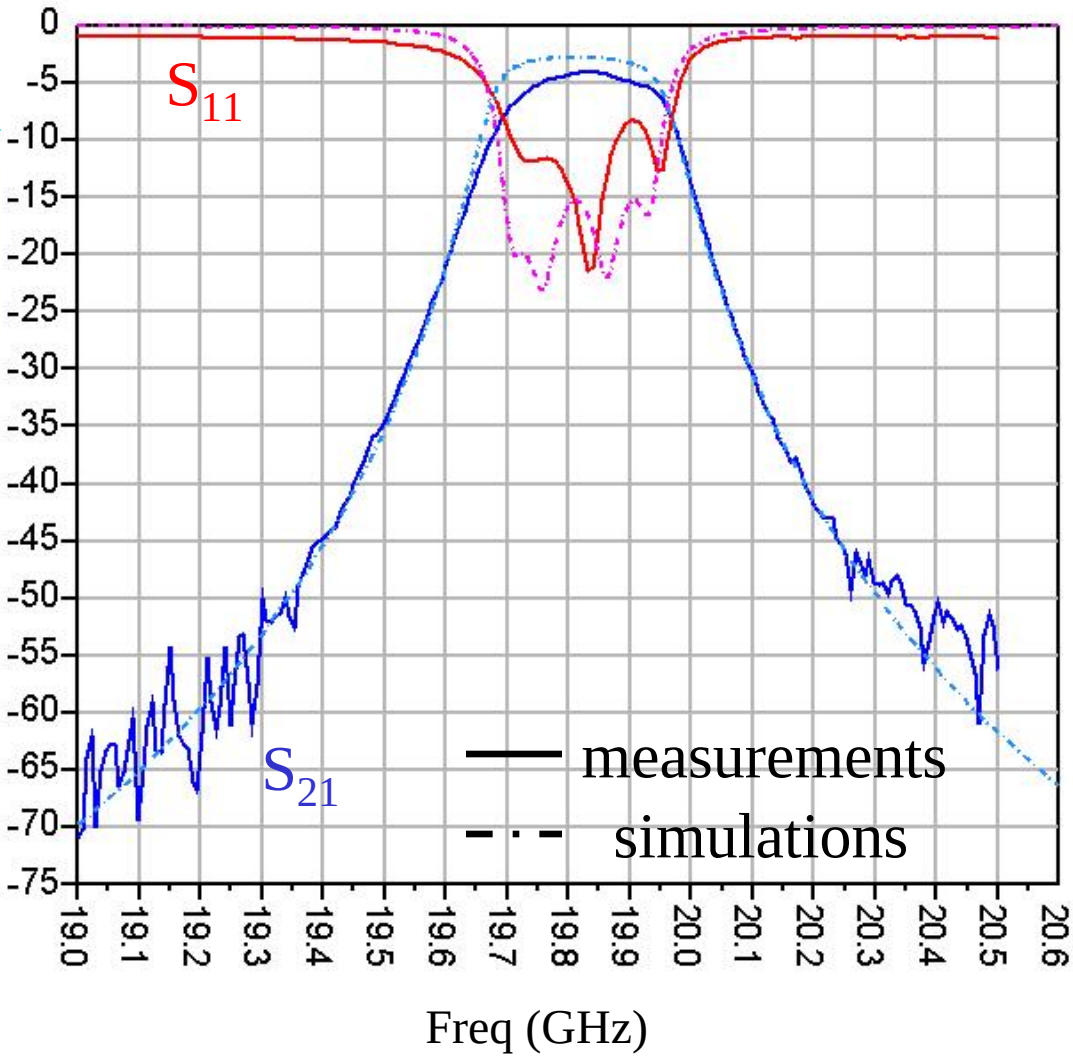
- Membrane suported
- Propagation in air
- High Q_0



