



HFML-FELIX

A national research infrastructure for science under extreme conditions

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Industry meeting sustainability
2 September 2026



A NATIONAL INSTITUTE & PARTNERSHIP WITH A UNIQUE MISSION

HFML-FELIX has a large-scale open-access research infrastructure that combines high scientific, innovative and societal impact.

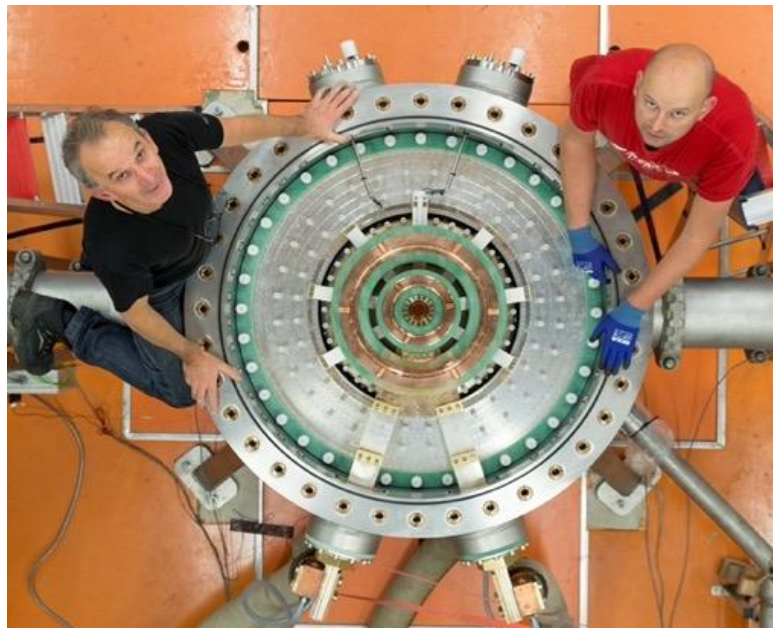
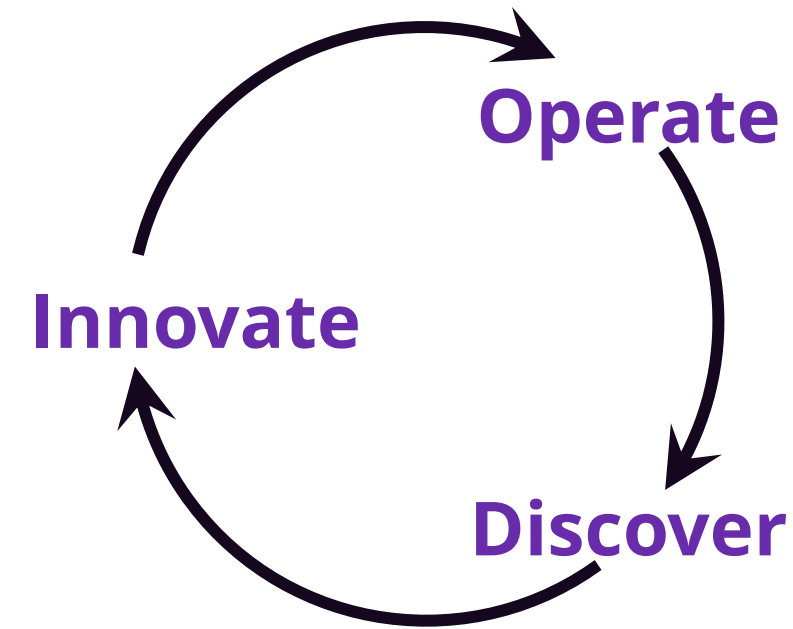
Its mission is to perform groundbreaking research by enabling molecules and materials to be taken to the extremes of modern-day technology both in terms of (persistent) magnetic field strength and intense radiation in the infrared and terahertz (THz) range of the electromagnetic spectrum.

By pushing the limits of these technologies to the extremes, researchers gain significant new insight into the nature of matter. To achieve the long-term ambition, the strategic developments are aligned with the three pillars: Discover, Innovate and Operate.



