

# ProtoDUNE and DUNE APA Wire Mapping Update

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DUNE Electronics Review

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# Signal paths from Head Boards to CE channels are Unchanged

- Head board ID (wire plane and stack position)
- Solder pad (1 thru 48 for X, 1 thru 40 for U & V)
- CR board input pin (one of 128)
- CR Board output connector & pin
- Adapter board: input and output pins
- CE board input connector and pin
- CE channel

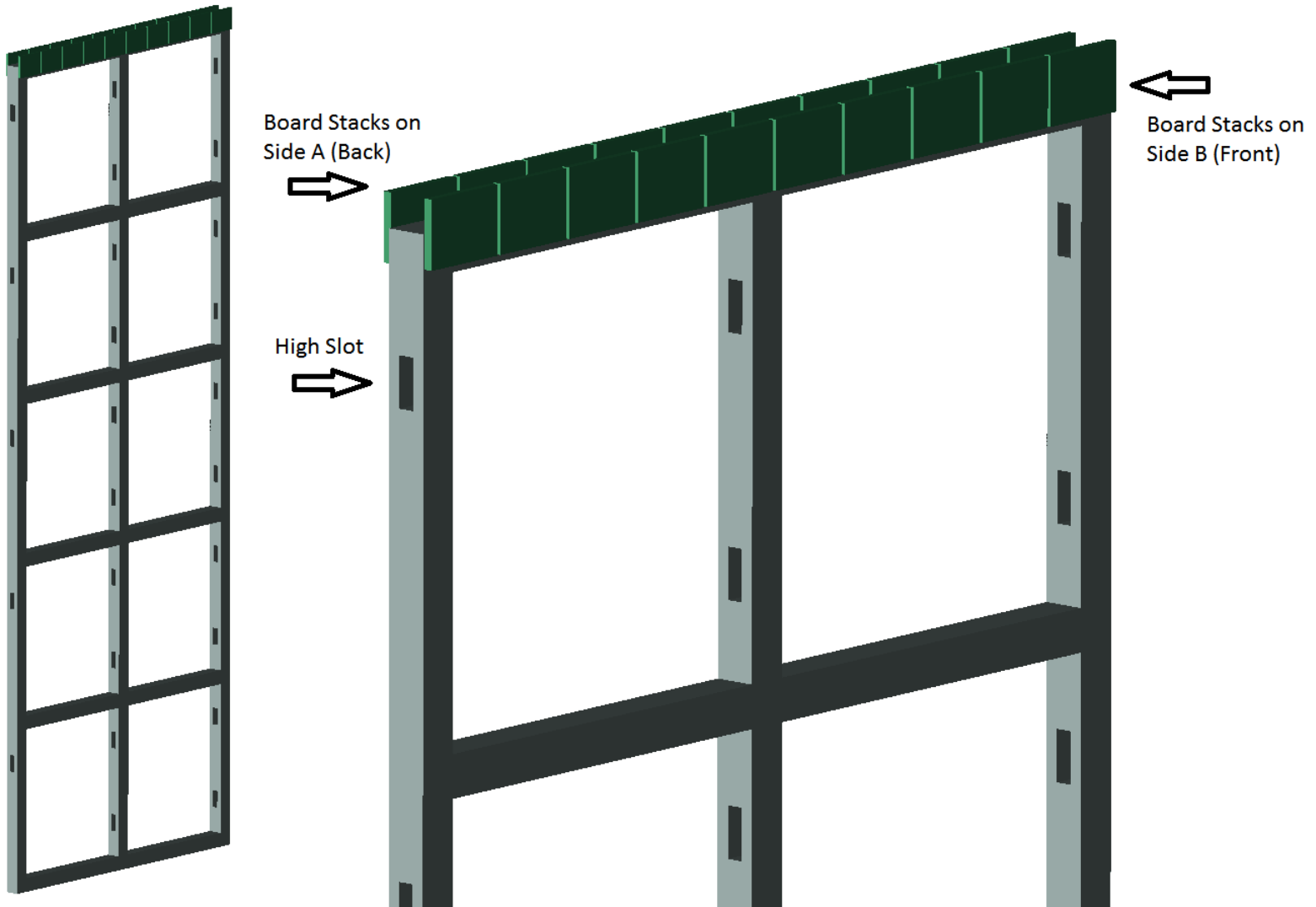
# PSL has completed a spreadsheet linking APA wire segments to CE channels

- Wire Segment names, embedded therein:
  - Head Board Stack number (1 through 20)
  - Wire layer (U, V, or X)
  - Solder Pad number (1 thru 40 or 1 thru 48)
  - Which of up to three segments (A, B, or C)
- X-Y-Z Coordinates of wire endpoints

