Nuclear Innovation Prize & Awards

Authors

FISA EURADWASTE 2025

SNETP Forum

11th European Commission Conference on EURATOM Research and Training in Reactor Safety & Radioactive Waste Management

European Commission

POLAND25.EU

NATIONAL CENTRE FOR NUCLEAR RESEARCH ŚWIERK

Nuclear Innovation Prize

Reactor Safety Systems (RSS)

- 1st Prize **Ahmed BENTAIB - COMOS:** Innovative Containment Monitoring System for Severe Accident Management
- 2nd Prize **Arnaldo LABORDA - ASVAD:** The ASVAD valve, the best passive element to avoid the undesired effects of nitrogen in the PWR reactors
- 3rd Prize **Máté SZIEBERTH - COSINE_NU:** COntinuous SIgnal-based NEutron Noise and mUltiplicity,

Radioactive Waste Management (RWM)

- 1st Prize **Virginie SOLANS - MODENA:** MOdel for Decay hEat prediction using Non-destructive Assay
- 2nd Prize **Ladislav VARGOVCIK - StarGate:** Robotic system for fragmentation of steam generators
- 3rd Prize **Riccardo CHEBAC - GC:** Innovative vacuum-grabbing tool for graphite-moderated reactors decommissioning and sustainability

Radiation Protection (RP)

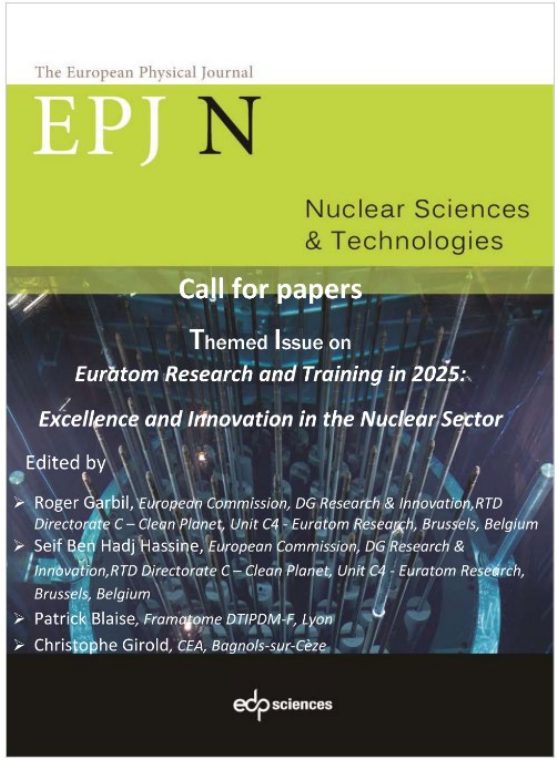
- 1st Prize **Charlotte CAMILLERI** - **Safer:** A way to achieve affordable large scale radiological survey network

