13th Diagnostics Experts of European Light Sources (DEELS)

Report of Contributions

https://indico.psi.ch/e/17840

Contribution ID: **5** Type: **Presentation**

Proposed Transition to CW Mode at the Eu-XFEL: Implications for Beam Diagnostics

Monday, 23 March 2026 11:05 (25 minutes)

The European X-ray Free-Electron Laser (Eu-XFEL) currently operates in a pulsed mode, delivering ultra-short, high-intensity X-ray pulses for a wide range of scientific applications. However, transitioning to a continuous-wave (CW) operation mode could significantly enhance its capabilities by enabling higher average brightness, improved temporal coherence, and novel experimental opportunities. This contribution addresses the critical modifications required in the electron beam diagnostics system to accommodate the transition from pulsed to CW operation.
Key challenges include the need for real-time, high-resolution monitoring of beam parameters under continuous conditions, such as beam position, energy spread, emittance, and charge stability. Existing diagnostic tools, optimized for pulsed operation, may face limitations in bandwidth and sensitivity. We propose adaptations such as the integration of high-speed, low-noise detectors and advanced signal processing techniques.
This work outlines a roadmap for upgrading the Eu-XFEL's electron beam diagnostics infrastructure, ensuring compatibility with CW operation while preserving the facility's cutting-edge performance for next-generation X-ray science.

Author: LIPKA, Dirk (DESY)

Presenter: LIPKA, Dirk (DESY)

Session Classification: Session

Contribution ID: **6** Type: **Presentation**

BPM electronics upgrade in the scope of SOLEIL II

Tuesday, 24 March 2026 10:55 (25 minutes)

SOLEIL II is the low emittance upgrade project for SOLEIL light source. Dark period is foreseen in October 2028 for a duration of 2 years (including commissioning time).
In this scope, it has been decided to anticipate the upgrade of the old BPM electronics to:
• Develop the commissioning tools on the new system and its final interfaces.
• Restart the new machine with an already validated and operational BPM system which is a key diagnostic for an efficient commissioning.
220 commercial Libera Brilliance Plus modules have been delivered at the end of 2025, and one cell of SOLEIL storage ring (7 BPMs) is already equipped with the new system.
The talk will focus on:
• The dedicated hardware and software developments that have been done by Instrumentation Technologies to fit SOLEIL requirements,
• The FAT and (ongoing) SAT results
• The strategy that is followed to upgrade such a critical system on an operational machine.

Authors: Mrs GRABAS, Aude (Synchrotron SOLEIL); Mr BENCE, Aurélien (Synchrotron SOLEIL); Mr PÉDEAU, Dominique (Synchrotron SOLEIL); HUBERT, Nicolas (Synchrotron SOLEIL)

Presenter: HUBERT, Nicolas (Synchrotron SOLEIL)

Session Classification: Session

Contribution ID: **7** Type: **Presentation**

Overview of FOFB developments for PETRA IV

Tuesday, 24 March 2026 11:45 (25 minutes)

We will report on various simulations and measurements that we have carried out for the FOFB signal chain of the PIV project. These include the fast corrector, the vacuum chamber, the simulation framework and other blocks.

Author: PFEIFFER, Sven (DESY)

Presenter: PFEIFFER, Sven (DESY)

Session Classification: Session

Contribution ID: **8** Type: **Presentation**

The SLS 2.0 Booster-to-Ring Transfer Line - Design Criteria, Diagnostics Layout and Beam Results

Monday, 23 March 2026 09:10 (25 minutes)

Due to the limited transverse acceptance of fourth generation light sources, the characterization and control of the incoming beam from the booster to the storage ring is an important asset to achieve highly efficient and reproducible injection.

For the up graded Swiss Light Source (SLS 2.0) storage ring, a new booster to ring transfer line (BRTL) has been designed with a non dispersive section for beam parameter measurements and a double BPM corrector configuration for position and angle feedback of the injected beam.

Based on the BRTL design criteria, first beam results during SLS 2.0 commissioning are presented, including experience with quadrupole scans to document emittance exchange at the end of the booster ramp and steering stabilization of the beam at the injection point, resulting in a stepwise optimization of transmission into the storage ring.

