WIDAR EVLA Correlator Configuration Transition Plan 2009

(8-bit Initial Quantization)

NRC-EVLA Memo# 031

Brent Carlson, February 4, 2009

ABSTRACT

This plan details which slots in which racks are populated with which boards to meet the 4 phases from section VII of the 12-17-08 McKinnon "Transition from the VLA Correlator to WIDAR" plan, leading to the shutdown of the old correlator in January 2010.

Assumptions and Rules

1. This plan assumes that the Baseline Board LOWER RXP FPGA can be made to synchronize and distribute/route data with no signals on its wafer inputs. This capability has been implemented and tested.

2. Each Cross-bar Board in a Station rack 6U slot provides 2 sub-band pair routing/distribution, in addition to distributing st-TC to Station Boards.

3. Cross-bar Boards must be in Station rack 6U sub-rack slots 0 (st-TC-A) or 7 (st-TC-B) for st-TC timecode distribution to Station Boards. Cross-bar Boards in both slots are required only for redundant timecode distribution.

4. Station Boards within a sub-rack must be contiguous (starting at slot 0 and working up, or slot 7 and working down) to facilitate daisy-chained st-TC (timecode) distribution.

5. 8-bit initial sampling (1 pol'n per Station Board) is assumed; if 3-bit becomes available (2 pol'ns per Station Board), then new optimized population tables should be developed, but generally, 3-bit initial sampling means 2 polarizations (where there is 1 before), or twice as many antennas (if populated for both polarizations 8-bit before).

6. "ext-TC" refers to the fiber timecode and 128 MHz delivered to the correlator from the NRAO system. "st-TC" refers to the timecode distributed to Station Boards via Station Boards and Cross-bar Boards in a daisy-chained fashion.

Phase 1 – Minimum (WIDAR-0) – March 1/09

System: 5 ants, 2 pols, 8-bit IQ, 2 sub-band pairs										
Notes	**Rack**	**Sub-rack**	**Sub-rack Slot (AntPol) | (sb)**							
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	S001	Upper	1R	1L	2R	2L				
	S001	Lower								
	S002	Upper	3R	3L	4R	4L				
	S002	Lower								
	S003	Upper	5R	5L						
	S003	Lower								
	S004	Upper								
	S004	Lower								
	S005	Upper								
	S005	Lower								
	S006	Upper								
	S006	Lower								
	S007	Upper								
	S007	Lower								
	S008	Upper								
	S008	Lower								
	S001	6U	0+8							
	S002	6U	0+8							
ext-TC into slot 0	S003	6U	0+8							
	S004	6U								
	S005	6U								
	S006	6U								
	S007	6U								
	S008	6U								
5 ants, all pol'ns	B101	Upper	0*	0						
	B101	Lower								
5 ants, all pol'ns	B102	Upper	8*	8						
	B102	Lower								
	B103	Upper								
	B103	Lower								
	B104	Upper								
	B104	Lower								
	B105	Upper								
	B105	Lower								
	B106	Upper								
	B106	Lower								
	B107	Upper								
	B107	Lower								
	B108	Upper								
	B108	Lower								

Total StBs	**10**	Notes: This configuration is also good for 10 antennas, single polarization, just by assigning each Station Board to a single antenna (i.e. fiber re-arrangement). * Required only if more spectral channels needed; with LOWER RXP slaved to UPPER clock, 2nd BlB in BlB pair may get sync errors and so this may not be reliable. #sbs limited by Cross-bar Board quantities.
Total Cross-bar Brd	**3**	
Total BlBs	**2 (*or 4)**	

Phase 1 – Desired – March 1/09

System: 5 ants, 2 pols, 8-bit IQ, 10 sub-band pairs										
Notes	**Rack**	**Sub-rack**	**Sub-rack Slot (Ant-Pol) | (sb)**							
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	S001	Upper	1R	1L	2R	2L				
	S001	Lower								
	S002	Upper	3R	3L	4R	4L				
	S002	Lower								
	S003	Upper	5R	5L						
	S003	Lower								
	S004	Upper								
	S004	Lower								
	S005	Upper								
	S005	Lower								
	S006	Upper								
	S006	Lower								
	S007	Upper								
	S007	Lower								
	S008	Upper								
	S008	Lower								
	S001	6U	0+8	1+9	2+10	3+11	4+12			
	S002	6U	0+8	1+9	2+10	3+11	4+12			
ext-TC into slot 0 brd	S003	6U	0+8	1+9	2+10	3+11	4+12			
	S004	6U								
	S005	6U								
	S006	6U								
	S007	6U								
	S008	6U								
5 ants, all pol'ns ea	B101	Upper		0		1		2		3
sub-band	B101	Lower		4						
	B102	Upper		8		9		10		11
	B102	Lower		12						
	B103	Upper								
	B103	Lower								
	B104	Upper								
	B104	Lower								
	B105	Upper								
	B105	Lower								
	B106	Upper								
	B106	Lower								
	B107	Upper								
	B107	Lower								
	B108	Upper								
	B108	Lower								
Total StBs	**10**	Notes: This configuration is not possible on the Phase-1 timeline of March 1/09, because of inavailability of Cross-bar Boards and Baseline Boards in these quantities.								
Total Cross-bar Brd	**15**									
Total BlBs	**10**									

