EUROPEAN
SPALLATION
SOURCE

Annual Report 2023

CORPORATE IDENTITY NO. 768200-0018 EUROPEAN SPALLATION SOURCE ERIC

Contents

1 This is ESS

To design cancer drugs that can target tumours more precisely and with greater success, it is critical to map the architecture of tumour cells at the molecular level. The unparalleled brightness of the ESS neutron source will give scientists one of the new tools essential to advance this research. Neutrons can reveal temporal and spatial information at the same time, providing the complex measurements needed to investigate the structure and dynamics of water in cells.

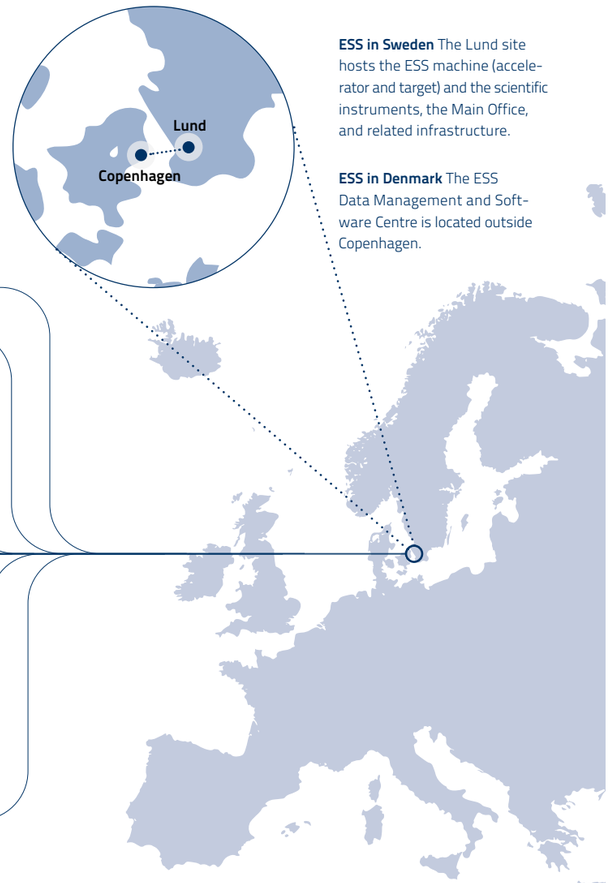
ESS in a nutshell

ESS, the European Spallation Source ERIC, is a research facility under construction in Lund, Sweden, with its data management and software centre located outside Copenhagen, Denmark.

When completed, ESS will be the world's most powerful accelerator-based neutron source to study the structure and behaviour of matter at the atomic level.

Every year, thousands of researchers from academia and industry will use the ESS facility to learn more about materials and biological systems, unlocking discoveries and driving innovative solutions to tackle global challenges, from energy to healthcare and sustainability.

ESS is funded by 13 European countries: Czech Republic, Denmark, Estonia, France, Germany, Hungary, Italy, Norway, Poland, Spain, Sweden, Switzerland and the United Kingdom. Member States contribute to the ESS organisation through financial and In-Kind contributions.



ESS in Sweden The Lund site hosts the ESS machine (accelerator and target) and the scientific instruments, the Main Office, and related infrastructure.

ESS in Denmark The ESS Data Management and Software Centre is located outside Copenhagen.

- Czech Republic
- Denmark (Host State)
- Estonia
- France
- Germany
- Hungary
- Italy
- Norway
- Poland
- Spain
- Sweden (Host State)
- Switzerland
- United Kingdom

Being one of Europe's flagship big science projects, ESS continues to attract experts from a variety of engineering, scientific and administrative fields, pooling know-how and expertise from its academic and commercial partners and experts from more than 100 research centres worldwide.

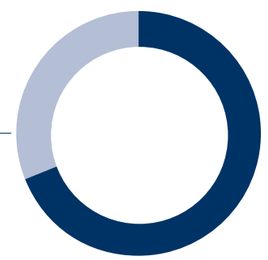
At the end of 2023, ESS had

551 employees

301 consultants

Distribution by nationality

60 nationalities



69% (382) From ESS Member States

31% (169) From other countries

Other countries:

Albania, Argentina, Armenia, Australia, Austria, Belarus, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Canada, China, Colombia, Croatia, Finland, Gambia, Georgia, Greece, Guatemala, Hong Kong, Iceland, India, Indonesia, Iran, Ireland, Japan, Jordan, Kazakstan, Lithuania, Mexico, Morocco, The Netherlands, Pakistan, Philippines, Portugal, Republic of Korea, Romania, Russia, Serbia, Slovakia, Slovenia, South Africa, Taiwan, Thailand, Turkey, Ukraine, United States

Distribution by area of expertise

48% engineers

19% scientists

15% technicians

18% administrators

2003	2009	2010	2013	2014	2022	2024	2025	2026	2027 – 2028
The first concept design is finalised	Decision to site ESS in Lund (Sweden) and its DMSC – Data Management and Software Centre in Copenhagen (Denmark)	ESS becomes ESS AB, a publicly held company with 75% of its stock held by Sweden and 25% by Denmark.	ESS Technical Design Report completed	Start of construction of the ESS site, Lund	Civil construction in Lund completed	Accelerator completed	First neutrons - the first proton beam strikes the target	First scientific experiments - Initial experiments from expert users providing the first scientific results	End of the current phase of the construction project and start of operations

The ESS Road to Science

The idea of a new, more powerful neutron source for European research emerged in the late 80's. At the beginning of the 2000's, visionary scientists and policy makers unite forces to advocate for the creation of the next generation's facility for research with neutrons.

Since then, the path from vision to Science has been marked by key milestones, all reached thanks to the effective collaboration across borders between scientific communities, policy makers and state representatives.

Above are the future milestones (as of December 2023) of the ESS Road to Science.

ESS Data Management and Software Centre, Copenhagen

In brief, the end of the current phase of construction is reached with the delivery of:

2 MW available beam power

an accelerator-based long-pulse neutron scattering source capable of 2MW beam power on target

15 neutron scattering instruments

15 neutron scattering instruments delivered and installed

0,800 GeV beam energy

Test beamline neutron flux consistent with beam energy

All infrastructure supporting User Programme operational

Trained staff, operating permits, and system documentation in place

To complete this phase of the construction project and be ready for routine operations, we at ESS, in Lund and Copenhagen, and at In-Kind partner institutes across Europe, continue to actively engage in thousands of intertwined activities leading towards the required readiness of:

Facility

in brief, all technical components, and related control systems, are manufactured, installed and commissioned to meet the agreed technical performance.

Science Programme

infrastructures, policies, and processes are in place, to enable and support the work of the scientific users.

Operations

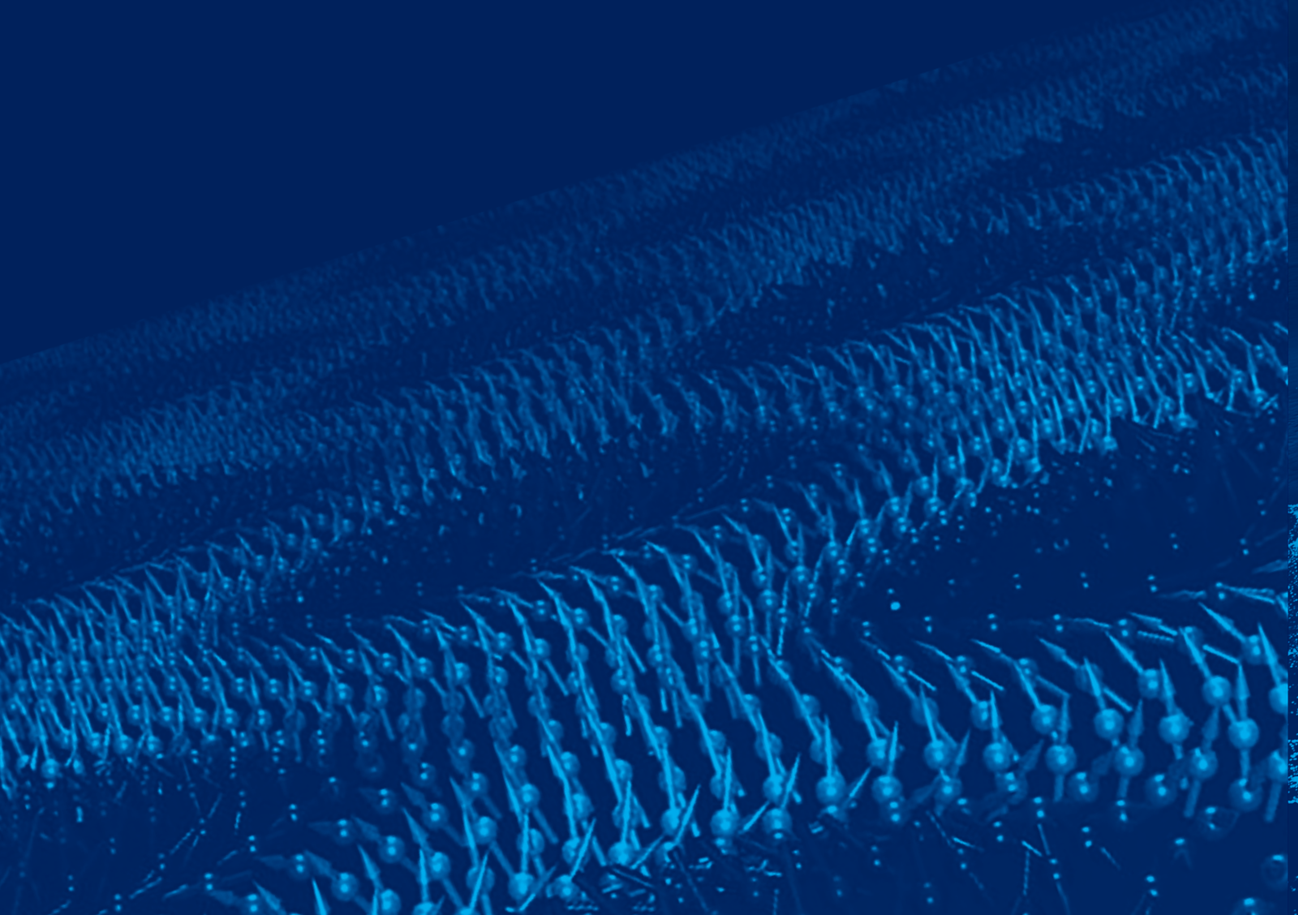
all systems, processes, permits and infrastructures needed to operate the facility and site in a safe and reliable way are established and tested.

Organisation

the administration and governance of ESS is fully established, with all the tools, systems and competencies needed to manage and govern a truly unique international organisation for excellent science.

All areas advancing together to reach readiness for Science >>

Modern technologies, from semiconductors to lasers to batteries, rely on science of materials. Neutrons are able to reveal more about materials by probing their structures on scales that range from the distance between atoms in a crystal to centimeters.



2 Governance and Management

The ESS Council

ESS is organised as a European Research Infrastructure Consortium, or ERIC, under the European Commission's ERIC legal framework.

The European Spallation Source ERIC is governed by the ESS Council (full name: European Spallation Source ERIC Council) which is bound by the Statutes ratified by the ERIC Member Countries: Czech Republic, Denmark, Estonia, France, Germany, Hungary, Italy, Norway, Poland, Spain, Sweden, Switzerland and the United Kingdom. The ESS Council is composed of up to two delegates from each Member State, as well as a Chair and Vice Chair appointed by the Council.

At the 34th meeting of the ESS Council (June 2023), the Council and Management thanked the Chair, Beatrix Vierkorn-Rudolph, and Vice Chair, Kurt Clausen - who had come to the end of their mandate – for their outstanding contribution to the project and relentless support to the ESS organisation.

The ESS Council

Chair

Robert McGreevy
Science & Technology Facility Council – STFC, UK

Vice Chair

Andrea Fischer
Permanent Representation of the Federal Republic of Germany to the European Union, Germany

Czech Republic

Marek Vyšinka
Research Infrastructures, Ministry of Education, Youth and Sports – MSMT

Ondřej Svoboda
Nuclear Physics Institute of the Czech Academy of Sciences – UJF-CAS

Denmark

Bo Smith
Ministry of Higher Education & Research

Jane Hvolbæk Nielsen
Technical University of Denmark – DTU

Estonia

Toivo Räim
Ministry of Education & Research

Priit Tamm
Estonian Research Council

France

Sylvain Ravy
National Centre for Scientific Research – CNRS

Marie-Hélène Mathon
Alternative Energies and Atomic Energy Commission – CEA

Germany

Ralph Dieter
Federal Ministry of Education & Research – BMBF

Martin Müller
Helmholtz-Zentrum Hereon

Hungary

Balázs Kápli
National Research, Development and Innovation Office - NKFIH

Ákos Horvath
Centre for Energy Research – HUN-REN

Italy

Aldo Covello
Ministry of Education, Universities, and Research – MUR

Pierluigi Campana
National Institute of Nuclear Physics – INFN

Norway

Odd Ivar Eriksen
Research Council of Norway

Poland

Marek Jezabek
Institute of Nuclear Physics of the Polish Academy of Sciences – IFJ-PAN

Mateusz Gaczyński
Ministry of Science & Higher Education – MNiSW

Spain

Ana Maria Aricha Yanguas
Ministry of Science, Innovation and Universities

Adolfo Morais Ezquerro
Basque Ministry of Universities & Research

Sweden

Lars Börjesson
Chalmers University of Technology

Viktoria Mattsson
Swedish Research Council

Switzerland

Xavier Reymond
State Secretariat for Education, Research and Innovation – SBFI

Christian Rüegg
Paul Scherrer Institute – PSI

United Kingdom

Mark Thomson
UK Research and Innovation – UKRI

Ana Delgado
Department for Science, Innovation & Technology – DSIT

The ESS Management

The ESS organisation is managed by the Director General and its Executive Board of Directors. During the year, Director of Administration Agneta Nestenborg and Associate Director for In-Kind Management Dimitri Argyriou left the organisation. In December, the Council appointed Ander Ihr as new Director of Administration, starting his mandate in January 2024.

Director General
Helmut Schober

Project Director
Andrew Kimber

Administration Director
Anders Ihr

Technical Director
Kevin Jones

Science Director
Giovanna Fragneto

Operations and Infrastructure Associate-Director
Carlo Bocchetta

Members of the ESS Council and Management in front of Visitor Centre at PSI (CH) during the 36th Meeting of the ESS Council

Advisory Committees to the ESS Council

The ESS Council established a number of committees of Member Country delegates and experts to serve as advisors to the ESS Council.

Administrative & Finance Committee - AFC

Composed of up to two delegates from each Member Country, the AFC advises the Council on all matters relating to administrative and legal issues and financial management. The Chair and Vice Chair are nominated by the Committee and appointed by the Council.

Chair

Stéphanie Lê Vàn
National Centre for Scientific Research – CNRS, France

Vice Chair

Xavier Reymond
State Secretariat for Education, Research and Innovation – SBFI, Switzerland

Czech Republic

Magda Pektorová
Ministry of education youth and sports – MSMT

Denmark

Line Bekker Poulsen
Ministry of Higher Education and Science – UFM

Morten Scharff
Ministry of Higher Education and Science – UFM

Estonia

Priit Tamm
Research Council of Estonia

France

Phillippe Sassier
Alternative Energies and Atomic Energy Commission – CEA

Roxanne Casemayou
National Centre for Scientific Research – CNRS

Germany

Johanna Brandenburg
Forschungszentrum Jülich

Johannes-Maria Wingen
Ministry of Education & Research – BMBF

Hungary

Balázs Kápli
National Research, Development and Innovation Office - NKFIH

Italy

Antonella Tajani
National Research Council – CNR

Ileana Gimmillaro
Elettra – Sincrotrone Trieste

Norway

Odd Ivar Eriksen
The Research Council of Norway

Poland

Michał Rybiński
Ministry of Higher Education & Education – MNiSW

Dagmara Milewska
National Centre for Nuclear Research – NCBJ

Spain

Guadalupe de Córdoba Lasuncion
Ministry of Science, Innovation and Universities

Begoña Asumendi Anza
ESS Bilbao

Sweden

Johan Holmberg
Swedish Research Council

Mikaela Rapp
Swedish Research Council

Switzerland

Simon Berger
State Secretariat for Education, Research and Innovation – SBFI

United Kingdom

Philippa Kingston
UK Research and Innovation – UKRI

Laura Woodward
UK Research and Innovation – UKRI

"2023 has been a challenging but rewarding year for AFC members. After working hard with them to develop a new Currency Policy, I was pleased to see it adopted by the Council and hopefully soon implemented. This new policy will be a great help to ESS in their day-to-day financial management. For me, this latest achievement was the finishing touch to four exciting years in office."

