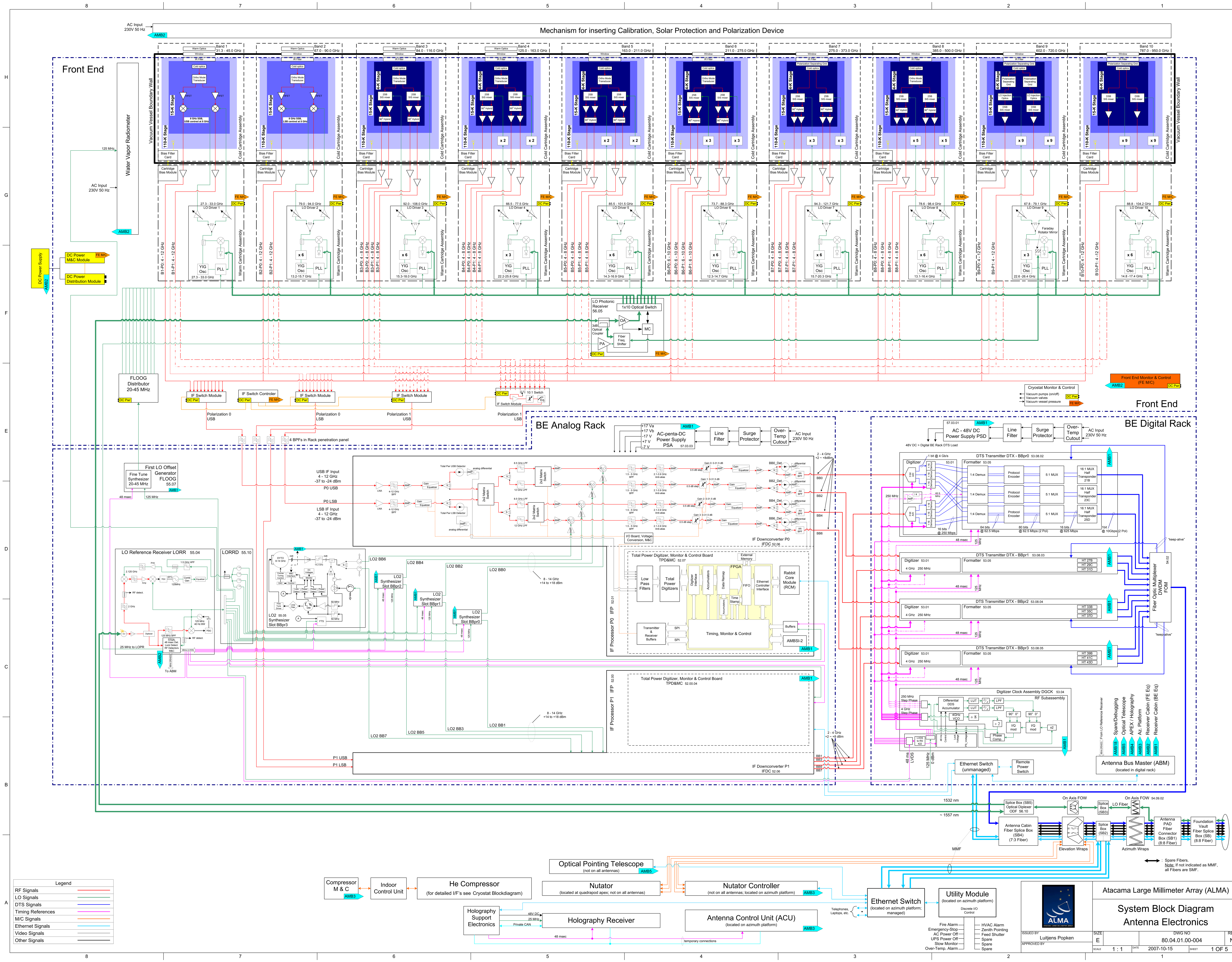


Mechanism for inserting Calibration, Solar Protection and Polarization Device
AC Input 230V 50 Hz
Front End
Water Vapor Radiometer
Vacuum Vessel Boundary Wall
Band 1 31.3 - 45.0 GHz
Band 2 67.0 - 90.0 GHz
Band 3 84.0 - 116.0 GHz
Band 4 125.0 - 163.0 GHz
Band 5 163.0 - 211.0 GHz
Band 6 211.0 - 275.0 GHz
Band 7 275.0 - 373.0 GHz
Band 8 385.0 - 500.0 GHz
Band 9 602.0 - 720.0 GHz
Band 10 787.0 - 950.0 GHz
Cold Cartridge Assembly
Warm Cartridge Assembly
15-K Stage
110-K Stage
4-K Stage
Bias Filter Card
Cartridge Bias Module
DC Power M&C Module
DC Power Distribution Module
DC Power Supply
LO Photonic Receiver 56.05
1x10 Optical Switch
FLOOG Distributor 20-45 MHz
IF Switch Module
IF Switch Controller
Polarization 0 USB
Polarization 0 LSB
Polarization 1 USB
Polarization 1 LSB
4 BPFs in Rack penetration panel
Cryostat Monitor & Control
Front End Monitor & Control (FE M/C)
BE Analog Rack
AC-penta-DC Power Supply PSA 57.03.03
Line Filter
Surge Protector
Over-Temp Cutout
BE Digital Rack
AC - 48V DC Power Supply PSD
First LO Offset Generator FLOOG 55.07
Fine Tune Synthesizer 20-45 MHz
LO Reference Receiver LORR 55.04
LORRD 55.10
LO2 Synthesizer Slot BBpr0
LO2 Synthesizer Slot BBpr1
LO2 Synthesizer Slot BBpr2
LO2 Synthesizer Slot BBpr3
IF Processor P0 IFP 52.01
IF Processor P1 IFP 52.00
IF Downconverter P0 IFDC 52.06
IF Downconverter P1 IFDC 52.06
Total Power Digitizer, Monitor & Control Board TPD&MC 52.07
Rabbit Core Module (RCM)
Timing, Monitor & Control
DTS Transmitter DTX - BBpr0 53.08.02
DTS Transmitter DTX - BBpr1 53.08.03
DTS Transmitter DTX - BBpr2 53.08.04
DTS Transmitter DTX - BBpr3 53.08.05
Digitizer 53.01
Formatter 53.05
Digitizer Clock Assembly DGCK 53.04
Fiber Optic Multiplexer DWDM FOM 54.02
Antenna Bus Master (ABM) (located in digital rack)
Ethernet Switch (unmanaged)
Remote Power Switch
Splice Box (SB5) Optical Diplexer ODF 56.10
Antenna Cabin Fiber Splice Box (SB4) (7:3 Fiber)
Elevation Wraps
Azimuth Wraps
Antenna PAD Fiber Connector Box (SB1) (8:8 Fiber)
Foundation Vault Fiber Splice Box (SB) (8:8 Fiber)
Multi-fiber cable to AOS Technical Building
Optical Pointing Telescope (not on all antennas)
Compressor M & C
Indoor Control Unit
He Compressor (for detailed I/F's see Cryostat Blockdiagram)
Nutator (located at quadrapod apex; not on all antennas)
Nutator Controller (not on all antennas; located on azimuth platform)
Ethernet Switch (located on azimuth platform; managed)
Utility Module (located on azimuth platform)
Holography Support Electronics
Holography Receiver
Antenna Control Unit (ACU) (located on azimuth platform)
Legend
RF Signals
LO Signals
DTS Signals
Timing References
M/C Signals
Ethernet Signals
Video Signals
Other Signals
Atacama Large Millimeter Array (ALMA)
System Block Diagram
Antenna Electronics
ISSUED BY Luitjens Popken
SIZE E
DWG NO 80.04.01.00-004
REV N
SCALE 1 : 1
DATE 2007-10-15
SHEET 1 OF 5

