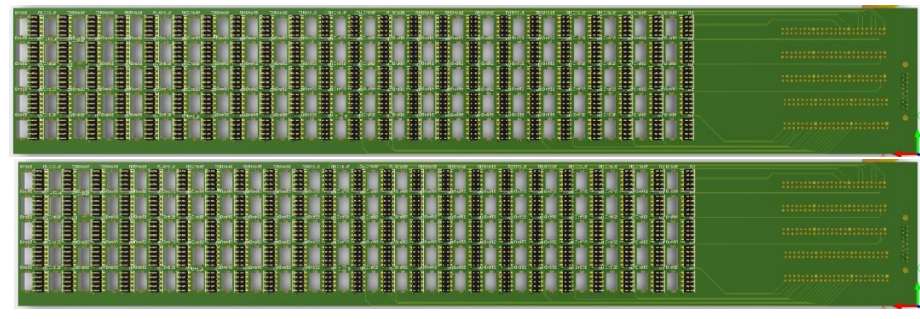
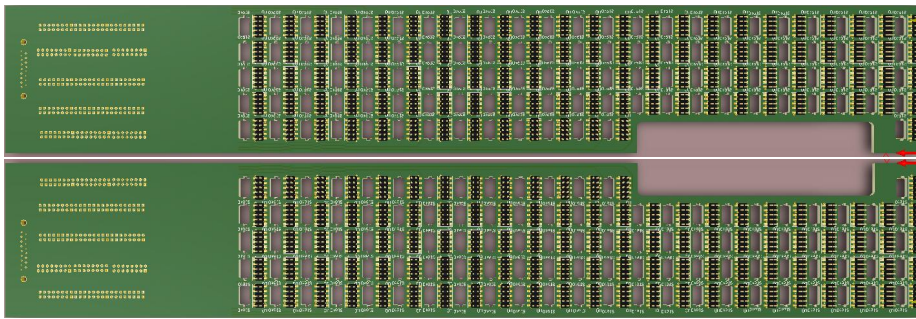
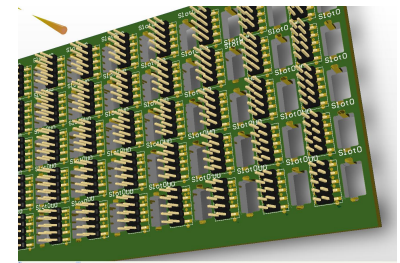
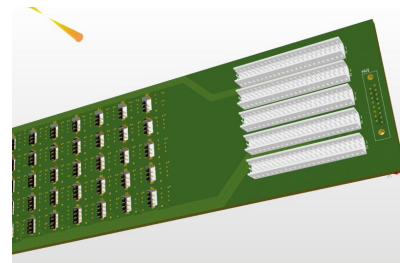
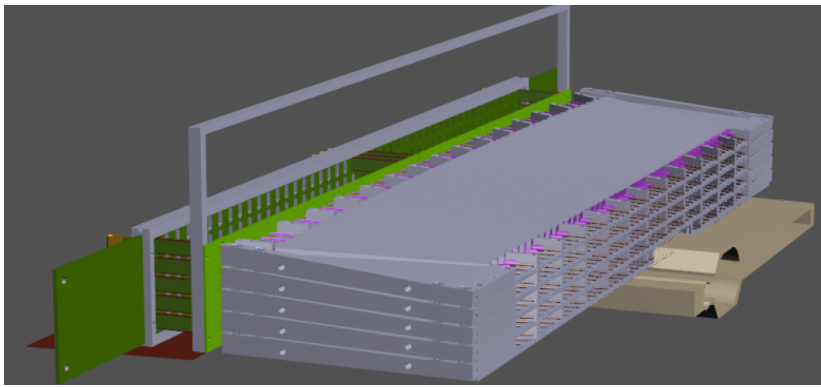


