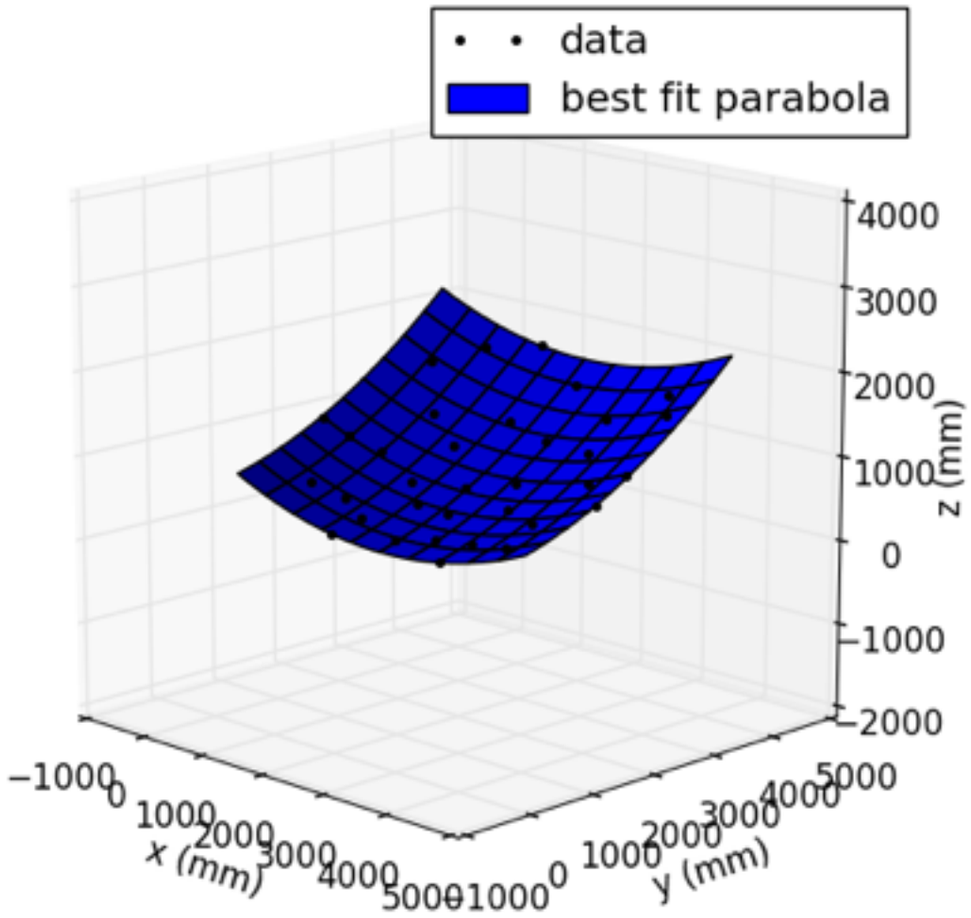
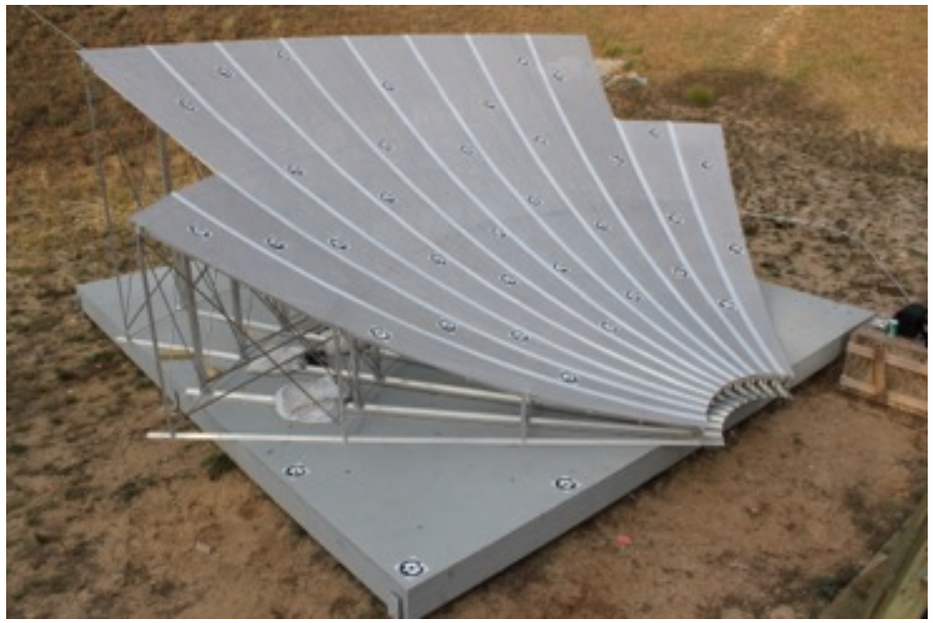
BMX status

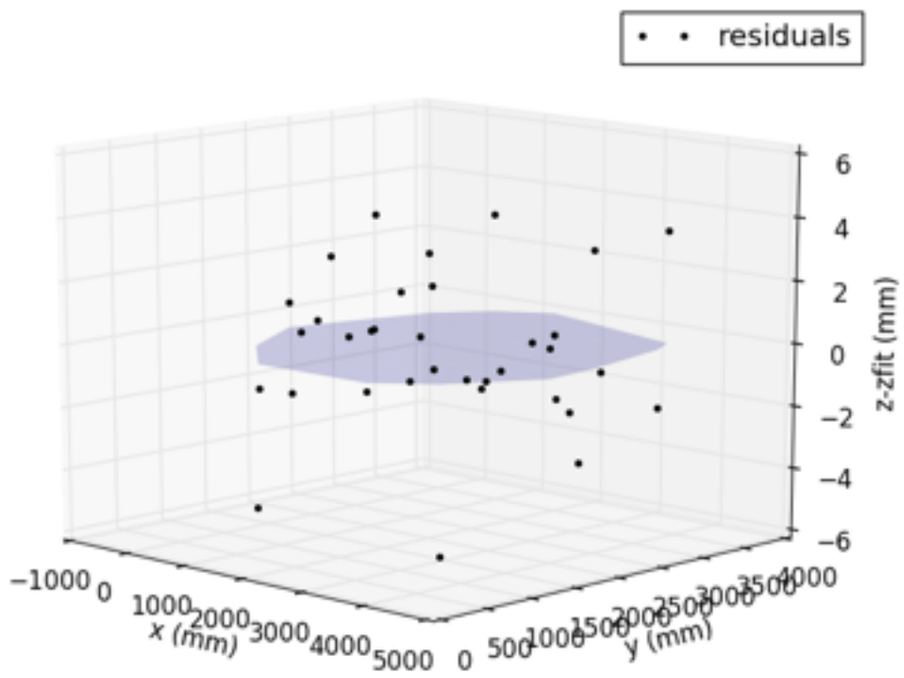
12/15/17

Yesterday. Snow on dish not obvious in data.

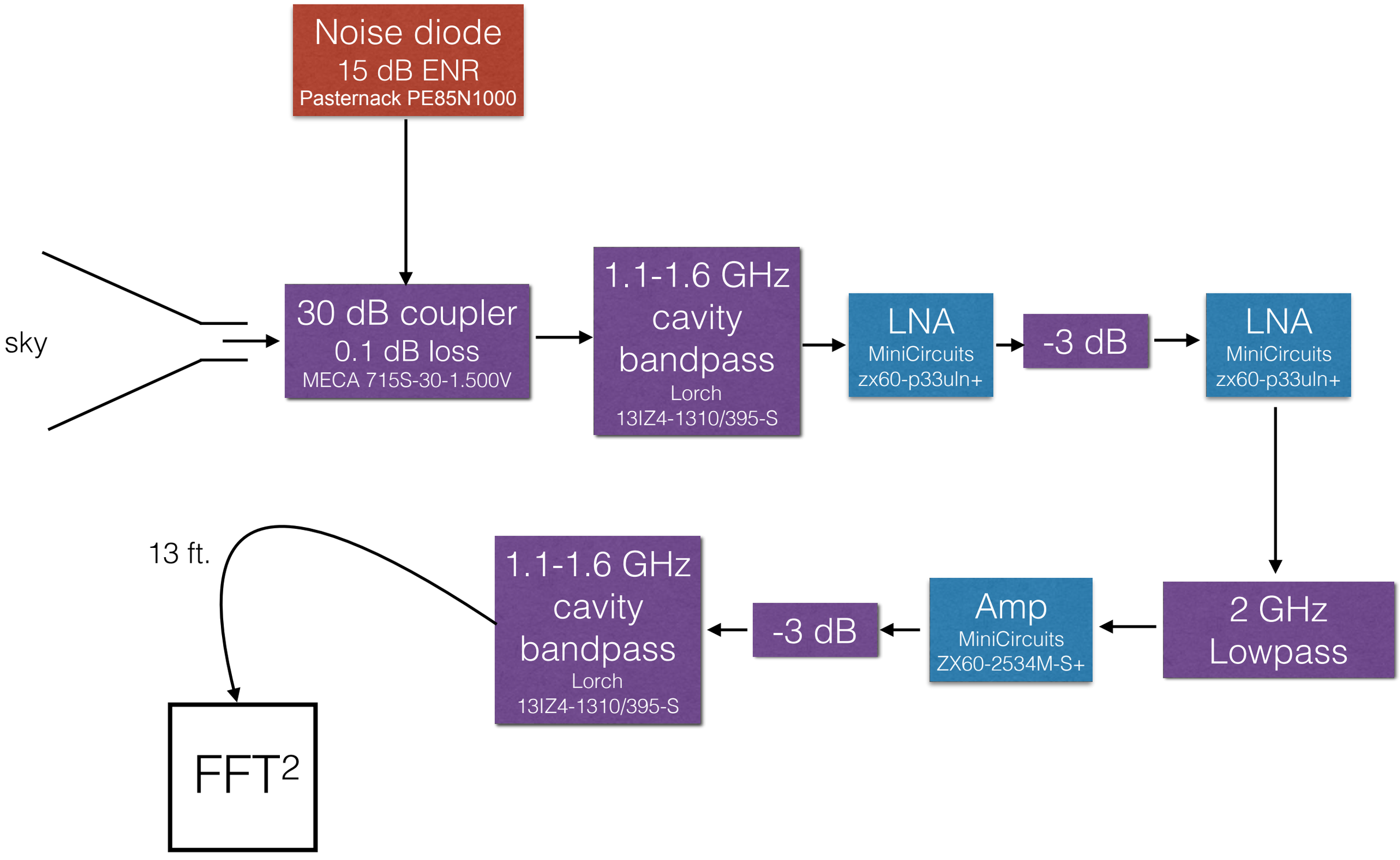
Dish surface accuracy with photogrammetry
N.B. probably still dominated by measurement error, but residuals are ~+/- 5 mm



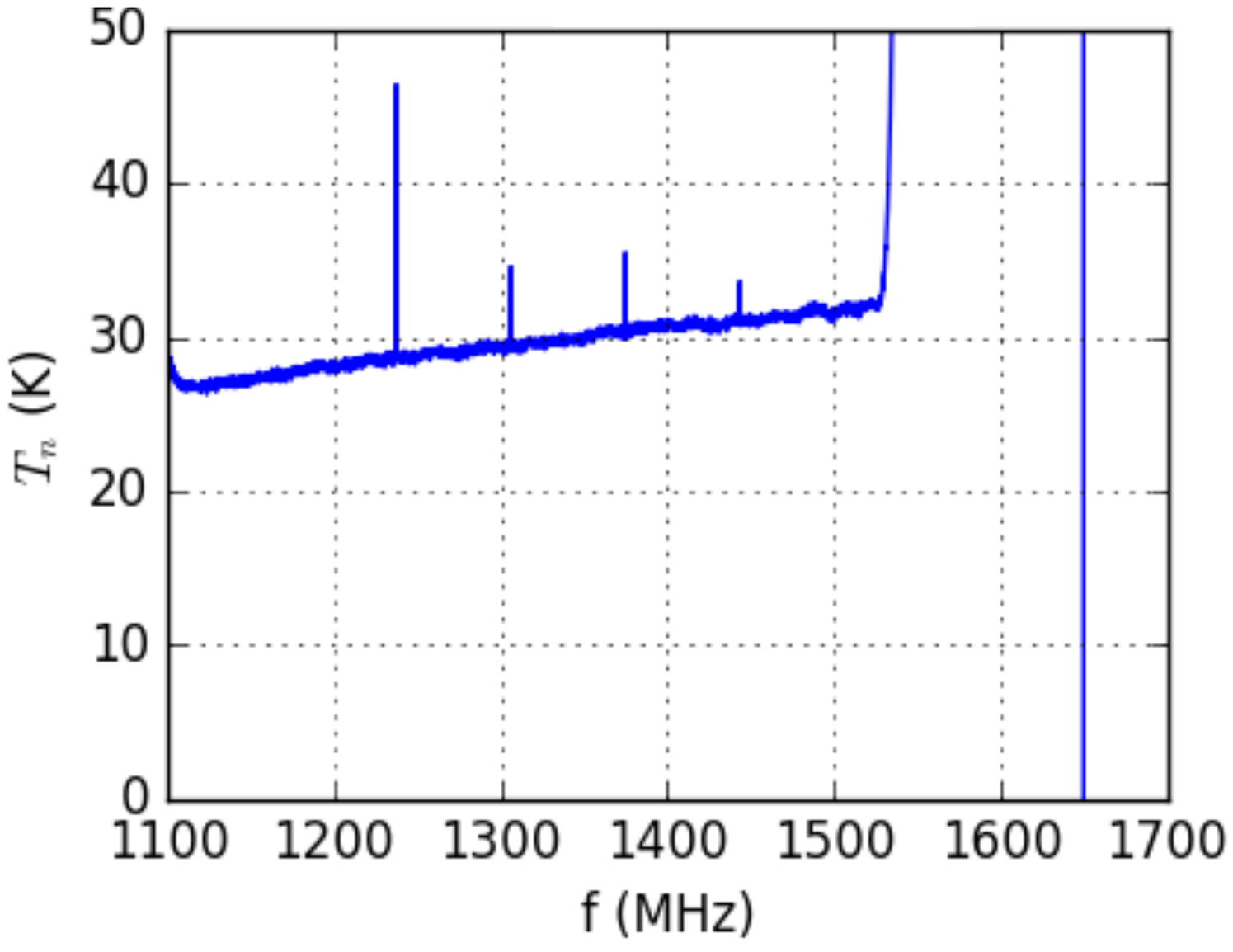




Current amp chain setup, only one polarization so far:

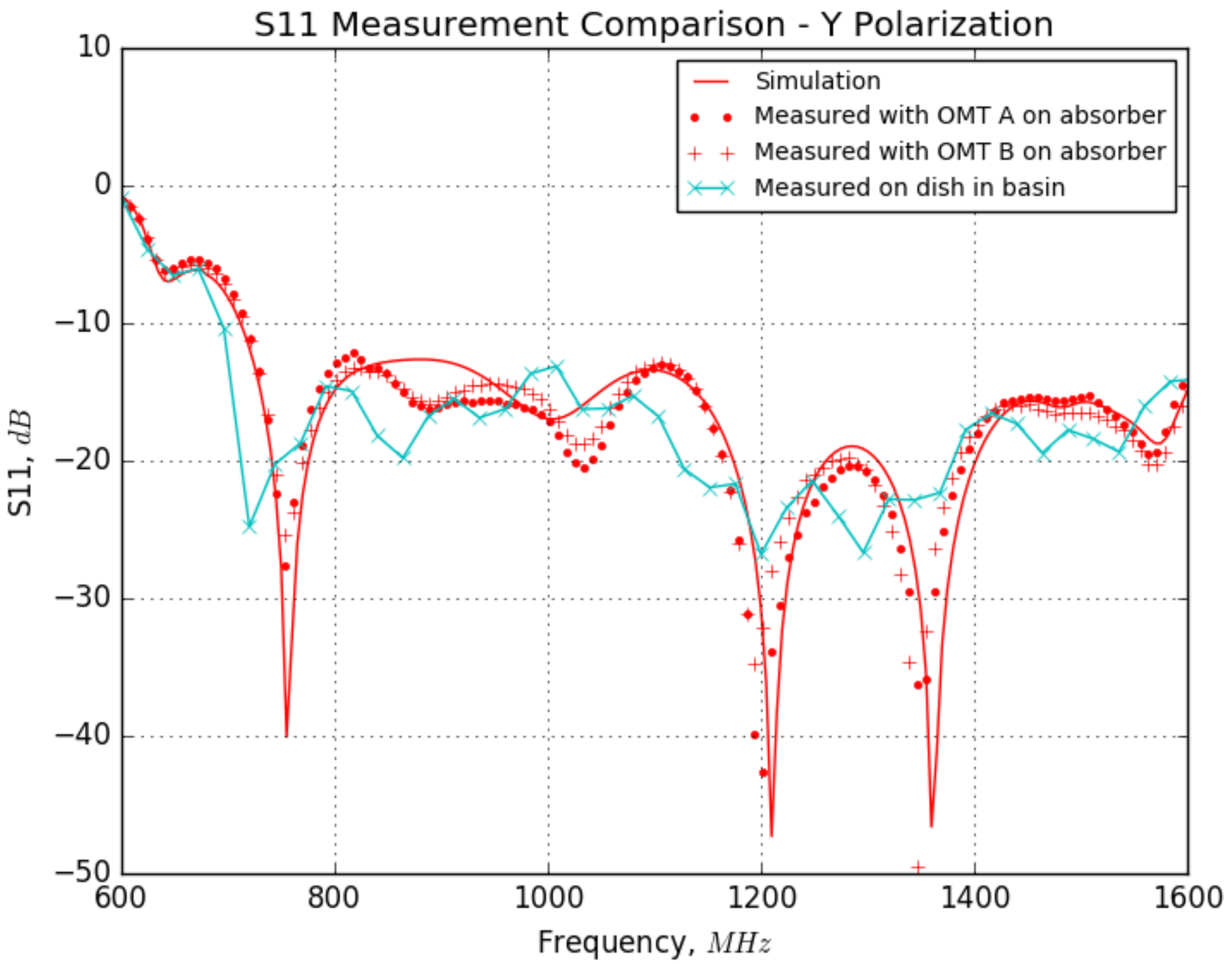


Terminated amp chain noise temperature (terminator on first LNA, LN2 dunk)
N.B. does not include loss from coupler or bandpass