Author: SCHLOTT, Volker (PSI - Paul Scherrer Institut)

Co-authors: KEIL, Boris (PSI - Paul Scherrer Institut); OZKAN LOCH, Cigdem (PSI - Paul Scherrer Institut); ARMBORST, Felix (PSI - Paul Scherrer Institut); KALLESTRUP, Jonas (PSI - Paul Scherrer Institut)

Presenter: SCHLOTT, Volker (PSI - Paul Scherrer Institut)

Session Classification: Session

Contribution ID: **9** Type: **Presentation**

Commissioning of SLS 2.0 BPM and Fast Orbit Feedback System

Monday, 23 March 2026 10:00 (25 minutes)

In this contribution, we present the commissioning results and experience of the SLS 2.0 RF BPM and fast orbit feedback BPM system. This includes an analysis of the orbit stability in the storage ring.

Authors: KEIL, Boris (PSI - Paul Scherrer Institut); MARCELLINI, Fabio (PSI - Paul Scherrer Institut); MARINKOVIC, Goran (PSI - Paul Scherrer Institut); Mr PURTSCHERT, Jonas (PSI); ROGGLI, Markus (PSI - Paul Scherrer Institut); Mr DITTER, Robin

Presenter: KEIL, Boris (PSI - Paul Scherrer Institut)

Session Classification: Session

Contribution ID: **10** Type: **Presentation**

First Beam Commissioning Experience with the RF System-on-Chip Based SLS 2.0 Filling Pattern and Multi-Bunch Feedback

Tuesday, 24 March 2026 12:10 (25 minutes)

For the new SLS 2.0 storage ring, we have replaced the SLS 1.0 filling pattern feedback (FPFB) and multi-bunch feedback (MBFB) systems with newly developed systems that deploy RF System-on-Chip (RFSoC) technology for data conversion, signal processing, communication and control system integration. In this contribution, the status and first beam commissioning experience will be presented.

Authors: KEIL, Boris (PSI - Paul Scherrer Institut); MARINKOVIC, Goran (PSI - Paul Scherrer Institut); BAETA NEVES DINIZ SANTOS, Pedro Henrique (PSI - Paul Scherrer Institut)

Presenter: KEIL, Boris (PSI - Paul Scherrer Institut)

Session Classification: Session

Contribution ID: **11** Type: **Presentation**

Single bunch phase measurement

Tuesday, 24 March 2026 14:30 (25 minutes)

Accurate knowledge of the longitudinal phase of individual bunches relative to a reference RF signal is essential for applications that demand tight synchronization, such as bunch-by-bunch transverse or longitudinal feedback systems. While many beam-phase diagnostics exist, they are not always optimal with sparse-filling or single-bunch operation.

Here we would like to discuss a method for measuring the phase of a single bunch directly from a BPM button signal, without using ultra fast ADC. The approach is based on IQ demodulation at the reference RF frequency, and moderately fast ADC. The system aims to be simple, low-cost, and readily integrable.

Applied to our booster synchrotron, it would generates a beam-synchronous reference signal that follows the rapidly varying beam phase throughout the acceleration cycle, enabling synchronous measurements even when only a single bunch is present.

Author: ROCHE, Benoit (ESRF)

Presenter: ROCHE, Benoit (ESRF)

Session Classification: Session

Contribution ID: **12** Type: **Presentation**

Test of the iTech XBS-FE module with the Spark BPM electronics

Tuesday, 24 March 2026 11:20 (25 minutes)

We have acquired 2 XBS-FE modules from iTech to perform tests with real beam signals and to evaluate their performance for enhancing the long-term stability of the Spark electronics, and in particular by reducing their dependence on hardware temperature.

The tests were performed by controlling the switching with an home-made controller, with software-based compensation applied externally. Switching was performed at a low frequency, each full cycle lasting 8 seconds.

The results of these tests are presented here.

