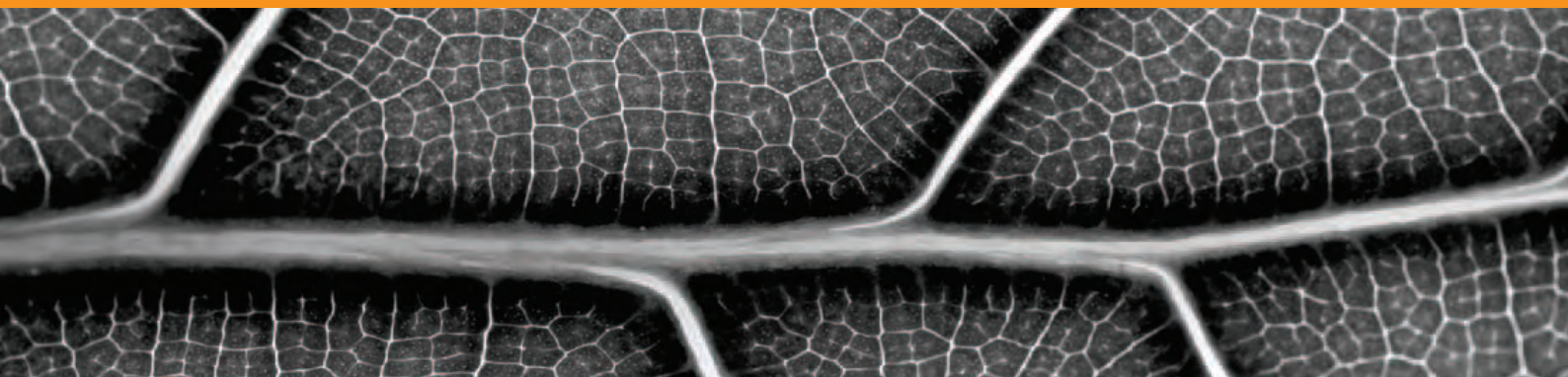
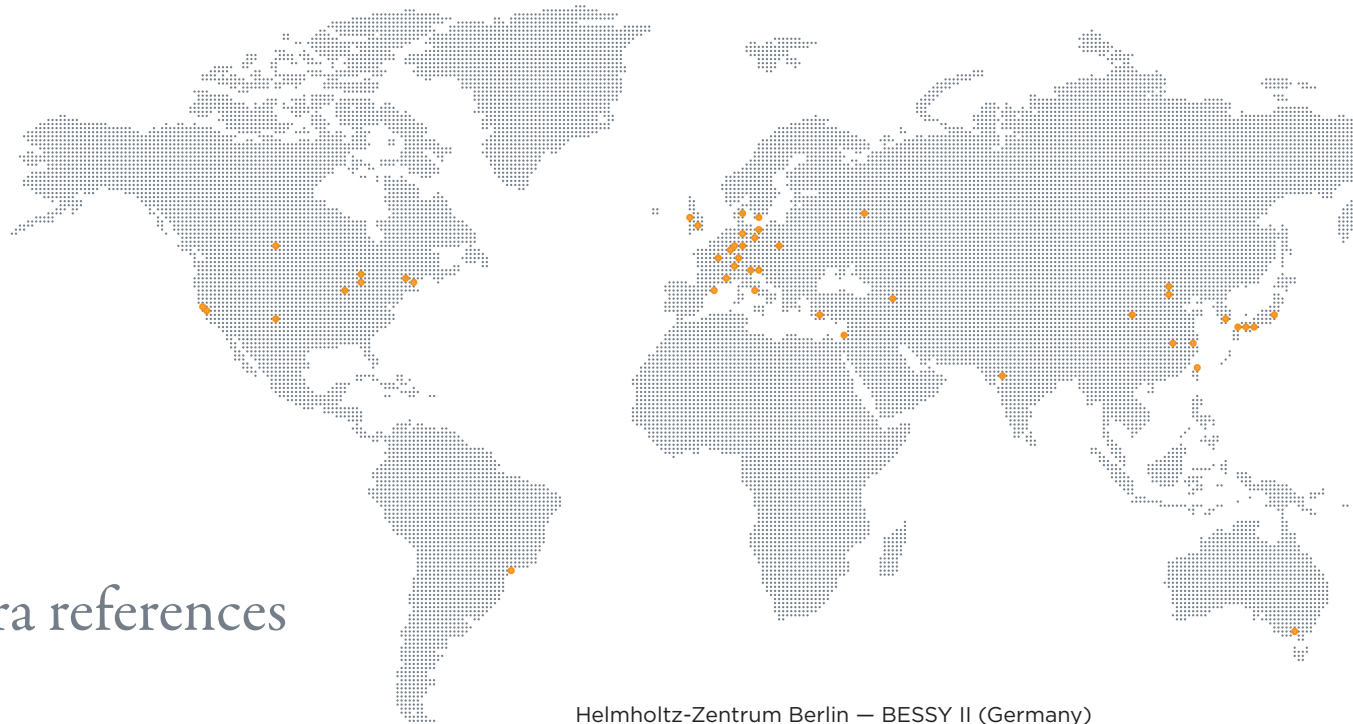


