



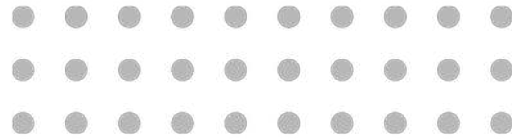
Updates on Libera Briliance+ and Libera Spark ERXR: projects and internal developments

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Solkan, April 17, 2024



Contents



- Libera Spark upgrades
- Libera Brilliance+ upgrades
- EPICS and TANGO upgrades
- Outlook and conclusion



Libera Spark

📅 December 2013



Highlights

- simple analog front end with no SAW filters (a single SAW was introduced later)
- no PLL
- SCPI interface
- installed at ESRF booster

Big installation: ESRF booster

Libera Spark ER and ERXR

📅 November 2016



Highlights

- improved analog front end
- extended range with programmable attenuation
- MC PLL and synchronization
- TANGO and EPICS interface
- additional output for streaming data
- swapped B ↔ C channels

Big installations: ESRF storage ring, PAL EUV, HZB BESSY-II booster

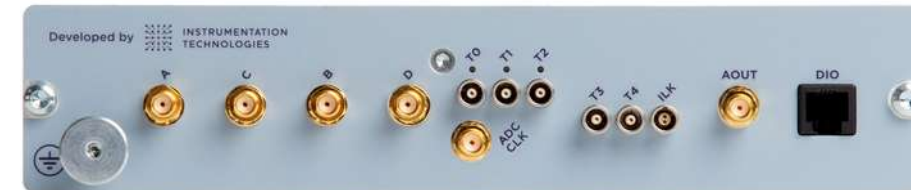
Libera Spark ERXR

 September 2023



Highlights

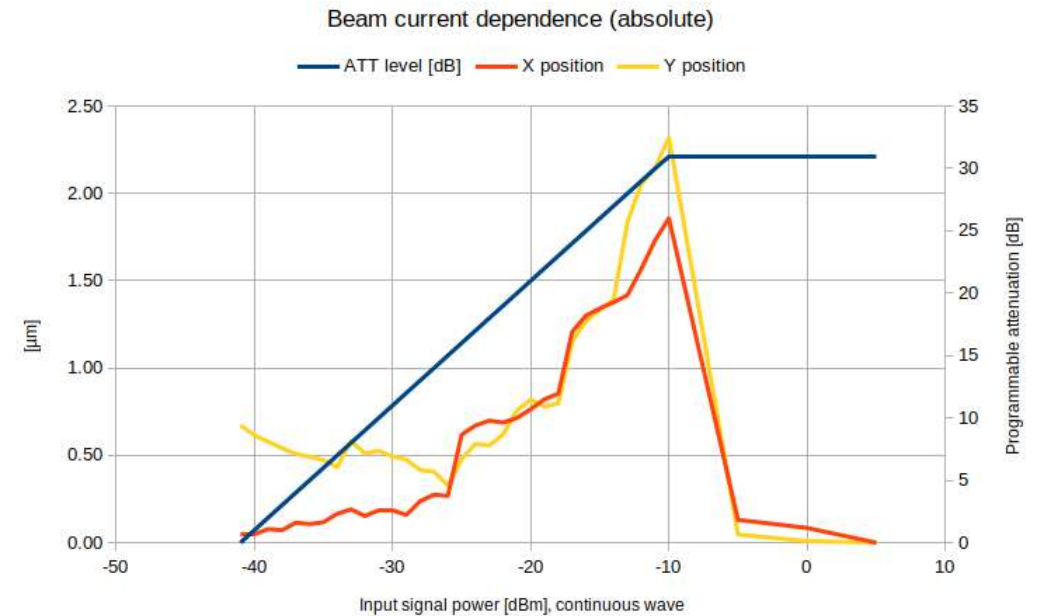
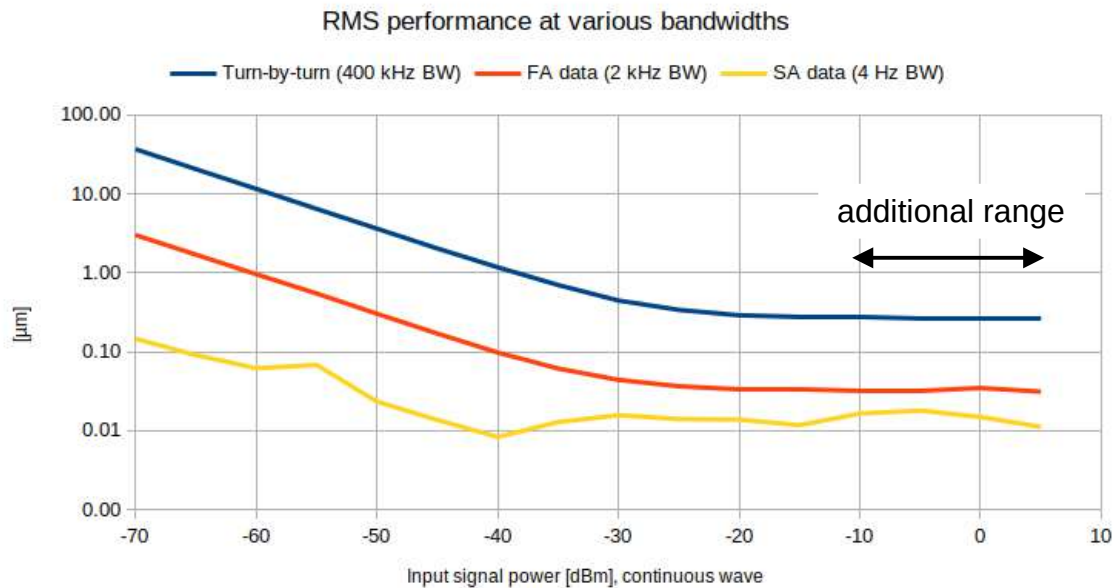
- extended range for additional 15 dBm
- external or internal ADC sampling clock
- additional trigger lines, analog and digital I/O, Interlock output (optional)



