



INSTRUMENTATION
TECHNOLOGIES



LIBERA



Libera XBPM Electronics for Future Light Sources

Danilo Bisiach, 10 June 2024

WWW.I-TECH.SI

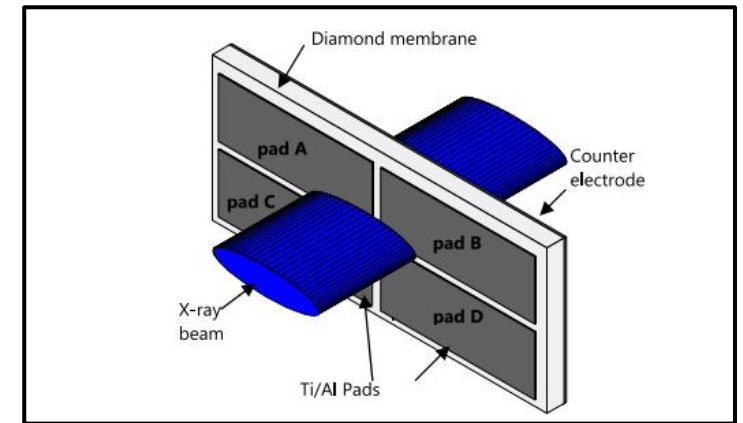
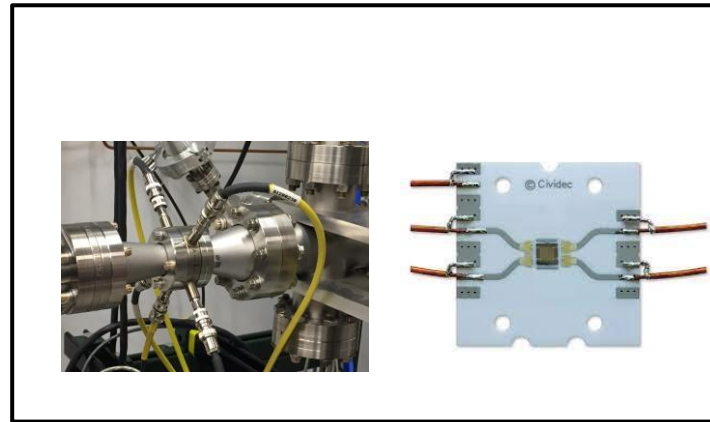
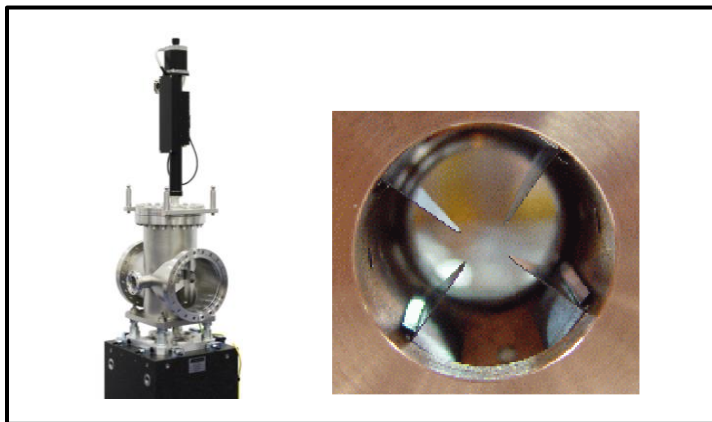
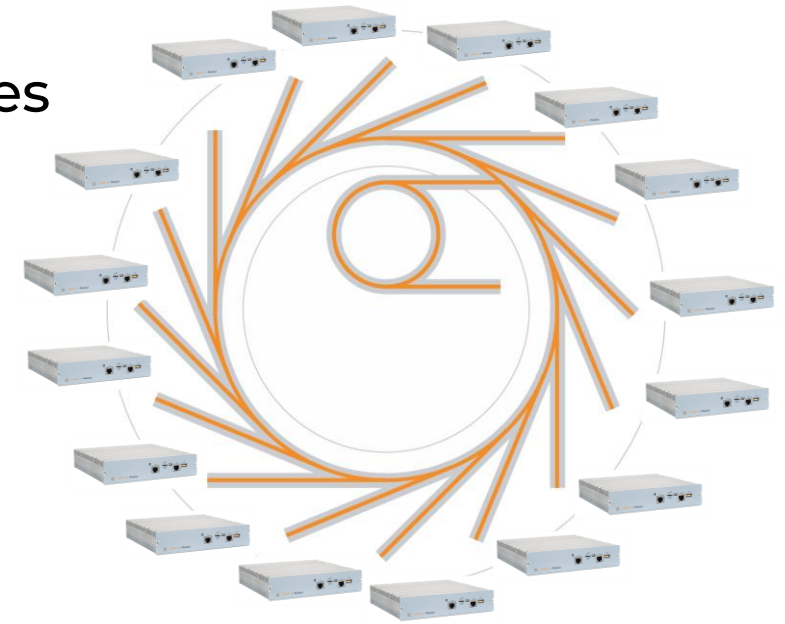
Agenda