**Libera**  
Sync 3

# Low-Jitter CW Reference Clock Transfer System





## Libera references

### Asia

HiSOR (Japan)  
IHEP — BEPC II, ADS (China)  
IMP-CAS — ADS (China)  
ISSP (Japan)  
JASRI — Spring-8 (Japan)  
KEK — PF, PF AR; LINAC, SUPER B (Japan)  
Nagoya University — Chubu Synchrotron (Japan)  
NSRRC — TLS, TPS (Taiwan)  
PAL — PLS II, XFEL ITF (Korea)  
RRCAT — INDUS, INDUS II (India)  
SINAP — SSRF (China)  
Tsinghua University (China)  
USTC, NSRL — HLS, HLSII (China)

### Australia

Australian Synchrotron (Australia)

### Europe

CANDLE (Armenia)  
CELLS — ALBA (Spain)  
CERN (Switzerland)  
DELTA (Germany)  
DESY — PETRA III, FLASH, DESY XFEL, DORIS III (Germany)  
DIAMOND Light Source (United Kingdom)  
ESRF (France)  
Forschungszentrum Juelich (Germany)  
FZK — ANKA (Germany)  
GSI — SIS 18 (Germany)

Helmholtz-Zentrum Berlin — BESSY II (Germany)  
IJS (Slovenia)  
INFN — Daphne (Italy)  
IPNO (France)  
ISA — ASTRID II (Denmark)  
Jagiellonian University — SOLARIS (Poland)  
Lund University — MAX III, MAX IV (Sweden)  
Physics Institute of the University of Bonn (Germany)  
PSI — SLS, SwissFEL (Switzerland)  
RRC Kurchatov Institute — SIBERIA II (Russia)  
SDU — TARLA (Turkey)  
SESAME (Jordan)  
Sincrotrone Trieste — Elettra (Italy)  
SOLEIL Synchrotron (France)  
STFC ASTeC - EMMA (United Kingdom)

### North America

ANL — APS (United States)  
BNL — ERL, NSLS II, X RAY ring (United States)  
Canadian Light Source, CLS (Canada)  
Cornell University — CHESS (United States)  
LANL — LANSCE (United States)  
LBNL — ALS (United States)  
Michigan State University — FRIB (United States)  
SLAC — LCLS (United States)

### South America

ABTLuS — LNLS (Brazil)

## More at [www.i-tech.si](http://www.i-tech.si)

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

*Libera Sync 3 is a new generation reference clock transfer system. It is primarily designed for FELs and suitable also for other light sources.*

Transmitter



Receiver



## Benefits

### Compact and robust design

- Industry standard 2U 19" form factor
- High reliability achieved by using high-end electronic and optical components operating in optimal working points
- Robust mechanical layout specifically designed to maintain a controlled environment inside the units
- Once tuned it becomes a self-sustaining integral part of the machine

### User-friendly control interface

- Integration into the control system by using SCPI command interface
- Local control over front panel
- Standard Ethernet connection
- Transmitter and Receiver diagnostic data available on both units simultaneously
- Diagnostic data logging on standard memory card with adjustable sampling time

### Simple commissioning and use

- Software guided one-time tuning procedure
- Retuning not required after system restart
- Low maintenance
- Support for system integration available

