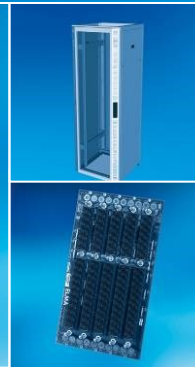




ELMA
Your Solution Partner



ELMA MTCA.4

3rd MTCA Wokshop

Aksel Saltuklar

Overview

System Solutions

Integrated Systems Chassis Platforms Backplanes Embedded Products Cabinets

Enclosures & Components

Enclosures Front Panels Handles

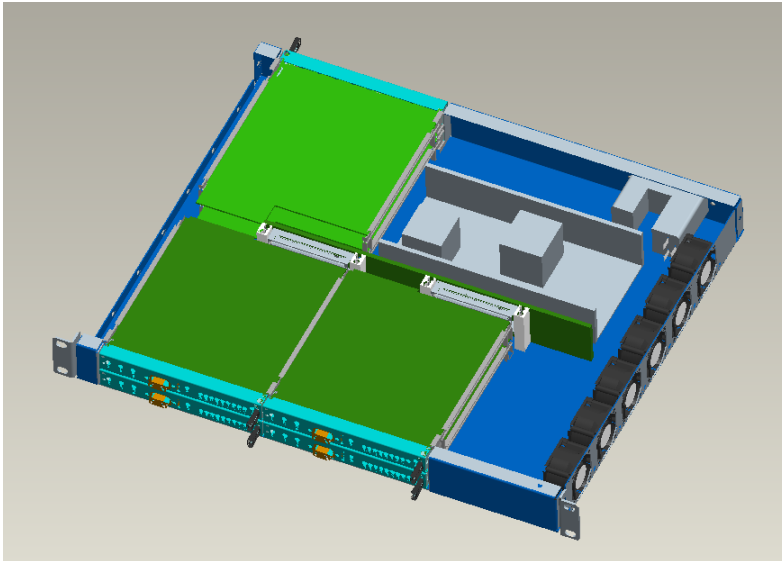
Rotary Switches

Switches/Encoders Knobs LEDs

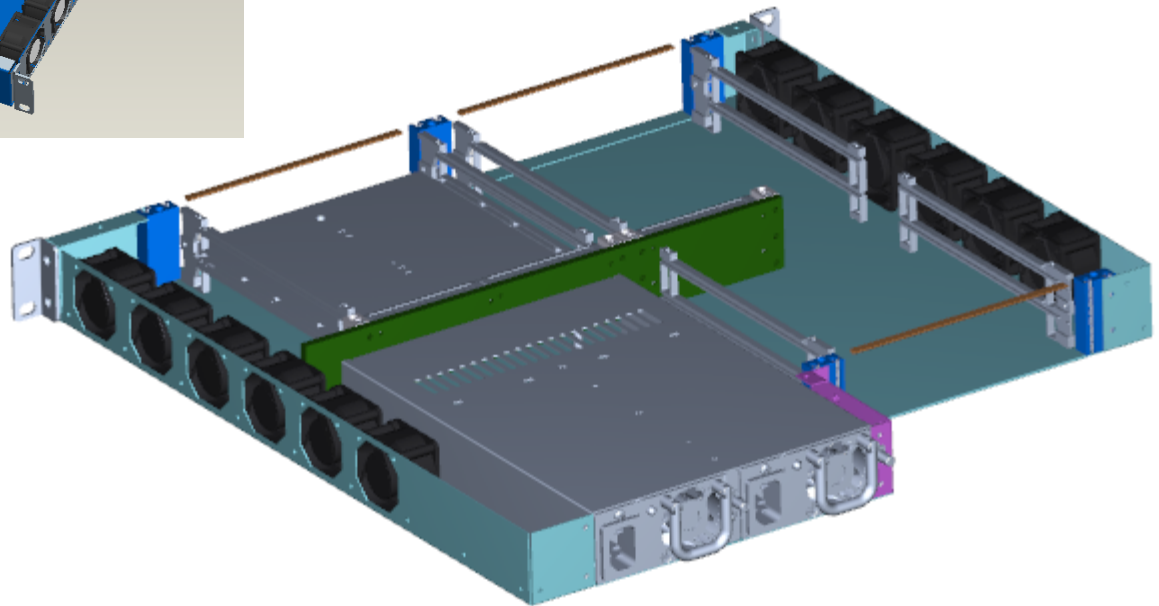


- MTCA.4 crate news
- ELMA MCH INSTR
- Demonstration

MTCA.4 1U System platform



- 2x MTCA.4 front and rear slots
- 1x CPU slot
- 300 Watt single/redundant PSU
- Cooling unit pull // push pull



MTCA.4 2U System platform

- 6x MTCA.4 front and rear slots
- 600 Watt single PSU
- Cooling unit pull // push pull

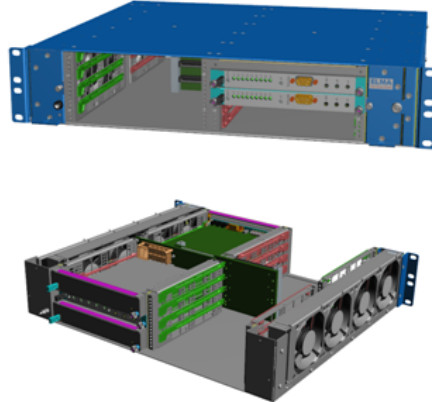


MTCA.4 2U System platform

050-145

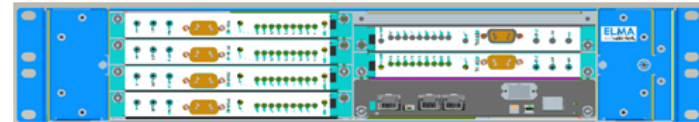
2U MTCA.4 crate

- side to side air flow
- 6x MTCA.4 AMC's including RTMs
- Redundant Cooling units
- Redundant 600 Watt PSUs (option)
- Different variants possible
- optional port 17-20 connection to MCH



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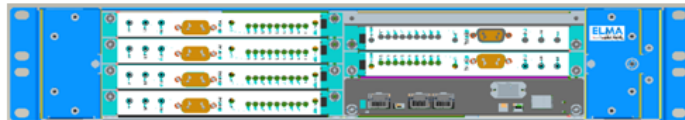
SYSTEM EQUIPPED WITH RTM for MCH
FRONT VIEW



