Bilfinger Noell GmbH

Successful collaboration between Technology Platforms (TP) and industry: conditions, constraints and perspectives

Experience from Bilfinger Noell GmbH

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2nd AMICI-Industry Forum, Brussels (17-18 September 2019)

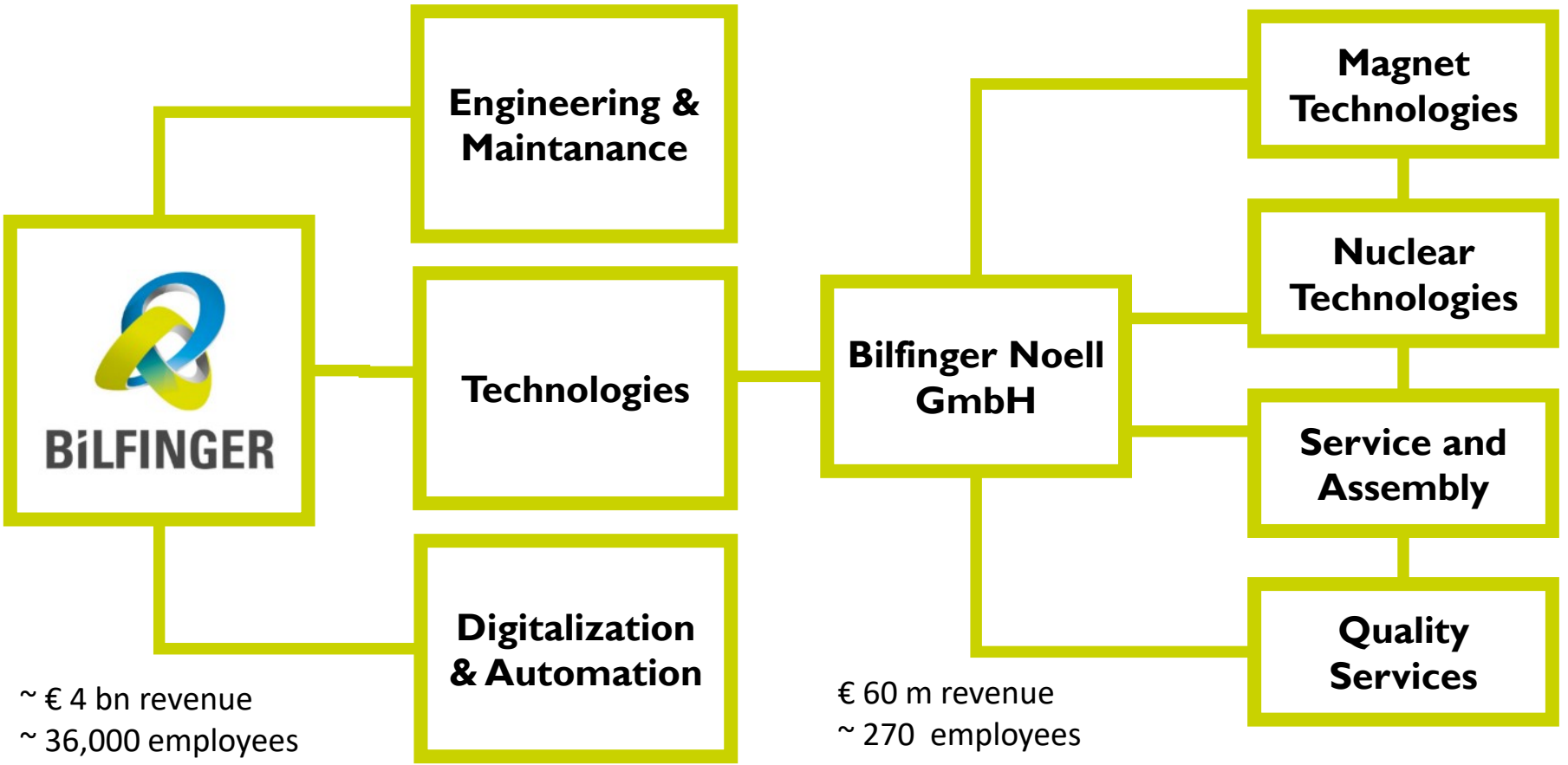
Introduction

- Introducing Bilfinger Noell GmbH
- Two thoughts on collaborations
- Collaborations: large scale projects
  SCU and SCW
  meteorology
  SC Flywheel
- Conditions, Constraints, Perspectives

