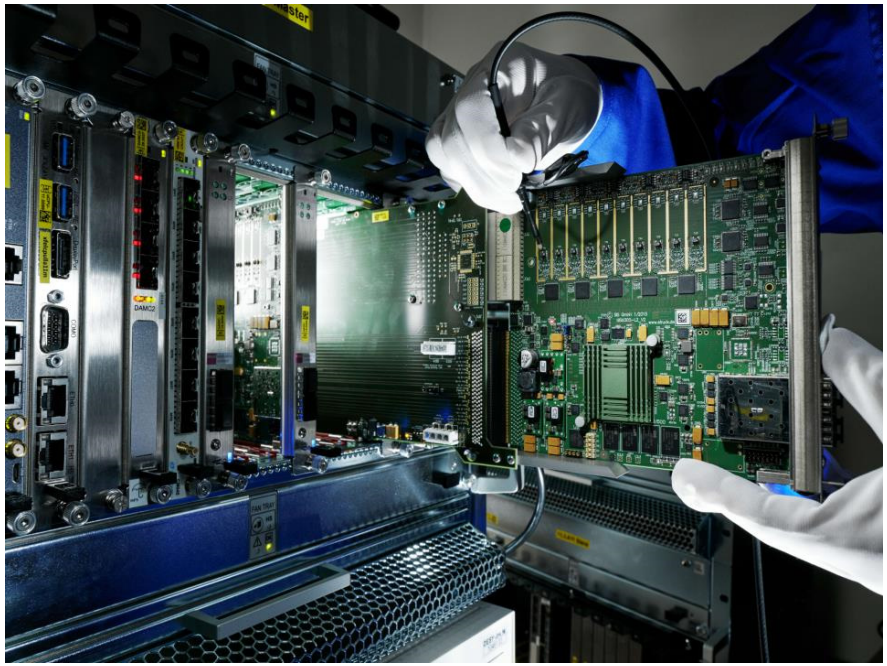
MicroTCA Technology Lab at DESY

Start-Up Phase Summary



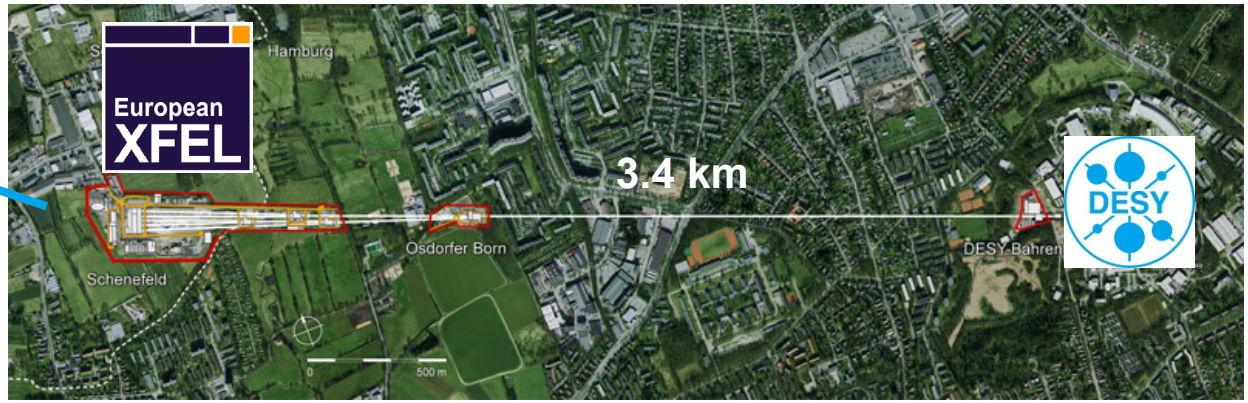
Thomas Walter
(on behalf of the MSK/ ITT teams)
IPAC Copenhagen, 18.05.2017

HELMHOLTZ ASSOCIATION

DESY

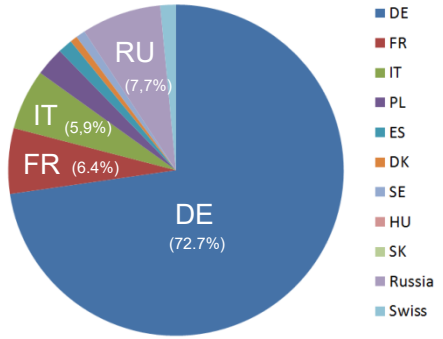
DESY

European XFEL

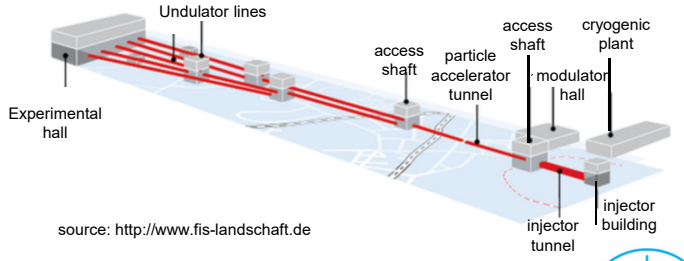


The European X-ray Free Electron Laser

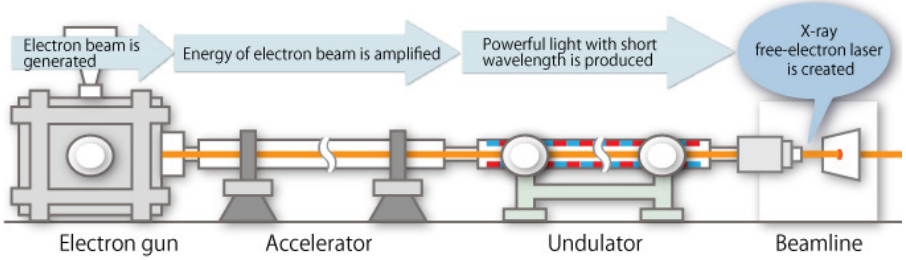
- 17.5 GeV light source user facility
- TESLA superconducting 1.3 GHz RF cavities
- 1.4 msec RF pulses at 10 Hz
- e- beam 1.35 mA nom. - 4.5 mA max
- Dec. 18th 2015: first beam in injector
- 2015-2016: main tunnel installation
- Q1 of 2017: main linac commissioning
- May 4th 2017 : first lasing
- End of 2017: first user operation



