Figure 1: CALIPSO Council meeting in SOLARIS, Krakow, Poland in May 2015.

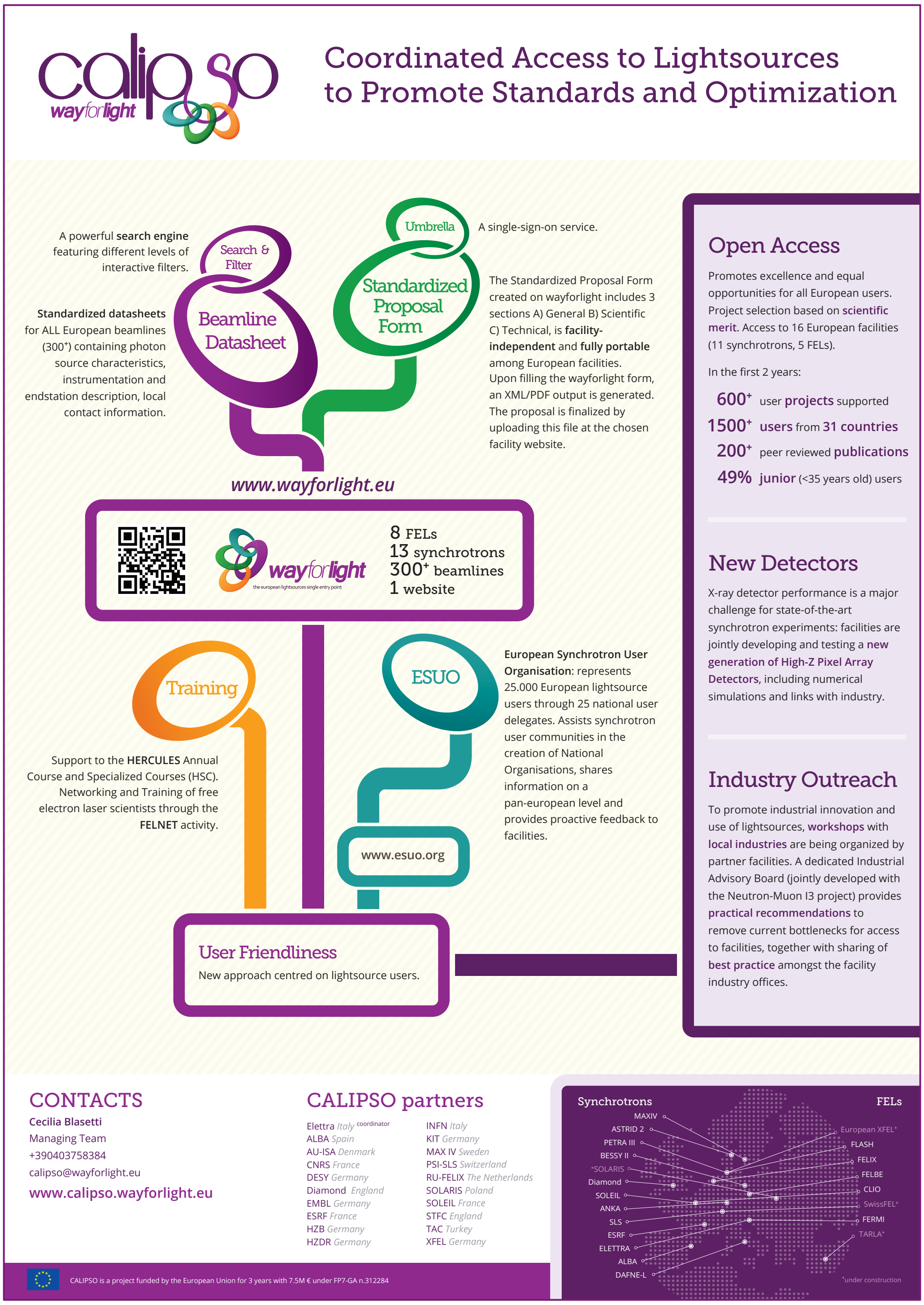


Figure 2: CALIPSO poster.

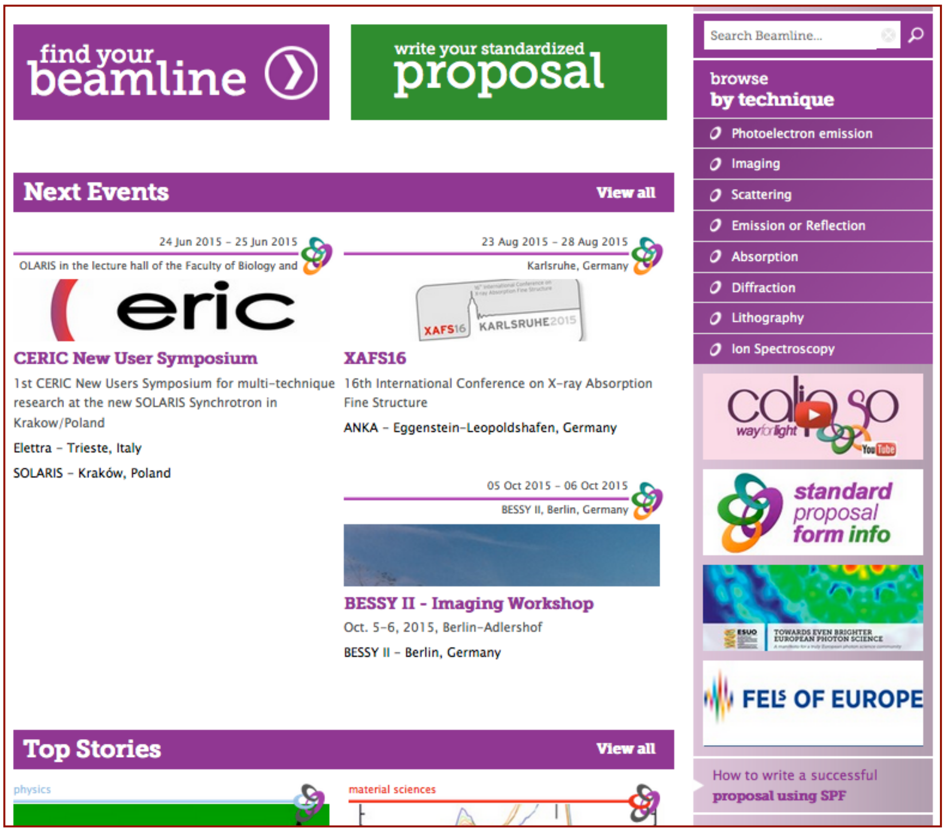


Figure 3: wayforlight homepage with links to beamlines search tool, Standardized Proposal, info pages and tutorials, facilities events and top stories.

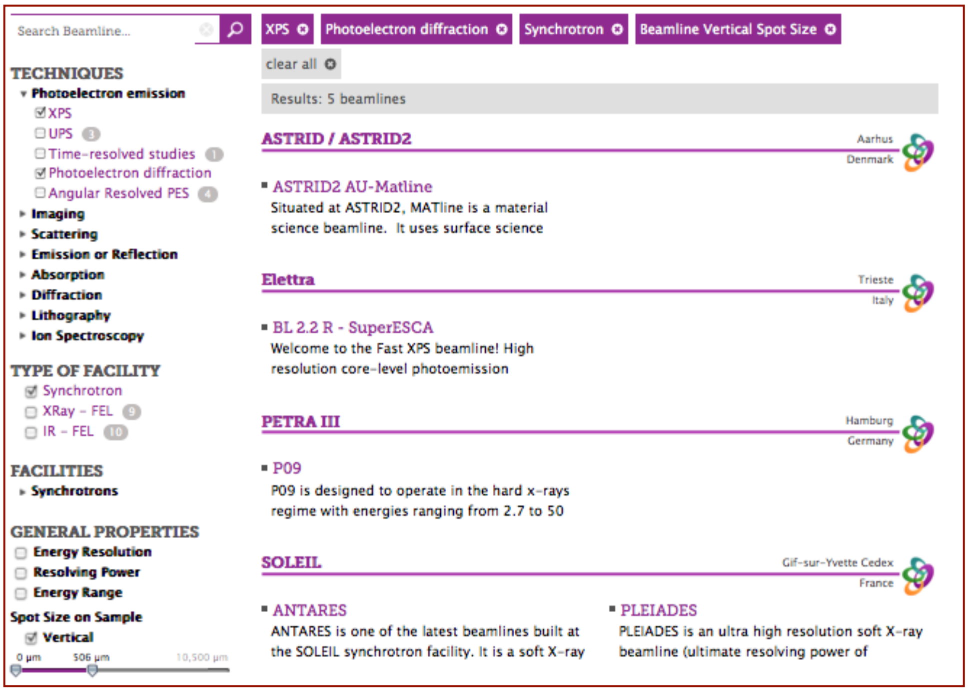


Figure 4a: Beamlines search page with active filters on technique, facility and spot size on sample.

You are in: Home / Synchrotrons / Elettra / BL 1.2 L – Nanospectroscopy

Elettra

BL 1.2 L - Nanospectroscopy

general | photon source | endstations | monochromator

Nanospectroscopy @ Elettra

The **Nanospectroscopy beamline** at Elettra operates the Spectroscopic and low energy electron microscope (**SPELEEM**), a state-of-the-art **photoemission electron microscopy (XPEEM)** providing a wide range of complementary methods with structural, chemical and magnetic sensitivity. The lateral resolution of the microscope approaches **20 nm** in **PEEM** and **10 nm** in **LEEM**. The **SPELEEM** is coupled to a high photon flux beamline, which can deliver elliptically polarised photons in the range 50 eV to 1000 eV. **Research applications** are targeted to Surface and Materials Sciences, addressing issues related to chemical and magnetic characterization of surfaces, interfaces, thin films, and nanostructures.

Beamline energy resolution	2.5×10^{-4} @ 400 [eV]
Beamline resolving power	4×10^{3} @ 400 [eV]
Energy Range	Min = 10 Max = 1000 [eV]
Max Flux On Sample	1.5×10^{13} [Ph/s] @ 150 [eV]
Spot Size On Sample Hor	Min = 20 Max = 50 [um]
Spot Size On Sample Vert	Min = 3 Max = 8 [um]
Angle of incidence light on sample value	Min = 16 Max = 16 [mrad]

Nanospectroscopy website »

TECHNIQUES

Photoelectron emission
- XPS
- UPS
- Angular Resolved PES

Imaging
- X-ray microscopy
- Photoemission EM

Absorption
- NEXAFS
- XMCD
- Time-resolved studies

CONTROL/DATA ANALYSIS

Control Software Type
Java

Data Output Type
images, spectra

Data Output Format
tiff 16 bit, ascii

Figure 4b: Nanospectroscopy beamlines datasheet – general section.

You are in: Home / Synchrotrons / Elettra / BL 1.2 L – Nanospectroscopy

Elettra

BL 1.2 L - Nanospectroscopy

general | photon source | endstations | monochromator

SPELEEM	
Type	Experimental chamber
Base Pressure	7×10^{-11} [bar]
Spectrometer	Hemispherical energy analyzer pass energy: 908 eV energy resolution: 300 meV (spectral imaging) 250 meV (diffraction imaging) 150 meV (microprobe spectroscopy)
Microscopes	Spectroscopic and low energy electron microscope (SPELEEM III, Elmitec GmbH), with magnetic triode objective and 120° separator. Imaging techniques available: LEEM, EELS-LEEM, XANES PEEM, XMC(L)D-PEEM; diffraction techniques available: μ-LEED, μ-ARUPS, μ-ARPES, μ-EELS, μ-XPD. Lateral resolution: 10 nm in LEEM, 30 nm in XPEEM Sample types: UHV compatible, flat with resistivity of few tens Ohms / cm
Other Facilities Available	Detector gating for time resolved XMCD, LEEM and LEED experiments LN cooling to 150 K. radiative and e-beam heating up to 2000K high pressure chamber with double differentially pumped QMS and pulse valves

TECHNIQUES

Photoelectron emission
- XPS
- UPS
- Angular Resolved PES

Imaging
- X-ray microscopy
- Photoemission EM

Absorption
- NEXAFS
- XMCD
- Time-resolved studies

CONTROL/DATA ANALYSIS

Control Software Type
Java

Data Output Type
images, spectra

Data Output Format
tiff 16 bit, ascii

Softwares For Data Analysis
image suite based on Wavemetrics Igor

Figure 4c: Nanospectroscopy beamlines datasheet – endstations section.

