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MOCRAF 2015

Australian Synchrotron
Melbourne

P. Valitutti

Facilities

- Imaging and medical beamline
- Infrared
- Crystallography
- Powder Diffraction
- Short/Wide angle X-ray scattering
- Soft x-ray spectroscopy
- X-ray absorption spectroscopy
- X-ray fluorescence microscopy

Organisation

- Admin – Communication – Services
- Accelerator
- Science - 8 Beamlines
- Engineering (43 p)
  - Mechanical (13 p)
  - Electronics, Instrumentation & Electrical (9 p)
  - Controls (19 p)
    - Hardware team (5 p)
      - **Motion control** (2 p)

Technologies

- Galil DMC-2000/4000 - M. Clift
- DeltaTau Turbo-PMAC - N. Afshar

Challenges

- Standard hardware solutions => better …
- Plug-and-play for simple requests
- Unified cabling and GUIs

Mocraf 2015

- Simple “point to point” vs “complex” motion
- Obsolete hardware (MaxV…)
- “Challengers” (PowerPMAC…)
- Enhanced EPICS motor support
- Robots (Epson, Kuka) vs EPICS supported (PMAC/Galil/…)
- Absolute vs Incremental enc… breaking news ?
- Stepper 2 phase = the absolute solution ?
- Bus controlled … newcomer? (Ethercat, Wago…)
- Fast scanning – PVT – Low speed control

Thank you to all contributors

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Dmitry Bolkhovityanov,
Pavel Cheblakov

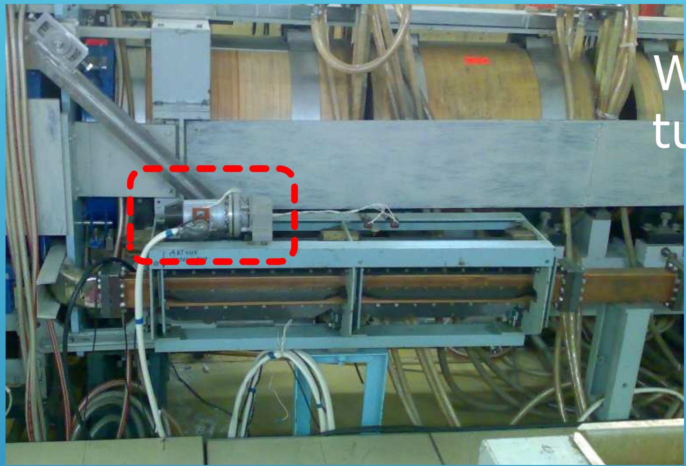
Budker Institute of Nuclear Physics

Novosibirsk, Russia

- About 3000 people
- including a dedicated electronics department of about 50
- …plus electronics groups in several labs

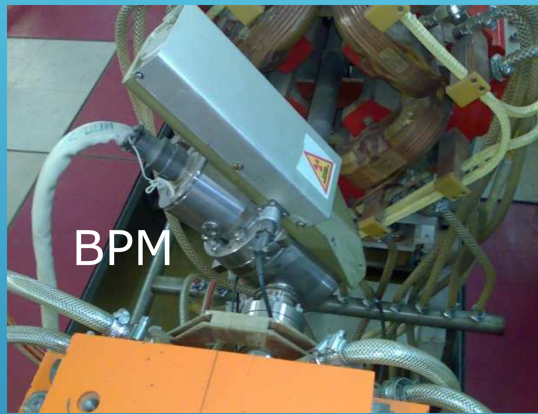
- Several large facilities: VEPP-2000, VEPP-4, VEPP-5 Injection Complex
- plus a number of smaller projects (LIA-2, electron beam welding, …)

Some of motion control applications at BINP



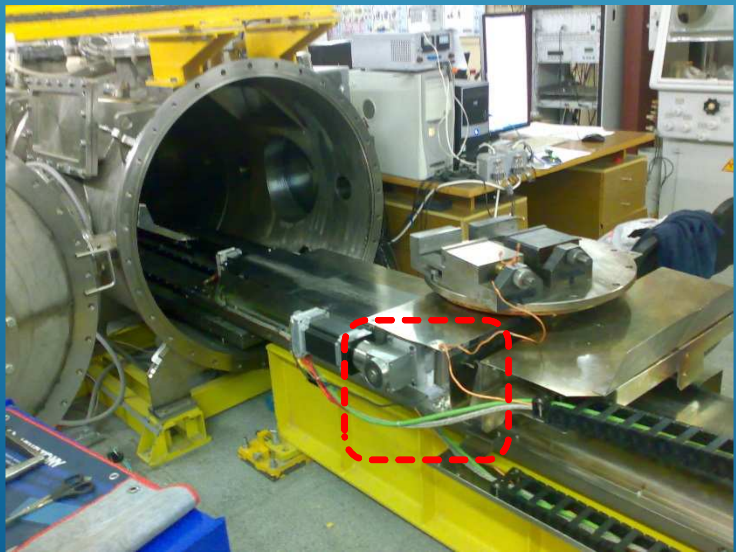
Waveguide tuning

CCD camera and BPMs control



BPM

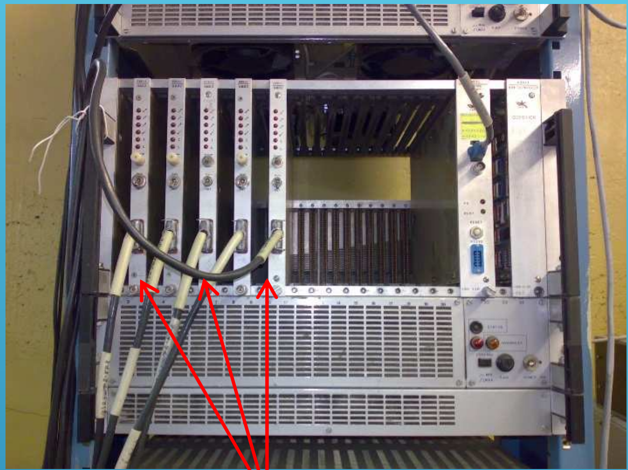
CCD



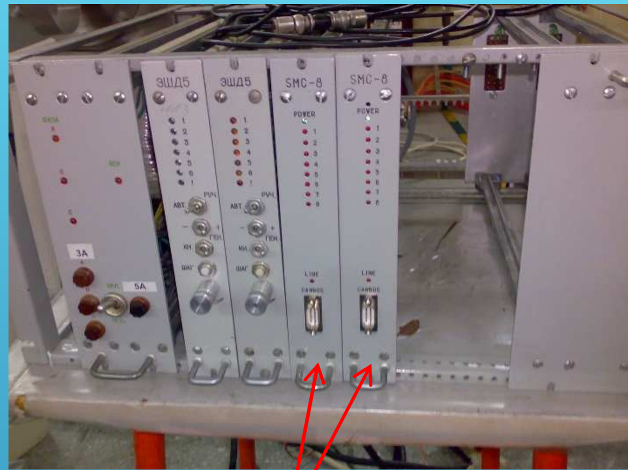
Electron beam welding facility: target movement/rotation servos

In most cases motion control is completely integrated with facilities' control system

Motion control hardware



CAMAC



CANbus

RS485

CANbus + USB

Problems and challenges

- Electronics DO suffer from radiation damage (except oldest CAMAC hardware from 1980s)

- The most challenging is electron beam welding. Movement must be precise and tightly coordinated between several servos and with beam control. Thus, we are looking into hard-realtime solutions:

  a. Arduino  -- usable but limited
  b. Realtime Linux:
     Xenomai – can it be used
     for direct control of all devices?

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NSLS-II Short Presentation

BROOKHAVEN NATIONAL LABORATORY

a passion for discovery

U.S. DEPARTMENT OF ENERGY | Office of Science

NSLS-II facility description

- New synchrotron at Brookhaven National Laboratory, replacing NSLS
- Started experimental user operations in 2015, first beamline light in 2014
- Seven operational beamlines, fifteen under development and construction, capacity for sixty
- Typical synchrotron, with broad range of x-ray scientific techniques

NSLS-II motion control

- Standardised on Delta Tau GeoBrick LV
- 2 phase steppers, incremental encoders are standard
- EPICS as basic user interface
- Using GMCA/Diamond-developed EPICS driver
- Attempting to minimise other controllers
- Small motion group in central controls group
- ~1000 motion axes installed now

Challenges and concerns

- Resourcing of controls activities
- Maintaining standardisation
- Encroachment of other controller types
- High-speed data collection (fly-scanning)
- Peer-to-peer communication between controllers for scanning diverse components
- Quality issues with vendor supplied solutions

Objectives for workshop

- Experience with Delta Tau PowerPMAC under EPICS
- Methods for synchronising between separate controllers
- Experiences (good/bad) with absolute encoders

