

APEX-SZ: A Millimeter-wave Galaxy Cluster Survey using the Sunyaev-Zel'dovich Effect



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APEX-SZ: A New SZ Survey Instrument

- Observe growth of structure and constrain cosmological parameters: Ω_m , w , σ_8 , H_0 , q_0
- Discover and catalog 1000's previously unknown galaxy clusters in a mass limited survey
- Survey 100-200 sq. degrees to $10 \mu\text{K}_{\text{CMB}}$ sensitivity per 1 arcmin pixel in 5 months observing time over several seasons
- Ambitious program requires technological leap

APEX Telescope



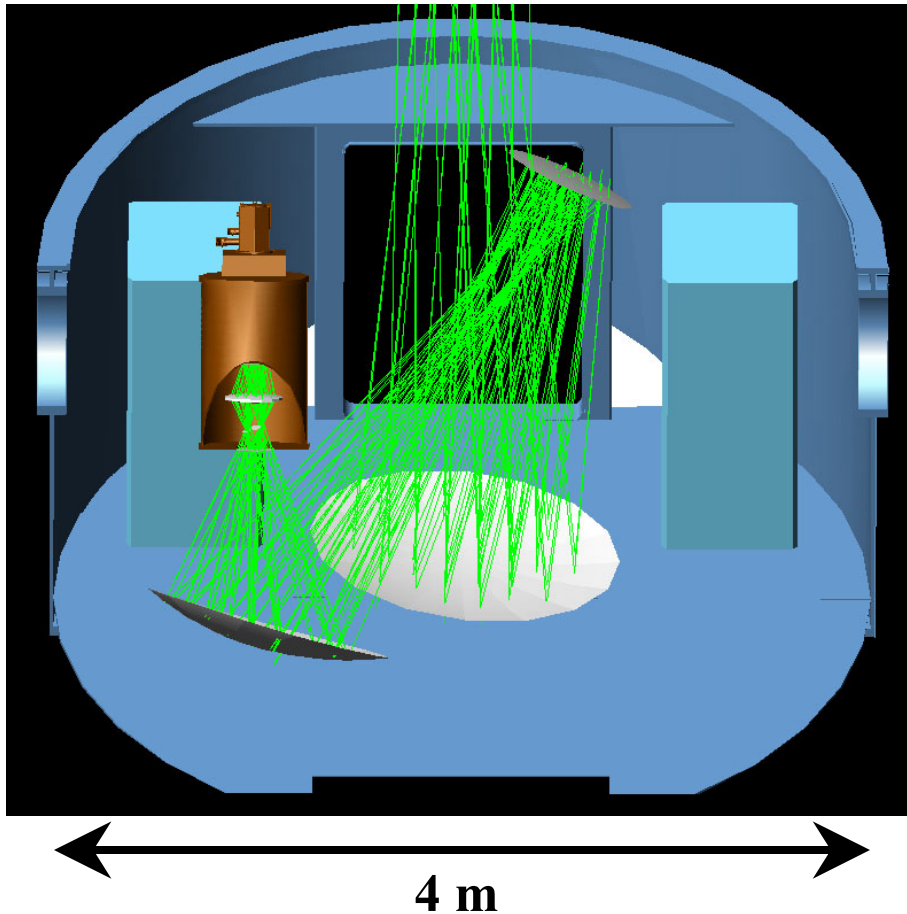
- 12 m on-axis ALMA prototype built by Vertex RSI
- Sited at the Atacama plateau, Chile, elevation 16,500 ft
- Submillimeter observatory
- 60" resolution @ $\lambda = 2$ mm
- 0.38° maximum field of view

Funded by:



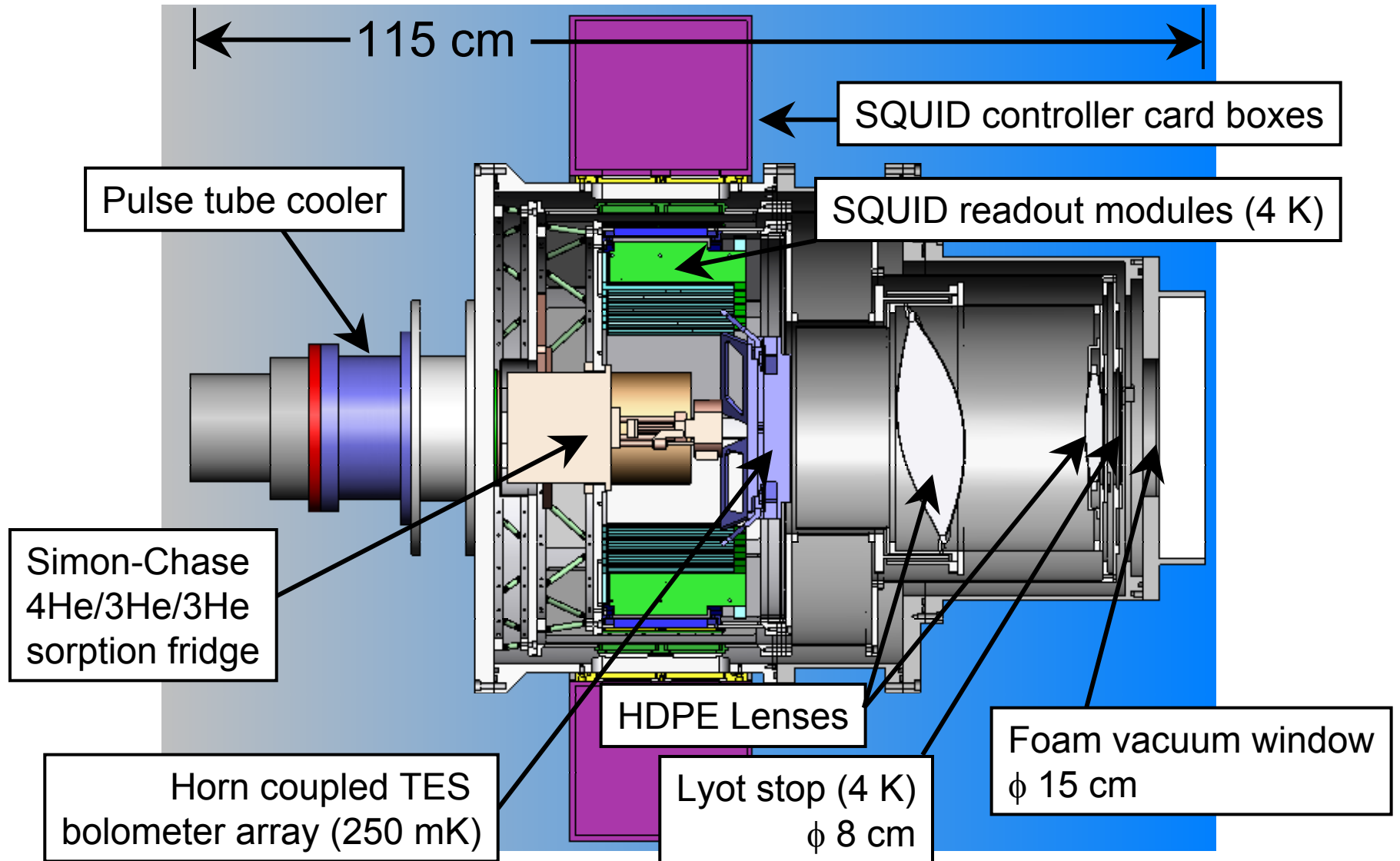
APEX-SZ Survey Instrument Optics

- Fast survey requires large field of view, well coupled to a large focal plane array
- 330 element horn coupled array
- Large throughput $A\Omega$ requires large reimaging optics

