Study of Hexagonal Tiles

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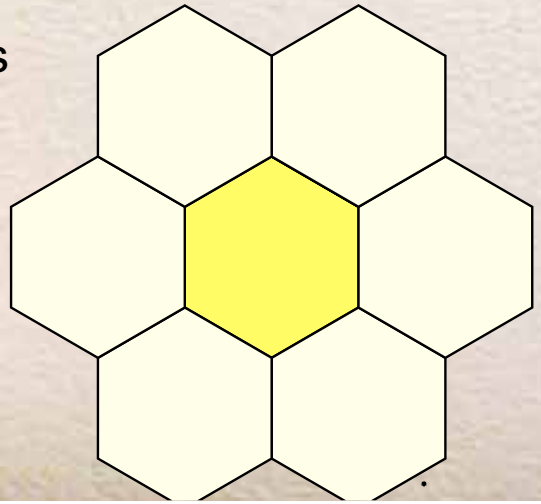
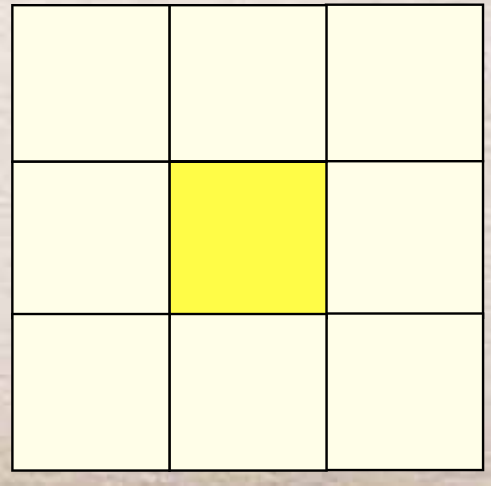
Introduction

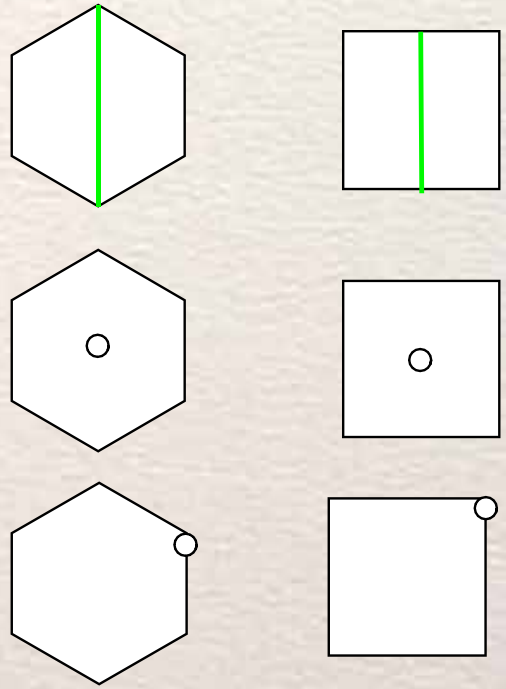
- The SiD ECAL uses hexagonal silicon pixels motivated by higher pixel yields from a wafer
- Hexagons are a better approximation to a circle than a square,
  - As for squares larger arrays can be constructed with hexagons without gaps
  - But at the module edges, we have to deal with half hexagons
- For EM showers, we obtain a better performance for hexagonal cells since the first ring around a center tile consists of 6 not 8 tiles and the second ring 12 and not 16
  - Better S/N since the energy of less cells is summed
- So why not using hexagonal scintillator tiles in the AHCAL?
- I think it will be useful to study the properties of hexagonal tiles





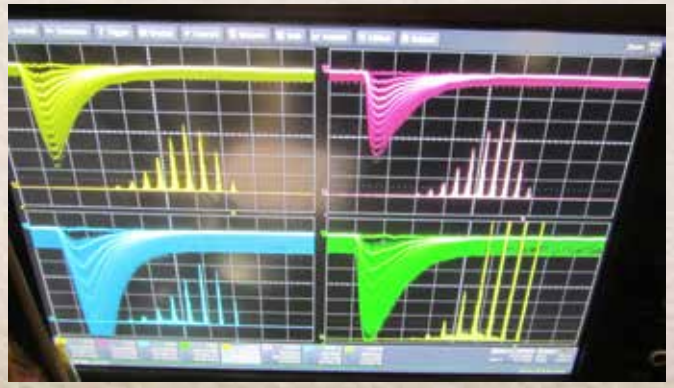
Tile Layouts

- Our machine shop produced 9 hexagonal-shaped tiles (a=1.86 cm) and 9 square-shape tiles (3 cm × 3 cm) having the same area
- Scintillator material is from St Gobain (Bicron)
- 3 hexagonal and 3 square tiles have a groove to insert a wavelength shifter (Y11)
- 3 hexagonal and 3 square tiles have a dimple in the center
- 3 hexagonal and 3 square tiles for readout at one corner/side
- Tiles will be wrapped in Tyvec paper
- Green fiber is Y11 from Kuraray
- For readout we use the Hamamatsu MPPC S13360-1325



Measurement setup

- We will do these measurements in our Bergen lab
- We have a large black box in which we place a small black box that holds 4 preamps
- We read out the MPPC signals with a 12-bit digital oscilloscope from Le Croy
- We have used this setup in our gain stabilization studies of 30 SiPMs from 3 different manufacturers
- We will compare light yields in the different setups and measure uniformity across the tiles



Comments

- My master student who started with with light yield measurements failed several exams and quit the HEP program
- I will ask my PhD student to take over with a new incoming postdoc
- There was a study for LYSO crystals in SuperB that showed better performance than for trapozoidal shapes but machining was too expensive
- For plastic scintillators this is not a problem since any shape can be produced by an appropriately shaped mold
- Besides the measurements it would be useful to simulat the performance of an AHCAL with hexagonal tiles in GEANT 4