INSTRUMENTATION TECHNOLOGIES

LIBERA

Introduction to Libera Workshop 2025

Manuel Cargnelutti, May 14th, 2025

WWW.I-TECH.SI

Welcome back to Štanjel!

- One of the oldest settlements in the Karst region
- Known for its unique stone architecture and medieval charm
- A Max Fabiani legacy – architect behind its restoration
- Home to the iconic Ferrari Garden with stunning valley views
- A vibrant art and culture hub, surrounded by Teran wine and Karst prosciutto

Libera Workshop 2025 – morning program

Time	Speaker	Talk Title
10:00 – 10:20	Kees Scheidt (ESRF)	Experience with the hybrid Libera BPM electronics and the Libera Beam Loss Monitors after 5 years of ESRF-EBS
10:25 - 10:45	Dima El Khechen (KIT)	Modified Libera Spark ERXR for cSTART storage ring
10:50 - 11:10	Jacek Biernat (Solaris)	Beam qualification using Machine Learning Techniques applied to Libera Brilliance+
11:15 – 11:45		**Coffee Break**
11:45 - 12:05	Nicolas Hubert (Synchrotron Soleil)	BPM electronics upgrade in preparation for SOLEIL II
12:10 - 12:30	Peter Leban (I-Tech)	Introducing the new Libera Brilliance X
12:35 - 12:55	Aleš Kete (I-Tech)	Upgrade of EPICS and TANGO Control System Adapters in Libera instruments
13:00 - 14:30		**Lunch Break**

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Libera Workshop 2025 – afternoon program

Time	Speaker	Talk Title
14:30 – 14:50	Christian Böhme (Forschungszentrum Jülich)	Libera Hadron usage experience with EPICS
14:55 - 15:15	Igor Pinayev (BNL)	Position measurements of co-propagating beams and Longitudinal bunch tilt measurements with Libera Single-Pass E
15:20 - 15:40	Simon Mattiazzi (I-Tech)	Updates in the Libera BLM and BLD calibration
15:40 – 16:10		**Coffee Break**
16:15 - 16:35	Piotr Tracz (ELI-NP)	Libera LLRF and Trigger Synchronization System for VEGA LINAC
16:40 - 17:00	Borut Baričević (I-Tech)	The Evolution of Libera LLRF Technology for Linear Accelerators
17:05 – 17:45	John Byrd	Developments in industrial accelerators for semiconductor manufacturing and beyond

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How was the last year?

- Some projects, product and technology highlights

Libera Brilliance+ for SOLEIL II

In 2024, I-Tech was awarded for the delivery of 220 Libera Brilliance+ BPM electronics for the SOLEIL II upgrade project. The instruments will be first integrated in the existing SOLEIL machine: **N. Hubert** will present the status of the project.

Source: Soleil CDR document

The Libera Brilliance+ instruments will be equipped with the latest developed modules, and deliveries will start in the next months.

Libera BrillianceX: MTCA.4 BPM electronics

Since 2021, we've been working with DESY on the BPM electronics for Petra IV, based on the MTCA.4 standard. The key-developments included:

- Remote switch matrix (Libera XBS-FE)
- Rear Transition Module (Libera 2BPMRTM)
- Advanced Mezzanine Card (DAMC-UNIZUP, licensed from DESY-MSK)
- The Libera eBPM application, derived from Libera Brilliance+
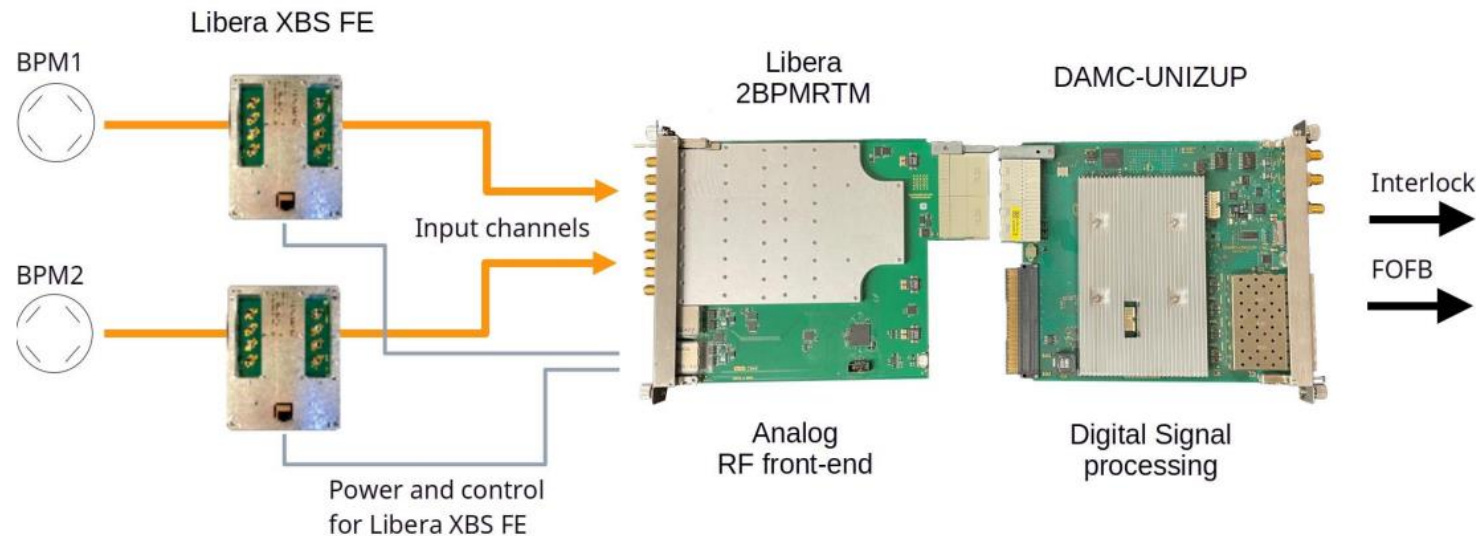
Block scheme of the Petra IV BPM electronics

The system will be available from 2026 and provided in different form factors.

P. Leban will introduce the Libera BrillianceX in his talk.
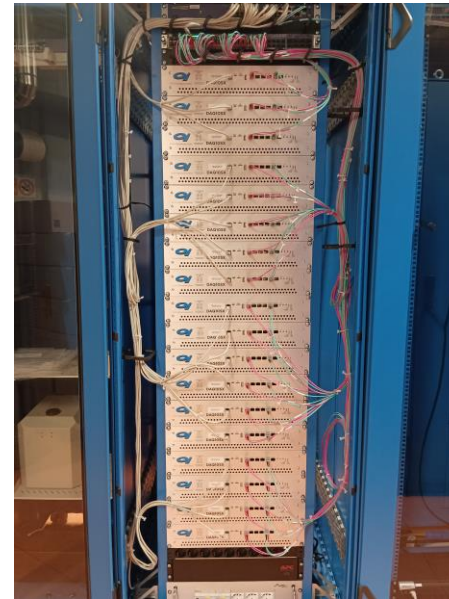
Elettra 2.0 – Pilot-Tone based BPM system

