ACADEMIA SINICA
Institute of Astronomy and Astrophysics

HARVARD-SMITHSONIAN
Center for Astrophysics

Electronics Instrumentation for the Greenland Telescope

Photo courtesy of M.T. Chen

Power Distribution

Control

VLBI

Rx Lab

Mech

Cables

Derek Kubo
ASIAA

Aug 5, 2020

Environmental Requirements

For Primary operating conditions:

Ambient temperature T: -50 °C < T < 0 °C

Wind: 11 m/s (25 mph) average wind

For Secondary operating conditions: (degraded performances)

Ambient temperature T: -55 °C < T < -50 °C

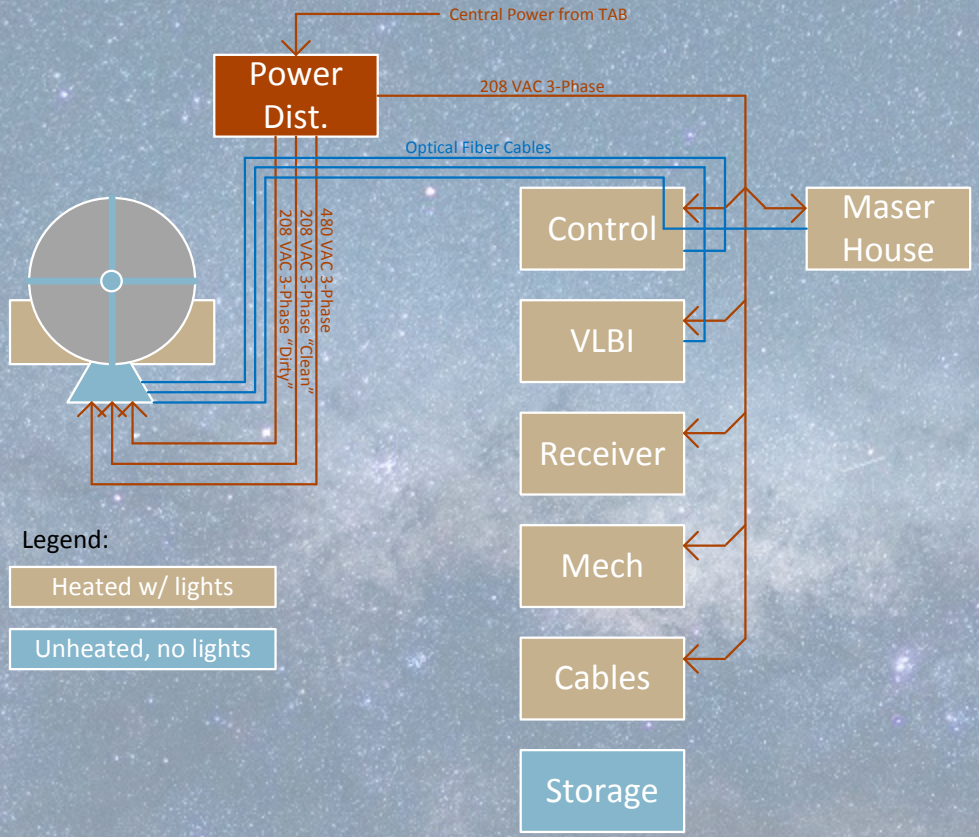
Wind: 11 m/s to 13 m/s (25 - 29 mph) average wind

For Survival conditions:

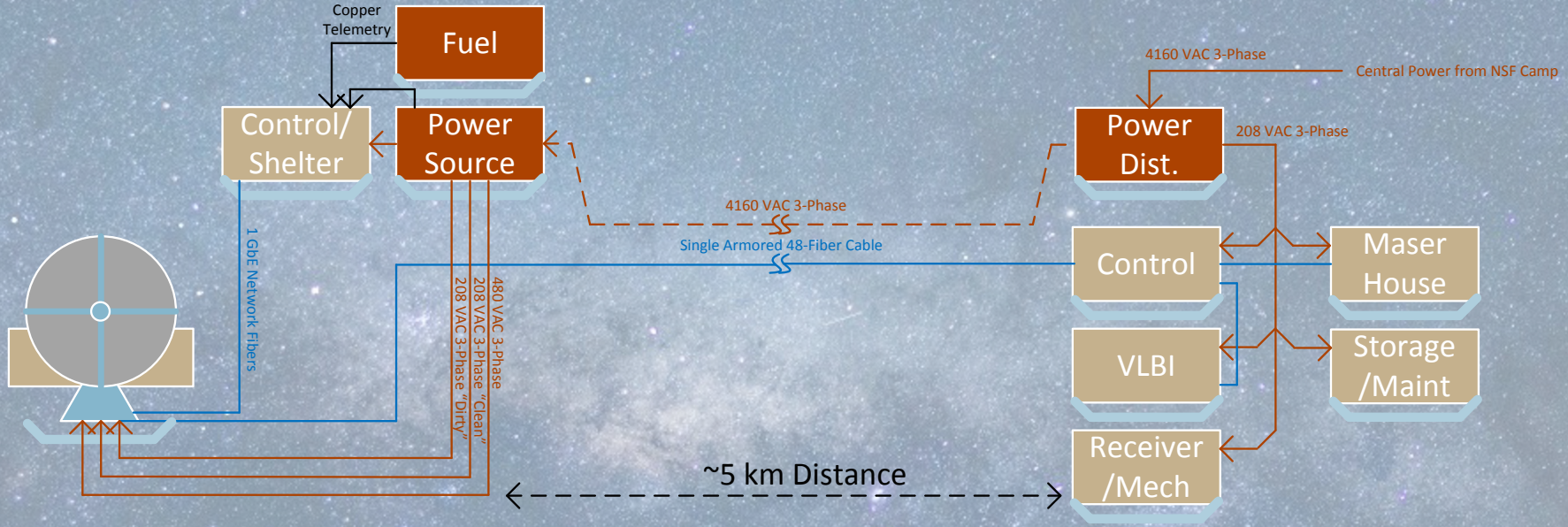
Ambient temperature: -73 °C

Wind: 55 m/s (123 mph)

