



EUROPEAN
SPALLATION
SOURCE

A new science infrastructure with fresh innovation elements

Juan Tomás Hernani
General Secretary for
Innovation and Industry



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ESS in short

FACILITY

A partnership of 17 European nations committed to the goal of collectively building and operating the world's leading facility for research using neutrons by the second quarter of the 21st century

SCIENCE

Researchers using ESS will produce new knowledge within:

- Materials physics
- Medicine, Life Science
- Energy, Climate & Environment
- Chemistry
- Engineering
- Fundamental Physics

SOCIETY

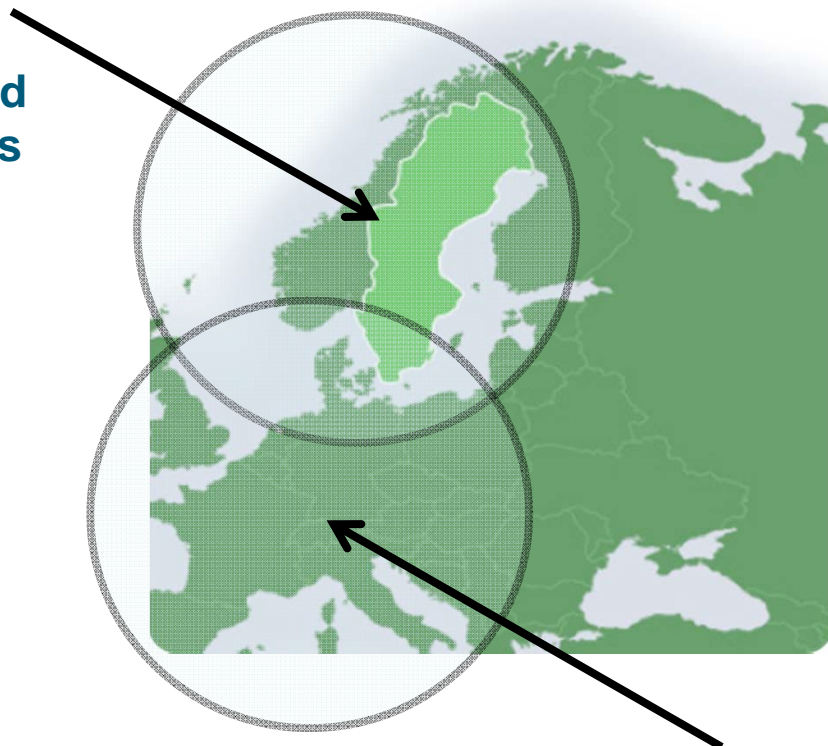
Transferring knowledge & technology to advance innovation, business life and society



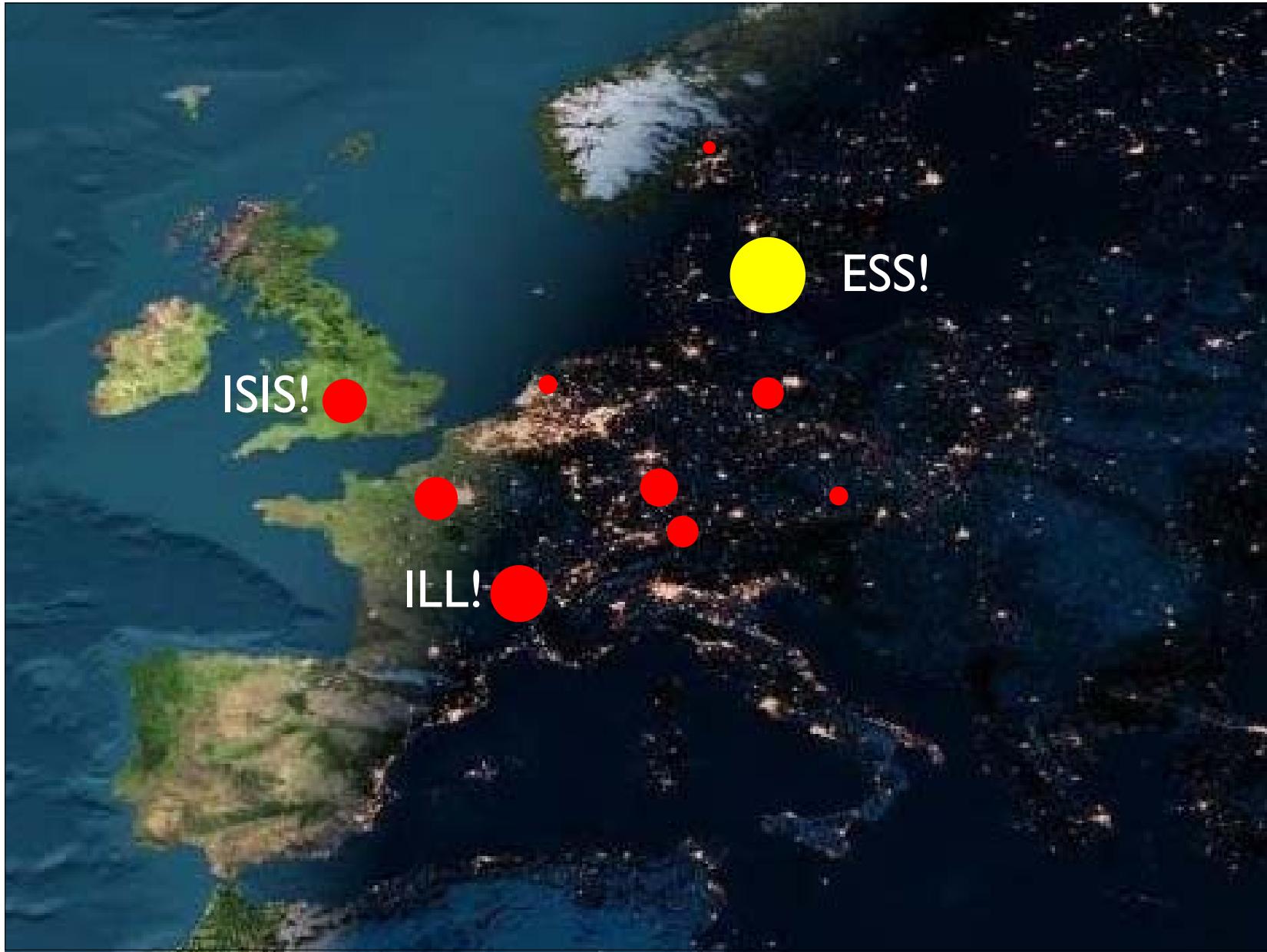
An International Collaboration



Sweden,
Denmark and Norway:
50% of construction and
20% of operations costs



European partners
pays the rest



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Facility



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How to produce Intense Neutron Beams ?

ILL - France



Fission:! One neutron in,
! ! ! three neutrons o
! ! ! Use a nuclear reactor

Spallation:! Up to 30 neutrons
! ! ! per proton; !!
Accelerator to propel
proton onto target



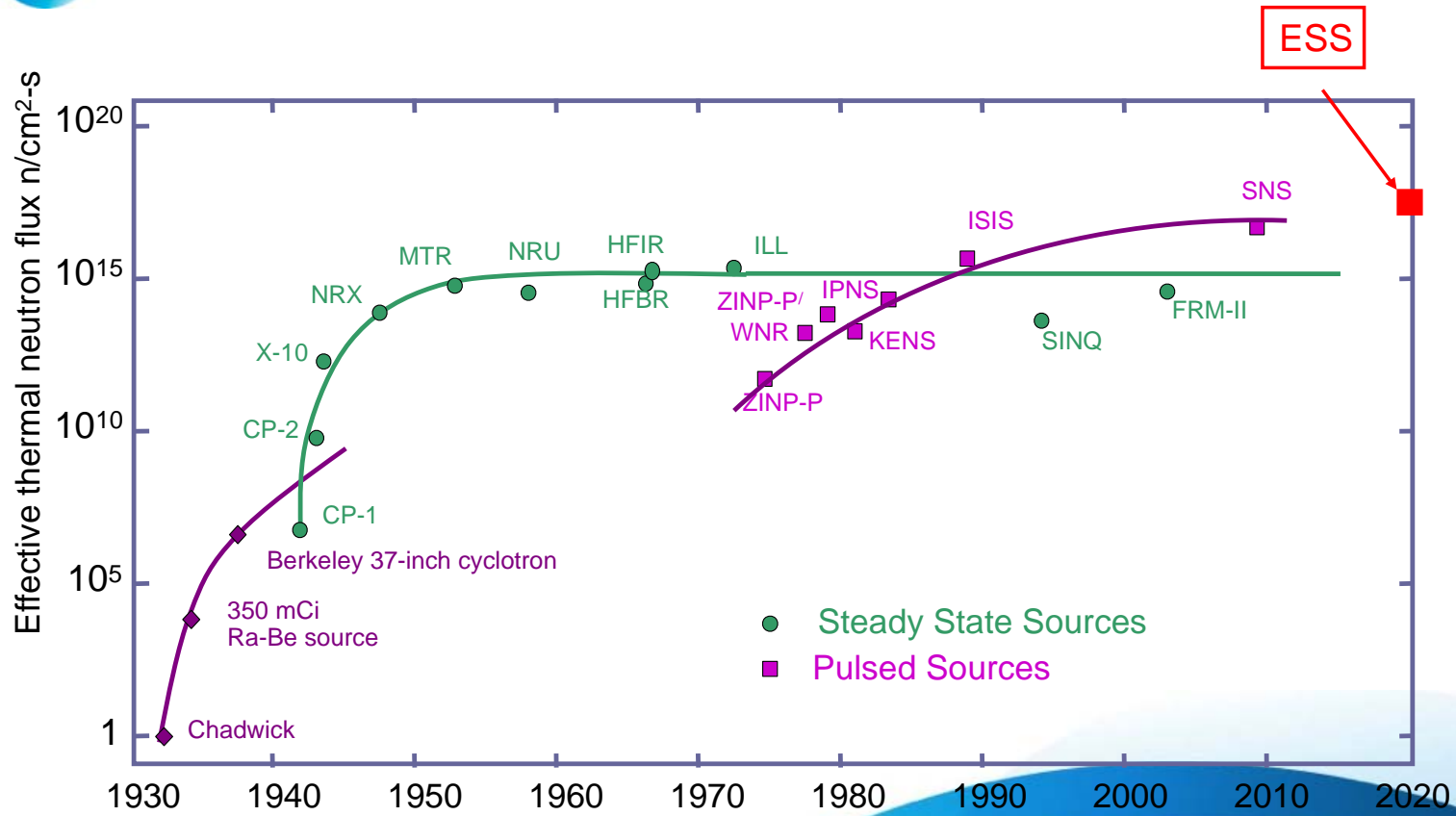
weden

High-intensity spallation sources



OECD 1999:
"One powerful
spallation source
in every global region"

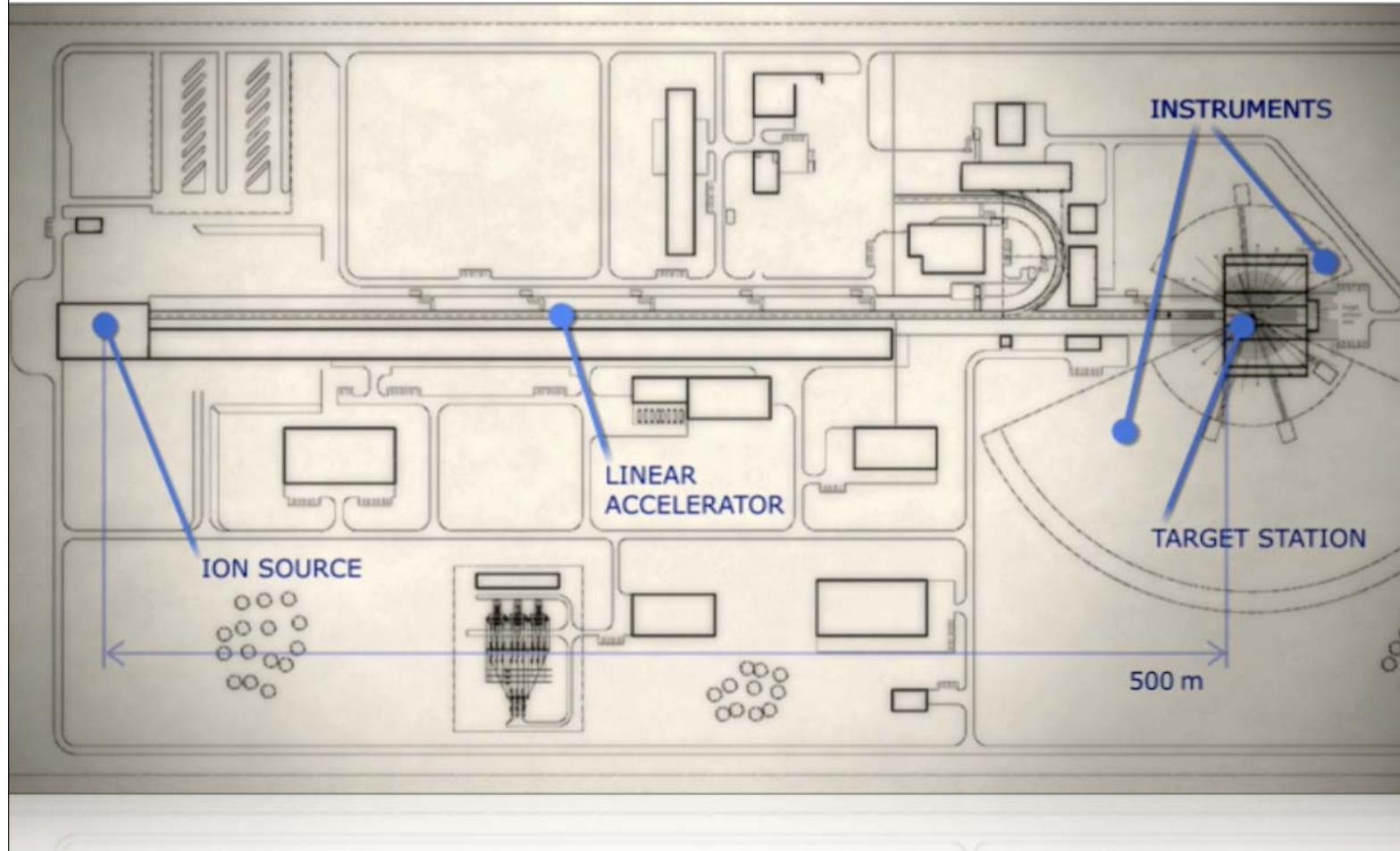
Evolution of Neutron Sources



(Updated from *Neutron Scattering*, K. Skold and D. L. Price, eds., Academic Press, 1986)

