

DIFFER

Science valorization

Examples of Co-evolution, Technology Transfer,
and Spin-Outs.

With special focus on Fusion Energy

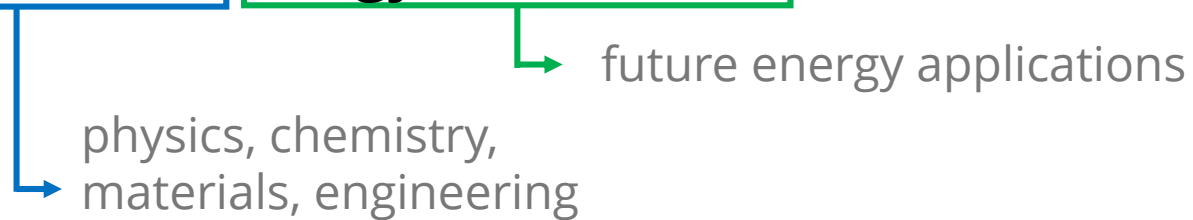
Marco de Baar



DIFFER

Science for Future Energy

Dutch Institute for Fundamental Energy Research



National institute

- 1 of 9 NWO-institutes
- 256 individuals in research and support
- 16,8M€ from NWO, EU, industry (per annum)

Nexus-role

- science, technology, education, industry
- OCW, EZK, I&W



Solar Fuels research projects

Co-evolution with academia and industry

UNIVERSITEIT TWENTE.

