HCal Electronics
with First-level ECal trig

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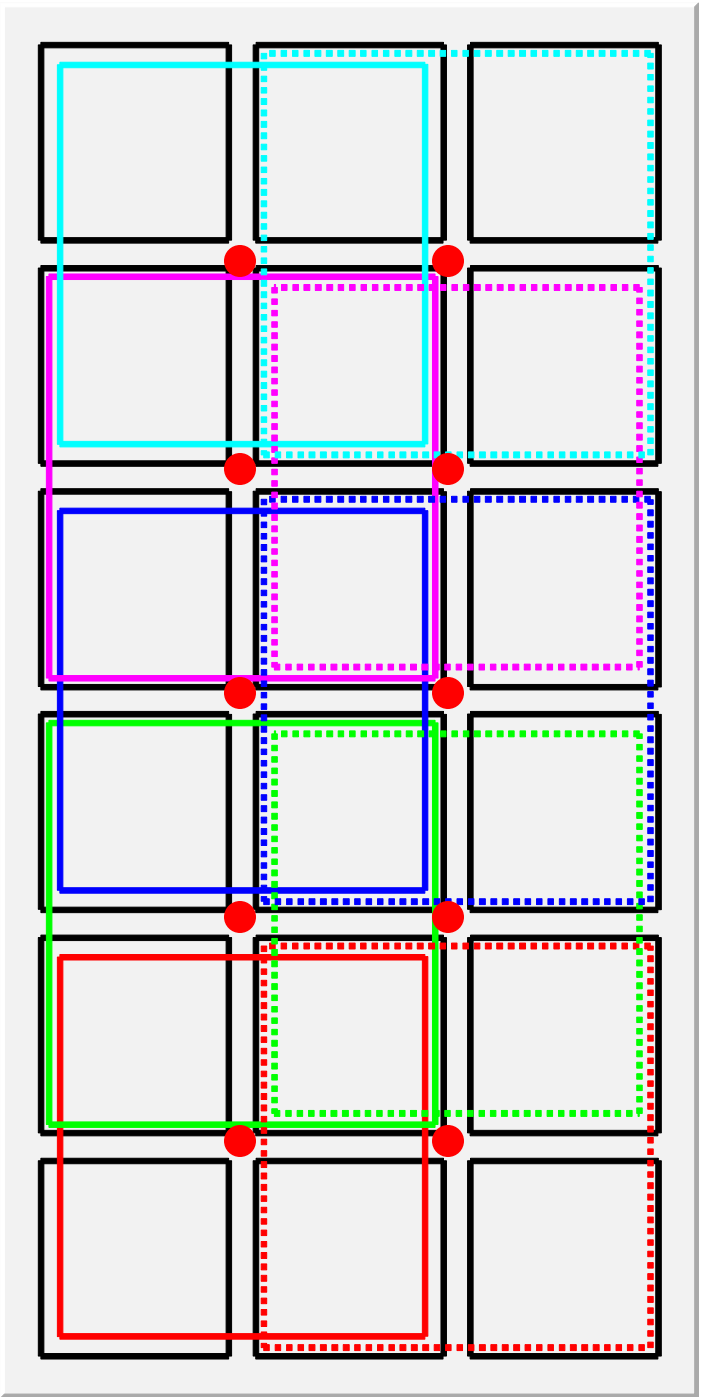


GEp trigger:

HCal is 12X24 array of modules.

Form overlapping regions by taking all possible 2X2 sets of (4X4 module) groups. Each group is a member of four regions (or less).

Total of 10 regions to be summed to give total energy in region. Each sum can be compared to threshold.

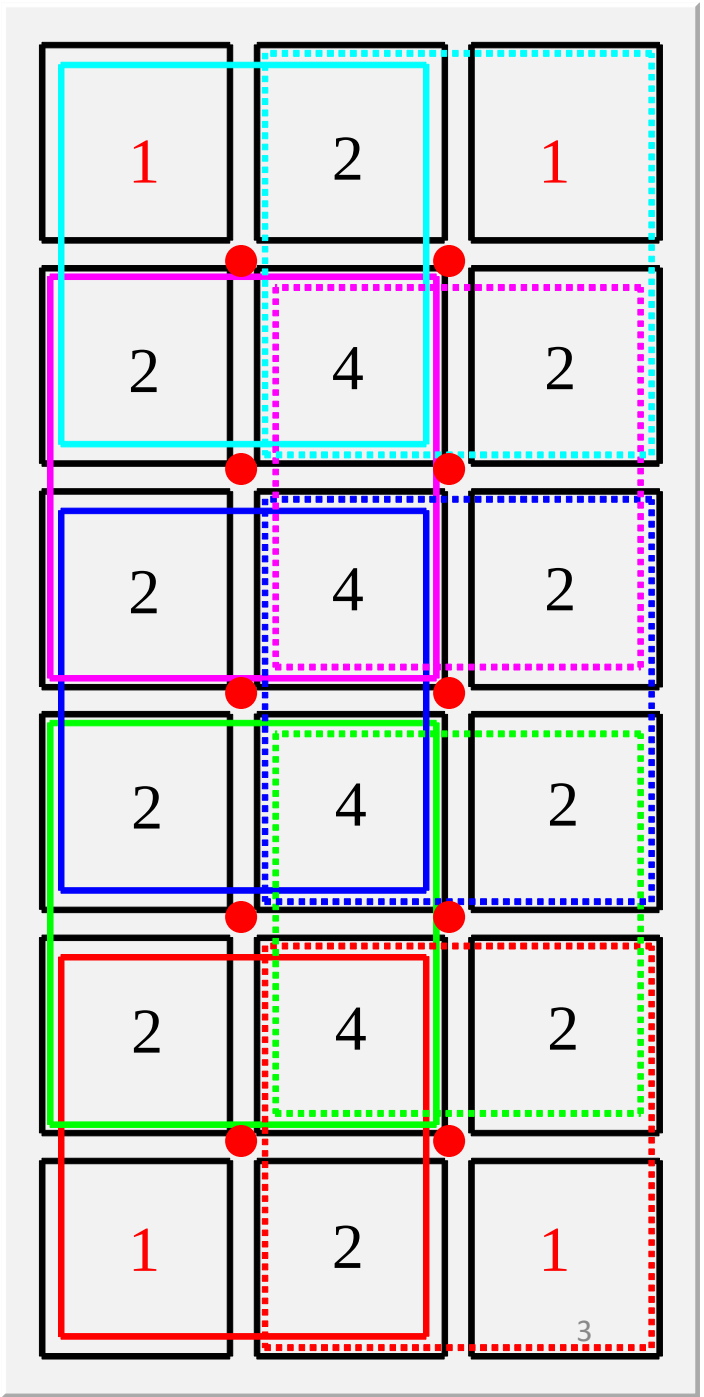
Ten logic signals to send to ECal to look for energy in region of HCal expected to correspond to ECal hit.