Big installation: HZB BESSY-II storage ring

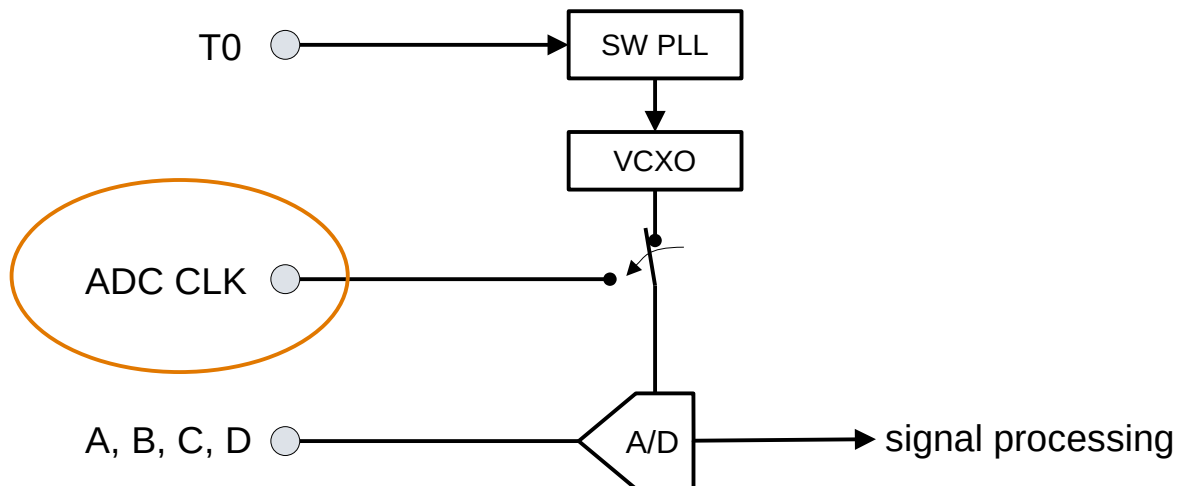
Libera Spark ERXR – latest hardware updates