Maastricht University



Radboud Universiteit Nijmegen



Brightsite
Transforming industry



TNO innovation for life



syngaschem BV
synthesis gas chemistry
fundamental research projects

OCI

سابك
sabic

sitech
services



pinkRF

TRAXXYS
Innovation & Sustainability



ISPT

Institute for Sustainable
Process Technology

OCI
NITROGEN

Nouryon

LGi

sustainable innovation

HZB
Helmholtz
Zentrum Berlin

DIFFER
Fundamental Energy Research

Light Fuel™

ENGIE

cea

BASF
We create chemistry

hte



Institute for
Sustainable
Process Technology



syngaschem BV
synthesis gas chemistry
fundamental research projects

vsparticle

VECO
precision metal

Fontys

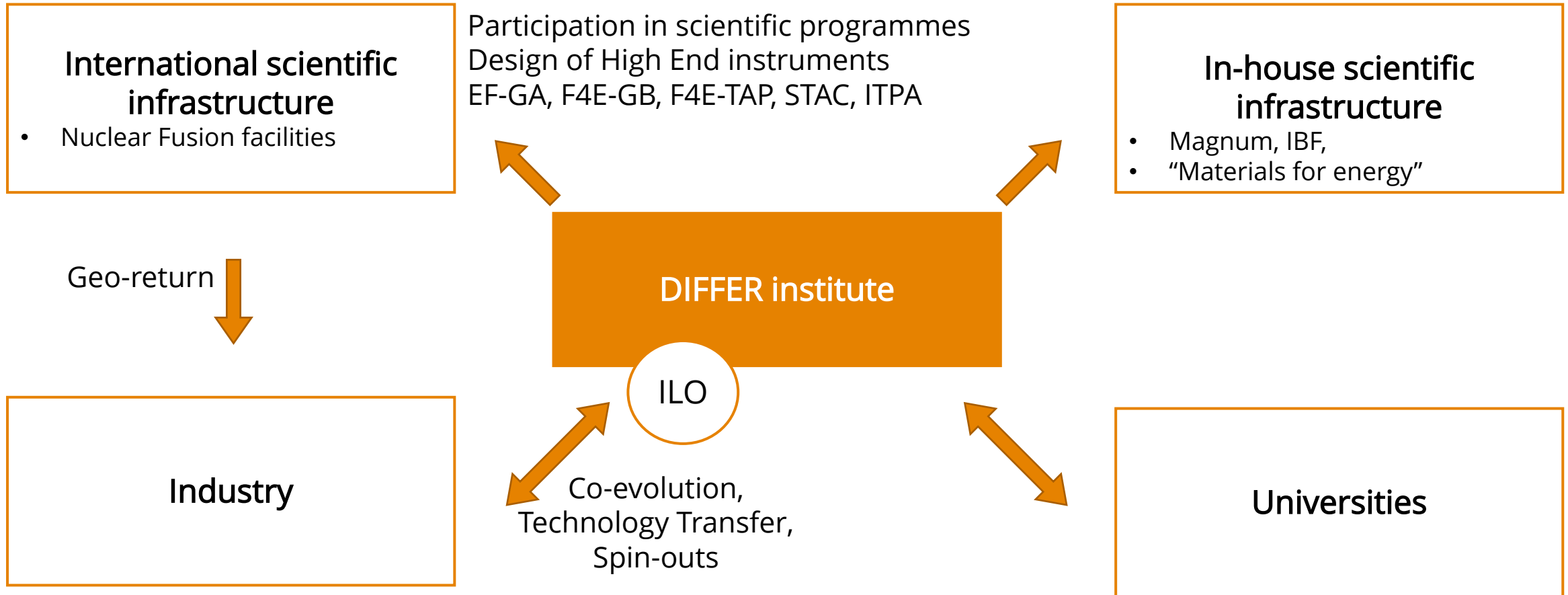
University of Applied Sciences

FORTH
INSTITUTE OF CHEMICAL ENGINEERING SCIENCES

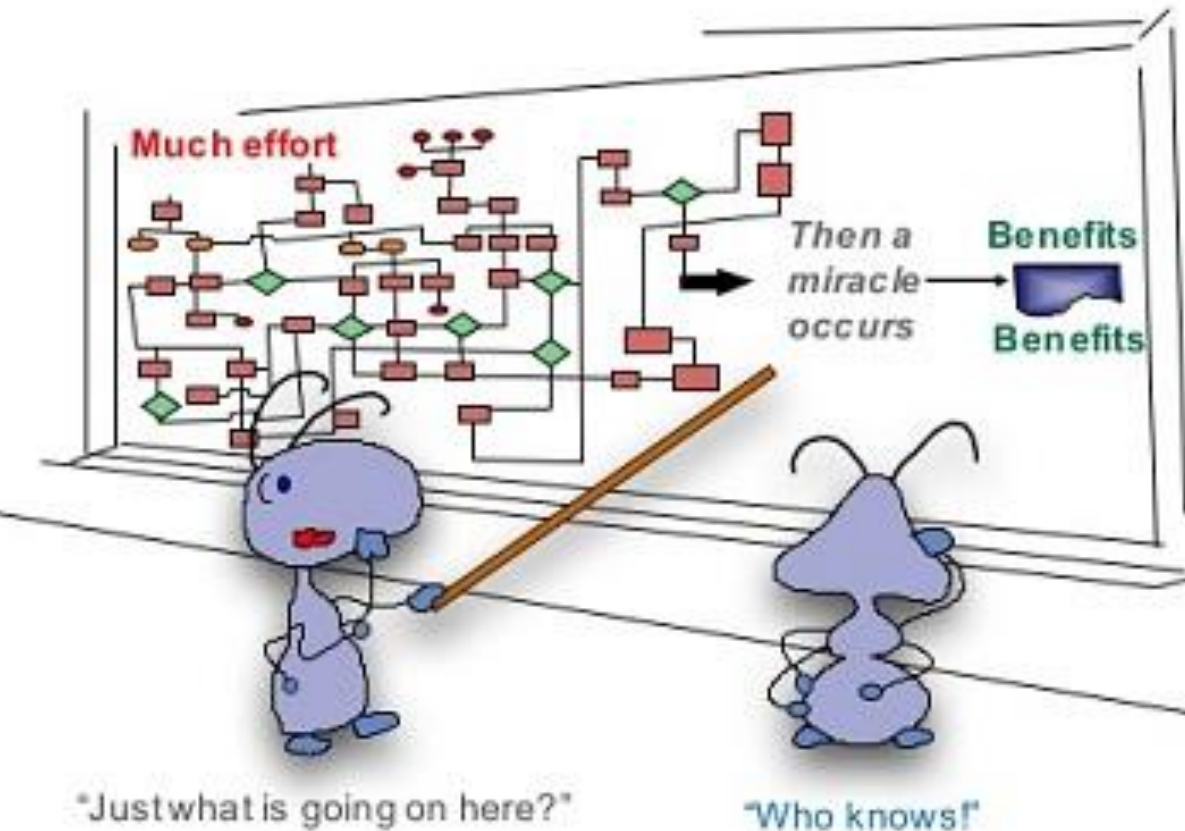


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24 June, 2022

But today → DIFFER's role in the Big Science ecosystem



Technology transfer



What is Technology transfer?

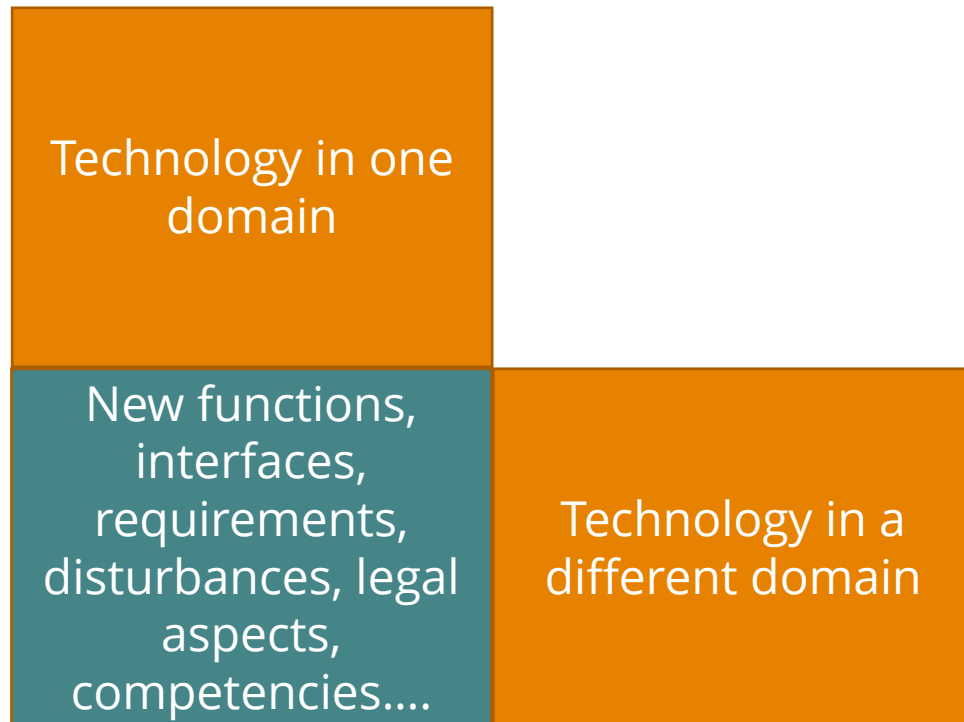
Make scientific and technological developments accessible to a wider range of users
Who will further develop and exploit the technology into new products, processes, applications, materials, or services.

