



**EUROPEAN
SPALLATION
SOURCE**



BEER@ESS reminder

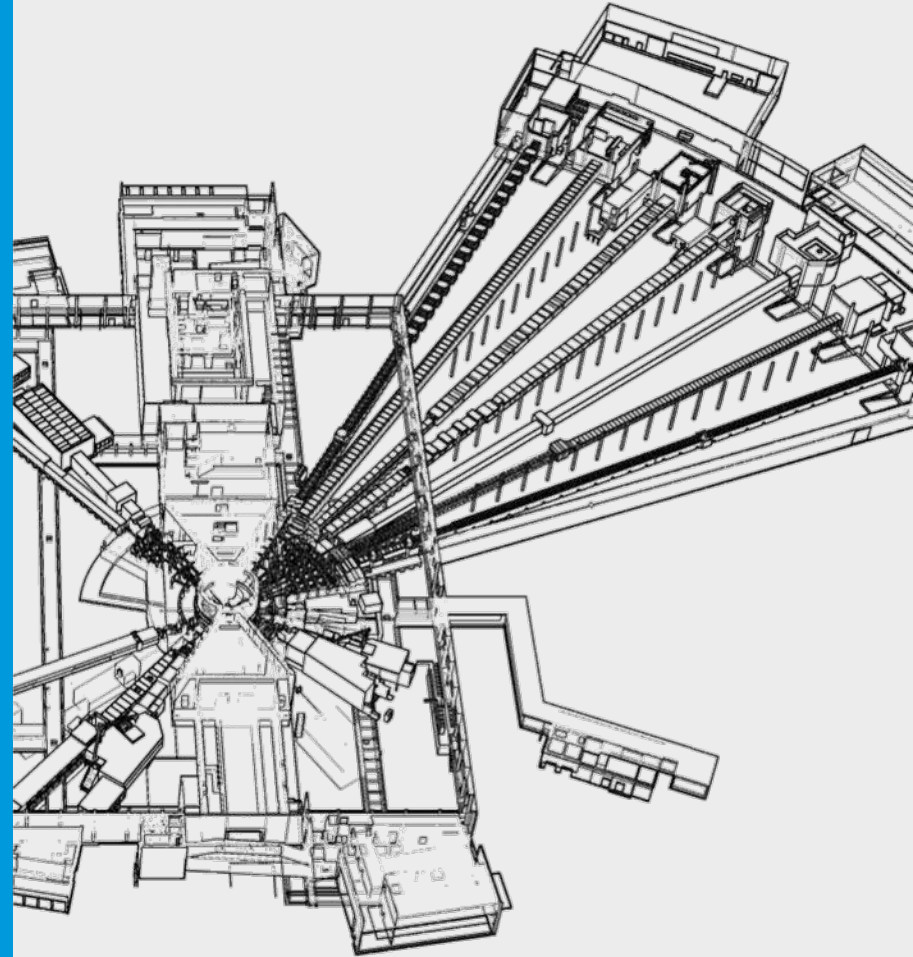
ESS - ILL Topical Workshop on Imaging, Materials and Engineering

