SINE2020 General Assembly

Bilbao, 28-29 May 2019

WP 7
Sample Environment

Eddy Lelièvre-Berna - ILL

— CSEC, ESS, HZB, LLB, ICMA, ILL, IMPMC, ISIS, MLZ, NPI, PSI —

This project is funded by the European Union (GA no. 654000)

Sample Env. WP objectives

neutrons & muons

- Establish standards to reduce development costs, strengthen relations with industry (7.1)
- Increase efficiency by reducing beam time losses and improving equipment (7.2),
- Open new fields of science by developing new equipment or extending physical parameter ranges (7.3 & 7.4)

This project is funded by the European Union (GA no. 654000)

Work carried out — Task 7.1

- **S**ample **E**nv. **Co**mmunication **P**rotocol: **SECoP**
  - 15 meetings + discussions with ISSE working group
  - Libraries coded at HZB to facilitate SECoP adoption
  - Version 1.0ß available on GitHub
  - Deployment started at ESS, MLZ, PSI, ILL, ISIS
  - First experiment with MLZ furnace at ILL successful
  - Discussed with industry: attocube, Hall Scientific, HTS-110, Kurt J. Lesker, OINS, etc.

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SampleEnvironment / SECoP

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SECoP — Sample Environment Communication Protocol https://sampleenvironment.org

Manage topics

268 commits 1 branch 0 releases 4 co

Branch: master New pull request Create new file

EnricoFaulhaber add minutes of vidconf 2019-05-08

protocol	add minutes of vidconf 2019-05-08
.gitignore	consistent scaling of railroad diagrams
LICENSE	Initial commit
README.rst	release v2018-11-07 (v1.0\beta)

README.rst

SECoP

Sample Environment Communication Protocol

- SECoP Motivation
- SECoP Specification
- SECoP Issues

Work carried out — Task 7.2

- Towards efficient Sample Env.: Simulations
  - ICMA has coded a Union component of McStas taking into account diffuse, elastic/inelastic and coherent/incoh. scattering, microstructures, etc.
  - Al7049A, Al7075, CuBe2, MP35N, NiCrAl, TAV6, TiZr data collected at ISIS on several instruments
  - Code benchmarked successfully with ISIS data
  - Now allows the simulation of any environment

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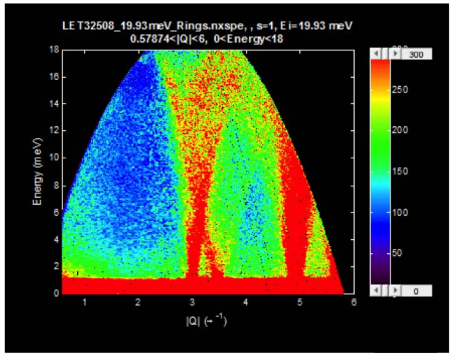
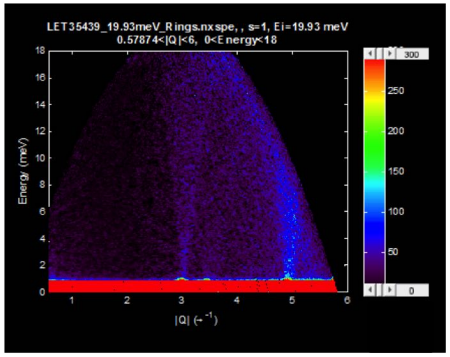
Work carried out — Task 7.2

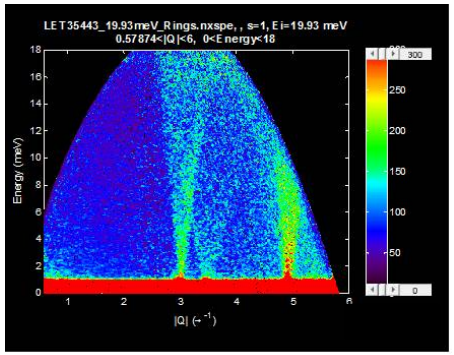
CuBe2



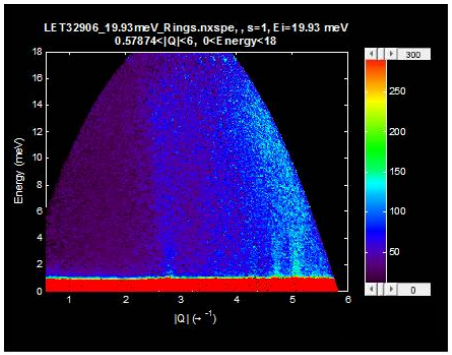
MP35N

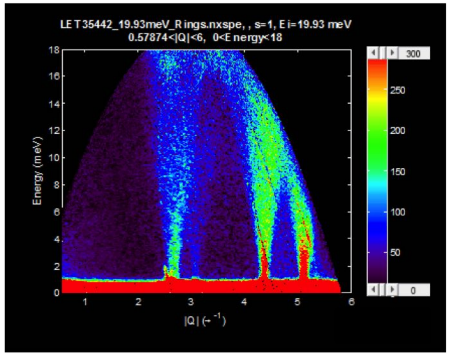


NiCrAl

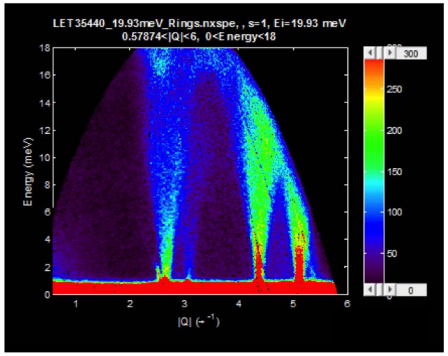


TAV6

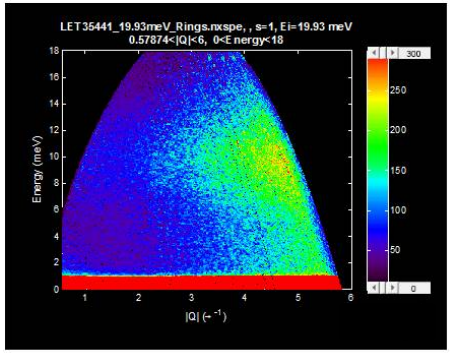




Al 7049A



AL 7075



TiZr

Science & Technology Facilities Council

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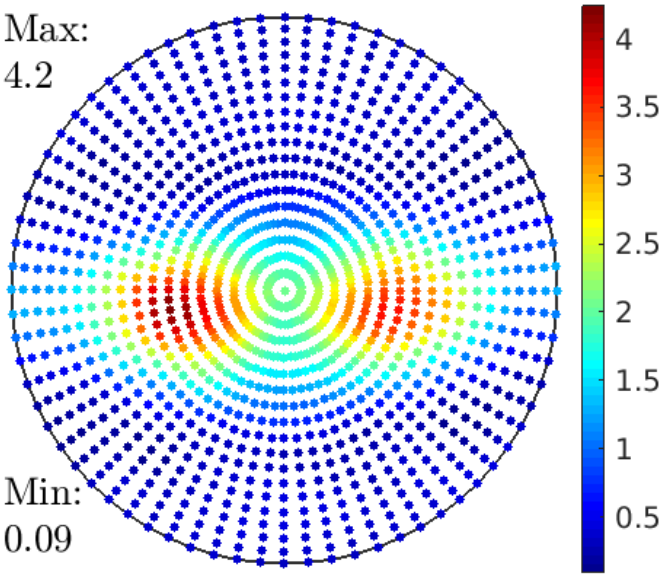
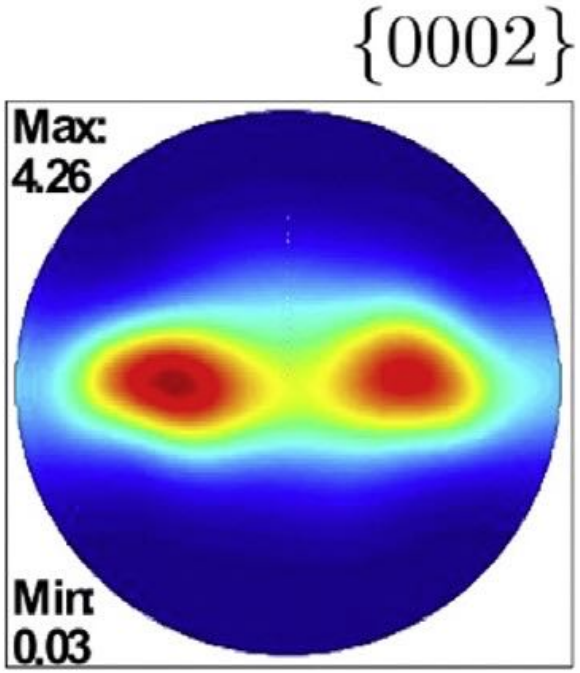
Work carried out — Task 7.2