Horizontal transfer is the movement of technologies from one area to another.
Transfer of technology is primarily horizontal.

Vertical transfer occurs when technologies are moved from applied research centers to research and development departments.

Horizontal transfer... Magic? Or is there a system to the madness?

System aspects:



Market aspects:

- Knowledge creation
- Disclosure
- Assessment and evaluation
- IP protection
- Fundraising and technology development
- Marketing
- Commercialization
- Product development, and
- Impact.



From Nuclear Fusion to Airbus A380



From Nuclear Fusion to care robotics

Start (2008): EC Heating Upper Launcher



Customer: F4E - ECHULA consortium

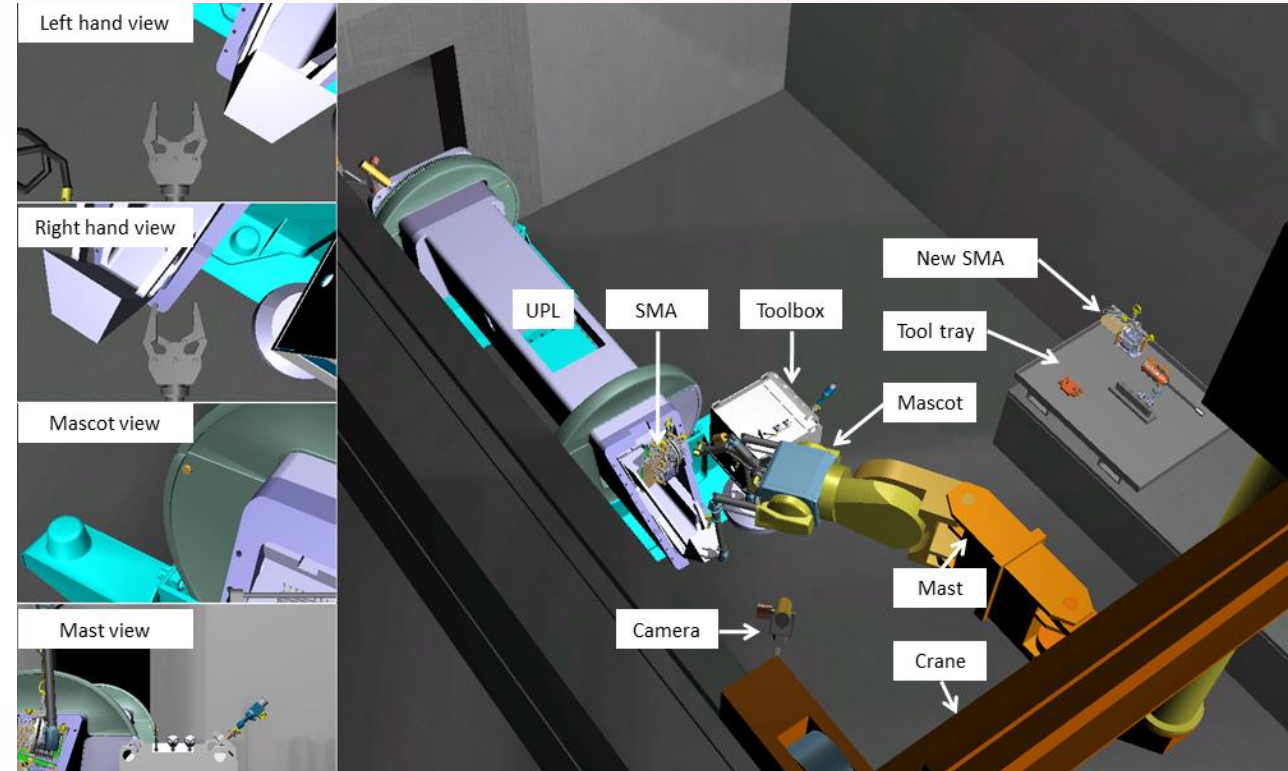
Task: RH Analysis of the Upper Launcher Port Plug

- Generic Hot Cell maintenance tasks
- Replacement of Blanket Shield Module (BSM), Mirrors, Closure Plate Subplate Assembly

Results:

- Virtual Reality used to study procedures
- Maintainability standard role in design validation
- Concept designs solutions proposed Influenced Hot Cell design (need for pit)
- Standards for maintenance procedure analysis (treat manual operations similar to RH ops)
- Importance of tool standards addressed

[movie](#)



Mapping...