Phase 2 – Minimum – June 1/09

System: 10 ants, 2 pols, 8-bit IQ, 4 sub-band pairs										
Notes	**Rack**	**Sub-rack**	**Sub-rack Slot (Ant-Pol) | (sb)**							
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
See Note 2	S001	Upper	1R	2R	3R	4R	1L	2L	3L	4L
	S001	Lower								
See Note 2	S002	Upper	5R	6R	7R	8R	5L	6L	7L	8L
	S002	Lower								
See Note 1	S003	Upper	9R	9L	10R	10L				
	S003	Lower								
	S004	Upper								
	S004	Lower								
	S005	Upper								
	S005	Lower								
	S006	Upper								
	S006	Lower								
	S007	Upper								
	S007	Lower								
	S008	Upper								
	S008	Lower								
see Note 3	S001	6U	0+8	1+9						
	S002	6U	0+8	1+9						
ext-TC into slot 0	S003	6U	0+8	1+9						
	S004	6U								
	S005	6U								
	S006	6U								
	S007	6U								
	S008	6U								
10 ants, all pol'ns	B101	Upper		0		1				
	B101	Lower								
10 ants, all pol'ns	B102	Upper		8		9				
	B102	Lower								
	B103	Upper								
	B103	Lower								
	B104	Upper								
	B104	Lower								
	B105	Upper								
	B105	Lower								
	B106	Upper								
	B106	Lower								
	B107	Upper								
	B107	Lower								
	B108	Upper								
	B108	Lower								

Total StBs	**20**
Total Cross-bar Brd	**6**
Total BlBs	**4**

Notes:

1. StBs must be contiguous for TC distribution.
2. Requires Cross-bar Board config from StB for "polarization cross-over". Normal fiber routing.
3. Qty=6 assumes end-Feb sign-off for full production; mid-May delivery to Penticton, and no problems testing. If only 3 are available, then only 2 sub-band pairs can correlate.

Phase 2 – Desired – June 1/09

System: 16 ants, 2 pols, 8-bit IQ, 10 sub-band pairs										
Notes	**Rack**	**Sub-rack**	**Sub-rack Slot (Ant-Pol) | (sb)**							
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	S001	Upper	1R	2R	3R	4R	1L	2L	3L	4L
	S001	Lower								
	S002	Upper	5R	6R	7R	8R	5L	6L	7L	8L
	S002	Lower								
	S003	Upper	9R	10R	11R	12R	9L	10L	11L	12L
	S003	Lower								
	S004	Upper	13R	14R	15R	16R	13L	14L	15L	16L
	S004	Lower								
	S005	Upper								
	S005	Lower								
	S006	Upper								
	S006	Lower								
	S007	Upper								
	S007	Lower								
	S008	Upper								
	S008	Lower								
see Note 1	S001	6U	0+8	1+9	2+10	3+11	4+12			
	S002	6U	0+8	1+9	2+10	3+11	4+12			
	S003	6U	0+8	1+9	2+10	3+11	4+12			
ext-TC into slot 0	S004	6U	0+8	1+9	2+10	3+11	4+12			
	S005	6U								
	S006	6U								
	S007	6U								
	S008	6U								
see Note 2	B101	Upper		0		1		2		3
	B101	Lower		4						
	B102	Upper		8		9		10		11
	B102	Lower		12						
	B103	Upper								
	B103	Lower								
	B104	Upper								
	B104	Lower								
	B105	Upper								
	B105	Lower								
	B106	Upper								
	B106	Lower								
	B107	Upper								
	B107	Lower								
	B108	Upper								
	B108	Lower								

Total StBs	**32**	Notes: 1. Qty=20 assumes end-Feb sign-off for full production; mid-May delivery to Penticton, and no problems testing. Requires Cross-bar Board config from StB for "polarization cross-over". All normal fiber routing. 2. Each BlB does 16 antennas, both polarizations, 1 sub-band pair. BlB build schedule for next Qty=8 should meet this.
Total Cross-bar Brd	**20**	
Total BlBs	**10**	

