

Launched solutions & Experience feedback

[EP / SY-BI]

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Joint Electronics-forum / RADWG event: Copper to Fibre [1/2] (20/06/2024)



Launched solutions & Experience feedback

[EP / SY-BI]

Outline:

- **Previous generations**
- **Current/Next generations**
- **Summary & Outlook**



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Outline:

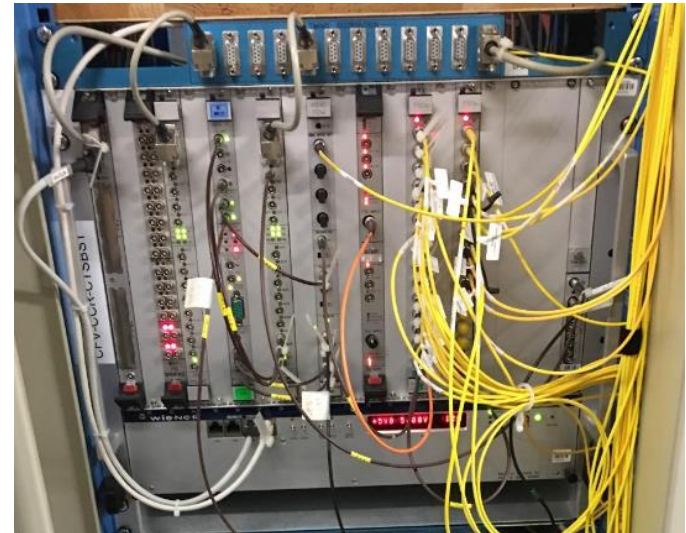
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Previous generations

Beam Synchronous Timing (BST)

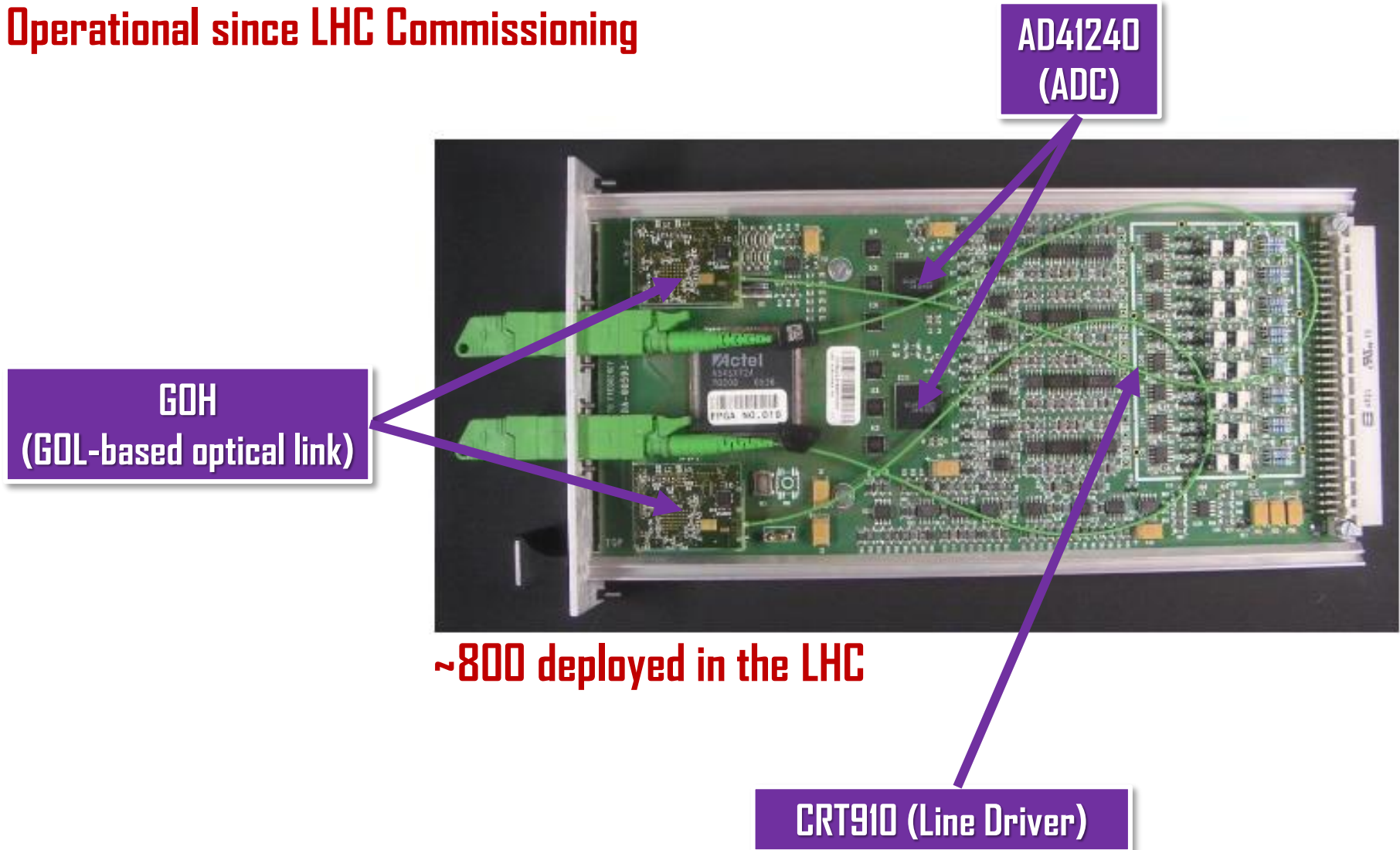
- Based on the Time Trigger and Control (TTC) system from EP-ESE
- Distribute beam synchronous clocks to beam instrumentation around the LHC and SPS rings (and transfer lines):
 - 40 MHz "bunch clock"
 - 11/43 kHz "turn clock" (n.b. also called "Frev" by RF and "orbit" by exp.)
- Distribute a number of messages containing machine status and triggers to all equipment
 - LHC: <https://wikis.cern.ch/display/BEBI/LHC+BST+Message>
 - SPS: <https://wikis.cern.ch/display/BEBI/SPS+BST+Message>



