

Noise and focal plane models

October 03, 2017

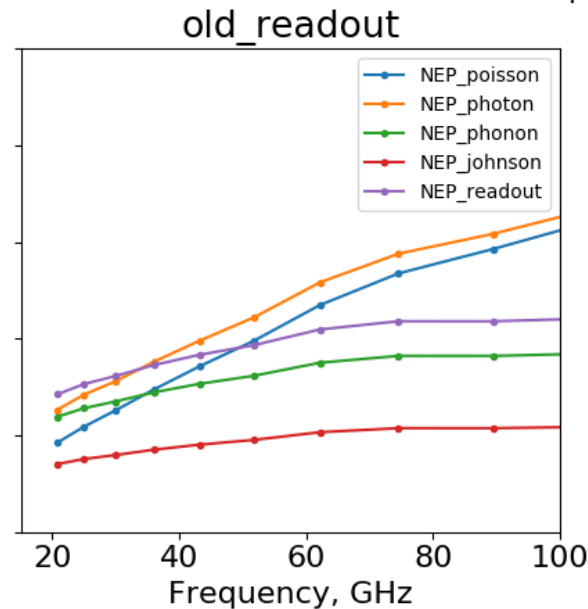
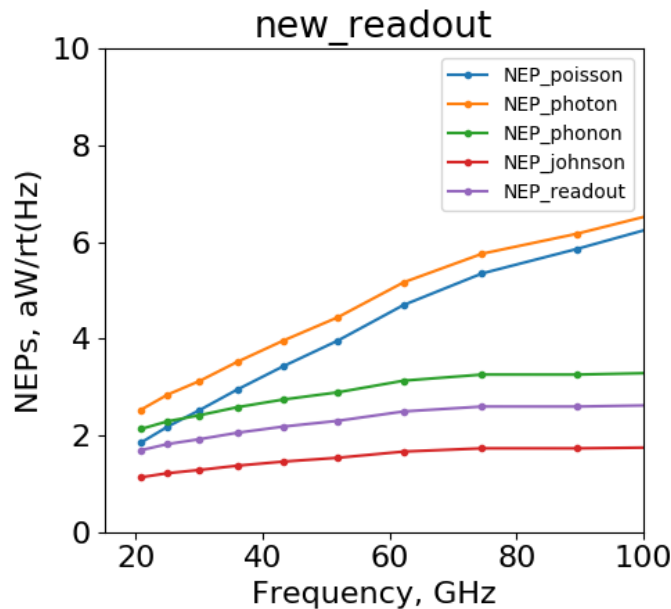
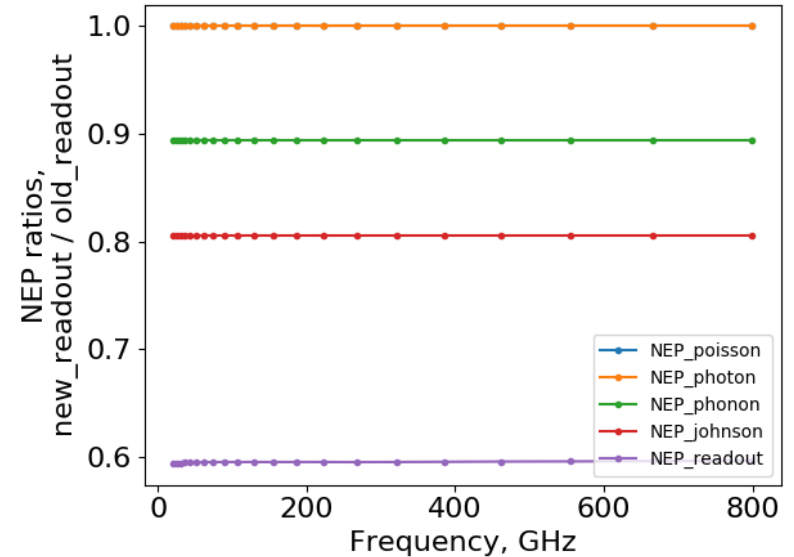
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Status

- Readout noise updated
 - Comparison of coma-corrected open dragone from Richard Hills with open dragone from past presentations.
 - Ability to optimize choice of edge taper.
 - Including correlated noise (still in progress)
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- Next steps:
 - Sensitivity loss of Qi's crossed dragone system at 10, 20, 30 K.
 - Add thermal filters to light path

