



| The European Synchrotron



Light Sources: Knowledge hubs for Industry



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AN INTERNATIONAL GOVERNANCE BRINGING TOGETHER NATIONS THROUGH SCIENCE



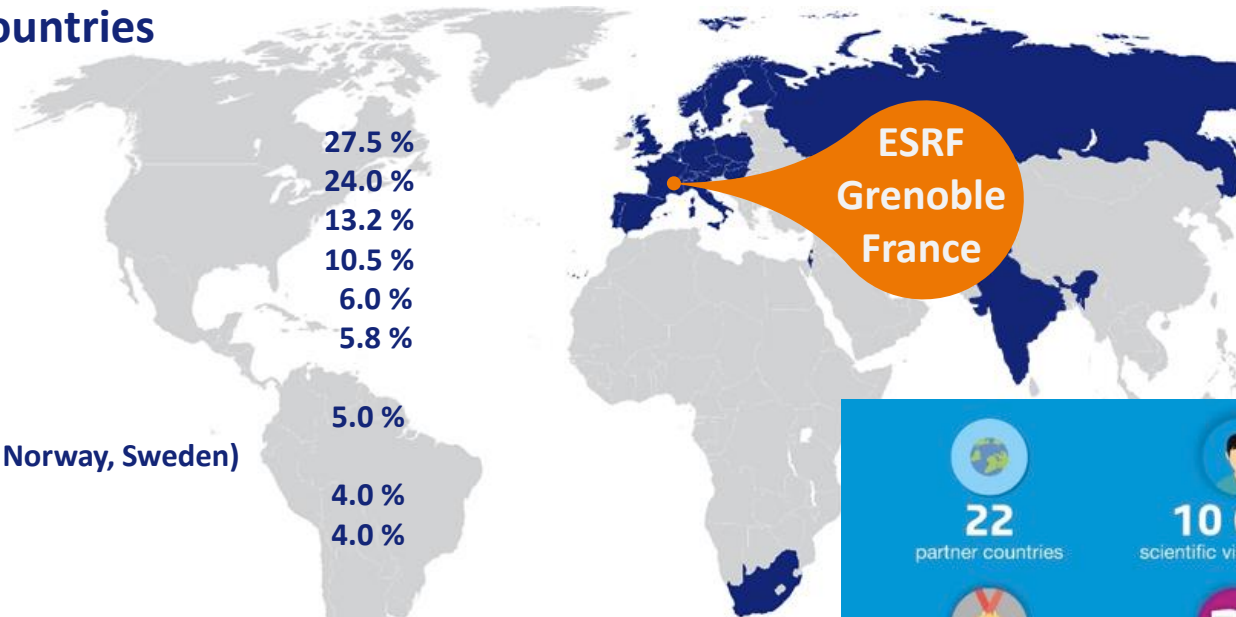
22 Partner Countries

13 Members:

France	27.5 %
Germany	24.0 %
Italy	13.2 %
United Kingdom	10.5 %
Russia	6.0 %
"Benesync" (Belgium, Holland)	5.8 %
"Nordsync" (Denmark, Finland, Norway, Sweden)	5.0 %
Spain	4.0 %
Switzerland	4.0 %

9 Associates:

Austria	1.75 %
Israel	1.75 %
"Centralsync" (Czech Republic, Hungary, Slovakia)	1.05 %
Poland	1.00 %
Portugal	1.00 %
India	0.66 %
South Africa	0.30 %



The first fourth generation high-energy synchrotron

22 partner countries	10 000 scientific visits per year	44 beamlines
4 Nobel Prizes	2000 publications per year	330 M€ over 2009-2022 2009-2022: delivery of a new portfolio of beamlines 2015-2022: construction of a new generation of synchrotron, EBS



30,000 strong: Assembling research, innovation and higher education in one location

GIANT

INNOVATION CAMPUS
www.giant-grenoble.org



EMBL



The European Synchrotron



*Version including amendments
resulting from the accession of the Netherlands
to the ESRF Convention*

Recognizing that synchrotron radiation will in future be of great significance in many different fields and for industrial applications;

In the hope that other European countries shall participate in the activities which they intend to undertake together under this Convention;

Building on the successful co-operation of European scientists in the framework of the European Science Foundation and the preparatory work carried out under its



Yes, We're

Open



- Might*
- Could*
- Should*
- Must*
- Like*

Photo by Tim Mossholder on Unsplash

WHY WORK WITH INDUSTRY?

- **IMPACT - POLITICS:** Demonstrate use of facilities, skills and intellectual property
- **GOOD SCIENCE:** Challenging, real samples
- **EFFICIENCY DRIVERS:** New access modes, standards, efficiency
- **CAREERS:** Wider opportunities for staff
- **CASH:** More resources

1. Industry as a user of light source services
2. Knowledge and technology transfer
3. Catalysing industry use

- 1. Industry as a user of light source services**
2. Knowledge and technology transfer
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1928: PERFECT GOLF BALLS

X-rays have been used for **Innovation** since their **discovery** in 1895 by Röntgen.

108 THE SATURDAY EVENING POST May 26, 1928

"This X-ray showed me how to reduce my score from 102 to 91"



HERE'S the original negative of a 'U. S.' Royal," said the doctor, "made in my own office."

"I made up my mind to diagnose my own putting trouble and to see for myself whether I wasn't missing a good many putts by using balls that were lopsided—off-center inside."

"I tested many different makes of balls and found the answer—only the 'U. S.' Royal showed a perfect center accurately

show why the "U. S." Royal is the truest putting golf ball in the world. —why, under normal conditions, it never wobbles or rolls off, and why its flight is equally dependable.

Look at these unretouched photographs

out of round. Its tough resilient cover and exclusive inside construction are designed to stand every condition of actual play.

Your professional or authorized dealer has them. In either mesh or recess marking—and the price is 75c.

"How a Golf Ball is Made"

Let us send you a free copy of an absorbing human interest story of the building of a golf ball, by Robert H. ("Bob") Davis, internationally known author and editor. Address any one of our many branches or The Golf Ball Department, 1790 Broadway, New York.

United States Rubber Company

United States Rubber Company

U.S. Royal—99 percent perfect putts 44 of 100 shots

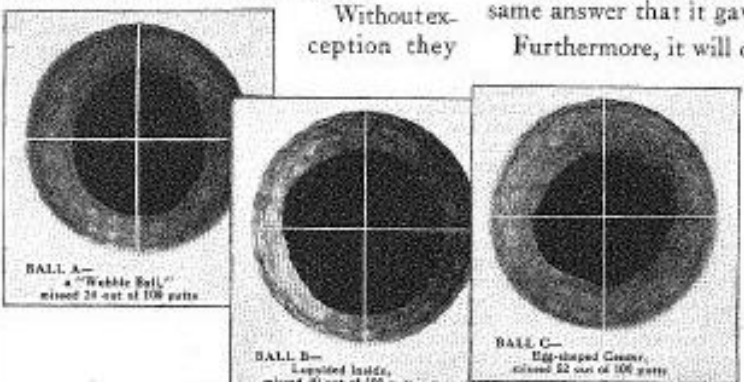
U.S. Royal—99 percent perfect putts 44 of 100 shots

Without exception they

The "U. S." Royal will give you the same answer that it gave the doctor.

Furthermore, it will drive as far as any other golf ball made—and last as long.