REAR VIEW



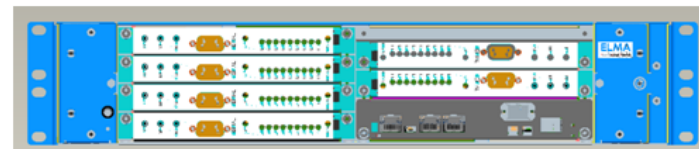
SYSTEM WITHOUT RTM for MCH
FRONT VIEW



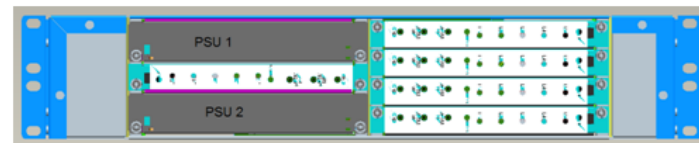
REAR VIEW



SYSTEM WITH 2 x PSU and NO RTM for MCH
FRONT VIEW

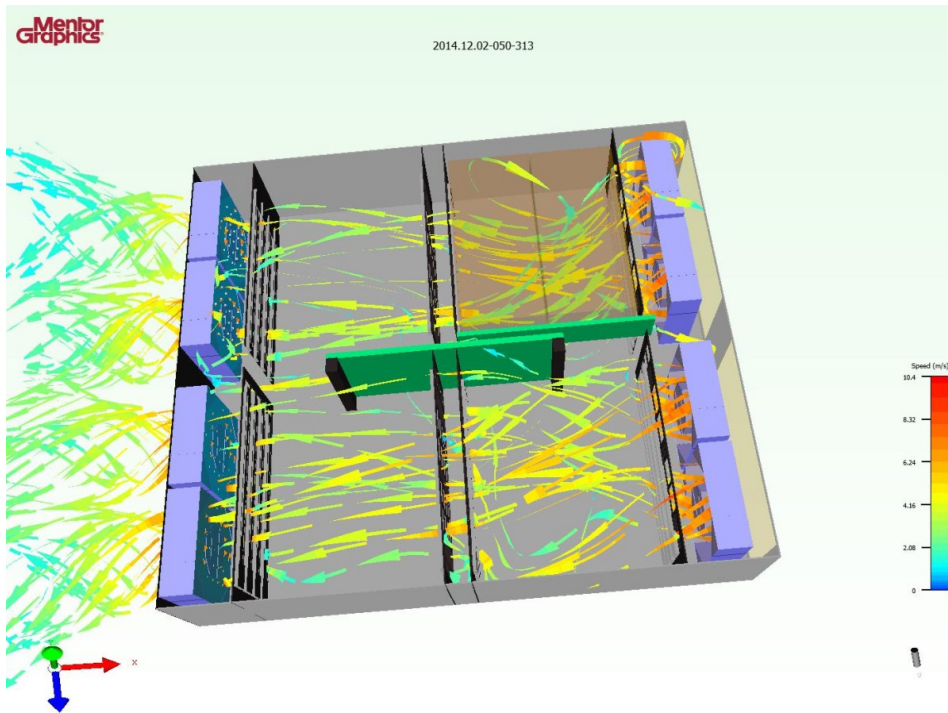


REAR VIEW

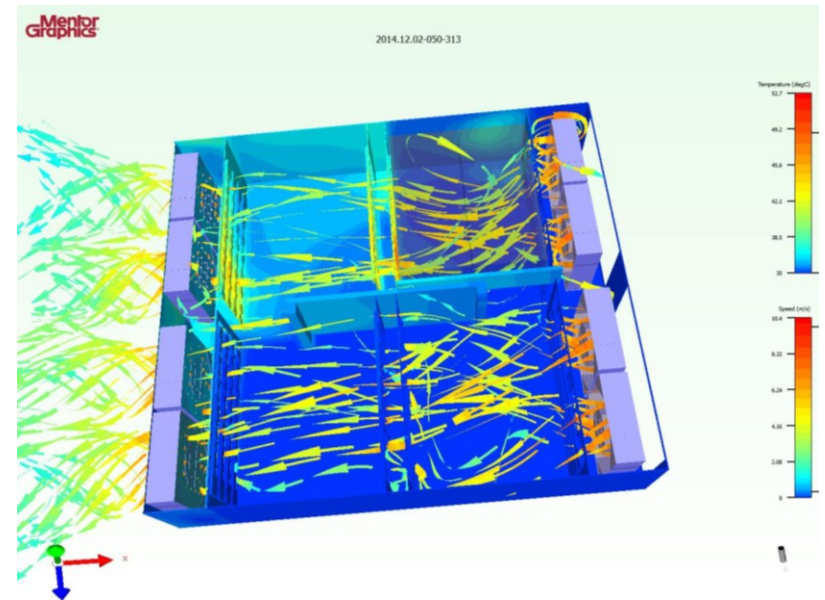


MTCA.4 2U System platform

Temperature



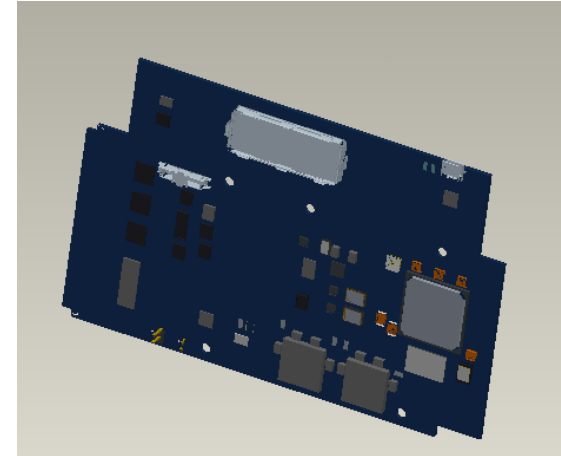
Air flow rate



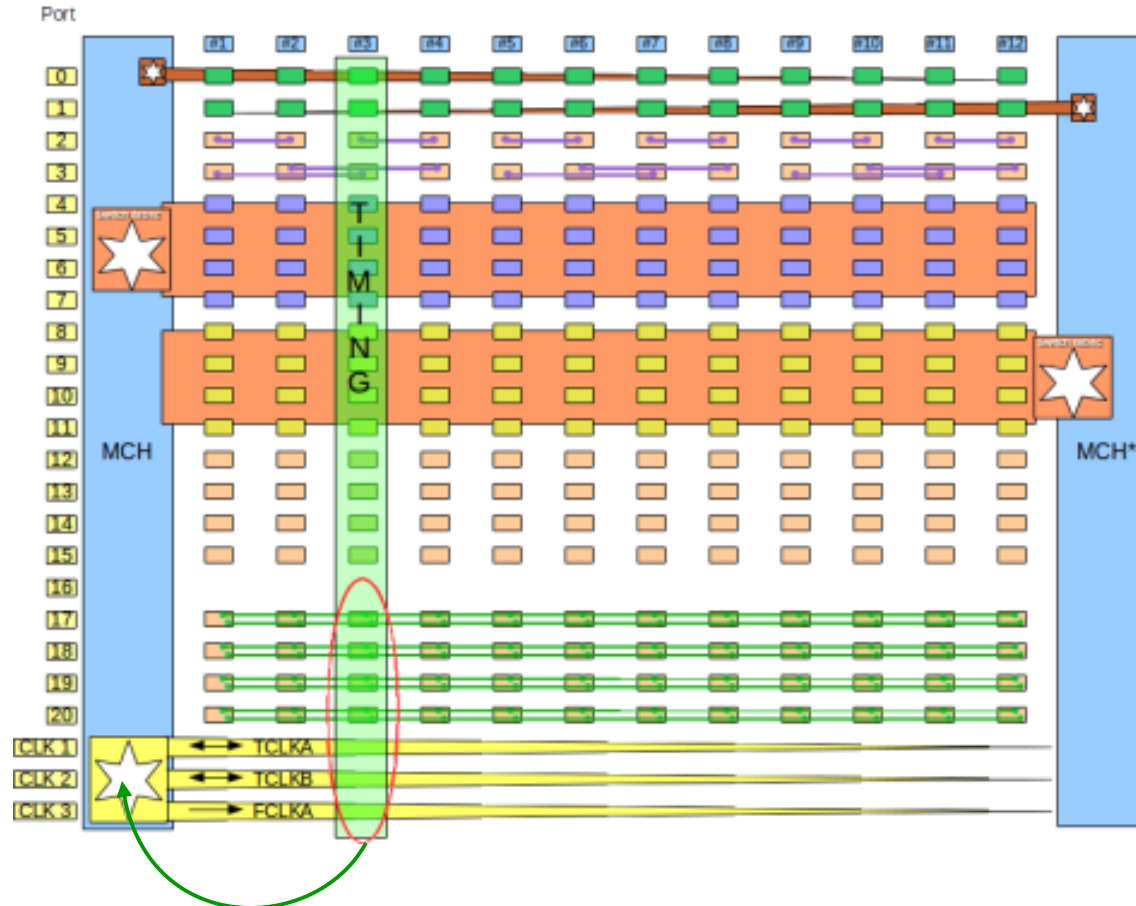


MTCA.4

improvements



The speciality of the ELMA MCH INST is, that the tongue 2 is a timing/synchronisation tongue based on an FPGA