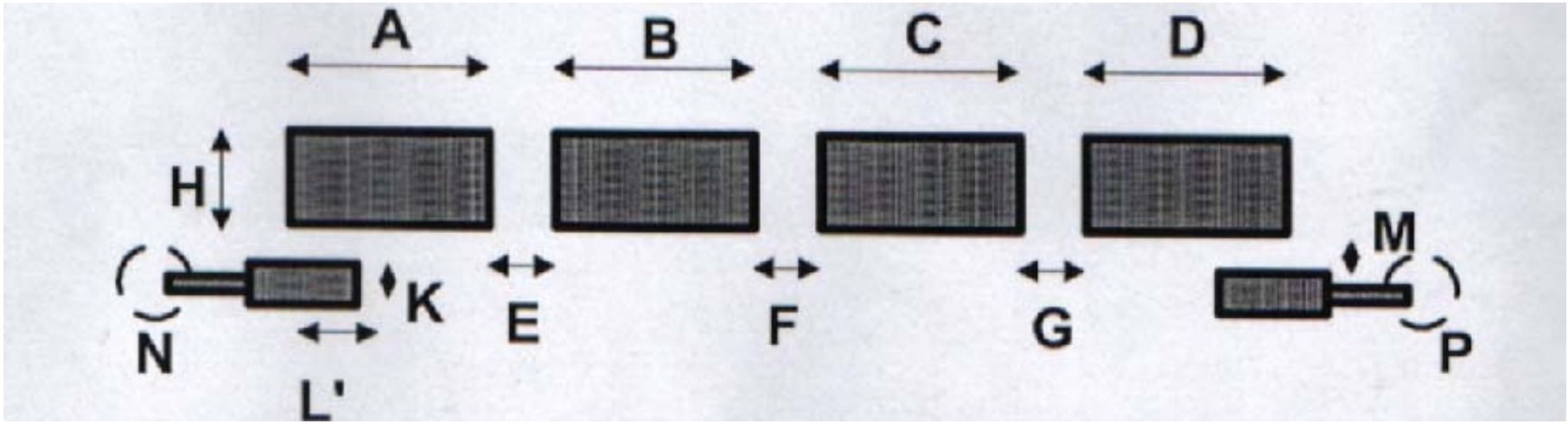
Upper cavity

First fabrication in XLIM





Deviation process study



Resonator length

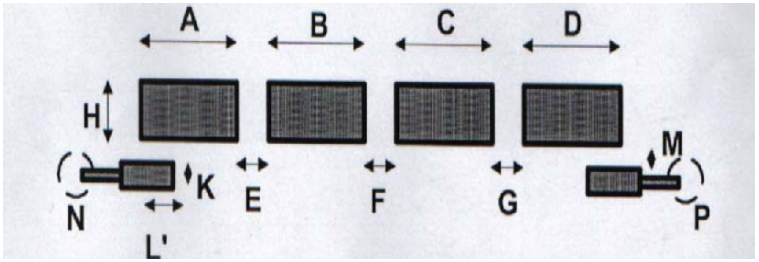
Inter-resonator coupling

Input/output coupling

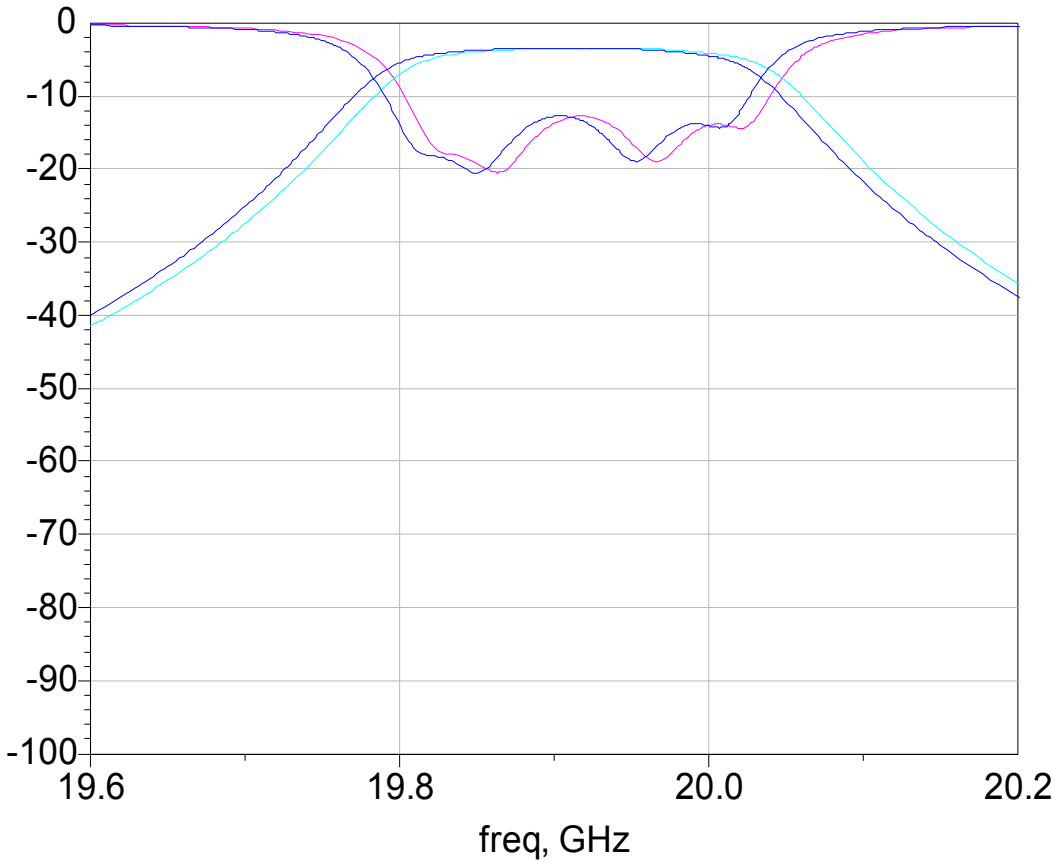
Resonator width

Cavity thickness

Resonator length

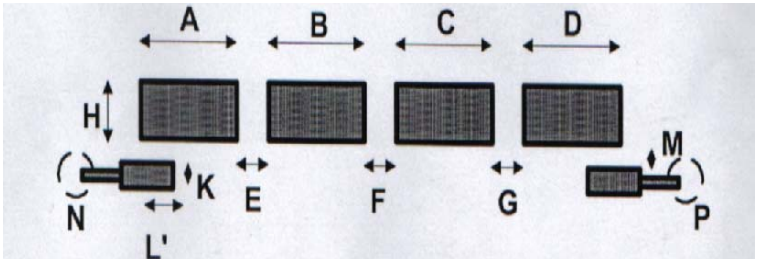


A B C D = +5µm

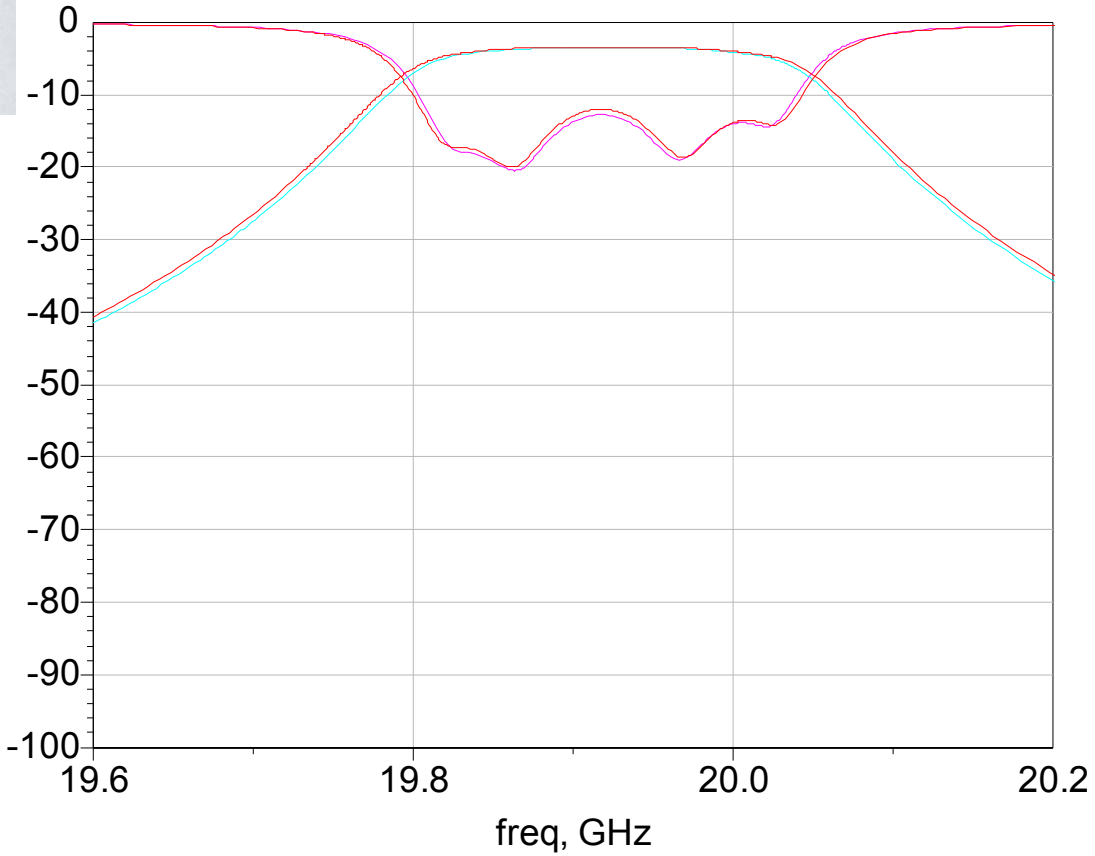


