LO/IF System

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Introduction

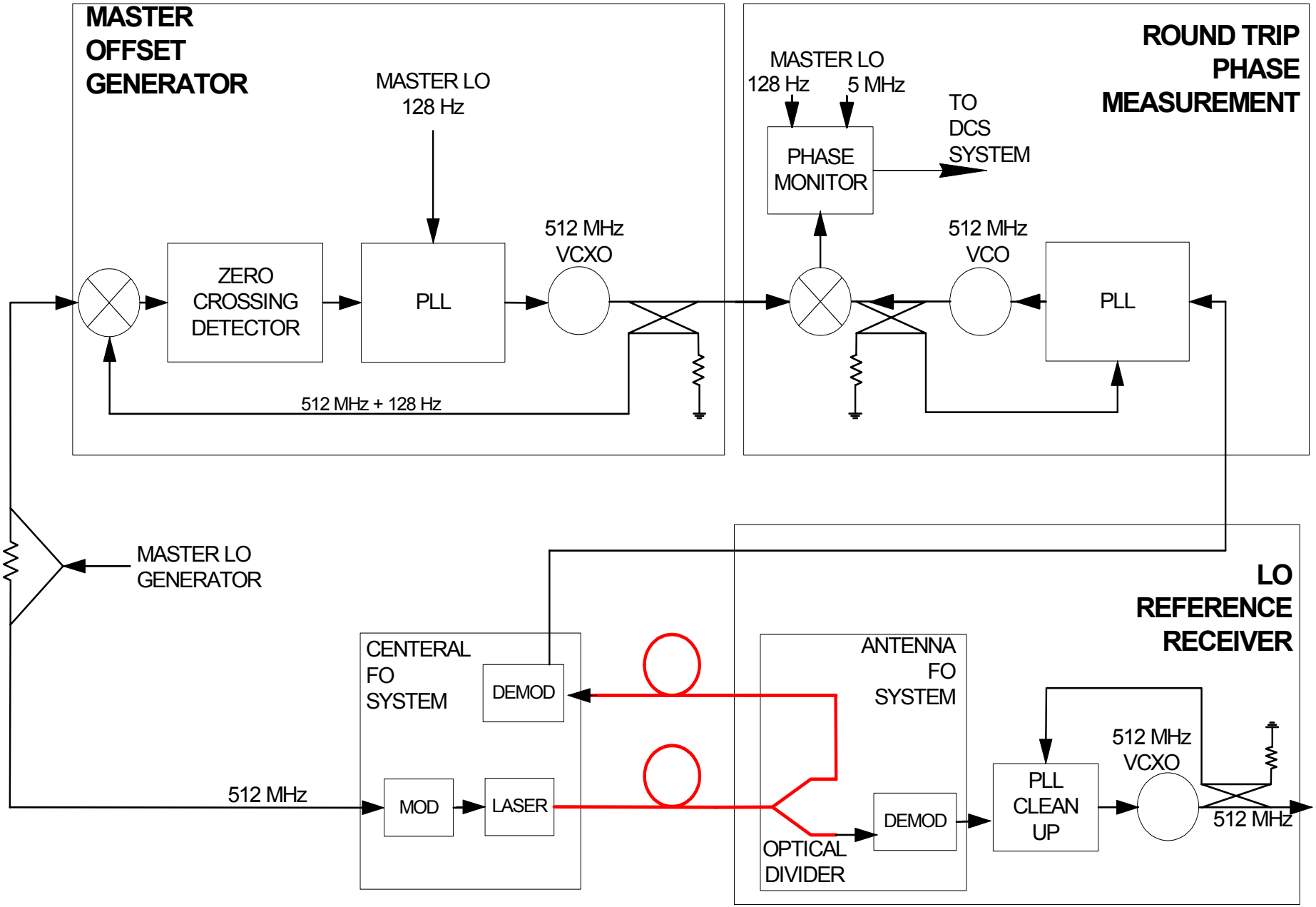
- The LO/IF system modules
  - Progress
  - Cost
  - Schedule
  - Issues

Issues

- Solar Attenuation
- PCAL removed
- Construction using new technologies
- PIN diode switches
- Broadband components for narrow band apps
- Sampling Phase detector
- Frequency Tuning steps
- Transition
- Round Trip Phase

