

MKID DemoCam: First Light with Kinetic Inductance Detectors

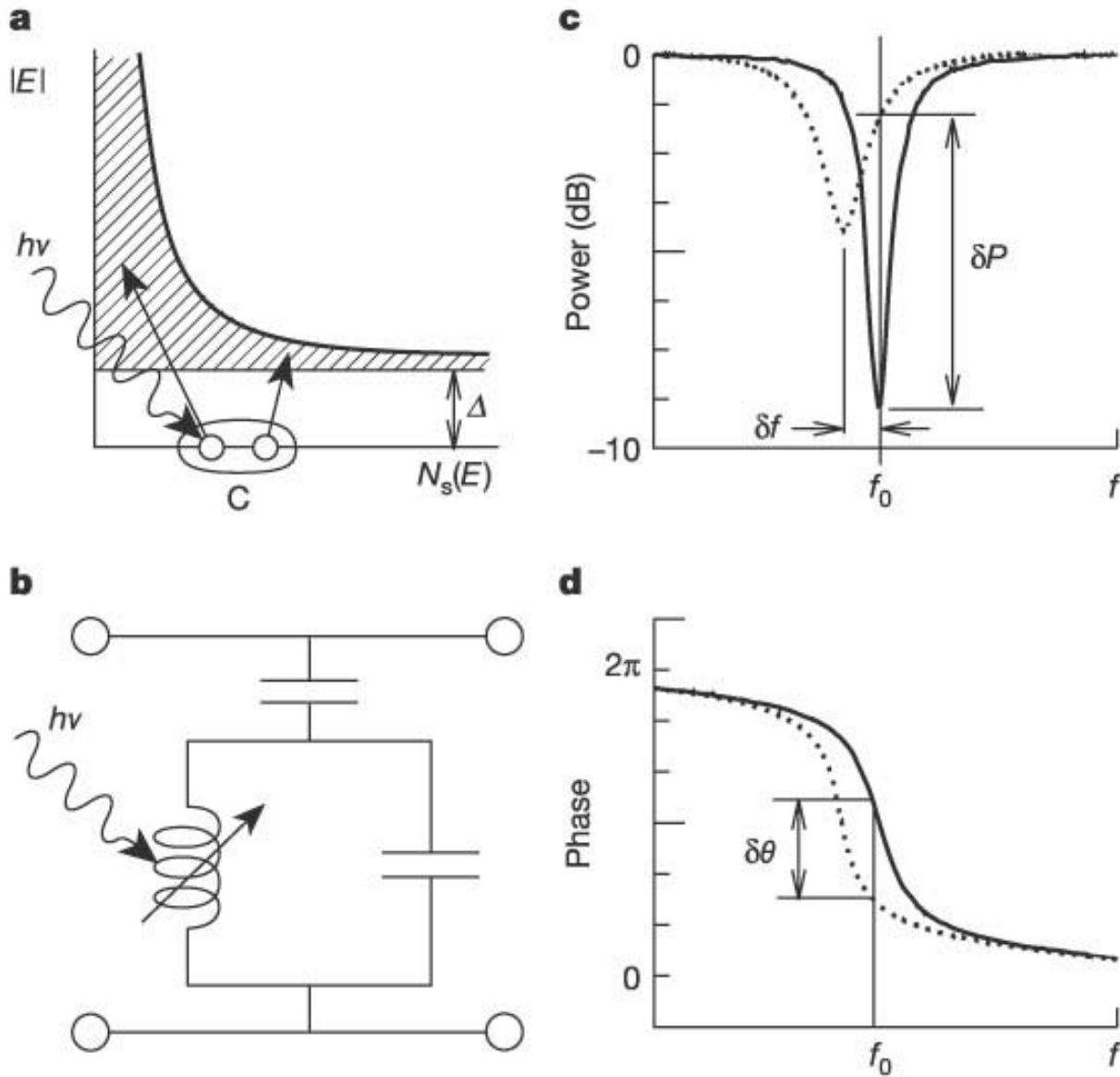


University of Colorado/CASA: James