- **Safe and reliable** control over critical tasks in **uncertain environment**



Operator



Tele-operation

Common technology:
Human in the loop
tele-operation



Development emphasis:
Verification and validation



ITER reactor
maintenance
robot

Remote robot



ROSE: Remotely Operated Service Robot

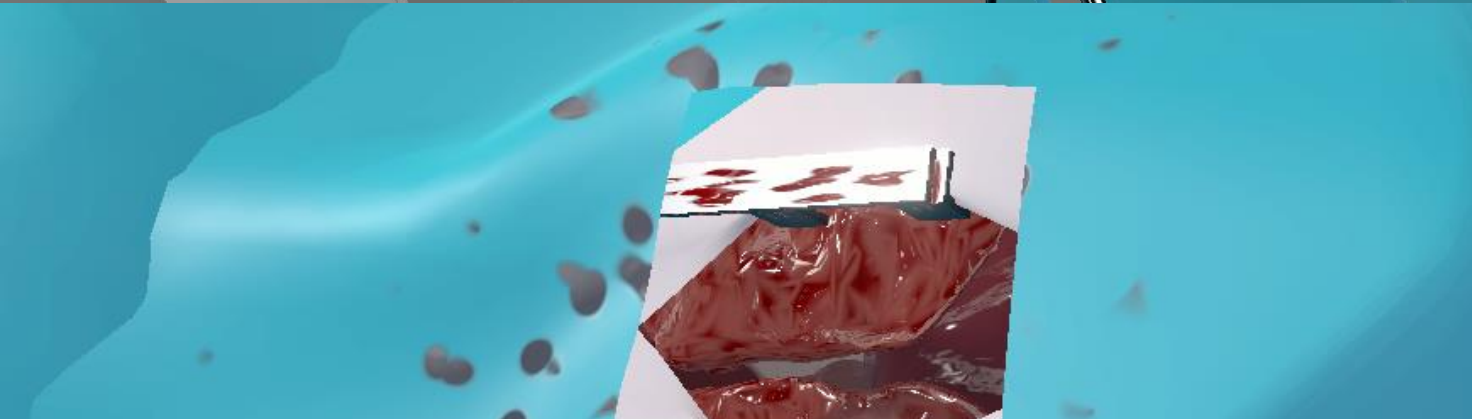
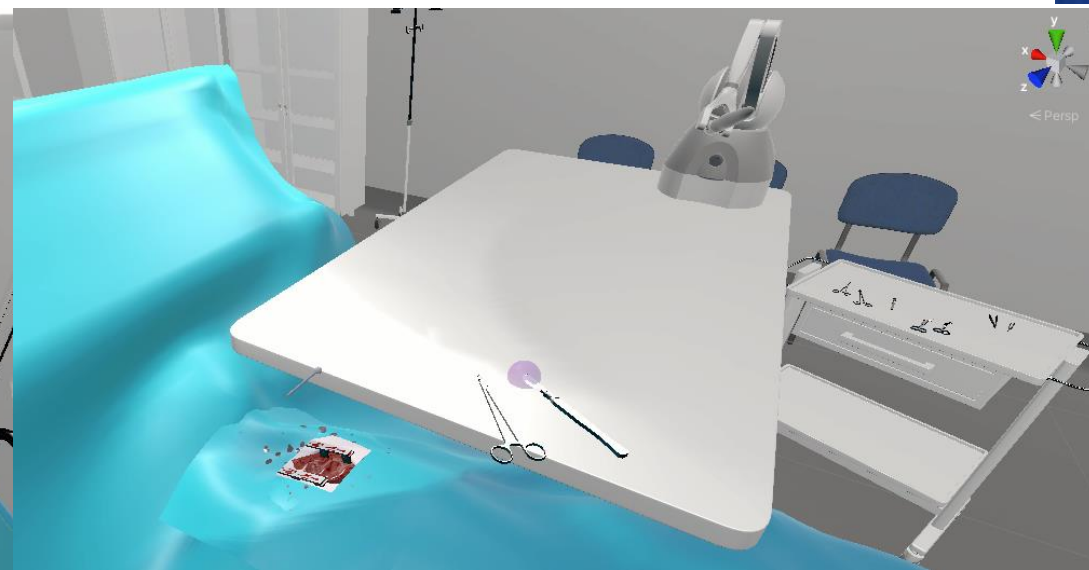
A family of service robots for ADL support in home care & care homes



- Efficient care:
 - Increase productivity care professionals (reduce transfer, 1:X)
 - Increase productivity medical professionals
 - OR decrease stress clients / load informal care takers
- High-quality care
 - More frequent, less waiting
 - More structured contact, less privacy invasive
- Smart & robust robotics:
 - Symbiosis between human intelligence and robot autonomy
- Scalable solution:
 - to increasing demand
 - to international market
 - to technology development (evolving autonomy, h/w costs)



From stiff, well modelled patient to open-heart surgery Prototype surgery training simulator