Stéphanie Lê Vàn
Chair AFC

In-Kind Review Committee - IKRC

The IKRC is charged with the general responsibility of evaluating the In-Kind contribution proposals and making recommendations thereupon to the Council. The Council approves all In-Kind contracts based on these recommendations. Each country participating in the Council is represented in the IKRC by one delegate. The Chair and Vice Chair are nominated by the Committee and appointed by the Council.

Chair

Fiamma García Toriello
ESS Bilbao, Spain

Czech Republic

Petr Šittner
Institute of Physics of the Czech Academy of Sciences – FZU

Denmark

Niels Bech Christensen
Technical University of Denmark – DTU

Estonia

Piret Pikma
Tartu University

France

Arsene Goukassov
Laboratoire Léon Brillouin – LLB

Germany

Tania Claudio Weber
Forschungszentrum Jülich, Vice Chair

Hungary

Viktória Sugár
Óbuda University

Italy

Giuseppe Gorini
University of Milano-Bicocca

Norway

Erik Wahlström
Department of Physics at Norwegian University of Science and Technology – NTNU

Poland

Dariusz Bocian
Institute of Nuclear Physics of the Polish Academy of Sciences – IFJ-PAN

Sweden

Jens Birch
Linköping University

Switzerland

Peter Allenspach
Paul Scherrer Institute – PSI

United Kingdom

Justin Greenhalgh
Science and Technology Facilities Council, STFC

"In-Kind partners are an essential part in the construction of the European Spallation Source, providing know-how and added value to the project. 2023 has been a challenging year with the delivery and installation of many key In-Kind components. I feel very honoured to be able to chair the IKRC Committee, with the arduous commitment to continue collaborating with the ESS Organisation to achieve its mission to build and operate what will be the most powerful neutron source in the world."

Fiamma García
Chair IKRC

Project Advisory Committee - PAC

The PAC is composed of international experts relevant for project oversight of construction of large scientific or similar complex technical facilities but not employed by or otherwise immediately connected to the Organisation. The PAC members, including the PAC Chair, are appointed by the Council.

Chair

Mark Reichanadter
consultant, previously SLAC National Accelerator Laboratory, USA

Members:

Alain Menelle
Laboratoire Léon Brillouin – LLB, France

Diane Hatton
consultant, previously Brookhaven National Laboratory – BNL, USA

Karen White
Oak Ridge National Laboratory – ORNL, USA

Lina Rodriguez Rodrigo
previously CIEMAT/ITER, Spain/France

Reinhard Brinkmann
consultant, previously Deutsches Elektronen-Synchrotron DESY, Germany

Stephen Jago
Science & Technology Facilities Council – STFC, UK

Thomas Klinger
Max Planck Institute for Plasma Physics – IPP-MPG, Germany

Winfried Petry
consultant, previously Technical University of Munich – TUM, Germany

"Summarising 2023, the PAC finds ESS making significant progress toward Beam on Target (BoT) in all areas, from Accelerator focusing primarily on installation and commissioning, Target continuing its steady progress toward completing the Monolith and NSS working with the In-Kind Partners to ensure the maximum number of Instruments are installed prior to BoT. Looking forward, the PAC will continue to provide expert advice during the transition into hot commissioning and operations."

Mark Reichanadter
Chair PAC

Scientific Advisory Committee – SAC

The SAC provides independent advice on all relevant scientific and technical issues related to the instrument suite and the scientific operation of the facility. The SAC is composed of experts in neutron scattering methods and potential users from the science communities. The Chair, Vice Chair and Members are appointed by the ESS Council.

Chair

Victoria García Sakai
Science & Technology Facilities Council – STFC, UK

Vice Chair

Elizabeth Blackburn
Lund University, Sweden

Members:

Alberto Mengoni
National Agency for New Technologies, Energy and Sustainable Economic Development – ENEA, Italy

Annette Langkilde
University of Copenhagen, Denmark

Fabrice Cousin
Laboratoire Léon Brillouin – LLB, France)

Giorgio Schiro
National Centre for Scientific Research – CNRS

Jacqueline Cole
University of Cambridge, UK

Jonathan White
Paul Scherrer Institute – PSI, Switzerland

Klaus Habicht
Helmholtz-Zentrum Berlin, Germany

Maria Paula Matos Marques
University of Coimbra, Portugal

Maria Teresa Fernandez Diaz
Institut Laue-Langevin – ILL, France

Martin Sahlberg
Uppsala University, Sweden

Mirijam Zobel
RWTH Aachen University, Germany

Stephen Hall
Lund University, Sweden

William Stirling
former European Synchrotron Radiation Facility/Institut Laue-Langevin – ESRF/ILL, France

"2023 has been a year of change for science at ESS: we welcomed a new science director and saw significant progress in the instrument halls. Scientific activity is high despite no neutrons in Lund yet. There is a unified drive to deliver the anticipated world-class neutron instrumentation and scientific user programme as scheduled, and the ESS leadership is putting in place the appropriate structures and processes required to achieve this. As SAC, we are supporting the ESS Science Leadership through this journey and are eager to see first scientific experiments that will demonstrate the scope of what ESS has to offer."

Victoria García Sakai
Chair SAC

Technical Advisory Committee - TAC

The TAC consists of international experts not employed by or otherwise immediately connected with ESS. The TAC advises the ESS Council in technical matters and other matters of importance for ESS. The Chair and Members are appointed by the ESS Council.

Chair

Mei Bai
SLAC National Accelerator Laboratory, USA

Accelerator

Co-Chair

Glen Johns
Oak Ridge National Laboratory – ORNL, USA

Members:

Alessandro Gallo
National Institute of Nuclear Physics – INFN, Italy

Joachim Grillenberger
Paul Scherrer Institute – PSI, Switzerland

Mike Glover
Science & Technology Facilities Council – STFC, UK

Nicolas Pichoff
French Alternative Energies and Atomic Energy Commission – CEA, France

Robin Ferdinand
Large Heavy Ion National Accelerator – GANIL, France

Sara Thorin
MAX IV Laboratory, Sweden

Controls

Co-Chair

Markus Janousch
Paul Scherrer Institute – PSI, Switzerland

Members:

Cyrille Berthe
Large Heavy Ion National Accelerator – GANIL, France

Eugenia Hatziangeli
European Organization for Nuclear Research – CERN, Switzerland

Freddie Akeroyd
Science & Technology Facilities Council – STFC, UK

Target

Co-Chair

Graeme Murdoch
Oak Ridge National Laboratory – ORNL, USA

Members:

Christian Nyfeler
Paul Scherrer Institute – PSI, Switzerland

Eric Pitcher
Los Alamos National Laboratory – LANL, USA

Kevin Jones
Science & Technology Facilities Council – STFC, UK

Masatoshi Futakawa
Japan Proton Accelerator Research Complex – J-PARC, Japan

Michael Butzek
Forschungszentrum Jülich, Germany

"The TAC was deeply impressed by the progresses that ESS has made in 2023. Overall, major milestones of the project have been on track. With the successful normal conducting linear accelerator beam commissioning, beam port installation, monolith vacuum pump down, delivery of controls software and hardware infrastructure, and more, the ESS machine is steadily progressing towards completion."

Mei Bai
Chair TAC

Chair's Committee - CC

The Chair's Committee provides advice to, and serves as a sounding board for, the Director General on emerging issues, challenges, and initiatives that ultimately may require the Council's attention. The CC has no general decision-making mandate unless explicitly delegated this by the Council, which is on an ad-hoc basis.

Ex-Officio members are: the Council Chair and Vice Chair, the ESS Director General, one Council delegate from each Host States (Sweden and Denmark), and the ESS Governance Office Lead.

Committee on Employment Conditions - CEC

The Committee on Employment Conditions (CEC) monitors, on behalf of the ESS Council, and provides advice to the Director General on all aspects related to employment conditions.

Chair
Beatrix Vierkorn-Rudolph
(ESS Council Chair until 30 June 2023)

Members:

Martin Müller
Helmholtz-Zentrum Hereon

Ex-officio Members - Host States

Katarina Bjelke
Swedish Research Council – VR, Sweden

Bo Smith
Ministry of Higher Education & Research, Denmark

The elected Members of the CEC concluded the mandate on 30 June 2023. An updated version of the Terms of Reference of the CEC was approved at Council.36 in December 2023 and new Members were elected starting their mandate in 2024.

Governance Meetings 2023

In 2023, the ESS Governance Office organised the following meetings:

10th Meeting of the CEC, 19 January 2023

48th Meeting of the CC, 31 January 2023

31st Meeting of the ESS Council, 20-21 February 2023

27th Meeting of the IKRC, 29-30 March 2023

21st Meeting of the AFC, 25-26 April 2023

30th Meeting of the SAC, 27-28 April 2023

50th Meeting of the CC, 9 May 2023

11th Meeting of the PAC, 15-16 and 22 May 2023

33rd Meeting of the ESS Council, 30 May 2023

34th Meeting of the ESS Council, 20-22 June 2023

35th Meeting of the ESS Council, 30 June 2023

12th Meeting of the PAC, 18-19 and 27 September 2023

22nd Meeting of the TAC, 25-27 September 2023

28th Meeting of the IKRC, 10-11 October 2023

22nd Meeting of the AFC, 24-25 October 2023

23rd Meeting of the AFC, 15 November 2023

Additional Meeting of PAC, 17 November 2023

36th Meeting of the ESS Council, 4-5 December 2023

Science and industry work together to develop materials for the catalysis of individual chemical reactions to fight air pollution by capturing and converting polluting particles and gases before they are released into the air. There is promising research demonstrating that a pioneering class of materials known as metal-organic frameworks – MOFs - could radically expand the application of capture, separation and catalysis in the fight against global warming and air pollution

3 Vision and Strategy

Nurturing resilience as we sprint to the finish line

Being part of the construction of ESS means taking part in one of the most modern, ambitious and compelling projects in the present ecosystem of large-scale infrastructures for scientific research.

In projects of the magnitude and complexity like ESS, where many stakeholders join forces driven by their common passion for science and its socio-economic impact, every year is a remarkable one.

2023 makes no exception.

It is a privilege to report that 2023 was filled with many and diverse achievements, in all areas of the project and of the organisation, in line with the new project plan rolled out in 2022.

Only two years ago, right after the pandemic, when ESS started with the implementation of the new project plan, the construction of the buildings had just drawn to an end. Although the major site infrastructure was in place, at that time the technical installation of the machine, composed of its accelerator and target as well as of the scientific instruments, was in its infancy.

Today, as you will be able to see in the following pages of this report, the situation has dramatically improved.

Every step towards science was made possible by the combined effort of the ESS staff and consultants, in Lund and Copenhagen, our In-Kind partners across Europe, and with the support of our Council and Member States, and other key ESS stakeholders.

In line with our top priorities, the construction of the facility is well-advanced, with the assembly of the accelerator entering its final phase, major target components in place, installation of the instruments steadily progressing. All these efforts are supported by the installation of the control systems as well as by the ramp-up of data management, scientific software provision and scientific computing services both at ESS in Sweden and Denmark. The development of the scientific programme continued to make steady progress.

Advancements in all areas of the project were enabled and successfully supported by the recently centralised operations and infrastructure services, while the entire organisation benefited from well-established administrative processes.

Looking back at 2023 and at our numerous collective achievements, there are two considerations that I would like to emphasise, as key aspects of the identity and culture that we are building together.

The first consideration is that this highly intensive installation and testing effort continued to be performed while preserving ESS' excellent safety record. We are fully committed to keeping this record, as part of the organisation ESS wants to be.

My second remark is about the growing resilience demonstrated by the ESS staff and In-Kind partners when faced with technical and project challenges that are expected in any complex and high-tech project like ESS. Our effective response to setbacks and obstacles has been essential in overcoming challenges while continuing to adhere to the project plan. I am grateful to the ESS staff and In-Kind partners for their commitment, ingenuity and flexibility demonstrated through the year and for their invaluable contribution to the success of the organisation.

As ESS continues its steady progress towards science, the management renews its commitment to the ESS Council, Member States and research community at large to deliver a state-of-the-art facility, where scientific and operational excellence will be at the service of sustainable development.

"In projects of the magnitude and complexity like ESS, where many stakeholders join forces driven by their common passion for science and its socio-economic impact, every year is a remarkable one. 2023 makes no exception."

Statement of the Chair of the ESS Council, Robert McGreevy

Setting the foundation for sustainable operations

My personal journey with the European Spallation Source has been longer than most. As a young researcher, and potential user, I attended the first meeting on science and instruments in 1992. I could not have imagined then that over 30 years later, and certainly more than 100 meetings, I would become the Chair of ESS Council.

I hope that the experience I have gained through that time can help ESS successfully start operation and provide world-leading research capabilities to a new generation of researchers.

Following on from the revised project plan in 2022, it is clear that the project is now making steady progress.

This is easily visible on site and through the detailed monthly project reporting that the Council receives. However, the schedule is tight and there will undoubtedly be technical challenges ahead as complex technical equipment is installed and commissioned.

The Council will continue to support ESS and In-Kind partners through this phase, but also keep up the pressure to deliver on time and with high quality.

The major achievement of the ESS Council during 2023 was to approve the final tranche of funding needed to complete the construction project.

Although still four years away, the end of construction is now clearly in sight and the Council has started to look beyond – to routine or Steady State Operations. We need to look not only to the transition period and early years of operation, but also to putting ESS on a stable footing for 40 years of success.

Getting things right at the beginning helps to avoid problems later.

For the Council, this means agreeing on the requirements – including budget - from 2028. Initial discussions in February 2023, leading on to the SSO Review in November, were valuable first steps in this direction.

ESS is a unique facility, so while we can draw on experience from similar facilities, there is still a lot of detailed work to do. We also need to develop or update all the policies that will be needed for operations, for example the scientific Access Policy which we started to discuss in December.

It may seem to most ESS staff, and most potential users, that this is just bureaucracy, but - as said – things that are not well set at the beginning are much harder to correct later.

In a more strategic context, the Council needs to set the expectations for how ESS should operate, what it should deliver and how this should be assessed. In any long construction project, it might be very easy to lose sight of the purpose of the facility, and very hard to change from the culture needed to successfully deliver the project into the culture needed to deliver decades of successful operations.

Leveraging our extensive experience in operating research infrastructures, the Council will support ESS in this challenging but exciting transition.

”Although still four years away, the end of this phase of the construction is now clearly in sight and the Council has started to look beyond – to routine or Steady State Operations. We need to look not only to the transition period and early years of operation, but also to putting ESS on a stable footing for 40 years of success. Getting things right at the beginning helps to avoid problems later.”

4

Activity Report 2023

Fast, safe and efficient transportation relies on strong, lightweight and heat-resistant materials (like this nickel-based super-alloy microstructure that can operate in the combustion chambers of engines.) At ESS, materials will be investigated in real-time in the midst of real-world processing or operational conditions. The results will contribute to the know-how needed to send new technologies skyward.

Accelerating the transition from project to operations

The ESS Project is regarded as an exciting and challenging endeavour due to its highly ambitious goal of building the world's most powerful accelerator-based neutron source for groundbreaking science. The ESS draws upon expertise and knowledge of research institutes and experts from its Member States and worldwide.

In 2023, the ESS leadership, under the governance of the ESS Council, continued to manage the overall ESS project with the ultimate objective to deliver a facility ready for operations within the schedule and budget established by the new project plan. This plan, introduced in January 2022, was developed as the output of a thorough project re-baseline that took into account the impact on project execution of internal and external factors, such as the COVID-19 pandemic.

