Development of the ITER CODAC Core Systems

COntrol Data Access & Communications
…. means ***Control*** *(system and team)*

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Introduction

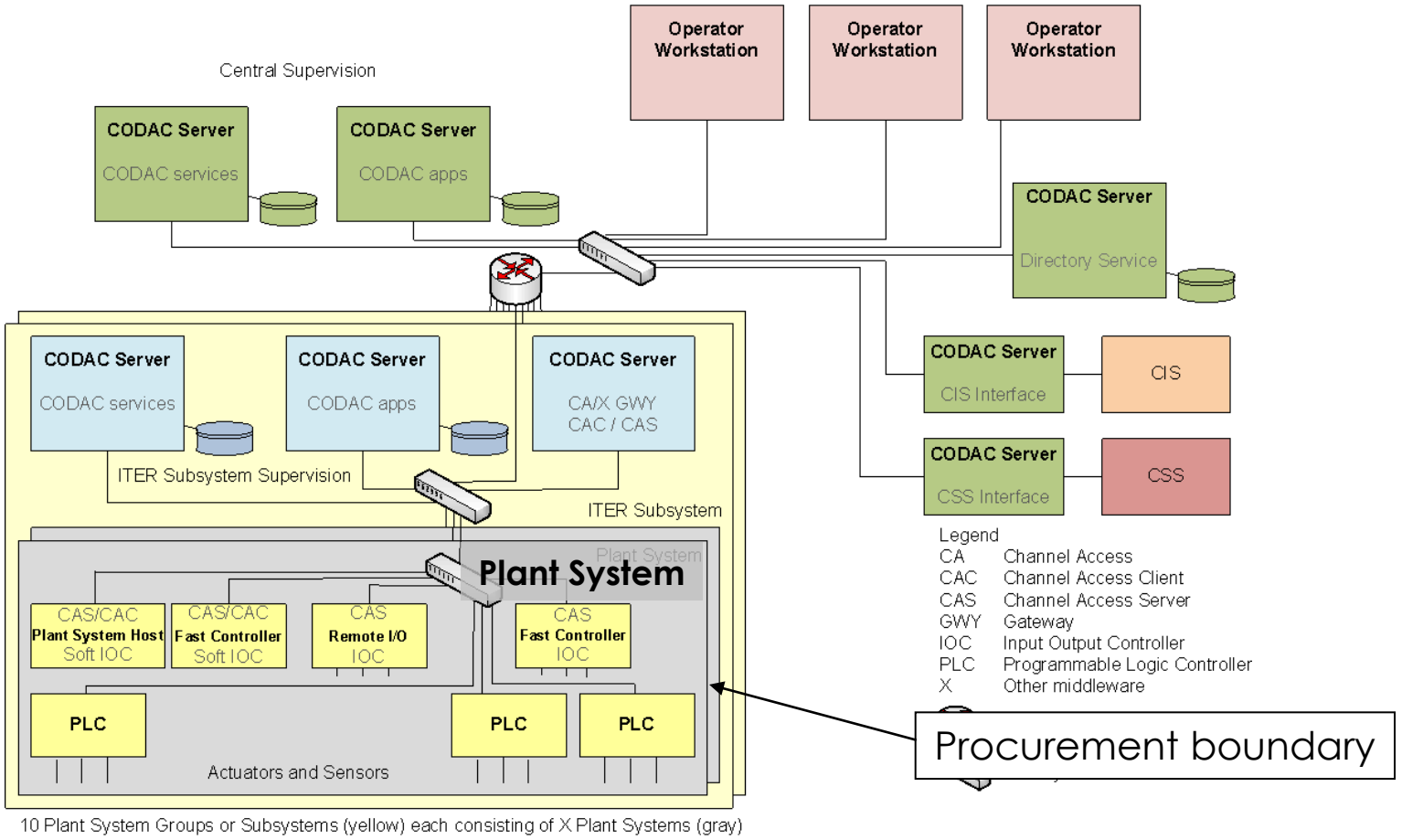
The ITER project has:

- ❑ A long schedule
  - Systems construction will start in 2010
  - Operation will start in 2018 (*)
  - Installation and commissioning will continue until 2025 (*) for the DT operation.
- ❑ A complex procurement scheme
  - Most of the plant systems are “in kind” procurements

