

White-Rabbit for MTCA.0 & MTCA.4

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Agenda

- Introduction N.A.T.
- Motivation of White-Rabbit on MCH
- Current Status
- Comparison AMC-psTiming-Module
- Summary

About N.A.T. Network and Automation Technology

Vollrath Dirksen
White-Rabbit for MTCA.0/.4



- Founded in 1990, privately owned
- Hard- and Software design and manufacturing
- Focus on innovation in communication
- international and worldwide operations
- Headquarters

Konrad-Zuse-Platz 9

53227 Bonn

Germany

- Presenter:
 - Dipl. Ing. Vollrath Dirksen, vollrath@nateurope.com





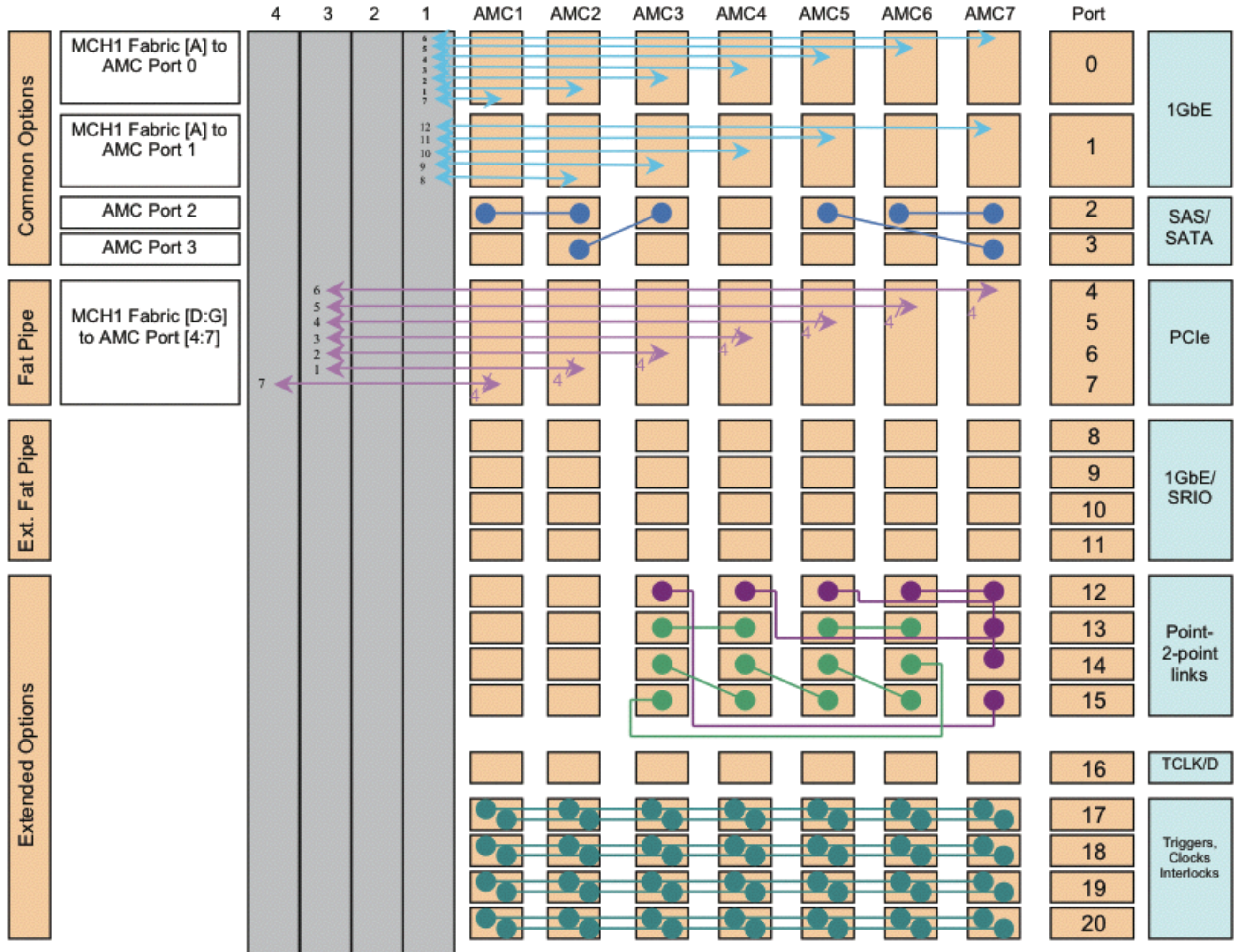
- Board Level Products
 - network interfaces, communication and processing boards
 - intelligent switches and system controllers
 - carriers, converters, adapters and extenders
- Software
 - board support packages, drivers
 - signaling stacks and protocols
 - applications and APIs
- Systems
 - pre-validated platforms for development and prototyping
 - turn-key solutions





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- Save one AMC slot
- Status of AMC design to shrink it to a sub-module size for MCH
- Discussion to design complete MCH or deliver submodule
 - Standard-MCH:
 - Ensures interoperability with nearly all MTCA and AMC components
 - shorter delivery time and quicker acceptance
- Additional functionality