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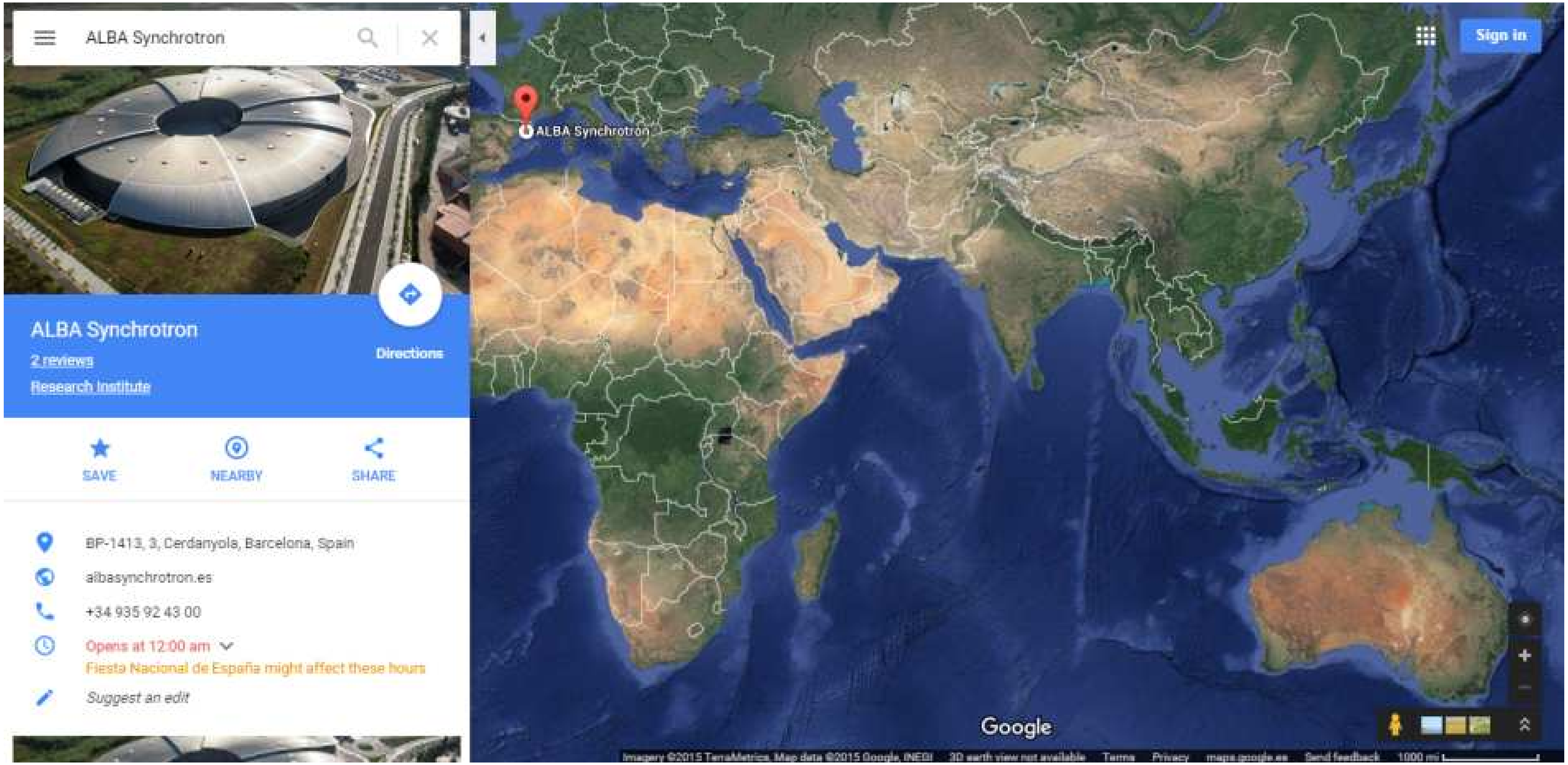
Motion at ALBA

Guifré Cuní - on behalf of the ALBA's Controls Group

October 2015

Synchrotron Light Source Located in Spain



Main Activities

Vision: To become a **center of excellence** for synchrotron light based **scientific and industrial applications** at a European level and to achieve the status of a recognized world-class facility.

Mission: To research, deliver and maintain methods and techniques with which to conduct **cutting edge synchrotron light based research and development**, in such a way that knowledge and added value data are pumped into the scientific and industrial communities, particularly those in Spain, with the ultimate goal of contributing to the improvement in the **well-being and progress of society** as a whole.

Beamlines: 7 operational beamlines, 2 under construction/design, Phase-III funding being secured

Motion Control (positioning)

Main motion actuator at Alba: 2-phase hybrid stepper

- ~500 axis distributed in 7 beamlines
- ~100 axis in the accelerators (~50 FE, ~50 in RF, DI, and ID)

Around 50% have an associated encoder (incremental, SSI, or analog)

99% driven by the **IcePAP controller**:

- Simple hardware maintenance, spare control and cabling
- Same axis configuration, test and operation
- Same software interface

Apart from steppers, a handful of brushless DC motors driven with **PMAC** or **ETEL** controllers for **specific equipments**.

Few **piezo** actuators with Jena and PI controllers

Few **Smaract** positioners

Motion Challenges/Concerns

- Integration of positioning information by means of encoder-like signals to counter cards
- Generate triggers by position (generic)
- Trajectory management
- Latch axis position in internal buffers
- Other motor types (DC, piezo)
- Analog absolute encoders

- Contributed Oral:

  TUB3O02

  Iterative development of the generic continuous scans in Sardana

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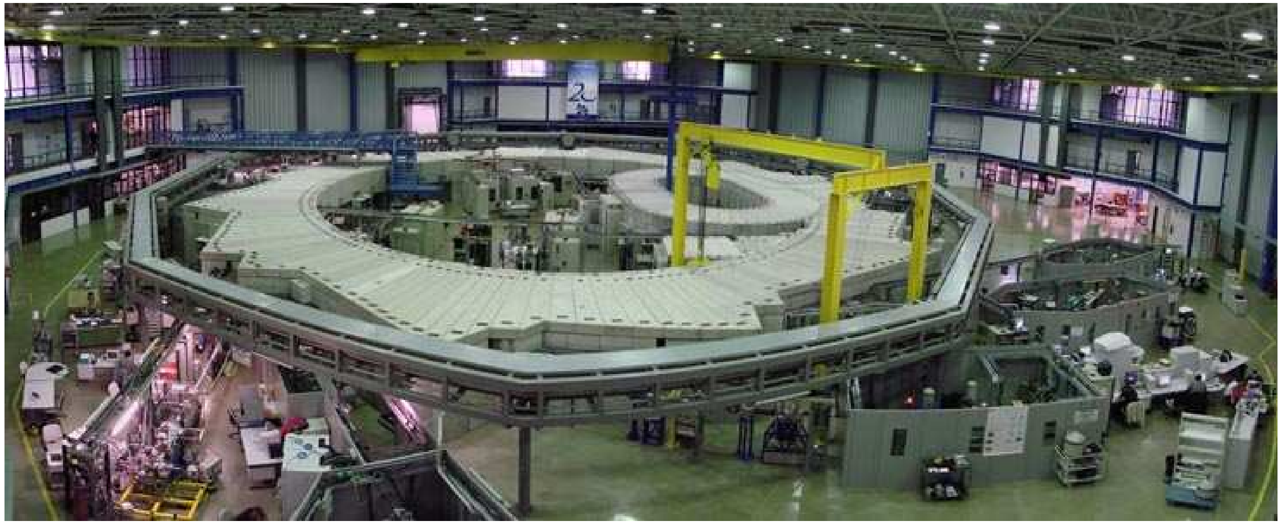
LNLS

Brazilian Synchrotron Light Source

- Light source for the scientific and business community
- 15 beam lines (few eV to 10s of KeV)
- Part of CNPEM – Brazilian Center of Research in Energy and Materials

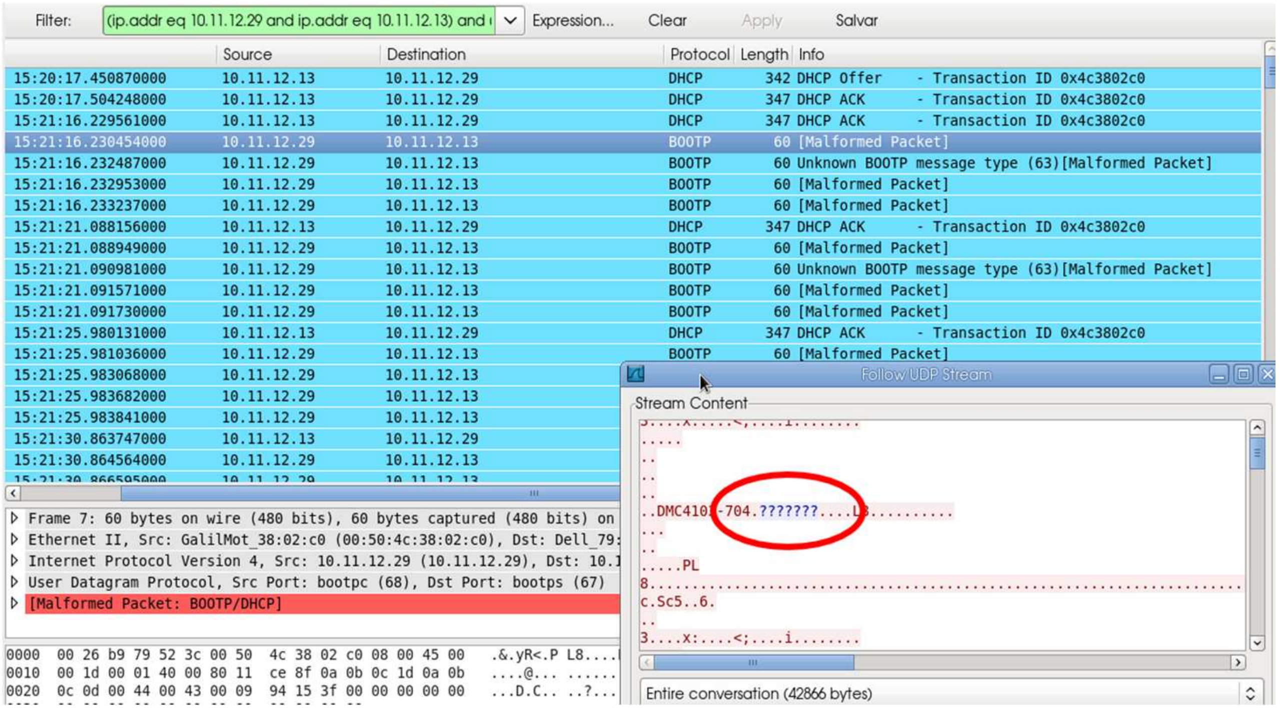


Motion Control

- SOL Group (software)
- GAE Group (hardware)
- both to set up the beam line and to control the
- Most used controllers: Galil DMC-4183 and Pa
- Others: Newport, IMS

Challenges

- Basic software concerns: software is still too simple, buggy or not robust firmware
- Basic hardware concerns: buggy or not robust hardware, motors move too much whe
- Advanced software concerns: missing complex coordinated movement



Workshop

Complex coordinated motion with EPICS

- Simultaneous motion
- Non-linear motion
- EPICS support

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$ caput RunComplexMotorProgram 1
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Diamond Light Source

- Diamond Light Source is the UK's national synchrotron facility, located at the Harwell Science and Innovation Campus in Oxfordshire. By accelerating electrons to near light-speed, Diamond generates brilliant beams of light from infra-red to X-rays which are used for academic and industry research
- Opened in 2007, Diamond is being developed in three phases. Phase I investment of £263 million included Diamond's buildings and the first seven photon 'beamlines'. Phase II funding of £120 million enabled the construction of 15 more beamlines between 2007 and 2012. In October 2010, the government confirmed further funding for Phase III expansion, for an additional 10 advanced beamlines between 2011 and 2017, which will bring the total to 32
- A total of 24 beamlines are now operational, with three more in commissioning phases.

