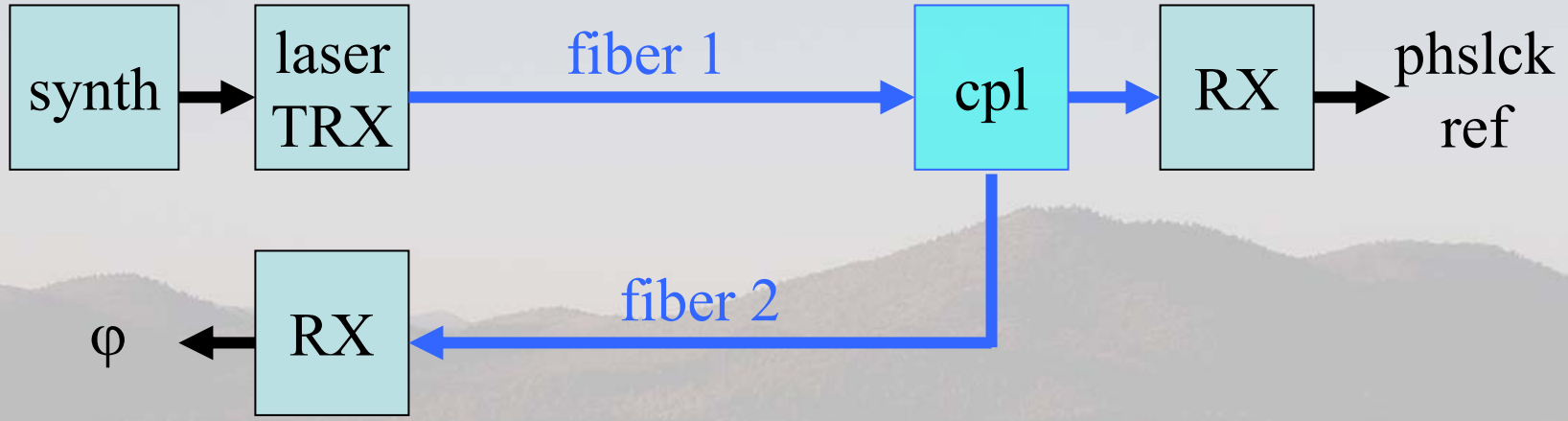
Receiver Development at Berkeley

Dick Plambeck

- fiber linelength system (installed May 07)
- next generation 1mm receivers

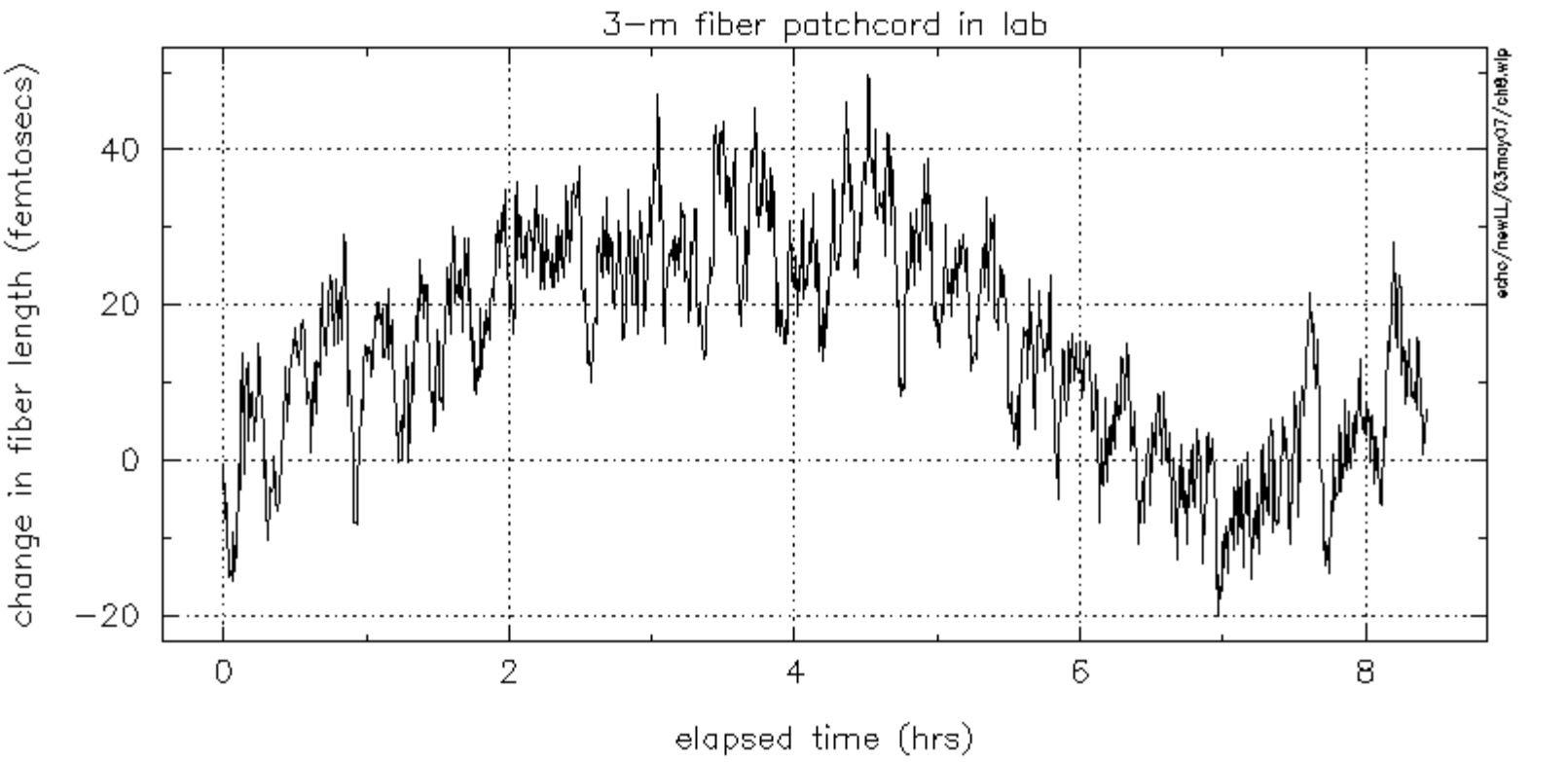
Fiberoptic linelength system

(Plambeck, Thornton, Gutierrez-Kraybill, MacMahon)