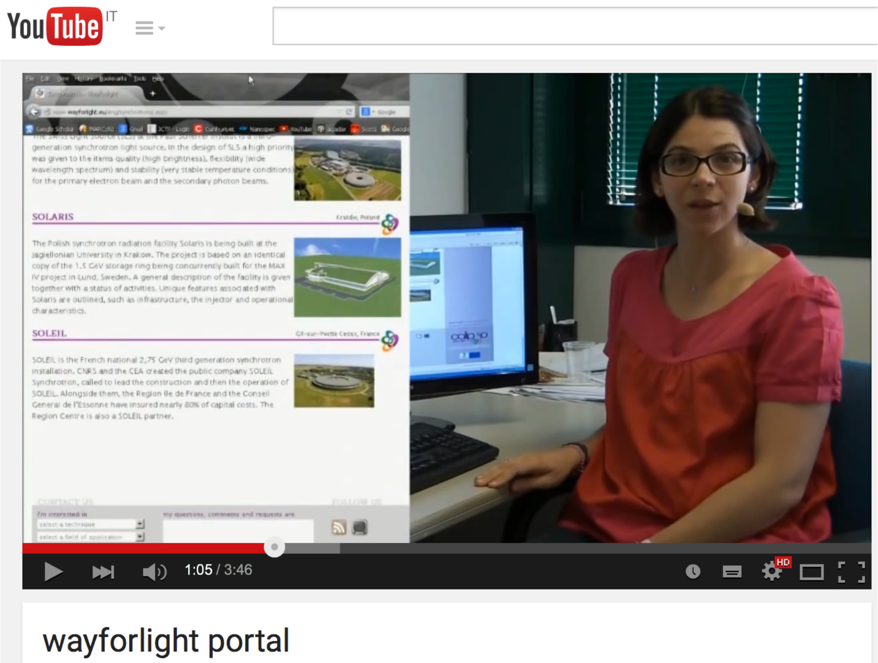


Figure 5: Snapshot from the wayforlight video tutorial about standardized beamlines datasheets.

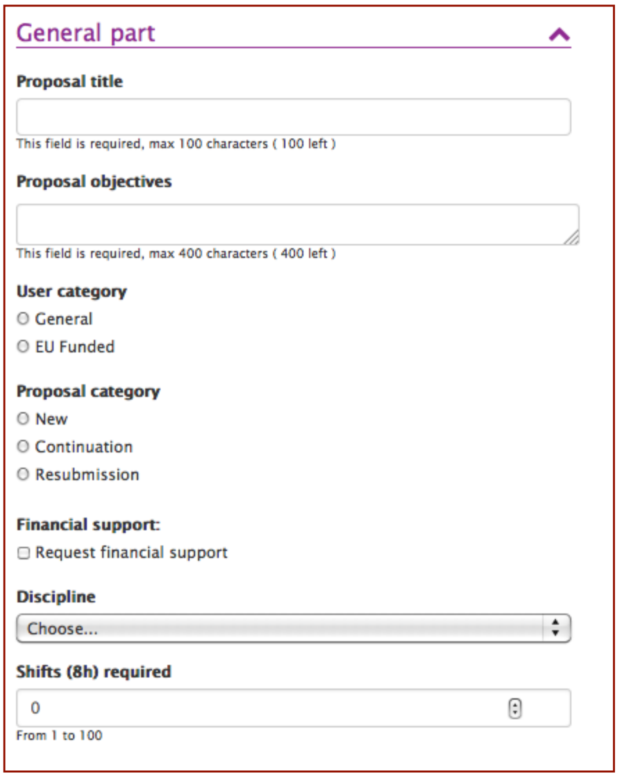


Figure 6a: Standardized Proposal Format filling page, general section.

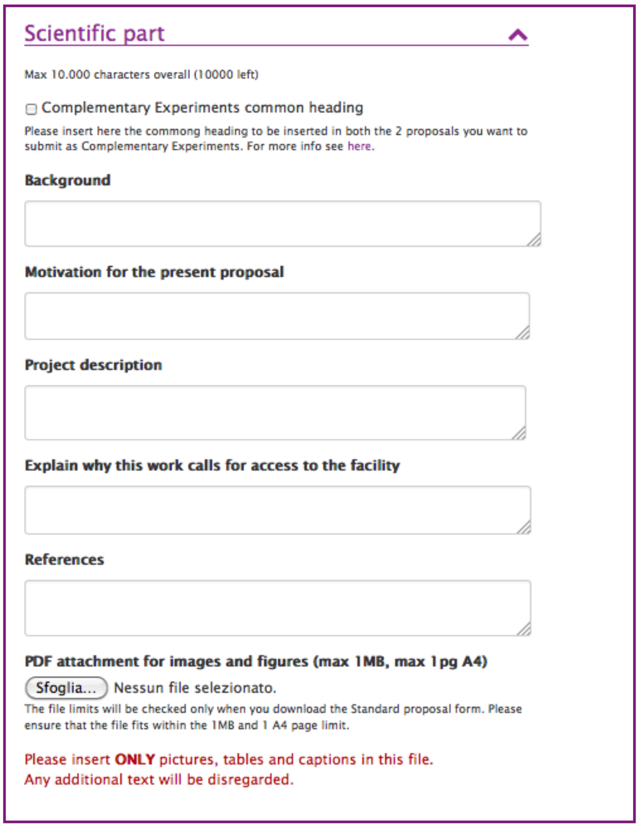


Figure 6b: Standardized Proposal Format filling page, scientific section.

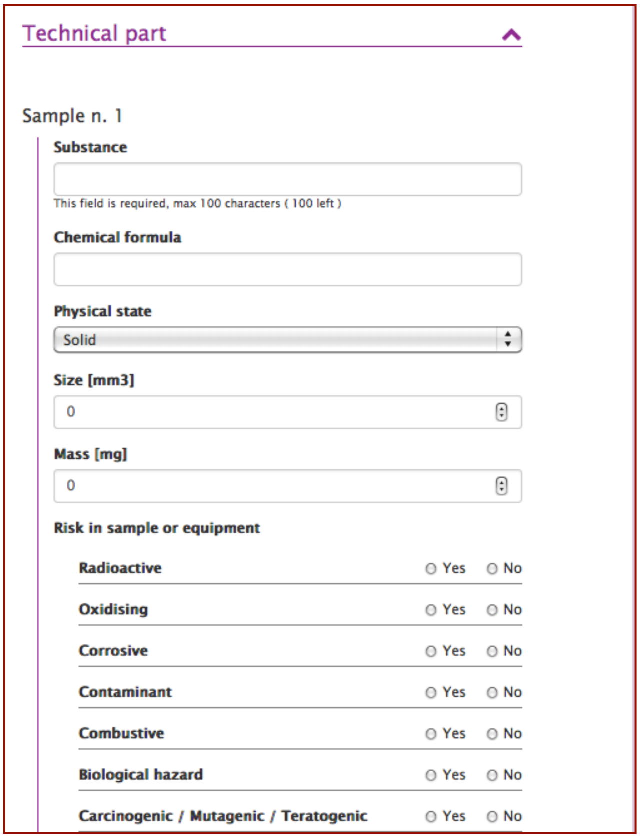
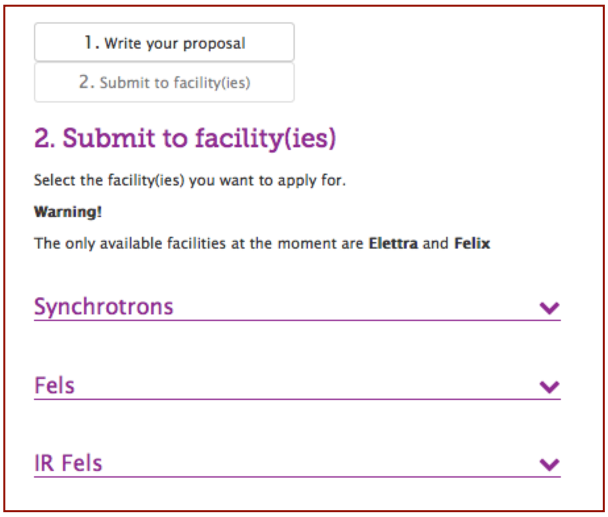


Figure 6c: Standardized Proposal Format filling page, technical section.



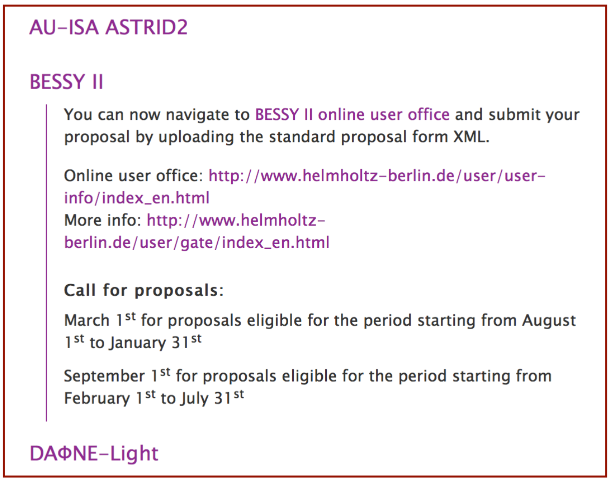


Figure 7: Standardized Proposal Format submission second step a) link to facilities page b) BESSY II section.

	Country	Acquisition Sessions
		3,290 % of Total: 100.00% (3,290)
1.	Italy	577 (17.54%)
2.	Germany	435 (13.22%)
3.	United States	275 (8.36%)
4.	France	205 (6.23%)
5.	United Kingdom	180 (5.47%)
6.	Sweden	140 (4.26%)
7.	Spain	135 (4.10%)
8.	India	89 (2.71%)
9.	Switzerland	86 (2.61%)
10.	Poland	78 (2.37%)

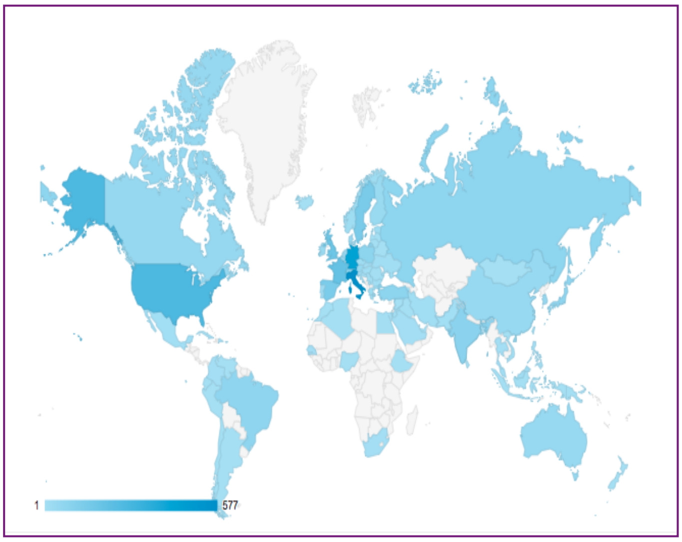


Figure 8: wayforlight visits by country, in the time period 09/2014-12/2014, a) list of top 10 countries b) map.