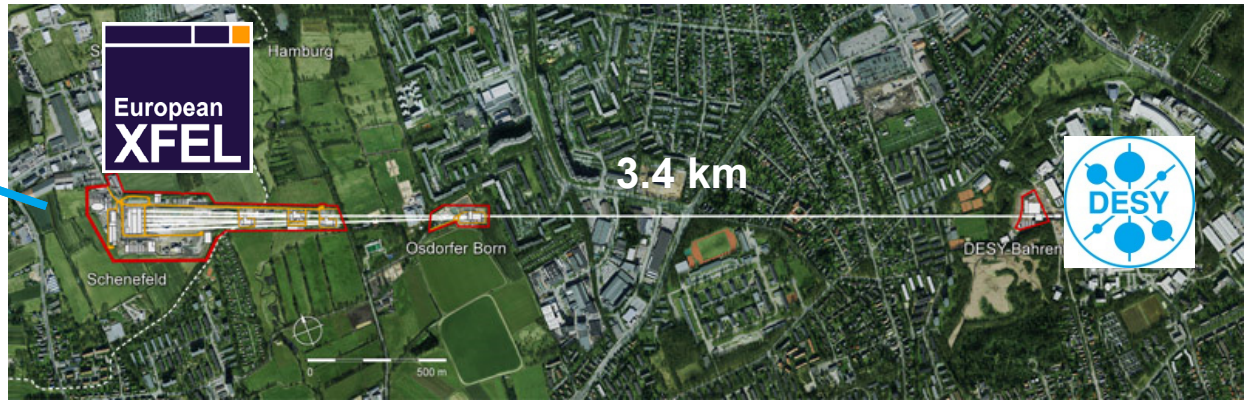
source: http://www.xfel.eu

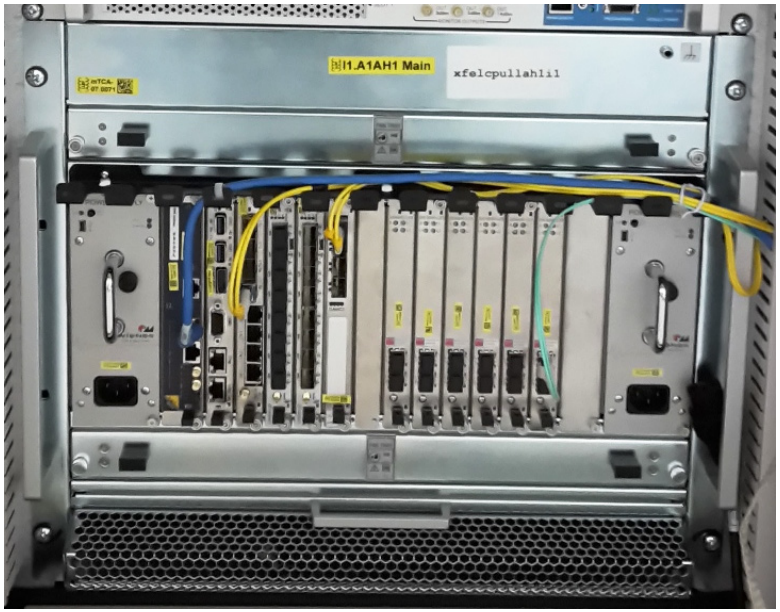


source: http://www.fis-landschaft.de



European XFEL





MicroTCA

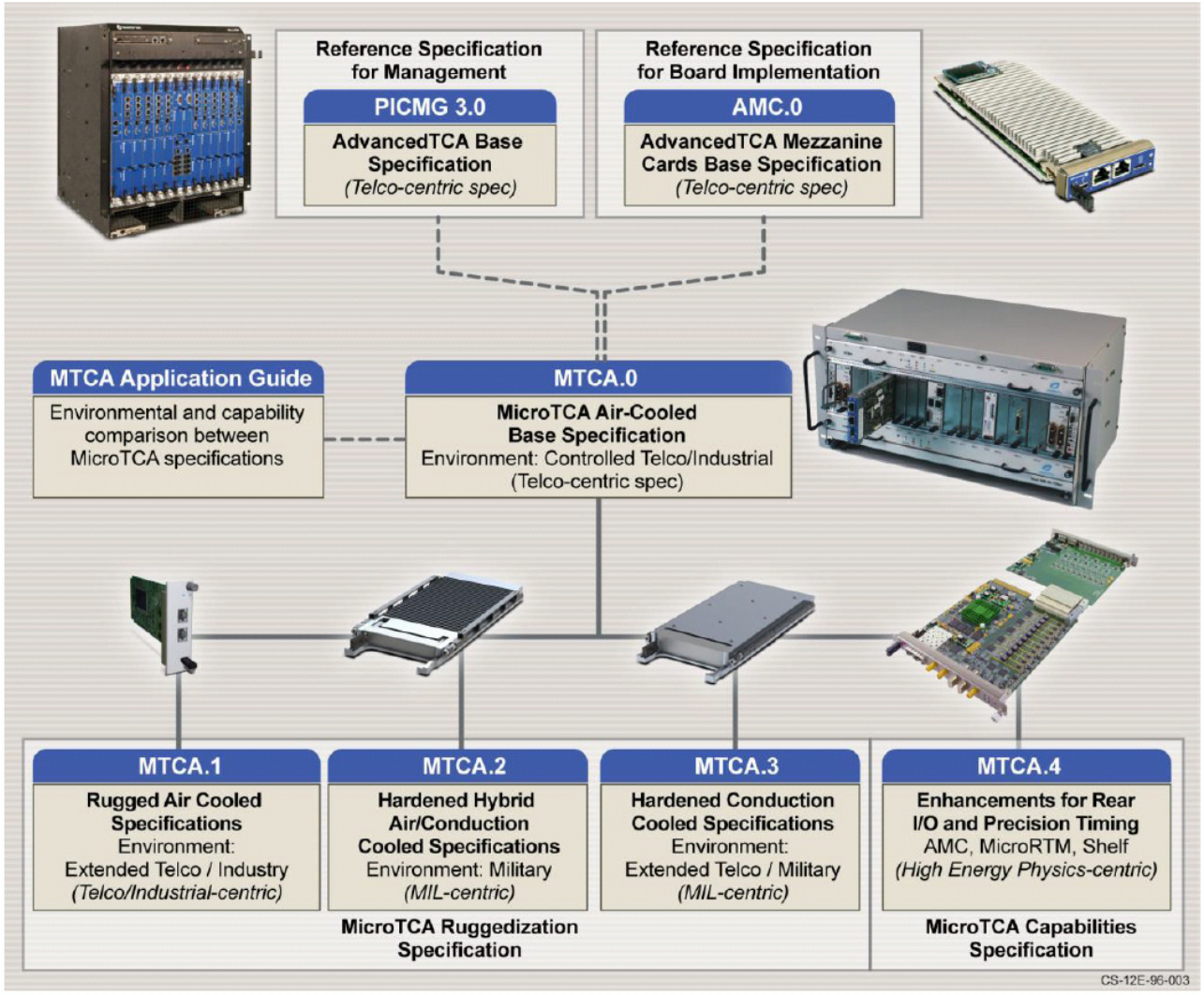


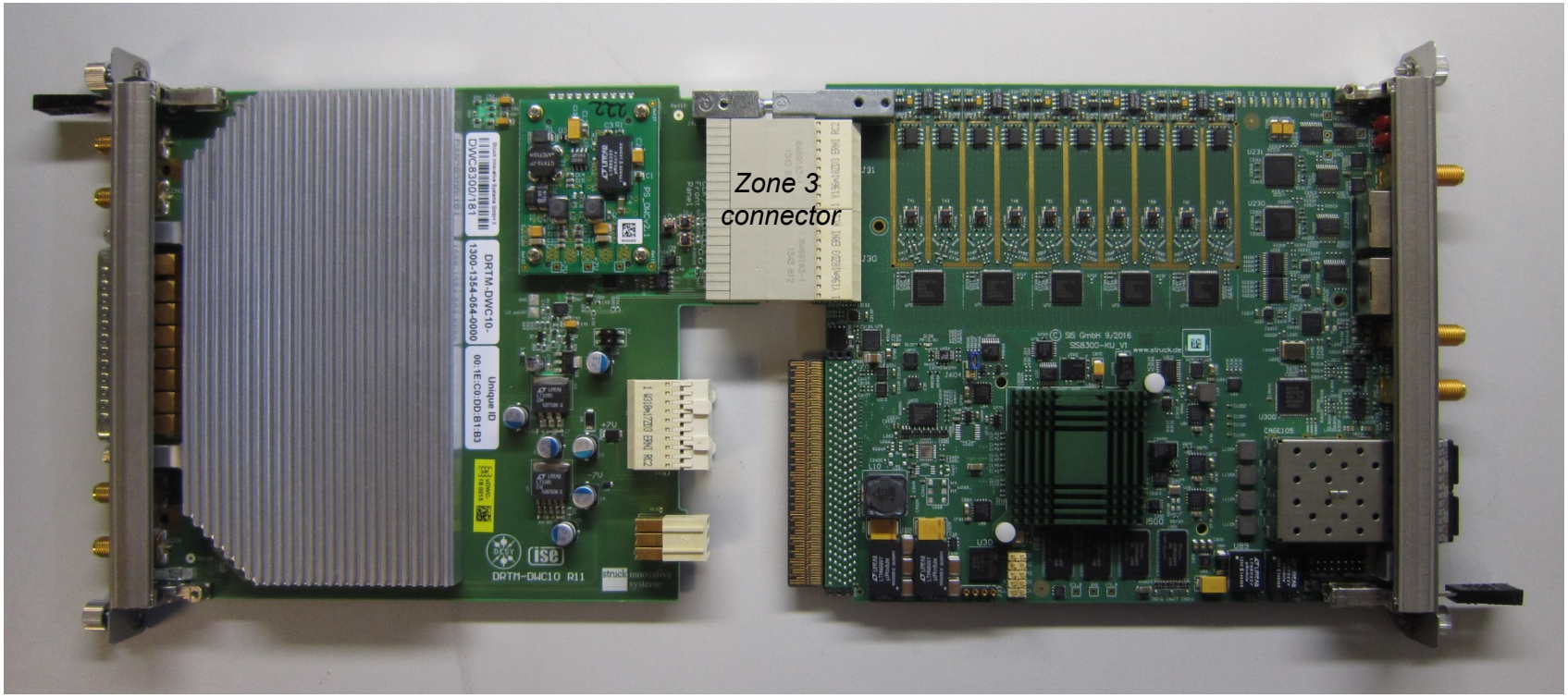
Figure 1. *The MicroTCA family of specifications maximizes reuse from its ATCA and AMC parent specifications.*

- open (no vendor lock-in)
- modular
- broadly supported (PICMG)
