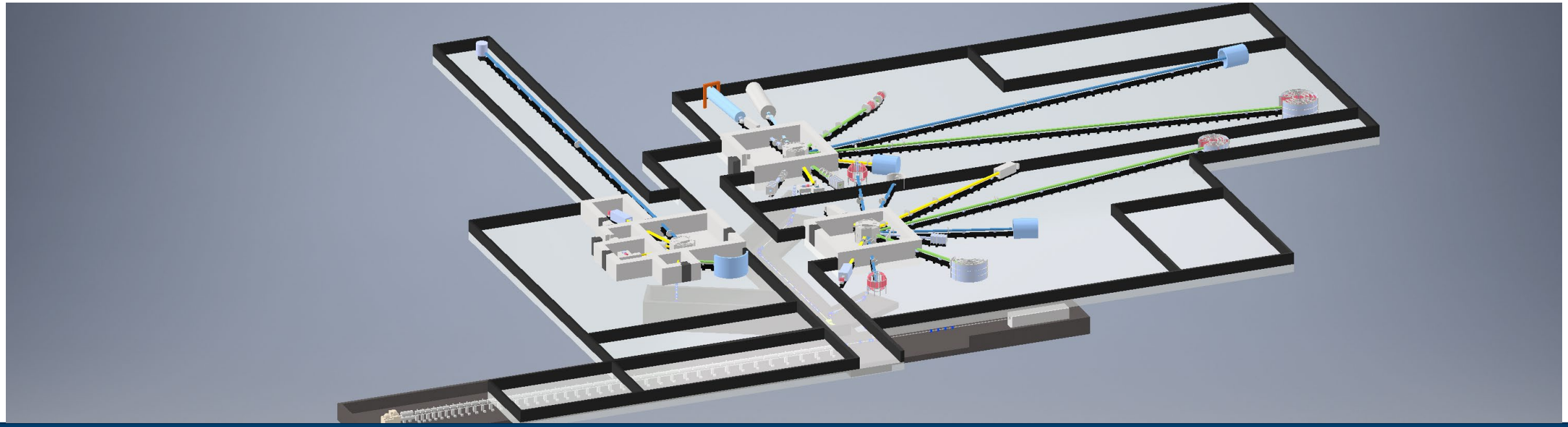


HBS

P. ZAKALEK, Y. BEßLER, R. HANSLIK & HBS TEAM

OUTLINE

- **HBS Status**
- Target
- JULIC Neutron Platform: a testbed for HBS
- Target test station
- HBS Moderators

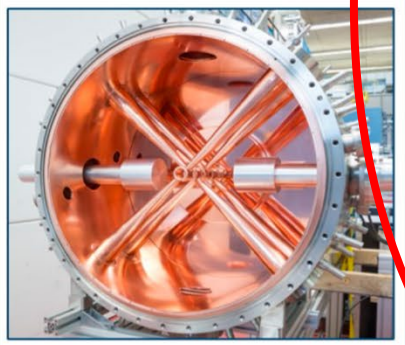
✓ DRAFT FOR 2 VOLUMES FINISHED

Technical Design Report (TDR) in 4 Volumes plus Summary

TDR Accelerator

Executive editors:

H. Podlech (IAP Frankfurt)
A. Lehrach (IKP-4)
R. Gebel (IKP-4)

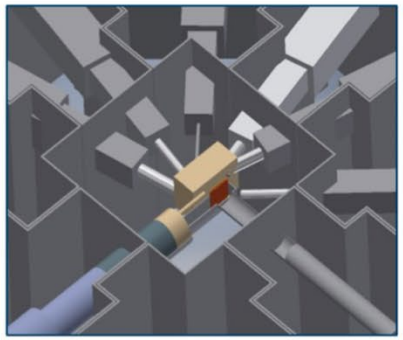


100 %

TDR Neutron Target

Executive editors:

P. Zakalek (JCNS-HBS)
J. Baggemann (JCNS-HBS)
U. Rücker (JCNS-HBS)
E. Mauerhofer (JCNS-HBS)

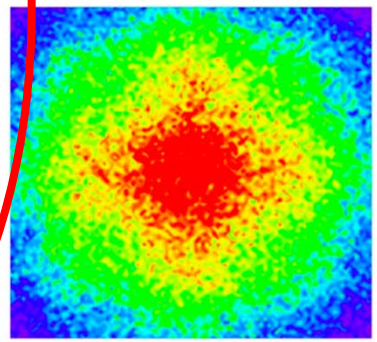


85%

TDR Neutron Instruments

Executive editors:

J. Voigt (JCNS-IT)
K. Lieutenant (JCNS-IT)

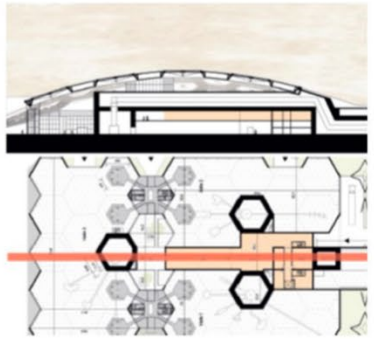


100 %

Infrastructure & Sustainability

Executive editors:

C. Claudio-Weber (JCNS)
T. Gutberlet (JCNS-HBS)



70%

(percentage of completion)

COMPETITIVE INSTRUMENTS BY FACILITY DESIGN

HBS: A High Current Accelerator-driven Neutron Source (HiCANS)

high current accelerator → HiCANS

- 100 mA, 70 MeV for increased source strength
- adapted macro bunch filling pattern

several target stations

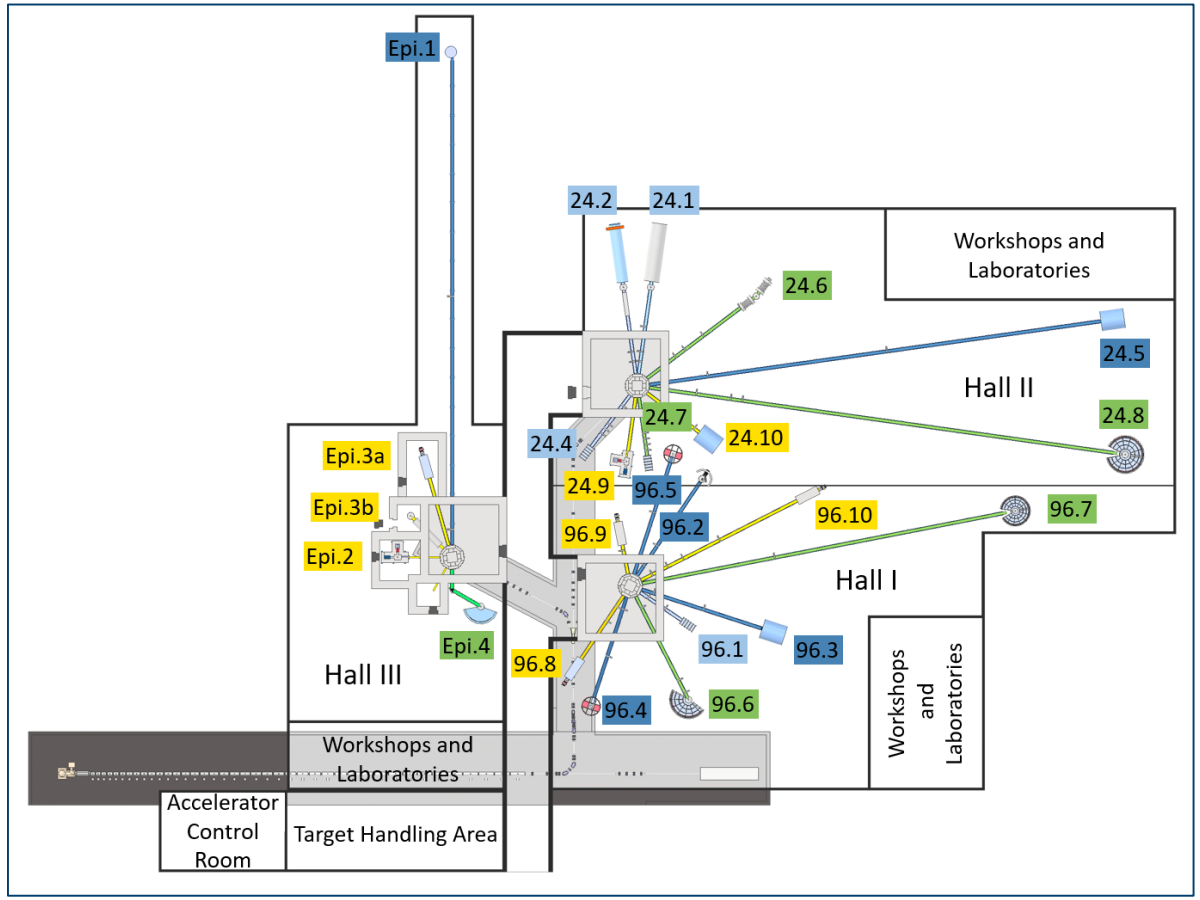
- served by multiplexer
- optimized pulse structure (length, frequency)

every beam port serves only 1 Instrument

- optimized source spectrum and geometry
- neutron optics integrated in beam port

compact shielding → optimal neutron optics

- optical elements positioned close to moderator
- optimal phase space extraction