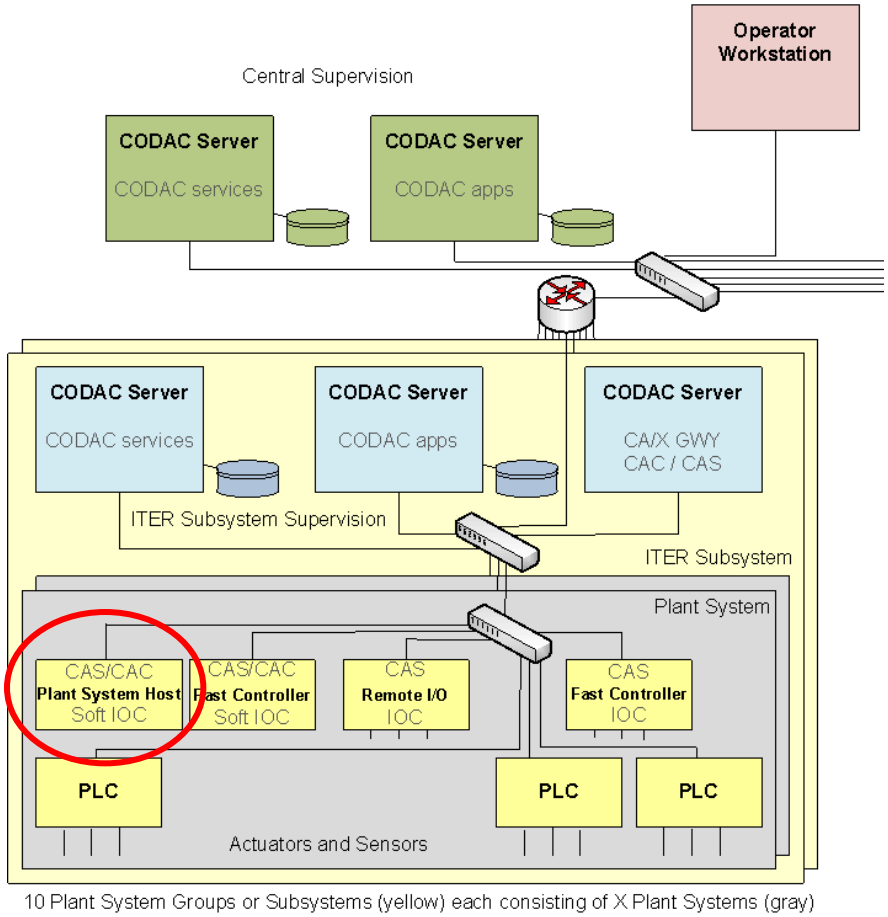
    ITER Organization (IO) ↔ Domestic Agencies (DA) ↔ Plant system suppliers.
  - Plant systems, including their controls, will be built, tested and delivered by many partners distributed among all ITER parties
- ➢ A long life cycle for controls.
- ➢ But requiring very early standardized solutions supplied and supported by IO.

(*) Schedule not yet approved by the ITER council

The ITER CODAC Architecture



Plant System Host (PSH)

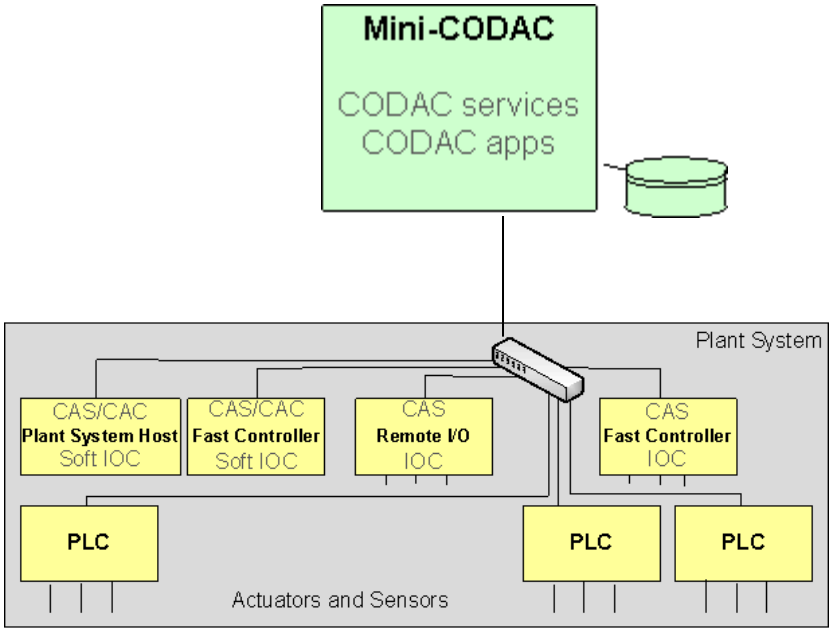


10 Plant System Groups or Subsystems (yellow) each consisting of X Plant Systems (gray)

- A CODAC system supplied by the ITER Organization
- That is a part of the plant system controls
- To allow the implementation of some CODAC services on a platform maintained by the CODAC group