Physical Configuration - Thule Air Base

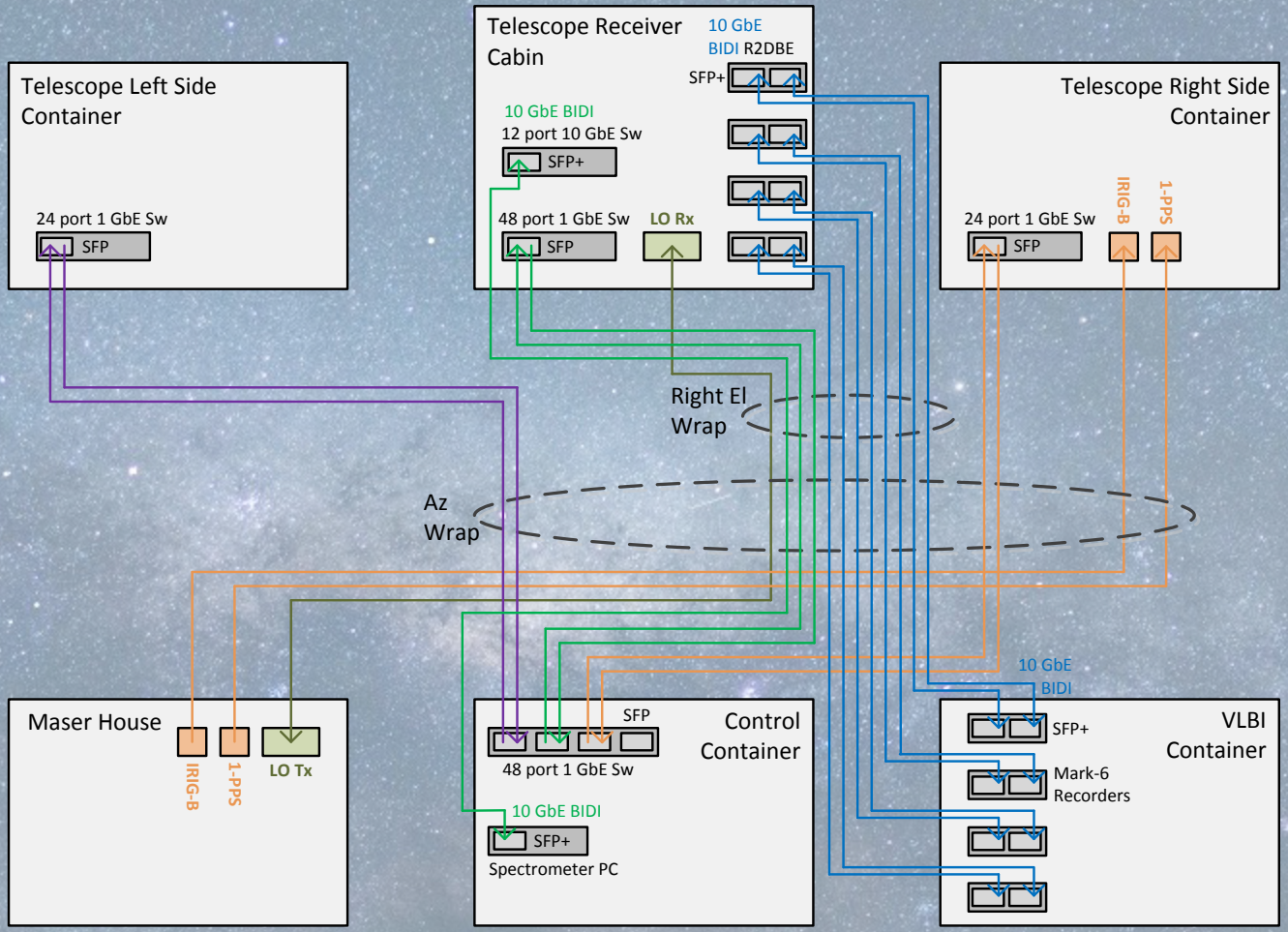


Physical Configuration - Summit Station

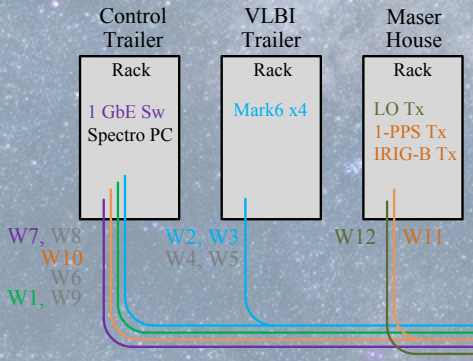


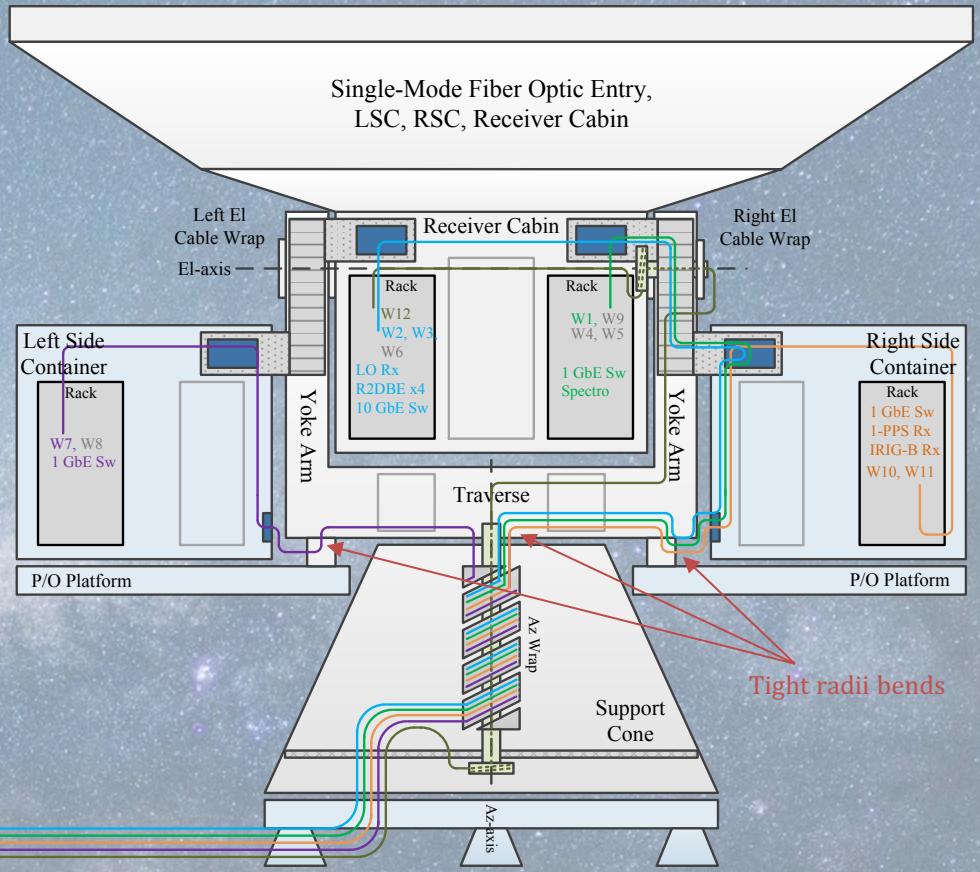
Contents

Fiber Optic System



Fiber Optic System





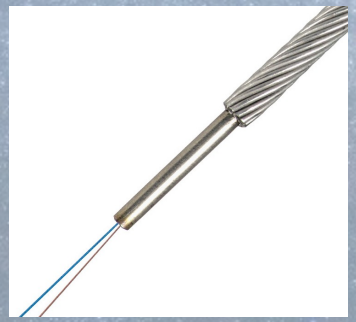
Fiber Optic System

Verrillon®
VHS100 Series Fibers

Specifications

PART NO.	SMF-1-P-125-2	SMF-1-P-125-3	SMF-1-CP-125-3
Description	125/155 µm Polyimide, Single-mode fiber, 0.12NA, 150 kpsi	125/155 µm Polyimide, Single-mode fiber, 0.12NA, 100 kpsi	125/155 µm Carbon/Polyimide, Single-mode fiber, 0.12NA, 100 kpsi
PARAMETER	**VALUE**		
Material			
Hermetic Coating	—	—	Carbon
Coating	Polyimide	Polyimide	Polyimide
Geometry			
Clad Diameter (µm)	125 ± 2	125 ± 2	125 ± 2
Core/Clad Offset (µm)	≤ 0.5	≤ 0.5	≤ 0.5
Coating Diameter (µm)	155 ± 5	155 ± 5	155 ± 5
