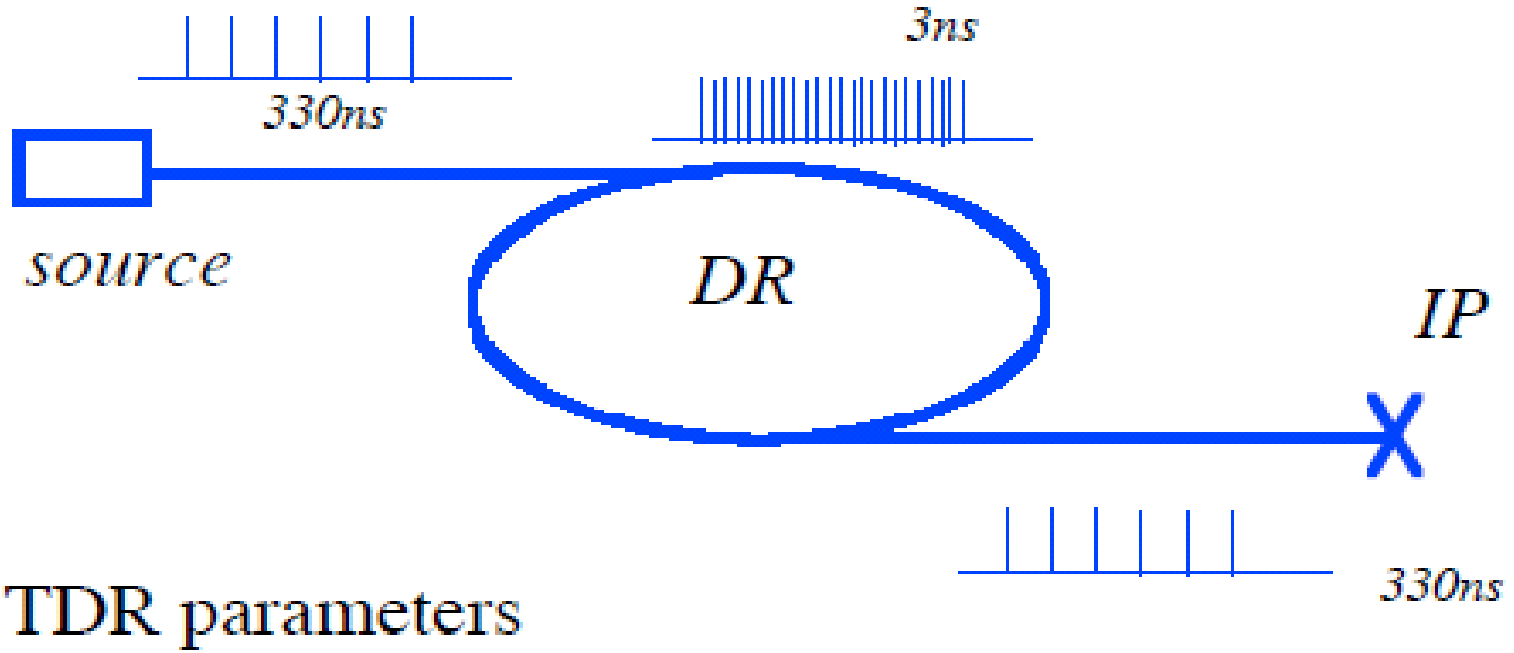
# Plans for KEK/ATF

**Junji Urakawa (KEK) at ILC Damping Rings R&D Workshop – ILCDR06, Cornell University**

1. Fast Kicker R&D at ATF
2. Instrumentation at ATF
3. Prospect of ATF and ATF2

# The specs.

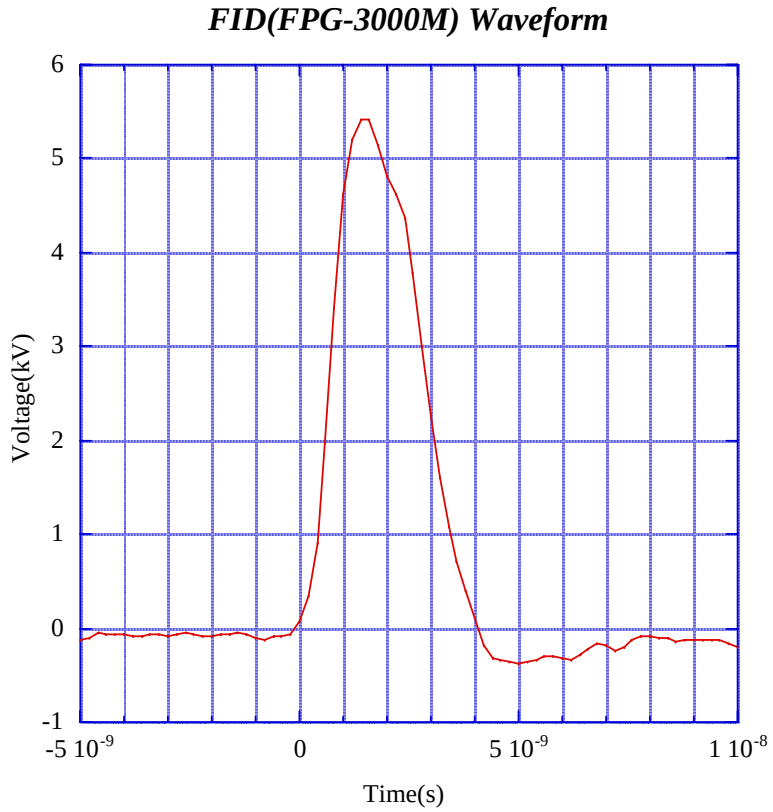



TDR parameters

**impulse: 100 G-m (3 MeV/*c*) ± 0.07 G-m (2 keV/*c*) @5GeV**
**At β~50m, 0.6mrad kick**
**residual (off) impulse: 0 ± 0.07 G-m (2 keV/*c*)**
**Rep. Rate in burst mode: 3MHz (or 6MHz)**
**rise/fall time: <3.077ns**
**Rise and fall times should be symmetric due to the positron source scheme of the undulator.**
**leading edge < 3.1ns, trailing edge < 3.1ns**

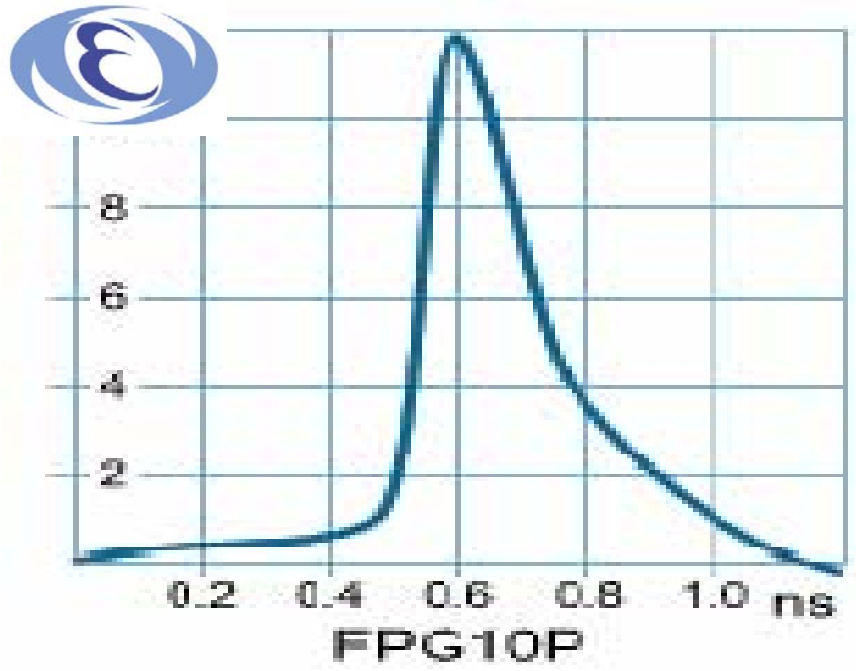
# Pulse generator

***FID Technology has very fast and high repetition rate pulse generators. The specification meets our requirements for the high voltage pulse source. We tested the kicker performance by using the pulse PS.***




## Specifications

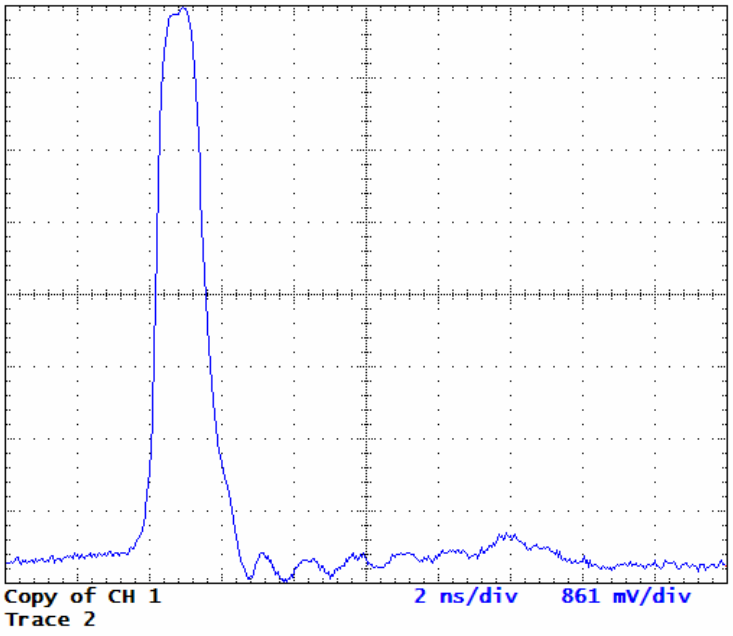
**Amplitude at 50 ohm : 5 kV**
**Rise time : 1-1.4 ns**
**Pulse width at 50% of amplitude : 2-3 ns**
**Maximum Pulse Repetition Frequency in burst mode : 3 MHz**



