

# Conference Guide

10<sup>th</sup> International Workshop on Personal  
Computers and Particle Accelerator Controls

October 14 -17, 2014, Karlsruhe | Germany



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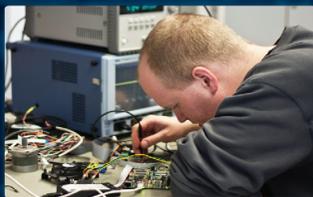
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FPGA programming

PVSS, FESA, DOOCS, TINE, ACS...

Timing system, MPS

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# 10<sup>th</sup> International Workshop on Personal Computers and Particle Accelerator Controls

October 14 -17, 2014, Karlsruhe | Germany

Hosted by



KIT – Karlsruhe Institute of Technology



ANKA - Synchrotron Radiation Facility at KIT

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# Table of Contents

Dear PCaPAC Participant,	V
Conference Organization	VI
Local Organizing Committee	VI
International Program Committee	VI
Sponsors	VII
Exhibitors	VII
KIT - Karlsruhe Institute of Technology	VIII
ANKA - Synchrotron Radiation Facility at KIT	VIII
Conference Venue	IX
Tutorial Day	X
Program	XI
Poster Presentation Guidelines	XII
Internet Access	XII
Abstracts	1

## Dear PCaPAC Participant,



### Welcome to Karlsruhe!

The 10th International Workshop on Personal Computers and Particle Accelerator Control (PCaPAC 2014) is taking place in Karlsruhe, Germany, from October 14th to 17th 2014. The conference is organized and hosted by the Synchrotron Radiation Facility ANKA, which is part of the Karlsruhe Institute of Technology (KIT). KIT was founded in 2009 with the merger of Forschungszentrum Karlsruhe and University Karlsruhe and with over 9000 employees it is one of the largest teaching and research organizations in the world.

PCaPAC traditionally focuses on the development and management of control and data acquisition systems using PC technology.

This year the focus is on emerging technologies like modern – mobile – user interfaces, DSPs, FPGAs, modern data acquisition systems, cloud computing, software management and databases. An interesting topic will be XLDBs and noSQL DBs.

As is traditional, PCaPAC will start on the first day with a series of tutorials. You will have the chance to join these tutorials and learn ‘hands on’ directly from the experts:

- Tango Control System for newbies, organized by ESRF and SOLEIL, France
- Introduction to noSQL DBs, organized by INFN, Italy
- Introduction into the Web2cToolkit, organized by DESY, Germany
- Set up for success - Creating a development environment from scratch, organized by Softwareschneiderei GmbH, Germany
- Introductory workshop on programmable hardware, organized by KIT, Karlsruhe

The scientific program will include invited talks, contributed talks and a poster session. For the invited talks I am happy to welcome: Pieter Hintjens, subject ZeroMQ; Fabrizio Gagliardi, subject Grids and Clouds; Carola Lilienthal, subject Current Trends in Software Development Management; Heiko Ehrlichmann, subject Machine availability monitoring; Dirk Düllmann, subject overview of current database systems.

On behalf of the Local Organizing Committee, it gives us great pleasure to welcome the more than 100 contributors to PCaPAC 2014, to Karlsruhe, to Baden-Württemberg and to Germany.

The local organizing committee suggests that you see some of the countryside around the city of Karlsruhe. A wine tasting excursion is planned at a vineyard in the palatinate region. A location for technology lovers has been selected for the conference dinner, the Technik Museum Speyer, with a Buran space shuttle on display among other extraordinary exhibits.

Wolfgang Mexner  
Chair PCaPAC 2014

## Conference Organization

### Conference Secretariat

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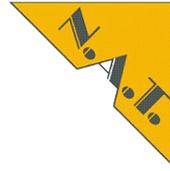
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Pavel Chevtsov	PSI, Switzerland
Matthias Clausen	DESY, Germany
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Akihiro Yamashita	Spring 8 (Japan)
Takashi Kosuge	KEK (Japan)
Philip Duval	DESY (Germany)
Ralph Baer	GSI (Germany)
Reinhard Bacher	Desy (Germany)

## Sponsors



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## Exhibitors



On October 01, 2009, the Karlsruhe Institute of Technology (KIT) was founded by a merger of Forschungszentrum Karlsruhe and Universität Karlsruhe.



KIT bundles the missions of both precursory institutions: A university of the state of Baden-Wuerttemberg with teaching and research tasks and a large-scale research institution of the Helmholtz Association conducting program-oriented provident research on behalf of the Federal Republic of Germany. Within these missions, KIT is operating along the three strategic fields of action of research, teaching, and innovation.

## ANKA - Synchrotron Radiation Facility at KIT



With the opening of ANKA in March 2003, Karlsruhe joined the exclusive club of some 50 cities worldwide that maintain and develop their own synchrotron light source for the benefit of an international user community.

As a large scale facility of the Helmholtz Association of National Research Centers ANKA is part of the national and European infrastructure offered to scientific and commercial users for performing excellent science and relevant technological development.

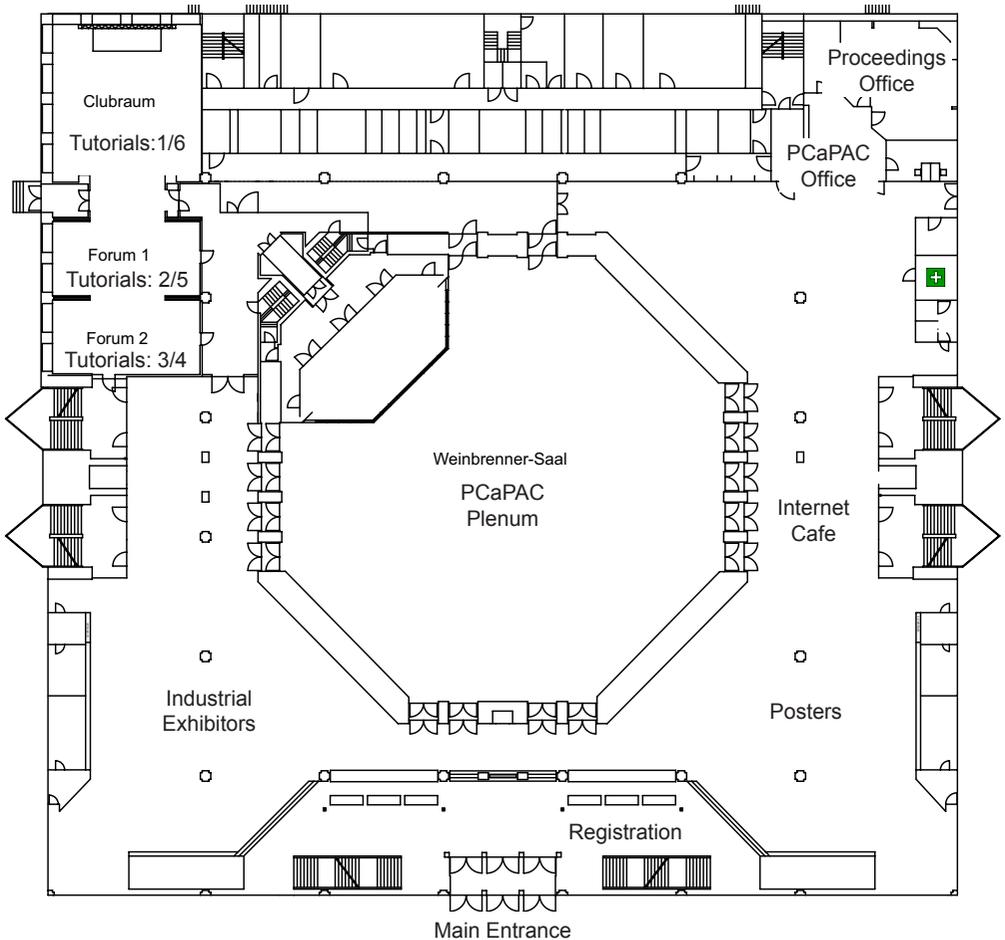


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# Conference Venue

Convention Center Karlsruhe  
Karlsruher Messe- und Kongress-GmbH, Festplatz 9, 76137 Karlsruhe  
www.messe-karlsruhe.de

## Ground floor



Tutorial: Session 7 - Meeting Point at Main Entrance for bus transfer to KIT

# Tutorial Day

(<http://www.anka.kit.edu/program.php>)

## Tuesday 14 th October

<b>Registration Tutorial</b> (08:00 → 09:00)				
09:00	<b>Session 1</b>	<b>Session 2</b>	<b>Session 3</b>	<b>Session 7</b>
↓	Tango	CSS	Software Development	Introduction Hardware
10:30	Introduction	Introduction	Environment Part 1	Programming (FPGA)
<b>Coffee Break</b> (10:30 → 11:00)				
11:00	<b>Session 1</b>	<b>Session 2</b>	<b>Session 3</b>	<b>Session 7</b>
↓	Tango	CSS	Software Development	Introduction Hardware
12:30	Introduction	Introduction	Environment Part 1	Programming (FPGA)
<b>Lunch Break</b> (12:30 ↔ 13:30)				
13:30	<b>Session 6</b>	<b>Session 5</b>	<b>Session 4</b>	<b>Session 7</b>
↓	Introduction	Introduction	Software Development	Introduction Hardware
15:00	noSQL Databases	Web2c Toolkit	Environment Part 2	Programming (FPGA)
<b>Coffee Break</b> (15:00 → 15:30)				
15:30	<b>Session 6</b>	<b>Session 5</b>	<b>Session 4</b>	<b>Session 7</b>
↓	Introduction	Introduction	Software Development	Introduction Hardware
17:00	noSQL Databases	Web2c Toolkit	Environment Part 2	Programming (FPGA)
<b>Registration PCaPAC</b> (17:00 → 19:00) <b>Coming Together</b>				

# Program

(<http://www.anka.kit.edu/program.php>)

	Wednesday 15 th October	Thursday 16 th October	Fridayday 17 th October
	<b>Registration</b> (07:30 → 08:30)		
	<b>Welcome (WEL)</b> (08:30 → 09:00)		
09:00 ↓ 09:45	<b>Plenary Talk (WIOM)</b> Fabrizio Gagliardi Experiences and trends in distributed computing	<b>Plenary Talk (TIOM)</b> Carola Lilienthal Current and Lasting trends in Software Development Management	<b>Plenary Talk (FIOM)</b> Dirk Düllmann Database Technologies and Applications
09:45 ↓ 10:30	<b>Contributed Oral (WC01)</b> Control System Chair: A. Buteau	<b>Contributed Oral (TCO1)</b> Software Management Chair: T. Kosuge	<b>Contributed Oral (FCO1)</b> Databases Chair: L. Catani
	<b>Coffee Break</b> (10:30 → 11:00)		
	<b>Contributed Oral (WC02)</b> Data Acquisition Chair: P. Chevtsov (11:00 → 12:45)	<b>Contributed Oral (TCO2)</b> Control System II Chair: A. Buteau (11:00 → 12:45)	<b>Poster Session II (FPO)</b> (11:00 → 12:30)
			<b>Poster in Pills (FPI)</b> (12:30 →12:45)
12:45 ↓ 13:45	<b>Lunch</b>		
	<b>Poster Session I (WPO)</b> (13:45 → 15:30)	<b>Plenary Talk (TIOA)</b> Pieter Hintjens "About ZeroMQ" (13:45 → 14:30)	<b>Plenary Talk (FIOA)</b> 13:45 → 14:15 Heiko Ehrlichmann Accelerator Avalability Monitoring
		<b>Contributed Oral (TCO3)</b> Hardware Chair: R. Baer (14:30 → 15:45)	<b>Contributed Oral (FCO2)</b> User Interfaces Chair: R. Bacher (14:15 → 15:45)
	<b>Poster in Pills (WPI)</b> (15:30 →15:45)		
15:45 ↓ 16:30	<b>Coffee Break</b>		
	<b>Exursion Palatinate Region (S1)</b> (return 21:30) (16:30 → 21:30)	<b>Visit Synchrotron ANKA (S2)</b> (16:30 → 18:00)	<b>Closing PCaPAC (CLOS)</b> Isamu Abe Price Good bye (16:15 → 18:00)
		<b>Workshop Dinner (S3)</b> (19:00 → 23:00) Space Hall /Museum Speyer	

## Poster Presentation Guidelines

Due to the large number of posters accepted for PCaPAC, the organizers have broken up poster presentation into two sessions. Posters accepted for Session I will be presented on Wednesday, October 15, at 13.45 and can be fitted from Wednesday 8 am. These posters will be removed by Thursday 12 noon. Posters accepted for Session II will be presented on Friday October 17 at 11 am. These posters can be fitted on Thursday lunch break starting at 12.45.

There is only one poster per person allowed and we will accept only poster from participants.

Posters will be on display in the Poster Area. Poster boards' dimensions will be 118 cm in width and 147 cm in height. We recommend a poster size of A0. Pins for fastening the posters will be available in the Poster Area.

## Internet Access

For PCaPAC, every participants will get his own free WLAN accounts and passwords for three devices. In case your accounts are blocked, please ask at the PCaPAC office for help. Near the poster area you will find a internet café with a switch, power sockets and two Windows PCs.

# Contents

WEL — Welcome . . . . .	5
WEL01 Welcome to KIT and the Synchrotron Radiation Facility ANKA . . . . .	5
WEL02 Welcome and Opening . . . . .	5
WIOM — Morning Plenary Talk . . . . .	5
WIOM01 Experience and Trends in Distributed Computing . . . . .	5
WCO1 — Control Systems . . . . .	6
WC0101 Drivers and Software for MicroTCA.4 . . . . .	6
WC0102 Controls Middleware for FAIR . . . . .	6
WC0103 Integration of New Power Supply Controllers in the Existing Elettra Control System . . . . .	7
WCO2 — Data Acquisition . . . . .	8
WC0201 Computing Infrastructure for Online Monitoring and Control of High-throughput DAQ Electronics . . . . .	8
WC0202 Data Management at the Synchrotron Radiation Facility ANKA . . . . .	8
WC0203 Profibus in Process Controls . . . . .	8
WC0204 A Prototype Data Acquisition System of Abnormal RF Wave- form at SACLA . . . . .	9
WC0205 Upgrade of SACLA DAQ System Adapts to Multi-Beamline Operation . . . . .	9
WC0206 Sardana - a Python Based Software Package for Building Sci- entific SCADA Applications . . . . .	10
WC0207 A New Data Acquisition Software and Analysis for Accurate Magnetic Field Integral Measurement at BNL Insertion Devices Laboratory . . . . .	10
WPO — Poster Session I . . . . .	11
WPI — Poster in Pills . . . . .	24
WPI01 News from the FAIR Control System under Development . . . . .	24
WPI02 The EMBL Beamline Control Framework . . . . .	24
WPI03 Status of the FLUTE Control System . . . . .	24
WPI04 STARS: Current Development Status . . . . .	24
WPI05 Control System Design for the VELA Test Accelerator at Dares- bury Laboratory . . . . .	25
S1 — Excursion Palatinate Region . . . . .	26
S1001 Social Event . . . . .	26
TIOM — Morning Plenary Talk . . . . .	27
TIOM02 Current and Lasting Trends in Software Development Man- agement . . . . .	27

TCO1 — Software Management . . . . .	28
TC0101 Benefits, Drawbacks and Challenges During a Collaborative Development of a Settings Management System for CERN and GSI . . . . .	28
TC0102 Eplanner Software for Machine Activities Management . . . . .	28
TC0103 Recent Highlights from Cosylab . . . . .	29
TCO2 — Control System II . . . . .	30
TC0201 Managing the FAIR Control System Development . . . . .	30
TC0202 Status of Indus-2 Control System . . . . .	30
TC0203 Progress Report of ILSF Control Group Activities . . . . .	30
TC0204 First Operational Experience of the ICHAOS Framework . . . . .	31
TC0205 Conceptual Design of the Control System for SPring-8 II . . . . .	31
TC0206 Status of KEK Electron/Positron Injector Linac Control Sys- tem toward SuperKEKB Upgrade . . . . .	32
TC0207 The Common Device Interface 2.0 . . . . .	32
TIOA — Afternoon Plenary Talk . . . . .	33
TIOA01 About ZeroMQ . . . . .	33
TCO3 — Hardware . . . . .	34
TC0301 Inexpensive Scheduling in FPGAs . . . . .	34
TC0303 TestBed – Automated Hardware-in-the-Loop Test Framework . . . . .	34
TC0304 Launching the FAIR Timing System with CRYRING . . . . .	35
TC0305 TCP/IP Control System Interface Development Using Mi- crochip Brand Microcontrollers . . . . .	35
S2 — Visit Synchrotron ANKA . . . . .	36
S2001 ANKA Synchrotron Radiation Facility . . . . .	36
S3 — Dinner Space Hall Museum Speyer . . . . .	37
S3001 Workshop Dinner . . . . .	37
FIOM — Morning Plenary Talk . . . . .	38
FIOM01 Database Technologies and Applications . . . . .	38
FCO1 — Databases . . . . .	39
FC0106 The Role of the CEBAF Element Database in Commissioning the 12 GeV Accelerator Upgrade . . . . .	39
FC0107 Latest Trends in Database Technology . . . . .	39
FPO — Poster Session II . . . . .	40
FPI — Poster in Pills . . . . .	51
FPI01 Using InfiniBand for High-Throughput Data Acquisition in a TANGO Environment . . . . .	51
FPI02 Picosecond Sampling Electronics for Terahertz Synchrotron Radiation . . . . .	51
FPI03 New developments on the FAIR Timing Master . . . . .	52
FPI04 Web Based Machine Status Display for the Siam Photon Source . . . . .	52
FPI05 Control System Software Environment and Integration for the TPS . . . . .	53
FIOA — Plenary Talk Afternoon . . . . .	54
FIOA01 Accelerator Availability Monitoring . . . . .	54

FCO2 — User Interfaces . . . . .	55
FC0201 Renovating and Upgrading the Web2cToolkit Suite: A Status Report . . . . .	55
FC0202 OpenGL-Based Data Analysis in Virtualized Self-Service Environments . . . . .	55
FC0203 Making it all Work for Operators . . . . .	55
FC0204 How the COMETE Framework Enables the Development of GUI Applications Connected to Multiple Data Sources . . . . .	56
FC0205 Archive Playback - Post Mortem Data Analysis . . . . .	57
FC0206 PANIC, a Suite for Visualization, Logging and Notification of Incidents . . . . .	57
CLOS — Isamu Abe Price and Closing . . . . .	58
CLOS01 Isamu Abe Prize . . . . .	58
CLOS02 Closing PCaPAC2014 . . . . .	58
Author List . . . . .	59

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15-Oct-14	08:30 – 09:00	Weinbrenner Plenary Room
<b>WEL — Welcome</b>		
<b>Chair:</b> W. Mexner (KIT)		

**WEL01** **Welcome to KIT and the Synchrotron Radiation Facility ANKA**  
**08:30** **T. Baumbach** (KIT)  
 Welcome from the director of the Synchrotron Radiation Facility ANKA, Prof. Tilo Baumbach.