Frequency shift = -115 MHz

Inter-resonator coupling



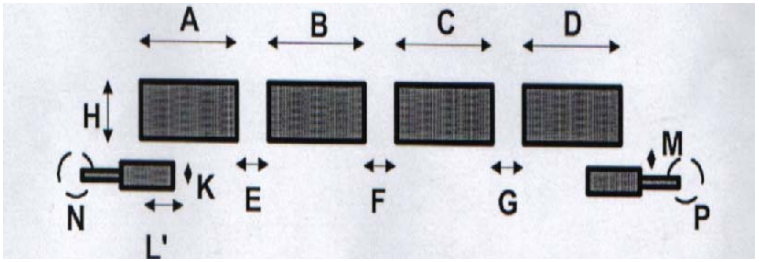
E F G = - 10 µm



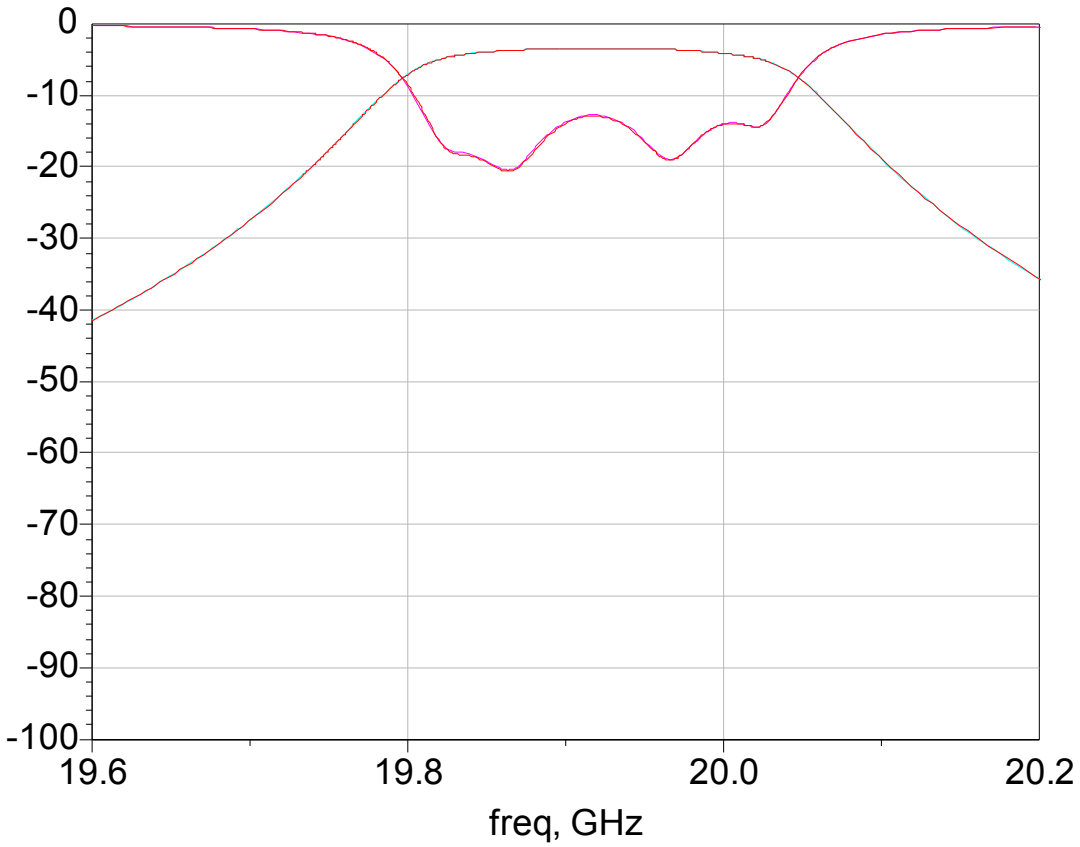
Larger bandwidth = +70 MHz

Worse adaptation = 0.7 dB

Resonator width



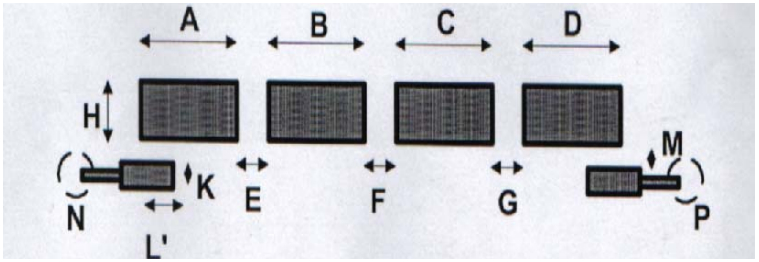
H = - 20 µm



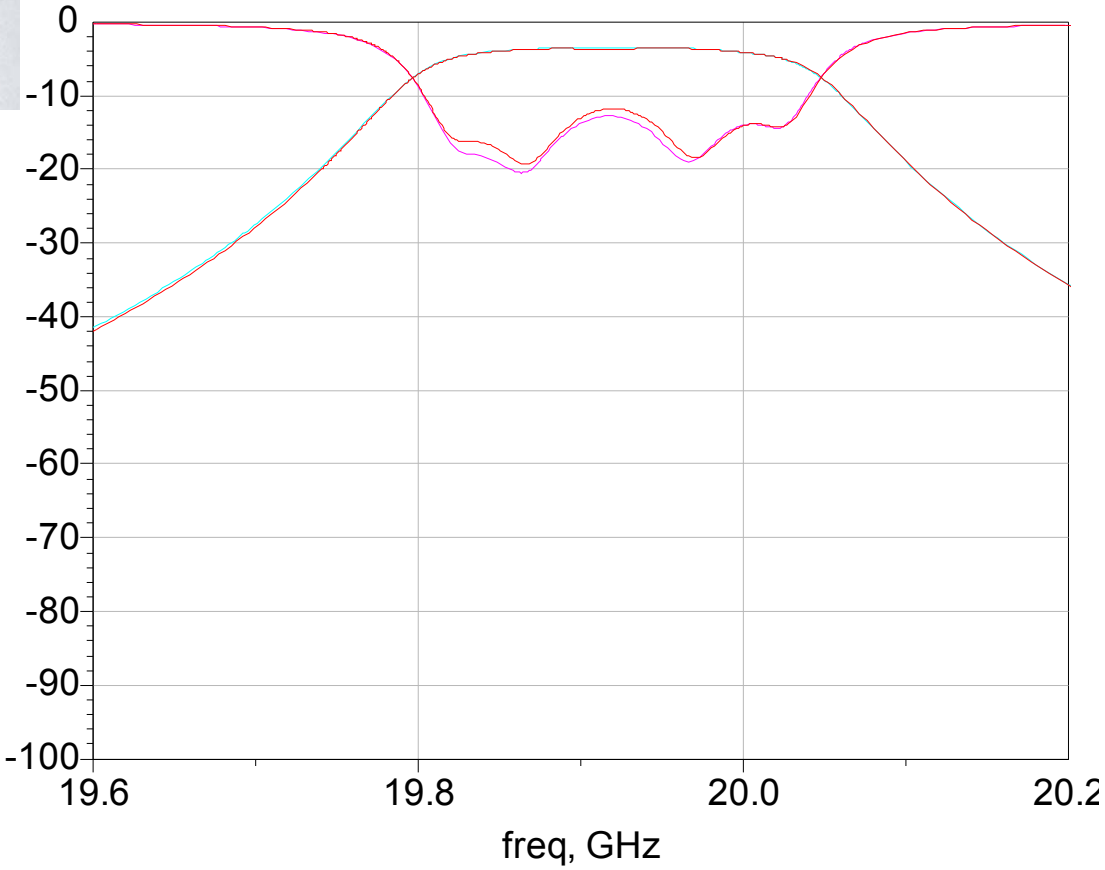
Very low influence

η_{ins} = + 0.15 dB

Input/output coupling (M)