Previous generations

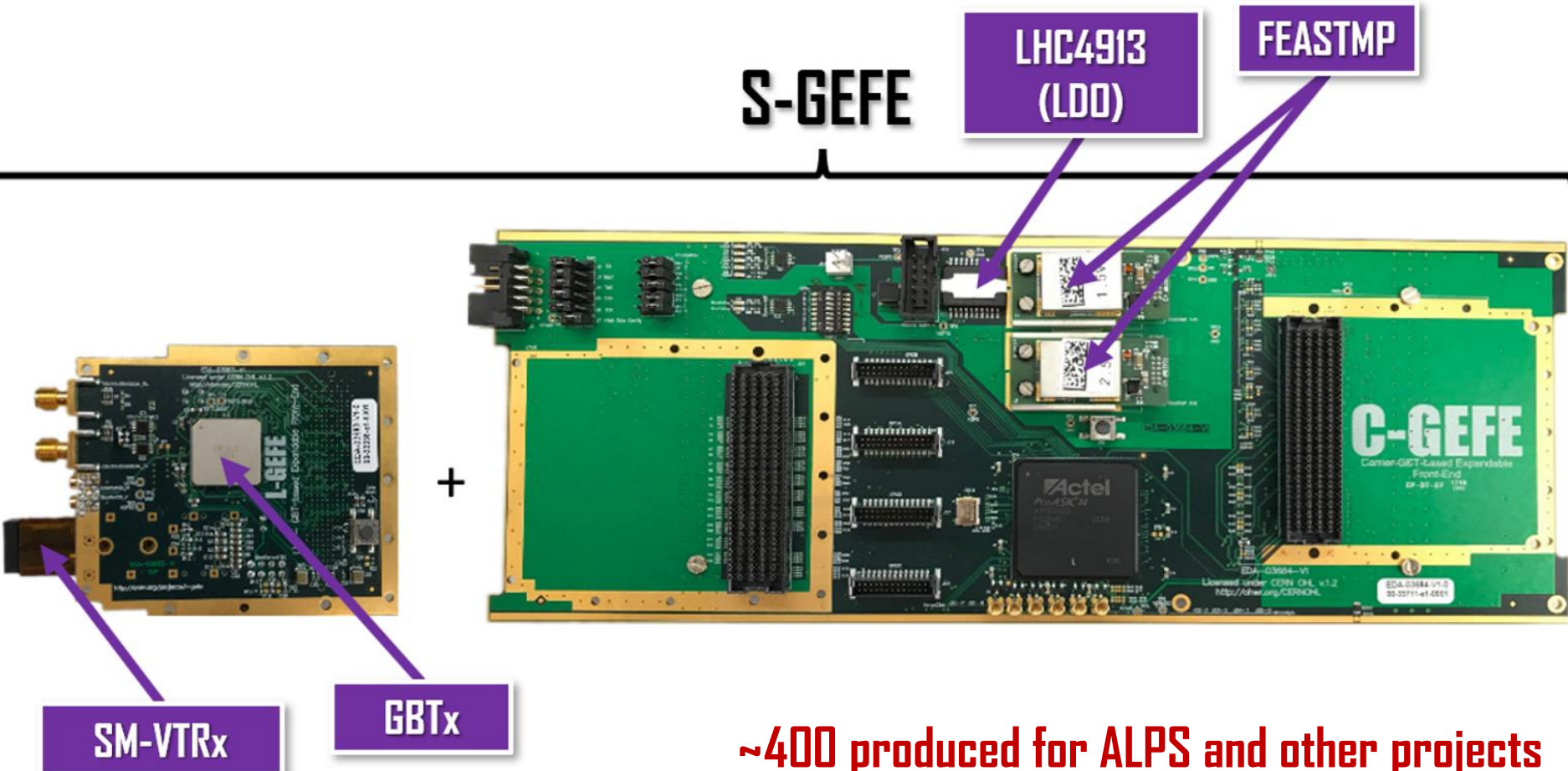
BLM Acquisition Module (SY-BI-BL)