Patch Panel Room

ALMA-B Fiber Optic Amplifier Demultiplexer FOAD 54.05 — AMB7

EDFA | DWDM | Controller | Op Spec | FOA 54.05.02 ANT 1 … ANT 64 — 12 Fibers

66 (80) Cables from all EDFAs → 54.07 66 (80) :1 Switch → Op Spec Analyzer

ACA Fiber Optic Amplifier Demultiplexer FOAD 54.05 — AMB7

EDFA | DWDM | Controller | Op Spec | FOA-M 54.05.03 ACA ANT 1 … ANT 16 — 12 Fibers

16 x 12 Fibers to ACA Correlator in ACA Correlator Room

1 Fiber per Antenna

64 Fibers | 16 Fibers | 66 (80) LO Fibers

Main Patch Panel Rack 1 — DTS, LO, M&C, M&C, Spare ×6

Main Patch Panel Rack 3 — DTS, LO, M&C, Spare ×6

ACA Patch Panel — DTS, LO, M&C, Spare ×6, Splitter

2 Fibers for ACA Baseline Correlation

2 x 199 (TBC) Fibers; Each with 2 spares; max 50 (64) + 16 (ACA) active lines

Ethernet 1000 BaseT GBIC Switch

Fiber Bundles from all 177 (TBC) ALMA-B Antenna Pads

Fiber Bundles from all 22 ACA Antenna Pads

8 fibers per Bundle

ALMA-B Correlator Room

Quadrant 1 — Baseband 0, Both Polarizations - all Antennas — Station Electronics Block

BBpr0

Antenna 1, BBpr0, Polarization 0 & 1

Antenna 2, BBpr0, Polarization 0 & 1

DTS Receiver DRX

21B FO-Rcvr | 23C FO-Rcvr | 25D FO-Rcvr — AMB8

1:16 Demux — 16 bits @ 625 MHz — 1:5 Demux — Protocol Decoder

3 bits x 32 samples at 125 MHz

Filter Bank Card form 32 subchannels — CMB

Packetizing & Tracking Delay Station Card — CMB

Ant 1, BB0, Polarization 0 — 80.1 of 2.5# sample — 32 parallel signals @ 125 MHz

Ant 1, BB0, Polarization 0 — 80.2 of 2.5# sample — 32 parallel signals @ 123 MHz

Ant 1, BB1, Polarization 1 — 80.1 of 2.5# sample — 32 parallel signals @ 125 MHz

Ant 1, BB1, Polarization 1 — 80.2 of 2.5# sample — 32 parallel signals @ 123 MHz

Ant 1, BB0, Polarization 0 — Data samples packetized into 32 bit words @125k samples/1msec

Ant 1, BB1, Polarization 1 — Data samples packetized into 32 bit words @125k samples/1msec

48 msec — 125 MHz

Station Rack Interface Card

Signal designations vary according to mode of operation; typical names shown.

Ant 2, BB0, Polarization 0 — 80.1 of 2.5# sample — 32 parallel signals @ 125 MHz

Ant 2, BB0, Polarization 0 — 80.2 of 2.5# sample — 32 parallel signals @ 123 MHz

Ant 2, BB1, Polarization 1 — 80.1 of 2.5# sample — 32 parallel signals @ 125 MHz

Ant 2, BB1, Polarization 1 — 80.2 of 2.5# sample — 32 parallel signals @ 123 MHz

Ant 2, BB0, Polarization 0 — Data samples packetized into 32 bit words @125k samples/1msec

Ant 2, BB1, Polarization 1 — Data samples packetized into 32 bit words @125k samples/1msec

Antenna 63, BBpr0, Polarization 0 & 1

Antenna 64, BBpr0, Polarization 0 & 1

DRX — 1:16 Demux — 1:5 Demux — Protocol Decoder — Filter Bank — Packetizing & Tracking Delay Station Card — Station Rack Interface Card

Quadrant 2 — Baseband 1, Both Polarizations - all Antennas — Station Electronics Block