Phase 3 – Minimum – August 1/09

System: 10 ants, 2 pols, 8-bit IQ, 2 tunable I/Fs, 2 sub-bands each										
Notes	**Rack**	**Sub-rack**	**Sub-rack Slot (Ant-Pol) | (sb)**							
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	S001	Upper	1R	2R	3R	4R	1L	2L	3L	4L
	S001	Lower	1Ra	2Ra	3Ra	4Ra	1La	2La	3La	4La
	S002	Upper	5R	6R	7R	8R	5L	6L	7L	8L
	S002	Lower	5Ra	6Ra	7Ra	8Ra	5La	6La	7La	8La
see Note 1	S003	Upper	9R	10R	9Ra	10Ra	9L	10L	9La	10La
	S003	Lower								
	S004	Upper								
	S004	Lower								
	S005	Upper								
	S005	Lower								
	S006	Upper								
	S006	Lower								
	S007	Upper								
	S007	Lower								
	S008	Upper								
	S008	Lower								
	S001	6U	0+8							
	S002	6U	0+8							
ext-TC into slot 0	S003	6U	0+8							
	S004	6U								
	S005	6U								
	S006	6U								
	S007	6U								
	S008	6U								
1st tunable I/F/sb0	B101	Upper		0						
	B101	Lower								
1st tunable I/F/sb8	B102	Upper		8						
	B102	Lower								
	B103	Upper								
	B103	Lower								
	B104	Upper								
	B104	Lower								
2nd tunable I/Fsb0 'a'	B105	Upper		0						
	B105	Lower								
2nd tunable I/Fsb8 'a'	B106	Upper		8						
	B106	Lower								
	B107	Upper								
	B107	Lower								
	B108	Upper								
	B108	Lower								

Total StBs	**40**
Total Cross-bar Brd	**3**
Total BlBs	**4**

Notes:

1. Contiguous StBs for st-TC routing. Fiber routing not normal/final.
2. Requires Cross-bar Board config from StB for "polarization cross-over".

Phase 3 – Desired – August 1/09

System: 16 ants, 2 pols, 8-bit IQ, 2 tunable I/Fs, 16 sub-bands each										
Notes	**Rack**	**Sub-rack**	**Sub-rack Slot (Ant-Pol) | (sb)**							
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
see Note 1	S001	Upper	1R	2R	3R	4R	1L	2L	3L	4L
	S001	Lower	1Ra	2Ra	3Ra	4Ra	1La	2La	3La	4La
	S002	Upper	5R	6R	7R	8R	5L	6L	7L	8L
	S002	Lower	5Ra	6Ra	7Ra	8Ra	5La	6La	7La	8La
	S003	Upper	9R	10R	11R	12R	9L	10L	11L	12L
	S003	Lower	9Ra	10Ra	11Ra	12Ra	9La	10La	11La	12La
	S004	Upper	13R	14R	15R	16R	13L	14L	15L	16L
	S004	Lower	13Ra	14Ra	15Ra	16Ra	13La	14La	15La	16La
	S005	Upper								
	S005	Lower								
	S006	Upper								
	S006	Lower								
	S007	Upper								
	S007	Lower								
	S008	Upper								
	S008	Lower								
	S001	6U	0+8	1+9	2+10	3+11	4+12	5+13	6+14	7+15
	S002	6U	0+8	1+9	2+10	3+11	4+12	5+13	6+14	7+15
	S003	6U	0+8	1+9	2+10	3+11	4+12	5+13	6+14	7+15
ext-TC into slot 0	S004	6U	0+8	1+9	2+10	3+11	4+12	5+13	6+14	7+15
	S005	6U								
	S006	6U								
	S007	6U								
	S008	6U								
1st tunable I/F/sb0-15	B101	Upper		0		1		2		3
see Note 2	B101	Lower		4		5		6		7
	B102	Upper		8		9		10		11
	B102	Lower		12		13		14		15
	B103	Upper								
	B103	Lower								
	B104	Upper								
	B104	Lower								
2nd tunable I/F/sb0-15 'a'	B105	Upper		0		1		2		3
	B105	Lower		4		5		6		7
	B106	Upper		8		9		10		11
	B106	Lower		12		13		14		15
	B107	Upper								
	B107	Lower								
	B108	Upper								
	B108	Lower								
Total StBs	**64**	Notes:								
Total Cross-bar Brd	**32**	1. Normal fiber routing.								
Total BlBs	**32**	2. 1 BlB does all 4 pol'n products for 16 antennas.								
		3. Requires Cross-bar Board config from StB for "polarization cross-over".								