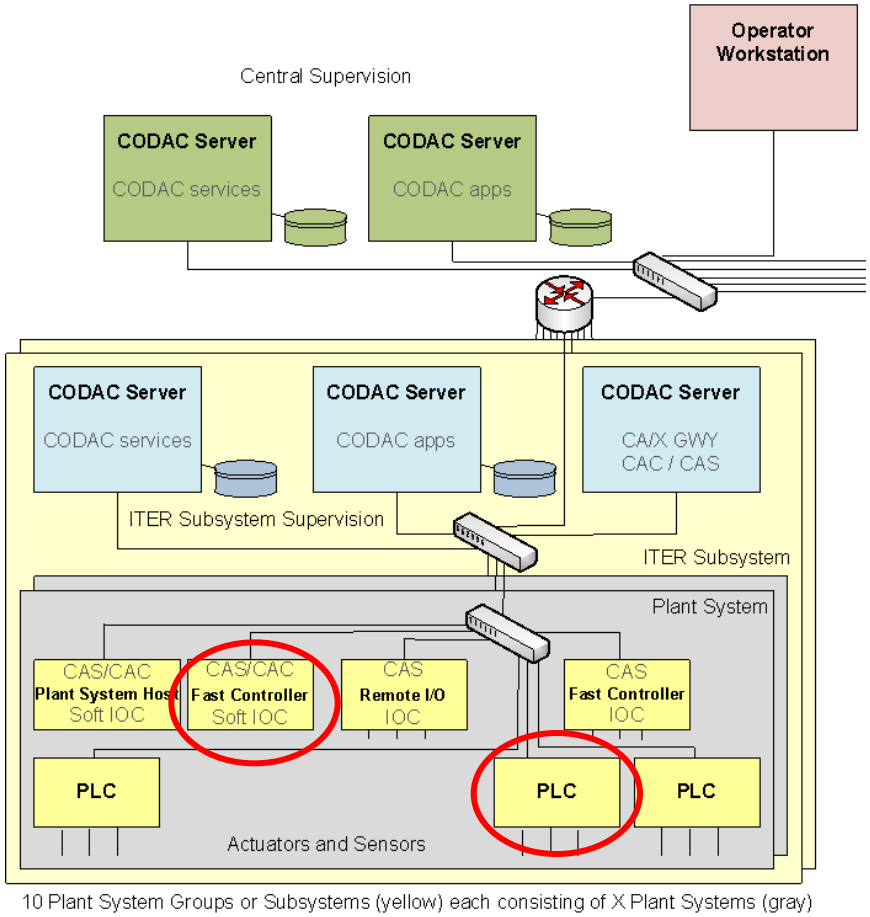
Mini-CODAC

Before integration.



- A CODAC system supplied by the ITER Organization
- Directly connected to the plant system controls
- To implement a reduced set of the CODAC services for the development and tests of the plant system

Plant System Controllers



10 Plant System Groups or Subsystems (yellow) each consisting of X Plant Systems (gray)

Technical specifications:

- Any “slow controller” (PLC) shall be a Siemens Simatic S7 PLC
- Any “fast controllers” shall be built with EPICS

CODAC Core Systems

- CODAC core systems designate the hardware platforms and the software components that implement “core” services:
  - Configuration management
  - Communications
  - Human Machine Interface (HMI) building
  - Alarms handling
  - Errors & Trace logging
  - Data archiving
  - Supervision
  - Tests tools
- Core systems will be:
  - based on EPICS,
  - implemented by increments with a new version every year.

