

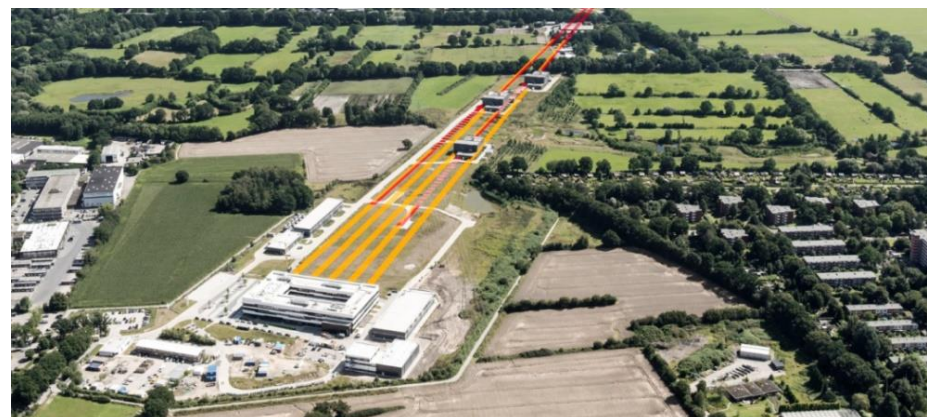


Impact of the Global Challenges on RI – *Our role in science diplomacy and open strategic autonomy*



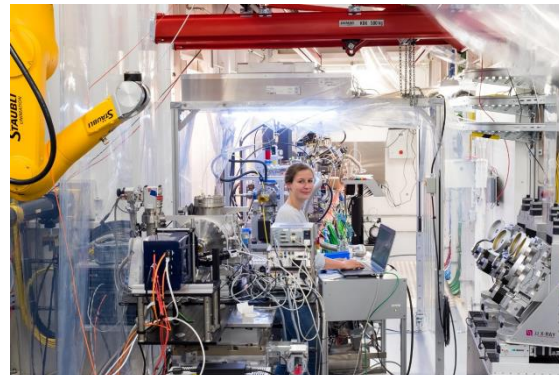
Dr. Nicole Elleuche
European XFEL Managing and Administrative Director

Conference RI in a Changing Global, Environmental and Socio-economical Context, Brussels, 4 June 2024



Research Infrastructure in a Changing Global, Environmental and Socio-economical Context

1. Research Infrastructures (RIs) as key players of strategic autonomy in a changing global context
2. The socio-economic and environmental impact of RIs
3. The broad ecosystems of RIs



European XFEL – a user facility of superlatives

■ Facts and Figures

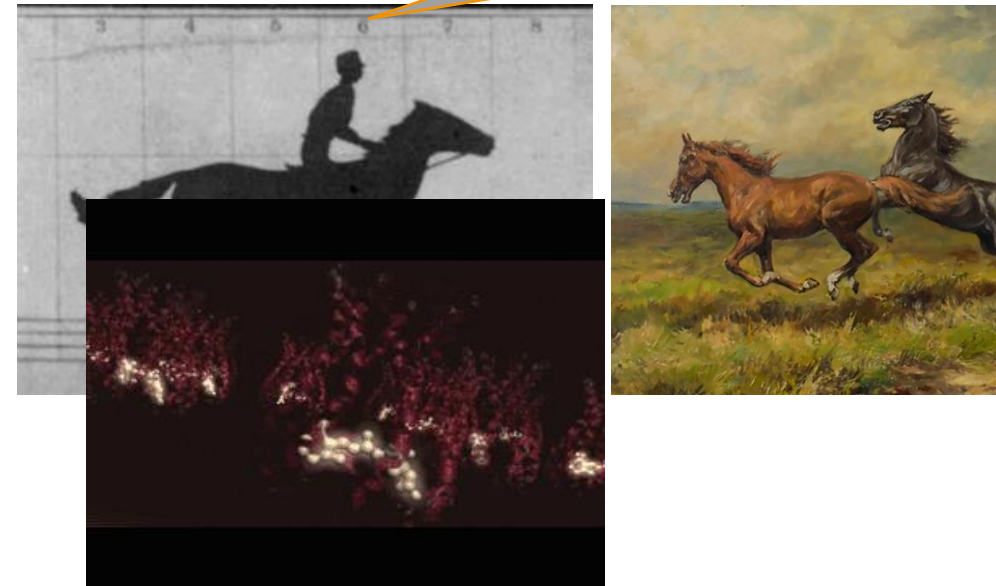
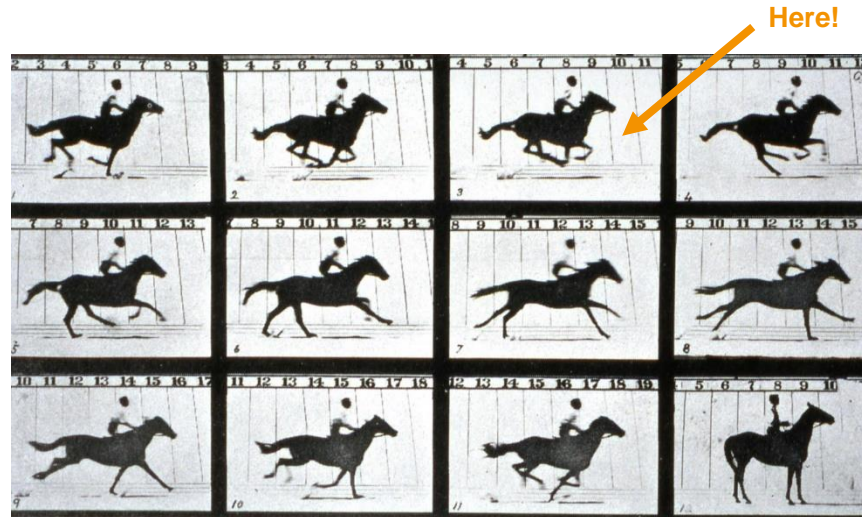
- Non-profit company with 12 Shareholder countries
 - ▶ Construction costs: 1.54 billion Euro (60% in-kind contributions)
 - ▶ Annual budget: about 150 million Euro
- More than 500 staff members (plus 250 at DESY)
 - ▶ Staff from more than 60 countries
- In full user operation since 2022
 - ▶ Around 1 200 different users per year from 30 countries
- In 2023, more than 9 000 hours of beamtime to users; about 100 experiments/year, ~ 3-4x oversubscribed



