# Update ESS and Science Directorate

## STAP meetings April 2021

PRESENTED BY ANDREAS SCHREYER, DIRECTOR FOR SCIENCE

14 April 2021

# Outline

1. ESS Project Highlights
2. Progress in the Science Directorate
3. Move to Campus
4. Ensuring ESS plans and resources are aligned
5. Conclusions

# Project Highlights

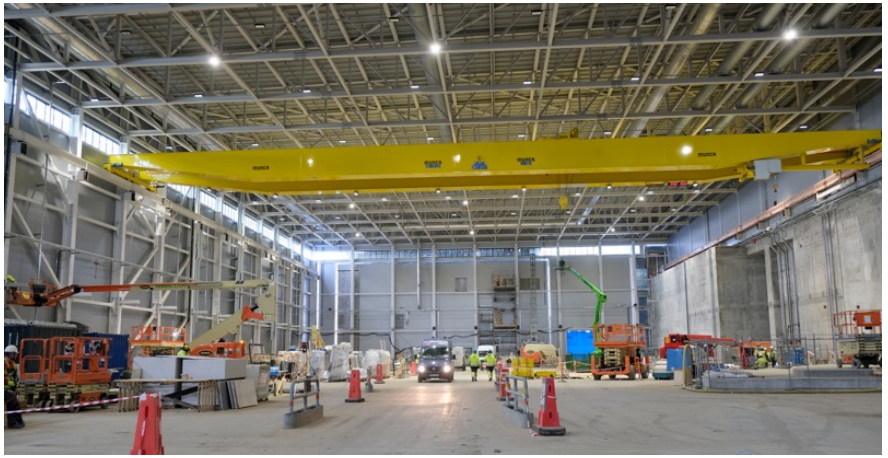
# Project Highlights – CF

Structural steel and cantilever roof takes shape as well as final building cladding

CF External Review completed. Skanska is at 85% staffing due to second wave

# Project Highlights – CF

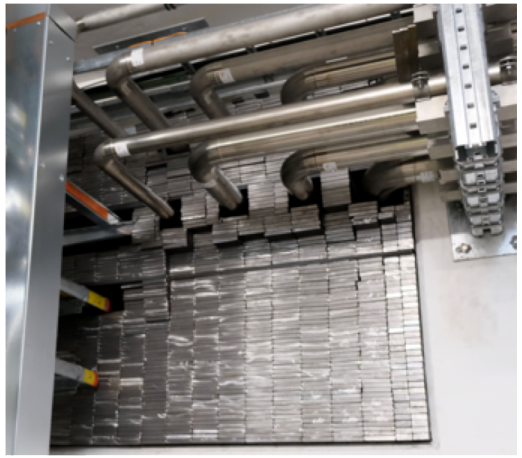

D03 overhead crane commissioned, and bunker crane installed

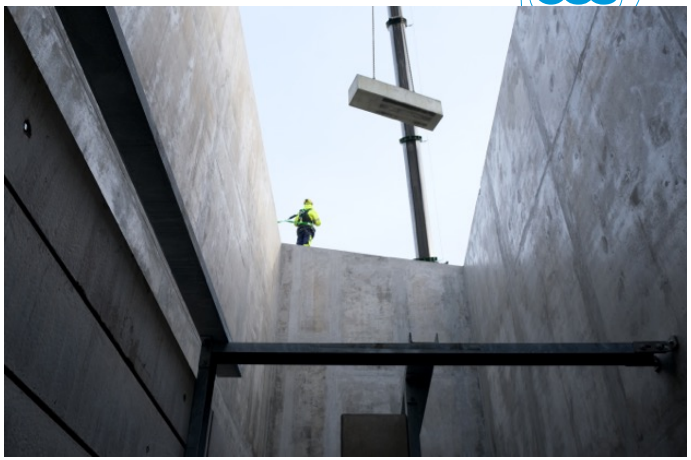


The 50m D01 overhead crane is welded and lifted in place, testing ongoing.

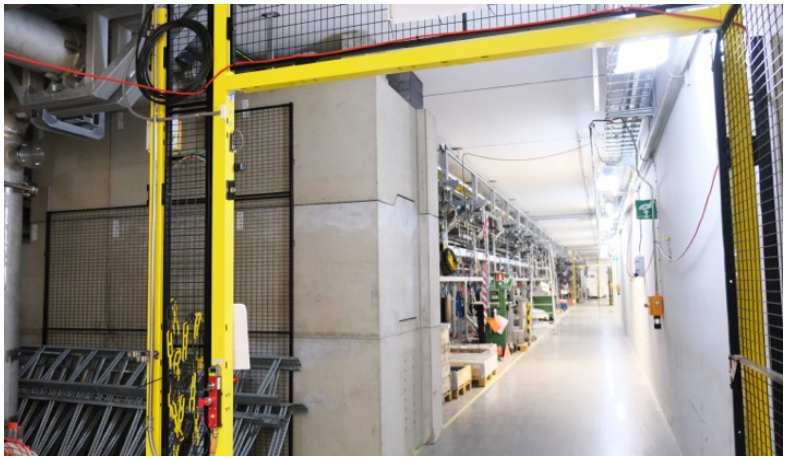
D01 crane consoles welded in place; D02 Transport Hall entrance gates;  E02 part 2 installations.

# Project Highlights - Accelerator





NCL Shielding: front end penetrations, front end chicane wall and drop hatch shielding.



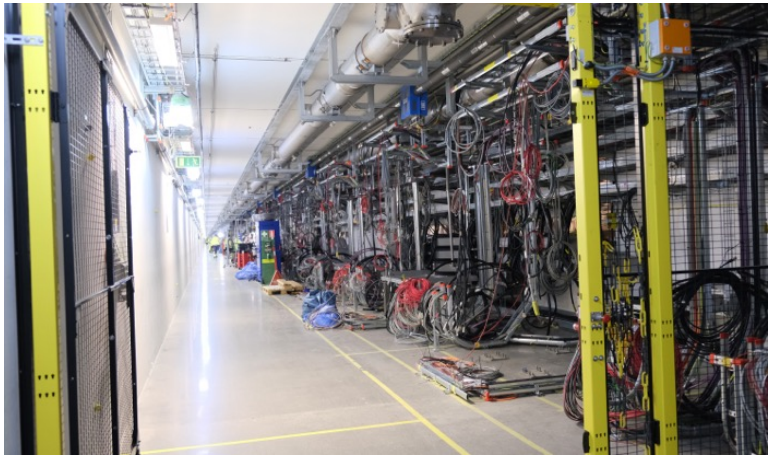
Temporary shielding wall.

Stands for LWUs.

# Project Highlights - Accelerator

First MB Modulator tested and in place.

NCL Modulator #1 and Klystron operated at full power, 5 of 6 NCL Klystrons in place.



Electrical installation in Gallery and Tunnel (cable pulling) continues now in SPK, MBL and HBL.

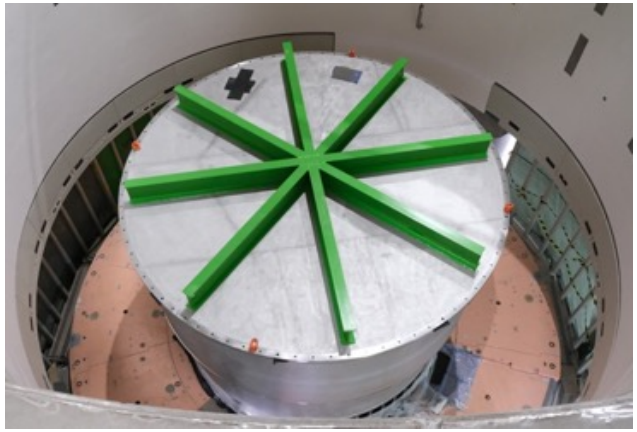
# Project Highlights - Target

16 NBPPs on site, with only 10 to come this year

Proton Beam Window Vessel and port block parts ready to ship to ESS

Mockup and test stand assembled in Transport hall

<-Final Machining of wheel



Vessel lower & mid installed

# Project Highlights - Target

Active Cell: RACE infrastructure works.

High bay: Ventilation ducting and piping.

Utility installations.