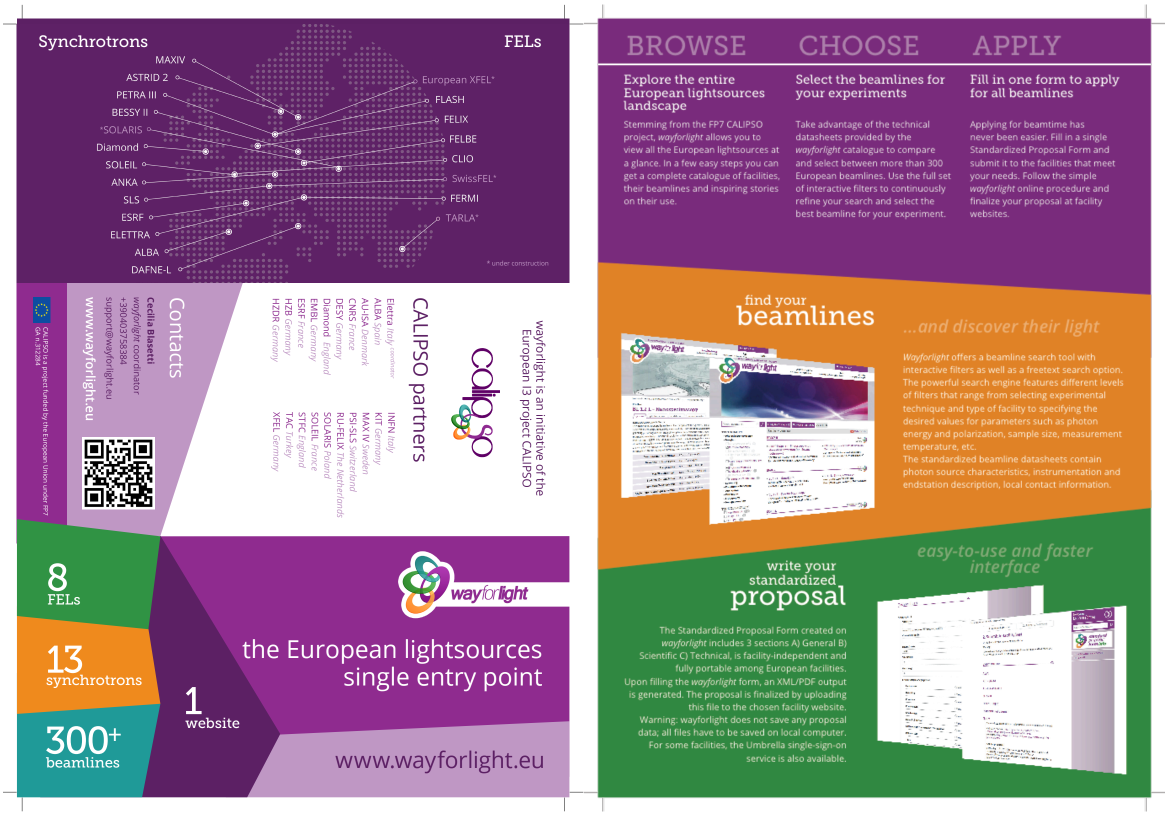


Figure 9: wayforlight flyer.

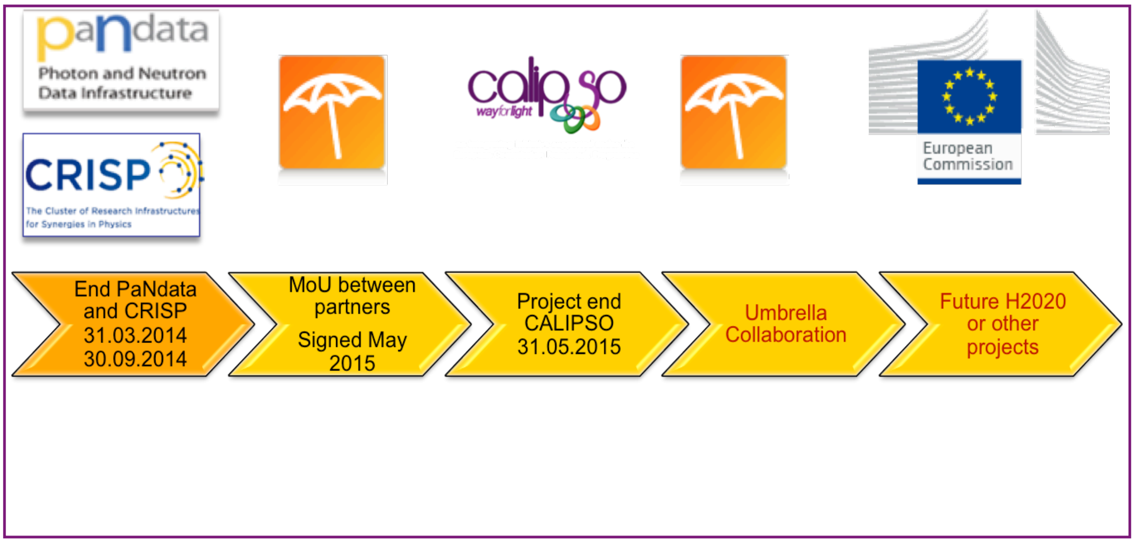
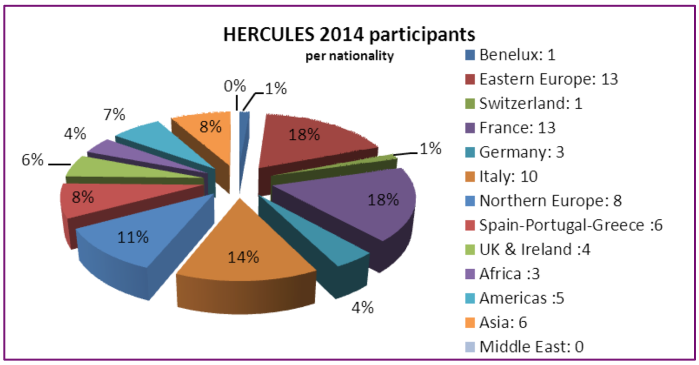


Figure 10: Umbrella collaboration roadmap.



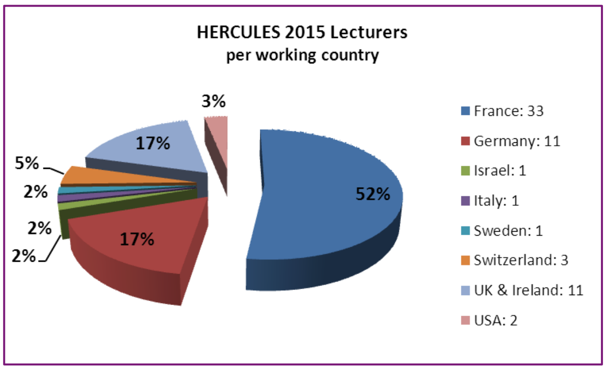


Figure 11a: the HERCULES Annual Session recruits participants from a wide range of countries. Here, the statistics for the 2014 HAS. About 37% of participants are women. 11b: the lecturers are also recruited internationally, to ensure the best specialists in their field are present during HERCULES.

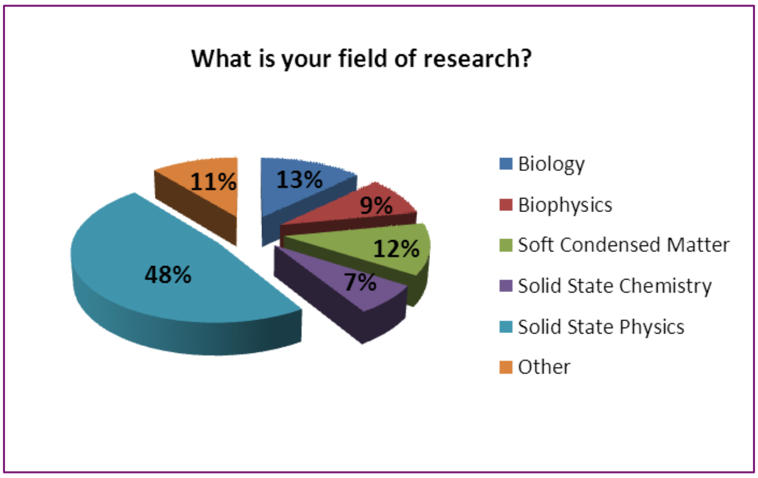
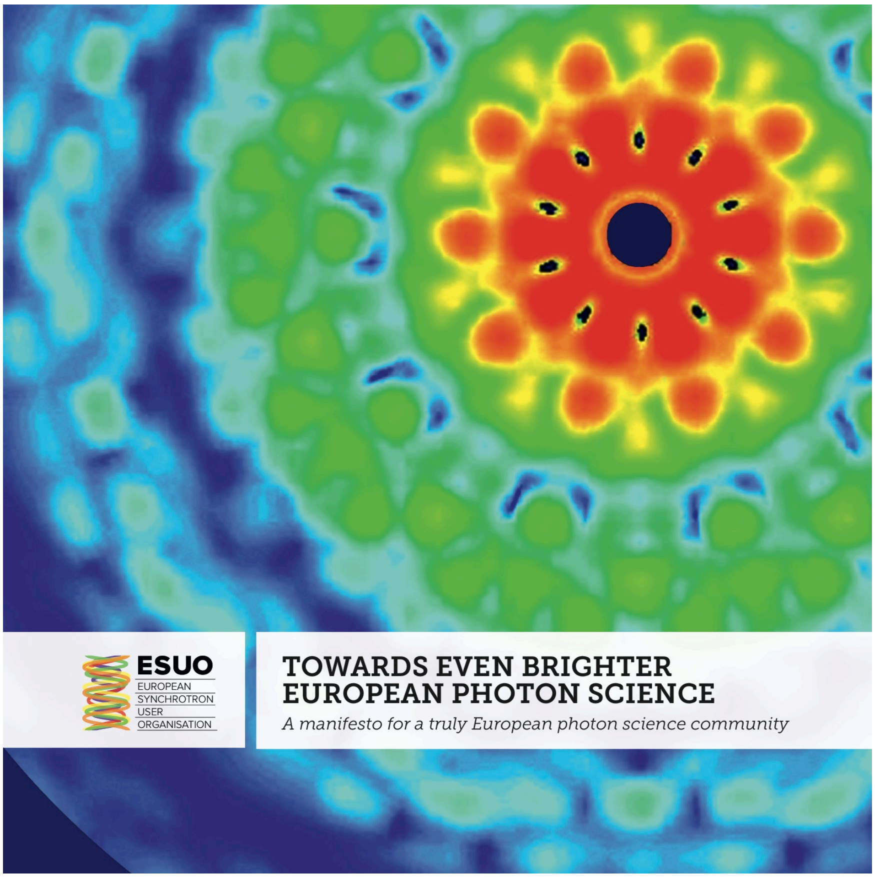


Figure 11c: participants come from a wide range of research fields. The one-month school duration allows covering topics from fundamental synchrotron and neutron theory to specialized topics. This allows training young researchers not only for their current research (~75% are PhD students) but also for their future career.

Figure 12: group photo of the participants to the Hercules annual session 2015. Since 1991, about 2000 young researchers have been trained during the one-month annual session, and around 300 during the one-week specialized schools.

Figure 13: a) Science@FEL 2014 conference at PSI, Switzerland b) PhotonDiag 2015 at ICTP in Trieste, Italy.

Figure 14: Group picture of the 2015 General ESUO meeting hosted by HZB, Berlin, Germany.



CONTENTS

FLOODLIGHT OR SPOTLIGHT?

For enlightening science you need them both

Dear Reader,

Crystallography is the shotgun approach at its best. You shoot a large number of photons at a crystal, which is nothing else but a vast number of orderly arranged atoms or molecules. Some photons interact with parts of the crystal, but each of these interactions is too weak to gain much information from it. However, all interactions together reveal fantastic insights into the probe. This is how we learned about the structure of sodium chloride and DNA decades ago. Since then, the structures of many molecules have been revealed, the mechanism of energy transfer in solar cells understood, and the long-time stability of materials analysed – in the floodlight of photon sources called synchrotrons.

But sometimes you need a different approach, for instance when you cannot grow crystals that survive a continuous flood of photons, or when you study extremely fast processes like some catalytic reactions. In these special cases, free-electron lasers are the tools of choice. They provide much more photons in much shorter flashes.

Which tool is superior? The synchrotron's floodlight or the free-electron laser's spotlight? It turns out: none. Both approaches are complementary. They are both shaping our knowledge about matter.

Why am I telling you this? We at ESUO, the European Synchrotron User Organisation, see the complementarity of synchrotrons and free-electron lasers as an analogy for floodlight and spotlight approaches in European science funding.

The floodlight approach of the European Commission in FP6 and FP7 enabled a worldwide unique open access system to European light sources with equal research opportunities for scientists from a broad range of different thematic areas. We are very grateful for the strong and generous EC support granted to the light source facilities and user community during the last decade.

However, the EC philosophy has changed to a spotlight approach in Horizon 2020 – focusing on seven societal challenges.