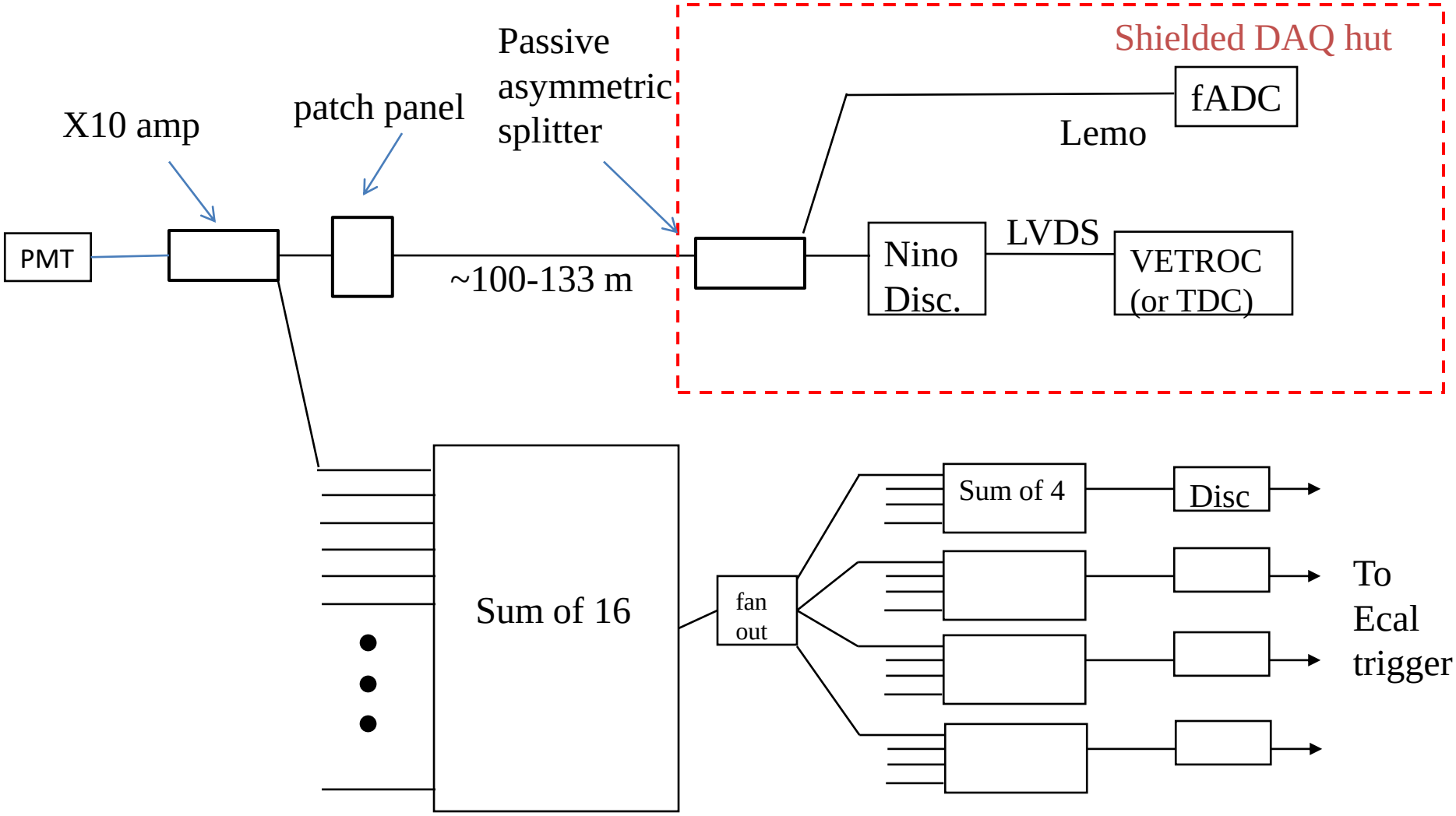
For ECal trigger
18 (4X4 module) groups require:

18 (16+ chan) summing modules
Have 17 UVa 120s (more available)
1 modified so far

14 fan-out channels (4 modules)

10 fan-in chanels (3 modules)
Have 2 UVa quad 133s (more available)
(Built-in disc. BUT 100 ns delay !! and ECL out)





(18 groups)

18 UVa Summing mod.

36 in -> 18 in (16 used)

(10 regions)

4 quad linear FO (e.g. Phillips 740 2.5V)

3 quad 4-fold linear FI (UVa 133)

12 chan L.E. Disc.(3X4 or 1X16)

