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Expanded Very Large Array

System Installation Plan

B. Carlson

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Outline

- General plan defined in A25005N0002
  - -48 VDC power plant
  - Hi-speed inter-rack cable
  - Correlator racks
  - Overhead cable trays
  - -48 VDC power cabling
  - Overhead Ethernet and PMCS wires
  - Control Racks
  - CBE
  - Production board install, test, commissioning
  - VLBI/Phasing rack install

Section	Description	Expected delivery/ installation	Existing Relevant Document(s)/ Plan(s)	Estimated NRAO Site Personnel (person-days)
3.1	-48 VDC power plant.	Q4-06/Q1-07	A25012N0000	40
3.2	Inter-rack hi-speed cabling (512 cables)	Q2/Q3-07	**A25005N0001**	51
3.3	Correlator racks.	Q4-07/Q1-08	A25017N005	24
3.4	Overhead cable trays.	Q1-08	A25012N0000	10
3.5	Overhead -48 VDC power cabling to correlator racks	Q1-08	A25012N0000	10
3.6	Overhead M&C and Ethernet communications wiring	Q1/Q2-08	D25028M0001	53
3.7	Control Racks	Q1/Q2-08	A25026N0000	5
3.8	Correlator Back End (CBE)	Q2/Q3-08	D25028R0002	20
3.9(a)	Stage 3 production; incremental board install and test.	Q2/Q3-08		
3.9(b)	Stage 4 (full) production; incremental board install and test.	Q1-09		
Total NRAO personnel requirements (person-days)				213

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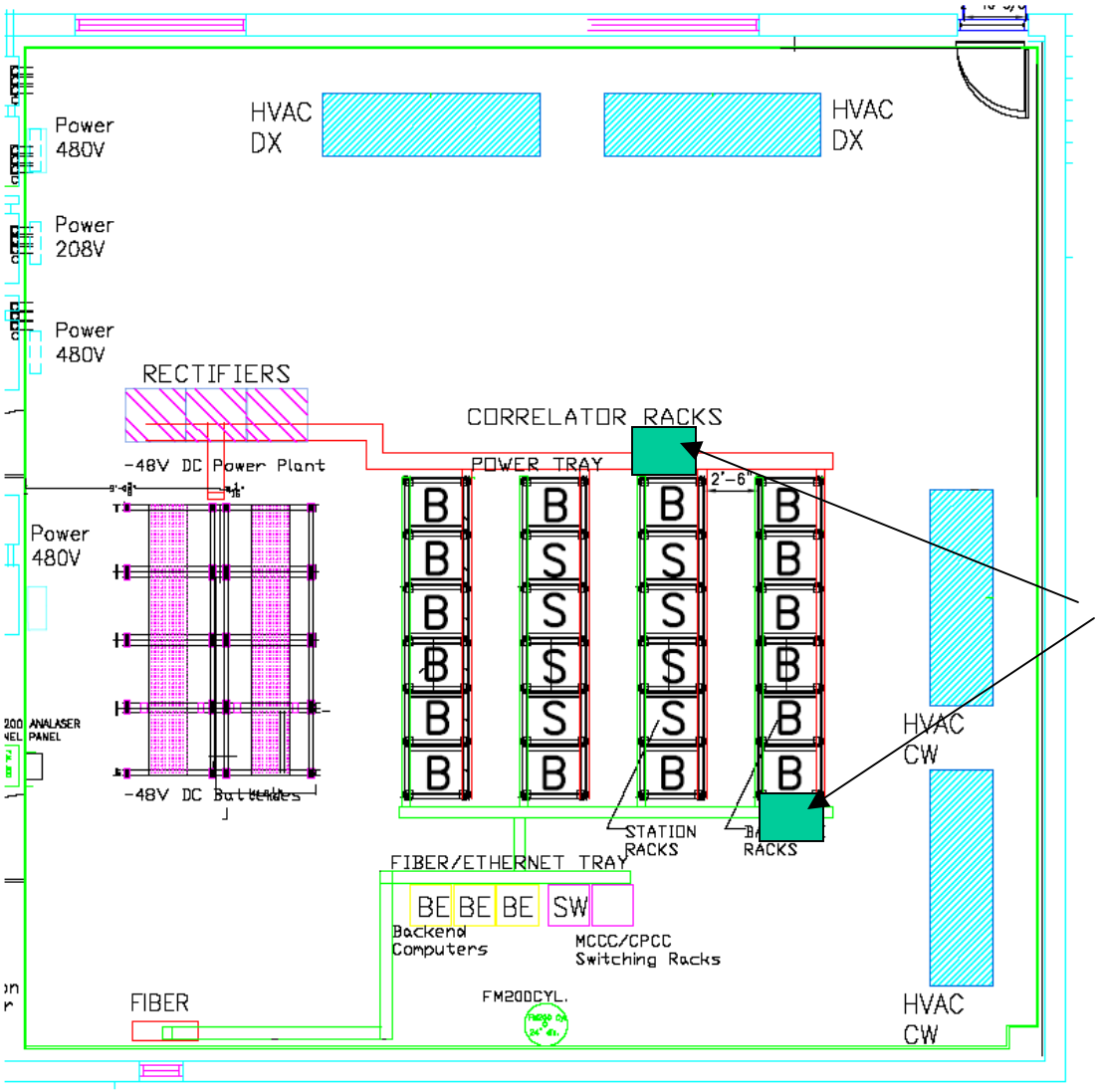
-48 VDC Power Plant

- PWGSC working on getting contract with Emerson signed.
  - Held up due to “federal employment equity” requirements.
  - Have to re-bid with a “directed tender” only to companies that originally bid on it. Some chance it could increase cost, but don’t know.
  - Expect signed contract by end of November…puts delivery at end of February 2007.

- Should begin installation in March 07…but won’t know for sure until contract is signed. **MUST** deliver to site by end of this F.Y. (end of March); $ in this FY budget.

- Install comes complete with 2 weeks consulting/install eng + training.

- Estimate 40 person-days NRAO effort.



Phasing Board rack/VLBI rec equip?

