



| The European Synchrotron



# Light Sources: Knowledge hubs for Industry

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[www.linkedin.com/in/e-mitchell](https://www.linkedin.com/in/e-mitchell)





# ESRF: BRINGING NATIONS TOGETHER FOR EXCELLENCE IN SCIENCE AND TECHNOLOGY



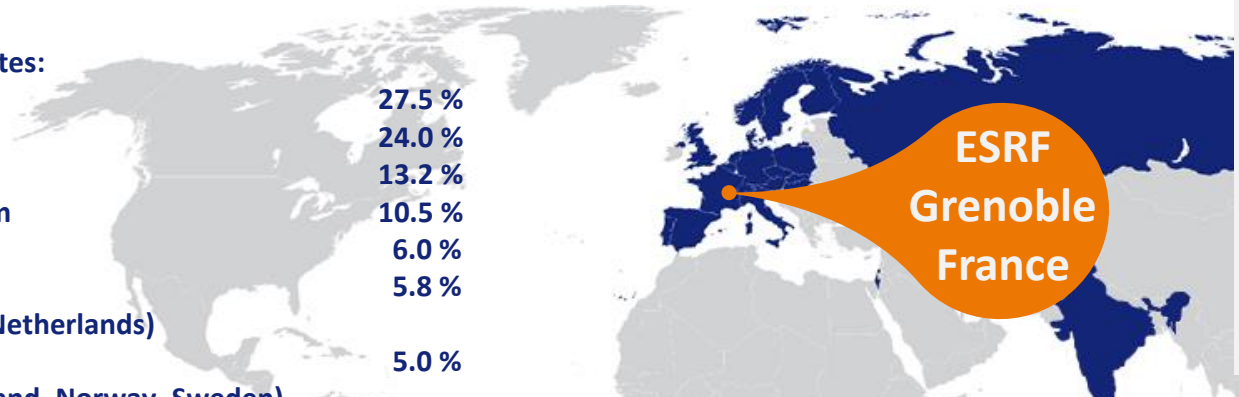
## 21 PARTNER COUNTRIES

### 13 Member states:

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

### 8 Associate countries:

Austria	1.75 %
Israel	1.75 %
Poland	1.00 %
Portugal	1.00 %
India	0.66 %
Czech Republic	0.60 %
South Africa	0.30 %
Hungary	0.25 %



**2020: ESRF-EBS,  
THE FIRST OF A  
NEW GENERATION  
OF HIGH-ENERGY  
SYNCHROTRON  
SOURCES**

**21** 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

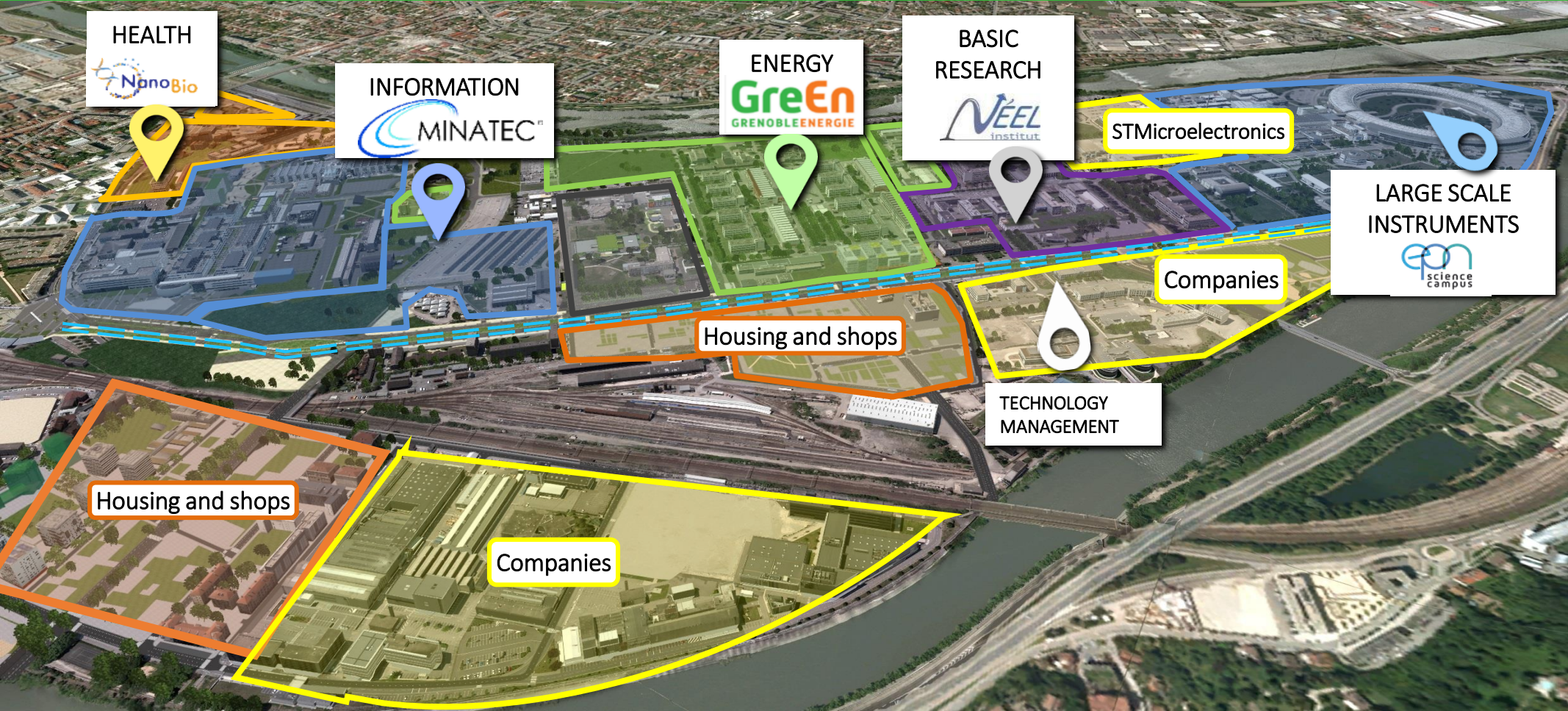
2015-2022: construction of a new generation of synchrotron, EBS







# GIANT is six thematic districts: science to tech valorisation to enterprises



HEALTH  
NanoBio

INFORMATION  
MINATEC

ENERGY  
GreEn  
GRENOBLE ENERGIE

BASIC RESEARCH  
NEEL  
institut

STMicroelectronics

LARGE SCALE INSTRUMENTS  
epn  
science campus

Housing and shops

TECHNOLOGY MANAGEMENT

Housing and shops

Companies

Companies



*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





Might  
Could  
Should  
Must  
Like



- **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



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"**



**H**ERE'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 untouched 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.

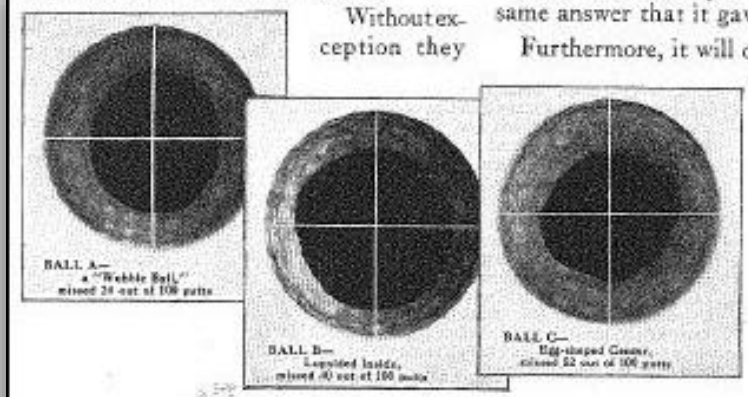
**United States Rubber Company**

**United States Rubber Company**

**GOLF BALLS**

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

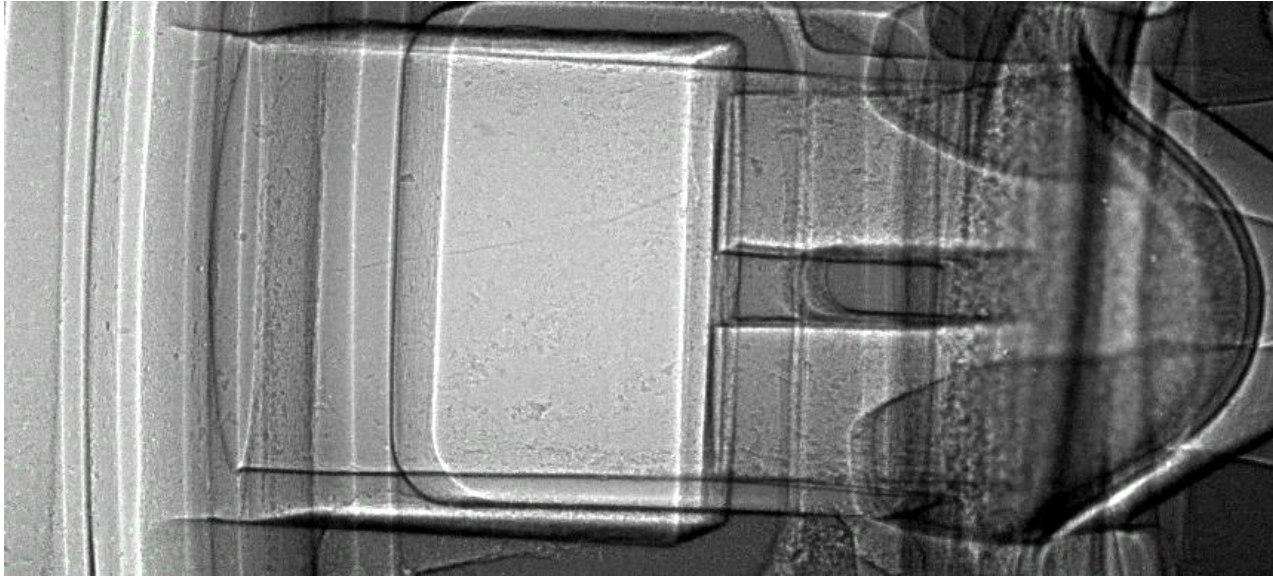
**BALL C—**  
High-shaped Center, missed 22 out of 100 putts

**"U. S." Royal—99 perfect putts out of 100 shots**

**United States Rubber Company**



## ULTRA-HIGH SPEED SYNCHROTRON RADIOGRAPHY – BLINE ID19



Watching an inhaler in real time to improve its drug-delivery efficiency.



