

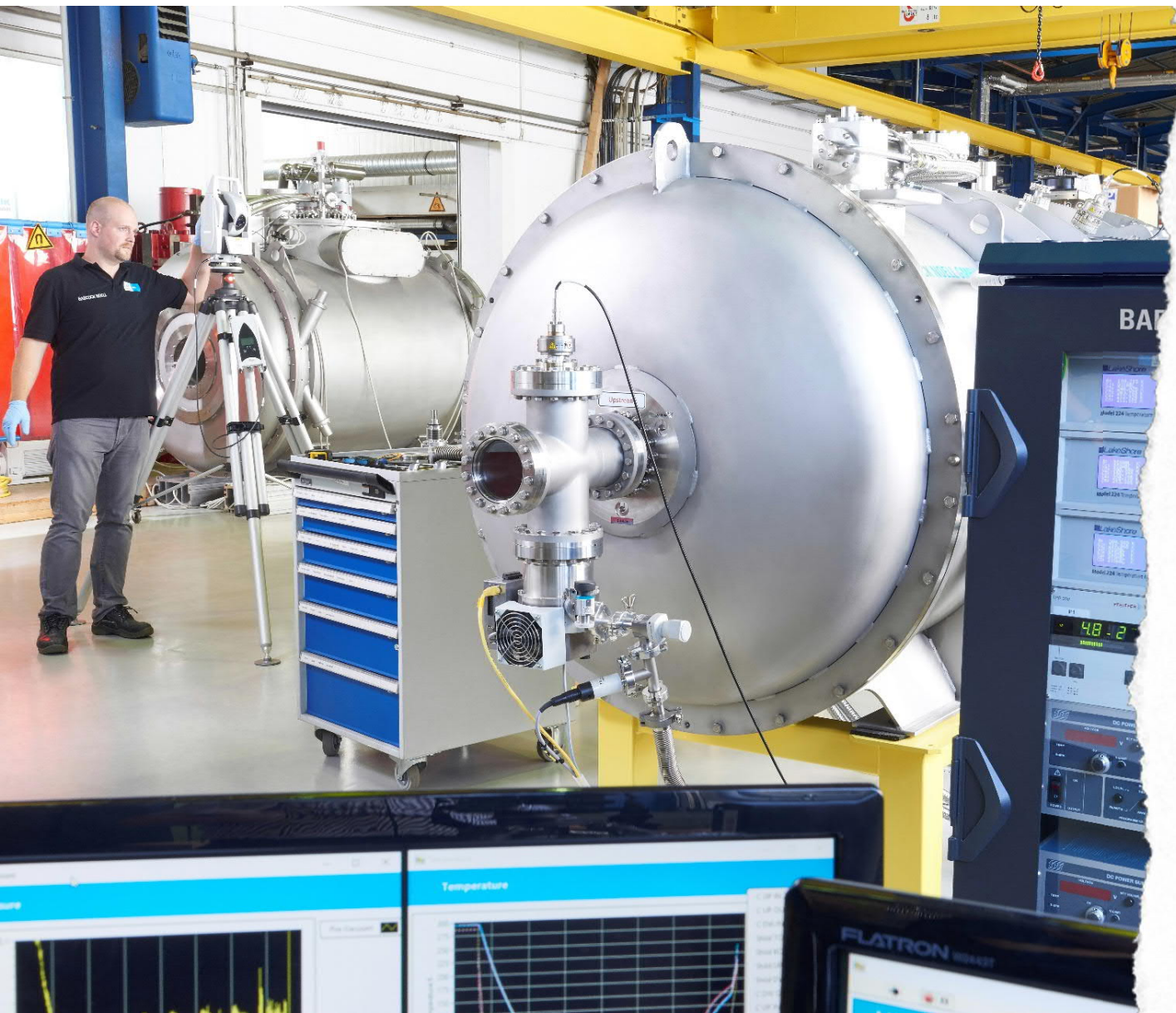


BILFINGER

Bilfinger Noell GmbH an overview

Bilfinger Noell GmbH | Superconducting Detector Workshop - CERN

13.09.2022



Outline

Bilfinger SE

Bilfinger Noell

Magnet Technologies

Summary

Bilfinger Noell a Member of Bilfinger SE – Overview

The 2-4-6 concept / 2 service lines



T – Technologies



E&M –
Engineering & Maintenance

2 SERVICE LINES
Technologies
Engineering & Maintenance

4 REGIONS
Northwest Europe
Continental Europe
North America
Middle East

6 INDUSTRIES



Chemical
& Petro-
chemical



Oil & Gas



Energy &
Utilities



Pharma-
ceuticals &
Biopharma



Metallurgy



Cement

Bilfinger Noell GmbH

*in Wuerzburg Germany since 1824,
part of Bilfinger SE since 2005*



Solutions and Services for all branches in the areas of:

