# WP3: MAPS Status

- Three main areas of work
  - Sensor design (RAL Technology)
  - Sensor simulation (RAL PPD)
  - Physics simulation (Birmingham and Imperial)
- Scope
  - Two rounds of MAPS sensor fabrication
  - Thorough testing on the bench
 - Beam test for the sensors from the second round

Sensor design

- Coming to end of feasibility study
  - Now need to start actual design for first round
  - Many design details still undecided
- Will have four variants of pixel design on first sensor
  - Each is a 64×64 array of pixels, control/readout is common to all

Pad & Power Ring

Control

Pixels

Readout

64x64   64x64

64x64   64x64

10 mm

10mm
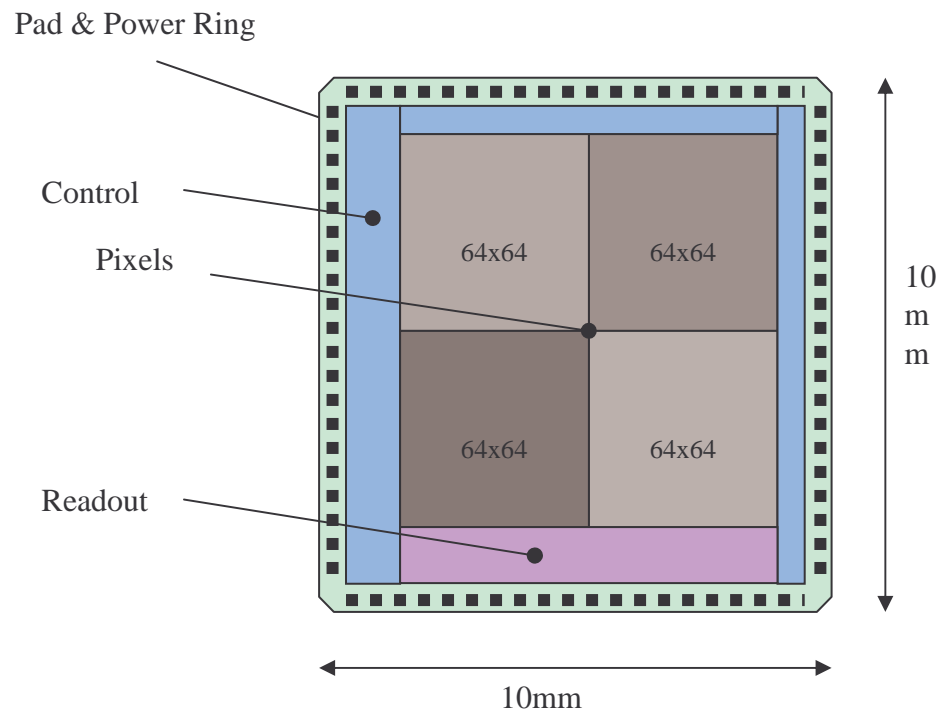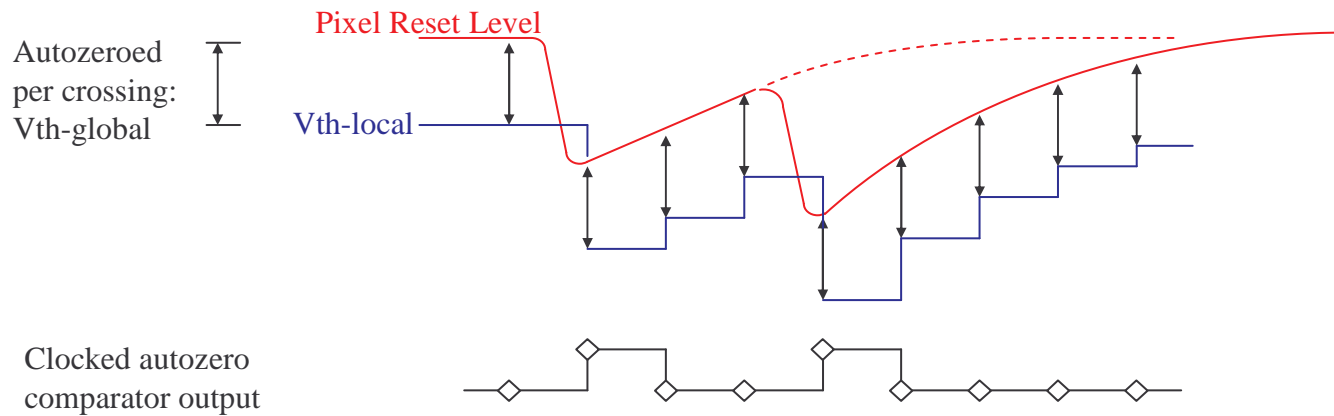
Some of the variants

