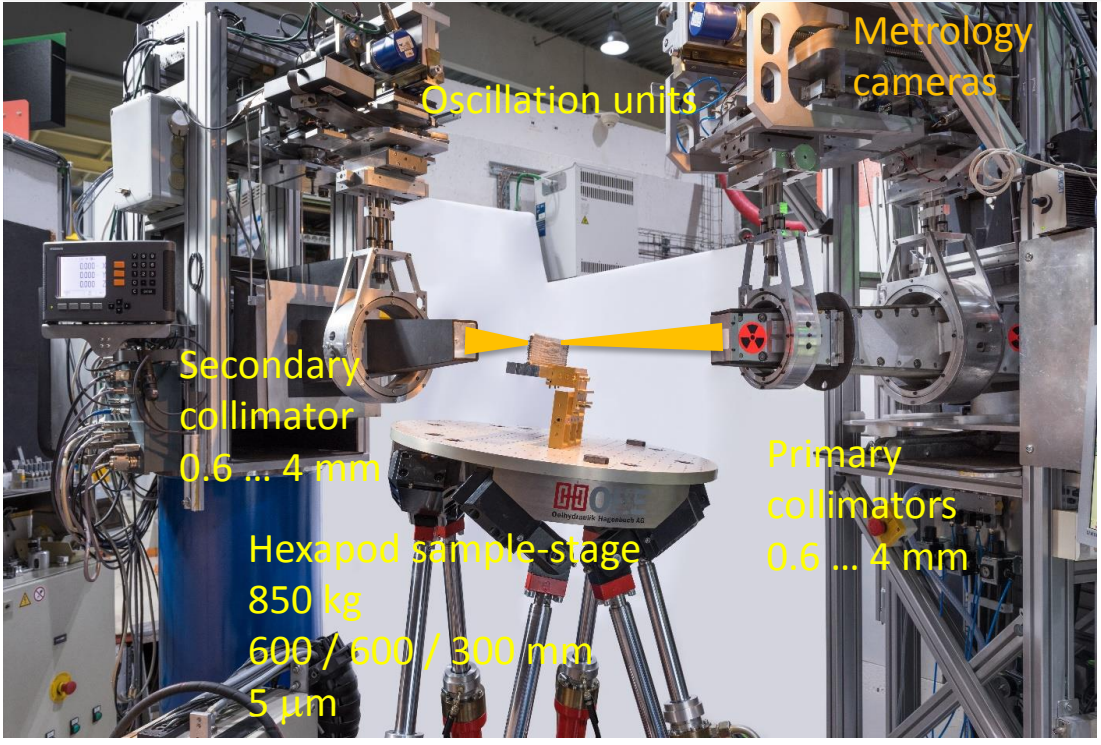
SALSA – 2020

Instrument responsibles: Thilo Pirling , Sandra Cabeza
Technician: Sergio Martinez
Post-Doc: Ranggi S. Ramadhan
Thesis student: Burak Özcan

SALSA

Technical data



Si-bent crystal monochromator, double focusing

Wavelength-range: 0.13 – 0.24 nm

Neutron flux at sample position: 2. 10^7 $cm^{-2}s^{-1}$

Continuously variable take-off

Technical improvements

New beam optics support structure

Stiffer and more compact support frame

⇒better **stability** and **reproducibility**

Motorized collimator alignment

⇒ reduce **alignment time** significantly

Parameter set for each collimator

⇒quick and **reproducible** collimator change

Anti-collision system to protect collimators and set up

Primary support and secondary support structure installed and commissioned

Technical improvements

Technical data

Completion of set of radial focussing collimators:

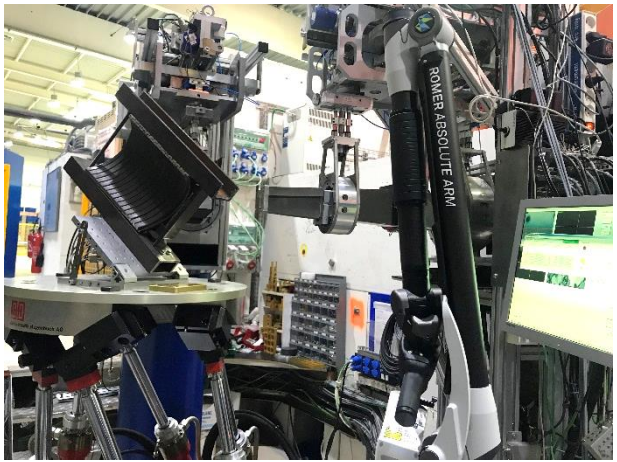
Primary vertical/horiz.	Primary horizontal/vert.	Secondary horizontal
2 mm	0.6 mm	0.6 mm
4 mm	2 mm	2 mm
10 mm	4 mm	4 mm

