

Cryogenic PAF Development

Progress Report



PAF Workshop
Provo, UT

May 3-5, 2010
Roger Norrod

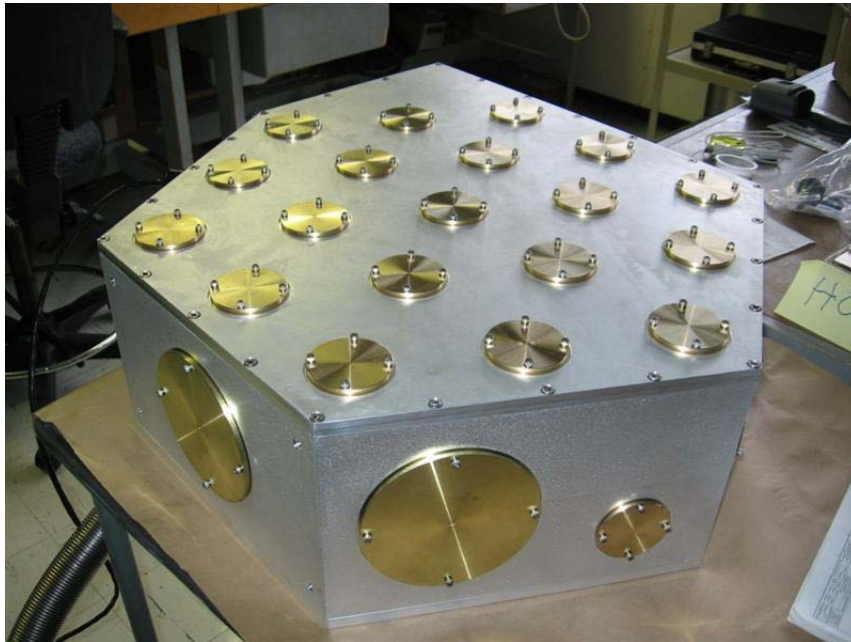


Cryogenic PAF

- BYU/NRAO targeting noise and efficiency competitive with best single-beam receivers. i.e. 18K, 70% at L-band.
- At Green Bank, construction of cryostat for 19 element L-band PAF underway.



PAF Cryostat



With blank-off covers for leak check
April 27



Model Drawing
24 X 21 X 8 in.
61 X 53 X 20 cm.

Dual LNA and Thermal Transition



NXP SiGe transistors.
Surface mount components.
Thin-wall SS tubular coax.
Quartz beads for vacuum seal and
center conductor heat sink.

Est. input coax heat load 150 mW /
chan.

Bias power 17 mW / chan.

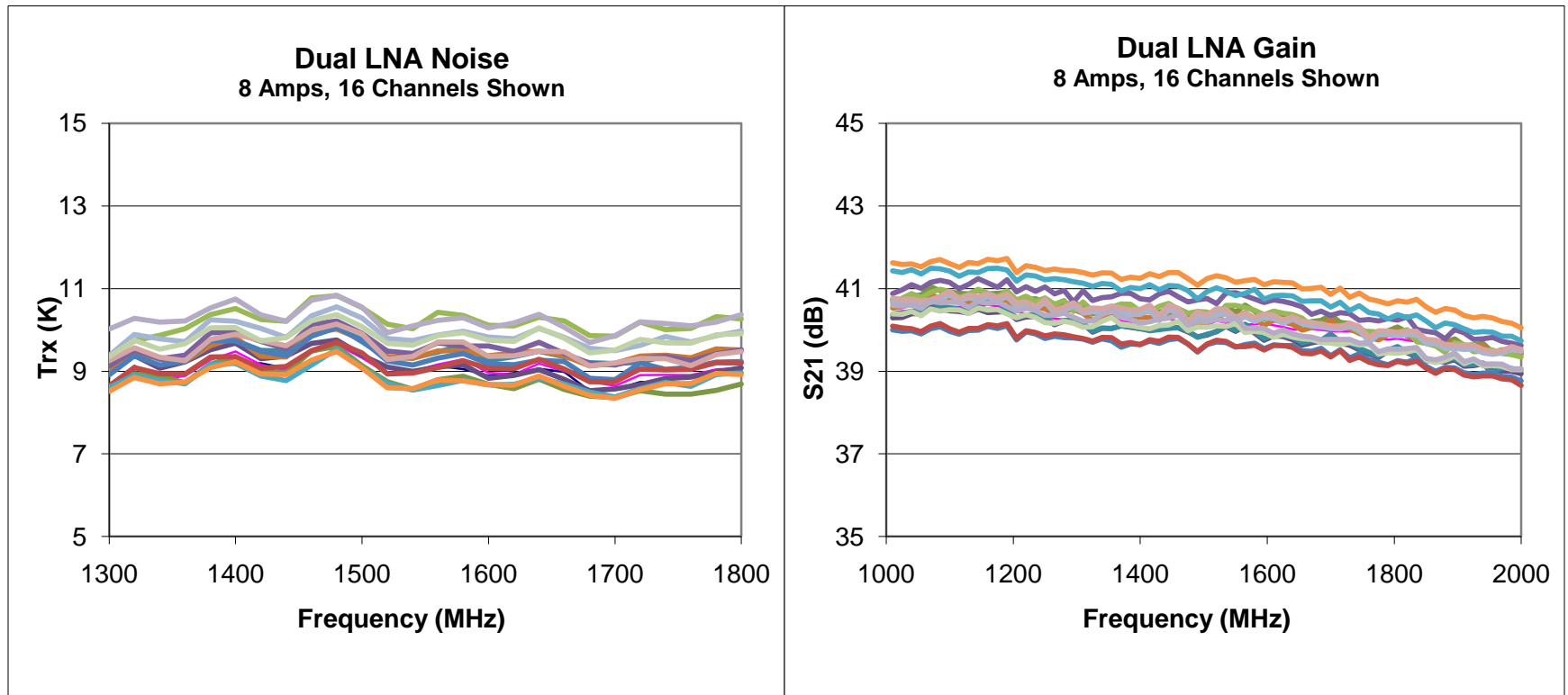
14 of 20 assembled, 8 tested cold.