Polyimide Coating Concentricity[1] (%)	≥ 80	≥ 80	≥ 80
Optical			
NA (nominal)	0.12	0.12	0.12
Attenuation[2] @ 1310 nm (dB/km) @ 1550 nm (dB/km)	 ≤ 0.7 ≤ 0.6	 ≤ 0.7 ≤ 0.6	 ≤ 0.7 ≤ 0.6
Cutoff Wavelength (nm)	1250 ± 50	1250 ± 50	1250 ±50
Mode Field Diameter[3] @ 1310 nm (µm) @ 1550 nm (µm)	 9.2 ± 0.6 10.4 ± 0.8	 9.2 ± 0.6 10.4 ± 0.8	 9.2 ± 0.6 10.4 ± 0.8
Mechanical			
Proof Test (kpsi)	≥ 150	≥ 100	≥ 100
Operating Temperature (°C)	-65 to +300	-65 to +300	-65 to +300

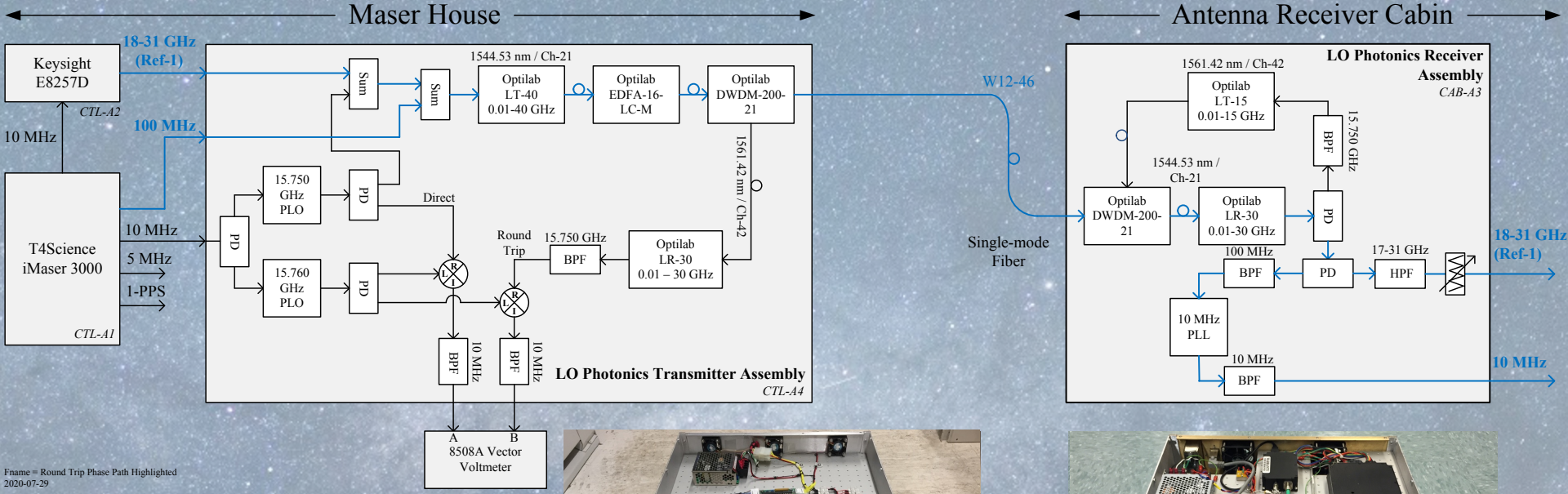
[1] Measured as (Min. Wall/Max. Wall) x 100 [2] Measured on Zero Tension spool [3] Petermann II Definition



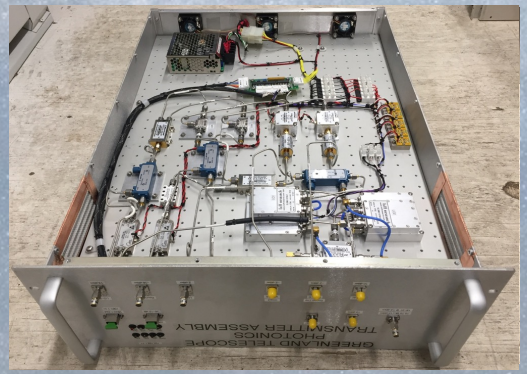
Fiber count 4
OD 3.8 mm
Dynamic bend radius 5.2 inches

Local Oscillator Signals

10 MHz and 18-31.5 GHz transmission



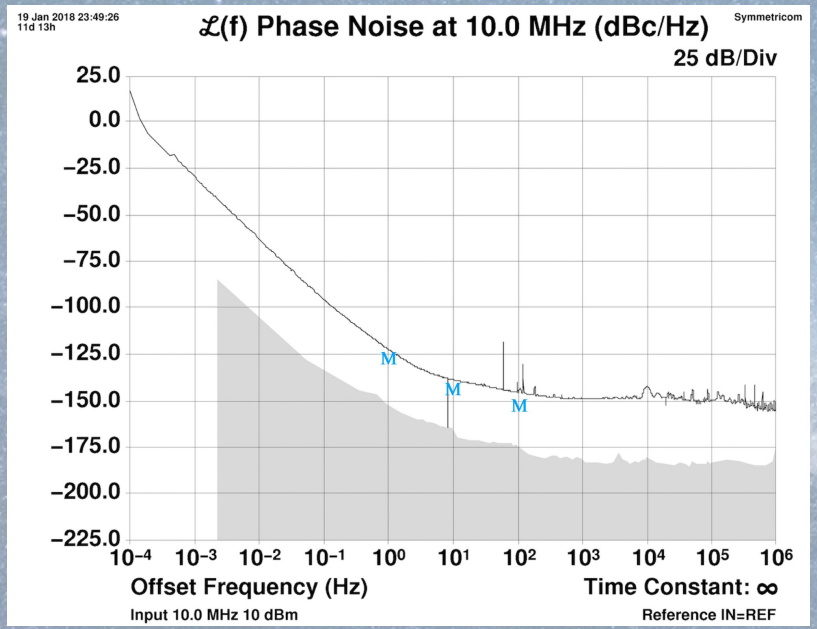
Fname = Round Trip Phase Path Highlighted
2020-07-29



