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

\[ T(x, t) = e^{-x\sqrt{\omega/2k}} \cos\left(\omega t - x\sqrt{\omega/2k}\right) \]
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 need 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
Side Note

Two master rack are required, one for back up

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