The Material Engineering Diffractometer BEER at ESS

Instrument overview and status reminder

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Jochen Fenske[2], Mustapha Rouijaa[2], Gregor Nowak[2],
Martin Müller[2], Dirk Jan Siemers[2], Rüdiger Kiehn[2],
Markus Strobl[3], Robin Woracek[3]

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Software Workshop on Engineering Diffraction

Outlook

1. Introduction and reminder of science case
   - BEER instrument teams
   - Engineering Materials
   - Science case
   - Instrument modalities
2. Current instrument status & time schedule
3. Instrument environment and layout
   - Operational environment
   - Instrument component description
   - Day-one performance
   - Sample environment
4. Summary
   - Work-package definition

BEER instrument teams

Presentation of the teams and team members

Nuclear Physics Institute CAS

Czech Republic

Leading Scientist

- Přemysl Beran

Leading Engineer

- Radim Šejda (NUVIA)

Core team members

- Jan Šaroun
- Petr Lukáš
- Petr Šittner

Helmholtz-Zentrum Geesthacht

Germany

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Zentrum für Material- und Küstenforschung

Leading Scientist

- Jochen Fenske

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- Dirk Jan Siemers

Core team members

- Martin Müller
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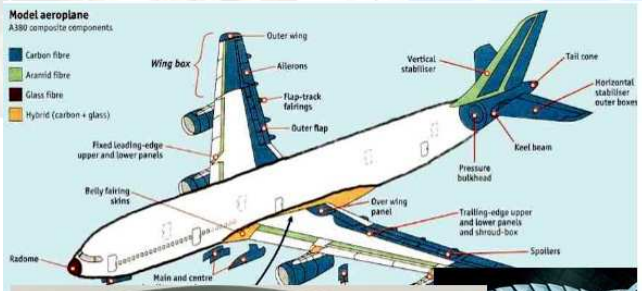
- Gregor Nowak

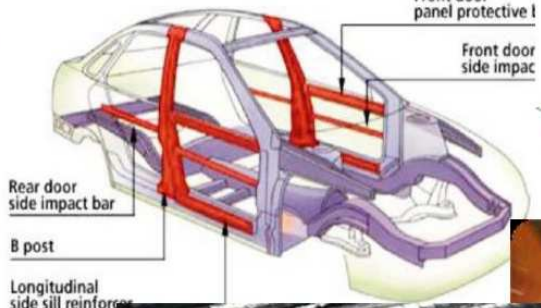
Engineering Materials

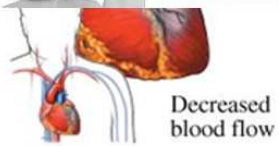
Areas of engineering research

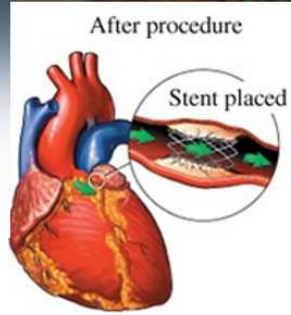
Beamline for **E**uropean Materials **E**ngineering **R**esearch

"BEER"







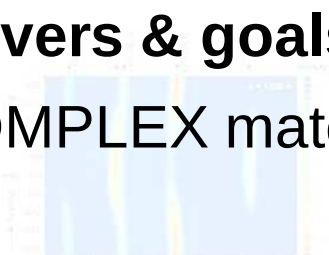


Science case

Why the BEER instrument is proposed?

Scientific drivers & goals

- more COMPLEX materials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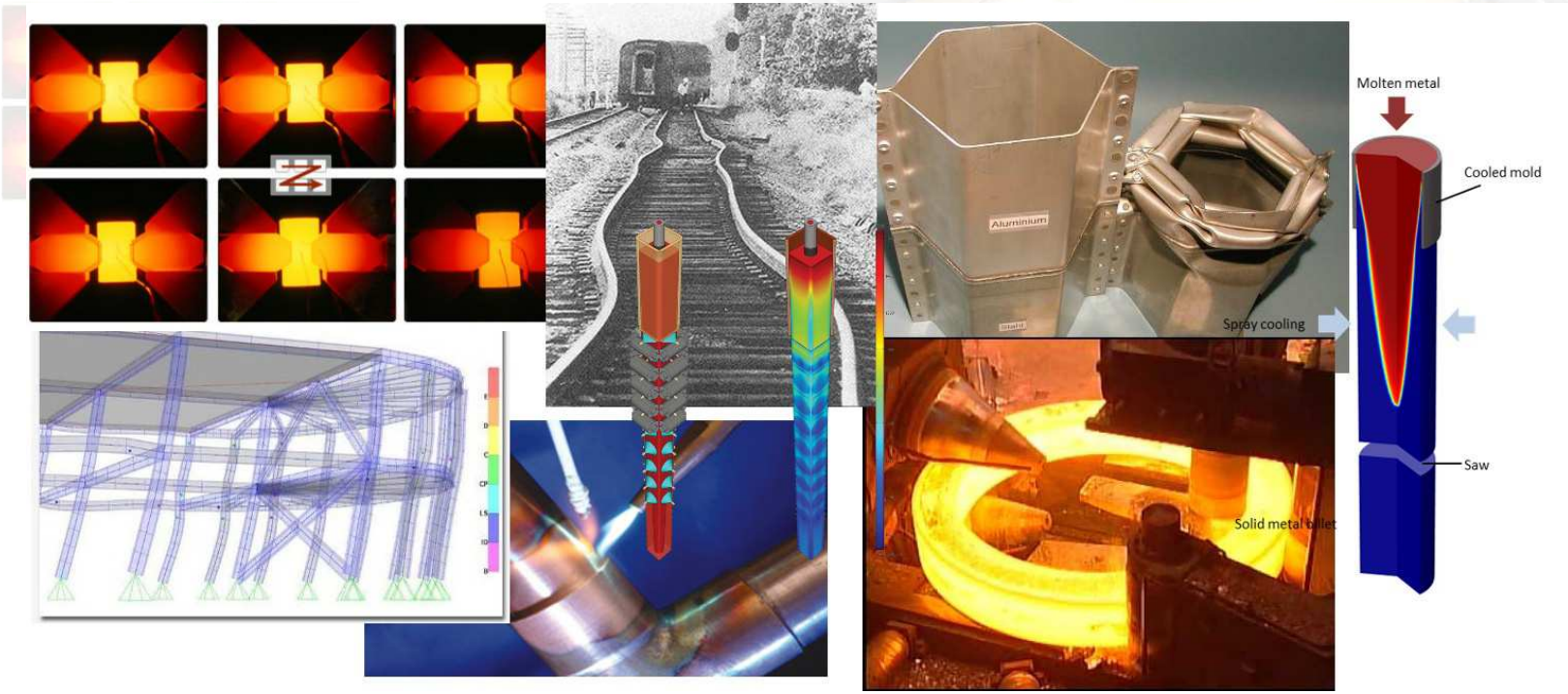

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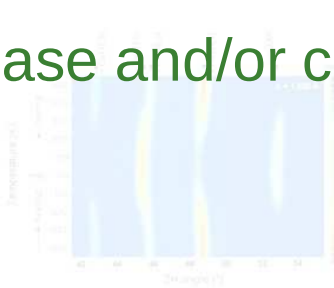
- Multi-phase and/or composite materials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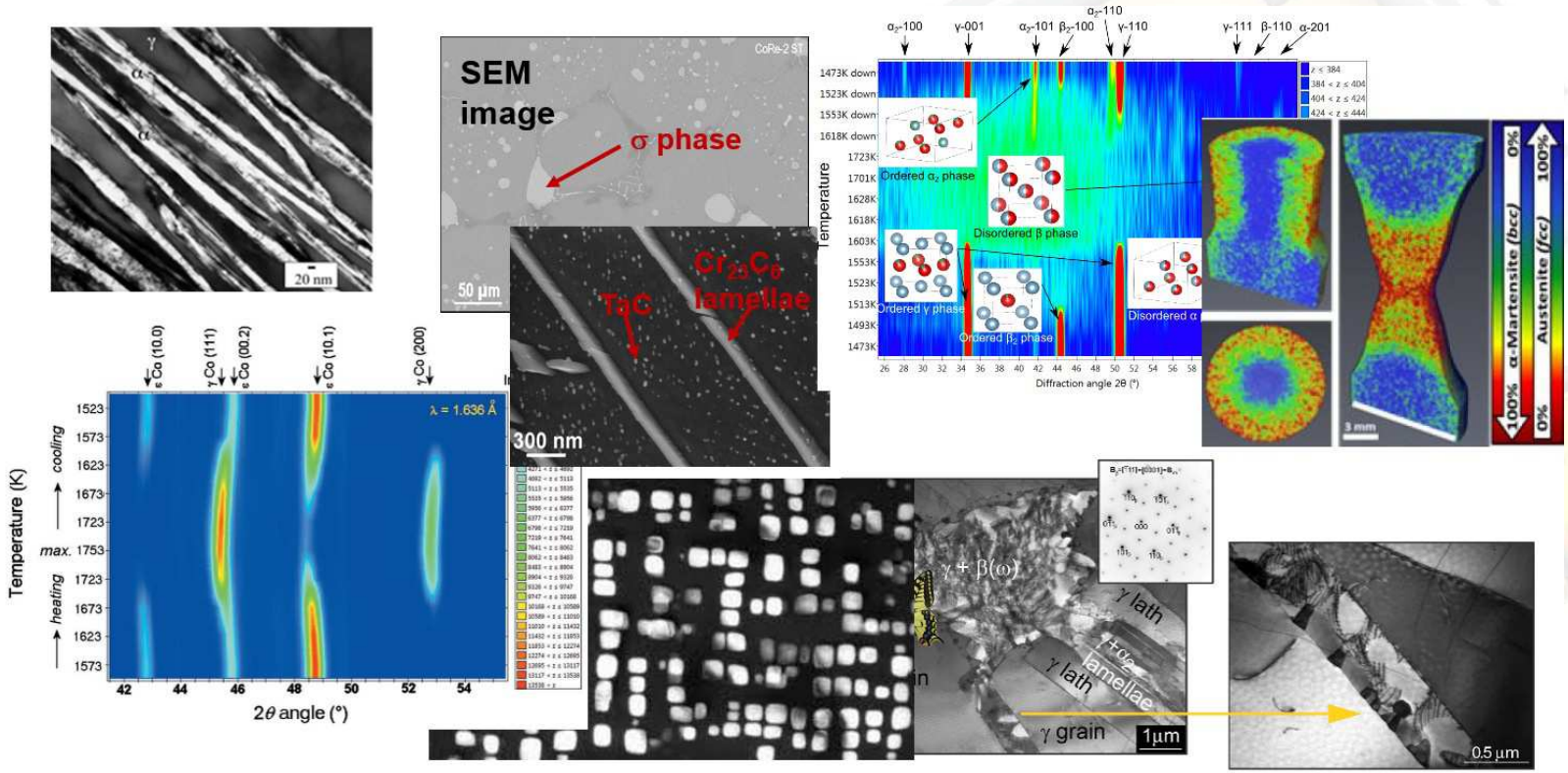

