CALICE CERN Beam Test Run Plans

Erika Garutti, Goetz Gaycken and Felix Sefkow

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This document presents a coordinated plan for the first two period of the CERN beam test:

- July 27 – August 10, 2006: ECAL Standalone Run Period
- August 24 – September 13, 2006: HCAL Standalone Run Period

It is clear that the run plans presented in this document serve only as starting point, to be revised when we have better knowledge of:

- beam purity
- trigger rates
- running efficiency ("duty cycle")

Here are some assumptions:

1. **Average DAQ rate**
   - Assume 1500 events per spill:
     - 400 Hz instant
     - 90Hz average
2. **Running efficiency**
   - Optimistic (pessimistic): 70% (50%)
     - Includes
       - time for change of configuration
       - down-time of experiment / DAQ
       - down-time of accelerator

   With the above assumptions, it would take 5 (7) hours for 1 million events.

   The necessary numbers of events for each detector system are:
   - ECAL: 3M desirable (2M e+ π, 1M π, equivalent to 1M e) but most likely not achievable since minimum grid in 3d has a total of 20-30 scan points. The primary goal is 1M "good e" events. This includes sufficient number of π for high precision statistical subtraction at every scan point.
     - Therefore chose 1.5M which means completing 25 (17) scan points in 7 days.
   - HCAL: 0.5 M
     - more degrees of freedom, more scan points worse systematics
     - possible exception: electrons on HCAL only: 1M
   - Muon calibration: 1M on ECAL, 2M on HCAL if beam is uniformly distributed over the entire surface of the detectors
3. **Energy grid**

   There is some discussion about emphasizing the low E region vs a more logarithmic grid for which we have a slight preference. In any case it must be the same for ECAL and HCAL.
   - Our energy choices based on even logarithmic energy interval:

6		10		18		50	
	8		13		30		100

     - if time permits one additional angle plus the 2nd position

4. Run Plans

Following sections present run plans for the first two periods based on the assumptions, number of events and the energy grids.

1.1 July 27 – August 10, 2006: ECAL period

During this period HCAL will be located behind ECAL and will have available scintillation counter cassettes in every other absorber plate which corresponds to sampling the EM shower tail roughly every 2 X_0. The proportion of number of e and π events in the section 2 above will be kept for ALL scan points to allow direct statistical subtraction of pion events.

- 14 days total, excluding the last day, Aug. 10, due to possible beam interruption for switchover??
  - First 7 days to understand beam
    - e+π and π energy scans on wafer center
  - Second 7 days physics using only the central slabs, two wafer rows: 2 positions one at the center of wafer and the other at the center between 4 wafers
- Position and angle scans are planned to minimize interruptions
  - 2 at 0 degree incident angle and 1 at all other angles
    - 2nd position for non-zero angles if time permits
- Baseline scenario for 70% efficiency
  - **5 energies at 3 incident angles** totaling 20 scan points in the following configurations:
    - **0 degree** incident angle at 2 positions
    - **30 degree** incident angle at 1 position
    - **45 (or 20)** degree incident angle at1 position
    - Energies at each of the above configurations are:

Priority 1	6		18		50
Priority 2		10		30	

    - if time permits one additional angle plus 2nd positions
- Baseline scenario for 50% efficiency
  - 5 energies at 2 incident angles, totaling 15 scan points in the following configurations:
    - **0 degree** incident angle at 2 positions
    - **30 degree** incident angle at 1 position
    - Energies at each of the above configurations are:

Priority 1	6		18		50
Priority 2		10		30	

    - if time permits two additional angles plus 2nd positions
- HCAL in ECAL period
  - low priority if Cerenkov works
  - minimize (un)cabling
  - if time permits: maybe try to steer beam directly to HCAL

1.2 August 24 – September 3, 2006: HCAL period

- 11 days total with the following allotments
  - 2 days for muon calibration
  - 4 days basic physics run

- 1 day for possible change of configuration, such as cabling/uncabling and placing/removing ECAL
  - 3 days extra physics run
  - 1 day spare
- Physics runs with 15 active layers, every second gap, about 4 lambda
  - No angular scans
  - Limited position scan with beam steering
  - One or two off-axis positions depending on range
  - At 8 energies

6		10		18		50	
	8		13		30		100

    - ◊ if low efficiency take at 5 energies:

6	10	18	30	50

  - Beam types
    - e (50:50)
    - π^- 98% pure
    - π^+ with 10% p admixture

- Baseline run with total of 34 – 44 scan points
  - π^-
    - 8 (5) energies incident into the center of the detector
    - 5 (4) energies off-centre (1 or 2 pos)
  - π^+
    - 8 (5) energies incident into the center of the detector
  - e^-
    - 8 (5) energies incident into the center of the detector
    - 5 (4) energies off-centre(1 or 2 pos)

- Extra programs
  - Option A: ECAL in front, total of 16 (10) scan points
    - ◊ π^- 8(5) energies at the center
    - ◊ π^+ 8(5) energies at the center
  - Option B: Re-arrange active layers, one into 15 front layers without gaps, total of 13 – 18 (9 – 13) scan points
    - ◊ e-
      - 8(5) energies at the center
      - 5(4) energies off-centre (1 or 2 pos)
  - Option C: small incidence angle, total of 16 (10) scan points
    - ◊ e- 8(5) energies center of the detector
    - ◊ pi- 8(5) energies center of the detector