- Introduction to X Ray beam position monitoring
- Libera Photon: a 14 years long journey
- Motivation and requirements for a new Libera Photon
- Kria SoM based platform
- Summary

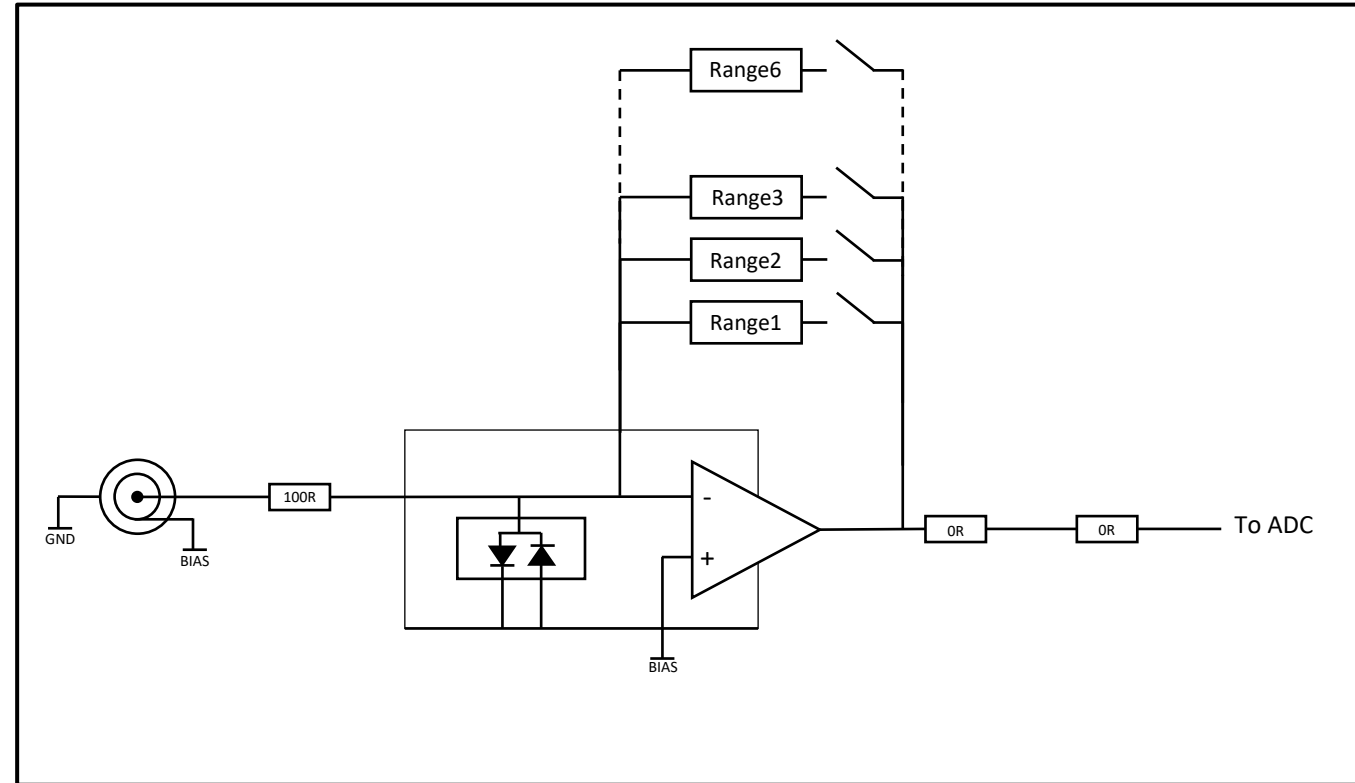
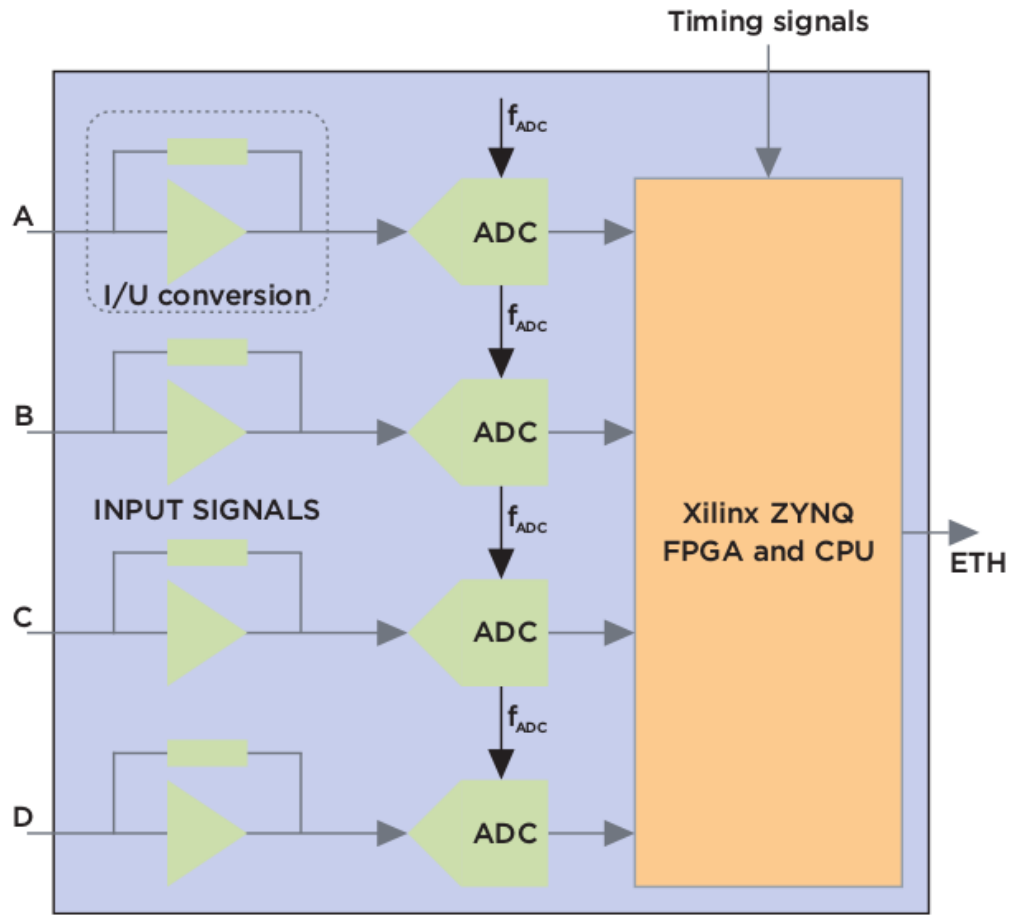