- Pixel memory storage local or clustered?
 - Originally assumed local but more memory-efficient to centralise
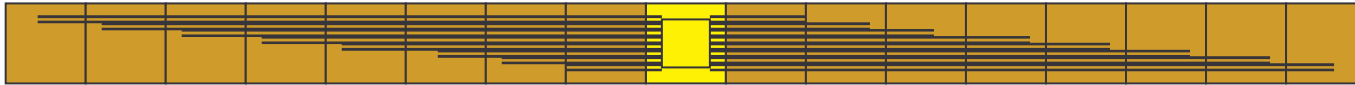
- Comparator type fixed or tracking?
  - Tracking more complex; better for drifting pedestal or two hits close in time

Pixel Reset Level

Autozeroed per crossing: Vth-global

Vth-local

Clocked autozero comparator output

- Number of charge collection diodes per pixel?
- Pixel reset: explicit or charge leakage?

Sensor simulation

- Two main aspects
  - Provides guide and interpolation for sensor design
  - Provide efficiency and crosstalk response for physics simulation
- Must be verified against real sensor during test period
- Sensor being simulated in very fine detail
  - ~$75 \times 75 \mu m^2$ sensor area fully modeled
  - Simulate diffusion of charge deposited in small $5 \times 5 \mu m^2$ volumes
 - Full simulation of each variant can take a few days!
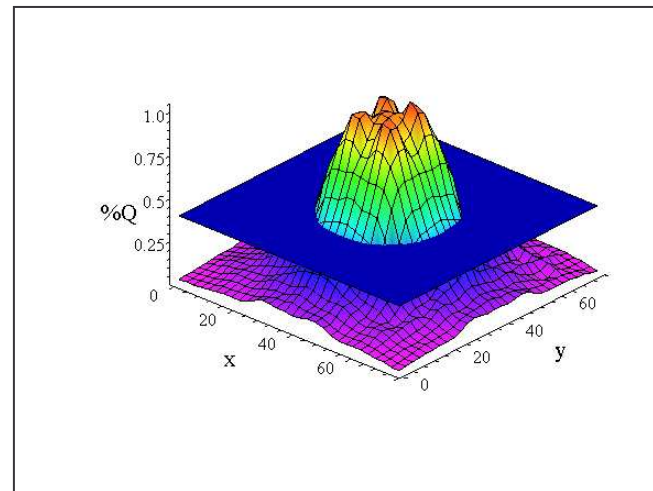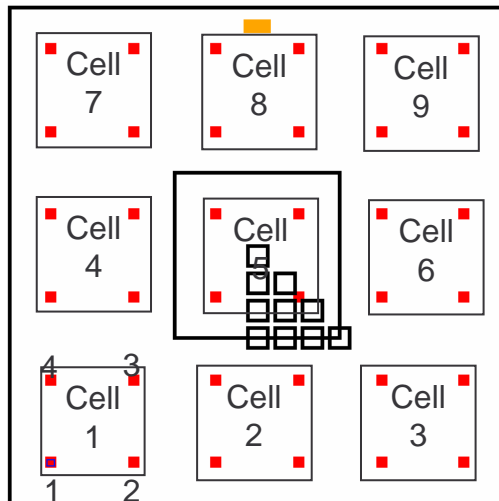
Physics simulation