Phase 4 – Minimum – December 1/09

System: 24 ants, 2 pols, 8-bit IQ, 2 tunable I/Fs, 1 sub-band each										
Notes	**Rack**	**Sub-rack**	**Sub-rack Slot (Ant-Pol) | (sb)**							
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
see Note 1	S001	Upper	1R	2R	3R	4R	1L	2L	3L	4L
	S001	Lower	1Ra	2Ra	3Ra	4Ra	1La	2La	3La	4La
	S002	Upper	5R	6R	7R	8R	5L	6L	7L	8L
	S002	Lower	5Ra	6Ra	7Ra	8Ra	5La	6La	7La	8La
	S003	Upper	9R	10R	11R	12R	9L	10L	11L	12L
	S003	Lower	9Ra	10Ra	11Ra	12Ra	9La	10La	11La	12La
	S004	Upper	13R	14R	15R	16R	13L	14L	15L	16L
	S004	Lower	13Ra	14Ra	15Ra	16Ra	13La	14La	15La	16La
	S005	Upper	17R	18R	19R	20R	17L	18L	19L	20L
	S005	Lower	17Ra	18Ra	19Ra	20Ra	17La	18La	19La	20La
	S006	Upper	21R	22R	23R	24R	21L	22L	23L	24L
	S006	Lower	21Ra	22Ra	23Ra	24Ra	21La	22La	23La	24La
	S007	Upper								
	S007	Lower								
	S008	Upper								
	S008	Lower								
	S001	6U	0+8							
see Note 2	S002	6U	0+8							
	S003	6U	0+8							
ext-TC into slot 0	S004	6U	0+8							
ext-TC in slot 0 optional	S005	6U	0+8							
	S006	6U	0+8							
	S007	6U	0+8							
	S008	6U	0+8							
1st tunable I/F/sb-0	B101	Upper	0	0						
	B101	Lower								
2nd tunable I/F/sb-8 'a'	B102	Upper	8	8						
	B102	Lower								
	B103	Upper								
	B103	Lower								
	B104	Upper								
	B104	Lower								
	B105	Upper								
	B105	Lower								
	B106	Upper								
	B106	Lower								
	B107	Upper								
	B107	Lower								
	B108	Upper								
	B108	Lower								
Total StBs	**96**	Notes:								
Total Cross-bar Brd	**8**	1. Normal fiber routing.								
Total BlBs	**4**	2. 8 Cross-bar Boards are required for st-TC distribution.								
		3. 2 BlB pairs required for a pol'ns, 24 antennas.								
		4. Requires Cross-bar Board config from StB for "polarization cross-over".								