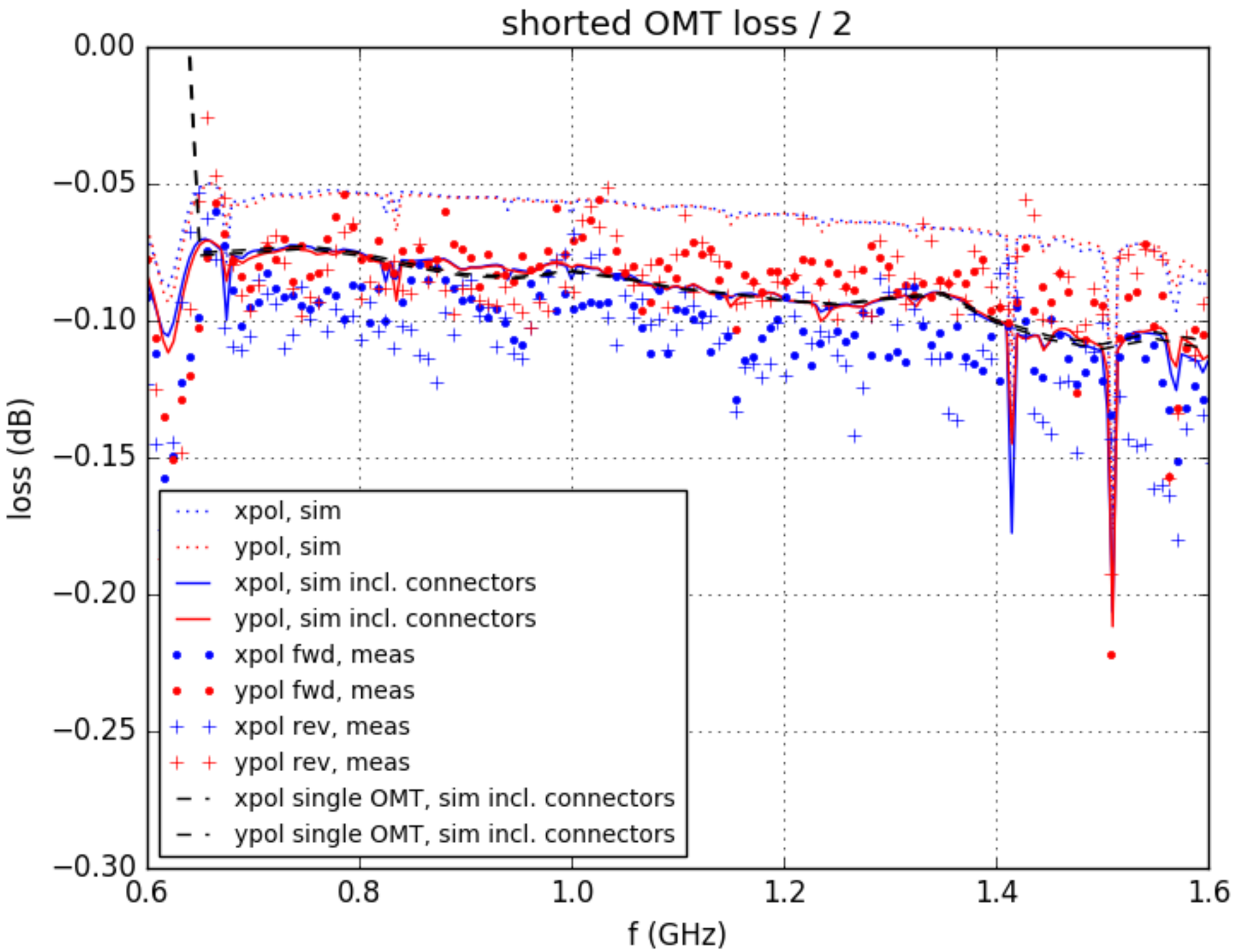


S11 of OMT + horn

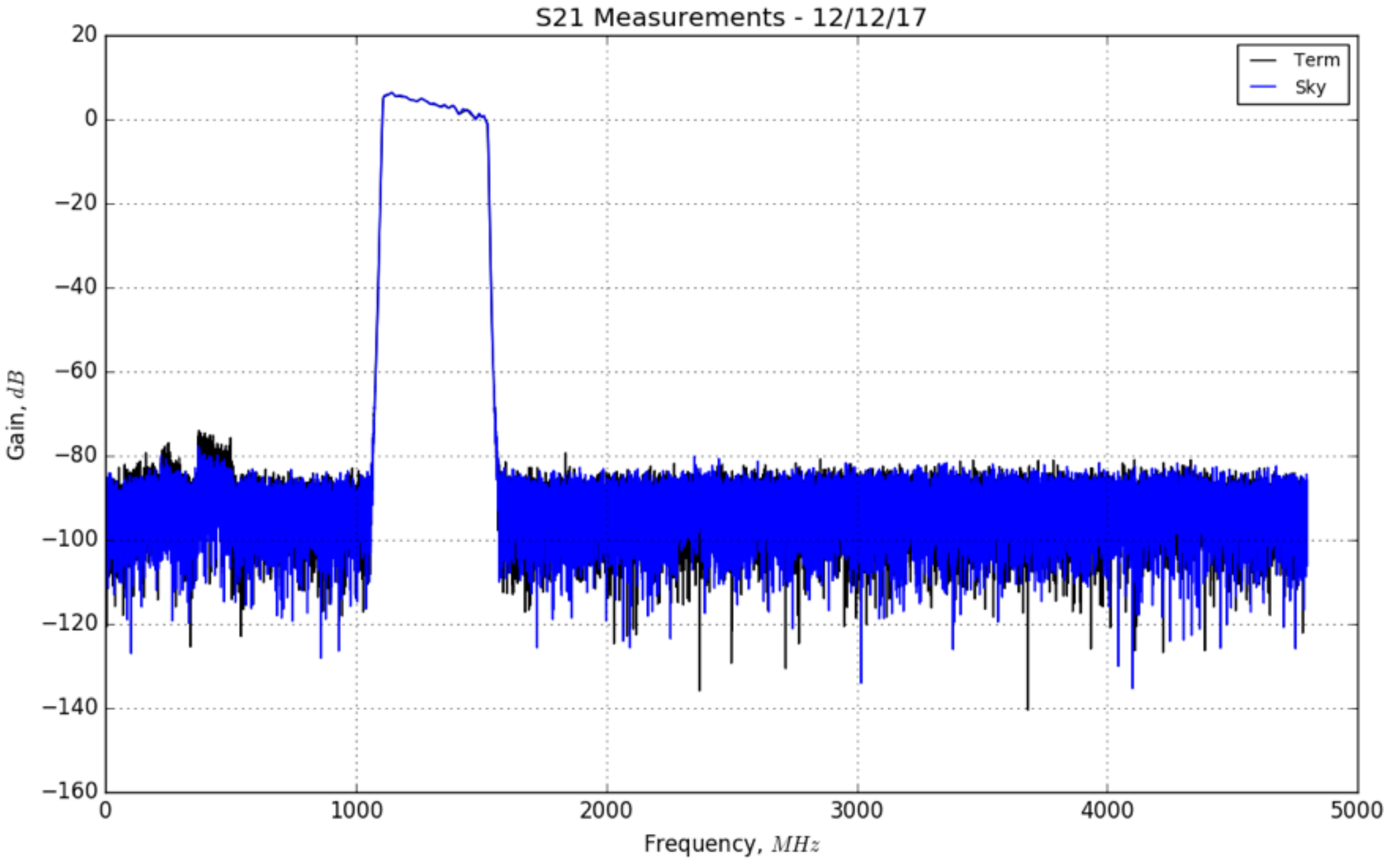
(VNA port 1 on OMT port, connected to horn, pointed at dish)



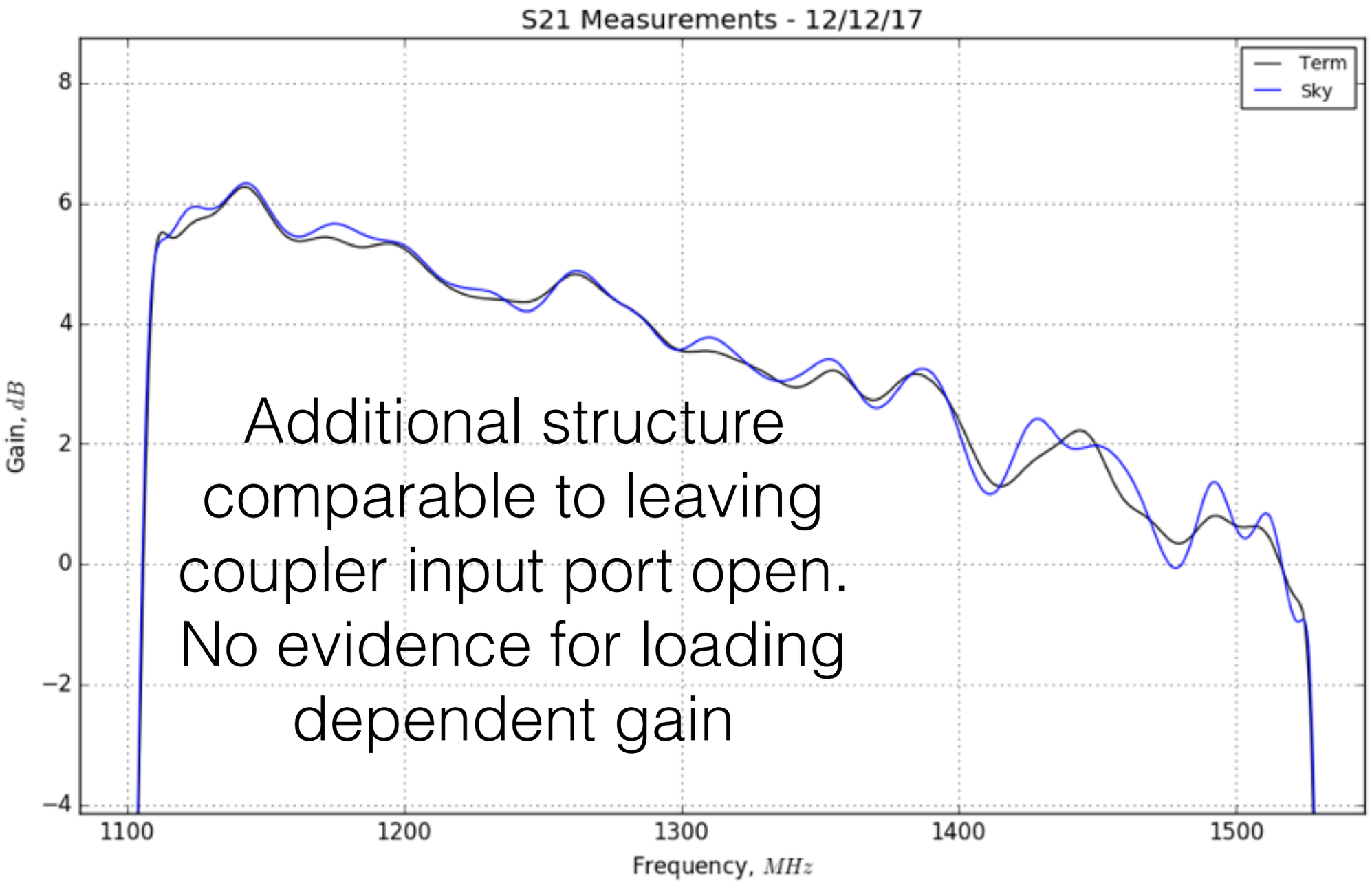
OMT loss < 0.1 dB



Amp chain S21 with VNA on directional coupler's 30 dB port and input port (1) terminated, and (2) connected to OMT + horn and seeing sky

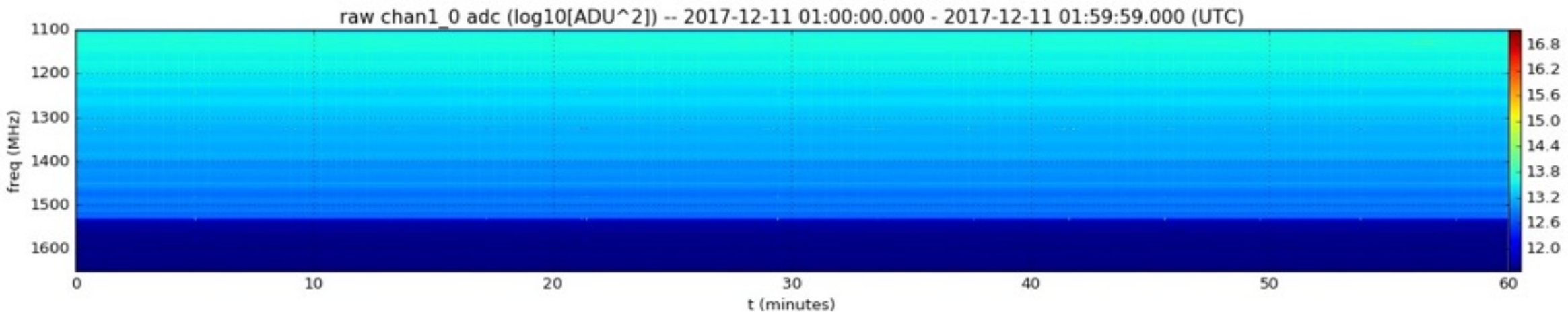


Amp chain S21 with VNA on directional coupler's 30 dB port and input port (1) terminated, and (2) connected to OMT + horn and seeing sky