- Slow start due to late arrival of RAs
  - Now with Anne-Marie and (particularly) Yoshi, coming up to speed
  - Currently working on physical implementation of simulation
  - PFLOW and physics studies must come later
- Main issues have been how to handle the 10^{12} pixels
  - More pixels than can be stored in a 32-bit integer (2×10^9)
  - Cannot do anything per pixel; e.g. one int each = 4TBytes!
- Organise simulation for ease of comparison with diode pads
  - Allow post-GEANT4 digi step to be done either for MAPS or diode pads
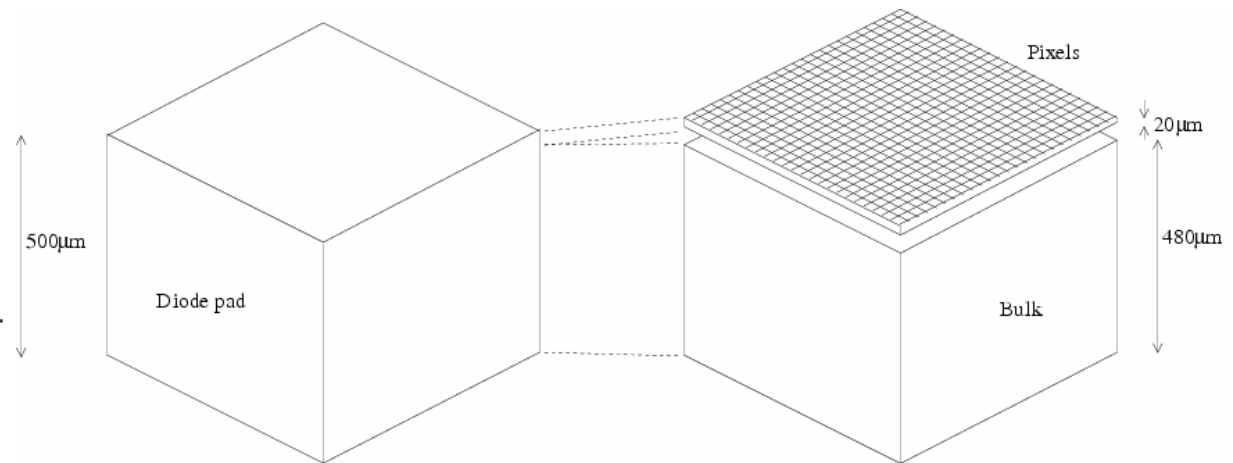
First results from GEANT4 look sensible
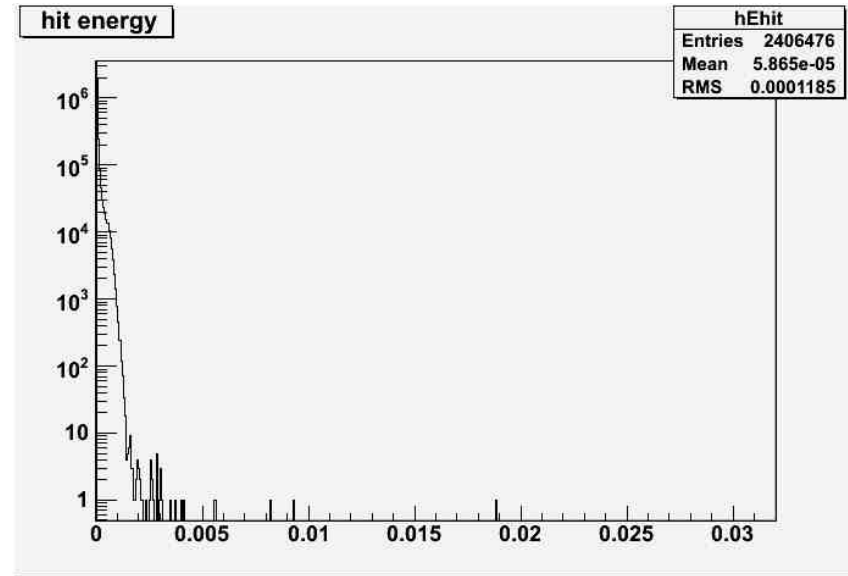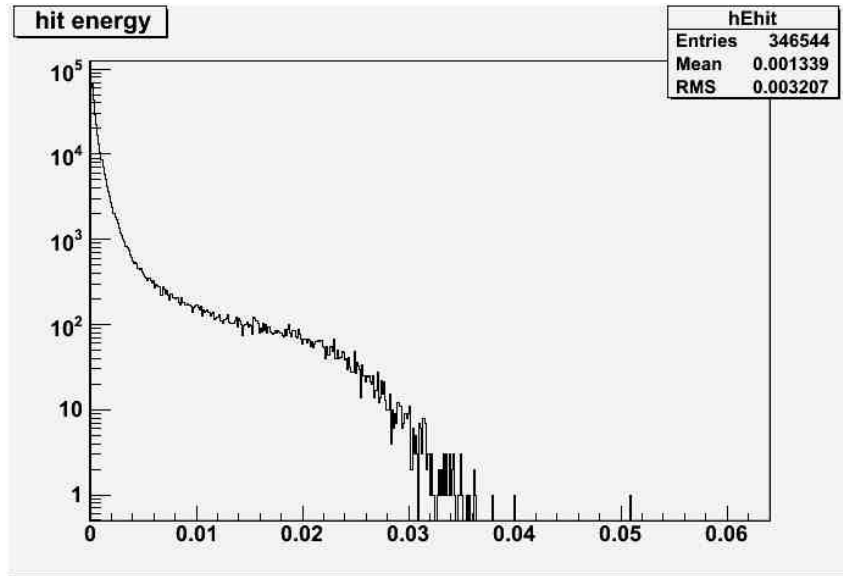
- Ratio of energy deposited in MAPS/diode pads = (3.04±0.10)%
  - Agrees with thickness ratio used here; 15μm/500μm = 3%
- Digi step not yet running
  - Wanted to implement diode pad digi first
  - Stalled due to lack of decision on structure and format of digi output
  - Issues with pixel numbers, etc, being tackled

