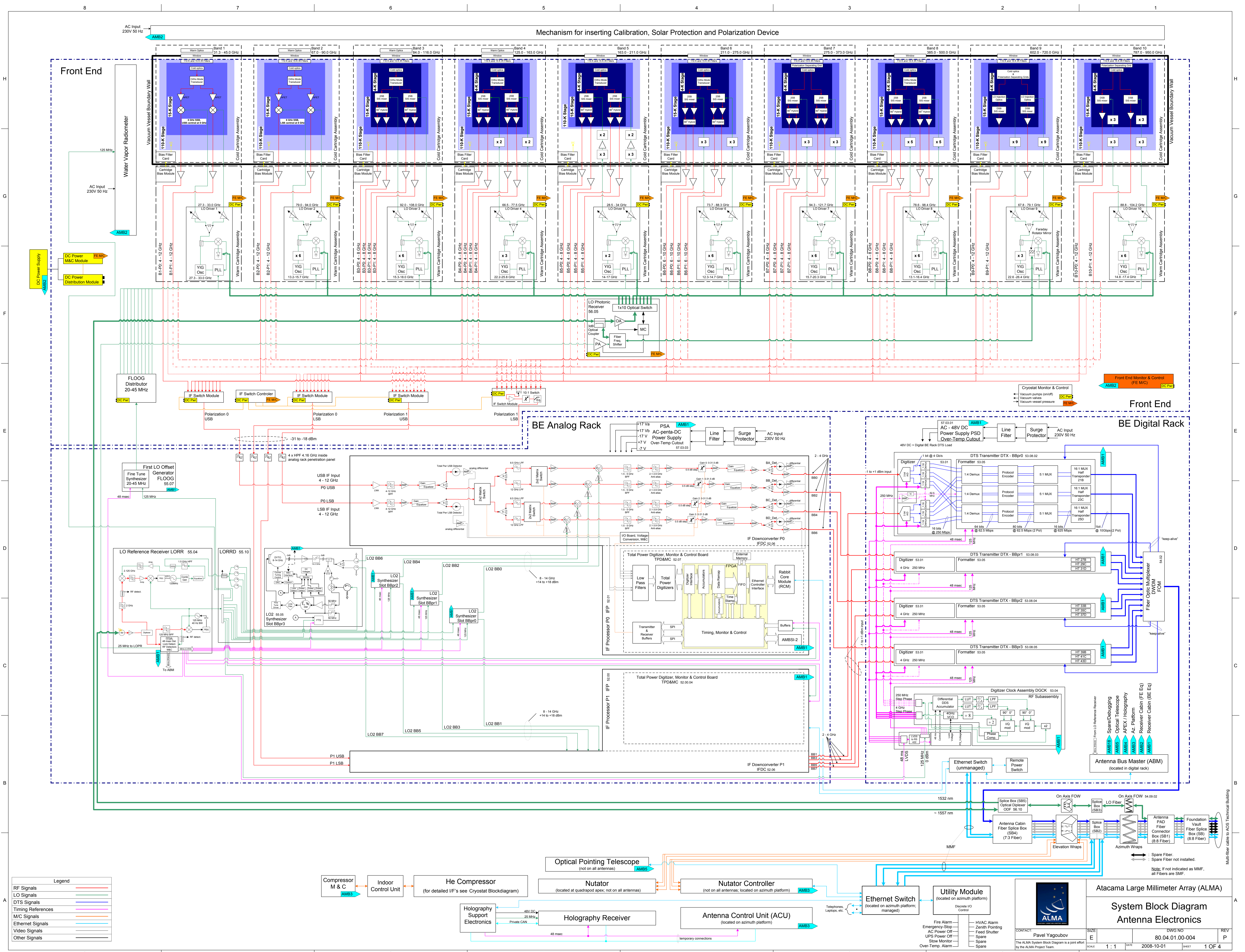


Mechanism for inserting Calibration, Solar Protection and Polarization Device



**Legend**

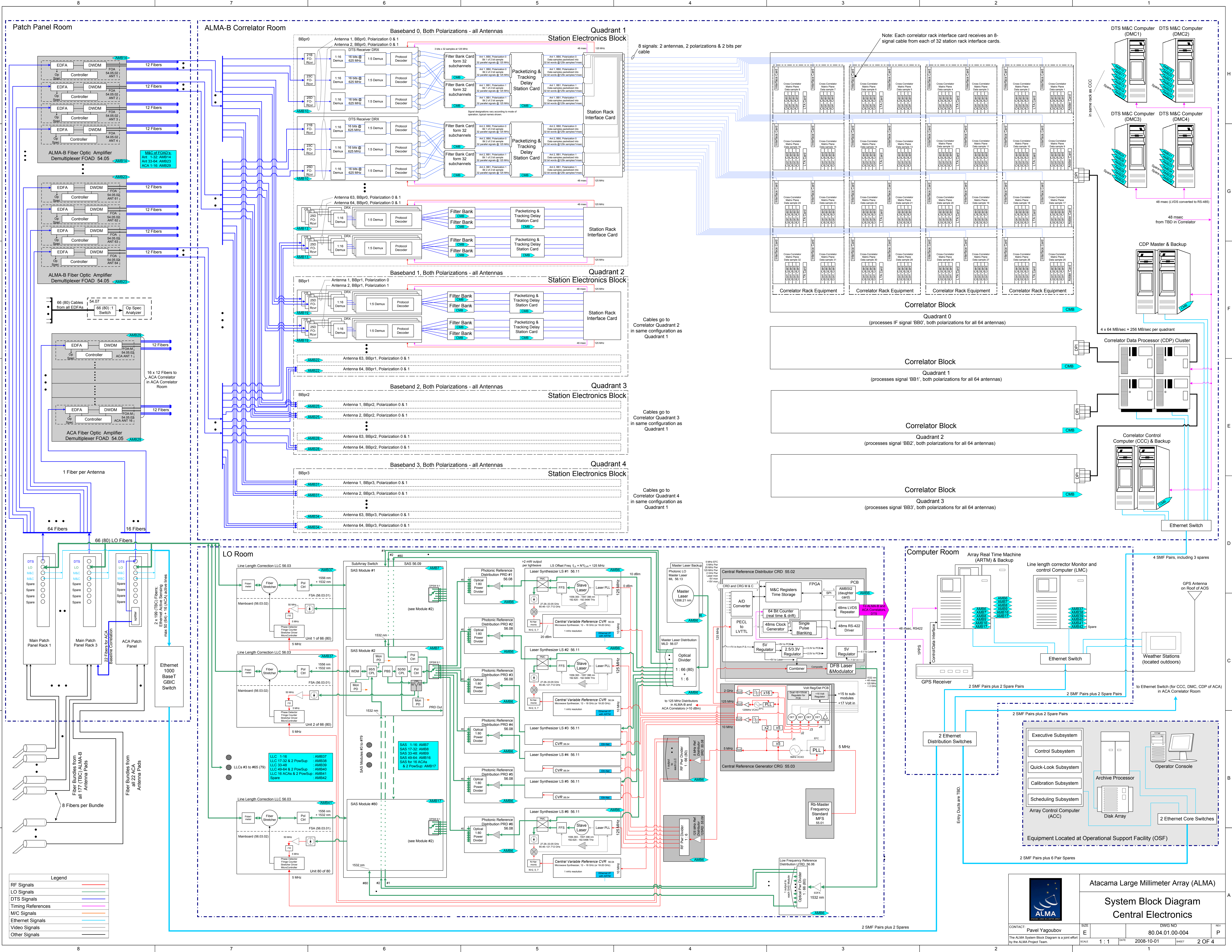
- RF Signals
- LO Signals
- DTS Signals
- Timing References
- M/C Signals
- Ethernet Signals
- Video Signals
- Other Signals

**Atacama Large Millimeter Array (ALMA)**  
**System Block Diagram**  
**Antenna Electronics**

CONTACT:	Pavel Yagoubov	DWG NO:	80.04.01.00-004
SCALE:	1:1	DATE:	2008-10-01
SIZE:	E	SHEET:	1 OF 4
REV:	P		

The ALMA System Block Diagram is a joint effort by the ALMA Project Team.