- Added 15 dB step attenuator at the inputs: selectable attenuation 0 dB, 5 dB, 10 dB, 15 dB
- Support input signals up to +5 dBm CW
- RMS performance extended over larger range



Libera Spark ERXR – latest hardware updates

- Added 15 dB step attenuator at the inputs: selectable attenuation 0 dB, 5 dB, 10 dB, 15 dB
- Support input signals up to +5 dBm CW
- RMS performance extended over larger range
- Use external source for ADC sampling clock



Libera Spark ERXR – software updates

Operating System

- Major upgrade since year 2013: transition to Operating System *neon*
- Improvements and updates:
 - python (version 3.10)
 - processing performance optimization using armHF kernel (benchmark test: 39 sec vs. 17 sec)
 - support to build the OS from sources: instructions for users
 - added a FTDI driver

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libera software

- support for the additional input attenuator + extended calibration table
- support for the external source for the ADC sampling clock
- support for a more flexible position calculation equation (orthogonal/diagonal, +/- offset)
- calibration factors can be stored and loaded from an independent file (not part of the configuration .xml file)

Libera Brilliance+

Generations

- Libera Brilliance+ in 2024:
 - Kintex Ultrascale+ in the BPM module
 - support for the external switching (Libera XBS FE)
 - Intel CPU with production lifetime to ≤ 2030
 - up to 16 GB CPU memory
- Ongoing updates
 - Timing module refresh with Artix FPGA
 - ICB module refresh with several new components

Big installations: NSRRC TPS, MAX-IV



2010

Big installations: Australian Lightsource, SESAME



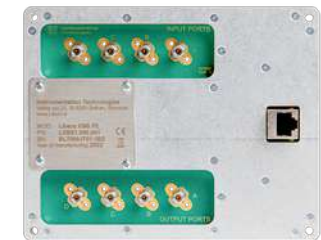
2016

Big installation: ANL APS-U



2020/
2023

Libera Brilliance+ hardware is up-to-date with recent technology.



Modules

Libera 2BPMRTM (for the MTCA.4 platform)



Specification

Input channels	8 (2x 4)
Maximum input signal	0 dBm, CW
Variable attenuation	0 dB to 31 dB
A/D converters	125 MHz, 16 bit
Maximum crosstalk	-76 dB (between channels) -95 dB (between BPMs)
Position drift vs temp	< 150 nm/K

