Inside-Out LAPPD's for the Large Hadron Collider

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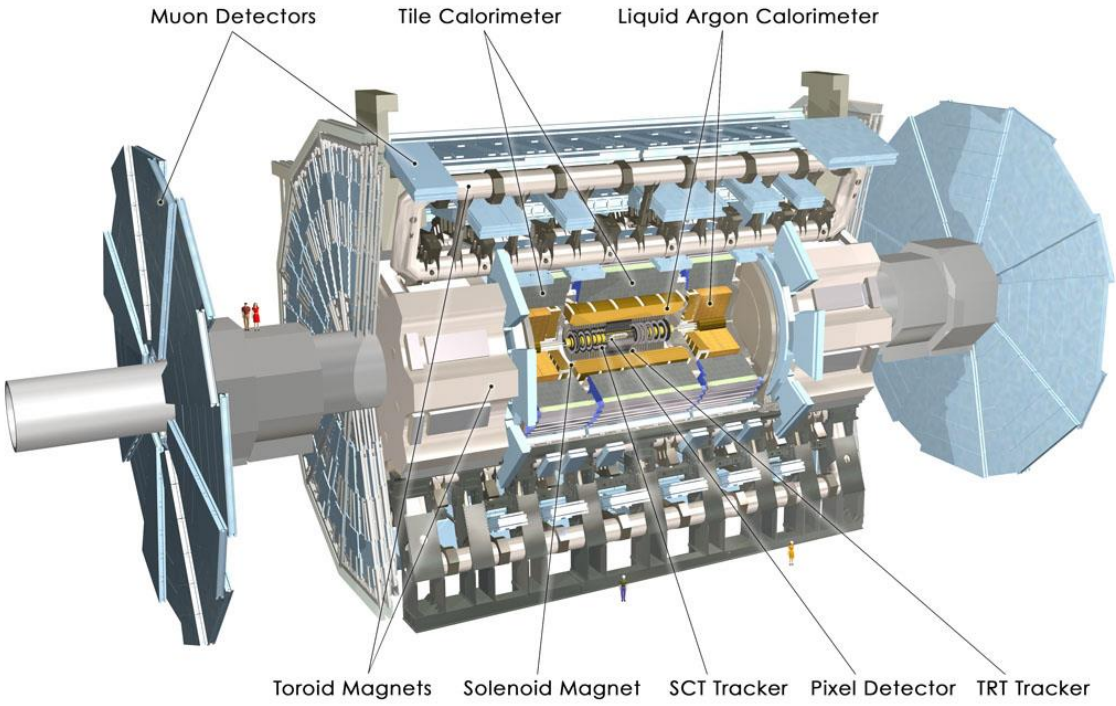
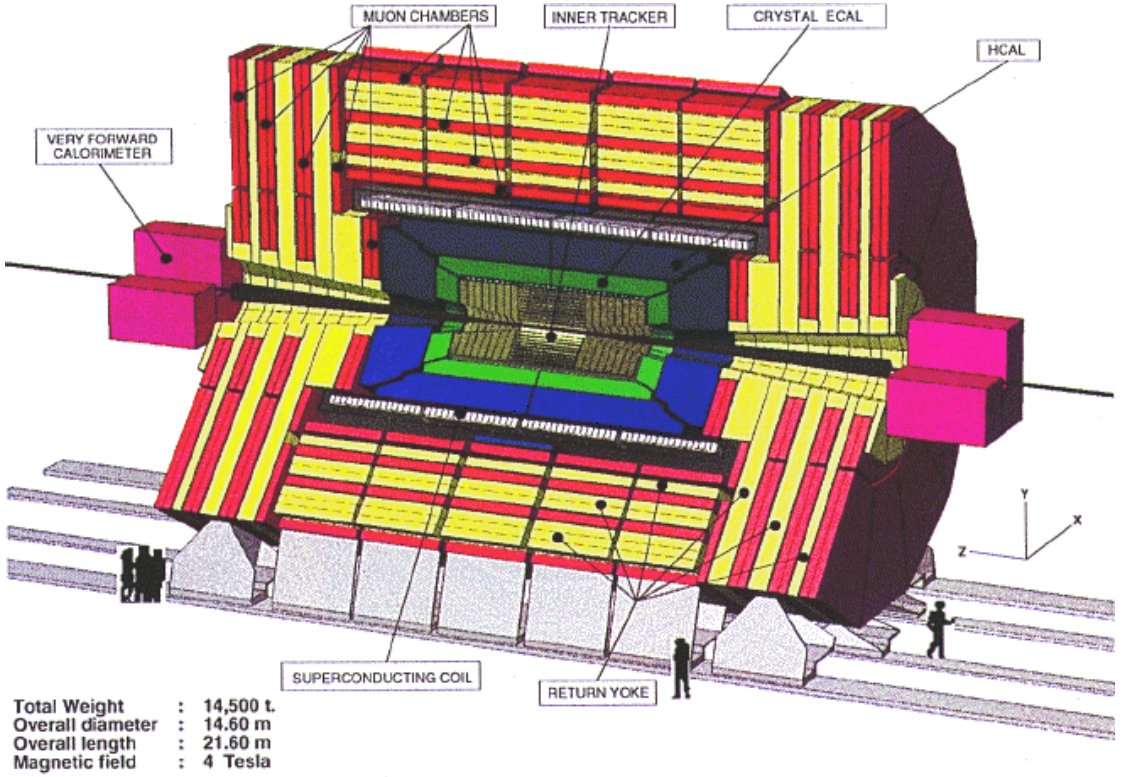
The Large Hadron Collider