Introducing Bilfinger Noell GmbH

Noell within Bilfinger

Synergy and stability



~ € 4 bn revenue
~ 36,000 employees

€ 60 m revenue
~ 270 employees

Passion for PRODUCTS

A diverse market spectrum

ENERGY

Superconducting flywheel energy storage

ACCELERATOR

Conduction-cooled superconducting undulators

SCIENCE

PINE mobile cloud chamber

MAGNETS

Conduction-cooled superconducting solenoid

NOELL CORE COMPETENCES

Engineering

Multi-physics approach towards complex engineering tasks for custom design solutions

Vacuum technology

Extensive experience in the design and manufacture of complex UHV components and vacuum vessels

Cryogenics

Highly efficient design of both helium and conduction-cooled systems down to 2 K

Series production

Optimization of complex manufacturing processes from small-scale to series production

Testing capabilities

Trained personnel and specialized equipment for cryogenic and vacuum testing in-house

Magnet technology

Wide range of experience in superconducting (LTS and HTS) as well as resistive and permanent magnets

Specialized hardware

Special tooling and equipment including winding and cabling machines and furnaces for impregnation

Two thoughts on collaborations

Noell is looking back on numerous successful collaborations

for a successful collaboration:

Common Goal

Synergy between *unique* skillsets of partners

Open and **Transparent** co-operation

Solution oriented culture

http://eu-amici.eu/download/AMICI_Industry_Days_-_BNG.pdf

Different Kinds of Collaborations

or who contributes what, when and why – depending on the boundary conditions

Goal of collaboration:

Realize research project or industrial product
Development for research project: academia defines goals
Industrial product development: industry defines goals

Contribution of Partners:

Basic condition: know-how and ressources (incl. TPs) of partners
Selection criteria: create synergy of partner‘s strength,
basic research, tests, characterisation by academia
manufacturing development, manufacturing by industry
TRL typically influences the SoW of a project

Framework of the collaboration

Agreement on protection of background and use of foreground IP
Financial comittment of partners and funding situation

Wendelstein 7-X fusion device produces its first hydrogen plasma

Federal Chancellor switches plasma on / Start of scientific experimentation

February 03, 2016

The Wendelstein 7-X fusion device at Max Planck Institute f… Physics (IPP) in Greifswald produced its first hydrogen… February 2016. This marks the start of scientific o… 7-X, the world's largest fusion device of the… investigate this configuration's suitabili…

Magnet tests on Wendelstein 7-X successfully completed

Important step in the preparation for operation / first plasma in the fusion device one step nearer

July 07, 2015

…n 10 …stein 7-X has …an 300 discharges with …, helium. These served …nly to clean the plasma vessel. The …cleaner the vessel wall, the more the plasma temperature increased, finally attaining six million degrees. In addition, plasma heating and data recording were tested, and the first measuring facilities for investigating the plasma were put into operation, viz. complex instrumentation such as X-ray spectrometers, interferometers, laser scattering and video diagnostics. "This makes everything ready for the next step", states Project

The LHC collides ions at new record energy

25 Nov 2015

Geneva, 25 November 2015. After the succe… months of data taking with proton collision… with the first… collider expe…

Magnetic field of Wendelstein 7-X exact to a hundred-thousandth

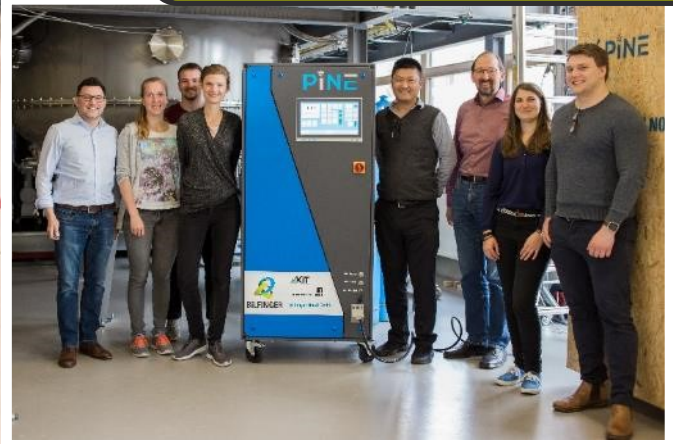
Evaluation of magnetic field measurement / Overview in "… Communications"

