

DTU



Agenda for TechForum 2023#2

- **Misc. Updates**
- **Lab expansions**
- **Facility projects and closures**
- **Decommissioning of old equipment**
- **New equipment**

MISC. UPDATES

Updates

- Advisory board meeting (Tyndall Labs, MIT)
- Summer period
- Enabling works – disruptions

New technicians

- **Sokratis Tsanakas**



- **Nicolás Cacheda**



Consumption of BHF/HF

Facts:

- Danish authorities requires a reduction of flouride in DTUs waste water.
- Nanolab is responsible for most of the flouride in the waste water at DTU.
- Nanolab has to reduce the amount now.

	Total (liter/year)	In baths (liter/year)	In Fumehoods (liter/year)
BHF/5%HF	477	182	295

Action:

- We are changing 5% HF in the RCA cleaning with 1% HF
- We are changing BHF with surfactant with BHF without surfactant in all our baths
- You have to use the dedicated baths when you have 2"- 8" Silicon wafers.
It is much cleaner and more safe to use wet benches than fumehoods.

IT, ISO 9001 ...

- IT@DTU – the infrastructure is changing – driven by IT-security and shared services
- MFA - Multi factor Authentication – “MS Authenticator” app (or SMS)
- If you need access to external systems - let’s collaborate: thes@dtu.dk
- External audit – periodic audit
- Contact us if you have a complaint regarding our services

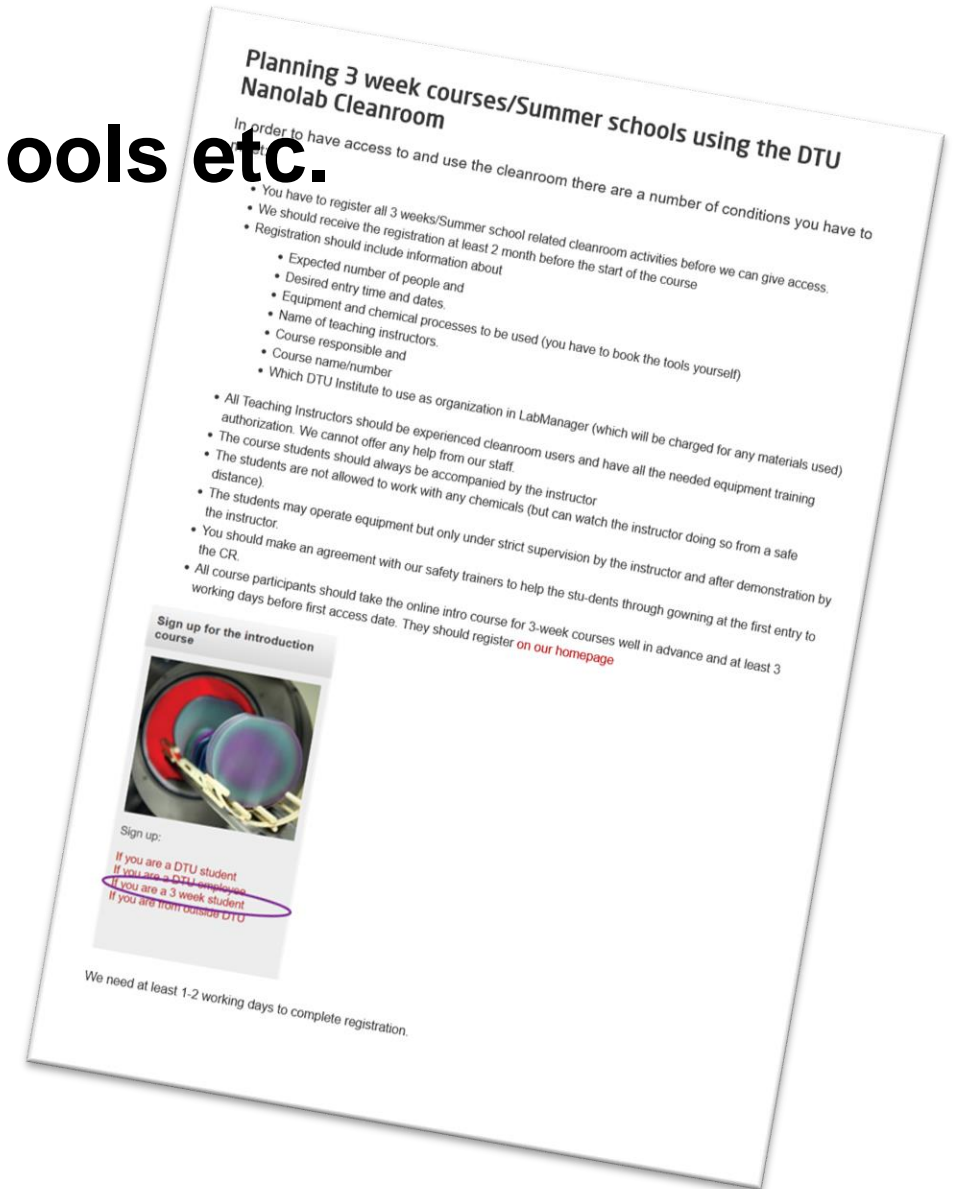


3-weeks courses, summer schools etc.

