



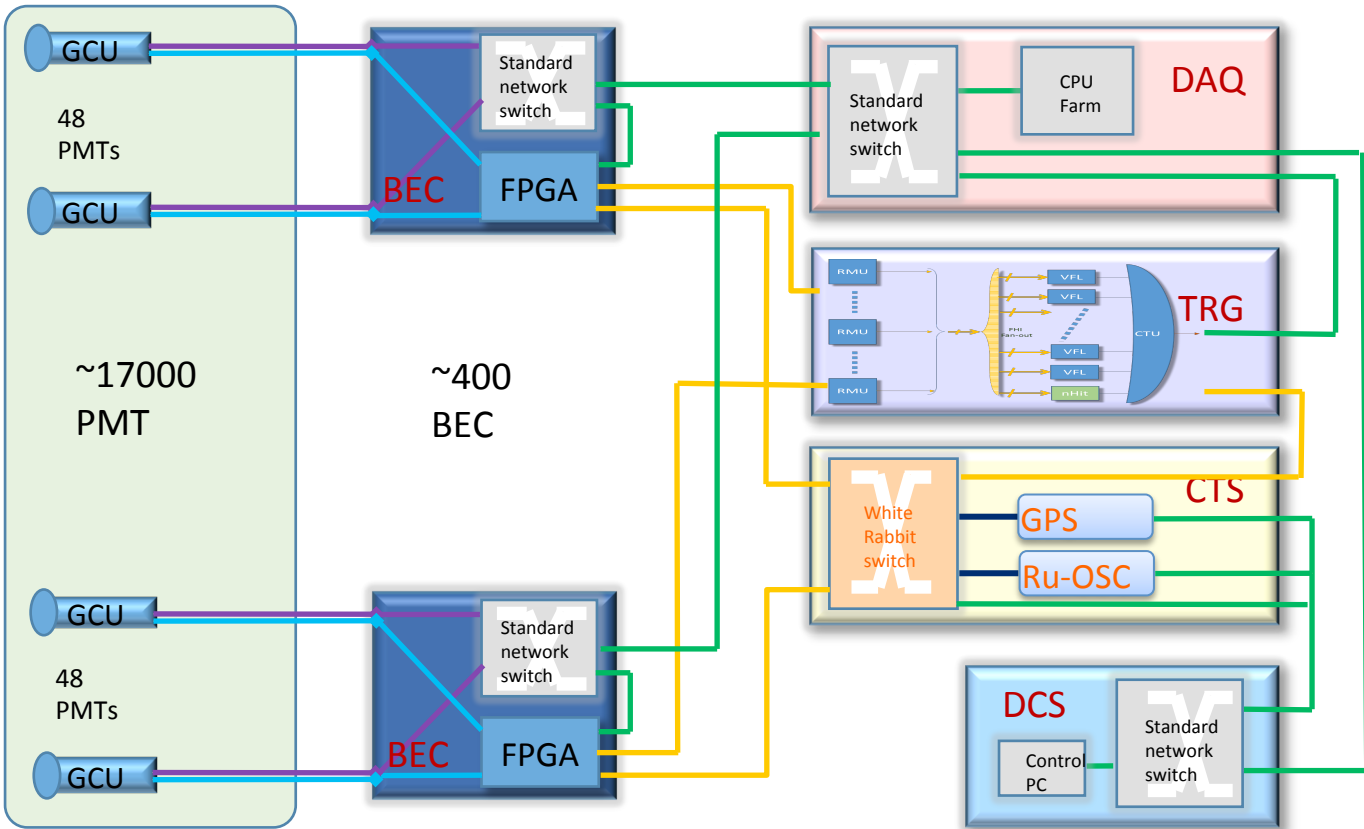
Trigger/timing progress and status

Guanghua Gong
Tsinghua University, Beijing

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JUNO Electronics Workshop, Brussels