- no electronics at the antenna, just a fiber coupler

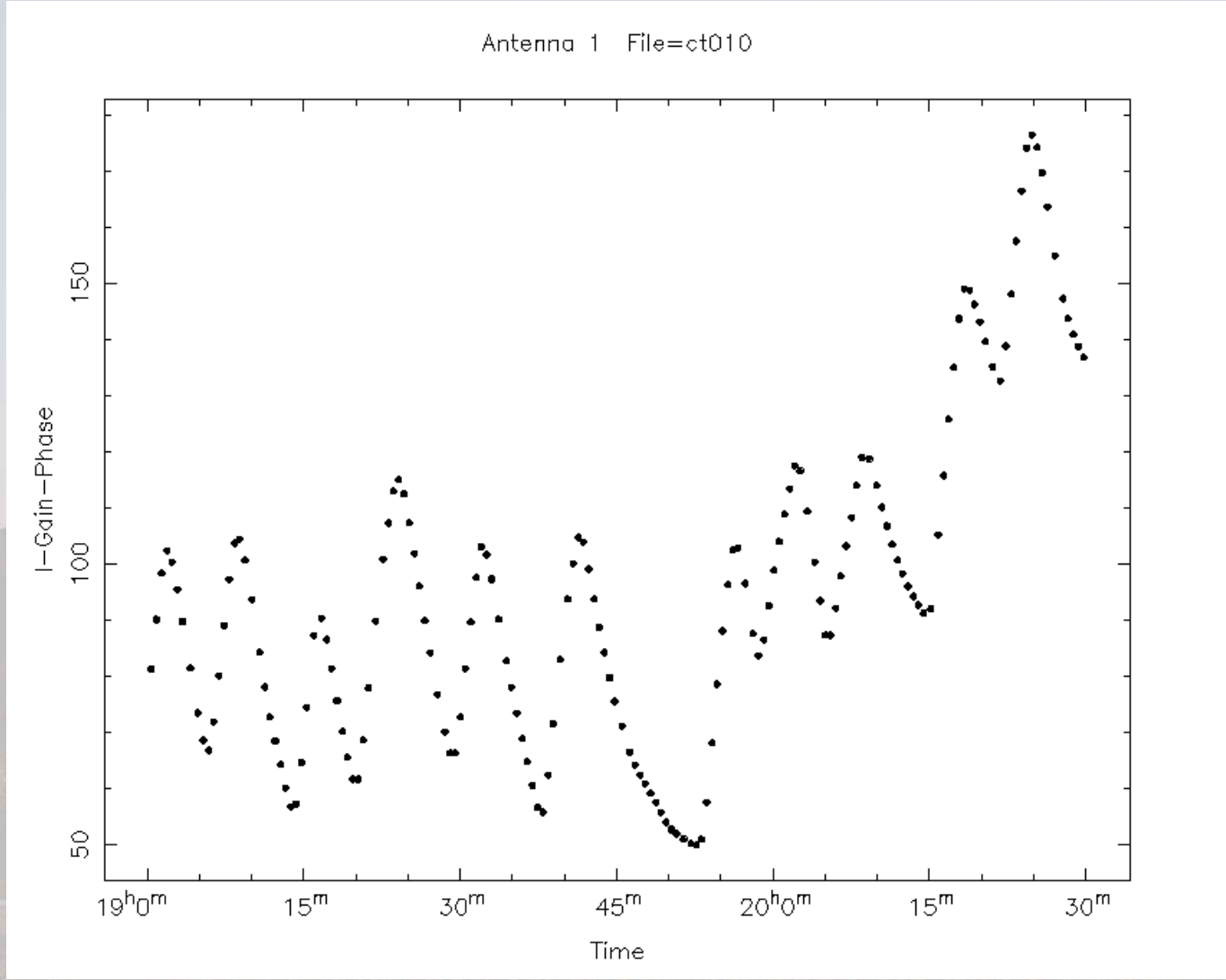
Fiberoptic linelength system