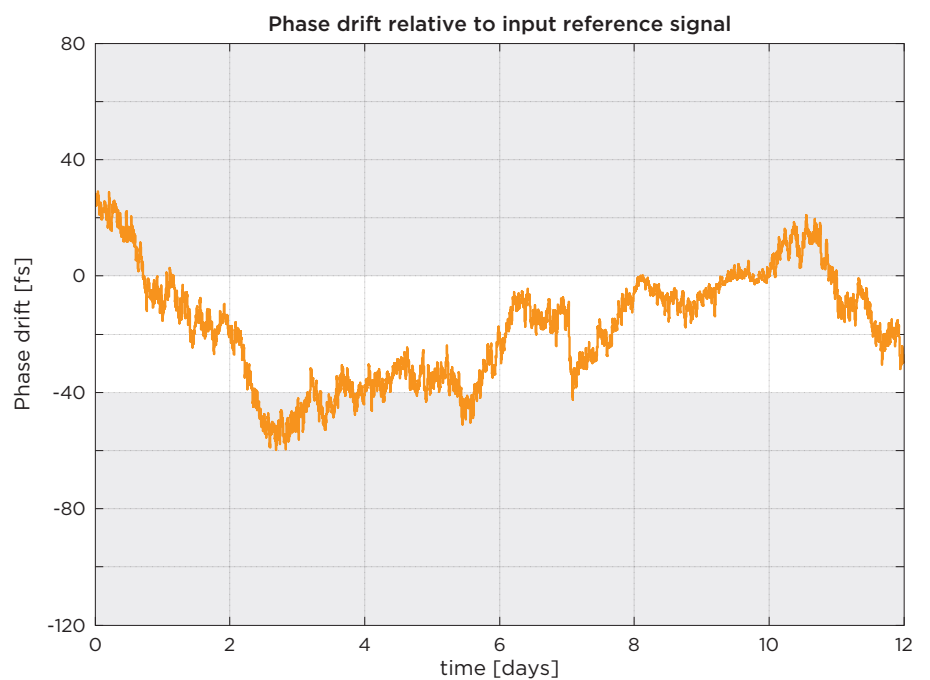
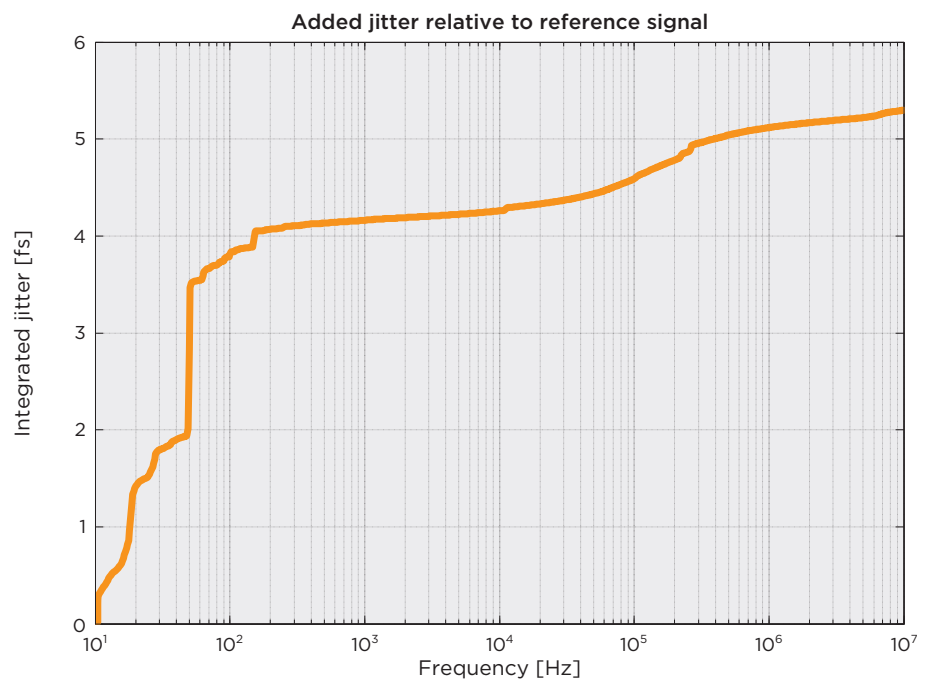
### Performance