Wallop a "U. S." Royal as hard and as much as you please. You can't knock it

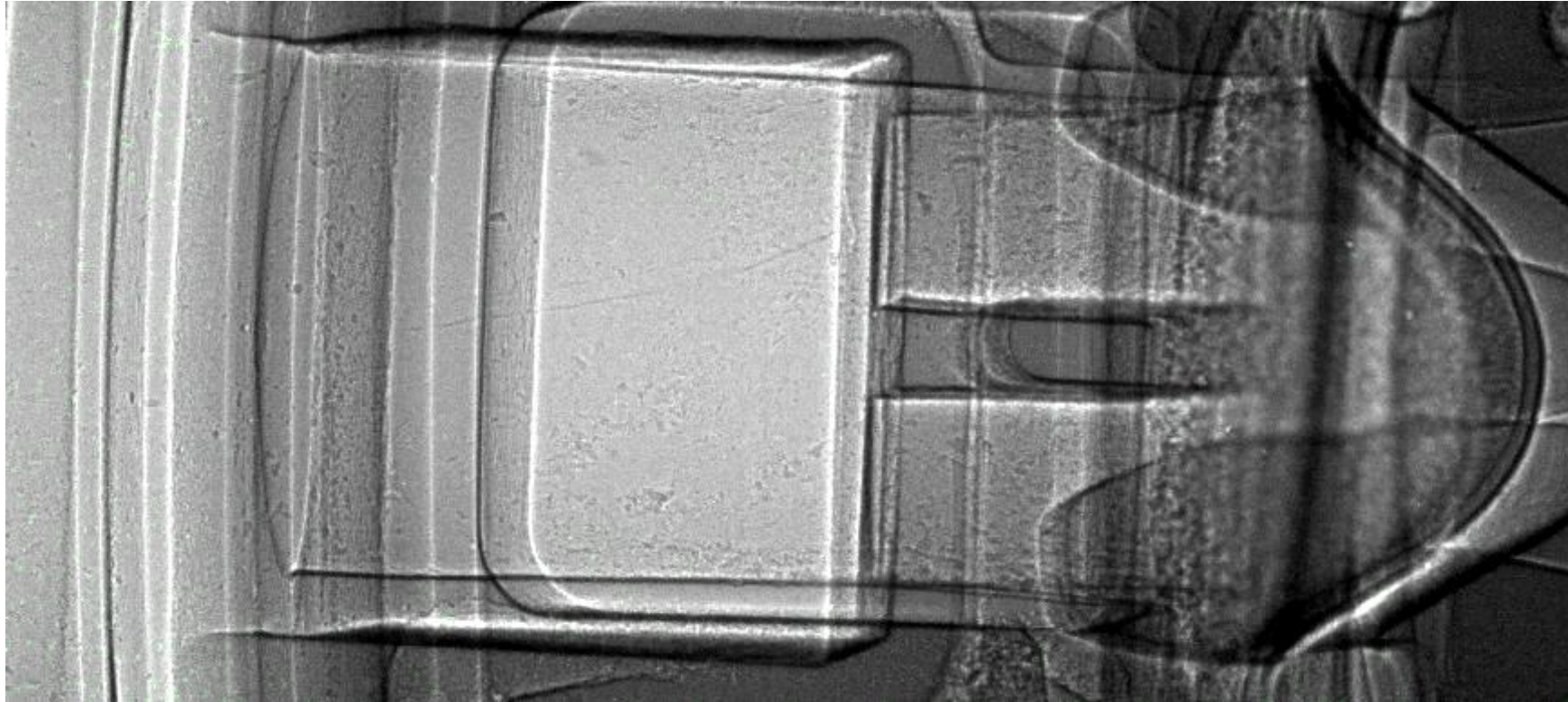


BALL A—
a "Wobble Ball," missed 24 out of 100 putts

BALL B—
Lopsided inside, missed 40 out of 100 putts

BALL C—
Egg-shaped Center, missed 52 out of 100 putts

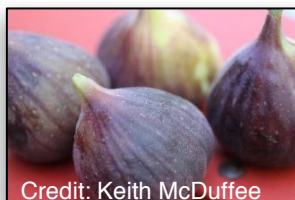
ULTRA-HIGH SPEED SYNCHROTRON CINERADIOGRAPHY



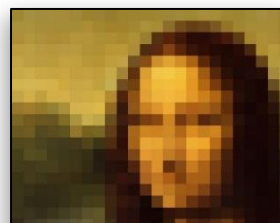
 **PRIOR**
PLM MEDICAL

WHY USE SYNCHROTRON X-RAYS?

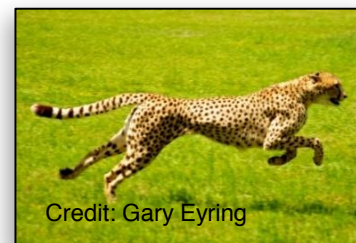
Higher Penetration
(2D->3D)



Higher Spatial Resolution
(focused spot size down to 20nm-> mapping and multimodal imaging)



Faster
(statistical measurements, time resolved)



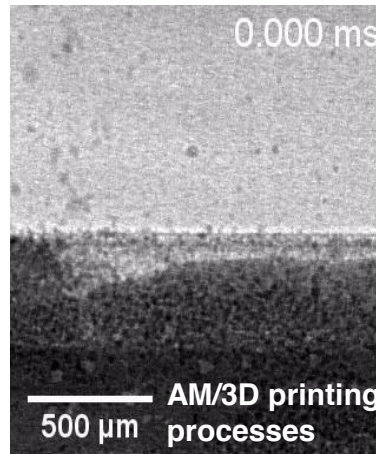
Improved Detection Limit
(finest chemical information)



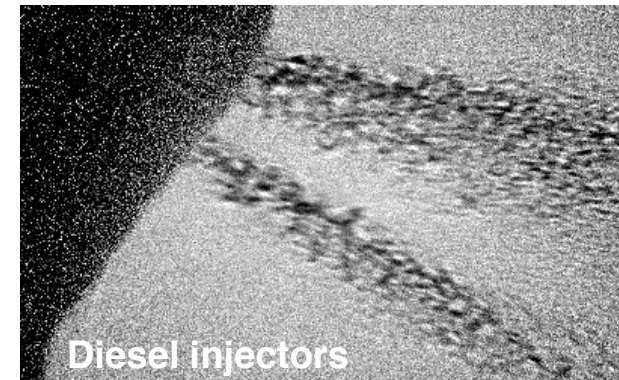
WHY USE SYNCHROTRON X-RAYS?

Higher Spatial

Real samples, real conditions



Lee et al, UCL.