Awards - Excellence and Innovation 1/2

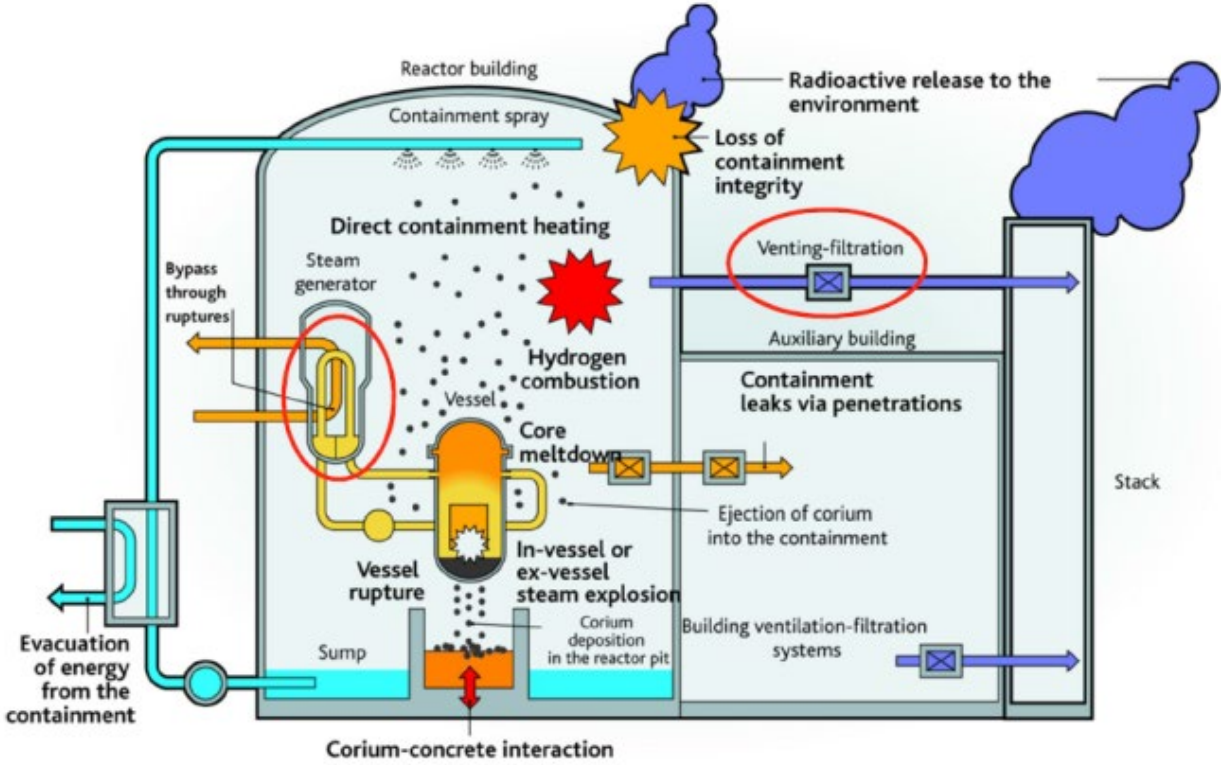
- 009 **Dragan Grgic** Experimental study of the impact of self-sealing on the water and gas permeability of fractures in Callovo-Oxfordian claystone
- 011 **Anna Sears** Direct immobilisation of liquid organic radioactive waste surrogate in a geopolymer matrix
- 052 **Eric Njayou** Transposition Studies with a Hybrid Experimental Database combining ZPR and PWR measurements
- 053 **Francesco Galluccio** iRE-SOLVE process: an inventive solution to address the pre-disposal of spent ion-exchange resins
- 054 **Gabriele Magugliani** Direct immobilization of real radioactive liquid organic waste in novel geopolymers: outcomes from the PREDIS project
- 060 **Luca F. Ferrante Vero** ETERE: A Portable Radioactive Aerosol Monitor capable of Fast Alarm Response and Quantitative Spectrometric Analysis of Artificial Alpha Emitters
- 068 **Eya Abed** Development of an analytical protocol for the determination of difficult to measure radionuclides in steel
- 073 **Ozgur Ilieri** Innovative matrix for radioactive waste conditioning; geopolymers and diatomaceous earth

Awards - Excellence and Innovation 2/2

- 083 **Dilmurod Tuymurodov** Neutronic Analysis of Accident Tolerant Fuel Concepts in Spectral Shift Regulation Condition
- 087 **Chahboub Yassine** Efficient prediction of ductile fracture in ferritic steels using artificial neural network