October 14, 2020

PRESENTED BY PREMEK BERAN

1

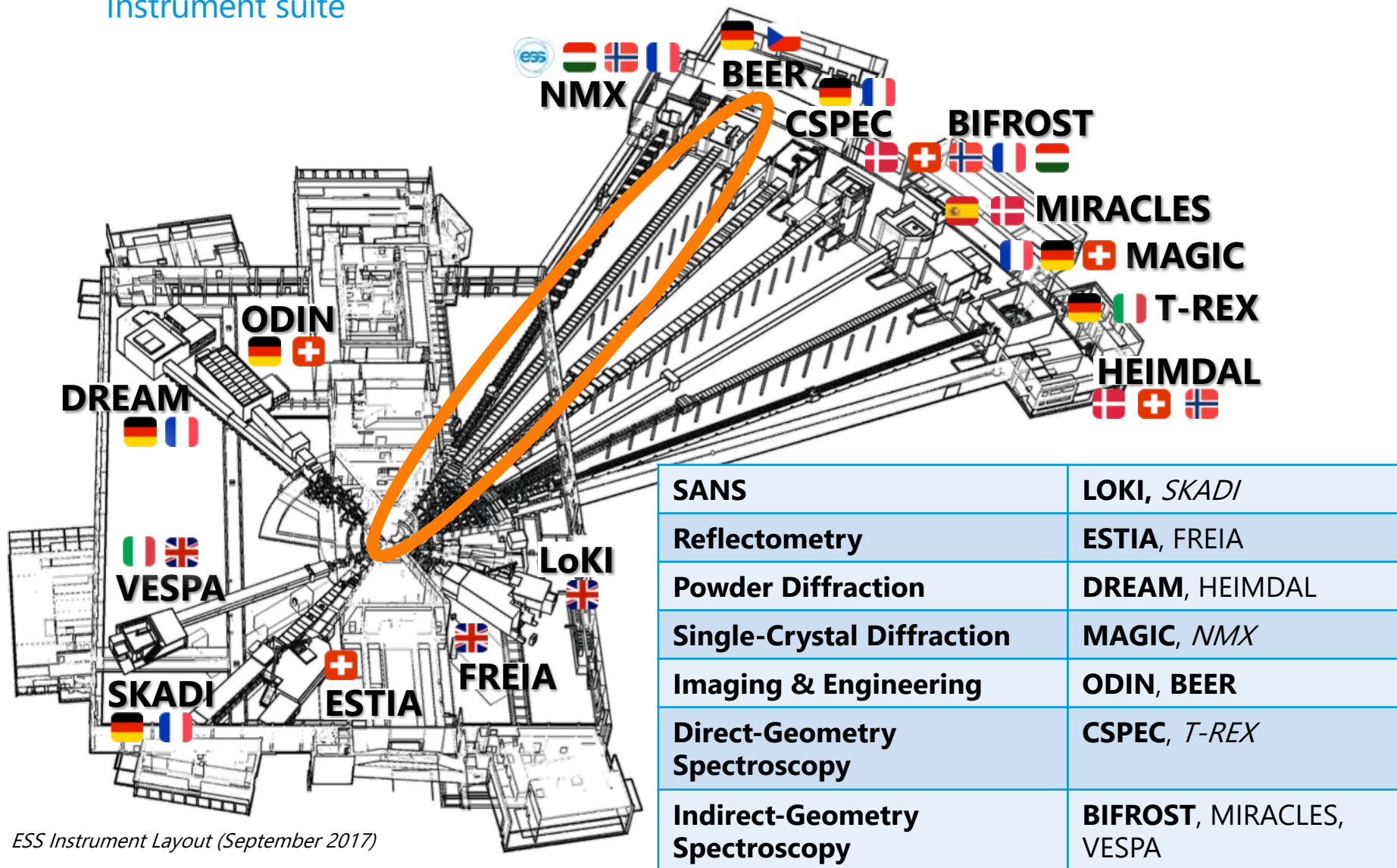
ESS instrumentation



ESS instrumentation



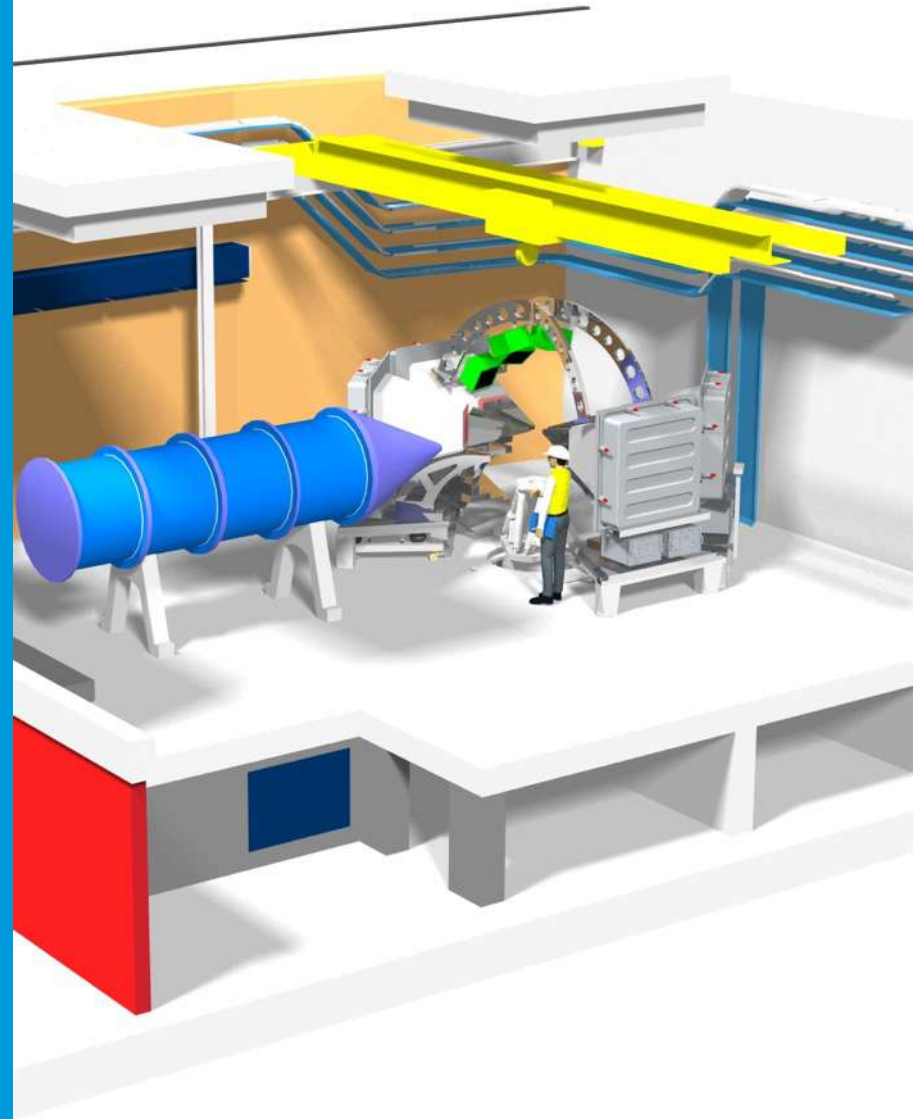
Instrument suite



ESS Instrument Layout (September 2017)

2

BEER instrument

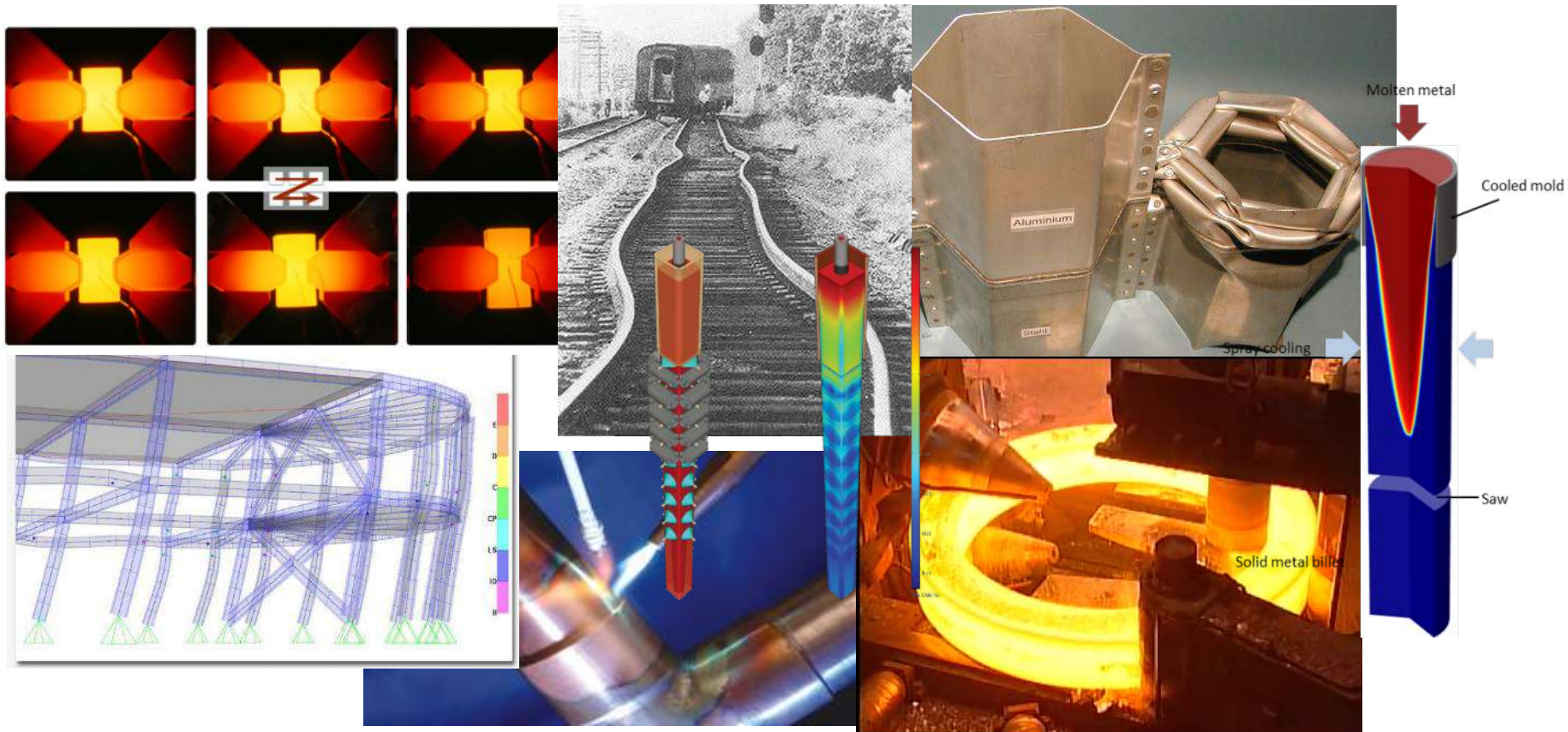


BEER instrument



Science case

- **In-situ / in-operando experiments close to the real conditions**
 - 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

