PICMG Hardware & Software Group Updates

3rd MicroTCA Workshop for Industry & Research

DESY, December 8-11, 2014

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Chair xTCA for Physics Standards Group

SLAC National Accelerator Laboratory

Outline

- Physics Standards Committees
- Goals & Methodology
- Hardware Progress & Roadmap
- Software Progress & Roadmap
- Summary Conclusion
- Acknowledgment

PICMG Physics Standards Committees

PICMG: PCI Industrial Computer Manufacturers Group
200+ Companies, 12 Laboratories
Open Source Industry Standards Consortium
Publish, Maintain all Standards & Design Guides

xTCA for Physics Coordinating Committee

xTCA for Physics Hardware Committee

xTCA for Physics Software Committee

Standing Committee

Temporary Committees develop standards
Based on specific Statement of Work (SOW)

Goals & Methodology

- ## Goals
  - Develop PICMG HW-SW Standards & Guidelines for common interfaces, Commercial availability
  - Reduce design time, enhance interoperability between labs, industry products

- ## Methodology
  - Weekly meetings HWG, SWG
  - Document Specifications & Guidelines
  - Approval by PICMG (200+ companies, 12 labs)
  - Coordinating Committee meetings for new projects
 - Annual 1-2 day Workshops

Annual Workshops

No,	Year	Location	Comments
1	2007	Fermilab Chicago	ATCA, MTCA Industry tutorials
2	2008	Dresden	IEEE NSS-MIC Decision to form comm.
3	2009	IHEP Beijing	IEEE Real Time, xTCA 4 Physics starts
4	2010	Lisbon	IEEE NSS-MIC
5	2011	Valencia	IEEE Real Time, MTCA.4, PICMG 3.8
6	2012	Berkeley	IEEE Real Time
7	2012	DESY	1st MTCAWS
8	2013	DESY	2nd MTCAWS, ATCA Timing Guideline
9	2014	Nara Japan	IEEE Real Time
10	2014	DESY	3RD MTCAWS

Accomplishments - Hardware

- ## PICMG 3.8 Issued Standard
  - ATCA Rear Transition Module
  - Fabric, power, JTAG, IPMI, ATCA host

- ## MicroTCA.4 Issued Standard
  - Double-Wide Card w/RTM
  - 12-slot crate, RTM interface, cooling
  - Fabric, power, JTAG, IPMI
  - managed from host AMC
  - RTM hot-swappable

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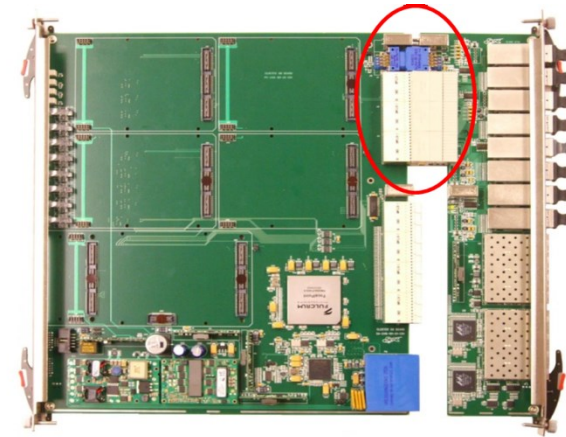
Physics Extensions Standards

--HWG & R. Downing, SLAC, Editor

AdvancedTCA®

PICMG® 3.8
Draft RC1.0 for Revision 1.0

AdvancedTCA Rear Transition Module Zone 3A

26 July 2011

PICMG®
Open Modular
Computing Specifications

MicroTCA™

PICMG® Specification MTCA.4
R 1.0 Draft 0.9xi

MicroTCA Enhancements for Rear I/O and Precision Timing

18 July 2011

PICMG®
Open Modular
Computing Specifications

μTCA®

Physics ATCA Design Guide - Timing

**Physics Design Guide
for
Clocks, Gates & Triggers
in
Instrumentation**

PDG.0 R0.8

19 March 2013

PICMG®

NOTE: This Design Guide is not a specification. It is intended to aid in using PICMG specifications to implement systems used in Physics research apparatus and machine control.