**WEL02** **Welcome and Opening**  
**08:45** **W. Mexner** (KIT)  
 Welcome from the Chairs and opening of the 10th International Workshop on Personal Computers and Particle Accelerator Controls.

15-Oct-14	09:00 – 09:45	Weinbrenner Plenary Room
<b>WIOM — Morning Plenary Talk</b>		
<b>Chair:</b> W. Mexner (KIT)		

**WIOM01** **Experience and Trends in Distributed Computing**  
**09:00** **F. Gagliardi** (BSC)  
 For the subject I would like to speak about the current transformation of the computing landscape. The advent of Virtualization have made possible highly scaleable and affordable distributed computing systems such as those offered by Cloud providers, public or private. This poses new challenges and problems to do with latency in accessing the data, SLAs, privacy and security issues. At the same time the explosion of data has generated the emergence of new computing paradigms such as MapReduce and Hadoop and the need for new computing storage hierarchies for HPC and distributed computing. Embedded and real-time systems are also affected from these new trends.

**WC01 — Control Systems****Chair:** A. Buteau (SOLEIL)**WC0101 Drivers and Software for MicroTCA.4**09:45 **M. Killenberg**, *L.M. Petrosyan (DESY) S. Marsching (Aqueos GmbH)*

The MicroTCA.4 crate standard provides a powerful electronic platform for digital and analogue signal processing. Besides excellent hardware modularity, it is the software reliability and flexibility as well as the easy integration into existing software infrastructures that will drive the widespread adoption of the new standard. The DESY MicroTCA.4 User Tool Kit (MTCA4U) comprises three main components: A Linux device driver, a C++ API for accessing the MicroTCA.4 devices and a control system interface layer. The main focus of the tool kit is flexibility to enable fast development. The universal, expandable PCIexpress driver and a register mapping library allow out of the box operation of all MicroTCA.4 devices which are carrying firmware developed with the DESY board support package. The control system adapter provides callback functions to decouple the application code from the middleware layer. Like this the same business logic can be used at different facilities without further modification.

**WC0102 Controls Middleware for FAIR**10:00 **V. Rapp** (*GSI*) *W. Sliwinski (CERN)*

With FAIR complex, the controls systems at GSI will face new scalability challenges due to significant amount of new hardware coming with the new facility. Although, the old systems have proven themselves as sustainable and reliable, they are based on technologies, which have become obsolete years ago. During the FAIR construction time and the associated shutdown, GSI will replace multiple components of the control system. The success in the integration of CERNs FESA and LSA frameworks had moved GSI to extend the cooperation with the controls middleware and especially Remote Device Access (RDA) and Java API for Parameter Control (JAPC) frameworks. However, the current version of RDA is based on CORBA technology, which itself, can be considered obsolete. Fortunately, it will be replaced by a newer version (RDA3), which will be based on ZeroMQ, and will offer a new improved API based on the experience from previous usage. The collaboration between GSI and CERN shows that new RDA is capable to comply with requirements of both environments. In this paper, we present general architecture of the new RDA and depict its integration in the GSI control system.

## **Integration of New Power Supply Controllers in the Existing Elettra Control System**

*C. Scafuri, S. Cleva (Elettra-Sincrotrone Trieste S.C.p.A.)*

The Elettra control system has been running since 1993. The controllers of the storage ring power supplies, still the original ones, have become obsolete and are no more under service. A renewal to overcome these limitations is foreseen. A prototype of the new controllers based on the BeagleBone embedded board and an in-house designed ADC/DAC carrier board, has been installed and tested in Elettra. A Tango device server running in the BeagleBone is in charge of controlling the power supply. In order to transparently integrate the new Tango controlled power supplies with the existing Remote Procedure Call (RPC) based control system, a number of software tools have been developed, mostly in the form of Tango devices and protocol bridges. This approach allows us to keep using legacy machine physics programs when integrating the new Tango based controllers and to carry out the upgrade gradually with less impact on the machine operation schedule.

**WCO2 — Data Acquisition****Chair:** P. Chevtsov (PSI)

15 October

**WC0201 Computing Infrastructure for Online Monitoring and Control of High-throughput DAQ Electronics**11:00 **S.A. Chilingaryan**, C.M. Caselle, T. Dritschler, T. Faragó, A. Kopmann, U. Stevanovic, M. Vogelgesang (KIT)

New imaging stations with high-resolution pixel detectors and other synchrotron instrumentation have ever increasing sampling rates and put strong demands on the complete signal processing chain. Key to successful systems is high-throughput computing platform consisting of DAQ electronics, PC hardware components, communication layer and system and data processing software components. Based on our experience building a high-throughput platform for real-time control of X-ray imaging experiments, we have designed a generalized architecture enabling rapid deployment of data acquisition system. We have evaluated various technologies and come up with solution which can be easily scaled up to several gigabytes-per-second of aggregated bandwidth while utilizing reasonably priced mass-market products. The core components of our system are an FPGA platform for ultra-fast data acquisition, Infiniband interconnects and GPU computing units. The presentation will give an overview on the hardware, interconnects, and the system level software serving as foundation for this high-throughput DAQ platform. This infrastructure is already successfully used at KIT's synchrotron ANKA.

**WC0202 Data Management at the Synchrotron Radiation Facility ANKA**11:15 **D. Ressmann**, W. Mexner (KIT)

The complete chain from submitting a proposal, collecting meta data, creating experiment data, towards analysis of these data and finally long term archive will be described. During this process a few obstacles have to be avoided. The workflow should be transparent to the user as well as to the beamline scientists. The data will be stored in NeXus compatible HDF5 file format. This format enables a faster transfer of experiment data, especially if there are many images created within one measurement. To transfer one large file is more efficient than transferring many small files. At the same time the HDF5 format groups the meta data together with the experiment data. For large data sets another implication is the performance to download the files. Furthermore the analysis software might not be available at each home institution, as a result a way to access the experiment data in place, should be an option. Having the right meta data collected will also help finding the data in a long term archive, which will become a requirement fairly soon.

**WC0203 Profibus in Process Controls**11:30 **M.R. Clausen**, T. Boeckmann, J. Hatje, O. Korth, J. Penning, H.R. Rickens, B. Schoeneburg (DESY)

The cryogenic installations on the DESY campus are widely distributed. The liquid Helium (LHE) is produced in a central building. Three cryo-

genic plants are installed. One is in operation for FLASH the other two are currently in the commissioning phase and will be used for the European XFEL. Thousands of I/O channels are spread over the campus this way. The majority of the I/O devices are standard devices used in process control. The de facto standard for distributed I/O in process controls in Germany is Profibus. So it is obvious to use this bus also for cryogenic controls. Subsequently we developed also special electronics to attach temperature and level readouts to this field bus. Special diagnostic tools are available and permanently attached to the bus. Condition monitoring tools provide diagnostics which enable preventative maintenance planning. Specific tools were developed in Control System Studio (CSS) which is -the- standard tool for configuration, diagnostic and controls for all cryogenic plants. We will describe our experience over the last years with this infrastructure.

WC0204  
11:45 <sup>15</sup> **A Prototype Data Acquisition System of Abnormal RF Waveform at SACLA**

*M. Ishii, M. Kago (JASRI/SPring-8) T. Fukui (RIKEN SPring-8 Center, Innovative Light Sources Division) T. Maruyama (RIKEN/SPring-8) T. Ohshima (RIKEN SPring-8 Center) M. Yoshioka (SES)*

At SACLA, an event-synchronized data acquisition system had been installed. The system collects shot-by-shot data, such as representative point data of the phase and amplitude of the rf cavity pickup signals, in synchronization with the beam operation cycle. In addition, rf waveform data is collected every 10 minutes. However a collection with several minutes cycle couldn't catch an abnormal rf waveform that suddenly occurs. To overcome this problem, we have developed a system to capture waveform when some abnormal event occurs. The system consists of the VMEbus systems, a DAQ server, and a NoSQL database system, Cassandra. The VMEbus system detects an abnormal rf waveform, collects all related waveforms with same shot and sends to a DAQ server. All waveforms are stored Cassandra via the DAQ server. The DAQ server keeps data for 2 seconds from current time on memory to complement Cassandra's eventual consistency model. We constructed a prototype DAQ system with a minimum configuration and checked its performance. We report the requirements and structure of the DAQ system and the test results in this paper.

WC0205  
12:00 <sup>24</sup> **Upgrade of SACLA DAQ System Adapts to Multi-Beamline Operation**

*K. Okada, T. Abe, Y. Furukawa, T. Hatsui, Y. Joti, T.K. Kameshima, T. Matsumoto, T. Sugimoto, R. Tanaka, M. Yamaga (JASRI/SPring-8) M. Yabashi (RIKEN SPring-8 Center)*

We report the data acquisition system (DAQ) for user experiments at SACLA (the SPring-8 Angstrom Compact Free Electron Laser). The system provides standardized experimental framework to various XFEL users since March 2012. It is required to store shot-by-shot information synchronized with the XFEL beam of 60Hz at the maximum repetition rate. The data throughput goes up to 6 Gbps with TOF waveforms and/or images (e.g. X-ray diffraction images) from experiments. The data are stored

to the hierarchical storage system capable of more than 6 PByte at the last stage. The DAQ system incorporates with prompt data processing performed by a 14 TFlops PC cluster as well as on-line monitoring. In 2014, SACLA will introduce the third beamline to increase the capacity of experiments. On the DAQ side, it is a challenge to operate multiple experiments simultaneously. The control and data stream will be duplicated and separated for beamlines. A new central server to manage each beamline condition in one place will help increase the efficiency of setup procedure and reduce risks of mishandling between beamlines.

WC0206  
12:15

**Sardana - a Python Based Software Package for Building Scientific SCADA Applications**

*Z. Reszela, G. Cuní, D. Fernandez-Carreiras, C. Pascual-Izarra (CELLS-ALBA Synchrotron)*

Sardana is a software package for Supervision, Control and Data Acquisition in scientific installations. It aims to reduce cost and time of design, development and support of the control and data acquisition systems. Taurus library allows building modern and generic interfaces to the laboratory instruments. Macroserver delivers a flexible python based macro environment which allows to write custom procedures or use a set of standard macros e.g. generic scans. Pool provides a mechanism to easily plug-in heterogeneous hardware based on common and dynamic interfaces. The Sardana development started in Alba, where it is extensively used to operate all beamlines and the accelerator as well as auxiliary laboratories. Sardana attracted interest of other laboratories where it is used with success in various configurations. A community of users and developers was formed and it now maintains the package. Modern data acquisition approaches guides and stimulates current developments in Sardana. Continuous scans, multi-purpose hardware, fast and high resolution detectors are the most critical ones. This article describes how the Sardana community approaches these challenging projects.

WC0207  
12:30

**A New Data Acquisition Software and Analysis for Accurate Magnetic Field Integral Measurement at BNL Insertion Devices Laboratory**

*M.M. Musardo, D.A. Harder, P. He, C.A. Kitegi, T. Tanabe (BNL)*

A new data acquisition software has been developed in LabVIEW to measure and characterize the first and second magnetic field integral distributions and integrated multipole errors of insertion devices (IDs). The main characteristics of the control system and of the control interface program are presented. The new system has the advantage to make automatic and synchronized measurements as function of gap and/or phase of an ID. The automatic gap and phase control is a real-time communication based on EPICS system and the eight servomotors of the measurement system are controlled using a Delta Tau GeoBrick PMAC-2. The methods and the measurement techniques are described and the performance of the system together with the recent results will be discussed.

**WPO — Poster Session I****WP0001 Integrating Siemens PLCs and EPICS over Ethernet at the Canadian Light Source**

*R. Tanner, T. Batten, S. Hu, R. Igarashi, G. Wright (CLS) E. D. Matias (Mighty Oaks)*

The Canadian Light Source (CLS) is a 3rd generation synchrotron light source on the University of Saskatchewan Campus in Saskatoon, SK, Canada. The control system is based on the EPICS control system toolkit. A number of systems delivered to the CLS arrived with Siemens, PLC-based control systems. EPICS integration was initially accomplished circa 2003 using application-specific hardware; communicating over Profibus. The EPICS driver software was developed at the CLS. The hardware has since been discontinued. To minimize reliance on specialized components, the CLS controls group (CID) is moving to a more generic solution using readily-available Siemens Ethernet modules, custom PLC code, and an IOC using the Swiss Light Source (SLS) Siemens/EPICS driver. This paper will provide details on the implementation of that interface. It will cover detailed functionality of the PLC programming, custom tools used to streamline configuration, deployment and maintenance of the interface. It will also describe handshaking between the devices and lessons learned. It will conclude by identifying where further development and improvement may be realized.

**WP0002 The Emotion Library: A Generic Framework for Motor Controllers**

*M. Guijarro, C. Guilloud, M. Perez (ESRF)*

Emotion is a Python package recently developed at the ESRF within the Beamline Control Unit. Emotion provides uniform Python objects and a full set of standard features on top of motor controllers plugins. Emotion is built around simple concepts: Configuration, Controller, Axis and Group; writing a new motor controller plugin can be done within minutes just by filling predefined entry points to implement the communication protocol with the motor controller, leaving more complicated logic to Emotion base classes. Emotion also brings the possibility to create pseudo axes, calculated from real ones. Under the hood Emotion relies on *gevent*, a coroutine-based Python networking library that uses *greenlet* to provide a high-level synchronous API on top of the *libev* event loop. On Linux systems, *gevent* offers maximum performance and minimum burden to communicate efficiently with Ethernet, Serial or USB motor controllers. Emotion is meant to be a building block for automation software or experiment control sequencers running the *gevent* loop, which opens a wide range of possibilities. Emotion is shipped with a TANGO server: Emotion axes are ready to use in TANGO-powered systems.

**WP0003 Setup of a History Storage Engine Based on a Non-Relational Database at ELSA***D. Proft, F. Frommberger, W. Hillert (ELSA)*

The electron stretcher facility ELSA provides a beam of unpolarized and polarized electrons of up to 3.2 GeV energy to external hadron physics experiments. Its in house developed distributed computer control system is able to provide real time beam diagnostics as well as steering tasks in one homogeneous environment. Recently it was ported from HP-UX running on three HP workstations to a single Linux personal computer. This upgrade to powerful PC hardware opened up the way for the development of a new archive engine with a noSQL database backend based on Hypertable. The system is capable of recording every parameter change at any given time. Beside the visualization in a newly developed graphical history data browser, the data can be exported to several programs - for example a diff-like tool to compare and recall settings of the accelerator. This contribution will give details on recent improvements of the control system and the setup of the history storage engine.

**WP0004 News from the FAIR Control System under Development***R. Bär, D.H. Beck, C. Betz, J. Fitzek, S. Jülicher, U. Krause, M. Thieme, R. Vincelli (GSI)*

The control system for the FAIR (Facility for Antiproton and Ion Research) accelerator facility is presently under development and implementation. The FAIR accelerators will extend the present GSI accelerator chain, then being used as injector, and provide anti-proton, ion, and rare isotope beams with unprecedented intensity and quality for a variety of research programs. This paper shortly summarizes the general status of the FAIR project and focusses on the progress of the control system design and its implementation. The poster presents the general system architecture and updates on the status of major building blocks of the control system. We highlight the control system implementation efforts for CRYRING, a new accelerator presently under recommissioning at GSI, which will serve as a test-ground for the complete control system stack and evaluation of the new controls concepts.