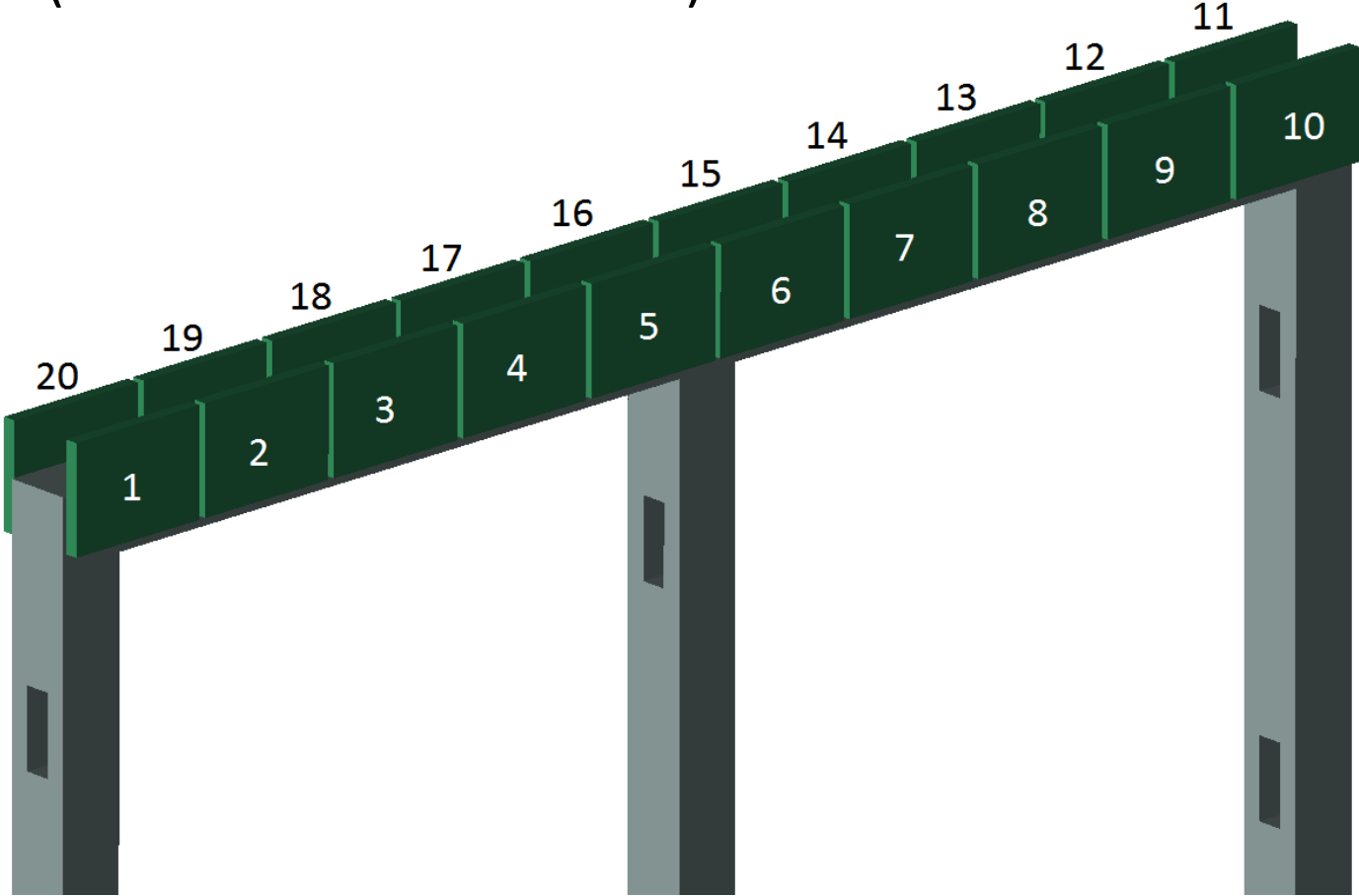
# Spreadsheet for wire segment mapping

	A	B	C	D	E	F	G	H	I	J
1	G Layer				Start		Finish			
2		Board	Pad	Segment position on wire	X	Y	X	Y	Segment number	Front/Back
3		1	1	A	-1150.000	5984.271	-1150.000	-10.050	1	Front
4		1	2	A	-1145.208	5984.271	-1145.208	-10.050	2	Front
5		1	3	A	-1140.417	5984.271	-1140.417	-10.050	3	Front
6		1	4	A	-1135.625	5984.271	-1135.625	-10.050	4	Front
7		1	5	A	-1130.833	5984.271	-1130.833	-10.050	5	Front
8		1	6	A	-1126.042	5984.271	-1126.042	-10.050	6	Front
9		1	7	A	-1121.250	5984.271	-1121.250	-10.050	7	Front
10		1	8	A	-1116.458	5984.271	-1116.458	-10.050	8	Front
11		1	9	A	-1111.667	5984.271	-1111.667	-10.050	9	Front
12		1	10	A	-1106.875	5984.271	-1106.875	-10.050	10	Front
13		1	11	A	-1102.083	5984.271	-1102.083	-10.050	11	Front
14		1	12	A	-1097.292	5984.271	-1097.292	-10.050	12	Front
15		1	13	A	-1092.500	5984.271	-1092.500	-10.050	13	Front
16		1	14	A	-1087.708	5984.271	-1087.708	-10.050	14	Front
17		1	15	A	-1082.917	5984.271	-1082.917	-10.050	15	Front
18		1	16	A	-1078.125	5984.271	-1078.125	-10.050	16	Front