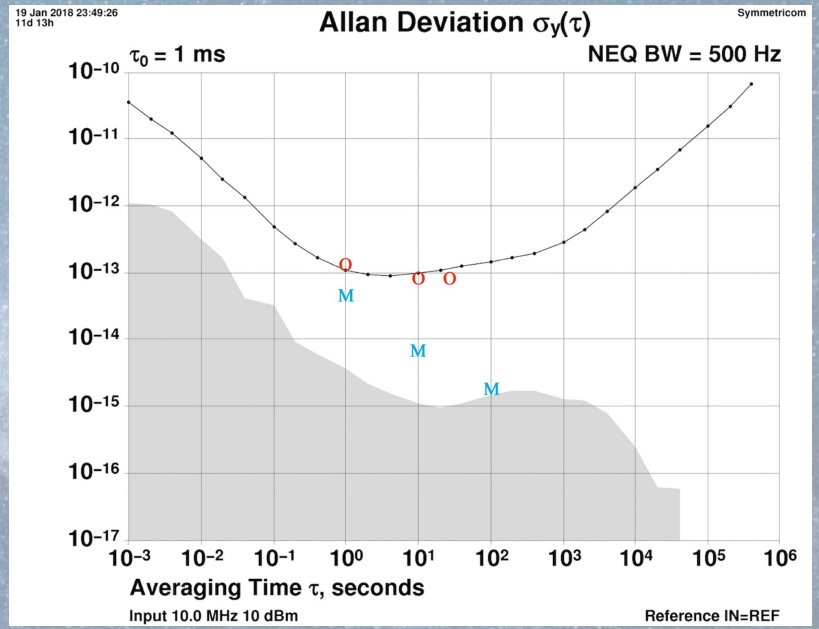
Local Oscillator Signals

iMaser Performance at Thule (relative to Oscilloquartz 8607 OCXO)

Dominated by Oscilloquartz test reference source



iMaser S/N 118 vs Oscilloquartz Phase Noise

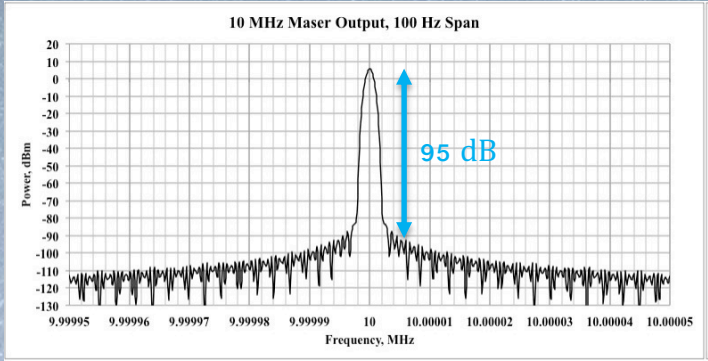


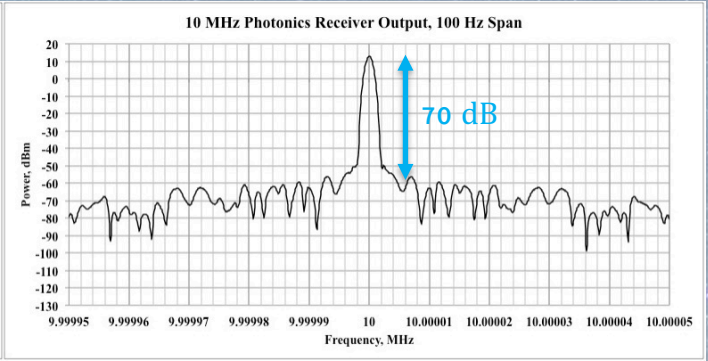
iMaser S/N 118 vs Oscilloquartz Allan Deviation

Local Oscillator Signals

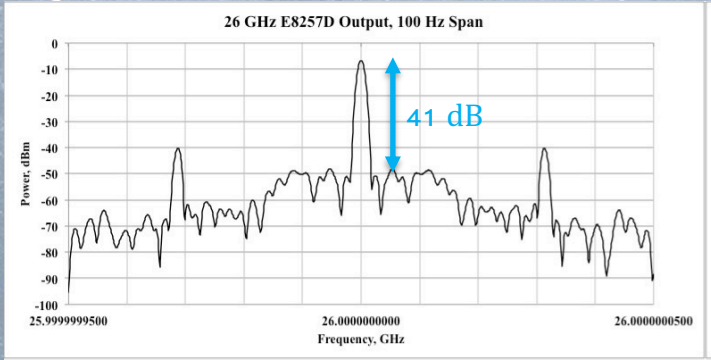
LO Photonics Transmitter and Receiver Performance