**WP0005 Progress and Challenges during the Development of the Settings Management System for FAIR***H.C. Hüther, J. Fitzek, R. Müller (GSI)*

A few years into the development of the new control system for FAIR (Facility for Antiproton and Ion Research), a first version of the new settings management system is available. As a basis for the system, the CERN LSA framework (LHC Software Architecture) is used and enhanced in collaboration between GSI and CERN. New aspects, like flexible cycle lengths, have already been introduced while concepts for other requirements, like parallel beam operation at FAIR, are being developed. At SIS18, the system is currently used for testing new machine models with beam and operation modes relevant for FAIR. It will also be used for commissioning and operation of CRYRING by the end of 2014. During the development, new challenges came up. To ease collaboration, the system has been split

into common and institute specific components in all layers. A remaining problem is the usage of separate build systems at GSI and CERN that manage dependencies differently. Besides technical problems, a data driven system like LSA requires high data quality. To ensure this, organizational processes need to be put in place at GSI.

**WP0006 FESA3 Integration in GSI for FAIR**

*S. Matthies, H. Bräuning, A. Schwinn (GSI) S. Deghaye (CERN)*

GSI decided to use FESA (Front-End Software Architecture) as the front-end software toolkit for the FAIR accelerator complex. FESA was originally developed at CERN. Since 2010 FESA3, a revised version of FESA, is developed in the frame of an international collaboration between CERN and GSI. During development of FESA3 emphasis was placed on the possibility of flexible customization for different environments and to provide site-specific extensions to allow adaptation for the contributors. GSI is the first institute to integrate FESA3 into its control system environment. Some of the necessary preparations have already been performed to establish FESA3 at GSI. Examples are RPM packaging for multiple installations, support for site-specific properties and data types, first integration of the White Rabbit based timing system, etc. . Further developments such as e.g. integration of a site-specific database or the full integration of GSI's beam process concept for FAIR will follow.

**WP0007 The FAIR R3B Prototype Cryogenics Control System**

*C. Betz, E. Momper, D. Sanchez Valdepenas, M. Zaera-Sanz (GSI)*

The superconducting GLAD magnet is one of the major parts for the R3B experiment at FAIR. R3B stands for Reactions with Relativistic Radioactive Beams. The cryogenic operation will be ensured by a fully refurbished TCF 50 cold box and oil removal system. One of the major design goals for its control system is to operate as independent as possible from magnet controls acting as a first prototype for the later cryogenic installations in the FAIR facility. The operation of the compressor, oil removal system, and the gas management was tested in Jan. 2014. We have followed a staged implementation of the controls, firstly implementing all processes in a S7-319F with PROFIBUS and PROFINET I/O modules using WinCC OA as SCADA. In a second step a migration and implementation into the CERN UNICOS framework will be done for the first time at GSI. This can be seen as preparatory work for novel industrial control systems to be established for the FAIR facility. Within late spring 2014 a first cool down of the refurbished cold box is foreseen. Once the magnet will be delivered, the magnet and the cryogenics controls will be commissioned together.

**WP0008 An Extensible Equipment Control Library for Hardware Interfacing in the FAIR Control System***M. Wiebel (GSI)*

In the FAIR control system the SCU (Scalable Control Unit, an industry PC with a bus system for interfacing electronics) is the standard front-end controller for power supplies. The FESA-framework is used to implement front-end software in a standardized way, to give the user a unified look on the installed equipment. As we were dealing with different power converters and thus with different SCU slave card configurations, we had two main things in mind: First, we wanted to be able to use common FESA classes for different types of power supplies, regardless of how they are operated or which interfacing hardware they use. Second, code dealing with the equipment specifics should not be buried in the FESA-classes but instead be reusable for the implementation of other programs. To achieve this we built up a set of libraries which interface the whole SCU functionality as well as the different types of power supplies in the field. Thus it is now possible to easily integrate new power converters and the SCU slave cards controlling them in the existing equipment software and to build up test programs quickly.

**WP0009 An Optics-Suite and -Server for the European XFEL***S.M. Meykopff (DESY)*

A software library for optics calculations was developed for the European XFEL Project. The calculations will be done with ELEGANT as the backend. The new software is available as a shared library as well as an own standing server in the control system. It creates and analyses all input and output files and allows to use different optics at the same time. The lattice is derived from an EXCEL file which is also used for machine installation purposes. The access from the control system uses a TINE interface; a MATLAB object offers an easy programming interface.

**WP0010 A Unified Matlab API for TINE and DOOCS Control Systems at DESY***J. Wilgen, S.M. Meykopff (DESY)*

At the European XFEL, MATLAB will play an important role as a programming language for high level controls. We present a standard MATLAB API which provides a unified interface for TINE and DOOCS control systems. It supports a wide variety of datatypes as well as synchronous and asynchronous communication modes.

**WP0011 Vacuum Interlock Control System for EMBL Beamlines at PETRA-III***A. Kolozhvari, S. Fiedler, U.R. Ristau (EMBL)*

A vacuum interlock system is developed for EMBL beamlines at PETRA-III facility. It runs on Beckhoff PLC and protects instruments by closing corresponding vacuum valves and beam shutters when pressure exceeds a safety threshold. Communication with PETRA-III interlock system is implemented via digital I/O connections. The system is integrated in the EMBL beamlines control via TINE and supplies data to archive and alarm subsystems. A LabVIEW client, operating in TINE environment, provides graphical user interface for the vacuum interlock system control and data representation.

**WP0012 The EMBL Beamline Control Framework***U.R. Ristau, A. Kolozhvari (EMBL)*

The EMBL hosts three Beamlines at the Petra Synchrotron at DESY. The control of the Beamlines is based on a Labview TINE Framework. Working examples of the layered structure of the control software and the signal transport with the Fieldbus based control electronic using Ethercat will be presented as well as the layout of the synchronization implementation of all beamline elements.

**WP0013 Status of the FLUTE Control System***S. Marsching, N. Hiller, V. Judin, A.-S. Müller, M.J. Nasse, R. Ruprecht, M. Schuh (KIT)*

The accelerator test facility FLUTE (Ferninfrarot, Linac- Und Test-Experiment) is being under construction nearby ANKA at the Karlsruhe Institute of Technology (KIT). FLUTE is a linac-based accelerator facility for generating coherent THz radiation. One of the goals of the FLUTE project is the development and fundamental examination of new concepts and technologies for the generation of intensive and ultra-broad-band THz pulses fed by femtosecond electron-bunches. In order to study the various mechanisms influencing the final THz pulses, data-acquisition and storage systems are required that allow for the correlation of beam parameters on a per-pulse basis. In parallel to the construction of the accelerator and the THz beam-line, a modern, EPICS-based control system is being developed. This control system combines well-established techniques (like S7 PLCs, Ethernet, and EPICS) with rather new components (like MicroTCA, Control System Studio, and NoSQL databases) in order to provide a robust, stable system, that meets the performance requirements. We will present the design concept behind the FLUTE control system and report on the status of the commissioning process.

**WP0016 Magnet Power Supply Control Mockup for the SPES Project***M.G. Giacchini, M. Montis (INFN/LNL) M.A. Bellato (INFN- Sez. di Padova)*

The Legnaro National Laboratories employs about 100 Magnet Power Supplies (MPSs). The existing control infrastructure is a star architecture with a central coordinator and ethernet/serial multiplexers. In the context of the ongoing SPES project, a new magnet control system is being designed with EPICS based software and low cost embedded hardware. A mockup has been setup as a test stand for validation. The paper reports a description of the prototype, together with first results.

**WP0017 IFMIF RFQ Local Control System to Power Test***M.G. Giacchini, L. Antoniazzi, M. Montis, A. Pisent (INFN/LNL) M.A. Bellato (INFN- Sez. di Padova)*

In the IFMIF EVEDA project, normal conducting Radio Frequency Quadrupole (RFQ) is used to bunch and accelerate a 130 mA steady beam to 5 MeV. RFQ cavity is divided into three structures, named super-modules. Each super-module is divided into 6 modules for a total of 18 modules for the overall structure. The final three modules have to be tested at high

power to test and validate the most critical RF components of RFQ cavity and, the control system itself. The choice of the last three modules is due to the fact that they will operate in the most demanding conditions in terms of power density (100 kW/m) and surface electric field ( $1.8 \cdot E_{kp}$ ). The Experimental Physics and Industrial Control System (EPICS) environment provides the framework to control any equipment connected to it. This paper report the usage of this framework to the RFQ power tests at Legnaro National Laboratories.

**WP0018 Upgrade of Beam Diagnostics System of ALPI-PIAVE Accelerator's Complex at LNL**

*B.J. Liu (CIAE) G. Bassato, M.G. Giacchini, M. Poggi (INFN/LNL)*

The beam diagnostics system of ALPI-PIAVE accelerators has been recently upgraded by migrating the control software to EPICS. The system is based on 40 modules each one including a Faraday cup and a beam profiler made of a couple of wire grids. The device's insertion is controlled by stepper motors in ALPI and by pneumatic valves in PIAVE. To reduce the upgrade costs the existing VME hardware used for data acquisition has been left unchanged, while the motor controllers only have been replaced by new units developed in house. The control software has been rebuilt from scratch using EPICS tools. The operator interface is based on CSS; a Channel Archiver based on .. has been installed to support the analysis of transport setup during tests of new beams. The ALPI-PIAVE control system is also a bench test for the new beam diagnostics under development for the SPES facility, whose installation is foreseen in mid 2015.

**WP0019 STARS: Current Development Status**

*T. Kosuge, Y. Nagatani (KEK)*

STARS (Simple Transmission and Retrieval System) is extremely simple and useful software for small-scale control systems and it runs on various operating system. STARS consists of client programs (STARS clients) and a server (STARS server) program. Each client is connected to the server via a TCP/IP socket and each client and the server communicate with text based message. STARS is used for various system at the KEK Photon Factory (beamline control system, experimental hall access control system, key handling system etc.) and development of stars (development many kind of STARS clients, interconnection of Web2c and STARS etc.) is still going. We will describe current development status of STARS.

**WP0020 Development and Application of the STARS-based Beamline Control System and Softwares at the Photon Factory**

*Y. Nagatani, T. Kosuge (KEK)*

STARS is a message transferring software for small-scale control systems originally developed at the Photon Factory. It has a server-client architecture using TCP/IP sockets and can work on various types of operating systems. Since the Photon Factory adopted STARS as a common beamline control software, we have developed beamline control system which controls optical devices (mirror, monochrometer etc.). We developed also various system and softwares, such as information delivering system of

Photon Factory ring status based on STARS and TINE or measurement softwares based on the STARS, for the Photon Factory beamlines. Now many kinds of useful STARS applications (device clients, simple data acquisitions, user interfaces etc.) are available. We will describe the development and installation status of the STARS-based beamline system and softwares.

**WP0021 Renovation of PC-based Console System for J-PARC Main Ring**

**S. Yamada** (*J-PARC, KEK & JAEA*)

Console system for J-PARC Main Ring (MR) was designed in 2007 and had been used for accelerator commissioning and operation since then. It was composed of 20 diskless thin clients and 10 terminal servers. Both of them are PC-based computers running Scientific Linux (SL) as their operating system. Migration to ordinary fat clients was planned in 2013, triggered by update from SL4 to SL6, based on use experiences of those thin clients. Intel NUC is selected as a result of preliminary investigation. Its evaluation is carried successfully out during commissioning of MR. Presently 10 thin clients have been replaced by fat clients. Migration scenario and technique of managing fat clients are discussed.

**WP0022 Control System of Two Superconducting Wigglers and Compensation Magnets in The SAGA Light Source**

**Y. Iwasaki, T. Kaneyasu, S. Koda, Y. Takabayashi** (*SAGA*)

The SAGA Light Source is a synchrotron radiation facility consisting of a 255 MeV injector linac and a 1.4 GeV electron storage ring. Three insertion devices: a superconducting wiggler, an APPLE-II undulator, and a planar undulator, are used for synchrotron radiation experiments. For the demand of hard x-ray experiment, we are planning to install a second superconducting wiggler in the electron storage ring. We are developing the control system for the next superconducting wiggler using conventional PLCs and PCs. To compensate the closed orbit distortion, tune shift and chromaticity change induced by the excitation of the superconducting wiggler, the control system of dipole, quadrupole and sextupole magnets power supplies are also being upgraded. PLCs are linked by optical fiber cable to synchronize each power supplies. We present the control system of the superconducting wigglers and the compensation magnets using PLCs and PCs at this meeting.

**WP0023 Personnel Safety System in SESAME***M. Mansouri Sharifabad, A. Ismail, I. Saleh (SESAME)*

SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) is a “third-generation” synchrotron light source under construction in Allan, Jordan. Personnel Safety System (PSS) in SESAME restricts and controls the access to forbidden areas of radiation. The PSS is an independent system which is built on Safety PLCs. In order to achieve the desired Safety Integrity Level which is SIL-3, as defined in IEC 61508, several interlocks and access procedures have been implemented in the system fulfilling characteristics such as fail-safe, redundancy and diversity. Also a system meant for monitoring and diagnostics of PSS is built based on EPICS and HMI. PSS PLCs which implement interlock logic send all the input and output bits and PLC status information to EPICS IOC which is not an integral function of PSS operation. This IOC will be connected to other control system’s IOCs to send informative signals describing the status of PSS to the main control system in SESAME. In addition, 5 combined Gamma-Neutron radiation monitors which are distributed around and over the booster area send interlock signals to personnel safety system.

**WP0024 Clients Development of SESAME’s Control System based on CSS***I. Saleh, A. Ismail, M. Mansouri Sharifabad (SESAME)*

SESAME is a third generation synchrotron light source under construction near Amman (Jordan). It is expected to begin operation in 2016. SESAME’s injector (Microtron) and pre-injector (Booster Ring) have been commissioned. Commissioning of the storage ring is expected in 2015. The control system at SESAME is based on EPICS. EPICS IOC’s are used for the servers. Control System Studio (CSS) is used for the clients. CSS BEAST alarm handler is used to identify all the critical alarms of the machine including configuration and visualization. This paper presents the architecture and design of the CSS BOY graphical user interfaces (GUIs) and CSS BEAST alarm handler for the different subsystems. It presents the standards followed in the development of SESAME’s clients. SESAME will use an archiving tool based on CSS to access process variable history.

**WP0025 Progress and Prospect of Beijing HI-13 Tandem Accelerator Control System***K.N. Li, Y.W. Bao, K.J. Dong, Y.M. Hu, C.X. Kan, S.Y. Su, X.F. Wang, T. Yang, Q.B. You, Y.S. Yu (CIAE)*

More than thirty years have passed since the Beijing HI-13 tandem accelerator put into operation at China Institute of Atomic Energy (CIAE) in 1987. The original control system has a big gap compared with the current application. In recent years, some important renovations, such as upgrade of injector control subsystem, vacuum management subsystem and radioactivity protection subsystem, have been developed step by step in order to meet user’s requirements. After several years of operation, stability and reliability of the control system is greatly improved. In this contribution, some Improvements of Beijing HI-13 accelerator control system and its prospects will be briefly introduced.

**WP0026 The Applications of OPC UA Technology in Motion Control System***M. Wang (IMP)*

The establishment of data model is more abundant based on OPC UA (Unified Architecture) technology, which has good platform independence and high reliability. Thus it becomes a new direction in the field of data exchange of industrial control. In this paper, the motion control model based on redundant ring network is built by using NI 3110 industrial controller and servo motors. And the data structures used in parallel communication between the host computer and multi terminal motors are designed by using OPC UA technology. So the problem of data exchange between the RT system of lower controller and the Windows system of upper computer is solved better.

**WP0027 The Measurement and Monitoring of Spectrum and Wavelength of Coherent Radiation at Novosibirsk Free Electron Laser***S.S. Serednyakov (NSU) V.V. Kubarev (BINP SB RAS)*

The architecture and capabilities of free electron laser radiation spectrum measurement system described in details in this paper. For execution of the measurements the monochromator and step-motor with radiation power sensor are used. As the result of the measurements, the curve of spectrum of radiation is transmitted to control computer. As this subsystem is fully integrated to common FEL control system, the results of measurements – spectrum graph, average wavelength, calculated radiation power, are able to transmit to any another computer on FEL control local area network and also on user stations computers.

**WP0028 EPICS BEAST Alarm System Happily Purrs at ANKA Synchrotron Light Source***I. Križnar (Cosylab) E. Hertle, E. Huttel, W. Mexner, A.-S. Müller, N.J. Smale (KIT) S. Marsching (Aquenos GmbH)*

The control system of the ANKA synchrotron radiation source at KIT (Karlsruhe Institute of Technology) is adopting new, and converting old, devices into an EPICS control system. New GUI panels are developed in Control System Studio (CSS). EPICS alarming capabilities in connection with the BEAST alarm server tool-kit from the CSS bundle are used as an alarming solution. To accommodate ANKA future requirements as well as ANKA legacy solutions, we have decided to extend the basic functionality of BEAST with additional features in order to manage the alarming for different machine operation states. Since the database of alarm sources is been populated from scratch, we have been able take fresh approach in management and creation of alarm sources to build-up alarm trees. New alarm system is being used, tested and refined and future developed in production environment since end of 2013.

**WP0029 Implementation of the Distributed Alarm System for the Particle Accelerator FAIR Using an Actor Concurrent Programming Model and the Concept of an Agent**

*D. Kumar, G.G. Gaperič, M. Pleško (Cosylab) R. Huhmann, S. Krepp (GSI)*

The Alarm System is a software system that enables operators to identify and locate conditions which indicate hardware and software components malfunctioning or nearby malfunctioning. The FAIR Alarm System is being constructed as a Slovenian in-kind contribution to FAIR project. The purpose of the paper is to show how to simplify the development of a highly available distributed alarm system for the particle accelerator FAIR using a concurrent programming model based on actors and on the concept of an agent. The agents separate the distribution of the alarm status signals to the clients from the processing of the alarm signals. The logical communication between an alarm client and an agent is between an actor in the alarm client and an actor in the agent. These two remote actors exchange messages through Java MOM. The following will be addressed: the tree-like hierarchy of actors that are used for the fault tolerance communication between an agent and an alarm client; a custom message protocol used by the actors; the message system and corresponding technical implications; and details of software components that were developed using the Akka programming library.