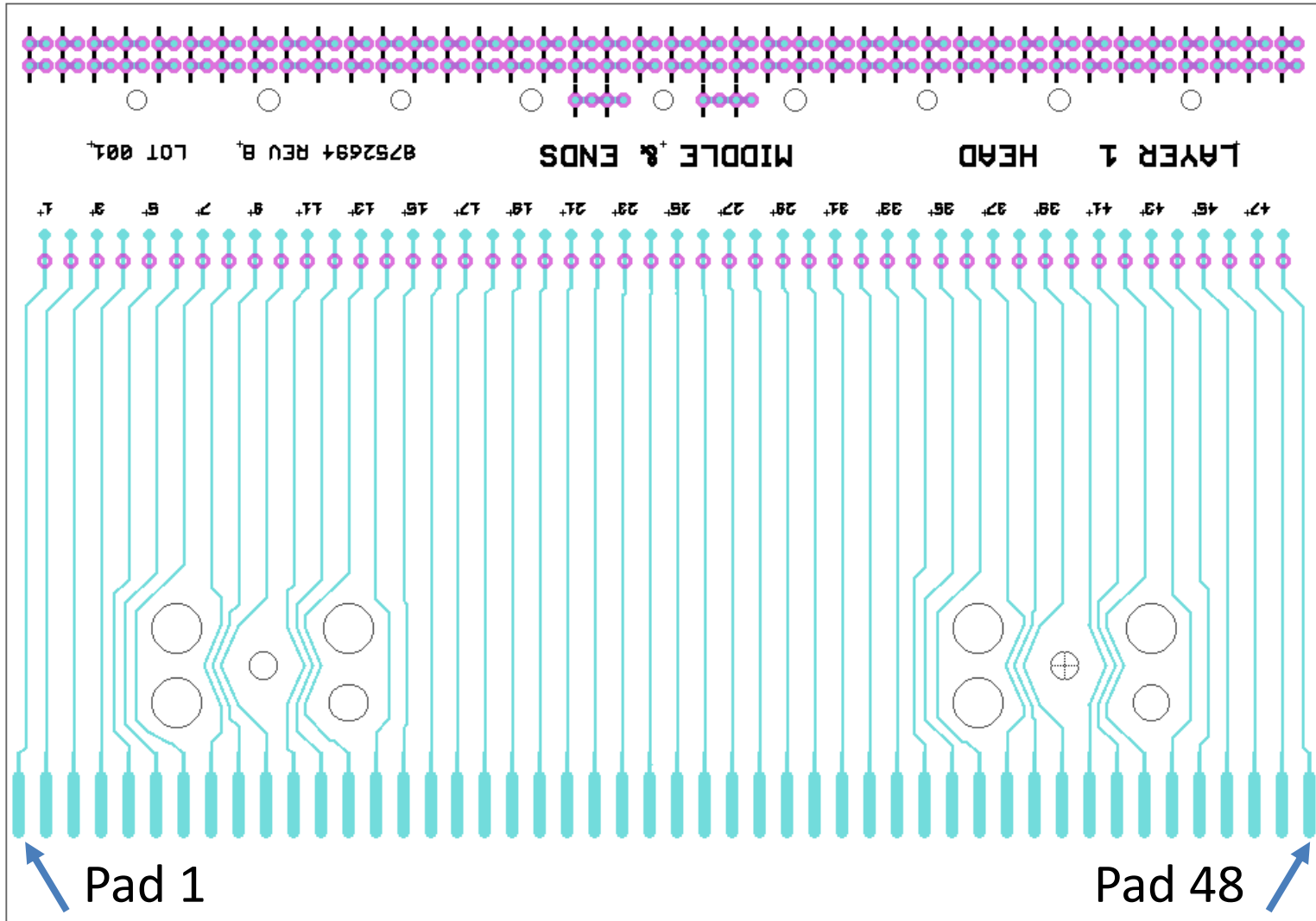
# Board Stack identification



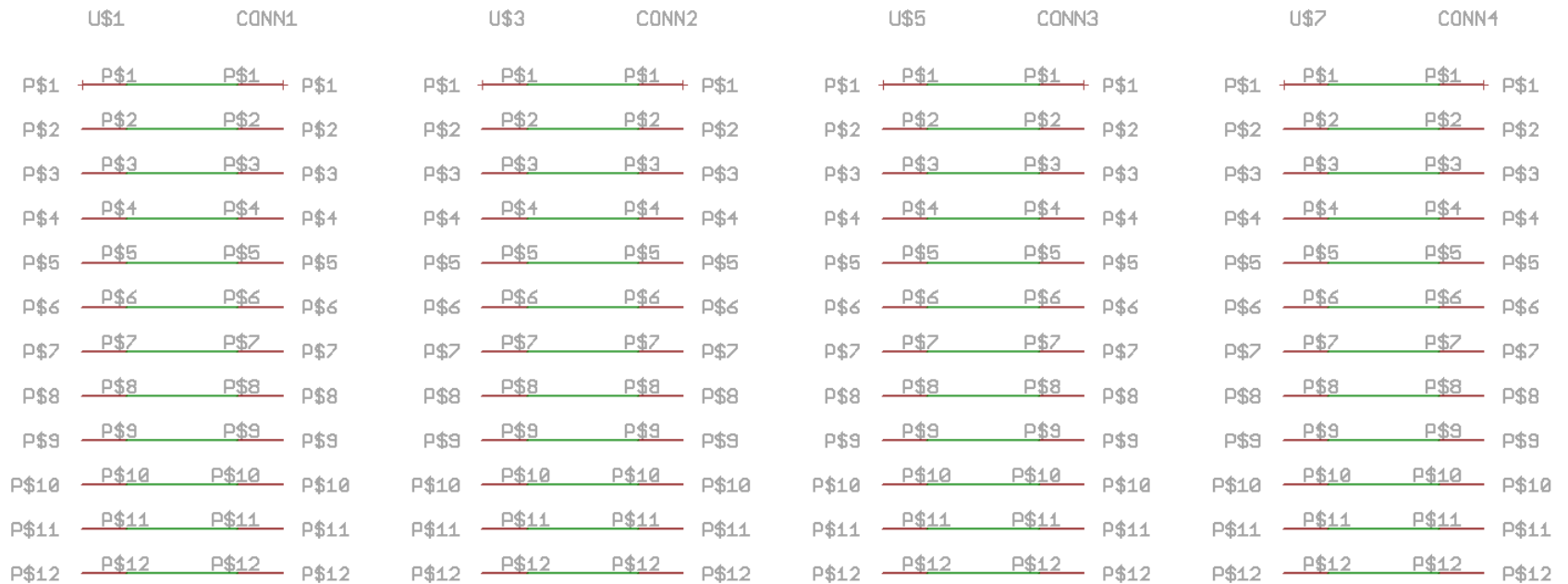
Board Stack numbering  
(Front view = Side B view)