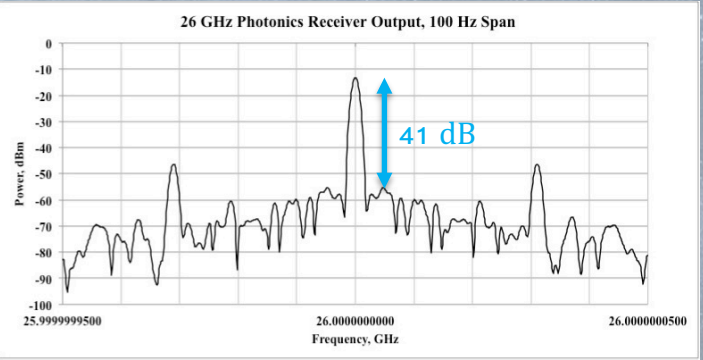
10 MHz Reference





26 GHz LO Reference



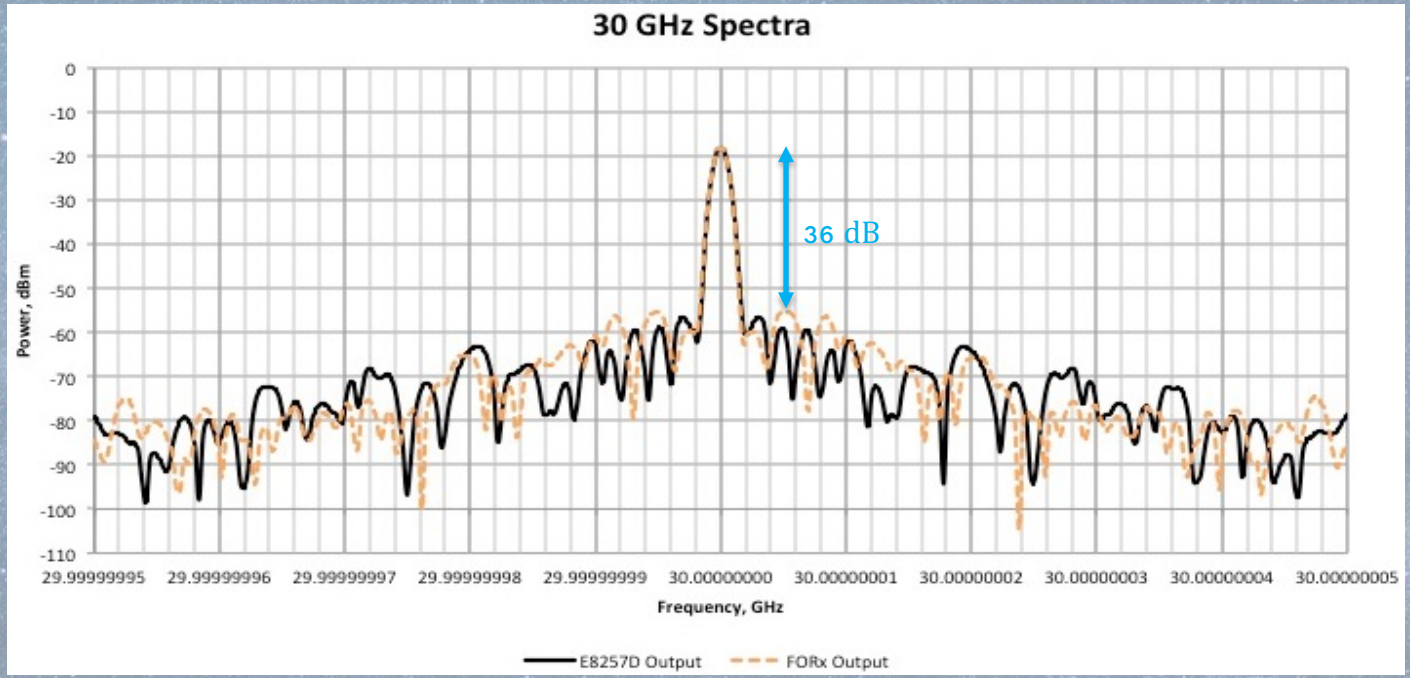


Before Optical Transmission

After Optical Transmission

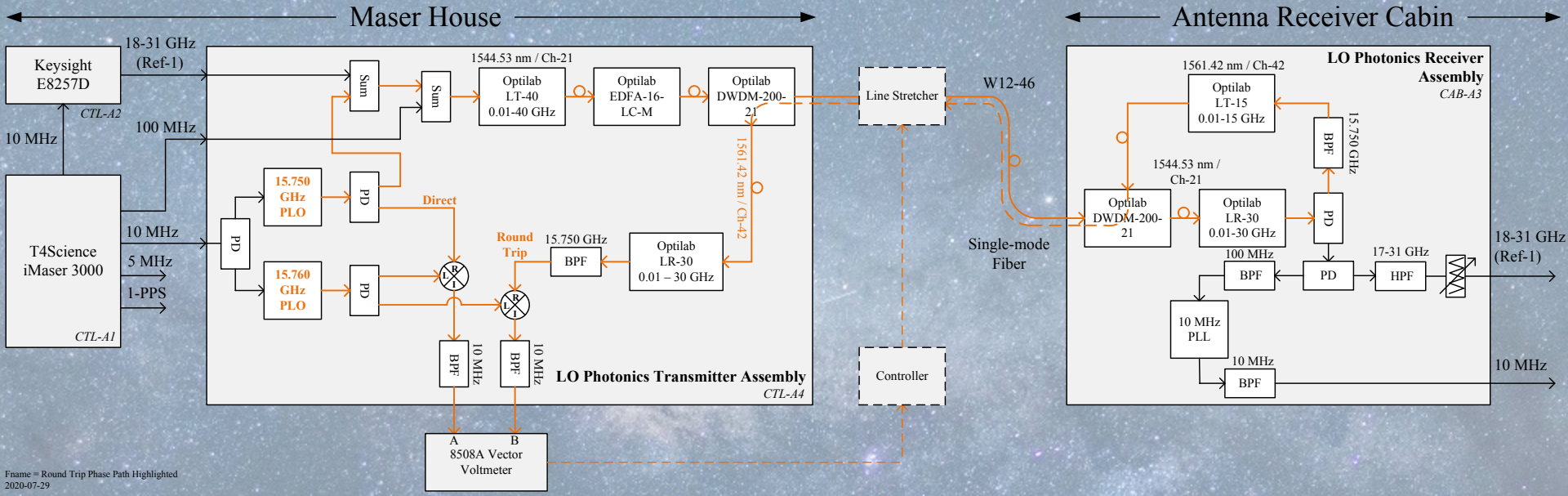
Local Oscillator Signals

LO Photonics Transmitter and Receiver Performance



Local Oscillator Signals

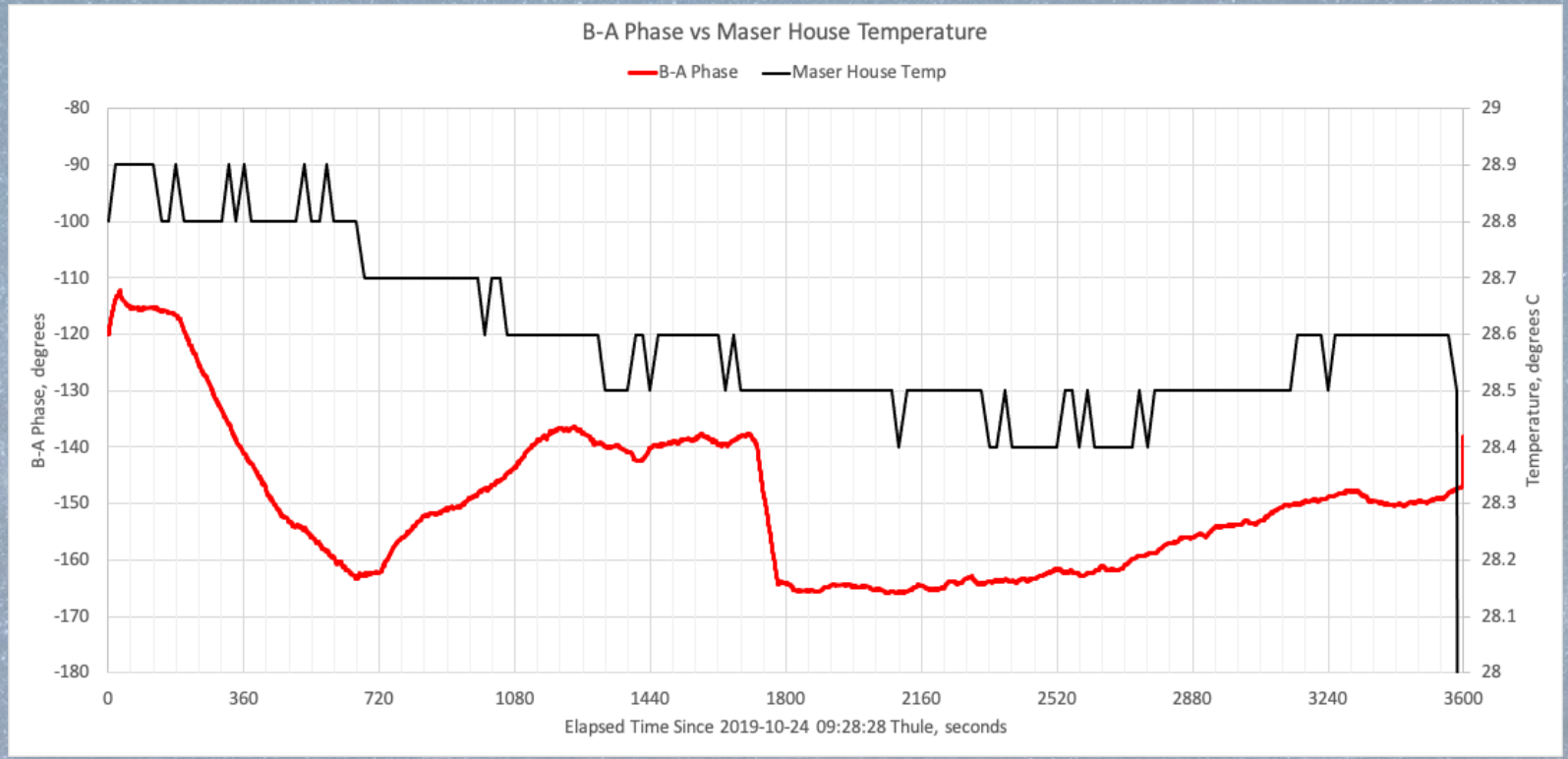
Round-trip phase performance of 15.75 GHz pilot tone