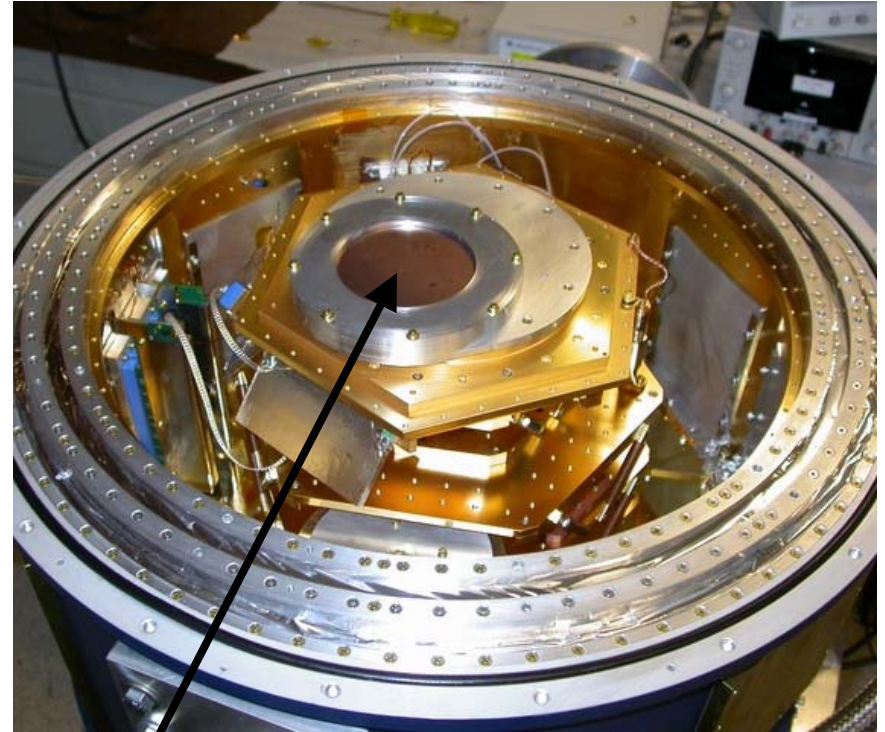


1.5 m diameter tertiary mirror

APEX-SZ Receiver Layout

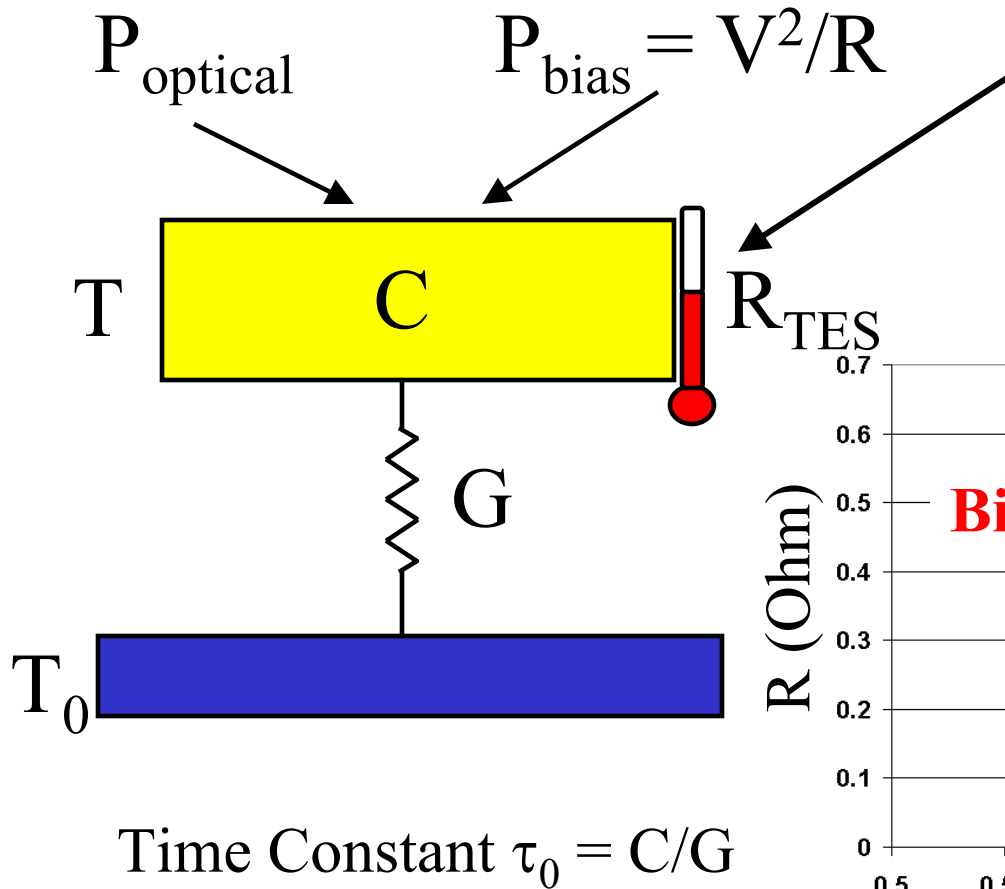


APEX-SZ Receiver

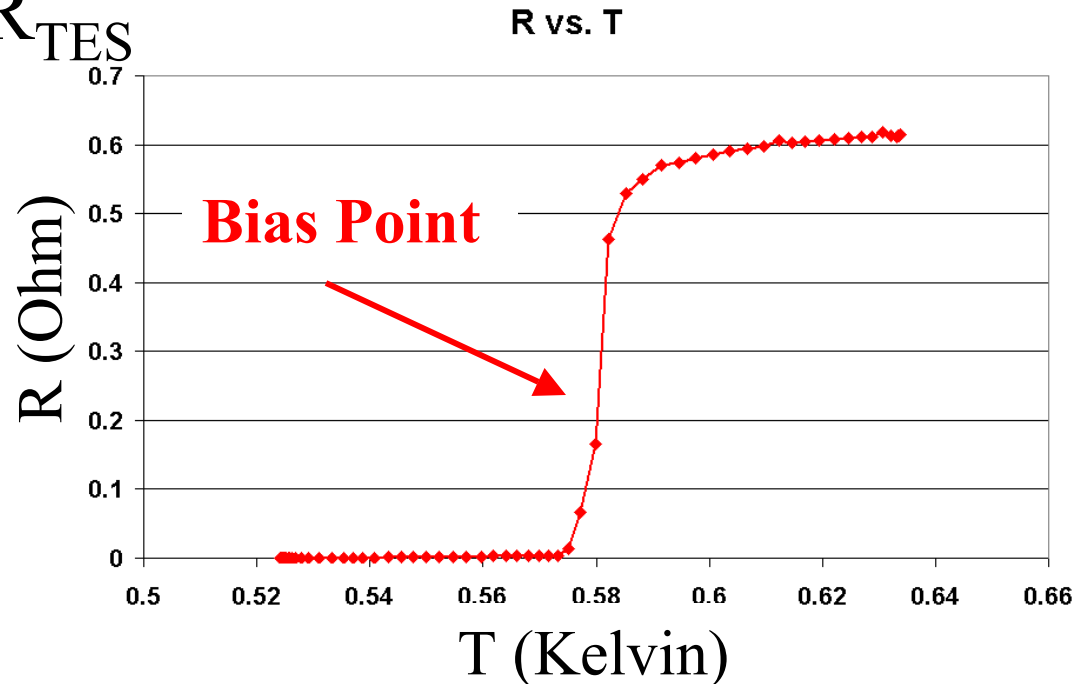


Filter stack for 55 pixel
engineering run at 150 GHz