Pair of two-channel LNAs with
integrated low-loss coaxial lines for
transition from 15 to 300K, vacuum
seal, and antenna base interface.

LNA based on: S. Weinreb, J. Bardin, H. Mani, G. Jones, "Matched wideband low-noise amplifiers for radio astronomy", Rev. of Sci. Instr., vol. 80, 044702, 2009.



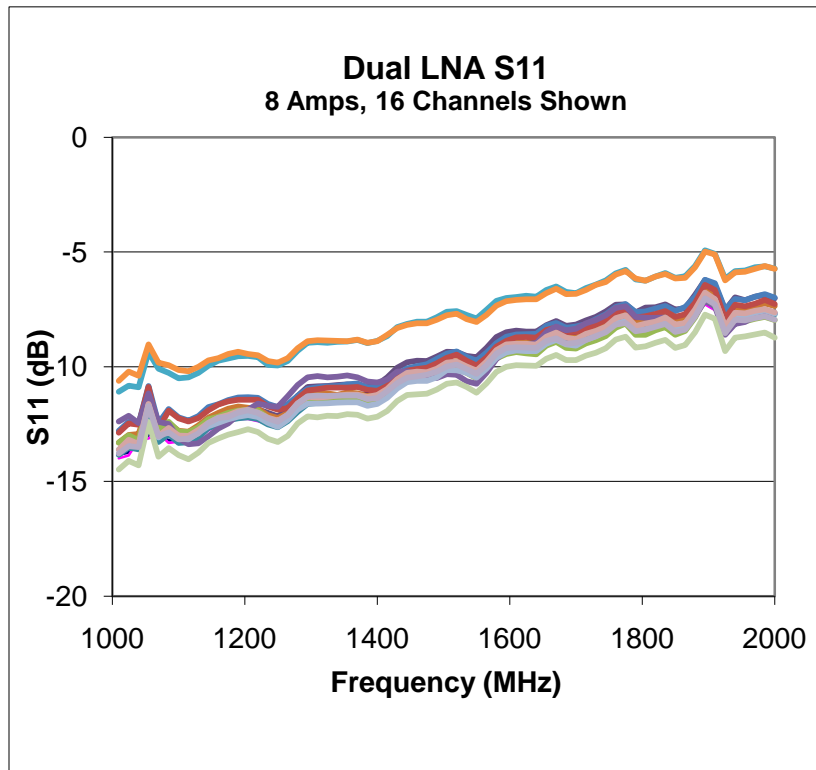
LNA Measured Performance



Noise Y-factor measured with LN2 cold load at room temperature SMA connector.