delay uncertainty ~ ±10 femtoseconds

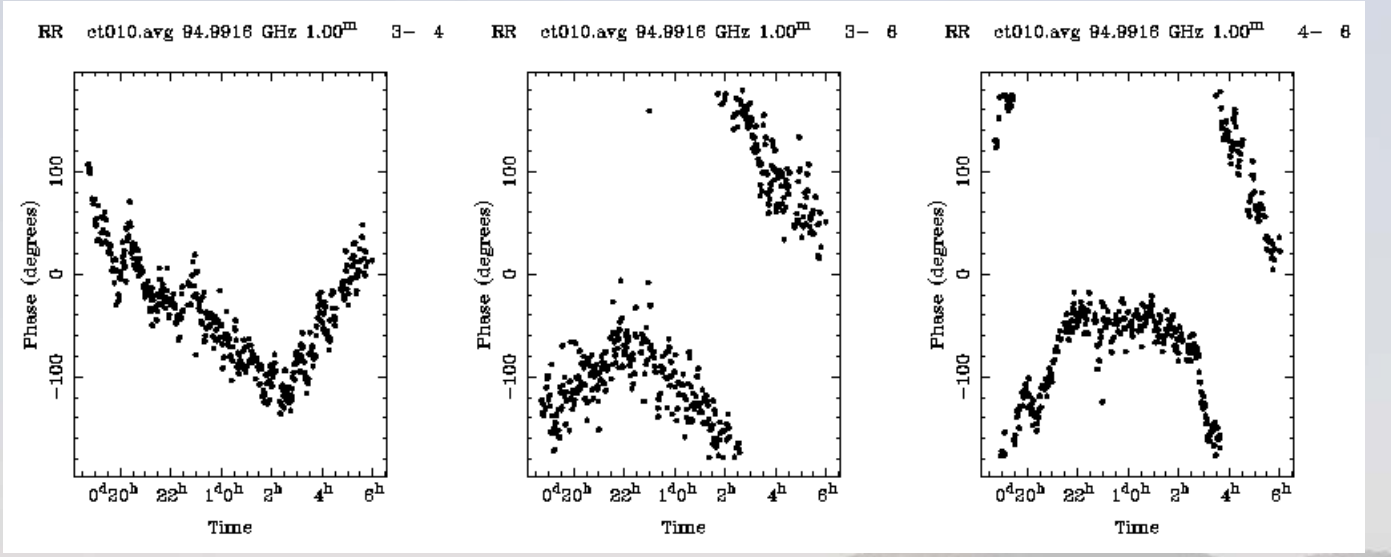
- 1 degree of phase at 230 GHz
- $\Delta T = 1$ C for 8 inches of fiber