Schlaerth, Jason Glenn, new postdoc

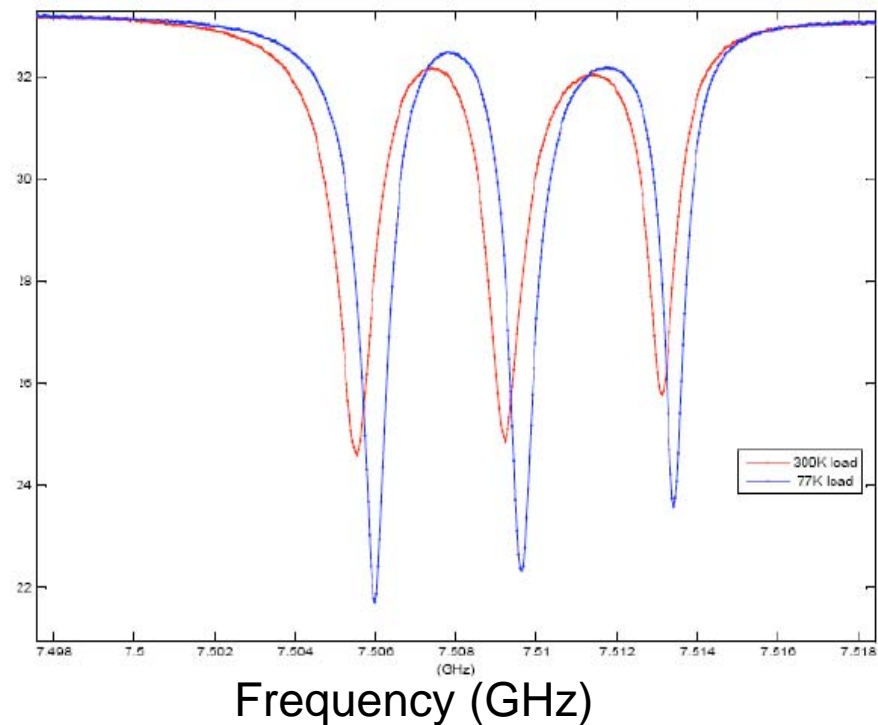
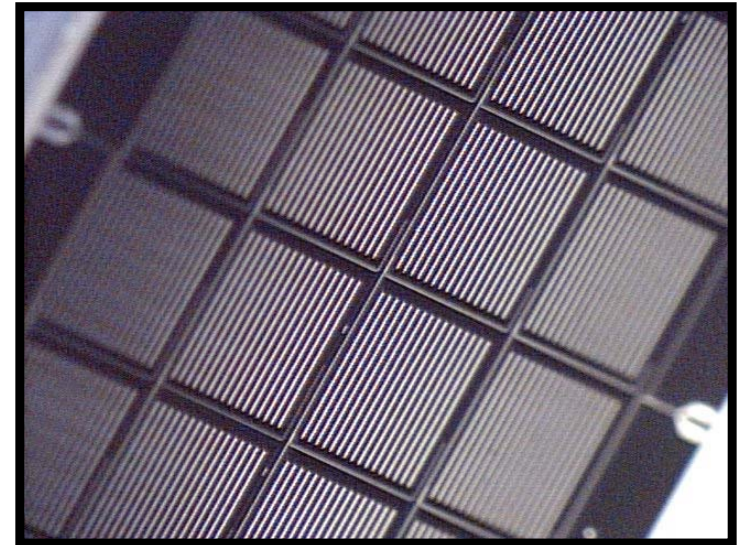
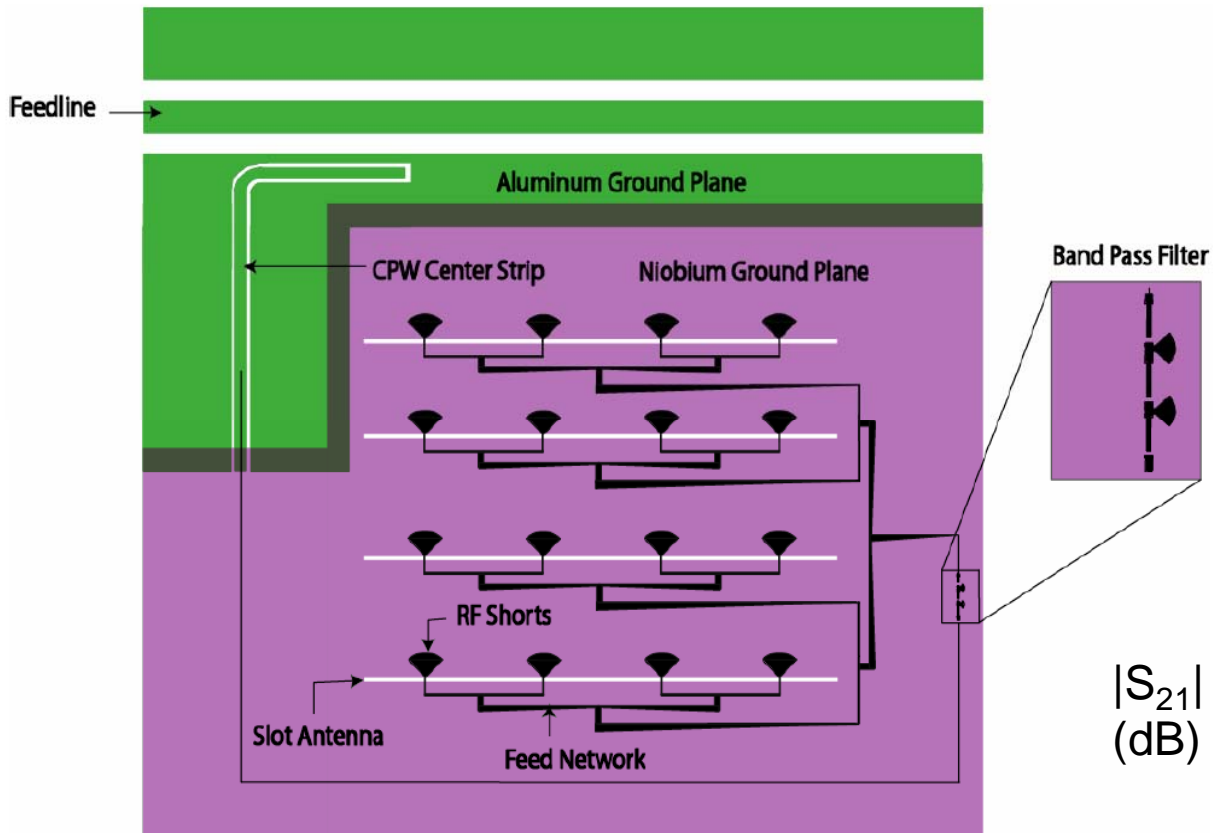
California Institute of Technology: Matt Ferry, Jiansong Gao, Sunil Golwala, Shwetank Kumar, John Vaillancourt, Tasos Vayonakis, Jonas Zmuidzinas