- Proton collider
- Collisions have tiny chance to produce interesting new particles
- Two general purpose detectors: ATLAS and CMS

ATLAS and CMS



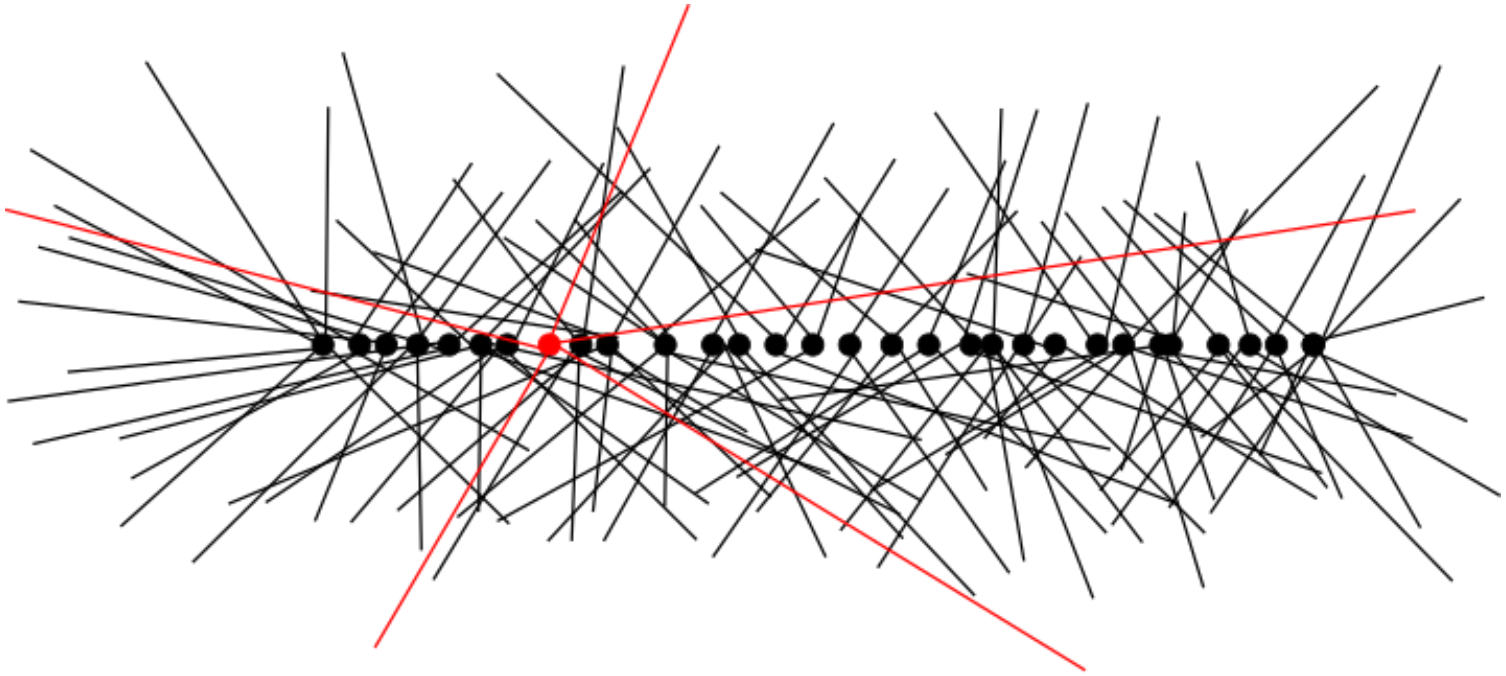
ATLAS



CMS

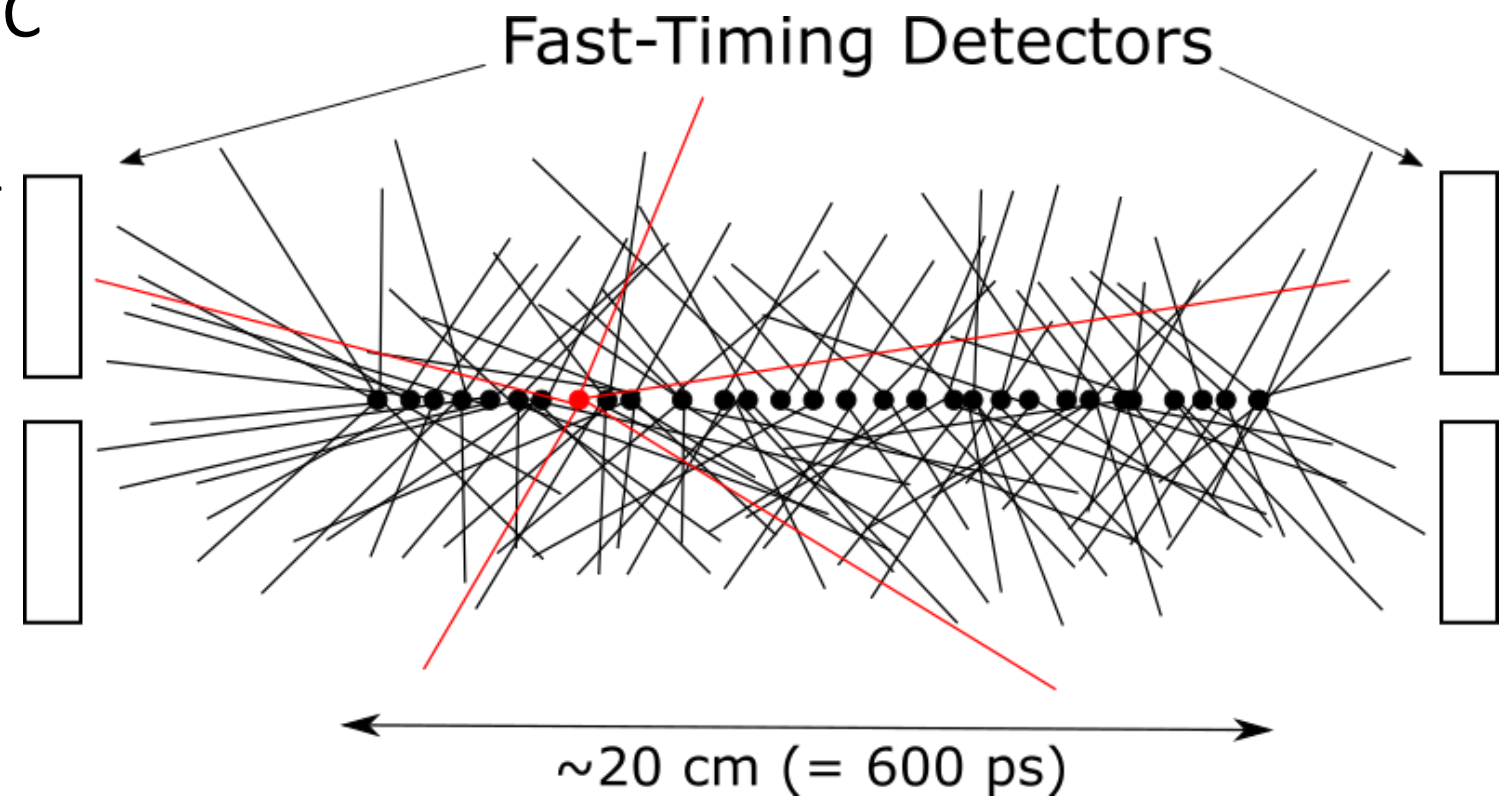
Interaction Region