Motion Control at Diamond Light Source

- There are currently over 2000 operational motorised axes in use at Diamond with more being added every day.
- Over 90% are DC stepper motors. Other motors include DC servo, Brushless servo, Pico motor, Nano motor, Piezo legs and Smaract.
- Feedback devices include incremental encoders, both digital and analogue, resolvers and absolute encoders using SSI, EnDat and BissC protocols. The latest device uses a 40 bit parallel output.
- Motors are commissioned using Vendors interfaces. The engineering interface is via EPICS. The experimental interface is via openGDA. Occasionally added functionality is embedded into the controller to increase productivity

Motion Challenges at Diamond Light Source

- Monochromators; Increase resolution and stability. Currently we operate at between 50-200nR rms. Aim to reduce further towards 5-10nR.
- Beam Conditioning; Increase resolution and stability to better than 10% beam size. With reducing beam size encoder feedback resolution has gone from1u to 20 nm.
- High Throughput; Implementing complex scanning trajectories on the motion controller with support at all levels – DIAMOND MAPPING PROJECT.
- Commonality; Increasingly vendors are offering higher precision devices , but at the same time reducing the availability of common control inputs. Particularly true of ceramic motor vendors. This increases the difficulty of incorporation into the overall control system and providing detector trigger signals for fly scanning.

High Throughput sample station – performance summary

Maximum sample delivery rates for the system described versus the pitch of the grid used.
The maximum delivery rate assumes continuous motion of the stages between equally spaced features with no pause at sample positions.
The measured delivery rate includes a 1 ms wait at the sample position after the encoder reports the stage to have reached the requested position.

Pitch of grid / separation of samples (microns)	Time to move between adjacent samples (ms)	Maximum delivery rate (Hz)	Measured delivery rate with 1ms dwell at sample location (Hz)
10	0.5	2,000	257
20	1	1,000	255
25	1.25	800	222
50	2.5	400	175
75	3.75	267	144
100	5	200	123
125	6.25	160	107
150	7.5	133	95

MOCRAF Workshop 2015

- Validate what we are doing is sensible
- Hear what other Facilities are attempting
- Create a mailing list for year round interaction rather than just at these workshops.
- Help others with our learning where we can.

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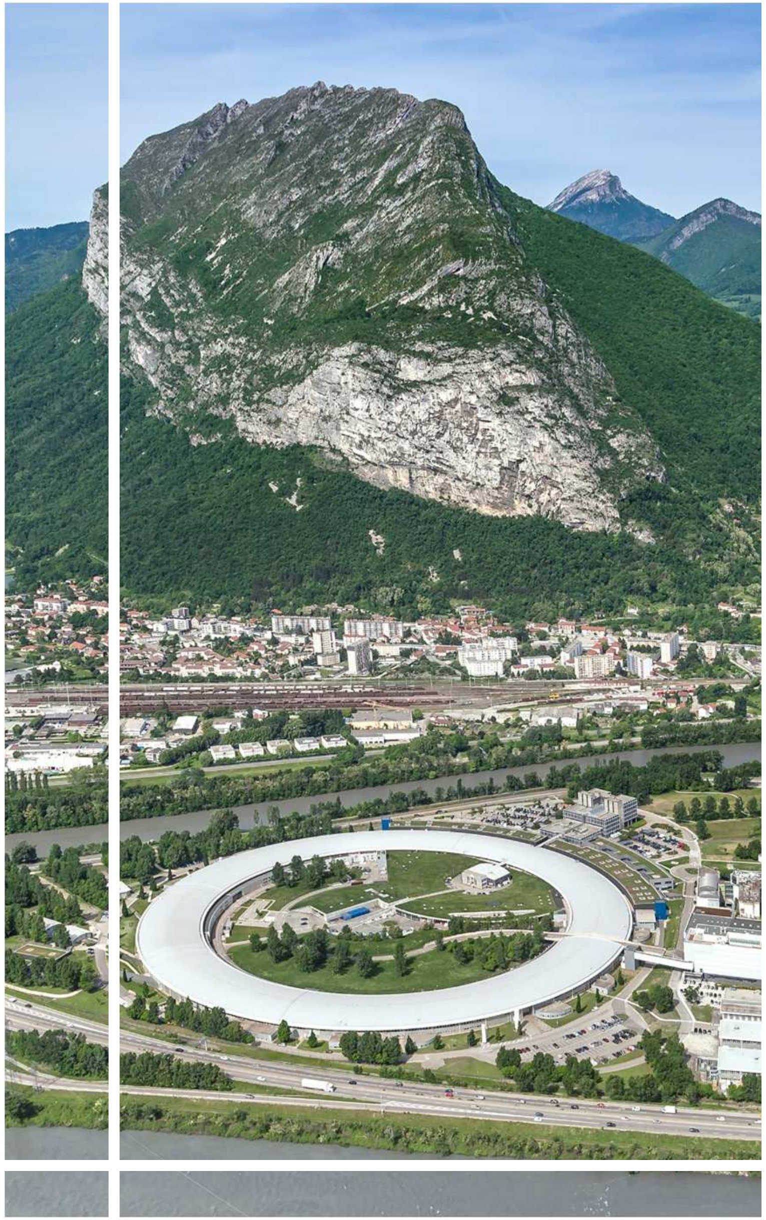


ESRF
The European Synchrotron

MOCRAF October 2015
Round Table Session

ESRF, France

- **21 partner nations – 13 member states**
- **100 M€ yearly Budget**
- **4000 users / year**
- **2,000 proposals** per year: **900 accepted,** 1,550 experimental sessions
- **30%** of the research involves **industrial developments**
- **~ 630 people** [scientists, technical staff, administrative staff, PhD students] – **40 nationalities**

The upgrade programme

2009 2015 Upgrade PHASE I – 180 M€

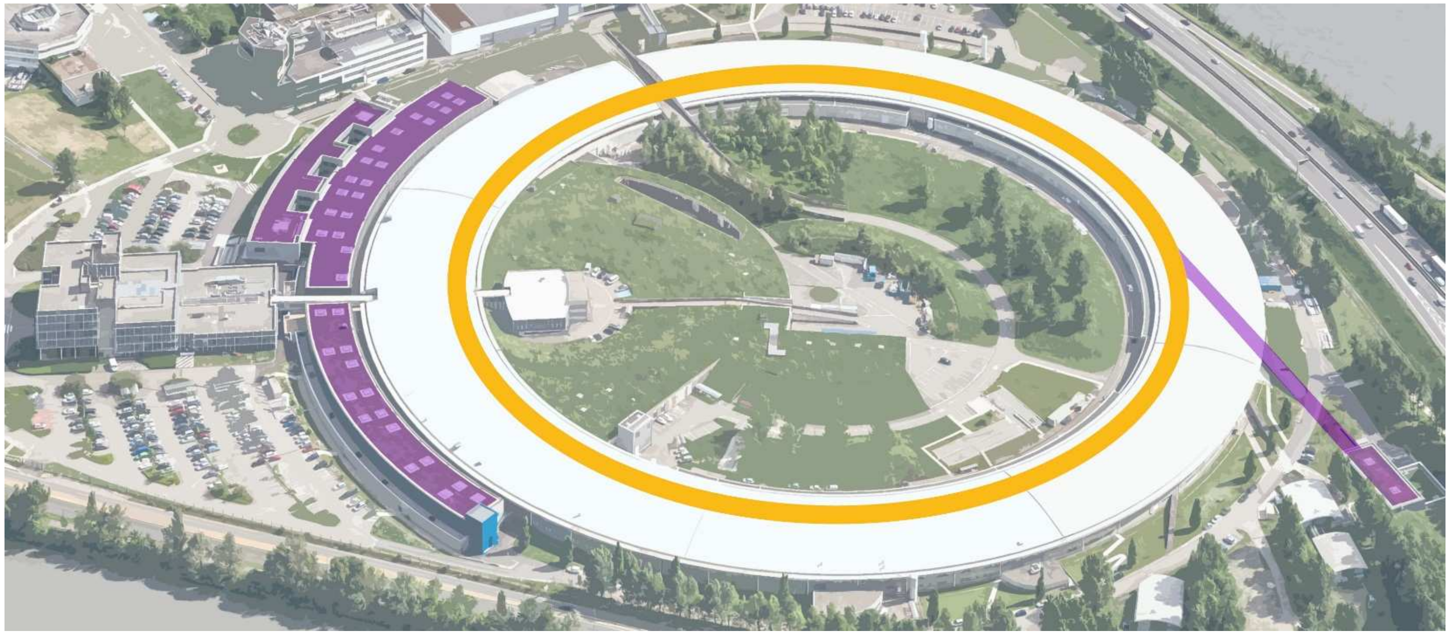
In time and within budget

- Construction of 19 new-generation experimental stations to explore the nanoworld
- Creation of a new ultra-stable experimental hall
- **Improvement and refurbishment of most of the scientific equipment**

2015 2022 EBS project – 150 M€

Launched in June 2015

- Construction of a new storage ring, inside the existing structure, with performance increased by a factor of 100
- Construction of new state-of-the-art beamlines
- Ambitious instrumentation programme (optics, high-performance detectors)
- Intensified big data strategy



MOTION CONTROL at esrf

- A dedicated organization for Instrumentation : ISDD (> 100 p)
- Motion Control:
  SOFT: Beam Line Control Unit / Accelerator Control Unit
  HARD: Electronics Unit

  - High performance solutions – while optimizing the cost and the support effort

- A Motion Controller developed in-house:
  - *High performances,*
  - *Optimization of cost & support effort*
  - *ESRF Standard Solution, interfaced with the control system*

Icepap

- More than 5000 axes [stepper] controlled with IcePAP at the ESRF
  - *Refurbishment AND new Installations*

- A collaboration with other institutes (ALBA, MAX IV)

WORK-SHOP EXPECTATIONS

- Hear about solutions and progress at facilities & vendors

- Present, discuss and compare answers to the (common) challenges

- Discuss the “Best Practices”

• Thank You for your attention !