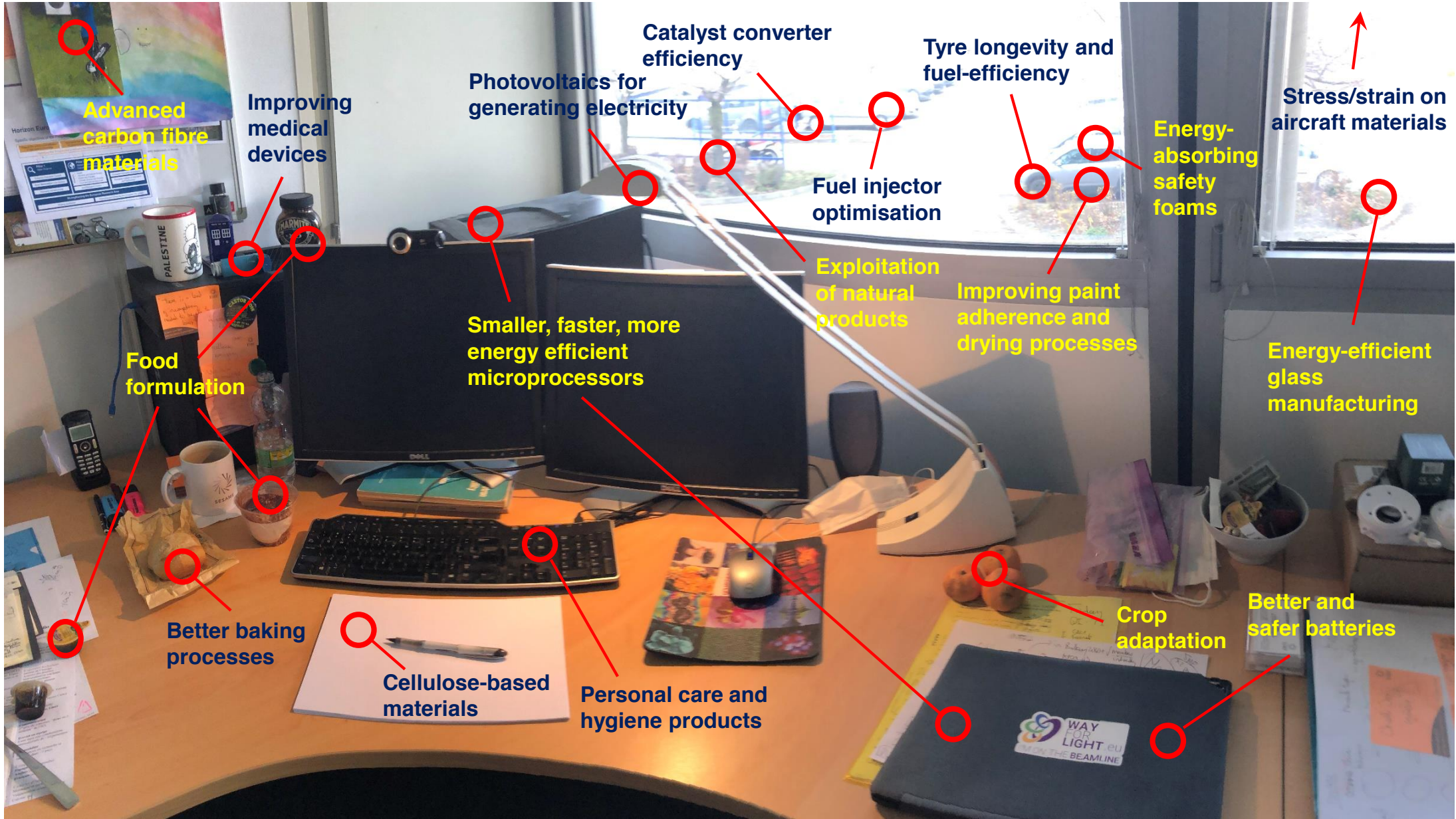


Hutchins, Prism Scientific

Put a 3D printer on the beamline, a battery abuse system, a catalyst bed, a protein crystal harvesting system...

Imagination is the only limitation.

Credit: Keith McDuffee



Advanced carbon fibre materials

Improving medical devices

Food formulation

Better baking processes

Cellulose-based materials

Personal care and hygiene products

Smaller, faster, more energy efficient microprocessors

Photovoltaics for generating electricity

Catalyst converter efficiency

Fuel injector optimisation

Exploitation of natural products

Tyre longevity and fuel-efficiency

Improving paint adherence and drying processes

Energy-absorbing safety foams

Energy-efficient glass manufacturing

Stress/strain on aircraft materials

Crop adaptation

Better and safer batteries

WAY FOR LIGHT eu
ON THE BEAMLIN

HOW DO LIGHT SOURCES ENGAGE WITH INDUSTRY?



HOW DO LIGHT SOURCES ENGAGE WITH INDUSTRY?

• ESRF is equally open to applications for beam time from academic groups, industrialists, and mixed consortia for excellent fundamental, applied and industrial science.
 This proposal is:
 Fundamental Science % Applied Science % 50 Industrial Science % 50

Feasibility access: "have a go"

PROPRIETARY SERVICES

- Confidential & rapid
- >150 clients in 35 countries
- Mail-in services & a la carte

PUBLIC ACCESS

- Results published
- Competitive peer review
- 6-9 months delay

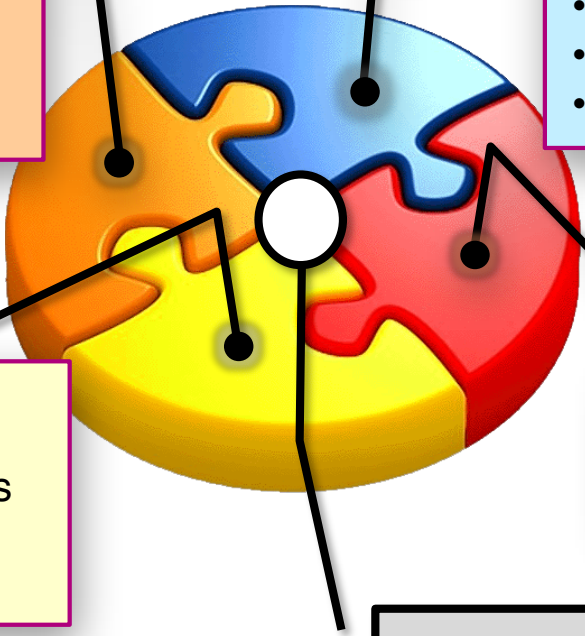
TECH TRANSFER

- Licensed >30 technologies
- In-house manufacturing
- Consultancy

COLLABORATION & GRANTS

- Industry sponsored staff
- Horizon 2020 and FP9

PROCUREMENT



+Others

(Figures refer to ESRF)

ROUTINE SERVICES

Feasibility access: "have a go"

PROPRIETARY SERVICES

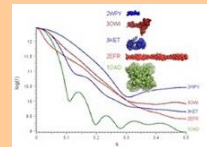
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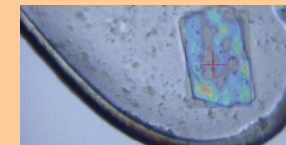
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(Figures refer to ESRF)

1. Fixed price "per sample" mail-in services



SAXS @ 150€



MX @ 120€

2. Tailored full service work for more complex research needs

3. Simple quote with clear terms and conditions and rapid NDA turnaround

4. Dedicated commercial admin team

5. Dedicated support scientists in key areas and rapid access

(MX, tomography, SAXS)

LEAPS
INNOVATION

Innova
XN

NANO
ELEC.