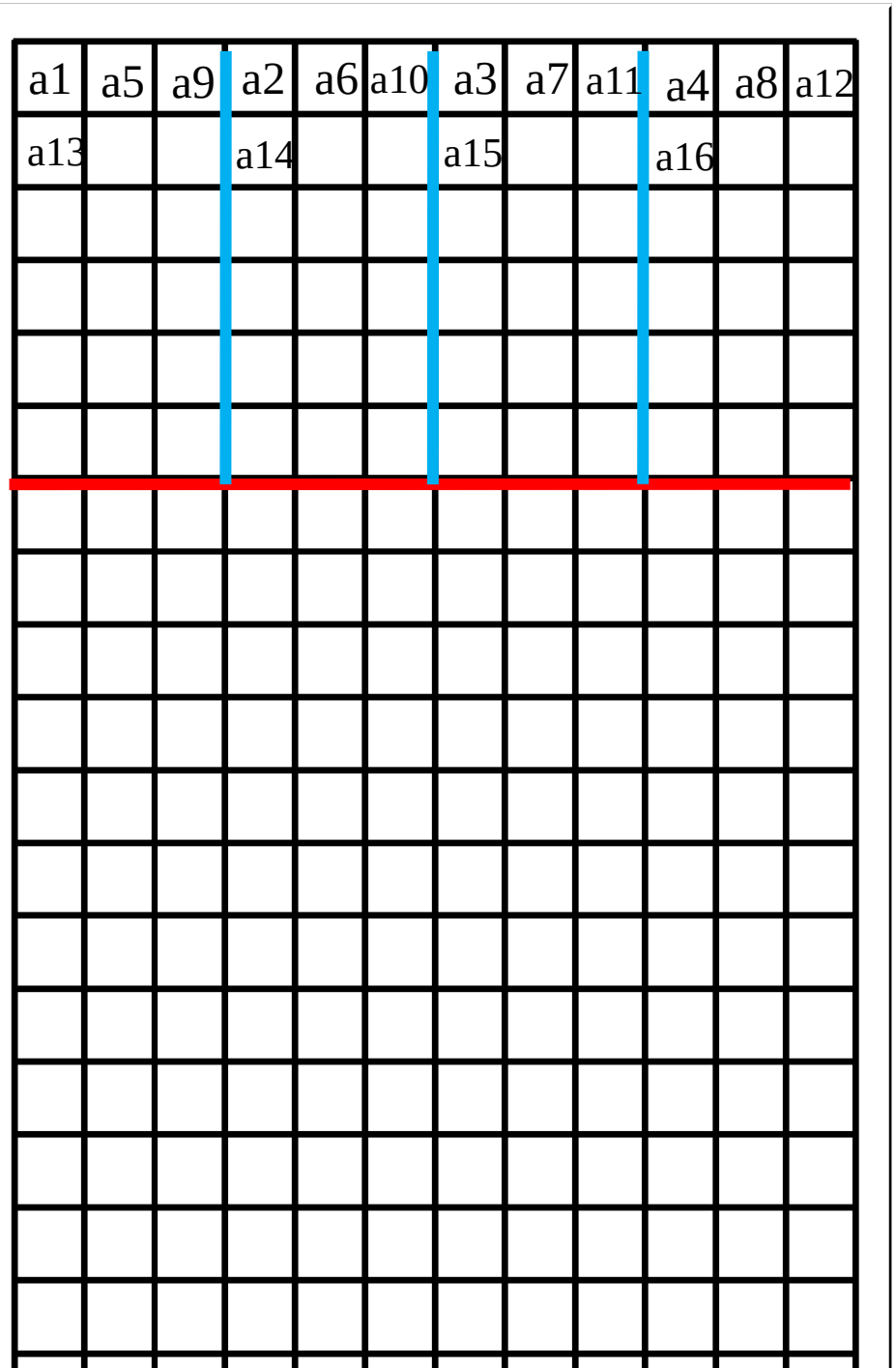
Simple cabling pattern.

Adjacent electronics channels don’t fire on same LED pulse and unlikely to fire in same cluster.

Electronics module problems show up as many bad HCal signals in two rows, easyo spot

.

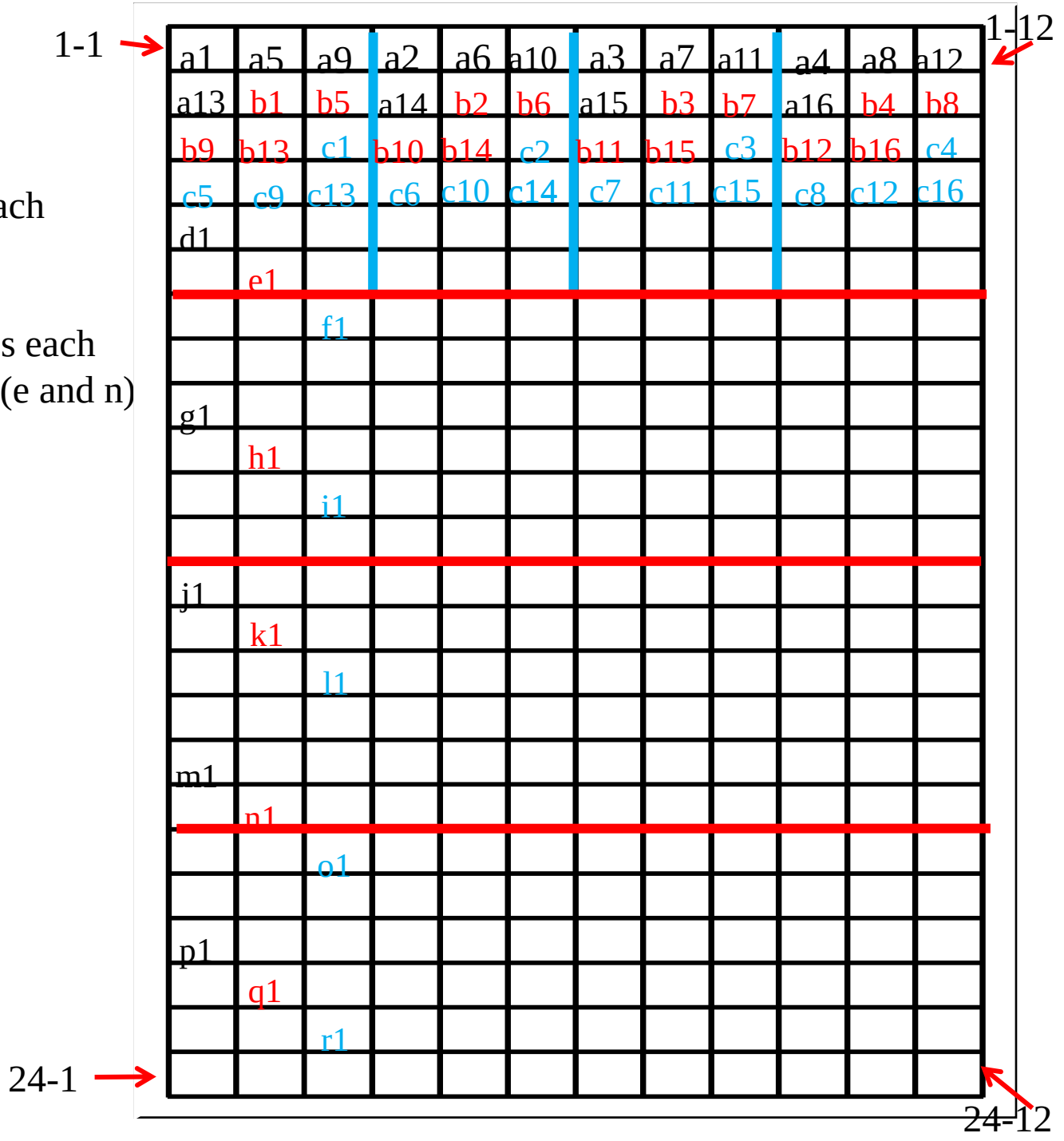
Somewhat easier to track down single-module problems.