- Plan in good time - NOW!
- Follow the guidelines given in
 - <https://www.nanolab.dtu.dk/About-DTU-Nanolab/FAQ/3weekCourse>
- Please contact us NOW if you want to use the Cleanroom for 3-week courses or summer schools this summer!
- **We will tighten the rules!**

If you want to use DTU Nanolab facilities (Clean room, labs in B346, B347, B307, B314, ...) in a course, we will require that you

 - Include DTU Nanolab as “Department involved” and
 - Involve a DTU Nanolab employee as “Course co-responsible” (after agreement)
- Contact jehan@dtu.dk for further information



LAB EXPANSIONS

PolyFabLab in B347 – The glittering future



PolyFabLab in B347 – The dirty present

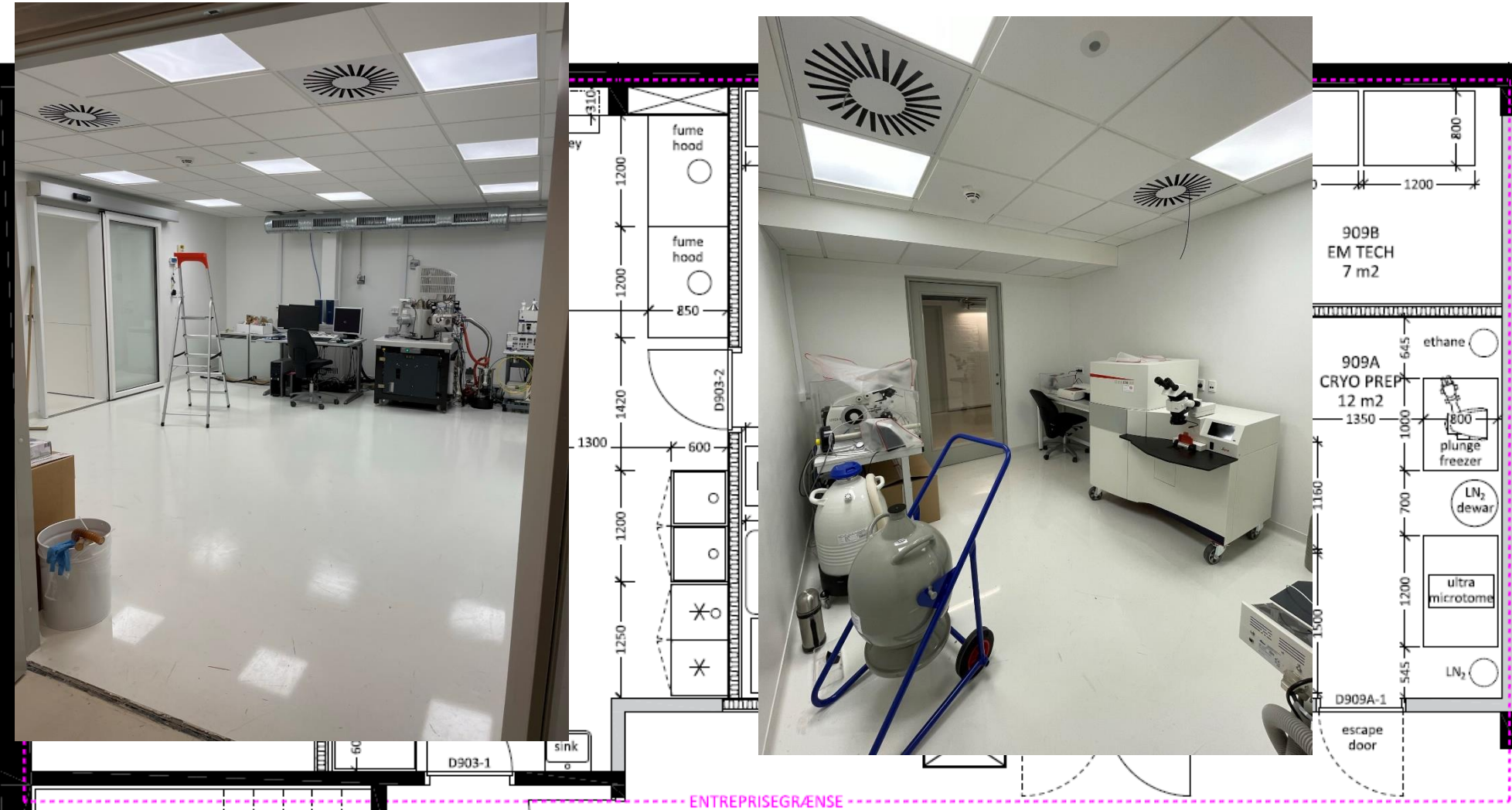


PolyFabLab (B347) time line – very loose

- Ca. Q1 2024: Project complete
- Q1 2024: People move back to B347
- Q2 2024: installation of tools in PolyFabLab