- high performance
- compact
- versatile
- reliable (through redundancy and "hot plug & play")
- remote diagnostics/ remote management
- economical

transfer potential:

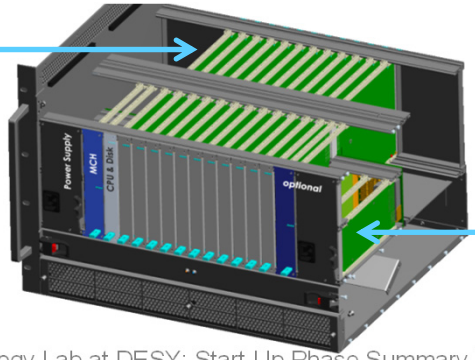
- **accelerator community**
- **other research facilities**
- **industry!**

MicroTCA.4



Rear **T**ransfer **M**odule (**RTM**)

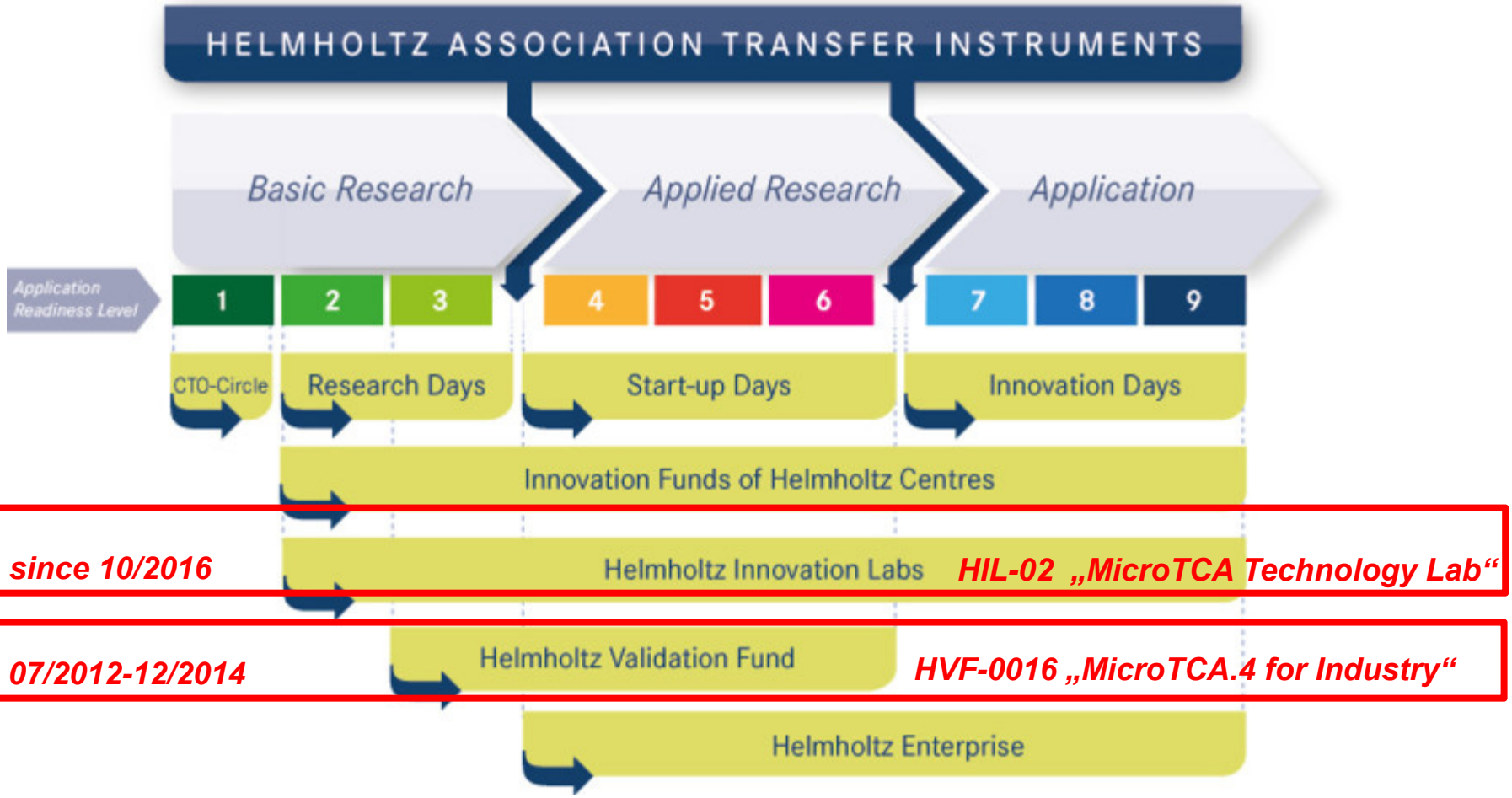
- rearside cable access
- mostly analog
- signal sampling & conditioning