Multi-fiber cable to AOS Technical Building



**Patch Panel Room**

**ALMA-B Correlator Room**

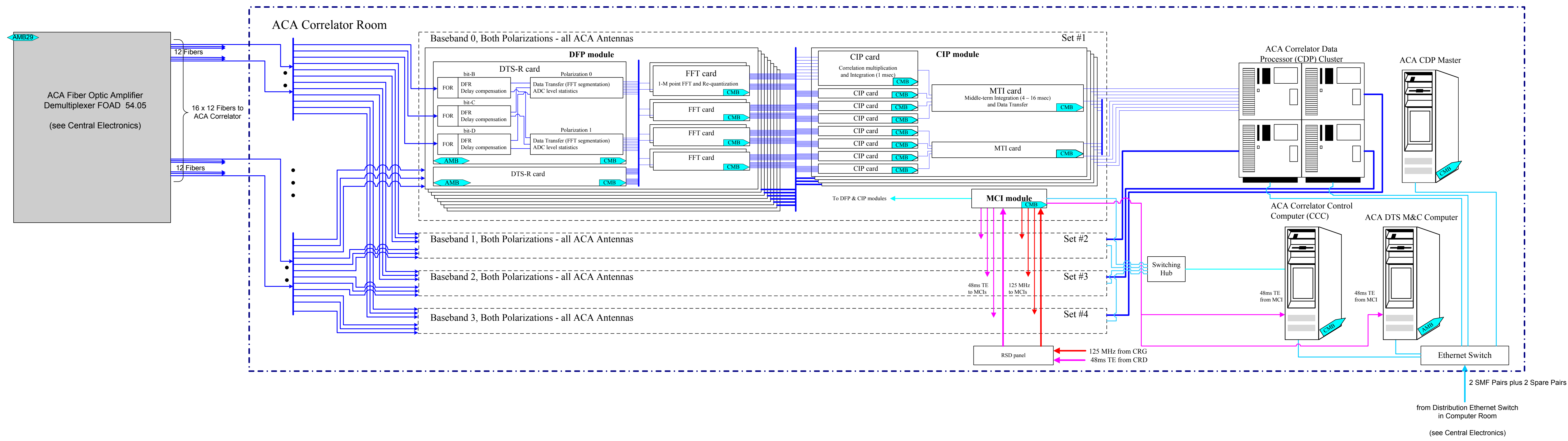
**Computer Room**

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

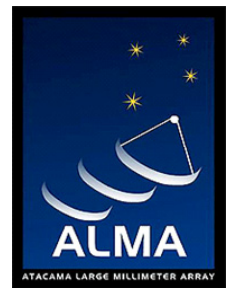
**Atacama Large Millimeter Array (ALMA)**

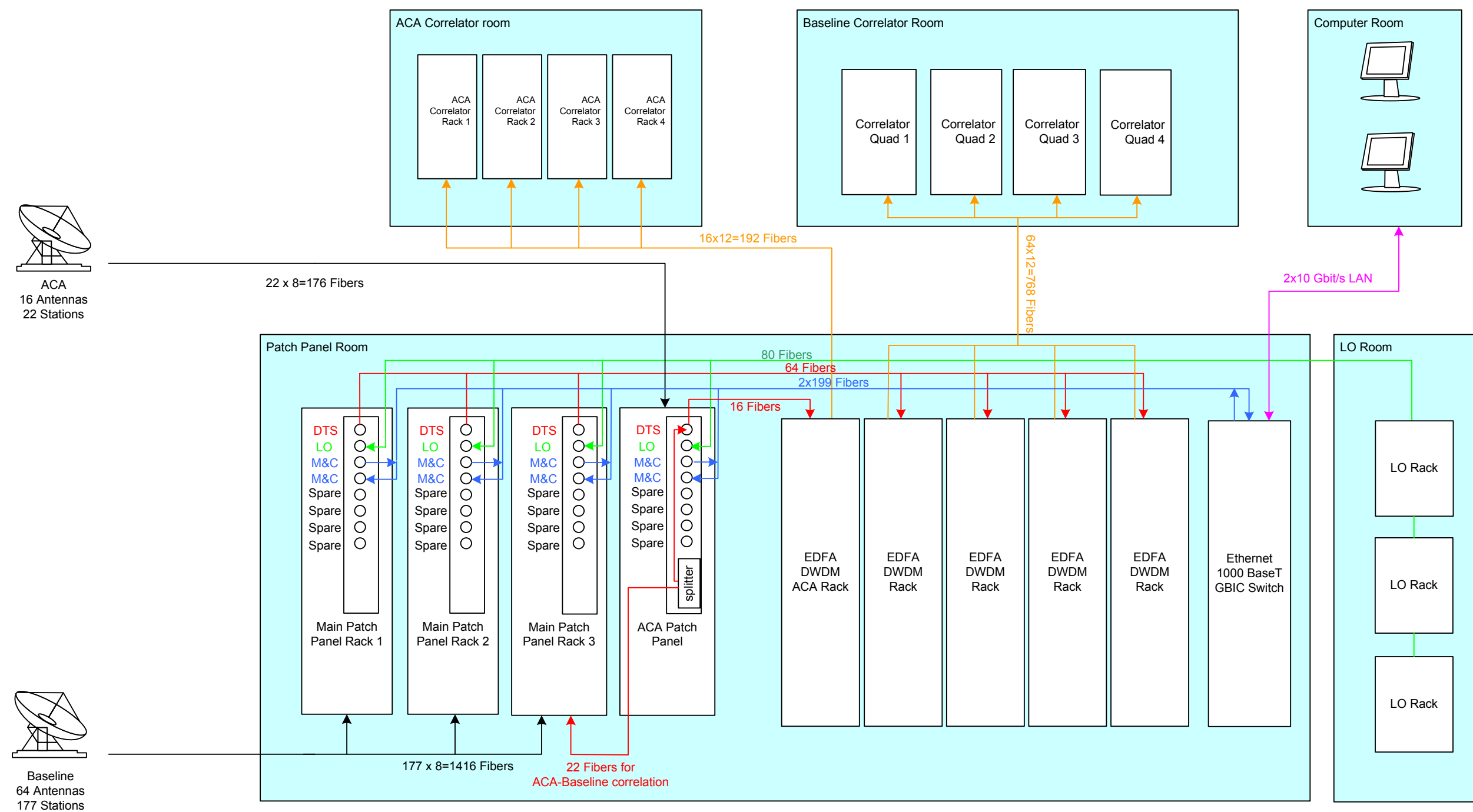
**System Block Diagram  
Central Electronics**

CONTACT: Pavel Yagoubov	SIZE: E	DWG NO: 80.04.01.00-004	REV: P
The ALMA System Block Diagram is a joint effort by the ALMA Project Team.		SCALE: 1:1	DATE: 2008-10-01
		SHEET: 2 OF 4	



