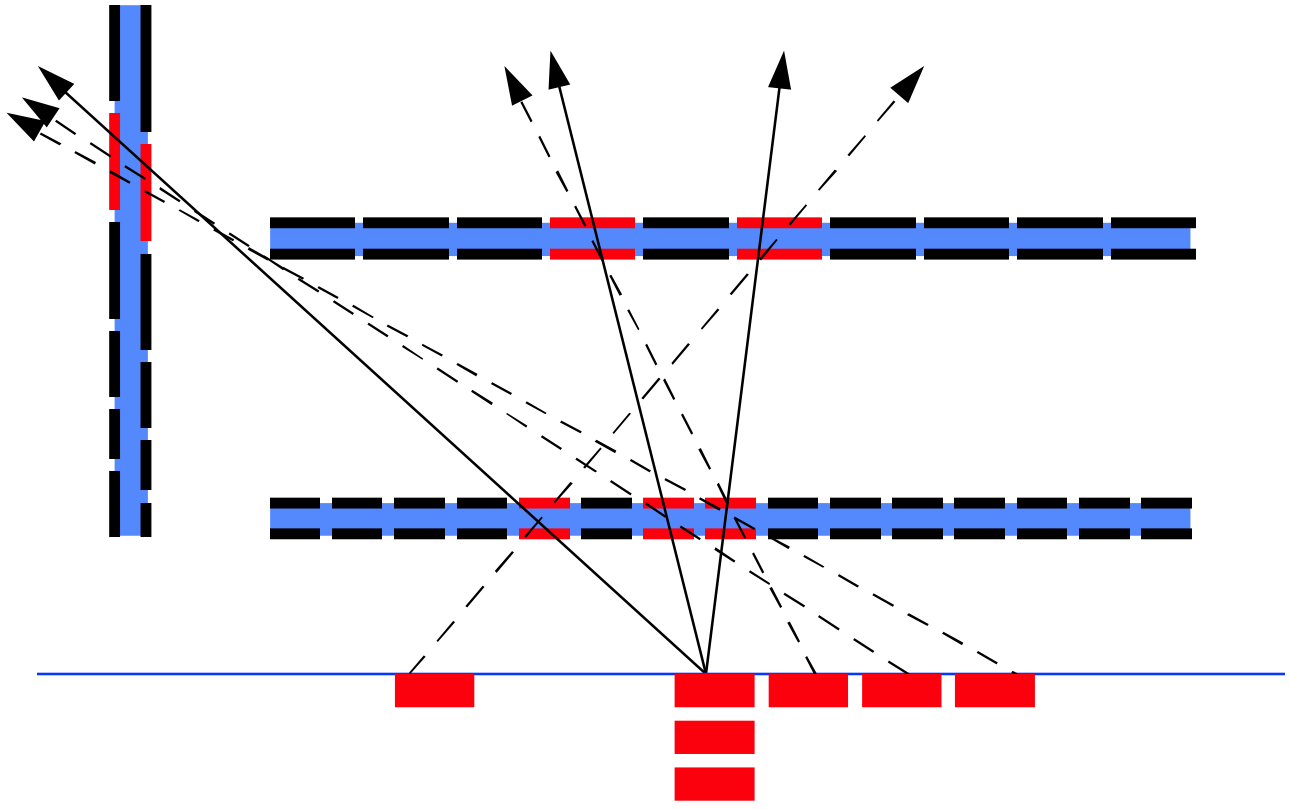
Forward Triggers

- Principle of z-vertex trigger operation.
- Forward MWPCs.
- Readout pads.
- Electronics, z-vertex trigger.
- Forward ray trigger.
- Use of FPCs after upgrade.
- Possible replacement for FPCs?