Roadmap

2010/Q1	Version 1 *Preliminary*	Integration of PLCs EPICS distribution with limited additions.
2011/Q1	Version 2 *Stable for developments*	Extensions for fast controllers Preliminary versions of new tools APIs frozen
2012/Q1	Version 3 *Stable for tests*	New tools Robustness

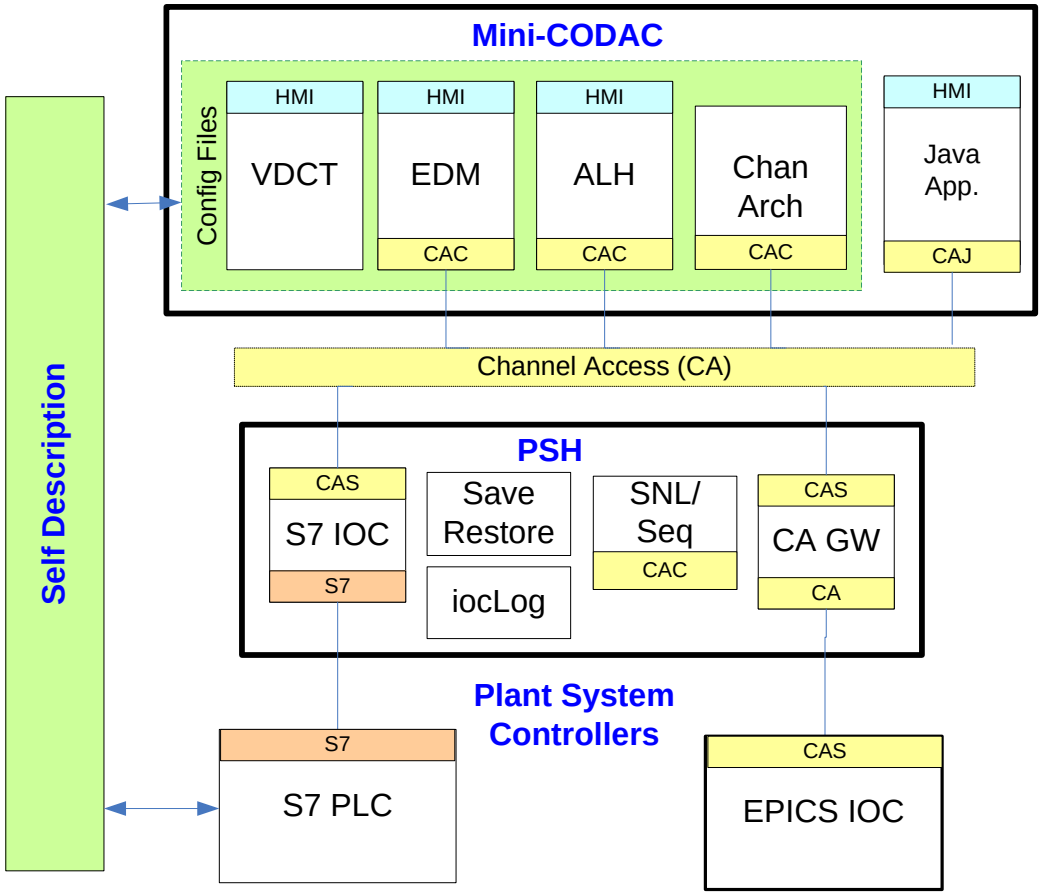
- The hardware platforms are Mini-CODAC and PSH (OS: RHEL)
- New tools will be based on Java and Eclipse (and very likely on Control System Studio)

Version 1

- Stable and widely used EPICS tools.
- S7 IOC built with the SLS S7plc driver.

Thanks ANL, SNS, SLS… !

- Configuration tool (“Self-description”) to manage the PSH/PLC interface and to facilitate usage.



Resources

The model:

- A small, but increasing (!), ITER team.
- Contracts.

For core systems versions 1-3:

- A team with members from the Indian Institute for Plasma Research (IPR) and Tata Consulting Services (TCS).
- Support from Cosylab.

…

Also partnership with other labs

- KSTAR (the Korean Tokamak)
- ASIPP (the Institute of Plasma Physics, China)
- RFX (the fusion facility in Padova)