Advanced **M**ezzanine **C**ard (**AMC**)

- mostly digital
- latest FPGAs
- data processing

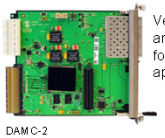
MicroTCA Technology Transfer



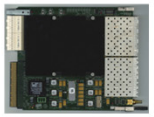
Source: https://www.helmholtz.de/en/transfer/technology_transfer/transfer_instruments/

HVF: Hardware development, community support

> analog/ digital signal processing boards


DAMC-2

Versatile data acquisition and processing board for high data throughput applications


DAMC-TCK7

General purpose low-latency data processing unit incl. reference clocks

DAMC-DS800

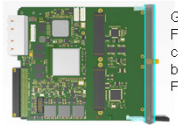
Very fast digitizer board with eight channels able to sample RF signals up to 2.7 GHz

DAMC-FMC20

General purpose FPGA mezzanine card (FMC) carrier board for 1 low pin and 1 high pin FMC

DAMC-X2timer

Low jitter synchronisation system: clock, trigger and data distribution on 1.3 Gbps fiber optics


DAMC-FMC25

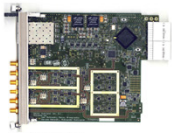
General purpose FPGA mezzanine card (FMC) carrier board for 2 high pin FMCs.

DRTM-PZT4

4-channel Piezo Driver module, supports simultaneous driving and sensing of 4 piezo elements (actuators and sensors)

DRTM-VM2

Two channel high frequency vector modulator for L and S bands at input center frequencies of 1.3GHz, 3.0GHz and 3.9GHz


DRTM-VM2LF

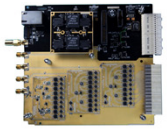
Two channel low frequency vector modulator 10MHz-500MHz

DRTM-AD84

Eight channel ADC (bandwith 90MHz), four channel DAC

DRTM-DWC8VM1

High frequency eight channel down- and single channel up conversion covering the L and S-band


DRTM-LOG1300

Multi-channel local oscillator generator and high frequency signal and low-jitter clock fan-out module

DRTM-DWC10

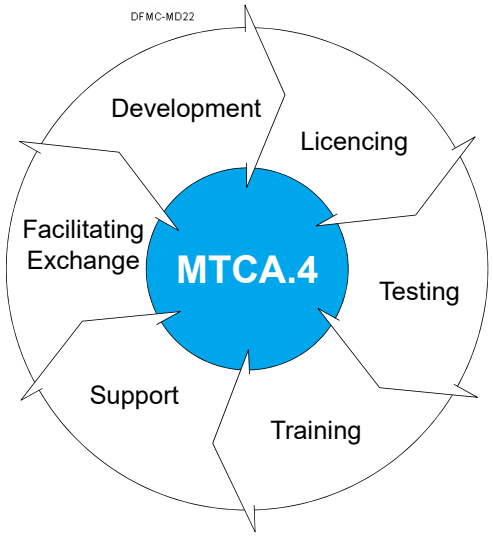
Ten channel high frequency down-converter operating in the L-, S band at input center frequencies from 700MHz–4GHz

DFMC-MD22

Cost-efficient two Channel stepper motor driver, providing up to 12V/1.8A per coil for bipolar stepper motors

> Support activities

- Annual MicroTCA Workshop (~150-200)
- MicroTCA Helpline
- Website: http://mtca.desy.de/
- MicroTCA Starter Kits
- MicroTCA Trainings (Basic, Advanced)

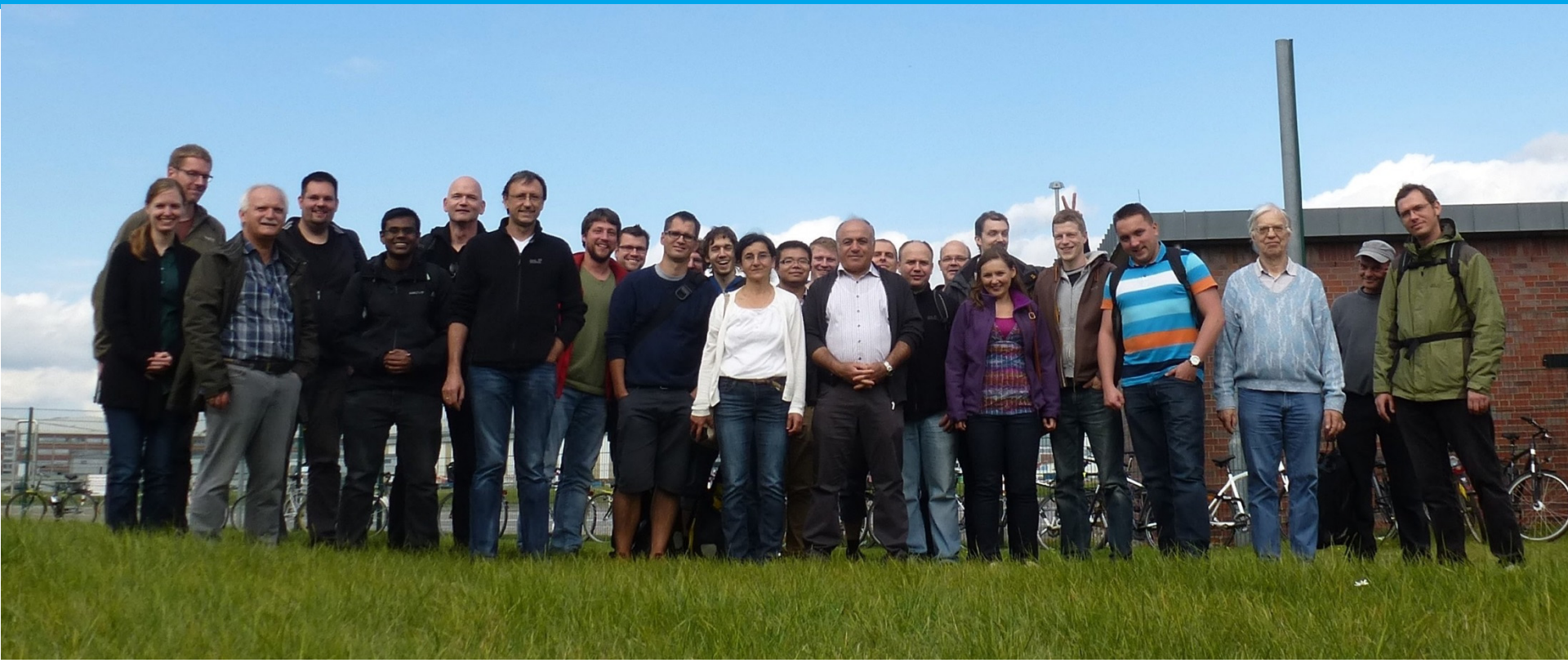


MicroTCA Technology Lab / MSK interaction

„MSK/TechLab Mixed Zone“:
306 – Advanced Measurements/ Special Equipment
305 – Kitchen/ Hospitality
304 – Meeting Room