JPL: Peter Day, Rick LeDuc, Ben Mazin, Hien Nguyen

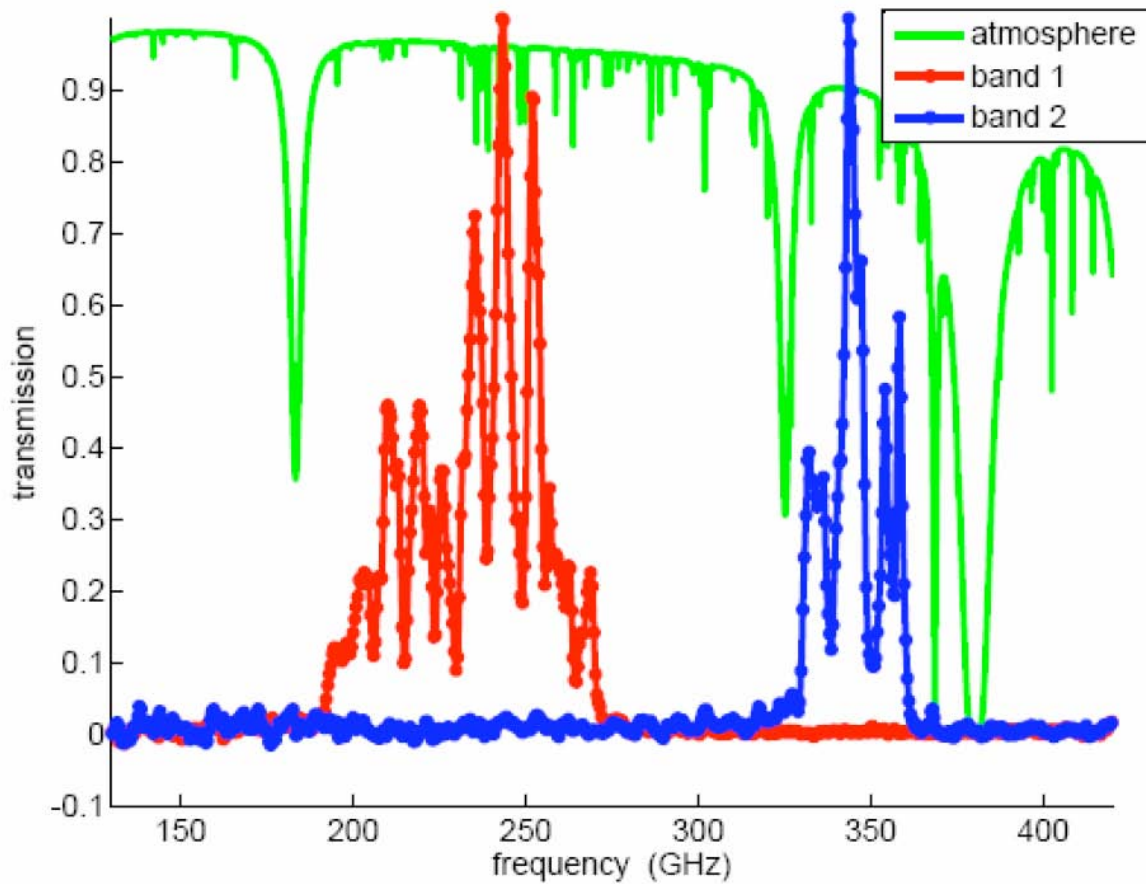
MKID Basics



Antenna-Coupled MKID Overview

