

# National infrastructure, synchrotron related research in academy and industry of relevance for Bio4Energy

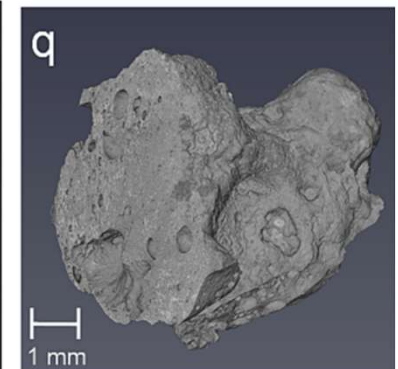
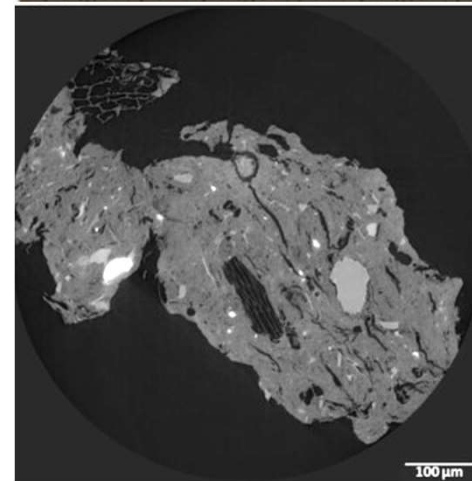
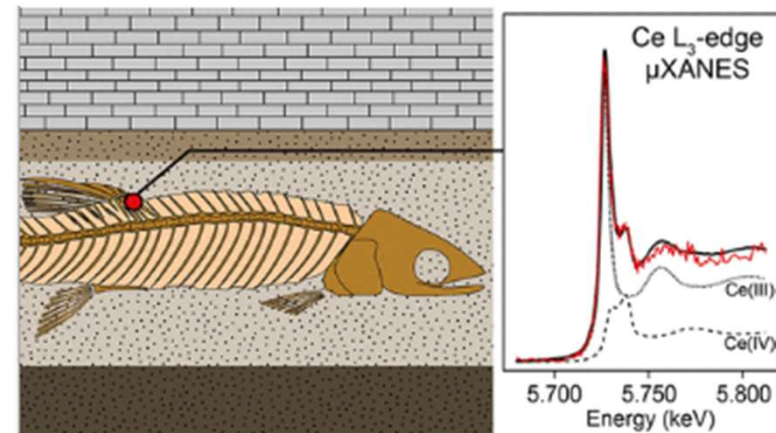
Bio4Energy Autumn Researchers' Meeting 2023

Nils Skoglund, Assoc. Prof., Umeå University

Mikael Thyrel, Senior Lecturer, Swedish University of Agricultural Sciences

# International infrastructure enabling excellent science – synchrotrons and neutron sources

- Enables experiments near impossible in laboratory settings today
- Versatile in terms of techniques and combinations
- Time-resolved studies at femtosecond possible
- X-rays or neutrons depending on research question
- Useful for any aggregation state
- Oxidation state measurements



## Light sources of the world

There are more than 50 light sources in the world (operational, or under construction). This page lists all the members of the lightsources.org collaboration.



- Application season – typically twice per year at each synchrotron and beamline
- You apply for a beamline and technique(s)
- Contact beamline scientist well in advance about your experiment
- Do your homework with in-house techniques to motivate why beamtime is necessary
- Beamtime is free if data is for publications – rarely, travel costs are also covered
- 1 shift is normally between 4 hours – 8 hours; usually at least 1 day total
- Example from Balder at MAX IV – 30 samples w/ triplicate EXAFS in 4 hours

# Homework – complementary analysis

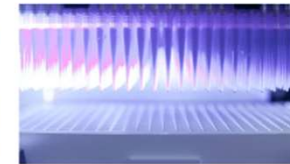
- Complementary to X-ray or neutron techniques
- National analytical infrastructures
- KBC research infrastructures
- Many techniques available through Bio4Energy collaborations

## National infrastructures



### Biochemical Imaging Centre Umeå (BICU)

BICU is an interdisciplinary facility providing state-of-the-art imaging technology with affinity measurements



### Chemical Biology Consortium Sweden

CBCS Umeå node enables screening and development of bioactive small molecules in all areas of life science



### NMR Core facility

Five different spectrometers (360-850 MHz) and provides support for a variety of scientific questions.



### Protein Expertise Platform, PEP

PEP offers services and expert advice in bioinformatics, cloning, growth optimisation and protein purification



### Swedish Metabolomics Centre (SMC)

SMC is specialized on use of MS-based methods for the analysis of metabolites in different biological systems



### Umeå Centre for Electron Microscopy (UCEM)

UCEM is a joint resource for research and higher education in electron microscopy techniques.