# Project Highlights - ICS

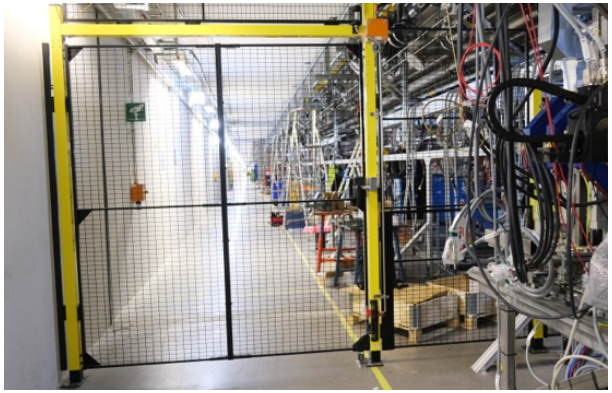

Activities for NCL ongoing projects are progressing according to plan
Good and steady progress with the PSS1-a iteration of the personnel safety system, focus now on integrated testing the associated access stations

Network and computing equipment in the H01 server hall, 1.3Pb of backup storage

**Equipment installed and deployed by the ICS infrastructure group ESS firewalls**

# Project Highlights - ICS


Personnel Safety Systems installed in Front End Building.

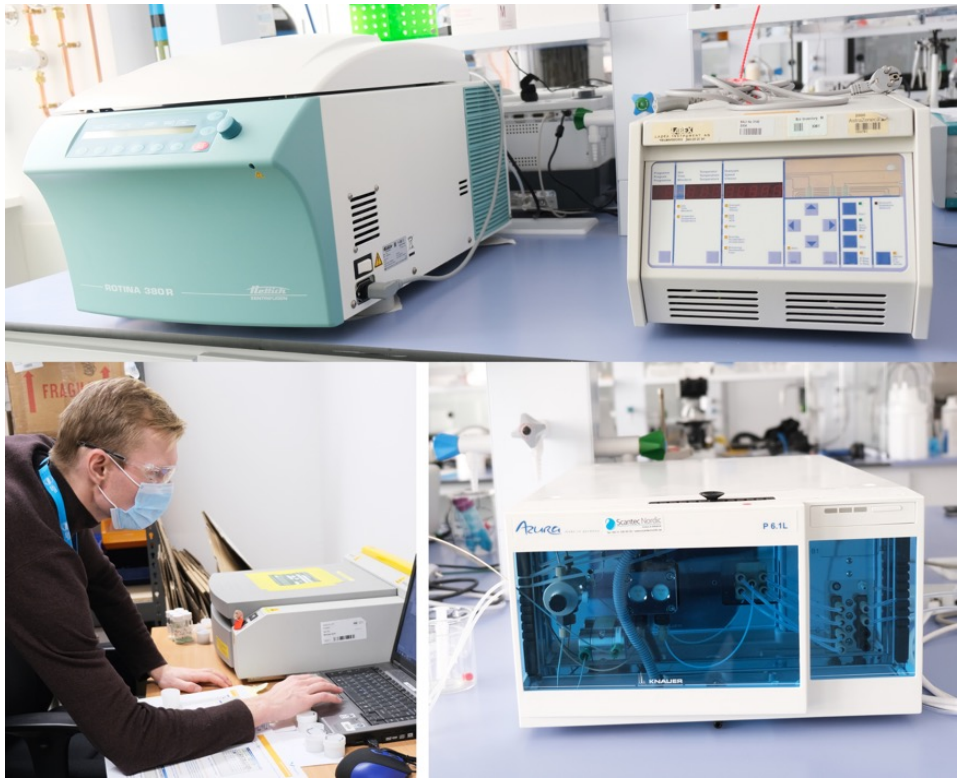


# Project Highlights - NSS


**Bunker** Pillar system installing in D03, outer west wall shielding 95% assembled.


**Bunker** North sector (D03) and East and South sector (D01 side)

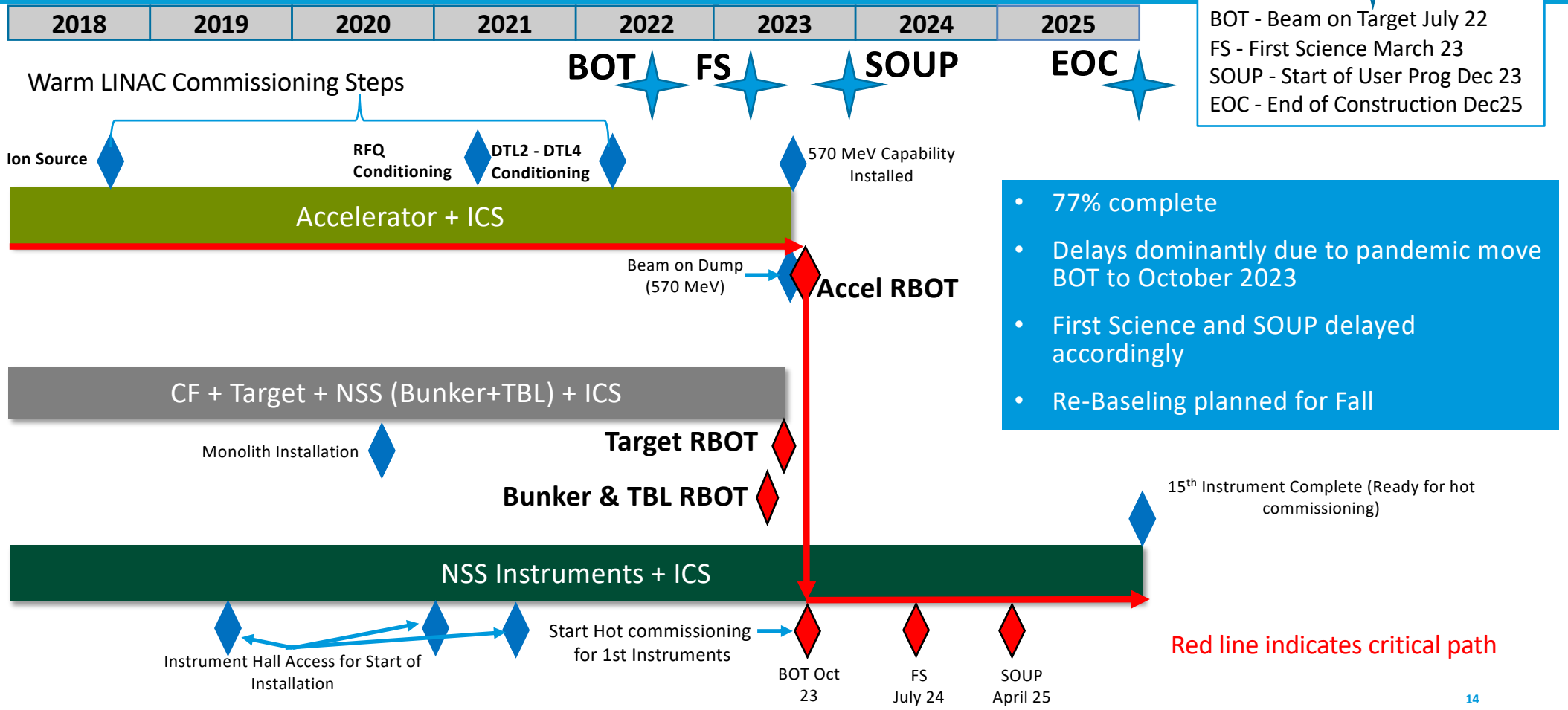
# Project Highlights - NSS





E04 labs fitted out and operational.