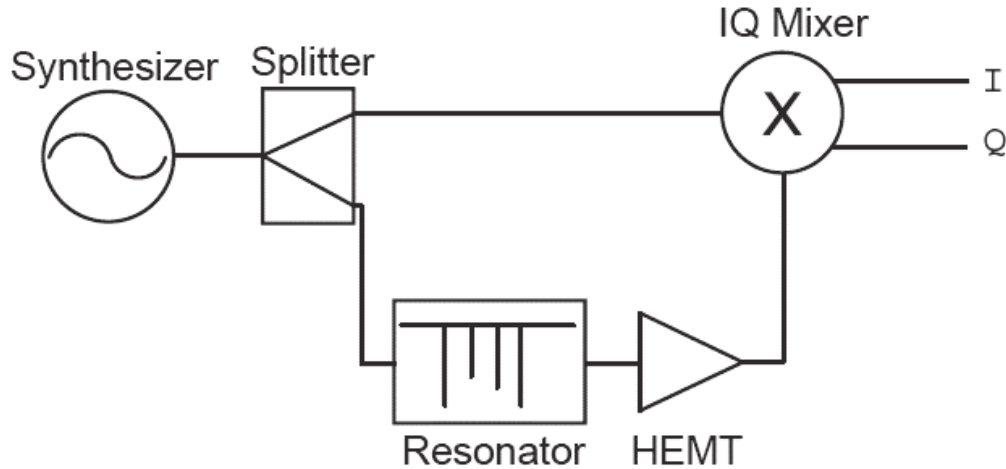


MKID DemoCam - Design

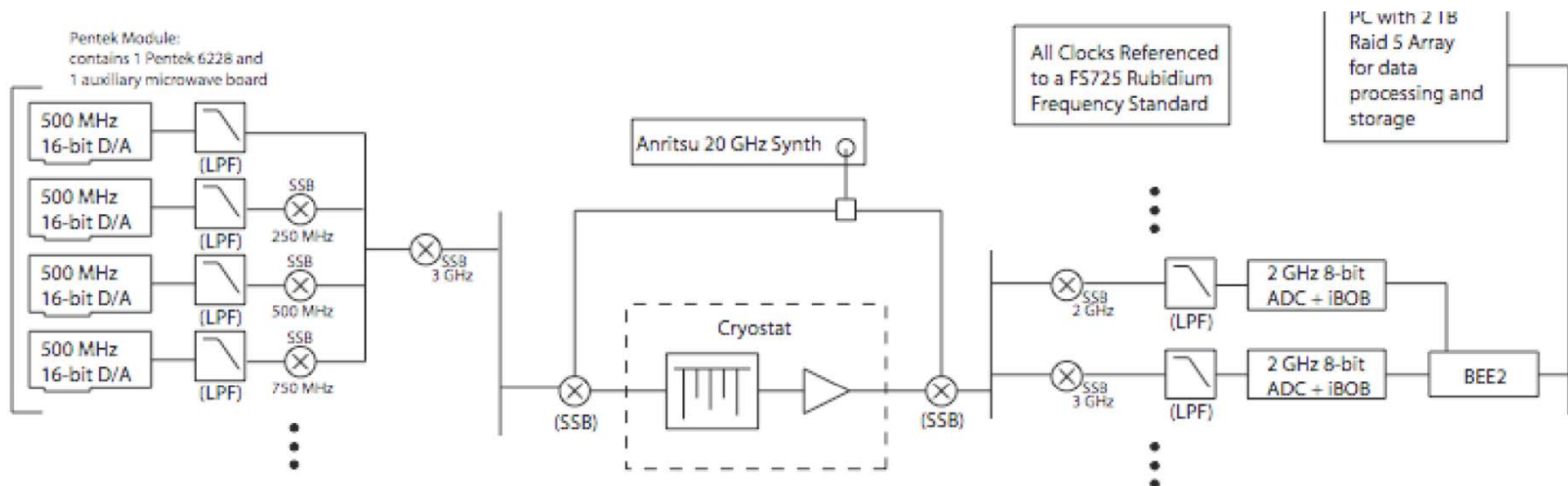


