Design and Simulation of Various KID Geometries used to Readout Elements of a mm-wave Filter Bank Spectrometer

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OVERVIEW

- ▶ Briefly describe the SuperSpec concept
- Discuss the simulation results of various mm-wave resonator geometries
- ▶ Discuss possible coupling schemes for KID readout

SUPERSPEC CONCEPT

- ▶ Superconducting filter bank utilising KID technology
- Antenna guides broadband radiation onto planar transmission line (e.g. CPW, microstrip)
- Series of half-wave (λ_n/2) resonators separate mm-radiation into N_C frequency bands (λ_n is central wavelength of channel n)
- KID is coupled to each individual channel allowing simultaneous readout of all channels



Zmuidzinas and Kovacs memo (2010)

MM-WAVE FILTER DESIGNS

- ▶ Simulation software Sonnet EM and ADS
- ▶ $\lambda/2$ open circuit termination theoretically 100% in band power transmission to detector
- ▶ Matched termination to feedline characteristic impedance (Z_0) - 80-85% power transmission - the 'U' resonator
- ▶ Only microstrip architecture presented here

$\lambda/2$ Open Circuit Termination



 Antenna and detector modeled as lumped port impedance





$\lambda/2$ Open Circuit Termination

- ▶ Problem with amount of power radiated
- $P_{rad} = 1 (|S_{21}|^2 + |S_{11}|^2)$
- Possible solution to meander a λ resonator (not shown here)



MATCHED TERMINATION

- ▶ $\lambda/2$ 'U' resonators coupled to feedline
- \blacktriangleright $\lambda/4$ spacing of resonators provides constructive inteference
- Able to control Q_C by varying distance from the feedline (g)











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- \blacktriangleright Motivated by desire to decrease the MKID readout frequency \rightarrow higher inductance required
- ▶ Also have a lot of unused space

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▶ Current distribution at 281.8 GHz



CONCLUSIONS

- ▶ Starting to converge on a viable mm-wave design
- ▶ Next step is to add in the readout feedline to see effect on mm-wave circuit

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