



# **ATF Damping Ring BPM System Upgrade**

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# Overview

- Motivation
- Current Status
- Preliminary results from this spring
- Future Plans

- Motivation
  - **Goal: generation and extraction of a low emittance beam ( $\epsilon_y < 2 \mu\text{m}$ ) with the nominal ILC bunch charge**
  - **A major tool for low emittance corrections: a high resolution BPM system**
    - a broadband turn-by-turn mode ( $< 10 \mu\text{m}$  resolution)
    - a narrowband mode with high resolution ( $\sim 100 \text{ nm}$  resolution)





# Present Status of the ATF DR BPMs

- 96 4-button BPM pick-up stations
- 76 connected to ATF-style read-out systems
  - Intensity dependent position reading
  - Resolution  $> 10 \mu\text{m}$
  - No turn-by-turn (multi-turn) capability (but single turn flash measurement)
- 20 with *Echotek*-based read-out systems
  - High resolution measurements in narrow-band mode (200-400 nm)
  - Turn-by-turn (4096 turns) and single turn (flash) measurements (resolution  $\sim 2\text{-}3 \mu\text{m}$ )
  - Analog downconverters v1.0, located in the tunnel
  - Digital signal processing located in 2 VME crates (1x MV5500 CPU, 1x TGF timing, 5x *Echotek*)

(Cont'd)