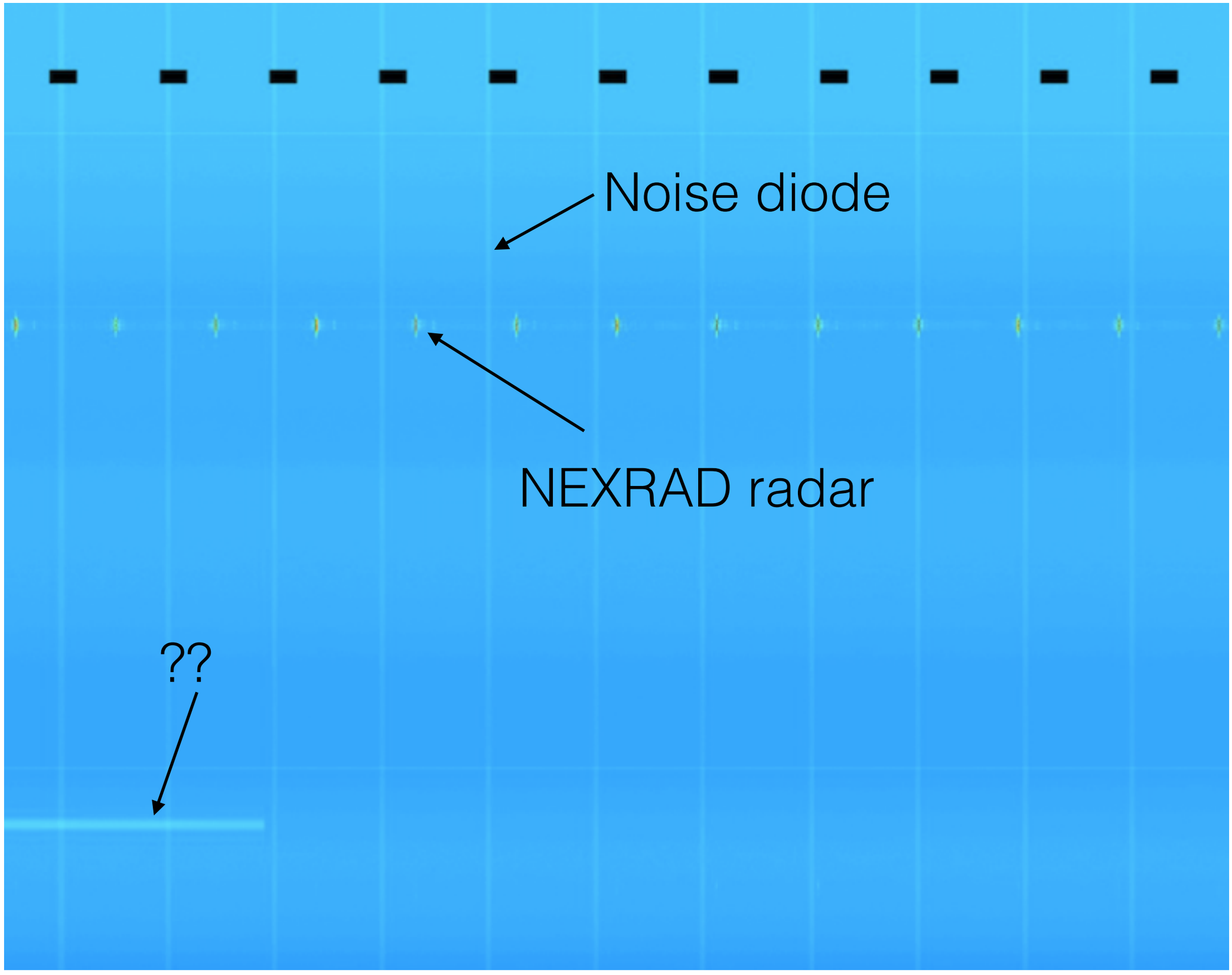
Additional structure comparable to leaving coupler input port open. No evidence for loading dependent gain

Raw waterfall plot, 1 hour of data

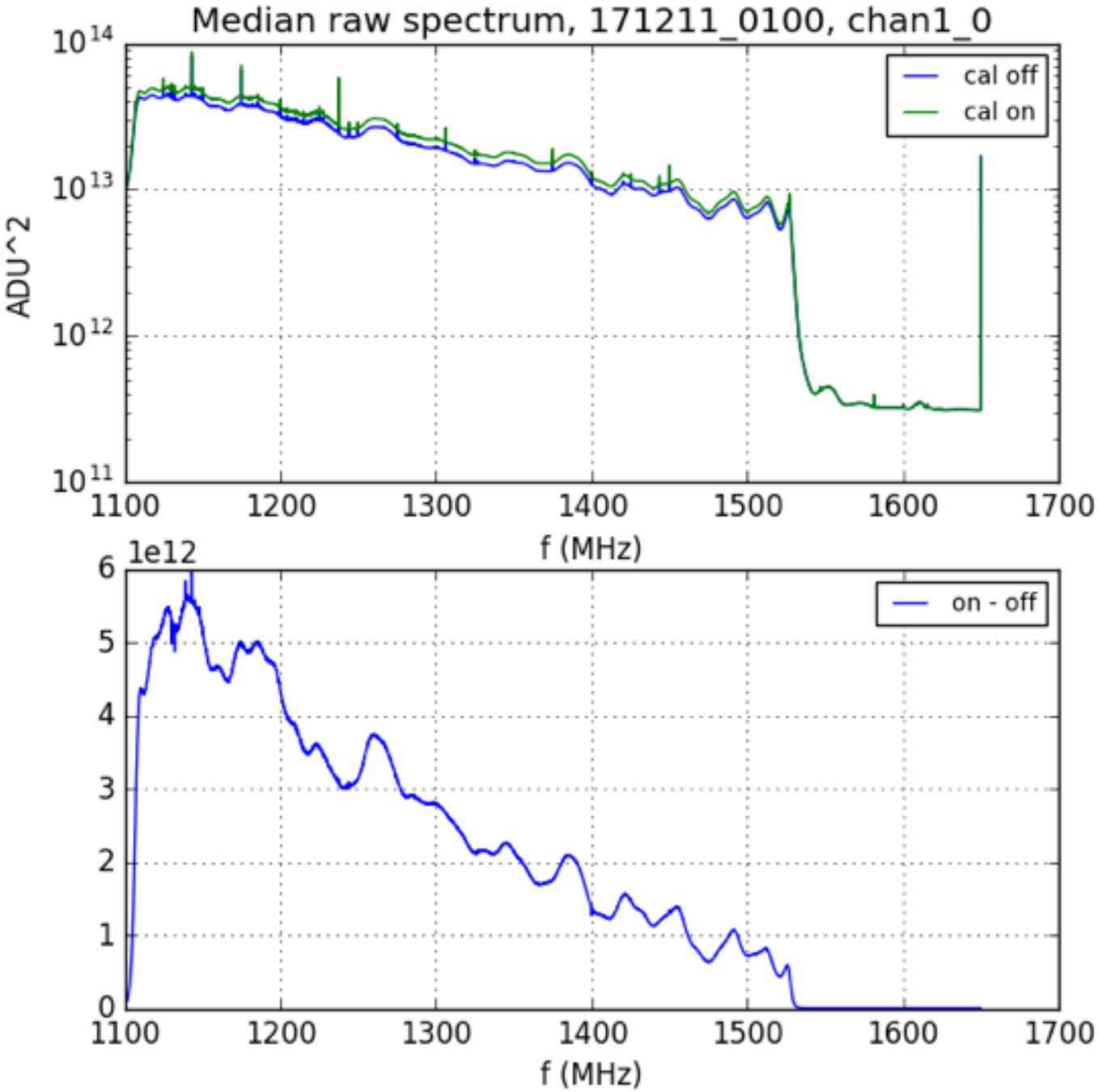


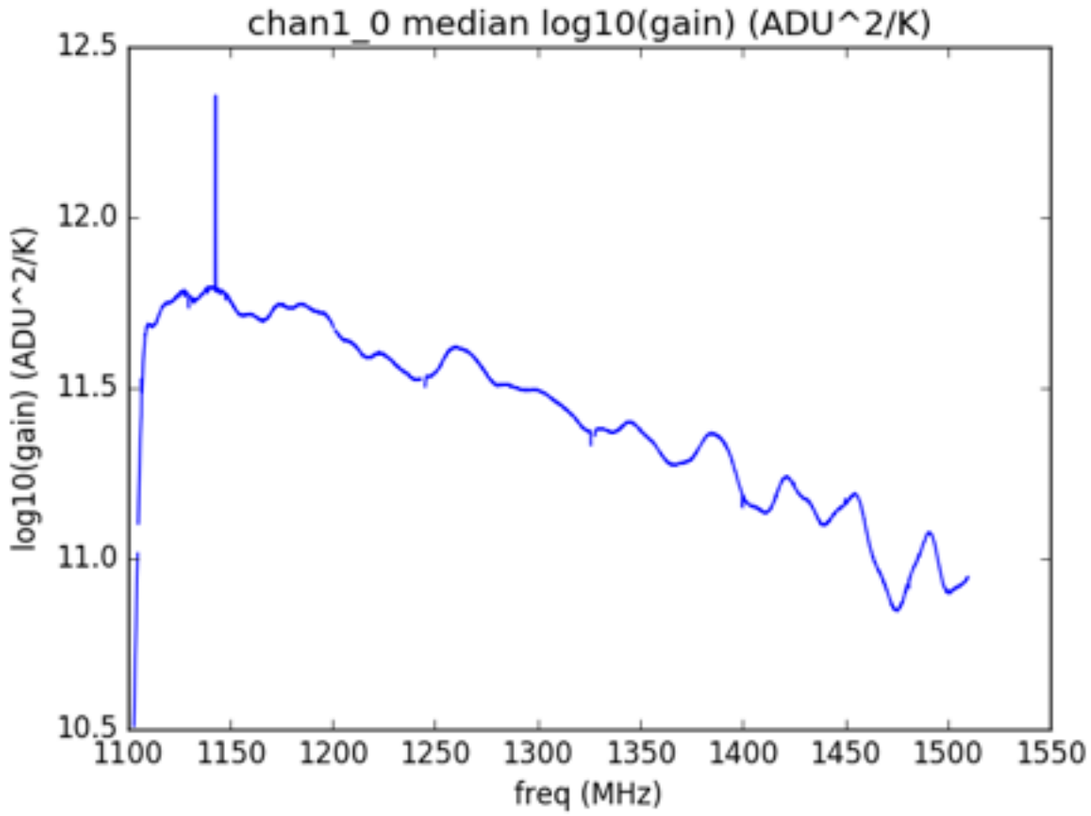
http://www.cosmo.bnl.gov/www/bmx/databrowser/

Raw waterfall plot, 1 hour of data

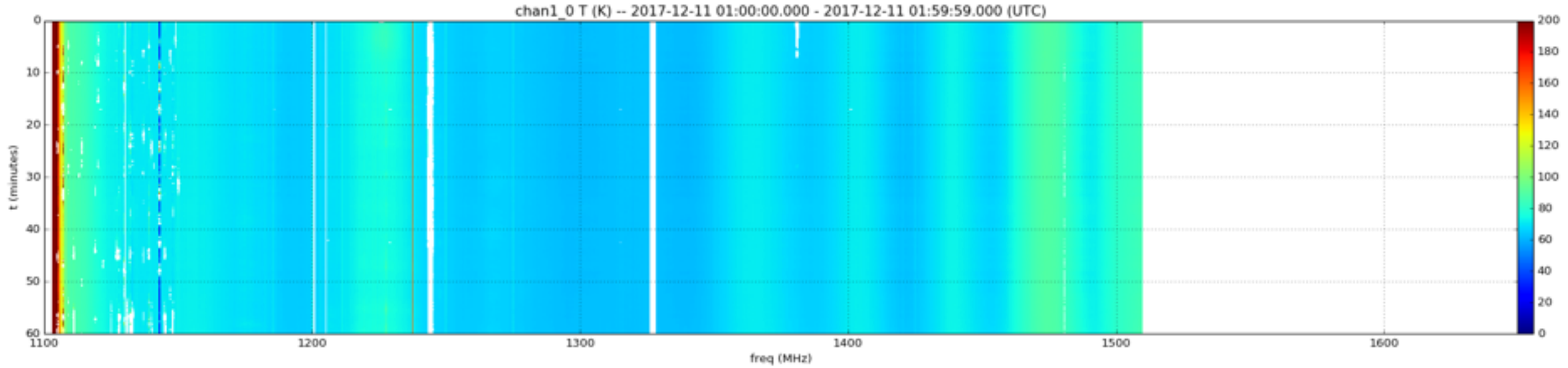


Raw spectrum (median over 1 hour), diode on - off, and gain (ADU^2 / K)

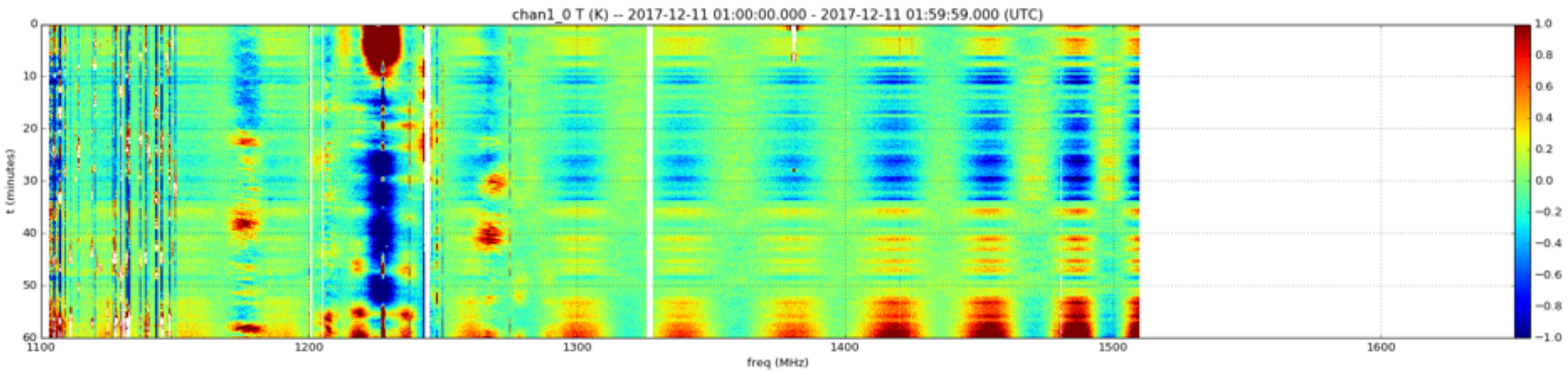




Calibrated waterfall plot

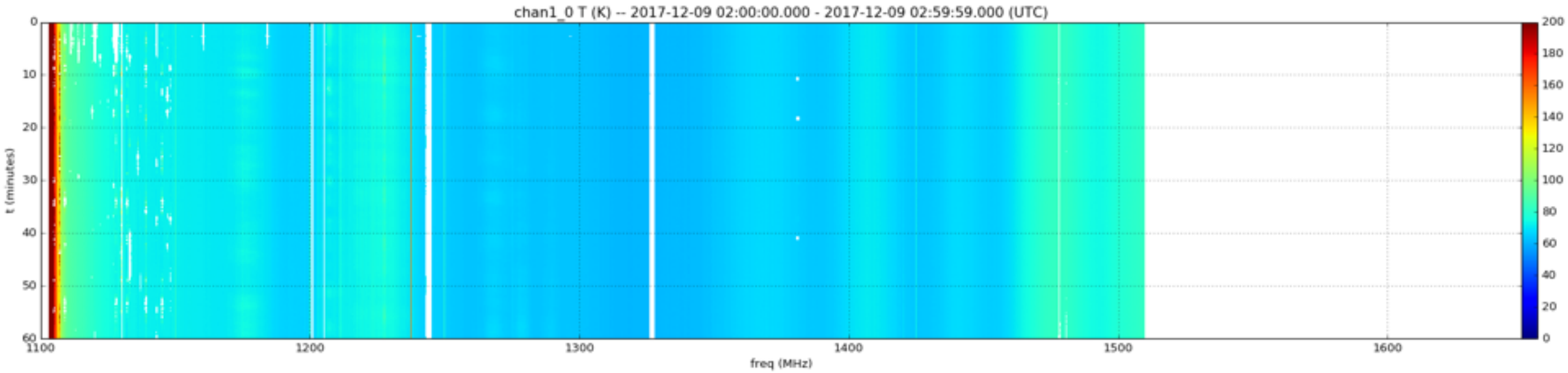


subtract mean over time in each freq bin

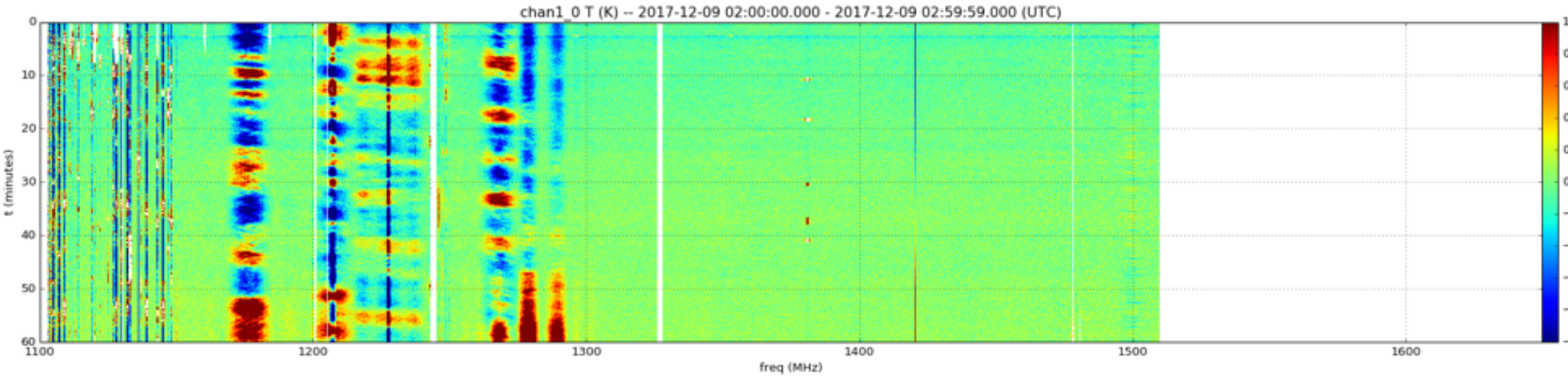


Calibrated waterfall plot

Sometimes cleaner. Switching to regulated amp power supply in coming days. Will also add temperature regulation. Not so worried about this yet…