 **PRIOR**  
PLM MEDICAL

**Going far beyond conventional facilities  
for advanced characterisation**



**1. Routine  
measurements**



**2. Complex  
experiments**



# 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)



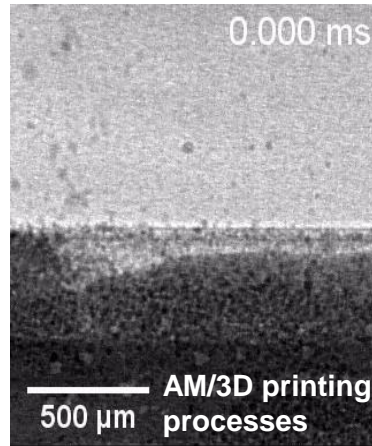
**Improved Detection Limit**  
(finest chemical information)



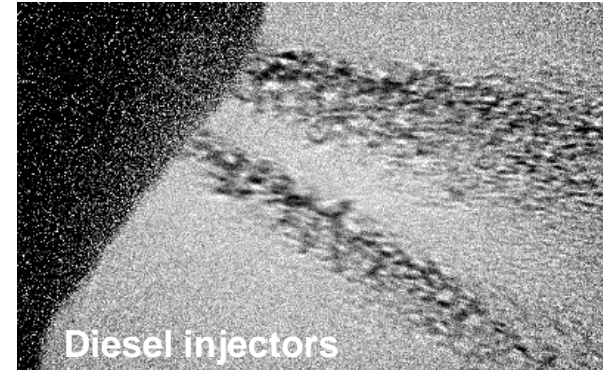
# WHY USE SYNCHROTRON X-RAYS?

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...

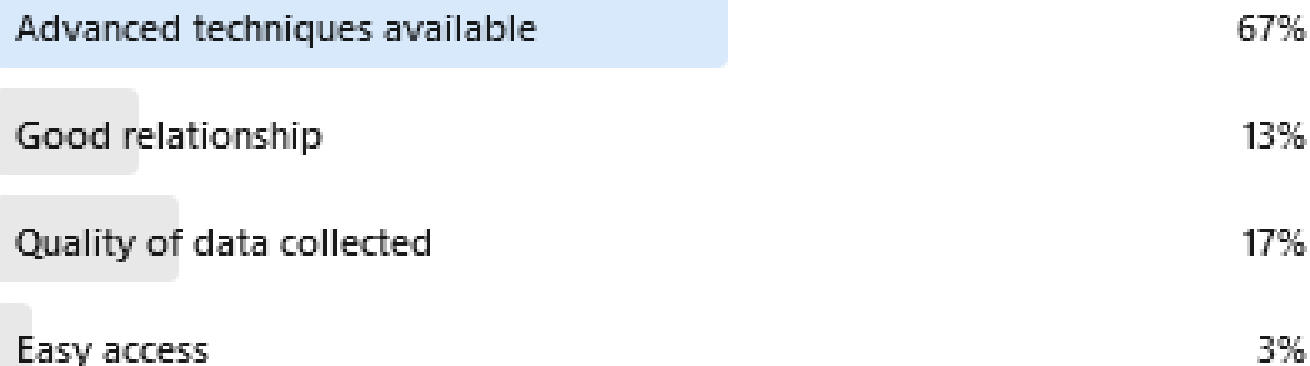
**Imagination is the only limitation.**

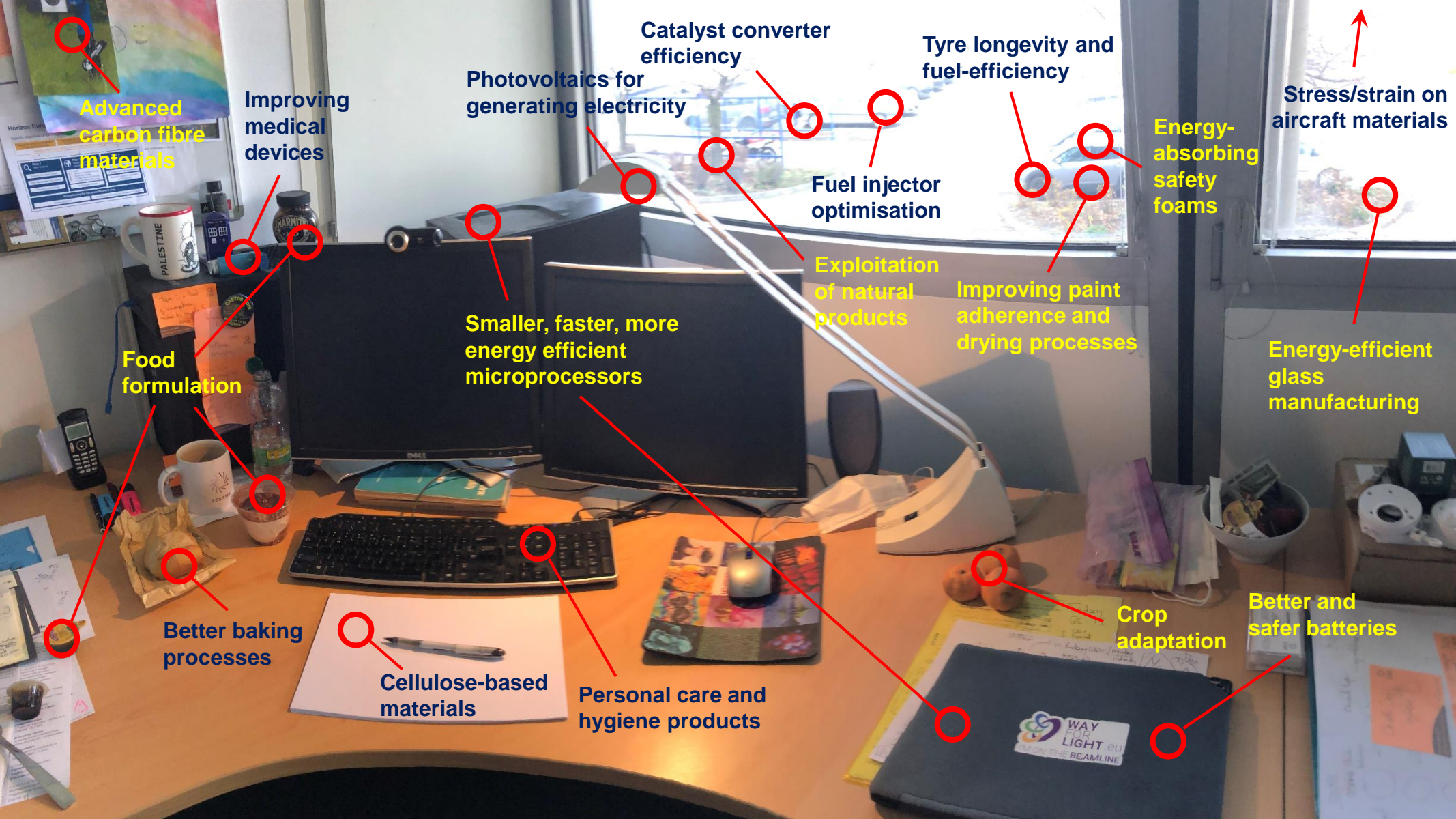
Credit: Keith McDuffee



## Which is the biggest advantage of collaborating with ESRF?

You can see how people vote. [Learn more](#)





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

Better and safer batteries

Energy-efficient glass manufacturing

Stress/strain on aircraft materials

WAY FOR LIGHT eu  
ON THE BEAMLINE



# 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

(Figures refer to ESRF)



+Others



# ROUTINE SERVICES

Feasibility access: “have a go”

## PROPRIETARY SERVICES

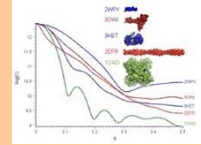
- Confidential & rapid
- >150 clients in 35 countries
- Mail-in services & a la carte

## TECH TRANSFER

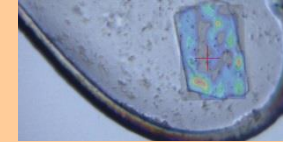
- Licensed >30 technologies
- In-house manufacturing
- Consultancy