Pole figure of the (0002) crystal planes of a Zircaloy-4 plate benchmarked against Texture.comp developed by ICMA



McStas Simulation
V. Laliena *et al.* (ICMA)



F. Malamud *et al.*
J. Nuclear Materials **510** (2018) 524

This project is funded by the European Union (GA no. 654000)

Work carried out — Task 7.2

- Towards efficient Sample Env.: Cryostats
  - Cooling/heating
    - 3x faster wet cryostats at ILL
    - Technical transfer to **AS Scientific Ltd** (UK)
    - Cryostats are getting faster at ISIS
  - Signal/background ratio
    - 30% less background produced by vanadium cryofurnaces
    - 5x less background at low-Q with TOF cryostat

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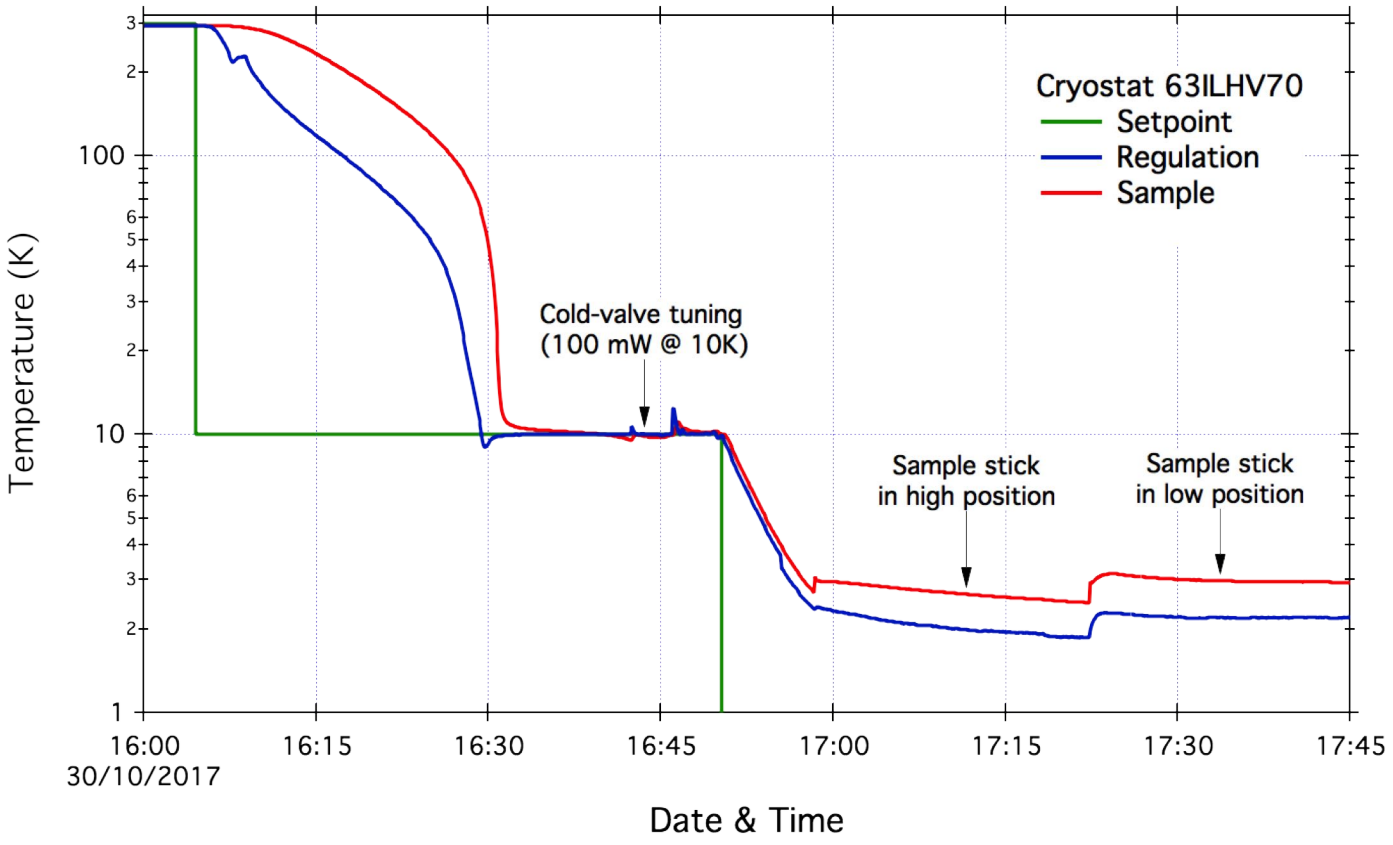
Work carried out — Task 7.2

Measurement of the cool-down time, the base temperature
and the gradient of temperature in different/thinner calorimeters at ILL



This project is funded by the European Union (GA no. 654000)

Work carried out — Task 7.2

- Towards efficient Sample Env.: Furnaces
  - Furnace type selected from survey
  - Technique developed by ISIS team
  - Results: 1000 to 150°C in less than 45’
    - 6x faster cool-downs at ISIS with 2 l/min He flow
    - 4x faster cool-downs at ILL with 7 cc He injection
  - Full automation being finalised at ISIS and ILL
  - Technical transfer to **AS Scientific** envisaged (UK)

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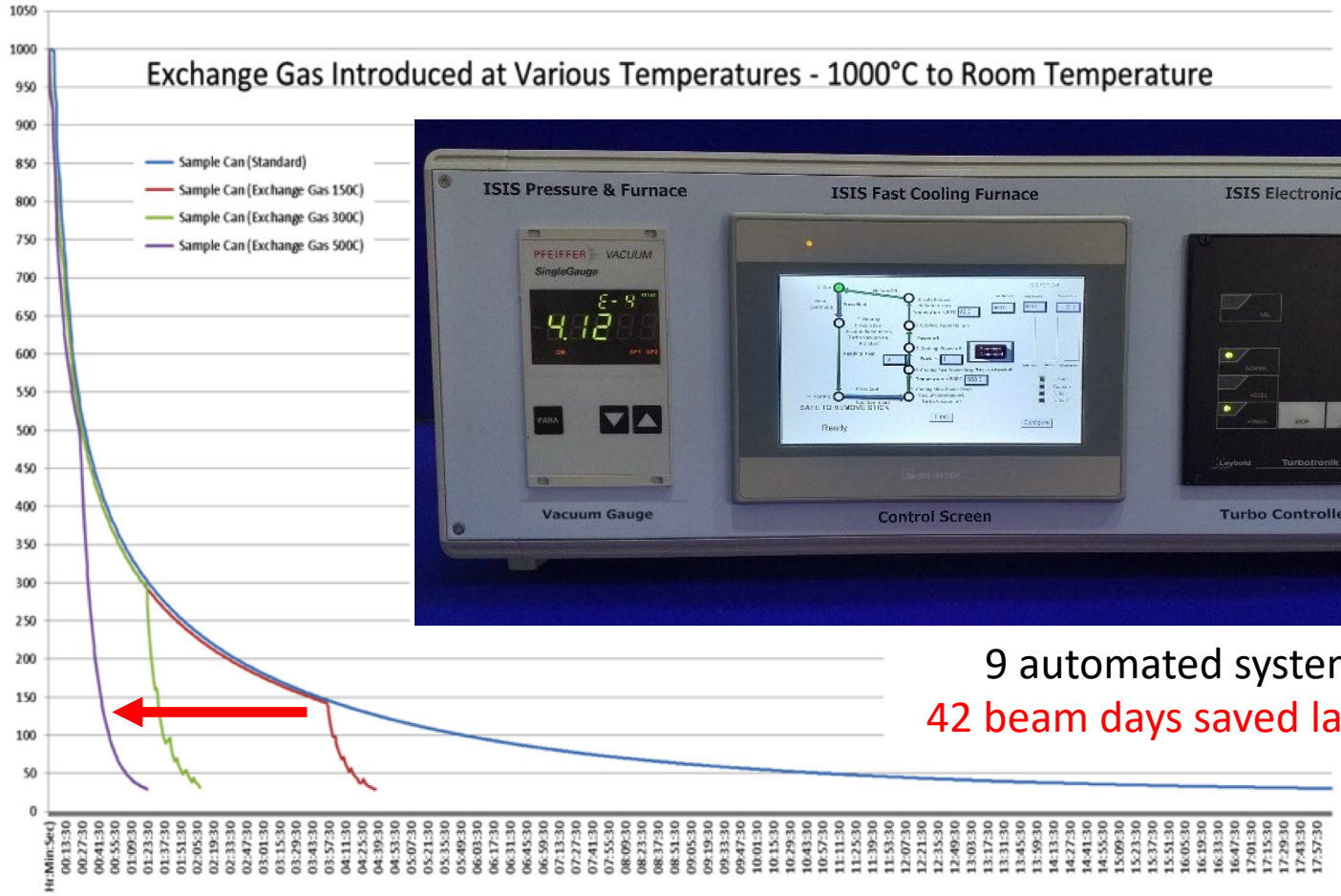
Work carried out — Task 7.2

