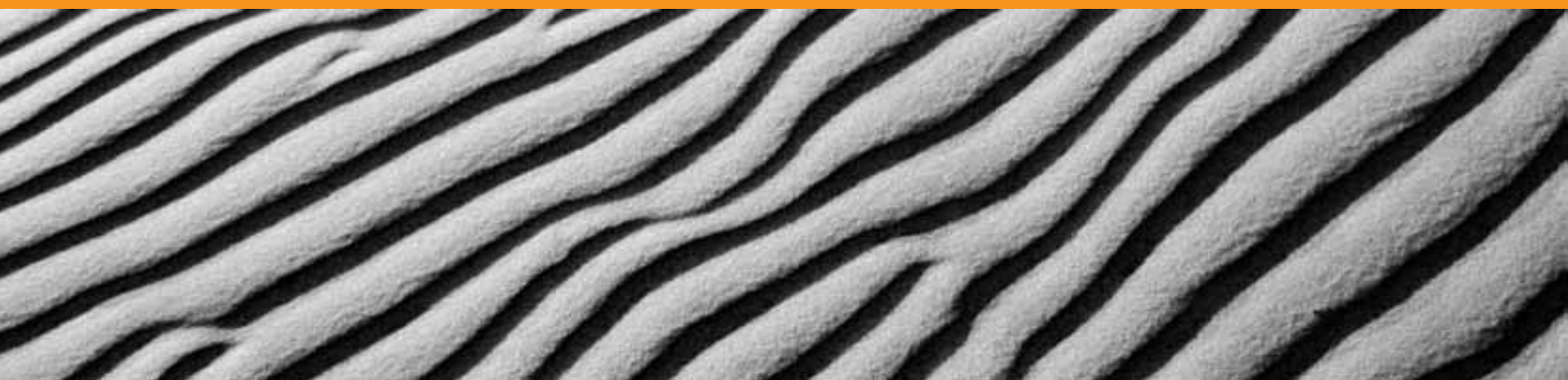
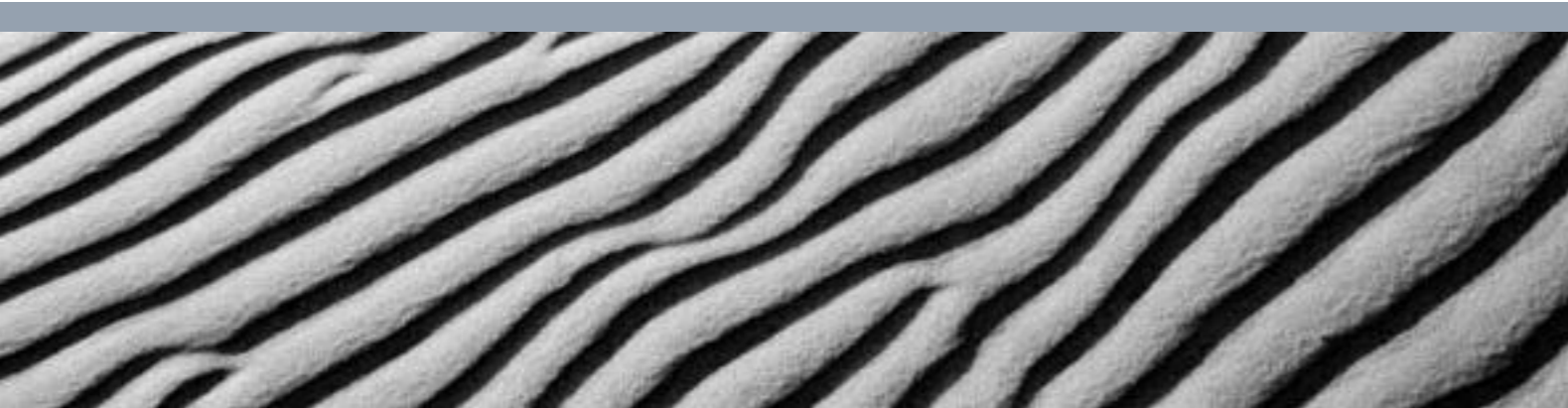


Libera

Libera Single Pass H

Hadron Phase and Position Processor





Many instruments. Many people. Working together.

