# JCOP/DCS Plans for HW Upgrade

A. Augustinus (ALICE), C. Gaspar (LHCb), F. Glege (CMS), S. Schlenker (ATLAS), M. Gonzalez (EN-ICE), Ph. Gayet (EN-ICE), F. Varela (EN-ICE)

ACES 2014
CERN, 20th March 2014

Joint COntrols Project

The DCS of the four LHC Experiments is done in common in the frame of the Joint COntrols Project (JCOP)

- Started in 1998

- Collaboration between the Experiments and EN-ICE (formerly IT-CO)

- Major subprojects:

  - PVSS Framework

  - Experiments' Gas Control Systems
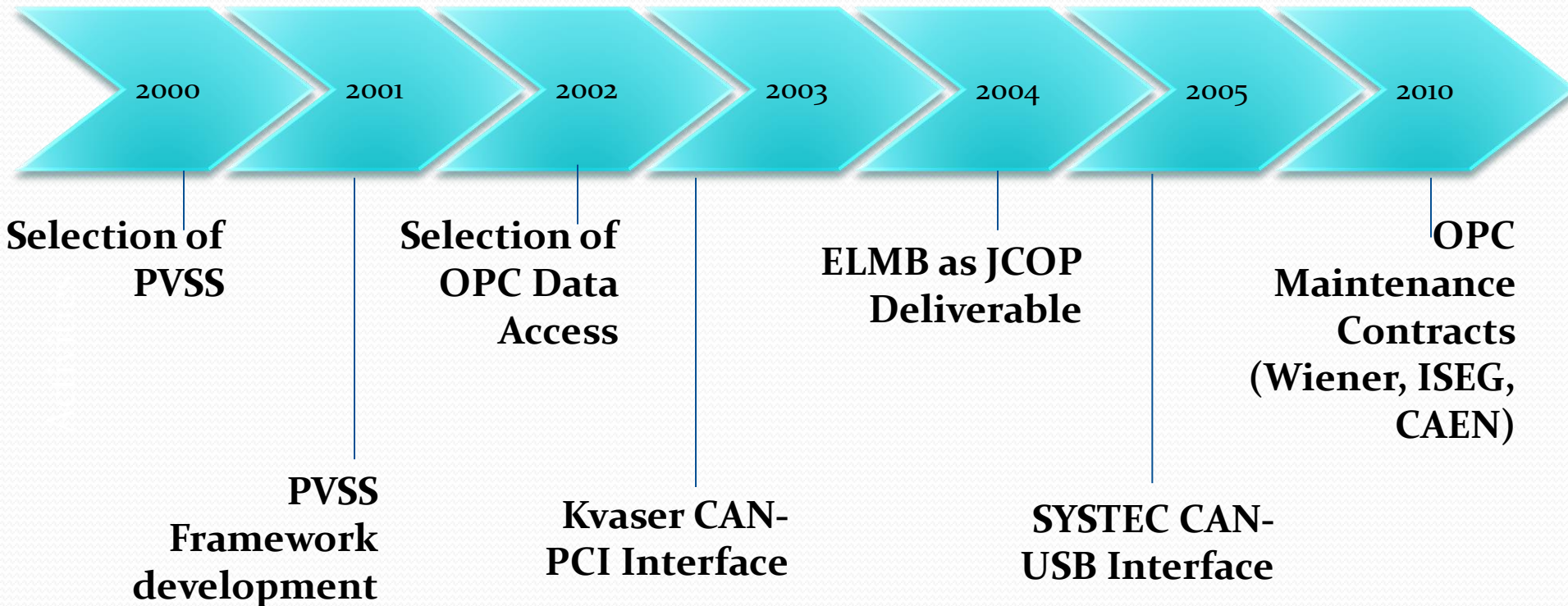
  - Detector Safety Systems
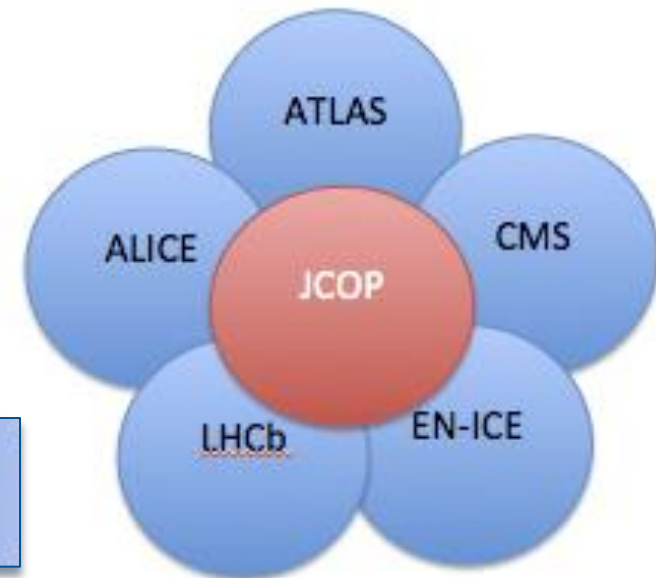
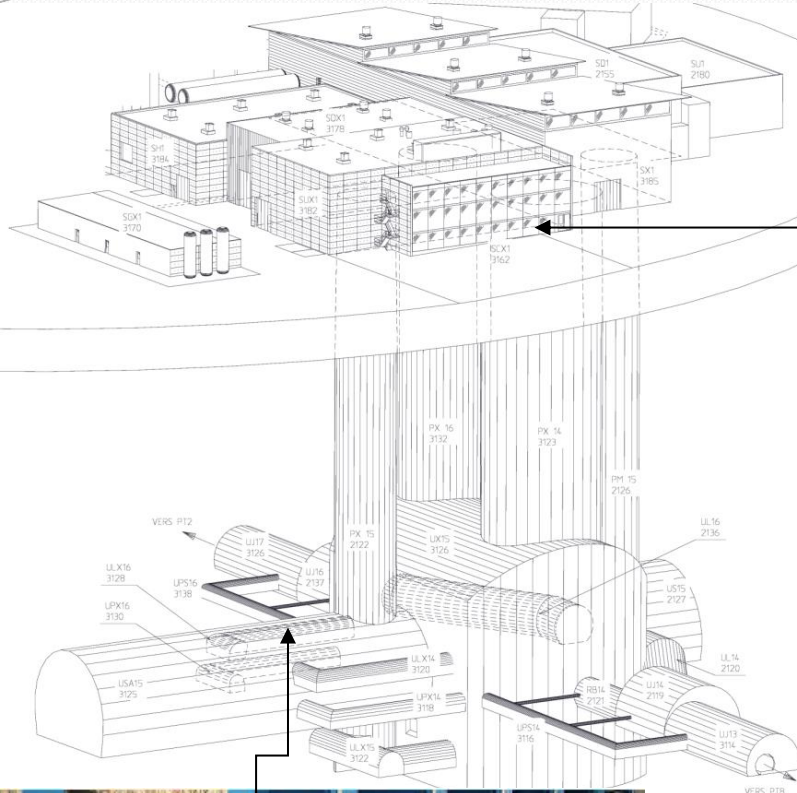Only common DCS components will be covered in this talk