FPG10P


FPG10 & FPG 20

**Horizontal : 2 nsec/div,**
**Vertical : 624 V/div**
**10kV, 20kV : possible but 3MHz PS is not available at present.**
**The technology of fast pulse PS will be upgraded soon.**

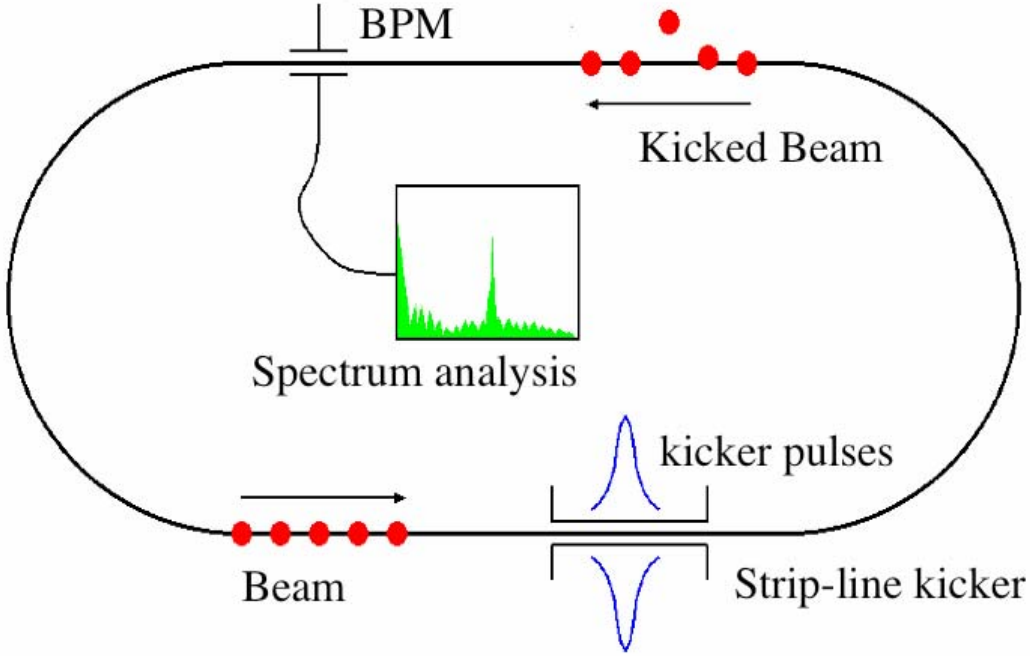


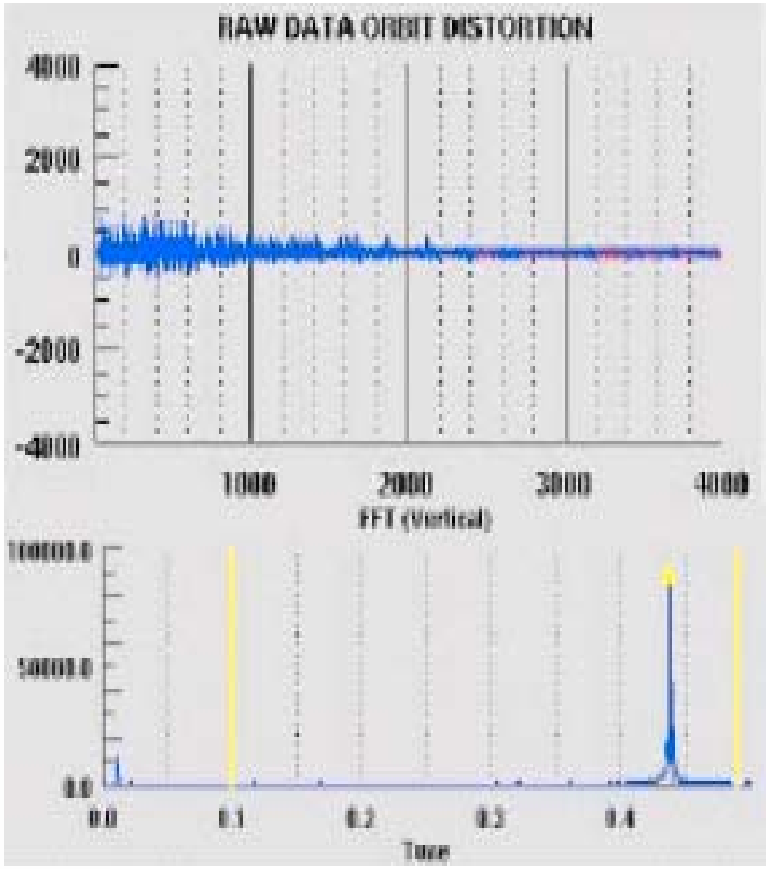
# Beam kick experiment at ATF DR

***The kicker pulse is applied to the strip-line electrode when the beam goes through the electrode.***

***The beam kick is observed by a turn-by-turn BPM as the amplitude of the oscillation of the betatron frequency component.***

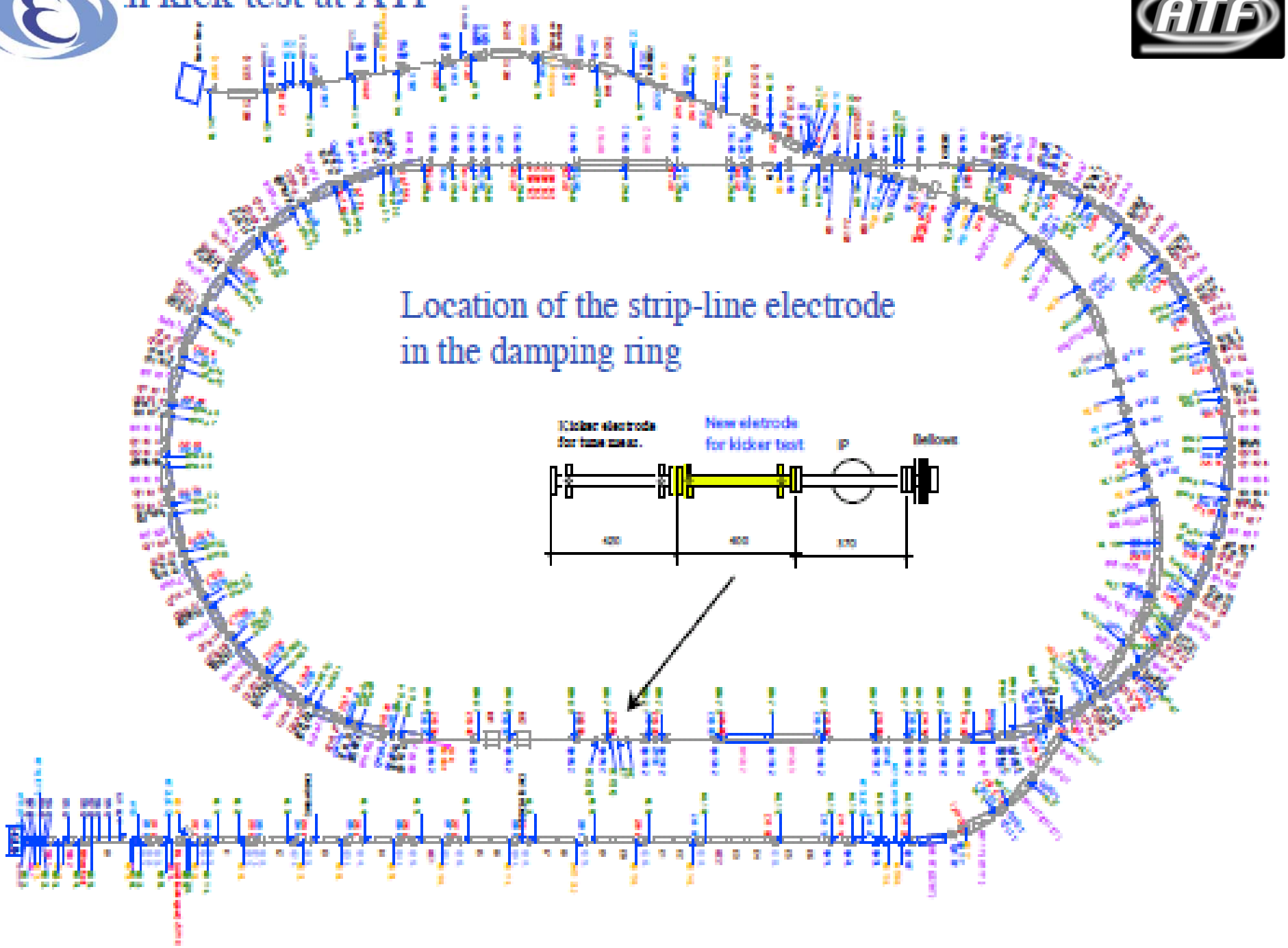
***The kick effect is measured by scanning the pulse timing precisely.***