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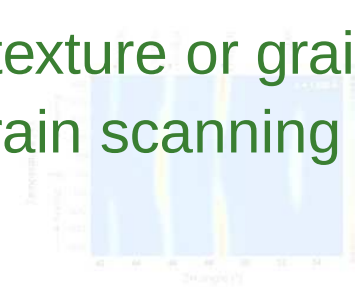
- Fast strain scanning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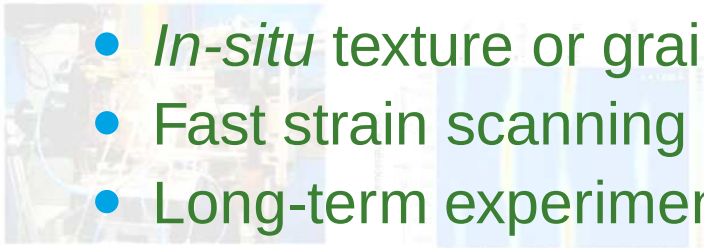

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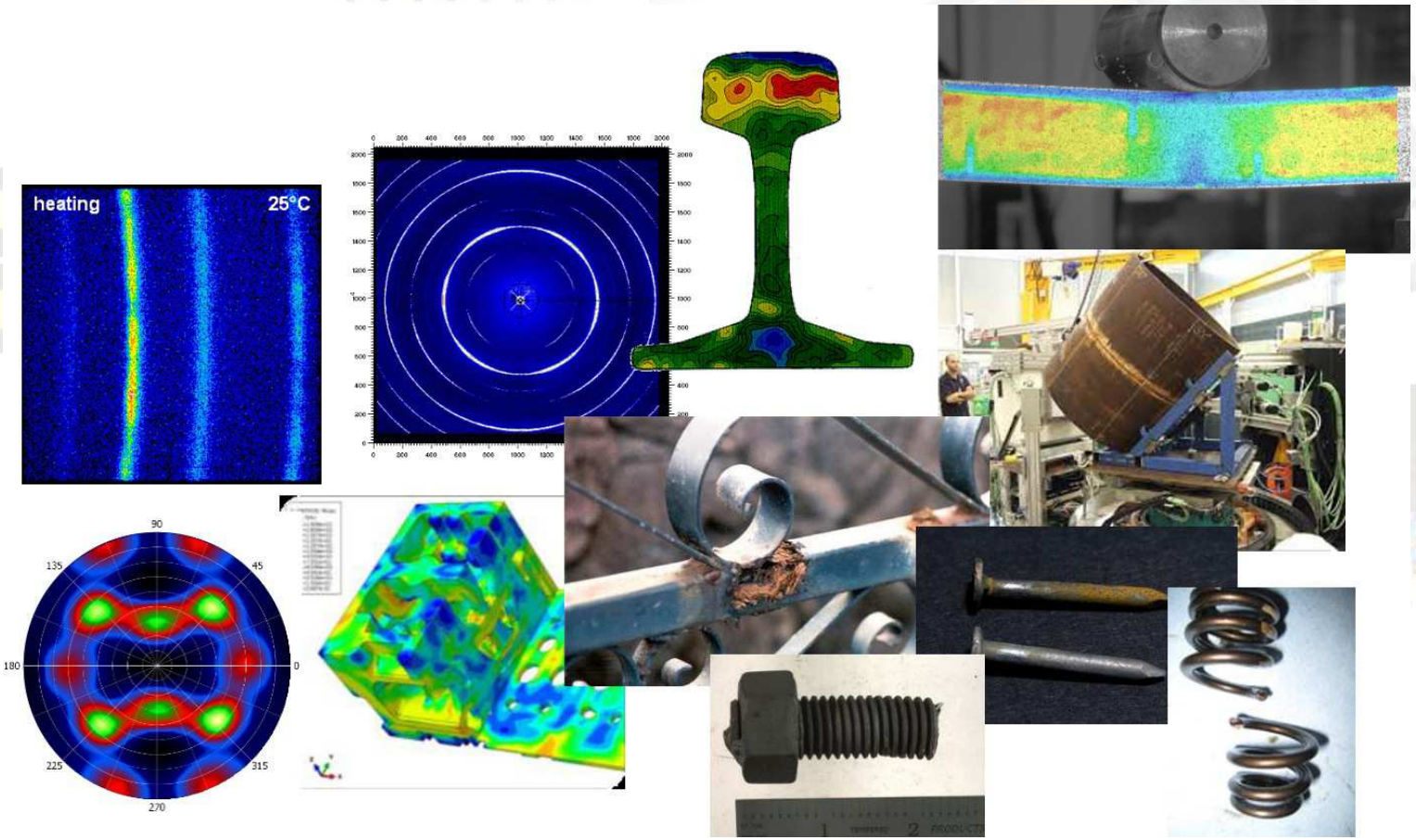

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Current status of the BEER instrument

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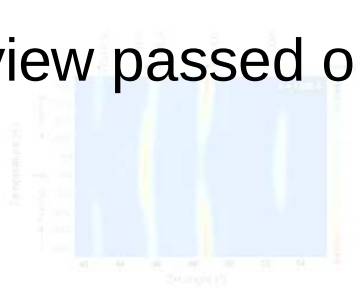
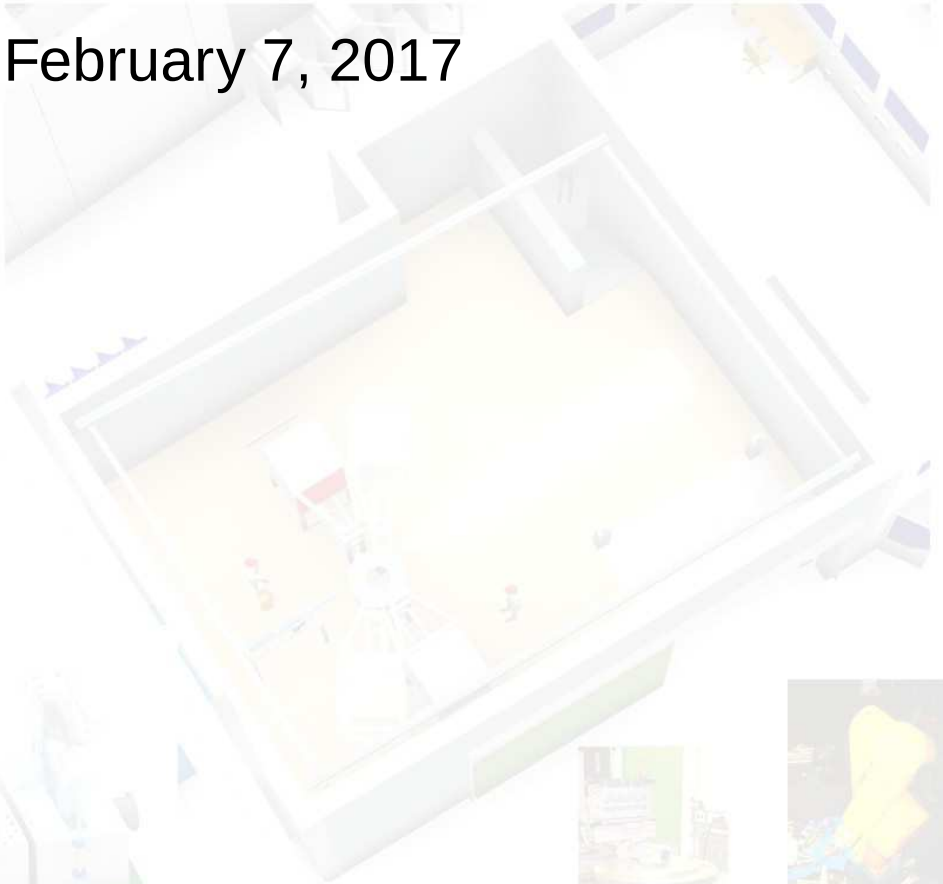