White Rabbit

Focus

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White-Rabbit for MTCA.0/.4

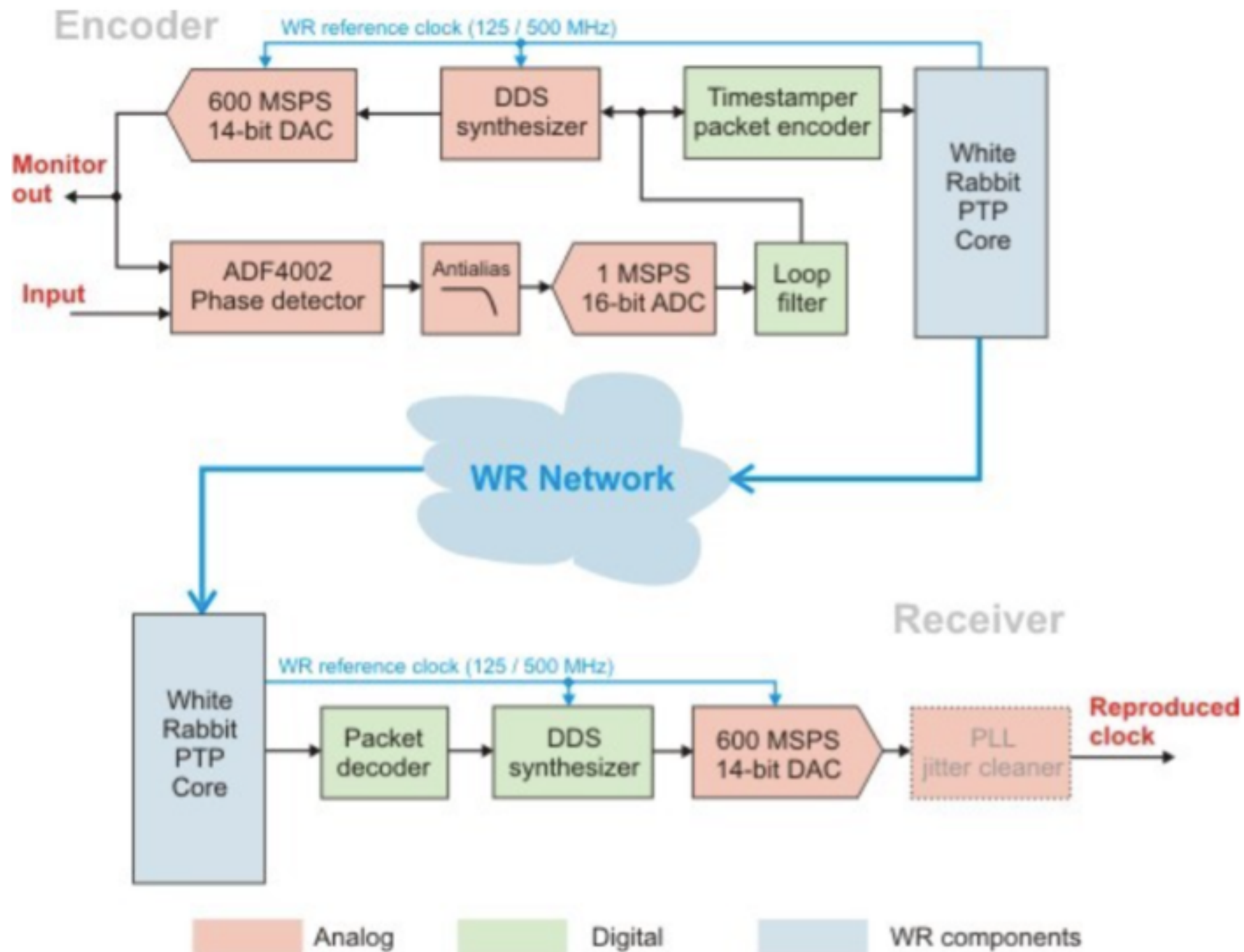


- Sub-nanosecond accuracy:
 - synchronization of more than 1000 nodes via fiber or copper connections of up to 10 km of length.
- Flexibility:
 - creates a scalable and modular platform with simple configuration and low maintenance requirements.
- Predictability and Reliability:
 - allows the deterministic delivery of highest priority messages by using Class of service.
- Robustness:
 - no losses of high priority system device control messages.
- Open source hardware and software:
 - to avoid vendor lock-in.

WR-DDS-RF principle

NAT-MCH-CLK-WR

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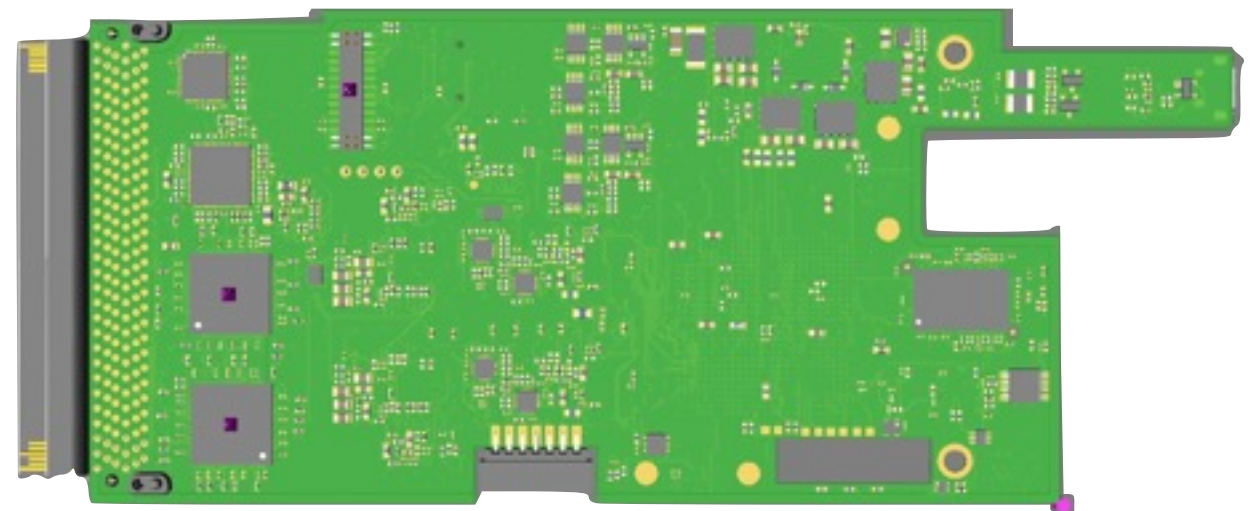
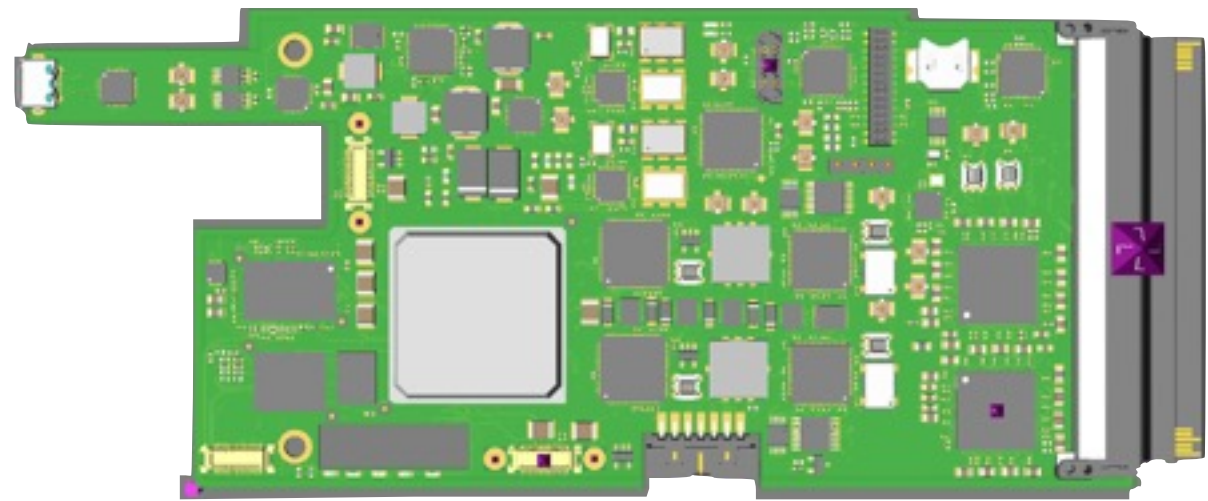
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White Rabbit