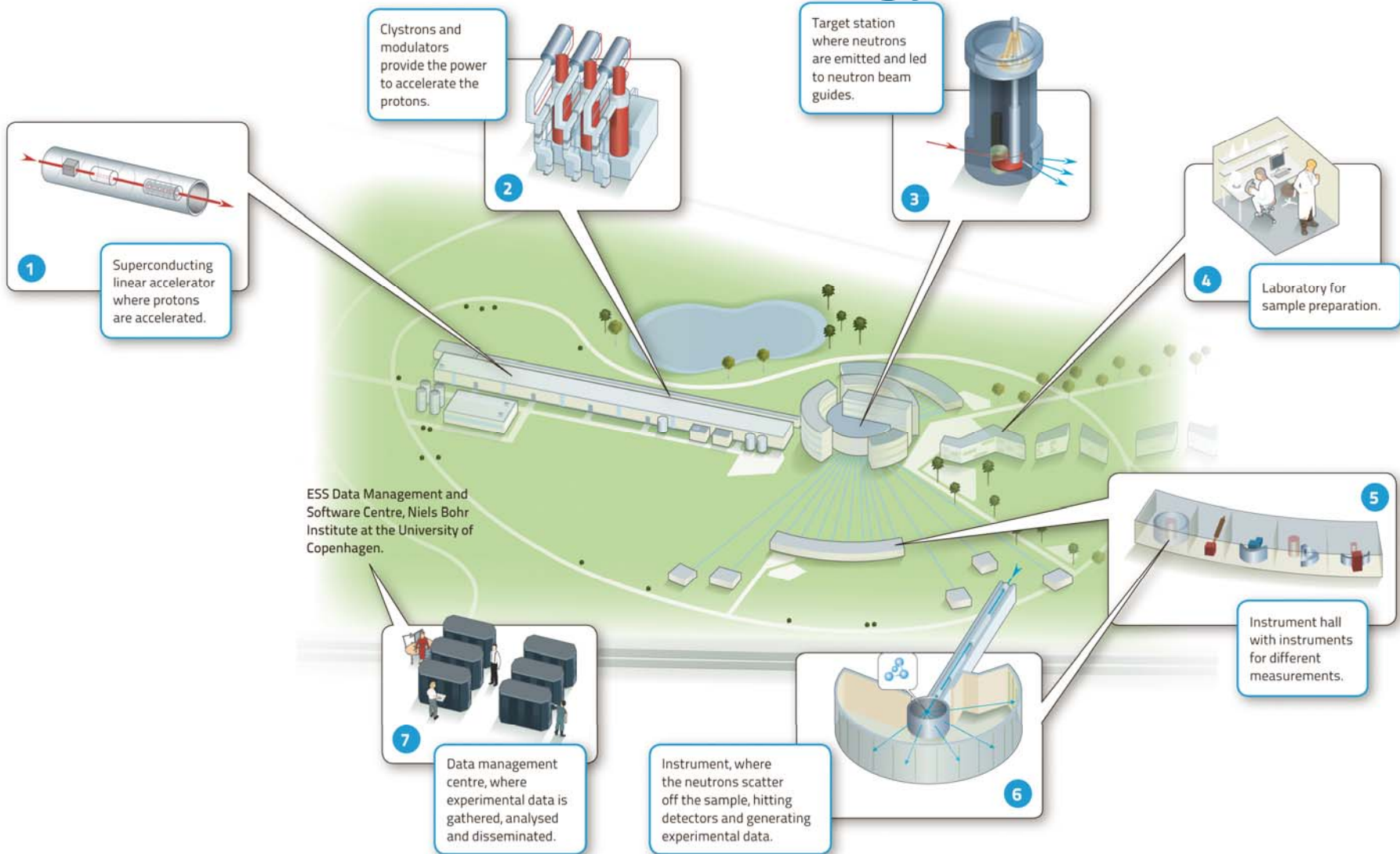


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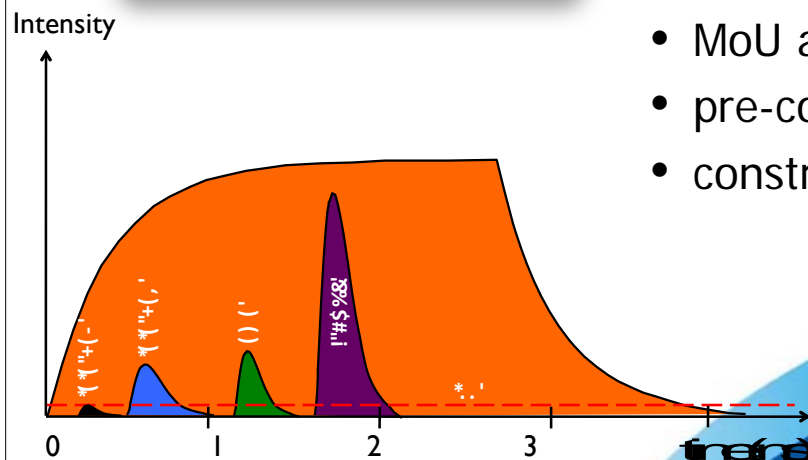
The Technology



ESS project: key facts

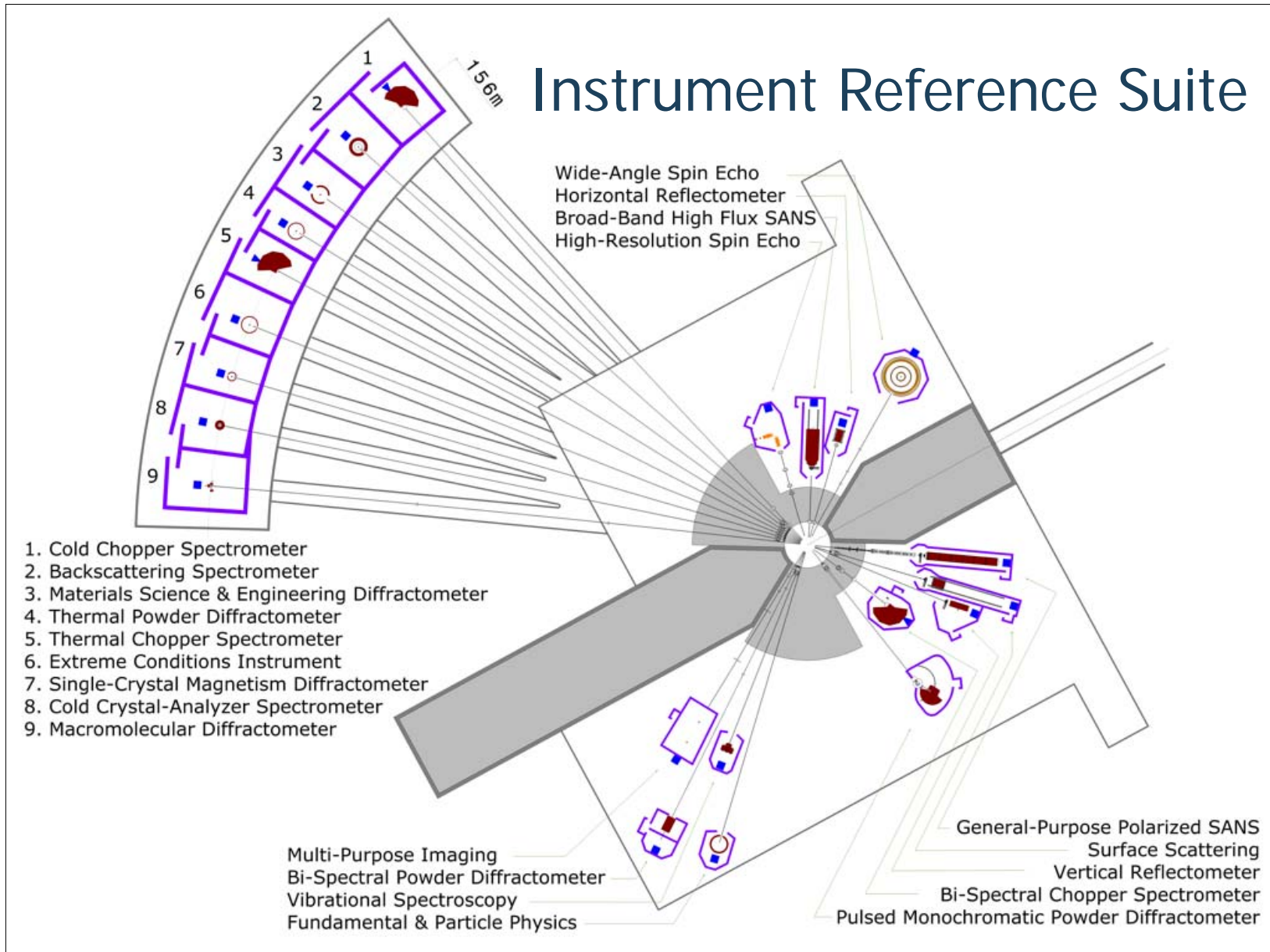


- 5MW long-pulse neutron source.
- First neutrons in 2019 on 7 instruments.
- 22 instruments by 2025
- ESS will be user facility.
- Total cost ~1700 M€; funding negotiation
- MoU agreed with 17 european countries
- pre-construction phase completed;
- construction phase started 1. Jan.

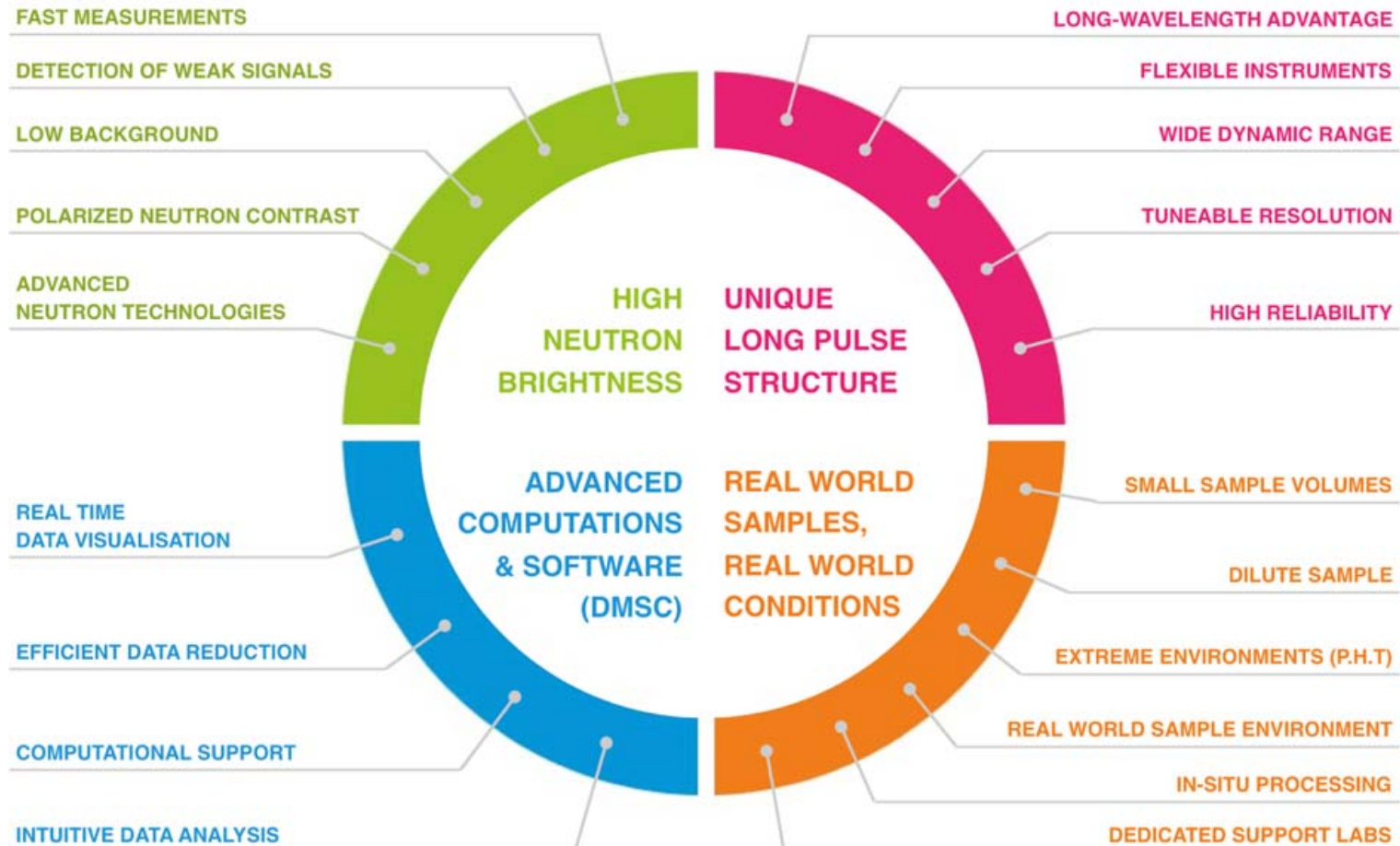


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Instrument Reference Suite



unique capabilities of ESS



Symbiosis

1. ESS will be around 30 times better than existing facilities:

- Create new scientific possibilities

2. Strengthen existing materials science and life science

3. Complement existing neutron facilities, such as:

- Materials and Life Science Facility, J-PARC
- ISIS, Oxfordshire
- Institut Laue-Langevin, Grenoble
- Helmholtz Zentrum für Materialien und Energie, Berlin