Author: ROCHE, Benoit (ESRF)

Presenter: ROCHE, Benoit (ESRF)

Session Classification: Session

Contribution ID: **13** Type: **Discussion Trigger**

Electromagnetic Resonances near BPMs: Impact of Vacuum Chamber Discontinuities on BPM Signal Integrity

Tuesday, 24 March 2026 10:15 (15 minutes)

Electromagnetic resonances localized near Beam Position Monitors (BPMs) can significantly distort the beam induced signal on the electrodes and compromise BPM readings. At the European Synchrotron Radiation Facility (ESRF), a detrimental resonance was identified in the vicinity of a BPM. It originates from a small break in the electrical continuity (˜2-3µm) due to the nearby RF gasket that expands and deforms during the bakeout. But other small gaps (for example from welds) may create similar resonances.
To prevent such a situation in SOLEIL II under-design storage ring, we are investigating the situation around the BPM that are integrated on bending magnet vacuum chamber. There is indeed a welding between two pieces of vacuum chambers located 30 mm from the BPM buttons creating a possible cavity. In collaboration with colleagues from ESRF, we have initiated simulation studies to assess the influence of such welding on nearby BPM readings. This contribution does not present results, but aims to trigger a discussion and gather feedback from the community, particularly regarding experience with possible resonances at welding location, simulation practices, and strategies to suppress or mitigate such effects.

Author: EL AJJOURI, moussa (Synchrotron SOLEIL)

Presenter: EL AJJOURI, moussa (Synchrotron SOLEIL)

Session Classification: Session

Contribution ID: **14** Type: **Presentation**

First measurements of a prototype Stripline BPM for PETRA IV and comparison with simulation

Tuesday, 24 March 2026 08:45 (25 minutes)

We present signal and thermal measurements from the first prototype of a stripline Beam Position Monitor (BPM) intended for the PETRA IV synchrotron ring. The monitor was installed at the PETRA III testbed for evaluation and compared against CST Studio Suite simulation results. Initial measurements revealed unexpected signal oscillations and significant heating (up to 135 ℃), which were not reproduced in ideal models. For a smooth beam pipe, the expected power loss based on the wake-loss factor would only be 5 W. Including mechanical details such as flanges and copper gaskets in the simulation revealed cavity-induced resonances, which increased the power loss up to 96 W. The updated model showed good agreement with the measured signals in both time (TD) and frequency domains (FD), as well as with thermal data. Replacing the gasket with a RF-sealing variant lowered the measured temperature to 65 ℃. This study highlights that multiple mechanical and electromagnetic factors must be understood and included in simulations to predict beam-induced effects in high-frequency diagnostics.

Author: STROKOV, Sergey (DESY)

Co-authors: LIPKA, Dirk (DESY); Dr KUBE, Gero (DESY); Dr LANTSCHNER, Martin (DESY)

Presenter: STROKOV, Sergey (DESY)

Session Classification: Session

Contribution ID: **15** Type: **Presentation**

Filamentation due to the Vacuum-to-Air Window of the X-ray Pinhole Camera

Monday, 23 March 2026 14:55 (25 minutes)

X-ray pinhole cameras are still the preferred option for emittance measurement in synchrotron light sources due to their simplicity in design, operation and data analysis. It has been observed over many years at multiple facilities, that a structure similar to a diffraction pattern is observed when the electron beam size is squeezed. This effect is called filamentation and has been identified to come from the vacuum-to-air window of the pinhole camera. It is problematic due to its interference with beam size measurements, particularly when operating close to the resolution limit of the pinhole camera. Given that the brilliance and coherence will increase in 4th generation synchrotrons, such as Diamond-II, from the reduction in beam emittance, it is important we minimise this filamentation effect to ensure accurate beam size measurements are available. Here we report on recent measurements in preparation for Diamond-II.

Author: BOBB, Lorraine (Diamond Light Source)

Co-author: VITORATOU, Niki (Diamond Light Source)

Presenter: BOBB, Lorraine (Diamond Light Source)

Session Classification: Session

Contribution ID: **16** Type: **Presentation**

Complexities in Designing Front-end XBPMs for APPLE Insertion Devices for Diamond-II

Tuesday, 24 March 2026 15:20 (25 minutes)

With the move to a 4th generation light source for Diamond-II, modifications to the front-end X-ray beam position monitors (XBPMs) are required to prevent damage due to the higher power loads. Several Diamond beamlines use advanced planar polarized light emitting (APPLE) undulators, which provide variable polarisation of the X-ray beam, including circular polarisation to minimise on-axis power provided to the beamline. The different transverse beam profiles resulting from the polarisations means that solutions for the APPLE-II XBPMs are a compromise between position sensitivity and risk of damage. The APPLE-Knot undulator for the I05 beamline in Diamond-II has provided further challenges in the design of the XBPMs due to the complex power densities provided by the magnetic fields present in the insertion device. Solutions found for APPLE-II XBPMs will be presented, as well as the design challenges caused by the X-ray beam profile from the APPLE-Knot.