HFML-FELIX

OUR MISSION



Strongest DC-magnets in Europe

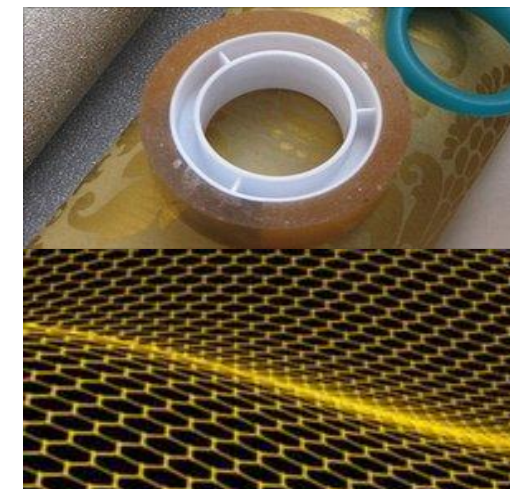
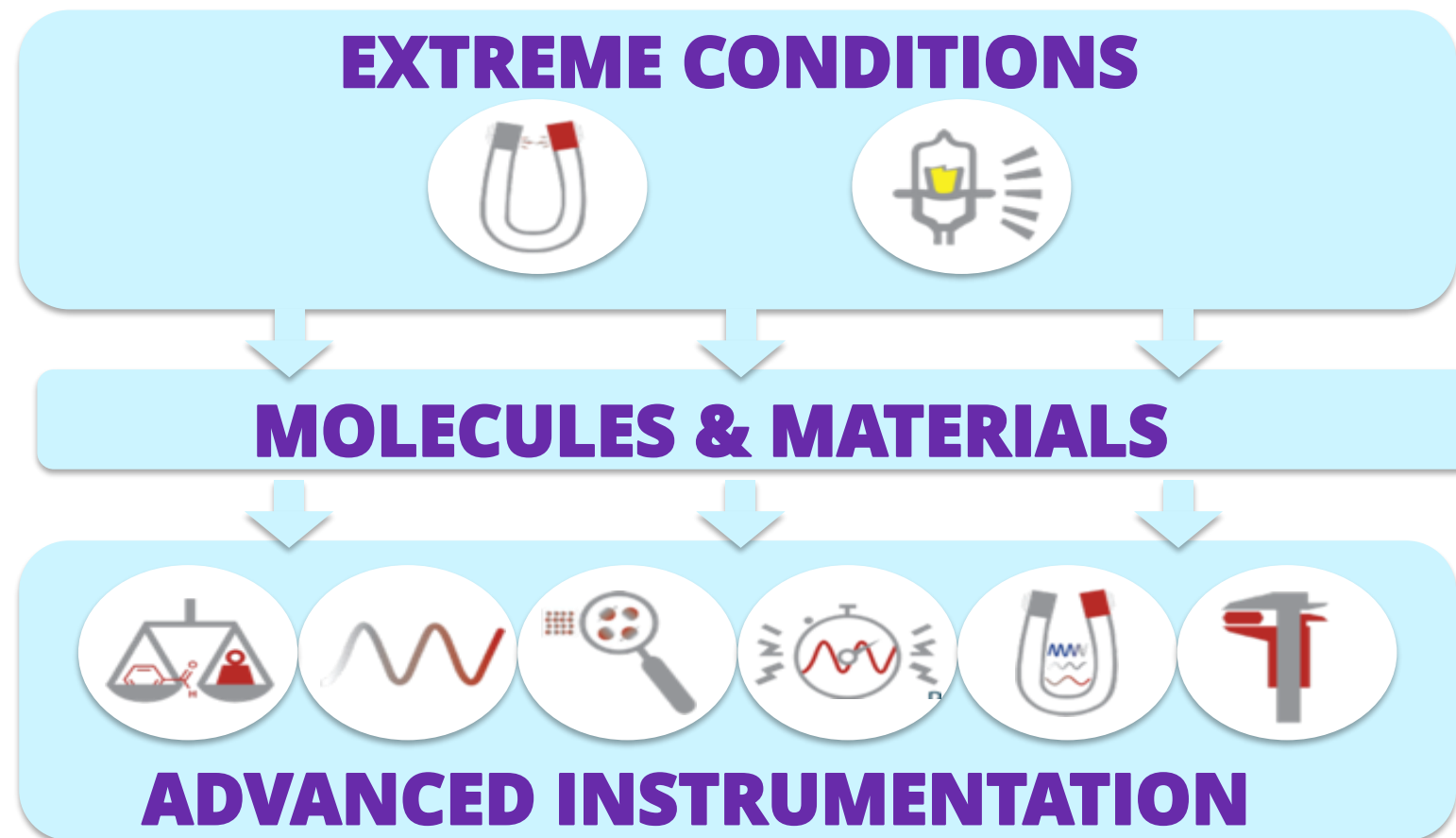


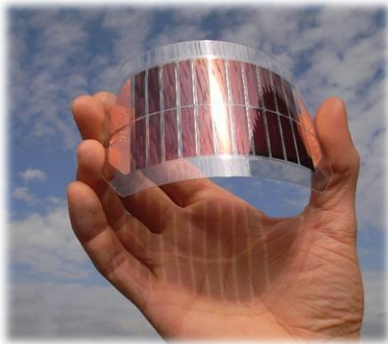
FELs = Free-Electron Lasers with the largest IR wavelength range (IR=infrared)