# Ecal Mother Boards

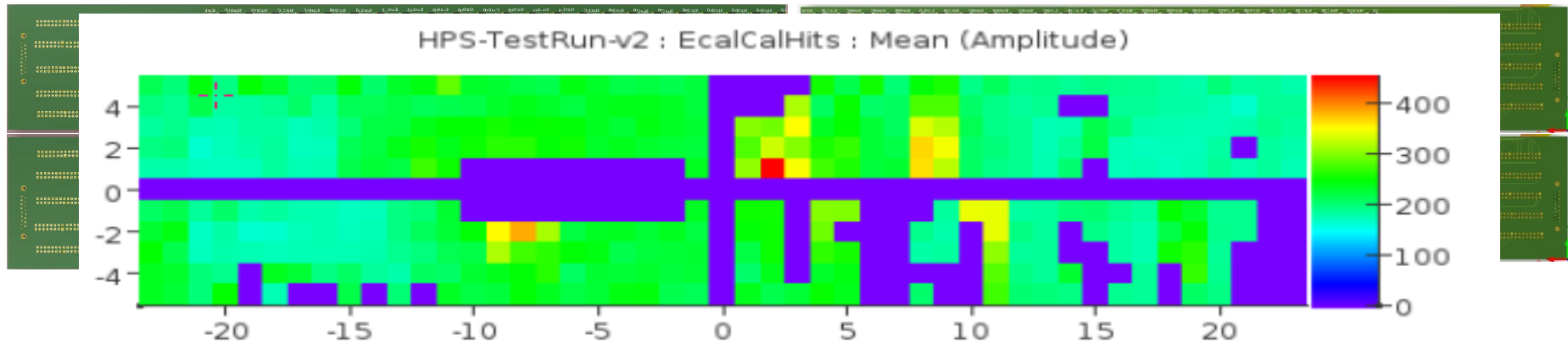
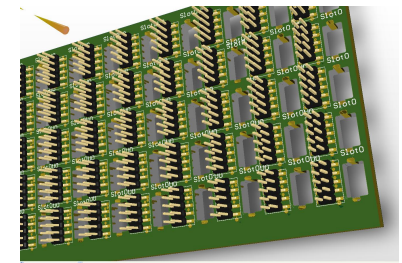
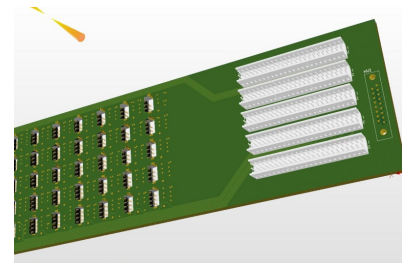
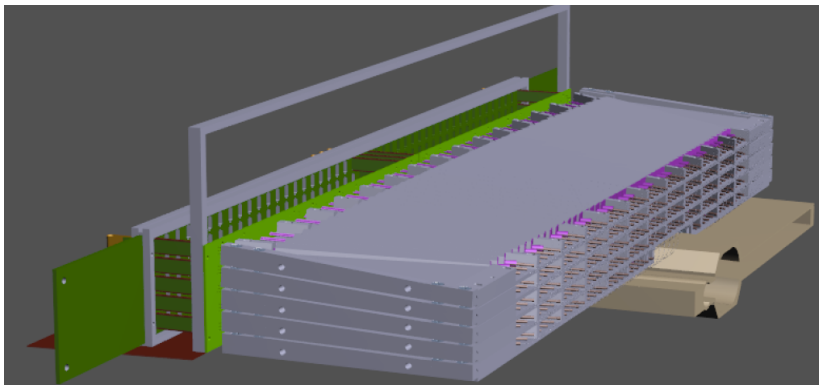
Fabio Pratolongo  
INFN-GE  
Italy

# ECal Motherboard



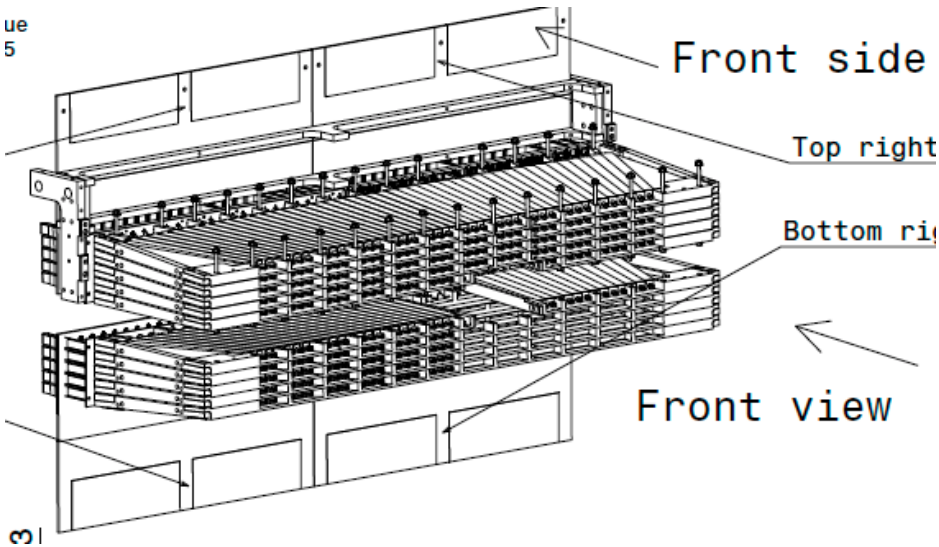
- \*MB connect preamplifiers and HV from the ECal to crates
- \*MB extend on Left/Right sides out the vessel to host signal and HV connectors