OUTLINE

- HBS Status
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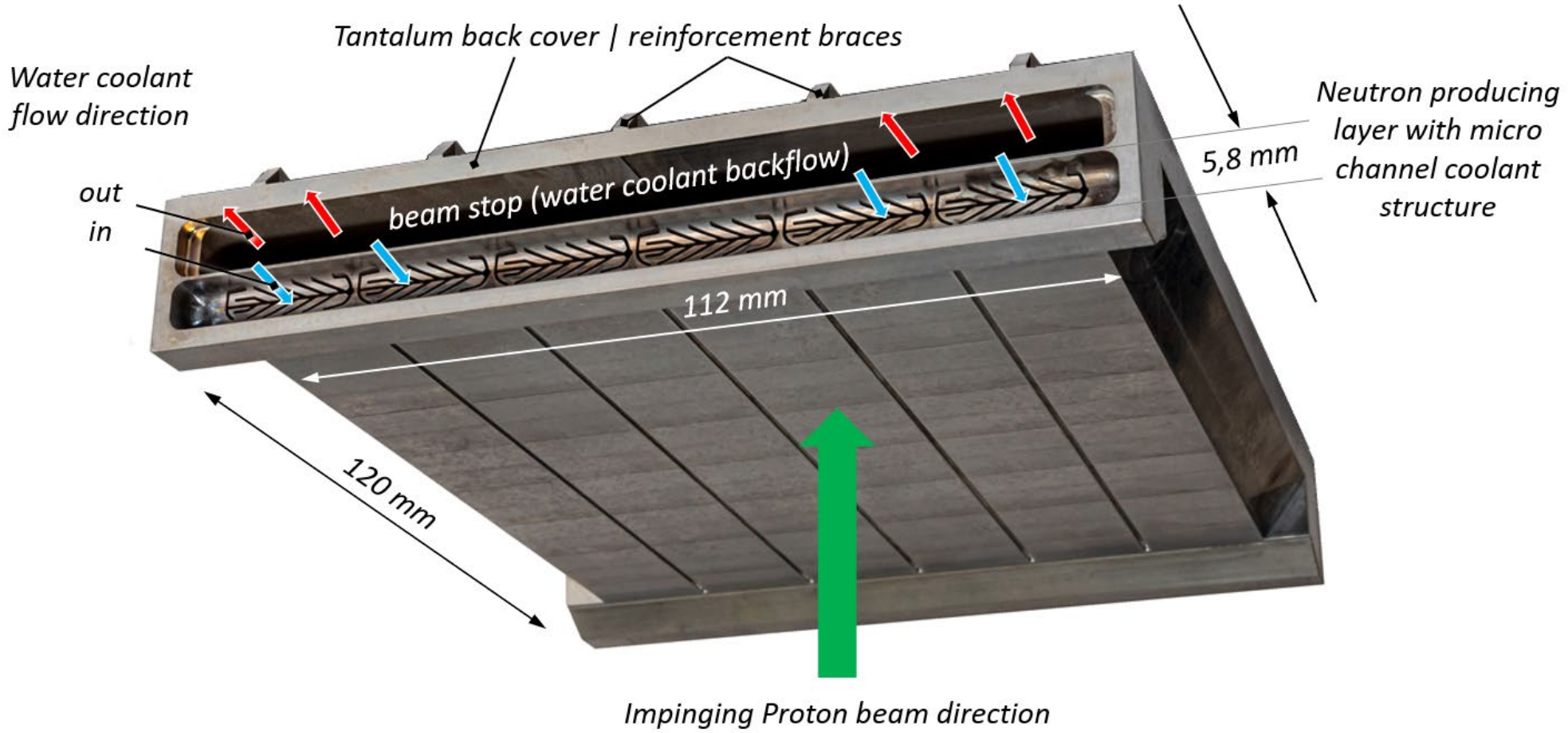
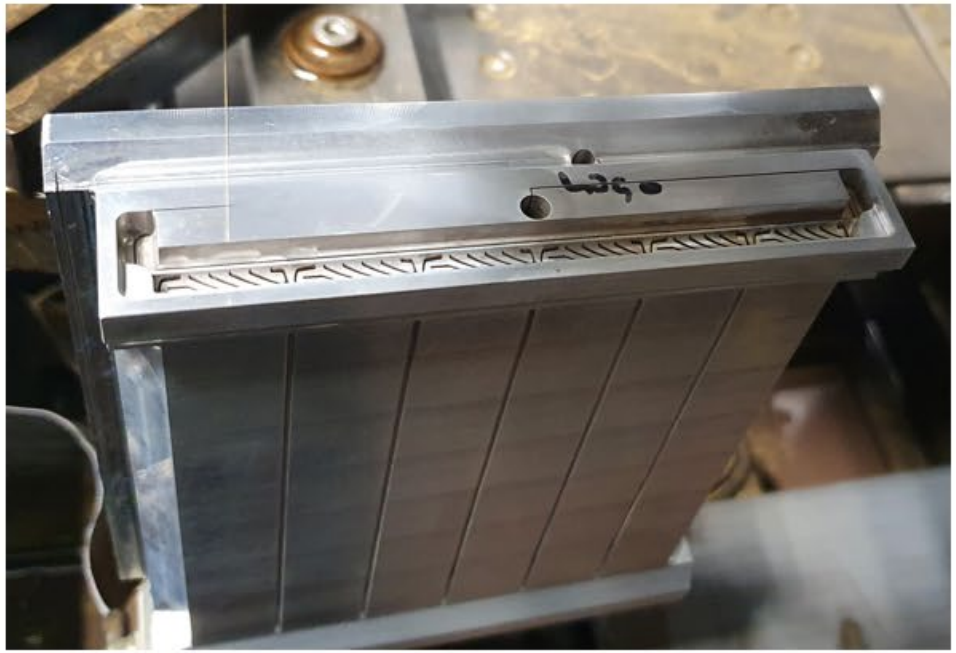
NEUTRON PRODUCING TARGET

Tantalum Microchannel Target



NEUTRON PRODUCING TARGET

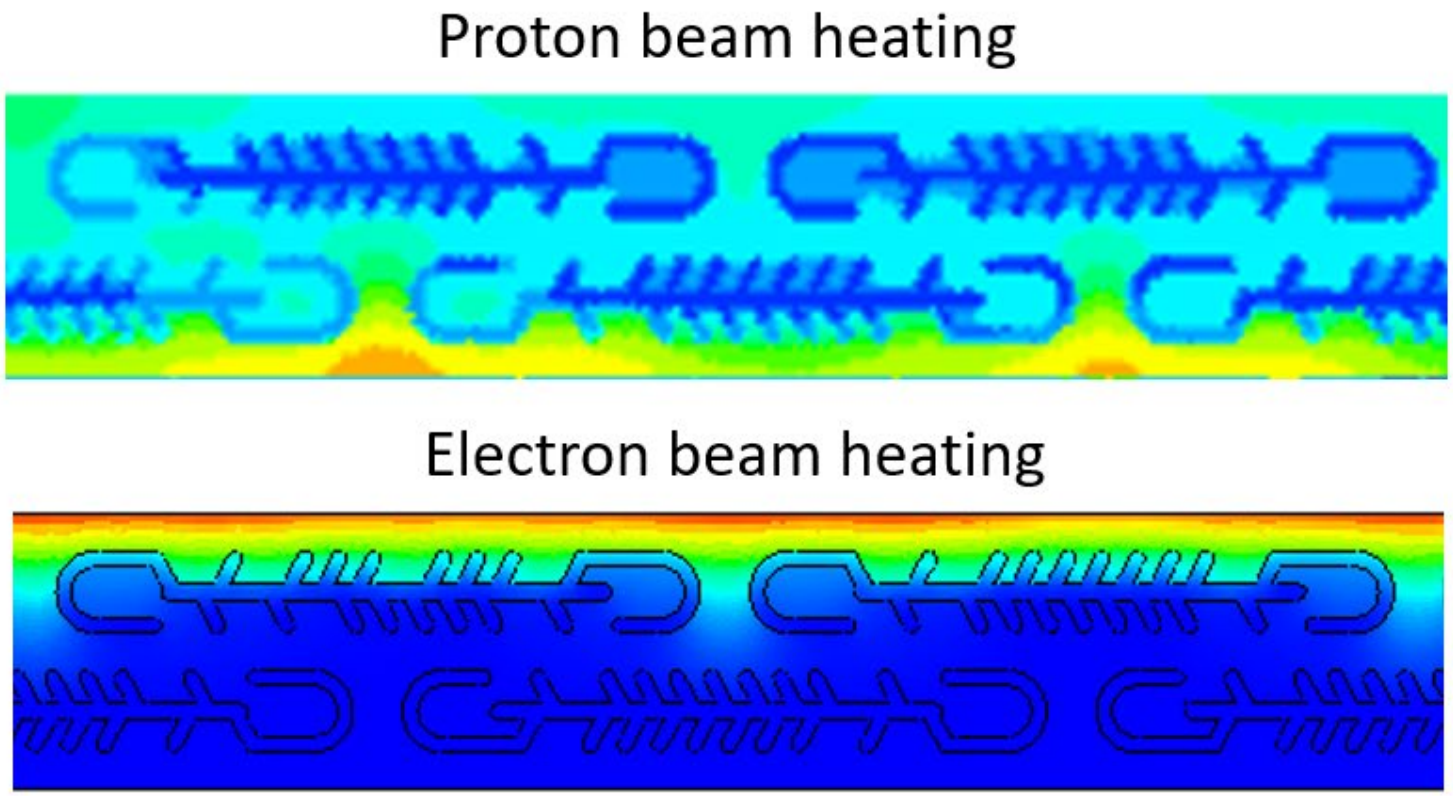
Wire erosion



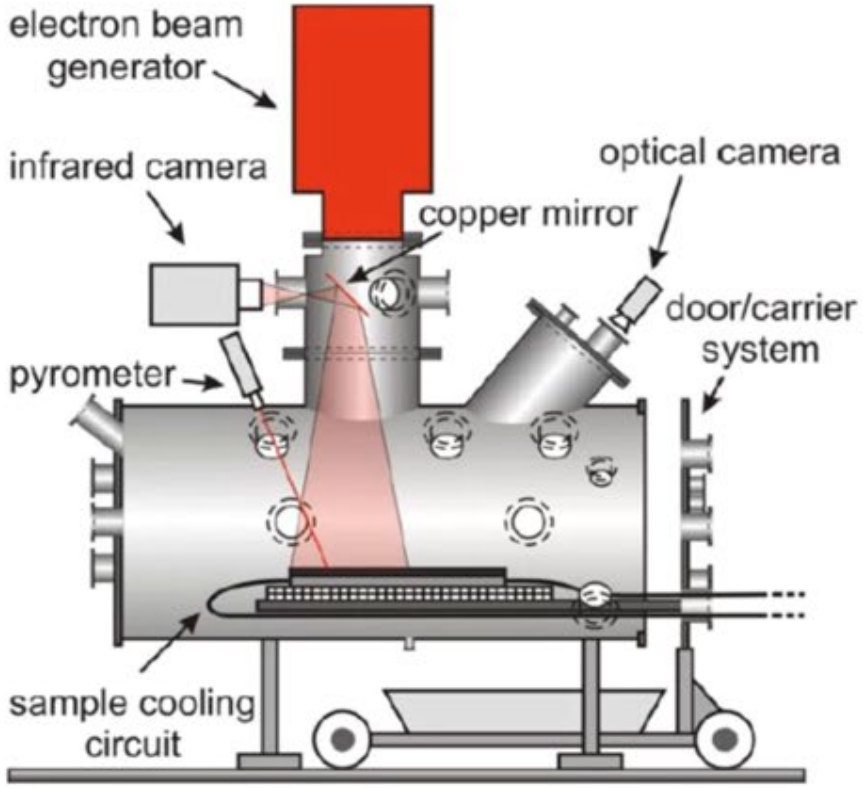
NEUTRON PRODUCING TARGET

Successful experiment with electron gun up to 1 kW/cm²

Electron beam test



Exemplary temperature distribution from CFD



Judith-2 basic design [IEK-4]