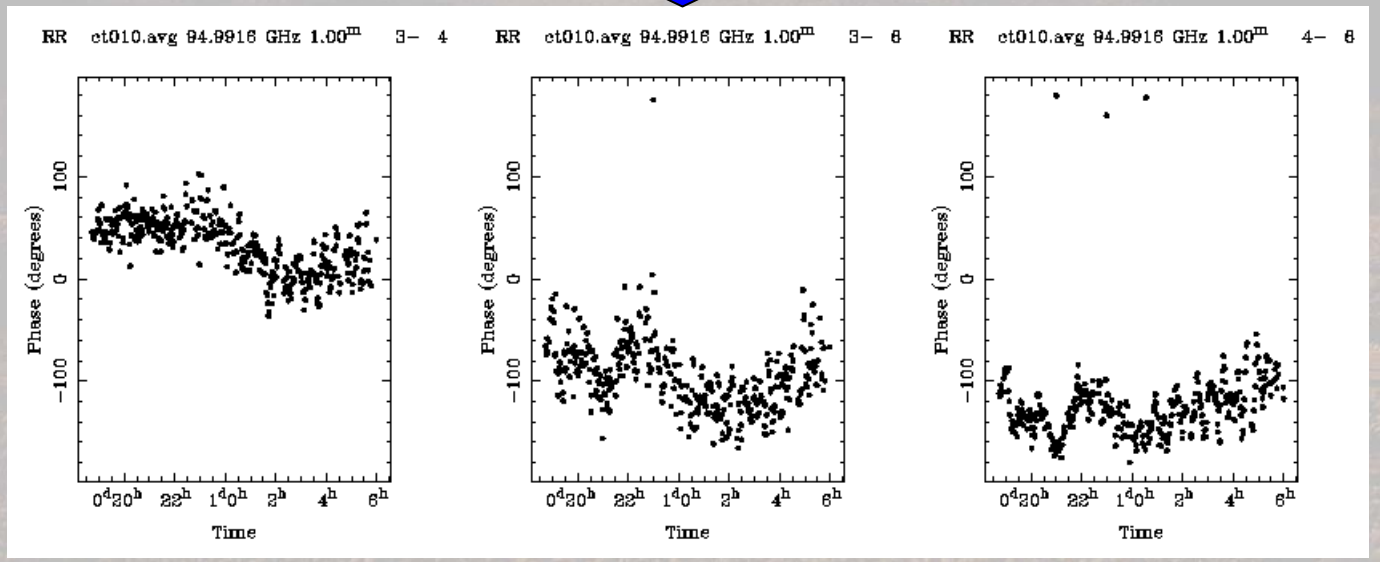
linephase correction example



shows effect of air conditioner cycling in rcvr cabin or base

effect of linephase correction



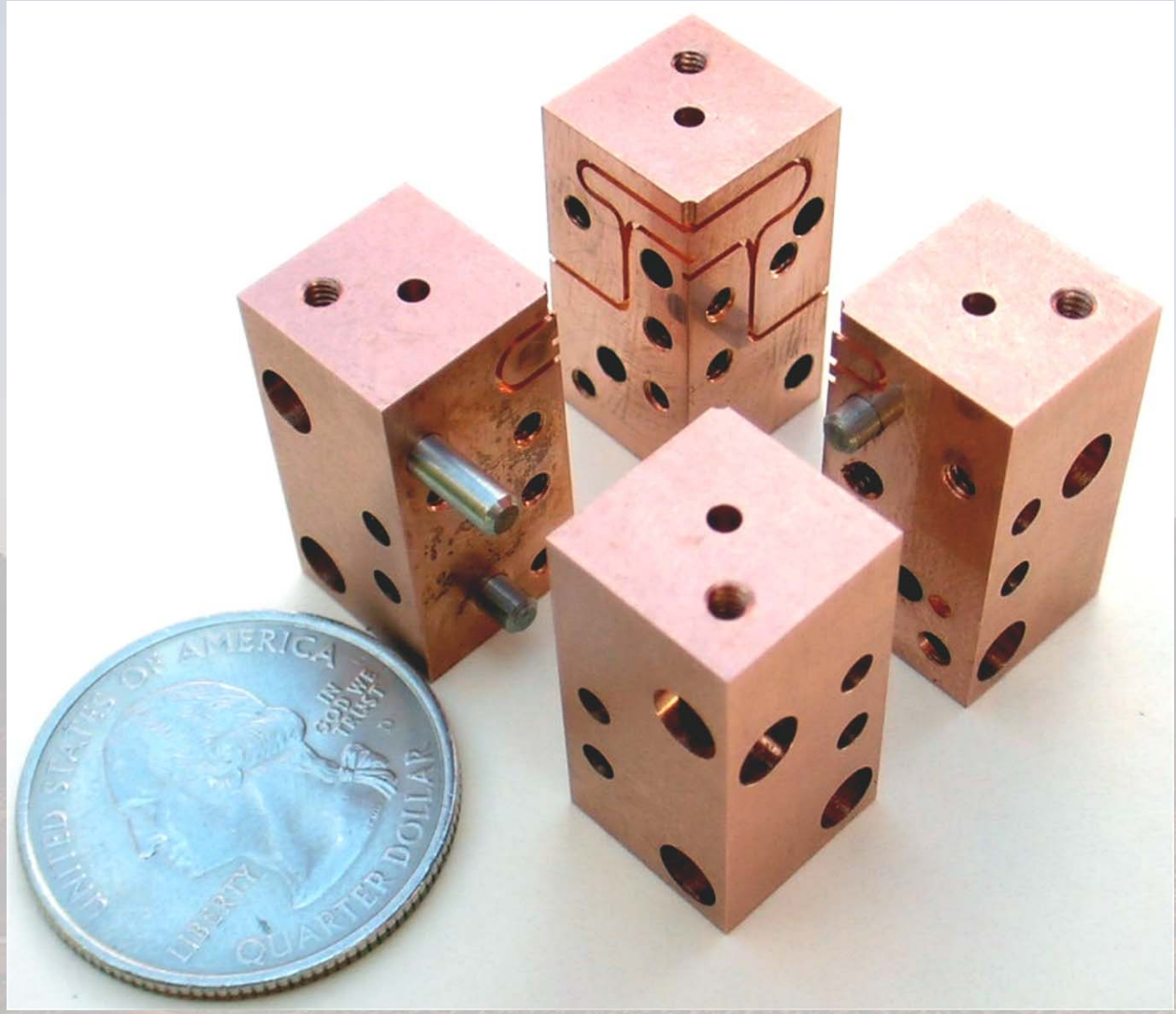


next generation 1mm receivers

(Plambeck, Engargiola, Navarrini, Bolatto, Madison)

- goals:
  - dual circular polarization
  - at least 4 GHz IF bandwidth per polarization
