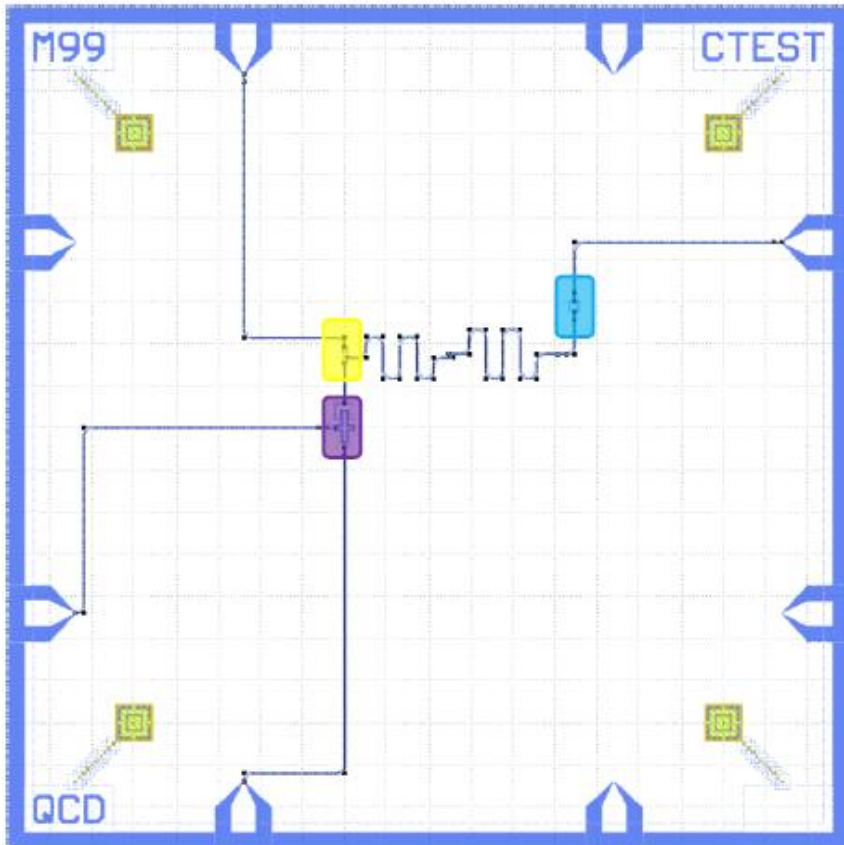


Frequency domain EM simulations using COMSOL®

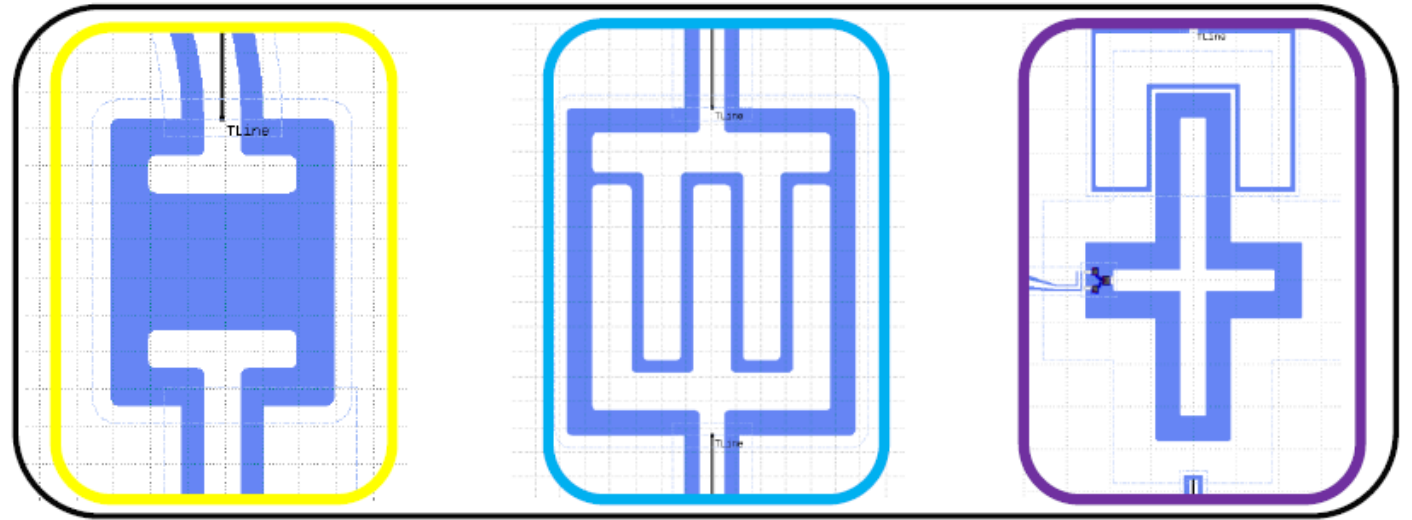
Lecture 5: Quantum circuits
14.03.2022

Lec4 Recap: electrostatic