# ECal Motherboard

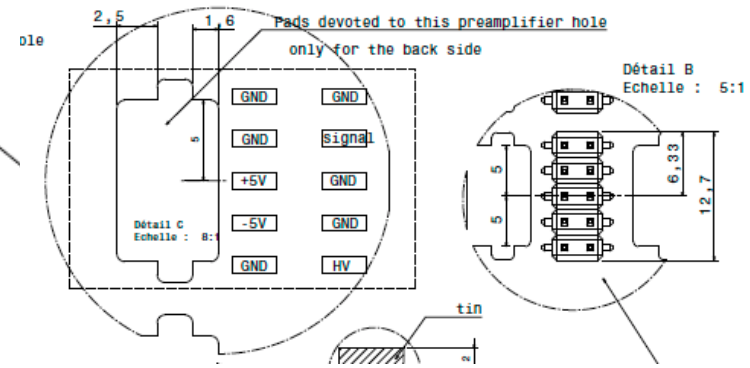
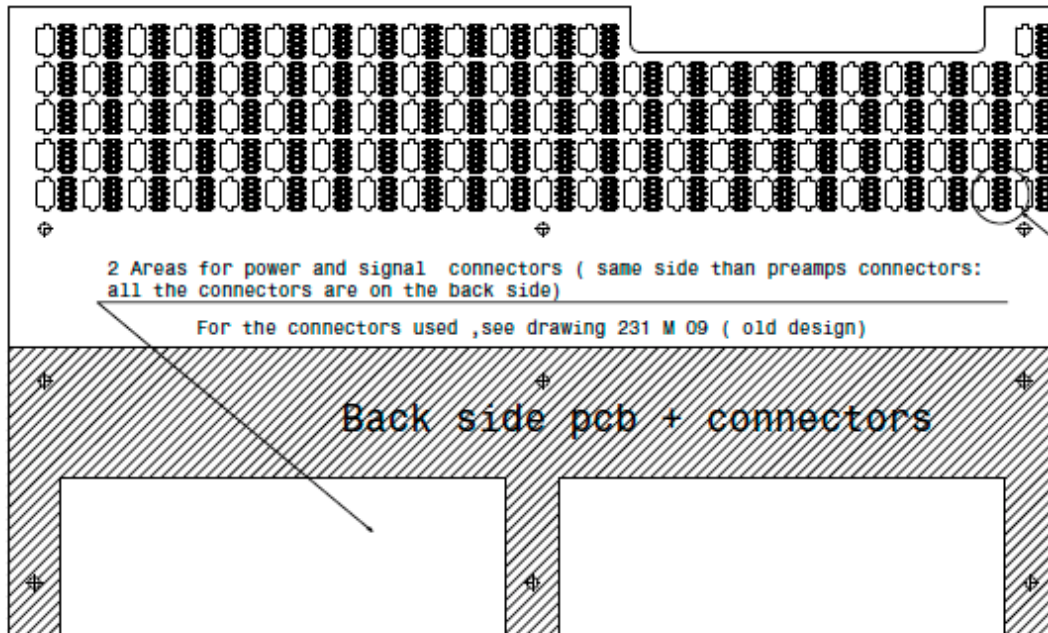


- \* Noise issues with many channels of the motherboards related to design (trace high density) and manufacturing (HV shorts for few channels and LV short for a whole MB)
- \* No time to debug and fix problems
- \* New simplified design, keeping the trace density and length as short as possible manufactured well in advance and fully tested
- \* Short vertical motherboards with connectors (power and signal) on top/bottom
- \* Design solutions taken from IC / FT-CAL experience (IPN-Orsay and INFN-Genova design)

# ECal Motherboard Mechanical design



- \* Mechanical design: IPN-Orsay
- \* Final design after iterations between Genova, Orsay and JLab
- \* Mechanics defined: 4 MB (TL, TR, BL, BR)



# HPS Motherboard Electronic Design

Electrical design: INFN-GE Electronic Service

Design coordinated with JLab (to reuse existing parts: cables, connectors ...)

First step (ORCAD) finished

Last step (ALEGRO) just started

- 4 PCB (115, 115, 106, 106 channels each)
- E.g.:TOP LEFT board (115 chs)
  - 115 SMD connectors (AMP 10 pin, same as used in FT-Cal) for preamps very similar to old MB (pin slightly smaller),
  - 15 TE signal connectors from 16 pin each, same as old MB
  - 2 HV connectors (15 pin) DSUB 750V, 5A, different from old MB for easier routing.
  - 1 LV connectors (6 pin).
- Same HV grouping (as old MB)
- Same 3M signal signal cable

PCB:

10 layers

3 signals + 1 HV + 1 fan-out + 5 GND

Layout specifications:

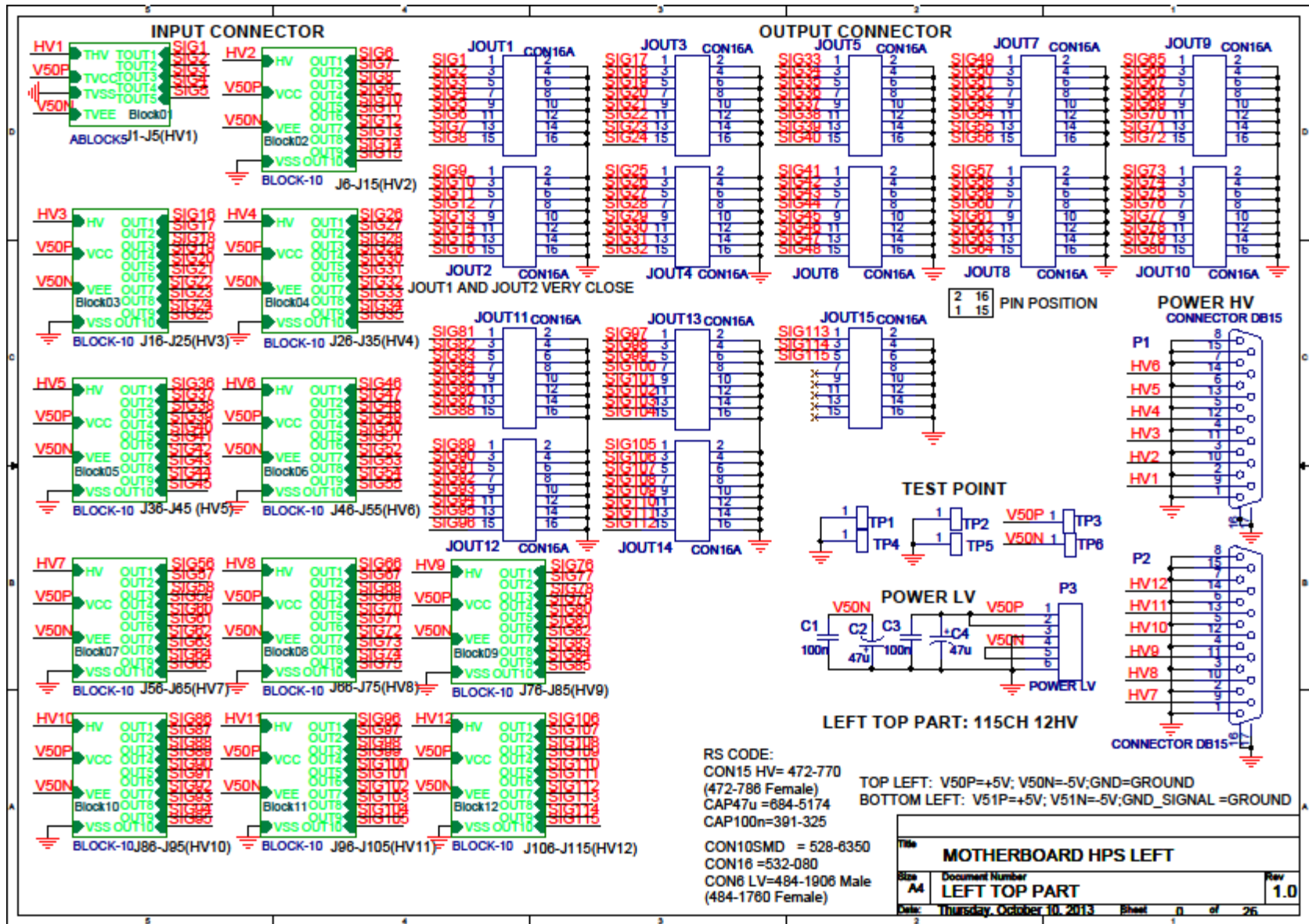
115 signal traces with 50 Ohms impedance.

Signal: 0.2 mm line width and 0.2 mm min. spacing.