Round Trip Phase System

- Under design
- Includes the RTP Measurement module
- Includes the LO Offset generator


MASTER
OFFSET
GENERATOR
MASTER LO
128 Hz
ZERO
CROSSING
DETECTOR
PLL
512 MHz
VCXO
512 MHz + 128 Hz
ROUND TRIP
PHASE
MEASUREMENT
MASTER LO
128 Hz
5 MHz
PHASE
MONITOR
TO
DCS
SYSTEM
512 MHz
VCO
PLL
MASTER LO
GENERATOR
LO
REFERENCE
RECEIVER
CENTERAL
FO
SYSTEM
DEMOD
512 MHz
MOD
LASER
ANTENNA
FO
SYSTEM
DEMOD
OPTICAL
DIVIDER
PLL
CLEAN
UP
512 MHz
VCXO
512 MHz

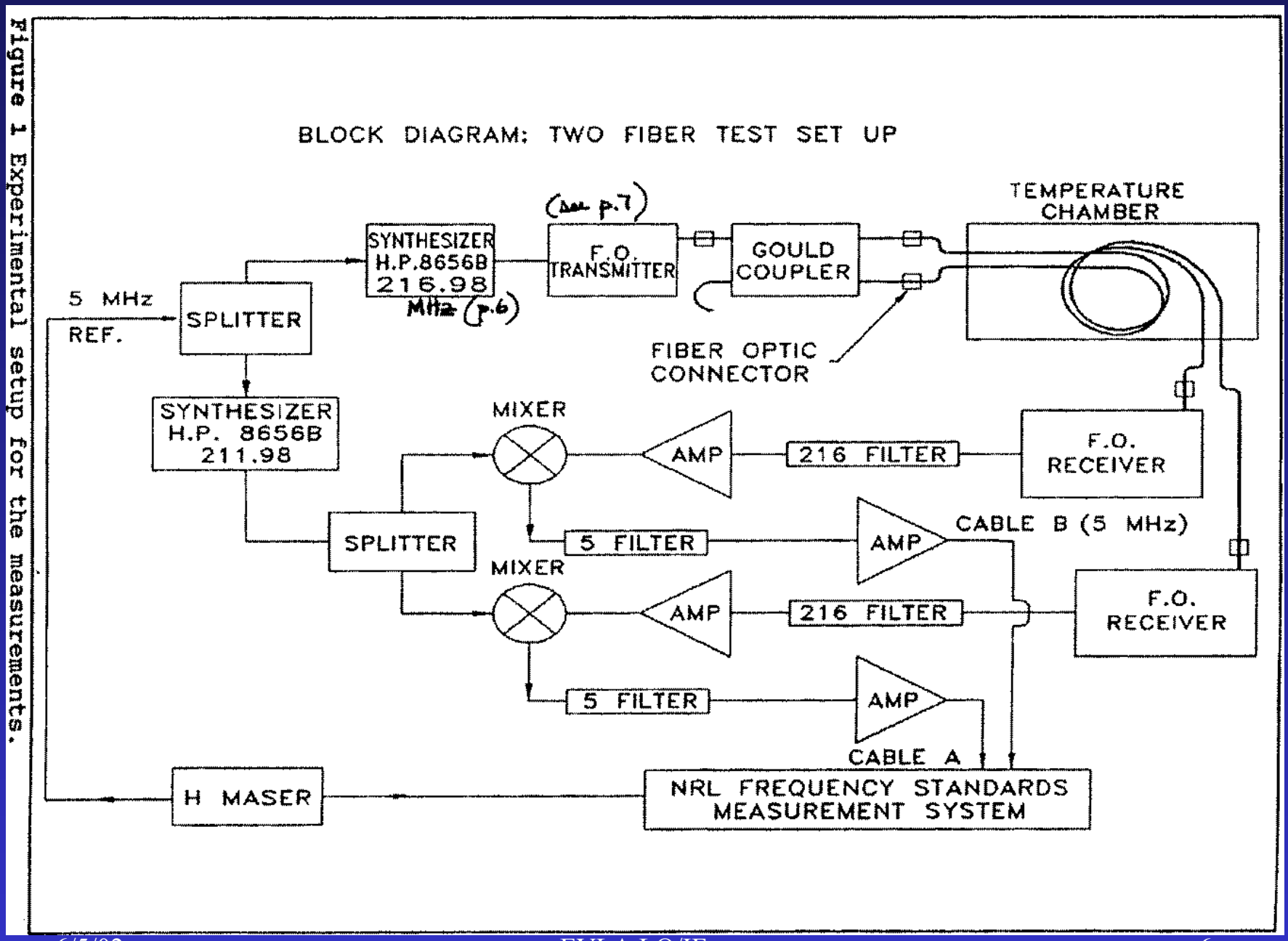


Figure 1 Experimental setup for the measurements.