Fast cooling tests in resistive furnaces at ISIS



9 automated systems soon

42 beam days saved last year!

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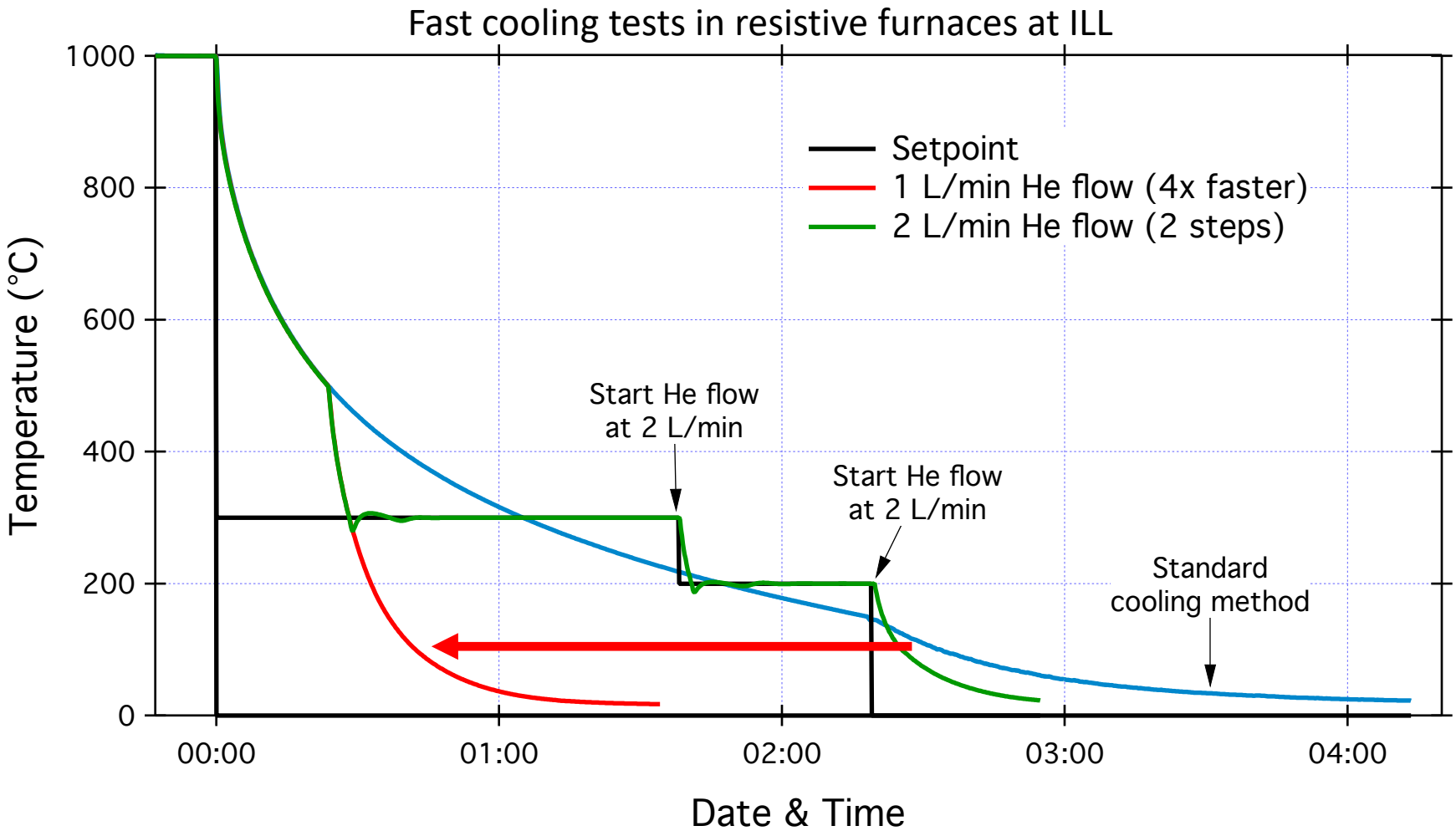
Work carried out — Task 7.2



This project is funded by the European Union (GA no. 654000)

Work carried out — Task 7.2

- Towards efficient Sample Env.: Goniometers
  - Ultra-low temperature goniometer specifications defined from survey => Ø36 outer diameter!
  - Concept design agreed (amongst 3 proposed by PSI)
  - Resistive and/or capacitive encoders
  - Prototype will soon be tested with dilution inserts at PSI and ILL
  - **attocube** will distribute the final version