# Wires are traceable to pins on the CR board

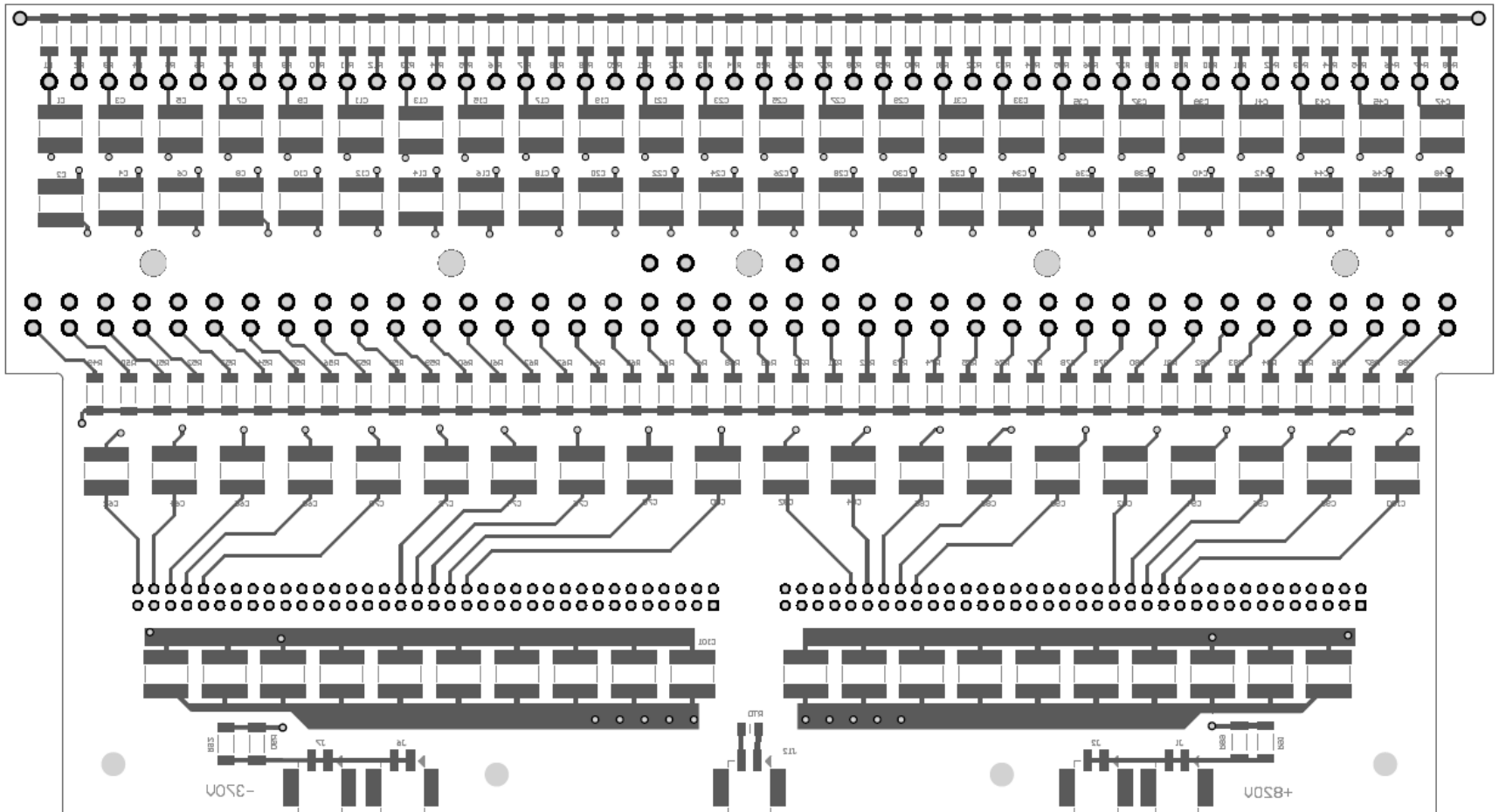


# Head board schematic shows connections from pads to pins

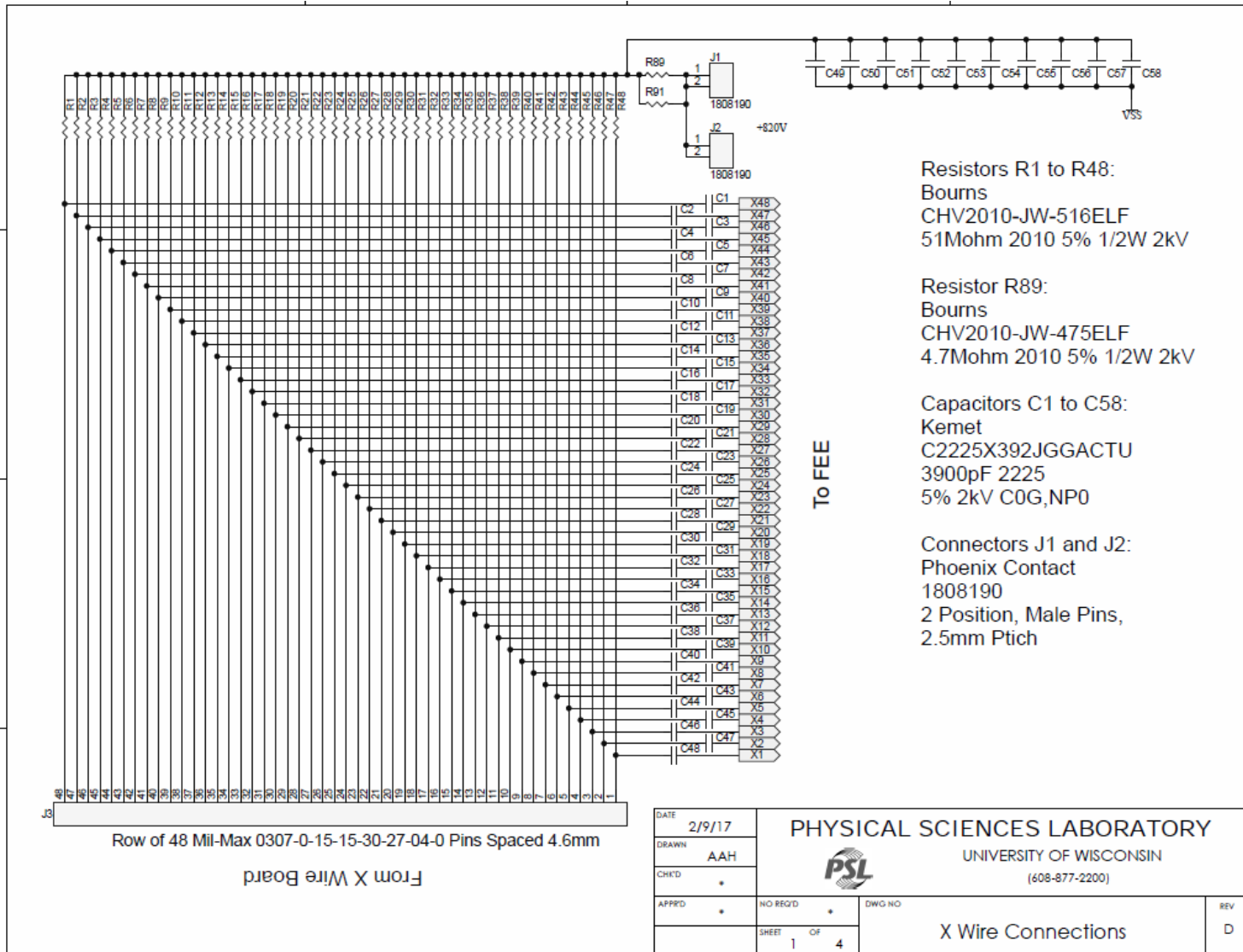