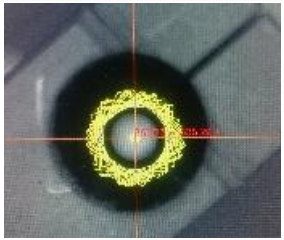
Existing collimator, replacement, new

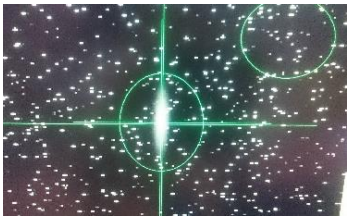
Instrument Alignment

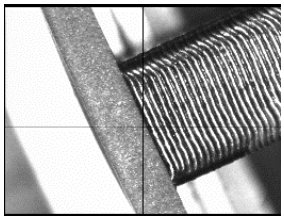
Sample alignment

- **3D metrology arm**
  - to align complex/distorted shaped samples
  - Improves precision
  - Saves alignment time
  - Scanning trajectories /points







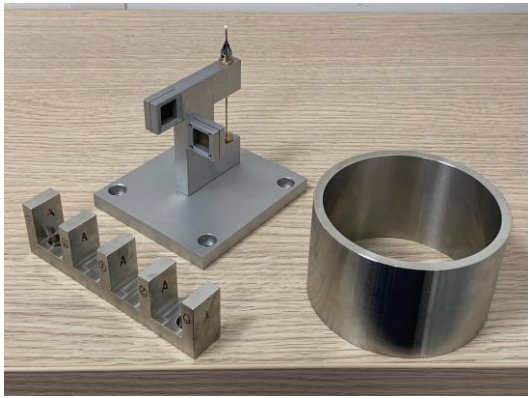


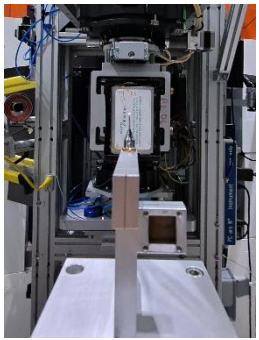
- **Camera assisted metrology system**
  - WaveMatrix: more complex, more versatile strain/stress curves possible
  - Link with data acquisition card: synchronization with neutron measurements plus additional sensors through analogue and digital channels

Instrument Alignment

BrightnESS[2]

- **Standardized Reference Samples**
  - …for instrument alignment
  - …for benchmarking analysis software
  - Improvement of precision
  - Determination of instrumental errors
  - Saves alignment time





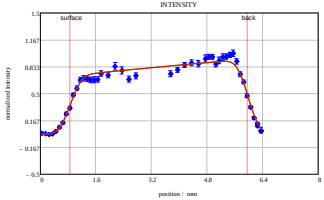
- **Collaboration between**
  - ISIS, ENGIN-X
  - FRM II, Stress-Spec
  - SAFARI, MPISI
  - ILL, SALSA

=> Talk of Ranggi S. Ramadhan

Sample Alignment

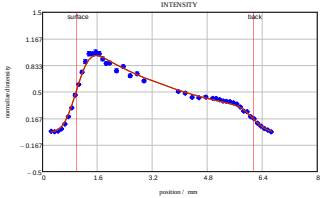
Analysis software

- **Fit of entry curves**
- **In reflection and transmission geometry**
  - for instrument alignment
  - For sample alignment



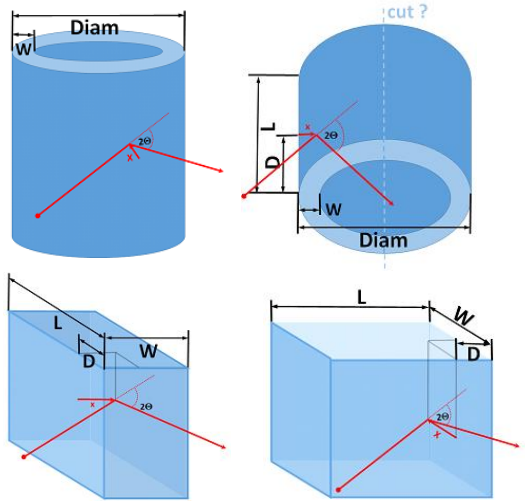
showresult =

"Parameter"	"Fitted value"	"Guess value"	"variation/%"
"primary beam"	1.323	1.323	0
"secondary beam"	1.276	1.276	0
"μ"	0.105	0.105	0
"W"	5.115	5.115	2.434×10^{-3}
"offset"	0.046	0.046	0.628
"h"	4.353	4.353	8.486×10^{-3}
"error"	0.247	0.247	-7.587×10^{-4}