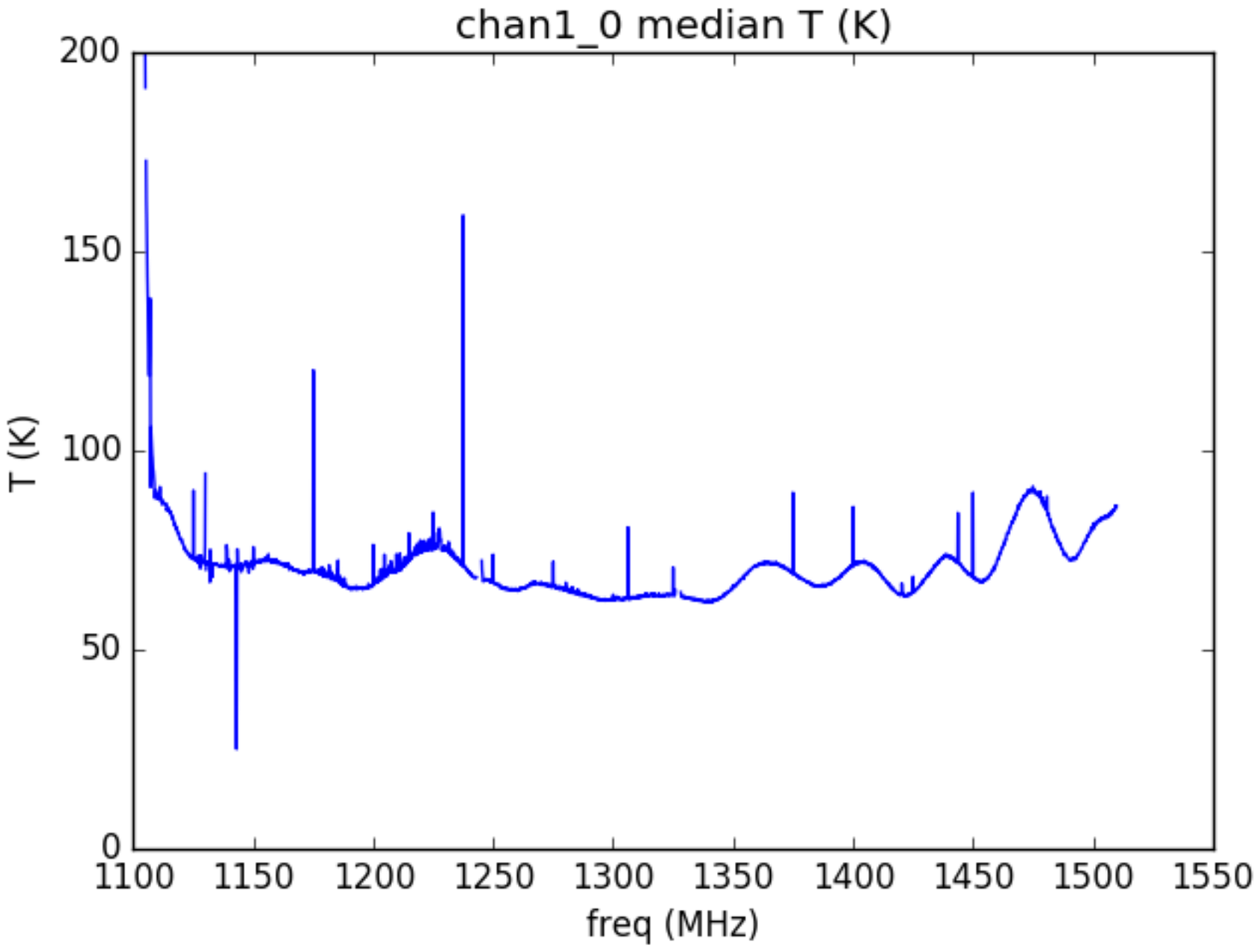


subtract mean over time in each freq bin

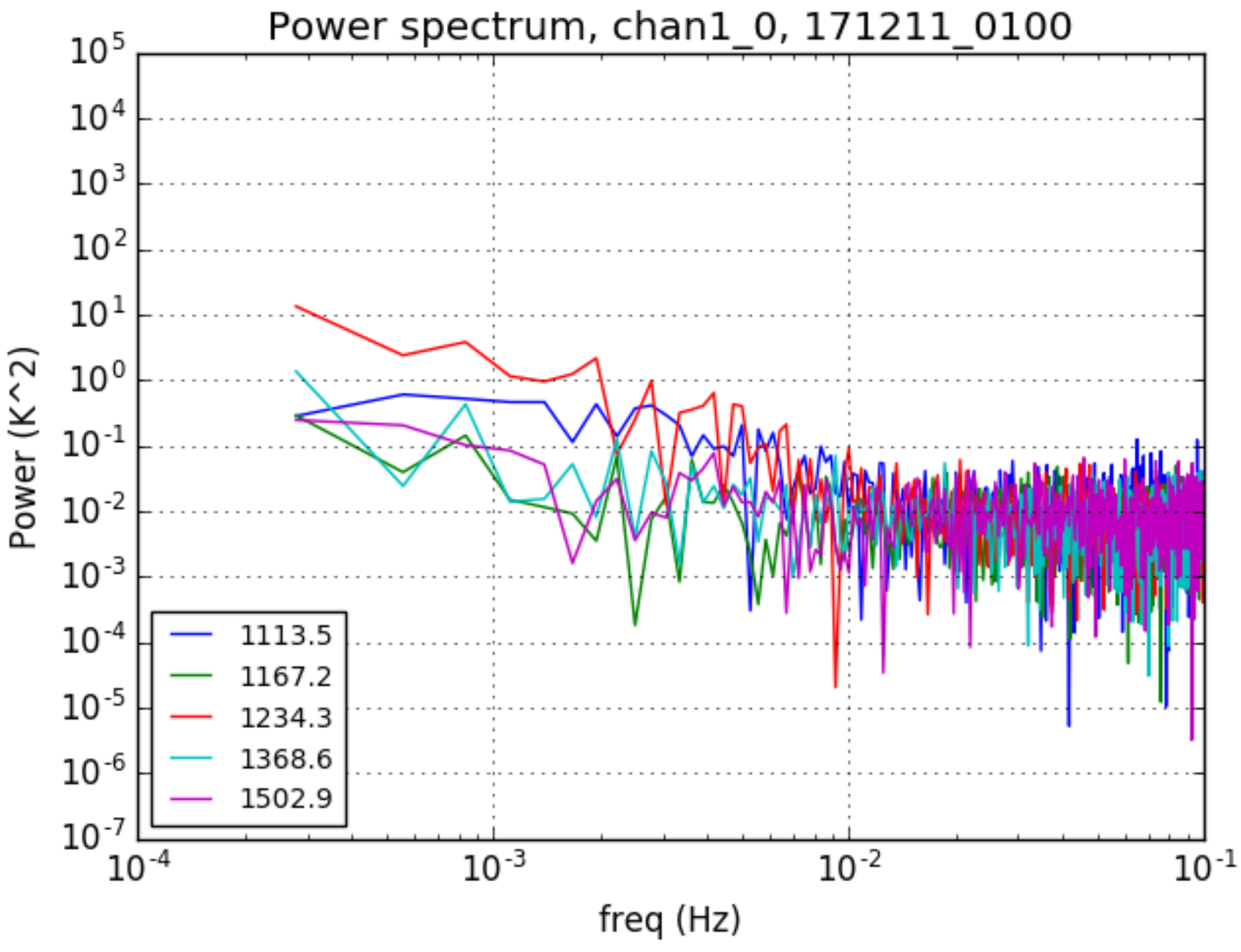


Calibrated median spectrum

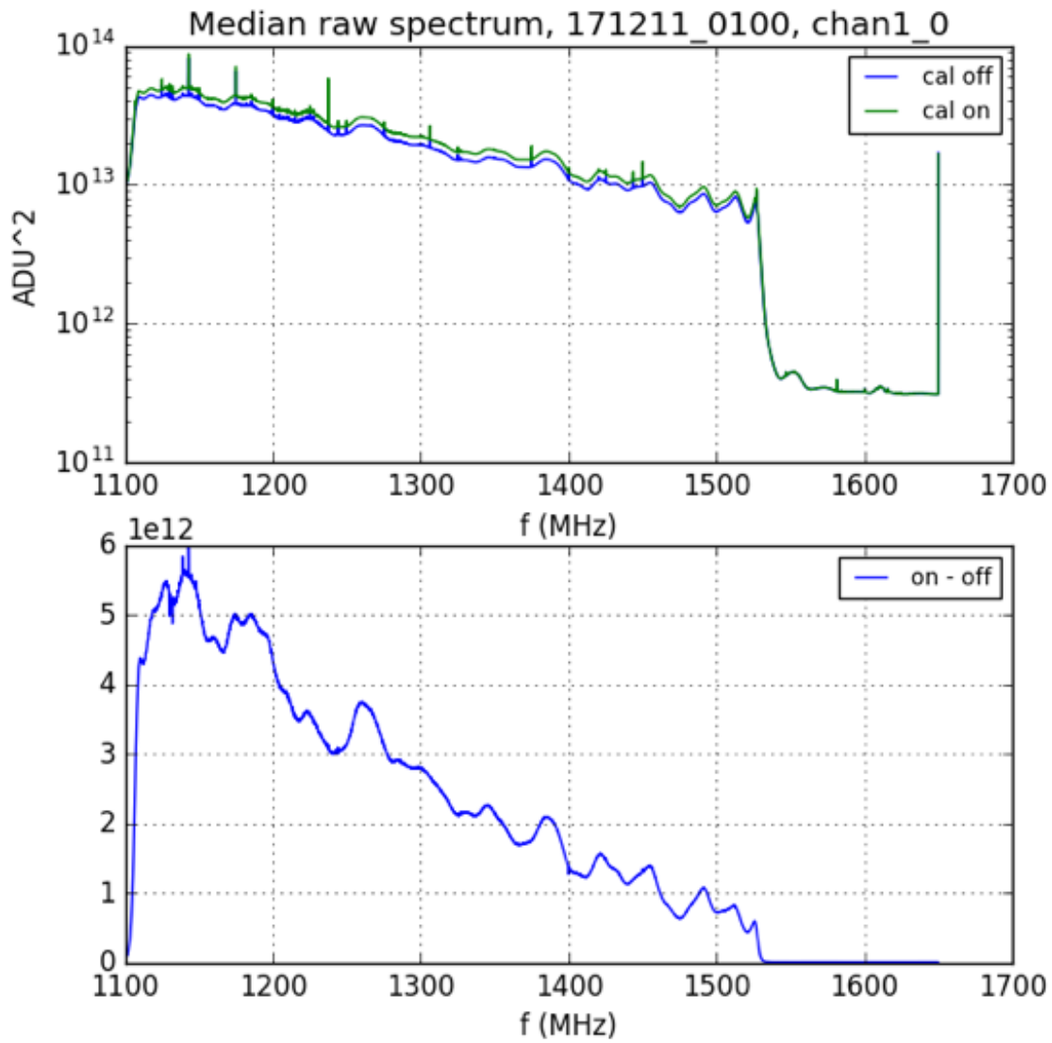
~70 K on sky. 30 K from amp, maybe ~20 K from loss in coupler and bandpass. Unexplained 20 K…