B307 basement Soft Matter Lab Sketch

- Soft Matter lab for:
 - Sample preparation
 - Cryo SEM and TEM
- Key requirements include:
 - Temperature stability 1°C P-P/24hrs
 - Low vibration levels
- Lab area >100m²



“Invite the curious and innovative to explore and exploit nanofabrication”



346A – Nanolab Phase 4

Situation for Nanolab Phase 4

- Cleanroom and structural design has been tendered
- Design team on board
- First major decision:
 - The subfab will not be clean
- Plan to open in 2026

Design goals

- Mission-critical facility
- Technology at the forefront
- Open and inspiring building
- EMI and vibration sensitivity
- Deep sub-fab for 200 mm toolsets
- Full ISO 4 possibility – ISO 4 to 6 initially
- Total area in excess of 4000 m²
- At least 700 m² cleanroom under filter
- Budget of 345 Mkr (2020 kr)

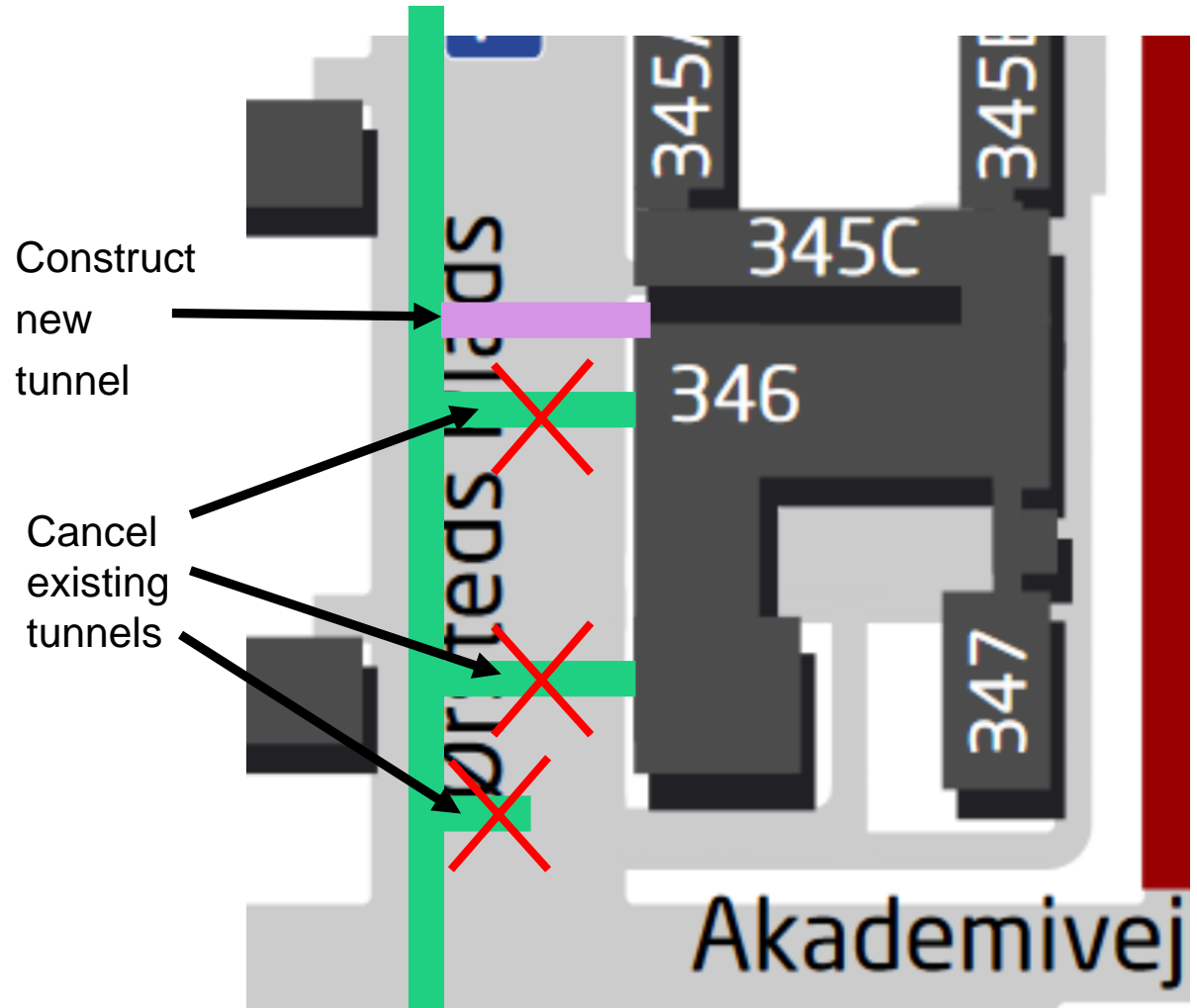


Concept drawing basement column
forrest – do not take too literally!