November 30, 2016

…perheavy element 117 weighs in

…ded in …n …a …of

Collaborations



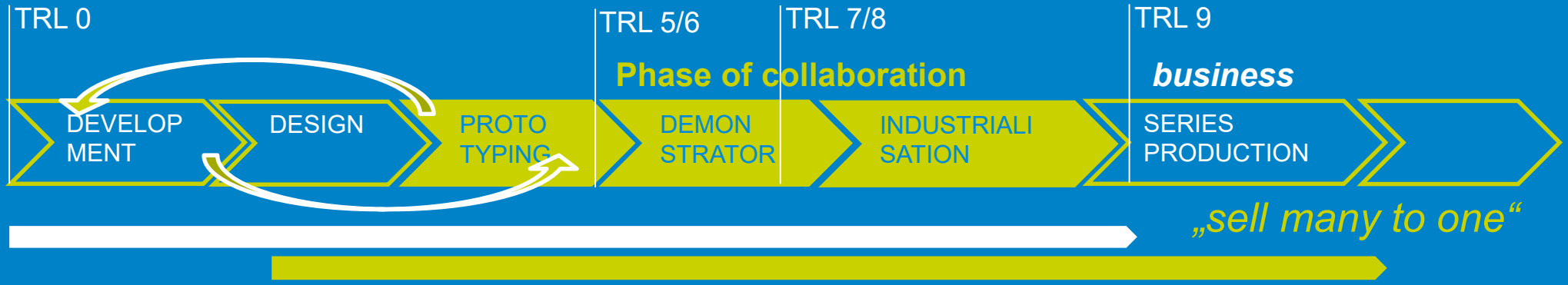
…ent in Cern, home of the

By Adrian Cho | Mar. 14, 2013 , 5:40 PM

Classical Project Oriented Collaborations

Principal setup of successful large scale projects always similar:

e.g.: LHC Dipoles, W7-X np coils, FAIR SIS100 Dipols + QDM, HL-LHC magnets …



Technology Platforms

Develop Functional Requirements and Demonstrators

Knowledge transfer in both directions with the goal of series production capability