Operational since LHC Commissioning



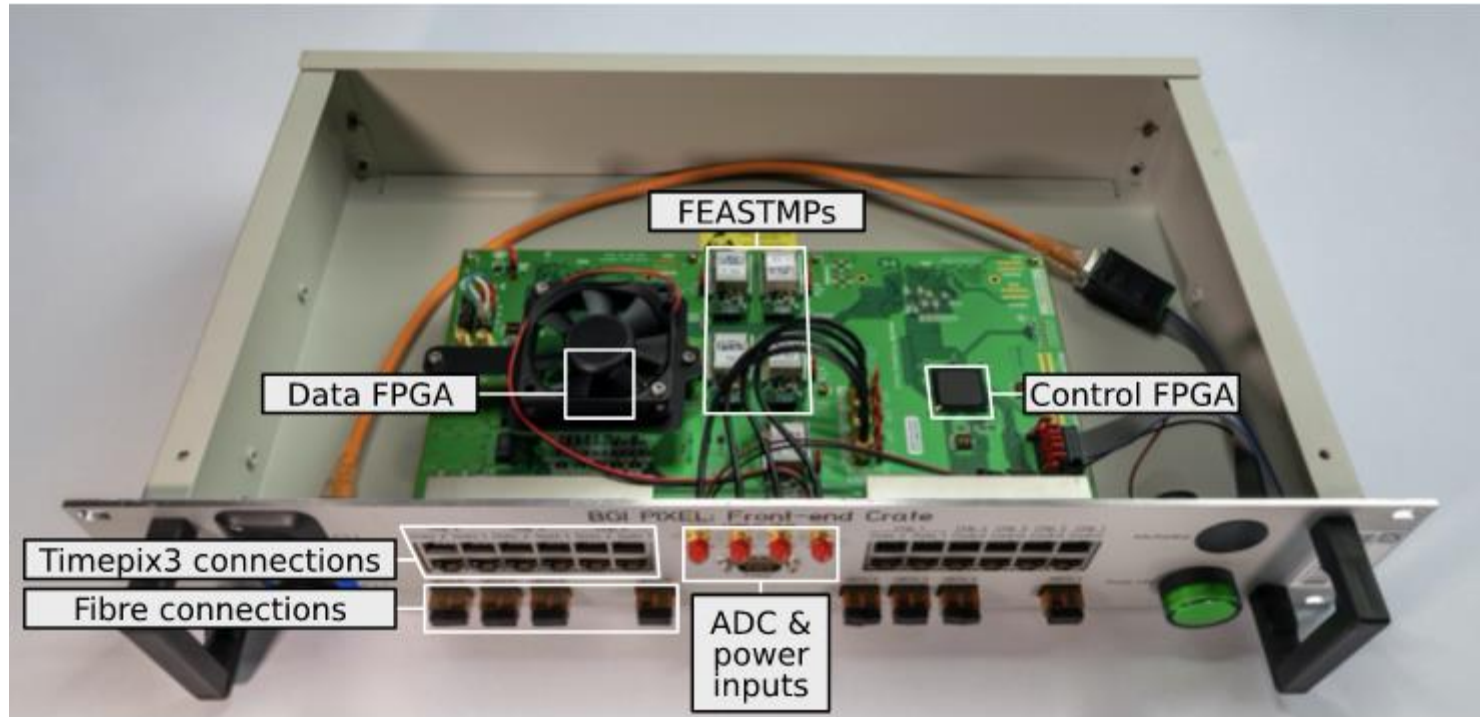
~800 deployed in the LHC

Previous generations



Previous generations

Radiation tolerant readout of Timepix3 (BIPXL) (SY-BI-XEI)