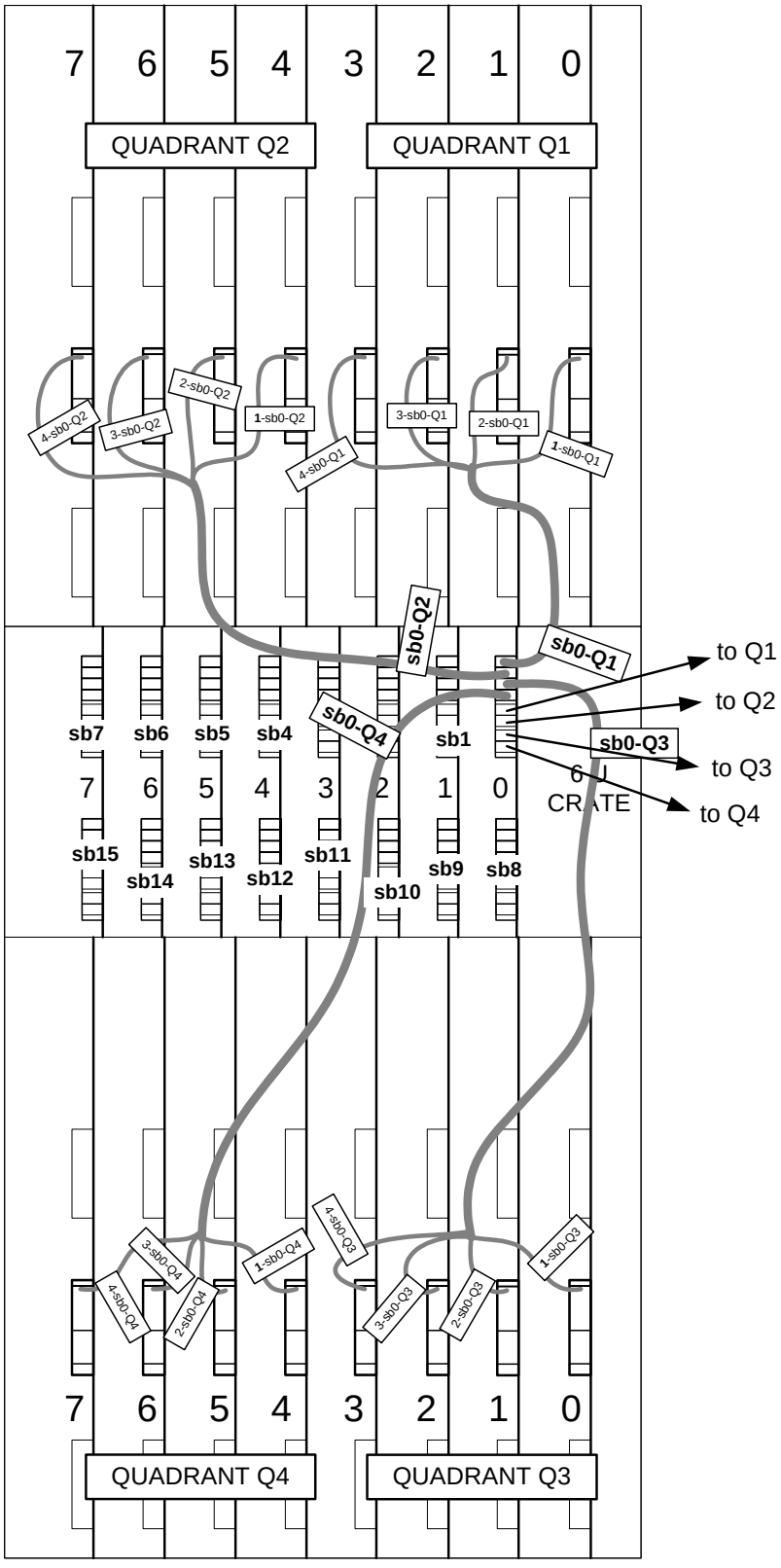
References

For routing of Station Board data to Cross-bar Boards, within Station racks, refer to **A25005N0003 "EVLA Correlator Station Rack Internal Hi-Speed Cable Installation Plan"**. This shows what sub-bands from what Station rack slots route to what Cross-bar Board slots.

For routing of Timecode (ext-TC and st-TC), refer to **A25005N0004 "EVLA Correlator TIMECODE Cable Installation Plan"**, Figure 4-1 and Figure 4-2.