Foreseen installation: DESY PETRA-IV

Libera XBS FE



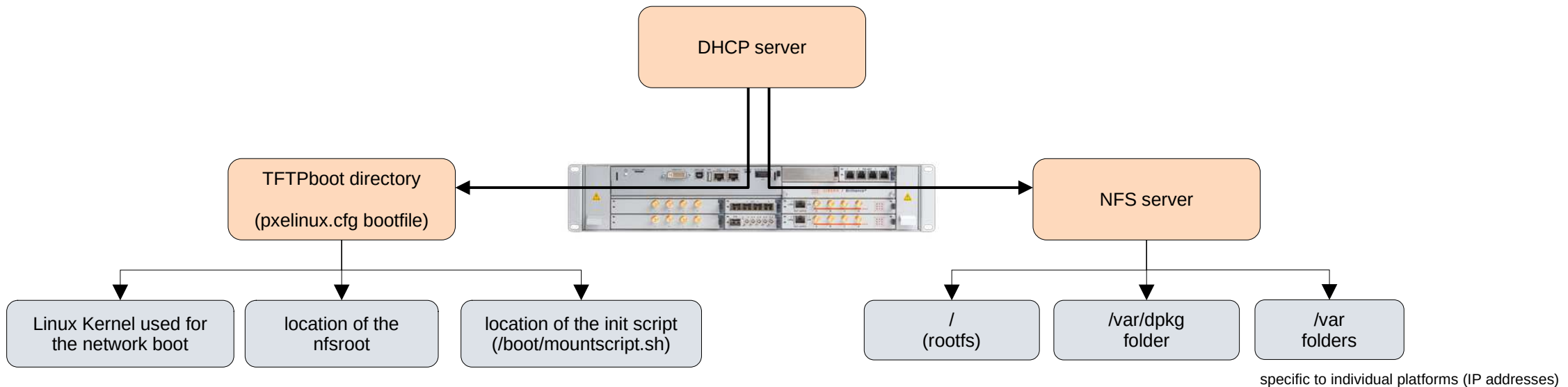
Specification

Inputs / Outputs	2.92 mm Connector Jack
RJ-45	1,2,7,8: control pins 3,6: ground 4,5: power
Maximum distance to BPM electronics	200 m (tested)
Dimensions	(163 x 128 x 19/27) mm 900 grams

Libera Brilliance+ – software updates

Operating System

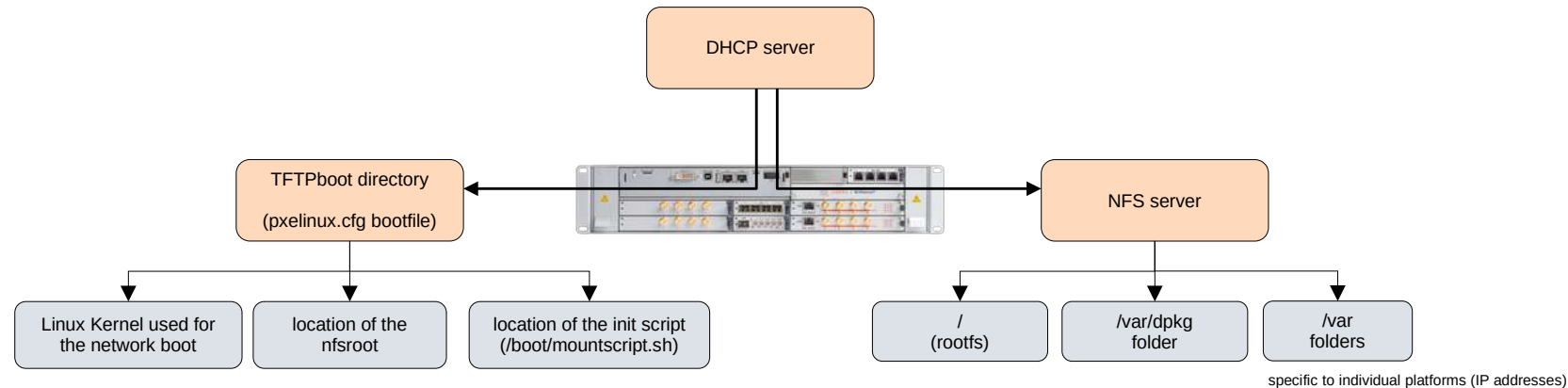
- Network boot support: Linux Kernel upgrade from version 5.0 to 5.4
- Started with migration to Ubuntu 24.04 (Noble Numbat)



Libera Brilliance+ – software updates

Operating System

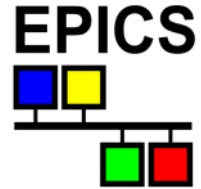
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libera software

- Improved Libera Grouping+: more configuration and diagnostics options
- Added FOFB application (on customer's request)
- Code compatibility between the Libera Brilliance+ and 2BPMRTM module (running in MTCA.4 platform)