FACILITY CLOSURES AND PROJECT UPDATES

Enabling works – tunnel, cooling building, roof

- Before B346A construction, we need to get rid of
 - B346K (black cooling building in parking lot)
 - Old tunnels in the way
- Establish
 - 4°C cooling water in B346 2nd floor for dehumidification
 - New tunnel north of B346A
- Impact
 - Power
 - Heat
 - Cooling water
 - CDA
- Schedule presently unknown – ca. Q3/Q4 2023
- Discussions with CAS and contractors ongoing
- Aim for “minimal impact” (but this is a big project)



Decommissioning of equipment

- Nickel electroplating
- Polymer Injection machine
- Old Thickness Measurer (Wafer)
- Imprinter 02
- Inclined UV
- RTP Jipelec 1
- Wordentec (2024)
- ATEM (hibernating)

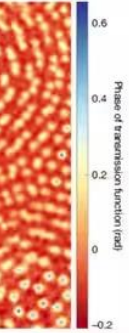
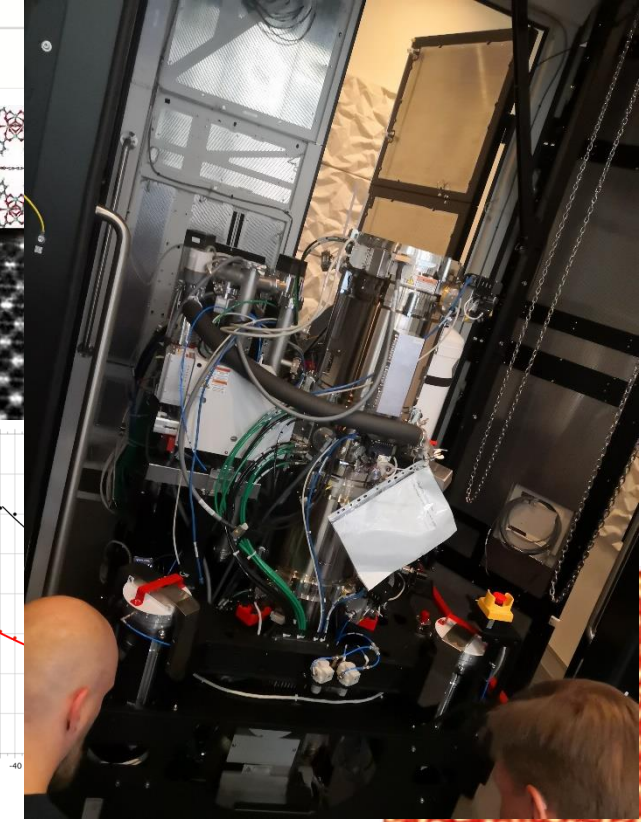
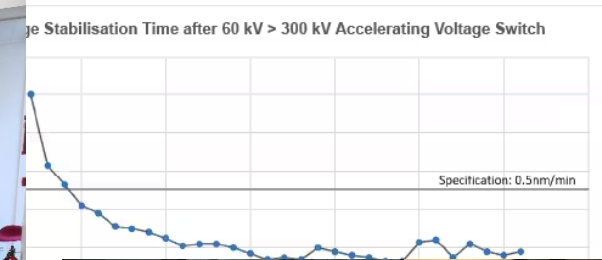
NEW EQUIPMENT

Spectra Ultra

- Probe and
- 60kV, 120
- Ultra X-ED
- Piezo-enh
- Monochrom
- Corrected
- Pressessio
- EMPAD (E
 - 128x
- 4D STEM,
- Ceta-S Ca
- GIF Contir
- Tomograp



ray
ed detector – iDPC)



Installation Q2+Q3 2023 in 314

- Energy spread: 0.05 eV (0.025 eV @ 60kV)
- Information limit: <60 pm
- STEM resolution: <50 pm at 300kV >30pA of probe current
- STEM resolution: <125pm at 30kV with >20pA of probe current