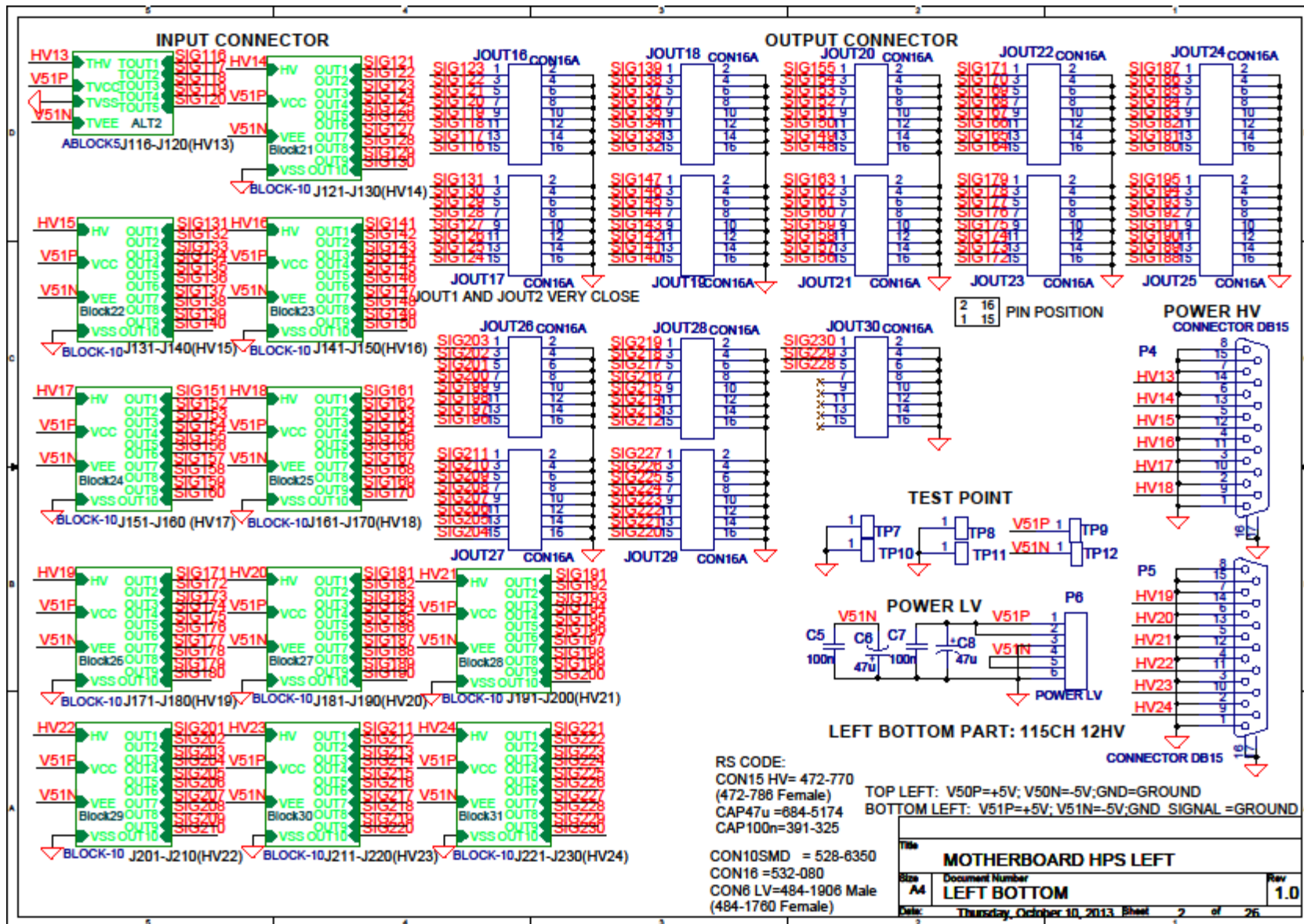
HV: 0.6 mm line width and 0.9 mm min. spacing.

Ground ring between two signals as FT-Cal project.

# LEFT TOP Design (115 channels)



# LEFT BOTTOM Design (115 channels)



# HV Grouping

J1 HV1	J6 HV2	J11 HV2	J16 HV3	J21 HV3	J26 HV4	J31 HV4	J36 HV5	J41 HV5	J46 HV6	J51 HV6	J56 HV7	J61 HV7	J66 HV8	J71 HV8	J76 HV9	J81 HV9	J86 HV10	J91 HV10	J96 HV11	J101 HV11	J106 HV12	J111 HV12
J2 HV1	J7 HV2	J12 HV2	J17 HV3	J22 HV3	J27 HV4	J32 HV4	J37 HV5	J42 HV5	J47 HV6	J52 HV6	J57 HV7	J62 HV7	J67 HV8	J72 HV8	J77 HV9	J82 HV9	J87 HV10	J92 HV10	J97 HV11	J102 HV11	J107 HV12	J112 HV12
J3 HV1	J8 HV2	J13 HV2	J18 HV3	J23 HV3	J28 HV4	J33 HV4	J38 HV5	J43 HV5	J48 HV6	J53 HV6	J58 HV7	J63 HV7	J68 HV8	J73 HV8	J78 HV9	J83 HV9	J88 HV10	J93 HV10	J98 HV11	J103 HV11	J108 HV12	J113 HV12
J4 HV1	J9 HV2	J14 HV2	J19 HV3	J24 HV3	J29 HV4	J34 HV4	J39 HV5	J44 HV5	J49 HV6	J54 HV6	J59 HV7	J64 HV7	J69 HV8	J74 HV8	J79 HV9	J84 HV9	J89 HV10	J94 HV10	J99 HV11	J104 HV11	J109 HV12	J114 HV12
J5 HV1	J10 HV2	J15 HV2	J20 HV3	J25 HV3	J30 HV4	J35 HV4	J40 HV5	J45 HV5	J50 HV6	J55 HV6	J60 HV7	J65 HV7	J70 HV8	J75 HV8	J80 HV9	J85 HV9	J90 HV10	J95 HV10	J100 HV11	J105 HV11	J110 HV12	J115 HV12