Resonator Readout

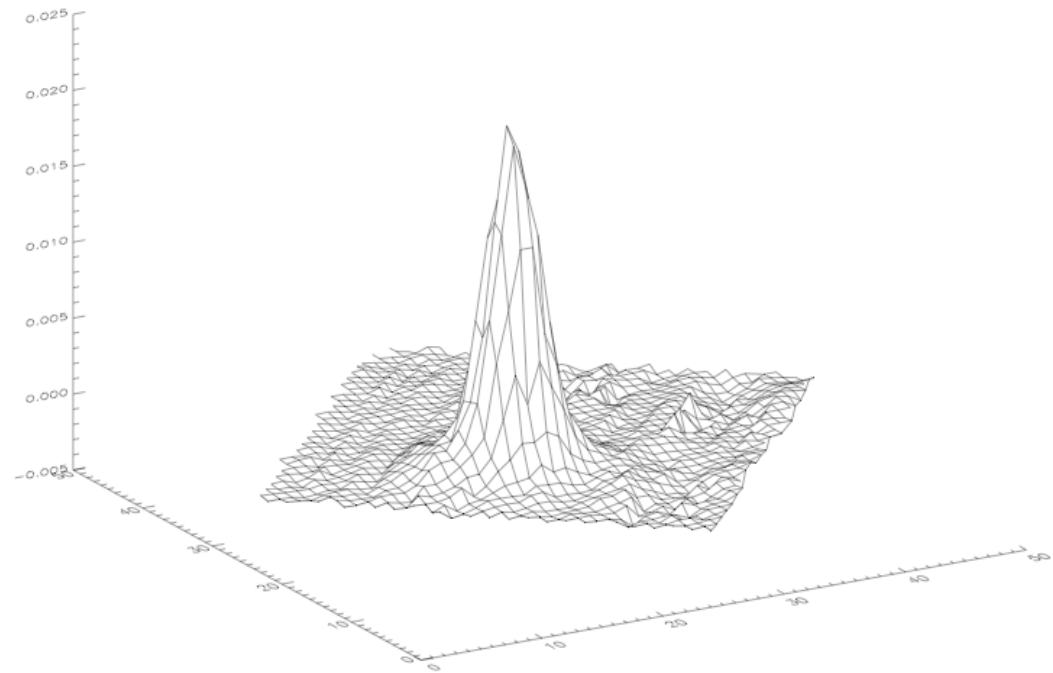
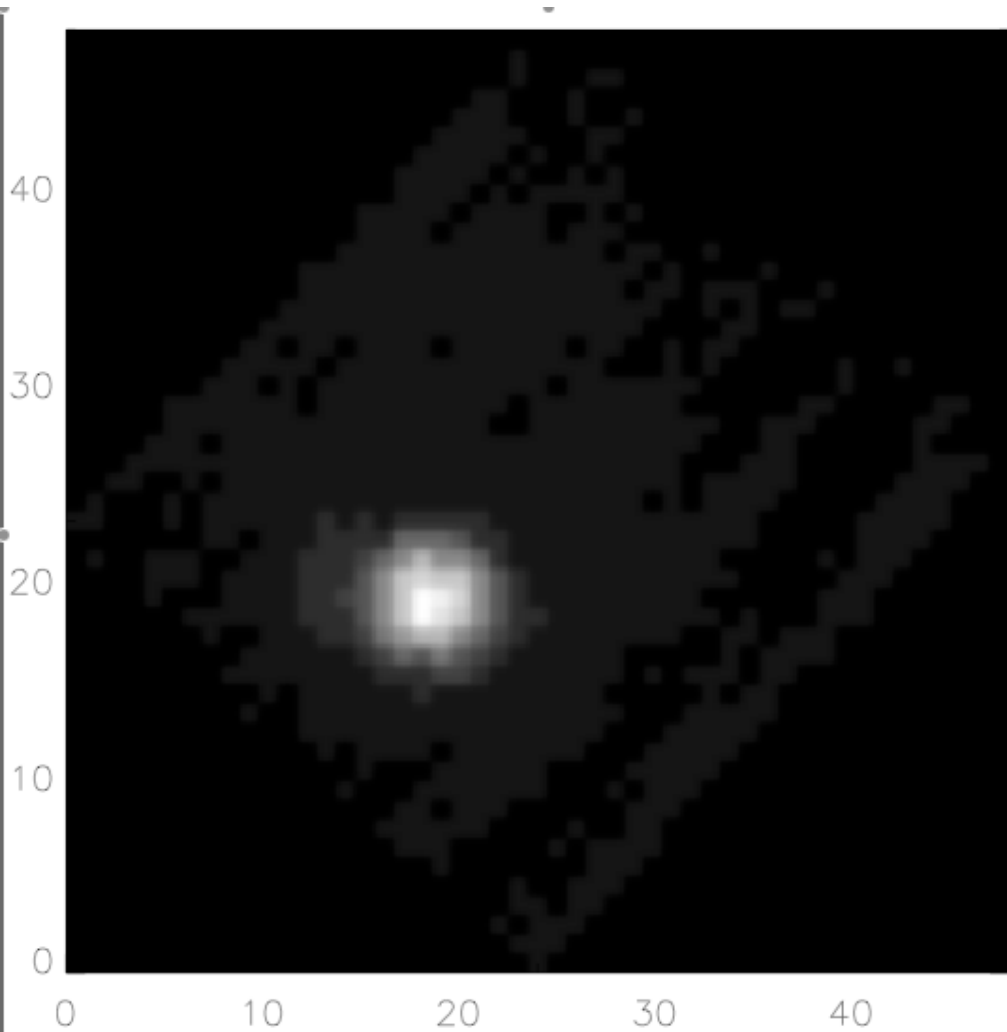
Simplified
Analog
Readout