# Summary Schedule and Critical Path for Remaining Work (Zero Float Schedule)




Baseline Dates
BOT - Beam on Target July 22
FS - First Science March 23
SOUP - Start of User Prog Dec 23
EOC - End of Construction Dec25

- 77% complete
- Delays dominantly due to pandemic move BOT to October 2023
- First Science and SOUP delayed accordingly
- Re-Baseling planned for Fall

Red line indicates critical path

# Progress in the Science Directorate

## ESS ILL User Meeting 2020

Lund, Sweden
23-25 September 2020

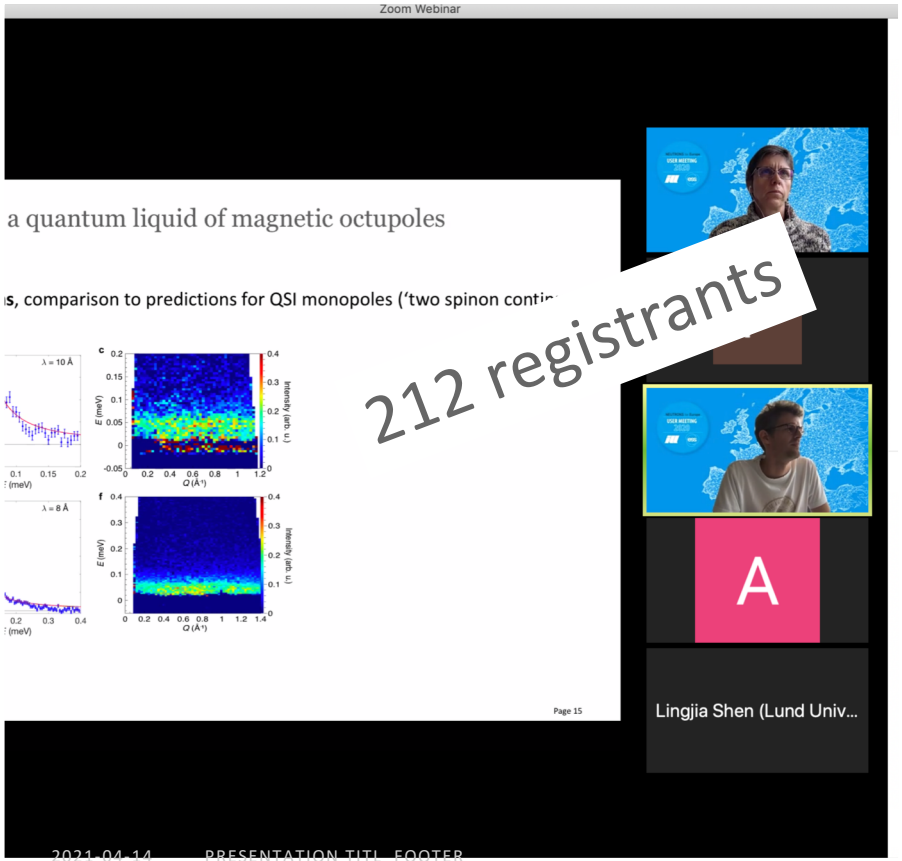
Welcome to the second ESS ILL User Meeting

- Plenary talks about using neutron science to meet societal challenges
- Reports on recent achievements and ongoing work at ESS and ILL
- Focused parallel sessions on specific areas of neutron science

neutrons4europe.com

# ESS/ILL Topical Workshop on Chemistry and Magnetism

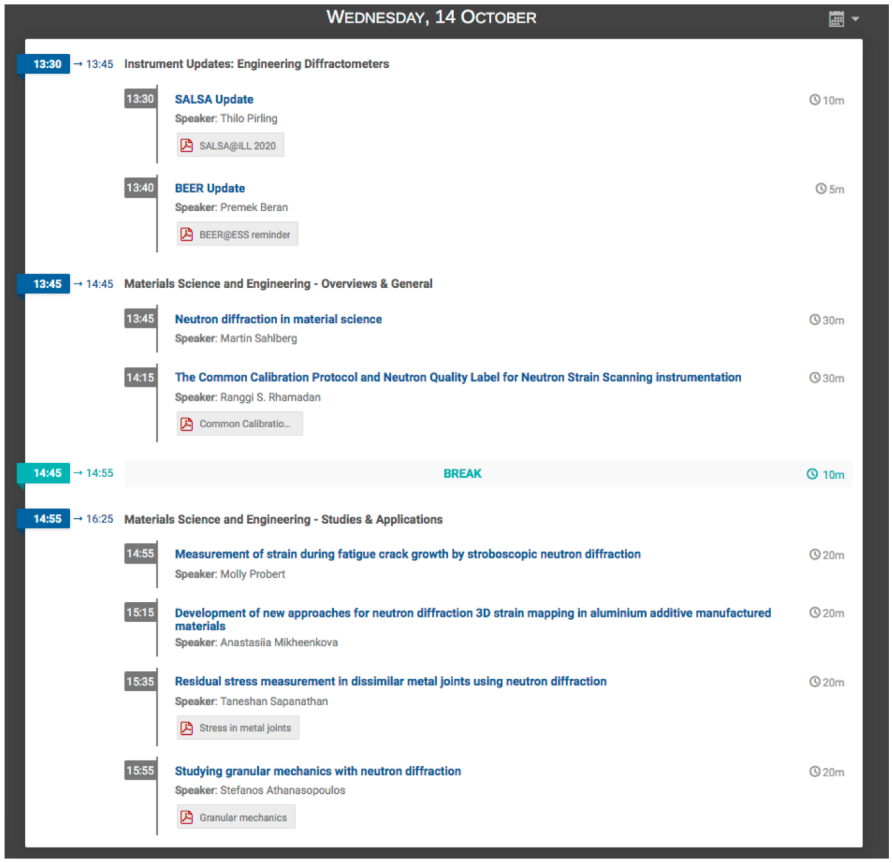
13. October 2020,
https://indico.esss.lu.se/event/1542/




| | |
|---|---|
| | Introduction: Link to the meeting; https://ill.zoom.us/j/94763977623?pwd=V2REeW5QOXFxZkUxV1JlVkdQUVNFQT09 Please note that the zoom public link directs you to a page where - if you don't already have a Zoom account in use - yo... |
| | Manila Songvilay, Institut Neel, CNRS, Grenoble. From one- to two-magnon excitations in the S = 3/2 magnet β-CaCr2O4 09:30 - 10:05 |
| 10:00 | Lingjia Shen (Lund University ). Hidden quantum critical point in SrCo2V2O8 10:05 - 10:40 |
| | Break 10:40 - 11:00 |
| 11:00 | Romain Sibille (PSI). Octupole ice in Ce2Sn2O7 quantum spin liquid 11:00 - 11:35 |
| | Matthew Coak (Warwick University). Tuning dimensionality, magnetism and conduction in van-der-Waals Mott insulators 11:35 - 12:10 |
| 12:00 | Lunch Break 12:10 - 14:00 |
| 13:00 | |
| 14:00 | Matthew Rosseinsky, (Liverpool University) . Design of Advanced Materials? 14:00 - 14:35 |
| | Eleonora Vottero, (University of Turin). Inelastic neutron scattering spectroscopy applied to supported metal nanoparticles in catalysis. 14:35 - 15:10 |
| 15:00 | Break 15:10 - 15:25 |
| | Werner Paulus, (Institut Charles Gerhardt Montpellier). LOW-T OXYGEN DIFFUSION PATHWAYS EXPLORED BY SINGLE CRYSTAL NEUTRON DIFFRACTION METHODS IN NON-STOICHIOMETRIC OXIDES. 15:25 - 16:00 |
| 16:00 | Pascal Launois, (University of Paris Sud). SPECIFIC WATER STRUCTURE IN A GEO-INSPIRED NANOTUBE AND INTERRELATED DYNAMICS. 16:00 - 16:35 |

# ESS/ILL Topical Workshop on Imaging, Materials and Engineering

## 14./15. October 2020, https://indico.esss.lu.se/event/1506/



**WEDNESDAY, 14 OCTOBER**

**13:30** → 13:45 **Instrument Updates: Engineering Diffractometers**

- 13:30 **SALSA Update** — 10m
  Speaker: Thilo Pirling
  SALSA@ILL 2020
- 13:40 **BEER Update** — 5m
  Speaker: Premek Beran
  BEER@ESS reminder