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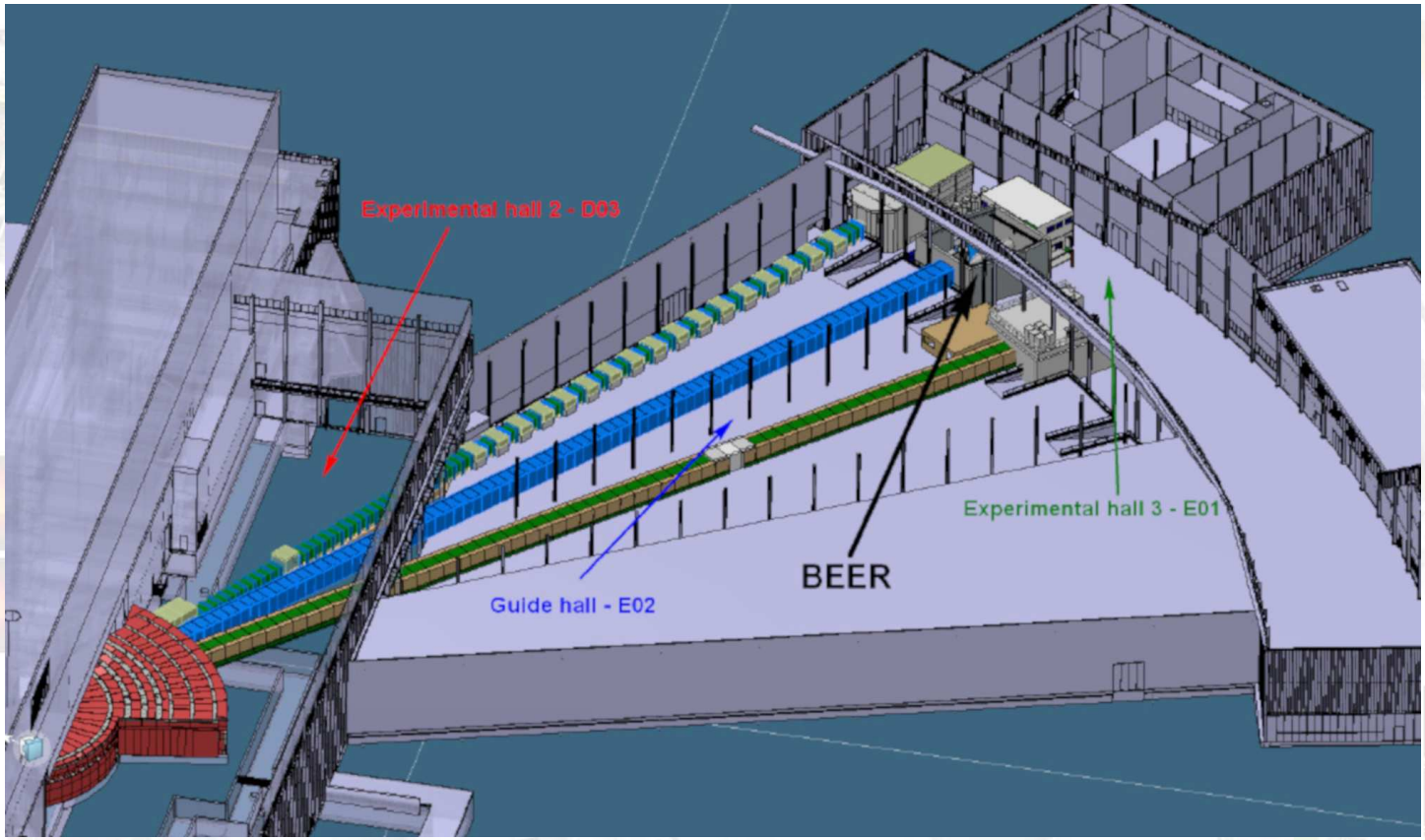
- beam on target Sep 2022
- start of hot commissioning 2023
- user program starts end 2023

Operational environment

BEER position on the ESS site



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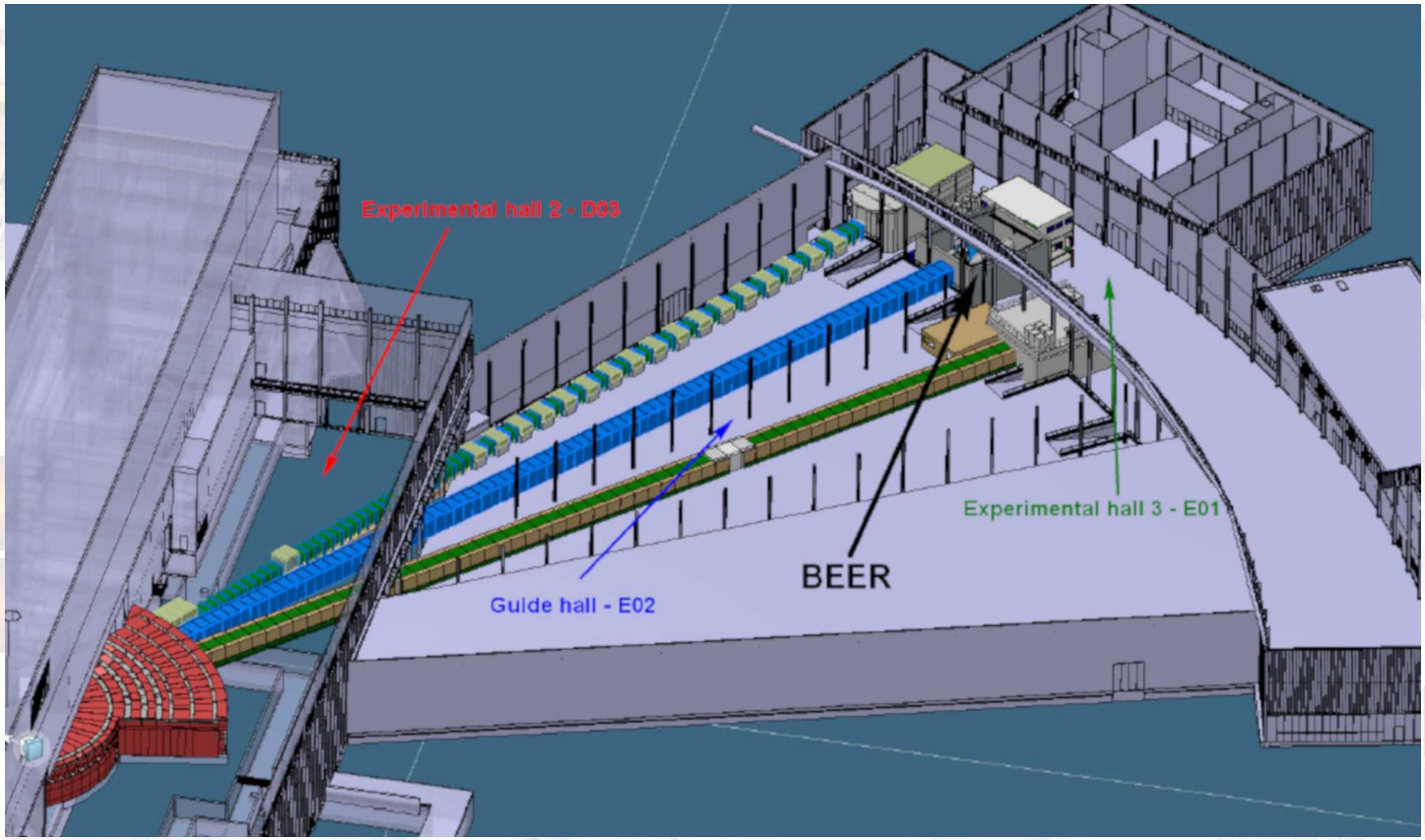
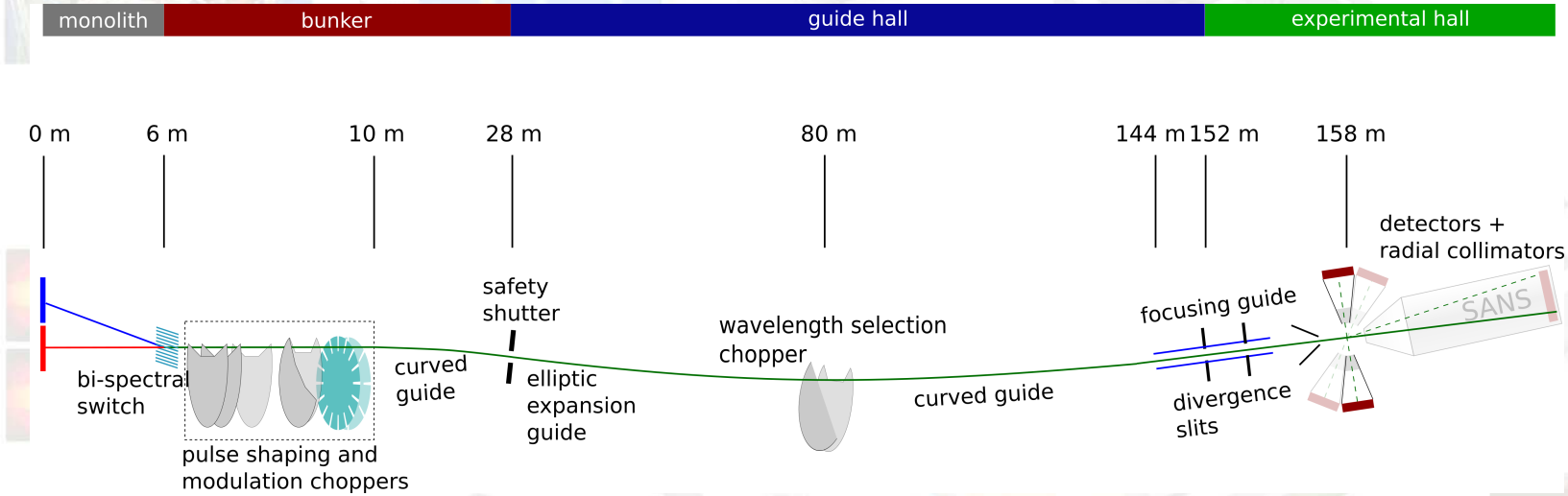