ESS, in close collaboration with its In-Kind partners, could celebrate an impressive number of achievements throughout 2023, leading to the steady progress in terms of readiness of all areas of the project. This year was dominated by installation activities, building up the various components and systems that are needed to produce the neutrons used for the 15 instruments that will contribute to the first phase of the science program. Key milestones in each sub-project were monitored, evaluated and completed as per the project plan. Highlights of the various achievements are described in more detail in the following sections.

Although much of the project is in an installation phase, there are work packages that are at various stages of the project lifecycle, from design to operations. The conventional facilities were handed over in December 2021, and are now largely in 24/7 operations, supporting the remainder of the project with all the infrastructure needed. Throughout the year, there was intensified delivery, installation and testing of components of the proton accelerator, target and instruments. Testing of single components and systems will rapidly turn to integrated testing and commissioning in the coming two years as the approach the Beam on Target milestone, where neutrons will be produced for the first time.

Along with the many successes, the organisation faced numerous challenges, linked to the phase in which the project is currently. Continuing issues with critical deliveries throughout the supply chains highlighted certain vulnerabilities that threatened the project schedule. These vulnerabilities reflect the technical complexity of the project, affecting both ESS Lund and the many important deliverables from In-Kind partners. A collaborative spirit was key in overcoming many of the difficulties and the project had to stay flexible, providing support and resources where it was most needed.

In order to overcome challenges linked to both project and technical aspects, ESS has put in place several measures for a timely response to issues while managing the project proactively.

Among other initiatives, the organisation:

- Continued the monthly cadence of monitoring, managing and reporting, with an emphasis on data quality and rapid recognition of trends. In January, ESS started a consolidated monthly review process that begins with an overarching alignment review with an extended group of ESS stakeholders, including areas such as Health & Safety, Security, Quality, Licensing, HR, Finance and Procurement.
- Seven Project Managers were appointed to be dedicated to each sub-area of the project. The PMs work closely with sub-project leaders, and are supported by project cost controllers and planners, with the goal of improving project performance.
- Continuously improved knowledge transfer from In-Kind partners to ESS staff. A breakdown of what is required was developed, covering both documentation (through technical manuals and training materials, among others) and a programme of partner-training of ESS staff. Knowledge transfer will be vital to ensure ESS' capability to test and commissioning key components and systems, and later apply that knowledge and experience to Operations.

To further strengthen the relation between ESS staff and In-Kind partners, a series of visits was organised to allow the many scientists, engineers and technicians to come to ESS. As in previous similar events with the UK and Estonian In-Kind partners, during a two-day visit in mid-September, over 70 personnel from France and Italy could see the results of their efforts, and see how their piece of the puzzle fits into the wider context.

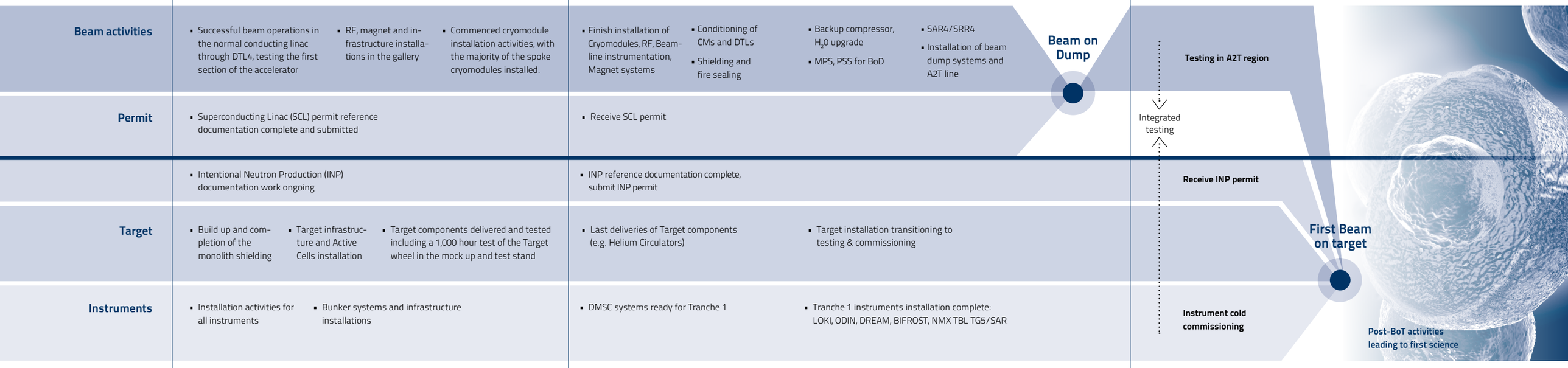
Looking ahead, if 2023 was the year of installation, 2024 will be the year of testing and commissioning. Activities in the Accelerator and Target included energisation and running of many systems, in preparation for integrated testing leading up to first beam transport to the low power beam dump, with beam to the target station and first neutrons planned for late 2025. The latter stages of the project will involve a ramp up of beam parameters and commissioning of instruments ensuring the availability of neutrons for unique science and a vibrant user programme.

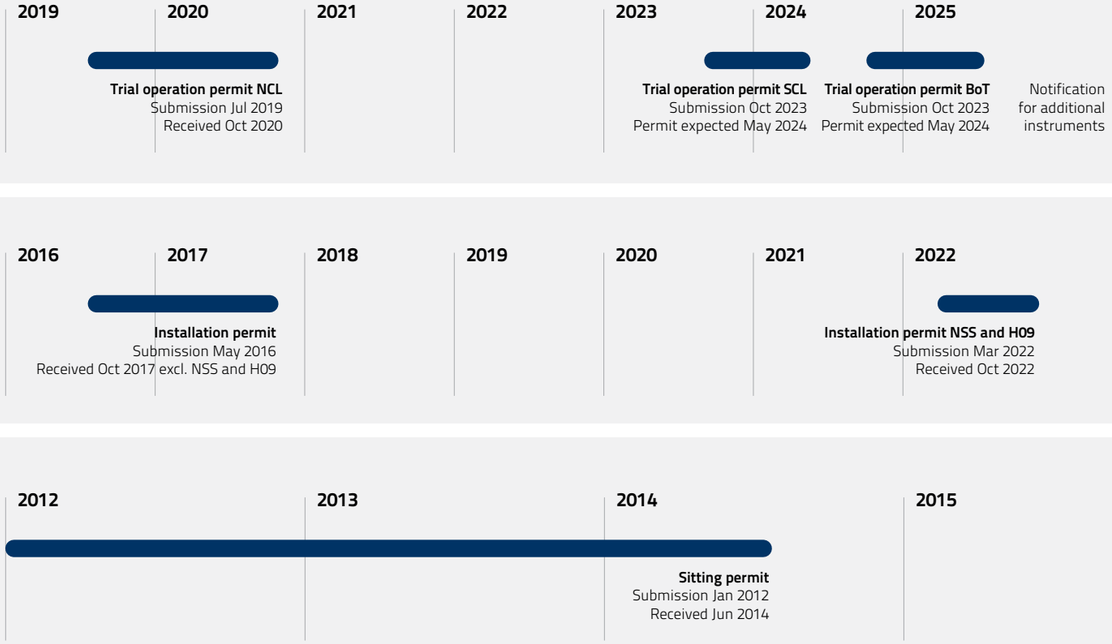
Quality and Compliance

During 2023, ESS Quality & Compliance maintained its focus on Supply Chain Management, identifying improvement opportunities as early as possible and securing timely deliveries of high quality.

Expert quality support was provided to each step of the project life cycle, through regular inspections at vendors, at arrival and during installations, quality visits and presence on the field.

A special project was launched to further improve the ESS Management System, in order to meet present and future needs of internal and external stakeholders.





Licensing

A key aspect of the ESS project is related to the Licensing process, the staged approach to obtaining the license to operate the facility, in compliance with the Swedish law and regulations.

As shown in the time plan below, the key achievement for 2023 was the application for the license for operation of the superconducting linac with beam to the tuning beam dump (SCL application).

The license application was submitted on schedule in early October 2023.

ESS received 96 questions from the licensing authority in December 2023 with responses to be submitted in Q1 2024. Indications are that the license should be received as planned in Q2 2024, well in advance of planned beam commissioning for this phase.

During the year, the organisation continued to work intensively on Licensing activities related to the application for Intentional Neutron Production (INP), a prerequisite for Beam on Target.

As part of the requirements for the INP license, ESS has been actively engaged in dialogues with Swedish authorities and Government representatives to secure a robust plan for the disposal of the radioactive waste generated by future ESS operations.

Safety and Security

The basics for ESS safety and security have been in place since before 2023, so the year has been more about ensuring implementation of the principles and processes, and to further develop in certain specific topics.

For example, considerable effort was put into developing ESS' capabilities regarding electrical safety. Another intensive area of work, led by the Safety organisation and involving many areas of the organisation, was emergency preparedness where the Crisis Management Team has regularly been trained in view of the extensive exercise Matilda, to be held in March 2024. As part of the preparation, ESS trained in cooperation with many regional and national Swedish authorities, including the Rescue Service, Lund Municipality, the County Administrative Board, Swedish Radiation Safety Authority (SSM) and Region Skåne.

In the area of Radiation Protection, planning and installation of radiation monitors have taken place in relevant areas of the ESS site in Lund.

Support was provided during the commissioning of the Normal Conducting Linac (NCL), monitoring the area and by giving entrance clearance during planned and unplanned maintenance stops in the accelerator tunnel.

During 2023, the Swedish Security Service raised the terrorist threat level to high. Following the Government's recommendations, and in line with our Security Policy, ESS has increased the level of alert and implemented further security measures.

Compared to previous years, the number of accidents stayed on the same level.

While celebrating the achieved safety culture, ESS continues to work on the ambition to further reduce the number of accidents.

In this framework, a number of risk assessment workshops have been held to improve the quality and understanding of risk assessments carried out at ESS. Also, safety experts continued to provide support and expert advice to all the project phases.

Safety and Security

	2023	2022	2021
Fatality	0	0	0
Accidents	9	9	12
Commuting accidents	5	5	3
Near misses	21	34	23
Risk observations/hazards	85	84	94

ESS In-Kind Partners, per country

Czech Republic
Nuclear Physics Institute of the CAS

Denmark
Aarhus University
Roskilde University
Technical University of Denmark (DTU)
University of Copenhagen

Estonia
Tallinn University of Technology
University of Tartu

France
Laboratoire Léon Brillouin (LLB)
National Center for Scientific Research (CNRS)
French Alternative Energies and Atomic Energy Commission (CEA)

Germany
Forschungszentrum Jülich
Helmholtz-Zentrum Geesthacht
Technical University of Munich

Hungary
Hungarian Academy of Sciences - Centre for Energy Research
Hungarian Academy of Sciences - Institute for Nuclear Research (ATOMKI)
Wigner Research Centre for Physics

Italy
National Institute for Nuclear Physics (INFN)
Elettra Sincrotrone Trieste
National Research Council of Italy (CNR)

Norway
Institute for Energy Technology (IFE)
University of Bergen
University of Oslo

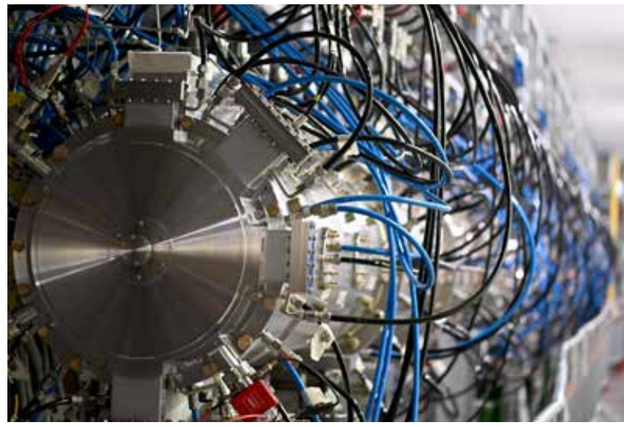
Poland
Henryk Niewodni Institute of Nuclear Physics (IFJ PAN)
National Center for Nuclear Research
Polska Grupa Energetyczna
Technical University of Lodz
Warsaw University of Technology
Wroclaw University of Science and Technology (WUST)

Spain
ESS Bilbao Consortium

Sweden
Lund University
University West
Uppsala University

Switzerland
Paul Scherrer Institute (PSI)
ZHAW Zurich University of Applied Sciences

United Kingdom
Science and Technology Facilities Council (STFC)
UK Atomic Energy Authority (UKAEA)



Facility

Driving installation and integration of the giant technical puzzle

A spallation neutron source is a complicated entity. It comprises the technical equipment needed to generate neutrons at the right energies, the neutron scattering instruments to use the neutrons for ground breaking scientific studies and the infrastructure needed to house and support these key components. All these elements constitute the ESS facility and contribute to its mission to deliver great science.

Concerning the ESS facility, the mission in 2023 was to advance the installation, testing and commissioning of the technical equipment and integrated controls needed to generate the neutrons together with the first five neutron scattering instruments. An important focus of this work is to assure the readiness of the facility to support the key milestones of Beam on Dump (2024) and Beam on Target (2025).

Readiness encompasses a number of key elements:

- The technical equipment has been manufactured according to design, received and tested for acceptance, installed in the proper location, integrated with all necessary supporting systems such as cooling, controls, cryogenics, vacuum and so on, and then tested at various stages of this process to ensure that it performs as intended when integrated with all the supporting systems. It also means that the engineering documentation and the necessary operating and maintenance manuals and procedures for the equipment are in place.
- The ESS safety basis is prepared, submitted to and approved by our licensing authority. This critical element describes the facility as well as how we work as an organisation and the systems and tools that we have in place to protect the public and workers from radiation hazards.
- ESS processes and procedures enable all this work. Such processes include work orders with related risk assessments and permits, maintenance planning, installation coordination, and main control room oversight during 24/7 testing and commissioning to enable safe operation.
- ESS central capabilities and systems support the operation of the technical systems. Such capabilities include building services, central water systems for heat rejection, compressed air, cryogenics and other utilities as well as the safety systems needed to protect workers from operating hazards.

As illustrated in the accompanying figures, at the beginning of 2023 there were very few components in place. Good planning and improved procedures for installation allowed for installation of 20 accelerator modules, a significant portion of the high energy beam transport system, the majority of the target monolith components including the target wheel and moderator-reflector assembly, and to make very good progress on the first five neutron scattering instruments.

Technical and project teams overcame challenges related to quality of components received, engaging earlier with partners and vendors to assure expected performance and addressed delayed deliveries by aggressive re-planning and strong partner and vendor engagement. Significant investments were made to improve internal work flows related to enhancing the efficiency of maintenance and installation activities.

It is important to ensure that the technical scope needed to support the planned capabilities achieves the appropriate state of readiness.

For this reason, in 2023 ESS began to emphasise and develop a programme to ensure that this scope is delivered, within the bounds of the planned schedule and cost. This programme will be implemented in 2024 to help ensure that the project will be capable of demonstrating the necessary performance at the BoD and BoT milestones.

The many achievements of 2023 paved the way to the completion of the installation and testing of all accelerator components needed to support commissioning with beam to the tuning beam dump by the end of 2024. Also, the progress with all target systems and the first four instruments, and the test beam line, will allow to proceed with full integrated testing and commissioning in preparation for Beam on Target in 2025.

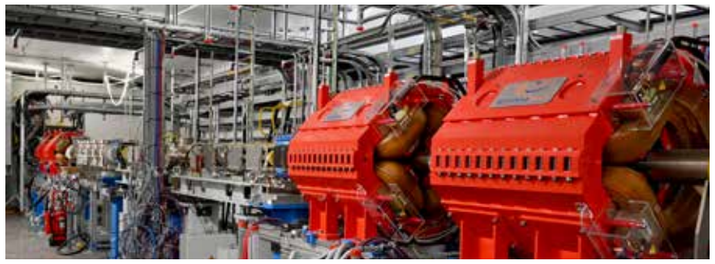
Start of 2023

End of 2023

Accelerator Tunnel: The accelerator was commissioned with beam through DTL-4, the temporary shield wall removed, and the DTL-5 tank was installed as well as 13 spoke and 6 medium beta cryomodules. Repairs were conducted on the cryogenic distribution system (CDS) valve boxes and a second cool-down of the CDS showed that this work was successful.