Preliminary Design Review

- RAL Technology follow ISO9000 QA system
  - Formalised set of reviews and documentation
- Change of project from feasibility study to design requires review
  - PDR – this afternoon from 2-5pm
  - Two external reviewers, as recommended by OsC
- Significant amount of documentation generated
  - Has revealed several misconceptions, missing pieces, etc.
- Helped define exactly who will do what in testing phase
  - OsC commented time allowed is short
  - Need to be well prepared and organised; this is definitely better now
- One concern revealed is that design schedule will be very tight
  - But have no schedule contingency later
  - Must prioritise design features and implement most important first
  - Potentially only implement some in the second round

Summary

- **Sensor design** moving to implementation phase
  - Design parameter space has narrowed but still many options
  - Concerns on schedule so need to prioritise; must keep a close eye on this
- **Sensor simulation** is progressing
  - Stalled recently due to technical limitations of PC farm; fixed soon
  - RAL PPD may shuffle money to get RA ~6 months earlier than Apr07 plan
  - Would contribute to sensor simulation verification tests using laser system
- **Physics simulation** is in initial phase
  - First implementation using GEANT4 working in LDC simulation
  - Just starting to provide results on expected pixel occupancy to guide design
  - Next step is LCIO digi; application of efficiency, crosstalk and threshold
  - Physics studies are some distance off yet
- **Reviews** can take some effort but can be very useful!