Stability means knowing your machine has innovative solutions. For users, stability means a machine achieving its full potential, enabling them to do more science. For us, stability means synchronized, connected, dynamic state-of-the-art instrumentation, working together as one system.

Because we know that the machine is more than just the sum of its parts.

Libera Single Pass H enables beam signal processing for single pass measurements. It is recommended for:

- hadron and heavy ion LINACs: beam phase and position monitor applications in LINACs and transfer lines
- pulsed and continuous wave (CW) operation
- pickup buttons and striplines.



Benefits

Accurate single pass phase and position measurements

- invaluable tool during machine commissioning, regular operations and machine physics studies
- covers from pulsed to continuous wave (CW) applications

Fully digital all-in-one solution

- analog and real-time digital signal processing and high-level software
- up to four beam processors in one chassis
- easy to integrate in any Control System

High-end technology embedded

- Virtex™ 5
- based on μ TCA
- embedded standard Computer on Module (COM) with Intel Core 2 Duo
- large playground for custom users written application
- Gigabit Ethernet (GbE) ready

Working together

- with other Libera family instruments: Libera LLRF, Libera Sync, Libera Hadron
- fast feedback ready
- integration of many instruments in the accelerator Control System

Role in the Accelerator

The aim of a single pass phase and position measurement is to resolve the beam position and phase from the information extrapolated from the pulsed or continuous wave structures that are crossing the beam position monitor.

Libera Single Pass H makes accurate beam position and phase measurements possible. Together with implemented fast communication protocols (e.g. GbE), it represents a reliable and deterministic building block for fast feedback building or feed forward loops and thus enables to achieve higher beam stability.

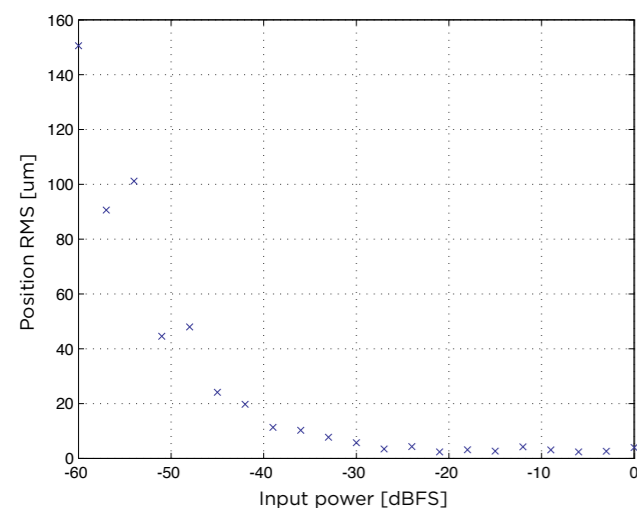
How Does It Work?

Libera Single Pass H is a system optimized for processing heavy particles beam signals in linear accelerators' applications. The beam RF signals are first processed by means of analog signal processing, then the amplitude and phase information is extracted from the digitized signals. A digital processing system extracts the beam phase and position information. The position and phase data is available in a stream that can be used for monitoring and feedback purposes.

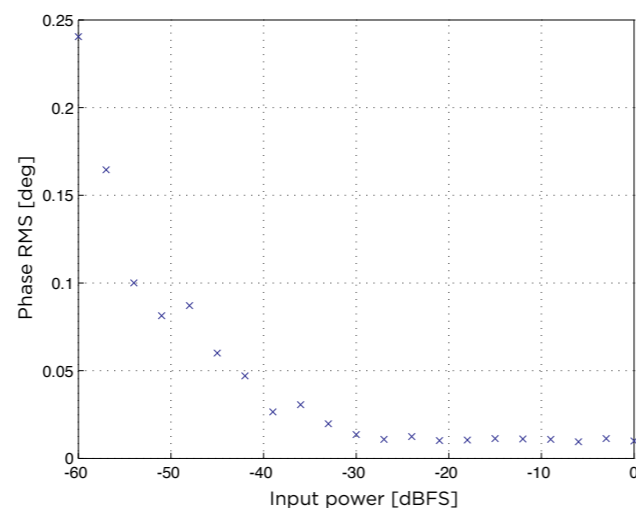
Performance Specifications

Signal Level [dBFS]	Measured Peak [mV]	Typical position RMS (μm)	Typical phase RMS ($^\circ$)
0	4000	3	0.01
-20	400	3	0.01
-40	40	-13	0.04
-60	4	150	0.25