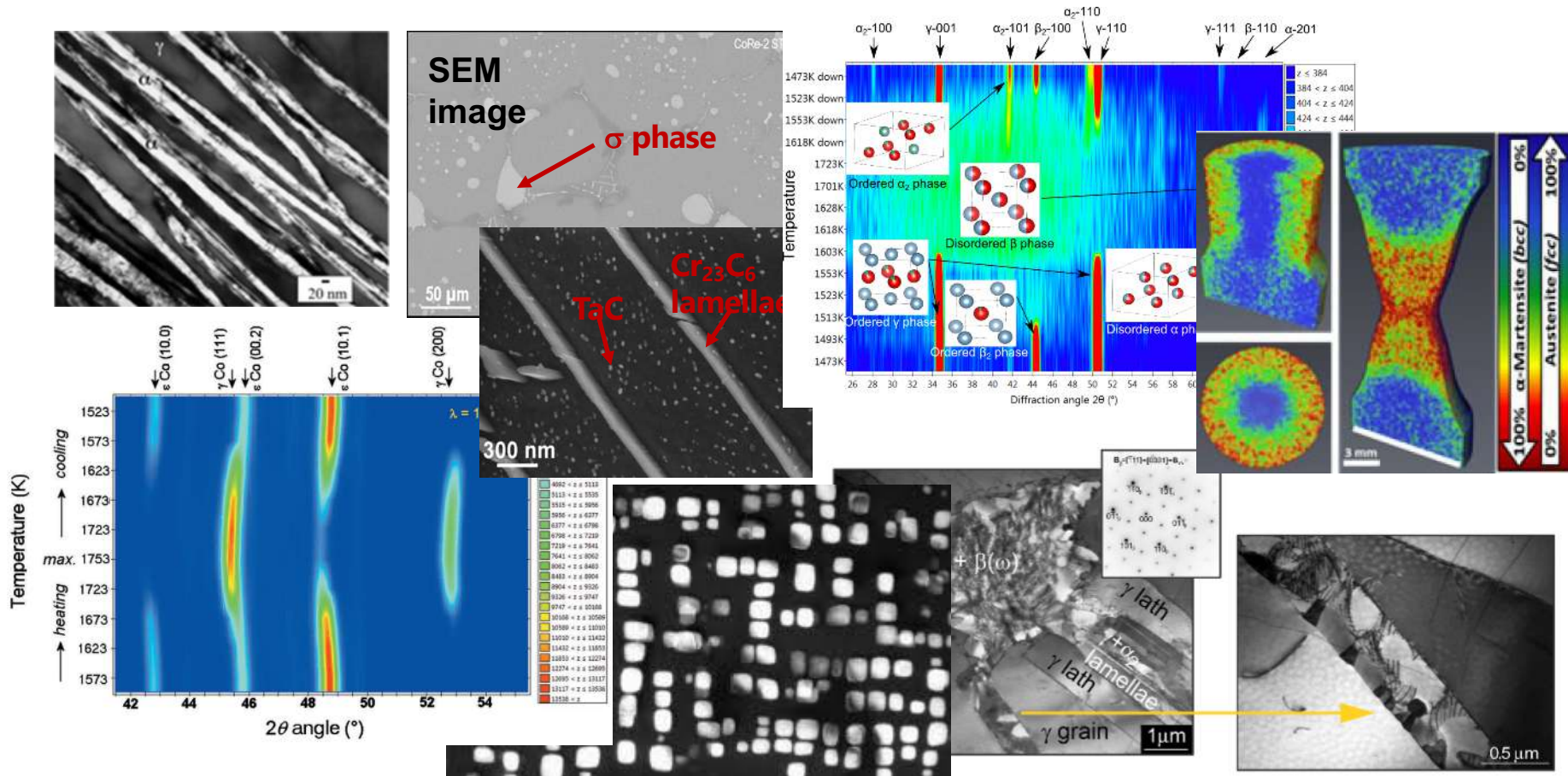


BEER instrument



Science case

- **Multi-phase and/or composite materials**
 - Resolve phases evolution together with microstructure changes
 - Multi-scale characterisation

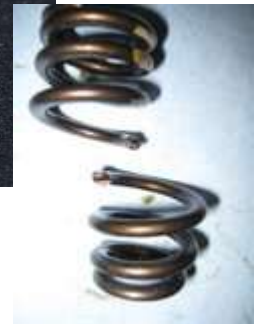
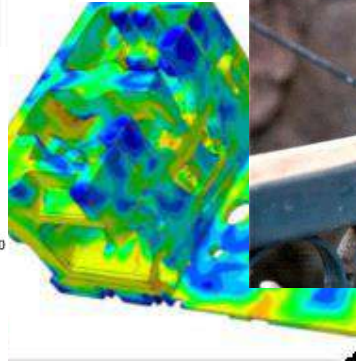
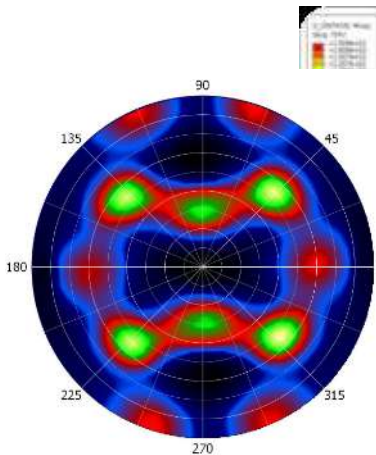
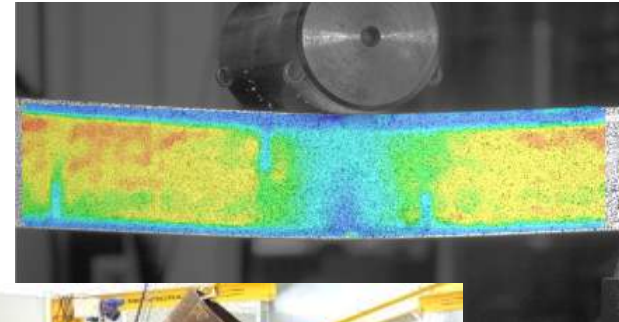
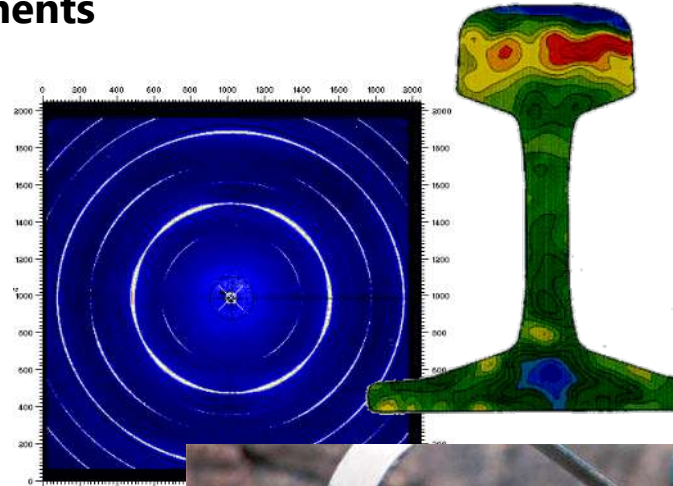
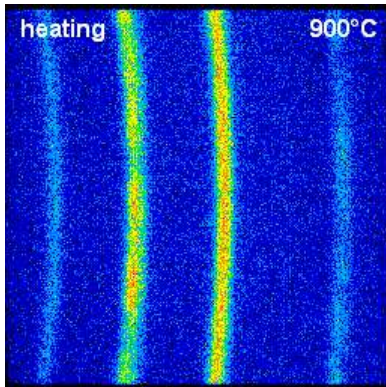