„TechLab Core Zone“:
307 – Programmers 1 and 2
308 – TechLab Guests/ Storage
Hallway – Showcases and Posters
309a – Production Workshop
309 – Demo/ Test Lab
310 – Showroom/ Meeting room

MSK – Maschine Strahlkontrollen



> Responsibilities:

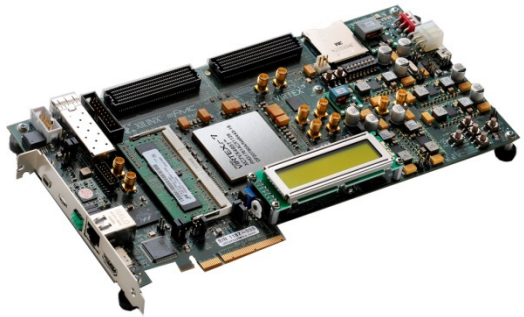
- Beam stabilization systems (transversal/longitudinal) in storage rings & linacs
- Timing for pre-accelerator systems
- Precision magnet controls for DESY II
- **Precision synchronization systems on femtosecond level Special Diagnostic devices**
- **RF Control Systems for the accelerator structures (LLRF)**

MicroTCA Technology Lab – basic facts and figures

- MicroTCA.4 → „MicroTCA“
- 5 year project, official start in October 2016
- 2,5m EUR grant, 5m EUR total budget
- team: 5-7, close collaboration with DESY MSK
- mid-term evaluation after 2,5 years
- mission: facilitate industrial applications based on MicroTCA, build „enabling space“ for collaborations with industrial partners
- break even after year 5
- continue HVF technology transfer: support, training, workshops, (…)
- expand services beyond HVF, build regular business operations:
  - **design services & product development (HW, FW, SW)**
  - **high-end test and measurement services**
  - **consulting (configuration, integration)**

MicroTCA Technology Lab – design services, product dev.

- VHDL
  - Board support packages
  - MGTs >10Gbps
  - High performance PCIe drivers
- Hardware
  - board development/ upgrades
  - latest FPGAs: Virtex 6, Kintex 7, Zynq
  - board portfolio
  - signal integrity >10Gbps
  - advanced board material
  - next generation backplanes
  - test adapters and calibration kits
- System Integration
  - vendor-independent, modular configurations
  - Custom designs for specific applications

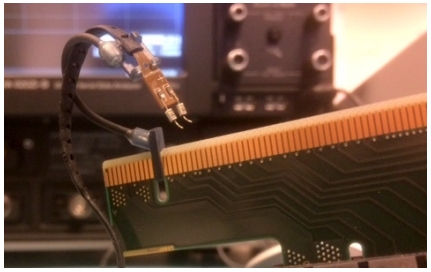


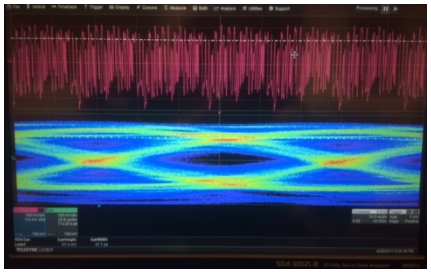
VIVADO™

https://www.xilinx.com/

MicroTCA Technology Lab – high-end test/measurement

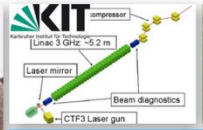
- 20 GHz / 80GS Scope
- Compliance testing
  - PCIe Gen3
  - 10GB Ethernet
  - DDR3/4 RAM
  - USB 3.0

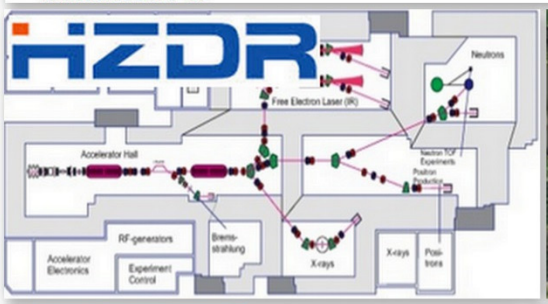


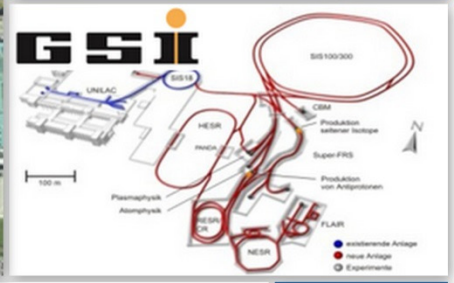


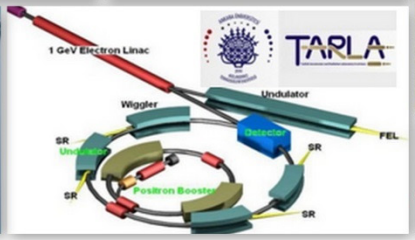
PCIe Gen3 testing in a medical technology device

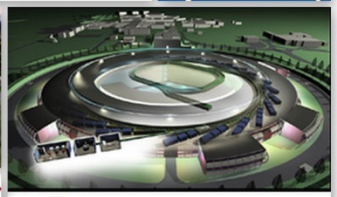
MicroTCA Technology Lab – consulting (config./integration)



