Round Trip Phase Measurement System

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Requirements

- IF Phase Stability Requirements
  - Short Term <.5ps rms for times <1s
  - Long Term <6ps linear slope over 30min
- IF Phase shift with pointing change
  - <.7ps across whole sky
  - <.07ps per degree of slew

* specs apply after any RTP correction

Considerations

- Fiber cable wrap
  - Needs to twist fiber not stretch it
- Temperature effects on fiber
  - burial depth
  - insulating/temperature stabilizing exposed fiber
- Laser/electronics stability
- Dispersion in the Fiber

Temperature Considerations

From EVLA Memo 10

Based on Duhamel's theorem

$$T(x,t) = e^{-x*\sqrt{\omega/2\kappa}} * \cos\left(\omega t - x*\sqrt{\omega/2\kappa}\right)$$

Temperature Considerations

Bottom line: For just the part buried @1m

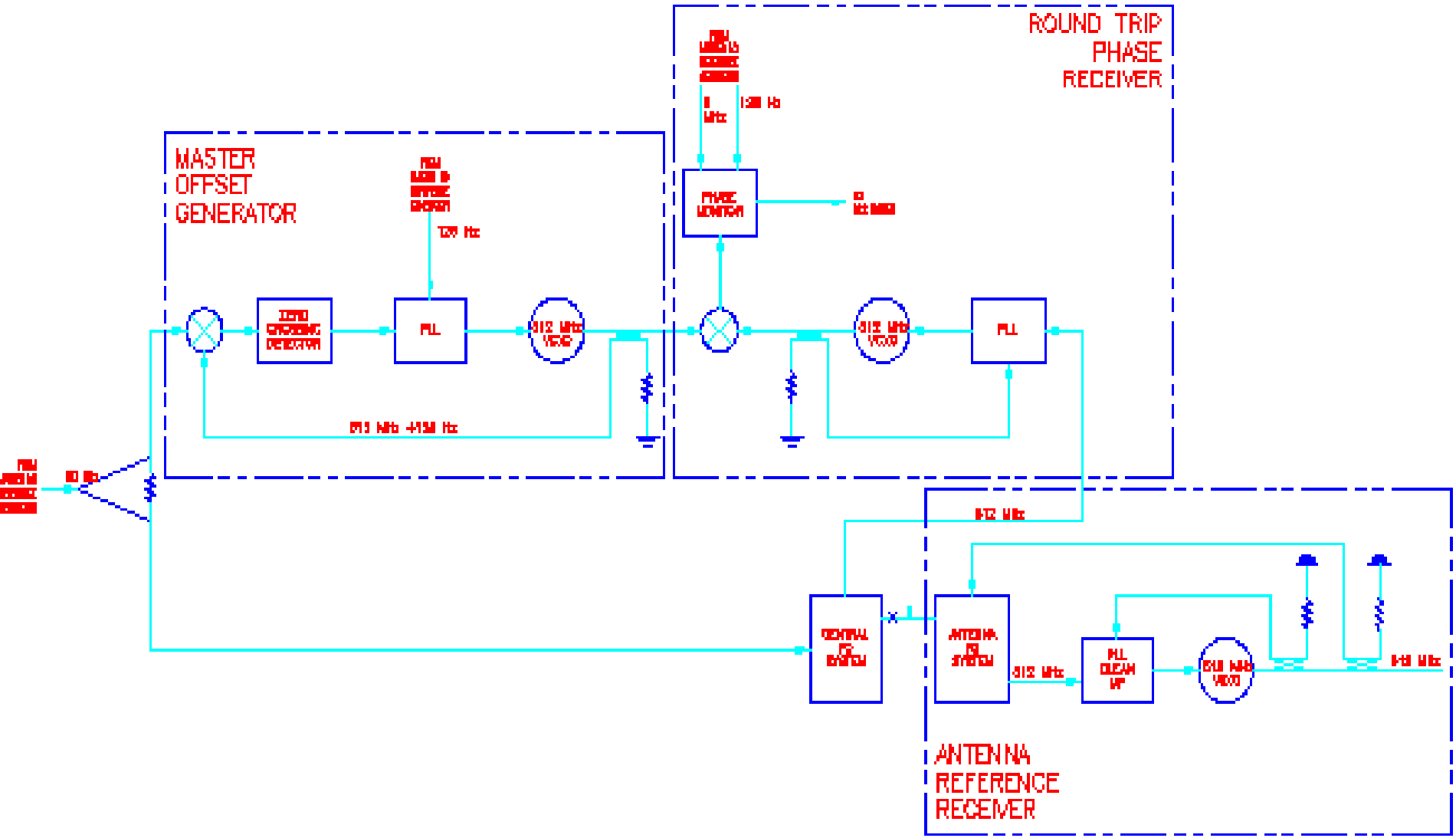
- Long term stability is .4 ps/s which meets the spec of 1.4 ps/s
- Short term stability is .0002 ps/s which far exceeds the spec of .5 ps/s

Temperature Considerations

- Do we really needs Round Trip Phase Correction?
- YES
  - Long term stability is near Spec
  - Short term above ground and in the building
  - Good monitor of system problems

Other Considerations

- Laser Stability
  - Unknown as to how much of a problem this is going to be
- Dispersion in the fiber
  - Will need to operate RTP system near zero dispersion point of the fiber ~1310nm


ROUND TRIP
PHASE
RECEIVER
MASTER
OFFSET
GENERATOR
PLL
PLL
PLL
ANTENNA
REFERENCE
RECEIVER

Side Note

Two master rack are required, one for back up

Round trip phase equipment can be used to monitor the master racks together.