Position RMS



Phase RMS



- 1 Intel dual core COM Express with extensive communication interfaces: The latest FPGAs and a powerful personal computer based on the PCIe interface offer good resources for the implementation of low-latency control algorithms, real-time data processing and dedicated RF system diagnostics tools.
- 2 RF acquisition modules: The system is configured to have four satellite modules, each of which can process 5 RF inputs. One channel on each board is used as RF reference signal for measurement.
- 3 GDX module (optional): Used for fast serial communication. Unidirectional GbE connection as a standard solution for data streaming is offered.
- 4 Timing module: Fast signal interfaces used for triggering, interlock and synchronization purposes
- 5 Optional

Hardware Interfaces



The Libera Single Pass H system architecture is based on PCIe implemented on AMC standards. It is a user-friendly network-attached device that has a powerful computational interconnect board (ICB) managing a number of satellite boards.

Parameters

Parameter	Value
Number of input channels	20 (4 per module + reference)
ADC resolution	16 bits
Max. ADC sampling clock frequency	up to 130 MHz
Memory size per module	up to 8 Gbits

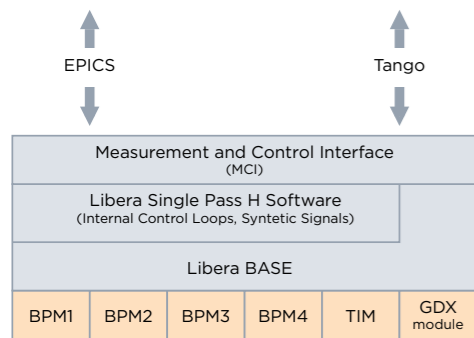
Do you need an instrument for your specific need? μ TCA-based Libera HW generation B is designed for fast prototyping covering wide range of different applications.

High-level Software Architecture

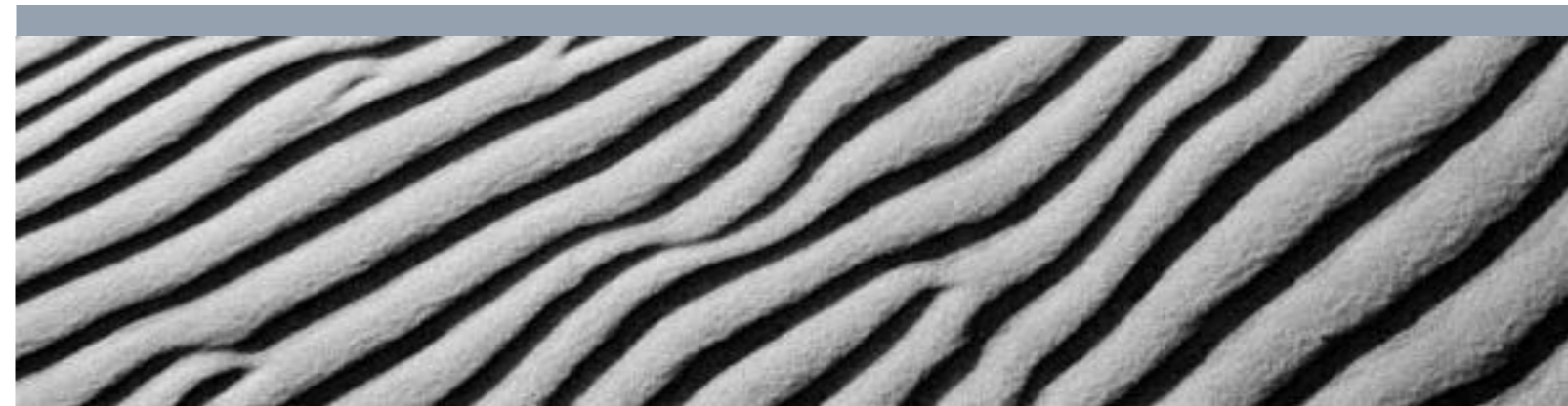
The hardware is based on μ TCA standards, with a proprietary chassis, which accommodates up to four full-width and two half-width modules. It also includes a high performance back-plane that satisfies most demanding applications. In addition, there is a platform management controller and a COMe module which support different CPU options.