# CR boards: connecting Head Boards to Adapter Boards

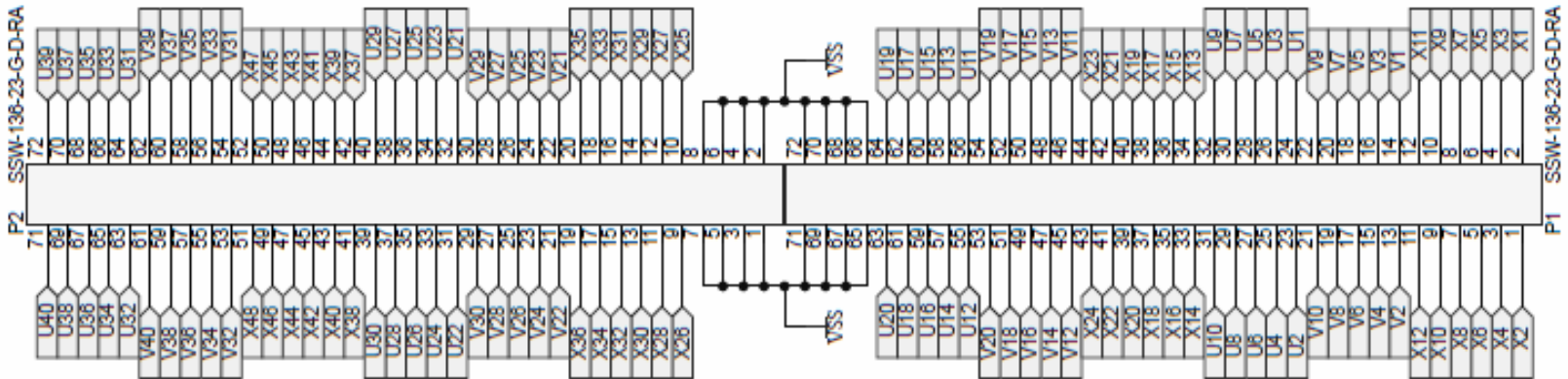


# CR board schematic indicates signal paths from Wire Boards to Adapter Boards

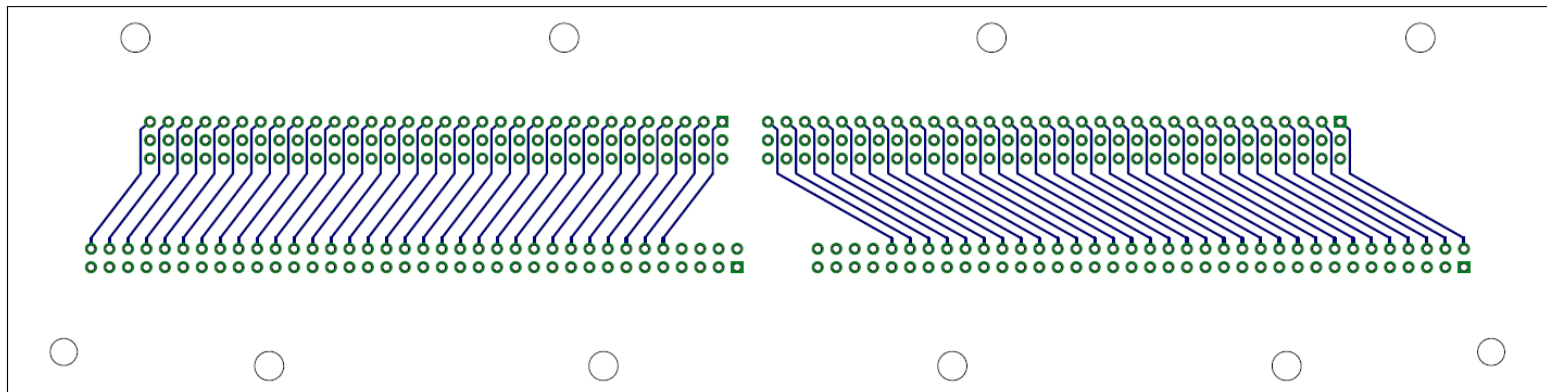