- Added jitter in the range of a few femtoseconds
- Long-term stability: a few tens of femtoseconds of phase drift per day
- Long-distance operation
- Broad operational range influenced by: temperature, humidity, length, fiber type

# Performance specifications

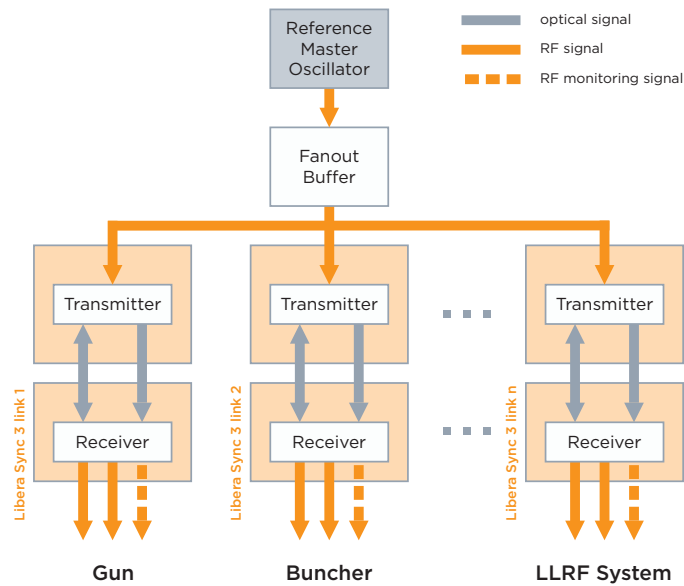
Parameter	Value
RF input level	15 dBm $\pm$ 1dB
No. of RF outputs	2
RF output level	15 dBm $\pm$ 1 dB
Monitoring RF output level	-10 dBm $\pm$ 3 dB
Added jitter	<6 fs RMS @10 Hz to 10 MHz
24 hour drift	<40 fs peak-to-peak
Carrier frequency	2.998 GHz *
Bandwidth	$\pm$ 200 kHz
Optical fiber drift compensation range	400 ps

\* Can be customized.



# Role in the accelerator

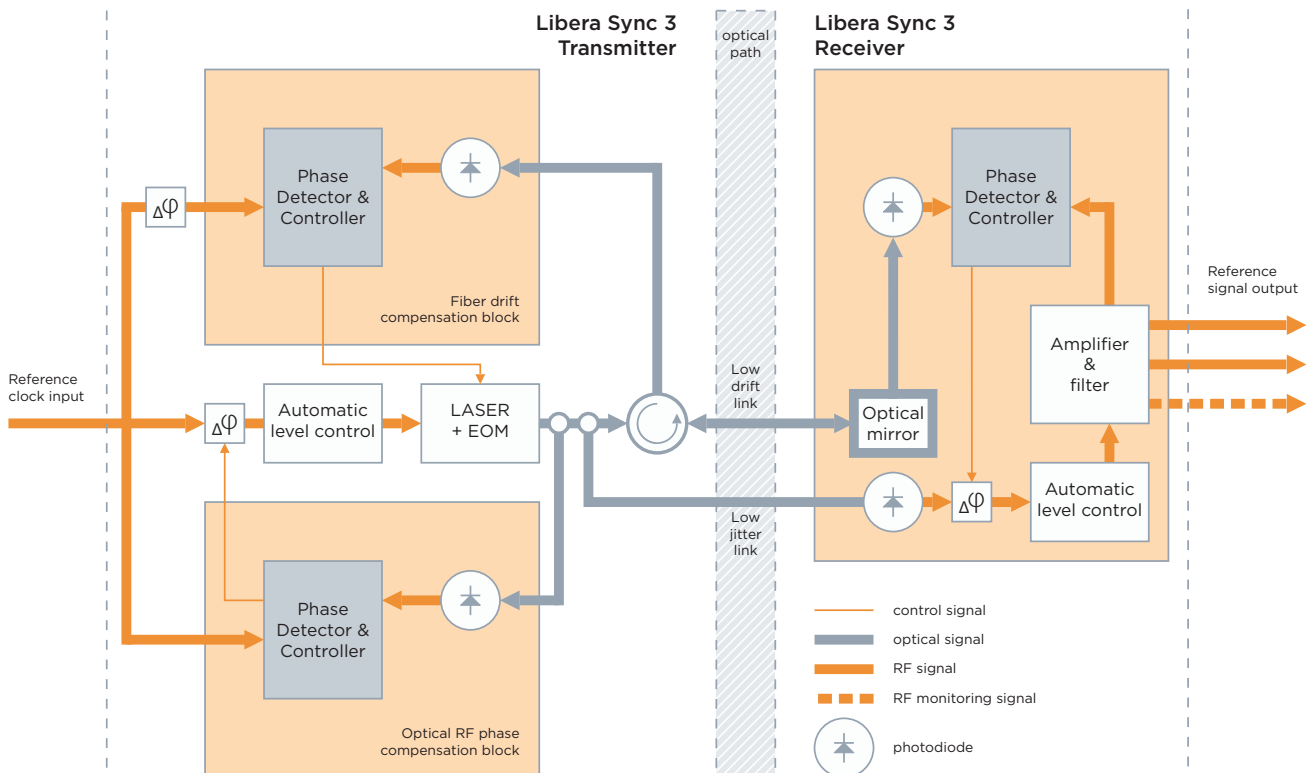
The Libera Sync 3 transfer system enables a number of instruments on the machine to be driven synchronously with a femtosecond jitter clock signal. Libera Sync 3 provides a long distance point-to-point link with low phase drift which enables better synchronization between instruments and other machine subsystems. Both performance parameters (added jitter, long-term stability) have a strong, if not critical, impact on the overall performance of the machine.