JCOP timeline

Some events with impact on the DCS hardware:

| 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2010 |

Selection of PVSS

Selection of OPC Data Access

ELMB as JCOP Deliverable

OPC Maintenance Contracts (Wiener, ISEG, CAEN)

PVSS Framework development

Kvaser CAN-PCI Interface

SYSTEC CAN-USB Interface

Typical DCS

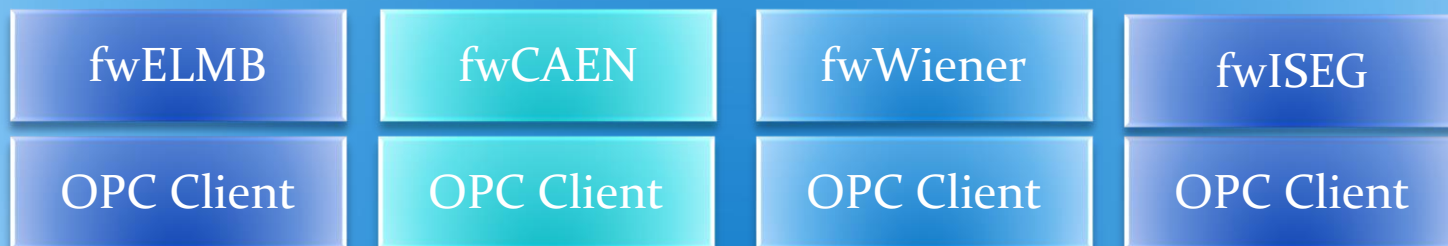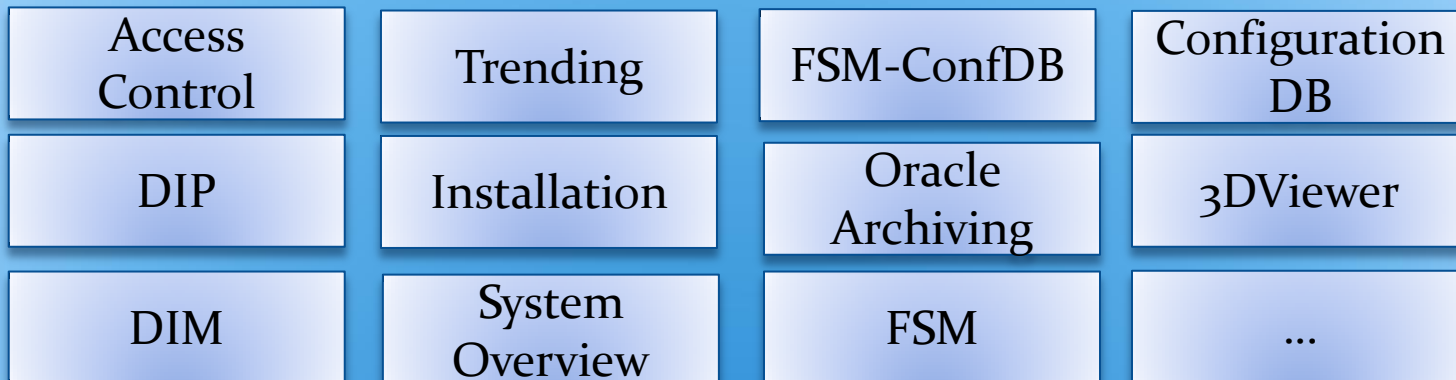- Up to 3M HW I/Os
  - i.e. up to several million dpes
- Up to 160 PVSS interconnected systems
  - Geographically distributed
  - Oracle archiving to a central DB server
- Up to 6000 PVSS processes
  - And many non-PVSS processes
- Apps developed around the world
  - Linux and Windows
  - Integrated and managed at CERN (1-2 men)
  - Lifetime ~20 years
- Operation as FSM