THE COMOS SYSTEM – AN INNOVATIVE MONITORING SYSTEM FOR CONTAINMENT ATMOSPHERE IN SEVERE ACCIDENT

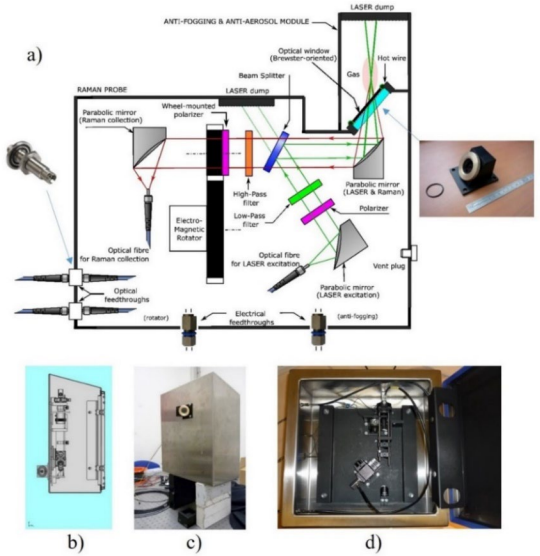


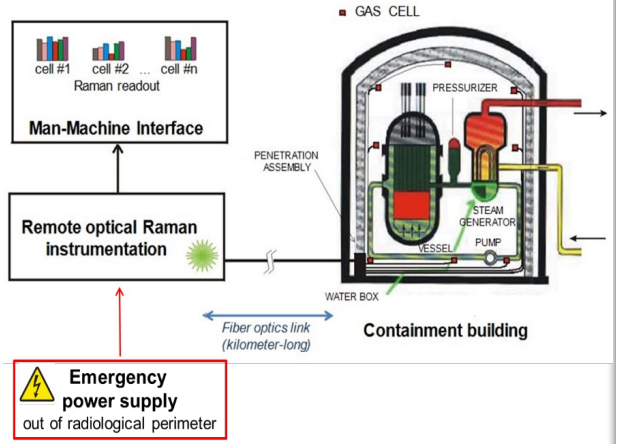
An effective gas monitoring system is crucial for supporting decision-making and implementing SAMG measures.

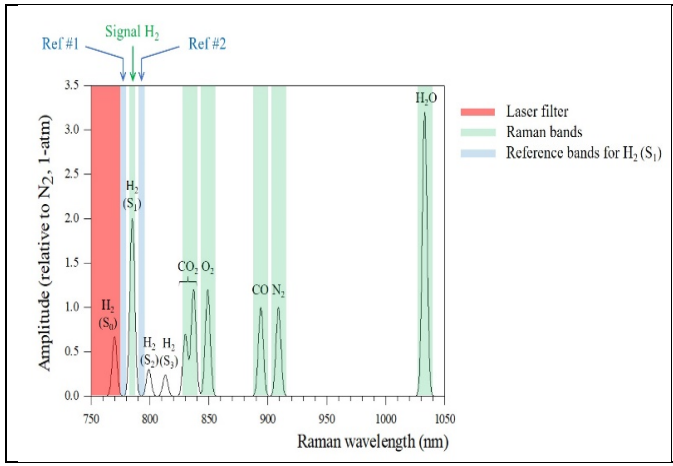
Concept & Objectives

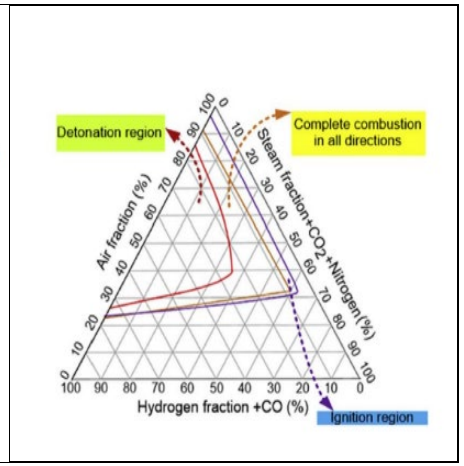
COMOS utilizes Raman spectrometry for in situ gas monitoring, covering both in-vessel and ex-vessel phases of severe accidents. It simultaneously measures six key gases (H_2, O_2, CO, CO_2, steam, and N_2), providing essential information for Severe Accident Management and Emergency Planning, including:

- Quantification of released hydrogen and carbon monoxide,
- Distribution of gases within the containment,
- Detection of MCCI based on carbon monoxide and carbon dioxide measurement,
- Identification of potential flammable gas mixtures,
- Recognition of conditions promoting rapid combustion,
- Assessment of Passive Autocatalytic Recombiners (PARs) efficiency in reducing hydrogen and carbon monoxide concentrations.









Qualification for severe accident conditions

To ensure the COMOS operability under representative severe accidents conditions, the French RCC-E standard was considered within the following specifications:

1) Pressure up to 9 bar,

2) Temperature peak up to 170°C,

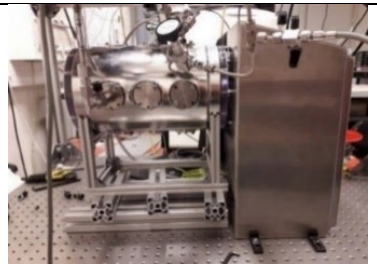
3) Annual radiation dose 2 MGy / dose rate 1 kGy/h,

4) Saturated water vapor condition (RH = 100%),

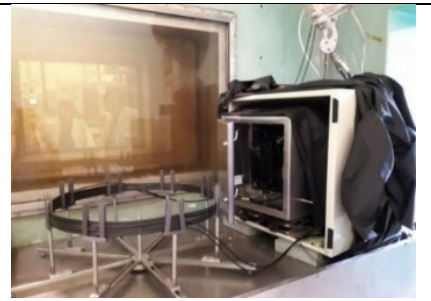
5) Presence of aerosols,

6) Shock/vibrations (Design Basis Earthquake – DBE).