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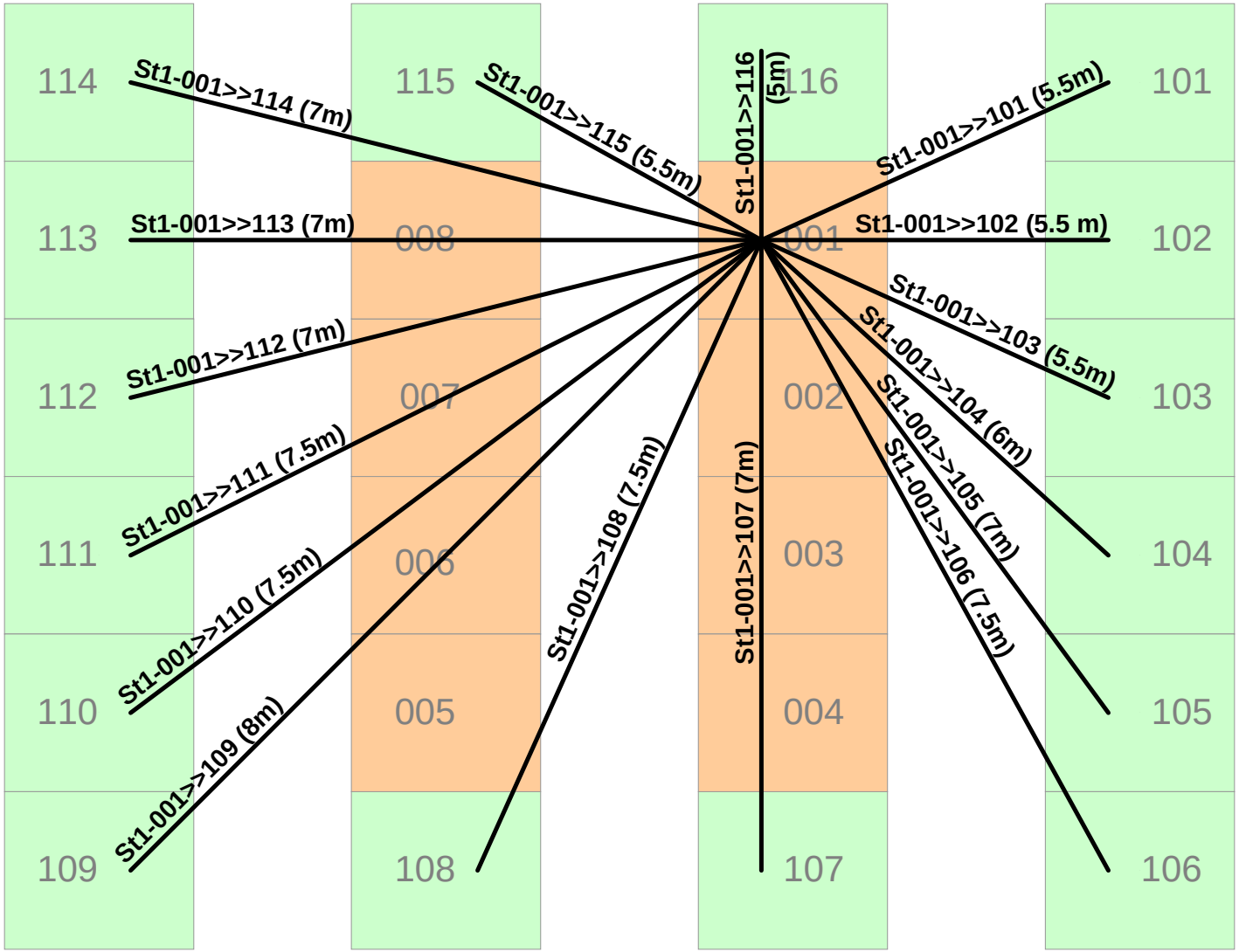
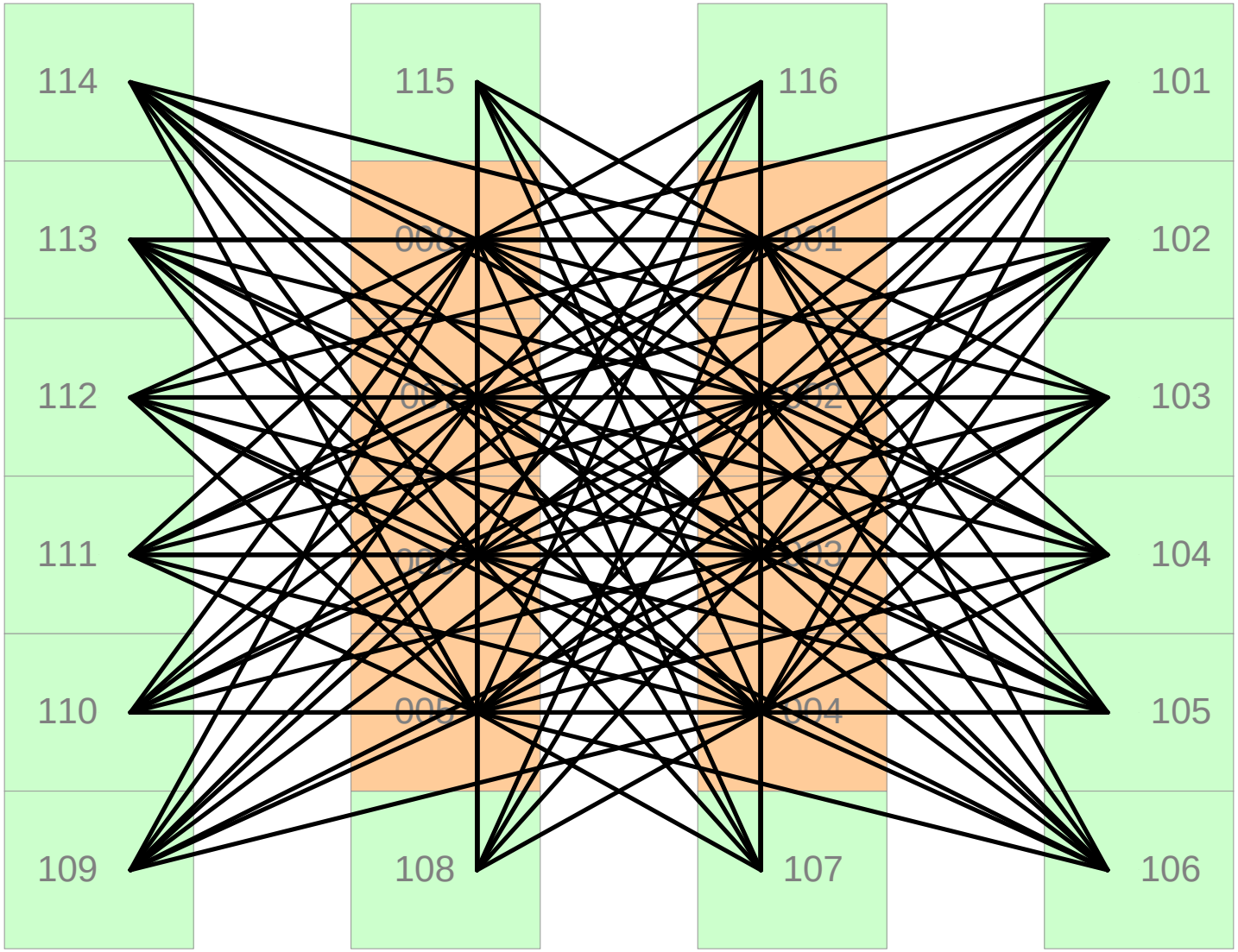
Hi-speed Inter-Rack Cable

- Install before correlator racks arrive.
- Could start install probably Q3-Q4 2007.
  - Requires successful end-to-end test, and production quantity cables.
- Full installation plan available (A25005N0001).
  - 32 pages of 16 cables each…512 cables.
  - Cables will be labeled and kitted in Penticton.
  - Estimate ~51 person-days NRAO effort (~0.5 hr/cable).
  - NRC eng on-site for assistance/consulting, at least initially.
  - May require update, depending on # of Phasing Boards, Phasing Board locations.



