

European XFEL Enlightening Science

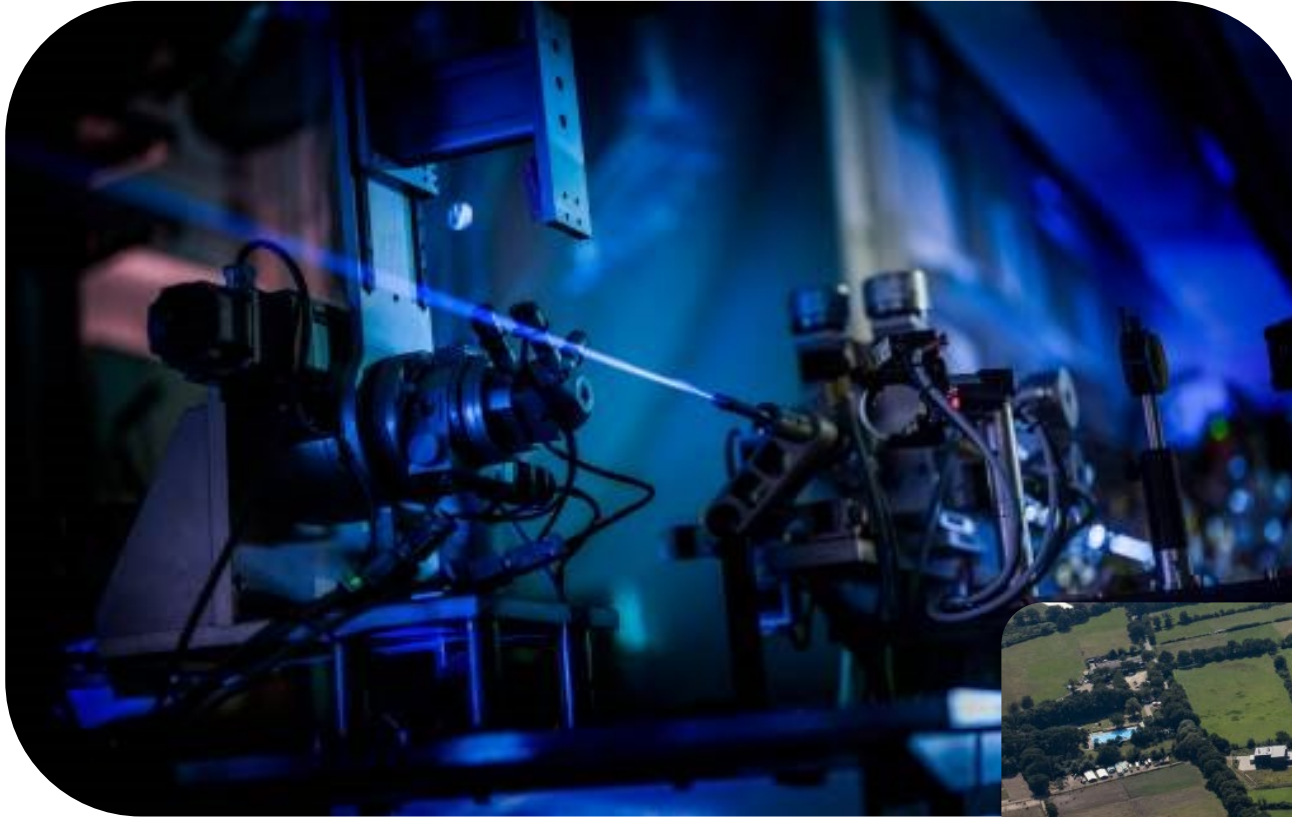


Antonio Bonucci
European XFEL Industrial Liaison Office
In-Kind Contributions Supply Chain Manager

antonio.bonucci@xfel.eu

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European XFEL—a leading new research facility



The European XFEL is a new research facility that uses high-intensity X-ray light to study the structure of matter.

- User facility with more than 400 employees (+250 from DESY)
- Location: Hamburg and Schenefeld, Germany
- September 2017: start of user operation

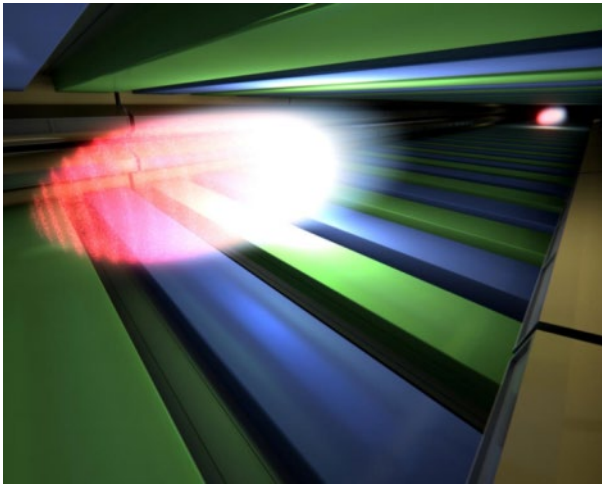


About European XFEL



- Organized as a non-profit corporation in 2009 with the mission of design, construction, operation, and development of the free-electron laser
- Supported by 12 partner countries
- Germany (federal government, city-state of Hamburg, and state of Schleswig-Holstein) covers 57% of the costs; Russia contributes 26%; each of the other international shareholders 1–3%
- Total budget for construction (including commissioning)
 - 1.25 billion € at 2005 prices, about 117 M€ operating budget
 - 600 M€ contributed in cash, over 550 M€ as in-kind contributions (mainly manufacture of parts for the facility)

What can the European XFEL do?



