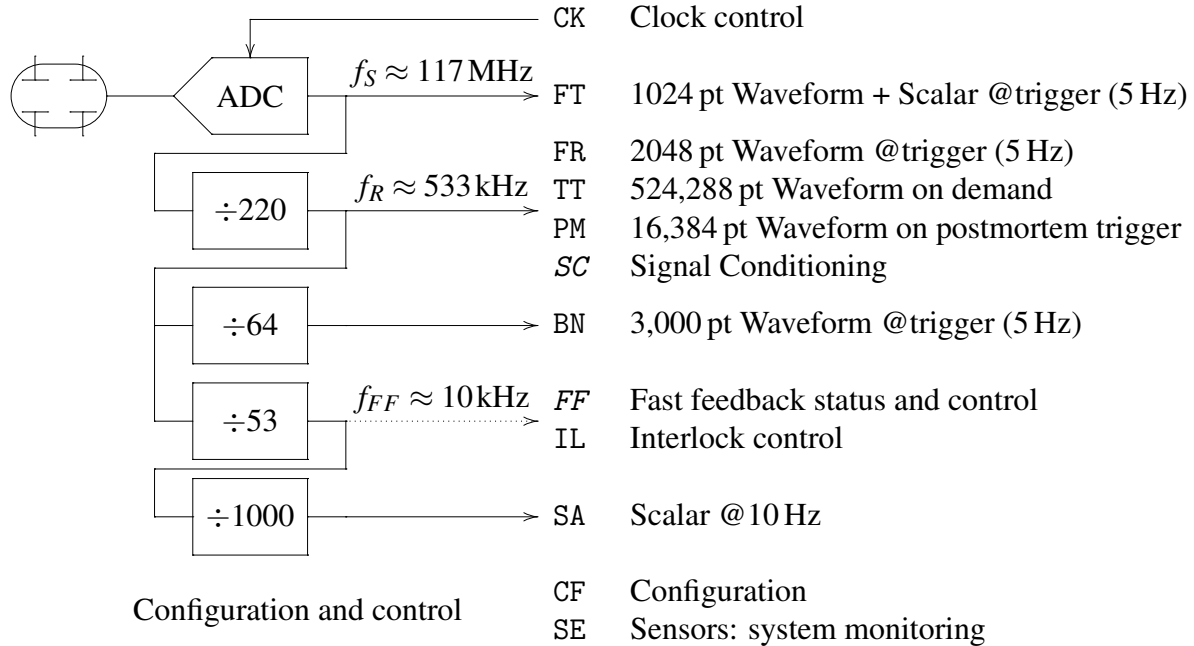


# Libera EPICS System Overview

**Buttons**

**FPGA Processing**

**EPICS Record Interface**



Note: SC not yet released; FF requires Diamond FPGA.

# Position Readout

The following groups of PVs are used to read positions.

- FT Single point reduced from selected window into ADC sample rate buffer (1024 points at approximately 117MHz), captured on trigger. Used for “first turn” analysis and transfer paths.
- FR, PM Fixed length waveforms (2048 and 16,384 points respectively) with one point per turn (“turn by turn”), updated on trigger or postmortem event respectively.
- TT Variable length turn by turn waveforms armed and captured on trigger. Sliding window used to read out up to half a million points.
- BN Fixed length waveforms with one point per 64 turns, and per 1024 turns, updated on trigger.
- SA One point per update, updates at 10Hz.

All points are available as raw A, B, C, D button readings (with I&Q quadrature, except for SA) as well as X, Y, Q and S.

# Control and Status

The following PV groups are used to manage and monitor the state of Libera.

- CF General configuration control, principally button geometry, beam offsets and attenuation control.
- IL Interlock management configuration and control including control of interlock window and interlock enable, as well as interlock status reports.
- SE System status monitoring, also aggregated into a single HEALTH PV. Monitors fans, temperature, voltages, and memory and cpu usage.
- CK Clock control including triggered synchronisation, status monitoring and timestamp management.
- SC Signal conditioning: control of rotating switches and computation of conditioning compensation parameters.