Photon science has been contributing to these challenges and will continue to contribute. Moreover, we do support the idea of focused objectives. **But we have many reasons to believe that the new spotlight approach will keep many scientifically important projects in the dark** – projects that do not fit one of the seven challenges.

This will affect many of the 25,000 photon scientists ESUO represents and will endanger Europe's pole position in photon science in the long term.

Photon science is unique in its multidisciplinarity. This uniqueness calls for a mixture of floodlights and spotlights. The price tag will not be high, the leverage huge.

This brochure is a contribution to a hopefully fruitful discussion to which we are looking forward to.

Yours sincerely,

Prof. Dr. Dr. h.c. Ullrich Pietsch,
Chair of ESUO

4

TOWARDS EVEN BRIGHTER EUROPEAN PHOTON SCIENCE

A manifesto for a truly European photon science community

Research at light sources provides insight into all **societal challenges**. This unique feature of photon science stems from its multidisciplinary openness and vast spectrum of methods. Light sources are like Swiss Army knives: They allow scientists to examine the structure of matter and facilitate research projects that shed light into the medical field, into food security, sustainable agriculture and forestry, into climate change and clean energy, into green transport as well as into resource efficiency. The contributions of photon science – for instance in information technology – also affect the innovative, reflective and protective power of societies.

Photon science is truly **multidisciplinary**; at light sources, scientists from many different disciplines meet – be it bioscience, chemistry, physics, or environmental science. Moreover, many projects in photon science are truly **interdisciplinary**, bringing together experts from many fields who examine a common scientific problem. Multidisciplinarity and interdisciplinarity release synergies and foster the exchange of knowledge and experience.

While light sources are vast machines, they serve numerous, but rather small project teams for a short time each. These teams typically comprise only a few scientists. This does not leave much room for overspecialization. Instead each team member has to develop a vast spectrum of problem-solving techniques. As such, light sources are **ideal environments for the education and training of young people**.

1 Advocating open access to European light sources

While there are more than a dozen light sources in Europe, the facilities differ in potential and focus. Together, they provide a spectrum of methods that cannot be offered by each single one. European scientists should be able to select the source best suited for their research.
Thus: We keep strongly advocating quality-based open access to all European sources for all European photon scientists. Fully Europeanizing the access to national light sources will allow specialization of the sources for the merit of the scientific output, independent of whether a country operates an own national light source or not.

2 Forming a pan-European light source user community

In recent years, European light source users became increasingly more connected – not least thanks to EU-based funding schemes. Scientists from countries across Europe – with national light source and without – met and have formed networks on various scales. These crystallization points of a stable user community strongly need further support.
Thus: We will continue to build a pan-European multidisciplinary light source user community – among others by organizing conferences, providing a central online access point to European light sources at wayforlight.eu, and connecting user subgroups.

3 Minimizing administrative obstacles

Good science knows to make clear why it is to be funded. But the more forms applicants have to fill in, the less time they can spend on pushing back the frontiers of knowledge. For small projects not exactly fitting one of Horizon 2020's seven societal challenges, the bureaucratic obstacles may become just too high.
We encourage everyone to discuss with us how to keep funding these projects possible. The prospective leverages are too high and the multidisciplinary possibilities of light sources are too promising, to miss this opportunity of thinking out of Horizon 2020's box.

4 Increasing competition to increase competitiveness

The more scientists, the more ideas. Competition pushes the quality of the scientific outcome to an even higher level. The fittest ideas survive and increase Europe's competitiveness with respect to other world regions such as the USA or Asia.
Thus: A central objective of a European light source user community must be to spur on to ever-greater achievements. A pan-European market of scientific ideas will help to be ahead of the rest of the world – not just scientifically.

5 Training scientists hands-on

Europe is no uniform space. There are more and less developed regions, light sources are distributed unevenly. This must not result in reduced scientific opportunities for qualified scientists from countries without local national light source. Providing access and on-site experience is for the benefit of everyone.
Thus: We are determined to participate in a European training network that promotes photon science throughout Europe and provides hands-on practicums at European light sources.

6 Assisting the industry in innovating

Light sources do not only offer beam time to publicly funded science, they also address industrial research. Yet, many industrial sectors in many European countries are not fully aware of these methodological possibilities. This has prevented and still prevents opportunities for innovation.
Thus: We will include the European industry in our efforts and show – through focused outreach activities – how to best benefit from modern light sources. There is no doubt that the involvement of the European industry will lead to exciting innovations and increase Europe's competitiveness.

Figure 15: Extracts from ESUO manifesto brochure, available on www.esuo.org and www.wayforlight.eu .

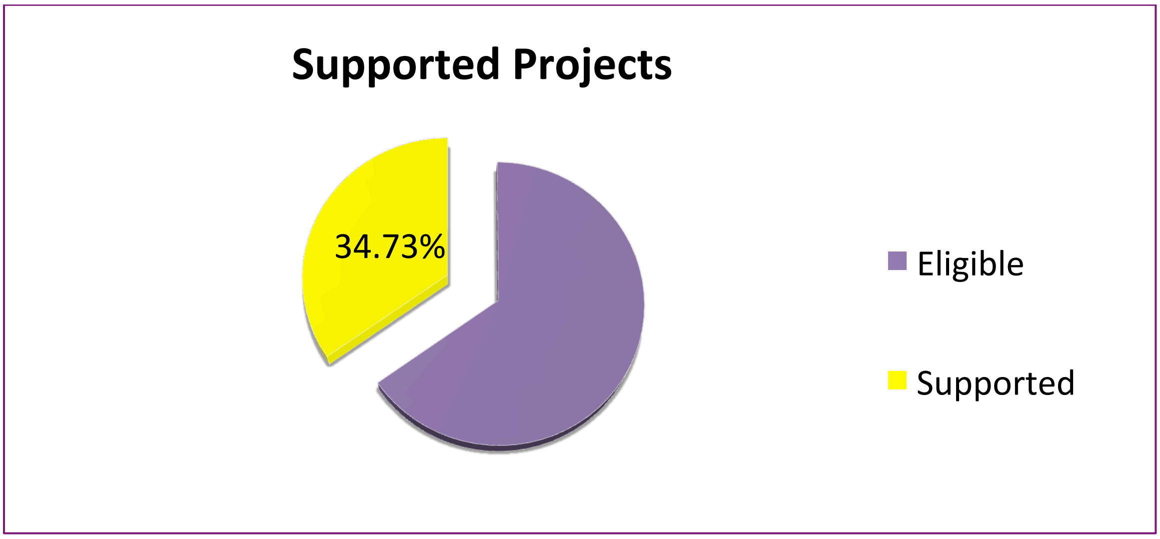


Figure 16: Transnational Access supported projects witin the whole CALIPSO duration (1/6/2012-31/5/2015).

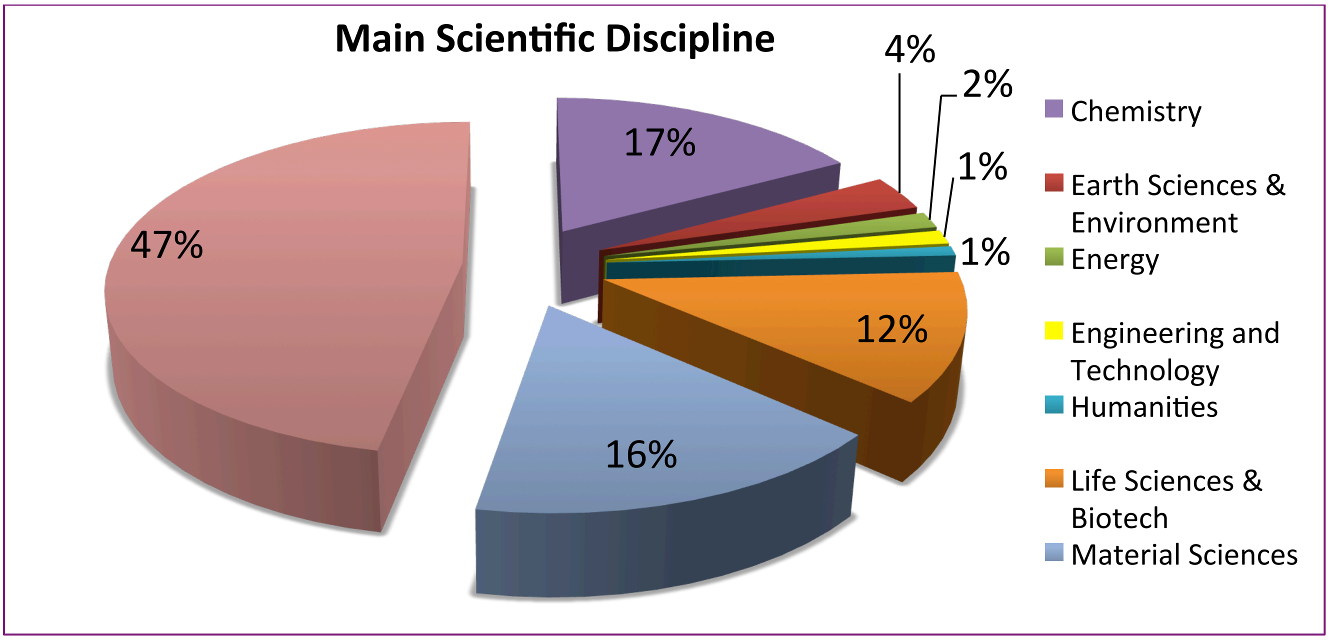


Figure 17: Supported experiments by main scientific discipline.

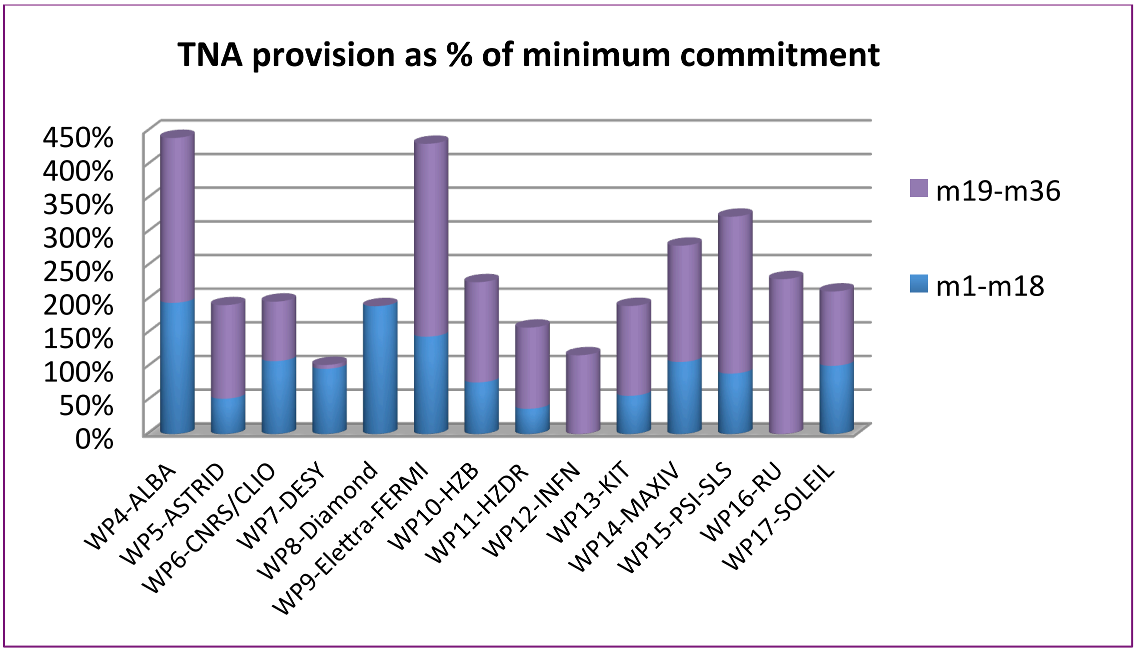


Figure 18: Transnational Access provision by beneficiary, as compared to minimum committment.