1st page of 32


114
115
116
101
113
102
112
103
111
104
110
105
109
108
107
106

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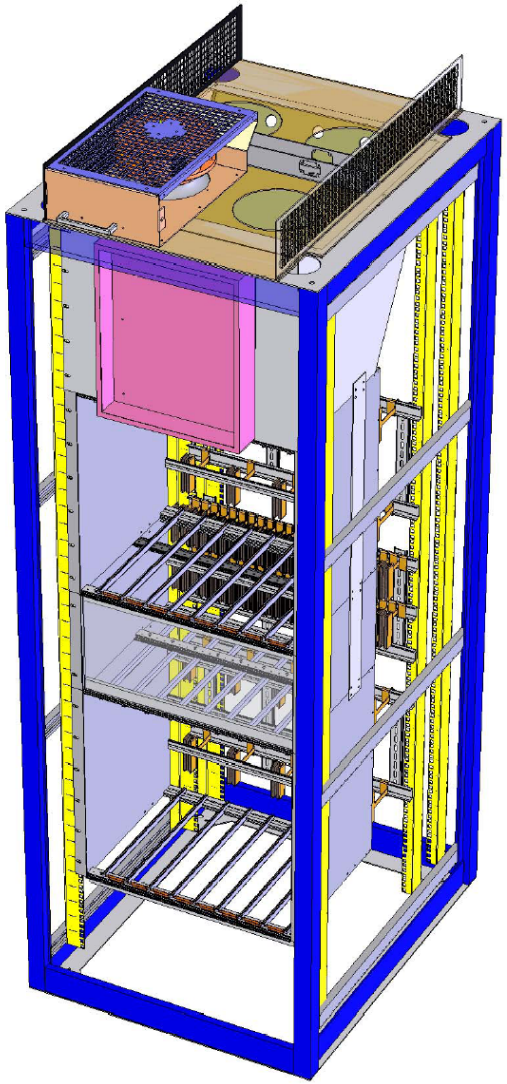
Correlator Racks

- Assembled and fully tested as much as possible in Penticton.

- Installation at the site entails:
  - Move into place.
  - Bolt racks to base and bolt adjacent racks to each other.
  - Bolt into place the fiber demux boxes (maybe in Penticton?).
  - Install Ethernet switches (set into place, connect power, connect internal rack Cat 5E/6 patch cables).
  - Install Meritec HM cables.
  - Add side panels and front doors.
  - Now ready for power, M&C, & communications cable installation.



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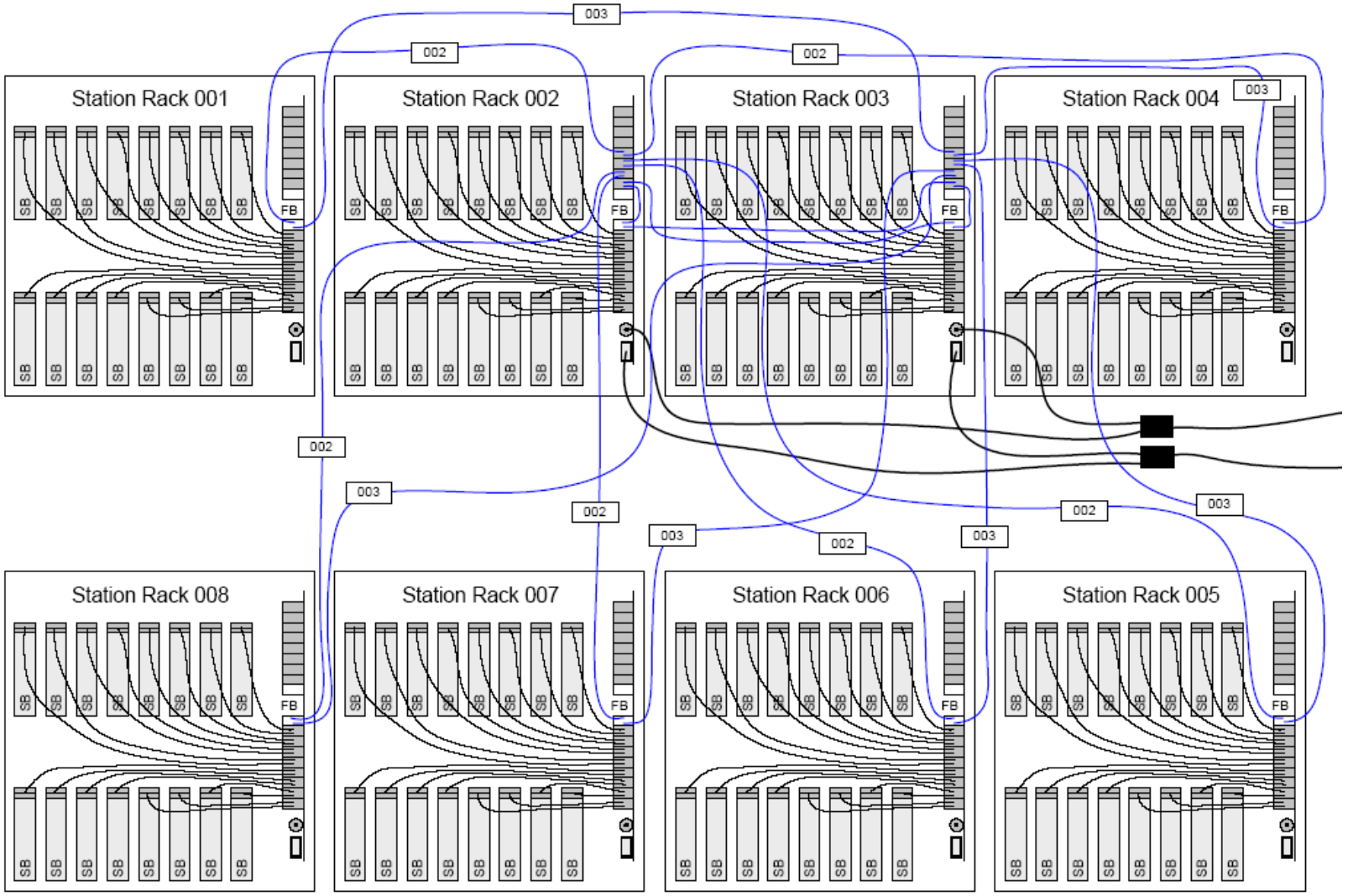
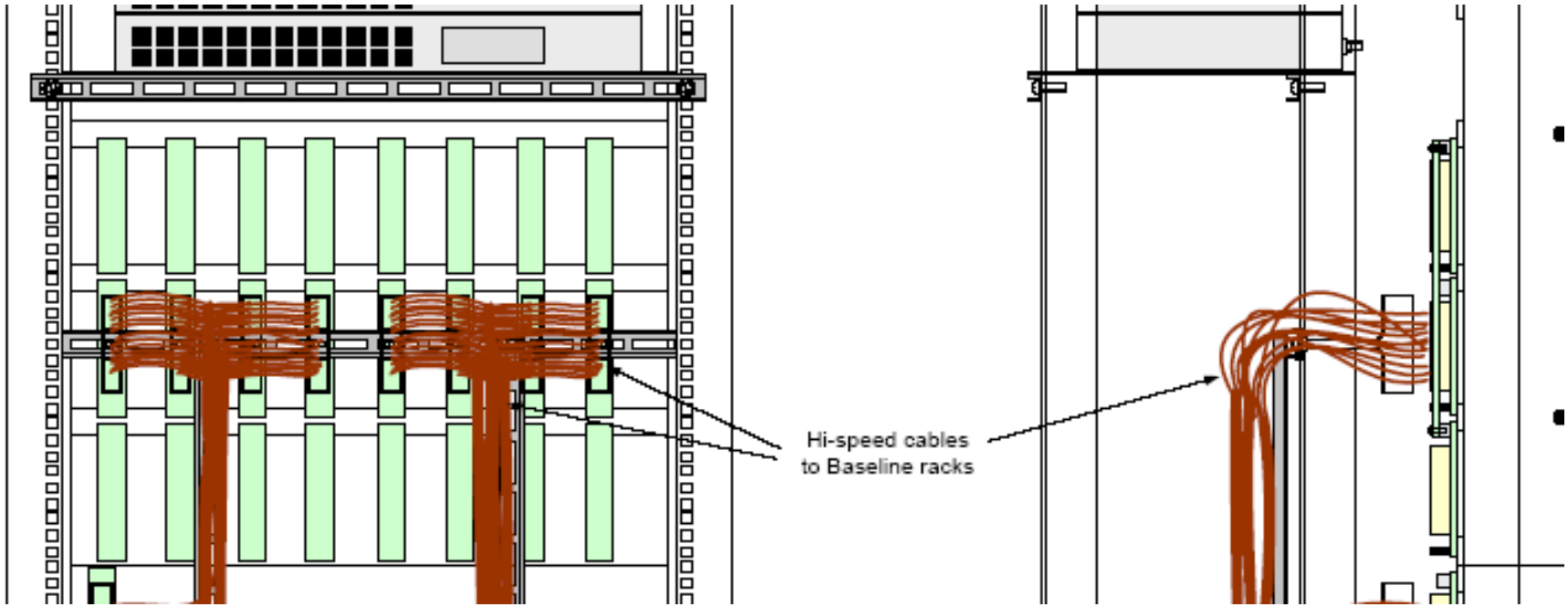
Correlator Racks