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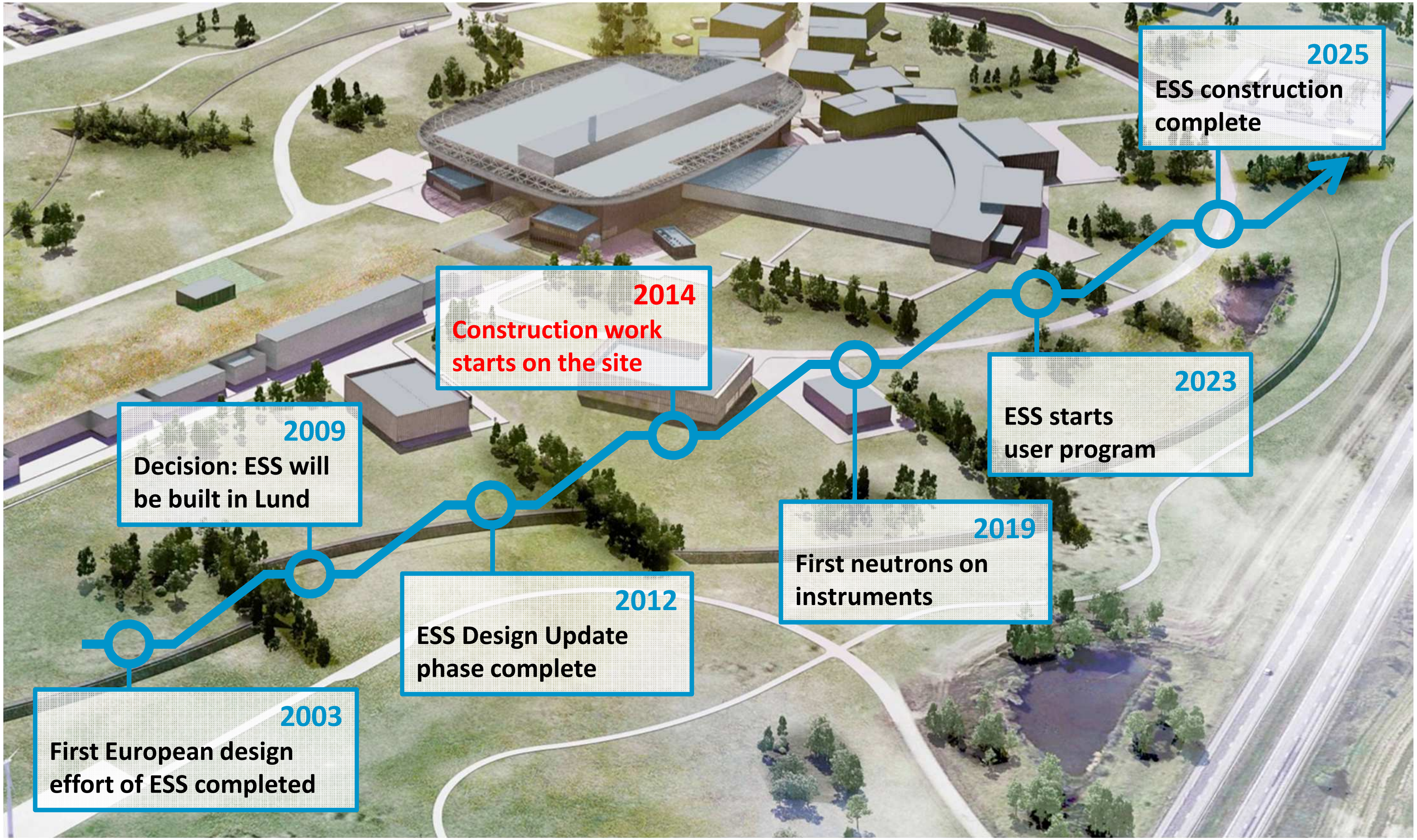
Motion Control
at the European Spallation Source (ESS)

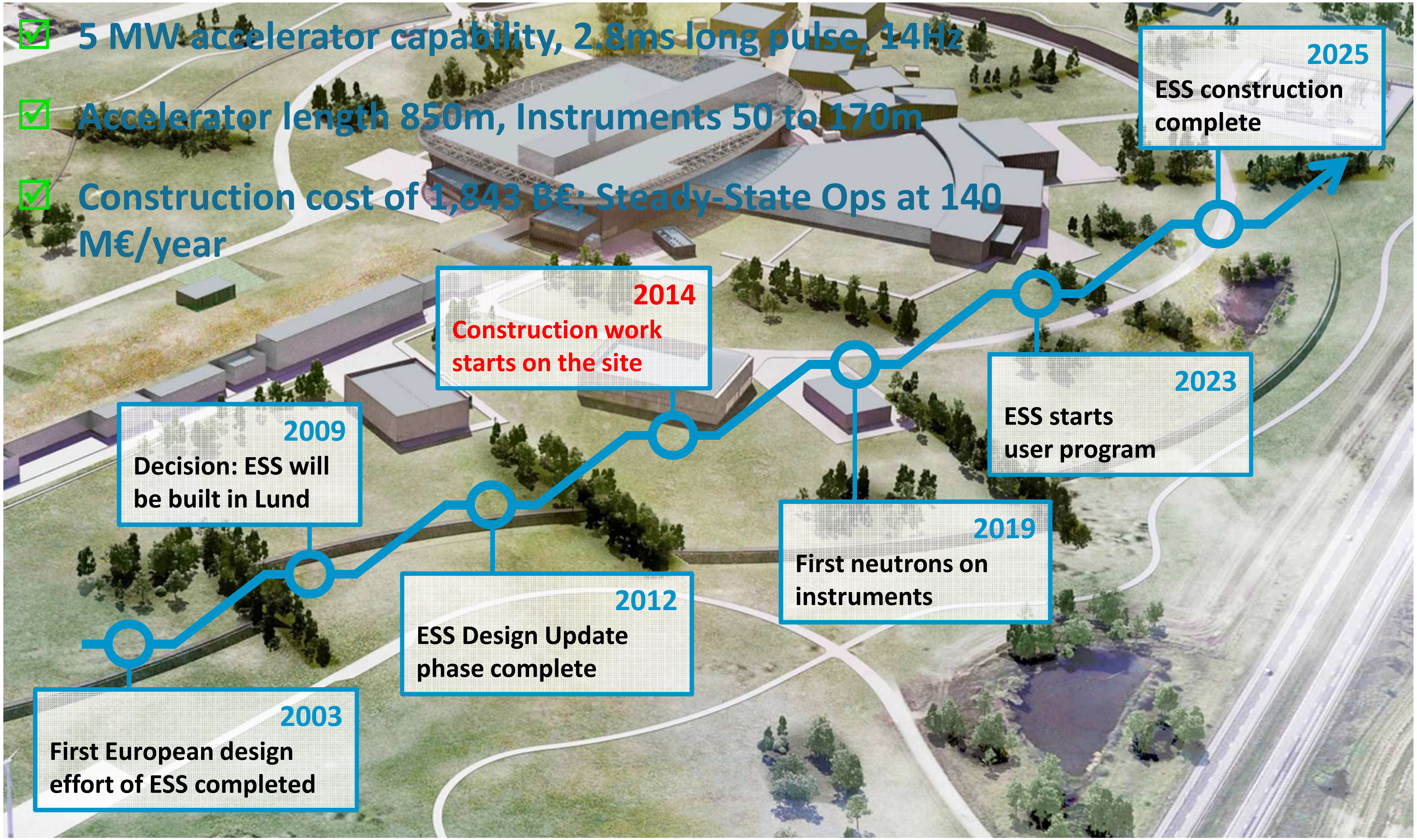
www.europeanspallationsource.se

European Spallation Source (ESS), Lund, Sweden

European Spallation Source (ESS), Lund, Sweden



European Spallation Source (ESS), Lund, Sweden



Motion Control & Automation Group (MCAG)

ESS Construction Phase

(2014 to 2025, 10 - 15 people)

- Develop / provide standardised technologies for all parts of ESS
- Support design and drawing of Neutron Instruments
- Supervise installation and cabling
- Commissioning
- Set up appropriated labs and workshops for R&D and service

ESS Operations Phase

(2019 to 2065, 8 people)

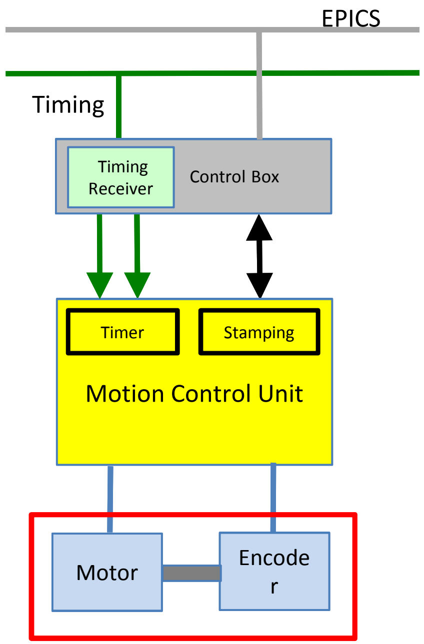
- Service / Maintenance
- Active obsolescence management
- Further develop technologies
- Support upgrades of instruments suite