Nobel prize physics 2010
Graphene

Andre Geim & Konstantin Novoselov

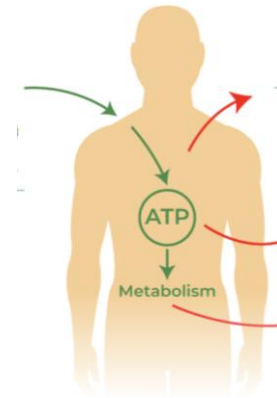




**SMART
MATERIALS**



**ENERGY AND
SUSTAINABILITY**



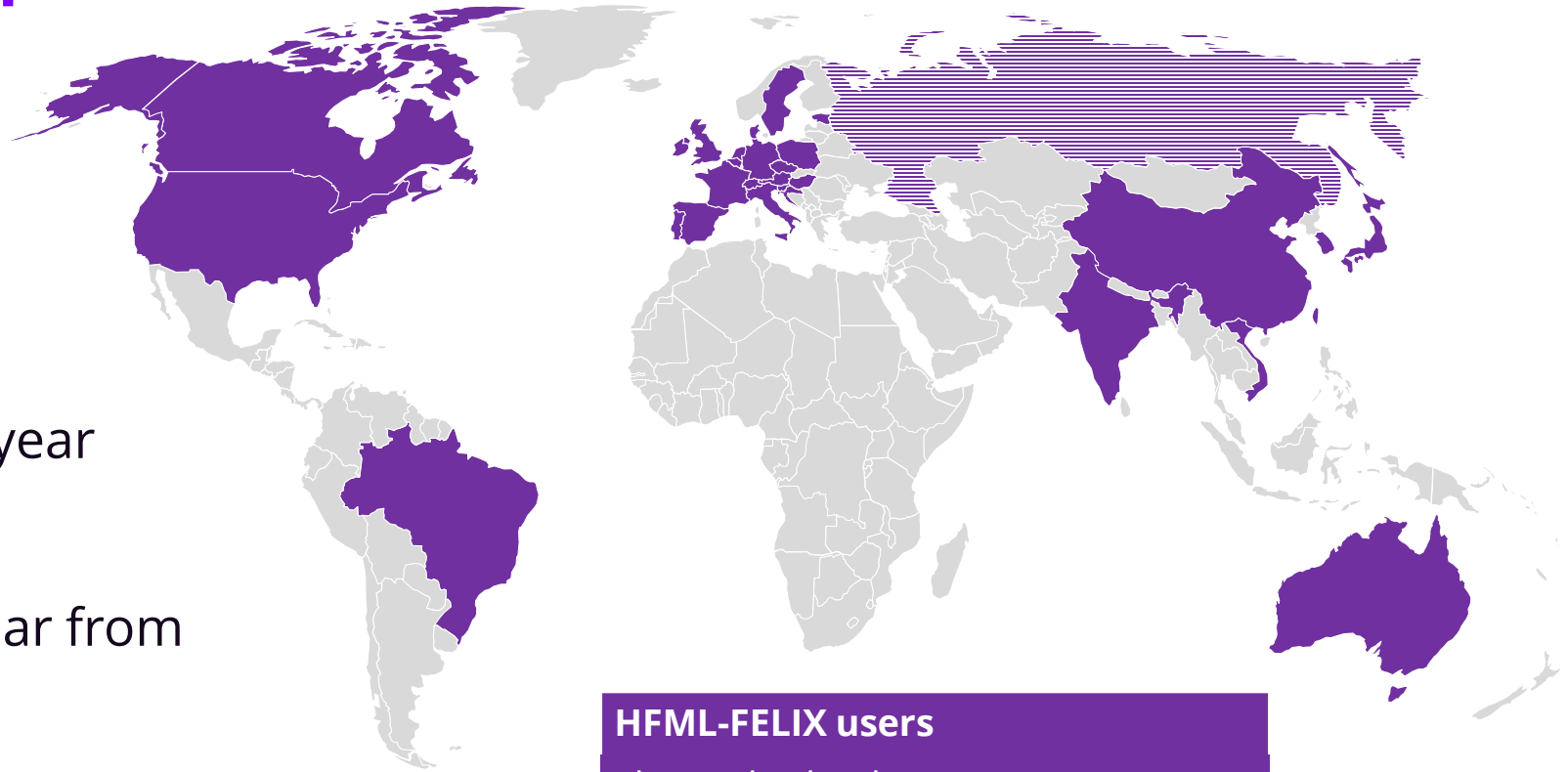
HEALTH

AN INTERNATIONAL FACILITY

- 6 research groups
- 2 technical groups
- > 80 publications/year
- Up to 3000 magnet hours/year
- Up to 6000 FEL hours/year
- > 150 projects/year
- > 400 guest researchers/year from over 25 countries

2 calls for proposals/year

- FELs & combi: www.hfml-felix.nl
- Magnets: via EMFL (www.emfl.eu)



HFML-FELIX users

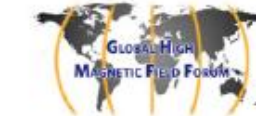
The Netherlands	38%
EU	44%
Other	18%

EUROPEAN CONSORTIA

HFML-FELIX is a member of several European consortia.

These consortia not only provide a valuable platform for exchanging experiences, but also enable HFML-FELIX to participate in joint EU networks.

Important examples are EMFL and LEAPS.

