FNAL test beam: Run Plan

In the following we assume:
- 2 pion working modes: low energy (1-32 GeV) and high energy (8-66 GeV). A third working more provides protons only at 120 GeV
- data acquisition rate 30 Hz, not energy dependent (optimistic)
- machine uptime 100%
- detector uptime 100%

We define a "FNAL day" as a 12 hours shift day.

Some info from Erik Ramberg concerning Cerenkov and pre-scaler possibilities:
The electrons coming down the beamline can be effectively tagged by both Cerenkov detectors. These Cerenkov signals can arrive at the experimental location within 20 nsec of the particle. This can thus provide a trigger signal you can use. I would highly recommend taking both electron and hadron data at the same time and then tagging the electron content with the Cerenkov signals. You could prescale the electron trigger to match your DAQ requirements. Doing separate electron and pion runs would waste beam time, in my opinion.
These info need to be crosschecked.
Open issues:
- effective Cerenkov signal delay (w.r.t. our latency)
- time needed for the pre-scaler
- option of purifying the beam to either e or pi only with absorbers in the beam line

We assume the following beam content for various energies (independent on the working mode) :

Energy [GeV]	e	π, μ
2	$>$70%	$<$3-4%
6	65%	35%
8	60%	40%
10	50%	50%
12	30%	70%
15	20%	80%
20	15%	85%
$>$30	$<$3%	

The first data taking period at FNAL is thought as a cross reference between CERN and FNAL. The main aim of the run plan for this first period (three weeks) is to cover some of the points in energy/angle/particle type that have been collected at CERN in 2007. This period has to contain also muon calibration and a large fraction of beam tuning and beam understanding.

For the muon run we request 2 runs of 3M ev each at 120 GeV (broad muon distribution) = 6 FNAL days to be taken one at the beginning and one at the end of the three weeks beam time of period 1.

For the physics program we consider the following energy points:
Very Low energy mode: 1,2,3,4,5 GeV
Low energy mode: 6,8,10,12,15 GeV

High energy mode: 8,10,15,20,30,40,60 GeV

The minimum number of pions and electrons to be collected for each energy point is 300 k ev.
The modality has still to be agreed (i.e. electron run only + pion run only with optimized beam rate to achieve 30 Hz in both cases seams to be the preferred option.

We present the minimum requirement physics packages in order of priority with the expected time for data taking. The time estimate does not include modifications of the detector configuration (i.e. rotation) nor change of the beam parameters.

Packages to be collected during Period 1 (07-28.05.08

Low Energy phys. package 0 :
Rotation angle: 0 deg.
Energy: 6,10,15(,8,12)
# of k ev per run: 600 (including 300 e k ev and 300 k ev pi)
total events = 1.8M (3)M

High Energy phys. package 0 :
Rotation angle: 0 deg.
Energy: 10,15,30,40,60,(8,20)
# of k ev per run: 600
total events = 3M (4.2M)

Very Low Energy phys. package 0 :
Rotation angle: 0 deg.
Energy: 5,3,2(,4,1)
# of k ev per run: 600
total events = 1.8M (3M)

Low Energy phys. package 10-30 :
Rotation angle: 10,20,30 deg.
Energy: 6,8,10,12
# of k ev per run: 500 (including 250 e k ev and 250 k ev pi)
total events = 6M

High Energy phys. package 10-30 :
Rotation angle: 20,30 deg.
Energy: 10,20,30,40,60
# of k ev per run: 500
total events = 5M

HCAL alone Very Low Energy phys. package 0 :
Rotation angle: 0 deg.
Energy: 5,3,2(,4,1)
# of k ev per run: 600
total events = 1.8M (3M)

HCAL alone Low Energy phys. package 0 :
Rotation angle: 0 deg.
Energy: 6,10,15(,8,12)

# of k ev per run: 600
total events = 1.8M (3)M

This amounts to a total of about 23M of physics events plus 6M muon calibration events, for a total of 22 FNAL days (12 hours data taking per day).
This plan does not include calibration runs (pedestal, SiPM gain calibration, LED runs) and the time for detector changes (rotation, ECAL removal).
The run plan will be effectively dictated by the rotation of the detector which should be done in the evening after the beam time is over and every minimum 2 days. The runs will be split in 500k ev runs. The coverage of all energy points will have priority on statistics. As far as possible we should try to collect the desired statistics for every energy point in a second repetition of 500k ev runs.

Packages to be collected during Period 2 (??-??.07.08

Minimum program for the second run period.

Very Low Energy phys. package 0 :
Rotation angle: 0 deg.
Energy: 5,3,2(,4,1)
# of k ev per run: 600
total events = 1.8M (3M)

Very Low Energy phys. package 0, position scan :
Rotation angle: 0 deg., 4 sets of (x,y) stage positions
Energy: 5,3,2(,4,1)
# of k ev per run: 600
total events = 7.2M (12M)

Very Low Energy phys. package 10-30 :
Rotation angle: 10,20,30 deg.
Energy: 5,3,2(,4,1)
# of k ev per run: 600
total events = 5.4M (9M)

HCAL alone Very Low Energy phys. package 0 :
Rotation angle: 0 deg.
Energy: 5,3,2(,4,1)
# of k ev per run: 600
total events = 1.8M (3M)

Very High Energy protons package 0 :
Rotation angle: 0 deg., 4 sets of (x,y) stage positions
Energy: 120 (protons)
# of k ev per run: 600
total events = 2.4M