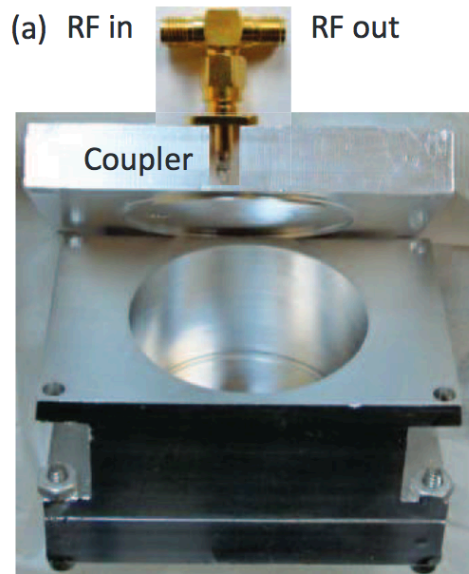
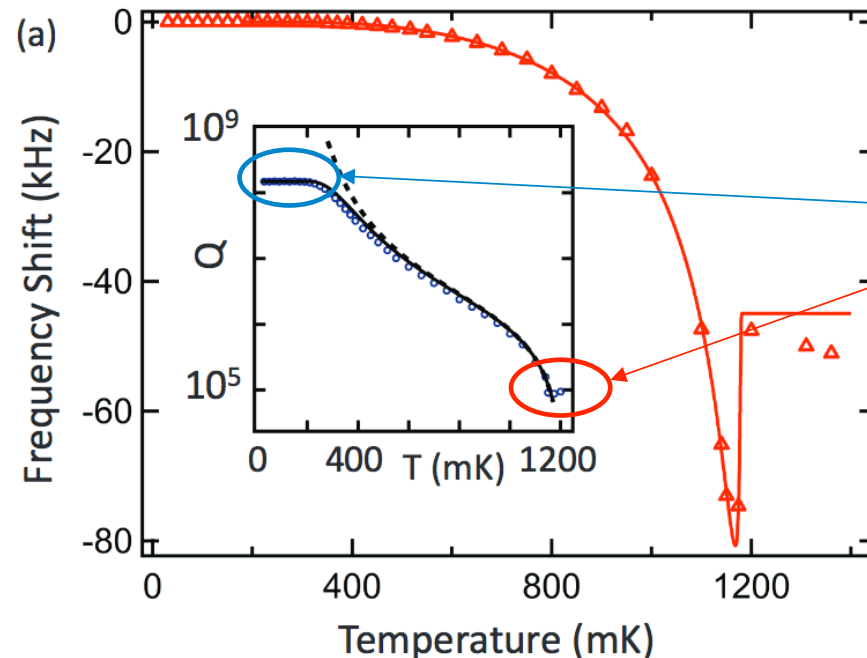


# Study cavity wall material

- Conductivity theory predicts the anomalous skin effect
  - Copper is the simplest conductor to demonstrate the effect
  - How about Aluminum?
    - The prediction is made for the BCS theory and it is more complicated than Cu (e.g. anisotropy of the scattering of conducting electrons)
  - Presently, high-purity Aluminum is one of the most popular materials to make a quantum computer (QC)



M. Reagor et al., arXiv:1302.4408v2 (2013)



- The test used a 11.442 GHz Al Cavity
- Purity: 99.999 %
- Critical temperature of Al: 1.2 K
- $Q = 3 \cdot 10^8$  in Super Conducting RF (SRF)
- $Q = 10^5$  in Normal Conducting RF (NRF)
- Dashed curve is a prediction
- Is Al better than Cu for ADMX?

# Work progress

- Made several high purity Aluminum cavities
  - 99.99% (4N), 99.999% (5N), and 99.9999% (6N)
  - Sumitomo Material provided a sample
- Collaborate with the QC group at U of Chicago
  - UC is interested in a high-Q SRF
    - Observe a Q-factor for various SRF materials
    - Utilize Fermilab SRF facility to prepare an SRF cavity
    - Study a surface roughness vs a Q-factor
    - First 4N Al cavity reaches  $1.7 \cdot 10^8$  (Preliminary)
  - ADMX is interested in a high-Q NRF
    - Measure the Q-factor of a high-purity Al cavity in a multi-Tesla magnetic field
    - Find a fridge + a multi-tesla magnet
- Looking for more collaborator and funding support
  - Task is halted because of short money