BBpr1

Antenna 1, BBpr1, Polarization 0

Antenna 2, BBpr1, Polarization 1

Antenna 63, BBpr1, Polarization 0 & 1

Antenna 64, BBpr1, Polarization 0 & 1

Cables go to Correlator Quadrant 2 in same configuration as Quadrant 1

Quadrant 3 — Baseband 2, Both Polarizations - all Antennas — Station Electronics Block

BBpr2

Antenna 1, BBpr2, Polarization 0 & 1

Antenna 2, BBpr2, Polarization 0 & 1

Antenna 63, BBpr2, Polarization 0 & 1

Antenna 64, BBpr2, Polarization 0 & 1

Cables go to Correlator Quadrant 3 in same configuration as Quadrant 1

Quadrant 4 — Baseband 3, Both Polarizations - all Antennas — Station Electronics Block

BBpr3

Antenna 1, BBpr3, Polarization 0 & 1

Antenna 2, BBpr3, Polarization 0 & 1

Antenna 63, BBpr3, Polarization 0 & 1

Antenna 64, BBpr3, Polarization 0 & 1

Cables go to Correlator Quadrant 4 in same configuration as Quadrant 1

8 signals: 2 antennas, 2 polarizations & 2 bits per cable

Note: Each correlator rack interface card receives an 8-signal cable from each of 32 station rack interface cards.

Correlator Rack Equipment ×4

Interface Card | Cross-Correlator Matrix Plane Data sample 0 … 31 | Adder Card

DPI

CMB

Correlator Block

Quadrant 0 (processes IF signal 'BB0', both polarizations for all 64 antennas)

Quadrant 1 (processes signal 'BB1', both polarizations for all 64 antennas)

Quadrant 2 (processes signal 'BB2', both polarizations for all 64 antennas)

Quadrant 3 (processes signal 'BB3', both polarizations for all 64 antennas)

DTS M&C Computer (DMC)

AMB5 | AMB6 | AMB7 | AMB8 | AMB9 | AMB10

48 msec (LVDS converted to RS-485)

48 msec from TBD in Correlator

CDP Master & Backup

1PPS

4 x 64 MB/sec = 256 MB/sec per quadrant

Correlator Data Processor (CDP) Cluster

Correlator Control Computer (CCC) & Backup

Ethernet Switch

4 SMF Pairs, including 3 spares

LO Room

Line Length Correction LLC 56.03 — AMB16 / AMB17

Polarized Beamsplitter | Polar meter | Slow Stretcher | Fast Stretcher | Loop Filter | 50 MHz | ÷10 | 5 MHz | Phase Detector Fringe Counter Stretcher Driver MicroController

Unit 1 of 66 (80) | Unit 2 of 66 (80) | Unit 66 (80) of 66 (80)

SubArray Switch — SAS 56.09 — AMB6

#1 … #6 (80) | #2

1556 nm + 1532 nm | 1556 nm

OPSW 8:1

SAS Module #1 | SAS Module #2 | SAS Modules #3 to #65 (79) | SAS Module #66 (80)

(see Module #2)

Mon PD | WDM | TAP CPL | PBS | Pol Ctrl | VOA 6dB

LLCs #3 to #65 (79)

Photonic Reference Distribution PRD #1 56.08 … #6 56.08

Optical 1:80 Power Divider — AMB6

Laser Synthesizer LS #1 56.11 … LS #6 56.11

FFS | Slave Laser | Laser PLL | 27.3 - 141.5 GHz / 61 - 122 GHz | 1556.393 - 1557.396 nm / 192.620 - 192.5496 THz | K=3,5,7,9,11 | 125 MHz | 10 MHz

Central Variable Reference CVR 56.04 — Microwave Synthesizer, 8 - 12 GHz or 12 - 18 GHz — Ethernet for with AMTM

CVR 56.04

Photonic LO Master Laser ML 56.13 — Master Laser 1556.2 nm — AMB6

Master Laser Distribution MLD 56.07 — Optical Divider 1 : 66 (80) + 1 : 6

to 125 MHz Distributors in ALMA-B and ACA Correlators (+10 dBm)