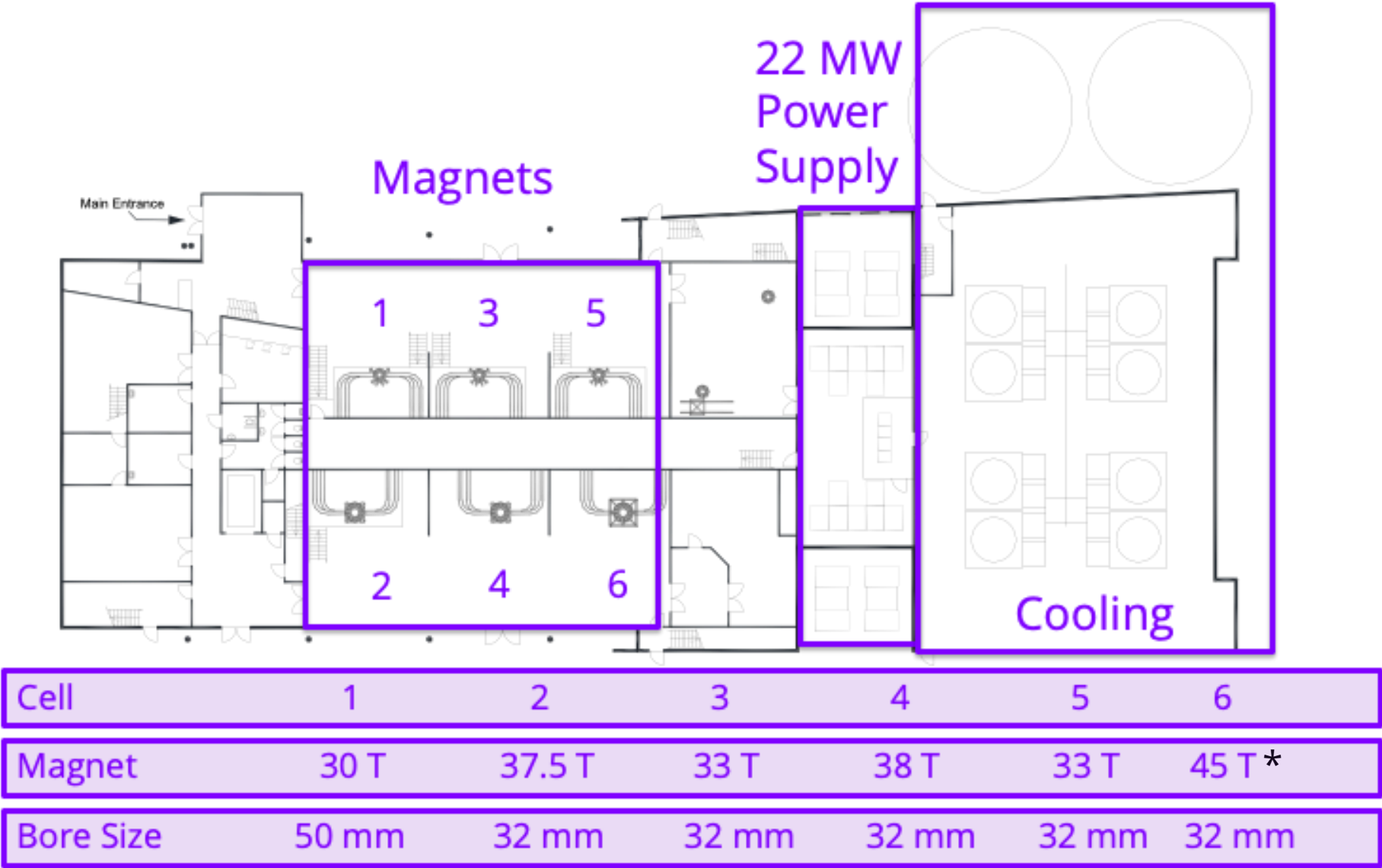


European Magnetic Field Laboratory



League of European Accelerator-based Photon Sources

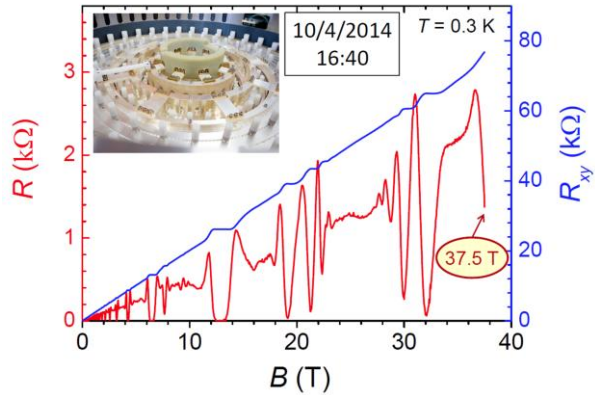
FACILITIES



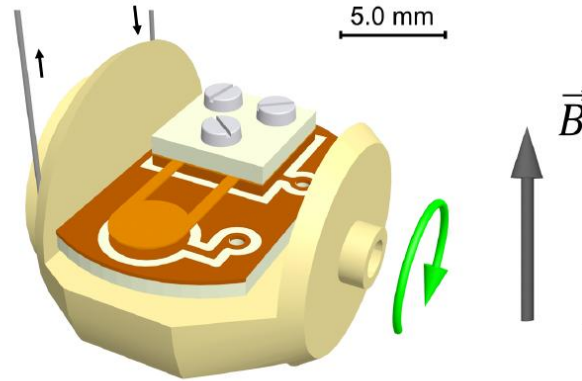
FACILITIES

Typical Measurement techniques at high magnetic fields

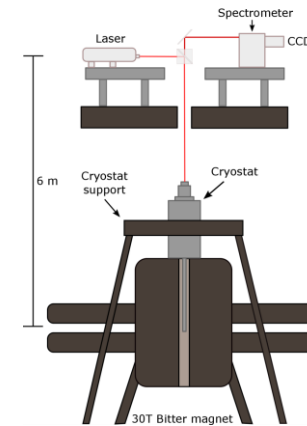