### SciLifeLab Umeå

SciLifeLab infrastructure units and seminar series in Umeå



# Homework – initial analysis



## LUMIA - Luleå Material Imaging and Analysis

LUMIA is a merger of four laboratories that perform micro-analysis of various solid materials in 2D/3D/4D.

Within LUMIA, analytical research expertise and advanced analytical equipment have been brought together to create a forum for groundbreaking research and analysis of various materials. LUMIA acts as a hub for the technical analytical capacity at the university and this experimental environment for advanced materials analysis is a creative meeting place for researchers, students, and companies.

### Director



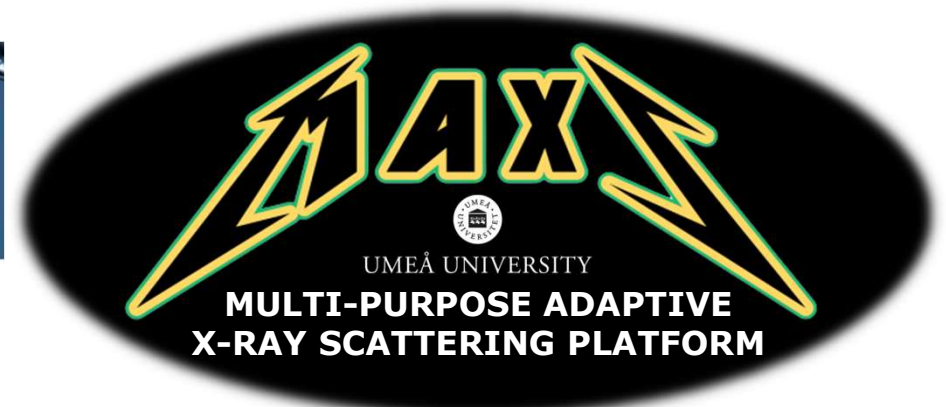
**Bark, Glenn - Senior Lecturer**

**Organisation:** Ore Geology, Geosciences and Environmental Engineering, Department of Civil, Environmental and Natural Resources Engineering

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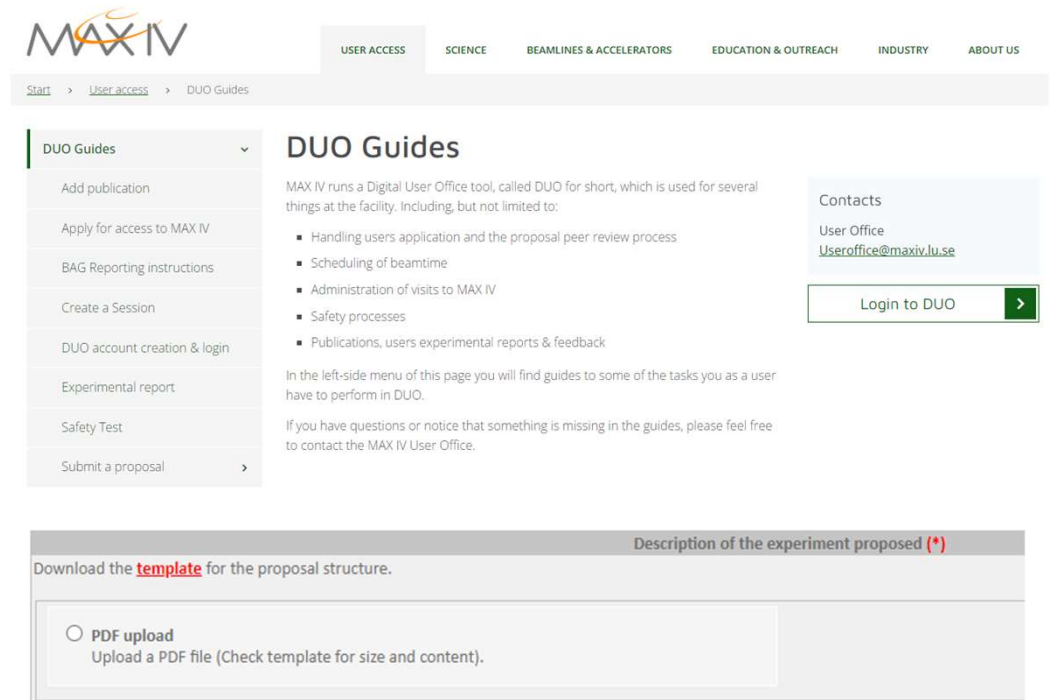
**Room:** T1336 - Luleå >



- 2x Bruker D8 Advance
- Eiger2 500K
- Lynxeye XE-T
- Powder X-ray diffraction (WAXS/SAXS)
- Total X-ray scattering
- X-ray reflectometry
- Multiple X-ray anodes
- Sample environments