*- J. Sousa, IPFN Lisbon,
& R. Downing, SLAC, Editor*

Progress 2014 – Hardware

- ## RTM Classes
  - Defined Classes for Zone 3 Rear Transition (RTM) for analog, digital interoperability between labs, vendors
  -

- ## Auxiliary RTM Backplane
  - Extended hardware standard with Auxiliary Rear Transition Backplane

- ## Module Covers
  - Developed designs for Side 1, Side 2 covers
  - *D. Mann, Schroff, E. Waltz, ELMA (ret.)*

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RTM Classes & SubClasses *F. Ludwig, DESY*

- ## Purpose:
  - Classify RTMs for greater compatibility of AMC-RTM analog & clock signals over Zone 3

- ## Class & Subclass Definitions
  - Class A1 defines two 3-row x 10 Zone 3 connectors
  - Subclass A1.0 defines analog Outputs
  - Subclass A1.C0 defines AMC_TCLK Outputs
  - Subclass A1.1C0 defines AMC_TLK Inputs & Outputs

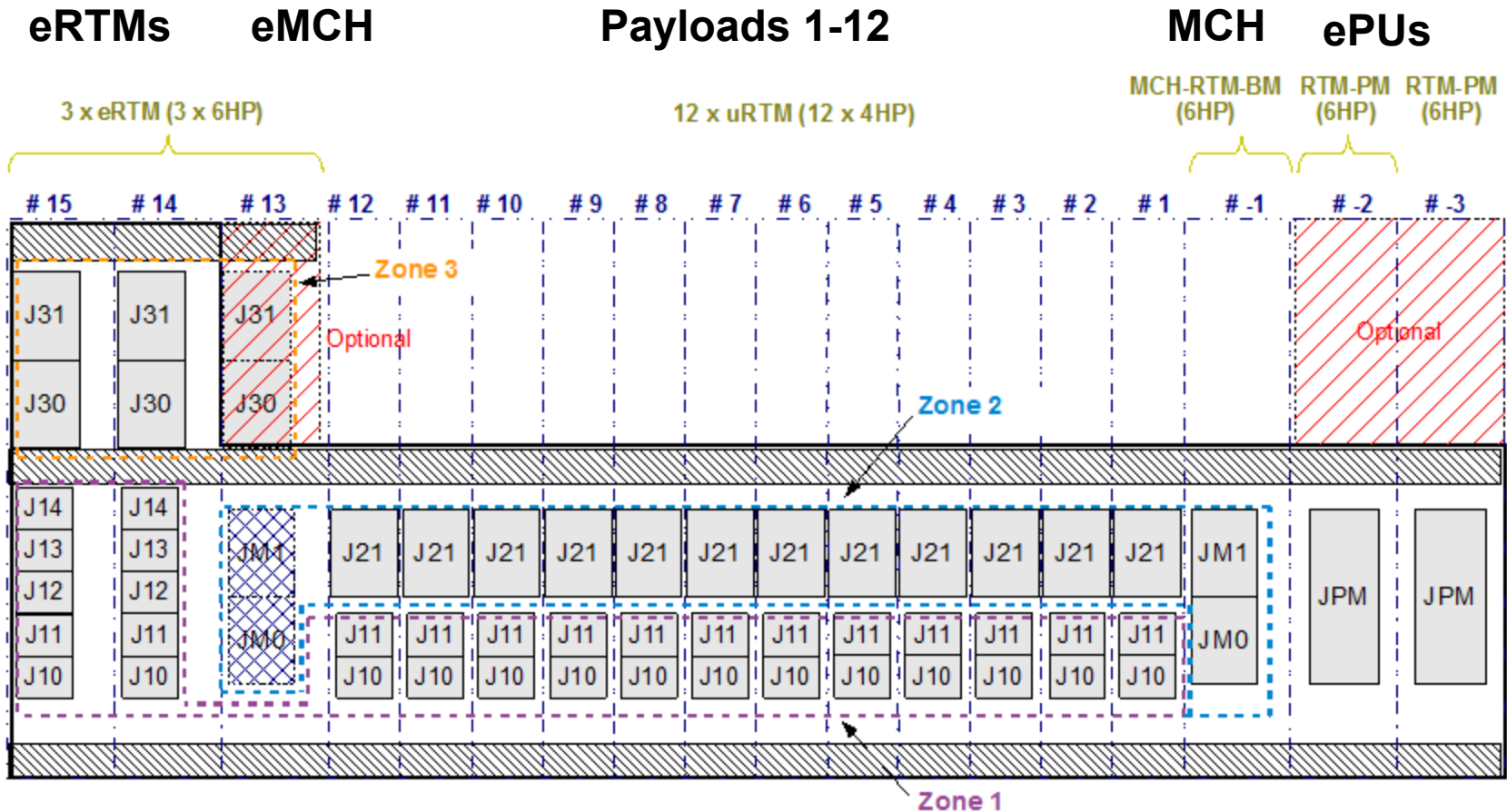# Auxiliary RTM Backplane *K. Czuba, DESY*