Fname = Round Trip Phase Path Highlighted
2020-07-29

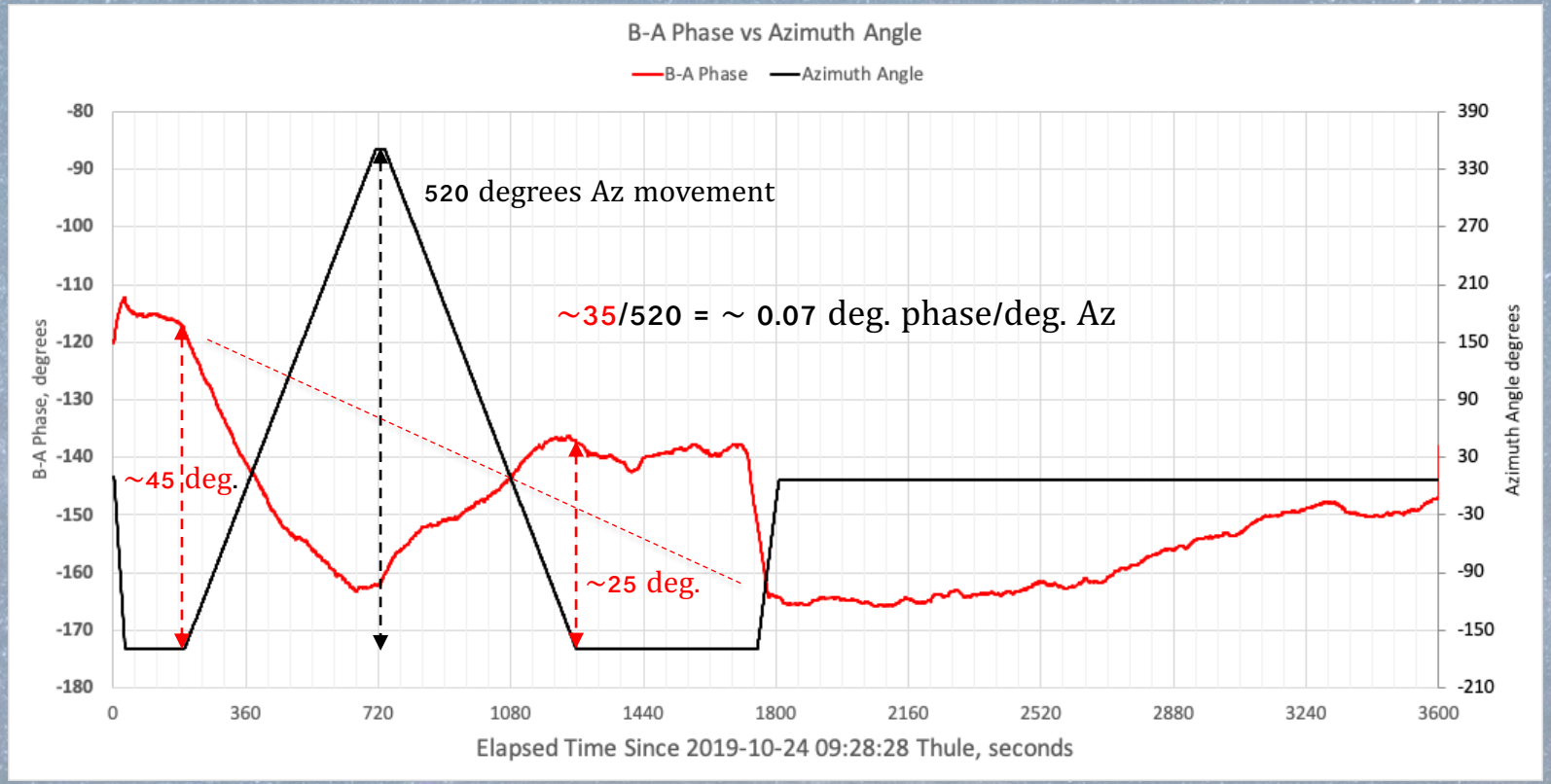
Local Oscillator Signals

Phase vs Azimuth performance



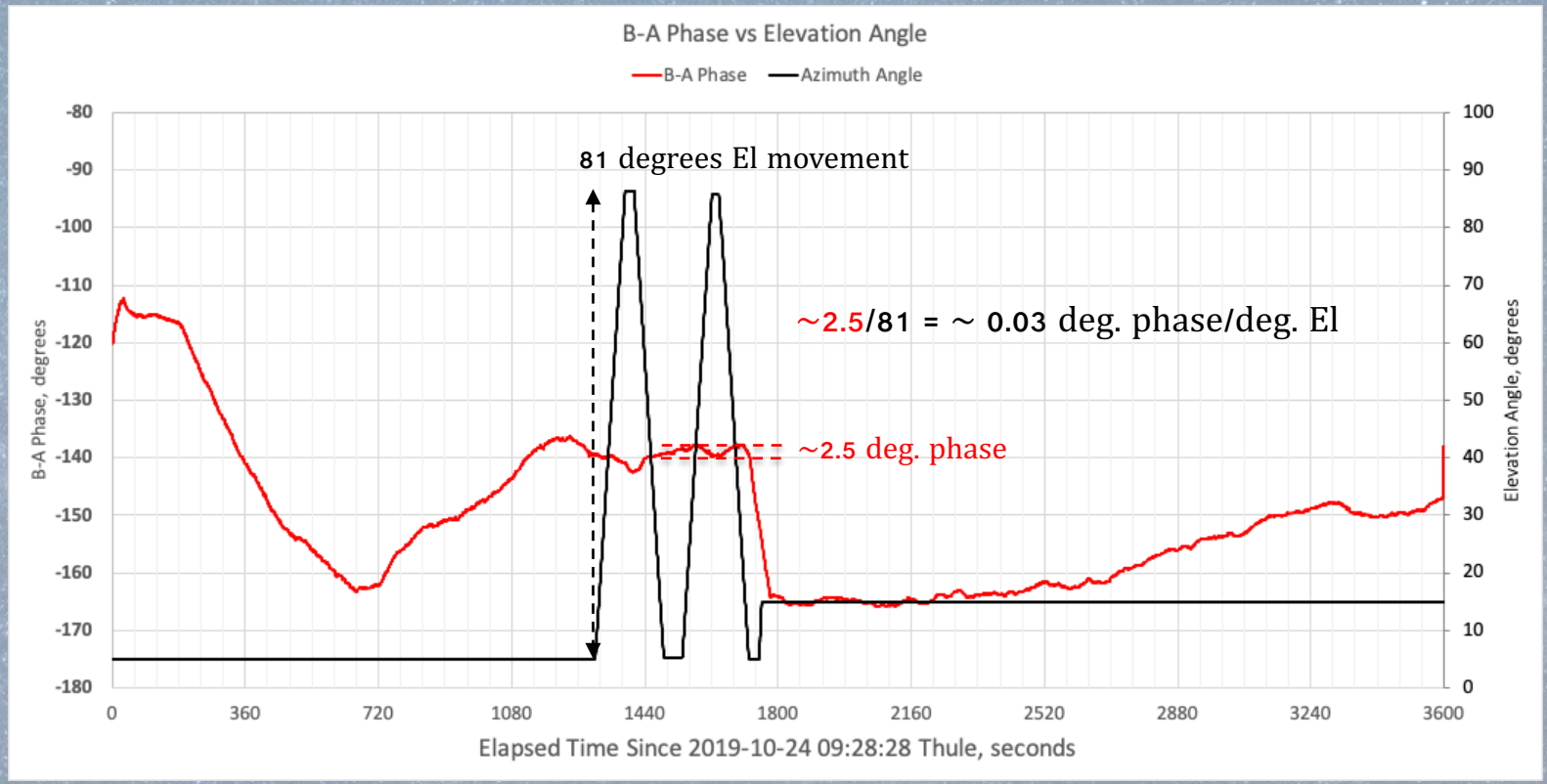
Local Oscillator Signals