BEER instrument



Science case

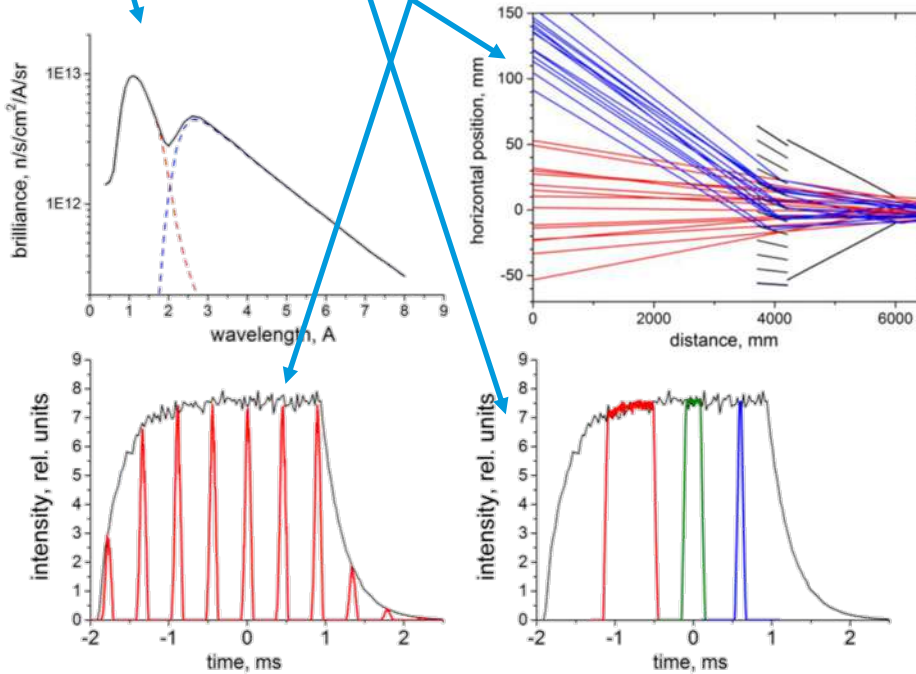
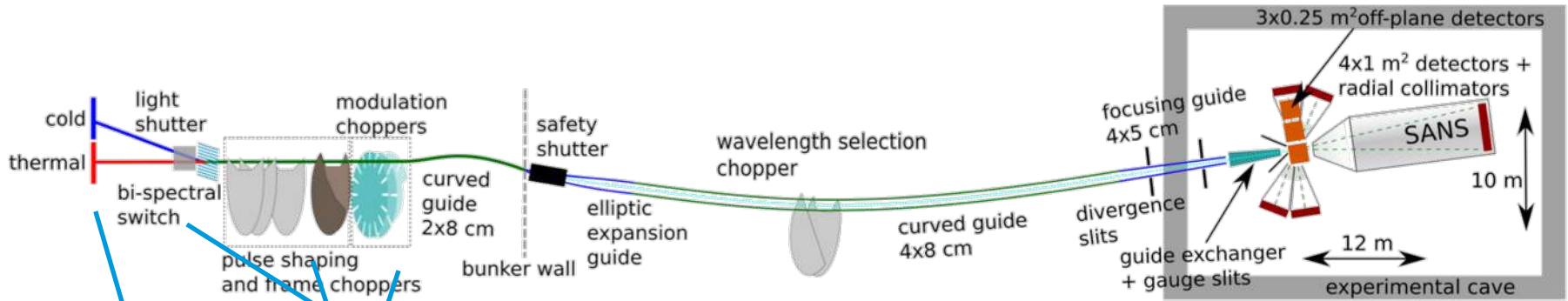
- In-situ texture or grain growth evolution
- Fast strain scanning
- Long-term experiments



BEER instrument



Layout

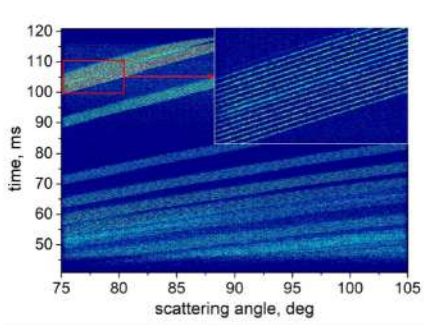
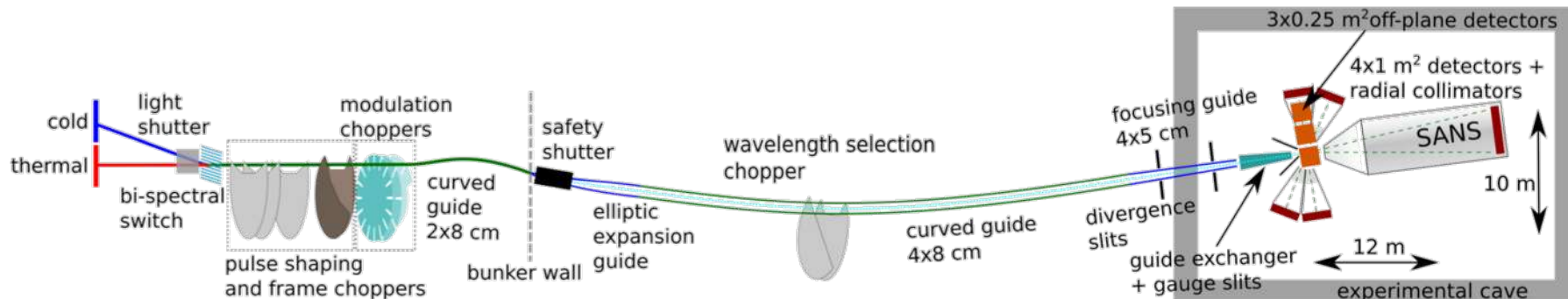