- Beams made of bunches of protons
- Roughly 200 events per bunch crossing after upgrade
- Hundreds of particles per event
- Need to be able to tell events apart with hundreds or thousands of particles around.



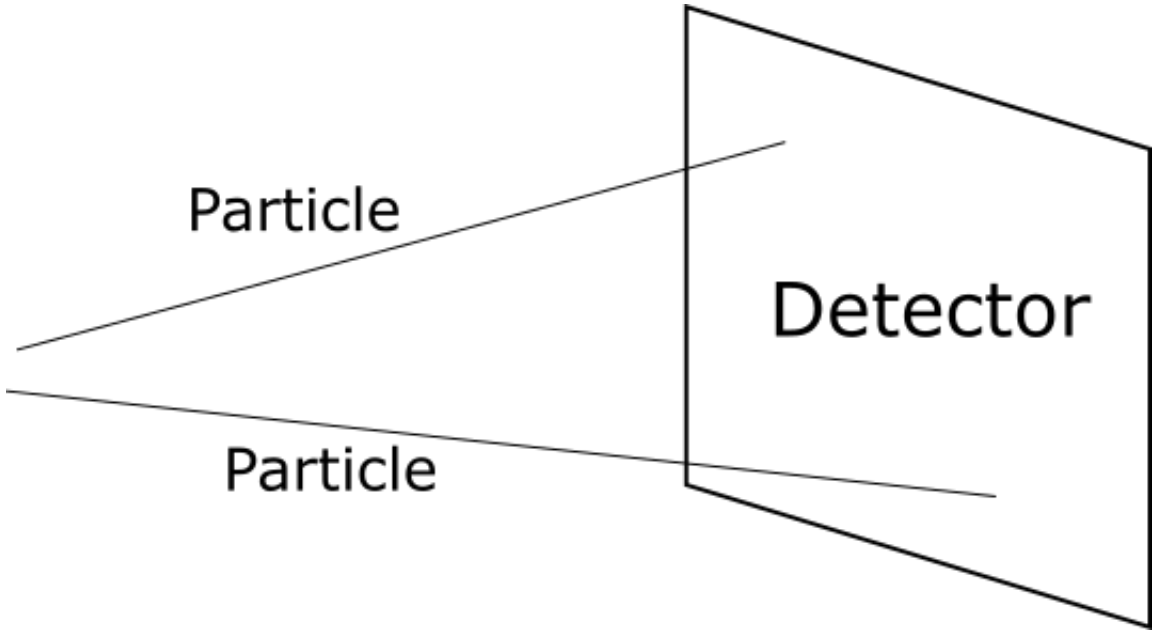
Fast-Timing

- Timing on the order of 10's of picoseconds allows us to tell apart different events
- Not done currently at LHC
- LAPPD's can do this!
  - (Glass window in front of detector. Charged particles passing through produce light for LAPPD)