- **Magnet Technology**

Bespoke solutions in magnet, cryo and vacuum technology, starting from design to finished

- **Nuclear Technology**

Planning, Engineering, manufacturing, construction, maintenance and disassembly of components and plants

- **Service and Montage**

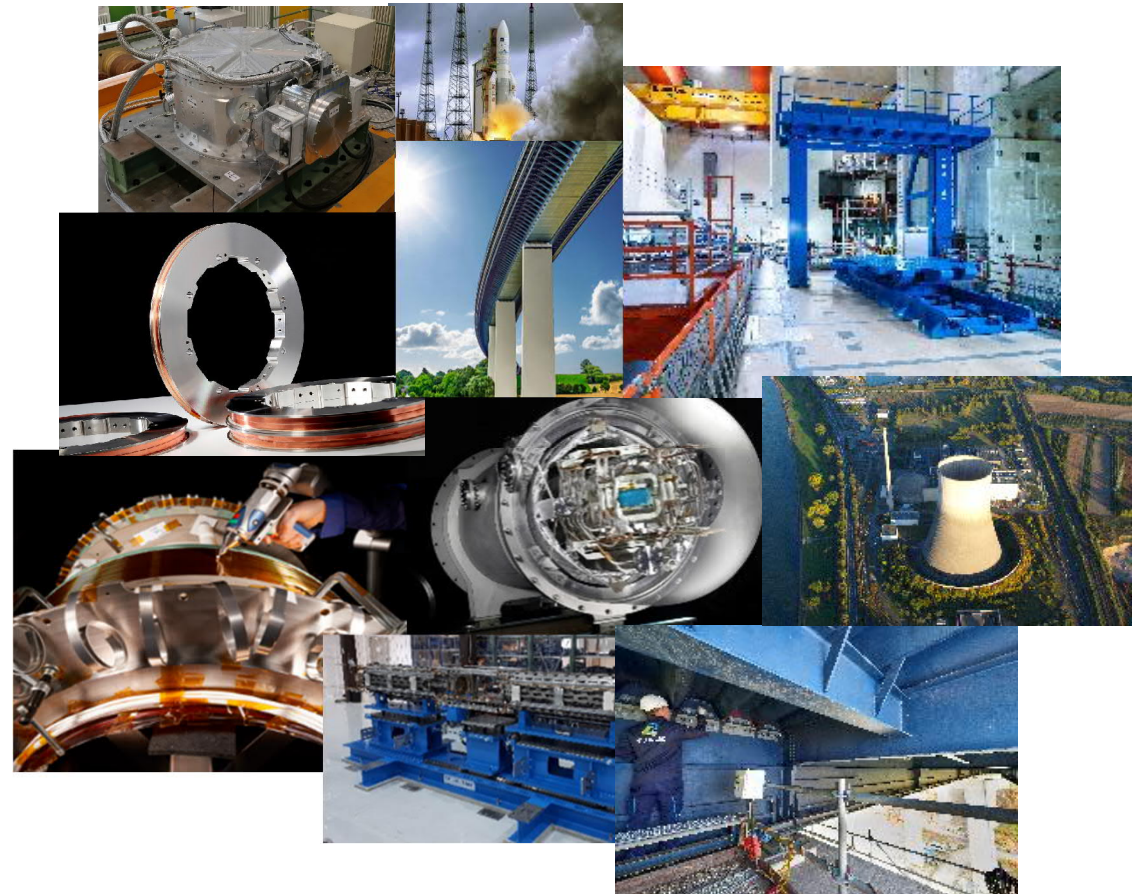
Manufacturing, operation and maintenance of Bilfinger Noell products

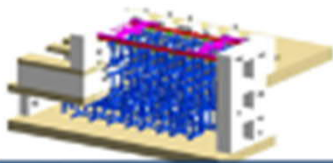
- **Structural Health Monitoring**

Continuous destruction free monitoring of mechanical structures

- **PINE – INP Measurement System**

Mobile, fully automatized measurement of ice-nucleating particles for cloud and climate research