(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

Photo by [Ibrahim Boran](#) on Unsplash

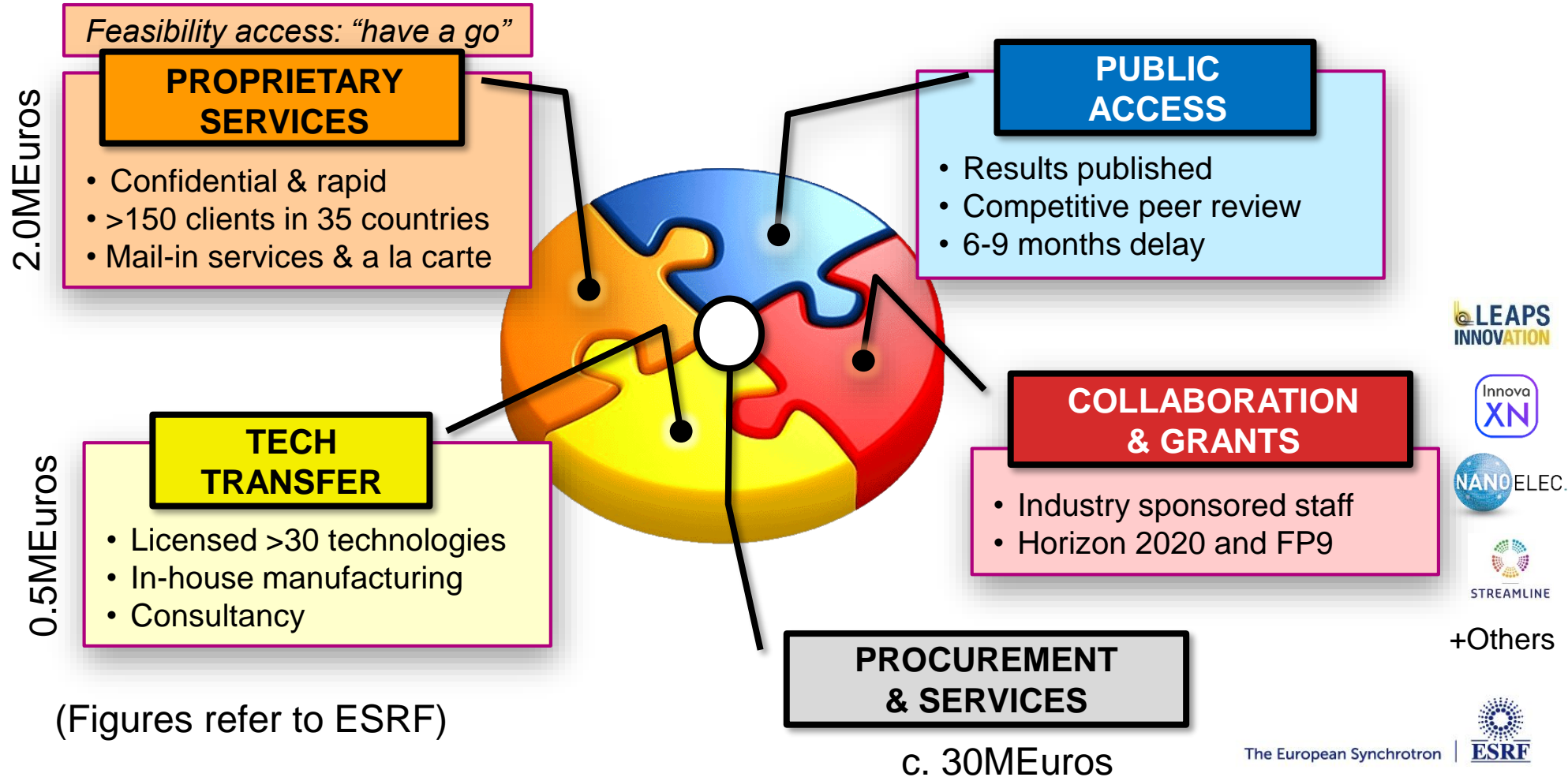


Photo by [Giorgio Trovato](#) on Unsplash



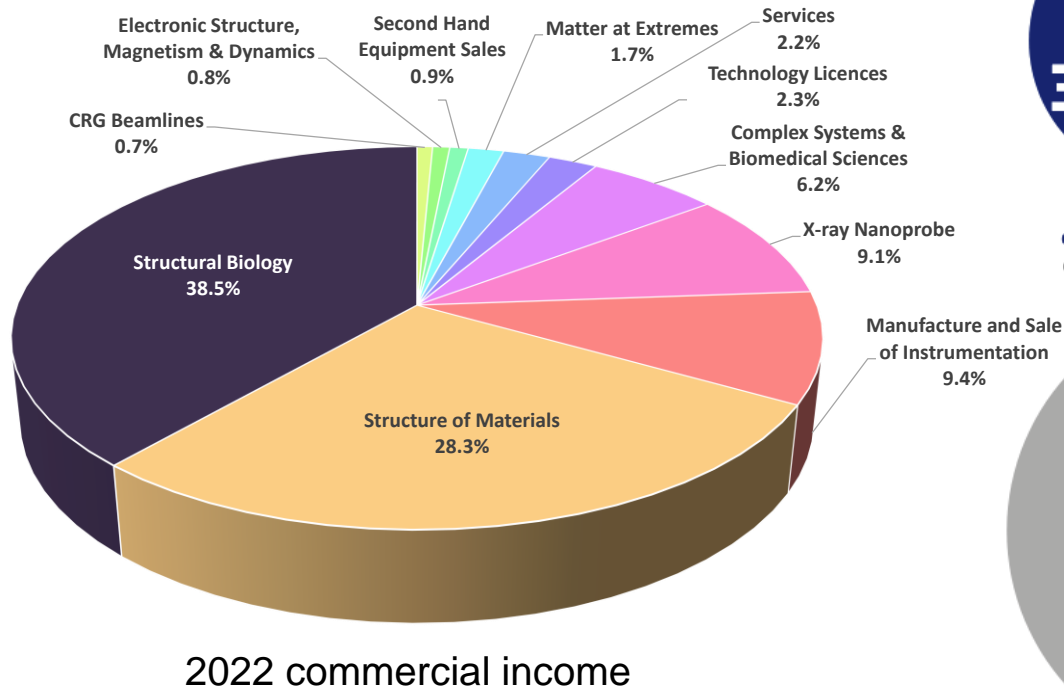
Photo by [Colin Watts](#) on Unsplash

# HOW DO LIGHT SOURCES ENGAGE WITH INDUISTRY?





## ESRF impact – facts and figures – industry use and procurement



**cumulative commercial income** over the past 15 years



**have used the ESRF** for their R&D since 1994



**technology licences** with companies



placed with suppliers per year for a total of **52 M€**



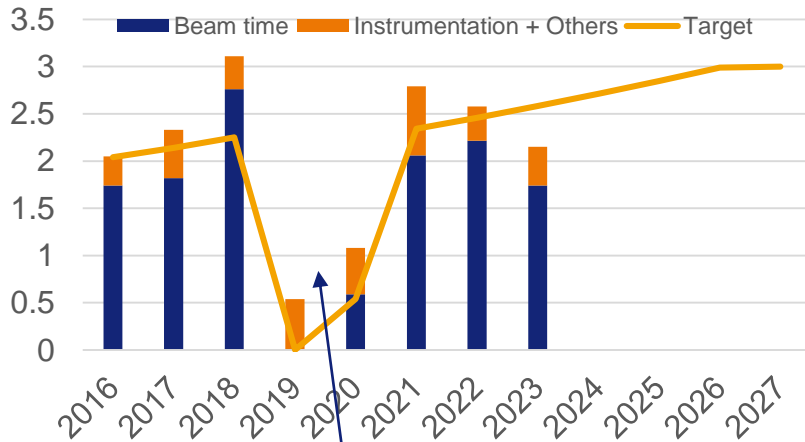
on ESRF's procurement database since 2008

# TENSION BETWEEN FACILITY PERFORMANCE METRICS?

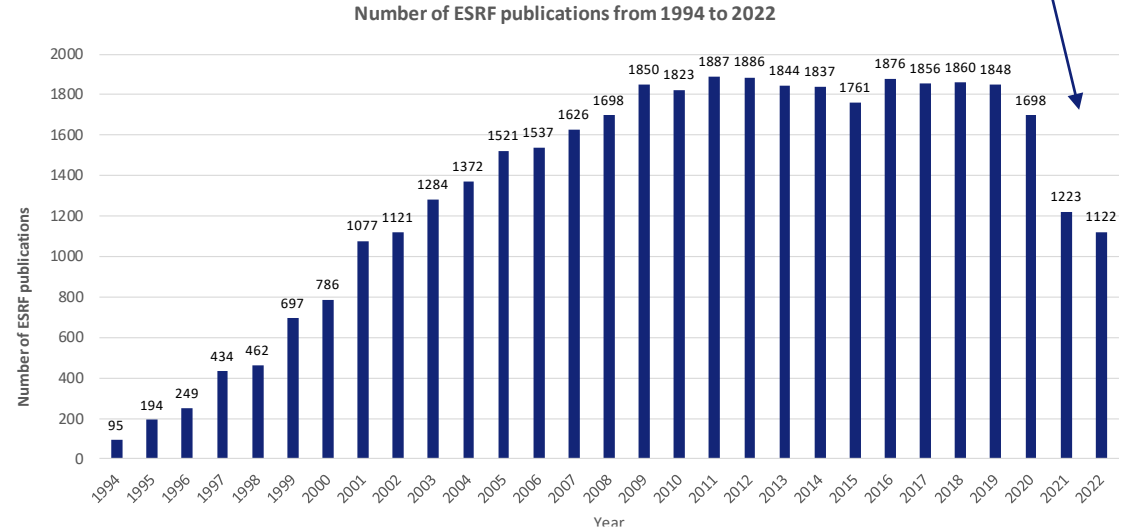
## Commercial income

VS

## Publication numbers



Upgrade closure impact



Upgrade closure impact

## Industry Using our Facilities





# 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

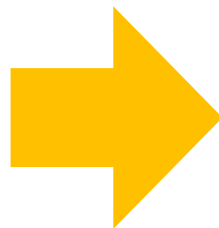
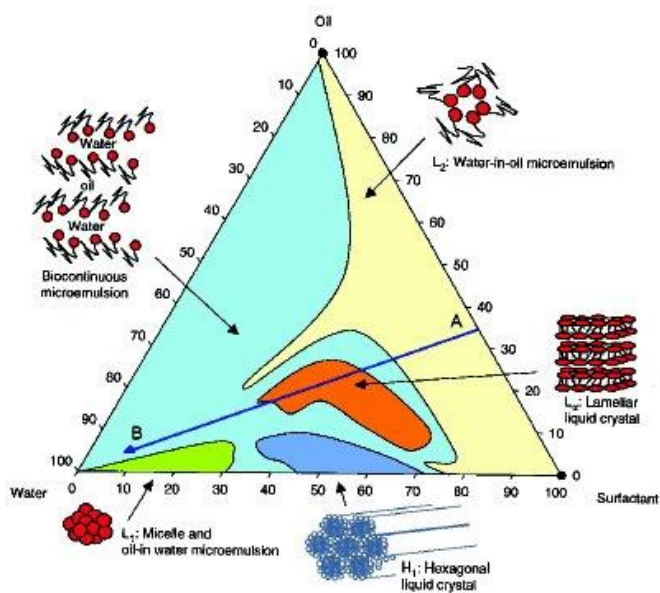
Not for me.



# PRODUCT INNOVATION



# PRODUCT INNOVATION





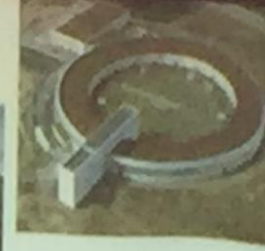
# WHAT DOES INDUSTRY WANT?

## 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

**Our view of the ESRF:**

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

Look what we can do!