# Application procedure

- Find user portal for the synchrotron with beamline identified as relevant
- Check for similar capabilities at other synchrotrons or beamlines
- Prepare the idea – in dialogue with beamline staff
- Discuss with experienced colleagues
- Typically 2-page template



The screenshot shows the MAX IV website's 'DUO Guides' page. The header includes the MAX IV logo and navigation links: USER ACCESS, SCIENCE, BEAMLINES & ACCELERATORS, EDUCATION & OUTREACH, INDUSTRY, and ABOUT US. The breadcrumb trail is 'Start > User access > DUO Guides'. A left sidebar menu lists options: Add publication, Apply for access to MAX IV, BAG Reporting instructions, Create a Session, DUO account creation & login, Experimental report, Safety Test, and Submit a proposal. The main content area is titled 'DUO Guides' and explains that MAX IV uses a Digital User Office tool (DUO) for various tasks. It lists several tasks: Handling users application and the proposal peer review process, Scheduling of beamtime, Administration of visits to MAX IV, Safety processes, and Publications, users experimental reports & feedback. It also provides contact information for the User Office (Useroffice@maxiv.lu.se) and a 'Login to DUO' button. Below this, a section titled 'Description of the experiment proposed (\*)' instructs users to download a template for the proposal structure. A 'PDF upload' section is visible, with the text 'Upload a PDF file (Check template for size and content)'.

# Experiment time!

- First visit is a learning experience
- Beamline scientists are the experts on analysis
- Describe samples well to find suitable measurement strategy
- Realise that you generate lots of data
- Bring enough people for 24 to 96 hours continuous measurement



# What to do with all the data?

- Ask someone experienced
- Participate in training courses
- XRT (LTU, UmU)
- XRD (UmU, LTU)
- XAS (SLU, UmU, LTU)
- XPS (UmU)
- Set time aside!



SEARCH

HOME ABOUT THEMES YOUNG RIS GOING ON RESOURCES CONTACT

## OUR STORY

Established in 2017, LINXS is an advanced study institute whose mission is to promote science and education focusing on the use of neutrons and X-rays.

LINXS brings together world-leading scientists for short-term focused research visits and creates international networks. It is a place to explore new ideas and research questions, to discuss methods and approaches, as well as meet and collaborate with scientists from around the world and from different disciplines and organisations.



## XAS 2023

Fundamentals of XAS Data Analysis: A Hands-on Tutorial

Hosted by Brookhaven National Laboratory  
October 10–12, 2023

## HERCULES SCHOOL: NEUTRONS & SYNCHROTRON RADIATION FOR SCIENCE

The next HERCULES session will take place from Monday 26<sup>th</sup> February to Thursday 28<sup>th</sup> March 2024

Our partner sites for HERCULES 2024 will be: ALBA, Elettra / FERMI, KIT, and SOLEIL.





# What are your thoughts?

- Pick up phone or laptop
- Either scan QR-code OR  
join at [menti.com](https://menti.com) with code  
7468 5385
- Questions will be shown in  
screen




# Industrial collaboration

- Industrial collaborations generally not considered in beam time applications
- However, often measured at the facilities as societal impact
- Vinnova have previously had calls for introducing industrial users to these techniques
- Uncertainty about 2024 ->

**VINNOVA** Search In Swedish →

[Start](#) > [Funding](#) > [Find funding](#) > [Research infrastructure - utilisation and collaboration](#) > Development...

## Development project for increased industrial utilization of neutron and synchrotron light-based technologies, 2023

 Closed on 12 September 2023 at 2PM

Developing next generation biostimulants using synchrotron X-rays



Image: Regina Gratz, business and product development manager at Arevo, at the MAX IV BALDER beamline.

# PRISMAS – another initiative to broaden use

- EU COFUND MSCA programme with MAX IV as main applicant
- 40 PhD students across Sweden
- 3 LTU, 2 UmU
- 2 related to Bio4Energy researchers
- Secondment at FORMAX and Balder



Affiliation	Total
Lund University	14
Stockholm University	8
Uppsala University	7
Malmö University	3
Luleå University of Technology	3
Karlstad University	2
Umeå University	2
University of Gothenburg	1
KTH	0
SLU	0
SUM	40



# Vinnova SPIRIT

- 3<sup>rd</sup> attempt to increase industrial engagement at MAX IV and ESS
- Purpose is to open up academic competence to industry and public sector
- National system of nodes
- Framework likely started in 2024 (application pending)
- Reports on synchrotron and neutron use on national level