NAT-MCH-CLK-WR

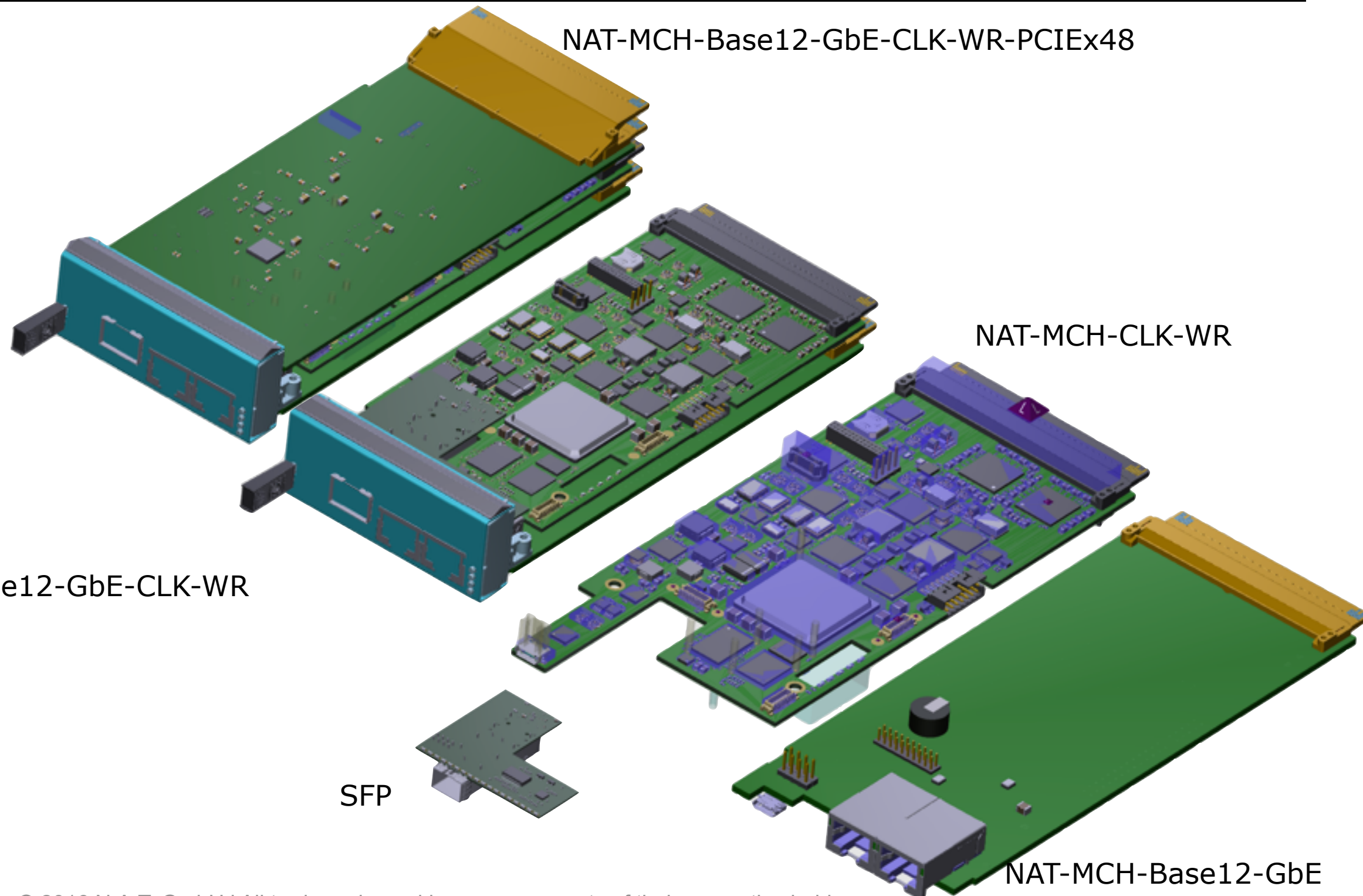
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Select MCH

NAT-MCH-Base12-GbE or NAT-MCH-M4

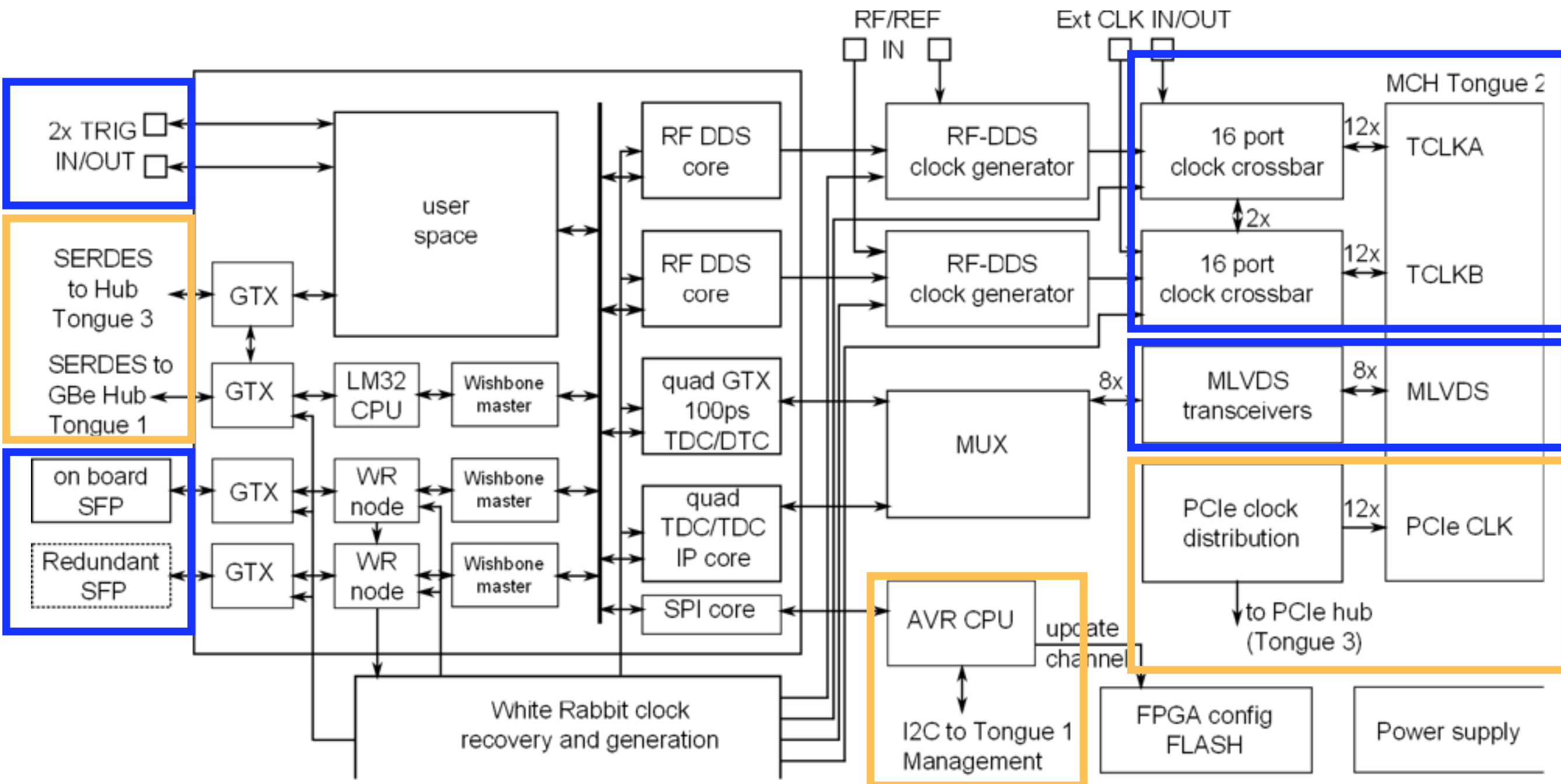
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White Rabbit