ENGINEERING AND REALIZATION

Target Station

Modular and flexible design

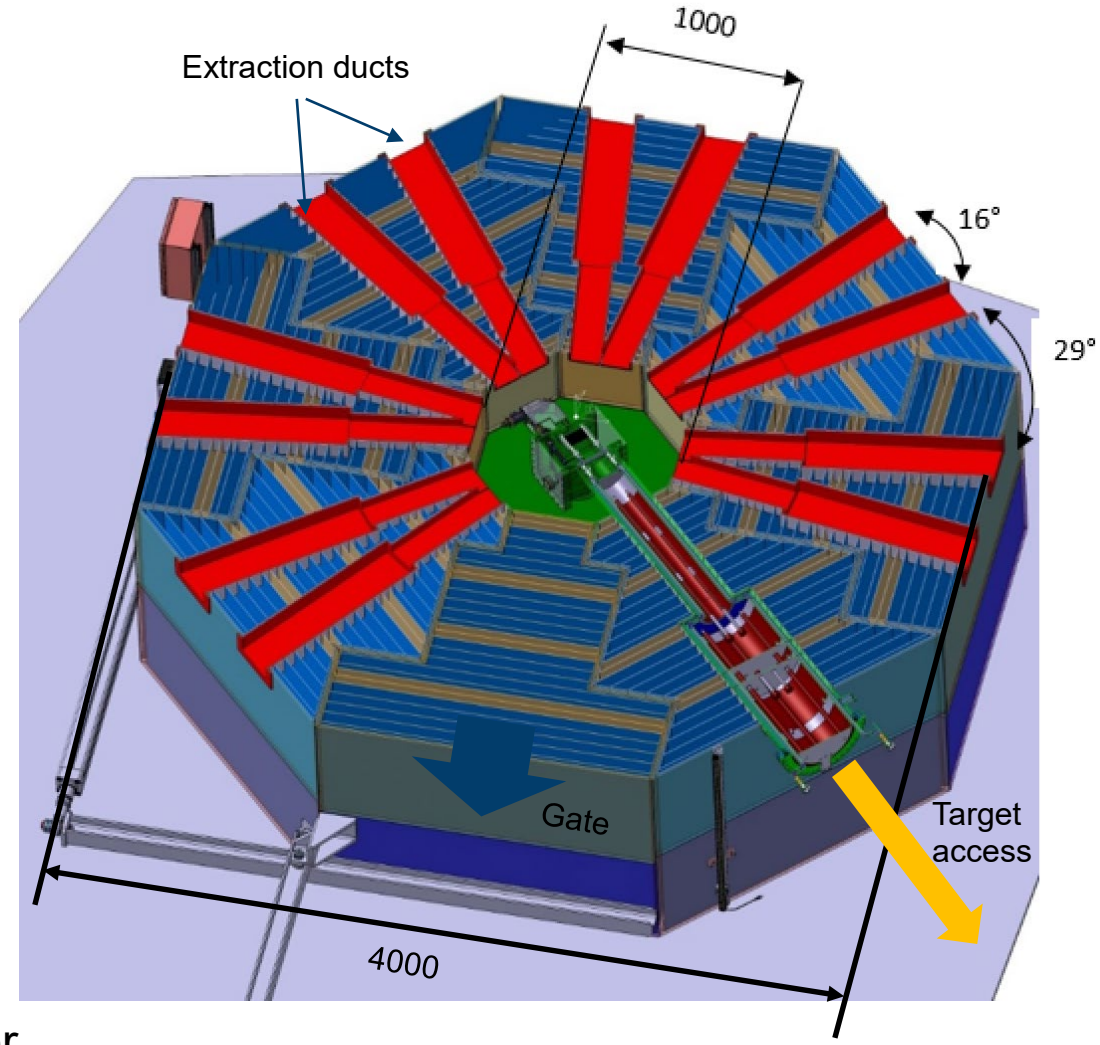
- Adjustable inner core
- Optimized moderator plugs

Compact design

- Instrument components close to moderator
- Large phase space volume

Vertical proton beam

- Space for instruments
- Low radiation background



Moderator Plugs → Yannick Beßler

Target test station → Romuald Hanslik

OUTLINE

- HBS Status
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- **JULIC Neutron Platform: a testbed for HBS**
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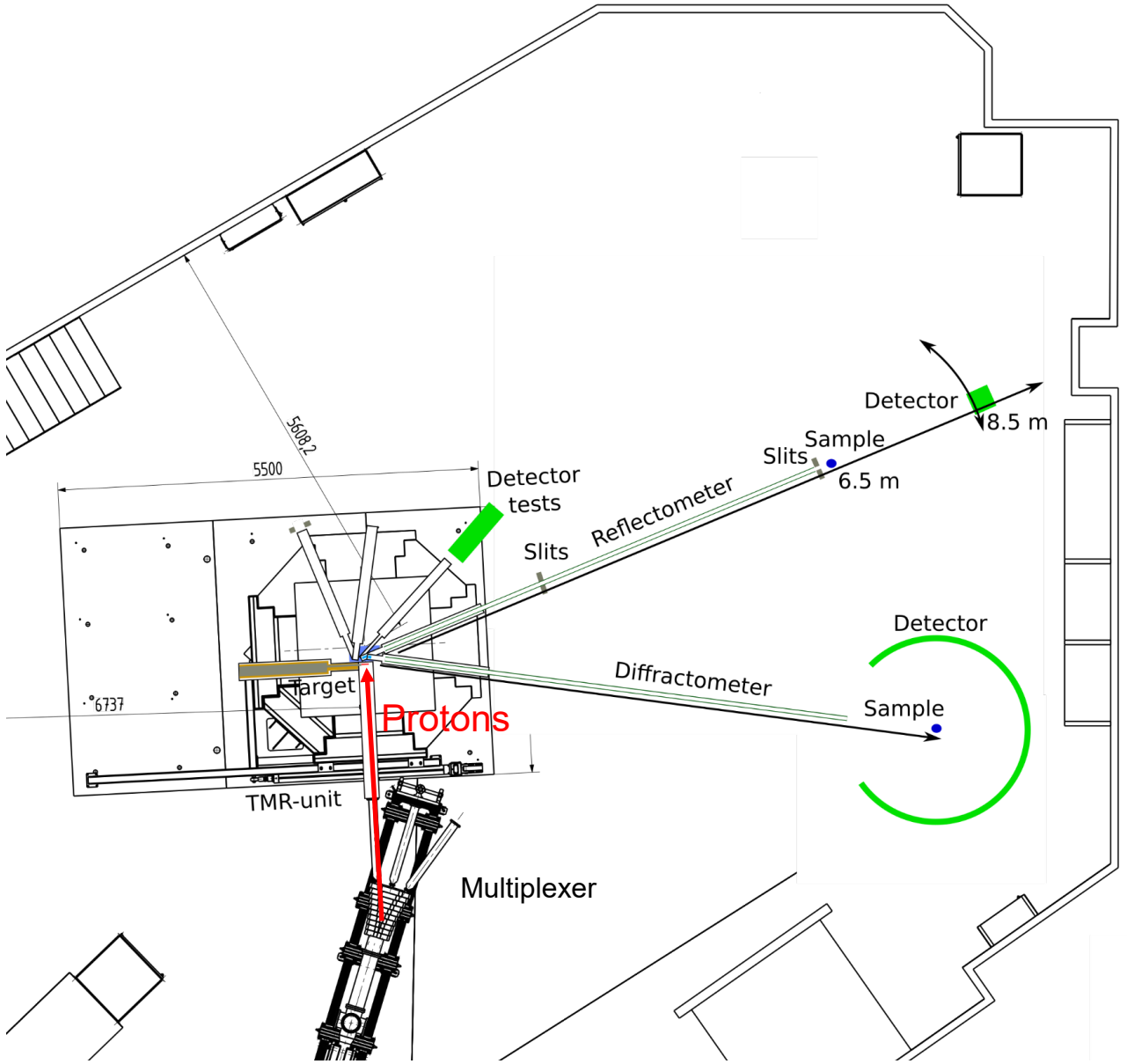
- HBS Moderators

JULIC Neutron platform

	Big Karl	HBS
Particle type	Proton	Proton
Energy	45 MeV	70 MeV
Peak current	~ 100 nA	90 mA
Duty cycle	4 %	1.6 %
Average power	< 1 W	100 kW
Neutron yield	$< 1 \cdot 10^{10}\ s^{-1}$	$2 \cdot 10^{15}\ s^{-1}$

Big Karl experimental area allows performing basic neutron scattering experiments in time-of-flight mode



✓ TEST-FACILITY AT FZJ COMMISSIONED

First beam on target on Dec. 12, 2022, with 3 beamlines in operation

proton beamline from cyclotron

- 45 MeV pulsed protons, only nano Ampere current

target-moderator-reflector (TMR) unit

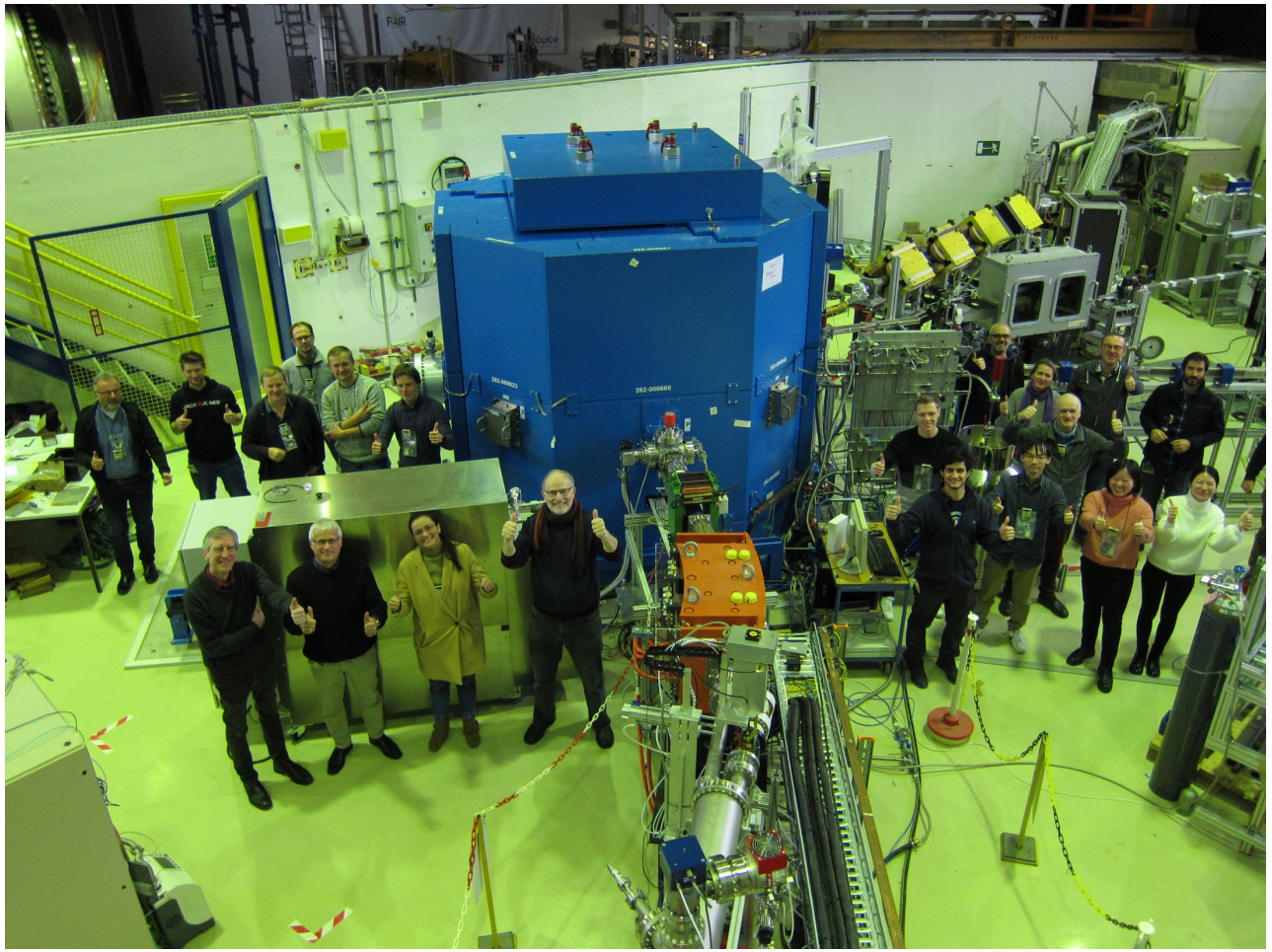
- HBS Ta-target, PE-moderator, Pb-reflector