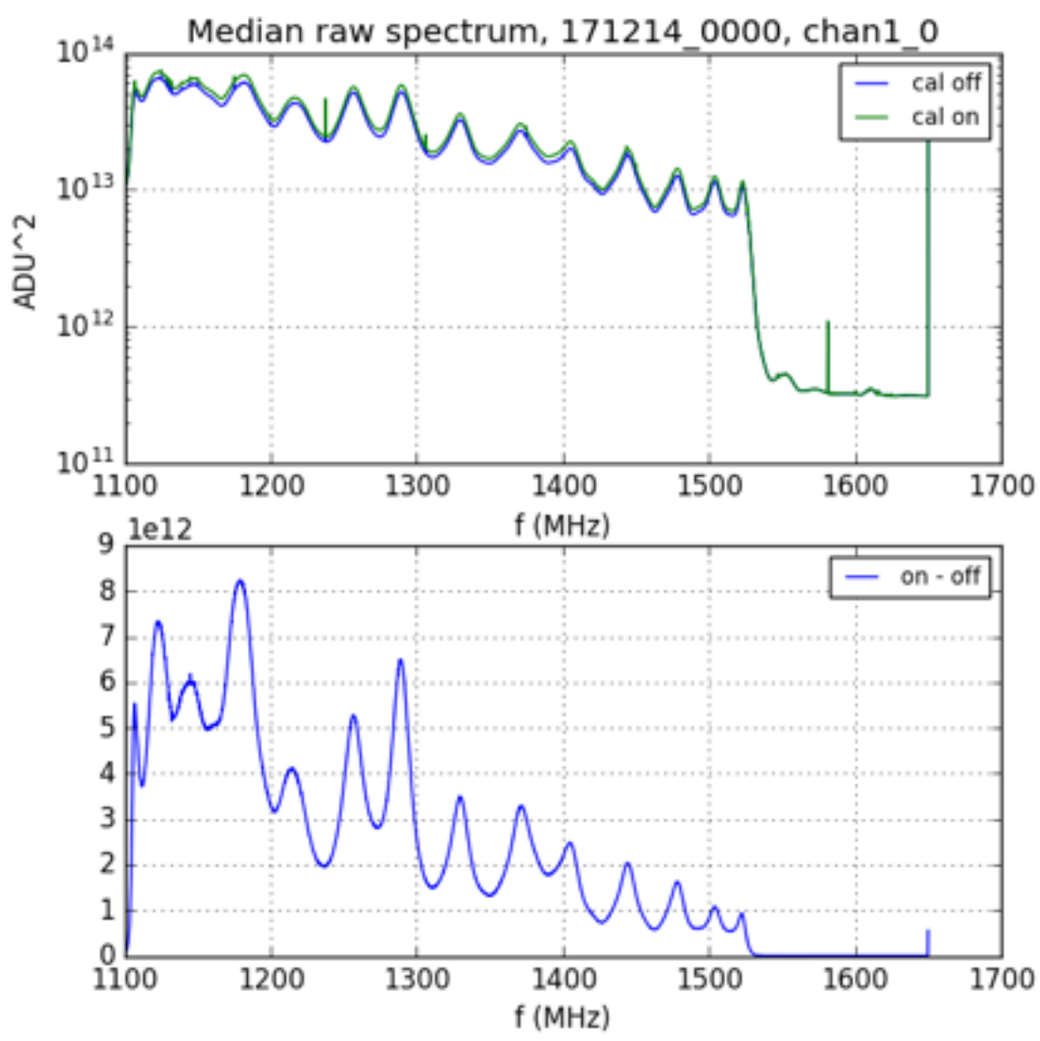


Temporal power spectra in a few different frequency bins showing 1/f

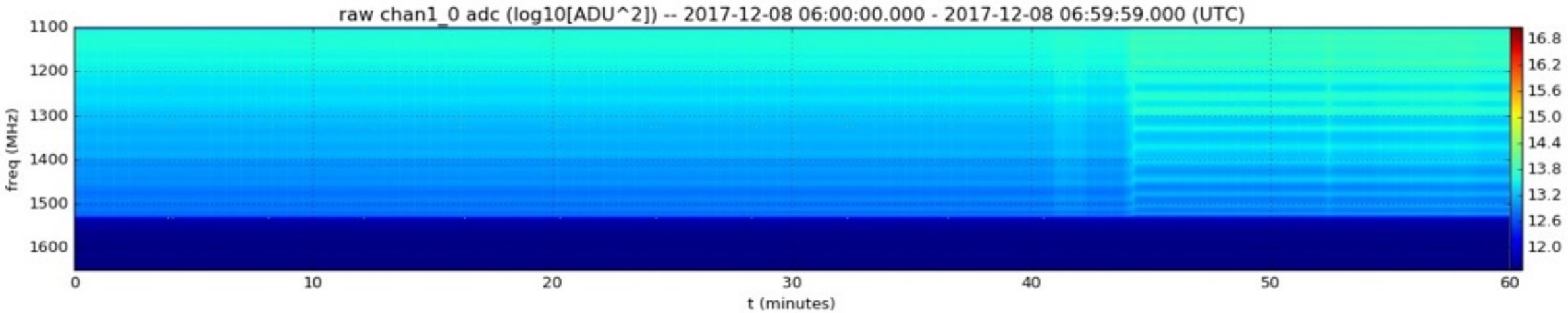


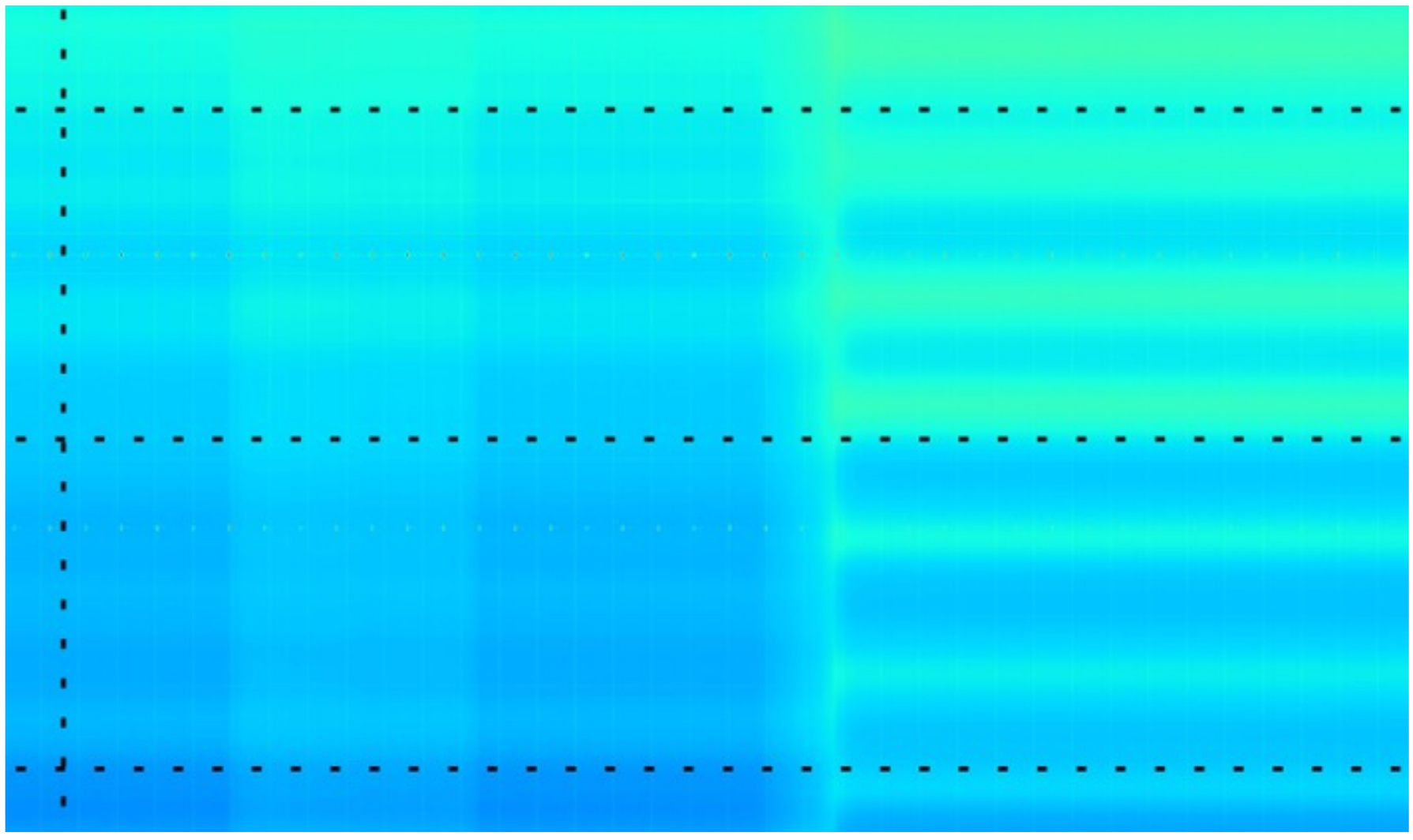
Data weirdness #1: Two state system





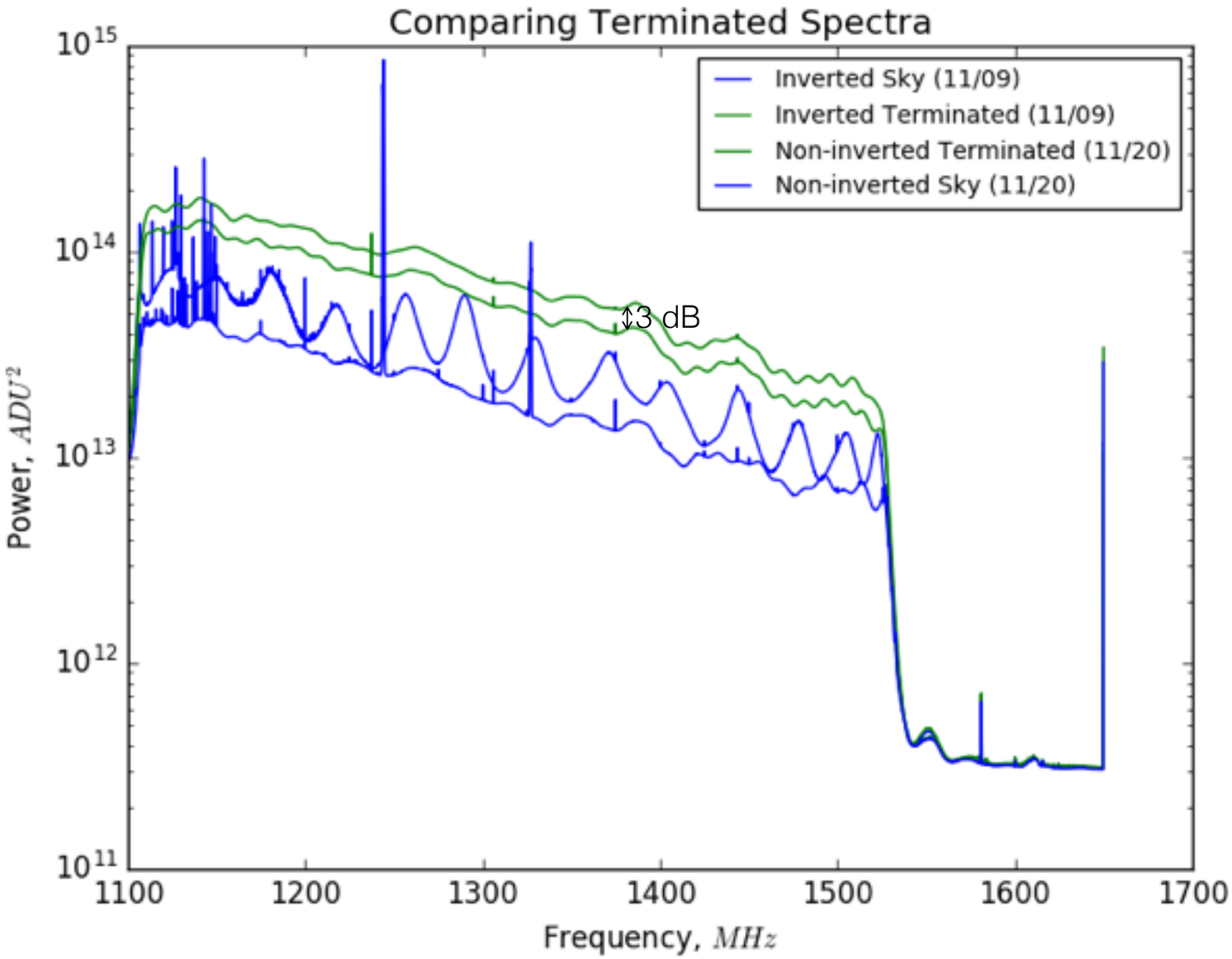
Data weirdness #1: Two state system





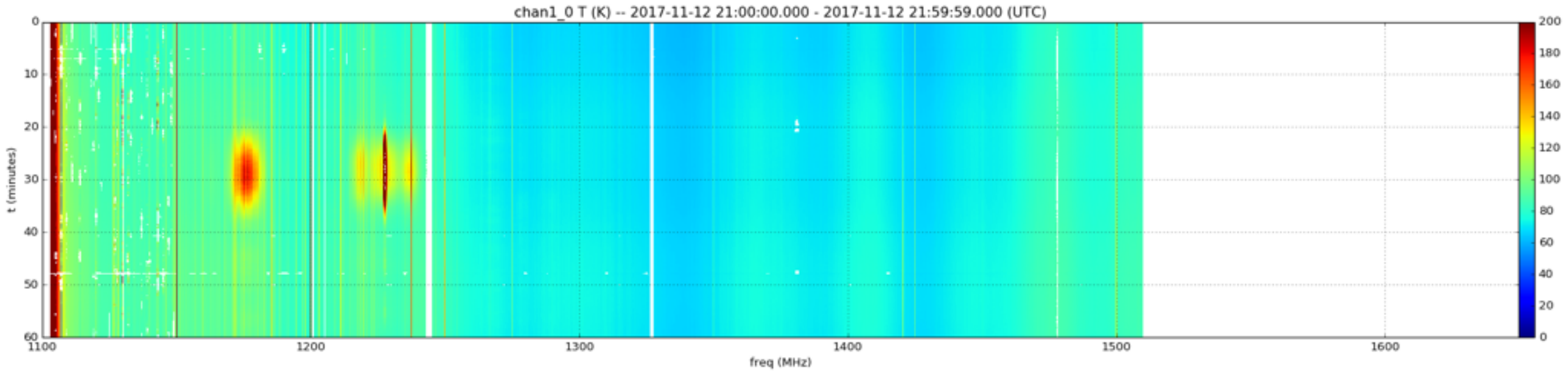
Data weirdness #1: Two state system

When terminating, system reverts to smooth spectrum state



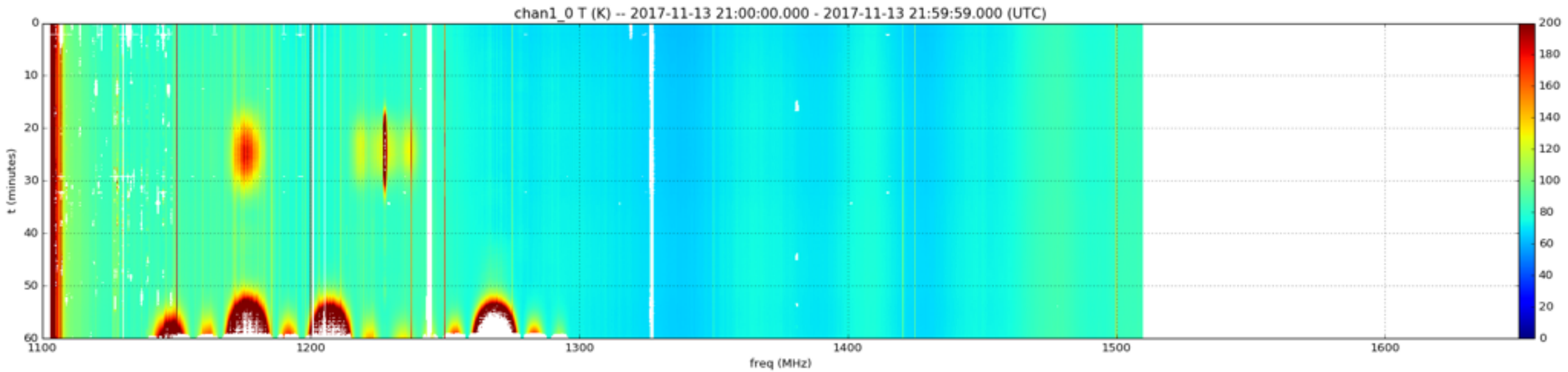
(Added 3dB coupler between comparisons)

