

# xTCA activities at CERN

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PH-ESE

- xTCA interest group
  - Background
  - Report of the 2<sup>nd</sup> meeting (held on 7.3.)
- uTCA evaluation and AMC development
  - Projects of PH-ESE group

# xTCA Interest Group

- Founded at TWEPP2010 as an open platform for the exchange of information on xTCA projects in HEP (Slides of the presentations at: <http://indico.cern.ch/materialDisplay.py?contribId=176&sessionId=26&materialId=slides&confId=83060>)
  - Main aims: Facilitate exchange of information by:
    - Regular meetings
      - Plan is to meet twice per year during a conference or via telephone / video conferencing
    - e-mail: [xtca-news@cern.ch](mailto:xtca-news@cern.ch)
    - Collecting information about completed, on-going and planned developments (H/W and S/W) on a TWiki page (see below)
  - Open to anyone interested
    - So far mostly CERN related activities listed
  - Contact person: Markus Joos, CERN ([markus.joos@cern.ch](mailto:markus.joos@cern.ch))

WEB site: <https://twiki.cern.ch/twiki/bin/view/XTCA/WebHome>

# Current activities

## List of projects:

Project name	Type	Short description	Institute	Status
GLIB	mid size, double width AMC	An evaluation platform and an easy entry point for users of high speed optical links	CERN	Under development
MMC_V2	39 x 20 mm mezzanine card for AMC board	A mezzanine implementing the Module Management Controller functions required by the $\mu$ TCA standard	CPPM	Available - Under multi-systems compliance tests
AMT	mid size, single width AMC	An easy to use MMC test board for the full functionality testing of the CPPM MMC.	CERN	Under development
WR MCH	full size, single width MCH	Used in the White Rabbit switch	CERN	Under development
MINI-T5	full/mid size, double width AMC	Processing card for an upgraded Level-1 Calorimeter Trigger. Substantial connectivity: 160Gb/s optical, 64Gb/s LVDS	Imperial College London	In system tests
ALB	mid size, double width AMC	An AMC load board based on the CPPM MMC that allows to control and monitor on-board dummy loads for crate power and cooling test purpose	CERN	Under development
uTCA evaluation	Evaluations of commercial products	Test various properties of commercial uTCA components	CERN	Under development
MicroHAL	Software	Provides Hardware Access Library (HAL) for R/W/RMW + Block R/W register/memory access over TCP/IP or UDP/IP.	Imperial College London	In system tests

# Summary of the 2<sup>nd</sup> meeting

- Number of participants: 25
- Number of presentations: 7
  - G. Iles: HAL for uTCA control
  - J. P. Cachemiche: MMC mezzanine and LHCb ATCA architecture
  - M. Joos: uTCA evaluation project
  - V. Bobillier: AMC load board
  - P. Vichoudis: GLIB AMC
  - N. Letendre / L. Fournier: ATCA based electronics and S/W for ATLAS IAr upgrade
  - R. Larsen: xTCA for physics committee work and LLRF controls upgrade at SLAC
- Some projects under time pressure due to LHC schedule
- Volunteers needed for working (e.g.) on xTCA S/W
- 3<sup>rd</sup> meeting: proposed to take place during TWEPP 2011

Slides presented at 2<sup>nd</sup> meeting: <http://indico.cern.ch/conferenceDisplay.py?confId=126133>

# $\mu$ TCA for physicists

A project to evaluate platforms for uTCA based systems at CERN  
and in the HEP community

- **Background**

- Raising interest and first projects in xTCA (and especially  $\mu$ TCA) in the HEP community
- CERN has followed this new technology as an observer for the last 2 years
- $\mu$ TCA is less complex than ATCA but many of the concepts are the same

- **Motivation**

- As the xTCA standards offer many optional features interoperability is an issue
- PH-ESE group recently has started to develop its first AMC (the GLIB card)
  - Some  $\mu$ TCA equipment has been purchased for the GLIB project and “first lessons” have been learned which may be relevant for other  $\mu$ TCA projects
- Other xTCA projects are currently under development in ATLAS, CMS and LHCb

# μTCA and MTCA.4

## μTCA

- Standardized in 2006
- Many optional features
- Rapidly growing base of suppliers and products

## MTCA.4

- Reduced set of features (e.g. less communication protocols)
- Additional rear transition modules (RTMs)
- Standard not yet ratified
- First commercial products available

## Interoperability MTCA.4 <-> μTCA

- Most components (e.g. MCH) work in both environments
- Some areas of incompatibility. E.g.:
  - Clock distribution
  - RTMs
  - Backplane topology

# Project scope

- Phase A:
  - Carry out **technical evaluations** of systems built to both the basic uTCA standard and the MTCA.4 sub-standard. System features that will be covered by the evaluation include:
    - Mechanics, Power supplies, Cooling, Backplane properties, MCH control, Redundancy, Scalability to large systems
  - Assess the respective advantages and disadvantages of the two alternatives
  - Objectives:
    - Understand and discuss with the community the issues related to this new technology. The discussion forum will be the newly formed **Interest Group on xTCA systems**
    - Design (at least) two AMC boards as tools for the evaluation phase:
      - An AMC load board with RTM
      - An evaluation board for the MMC designed by J.P. Cachemiche (Marseille). This board is already available in prototype form and in use
- Phase B:
  - Carry out informal market **surveys** and user surveys
- Phase C:
  - Eventually the **support** of a selected set of components of uTCA systems, if consensus is reached, could become part of the PH-ESE service activities.
- The results of all phases will be available to the community