X-ray light

See samples at atomic resolution

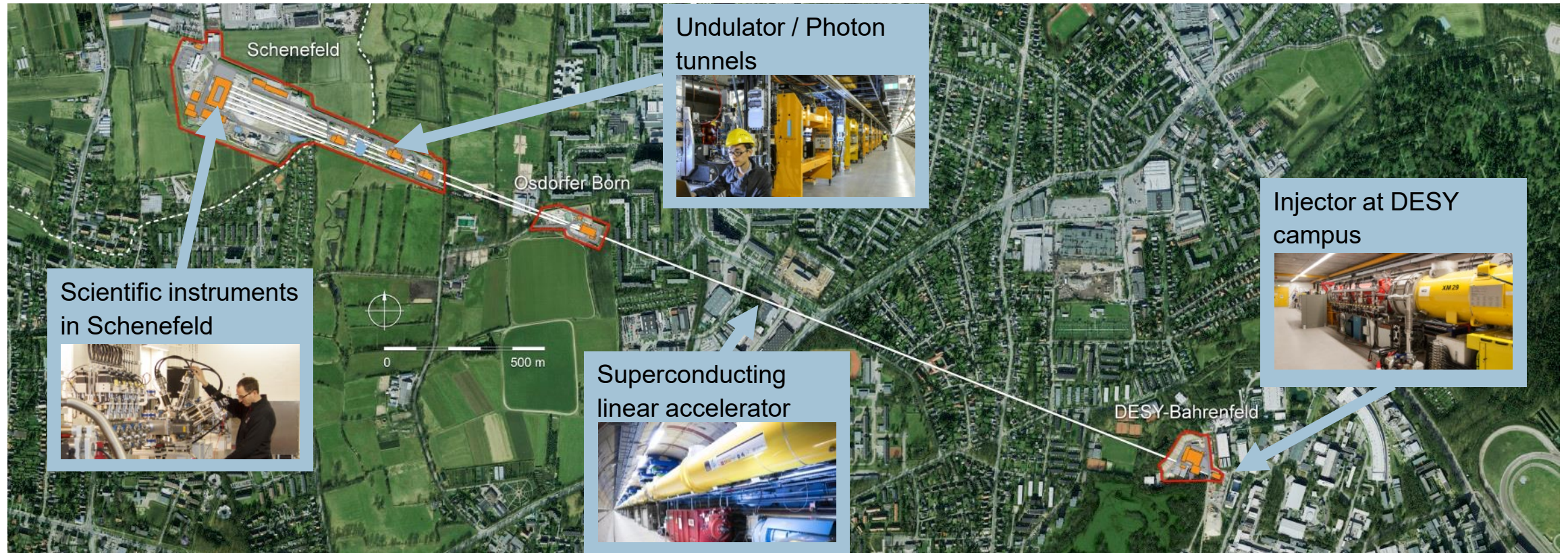
Ultrashort flashes

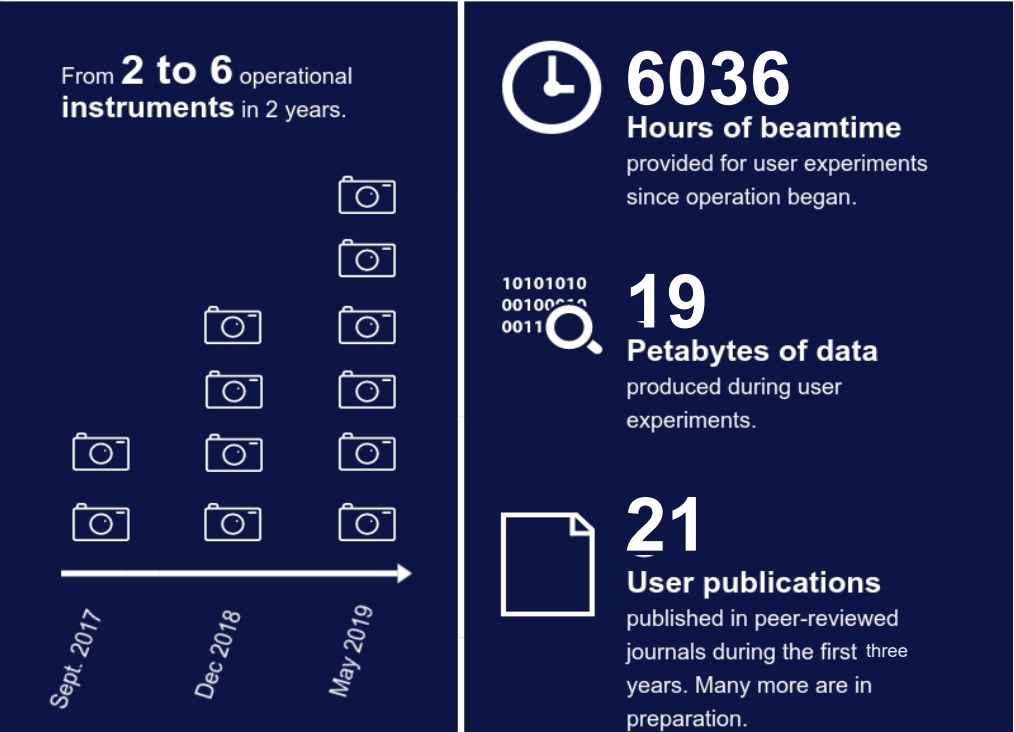
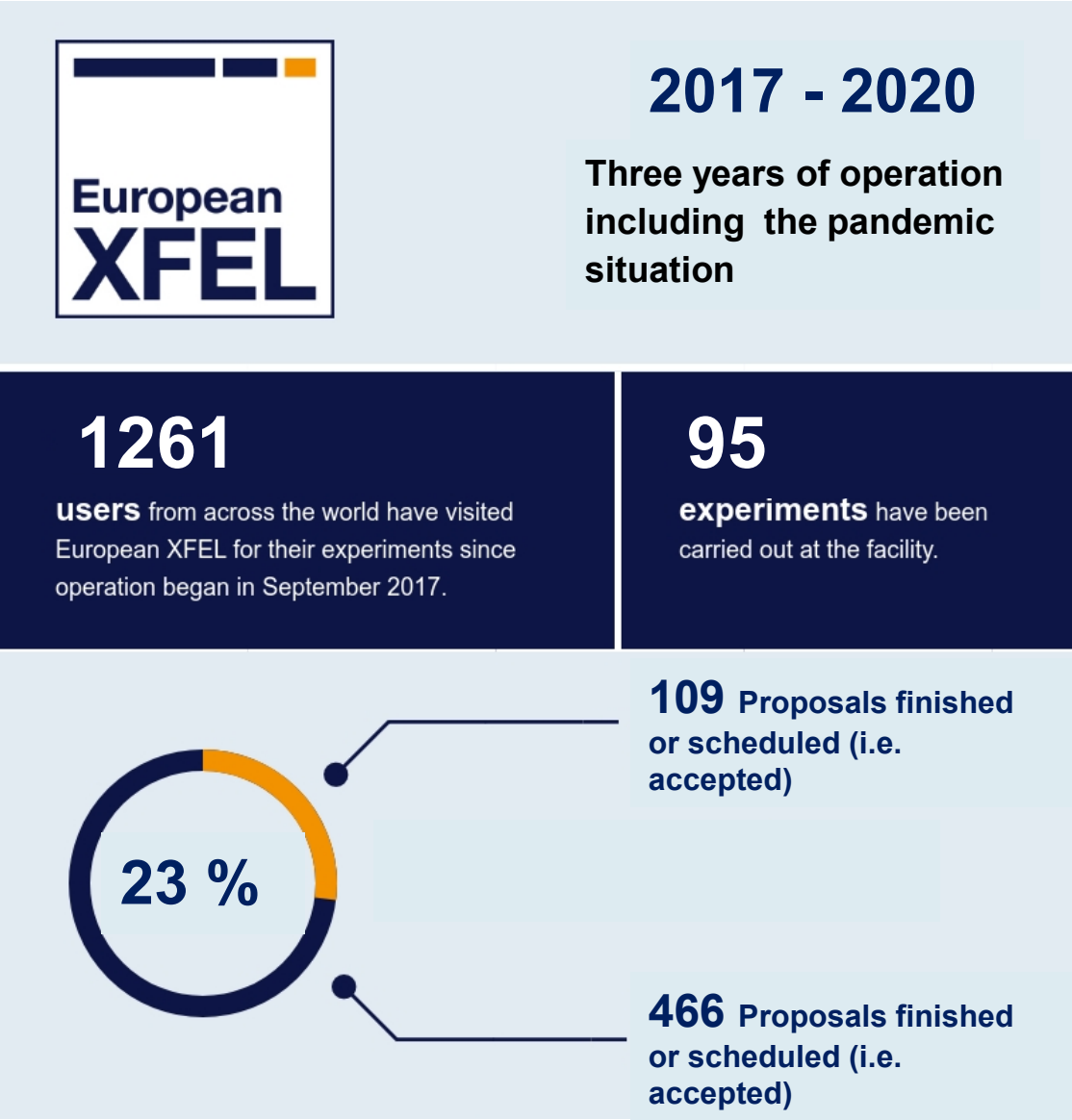
Film (bio-)chemical reactions