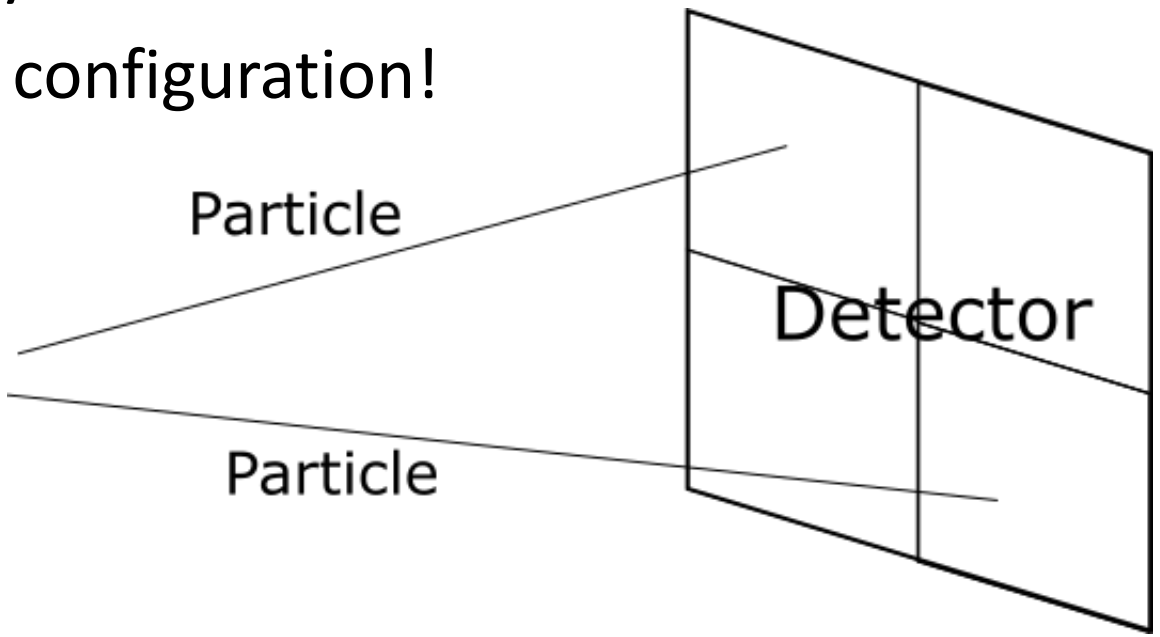
Problem: Too Many Particles!

- Detector with large area totally overwhelmed with all the particles around in LHC collisions
- Several particles hitting different parts of the detector would produce messy signals