- 158 m long isntrument (distance from source to sample)
- neighbour instruments NMX (crystallography) and C-Spec (spectrometer)
- preparatory lab below control hutch
- SLIM lab for storage and long term experiments (20 m from cave)

BEER instrument layout

Description of the main parts of the BEER instrument



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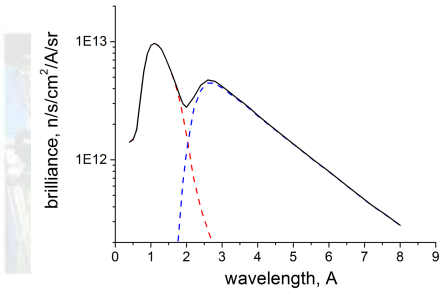

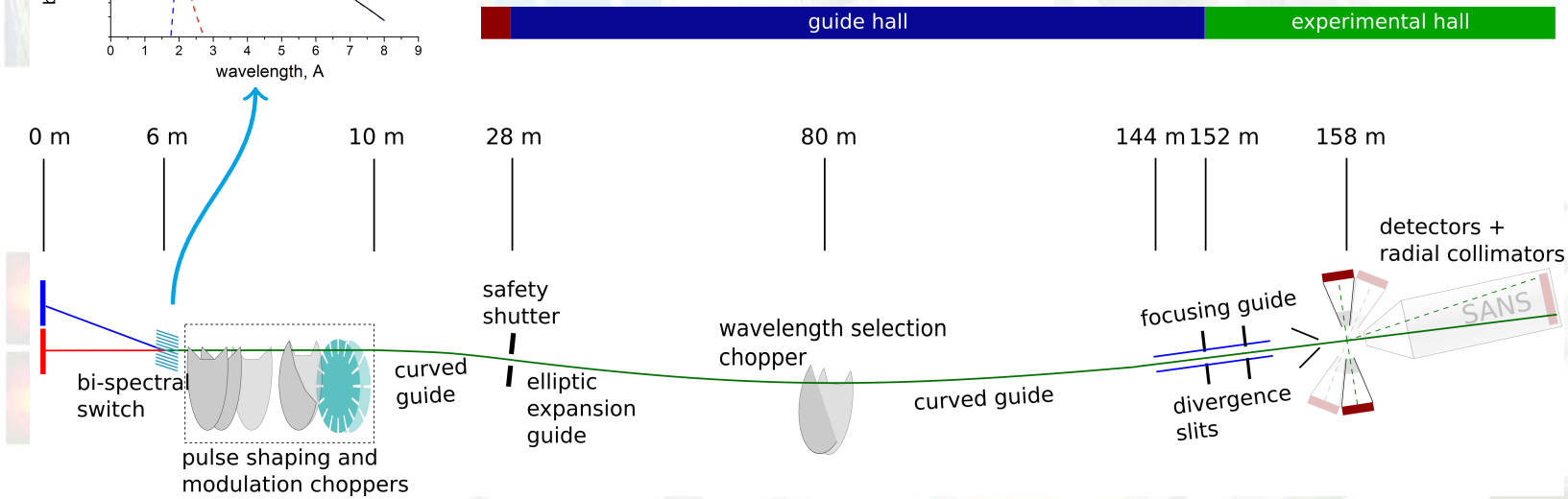

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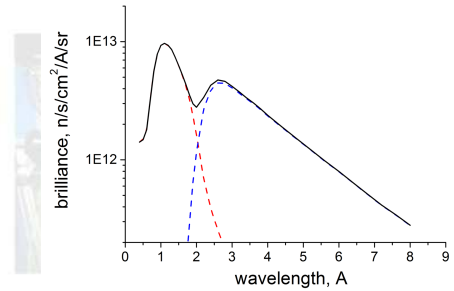

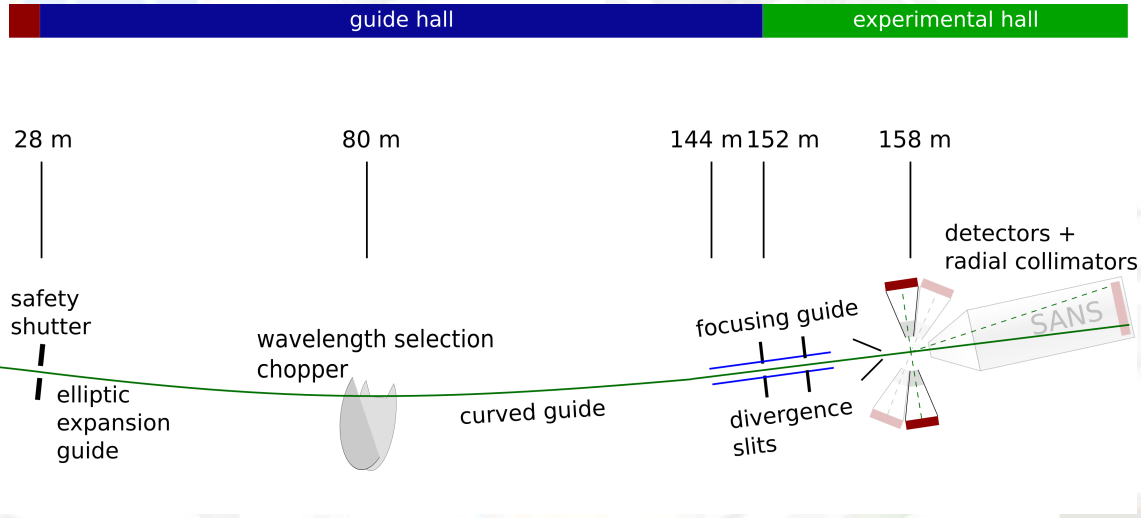

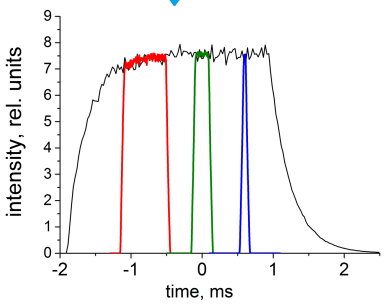

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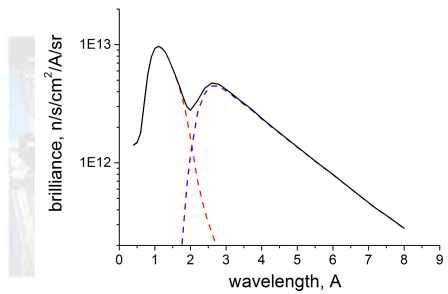