showresult =

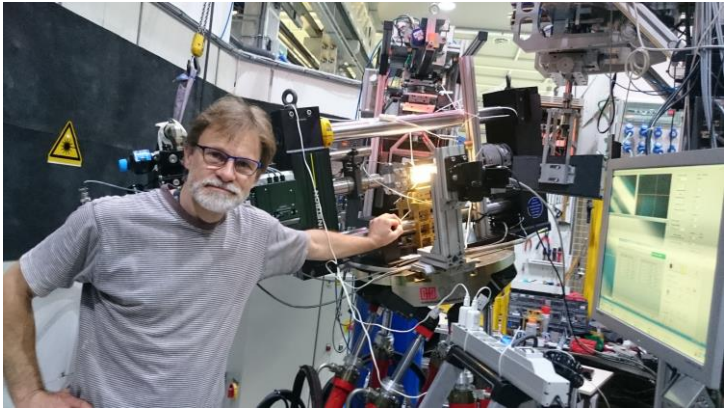
"Parameter"	"Fitted value"	"Guess value"	"variation/%"
"A"	1.323	1.323	0.000
"B"	1.276	1.276	0.000
"μ"	0.103	0.103	0.000
"D"	5.153	5.153	0.000
"offset"	0.248	0.248	0.000
"h"	1.146	1.146	0.000
"error"	0.082	0.082	0.000



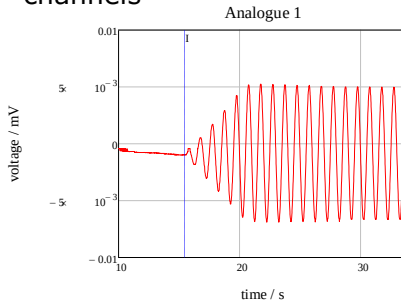
- **Taking into account different geometries and scan directions**

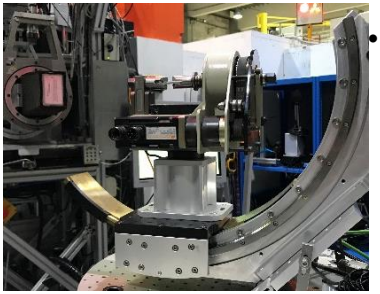
Sample Environment

Load rigs



- **Upgrade of 50kN stress rig**
  - WaveMatrix: more complex, more versatile strain/stress curves possible
  - Link with data acquisition card: synchronization with neutron measurements plus additional sensors through analogue and digital channels



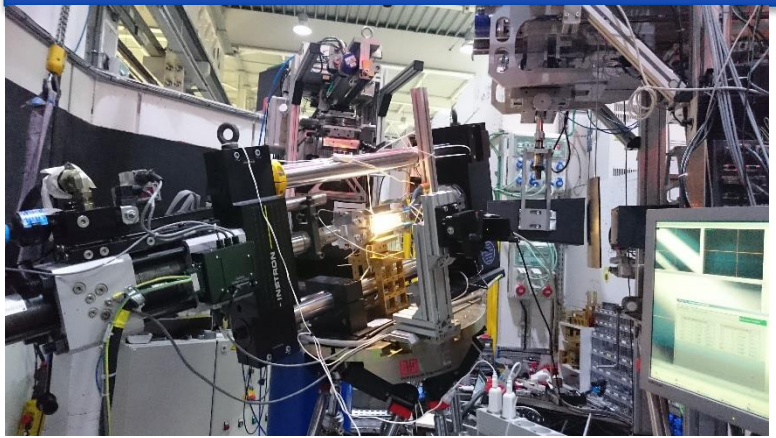


- **Refurbishment of 10kN stress rig**
  - Same link as for 50kN one
  - Fits on cradle