Software Radio for
multiple channel
readout

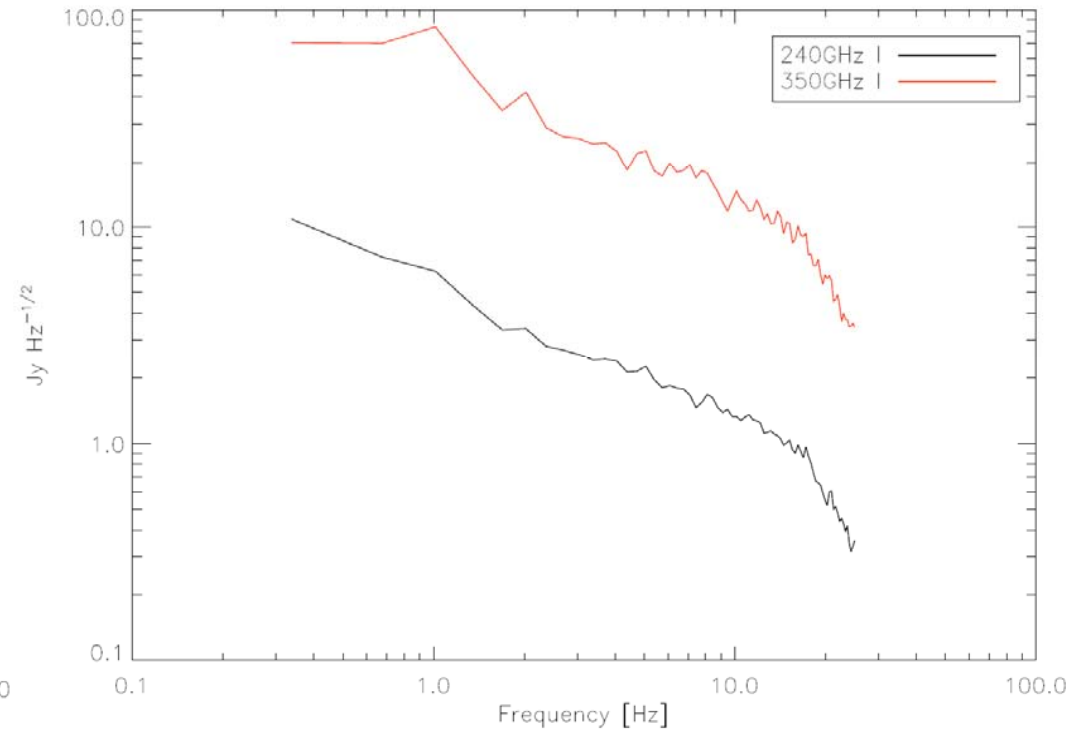
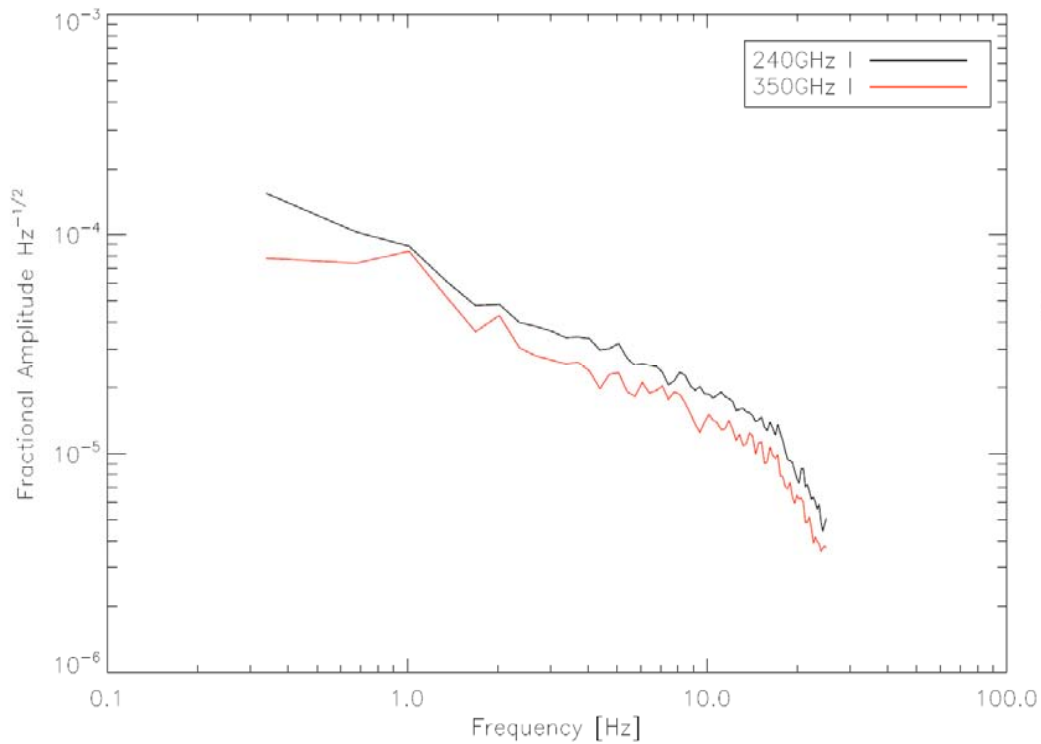


First Light Image (Jupiter)