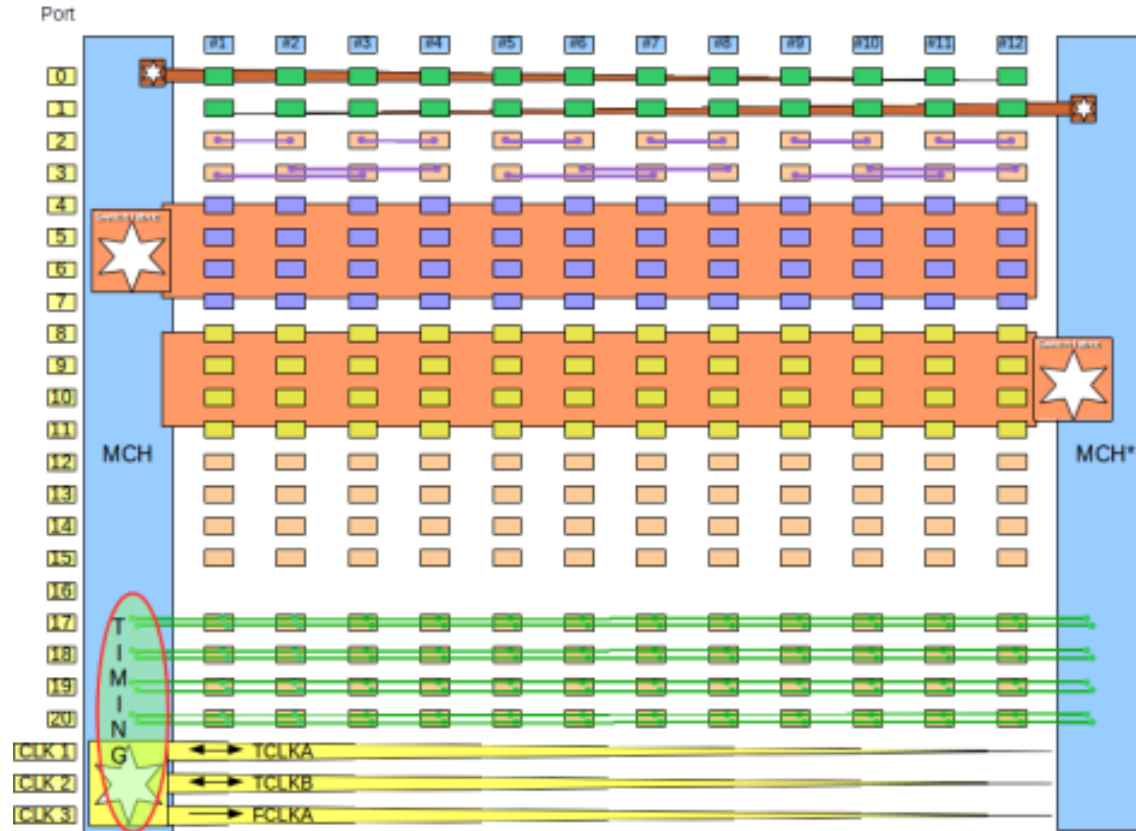


Each DAQ/Control System has timing

Clock signal recovered/generate in AMC slot send to MCH and then distributed – added jitter ↑↑↑