Science

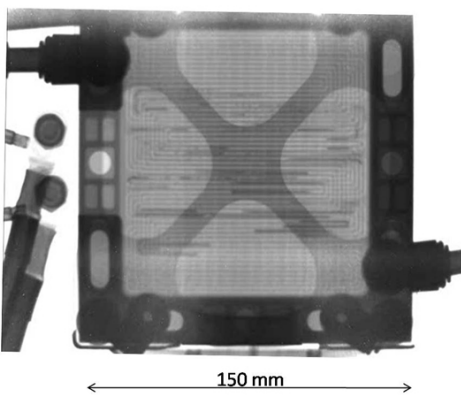


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Neutrons > New Knowledge > New Innovations

Charge neutral
Deeply penetrating

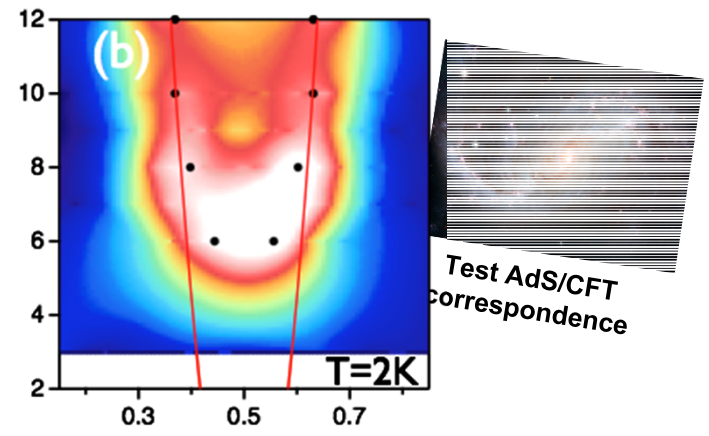


Li motion in fuel cells



Help build electric cars

S=1/2 spin
probe directly magnetism

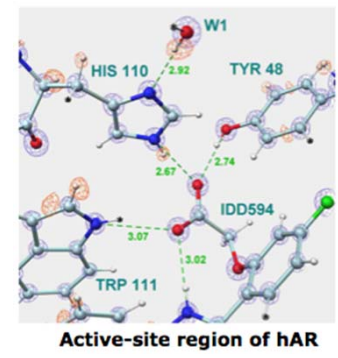


Solve the puzzle of High-Tc
superconductivity



Efficient transfer of electricity

Nuclear scattering
Sensitive to light elements and
isotopes



Active sites in proteins

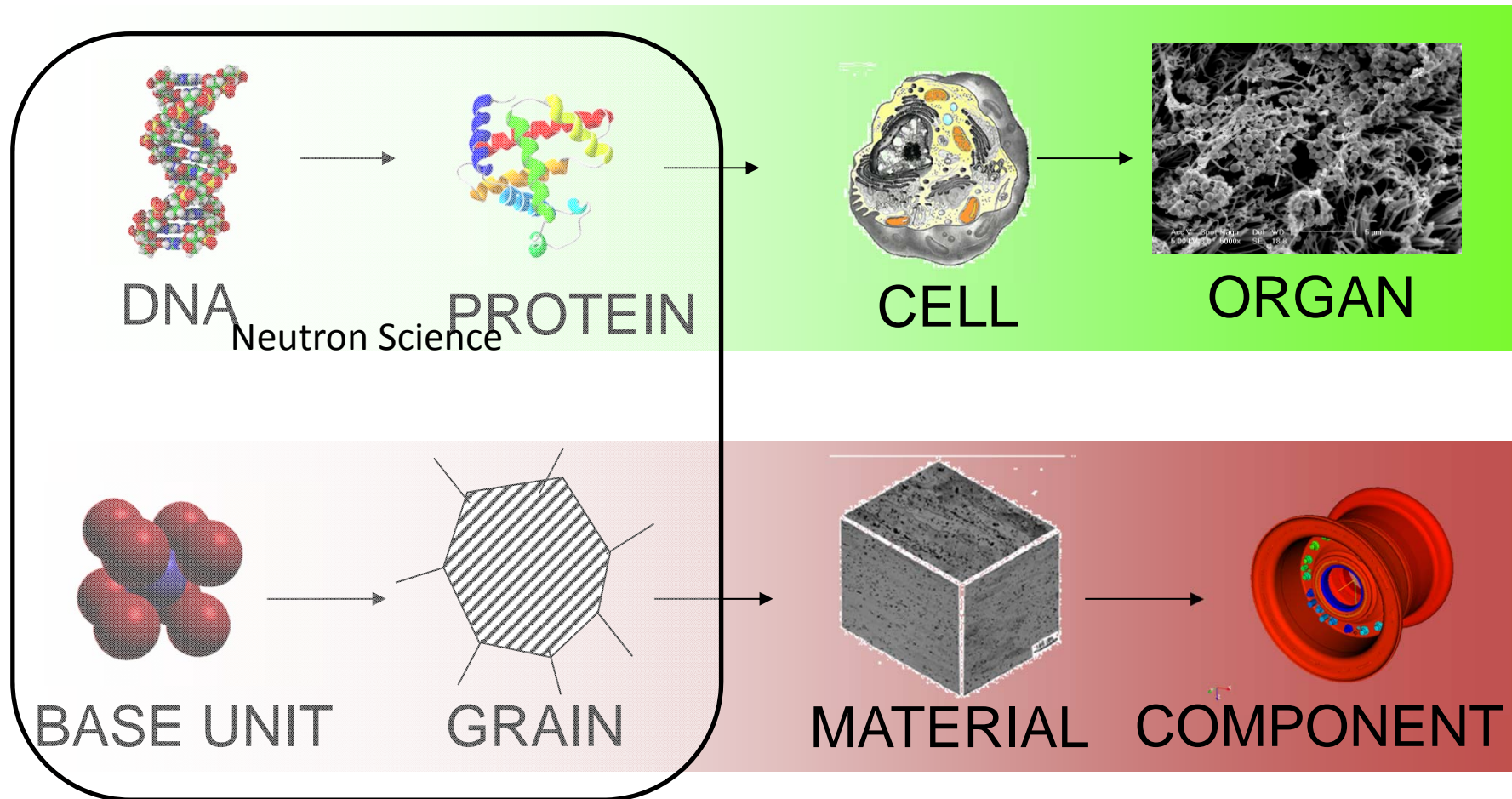


Tertiary structure of
hAR

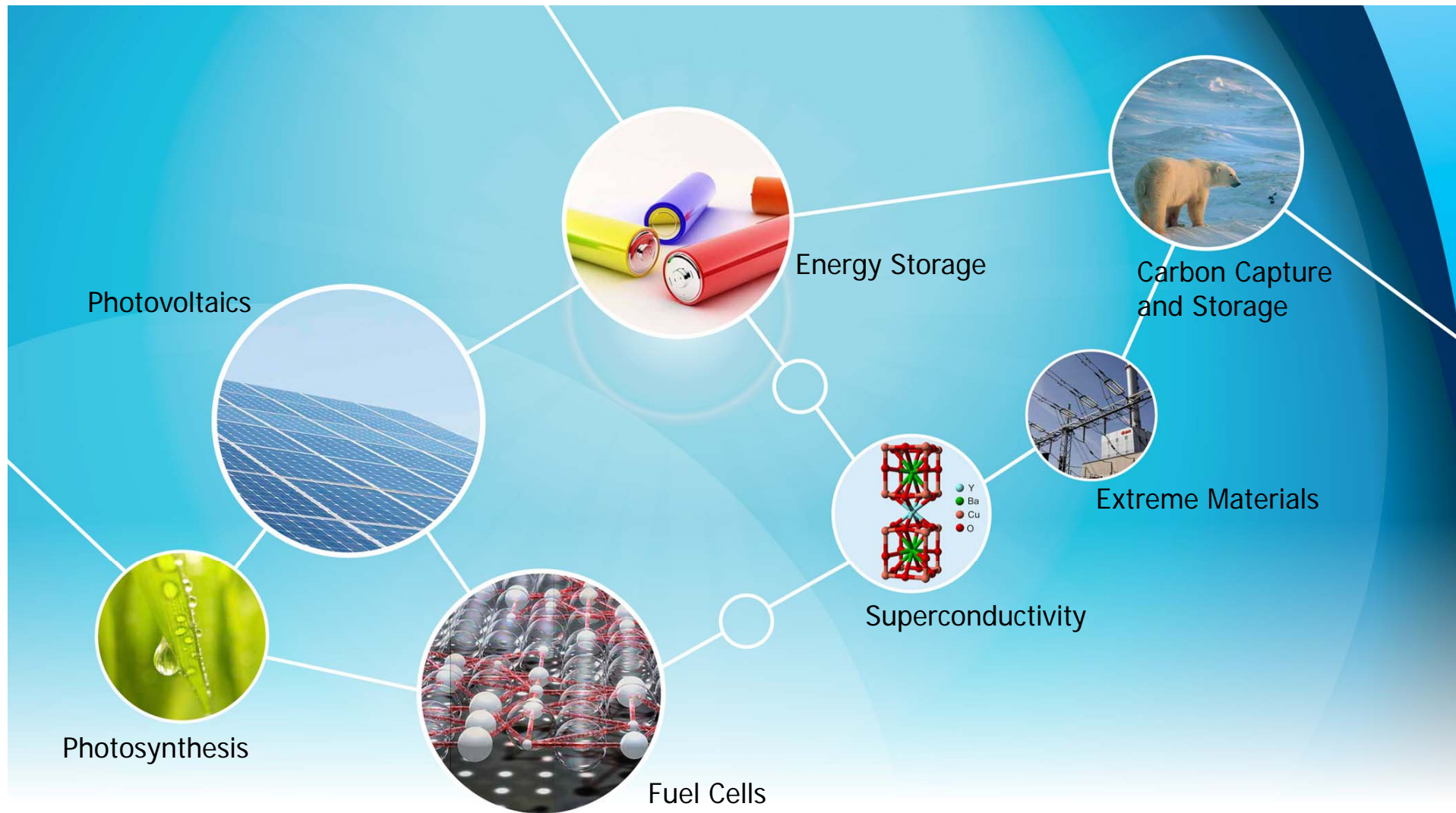
Better drugs

Applied materials – life science analogy

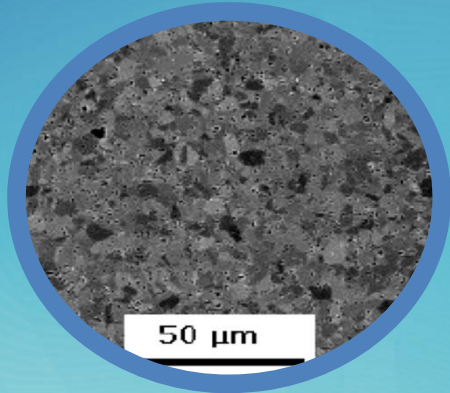
Life Science



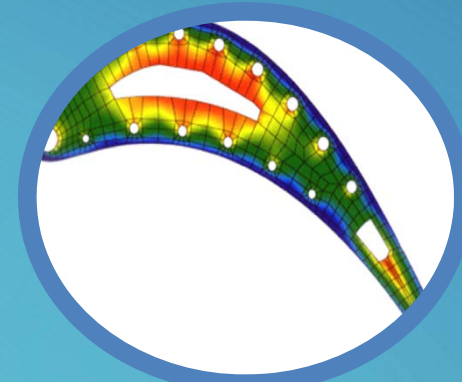
Materials Science



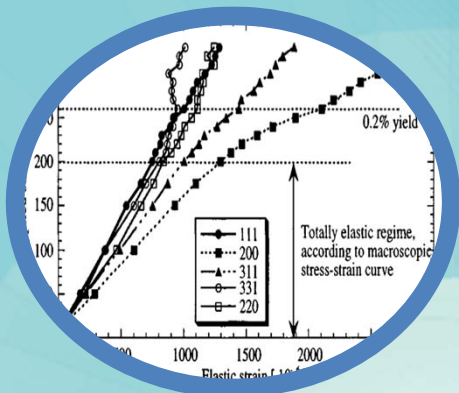
Materials engineering



Microstructure



Stress & Strain



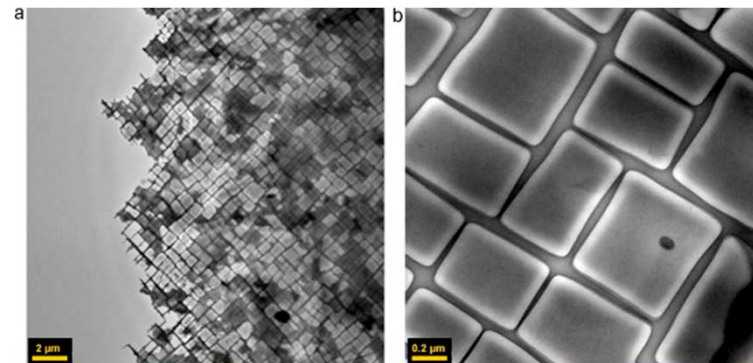
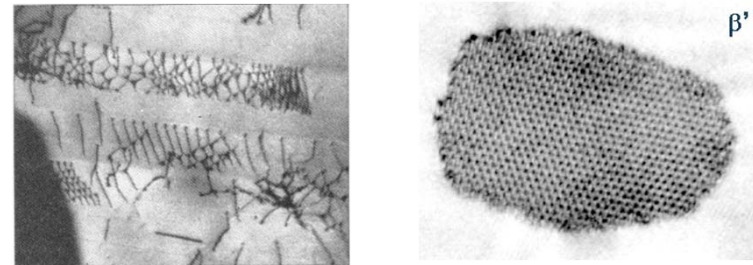
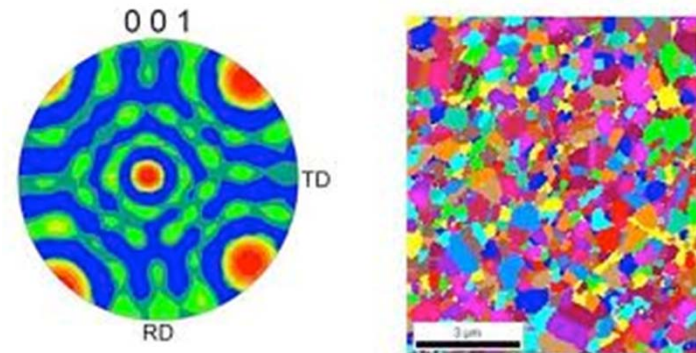
Mechanical Properties