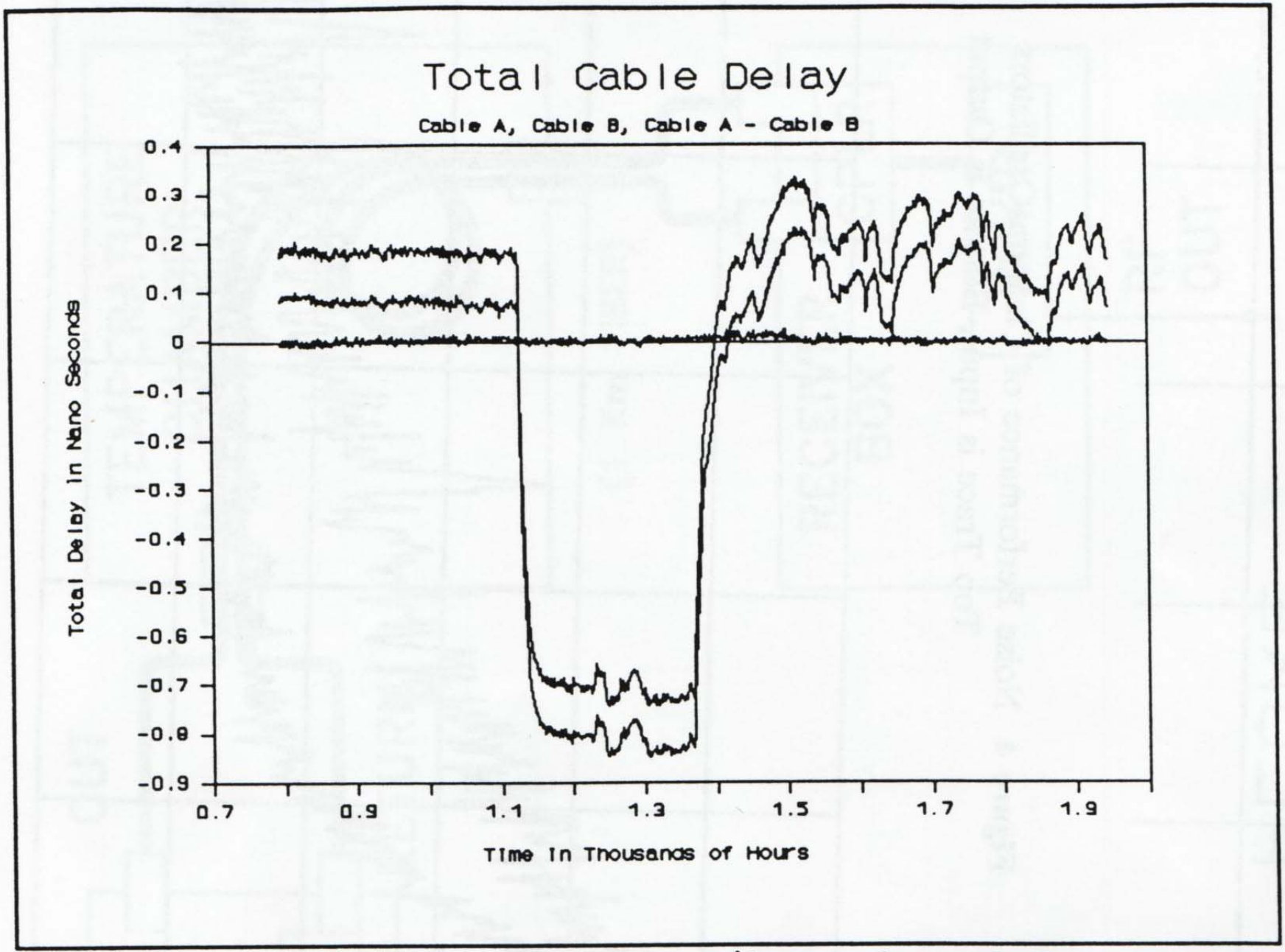


Figure 2 Total Delay for Two Fibers for 48 Days