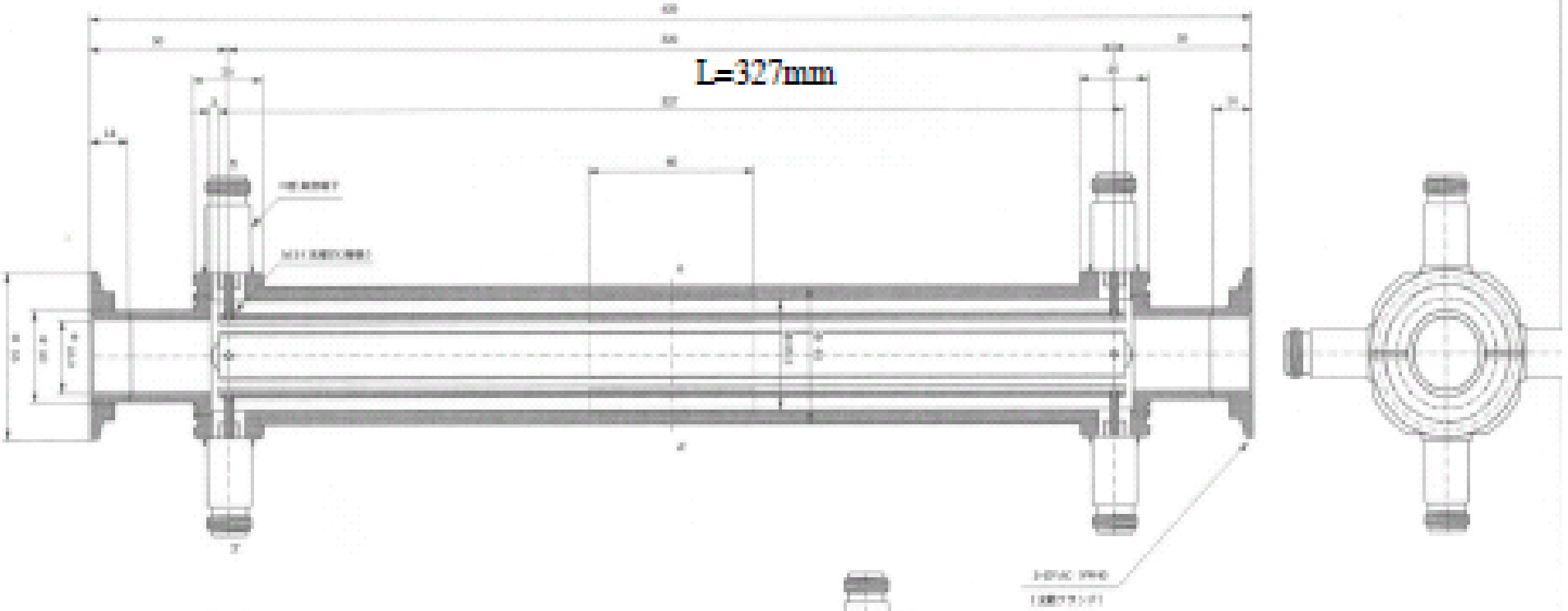



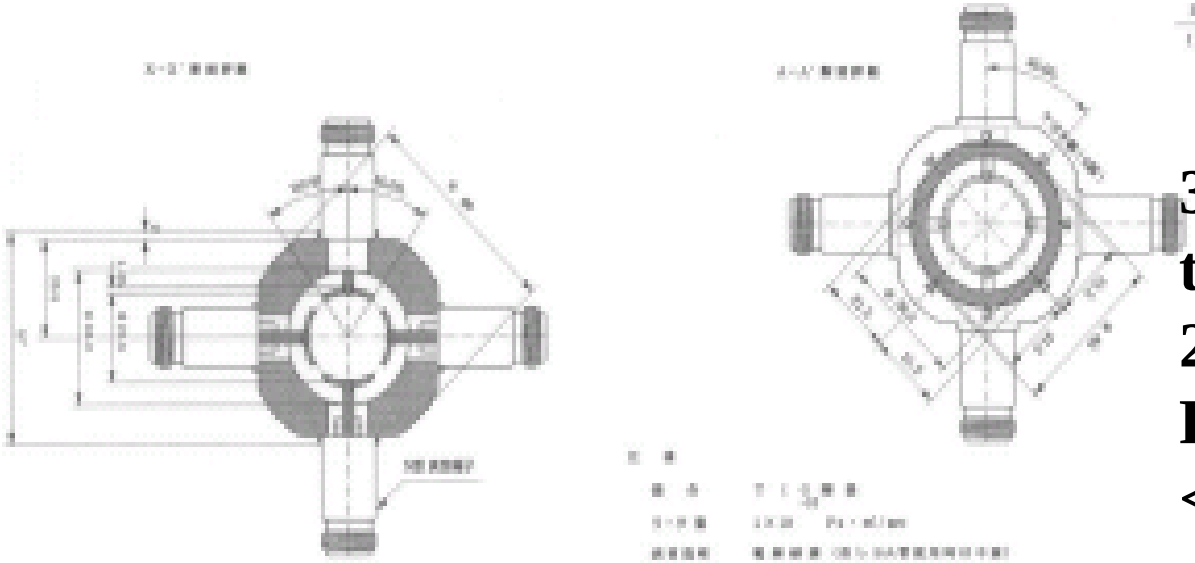
# n kick test at ATF

## Location of the strip-line electrode in the damping ring



# Kicker chamber for beam excitation



**32.7cm : correspond to rise/fall time of 2.2nsec**

**Fast pulse PS :<1.4nses**

**<3.6nsec**


Strip-line
Electrode
Pulse Power supply

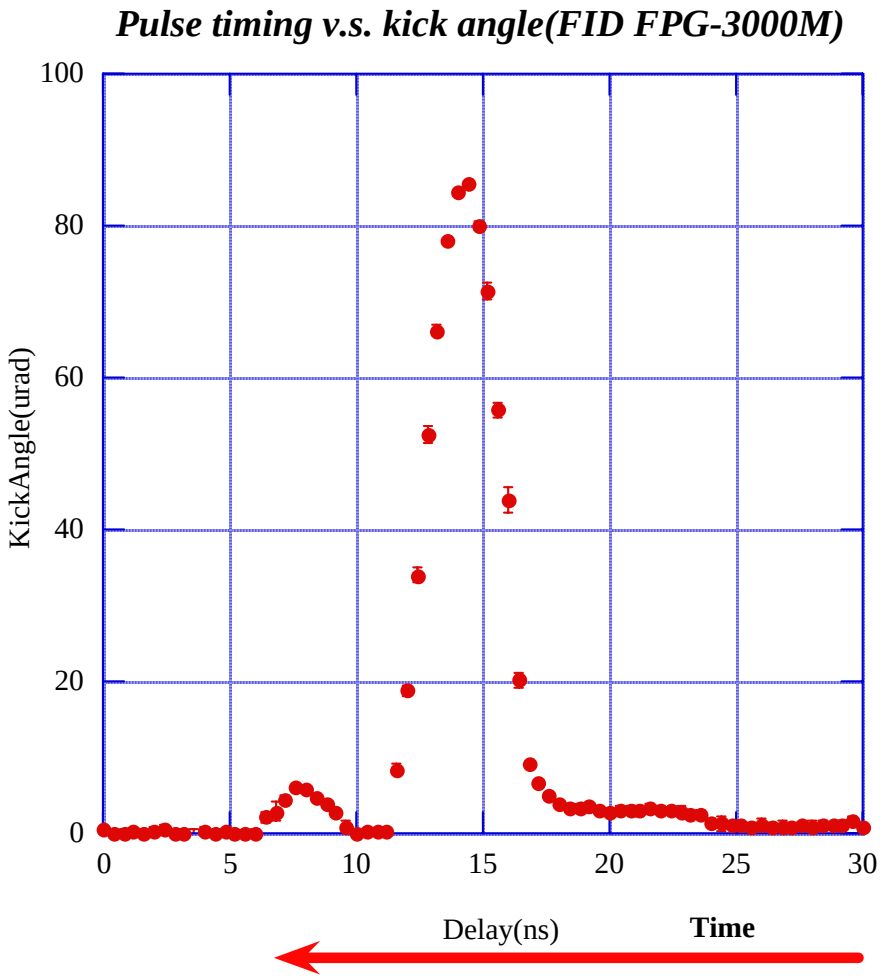
# We tested three kinds of fast pulse PS's.

1.FID (FPG5 – 3000M)
5kV peak, rise time ~1.4ns, timing jitter less than 30ps

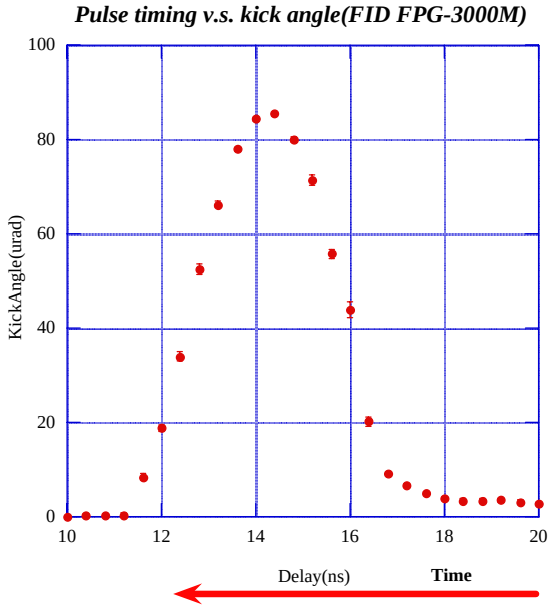
2.DESY Behlke HTS-80-UF
2.5kV peak, rise time~3ns, timing jitter less than 30ps