http://eu-amici.eu/download/AMICI_Industry_Days_-_BNG.pdf

SUPERCONDUCTING UNDULATORS

https://www.kit.edu/kit/23201.php

SINCE 2007

Karlsruher Institut für Technologie

Institute for Beam Physics and Technology
Prof. Dr. A.-S. Müller

BILFINGER NOELL GMBH

Division Magnet Technology
Dr. W. Walter

Performance of SCUs -

A Proven Advantage

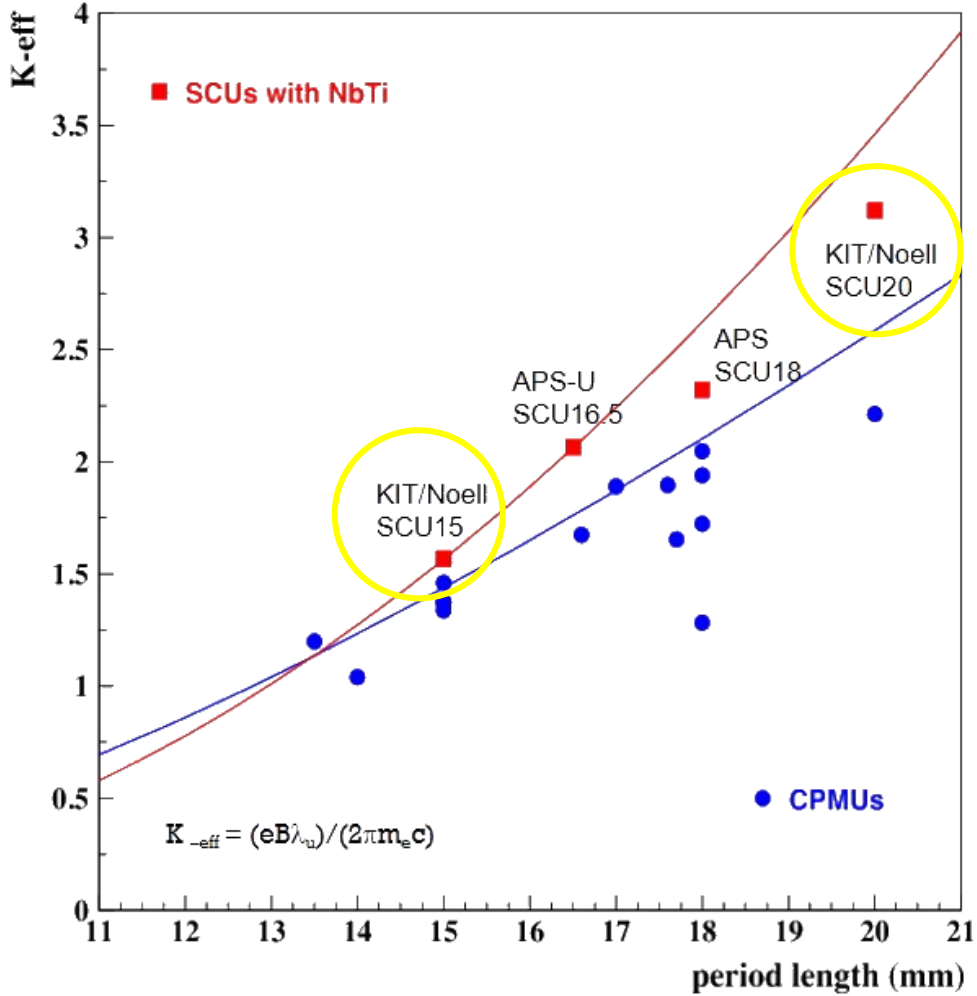
Status 2019:

Two devices manufactured and successfully operated in accelerator producing light

Higher peak field on axis for the same gap and period length in operation with electron beam.

Demonstrated higher radiation resistance compared to permanent magnet undulators.

TP (KARA at KIT): assisted development with **scientific input**, provided **testing and characterization** facility (CASPAR-2), was essential to **demonstrate** project success (ANKA/KARA)