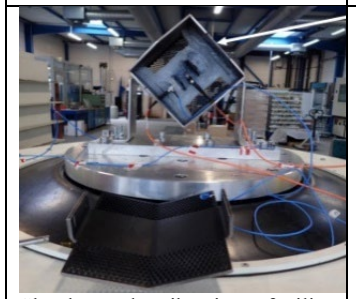
Climatic chamber (CEA) tests up to 95% RH



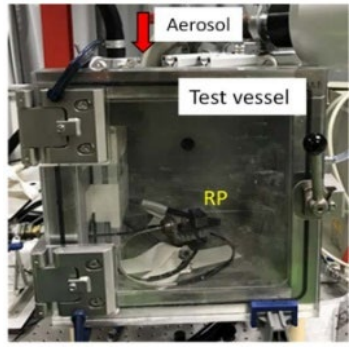
NC2V (CNRS-ICARE) facility for H_2, CO, N_2, CO_2, O_2, H_2O measurements



IRMA (IRSN) facility for radiation tests



Shock and vibration facility (LNE)

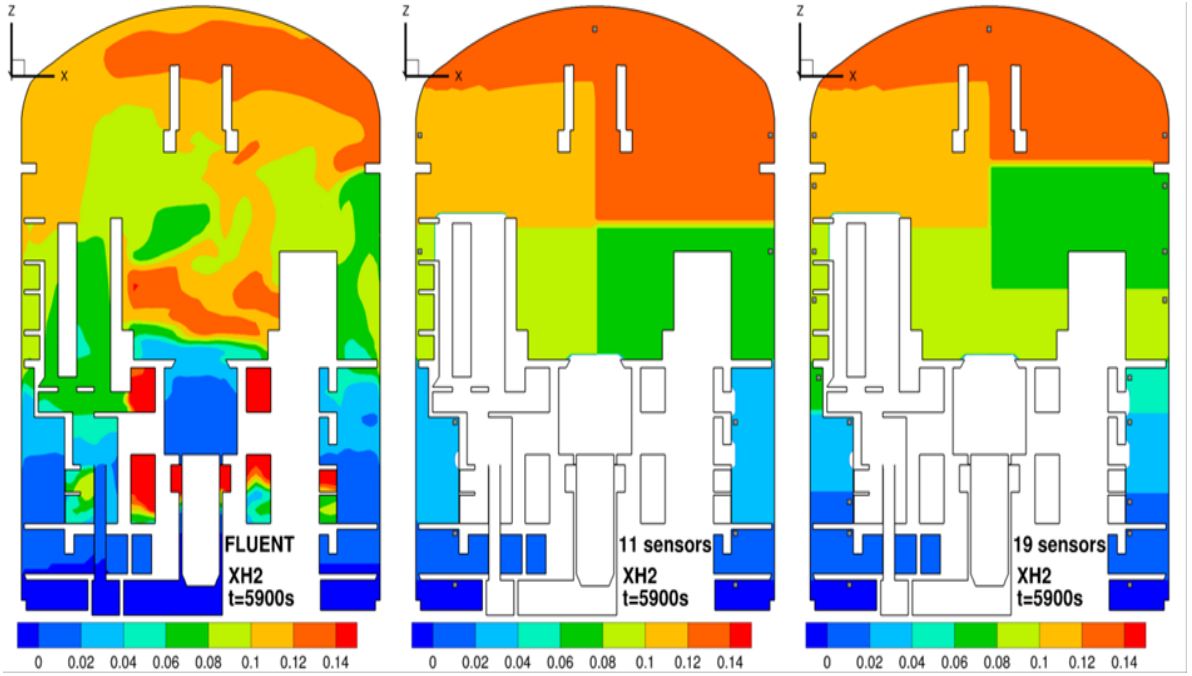


Aerosol facility (IRSN)

MISTRA facility (CEA): integral tests

Summary

- The COMOS prototype meets the need for in situ, real-time gas measurement and is suitable for use in both current and next-generation power plants (e.g., EPR2, SMR). Another key application is in decommissioning and dismantling operations, such as monitoring hydrogen during corium cutting activities (e.g., within Fukushima's PCV).
- A patent has been filed by CEA and ASNR for the COMOS system
- The COMOS prototype has a TRL of 5 to 6



Using Machine Learning (ML) algorithms, it was possible to optimize the sensors' location and their numbers (9 to 11) leading to comparable results as those obtained with CFD analysis

Acknowledgments

Submitted to **Journal Title** [EPJ Nuclear Sci. Technol.]