Cabling pattern.

Three patch panel strips for each four rows.

Only one patch panel straddles each of two sub-module divisions (e and n)



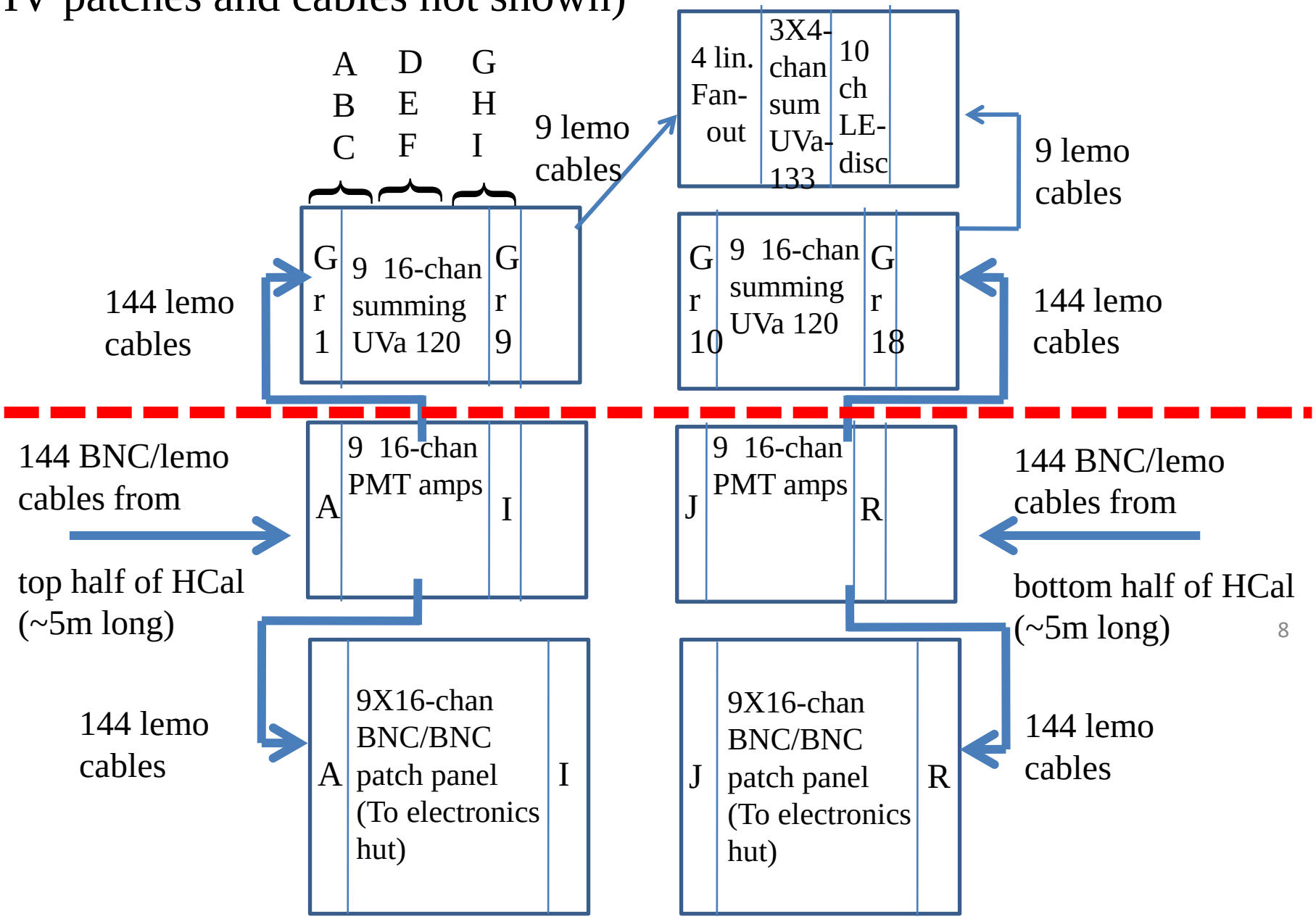
Map from electronics channels to HCal module
-Amplifiers
-Patch panels
-Ninos
-TDCs (or VETROCs)
-fADCs