**WP0030 Vacuum Pumping Group Controls Based on PLC**

*S. Blanchard, F. Antoniotti, F. Bellorini, J-P. Boivin, J. Gama, P. Gomes, H.F. Pereira, G. Pigny, B. Rio, H. Vestergard (CERN) L. Kopylov, S. Merker, M.S. Mikheev (IHEP)*

In CERN accelerators, high vacuum is needed in the beam pipes and for thermal isolation of cryogenic equipment. The first element in the chain of vacuum production is the pumping group. It is composed of a primary pump, a turbo-molecular pump and a few isolation and intermediate valves; as optional devices we can also find: vacuum gauges, venting valves and leak detection valves. At CERN accelerators, the pumping groups controllers may be found in several hardware configurations, depending on the environment and on the vacuum system used; all of them are based on PLCs and communicate over a field bus; they are controlled by the same flexible and portable software. They are remotely accessed through a SCADA application and can be locally controlled by the same mobile touch-panel. More than 250 pumping groups are permanently installed in the Large Hadron Collider, Linacs or North Area Experiments.

**WP0031 Diagnostics Test Stand Setup at PSI and its Controls in Light of the Future SwissFEL**

*P. Chevtsov, R. Ischebeck (PSI)*

In order to provide high quality electron beams, the future SwissFEL machine needs very precise and reliable beam diagnostics tools. At Paul Scherrer Institute (PSI), the development of such tools is performed based on the SwissFEL Injector Test Facility and a dedicated automated diagnostics test stand. The test stand is equipped by not only major SwissFEL beam diagnostics elements (cameras, beam loss monitors, beam cur-

rent monitors, etc.) but also their controls and data processing hardware and software. The paper describes diagnostics test stand controls software components, which were designed in view of the future SwissFEL operational requirements.

**WP0032 Magnet Measurement System Upgrade at PSI**

*P. Chevtsov, V. Vranković (PSI)*

The magnet measurement system at the Paul Scherrer Institute (PSI) was significantly upgraded in the last few years. At the moment, it consists of automated Hall probe, rotating wire, and vibrating wire setups, which form a very efficient magnet measurement facility. The paper concentrates on the automation hardware and software implementation, which has made it possible not only to significantly increase the performance of the magnet measurement facility at PSI, but also to simplify magnet measurement data handling and processing.

**WP0033 Status of Control System for the TPS Commissioning**

*Y.-S. Cheng, Y.-T. Chang, J. Chen, P.C. Chiu, K.T. Hsu, S.Y. Hsu, K.H. Hu, C.H. Huang, C.H. Kuo, D. Lee, C.Y. Liao, C.-J. Wang, C.Y. Wu (NSRRC)*

Control system for the Taiwan Photon Source (TPS) project has been implemented. The accelerator system is schedule to be commissioning in third quarter of 2014. Final integration test of each subsystem will be done. The EPICS was chosen as the TPS control system framework. The subsystems control interfaces include event based timing system, Ethernet based power supply control, corrector power supply control, PLC-based pulse magnet power supply control and machine protection system, insertion devices motion control system, various diagnostics, and etc. The standard hardware components had been installed and integrated, and the various IOCs (Input Output Controller) had been implemented as various subsystems control platforms. Development and test of the high level and low level software systems are in final phase. The efforts will be summarized at this report.

**WP0034 Network Architecture at Taiwan Photon Source**

*C.H. Huang, Y.-T. Chang, Y.-S. Cheng, K.T. Hsu, C.H. Kuo (NSRRC)*

A robust, secure and high throughput network is necessary for the 3 GeV Taiwan Photon Source (TPS) in NSRRC. This includes CS-LAN, ACC-LAN, SCI-LAN and NSRRC-LAN for the instrumental control, subsystem of accelerator, beam-line users and office users respectively. Each LAN is connected via core switch by routing protocol to avoid traffic interference. Outside traffic is block by access control list to ensure the independence of control network (CS-LAN). Subsystem subnets connect to control network via EPICS based channel-access gateways for forwarding data. Various network management tools and machines are used for maintenance and troubleshooting. The network system architecture, cabling topology and maintainability are described in this report.

**WP0035 TPS BPM Control, Monitor, and Configuration Environment**

*P.C. Chiu, Y.-S. Cheng, K.T. Hsu, K.H. Hu, C.H. Kuo (NSRRC)*

The TPS is a latest generation of high brightness synchrotron light source and scheduled to be commissioning in 2014. The acceptance test of BPM electronics Libera Brilliance<sup>+</sup> had been completed in August 2012. Performance of each unit are individually tested and measured. The control environments based on EPICS framework are developed and built. This report summarizes the efforts on BPM control, monitor and configuration environment.

**WP0038 A Modular Personnel Safety System for VELA based on Commercial Safety Network Controllers**

*M.D. Hancock, B.G. Martlew (STFC/DL)*

STFC Daresbury Laboratory has recently commissioned VELA (Versatile Electron Linear Accelerator), a high performance electron beam test facility. It will be used to deliver high quality, short pulse electron beams to industrial users to aid in the development of new products in the fields of health care, security, energy and waste processing and also to develop and test novel compact accelerator technologies. In the early stages of the design it was decided to use commercial Safety Network Controllers and I/O to implement the Personnel Safety System in place of the electro-mechanical relay-based system used on previous projects. This provides a high integrity, low cost solution while also allowing the design to be modular, programmable and easily expandable. This paper describes the design and realisation of the VELA Personnel Safety System and considers its future development. In addition, the application of the system to the protection of high-power laser systems and medical accelerators will also be discussed.

**WP0039 Control System Design for the VELA Test Accelerator at Daresbury Laboratory**

*A. Oates, G. Cox, B.G. Martlew (STFC/DL)*

VELA (Versatile Electron Linear Accelerator) is a high performance, modular injector facility capable of delivering a highly stable, short pulse, high quality electron beam to test enclosures. The new facility delivers a capability for the cutting edge development and qualification of advanced accelerator systems, enabling industry to expedite their technology development from prototypes to market ready products. Initial design began in 2011 and was followed by an aggressive programme of procurement, construction and commissioning, leading to first beam in summer 2013 and operation for industrial partners in autumn 2013. The control system for this completely new accelerator was designed from scratch and is based entirely on COTS (commercially off-the-shelf) hardware such as EtherCat, the latest generation of PLCs, Ethernet serial control and Linux rack mount IOCs. EPICS is used as the software toolkit. This paper describes the overall structure of the control system and discusses the choice of hardware and software together with some reflections on the suitability of those choices in the light of the first 12 months of operation.

WP0040 **A Stand-Alone Control System for the Commissioning of a Superconducting Solenoid Magnet**

*P.H. Owens (STFC/DL)*

The Muon Ionisation Cooling Experiment (MICE) is currently being constructed at STFC's Rutherford Appleton Laboratory and will allow an international team of scientists and engineers to gain working experience of the design, construction and operation of a muon cooling channel. Among the key components of the experiment are a number of superconducting solenoid and focus coil magnets. These magnets have been built by industrial partners and have been specially designed for the MICE project. This paper describes a small, stand-alone control system used to test and commission two superconducting spectrometer solenoid magnets at the manufacturer's site in California prior to being shipped to the UK. In order to ease integration the control system is based on a cut down version of the EPICS system used to control MICE. A single Linux server in a rack mounted PC is used as a boot server for IOCs, to provide EDM user interfaces, archiving and other EPICS tools. Plant I/O is via two VME based IOCs. One monitoring analogue and digital signals and providing equipment protection interlocks, the other providing serial connections to equipment.

**WPI — Poster in Pills****Chair:** P. Duval (DESY)**WPI01 News from the FAIR Control System under Development**15:30 **R. Bär**, D.H. Beck, C. Betz, J. Fitzek, S. Jülicher, U. Krause, M. Thieme, R. Vincelli (GSI)

The control system for the FAIR (Facility for Antiproton and Ion Research) accelerator facility is presently under development and implementation. The FAIR accelerators will extend the present GSI accelerator chain, then being used as injector, and provide anti-proton, ion, and rare isotope beams with unprecedented intensity and quality for a variety of research programs. This paper shortly summarizes the general status of the FAIR project and focusses on the progress of the control system design and its implementation. The poster presents the general system architecture and updates on the status of major building blocks of the control system. We highlight the control system implementation efforts for CRYRING, a new accelerator presently under recommissioning at GSI, which will serve as a test-ground for the complete control system stack and evaluation of the new controls concepts.

**WPI02 The EMBL Beamline Control Framework**15:33 **U.R. Ristau**, A. Kolozhvari (EMBL)

The EMBL hosts three Beamlines at the Petra Synchrotron at DESY. The control of the Beamlines is based on a Labview TINE Framework. Working examples of the layered structure of the control software and the signal transport with the Fieldbus based control electronic using Ethercat will be presented as well as the layout of the synchronization implementation of all beamline elements.

**WPI03 Status of the FLUTE Control System**15:36 **S. Marsching**, N. Hiller, V. Judin, A.-S. Müller, M.J. Nasse, R. Ruprecht, M. Schuh (KIT)

The accelerator test facility FLUTE (Ferninfrarot, Linac- Und Test-Experiment) is being under construction nearby ANKA at the Karlsruhe Institute of Technology (KIT). FLUTE is a linac-based accelerator facility for generating coherent THz radiation. One of the goals of the FLUTE project is the development and fundamental examination of new concepts and technologies for the generation of intensive and ultra-broad-band THz pulses fed by femtosecond electron-bunches. In order to study the various mechanisms influencing the final THz pulses, data-acquisition and storage systems are required that allow for the correlation of beam parameters on a per-pulse basis. In parallel to the construction of the accelerator and the THz beam-line, a modern, EPICS-based control system is being developed. This control system combines well-established techniques (like S7 PLCs, Ethernet, and EPICS) with rather new components (like MicroTCA, Control System Studio, and NoSQL databases) in order to provide a robust, stable system, that meets the performance requirements. We will present the design concept behind the FLUTE control system and report on the status of the commissioning process.

WPI04 **STARS: Current Development Status**

15:39 m **T. Kosuge, Y. Nagatani (KEK)**

STARS (Simple Transmission and Retrieval System)\* is extremely simple and useful software for small-scale control systems and it runs on various operating system. STARS consists of client programs (STARS clients) and a server (STARS server) program. Each client is connected to the server via a TCP/IP socket and each client and the server communicate with text based message. STARS is used for various system at the KEK Photon Factory (beamline control system, experimental hall access control system, key handling system etc.) and development of stars (development many kind of STARS clients, interconnection of Web2c\*\* and STARS etc.) is still going. We will describe current development status of STARS.

WPI05 **Control System Design for the VELA Test Accelerator at Daresbury Laboratory**

15:42 m

**A. Oates, G. Cox, B.G. Martlew (STFC/DL)**

VELA (Versatile Electron Linear Accelerator) is a high performance, modular injector facility capable of delivering a highly stable, short pulse, high quality electron beam to test enclosures. The new facility delivers a capability for the cutting edge development and qualification of advanced accelerator systems, enabling industry to expedite their technology development from prototypes to market ready products. Initial design began in 2011 and was followed by an aggressive programme of procurement, construction and commissioning, leading to first beam in summer 2013 and operation for industrial partners in autumn 2013. The control system for this completely new accelerator was designed from scratch and is based entirely on COTS (commercially off-the-shelf) hardware such as EtherCat, the latest generation of PLCs, Ethernet serial control and Linux rack mount IOCs. EPICS is used as the software toolkit. This paper describes the overall structure of the control system and discusses the choice of hardware and software together with some reflections on the suitability of those choices in the light of the first 12 months of operation.

**S1 — Excursion Palatinate Region****S1001 Social Event****16:30<sup>300</sup> W. Mexner (KIT)**

Trip to wine yard Marienhof Flemlingen in the state of Rhineland-Palatinate. Enjoy the flavor of famous palatinate wines during a wine testing with local cuisine.

The buses will depart from the main entrance at 16:30.



**TIOM — Morning Plenary Talk****Chair:** T. Kosuge (KEK)**TIOM02 Current and Lasting Trends in Software Development Management****09:00** <sup>45</sup> **G. Gryczan, C. Lilienthal** (*CI WPS GmbH*)

Over the past decades the Software Engineering community has proposed (and later rejected) numerous methods to tackle essential problems of software development. In this talk we summarize which of these methods and techniques to our understanding contribute to successful development projects. A special emphasis will be given to so called "agile development methods". We will outline how these methods, in particular extreme Programming and Scrum, help to identify problems of development projects at early points of time. In addition the talk will try to summarize which architectural and programming guidelines have proven successful to implement maintainable software, for example design by contract. WPS Workplace Solutions GmbH is a spin off of the University of Hamburg, Department of Informatics. WPS manages and implements medium size to large software projects. WPS's experience covers the whole range of Software Engineering methods and techniques from code analysis of legacy software and software requirements elicitation to software design and implementation - in long term projects and in big teams.

**TCO1 — Software Management****Chair:** T. Kosuge (KEK)**TCO101 Benefits, Drawbacks and Challenges During a Collaborative Development of a Settings Management System for CERN and GSI**09:45 **R. Müller, J. Fitzek, H.C. Hüther (GSI) G. Kruk (CERN)**

The settings management system LSA (LHC Software architecture) was originally developed for the LHC (Large Hadron Collider). GSI supported CERN during the LHC commissioning by sending two software developers in 2007 to aid with the development of LSA. For FAIR (Facility for Antiproton and Ion Research) a renovation of the GSI control system was necessary, it was decided to use the LSA system for settings management and so in 2008 the middle management agreed on a collaborative development. This paper highlights the insights gained during the collaboration, from three different perspectives: Organizational aspects of the collaboration like roles that have been established, planned procedures, the preparation of a formal contract and social aspects to keep people working as a team across institutes. It also shows technical benefits and drawbacks that arise from the collaboration for both institutes as well as challenges that are encountered during development. Furthermore, it provides an insight which aspects of the collaboration were easy to establish and which still take time.

**TCO102 Eplanner Software for Machine Activities Management**10:00 **P. Fatnani (Raja Ramanna Centre For Advanced Technology) R.K. Agrawal, B.S.K. Srivastava (RRCAT)**

For Indus-2, A 2.5 GeV Synchrotron Radiation Source, operational at Indore, India, the need was felt for software for easily managing various related activities for avoiding communication gaps among the crew members and clearly bringing out the important communications for machine operation. Typical requirements were to have the facility to enter and display daily, weekly and longer operational calendars, to convey system specific and machine operation related standing instructions, to log and track the faults occurring during the operations and follow up actions on the faults logged etc. Overall, the need was for a system to easily manage the number of jobs related to planning the day to day operations of a national facility. The paper describes such a web based system developed and in use regular use and found extremely useful.

Cosylab was established 13 years ago by a group of regular visitors of the PCaPAC. In the meantime, it has grown to a company of 90 employees that covers the majority of accelerator control projects. In this talk, I will present the most interesting developments that we have done in the past two years on a very different range of projects and I will show how we had to get organized in order to be able to manage them all. The developments were made for labs like KIT, ITER, PSI, EBG-MedAustron, European Spallation Source, Maxlab, SLAC, ORNL, GSI/FAIR but also generally for community software like EPICS, TANGO, Control System Studio, White Rabbit, etc. And they range from electronics development to high level software: electric signal conditioning and interfacing, timing system, machine protection system, fibre-optic communication, linux driver development, core EPICS development, packaging, high performance networks, medical device integration, database development, all the way up to turnkey systems. Efficient organisation comprises a matrix structure of teams and groups versus projects and accounts, supported by rigorous reporting, measurements and drill-down analyses.

**TCO2 — Control System II****Chair:** A. Buteau (SOLEIL)**TC0201 Managing the FAIR Control System Development****11:00** **R. Bär, F. Ameil (GSI)**

After years of careful preparation and planning, construction and implementation works for the new international accelerator complex FAIR (Facility for Antiproton and Ion Research) at GSI have seriously been started. The FAIR accelerators will extend the present GSI accelerator chain, then being used as injector, and provide anti-proton, ion, and rare isotope beams with unprecedented intensity and quality for a variety of research programs. The accelerator control system for the FAIR complex is presently being designed and developed by the GSI Controls group with a team of about 50 soft- and hardware developers, complemented by an international in-kind contribution from the FAIR member state Slovenia. This paper presents requirements and constraints from being a large and international project and focusses on the organizational and project management strategies and tools for the control system subproject. This includes the project communication, design methodology, release cycle planning, testing strategies and ensuring technical integrity and coherence of the whole system during the full project phase.