Template provided by EDP Sciences

Regular Article OPEN ACCESS

THE COMOS SYSTEM - AN INNOVATIVE MONITORING SYSTEM FOR CONTAINMENT ATMOSPHERE IN SEVERE ACCIDENT

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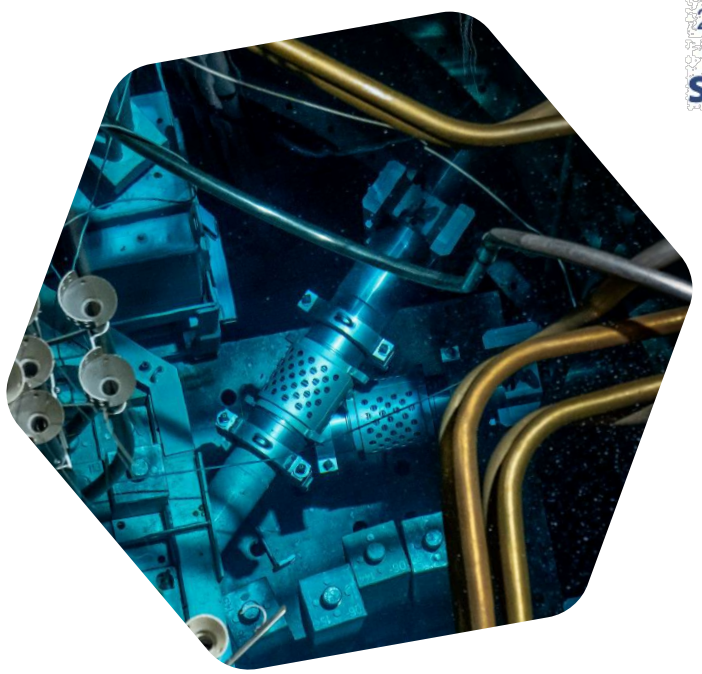

The MITHYGENE project was coordinated by the French ANR (*Agence Nationale de la Recherche*), partly funded by the PIA-RSNR (*Programme d'Investissements d'Avenir, Recherche en Sûreté Nucléaire et Radioprotection*) of the French government, and was also partly financially supported by two French companies: EDF and AIR-LIQUIDE

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THE SIMPLE ANSWER TO A SERIOUS PROBLEM

THE PROBLEM

Nitrogen escaped from the accumulators can be a risky complication during a LOCA accident.
It can challenge the core cooling in various ways.

CURRENT STATE

PWR plants only have manual strategies to cope with it.
They rely on ACTIVE equipment, HUMAN actions, and having ENOUGH TIME to perform these strategies.

THE FUTURE

The ASVAD valve is the reliable solution to avoid this problem.
It is PASIVE. It is AUTOMATIC. It acts FAST at the CORRECT moment. It exhausts all the nitrogen before it can reach the RCS.

THE SIMPLE ANSWER TO A SERIOUS PROBLEM

We're proud to share with our Nuclear Community our safety innovation. We're also happy to enhance the safety of all the nuclear plants with accumulators.

COUNCIL DIRECTIVE 2014/87/EURATOM

Art. 6 (c). Licence holders are to regularly assess, verify, and continuously improve, as far as reasonably practicable, the nuclear safety of their nuclear installations in a systematic and verifiable manner. That shall include verification that measures are in place for the prevention of accidents and mitigation of the consequences of accidents, including the verification of the application of defence-in-depth provisions;

The ASVAD valve is the state-of–the–art safety element to avoid the nitrogen problem. Installing ASVAD is a small modification, reasonable and practicable.

Now, we need the REGULATOR support, to become REAL in our plants.
Our Spanish Regulator (CSN) was the first one giving us their approval.