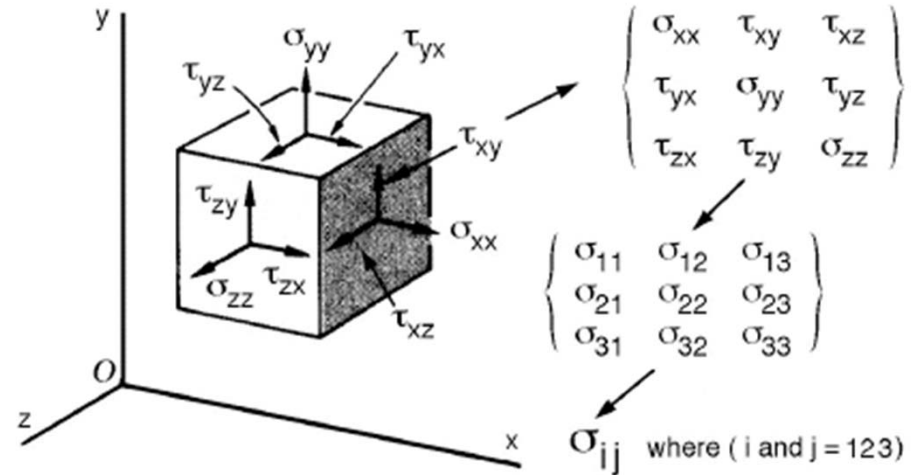
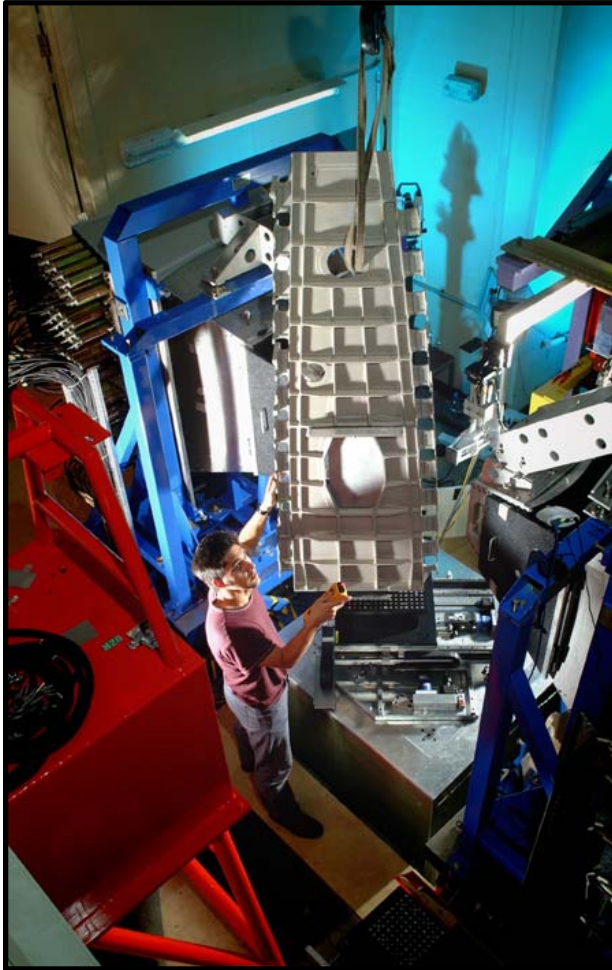
Visualisation

Materials characterisation

- Residual Stress
- Grain size
- Microstrains
- Dislocations
- Texture
- Precipitation
- Single Crystals
- Joining Technology
- Alloy Development
- In-situ processing
- Hardening mechanism
- ..



Diffraction: stress and strain



Applications w.r.t. Residual stresses

Fatigue/Structural Integrity

Welds

Alloy development

Microstructure/Texture

Phase transformation

Applied research: Aerospace

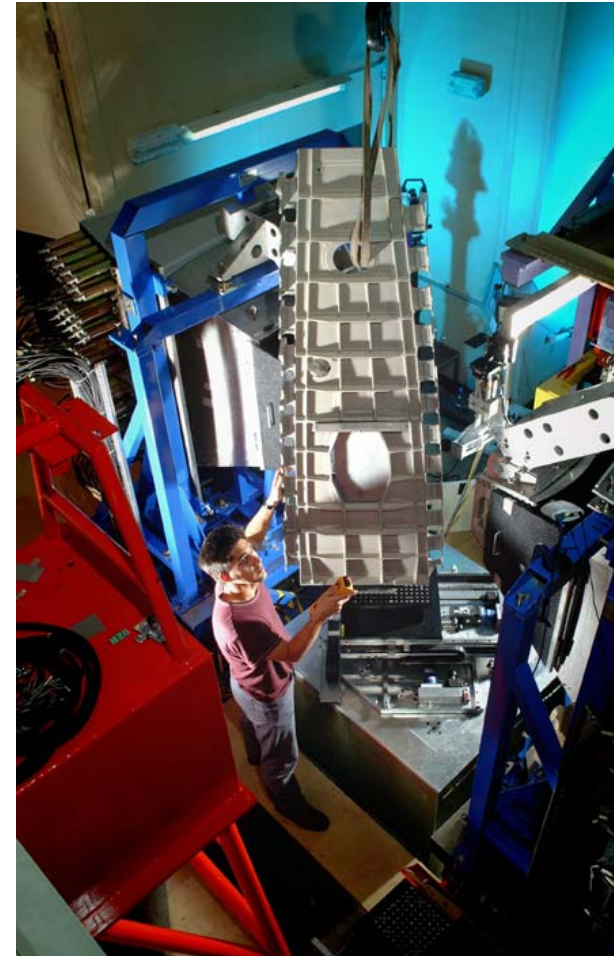
Drivers of new, safe technology

Alloy development

Joining technology

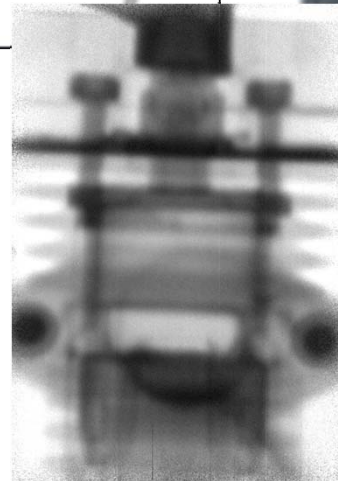
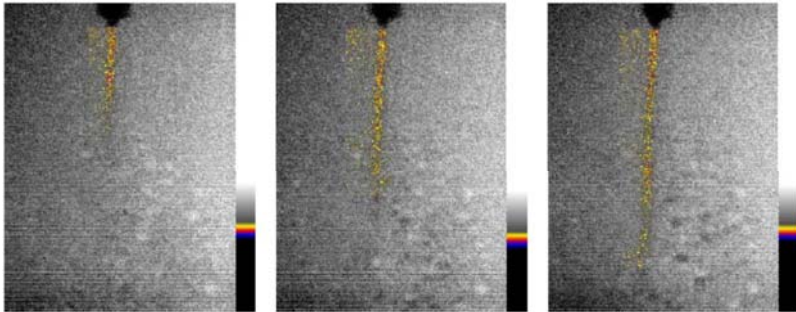
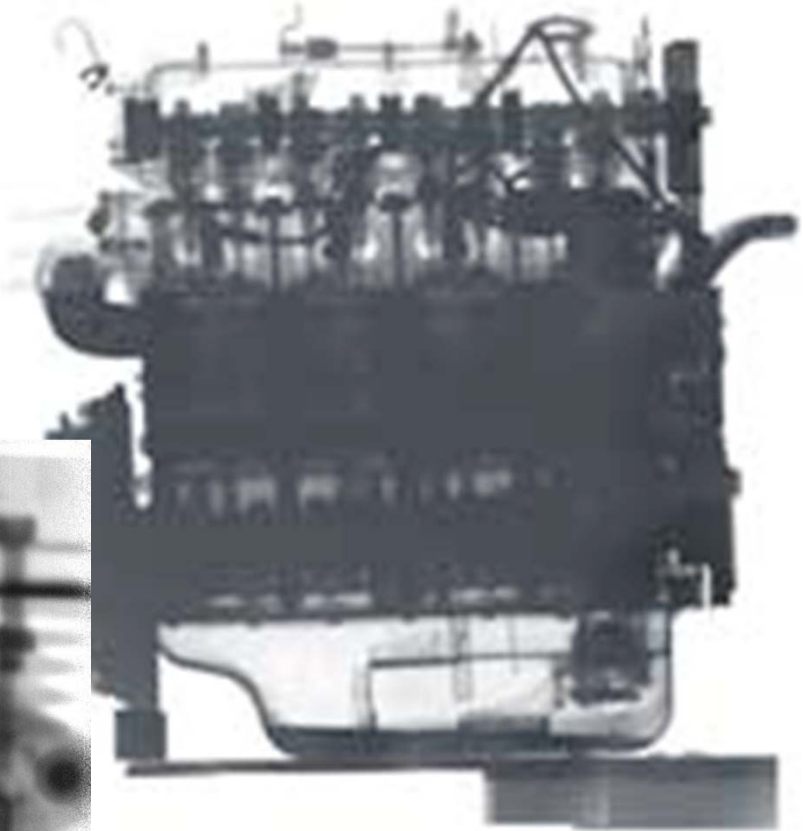
Structural Integrity

Aeronautics



Neutron imaging/tomography

E. Lehmann et al. PSI Switzerland



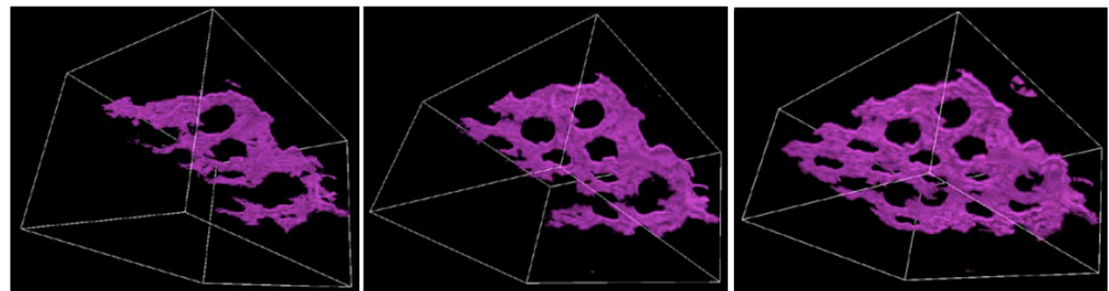
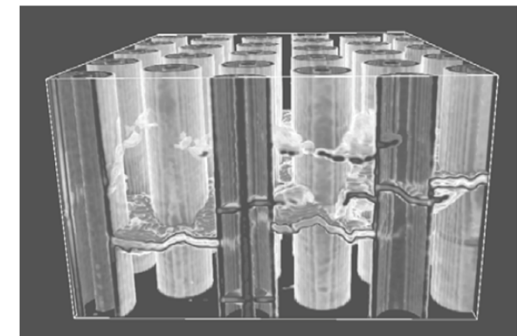
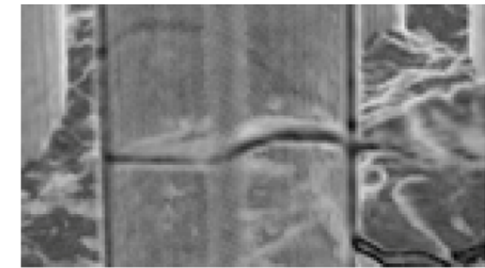
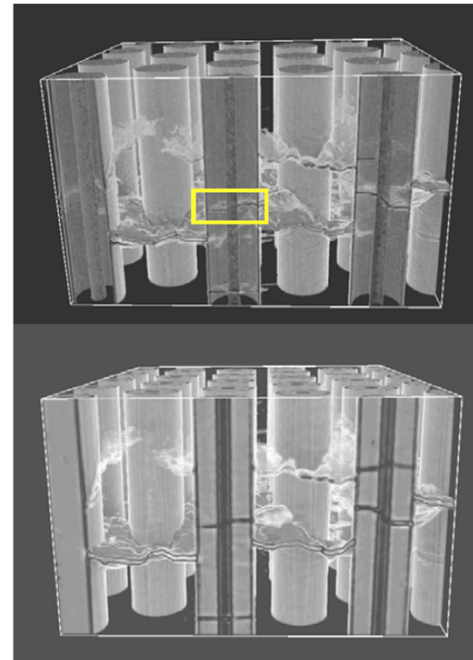
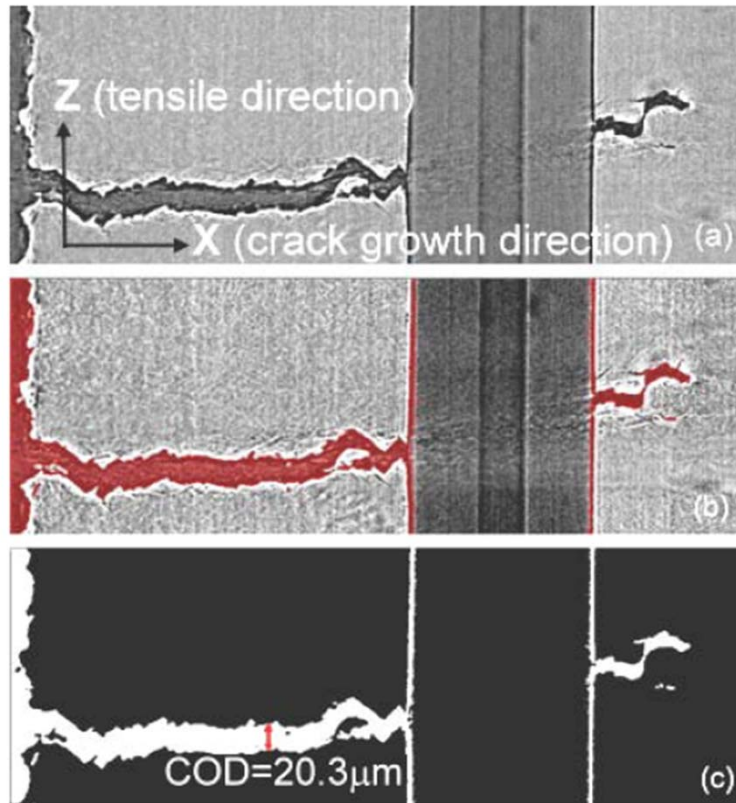
M. Muehlbauer et al. TUM Munich