Superconducting qubit chip



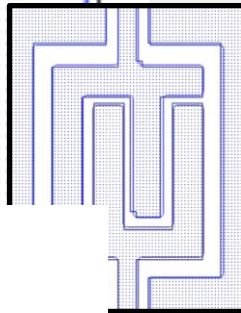
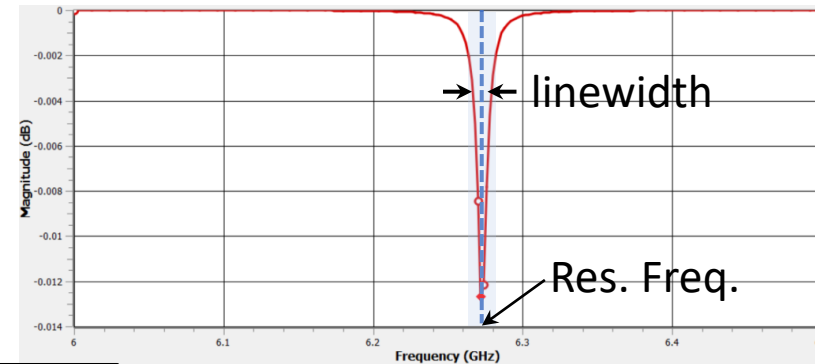
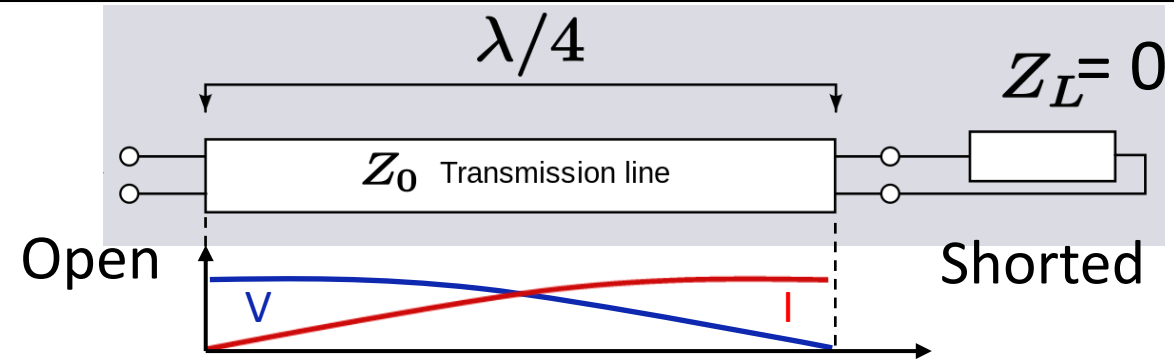
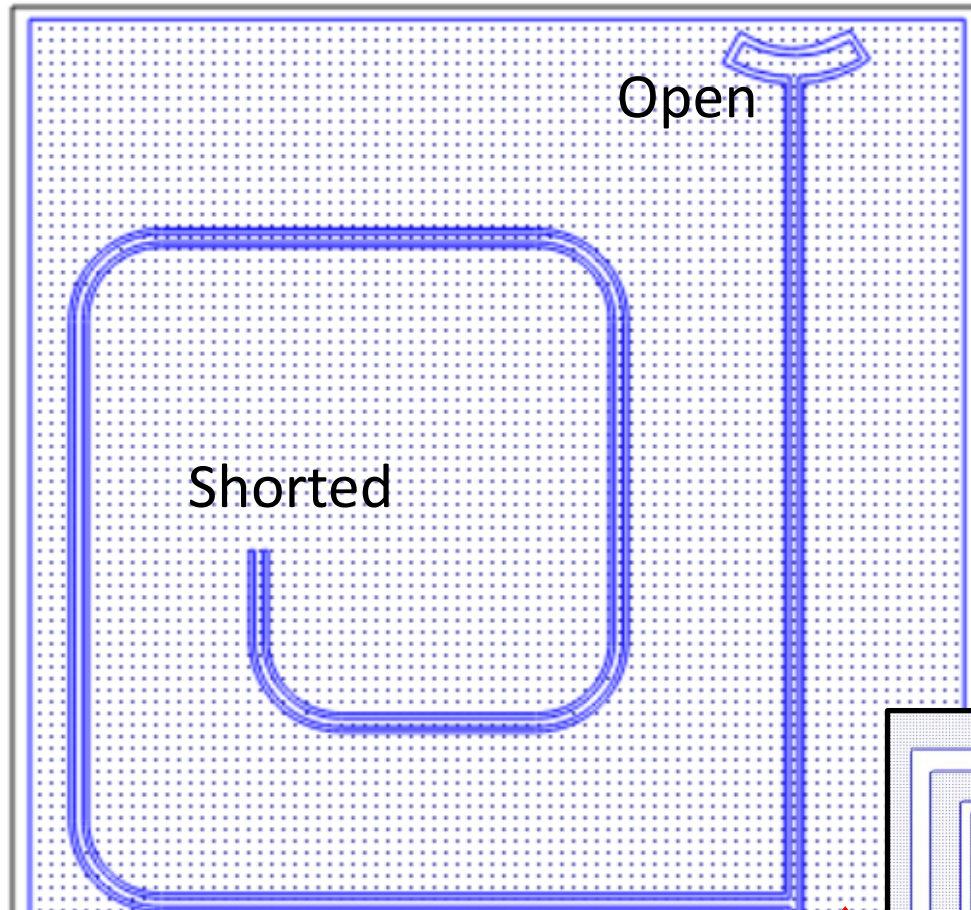
Capacitances