Intense X-ray pulses

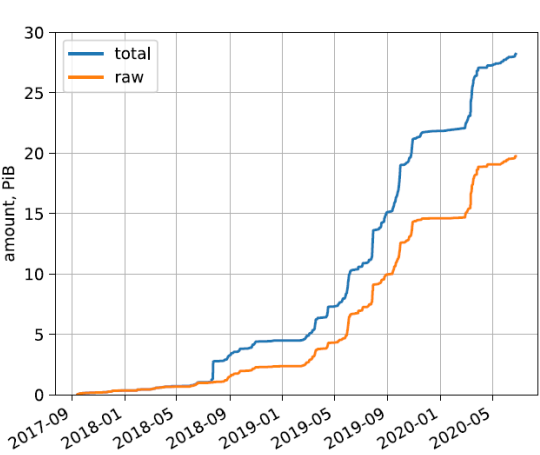
Study single molecules or tiny crystals

General layout of the European XFEL





Data profile



	dtype	proc	raw	total
instrument				
SPB		3.2 PiB	8.5 PiB	11.6 PiB
MID		2.7 PiB	4.6 PiB	7.2 PiB
SCS		352.9 TiB	2.7 PiB	3.1 PiB
FXE		1.2 PiB	1.3 PiB	2.5 PiB
SQS		59.0 TiB	429.4 TiB	488.4 TiB
HED		18.4 TiB	25.6 TiB	44.0 TiB
total		7.5 PiB	17.5 PiB	25.1 PiB

Activity of ILO harmonized with the vision and mission

■ The office covers tasks that typically in large scale facilities are associated with several offices:

■ **Supporting state-of-art technologies as IRO/ICO:**

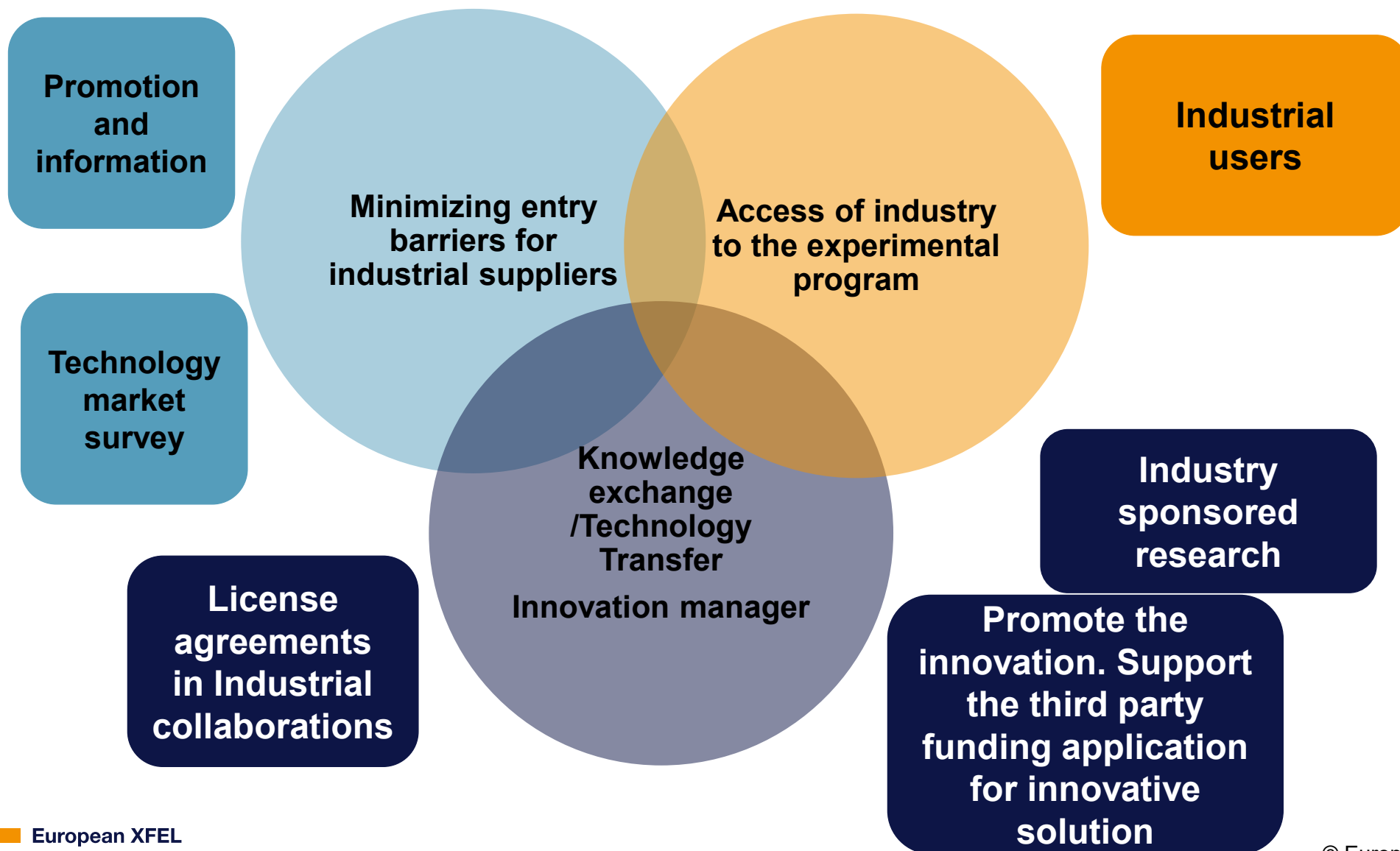
- ▶ Minimizing entry barriers for technology providers, in particular for cutting-edge components and challenging specifications
- ▶ Enlarging the pool of tenders
- ▶ Promoting industrial collaborations