Legend	
RF Signals	— (Red)
LO Signals	— (Green)
DTS Signals	— (Blue)
Timing References	— (Magenta)
M/C Signals	— (Orange)
Ethernet Signals	— (Cyan)
Video Signals	— (Grey)
Other Signals	— (Black)

	Atacama Large Millimeter Array (ALMA)			
	<b>System Block Diagram</b> <b>Central Electronics (ACA)</b>			
CONTACT: Pavel Yagoubov	SIZE: D	DWG NO: 80.04.01.00-004	REV: P	
The ALMA System Block Diagram is a joint effort by the ALMA Project Team.		SCALE: 1 : 1	DATE: 2008-10-01	SHEET: 3 OF 4



Legend	
DTS-DWDM	<span style="color: red;">—</span>
LO Signals	<span style="color: green;">—</span>
M&C Signals	<span style="color: blue;">—</span>
LAN	<span style="color: magenta;">—</span>
DTS	<span style="color: yellow;">—</span>
External Fiber	<span style="color: black;">—</span>



Atacama Large Millimeter Array (ALMA)

## System Block Diagram Patch Panel

CONTACT:  
Pavel Yagoubov

SIZE  
C

DWG NO  
80.04.01.00-004

REV  
M

The ALMA System Block Diagram is a joint effort  
by the ALMA Project Team.

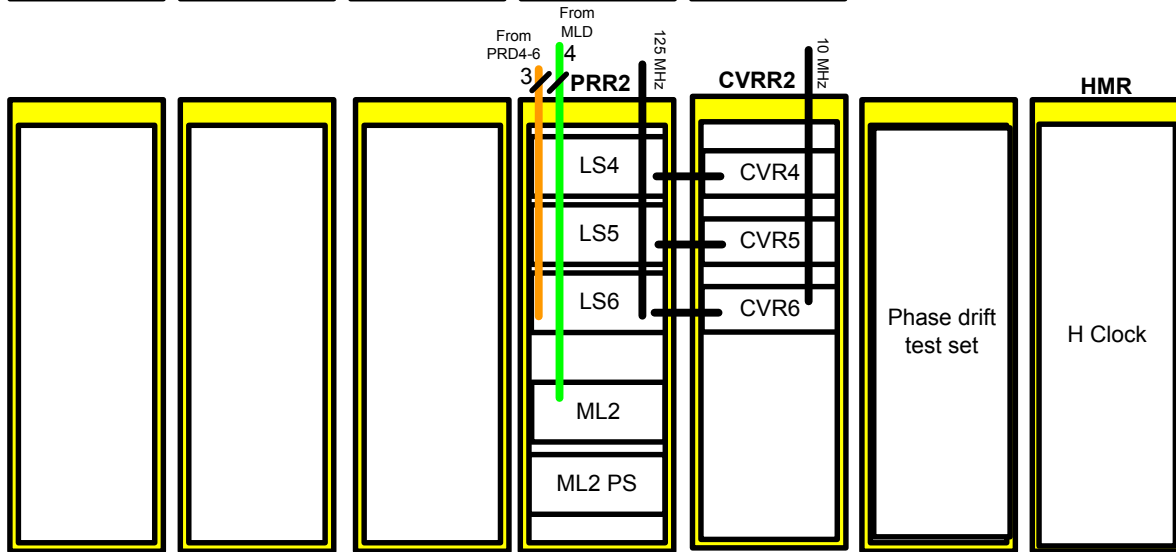
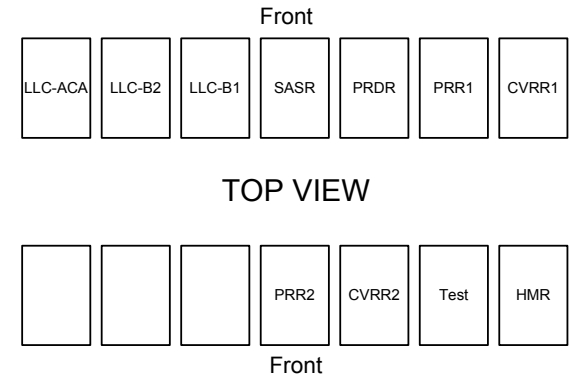
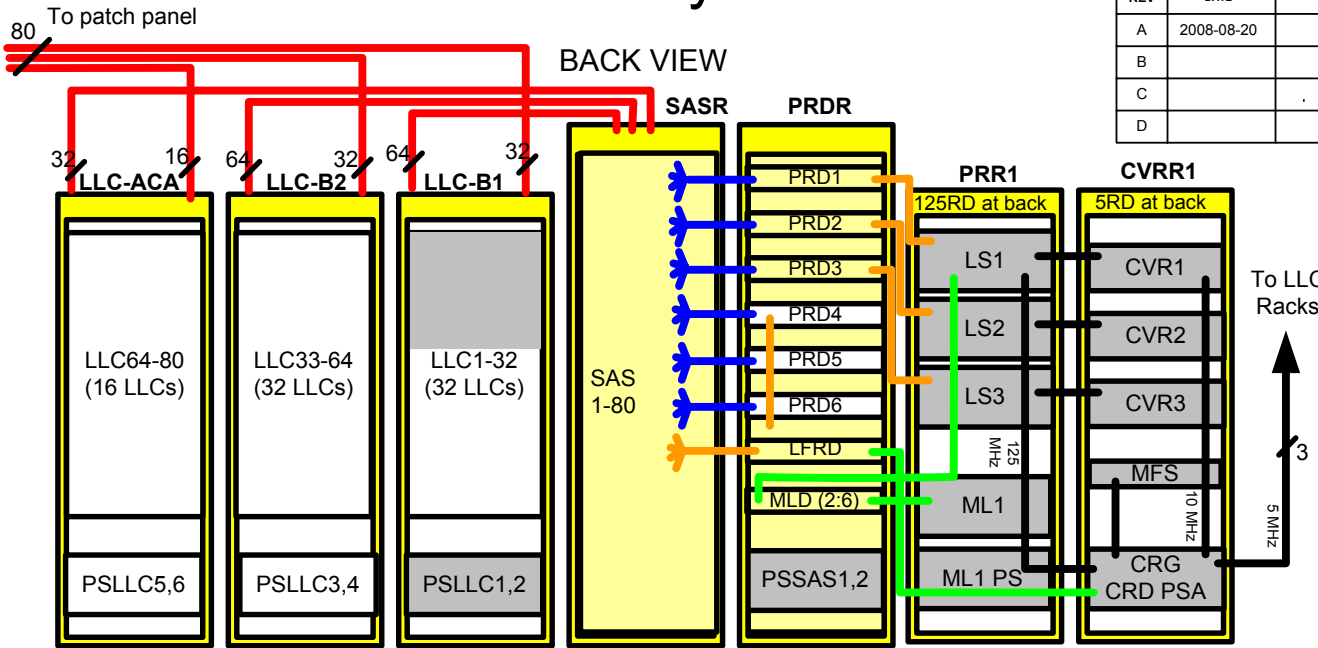
SCALE 1 : 1