JCOP PVSS Framework

JCOP PVSS Framework

Access Control	Trending	FSM-ConfDB	Configuration DB
DIP	Installation	Oracle Archiving	3DViewer
DIM	System Overview	FSM	...

fwELMB	fwCAEN	fwWiener	fwISEG
OPC Client	OPC Client	OPC Client	OPC Client

ELMB OPC Server	CAEN OPC Server	Wiener OPC Server	ISEG OPC Server

Commercial OPC Servers

JCOP Hardware

- Commercial Powering Systems
  - CAEN, Wiener, ISEG
  - Support
    - Hardware and firmware: PH-ESE
    - Interface Software (OPC): EN-ICE
- PLC-based safety systems (ALICE and CMS)
- Wiener VME crates
- ATLAS Embedded Local Monitor Board (ELMB)
- CANbus interfaces:
  - Kvaser PCI
  - Systec USB
- Lots of custom hardware where JCOP supports interfaces
  - DIM, Modbus, etc.

Motivations for Upgrade

- New Requirements
  - Virtualization (LHCb)
  - Redundancy (CMS)

  No direct connections between hosts and front-end equipment => Go Ethernet!!

  - Full DCS under Linux (ATLAS)
  - For new electronics, part of the DCS data will share data path with DAQ (e.g. GBT)
    - Needs DCS BE interface on off-detector electronics (e.g. Embedded OPC UA servers on FPGA/ARM processors)
- Technology obsolescence
  - OPC DA based on MS DCOM
- Equipment ageing due to radiation (foreseen)
  - e.g. ELMB
- New standards/new functionality
  - xTCA as replacement for VME
  - e.g. EtherCat

CAN Upgrade Plans

- CAN in the Experiments' DCS
  - Hundreds of ELMB applications (detector, environment, racks, etc.)
  - Control of Wiener VME Crates
  - ISEG HV PS on PEAK CAN-USB or CAN-PCI interface

- Issue: Current CAN USB or PCI interfaces put limits to redundancy and virtualization

- Short/mid term plan: Look for an Ethernet-based replacement
  - Multi-port (at least 12 CAN ports)
  - Drivers for Windows and Linux
  - AnaGate CAN Quattro as a very promising candidate
  - Decision expected by Spring 2014

- Longer run:
  - Look into EtherCat or other Ethernet based protocols, as possible replacement of CANbus for new applications

Commercial Power Systems

- Currently OPC Data Access is the software interface to CAEN, Wiener and ISEG power supplies

- Issue: OPC DA is based on DCOM -> Technology phased out by Microsoft

- Mid/Long term upgrade plan: OPC Unified Architecture as natural evolution
    - Platform Independence
    - Embedded Platforms
    - Modern Security
    - OO-like Information Modelling

OPC: Lessons learnt

- CAEN, ISEG, Wiener are <u>hardware</u> vendors
  - Significant effort for them to develop OPC servers
- "Black-box" model followed in the past does not work, i.e. CERN does not care how the server is implemented as long at it works
  - Far too long to deliver working OPC servers
  - Extremely inefficient debugging
    - Problems are only manifested in production setups
      - Not possible to reproduce in smaller lab setups
    - CERN had no access to the source code for debugging
      - Luckily enough this has changed recently