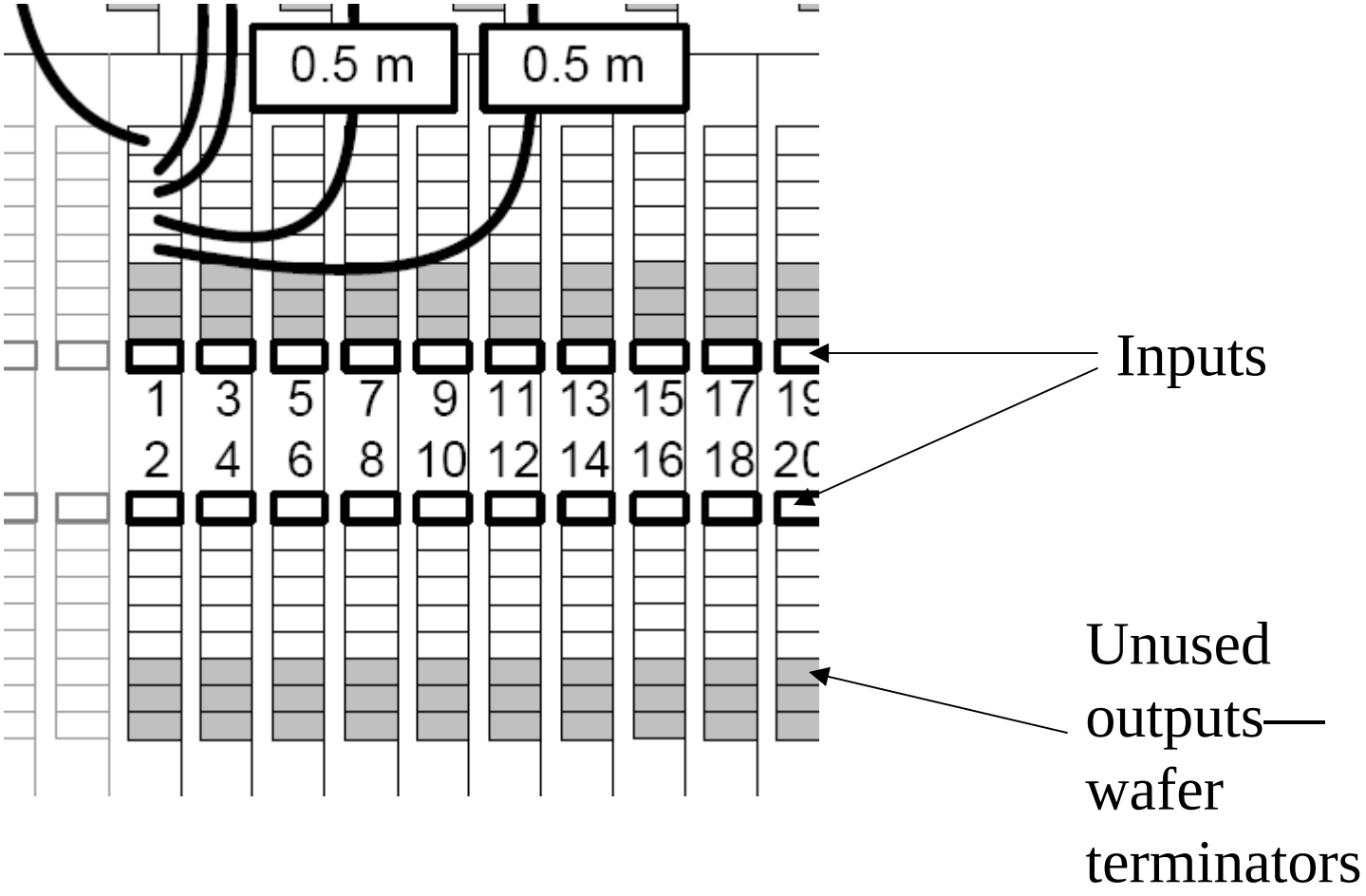
- Install Meritec HM cables…extreme care + patience required!
  - First, install the Timecode distribution cables (A25005N0004).

