Laser Megajoule Facility (L.M.J.)
Control system status report

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Presentation overview

- Laser Megajoule (L.M.J.) facility
- Laser Integration Line (L.I.L.) prototype
- Control system architecture and industrial policy
- Common components software framework
- High level supervisory software
- Control system road map
LMJ facility overview

LMJ is designed to deliver about 2 MJ of energy on tiny targets for high density plasma physics and fusion experiments.

**Amplification**

**Synchronization**

**Alignment**

**Focalization**

$X \sim 200$

1 nJ

7 kJ

50 µm

15 ps

10 mm
LMJ facility overview

Up to 30 bundles of 8 beams located in 4 bays = 240 beams

More than 1 MJ of 350 nm UV light on a target
LMJ building

Mai 2003: beginning
End 2006: target chamber put in place
End 2008: building completed
First laser bay, 5 bundles completed
Second laser bay, assembly of bundles is ongoing
Third laser bay
LIL facility = LMJ prototype

• LIL was commissioned in March 2002
LMJ control system architecture

N3
Facility planning and operations

N2
Supervisory control system

N1
Subsystem control

N0
Equipment control

Control Points
500 000

Alarms
100 000

Processors
500

Shot data
~1 GB / shot
2 years on line
LMJ industrial policy

N3 Facility planning and operations
N2 Supervisory control system
N1 Subsystem control
N0 CC Equipment

High level
Supervisory control system

Maintenance Management
Shot data archiving and analysis
Network Administration

High level
Supervisory

Power Cond.
PAM
Timing
Align.
Laser High Vac.
PEPC
Laser Diag.
Target Chamb Equip.
Target Diag.
Bldg Util.
Pers. Safety

Adapt. Optics
Amplifiers
Freq. conv.
Laser low Vac.
During the N2-N3 conception phase we have identified common functional components with N1 level.

- User interface
- Sequence
- Reservation management
- Operational modes management
- Event logging
- Facility configuration management
- Maintenance management
- Shot data management
- User interface
- Sequence
- Reservation management
- Operational modes management
- Event logging
- Facility configuration management

Common framework

General framework
General framework data model

Resources

Operational Modes
State machine

Stopped
Standby
Running

Functions

Methods
Execute()
Reserve()
Release()

Attributes
Reservation state

Resource

Methods
Reserve()
Release()

Attributes
Reservation state

Control Points

Name
14 °C
10 kV

Methods
Value
Read()
Subscribe()

Alarms

Nom

Attributes
On/Off

Methods
Subscribe()
General framework data model

Functional trees
Supervisory Control Contractors Developments

Maintenance Management

Facility Configuration Management

Shot director

PANORAMA Application

Séquences Management

Resources Management

Shot database

Event Logging

Fully Standardized External Interface Protocol (PIE)

Subsystem Operator

PANORAMA Application

Resources Management

Séquences Management

Event Logging

Subsystem Contractor Developments

Process Specific

N0: Equipment Controls

Equipments

General framework common components
General framework common components

- Maintenance Management
- Shot director
- PANORAMA Application
- Resources Management
- Séquences Management
- Shot database
- Event Logging
- Fully Standardized External Interface Protocol (PIE)
- Subsystem Operator
- PANORAMA Application
- Resources Management
- Séquences Management
- Event Logging
- Subsystem Configuration Management
- Process specific
- N0: Equipment Controls
- Equipments
- Supervisory Control Contractors Developments
- Subsystem Contractor Developments

Supervisory Control Contractors Developments

Subsystem Configuration Management

Facility Configuration Management

PANORAMA Application

CCNO N0: Equipment Controls

Event Logging
Supervisory software technical choices

- SCADA: Panorama E² from CODRA
- Specific developments: .Net
- Database: Oracle 10g, N-Hybernate
- Shot data storage: XML and HDF5
- CMMS: D7i product from Datastream
Supervisory software status

- October 2007 Contracts Signature
- Summer 2008 Requirement Reviews
- Summer 2009 Design Reviews

- Requirement Stage
- Design Stage
- Realization Stage

Supervisory Software
Common Components
LMJ control system road map

Step 2: software integration on PFI (end of 2011)

Step 3: Functional integration on LMJ: 1st bundle, 2nd bundle...

Today

N3: facility management

N2 supervisory

Network administration

Common components

Laser bay

Control systems

Target Bay

Control systems
Any questions?