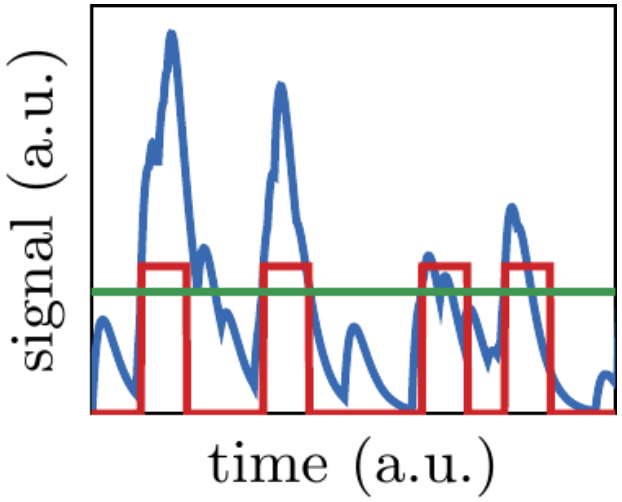
Continuous Signal-based Neutron Noise and Multiplicity Measurements

FISA EURADWASTE 2025 SNETP Forum

Máté Szieberth[1], Gergely Klujber[1], Máté I. Boros[1], István Barth[1] and Imre Pázsit[2]

[1]Budapest University of Technology and Economics (BME), Institute of Nuclear Techniques, Budapest 1111, Hungary, szieberth@reak.bme.hu

[2]Chalmers University of Technology, Department of Physics, Gothenburg 412 96, Sweden, imre@chalmers.se

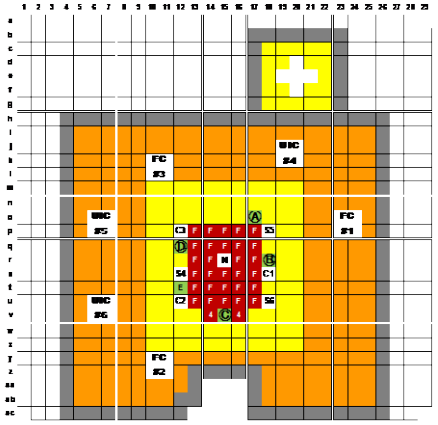


- Neutron fluctuations are consequences of the stochastic nature of the nuclear chain reaction.
- Most important applications:
  - **neutron multiplicity counting** (doubles, triples) for safeguards measurements;
  - **neutron noise methods** (zero noise) for the measurement of reactivity and dynamic parameters of reactors (Rossi-α, Feynman-α, etc.).
- **Pulse counting** is limited by the dead time at high count rate.
- **Continuous signal**-based evaluations can overcome this issue.
- The new method required the development of theory, data acquisition and evaluation methods.
- The innovation opens new opportunities for the application of neutron fluctuation methods for nuclear safeguards and safety.

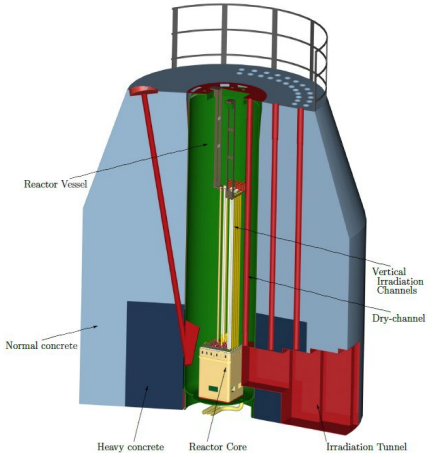
MŰEGYETEM 1782

CHALMERS UNIVERSITY OF TECHNOLOGY

Continuous Signal-based Neutron Noise and Multiplicity Measurements



KUCA core configuration



Vertical section of BME TR

- Proof-of-concept **measurements** have been performed at the **Kyoto University Critical Assembly (KUCA, Japan)** and at the **Training Reactor of the BME** (Hungary).
- Good agreement was observed with the traditional pulse counting methodology.
- The new method was demonstrated to be applicable in high-count-rate environments.
- **Simulations** further proved that the methodology is less sensitive to the high source intensity (dead-time effect) and can estimate higher kinetic eigenvalues more accurately.
- The ongoing development may open several ways for application, e.g.:
  - Neutron multiplicity counting on irradiated fuel assemblies.
  - Reactivity measurement in subcritical configurations (e.g. refuelling, Accelerator-Driven System).
  - More accurate measurement of reactor dynamics parameters to validate reactor dynamics codes.
- **Last chance to view the poster in the Expo Area!**

MŰEGYETEM 1782

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MODENA

MOdel for Decay hEat prediction using Non-destructive Assay

- Aim: Fast prediction of decay heat using measurements.
- Why? Decay heat is usually the limiting factor in canister loading.
- How? Use a passive gamma and neutron measurement device.
- Solution: Robust model, easily applicable.