Introduction to X Ray beam position monitoring

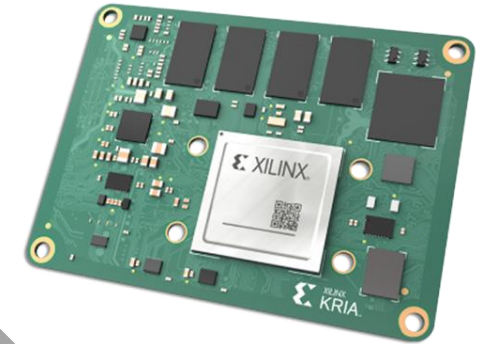
- XBPMs are positioned at the front end of the beamlines
- Working with low currents (nA to mA)
- Sometimes HV polarization is required
- Sensors: blades/diamonds
- Similar principle of position calculation as in electron BPMs (current measurement, lower BW...)



Introduction to X Ray beam position monitoring



Libera Photon: a 14 years long journey



Platform A (2010-2016)

Platform C (2016-2030)

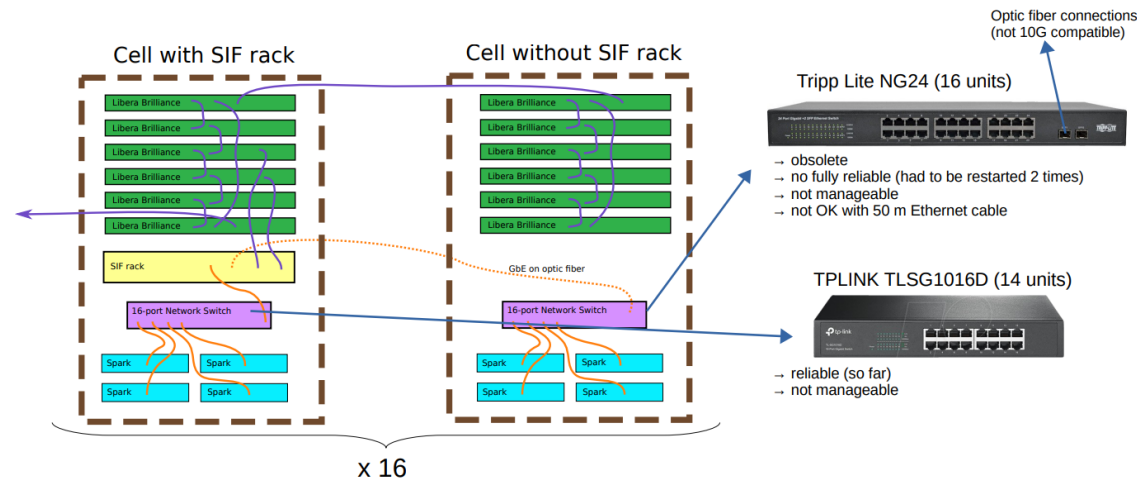
Platform KRIA (2025-)

Years of activity	2010-2016	From 2016	2025-
HV internal source	Yes	No	No
A/D	300 kS/s – 24 bit	2 MS/s – 18 bit	2 MS/s – 18 bit
FPGA	Virtex II Pro	Zynq 7020	Zynq UltraScale+ MPSoC
Current ranges	± 2 nA / ± 1.85 mA	± 60 nA / ± 2 mA	± 60 nA / ± 20 mA
Fast Orbit Feedback integration	Yes	No (FA data through GbE available)	Yes
Power supply	220 VAC	PoE	220 VAC