OPC Upgrade Plans

CERN to collaborate with the companies on the development of the OPC UA servers

- Develop in-house knowledge of the code to improve troubleshooting and issue reporting to the company
- Restrict the work done by the companies to communication with hardware
- Provide coherency and promote utilization of common software components across OPC servers
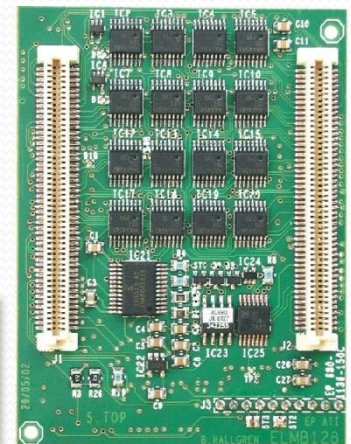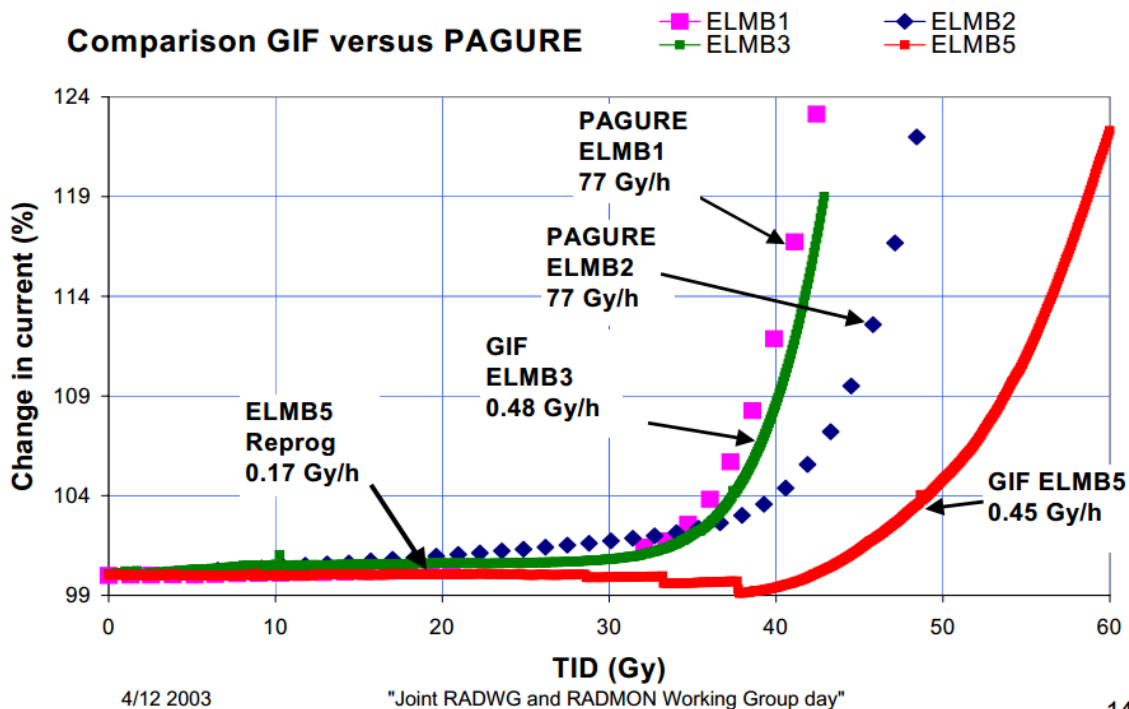- Expected in production by end of LS2

Still under discussion. Personal view

ELMB Ageing

ELMB designed to operate 10 years outside the ATLAS calorimeters

4.7 Gy (Expected dose rate)* 3.5(sim. rad level) * 1 (low dose rate effect) * 2 (COTS components homogeneous preselected) = **33 Gy** = 3.3 kRad in 10 years

Comparison GIF versus PAGURE

Legend: ELMB1, ELMB2, ELMB3, ELMB5

PAGURE ELMB1 77 Gy/h
PAGURE ELMB2 77 Gy/h
GIF ELMB3 0.48 Gy/h
ELMB5 Reprog 0.17 Gy/h
GIF ELMB5 0.45 Gy/h

Change in current (%) vs TID (Gy)

4/12 2003   "Joint RADWG and RADMON Working Group day"   14

JCOP is very interested in initiatives like the ELMB++

Conclusions

- As many other systems, DCS builds on top of technologies chosen and decisions taken years ago

  - Although if we were to do it all over again, things wouldn't look very different

- New requirements have also appeared

- In same cases, there is a clear plan to upgrade

- Workshop to define the long term objectives for JCOP

  - to be scheduled early this Summer