■ **Enabling to solve major societal challenges as Industrial User office:**

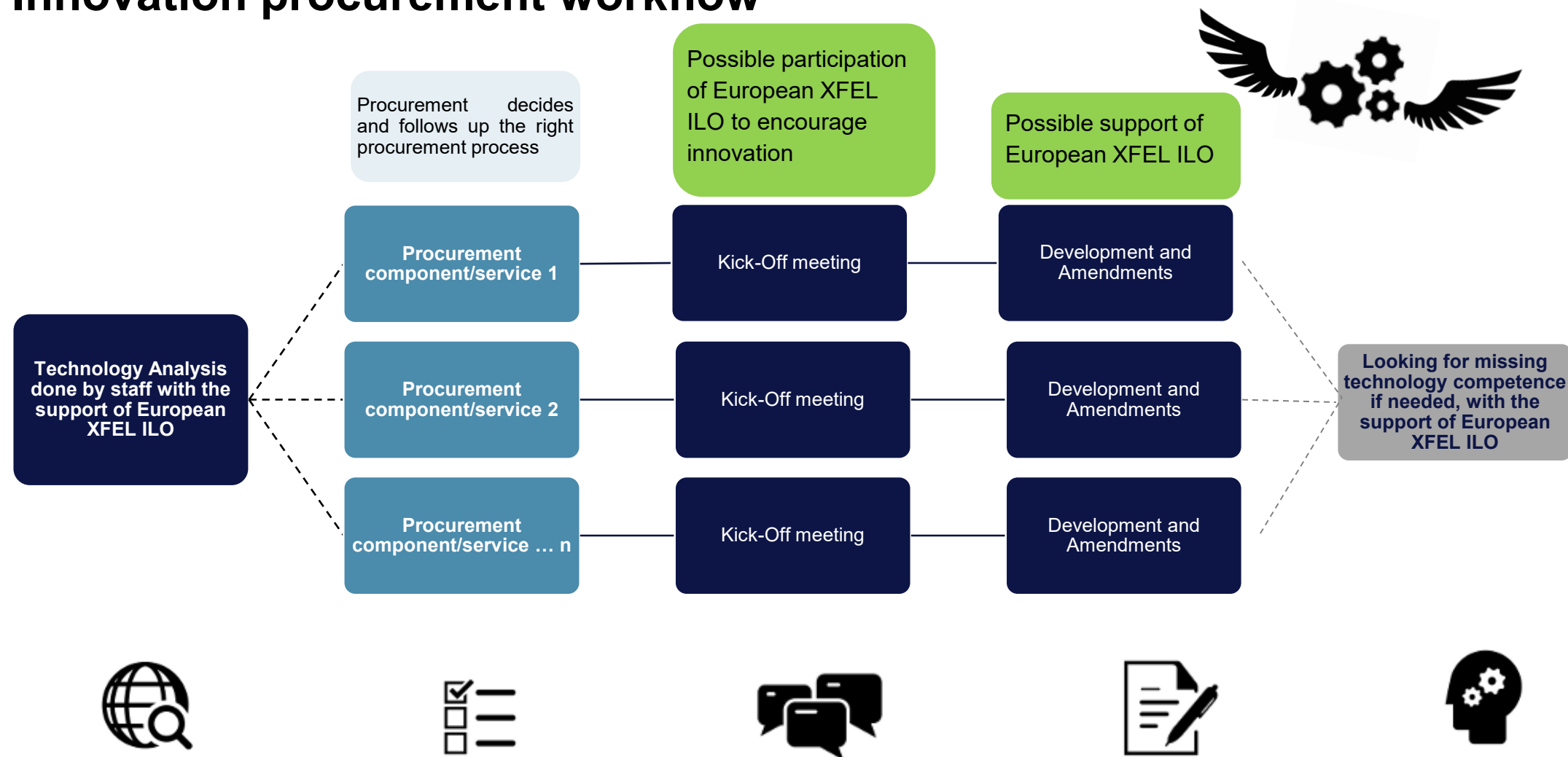
- ▶ Access of industry to the experimental program, to the lab facilities and knowledge

■ **KTO and TTO towards industry:**

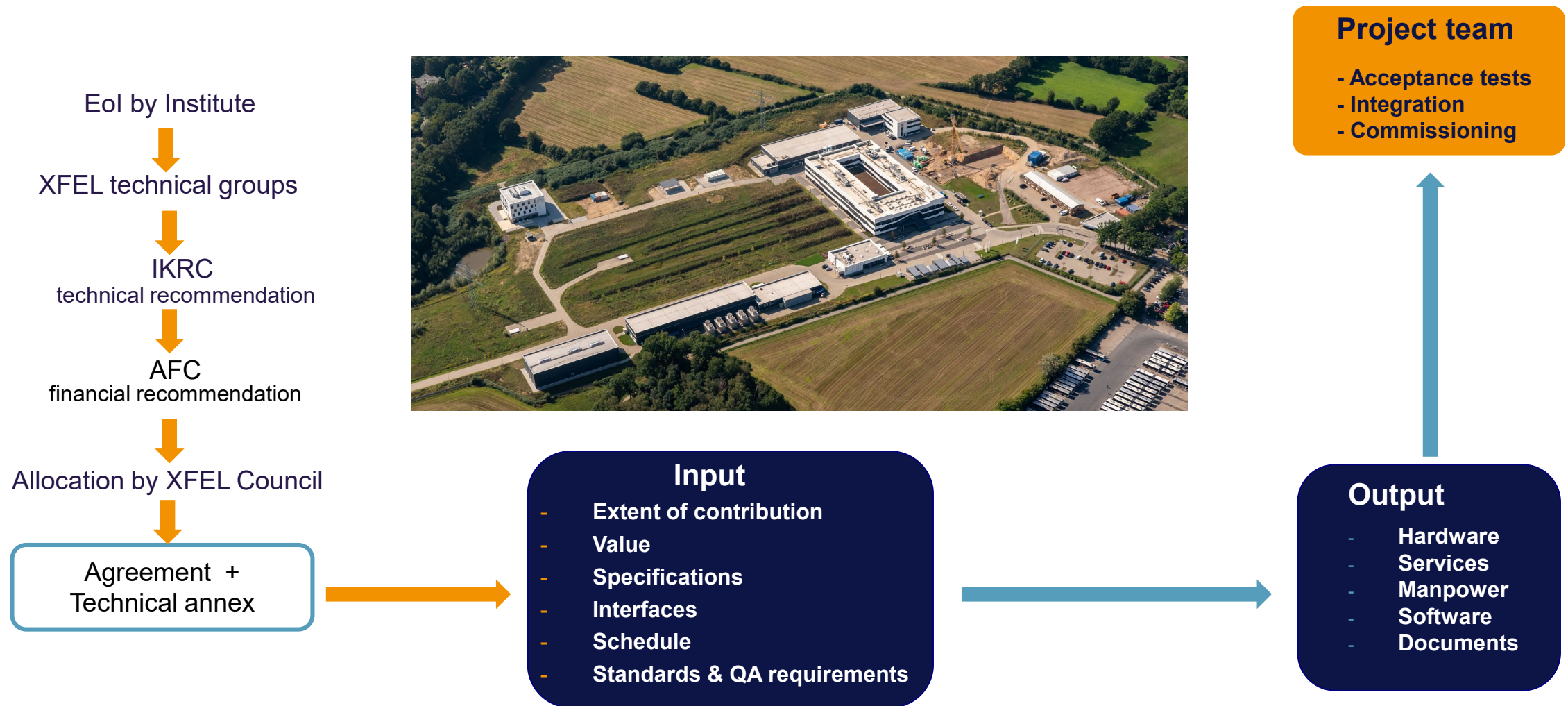
- ▶ Technology transfer and knowledge transfer towards industry