Figure 1 Connector zones located on the μRFB

Auxiliary RTM Backplane

Courtesy K. Czuba, DESY

- Features
  - Rear power units
  - Power distribution to RTMs
  - IPMI from MCH
  - IO connections
  - Local oscillator distribution (RF case)
  - Standard form factor, mounting, tolerances, Zone 2-3 connectors & locations, not specific applications.
  - Allows new classes of e-backplane
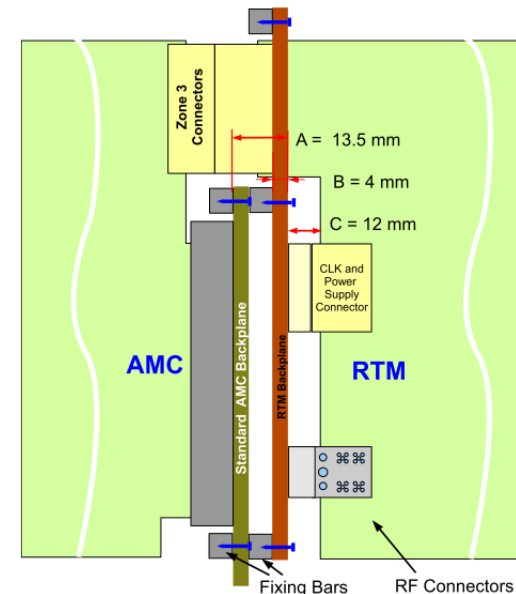
Side Elevation

Module Cover Side 1

D. Mann (Schroff) & E. Waltz (ELMA, ret.). See Schroff Exhibit

AMC keepout zones

SIDE 1

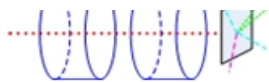**(Picture is mirrored)**

Precision +/-.05 mm
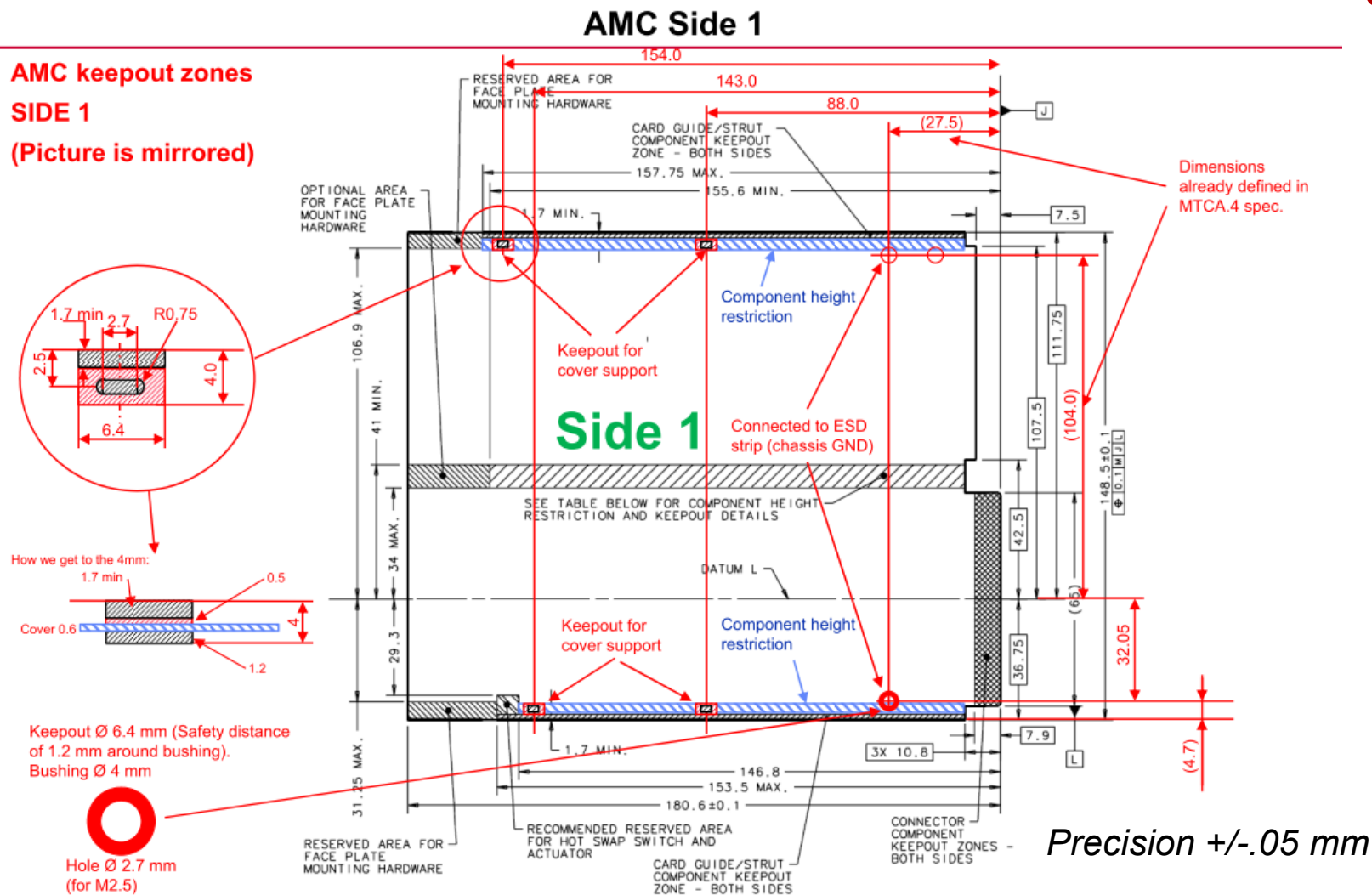
Progress 2014 - Software