Why is the European XFEL unique?



Quick pictures with light (1882):
Does a horse jump during gallop?

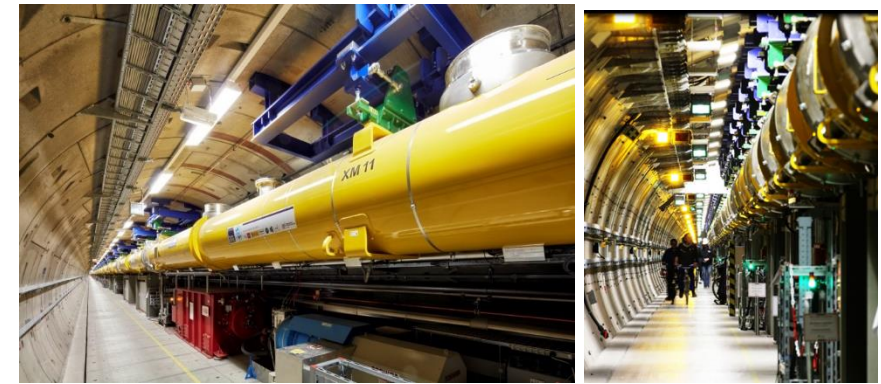
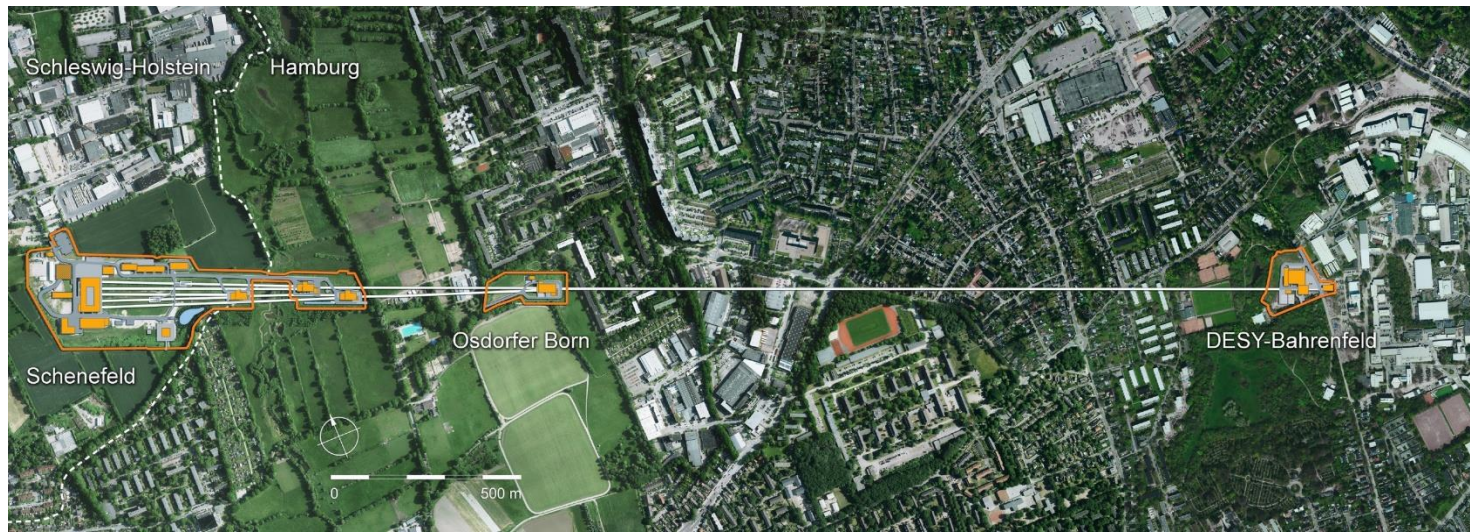