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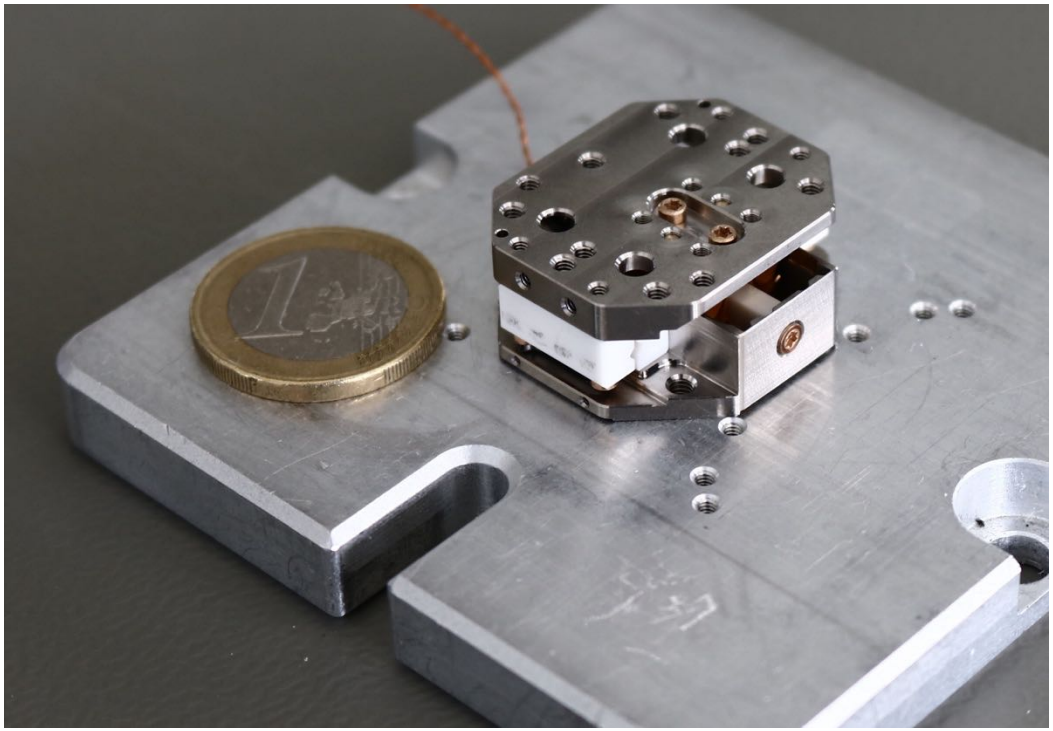
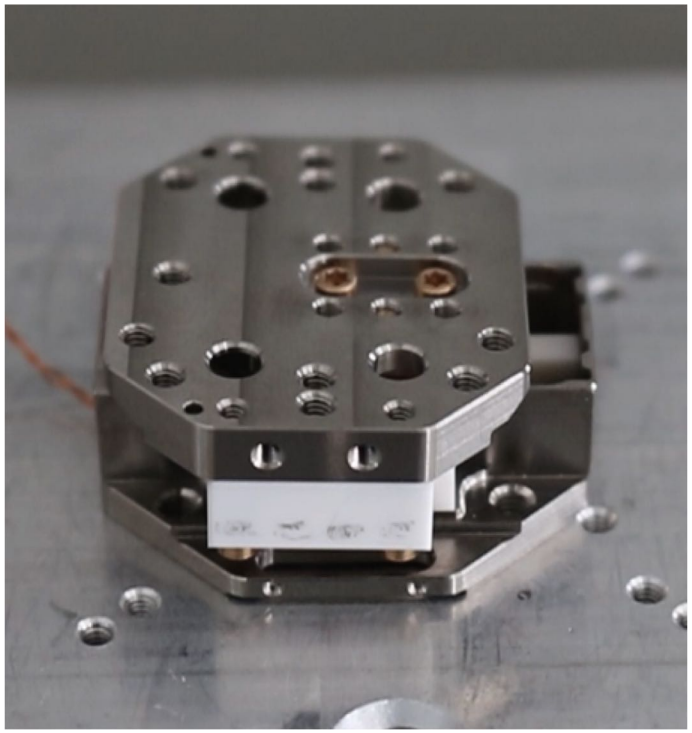
Work carried out — Task 7.2

Ultra-low temperature goniometer designed by attocube, PSI & ILL





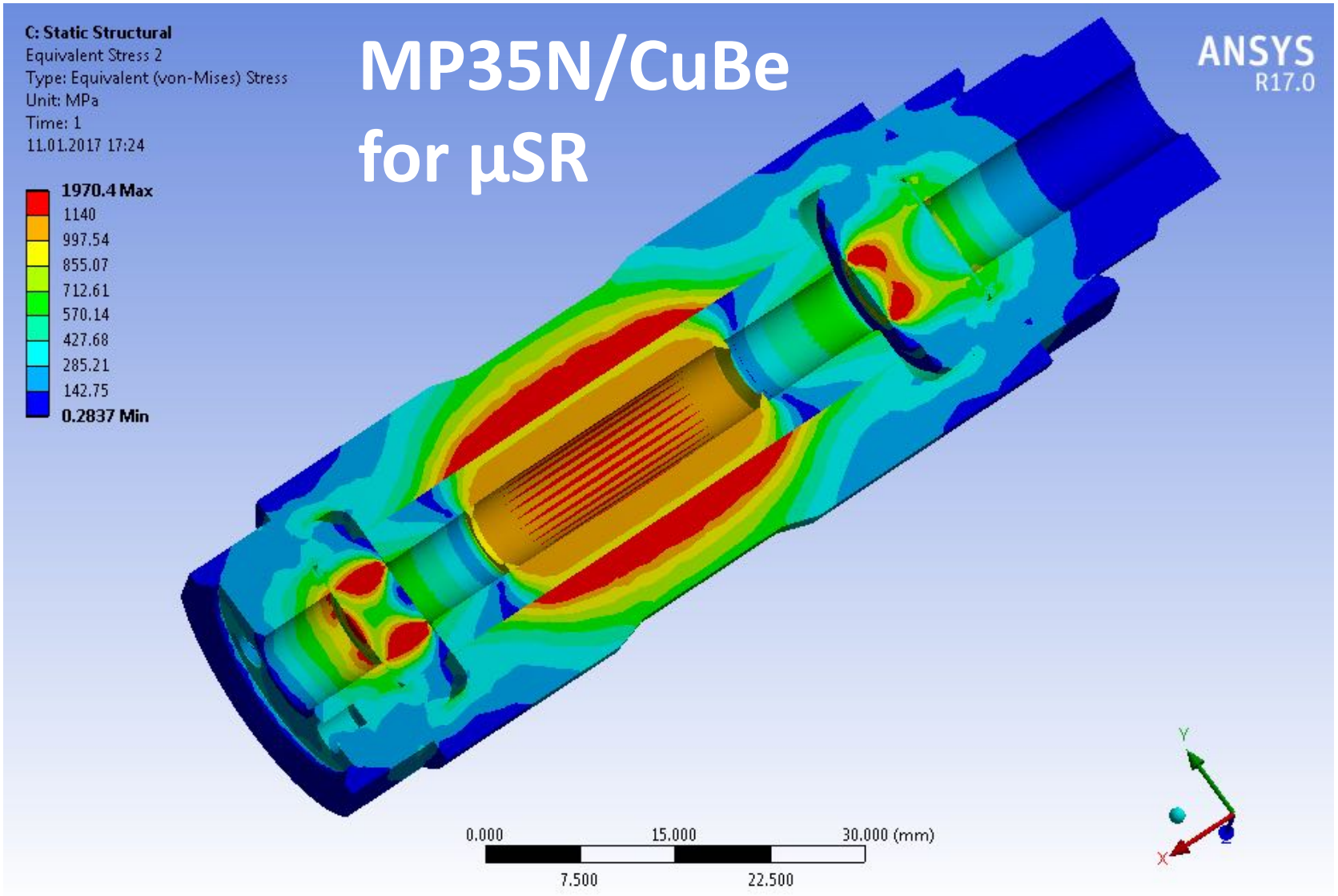
This project is funded by the European Union (GA no. 654000)

Work carried out — Task 7.3

- Next-generation high-P cells for NS & μSR
  - Kick-off meeting gathering μSR, NS and HP experts
  - CSEC high-pressure expertise transferred to PSI
    - Multi-layer design adopted for μSR clamp cell
    - 1.5 gain factor established with 2.6 GPa μSR cell
  - Same concept adopted for neutron clamp cell
    - Material survey performed at ISIS (task 7.1)
    - In-situ pressure measurement tested at ILL
    - Multi-layer clamp cell to be tested at ISIS soon

This project is funded by the European Union (GA no. 654000)