Software modules are implemented using the Libera BASE framework, which provides HW abstraction and simplifies development and integration. The Libera BASE also takes care of all common tasks such as platform management and health monitoring. Besides this, the Libera BASE is an extensible application layer with configuration parameters (registry tree) and signal acquisition, processing and dispatching functionality. On the top layer, it provides the Measurement and Control Interface (MCI) with a development package and an example CLI utility for open interaction in different control systems. All the software runs on a standard Linux Ubuntu distribution.

The FPGA software resides in different modules and is smoothly integrated into the Libera BASE framework. Using the development kit, it is also possible to change the functionality and implement different processing algorithms.



LIBERA HW GENERATION B



Services

Libera Promo

Get the first unit at the promotional price with a money-back warranty option.

Complete System

Guarantee smooth and fast installation, commissioning and integration into the Control System.

Support Packages

Priority support, on-site support, remote access support.

Training

Hands-on training sessions on the use of Libera instruments are organized either on-site or at the Instrumentation Technologies premises.

On-site Testing

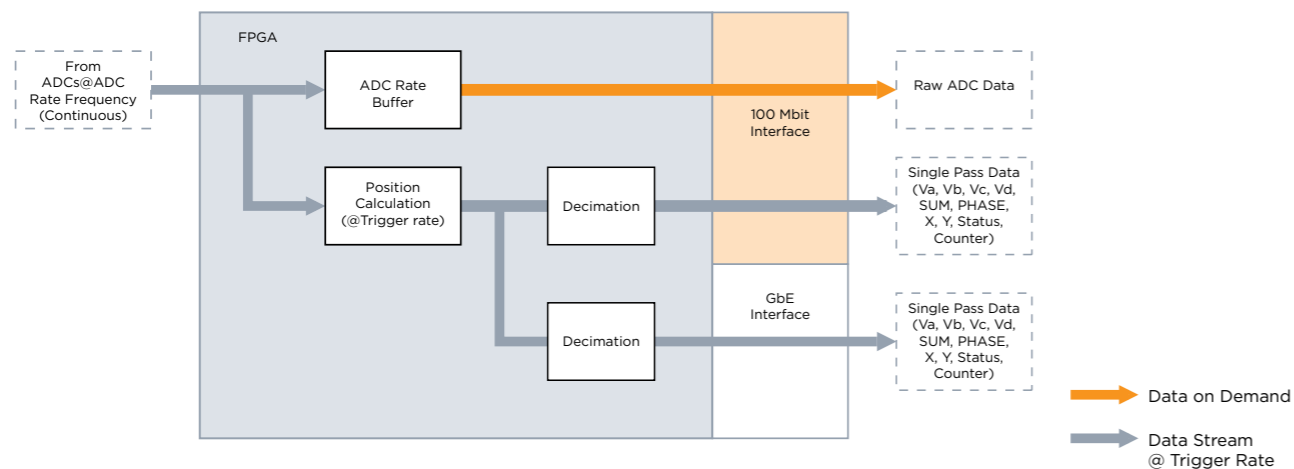
Try the instruments at your machine. One of our experts can visit you and assist you with testing.