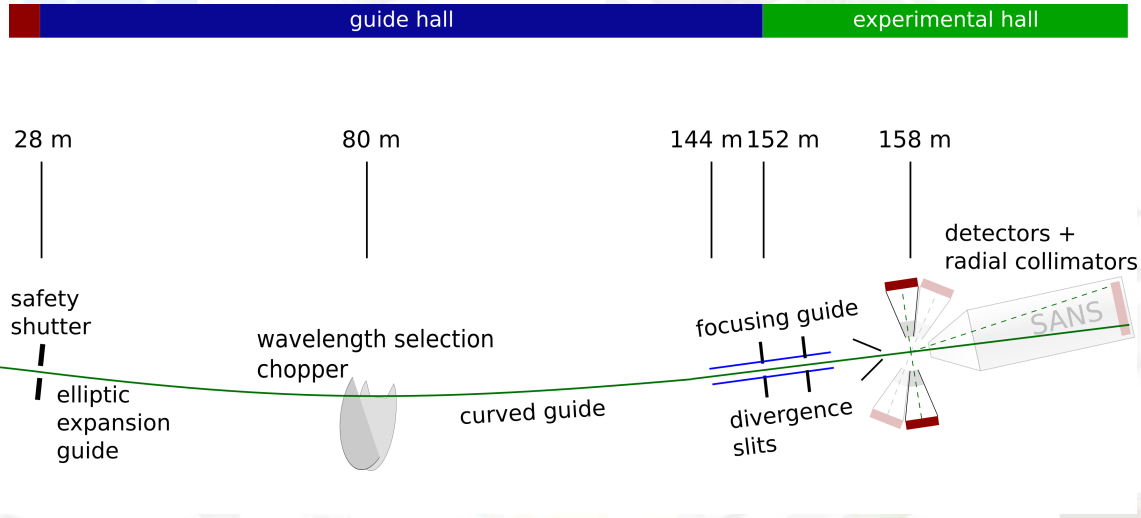

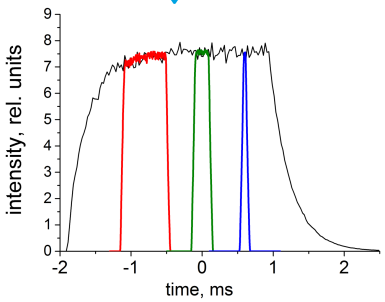

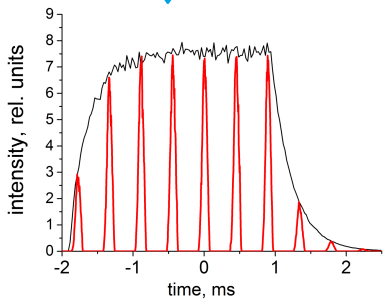

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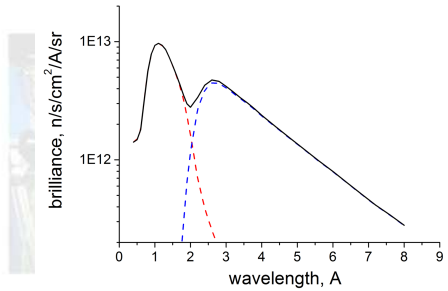

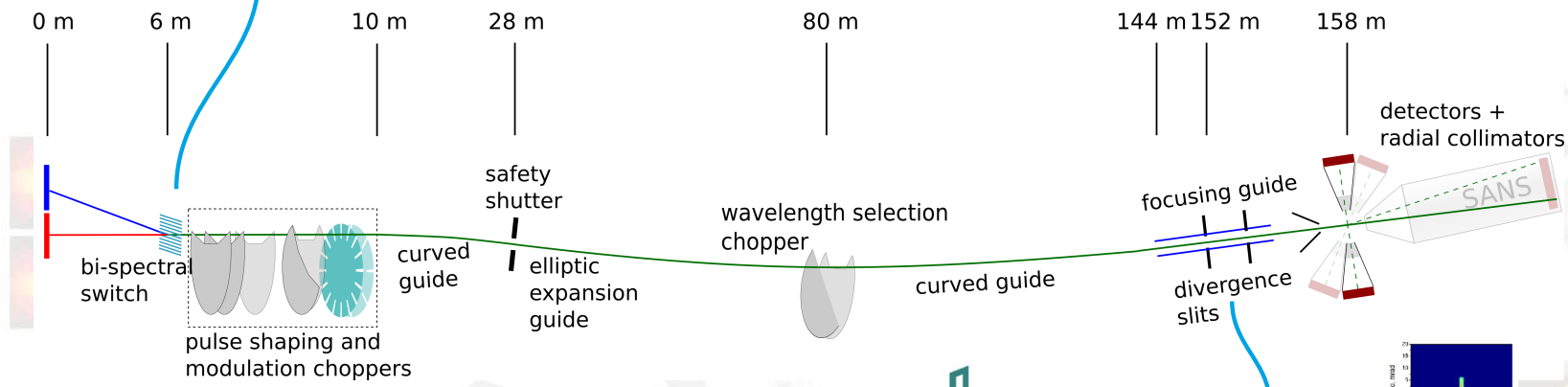

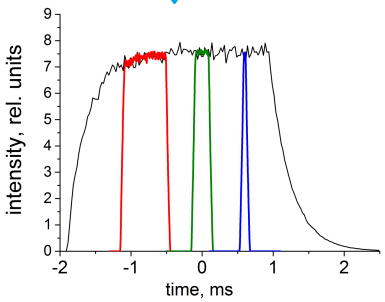

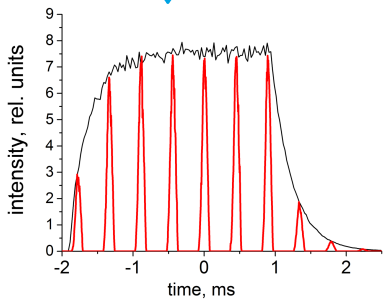

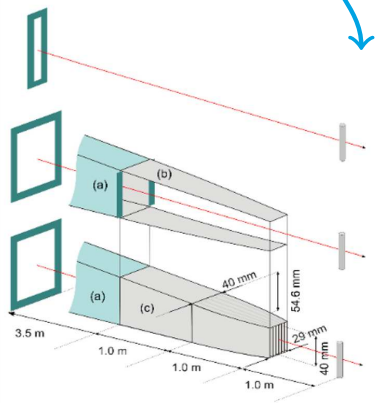

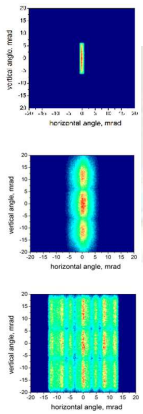

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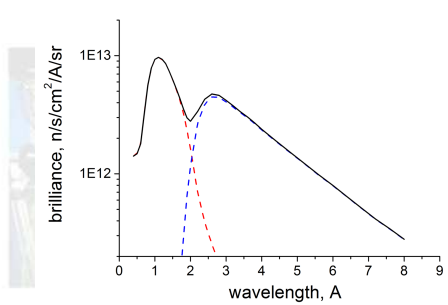
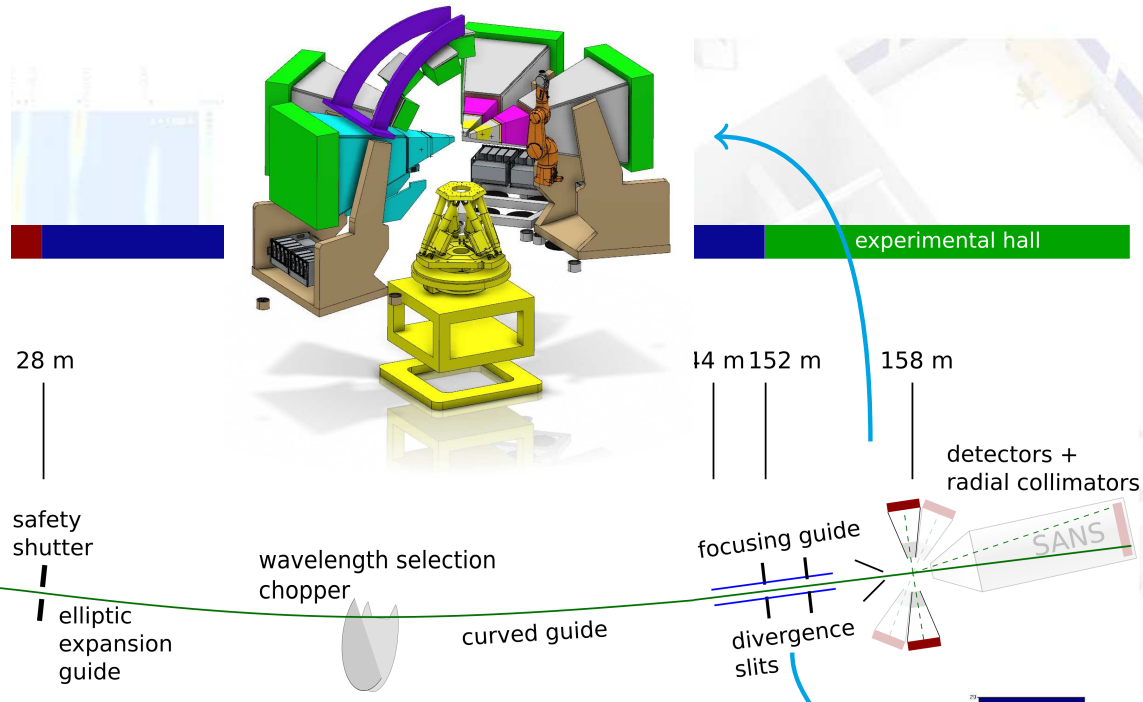
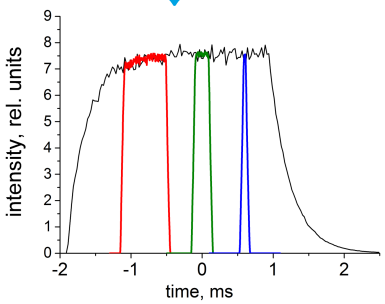
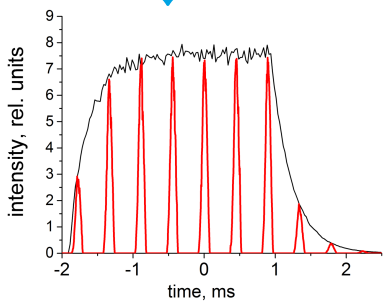
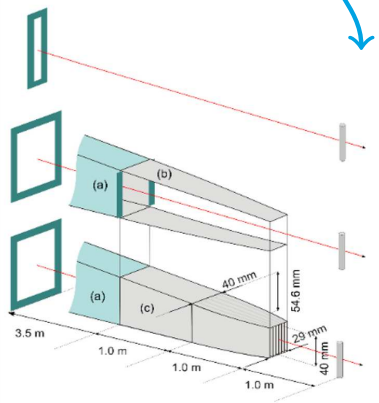
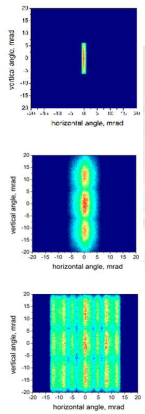