MP35N/CuBe for µSR



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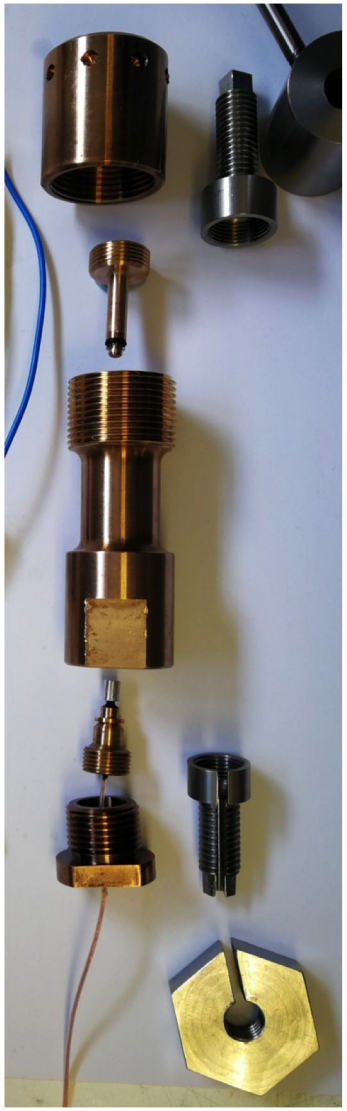
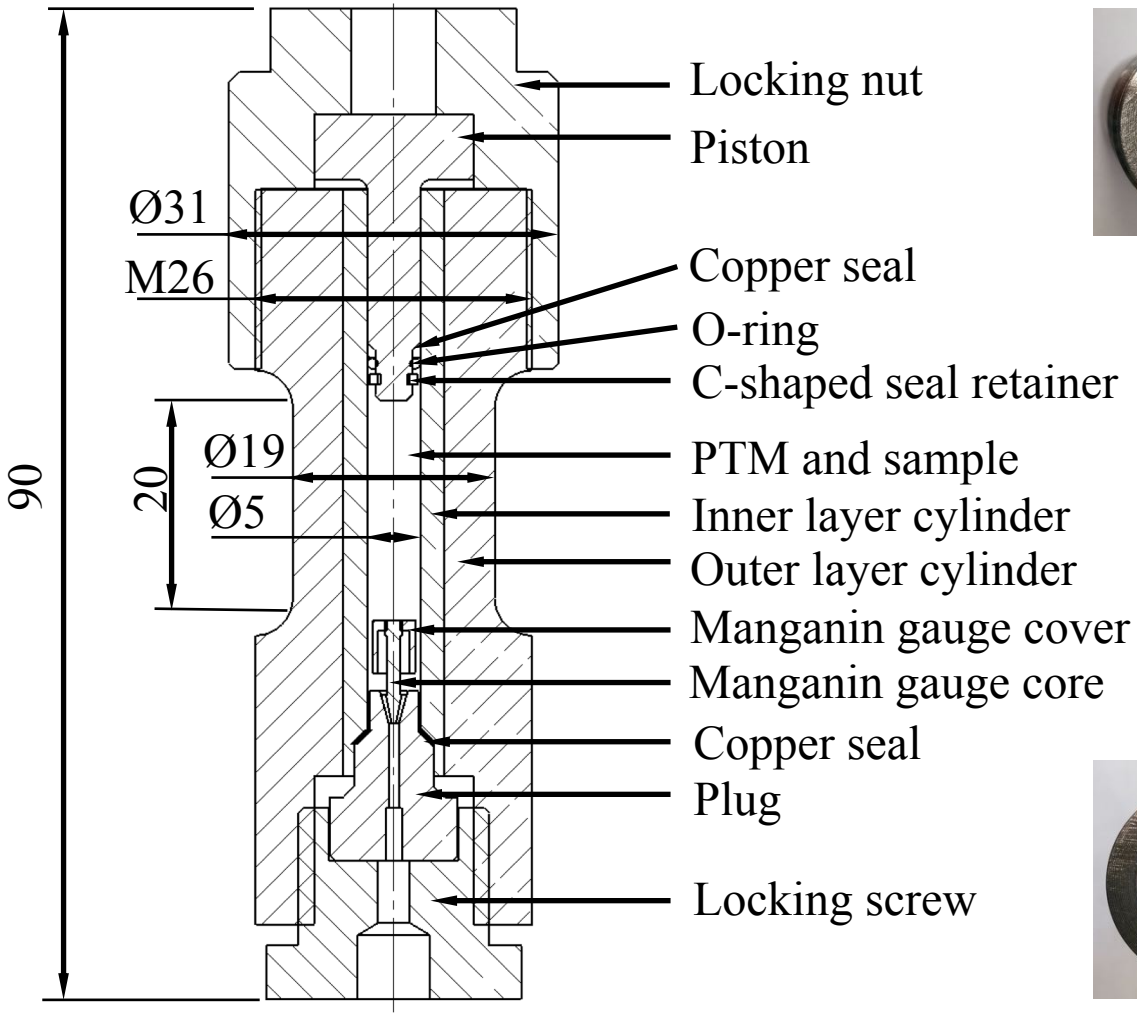
Work carried out — Task 7.3





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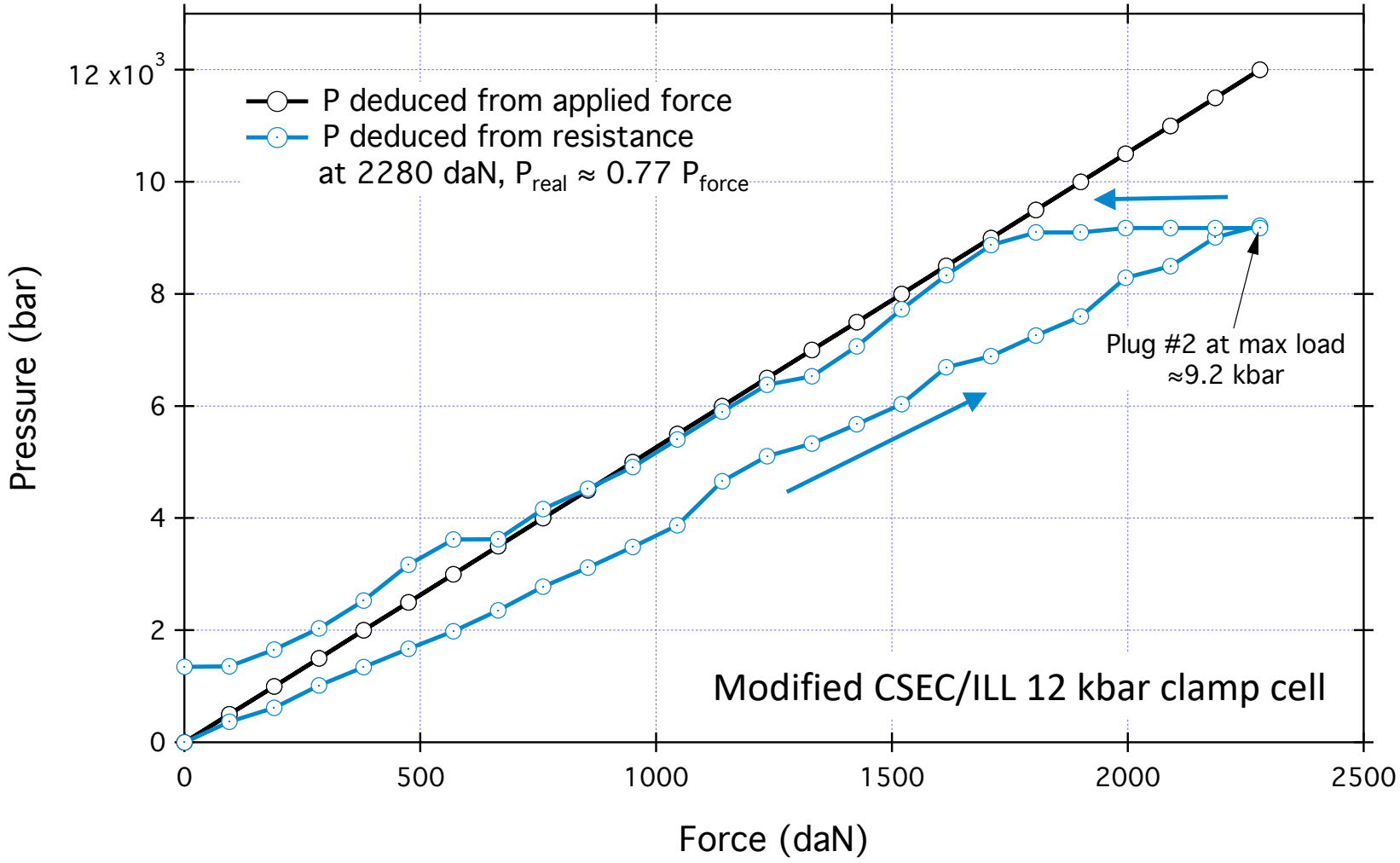
Work carried out — Task 7.3



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Work carried out — Task 7.3

- Next-generation high-P cells for NS & µSR
  - Test experiments performed by IMPMC at ILL with Paris-Edinburgh cell have identified solutions for improving the signal to background ratio:
    - transparent sintered diamond anvils
    - thinner TiZr gaskets
  - First tests at ILL on D20 revealed:
    - same signal/bckg ratio with 2x less sample
    - 25% higher pressure efficiency