BEER Quick Facts	
Instrument Class	Engineering Diffraction
Moderator	Bispectral
Primary Flightpath	158 m
Secondary Flightpath	2 m
Wavelength Range	0.8–6 Å
Bandwidth	1.7 Å
d-spacing Range	0.6–7 Å
Pulse-Shaping Mode	
Resolution $\Delta d/d$	0.15 – 0.6 %
Flux at Sample at 2MW	$0.18-1.4 \cdot 10^8 \text{ n s}^{-1} \text{ cm}^{-2}$
Modulation Mode	
Resolution $\Delta d/d$	0.1 – 0.3 %
Flux at Sample at 2MW	$0.18-0.87 \cdot 10^8 \text{ n s}^{-1} \text{ cm}^{-2}$

BEER instrument

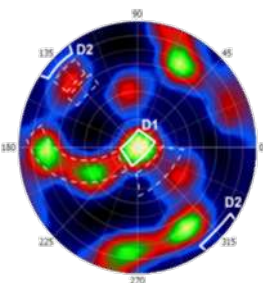


Layout



Modulation technique

- Fast strain scanning
- Multiplication factor < 12
- Keep high resolution



Off plane detectors

- Bigger coverage for texture
- Texture evolution in SE

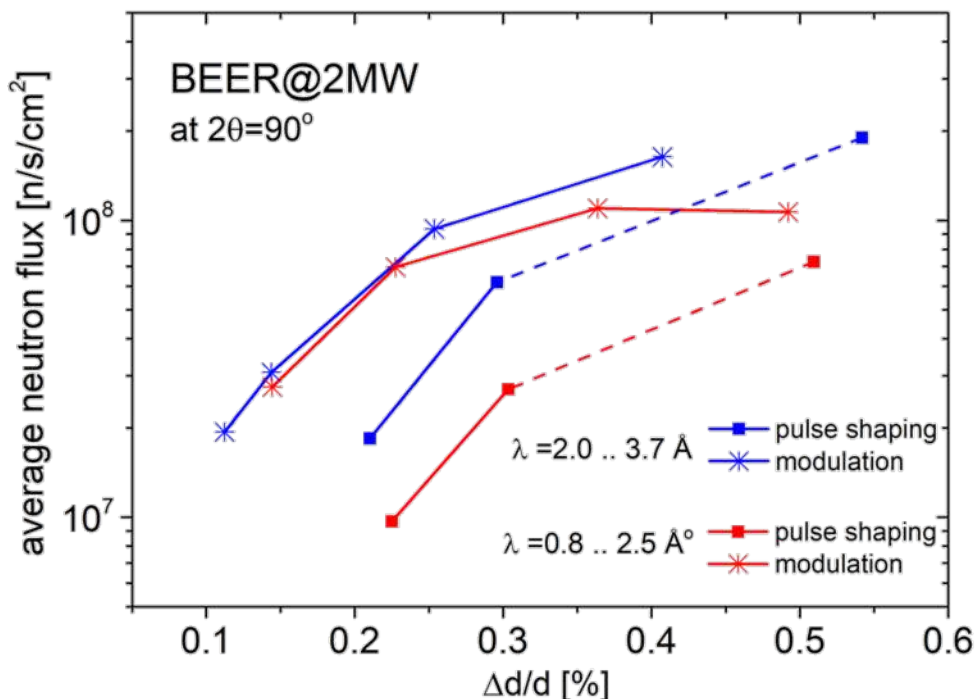
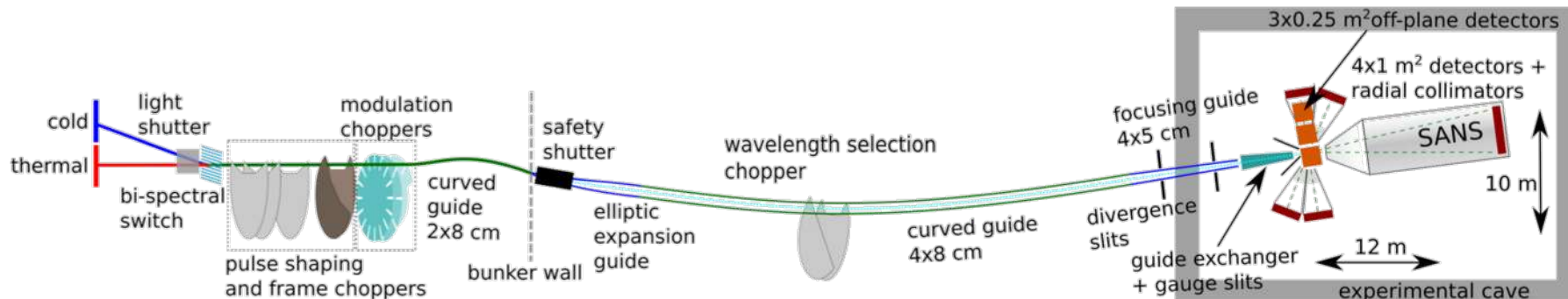
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BEER instrument



Layout

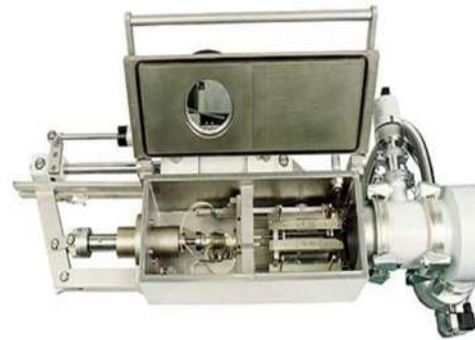
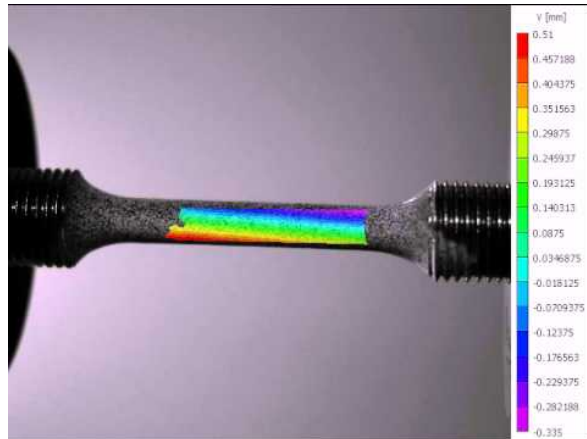
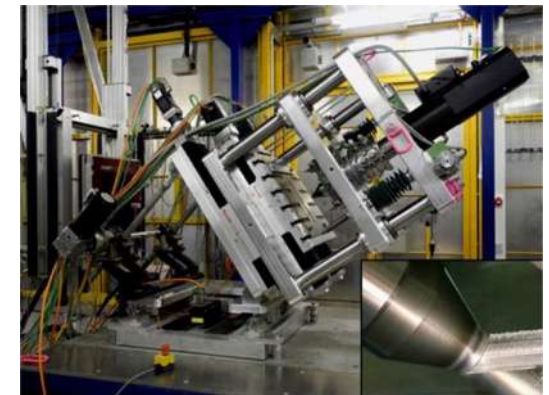
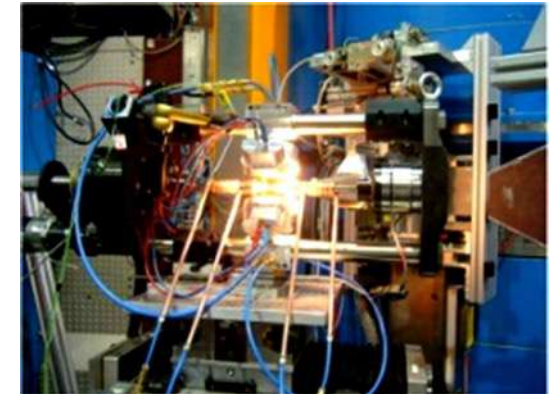


