Aims of simulation studies

- There are three main studies which are needed
  - Optimise design in terms of sensor parameters
  - Determine EM shower resolution
  - Determine PFA jet resolution
- In second and third cases, need to compare to diode pad ECAL
  - In a consistent, controlled way
- These items are really all inter-related
  - Optimisation of sensor is really to optimise resolution
  - But need to consider independently to keep work finite
- Following based on our LCWS list plus a few extras…

Sensor optimisation

- How big should the pixels be?
  - Main driver is number of MIPS/pixel or noise due to widely-spaced diodes?
  - Is this yet possible to determine the truth number of MIPS/pixel?
- What shape should the pixel be?
  - Mainly square vs hexagon? Main driver is charge-sharing at corners?
- How many memory columns can we afford?
  - How does dead area and its geometry affect resolution?
  - What about the space around the outside of the sensor?
- How thick should the epitaxial layer be?
  - Main drivers are charge diffusion and signal size?
  - Does clustering mean charge sharing is not such a big problem?
- Ideally would know the answers for the second sensor fabrication round, i.e. by the end of 2007
  - Round 2 interim design review at this time

EM resolution

- Unclear what determines requirement for EM resolution
  - May be $H \rightarrow \gamma\gamma$? Until we know, clearly go for best resolution possible
  - Need to understand the physical limits from physics and detector structure
- For EM resolution, the obvious measures are
  - Photon shower linearity and resolution vs energy (0.5-500GeV)
  - Two-shower separation and/or MIP-shower separation resolution
- Need to do for various clustering algorithms
  - Trade-off of linearity vs resolution?
  - How big an area should the clustering consider around each pixel?
- Need to compare with standard ECAL
  - Cell/layer/shower comparison of energies and resolutions
  - Need controlled comparison; same events in same detector. Requires bulk silicon SimCalorimeterHits to be stored; is this done?
  - Also need noise to be handled in a reasonable way; how?
- Also need to see sensitivity to our sensor assumptions

PFA resolution

- Here the main issue is to do the controlled comparison
  - PFA seems enormously complicated so very difficult to be sure differences are due to effect being studied
  - Keep detectors and events as identical as possible
  - Only change one thing at a time
- First study has to be “no harm” case
  - Sum pixels at same position granularity as ECAL cells
  - Single calibration value changes pixel count to GeV
  - The rest of PFA should then work effectively identically
- Only then can study of possible advantage of granularity be understood
  - Extrapolated from the “no harm” point in semi-continuous parameter space of pixel size/noise/dead areas, etc.
  - This may need re-optimisation of the PFA algorithm which is a major task
- Again, need to check sensitivity to our sensor assumptions