Author: JACKSON, Samuel (Diamond Light Source)

Co-authors: HOUGHTON, Claire (Diamond Light Source); BOBB, Lorraine (Diamond Light Source)

Presenter: JACKSON, Samuel (Diamond Light Source)

Session Classification: Session

Contribution ID: **17** Type: **Discussion Trigger**

Data Timestamping for Fast Data Acquisition (sniffer archiver)

Monday, 23 March 2026 12:45 (15 minutes)

In the context of the new BPM readout electronics deployment on the machine, the fast data capture (Diamon Sniffer Archiver) is becoming obsolete and will be replaced with enhanced capability for Soleil II :
- the storage of any types of data: BPM, PSC (instructions and/or re-read values), LLRF (?)
- coming from different equipments,
- for several days (currently 2 weeks)

Main purposes of this “fast archiver” is to:
- investigate in case of problems: search for repetitive patterns
- perform measurements to identify the machine (fast matrix, BBA, etc.)
- perform analyses to understand the machine

Two architectures are currently evaluated in term of performance at Soleil. But there is still an open question :
which time source should be used to timestamp the data ?
Granularity issue, synchronisation, strategy, philosophy… Let’s discuss!

Author: GRABAS, Aude (Synchrotron Soleil)

Presenter: GRABAS, Aude (Synchrotron Soleil)

Session Classification: Session

Contribution ID: **18** Type: **Discussion Trigger**

Evaluation of Kovar for buttons BPMs

Tuesday, 24 March 2026 10:00 (15 minutes)

As part of our current facility upgrade, we are developing Beam Position Monitors (BPMs) designed for integration into a copper vacuum chamber. Following the preliminary design phase, the manufacturer suggested utilizing Kovar as an alternative to stainless steel for the housing. This presentation aims to discuss the implications of this material shift with the community, supported by Opera simulation results regarding magnetic field interference and thermal performance.

Authors: TORINO, Laura (ALBA-CELLS); NING, Maisui (ALBA-CELLS)

Presenter: TORINO, Laura (ALBA-CELLS)

Session Classification: Session

Contribution ID: **19** Type: **Presentation**

Zynq FPGA processing signal system for SOLARIS storage ring diagnostics.

Monday, 23 March 2026 12:20 (25 minutes)

After the successful testing of the BBQ system for passive tune measurements using direct diode detectors at the SOLARIS storage ring, the next step - and a significant challenge - was the proper acquisition and processing of the analog signal. To address this, a 24-bit ADC system integrated with a Zynq FPGA was developed to ensure high-quality signal acquisition and reliable data processing.
In addition, based on the developed hardware platform, a dedicated BPM signal spectrum analyzer is currently being designed, with the ultimate goal of replacing the device presently in use.
The presentation will summarize the progress achieved to date, planned improvements, technical challenges encountered, and the expected final performance parameters of the system.

Authors: SZCZEPANIAK, Mateusz (NSRC SOLARIS); Mr ZUREK, Michal (NSRC SOLARIS)

Presenters: SZCZEPANIAK, Mateusz (NSRC SOLARIS); Mr ZUREK, Michal (NSRC SOLARIS)

Session Classification: Session

Contribution ID: **20** Type: **Presentation**

Electron bunch length measurement at ESRF-EBS using Time Correlated Single Photon Counting

Monday, 23 March 2026 14:30 (25 minutes)

The commonly used bunch length diagnostics in electron storage rings is the streak camera, fed by visible synchrotron light. Although this instrument is able to precisely measure the shape of very short longitudinal profiles of idividual bunches, it also has a major disadvantage: its photocathode is subject to aging upon permanent exposure to incoming light. It is therefore mainly used for dedicated beam studies under controlled conditions.
Time correlated single photon counting (TCSPC) is already used in synchrotron light sources to precisely measure the filling pattern and bunch purity. Modern fast single photon counting detectors and TCSPC electronics open the way to apply this technique to resolve the bunch lengths of stored electron beams.
We present our first results of bunch length measurements using TCSPC at the ESRF.