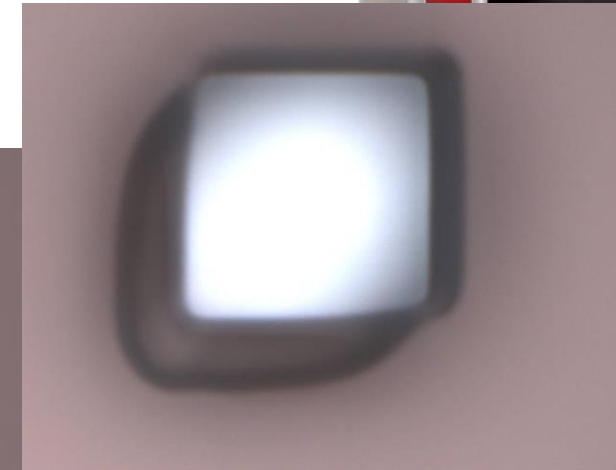
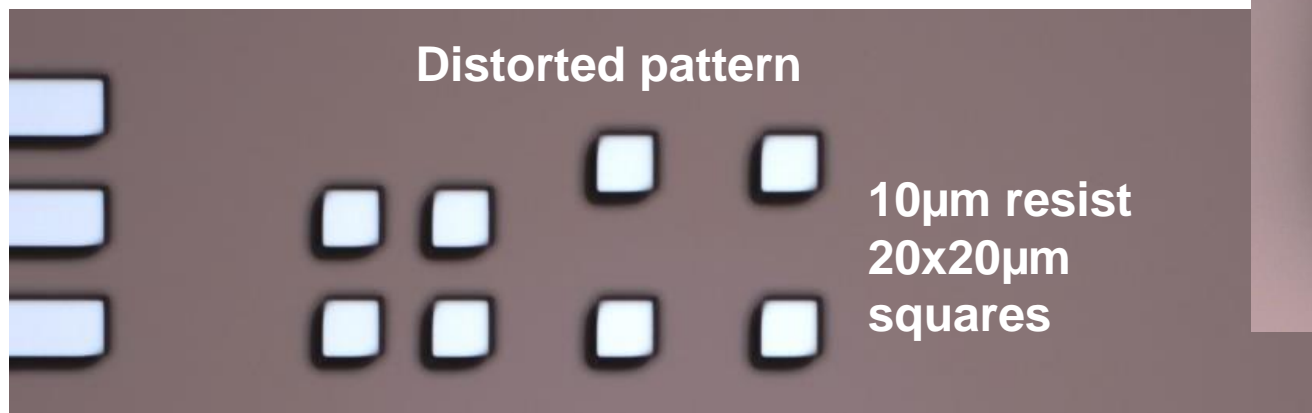
MLA2 – upgraded from Write Mode 1 to Write Mode 2

Has been changed from WM1 to WM2:

- A new write head is mounted
- All optics is changed
- The OAF adjusted to fit the new write head
- Resolution as MLA3 ($>1 \mu\text{m}$)
- Faster writing speed ~ half the speed of MLA3

Heidelberg will be back in week 33 to fix it

BUT: Out of use/limited use, poor resolution and Lift-off issues

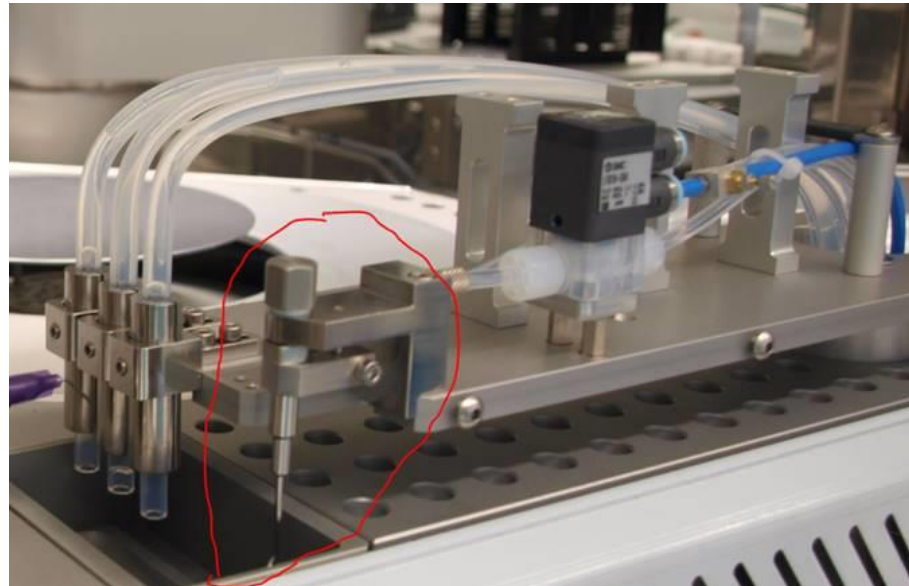


Edge bead removal and backside rinse on Spin coater: Süss Stepper

- Issues with contamination on backside of wafers when spincoating
 - Issues with uniformity on some wafer types due to heat transfer from end effector to wafer
 - Computer old and need to be changed
- Edge bead removal and backside rinse makes it possible to spin coat all wafers first and then do the pre exposure baking afterwards without contaminating the tool

EBR-needle will fit through existing nozzle holder

Solvent supply by existing TS1



Süss will come in week 36 doing the computer exchange and installation of EBR and backside rinse

Replacement of SU8 developer bench and Fumehood (RCA)

Delayed due to supply shortage of stainless steel



Old SU8 developer bench



Old Fumehood (RCA)