# How does it work?

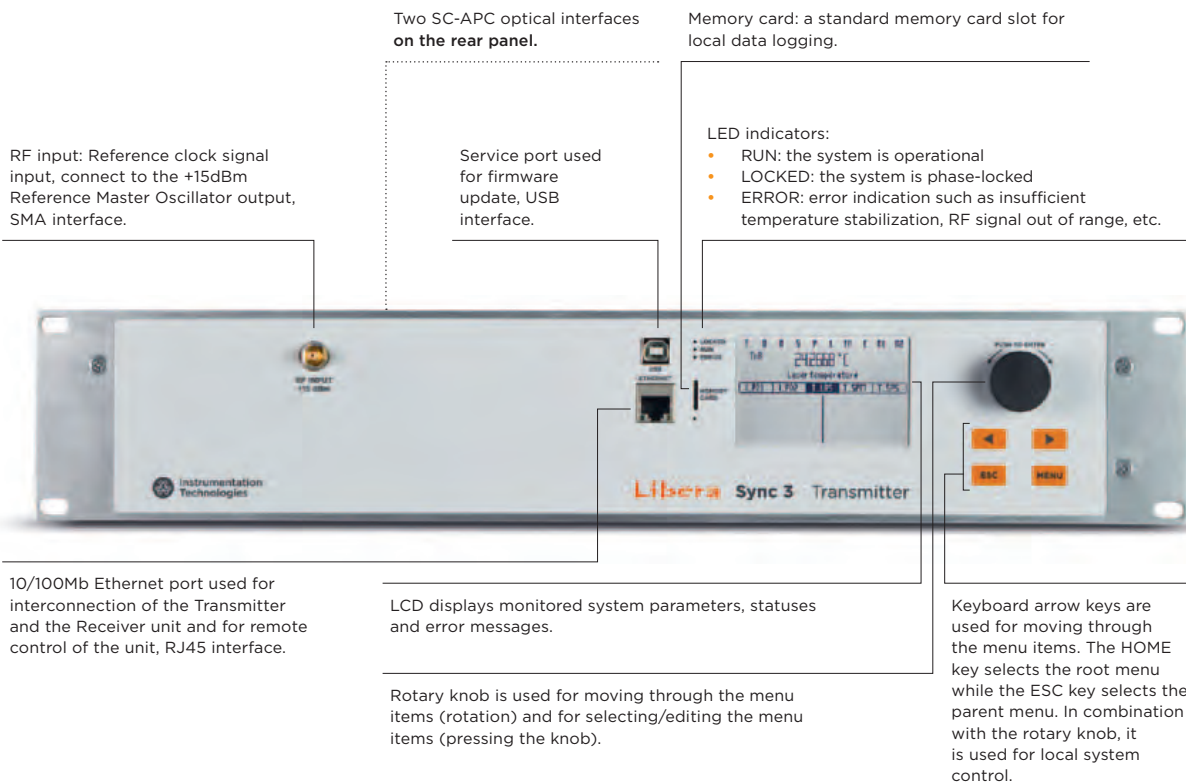
The Libera Sync 3 system consists of a Transmitter and a Receiver unit. The units are connected with a pair of single-mode optical fibers.

