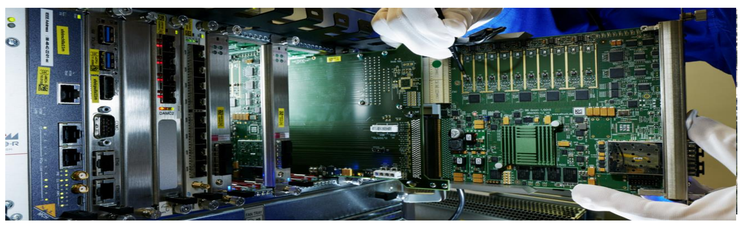
# MicroTCA Technology Lab - A Helmholtz Innovation Lab at DESY.



## MicroTCA at DESY/ XFEL


### Why MicroTCA? XFEL Requirements

- Standardized electronics for easy maintenance
- 24/7 operations, high availability
- access to electronics in tunnel restricted
- precision sensors with high data rates (>TeraBit/sec)
- low latency (<2us) control loops
- open source, no vendor lock-in
- industrial electronics to ensure long life times

### Advancement on Previous Standards

- Fully managed components (temperature, power, firmware)
- Remote diagnostics and remote management
- Hot-swap and redundancy options
- High–bandwidth digital signal processing and low-noise analog electronics in a single crate
- Compact, versatile formats
- Decoupling of analog and digital development cycles

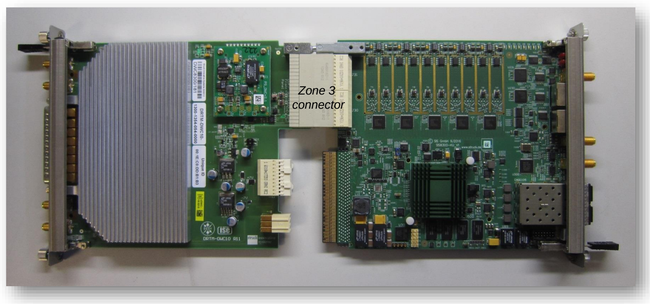
### MicroTCA at DESY

- Long tradition of contributing to standards at DESY
- 10+ years experience with MicroTCA
- Structured selection process for the XFEL in 2006
- Technology Transfer:
  - HVF-0016 „MTCA.4 for Industry“ (2012-2015)
  - HIL-02 „MicroTCA Technology Lab“ (since 2016)

## MicroTCA Standard

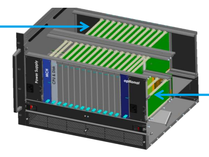
### Key facts

- Open, modular standard (PICMG, 100+ organizations)
- Origin: telecommunications, proven in a wide range of applications, incl. transport, medical, aerospace
- Significant developments in the physics research community incorporated into the standard MicroTCA.4 (precision timing, rear access via RTMs)




**R**ear **T**ransfer **M**odule (**RTM**)

**A**dvanced **M**ezzanine **C**ard (**AMC**)



### RTM

- rear side cable access
- mostly analog
- signal sampling and conditioning

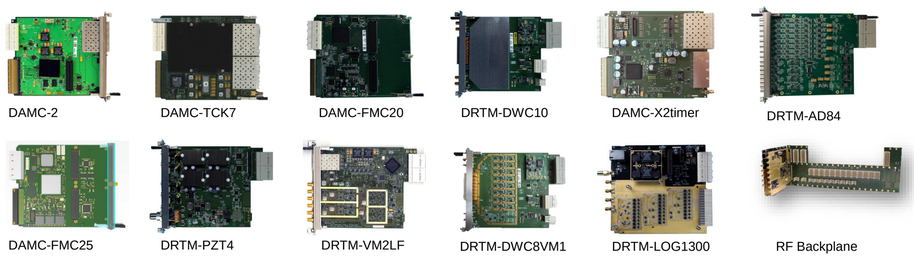
### AMC

- mostly digital
- latest FPGAs
- data processing

## Lab Structure Implementation: From Innovation to Market

### Mission

- To make the DESY-developed MicroTCA board portfolio commercially available through industry partnerships
- To foster the widespread adoption of MicroTCA-based solutions beyond research and facilitate transition to industry
- To create an *Enabling Space* for the interaction with external and internal clients




### Business Model

- Design services and product development: hardware, firmware, software
- High-end test and measurement services
- Consulting (neutral, vendor-independent system configuration and integration)