Engineering



Key Components & equipment for NPPs



Complex piping For NI, TI & BOP



High quality welding technologies



Waste Treatment equipment & facilities



Decommissioning activities



Automation, E,I&C



Inspection & Non-Destructive Testing



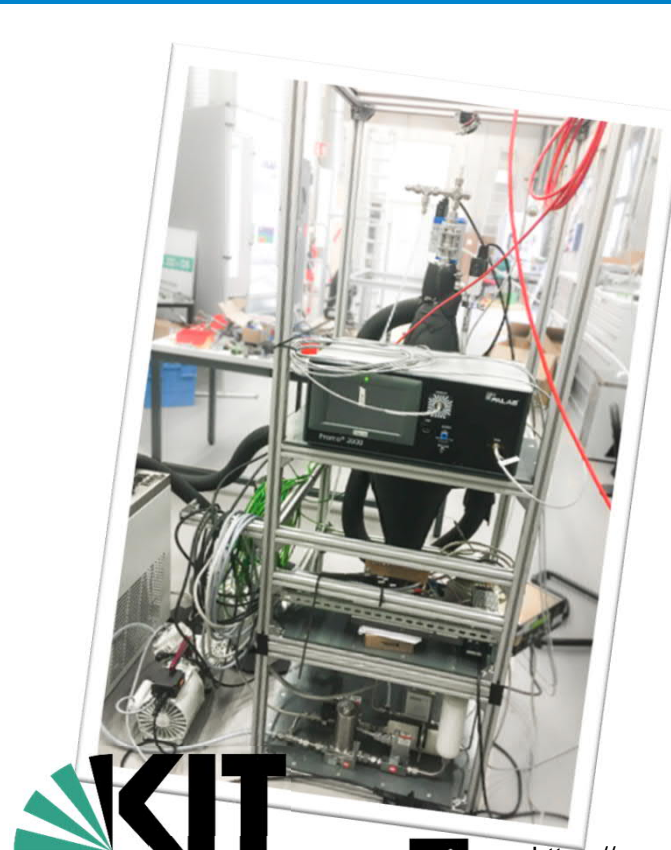
Magnet technology



Insulation, Scaffolding, Painting

PINE – mobile cloud chamber for cloud research

Knowledge Transfer from successful experiment to Instrument



UNIVERSITY OF LEEDS

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

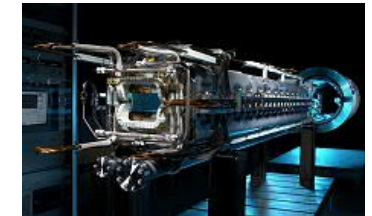
<https://www.kit-technology.de/en/newsletter/innovation-project/>

Bilfinger Noell GmbH

Superconducting Magnet Technology from A to Z



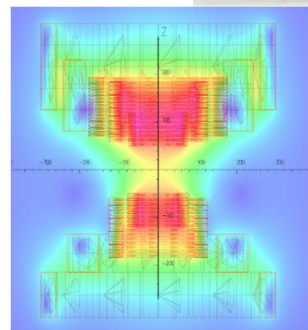
We support your project from the first idea with functional design studies, engineering, manufacturing, operation and maintenance to disassembly.



We are able to draw our our experience from Diverse projects, covering the entire spectrum of superconducting magnets to find the optimal solution for you.