NEW TOP LEFT (the same as previous project)

J1 HV1	J6 HV2	J11 HV2	J16 HV3	J21 HV3	J26 HV4	J31 HV4	J36 HV5	J41 HV5	J46 HV6	J51 HV6	J56 HV7	J61 HV7	J66 HV8	J71 HV8	J76 HV9	J81 HV9	J86 HV10	J91 HV10	J96 HV11	J101 HV11	J106 HV12	J111 HV12
J2 HV1	J7 HV2	J12 HV2	J17 HV3	J22 HV3	J27 HV4	J32 HV4	J37 HV5	J42 HV5	J47 HV6	J52 HV6	J57 HV7	J62 HV7	J67 HV8	J72 HV8	J77 HV9	J82 HV9	J87 HV10	J92 HV10	J97 HV11	J102 HV11	J107 HV12	J112 HV12
J3 HV1	J8 HV2	J13 HV2	J18 HV3	J23 HV3	J28 HV4	J33 HV4	J38 HV5	J43 HV5	J48 HV6	J53 HV6	J58 HV7	J63 HV7	J68 HV8	J73 HV8	J78 HV9	J83 HV9	J88 HV10	J93 HV10	J98 HV11	J103 HV11	J108 HV12	J113 HV12
J4 HV1	J9 HV2	J14 HV2	J19 HV3	J24 HV3	J29 HV4	J34 HV4	J39 HV5	J44 HV5	J49 HV6	J54 HV6	J59 HV7	J64 HV7	J69 HV8	J74 HV8	J79 HV9	J84 HV9	J89 HV10	J94 HV10	J99 HV11	J104 HV11	J109 HV12	J114 HV12
J5 HV1	J10 HV2	J15 HV2	J20 HV3	J25 HV3	J30 HV4	J35 HV4	J40 HV5	J45 HV5	J50 HV6	J55 HV6	J60 HV7	J65 HV7	J70 HV8	J75 HV8	J80 HV9	J85 HV9	J90 HV10	J95 HV10	J100 HV11	J105 HV11	J110 HV12	J115 HV12

OLD TOP RIGHT BACK SIDE VIEW 106 input connectors 12 HV nets HV25 to HV36  
8 groups of 10, 2 groups of 9, 1 group of 6 and 1 group of 2

J1 HV25	J6 HV25	J11 HV26	J16 HV26	J21 HV27	J26 HV27	J31 HV28	J36 HV28	J41 HV29	J46 HV29	J51 HV30	J56 HV30	J61 HV31	J66 HV31	J70 HV32	J74 HV32	J78 HV32	J82 HV36	J86 HV36	J90 HV36	J94 HV36	J98 HV36	J102 HV36
J2 HV25	J7 HV25	J12 HV26	J17 HV26	J22 HV27	J27 HV27	J32 HV28	J37 HV28	J42 HV29	J47 HV29	J52 HV30	J57 HV30	J62 HV31	J67 HV31	J71 HV32	J75 HV32	J79 HV33	J83 HV33	J87 HV33	J91 HV33	J95 HV33	J99 HV33	J103 HV36
J3 HV25	J8 HV25	J13 HV26	J18 HV26	J23 HV27	J28 HV27	J33 HV28	J38 HV28	J43 HV29	J48 HV29	J53 HV30	J58 HV30	J63 HV31	J68 HV31	J72 HV32	J76 HV32	J80 HV33	J84 HV34	J88 HV34	J92 HV34	J96 HV34	J100 HV33	J104 HV36
J4 HV25	J9 HV25	J14 HV26	J19 HV26	J24 HV27	J29 HV27	J34 HV28	J39 HV28	J44 HV29	J49 HV29	J54 HV30	J59 HV30	J64 HV31	J69 HV31	J73 HV32	J77 HV32	J81 HV33	J85 HV34	J89 HV35	J93 HV35	J97 HV34	J101 HV33	J105 HV36
J5 HV25	J10 HV25	J15 HV26	J20 HV26	J25 HV27	J30 HV27	J35 HV28	J40 HV28	J45 HV29	J50 HV29	J55 HV30	J60 HV30	J65 HV31										J106 HV36