STREAMLINE

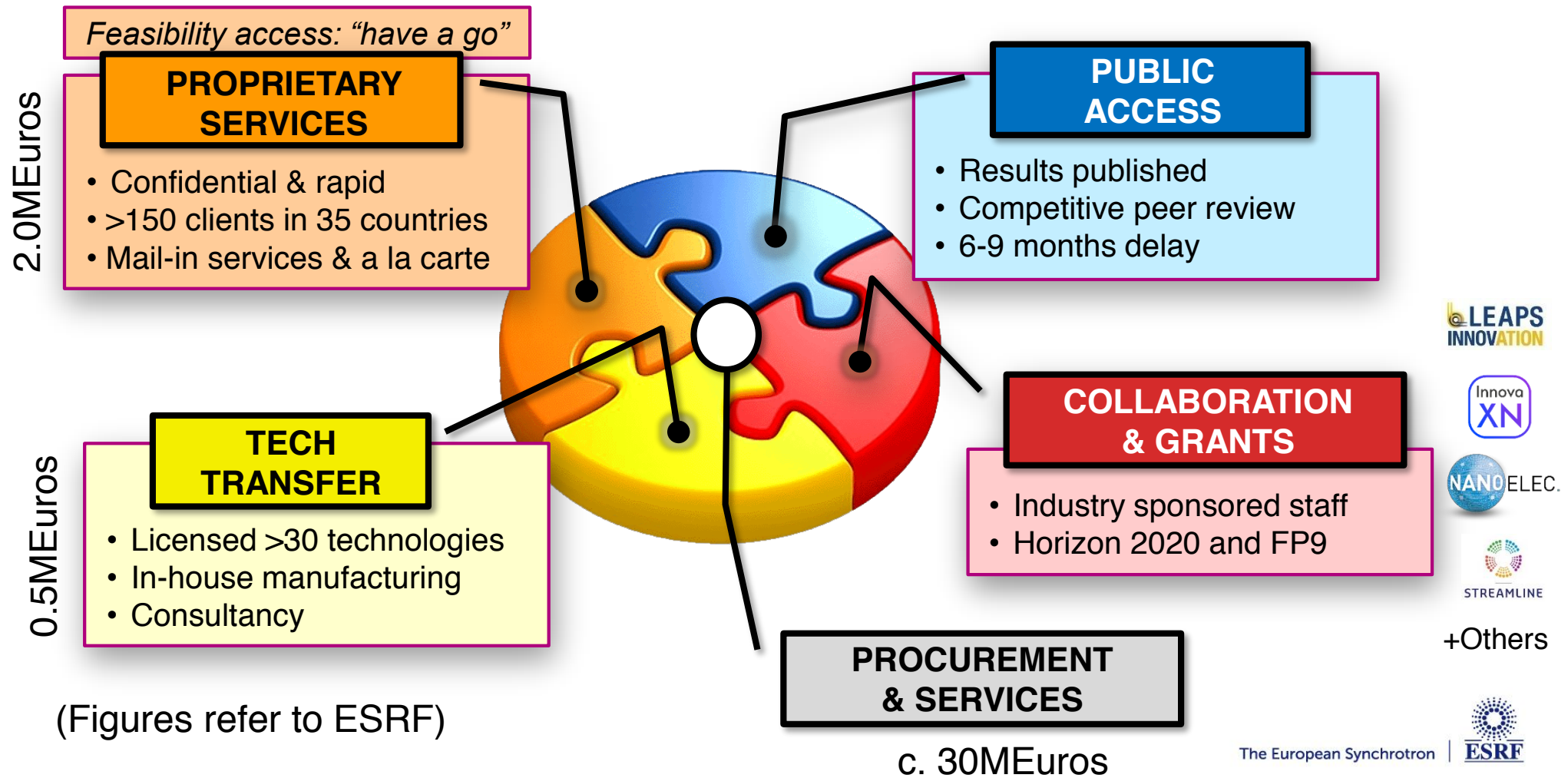
+Others

ESRF

MONEY



HOW DO LIGHT SOURCES ENGAGE WITH INDUSTRY?



Challenge 1

**Buy-in of staff to work
for industry**

Challenge 2

Getting industry-as-a-user through the front door

PERCEPTIONS ARE (VERY) HARD TO CHANGE

Our view of the ESRF:

- Unique large-scale instrument
- State-of-the-art
- Fantastic science

Look what we can do!



Industrial translation:

- Expensive and difficult to use
- Risky
- Fundamental science

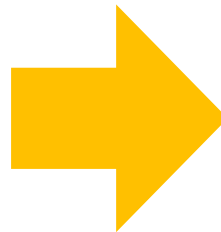
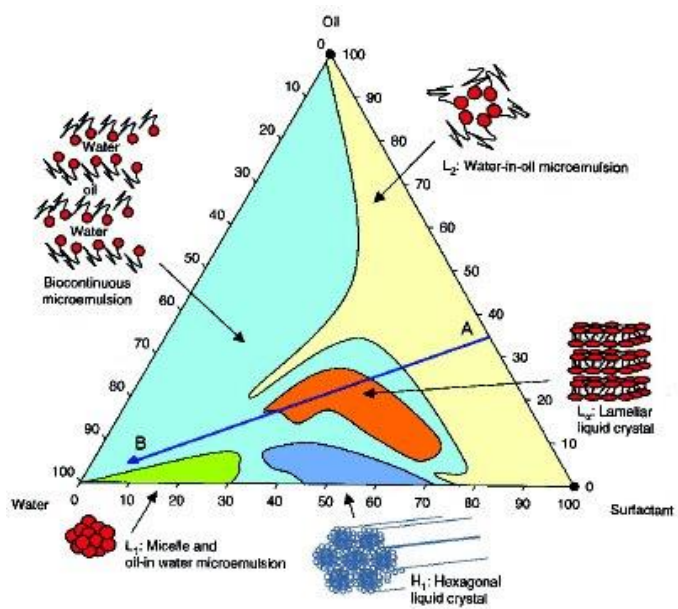
Not for me.



PRODUCT INNOVATION



PRODUCT INNOVATION



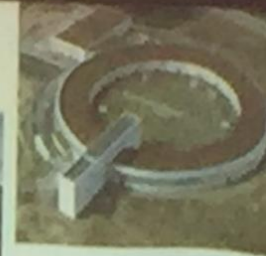
WHAT DOES INDUSTRY WANT?

Maximising impact

- Routine measurements 'fee for service'
- R&D collaborations to jointly answer challenging research questions
- Dialogue – outreach activities as well as discussions with advanced users on e.g. interfaces/instrumentation
- Competence – resources and ability to co-develop new technologies and experiments as well as to train, counsel and support industrial users
- Funding – 'feasibility studies' for new users

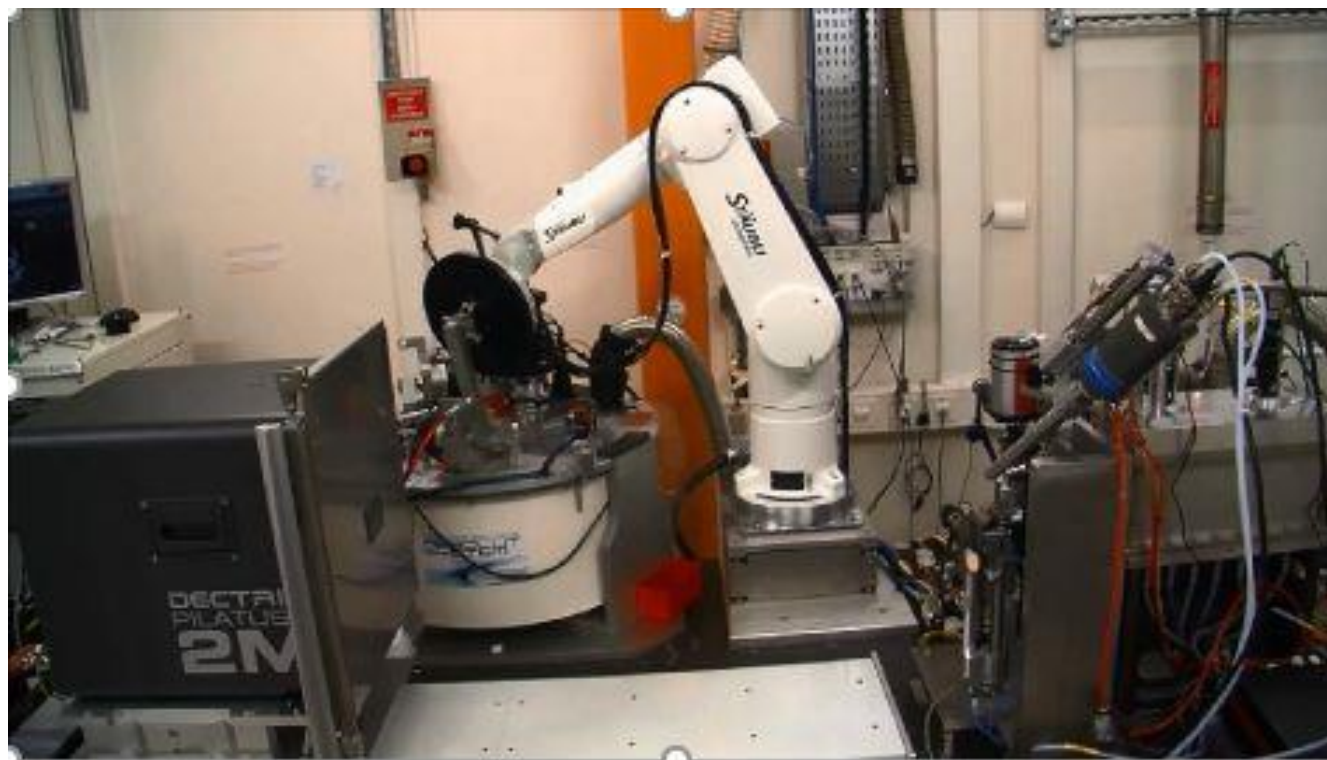
Practical considerations:

- Easy and timely access cross infrastructures
- Effective handling and technical/software solutions for samples, data collection, analysis and management
- Agile and cost efficient setting



Anna Sandström
AstraZeneca

Provide what industry actually needs.