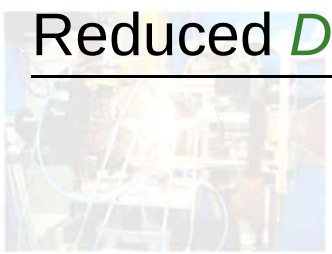
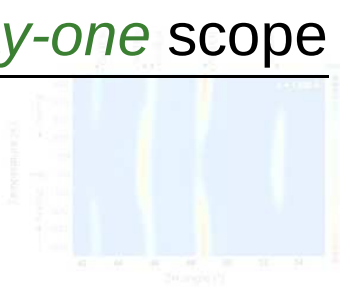




Instrument at Day-one

Scope reduction and completion status of the BEER instrument

Reduced *Day-one* scope

Instrument at Day-one

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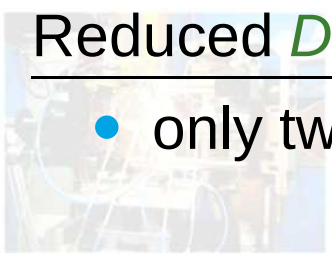
Reduced *Day-one* scope

- only two 1 m^2 detectors at $\pm 90°$ (resolution 2×5 mm)



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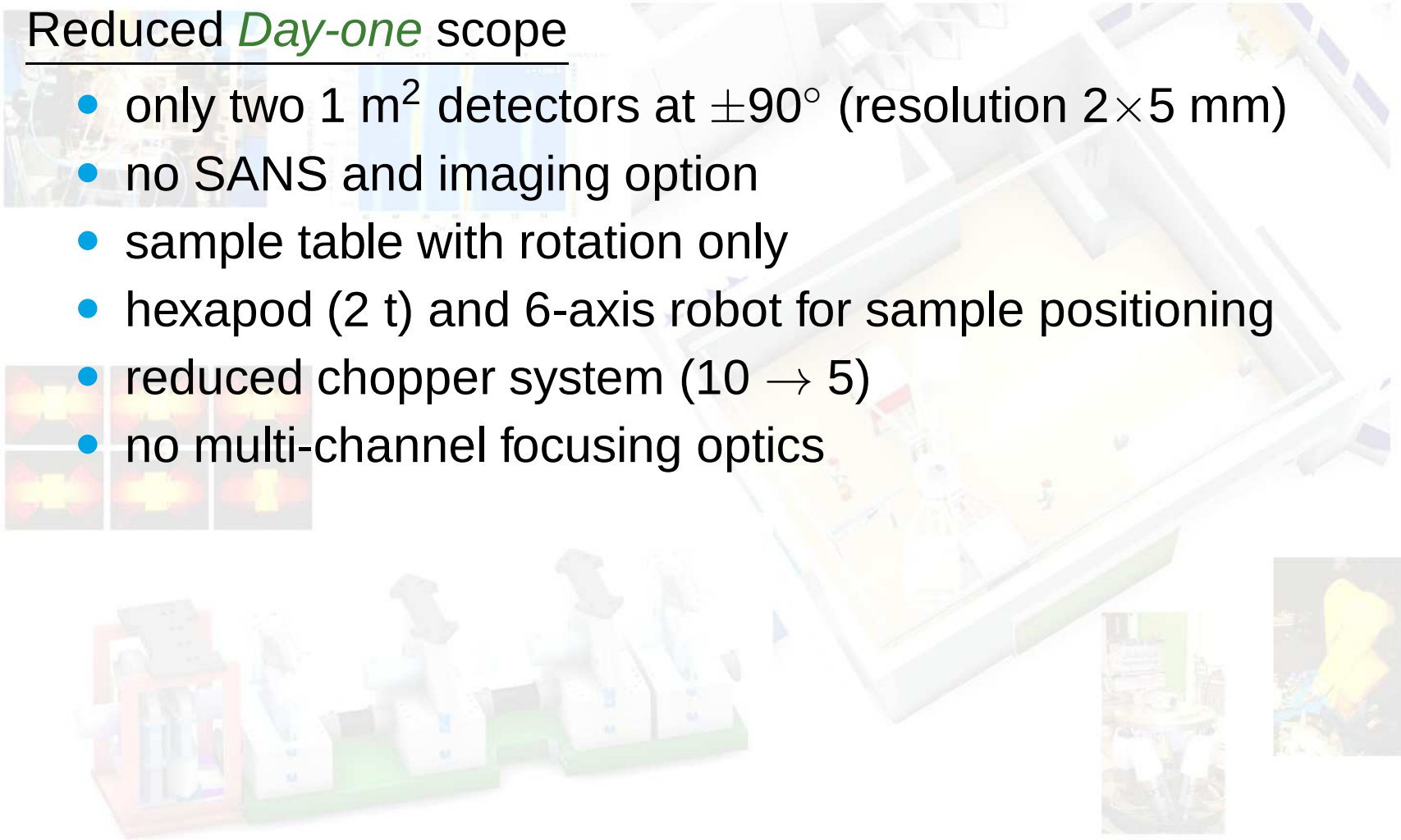

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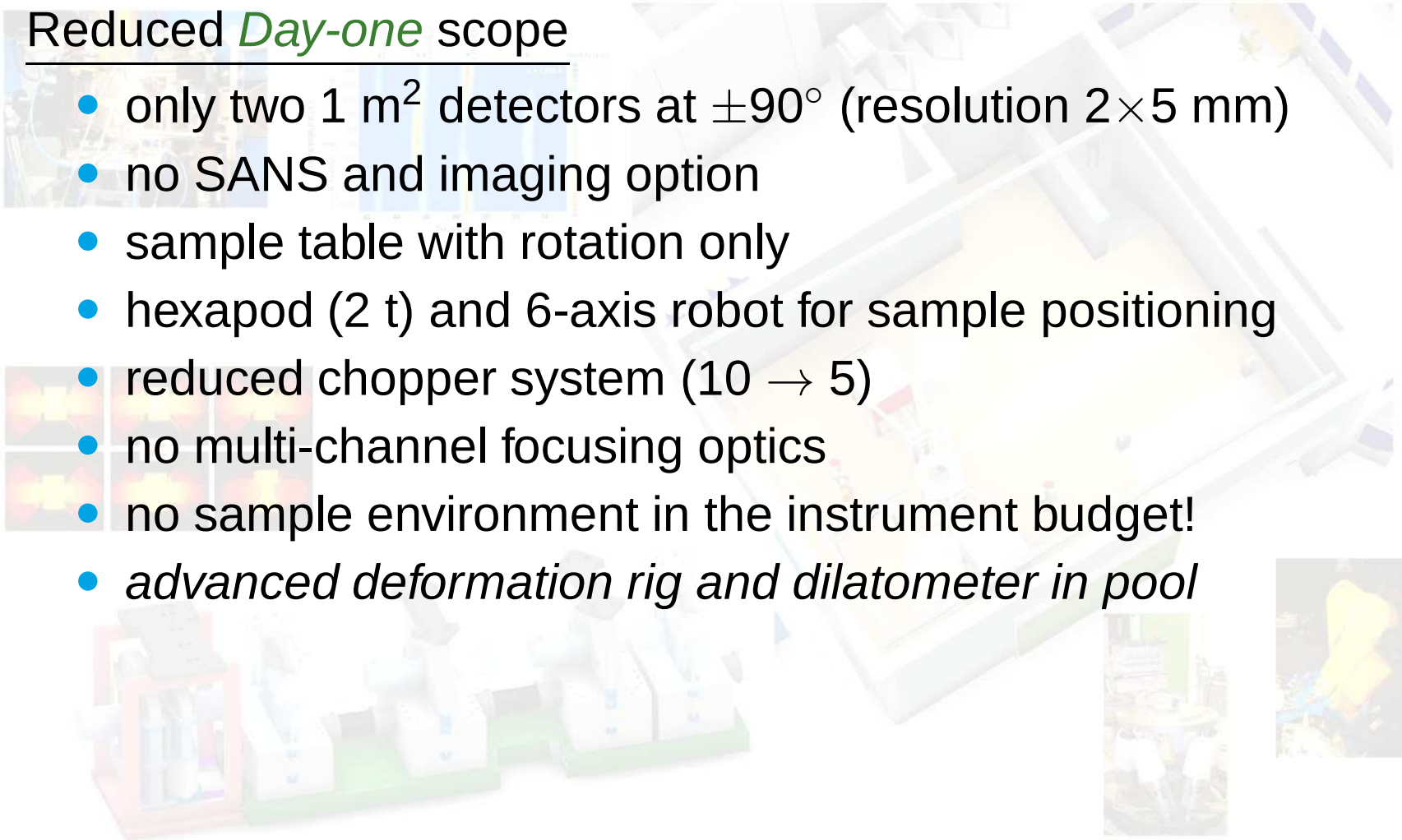