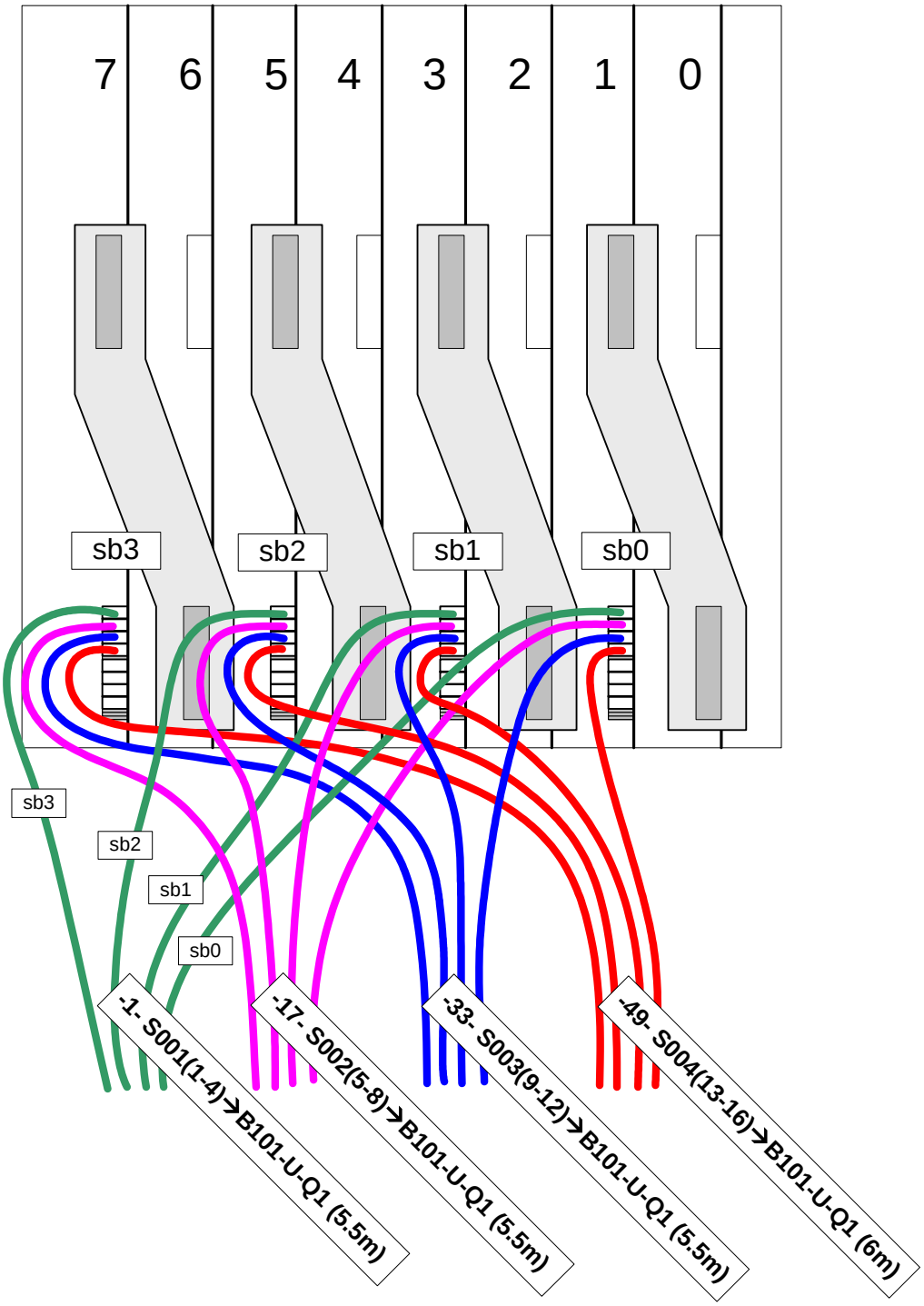
For routing of Cross-bar Board outputs to Baseline rack quadrants, refer to **A25005N0001 "EVLA Correlator Room Station Rack-to-Baseline Rack High-Speed Cable Installation Plan"**. This shows how the outputs of Cross-bar Boards in Station racks are routed to the inputs of Baseline Boards in Baseline racks.