# Unique Features of Diamond Driver

- Clock control: machine and system clocks.
- ADC rate data
- Signal Conditioning
- Slow Acquisition (SA) data features
- Fast feedback interface
- Separated origins: BBA / BCD / “Golden Orbit”

# Detailed SC Overview

Configure Libera

## TS-DI-EBPM-03 Configuration

**Geometry**

KX: 10.0000 KY: 10.0000  
KQ: 10.0000 Diagonal

**Origins**

	X	Y
BBA:	-0.0678	-0.2141
BCD:	0.0000	0.0000
Golden:	0.0000	0.0000

**FT Channel Gains**

G0: 1.0000 G1: 1.0000  
G2: 1.0000 G3: 1.0000

**Mode Enables**

First Turn:  Enabled  
Free Run:  Enabled  
TT / 64:  Enabled

**Current Scale**

Current at 0dBm: 1000.0

**Interlock**

Enabled  ■ ■ ■ ■ adc Y X

X: -1.0000 1.0000  
Y: -1.0000 1.0000  
Auto on/off: 10.0 0.0

Ovfl detect:  Disabled

Max ADC: 92.0 % = 30000  
ADC Time: 5

**Signal Conditioning**

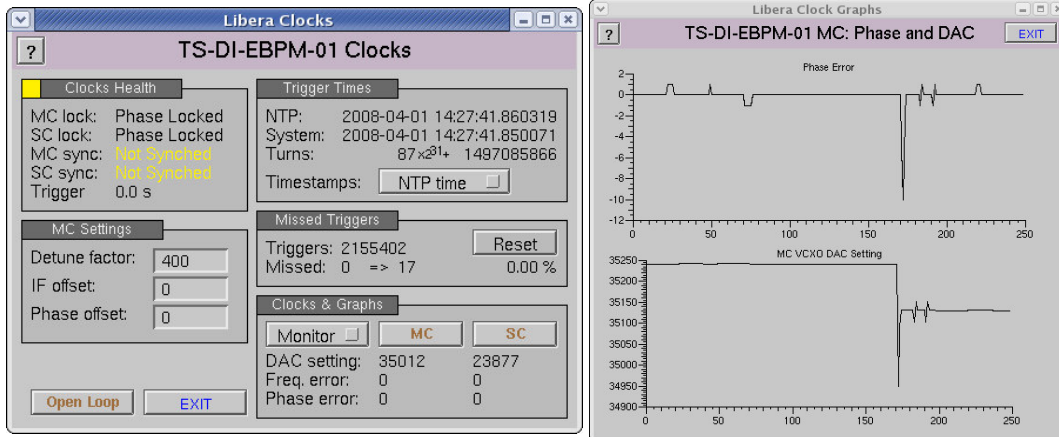
Switches:  Automatic  
Trigger src:  External  
DSC:  Automatic  
Manual Switch: 3      
Trigger delay: 80  
Attenuation: 38

[SC Detail](#)

[Clocks](#) [EXIT](#)

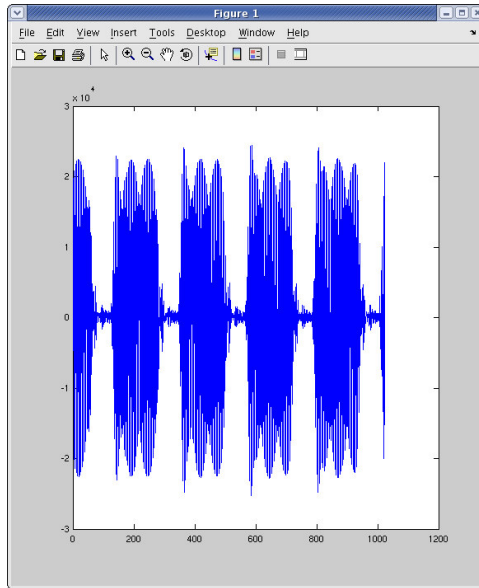
# Clock Control

- Sample clock phase locked to machine clock (within hardware constraints).
- System clock synchronisation exposes previously unseen system clock driver fault: cannot rely on system timestamps yet!
- Talking with i-Tech about using Diamond PLL in general release.