BI Instrument Family	Timepix Version	Facility	(Original) Delivery Date	Status
BGI	3	PS	Post-LS2 (2021)	Working to make operational.
BGI	3	SPS	2024	Preparing instruments for installation in June 2024.

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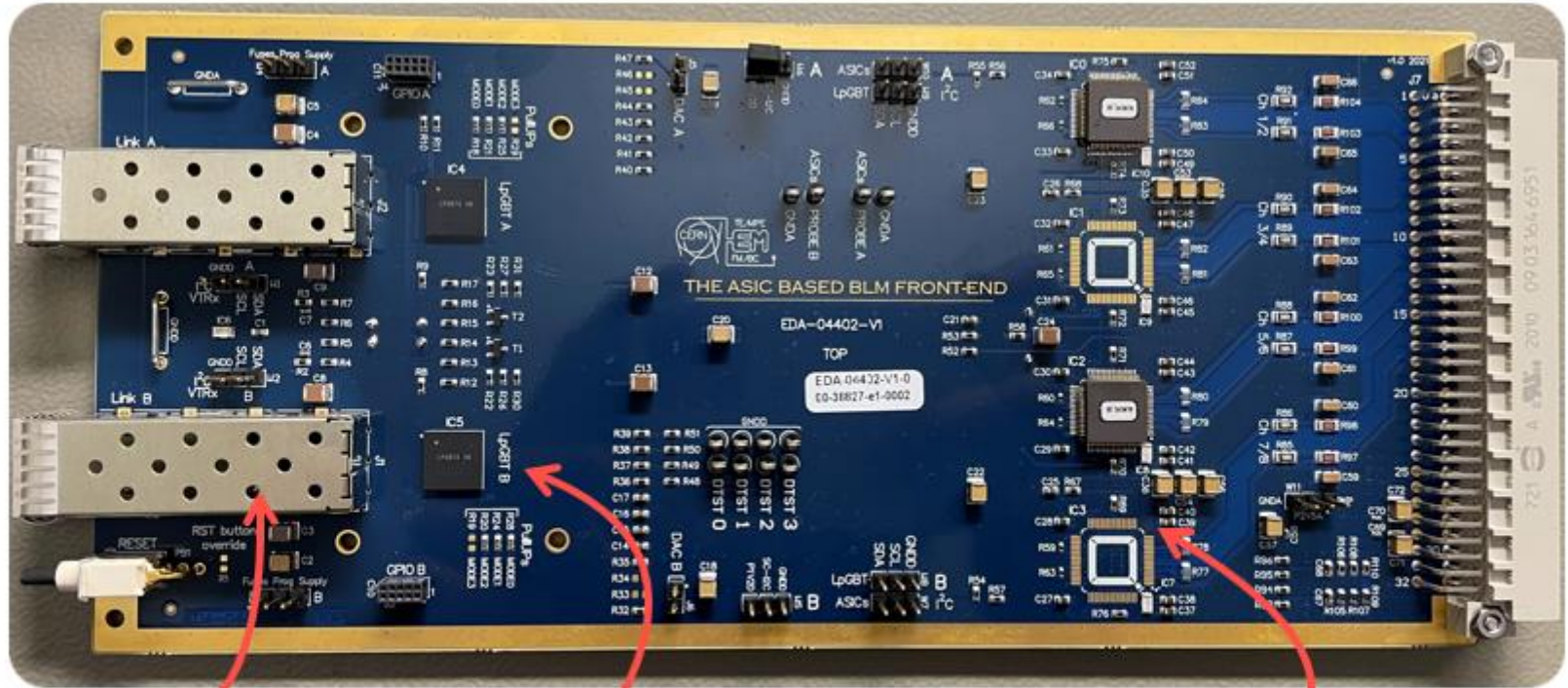
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Current/Next generations

BLM ASIC (SY-BI-BL)