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BEER instrument

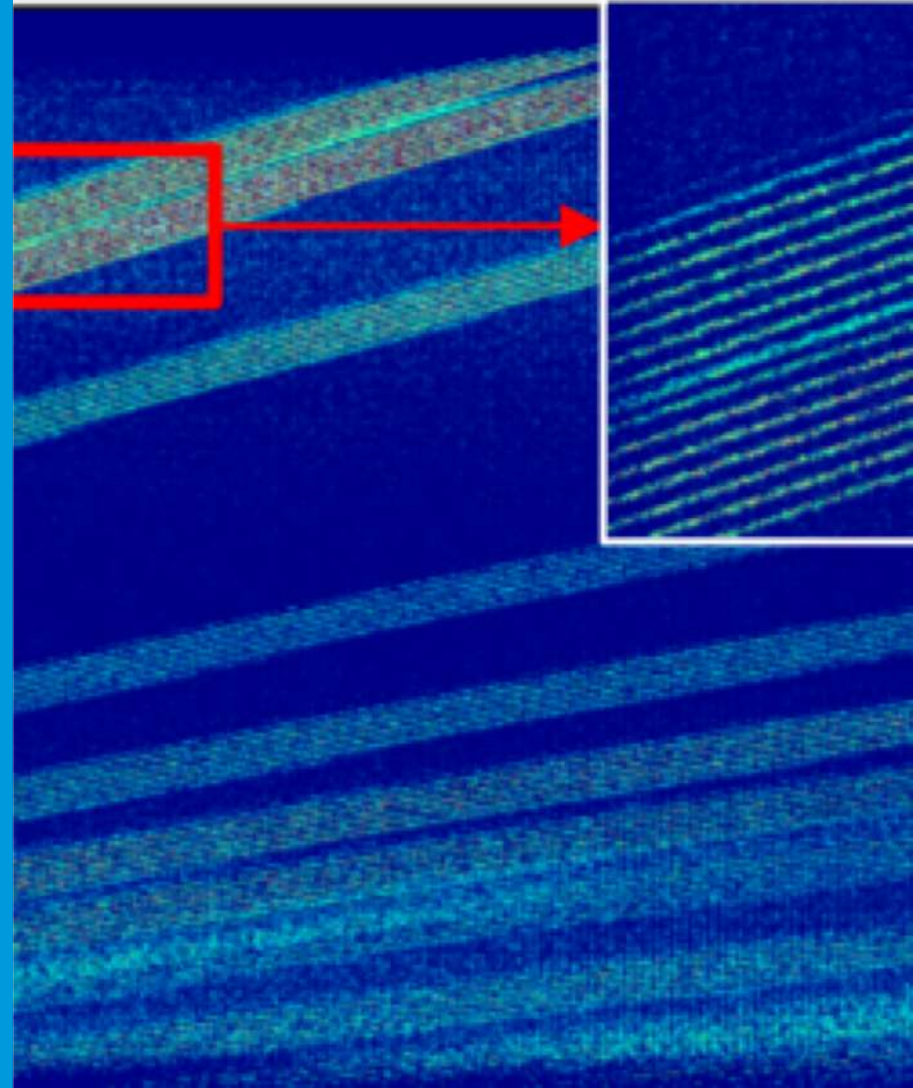
Sample environment

- ❖ Advance sample positioning systems
- ❖ Dedicated deformation rig
- ❖ Dilatometer
- ❖ Laser or stir welding machines
- ❖ Gleeble
- ❖ Image correlation