Data weirdness #2: Frequency response to astronomical sources is strange



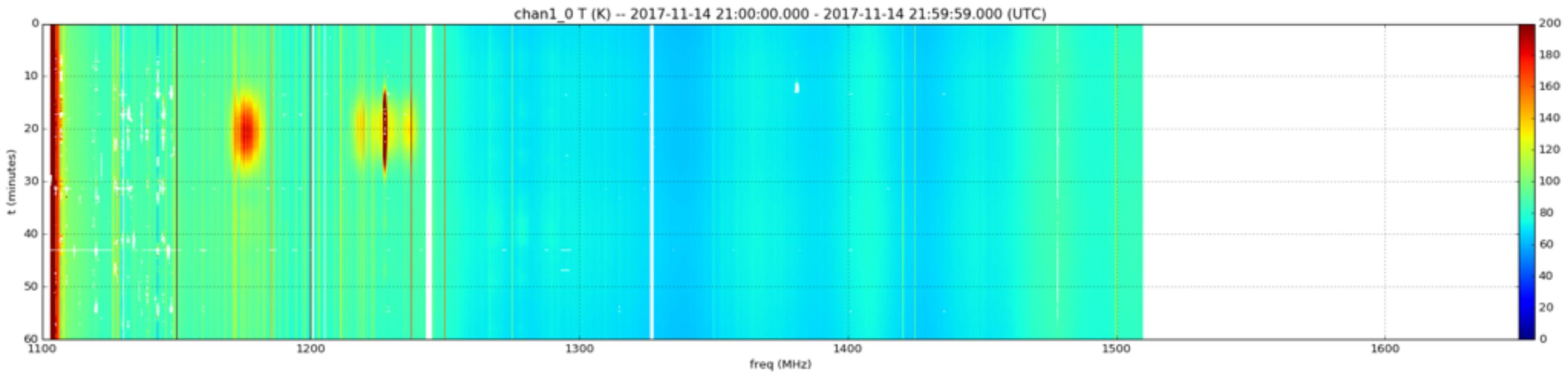
Astronomical source tracks sideral time

Data weirdness #2: Frequency response to astronomical sources is strange



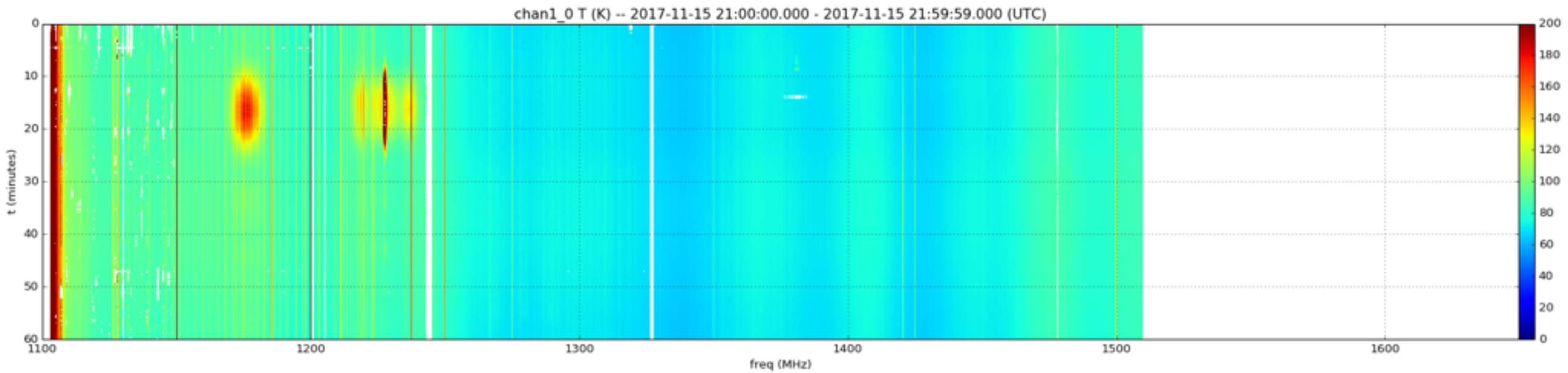
Astronomical source tracks sideral time

Data weirdness #2: Frequency response to astronomical sources is strange



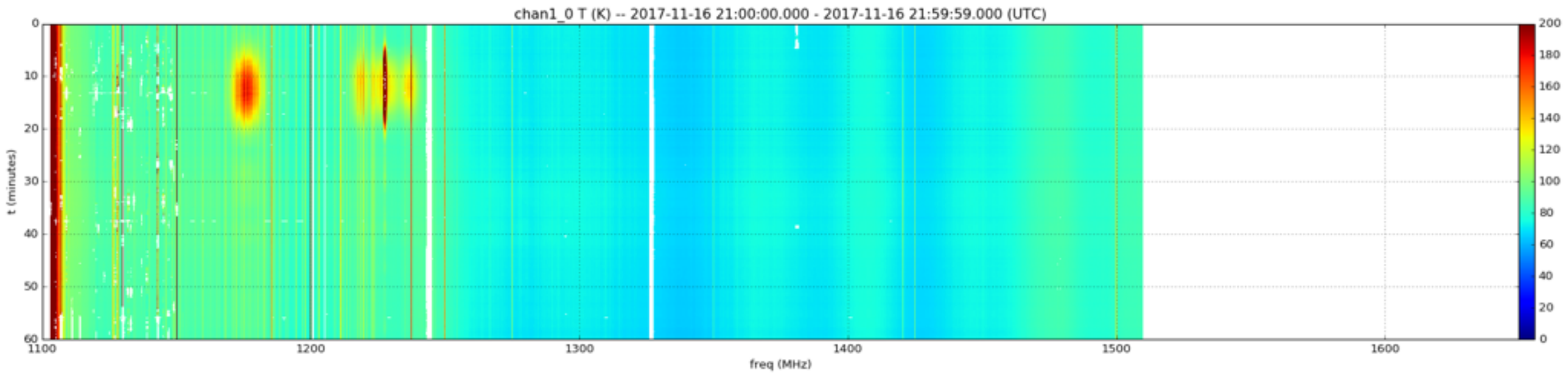
Astronomical source tracks sideral time

Data weirdness #2: Frequency response to astronomical sources is strange



Astronomical source tracks sideral time

Data weirdness #2: Frequency response to astronomical sources is strange



Astronomical source tracks sideral time

Data weirdness #2: Frequency response to astronomical sources is strange

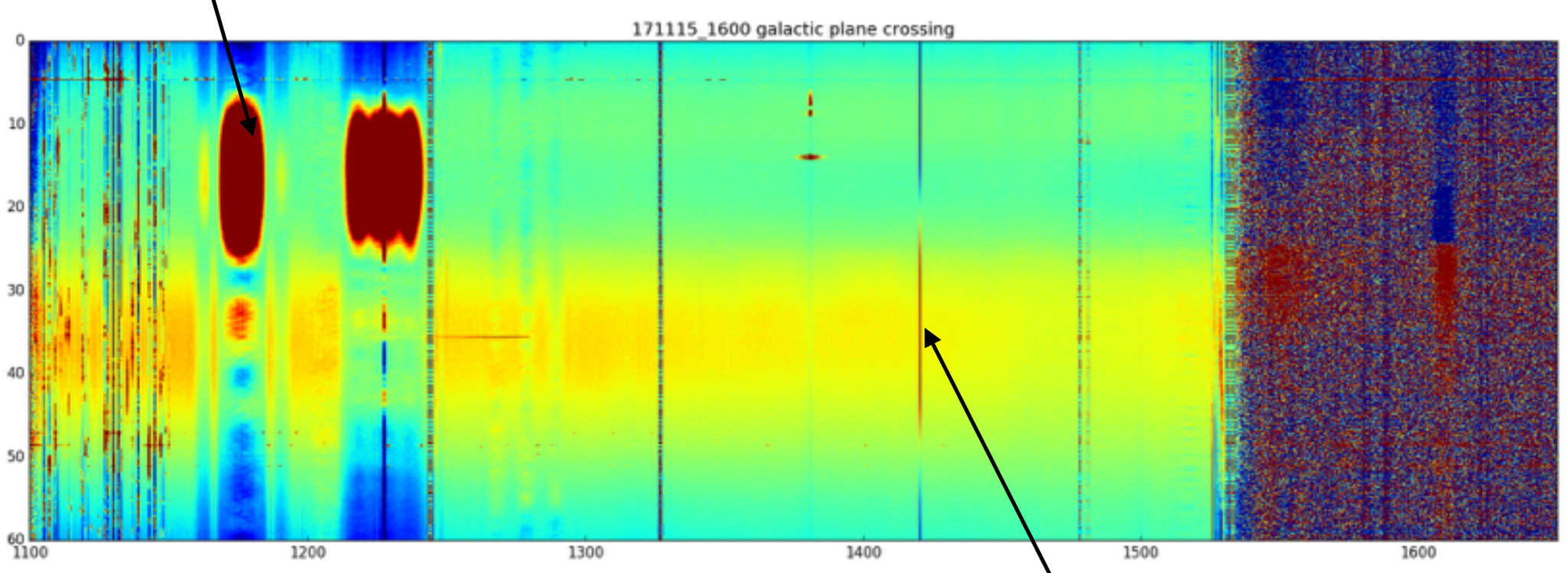
All other sources we identify that track sidereal also have peaks at 1200 +/- 25 MHz, though sometimes just at + and sometimes just at -

Data weirdness #2: Frequency response to astronomical sources is strange

Galactic plane crossing, median subtracted in each freq bin over 1 hr.

probably Cyg A, ~ 400 K

Color scale +/- 5 K

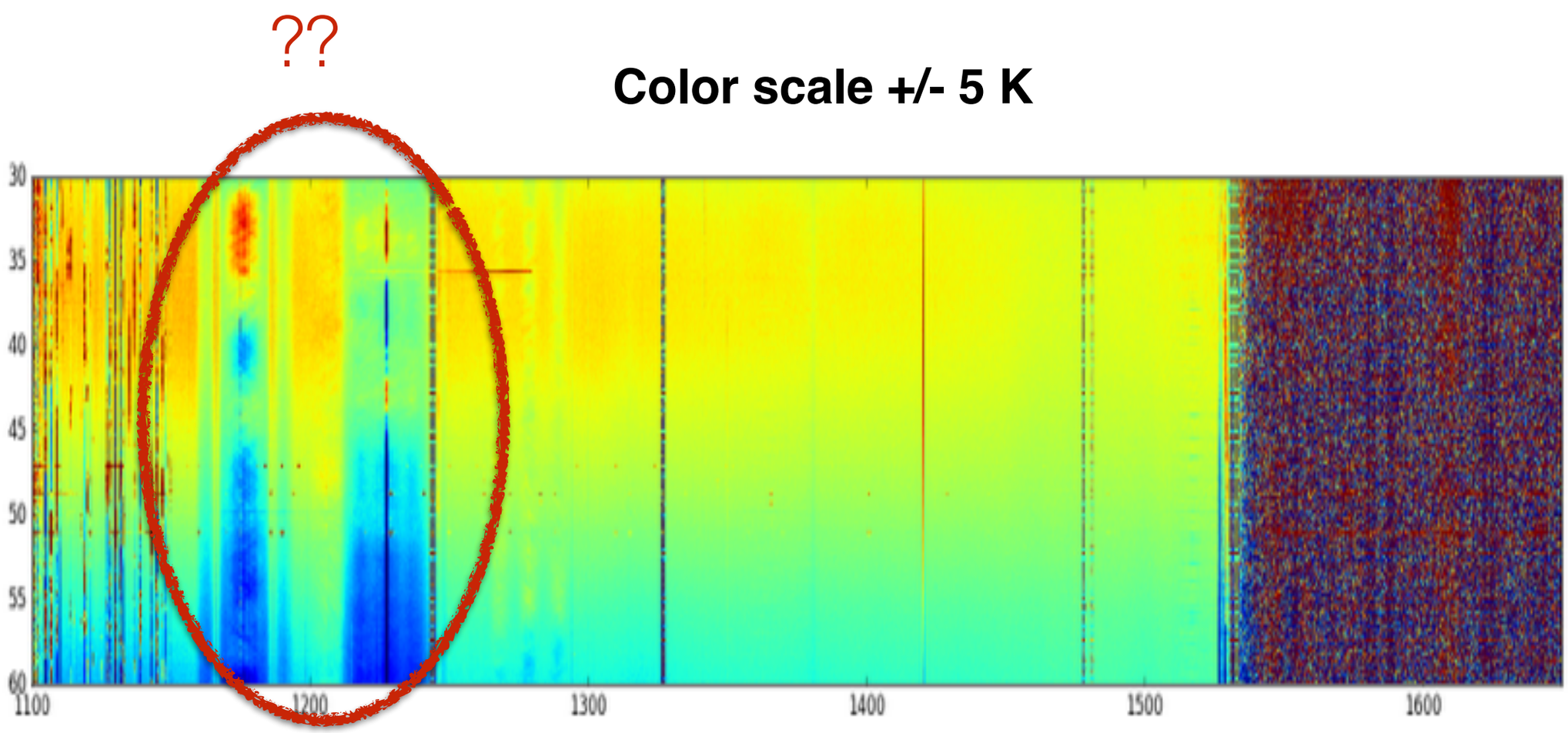


Galactic synch, ~ 1 K

Galactic 21 cm

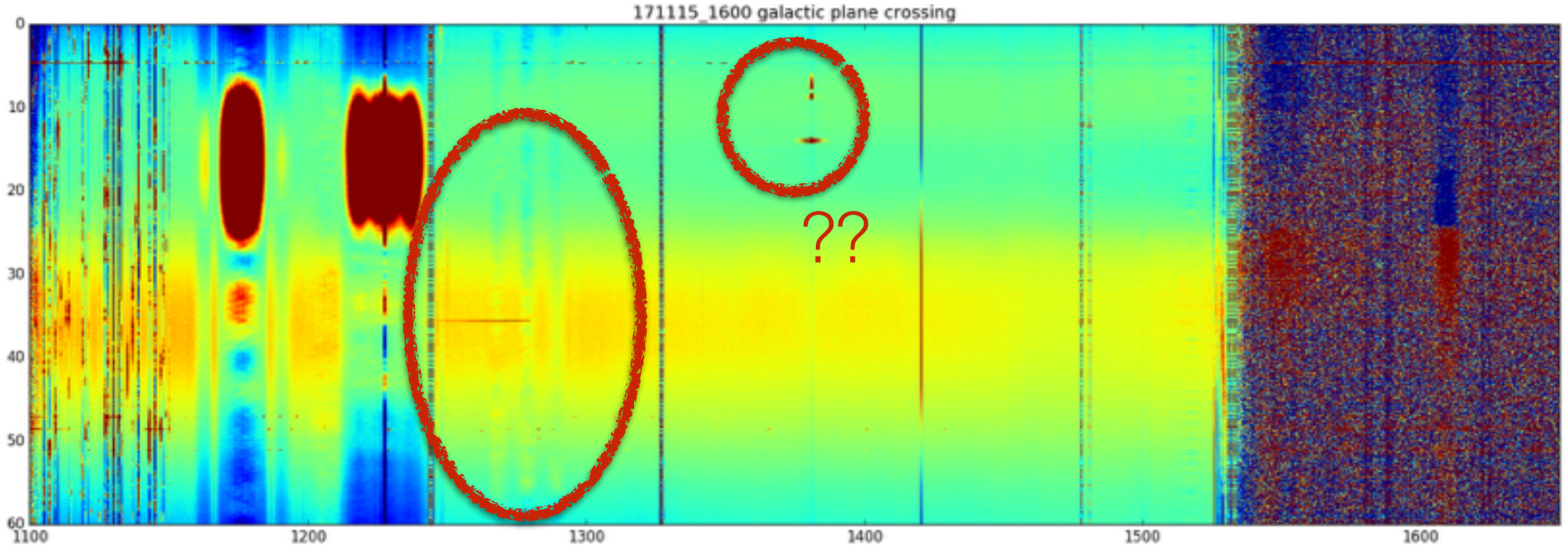
Data weirdness #2: Frequency response to astronomical sources is strange

Exclude Cyg A from median filter, frequency response to galactic synch is not an artifact