	A	B	C	D	E	F	G	H	I
1	1- 1	2- 2	3- 3	5- 1	6- 2	7- 3	9- 1	10- 2	11- 3
2	1- 4	2- 5	3- 6	5- 4	6- 5	7- 6	9- 4	10- 5	11- 6
3	1- 7	2- 8	3- 9	5- 7	6- 8	7- 9	9- 7	10- 8	11- 9
4	1-10	2-11	3-12	5-10	6-11	7-12	9-10	10-11	11-12
5	1- 2	2- 3	4- 1	5- 2	6- 3	8- 1	9- 2	10- 3	12- 1
6	1- 5	2- 6	4- 4	5- 5	6- 6	8- 4	9- 5	10- 6	12- 4
7	1- 8	2- 9	4- 7	5- 8	6- 9	8- 7	9- 8	10- 9	12- 7
8	1-11	2-12	4-10	5-11	6-12	8-10	9-11	10-12	12-10
9	1- 3	3- 1	4- 2	5- 3	7- 1	8- 2	9- 3	11- 1	12- 2
10	1- 6	3- 4	4- 5	5- 6	7- 4	8- 5	9- 6	11- 4	12- 5
11	1- 9	3- 7	4- 8	5- 9	7- 7	8- 8	9- 9	11- 7	12- 8
12	1-12	3-10	4-11	5-12	7-10	8-11	9-12	11-10	12-11
13	2- 1	3- 2	4- 3	6- 1	7- 2	8- 3	10- 1	11- 2	12- 3
14	2- 4	3- 5	4- 6	6- 4	7- 5	8- 6	10- 4	11- 5	12- 6
15	2- 7	3- 8	4- 9	6- 7	7- 8	8- 9	10- 7	11- 8	12- 9
16	2-10	3-11	4-12	6-10	7-11	8-12	10-10	11-11	12-12

	J	K	L	M	N	O	P	Q	R
1	13- 1	14- 2	15- 3	17- 1	18- 2	19- 3	21- 1	22- 2	23- 3
2	13- 4	14- 5	15- 6	17- 4	18- 5	19- 6	21- 4	22- 5	23- 6
3	13- 7	14- 8	15- 9	17- 7	18- 8	19- 9	21- 7	22- 8	23- 9
4	13-10	14-11	15-12	17-10	18-11	19-12	21-10	22-11	23-12
5	13- 2	14- 3	16- 1	17- 2	18- 3	20- 1	21- 2	22- 3	24- 1
6	13- 5	14- 6	16- 4	17- 5	18- 6	20- 4	21- 5	22- 6	24- 4
7	13- 8	14- 9	16- 7	17- 8	18- 9	20- 7	21- 8	22- 9	24- 7
8	13-11	14-12	16-10	17-11	18-12	20-10	21-11	22-12	24-10
9	13- 3	15- 1	16- 2	17- 3	19- 1	20- 2	21- 3	23- 1	24- 2
10	13- 6	15- 4	16- 5	17- 6	19- 4	20- 5	21- 6	23- 4	24- 5
11	13- 9	15- 7	16- 8	17- 9	19- 7	20- 8	21- 9	23- 7	24- 8
12	13-12	15-10	16-11	17-12	19-10	20-11	21-12	23-10	24-11
13	14- 1	15- 2	16- 3	18- 1	19- 2	20- 3	22- 1	23- 2	24- 3
14	14- 4	15- 5	16- 6	18- 4	19- 5	20- 6	22- 4	23- 5	24- 6
15	14- 7	15- 8	16- 9	18- 7	19- 8	20- 9	22- 7	23- 8	24- 9
16	14-10	15-11	16-12	18-10	19-11	20-12	22-10	23-11	24-12

Electronics racks on HCal gantry (2 relay racks)

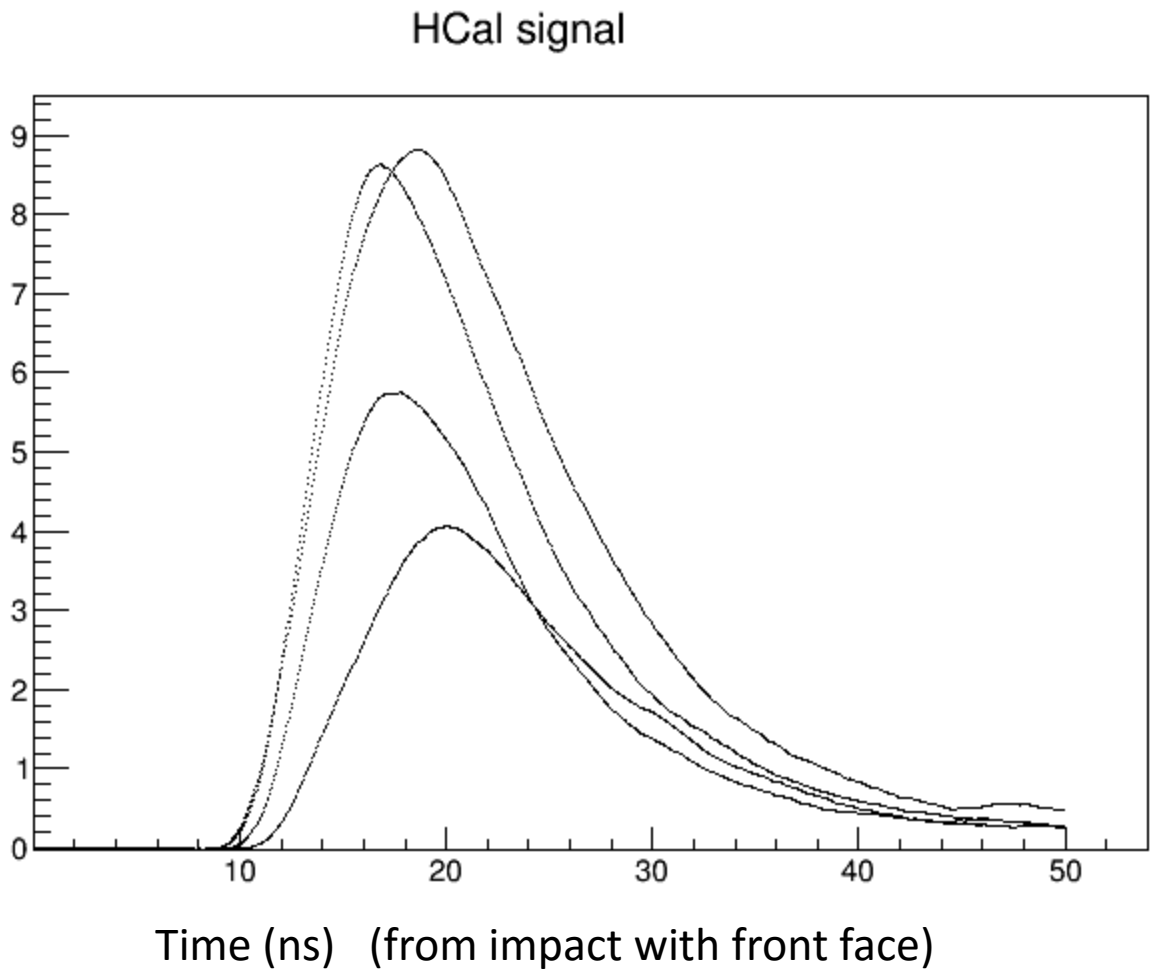
(HV patches and cables not shown)