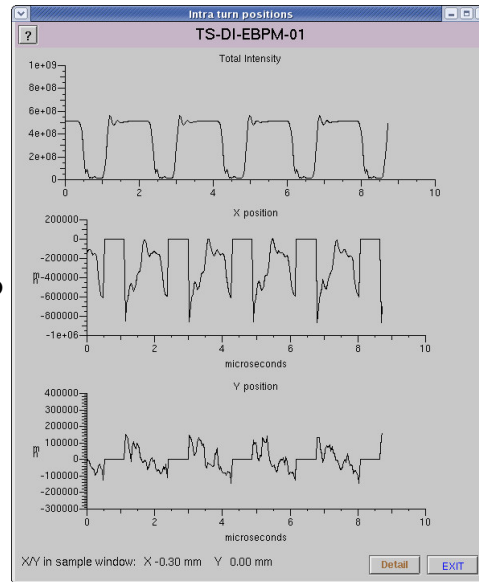


# ADC Rate Data

- Reduction of raw ADC rate data (at intermediate frequency) to magnitudes: filtering and cordic.
- Computation of intra-turn beam positions at ADC rate: quite noisy, but can be quite useful.



to



# SA Features

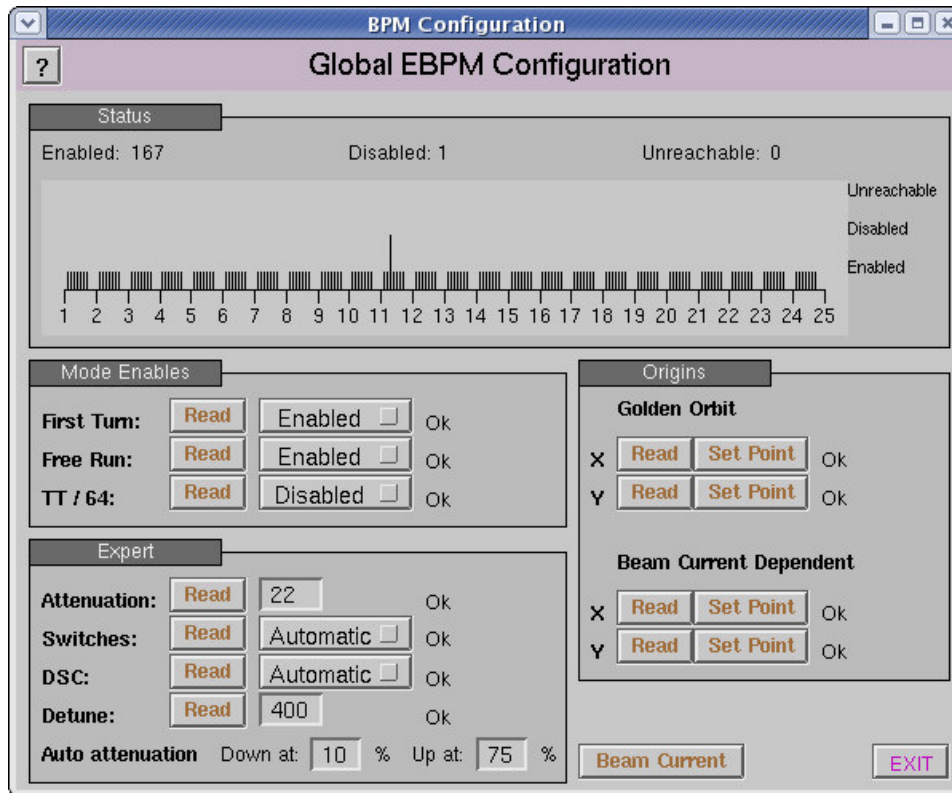
- Beam current estimate from intensity: low noise (but inaccurate) beam current measurement.
- Accurate MAXADC calculation at SA rate using DLS FPGA: used for automatic attenuation control.