Author: EWALD, Friederike (ESRF)

Presenter: EWALD, Friederike (ESRF)

Session Classification: Session

Contribution ID: **21** Type: **Discussion Trigger**

SLS 2.0 MPS Commissioning and First Operation Experience

Monday, 23 March 2026 10:25 (15 minutes)

As SLS 2.0 transitions from machine commissioning to full beamline commissioning and user operation, the demands on long-term reliability and high availability of the accelerator complex increase significantly. Ensuring minimal downtime requires fault-handling mechanisms that are both rapid and systematic, enabling the machine to respond safely and consistently to unexpected conditions. This discussion will examine the architectural principles, integration strategy, and operational experience of the key machine-protection systems. For SLS 2.0. these systems include the beam dump controller, the machine interlock system, the post-mortem framework, the injection guard, and the controlled emergency beam-dump procedure. Together, they form a coordinated protection layer essential for safeguarding equipment, maintaining beam quality, and supporting reliable user operation. The session aims to explore lessons learned, remaining challenges, and opportunities for further optimization as SLS 2.0 enters routine operation.

Author: ARMBORST, Felix (PSI - Paul Scherrer Institut)

Co-author: Dr PARALIEV, Martin (PSI - Paul Scherrer Institut)

Presenter: ARMBORST, Felix (PSI - Paul Scherrer Institut)

Session Classification: Session

Contribution ID: **22** Type: **Presentation**

Digital Platform Reusability for Elettra 2.0 Systems

Monday, 23 March 2026 11:30 (25 minutes)

An FPGA-based platform has been developed in-house for the Electron Beam Position Monitor (eBPM) systems of Elettra 2.0, the ongoing upgrade of the Italian synchrotron toward a higher brilliance lightsource. Leveraging its modularity and high processing capabilities, this platform has been extended to various subsystems, including the Digital Low-Level Radio Frequency (DLLRF).

To maximize firmware and software reuse, a scaled-down version utilizing a lower-density FPGA was developed for less resource-intensive applications, such as Beam Loss Monitors (BLM) and Fast Beam Dump systems.

This paper discusses the advantages of this standardized framework, highlighting not only the increased development efficiency but also the benefits of a unified architecture. This approach enables the delivery of synchronous turn-by-turn data across all integrated units via a coherent data ecosystem, which then interfaces with the DPDK-based (Data Plane Development Kit) control layer.

Author: BRAJNIK, Gabriele (Elettra-Sincrotrone Trieste Scpa)

Co-authors: GAIO, Giulio (Elettra-Sincrotrone Trieste S.C.p.A.); CAUTERO, Marco (Elettra-Sincrotrone Trieste); COLJA, Matija (Elettra-Sincrotrone Trieste); DE MONTE, Raffaele (Elettra-Sincrotrone Trieste S.C.p.A.)

Presenter: BRAJNIK, Gabriele (Elettra-Sincrotrone Trieste Scpa)

Session Classification: Session

Contribution ID: **23** Type: **Presentation**

Libera Digit 500 as a precise averaged bunch-by-bunch charge readout at ESRF

Monday, 23 March 2026 11:55 (25 minutes)

The Libera Digit 500 at the ESRF is equipped with firmware that does a real-time internal summing-up at Turn-by-Turn rate (355KHz)
on the charge of each of the individual bunches (992 for SR , 352 for SY), effectively providing averaged data in bunch-by-bunch domain. (bunch period is 2.8nsec, RF-frequency 352MHz)
This allows very precise measurements of the evolution of these bunch charges over an acquisition duration of typically 1 second.
i.e. this summing-up reduces the noise by roughly a factor 600 w.r.t. to single shot noise.
Results obtained with tests on the beam show that e.g. a tiny loss on one bunch of the order 1E-4 can be clearly detected.
This technique works both during injection and the slow decay of the stored beam.
The inconveniences of e.g. the precise & strong dependence of the phase & synchronization of the device w.r.t. the beam phase will also be mentioned, e.g. the above technique works only well for filling-patterns with a stable beam phase over time.