The innovation partnership between I-Tech and Elettra Sincrotrone Trieste was successfully concluded in December 2024 with the delivery of 204 BPM electronics for the Elettra 2.0 project.
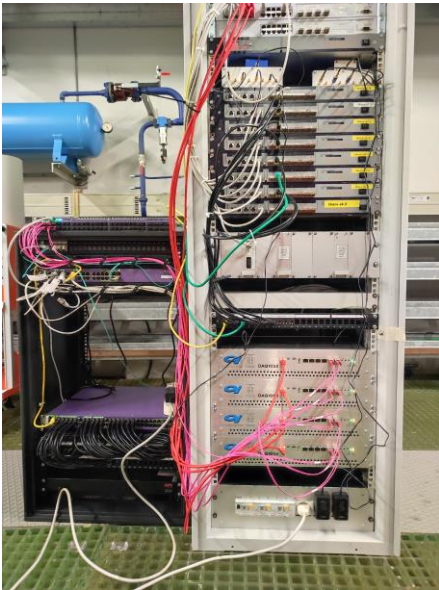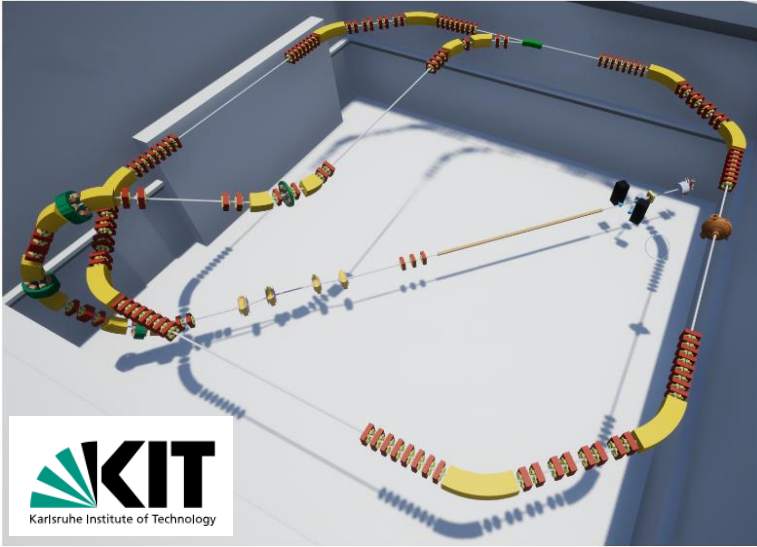

A first batch of BPM electronics is in operation from May 2024 and transparently integrated in the Fast Orbit Feedback

Part of the delivered systems is used to test the data infrastructure for the upcoming upgrade project.

The developed DAQ platform is also being considered for the development of the future LLRF for the machine.

News from other Light Sources

In 2024, we took part in the TDR phase of the cSTART project at KIT, and at the end of the year was awarded the contract for the delivery of 31 Libera Spark ERXR instruments.

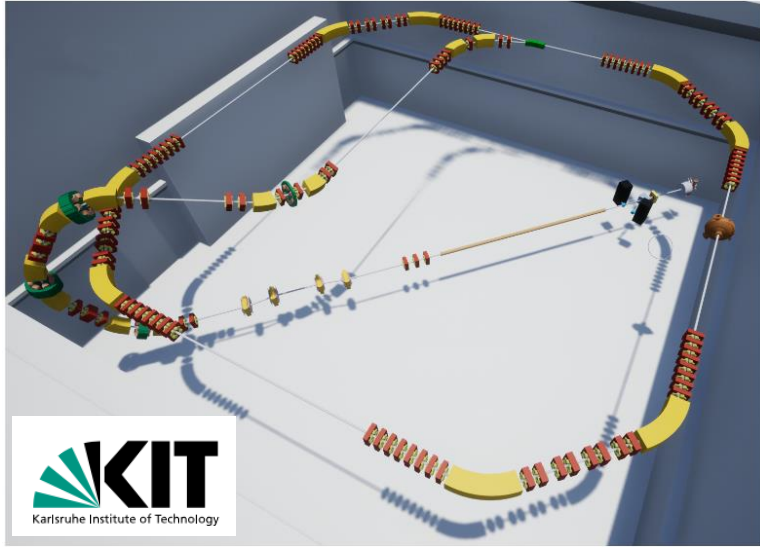**D. El Khechen** will present the specific modifications required for this special machine.

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After 10 years on the market, the Libera Beam Loss Monitor system became a standard tool for beam diagnostics.