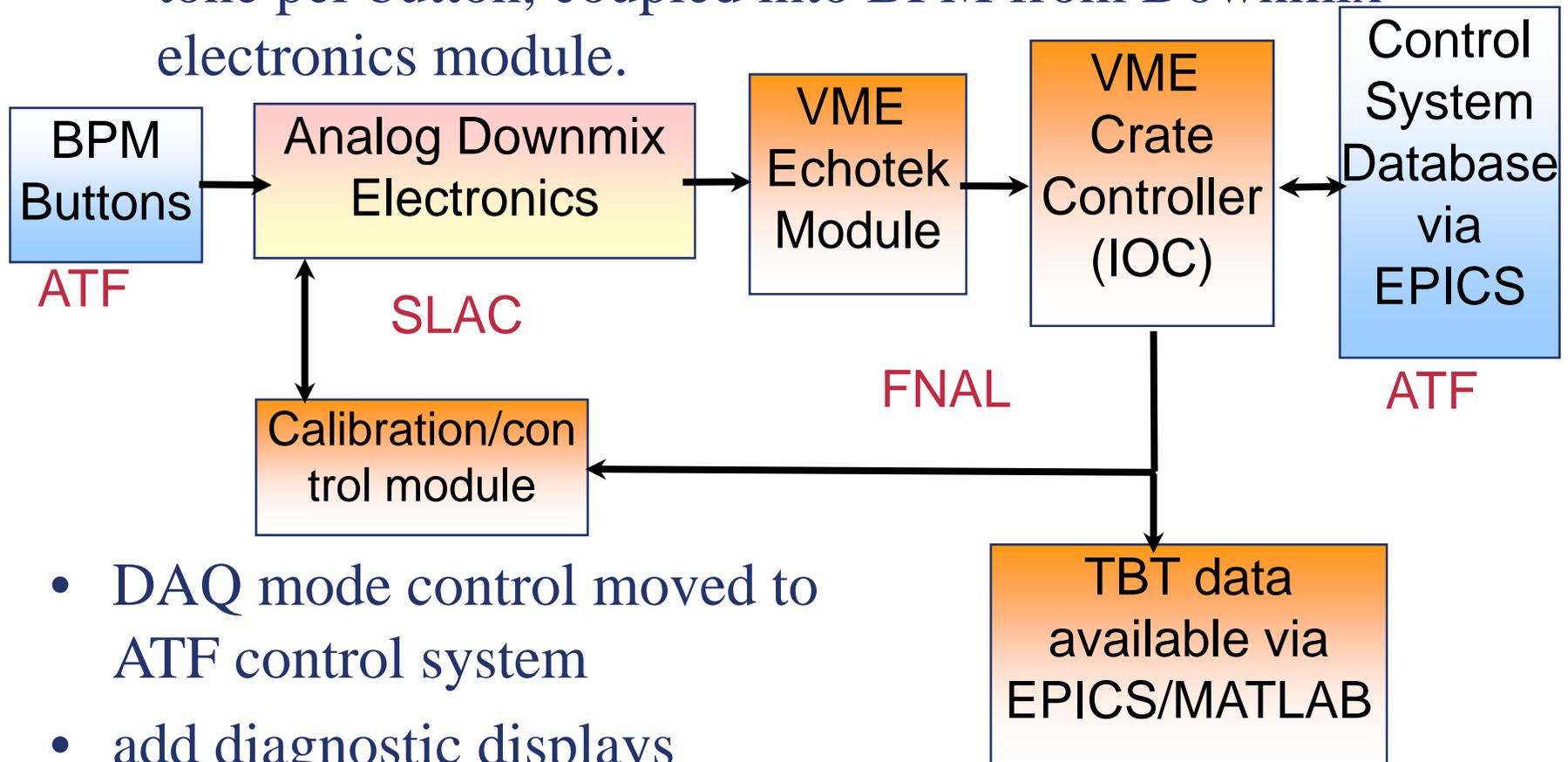


## Status of the ATF DR BPMs (cont'd)

- 1 *Echotek*-based read-out system with automatic calibration and remote control functions
  - integrated calibration system can automatically correct for component aging effects (gain), to stabilize the BPM offset
  - remote controlled gain/attenuator settings to accommodate multibunch and high current operating modes
  - remote monitoring of engineering data (supply voltage and current, LO-level, temperature) in the analog downconverter section through the CAN-bus.
  - **Requires an updated downconverter section (SLAC), and a new CAN-bus based calibration and remote control interface (Fermilab), proposed to be installed for the final BPM upgrade at all BPM locations.**



- Calibration tones produced locally from LO tone, one tone per button, coupled into BPM from Downmix electronics module.



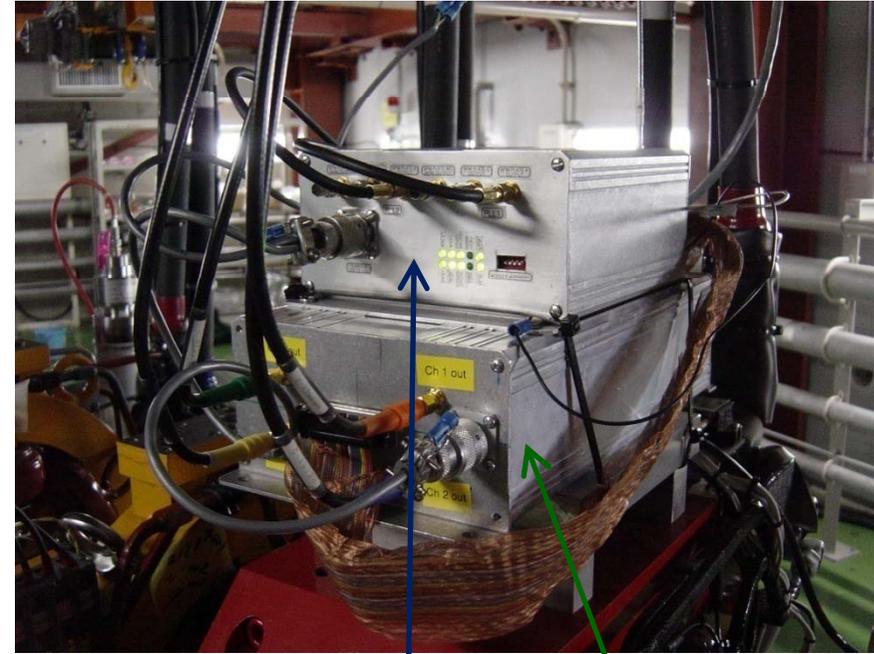
- DAQ mode control moved to ATF control system
- add diagnostic displays



# BPM #54: Downconverter & CAL Proto



- Mini VME crate accommodating:
  - *Motorola 5500 CPU*
  - PMC CAN bus interface *ECAN-2*
  - Timing module TGF
  - *Echotek* digital receiver module