1 output each LLC — RF Pwr Divider 1 : 66 (80) — 5 MHz Ref Distribution 125RD 55.08

RF Pwr Divider 1 : 6 — 125 MHz Ref Distribution 125RD 55.09

Central Reference Distributor CRD 55.02 — AMB6

CRD and CRG M & C — A/D Converter — PECL to LVTTL — 64 Bit Counter (real time & drift) — 48ms Clock Generator — Single Pulse Blanking — M&C Registers Time Storage — FPGA — PCB — AMBSI2 (daughter card) — SPI — 48ms LVDS Repeater — 48ms RS-422 Driver — To ALMA-B and ACA Correlators DTS

5V Regulator — 2.5/3.3V Regulator — 5V Regulator — Combiner — Composite — DFB Laser &Modulator — CLK

2 GHz — x16 — PLL — 125MHz VCXO — EFC — x2 — x5 — x5 — 5MHz VCXO — PLL — 5 MHz

Volt Reg/Det PCB — Dual +5/+10VDC Regulator for PCB — +15 Volt Regulator — +15 to sub-modules — +17 Volt in

DET | DET | DET | ÷4 — J1 | J2 | J3 | J4

Central Reference Generator CRG 55.03

Rb-Master Frequency Standard MFS 55.01

Low Frequency Reference Distribution LFRD 56.06 — 1 output each LLC — Optical Pwr Divider 1 : 66 (80) — EDFA — 1532 nm — AMB6

2 SMF Pairs plus 2 Spares

Computer Room

Array Real Time Machine (ARTM) & Backup

AMB5 | AMB6 | AMB7 | AMB8 | AMB9 | AMB16 | AMB17

48 msec, RS422

1PPS | Control/Data Interface

Ethernet Switch

GPS Antenna on Roof of AOS

Weather Stations (located outdoors)

GPS Receiver

2 SMF Pairs plus 2 Spare Pairs

2 SMF Pairs plus 2 Spare Pairs

to Ethernet Switch (for CCC, DMC, CDP of ACA) in ACA Correlator Room

2 Ethernet Distribution Switches

Entry Ducts are TBD.

Executive Subsystem

Control Subsystem

Quick-Look Subsystem

Calibration Subsystem

Scheduling Subsystem

Array Control Computer (ACC)

Archive Processor

Disk Array

Operator Console

Ethernet Switch

Equipment Located at Operational Support Facility (OSF)