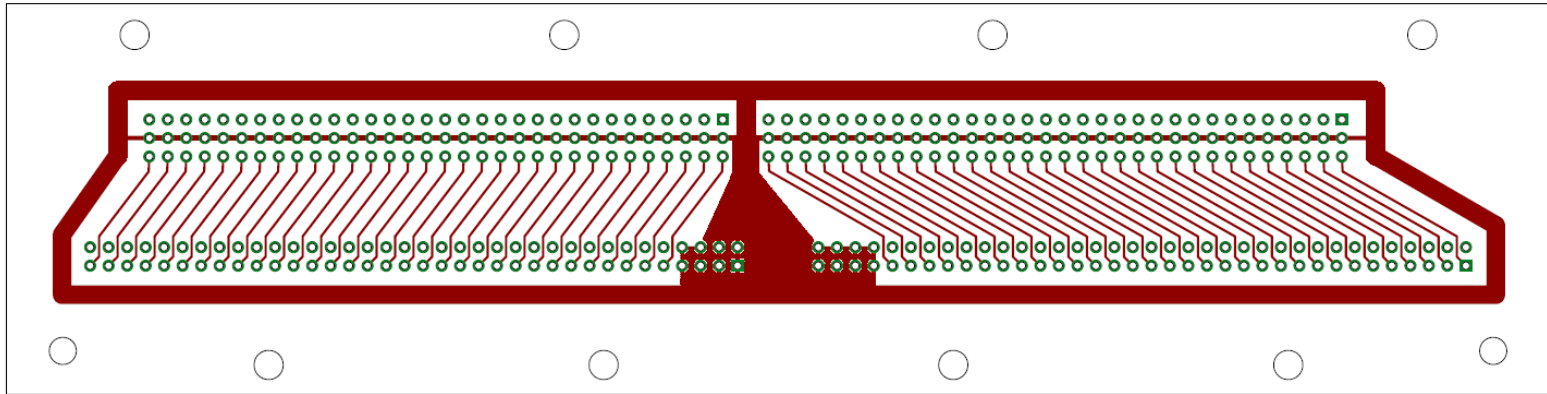


# CR board schematic (continued)

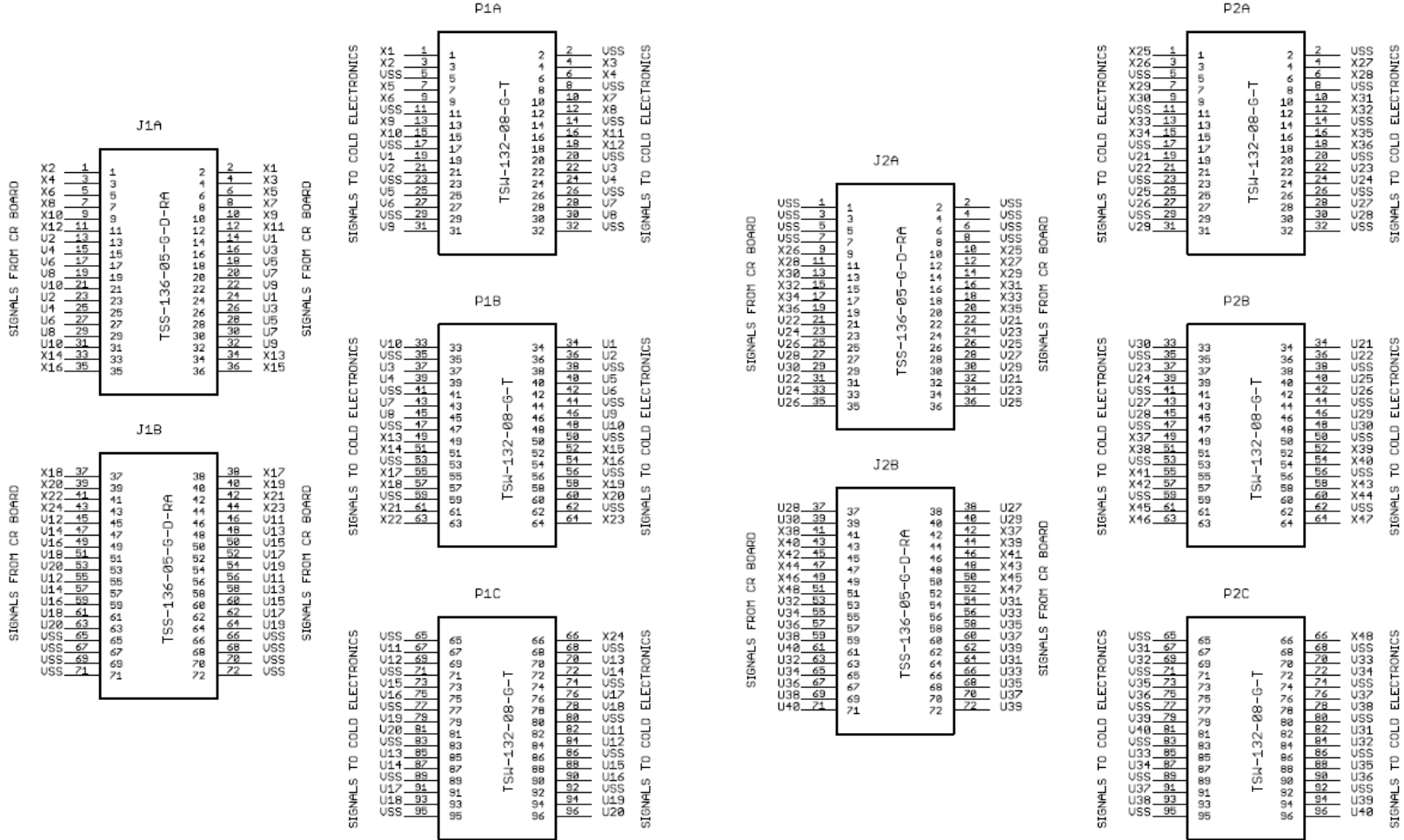
Pins on connectors that mate with the Adapter board are identified with APA wire names