DATE 2007-06-10

SHEET 4 OF 4

# CLOA2 Rack Layout


REVISION HISTORY			
REV	DATE	ICO/CRE	DESCRIPTION OF CHANGE
A	2008-08-20		INITIAL DESIGN
B			
C			
D			

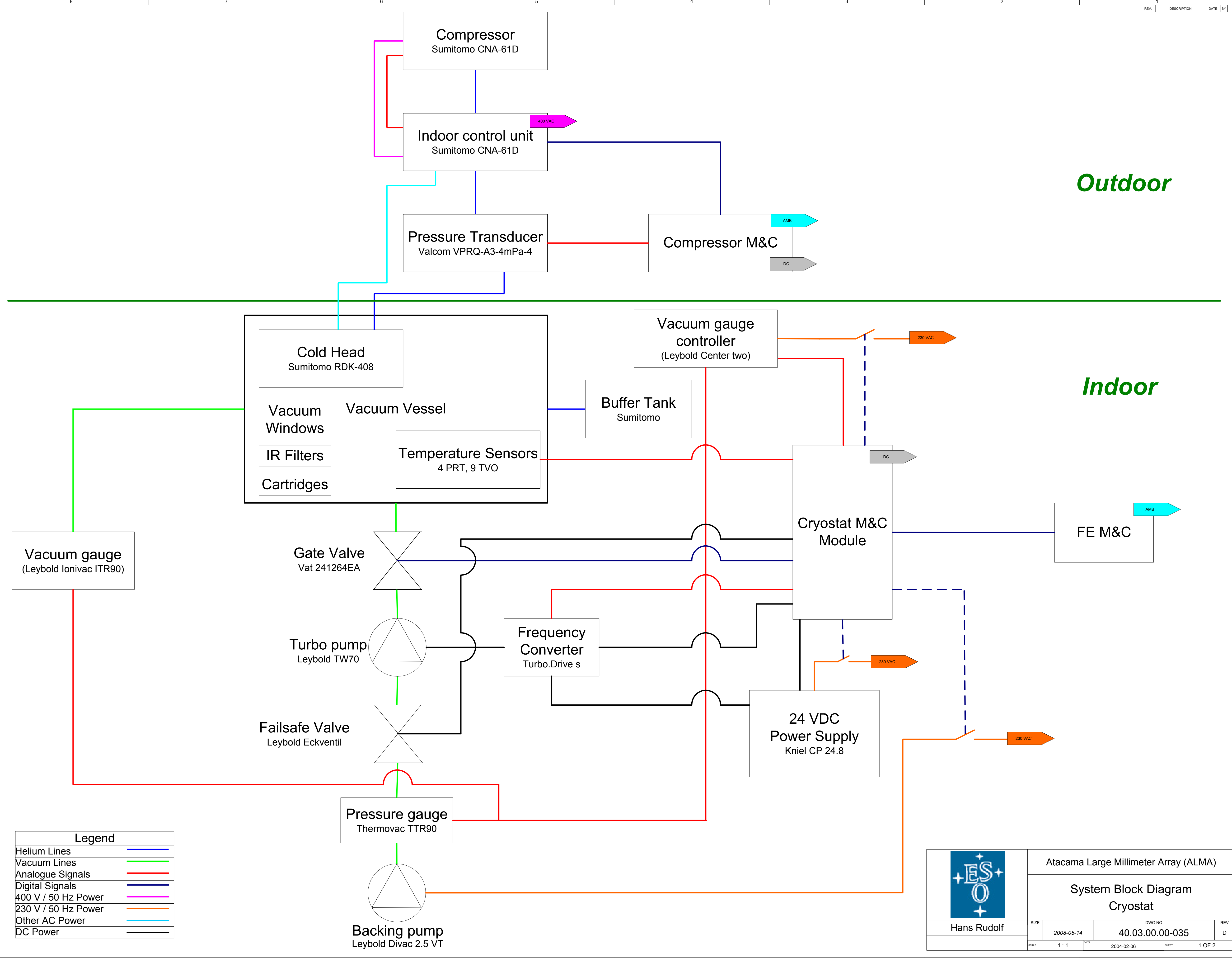


**LEGEND**

- RF Cable
- All following are fibers, classified by the effect of fiber perturbation on LO Reference phase:
  - Common to all antennas
  - Common to all antenna in subarray. Affects VLBI spec.
  - Differential phase drift btw ant in subarray.
  - Differential phase drift btw ant in subarray, compensated by LLC
- Unit that was installed in CLOA1 and remain in CLOA2
- Unit that was installed in CLOA1 but is replaced by another unit in CLOA2
- New unit for CLOA2

FRONT VIEW

				National Radio Astronomy Observatory			
				ALMA Project Back End IPT			
Central LO Article				CLOA2 Rack Layout			
DWG NO BEND-50.01.00.00-001-A-DWG		DATE 2008-08-20		DESIGNED BY R. Brito, W. Grammer, JF. Cliche			
DRAWN BY R. Brito, JF. Cliche		APPROVED BY IPT LEAD		APPROVED BY IPT LEAD			
DRAWN BY		DRAWING SIZE A		SCALE 1:1		SHEET 5 OF 6	



*Outdoor*

*Indoor*

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

	Atacama Large Millimeter Array (ALMA)		
	System Block Diagram Cryostat		
Hans Rudolf	SIZE	DWG NO	REV
	2008-05-14	40.03.00.00-035	D
SCALE	DATE	SHEET	1 OF 2
1 : 1	2004-02-06		

Luitjens Popken/estec/ESA

09/10/2008 17:34

To wbrundage@aoc.nrao.edu, Hans Rudolf <hrudolf@eso.org>, "Kamaljeet S. Saini" <ksaini@nrao.edu>, John Webber <jwebber@nrao.edu>, pmartine@eso.org,

cc

bcc

Subject ALMA System Block Diagram Rev P - Final

Hi all:

After my e-mail of Sept 24 some more comments were received and implemented in the final System Block Diagram Rev. P attached to this e-mail. Apart from a few editorials the latest technical changes are as follows:

**"Antenna Electronics":**

(1) The 4 spare fibers (between foundation vault and antenna fiber box) now indicated as not yet installed.

**"Central Electronics":**

(1) SAS Module and LLC Module architectures modified consistent with latest information received. It is recommended to review this part again for any changes to be included in the next Rev. Q.

**"Central LO Racks":**

This sheet has been replaced by the diagram "CLO-2 Rack Layout" provided by Wes Grammer.

**"Cryostat":**

A disclaimer is needed here; according to an e-mail from C. Haupt on Sept 25: "The cryo-system block diagram has several errors. We are in the progress of preparing an update and we will send to you." Since then I have not received any further input. Changes will need to be included in the next Rev. Q distribution.

Pavel Yagoubov at ESO takes over to maintain and distribute the diagrams in future. Please, support him by sending the required updates as needed.

The attached pdf file includes four pages 1 to 4 with DWG No. 80.04.01.00-004; plus pages for the CLO-2 Rack Layout, and the Cryostat. This e-mail with the change record since Rev. N is included as an appendix.

Page 1 (Size E): "Sheet 1 of 4: Antenna Electronics", Rev. P

Page 2 (Size E): "Sheet 2 of 4: Central Electronics", Rev. P

Page 3 (Size D): "Sheet 3 of 4: Central Electronics (ACA)", Rev. P

Page 4 (Size C): "Sheet 4 of 4: Patch Panel" (Rev. M unchanged)

Page 5 (Letter Size): "CLO-2 Rack Layout" (new; received from Wes Grammer)

Page 6 (Size D): "Sheet 1 of 2: Cryostat", Rev. D, 2008-05-14; (maintained by H. Rudolf).

Appendix: This e-mail.