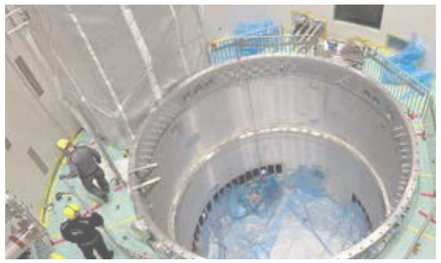
Start of 2023

End of 2023



A2T: All technical components for the Accelerator to Target (A2T) beam transport system were installed, including the focusing magnets and correctors as well as the critical beam rastering system that will distribute the beam energy over each target segment.

Start of 2023



End of 2023

Target Monolith: All the neutron beam port inserts and neutron beam windows were installed and successfully leak tested under vacuum. The inner shielding, target wheel and shaft and the moderator-reflector system were installed after remediation of the inner shielding cooling channels for cleanliness and weld/piping material integrity and an endurance test of the target wheel rotation in the Target mock up and test stand.

Start of 2023

End of 2023

Instruments: Neutron guides were installed for all Tranche 1 and some Tranche 2 instruments, along with the light shutter system and a number of neutron beam choppers. The LOKI, ODIN, DREAM, BIFROST, NMX and ESTIA caves were constructed, and installation of equipment such as detector assemblies started.

ESS Facility – Key achievements 2023

First fast triplet chopper system for MAGIC produced. All choppers installed for LoKI, ESTIA and NMX. Over half of the choppers for BIFROST, ODIN and DREAM installed.

Key components of the Active Cells Facility delivered, installed and commissioned (remote handling telbot arms and associated control room systems) allowing extensive equipment testing, procedure verification, and training of the remote handling operators.

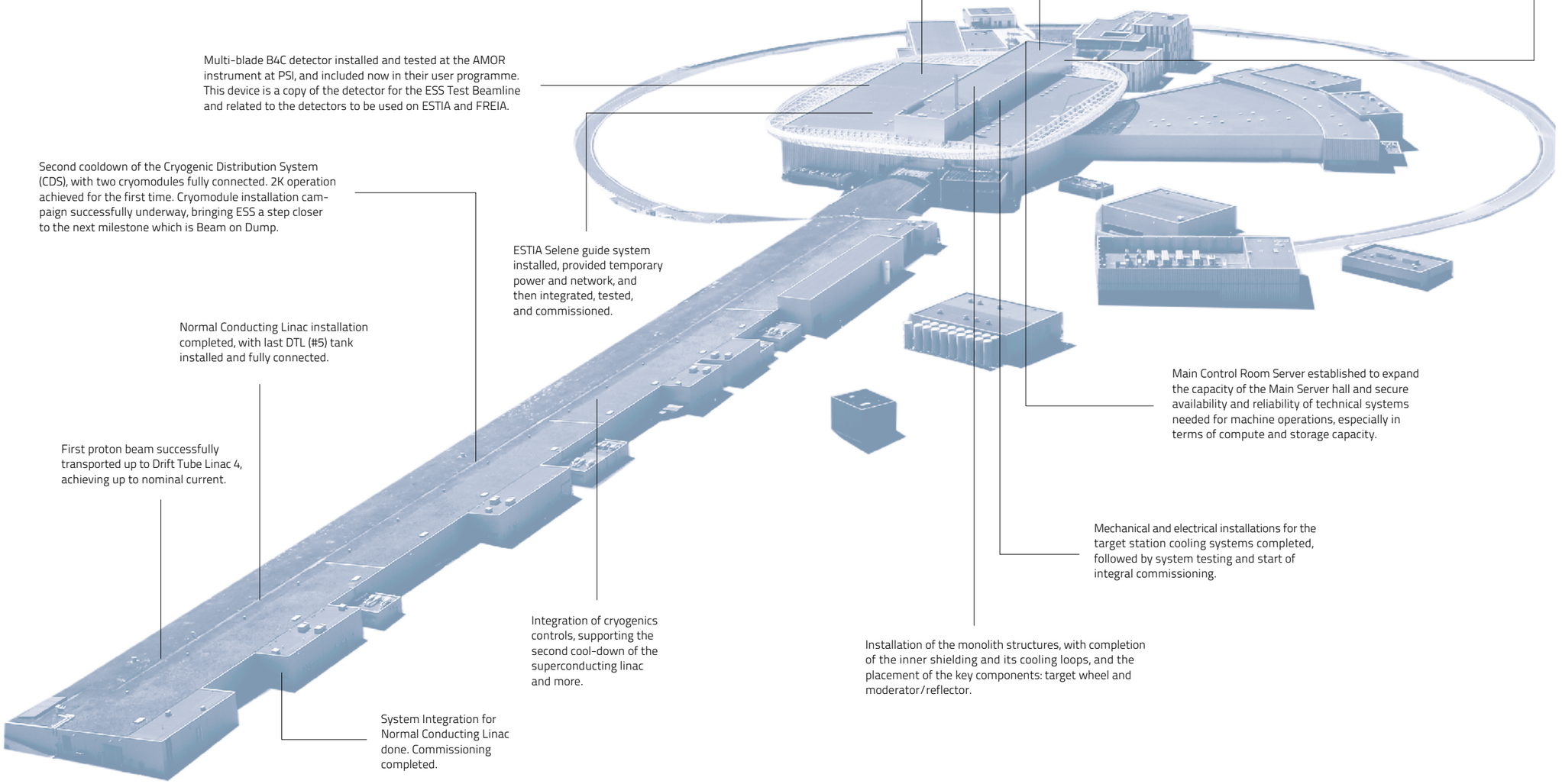
Extensive Control system integration tests on the Target Wheel in the mock up and test stand, involving synchronization with the Timing System, successfully completed.

Multi-blade B4C detector installed and tested at the AMOR instrument at PSI, and included now in their user programme. This device is a copy of the detector for the ESS Test Beamline and related to the detectors to be used on ESTIA and FREIA.

Second cooldown of the Cryogenic Distribution System (CDS), with two cryomodules fully connected. 2K operation achieved for the first time. Cryomodule installation campaign successfully underway, bringing ESS a step closer to the next milestone which is Beam on Dump.

ESTIA Selene guide system installed, provided temporary power and network, and then integrated, tested, and commissioned.

Normal Conducting Linac installation completed, with last DTL (#5) tank installed and fully connected.



Main Control Room Server established to expand the capacity of the Main Server hall and secure availability and reliability of technical systems needed for machine operations, especially in terms of compute and storage capacity.

First proton beam successfully transported up to Drift Tube Linac 4, achieving up to nominal current.

Mechanical and electrical installations for the target station cooling systems completed, followed by system testing and start of integral commissioning.

Integration of cryogenics controls, supporting the second cool-down of the superconducting linac and more.

Installation of the monolith structures, with completion of the inner shielding and its cooling loops, and the placement of the key components: target wheel and moderator/reflector.

System Integration for Normal Conducting Linac done. Commissioning completed.

Operations

Establishing the foundation for future success

Linac cryomodules are prepared for installation.

At the beginning of the year, activities related to machine and site operations and associated infrastructures were consolidated in a new technical service and support-oriented organisation, the Operations and Infrastructure directorate.

The change in the organisational structure, approved in 2022, was part of the continuous transformation of the organisation from a construction project into an operating facility.

During the year, the newly established directorate successfully fulfilled its two-fold mission:

- Support project objectives through technical services, optimised allocation of central and specialised resources, and to support the integrated testing and commissioning of systems leading to Beam on Target (BoT) and initial science.
- Ready the organisation and prepare for the handover and operation of systems for steady state operations, and for the maintenance of these systems.

In addition to routinely providing support and services to every sector of the project, considerable effort has been increasingly invested into the training of teams and the establishment of processes and tools needed in trial and routine operations, such as for 24/7 overall machine and site operations support.

In particular, in 2023 the work focused on:

Design and Engineering

Through the year, technical and site activities, related to all aspects of the ESS project, benefited from the centralised Design and Engineering unit, allowing for a strategic and agile allocation of engineering resources to secure adherence to schedule and budget, while meeting the expected quality and safety standards.

Design and Engineering operational support covers all areas of engineering, from Mechanical to Electrical, Plant and Process, Facility Engineering, including the Mechanical Measurement Laboratory.

The table below shows the number of yearly engineering requests during 2023.

An Engineering Task Execution Coordination work model was successfully established and rolled out, for more systematic and optimised processes, in line with the ESS Engineering Programme.

Set up by Design and Engineering, a dedicated space for the preparation of technical equipment, resulted in a streamlined and more effective installation process for the cryomodules needed for the ESS Superconducting Linac.

Task duration

	~ Yearly requests	1-3 days	4-15 days	16+ days
Electrical Engineering	100	50%	40%	10%
Mechnical Engineering	140	50%	45%	5%
Process and Piping Engineering	80	60%	35%	5%
Analysis Request	180	60%	35%	5%
Measurement lab	25	0%	50%	50%
Facility	500	60%	30%	10%
Total	**1025**			

Site Operations

In line with the overall project, installation efforts steadily increased over the year, meeting the needs of the different parts of the project.

Centralised Field Engineering covered all installation-related activities (mainly mechanical manufacturing, rigging, survey, alignment and metrology.)

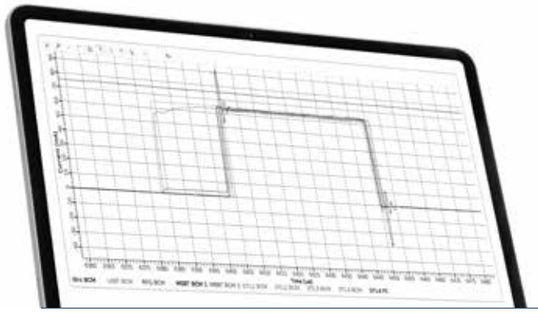
Like Field Engineering, Site Support activities (management of site and buildings and office support) intensified, reflecting both the progress with the project and the many activities taking place on site, including the main office. Access processes and Office Support successfully adjusted to manage the growing number of personnel (staff, consultants and contractors) and of visitors attending business meetings, workshops and events.

During the year, site activities included remaining civil construction work, so far postponed to give priority to installations of the machine. About 25% of this remaining work was completed, including the removal of the temporary 65 ton crane and the painting of the high bay lids.

In 2022, ESS started to relocate external workshops and labs to the Lund site, reducing cost and carbon footprint and improving integration with other parts of the organisation. The consolidation started by relocating the Detector and Chopper workshop to Experimental Hall 2.

In 2023, two additional laboratories were relocated to the Lund site: the Chemistry Lab (part of scientific activities), now in lab building D04, neighboring the Instrument Hall, and the Detector Workshop, from Linköping to the ESS Technical Workshops building.

Staff from ESS Chemistry Labs assist a team of high school students during their project about ESS.



Monitoring and control of the proton beam during the commissioning of the Normal Conducting Linac.

The ESS Main Control Room (right), established in 2022, functions as the facility's central hub. Staff is routinely trained to prepare for future operations' monitor and control.

Machine Operations

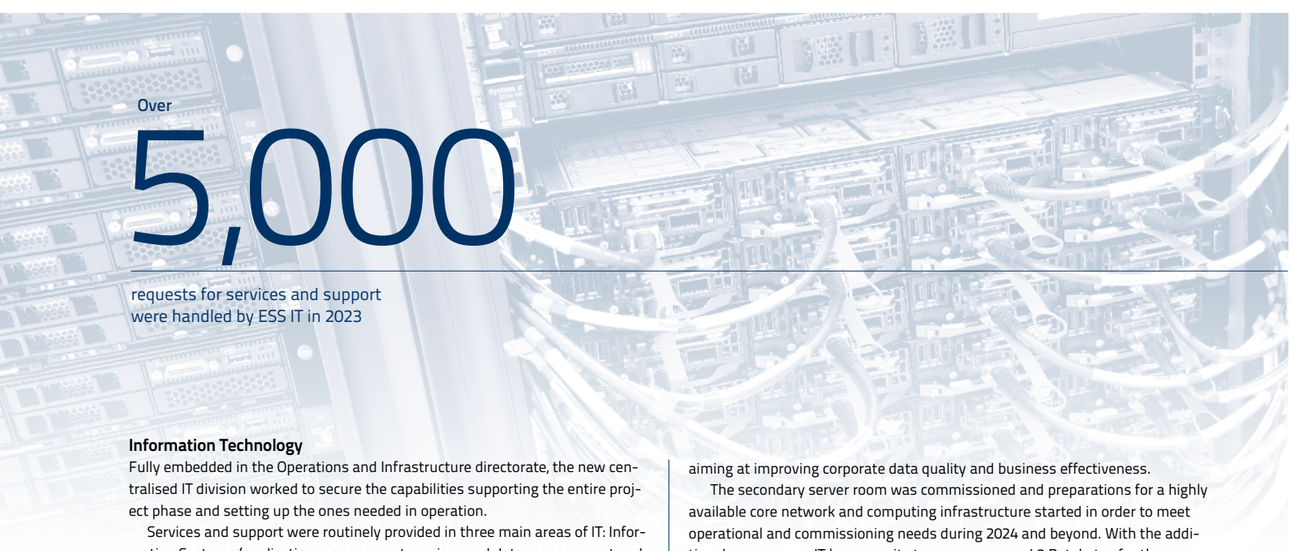
The newly established unit fully dedicated to machine operations coordinates and manages all activities related to the Main Control Room, infrastructure and operations of conventional facilities, and is also responsible for the coordination of work in buildings housing the accelerator and test stands.

Like for the rest of 'operational' functions, the work supports current project activities while preparing for the management of routine operations.

In this framework, in 2023, operations and maintenance of infrastructure systems was routinely provided, as was systems expertise and support for electrical and processes across the entire organisation.

A centralised Work Coordination and Planning Office was also established to provide, together with Safety teams, the preparation and release of work orders, including permits.

During the year, the level of support in the Main Control Room was increased to offer 2-3 shifts/day service, enabling faster execution of testing and commissioning activities as well as faster recovery times in case of operational deviations.



Over

5,000

requests for services and support were handled by ESS IT in 2023

Information Technology

Fully embedded in the Operations and Infrastructure directorate, the new centralised IT division worked to secure the capabilities supporting the entire project phase and setting up the ones needed in operation.

Services and support were routinely provided in three main areas of IT: Information Systems (application management services and data management and integration services to all of the ESS), IT Operations and Support (IT infrastructure, devices and services) and Controls Infrastructure (IT infrastructure necessary for the operation of technical systems and the SCADA/EPICS environment.)

Central IT provided support to administrative services, both to support well-established operations and to play a key role in multidisciplinary projects aiming at improving corporate data quality and business effectiveness.

The secondary server room was commissioned and preparations for a highly available core network and computing infrastructure started in order to meet operational and commissioning needs during 2024 and beyond. With the additional server room, IT has capacity to manage around 3 Petabytes for the upcoming phase of the project.

Support for technical networks and neutron instruments continued for many projects across ESS. IT significantly advanced Information Security by implementing remote access solutions, multi-factor authentication, and migrating the general-purpose network from Lund University's infrastructure to the ESS site in Lund.

Science Programme

Developing the capabilities for future scientific activities

During 2023, the Science Directorate at ESS underwent a number of modifications to strengthen support to science activities and become ready for neutron science delivery in view of a stronger contribution to instrument installation and hot commissioning while preparing for operating a scientific user programme.

To continue to expand into an effective operational organisation, the science management has been reorganised to include three instrument divisions responsible for scientific activities around instruments falling in the categories below:

Diffraction and Imaging Large-Scale Structures Spectroscopy

All instrument scientists became part of the Science Directorate in early 2024, to nurture a lively scientific culture at ESS with scientifically active members of staff – which is a prerequisite for success.

Furthermore, the Science Directorate unified a number important science-supporting functions under the newly formed Research Coordination Office (as from March 2024), which is responsible for the User Office, ESS Library and Grants support.