Motivation and requirements for a new Libera Photon

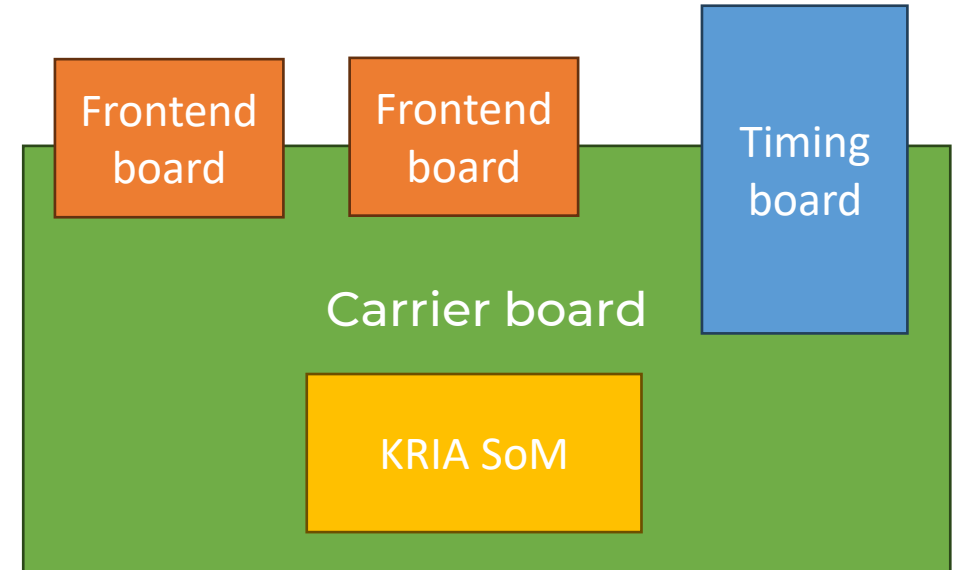
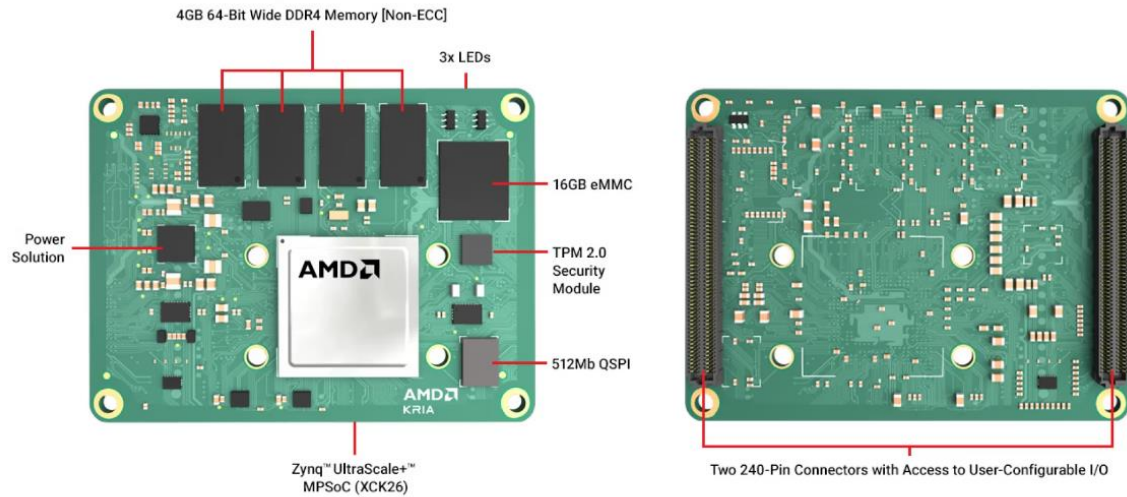
- Current limits of Libera Photon pIC is the SFP support needed for FOFB:
Zynq 7020 cannot support fast data streaming through SFP interface.
UDP packages can be streamed through through GbE port.
- How can we enable the instrument to stream out the data in a way that is compatible with the future FOFB architectures?
- Different solutions possible
 - Libera Photon based on Zynq 7035
 - ESRF*: GbE streaming + aggregator



*B. Roche: Integration of Sparks in the Fast Orbit Feedback correction loop

Kria SoM based platform - the idea

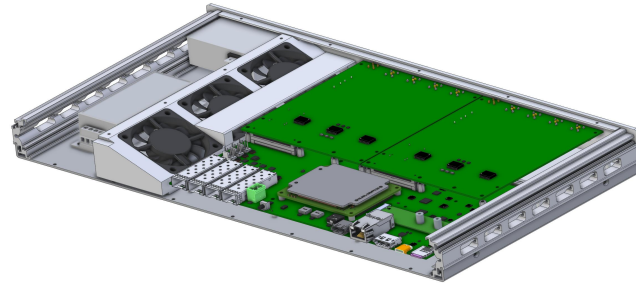
- What about redeveloping the entire platform using a modular approach?
 - KRIA SOM



Building blocks



Kria SoM based platform - the idea



Libera Spark / Photon

- Passive cooling
- PoE
- 4 channels
- Zynq 7020: 85K logic cells
- GbE

Libera platform based on KRIA SoM

- Active cooling
- 220 V
- 8 channels
- KRIA: 275K logic cells
- SFP/FOFB

Libera Brilliance+

- Active cooling
- 220 V
- 16 channels
- Kintex Ultrascale+: 356K logic cells
- SFP/FOFB

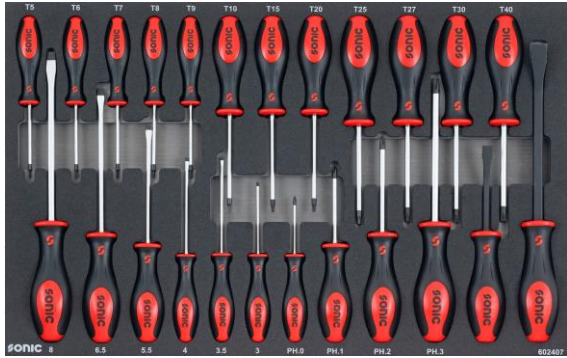
Performance

Power consumption



Kria SoM based platform – reasons behind

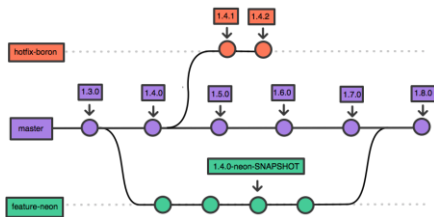
KRIA will not be applied to the Photon only but it will be a new platform for Libera