cold methane moderator

- spectrum measured at various temperatures

three beamlines in operation

- time-of-flight diffractometer:
  neutron energy spectrum, first diffractogram
- HERMES reflectometer provided by LLB:
  total reflection edge of supermirror
- detector test station:
  SONDE detector for ESS tested



OUTLINE

HBS Status

Target

JULIC Neutron Platform: a testbed for HBS

- Beamline 2: TOAD
- Beamline 3: HERMES
- Beamline 4: PSD test beam

Target test station

HBS Moderators

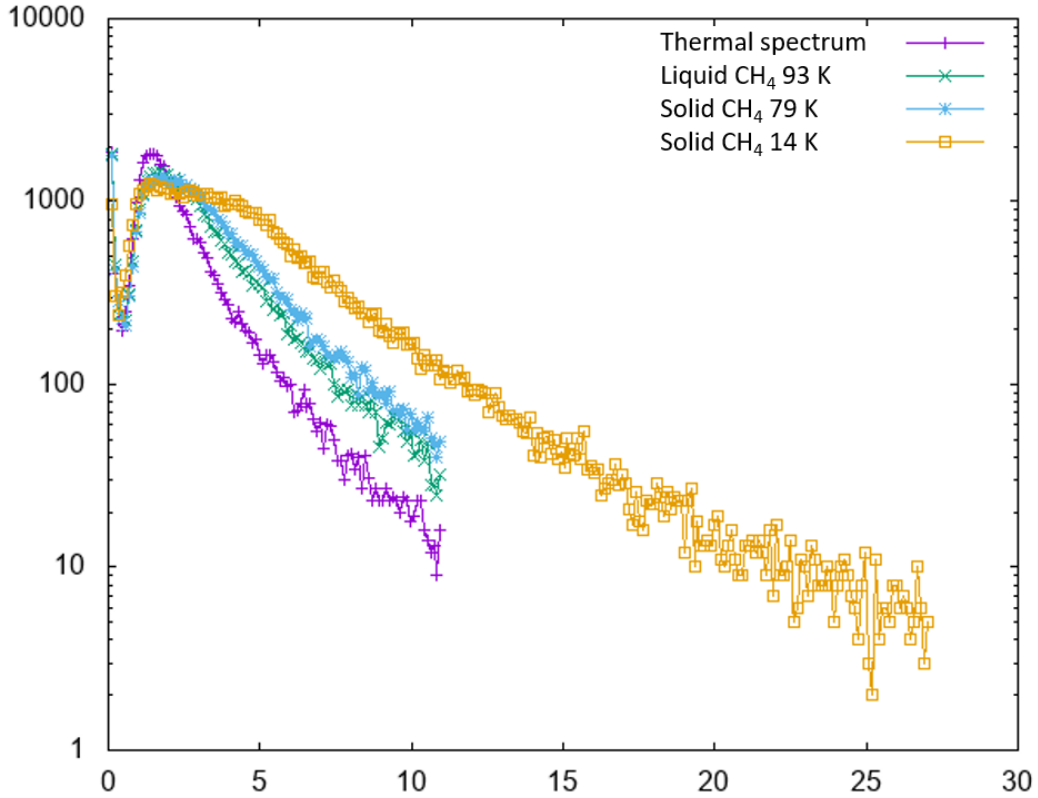
Beamline 2: TOAD

Time-Of-flight AKR Diffractometer
(formerly installed at
AKR-2 zero-power-reactor,
TU Dresden)

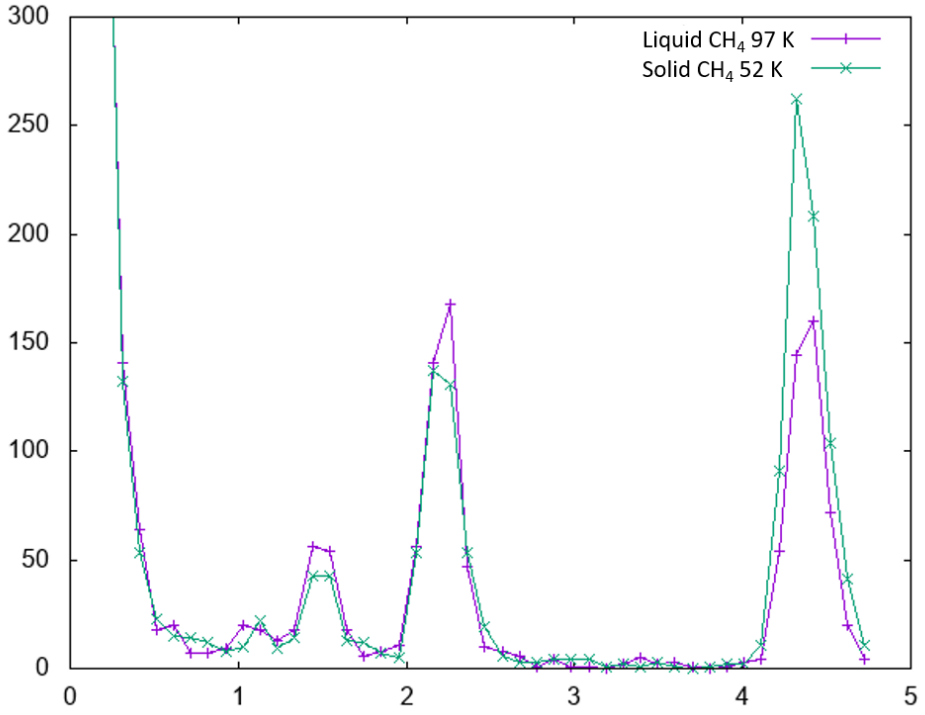
Solid CH_4 cold source (A. Schwab)
6.5 m ^{58}Ni neutron guide 30 x 50 mm²

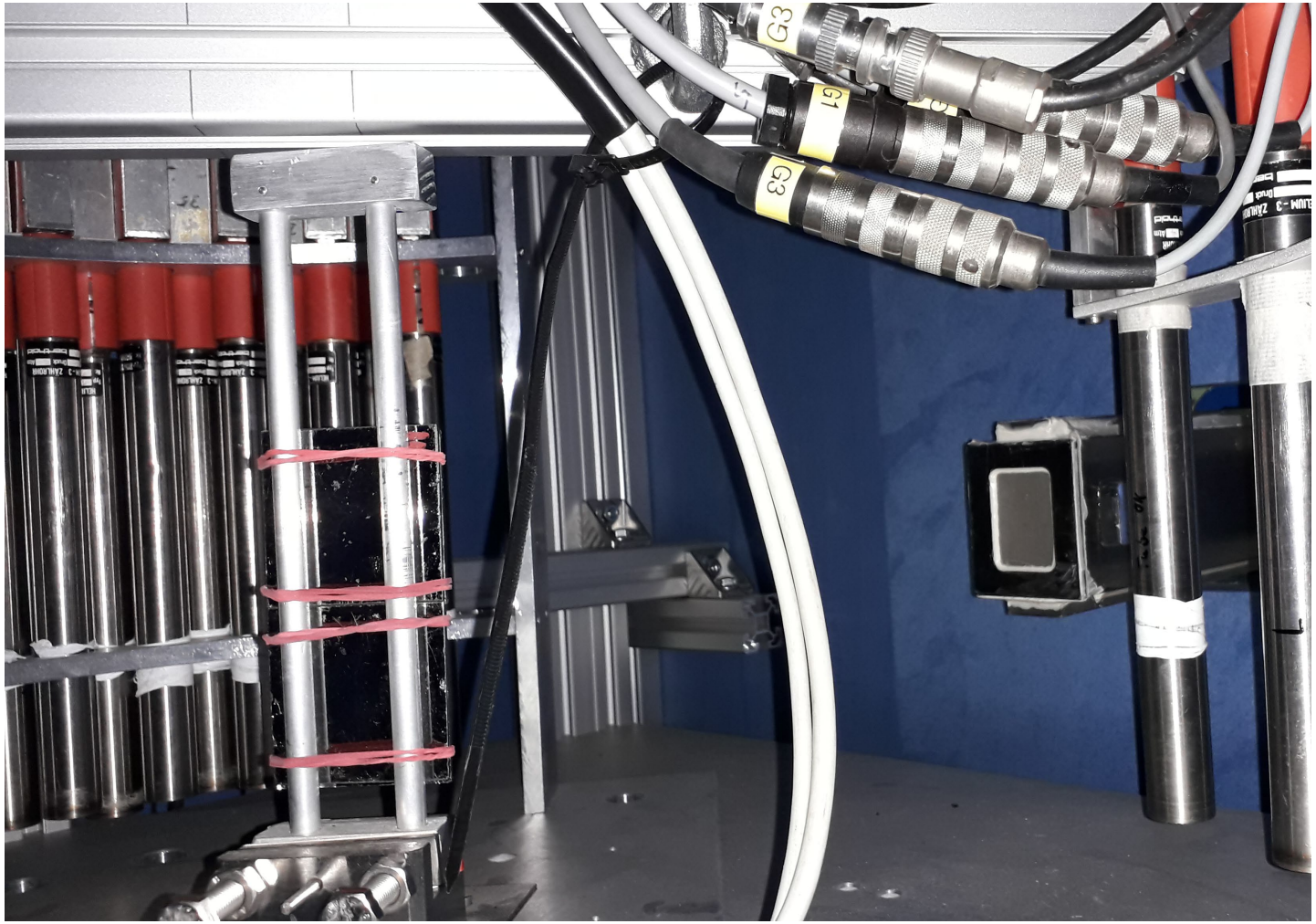
TOF detector + diffractometer
in shielding box of PE + B_2O_3