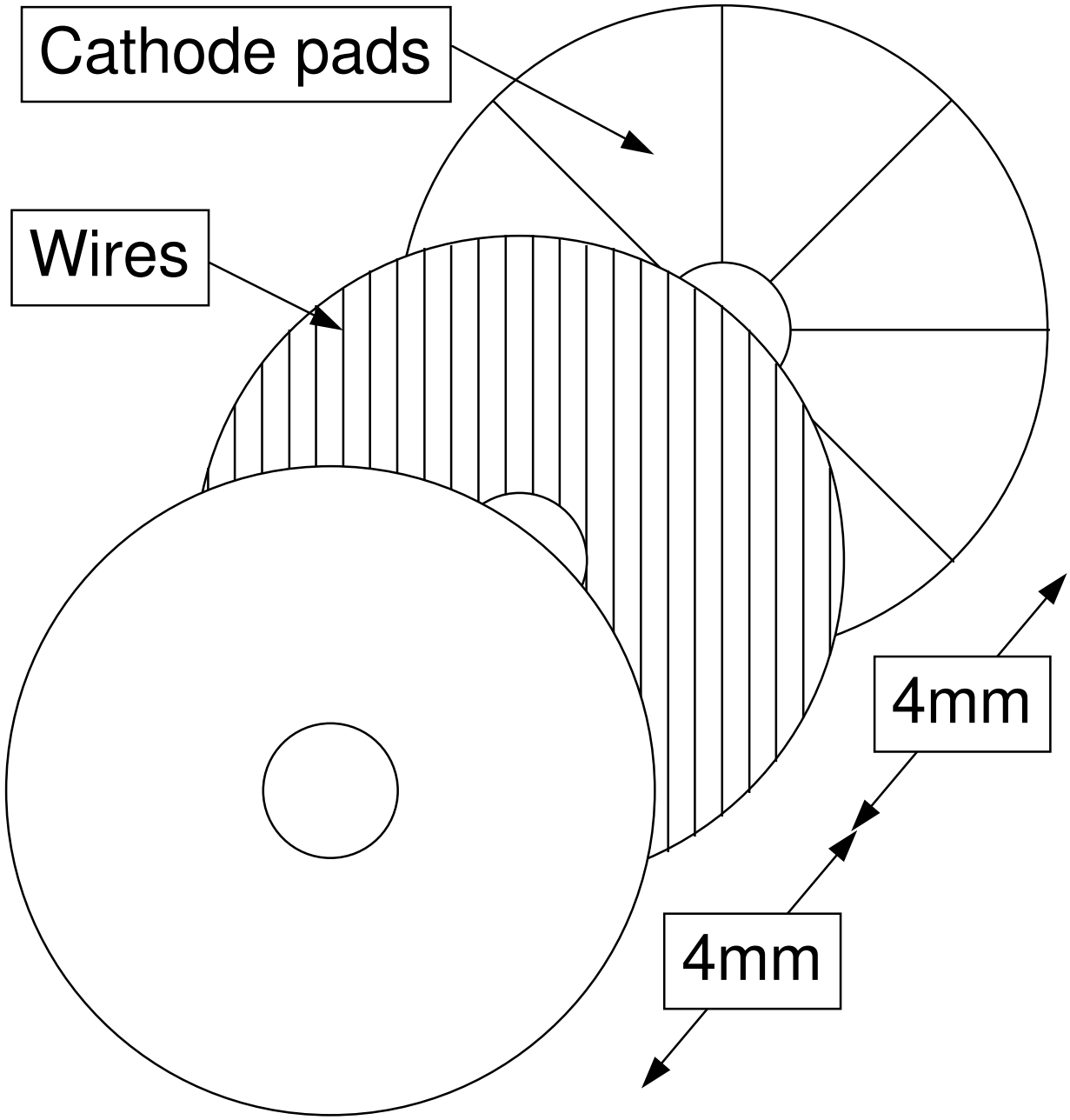
Principle of Z-Vertex Trigger Operation

- Is there evidence that tracks come from common z-vertex in nominal interaction region?
- Use pad hits in CIP, COP and first FPC.



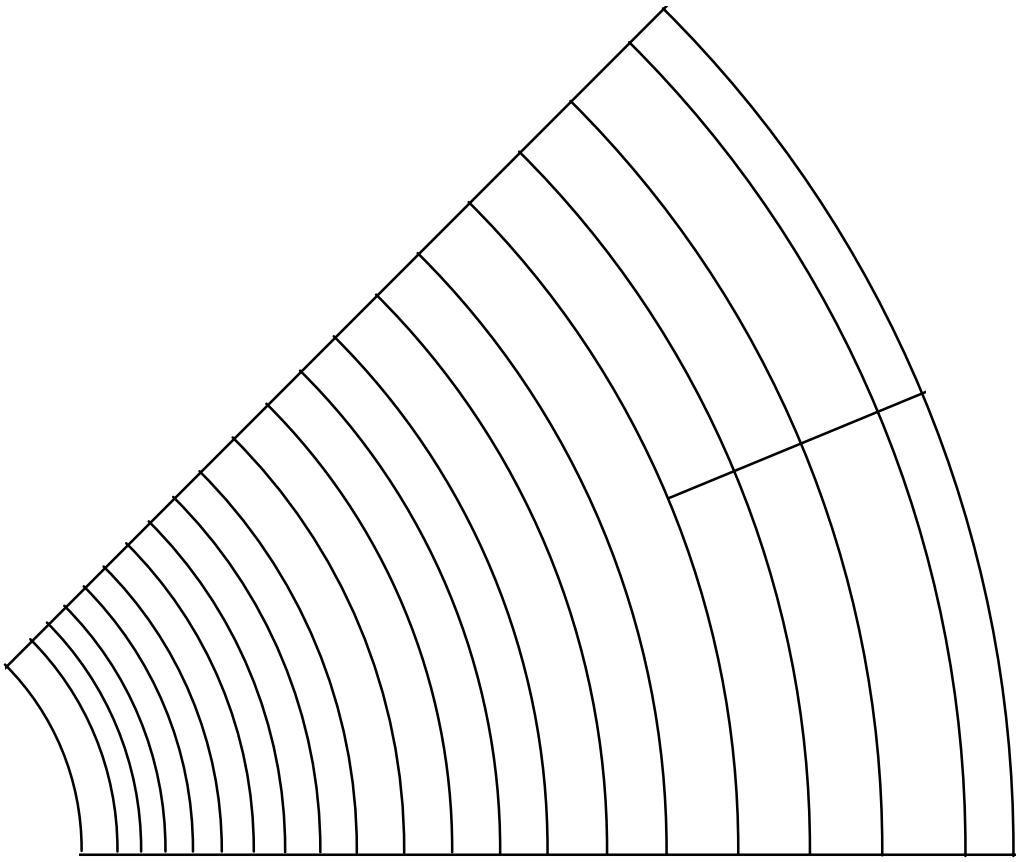
Forward MWPCs

- Each module consists of two back to back chambers, two wire planes separated by 12mm.