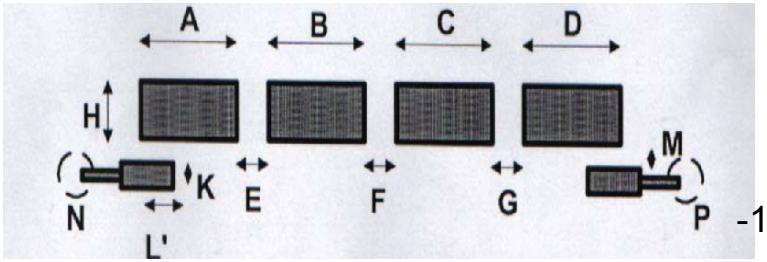


M = + 5 µm

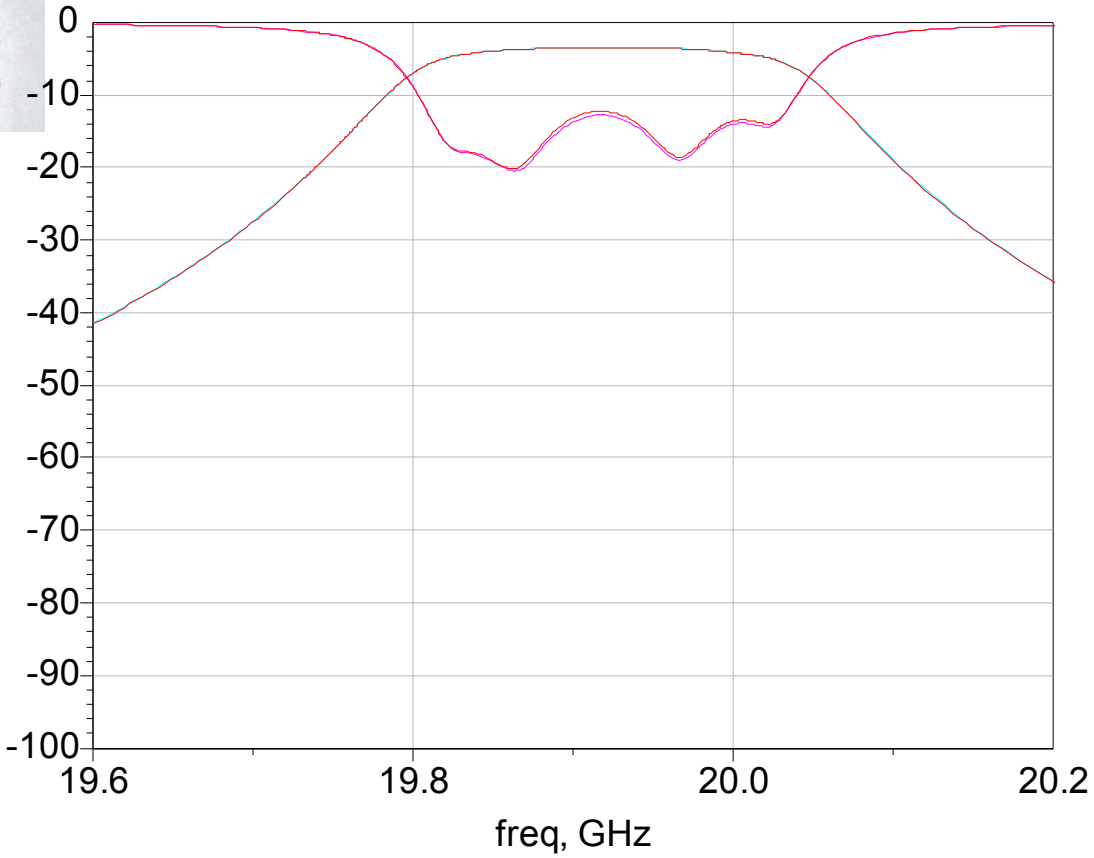


Worse matching = 0.9 dB

Input/output coupling (K)