- **K. Scheidt** will give us an overview talk on his experience from operations at ESRF-EBS.
- **S. Mattiazzi** will introduce new ideas to improve the calibration of the entire system.
- Diamond will receive 40 Libera BLMs and 150 Libera BLDs in in 2025

J. Biernat will present how Machine Learning algorithms can be used on data from BPM electronics at SOLARIS for assessing beam quality, optimizing stability and predicting losses.
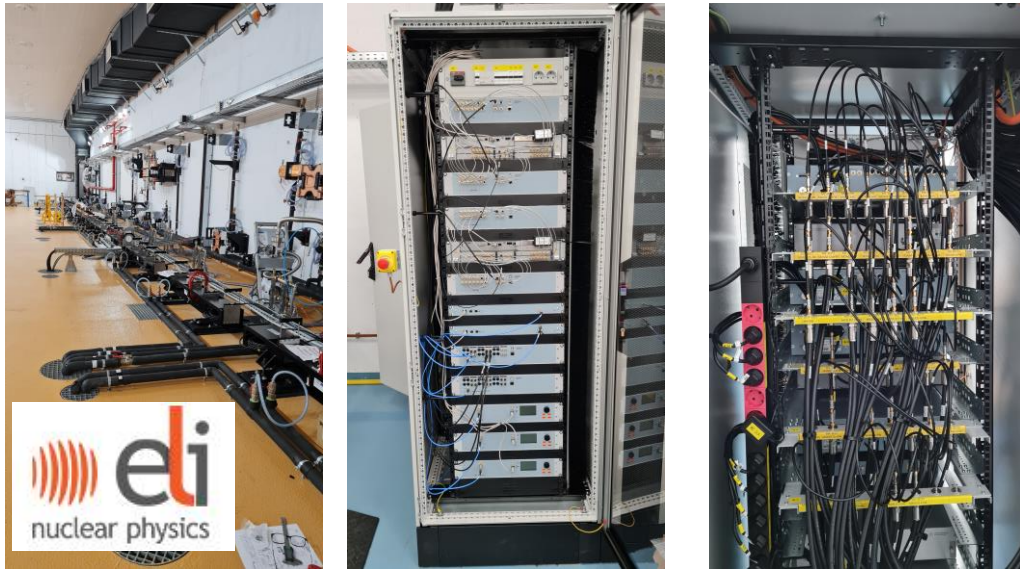
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…and many other projects!

For the **VEGA** electron LINAC, I-Tech installed three racks covering RF generation (RMO), distribution (DA) and the digital LLRF systems to control the S-band accelerating structures. We are now discussing BPM and BLM applications.
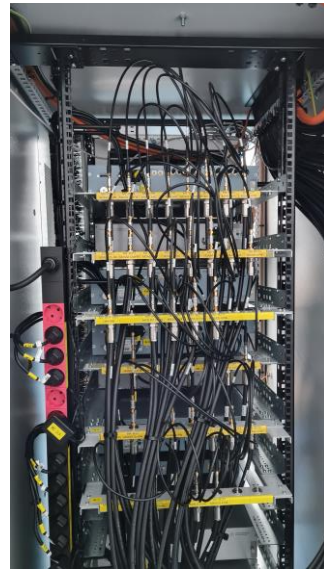
An overview will be provided by *P. Tracz*.
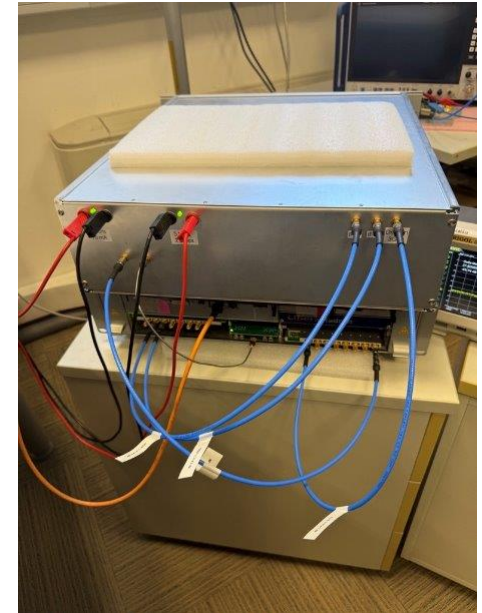
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We continue our development of an X-band LLRF prototype, based on the requirements of the injector LINAC for EuPRAXIA @ SPARC_LAB, planned to be realized at INFN-LNF.

