Summary of "Instrumentation"

- Production and Installation Policy -

P.Burrows and T.Tauchi, 20th December 2006

FONT, P. Burrows

FONT4 as the digital feedback system

in December 2006;

tested FONT4 amplifier (measurement of inductance at FEATHER kicker)

ADC clocking at 357/4=90MHz

observed kicks at 2nd and 3rd bunches in the three-bunch train with 150ns separation

in March/April 2007

Closed-loop FB

FONT5

for long ILC-like train of 20-60 bunches since the amplifier was specified

waiting for fast-extraction kicker, in 2008/9 ?

IP FB system

IPBPM to drive an upstream kicker

need serious study (simulation, location)

Feed-Forward System, A. Kalinin

an ILC turnaround feed-forward prototype at ATF

corrections of fast bunch-by-bunch jitter, a drift across a train, slow drift

the final goal : $\pm 6\sigma$ to 0.1σ

only vertical plane for 2 or 3 buches within 0.45us feed-forward time

BPM : one pair in DR and 3 pairs (4BPMs) in EXT

stripline kicker : one pair in EXT

R&D at Darebury lab.

sub-μm BPM of compass-needle-like strip line pickup, table test in March07

the electronics and a high voltage kicker amplifier

Purpose of the prototype

a basis for engineering design of the ILC system

algorithm and procedure of betatron matrix measurement

algorithm and procedure of the gain measurement and adjustment

QBPM Electronics, D.McCormick

Hardware : the performances have been checked and OK

39 boards have been tested on the gains and noise figures< 15dBm (100nm)

Cross talk between channels on same board = about 60dB

Resolution < 100nm,

Saturation starts at 200um and about 10% lower gain at 1.6mm

Gain dependence of temperature = -0.0172dB/^{O}C around 30^{O}C

Operation : first pulse calibration of correct position signs by beam through the first QBPM and reference cavity with well known z-positions

Installation : electronics and hardware - 38 down mix boxes, RF infrastructure

software development - VME control, mover calibration, position calculation, amp. gain monitoring, temperature monitoring, EPICS with ATF control system.

Test bed setup - ready in Spring 2007 to test first pulse and mover calibration

Signal and background simulation for LW and BSM, L. Deacon

Background simulation along the ATF/ATF2 beam line with the beam halo, which has been measured with wire-scanners by Shintake group.

First, simulation the present ATF extraction line using BDSIM
- experimental data with calorimeter and Cherenkov detector
- to be reproduced by the simulation

Then, apply to LW and BSM at ATF2

Development of simulation technique
- weighting the halo particles for efficient statistical calculations

The experimental data of LW signals

Signals have been measured with minimizing background by tuning optics both at upstream and downstream of the LW for spray and back-scattered particles, respectively. For the above study, also "bad" optics data can be used.

Shintake monitor, T.Suehara

Goal of the phase stabilization = 10nm for 2nm error of 35nm beam size
(fringe pattern) with safety factor of 3

The 10nm-level phase stabilization was demonstrated with two off-axis monitors and a phase scanner controlled by one of monitors;
i.e. 3.2nm at the stabilized monitor and 7.5nm with subtraction of drift at the other one . (low power CW laser)

Issues to be done;

test by high power pulsed laser - to check the performance of linear sensors
identification of sources for the phase drift
optimization of stabilization algorithm
equalization of two laser beams after splitting by a Pockels cell
correction of laser timing jitter (1ns) by using TDC

High power laser is desired; the FFTB laser produces about 1,000 signals/bunch.

Shintake monitor Detector, H. Yoda

Two detector concepts have been studied for robust against backgrounds;

(1) multi-material Cherenkov counter

not practical for too long space and small number of lights

(2) two layer scintillation calorimeter (CsI crystal)

our solution and optimized geometries by simulation (S/N=2000/1000)

the crystals have cross section of 10cm x 5cm and length of 2cm and 30cm.

Plan in 2007

prototype fabrication in March

test it by cosmic ray and beam in June

detector fabrication in September

detector test in November

Area for the detector : 40cm x 40cm x 45cm long behind the beam dump

Background study/supression is very important for the detector optimization.

IPBPM, T. Nakamura

Two IPBPMs were fabricated, where a IPBPM has 2 cavities.

Test bench measurements :

R/Q by small bead scanning in cavities; parabolic as expected for dipole signals

Electronics noise; -95dBm to be compared with -90dBm/nm

They were installed at the extraction line and tested by beam.

Measured results;

- position sensitivity = 0.15 and 0.35 mV/um in x and y; 2 amd 3 times of QBPM
- angle sensitivity = 1.8 and 3.8 mm/rad in x and y; 1/2 and 1/4 of QBPM
- position resolution was estimated to be 2.7nm by correlation of split signals.

Plan in 2007

- position resolution measurement by piezo-movers on the FFTB movers.
- design and fabrication of bunch length/charge monitor
- IPBPM in the IP vacuum pipe of the Shintake monitor

BSM using a pattern target, Y. Honda

motivation : beam size measurement for 1um to 350nm of "blind" region.

target is a thin film with fine strips which can be realized by present technology.

- small beam : two peaks of signals
- large beam : two peaks move closer, finally merge in a single peak

Extendable target for destroy by beam,

e.g. tape-10mm long/one measurement (10um x 1000 pulses) or zigzag pattern

Since the method is statistical, the result is robust for beam jitters.

Simple calculation shows that 1.5um pattern can measure the beam size from 350nm to 1um.

Simulation (GEANT4) with 10um pattern on 10um thick Aluminum sheet

Multiple scattering effect is negligibly small and 10% yield of the wire scanner.

Engineering and radiation issues to be investigated.