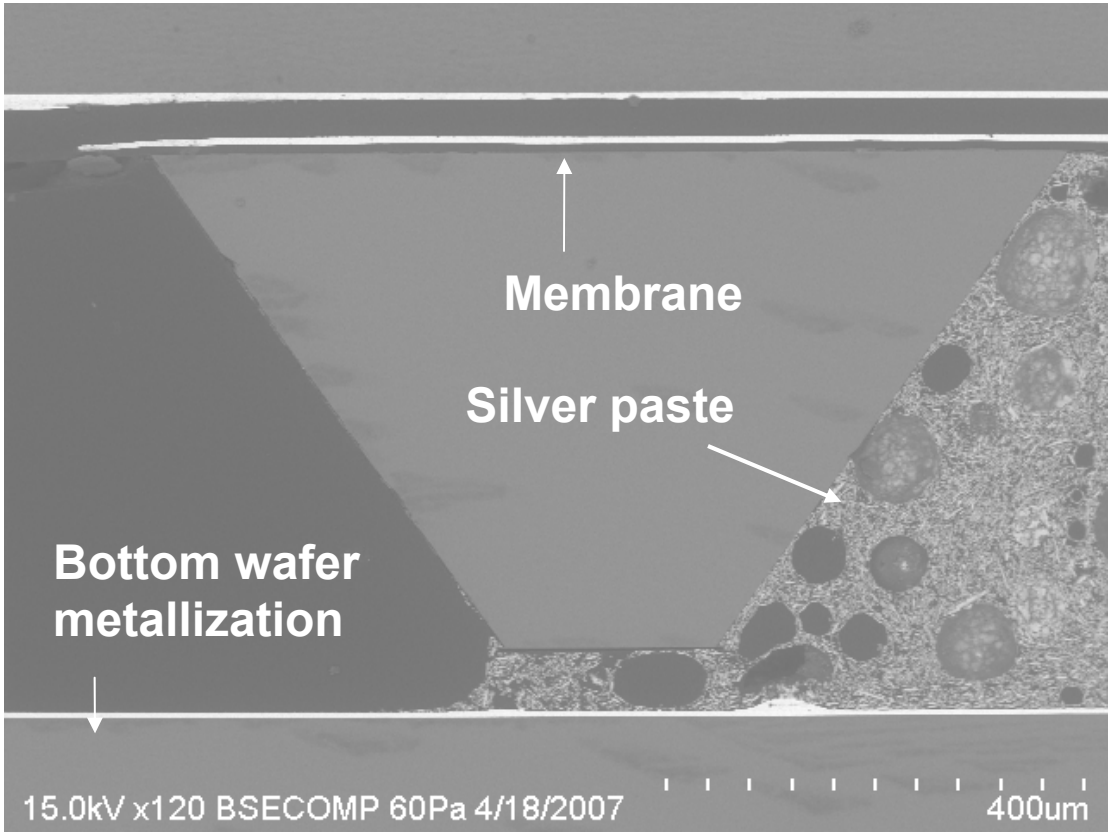


K = + 5 µm



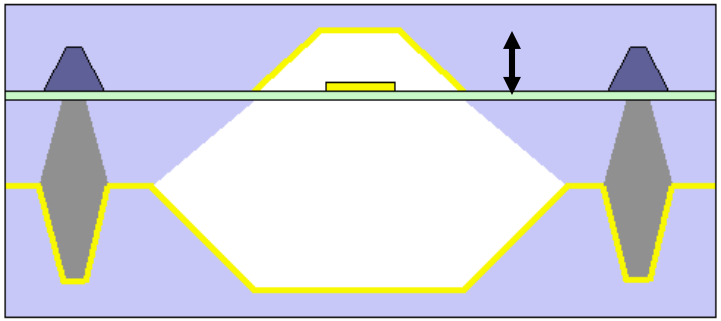
Worse matching = 0.5 dB

Cavity assembly

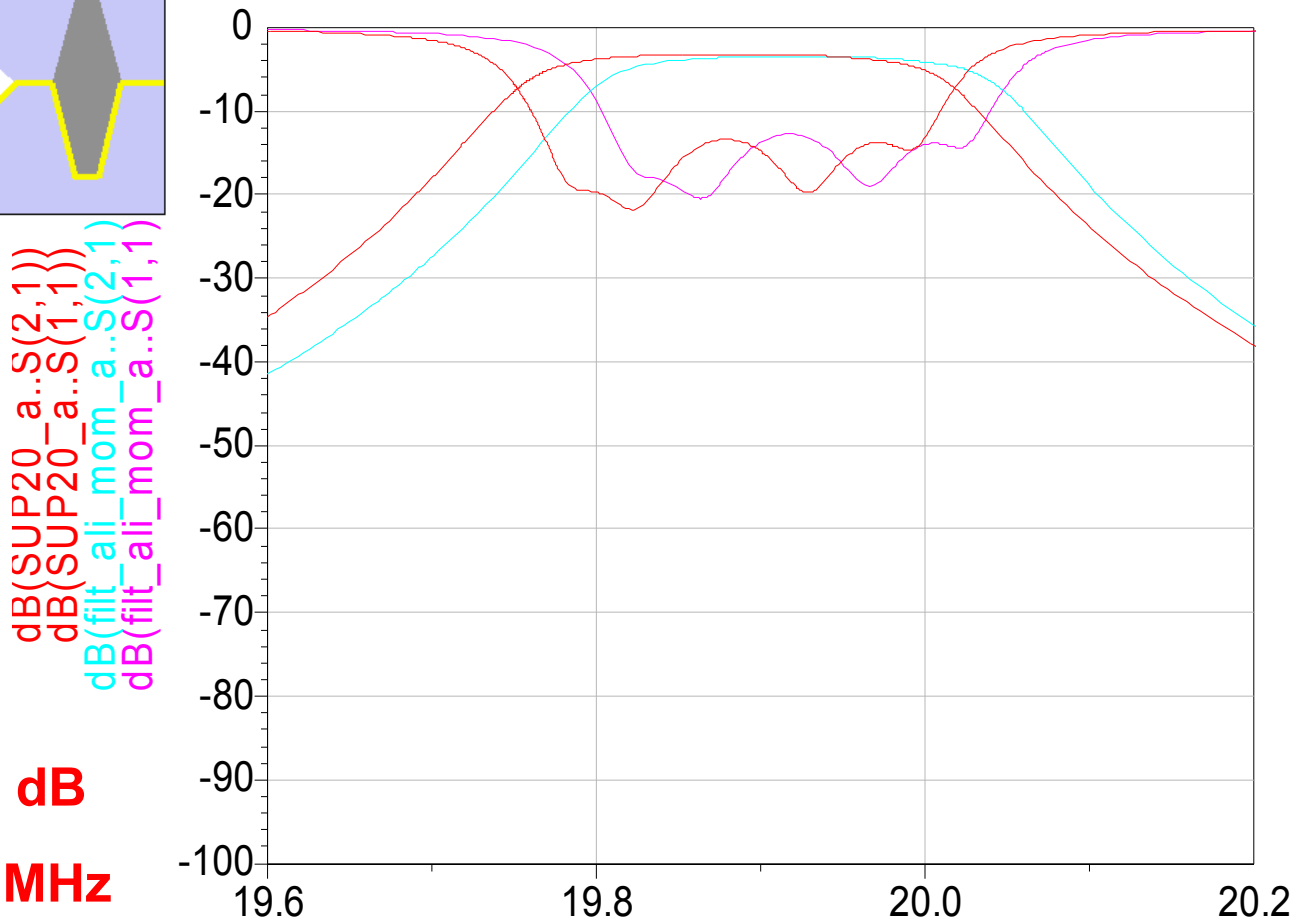


↕ Thickness increase

Cavity thickness



Hup = + 20 µm



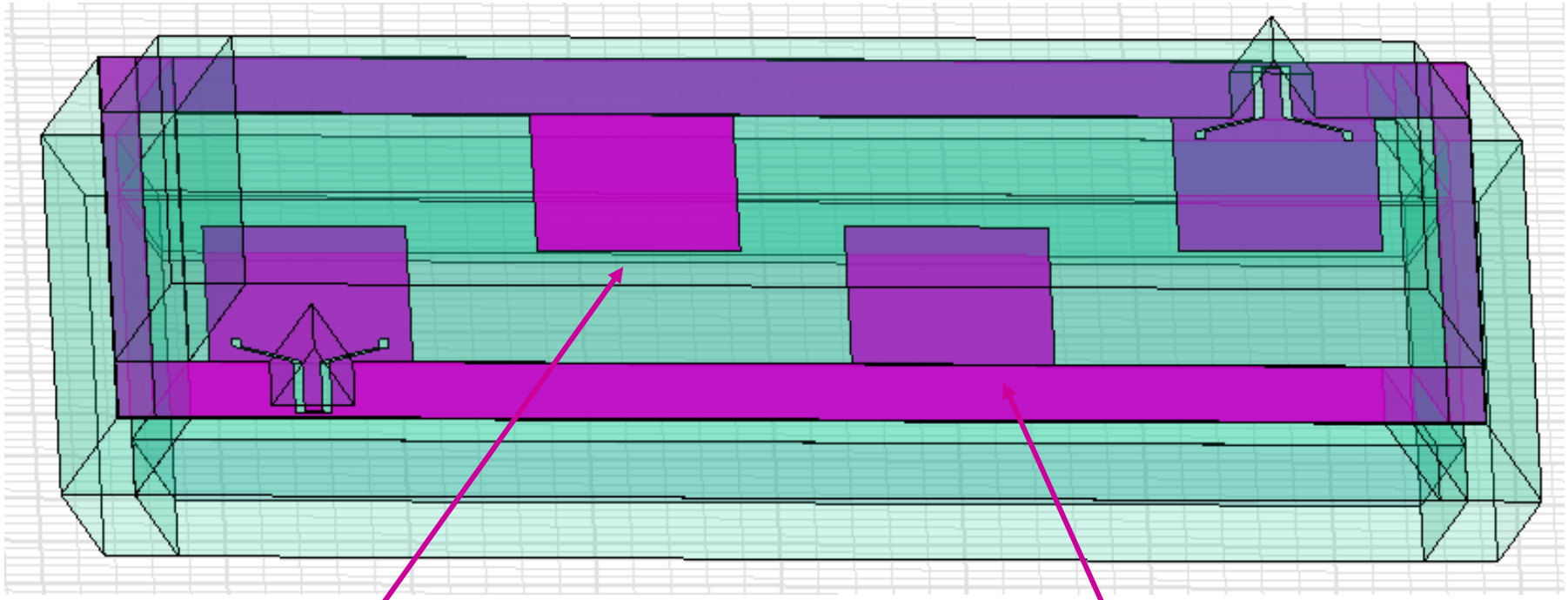
better matching = 0.7 dB

Frequency shift = 350 MHz

Summary parameters influence

PARAMETER	INFLUENCE
A B C D (resonator length)	Frequency shift
E F G (inter resonator coupling)	Bandwidth and adaptation
M L (input/output coupling)	Adaptation
Hup Hlo (cavity thickness)	Frequency shift and adaptation

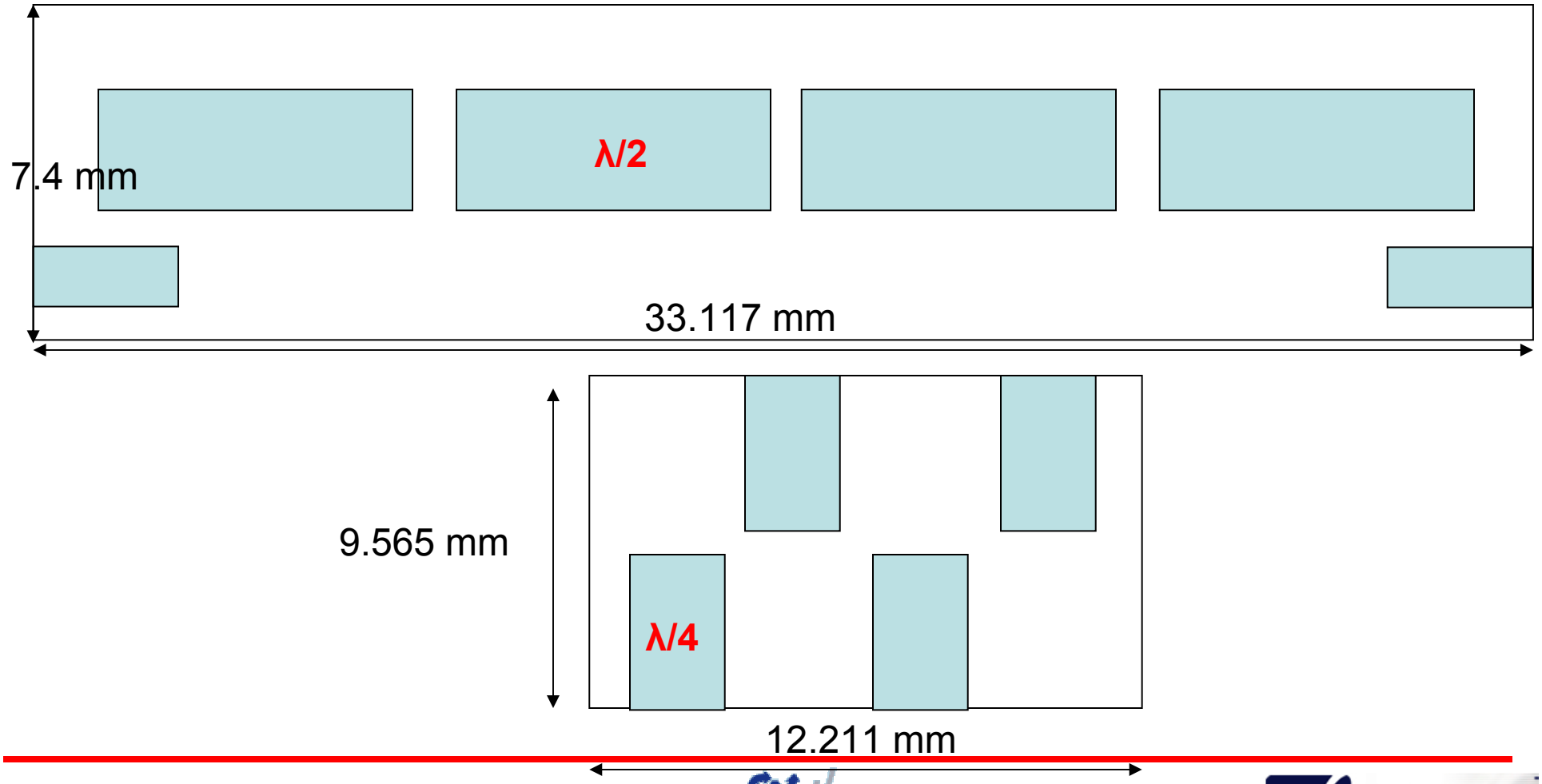
Size reduction (1)