Phase vs Azimuth performance

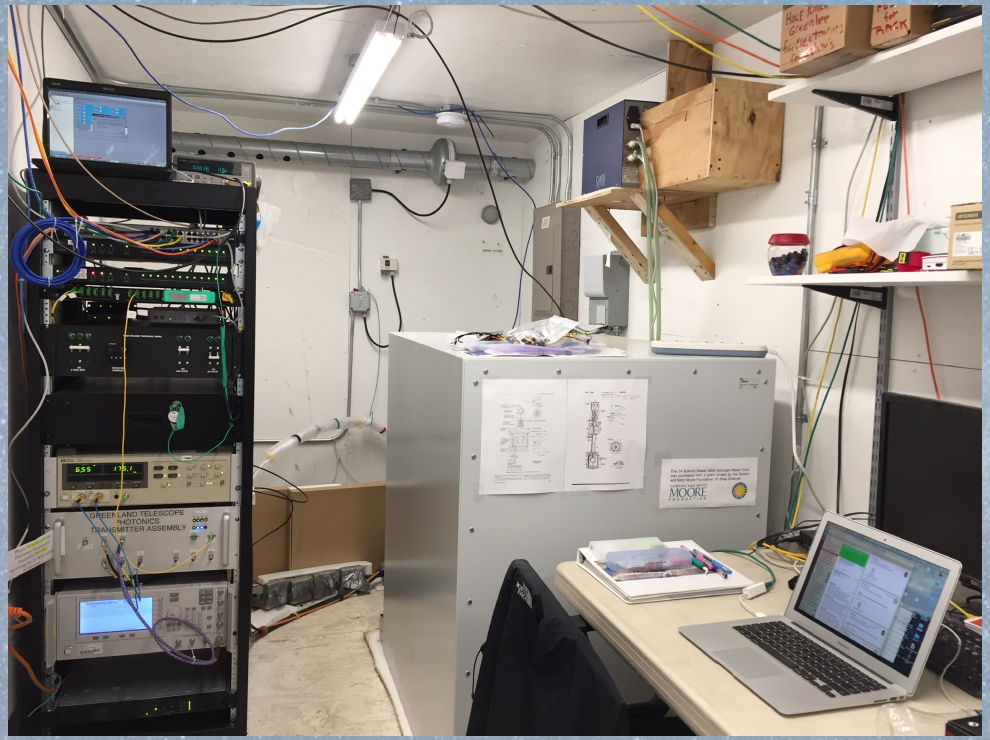


Local Oscillator Signals

Phase vs Elevation performance

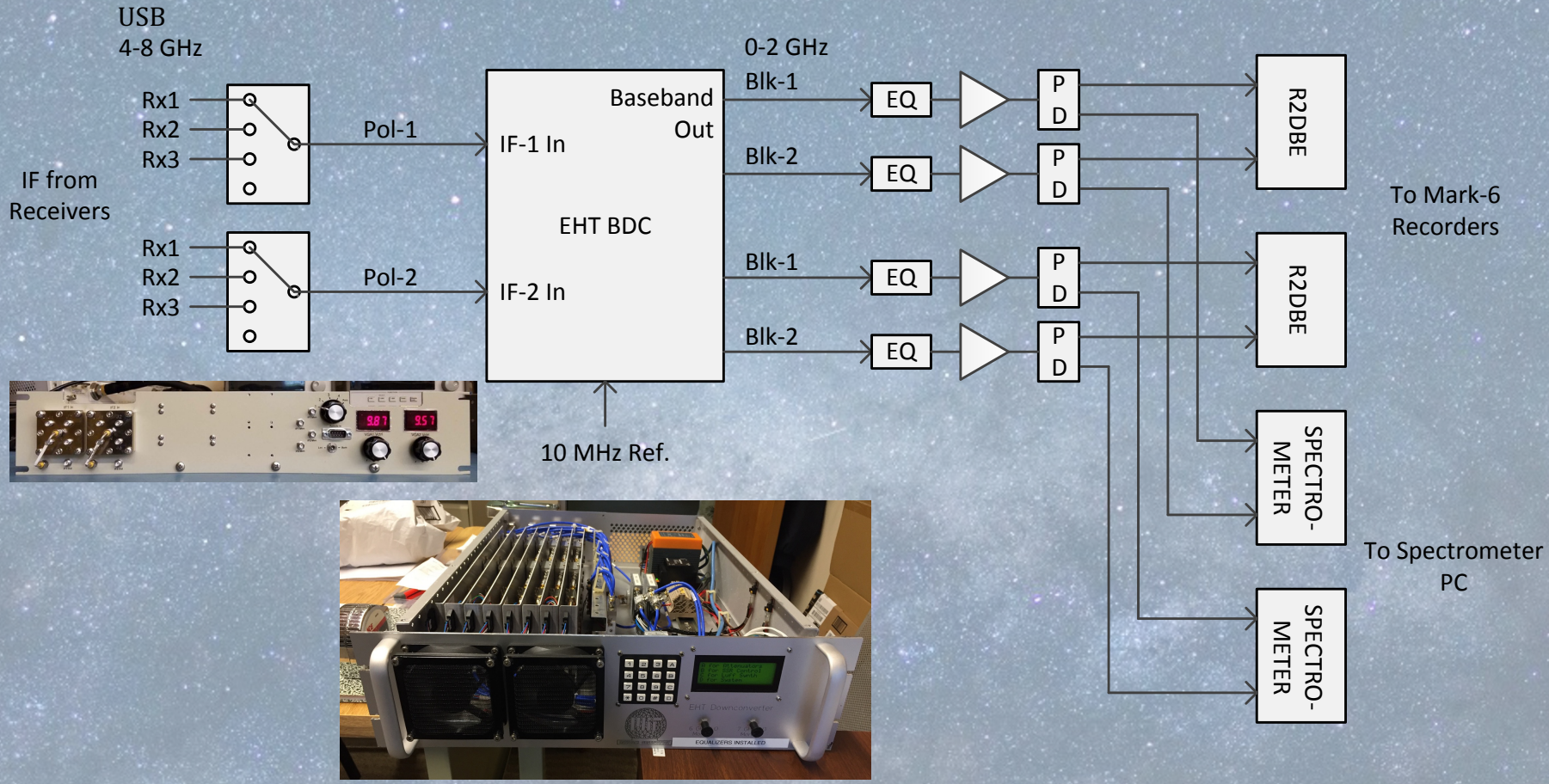


Local Oscillator Signals



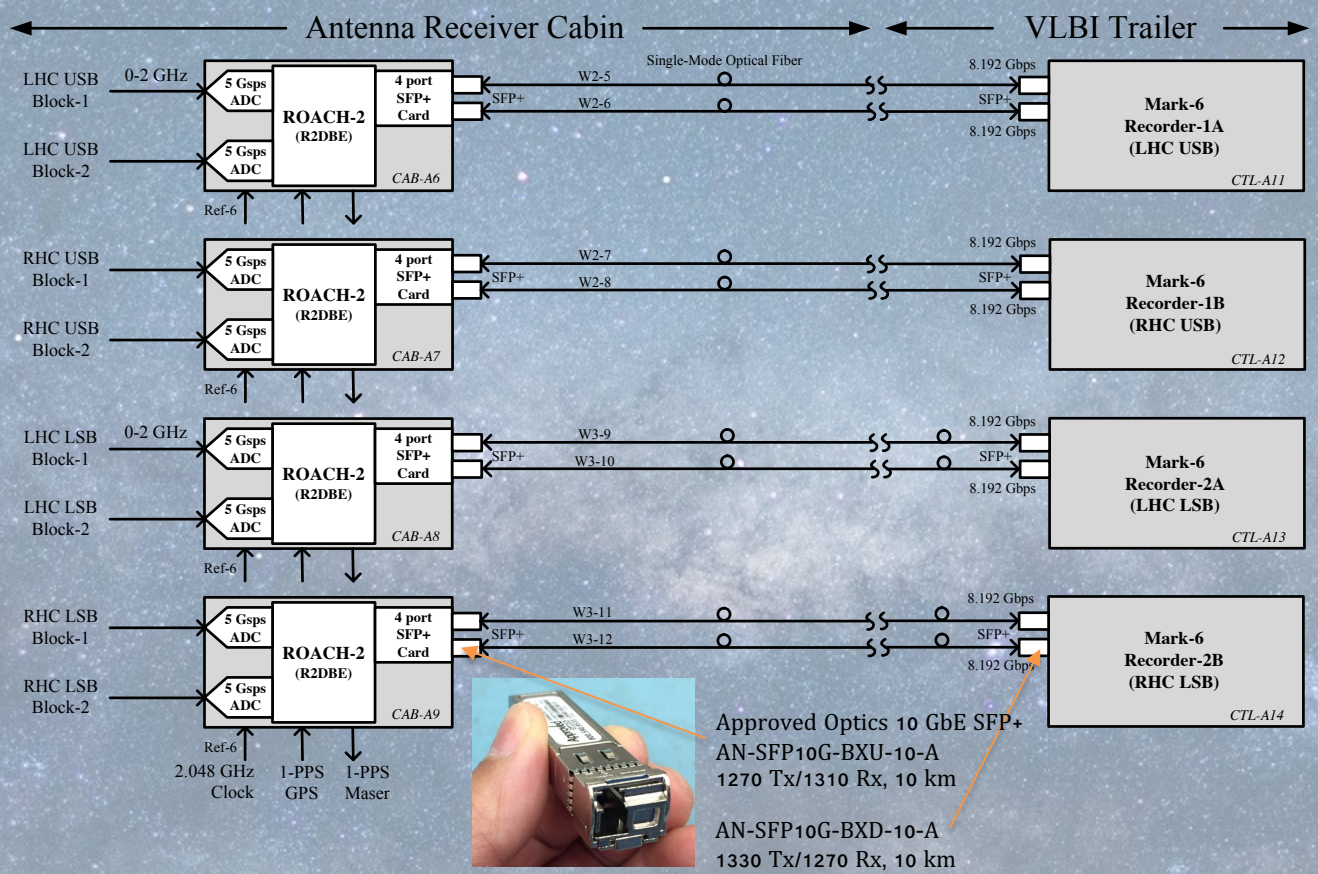
Equipment Rack and Maser Unit

IF Subsystem



IF Subsystem

Digital Backend



Approved Optics 10 GbE SFP+
AN-SFP10G-BXU-10-A
1270 Tx/1310 Rx, 10 km

AN-SFP10G-BXD-10-A
1330 Tx/1270 Rx, 10 km

IF Subsystem

Spectrometer