Author: MATTIAZZI, Simon (Instrumentation Technologies)

Presenter: MATTIAZZI, Simon (Instrumentation Technologies)

Session Classification: Session

Contribution ID: **24** Type: **Presentation**

Using a Button BPM at 3GHz

Tuesday, 24 March 2026 09:10 (25 minutes)

This talk illustrates an attempt to use an installed BPM pickup to detect signals at 3 GHz.

Author: REHM, Guenther (Helmholtz-Zentrum Berlin)

Co-authors: Mr FALKENSTERN, Fjodor (Helmholtz-Zentrum Berlin); Dr ATKINSON, Terry (Helmholtz-Zentrum Berlin)

Presenter: REHM, Guenther (Helmholtz-Zentrum Berlin)

Session Classification: Session

Contribution ID: **25** Type: **Presentation**

Overview of Silicon Carbide detector for synchrotron environments

Tuesday, 24 March 2026 14:55 (25 minutes)

Silicon carbide (SiC) sensors have been widely validated as compact, radiation-hard, and high-resolution X-ray beam diagnostics elements, able to perform in-line beam intensity and position monitoring with minimal perturbation of the photon beam.
The intrinsic properties of SiC as a wide-bandgap semiconductor, thermal and radiation resistant, with a silicon-like industrial maturity, make it particularly suitable for high-brilliance photon sources and harsh radiation environments.
This contribution provides an overview of different SiC-based detector concepts developed across a wide range of beamline conditions, from white-beam to monochromatic X-rays.

For high-power polychromatic beams, non-fully intercepting SiC sensors have been developed as white-beam monitors, capable of operating directly in the front-end sections of synchrotron beamlines. These devices typically feature a central aperture allowing the main photon beam to pass, while collecting a fraction of the radiation halo and higher-energy harmonics. The detection mechanism relies on internal photoemission at the semiconductor interface, providing signals significantly larger and more stable than conventional metal blade monitors. This approach enables robust beam intensity and position diagnostics upstream of monochromators, where radiation levels and spectral bandwidth would rapidly degrade conventional semiconductor detectors.

Among the most innovative monochromatic beams SiC detectors, resistive X-ray beam position monitors (rXBPMs) exploit lateral charge division on a resistive layer. Unlike conventional segmented XBPMs, whose response depends on the beam spot size and geometry, rXBPMs measure the beam centroid independently of the beam-spot size, enabling more robust and calibration-free position monitoring over a wide range of beam conditions.

Author: TROVATO, Gabriele (University of Catania)

Co-authors: Dr CAMARDA, Massimo (SenSiC GmbH); Mr LA ROSA, Niccolò (University of Catania); Dr MOSCATO, Samuele (University of Catania)

Presenter: TROVATO, Gabriele (University of Catania)

Session Classification: Session

Contribution ID: **26** Type: **Presentation**

Connection Checker for the Elettra 2.0 eBPM System

Tuesday, 24 March 2026 12:35 (25 minutes)

The upgrade of the Elettra synchrotron to the ultra-high brightness Elettra 2.0 requires the installation of a new electron Beam Position Monitor (eBPM) system. The infrastructure comprises 168 BPMs, each featuring a complex signal chain: two pairs of four-conductor RF cables connecting the pickups to the RF front-end (PTFE), followed by five-conductor RF cabling and a network link to the DAQ10SX acquisition unit.
With over 3,000 cables and 6,000 total connections—including triggers, clocks, and data networks—systematic validation is critical. To ensure reliable beam trajectory measurements from the onset of machine commissioning, it is essential to verify that all physical links and associated subsystems are correctly mapped and fully operational.
This contribution describes the dedicated hardware and software tools developed for this purpose. We outline the automated test strategy, the verification workflow, and the management of the data collected during the large-scale installation phase.

Author: DE MONTE, Raffaele (Elettra-Sincrotrone Trieste S.C.p.A.)