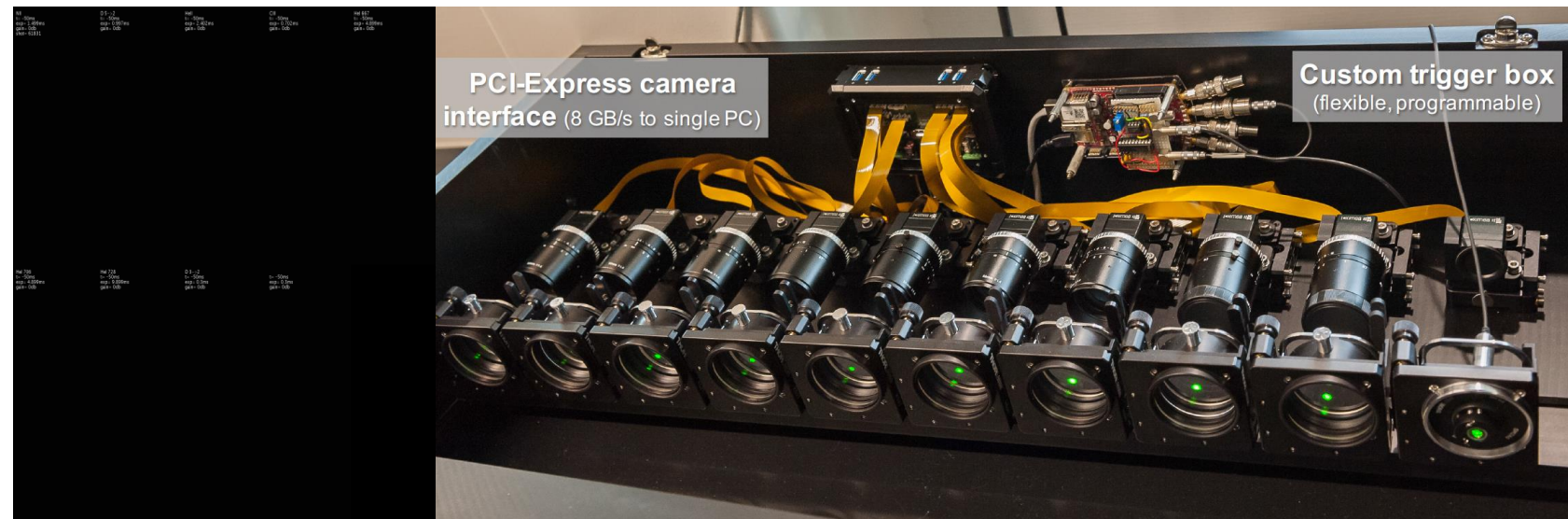
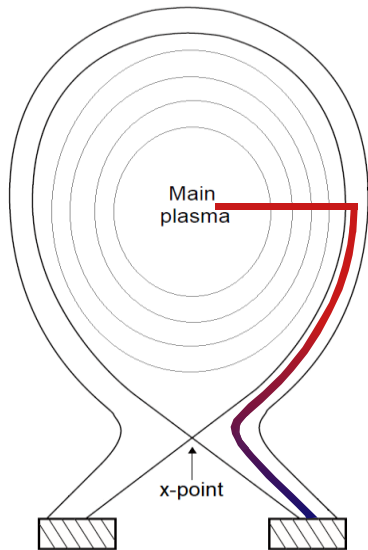


Spin-out Chromodynamics

From fusion reactor diagnostic to industrial inspection tool

High-speed, real-time spectral imaging systems for wide range of applications.

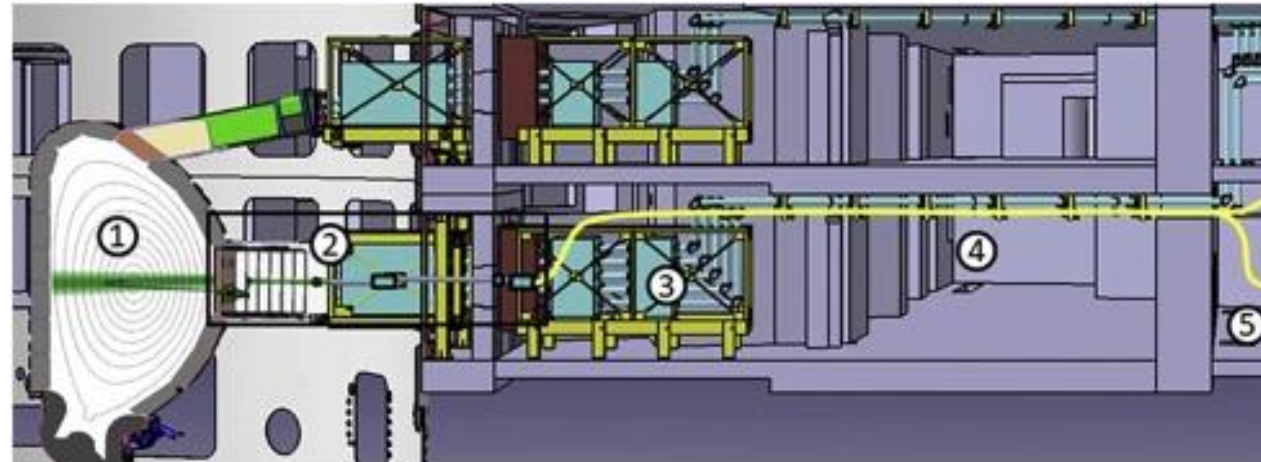
Current focus: imaging solutions for industrial inspection, e.g. food sorting and pharmaceutical packaging.