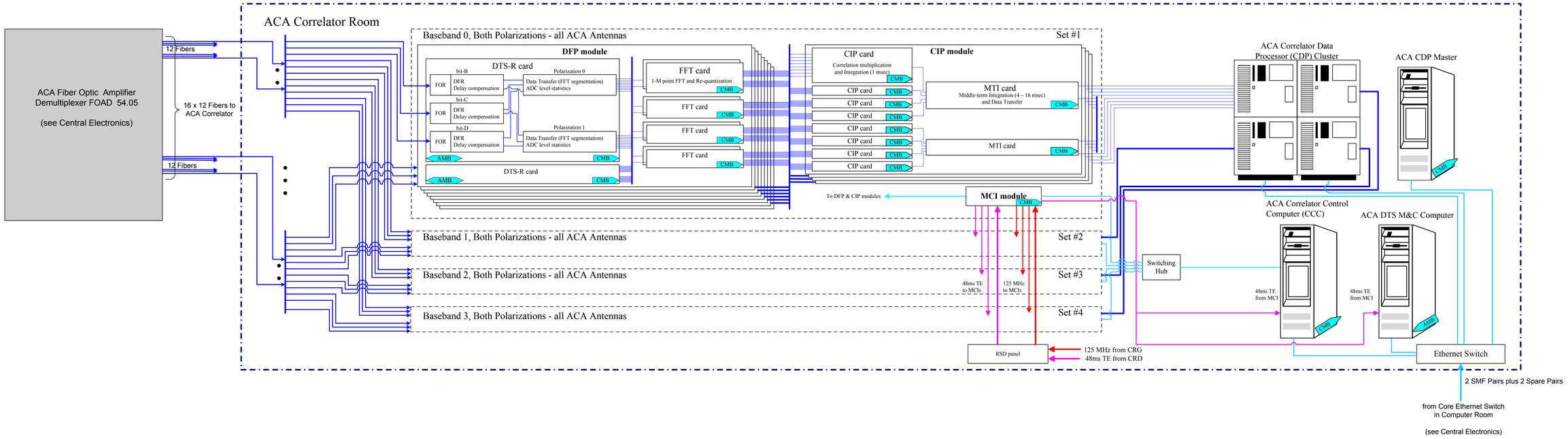
2 SMF Pairs plus 6 Pair Spares

Legend
RF Signals
LO Signals
DTS Signals
Timing References
M/C Signals
Ethernet Signals
Video Signals
Other Signals

Atacama Large Millimeter Array (ALMA)