Co-authors: BRAJNIK, Gabriele (Elettra-Sincrotrone Trieste Scpa); BASSANESE, Silvano (Elettra Sincrotrone Trieste); CLEVA, stefano (Elettra SincrotroneTrieste)

Presenter: DE MONTE, Raffaele (Elettra-Sincrotrone Trieste S.C.p.A.)

Session Classification: Session

Contribution ID: **27** Type: **Presentation**

Welcome

Monday, 23 March 2026 09:00 (10 minutes)

Presenter: ÖZKAN LOCH, Cigdem (PSI - Paul Scherrer Institut)

Session Classification: Session

Contribution ID: **28** Type: **not specified**

Overview of SLS 2.0 Commissioning

Monday, 23 March 2026 09:35 (25 minutes)

Presenter: ARMBORST, Felix (PSI - Paul Scherrer Institut)

Session Classification: Session

Contribution ID: **29** Type: **Presentation**

Electromagnetic characterization of the first 16 pickup prototypes for the Elettra 2.0 BPMs

Tuesday, 24 March 2026 09:35 (25 minutes)

A total of 916 button type beam position monitor (BPM) pickups have been foreseen to meet the requirements of the Elettra 2.0 light source.
The first 16 prototype units, intended to validate the complete set of mechanical, vacuum, and electromagnetic characteristics, have been fully evaluated and successfully
qualified through Factory Acceptance Tests (FAT) and Site Acceptance Tests (SAT).
After a brief overview of the pickup design rationale, this contribution presents the results obtained from the electromagnetic characterization of each pickup sample,
performed using two types of RF test fixtures. The first test fixture operates up to 16 GHz, while the second one extends the measurement range up to 40 GHz.
Final considerations focus on the comparison between measured data and electromagnetic simulations.

Author: CLEVA, stefano (Elettra SincrotroneTrieste)

Presenter: CLEVA, stefano (Elettra SincrotroneTrieste)

Session Classification: Session

Contribution ID: **30** Type: **Presentation**

Status and Prospects of Readout and Control Systems for Real-Time X-ray Beam Monitoring at SenSiC GmbH

SenSiC GmbH is a Swiss technology company delivering advanced Silicon Carbide (SiC)–based sensor solutions and customized electronics for high-brilliance X-ray and particle beam diagnostics.

Originating as a spin-out of the R&D activities of the Swiss Light Source (PSI), SenSiC designs and manufactures ultra-compact, radiation-hard beam position (XBPM) and intensity monitors tailored for high-brilliance X-ray beams in synchrotron and accelerator facilities.

Besides the SiC sensors, which will be presented by Dr. Trovato in this workshop, a central element of the detection platform is the PCR4, a multichannel pico-to-milliammeter system designed for the readout of SiC X-ray Beam Position Monitors (XBPMs). The system performs bipolar current measurements across a very wide dynamic range, from ±2.5 nA up to ±50 mA, with nominal resolution down to a few femtoamperes, noise levels down to 1 ppm (@10 Hz) with respect to the selected current range, and sampling frequencies up to 10 kHz at 24-bit resolution. It integrates a programmable sensor bias source (±20 V) and communicates through standard Ethernet interfaces compatible with both EPICS- and TANGO-based control infrastructures. This architecture enables accurate current measurements across more than five decades, supporting precise beam diagnostics and high-resolution spatial monitoring of synchrotron radiation beams, the system has been tested in multiple beamlines at PSI/SLS. The PCR4 also incorporates a proportional–integral feedback control system for active beam stabilization. The system has been experimentally validated at the SOLEIL synchrotron (GALAXIES beamline), where slow drifts during energy-scan experiments were effectively compensated, reducing the RMS beam displacement from approximately 15 μm to about 1 μm at the feedback monitor.

Together with this system, the company is now working on three important developments: (i) dual-sensor monitoring, (ii) multi-sensor asynchronous readout, and (iii) Enhanced Lateral Resolution (ELR) Front-Ends (FE).

(i) By using a multi-input multi-output (MIMO) controller based on signals from two synchronized XBPMs, it will be possible to reconstruct, and correct in real time, both beam tilts and beam offsets thus compensating the angular and translational components of beam motion and enabling stabilization directly at the sample location. First experimental tests on this new system are planned for May at the SOLEIL synchrotron.