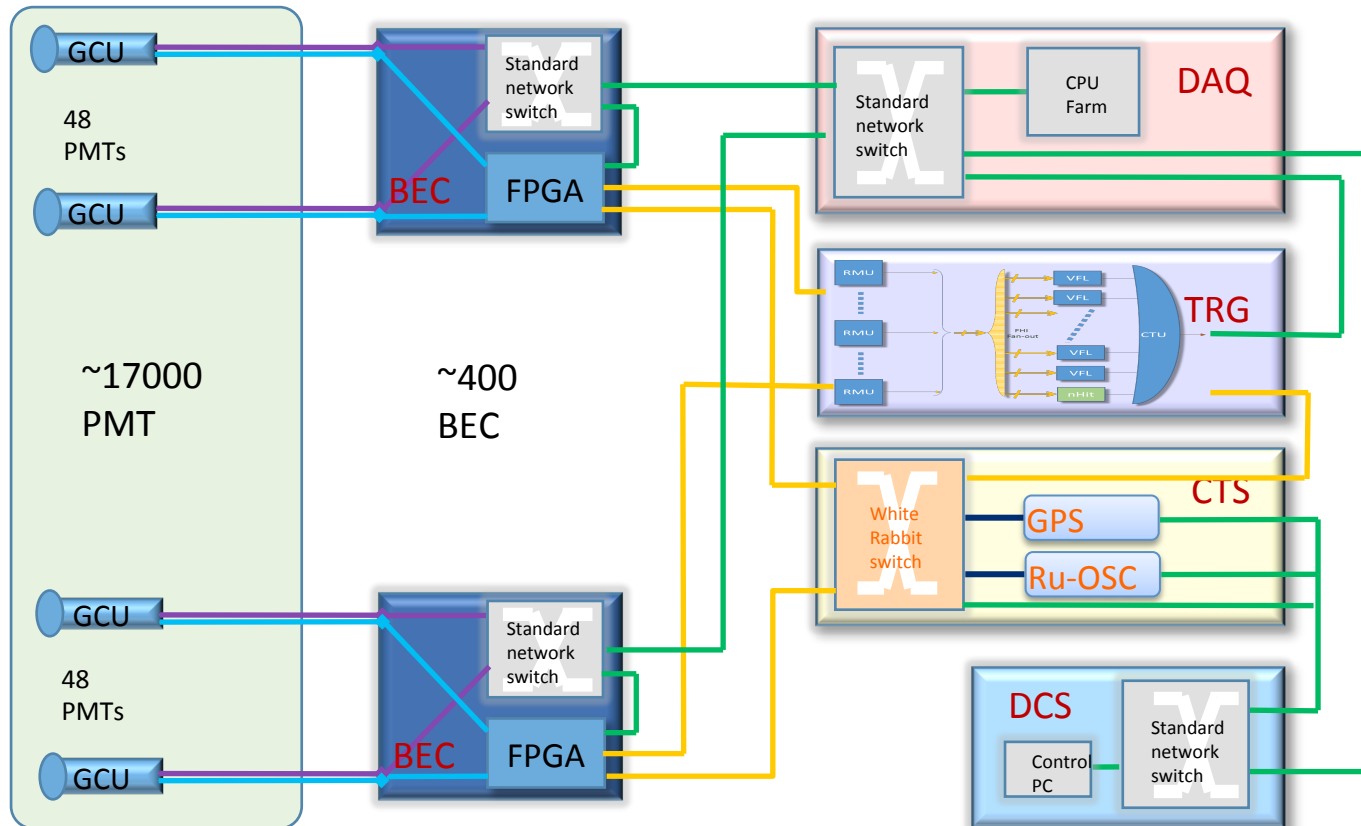
JUNO Electronics structure



Blue: Sync pair; Purple: Async pair; Green: Ethernet cable; Yellow: Optical fiber