Excerpts from the above documents are included in the following pages for reference.

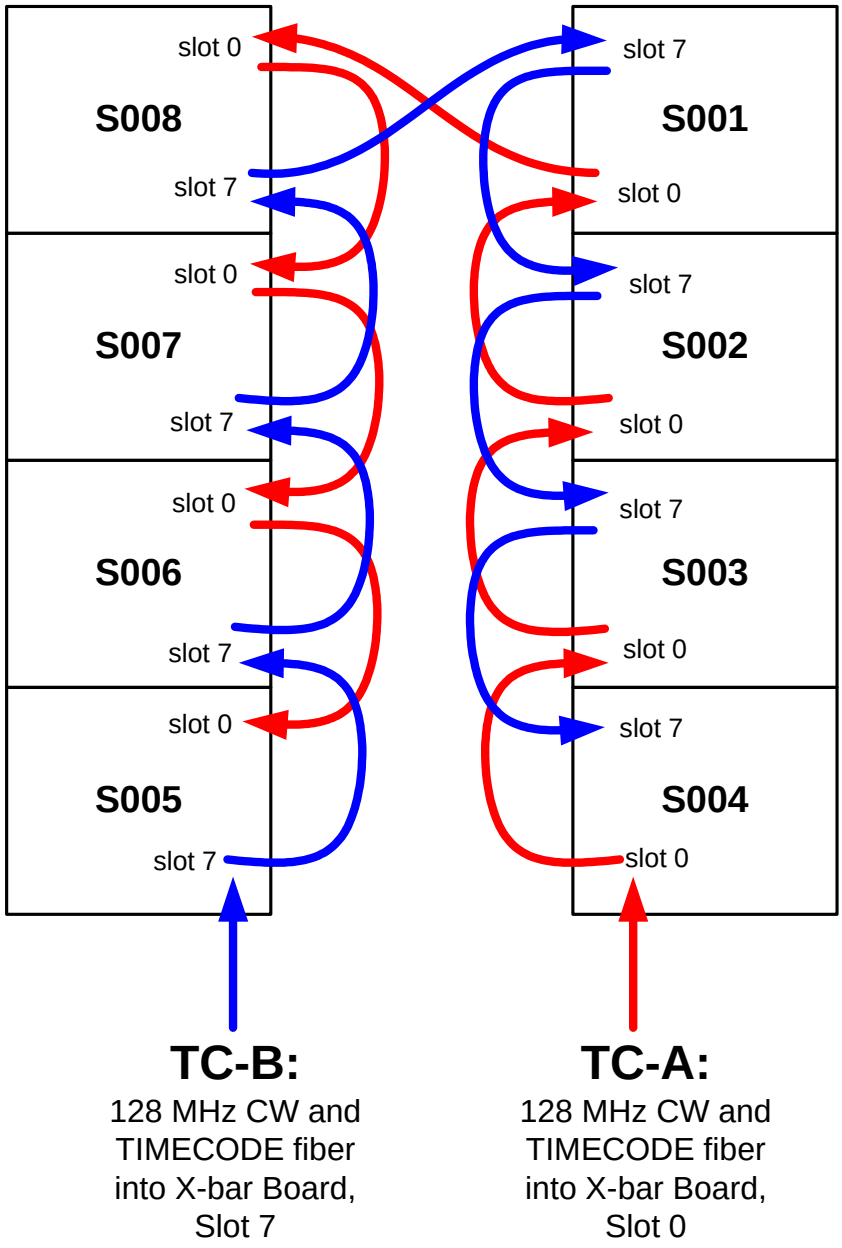


Station Rack wiring detail, showing sub-band 0 and sub-band locations.

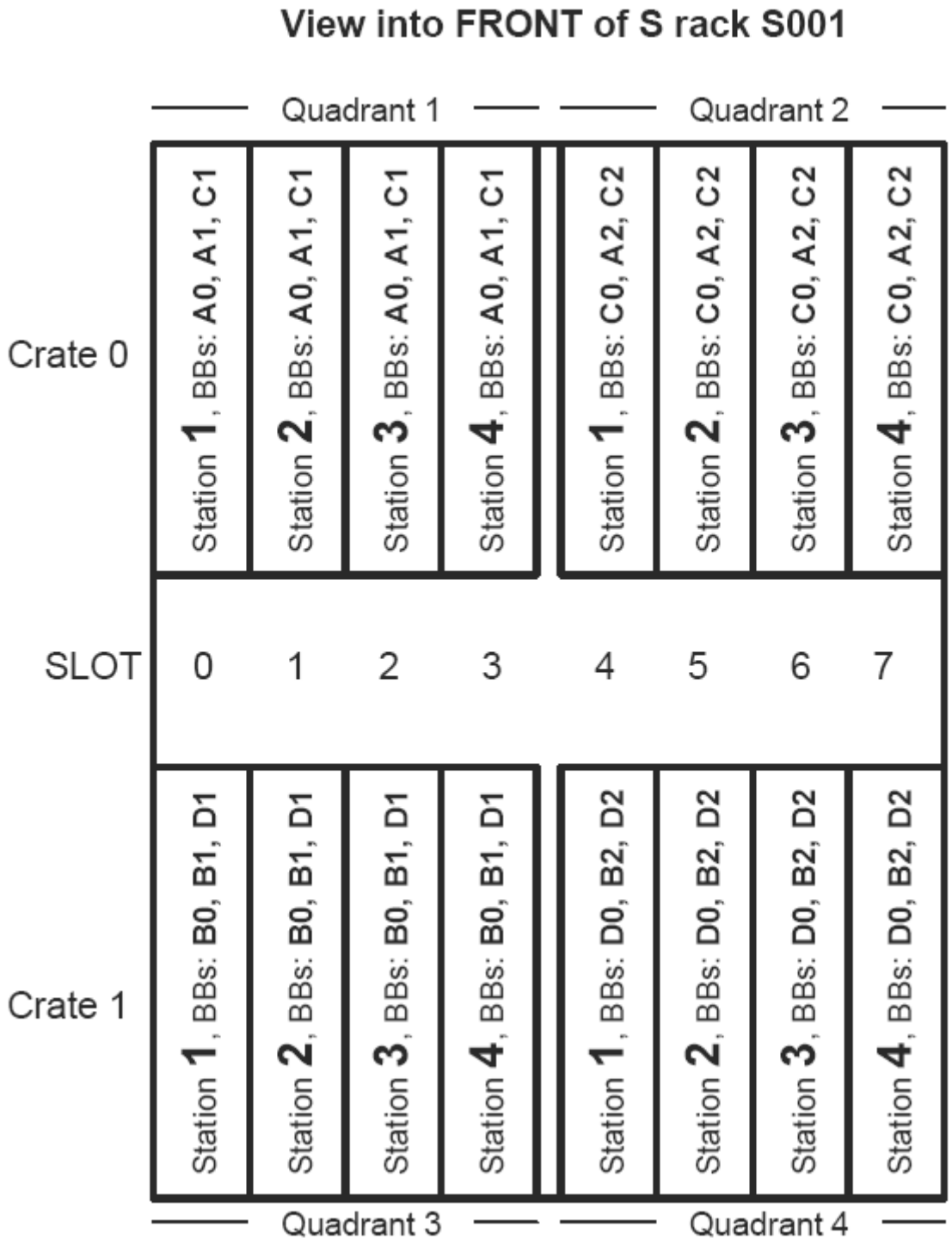
B101:Q1 - Top/Upper Crate:
sb0-3, stations 1-16