ELMA-MCH-INSTR

Timing integration into MCH



Reduced added jitter

Save slot for application

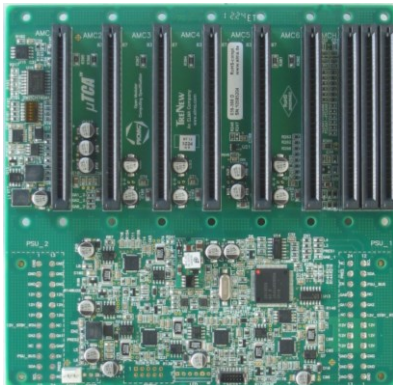
Backplane variants



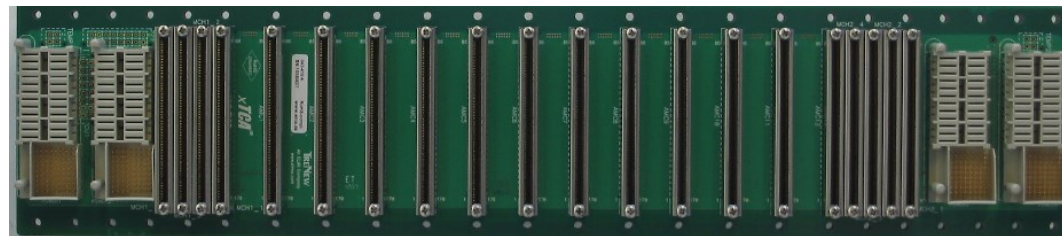
1x MCH



1,5x MCH



1x MCH



2x MCH

MTCA 6 slot crate

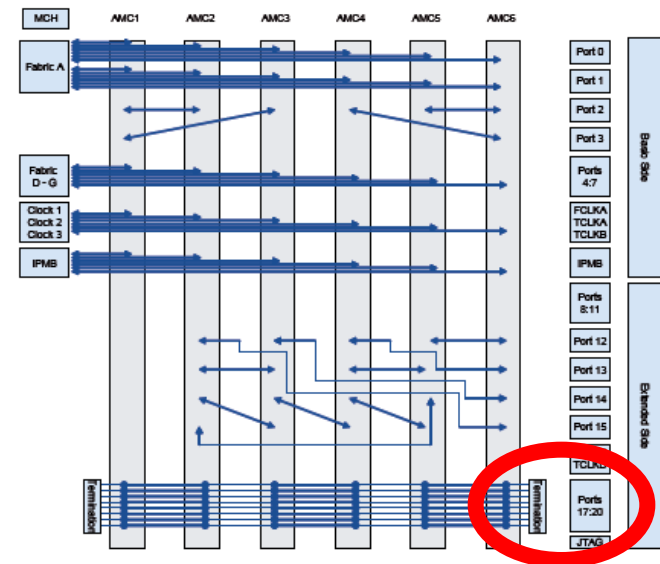
XTCA-6 Slot

- 6 mid size double units in front and rear
- PSU 600W

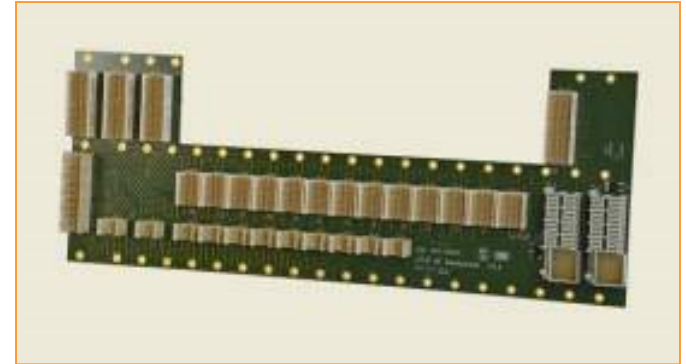


ELMA DATASHEET

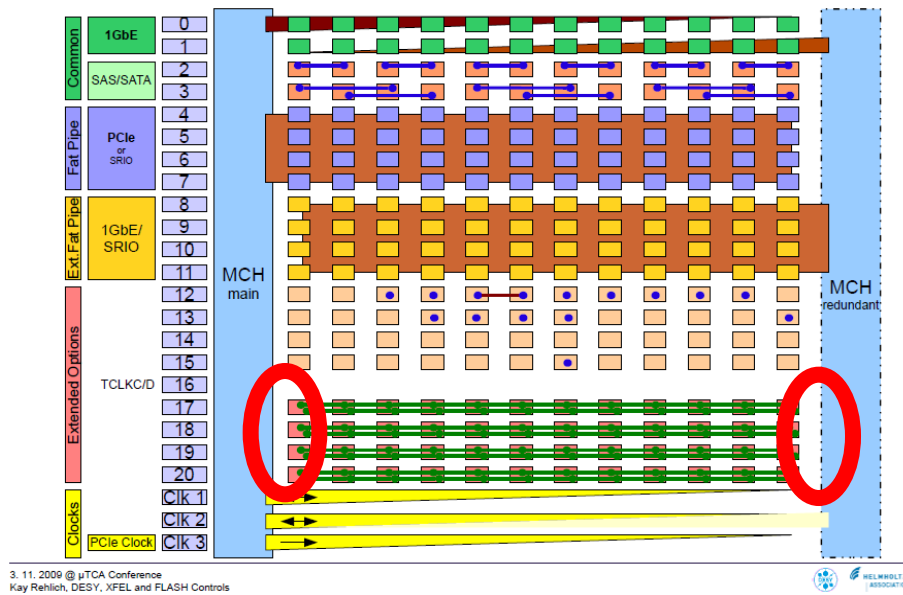
039-351



MTCA 12 slot LLRF crate

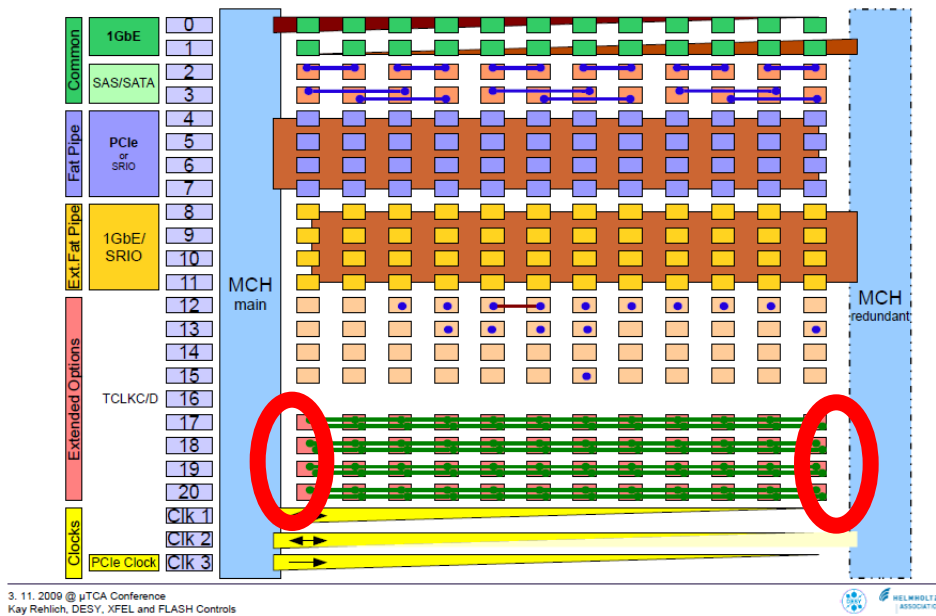


MTCA 12 slot LLRF crate



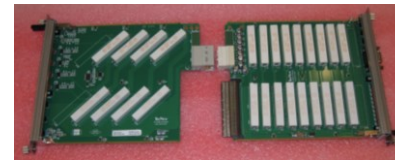
MTCA 12 slot PICMG crate

2x redundand MCHs



JTAG communication

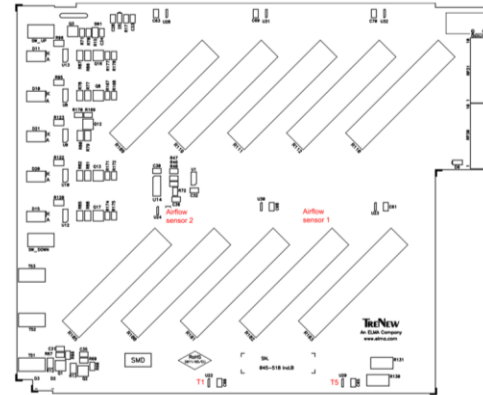
Temperature & airflow tests



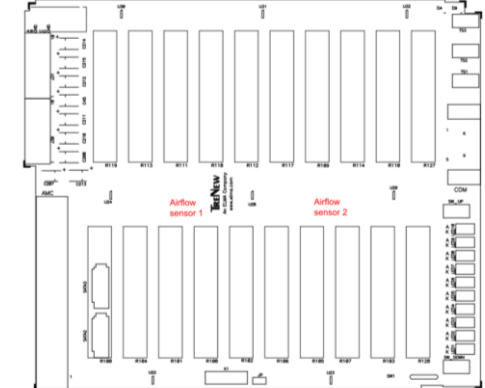
4. Temperature measurement with 80W Load on each AMC

	Temp 1	Temp 2	Temp 3	Temp 4	Temp 5	Temp 6	Temp 7	Temp 8
AMC 1	31	30	44	56	49	37	48	37
AMC 2	31	30	43	54	46	36	47	36
AMC 3	31	29	44	56	48	36	48	35
AMC 4	32	30	45	58	50	38	49	37
AMC 5	33	31	45	60	51	39	49	38
AMC 6	33	32	44	56	49	38	47	37
AMC 7	30	30	42	56	49	38	48	37
AMC 8	31	31	43	56	48	37	47	37
AMC 9	30	30	43	57	48	37	47	37
AMC 10	32	30	44	58	48	38	48	38
AMC 11	31	30	44	57	49	37	46	36
AMC 12	32	30	43	54	48	37	45	36

Table 2. Measurements results in °C



Picture 5. Position of the airflow sensors on the RTM load board

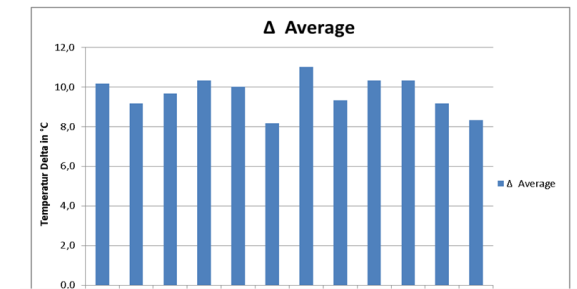


Picture 4. Position of the airflow sensors on the AMC load board

7. Airflow measurements on each RTM Slot

	Air speed on RTM Slots		
	Sensor 1 m/s	Sensor 2 m/s	Average m/s
RTM 1	0,73	1,2	0,97
RTM 2	0,36	1,67	1,02
RTM 3	0,49	1,57	1,03
RTM 4	1,65	1,54	1,60
RTM 5	1,16	1,15	1,16
RTM 6	1,33	0,56	0,95
RTM 7	1,22	0,9	1,06
RTM 8	0,39	1,77	1,08
RTM 9	0,67	1,81	1,24
RTM 10	1,12	1,74	1,43
RTM 11	1,2	0,82	1,01
RTM 12	0,82	1,34	1,08