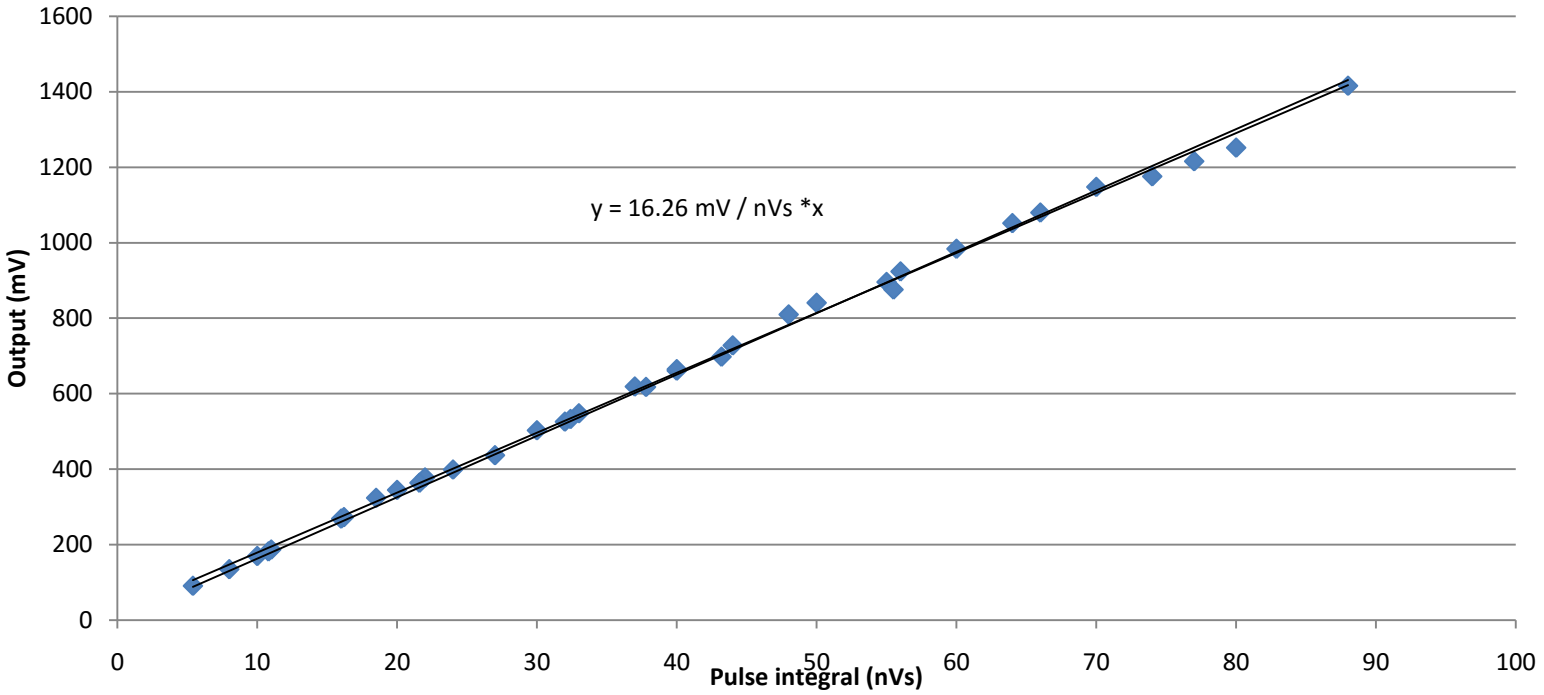


~325 p.e. for 2.6 GeV n
to
~1700 p.e. for 10.5 GeV n

325 p.e. X 10^6
= 52 pC = 2.6 nVs
~ 0.2 V signal amplitude

after amplifier
~2 V amplitude
26 nVs





Choose PMT gain so expected signal sums to ~60 nVs giving ~1V output. Discriminate at eg. ~0.25 V.