EPICS and TANGO updates



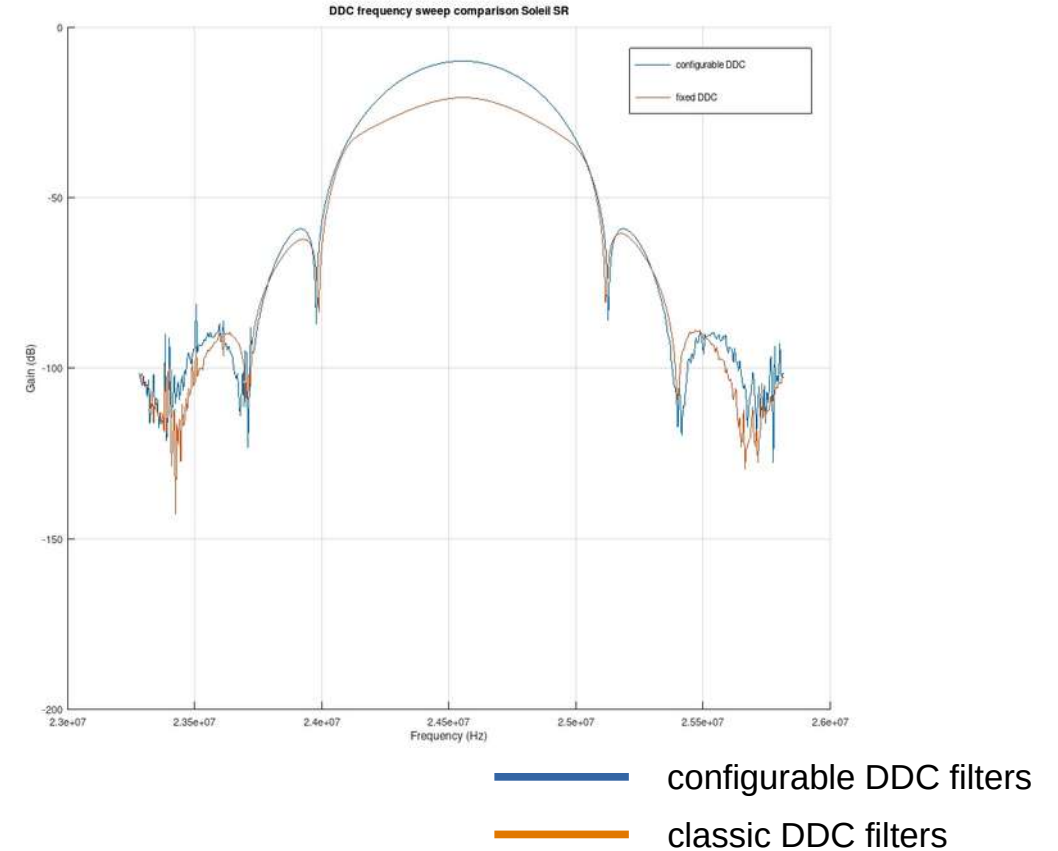
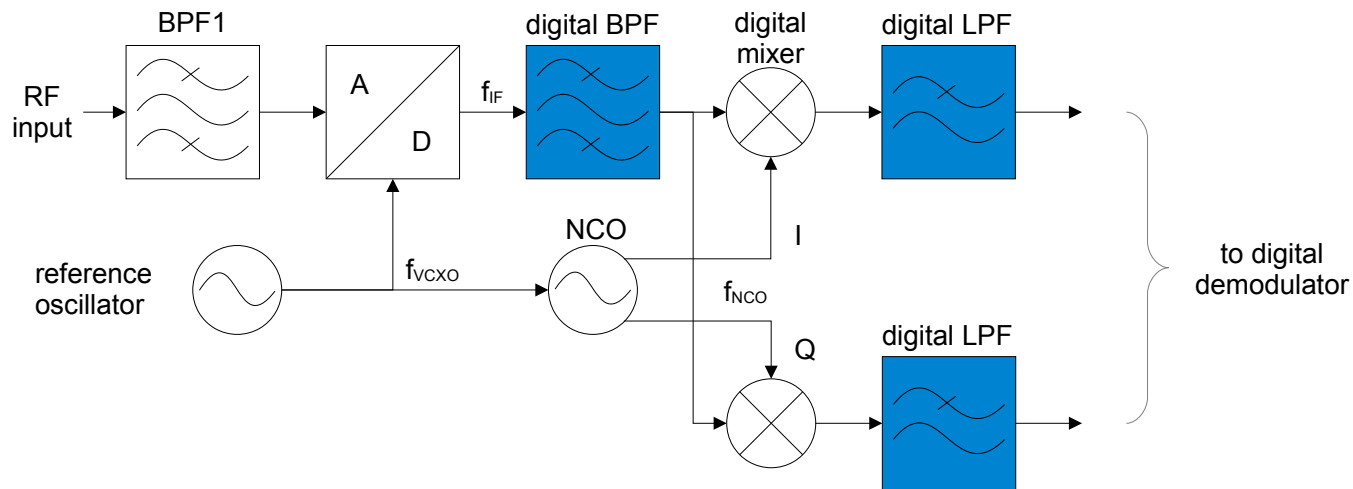
- support for new OS in platforms B and C
- basic support for DBE_ARCHIVE event
- FLNK support on PVs with I/O Intr SCAN
- introduced iocAdminSoft extension
- building infrastructure provided to users
- introducing more EPICS7 functionalities into libera-ioc interface