Collaboration

- MCAG is part of Science Directorate
- Controls Group is part of Machine Directorate

MCA Standard: Motion Control Components I (Motor, Encoder, End Switches as Standard for In-kind Partners)

- Preliminary standard approved by ESS Harmonisation Committee
- Issued with CHESS-Nr. 37290
- Actual Range
  - 2Ph. Hybrid Stepper Motors, 24/48V, max. 3,5A_{rms} (5A_{pk}), 1/64 Micro stepping
  - DC brushless, piezo (not yet specified)
  - Incremental Encoders, digital quadrature (A,B + R), RS-422 output
  - SSI absolute Encoder, max 32 Bit, 1 Mhz clock
  - BissC, Resolver, LVDT (not yet specified)
- Will be extended after final decision on Motion Control Unit
- Will be issued end 2015



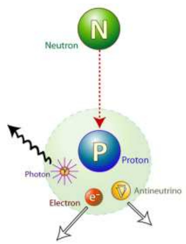
Responsibilities

Technology: MCA

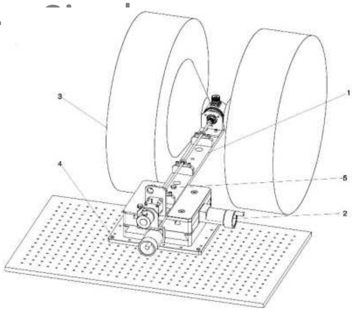
Integration: MCA

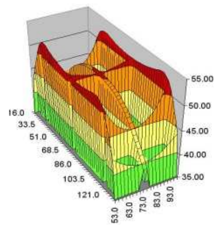
MCA Standard: Motion Control Components II
(Harsh Environment)

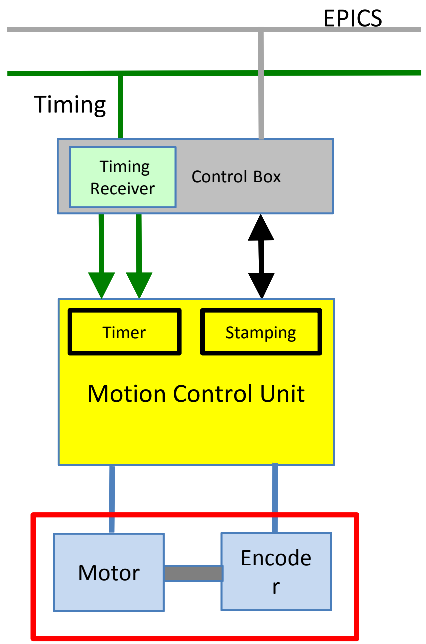
- Radiation Environment (Gamma, Neutrons)
  - Identify and evaluate motors and encoders
  - Integrate components into motion control unit
  - Test in radiation environment if necessary



- High Magnetic Field (DC)
  - Identify and evaluate motors and encoders
  - Integrate components into motion control unit
  - nts







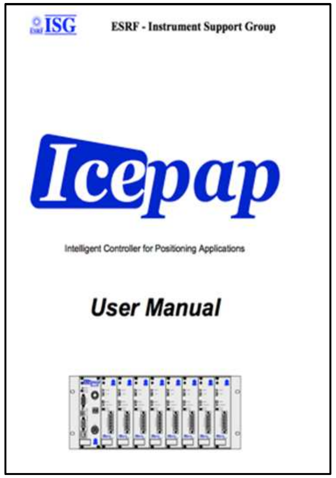
<u>Responsibilities</u>

Technology: MCA

Integration: MCA

MCA Standard: Generic Motion Control Unit

DELTA TAU
EUROPA UK

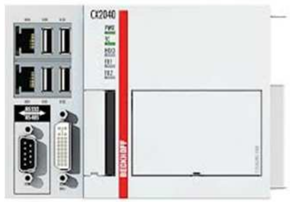

ISG ESRF - Instrument Support Group

Icepap

Intelligent Controller for Positioning Applications

User Manual

BECKHOFF



SIEMENS

1STEP

1STEP-Drive
- Phytron

FM357
-4 axes controller

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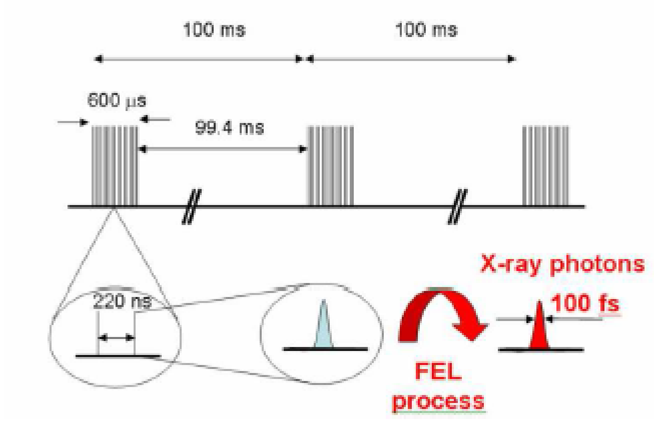
Motion Control at European XFEL

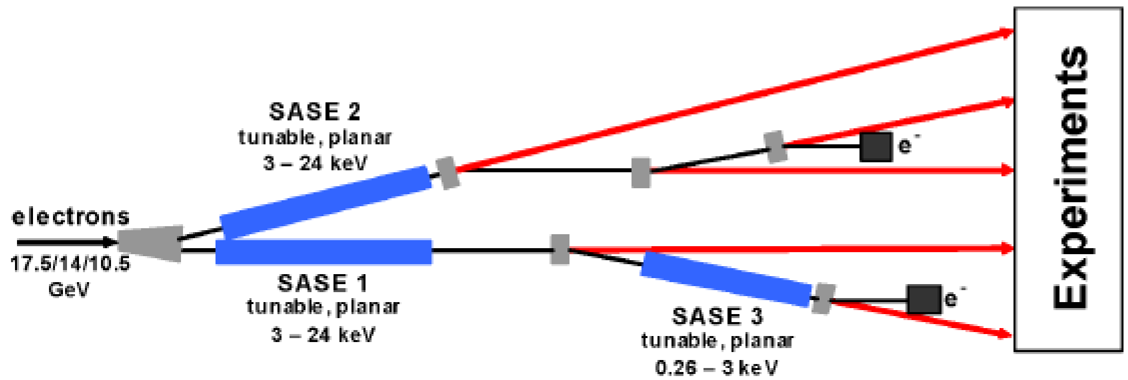
Nicola Coppola, Suren Karabekyan
European XFEL

European XFEL

The aim of the European XFEL

- The European XFEL project is a 4th generation light source.
- The first beam will be delivered at the end of 2016
- Spatially coherent <100fs short photon pulses
- Peak brilliance of 10^{32}-10^{34} photons/s/mm^2/mrad^2/0.1% BW
- Energy range from 0.26 to 29.2 keV at electron beam energies of 10.5 GeV, 14 GeV, or 17.5 GeV
- Electron bunch time pattern with 10 Hz repetition rate and up to 2700 bunches in a 0.6 ms bunch train





- 5 photons beams produced by means of undulator systems
- Photon beam transport and diagnostics
- 7 broad scientific experiments and R&D on X-ray instrumentation
- 4 specific XFEL experiments instrumentation

HELMHOLTZ
| ASSOCIATION

Motion control at European XFEL

- **The motion control system at European XFEL is based on industrial components produced by Beckhoff Automation GmbH and a PLC implemented in the TwinCAT system.**
  - State of the art motion control
  - Widely used in Automation Industry
  - EtherCAT Fieldbus - fast and truly open communication standard with runtime self-diagnostic capabilities (fully exploited)
  - TwinCAT based software with mighty diagnostic tools (moved to TC3.1 since 2015 Q2, except for undulator systems still TC2.11)
  - Wide variety of control terminals and motors available off the shelf: servos, steppers, ADCs (up to 24 bit), DACs (up to 16 bits), encoders, I/O…..
  - Simple integration of products of other vendors (Elmo MC, Technosoft motion, PI already tested)
  - Growing scientific use: FLASH, PETRA III, EMBL, ELBE, LCLS II (the last not for MoCo)…
  - Provides a possibility for cost effective solutions

European XFEL

Technical challenges and concerns

- Historically many commercial implementations exist:
  - PI, piMicos, Galil, Phytron, Newport, attocube, DeltaTau, etc
- By using a single standard XFEL 's implementation is simplified (man power, scalability, interchangeability)
- Many commercial solutions are
  - vendor centric, they want to sell a full solution,
  - Controller just sitting on switched network (no ACL, or access policy implemented)
  - since a long time no longer state-of-the-art.
- Friendly vendors accept selling motors and controllers separately (also giving possibility to exchange encoder and driver types separately).
- XFEL is not alone requiring solutions of this type.
- Vendor entrapment problem exists for sub-micron to nanometer precision stages (in-house solution circumvention are possible)
- A common vendor problem is the I/O interface to the control system:
  - serial interface (rs232) i.e. slow, limited cable length
  - USB interface: limited geographical range, non identificability of port
  - non scalability both at H/W and S/W (library: for specific Operating systems, not thread safe) levels
  - vendor specific protocols (if they are open at all)
- To counteract these problems, solution:
  - in-house control loop implementation using low level signals interfaced to Beckhoff NC/MC libraries (already there for nanoMotion, piezo Uppsala/Nanos, piezo stretcher, piezoMike/picoMotor, investigating possibility with SMARACT).
  - This frees us from possible protocol changes on vendor's side, improve our knowledge

European XFEL

Technical challenges and concerns

- Most commercial solutions are reasonable for:
  - table top applications,
  - slow or non-synchronized systems
  - large latency between move operations with very limited position monitoring
- but not :
  - for distributed system within a wide area (from 50 m to ~km distances),
  - middle to fast synchronization needs,
  - ~1 kHz position/velocity read out operations,
  - move and while moving “do something”
- Luckily something is changing in the field and some companies started selling EtherCAT slave controller:
  - PI hexapod tested, will be used (other controller, also for single axes, should come)
  - Newport, advertised new controller for Q1/2016
  - Attocube at least for new interferometer (promised also other controller)
- Small companies may have investment problem
- Large companies may not get interested if the numbers of sold equipment not large enough

the community should show more interest

Wish list and expectation from other institutions

- The community should push vendors:
  - to use modern interfaces in a modern fashion
  - to use common protocols
  - to use open-software solutions
  - to use modern standards (ie EtherCAT or similar) for controllers
  - allow for interchangeability of motors-stages, encoders and controllers

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PAUL SCHERRER INSTITUT

Wir schaffen Wissen – heute für morgen

Paul Scherrer Institute, Switzerland

Dragutin Maier-Manojlovic,

Embedded Software and Motion Control Systems

ICALEPCS 2015 - Melbourne, Australia

PSI Switzerland - Facilities

The **Paul Scherrer Institute** (PSI) is the largest research centre for natural and engineering science in Switzerland.