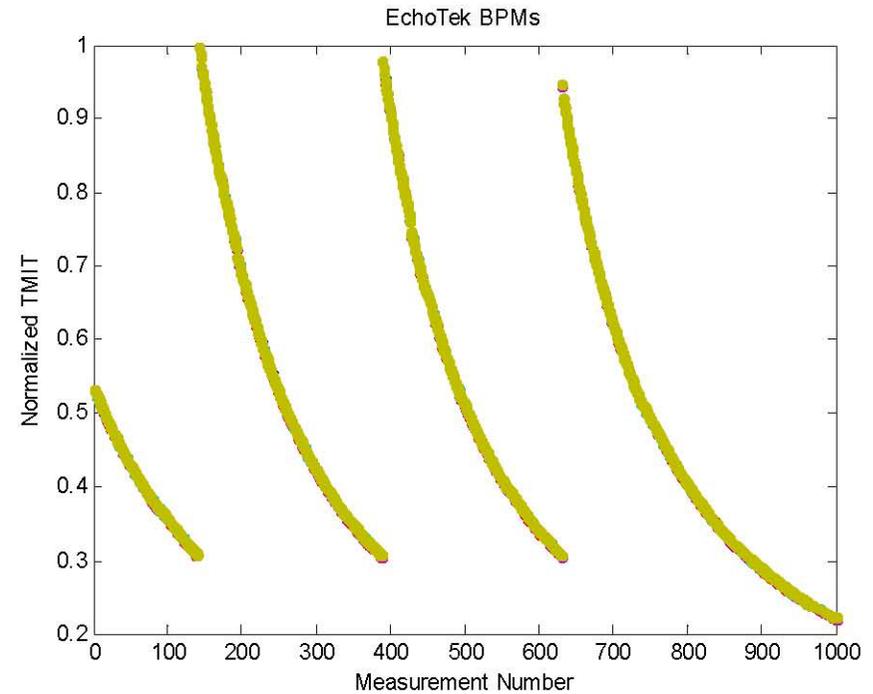
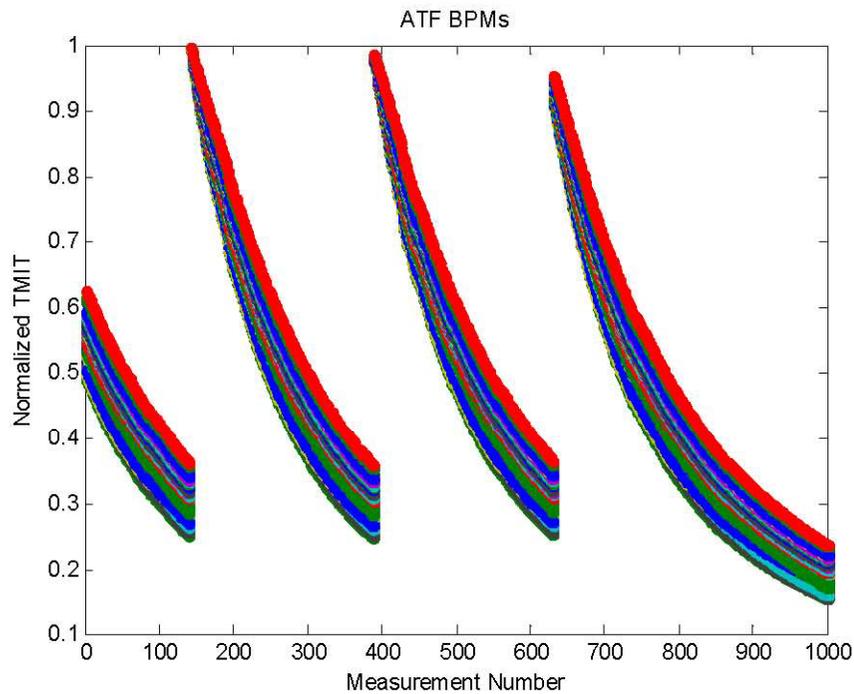
- BPM #54 prototype installation (temporary):
  - CAN bus remote control & CAL signal PLL unit (Fermilab)
  - **4 ch. Downconverter unit (SLAC)**