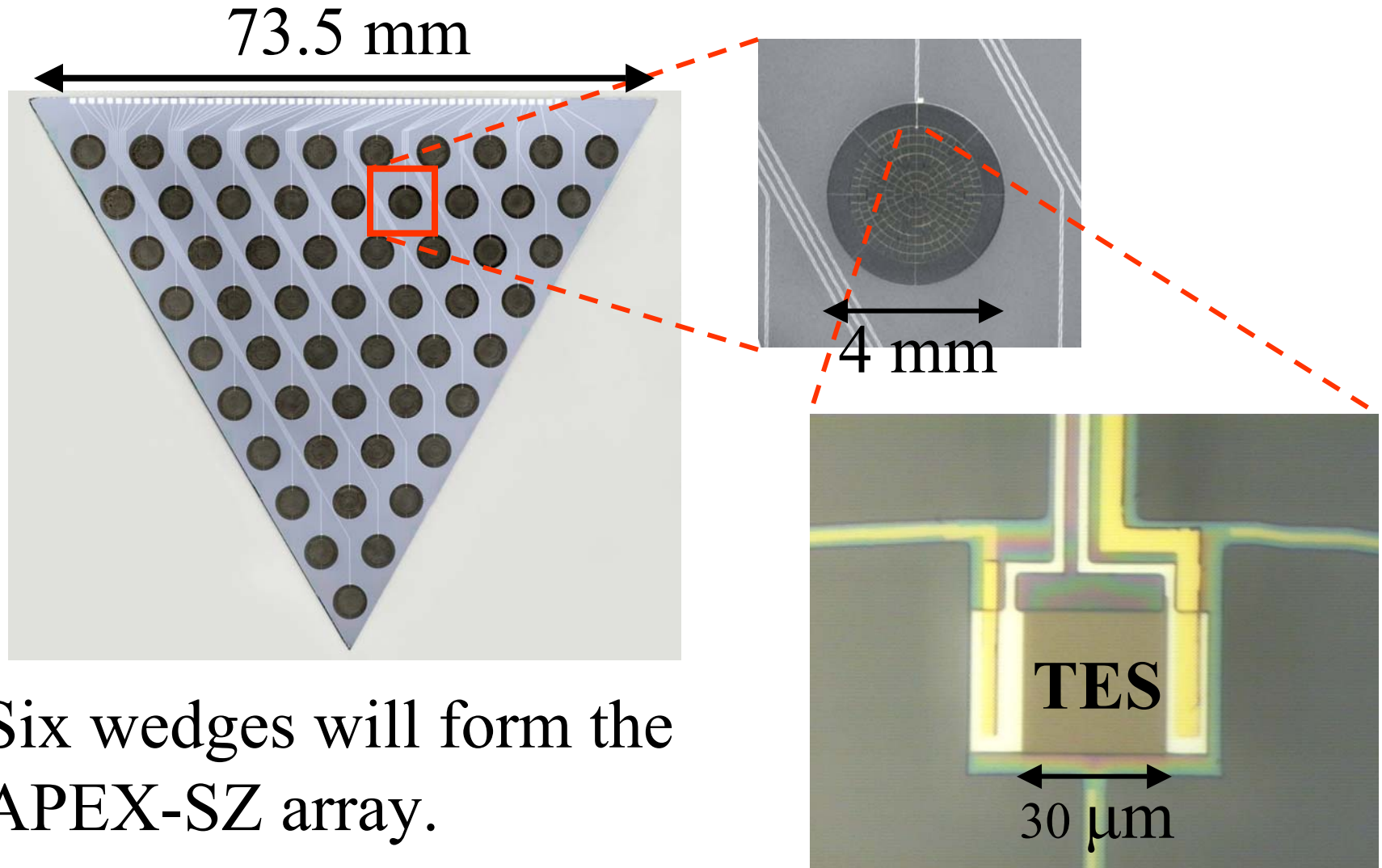
TES Bolometer Array



Thermistor is
superconducting Al/Ti
thin film **T**
Edge **S**
Sensor

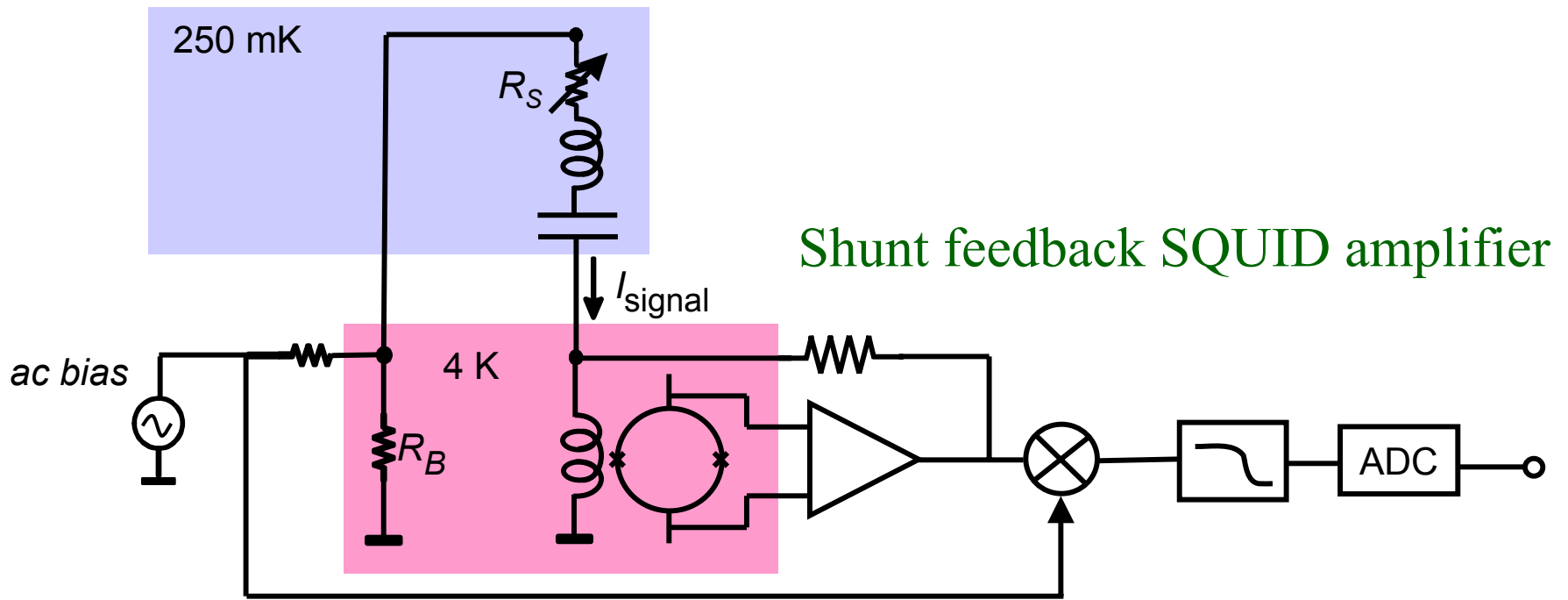


55 Pixel Array Layout



Six wedges will form the APEX-SZ array.

AC Bias SQUID Readout



- Low-noise shunt feedback SQUID amplifier for low impedance readout of voltage-biased TES detectors
- AC bias for individual TES bolometers minimize susceptibility to microphonics and crosstalk
- Upgradeable to frequency domain multiplexing

APEX-SZ: Conclusions

- We have developed new technologies that are scalable to even more powerful future experiments, i.e., SPT
- TES bolometers, 2 observation ready wedges complete
- AC Bias SQUID readout undergoing system integration tests
- Pulse-tube cooler operating at 250 mK
- 55 element engineering run in Chile late summer 2005