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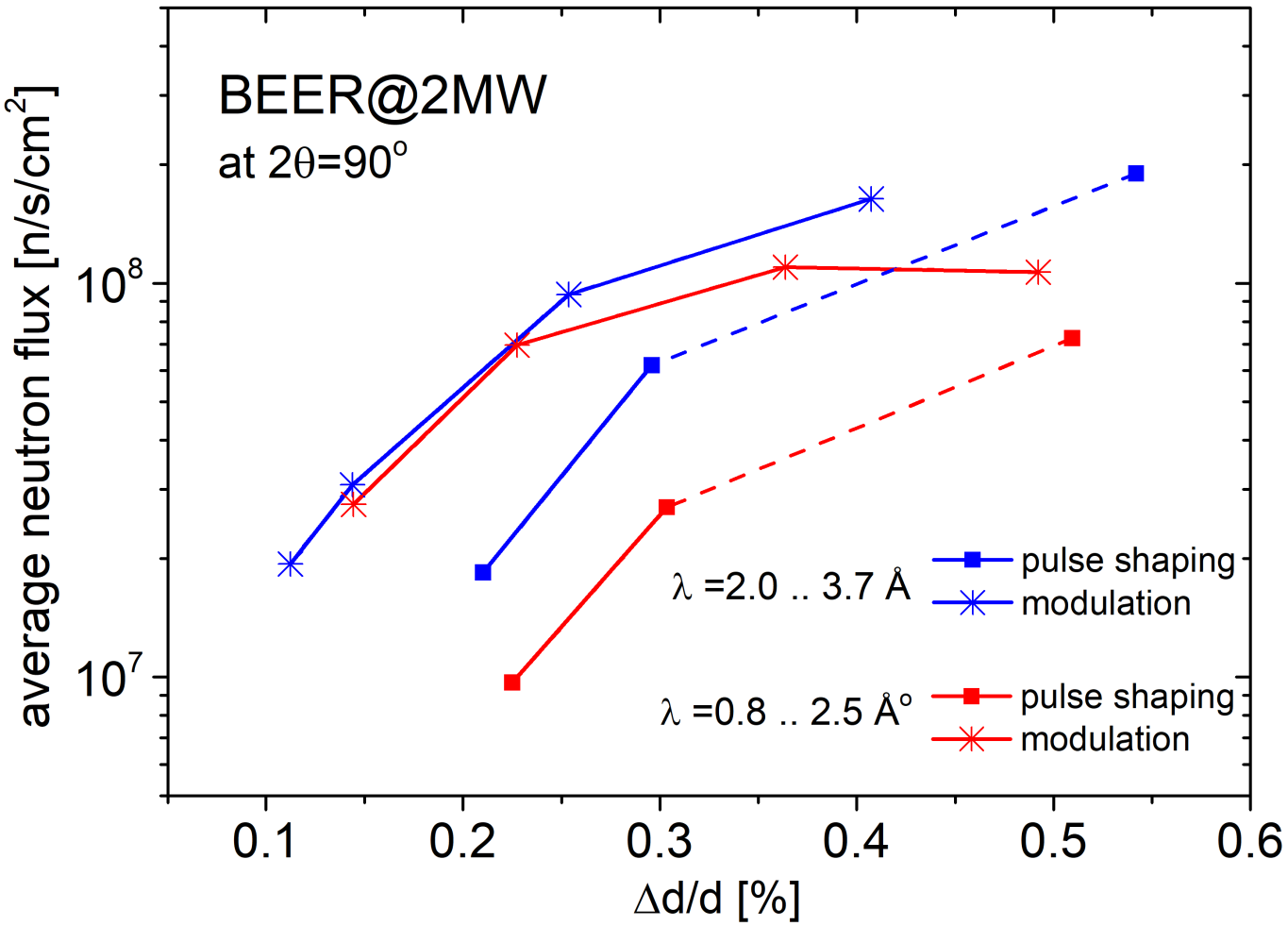
- ..., SE, SANS option, ...

Day-one performance

Performance of BEER at 2 MW



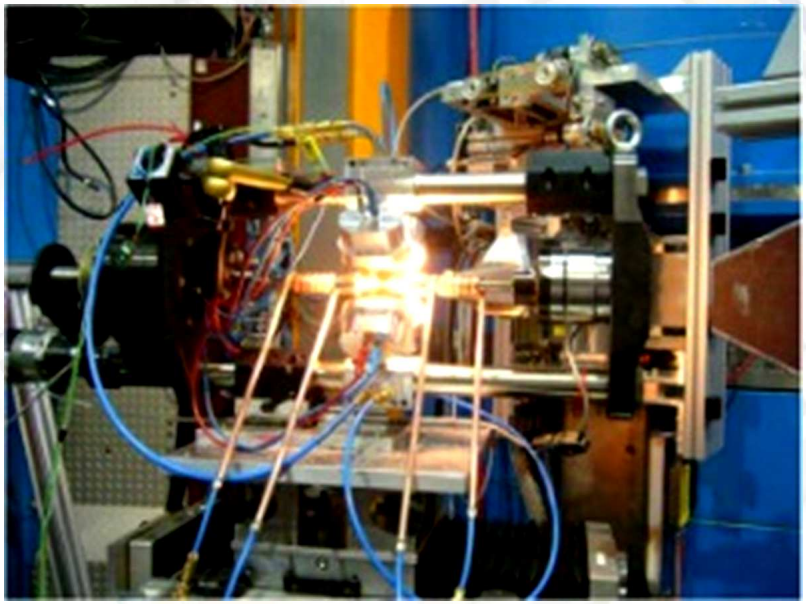
Dashed line shows the extension of the resolution range by adding the 3rd chopper as suggested for the staging plan.

Sample environment

Examples of SE foreseen for the BEER instrument

BEER dedicated SE

- advanced deformation rigs
  - uni-axial deformation
  - max. load 60 kN
  - with furnace (1200°C)
  - vacuum chamber

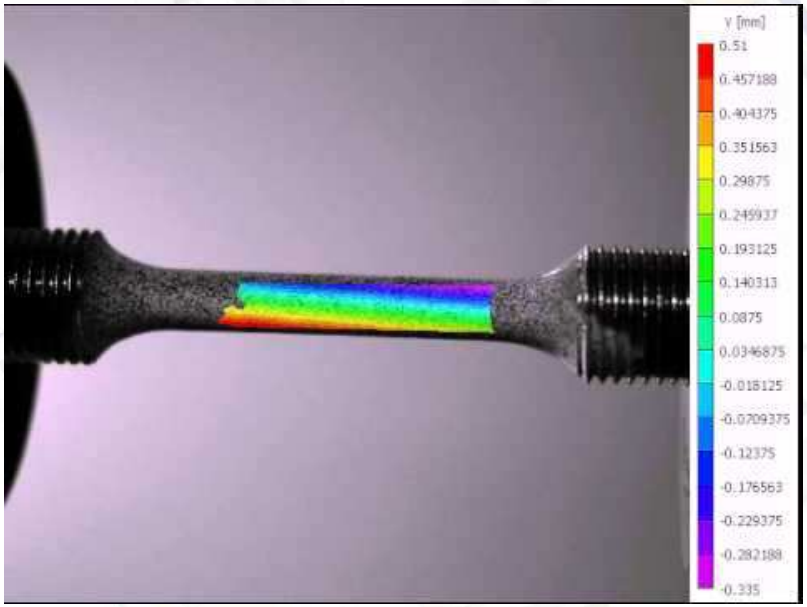


Sample environment

Examples of SE foreseen for the BEER instrument

BEER dedicated SE

- advanced deformation rigs
- digital image correlation

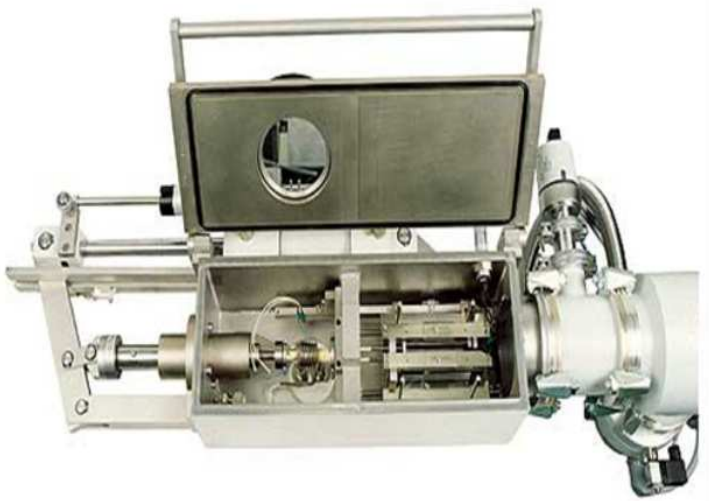


Sample environment

Examples of SE foreseen for the BEER instrument

BEER dedicated SE

- advanced deformation rigs
- digital image correlation
- dilatometer
  - DSC unit
  - max. load 25 kN
  - heating rate (4000 K/s)
  - cooling rate (2500 K/s)