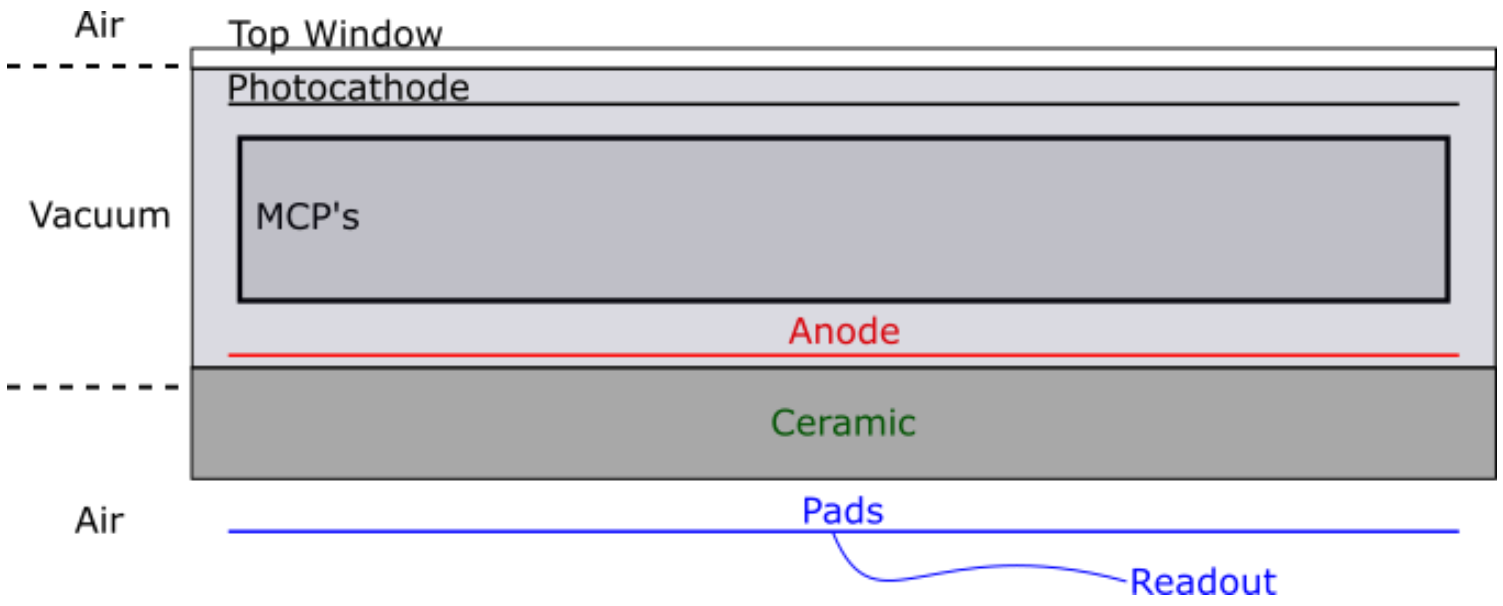


Solution: Segmentation

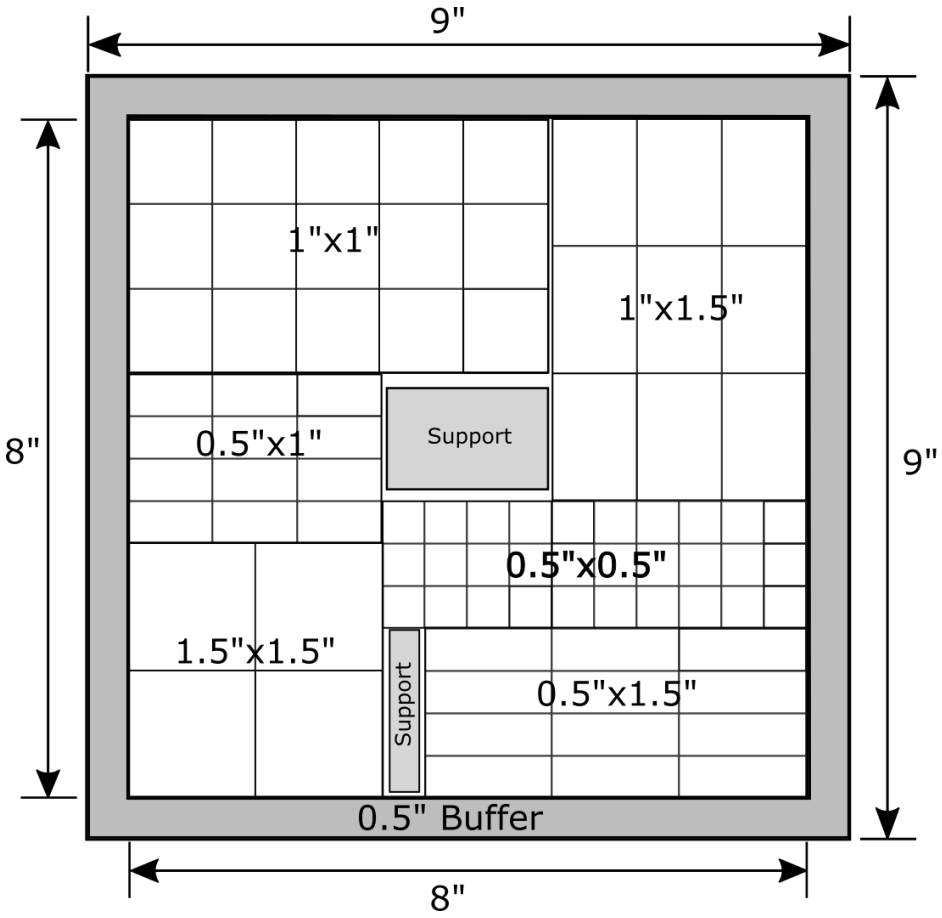
- Need to segment detector so a particle hitting in one region doesn't affect the whole detector. Decouples different parts of detectors.
- For LAPPD, do this with pads, small square areas that read the electron pulse only directly above it.
- Easy to do with inside-out configuration!