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Work carried out — Task 7.3

- Next-generation high-P cells for NS & µSR
  - Review of the 700 bar H_2 container used at X-ray facilities
  - Specifications refined with the help of high-P experts and SE teams of neutron facilities
  - Concept design and engineering drawings produced by HZG and reviewed with partners
  - 700 bar H_2 container built and tested at FRM II

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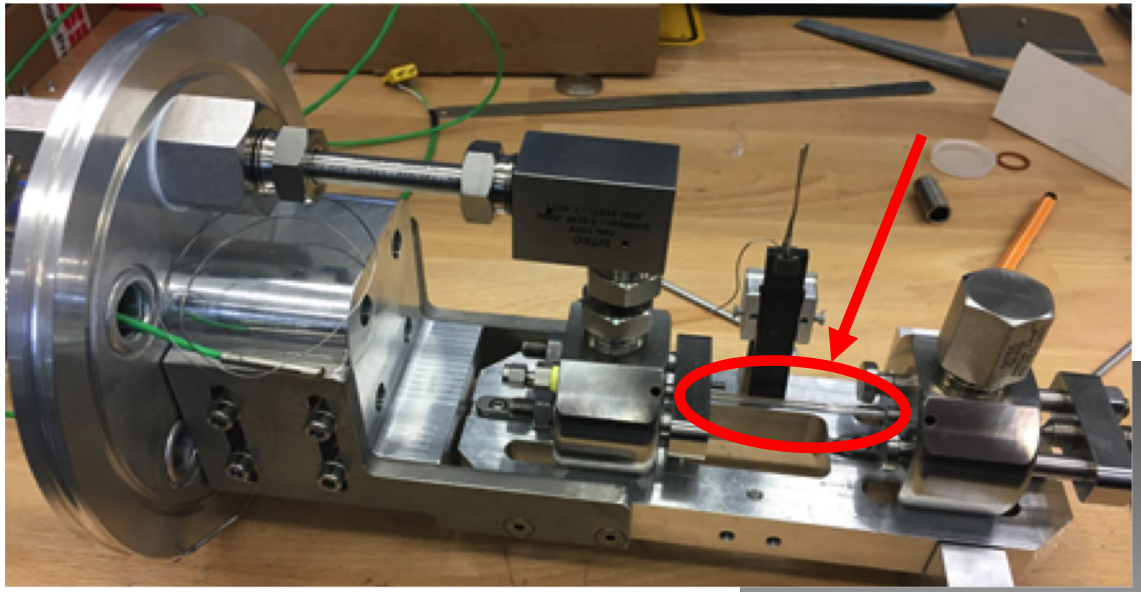
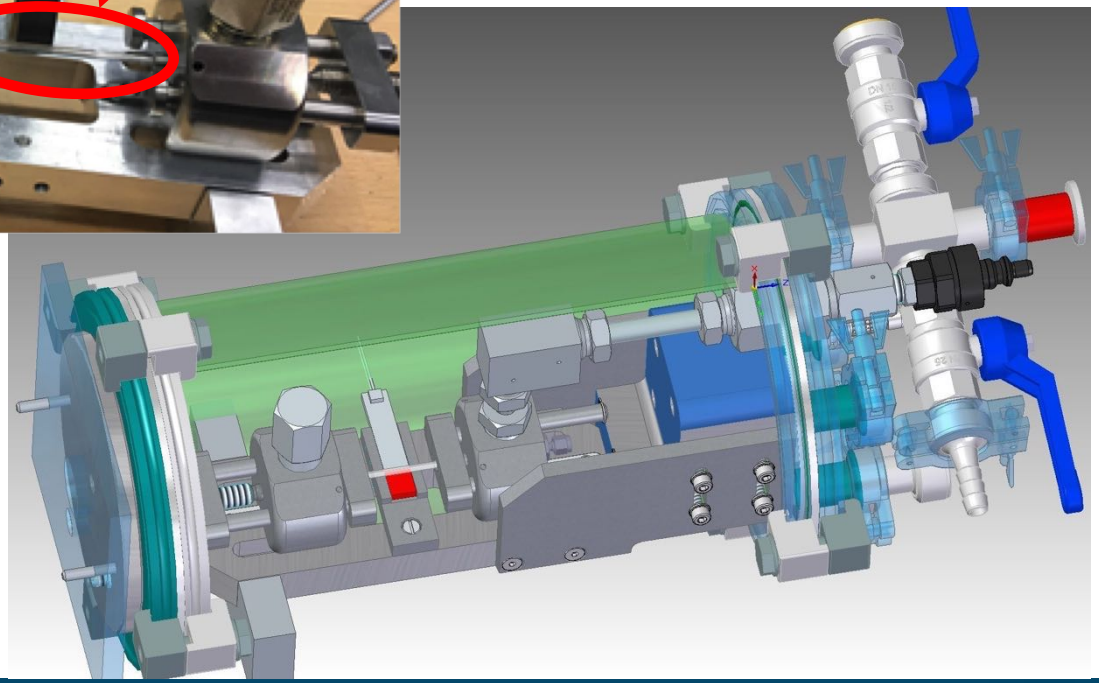
Work carried out — Task 7.3



700 bar hydrogen container for SANS built at HZG



Ø1 mm capillary for SANS but much larger diameter required for DIF and INS

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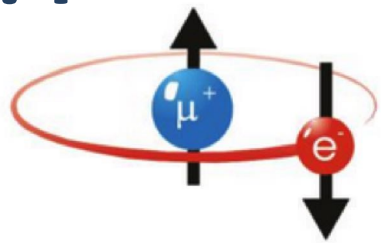
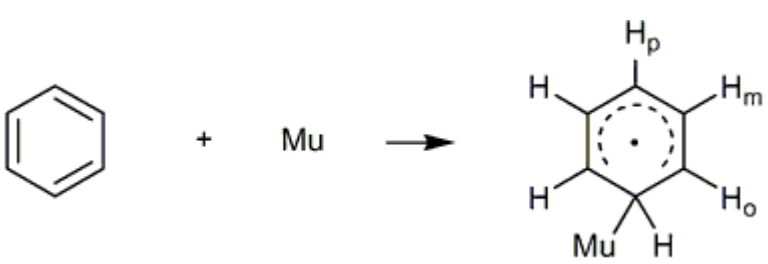
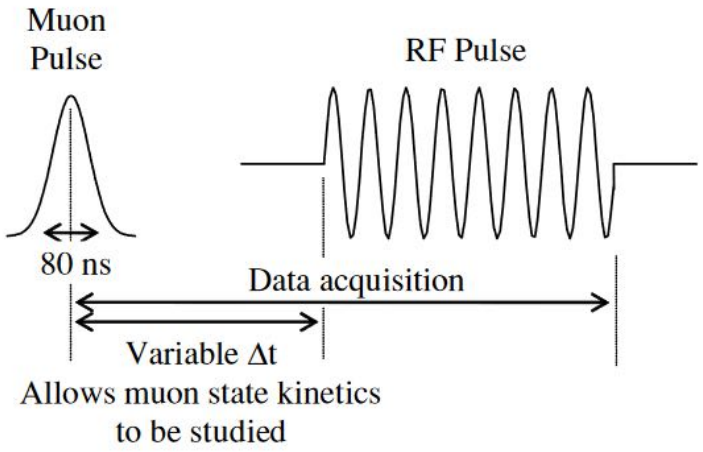
Work carried out — Task 7.4



- In-situ muonium studies for μSR
  - Stainless steel and glass rigs removing O_2 in liquids
  - Insert developed for standard 4-400 K cryostat
  - RF Mu chemistry chamber developed



RF-MuSR: Probing reaction final states!