# The Gigabit Link Interface Board (GLIB)

Project leader:

Paschalis Vichoudis

Purpose:

Evaluation platform and an easy entry point for users of high speed optical links (GBT)



Target applications:

- Optical link evaluation in the laboratory
- Control, triggering and data acquisition from remote modules in beam or irradiation tests

AMC features:

- Mid-size double-width Advanced Mezzanine Card (AMC)
- 4 SFP+ transceiver modules
- Virtex-6 FPGA with twenty 6.5Gbps transceivers
- I/O capability can be further enhanced with two FPGA Mezzanine Cards (FMC) with High Pin Count sockets
- Gigabit Ethernet link to PC for bench-top operation

Status: First prototype available, H/W tests and F/W development on-going



# AMC load module & uRTM

Purpose: Test uTCA and MTCA.4 shelves under load

Designer: Vincent Bobillier

AMC:

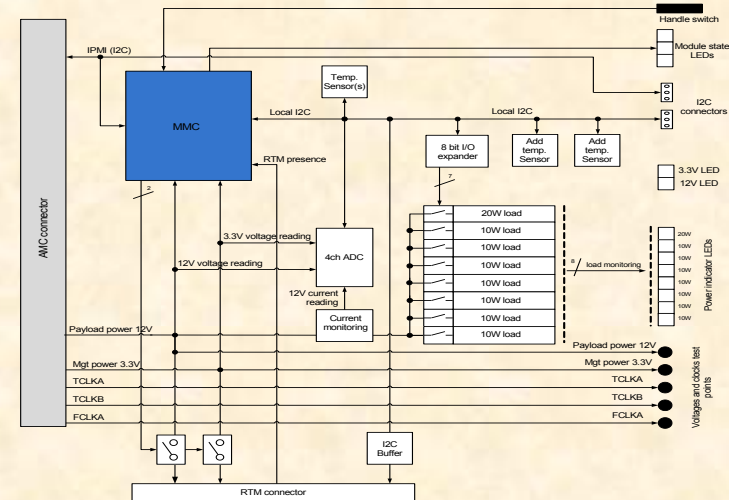
- Based on the CPPM MMC
- Test points: MP and PP voltages, (optional: clks).
- Dip switch: manual switch on/off of loads.
- Load distribution (90W, AMC std: 80W):
  - x 20W & 7 x 10W

uRTM:

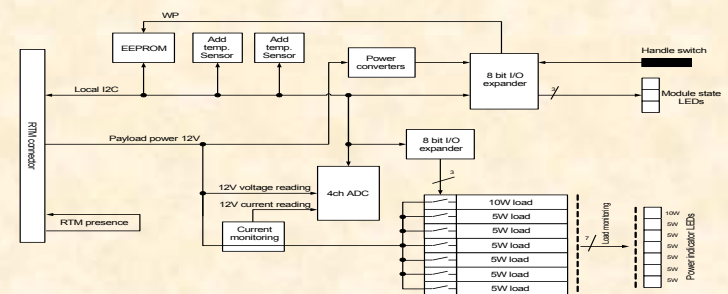
- Same general lay-out as AMC load board but
- Load distribution (40W, MTCA.4: 30W):
  - 1 x 10W & 6 x 5W

Schedule:

- AMC prototype: April
- uRTM prototype: May



AMC (double width, mid size)



uRTM (double width, mid size)

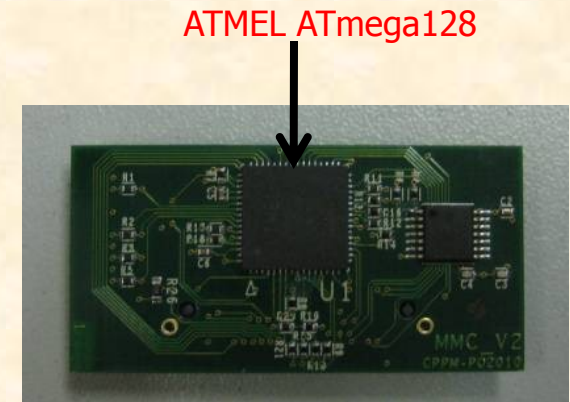
# MMC mezzanine

## Background

- First version of MMC developed by CPPM for local use
- Motivation:
  - Few commercial solutions
  - Mostly proprietary and single source or expensive IPs
- Use of a mezzanine to:
  - Save room on AMC board
  - Speed-up development
- CPPM used F/W originally developed by DESY

## Now a joint **DESY / CPPM / CERN** activity (first common project on xTCA IG)

- CERN will use the MMC on several AMCs
- DESY will add uRTM and JTAG support to the F/W
- CPPM is working on a new revision of the mezzanine (different connector)
  - CERN will produce the prototypes and a small number of mezzanines for various projects (contact M. Joos if you are interested)
  - Testing will be done by CPPM & CERN
- The F/W is now in a CERN SVN repository (CPPM and DESY have access)



# MMC test AMC

**What:** A single-width mid-size AMC board on which all CPPM MMC functions can be tested

## Main features:

- AMC Test board for MMC
  - Testing of the MMC mezzanine (test points, LEDs and test dedicated IO expanders)
  - On-board temperature readings
  - uRTM simulation circuitry (with front panel LEDs and switches)
- Local (AMC) and crate I2C connection for I2C monitoring purpose
- Option: Connection of external power source

## Current status:

Placement and routing starting soon...