*"I want to occasionally capture what the human eye could not distinguish as separate moments in time."
(E. Muggeridge)*

- What do we need to gain the same insight into molecules and atomic movement?
 - Brilliant and bright x-rays because of the small size
 - Quick cameras/detectors with 27,000 pictures/minute to show movement

Why is the European XFEL unique?

The largest and strongest x-ray free-electron laser worldwide (European XFEL) can capture what the human eye could not distinguish as separate moments in time — we can make molecular movies!



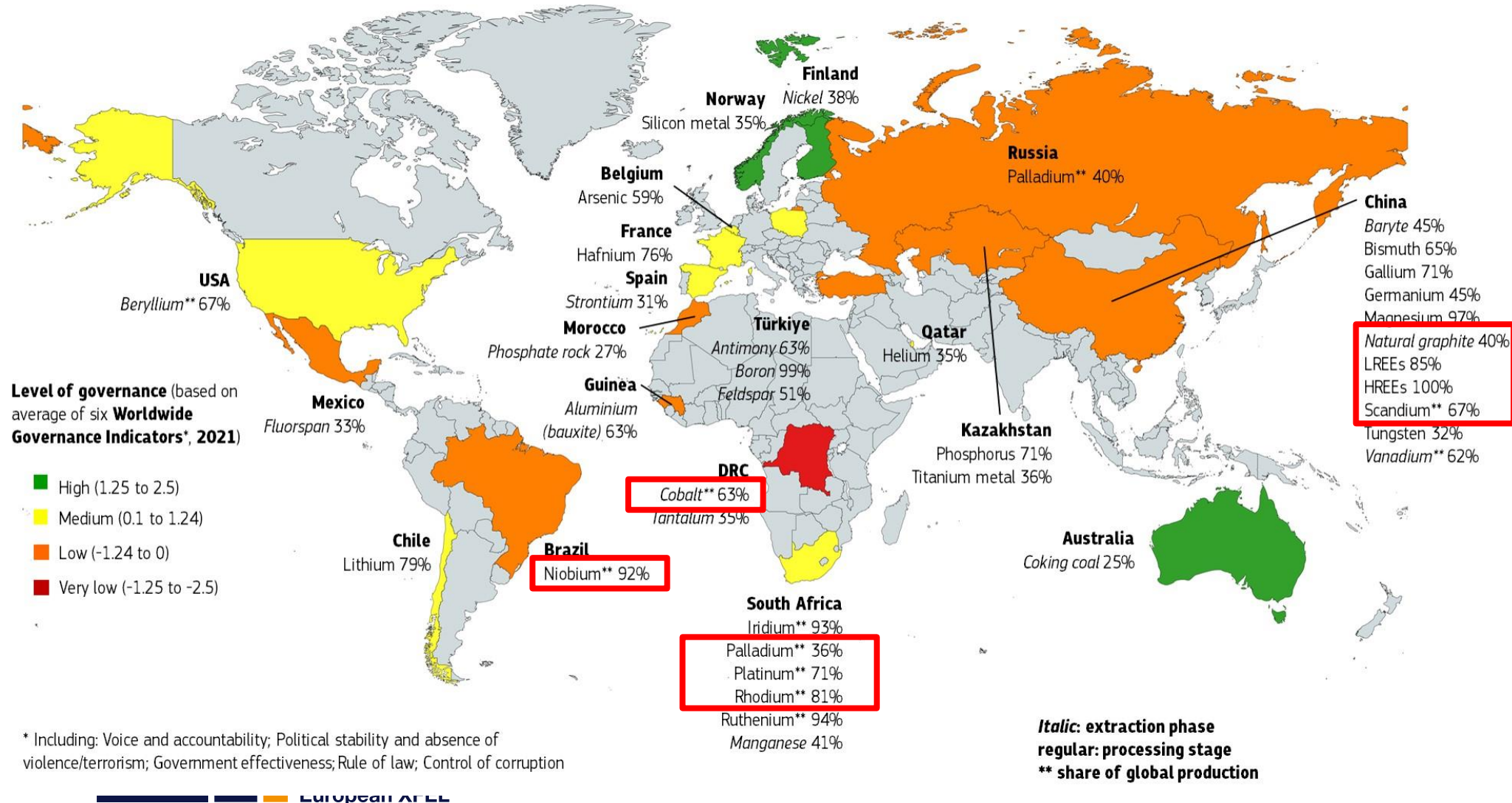
2 km accelerator, Total length: 3,4 km

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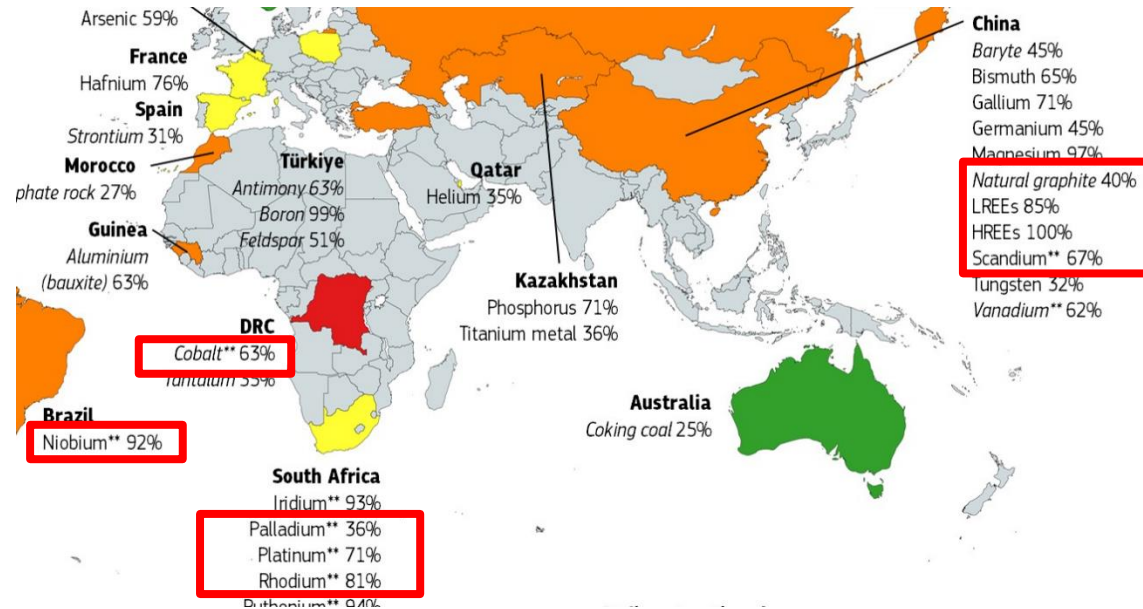
Contribution by RI/European XFEL helping Europe enhance sovereignty: Example: Critical Raw Material (CRM)



Critical, strategic and advanced materials:
 Crucial for various high-tech applications such as electronics, renewable energy technologies, and defence systems.

Research is focused on finding substitutes for CRM or developing more efficient recycling methods to reduce dependence on imports

European XFEL Example: Material Science on Critical Raw Material (CRM)



- **REE:** EuXFEL conducts experiments to study **rare-earth elements** to understand their behaviour at extreme conditions better
- Helps to predict which properties could be substituted with cheaper and easy-access materials
- **Cobalt:** Essential for lithium-ion batteries, used in electric vehicles and electronic devices.
- EuXFELs Research aims at reducing the cobalt content in batteries, developing alternative battery chemistries, and exploring new sources of cobalt to decrease reliance on unstable supply chains.

■ **Platinum Group Metals (PGMs)** are crucial for catalytic converters, fuel cells, and various industrial applications. EuXFEL is focusing on substituting them by much cheaper transition metals in catalytic organic complexes.