2 x SM-VTRx

2 x LpGBT

4 x BLMASIC

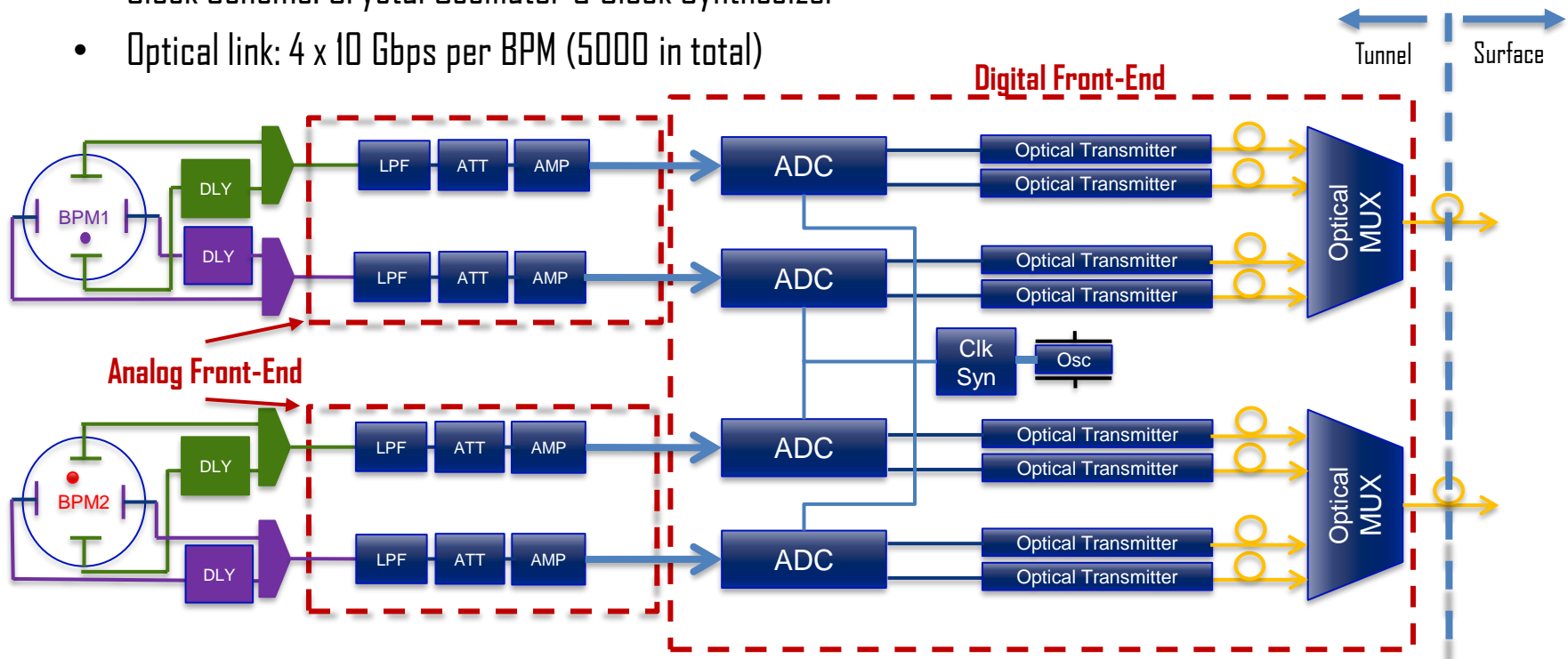
BLM ASIC-based FE cards to be produced: ~60 for LS3 and ~1000 for LS4

Current/Next generations

LHC BPM Consolidation Project (SY-BI-BP)

- BPM pick-ups as current system
- Analog FE: TBD
- Digital FE:
 - ADC (4 x 12-bit @ 1.25GSps)
 - Clock Scheme: Crystal Oscillator & Clock Synthesizer
 - Optical link: 4 x 10 Gbps per BPM (5000 in total)

All active components must be radiation tolerant



Current/Next generations

SY-BI-XEI applications

BI Instrument Family	Timepix Version	Facility	(Original) Delivery Date	Status
BGI	4	LHC	Post-LS3 (2029)	Working on conceptual design.
Telescope	4	North Area	Summer 2025	New project.
BLM	4	LHC	?	Deliverables & timeline to be confirmed with Christos.