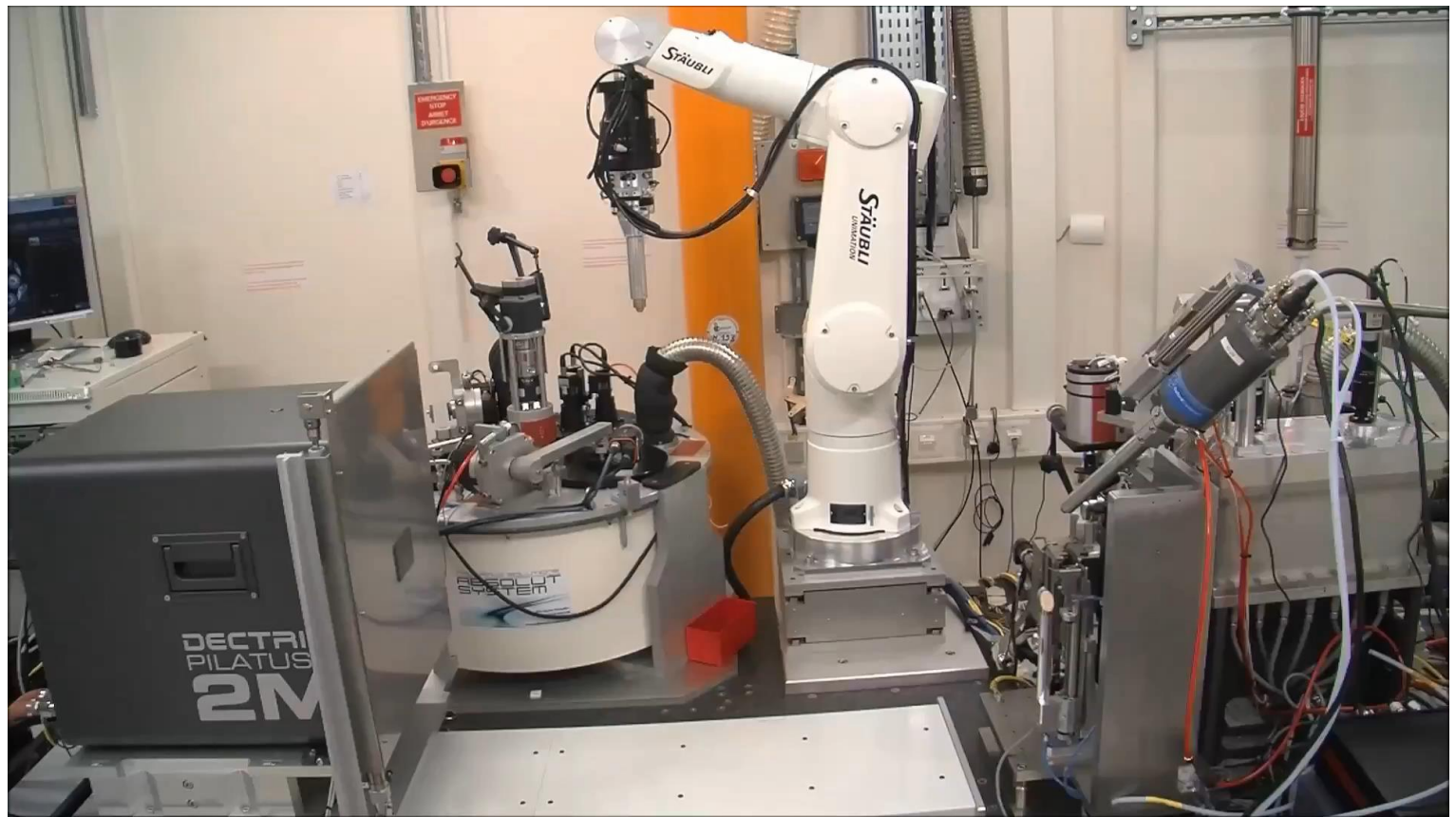


**Industrial translation:**

- Expensive and difficult to use
  - Risky
  - Fundamental science
- Not for me.



Provide what industry actually needs.







Advanced  
Photon  
Source

# IMPACT



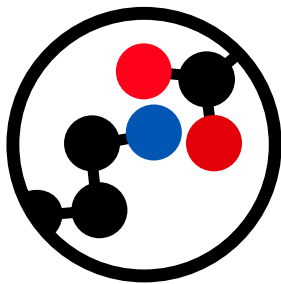
**IMCA-CAT**

Industrial Macromolecular Crystallography Association  
Collaborative Access Team



Advanced  
Photon  
Source





# IMCA-CAT

Industrial Macromolecular Crystallography Association  
Collaborative Access Team

## INDUSTRY

IMCA Members

abbvie

Bristol Myers Squibb™

Janssen  
PHARMACEUTICAL COMPANIES OF  
Johnson & Johnson

MERCK

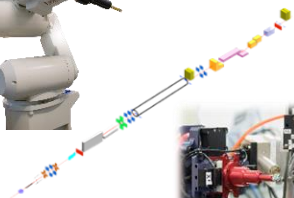
NOVARTIS

Pfizer

IMCA-CAT Subscribers

## EXPERIMENT

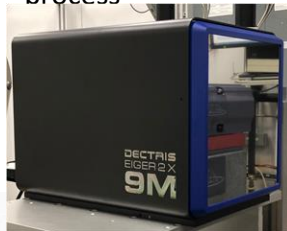
Beamline 17-ID @ APS



- focused, intense beam
- mini beam 5-50  $\mu\text{m}$
- pucks: Unipuck, ACTOR, ALS

## CAPABILITIES

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



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

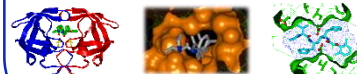
[www.imca-cat.org](http://www.imca-cat.org)

## PRODUCTIVITY

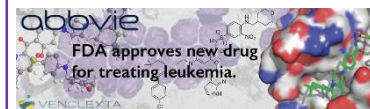
23,000+  
structures annually



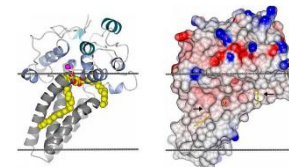
- high-throughput
- fast, encrypted data transfer
- real-time integration to company pipelines



## DISCOVERY



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





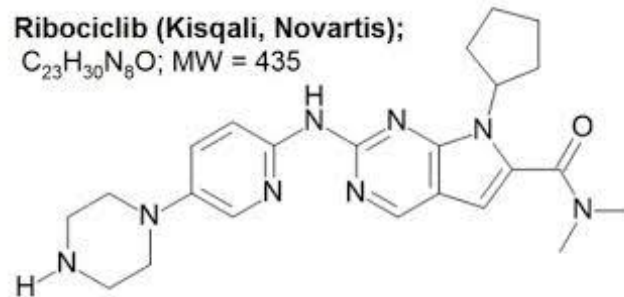
# Drugs

Kisqali® (Novartis)  
metastatic breast cancer

- FDA:
- Breakthrough Therapy
  - Priority Review



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



Ribocil (Merck)  
antibiotic

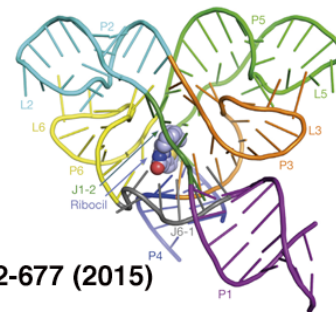


Science Highlight:  
Discovering Antibiotics

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



Nature 526, 672-677 (2015)



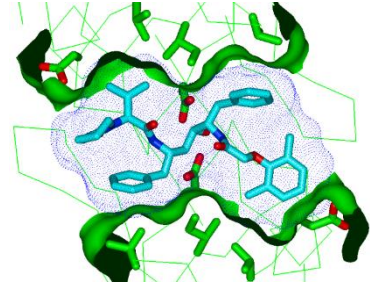
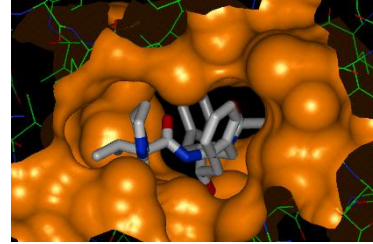
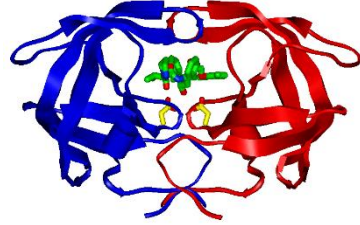
Venclexta™ (AbbVie)  
chronic lymphocytic leukemia

- FDA:
- Breakthrough Therapy
  - Priority Review

abbvie  
FDA approves new drug  
for treating leukemia.  
VENCLEXTA

# Drugs

Kaletra<sup>®</sup> (Abbott)  
AIDS



**KALETRA<sup>®</sup>**  
(lopinavir/ritonavir)

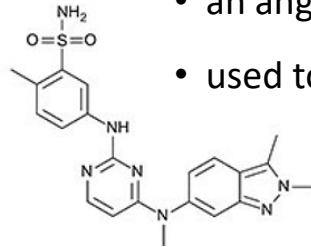
Januvia<sup>®</sup> (Merck)  
type 2 diabetes



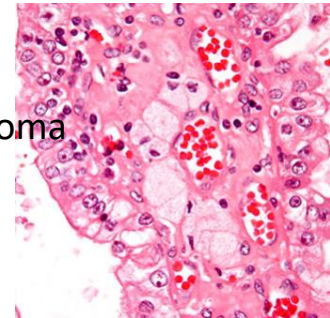
- approved by the FDA in 2006
- one of the most popular type 2 diabetes drugs on the market

