The Material Engineering Diffractometer
BEER at ESS

Instrument overview and status reminder

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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

- Leading Scientist
  - Jochen Fenske
- Leading Engineer
  - Dirk Jan Siemers
- Core team members
  - Martin Müller
  - Rüdiger Kiehn
  - Gregor Nowak
Beamline for European Materials Engineering Research “BEER”
Science case
Why the BEER instrument is proposed?

Scientific drivers & goals

• more COMPLEX materials
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- *SAMPLE ENVIRONMENT*
Science case
Why the BEER instrument is proposed?

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- ...
Instrument modalities

What the BEER instrument should be able to do?

- *In-situ* simulation of thermo-mechanical processes
Instrument modalities
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- *In-situ* simulation of thermo-mechanical processes
- Study the processes to tailor the material properties for application needs
- To optimise thermo-mechanical treatment to reduce production cost
- Understand processes happening during material application
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- Multi-scale characterisation
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Instrument status
Current status of the BEER instrument

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  - defined and fixed scope
  - frozen reduced budget of 14.98 M€
  - work package schema NPI:HZG = 50:50%
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- user program starts end 2023
Operational environment
BEER position on the ESS site
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BEER position on the ESS site

- 158 m long instrument (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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Description of the main parts of the BEER instrument

Slide 11/16

- **Introduction**
- **Instrument teams**
- **Eng. materials**
- **Science case**
- **Modalities**

**Current status**

**Instrument**
- **Hall layout**
- **Description**
- **Performance**
- **Sample environment**

**Summary**
- **WP definition**
Description of the main parts of the BEER instrument
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Instrument at Day-one
Scope reduction and completion status of the BEER instrument

Reduced *Day-one* scope
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- only two 1 m² detectors at $\pm 90^\circ$ (resolution $2 \times 5$ mm)
Reduced *Day-one* scope

- only two 1 m² detectors at ±90° (resolution 2×5 mm)
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- sample table with rotation only
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- hexapod (2 t) and 6-axis robot for sample positioning
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- increase of detector coverage (off & in plane)
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- ..., SE, SANS option, ...
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
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- 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
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- 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

THANK YOU FOR YOUR ATTENTION