The Transmitter input signal is a continuous wave RF reference clock signal. It modulates the 1550 nm optical carrier through an electro-optical modulator. The optical signal is split and fed into two separate paths. One of the signals along with the onboard control circuitry is used for link phase drift compensation and is partly reflected at the Receiver side. Phase drift compensation is performed by optical carrier wavelength adjustments and other mechanisms. The other path is used to transfer the signal at low added jitter. In the Receiver, both incident optical signals are demodulated into the RF domain. The low jitter signal is further amplified, filtered and stabilized in amplitude and phase. This signal is now fed to one monitoring and two users' outputs.

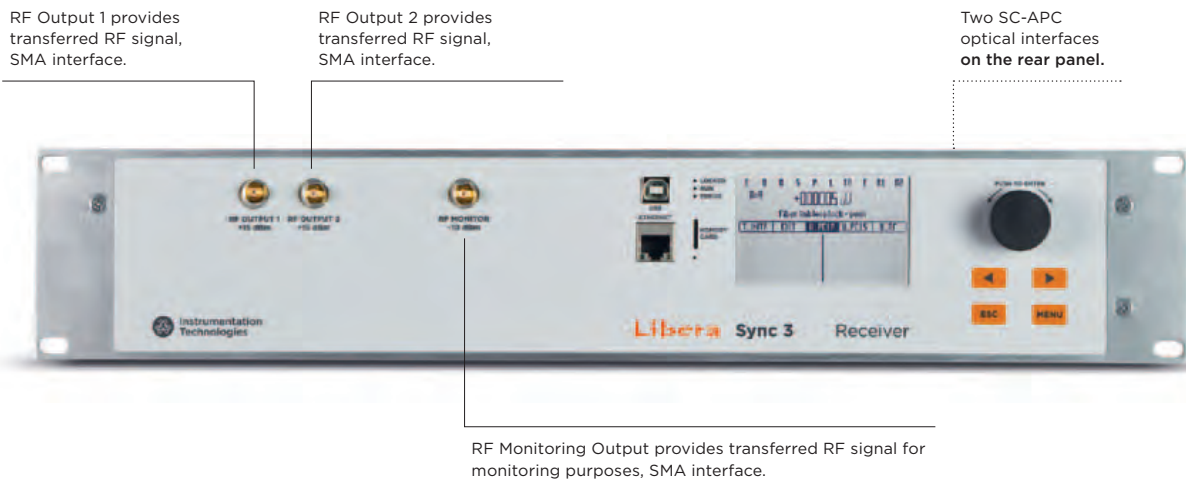


# Hardware interfaces

## Transmitter



## Receiver



# Services

## **Libera Sync 3 promo**

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

## **Complete system**

Assistance in installation, commissioning and integration into the control system.

## **Support**

Various support packages are available.