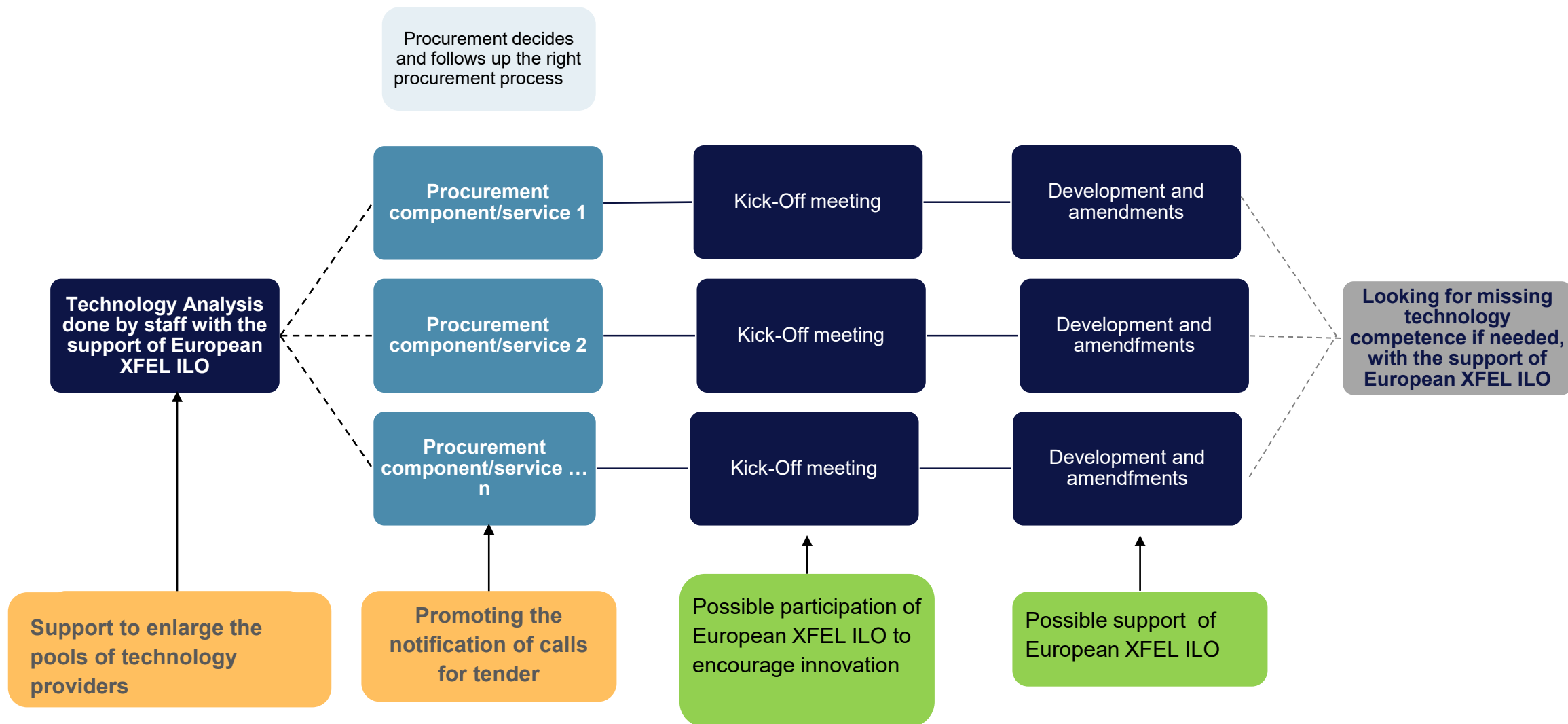
Innovation procurement workflow



Process of an IKC in the construction phase



Innovation procurement workflow: **National ILO** involvement



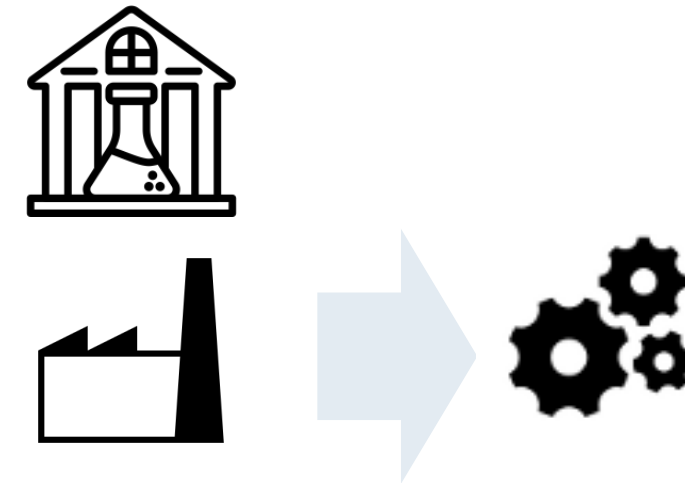
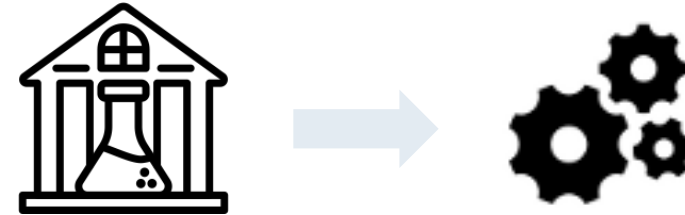
Intellectual property generation