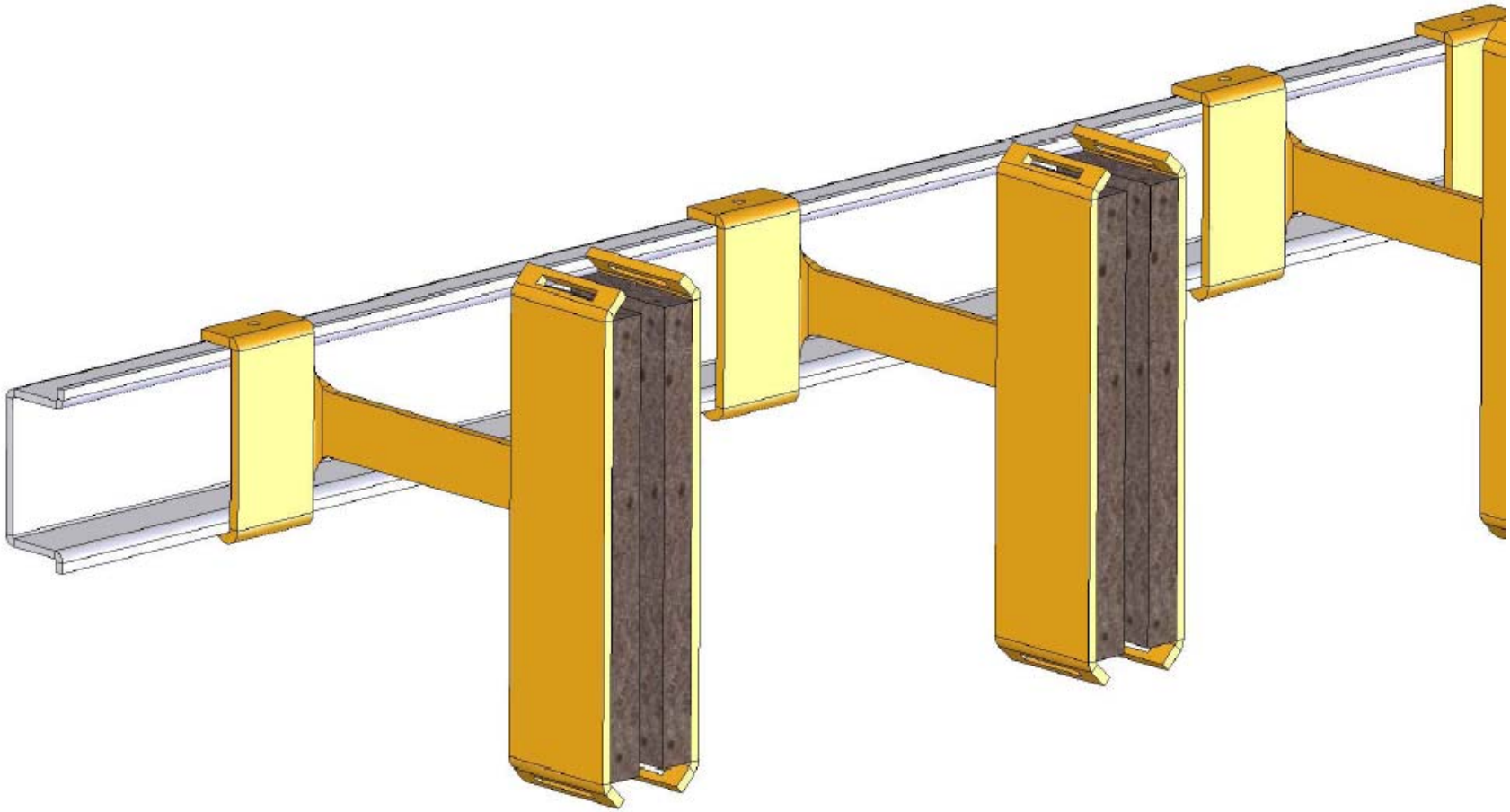
- In Station rack, 4-wafer quads must be separated at cable end…each wafer is pre-labeled and installed in the same row of the middle connector—one wafer to each of the Station Boards in a quad.
  - Delicate connections…Velcro tie-wrap into place, finally secured with the strain relief backshell tie-wrapped into place.

- In Baseline rack, remove backshell tie-wrap, install into Fanout Board Common Backplane inputs.
  - Delicate connections…but wafer quad does not need to be separated.
  - Finally re-tie-wrap the backshell strain relief.


Station Rack 001
Station Rack 002
Station Rack 003
Station Rack 004
Station Rack 008
Station Rack 007
Station Rack 006
Station Rack 005
SB
FB
002
003


Hi-speed cables
to Baseline racks


0.5 m
0.5 m
1 3 5 7 9 11 13 15 17 19
2 4 6 8 10 12 14 16 18 20
Inputs
Unused outputs— wafer terminators