NAT-MCH-CLK-WR

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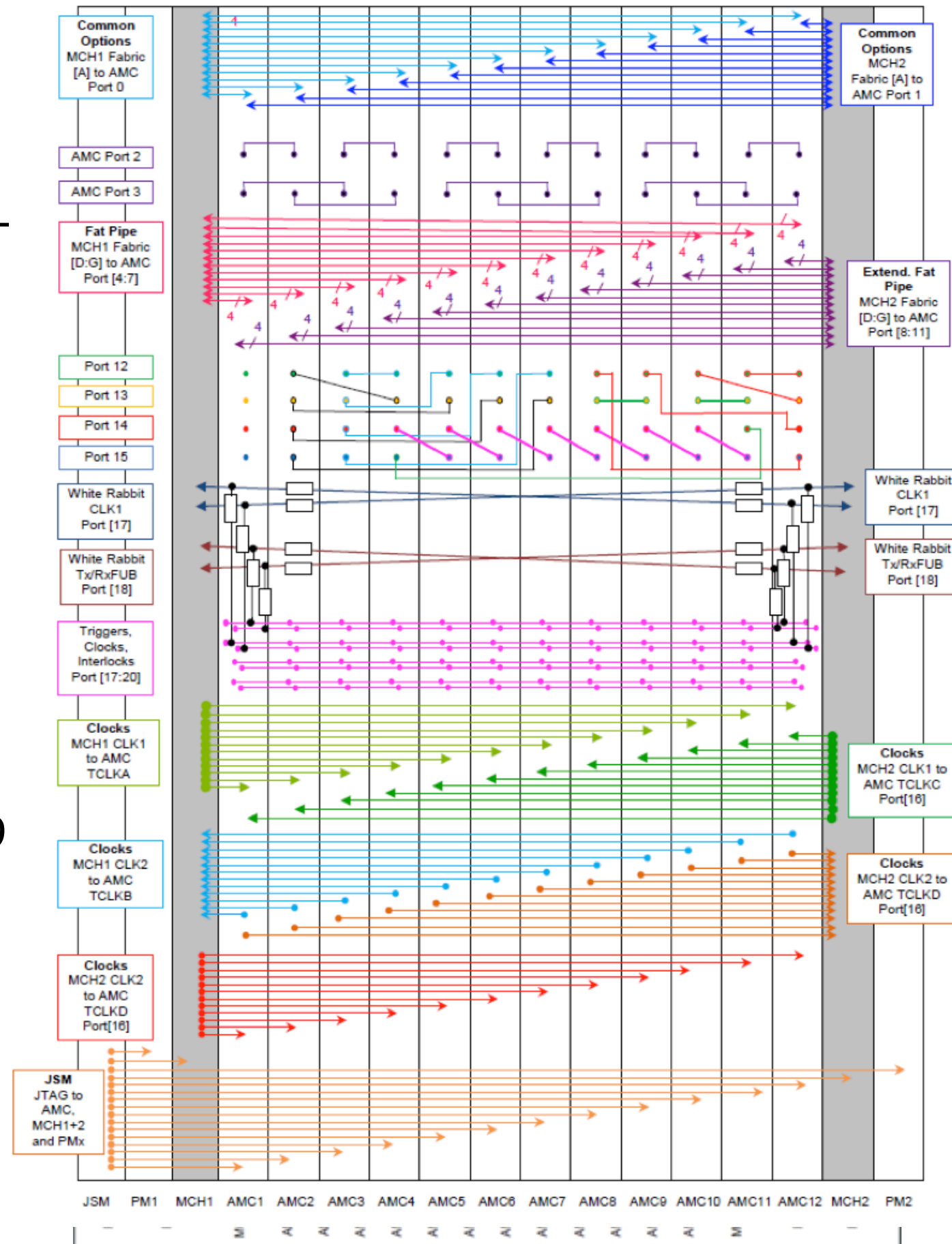
NEW NATIVE-R9

White-Rabbit-Support

- Available Chassis
 - NATIVE-R2
 - NATIVE-R9
- White Rabbit Support
 - optional
 - set of registers
 - connect reserved clock pins to
 - bus for Triggers, Clocks, Interlocks