FAT expected to be in
Autumn 2023

New TePla Plasma asher

- Old Plasma Asher 1 installed in 1996
 - difficulties to get spareparts
 - we will repair as long as we can
- Needs a replacement
- New one will be ordered soon (8" capability)



Plasma System
GIGAbatch 360M
from PVA Metrology
and Plasma Solutions

Next SEM in 346



GeminiSEM 560 from Carl Zeiss

- **Sophisticated in-column detectors:** The detectors have seen a lot of development since the Supra models. The column now hosts detectors with **energy-selective filtering** to reveal **subtle material contrasts** – from both secondary and backscattered electrons.
- **Greatly improved low vacuum modes: Local charge compensation** that enable the use of in-column detectors (usually reserved for high vacuum) of secondary and backscatter electrons thus dramatically **improving the imaging capabilities on non-conducting samples**
- **STEM detector**
- **Also: A variety of automated features, beam deceleration...**

Factory Acceptance Test: 13 July 2023

Installation / Site Acceptance: 7-18 August

Next E-Beam Evaporation System



FC2000 from FerroTec-Temescal

Features in general

- Robust & reliable system – easy maintenance
- High flexibility (substrate sizes)
- 10-pocket crucible

Factory Acceptance done 29 May – 1 June

**Delivery postponed due to delayed cryo-pump:
Installation / Site Acceptance: Mid/end August**



New Particle Scanner – Takano WM-7SR

- to replace our current KLA-Tencor Surfscan 6420

Special agreement with ClassOne/Takano:

- Demo-site for Takano



3 months trial period, incl. comparison test, went well

Agreement on contract, incl. trade-in of old Surfscan

System released – contact Patama for details

Reproducibility σ/\bar{x}	60wph@150mm 1.0% or less
Dynamic Range	0.079 μm ~5.0 μm
Coordinate Precision 3σ	100 μm or less



Coming up – 2024

X-Ray Diffractometer – outside the cleanroom

Material properties (crystalline/ poly/nano-crystalline):

- crystal orientation
- grain size
- electron density



3 demo-visits performed with our own test samples ("top candidates")

Ready for setting up tender-specs

Expect to publish tender latest end of August
(Contact Evgeniy, Rebecca, Flemming for details)



Upgrade of Thermal Evaporator (KJL-NANO 36)

Substrate rotation for improving uniformity

- preparation for end-of-life of Wordentec

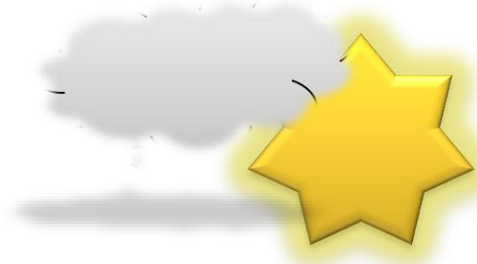
Released 25 May 2023

Contact Henrik /Patama / Rebecca for details

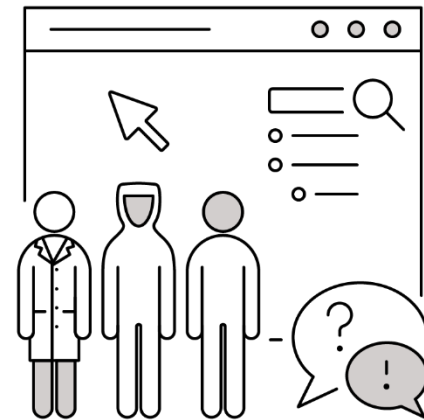


End of Presentation

- Updates
 - New technicians
 - HF consumption
 - IT structure changes
 - ISO audit
 - 3-week courses
- Lab expansions
- Possible interruptions due to 346A enabling works
- Decommissioning of old equipment
- New tools and upgrades of existing
- Slides will be available online