System Block Diagram Central Electronics

ISSUED BY	Luitjens Popken	SIZE	E
APPROVED BY		DWG NO	80.04.01.00-004
		REV	N
SCALE	1 : 1	DATE	2007-10-15
		SHEET	1 OF 5

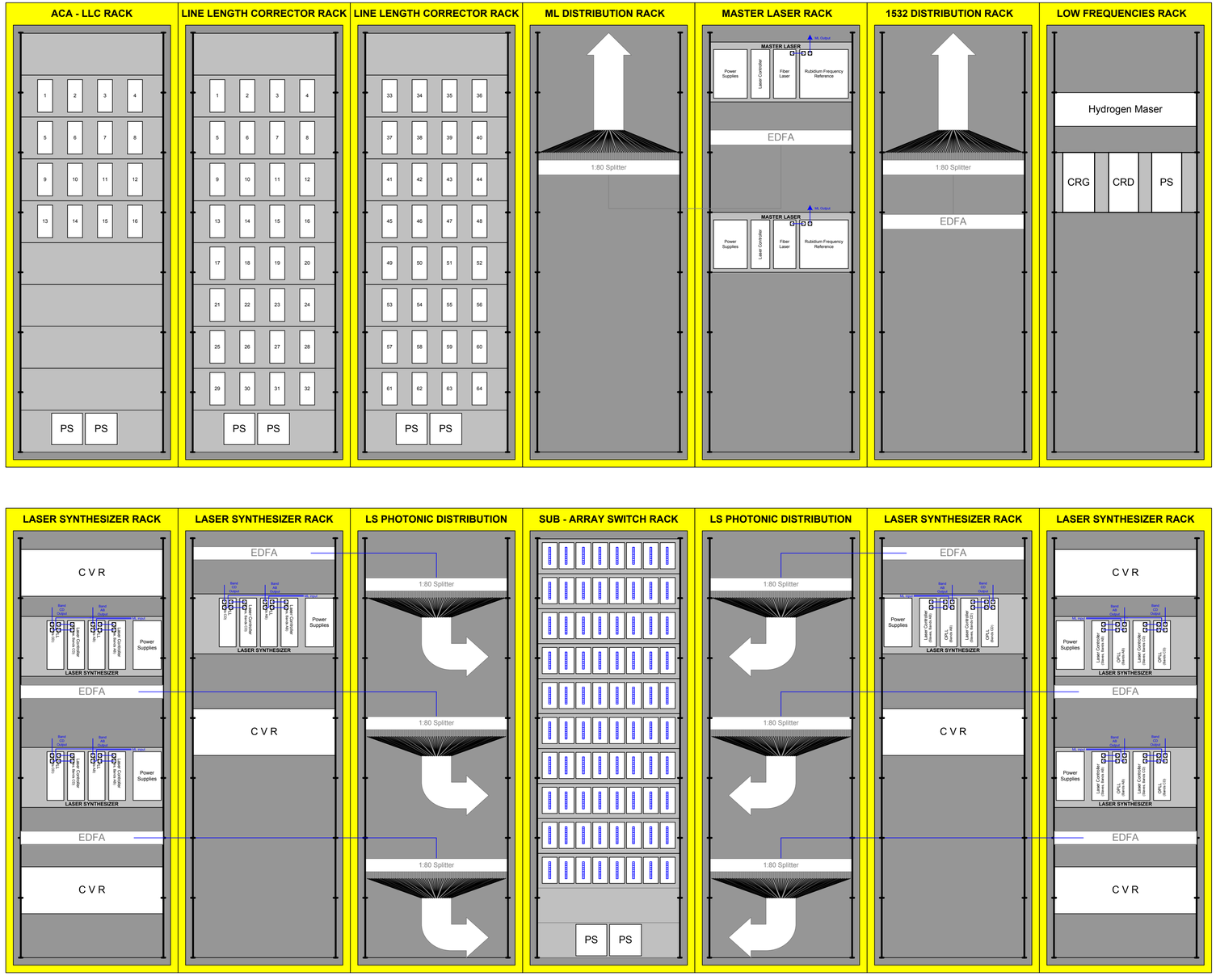


Legend	
RF Signals	