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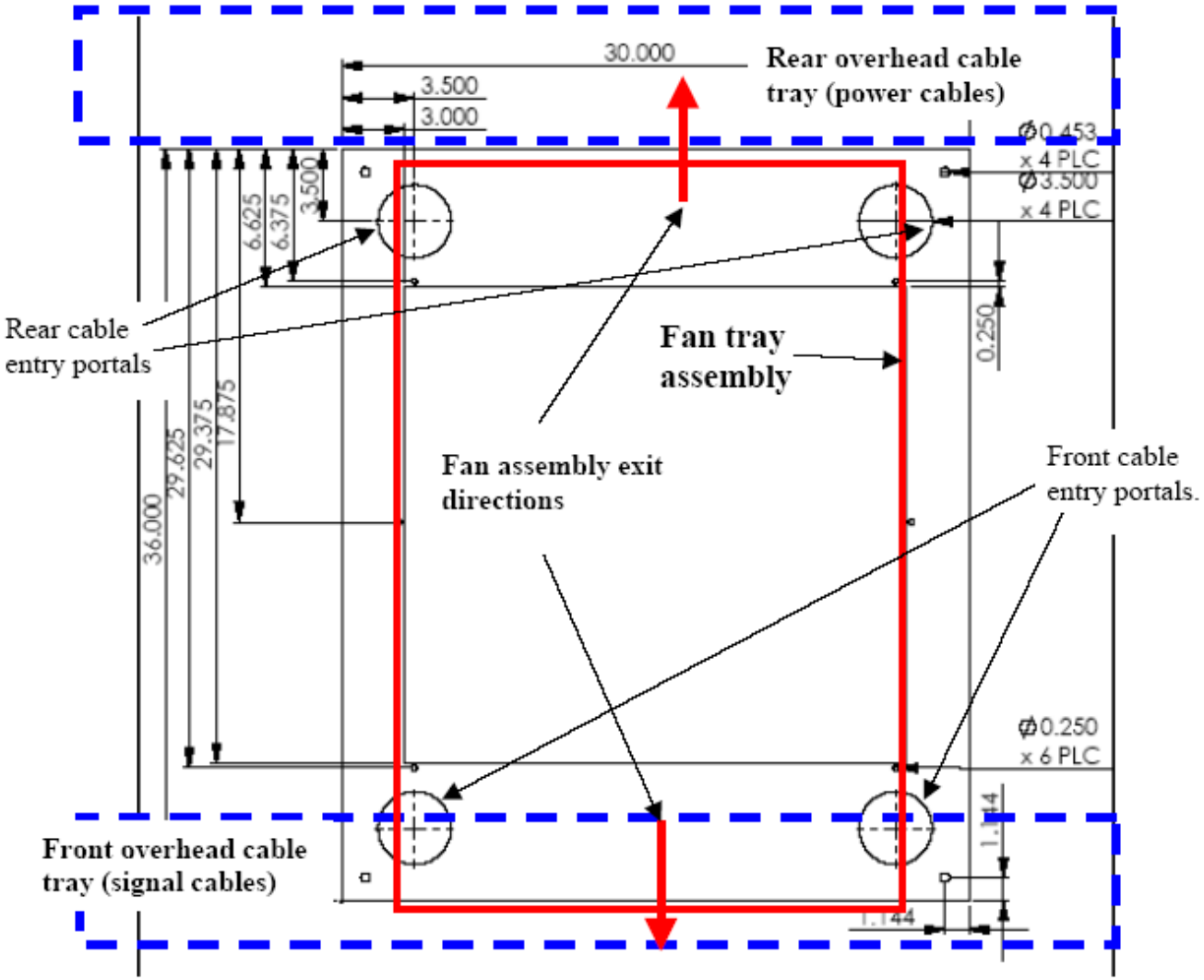
Overhead cable tray installation

- Supported by correlator racks.
- Require one tray running along/above the rear of racks for –48 VDC power cable; one tray running along/above the front of racks for all PMCS and Ethernet cables.
- NRAO responsibility…estimate 10 person days. Hole locations in rack ceiling to support trays.


30.000
Rear overhead cable tray (power cables)
3.500
3.000
Ø0.453 x 4 PLC
Ø3.500 x 4 PLC
6.625
6.375
3.500
Rear cable entry portals
Fan tray assembly
0.250
Fan assembly exit directions
Front cable entry portals.
36.000
29.625
29.375
17.875
Ø0.250 x 6 PLC
Front overhead cable tray (signal cables)
1.144
1.144

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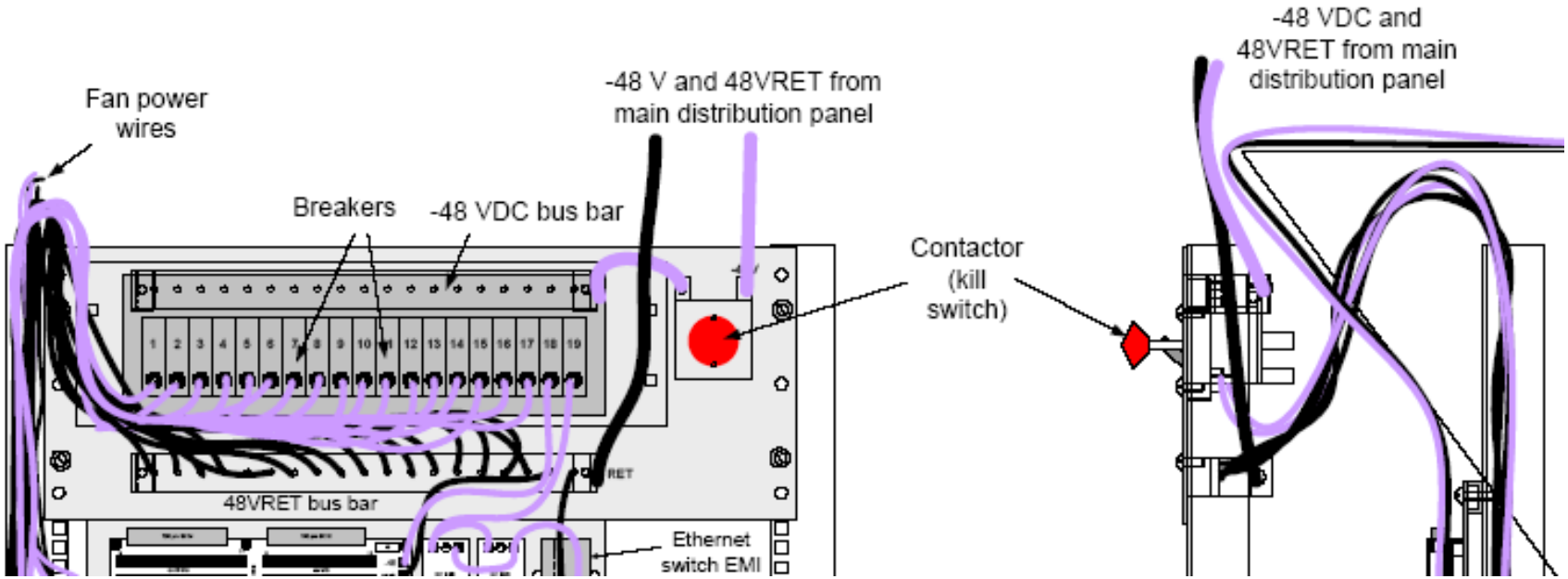
-48 VDC power cabling

- Routes from the power plant breaker panel to each rack.
- Two wires from the breaker panel to each rack.
- Terminate in the rear of the rack at bolting locations in behind the breaker panel.
- Perform polarity check with power applied and rack breakers off.
- NRAO responsibility…estimate 10 person days.