=> Talk of Molly Probert

Sample Environment

Load rigs



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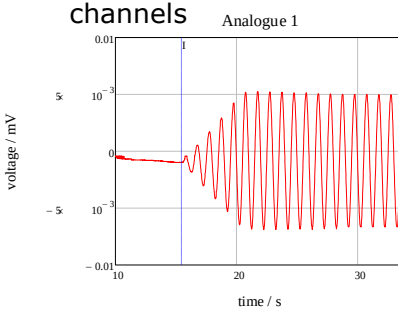

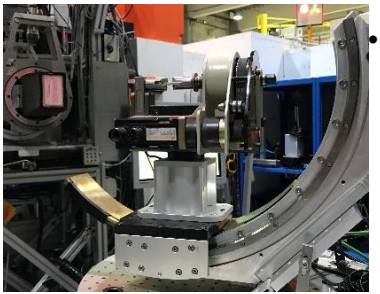

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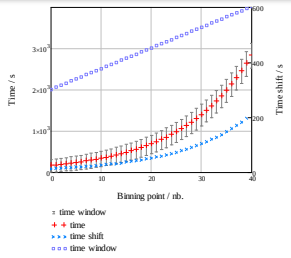
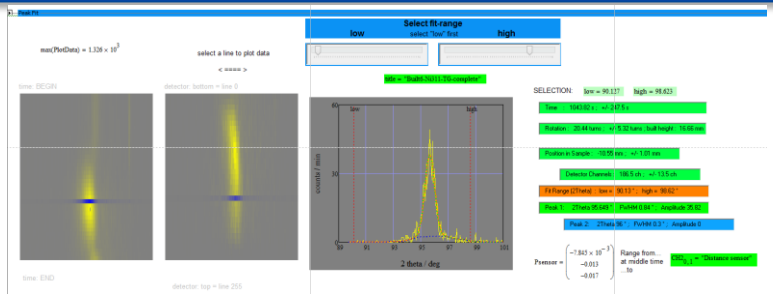
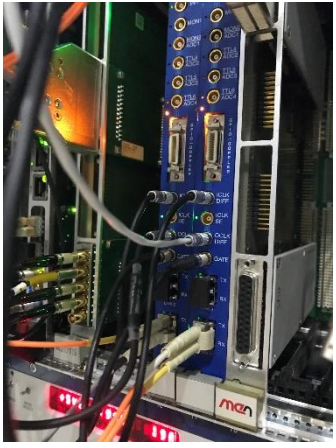
New Measuring approaches

Event mode acquisition and 3D-scans





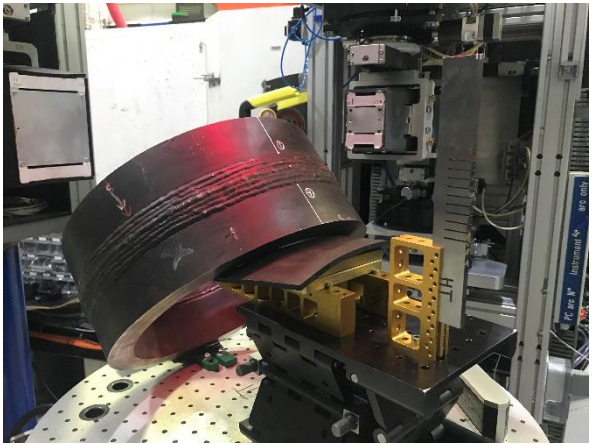


- **Event-mode data acquisition**
  - Interface card provides 4 A/D channels, 1 encoder, Bidim-detector
  - Read and analyze detector, analogue, encoder and digital channels simultaneously ⇒ in-situ studies
  - Continuous acquisition, stroboscopic mode etc.

- **Dynamic scan mode**
  - NOMAD now carries out scans with arbitrary coordinates, given from a list (i.e. input from CAD)
  - ⇒ complex shapes, 6-tensor components…