old NATIVE-R9





Status

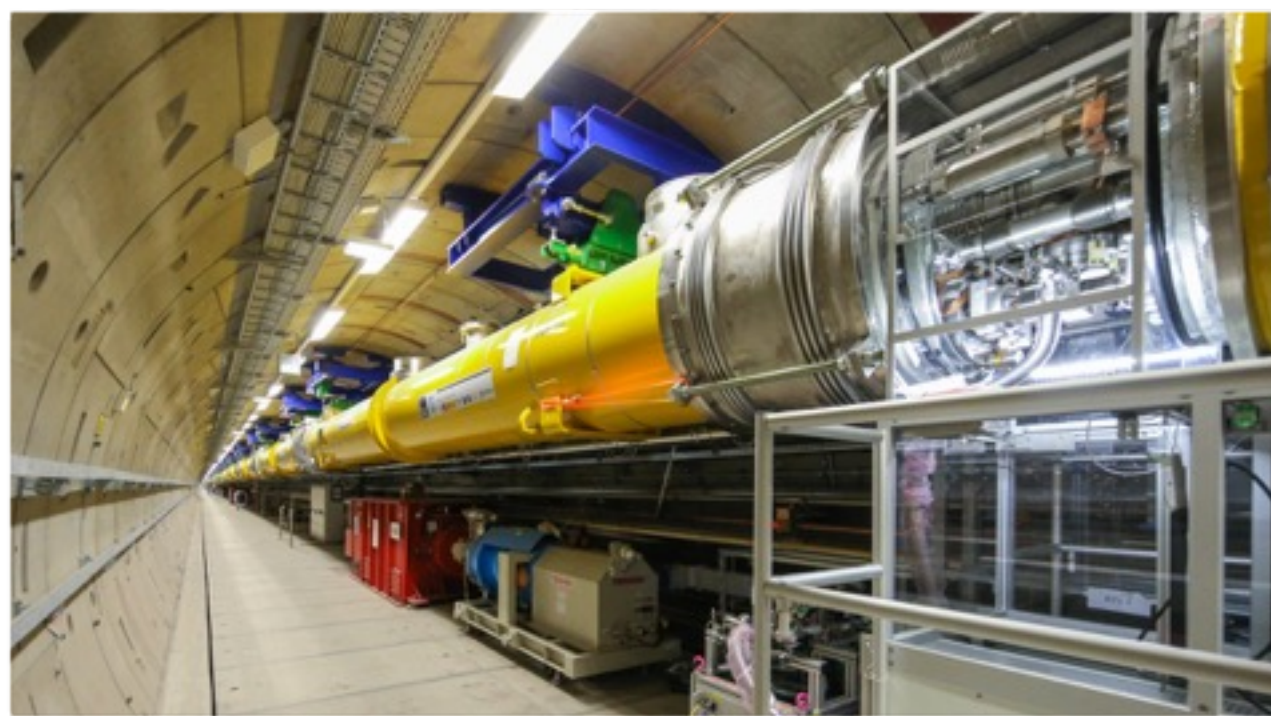
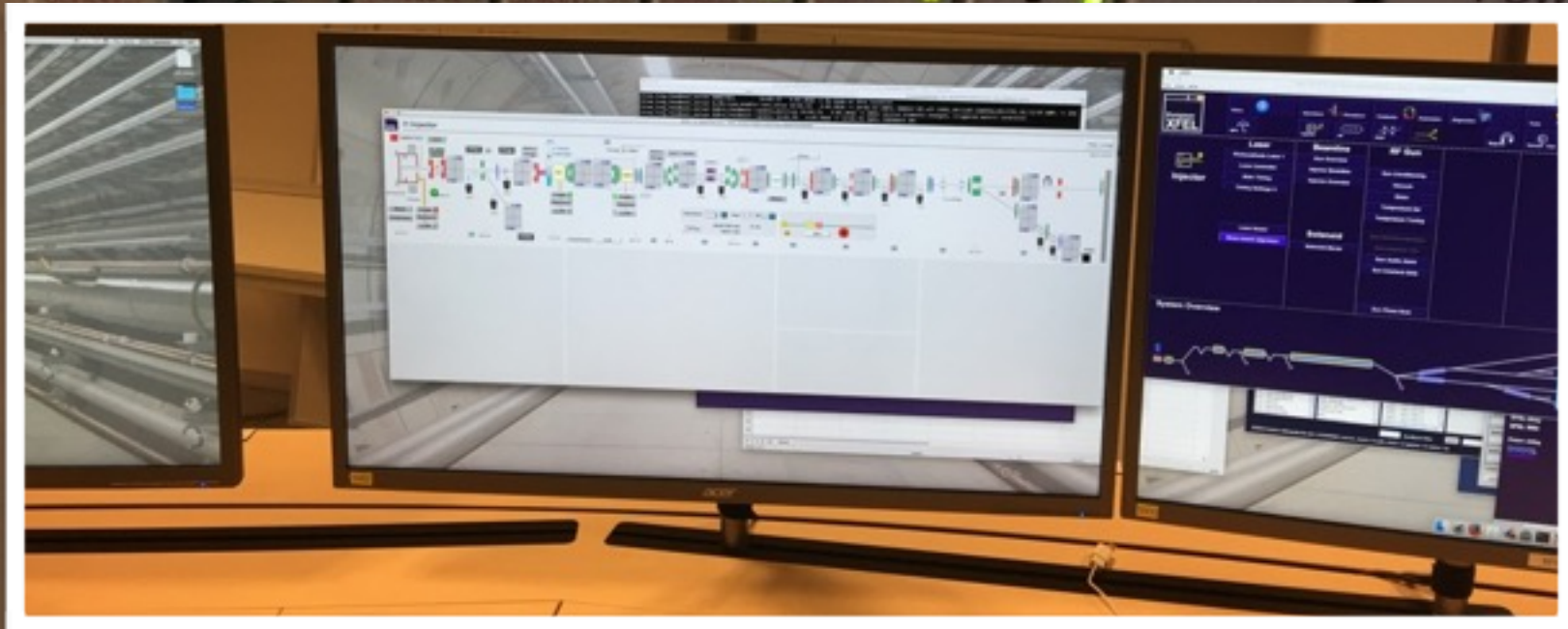
- Probably first installation will be in GSI at the FAIR/CBM experiment
- The timing module specification changed a little after we got feedback from potential users
- Main changes:
 - replacement of FPGA by ZynQ
 - fully redundant WR receiver (not only MAC)
 - additional clock paths and jitter cleaners.
 - Management interface also changed
 - since ZynQ is on board, we can run web interface directly on it
- Project Status:
 - Review of schematics by N.A.T.
 - Review of schematics as pdf by White Rabbit Community



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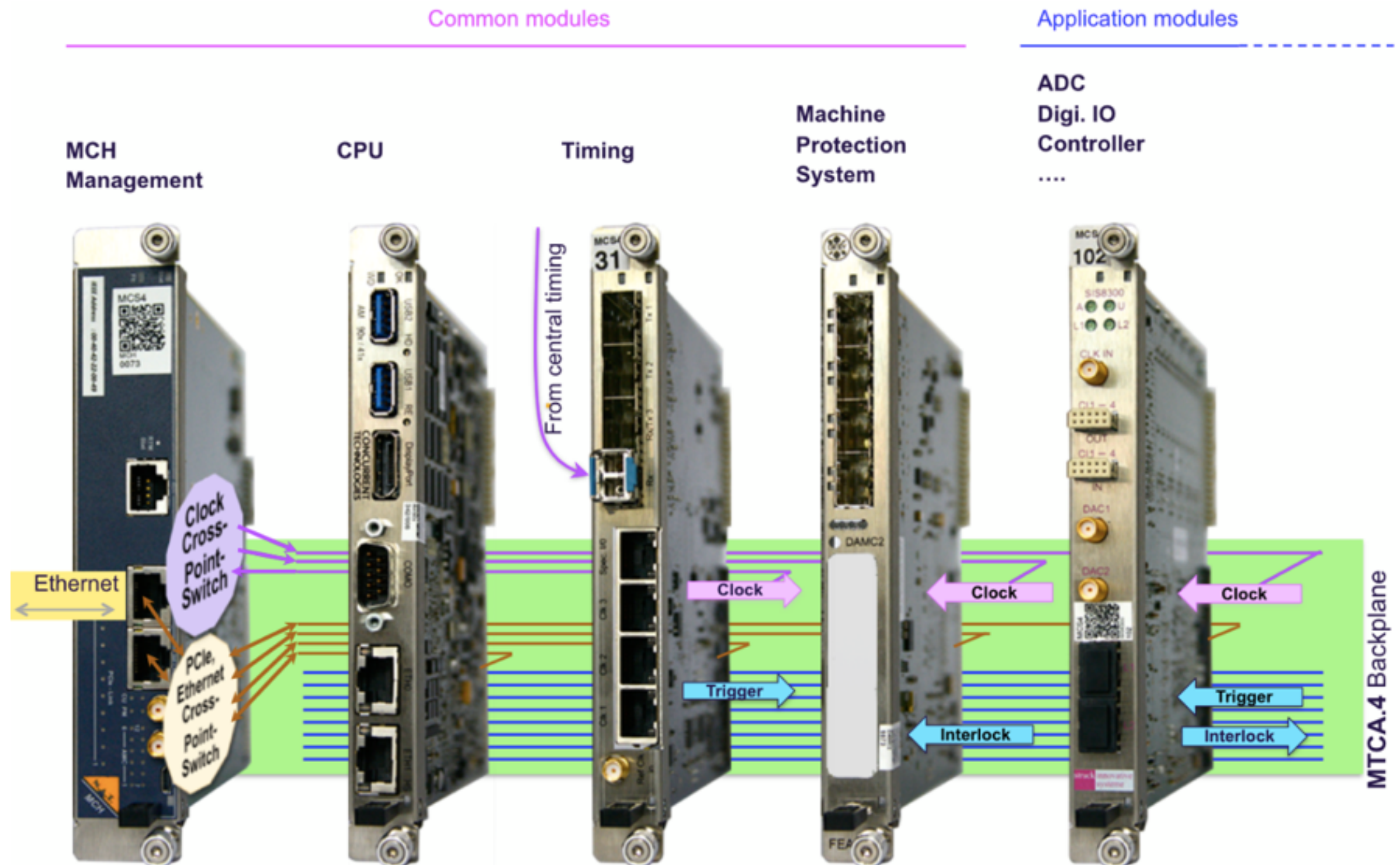
N.A.T. at and in DESY XFEL