Fan power wires
-48 V and 48VRET from main distribution panel
Breakers
-48 VDC bus bar
Contactor (kill switch)
-48 VDC and 48VRET from main distribution panel
48VRET bus bar
Ethernet switch EMI

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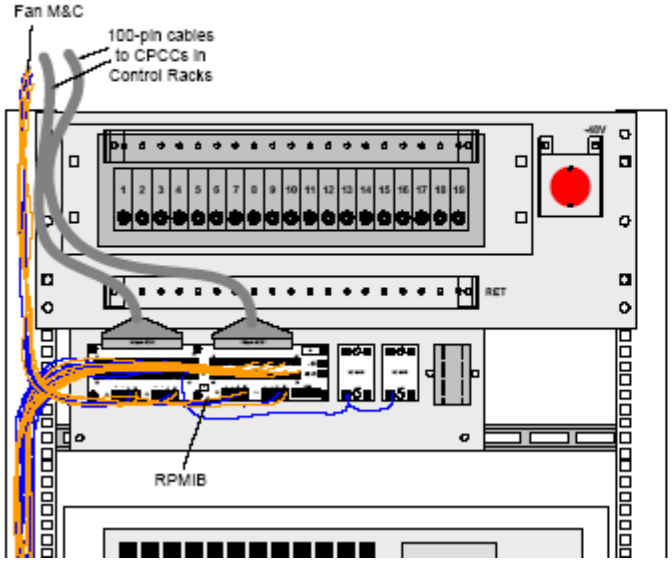
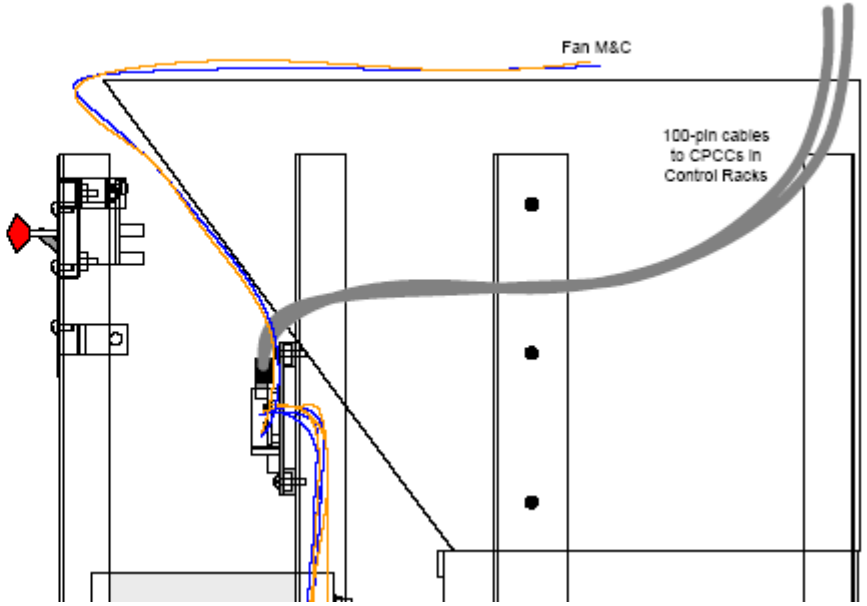
Ethernet and PMCS wires

- Install the 100-pin PMCS cables first.
  - Two cables from each rack to the Control Racks.
  - Cables are custom-built to length. Must feed cables through the top front rack portal to the RPMIB at the back of the rack (don't worry, the connector fits through the hole…I tried it).
  - Secure to the RPMIB mounting panel with tie-wraps.


Fan M&C
100-pin cables
to CPCCs in
Control Racks
RPMIB


Fan M&C
100-pin cables
to CPCCs in
Control Racks

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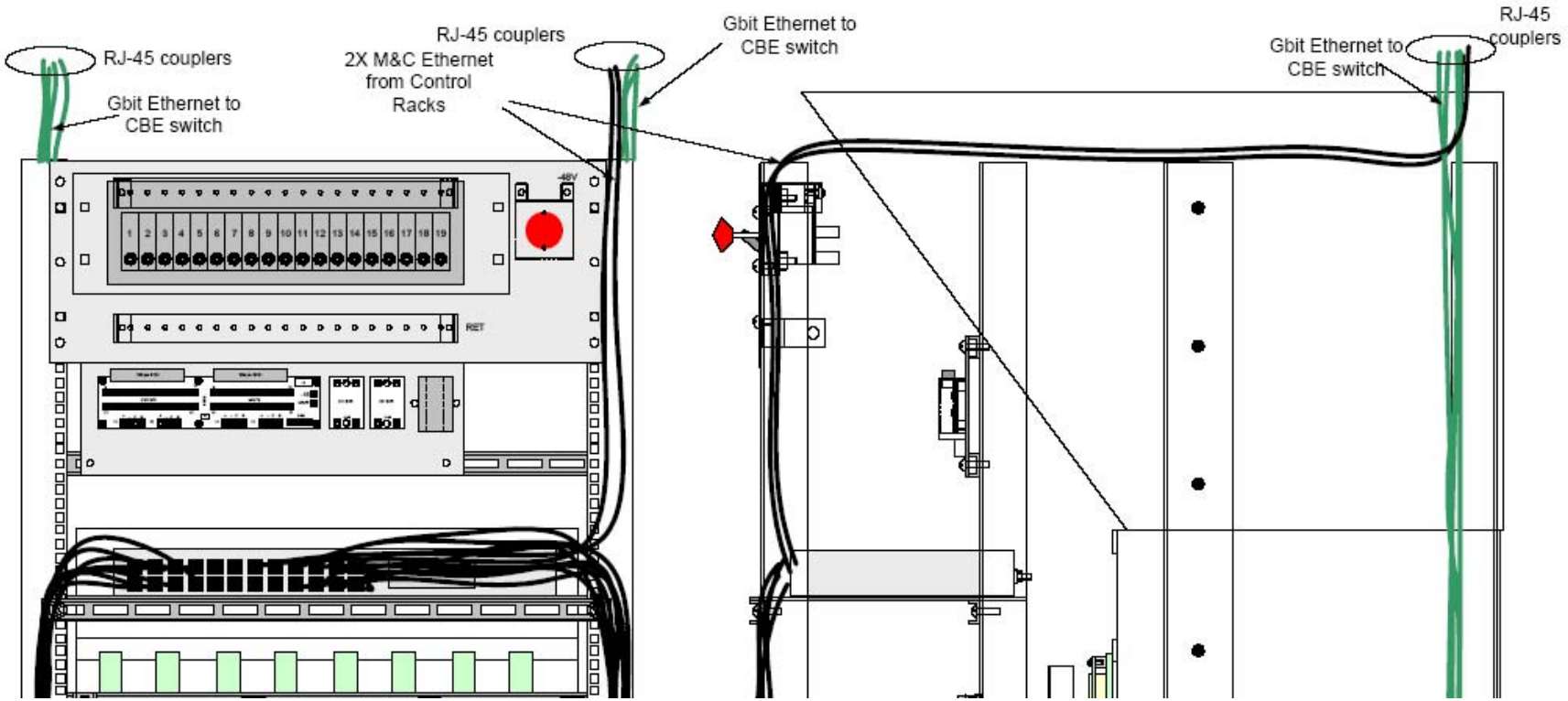
Ethernet and PMCS wires

- Install Ethernet M&C wires next.

- Two Cat 5E/6 patch cables with RJ-45 terminations run from each rack Ethernet switch to the Control Racks (one for each Control Rack's switch).
  - For convenience, all Ethernet cables are broken out at the top of the rack with RJ-45 couplers, so no need to route cable within racks (cable routing within racks is already finished).
  - Cables are cut and ends are crimped on-site.