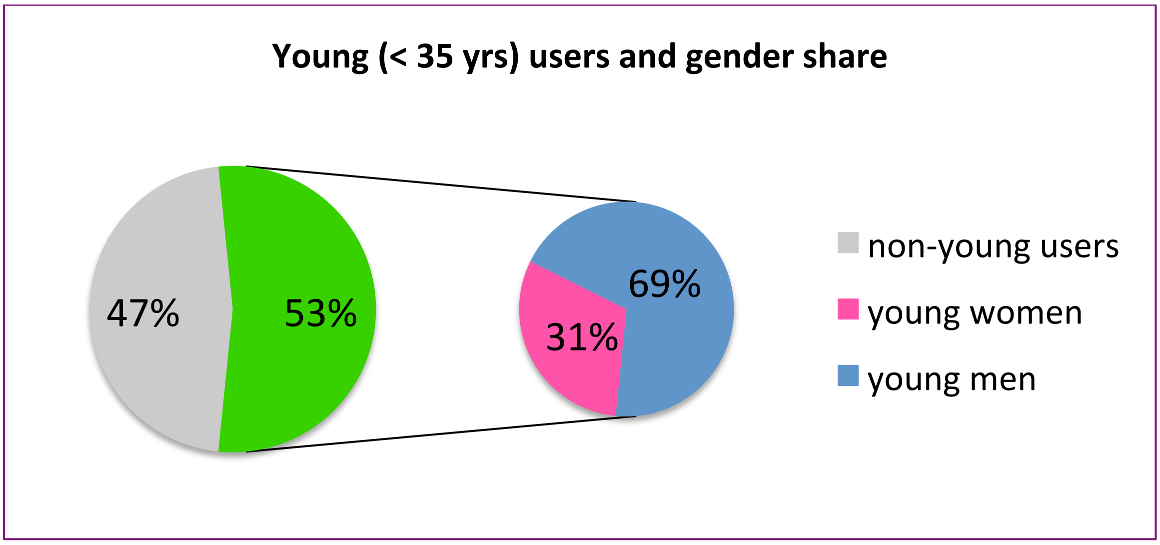


Figure 19: Young users and gender share within young users.

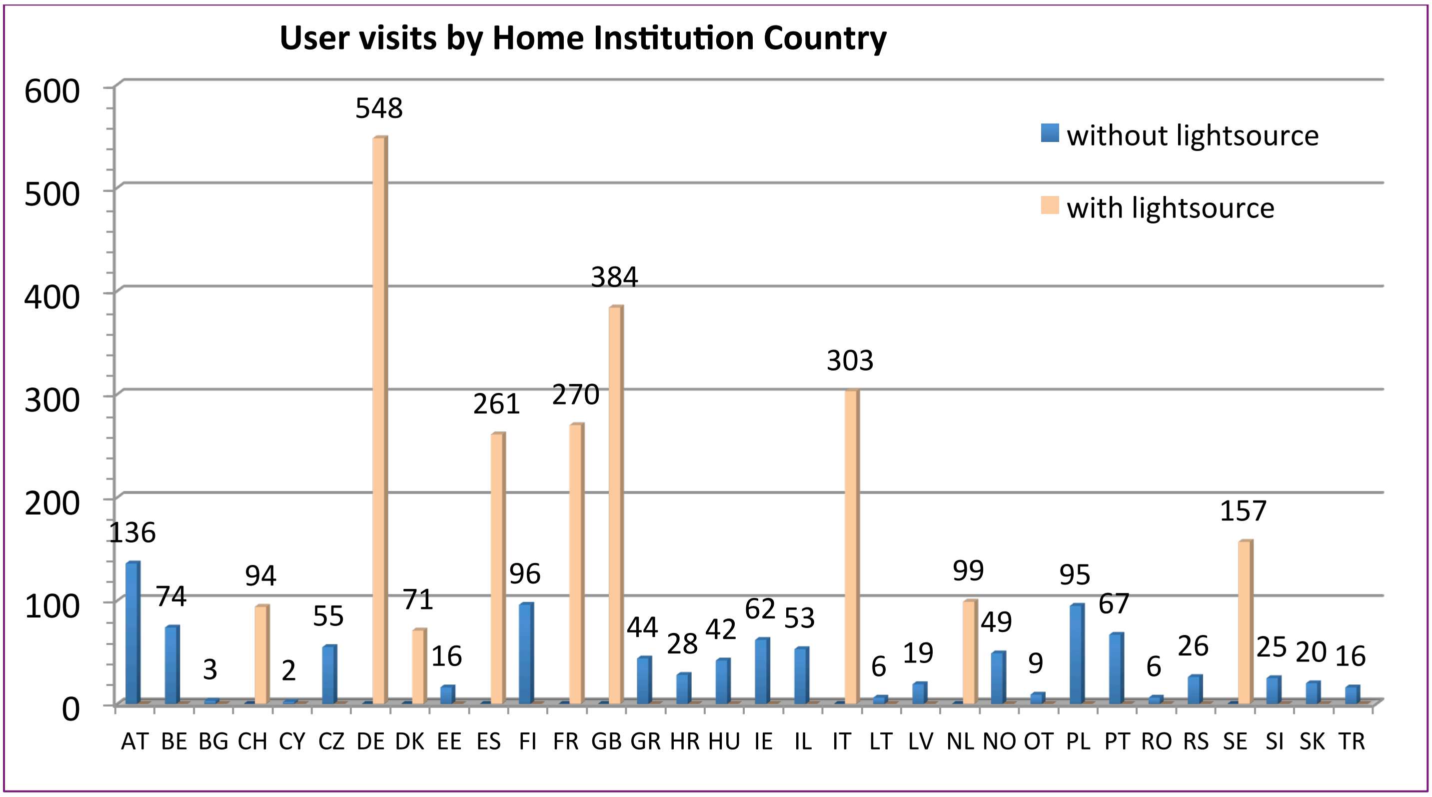


Figure 20: User visits by Home Institution Country.

FLAG	COUNTRY	USERS	FLAG	COUNTRY	USERS
	Austria (AT)	73		Israel (IL)	31
	Belgium (BE)	59		Italy (IT)	224
	Bulgaria (BG)	1		Lithuania (LT)	5
	Switzerland (CH)	77		Latvia (LV)	7
	Czech Republic (CZ)	32		The Netherlands (NL)	68
	Cyprus (CY)	2		Norway (NO)	26
	Germany (DE)	424		Poland (PL)	69
	Denmark (DK)	48		Portugal (PT)	45
	Estonia (EE)	14		Romania (RO)	3
	Spain (ES)	175		Serbia (RS)	1
	Finland (FI)	43		Sweden (SE)	112
	France (FR)	190		Slovenia (SI)	16
	United Kingdom (GB)	262		Slovakia (SK)	17
	Greece (GR)	23		Turkey (TR)	11
	Croatia (HR)	16	-	Other countries (OT)	16
	Hungary (HU)	33			
	Ireland (IE)	36		***TOTAL***	***2159***

Figure 21: CALIPSO supported users by Home Institution Country – table with total figures.

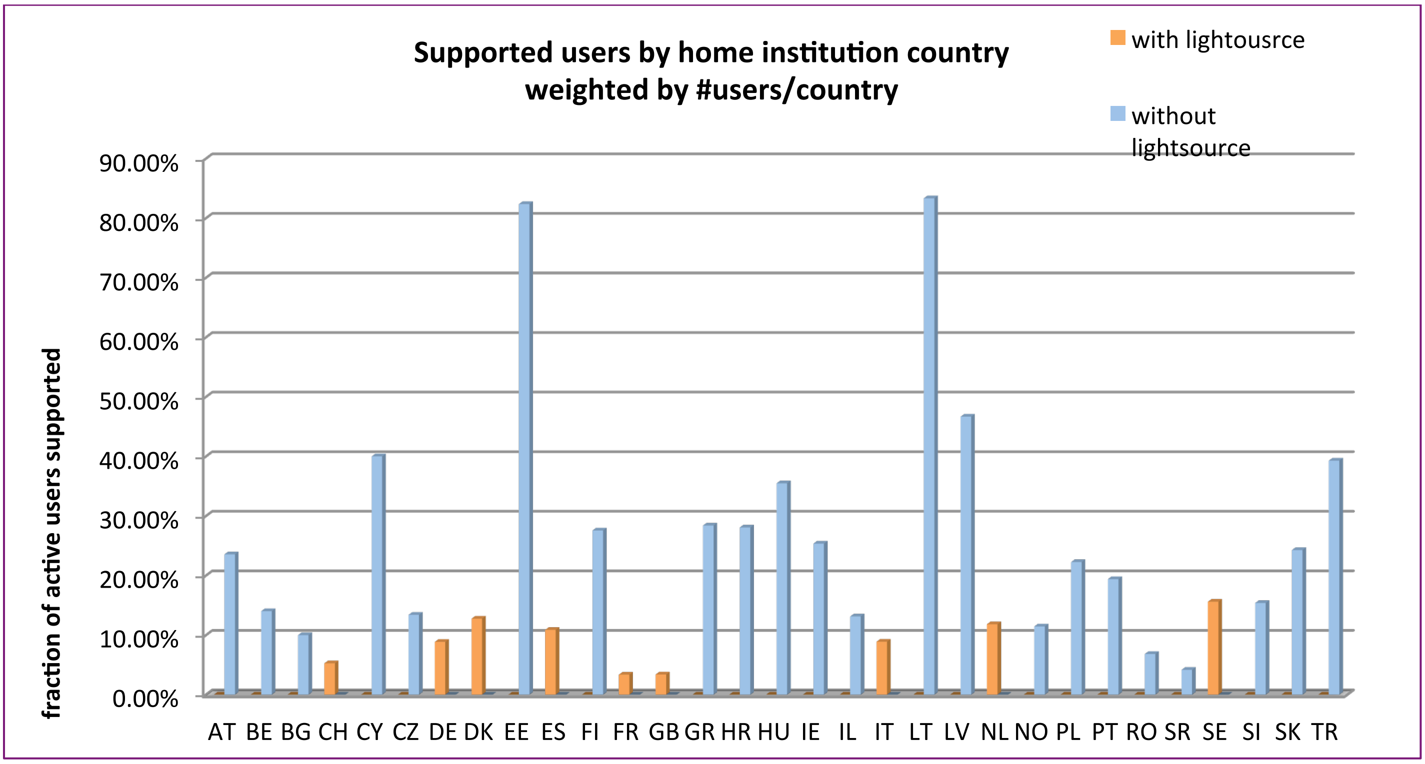


Fig. 22: Supported users by Home Institution Country, weighted by # of active users per Country.

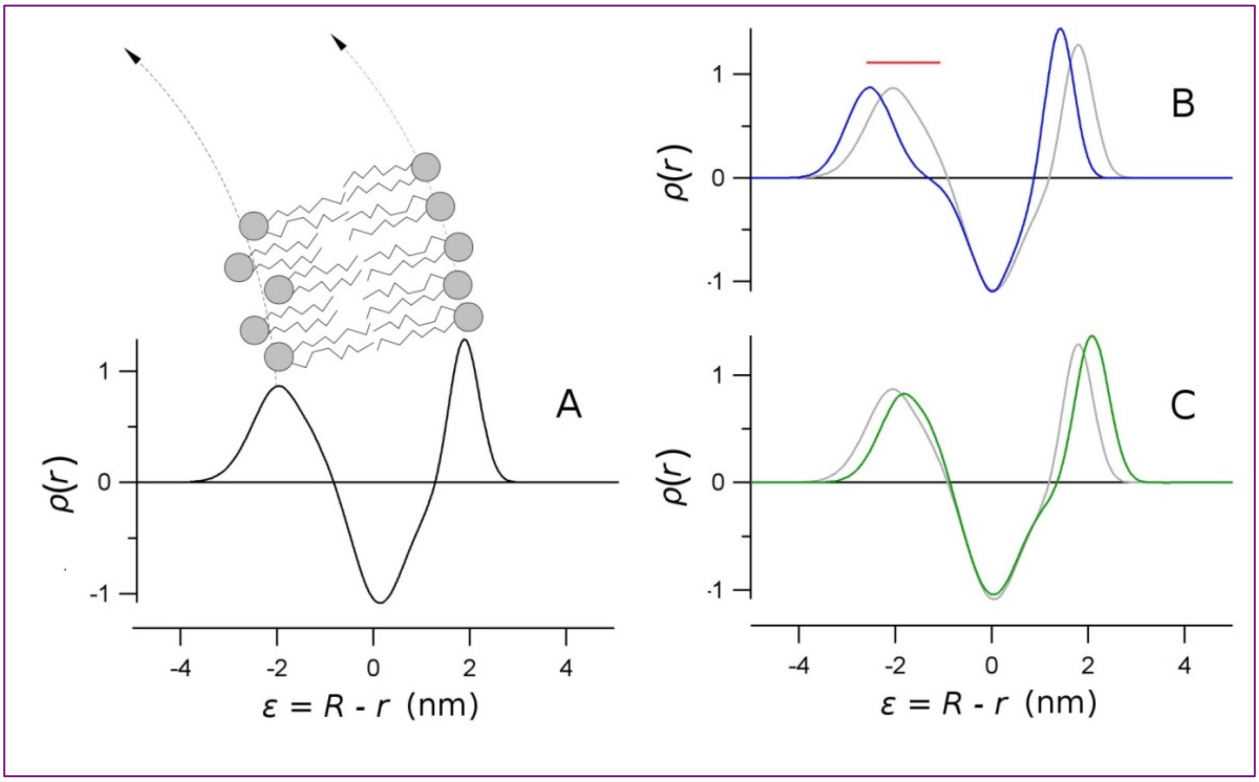


Figure 23: ALBA TNA - the electronic density, ρ(r), of the phospholipid bilayer models. ε is the distance from the center of the bilayer, and R is the radius of the phospholipid large unilamellar lipid vesicles (LUV); ρ(r) is expressed in arbitrary units. A: The calculated ρ(r) profile obtained from parameters for the untreated LUV bilayers, with a depiction of bilayer structure and arrangement. Circles represent plausible head-group locations. B and C: The ρ(r) of bilayers of the models corresponding to LUVs treated with 1 μM VX-770 and 3 μM VX-809, respectively. The ρ(r) of the untreated bilayer is shown in grey in each panel to enable better comparison.