COMSOL Electrostatic simulation:

1. Design
2. Physics: Electrostatic
3. Study: Stationary
4. Define materials and terminals
5. Mesh the structure
6. Derived results(capacitance)

Necessity of EM simulation



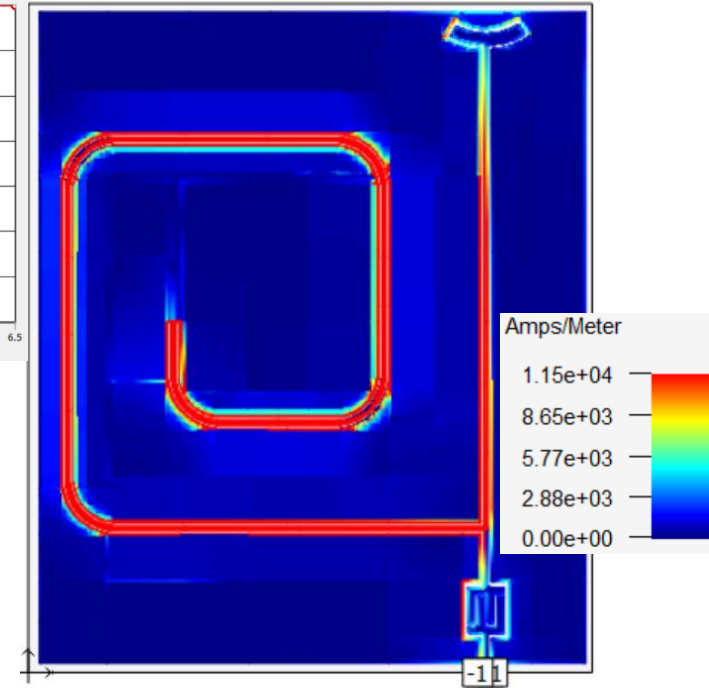
Res. Freq. adjustment:

➤ Length

Linewidth adjustment:

➤ Capacitor size

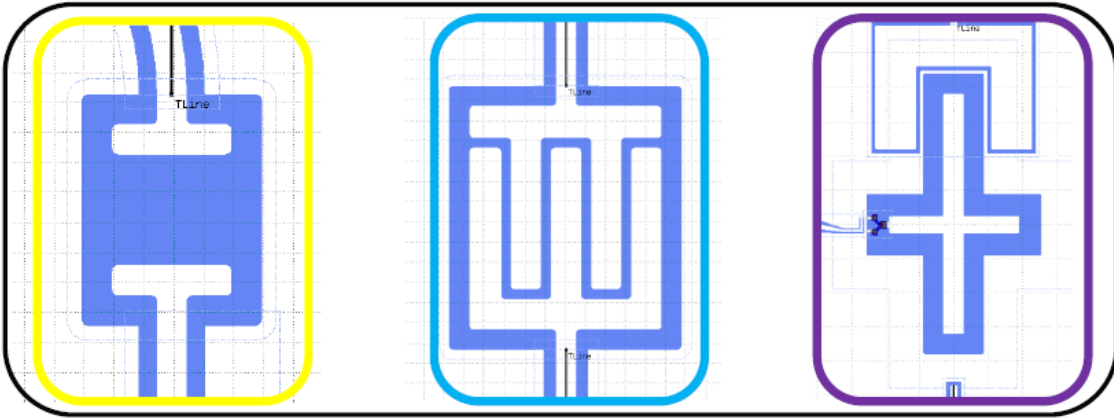
➤ Location of capacitor



Frequency domain EM simulation

Electrostatic and EM frequency domain

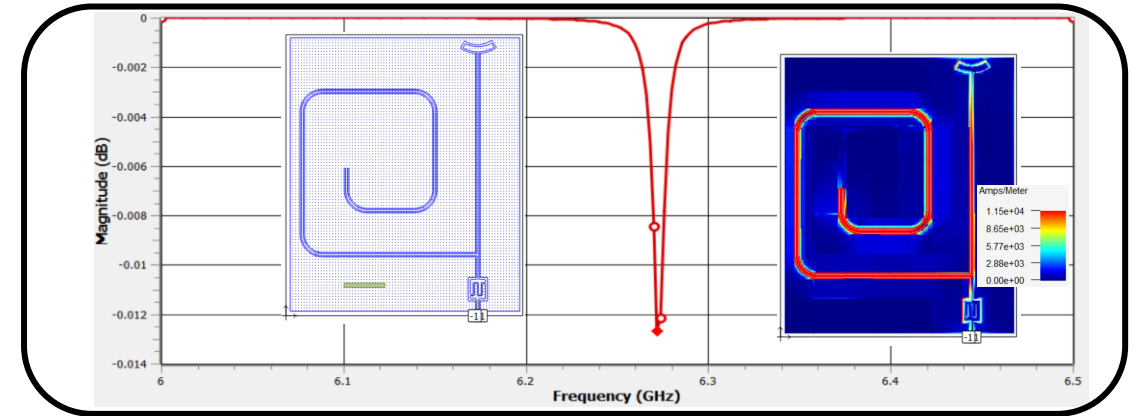
Capacitances



COMSOL Electrostatic simulation:

1. Design
2. Physics: Electrostatic
3. Study: Stationary
4. Define materials and terminals
5. Mesh the structure
6. Derived results(capacitance)