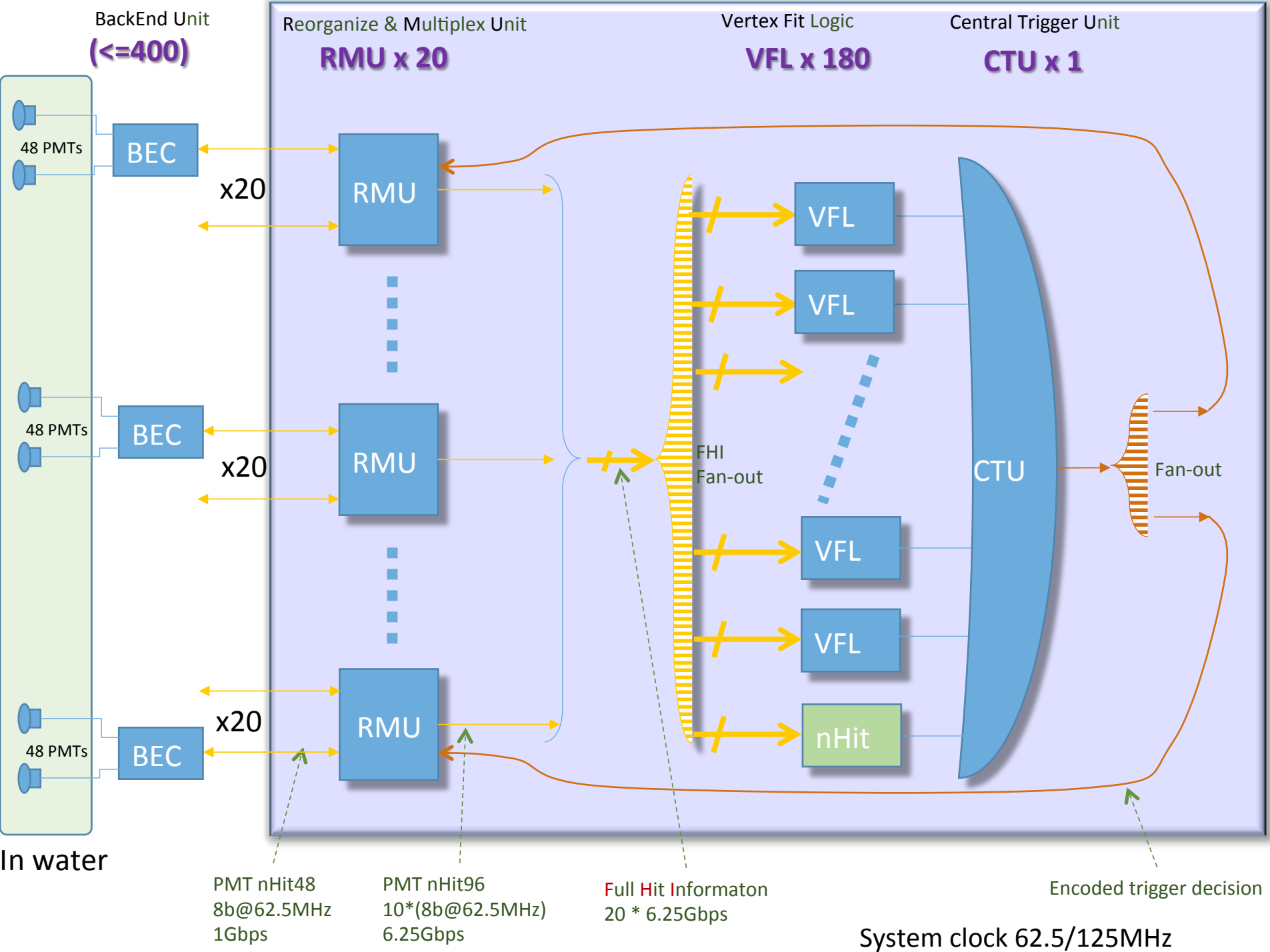
TRG: Trig system; CTS: Clock & Timing system; DCS: Detector control system

JUNO Electronics structure



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System components

- BEC
 - A TRG/TIMING interface mezzanine sitting on BEC
- RMU
 - Stand-alone modules
 - University of Roma Tre, Department of Mathematics and Physics

- VFU
- CTU

Centralize located in one rack!