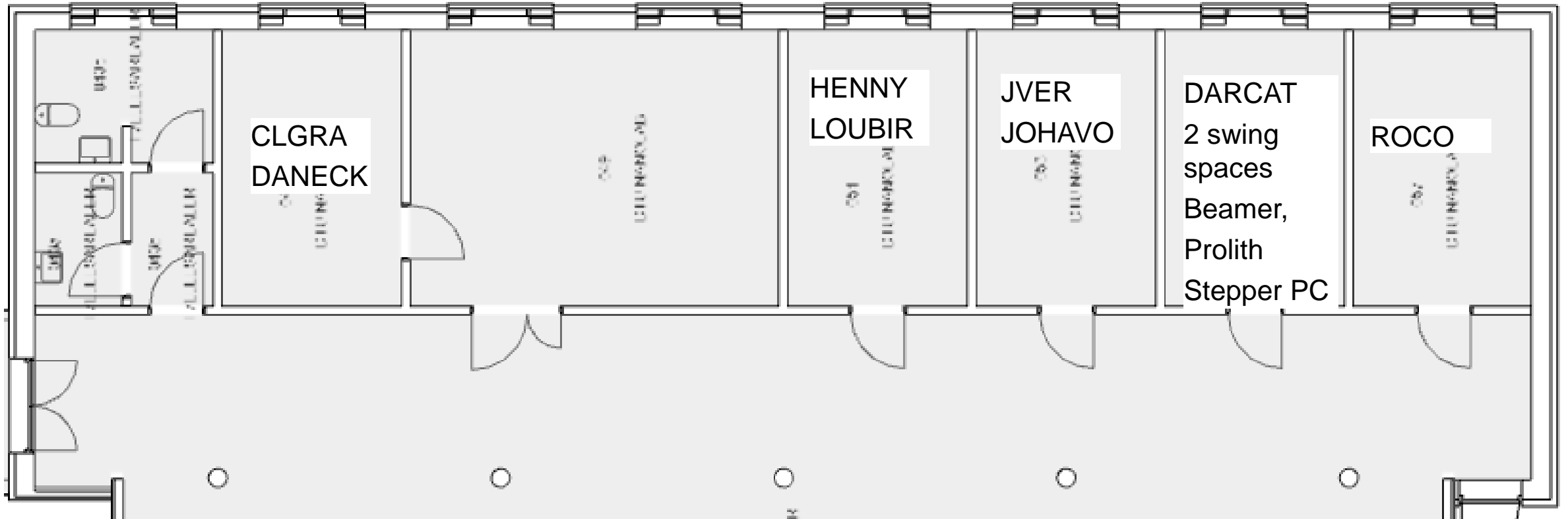


have a nice summer



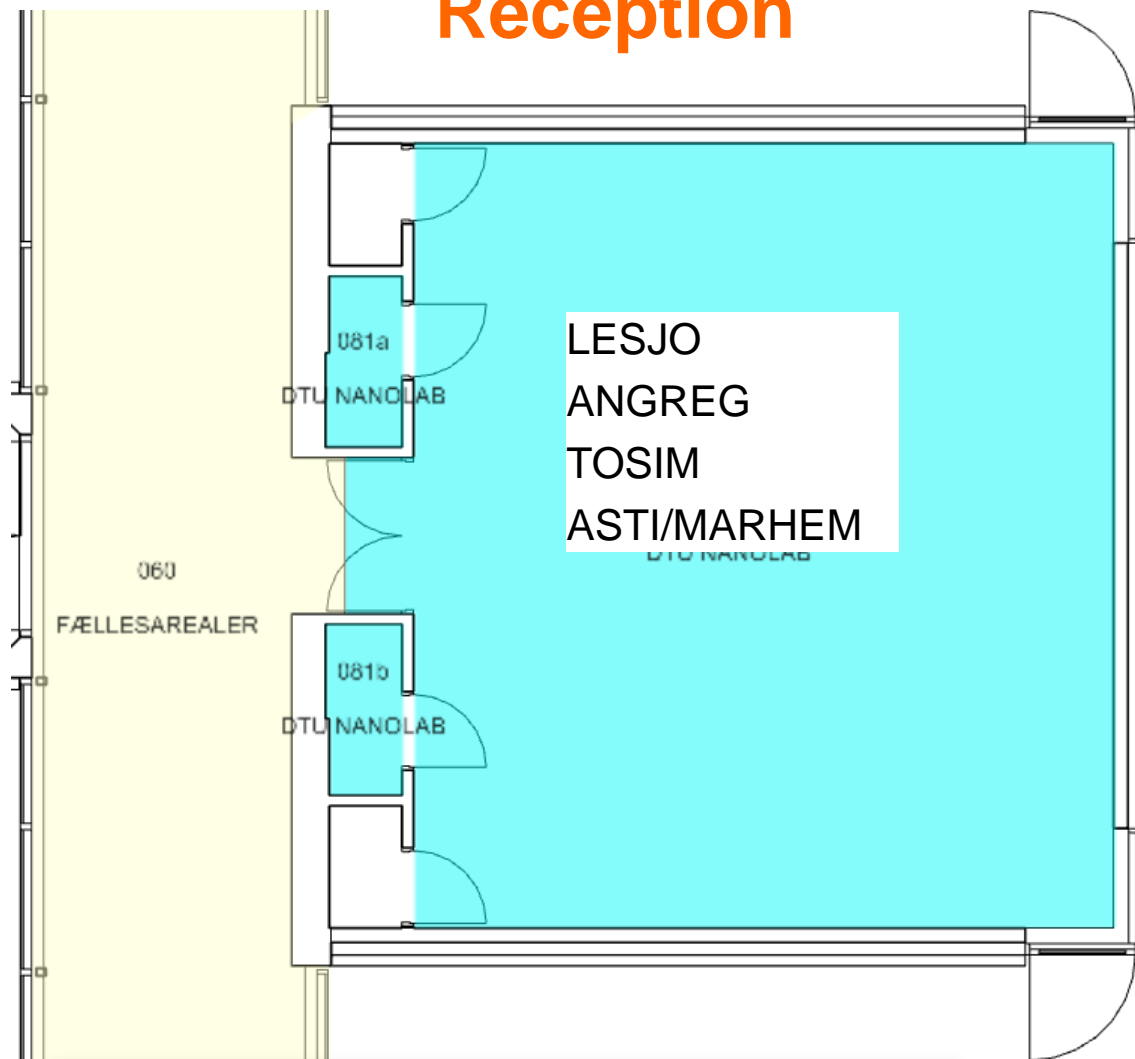
B346 Offices

(Most of) Facility



B347 Seminar Room

Reception



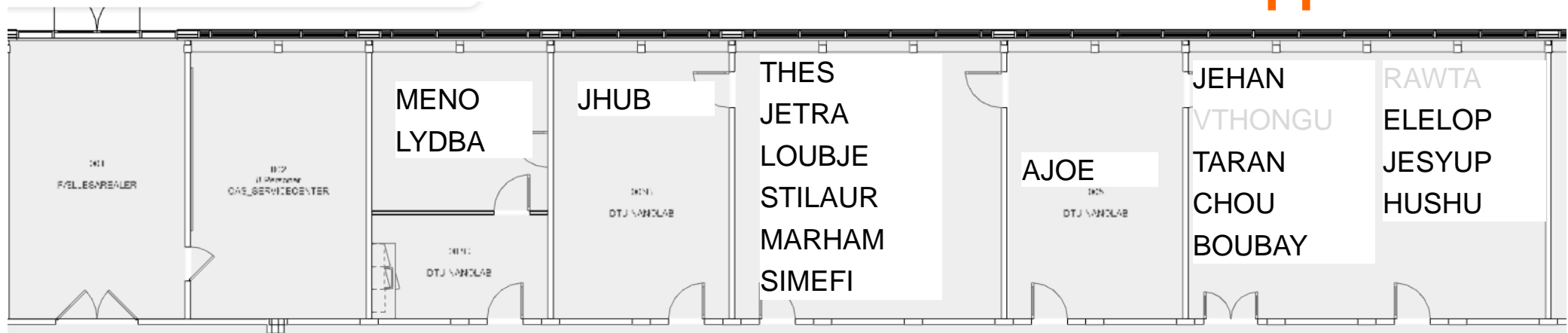