  - 40 K DSB receiver temperature
- dual polarization advantages:
  - sqrt 2 improvement in sensitivity for spectral line observations
  - higher quality polarization science
  - ultimately, with 8 GHz correlator, improved continuum sensitivity

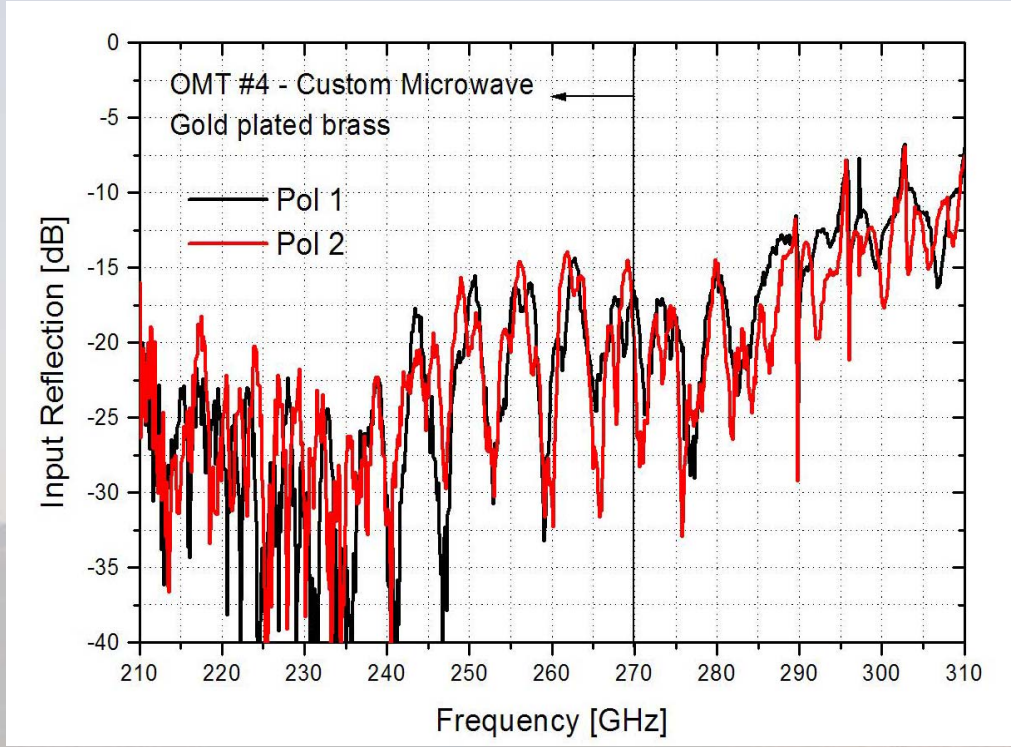
1mm OMT



Navarrini et al. 2006, IEEE-MTT, 54, 272.