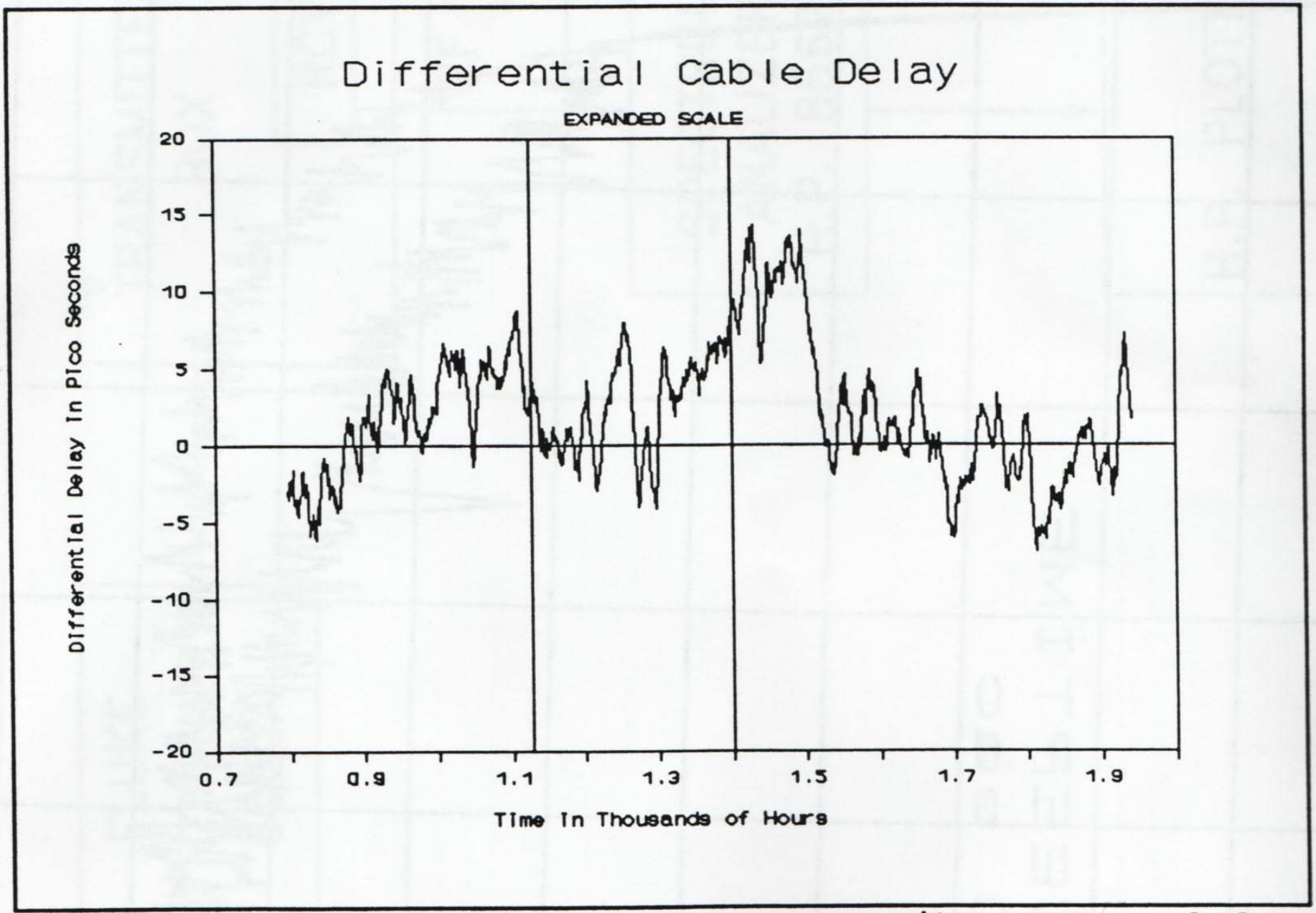
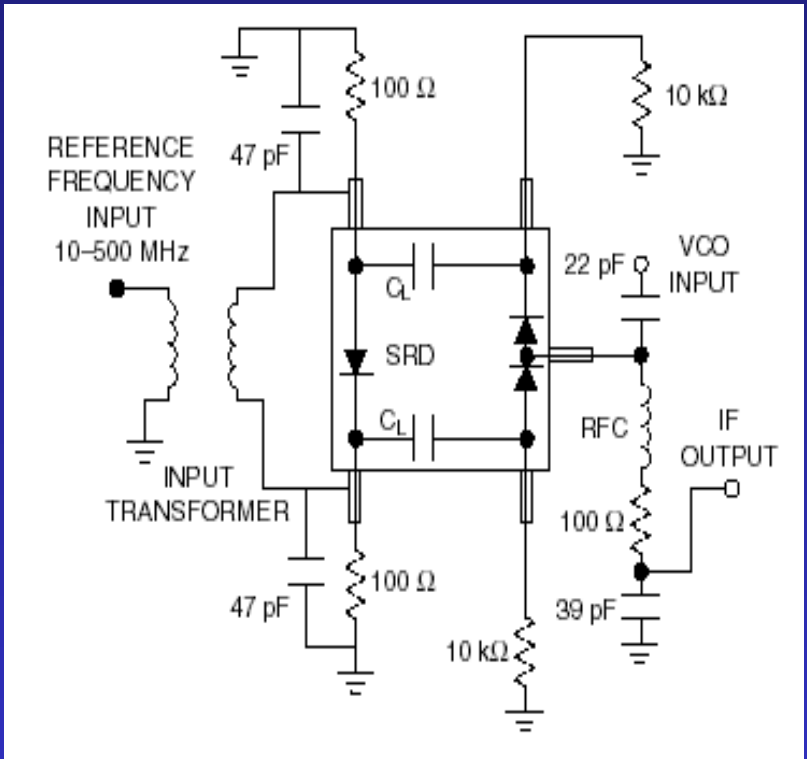