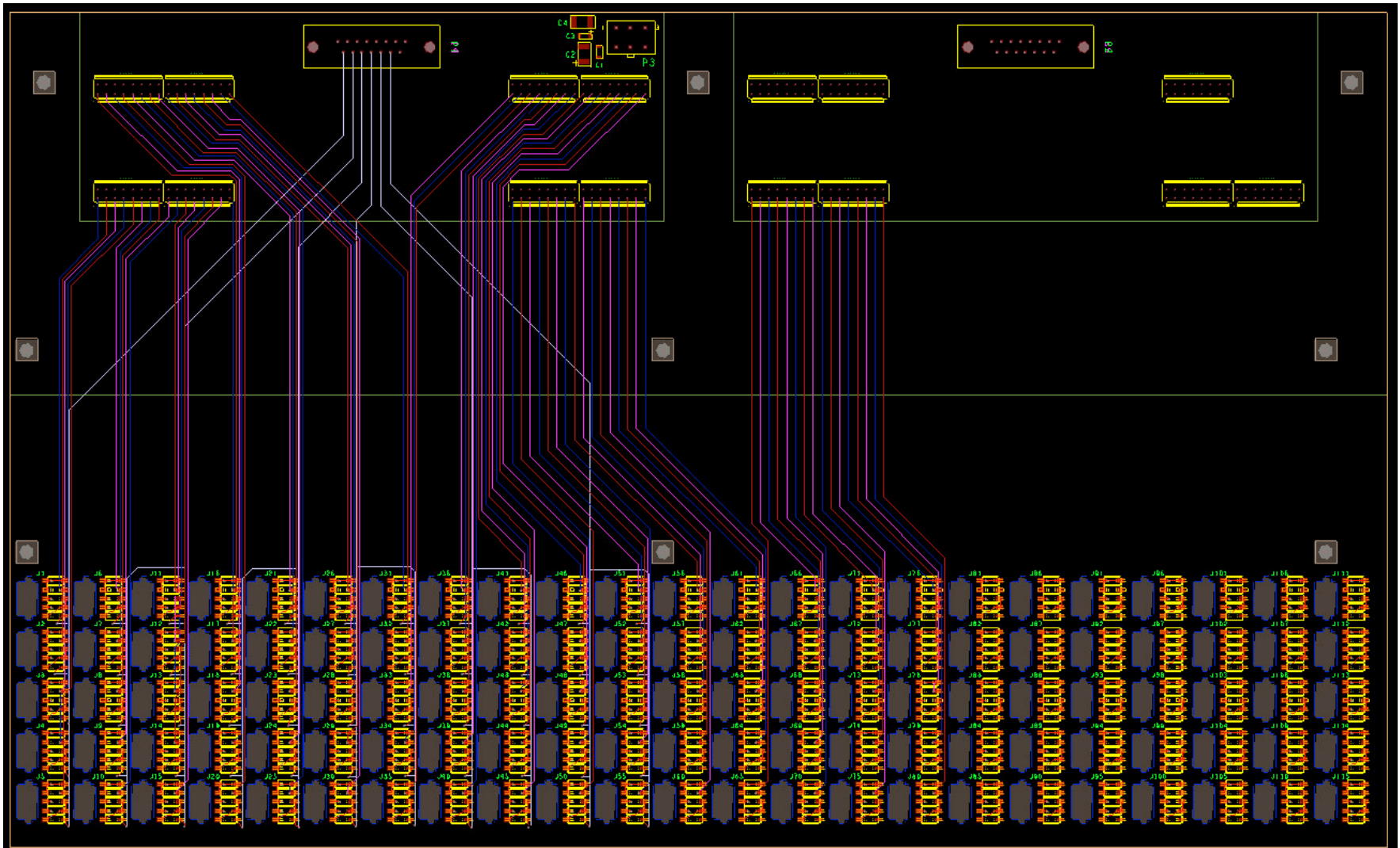
NEW TOP RIGHT (a little bit different)  
6 groups of 10, 1 group of 11, 1 group of 8, 1 group of 6 and 1 group of 3

J1 HV25	J6 HV25	J11 HV26	J16 HV26	J21 HV27	J26 HV27	J31 HV28	J36 HV28	J41 HV29	J46 HV29	J51 HV30	J56 HV30	J61 HV31	J66 HV31	J70 HV32	J74 HV32	J78 HV33	J82 HV33	J86 HV33	J90 HV35	J94 HV36	J98 HV36	J102 HV36
J2 HV25	J7 HV25	J12 HV26	J17 HV26	J22 HV27	J27 HV27	J32 HV28	J37 HV28	J42 HV29	J47 HV29	J52 HV30	J57 HV30	J62 HV31	J67 HV31	J71 HV32	J75 HV32	J79 HV33	J83 HV33	J87 HV34	J91 HV35	J95 HV36	J99 HV36	J103 HV36
J3 HV25	J8 HV25	J13 HV26	J18 HV26	J23 HV27	J28 HV27	J33 HV28	J38 HV28	J43 HV29	J48 HV29	J53 HV30	J58 HV30	J63 HV31	J68 HV31	J72 HV32	J76 HV32	J80 HV33	J84 HV33	J88 HV34	J92 HV35	J96 HV35	J100 HV36	J104 HV36
J4 HV25	J9 HV25	J14 HV26	J19 HV26	J24 HV27	J29 HV27	J34 HV28	J39 HV28	J44 HV29	J49 HV29	J54 HV30	J59 HV30	J64 HV31	J69 HV31	J73 HV32	J77 HV32	J81 HV33	J85 HV33	J89 HV34	J93 HV35	J97 HV35	J101 HV36	J105 HV36
J5 HV25	J10 HV25	J15 HV26	J20 HV26	J25 HV27	J30 HV27	J35 HV28	J40 HV28	J45 HV29	J50 HV29	J55 HV30	J60 HV30	J65 HV31										J106 HV36