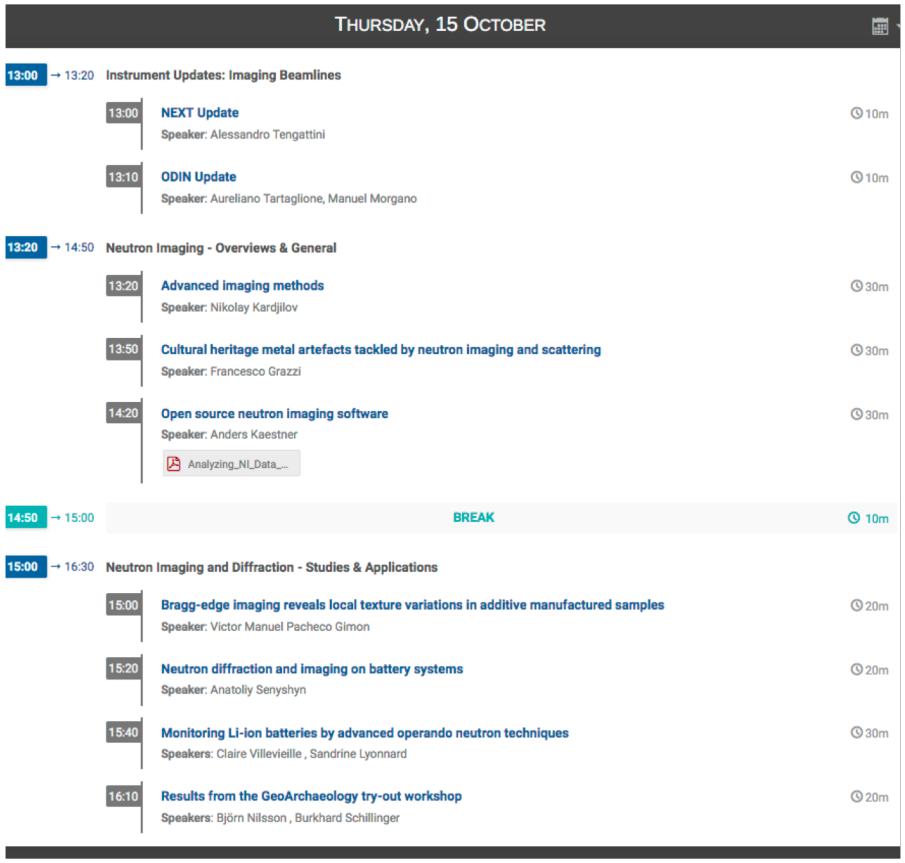
**13:45** → 14:45 **Materials Science and Engineering - Overviews & General**

- 13:45 **Neutron diffraction in material science** — 30m
  Speaker: Martin Sahlberg
- 14:15 **The Common Calibration Protocol and Neutron Quality Label for Neutron Strain Scanning instrumentation** — 30m
  Speaker: Ranggi S. Rhamadan
  Common Calibratio...

**14:45** → 14:55 **BREAK** — 10m

**14:55** → 16:25 **Materials Science and Engineering - Studies & Applications**

- 14:55 **Measurement of strain during fatigue crack growth by stroboscopic neutron diffraction** — 20m
  Speaker: Molly Probert
- 15:15 **Development of new approaches for neutron diffraction 3D strain mapping in aluminium additive manufactured materials** — 20m
  Speaker: Anastasiia Mikheenkova
- 15:35 **Residual stress measurement in dissimilar metal joints using neutron diffraction** — 20m
  Speaker: Taneshan Sapanathan
  Stress in metal joints
- 15:55 **Studying granular mechanics with neutron diffraction** — 20m
  Speaker: Stefanos Athanasopoulos
  Granular mechanics



**THURSDAY, 15 OCTOBER**

**13:00** → 13:20 **Instrument Updates: Imaging Beamlines**

- 13:00 **NEXT Update** — 10m
  Speaker: Alessandro Tengattini
- 13:10 **ODIN Update** — 10m
  Speaker: Aureliano Tartaglione, Manuel Morgano

**13:20** → 14:50 **Neutron Imaging - Overviews & General**

- 13:20 **Advanced imaging methods** — 30m
  Speaker: Nikolay Kardjilov
- 13:50 **Cultural heritage metal artefacts tackled by neutron imaging and scattering** — 30m
  Speaker: Francesco Grazzi
- 14:20 **Open source neutron imaging software** — 30m
  Speaker: Anders Kaestner
  Analyzing_NI_Data_...

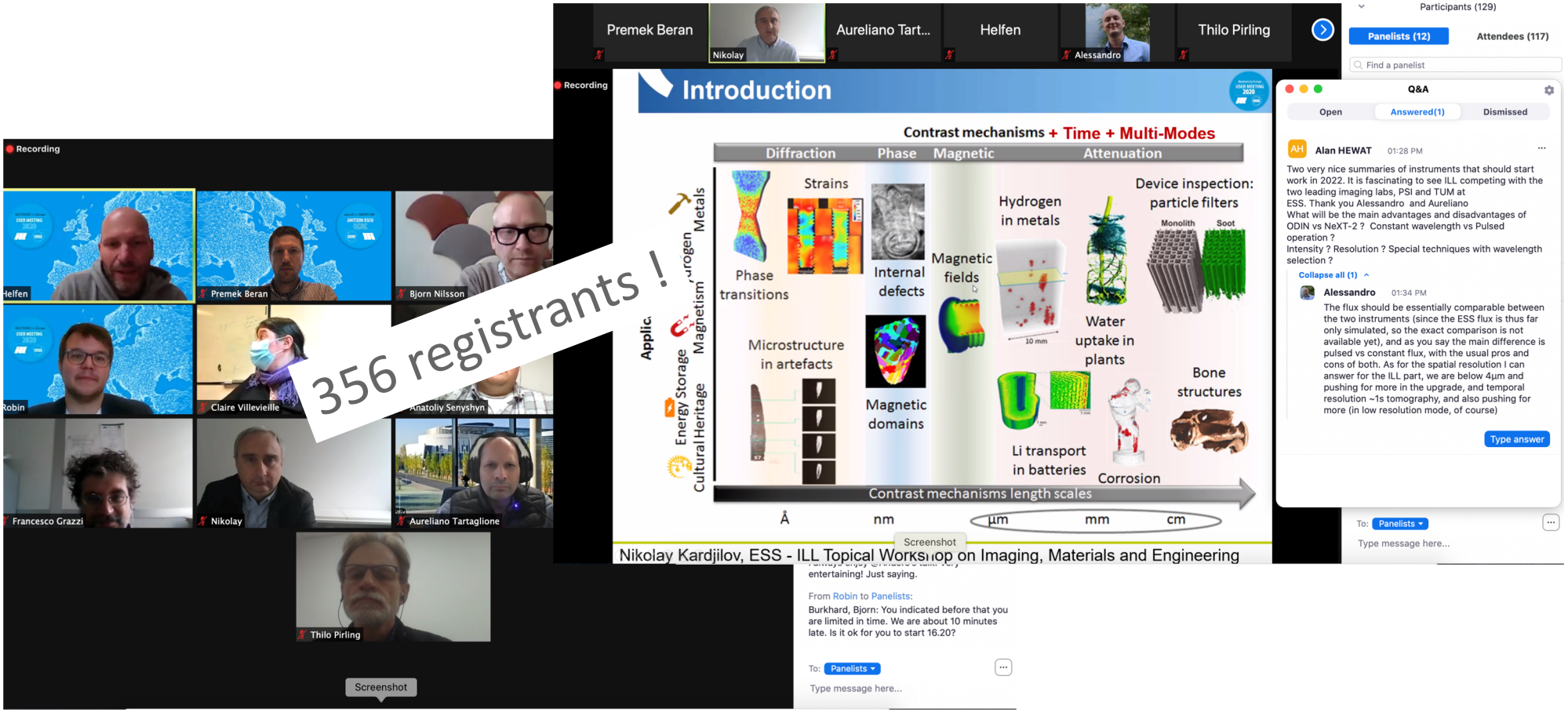
**14:50** → 15:00 **BREAK** — 10m

**15:00** → 16:30 **Neutron Imaging and Diffraction - Studies & Applications**

- 15:00 **Bragg-edge imaging reveals local texture variations in additive manufactured samples** — 20m
  Speaker: Victor Manuel Pacheco Gimon
- 15:20 **Neutron diffraction and imaging on battery systems** — 20m
  Speaker: Anatoliy Senyshyn
- 15:40 **Monitoring Li-ion batteries by advanced operando neutron techniques** — 30m
  Speakers: Claire Villevieille , Sandrine Lyonnard
- 16:10 **Results from the GeoArchaeology try-out workshop** — 20m
  Speakers: Björn Nilsson , Burkhard Schillinger

# ESS/ILL Topical Workshop on Imaging, Materials and Engineering

14./15. October 2020, https://indico.esss.lu.se/event/1506/



# ESS/ILL Topical Workshop about Fundamental Physics

## 14. October 2020, https://indico.esss.lu.se/event/1507/

13:00 → 13:10 **Introduction** 10m
Speaker: Valentina Santoro
santoro.pdf

13:10 → 13:35 **The ESS neutrino Super Beam Design Study (ESSnuSB) and the High Intensity Frontier Initiative (HIFI)** 25m
Speaker: Tord Ekelof (Uppsala University)
ESSnuSB-HIFI pres...