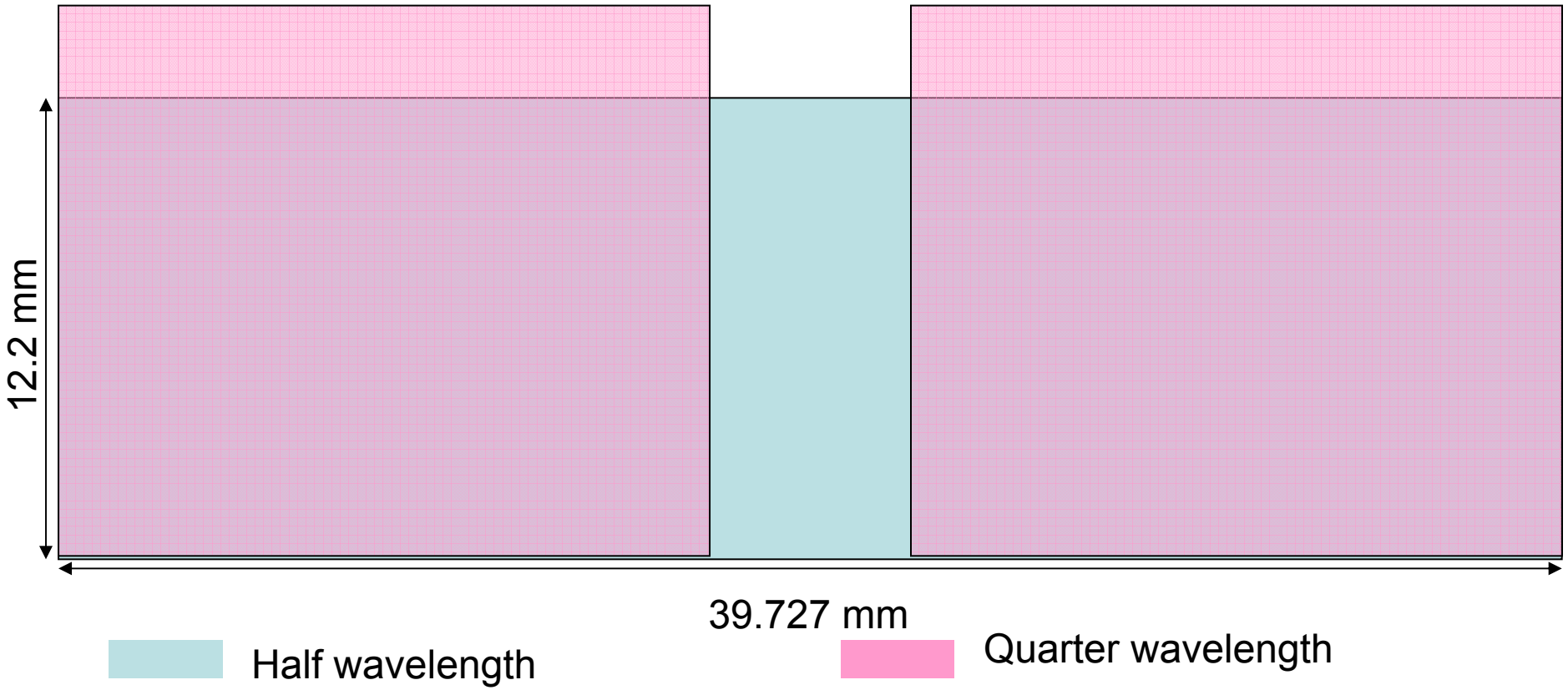
short circuited quarter wave length = half wave length

Size reduction (2)