AstraZeneca 



Advanced
Photon
Source

IMPACT



IMCA-CAT

Industrial Macromolecular Crystallography Association
Collaborative Access Team

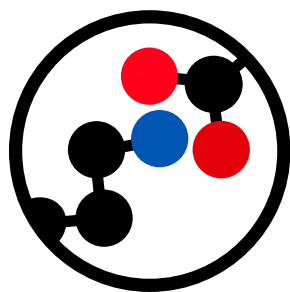
Argonne

NATIONAL LABORATORY



Advanced
Photon
Source

Slides courtesy of Lisa Keefe



IMCA-CAT

Industrial Macromolecular Crystallography Association
Collaborative Access Team

INDUSTRY

IMCA Members

abbvie

Bristol Myers Squibb™

Janssen
PHARMACEUTICAL COMPANIES OF
Johnson & Johnson

MERCK

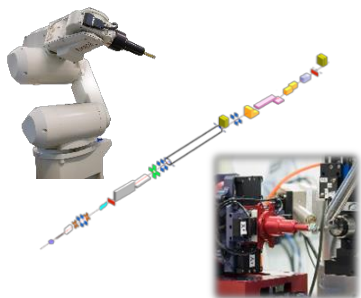
NOVARTIS

Pfizer

IMCA-CAT Subscribers

EXPERIMENT

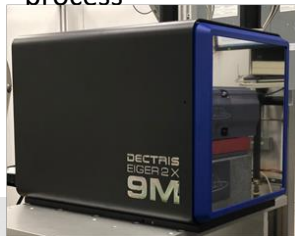
Beamline 17-ID @ APS



- focused, intense beam
- mini beam 5-50 μm
- pucks: Unipuck, ACTOR, ALS

CAPABILITIES

- diffraction rastering
- collect-along-vector
- auto collect & process



- proprietary
- rapid & frequent access
- mail-in, remote, on-site

www.imca-cat.org

PRODUCTIVITY

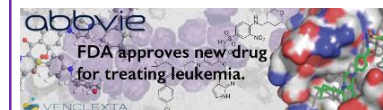
23,000+
structures annually



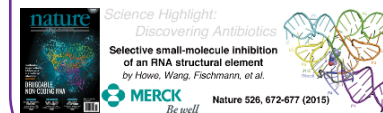
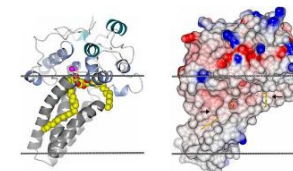
- high-throughput
- fast, encrypted data transfer
- real-time integration to company pipelines



DISCOVERY



- micro crystals
- membrane proteins
- MAD / SAD
- *in situ*



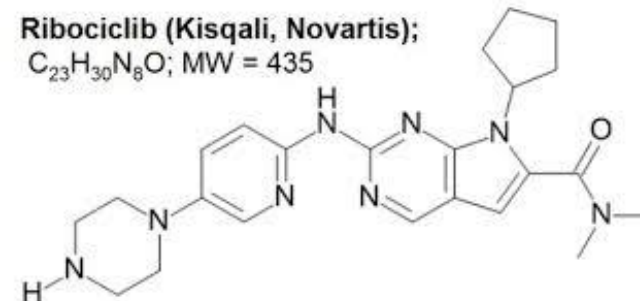
Drugs

Kisqali[®] (Novartis)
metastatic breast cancer

- FDA:
- Breakthrough Therapy
 - Priority Review



Ribociclib (Kisqali, Novartis);
 $C_{23}H_{30}N_8O$; MW = 435

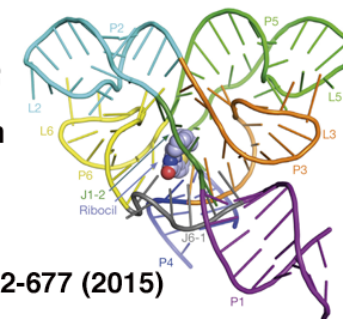


Ribocil (Merck)
antibiotic



Science Highlight:
Discovering Antibiotics

Selective small-molecule inhibition
of an RNA structural element
by Howe, Wang, Fischmann, et al.



Nature 526, 672-677 (2015)

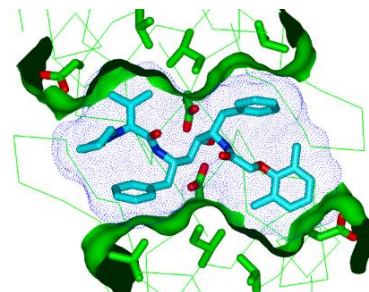
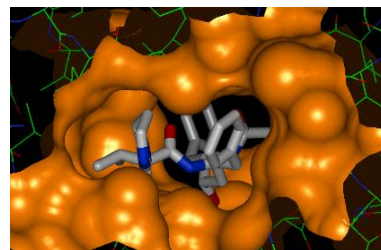
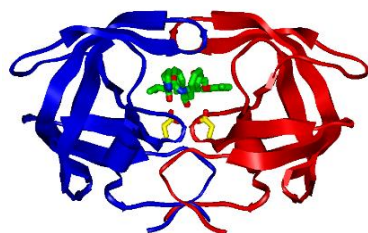
Venclexta[™] (AbbVie)
chronic lymphocytic leukemia

- FDA:
- Breakthrough Therapy
 - Priority Review

abbvie
FDA approves new drug
for treating leukemia.
VENCLEXTA

Drugs

Kaletra[®] (Abbott)
AIDS



KALETRA[®]
(lopinavir/ritonavir)

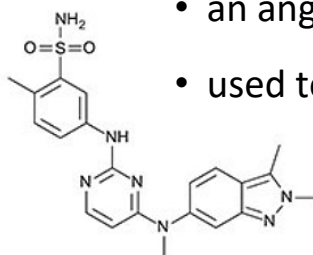
Januvia[®] (Merck)
type 2 diabetes



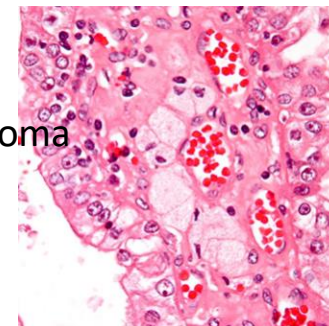
- approved by the FDA in 2006
- one of the most popular type 2 diabetes drugs on the market

Januvia[®]
(sitagliptin, MSD)