Prototype to Product

KIT-NOELL collaboration from TRL0 to TRL9

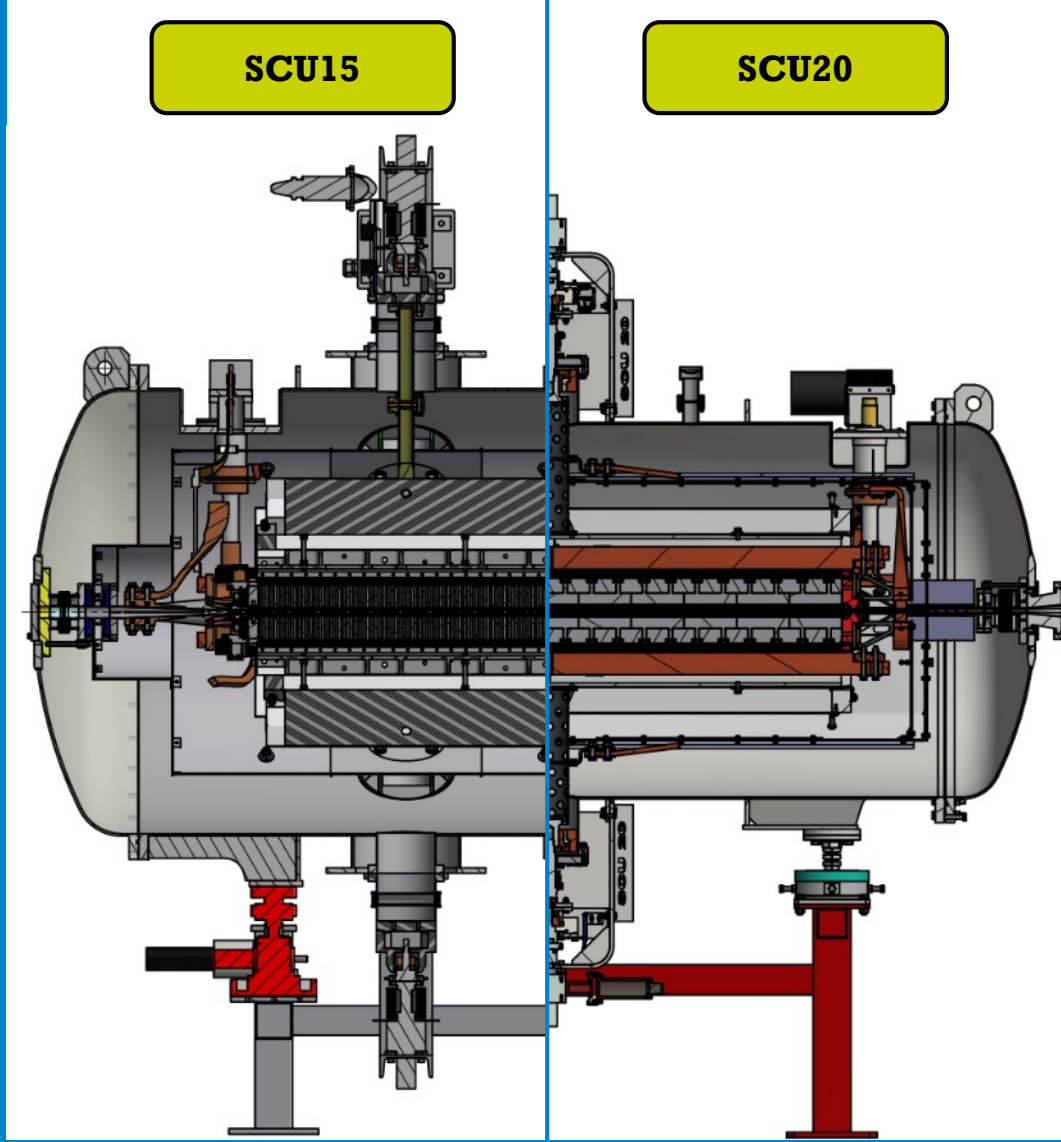
Throughout all development phases:
TP: accelerator and insertion device expertise
Industry: magnet expertise

Design, development:
TP: basic research on SCUs, test of mock-ups
Industry: manufacturing of mock-ups, development of complete magnet design

Demonstrator, industrialisation:
TP: test of components, test of demonstrator and product
Industry: manufacturing of demonstrator and product

Series product:
TP: test of product (incl. component tests)
Industry: manufacturing of product

Succesfull collaboration throughout all TRL exploiting synergies of TP and Industry core competences!



Product Development:
Scientific Instrument

https://www.noell.bilfinger.com/pine/

https://www.kit-technology.de/en/newsletter/innovation-project/

BILFINGER

NOELL

Dr. W. Walter, T. Pfeuffer, C. Boffo

Karlsruher Institut für Technologie

Institute of Meteorology and Climate Research Atmospheric Aerosol Research

Dr. O. Möhler, Dr. L. Lacher

UNIVERSITY OF LEEDS

Mobile Cloud Chamber

PINE revolutionizes the field of atmospheric ice nucleating particle measurements

Allows researchers to perform fully automated campaigns and long-term monitoring down to -60°C.

Application in cloud physics research

https://www.noell.bilfinger.com/pine/

TP KIT AIDA as competence center in cloud chamber technology developed demonstrator for scaled down cloud chamber (TRL6/7)

NOELL as industrial partner with expertise in industrialization, vacuum technology and cryogenics

Collaboration to bring the PINE cloud chamber to TRL9
TP: tests incl. evaluation, software for data-analysis, calibration of PINE at cloud chamber AIDA
Industry: new user friendly cooling concept (patent), product design with prototyping on components, manufacturing

PINE: highly integrated system for Ex-Lab use hit market successfully after development cycle <12 month!