Warranty Extension

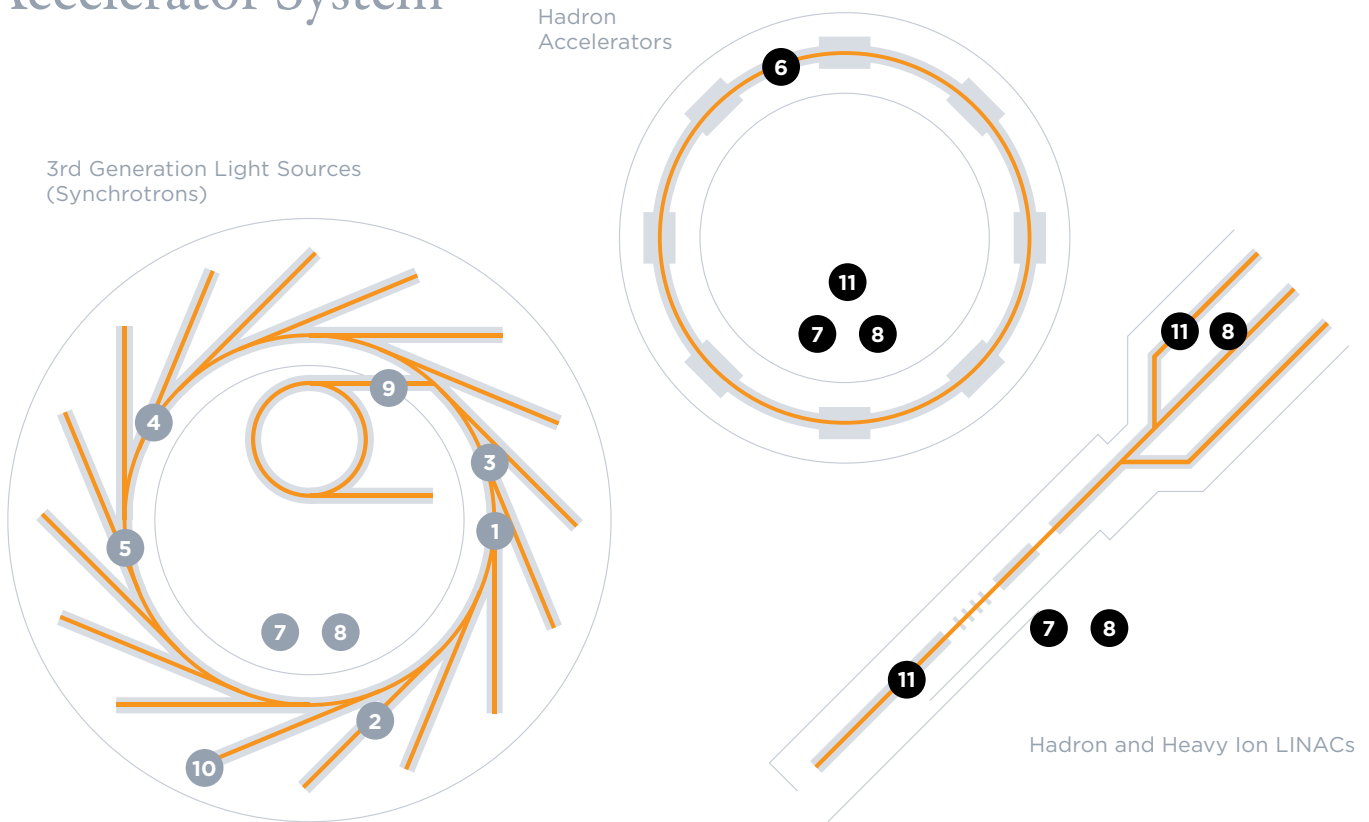
Extend the standard 2-year warranty for the instruments and fix the cost of potential malfunctions in advance.

Data Paths

Libera Single Pass H provides 3 main data paths. Acquisitions can be done simultaneously on all three data paths (raw ADC Data, Single Pass Data, GbE Single Pass Data). GbE (optional) single pass data is available over SFP slot using GbE protocol.



Related Products in the Accelerator System



- 6** **Libera Hadron**
Hadron beam position processor
- 7** **Libera LLRF**
Digital RF stabilization system
- 8** **Libera Sync**
Low-jitter clock distribution system
- 11** **Libera Single Pass H**
Hadron phase and position processor
- +** *See the cover spread for the whole product range*

→ Solution	Building Block
Linac energy stabilization	Libera LLRF + Libera Sync + Libera Single Pass H
Hadron beam stabilization solution	Libera Single Pass H + Libera Hadron
Longitudinal beam stabilization	Libera Single Pass H + Libera LLRF

More at www.i-tech.si

Visit our website to read more about Libera products, download conference papers on the use of Libera at different accelerators around the world, subscribe to the I-Tech Newsletter and learn about the next gathering of the community at the Libera Workshop.

Technical Support

Prompt and reliable. You can ask for on-site support or we can assist you remotely. You are also welcome to join us at the Libera Workshop training sessions to get the most out of Libera products.