The screenshot shows a software window titled "Diagnostics Storage Ring Overview" with a sub-header "Storage Ring". The interface is divided into several panels:

- Stored Beam (DCCT):** Displays current and lifetime data for 0.3Hz and 5Hz beams, along with accumulated beam current and transfer efficiency.
- EBPM Controls:** Includes controls for Max ADC, Attenuation, Auto BCD, and Measurement, along with BPM current and various control buttons.
- SR01C:** Shows emittance, coupling, and temperature data for various components like PINH-01, SRM-01, and COL-01.
- SR21C:** Displays bunch-by-bunch data, pinger magnet status, and temperatures for AMP 01 and AMP 02.

At the bottom of the window, there are several status and control buttons: Beam Loss, Fill Pattern, XBPMs, FOFB, BS, All, and EXIT.

# BPM Concentrator Overview



# Signal Conditioning

- Constrained by a non-disclosure agreement with i-Tech: currently unable to release EPICS driver until this is resolved.
- Reworked signal conditioning algorithm: reduces or avoids jumps in position when attenuation changes. (Still need to drop interlock while changing attenuation.)
- Detailed monitoring of individual channel gains exposes previously unseen faults!

**Signal Conditioning**  
**TS-DI-EBPM-03 Conditioning**

**SC Control**

Max deviation: 2.0  
IIR factor: 0.10  
Interval (s): 1.0  
DSC: Automatic

**Inputs**

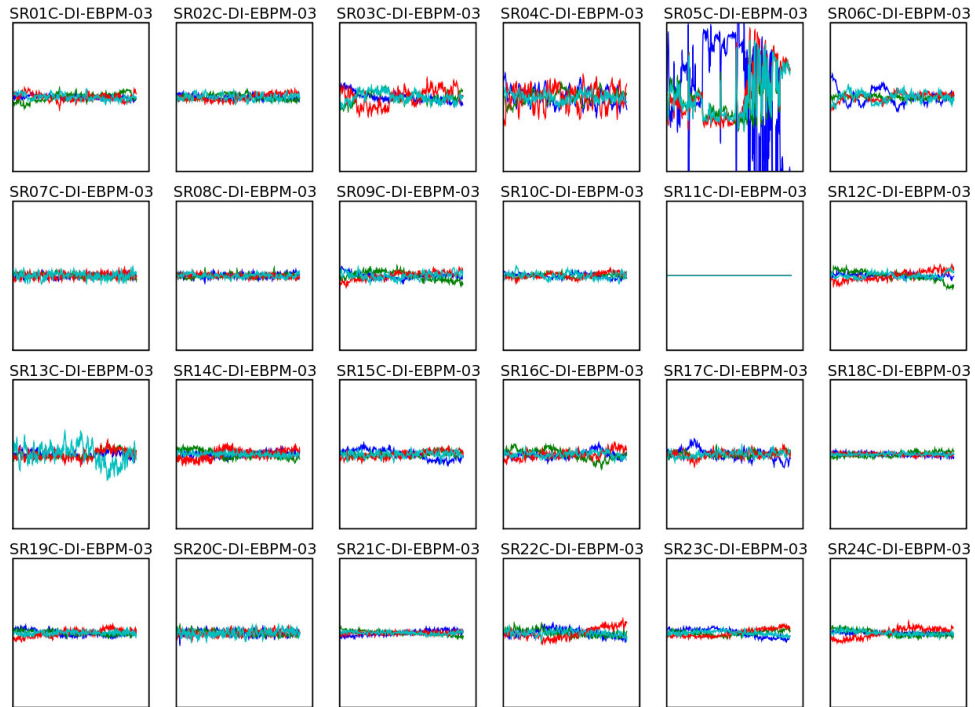
Deviation: 1.1 %  
Status: Good  
Button B-A: 87.58 deg  
Button C-A: 87.39 deg  
Button D-A: 87.50 deg

**Channel Gains**

Angle (deg):	10.729	33.972	-16.206	-28.003
Magnitude:	0.97255	1.02319	0.99492	1.01015
Variance:	0.018	0.020	0.015	0.013