3.LLNL pulse PS
+/- 3.1kV peak, rise time~5ns

# Measurement result of FPG5-3000M

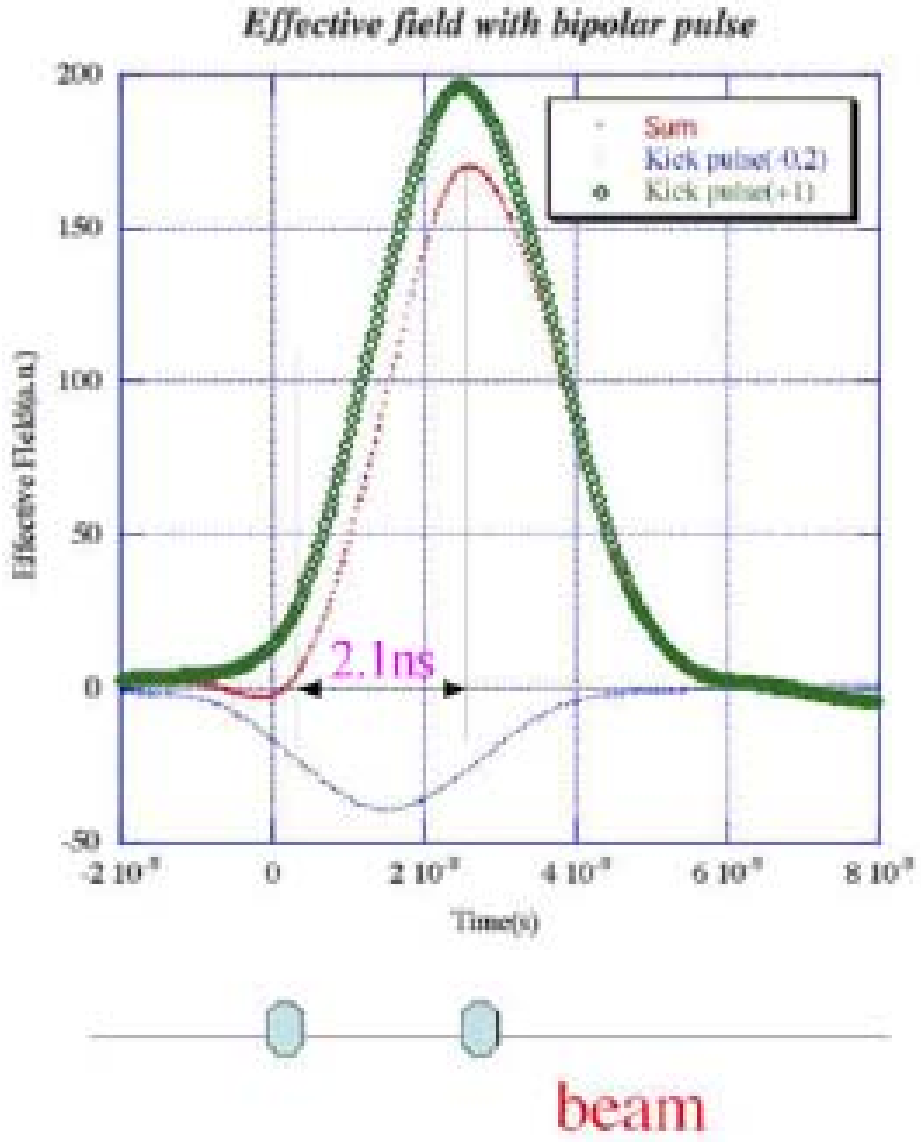



Rise time~3.2ns
Kick angle ~85μrad
(calc. 94.7μrad)



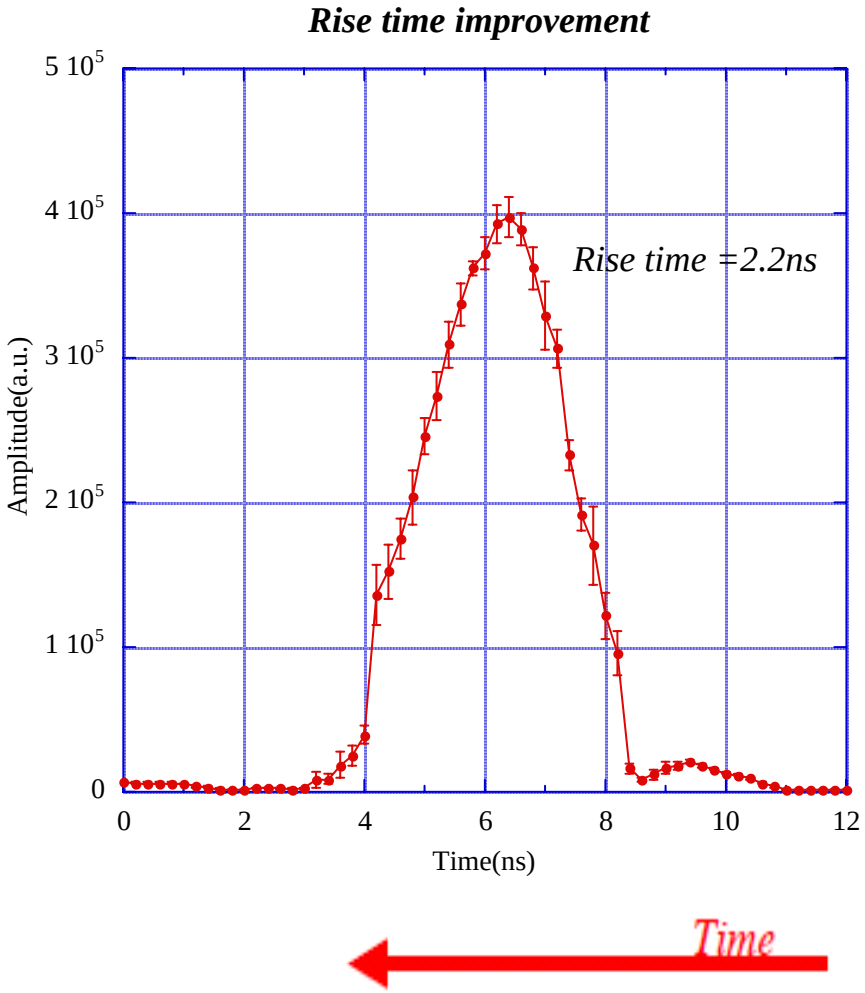

Expanded horizontal scale

# Rise Time improvement by using bipolar pulse




The figure shows the positive pulse(+1), the negative pulse(-0.2) and the sum of the pulses. The rise time of the sum signal is improved for the positive pulse from 3.2ns to 2.1ns. The most significant result of this idea is that the method will be able to make the zero cross field at any timing, for example, the previous beam timing.