Table 4. Airspeed measurements results in m/s





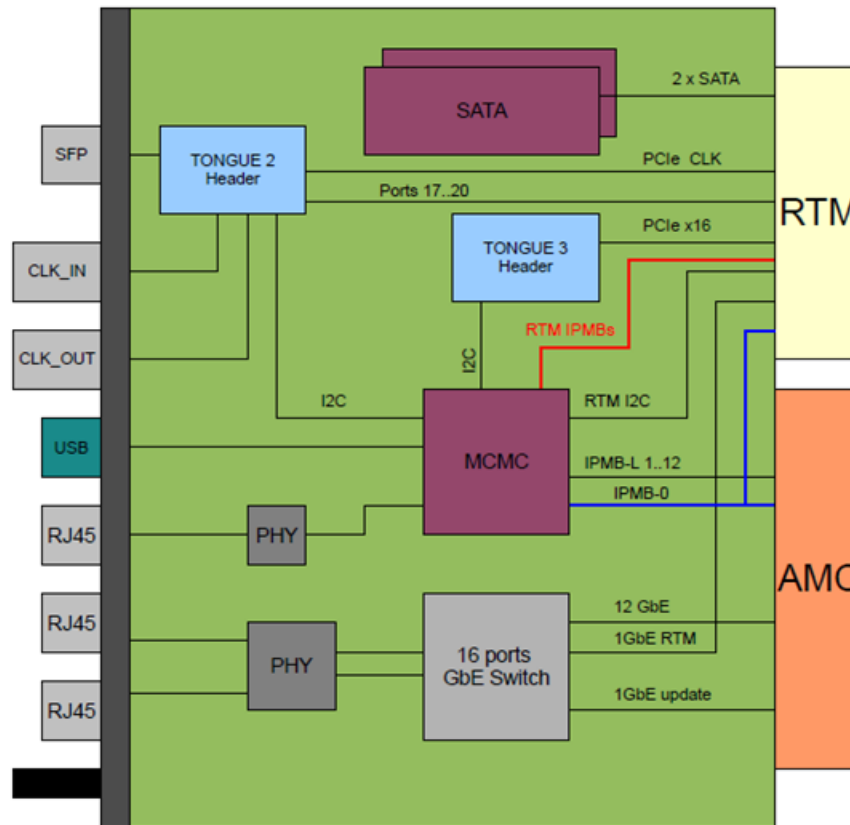
 **ELMA-MCH-INSTR**

Features at a glance

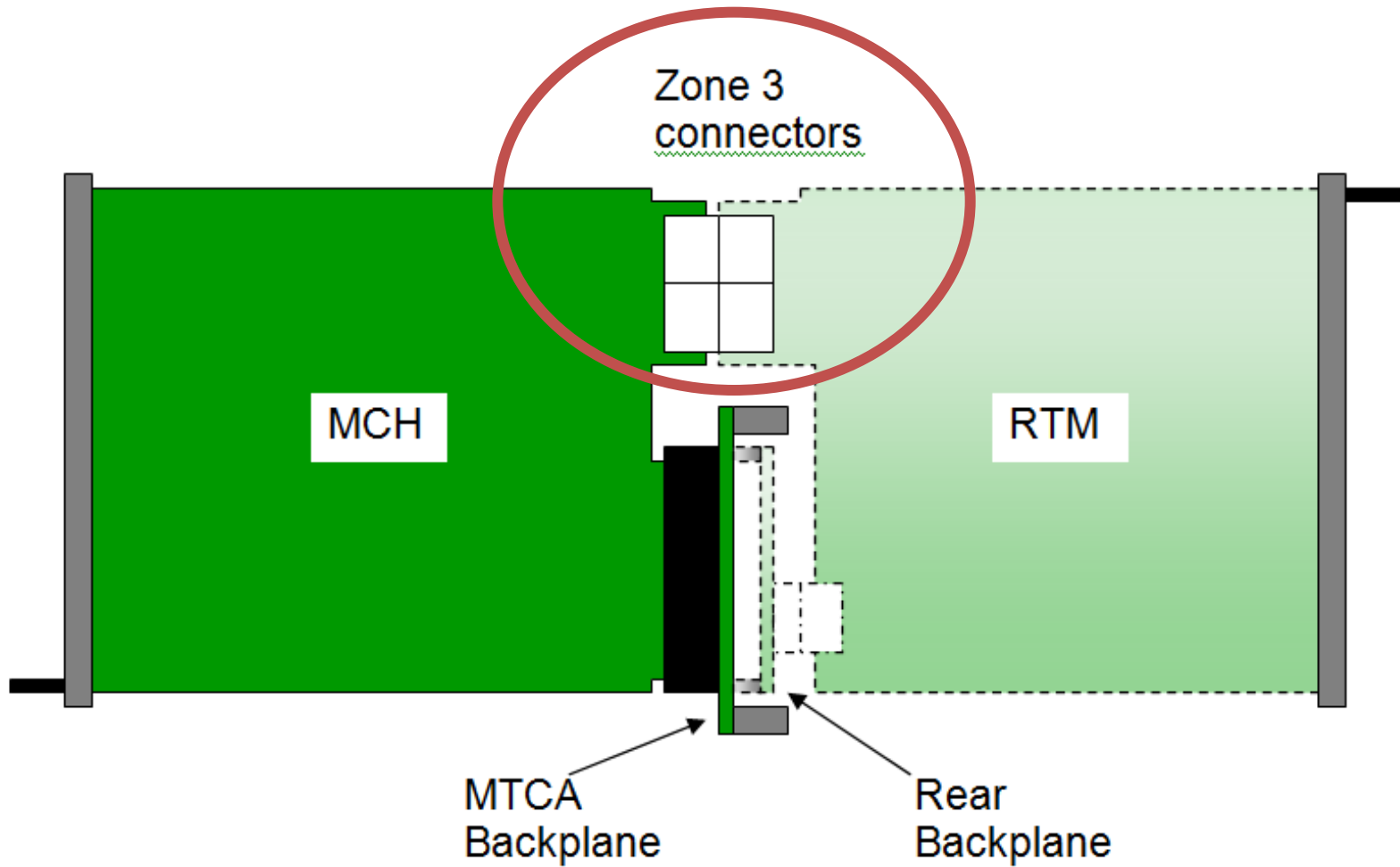
Management	<ul style="list-style-type: none"> • For up to 12 AMCs, 12 uRTMs, up to 4 PMs, up to 2 CUs • On-board Carrier manager • CLI via Telnet or USB • Firmware update via the front-panel USB or TFTP • Web based GUI • 10/100 Ethernet management port that supports DHCP, RMCP, Telnet, HTTP and SNMP.
Switches	<ul style="list-style-type: none"> • 16 Port GbE switch Fabric A to 12 AMCs, 2 front panel uplink ports and an update link to the second MCH slot • FPGA based Clock Distribution: <ul style="list-style-type: none"> ◦ Trigger distribution for ports 17 to 20 of the extended AMC backplane ◦ WhiteRabbit Clock Distribution (this synchronization protocol was developed by CERN and can be used to connect the MCH directly to the WhiteRabbit network) • 80 lanes, 20 port PCI Express Gen3 Switch (Gen3 backwards compatible to Gen 2 and Gen1) Fabric D-F to 12 AMCs (x4), x16 to RTM and x16 to the front panel optic uplink connector
Front Panel connectors	<ul style="list-style-type: none"> • 2x GbE Uplinks • USB mini B connector • 10/100 Ethernet Management port • x16 fibre optic PCIe uplink • 2x SMA: clock input and clock output for the clock distribution circuit • SFP module for connecting to the Gigabit interface of the clock distribution module.
Storage	<ul style="list-style-type: none"> • 2 x connectors for half size mSATA SSD
Compliance	<p>Compliant to the following specifications:</p> <ul style="list-style-type: none"> • MTCA.0 • MTCA.1 • MTCA.4 R1.0, • AMC.0 R2.0 • IPMI



Base Tongue



- ❖ Management
- ❖ 16 port GbE switch
- ❖ Extern CLK's
- ❖ Storage

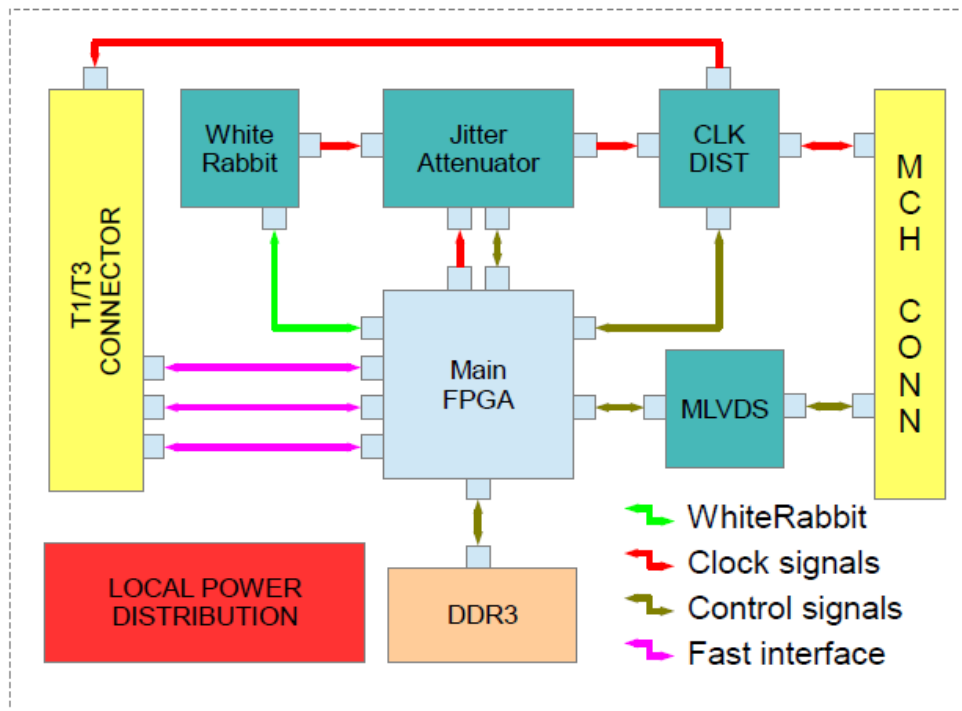


Datasheet

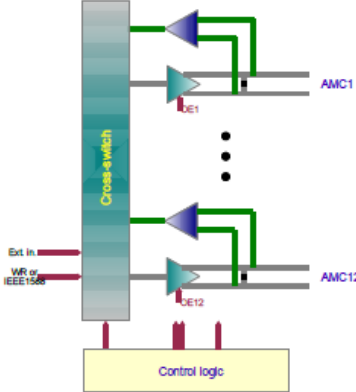
Description:

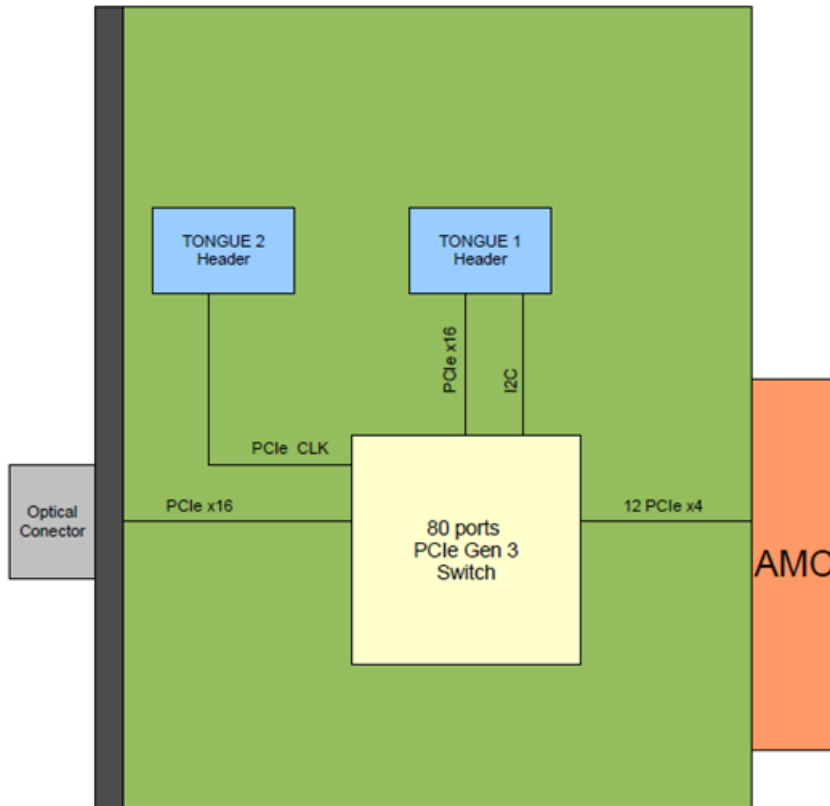
MCH Clock Board is a part of MCH module responsible for clock generation and distribution inside uTCA chassis. It extends capabilities of MCH base board and it is placed as a Tongue 2 of the whole module. It interfaces with clock distribution part of AMC backplane and passes all needed signals between Base Board, Tongue 3 and Tongue 4. The board is equipped with additional components and interfaces, which allow to implement advanced synchronization protocol handling (such as WhiteRabbit or IEEE1588)

Block Diagram:



Features	
Processing Unit with fast interfaces	<p>Central device of the board is FPGA based processing and control unit, which is used as a primary management device. It communicates with the base board and receives configuration data for the whole clock distribution part and other peripherals. It plays the main role in an implementation of synchronization protocols.</p> <p>The FPGA unit is connected with other Tongues with fast interfaces:</p> <ul style="list-style-type: none"> – Gigabit Interface to SFP module on the Base Board – the interface allows to connect module to synchronization or Ethernet networks. When combined with Ethernet link it can be the only connection to Ethernet network for the whole chassis.
	<ul style="list-style-type: none"> – Ethernet switch on the Base Board – provides access to Ethernet network. It can be used either as an up-link or endpoint. – PCIe link to Tongue 3 and 4 – allows to map clock board into PCIe tree of the root complex implemented in CPU board (either on RTM or any AMC slot). This allows to distribute events, timestamps and other information directly to software layer.
Trigger Distribution	<p>The board is equipped with dedicated MLVDS buffers to control ports 17-20 of extended AMC back-plane (for version with ports extended up to MCH slot). It can be a source or a receiver of the signals. The trigger signals can be decoded or coded locally by Main FPGA chip and the information is passed to RTM module plugged in behind RTM slot.</p>

Clock Distribution	The clock distribution part is responsible for generation of two independent clocks for each slot in the chassis. The clock can be synthesized based on a local oscillator, front panel SMA input, clock from advanced synchronization interface or an input clock generated by AMC modules in the chassis. The subsystem also generates global PCIe reference clock, which is distributed to the modules and RTM.	 <p>The diagram illustrates the clock distribution architecture. A central vertical block labeled 'Cross switch' is connected to two input lines on the left: 'Ext. In.' and 'VME or IEEE1586'. The 'Cross switch' is connected to two output lines on the right, labeled 'AMC1' and 'AMC12'. Each output line has a corresponding input line labeled 'DE1' and 'DE12' respectively. Below the 'Cross switch' is a block labeled 'Control logic'.</p>
WhiteRabbit	The Clock Distribution part has been extended with the components required by WhiteRabbit synchronization protocol developed by CERN. This creates the possibility to connect the MCH directly to WhiteRabbit network. The components can also be used for custom protocol implementations. WhiteRabbit (or other protocol) events can be forwarded to MLVDS bus and distributed throughout the chassis.	
Local Power Distribution	Local power distribution generates all local voltages based on single 12V power supply distributed throughout MCH tongues.	
Management	The firmware for main FPGA can be upgraded using several interfaces including USB, PCIe, ETH. All configuration memories are back buffered so the chance of damaging the board is minimal.	



- ❖ PCIe gen3 switching
- ❖ x4 PCIe links to 12 slots
- ❖ x16 PCIe fiber optic uplink
- ❖ x16 PCIe link to RTM



Fiber optics

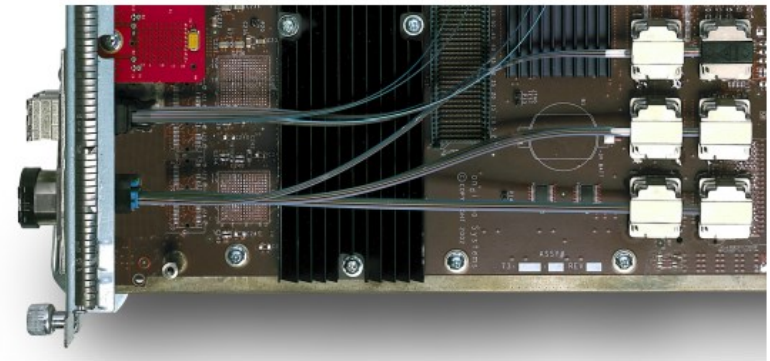
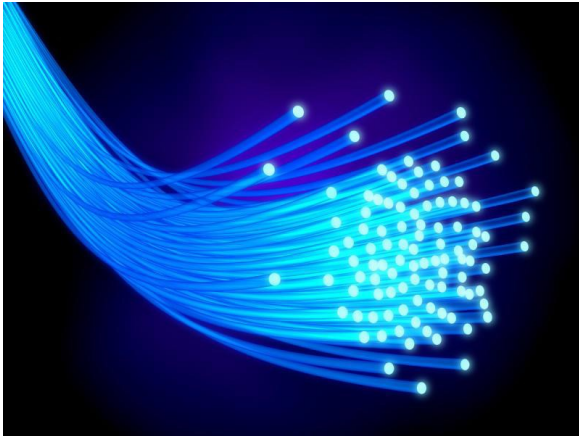