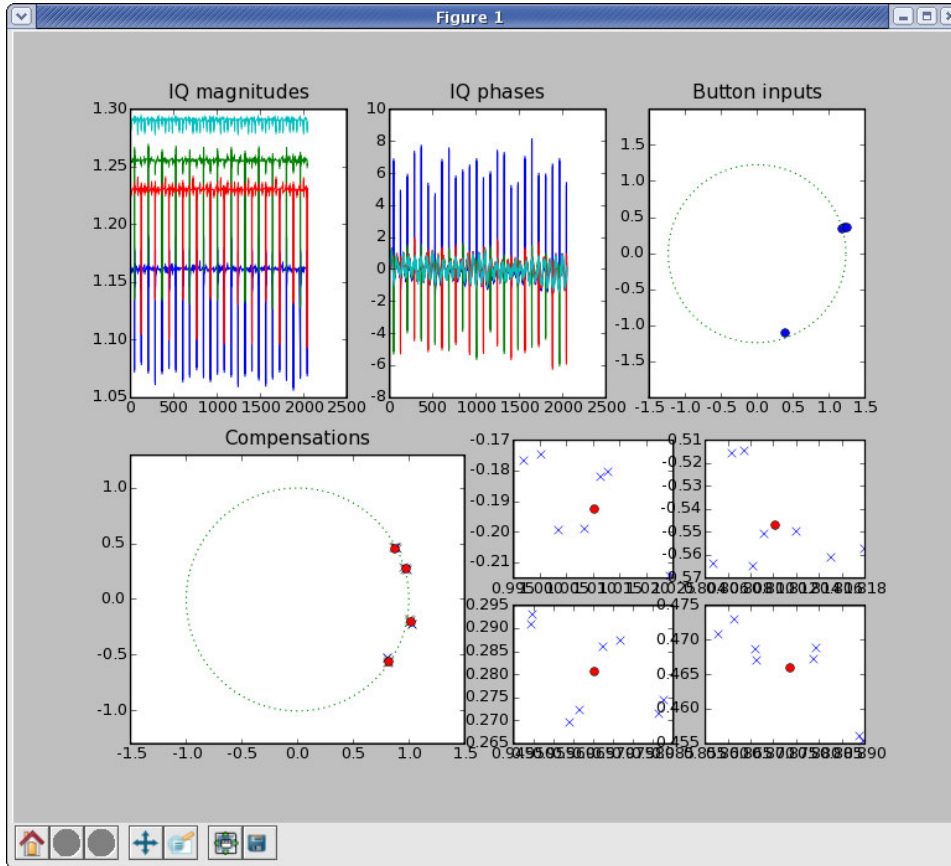
Strip I & Q EXIT

# Channel Gain Evolution



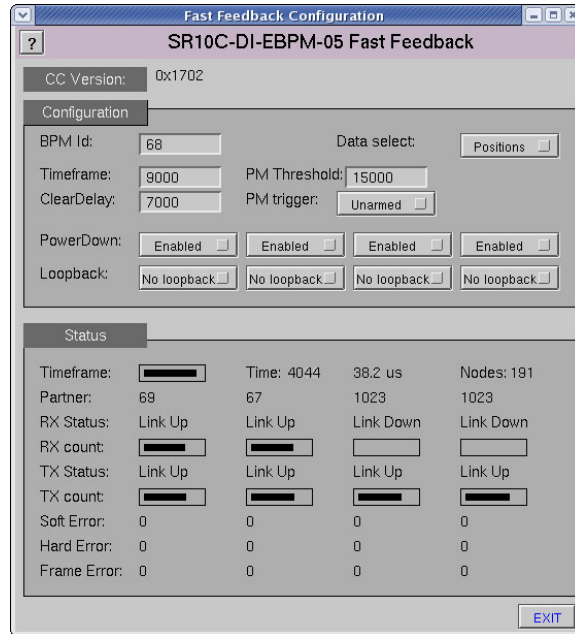
Evolution of channel gains over one hour (vertical range  $\pm 0.002$ ).

# Detailed SC Overview



# Fast Feedback Interface

- Postmortem trigger on excessive FA movement: very useful.
- Detailed communicator view.



# Fast Feedback System Overview