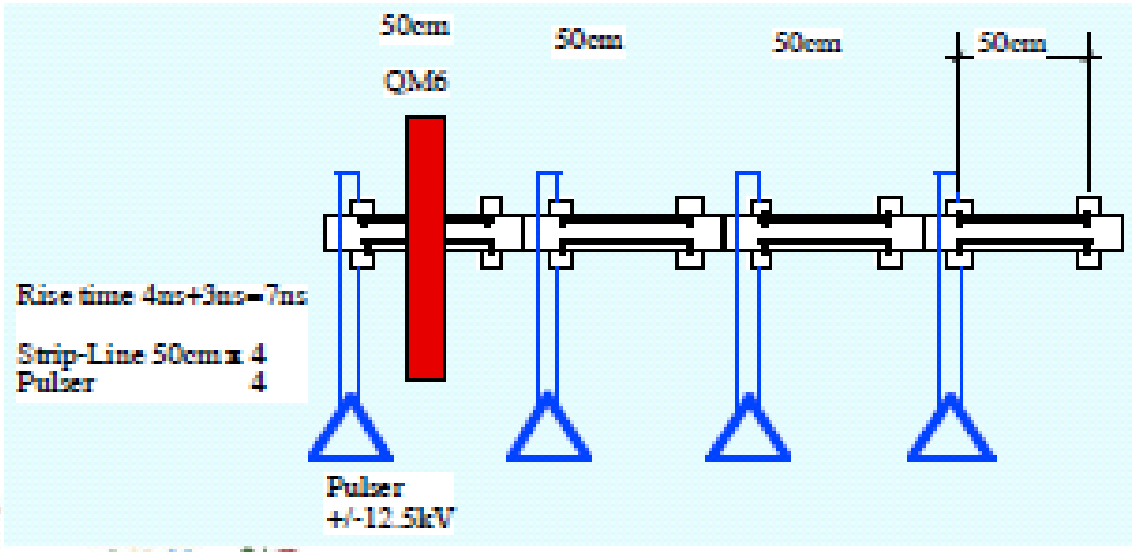
# e time improvement

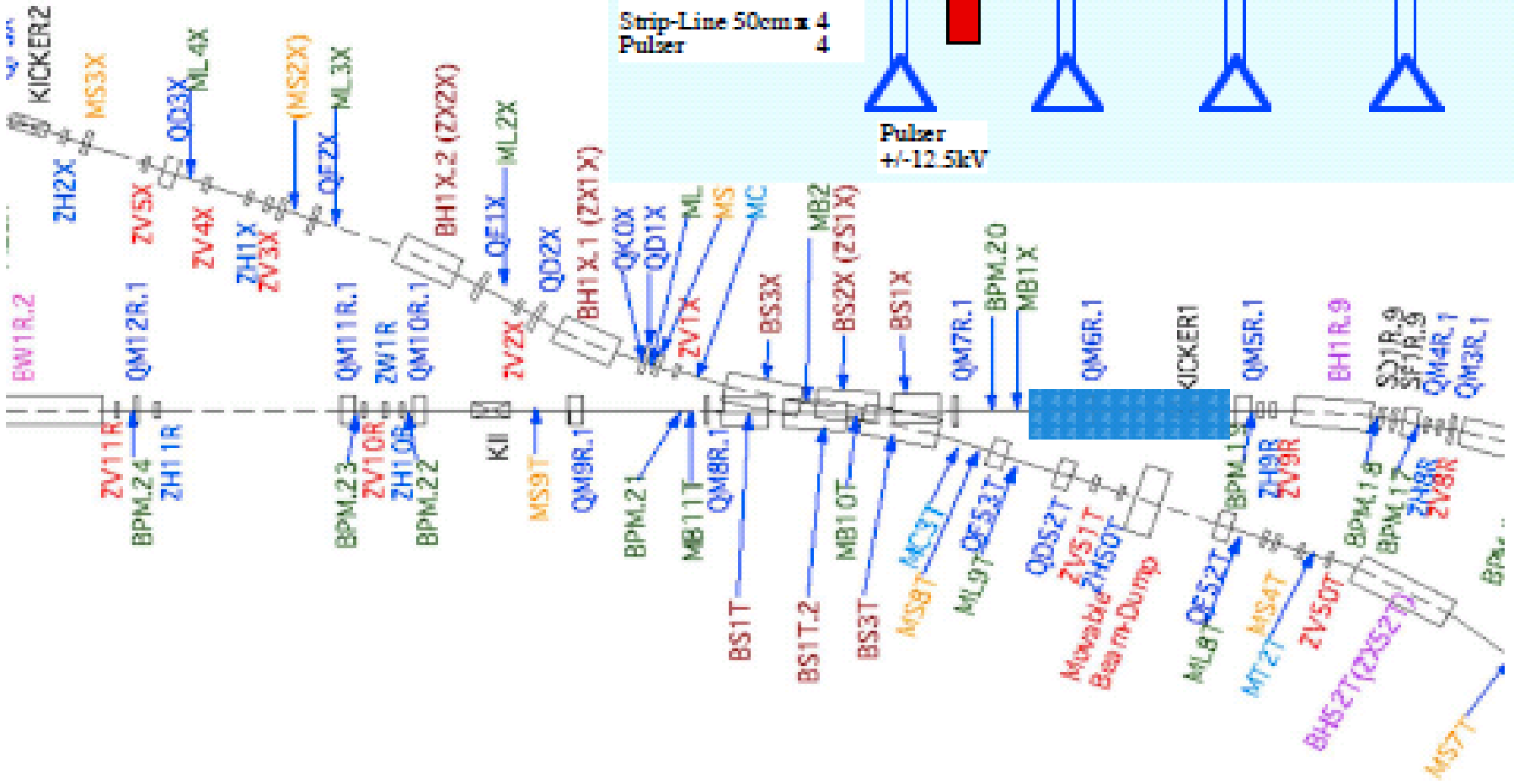



***The rise time improvement was observed by applying the two pulses which has opposite polarity, different amplitude and shifted timing.***
***The graph shows the timing scan result at the combination of the 100% positive pulse and the 8% of negative pulse. The rise time, at the right side slope, improved from 3.2ns to 2.2ns. The small amplitude at right side of the main pulse is the negative kick.***

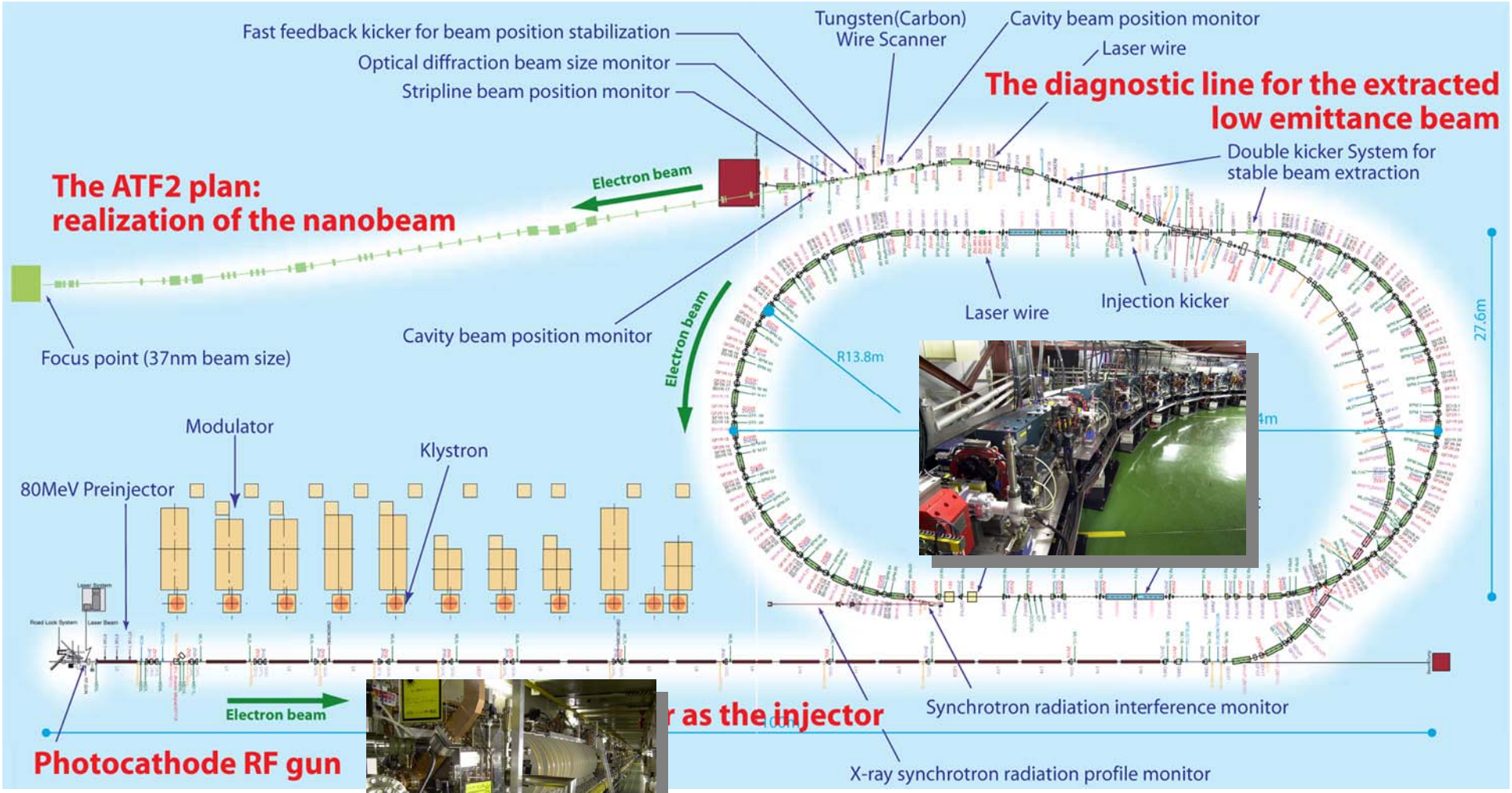
# of ATF fast beam extraction bunch-by-bu

## Beam extraction test with strip-line kicker

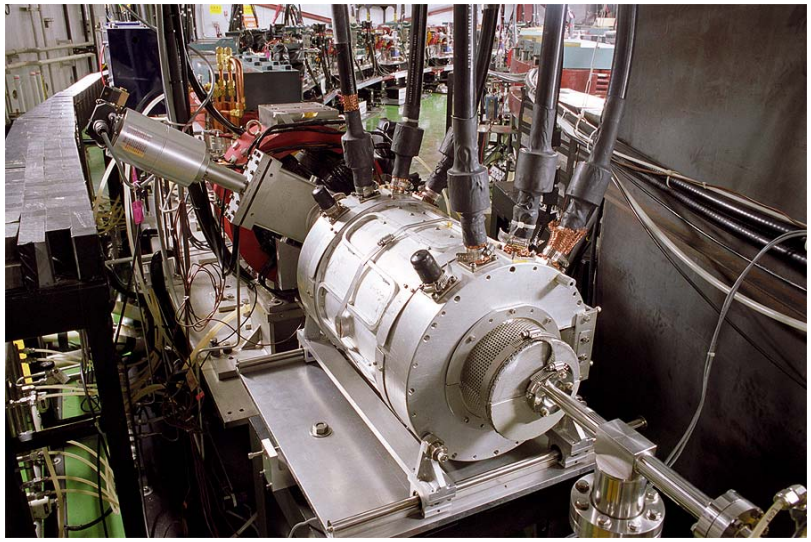


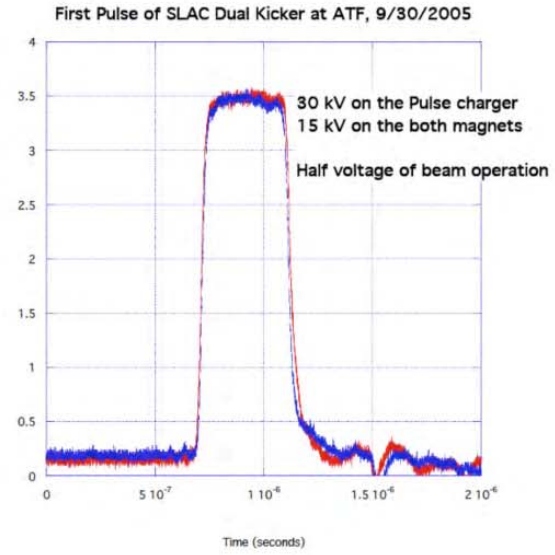



# ATF
## Accelerator Test Facility



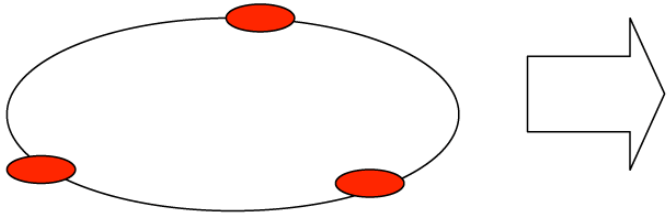
# ILC like beam extraction at ATF (1)