Beamline 2: TOAD



Beamline 2: Diffraction at TOAD





OUTLINE

HBS Status

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JULIC Neutron Platform: a testbed for HBS

- Beamline 2: TOAD
- Beamline 3: HERMES
- Beamline 4: PSD test beam

Target test station

HBS Moderators

Beamline 3: HERMES

Time-Of-flight Reflectometer
(formerly installed at
Orphée, LLB Saclay, France)

Cooperation with LLB Saclay
M.-A. Paulin
F. Ott
A. Menelle

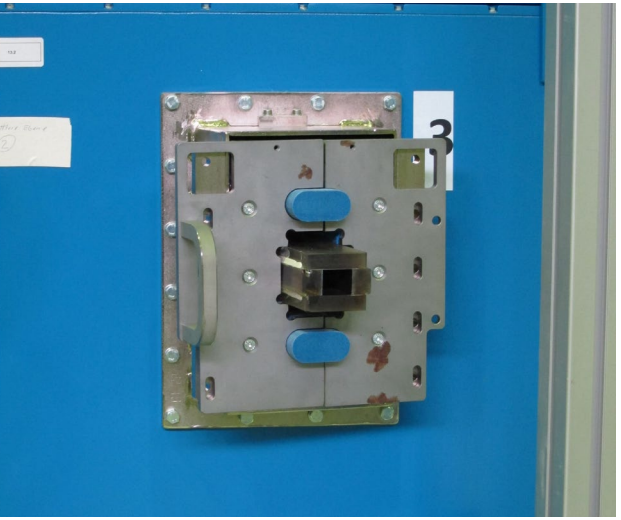
Scientific use:
Reflectometry of neutron optics
Investigation of s/n issues