Common integration platform



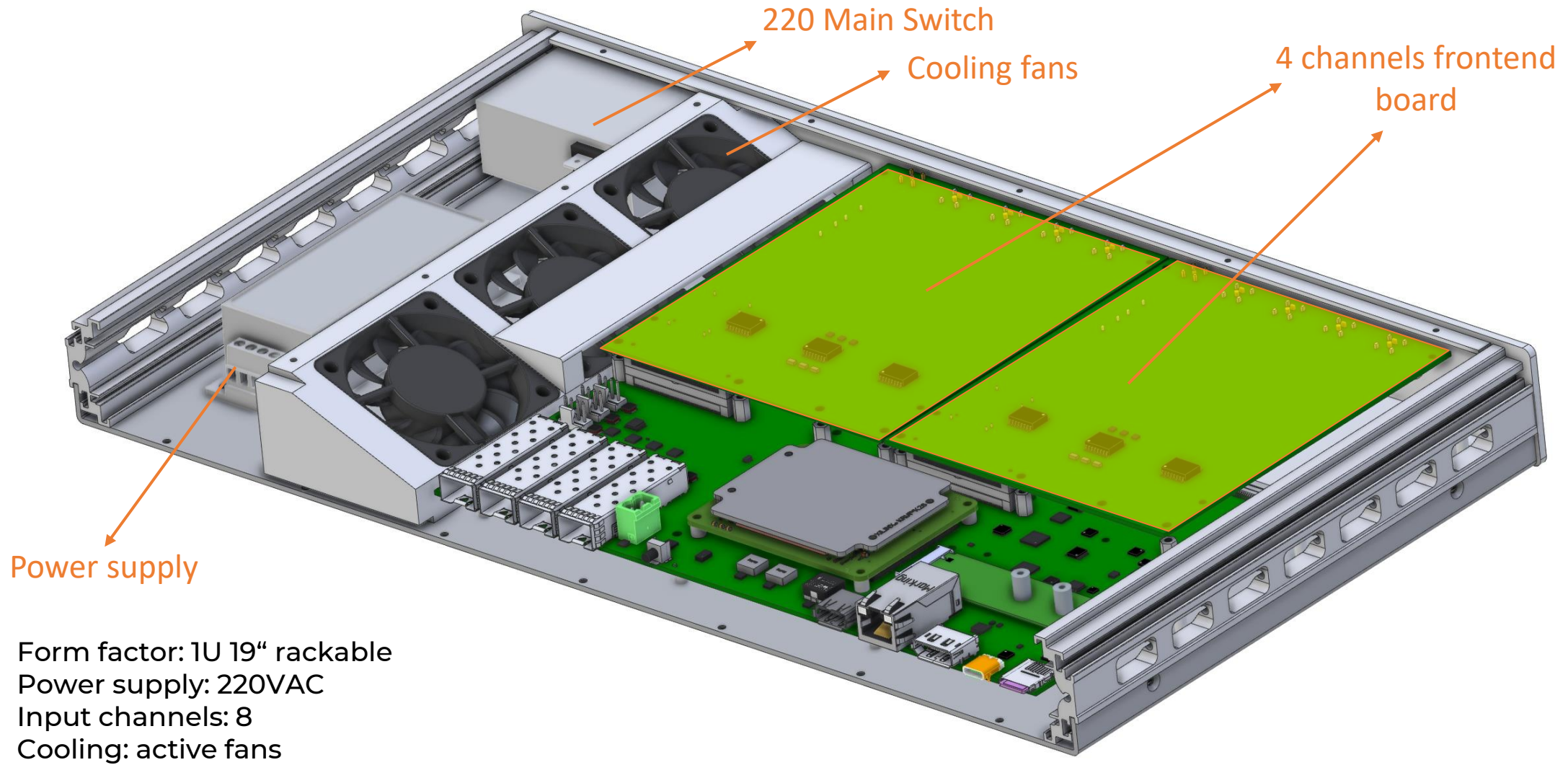
Inventory and logistics optimisation



Portable SW design



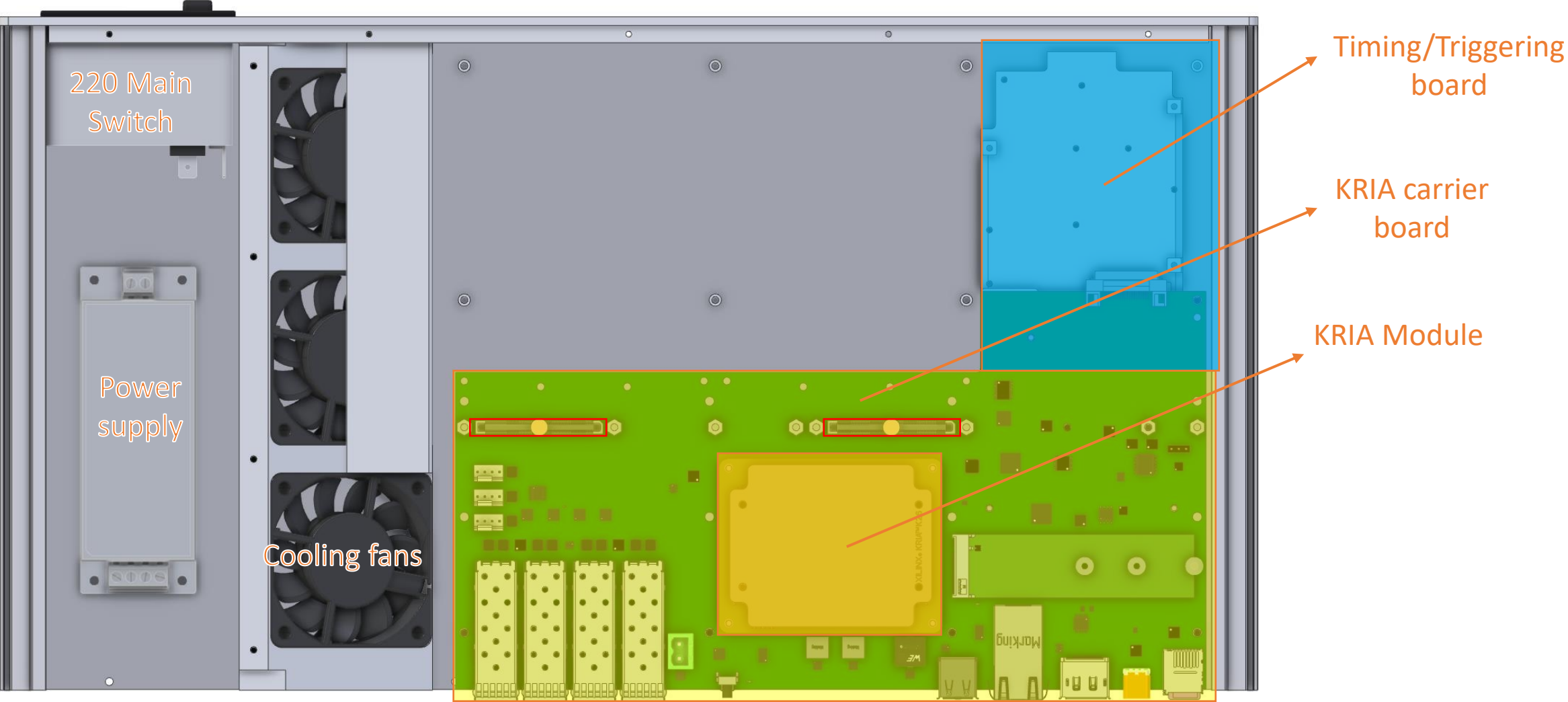
Kria SoM based platform – Libera Photon



- Form factor: 1U 19" rackable
- Power supply: 220VAC
- Input channels: 8
- Cooling: active fans



Kria SoM based platform – Libera Photon



Summary

- I-Tech has over 14 years of expertise in **XBPM electronics**
- Currently more than **200 Libera Photons** are based on PlatformC across various customer sites
- Requirements are being collected, with efforts to **involve multiple labs**
- New synchrotrons will require xBPMs to be integrated into the **Fast Orbit Feedback**: this presentation presents a possible approach based on the **KRIA SoM technology**
- We would like to receive **your comments and suggestions** about the presented idea
- **Where** do you think the **design can be further improved?**



daniло.bisiach@i-tech.si



INSTRUMENTATION
TECHNOLOGIES



LIBERA