3

Modulation technique

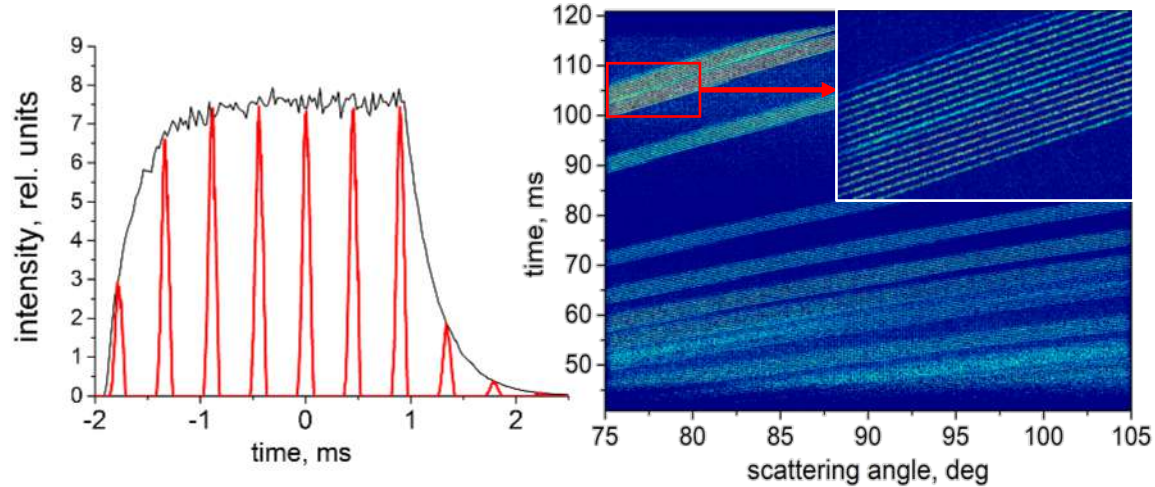


Modulation technique

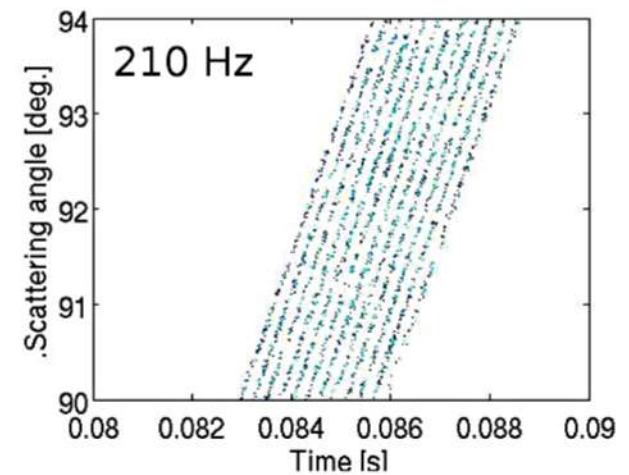
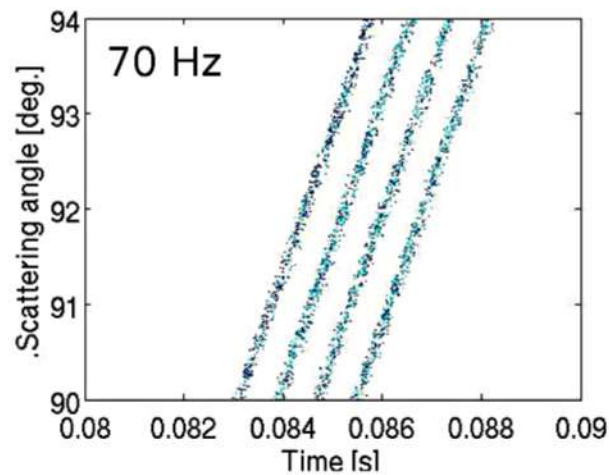
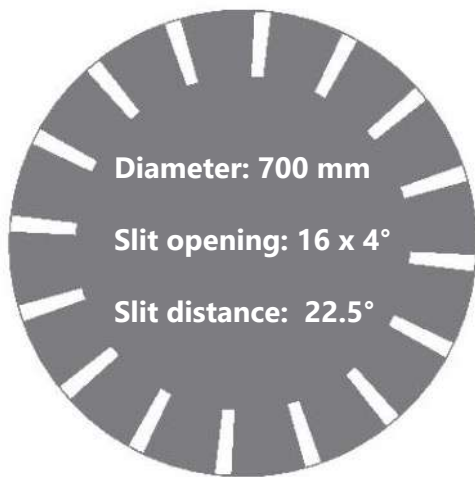


Advantages of the BEER instrument

- For high symmetric materials
- High resolution with high intensity
- Enhanced throughput for strain scanning
- Special data reduction procedure
- Simulation before experiment
- Multiplication factor up to 12