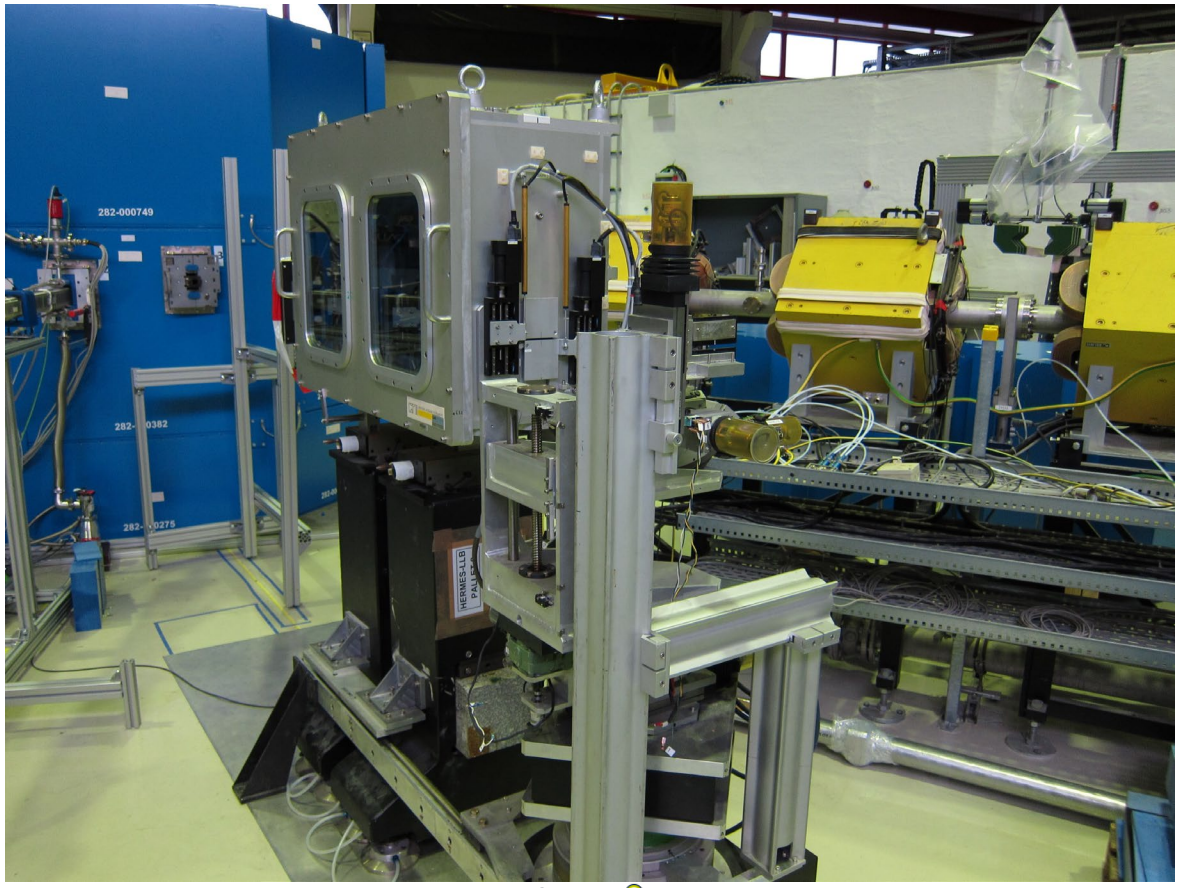
Beamline 3: HERMES

Arrival Wednesday 07.12.2022

Beamline 3: HERMES

Assembly, Motor tests
Saturday 10.12.2022



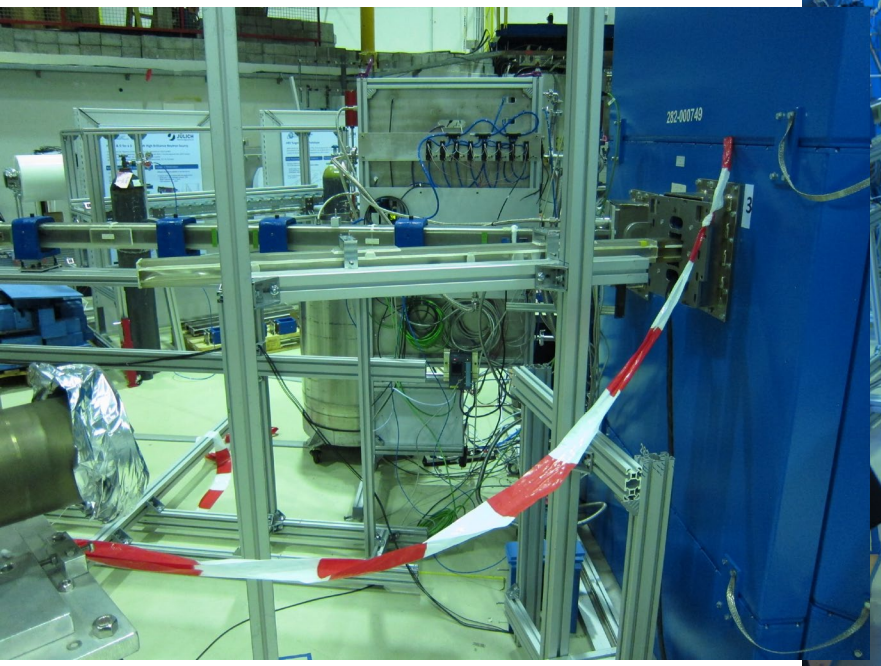


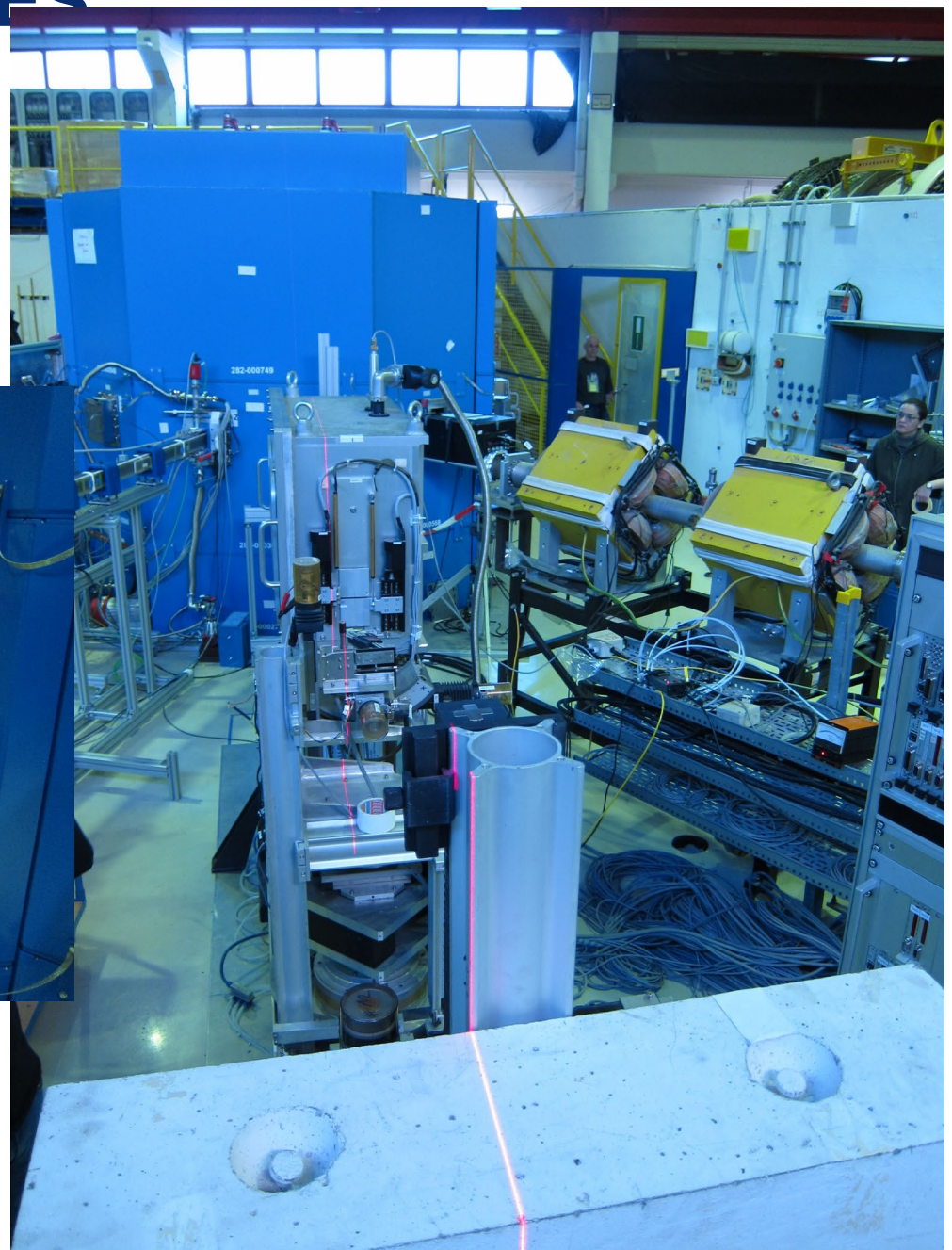
Orphée Laboratoire Léon Brillouin

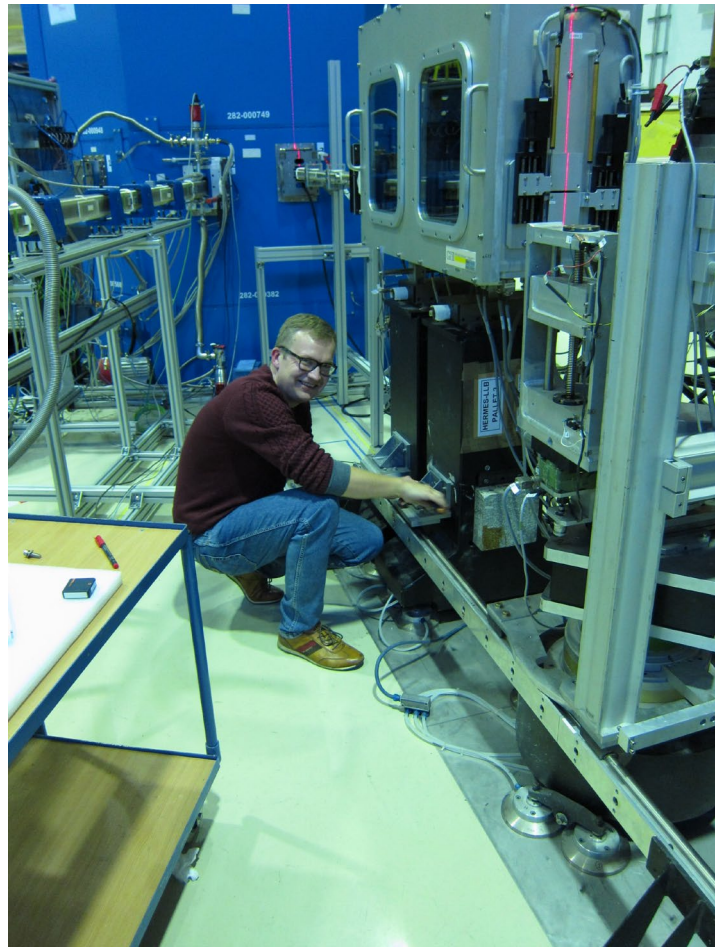
JÜLICH Forschungszentrum

Beamline 3: HERMES

Optical Alignment
Monday 12.12.2022

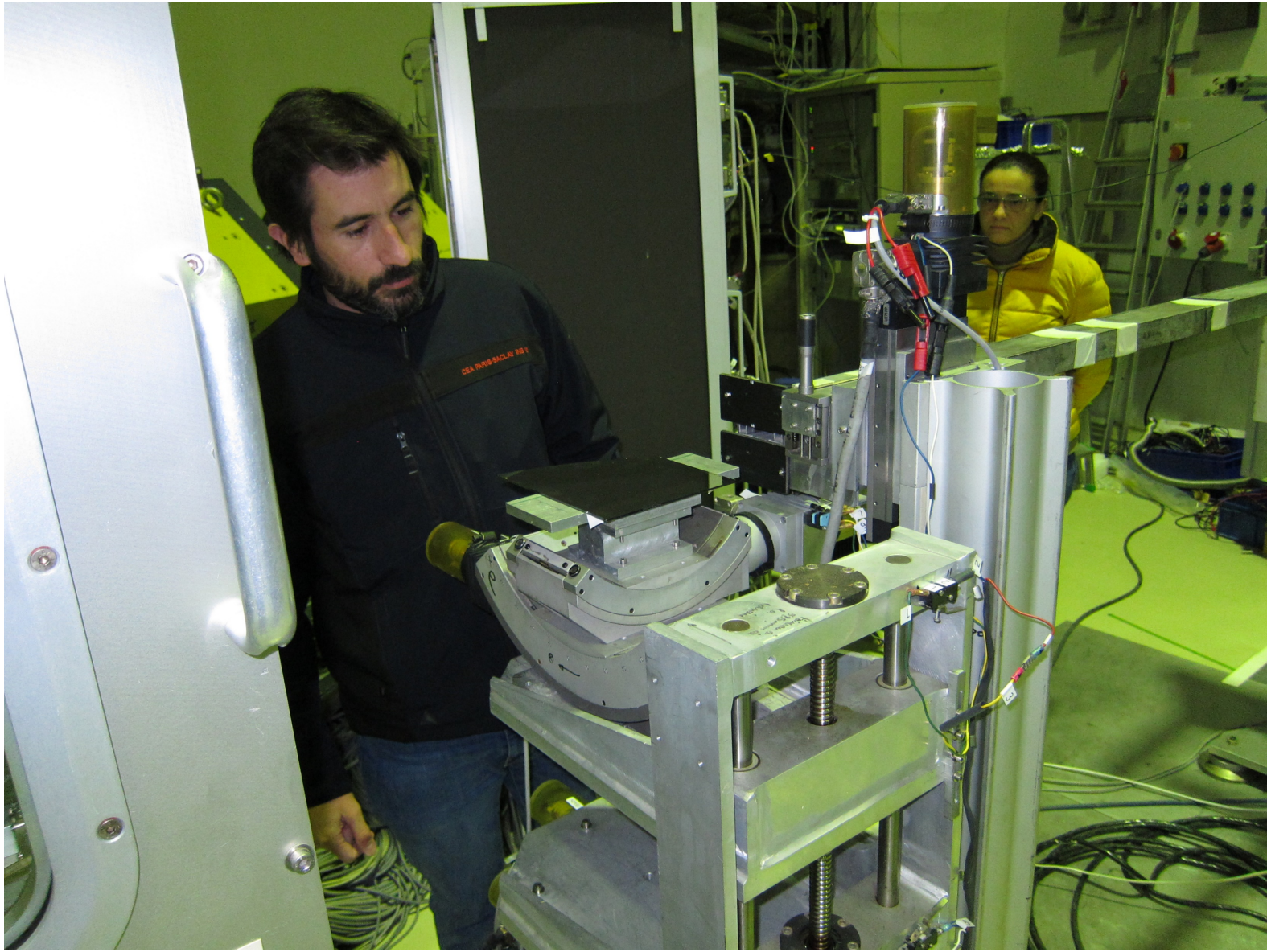






Beamline 3: HERMES

First sample in the beam
Wednesday 14.12.2022



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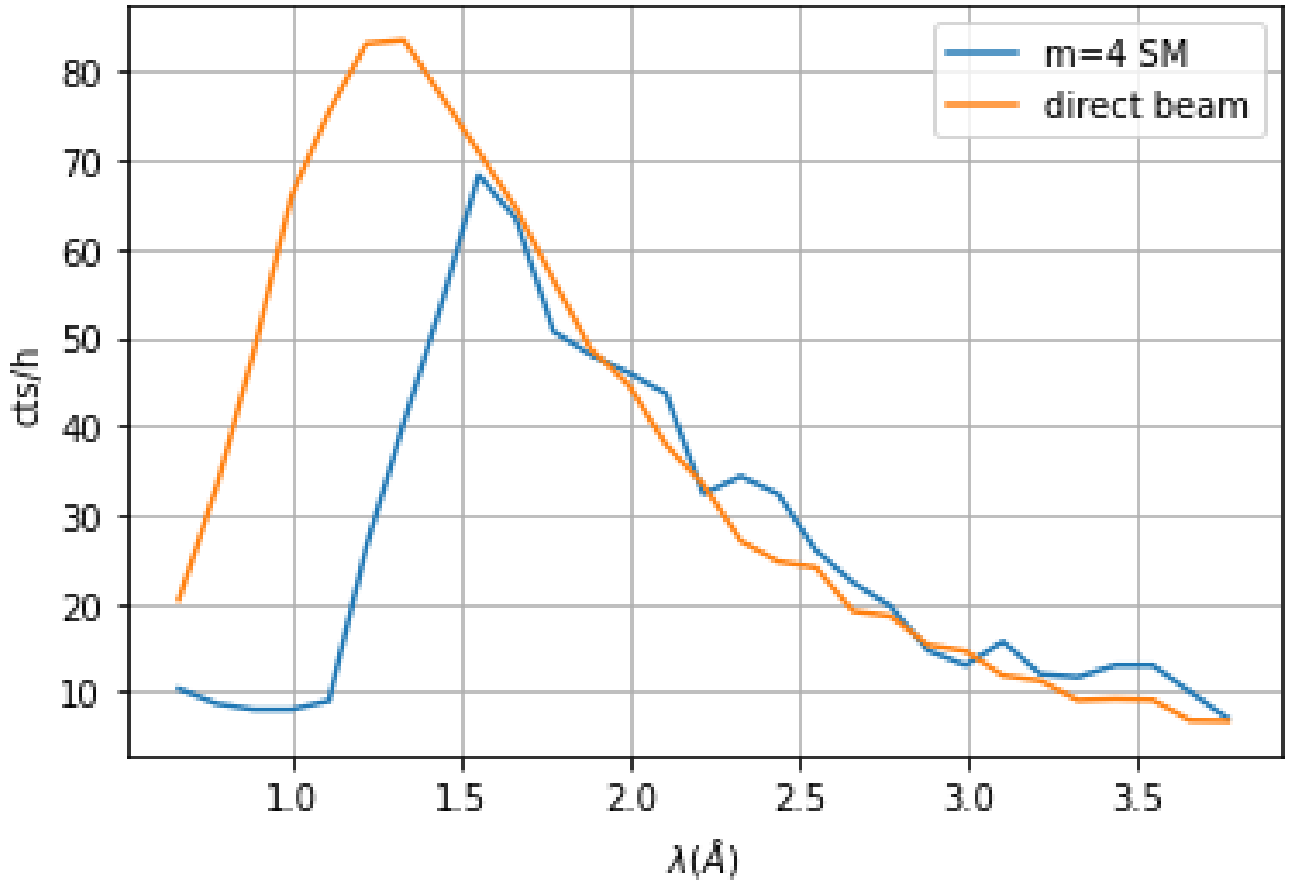
Beamline 3: HERMES

First total reflection edge measured
Thursday 15.12.2022

To be improved:
- Installation of cold source
- Frame overlap chopper
- Increased intensity of proton beam