~ 20 cent



Bilfinger Noell Products

Magnet Technology, custom solutions and series manufacturing



Superconducting Accelerator Magnets



Transportable Solenoid Magnet System



PiNE Mobile Cloud Chamber



Customized Solenoids



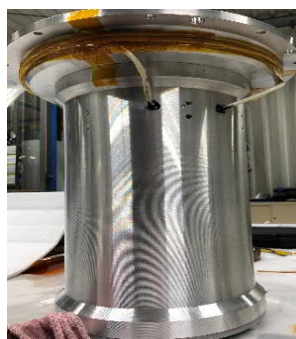
HTS Magnets



Cryo- & Vacuum Technology



Sample Environment Solenoids



Superconducting Insertion Devices



Superconducting NSE Spectrometer



Magnets for Nuclear Fusion





**BILFINGER
NOELL GMBH**

Magnet Technology 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

Spectrum of Performance

TRL

0

1

2

3

4

5

6

7

8

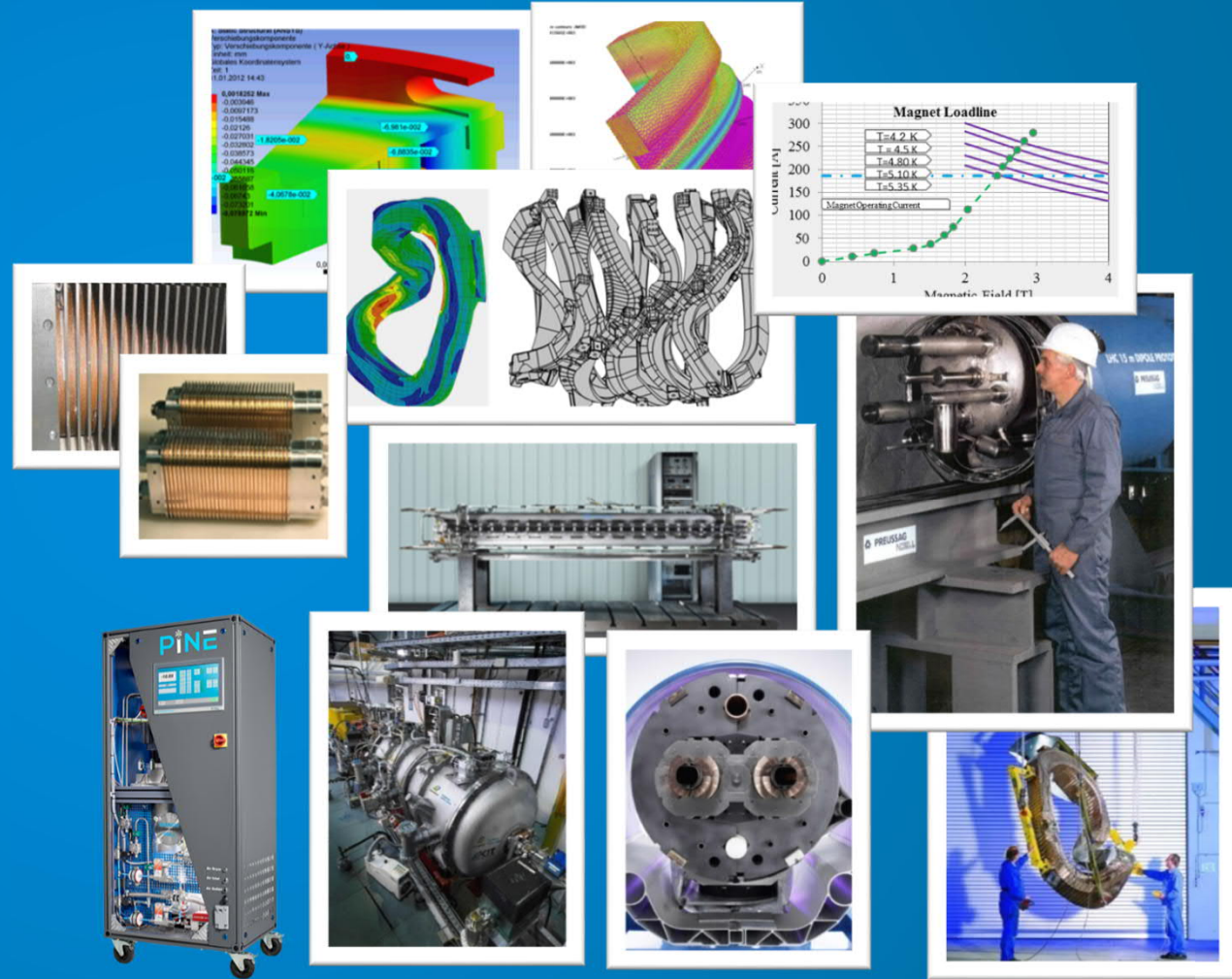
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Studies: Feasibility, Cost, Industrialisation; Functional Design, Design Engineering, etc.

Mock-Ups, Testing, Process development and validation, Test stands, platform development

