Challenges of the XFEL Cryomodule Integration and Industry Transfer

IPAC’14
Introduction

- ALSYOM overview
- Project structure
- Progress status
- Team structure
- Workshop layout
- Technical issues
- Production challenges
ALCEN Group

- French group created in 1988
- High technology dedicated to:
  - Defence and Security
  - Energy
  - Medical machines
  - Aeronautics
  - Large scientific equipment
- 206 million euros turnover in 2013
- About 30 subsidiaries
- 1950 employees in 2013

ALSYOM

- Large Scientific Instruments
  - Laser Mégajoule (nuclear simulation)
  - Laser PETAL
  - Experimental Fusion Reactor ITER
  - Particle Accelerators (XFEL)
- Defence
- Aeronautics, Space and Astronomy
ALSYOM main activities

- Program Management
- Engineering and Industrialization (in Tarbes and Mérignac)
  - System Analysis, Mechanical, and Opto-mechanical design, Optic, Electronic, Instrumentation and Control System
  - Industrial Process Definition
- Opto-mechanisms manufacturing (in Tarbes)
  - Mechanical infrastructures with large dimensions and high accuracy
  - Vacuum vessels
  - Opto-mechanical systems with cleanliness and vacuum requirements
- Integration and clean environment (in Tarbes, Laseris Le Barp, Saclay)
  - Geometric characterization
  - Getting ISO 5 and ISO 8 cleanliness
  - Integration and testing
- Mechanical structures mounting & assembly in clean environment on Customer sites

*Industrial entity, unique in France, combining these domains of competences and level of performances (high accuracy, large size, ultra clean and vacuum)*
More than 100 cryomodules to be produced

Delivery rate: 1 module / week

4 phases:

- **Pre-series production**
  - XM-3: observation
  - XM-2 and XM-1 for training

- **Series production**
  - From XM1 to XM7, ramp-up period
  - From XM8 up to XM100: nominal production rate: 1 module/week

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Progress status

- XM1, XM2, XM3, XM4 already delivered
- XM5 shipment on 06/17/2014
- XM11 coupler cold parts assembly on W25/2014
Team structure

- 29 people including:
  - Management
  - Support activities
  - Production staff

Workforce over time from Kick Off Meeting:

- Week 1 to Week 79
- Chart showing workforce growth over weeks

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Disclosure and copy prohibited
- 7 workstations
  - WS1-CC: Coupler Cold part assembly (ISO4 clean room)
  - WS2-SA: String Assembly (ISO4 clean room)
  - WS3-RO: Roll-Out area
  - WS4-AL: Alignment
  - WS5-CA: Cantilever
  - WS6-CO: Warm Coupler parts assembly
  - WS7-SH: Shipment

- Most of workstations are doubled
Workshop layout

Cold coupler assembly

String assembly
Workshop layout

From Clean Room to Roll-Out area

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Workshop layout

- Multi-Layer Insulation
- Magnetic shields
- Tuner systems
- Titanium bellows welding
- Cold Mass transfer
Workshop layout

Alignment area
Workshop layout

Cantilever

Warm Coupler Assembly
Workshop layout

Transfer to shipment

Shipment area
Technical issues

- XM-1 Welding
  - X-Ray has shown pores in Titanium welds

- String and Cold Mass assembly
  - Bearings tightening improvement

- Couplers overheating
  - Under investigation for XM-1 and XM1

X-Ray picture

Bearings assembly between Cold Mass and Cavity String
Production challenges

- A powerful Data Management System (EDMS)
  - For traceability
  - For non conformities and design changes recording
Production challenges

- A traveler file
  - To follow every assembly step
Production challenges

- Assembly steps monitoring
- Workload balance
- Lifting and handling operations

Aluminium thermal shields welding
Production challenges

- Roll-Out and clean room coordination
Further improvements

- A new string assembly method has been proposed
  - No more pumping and venting units needed
THANK YOU FOR YOUR ATTENTION