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European XFEL contribution to solving global challenges



Health

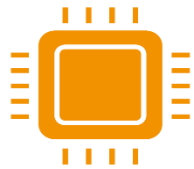
- Understanding the mechanisms of antibiotic resistance in tuberculosis
- Study the response of H₂O to ionizing radiation



Environment and Sustainability

- Light-sensitive copper complexes produce a reactive oxygen species that effectively kills bacteria
- Natural bacterial insecticides for use in agriculture and medicine

UN Sustainable Development Goals (SDGs)



Digitalization

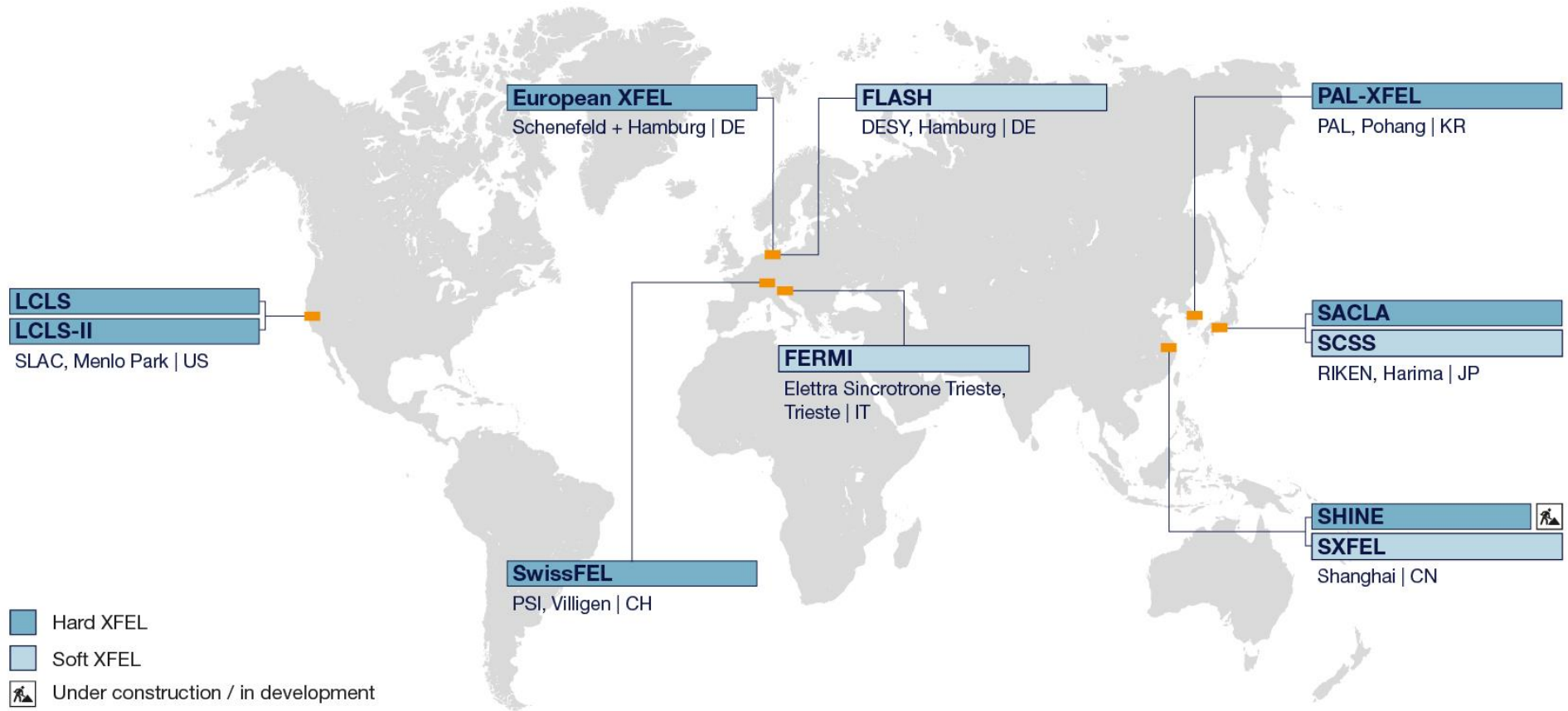
- Research into **magnetic materials for data storage** devices for smaller, more energy-efficient storage media



Climate and Energy

- Research into more **efficient renewable energy** sources, new (cheaper and more abundant) catalysts for the production of hydrogen and e-fuels