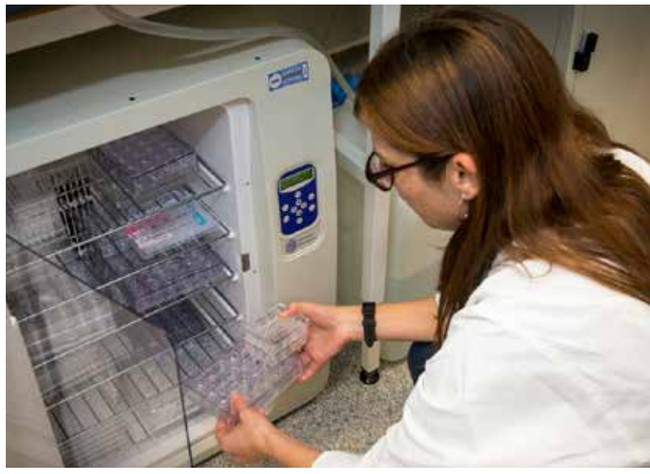
Existing and new activities were rolled out during the year to further develop the ESS User Programme, spanning from policies to tools to scientific infrastructure.

In particular:

Building on the knowledge-exchange between ESS and In-Kind partners' scientists, the ESS workshop 'Partner involvement in the User Programme' resulted in Memoranda of Understanding with the Nuclear Physics Institute (Czech Academy of Science) for the BEER instrument and the Paul Scherrer Institute for BIFROST, ESTIA, HEIMDAL, MAGIC, and ODIN instruments. These agreements are integral to engaging the neutron community in early science at ESS.

The Deuteration and Macromolecular Crystallisation team (DEMAX) have implemented a rolling call for proposals that facilitates neutron science experiments with deuterated samples carried out at operational neutron facilities. In 2023, it accepted 8 proposals, supporting fundamental research as well as investigations into health, climate, and the environment.

The review of the Science Evaluation and Access Policy by ESS Council in December 2023 signals progress toward refining the policy framework. Further information gathering and redrafting will ensure the final policy document aligns with ESS"s objectives, enhancing transparency and effectiveness in scientific evaluation and access procedures.

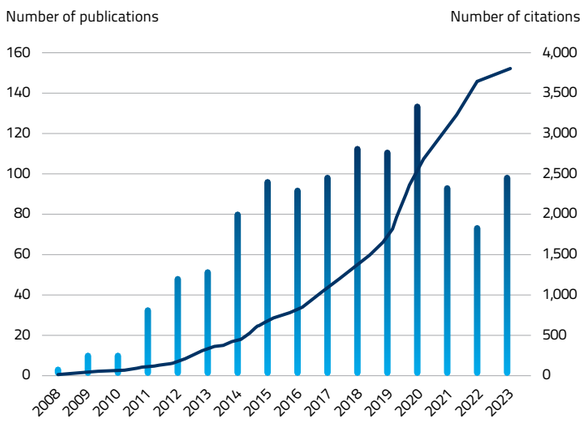


An ESS scientist preparing samples in the DEMAX lab.

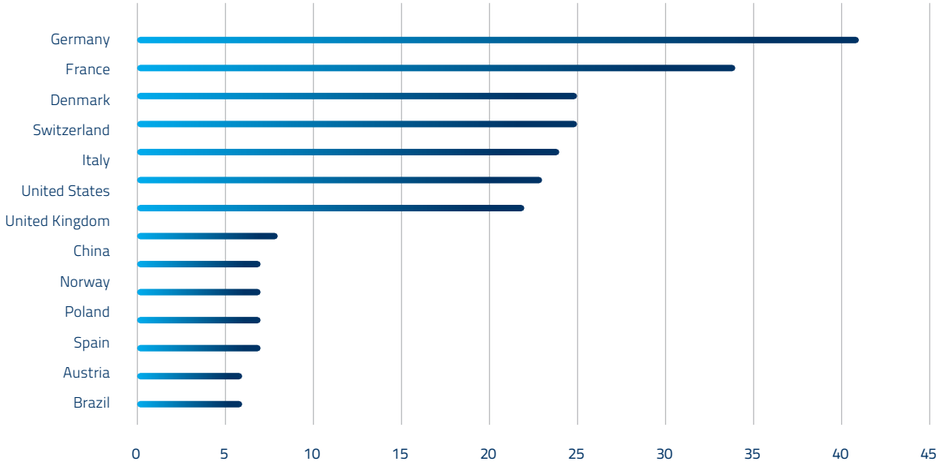
Science Activities and Neutron Community Engagement
100 publications were produced by ESS scientists, primarily from the Science and Technical Directorates, continuing to conduct active research in 2023. 74% of these are Open Access articles, contributing to ESS's all-time H-index of 63.

Below: The dark blue line indicates the number of citations the ESS library receives each year and is equivalent to one citation every 3 days.

Total publications per year



Documents



The cohort of publications from 2023 includes authors from 14 countries in addition to Sweden, with the distribution charted in this figure. All documents will have Sweden as author country since affiliation with ESS is counted as Swedish. For this reason, Sweden is removed for ease of reading. More than 72% of the authors work in ESS member states.

100

publications by ESS scientists

74%

of these are Open Access articles

In March 2023, ESS took part in the European Conference for Neutron Scattering. ESS scientists gave 11 presentations and exhibited numerous scientific posters.

ESS hosted 19 internal seminars, featuring presentations from ESS scientists involved in neutron production or application to science, along with guests of the science directorate. These seminars foster knowledge exchange among ESS staff, local attendees, and the global community who can join remotely, enhancing collaboration, sharing insights, and promoting interdisciplinary understanding.

To engage with scientific communities, including those fostered at In-Kind partner institutes, ESS scientific staff actively participated in conferences and workshops in various capacities, serving on organising committees, delivering presentations, and showcasing scientific posters.

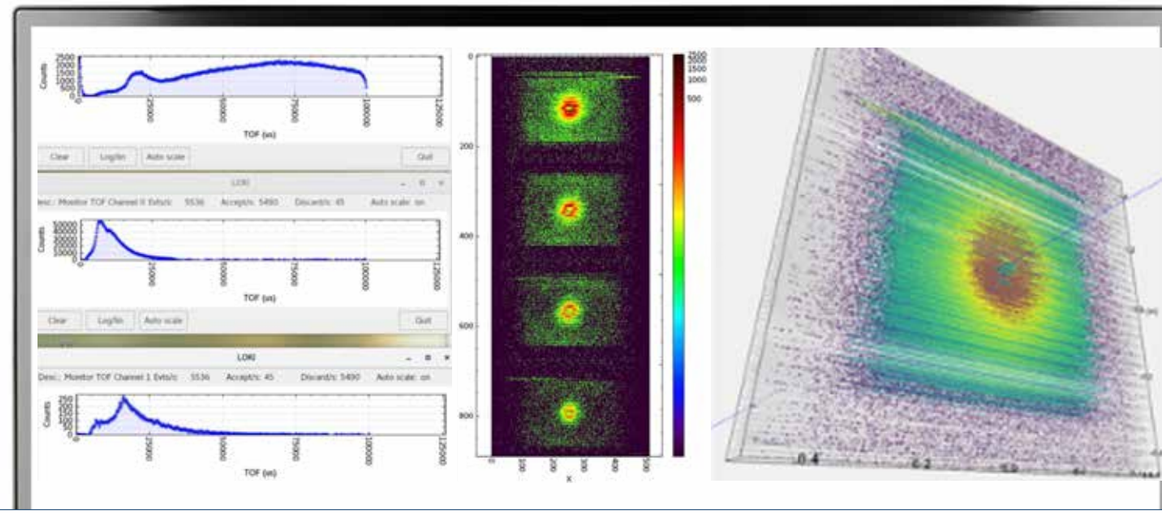
To mention a few of the ESS engagement activities with the scientific community:

- ESS exhibited at the European Conference for Neutron Scattering in Munich in 2023 and was chosen, in collaboration, to organising the 2025 International Conference for Neutron Scattering in Copenhagen.
- The 22nd Instrument Collaboration Board meeting was held in September and IKON 24 in November. Additionally, partners actively participate in meetings with ESS counterparts and work together at ESS in Lund, driving progress in instrument construction through their strong partnerships.
- In September, the Data Management and Software Centre division (DMSC) organised a week-long summer school for 14 students representing the next generation of neutron scientists. The aim was to equip them with the necessary skills to effectively utilise the data to be generated by ESS, in light of increased demands for complex neutron data reduction and analysis as well as adherence to the FAIR principles.
- In November, ESS hosted a workshop to engage the theorists and experimentalists in working with quantum materials. Quantum materials, included superconductors, topological magnetic materials, quantum magnetic materials and functional quantum materials are often suitable to study with neutron scattering. The workshop, 'Illuminating the Possibilities: What can ESS contribute to the study of quantum materials?' provided a starting point for future collaborations to further understand these remarkable materials.

In November 2023, theorists and experimentalists working to understand quantum materials met together to explore the contributions ESS will make to the field.

In September 2023, ESS hosted the first DMSC Summer School. The staff and students are pictured here after the poster session they hosted in the atrium of B01 on the ESS campus.

The D04 lab where DEMAX is now located.

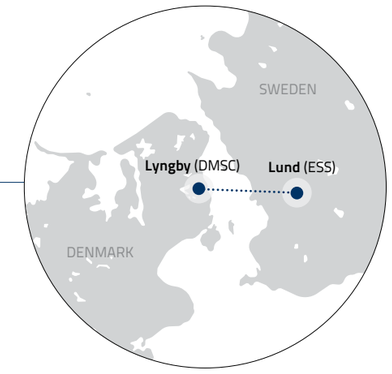


User Support Labs and Sample Environments

In June 2023, the Chemistry and Life Science (CLS) unit achieved a significant milestone as the DEMAX platform transitioned to the newly completed D04 labs at the ESS site. Resuming deuterated material production for the user community, DEMAX extended its rolling access until the end of 2024, ensuring continued support for neutron science research initiatives.

In August, the Materials Science and Physics Support (MSPS) team effectively utilised the new helium recovery system to conduct initial testing of their 15 T superconducting magnet. Through rigorous testing, including safety analysis, the magnet reached a magnetic field of 11 Tesla at 4.2 K. The successful performance of all systems, including controlled quenching and helium recovery, confirms the functionality of the magnet as anticipated, ensuring its readiness for future experiments.

The detector collects the neutrons after they have been scattered by the sample. The pattern revealed in the detected neutrons contains information about the sample. The detector for LOKI has been tested and the instrument software effectively interpreted and analysed the neutron data, validating this essential step in the process.



To generate extremely strong magnetic forces, superconducting magnets utilize superconducting wire within an electromagnet structure. When cooled, this wire conducts electricity without resistance, enabling the magnet to generate intense magnetic fields by carrying large electric currents. Pictures is the result of liquid helium vaporizing during the cooling of the 15 T superconducting magnet to 4.2 K

In November, the MSPS team successfully testing a dilution fridge in the sample environment workshop, achieving an ultra-low temperature of 27 mK. The Oxford Instruments dilution insert from HZB, tailored to fit within various sample environment devices, can be used with the 15 T magnet enabling users to subject their samples to high magnetic fields at extremely low temperatures. This capability is particularly valuable for experiments on the BIFROST instrument.

An agreement between ESS and ILL for the development of a Metastable Exchange Optical Pumping (MEOP) station at ESS has been established, allowing for the utilisation of this advanced technique for polarizing neutrons. MEOP, based on spin-dependent neutron absorption cross-section of 3He, enables polarised experiments on up to ten of the first fifteen instruments at ESS, offering cutting-edge capabilities for user science.

For the purpose of neutron experiments, the dilution fridge is constructed as a 'stick' on where the sample will be mounted at the very bottom. This stick can then be mounted on the neutron instrument, such that the neutrons pass through the sample. Here we see the inside of the dilution fridge stick in the ESS Sample Environment Lab.

Data Management and Software Centre

During the year, plans for the move of the Data Management and Software Centre (DMSC) to the Technical University of Denmark (DTU) campus in Lyngby, next to the departments of physics and computer science, progressed, in view of the move in March 2024. Thomas Holm Rod was appointed as Head of the DMSC in November.

The software development for data reduction and analysis steadily progressed. In December, DMSC demonstrated on LOKI detector test data that the instrument software effectively interpreted and analysed the neutron data, validating this essential step in the process.

DMSC and User Office continued to collaborate to develop user office software for managing the user journey at ESS, enabling efficient proposal submission and experiment management. STFC (UK) uses the User Office Software at the ISIS Neutron and Muon Source and the Central Laser Facility where it is already benefiting researchers in the user community.

Collaborating with counterparts from ESRF, ILL and PSI, as well as three industrial partners, the DMSC co-authored the Artificial Intelligence for Science and Innovation (AI4SI) grant proposal, slated for submission to the EU Infratech call in early 2024, showcasing proactive efforts in advancing AI applications for scientific endeavours.

To foster collaboration between DMSC and the local academic and research environment, two workshops organised in collaboration with University of Copenhagen (Spring) and DTU (Autumn).
The plan is to continue these events biannually and also extend them to involve other universities.

The DMSC has seen an increased level of joint projects, particularly student projects, with local universities in 2023.

McStas, the worldwide leading software for neutron scattering simulations, celebrated its 25th anniversary at the DMSC. The McStas lead developer Peter K. Willendrup from DTU and the DMSC celebrated with those who had played a major role for its development through the last 25 years, including the initial proposer Kurt Clausen, its first developer Kristian Nielsen, and the founder of the McStas team Kim Lefmann. The original idea has since evolved into an international project.

During the year, plans for the move of the Data Management and Software Centre (DMSC) to the Technical University of Denmark (DTU) campus in Lyngby, next to the departments of physics and computer science, progressed.

Organisation

Promoting efficiency by enhancing our business framework

During 2023, ESS administrative and stakeholder engagement functions – for the large part in the Administration Directorate - continued to provide the services and support needed for the execution of the project and smooth running of organisational operations. In parallel, all key central functions engaged in initiatives to improve integration and effectiveness of processes, systems and tools with the ultimate goal to achieve operational excellence in routine operations of the ESS facility.

Informed by the outcome of a series of internal audits conducted in 2022-2023, several improvement initiatives were undertaken and quickly translated into actionable steps in the area of Finance, Procurement and Communications.

In general, all administrative functions worked to simplify and streamline processes, and, with an increased attention to strategic stakeholder management in corporate matters, enhanced collaboration and cooperation with a variety of stakeholders, from the European Commission to regional and international authorities, Industry representatives, Academia, media and public, within Host States, Member States and beyond.

Under the lead of the Administration Directorate, ESS actively engaged in the ERIC Forum, the network of European Research Infrastructure Consortia created to unlock the potential of this legal status for the benefit of Europe's competitiveness. In addition to taking part in network and knowledge-exchange meetings, in 2023 ESS joined the ERIC Forum 2.0 project. The three-year EU-funded project follows the successful set-up and implementation of the ERIC Forum, aiming at consolidating its achievements and expand cooperation among the ERICs.

Highlights of key corporate activities and performance are provided below for the different areas of work.

Legal and Contracting Function

In 2023, the network of legal experts within ESS continued to provide counsel and services to all internal stakeholders, introducing, when appropriate, the use of Artificial Intelligence to support daily work and improve efficiency.

In addition to routine corporate tasks, the network engaged in the development of legal frameworks for the management of the intellectual property generated by research conducted at ESS and for managing collaborations with universities, other research institutions and industry partners, taking into account the latest developments in this fast-changing area of expertise.

Management of Financial Resources

The well-established Finance and Business Control unit continued to provide corporate services to the organisation.

In the fiscal year 2023, Finance handled 20780 invoices, marking a 12% increase compared to the previous year. Additionally, the number of travel expense and healthcare claims reached a peak at 1942.

The division processed the annual renewals of several insurances in ESS' insurance portfolio, e.g., property insurance for locations in Sweden and Denmark, Directors' & Officers' and crime insurance, and travel insurance.

Following the annual budget cycle, ESS submitted the budgetary documents to ESS Council. The annual budget for 2024 was approved by the ESS Council in December 2023.

During 2023, the following initiatives were successfully implemented:

In the beginning of 2023, ESS successfully reconciled the financial years 2013-22. Based on this work, the organisation started to pro-actively pre-pay cash facilities, thereby reducing significantly exposure to high interest rates.

ESS continued to work with fixed assets. This work will continue during the project phase and also during steady-state operations, when ESS intends to invest into upgrades. The work covers the fixed-asset process, the associated business systems, and their integration with ESS' ERP system.

In Q3 2023, the Cost Control Project started, with the aim to further improve financial control, automation, and end-to-end processes. The first phase is focusing on cost structures, related processes, and reporting through a data warehouse and a business intelligence software.