MTCA.4 for JUNO-TRG

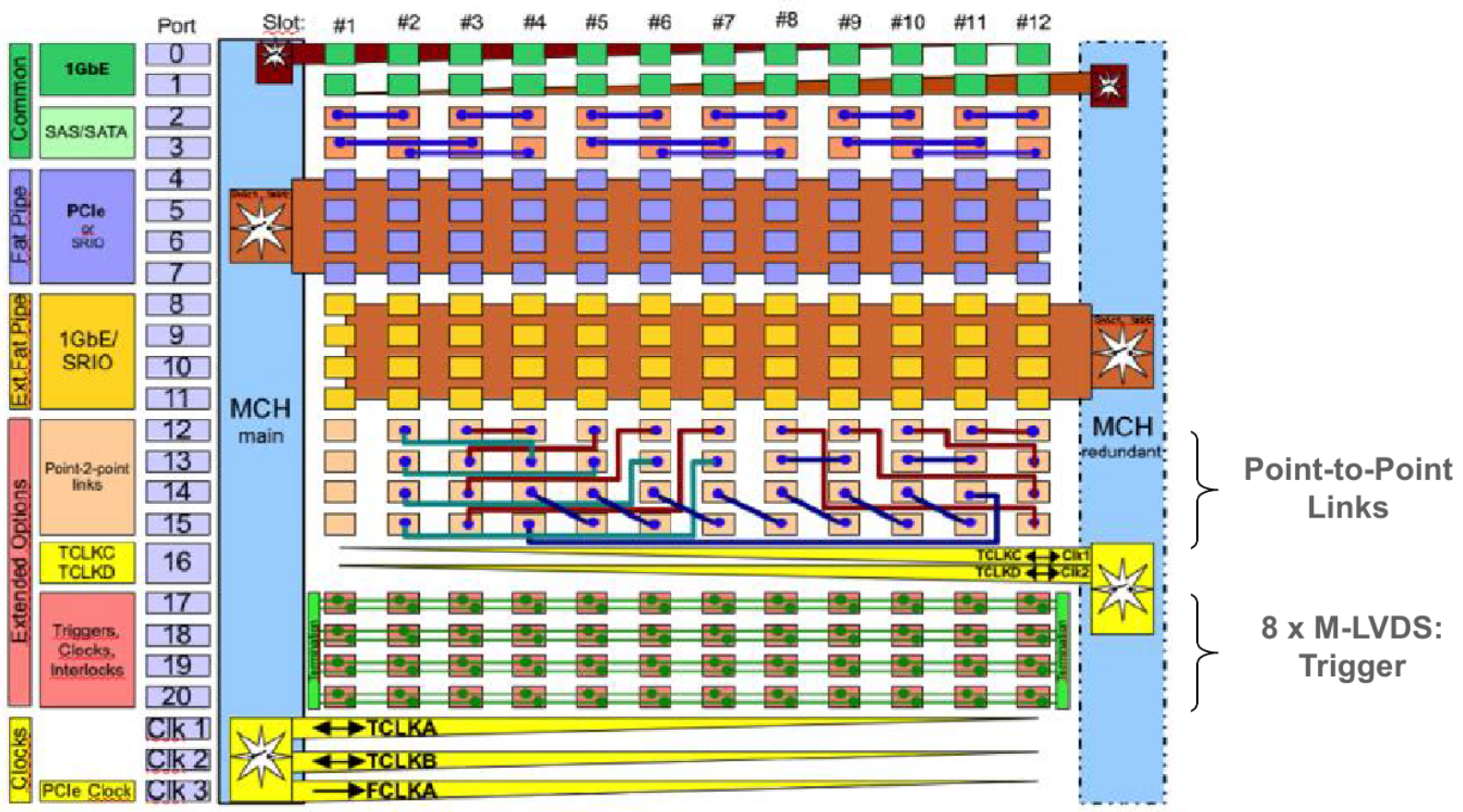
- ATCA and MicroTCA is the first platform available to the physics community providing:
 - all-serial communication platform;
 - both complex experiment controls and large, high bandwidth and throughput data acquisition systems;
 - a multi-layer highly scalable managed platform architecture;
 - the highest possible system performance, availability and interoperability.
- xTCA for Physics extensions goal:
 - Improve the management system that is an important tool for the instrumentation and control systems of complex scientific machines and instruments;
 - Extend the ATCA and MTCA telecom standards hardware for physics controls and applications;
 - Provide Software Guidelines to promote interoperability of modules designed by industry and laboratories, in particular focusing on middleware and generic application interfaces such as Standard Process Model, Standard Device Model and Standard Hardware API.