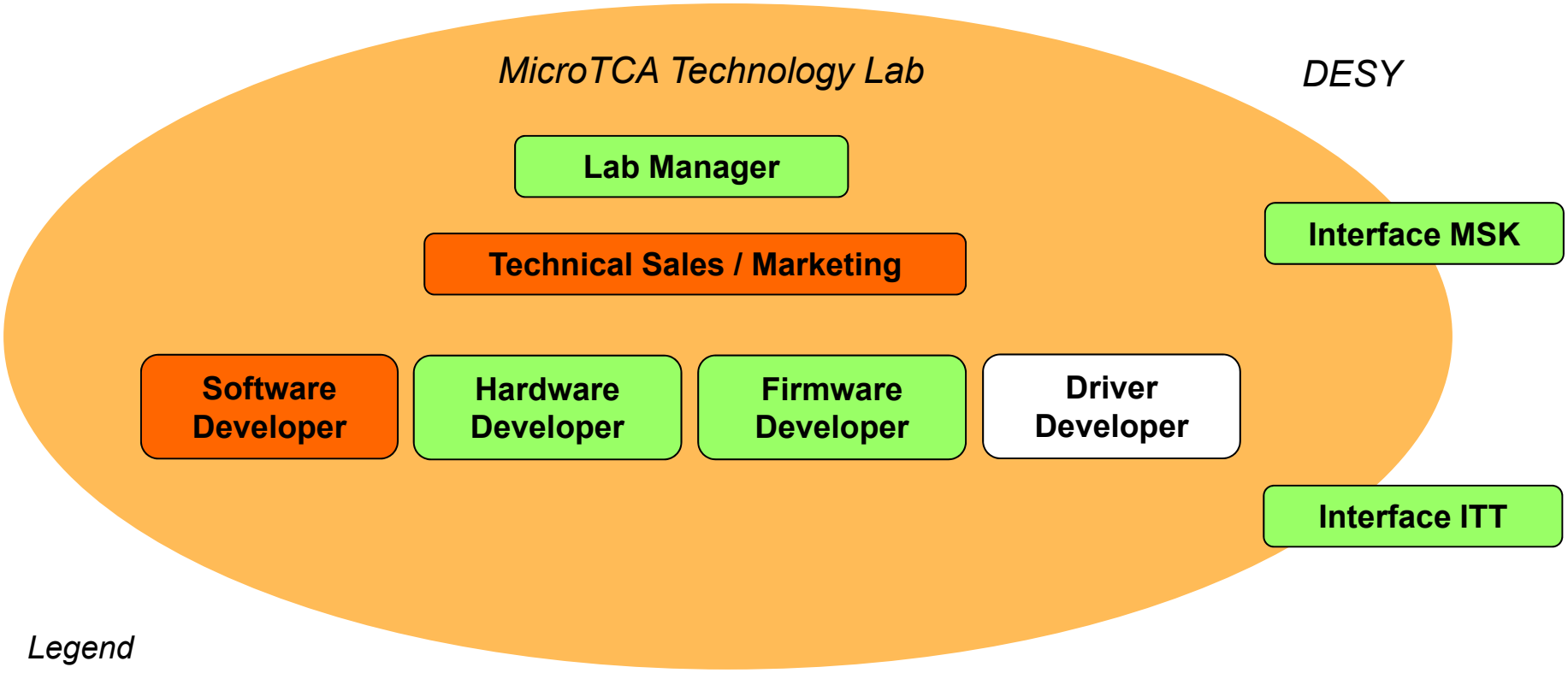








MicroTCA Technology Lab – Team status



Legend

- position filled
- position advertised 06/17
- position to be advertised later

JOB OFFERS.

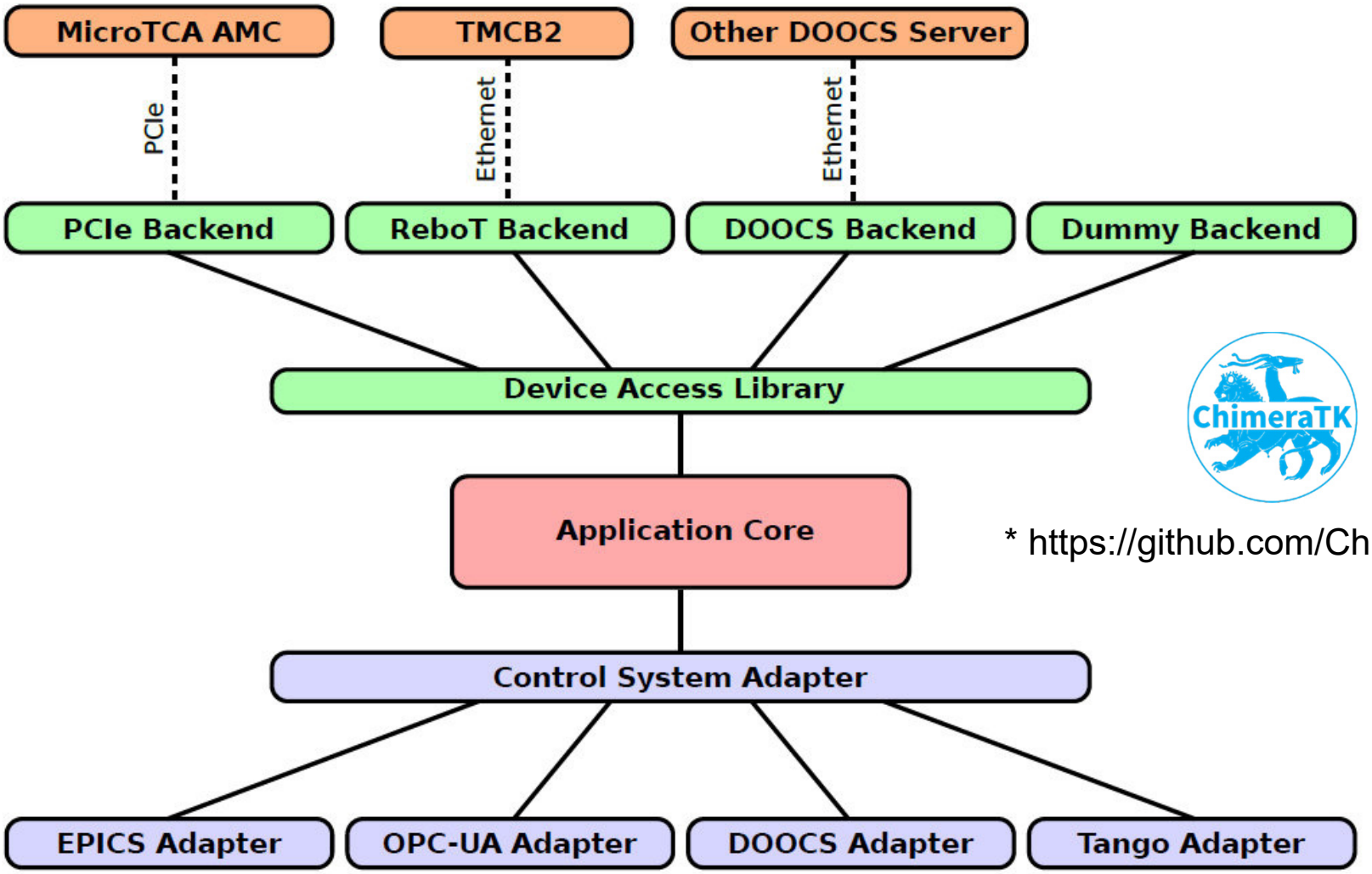
DESY offers challenging tasks in an international setting

Home / About DESY / Career / Job offers

http://www.desy.de/about_desy/career/job_offers/index_eng.html

MSK - Maschine Strahlkontrolle
ITT - Innovations- und Technologietransfer

TechLab/MSK – Software development framework and tools



ChimeraTK

* https://github.com/ChimeraTK/

* **C**ontrol system and **H**ardware **I**nterface with **M**apped and **E**xtensible **R**egister-based device **A**bstraction **T**ool **K**it

DESY

TechLab – Context: Entrepreneurship in PROs

Steinmo, M. and Rasmussen, E.: ***How firms collaborate with public research organizations: The evolution of proximity dimensions in successful innovation projects***. Journal of Business Research 69 (2016) 1250-1259

Coccia, M. and Rolfo, S.: ***New entrepreneurial behaviour of public research organisations: opportunities and threats of technological services supply***. Int. J. Services Technology and Management, 13-1/2 (2010), 134-151.