**TC0202 Status of Indus-2 Control System****11:15** **P. Fatnani, A. Bansal (Raja Ramanna Centre For Advanced Technology) R.K. Agrawal, K.G. Barpande, A. Chauhan, S. Gangopadhyay, P. Gothwal, A.M. Gupta, M. Janardhan, B.N. Merh, R. Mishra, K. Saifee, M. Seema, Y.M. Sheth, B.S.K. Srivastava, R. Yadav (RRCAT)**

Indus-2 is a 2.5 GeV Synchrotron Radiation Source at Indore, India. With 6 beamlines commissioned, several more under installation & commissioning and 5 insertion devices planned, the machine is operated in round the clock mode. With implementation of orbit, tune and bunch feedback systems and many new systems in planning, machine is constantly evolving and so is the control system. The control system software is based on PVSS SCADA running on windows PCs and also integrates other software modules in Labview and Matlab. The control hardware is a combination of VME based control stations interconnected over Ethernet and Profibus. Some recent system enhancements include Parameter deviation alarms, transient data capture system, database improvements and web services. Paper takes a stock of the control system and it's evolution with new systems in the offing.

**TC0203 Progress Report of ILSF Control Group Activities****11:30** **A. Khaleghi (IKIU) M. Akbari, M. Jafarzadeh, J. Rahighi (ILSF)**

The Iranian light source Facility (ILSF) project started in September 2009. Its conceptual design report was completed in October 2012. The report envisions the construction of a 3 GeV third generation light source with a current of 400 mA and storage ring circumference of about 500 m. With a natural emittance of 0.93 nm.rad, this synchrotron will indeed be a very

bright source of synchrotron light that can serve up to 44 beamlines. Simultaneous with progress of ILFS project, the role of control system, with a scope from the interface of the equipment being controlled to the operator interfaces, has increased. This paper is a status report of ILSF control system, aiming to explain the progress of primary and support activities of control group such as: preparing Technical Design Report (TDR), providing control design support for the other technical groups and human resources management. In the process of preparing TDR, the items required to be included, has been listed in a format called, Content Table of Reference (CTR). By gradually expanding these items, the appropriate control system tools and components are chosen and the ILSF control system architecture is designed.

**TC0204 First Operational Experience of the !CHAOS Framework**

11:45 

**L. Catani** (INFN-Roma II) **C. Bisegni, P. Ciuffetti, G. Di Pirro, L.G. Foggetta, F. Galletti, G. Mazzitelli, A. Stecchi** (INFN/LNF) **R. Gargana, A. Michelotti** (Consorzio Laboratorio Nicola Cabibbo)

The !CHAOS framework for control systems has been designed for a wide range of different applications in terms of performance, size and complexity of the system to control and the technologies used for implementing its services. Although sub-components and core-services of the !CHAOS framework have been already tested in data acquisition and control applications and are currently in use as part of control systems of accelerators at LNF, this document reports the very first operational experience of a control system set up, employed as the control solution for the magnets of the DAΦNE Beam-Test Facility (BTF) transfer line, completely developed with the !CHAOS framework services and components. The paper presents the current stage of development of the !CHAOS framework, the experimental setup and the solutions adopted to fix bugs and optimise the performance.

**TC0205 Conceptual Design of the Control System for SPring-8 II**

12:00 

**R. Tanaka, T. Matsushita, T. Sugimoto** (JASRI/SPring-8) **T. Fukui** (RIKEN SPring-8 Center, Innovative Light Sources Division)

Seventeen years have passed since the inauguration of the SPring-8 storage ring in 1997. The storage ring is an 8GeV synchrotron that has been working as a third generation light source with providing brilliant X-ray to hundreds of thousands of experimental users from all over the world. Recent middle-energy light sources in the world of beam energies around 3GeV triggered discussions on the necessity of upgrade of the current ring towards a diffraction-limited storage ring at the same location. The planning of new project, called SPring-8 II, has launched. At first, the design of new beam optics with five-bend magnets system at the beam energy of 6GeV started to get the smaller electron beam emittance to produce brighter coherent X-rays than the current ring. The design of control system started as well to meet the performance requirements. Equipment control devices are based on the factory automation technology such as PLC and VME families; on the other hand telecommunication technology such as xTCA will be used for digital data handling with high bandwidth.

In this paper, we will report on the conceptual design of control system for SPring8 II together with project status.

**TC0206** **Status of KEK Electron/Positron Injector Linac Control System toward SuperKEKB Upgrade**  
12:15 🕒

*M. Satoh, K. Furukawa, F. Miyahara, T. Suwada (KEK) T. Kudou, S. Kusano (Mitsubishi Electric System & Service Co., Ltd)*

Toward SuperKEKB project, the injector linac upgrade is ongoing at KEK in order to deliver the low emittance electron/positron beams with high bunch intensity and small emittance to two independent storage rings. A large number of accelerator components and control devices will be newly installed before the autumn of 2014. Finally, we are aiming at the simultaneous top-up operation for the four independent storage rings including two light sources. The high availability and reliability of control system is strongly required for the long-term stable beam operation under such complex operation schemes. In this presentation, we will describe the control system upgrade plan and status.

**TC0207** **The Common Device Interface 2.0**  
12:30 🕒

*P. Duval, H. Wu (DESY)*

The Common Device Interface (CDI) is a popular device layer in TINE control systems. Indeed, a de-facto device server (more specifically a 'property server') can be instantiated merely by supplying a hardware address database, somewhat reminiscent of an epics IOC. It has in fact become quite popular among users to do precisely this, although the original design intent anticipated embedding CDI as a hardware layer within a dedicated device server. When control system client applications and central services communicate directly to a CDI server, this places the burden of providing useable, viewable data (and in an efficient manner) squarely on CDI and its address database. In its initial release variant, any modifications to this hardware database needed to be made on the file system used by the CDI device server. In this report we shall describe some of the many new features of CDI release 2.0, which have drawn on the user/developer experience over the past eight years.

**TIOA — Afternoon Plenary Talk****Chair:** R. Bär (GSI)**TIOA01 About ZeroMQ****13:45**  **P. Hintjens** (*imatix*)

In this talk, Pieter Hintjens, founder of the ZeroMQ community, and author of the O'Reilly ZeroMQ book, will explain why we built ZeroMQ, how it works, and how to use it in your projects. Pieter will also touch on the ZeroMQ development process itself, a reusable model for other open source projects.

**TCO3 — Hardware****Chair:** R. Bär (GSI)**TC0301 Inexpensive Scheduling in FPGAs**14:30 *W.W. Terpstra, D.H. Beck, M. Kreider (GSI)*

In the new scheme for machine control used within the FAIR project, actions are distributed to front-end controllers (FEC) with absolute execution timestamps. The execution time must be both precise to the nanosecond and scheduled faster than a microsecond, requiring a hardware solution. Although the actions are scheduled at the FEC out of order, they must be executed in sorted order. The typical hardware approaches to implementing a priority queue (CAMs, shift-registers, etc.) work well in ASIC designs, but must be implemented in expensive FPGA core logic. Conversely, the typical software approaches (heaps, calendar queues, etc.) are either too slow or too memory intensive. We present an approach which exploits the time-ordered nature of our problem to sort in constant-time using only a few memory blocks.

**TC0303 TestBed – Automated Hardware-in-the-Loop Test Framework**14:45 *P.A. Maslov, K. Žagar (Cosylab)*

The control systems in big physics facilities may be updated several times a year. Ideally, prior to each release all components of the control system would be tested. One common control system component is a DAQ driver which is generally tested manually according to a predefined test plan. In order to simplify this process, we have developed the TestBed suite, a test framework that executes tests automatically. TestBed is a PXI chassis which contains an embedded controller running the control system on Scientific Linux and a DAQ board capable of generating and acquiring analog and digital signals. TestBed provides an easy-to-use framework written in Python and allows for the quick development and execution of automatic test scripts. From a hardware perspective, each system under test is physically connected to TestBed with a connector board using a predefined pin configuration. Both the system under test and TestBed are connected to the network. The resulting test framework makes it possible for the automatic tests to be executed with each new release of the control system, thus liberating human resources and ensuring complete consistency and repeatability in the testing protocol.

TC0304 **Launching the FAIR Timing System with CRYRING**

15:00 

**M. Kreider** (*Glyndŵr University & GSI*) *R. Bär, D.H. Beck, J. Hoffmann, N. Kurz, C. Prados, S. Rauch, W.W. Terpstra, M. Zweig (GSI) J.N. Bai (IAP)*  
During the past two years, significant progress has been made on the development of the General Machine Timing system for the upcoming FAIR facility at GSI. The prime features are time-synchronization of 2000-3000 nodes using the White Rabbit Precision-Time-Protocol (WR-PTP), distribution of International Atomic Time (TAI) time stamps and synchronized command and control of FAIR control system equipment. A White Rabbit network has been set up connecting parts of the existing facility and a next version of the Timing Master has been developed. Timing Receiver nodes in form factors Scalable Control Unit (standard front-end controller for FAIR), VME, PCIe and standalone have been developed. CRYRING is the first machine on the GSI/FAIR campus to be operated with this new timing system and serves as a test-ground for the complete control system. Installation of equipment starts in late spring followed by commissioning of equipment in summer 2014.

TC0305 **TCP/IP Control System Interface Development Using Microchip Brand**

15:15 

**Microcontrollers**

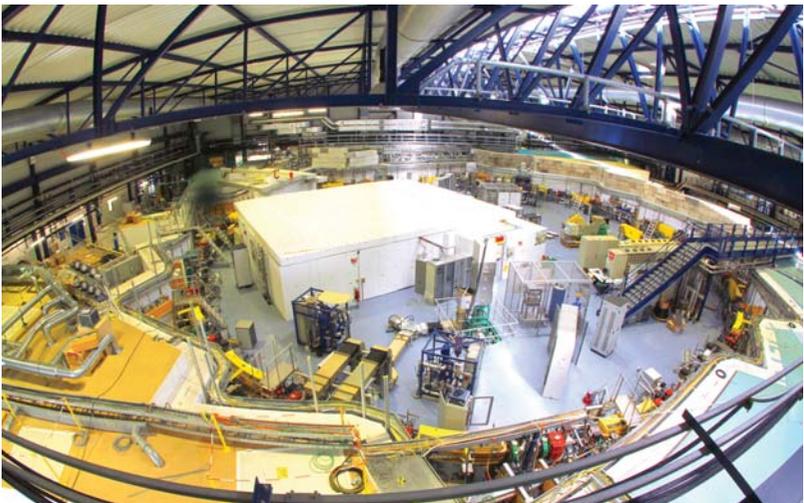
**C.E. Peters, M.A. Power** (*ANL*)

Even as the diversity and capabilities of Single-Board-Computers (SBCs) like the Raspberry Pi and BeagleBoard continue to increase, low level microprocessor solutions also offer the possibility of robust distributed control system interfaces. Since they can be smaller and cheaper than even the least expensive SBC, they are easily integrated directly onto printed circuit boards either via direct mount or pre-installed headers. The ever increasing flash-memory capacity and processing clock speeds has enabled these types of microprocessors to handle even relatively complex tasks such as management of a full TCP/IP software and hardware stack. The purpose of this work is to demonstrate several different implementation scenarios wherein a computer control system can communicate directly with an off-the-shelf Microchip brand microcontroller and its associated peripherals. The microprocessor can act as a Hardware-to-Ethernet communication bridge and provide services such as distributed reading and writing of analog and digital values, webpage serving, simple network monitoring and others to any custom electronics solution.

**S2 — Visit Synchrotron ANKA****S2001 ANKA Synchrotron Radiation Facility****16:30**  **W. Mexner (KIT)**

Visit to the ANKA Synchrotron Radiation Facility of KIT.

With the opening of ANKA in March 2003, Karlsruhe joined the exclusive club of some 50 cities worldwide that maintain and develop their own synchrotron light source for the benefit of an international user community. The buses will depart from the main entrance at 16:30. After the ANKA visit the buses will not return to the conference venue and directly drive to the dinner location.



**S3 — Dinner Space Hall Museum Speyer****S3001 Workshop Dinner**19:00 <sup>270</sup> **W. Mexner (KIT)**

Speyer is a famous ancient town centered around the Roman cathedral build in 1030. The cathedral houses the tombs of eight Holy Roman Emperors and German kings and is a Unesco World Heritage site.

The workshop dinner will be held in the 'Technik Museum Speyer' in the space flight exhibition hall. One of the famous Russian space shuttles Buran, which actually made flight tests in the earth's atmosphere, is located here together with many other examples from recent US- and European space activities.

Before dinner there will be a guided tour through the exhibition park. The buses to Speyer will depart at 16:30 at the main entrance for a visit to the synchrotron ANKA and then continue at 18:00 from ANKA to Speyer.



**FIOM — Morning Plenary Talk****Chair:** L. Catani (INFN-Roma II)**FIOM01 Database Technologies and Applications****09:00**  **D. Duellmann** (CERN)

This contribution will give an overview of current database systems and their main application areas. The presentation will start with a brief introduction describing the key implementation technologies and different applications areas of traditional relational database systems. The talk will then cover more recent developments in the area of extremely large databases, in-memory databases and several “no-SQL” systems to point out their respective advantages for specific problem areas. The presentation will conclude with an outlook on upcoming technology changes in the database and storage area, outlining their possible impact on science database applications.

**FCO1 — Databases****Chair:** L. Catani (INFN-Roma II)**FC0106 The Role of the CEBAF Element Database in Commissioning the 12 GeV Accelerator Upgrade**

09:45 ☞

*T. L. Larrieu, M.E. Joyce, C.J. Slominski, D.L. Turner (JLab)*

The CEBAF Element Database (CED) was first developed in 2010 as a resource to support model-driven configuration of the Jefferson Lab Continuous Electron Beam Accelerator (CEBAF). Since that time, its uniquely flexible schema design, robust programming interface, and support for multiple concurrent versions has permitted it to evolve into a more broadly useful operational and control system tool. The CED played a critical role before and during the 2013 startup and commissioning of CEBAF following its 18-month long shutdown and upgrade. Information in the CED about hardware components and their relations to one-another facilitated a thorough Hot Checkout process involving more than 18,000 system checks. New software relies on the CED to generate EDM screens for operators on-demand thereby ensuring that the information on those screens is correct and up-to-date. The CED also continues to fulfill its original mission of supporting model-driven accelerator setup. Using the new `ced2elegant` and `eDT` (`elegant Download Tool`), accelerator physicists have proven able to compute and apply energy-dependent set points with greater efficiency than ever before.

**FC0107 Latest Trends in Database Technology**

10:00 ☞

*S. Marsching (Auenos GmbH)*

In the last ten years, the increasing demand for extremely large, distributed, and highly available data stores, driven by companies like Amazon, Google and Facebook, has led to the development of new solutions which are known under the term "NoSQL". These NoSQL databases outperform traditional RDBMS in many applications. In general, they rely on clusters of cheap, standard issue PCs instead of a single large and expensive computer. This can help to reduce operational costs while improving availability. Recently, NoSQL concepts have been adopted for applications at particle accelerators, in particular for control-system data archives, allowing to archive more data at higher rates and for a lower price. This talk will demonstrate how applications for particle accelerators can benefit from NoSQL concepts, using the Apache Cassandra database system as an example.

## FPO — Poster Session II

**FP0001 Using InfiniBand for High-Throughput Data Acquisition in a TANGO Environment**

*T. Dritschler, S.A. Chilingaryan, T. Faragó, A. Kopmann, M. Vogelgesang (KIT)*

Real-time streaming of detector data has become increasingly important as it allows for fast feedback control loops. However, low ethernet network bandwidth caused by TANGOs CORBA remote IPC mechanism and non-uniform latencies induced by concurrent client access limits the effective maximum bandwidth left for data transmission. In order to increase data bandwidth nominally and under client load, we realized a secondary data channel based on InfiniBand communication primitives. This data channel is implemented as part of a TANGO device and by itself is independent of CORBA. TANGO mechanisms are used for configuration, thus the data channel can be used by any TANGO-based software that implements the corresponding interfaces. First results show, that we can achieve a maximum bandwidth of 31 Gb/s which is close to the theoretical maximum of 32 Gb/s possible with our 4X QDR InfiniBand test network. This indicates that we are able to surpass the bandwidth limitations of standard 10 gigabit Ethernet networks while retaining the TANGO control schemes via CORBA, enabling high data throughput in a TANGO environment.

**FP0002 Picosecond Sampling Electronics for Terahertz Synchrotron Radiation**

*C.M. Caselle, B.M. Balzer, M. Brosi, S.A. Chilingaryan, T. Dritschler, V. Judin, A. Kopmann, A.-S. Müller, L. Petzold, J. Raasch, L. Rota, M. Siegel, N.J. Smale, J.L. Steinmann, M. Vogelgesang, M. Weber, S. Wuensch (KIT)*

To study the synchrotron terahertz emission superconducting (YBCO) film detectors are used with the intrinsic response time in the order of a few picoseconds. For fast, continuous sampling of the individual THz ultra-short pulses a novel digitizer system has been developed. The system consists of detector, wideband low-noise amplifier, fast pulse digitizer board, back-end readout board. High-end graphic processing units (GPUs) perform real-time data analysis. Four samples with 12 bit are recorded in parallel for each fast pulse with programmable sampling times in the range of 3 to 100 ps. A new bus master DMA engine connected to PCI express endpoint has been developed to ensure a continuous high data throughput of up to 4 GByte/s. This heterogeneous real-time system architecture based on FPGA and GPU has successful been used for on-line pulse reconstruction and evaluations and calculates the peak amplitude of each pulse and the time between consecutive bunches with a picosecond time resolution at ANKA. A Fast Fourier Transform (FFT) is performed on-line for the frequency analysis of the CSR undulations.

