Referee report on the Progress report on Calorimeter R & D

CALICE collaboration
PRC R&D 01/02

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DESY PRC 31.10.2002

- May 2001: R&D proposal, conditional approval
- Oct 2001: Memorandum,
  W-Si ECAL prototype R&D approved
  HCAL: more technical studies and simulations required

Si-W ECAL

- Status:
  - First W plates delivered, within specs
  - First C/W module built. 3 stacks of 30 layers (reduced from 40) by end 2003.
    $10 \times 0.4\,\mathsf{X}_0$, $10 \times 0.8\,\mathsf{X}_0$, $10 \times 1.2\,\mathsf{X}_0 = 24\,\mathsf{X}_0$
  - Si sensor production has started with good yield:
    $d = 530\,\mu$m, guard ring 1 mm wide, 1 nA/cm^2
    Deliver 270 through 2003. Cost?
  - 18-channel preamp ASIC produced
    single gain stage, 12 bit range , need 18 bit.
    noise 1500 e$^-$, expect S/N = 25 for MIPs
  - ADC and DAQ under development, aim for mid 2004.
  - First beam test in 2004.

- New idea: readout inside detector
  - Avoids up to 1.6 m readout lines.
  - Cooling issues under study.
  - Preamp sensitive to shower particles?

Simulation

- Energy flow algorithms are being improved.
- Benchmark tests of the different HCAL options are being prepared.
- Large differences between GEANT3 and GEANT4 in hadronic showers observed.
- Test beam data needed to tune the GEANT simulation.
- No decision between options yet.

Tile HCAL

- Large progress in technical studies:
  - Light yield 25 e^-/tile for MIPs.
  - APDs and new Si-PMs under test. Use both in prototype. Test in 4 T.
  - 3 APD postamps designs under study, decision in Spring 2003.
  - Minical being assembled, for cosmic and DESY beam test

- New ideas:
  - New, less expensive scintillators under development
  - Put one Si-PM on each tile, instead summing into cells, for increased granularity (800k instead 200k channels in full HCAL).

- Planning:
  - Technical studies through Spring 2003
  - Produce 1 m^3 prototype in 2nd half of 2003
  - Ready for test beam in summer 2004

Digital HCAL: 3 options

- RPC:
  - Ongoing tests by several groups for chambers and readout
  - Aim: one full plane in Spring 2003
- GEM:
  - First studies underway
  - Gain in 4 T?
- Small scintillator tiles:
  - First studies underway
  - 50 M photodetectors?
- All:
  - Use common, simple digital readout.
  - Expected to be ready for test beam in 2005

Recommendation

As the present hadron shower simulations are not reliable at the level required for the energy flow technique, and since the response of the various HCAL options appears to depend on details in the tails, I recommend to proceed towards the 1 m^3 prototype with all feasible options.

High quality test beam data under various conditions should allow to tune the simulations.