13:35 → 14:00 **Coherent Elastic Neutrino-Nucleus Scattering at the European Spallation Source** 25m
Speaker: Juan Collar
ESS_CEvNS_Collar....

14:00 → 14:25 **New platforms for ultra cold neutron production: SuperSUN and beyond** 25m
Speaker: Skyler Degenkolb
20201014_ILL-ESS...

14:25 → 14:50 **Neutron Beam EDM Experiment** 25m
Speaker: Florian Piegsa
piegsa_ess+ill.pdf

14:50 → 15:05 **Virtual Coffee Break** 15m

15:05 → 15:30 **Sterile Neutron Searches at ORNL** 25m
Speaker: Leah Broussard
ESS-ILL workshop ...

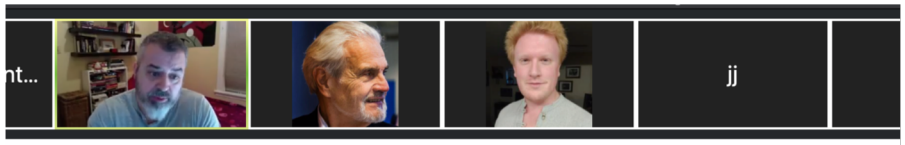
15:30 → 15:55 **The HIBEAM and NNBAR experiment** 25m
Speaker: David Milstead (Stockholms Universitet)
hibeam-ess-ill-ws-s...

15:55 → 16:20 **Antineutron optics** 25m
Speaker: William Snow (Indiana University)
nnbartalkWMSESS....

16:20 → 16:35 **A combined paper on fundamental physics possibilities at ESS?** 15m
Speakers: David Milstead (Stockholms Universitet), Valery Nesvizhevsky
ESS overview paper...

66 registrants

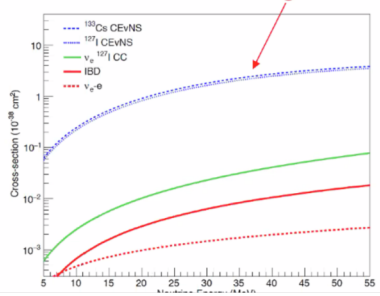
2021-04-14




CEvNS: the advent of "miniature" neutrino detectors

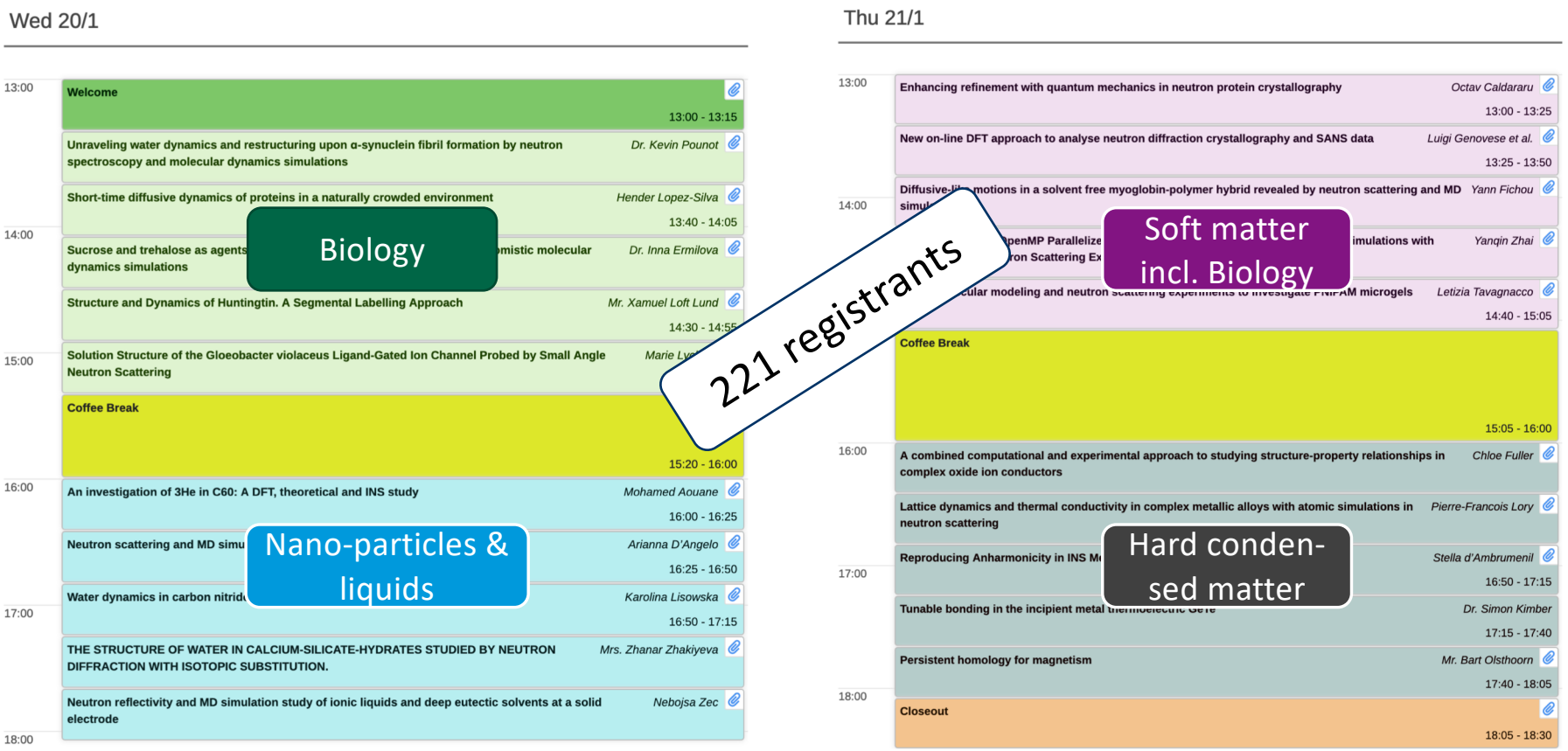

CEvNS has largest ν x-section

The catch: low-E NRs are the only detectable signature



# ESS/ILL topical workshop on Atomic-scale simulations in NS

## 20./21 January 2021 (https://indico.esss.lu.se/event/2411/)



# Neutron Instruments Division

## Outreach, Research, & Community Interactions

In addition to instrument project duties, which take up most of the time, NID/ISG has responsibilities in outreach, user and community development, and undertaking scientific research activities.

Grants & Supervision

- Swedness, Tillväxtverket, Vinnova, Sakura, VR, 7 PhD students

Teaching

- LU, KU, UU courses

Reviewing, Advisory Boards & Community Groups

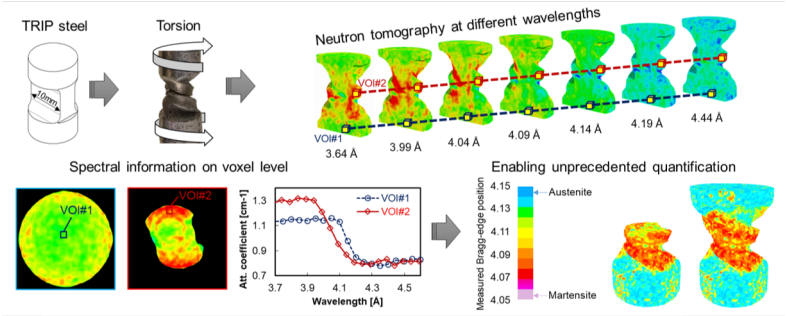
- SuperAdam Board; Mantid Board; ISIS SAC; CSNS Instrument Advisory Panels; Reviewing for ILL, MLZ, NIST, ANSTO, SNS, J-PARC; ORSO; canSAS;