SC flywheel energy storage
Project FlyGrid

Bilfinger Noell GmbH

Karlsruher Institut für Technologie

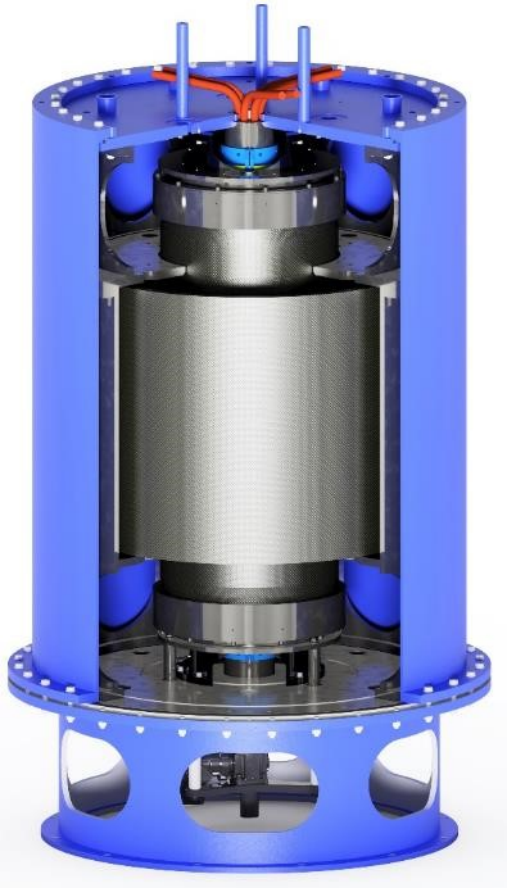
NHF netze
Ein Unternehmen der ZEAG Energie AG

Supported by:

Federal Ministry
for Economic Affairs
and Energy

on the basis of a decision
by the German Bundestag

ptj



Fast cycling energy storage to improve power quality

- Smoothing/buffering of energy feed-in
  for distributed / volatile / renewable generation
- Grid stabilization and support at local nodes
- Power management in industry, public transportation
  and island networks

Advantages

- High power in small foot-print
- No degradation under cycling
- Frequency and voltage control
- Spinning reserve
- Black start capability

Project initiated and led by Noell

Previous projects:

- NOELL in-house development of demonstrator
- BMWi funded project with TU-Braunschweig (IMAB) and DLR to develop the protoype

Goal of FlyGrid – Industrialization (TRL8/9):
Develop industry ready Flywheell (NOELL and KIT-ETI), demonstrate performance at KIT Power hardware in the loop TP (KIT ITEP), demonstrate performance in the field (Netzgesellschaft Heibronn Franken)

Publically funded by BMWi

TP KIT: development of power electronics, test and characterization of prototype
Industry (NOELL and NHF): prototype, field test

Conditions, Constraints, Perspectives

Conditions, Constraints, Perspectives

- TP's and industry are complementary and enable synergies to be leveraged:

  TPs (scientific research, test …) industry (manufacturing, industrialization …)
- All partners must gain added value (know-how, resources, publications, benefit,…)
- Academia could support industry by
  - Providing test infrastructure and expertise for characterization and qualification
  - Support product research and development with know-how
- Industry could support academia by
  - Studies, prototyping and series productions (cost and schedule optimization)
- Support of development activities by public funding is essential for TPs and industry

Conditions, Constraints, Perspectives

- Large research projects (FCC, DEMO, Light sources…) as technology drivers
  - Academia's strength: research, development and complex tests
  - Early involvement of industry by studies and prototyping can reduce cost
  - Manufacturing at industry necessary to secure industrial know-how and jobs
- Product development
  - TP needs funding to provide and conserve know how and infrastructures
  - Administration for TP services have to be simple and fast, IPR regulations too
  - Reliable planning and availability of personnel and equipment is essential

Conditions, Constraints, Perspectives

- Cooperation of TP's and industry enables synergies and is essential for progress
- Collaboration works best when both sides bring in their strength
- A win-win situation is essential (common project goals, fair share of funding and risks, commensurable IP regulations)
- New products and markets can be opened up with the development of the institutes and product development in the industry. (RoI to TP's through IPR royalties)
- Funding must be adapted to the specific requirements, new tools (e.g. innovation partnerships) enable new chances

Thank you!
Q U E S T I O N S ?