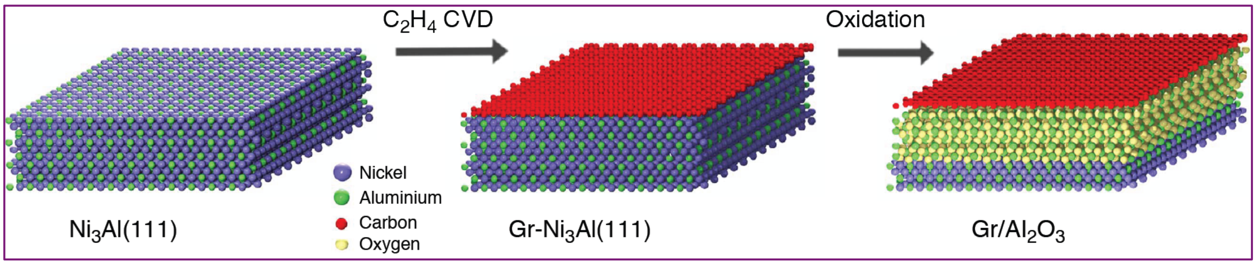


Figure 24: AU-ISA TNA - bottom-up synthesis of a graphene-oxide-metal system. The graphene is initially grown on the metallic $Ni_3Al(111)$ surface. After the growth, oxygen is intercalated under the graphene, leading to an oxidation of the metal and the formation of a thin alumina insulation between the graphene and the metal.

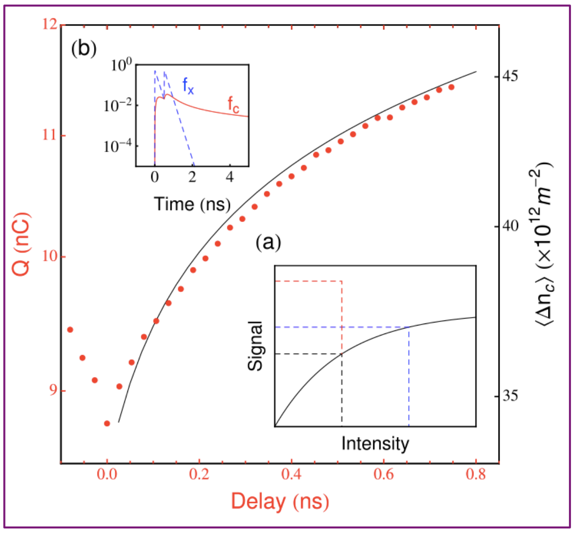


Figure 25: CLIO TNA - *the time-domain "pump-pump" experiment. The observed integrated photocurrent is shown against the time delay between the pulses (red points). Insert (a) cartoon of the pump-pump effect. (b) An example calculation of the excess electron densities for a time delay of 0.5ns at an energy density of 0.6 Jm-2 per pulse.*

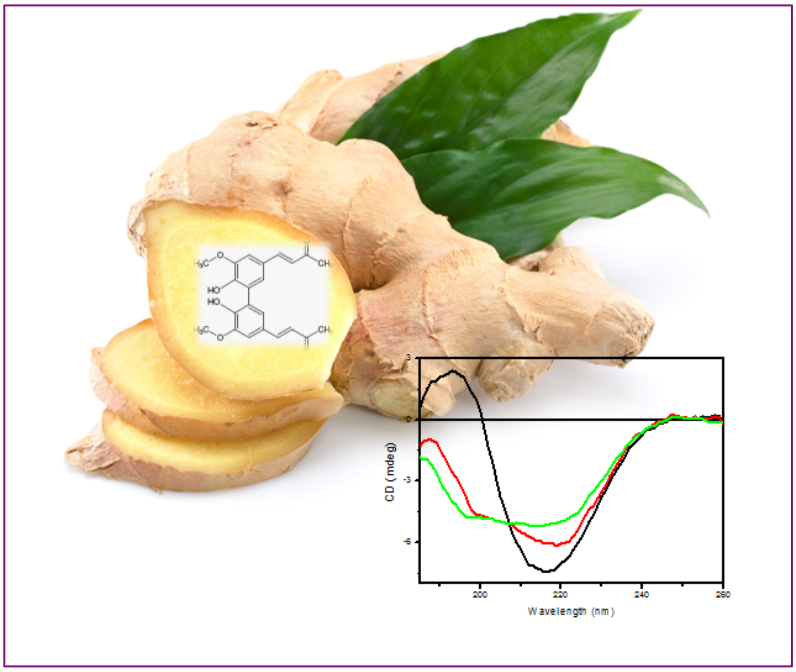


Figure 26: DIAMOND TNA - turmeric plant and leaves. The chemical structure of the curcumin by-products tested (left) and UV spectra of the misfolding protein alone or in the presence of the compound (right).

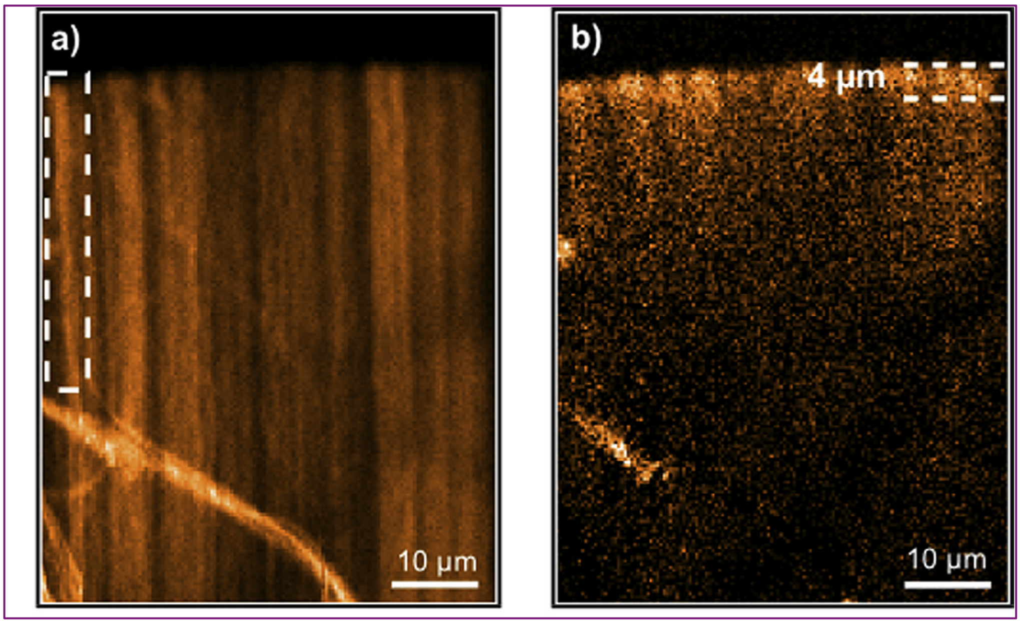


Figure 27: Eletra-FERMI TNA a) 54x70 um^2 image of vertical carbon nanotubes after 10 min of nitrogen plasma treatment b) Same region with intensity given by carbon atoms bonded or neighbour to nitrogen atoms.

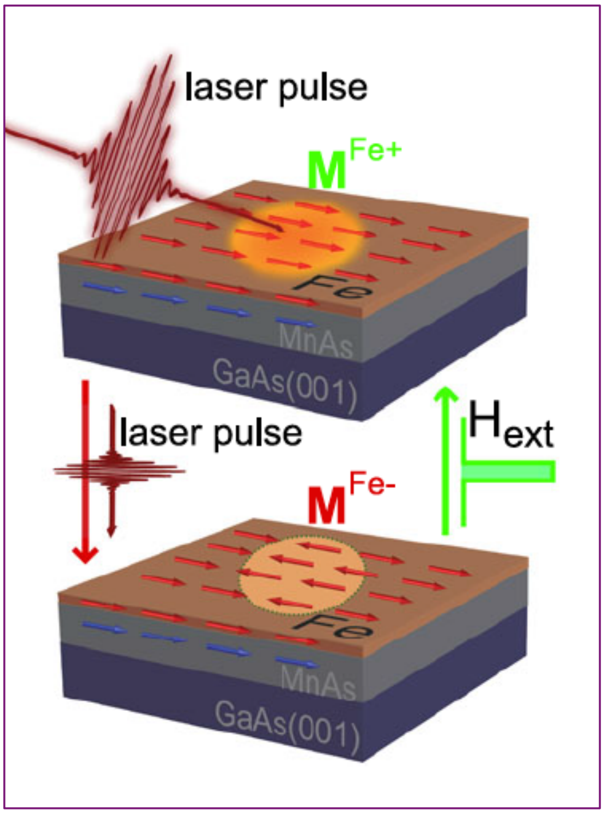


Figure 28: Elettra-FERMI TNA - the first laser pulse produces local heating, that modifies the surface layer magnetization. The second pulse allows to reveal this change.

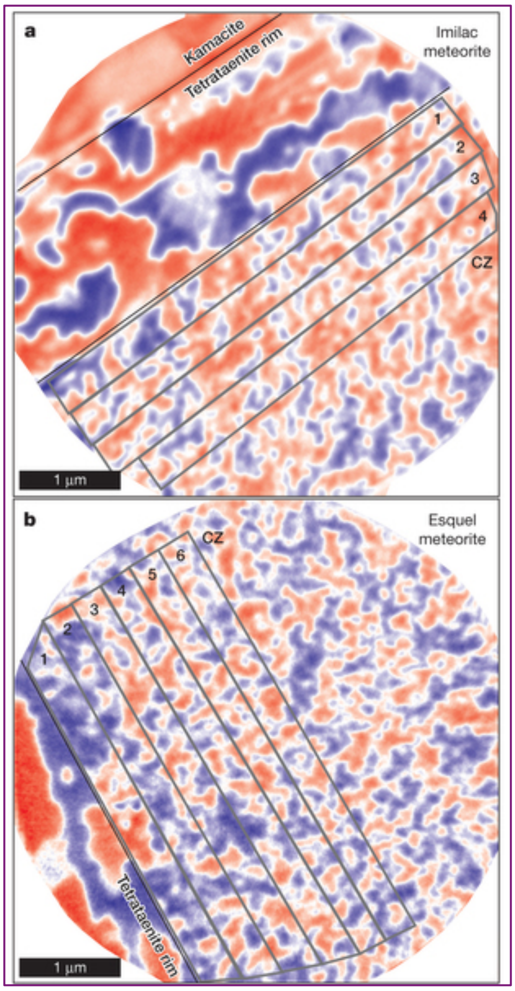


Figure 29: BESSY II TNA - representative XPEEM images of the kamacite, tetrataenite rim and CZ in the Imilac and Esquel pallasites. (Fig. 1, J. Bryson et al., Nature, 517, 472-475, 2015, doi:10.1038/nature14114).