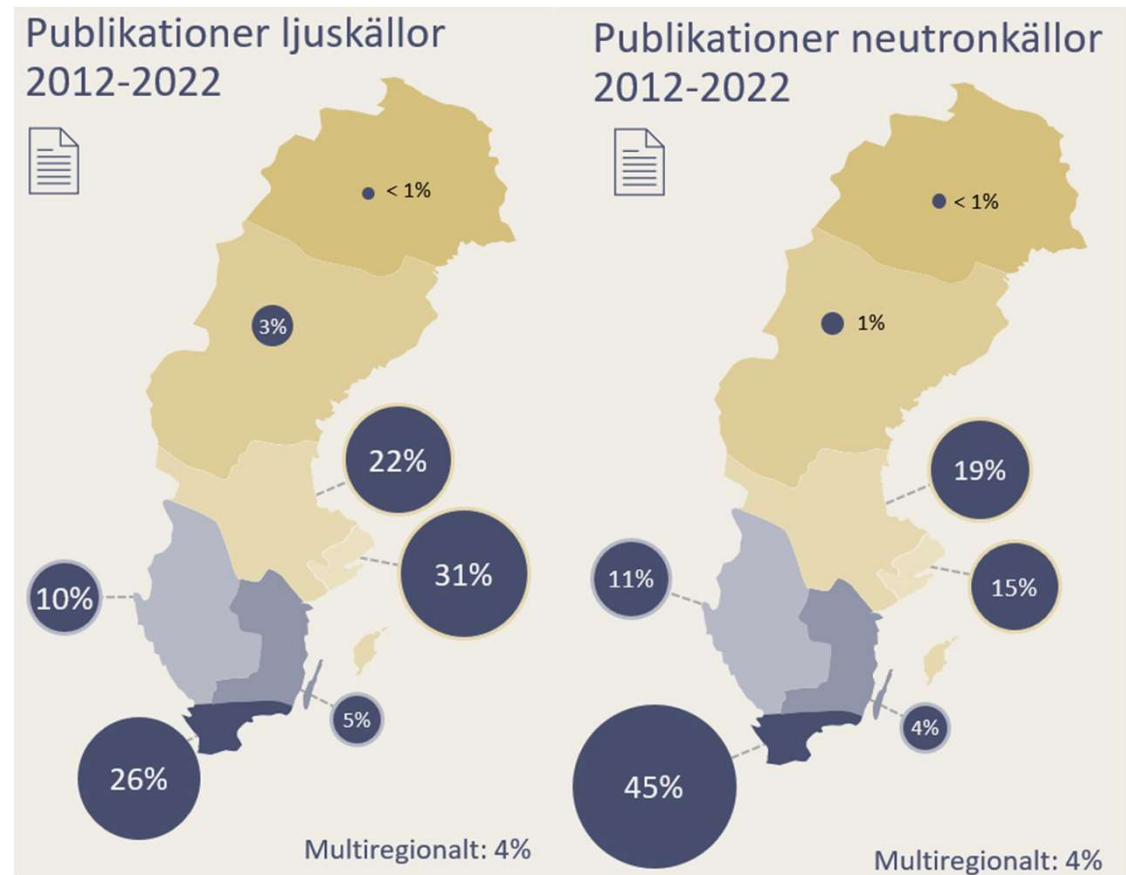
NATIONELLA NODER I PROJEKTET

NOD	Koordinator	Kontaktperson
NORR UNDRE	Umeå universitet	Nils Skoglund
NORR ÖVRE	Luleå Tekniska U	Ekaterina Osipova
NOD MITT	Uppsala U	Martin Sahlberg
NOD STHLM	Stockholms U	Gunnar Svensson
NOD SYDVÄST	Chalmers	Aleksandar Matic
NOD SYDÖST	Linköpings U	Martin Magnuson
NOD SYD	Lunds universitet	Fredrik Melander



# Vinnova SPIRIT

- Current status – share of Swedish publications in the node regions
- Bio4Energy represented from UmU, LTU, SLU
- Engagement in LINXS themes may improve chances for beam time
- Also suitable for industrial collaborations



# LINXS theme – good start within Bio4Energy?

- Actors from multiple partners permitted
- 3-year themes
- Earlier examples have started solid collaborations between academia and actors in industry or public sector
- Any existing collaborations where it fits?



# Questions? Ask a Bio4Energy researcher!

- Umeå university – Nils Skoglund (MAXS), Anna Strandberg
- Swedish University of Agricultural Sciences – Mikael Thyrel
- Luleå University of Technology – Fredrik Forsberg (LUMIA)



## Anna Strandberg

Min forskning är inom bioenergi och resursåtervinning. Jag studerar biokol och askor från restströmmar med avseende på vatten- och markapplikationer och återvinning av näringsämnen.

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### Kontakt

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### Verksam vid

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## Fredrik Forsberg

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**Avdelning:** Strömningslära och experimentell mekanik  
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