**Januvia<sup>®</sup>**  
(sitagliptin, MSD)

Votrient<sup>®</sup> (GSK)  
kidney cancer



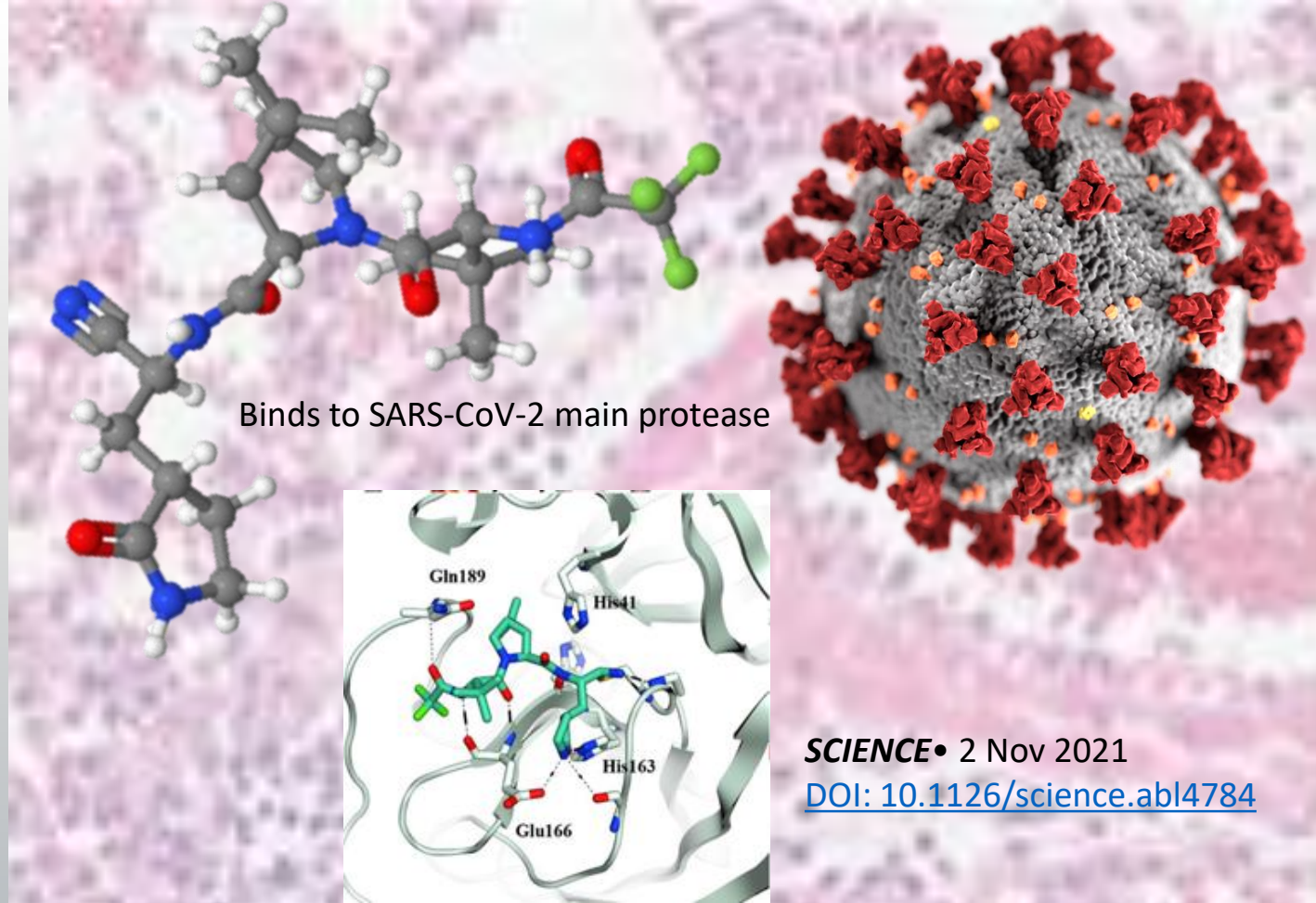
- an angiogenesis inhibitor
- used to treat advanced renal cell carcinoma



**Votrient<sup>®</sup>**  
pazopanib

# Drugs

## Paxlovid™







STREAMLINE

Win-win format

Magnus@MAXIV - “Not static, fitting needs”



Energy & raw materials

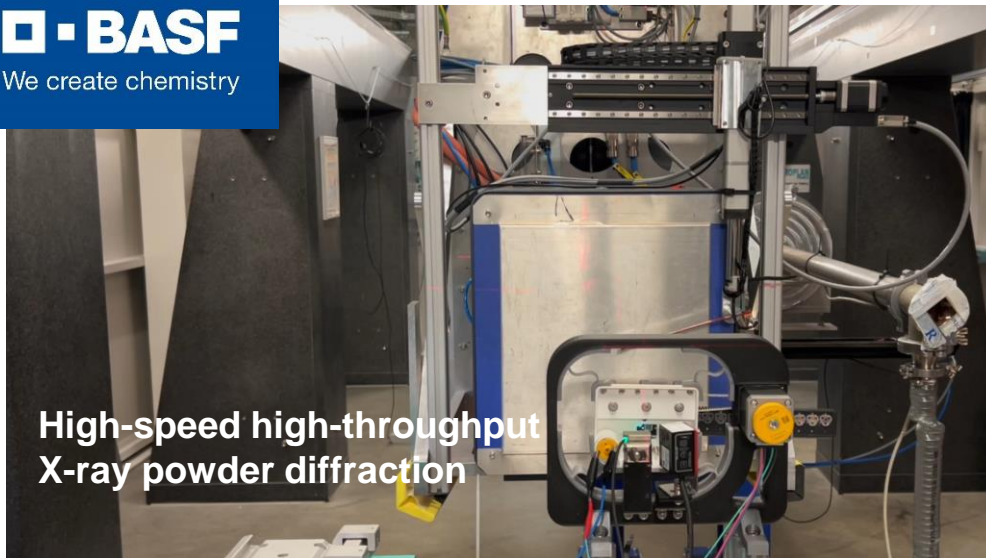
Collaboration with university

Collaboration with company

## NEW HIGH THROUGHPUT SERVICES – XRF and XRPD

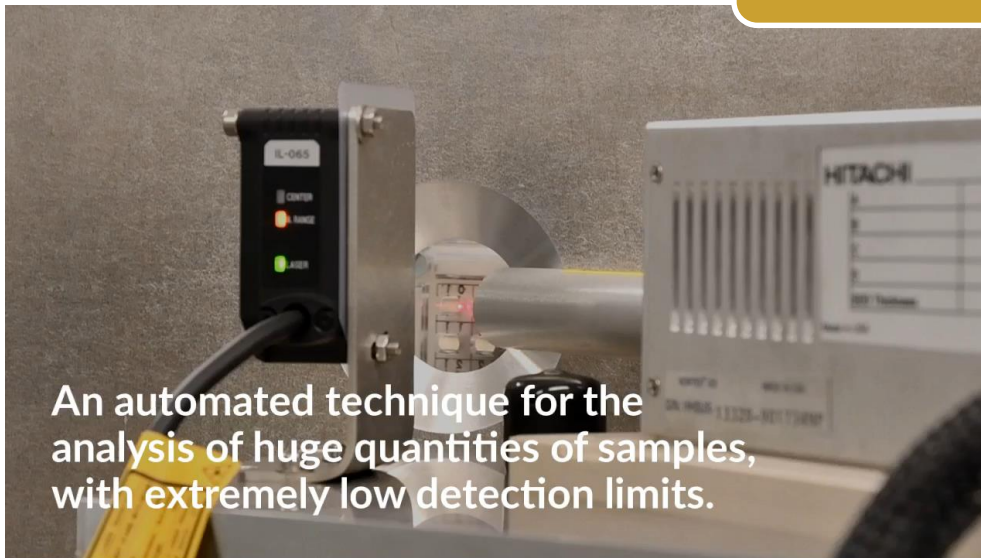
- Enable analysis of thousands of samples
- Accurate component analysis
- Mining industry, materiomics, chemistry, catalysis....
- First client with 4,000 samples running on XRF, XRPD due to start soon

**BASF**  
We create chemistry



High-speed high-throughput X-ray powder diffraction

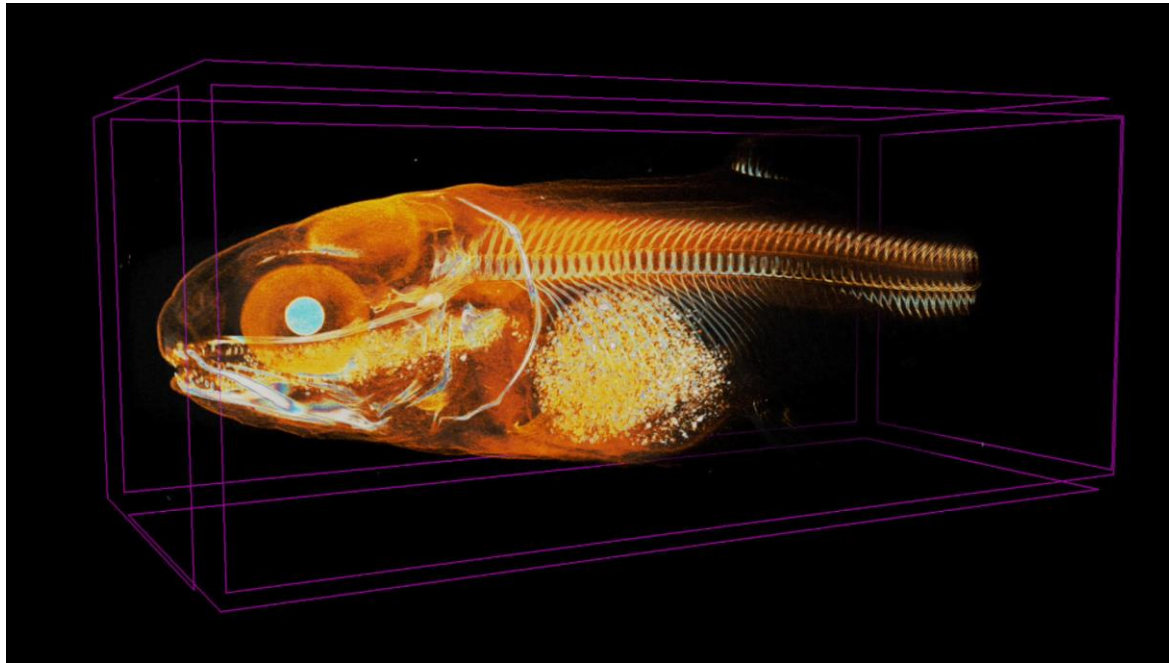
With Bernd Hindrichsen (BASF)



An automated technique for the analysis of huge quantities of samples, with extremely low detection limits.

With Prof. Manuel Munoz (Montpellier University)  
With Prof. Manuel Munoz (Montpellier University)

## X-RAY COMPUTED TOMOGRAPHY- BLINE BM05



Biomar interested in how experimental diets affect fish digestion process, which is why they saw a great potential in non-destructive 3D imaging as a complement to dissection and histological analysis.



X-R



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**News**

## Non-destructive 3D imaging expands aquafeed research tools

Thursday, April 21, 2022

The [Danish Technological Institute](#) (DTI), in collaboration with BioMar, investigated batches of fish larvae after being fed different experimental diets. BioMar was interested in how the experimental diets affect the digestion process of fish, and the company found great potential in non-destructive 3D imaging as a complement to dissection and histological analysis.

“Our collaboration with DTI has tremendously aided in expanding our research tools to increase our knowledge of fish physiology. The overarching gain to include this top-of-the-art technology is to continue improving what we offer to the aquaculture industry in form of a feed. In other words, each pellet we produced is based on solid science, and this exciting collaboration provided us with the right tools,” said Pedro Gómez, senior scientist, Biomar Denmark.