MTCA.4 for JUNO-TRG

- To achieve **high availability** in a complex physics system requires three main features common to ATCA/ μ TCA:
 1. **Modular** architecture
 2. **N+1 or N+M redundancy** of single-point-of-failure modules (whose malfunction could stop operation of the machine or experiment)
 3. **Intelligent platform management** for quick isolation of faults and **hot-swap**
- In addition, physics modules need a few extended features not covered by current specifications:
 4. **Rear transition modules** (RTM) with standardized interconnects and management features
 5. Extended **real estate on cards** for high performance analog conversion, signal conditioning and calibration circuitry
 6. Extended options for backplane **distribution of high precision timing, triggering and machine synchronization** of modules and groups of modules
- The goal of xTCA is to accomplish the latter features with **backward compatibility** to existing designs of processors, modules or carrier cards that use the **standard backplane**.

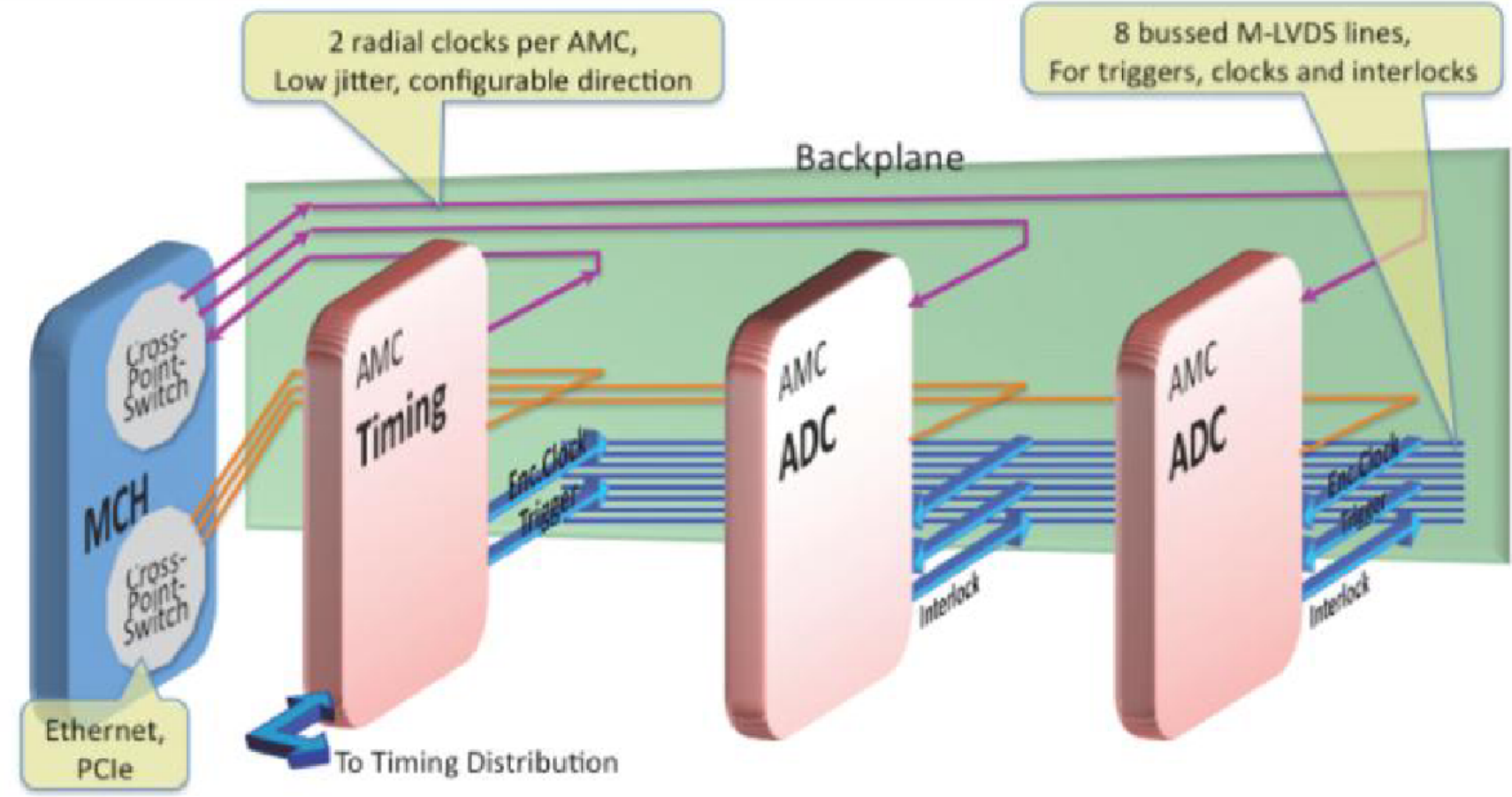
MTCA.4 for JUNO-TRG

12-Slot MTCA.4 Backplane



MTCA.4 for JUNO-TRG

Clock, Trigger and Interlock Signals



MTCA.4 for JUNO-TRG

No	Part	Description	UNIT price	QTY	total
1	NATIVE-R9	9U高, 19吋上架机箱 12个double mid-size槽位 2个MCH槽位 4个double full-size 电源槽位 12个RTM double mid-size槽位 1个JSM槽位	¥46,900.00	1	¥46,900.00
2	NAT-MCH-PHYS80	double full-size MCH 支持系统管理功能 支持12个AMC槽位千兆以太网交换, 2个GbE uplink口 支持12个AMC槽位PCIe x4交换, 16x PCIe lane到Zone3, 16x PCIe lane到前面板 支持PCIe SSC(spread spectrum clock) 时钟源可来自前面板或AMC卡	¥29,591.00	1	¥29,591.00
3	NAT-PM-AC600D	double full-size 600W AC电源	¥10,810.00	1	¥10,810.00
4	NAMC-EXT-RTM-F-PS	double full-size AMC扩展卡, 可将前板背板上的信号引出, 进行调试。 板上可供3.3V, 支持stand-alone模式	¥9,283.00	1	¥9,283.00
5	NAMC-EXT-RTM-R	double full-size AMC扩展卡, 可将RTM卡背板上的信号引出, 进行调试。	¥8,345.00	1	¥8,345.00
6	NAT-JSM	jatagi调试卡	¥8,345.00	1	¥8,345.00