FP0004 **Synchronous Ramp-Data Capture Scheme for Indus-2 Magnet Power Supply Control System**

*A. Chauhan, R.K. Agrawal, P. Fatnani, B.N. Merh, C.P. Navathe, K. Saifee, Y.M. Sheth (RRCAT)*

Indus-2 is a Synchrotron Radiation Source. Injection energy of electron beam is 550 MeV which is raised to 2.5 GeV using Ramping process. Magnet Power Supply Control System(MPS-CS) is used to energize magnets during filling & Ramping. Part of MPS-CS that mainly caters to Ramping consists of 19 VME stations controlling 29 Power Supplies. Global data capturing rate of MPS-CS is 1 Hz that records readback of set-value, control's reference & power supply's output. But Ramping changes control's reference at rates between 20-150 Hz. So a system of 1 Hz may miss out any deviation in data occurring during Ramping at higher rate. For this purpose a Synchronized Ramp-Data Capture(RDC) scheme has been incorporated in the MPS-CS which helps in capturing & analyzing any deviation in control's reference & power-supply readback during Ramping. Using this scheme we can capture data at distributed VME stations at the rate of Ramping-clock & in a synchronized way. Main hardware consists of a 24-bit ADC board & 18-bit DAC board for each of 29 Power Supplies & a common Ramp-clock generator board. Amount of data captured in one Ramping Cycle is between 12-14 MB which is collected & transferred to User-interface.

FP0006 **Integration of Independent Radiation Monitoring System with Main Accelerator Control**

*N. Kamikubota, N. Yamamoto (KEK) T. Iitsuka, S.Y. Yoshida (Kanto Information Service (KIS), Accelerator Group)*

The radiation monitoring system of J-PARC was constructed as a part of safety facilities. Thus, it has been operated independently from the main accelerator control system. In fact, the radiation monitoring system consists of two subsystems. The first subsystem developed by JAEA, which covers Linac and RCS ring, is PLC-based. We add a FL-net module to this subsystem to enable one-way data transfer to the accelerator control system. Here FL-net is a device-level communication network using UDP/IP, defined by a Japanese consortium. The second subsystem developed by KEK covers MR ring. It is a CAMAC-based DAQ system. Since this subsystem was difficult to extend, we made signal branches from radiation monitors, and fed them to a new PLC-based DAQ system. As same as the first subsystem, a FL-net module is used for one-way data transfer. In 2013-2014, integration of two subsystems has been carried out. Now radiation monitors can be supervised with the accelerator control system. As a result, accelerator operators can check radiation levels much easier than before. We understand that this is a significant improvement to realize safer operation of J-PARC accelerators.

**FP0007 Synchronized Beam Position Measurement System for KEK Electron/Positron Injector Linac**

*M. Satoh, K. Furukawa, F. Miyahara, T. Suwada (KEK) T. Kudou, S. Kusano (Mitsubishi Electric System & Service Co., Ltd)*

The KEK electron/positron linac is a 600-m-long injector that provides the beams with different energies to four independent storage rings. A non-destructive beam position monitor with the four strip-line type electrodes is utilized for the beam orbit and bunched charge measurement up to 50 Hz with the double bunch operation of 96 ns interval. Using the measured beam position, the beam orbit and energy feedback loops can be operated. The data acquisition of beam position monitor is conducted by the EPICS IOC running on the Windows-based fast digital oscilloscope. In our current system, 23 oscilloscopes process the analog data from 100 independent beam position monitors. Each data acquisition sequence has the time interval of 20 ms and is invoked by the common timing signal generated from the VME-based event timing system. Using the global beam shot number tagged by the event system, our system archived the synchronized beam position measurement among 100 monitors via 23 independent digital oscilloscopes. In this paper, the system description and the result of synchronized beam position measurement is presented in detail.

**FP0008 LabVIEW PCAS Interface for NI CompactRIO**

*G. Liu, C. Li, J.G. Wang, K. Xuan (USTC/NSRL)*

When the NI LabVIEW EPICS Server I/O Server is used to integrate NI CompactRIO devices into EPICS, we notice that it only supports "VAL" field, neither alarms nor time stamps are supported. In order to overcome the drawbacks, a new LabVIEW Portable Channel Access Server (PCAS) Interface is developed, and is applied to the Hefei Light Source (HLS) cooling water monitor system. The test results in the HLS cooling water monitor system indicate that this approach can greatly improve the performance of the NI CompactRIO devices which are integrated into EPICS.

**FP0009 The Power Supply Control System of HLS Based on Virtual Machine**

*J.G. Wang, C. Li, G. Liu, K. Xuan (USTC/NSRL)*

The Hefei Light Source (HLS) is a VUV synchrotron radiation light source. It is upgraded recently to improve its performance. The power supply control system is a part of the HLS upgrade project. 5 soft IOC applications running on the virtual machine are used to control 187 power supplies via Moxa's serial-to-Ethernet device servers. The power supply control system has been under operation since November 2013, and the operation results show the power supply control system is reliable and can satisfy the demands of storage ring closed orbit correction with the frequency of 1Hz.

**FP0010 The Software Tools and Capabilities of Diagnostic System for Stability of Magnet Power Supplies at Novosibirsk Free Electron Laser**

*S.S. Serednyakov (BINP SB RAS)*

The magnetic system of Novosibirsk Free electron laser containing large amount of magnetic elements, feed by power supplies of different types.

The time stability of output current of these power supplies is directly influence on coherent radiation parameters, and operation of whole FEL facility. Therefore, system for diagnostics of power supplies state, integrated to common FEL control system, was developed. The main task of this system is to analyze output current of power supply, determinate its time stability value. Also this system is able to determinate the amplitude and frequency of output current ripples, if they have a place for particular power supply, and display obtained results. The main architecture, some other capabilities, and results of usage of this system, are described in this paper.

**FP0011 PyPLC, a Versatile PLC-to-PC Python Interface**

*S. Rubio-Manrique, G. Cuni, D. Fernandez-Carreiras, Z. Reszela, A. Rubio (CELLS-ALBA Synchrotron)*

The PyPLC Tango Device Server provides a developer-friendly dynamic interface to any Modbus-based control device. Raw data structures from PLC are obtained efficiently and converted into highly customized attributes using the python programming language. The device server allows to add or modify attributes dynamically using single-line python statements. The compact python dialect used is enhanced with Modbus commands and methods to prototype, simulate and implement complex behaviors. As a generic device, PyPLC has been versatile enough to interact with PLC systems used in ALBA Accelerators as well as to our Beamlines SCADA (Sardana). This article describes the mechanisms used to enable this versatility and how the dynamic attribute syntax allowed to speed up the transition from PLC to user interfaces.

**FP0012 A Real-Time Data Logger for the MICE Superconducting Magnets**

*J.T.G. Wilson, A. Oates (STFC/DL)*

The Muon Ionisation Cooling Experiment (MICE) being constructed at STFC's Rutherford Appleton Laboratory will allow scientists to gain working experience of the design, construction and operation of a muon cooling channel. Among the key components are a number of superconducting solenoid and focus coil magnets specially designed for the MICE project and built by industrial partners. During testing it became apparent that fast, real-time logging of magnet performance before, during and after a quench was required to diagnose unexpected magnet behaviour. To this end a National Instruments Compact RIO (cRIO) data logger system was created, so that it was possible to see how the quench propagates through the magnet. The software was written in Real-Time LabVIEW and makes full use of the cRIO built-in FPGA to obtain synchronised, multi-channel data logging at rates of 10kHz and above. This paper will explain the design and capabilities of the created system, how it has helped to better understand the internal behaviour of the magnets during a quench and additional development to allow simultaneous logging of multiple magnets and integration into the existing EPICS control system.

**FP0013 Beam Data Logging System Base on NoSQL Database at SSRF***Y.B. Yan, Y.B. Leng (SINAP)*

To improve the accelerator reliability and stability, a beam data logging system was built at SSRF, which is base on NOSQL database Couchbase. The Couchbase is an open source software, and can be used both as a document database or pure key-value database. The logging system stores beam parameters under predefined conditions. It is mainly used for the fault diagnosis, beam parameters tracking or automatic report generation. The details of the data logging system will be reported in this paper.

**FP0014 New Data Archive System for SPES Project Based on EPICS RDB Archiver with PostgreSQL Backend***M. Montis, S. Fantinel, M.G. Giacchini (INFN/LNL) M.A. Bellato (INFN-Sez. di Padova)*

SPES project is a ISOL facility under construction at INFN, Laboratori Nazionali di Legnaro, which requires the integration between the accelerator systems actually used and the new line composed by the primary beam and the ISOL target. As consequence, a migration from the actual control system to a new one based on EPICS is mandatory to realize a distributed control network for the new facility. One of the first implementation realized for this purpose is the Archiver System, an important service required for experiments. Comparing information and experiences provided by other Laboratories, an EPICS Archive System based on PostgreSQL is implemented to provide this service. Preliminary tests are done with a dedicated hardware and following the project requirements. After these tests used to determinate a good configuration for Database and EPICS Application, the system is going to be moved in production, where it will be integrated with the first subsystem upgraded to EPICS. Dedicated customizations are made to the application for providing a simple user experience in managing and interact with the archiver system.

**FP0015 Device Control Database Tool (DCDB)***P.A. Maslov, M. Komel, K. Žagar (Cosylab)*

In a physics facility containing numerous instruments, it is advantageous to reduce the amount of effort and repetitive work needed for changing the control system (CS) configuration: adding new devices, moving instruments from beamline to beamline, etc. We have developed a CS configuration tool, which provides an easy-to-use interface for quick configuration of the entire facility. It uses Microsoft Excel as the front-end application and allows the user to quickly generate and deploy IOC configuration (EPICS start-up scripts, alarms and archive configuration) onto IOCs; start, stop and restart IOCs, alarm servers and archive engines, etc. The DCDB tool utilizes a relational database, which stores information about all the elements of the accelerator. The communication between the client, database and IOCs is realized by a REST server written in Python. The key feature of the DCDB tool is that the user does not need to recompile the source code. It is achieved by using a dynamic library

loader, which automatically loads and links device support libraries. The DCDB tool is compliant with ITER CODAC (used at ITER and ESS), but can also be used in any other EPICS environment.

**FP0016 Status of Operation Data Archiving System Using Hadoop/HBase for J-PARC**

*N. Kikuzawa, Y. Kato, A. Yoshii (JAEA/J-PARC) H. Ikeda (JAEA)*

J-PARC (Japan Proton Accelerator Research Complex) consists of much equipment. In Linac and 3 GeV rapid cycling synchrotron ring (RCS), the data of over the 64,000 EPICS records for these equipment has been collected. The Data volume is about 2 TB in every year, and the stored total data volume is about 10 TB. The data have been being stored by a Relational Data Base (RDB) system using PostgreSQL, but it is not enough in availability, performance, and capability to increase of data volume flexibility. Hadoop/HBase, which is known as a distributed, scalable and big data store, has been proposed for our next-generation archive system to solve these problems. The test system was built and verified about data transition or database utilization. This report shows the current status of the new archive system, and its advantages and problems which have been obtained through our verification.

**FP0017 Managing Multiple Function Generators for FAIR**

*S. Rauch, R. Bär, M. Thieme (GSI)*

In the FAIR control system, equipment which needs to be controlled with ramped nominal values (e.g. power converters) is controlled by a standard front-end control unit (SCU). An SCU combines a ComExpressBoard with Intel CPU and an FPGA baseboard and acts as bus-master on the SCU host-bus. Up to 12 function generators can be implemented in slave-board FPGAs and can be controlled from one SCU. The real-time data supply for the generators demands a special software/hardware approach. Direct control of the generators with a FESA (front-end control software) class, running on an Intel Atom CPU with Linux, does not meet the timing requirements. So an extra layer with an LM32 soft-core CPU is added to the FPGA. Communication between Linux and the LM32 is done via shared memory and a ring buffer data structure. The LM32 supplies the function generators with new parameter sets when it is triggered by interrupts. This two-step approach decouples the Linux CPU from the hard real-time requirements. For synchronous start and coherent clocking of all function generators, special pins on the SCU backplane are being used to avoid bus latencies.

**FP0018 Setup and Diagnostics of Motion Control at ANKA-Beamlines***K. Cerff, D. Haas, J. Jakel, M. Schmitt (KIT)*

The precise motion control in high resolution is one of the necessary conditions for making high quality measurements at beamline experiments. At a common ANKA beamline up to one hundred actuator axes are working together to align and shape beam, to select beam Energy and to position probes. Some Experiments need additional motion axes supported by transportable controllers plugged temporarily to a local beamline control system. In terms of process control all the analog and digital signals from different sources have to be verified, leveled and interfaced to the motion controllers. They have to be matched and calibrated in the control systems configuration file to real physical quantities which give the input for further data processing. A set of hard- and software tools and methods developed at ANKA over the years is presented in this paper.

**FP0019 FPGA Utilization of the Accelerator Interlock System through MPS Development in the LIPAc***K. Nishiyama (Japan Atomic Energy Agency (JAEA), International Fusion Energy Research Center (IFERC)) J. Knaster, A. Marqueta Barbero (IFMIF/EVEDA) T. Kojima, T. Narita, H. Sakaki, H. Takahashi (JAEA)*

The development of IFMIF (International Fusion Material Irradiation Facility) to generate a 14 MeV source of neutrons with the spectrum of DT fusion reactions is indispensable to qualify suitable materials for the First Wall of the nuclear vessel in fusion power plants. As part of IFMIF validation activities, LIPAc (Linear IFMIF Prototype Accelerator) facility, currently under installation at Rokkasho (Japan), will accelerate a 125mA CW and 9MeV deuteron beam with a total beam power of 1.125MW. The Machine Protection System (MPS) of LIPAc provides an essential interlock function of stopping the beam in case of anomalous beam loss or other hazardous situations. High speed processing is necessary to achieve properly the MPS main goal. This high speed processing of the signals, distributed alongside the accelerator facility, is based on FPGA technology. This paper describes the basis of FPGA use in the accelerator interlock system through the development of LIPAc's MPS, with a comparison with using of FPGA of the other accelerator control system.

**FP0021 A Microcontroller-Based ADC Trigger System for the ALICE Beam Position Monitors***H.J. Bulman (STFC/DL)*

ALICE (Accelerators and Lasers in Combined Experiments) is a 35 MeV energy recovery linear accelerator (ERL) that incorporates all the features of a fourth-generation light source albeit at a smaller scale. An ERL is not restricted by the dynamic properties of storage rings and, therefore, can attain an unprecedented electron beam brightness limited only by the electron gun. This paper describes the hardware and software design of a rack-mounted trigger control unit for a new Beam Position Monitoring (BPM) system. The system comprises of a new BPM front end amplifier feeding conventional VME ADCs. The trigger unit provides ADC triggers which allow all the bunch lengths to be measured and the position average to be taken.

FP0022 **New developments on the FAIR Timing Master**

*M. Kreider, R. Bär, D.H. Beck, W.W. Terpstra (GSI) J. Davies, V. Grout, M. Kreider (Glyndŵr University)*

This paper describes the progress of the field tests of the FAIR timing system's Director unit, which controls the accelerator's schedule in real-time. It also describes the details of the new design concepts and of the implementation of the new prototype that is to be tested with the CRYRING synchrotron's timing system. A message management layer has been introduced as hardware acceleration for the timely dispatch of control messages. It consists of a priority queue, combined with a scheduler and network load balancer. This lessens the real-time constraints for the Soft-CPU's composing the control messages, making the control firmware simpler and deterministic. This also opens the possibility of moving away from the current virtual machine like implementation on to a specialized programming language for accelerator control. Additionally a streamlined and better fitting model for beam production chains and cycles has been devised for use in the Director firmware. The worst case processing time becomes calculable, enabling fixed time-slices for safe multiplexing of cycles in all CPUs to be found and hence increasing the system's capacity.

FP0024 **First Idea on Bunch to Bucket Transfer for the FAIR Facility**

*J.N. Bai (IAP) R. Bär, D.H. Beck, T. Ferrand, M. Kreider, D. Ondreka, C. Prados, S. Rauch, W.W. Terpstra, M. Zweig (GSI)*

The FAIR facility makes use of Bunchphase Time Synchronization System (BuTiS) and the General Machine Timing (GMT) system to realize synchronization for transfer particles between ring machines, such as SIS18 and SIS100. We investigate a scenario where the master machine (SIS100) uses a Timing Receiver (TR) node to label the number and status of a bucket. The TR at the master machine sends a "tag" to a TR at the slave machine (SIS18). The tag includes an identifier of the empty bucket and the phase of the RF signal. As the position of bunches in the slave machine is controlled during acceleration by using phase information of "tag", bunches have the correct position at the moment of the transfer. The tag includes also the proper timing for triggering the kickers at the time of the empty buckets in the SIS100.

FP0026 **ADEI and Tango Archiving System – A Convenient Way to Archive and Represent Data**

*D. Haas, S.A. Chilingaryan, A. Kopmann (KIT)*

Tango offers an efficient and powerful archiving mechanism of Tango attributes in a MySQL database. The tool Mambo allows an easy configuration of all to be archived data. This approved archiving concept was successfully introduced to ANKA. To provide an efficient modern web based interface for database query, the TANGO Archiving System was bind to ADEI (Advanced Data Extraction Infrastructure), which was original developed for the KATRIN (Karlsruhe Tritium Neutrino Experiment) at KIT. ADEI is a complex and reliable web interface, which guarantees fast access and demonstration of a huge amount of data stored in a MySQL database. The ADEI binding has been successfully tested at the Image-Beamline at ANKA. In a further step it will be deployed to all ANKA beamlines.