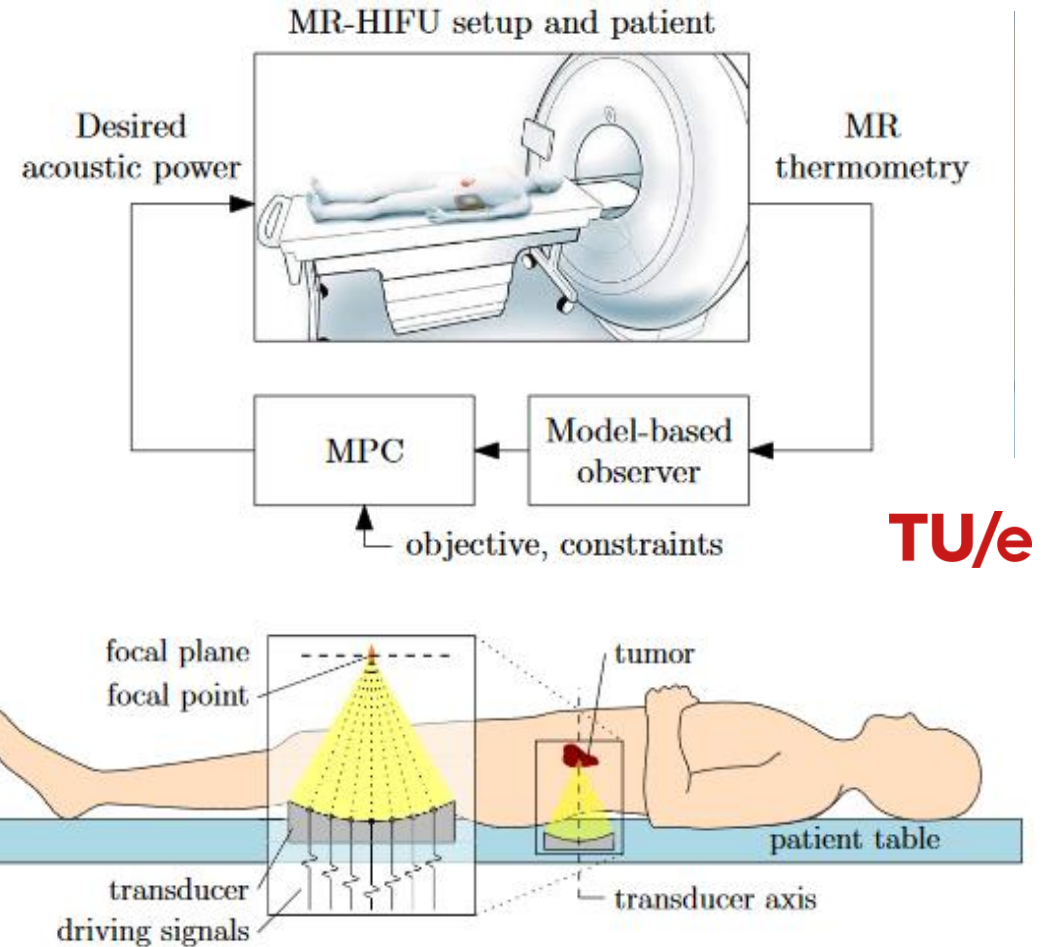
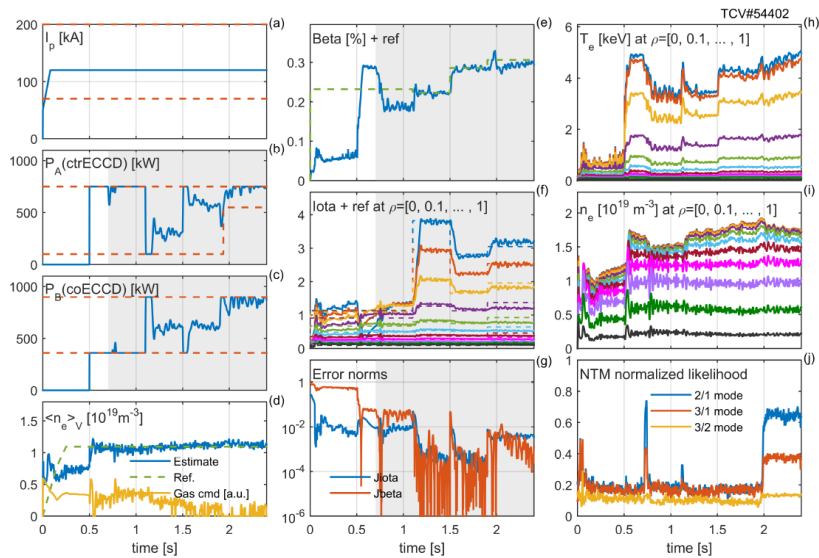
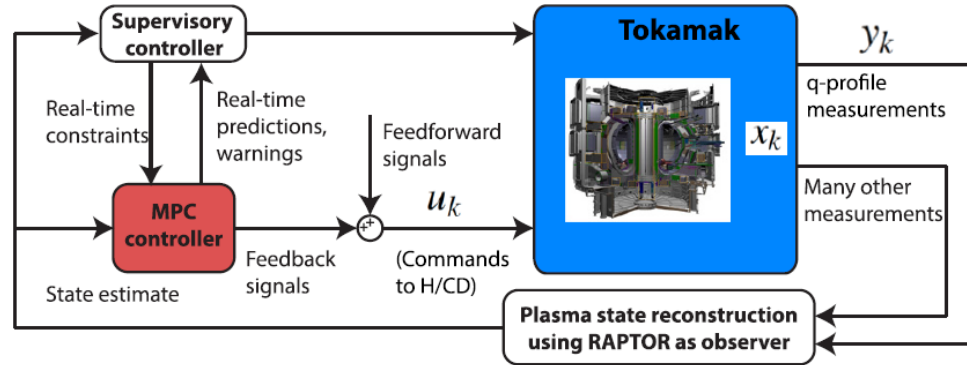
ITER Diagnostics system development key “stepping stone”

Consortium with AST, TNO, DIFFER and Chromodynamics to realize ITER instrument Visible Spectroscopy Reference System.

