

Timing module for Libera and μ TCA.4 platforms

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History

- Timing module for Libera platform ('TIM'), only SMA connectors, no SFP
- Optical link required by LANSCE & KEK
- 'TIM' replaced by 'EvRx' module, by adding the SFP → more space for applications:
 - Event decoding (control the processing, signal conditioning, FOFB control, etc.)
 - Event generation (Interlock notification, arbitrary event generation, etc.)
 - Optical-to-electrical event conversion
 - etc.

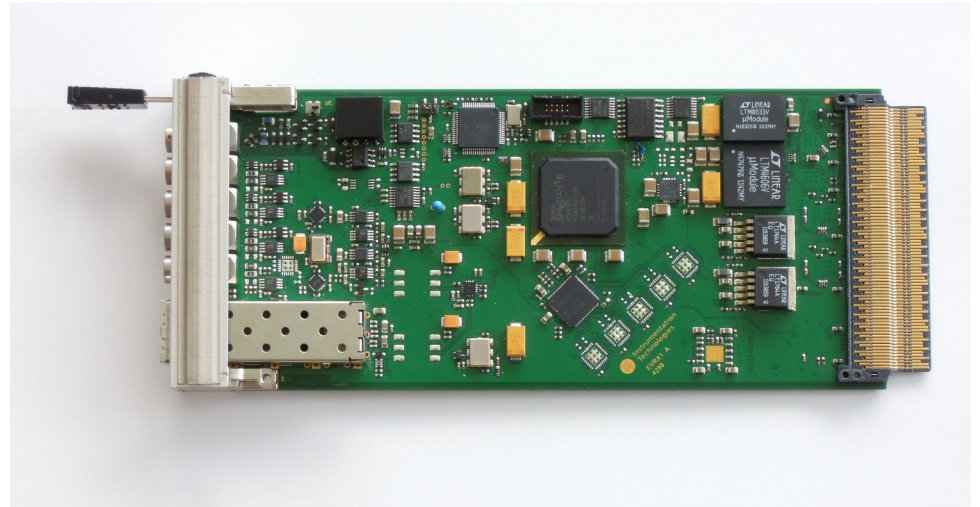
TIM module in 2010



EvRx module in 2012



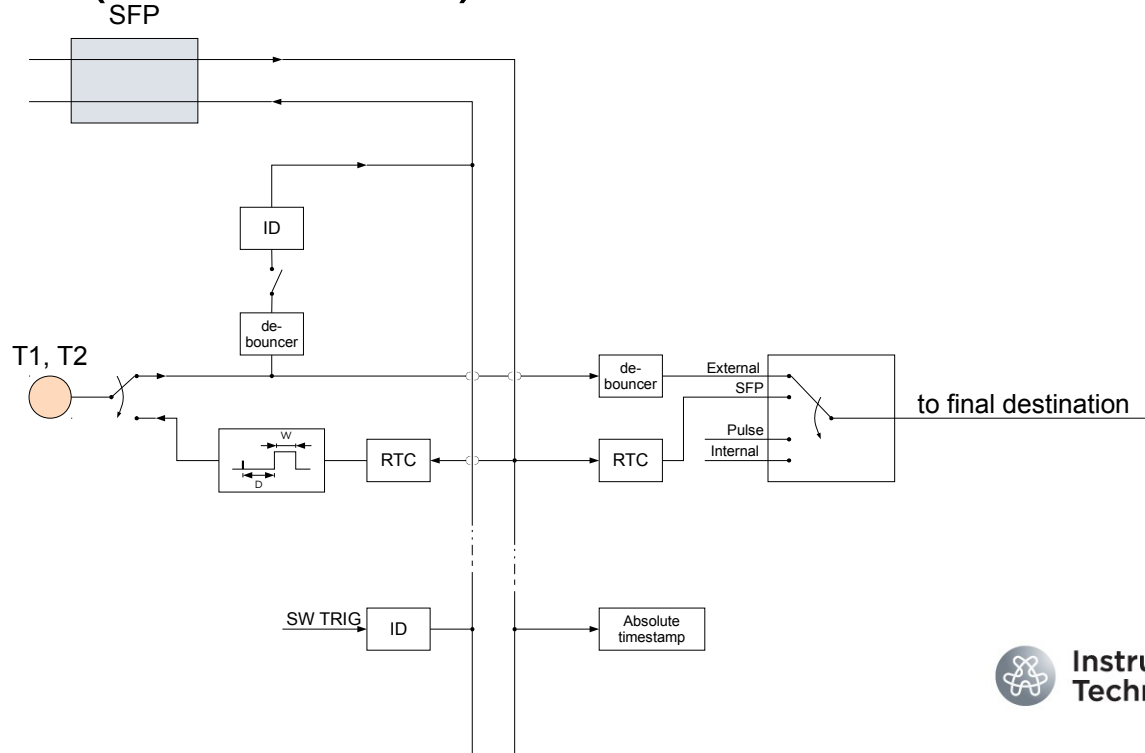
The 'EvRx' module



Functionalities (default)

- Receive the reference clock for sampling clock generation and/or phase calculation
- Receive electrical triggers/level signals
- Receive optical events from the MRF generator (can replace all electrical triggers)
- Generate optical events and send them to the MRF receiver
- Transform the optical event(s) to electrical pulse(s)
- Multi-chassis synchronization with I-Tech code
- Interlock signal & event generation
- Arbitrary event ID generation
- Support for FOFB functionalities
- Timestamping with ADC clock precision

Functionalities (schematics)



Libera or μ TCA.4 platform?