- **λ/4 resonator**

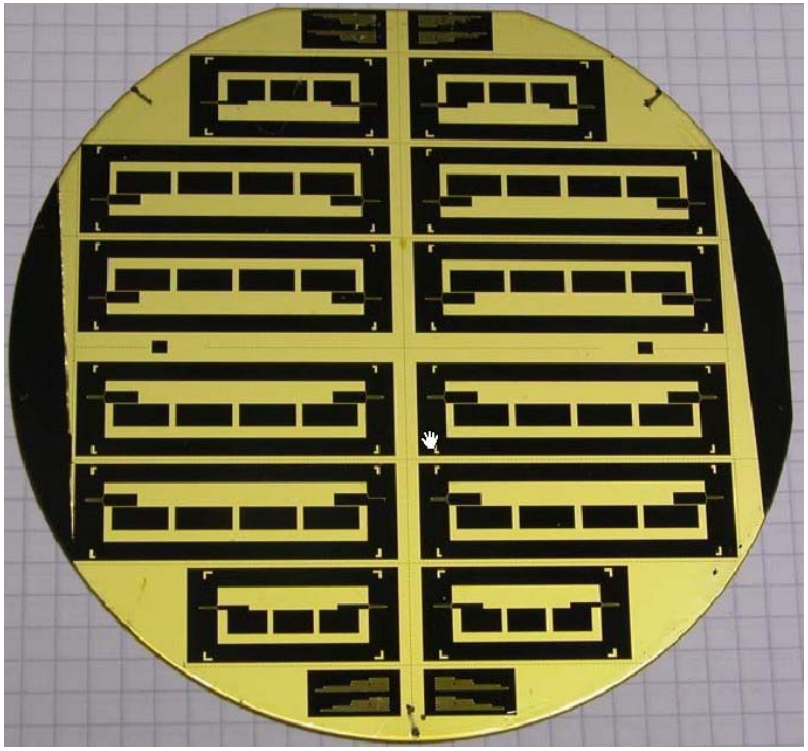


Comparison after packaging

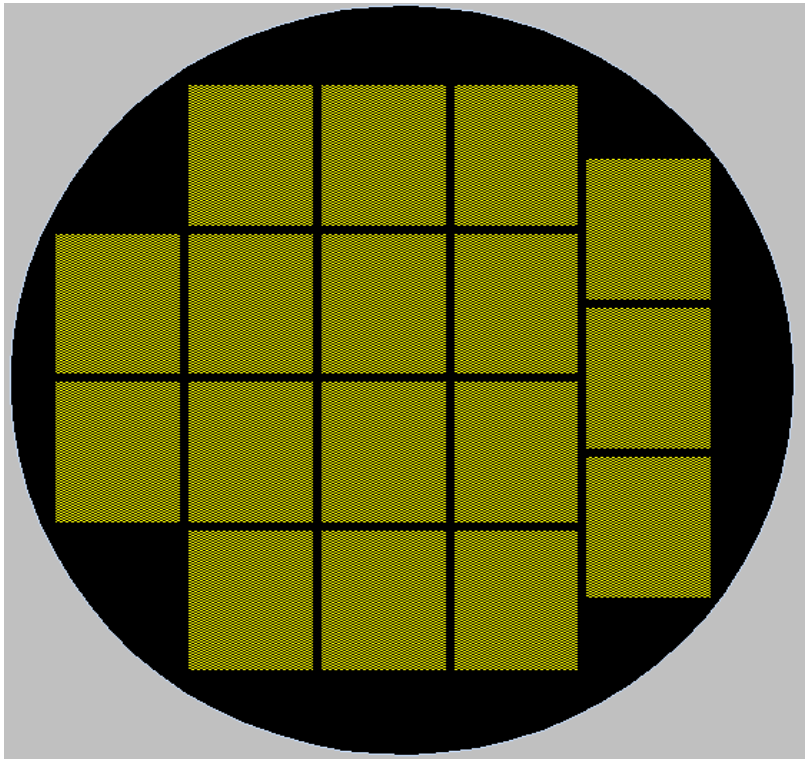


Very important improvement because length is the critical size in the module

4” wafer

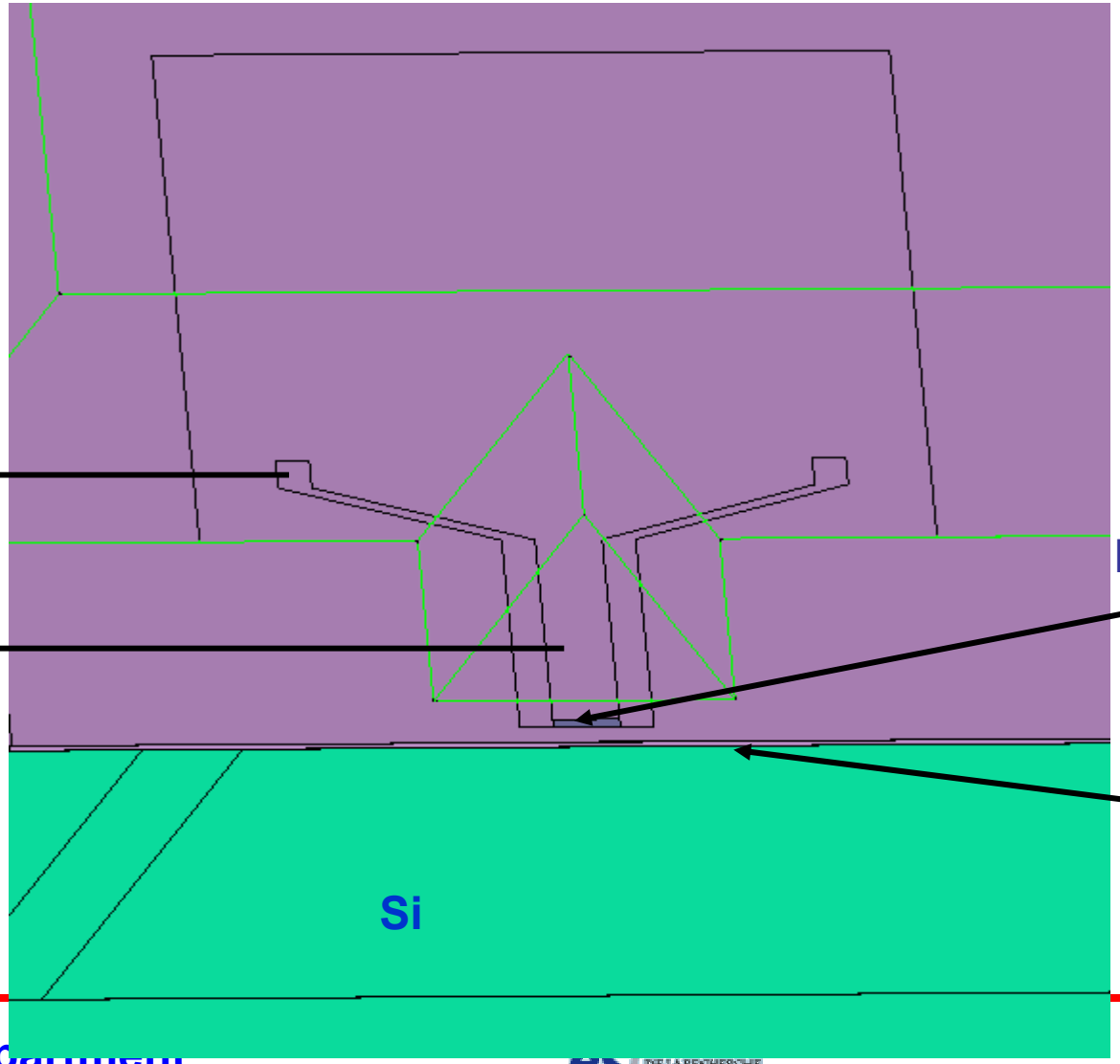


10 filters half wave



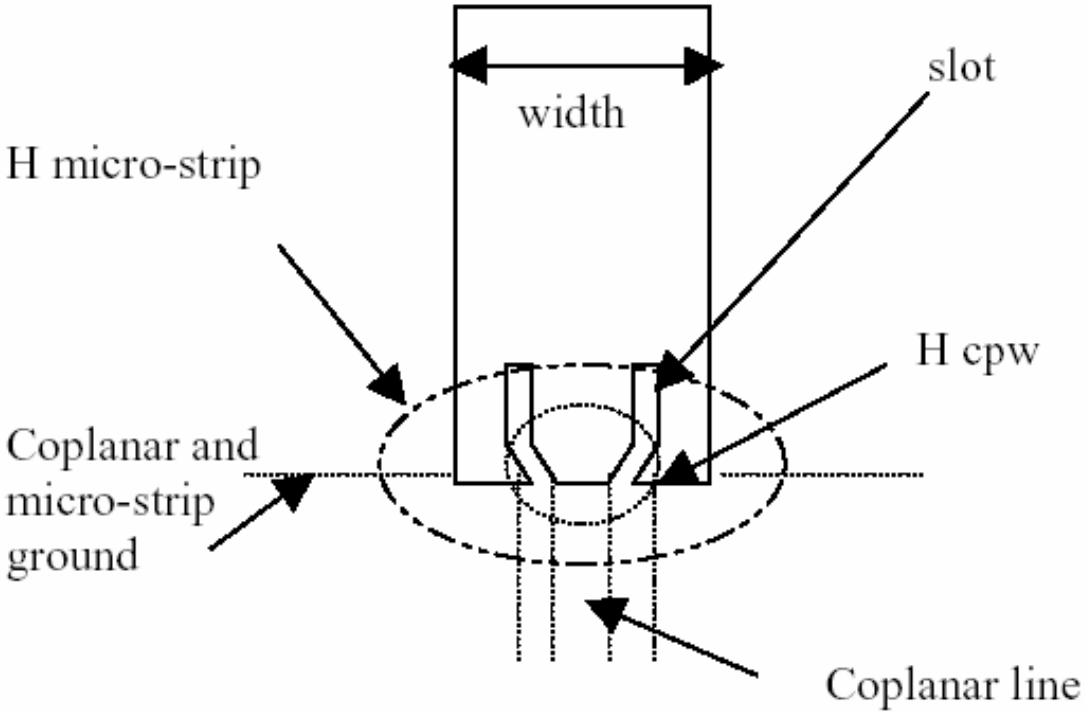
17 filters quarter wave

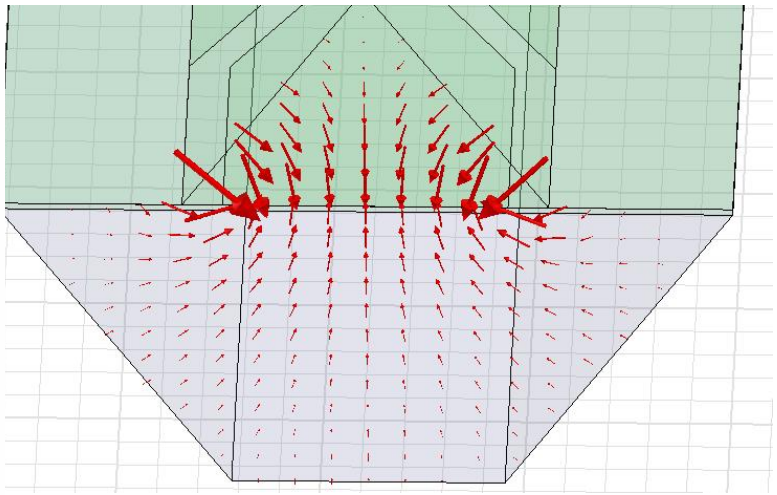