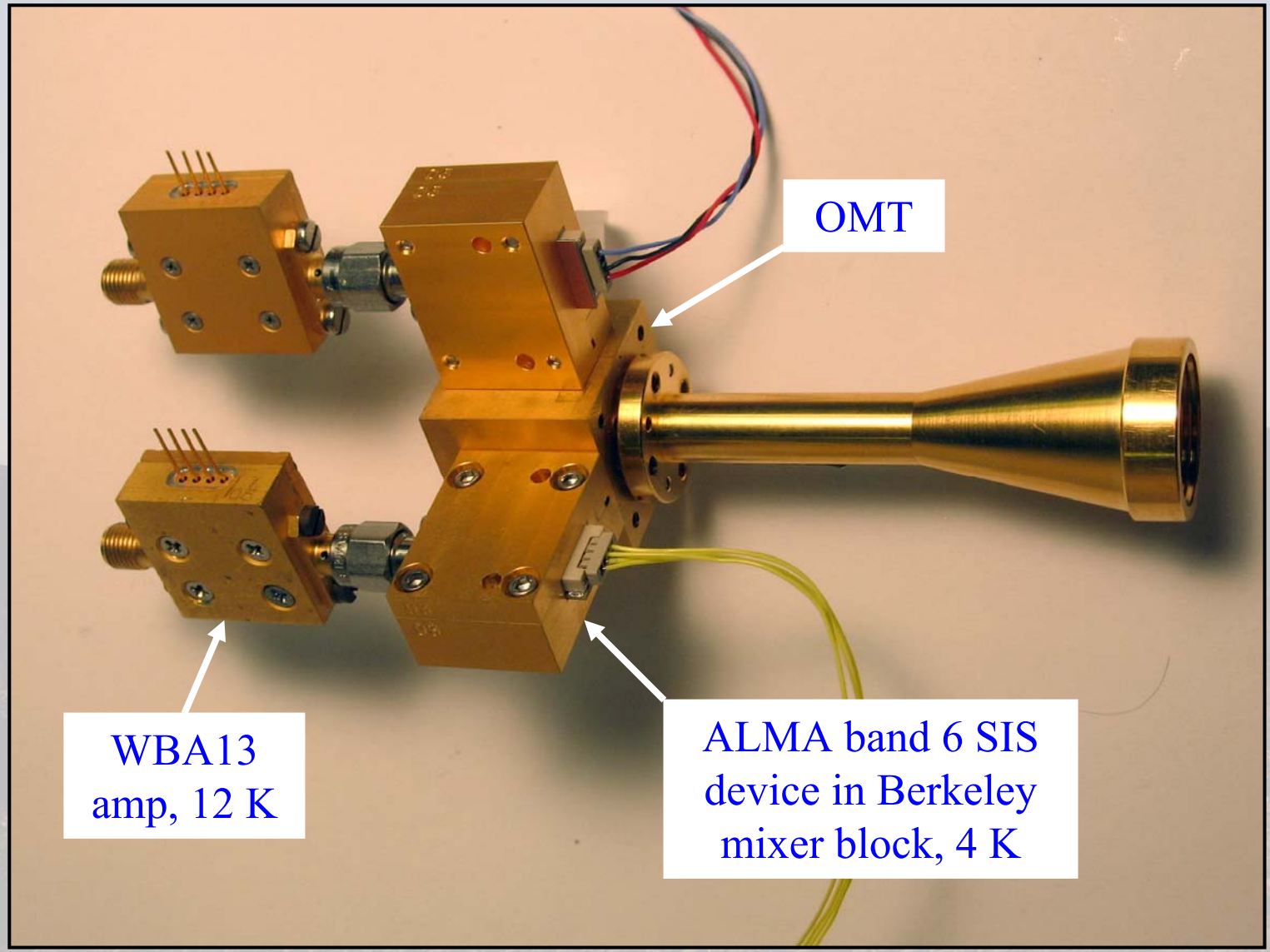
4 OMTs tested

(Navarrini and Bolatto, using NRAO network analyzer)