The prototype will be characterized at the test facility in Frascati within the next months.

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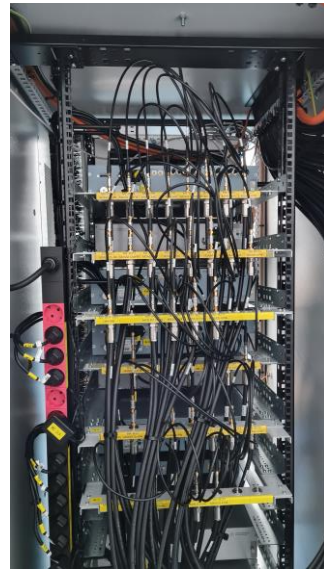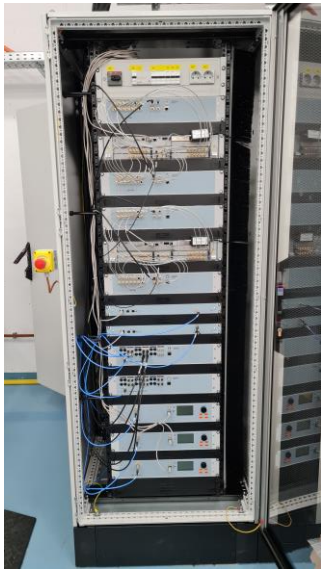
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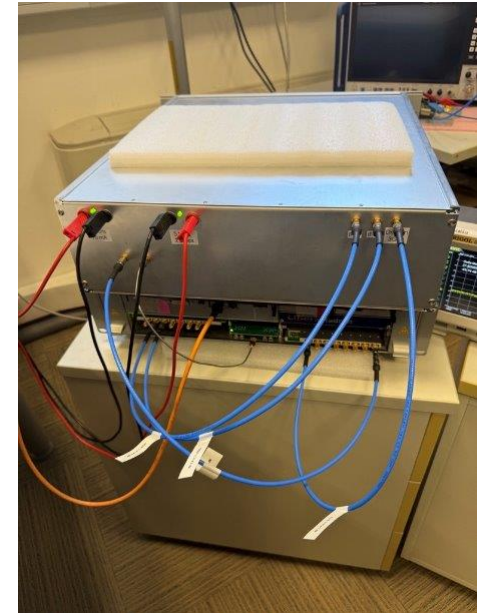

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I. Pinayev will present his special use case with Libera Single-Pass E measuring two different co-propagating beams.

J. Byrd will present the industrial applications of particle accelerators for the semiconductor industry. A lot is going on, that could potentially lead to big changes in the current market.

Updates from the Libera Software

During the Libera Workshop 2024, we presented a process for **sharing the source code of our instruments** with their users. In the last months we went through this process with quite some laboratories

New **Operating Systems** are being released for both our platforms

The **EPICS and Tango Control System adapters** are also being upgraded to the latest versions, *A. Kete* will present the current status. *C. Bohme* will present its user experience

Regular **OS releases with Security Updates** are subject of discussion with a few laboratories. A dedicated process was reviewed to prepare, test and release the Libera applications to the interested users.

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Where we are, in a few words:

- Our modular platform (Libera Brilliance+, Libera LLRF and others) can now count on brand new modules that will make it supportable for many more years.

- Through the cooperation with DESY and the licensing of the DAMC-UNIZUP module, we can now offer solutions entirely based on the MTCA.4 technology.

- A lot of activities in the Software group are devoted to the upgrade the OS and the control system adapters. In parallel, we continue the discussions related to the support of security patches on the released Operating Systems.

Thanks for your contribution and have a nice Libera workshop 2025!