B. Schillinger et al. TUM Munich

N. Kardjilov et al. HZB Berlin

Courtesy: PSI, HMI/HZB, FRM2

Crack tomography



Courtesy: PJ Withers, Manchester

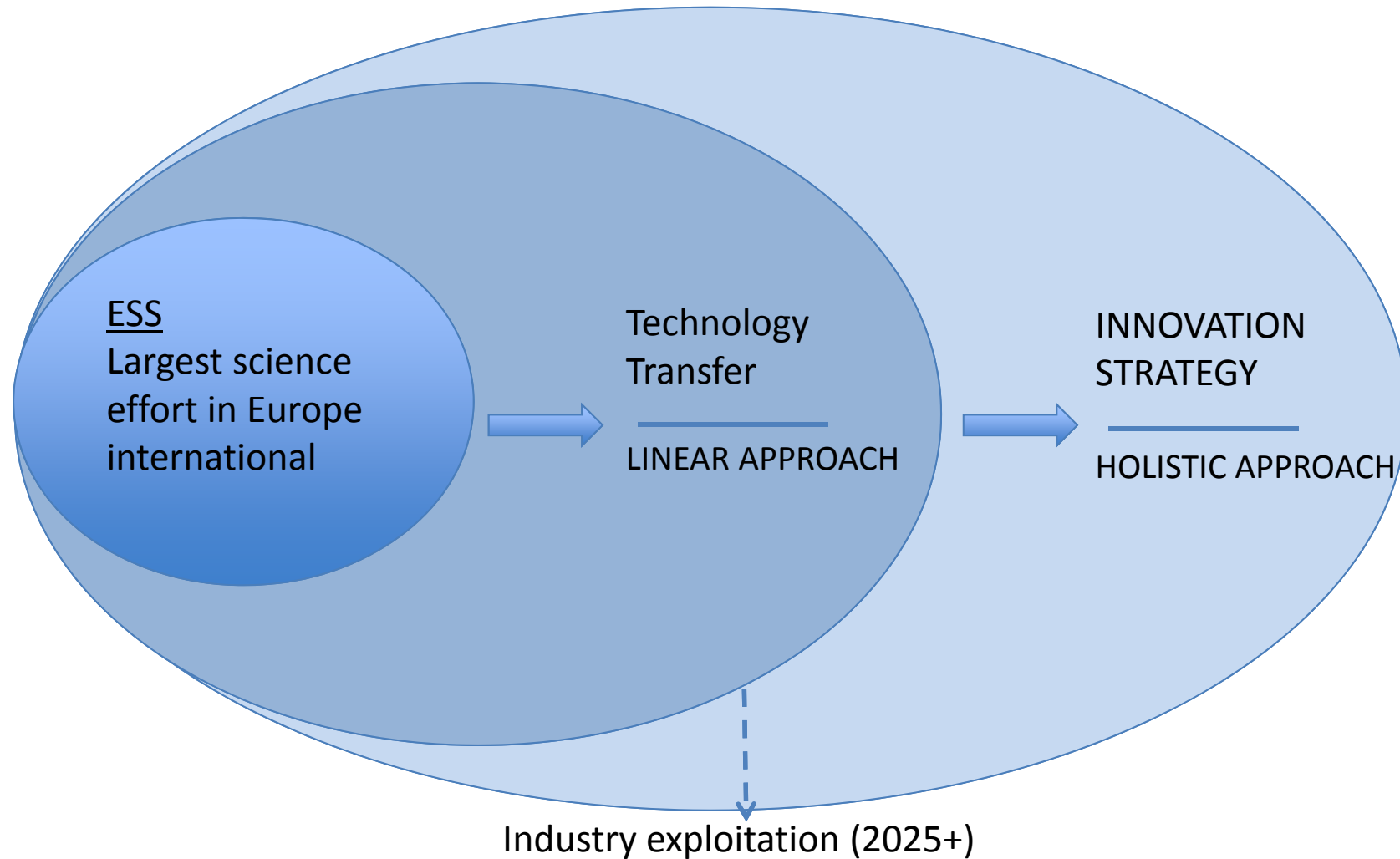
Innovation

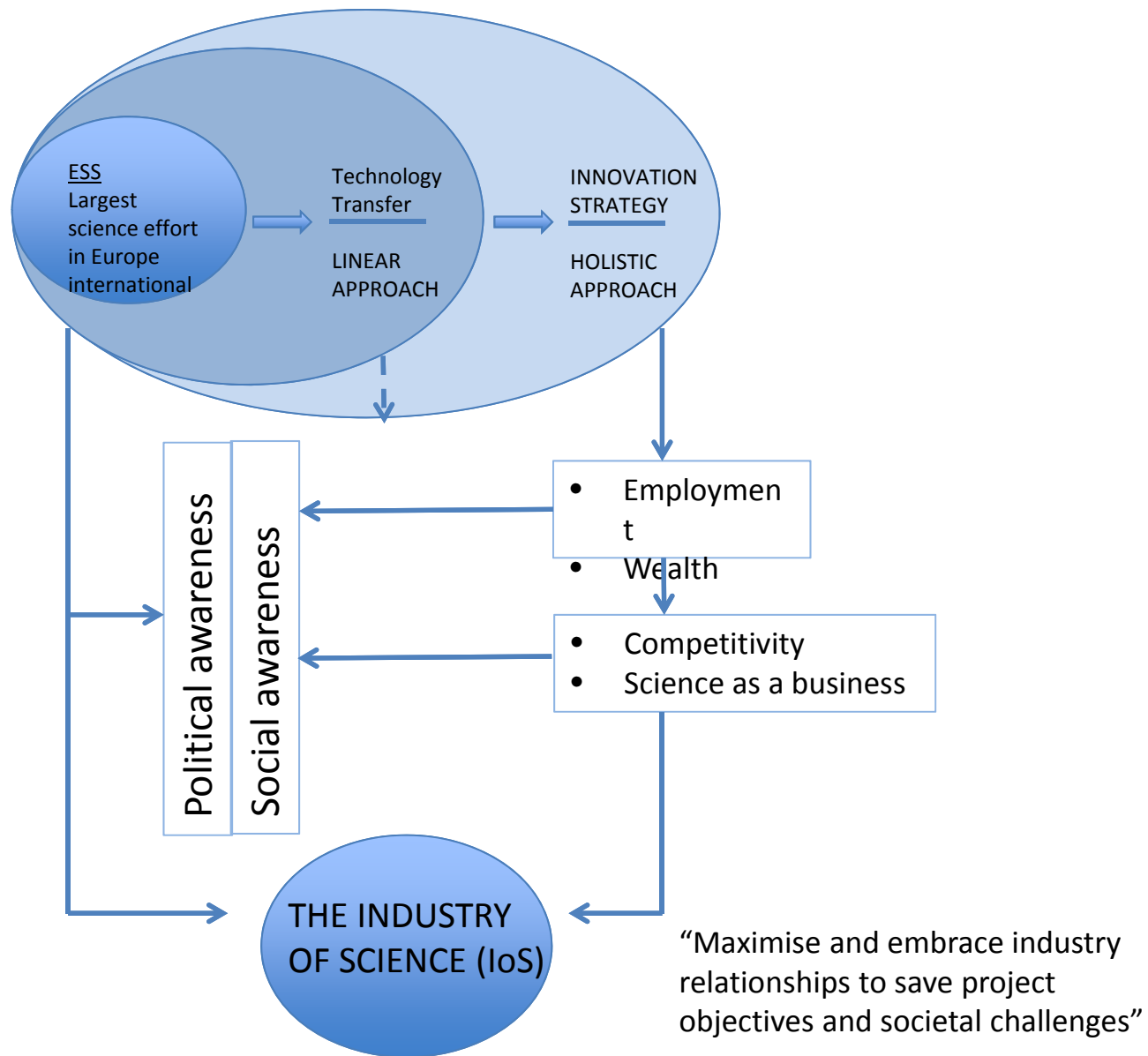


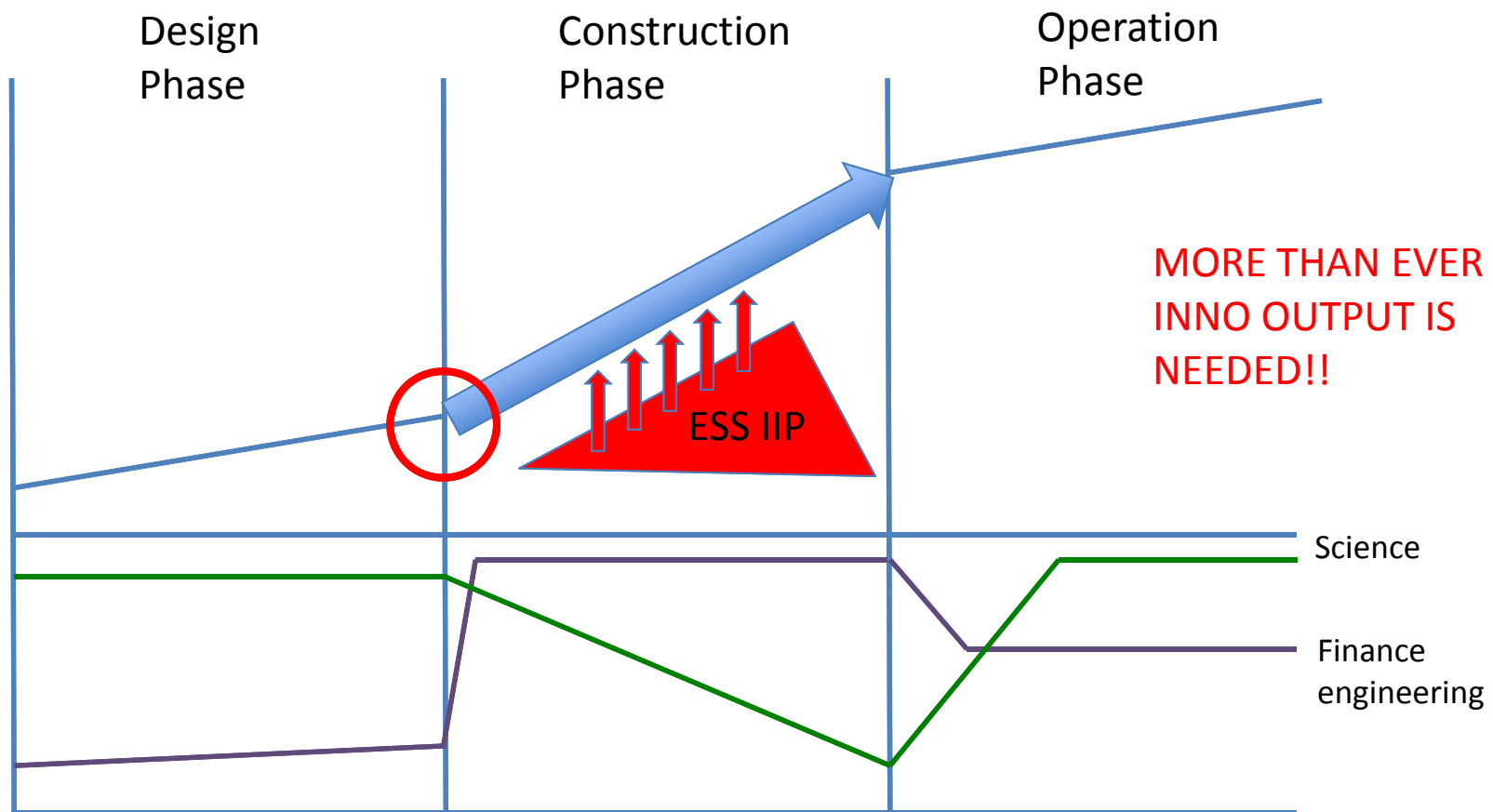
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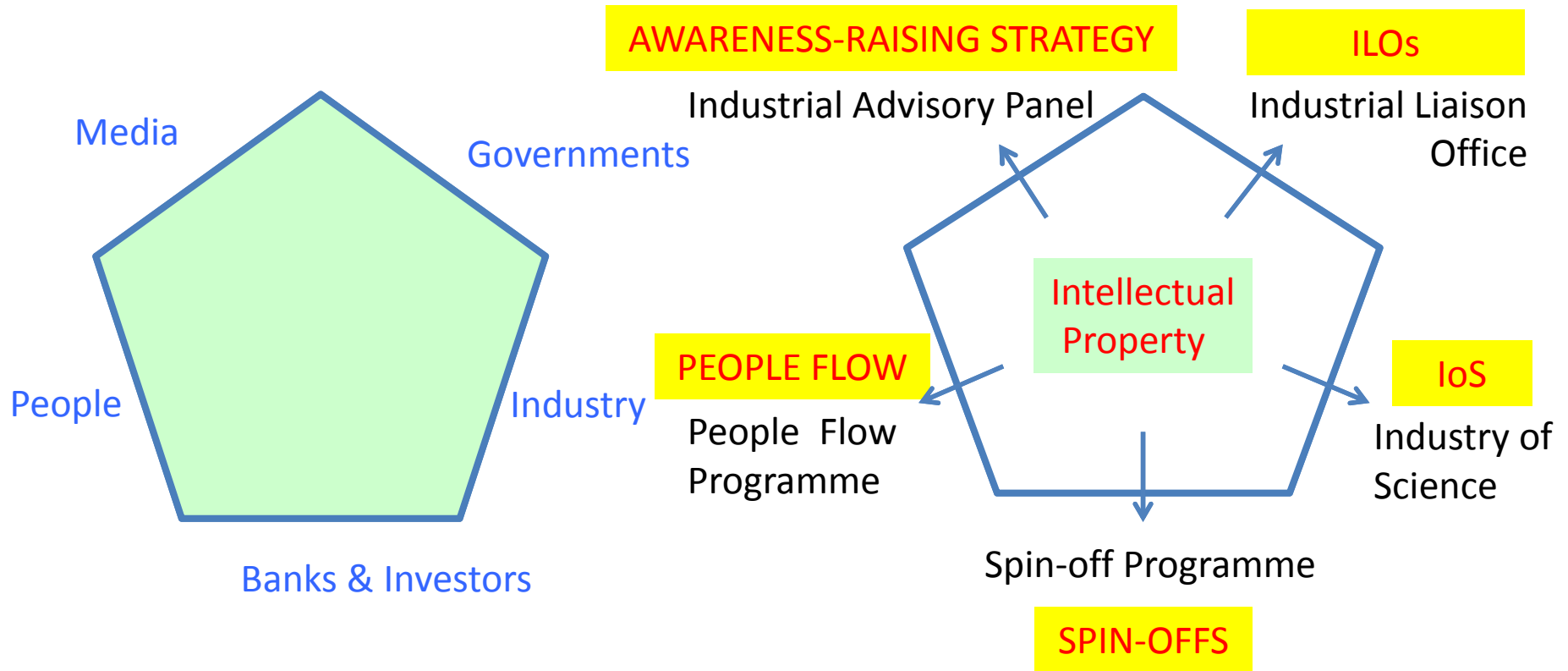
Why ESS Innovation?