**FP0027 NICOS – the Instrument Control Solution for MLZ**

*E. Faulhaber, G. Brandl, C. Felder, J. Krüger, A. Lenz, B. Pedersen (MLZ)*

At the MLZ, a unified instrument control solution was found in NICOS - the (N)etworked (I)nstrument (Co)ntrol (S)ystem. Primarily developed on and for the triple-axis machines for quite some time, it got enhanced and adopted to also support other instrument types reliably. The modular approach and the inherent flexibility allowed this easily. Feedback from users as well as instrument responsables helped to improve the usability significantly. Long wished features like auto-detection of sample environment or enhanced scripting capabilities ease the setup phase of each experiment. A state-of-the art help system, a modern GUI and seamless integration with pluggable hardware modules (via TACO/TANGO) allow scientists to focus on the experiment and reduce distractions due to machine peculiarities. Since NICOS is written in Python, it is easy to implement new features or requests. Abstract device classes easy handling of different kind of hardware. Primarily developed for neutron scattering instruments, NICOS is also more than capable to control x-ray diffractometers or beamline instruments. We want to present its capabilities to extent its use outside our facility.

**FP0028 Web Based Machine Status Display for the Siam Photon Source**

*N. Suradet, Ch. Dhammatong, S. Klinkhieo, P. Klysubun, C.P. Preecha (SLRI)*

The machine status broadcasting system has been developed to improve the display quality and operation status of the Siam Photon Source (SPS, a 1.2 GeV synchrotron light source). The broadcasting system is implemented using web-based interface via the SPS website, mobile application, and TV network within the SPS facility, allows users easily to utilize browsers and observe the variety information related to the machine, and provides supporting message services for alarm, event notification, and other operational needs. In this report, the design of web and mobile application based on HTML5, CSS3, and adopting the PHP, AJAX, Bootstrap framework (for responsive design), jQuery, Highcharts JS, Twitter widget, etc., will be described. The detail of the hardware and software structure, users requirements and satisfactions, as well as suggestions on further improvements, will be presented.

**FP0029 Redesign of Alarm Monitoring System Application "BeamlineAlarminfoClient" at DESY**

*S. Aytac (DESY)*

The alarm monitoring system "BeamlineAlarminfoClient" is a very useful technical-service application at DESY, as it visually renders the locations of important alarms in some sections (e.g. fire or other emergencies). The aim of redesigning this application is to improve the software architecture and allow the easy integration of new observable areas including a new user interface design. This redesign also requires changes on server-side, where alarms are handled and the necessary alarm information is prepared for display. Currently, the client manages alarm data from 17

different servers. This number will increase dramatically in 2014 when new beam lines come into play. Thus creating templates to simplify the addition of new sections makes sense both for the server and client. The client and server are based on the Tine control system and make use of the Tine-Studio utilities, the Alarm Viewer and the Archive Viewer. This paper presents how the redesign is arranged in close collaboration with the customers.

**FP0030 Control System Software Environment and Integration for the TPS**

*Y.-S. Cheng, J. Chen, P.C. Chiu, K.T. Hsu, C.H. Huang, C.H. Kuo, C.Y. Liao, C.Y. Wu (NSRRC)*

The TPS (Taiwan Photon Source) is the latest generation 3 GeV synchrotron light source, and the commissioning starts from third quarter of 2014. The EPICS is adopted as control system framework for the TPS. The various EPICS IOCs have implemented for each subsystem. The control system software environment has been established and integrated specifically for the TPS commissioning. The various purposed operation interfaces have been created and mainly include the function of setting, reading, save, restore and etc. The database related applications have been built, and the applications include archive system, alarm system, logbook, Web and etc. The high level applications which are depended upon properties of each subsystem have been developed and are in test phase. The efforts will be summarized at this report.

**FP0031 Power Supplies Transient Recorders for Post-Mortem Analysis of BPM Orbit Dumps at Petra-III**

*G.K. Sahoo, P.K. Bartkiewicz, A. Kling, B. Pawlowski (DESY)*

PETRA-III is a 3rd generation synchrotron light source dedicated to users at 14 beam lines with 30 instruments. The storage ring is presently modified to add 12 beam lines. PETRA III was operated with several filling modes such as 40, 60, 480 and 960 bunches with a total current of 100mA at electron beam energy of 6 GeV. The horizontal beam emittance is 1 nmrad while a coupling of 1% amounts to a vertical emittance of 10 pmrad. During a user run Machine Protection System (MPS) may trigger an unscheduled beam dump if transients in the current of magnet power supplies are detected which are above permissible limits. The trigger of MPS stops the ring buffers of the 226 BPM electronics where the last 16384 turns just before the dump are stored. These data and transient recorder data of Magnet Power Supply Controllers are available for a post-mortem analysis. Here we discuss in detail the functionality of a Java GUI used to investigate the transient behavior of the differences between set and readout values of different power supplies to find out the responsible power supply that might have led to emittance growth, fluctuations in orbits or beam dumps seen in a post-mortem analysis.

**FP0032 TPS Screen Monitor User Control Interface**

**C.Y. Liao**, Y.-S. Cheng, K.T. Hsu, K.H. Hu, C.H. Kuo, S.H. Lee, C.Y. Wu (NSRRC)

The Taiwan Photon Source (TPS) is being constructed at the campus of the NSRRC (National Synchrotron Radiation Research Center) and commissioning expected in 2014. For beam commissioning, the design and implementation of a system for image acquisition, analysis and display is in progress. A CCD camera with Gigabit Ethernet interface (GigE Vision) is a standard device for image acquisition, to be undertaken with an EPICS IOC via a PV channel; analysis of the properties is made with a Matlab tool to evaluate the beam profile (sigma), beam-size position and tilt angle etc. The system architecture, installation, and user control interface were presented in this report.

**FP0033 Development Status of SINAP Timing System**

**M. Liu**, K.C. Chu, C.X. Yin, L.Y. Zhao (SINAP)

After successful implementation of SINAP timing solution at Pohang Light Source in 2011, we started to upgrade SINAP timing system to version 2. The hardware of SINAP v2 timing system is based on Virtex-6 FPGA chip, and bidirectional event frame transfer is realized in a 2.5Gbps fiber-optic network. In event frame, data transfer functionality substitutes for distributed bus. The structure of timing system is also modified, where a new versatile EVO could be configured as EVG, FANOUT or EVR with optical outputs. Besides standard VME modules, we designed PLC-EVR as well, which is compatible with Yokogawa F3RP61 series. Based on brand new hardware architecture, the jitter performance of SINAP v2 timing system is improved remarkably.

**FPI — Poster in Pills****Chair:** P. Duval (DESY)**FPI01 Using InfiniBand for High-Throughput Data Acquisition in a TANGO Environment**  
12:30 m*T. Dritschler, S.A. Chilingaryan, T. Faragó, A. Kopmann, M. Vogelgesang (KIT)*

Real-time streaming of detector data has become increasingly important as it allows for fast feedback control loops. However, low ethernet network bandwidth caused by TANGOs CORBA remote IPC mechanism and non-uniform latencies induced by concurrent client access limits the effective maximum bandwidth\* left for data transmission. In order to increase data bandwidth nominally and under client load, we realized a secondary data channel based on InfiniBand communication primitives. This data channel is implemented as part of a TANGO device and by itself is independent of CORBA. TANGO mechanisms are used for configuration, thus the data channel can be used by any TANGO-based software that implements the corresponding interfaces. First results show, that we can achieve a maximum bandwidth of 31 Gb/s which is close to the theoretical maximum of 32 Gb/s possible with our 4X QDR InfiniBand test network. This indicates that we are able to surpass the bandwidth limitations of standard 10 gigabit Ethernet networks while retaining the TANGO control schemes via CORBA, enabling high data throughput in a TANGO environment.

**FPI02 Picosecond Sampling Electronics for Terahertz Synchrotron Radiation**  
12:33 m*C.M. Caselle, B.M. Balzer, M. Brosi, S.A. Chilingaryan, T. Dritschler, V. Judin, A. Kopmann, A.-S. Müller, L. Petzold, J. Raasch, L. Rota, M. Siegel, N.J. Smale, J.L. Steinmann, M. Vogelgesang, M. Weber, S. Wuensch (KIT)*

To study the synchrotron terahertz emission superconducting (YBCO) film detectors are used with the intrinsic response time in the order of a few picoseconds. For fast, continuous sampling of the individual THz ultra-short pulses a novel digitizer system has been developed. The system consists of detector, wideband low-noise amplifier, fast pulse digitizer board, back-end readout board. High-end graphic processing units (GPUs) perform real-time data analysis. Four samples with 12 bit are recorded in parallel for each fast pulse with programmable sampling times in the range of 3 to 100 ps. A new bus master DMA engine connected to PCI express endpoint has been developed to ensure a continuous high data throughput of up to 4 GByte/s. This heterogeneous real-time system architecture based on FPGA and GPU has successfully been used for on-line pulse reconstruction and evaluations and calculates the peak amplitude of each pulse and the time between consecutive bunches with a picosecond time resolution at ANKA. A Fast Fourier Transform (FFT) is performed on-line for the frequency analysis of the CSR undulations.

**FPI03 New developments on the FAIR Timing Master**

12:36 m

**M. Kreider**, R. Bär, D.H. Beck, W.W. Terpstra (GSI) J. Davies, V. Grout, **M. Kreider** (Glyndŵr University)

This paper describes the progress of the field tests of the FAIR timing system's Director unit, which controls the accelerator's schedule in real-time. It also describes the details of the new design concepts and of the implementation of the new prototype that is to be tested with the CRYRING synchrotron's timing system. A message management layer has been introduced as hardware acceleration for the timely dispatch of control messages. It consists of a priority queue, combined with a scheduler and network load balancer. This lessens the real-time constraints for the Soft-CPU's composing the control messages, making the control firmware simpler and deterministic. This also opens the possibility of moving away from the current virtual machine like implementation on to a specialized programming language for accelerator control. Additionally a streamlined and better fitting model for beam production chains and cycles has been devised for use in the Director firmware. The worst case processing time becomes calculable, enabling fixed time-slices for safe multiplexing of cycles in all CPUs to be found and hence increasing the system's capacity.

**FPI04 Web Based Machine Status Display for the Siam Photon Source**

12:39 m

**N. Suradet**, Ch. Dhammatong, S. Klinkhieo, P. Klysubun, C.P. Preecha (SLRI)

The machine status broadcasting system has been developed to improve the display quality and operation status of the Siam Photon Source (SPS, a 1.2 GeV synchrotron light source). The broadcasting system is implemented using web-based interface via the SPS website, mobile application, and TV network within the SPS facility, allows users easily to utilize browsers and observe the variety information related to the machine, and provides supporting message services for alarm, event notification, and other operational needs. In this report, the design of web and mobile application based on HTML5, CSS3, and adopting the PHP, AJAX, Bootstrap framework (for responsive design), jQuery, Highcharts JS, Twitter widget, etc., will be described. The detail of the hardware and software structure, users requirements and satisfactions, as well as suggestions on further improvements, will be presented.

**Y.-S. Cheng**, *J. Chen, P.C. Chiu, K.T. Hsu, C.H. Huang, C.H. Kuo, C.Y. Liao, C.Y. Wu (NSRRC)*

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**FIOA — Plenary Talk Afternoon****Chair:** R. Bacher (DESY)**FIOA01 Accelerator Availability Monitoring****13:45**  **H. Ehrlichmann** (DESY)

Maximized availability has become an important issue in the field of today's particle accelerator operation, where downtimes of even a few minutes can have a significant influence. Thus a reliable online monitoring of accelerator states within the control system is required, including both declared operation modes as well as alarm states. Would it be possible to rely completely on fully automated data collection for predefined states and predefined operation schedules? And if so, how would we best go about doing this? Or is offline data manipulation unavoidable? Some practical experience will be presented.

**FCO2 — User Interfaces****Chair:** R. Bacher (DESY)**FC0201 Renovating and Upgrading the Web2cToolkit Suite: A Status Report**14:15  **R. Bacher** (DESY)

Web2cToolkit is a collection of Web services. It enables scientists, operators or service technicians to supervise and operate accelerators and beam lines through the World Wide Web. In addition, it provides users with a platform for communication and the logging of data and actions. Recently a novel service, especially designed for mobile devices, has been added. Besides the standard mouse-based interaction it provides a touch- and voice-based user interface. Web2cToolkit is currently undergoing an extensive renovation and upgrading process. Real WYSIWYG-editors are now available to generate and configure synoptic and history displays, and an interface based on 3D-motion and gesture recognition has been implemented. Also the multi-language support and the security of the communication between Web client and server have been improved substantially. The paper reports the complete status of this work and outlines upcoming development.

**FC0202 OpenGL-Based Data Analysis in Virtualized Self-Service Environments**14:30  **V. Mauch**, *M. Bonn* (KIT)

Modern data analysis applications for 2D/3D data samples apply complex visual output features which are often based on OpenGL, a multi-platform API for rendering vector graphics. They demand special computing workstations with a corresponding CPU/GPU power, enough main memory and fast network interconnects for a performant remote data access. For this reason, users depend heavily on available free workstations, both temporally and locally. The provision of virtual machines (VMs) accessible via a remote connection could avoid this inflexibility. However, the automatic deployment, operation and remote access of OpenGL-capable VMs with professional visualization applications is a non-trivial task. In this paper, we discuss a concept for a flexible analysis infrastructure that will be part in the project ASTOR, which is the abbreviation for “Arthropod Structure revealed by ultra-fast Tomography and Online Reconstruction”. We present an Analysis-as-a-Service (AaaS) approach based on the on-demand allocation of VMs with dedicated GPU cores and a corresponding analysis environment to provide a cloud-like analysis service for scientific users.

**FC0203 Making it all Work for Operators**14:45  **I. Križnar** (Cosylab) *E. Hertle, E. Huttel, W. Mexner, A.-S. Müller, N.J. Smale* (KIT) *S. Marsching* (Aquenos GmbH)

As the control system of the ANKA synchrotron radiation source at KIT (Karlsruhe Institute of Technology) is being slowly upgraded it can become, at key stages, temporarily a mosaic of old and new panels while the operator learns to move across to the new system. With the development of general purpose tools, and careful planning of both the final and

transition GUIs, we have been able to actually simplify the working environment for machine operators. In this paper we will explain concepts, guides and tools in which GUIs for operators are developed and deployed at ANKA.

FC0204  
15:00  **How the COMETE Framework Enables the Development of GUI Applications Connected to Multiple Data Sources**

**R. Girardot, A. Buteau, M. Ounsy, K.S. Saintin, G. Viguier (SOLEIL)**

Today at SOLEIL, our end users requires that GUI applications display data coming from various sources: live data from the Tango [\*] control system, archived data stored in the Tango archiving databases and scientific measurement data stored in HDF5 files. Moreover they would like to use the same collection of widgets for the different data sources to be accessed. On the other side, for GUI application developers, the complexity of data source handling had to be hidden. The COMETE [\*\*] framework has been developed to fulfil these allowing GUI developers to build high quality, modular and reusable scientific oriented GUI applications, with consistent look and feel for end users. COMETE offers some key features to software developers:

- A data connection mechanism to link the widget to the data source
- Smart refreshing service
- Easy-to-use and succinct API
- Components can be implemented in AWT, SWT and SWING flavors.

This paper will present the work organization, the software architecture and design of the whole system. We'll also introduce the COMETE ecosystem and the available applications for data visualisation.

**FC0205 Archive Playback - Post Mortem Data Analysis**

15:15 

**J. Penning**, *M.R. Clausen (DESY) C. Mein (University of Hamburg)*

The cryogenic systems at DESY are controlled by the process control system EPICS. New cryogenic plants and new test facilities for the European XFEL are currently beginning their routine operations. Other components of the XFEL are under construction or currently in the commissioning phase. Diagnostic analysis of events in the system is getting more difficult due to the complex environment. Current post mortem analysis is typically carried out by retrieving archived data and plotting the results in a trend plot. The disadvantage of this approach is that you only see those channels which are configured as potential candidates for a good analysis. Channels which might actually explain the root cause of the event stay out of sight. We have developed mechanisms to play back the archived data directly into the data stream of the operator console. This way the data get displayed into the synoptic displays in the same manner the operator is used to. This way the analysis of events is eased. Within a given time period it is possible to run forward or backward with a time-slider. First results will be shown.

**FC0206 PANIC, a Suite for Visualization, Logging and Notification of Incidents**

15:30 

**S. Rubio-Manrique**, *F. Becheri, G. Cuni, D. Fernandez-Carreiras, C. Pascual-Izarra, Z. Reszela (CELLS-ALBA Synchrotron)*

PANIC is a suite of python applications focused on visualization, logging and notification of events occurring in ALBA Synchrotron Control System. Build on top of the PyAlarm Tango Device Server it provides an API and a set of graphic tools to visualize the status of the declared alarms, create new alarm processes and enable notification services like SMS, email, data recording, sound or execution of Tango commands. The user interface provides visual debugging of complex alarm behaviors, that can be declared using single-line python expressions. This article describes the architecture of the PANIC suite, the alarm declaration syntax and the integration of alarm widgets in Taurus user interfaces.