The work has started on data and system alignment, preparation for the procurement of a data warehouse, and the process mapping for the monthly closing process. These activities will continue into 2024.

20,780 invoices

Finance handled 20,780 invoices, marking a 12% increase compared to the previous year

1,942

The number of travel expense and healthcare claims reached a peak at 1,942.

Supply Chain Management

In 2023, ESS conducted:

7,000

procurements in all ranges, from small value to large and complex tender procedures.

40%

of all procurements are handled by way of electronic ordering (punch-out and catalogue).

Streamlined Procurement processes were further improved and promoted through a dedicated e-learning.

The Logistics and Warehousing services:

8,500

incoming deliveries handled

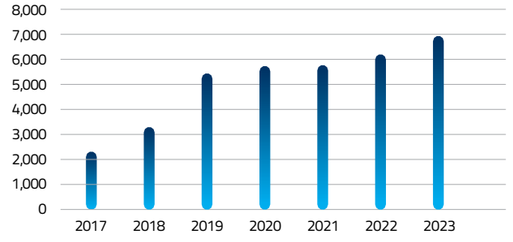
600

transports arranged

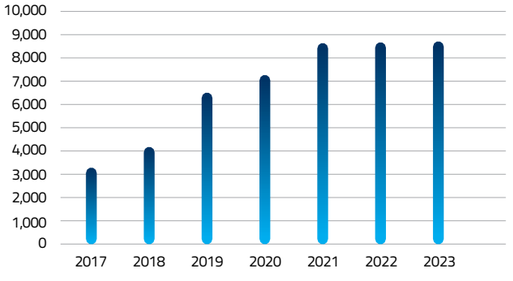
The Logistics function started to create an inventory for the ESS warehouse as well as for the external RATS facility while working on the implementation of a warehouse management system.

ESS Logistics continued to contribute to the works of RI.Logistica, the network of Logistics representatives from national and international research infrastructures as well as suppliers with the goal to promote sustainability and reduce the environmental impact of transports.

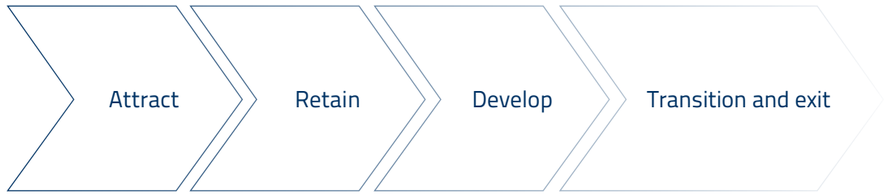
Number of procurements per year



Number of deliveries received at ESS per year



ESS Human Resources continued to provide and improve the support to the organisation related to every phase of the employee and manager experience, from recruitment and onboarding, employee retention and development, to offboarding.



As part of competence management, learning and development opportunities were provide to employees, mostly in areas related to technical work, leadership, safety and security.

As a truly international organisation, with staff with nearly 60 nationalities, HR continued to support employees in matters related to taxation, relocation and migration.

Among the initiatives undertaken to prepare for trial and routine operations, the HR function was actively involved in setting up the framework to allow non-standard working hours, in close collaboration with the Operations unit and relevant stakeholders, such as Unions and Swedish regulators.

In order to support the organisation in the best possible way, the framework will continue to evolve until ESS is in full operation.

In Q4 2023, HR launched a comprehensive initiative, the HR Management project, to improve and fully integrate all existing HR processes and supporting IT systems and tools, to simplify the user experience and improve data quality. The HRM project is expected to be finalised by the end of 2025.

141

recruitments finalised in 2023
(20% more than 2022)

Staff attending a plenary meeting in the atrium of the ESS Main Office, Lund

Communications, Public Relations and Stakeholder Engagement

At the beginning of 2023, ESS adopted a new high-level strategy for Communications and Stakeholder Engagement to set priorities, principles and approaches to deploy coherent and integrated strategic communications, public relations and engagement activities.

As a result, ESS Communications prioritised business-critical activities, in order to support and facilitate the completion of the project and successful transition into routine operations.

Daily communications and special projects, at all levels and in all channels, focused on project progress and on ESS' mission to enable excellent science. Whenever possible, content highlighted the contribution of In-Kind partners, and was disseminated through regular in-person and digital communications.

At a glance, in 2023, ESS internal and external communications produced and distributed:

40

articles for the ESS public web and the same number of spotlights and weekly highlights for the intranet

24

YouTube original videos and many more for internal screens

200 GB

worth of photos of ESS, sharing in all channels.

Around 400

Social Media posts sharing the ESS Road to Science with the public

12

Plenary Monthly Project Updates and Staff Meetings

ESS continued to attract the interest of a variety of stakeholders, as proven by the high-number of visit requests received during the year.

The total number of external visitors to the ESS site in Lund in 2023 was 6,769. The number includes business visits.

In April, the President of Estonia Alar Karis and his delegation visited ESS to learn more about the organisation and its future activities.

In the framework of the Swedish Presidency of the Council of the European Union (January-June 2023), several events related to Science and Innovation were organised in Lund. ESS was proud and delighted to take part, both with active participation in conferences and workshops, and by welcoming participants to the ESS site.

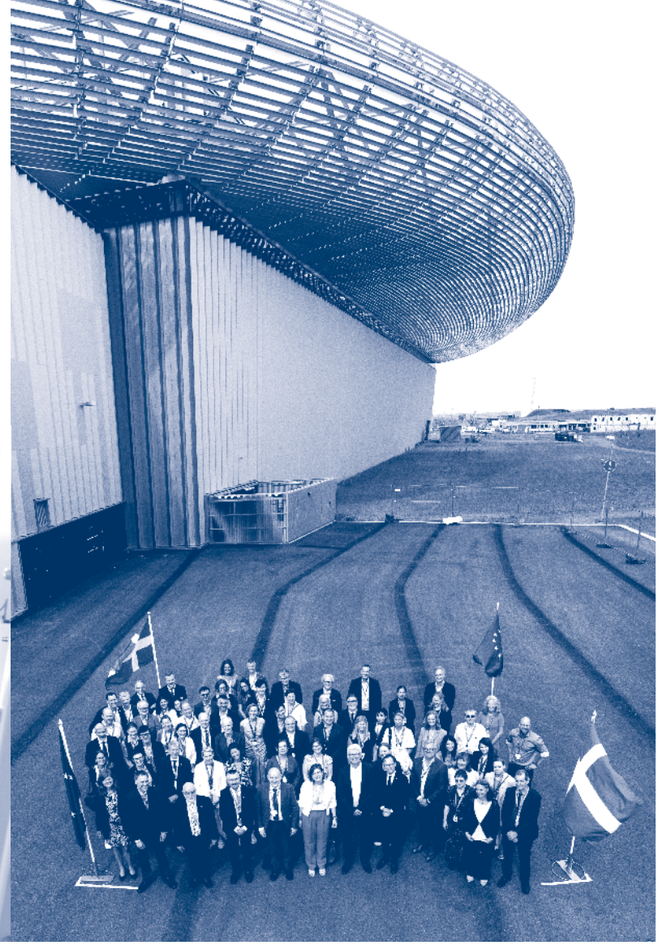
6,769 total number of external visitors to the ESS site in Lund

700 visitors during events linked to the Swedish Presidency

President of Estonia Alar Karis visiting one of the ESS Labs.

19 June: A two-day conference themed 'The Potential of Research Data: How Research Infrastructures Provide New Opportunities and Benefits for Society", was held at Lund University. The event was organised by the Swedish Presidency of the Council of the European Union in collaboration with the Swedish Research Council and Vinnova.

Above: (left) DG for Research and Innovation of the European Commission Anna Panagopoulou addresses participants to the visit of 20 June. (right) Swedish Minister for Education Mats Persson and Alfa Laval CEO Tom Erixon on ESS premises during the June events.



20 June - To celebrate the latest progress in the construction of ESS, with focus on the achievement of major project milestones in the Accelerator and Target, ESS welcomed representatives from Politics, Science Infrastructures and Science Policy Institutions from Swedish and European organisations.

21 June - A joint presentation by Olof Karis (above), Director of neighbouring light-source research infrastructure, MAX IV Laboratory and ESS DG Helmut Schober highlighted the opportunities offered by the region, creating a unique eco-system for research and innovation.

In view of future operations and start of research activities, relations with Industry intensified, including awareness-raising initiatives as well as active participation in networks and platforms – mainly at regional level – fostering a dialogue between Industry and the scientific communities.

In August, ESS and Hitachi Energy jointly organised the second Innovation Day. The event, which was hosted by energy company Hitachi Energy at their Swedish main site in Ludvika (Sweden), was attended by executives from Swedish and European industry discussing the opportunities that arise through ESS, and how to best make use of the benefits in order to strengthen the competitiveness of Scandinavian and European Industry.

A key mission of research infrastructures like ESS is to promote science, close the gap between science and society, and inspire young generations encouraging careers in STEM (Science, Technology, Engineering and Mathematics) disciplines.

In 2023, ESS continued to engage with the public and students and educators, either through visits to the Lund site or by participating in public events, showing ESS' societal and scientific value.

During the open day at the Danish Experimentarium Science Centre, along with students from Copenhagen University, ESS staff explained the science of ESS and neutron scattering and their applications to hundreds of teenagers and their families.

The event also coincided with the launch of 'Accelerate Your Teaching", a free online course for high school teachers across Europe. ESS is part of the ERASMUS+ funded consortium that put together the course, which uses pedagogical and didactic research to give real examples of how teachers can use the stories of large accelerator-driven facilities to bring to life the topics they teach in their STEM lessons.

While steadily progressing towards Science, the people of ESS continued to share the ESS compelling story, inspiring young generations and promoting the values championed by scientific research and international collaborations.

ESS Management meets Industry at the Innovation Day.

Staff from ESS and students from Copenhagen university engage the public about ESS and neutrons at the Experimentarium in Copenhagen.

5

Statutory Report

Annual Report, 1 January – 31 December 2023
European Spallation Source ERIC, Corp. ID No. 768200-0018

Management Report

The Director General of European Spallation Source ERIC (Corporate Identity No. 768200-0018), with its registered office in Lund, hereby submits the Annual Report for the financial year 1 January – 31 December 2023.

General information on the Consortium

The European Spallation Source (ESS) has been established as a 'European Research Infrastructure Consortium' (ERIC) which is a legal entity type introduced by Council Regulation (EC) No. 723/2009 (the 'ERIC Regulation"), facilitating the establishment and operation of research infrastructures with European interests. According to the ERIC Regulation, the European Spallation Source ERIC, possesses the 'most extensive legal capacity' recognised in all EU Member States, enabling the EU Member States as well as third countries to participate in decision-making and directly contribute to funding. See also Notes, note 2.

ESS will be the next-generation neutron source, and will be one of the most powerful in the world once completed. The facility will be used for materials research in areas such as energy, health and environment, and will be of great importance for long-term competitiveness of European research and industry. The facility is under construction in the city of Lund and is scheduled to be in full operation with 15 instruments by 2028. The project is one of the largest research infrastructure projects in Europe, and has been recognised as a 'Landmark' project by the European Strategy Forum for Research Infrastructures (ESFRI).

ESS's operations comprise the research facility with associated campus and laboratories in Lund, Sweden, and the Data Management and Software Centre (DMSC), in Copenhagen, Denmark. DMSC is registered in Denmark as 'other foreign entity' (Danish: Udenlandsk, anden virksomhed).

By 31 December 2023, ESS had 551 employees from 59 different nations and substantial number of contractors.

In addition to its own activities, ESS collaborates with partners from all over Europe and other parts of the world. ESS is owned and funded by 13 Member States: Czechia, Denmark, Estonia, France, Germany, Hungary, Italy, Norway, Poland, Spain, Sweden, Switzerland and the United Kingdom.

When the ESS user programme is in full operation, an estimated 2,000-3,000 researchers from around the world will conduct experiments at the facility each year.

In-Kind contributions

The ESS project is based on extensive collaboration with research institutions in the Member States, to exchange knowledge, personnel, and experience. The ESS is expected to be partially funded through In-Kind contributions where, in particular, significant parts of the instruments, the target station, and the accelerator will be delivered as In-Kind. During the year, extensive work has continued to secure In-Kind collaborations with partner institutions across Europe. More than 100 institutions are now actively involved in the ESS project.

Information on risks and uncertainties

Active and structured risk management contributes to successful execution of the ESS project and fulfilment of ESS's overall objectives. The knowledge ESS accumulates in relation to risks is used to further develop ESS's management system, personnel, and project plans.

ESS has a risk management framework, which is described in two main documents: ESS Risk Management Policy and ESS Risk Management Process. The Risk Management Policy describes in general why and how risk management work is to be carried out. The Risk Management Process describes processes and flow charts, as well as criteria for how risks are assessed at ESS. In addition to these two documents, the ESS Procedure for Risk Management specifies roles, responsibilities, and timeframes for risk-related activities within the organisation.

Risk management objectives

ESS has established the following risk management objectives:

- Frequent and open risk communication that enables a clear and shared view of risks and uncertainties within ESS, as well as among partners, suppliers, and other stakeholders.
- A continuously updated risk register for an overview of risks, uncertainties, and risk mitigation measures.
- Reduced risk exposure through rapid and active application of measures and mitigations.
- Focus on risks and uncertainties through effective risk reporting, internally and externally. Risk analyses are based on qualitative estimates as well as quantitative calculations, and decisions are made after careful consideration of the results of such analyses, in combination with an impact assessment.

Risks and uncertainties

Any potential event that may affect ESS's overall objectives poses a risk. Risk identification and risk analysis are part of ESS's daily work, and aim at contributing to effective risk management by providing increased insight into the consequences of a particular risk, as well as the probability of it occurring. Structured risk analysis enables comparisons, simplifies risk communication, and is crucial in understanding whether a risk is acceptable or not. A number of accident scenarios have been analysed, and these form the basis of the classification work on which the design of ESS's safety system is based.

Risks are judged from several different perspectives:

Risks related to personal injury

Health and safety risks are assessed for all activities performed. Particular emphasis is placed upon assessing and managing potential radiation safety and radiation protection issues.

To handle such risks safety rules and procedures are prepared as part of the ESS management system. Work permits are also issued for higher hazard risks such as hot works, working in confined spaces and working in radiation areas.

In order to be a learning organisation, near misses and accidents are registered, investigated and followed up by the responsible manager.

Risks related to quality and function

Risks that could potentially impair the quality and thereby the function of technical structures, systems, and components are of great importance to ESS. To handle such risks, ESS continuously refines existing processes for configuration work, as well as rules for design and installation work. Processes and systems for quality management and governance have been continuously developed and implemented with an increasing demand, and in consultation with the ESS management team. Since May 2016, ESS has been a member of EFQM (European Foundation for Quality Management), and, through that network, is able to ensure a world-wide analysis of best practice in the area. Significant focus has been on compliance with the European Product Safety Directives applicable to ESS, and that these are also complied with by suppliers and collaborative partners.

Risks related to the environment and the surrounding area

ESS has the ambition of becoming the world's first major research facility with energy-sustainable operations, thereby paving the way for a new way of building and operating the facilities of the future. This means, among other things, that the facility will be energy efficient, that it will be supplied with electricity from renewable energy sources, and that some of the surplus heat will be utilised in the district heating network of Lund as well as for heating buildings at ESS site.

Other environmental risks are the handling of chemicals, surplus materials, and transport to and from the area. These risks are managed in accordance with current legislation and are followed up regularly with inspections of physical areas as well as associated documentation and processes.

Risks regarding society's view of ESS

ESS is committed to providing a positive social contribution to the local community in which the organisation is located; to operate the Consortium as a responsible social actor; to respect the laws, customs and needs regarding the countries that contribute to the development, construction and operation of the research facility; to respect internationally recognised human rights; and to act in an environmentally responsible way by minimising the environmental impact of the activities. In this way, ESS actively contributes to sustainable development. Sustainability is one of ESS's four core values: Excellence, Openness, Collaboration, Sustainability.