NAMC-psTimer

Installation Example

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NAMC-psTimer

AMC Fast Timing System with pico-second Resolution

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- Double, mid-size AMC for MTCA.4 systems
- pico-second stable clock and trigger **distribution and receiving** system
 - Clocks and triggers are programmed & generated by a master module
 - distributed in a multi-star topology
- All triggers within the entire timing system are synchronized with a jitter of approximately 10ps.
- The receiver has 23 programmable outputs:
 - trigger with delay
 - immediate or delayed trigger events
 - gates between trigger events
 - slow clocks
 - two different slow data protocols
 - fast data protocol
- References for timing systems
 - large installation at European XFEL (X-Ray Free Electron Laser)
 - 365/24h installation at FLASH, no problems



NAMC-psTimer

AMC Fast Timing System with pico-second Resolution

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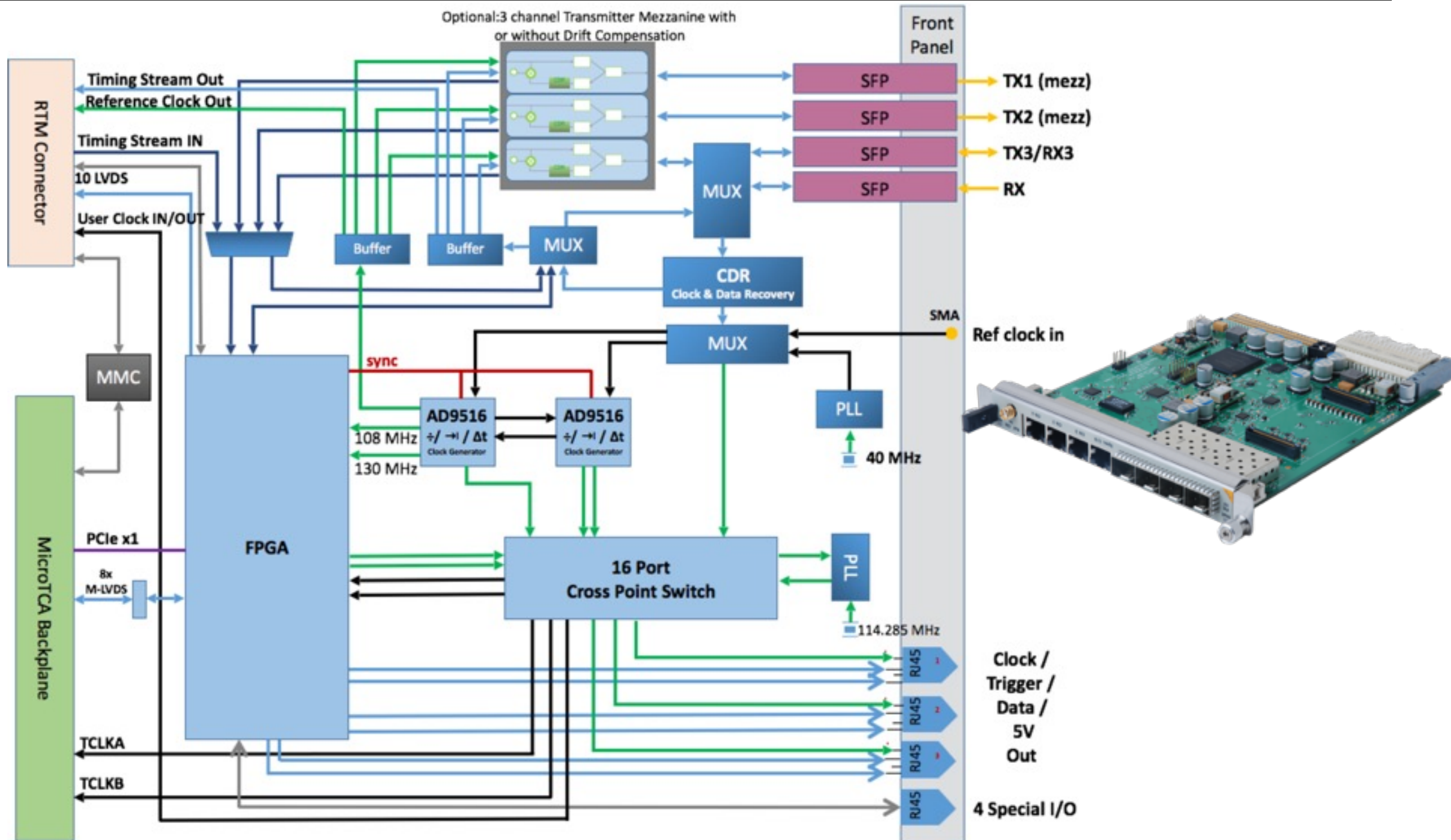
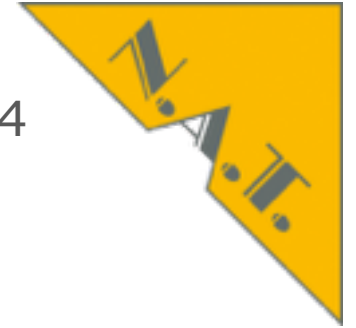
- Key Features:
 - can be used as a transmitter or receiver or gateway module
 - delivers precision clocks on TCLKA and TCLKB
 - provides triggers, gates, clocks or data on M-LVDS ports 17 - 20 in an MTCA.4 backplane
 - 3x RJ45 outputs at front panel with 2 triggers and one precision clock as LVDS signals
 - trigger position: 0 .. 160ms delay, 1ns resolution
 - trigger width: 0 .. 160ms, 10ns resolution
 - up to 255 trigger event numbers
 - precision clocks: 2.5 .. 650MHz
- Applications:
 - Diagnostic, Controls and Experiments
 - other distributed systems requiring very precise clock and trigger distribution, synchronous with for example the 1.3 GHz system RF-frequency, over distances of more than 3.4 km
 - Single stand-alone systems requiring high precise clock and trigger