…

(!) Check job positions

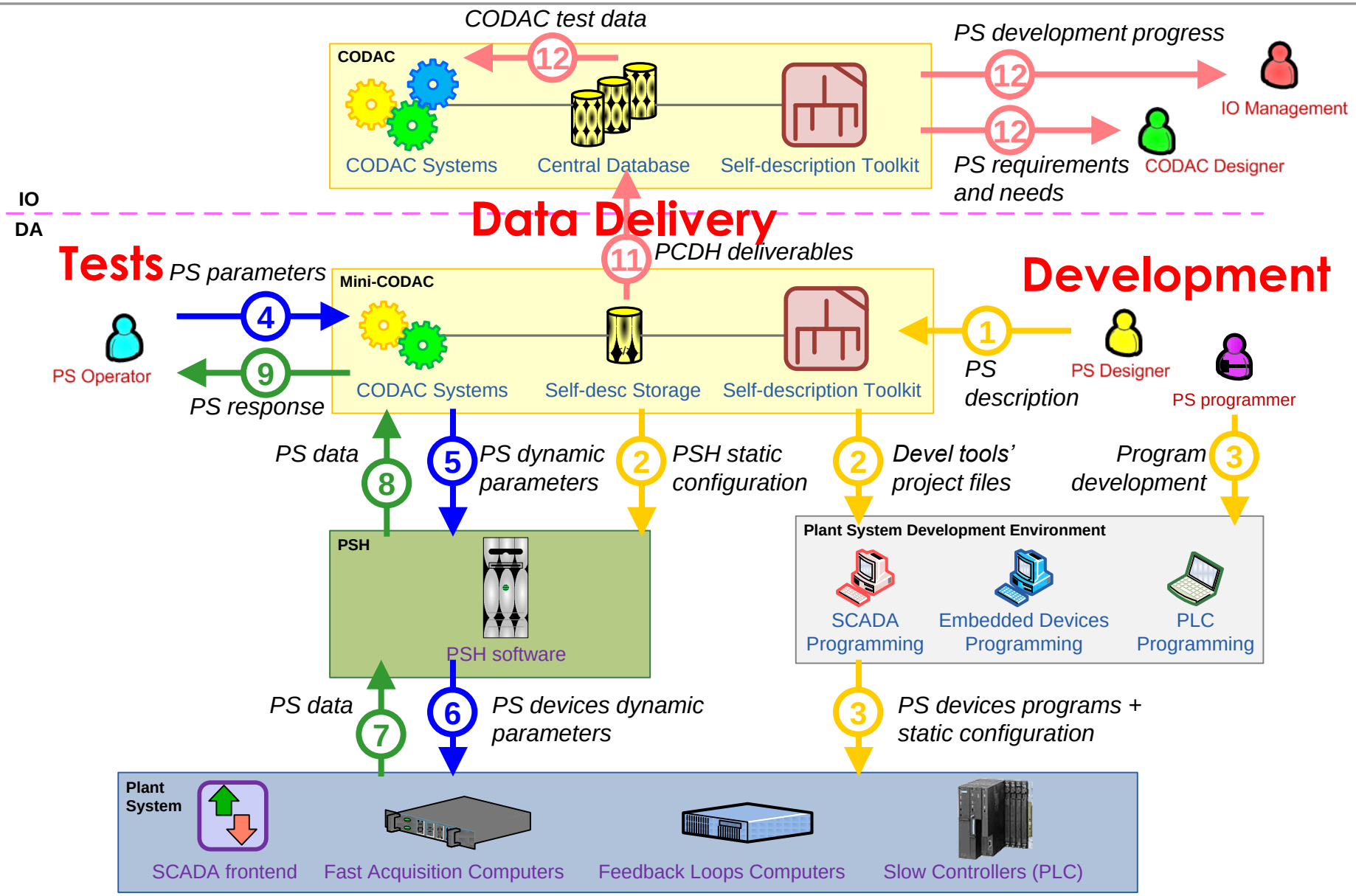
Plant System Self-Description

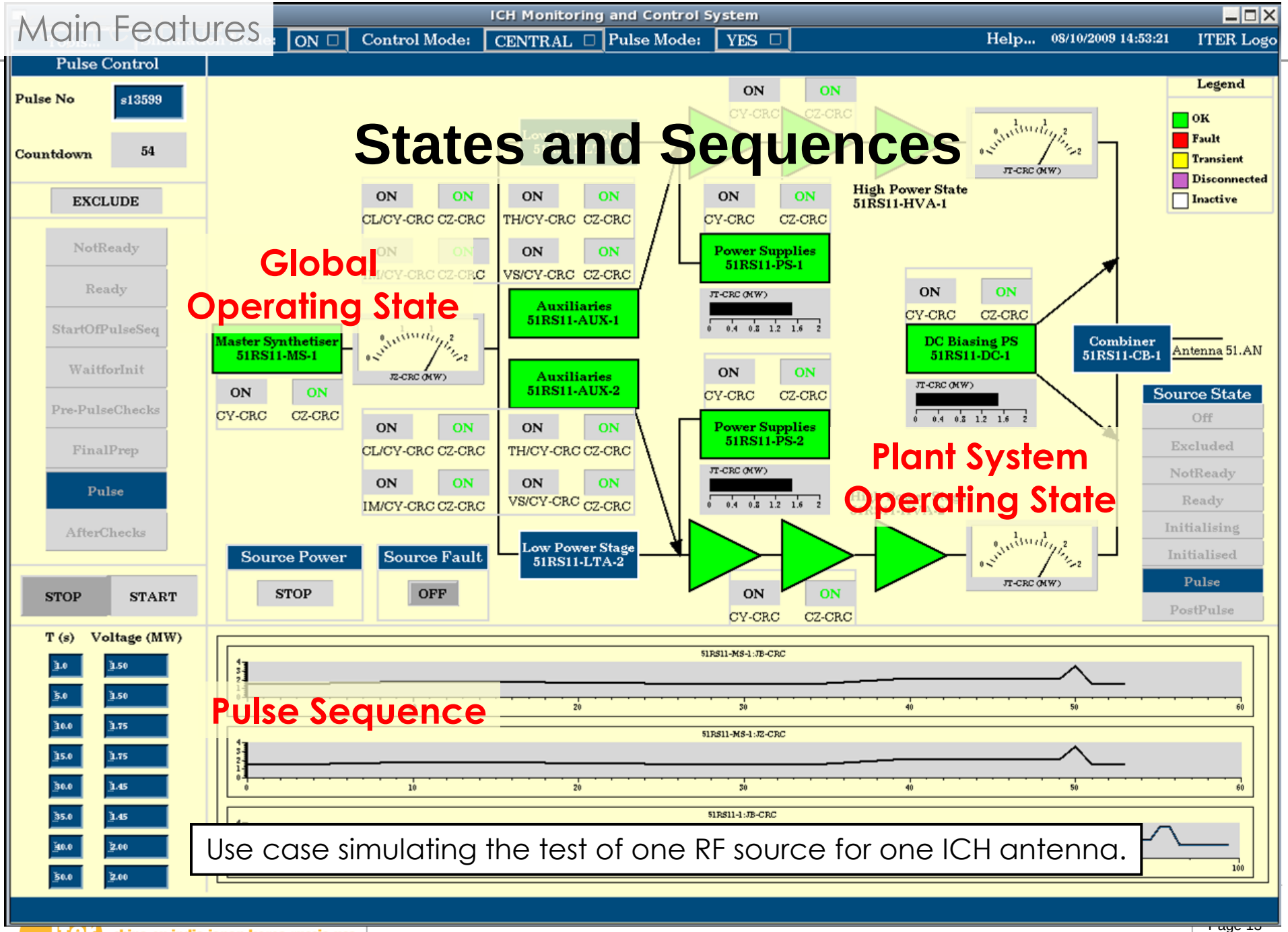
The concept:

- The component shall disclose all the necessary data about its interfaces and internal structure for enabling treatment by external programs.
- All data shall be expressed using XML in conformance with a schema specified at project level.

The objectives:

- Configure in an automatic manner the CODAC core systems from the plant systems' configuration data.
- Treat configuration data as a deliverable.


CODAC test data
12
CODAC
CODAC Systems
Central Database
Self-description Toolkit
PS development progress
12
IO Management
12
CODAC Designer
PS requirements and needs
IO
DA
Data Delivery
Tests
PS parameters
4
PS Operator
9
PS response
11
PCDH deliverables
Mini-CODAC
CODAC Systems
Self-desc Storage
Self-description Toolkit
Development
1
PS description
PS Designer
PS programmer
PS data
8
5
PS dynamic parameters
2
PSH static configuration
2
Devel tools' project files
Program development
3
PSH
PSH software
Plant System Development Environment
SCADA Programming
Embedded Devices Programming
PLC Programming
PS data
7
6
PS devices dynamic parameters
3
PS devices programs + static configuration
Plant System
SCADA frontend
Fast Acquisition Computers
Feedback Loops Computers
Slow Controllers (PLC)



Use case simulating the test of one RF source for one ICH antenna.

Conclusion

- The direction:
  - Epics as the baseline framework
  - “Self-description” : configuration management with XML schema
  - New toolkit based on Java and Eclipse.
- The process:
  - One step every year
  - With many partners from the ITER parties

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