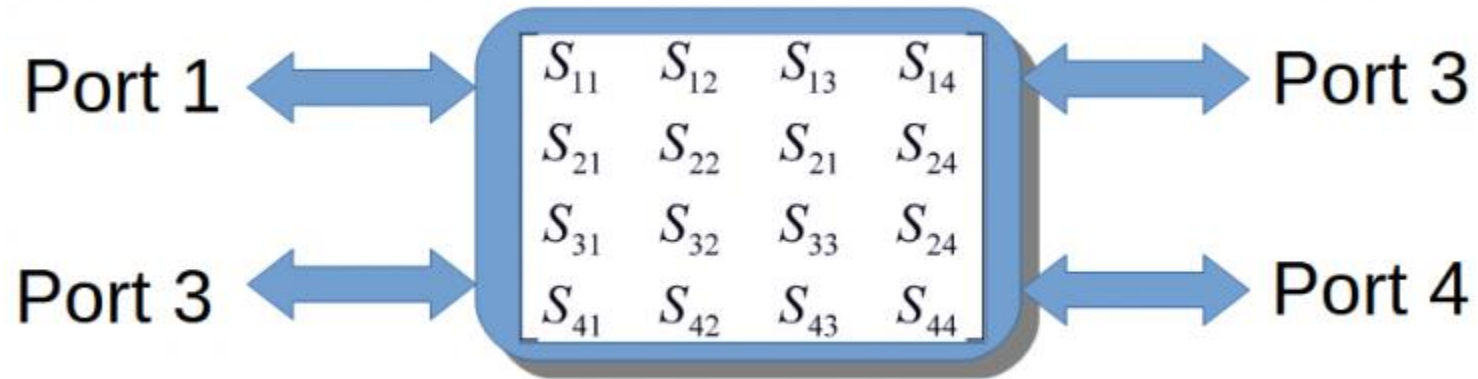
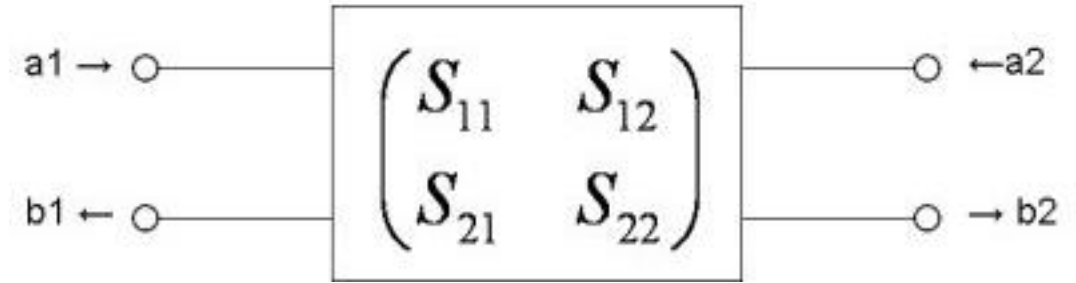
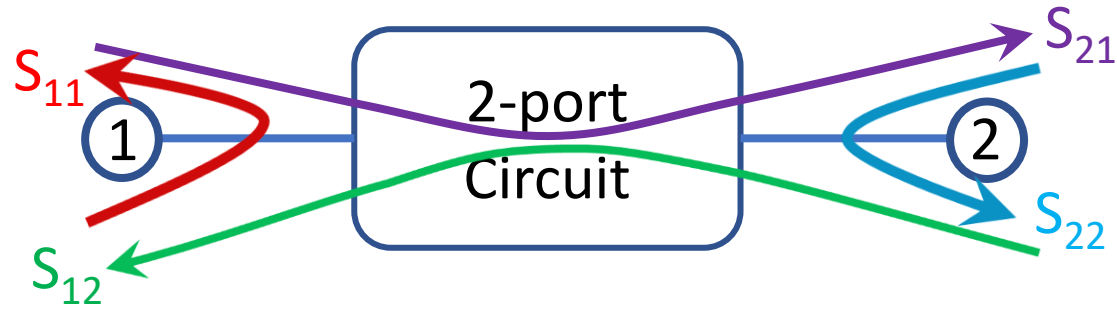
EM frequency domain



COMSOL EM simulation:

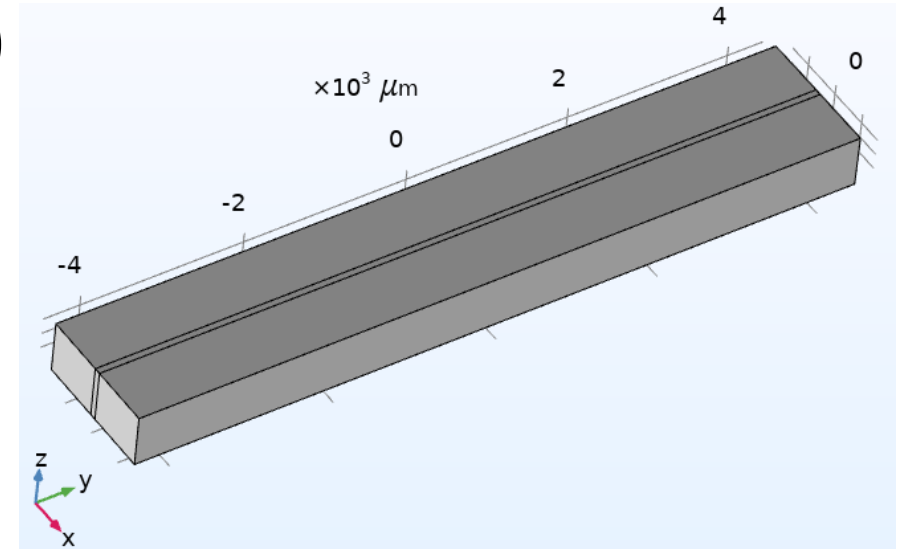
1. Design
2. Physics: Electromagnetic waves, frequency domain (emw)
3. Study: Frequency domain
4. Define materials and ports
5. Mesh the structure
6. Derived results
 - S parameter, EM fields etc.

S-parameter:



Transmission line and resonator:

- Transmission through a microstrip line (demo)
- Microstrip resonator(exercise session)
- Coaxial line (exercise session)
- CPW resonator (exercise session)



Let's move to COMSOL demo...