Cabling scheme for HCal

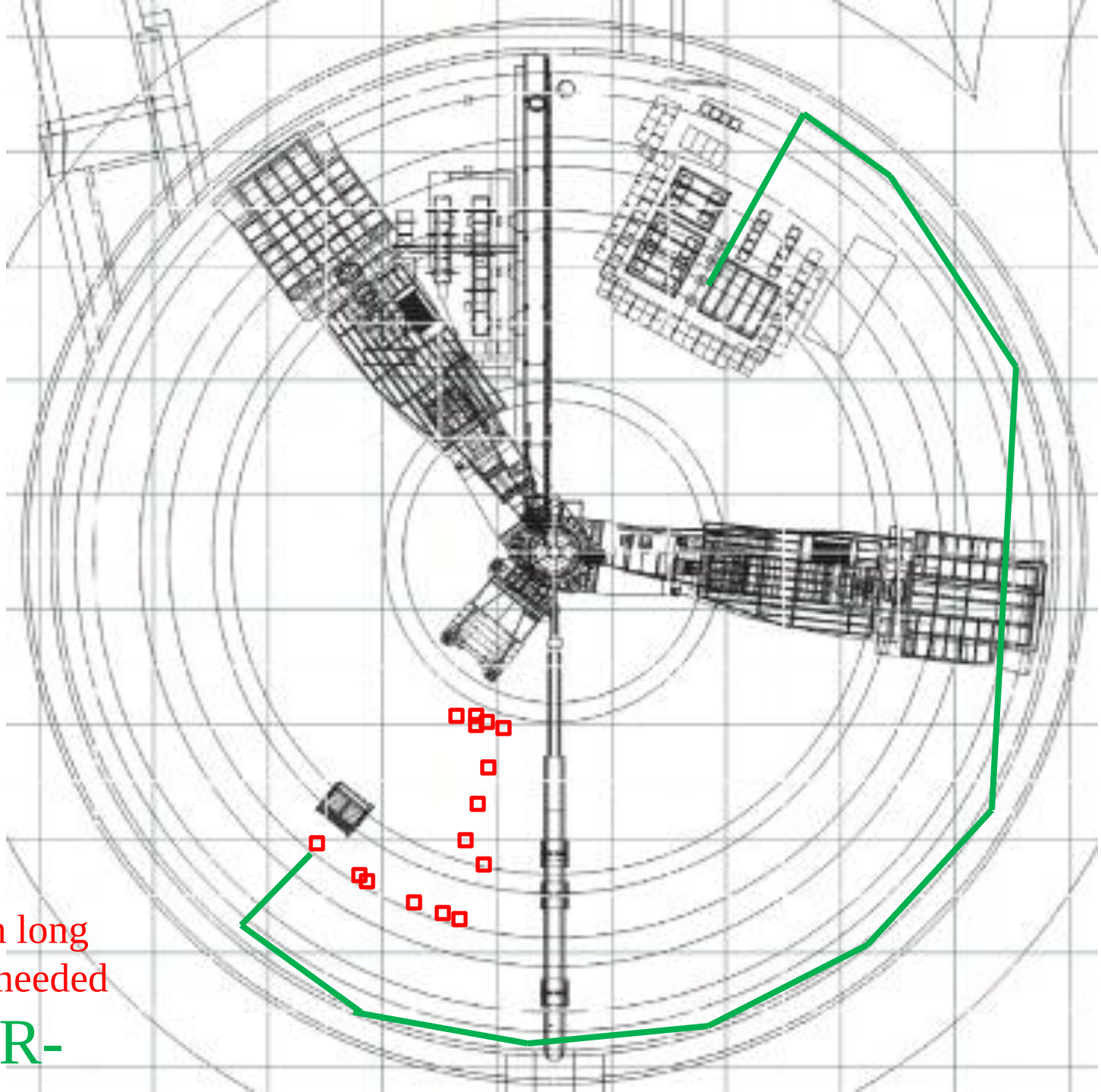
One signal, one HV cable to each tube. (Plus one HV & 3 signal/section for pulser)
Cables secured, strain-relieved on gantry behind HCal.
Cables held in place by gantry so they can be quickly re-connected to correct tubes.

On HCal electronics/cabling platform

- X10 amp
- Outputs to electronics hut (BNC ~100-133 m. long)
- Lemo cable outputs to UVa summing module

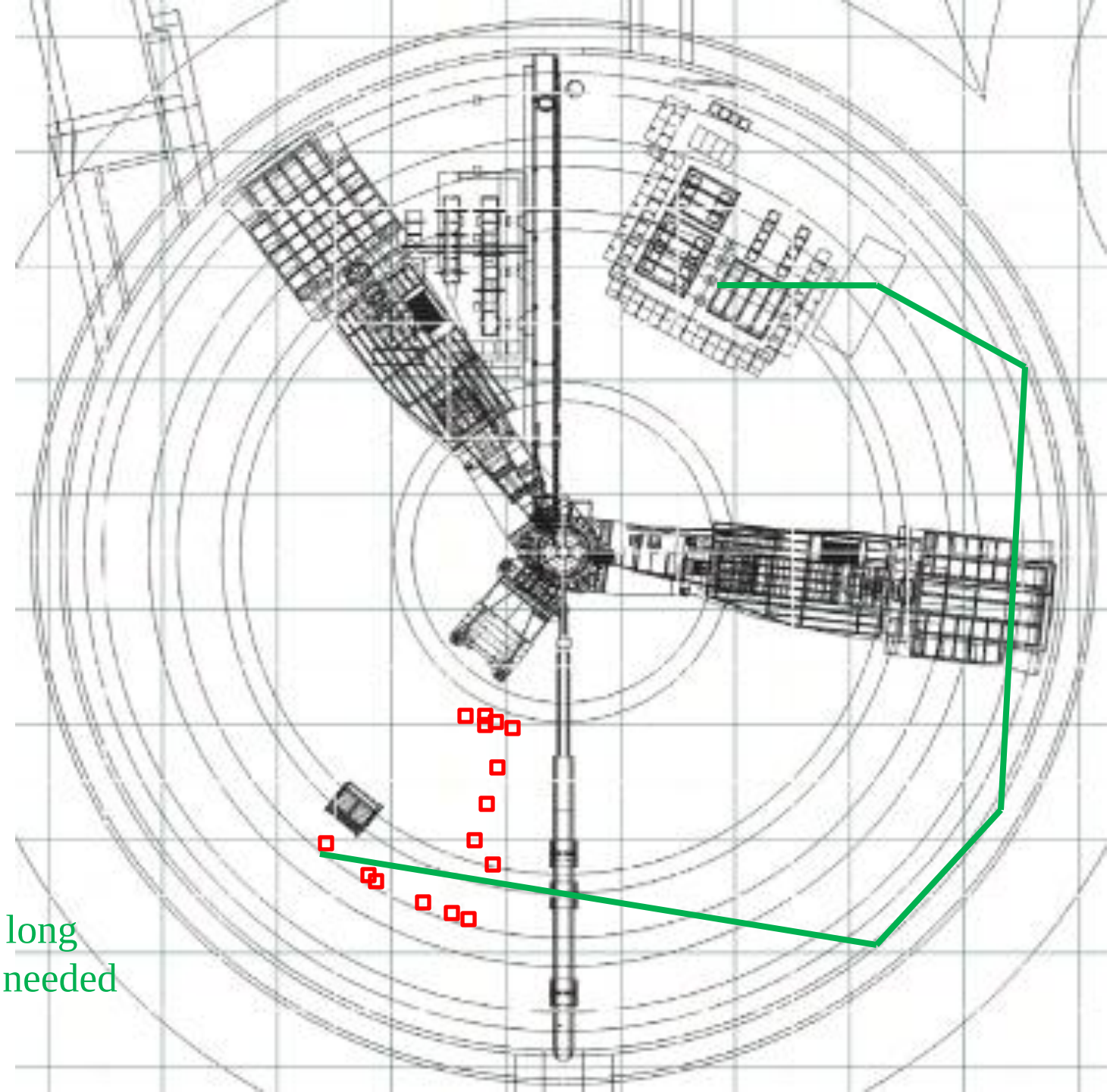
Second patch panel in electronics hut

- Asymmetric passive splitter (board with connection/housing/power for Nino)
- Signal cables run to one of eighteen 16-input BNC sub-panels (a-r)
- Sequential inputs go to sequential channels of Nino, fADC
- Nino outputs go to VETROC-based TDC