Figure 18. MiniPOD Modules Interfaced Through a 72 fiber Circular MT Connector

PCI-e gen3
fibre optic
connection

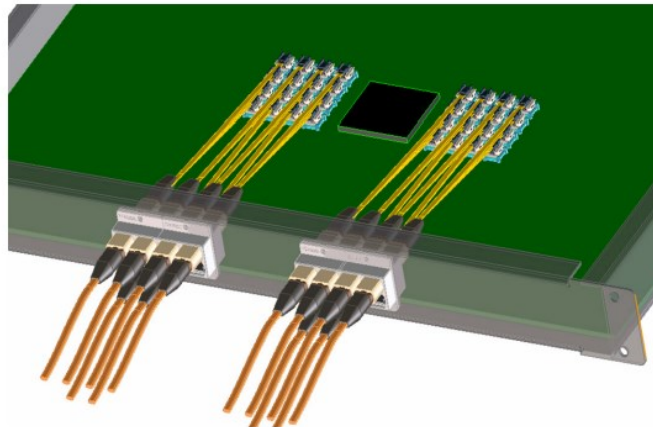


Figure 15. Application of tiled MicroPOD modules in a high density switch

Optical Engine Technology

Fig. 3 shows several examples of optical engine cores from different companies. Note that I use the word *core* on purpose here: this is only part of the story. A complete, practically useable optical engine solution comprises of an electrical connector, an optical connector, a mechanical retention system, fiber stress relief and a heat-sinking solution. In practice, these extraneous elements are often much more important than the optical technology used in the core engine itself. Note that all these cores, despite using different technologies, look relatively similar. Differences will become more apparent when we consider the complete solutions in the next section.

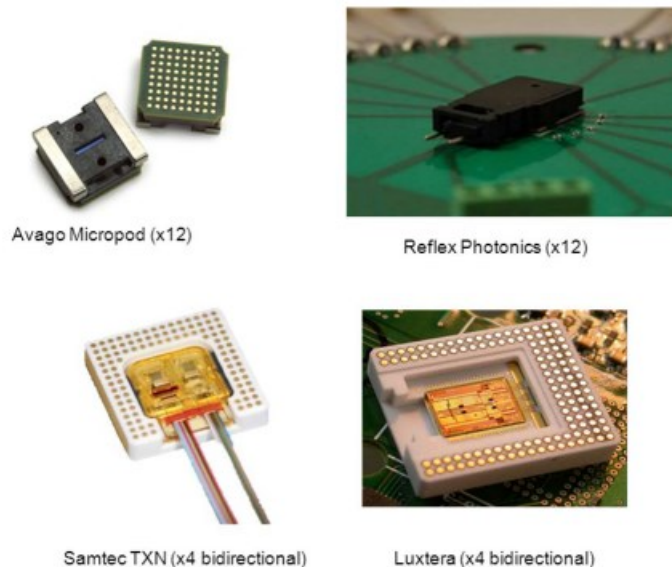
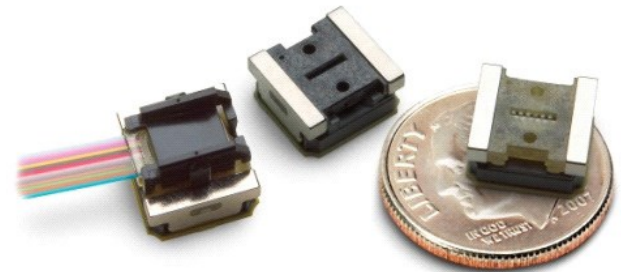

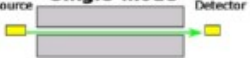


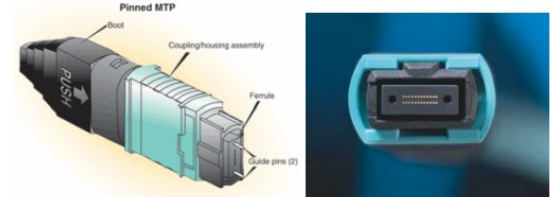
Fig. 3: Optical Engine Cores

MicroPOD™ AFBR-77D1SZ, AFBR-78D1SZ 10 Gbps/Channel Twelve Channel Parallel Fiber Optics Modules



Fiber optics

Multimode	Single-mode
	
+ Low cost sources + 850 nm and 1310 nm LEDs + 850 nm lasers at 1 & 10 Gb/s + Low precision packaging + Low cost connectors + Lower installation cost - Higher fiber cost + Lower system cost - Higher loss, lower bandwidth + Distance up to 2 km Best for: • LAN, SAN, Data Center, CO	- High cost sources - 1310+ nm lasers 1 and 10 Gb/s - 1 Gb/s + w/ DWDM - High precision packaging - Higher cost connectors - Higher installation cost + Lower fiber cost - Higher system cost + Lower loss, higher bandwidth + Distance to 60 km+ Best for: • WAN, MAN, Access, Campus

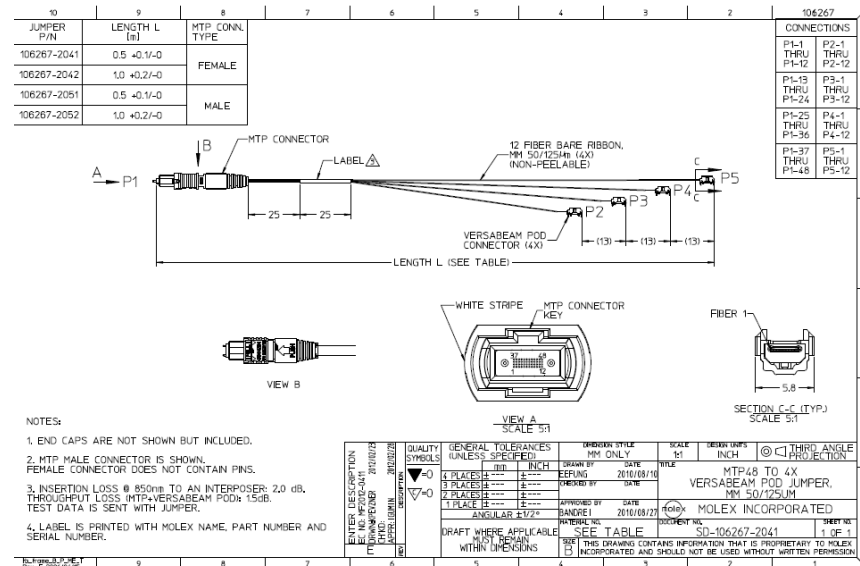


: MT ferrules and MTP® connector
(source: US Coec)