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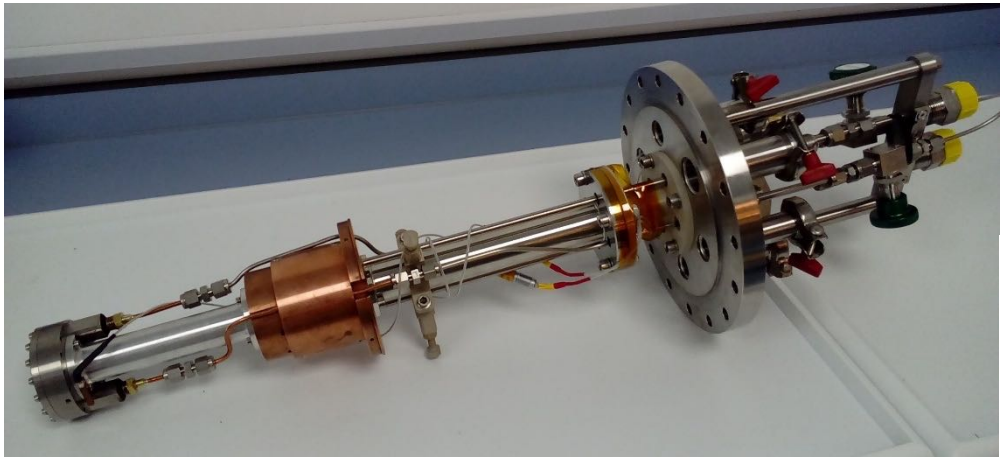
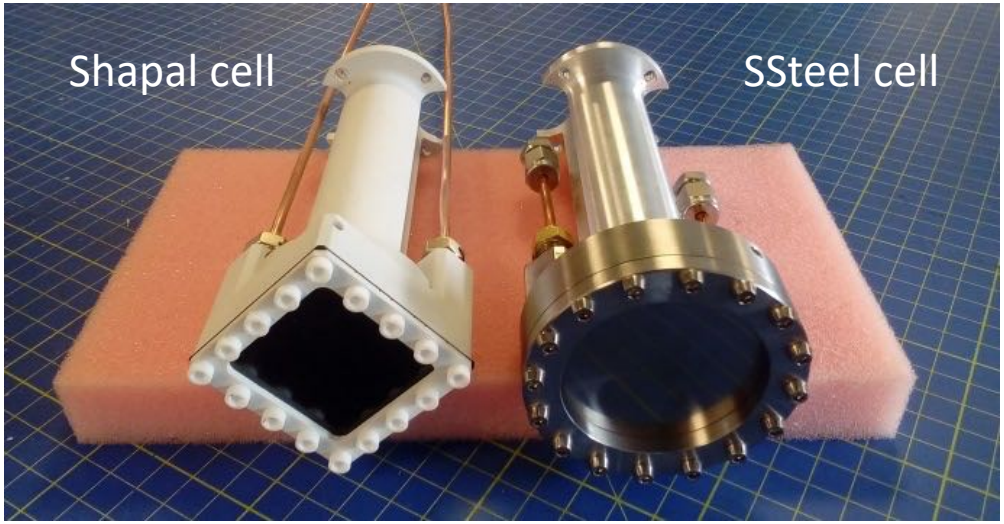
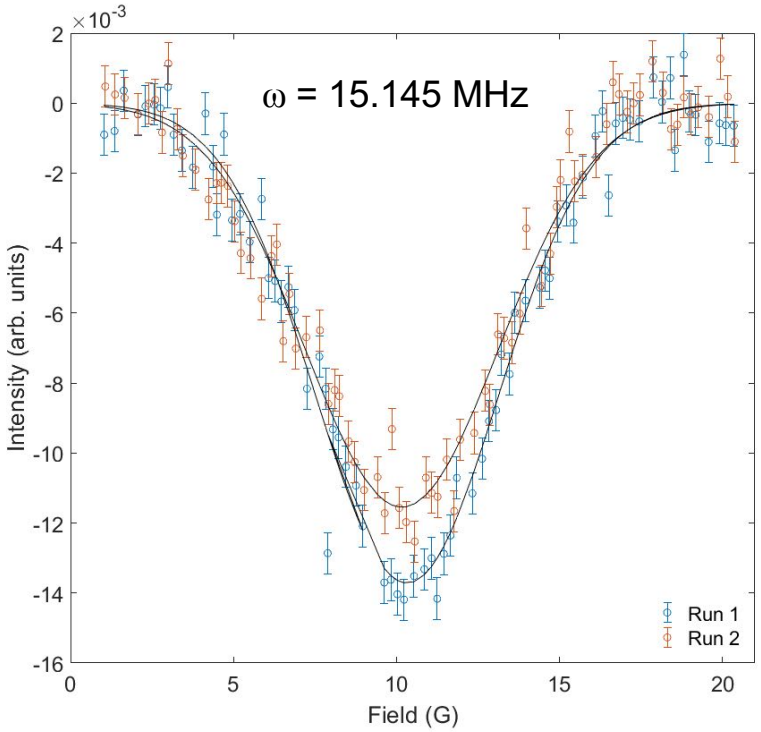
Work carried out — Task 7.4





with Shapal cell:
Mu formed in water, sample flowing, in-situ degassing



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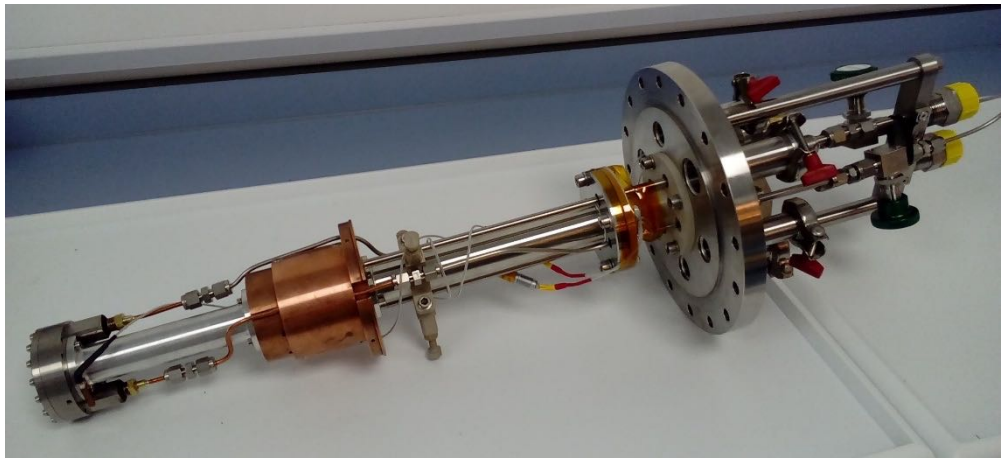
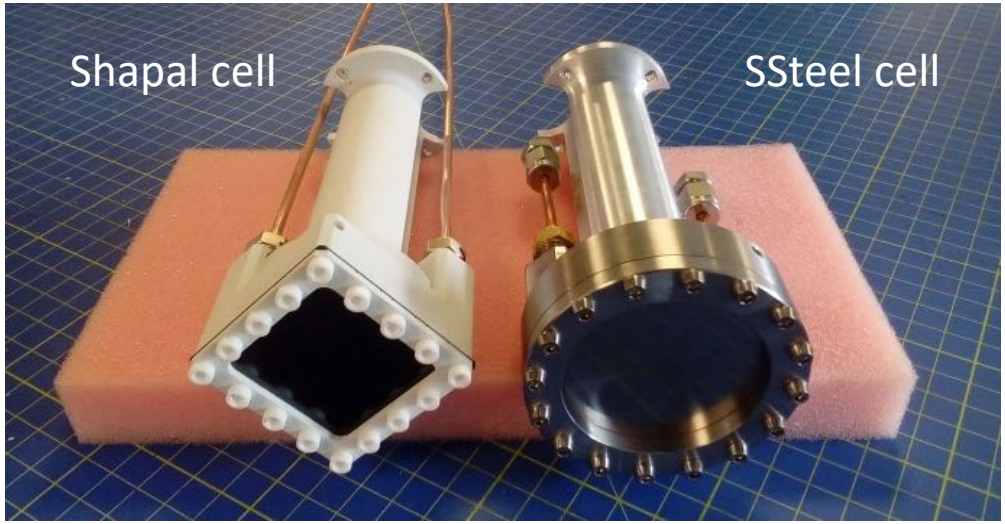
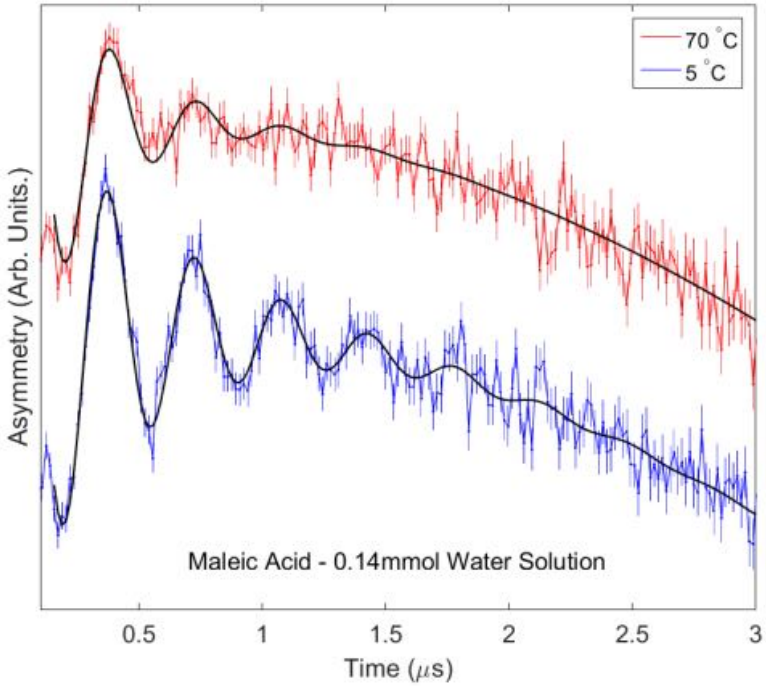
Work carried out — Task 7.4