- ## Draft Standard Design Guidelines
  - Standard Process Model, Device Model, Hardware API, Hot Plug Procedure, Management extensions

    - A.P. Lowell, TripleRing.

Standard Process Model

xTCA for Physics
Standard Process Model Design Guide

Guidelines for designing multi-threaded software for xTCA-based physics systems

26 January, 2013

Rev. 00.5

This design guide is not a specification. It contains additional detail information but does not replace applicable PICMG xTCA for Physics specifications.

For complete guidelines on the design of xTCA for Physics compliant boards and systems, refer also full specification – do not use this design guide as the only reference for any design decisions.

Standard Device Model

xTCA for Physics
Standard Device Model Design Guide

Guidelines for designing I/O access software for xTCA-based physics systems

July 23, 2014

Rev. 00.10

This design guide is not a specification. It contains additional detail information but does not replace applicable PICMG xTCA for Physics specifications.

For complete guidelines on the design of xTCA for Physics compliant boards and systems, refer also full specification – do not use this design guide as the only reference for any design decisions.

Standard Hardware API

xTCA for Physics
Standard Hardware API Design Guide

Guidelines for designing hardware access APIs for xTCA-based physics systems
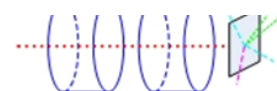
February 21, 2014

Rev. 00.1

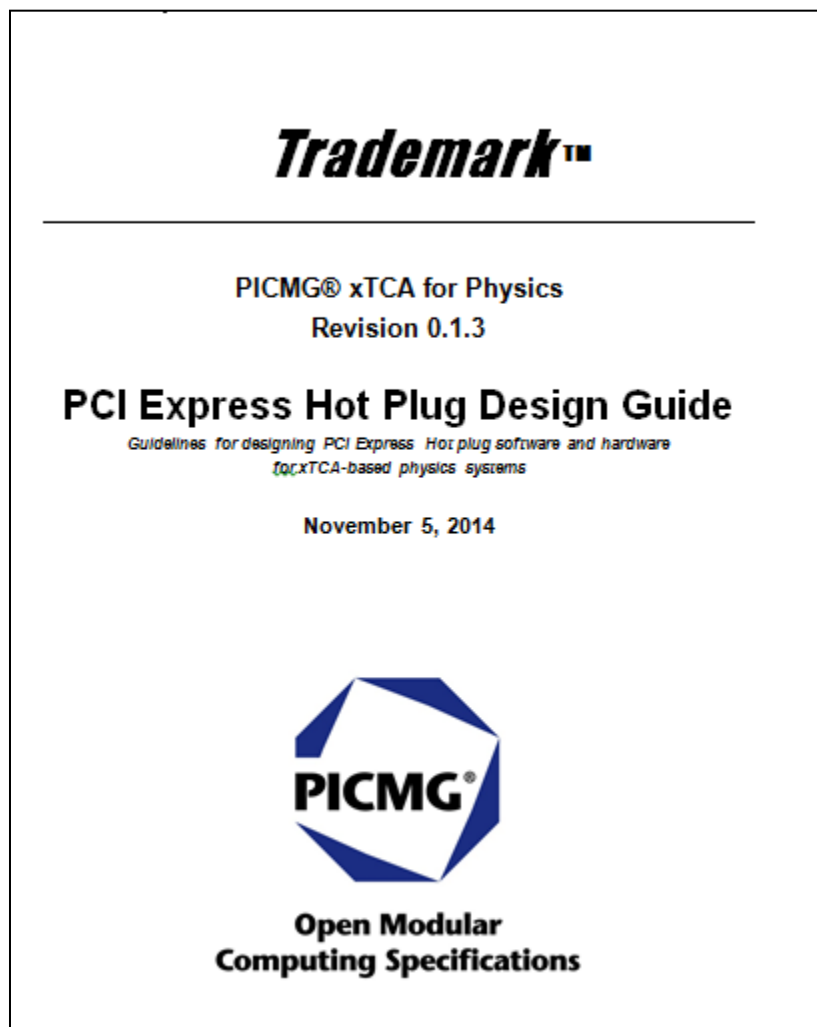This design guide is not a specification. It contains additional detail information but does not replace any applicable PICMG xTCA for Physics specifications.