Conferences & Community Interactions

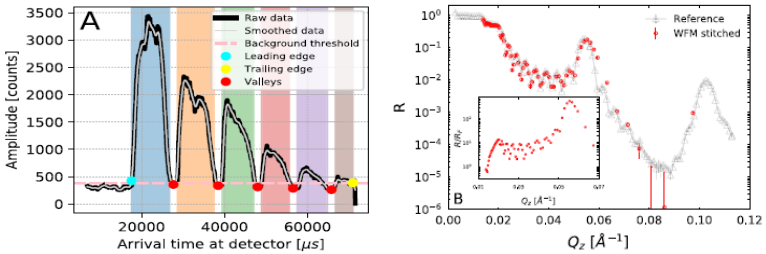
- Accelerate Webinars in Nov 2020 – Andrew,  Judith, Zöe and Robin
- CanSAS Workshop on Resolution – March 25$^{th}$ and 26$^{th}$ (Judith and Wojciech organising)

# Neutron Instruments Di

## Papers, PhDs, and Prizes!

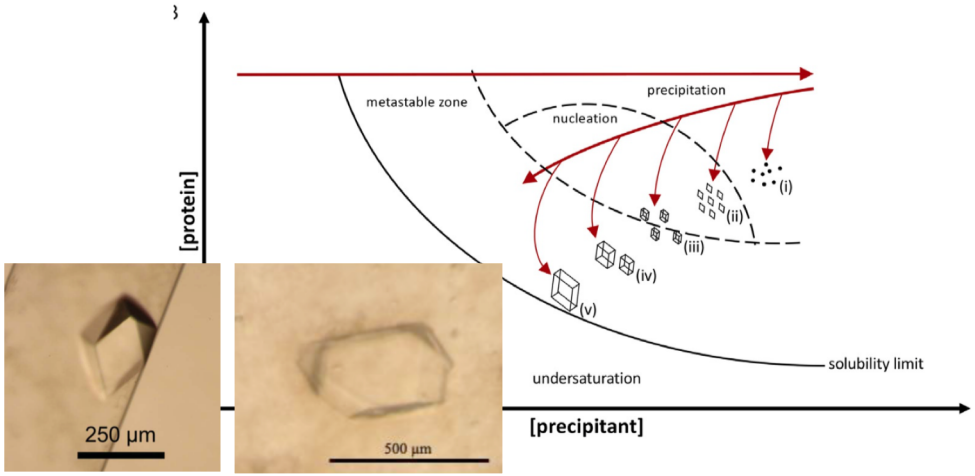



"Spectral neutron tomography" Tran, Woracek, et al, *Materials Today Advances*, 9 (2021)




"Wavelength frame multiplication for reflectometry at long-pulse neutron sources." Löhmann, et al, R*eview of Scientific Instruments* 91 (2020)

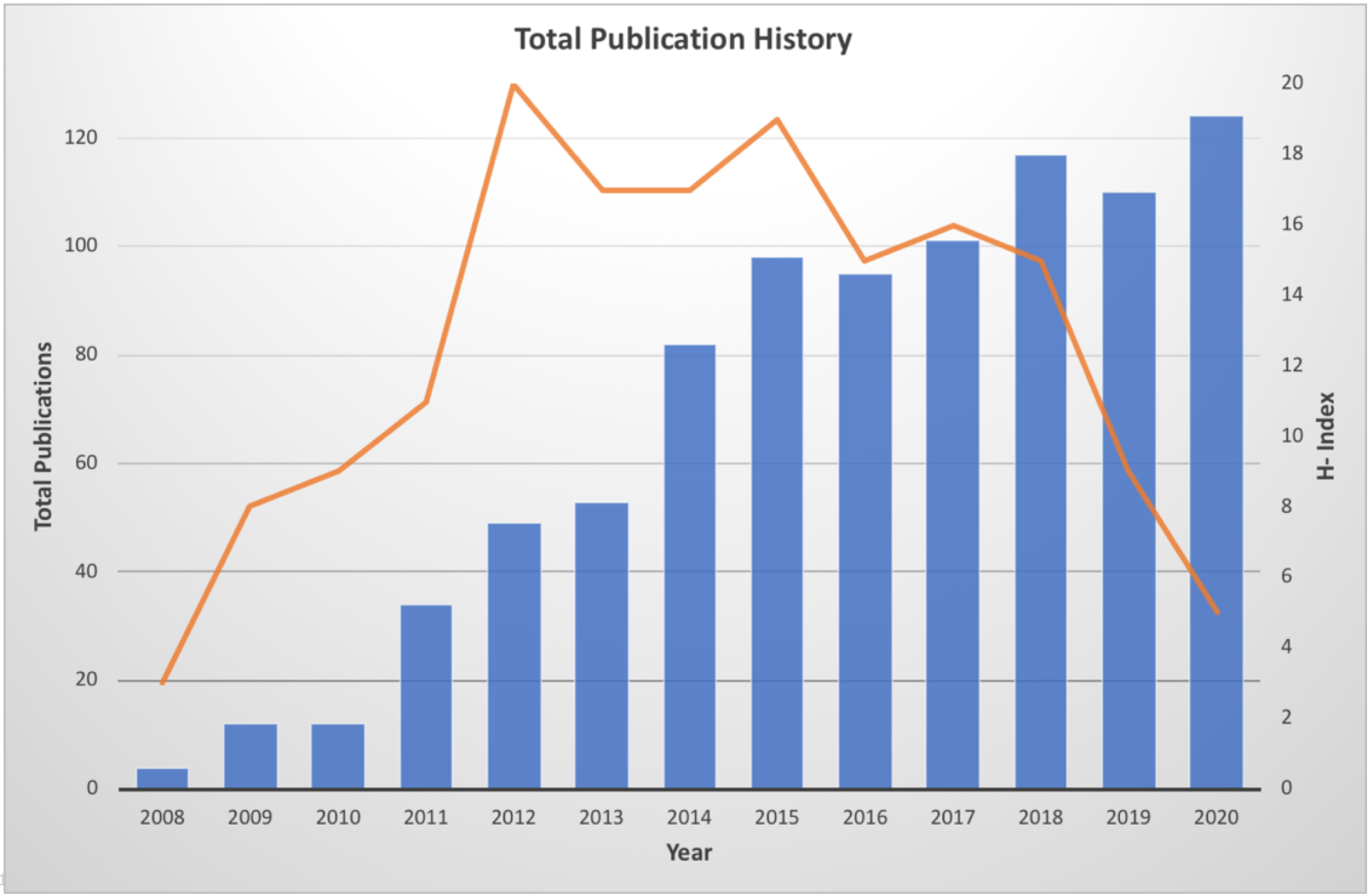

German Materials Society Werner Köster Prize
Premek Beran




Sam Hjorth-Jensen PhD defence - Co-supervisor Esko Oksanen

# ESS Publications

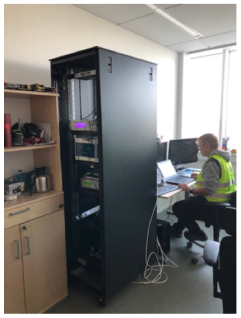
## All Directorates



# Scientific Activities Division – towards operations

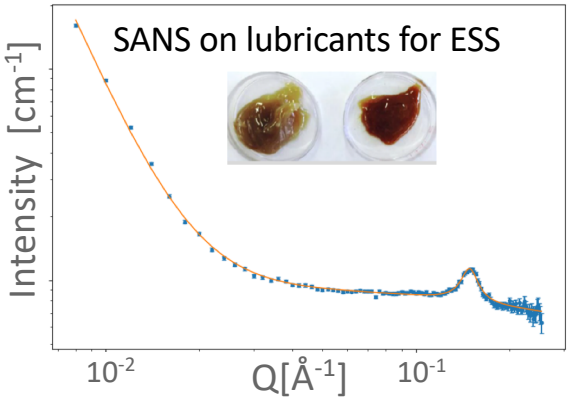
## chemistry (SULF) & deuteration (DEMAX) services support ESS construction & users