MCa: 42 – 280 Hz

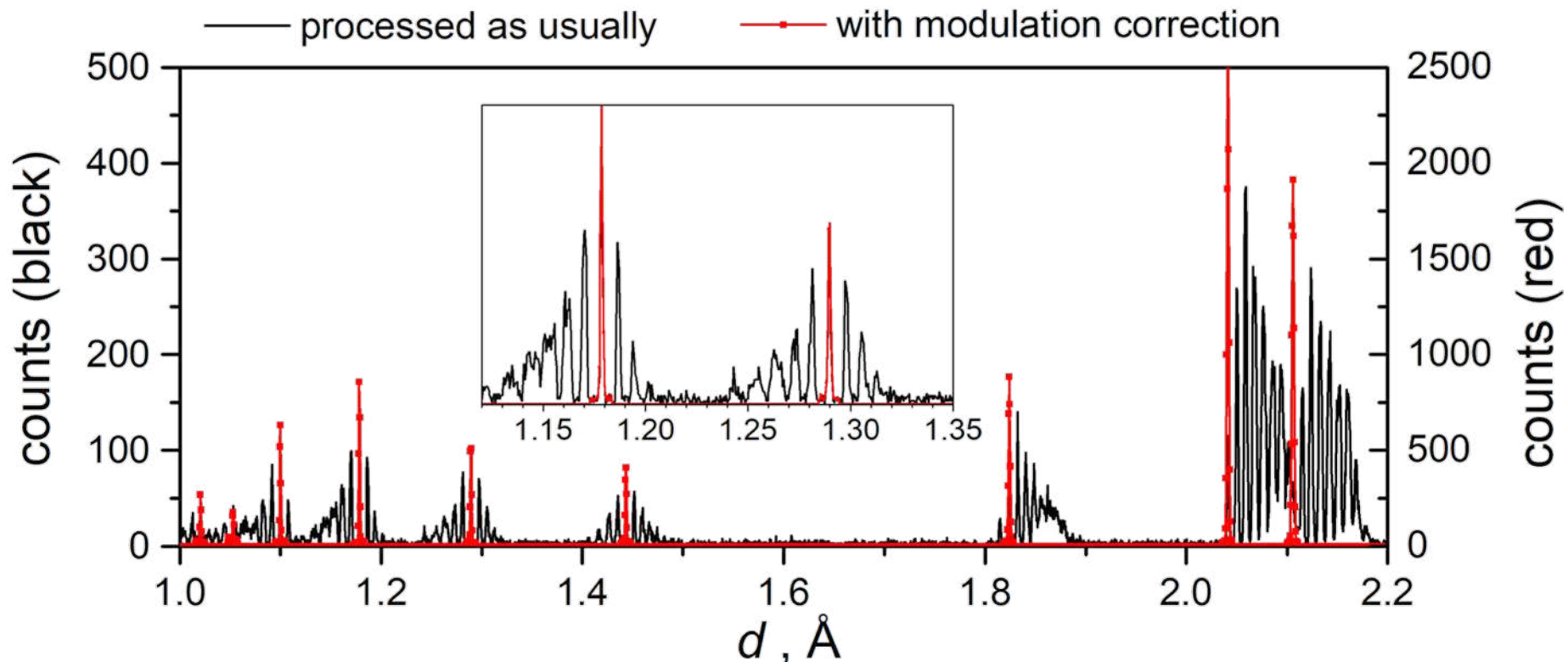


Modulation technique



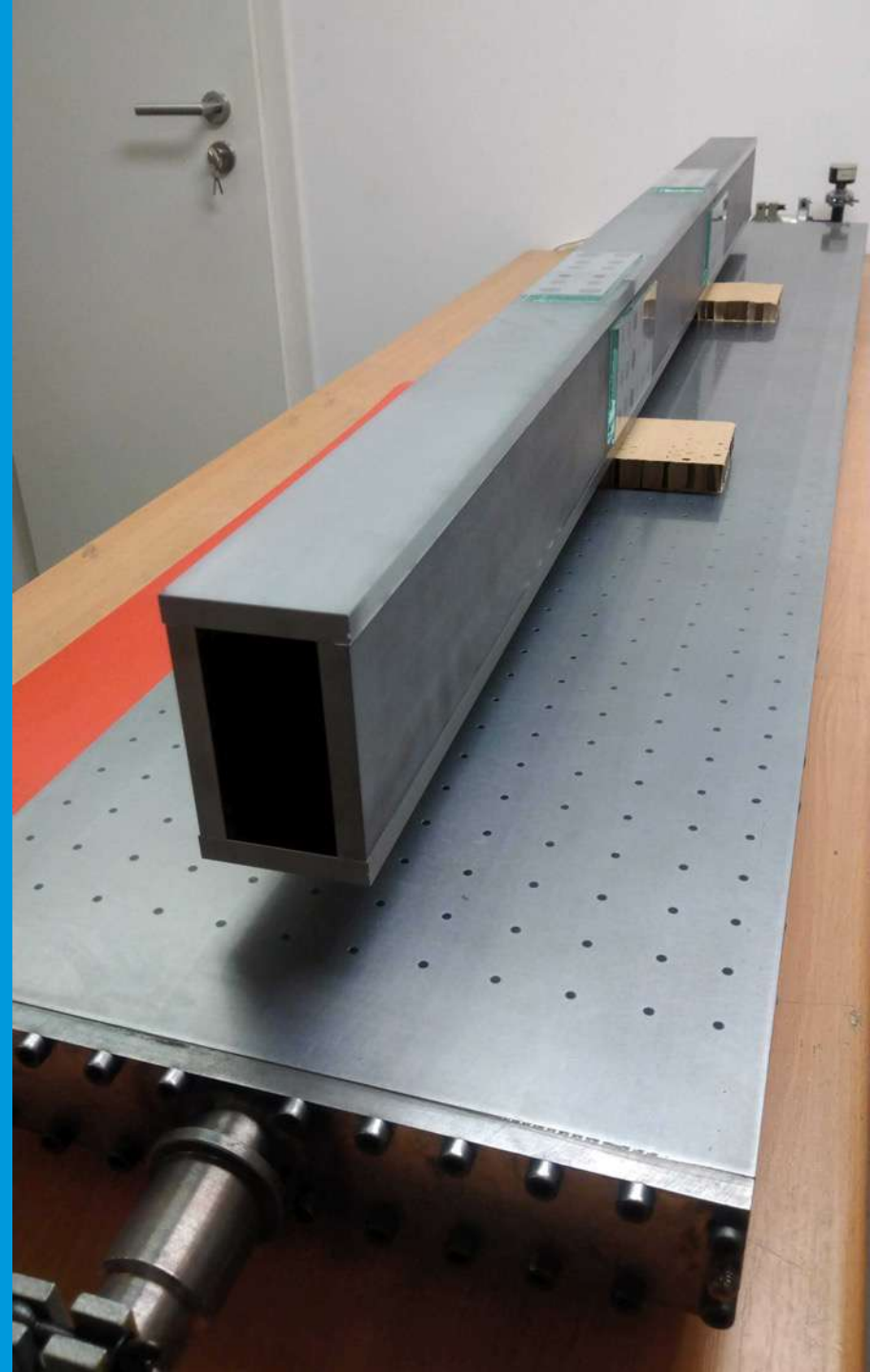
Advantages of the BEER instrument

Accumulated diffractograms assuming a single chopper window (black) and with account for the modulation (red).



4

Current status



BEER instrument



Current status

Final design

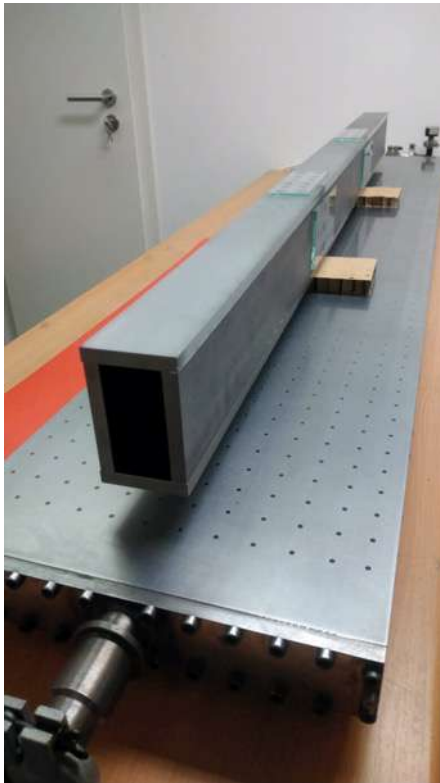
- Neutron guide out of bunker
- Neutron guide support
- Manufacturing started

Preliminary design

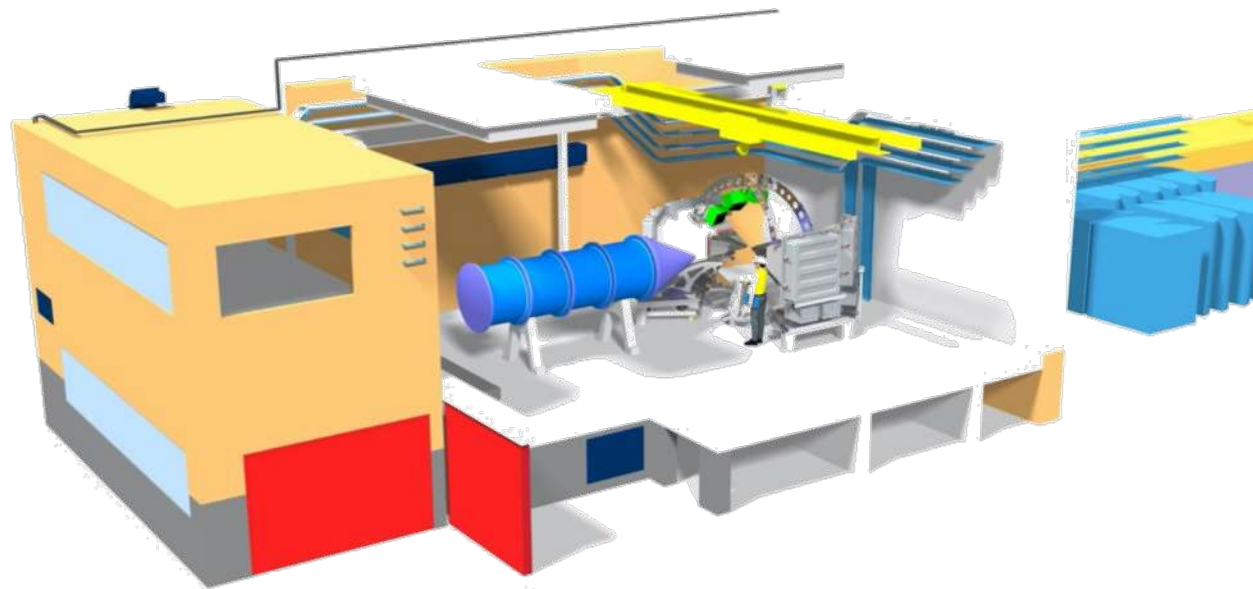
- Cave & hutch
- Safety shutter
- Shielding tunnel
- Detectors – B₄C technology

Conceptual design

- Choppers
- Guide in bunker
- Detectors support
- Sample tower



User program start: Q1 2024





Thank you for your attention

OCTOBER 14, 2020