Dedicated team of ca. 7 FTE
>20 licenses to date, ~30TEUR p.a.
State-of-the-Art Infrastructure
Five year initial funding period
**2021: Self-sustaining operations**

### Target Sectors

- Industrial automation & quality control
- Medical technology
- Laser
- Radar
- Traffic control

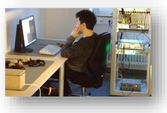
## Lab Integration: MSK, M and DESY

DESY

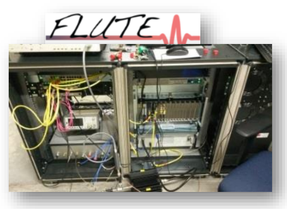
M-DIVISION
Accelerator-Division at DESY

### DESY. MSK

- Focused on front-end electronic, firmware and software developments for accelerators
- Beam stabilization systems in storage rings and LINACs
- RF control systems for the accelerator structures (LLRF)
- Timing for pre-accelerator systems
- Precision magnet controls for DESY II
- Precision synchronization systems on femtosecond level
- Special diagnostic devices
- **MicroTCA Technology Lab**
  - First point of contact for research and industry
  - Industry showroom
  - Licensing opportunities
  - Order processing
  - Internal technology transitions
  - Production, Certification
  - Project pipeline hub




## Technology Transfer: Helmholtz Association (ARD-ST3)




KIT Karlsruher Institut für Technologie


HZDR


HZB Helmholtz Zentrum Berlin

e.g. DFMC-UNIO

GSI

*PoF III Topic: Accelerator Research & Development (ARD) – Talk by Sven Pfeiffer “Precision RF controls for accelerating structures”*

## International Collaboration, Dissemination, Exchange

CERN · diamond · ESS EUROPEAN SPALLATION SOURCE · IHEP · PAL · LNLS sirius · SPring-8 · KEK-JAPAN · OAK RIDGE National Laboratory · IPP W7-X · Australian Synchrotron · SOLEIL SYNCHROTRON · CANDLE · SINAP · SLAC NATIONAL ACCELERATOR LABORATORY · iter · TARLA

### Support

- Hardware
- Firmware
- Software

Integration

### Training

- MicroTCA Basic/ Advanced (at DESY)
- System start-up (on site)

### Consulting

- LLRF specification and design
- Interoperability
- Operations performance optimization
- Upgrades, further developments

## Collaboration with Industry

### Advance Research and Development for Next Generation MicroTCA Systems

- New materials, design concepts, interfaces and communication protocols
- MicroTCA component design

### Tutorials, Trainings and Workshops

- MicroTCA system configuration and module designs
- Advanced electronics design
- High-end test and measurement methods

### Joint Marketing Activities

- MicroTCA standard promotion
- Market research
- Industry exhibitions on conferences and trade fairs
- Hardware loaner pool and online system configurator

### Interoperability Improvements

- Joint test sessions
- Design reviews
- Dedicated MicroTCA component test stands

ROHDE&SCHWARZ · PENTAIR · powerBridge Computer · elspec group GmbH · struck innovative systeme · CAENels Gear For Science · V.A.T.

## Contribution to the MicroTCA Ecosystem

### Annual MicroTCA Workshop (since 2012)

- Tutorials for beginners
- Interoperability testing opportunities
- Short talks from industry and research
- Industry exhibition and social program

### PICMG Standard Evolution

- Executive membership (voting rights)
- Major contribution to capability specification MicroTCA.4
- Working group member, e.g. Standard Process  Model Design Guide
- Emerging technology watch (e.g. IoT)

PICMG · µTCA®

### Website

- Presentation of new DESY/ Techlab developments
- Repository for MicroTCA developers and users
- Directory of partners, suppliers, events, guidelines
- Contact point for support and training requests


https://techlab.desy.de/

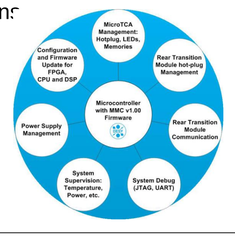
### Software Framework / Tool Kit

- Open Source: https://github.com/ChimeraTK/
- Device and control system independent

ChimeraTK

### Starter Kits

- AMC/RTM board templates ready to use
- Module Management Controller Software implementing basic board functions




HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES

MICROTCA TECHNOLOGY LAB
A HELMHOLTZ INNOVATION LAB

DESY. MSK
Maschine Strahlkontrollen

DESY