The PSI runs several large research and patient treatment facilities, such as:

- Swiss Light Source (SLS)
- High Intensity Proton Accelerator (HIPA)
- COMET Proton Cyclotron, used for cancer treatment irradiation facility (ProSCAN)
- Swiss Spallation Neutron Source (SINQ)
- Swiss Free Electron Laser (SwissFEL) – in progress

PSI – Motion Control Systems

PSI facilities a range of internally supported Motion Control Systems, with a few additional systems, either specialized and/or proprietary (motion systems for patient treatment facilities) or used by some external users (SLS Beamlines, etc).

The new large research facility at PSI (being built right now), SwissFEL, will mostly use customized version of DeltaTau PowerBrick motion controller (PowerPMAC), with a variety of supported motors and encoders, plus a few Beckhoff-based systems.

Motion Control Systems hardware:

- DeltaTau PowerPMAC controller (tables, apertures, grating and optical units, benders, gun laser and solenoid, X-Band cavities, UHV mirrors, ...)
- Beckhoff TwinCAT controller (undulator movers, phase shifter gap motors, ...)
- Various motors and encoders (some with built-in controllers and similar hardware): Phytron, Nanotec, OWIS, Parker, Schneider, Newport, Smaract, Baumer, Num.Jena, Renishaw, Marquardt, ...

PSI – Motion Control Systems

As with other equipment at PSI, Motion Control Systems are controlled using EPICS and software base developed in-house (drivers, applications, kinematic routines, etc).

EPICS allows us to rapidly deploy and control various controllers, motors and encoders, by reusing the already existing drivers and other software.

Challenges, current and future, and our interests:

- Streamlining of motion controller setup and integration
- Complex kinematics, synchronous and superimposed axis movement
- Support for industrial robots and robot controllers
- Redesign of the EPICS Motor Record support, in order to streamline and encapsulate support for various advanced controller features

PAUL SCHERRER INSTITUT

Paul Scherrer Institute (PSI), Switzerland

Dragutin Maier-Manojlovic, Embedded Software and Motion Control Systems, Large Research Facilities

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Motion Control Workshop

- SLAC Overview

Shawn Alverson 10/17/2015

U.S. DEPARTMENT OF ENERGY
Office of Science

SLAC NATIONAL ACCELERATOR LABORATORY

SLAC Site Overview

- The SLAC National Accelerator Laboratory was established in 1962 in Menlo Park, California. It is funded by the U.S. Department of Energy and managed by Stanford University.

- At 3 km (~2 miles), the main linac tunnel once housed the longest linear accelerator in world and was used for high energy particle physics. This original accelerator has now been divided into two separate accelerators (LCLS & FACET).

- These along with SPEAR and several smaller test accelerators require many motion control devices to perform the many high energy physics, XFEL, and synchrotron experiments conducted on site.

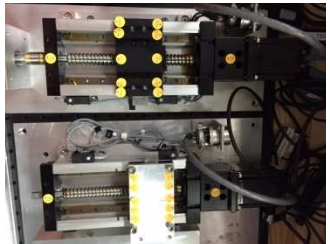
SLAC Site Overview

- **LCLS** – Free Electron Laser user facility
- **SPEAR** – Synchrotron user facility
- **FACET** – High energy accelerator test facility
- **NLCTA** – Accelerator R&D
- **XTA** – X-Band Photocathode research
- **ASTA** – Gun development and high energy gradient research

Motion Control at SLAC

- Motion Control is used heavily at SLAC for a variety of diagnostic devices:
- Laser steering mirrors and delay stages
  - Newport XPS-Q8 controller
  - Newfocus picomotors

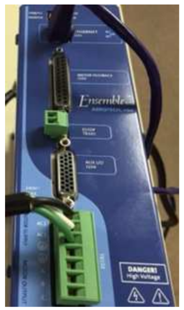
- Wire scanners
  - OMS MAXv
- Collimators/Slits
  - Hytec
- Undulators/Dechirper
  - Animatics



- Other (RF tuners, profile monitors, mirrors, insertion devices, etc.)

  - Schneider IMS
  - SmarAct
  - PI
  - Micronix

  - Attocube
  - Aerotech
  - Beckhoff



Motion Control at SLAC - Challenges

- Large variety of motion control currently used around site can be difficult to implement and maintain within a common controls architecture.

- A lot of older equipment used around site that needs to be integrated into newer control systems.

- Laser motion control typically uses small range of travel but requires high resolution and very good reproducibility due to sensitivity of cathode to laser shape and position.

- Motion of larger devices such as Undulators and Dechirper require some degree of coordinated motion to ensure they do not get bound up.

Workshop Goals

- Learn about more complicated coordinated motion schemes

- Motor calibration and backlash compensation

- Any experiences with optical steering feedbacks

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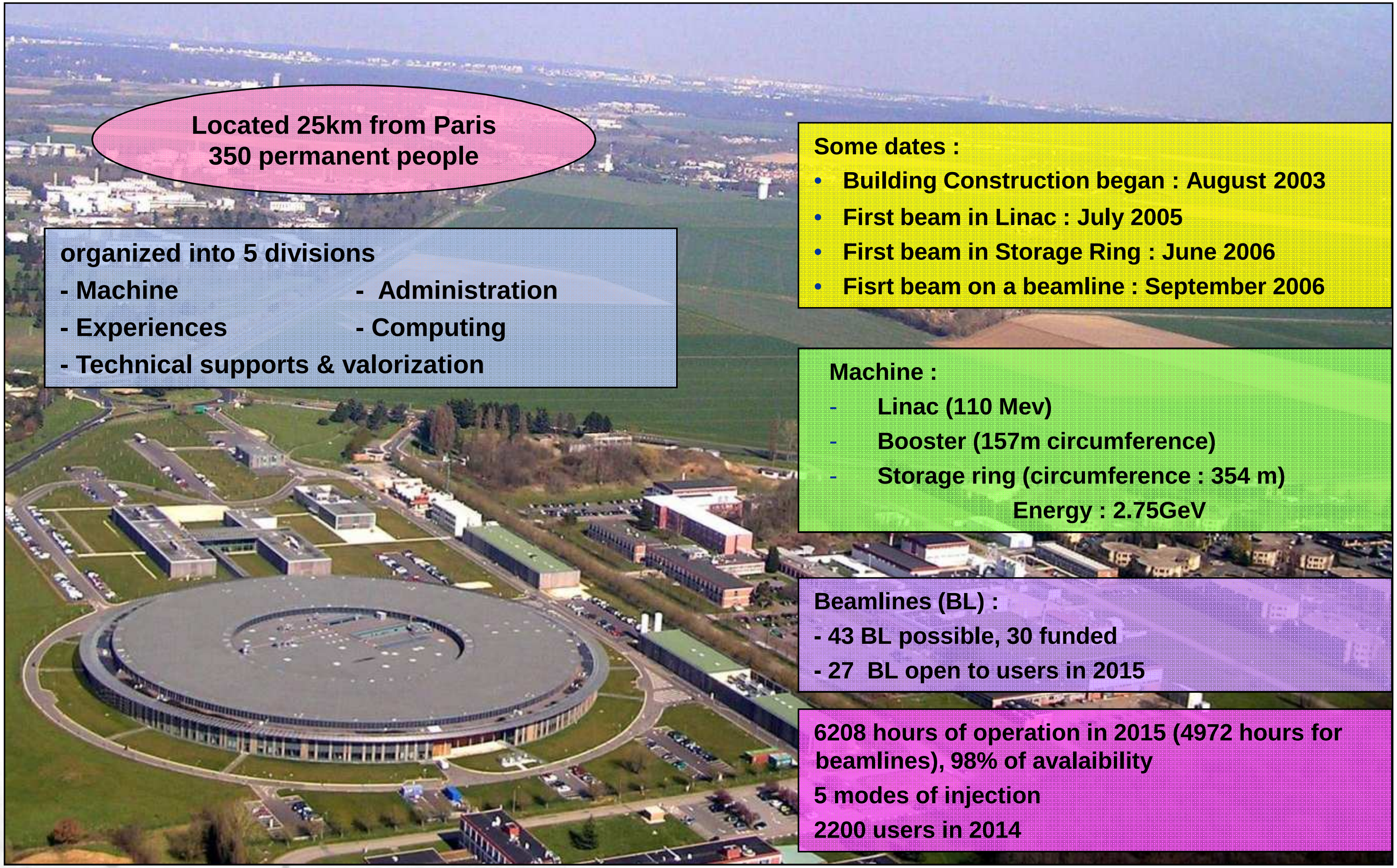
SOLEIL, Control and data Acquisition overview