Next-gen BIPXL is based on Timepix4 and IpGBTx

Current/Next generations

SM-CTXx

- SM-CTRx: Full duplex
- SM-CTTx: Dual transmitter

Parameter	Value	Units
Uplink Bit Rate	4.8 or 5.12 or 10.24	Gb/s
Downlink Bit Rate	2.56 or 4.8	Gb/s
Wavelengths	1270/1290/1310/1330	nm
Total ionizing dose (TID)	10	kGy
Fluence	$5 \cdot 10^{14}$	n/cm ² MeV neutrons

"old" SM-VTRx



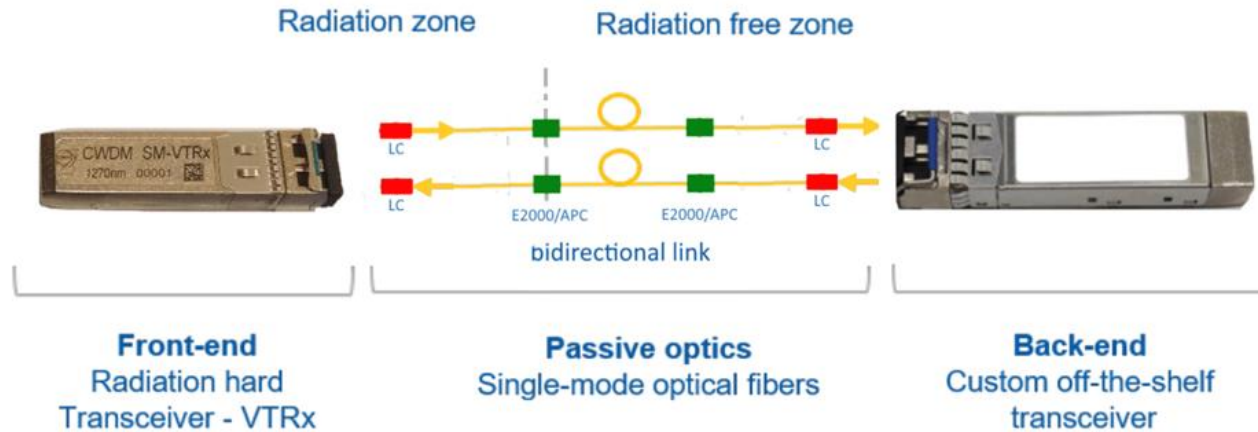
SM-CTXx



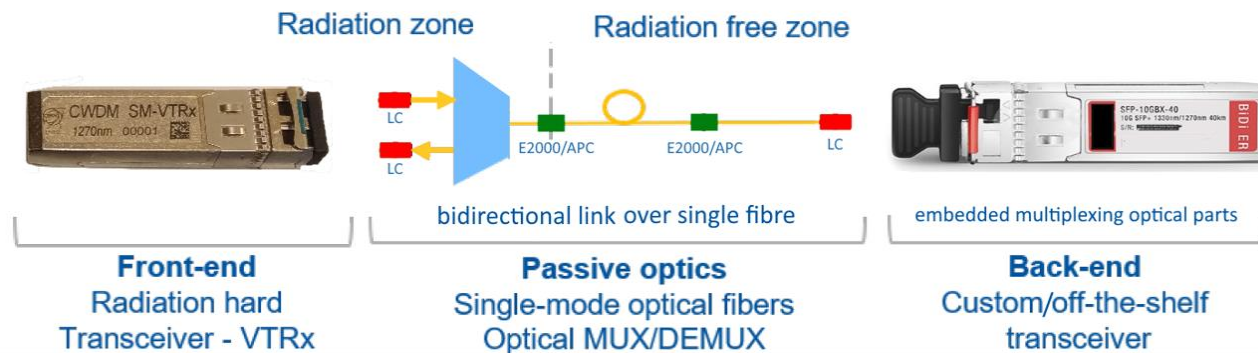
Current/Next generations

SM-CTR_x

Example: Topology for BLM Consolidation (SPS) (LS3)



Example: Topology for BLM Consolidation (LHC) (LS4 with prototypes in LS3)