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OUTLINE

HBS Status

Target

JULIC Neutron Platform: a testbed for HBS

- Beamline 2: TOAD
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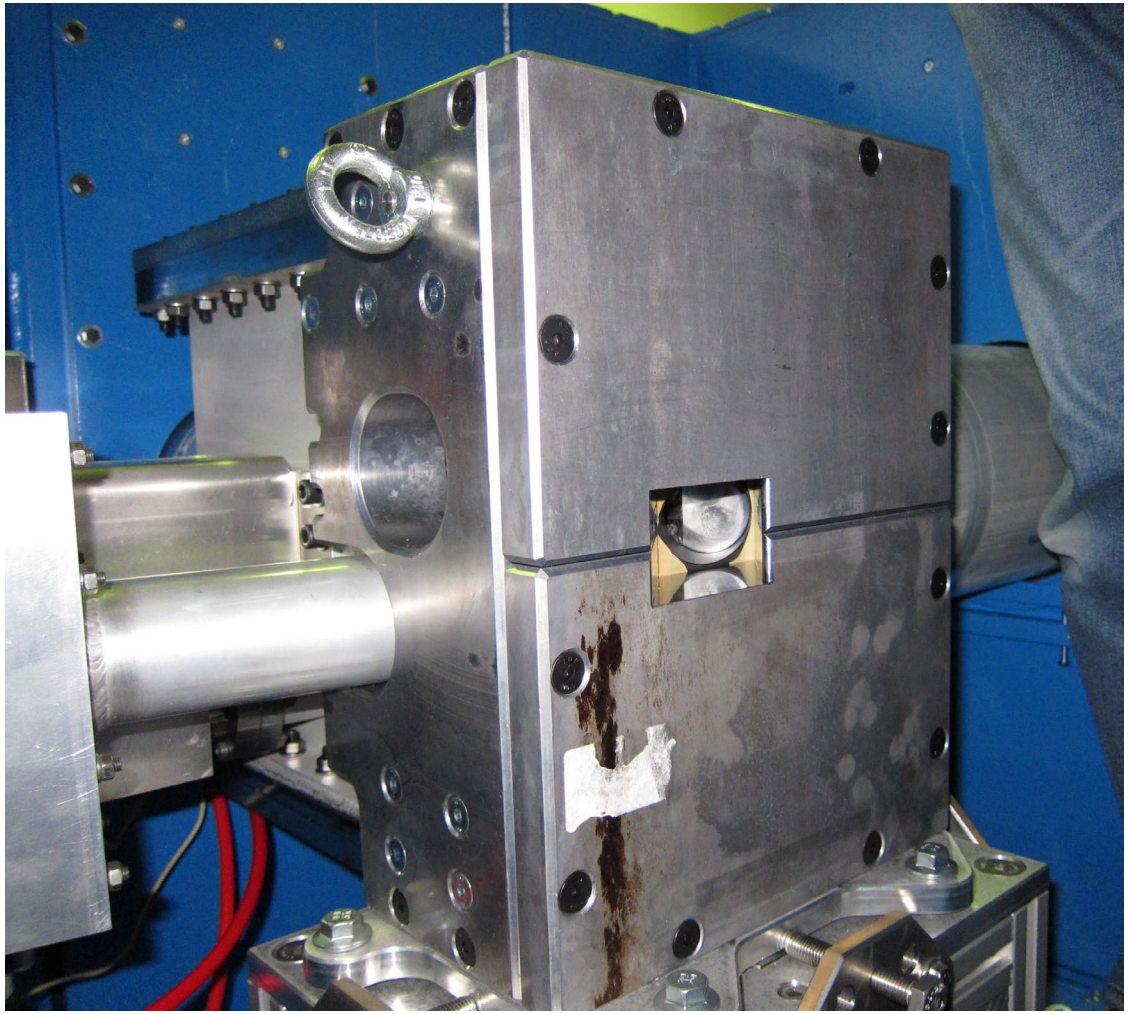
- Beamline 4: PSD test beam

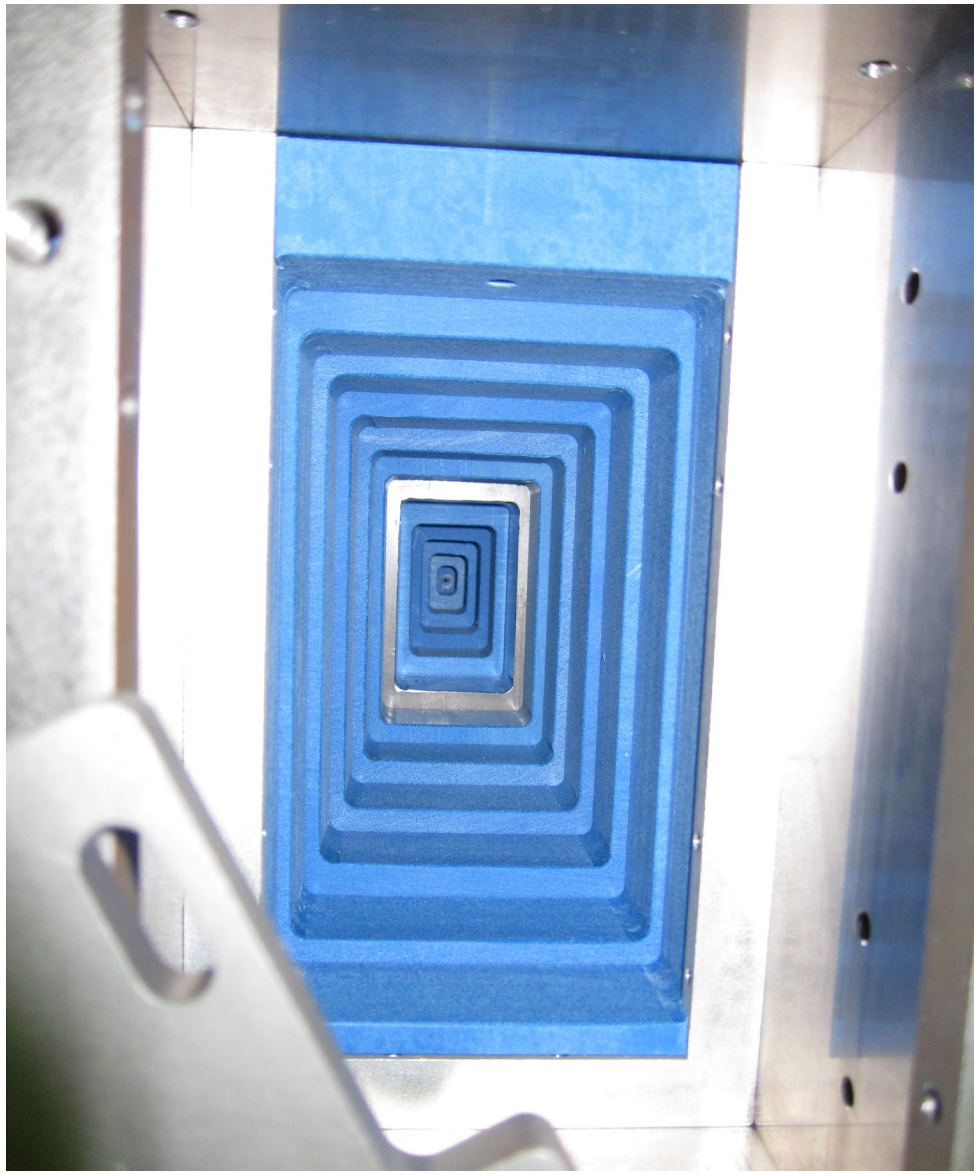
Target test station

HBS Moderators

Beamline 4: PSD Test beam

Camera pinhole 5 mm Ø
facing thermal extraction channel





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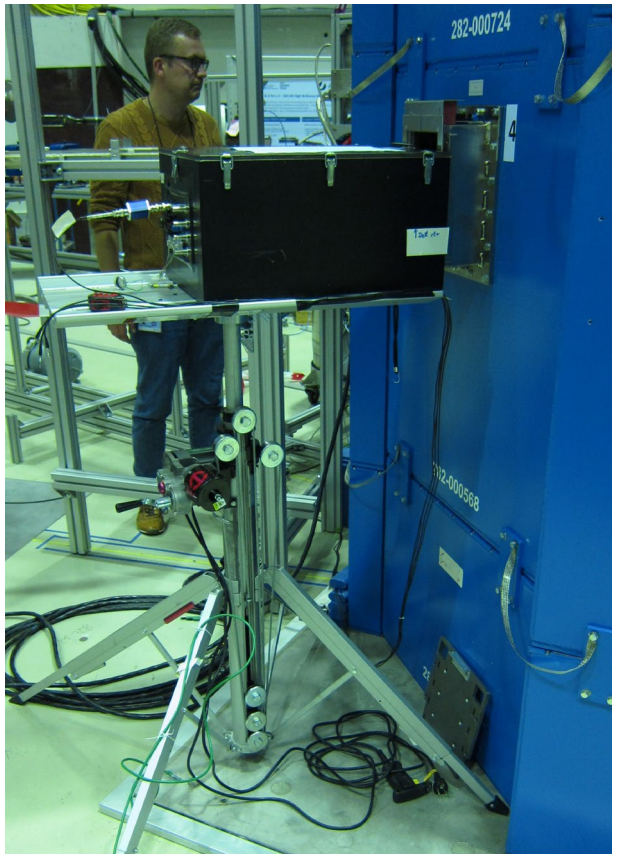
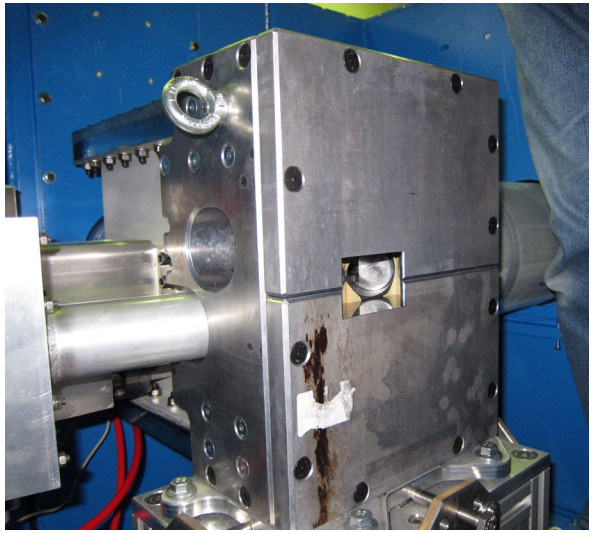
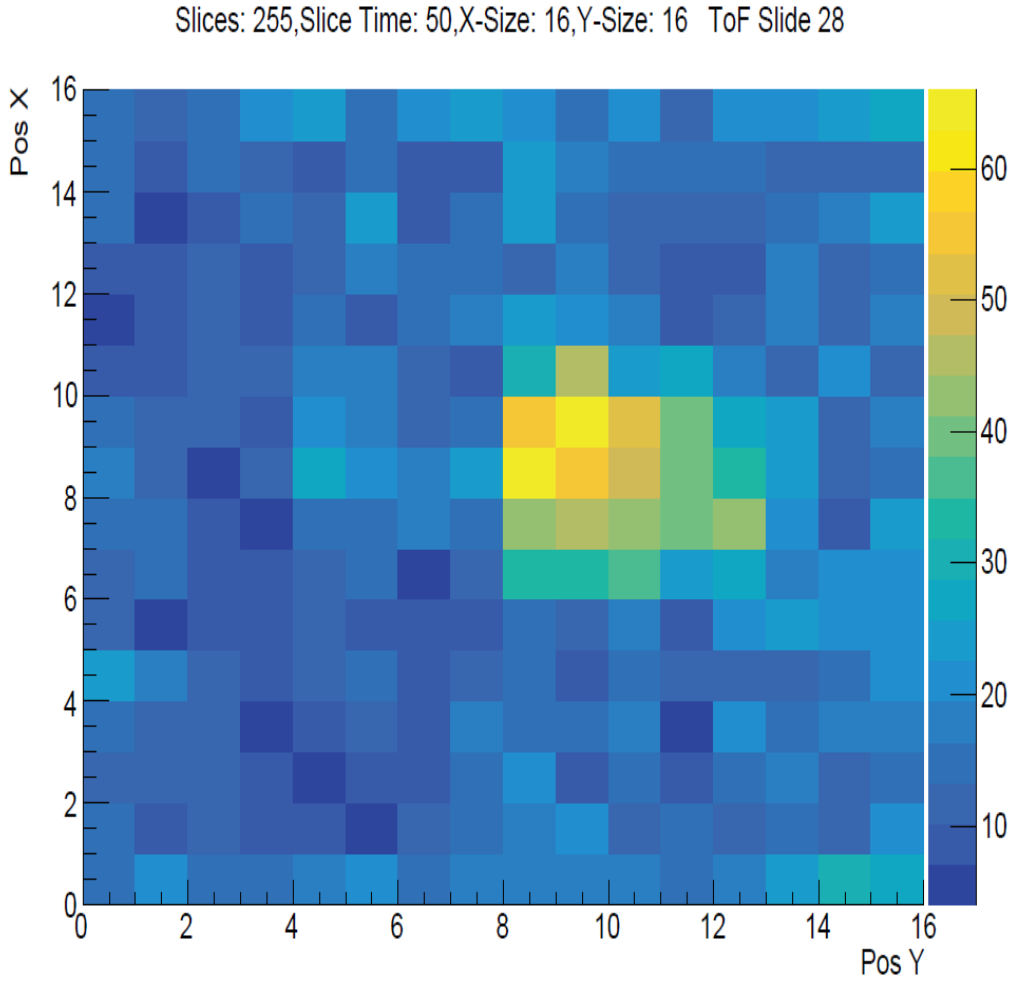
Beamline 4: PSD Test beam