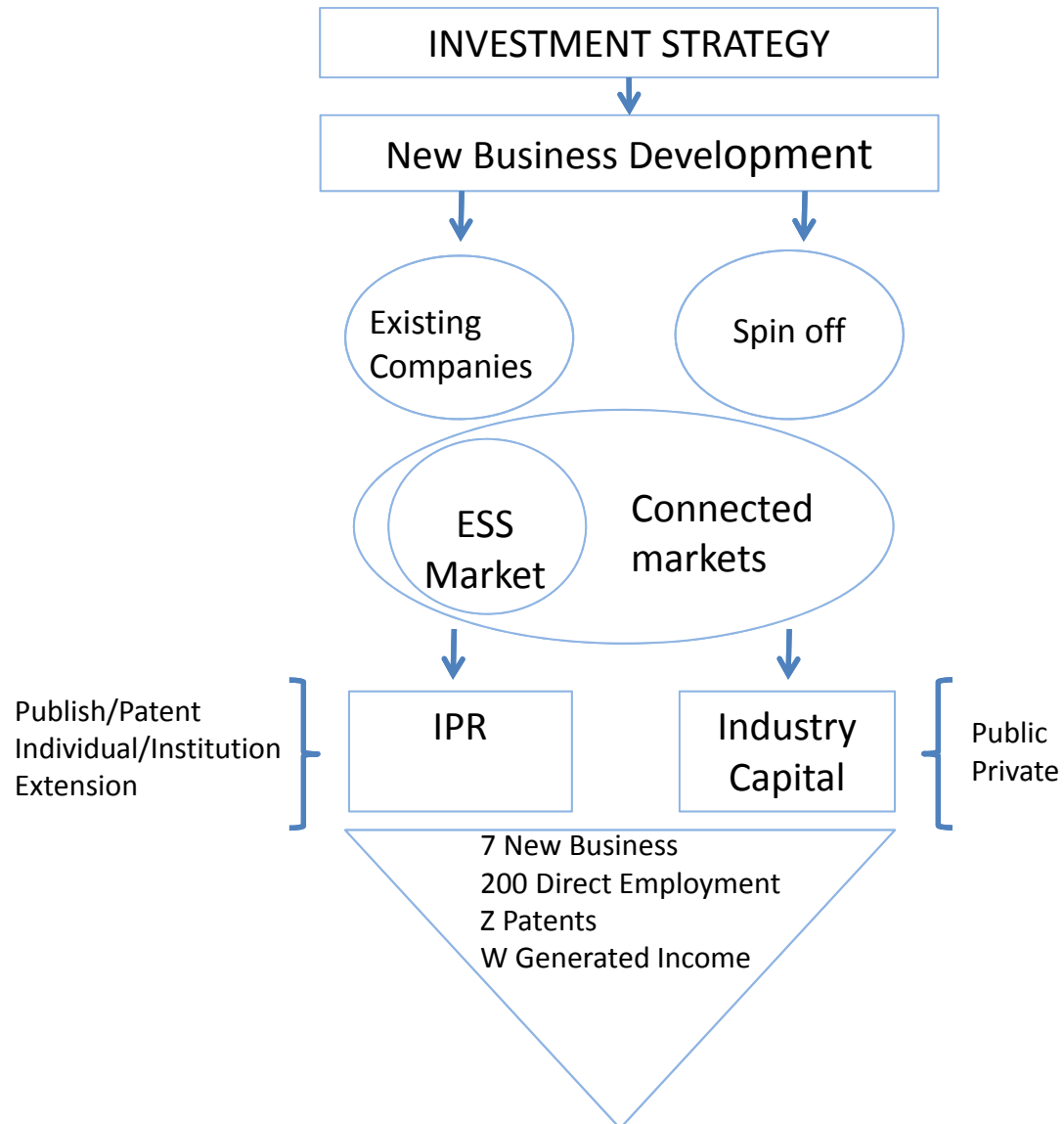


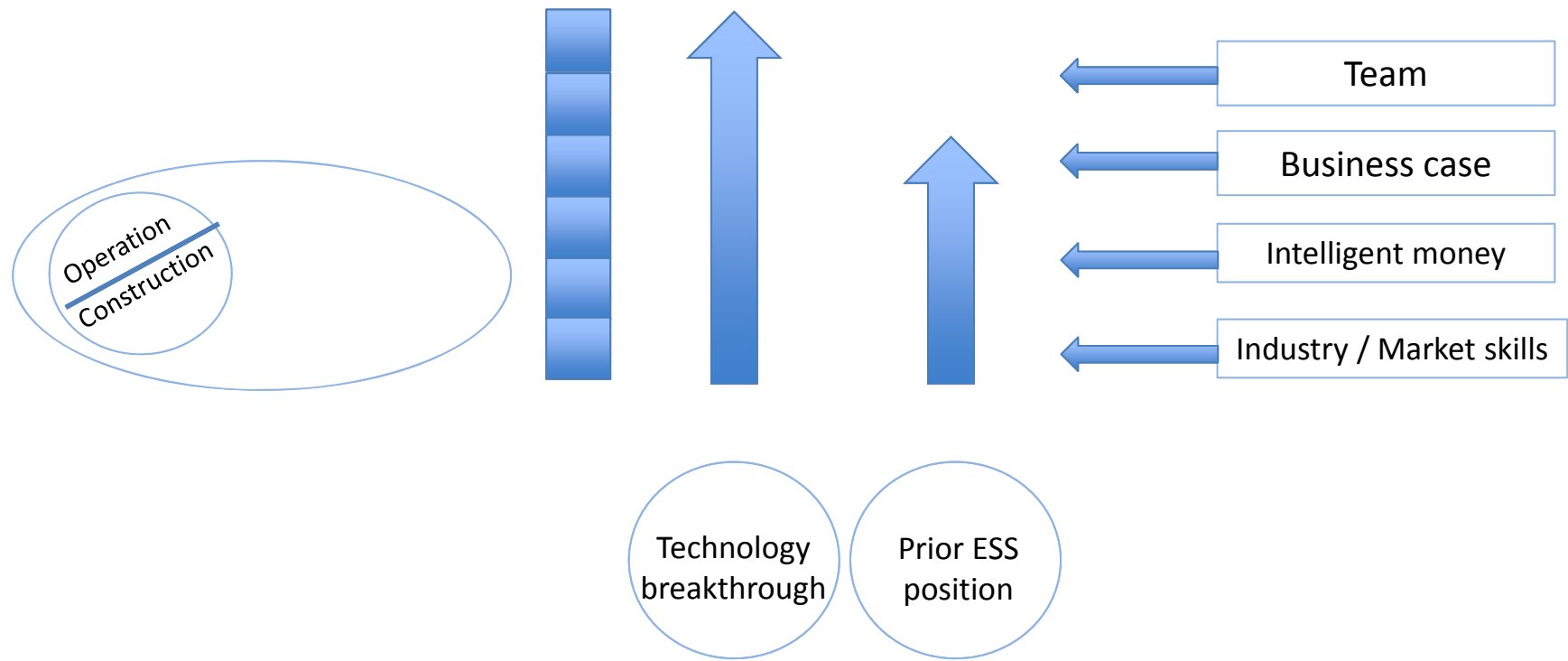


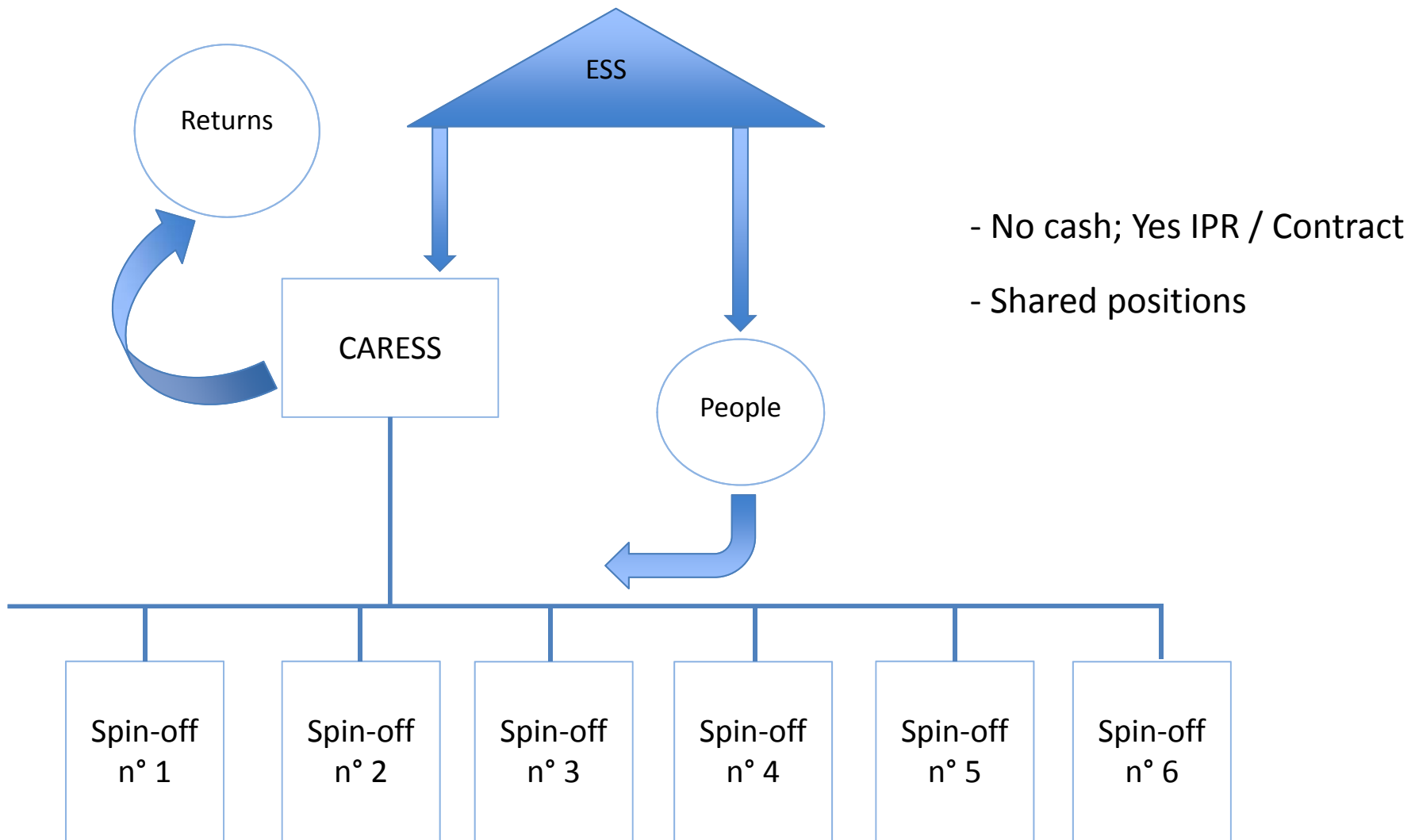
What is ESS Innovation?