# Adapter boards connect CR Boards to CE Boards



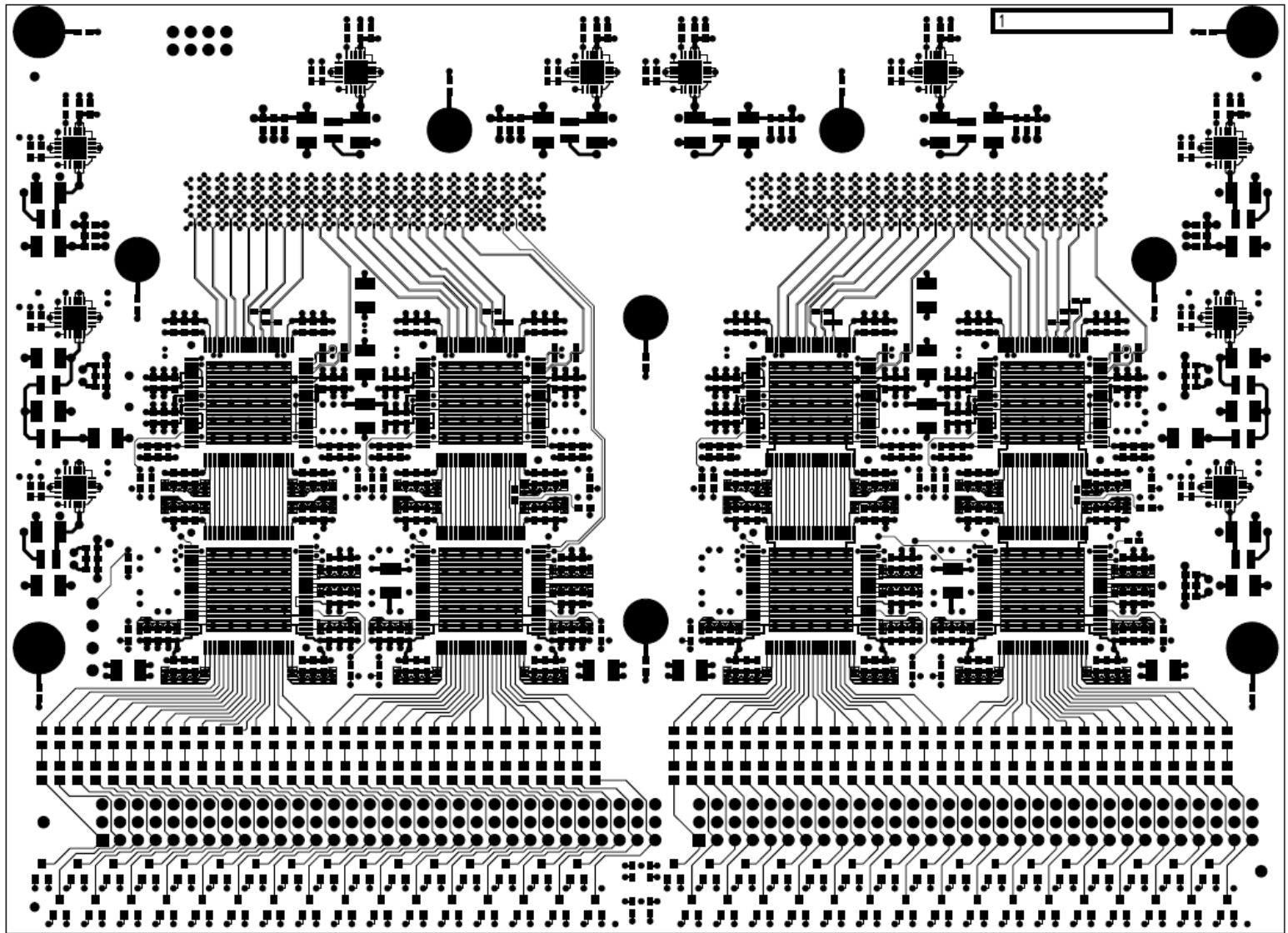
# Pins on connectors that mate with the CE board are identified using APA wire names