Klein, P. et al: ***Toward a theory of public entrepreneurship***. European Management Review 7 (2010), 1–15.

Tether, B.S. and Tajar, A.: ***Beyond industry–university links: Sourcing knowledge for innovation from consultants, private research organisations and the public science-base***. Research Policy 37, Issues 6–7 (2008), 1079–1095.

Rothaermel, F. T. et al: ***University entrepreneurship: a taxonomy of the literature***. Industrial and Corporate Change, 16-4 (2007) 691–791.

Lockett, A. et al: ***The creation of spin-off firms at public research institutions: Managerial and policy implications.*** Research Policy, 34-7 (2005), 981–993.

Hindle, K. and Yencken, J.: ***Public research commercialisation, entrepreneurship and new technology based firms: an integrated model***. Technovation 24 (2004), 793–803.

Beise, M. and Stahl, H.: ***Public research and industrial innovations in Germany***. Research Policy 28 (1999) 397–422.

TechLab – Context: Entrepreneurship in PROs

Steinmo, M. and Rasmussen, E.: ***How firms collaborate with public research organizations: The evolution of proximity dimensions in successful innovation projects***. Journal of Business Research 69 (2016) 1250-1259

Coccia, M. and Rolfo, S.: ***New entrepreneurial behaviour of public research organisations: opportunities and threats of technological services supply***. Int. J. Services Technology and Management, 13-1/2 (2010), 134-151.

Klein, P. et al: ***Toward a theory of public entrepreneurship***. European Management Review 7 (2010), 1–15.

Tether, B.S. and Tajar, A.: ***Beyond industry–university links: Sourcing knowledge for innovation from consultants, private research organisations and the public science-base***. Research Policy 37, Issues 6–7 (2008), 1079–1095.

Rothaermel, F. T. et al: ***University entrepreneurship: a taxonomy of the literature***. Industrial and Corporate Change, 16-4 (2007), 691–791.

Lockett, A. et al: ***The creation of spin-off firms at public research institutions: Managerial and policy implications.*** Research Policy, 34-7 (2005), 981–993.

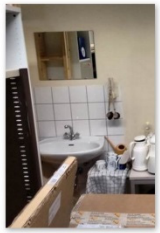
Hindle, K. and Yencken, J.: ***Public research commercialisation, entrepreneurship and new technology based firms: an integrated model***. Technovation 24 (2004), 793–803.

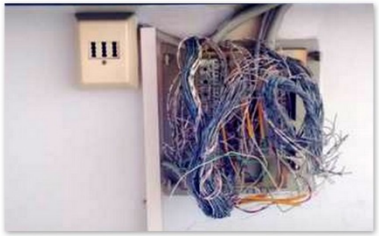
Beise, M. and Stahl, H.: ***Public research and industrial innovations in Germany***. Research Policy 28 (1999) 397–422.

TechLab – Context: Entrepreneurship in PROs

Steinmo, M. and Rasmussen, E. (2016)	→ ***proximity parameters*** *of firm-PRO interactions: social, geographical, organisational , cognitive; science –based vs. engineering firms*
Coccia, M. and Rolfo, S.: (2010)	→ ***matrix organisation*** *for Italian PROs (to make them more entrepreneurial)*
Klein, P. et al (2010)	→ ***research framework*** *and summary of open research questions/ research opportunities*
Tether, B.S. and Tajar, A (2008)	→ ***patterns of PRO use*** *in the UK: R&D, financial commitment to innovation, human capital, degree of innovation*
Rothaermel, F. T. et al (2007)	→ *how to make universities more entrepreneurial*
Lockett, A. et al (2005)	→ *role of* ***tacit knowledge*** *transfers, location issues*
Hindle, K. and Yencken, J (2004)	→ ***structure of innovation process*** *and spin-off creation*
Beise, M. and Stahl, H. (1999)	→ *PROs instrumental in product and process* ***innovations of the private sector***

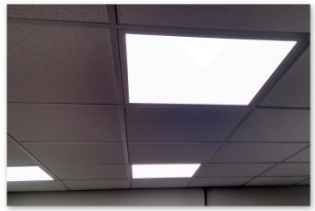
TechLab – Focus area: Infrastructure



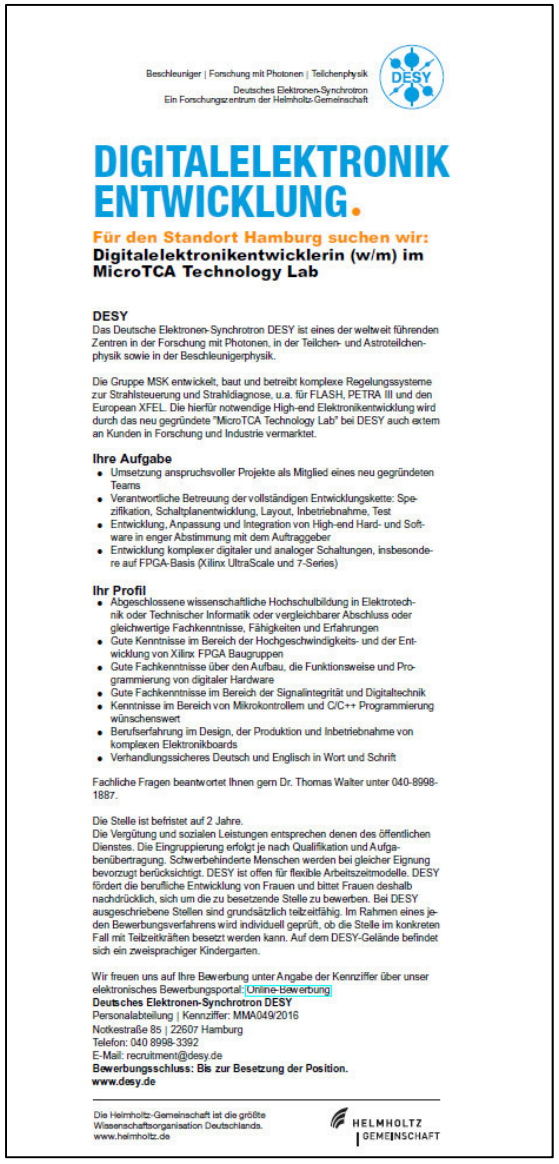


- *removals*
- *asbestos clean-up*
- *carpets*
- *ceiling tiles*
- *electrics/ lighting*
- *LAN/ WLAN*
- *safety/ security/ access control*
- *audio visual equipment*
- *painter/ decorators*
- *graphics design*
- *carpentry/ furniture*
- *lab installations*
- *locksmithery/ doors*
- *airconditioning*
- *plumbers*
- *…*

MicroTCA TECHNOLOGY LAB
A HELMHOLTZ INNOVATION LAB



TechLab – Focus area: Personnel



Beschleuniger | Forschung mit Photonen | Teilchenphysik
Deutsches Elektronen-Synchrotron
Ein Forschungszentrum der Helmholtz-Gemeinschaft

DIGITALELEKTRONIK ENTWICKLUNG.