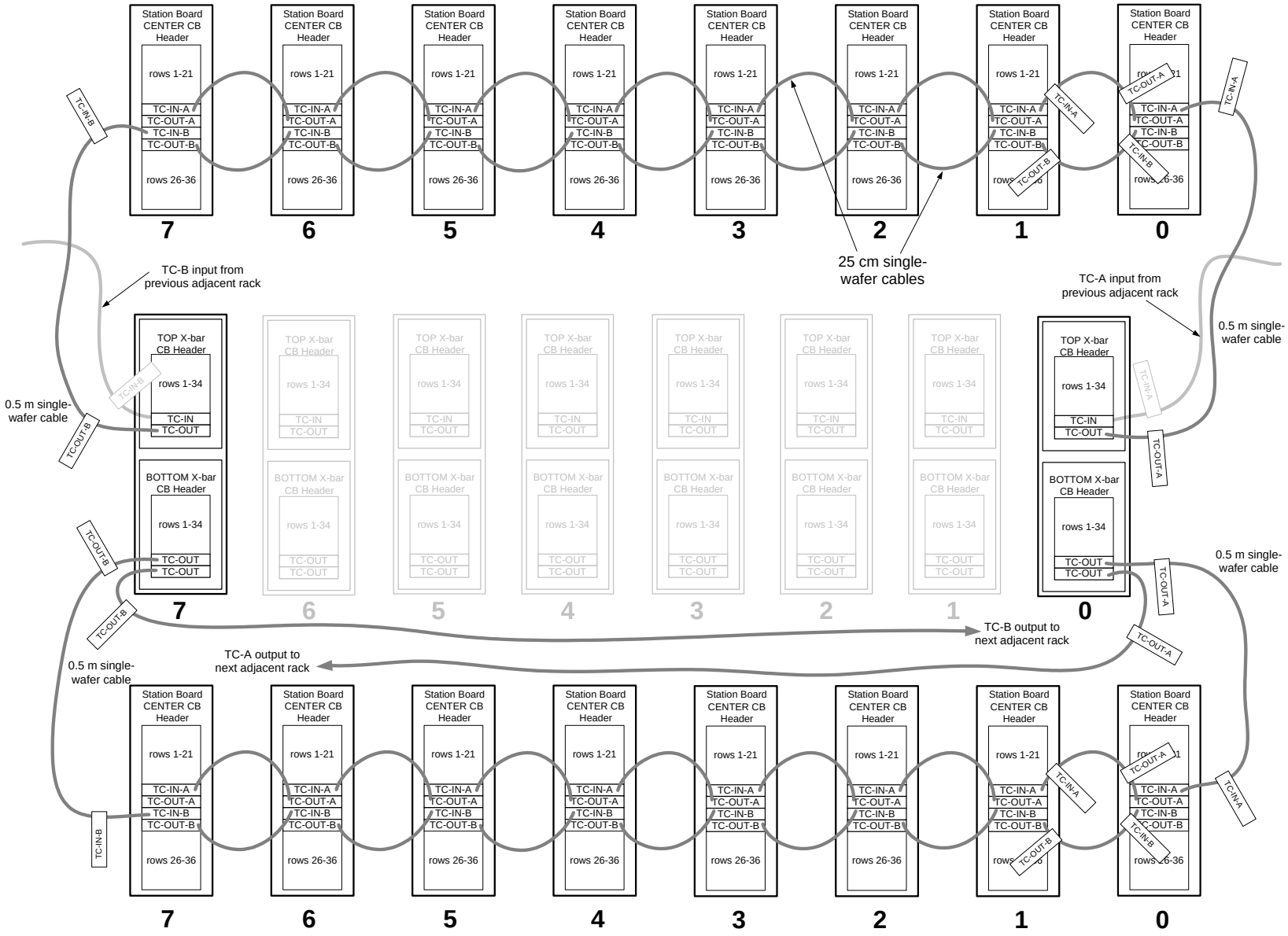
Baseline Rack detail, showing antennas 1-16, sub-bands 0-3 in B101 Q1.



System "st-TC" distribution. TC-A and TC-B are "ext-TC" inputs.



Station Rack S001 front view; standard I/F allocations.



Station Rack st-TC distribution plan detail.