Yves-Marie ABIVEN, on behalf of the SOLEIL Computing Division

SOLEIL in a few figures



Located 25km from Paris
350 permanent people

organized into 5 divisions
- Machine
- Administration
- Experiences
- Computing
- Technical supports & valorization

Some dates :
- Building Construction began : August 2003
- First beam in Linac : July 2005
- First beam in Storage Ring : June 2006
- Fisrt beam on a beamline : September 2006

Machine :
- Linac (110 Mev)
- Booster (157m circumference)
- Storage ring (circumference : 354 m)

Energy : 2.75GeV

Beamlines (BL) :
- 43 BL possible, 30 funded
- 27 BL open to users in 2015

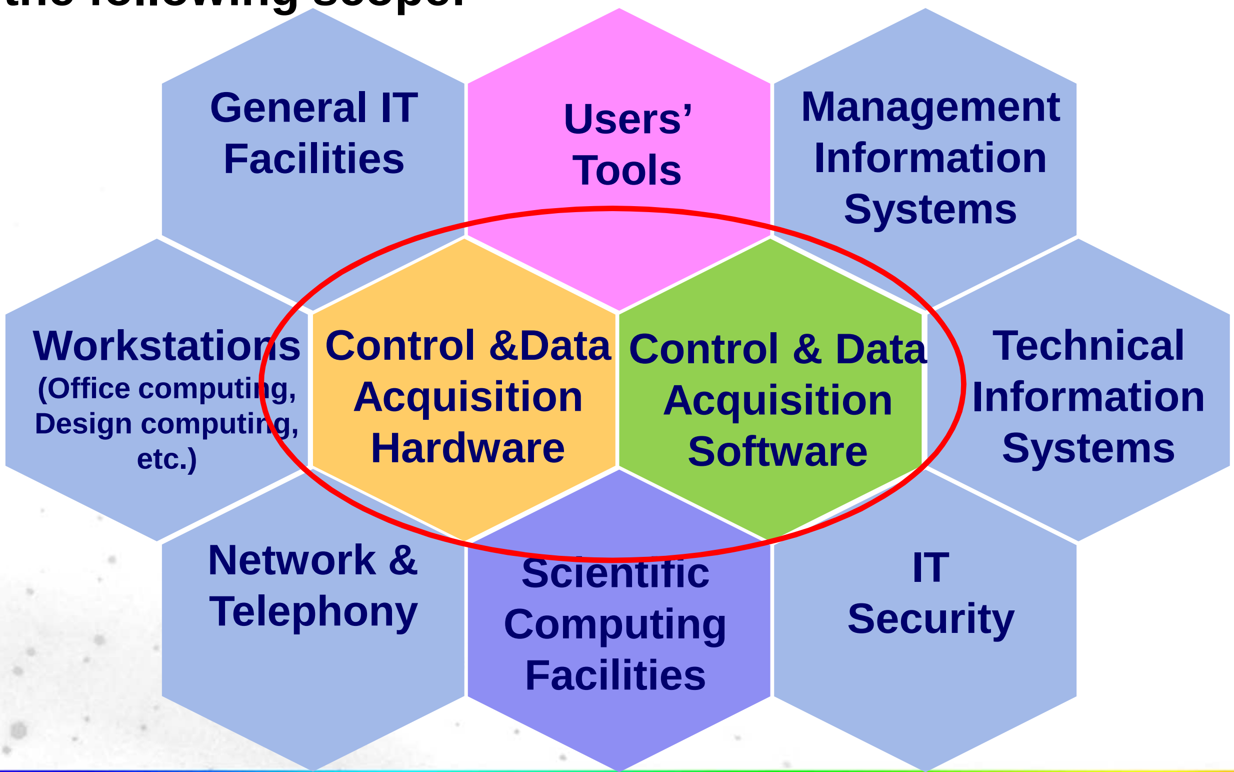
6208 hours of operation in 2015 (4972 hours for beamlines), 98% of avalaibility

5 modes of injection

2200 users in 2014

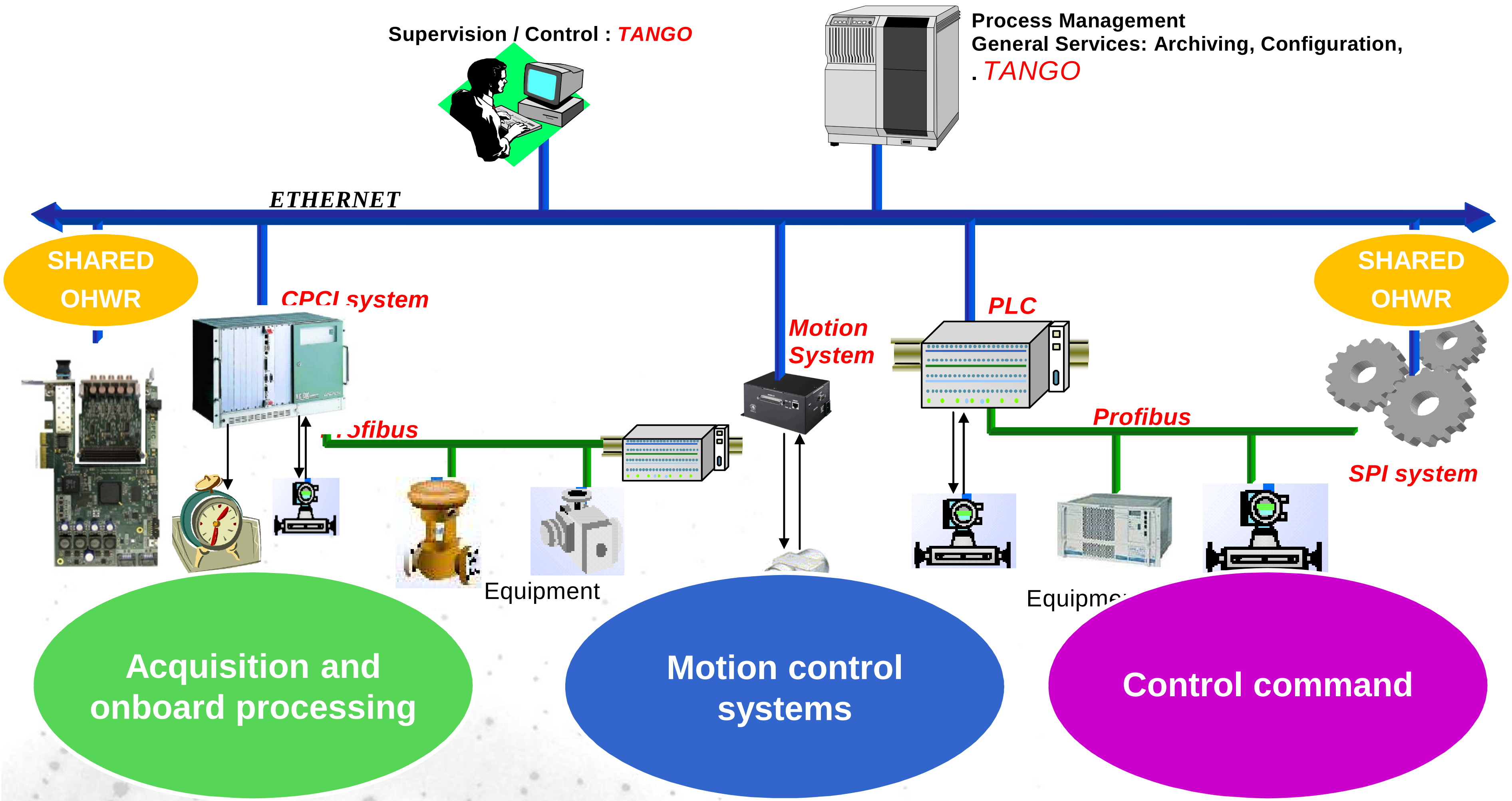
The SOLEIL Computing Division

- **5 groups (about 40 permanent people) :**
  - **IT Security and Methods (SIM)**
  - **IT Infrastructures (ISI)**
  - **Integration of Management Systems (ISG)**
  - **Control and Data Acquisition Software (ICA)**
  - **Control and Data Acquisition Hardware (ECA)**
- **in charge of the following scope:**



SOLEIL control/command architecture

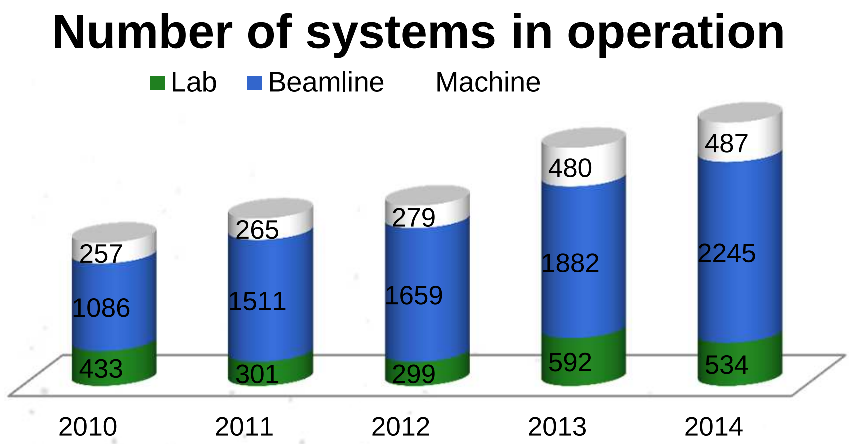
Based on the TANGO « Device-oriented » Philosophy