Pisciculture

RTO  
expertise



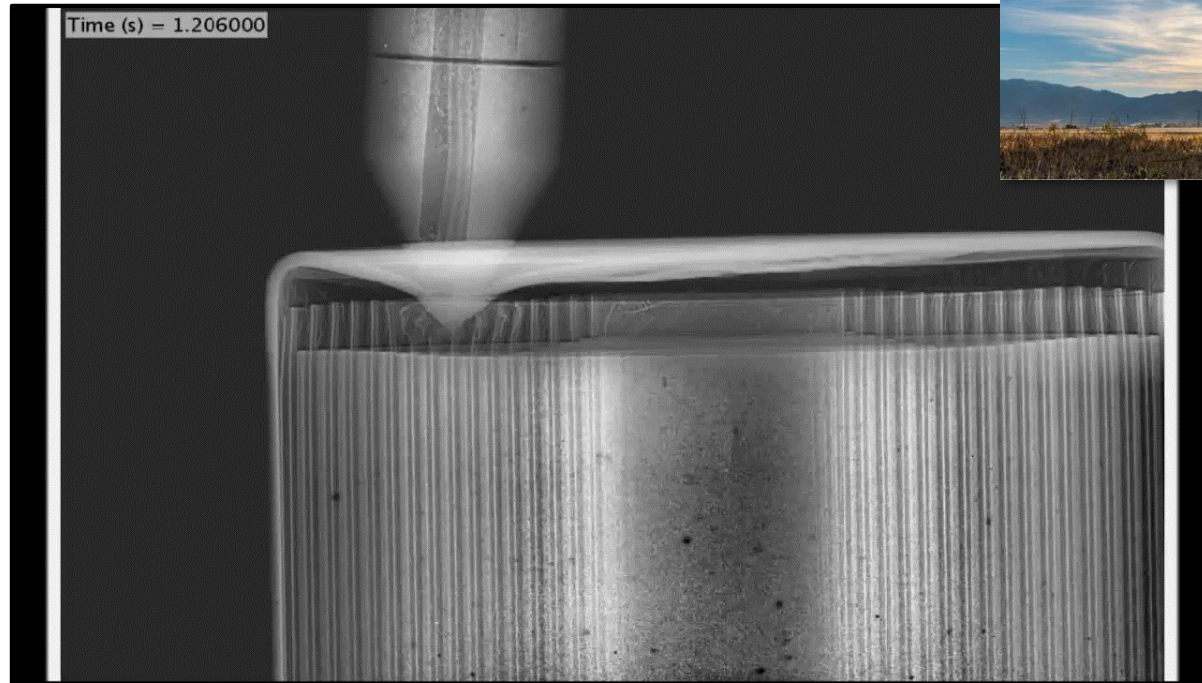
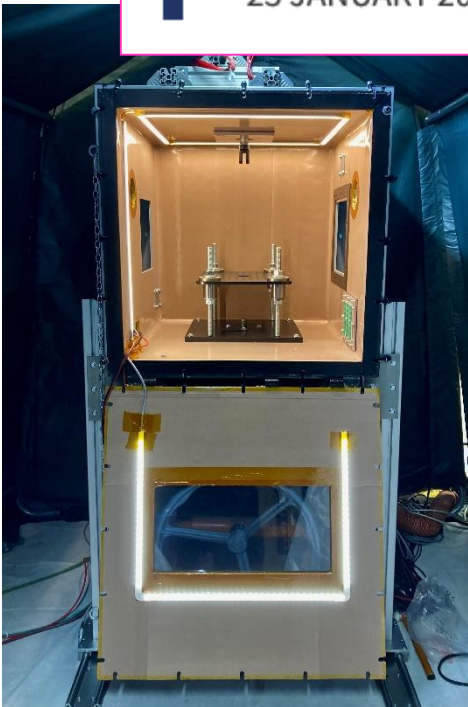
and in how  
diets affect fish  
growth, which is why  
3D imaging has  
great potential in  
non-destructive  
3D imaging as  
an alternative to  
dissection  
analysis.

<https://www.dti.dk/synchrotron-imaging-of-low-density-materials/visualization-of-soft-tissue-in-small-fish-phase-contrast-ct/43911,3>

<https://www.aero-mag.com/archer-aviation-signs-deal-with-nasa-on-battery-development>

# Archer Aviation signs deal with NASA on battery development

23 JANUARY 2024 • IN NEWS

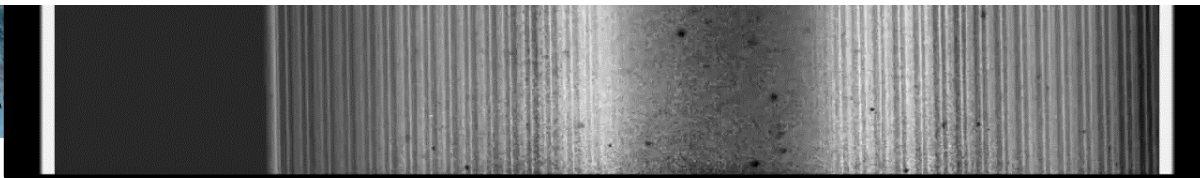
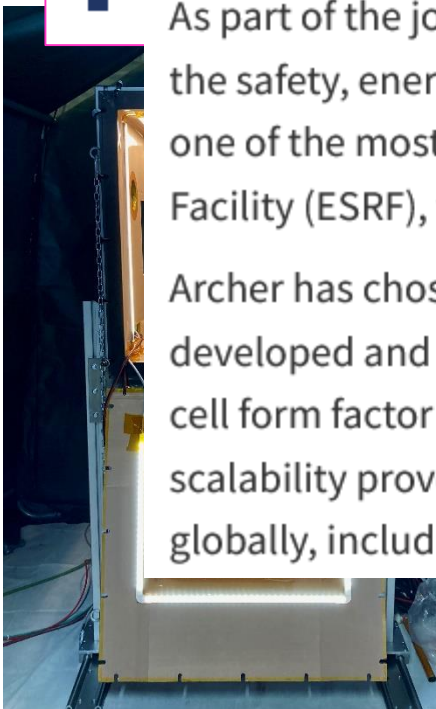


# Archer Aviation signs deal with NASA

“We’re extremely proud to partner with NASA, who has pioneered the eVTOL industry over the last three plus decades, in support of our collective mission to ensure U.S. leadership in aerospace continues for decades to come,” said Adam Goldstein, Archer’s Founder and CEO.

As part of the joint efforts around battery characterisation, NASA and Archer will focus on further testing the safety, energy and power performance capabilities of the battery cells. Tests will be performed using one of the most advanced high speed X-ray facilities in the world, the European Synchrotron Radiation Facility (ESRF), to understand how the cells function during extreme abuse cases.

Archer has chosen these cells to power the proprietary electric powertrain system Archer has designed, developed and is beginning to mass manufacture for its production electric air taxi, Midnight. The battery cell form factor chosen by Archer, a cylindrical cell, has a track record of safety, performance and scalability proven through decades of volume manufacturing, deployed across many applications globally, including in millions of electric vehicles.





# SOME THINGS CANNOT BE CHANGED....

## But we can try to make them easier:

- Safety and regulatory steps
- Administrative access steps
- Sending samples - tracking
- Legal: simple quotes and clear T&C
- Acceptance of company NDA, MSA, MTA models

### Which are the perceived barriers that can impact the use of the ESRF services?

You can see how people vote. [Learn more](#)

Cost and/or scheduling time	38%
Amount of paperwork	14%
Intellectual property	14%
None of the above/others	33%

- three weeks' notice in writing
  - two weeks' notice in writing
  - one week's notice in writing
- of the full quoted price plus VAT (as per...)
4. **Scientific and Technical Assistance**
- 4.1 **Technical support:** A Local Contact beamline, within the limits of a user to the operation of the beamline environment. His/her role is to assist the Client in the operation of the experiment. The Client must provide the *Experimentalists* to operate the assistance as per § 4.2 below in relation to the assistance.
- 4.2 **Scientific assistance:** in addition outlined in § 4.1, the ESRF may provide request, subject to availability, at the discretion of the ESRF.
- 4.3 Normally, no assistance as described above is available after 22h00. However, may be called on extension 252 technical problem occurring on site.
5. **Liability**
- 5.1 Responsibility for any material property of the Client rests with the Client. The Client must ensure the timely transport to and from the facility carried out at the ESRF. The ESRF provides service or guarantee.
- 5.2 While the ESRF will take all material or equipment which is provided to the ESRF will not indemnify the Client except in the case of fault or gross negligence of the ESRF.
- 5.3 The Client will be solely responsible for the substance(s) analysed supplied by the ESRF and caused by the experiment.
- 5.4 At all times, ESRF retains complete control over and responsibility for its personnel, who shall not, in any sense, be considered to be employed by the Client. ESRF shall meet all costs related to the employment of its personnel (salaries, insurance payments, medical attention, etc.). The same holds



AS TO THE RESEARCH CARRIED OUT IN THE SCOPE OF THE USE OF THE FACILITY, OR ANY INTELLECTUAL PROPERTY, GENERATED INFORMATION OR PRODUCT MADE OR DEVELOPED OR THE MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE RESEARCH OR ANY RESULTING PRODUCT.

**ESRF FACILITIES**

*Experimentalists* (when...)

the Client related to the... of an experiment, unless... generated as part of the... the Client. The Client is... the experiment, but if the... credit to the ESRF. If(s) is required by the... the experiment, dated 6 January 1978, opened Union's General PR) n° 2016/679, on... and Civil Liberties, the... to request access to, and... of, their personal data... the responsibility of the... of its employees leave... to modify the rights of... ESRF shall not be held... by which may result due... the aforementioned



# **TamaTA-Innov: Boosting SME innovation with advanced X-ray analysis**

**European H2020 project “LEAPS Innov” enabling subsidised & confidential access for SMEs.**

Easy and fast applications - Κρατώντας το απλό!

**To apply: [www.wayforlight.eu/en/industries](http://www.wayforlight.eu/en/industries)**

**Clients using the TamaTA SME support:**

- ✓ “We obtained very useful results for **improving the formulation and manufacturing process** of a very innovative product that we are currently introducing in the market.”
- ✓ “We are extremely satisfied with the results and they have given us **new insights into our materials discovery** pipeline.”