X-ray free-electron lasers worldwide

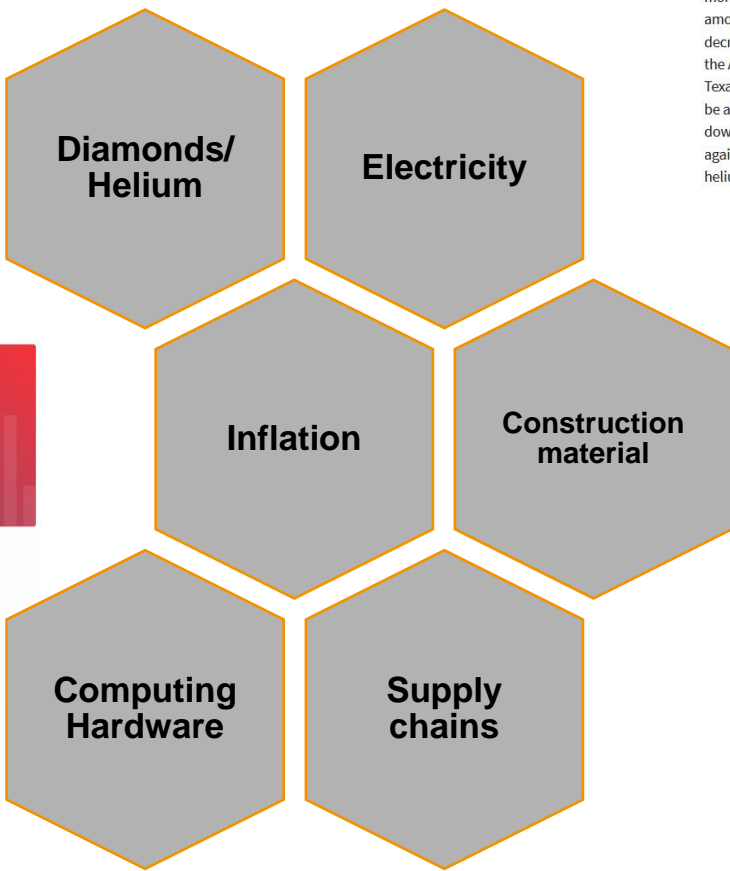
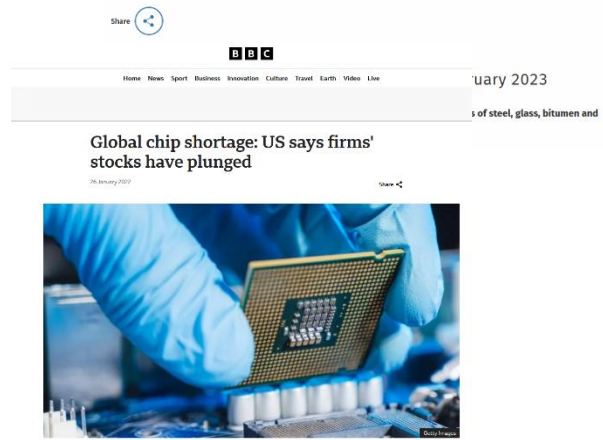


- Hard XFEL
- Soft XFEL
- Under construction / in development

Challenges arising from the global situation



Press
Another strong increase in building material prices in 2022



Energy prices and security of supply

Russia's war of aggression against Ukraine caused an unprecedented energy crisis in Europe in 2022. EU countries stood united and their response was swift and effective.

Reasons for worldwide helium shortage

If you want to buy liquid helium, you currently have to dig deep in your pocket. Prices have increased considerably during the past 12 months. Since the second half of 2021, the amount of available helium has significantly decreased. The reason was maintenance work at the American gas processing plant Cliffs in Texas. Hope to be able to avoid downtime work against Ukraine's helium gas p...



Helium shortage disrupts celebrations - and even US weather service

Supply chain disruptions, including production plant closures and 2017 embargo on Qatar, have caused shortage of rare substance

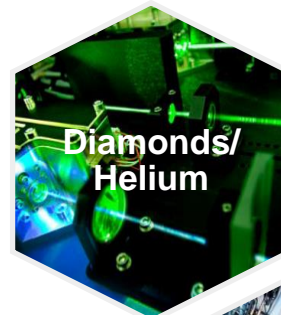
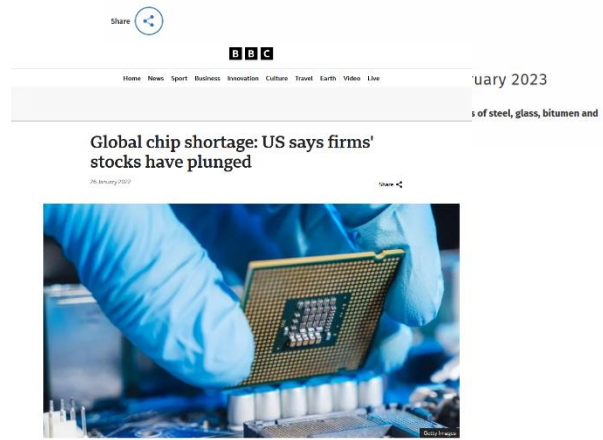