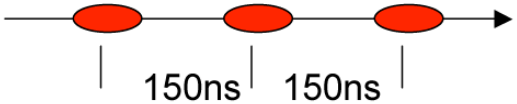



Store 3 bunches in DR by 3 injections

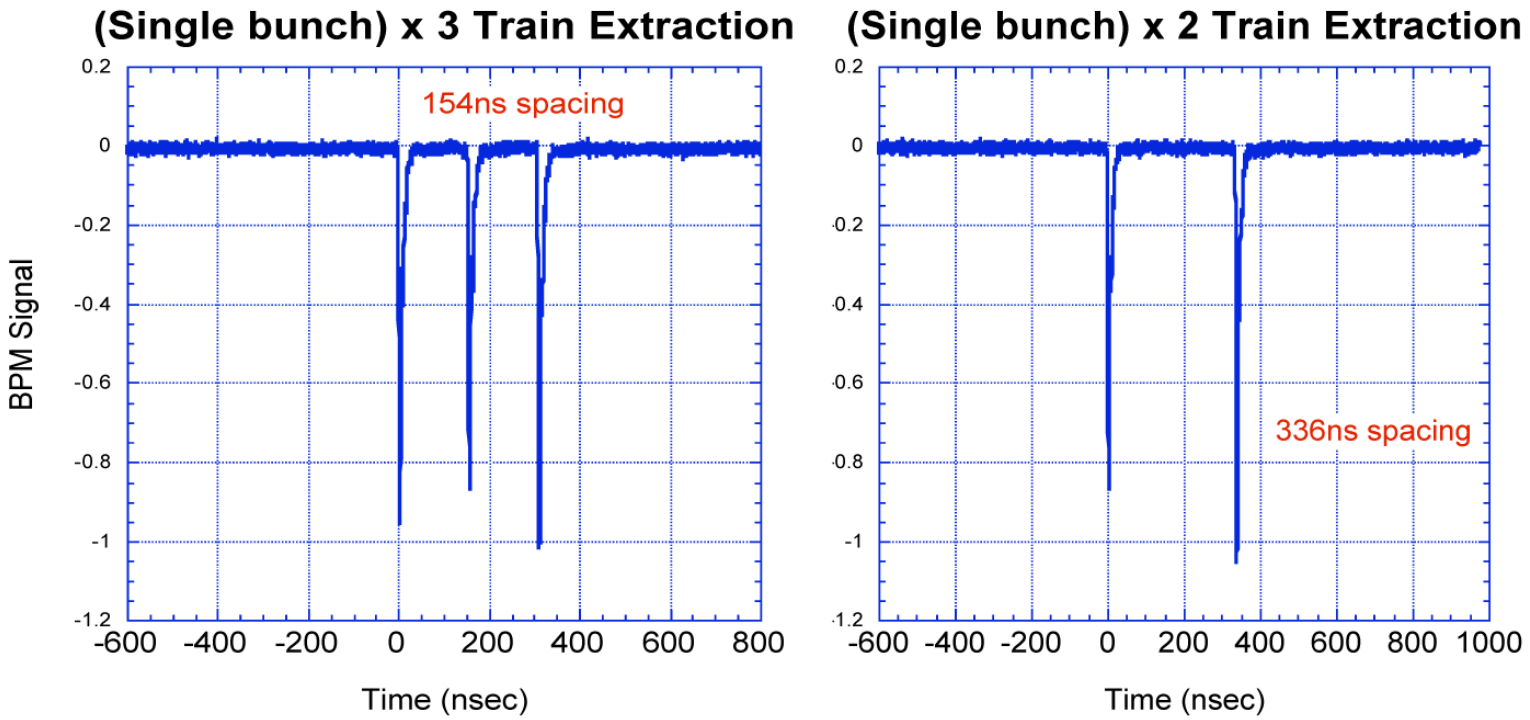
Injection kicker 60ns(rise/fall/flat-top)



ILC like beam bunches for EXT line and ATF2



# ILC like beam extraction at ATF (2)




New beam mode at EXT-line and ATF2.

# ATF Ring BPM R&D

M. Ross (SLAC)

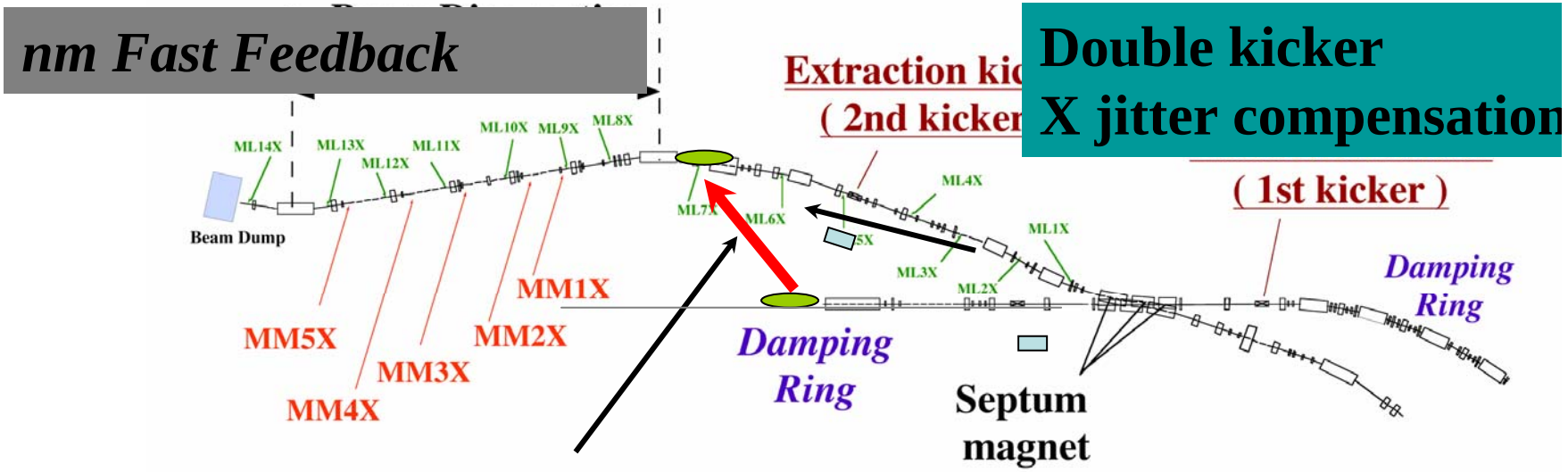
- Develop ILC ring BPM system towards 1~2 pm emittance as required in BCD with:
  - Adequate resolution
  - Low systematic errors and related drifts
  - Simple, fast(er) calibration
- Replace existing ATF ring system (4 um resolution at nominal current, large systematic errors ~ several hundred microns)
- Ultra-low emittance tuning, stabilization for ATF2 and ILC DR development.

# Feedforward to Extraction Line

Planned

FONT project (UK Institutes)

## Layout of KEK-ATF Extraction Line

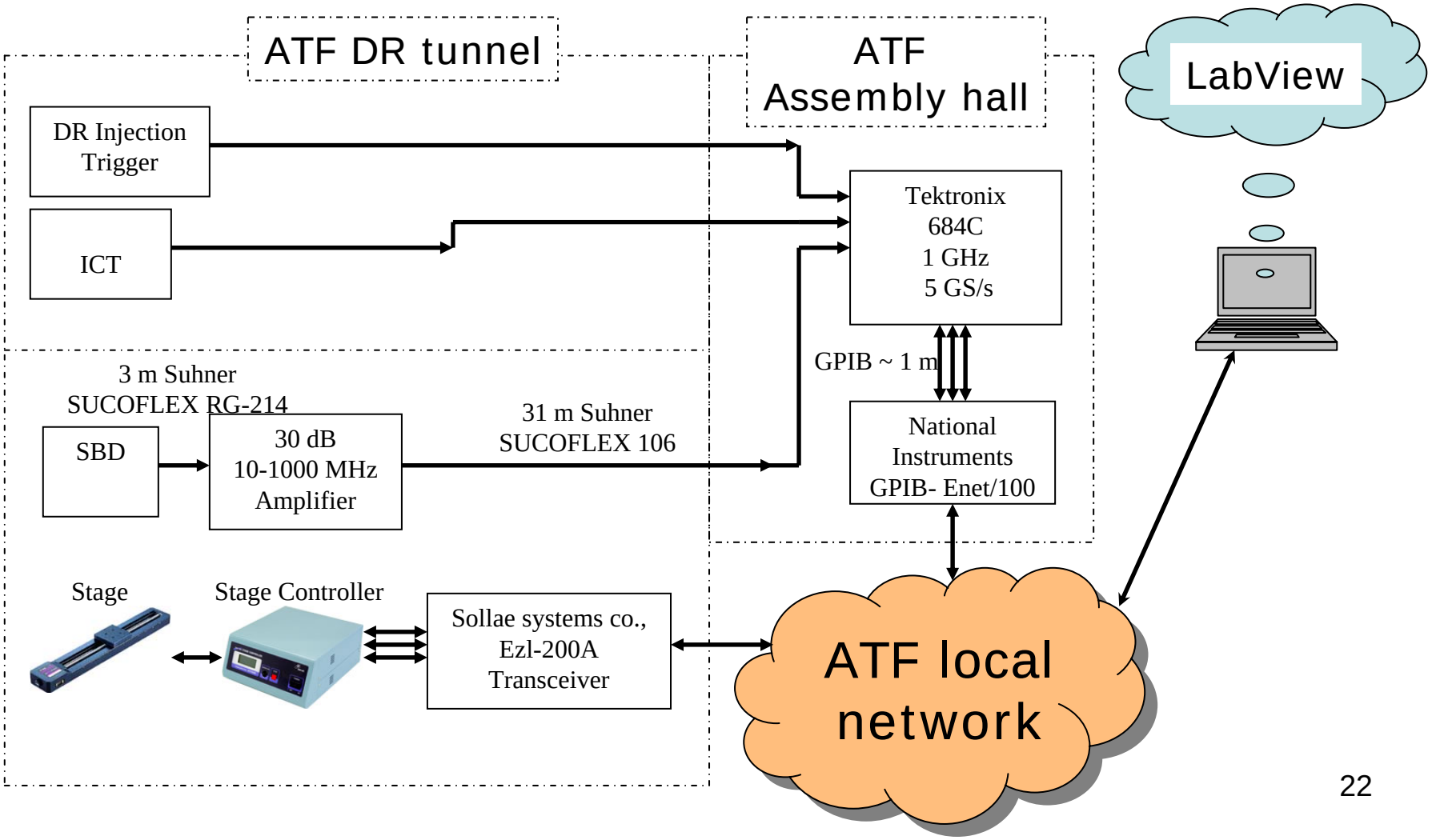



**μm Feedforward ( DR BPM -> EXT Line new strip line kicker)**

# Prospect of ATF and ATF2

- ATF International R&D will generate necessary results for ILC, especially how to control high quality beam, develop many kinds of advanced instrumentation, educate young accelerator physicists and engineers.
- ILC like beam which means 20 bunches with bunch spacing about 300nsec.
- Realization of about 35nm beam for long period.