**Buildings E03/E04** used daily! **SULF** & part of sample env. moved on-site using labs & office spaces



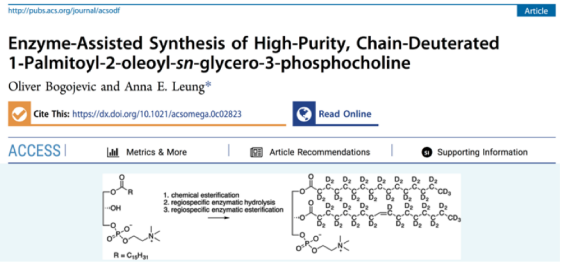

**SULF** starts support services for ESS from E04 – in temporary spots as labs are being finished






**DEMAX** delivering 2nd pilot & Covid-19 related projects;

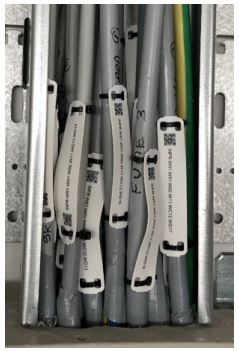
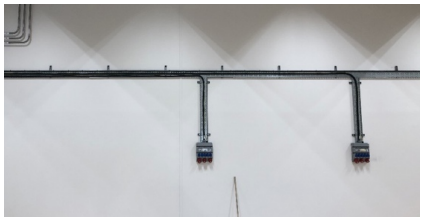
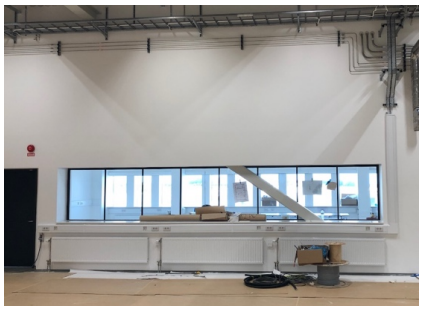
**DEMAX** demonstrates enzyme capabilities supported by grants (publication ACS omega)



# Scientific Activities Division – towards operations

## Sample Environment (SE) moving on-site and commissioning first systems

**E03** electrical installation is 90% complete – testing/commissioning phase ongoing (with QA team)


**B02** campus workshop nearing completion & SE fit-out starts

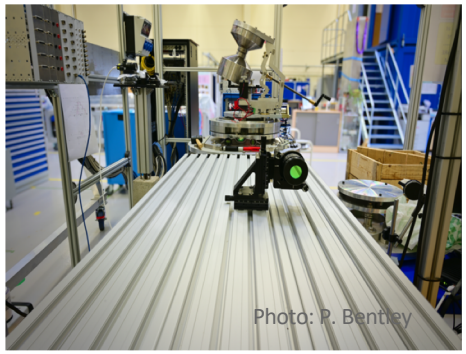



Photo: P. Bentley

First **SE systems** arriving to ESS & constructed at ESS being mechanical / control integrated & commissioned.

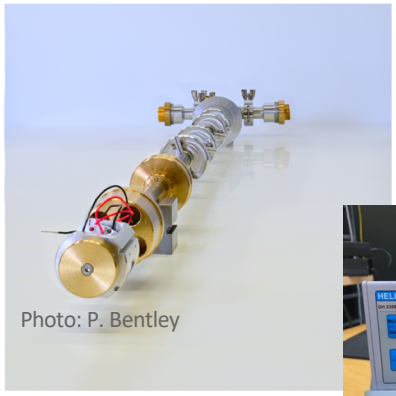
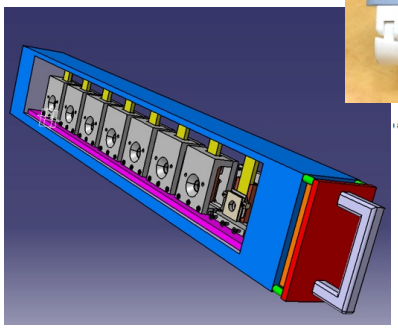
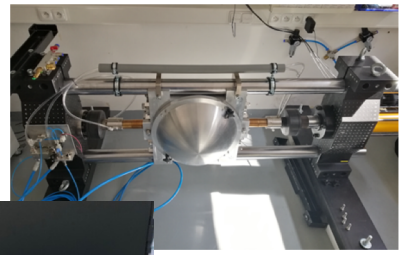
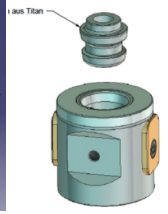