NAMC-psTimer

Block Diagram

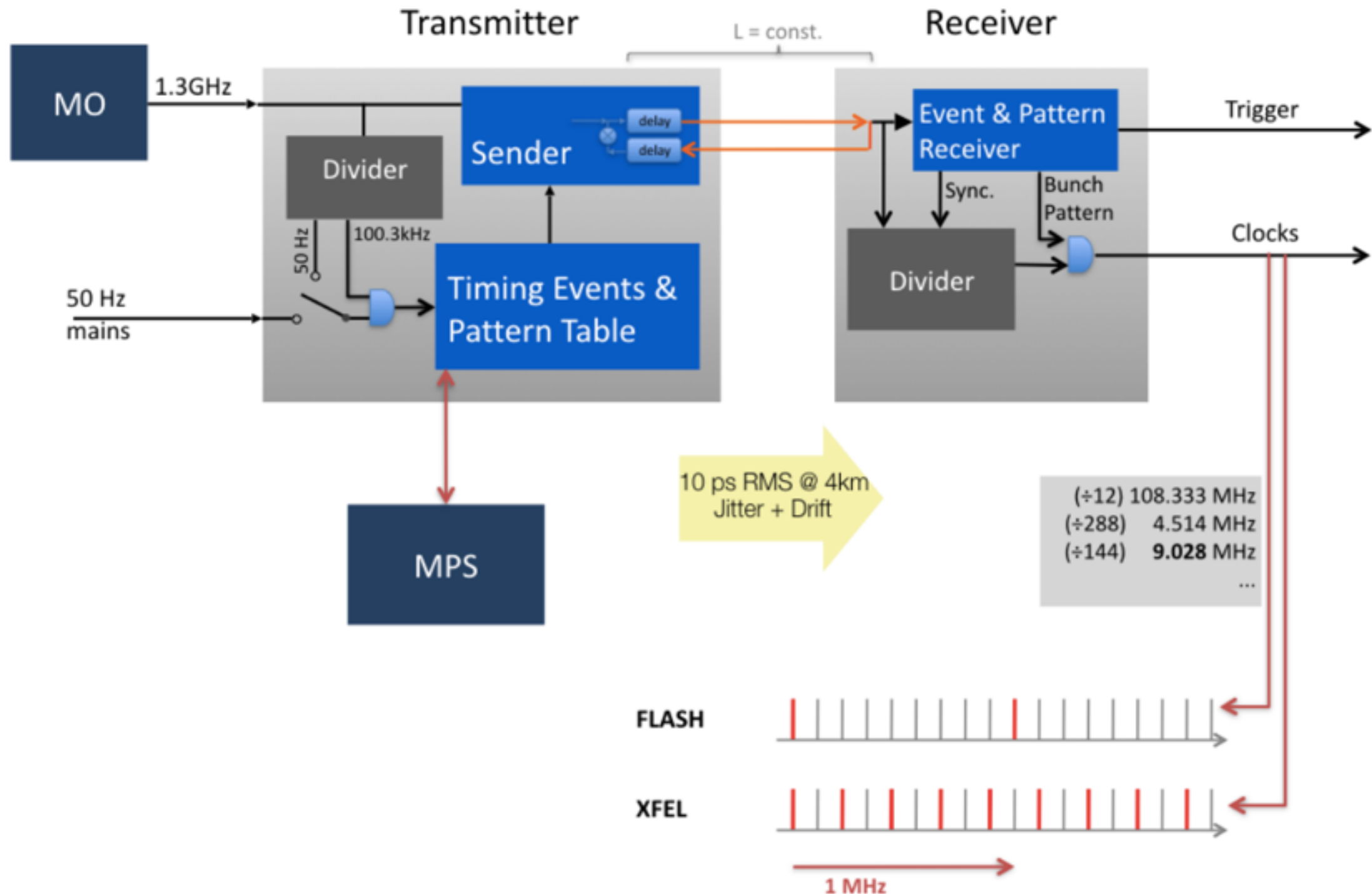
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Synchronisation simplified

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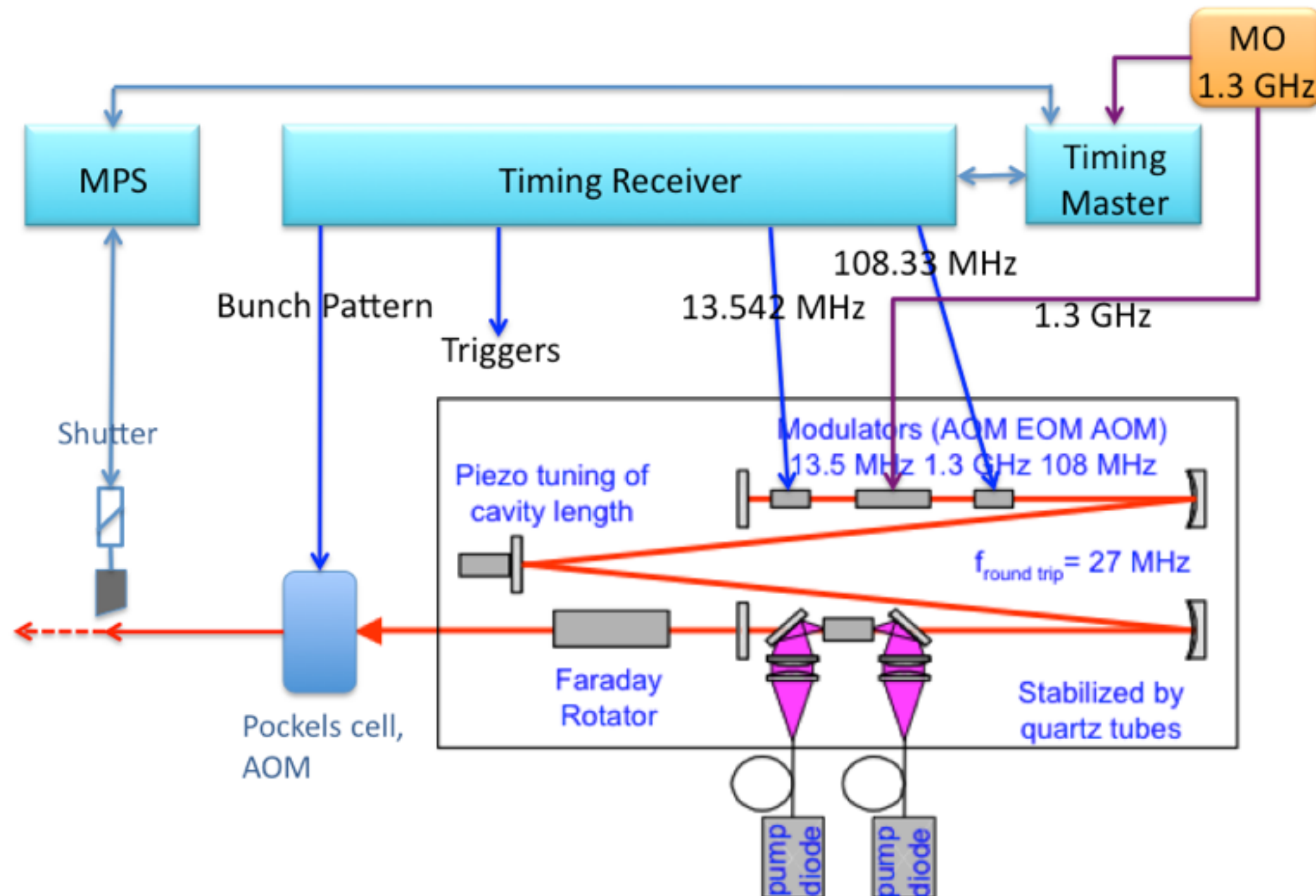