Accesses geometry



Feeding principle

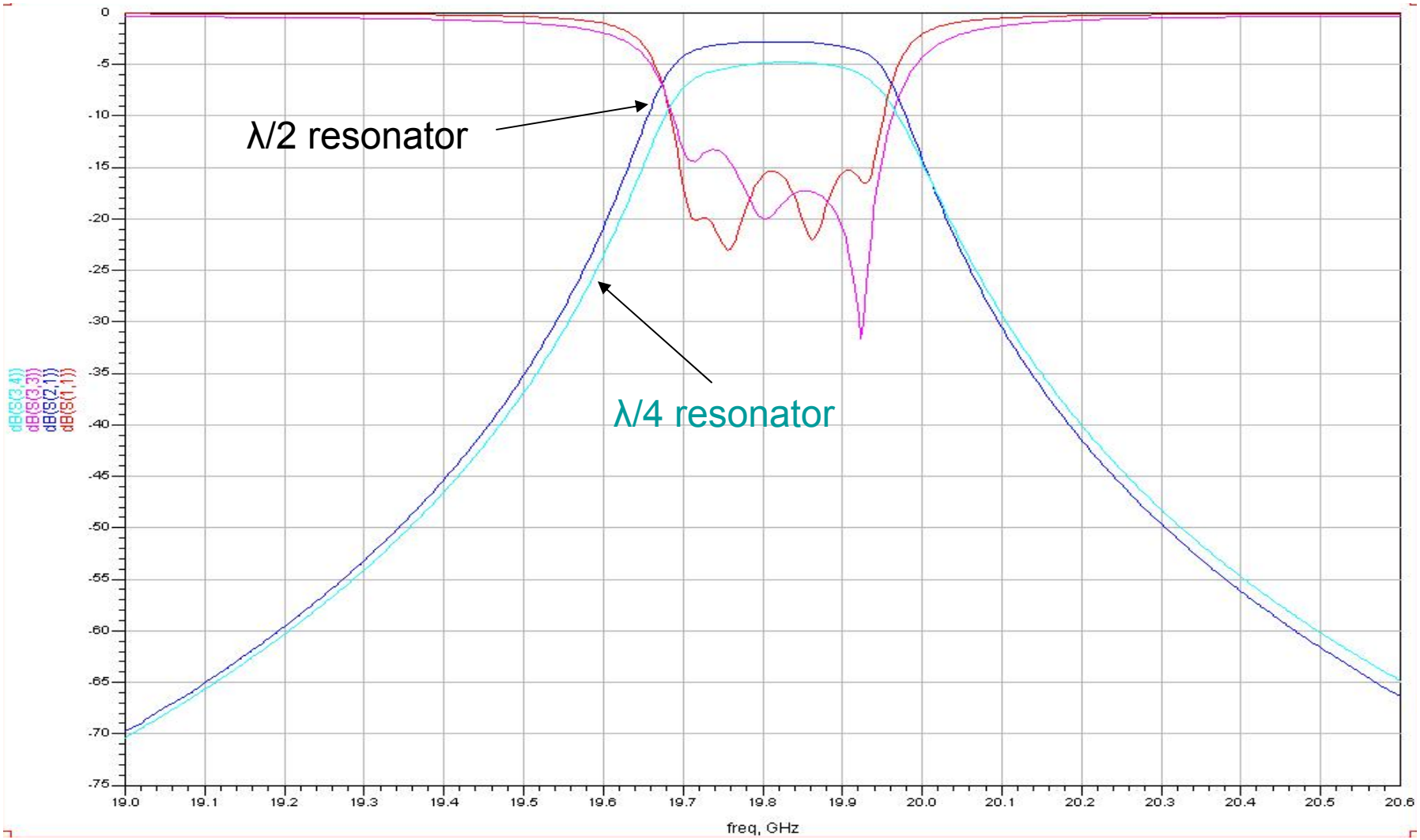
- **Magnetic loop**



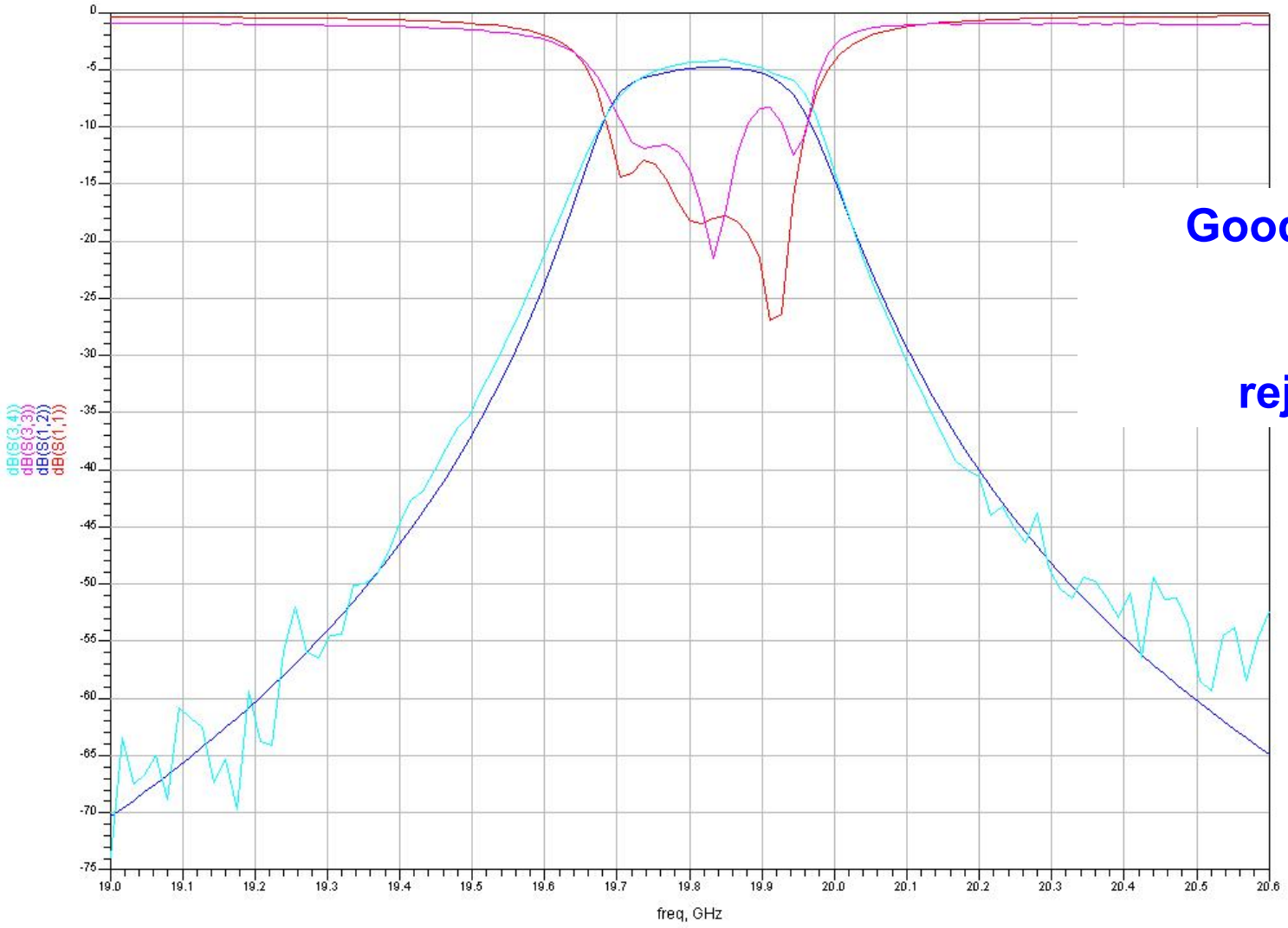


CPW mode in the accesses

Simulations comparison



Measured λ/2 : simulated λ/4



Good match :

ηins

rejection

conclusion

- **Budget loss**
  - Cavity thickness
- **3D computation**
- **Size reduction**
  - λ/4 resonator