# Scrubbing Mode, Intensities

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## Normalized Intensities



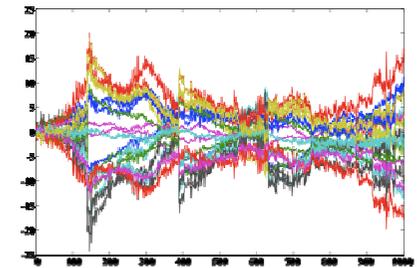
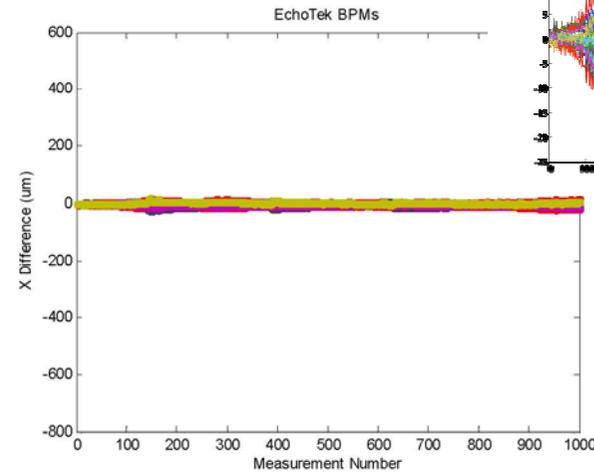
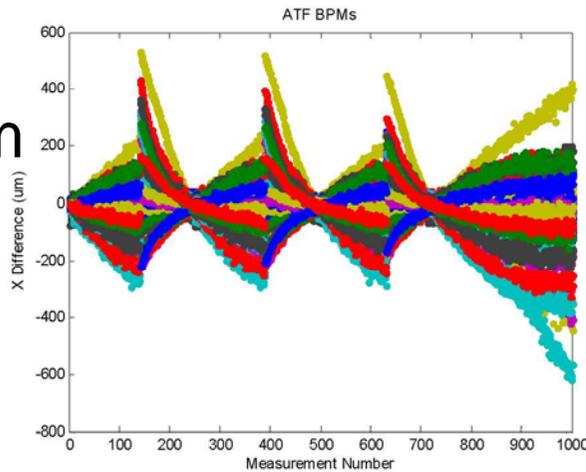


# Scrubbing Mode, Positions

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Horizontal Position

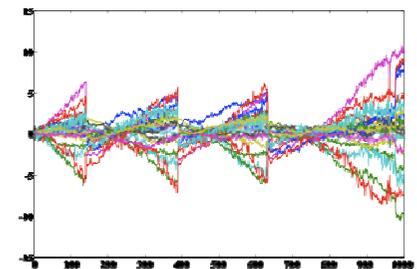
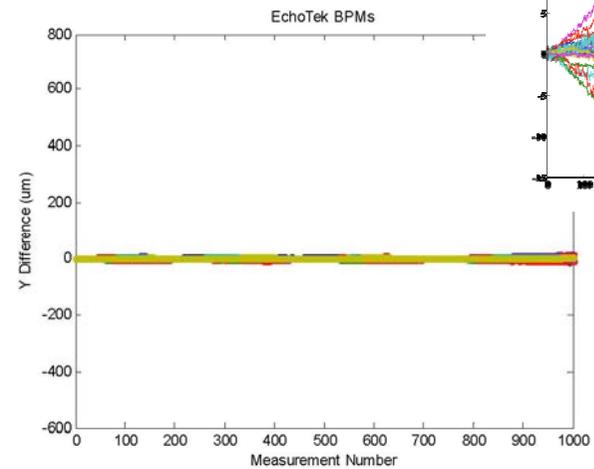
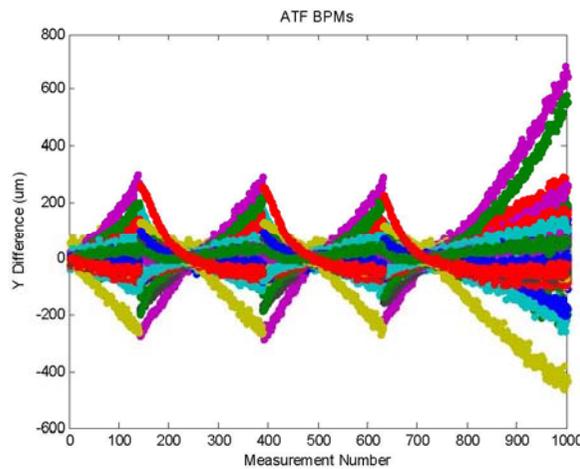
$\pm 700 \mu\text{m}$