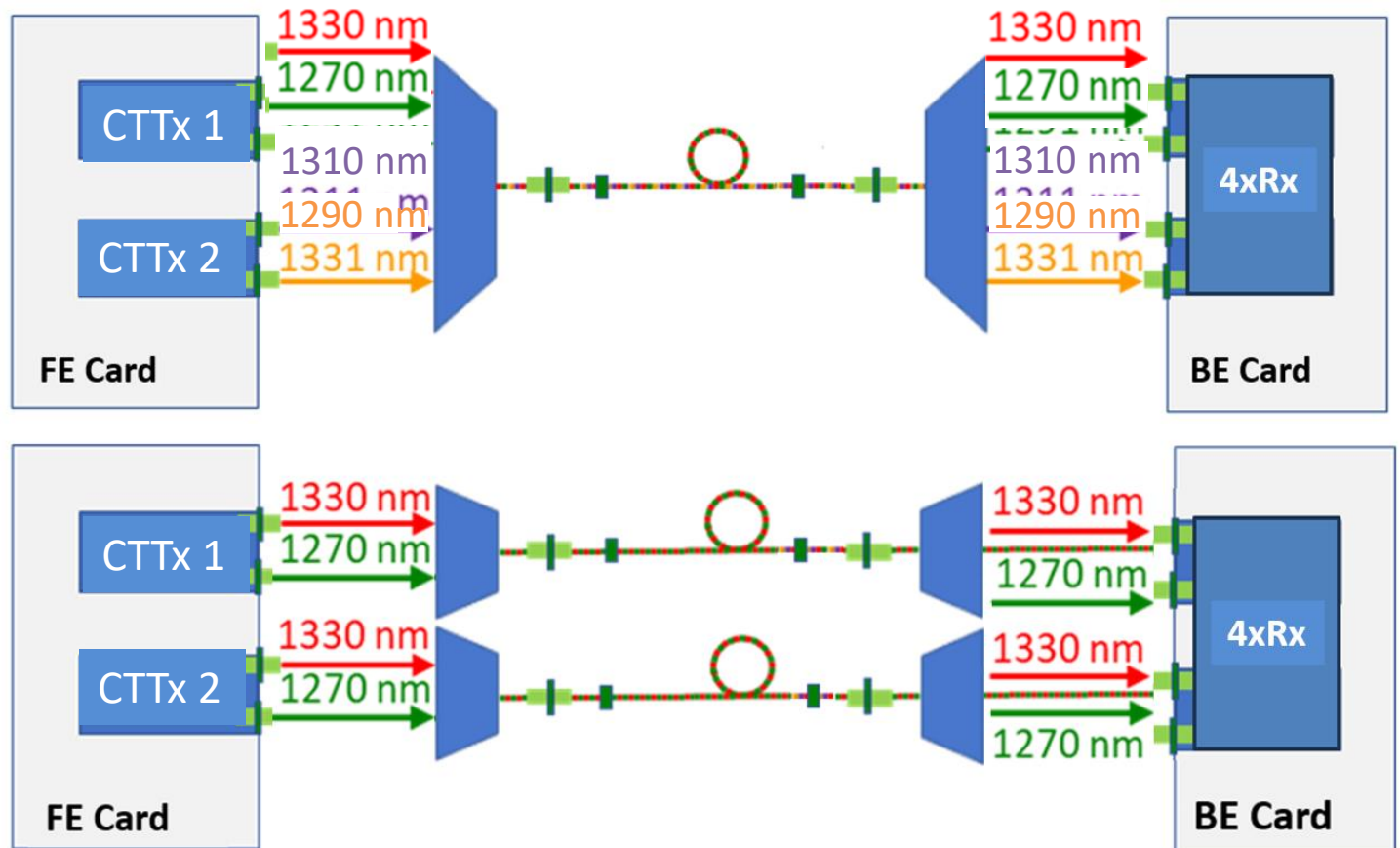


SM-CTR_x to be produced: ~3200 (BL) and ~300 (XEI)

Current/Next generations

SM-CTTx

**Example:
Two possible
topologies for
LHC BPM
Consolidation**



CWDM SM-CTTx to be produced: ~3200 (BP) and ~200 (XEI)

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Summary & Outlook

Summary

- **EP-ESE provides a wide portfolio of services and custom components and services**
- **BI/EP-ESE collaboration dating many years back**
- **Most BI systems benefit from components developed by EP-ESE**
- **Several BI projects in R&D stage foresee to use next-gen EP-ESE components**

Outlook

- **Continue the fruitful collaboration between BI and EP-ESE**
- **Try to maximise synergies between the two groups**

Acknowledgements

Thanks to:
Christos Z. (SY-BI-BL) and James S. (SY-BI-XEI)
for sharing their knowledge and materials
&
Our colleagues from EP-ESE