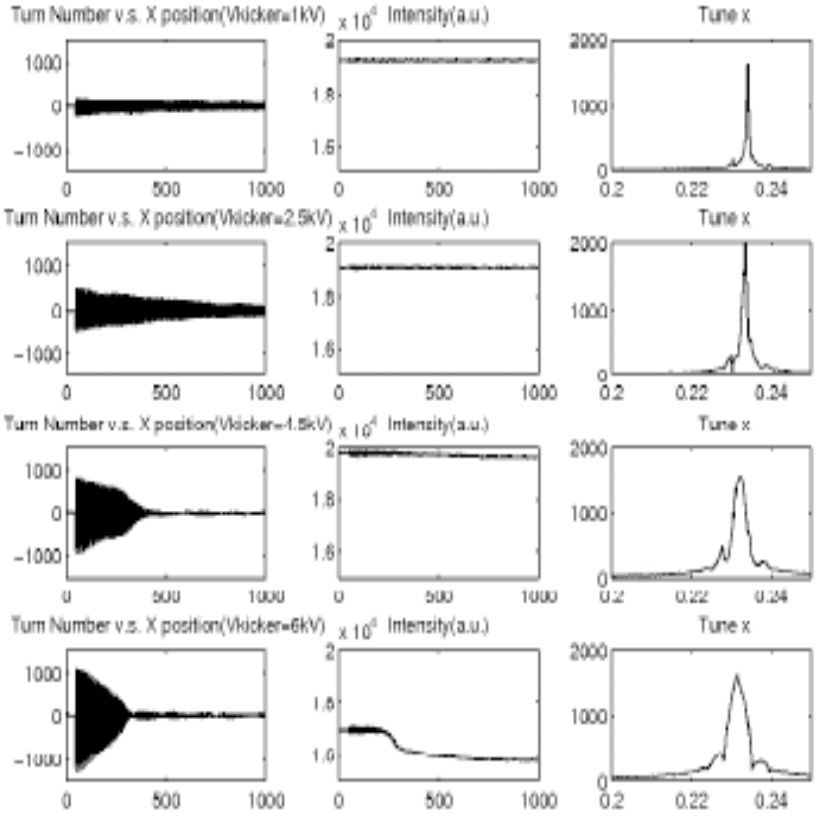
# Present DAQ


ATF DR tunnel
ATF
Assembly hall
LabView
DR Injection
Trigger
ICT
Tektronix
684C
1 GHz
5 GS/s
GPIB ~ 1 m
3 m Suhner
SUCOFLEX RG-214
SBD
30 dB
10-1000 MHz
Amplifier
31 m Suhner
SUCOFLEX 106
National
Instruments
GPIB- Enet/100
Stage
Stage Controller
Sollae systems co.,
Ezl-200A
Transceiver
ATF local
network

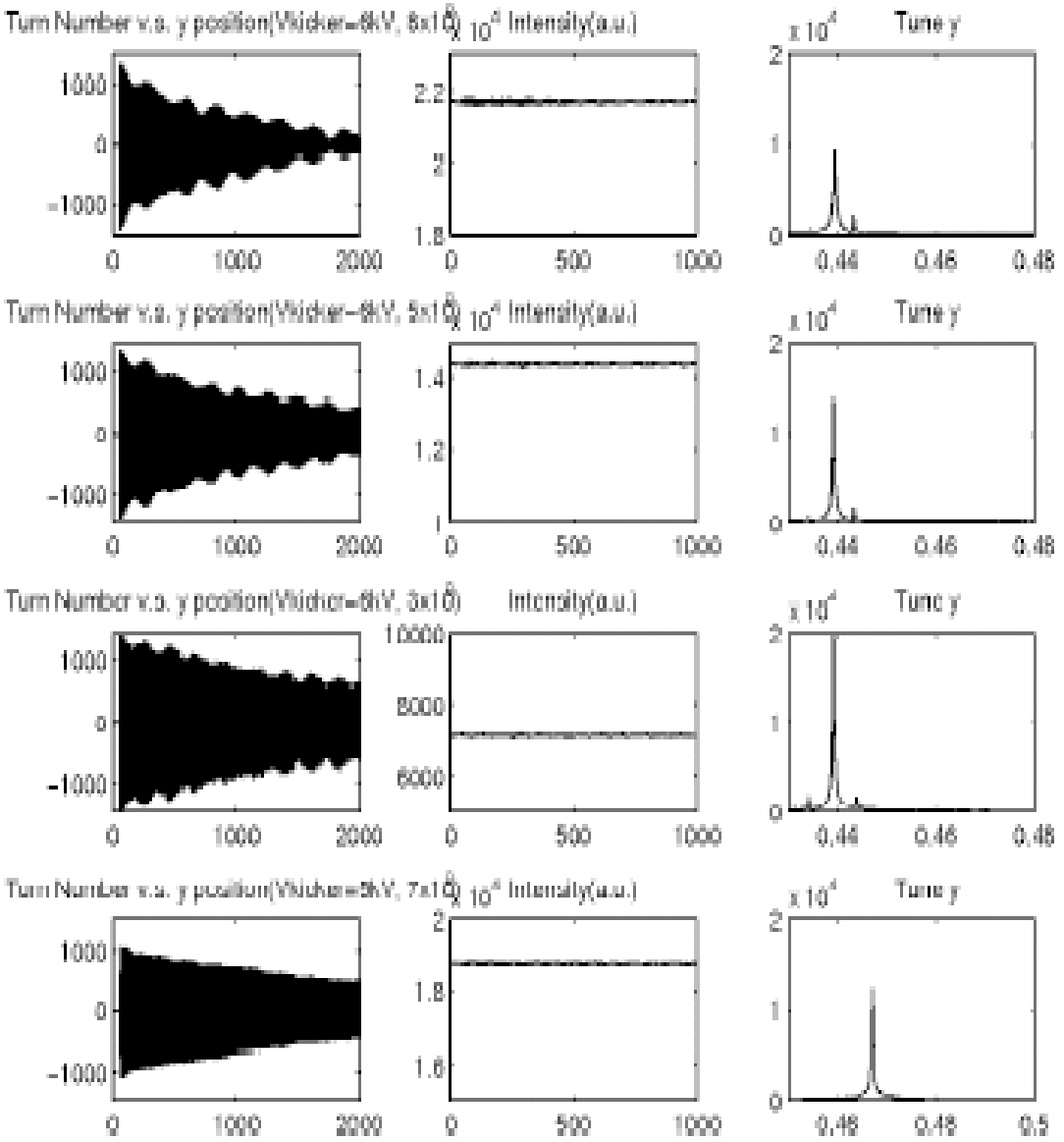
**New powerful data acquisition system will be installed in Nov..**

**Tektronix, DPO7000, 20GS/sec, 500MHz to 7.25GHz,**
**1msec continuous signal measurements just after triggering**
**In the step of 100psec for fast kicker study.**