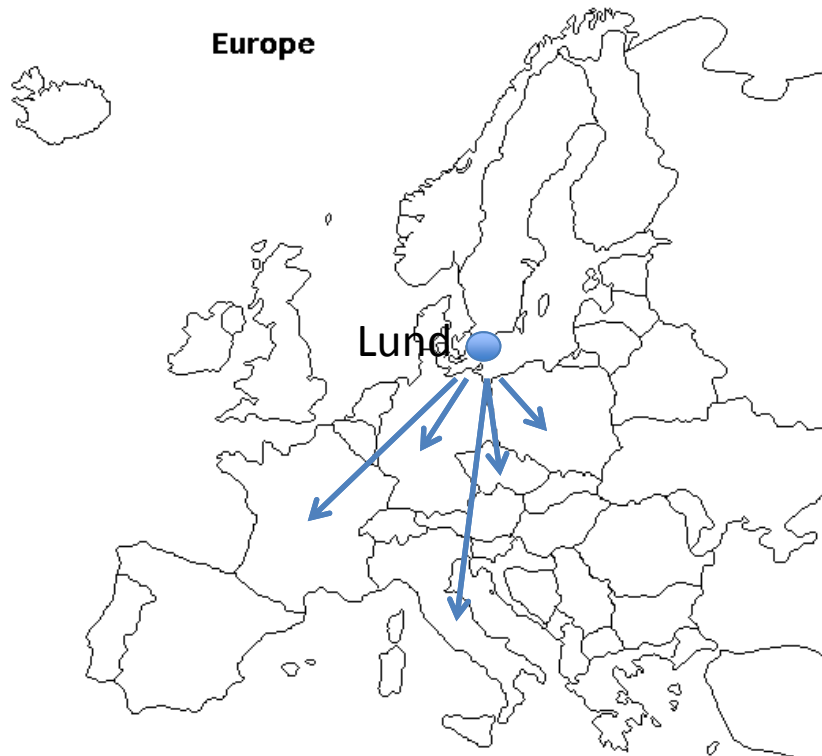
Spinoff Policy





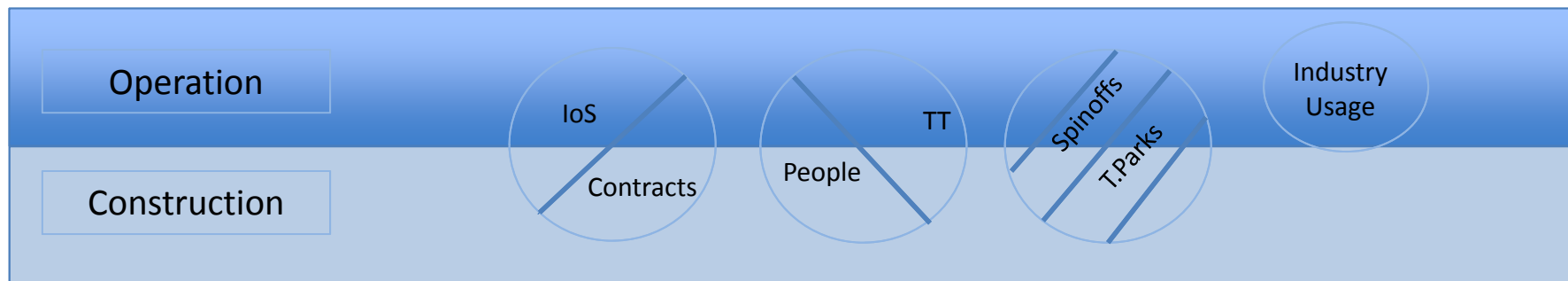
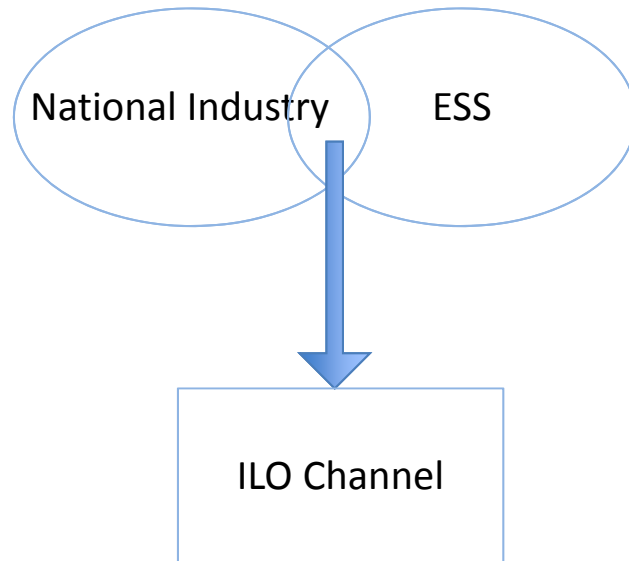


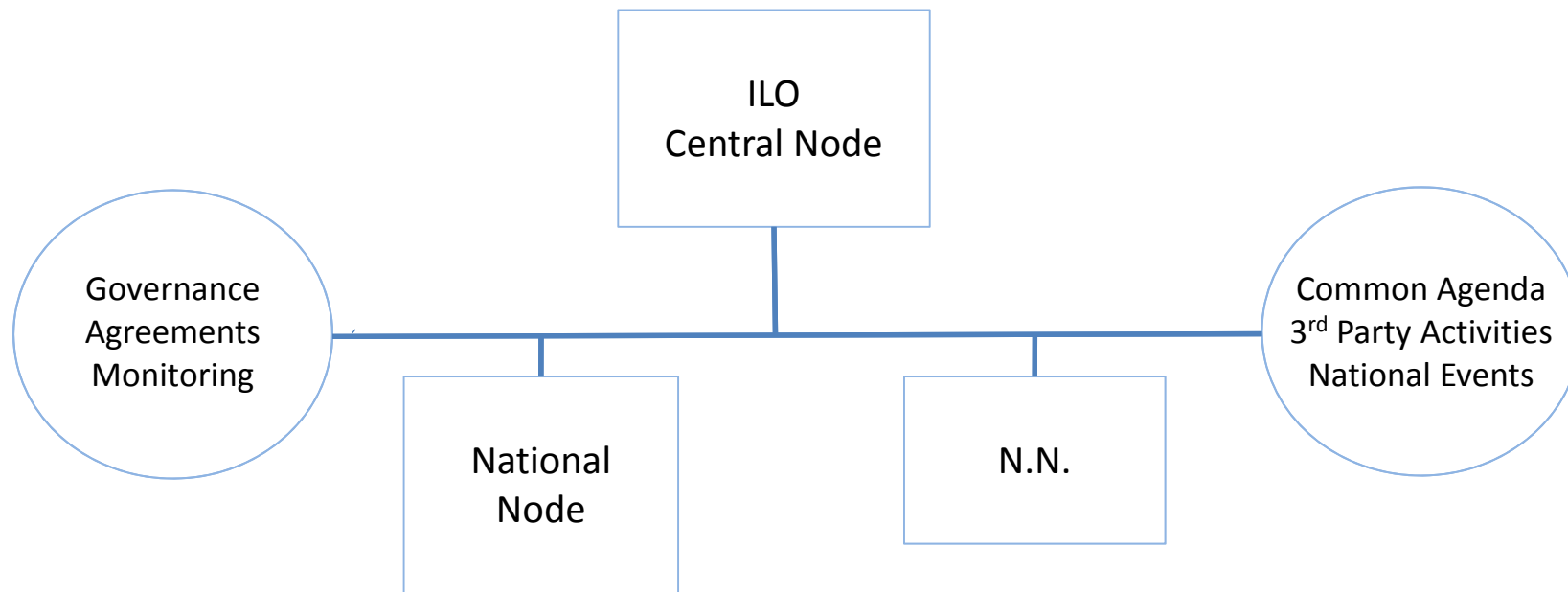
MARKET & INTERNATIONAL STRATEGY

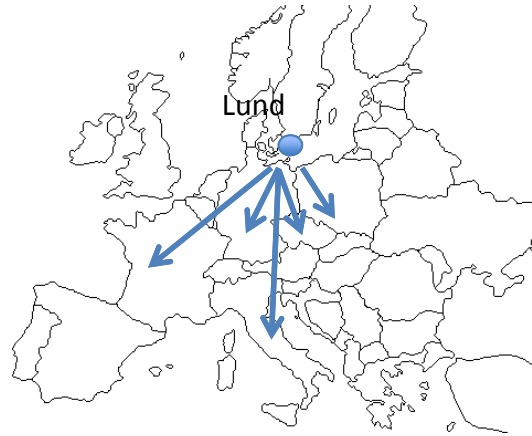


Industrial Liaison Offices Network ILO

- Link to National Governments
- Link to National Industries
- Service to Procurement



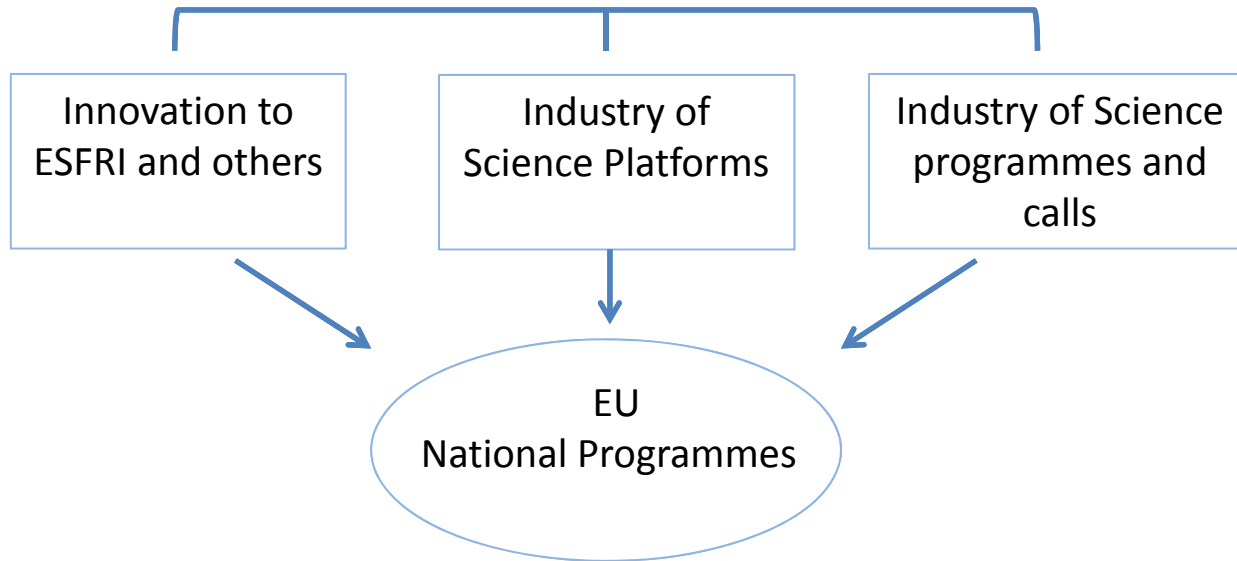
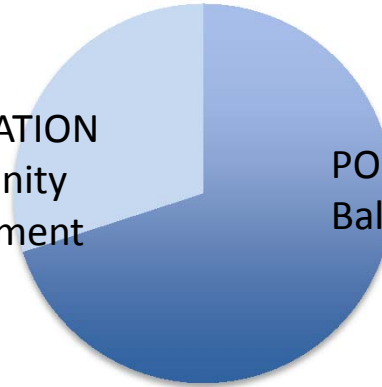




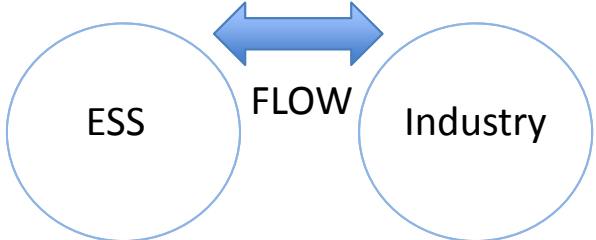
ILO NET

ANTICIPATION
Opportunity
development

POLITICAL VALUE
Balance



PEOPLE POLICY



- Knowledge
- Money

- Contracts

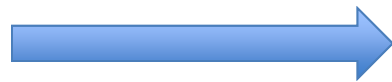
- PEOPLE

ESS
Programmes

External
Programmes

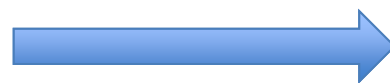
- Joint agenda
- Science park logistics
- Extended dissemination agenda

AWARENESS-RAISING STRATEGY



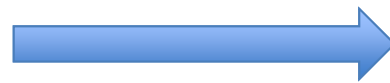
INDUSTRIAL ADVISORY PANEL

- Top 50 European Users and Constructors
- High level support
- Event - Book - Web