With VDL, Proto-Consortium to establish several ITER Diagnostics sub-systems (OMF-1126).



Technology transfer From Fusion to thermal control for advanced cancer treatment



TU/e

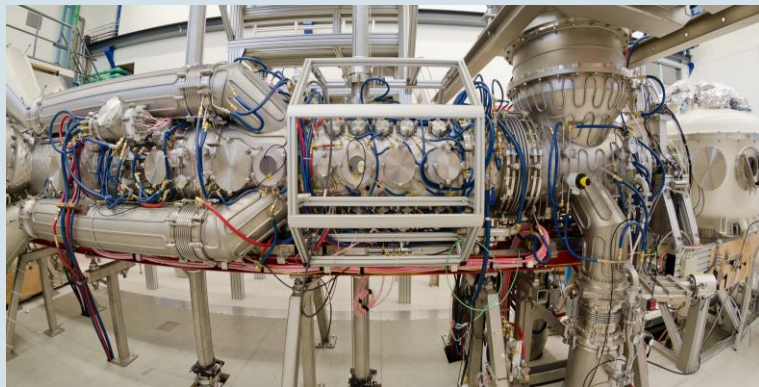


Large Infrastructure “Materials for Energy” at DIFFER

Modeling and System Integration

Plasma Facilities (Magnum, UPP, Nano)

Investigate plasma surface interaction and nano-structuring



Ion Beam Facility (IBF)

Characterize materials
Perform ion implantation



MSR

Synergetic neutron-chemical corrosion in MSR Thorium reactors

Plasma Facilities

LiMeS lab

Liquid-Metal Shield technology for fusion reactors

Pulsed Laser Deposition

- Deposition of complex stoichiometric materials including in-situ characterization

Open Ion Beam

- Operando Electrochemical Ion Beam Analysis
- Raman Micro Spectrometry
- Mass Spectrometry for Electrocatalytic Interfaces