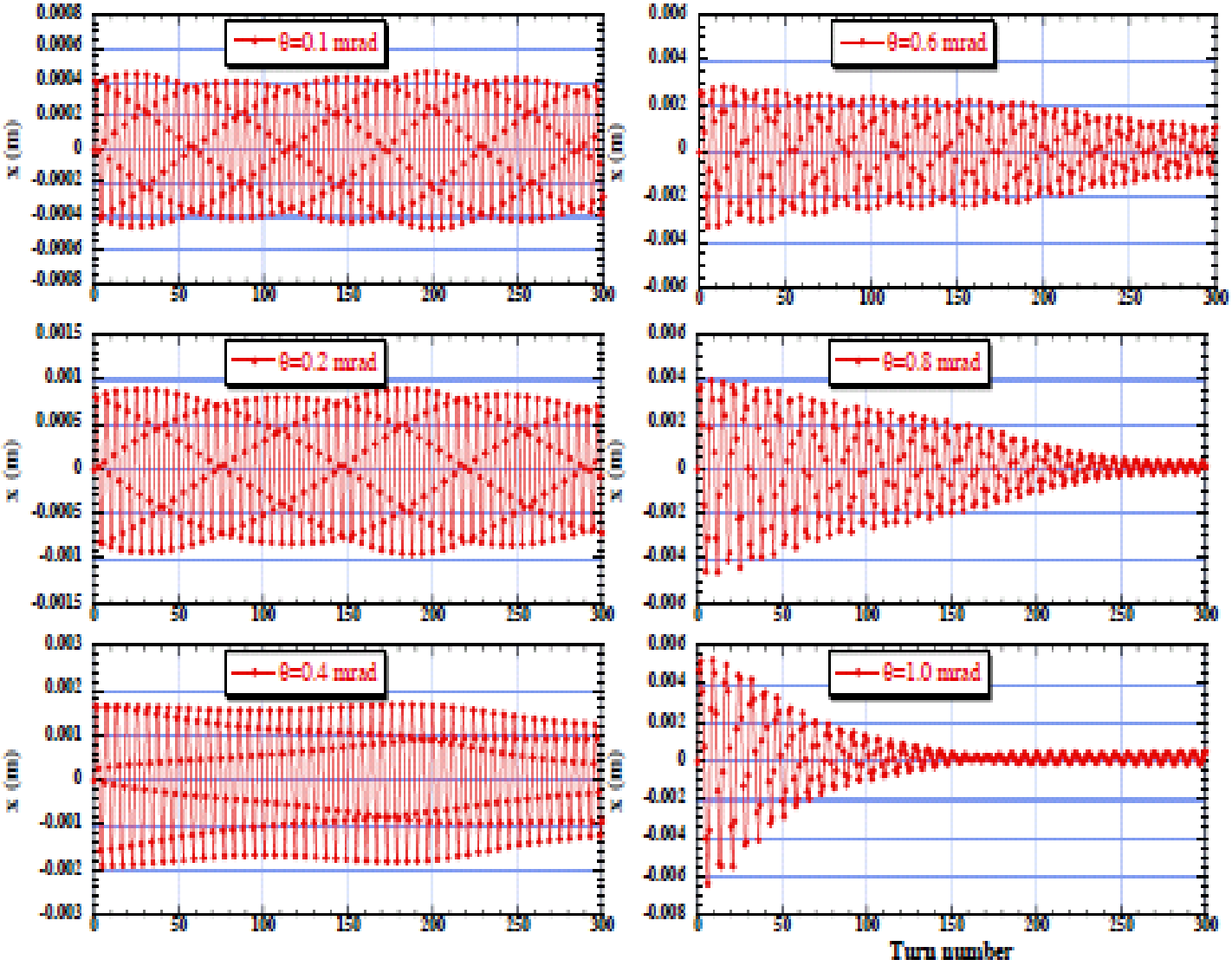
*Single kick result(Horizontal)*



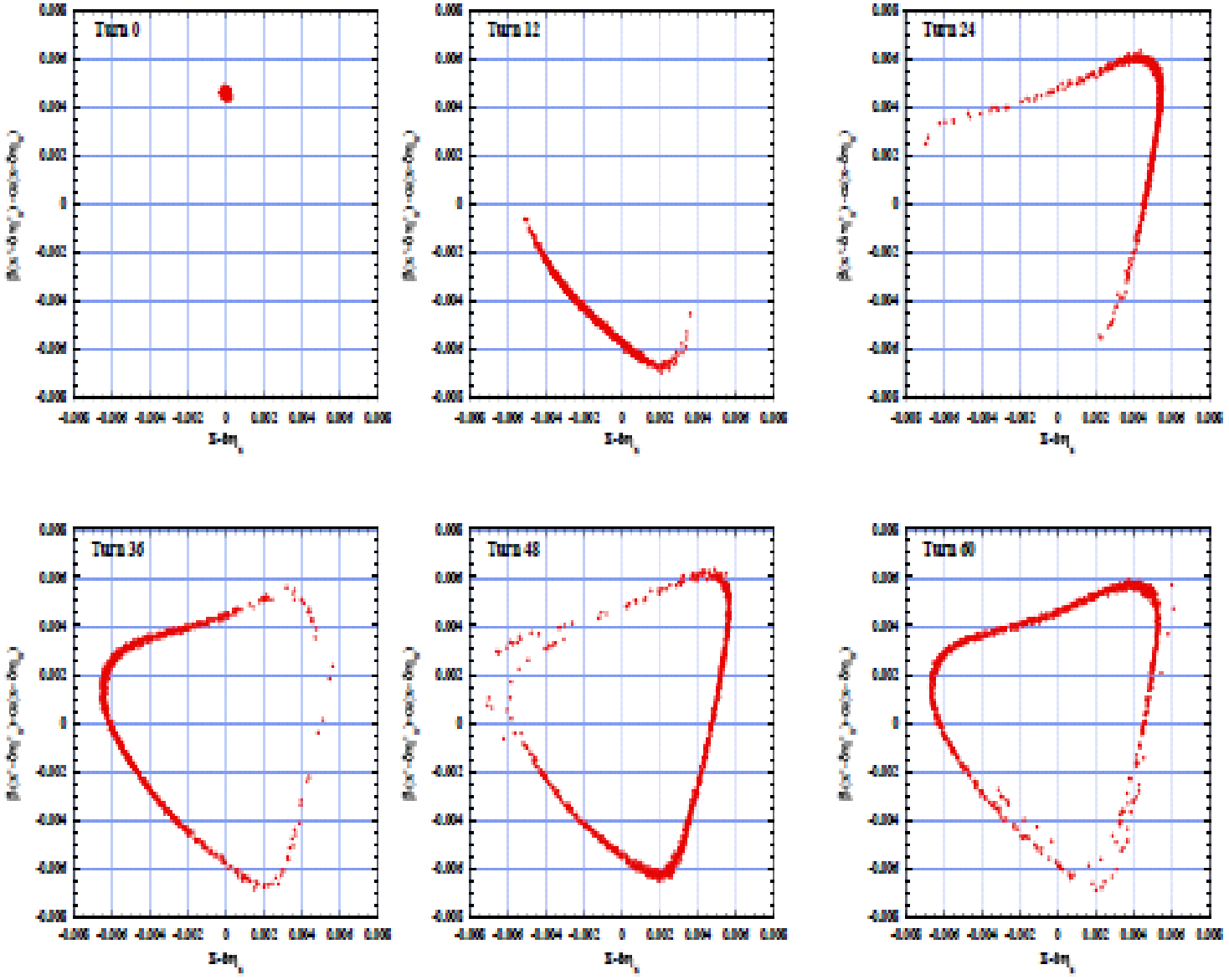
# Single kick result(Verticall)



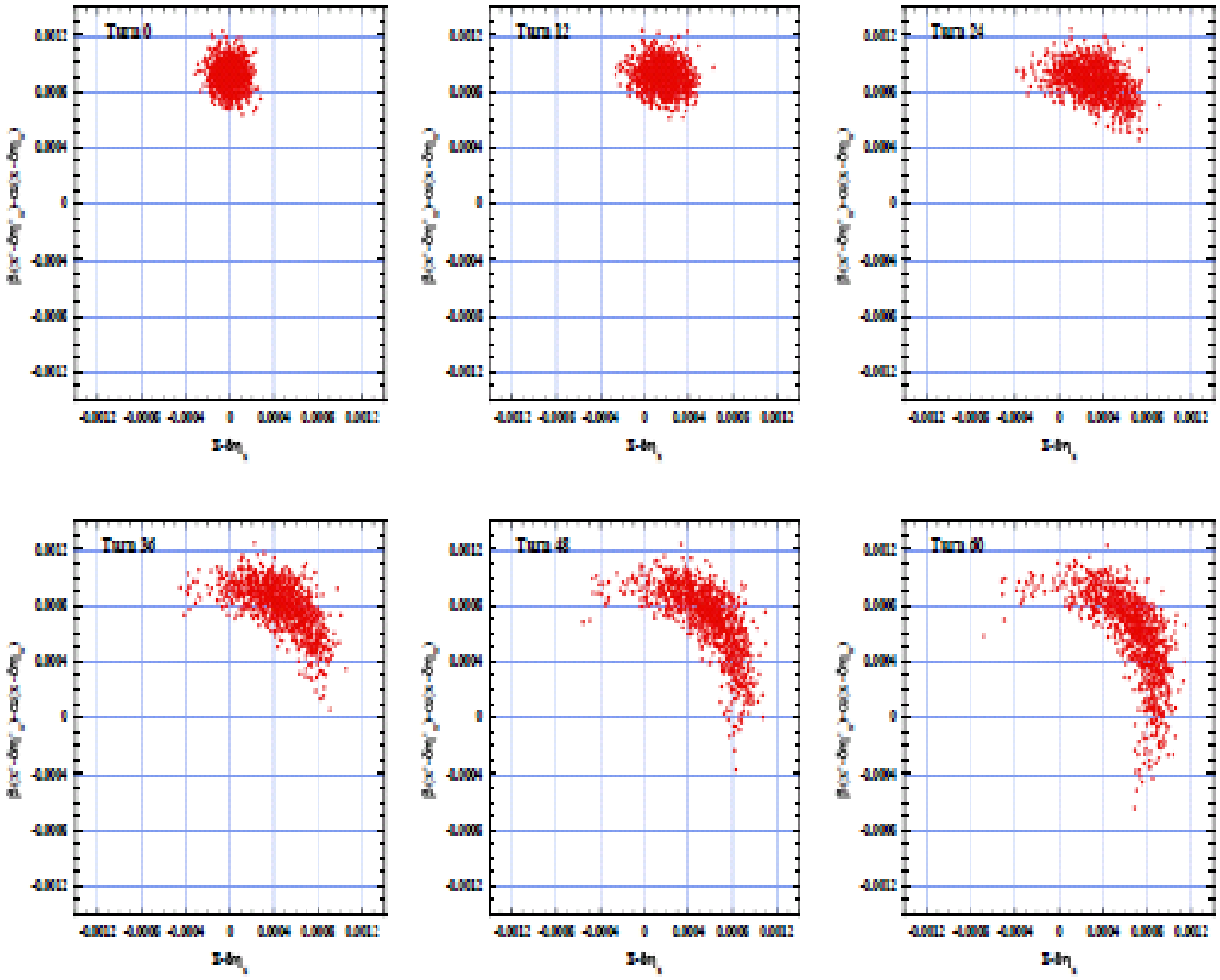
# Fig.1, x vs. turn number for various initial kick angle, 0~300 turns



# Fig. 3, Horizontal phase space distribution for large amplitude, turn 0 ~ 60



# Fig. 4, Horizontal phase space distribution for small amplitude, turn 0 ~ 60



# Experimental Plan for study on bunch lengthening

Precise energy spread measurement at the extraction line
Accurate bunch length measurement systematically
Precise transverse emittance measurement
The range from several $10^9$ to $3x10^{10}$ electrons/bunch
Precise tune measurement versus the bunch intensity
The measurement of CSR
Accurate beam position measurement during 1msec in the step of 100psec ; huge data will be obtained.

Appropriate period is Jan., Feb. and March in 2007 because all instrumentations require the check and fine tuning for three months from now and fast kicker R&D has first priority.
Anyway, I want to finish the study of bunch lengthening and CSR within 2007 and 2008 at ATF.