Magnetotransport



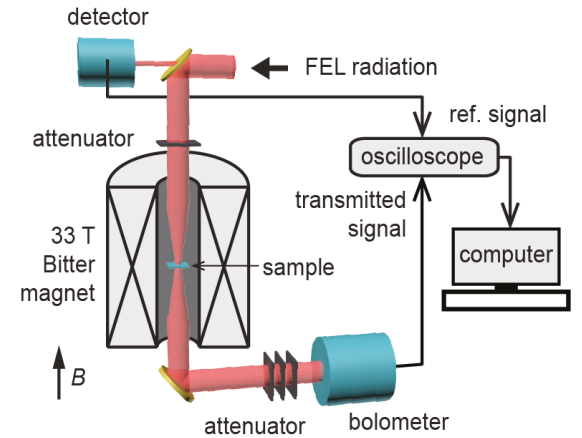
Magnetometry



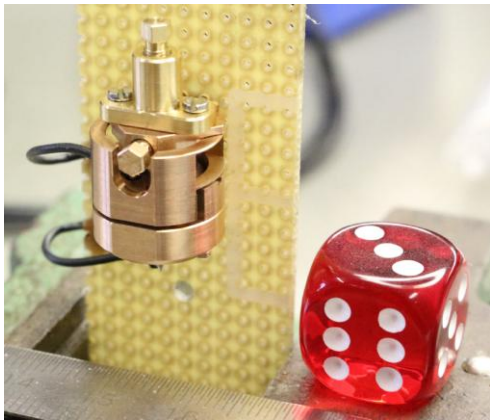
Optics, FTIR & Raman



FELIX/FLARE



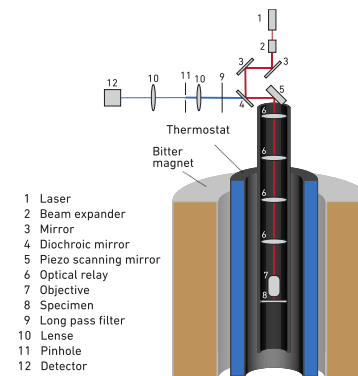
(Strain) Dilatometry



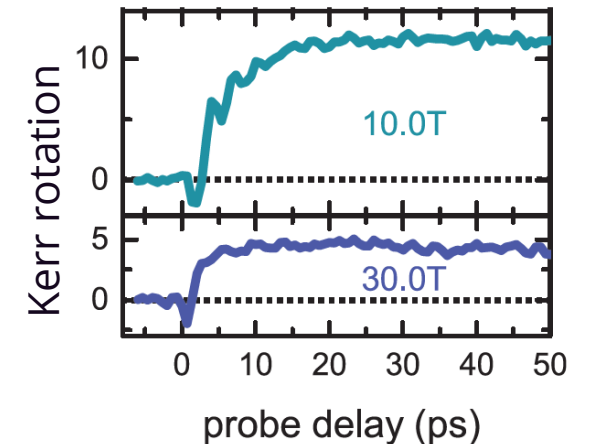
Low temperatures



Optics @ Room Temp.