LO Signals	
DTS Signals	
Timing References	
M/C Signals	
Ethernet Signals	
Video Signals	
Other Signals	

Atacama Large Millimeter Array (ALMA)

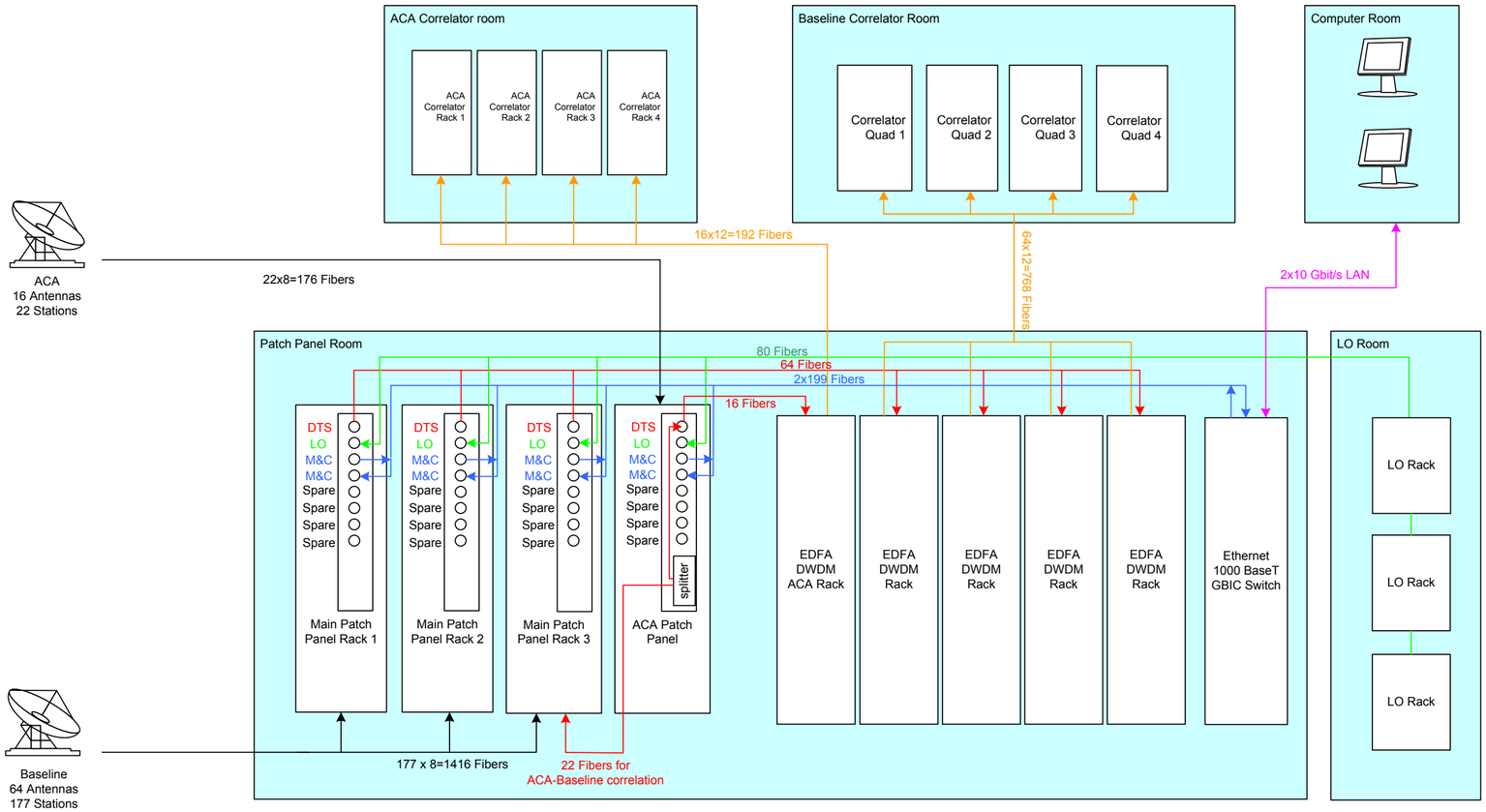
System Block Diagram
Central Electronics (ACA)