Testing Pads in Inside-Out

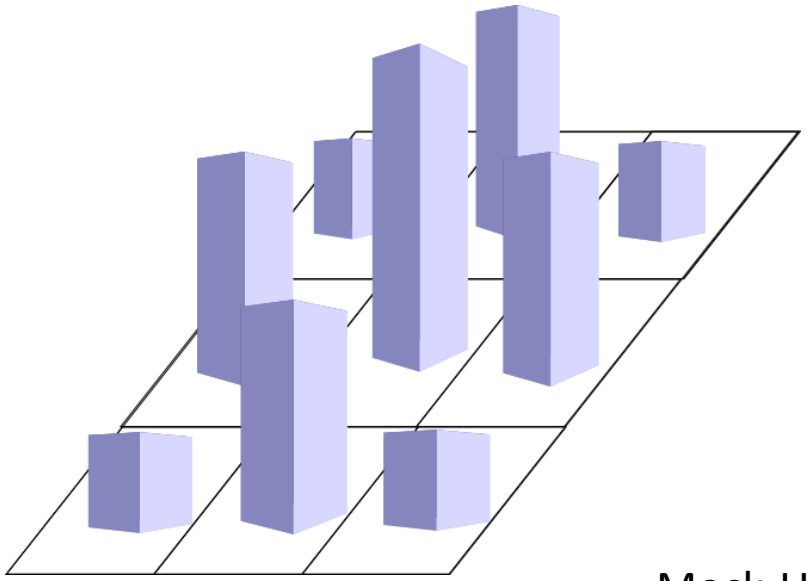


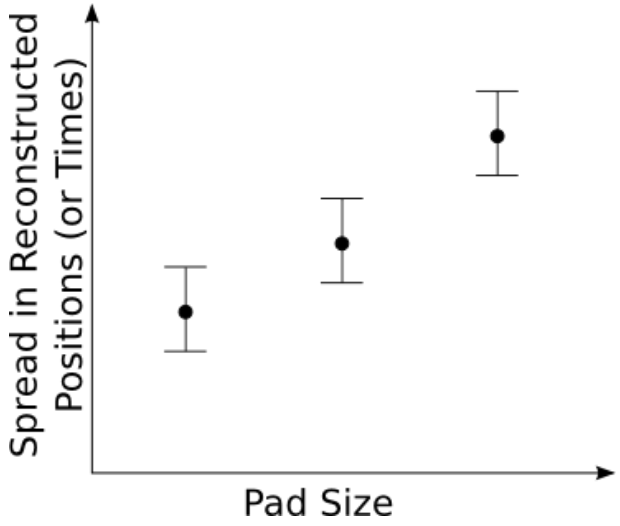
Test Board: Printed Copper Pads



My Project

- See how well the segmentation works
- Compare time/position resolution to what is required at the LHC
- I will soon be taking and analyzing data!





Mock-Up Plots

Conlcusion

- Inside-out LAPPD has real applications
- Can’t do segmentation without it. Would needs lots of readout channels running from vacuum to air