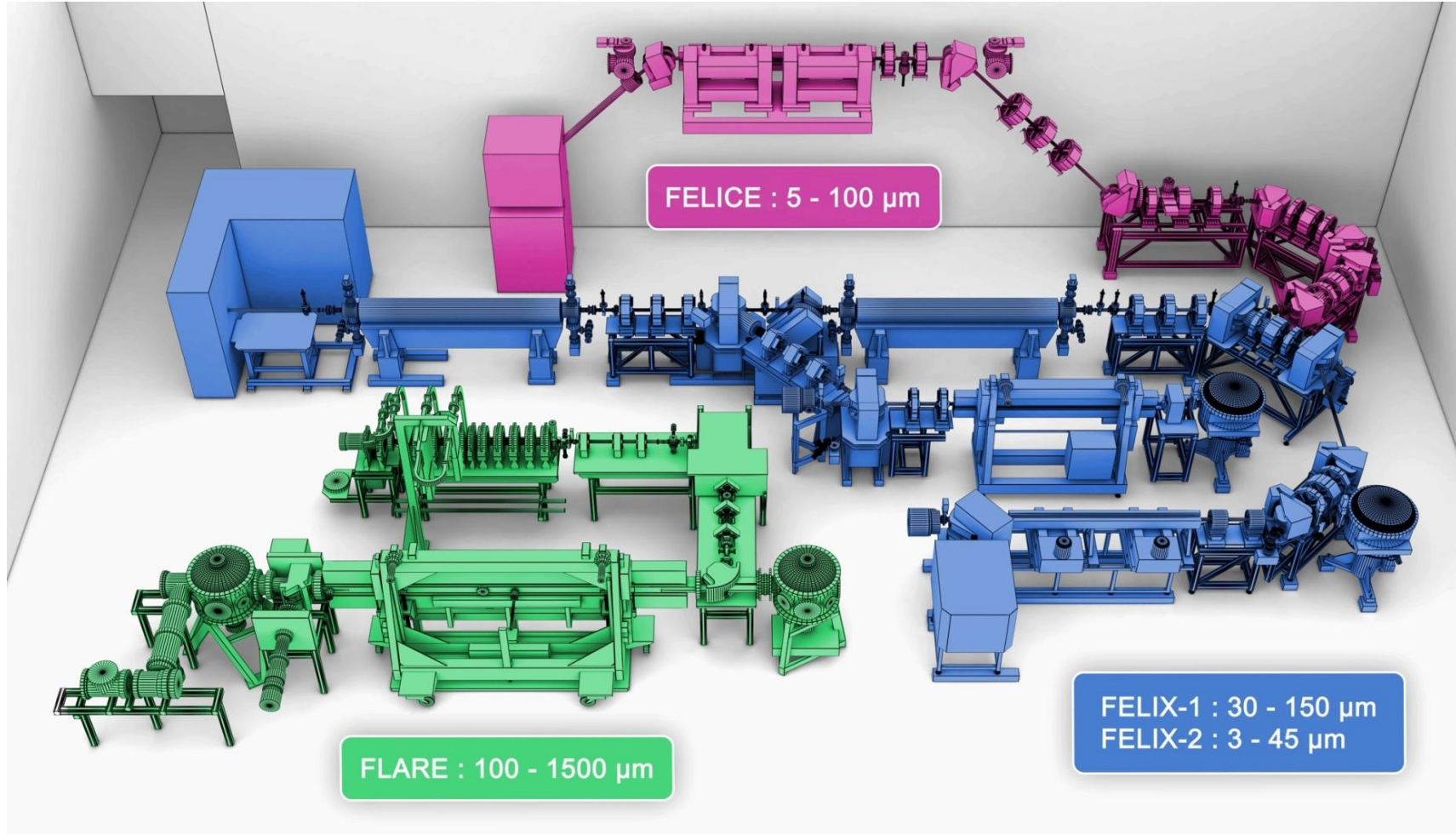


fs spectroscopy



FACILITIES

Overview of the free electron lasers

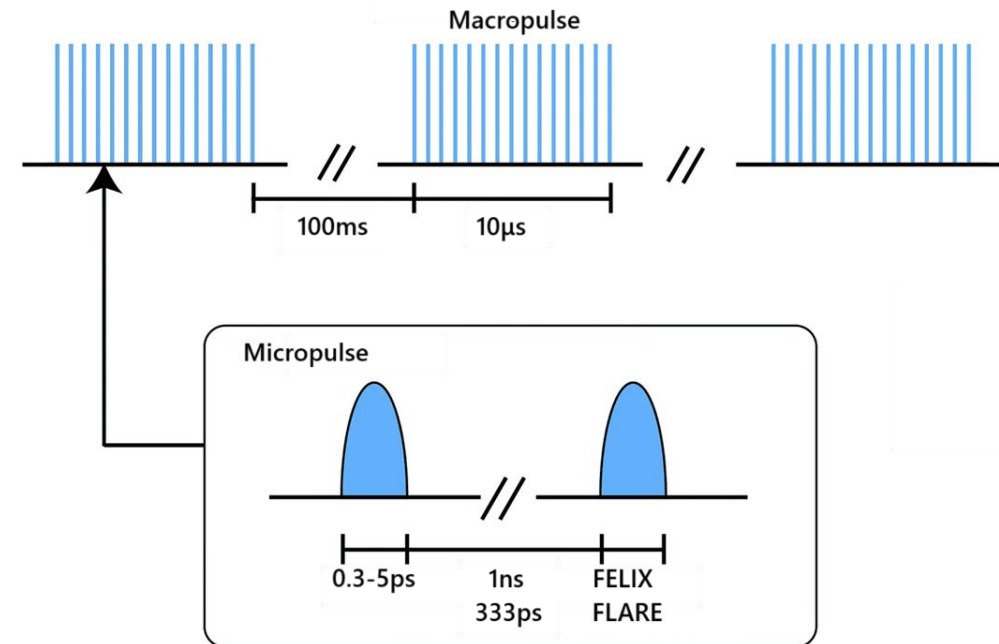


FLARE, FELICE and FELIX-1 or FELIX-2 can be operated in parallel

FACILITIES

Characteristics of the free electron lasers

Specs	FELIX	FLARE
e-beam energy	50/45 – 15 MeV	15 – 10 MeV
Spectral range	2.7 – 150 μm 3600 – 66 cm^{-1} 120 – 2 THz 450 – 8 meV	100 – 1500 μm 100 – 6.6 cm^{-1} 3 – 0.2 THz 12 – 0.8 meV
Macropulse rep. rate	5/10 Hz	5/10 Hz
Micropulse rep. rate	1 GHz FELIX FELICE 25/50/100 MHz 16/33/50/100 MHz	3 GHz 20/60/100 MHz
Micropulse energy	1 – 20 μJ	5 μJ
Macropulse energy	$\leq 100 \text{ mJ}$ @ 1 GHz	$\leq 100 \text{ mJ}$ @ 3 GHz
Peak power	$\leq 10 \text{ MW}$	$\leq 1 \text{ MW}$
Polarization	Linear	Linear
Spectral bandwidth (FWHM)	0.2 – 5 %	$\leq 1 \%$
Corresponding Pulsewidth	0.25 – 6 ps @ 10 μm	70 ps @ 500 μm