Since 2014 the work at ESS is carried out in line with a code of conduct based on the 10 principles of the UN's Global Compact relating to human rights, working conditions, the environment, and anti-corruption, as well as the International Chamber of Commerce's rules on combatting corruption. As such, ESS has undertaken to comply with these principles and rules. The ESS Code of Conduct encompasses all employees and others who have ESS as their permanent or temporary workplace. ESS also requires equivalent codes of conduct of external collaboration partners. ESS evaluates its suppliers through competitive procurement processes in accordance with Article 23 of the European Spallation Source ERIC procurement rules. ESS may not invite any supplier to submit a bid, or award a contract, if the supplier, or its board of directors, or any other person empowered to represent, decide, or control the supplier when they:

a) have been convicted of any of the following offenses in the last three years: participation in criminal organisation, corruption, fraud, money laundering, terrorist offenses, or a crime related to terrorist activity, child labour, or other forms of illegal trafficking;

b) have failed to comply with current environmental, social, or labour laws in the last three years;

c) has not breached applicable anti-bribery and anti-corruption laws and regulations, trade embargoes, sanctions or other restrictive measures including, but not limited to, whether applicable locally or adopted by the United Nations, the European Union, the United Kingdom or the United States in the last three years;

d) are guilty of gross professional shortcomings, which cast doubt on the supplier's or tenderer's integrity;

e) are involved in, or in the past three years has been involved in, a secret agreement; or where the organisation has knowledge of the occurrence of any of the following circumstances:

f) have an unfair advantage that may distort competition as a result of the supplier's or tenderer's previous participation in the preparation of the procurement process in accordance with Article 28.4,

g) have significant previous shortcomings in the performance of previous contracts awarded by ESS,

h) have committed serious misrepresentation of information in that submitted as part of a tendering procedure, or

i) if the supplier or tenderer is in bankruptcy, or is subject to insolvency or liquidation, or is in an equivalent situation arising from a similar procedure under the laws and regulations of a state.

ESS often requests proof of quality assurance and sustainability, in accordance with ISO 9001 or ISO 14001, or equivalent.

ESS's general procurement terms include requirements on anti-corruption. The supplier shall guarantee that no offer, payment, remuneration, or benefit of any kind which constitutes an illegal or corrupt practice has been, or shall be, made, either directly or indirectly, as an inducement or reward for entering into the contract or implementing the agreement.

Risks regarding timetable

Risks related to the ESS timetable concern the processes and activities that could delay implementation of the project plan.

Risks regarding annual operational costs

In order to achieve ESS's overall objectives, a number of requirements related to the annual operational costs are required. Risks in the form of, for example, maintenance and service, energy consumption, downtime, insurance premiums, and/or loss of property have therefore been identified. Established plans and cost estimates for completing the project and transitioning to steady-state operations post-2027 have been continuously evaluated and updated, and been presented to the ESS Council.

Risks related to finances and funding

Understanding and managing risks that may have financial consequences in terms of exceeding the project budget are central to ESS, and are managed through established processes related to the identification and analysis of uncertainties in cost estimates. Each part of the project has its own budget, and each risk of exceedance is handled individually. Such measures are handled by the management team in a well-defined process.

The activities undertaken by ESS are funded by all Member States contributing to the financing.

Sustainability Report

Environment

Sustainability is one of the four core values of ESS, and the environmental dimension is essential for ESS, both in terms of the research that will be carried out at the facility and the actual construction and operation of the facility. As stated in the Sustainability Policy, ESS accomplishes excellence in the environmental dimension by minimizing the environmental impact of its activities. As an example, the surplus heat from the cooling of the target and accelerator is reused in the Lund municipality district heating network, heating homes in Lund and reducing environmental impact. 12.5 GWh was reused in this way during 2023.

Thousands of concrete blocks are transported from Spain to ESS in Lund with a frequency of about 3 shipments per week. During autumn 2023, all transports were switched from road to train which has reduced the carbon footprint as well as the transport cost.

In order to further reduce ESS carbon footprint it is essential to partner up with external initiatives and projects. During 2023, ESS joined two external initiatives with the main purpose to reduce carbon footprint.

The first initiative, CoAction Lund, led by Lund municipality, is a system demonstrator to drive and reach climate neutrality for cities. Within this project ESS is striving to reduce the carbon footprint from commuting and from transportation of goods. The project is a joint effort together with other local businesses and academia in Lund and will continue during the upcoming two years.

The second initiative, ERIC Forum 2.0 'Towards the green and digital transition", is a cooperation and knowledge sharing between ERIC facilities. The objective is to identify best-practice and define recommendations for buildings as well as digital solutions leading to reduced carbon emissions.

The buildings at ESS site is built with sustainability as core value in mind and by that minimizing the environmental impact. The office building has been awarded the rating Outstanding, the highest level in the sustainability standard provided by BREEAM international.

All detention ponds onsite for storm water are created in such a way that they have a natural function in the landscape and that they are promoting biodiversity.

Social and stakeholder responsibility

ESS stays within the permissible noise levels regulated in the environmental judgment, and has special contact channels with the nearby residents to inform about ongoing and upcoming work, and to receive any complaints. No complaints were received during the year related to the construction of the facility. As with previous years, forty of the immediate neighbours around the Lund site were also invited in person to see progress of the project.

ESS welcomed 6769 visitors in 2023 in 2014 groups. While most of ou visitors came to ESS for business-related reasons, major emphasis was kept on visits under the Swedish presidency of the Council of the European Union. We had about 700 visitors connected to the Swedish Presidency events with large conferences in Lund at the end of June.

ESS has started implementing the new strategy for public engagement which covers the period until First Science, and outlines priority public and school audiences, and key themes of, for example, engaging with educators and creating opportunities for researcher-public interactions.

ESS participated in an event for over 2000 members of the public in Copenhagen for Culture Night.

We also ran a pilot artistic residency scheme with seven artists from four different continents working via video with people from ESS. The residency was funded by the European Regional Development Fund through Wisdom Innovation and is a collaboration between Malmö Museums, Lund University's Inter Arts Centre (IAC) and ESS. The project culminated with a public exhibition at the Inter Arts Centre in Malmö, as well as a live-streamed seminar, and a visit to the ESS site for artists and the project partners.

Environment, Safety & Health and Quality

The Environment, Safety, Health & Security (ESH&S) and Quality & Compliance (Q&C) Divisions play a key role at ESS, and shall ensure that safety and quality requirements are implemented throughout the organisation during the actual construction of the facility but also leading into steady state operations.

During 2023 the cryogenic distribution system was commissioned in the accelerator tunnel introducing a new risk of potential helium leakage which presents an Oxygen Deficiency Hazard into the area. Gas monitors have been installed in the area and all personnel entering the area are trained. Exercises were also performed by the on-site Emergency Response team.

A new framework for electrical safety was introduced in the autumn of 2023. A programme of safety training for the different electrical roles has been established and managed within the ESS Learning Management System.

Preparations are underway for an Emergency Exercise, to be carried out in March 2024, involving the ESS Crisis Management team and a number of external authorities. This is a pre-requisite before Beam on Target from SSM.

Regular safety rounds are carried out in all operational and installation areas to improve the work environment and identify safety risks.

The ESS Safety Committee consisting of Managers representing different parts of the organisation and safety delegates (employee representatives) met 6 times during 2023.

During 2023, the Quality & Compliance division continued enforcing a specific program for mitigating quality defects, arising in deliveries from the In-Kind partners and commercial contracts.

ESH ensures ESS's safety and environmental objectives for personnel and users, as well as the surrounding area. This is done by setting requirements regarding the design, installation, and operation of the facility, among other measures. ESH has an important duty in coordinating and leading the work in order to obtain the required permits from Swedish authorities. The largest and most important task is the permit for ionising radiation, which is being handled by the Swedish Radiation Safety Authority (SSM).

All suppliers who have components or tools to be installed in or used at ESS shall ensure that these comply with EU regulations in relation to CE marking. This applies to both external suppliers and deliveries from In-Kind partners.

Personnel

All personnel working at ESS are required to comply with the ESS Code of Conduct. It consists of rules describing responsibilities and appropriate procedures for employees at ESS. The rules define business principles, values and norms, and appropriate behaviour for ESS personnel.

The ESS policy for safety and health regulates that well-being and health are important topics for the organisation. The ESS policy for safely and health clearly describes the ESS´ direction in regards to work environment. The key points in the policy are the following:

- Prevent injury and promote wellbeing
- Meet all legal requirements
- Ensure that health, safety and wellbeing are an integral part of our organisation and are actively supported through management, leadership and commitment
- States that it is also employees' responsibility to contribute to a good and safe working environment

At ESS, the distribution of the number of employees is 73% men and 27% women. A more even gender distribution is sought.

The number of sick leave days has, and continuous to be quite low, with a small decrease of 1% compared with 2022.

No serious accidents were reported during 2023.

Respect for human rights

The diversity of ESS's employees is its strength. ESS wants to create an inclusive work environment where each employee is valued and individual achievement is recognised.

ESS does not tolerate discriminatory behaviour, either in recruitment or in our daily interaction with each other. We strive to develop the full potential of our employees, regardless of external conditions. To do that, we endeavour to identify and remove obstacles in our thinking and in our processes.

In all procurements, the supplier is required to sign a Declaration of Honour Regarding Exclusion Criteria, which means that they certify that someone in a leading position has not committed a number of defined crimes, including child labour and human trafficking, as well as that they have had no advantage or otherwise committed fraud in the procurement. In addition, clause 8.6 of the ESS's general procurement conditions stipulates that a breach of this clause means that the contract may be terminated. This procedure follows that used by the European Union. No deviations from the requirements have been noted during 2023.

The diversity of the workforce and an open and appreciative culture are important success factors in a globalised world, and with many employees from different countries, cultural diversity is a well-established part of everyday life at ESS.

Anti-corruption

The ESS Code of Conduct specifies that the organisation actively works against corruption in all its forms, including extortion, bribery and other influences directed at the organisation, any of its employees, or related parties. In addition, a Code of Ethics in Contracting has been developed.

This means that ESS has prepared a regulatory framework for how procurements shall be conducted based on five items, where integrity is item 3 with the wording 'All procurements shall be carried out in an impeccable manner with full objectivity and without benefits for any person or organisation".

The document Declaration of Honour Regarding Exclusion Criteria contains, in addition to the declaration that no crime has been committed against other people, a declaration that the Consortium has been guilty of or engaged in something that may be considered corruption. Section 8.6 of the ESS's general procurement conditions also stipulates that a contract can be terminated if the requirements are not met or violated. No deviations from the requirements have been noted during 2023.

Significant events during the year

During the year 2023 ESS continued to successfully roll-out new project plan. This plan engages ESS to complete the project by the end of 2027, at which point the user programme is started on at least 8 out of 15 first instrument, with the remaining instruments at the final stages of hot commissioning. The accelerator will possess 2 MW capability and the target will deliver the corresponding neutronic performance. Excellent progress was achieved for all parts of the project. Among the many milestones reached in 2023 the following merit to be singled out: (i) successful cool-down of the cryo-distribution system for the accelerator, (ii) commissioning of four out of five Drift Tube Linac elements as well as the (iii) installation of all the major parts of the monolith inner shielding into the monolith vessel, installation of all neutron beam port inserts, plugs and windows as well as installation of the wheel and moderator in the target complex.

It should also be mentioned that the Council of the ESS agreed at its 36th meeting on the funding for the new project plan thus providing planning security for the project up to its completion.

Expected future development and significant risks and uncertainties

ESS is a highly complex technical project. At the current state most fabrication work is completed and the challenge relies predominantly with the integration of components into the system. A condition for achieving the next milestones is obtaining the licenses for putting into operation the accelerator and later the whole facility. In addition, the commissioning period after having achieved beam on target moves closer and requires outstanding preparation efforts.

The development of the Company's financial performance and position

The net result for the year amounted to MSEK –1,559 (-1,451). The result includes costs for personnel and consultants, as well as the administrative and technical infrastructure during the Construction Phase. Equity amounted to MSEK 9,004 (7,042).

Investments

Investments were made during the year in fixtures and fittings, and ongoing new facilities totalling MSEK 592 (642).

Financing and liquidity

During its fiscal year 2023, ESS received cash contributions from member countries totalling MSEK 3,521 (3,219). Further information on the contributions received can be found in Note 18. Cash and cash equivalents amounted to MSEK 3,213 (3,167).

Income Statement

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Net turnover	0	0
Gross result	**0**	**0**
Administration expenses (Note 4,5,6)	**-564,368**	**-536,454**
Research and development expenses (Note 4,6)	-973,030	-900,735
Other operating income (Note 7)	18,838	36,545
Operating result	**-1,518,560**	**-1,400,644**
Financial income (Note 8)	93,718	6,730
Financial expenses (Note 9)	-133,856	-56,651
Result after financial items and before tax	**-1,558,698**	**-1,450,565**
Tax (Note 10)	0	0
RESULT FOR THE YEAR	**-1,558,698**	**-1,450,565**

Balance Sheet

KSEK	2023	2022
ASSETS		
Non-current assets		
Buildings (Note 11)	5,646,696	5,770,488
Land (Note 12)	64,250	64,250
Equipment, tools and installations (Note 13)	74,931	64,399
Construction in progress (Note 14)	2,658,173	2,152,818
Total non-current assets	**8,444,050**	**8,051,955**
Current assets		
Accounts receivable	1,141	3,856
Current receivables (Note 15)	114,158	89,857
Current tax receivables	44,821	17,014
Prepaid expenses and accrued income (Note 16)	31,829	43,310
Cash and bank balances	3,213,249	3,166,583
Total current assets	**3,405,198**	**3,320,620**
TOTAL ASSETS	**11,849,248**	**11,372,575**
EQUITY AND LIABILITIES		
Equity		
Capital contribution (Note 18)	10,563,141	8,492,743
Net result	-1,558,698	-1,450,565
Total equity	**9,004,443**	**7,042,178**
Long-term liabilities		
Liabilities to credit institutions (Note 19)	1,226,268	2,577,145
Current liabilities		
Accounts payable	186,694	150,453
Other current liabilities (Note 20)	982,460	1,094,219
Accrued expenses and prepaid income (Note 21)	449,383	508,580
Total current liabilities	**1,618,537**	**1,753,252**
TOTAL EQUITY AND LIABILITIES	**11,849,248**	**11,372,575**

Equity

KSEK	Cash contribution	Previous year's result	Result for the year	Total equity
Opening balance,	12,722,675	-7,448,512	–	5,274,163
Contributions received	3,218,580	–	–	3,218,580
Net result 2022	–	**-1,450,565**		**-1,450,565**
Opening balance, 2023-01-01	15,941,255	-8,899,077		7,042,178
Contributions	3,520,963	–	–	3,520,963
Net result 2023	–	–	**-1,558,698**	**-1,558,698**
Closing balance, 2023-12-31	**19,462,218**	**-8,899,077**	**-1,558,698**	**9,004,443**

Cash Flow Analysis

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Operating activities		
Result after financial items	- 1,558,698	-1,450,565
Adjustment for non-cash items	199,615	192,685
Cash flow from operating activities before changes in working capital	**-1,359,083**	**-1,257,880**
Cash flow from changes in working capital		
Increase(-)/Decrease(+) of operating receivables	-37,912	58,700
Increase (+)/Decrease (-) of operating liabilities	-22,140	-103,146
Cash flow from operating activities	**-1,419,135**	**-1,302,326**
Investment activities		
Acquisition of tangible fixed assets (Note 12,13)	-39,179	-21,736
Acquisition of construction in progress (Note 14)	-552,531	-620,527
Cash flow from investment activities	**-591,710**	**-642,263**
Financing activities		
Cash contributions	3,520,963	3,218,581
Amortization	-1,463,452	-620,463
Cash flow from financing activities	**2,057,511**	**2,598,118**
Cash flow for the year	46,666	653,529
Cash and cash equivalents at the beginning of the year	3,166,583	2,513,054
Cash and cash equivalents at the end of the year	**3,213,249**	**3,166,583**

Notes

Note 1 | Basic accounting principles

The annual report has been prepared in accordance with the Swedish Annual Accounts Act (Swedish: **Årsredovisningslagen**) and the Swedish Accounting Standards Board's general advice BFNAR 2012:1 Annual report and group consolidation (K3) (Swedish: **Bokföringsnämndens allmänna råd BFNAR 2012:1 Årsredovisning och koncernredovisning** (K3)).

