Racks, Cabling and Latency

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Overview

- Rack Layout
- Cabling paths
- Latency estimates
- Outstanding issues

`http://www.hep.ph.qmw.ac.uk/~landon/talks`

Racks Layout

Original Requirements

- Minimise the overall level 1 latency (total cable path)
- Consider incoming cable paths and location of CTP, TTC systems (now Silicon RODs may be most important?)
- Digital cables from PPM to CPM/JEM less than 10m (now less of an issue?)
- Ease of installation, use and maintenance

Constraints

- High fanout of equal length cables between crates
- Receivers crates in separate racks (Calo grounding rules)

Suggested Arrangement

- Both floors of USA15 used: niveau 1 for muons, CTP, TTC; niveau 2 for calorimeter.
- Contiguous central block of racks for the calo trigger
- Analogue cables arrive through holes in the shielding wall about 5 racks away from the centre each side
- Hence receiver crates on the outside
- Front panel cables to adjacent PPM racks
- Cluster and Jet/Et processors in the centre
- Maybe one central rack for TTCvi and ROD crates?
- CTP hits cables down through private hole in the floor
- Normally two centrally positioned 9U crates per rack

Cable paths

Cable trays

- Cable tray 30cm above the racks: accessible only for front panel cables
- Three cable trays about 40cm, 65cm, 90cm under the floor for cables to front or back of crates
- Racks are 52U high, about 2.4m

Receivers to PPMs

- Cables run from front panel to front panel
- Shortest path: central cable tray across the front of four racks on each side (need about 5U!). Disadvantage: cant replace fan tray from upper crates. Also, maybe harder to lose excess cable length.
- Longest path: up sides of racks to upper cable tray. Disadvantage: latency.
- Middle option: always take cables up above each crate, but run cables between racks at crate height. Cable bulk at sides may still prevent removal of crates and fan trays.

PPMs to CPMs/JEMs

- Cables run from backplane to backplane
- Must use lower cable tray.

Between Merger Modules

- Front panel or backplane not decided?
- If via backplane, for four ribbon cables we could cut a small hole between adjacent CPM racks.

Cable lengths: RX to PPM

Short option

Bending away from front panel:	0.2m
Up/down to central cable tray:	0.5m
Across up to four racks:	2.8m
Up/down to central cable tray:	0.5m
Bending away from front panel:	0.2m
Total	4.2m

Medium option

Bending away from front panel:	0.2m
Up to upper crate cable tray:	0.5m
Across up to five racks:	3.5m
Down to lowercrate cable tray:	1.2m
Bending away from front panel:	0.2m
Total	5.6m

Long option

Bending away from front panel:	0.2m
Up to ceiling cable tray:	2.5m
Across up to five racks:	3.5m
Down from ceiling cable tray:	2.5m
Bending away from front panel:	0.2m
Total	8.9m

NB calculations assume 0.7m from rack to rack - but it may only be 0.6m.

Cable lengths: CP and JEP

PPM to CPM/JEM

Cabling from central slots at each end may take the least optimal route to the sides of each rack. Hence allow NRacks+2 width.

Back to vertical cable tray:	0.5m
Down to underfloor cable tray:	2.0m
Across up to seven racks:	3.5m
Up from underfloor cable tray:	2.0m
Back from vertical cable tray:	0.5m
Total	8.5m
Total (using lowest tray)	9.0m
Total (without ROD/TTCvi rack)	7.8m

Between Merger Modules

Cabling from central slots at each end may take the least optimal route to the sides of each rack. Hence allow NRacks+2 width.

CP Mergers (via cable tray):	4.2m
CP Mergers (via hole in rack):	1.7m
JEP Mergers:	1.0m

Cable lengths: Summary

Receivers: Barrel/Endcap summing

Some cables are required between Barrel and Endcap receivers for summing across the transition. The lengths will be either 1m (in the same rack) or about 5m (via underfloor cable tray between racks). If the summing is from Barrel to Endcap this may be within the latency difference between them.

Mergers to CTP

Route is down through the floor. Approximate length 5m down and 12*0.7m across, say 14m for furthest merger, maybe 12.5m for nearest merger. (CTP and TTC are now quite off centre).

Glinks to RODs

If RODs are placed centrally, cable lengths will be under 3m. If the RODs are at the edge, this rises to about 12m.

Likely minimum and maximum cable lengths

Path:	Min	Max	Safe?	TDR
RX to PPM:	4.2m	8.9m	5m	10m
PPM to CPM/JEM:	7.8m	9.0m	8m	10/7.5m
Between CP Mergers:	1.7m	4.2m	2m	2.5m
Between JEP Mergers:	1.0m	1.0m	1m	2.5m
Mergers to CTP:	12.5m	14.0m	13m	2m?
CTP to TTC :	5m	5m	5m	8m?
Total cable:	30.5m	41.1m	32m	30m?
Total RX-CMM:	13.7m	22.1m	14m	20m?
Cable latency/ticks:	6	8	6.5	6?

Outstanding Issues

- Should central rack be left for RODs etc? Latency could be slightly reduced; but no space for future trigger improvements (or problems).
- My diagrams have JEM crates closer to CTP than CPMs. If Jet/Et system in fact has the shortest latency this should be reversed.
- EM Barrel/Endcap summing is easiest if Barrel and Endcap receivers for one side (A or C) are in the same rack - if Calo grounding etc permits.
- Most significant effect comes from decision on routing of the cables between Receiver modules and the PPMs. Do these need to be the same stiff bulky cables as those from the detectors? (NB cable splicing required?) Probably 10cm*10cm from each crate.
- Central racks have limited space in front... Since the cables will now be laid through the shielding wall without connectors, we may not need all three holes. Maybe shift trigger racks to one side (reversing previous request to ATLAS technical coordination!). This would also put the calo trigger above the CTP.
- Aside: since Muon RPC trigger has lowest latency, it seems more sensible (for the latency) if the CTP, MuCTPI and TTC systems were more central.
- Timescales: changes within the calo trigger system dont have much effect and can be left till later. But calorimeter signal cable lengths need to be determined earlier? When? If USA15 end connectors are installed in situ, can this decision be left till much later? Last date for changing rack layout in USA15?.