(ii) Multi-sensor asynchronous readout (MUX) enables the connection of up to 16 signal channels and 4 bias lines, corresponding to the monitoring of up to four XBPMs. This architecture allows several beam position monitors, each optimized for a specific photon-energy range, to be operated and read out using a single acquisition system without the need for parallel hardware. The MUX system is fully integrated with EPICS and TANGO control frameworks, the system has been tested at BESSYII synchrotron facility.

(iii) ELR-FE circuits are dynamically adjustable transimpedance stages capable of optimizing the mapping between sensor signal and the ADC input range. They allow maximizing sensitivity thus
enabling significant improvements in beam position lateral resolution. Preliminary results indicate
resolution enhancements exceeding a factor of five, benefiting all sensor types but particularly improving the performances of resistive-XBPM and White-beam sensors.
These results demonstrate the effectiveness of the PCR4 platform for high-dynamic-range beam diagnostics and active beam stabilization, while ongoing developments aim to further extend the capabilities of SiC-based instrumentation to meet the increasingly stringent requirements of real-time
beam monitoring in modern high-brilliance synchrotron beamlines.

Presenter: CAMARDA, Massimo (SenSiC GmbH)

Contribution ID: **31** Type: **not specified**

Closing Remarks

Presenter: ÖZKAN LOCH, Cigdem (PSI - Paul Scherrer Institut)

Contribution ID: **32** Type: **Presentation**

Status and Prospects of Readout and Control Systems for Real-Time X-ray Beam Monitoring at SenSiC GmbH

Tuesday, 24 March 2026 15:45 (25 minutes)

SenSiC GmbH is a Swiss technology company delivering advanced Silicon Carbide (SiC)–based sensor solutions and customized electronics for high-brilliance X-ray and particle beam diagnostics.
Originating as a spin-out of the R&D activities of the Swiss Light Source (PSI), SenSiC designs and manufactures ultra-compact, radiation-hard beam position (XBPM) and intensity monitors tailored for high-brilliance X-ray beams in synchrotron and accelerator facilities.
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and high-resolution spatial monitoring of synchrotron radiation beams, the system has been tested in
multiple beamlines at PSI/SLS. The PCR4 also incorporates a proportional–integral feedback control
system for active beam stabilization. The system has been experimentally validated at the SOLEIL synchrotron (GALAXIES beamline), where slow drifts during energy-scan experiments were effectively compensated, reducing the RMS beam displacement from approximately 15 μm to about 1 μm at the feedback monitor.
Together with this system, the company is now working on three important developments: (i) dual-sensor monitoring, (ii) multi-sensor asynchronous readout, and (iii) Enhanced Lateral Resolution (ELR) Front-Ends (FE).
(i) By using a multi-input multi-output (MIMO) controller based on signals from two synchronized XBPMs, it will be possible to reconstruct, and correct in real time, both beam tilts and
beam offsets thus compensating the angular and translational components of beam motion and enabling stabilization directly at the sample location. First experimental tests on this new system are
planned for May at the SOLEIL synchrotron.
(ii) Multi-sensor asynchronous readout (MUX) enables the connection of up to 16 signal channels and 4 bias lines, corresponding to the monitoring of up to four XBPMs. This architecture allows several beam position monitors, each optimized for a specific photon-energy range, to be operated and read out using a single acquisition system without the need for parallel hardware. The MUX

system is fully integrated with EPICS and TANGO control frameworks, the system has been tested at BESSYII synchrotron facility.
(iii) ELR-FE circuits are dynamically adjustable transimpedance stages capable of optimizing the mapping between sensor signal and the ADC input range. They allow maximizing sensitivity thus
enabling significant improvements in beam position lateral resolution. Preliminary results indicate
resolution enhancements exceeding a factor of five, benefiting all sensor types but particularly improving the performances of resistive-XBPM and White-beam sensors.
These results demonstrate the effectiveness of the PCR4 platform for high-dynamic-range beam diagnostics and active beam stabilization, while ongoing developments aim to further extend the capabilities of SiC-based instrumentation to meet the increasingly stringent requirements of real-time
beam monitoring in modern high-brilliance synchrotron beamlines

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