Figure 3 Differential Delay for Two Fibers Expanded Scale

Sampling Phase Detector



- Advantage: Much less expensive than comb generator and mixer
- Advantage: Phase v. Temp stable
- Disadvantage: Design-Test-Mfg. cycle

4096 Synthesizer

- Last LO before digitization to convert IF to the 1-2 GHz range
- Used with high resolution sampler
- Tuning is 4096 +/- 10 MHz in 1 Hz steps
- Tuning needed for transition
- Initial design complete
- Initial board layout is complete

4096 Synthesizer

- Need to evaluate filters from different vendors.
- Parts are here or on order
- Testing to start 7/02
- Cost in quantity either 1.5K or 1K each depends on filters (2 per antenna in same module)
- Not in original budget

8-Bit Digitizer

- Boards received from vendor.
- Checkout in progress.
- Design completed.
- Power supply and M/C interface finished.
- $4k per sampler, 4 per antenna.
- Interleaved design

High Speed Digitizer

- Uses ALMA digitizer microcircuit.
- Development of EVLA board starts in ’03
- Microcircuit cost $1.2k.
- Board cost similar to 8-bit digitizer.
- 8 per antenna.
- Must buy all chips at one time

DTS Module

- Includes both types of samplers
- Includes formatter (ALMA) (FO Budget)
- Includes lasers and modulators (FO Budget)
- Budgeted cost 7.8K each (7/01)*
- Current estimated cost 10K each (6/02)*
- *LO/IF portion only

IF Downconverter

- -Converts 8-12 GHz IF to two 2-4 GHz baseband IF's for 3-bit, 4GHz sampling
- -Converts 8-12 GHz IF to one 1-2 GHz baseband IF's for 8-bit, 2GHz sampling
- Bench Integration: 7 October 02

IF Downconverter

- All parts on order or in house
- Total Power Detector Boards on order
- Detector Digitizer board (ALMA under design)
- Most parts have been tested or under test
- Bench Version 27K (qty 1) original est 45K/2 (07/01)
- Integrated Version $8500 (qty 1 estimate)