Leading in times of crises - the revelation of dependencies



Press

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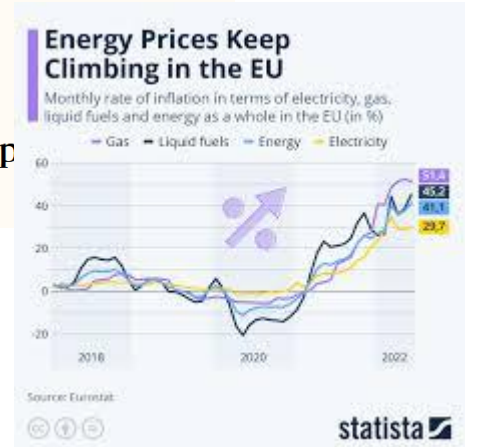
SCIENCE & TECH

Global helium shortage jams brakes at Harvard labs

Juan Sillezar | Harvard Staff Writer

June 13, 2022 • 7 min read

Crisis threatens research, equip progress of grad students



Energy prices and security of supply

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How can research infrastructures contribute to develop and maintain technological sovereignty

Investing in Strategic Research Areas → EU Funding Guidance

■ Foster projects to increase technological development

■ Development of new materials for more sustainable batteries

- ▶ *UltraBat* project as part of Initiative Battery 2030+ (led by DTU)
 - Inventing sustainable batteries of the future

■ Development of new high-end technology products

- ▶ LEAPSInnov Work Package “SuperFlat” on high-quality X-ray mirrors (led by ESRF/SOLEIL)
 - “Aims to improve European capabilities for the production of very **high-quality X-ray mirror and grating substrates** which are key to achieving the ultimate performance of our user facilities.”

■ Foster and use new production and procurement chains

- ▶ Procurement and testing of diamonds as high-precision monochromators



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3. The broad ecosystems of RIs – the “European XFEL case”



European XFEL - organizational uniqueness

- Founded in 2009 as an international facility based on an intergovernmental convention signed by 12 shareholding countries:
 - Germany: 57%, Russia: 26%, other shareholders: 1-3% each
- Non-profit limited liability company subject to German law
 - Both EU and German law apply
- Use of the facility based on scientific excellence and benefits to society



Convention: Activities for peaceful ends only

Since 18 December 2023:

Free electron 'lasers' listed as dual-use technology

Safeguarding research



Position paper of the German Federal Ministry of Education and Research on research security in light of the *Zeitenwende*

We are experiencing a **Zeitenwende** (turning point in history) which is having a wide-ranging impact on our lives. The Russian war of aggression against Ukraine and its serious consequences play a substantial role in this. But our world was already undergoing radical change, with multipolarity, cyber threats and systemic rivalry, particularly with China, all on the rise. All this has significant **consequences** for science and research. The Federal Ministry of Education and Research (BMBF) responded to Russia's attack on Ukraine by suspending all ongoing and planned measures with Russia. At the same time, the BMBF is taking a more critical view of countries like China and Iran

The *Zeitenwende* requires a **more strategic approach** that dovetails the freedom of science that we cherish with our security interests. The Federal Government has created an important framework for this by adopting **National Security Strategy and China Strategy**

and procedures that are of relevance to research security must be **reviewed** in light of the *Zeitenwende* in terms of whether they still reflect national security interests and, if required, how they can be enhanced to provide effective, risk-appropriate but also proportionate protection.

Secondly, a **broader awareness and knowledge** of the risks and threats that research increasingly faces is to be created and established within the science system. The risks include, in particular, the misuse of research, foreign interference, espionage targeted at staff and above all the leakage of



COUNCIL RECOMMENDATION ON RESEARCH SECURITY

24 January, 2024

Factsheet

Economic Security package

This initiative supports Member States and the research and innovation sector to enhance research security across Europe. It aims at managing risks such as undesirable transfer of critical technology, malign influence, and ethical or integrity violations by third countries.

At the same time, it underscores the importance of international cooperation and openness following the principle 'as open as possible, as closed as necessary'.

In its proposal for a Council recommendation on research security, the Commission sets out several guidance and support actions to raise awareness and enhance resilience across Europe.



Making Science More Open Is Good for Research—but Bad for Security

The open science movement pushes for making scientific knowledge quickly accessible to all. But a new paper warns that speed can come at a cost.