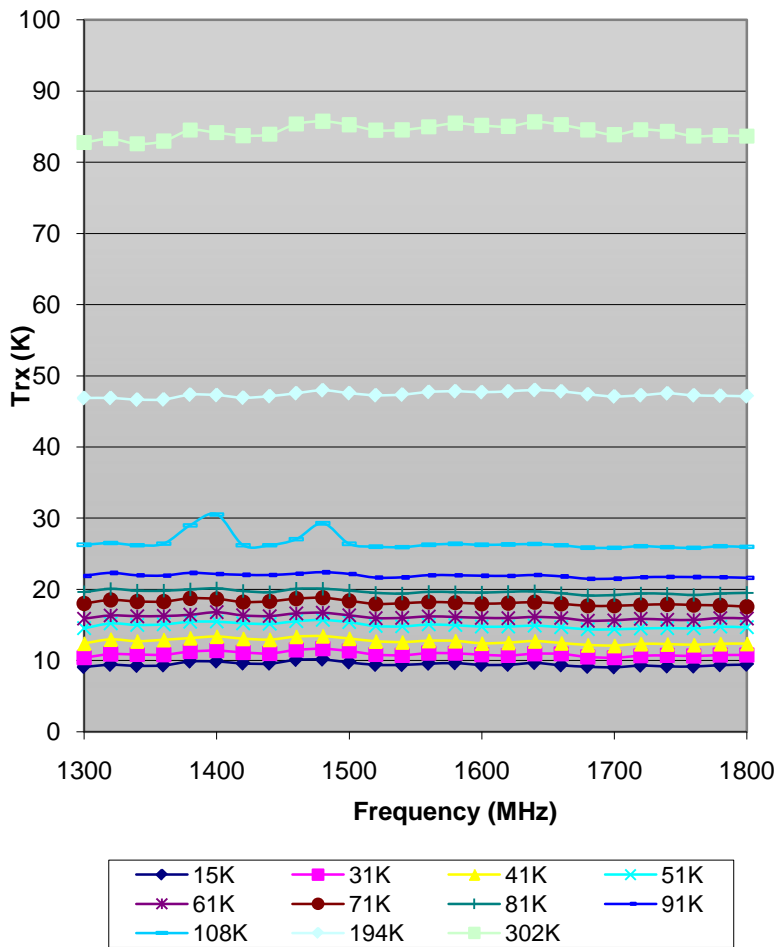


LNA Measured Performance

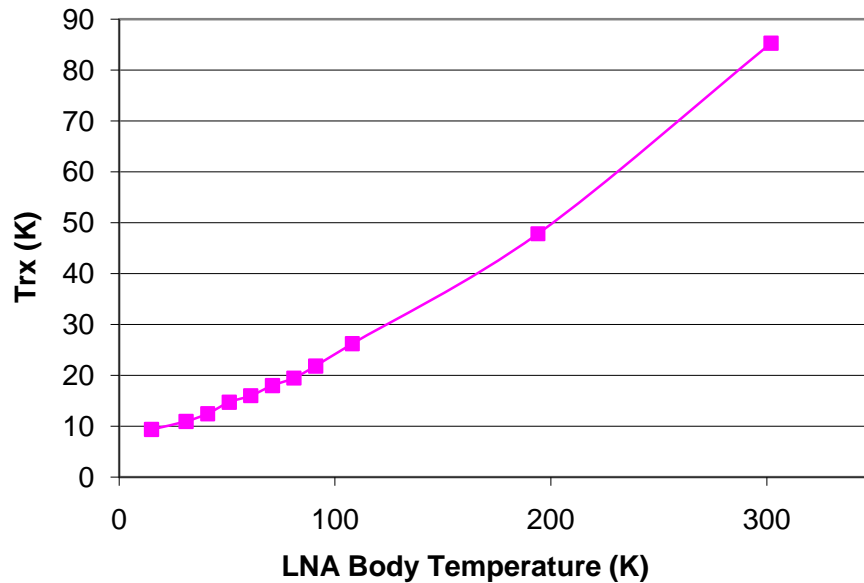


LNA Measured Performance

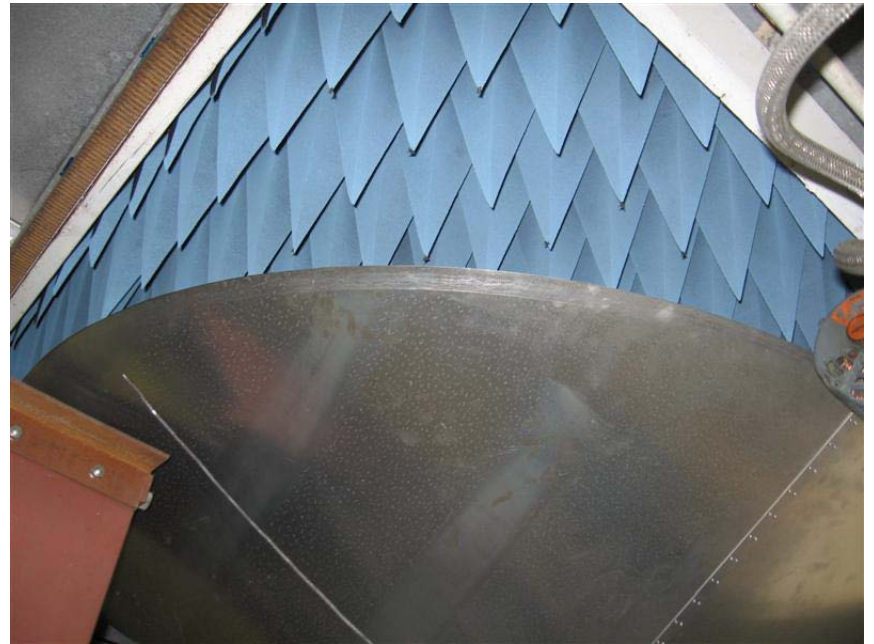
SN6-Y Noise vs. Physical Temperature



SN6-Y Noise vs. Physical Temp
At 1660 MHz



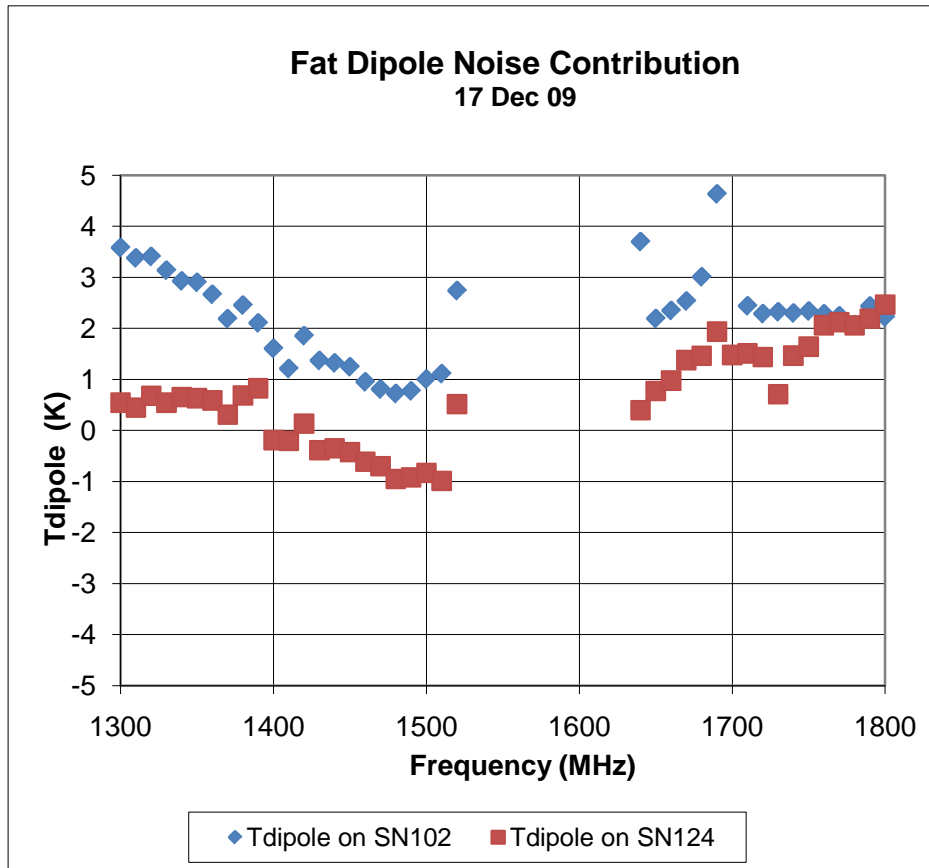
Dipole Ohmic Losses



Sky noise tests Nov-Dec 2009 to determine dipole noise contribution. Measured on Ciao room-temp amps ($\sim 35\text{K}$).



Dipole Ohmic Losses



1. Measured LNA/Rx with coaxial hot/cold load.
2. Attached dipole and measured using ambient load and sky.
3. Corrected for scatter, galactic plane, etc. ($T_{\text{sky}} = 7.5\text{K}$)



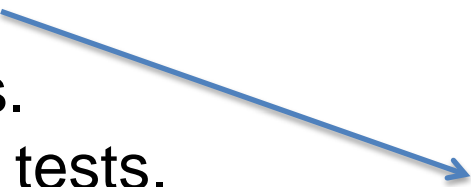
Achievable Tsys?

Contributor	Noise
Receiver	9
Dipole Losses	2
Mutual Coupling	2
Spillover	5
CMB and Atm	4

Total 22 K



Next

- Install LNA/TT assemblies.
- Cooldown, measure cooling capacity.
- Mount in FEB. 
- Sky noise tests.
- Antenna (20m) tests.