The timing module can be used in either platform

Libera platform	μ TCA.4 platform
	SFP cage; 600 MHz < f < 2.7 GHz
	3x software selectable I/O: <ul style="list-style-type: none">• HighZ (default), 50 Ω termination• Coaxial LEMO EPL.00.250.NTN, 3.3 V TTL
	1x Interlock output: <ul style="list-style-type: none">• Differential LEMO EPG.00.302.NLN optoisolated• 24 V open collector (default), 24 V internal supply (optional)
	LED indicators: activity, input or output function
	8 MLVDS pairs to backplane @ 100 MHz
	GbE over the backplane
	PCIe x1
	TCLKA, TCLKB, FCLK

Firmware, FPGA, software, EPICS, TANGO

No worries, everything is available!

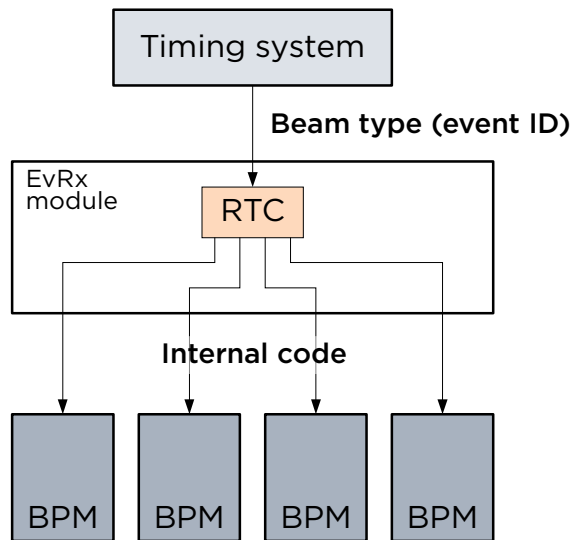
Firmware	Compliant to μ TCA.4 recommendations Compliant to Libera platform requirements LPC2148FBD64 Microcontroller
FPGA	Xilinx XC6SLX45T-2FGG484C
Software	Libera BASE (framework) (non)Libera application Upper layer is 'MCI', access examples provided
EPICS	Upper layer that connects to Libera BASE
TANGO	Upper layer that connects to Libera BASE

All source code is available.

EPICS IOC and/or TANGO server provided by default

Use case at KEK accelerators (LINAC)

- Timing system announces the beam type
- EvRx/RTC recognizes the ID and sends internal codes to the BPM modules
- Processing in the BPM modules identify the data with beam type, counters, etc.
- User can read out all beam types or select ones only

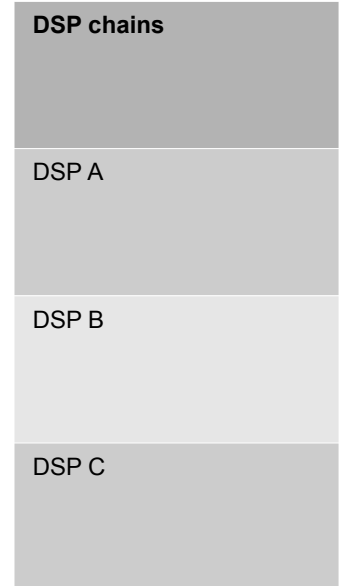
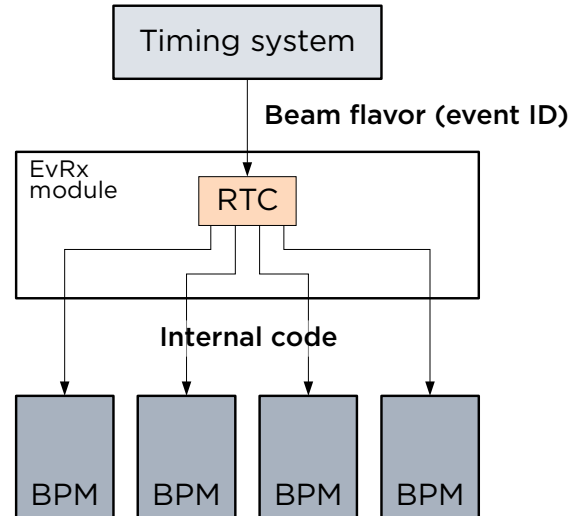