2008-10-01 SystemBlockDiagramRevP.pdf

Best regards,  
Luitjens

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Luitjens Popken  
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The Netherlands

Luitjens.Popken@esa.int

----- Forwarded by Luitjens Popken/estec/ESA on 09/10/2008 17:34 -----

Luitjens  
Popken/estec/ESA  
24/09/2008 19:31

To wbrundage@aoc.nrao.edu, Hans Rudolf <hrudolf@eso.org>, "Kamaljeet S. Saini" <ksaini@nrao.edu>, John Webber <jwebber@nrao.edu>, Jeff Zivick <jzivick@nrao.edu>, pmartine@eso.org, bglenden@nrao.edu, rsramek@nrao.edu, Christoph Haupt <chaupt@eso.org>, Gianni Raffi <graffi@eso.org>, Jim Pisano <jpisano@nrao.edu>, Arno van Kesteren <avkester@eso.org>, Eric Pangole <epangole@eso.org>, Satoru IGUCHI <s.iguchi@nao.ac.jp>, fheissen@eso.org, Gene DuVall <eduvall@aoc.nrao.edu>, hkurland@eso.org, Fabio Biancat Marchet <fmarchet@eso.org>, Rick Murowinski <rmurowin@alma.cl>, Gie Han Tan <ghtan@eso.org>, Ferdinand Patt <fpatt@eso.org>, akempff@eso.org, Stefano Stanghellini <sstanghe@eso.org>, Peter Napier <pnapier@aoc.nrao.edu>, pramirez@alma.cl, Koh-Ichiro MORITA <morita@nro.nao.ac.jp>, Robert Laing <rlaing@eso.org>, jschwarz@eso.org, Richard Hills <rhills@alma.cl>, Bill Shillue <bshillue@nrao.edu>, rkurz@eso.org

cc

Subject New ALMA System Block Diagram Rev P

Hi all:

I am sending the latest Rev. P of the ALMA System Block Diagrams and, please, forward this e-mail as appropriate, because my distribution list appears to me not complete.

The Change Record since Rev. O (Feb 28, 2008) is as follows (design-irrelevant changes in drawing layout are minor and not listed):

**"Antenna Electronics":**

- (1) Band-5 Cartridge Design changed according to revised baseline.
- (2) 4 blocks "AA BPF" removed in baseband output lines of IFP block.
- (3) Correction: LORR is a BE deliverable and hence is on AMB1.
- (4) Band-10 Cartridge: The x9 multiplier is implemented as x3 and x3, with the first multiplication on 110 K, and the second on the 4K stage.

**"Central Electronics":**

- (1) "Ethernet Switch" in OSF changed to "2 Ethernet Core Switches".
- (2) Doubling the number of DMC computers (from 2 to 4) and adding another computer for the monitor and control of the line-length correctors called the Line-length corrector Monitor & control Computer (LMC):

(2.1) ARTM: Monitor and control (M&C) of all central LO equipment except the line-length correctors (which is done by the LMC). As this is a single point of failure for observing across the entire array a backup ARTM computer is foreseen (as already shown on revision O).

AMB6: CRD, Laser Synthesizer (all 6), Master laser distributor, Master laser (both of them), Photonic reference distributor (all 6), Low frequency reference distributor, 5MHz distributor, 125MHz distributor



AMB7: Subarray switch for antennas 1 - 16  
AMB8: Subarray switch for antennas 17 - 32  
AMB9: Subarray switch for antennas 33 - 48  
AMB16: Subarray switch for antennas 49 - 64  
AMB17: Subarray switch for all 16 ACA antennas & 2 power supplies for the subarray switches.

(2.2) LMC: M&C of the line-length correctors. Computer in the same rack as the ARTM.

AMB37: Line-length correctors for antennas 1 - 16  
AMB38: Line-length correctors for antennas 17 - 32 & 2 power supplies  
AMB39: Line-length correctors for antennas 33 - 48  
AMB40: Line-length correctors for antennas 49 - 64 & 2 power supplies  
AMB41: Line-length correctors for all 16 ACA antennas & 2 power supplies  
AMB42: spare

(2.3) DMC1: M&C of the DTS receivers in quadrant 1 of the baseline correlator. All DMC computers will be in the correlator room (near the CCC).

AMB10: M&C of the DRX for antennas 1-16 in base-band 0.  
AMB11: M&C of the DRX for antennas 17-32 in base-band 0.  
AMB12: M&C of the DRX for antennas 33-48 in base-band 0.  
AMB13: M&C of the DRX for antennas 49-64 in base-band 0.  
AMB14: M&C of the FOAD's for antennas 1 - 32  
AMB15: spare

(2.4) DMC2: Monitor and Control of the DTS receivers in quadrant 2 of the baseline correlator.

AMB19: M&C of the DRX for antennas 1-16 in base-band 1.  
AMB20: M&C of the DRX for antennas 17-32 in base-band 1.  
AMB21: M&C of the DRX for antennas 33-48 in base-band 1.  
AMB22: M&C of the DRX for antennas 49-64 in base-band 1.  
AMB23: M&C of the FOAD's for antennas 33 - 64  
AMB24: spare

(2.5) DMC3: Monitor and Control of the DTS receivers in quadrant 3 of the baseline correlator.

AMB25: M&C of the DRX for antennas 1-16 in base-band 2.  
AMB26: M&C of the DRX for antennas 17-32 in base-band 2.  
AMB27: M&C of the DRX for antennas 33-48 in base-band 2.  
AMB28: M&C of the DRX for antennas 49-64 in base-band 2.  
AMB29: M&C of the FOAD's for all 16 ACA antennas  
AMB30: spare

(2.6) DMC4: Monitor and Control of the DTS receivers in quadrant 4 of the baseline correlator.