For complete guidelines on the design of xTCA for Physics compliant boards and systems, refer also to the full specification – do not use this design guide as the only reference for any design decisions.

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Hot Plug Design Guide   *L. Petrosyan, DESY.*

Trademark™

PICMG® xTCA for Physics
Revision 0.1.3

PCI Express Hot Plug Design Guide
Guidelines for designing PCI Express Hot plug software and hardware
for xTCA-based physics systems

November 5, 2014

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**Open Modular
Computing Specifications**

*Draft complete except for
adding RTM procedure
reference*

Roadmap Status - Hardware

Item	Task Name	Issue	Status
1.	**MECHANICS**		
1.1	Backplane Grndg.	PU noise on BP	Solved
1.2	Covers AMC, RTM	Protection	Prototypes built
1.3	RTM Backplane	Save space, imbed RF cables	Agreed, in documentation
2.	**POWER UNITS**		
2.1	Define Redundancy	Current share for ½ load each	Experts meeting held, hard prob.
2.2	Limit voltage Tr	Noise upsets IPMI	Agreed, need doc
2.3	Classify PU noise	16-bit ADCs need low noise	Pending

Roadmap Status - Management

Item	Task Name	Issue	Status
3.	**MANAGEM'T**		
3.1	FMC Carrier	Identify type, power, status	Pending
3,2	PCIe endpoint ready	Make rule for delay store in all AMC FRUs	Agreed, Pending
3.3	RTM Hot Plug	Note on AMC-RTM MMC communication	Agreed, Pending
3.4	Define pins for AMC control of RTM power	Possible damage if pwr. not applied first	Pending action or done?
3.5	RTM analog Classes Zone 3	Analog, TCLK mixed classes defined in tables	Draft, expand to digital classes

Roadmap Status - Software 1

Item	Task Name	Issue	Status
4.	**SOFTWARE**		
4.1	Std Process Model	Standardize interface OS Access-POSIX	Draft reviewed; adapter pending
4.2	Std Device Model	Standardize access	RTOS adapt pending
4.3	Std HW API	Standard register set sync w/ DESY	Register model done; doc in prog
4.4	Routing, pro'cols, latency, jitter	Typical Specs needed	Pending
4.5	Command & Control	Bring IPMI to POSIX level	Not needed in DOOCS, EPICS

Roadmap Status - Software 2

Item	Task Name	Issue	Status
4.5	Enterprise Platform Mgmt., updates	Fast Application Level code updates need DG	Solution is HPM.2 IPMI over Ethernet, IPMI in //
4.6	Hot Plug Guideline	Design Guide for IPMI-PCI procedure	Draft done; add note re: RTM Hot Plug via AMC
4.6	Reference Libraries	. Labs moving to COTS host systems	DESY repository for code, PICMG for Specs, DG's;
4.7	Application Failover Management, HW/SW redundancy.	Special for very high availability. Open source tools e.g. Open Clovis may be applicable	Discussion of applicability started, pending definition

Summary Conclusions

- Future Roadmaps
  - 75% of jobs worked on 2014; aim to complete in progress documentation jobs in Q1-2 of 2015
  - _Progress due to new people added since MTCAWS 2013._

- Future Resource Needs
  - MTCA.4 is a huge investment by growing number of labs especially DESY soon to be joined by SLAC.
  - _Need additional volunteers for reference testing, documentation, interoperability issues, committees_
  - Vital to maintain momentum of new standards culture!
  - _Contact larsen@slac.stanford.edu_

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Acknowledgments

- Individual Contributors:
  - Far too numerous to list individuals but special thanks to all members of following teams:

- Lab HW, SW Teams:
  - DESY, SLAC, XFEL, ITER, IHEP, IPFN Lisbon, IN2P3 & Saclay, Lodz, U. Stockholm

- Industry Teams:
  - TripleRing Technologies, Pentair Schroff, ELMA, NAT, PowerBridge, TEWS, VadaTech, Hytec