CAENels
Gear For Science

BEST
Beamline Enhanced Stabilization Technology

Integrated Photon Beam Optimization and Stabilization System

The BEST (Beamline Enhanced Stabilization Technology) is the first hardware system for the optimization and stabilization of the photon beam based on a distributed architecture.

System configurability and expandability – building blocks are independent and stand-alone.

Performs a real-time compensation of intensity and positional drifts of the beam.

Features

- Readout module – i.e. TetrAMM – for photon BPM
- Actuation module – multi-channel DAC
- Control & Interface module
- X, Y correction and stabilization
- I0 stabilization (optional)
- Web-server interface
- Configurability to different detector geometries and configurations
- Firmware remote update on all building blocks
- Low-latency and high-speed links between blocks allow for higher frequency beam instability correction – e.g. mechanical vibrations
- TCP-IP control
- EPICS IOC

Applications

- Photon Beam Stabilization

The BEST (Beamline Enhanced Stabilization Technology) is a powerful instrumentation and software suite specially designed to easily provide the capabilities for simultaneously controlling position (X, Y) and intensity (I0) of the photon beam in synchrotron radiation X-ray beamlines.

The system is designed on a distributed architecture that allows installing all electronic building blocks as close as possible to the corresponding device – e.g. a piezo driver or a photon BPM.

The system is composed by three main building blocks:

- the **readout** block
- the **control** and interface unit
- the **actuator** block

The **readout block** is represented by the TetrAMM device: a 4-channel bipolar picoammeter with an integrated HV bias voltage source that can be connected directly to a four-quadrant phBPM detector – e.g. diamond detector, ion chamber or quadrature diodes.

This readout block has an independent 10/100/1000 Ethernet interface for standard communication and can be also used as a stand-alone readout unit. In addition to this, the TetrAMM has a high-throughput and low-latency SFP link that guarantees interface to the control unit.

The **control and interface unit** is the "brain" of the entire system and it is made by a 19"-1U rack that interconnects and interfaces to the other building blocks and gives access and control to the users directly via a Gigabit Ethernet interface. The control interface has a dedicated application that allows to set the parameters to configure the beamline system (detectors, piezo actuators, geometry) and control the photon beam behavior.

This central unit has four fast SFP links implemented on a board that includes a high-performance FPGA that performs the beam control tasks independently.

This FGPA communicates to a higher-level layer via a PCI-e protocol. A dedicated EPICS IOC is implemented on this central unit and accessible via the Gigabit Ethernet link in order to interface to the beamline control system.

The central unit also has a video interface in order to optionally connect a monitor and USB ports to connect a mouse and a keyboard.

The SFP links are also dedicated to connect the system to the **actuator block** – i.e. PreDAC unit.

This actuation block provides two different high-resolution and high-bandwidth DAC channels (X, Y controls) in its standard configuration. An additional DAC channel – I0 – can be optionally added to act on the intensity.

The BEST system basic configuration includes one TetrAMM, one control unit and one 2-channel actuator block. Up to two TetrAMMs and two actuator blocks can be handled from the control unit. Please check our website www.caenels.com for updates and further information on the BEST.

Technical Specifications — BEST

Control Interface	10/100/1000 Ethernet TCP-IP
BEST Application	Web-Server
Standard Configuration	1 TetrAMM picoammeter 1 PreDAC actuator unit (2-channels) 1 control and interface unit
Extended Configuration	2 TetrAMM picoammeters 2 PreDAC actuator units (2-channels) 1 control and interface unit
Control and Interface Unit OS	Linux OS
Compensation Loops	Horizontal position (X) Vertical position (Y) Intensity (I0) - *optional*
Detector configurations	Quadrature detectors (45° or 90°)
Loop Communication Interface	SFP – Small Form Factor Pluggable
Additional Features	Firmware Remote Upgrade for each building block
Drivers	EPICS IOC
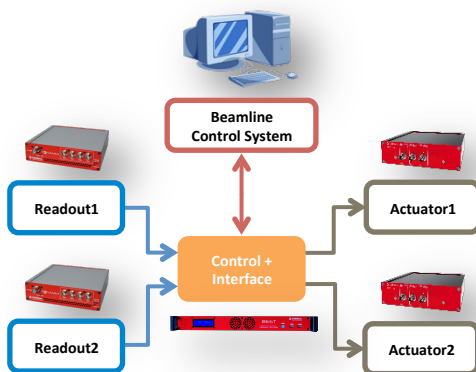
BEST – System Structure

The Beamline Enhanced Stabilization Tech full-configuration is composed by two readout blocks (TetrAMM), two actuator blocks (DAC unit) and a Control & Interface Unit that directly interfaces to the beamline control system
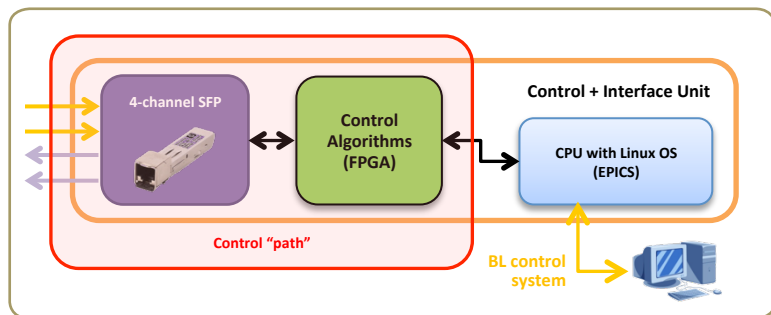
Control & Interface Unit Architecture

Ordering Options

WBEST2XAAAAA	**BEST-2**	BEST - Beamline Enhanced Stabilization Technology system, 2-channel turnkey solution (with EPICS driver)
WBEST3DACXAA	**BEST-3-DAC**	BEST High-Precision additional channel (I0) for Fast Actuator Unit