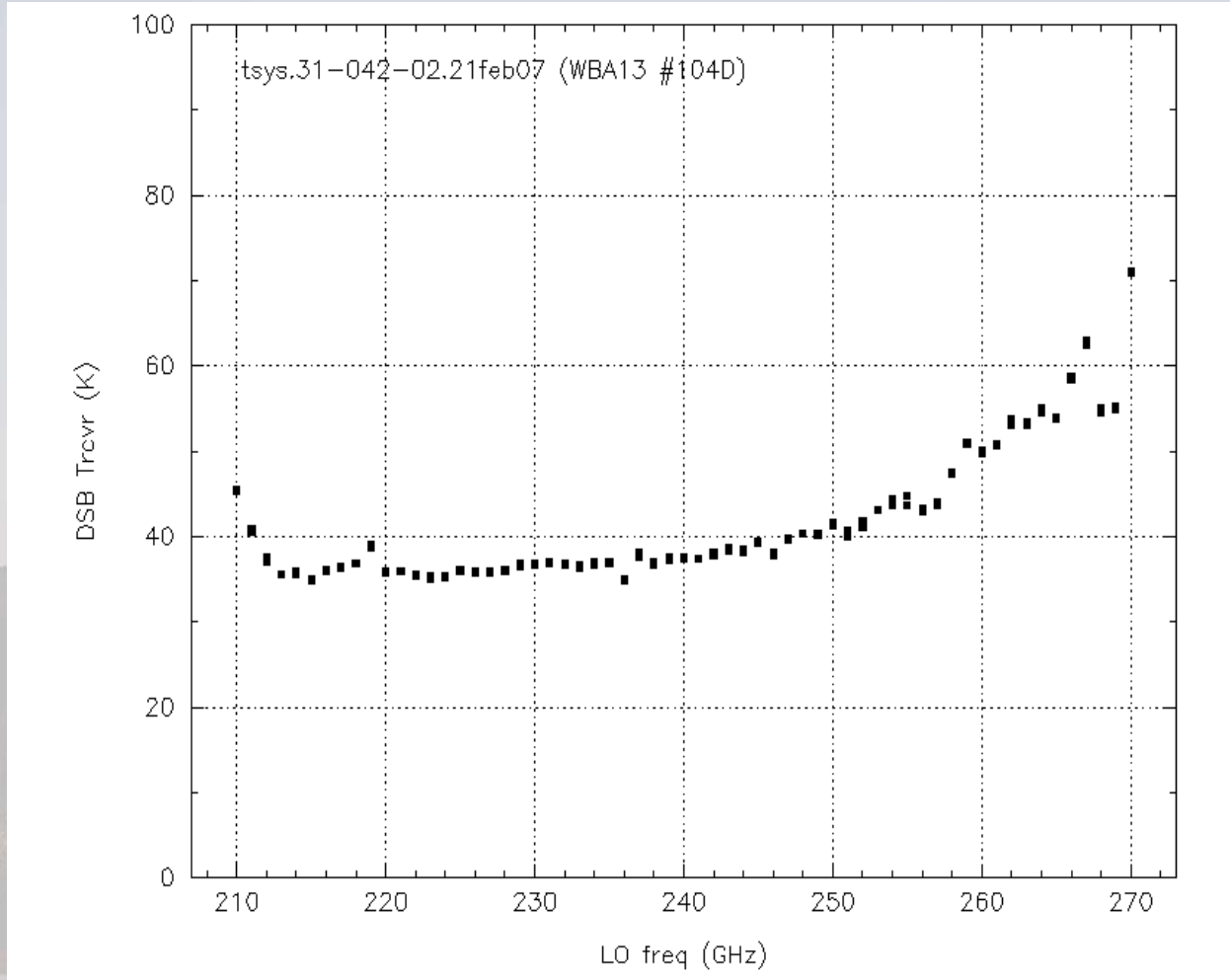


- transmission loss ~ 0.8 dB (0.3 dB expected at 4 K)
- input reflection coefficient -20 dB
- polarization isolation > 35 dB