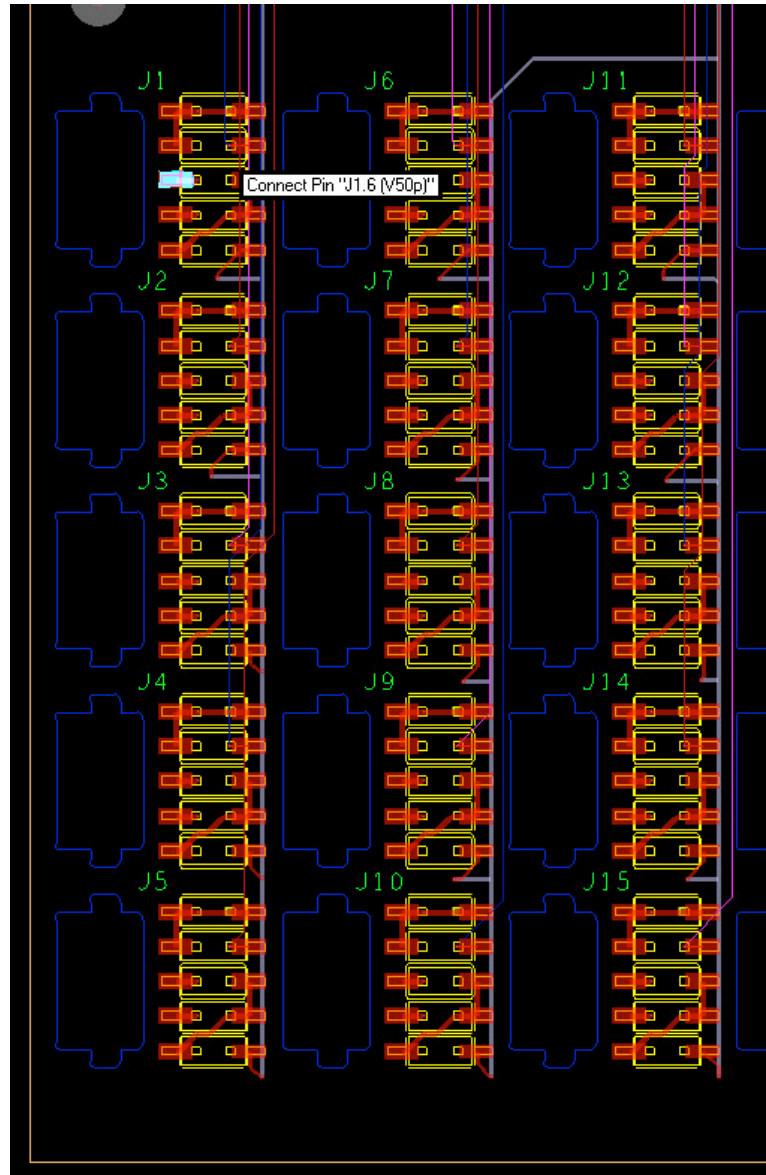
- Old: hits-load well distributed
- New: simple trace routing
- We are working to find a compromise



# LEFT TOP Routing (preliminary)



# Routing Zoom on 3 columns



# HPS Motherboard WorkPlan

- Mechanical Specifications with Orsay Done!
  - Design of LEFT TOP and LEFT BOTTOM boards Done!
  - Layout routing of LEFT TOP and LEFT BOTTOM boards in progress
  - Left T/B Boards purchase requisition
- November
- Design of RIGHT TOP and RIGHT BOTTOM boards with the correct HV grouping November
  - Layout routing of RIGHT TOP and RIGHT BOTTOM boards.
- December
- Test Left T/B Electrical connections and Full crosstalk December
- Board Productions and Assembly (with the same company serving the FT-Cal). 12k euro January 2014
- Test on Electrical connections and Full crosstalk test with FT-Cal crystals 3k euro Mid February 2014