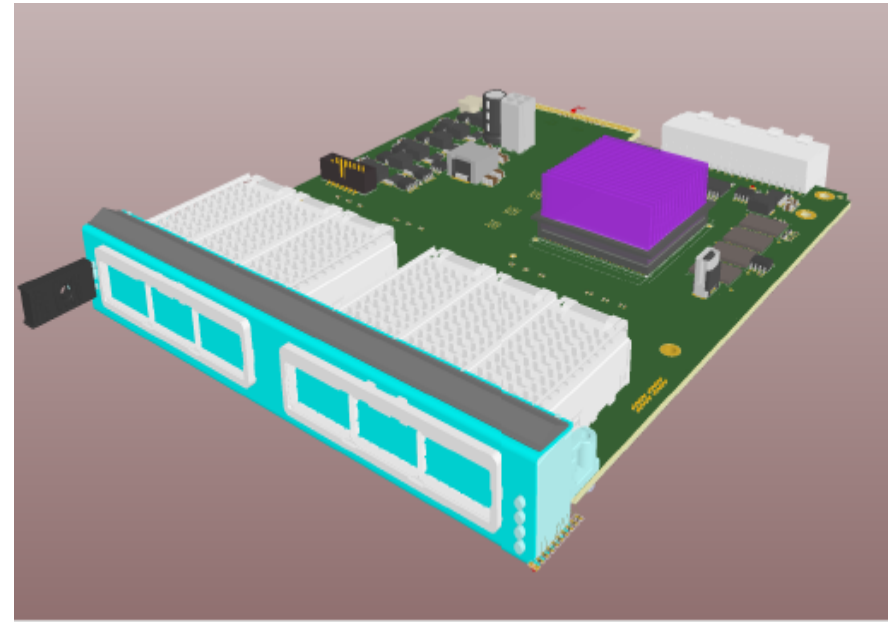


Order has been made, will arrive in one month

MTCA.4 Modules for JUNO-TRG

AMC FPGA QSFP board

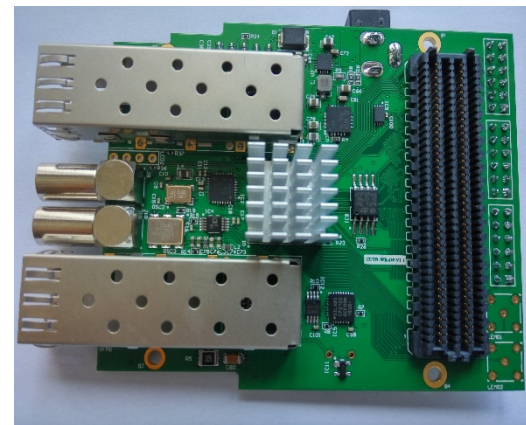
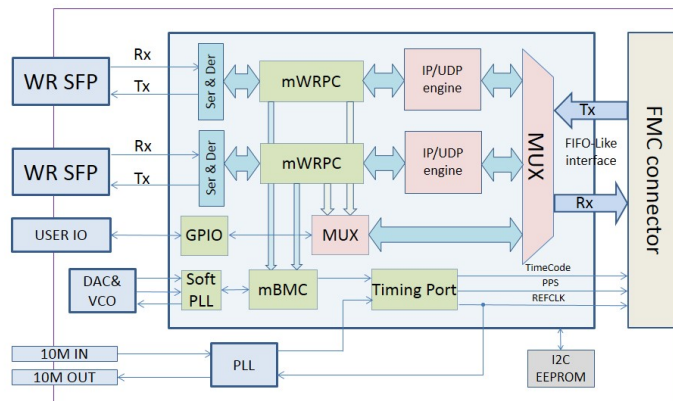
- Kintex Ultra Scale FPGA
- 6 QSFP, 24 x10Gbit/s optical links
- RTM for additional QSFP and SFP+ optical transceivers
- clock distribution circuit with crosspoint switch, VCX0
- WR clock recovery
- DDR3 SRAM, 800MHz, 3 individual
- Dual configuration FLASH.



Prototype is designed by WUT for CBM experiment, under OPEN hardware license.

Trigger/Timing interface for BEC

- Dedicated fiber interface for trigger
 - Sum of 48 hits on each clock cycle on up-link
 - Real-time trigger decision on down link
- Dedicated fiber interface for timing
 - Carries 125MHz /UTC clock /Phase correction information on L1/L2 with white rabbit protocol
 - Also bridges BEC control information to control system
- A dual-port white rabbit mezzanine under development
- A third link to inject trigger decision information into BEC data switch in under consideration



Summary

- Components and interface are clearly defined.
- MTCA.4 based structure for Fitting part of JUNO trigger will be built.
- Reference design for VFU available, modification and optimizations are under discussion
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- Developing of BEC TRG/Timing interface mezzanine is under going.