Safeguarding research – Three major research security measures



- Clear policies and guidelines
 - Data security, IP, Shareholder relation, research ethics
- Secure Data Management and Communication
 - Increased need for cybersecurity measures
 - Encryption methods, double authentication
 - Implement robust data management
- Training, Awareness, Compliance and transparent communication

Position paper of the German Federal Ministry of Education and Research on research security in light of the Zeitenwende

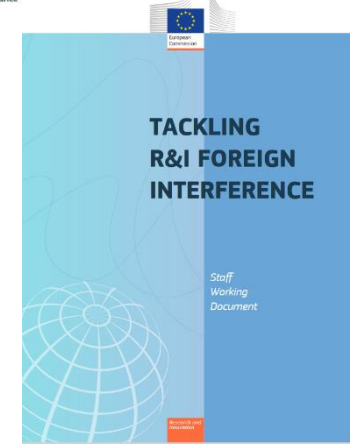
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The **Zeitenwende** requires a **more strategic approach** that dovetails the freedom of science that we cherish with our security policy interests. The Federal Government has created an important framework for this by adopting its **National Security Strategy and China Strategy**.

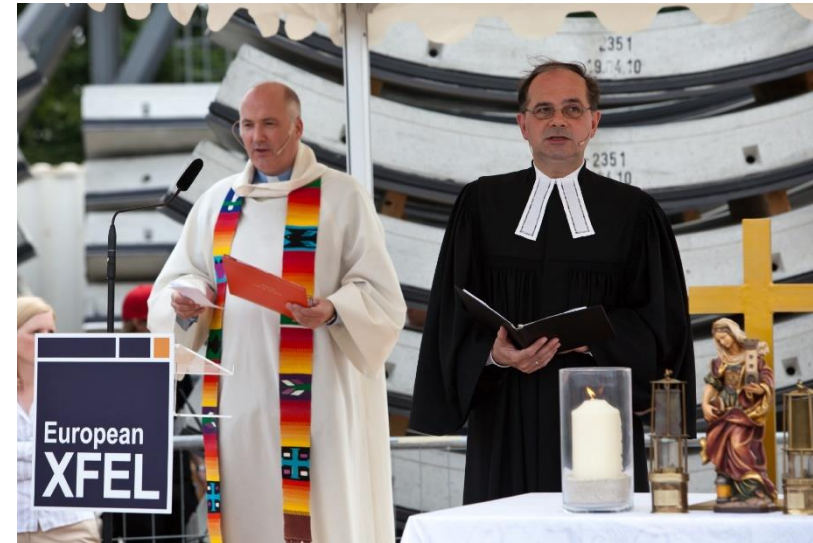
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Secondly, a **broader awareness and knowledge** of the risks and threats that research increasingly faces is to be created and established within the science system. The risks include, in particular, the misuse of research, foreign interference, espionage targeted at staff and above all the leakage of know-how and technologies to other countries.

The BMBWF will therefore actively support the review and (further) development of the relevant **guidelines and instruments** by the science community under the latter's responsibility for *vermeidbare Verantwortung* (avoidable responsibility).



Summary and 6 key answers



Christening ceremony for the first tunnel and drilling machine on the European XFEL construction site in Schenefeld (30 June 2010)

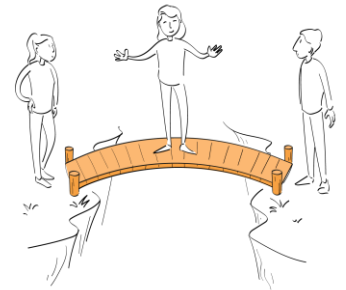
Research Infrastructure in a Changing Global, Environmental and Socio-economical Context

1. RIs as key players of strategic autonomy in a changing global context

- Science is and remains a bridge – we should be aware of this important role we have
- Europe needs to be as independent as possible and foster its technological sovereignty, and science is key to that – fully exploit our scientific capabilities (Coordination and Guidance)

2. The socio-economic and environmental impact of RIs

- The indicators for measuring impact have changed significantly
- RIs impact should be contribution to achieving strategic autonomy and technological sovereignty



3. The broad ecosystems of RIs.

- We need guiding principles and policy recommendations to align our strategies and to act comparably and unite in the international context
- Science is key, but we should not forget the crucial role our research administration and management play in this context

Thank you for your attention!



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<https://www.linkedin.com/company/5359345/admin/>

Science is everywhere!

We can change your view—and the world!



Two horsemen galloping,
Franz Krüger, 19th century



Galloping Horses,
Heinrich Faus, 1910