Industrial experience on
Laser MegaJoule Project

Workshop Diagnostics and Optics

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Industrial Experience on Laser MegaJoule Project

- Laser MegaJoule Project
  - What is Laser MegaJoule

- LIL Diagnostic plasma
  - IRELEC
  - Physics instrumentation in high stress environment
  - Physics instrumentation from lab to industrial plant
  - Plasma Diagnostic 1.04

- LMJ ECI
  - BERTIN Technologies
  - Organization for ECI

- Conclusion
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**Laser MegaJoule Project**

The **Laser MegaJoule** program is the 1.5 billion € cornerstone project of the French CEA Simulation Program.

The 170 power lasers will, in 2014, deliver 1.8 MJ of 0.35 µm light to targets for high energy density physics experiments and to ultimately obtain ignition and propagating burn with DT targets in laboratory.
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Industrialists: IRELEC-ALCEN

IRELEC was a member of the consortium in charge of Plasma Diagnostics delivery

AER acted as proxy, with
- ELTA for hardware electronics
- CYBERALEPH for software and supervision

The consortium delivered and installed 12 diagnostic assemblies, including electronic, mechanical, opto-mechanical and optical components
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Physics instrumentation in high stress environment

High stress environment means for material and design
- Irradiation
  - acceptable dose for components
- Activation
- Heat load
- EMC
- Limited accessibility

Completely new environmental set up
- Low feedback information
- Over-specification
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Physics instrumentation from lab to industrial plant

Highly sophisticated instruments must meet industrial requirements

- Electronics standards
- Data exchange
- Mechanical interfaces
  - for installation
  - for handling
- Maintenance
  - ability of the equipment to be maintained according to general plant policy and organization
- Safety rules
  - each new project induces reinforcement of safety rules
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Example - Plasma Diagnostic 1.04

Single pinhole diagnostic equipped with an X-ray film-holder and filter
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**Industrialists: Bertin Technologies**

**Target area room and Integration (ECI) facilities**

- Bertin Technologies is a member of the CNIM / Thales E&C consortium
- Alignment function in centre of target chamber:
  - Definition of procedures, chronogram and alignment performances (precision 10μ)
  - Equipment design and integration:
    - reference on which the 176 laser beams and the plasma diagnostics are aligned
    - SOPAC sights for target alignment
- Mobile handling robot I&C system
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Organization for ECI

Matrix structure

- Work sectors: interface management, integration, ILS-Operating safety, I&C,…
- Operational performances: alignment, stability,…
- Operation-environment: vacuum, nuclear safety, EMC, hardening,…
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Organization for ECI

Co-Engineering
- Systems development performed by industrialists
- Specifications modifications managed by the CEA/DAM

Procedures set up by the CEA
- Central working group guaranteeing systems interfacing
- Performance Unit
- Business engineer for each contract backed up by a technical team

Satisfactory solution except for modifications management
- Long procedure (decisions by consensus) lagging behind program progress
- Lag generating important design changes

Solutions to be found
- Upstream involvement of industrialists in program?
Conclusion

Diagnostic as other scientific equipment needs high skill industrial engineering.

For LMJ project, Industrialists with different know how built successful Consortium.

These Consortium with the contribution of the associations can be good candidate for ITER project.

Thanks to CEA DAM -DCRE and CNIM for their contribution.