ISSUED BY	SIZE		DWG NO	REV
Luitjens Popken	D		80.04.01.00-004	N
APPROVED BY	SCALE 1 : 1	DATE 2007-10-15	SHEET 3 OF 5	



Racks are 35 RU height

	Atacama Large Millimeter Array (ALMA)			
	System Block Diagram Central LO Racks			
ISSUED BY: Luitjens Popken	SIZE: D		DWG NO: 80.04.01.00-004	REV: M
APPROVED BY:	SCALE: 1 : 1	DATE: 2007-06-10	SHEET: 4 OF 5	



Legend	
DTS-DWDM	
LO Signals	
M&C Signals	
LAN	
DTS	
External Fiber	

ISSUED BY: Luitjens Popken	SIZE: C	DWG NO: 80.04.01.00-004	REV: M
APPROVED BY:	SCALE: 1 : 1	DATE: 2007-06-10	SHEET: 5 OF 5

Atacama Large Millimeter Array (ALMA)

System Block Diagram
Patch Panel

REV.	DESCRIPTION	DATE	BY

Compressor
Sumitomo CNA-61D

Indoor control unit
Sumitomo CNA-61D

400 VAC

Pressure Transducer
Valcom VPRQ-A3-4mPa-4

Compressor M&C

AMB

DC

Outdoor

Indoor

Cold Head
Sumitomo RDK-408

Vacuum Vessel

Vacuum Windows

IR Filters

Cartridges

Temperature Sensors
4 PRT, 9 TVO

Vacuum gauge controller
(Leybold Center two)

230 VAC

Buffer Tank
Sumitomo

Bypass Valve
Varian

Vacuum gauge
(Leybold Ionivac ITR90)

Gate Valve
Vat 241264EA

Turbo pump
Leybold TW70

Frequency Converter
Turbo.Drive s

Cryostat M&C Module

DC

FE M&C

AMB

230 VAC

24 VDC Power Supply
Kniel CP 24.8

230 VAC

Failsafe Valve
Leybold Eckventil

Pressure gauge
Thermovac TTR90

Backing pump
Leybold Divac 2.5 VT

Legend	
Helium Lines	
Vacuum Lines	
Analogue Signals	
Digital Signals	
400 V / 50 Hz Power	
230 V / 50 Hz Power	
Other AC Power	
DC Power	

DRAWN BY

APPROVED BY

Hans Rudolf

Atacama Large Millimeter Array (ALMA)

System Block Diagram
Cryostat

SIZE	DWG NO	REV
	40.03.00.00-035	B
SCALE 1 : 1	DATE 2004-02-06	SHEET 1 OF 3

2006-01-25