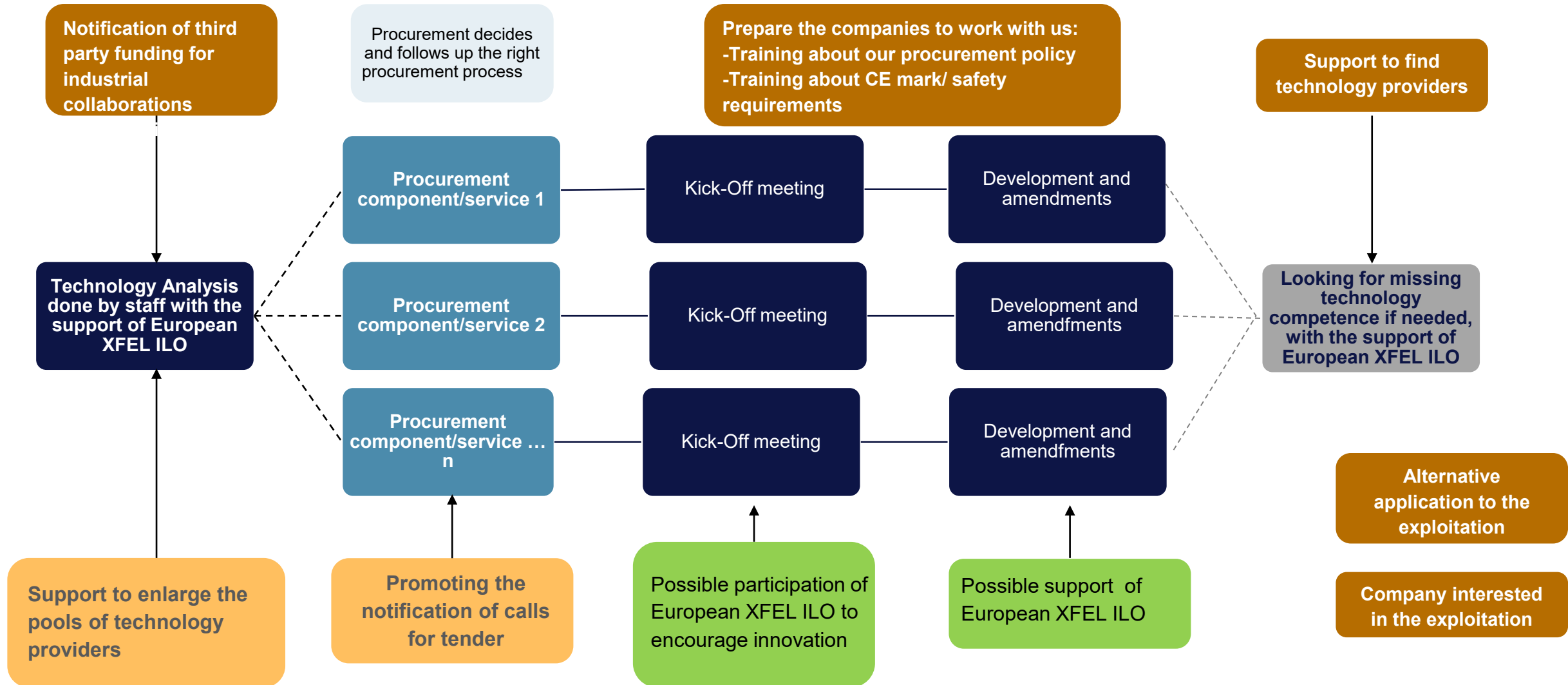
Internal development ready for TT

In collaboration with our industrial cooperators:

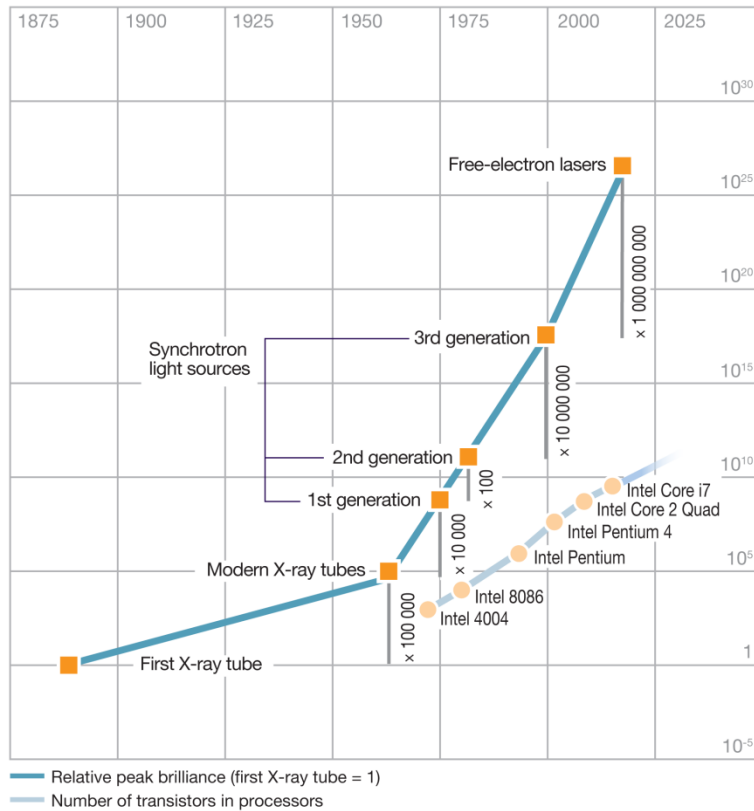
- Procurement
- Industrial collaborations
- Third party funding consortia