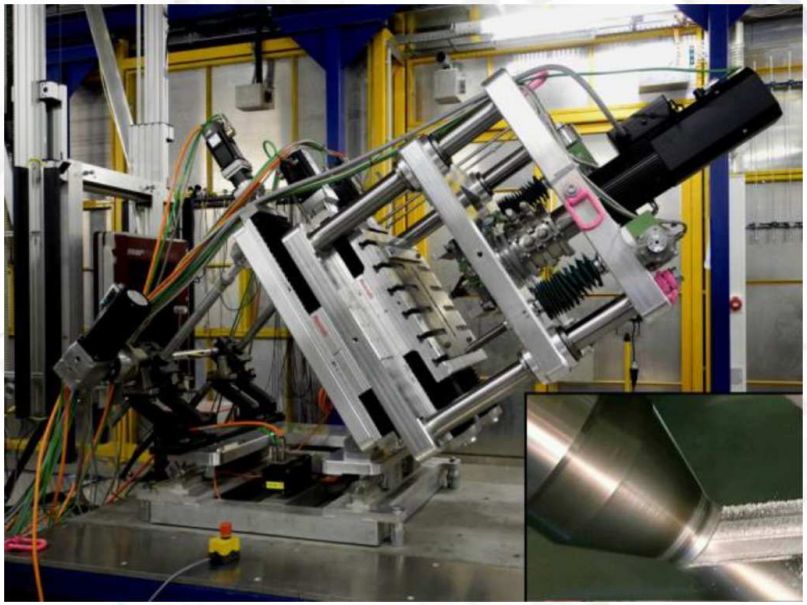


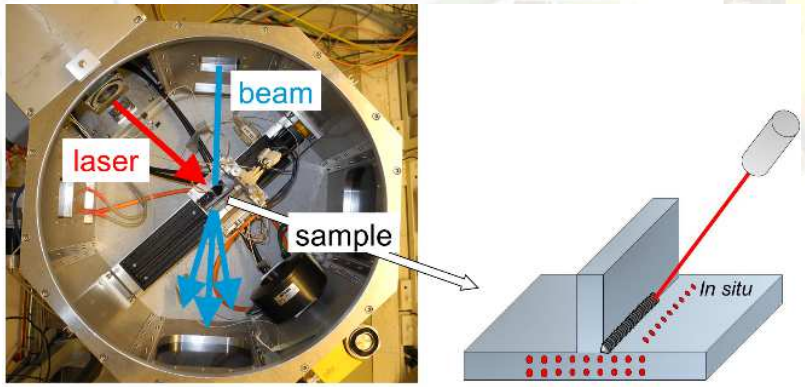
Sample environment

Examples of SE foreseen for the BEER instrument

BEER dedicated SE

- advanced deformation rigs
- digital image correlation
- dilatometer
- different welding machines
  - stir-welding
  - laser-welding



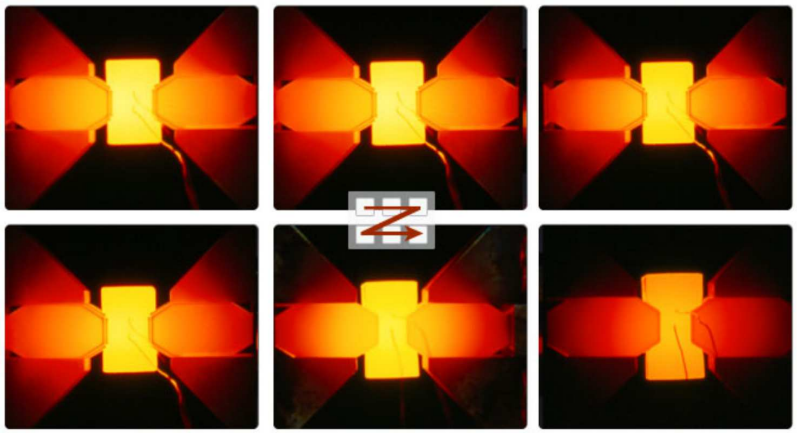


Sample environment

Examples of SE foreseen for the BEER instrument

BEER dedicated SE

- advanced deformation rigs
- digital image correlation
- dilatometer
- different welding machines
- Gleeble ®

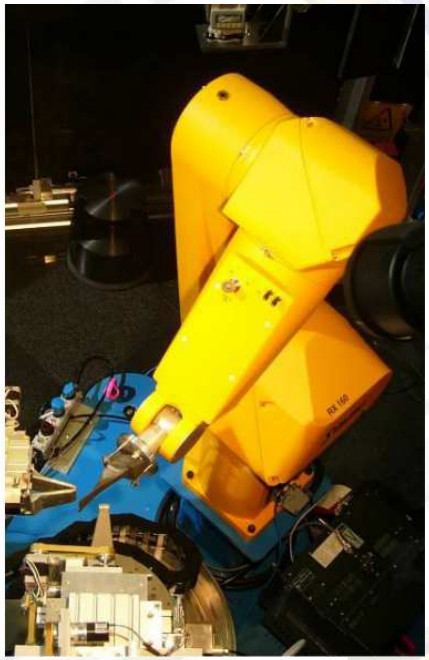


Sample environment

Examples of SE foreseen for the BEER instrument

BEER dedicated SE

- advanced deformation rigs
- digital image correlation
- dilatometer
- different welding machines
- Gleeble ®
- advanced positioning
  - payload 2 t
  - x, y: ±110 mm
  - z: ±150 mm
  - payload 14 kg
  - repeatability: ±0.06 mm



Sample environment

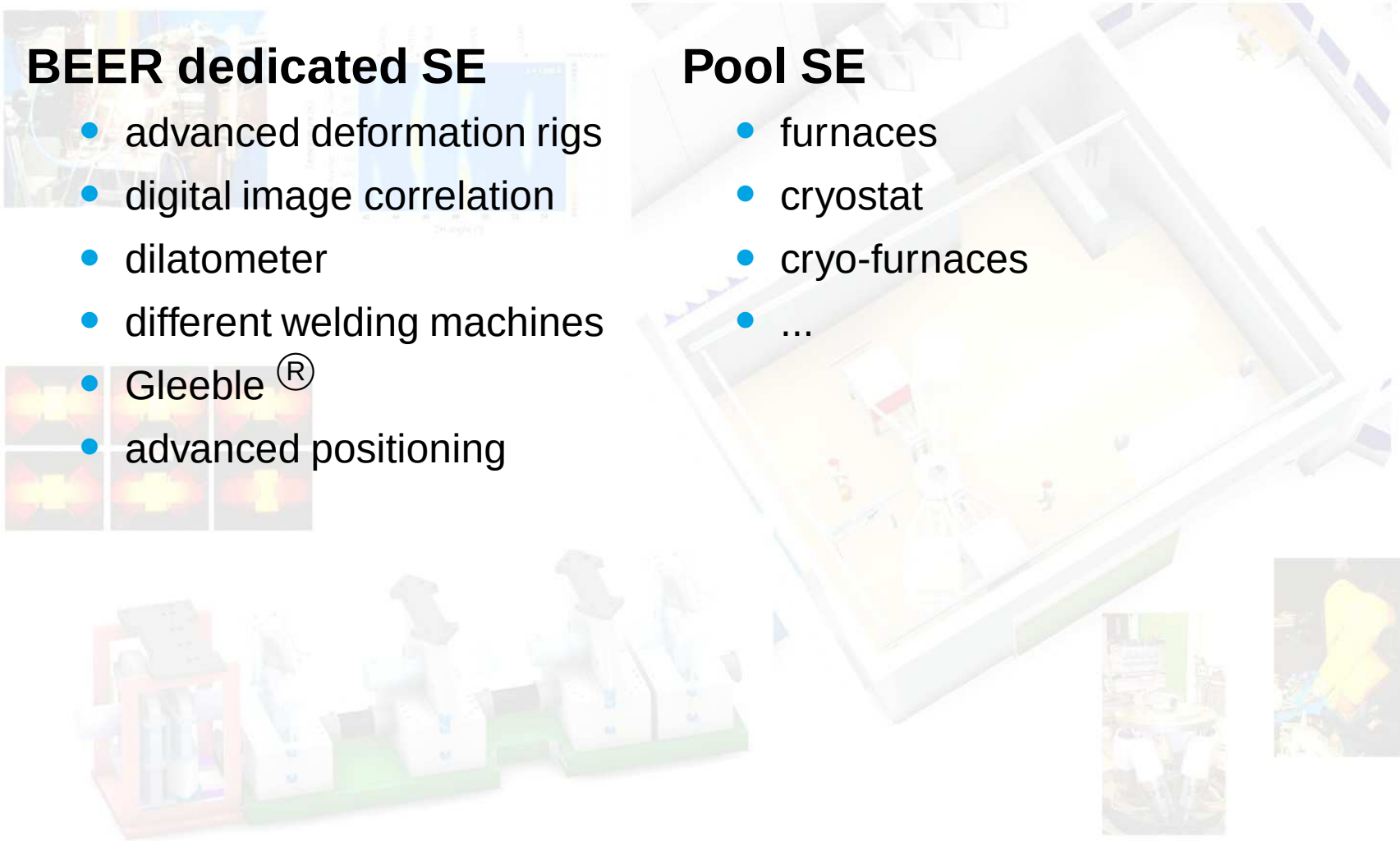
Examples of SE foreseen for the BEER instrument

BEER dedicated SE

- advanced deformation rigs
- digital image correlation
- dilatometer
- different welding machines
- Gleeble ®
- advanced positioning

Pool SE

- furnaces
- cryostat
- cryo-furnaces
- ...



Work-packages

Definition and split of work-packages

NPI

- after-bunker optics
- safety shutter
- focusing optics
- guide shielding
- elevated floor
- cave & hutch
- transport platform

HZG

- in-monolith optics
- in-bunker guides
- choppers
- detectors
- monitors
- sample table
- hexapod, robot

Acknowledgment

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

THANK YOU FOR YOUR ATTENTION

EUROPEAN SPALLATION SOURCE