X-ray Facility

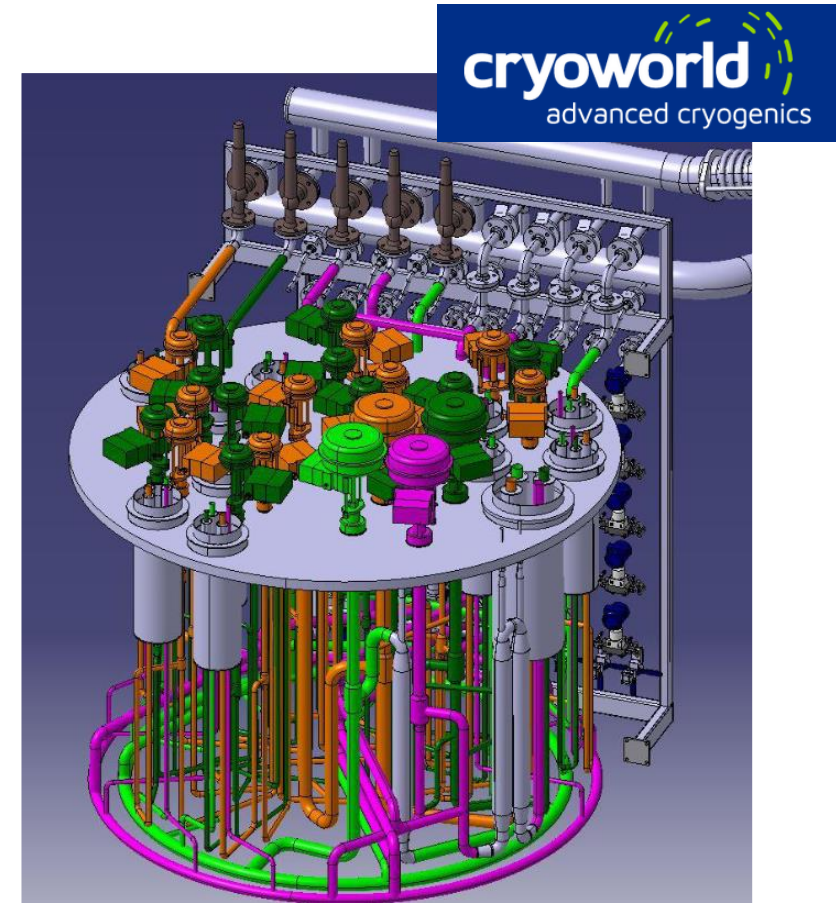
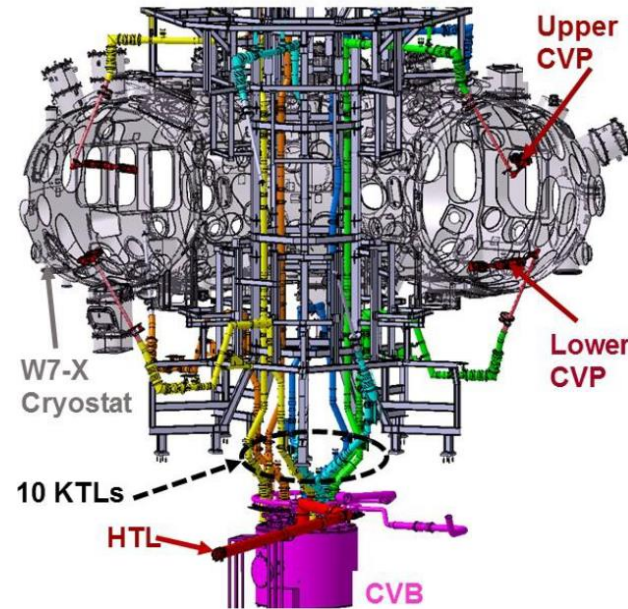
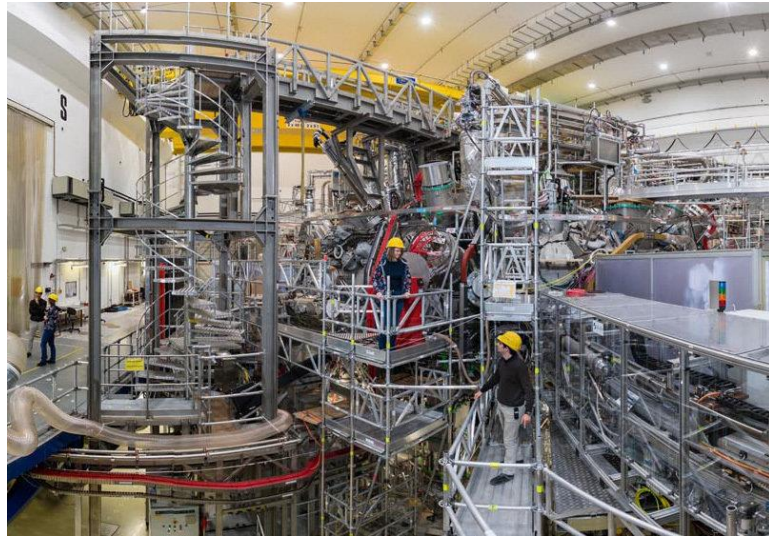
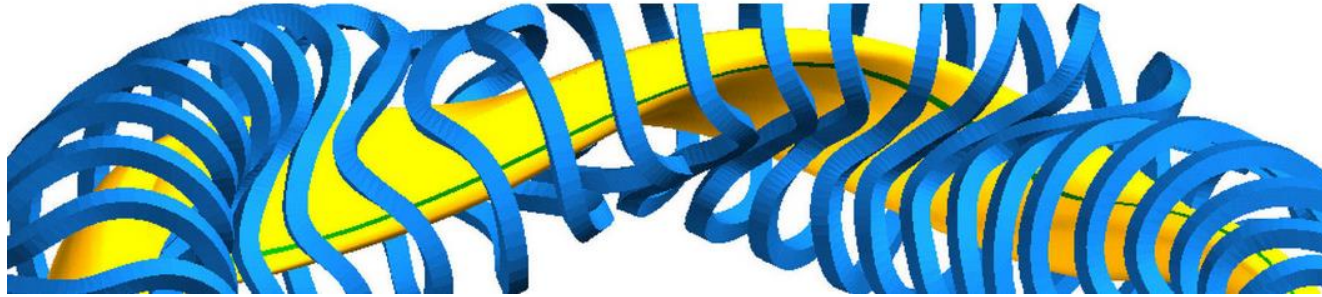
- Determination of electronic structure under high resolution (without synchrotron)

Example Geo-return: Specialized transport of ITER reactor components, Cadarache, France

Mammoet's Efficient Trailer Power Assist system developed for the 100 km road transport of the ITER's toroidal field coils (430 tonne) and vacuum vessel segments (600 tonne) from harbor to ITER site



Example Geo-return: W7X Cryostat design and build → new type of sensors



Example Geo-Return: Coil-cases for MAST-U, CCFE, Culham, UK

3D-Metal Forming



A set of #7 different Coil Can halves was supplied by 3D Metal Forming ranging from 1-5 m diameter
Largest Diameters we welded the banana shape flat blanks before forming.

Material: 4 mm. thick Stainless steel 316.



A set of #2 Coil Can halves was supplied by 3D Metal Forming

Material: 2 mm. thick Inconel 615.

Recent Return successes

- ATG-Europe Engineering support for F4E 30Meur
- Somni Advanced sensors for ITER
- Ratio-Case System Engineering Remote Handling F4E

Conclusions

There are disciplines in which TT is standard: e.g. Control engineering, Systems engineering
We can learn from those disciplines how to do this!

Successful TT requires

Market proposition analysis AND

Systems mapping of one domain to the other

Institutes are very well connected to big science infrastructure

In-house instrumentation developments

People development, networks.

Co-development and spin-outs in combination with big science endeavors can work.



System view Required

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24 juni 2022