Beam types

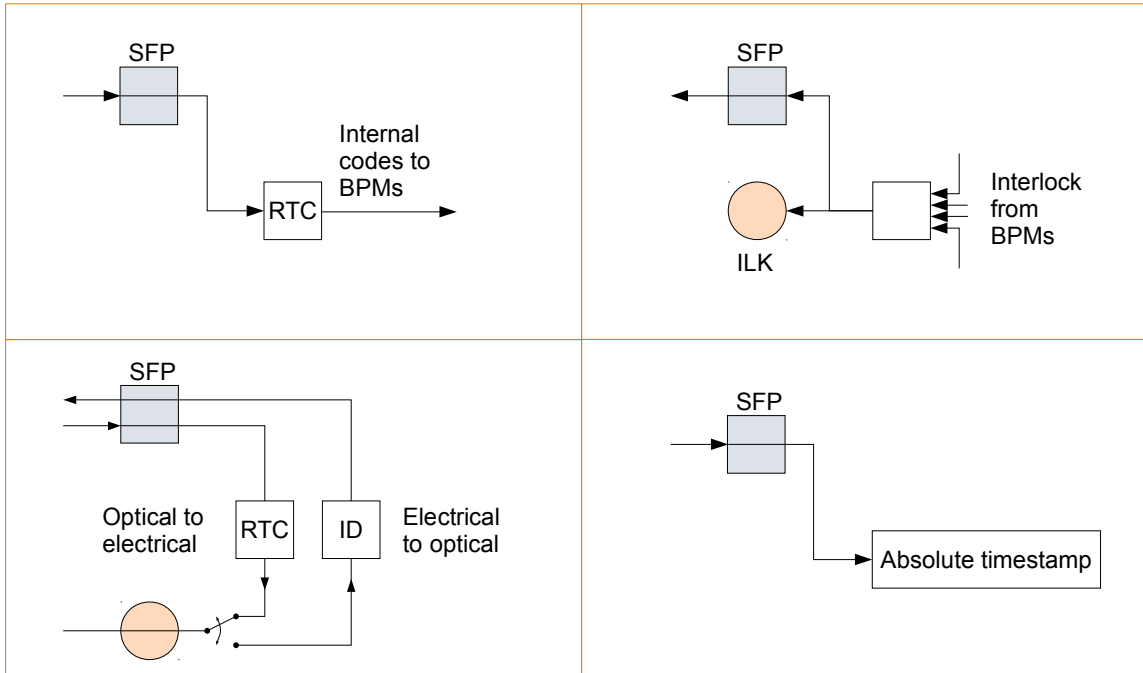
KEKB e-
KEKB e+
PF
PF-A1
AR
KEKB e- Study
KEKB e+ Study
PF Study
PF-A1 Study
AR Study
No Injection mode
Slow e+

Use case at LANSCE

- Timing system announces the beam flavor
- EvRx/RTC recognizes the ID and sends internal codes to the BPM modules
- Based on internal code, 3 different DSP chains can be used
- User can read the data from the DSP chains in parallel



Use case at MAX-IV

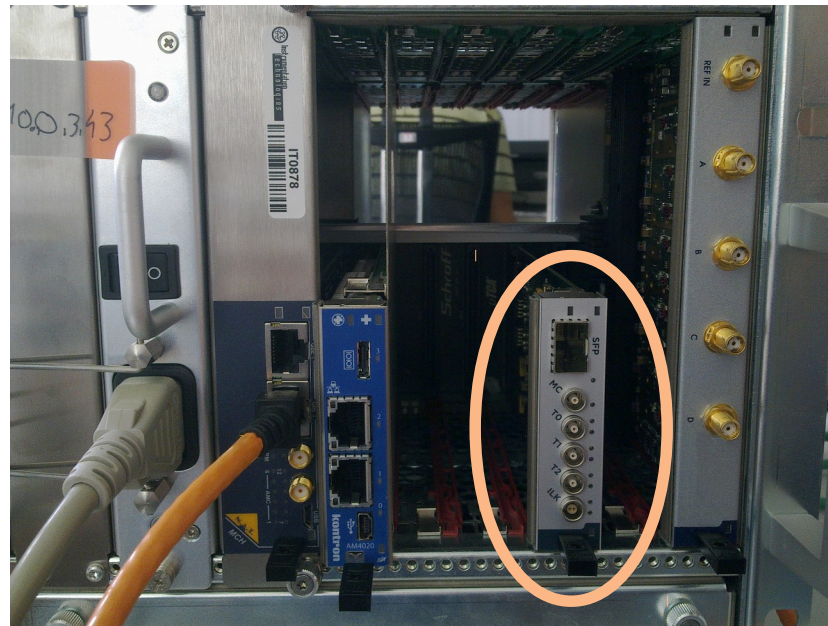


Tests in the μ TCA.4 chassis

- Linux Kernel 2.6.38-10-generic-pae
- Libera BASE 3.0
- FOFB application software

- Event reception OK
- Event stream OK
- Optical-to-electrical event OK

- Tests with the BPM module follow (rightmost module)



Final remarks

- EvRx module for μ TCA.4 platform **is available from 2012** but was not announced officially
- It is a standalone module which was used in Libera platform so far
- Installed (in Libera platform) at MAX-IV, SOLARIS, KEK-PF-AR, IHEP (big installations) and many other laboratories like NSRRC, ANL APS, Cornell, Hefei, and more (apologies for not mentioning all)
- FPGA and software source code is available for custom development at laboratories
- Common projects can be run with I-Tech