(nearly) complete 1mm receiver

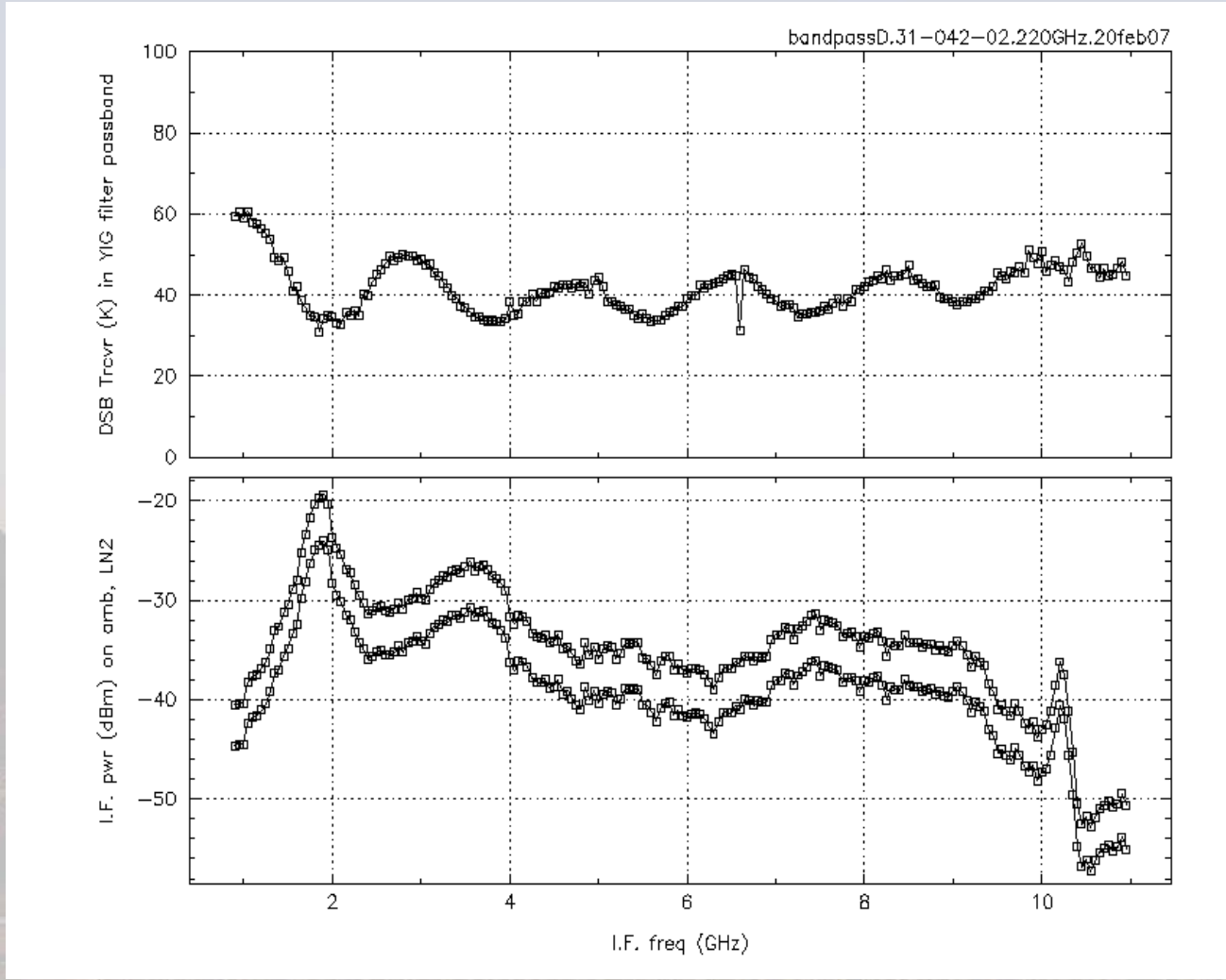


Trcvr (single mixer, no OMT)



35-45 K DSB, averaged across 1-10 GHz IF passband

IF passband


bandpassD.31-042-02.220GHz.20feb07
DSB Trcvr (K) in YIG filter passband
100
80
60
40
20
0
I.F. pwr (dBm) on amb, LN2
-20
-30
-40
-50
2
4
6
8
10
I.F. freq (GHz)

I.F. components

- fibers already in place for 2nd polarization
- splitters and transfer switches split signals between existing correlator sections
  - {RR,LL} for normal observing, spectral lines overlapped
  - switch rapidly between {RR,LL} and {RL,LR} for polarization measurements

1mm rcvr status

long lead time items already ordered:

Component	*Source*	*Cost*	*Date*
SIS devices	Lichtenberger, UVa	$90K	Oct 07
WBA13 amps	Weinreb, Caltech	$90K	Dec 07
OTX (laser trx)	Photonics, Inc.	$57K	Apr 07