Für den Standort Hamburg suchen wir:
Digitalelektronikentwicklerin (w/m) im MicroTCA Technology Lab

DESY
Das Deutsche Elektronen-Synchrotron DESY ist eines der weltweit führenden Zentren in der Forschung mit Photonen, in der Teilchen- und Astroteilchenphysik sowie in der Beschleunigerphysik.

Die Gruppe MSK entwickelt, baut und betreibt komplexe Regelungssysteme zur Strahlsteuerung und Strahldiagnose, u.a. für FLASH, PETRA III und den European XFEL. Die hierfür notwendige High-end Elektronikentwicklung wird durch das neu gegründete "MicroTCA Technology Lab" bei DESY auch extern an Kunden in Forschung und Industrie vermarktet.

Ihre Aufgabe
- Umsetzung anspruchsvoller Projekte als Mitglied eines neu gegründeten Teams
- Verantwortliche Betreuung der vollständigen Entwicklungskette: Spezifikation, Schaltplanentwicklung, Layout, Inbetriebnahme, Test
- Entwicklung, Anpassung und Integration von High-end Hard- und Software in enger Abstimmung mit dem Auftraggeber
- Entwicklung komplexer digitaler und analoger Schaltungen, insbesondere auf FPGA-Basis (Xilinx UltraScale und 7-Series)

Ihr Profil
- Abgeschlossene wissenschaftliche Hochschulbildung in Elektrotechnik oder Technischer Informatik oder vergleichbarer Abschluss oder gleichwertige Fachkenntnisse, Fähigkeiten und Erfahrungen
- Gute Kenntnisse im Bereich der Hochgeschwindigkeits- und der Entwicklung von Xilinx FPGA Baugruppen
- Gute Fachkenntnisse über den Aufbau, die Funktionsweise und Programmierung von digitaler Hardware
- Gute Fachkenntnisse im Bereich der Signalintegrität und Digitaltechnik
- Kenntnisse im Bereich von Mikrokontrollern und C/C++ Programmierung wünschenswert
- Berufserfahrung im Design, der Produktion und Inbetriebnahme von komplexen Elektronikboards
- Verhandlungssicheres Deutsch und Englisch in Wort und Schrift

Fachliche Fragen beantwortet Ihnen gern Dr. Thomas Walter unter 040-8998-1887.

Die Stelle ist befristet auf 2 Jahre.
Die Vergütung und sozialen Leistungen entsprechen denen des öffentlichen Dienstes. Die Eingruppierung erfolgt je nach Qualifikation und Aufgabenübertragung. Schwerbehinderte Menschen werden bei gleicher Eignung bevorzugt berücksichtigt. DESY ist offen für flexible Arbeitszeitmodelle. DESY fördert die berufliche Entwicklung von Frauen und bittet Frauen deshalb nachdrücklich, sich um die zu besetzende Stelle zu bewerben. Bei DESY ausgeschriebene Stellen sind grundsätzlich teilzeitfähig. Im Rahmen eines jeden Bewerbungsverfahrens wird individuell geprüft, ob die Stelle im konkreten Fall mit Teilzeitkräften besetzt werden kann. Auf dem DESY-Gelände befindet sich ein zweisprachiger Kindergarten.

Wir freuen uns auf Ihre Bewerbung unter Angabe der Kennziffer über unser elektronisches Bewerbungsportal: Online-Bewerbung
Deutsches Elektronen-Synchrotron DESY
Personalabteilung | Kennziffer: MMA049/2016
Notkestraße 85 | 22607 Hamburg
Telefon: 040 8998-3392
E-Mail: recruitment@desy.de
Bewerbungsschluss: Bis zur Besetzung der Position.
www.desy.de

Die Helmholtz-Gemeinschaft ist die größte Wissenschaftsorganisation Deutschlands.
www.helmholtz.de

HELMHOLTZ GEMEINSCHAFT

- Timeline:
  - October 2016: official project start
  - January 2017: job advertisment placed
  - April 2017: job interviews, candidate selected
  - May 2017: negotiations successful, paperwork completed
  - September 2017: candidate starts
  - ~ end of 2017: onboarding/ qualification completed
  - March 2019: mid-term evaluation of the project
- Time-limited contracts
- Public pay scale

TechLab – Focus area: Processes

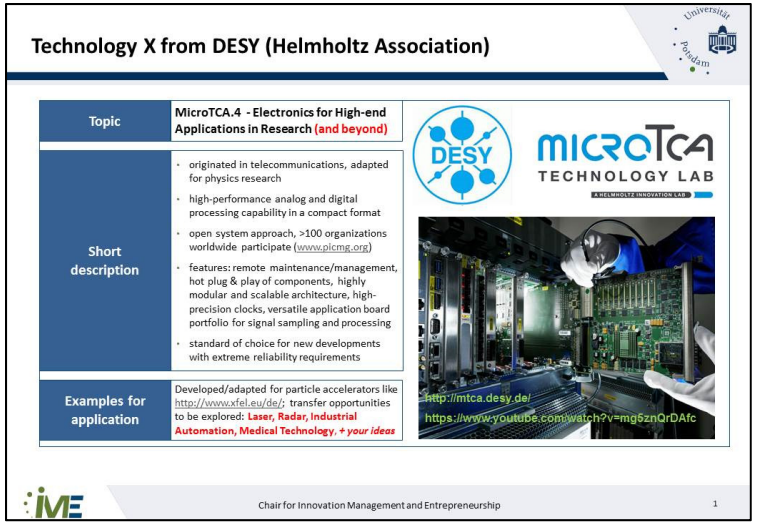
- Price indication / official quotation
- Contractual paperwork for collaboration agreements
- Procurement of non-standard IT
- Outbound logistics (insurance!)
- Project-specific cost controlling and budget transfers
- Website set-up (sub domain DESY)
- DESY CI-compliant marketing material
- …

TechLab – Focus area: Strategy

Federal Ministry of Education and Research

ENABLING INNOVATION

- objective: sustainable innovation strategy
- questionnaire + two-stage workshop:
  - Ressources, leadership, culture, organisation, clients, location, context, technological environment,…



- student team from TU Berlin/Potsdam, 2 month project
- market research/ market strategy (update)
- fresh ideas?

TechLab – (Preliminary) Summary of the Start-up Phase

- Your best estimate ? (... x2)
- Team diversity
- Celebrate victories (also the little ones)
- Enlist top-level support
- Working relationships
- 80/20
- Go explore…

Q&A, Contact

Dr. Thomas Walter
Head of MicroTCA Technology Lab

Deutsches Elektronen-Synchrotron DESY
A Research Centre of the Helmholtz Association
Notkestr. 85, 22607 Hamburg, Germany

phone: +49 (0) 40 8998 1887
mobile: +49 (0) 175 5080 473
email: thomas.walter@desy.de
web: http://mtca.desy.de/
visitors: building 3, room 319