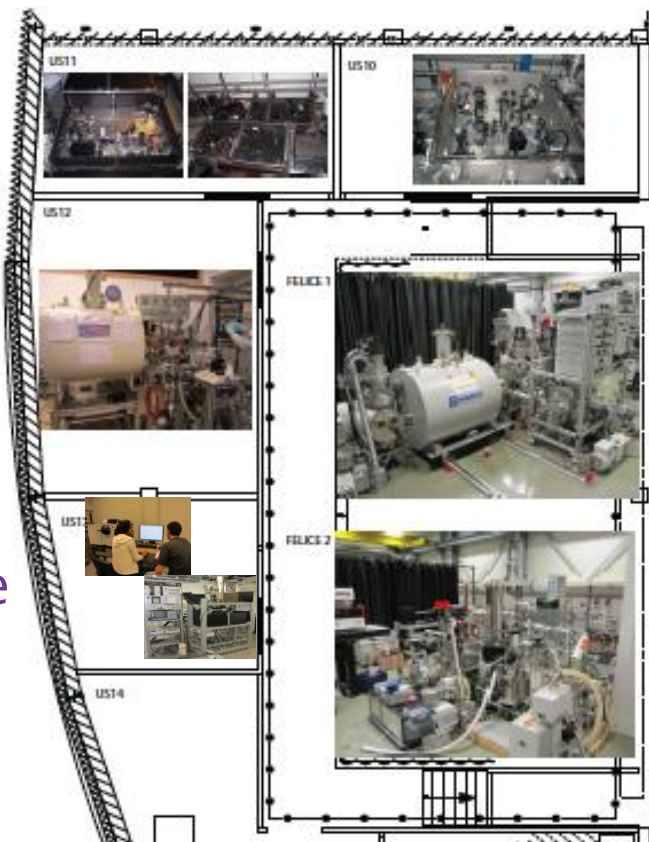
FACILITIES

FEL user stations

FEL pump-probe

FTICR mass spectrometer

Quadrupole ion trap

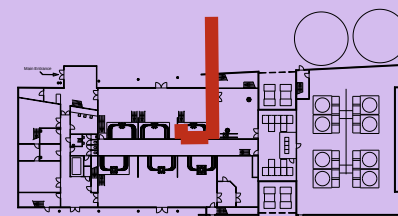


FELICE
FTICR MS

FELICE
Clusters

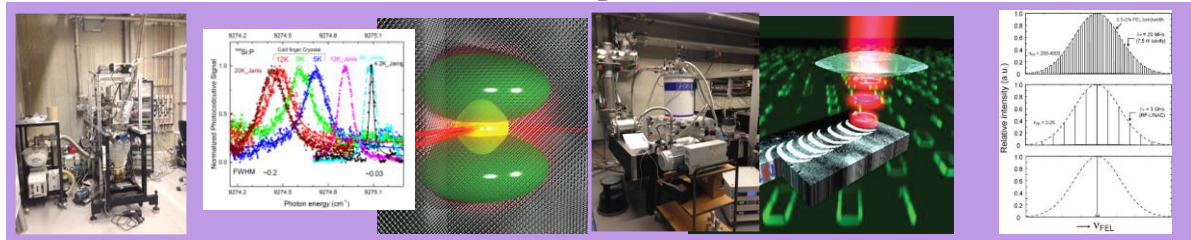
User laboratory 2 – FELIX & FELICE

IR/THz FELs in Magnets

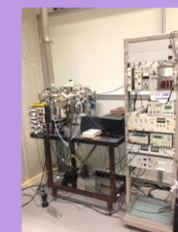


User laboratory 1 – FLARE & FELIX

Molecular Ices Dil fridge Pump-probe HHG



Cold 22-pole ion trap



Ambition NWO-I: climate-neutral in 2050

- **Buildings**
- **Operations**
- **Research**

Energy use @ HFML-FELIX :

- Contributing to a solution to grid congestion
- Tailoring infrastructure & experiments

Sustainability

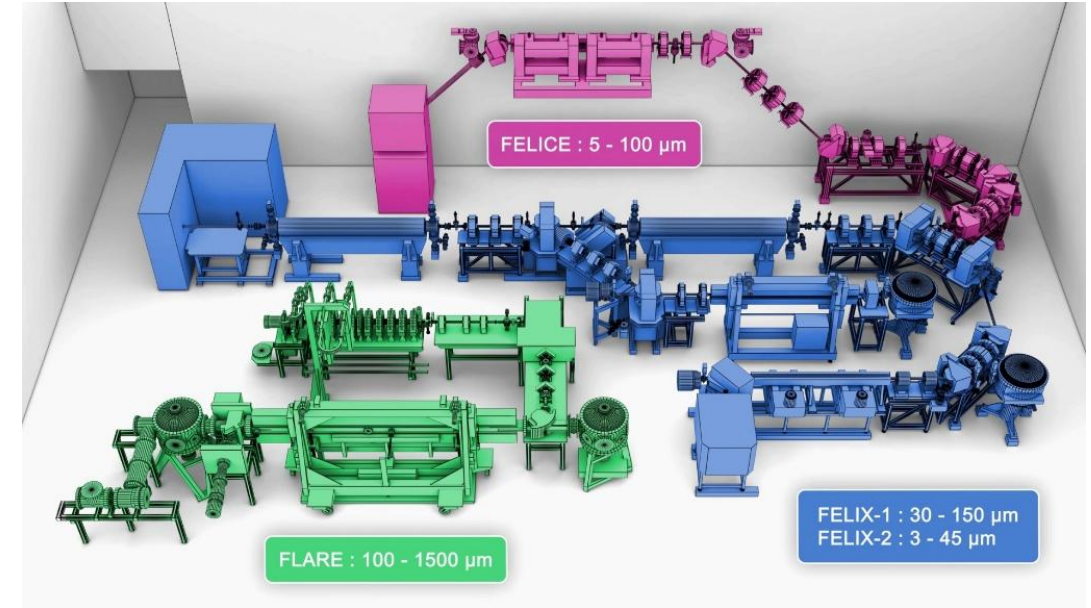
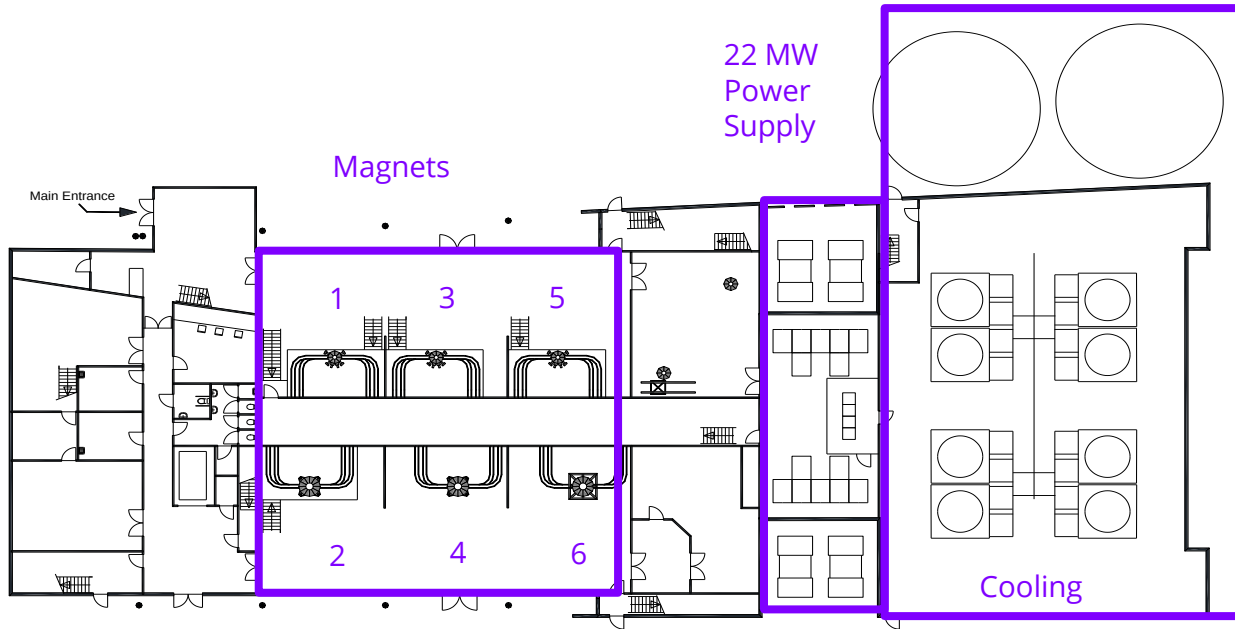
At NWO-I, we are working on research that helps find solutions to the challenges of today and tomorrow. Sustainability is an integral part of this.