# SUPPORTING INNOVATIVE SME COMPANIES



## Takis Biotech (It)

- COVID therapy
- ID23-2/micro-MX



**SCANDIFLASH™**

## Scandiflash (Se)

- Instrumentation
- ID19/MHz radiography



## Hey Planet (Dk)

- Food ingredients
- BM05/micro-CT



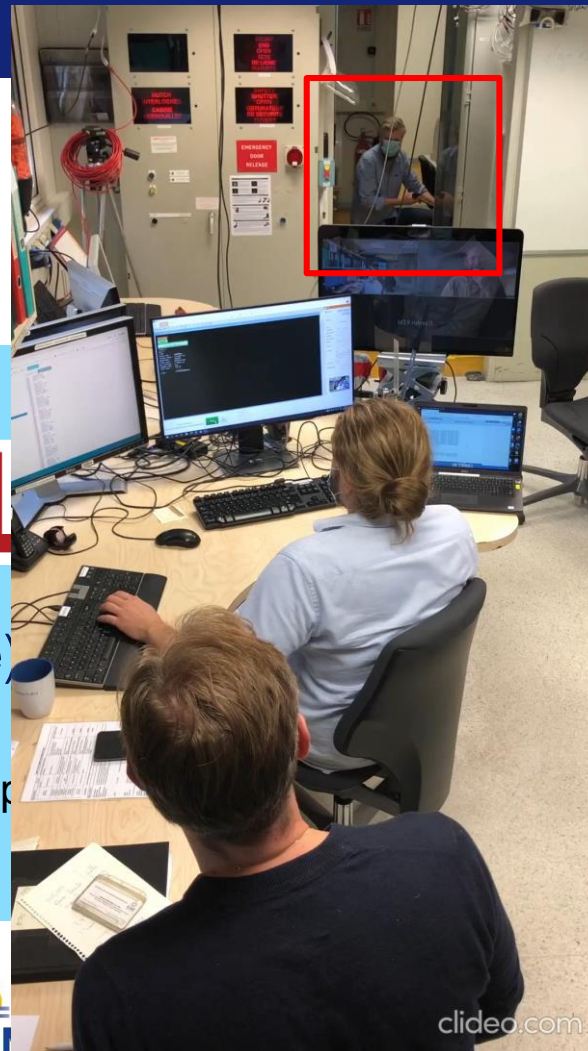


# SUPPORTING INNOVATIVE SME COMPANIES



## Takis Biotech

- COVID therapy
- ID23-2/micro-MX



AS

(Se)

on

- ID19/MHz radiograph



clideo.com

## ESRF is now partnering with the European Innovation Council!



Free consulting services



5 Tailored Services for EIC  
Beneficiaries



Visit the **EIC** service catalogue and  
find us in the **pathfinder** section!





## *Initial Expert Consultancy*

- Respond to industrial R&D needs/questions using cutting-edge X-ray characterisation techniques
- Remote one-on-one or group meetings
- Free of charge

## *Fast Track Access to X-ray Services*

- Quick access to advanced X-ray techniques for routine materials and products characterisation
- Measure sample structures at different scales, from atomic to macro, whilst being non-destructive

## *Tailor-made Support and Experimentation*

- Build a tailored support and exploitation of synchrotron X-ray techniques for a longer-term R&D support
- Specific experiment environments, set-ups



MAX IV



Photo ABML4



MAXIM

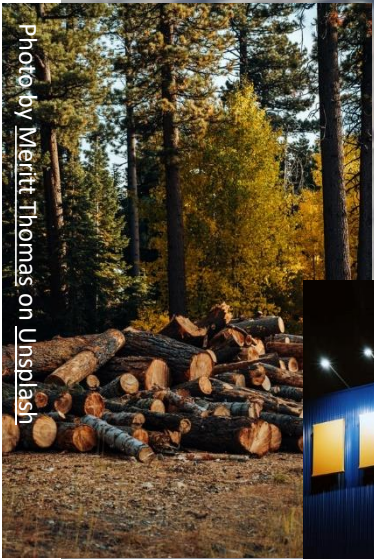


Photo by Meritt Thomas on Unsplash



Photo by Rendy Novantino on Unsplash

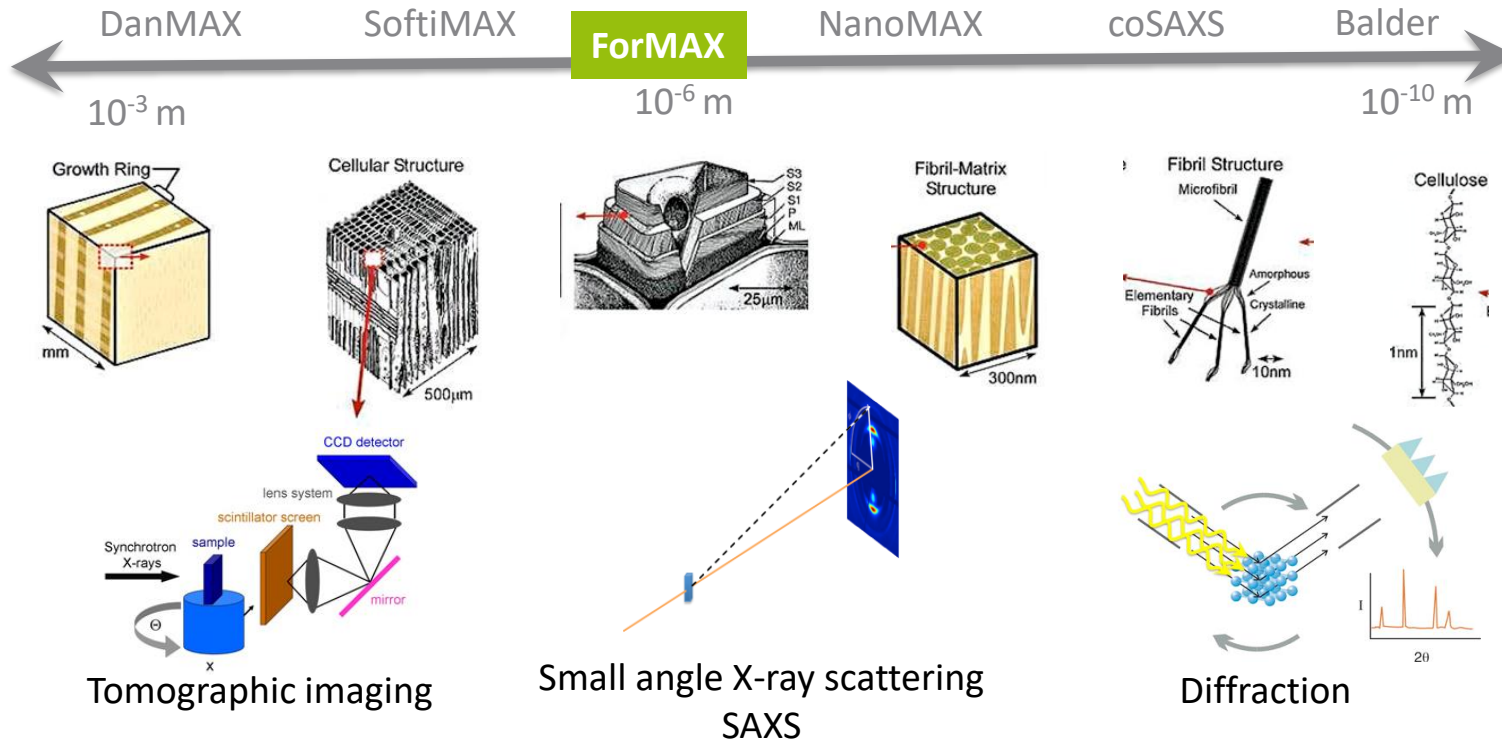


Tetra Pak®

Photo ABML4

# Wood – from Logs to Lignin Molecules

Wood is a hierarchical multi-scale raw material







TRESEARCH

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

OPEN: November 2022



### **ForMAX:**

- Supports R&D on biocomposites, nanocellulose, modification of wood, the pulping process, fibre ultrastructure and fibre-fibre bonding
- Provides advanced material characterisation, including complex real-time processes
- Contribute to the Swedish forest industry competitiveness (paper/pulp industries – Tetra Pak).

Joint funding from Wallenberg Foundation and industry



### **“ForMAX”**

SAXS/WAXS/tomo beamline

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



Outreach.  
Translation.  
Matching.  
Common understanding.





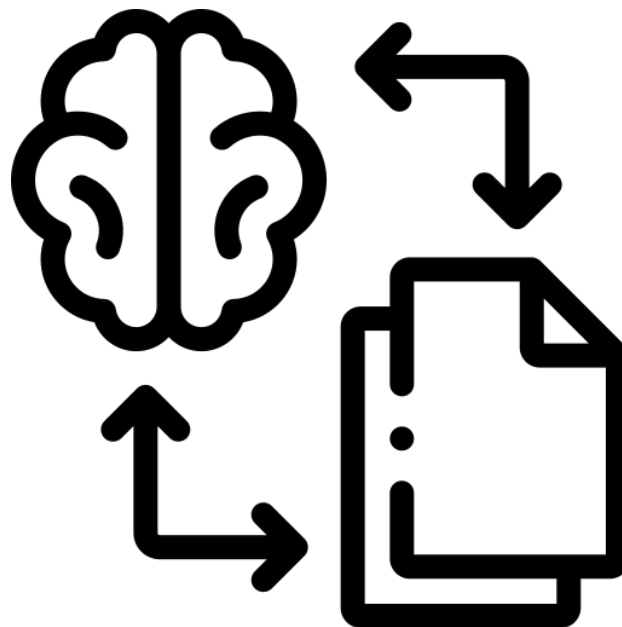
**Mediators connecting industry to X-rays and neutrons**  
A network of analytical service companies



et al.