## **Training**

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

## **On-site testing**

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

## **Warranty extension and insurance**

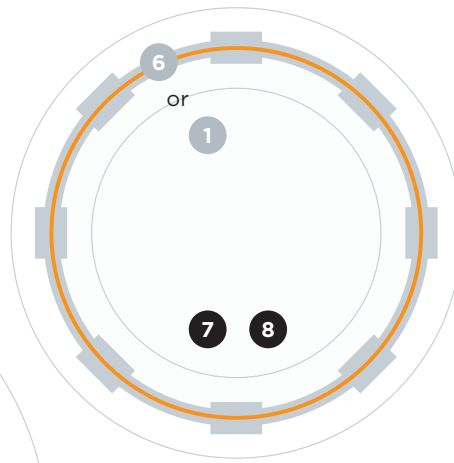
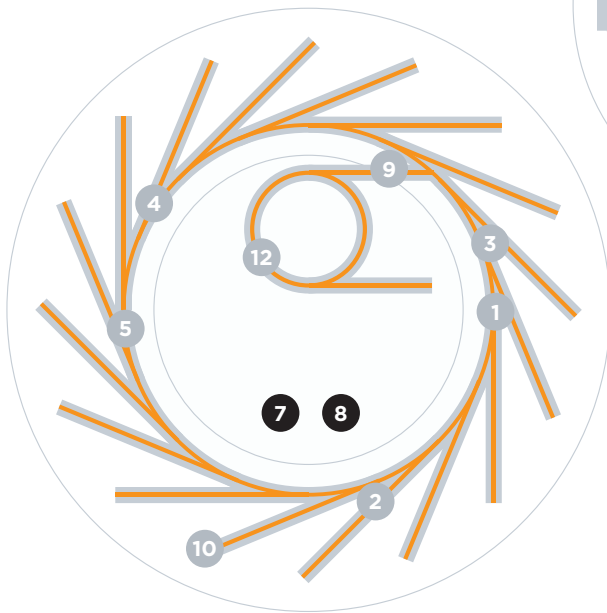
Extend the standard two-year warranty for the instruments and fix the cost of potential malfunctions in advance.

## **Libera instrument modifications**

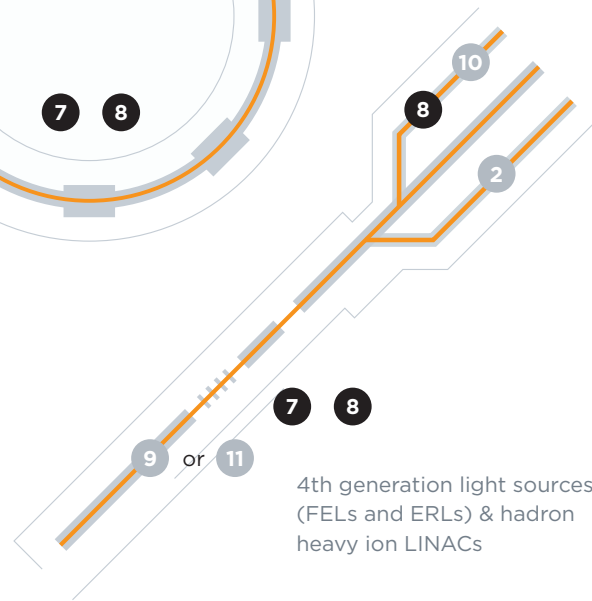
Each Libera instrument is developed for a particular beam stabilization solution. However, the complex SW and HW architecture enables different options for extension and alternative uses. We are open to suggestions for a new or modified type of instrument.

# Libera products in the accelerator system

Light sources (synchrotrons)



Hadron accelerators & colliders



4th generation light sources (FELs and ERLs) & hadron heavy ion LINACs

Other products

Related products

**1 Libera Brilliance+**



*Electron beam position processor*

**2 Libera Photon**



*Photon beam position processor*

**3 Libera Clock Splitter**



*Clock and trigger signals distributor*

**4 Libera Bunch-by-Bunch**



*Digital processing unit for combating coupled bunch instabilities*

**5 Libera Bunch-By-Bunch Front End Bunch-by-Bunch Back End**



*RF signal processing for Libera Bunch-by-Bunch*

**6 Libera Hadron**



*Hadron beam position processor*

**7 Libera LLRF**



*Digital RF stabilization system*

**8 Libera Sync Sync 3**



*Low-jitter CW reference clock transfer system*

**9 Libera Single Pass E**



*Hadron phase and position processor*

**10 Libera Spectra**



*Digital pulse processor for spectroscopy studies*

**11 Libera Single Pass H**



*Hadron phase and position processor*

**12 Libera Spark**



*Compact electron beam position monitor*

**+ Supplementary products:** RF&Clock Generator, SDC, RF Gate, GDx module, DWC-SP