NAMC-psTimer

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Timing for the Injector Laser



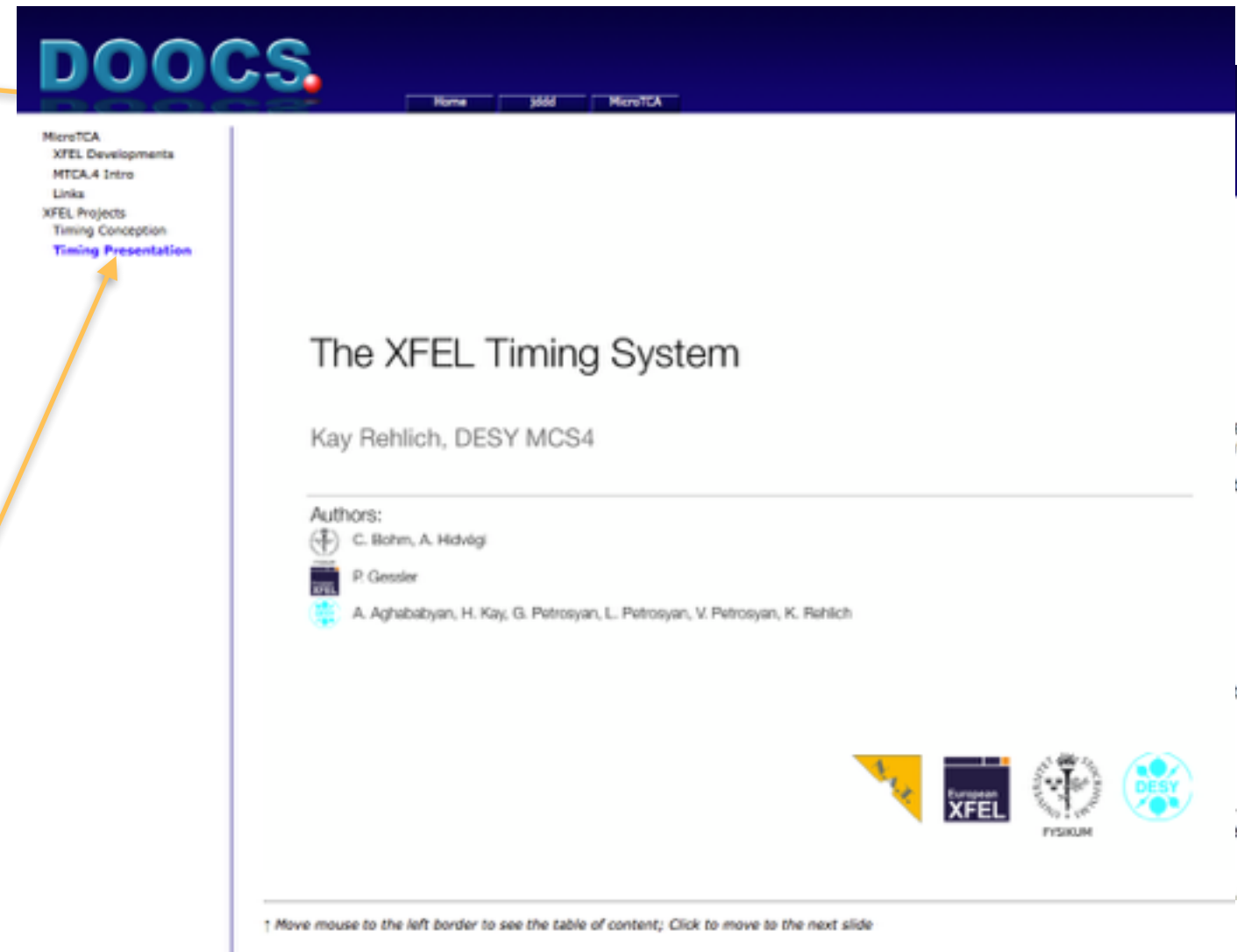
NAMC-psTimer

More Information and Application

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- <https://doocs.desy.de>
 - select MicroTCA
- MicroTCA
 - XFEL Developments
 - MTCA.4 Intro
 - Links
- XFEL Projects
 - **Timing Conception**
 - **Timing Presentation**





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Summary

- NAT-MCH-CLK-WR for single MCH (MTCA.0) and double MCH (MTCA.4)
 - mainly CERN and FAIR projects
 - need special external White-Rabbit-Ethernet Switches
 - does not consume any AMC slot
 - Competition:
 - Vadatech announced start of development of WR-Support for MCH
 - Samway/Elma have WR support for MCH but do not understand FPGA image
- NAMC-psTimer = x2Timer for MTCA.4 systems
 - same hardware used as transmitter and receiver
 - very flexible and powerful (up to external 9 + 4 trigger and clock lanes)
 - can distribute any data for example precise real time clock data
 - any application with need for precise timing information
 - FUTURE: may become also a MCH special clock module dependent on market request and success of White Rabbit MCH module
- MRF-Timer for MTCA.4 systems
 - expected to be used in ESS

Questions

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Danke
Thanks
Arigatô
Toda
Tack
Merçi
Xièxie
Graças
Dhanyavad
Gamsahamnida