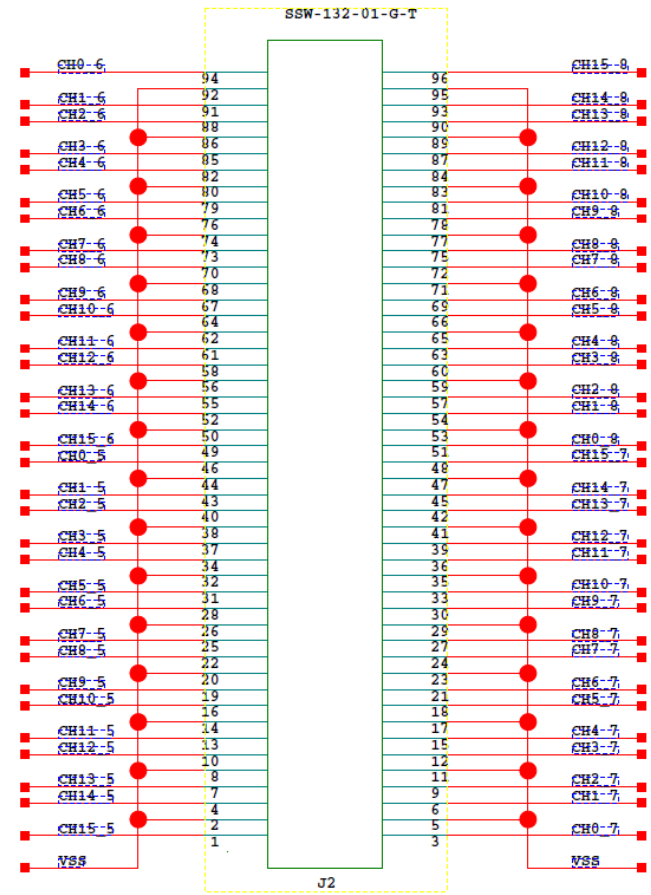
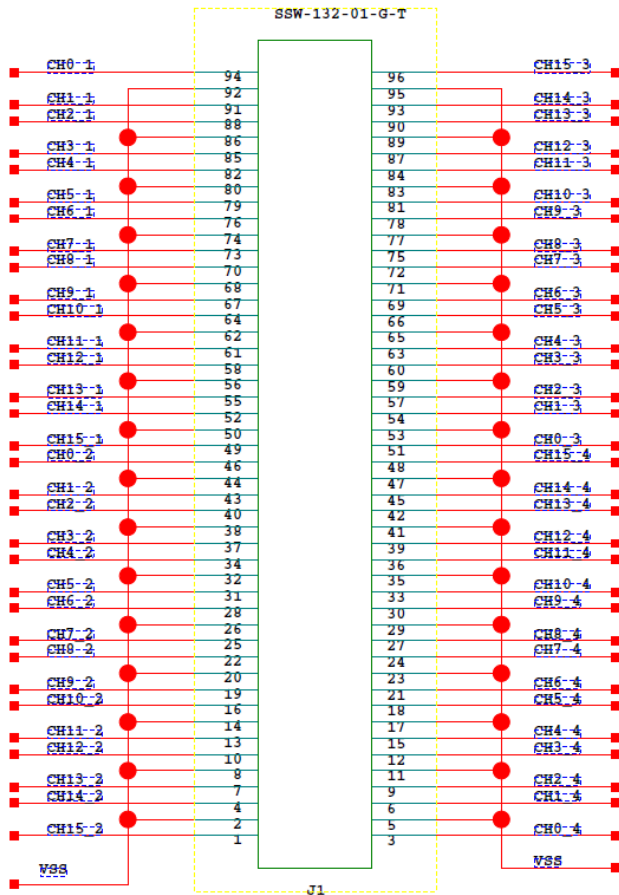
# Connections between CR board and CE board are tabulated along with APA wire assignments

CONN J1 PIN (TO CR BOARD)	CONN P1 PIN (TO CE BOARD)	WIRE NUMBER	WIRE PLANE	CONN J1 PIN (TO CR BOARD)	CONN P1 PIN (TO CE BOARD)	WIRE NUMBER	WIRE PLANE	CONN J2 PIN (TO CR BOARD)	CONN P2 PIN (TO CE BOARD)	WIRE NUMBER	WIRE PLANE	CONN J2 PIN (TO CR BOARD)	CONN P2 PIN (TO CE BOARD)	WIRE NUMBER	WIRE PLANE
64	94	19	U	63	96	20	U	9	3	26	X	10	1	25	X
62	91	17	U	61	93	18	U	11	6	28	X	12	4	27	X
60	88	15	U	59	90	16	U	13	9	30	X	14	7	29	X
58	85	13	U	57	87	14	U	15	12	32	X	16	10	31	X
56	82	11	U	55	84	12	U	17	15	34	X	18	13	33	X
54	79	19	V	53	81	20	V	19	18	36	X	20	16	35	X
52	76	17	V	51	78	18	V	21	21	22	V	22	19	21	V
50	73	15	V	49	75	16	V	23	24	24	V	24	22	23	V
48	70	13	V	47	72	14	V	25	27	26	V	26	25	25	V
46	67	11	V	45	69	12	V	27	30	28	V	28	28	27	V
44	64	23	X	43	66	24	X	29	33	30	V	30	31	29	V
42	61	21	X	41	63	22	X	31	36	22	U	32	34	21	U
40	58	19	X	39	60	20	X	33	39	24	U	34	37	23	U
38	55	17	X	37	57	18	X	35	42	26	U	36	40	25	U
36	52	15	X	35	54	16	X	37	45	28	U	38	43	27	U
34	49	13	X	33	51	14	X	39	48	30	U	40	46	29	U
32	46	9	U	31	48	10	U	41	51	38	X	42	49	37	X
30	43	7	U	29	45	8	U	43	54	40	X	44	52	39	X
28	40	5	U	27	42	6	U	45	57	42	X	46	55	41	X
26	37	3	U	25	39	4	U	47	60	44	X	48	58	43	X
24	34	1	U	23	36	2	U	49	63	46	X	50	61	45	X
22	31	9	V	21	33	10	V	51	66	48	X	52	64	47	X
20	28	7	V	19	30	8	V	53	69	32	V	54	67	31	V
18	25	5	V	17	27	6	V	55	72	34	V	56	70	33	V
16	22	3	V	15	24	4	V	57	75	36	V	58	73	35	V
14	19	1	V	13	21	2	V	59	78	38	V	60	76	37	V
12	16	11	X	11	18	12	X	61	81	40	V	62	79	39	V
10	13	9	X	9	15	10	X	63	84	32	U	64	82	31	U
8	10	7	X	7	12	8	X	65	87	34	U	66	85	33	U
6	7	5	X	5	9	6	X	67	90	36	U	68	88	35	U
4	4	3	X	3	6	4	X	69	93	38	U	70	91	37	U
2	1	1	X	1	3	2	X	71	96	40	U	72	94	39	U

# CE boards connect Adapter Boards to Digitizer ASICS



# CE schematic from BNL indicates paths from input connectors to digitizer channels





# Summary of Wire Tracing

- Documentation exists to support tracing active APA wires to CE channels
- A spreadsheet provides endpoint coordinates for wire segments on ProtoDUNE APAs
- A similar spreadsheet will be created for DUNE
- A relational database would help with capturing and verifying all this data!!
- It would also help link wire-tension data which uses a different wire-numbering system