- support for new OS in platforms B and C
- libera-ds can run outside of the instrument
- multiple independent device classes supported
- improved configuration through Device Wizard

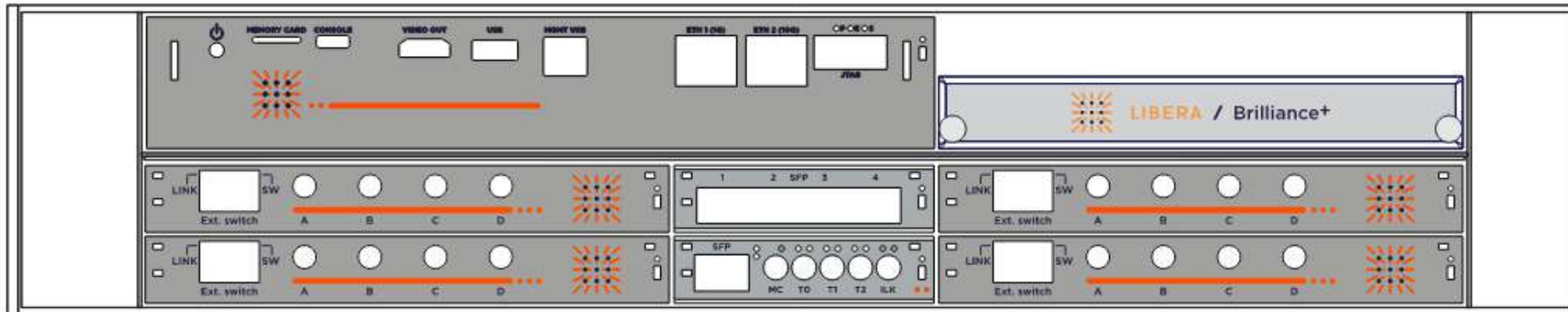
Work in progress (Libera Brilliance+)

- Configurable digital filters for the turn-by-turn data:
 - a single FPGA design (no customer-specific build)
 - runtime configurable DDC filters through a .xml file
 - supported on 2nd and 3rd generation BPM modules



Work in progress (Libera Brilliance+)

- Configurable digital filters for the turn-by-turn data:
 - a single FPGA design (no customer-specific build)
 - runtime configurable DDC filters through a .xml file
 - supported on 2nd and 3rd generation BPM modules
- Development projects:
 - timing module (2nd generation EVRX module)
 - ICB module (2nd generation ICB module)



Render (not a real image)

Conclusion

- 10 years of Libera Spark (ERXR)
- 14 years of Libera Brilliance+
- libera-ebpm application runs in μ TCA platform
- Continuous improvements keep the instruments state-of-the-art BPM system
- ~2 EY spent for hardware and software upgrades (spread over a couple development projects in the last ~1.5 years)