$\pm 25 \mu\text{m}$

Vertical Position

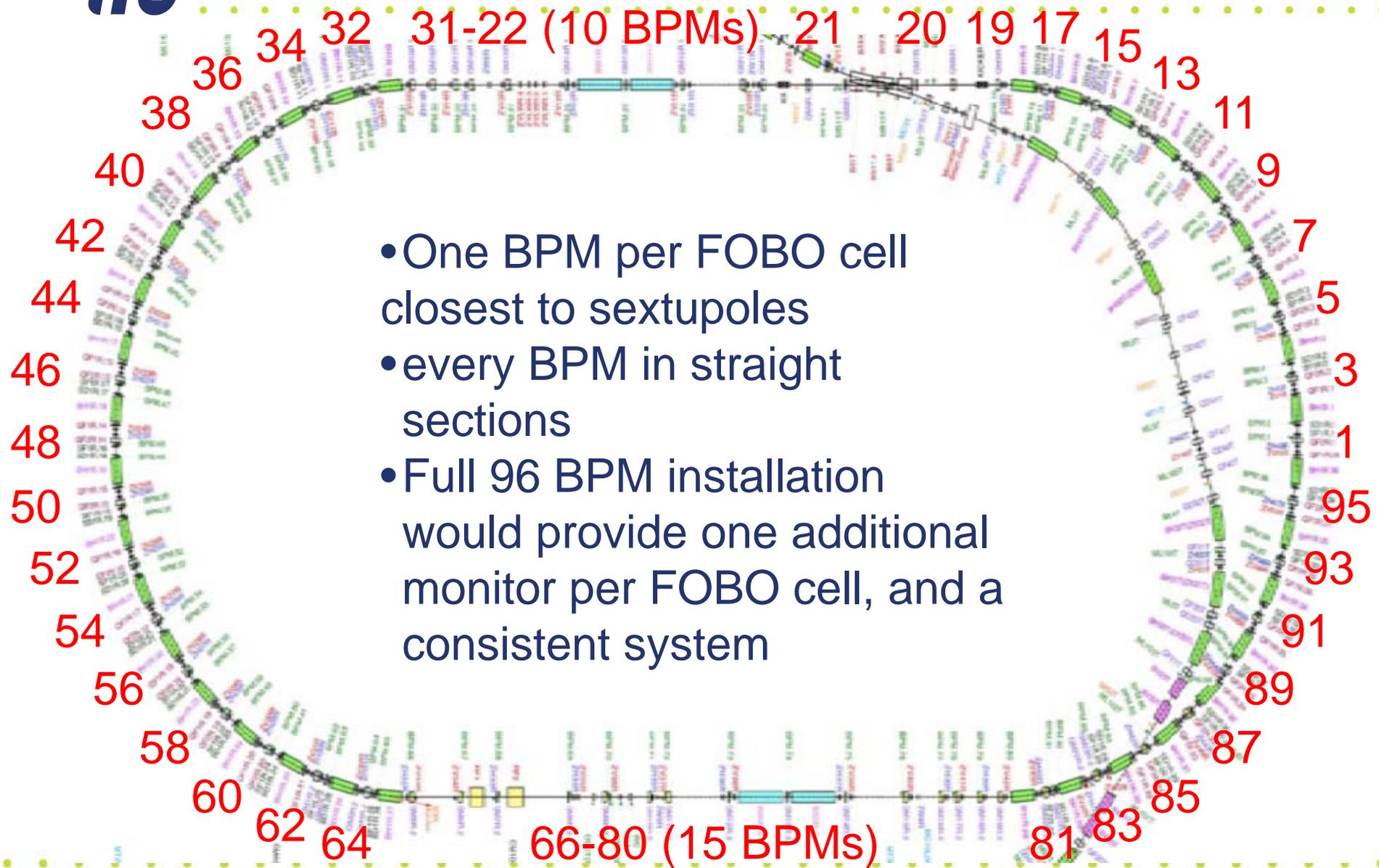
$\pm 700 \mu\text{m}$



$\pm 15 \mu\text{m}$

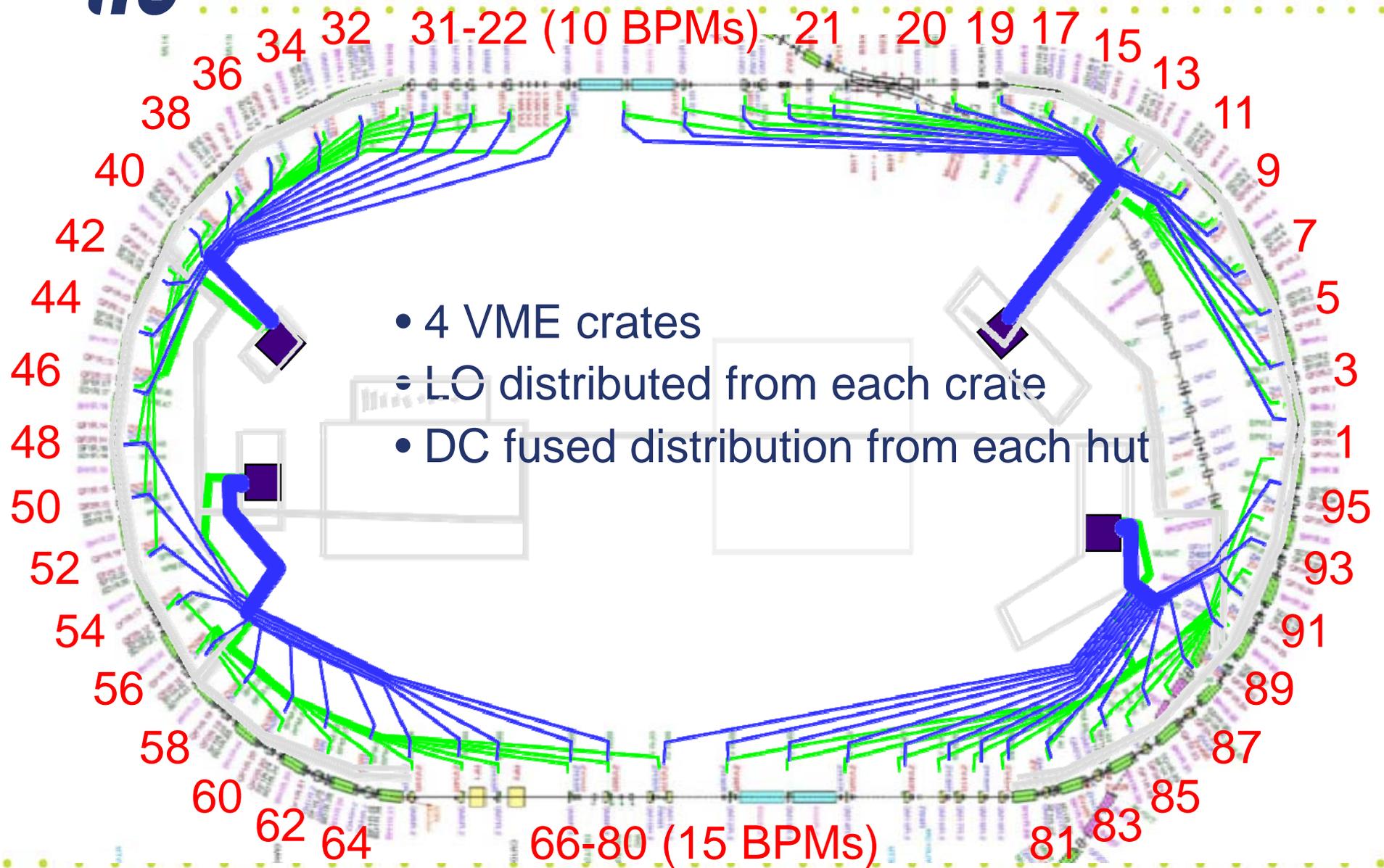


# Minimum coverage: 63 BPMs





# 63 or 96 BPMs





# Complete installation

- Four VME crates, one in each RF hut
  - 1 IOC, 1 timing module in each
    - **12 Echoteks each for full 96 BPMs, 8 for 63 BPMs**
    - **ADC, DIO, serial communication in one crate**
- LO and DC distribution
  - each VME crate (4) to provide an LO source
    - **high-power amplifier in each RF hut, split in tunnel between two 8-way splitters (straight and arc)**
    - **DC source with fused distribution panel in each RF hut, individual supply to each BPM**
- New enclosures
  - calibration/control module isolated from analog receiver
  - two 2-channel boards (one full BPM) per enclosure
    - **adequate isolation has been demonstrated with boards back-to-back**
- 215 analog receivers, 110 cal/control boards to be produced.