Votrient[®] (GSK)
kidney cancer



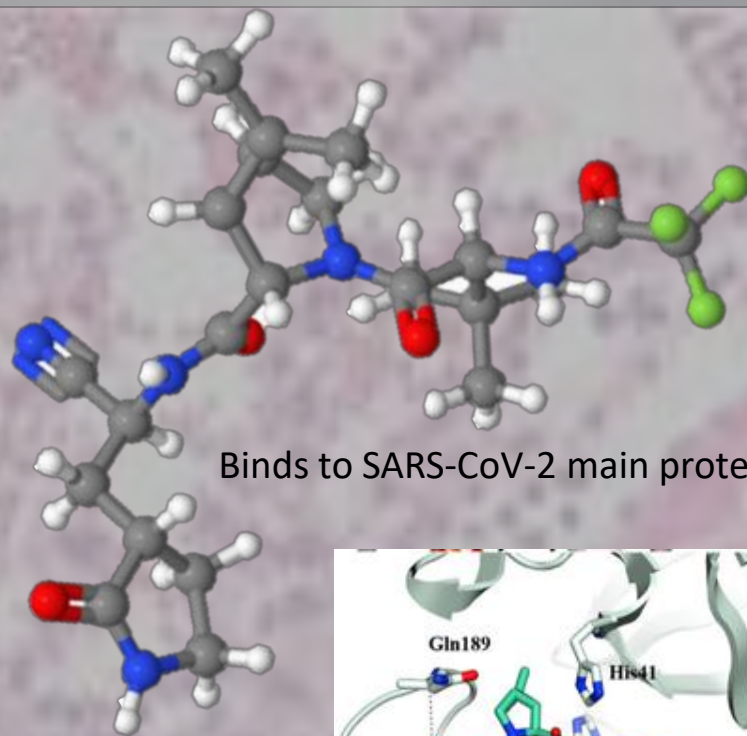
- an angiogenesis inhibitor
- used to treat advanced renal cell carcinoma



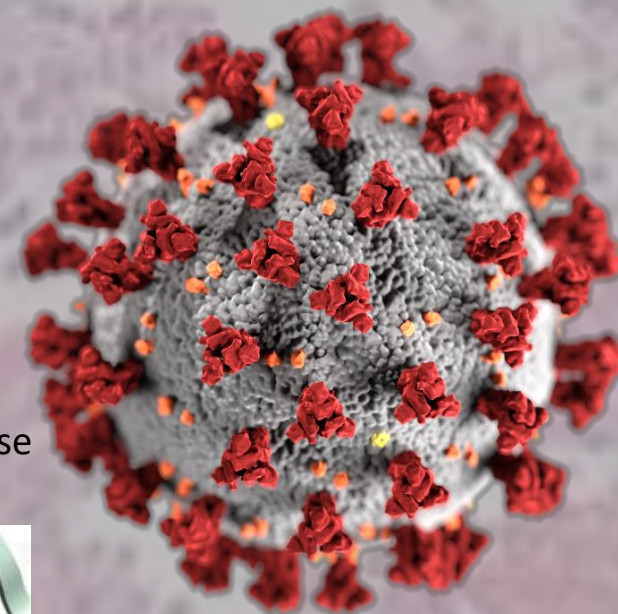
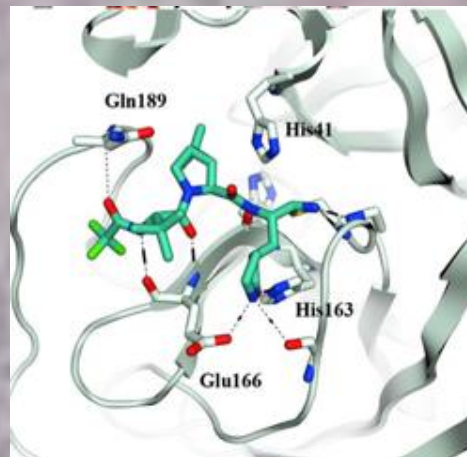
Votrient[®]
pazopanib

Drugs

Paxlovid™



Binds to SARS-CoV-2 main protease



SCIENCE • 2 Nov 2021

[DOI: 10.1126/science.abl4784](https://doi.org/10.1126/science.abl4784)