**CLOS — Isamu Abe Prize and Closing****Chair:** W. Mexner (KIT)**CLOS01 Isamu Abe Prize**16:15 **W. Mexner (KIT)**

The Isamu Abe Prize recognizes innovative ideas, achievements and applications in the field of accelerator controls and it is granted every two years by PCaPAC.

The main purpose of the Isamu Abe Prize is to encourage people in the early stages of their career. The prize awarded by the International Program Committee seeks to recognize innovative ideas, achievements and applications presented at PCaPAC.

The prize is named in recognition of Isamu Abe, from KEK, one of the co-founders of PCaPAC, who suddenly passed away in June 2002.

**CLOS02 Closing PCaPAC2014**16:30 **W. Mexner (KIT)**

This session will discuss and close the 10th International Workshop on Personal Computers and Particle Accelerator Controls.

**Boldface** papercodes indicate primary authors

— A —

Abe, T. WC0205  
Agrawal, R.K. TC0102, TC0202, FP0004  
Akbari, M. TC0203  
Ameil, F. TC0201  
Antoniazzi, L. WP0017  
Antonioti, F. WP0030  
Aytac, S. **FP0029**

— B —

Bacher, R. **FC0201**  
Bär, R. **WP0004, WPI01, TC0201**, TC0304, FP0017, FP0022,  
FP0024, FPI03  
Bai, J.N. TC0304, **FP0024**  
Balzer, B.M. FP0002, FPI02  
Bansal, A. TC0202  
Bao, Y.W. WP0025  
Barnwal, R. WP0015  
Barpande, K.G. TC0202  
Bartkiewicz, P.K. FP0031  
Bassato, G. WP0018  
Batten, T. WP0001  
Becheri, F. FC0206  
Beck, D.H. WP0004, WPI01, TC0301, TC0304, FP0022, FP0024,  
FPI03  
Bellato, M.A. WP0016, WP0017, FP0014  
Bellorini, F. WP0030  
Betz, C. WP0004, **WP0007**, WPI01  
Bhattacharjee, D. WP0015  
Bisegni, C. TC0204  
Blanchard, S. **WP0030**  
Boeckmann, T. WC0203  
Boivin, J-P. WP0030  
Bräuning, H. WP0006  
Brandl, G. FP0027  
Brosi, M. FP0002, FPI02  
Bulman, H.J. **FP0021**  
Buteau, A. FC0204

— C —

Caselle, C.M. WC0201, **FP0002, FPI02**  
Catani, L. **TC0204**  
Cerff, K. **FP0018**  
Chandan, S. WP0015  
Chang, Y.-T. WP0033, WP0034

Chaudhary, N.	WP0015
Chauhan, A.	TC0202, <b>FP0004</b>
Chavan, R.B.	<b>WP0015</b>
Chen, J.	WP0033, FP0030, FPI05
Cheng, Y.-S.	<b>WP0033</b> , WP0034, <b>FP0030</b> , FP0032, <b>FPI05</b>
Chevtsov, P.	<b>WP0031</b> , <b>WP0032</b>
Chilingaryan, S.A.	<b>WC0201</b> , FP0001, FP0002, FP0026, FPI01, FPI02
Chiu, P.C.	WP0033, <b>WP0035</b> , FP0030, FPI05
Chu, K.C.	FP0033
Ciuffetti, P.	TC0204
Clausen, M.R.	<b>WC0203</b> , FC0205
Cleva, S.	WC0103
Cox, G.	WP0039, WPI05
Cuní, G.	WC0206, FP0011, FC0206

## — D —

Davies, J.	FP0022, FPI03
Deghaye, S.	WP0006
Dhammatong, Ch.	FP0028, FPI04
Di Pirro, G.	TC0204
Dixit, K.P.	WP0015
Dong, K.J.	WP0025
Dritschler, T.	WC0201, <b>FP0001</b> , FP0002, <b>FPI01</b> , FPI02
Duellmann, D.	<b>FI0M01</b>
Duval, P.	<b>TC0207</b>

## — E —

Ehrlichmann, H.	<b>FI0A01</b>
-----------------	---------------

## — F —

Fantinel, S.	FP0014
Faragó, T.	WC0201, FP0001, FPI01
Fatnani, P.	<b>TC0102</b> , <b>TC0202</b> , FP0004
Faulhaber, E.	<b>FP0027</b>
Felder, C.	FP0027
Fernandez-Carreiras, D.	WC0206, FP0011, FC0206
Ferrand, T.	FP0024
Fiedler, S.	WP0011
Fitzek, J.	WP0004, WP0005, WPI01, TC0101
Foggetta, L.G.	TC0204
Frommberger, F.	WP0003
Fukui, T.	WC0204, TC0205
Furukawa, K.	TC0206, FP0007
Furukawa, Y.	WC0205

— G —

Gagliardi, F.	<b>WIOM01</b>
Galletti, F.	TC0204
Gama, J.	WP0030
Gangopadhyay, S.	TC0202
Gargana, R.	TC0204
Gaperič, G.G.	WP0029
Ghodke, S.R.	WP0015
Giacchini, M.G.	<b>WP0016</b> , <b>WP0017</b> , WP0018, FP0014
Girardot, R.	<b>FC0204</b>
Gomes, P.	WP0030
Gothwal, P.	TC0202
Grout, V.	FP0022, FPI03
Gryczan, G.	<b>TIOM02</b>
Guijarro, M.	<b>WP0002</b>
Guilloud, C.	WP0002
Gupta, A.M.	TC0202

— H —

Haas, D.	FP0018, <b>FP0026</b>
Hancock, M.D.	<b>WP0038</b>
Harder, D.A.	WC0207
Hatje, J.	WC0203
Hatsui, T.	WC0205
He, P.	WC0207
Hertle, E.	WP0028, FC0203
Hiller, N.	WP0013, WPI03
Hillert, W.	WP0003
Hintjens, P.	<b>TIOA01</b>
Hoffmann, J.	TC0304
Hsu, K.T.	WP0033, WP0034, WP0035, FP0030, FP0032, FPI05
Hsu, S.Y.	WP0033
Hu, K.H.	WP0033, WP0035, FP0032
Hu, S.	WP0001
Hu, Y.M.	WP0025
Huang, C.H.	WP0033, <b>WP0034</b> , FP0030, FPI05
Hüther, H.C.	<b>WP0005</b> , TC0101
Huhmann, R.	WP0029
Huttel, E.	WP0028, FC0203

— I —

Igarashi, R.	WP0001
Iitsuka, T.	FP0006
Ikeda, H.	FP0016

Ishii, M.	<b>WC0204</b>
Ismail, A.	WP0023, WP0024
Iwasaki, Y.	<b>WP0022</b>

— J —

Jafarzadeh, M.	TC0203
Jakel, J.	FP0018
Janardhan, M.	TC0202
Jayaprakash, D.	WP0015
Joti, Y.	WC0205
Joyce, M.E.	FC0106
Judin, V.	WP0013, WPI03, FP0002, FPI02
Jülicher, S.	WP0004, WPI01

— K —

Kago, M.	WC0204
Kameshima, T.K.	WC0205
Kamikubota, N.	<b>FP0006</b>
Kan, C.X.	WP0025
Kaneyasu, T.	WP0022
Kato, Y.	FP0016
Khaleghi, A.	<b>TC0203</b>
Kikuzawa, N.	<b>FP0016</b>
Killenbergh, M.	<b>WC0101</b>
Kitegi, C.A.	WC0207
Kling, A.	FP0031
Klinkhieo, S.	FP0028, FPI04
Klysubun, P.	FP0028, FPI04
Knaster, J.	FP0019
Koda, S.	WP0022
Kojima, T.	FP0019
Kolozhvari, A.	<b>WP0011</b> , WP0012, WPI02
Komel, M.	FP0015
Kopmann, A.	WC0201, FP0001, FP0002, FP0026, FPI01, FPI02
Kopylov, L.	WP0030
Korth, O.	WC0203
Kosuge, T.	<b>WP0019</b> , WP0020, <b>WPI04</b>
Krause, U.	WP0004, WPI01
Kreider, M.	<b>TC0304</b> , <b>FP0022</b> , <b>FPI03</b> , TC0301, FP0024
Krepp, S.	WP0029
Križnar, I.	<b>WP0028</b> , <b>FC0203</b>
Krüger, J.	FP0027
Kruk, G.	TC0101
Kubarev, V.V.	WP0027

Kudou, T.	TC0206, FP0007
Kumar, D.	<b>WP0029</b>
Kuo, C.H.	WP0033, WP0034, WP0035, FP0030, FP0032, FPI05
Kurz, N.	TC0304
Kusano, S.	TC0206, FP0007

— L —

Larrieu, T. L.	<b>FC0106</b>
Lee, D.	WP0033
Lee, S.H.	FP0032
Leng, Y.B.	FP0013
Lenz, A.	FP0027
Li, C.	FP0008, FP0009
Li, K.N.	<b>WP0025</b>
Liao, C.Y.	WP0033, FP0030, <b>FP0032</b> , FPI05
Lilienthal, C.	TIOM02
Liu, B.J.	<b>WP0018</b>
Liu, G.	<b>FP0008</b> , FP0009
Liu, M.	<b>FP0033</b>

— M —

Mansouri Sharifabad, M.	<b>WP0023</b> , WP0024
Marqueta Barbero, A.	FP0019
Marsching, S.	WC0101, WP0028, <b>FC0107</b> , FC0203, <b>WP0013</b> , <b>WPI03</b>
Martlew, B.G.	WP0038, WP0039, WPI05
Maruyama, T.	WC0204
Maslov, P.A.	<b>TC0303</b> , <b>FP0015</b>
Matias, E. D.	WP0001
Matsumoto, T.	WC0205
Matsushita, T.	TC0205
Matthies, S.	<b>WP0006</b>
Mauch, V.	<b>FC0202</b>
Mazzitelli, G.	TC0204
Mein, C.	FC0205
Merh, B.N.	TC0202, FP0004
Merker, S.	WP0030
Mexner, W.	<b>WEL01</b> , WC0202, WP0028, <b>S1001</b> , <b>S2001</b> , <b>S3001</b> , FC0203, <b>CLOS001</b> , <b>CLOS02</b>
Meykopff, S.M.	<b>WP0009</b> , WP0010
Michelotti, A.	TC0204
Mikheev, M.S.	WP0030
Mishra, R.	TC0202
Mishra, R.L.	WP0015
Mittal, K.C.	WP0015

Miyahara, F.	TC0206, FP0007
Momper, E.	WP0007
Montis, M.	WP0016, WP0017, <b>FP0014</b>
Müller, A.-S.	WP0013, WP0028, WPI03, FP0002, FPI02, FC0203
Müller, R.	WP0005, <b>TC0101</b>
Mukesh Kumar, M.K.	WP0015
Musardo, M.M.	<b>WC0207</b>

— N —

Nagatani, Y.	WP0019, <b>WP0020</b> , WPI04
Narita, T.	FP0019
Nasse, M.J.	WP0013, WPI03
Navathe, C.P.	FP0004
Nimje, V.T.	WP0015
Nishiyama, K.	<b>FP0019</b>

— O —

Oates, A.	<b>WP0039</b> , <b>WPI05</b> , FP0012
Ohshima, T.	WC0204
Okada, K.	<b>WC0205</b>
Ondreka, D.	FP0024
Ounsy, M.	FC0204
Owens, P.H.	<b>WP0040</b>

— P —

Pascual-Izarra, C.	WC0206, FC0206
Pawlowski, B.	FP0031
Pedersen, B.	FP0027
Penning, J.	WC0203, <b>FC0205</b>
Pereira, H.F.	WP0030
Perez, M.	WP0002
Peters, C.E.	<b>TC0305</b>
Petrosyan, L.M.	WC0101
Petzold, L.	FP0002, FPI02
Pigny, G.	WP0030
Pisent, A.	WP0017
Pleško, M.	WP0029, <b>TC0103</b>
Poggi, M.	WP0018
Power, M.A.	TC0305
Prados, C.	TC0304, FP0024
Preecha, C.P.	FP0028, FPI04
Proft, D.	<b>WP0003</b>

— R —

Raasch, J.	FP0002, FPI02
Rahighi, J.	TC0203
Rapp, V.	<b>WC0102</b>
Rauch, S.	TC0304, <b>FP0017</b> , FP0024
Resmann, D.	<b>WC0202</b>
Reszela, Z.	<b>WC0206</b> , FP0011, FC0206
Rickens, H.R.	WC0203
Rio, B.	WP0030
Ristau, U.R.	WP0011, <b>WP0012</b> , <b>WPI02</b>
Rota, L.	FP0002, FPI02
Rubio, A.	FP0011
Rubio-Manrique, S.	<b>FP0011</b> , <b>FC0206</b>
Ruprecht, R.	WP0013, WPI03

— S —

Sahoo, G.K.	<b>FP0031</b>
Saifee, K.	TC0202, FP0004
Sakaki, H.	FP0019
Saleh, I.	WP0023, <b>WP0024</b>
Sanchez Valdepenas, D.	WP0007
Sarukte, H.E.	WP0015
Satoh, M.	<b>TC0206</b> , <b>FP0007</b>
Scafuri, C.	<b>WC0103</b>
Schmitt, M.	FP0018
Schoeneburg, B.	WC0203
Schuh, M.	WP0013, WPI03
Schwinn, A.	WP0006
Seema, M.	TC0202
Serednyakov, S.S.	<b>FP0010</b> , <b>WP0027</b>
Sheth, Y.M.	TC0202, FP0004
Siegel, M.	FP0002, FPI02
Sliwinski, W.	WC0102
Slominski, C.J.	FC0106
Smale, N.J.	WP0028, FP0002, FPI02, FC0203
Srivastava, B.S.K.	TC0102, TC0202
Stecchi, A.	TC0204
Steinmann, J.L.	FP0002, FPI02
Stevanovic, U.	WC0201
Su, S.Y.	WP0025
Sugimoto, T.	WC0205, TC0205
Suneet, S.K.	WP0015
Suradet, N.	<b>FP0028</b> , <b>FPI04</b>
Suwada, T.	TC0206, FP0007

— T —

Takabayashi, Y.	WP0022
Takahashi, H.	FP0019
Tanabe, T.	WC0207
Tanaka, R.	WC0205, <b>TC0205</b>
Tanner, R.	<b>WP0001</b>
Terpstra, W.W.	<b>TC0301</b> , TC0304, FP0022, FP0024, FPI03
Thieme, M.	WP0004, WPI01, FP0017
Tillu, A.R.	WP0015
Tiwari, R.	WP0015
Turner, D.L.	FC0106

— V —

Vestergard, H.	WP0030
Viguier, G.	FC0204
Vincelli, R.	WP0004, WPI01
Vogelgesang, M.	WC0201, FP0001, FP0002, FPI01, FPI02
Vranković, V.	WP0032

— W —

Wang, C.-J.	WP0033
Wang, J.G.	FP0008, <b>FP0009</b>
Wang, M.	<b>WP0026</b>
Wang, X.F.	WP0025
Weber, M.	FP0002, FPI02
Wiebel, M.	<b>WP0008</b>
Wilgen, J.	<b>WP0010</b>
Wilson, J.T.G.	<b>FP0012</b>
Wright, G.	WP0001
Wu, C.Y.	WP0033, FP0030, FP0032, FPI05
Wu, H.	TC0207
Wuensch, S.	FP0002, FPI02

— X —

Xuan, K.	FP0008, FP0009
----------	----------------

— Y —

Yabashi, M.	WC0205
Yadav, R.	TC0202
Yadav, V.	WP0015
Yamada, S.	<b>WP0021</b>
Yamaga, M.	WC0205
Yamamoto, N.	FP0006
Yan, Y.B.	<b>FP0013</b>
Yang, T.	WP0025
Yin, C.X.	FP0033
Yoshida, S.Y.	FP0006
Yoshii, A.	FP0016
Yoshioka, M.	WC0204
You, Q.B.	WP0025
Yu, Y.S.	WP0025

— Z —

Zaera-Sanz, M.	WP0007
Žagar, K.	TC0303, FP0015
Zhao, L.Y.	FP0033
Zweig, M.	TC0304, FP0024

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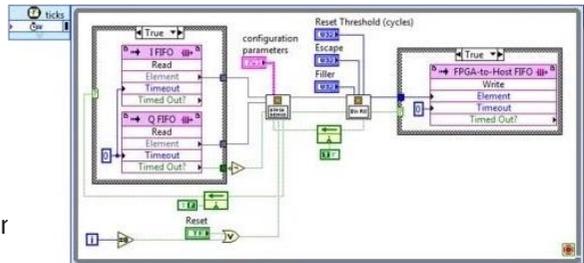
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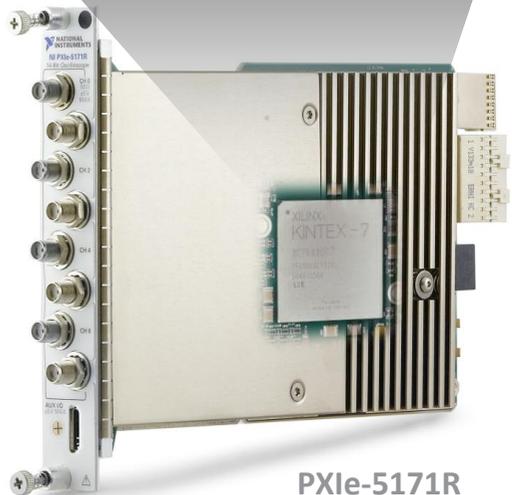
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