SONDE detector test segment looking at the pinhole
TOF picture @ 1.4 ms (ca. 2.5 Å wavelength)
Pixel size: 6 x 6 mm²





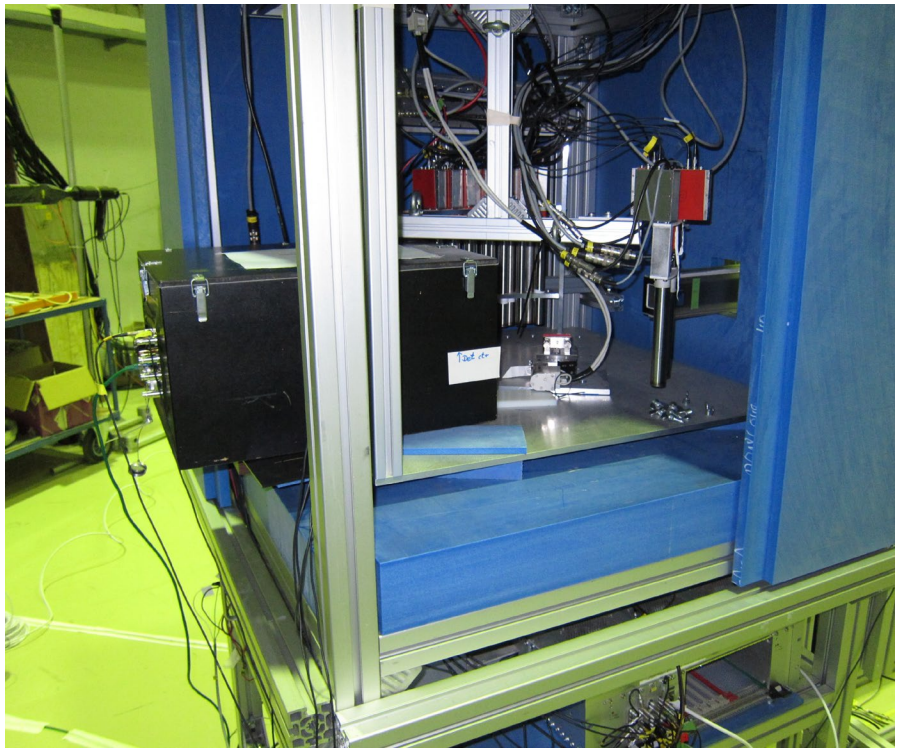


EUROPEAN SPALLATION SOURCE

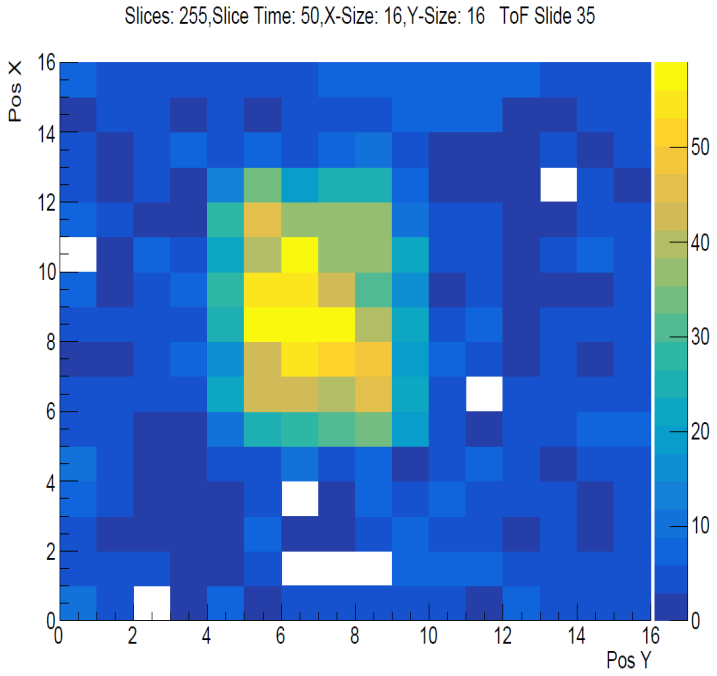
JÜLICH Forschungszentrum

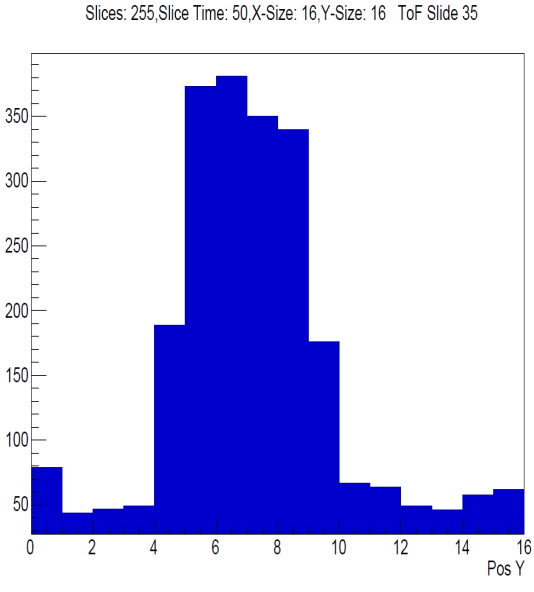
PSD test @ TOAD neutron guide

SONDE detector test segment
looking at the exit
of the neutron guide
Pixel size: 6 x 6 mm²

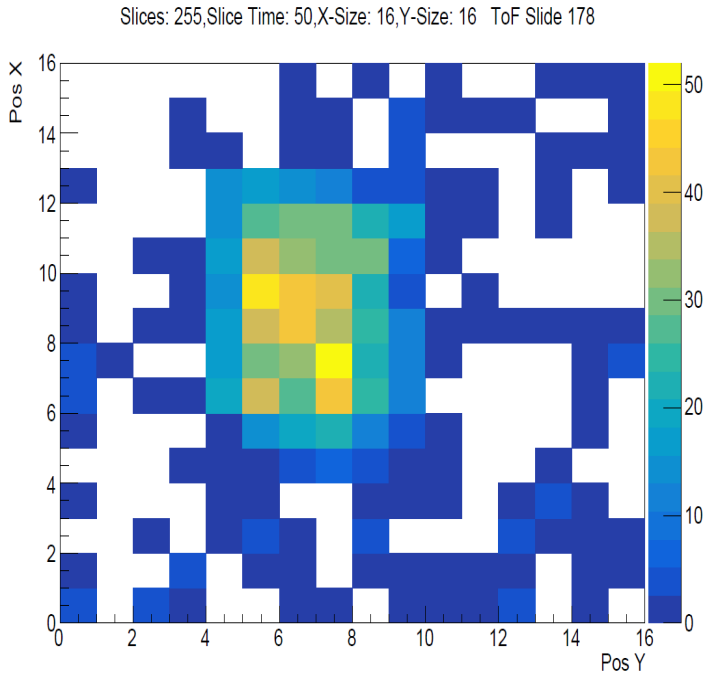


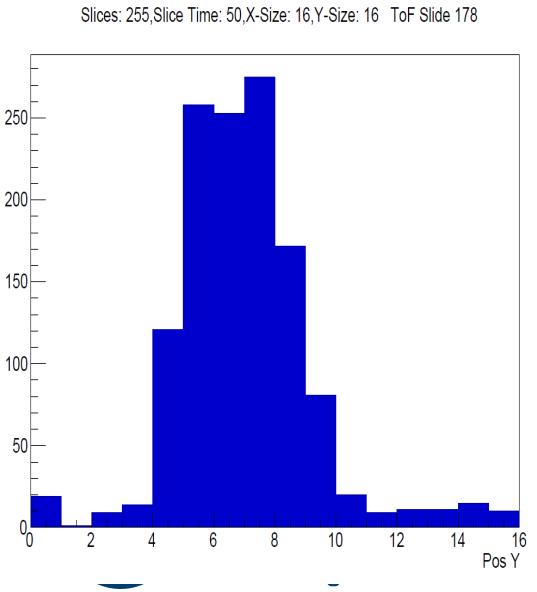
t = 1.8 ms
λ = 0.9 Å





t = 9 ms
λ = 4.5 Å





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