Converter Modules

GENERAL SCHEDULING SCHEME:

May-June: *Construction 4/P Test Set

June-July: *Construction 4/P Converter

July-Sept.: Construction L/S/C Converter

Sept.-Nov.: Construction UX Converter

Nov.-Dec.: Bench integration & packaging

* *Under construction now (in-house)*

4/P Band Test Set

- There is a need to simulate the 4/P Band receivers and the new 1024MHz LO for construction. (New LO's not available until end of year for module checkout).
- Lighten load on lab test equipment for module checkout & bench integration

JUNE 2002 STATUS (Test Set):

Designed; construction nearly completed

T301 4/P Converter

DESIGN CHANGES SINCE PDR: minor

- Better determination of "narrow band" receiver powers for proper amplifier selection
- Improved RF and LO isolation & headroom
- Exact Solar Attenuation still pending

COST/BUDGET: no significant changes

T301 4/P Converter

JUNE 2002 STATUS:

This converter is being built at this time

- 80% of RF components ordered & received
- PCB layout/artwork in progress
- PC Boards expected delivery: first of July
- Prototype completion: end of July
- Mechanical completion: end of year

T302 L/S/C Converter

DESIGN CHANGES SINCE PDR: minor

- Final amplifier gains and LO levels
- Exact Solar Attenuation still pending

COST/BUDGET: no significant changes

JUNE 2002 STATUS:

- Major components to be ordered June 2002
- Electronic construction Aug.-Sept.; mechanical packaging end of year

T303 UX Converter

JUNE 2002 STATUS:

- Significant time was spent Mar.-May in converter redesign and performance issues
- Major components to be ordered July 2002
- Electronic & mechanical construction Sept.-Nov. 2002
- Bench integration Nov.-Dec. 2002

T303 UX Converter

DESIGN CHANGES SINCE PDR: **MAJOR**

- "Block convert" scheme changed overall LO/IF concept for complete redesign.
- 32 req'd; no longer a transition converter.
- No longer suitable as a module; unique packaging and metal work required.
- Redesign/approval completed May 2002.

T303 UX Converter

- COST/BUDGET: Significantly increased complexity and cost of converter by about $7-10K each. (?)

Easily absorbed by the $1.2M “saved” by the front-end lab ☺

T303 UX Converter

JUNE 2002 STATUS:

- Significant time was spent Mar.-May in converter redesign and performance issues
- Major components to be ordered July 2002
- Electronic & mechanical construction Sept.-Nov. 2002
- Bench integration Nov.-Dec. 2002

T310 Converter Interface Module

- This 1-wide module will house the MIB and service the M/C requirements of all 3 converters.
- M/C loading fairly low. (Mostly power monitors & solar attenuator control).
- Preliminary design only. Final design near bench integration when MIB specifications are finalized.

L301, L302 Progress

- 50% designed, prototyping in progress
- Proto YIGs on hand
- Sampling Phase Detector PCB fabricated
- Phase Lock Loop board in 2nd revision
- Output amplifiers ordered (~45-90 day lead)
- Other (anticipated) long-lead parts on hand

L301, L302 *Preliminary* Cost Estimate

- L301 12-20 GHz
- YIG ~$2,600
- RF parts ~$4,500
- Other ~$3,000
- Total ~$10,000
- Array Total ~$640K
- Original est 7/01 13.6K

- L302 10-15 GHz
- YIG ~$1,900
- RF Parts ~$5,000
- Other ~$3,000
- Total ~$10,500
- Array Total ~$1.3M
- Original est 7/01 13K

References Gen & Distribution

PROGRESS

- Central Ref Gen/Dist Preliminary Block Diagram Complete
- Antenna Ref Gen/Dist Preliminary Block Diagram Complete
- 128/32 MHz Synth Detailed Block Diagram Complete

References Gen & Distribution

PROGRESS

- 128/32 MHz Synth Long Lead Components Received
- 128/32 MHz Phase Detector Circuit and PCB Design in Progress

References Gen & Distribution

SCHEDULE

- 128/32 MHz Phase Detector Circuit and PCB Design Completion – July 8
- 128/32 MHz Synthesizer Begin Test – July 22
- 128/32 MHz Synthesizer Approx Cost - $1850