The Company's registered office etc.

European Spallation Source ERIC (ESS) is a European Research Infrastructure Consortium, which is a legal entity and has its registered office in Lund, Sweden. The head office's visiting address is Partikelgatan 2 in Lund, with post box address P.O. 176, 221 00 Lund, Sweden. The Company's corporate identity No. is 768200-0018.

Classification etc.

Fixed assets, long-term liabilities and provisions in all materials aspects consist only of amounts expected to be recovered or paid after more than twelve months from the balance sheet date. Current assets and current liabilities n all materials aspects consist only of amounts expected to be recovered or paid within twelve months from the balance sheet date.

Valuation principles etc.

Assets, provisions and liabilities have been valued at acquisition value, unless otherwise stated below. ESS comprises the operations with the facility under construction in Lund, Sweden, and the Data Management and Software Centre (DMSC) in Denmark. DMSC is operated by the Swedish company with its headquarters in Copenhagen as an overseas second company (Danish: **udenlandsk, anden virksomhed**). As for DMSC, monetary items in the balance sheet are valued at the rate when closing the accounts and profit and loss items at the closing rate for each month.

Tangible fixed assets

Tangible assets are recognised as assets if it is probable that future economic benefits will accrue to the business, and the cost of the asset can be measured reliably. Tangible fixed assets are stated at acquisition cost after deductions for accumulated depreciation and any impairment. The acquisition value includes the purchase price as well as costs directly attributable to the asset in order to bring it to the location and condition to be utilised in accordance with the intended purpose. Other additional expenses are recognised as an expense in the period in which they arise. Decisive in the assessment of when an additional expense is added to acquisition value is whether the expense relates to the replacement of identified components, or parts thereof, in which case such expenses are capitalised. Even in cases where a new component has been added, the expense is added to the acquisition value. Any undepreciated reported values of replaced components, or parts of components, are discarded and expensed in connection with the replacement. Any additional work related to the buildings are activated immediately.

Construction in progress
ESS is constructing a complex facility consisting of a large number of components and instruments, which takes a long time. This means that significant amounts are reported as construction in progress throughout the construction phase. Once the facility is ready to be put into use, it will be reported as machinery and equipment and be subject to scheduled depreciation based on the estimated economic life.

Depreciation according to schedule
Depreciation according to schedule is based on the original acquisition values less estimated residual value. Depreciation is linear over the asset's estimated lifetime.

The following depreciation schedules are applied:	
Buildings	25-45 years
IT equipment	3-5 years
Machinery and equipment	5-25 years

Impairments
The recorded value of the Company's assets is checked each balance sheet date to determine if there is any indication of the need for impairment. If any such indication exists, the asset's recoverable value is calculated as the higher of value in use and net realisable value.

Impairment is recognised if the recoverable value is less than the recorded value. When calculating the value in use, future cash flows are discounted at an interest rate before tax in order to take into account the market's assessment of risk-free interest and risk associated with the specific asset. An asset that is dependent on other assets is not considered to generate any independent cash flows. Such an asset is instead attributed to the smallest cash-generating unit where the independent cash flows can be determined.

An impairment is reversed if there has been a change in the calculations used to determine the recoverable value. A reversal is only made to the extent that the assets balance sheet value does not exceed the balance sheet value that would have been recognised, less depreciation, if no impairment had been made.

ESS conducts non-profit activities in accordance with the requirements of the EU regulation relating to an ERIC. Financing the future operation of the facility is planned to be take place through contributions that guarantee full cost coverage. This means that the assessment of external and internal indicators regarding the assessment of need for impairment for ESS, in accordance with K3 regulations, is applied taking into account ESS ERIC´s specific conditions. This specific application complies in all material respects with the principles and methods as expressed in the 'Draft accounting statement from FAR Impairments in municipal companies that are covered by the Local Government Act's cost principle" (Swedish: **Utkast till redovisningsuttalande från FAR Nedskrivningar i kommunala företag som omfattas av kommunallagens självkostnadsprincip**), which is thereby similarly applied to ESS.

Receivables
Receivable are recognised at acquisition value, less any impairment.

Receivables and liabilities in foreign currencies
Receivables and liabilities in foreign currencies have been translated at the exchange rate on the balance sheet date. Exchange rate differences in operating receivables and operating liabilities are included in the operating result, while differences in financial receivables and liabilities are recognised under financial items.

Short-term investments
Short-term investments are valued in accordance with the Swedish Annual Accounts Act (Swedish: **Årsredovisningslagen**) at the lower of acquisition value and fair value.

Financial instruments
A financial asset or financial liability is recorded in the balance sheet when the Company becomes a party to the instrument's contractual terms. Accounts receivable are recorded in the balance sheet when the invoice has been sent. Accounts receivable are recorded when the invoice has been sent. A financial asset is removed from the balance sheet when the contractual rights are realised, expire, or the Company loses control over them. A financial liability is removed from the balance sheet when the contractual obligation is fulfilled or otherwise extinguished.

Leasing
All leasing agreements are recognised in accordance with the rules operational leasing. Leasing fees are expensed over the term, based on the usage, and taking into account benefits provided or received at the signing of the agreement.

Cash and cash equivalents
Cash and cash equivalents include cash, immediately available bank balances recalculated at the exchange rate on the balance sheet date, and other money market instruments with original maturities of three months or less. Money market instruments are generally valued at accrued acquisition value.

Accounts payable
Accounts payable have a short expected maturity, and are valued without discounting at the nominal amount.

Remuneration to employees
Defined contribution pensions
Operational payments relating to defined contribution pension plans are recognised as an expense during the period in which the employee performed the services to which the charge relates. Consequently, no actuarial assumptions are necessary in order to calculate the obligation or the cost, and there is no possibility of any actuarial gains or losses. The obligation is calculated without discounting, except in cases where they are not entirely due for payment within twelve months after the end of the period during which the employees perform the related services.

Tax
The tax consists of current tax and deferred tax. Taxes are recognised in the income statement, except where the underlying transaction is recognised directly against equity, whereby the associated tax effect is recognised in equity. Current tax is tax that shall be paid or received for the current year. This includes adjustment of current tax attributable to previous periods. Deferred tax is calculated according to the balance sheet method, based on temporary differences between the recognised and taxable values of assets and liabilities. The amounts are calculated based on how the temporary differences are expected to be settled, and by applying the tax rates and tax rules adopted or announced at the balance sheet date. Temporary differences are not taken into account in the differences attributable to participations in subsidiaries and associated companies that are not expected to be taxed in the foreseeable future. Untaxed reserves are reported including deferred tax liabilities. Deferred tax assets relating to deductible temporary differences and unused tax losses are only recognised to the extent that it is probable that these will result in lower tax payments in the future.

Contributions
ESS is financed partly with cash and partly with In-Kind contributions (non-financial contributions) from the member countries.

Cash contributions
Received cash contributions from members are recognised in equity in the balance sheet. For a summary of the contributions received, see note 18.

In-Kind contributions
The process for approving In-Kind contributions during the construction phase is performed by a committee (In-Kind Review Committee). The committee reviews underlying agreements and recommends them to the ESS Council, with delegates from the member countries, for final approval. Following this approval, final documented agreements between the parties regarding the value of completed deliveries and signed contribution documents from the contributors are required in order for the In-Kind contributions to be recorded. In-Kind contributions are considered as Government grants as they are received with special conditions for their use. In-Kind contributions can be obtained partly in the form of cash and partly in the form of fixed assets. Received In-Kind cash contributions are used to purchase specified fixed assets. Received cash In-Kind contributions are reported by netting in the balance sheet towards invoiced fixed assets, which mainly refer to machinery and installations. In-Kind contributions in the form of fixed assets are booked with their calculated gross value according to the agreement and are also reported net in the balance sheet towards the Government grants.

Note 2 | Related parties with a controlling influence
The Council is the highest governing body of the organisation, which consists of up to two delegates from each member of the organisation. The delegates may be assisted by experts. Each member is entitled to the number of votes corresponding to its contribution to the planning and construction costs. Observers are entitled to participate in the Council but have no voting rights.

Note 3 | Significant events after the end of the financial year
No significant events have occurred after the financial year.

Note 4 | Employees, staff costs, and fees to auditors

AVERAGE NUMBER OF EMPLOYEES

	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Sweden		
Men	366	353
Women	142	139
Total	**508**	**492**
Denmark		
Men	33	30
Women	4	3
Total	**37**	**33**
TOTAL	**545**	**525**

GENDER DISTRIBUTION IN THE MANAGEMENT

	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Number of senior executives	7	8
Of which are women	29%	38%

SALARIES, OTHER REMUNERATION AND SOCIAL SECURITY COSTS

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Sweden	340,968	330,642
Denmark	37,159	35,154
TOTAL	**378,127**	**365,796**
Social security costs	105,808	102,257
Pension costs incl. salary tax	84,688	86,196
TOTAL SOCIAL SECURITY AND PENSION COSTS	**190,496**	**188,452**
Salaries and other remuneration include:		
to the Director General	2,085	2,018
to other executives in senior management	10,147	12,042

REMUNERATION TO SENIOR EXECUTIVES 2023

KSEK	Basic salary	Other benefits	Pension costs	Total
Director, General	2,030	55	691	2,776
Other senior executives (8 ppl)*	10,140	7	1,970	12,117
TOTAL	**12,170**	**62**	**2,661**	**14,893**

REMUNERATION TO SENIOR EXECUTIVES 2022

KSEK	Basic salary	Other benefits	Pension costs	Total
Director, General	1,965	53	694	2,712
Other senior executives (8 ppl)	12,003	39	2,369	14,411
TOTAL	**13,968**	**92**	**3,063**	**17,123**

*To note for the English version: other senior executives includes the ESS Directors, Associate Directors, and the Council leadership.

Incentive programme
European Spallation Source ERIC has no incentive programme.

Severance pay to senior executives
The Director General and other senior executives' employment agreements do not include commitments for severance pay.

FEES AND REMUNERATION TO AUDITORS

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Audit assignment, KPMG	399	399
Other assignments:		
KPMG	38	38
TOTAL	**437**	**437**

Audit assignments refer to the review of the annual report and accounts, other duties that are the responsibility of the Company's auditors to perform, and advice or other assistance which have arisen from observations during such a review, or the implementation of such duties.

Note 5 | Leasing fees relating to operational leases

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Leasing agreements where the Company is the lessee:		
Minimum leasing fees	14,505	11,769
Variable fees	0	35
TOTAL LEASING COSTS	**14,505**	**11,804**

Agreed future minimum leasing fees relating to non-cancellable contracts which are due for payment:

Within a year	15,340	8,605
Between two and five years	35,911	10,179
TOTAL	**51,251**	**18,784**

Note 6 | Depreciation

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Depreciation according to plan, distributed by asset:		
Buildings	-170,968	-170,811
Equipment, tools and installations	-28,647	-21,875
TOTAL	**-199,615**	**-192,686**

Note 7 | Other operating income

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Exchange rate gains on receivables / liabilities of an operational nature	0	9,691
EU project grants	11,901	16,198
Other operating income	6,937	10,656
TOTAL	**18,838**	**36,545**

Note 8 | Financial income

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Interest income	93,718	6,730
TOTAL	**93,718**	**6,730**

Note 9 | Financial expenses

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Interest expenses	-133,856	-56,651
TOTAL	**-133,856**	**-56,651**

Note 10 | Tax on the result for the year

KSEK	2023-01-01–2023-12-31	2022-01-01–2022-12-31
Current tax	0	0
Deferred tax	0	0
TOTAL	**0**	**0**

ESS currently has costs that incur ongoing losses from an income tax perspective. Uncertainty regarding the possibilities and timeframe to be able to utilise these unused tax losses means that no deferred tax has been entered. Unused tax losses amounts to 7,753,989 KSEK (6,304,644 KSEK).

Note 11 | Buildings

KSEK	2023	2022
Accumulated acquisition values:		
At the beginning of the financial year	5,942,633	5,688,734
Transfer from construction in progress	47,176	253,899
TOTAL	**5,989,809**	**5,942,633**
Accumulated depreciation according to plan:		
At the beginning of the financial year	-172,145	-1,335
Depreciation according to plan	-170,968	-170,810
Accumulated depreciation	**-343,113**	**-172,145**
TOTAL NET VALUE	**5,646,696**	**5,770,488**

Note 12 | Land

KSEK	2023	2022
Accumulated acquisition value:		
At the beginning of the financial year	64,250	64,250
TOTAL	**64,250**	**64,250**

Note 13 | Equipment, tools and installations

KSEK	2023	2022
Accumulated acquisition values:		
At the beginning of the financial year	144,896	123,160
Acquisitions	39,179	21,736
TOTAL	**184,075**	**144,896**
Accumulated depreciation according to plan:		
At the beginning of the financial year	-80,497	-58,622
Depreciation according to plan	-28,647	-21,875
Accumulated depreciation	**-109,144**	**-80,497**
TOTAL NET VALUE	**74,931**	**64,399**

Note 14 | Construction in progress

KSEK	2023	2022
Accumulated acquisition values:		
At the beginning of the financial year	2,152,818	1,786,190
Acquisitions	552,531	620,527
Transfer to buildings	-47,176	-253,899
TOTAL	**2,658,173**	**2,152,818**

Note 15 | Current receivables

KSEK	2023	2022
VAT receivables	112,767	87,659
Receivables, contributions from member countries	1,391	2,155
Other	0	43
TOTAL	**114,158**	**89,857**

Note 16 | Prepaid expenses and accrued income

KSEK	2023	2022
Prepaid insurance premiums	5,255	7,884
Accrued income, EU projects	14,037	27,853
Accrued interest income	0	906
Other	12,537	6,667
TOTAL	**31,829**	**43,310**

Note 17 | Financial instruments and financial risk management

Finance policy
No financial instruments have been used to hedge flows or the Balance Sheet.

Liquidity risks and interest rate risks
Cash surpluses are placed in bank accounts or other equivalents.

Credit risks
Credit risks are considered limited, as the company's receivables are low in amount.

Exchange rate risks
Exposure to exchange rate fluctuations has been low, and the exchange rate results that occurred during the year relate to exchange rate differences on account payables and bank balances, mainly in EUR.

Note 18 | Capital cash contributions, accumulated from member states

KSEK	2023	2022
Czech Republic	458,204	290,316
Denmark	2,723,388	2,278,700
Estonia	37,462	33,119
France	1,177,974	834,798
Germany	2,767,032	2,438,313
Hungary	79,837	71,269
Italy	761,066	466,255
Norway	571,215	524,272
Poland	272,615	215,835
Spain	345,454	276,928
Sweden	6,838,180	5,787,033
Switzerland	515,631	450,488
United Kingdom	2,068,547	1,428,316
TOTAL	**18,616,605**	**15,095,642**

Note 19 | Interest-bearing liabilities to credit institutions

KSEK	2023	2022
External loans to credit institutions, due between 1-5 years	1,226,268	2,577,145
TOTAL	**1,226,268**	**2,577,145**

Note 20 | Other liabilities

KSEK	2023	2022
Employee taxes and fees	18,856	16,837
VAT	19,683	20,817
Liabilities to credit institutions	943,840	1,056,415
Other	81	150
TOTAL	**982,460**	**1,094,219**

Note 21 | Accrued expenses and prepaid income

KSEK	2023	2022
Property tax	3,145	3,145
Accrued vacation pay	25,316	25,987
Statutory social security costs	7,518	7,899
Accrued salary tax	10,539	10,823
Advances for EU-related projects	65,509	50,362
Cash In-Kind	304,784	373,433
Accrued interest	18,538	19,783
Other accrued expenses and prepaid income	14,034	17,148
TOTAL	**449,383**	**508,580**

Note 22 | Contingent liabilities and pledged assets

KSEK	2023	2022
Contingent liabilities	None	None
Pledged assets	None	None

European Spallation Source ERIC's income statement and balance sheet will be subject to approval at the Council's meeting.

The Director General certifies that, based on my best knowledge, belief and understanding, the Annual Report has been prepared in accordance with applicable accounting rules, that the information provided is in accordance with actual circumstances, and that nothing of significance that would affect the view of the Company as a result of the annual report has been omitted.

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ESS ANNUAL REPORT 2023