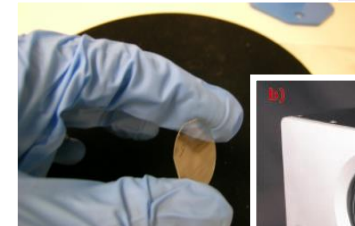
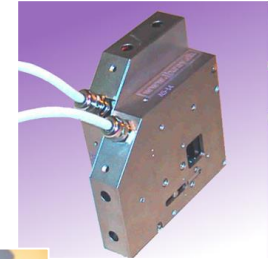
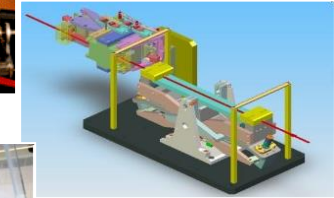
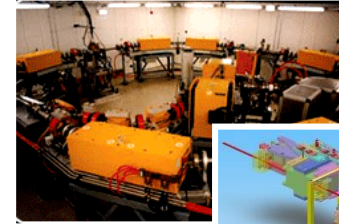
## Technology and Knowledge Transfer



# 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.





**sef**  
Technologies

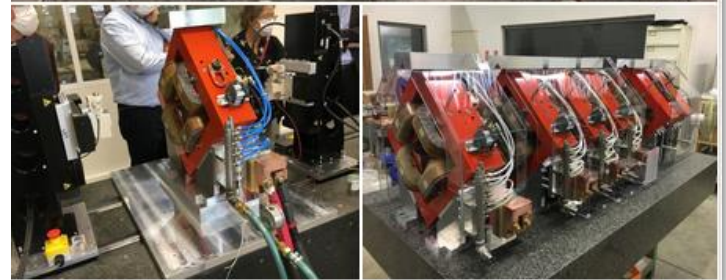
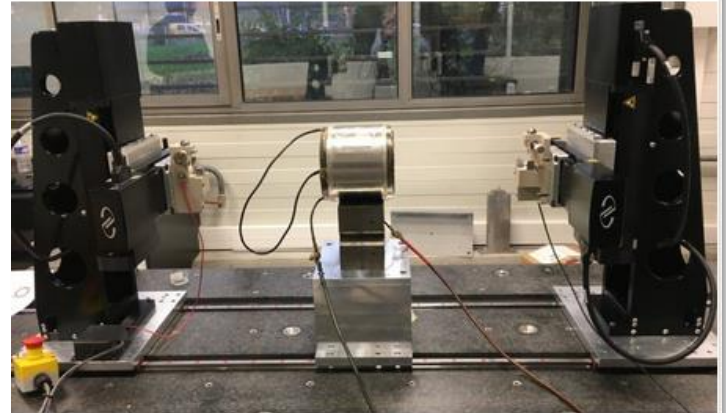
KTT action.  
Trust.

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396 followers  
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As part of our development, we acquired a magnetic measurement bench (Stretched Wired Bench) in early 2022. We carried out the magnetic measurements of the first 13 QP TITANS magnets manufactured for the CEA that we will deliver this month. Currently SEF is conducting magnetic measurements on the QP IX magnet manufactured for CERN.

These few are equipped, which saves them time and facilitates the physical installation of the magnets on their line.





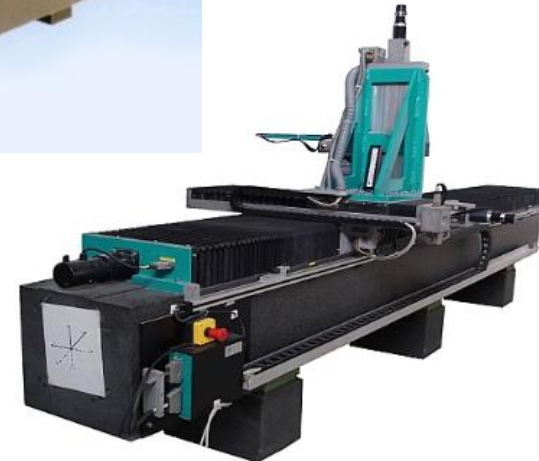
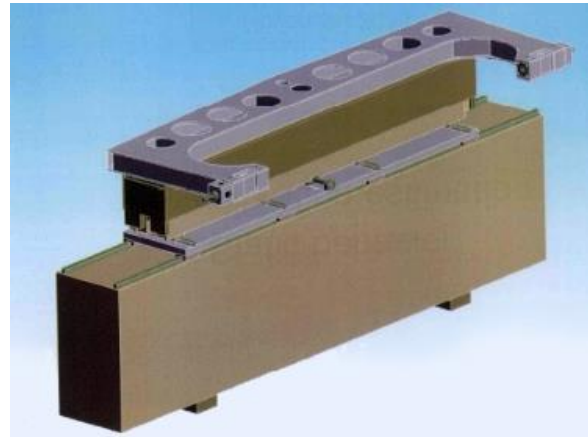


# Magnetic measurements laboratory at ALBA Synchrotron

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





## 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)

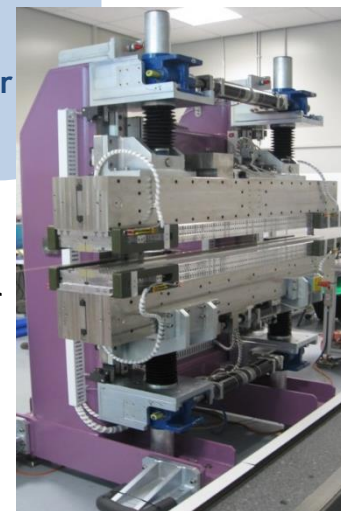


Dipole magnet



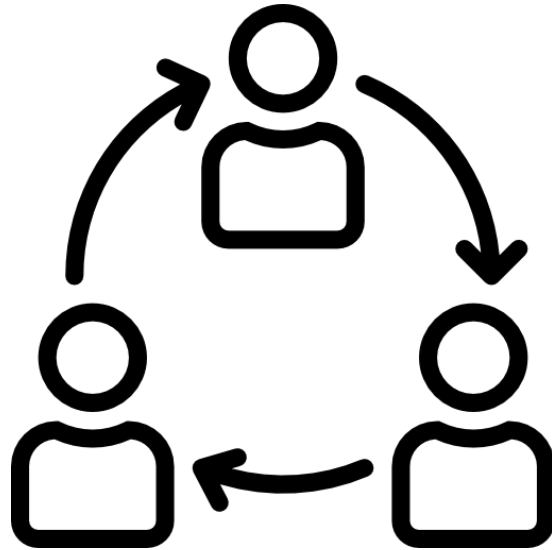
Multipole magnet

Undulator





## Collaborating and Partnering with Industry

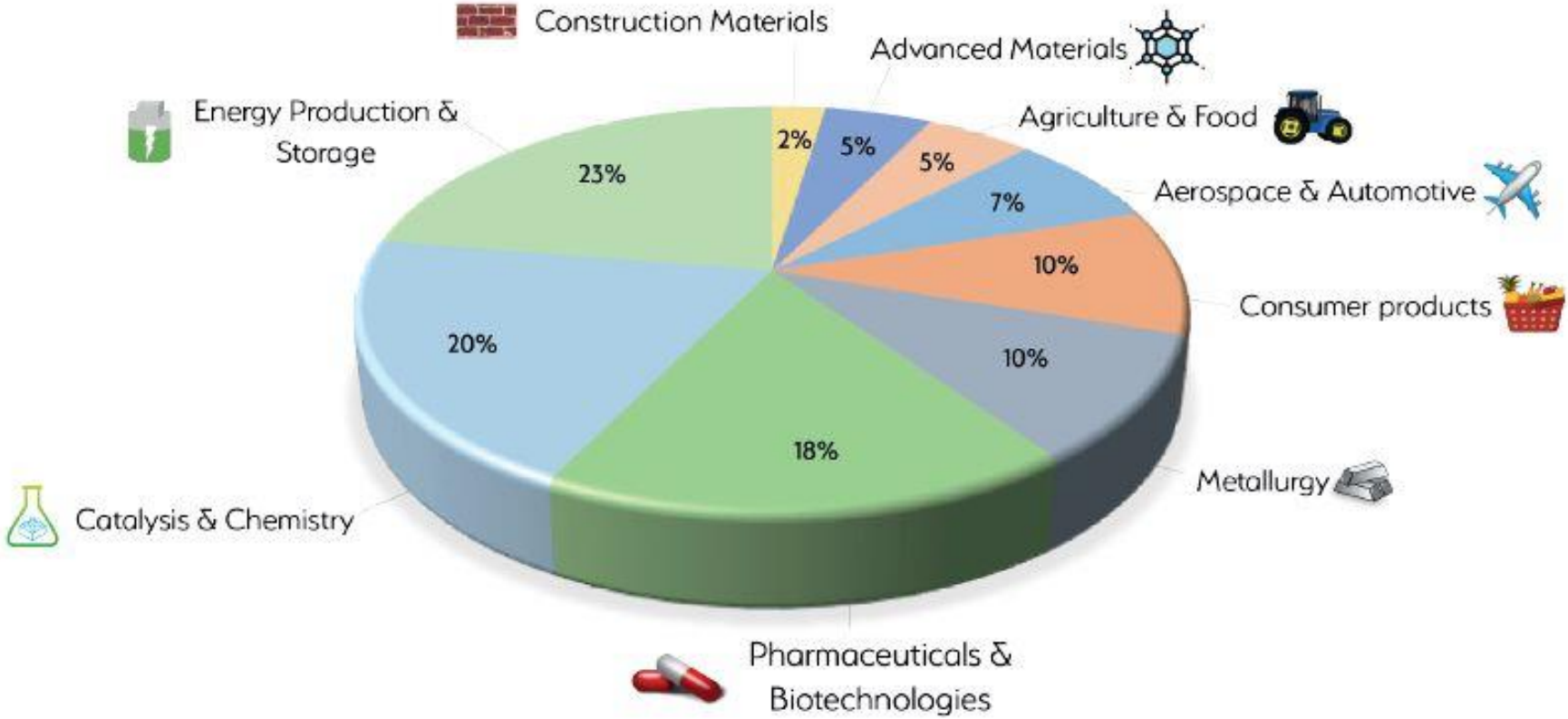
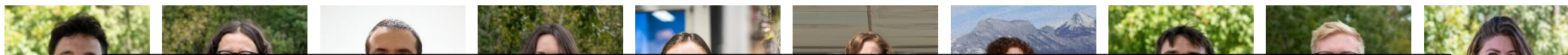




40 PhD projects using ESRF & ILL  
40 industry partners driving the research challenges  
Next generation ambassadors

[www.innovaxn.eu](http://www.innovaxn.eu)





40 industry partners driving the research challenges  
Next generation ambassadors

[www.innovaxn.eu](http://www.innovaxn.eu)







**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**



## PRECISE FAULT INSERTION – BLINE ID09

Airbus has come to the ESRF to test how well electronic devices used in satellites can sustain cosmic radiation.



Testing electronics  
for space  
#ESRFforindustry



Might  
Could  
Should  
Must  
Like

Stakeholder and EU support is critical.  
Facility engagement is key.  
Outreach, outreach, outreach.





Extended ESRF  
Business Development Office  
Team



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**Thank you for your attention**

Ed Mitchell

Head of Business Development

**mitchell@esrf.eu**

**in [www.linkedin.com/in/e-mitchell](http://www.linkedin.com/in/e-mitchell)**