RJ-45 couplers
Gbit Ethernet to CBE switch
RJ-45 couplers
2X M&C Ethernet from Control Racks
Gbit Ethernet to CBE switch
Gbit Ethernet to CBE switch
RJ-45 couplers

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Ethernet and PMCS wires

- Install Cat 5E/6 patch cable from the Baseline racks (one for each Baseline Board) to the CBE racks.
  - Cut and crimp on site…leave adequate length for connections to any points within CBE racks for possible CBE configuration changes in the future.
  - All connection broken out at the top of the rack with RJ-45 couplers, so no need for routing within rack.
  - 160 cables in total.

- Total Ethernet and PMCS NRAO wiring effort, estimate 53 person days (1 hour per cable).

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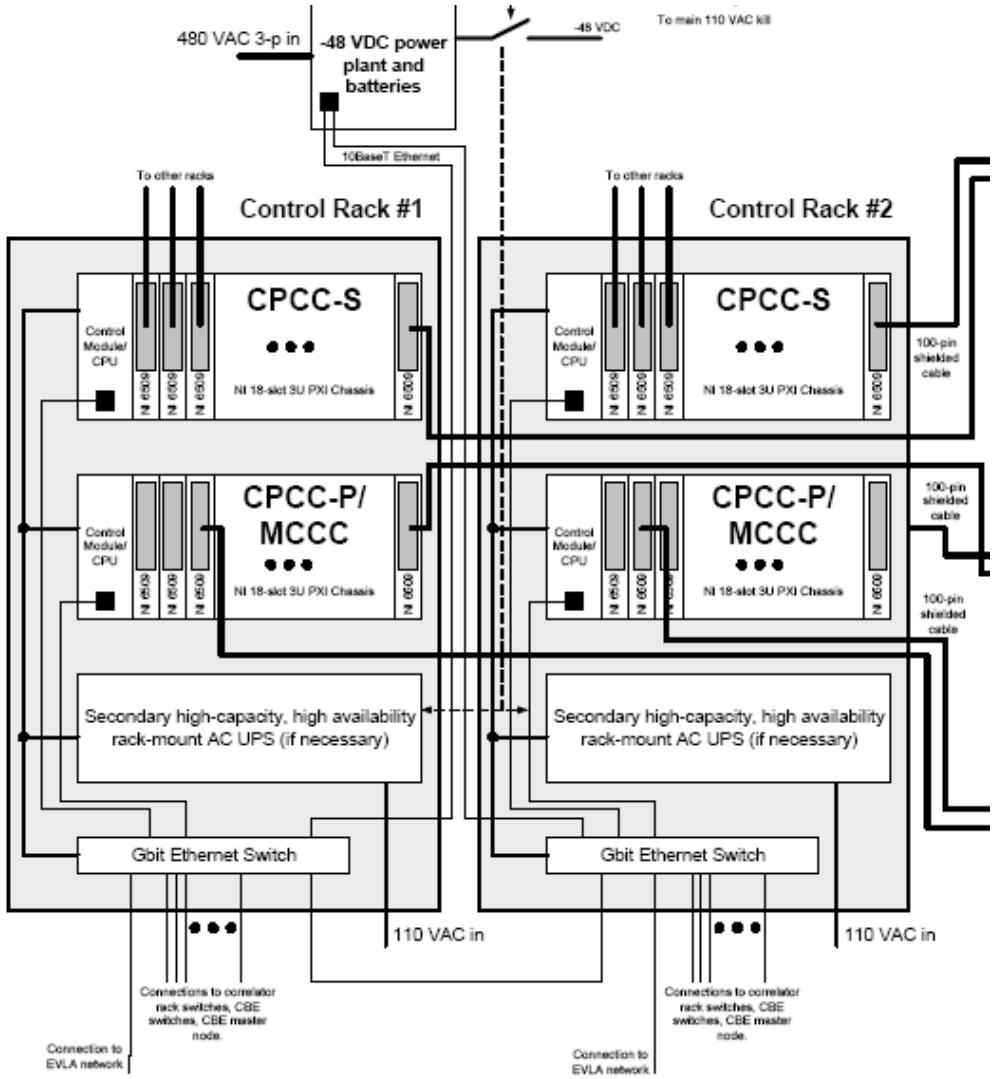
Control Racks

- Each rack configuration/content is the same. 19” COTS racks (2 racks).
- Install 2 rack-mount PCs c/w NI=6509 cards in each one. Install 48-port GigE switch in each one.
- Wire and connect 110 VAC power (+rack UPS if required), connect M&C Ethernet cables, connect to NRAO network, connect PMCS 100-pin cables, connect Ethernet cables to –48 VDC power plant.
- RPMIB mounted in each rack could be used for HVAC and aux control if required.
- Estimate total NRAO effort ~5 days.


490 VAC 3-p in
-48 VDC power plant and batteries
-48 VDC
To main 110 VAC kill
10BaseT Ethernet
To other racks
Control Rack #1
To other racks
Control Rack #2
CPCC-S
Control Module/ CPU
NI 18-slot 3U PXI Chassis
100-pin shielded cable
CPCC-P/ MCCC
Secondary high-capacity, high availability rack-mount AC UPS (if necessary)
Gbit Ethernet Switch
110 VAC in
Connections to correlator rack switches, CBE switches, CBE master node.
Connection to EVLA network

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CBE Install

- Install 19” racks, computers, switches. All components are COTS…may spec and purchase entire CBE as a complete system rather than piecemeal.
  - Blade crates require 208 VAC power, so likely that both 208 VAC and 110 VAC are required.
- Install GigE Ethernet cables from Baseline racks into switches, and from switches to FF/Archive.
  - Mapping plan required once final CBE configuration determined…each BB needs to be told where (MAC+IP) its supposed to send its data packets.
- Estimate ~20 person-days NRAO effort.

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Production board install+test

- Incrementally install and test correlator modules.
  - Any Baseline rack's open Baseline Board slots require installation of the Terminator Board to properly terminate the hi-speed signals.
  - The number of Terminator Boards determines limitations in the flexibility of incremental install+test. BEST is to get one complete Baseline rack going at a time.

- "Stage 3" production boards (16 SBs, 16 BBs) likely available several months in advance of full production.
  - One BB in each Baseline rack requires 288 Terminator Boards…we'll make ~20, enough to completely terminate one Baseline rack.
  - Means that 1 sub-band correlator will be completely brought up at a time.

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VLBI rack install

- Separate 19” rack containing at least one CompactPCI sub-rack c/w at least one Phasing Board and CPU.
- Required to synchronize signals from multiple Phasing Boards, perform sub-sub-band filtering, format data for VSI-H output and/or 10 GigE via XPAK XAUI.
- Could contain other phased-array processing equipment:
  - VLBI recorder.
  - Pulsar Backend.
  - Dedicated Baseline Board for phased-array autocorrelations.