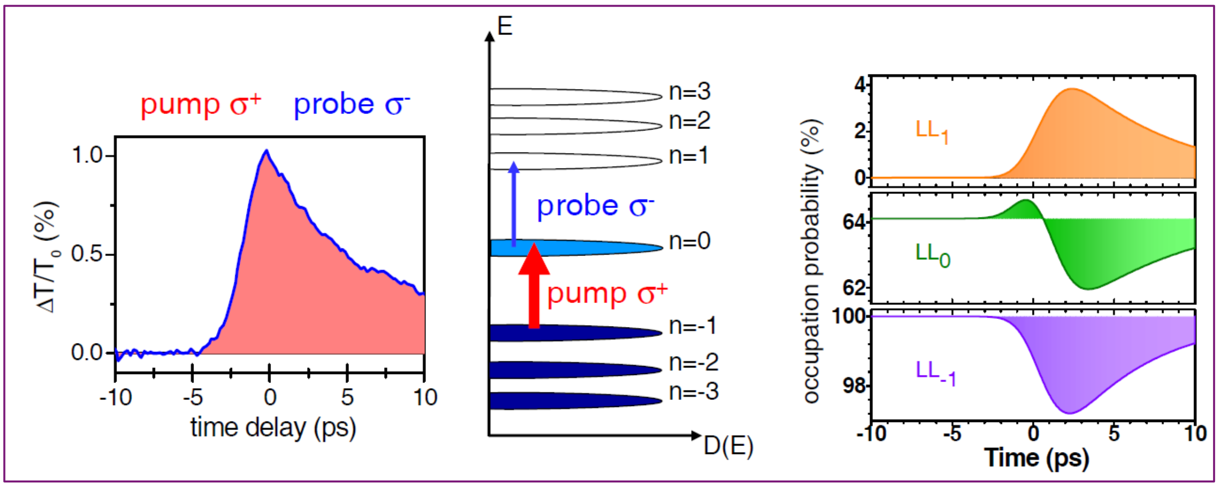


Figure 30: FELBE TNA - experimental pump-probe signal (left), excitation scheme (middle) and level occupation calculated using microscopic theory (right).

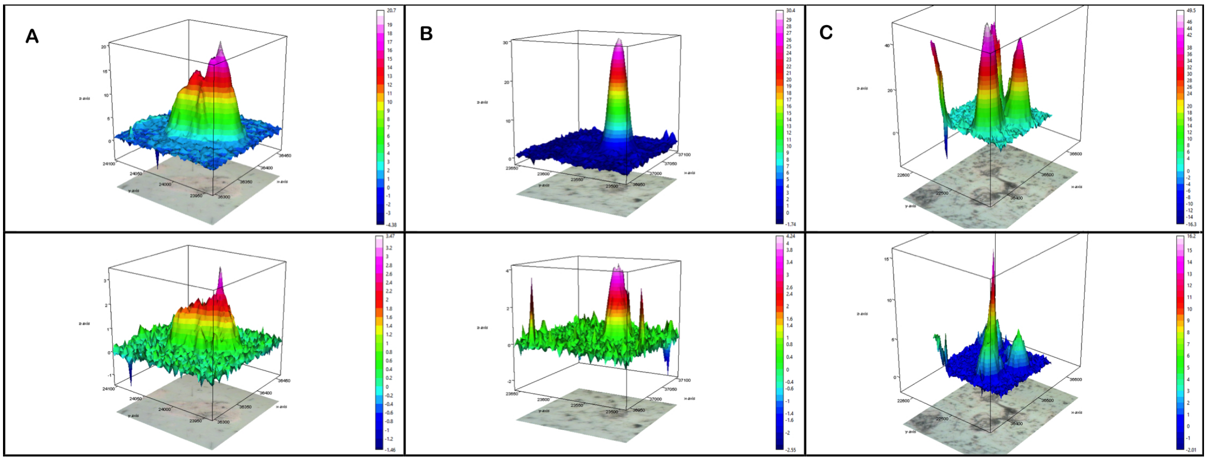


Figure 31: DAFNE-Light TNA - distribution of amides (top) and fatty acyl chains (bottom) absorption in single cells exposed to 0 (A), 1 (B) and 5 (C) μg/cm² crocidolite asbestos fibers for 24 hours.

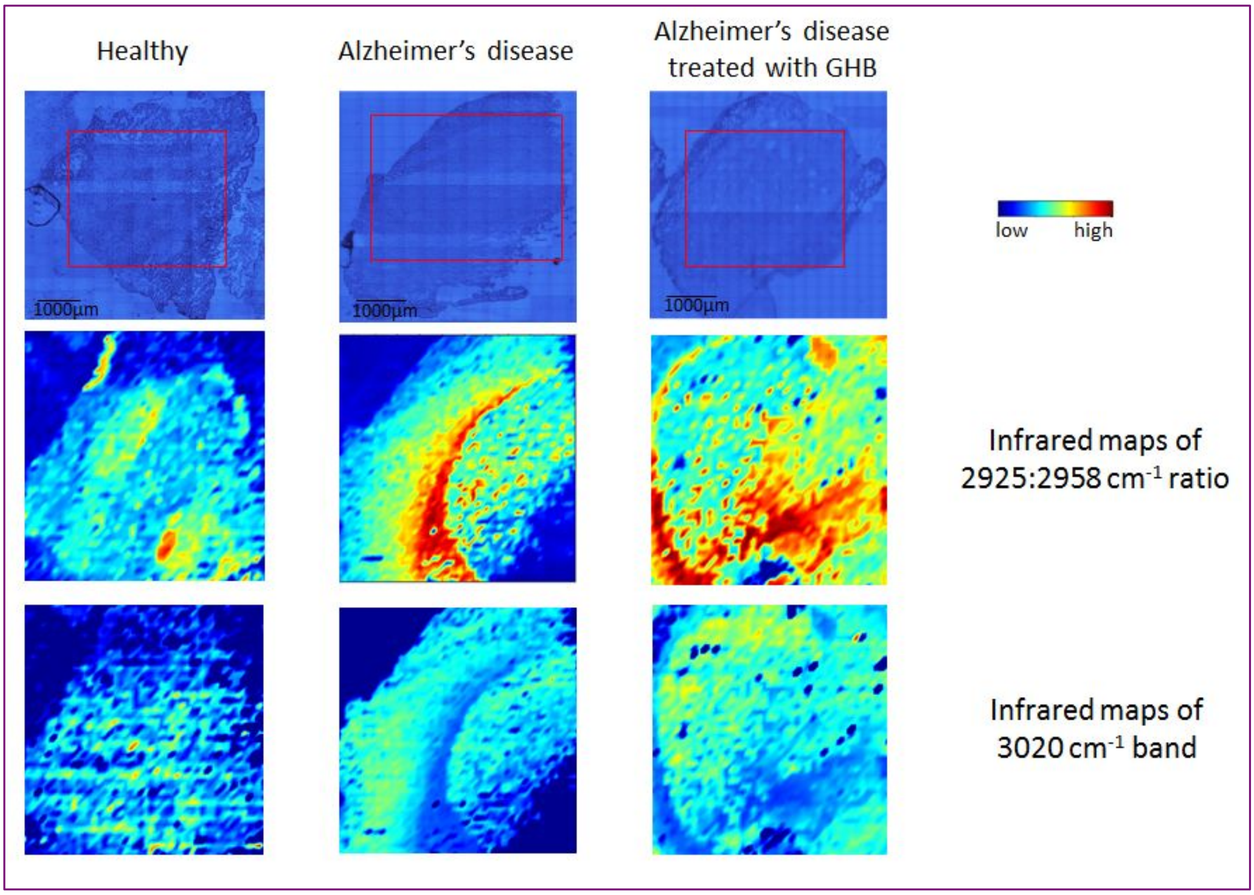


Figure 32: ANKA TNA - infrared maps of heakth vs Alzheimer's disease tissues, without and with GHB treatment.

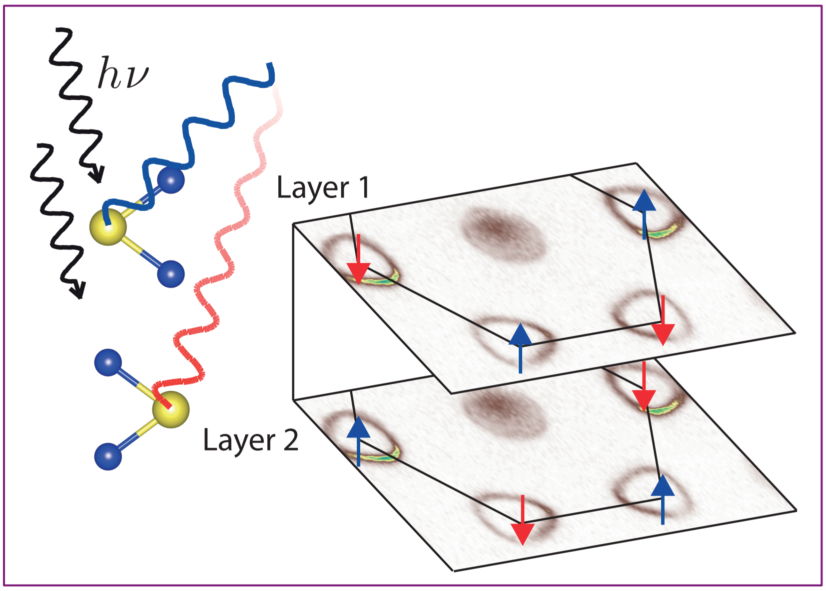


Figure 33: MAXIV TNA - angle-resolved photoemission measurements of WSe_2 throughout the Brillouin zone, schematically showing the complex layer- and momentum-dependent spin texture uncovered.

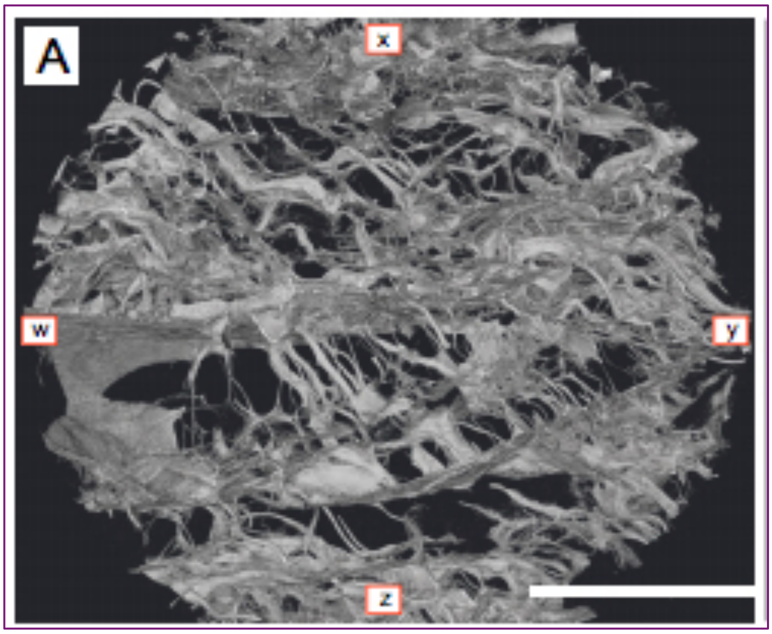


Figure 34: PSI-SLS TNA - overview of a mucograft scan (spongious layer) demonstrating the trabecular internal structure of the spongious layer of the membrane at low magnification (white bar = 600 µm).