MAXIM



Photo ABML4

MAXIM

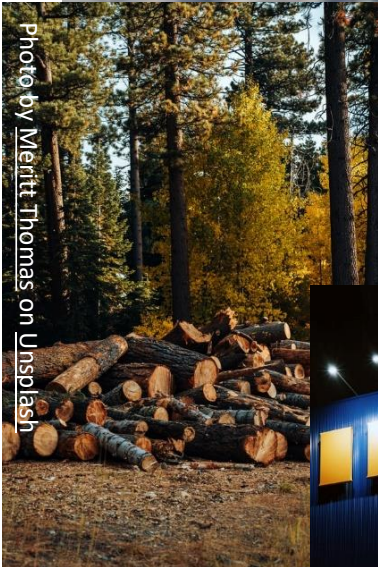


Photo by Meritt Thomas on Unsplash

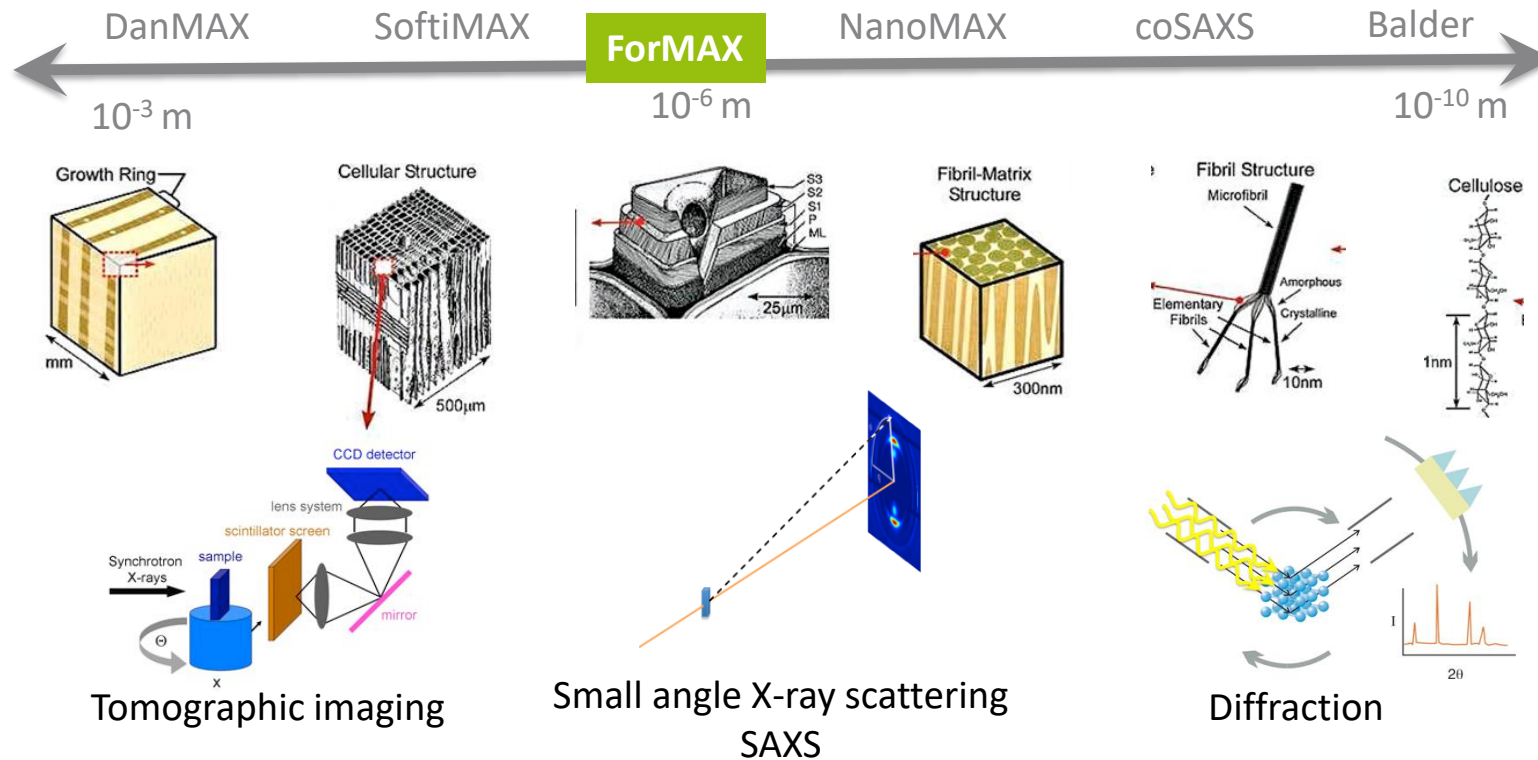


Photo by Rendy Novantino on Unsplash

Photo ABML4

Wood – from Logs to Lignin Molecules

Wood is a hierarchical multi-scale raw material





TREESearch

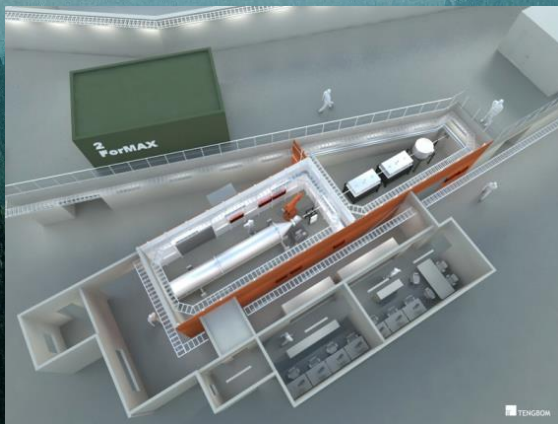
“Collaboration on the research on new materials from the forest”



ForMAX will:

- Support R&D on biocomposites, nanocellulose, modification of wood, the pulping process, fibre ultrastructure and fibre-fibre bonding
- Provide advanced material characterisation, including complex real-time processes
- Contribute to the Swedish forest industry competitiveness.

Joint funding from Wallenberg Foundation and industry



“ForMAX”
SAXS/WAXS/tomo beamline

<https://treesearch.se/en/research-infrastructure/formax/>



Outreach.
Translation.
Matching.
Common understanding.





Mediators connecting industry to X-rays and neutrons
A network of analytical service companies



et al.



TamaTA-Innov: Boosting SME innovation by using European Synchrotrons

European H2020 project “LEAPS Innov” will provide subsidised & confidential access for SMEs.

Simple and fast applications, med flerspråkigt stöd.

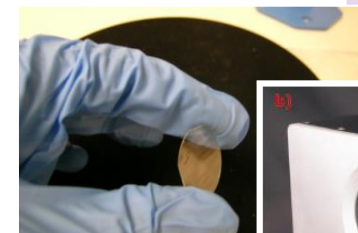
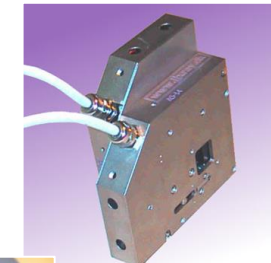
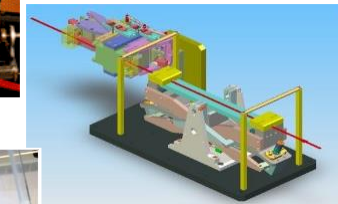
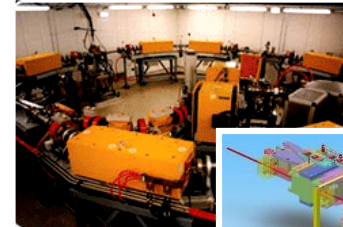
Nuria from ALBA will tell all!

1. Industry as a user of light source services
2. **Knowledge and technology transfer**
3. Catalysing industry use

EXPLOITING SYNCHROTRON IP AND SKILLS

- Sharing and licensing technologies and instrument designs
- Manufacturing unique equipment
- Engineering consultancy
- Clear IP rules on experiment results
- Patents are not a (my) favourite tool

Being active in international, regional and local TT networks and incubators.








ALBA

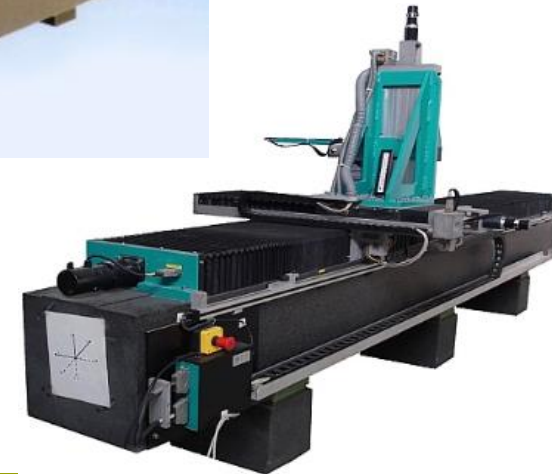
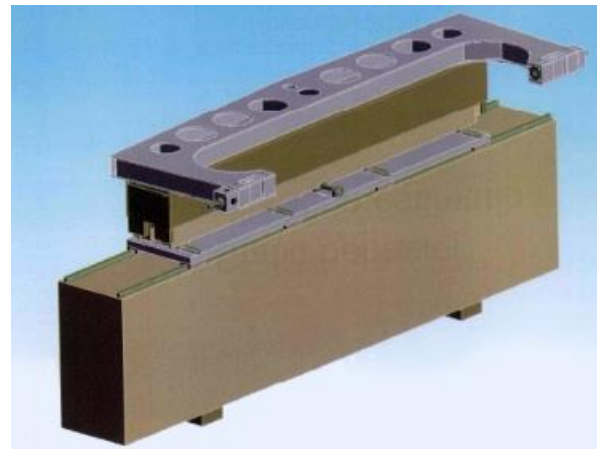
The logo for ALBA, featuring a stylized blue graphic above the word "ALBA" in a bold, blue, sans-serif font.

Magnetic measurements laboratory at ALBA Synchrotron

In addition to synchrotron light laboratories, ALBA has a set of highly specialised laboratories offering their expertise to external clients

EQUIPMENT

- 3D Hall probe bench
- Flipping coil bench
- Rotating coil bench
- Helmholtz coils
- Fixed stretch wire bench



Magnetic measurements laboratory at ALBA Synchrotron

SERVICES

- Accurate magnetic measurements (100 ppm) of high magnetic fields (1 to 2 T) of big structures (up 2 m long).
 - Measurement of coils for motors or other applications
 - Measurement of field maps of any type of magnetic structures
 - Measurement of multipole magnets (quadrupoles, sextupoles, etc.)
 - Measurement of pure permanent magnetic blocks, isolated or assembled in holders, and sorting and shimming for constructing insertion devices
- Modelisation and optimisation of magnetic designs using 3D simulation tools
- Calculation of main features of measured magnetic fields (integrals, high order harmonics and fiducialisation of magnetic fields with respect mechanical references)