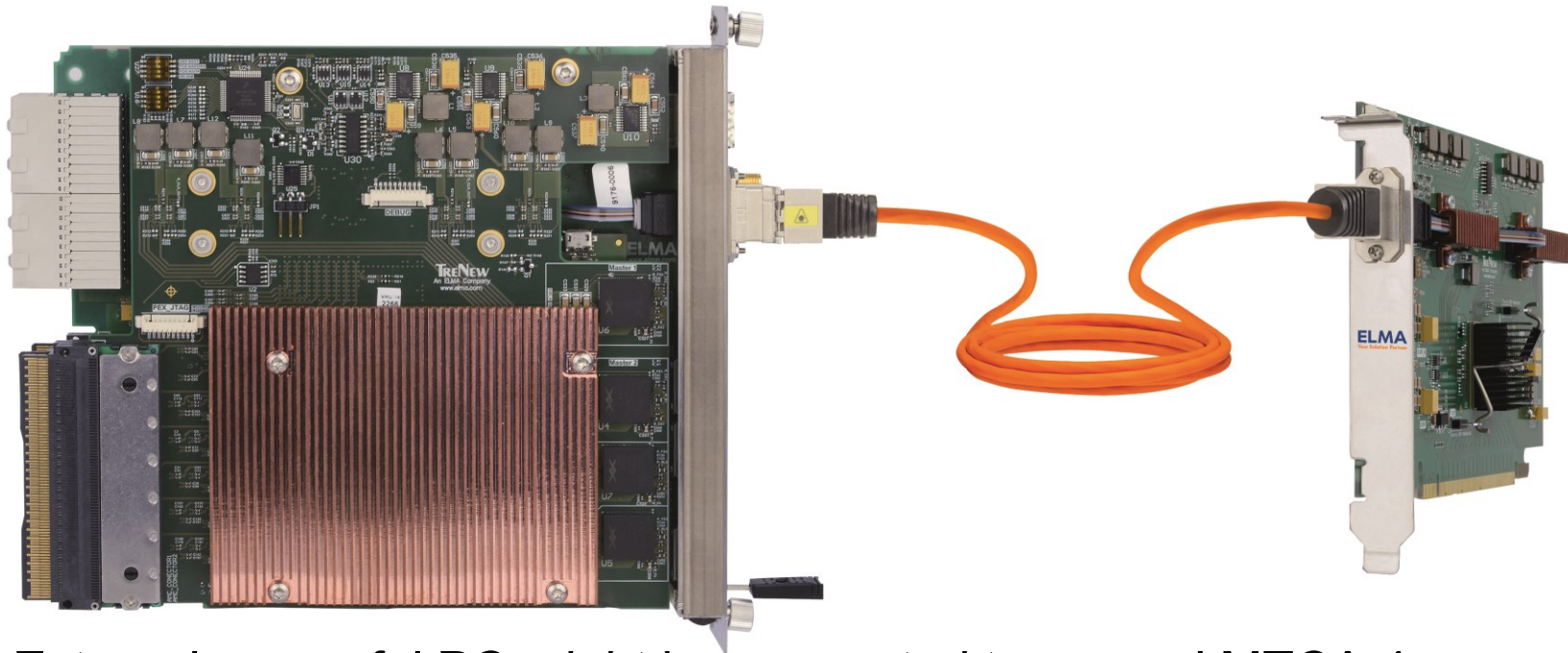
: Multimode vs. Single-Mode Fiber (source: Furukawa)



Male and Female MTP Connectors with Bulkhead Connector

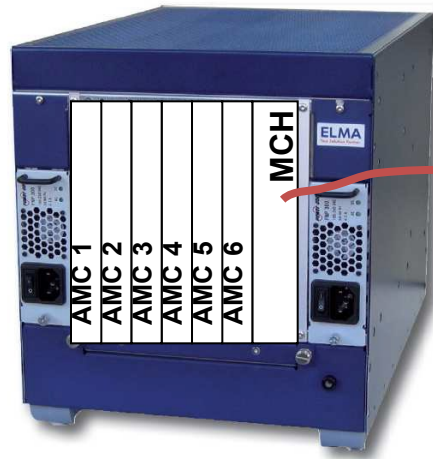


ELMA-MCH-INSTR and PC BOARD



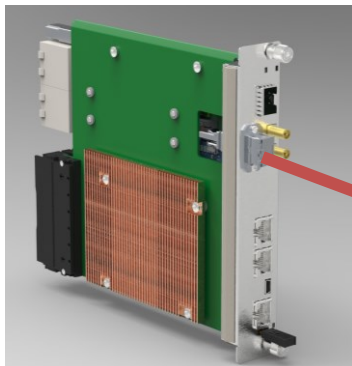
- External, powerful PC might be connected to several MTCA.4
- Distance between PC and chassis (field & office) is possible
- Daisy chain between MTCA.4 system possible

Fiber optics

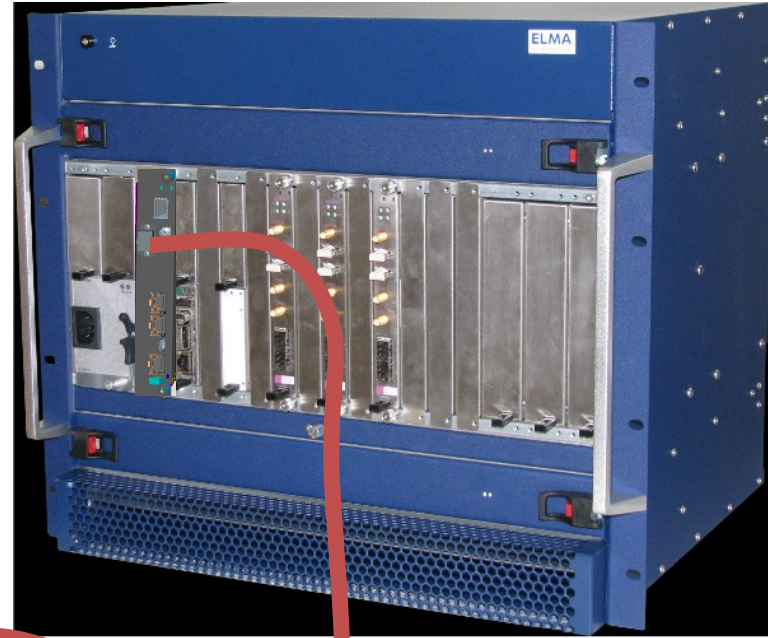


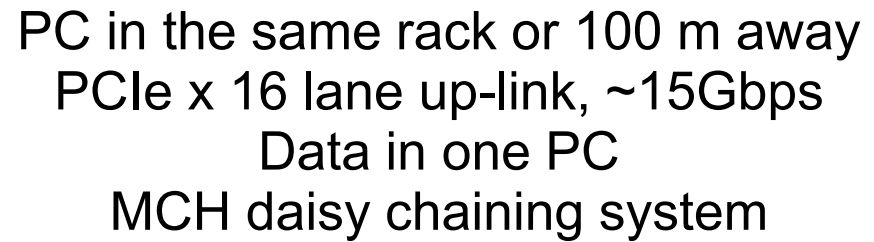
Connection with fibre optics, distance 150m

e.g. connection MCH with
external CPU

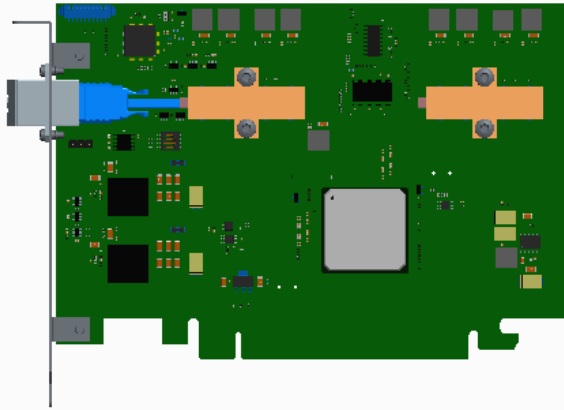


Daisy chaining several MTCA.4 crates





050-395 PCI-express PC board



PCIe PC Board

The PCI Express PC Board provides a nonblocking switching architecture that serves as a bridge between a Personal Computer and a MTCA system. The board uses a PEX8748 chip that is fully compliant with the PCI Express Base Specification r3.0, and backwards compatible to older PCI Express Base Specifications.

The interfaces consist of two x16 links: one to the PC, and one to the MCH.

By default, the PC link is designated as the upstream port, but the MCH can also be set up as the root complex.

The second configuration is used to connect together two MCHs. The board uses a standard PCIe card format and can be plugged in any x16 main board PCIe slot.

The PC board could operate also in x8, x4, x2 or x1 mode. The PCIe PC Board has an optical connector on the front panel, that supports an external PCIe x16 optical connection. The optical interface uses 4 Avago MicroPOD, 12 channels parallel fiber optic modules. The external optical PCIe connection could be configured as a single x16 upstream link or as two x8 upstream, which could allow connection to two MTCA systems.

Thank you for your attention.