B358 ground floor



Cleanroom

Akademivej

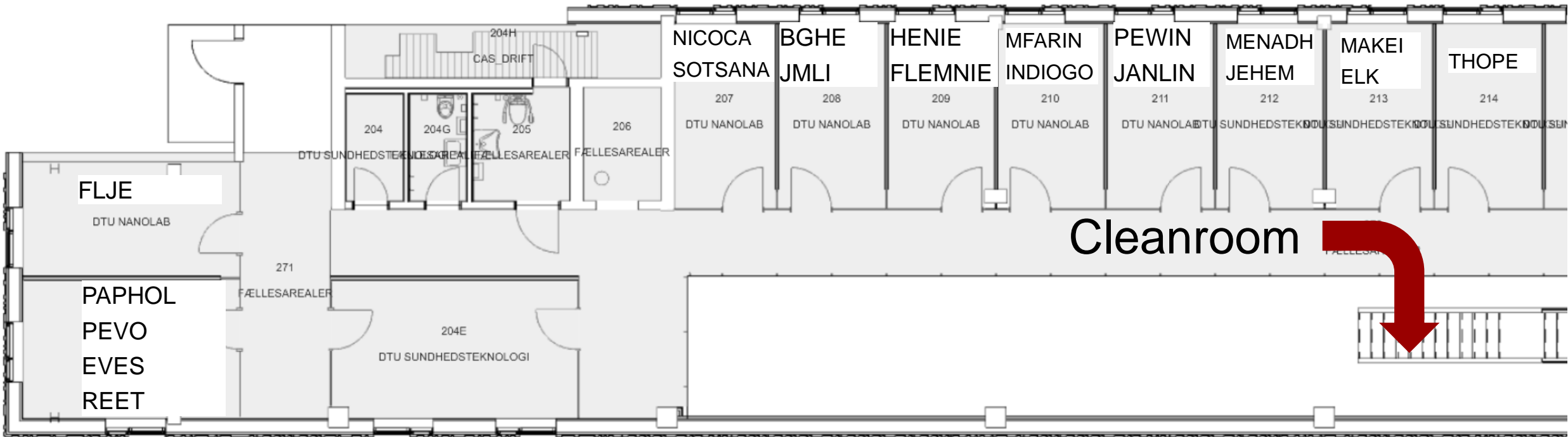
Fabrication support



B345C 2nd floor

← Ørsted's Plads

Thin Film & Dry Etch



345B ground floor

Cleanroom

Wet chemistry