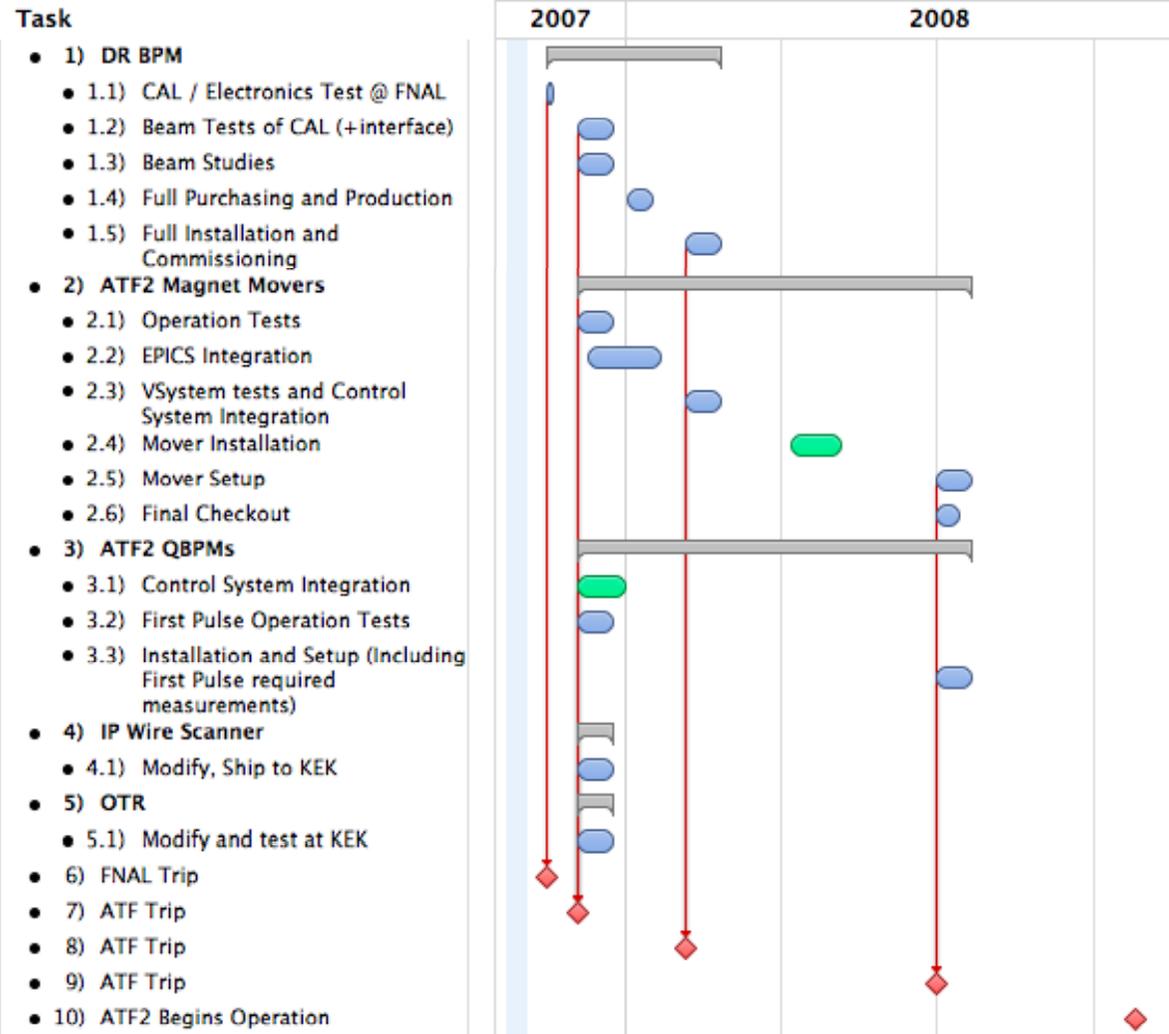


# Schedule

- Electronics production, assembly, and testing to be completed by April '08
  - **Delivered to ATF for installation in MAY '08 (concurrent with majority of SLAC's ATF2 installation efforts)**
  - **Beam commissioning of full system before shut down in June '08**



# Original Schedule





# More likely schedule...