with Stainless-steel cell:
Relaxation rate constants
determined for maleic acid
in water at 5 and 70°C



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Work carried out — Task 7.4

- In-situ NMR for neutron scattering
  - NMR probe head designed and commissioned successfully on food science case
  - In-situ setup tested successfully at LLB on PRAXY (SANS) and IMAGINE (tomograph) instruments

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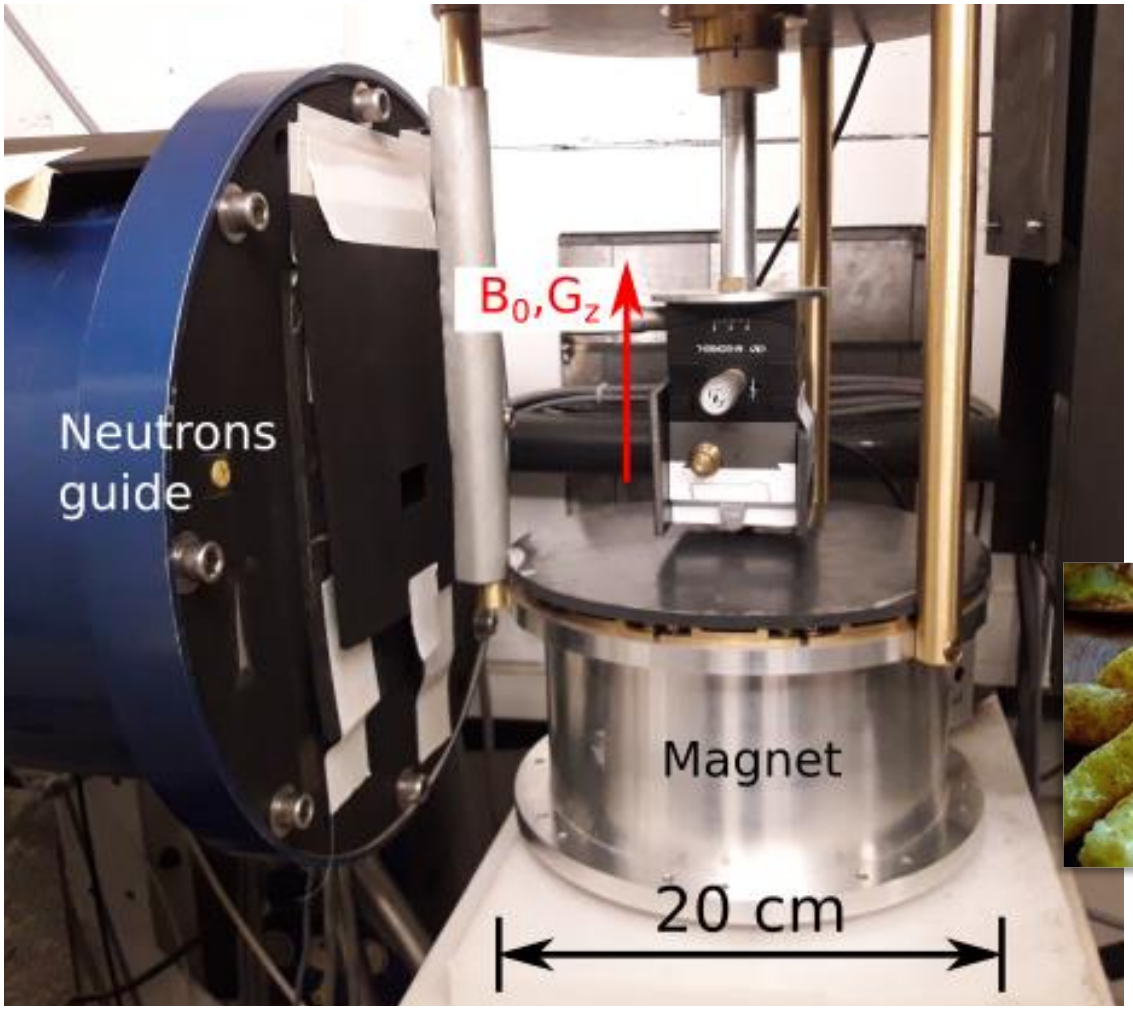
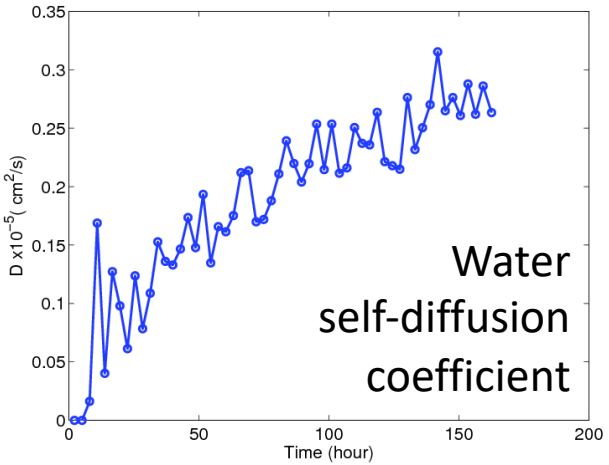
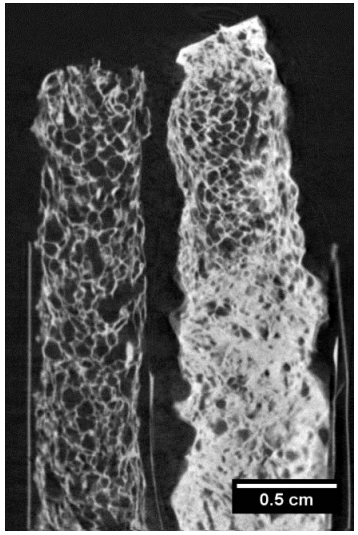
Work carried out — Task 7.4







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Impact / KPIs

- Facilities and contacted companies are adopting the SECoP international standard
- 1.5x better clamp cells, 4x faster furnaces, 3x faster cryostats, 1.5 to 5x lower background cryostats, new in-situ techniques for NS & µSR
- AS Scientific Ltd upgrade cryostats, attocube will distribute ULT non-magnetic goniometers
- Works soon published in a special issue of JNR

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Future…

- Deploy SECoP at all facilities, adopt standard high-P cells featuring in-situ pressure measurement, adopt new PE anvils, etc.
- Meet twice a year, review progress, select common projects and define milestones
  - Work with experts e.g. high-P, high-B, etc.
  - Work with x-ray community on e.g. standards, robotics, He management, SECoP, etc.

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Warm thanks
to all WP7 ~~participants~~ friends
for their great efforts!

…and to you
for your attention

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