Innovation procurement workflow: **potential national ILO** involvement



Industrial user: preamble Light source development

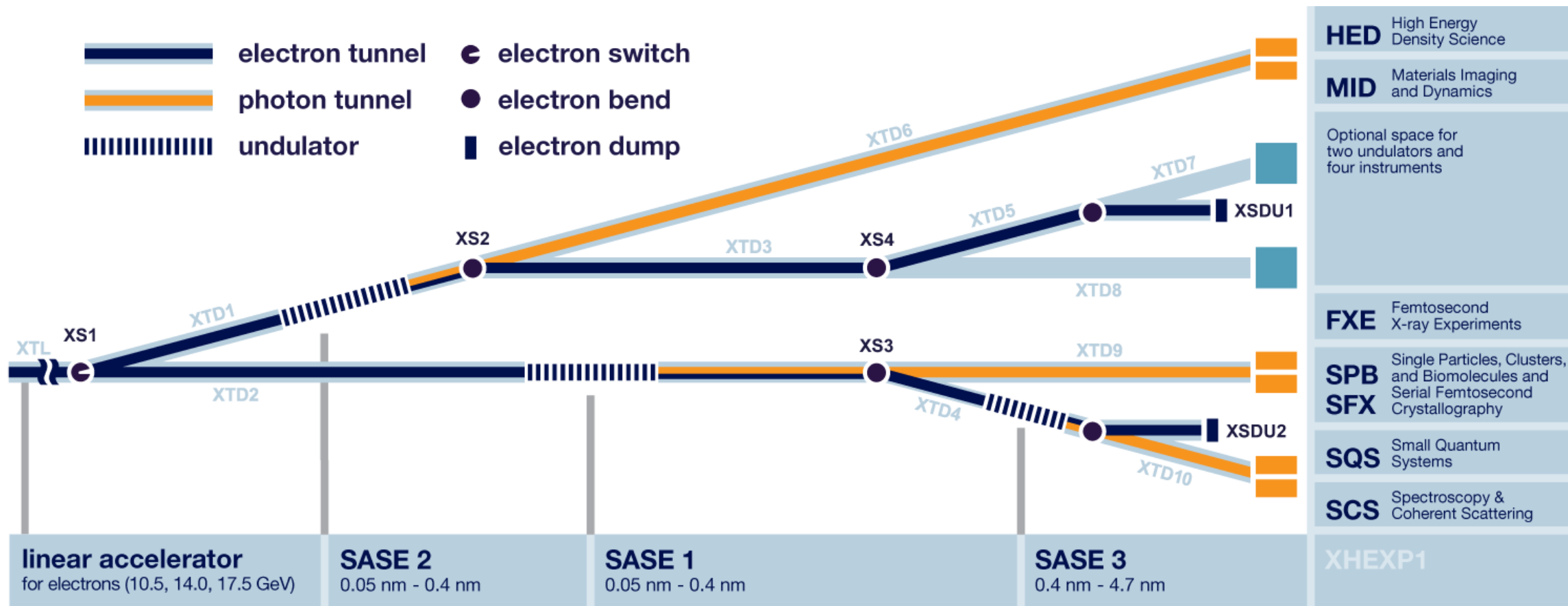


The development of light source facilities has been faster than the increase in computer processing capacity (i.e., Moore's Law)

X-ray free-electron lasers worldwide

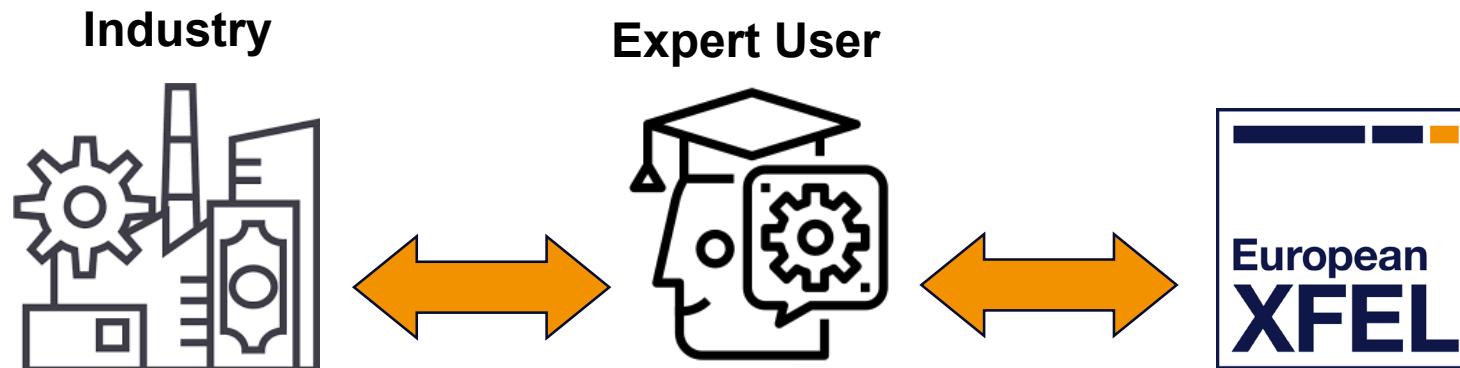
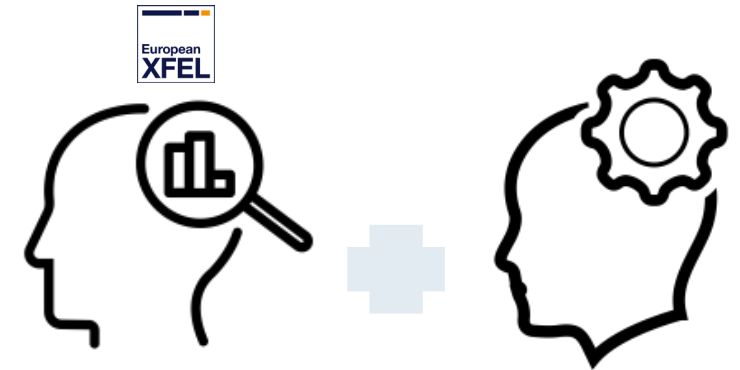
Project	LCLS (USA)	LCLS-II CuRF	LCLS-II SCRF	SACLA (Japan)	European XFEL	SwissFEL (CH)	PAL-XFEL (S. Korea)	SHINE (China)	FERMI (1)
Max. electron energy (GeV)	14.3	15	5.0	8.5	17.5	5.8	10	8	1.55
Wavelength range (nm)	0.1–4.6	0.05–5.0	0.25–5.0	0.06–0.3	0.05–4.7	0.1–7	0.06–10	0.05–3.1	4-100
Photons/pulse	$\sim 10^{12}$	2×10^{13}	3×10^{13} (soft X-rays)	2×10^{11}	$\sim 10^{12}$	$\sim 5 \times 10^{11}$	10^{11} – 10^{13}	10^{10} – 10^{13}	10^{11} – 10^{14}
Peak brilliance	2.7×10^{34} (with seeding)	2.7×10^{34} (with seeding)	1×10^{32}	1×10^{33}	5×10^{33}	1×10^{33}	1.3×10^{33}	1×10^{33}	10^{30} – 10^{32}
Pulses/second	120	120	1 000 000	60	27 000	100	60	1 000 000	10-50
Date of first beam	2009	2019	2020	2011	2017	2016	2016	2025	2010