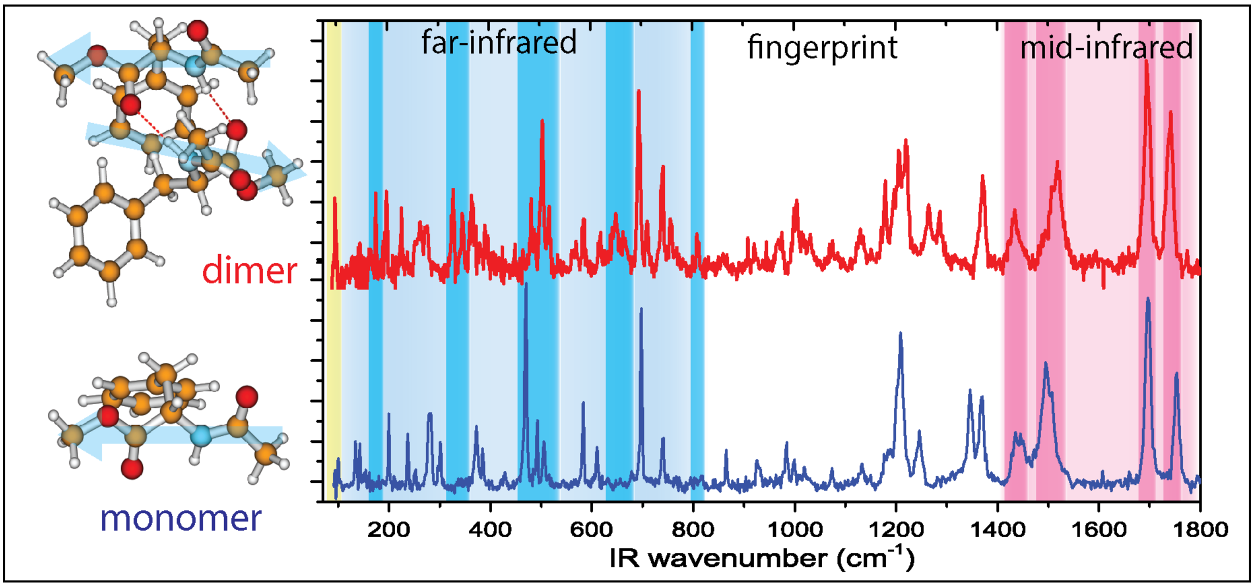


Figure 35: FELIX TNA - far-infrared spectroscopy as a superb diagnostic probe for structural characterization. Using the suite of FELIX free electron lasers the infrared and far-infrared spectrum of a beta-sheet model peptide monomer and dimer have been recorded. The mid-infrared region showing only minor differences (highlighted in pink) is found to be hardly diagnostic whereas the far-IR region showing very distinct differences (highlighted by the blue bars) provides the structural assignment.

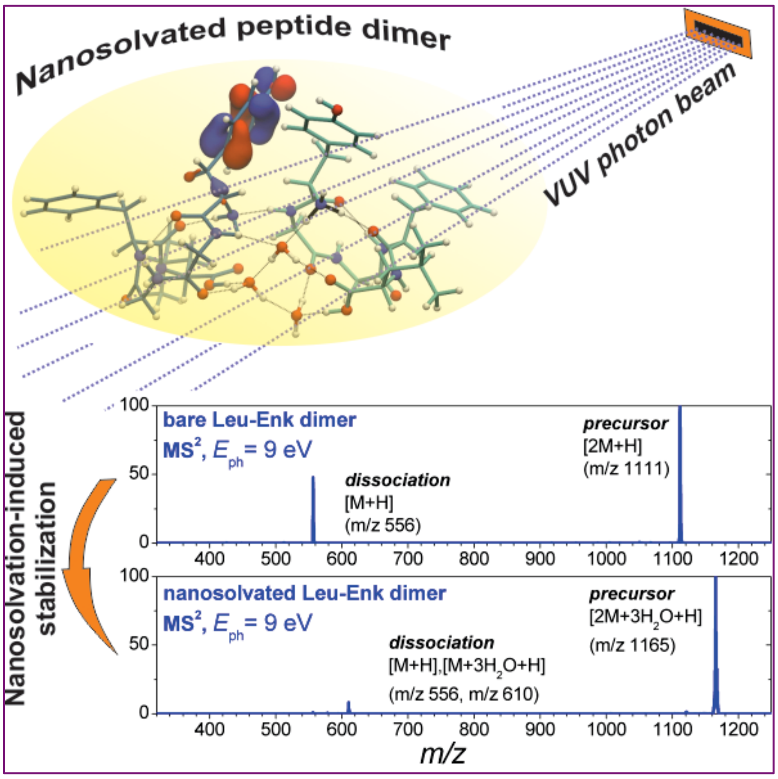


Figure 36: SOLEIL TNA - mass Spectrum showing the photofragmentation dramatic reduction of the leucine-encephaline dimer solvated by 3 water molecules. The stabilization effect is due to the bridging position of the water molecules increasing the number of effective hydrogen bonds.

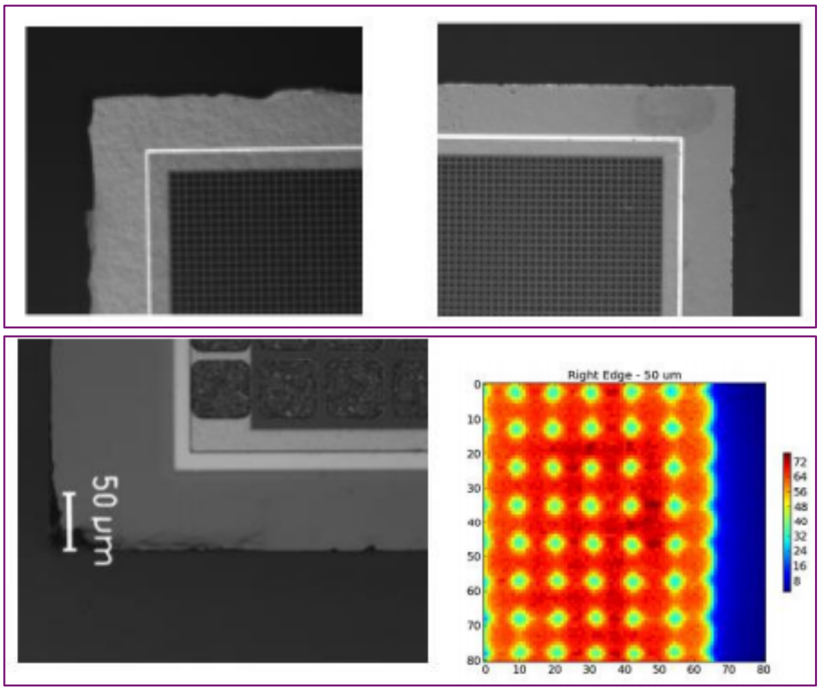


Figure 37: Improvement of CdTe sensors dicing (top). Reduction of the sensor edge width with no induced image distortion (bottom).

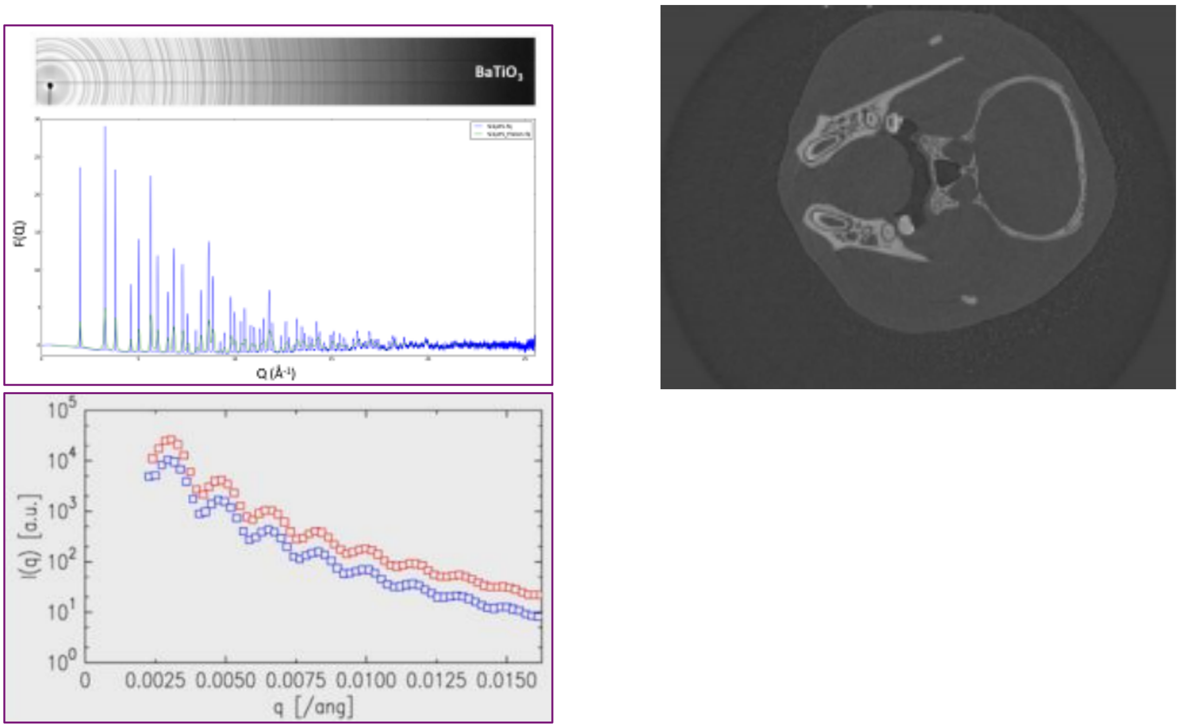


Figure 38: a) Improved resolution of powder diffraction spectra in comparison with a CCD detector of same pixel size. Small-animal CT with reduced X-ray dose (b). Improved efficiency in small-angle scattering in comparison with Si sensor (c). Data to be published.

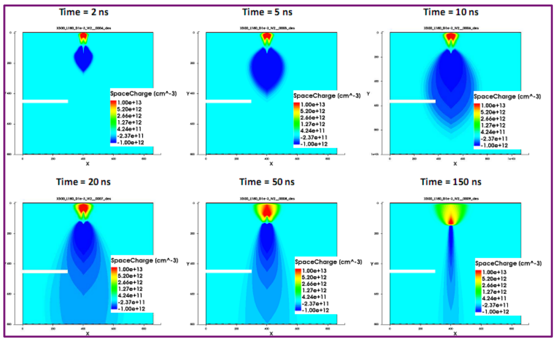
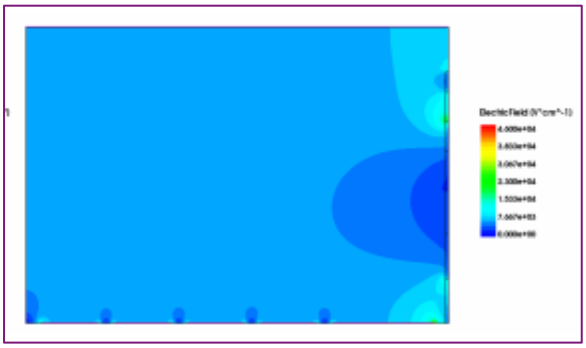



Figure 39: Space and time resolved modelling of charge transport in the sensor bulk (left). Modelling of electric field distortions induced by non homogeneous edge resistivity (right).

Figure 40: Large-area X-ray detector based on CdTe pixel sensors.

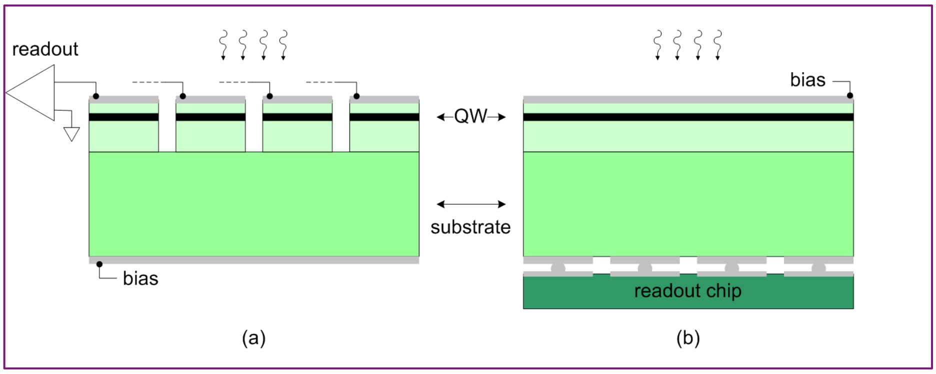


Figure 41: Schematics of the front-side (left) and back-side (right) segmented GaAs quantum well devices.