Summary of Industrialization
Symposium

- Short list of highlights
- Summary of findings & discussions
- Conclusion
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Series manufacture of the LHC main dipole magnets

Notes about the CERN approach to industrial production

C.Wyss & L.Rossi / CERN
LHC main dipole magnets

- **Responsibility for design and performance with CERN**
- **Responsibility for faultless assembly with the vendors**
- Responsibility for operation and maintenance of the tooling with the owners of the tooling design
- Quality checks after completion of each main assembly step to intercept errors at the earliest moment and minimize the loss of added value
- Bonus (1%) for magnets needing no more than three quenches to reach 9 T (reduced test time and hence cost for CERN)
Industrial evaluations, TESLA

- **Cavity fabrication (welding) for TESLA**
  - Noell (Dornier- Astrium),

- **Cavity preparation and module assembly**
  - Noell,
  - ACCEL

- **Niobium production for TESLA**
  - Noell (W.C.Heraeus)
  - H.C.Stark (under test sheets production)
X-FEL coupler

- waveguide to coax transition
- room temperature window
- warm vacuum pumping port
- warm coax Z = 50 Ohm
- cold coax Z = 70 Ohm
- 70 K point
- 4.2 K point
- cold window
- 1.8 K flange to cavity
- Qext tuning rod
- room temperature isolating vacuum flange
- isolating Kapton foil
- bias voltage feedthrough
- Qext tuning actuator
- position sensor
Study of X-FEL Coupler

• For the XFEL power couplers, industrialization studies will be performed through “Definition contracts”

• Intellectual work (in dialog between the industry and our Lab):
  – Define all manufacturing processes (analysis and validation models)
  – Risk analysis (process, logistics)
  – Determine cost in series and justify

• Produce 2 prototypes (to be tested at LAL – Orsay)
Cryomodule Assembly

the study shall cover clean room assembly and the assembly outside cleanroom

Startpoint: string assembly in cleanroom

(all parts are tested and ready for assembly)
Procurement Procedures

- EU call for tender
- Specification of criteria
- Selection of suited contractors for bidding
- Auditing of suited contractors
- Specification (framework of studies)
- Supervising contractors
- Module assembly
- Reports on assembly studies

Selection of suited offers & contracting

21.01.2005
22.04.2005
Boundary of Laboratory - Industry

Lab. - Industry Boundary
Typical examples.

1. Conceptual design
2. Detail system design
3. Detail drawings
4. Purchasing of materials, parts, products
5. Fabrications
6. Inspection for fabricated products
7. Assembly of sub-system
8. Testing of sub-system
9. Temporary storage, transportation
10. Installation in tunnel
11. Testing as an accelerator

KEK
Mass-production in Asia

- Shared by 3 regions, in 5 years (5 x 235 working days).
- **Total:** 15000 cavities, 1500 modules, 750 klystrons, 750 modulators.
  
  in Asia: 5000 cavities, 500 modules, 250 klystrons, 250 modulators.

For example
Production in Asia: (1175 working days)
  
cavities: 5000 (4.3 / day / company) 10 companies has 5 lines each => 1 cavity / 12 days
  modules: 500 (0.4 / day / company) 5 companies has 2 lines each => 1 module / 24 days
  klystrons: 250 (0.2 / day / company) 2 companies has 3 lines each => 1 klystron / 28 days
  modulators: 250 (0.2 / day / company) 3 companies has 2 lines each => 1 modulat / 28 days
SMTF ILC Industrial Strategy

- View being developed by Helen Edwards, Shekhar Mishra, Hasan Padamsee, Warren Funk, Pat Kelley, Chris Adolphson and SMTF Collaboration

- “SMTF” committed to developing entire cavity/cryomodule chain with industry

- Will work with “forming” US industrial consortium Tony Favali, Ken Olsen….
- US industry is “self organizing”
- SMTF role is supplying consortium information
Linear Collider Forum of Japan

Missions

- The objectives of the Forum are to
  - establish international industrial collaboration scheme, and
  - discuss industry’s role in facility design and construction,
  - assess associated infrastructure and economical effects.
- Another object is to provide a forum for information exchange between academic society and industrial communities.
Activities

- Ordinary Meetings/Lectures
- Cost Estimation (Cold & Warm Technologies)
- Participation in ILC Regional Working Groups
- Information Exchange with Overseas Laboratories (DESY, CERN, FNAL, SLAC, JLab, SNS, BNL)
„Linear Collider Forum of Europe“
- short summary for the SRF workshop 2005

European SCRF Forum

European Superconducting Radio-Frequency Forum

A brief summary of the Kick-off Meeting
April 7/8, 2005
DESY (Karsten Wurr, see XFEL website)

Very compact version for SRF workshop 2005 (Michael Peiniger)
Discussed Tasks of the Forum

• Create a **European industrial base** (esp. for the European XFEL and the future International Linear Collider)

• Provide a **point of contact** between
  – **European** industry active and interested in all aspects of SC RF accelerators
  – **European** accelerator laboratories, scientists and engineers
  – the **European Union** and its member countries
  – accelerator laboratories in **Asia** and the **US**
A SHORT OVERVIEW

ANTHONY J. FAVALE

July 12, 2005
MISSION STATEMENT

• The Linear Collider Forum of America (LCFOA) provides a formal network for its U.S. industry members with a common business interests to interact with U.S. Government funded R&D efforts during the design of The International Linear Collider (ILC) in the U.S..

• The LCFOA provides a partnership between its industry members and government, National Laboratories, Universities, the ILC
Summary of findings & discussion: Industry forum

- Industry Fora about SC accelerator technology in all 3 regions
  - Asia: operating since 2 years
  - Europe: under formation
  - USA: under planning
- All with strong local commitment
  - Critical to secure funds for ILC from ministries in all regions
  - Strong local commitment might be necessary at this moment because of differences in technical expertise and political boundary conditions
  - But: danger of too large diversity in technology/design: Is the 1/3 linac per region the right approach for ILC?
Summary of findings & discussion: Industrialization

- Industrialization of SC accelerator technology is high priority for ILC
- Solid progress by „industrial studies“ in Europe by TESLA effort
- New activities started in preparation for X-FEL
- USA: activities for industrialization just started
- Japan: Intensive interaction between laboratories and industries is established.
Summary of findings & discussions: Exchange of experience

- Industrial experience is gained in different activities:
  - Financed by funding agencies in different countries
  - Bilateral contracts
  - TESLA, TTC (Tesla Technology Collaboration)
  - X-FEL
  - EU supported activities:
    - CARE
    - EUROFEL
- There also exists „pre-existing knowledge“ and patents
Summary of findings & discussions: Exchange of experience, cont.

- TTC (Tesla Technology Collaboration) will serve (besides others) as global platform for experience exchange

- Most urgent and critical task for this function is to establish the rules how to handle intellectual properties
Conclusion

• First hand information from key player in industrialization process of SC accelerator technology was presented
• Major action items from this meeting
  – Define rules for exchange of intellectual properties
  – Establish intensive experience exchange
  – GDE should accelerate industrialization effort in the three „global regions“ of ILC
  – Synchronize this effort to avoid divergence of design and technology