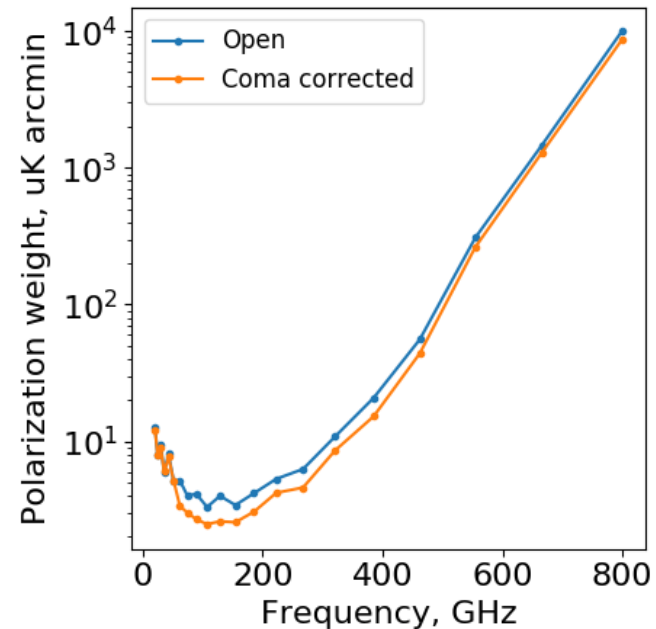
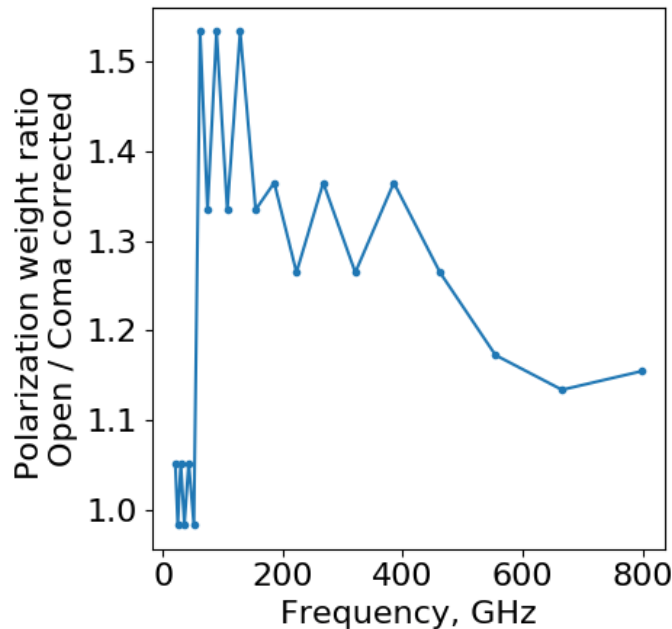
Updated readout noise

- With input from Matt Dobbs and François Aubin we've updated the readout noise calculation.
 - Reduced safety factor to 2. Matches Roger's calculation.
 - Adjusted various resistors on the boards.
 - SQUID noise is largest contribution.
 - Currently at 3.5 pA/rt(Hz)
- Readout noise now below photon and phonon at all frequencies.



Coma corrected Open Dragon

- Using increased DLFOV from Richard Hills' coma corrected open dragon.
- NET per detector is identical.
- More detectors lowers NET
 - Dependent on how I distribute number of pixels per band.
- This gives flexibility to weight higher bands more heavily.
 - i.e. we could remove 1 pixel at low frequency and add ~10 pixels in the CMB bands
- Full sky and 4 yr mission at 100% observing.
- Coma corrected: 5k detectors
- Old Open: 3k detectors



Optimizing edge taper

- Calculate mapping speed, $1/\text{NET}^2$ for a fixed focal plane area
 - Area = $50 F \lambda$ at each frequency
- Vary edge taper, recalculate, and find the maximum mapping speed
- Including correlated Bose photon noise
 - If more than 1 pixel samples an Airy disc, the Bose noise is correlated and adds coherently.
 - This needs to be refined to include near-field effects of the mirrors properly.
- Example of Open Dragone. Same system as past telecons. Currently we used $2 F \lambda$ pixels.
- This ignores near sidelobes. At $2 F \lambda$ the first sidelobe is at approximately -25 dB and $\sim 1.5x$ FWHM from the center of the main beam.