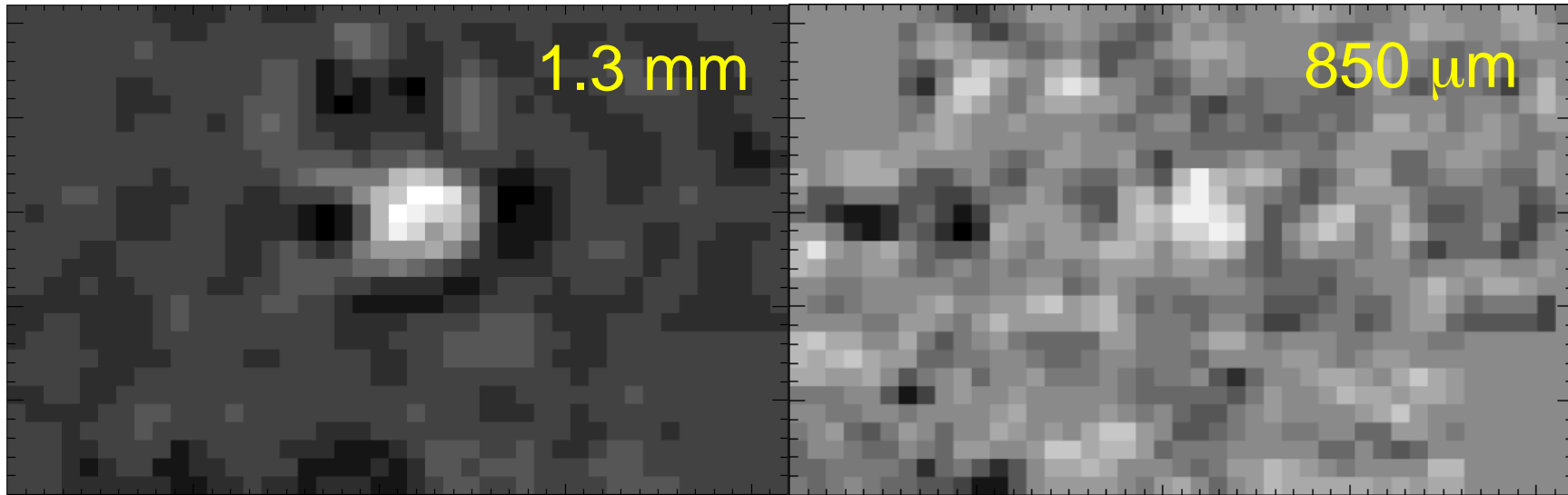
Noise Performance at the CSO

Amplitude (I) Readout



Calibration →

Images and Sensitivity



G34.3 in two bands – one drift scan observation

This observation $\text{NEFD}_{240} = 1.6 \text{ Jy s}^{1/2}$, $\text{NEFD}_{350} = 14 \text{ Jy s}^{1/2}$.

Raster scan of Saturn: $\text{NEFD}_{240} = 1.3 \text{ Jy s}^{1/2}$, $\text{NEFD}_{350} = 8 \text{ Jy s}^{1/2}$

Sensitivity Limiters

- Optical efficiency: modify filter stack, optimize antenna coupling
- Detectors (not well matched to atmospheric load): use higher Qs for greater responsivity & lower resonator frequency for reduced noise
- Magnetic Fields: better magnetic shielding, holes in ground plane

Future Observing Runs: Improvements and Solutions

DemoCam

- Trial device for Final camera - 36 pixels, 4 colors, 144 total resonators
- 400 MHz bandwidth in readout – more detectors simultaneously read out
- Optical efficiency and resonator improvements

Final Camera

- Pulse tube cooler with Simon Chase sorption fridge
- 8 Separate coaxes, 8 HEMTs for 576 total 4-color pixels (0.75, 0.85, 1.1 and 1.3 mm bands)
- Replaceable focal plane for future longer-wavelength observations
- Fully funded by NSF (AST-0705157) and Gordon & Betty Moore Foundation
- Bolocam's successor on the CSO

Schedule/Milestones for Full MKID Camera for CSO

- **Year 1**: Cryostat delivery, expand SDR readout, specify optics
- **Year 2**: 6x6x4 color DemoCam run at CSO; completion of focal plane/tile design
- **Year 3**: Completion of software interface, full 2GHz readout capacity, delivery of full focal plane for integration at CU/CASA. Engineering run follows lab tests of integrated system
- Working camera by 2010 - adaptable for first light on CCAT