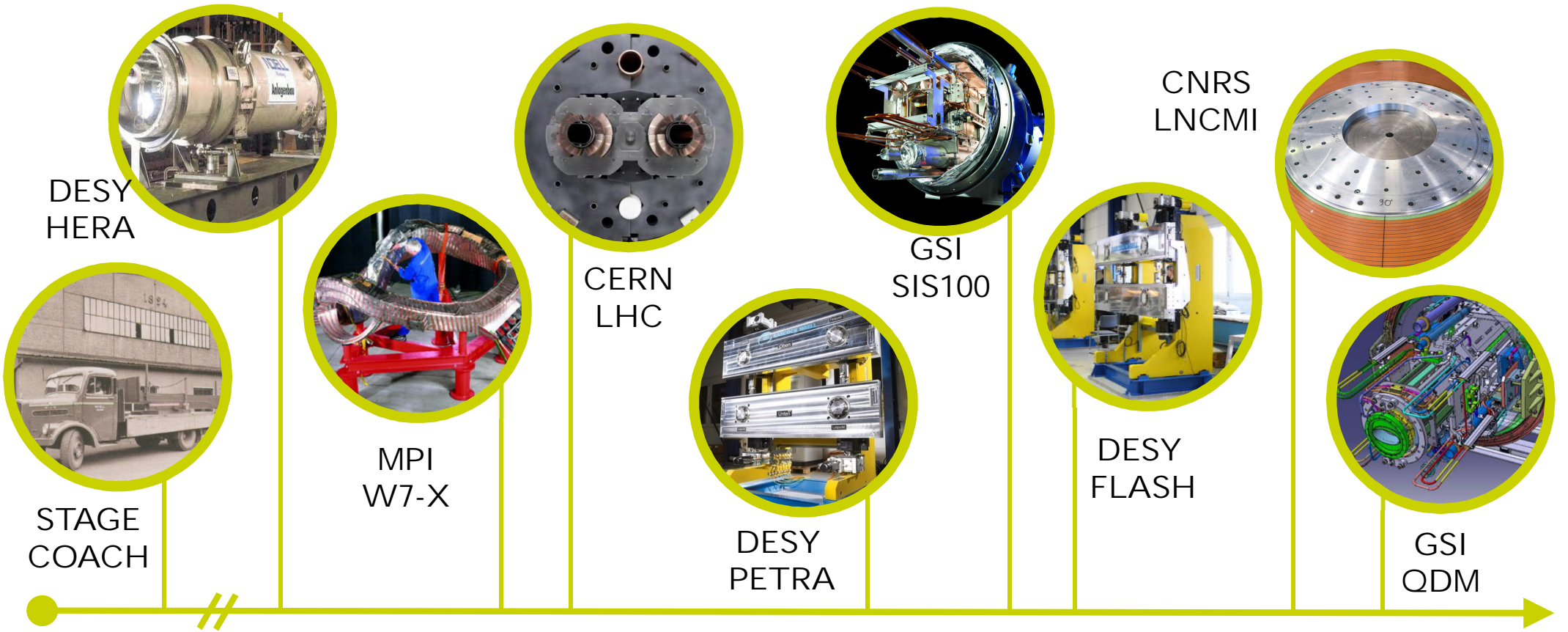
Prototypes, First of Series Single Systems, One of a kind

Series Production, modular product platform



SERIES production at NOELL

A history of performance since 1824



SERIES production for FAIR

SIS100 Dipoles

111 magnets
Maximum flux density 1.9 T
Ramp rate 4 T/s
Total weight: 3 mt (per magnet)
Length: 3.2 m (per magnet)
Production rate: 1 magnet per week

Production of over 20 km of Nuclotron type cable at Bilfinger Noell GmbH



SERIES production for FAIR QDM

Integration of 83 Quadrupole Doublet Magnets (QDM) and manufacturing of
12 Missing Dipoles (MDP)



Quadrupole cold mass in kind from Russia – Production currently stopped

Superconducting Insertion Devices for Lightsources

Prototype to Product

Since 2007 Noell is developing superconducting undulators with KIT

Two devices (SCU15 / SCU20) produced and successfully operated in accelerator

SCU20 is a technology platform for superconducting insertion devices

Other devices delivered:

SCU16 for Australian Lightsource
Sc Wiggler for NSLS II – HEX beamline



Large Bore Solenoid VATESTA for materials testing

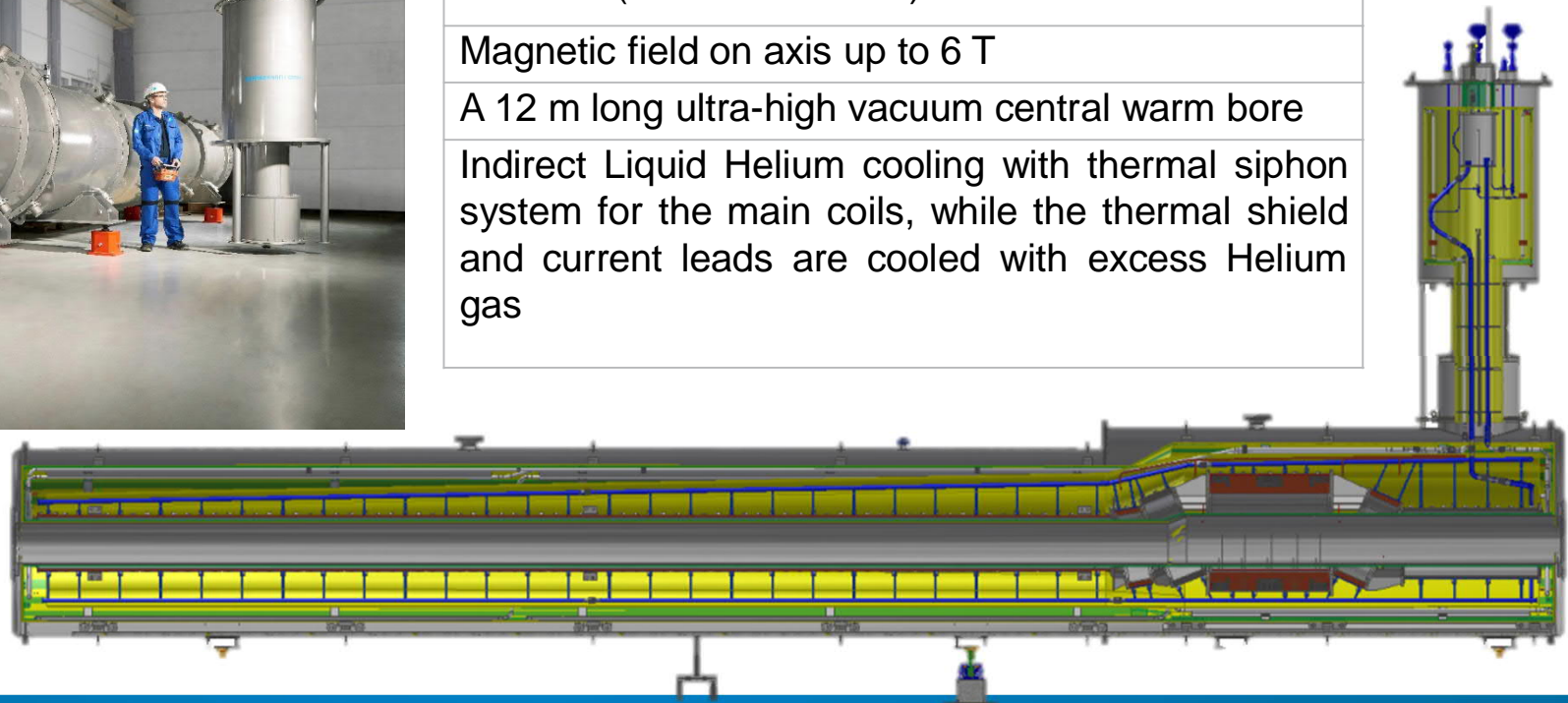
Diameter warm bore	800 mm
Conductor	NbTi
Central magnetic field	5 T
Warm bore diameter	800 mm
Field homogeneity	5% in a cylindrical volume of 200 mm length 100 mm diameter on the central axis
Operating temperature	4.5 K



Magnet array for PERC experiment



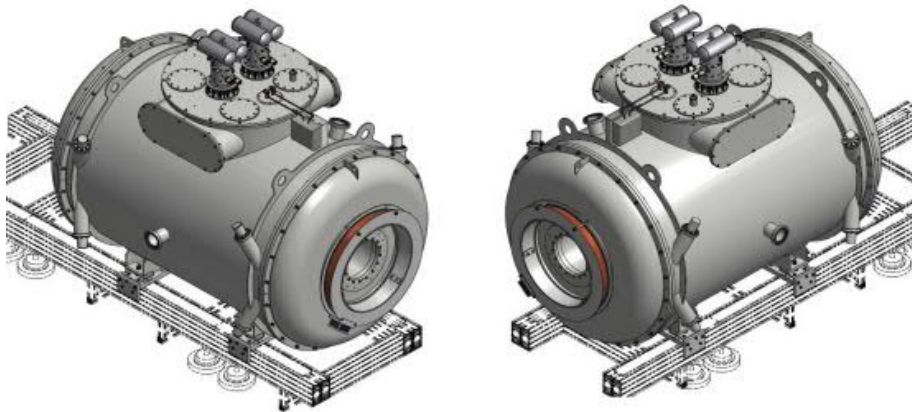
PERC
11 solenoids, the longest with a length of 8 m
2 types of superconductor: both NbTi in a Cu-Channel (Wire-in-Channel)
Magnetic field on axis up to 6 T
A 12 m long ultra-high vacuum central warm bore
Indirect Liquid Helium cooling with thermal siphon system for the main coils, while the thermal shield and current leads are cooled with excess Helium gas



Neutron SPIN ECHO SPECTROMETER

Key facts about the NSE spectrometer:

- 5 pairs of field- and corresponding shielding solenoids per magnet
- Cryogen-free
- Field integral homogeneity of 10^{-6} Tm along different neutron paths through the solenoids
- Axial forces up to 220 kN
- 2 full systems delivered



Background solenoid for ALPHA-g experiment

ALPHA-g

1 T magnetic field on axis

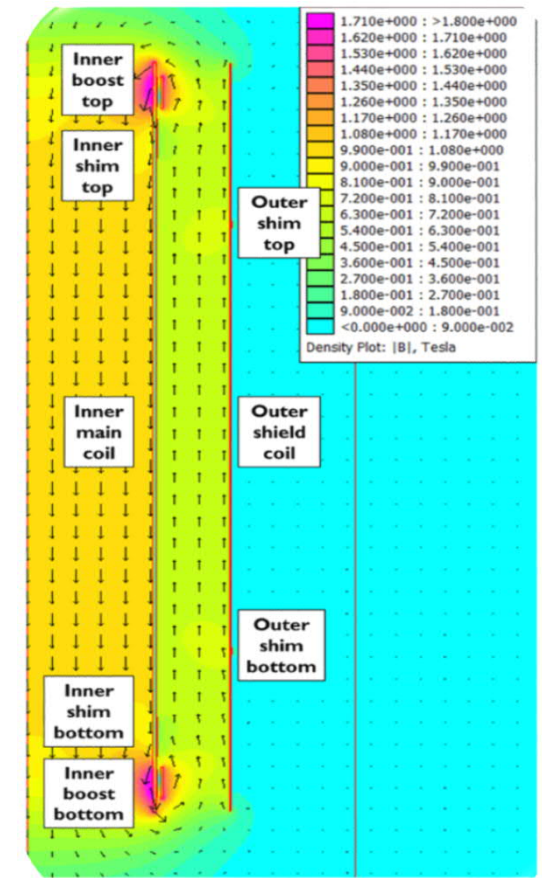
<0.1 % homogeneity cylinder volume, length 1500 mm, Ø 50 mm