Photo: P. Bentley




# E03 / E04 labs and workshops from 2019 to 2020

**Basic chemistry lab** E04.110.2021



**Cutting & polishing lab**

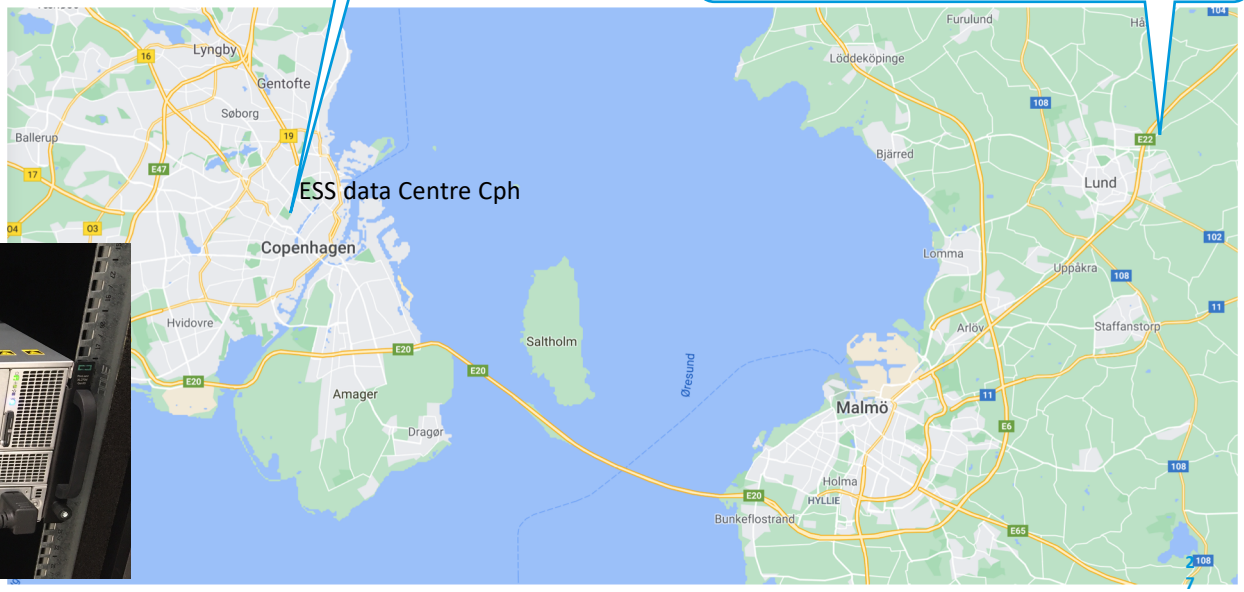


**kitchen & conference room** 'first lunch'


# DMSC: Hardware procurement

## Storage and Compute for H01 & Copenhagen 1M€.

ESS Data Centre Lund

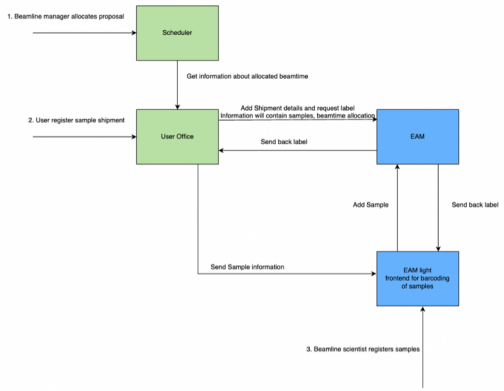


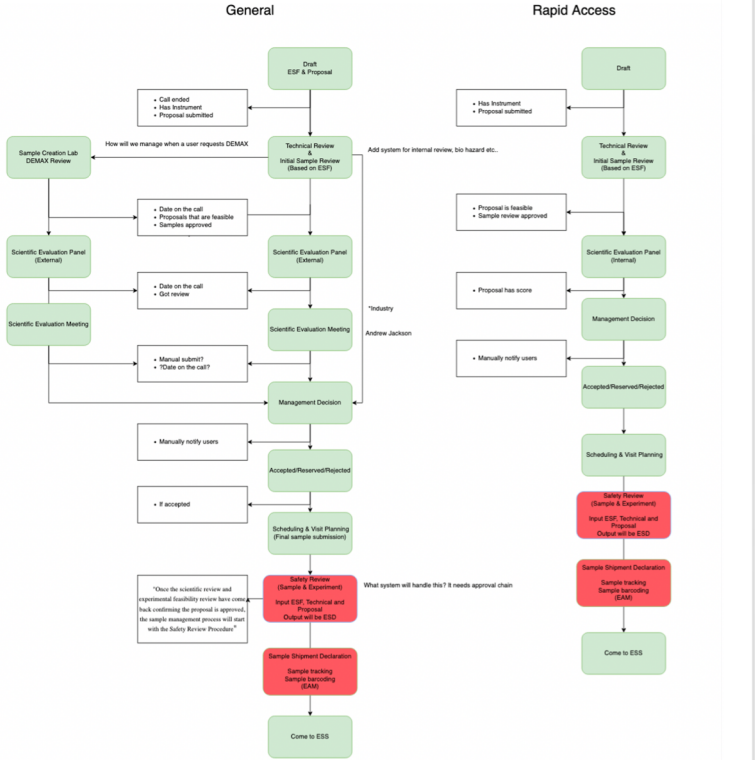
# DMSC/SAD: User Office Software Development

## Significant progress has been made

### Ongoing

- Proposal submission with sample
- Sample safety review
- Proposal scheduling
- Visit declaration
- Shipment declaration
- Sample shipment handling
- Sample barcoding

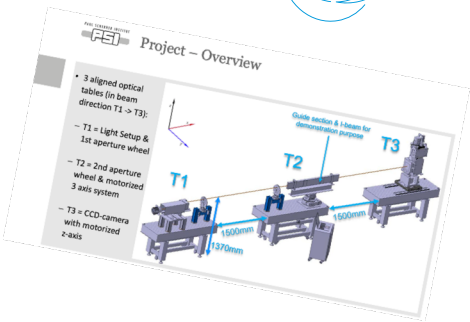


# Instrument Technologies Division

## Optics lab, collaboration with PSI & installation support

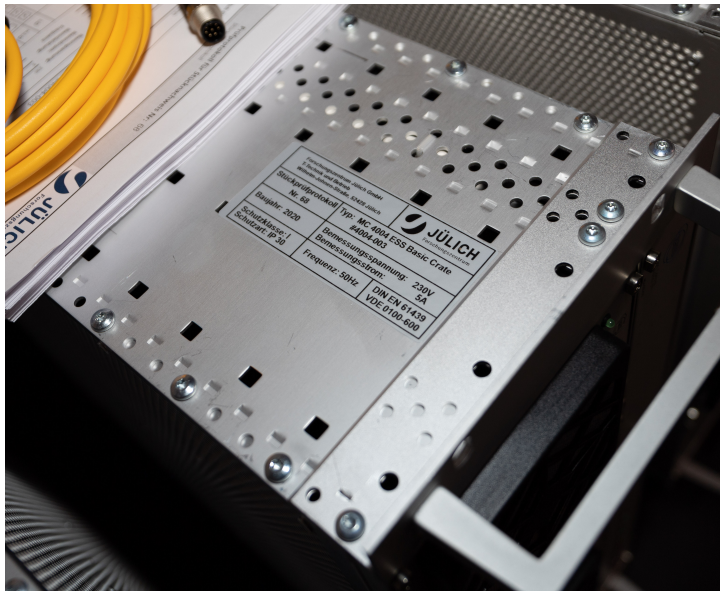
…from an empty room to equipment being installed in E03.100.1002 (thanks to SAD team & SANBER); continuing into early 2021.
PSI on Optical Test Bench System collaboration progressing well…




# Instrument Technologies Division

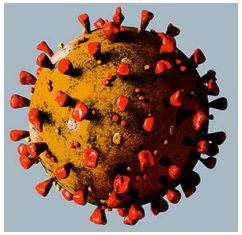
## Motion Control & Automation

Jülich delivered 3 MCU 4004 test crates to ESS in February (fully tested, documented and CE marked) ready for deployment at partner labs.



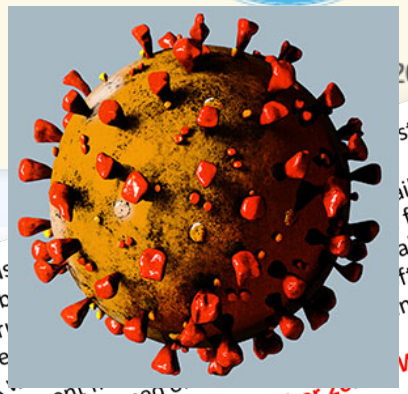

MCA lab installation in E04.100.2025 progressing….

…despite…



# Instrument Technologies Division: Polarisation

## Aim to have Scientific Case and plan at the end of 2020



Joint ESS ILL User Meeting

**Report on**

**ESS Polarisation Workshop**

**21-22 September, 2020**


Wai Tung (Hal) Lee, European Spallation Source
Arantxa Arbe, Materials Physics Center, CSIC-UPV/EHU, Spain
Tom Arnold, European Spallation Source
Elizabeth Blackburn, Lund University, Sweden
Stefano Carretta, Università di Parma, Italy
Pascale Deen, European Spallation Source
Eddy Lelièvre-Berna, Institut Laue-Langevin, France
Stefan Mattauch, Forschungszentrum Jülich, Germany
Gøran Nilsen, ISIS Neutron and Muon Facility, UK
Katia Pappas, Delft University of Technology, The Netherlands
Søren Schmidt, European Spallation Source
Xin Tong, China Spallation Source, China


Scientific Advisory Committee, October

https://indico.esss.lu.se/event/1390/

Participation fee payment

From a workshop postponed due to Corona pandemic to a report and plan for discussion with the Director for Science and NSS project leads on 15 December 2020

# Move to Campus

# Campus handed over to ESS

The ESS Campus, consists of three buildings:

- an entrance building,
- an office complex including a canteen and an auditorium,
- a labs & workshop building.

ESS staff is moving into the new buildings, slowed down by pandemic/work from home

# Office Building

## B01

# Lab and Workshop Building

## B02, High Bay Area, Oct. 2020

# Lab and Workshop Building

## B02, High Bay Area, April 2021

# Ensuring ESS plans and resources are aligned

# We are at a critical point for ESS

- Both Construction and Initial Operations resources are highly constrained
- Construction contingency remaining is very limited and costs increase
- IO funding secured only at the level of 763M€$_{2013}$ – under additional pressure
  - 124M€$_{2013}$ lower than our initial plans and 43M€$_{2013}$ below the level in the ESS statutes
- Additional costs and delays from Covid-19 – not yet contained

➢Hiring freeze at ESS

➢Way forward discussed with Council:

- **Focus remains to complete scope of 15 Instruments, 2MW source capability**
- Might have go from technically limited to ressource limited schedule
- Acceptable delay would require additional funding ( < 10% of approved Construction funding)

➢Rebaselining planned for later this year

# What does this mean for the instruments?

## and for the path towards an operational facility?

- BOT now at Oct 2023
- BOT will be delayed further due to technical/delivery issues in Acc./Target and potentially due to changing to a resource limited schedule
- Instruments projects are NOT driving these delays
- End of Construction (EOC) milestone is December 2025
- The reduction of the time between BOT and EOC makes it impossible to achieve FS, SOUP and complete the construction of all 15 instruments by the end of 2025, delay of EOC is required and being discussed
- Instrument schedule needs to be adjusted

- FS on the first three instruments is one key priority
- Delivering all 15 instruments into operation as fast as possible is another priority
- Discussions with in-kind partners started

# Conclusions

- Successful user meeting, next one in Lund in 2022
- We have been able to make good progress despite the pandemic.
- Schedule delays also due to Covid-19
- Full picture only when combined with financial boundary conditions
- Re-optimization of the instrument schedule is needed
- Close collaboration and open discussion with in-kind partners is key to success
- Issues will be focus of the upcoming SAC meeting


➢ **Ensure that within the emerging financial limitations we get the best Science Output for the Euro**