AMB31: M&C of the DRX for antennas 1-16 in base-band 3.  
AMB32: M&C of the DRX for antennas 17-32 in base-band 3.  
AMB33: M&C of the DRX for antennas 33-48 in base-band 3.  
AMB34: M&C of the DRX for antennas 49-64 in base-band 3.  
AMB35: spare

AMB36: spare

(3) Indicating the Backup for the Master Laser.

**"Central Electronics (ACA)":**

(1) "from Core Ethernet Switch in Computer Room" changed to "from Distribution Ethernet Switch in Computer Room".

(2) AMB29: M&C of the FOAD's for all 16 ACA antennas.

**"Cryostat":**

(1) Bypass valve removed, along with corresponding vacuum lines and connection to the cryostat M&C.

The attached pdf file includes five Pages 1 to 5 with DWG No. 80.04.01.00-004, plus Page 6 with DWG No. 40.03.00.00-035:

Page 1 (Size E): "Sheet 1 of 5: Antenna Electronics", Rev. P

Page 2 (Size E): "Sheet 2 of 5: Central Electronics", Rev. P

Page 3 (Size D): "Sheet 3 of 5: Central Electronics (ACA)", Rev. P

Page 4 (Size D): "Sheet 4 of 5: Central LO Racks" (Rev. M unchanged)

Page 5 (Size C): "Sheet 5 of 5: Patch Panel" (Rev. M unchanged)

Page 6 (Size D): "Sheet 1 of 2: Cryostat", Rev. D, 2008-05-14; (maintained by H. Rudolf).

[attachment "2008-10-01 SystemBlockDiagramRevP.pdf" deleted by Luitjens Popken/estec/ESA]

Comments on Rev. P can still be implemented (if no big change) before in a week or so the original Visio file, Rev. P, will be uploaded to ALMA edm. Future revisions will be taken over by the System IPT at ESO.

Cheers.  
Luitjens

PS:

Previous Change Record from Rev. N to Rev. O (Feb 28, 2008):

**"Antenna Electronics":**

(1) In all cartridges "IR Filter" changed to "110 K and 15 K IR Filters".

(2) In Bd-9 cartridge, the Polarization Separating Grids merged with Cold Optics. Avoid showing the grids twice.

(3) In 4K-Stage of Bd-3 and Bd-5 Cartridges, the cold AMPs swapped with 90deg Hybrids.

(4) For Band-5 the multiplier chain and LO (YIG) frequency plan changed; no LO multipliers on 110 K stage. Note: Isolators are not shown in any Cold Cartridge Assembly.

(4) Digital Rack:

(4a) "Over Temp Cutout" block deleted and inserted in power supply PSD instead.

(4b) Label added to baseband input to DTX blocks: "-1 to +1 dBm".

(5) FE Block:

(5a) Label "-31 to -18 dBm" added, which is the level at the FE/BE interface defined at the output connectors on the FE rack.

(6) BE Analog Rack:

(6a) Re-label "4 x HPF 4.16 GHz inside analog rack penetration panel", re-symbol inside each HPF block and moved from the FE block to inside the BE Analog Rack block.

(6b) "Over Temp Cutout" block deleted and inserted in power supply PSA instead.

(6c) USB & LSB labels at left of IFP block: "-37 to -24 dBm" deleted.

(7) IFP Block:

(7a) Connections between "I/O Board" and two "Gain Equalizer" blocks deleted.

(7b) Labels "BB0\_Det, BB2\_Det, ..." labels changed to "BA\_Det, BB\_Det, BC\_Det, BD\_Det" (to match the IFP LRU internal labels).

(7c) IFP block, baseband outputs BB0, BB2, ...: Labels "+2 ~ +8 dBm" removed.

"Central Electronics":

(1) Ethernet Interfaces indicated also for LS #2, 3 and 4.

(2) Variable Microwave Reference Harmonic Number,  $K=3,5,7,9,11$ , changed to " $N=2,5, 7$ " in accordance with LS Specification.

(3) LS (Laser Synthesizer) Total Tuning Ranges revised to 27.26 - 33.05 GHz and 65.46 - 121.712 GHz in accordance with LS Specification.

(4) Performance information added to LS for clarity.

(5) A second DTS Monitor & Control Computer (DMC) added in the correlator room: DMC1 with AMB10 to AMB15; DMC2 with AMB19 to AMB24.

(5a) Each DMC does the monitor and control for the DTS receiver modules in half the correlator;

(5b) Accordingly, reassignment of AMBs to the DTS receivers in Station Electronic Blocks of Correlator Quadrants.

(5c) AMB8 and AMB9 now assigned to SubArray Switches.

(5d) FOADs of ALMA-B connected to DMC1, AMB14. - FOADs of the ACA connected to DMC2, AMB23.

(6) Connection of GPS 1 ppm to ARTM removed.

"Central Electronics (ACA)":

(1) AMB23 connection indicated in FOAD.

---

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