Control and acquisition: Overview

- Systems in operation

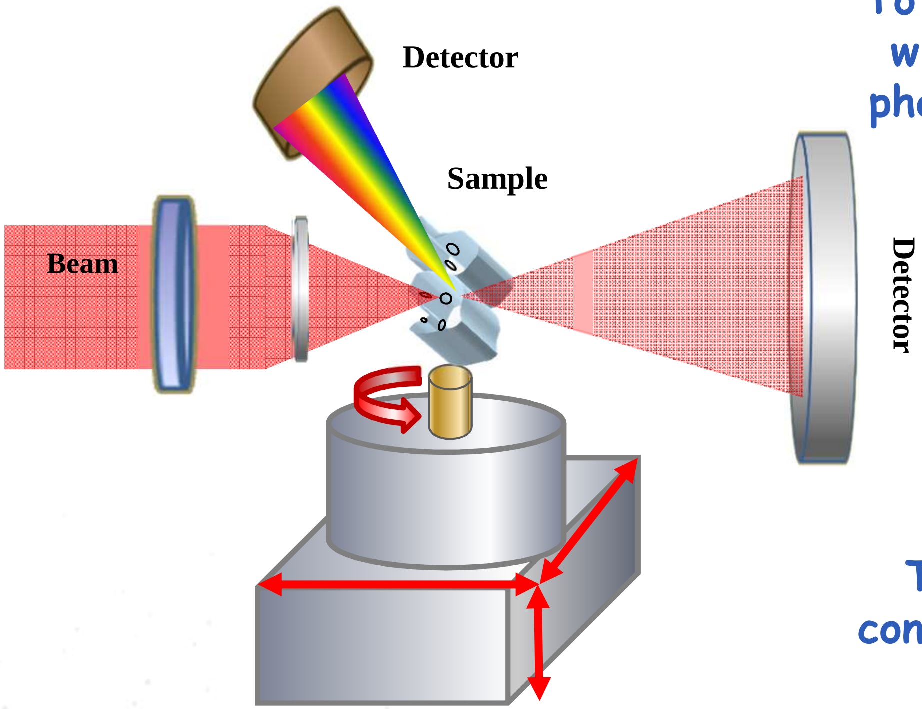
Familly	Type of equipment	Beamlines	Machine	Total
Motion	**basic motion controller**	**303**	**41**	**344**
Motion	**Standard axes**	**1829**	**169**	**1998**
Motion	**non standard**	**150**	**100**	**250**
CPCI system	CPCI CPU	**98**	**125**	**223**
CPCI system	CPCI Crate	**62**	**79**	**141**
CPCI system	CPCI IO Boards	**282**	**249**	**531**
PLC system	PLC	**46**	**189**	**235**
SPI systems	SPI boards	**44**	**19**	**63**



- More than **10300** references managed by electronics team.
- More than **30,000** TANGO devices

Control and Acqusition challenges

To increase electron beam stability and photon energy accuracy



To synchronize detectors with optics that select photon energy to acquire only useful data

To perform fastest continuous acquisition to save time

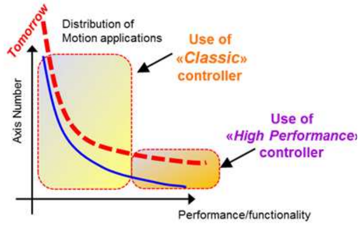
- ✓ ***More accurate***
  towards nanopositioning
- ✓ ***More stable***
  permanent static regulation in spite of disturbances
- ✓ ***Faster***
  Continuous movement for all trajectories
- ✓ ***Better synchronized***
  A shorter delay between several trajectories and data acquisition

Next series of challenges will be storage and processing of the large stream of data generated from new data acquisitions technique and new detectors !

Ongoing projects related to motion control

- Revolution Project:
  - Upgrade of our motion control Architecture
  - Changing from a single and universal motion controller for any applications to a two- controller setup depending on the applications performances required.

See MOPGF047

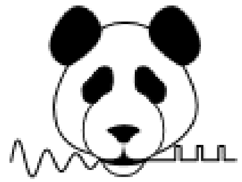


- Nanoprobe:
  - A joint project between Synchrotron SOLEIL in France and MAXIV in Sweden, currently developing a high precision, hard X-ray nanoprobe system.
  - The goal is to produce a fast scanning set-up capable of deca-nanometer spatial resolution in 2D as well as 3D measurements.

See MOPGF060

- PandA motion project:
  - Collaboration between SOLEIL and DIAMOND to upgrade the SPIETBOX and ZEBRA platform
  - PandA is an encoder processing, common synchronous triggering and data capture platform for simultaneous and multi-technique scanning applications.

See MOPGF098



- Flyscan:
  - A fast, simultaneous and multi-technique scanning platform aiming to reduce data acquisition time.
  - Based on the synchronization of multiple actuators and sensors which deliver their data in temporary files. This data is then merged into common file(s) in order to make the whole experiment data available for on-line processing and visualization

See WEPGF056

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Where is it?

Photo: SKA South Africa

Photos: SKA South Africa

Site Complex

Photo: SKA South Africa

Purpose

Origins

- Epoch of Reionization, first galaxies, active galactic nuclei (black holes)
- Galaxy Evolution, Cosmology, and Dark Energy
- Cradle of Life - Organic molecules, Search for Extraterrestrial Intelligence (SETI)

Fundamental Forces

- Pulsars, General Relativity and Gravitational Waves
- Cosmic Magnetism

Exploration of the Unknown

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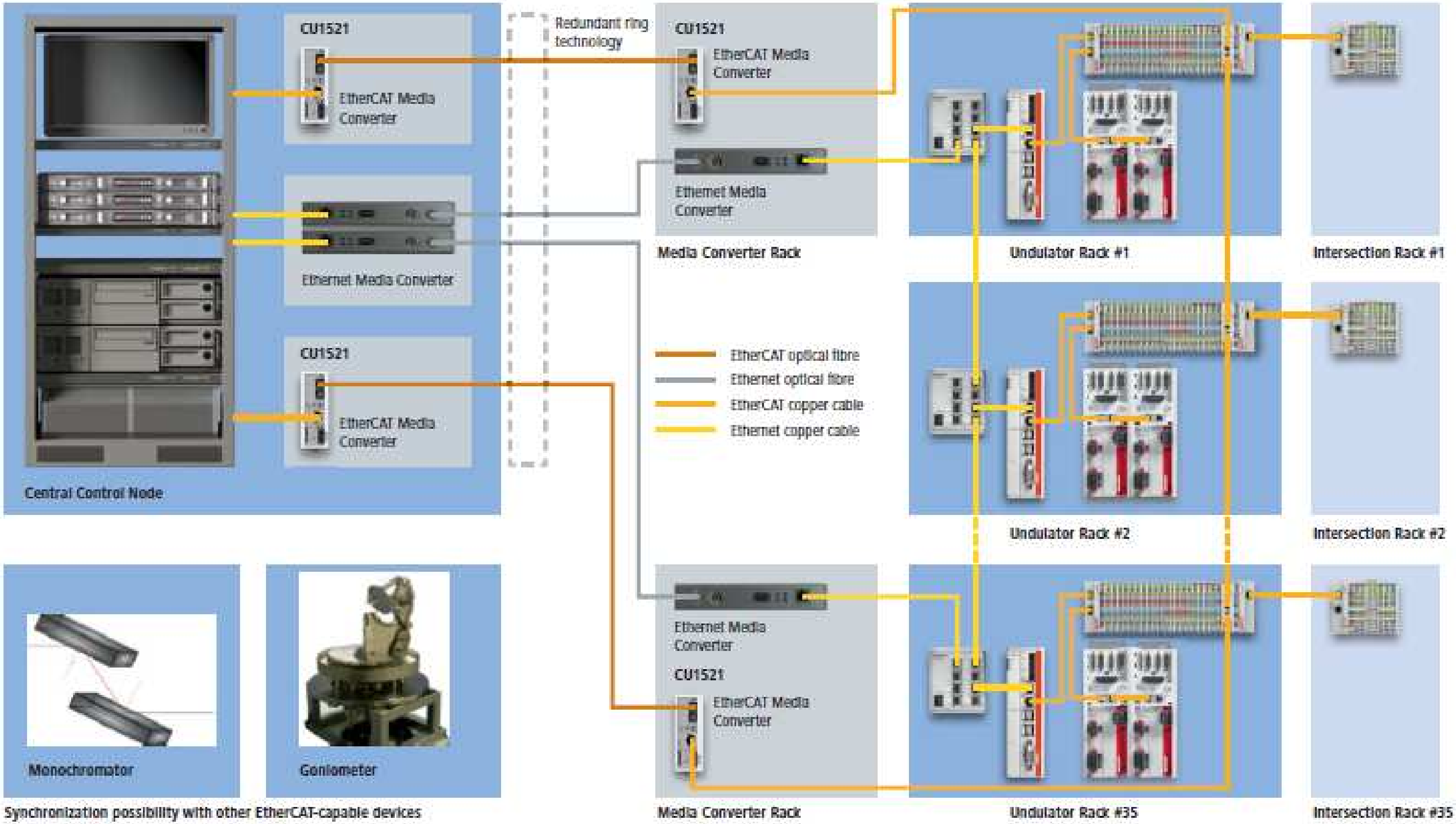
Drive Technology @ DESY and European XFEL

Nils Burandt

European XFEL Schematic – Undulator Control



Drive technology for highly dynamic positioning tasks

Servo Drives

Servomotors

Compact Drive Technology

eXtended Transport System

AX5000/AX8000 | Highlights Servo Amplifier

AX5000

- fast control technology
  - current control: minimum 62.5 µs
  - speed control: minimum 125 µs
  - position control: minimum 250 µs

AX8000

- FPGA-based control algorithms
- multi-channel current control technology
  - sample and response times of less than 1 µs
  - current control cycle time 16 µs
- positioning control cycle time 31.25 µs
- minimum EtherCAT cycle time 62.5 µs

Kinetic Rain at Shanghi Airport / Singapore

IPC

- 7 Industrial-PCs C6525

I/O

- EtherCAT-Cuppler EK1100 and EK1110
- withEtherCAT-Terminal
- EL6692

Motion

- 1.216 Servoterminals EL7201
- 1.216 Servomotors AM3121 with clamps

Automation (Software)

- TwinCAT NC PTP
- TwinCAT NC Camming

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