New Measuring approaches

Event mode acquisition and 3D-scans

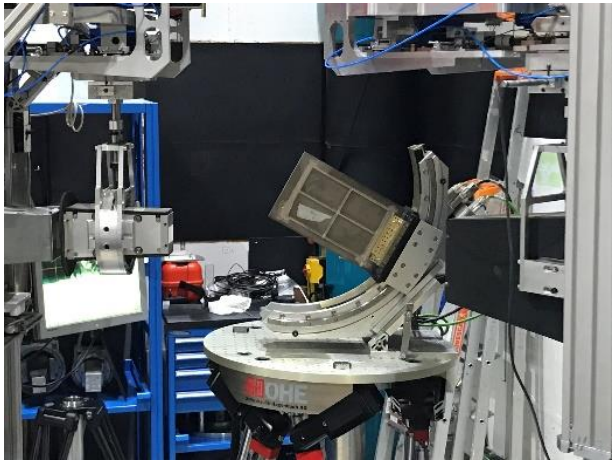


Tx	Ty	Tz	Rx	Ry	Rz	omega	chi
0	25.605	4.515	0	0	0	-12	80
0	27.575	4.862	0	0	0	-12	80
0	29.544	5.209	0	0	0	-12	80
0	31.514	5.557	0	0	0	-12	80
0	33.483	5.904	0	0	0	-12	80
0	35.453	6.251	0	0	0	-12	80
0	36.438	6.425	0	0	0	-12	80
0	37.423	6.599	0	0	0	-12	80
0	38.408	6.772	0	0	0	-12	80
0	39.392	6.946	0	0	0	-12	80
0	40.377	7.12	0	0	0	-12	80
0	42.347	7.467	0	0	0	-12	80
0	45.301	7.988	0	0	0	-12	80
0	25.605	4.515	0	0	0	23	80
0	27.575	4.862	0	0	0	23	80
0	29.544	5.209	0	0	0	23	80
0	31.514	5.557	0	0	0	23	80
0	33.483	5.904	0	0	0	23	80

- **Dynamic scan mode**
  - NOMAD now carries out scans with arbitrary coordinates, given from a list
  - Use point cloud from 3D-scan
  - ⇒ complex shapes, tilt samples, 6-tensor components…

Ongoing Developments

Hard and Software

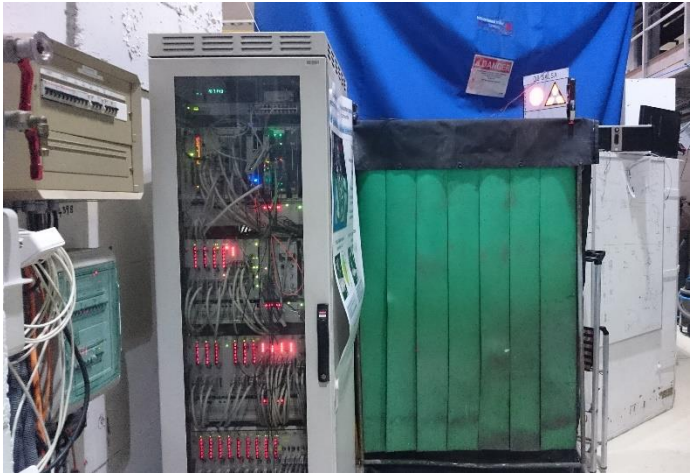


- **Non-destructive spatially resolved texture analysis**
- **Full stress tensor analysis**
- **Standardization of characterization of experimental set-up and determination of errors and uncertainties**
- **Implementation of SScanSS**

- **Additional Cu-Monochromator**
  - Wavelenths above 2Å with 5 times higher flux than Si-monochromator

Industrial Activity

Which way to go?



- SALSA deployment phase has ended
- 70% academic beam time
- Collaborating projects
- Memorandum of understanding with companies and technological centres -> OHB, Fraunhofer
- EASI-STRESS

- Examples: CEA-Liten and Technip on hoses for oil extraction, MTC with additive manufacturing, Arcelor Mittal with steel simulations…

Summary

- Complex samples alignment
  - **3D-measuring arm -> alignment of complex geometry samples**
  - **3D-maps**
- In-situ tests:
  - **Event mode data acquisition:** synchronous acquisition of analogue and digital signals with neutron data => extremely flexible for all sorts of sample environment
  - **INSTRON 50kN load rig:** wave-matrix software to program loading procedures. SALSA acquires data synchronously
  - **small load rig (10kN)**: modernization, same interface as 50 kN load rig, fits in cradle
- 3D Texture characterization on real components
  - Neutron characterization in other instruments require sample destruction.
  - **Need of 3D simulator of beam path for all angles to correct absorption**
- Data treatment
  - Working on interfaces with commercial software
  - Data treatment on Python based software (from peak fit to stress, texture, etc)
- Industrial collaboration
  - Trying to find collaboration partners directly or through technological centres more than direct beam time sales