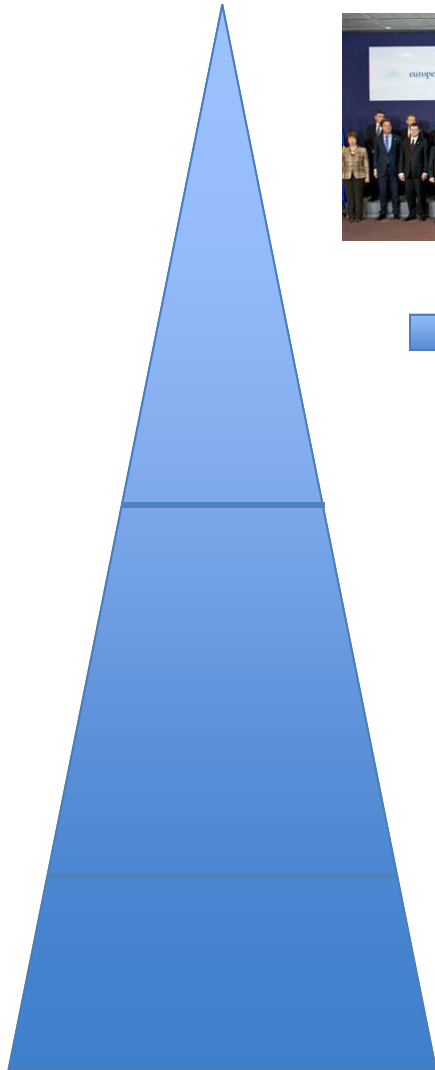
INDUSTRY DAYS

- Connected to ILOs
- With National Ministry Involvement

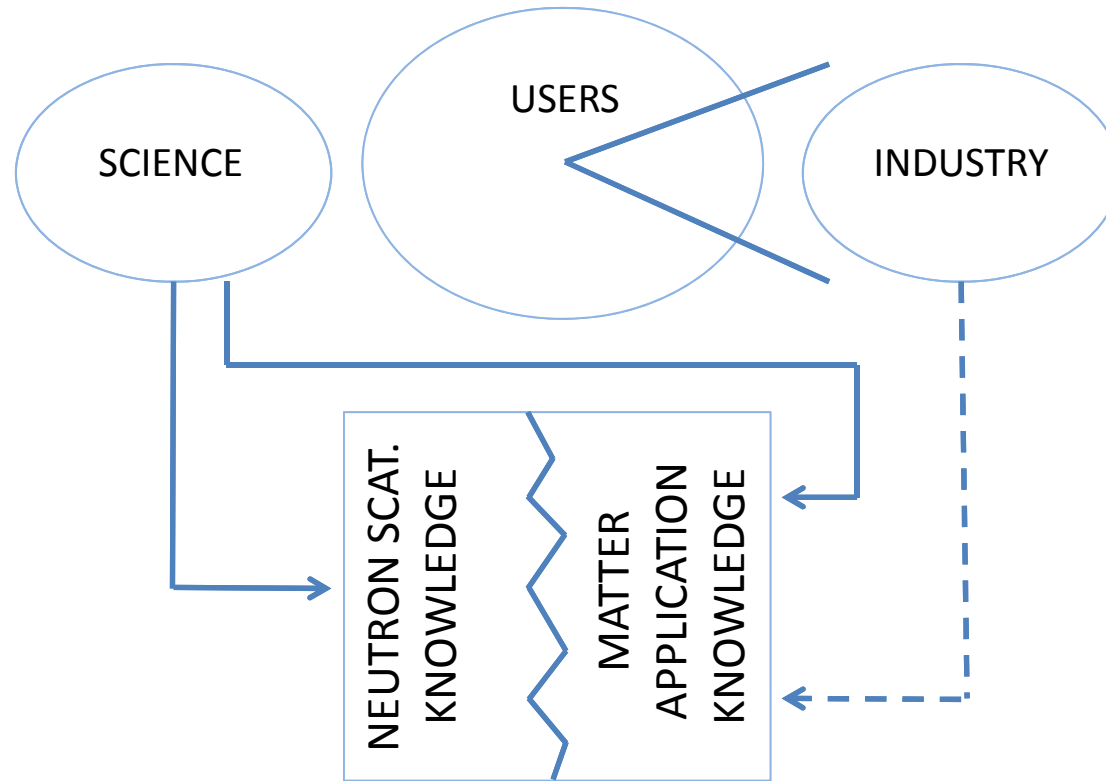


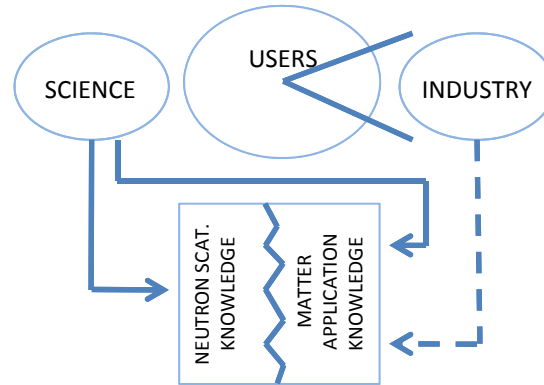
COMMUNICATION AGENDA

- Innovation interviews
- Innovation conferences and events

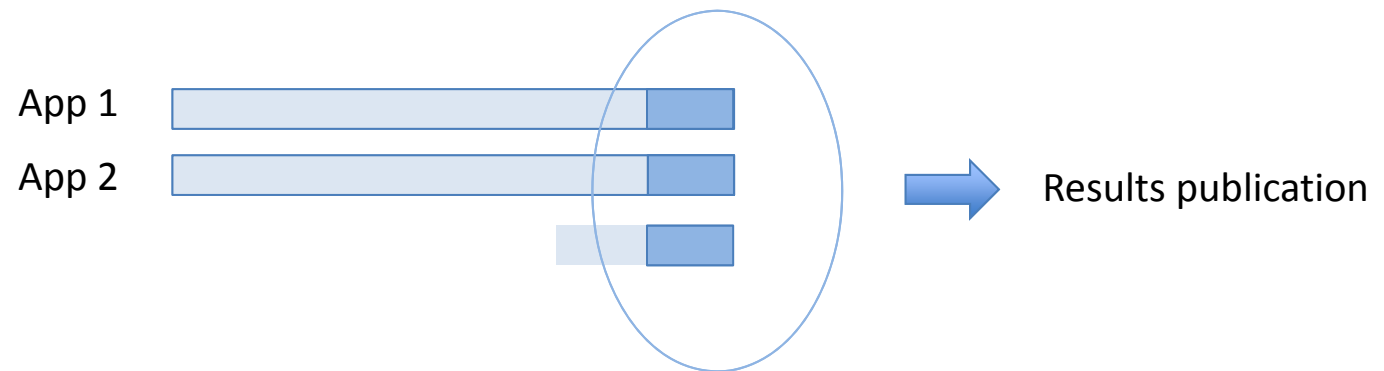


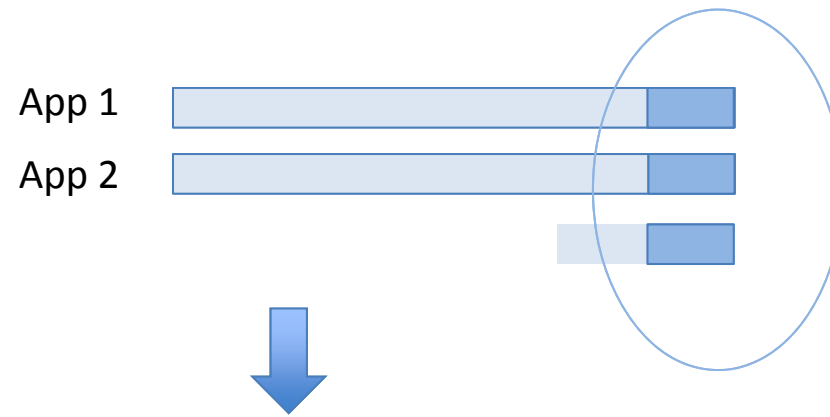
User support in the ESS innovation system





- Application submission
- Beam time
- Free of charge



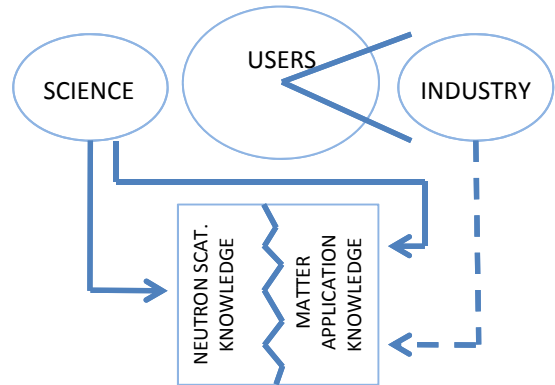


- generated data
- user oriented/shared tools

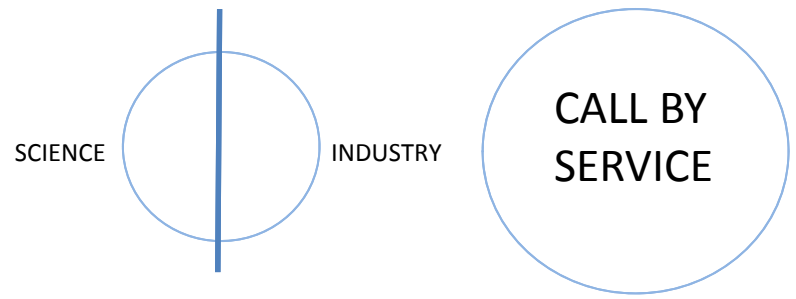
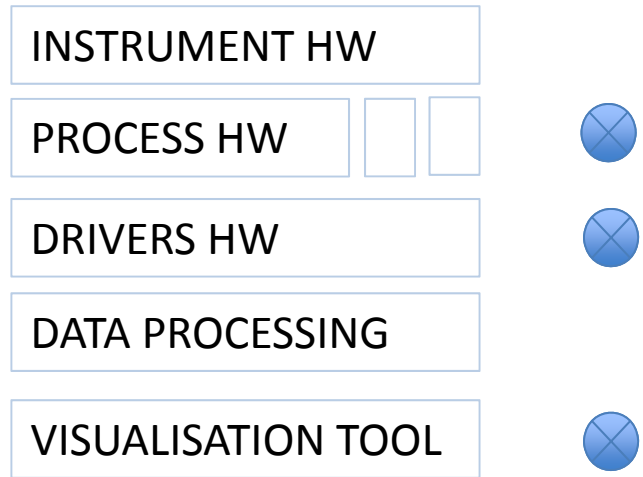
→ high throughputs

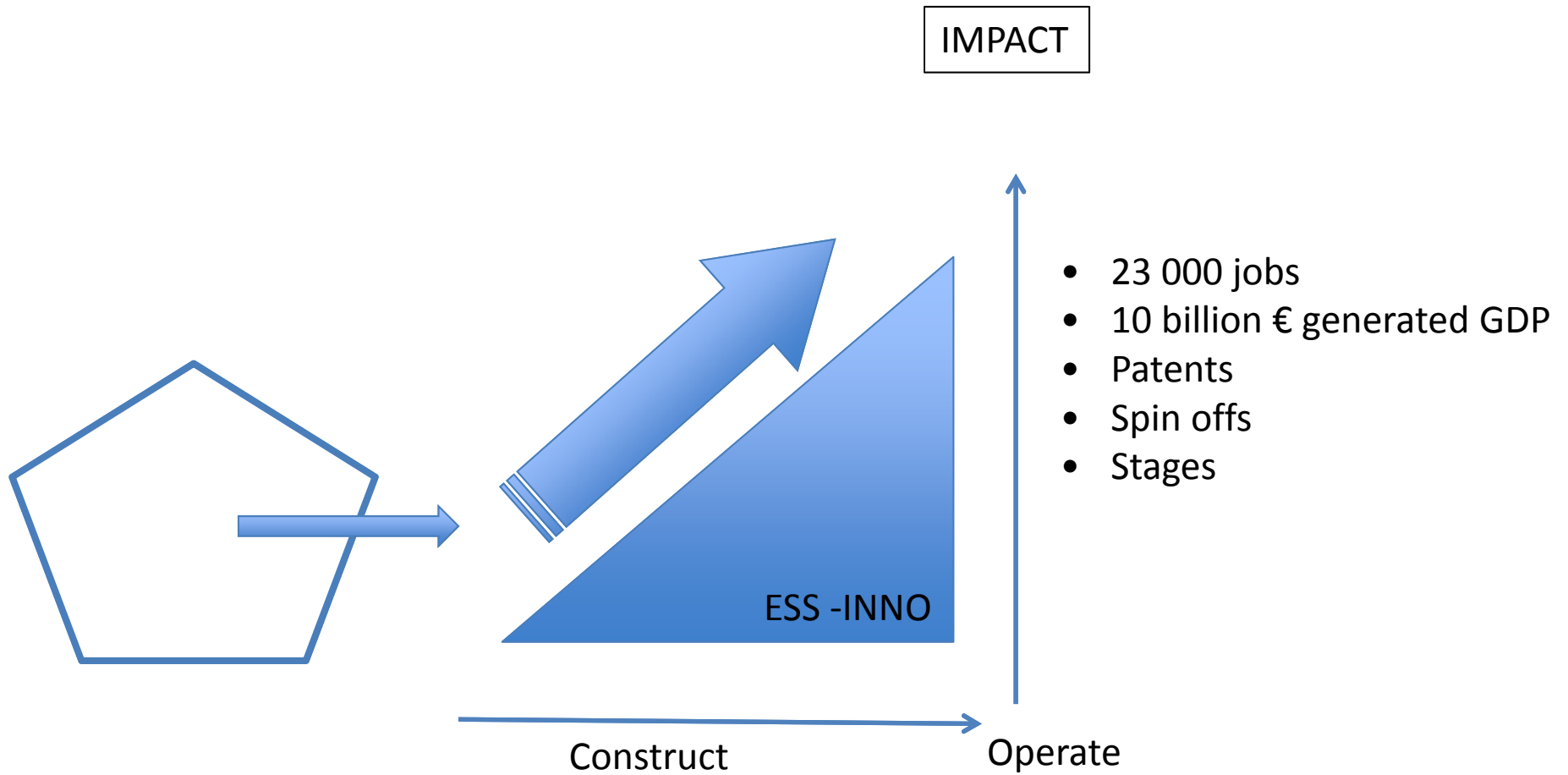
→ common architecture

FROM



TO





“The inno strategy will transform ESS in a world class project for industry and society impact, on top of its world class ambition for science generation and sustainability.”