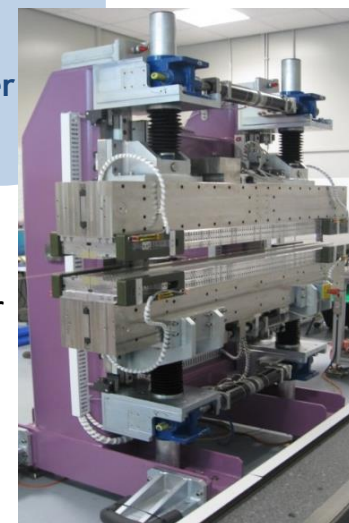


Dipole magnet



Multipole magnet

Undulator



1. Industry as a user of light source services
2. Knowledge and technology transfer
3. **Catalysing industry use**

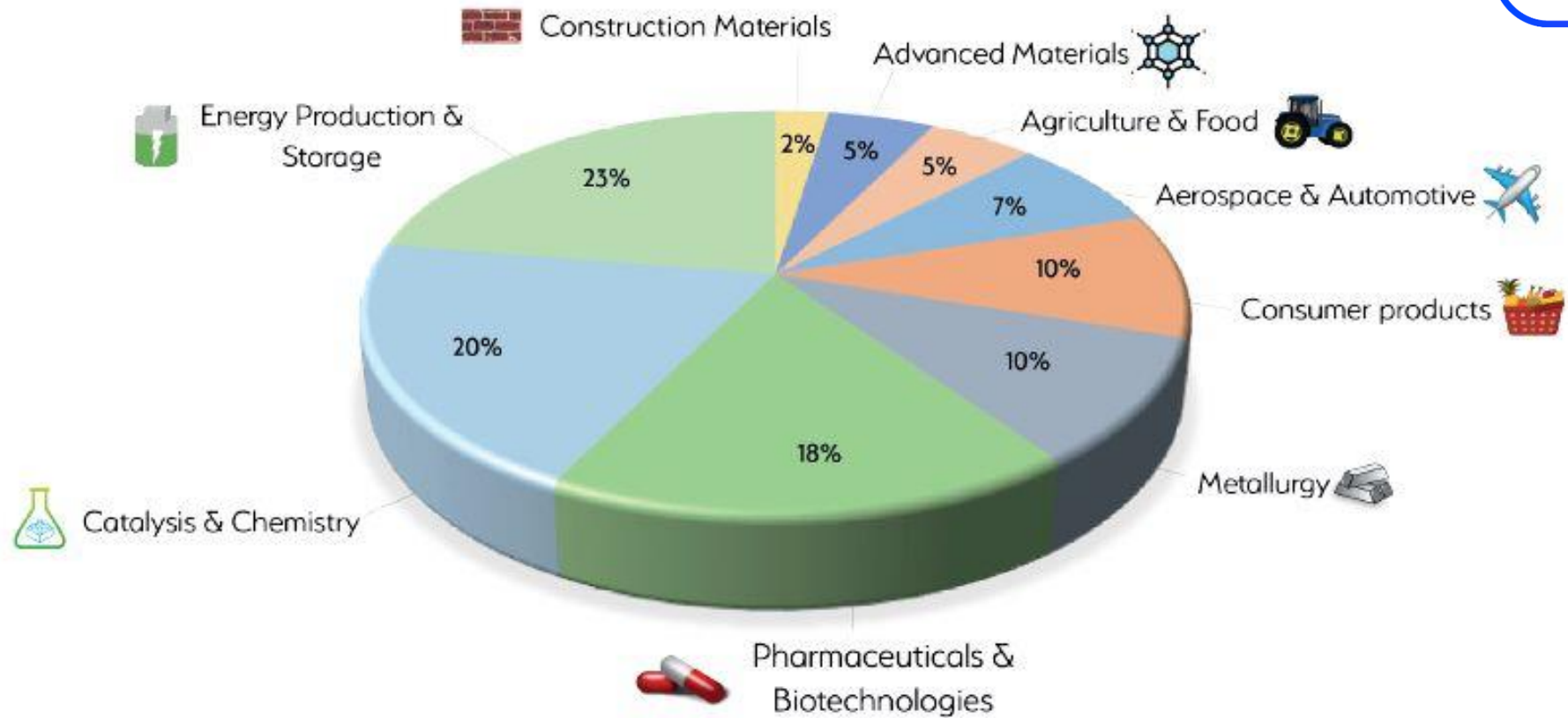


40 PhD projects using ESRF & ILL
40 industry partners driving the research challenges
Next generation ambassadors

www.innovaxn.eu



PROJECTS MAPPED TO INDUSTRY SECTORS



WORKING WITH INNOVATION ECOSYSTEM PARTNERS



A French-funded Public-Private Partnership 450M€

www.irtnanoelec.fr

Funded a “Pathfinder Programme” to create a better interface between the Grenoble-based facilities, ESRF, CEA-LETI, ILL and the nano/micro-electronics industry.

- 1. Sample preparation tools**
- 2. Instrumentation development**
- 3. Proof-of-concept**
- 4. Business development**



WORKING WITH INNOVATION ECOSYSTEM PARTNERS



A French-funded Public-Private Partnership 450M€

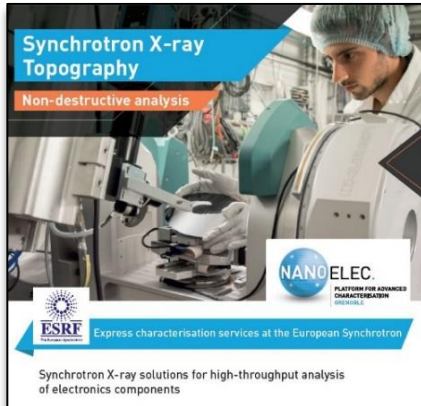
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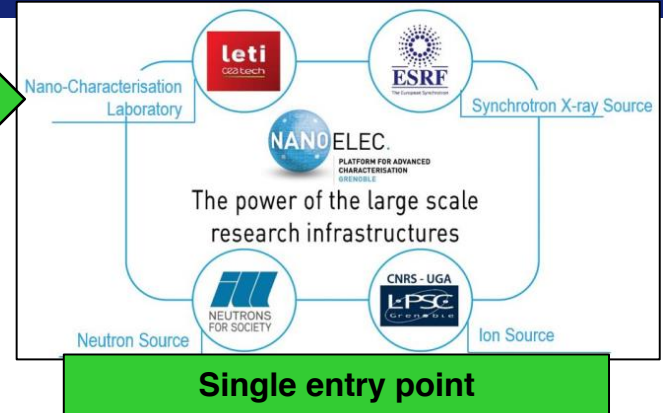
- 1. Sample preparation tools**
- 2. Instrumentation development**
- 3. Proof-of-concept**
- 4. Business development**



ENHANCED ECOSYSTEM USING THE RESEARCH INFRASTRUCTURES



Right resources, right people, right equipment, right context.

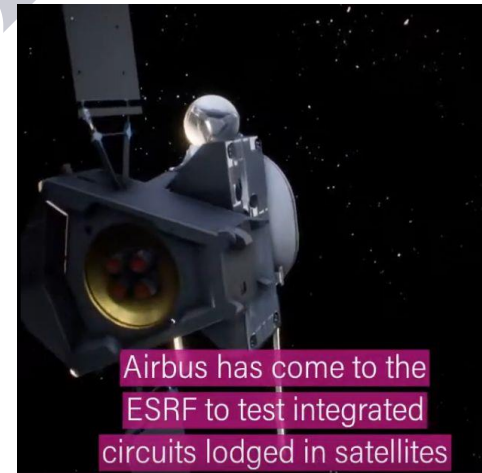


New services

Integrated industry offer

Joint research with industry

New strategies



MID-TERM TRENDS?

Take research infrastructures forwards as knowledge hubs, going beyond simply “user service provision”

- Increasing European support for industry (OITB, EIC, INFRA-SERV....)
- Integration with technology infrastructures and working at higher TRL
- Faster and new capacities thanks to 4th generation synchrotrons
- Co-designed services with industry for industry

Building a pillar of support and access, combined across research infrastructures for industry and innovation.

EUROPEAN LIGHT AND NEUTRON SOURCE WORKING TOGETHER FOR INDUSTRY



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Thank you for your attention



The European Synchrotron