Active shielding: Less than 3 Gauss at 3 m from center

Ø 500 mm room temperature bore

Cryogen-free with 2 PulseTube-type cold heads

Conduction cooling for coils, shield and current leads

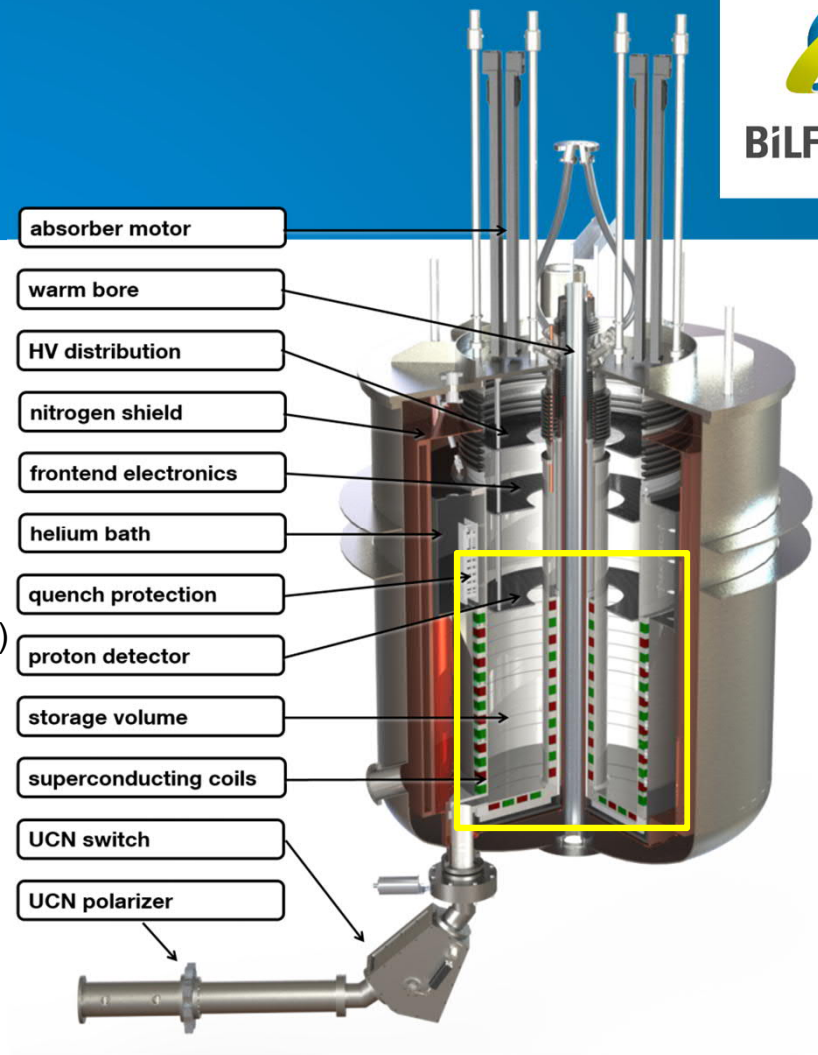


Magnet array for PENELOPE experiment

Neutron trapping for Lifetime measurement



High magnetic field gradient
 108 cm maximum coil Ø
 5.4 T maximum field @ coils
 1.8 T usable trap field (110 neV)
 100 s ramp-up time
 1.2 MN max. axial coil force (quench)
 30.8 H series inductance
 1.24 MJ magnetic energy
 30 – 110 neV neutron energy (< 1 mK!)

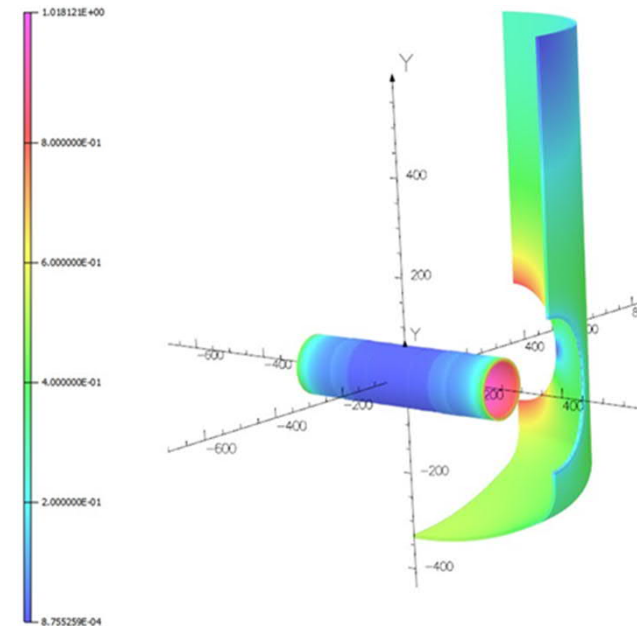


- 24 solenoids
- Cooled with liquid helium bath

Background magnet for BASE STEP

Antimatter trapping

- 3 solenoids
- Cooled with 1 PT cryocooler
- Persistent mode with PCS <1 ppm/h
- Passive magnetic shielding < 5 gauss @ 1 m
- Cold diameter 110 mm
- Magnetic length 500 mm
- Axial magnetic field 1.0 T
- High field quality in dia 5 mm x L100 mm
- Operating current 33 A
- Inductance 3.6 H
- Passive quench protection system
- Transportable with truck at full field!





We provide MORE

Capabilities that count

More than MANUFACTURING

Technical design including feasibility studies, costs and schedule.
Industrialization and production line management.
Testing, installation and maintenance.

More than SUPERCONDUCTIVITY

Resistive and permanent magnet components and systems.

More than MAGNETS

Cryogenic, vacuum and insulation technologies.
Power and energy storage.
Specialized machines and devices.

Contact



Bilfinger Noell GmbH
Alfred-Nobel-Str. 20
97080 Würzburg
Germany

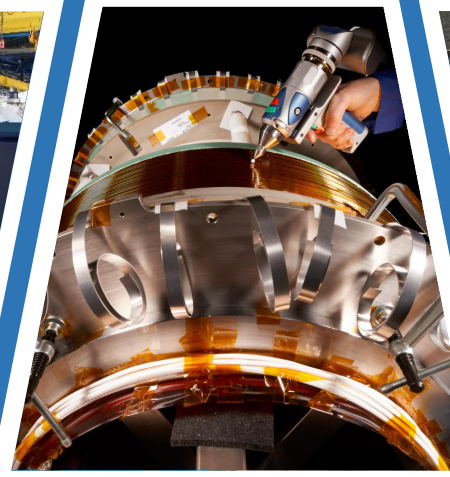
Phone +49 931 903-0
Fax +49 931 903-6000
noell.info@bilfinger.com
www.noell.bilfinger.com

Registered at Local Court Würzburg, HRB 7156
VAT-Id. No.: DE211420259

Executive Management:
Roland Pechtl

Interested in collaborating?

michael.gehring@bilfinger.com



Your PARTNER in INNOVATION