MWPC readout pads

- Pads with $\pi/4$ symmetry (8 sectors).
- Radial width 1.3...5.4cm.
- Arc-length 7.1...22.7cm.



- Second chamber of pair rot. by $\pi/8$.
- Second pad set displaced by half pad width in r.

FPC readout pads cont.

- Total number of pads:
  - per chamber 192
  - per chamber pair 384
  - in forward tracker 1152.
- All these used in forward ray trigger.
- 384 pads from first FPC used in z-vertex trigger.

Electronics, z-vertex trigger.

- Receives total of 1920 signals.
- “Rayfinder” electronics builds 16 histograms for 16 ϕ sectors independently.
- Big ray candidates identified.
- Histograms added on adder cards.
- Peak finding logic consists of:
  - Vertex finder card, extracts “significant” numbers.
  - “Significant” numbers on address lines of RAM look-up table give trigger signal at output, inc. peak position if found.

Rayfinder cards

- Four-fold coincidence defines ray.
- Average of 134 combinations examined for each of 16 x 16 (z, ϕ) bins.
- Calc. number of active rays in bin, pass to adder card.
- Realised on 256 pc boards, each containing 8 gate arrays (non-programmable).
- In total z-vertex trigger requires 2112 gate arrays.
- Late 80's technology, but replacement with verifiable system not trivial!
- Keeping electronics demands that pad (θ, ϕ) structure be maintained.

Forward Ray Trigger

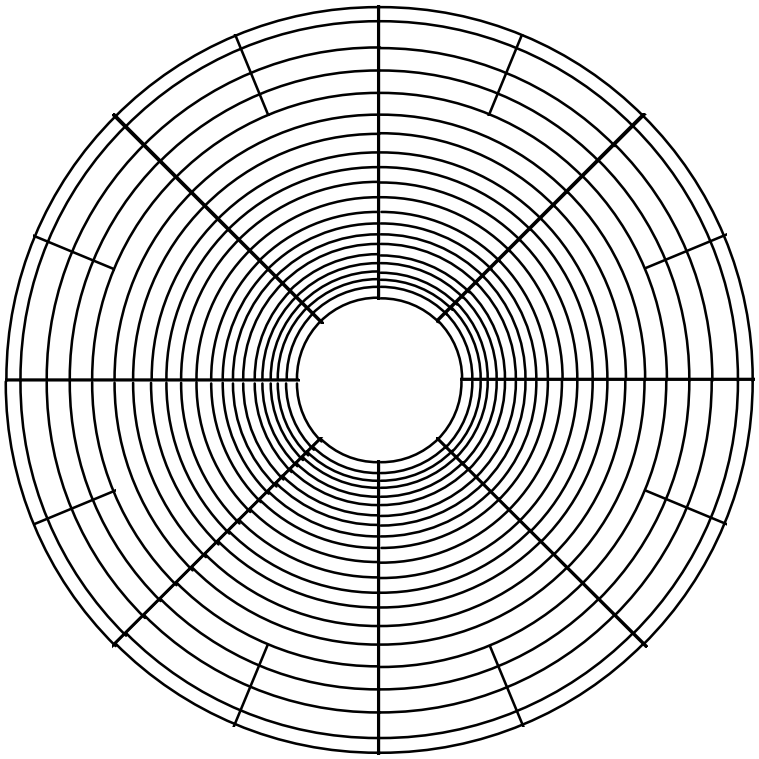
- Forward ray trigger uses signals from FPCs and CIP.
- Builds roads of 5 hit pads from possible 6 (low and high θ) or of 7 from possible 8 (intermediate θ).
- 206 possible roads in each of 16 ϕ sectors.
- Set of pads corresponding to a road programmed in RAM.

Use of FPCs after upgrade

- Christian Pascaud wrote
  - ...for the FPC one may fear that ageing may be fatal to them in the years 2000...
  - ...I do not see our group taking responsibilities here...
- Do not know if evidence for ageing seen, or if above just expresses vague concern...

Possible replacement for FPCs?

- Duplicate pad (θ, ϕ) structure in scintillator, supported on low density disc.



- Second set of "pads" on other face of disc.
- Read out using wave-shifter(?) and avalanche photodiodes, with pre-amps at outer edge of disc.

APDs and scintillator

- APDs available with gain 100.
- 80% QE at λ~600..900nm.
- Plastic scintillators emit at λ~390..430nm.

- Higher (~10^4) gains tested, but not in production yet?

Conclusions

- Replacement of FPCs necessary?
- Maintaining current trigger logic desirable?
- Too much for us to upgrade tracker and provide new forward trigger?