Data weirdness #2: Frequency response to astronomical sources is strange

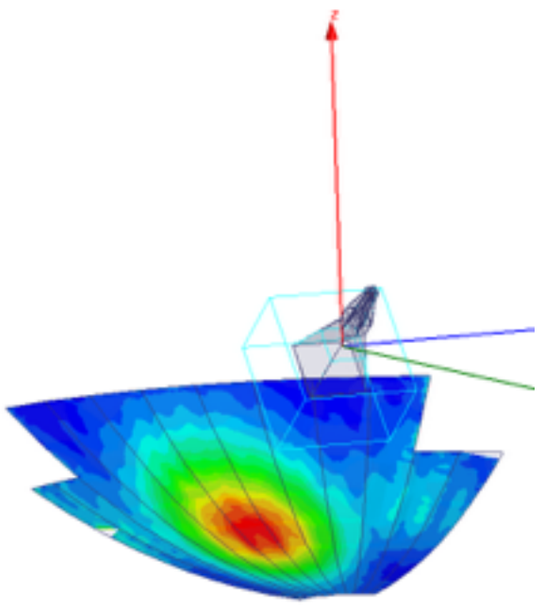
Other oddities that persist

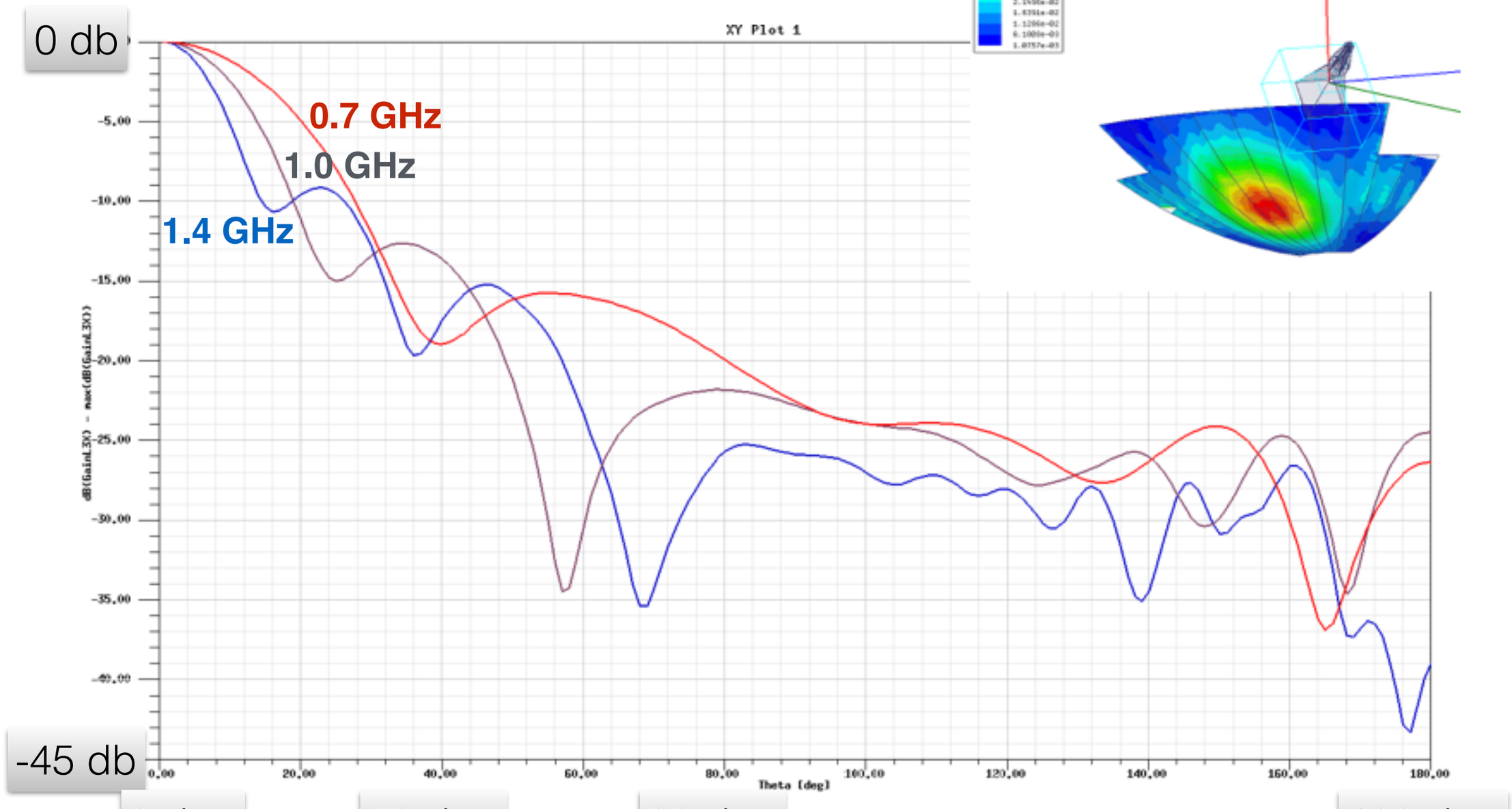


These features always present

Data weirdness #2: Frequency response to astronomical sources is strange

HFSS sims





Co-pol far field beam

0 deg

40 deg

90 deg

180 deg

Data weirdness #2: Frequency response to astronomical sources is strange

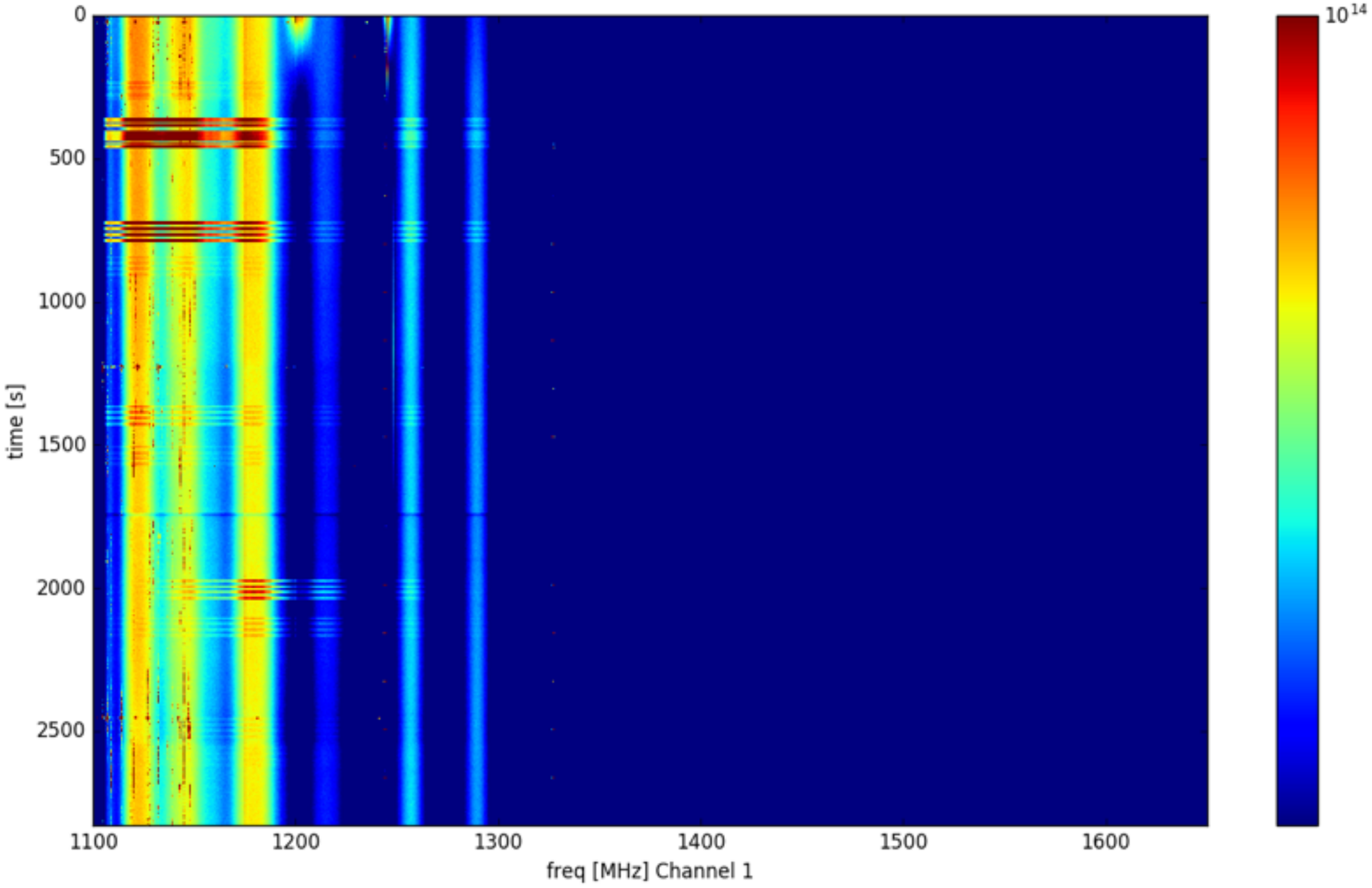
- Re-running sims at the oddball frequencies shows nothing out of the ordinary
- Adding reflecting ground plane does not seem to do much either
- Multi-path interferometric effects seem like a possible culprit, but it's hard to see that making the amplitude of the sources so large in certain frequency bins
- S11 of OMT + horn is fine…
- Only measuring a single polarization, so Faraday rotation could cause pol angle wrapping. But this should be different for different sources, so the fact that every source shows huge response at the same frequencies seems to rule this out

Broadband noise test

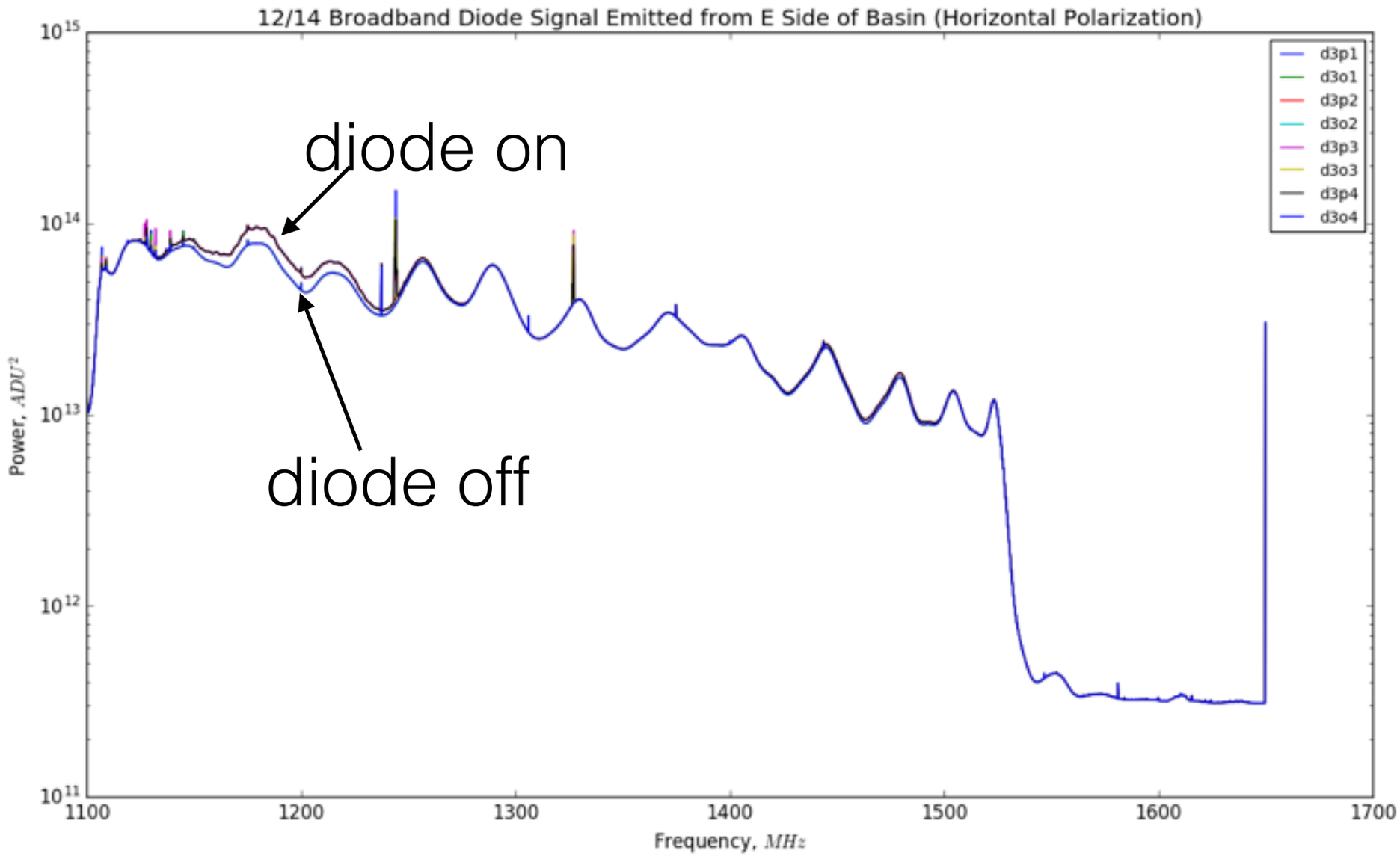
Broadcast amplified noise diode through Yagi antenna from a few positions at the edge of basin. Calibrate out amplifier gain. (N.B. these data taken with system in non-smooth spectrum state).

Noise diode and broadcast amplifier have smooth frequency spectrum. Yagi antenna less so.

Broadband noise test

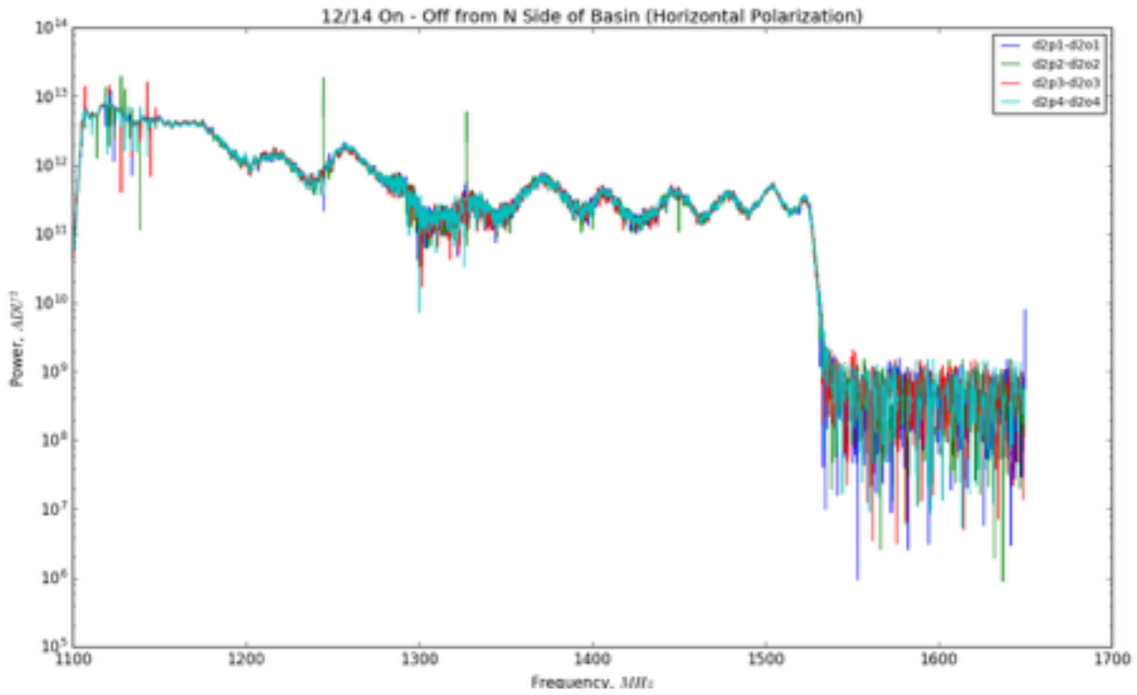


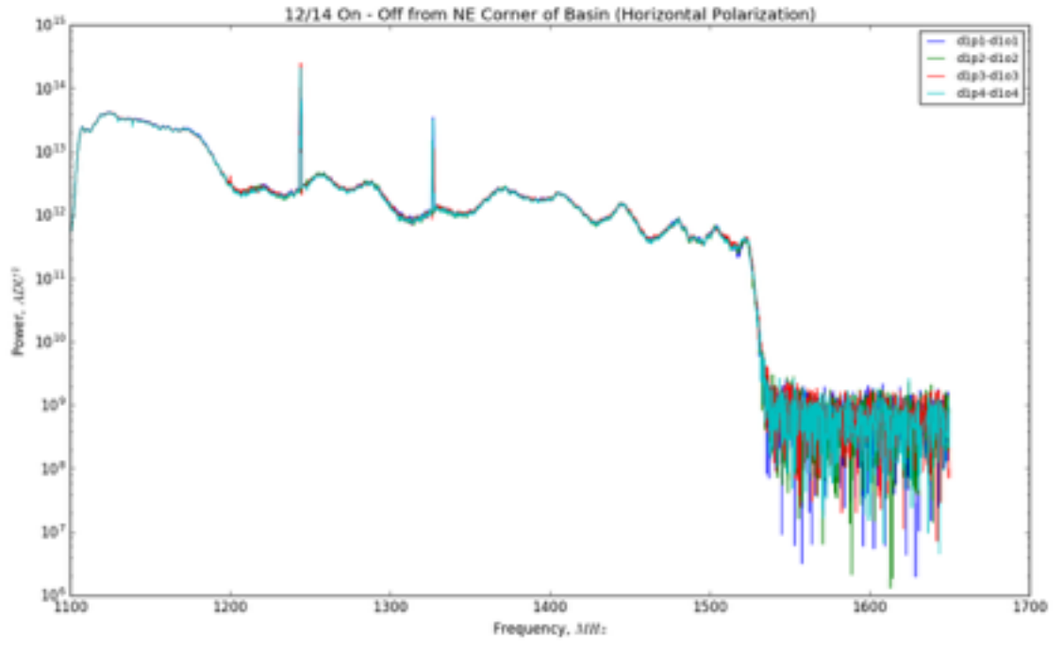
Broadband noise test

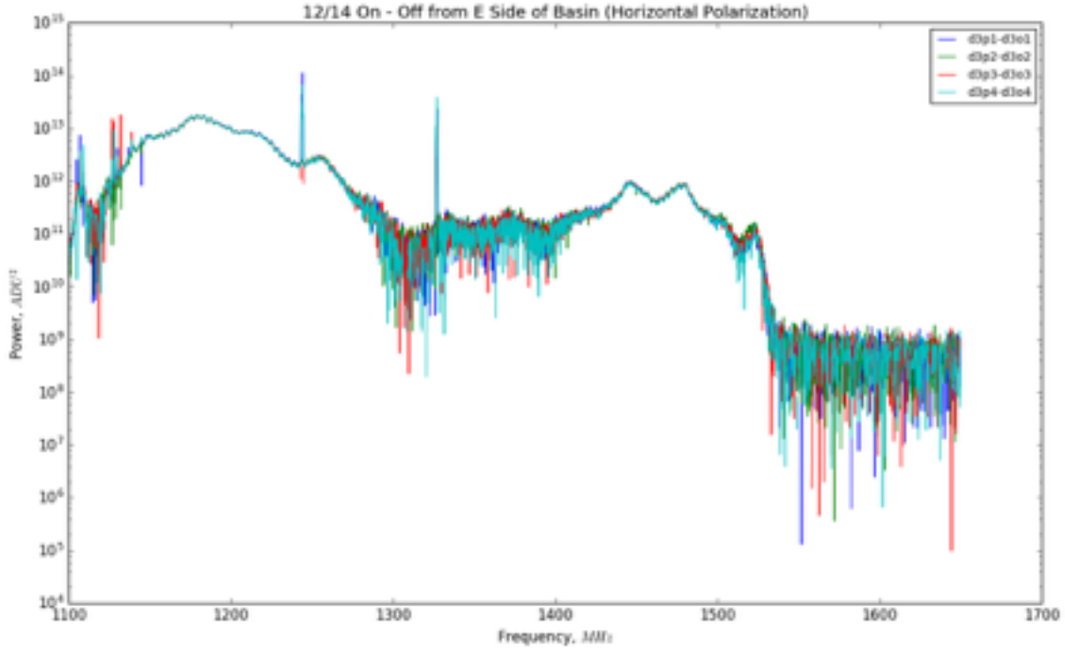


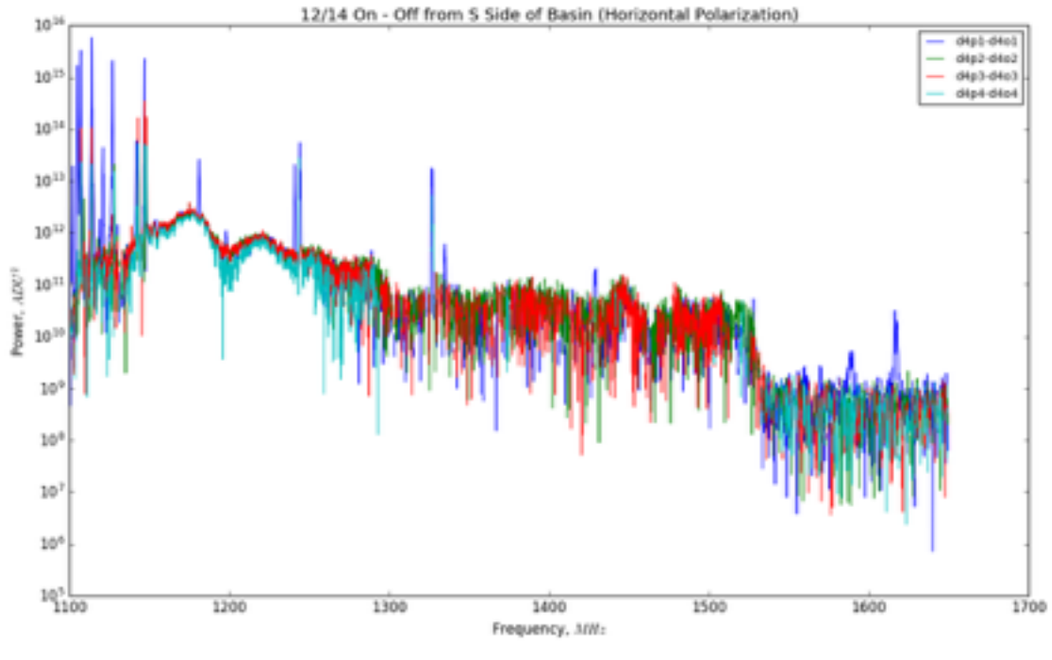
Broadband noise test

on minus off [ADU^2]