Industrial user: preamble Beamline layout and experiment stations



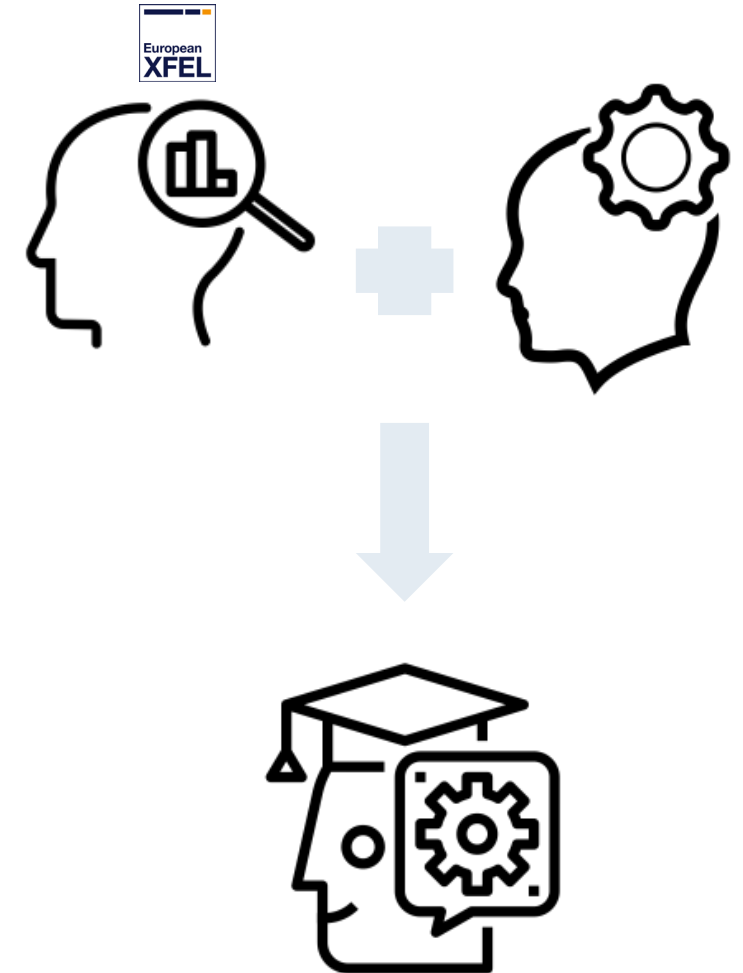
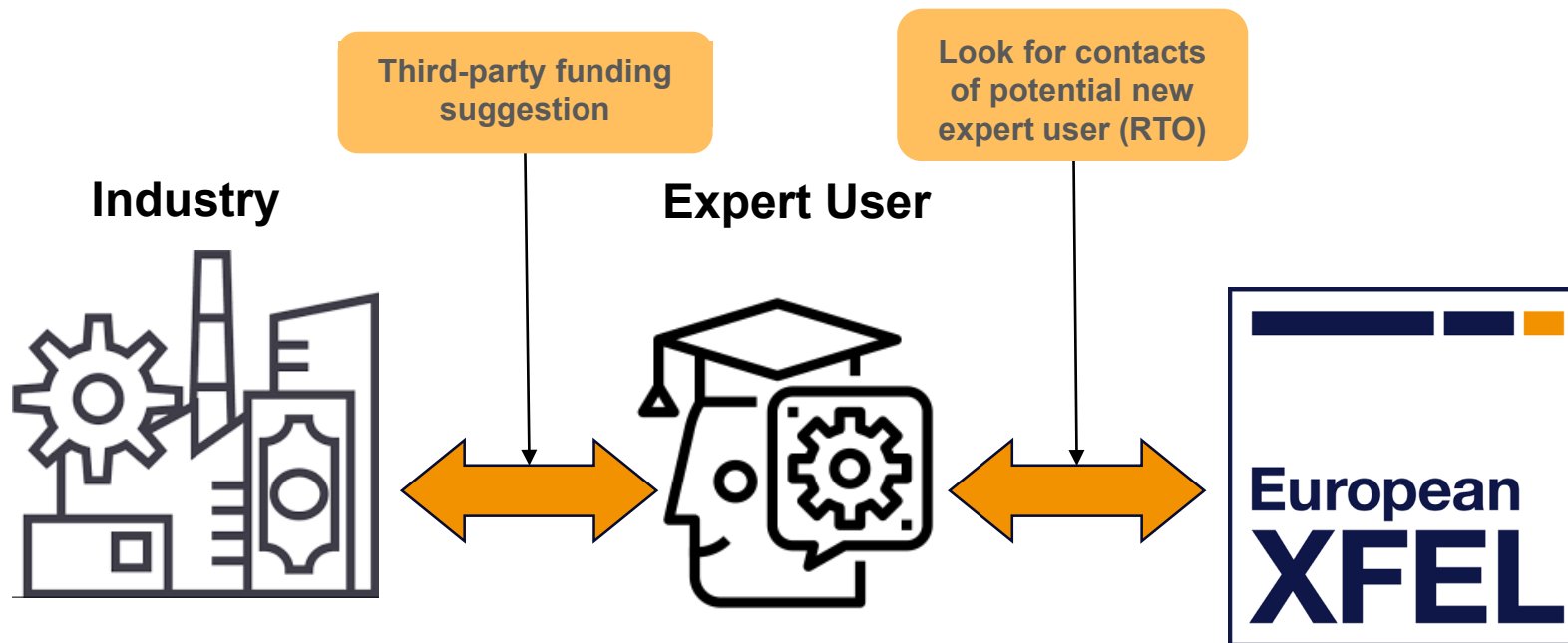
Industrial user: first approach

- We don't make measurements
 - New users with new experiments need ad-hoc developments
- ... industrial users can be industrial collaborators



Industrial user: first approach and **potential national ILO** involvement

- We don't make measurements
- New users with new experiments need ad-hoc developments
- ... industrial users can be industrial collaborators

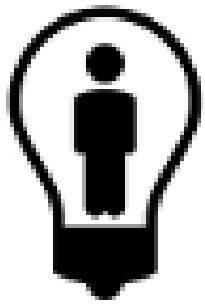


Conclusion

- The industrial network of the national ILO is an extremely important resource for the development of our facilities
- National ILOs are currently involved in the procurement process
- National ILOs can be also involved:
 - In the training of the industrial co-operators to facilitate the collaboration with the facilities
 - Suggestion of expert users in industrial collaboration for new experiments in the area of applied science
 - Suggestion of third party funding for industrial collaboration
 - In the exploitation phase of the IP, looking for interested companies

LEAPS & HR4tech

- **LEAPS** – the League of European Accelerator-based Photon Sources – is a strategic consortium initiated by the Directors of the Synchrotron Radiation and Free Electron Laser user facilities
- **LEAPS** consists of 16 organisations representing 19 light source facilities across Europe



One of the current leading LEAPS projects - **HR⁴tech** – celebrates proactive innovation and industrial exchange through fostering of industrial ecosystem within LEAPS facilities.

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