We are working towards climate-neutral operations by 2050 at the latest. Our approach focuses on making our research and research infrastructure, our buildings and our operations more sustainable. We are reducing energy consumption and emissions where this has the greatest impact, and making conscious choices in areas such as mobility and procurement. In addition, we encourage research to be conducted as sustainably as possible, without compromising on scientific quality. This sometimes even leads to sustainable innovation, such as more efficient computing or energy solutions for the future.

We do this together: by respecting the unique character of our institutes, and by encouraging collaboration and the exchange of best practices. In this way, we are building, step by step, a future-proof and inspiring research environment with a lasting impact on society.

<https://www.nwo-i.nl/en/about-nwo-i>

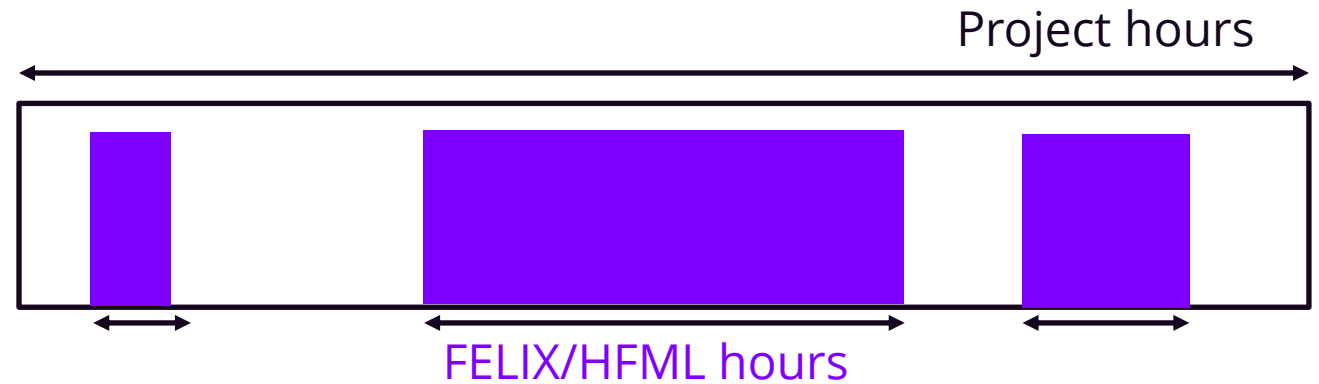
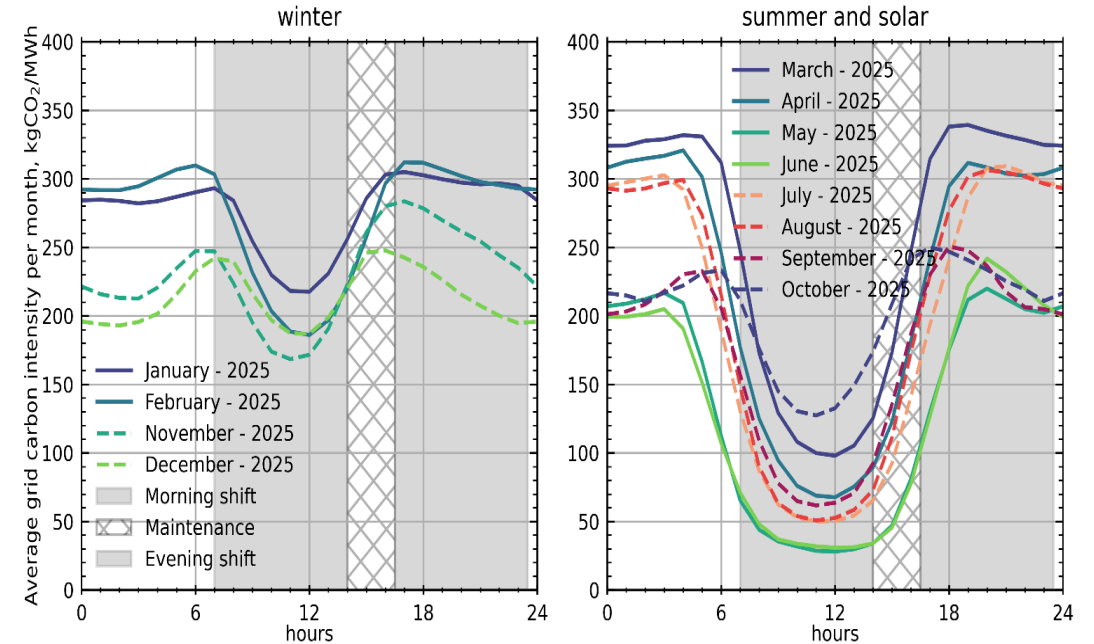
Research infrastructures



- Sustainable investments
- He-recycling
- Addressing grid congestion in relation to daily and annual planning
- Tailored solutions for experiments
- Operating safely

Tailoring infrastructure usage

- Smart timing of experiments
- Use of green energy
- Incorporation of superconducting magnets
 - lower energy consumption
 - longer experiments
- Additional FTEs for development, operations and technical support



<https://www.hfml-felix.nl/en/sustainability/>



Thank you for your attention
www.hfml-felix.nl