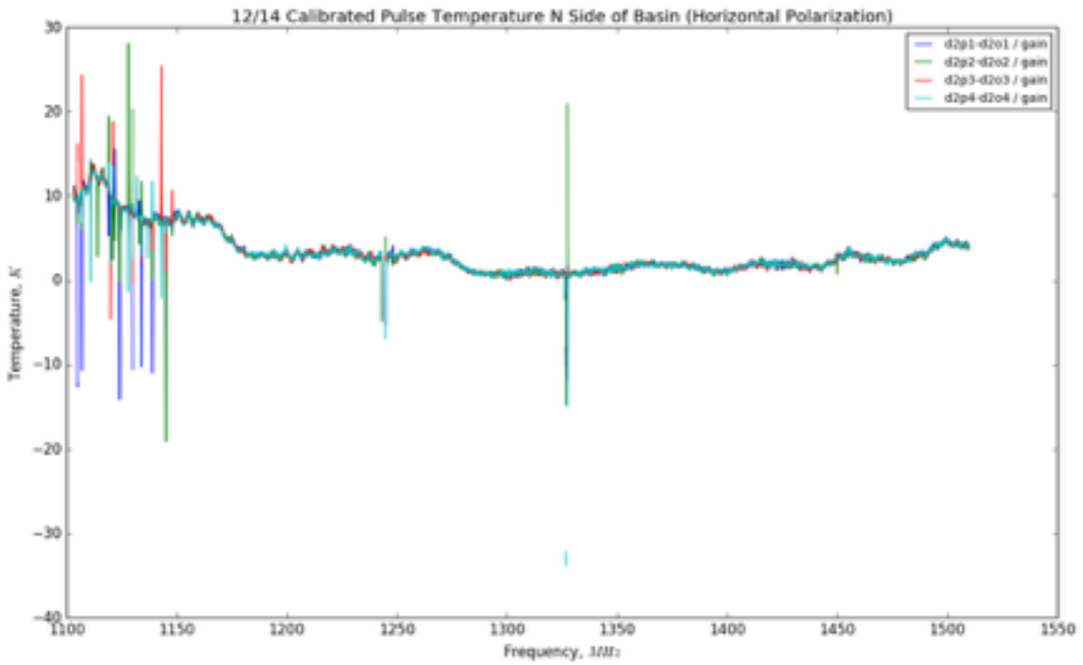


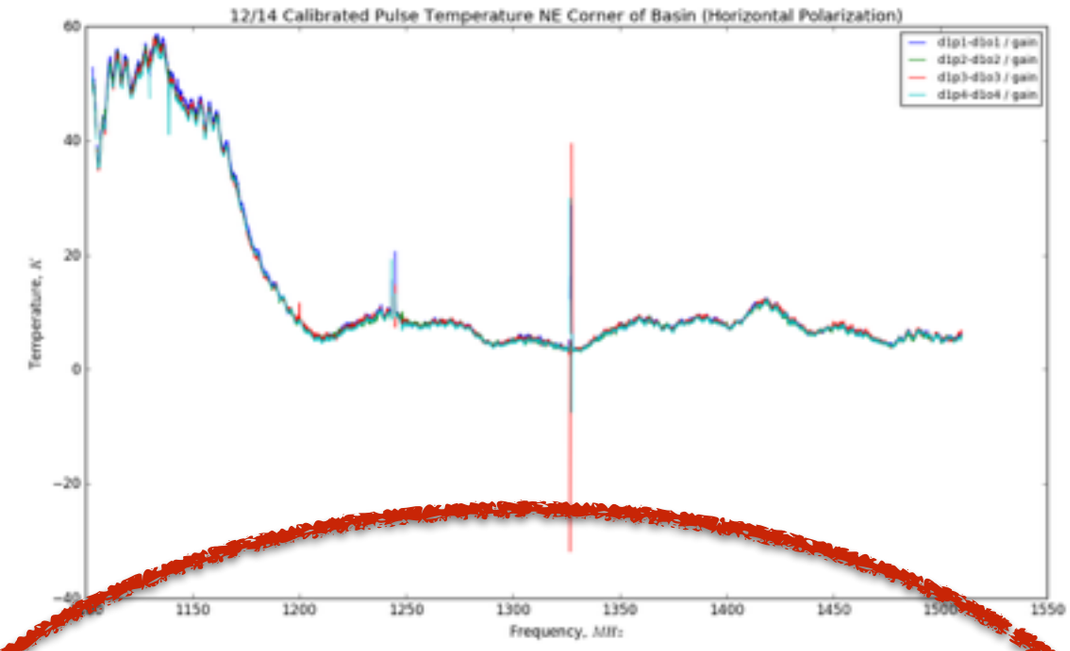


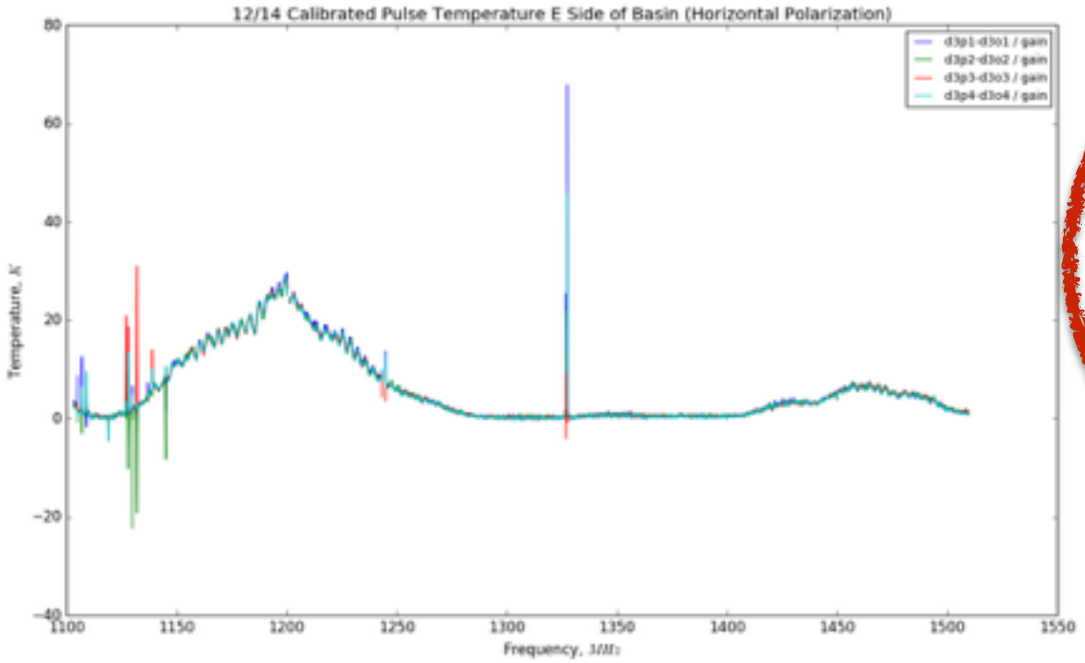


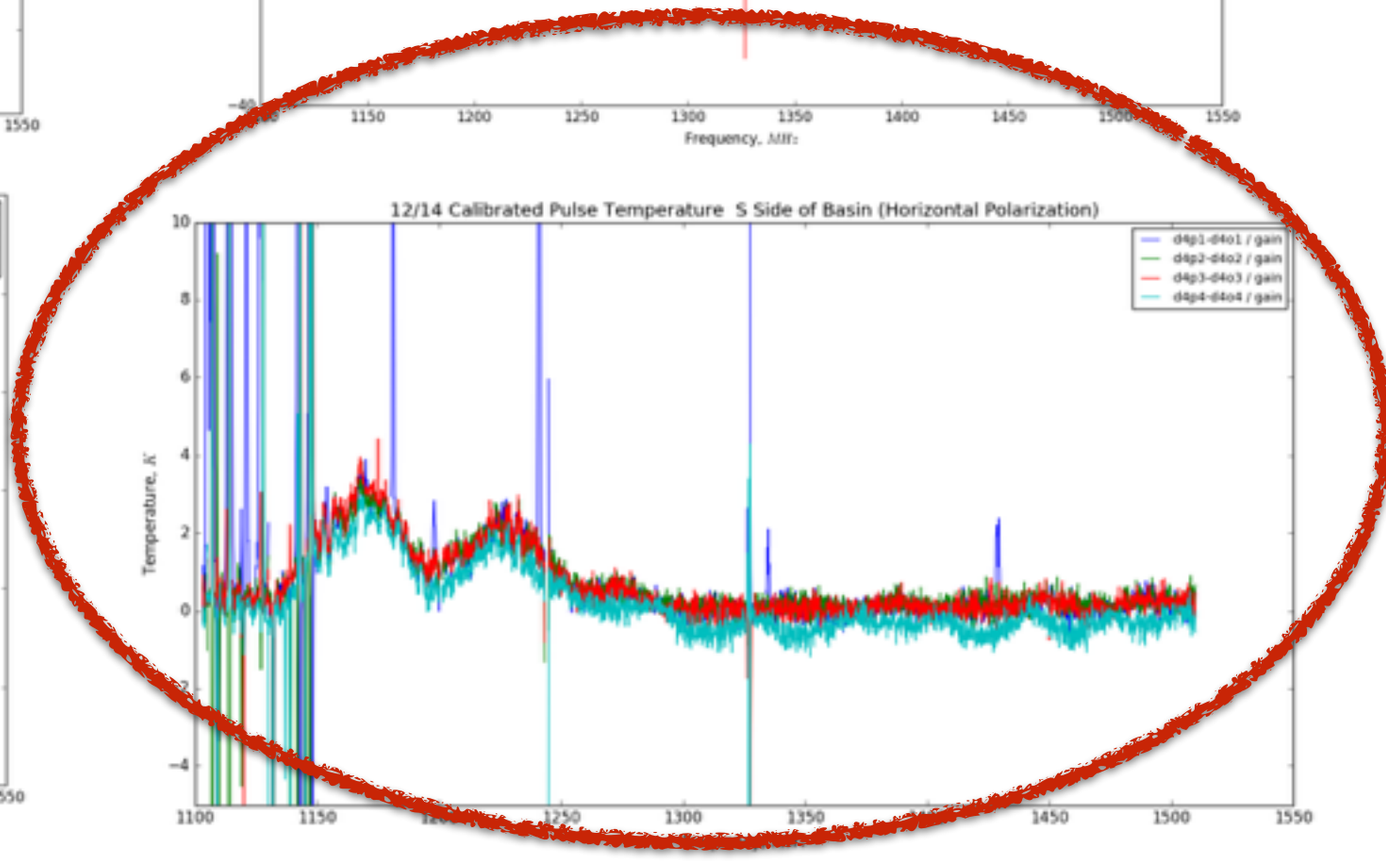
Broadband noise test

(on minus off) / gain [K]

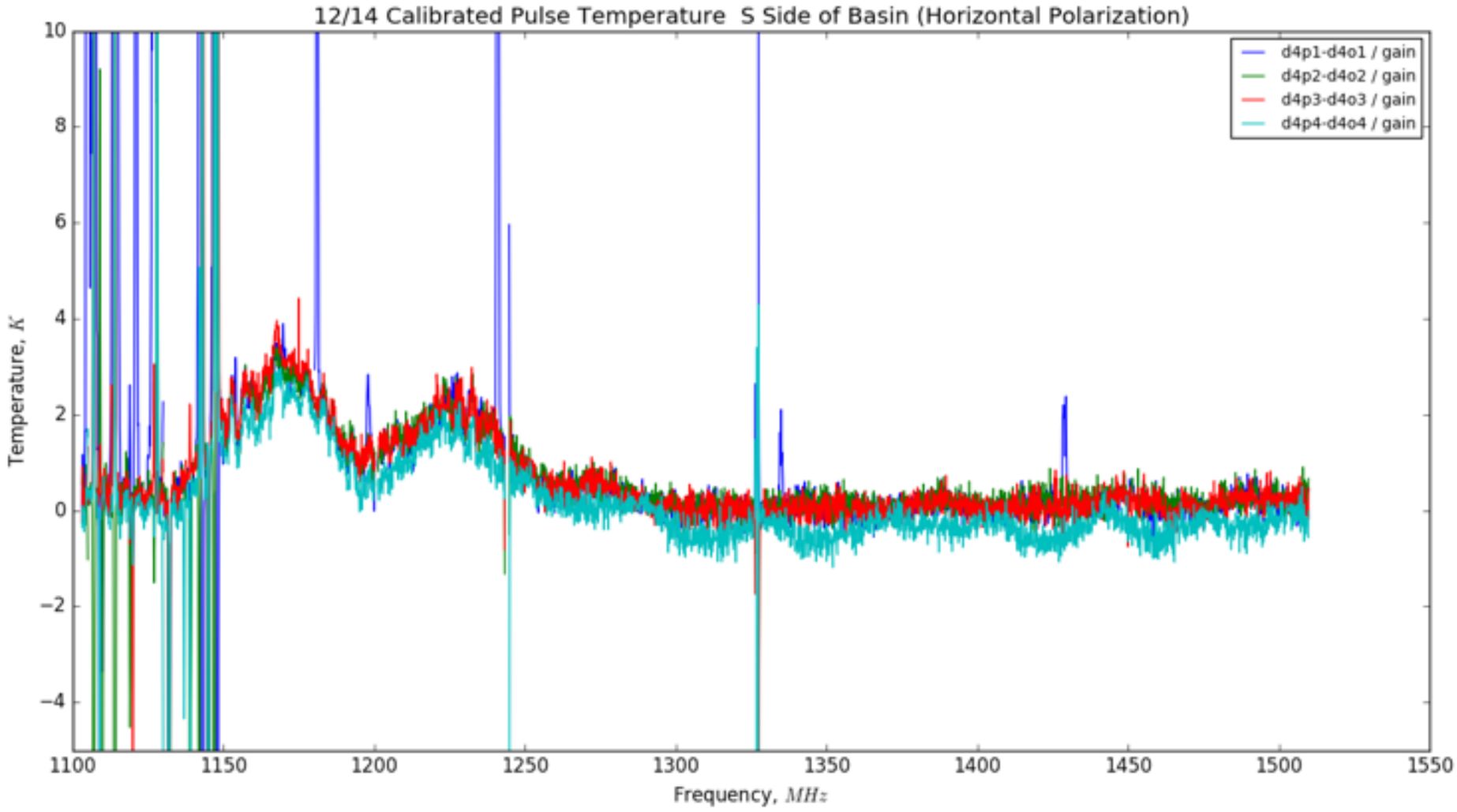


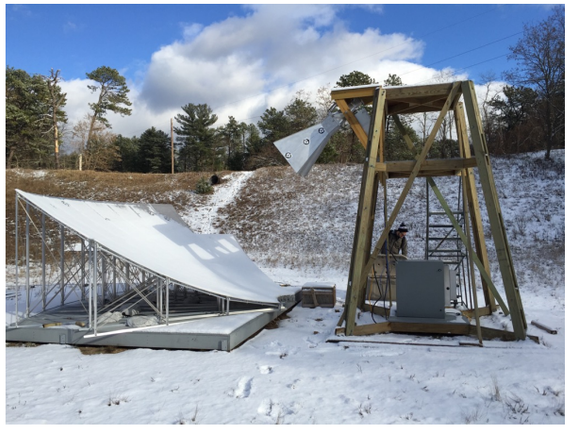






Broadcasting from directly behind horn





Yagi