~133 m long
cables needed

-OR-



~93 m long
cables needed

For all experiments:
288 ~5m BNC/lemo cables
24 12-chan amps &2 NIM bins
288 lemo/BNC jumper cables
288 chan BNC-BNC patch panel
** 288 long BNC low loss cables **
3 long cables +1 SHV for pulser
Asymmetric splitter panel in Electronics hut
with connection/housing for Nino cards
18 Nino cards (with pin connectors)
18 sixteen channel LVDS cables
18 VETROCs (or F1 TDCs)
288 lemo cables
18 fADCs
2VXI crates (+1?)
2? ROCs & TIs

288 chan HV (2 1458 crates
24 1461N)
12 24-conductor HV cables
24 24-chan. SHV boxes
288 1.5 m SHV
288 5 m SHV

} Acquisition in progress

For GEp:
288+ lemo cables
18 UVa 120 Summing modules (modified)
4 quad linear FI/FO (e.g. Phillips 740 2.5V)
3 UVa 133 quad 4-chan summing modules
12 channels L.E. Disc.
3 NIM bins

To do list from July meeting:

Understand expected PMT current

Make final decision on amp/splitter (by end of summer)

Amplifiers available

Make final decision on Nino card (borrow and test one)

Spare card (with header pins) being sent from Glasgow

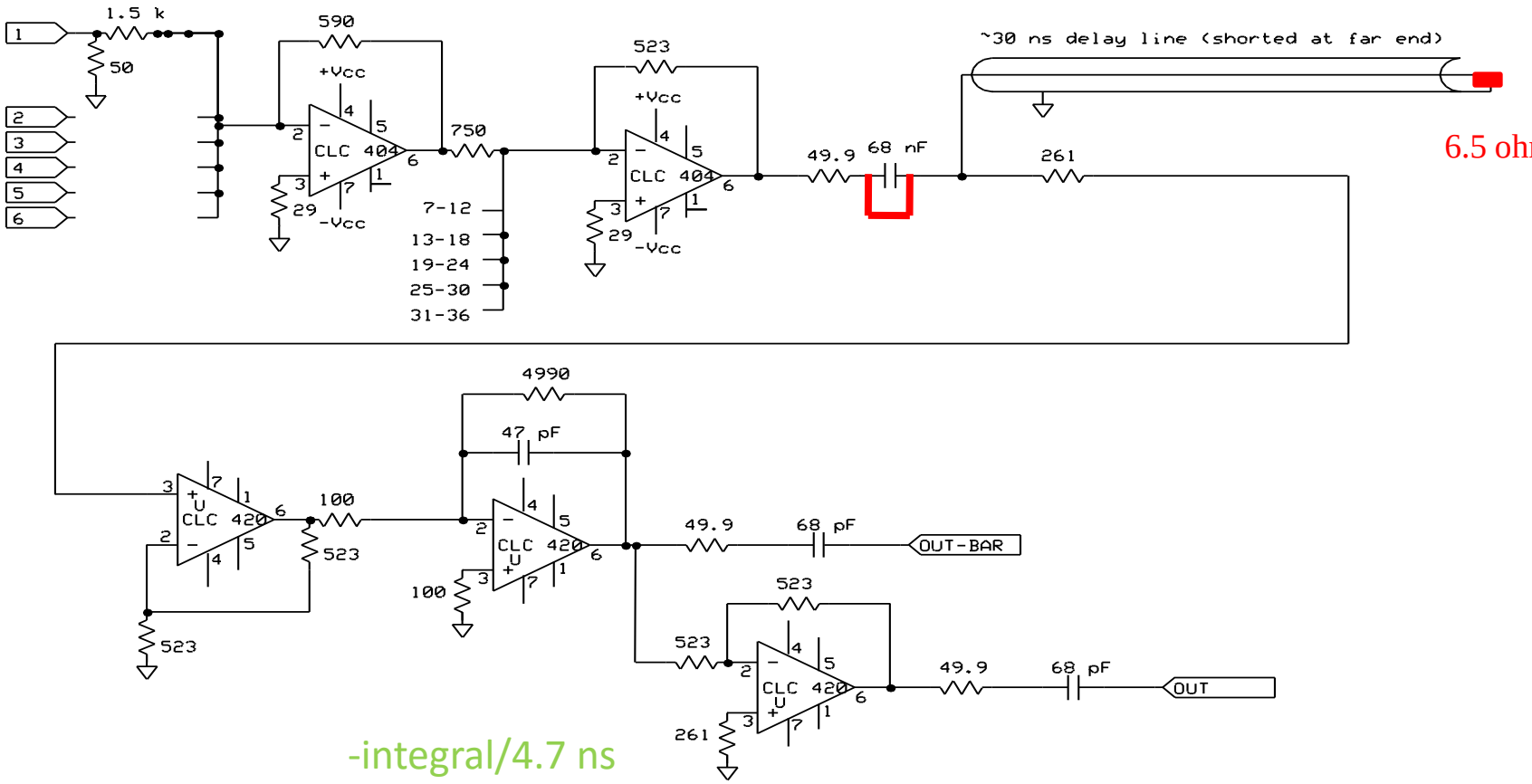
Layout racks for gantry and electronics hut

Gantry layout “done”

Choose cable route in hall, set all cable lengths/types.

Sum X -0.393

Sum X -0.697



-integral/4.7 ns

X 2

-decay time=
-230 ns

X -1