Team: Virginie Solans, Henrik Sjöstrand, Sophie Grape, Erik Branger.

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SNETP Forum

Anders SJÖLAND

27.01.1965-02.05.2025

Technical University of Kosice

"ROBOTIC FRAGMENTATION OF STEAM GENERATORS"

Ladislav Vargovcik

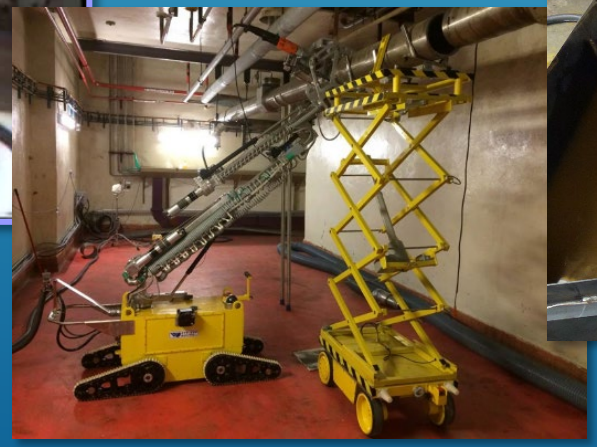
Jozef Varga

Jan Semjon

FISA-EURADWASTE 2025 & SNETP Forum

Warsaw 13 – 15 May 2025

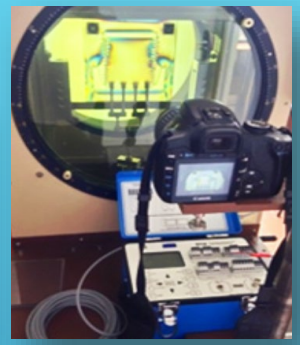
Products from TUKE´s collaboration on robotics for nuclear industry



SERVICES AND INFRASTRUCTURE

Electronic Speckle Interferometry

Computed tomography

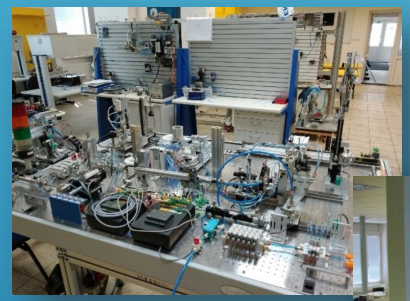


Transmissive Photoelasticimetry

Start-up Centre

Machining Hall

Halls for Assembly and Testing of Prototypes



Labs for testing of robot´s control system and trainings of operators

CMM system

- Strategic RDI (e.g. Joint pre-competitive R&D, secondment from companies),
- Contract research (e.g. Specific R&D, technology concept development, proof of concept),
- Technical support on scale-up (e.g. Concept validation, prototyping, small series production),
- Provision of technology infrastructure (e.g. Renting equipment, low rate production,
- platform technology infrastructure, Lab facilities),
- Testing and validation (e.g. Certification, product demonstration, product qualification)

Robotic system for cutting of the steam generator´s pipes

Factory tests on 1:1 mock-up

Manipulator:
- payload 200kg and 5+2 DOF
- working mode – robotic or master/slave

Tooling:
- circular saws (with basket and without basket)
- flame cutter
- plasma cutter
- grinding cutter
- gripper

Cutting speed:
200mm/min sawing 5 rows of pipes using circular saw with a basket for cut pieces

Manipulator in operation at NPP V1 Jaslovske Bohunice (SK)

Automatic cutting of the steam generator´s casing

Installation in NPP V1 Jaslovske Bohunice (SK)

Orbital casing cutting system works on guidance of circular shape with two cutting modules – longitudinal and cross sectional.
Cutting tool: milling disk cutter

Cutting speed:
180mm/min at wall thickness 75mm
 90mm/min at wall thickness 140mm

Thank you for your attention

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SNETP Forum

isymap

data everywhere

ISYmap

ISYmap is a <u>radiological sensor and robot</u> manufacturer addressing nuclear industry and CBRN defense markets.

Our products include:

- Real time & long-range communication
- Localization
- Wireless with long battery life

GLOBall

Guard

Safer

Flighter

ISYroll

Focus on SAFER innovation

We have developed an ultra low power dose rate sensor.

❖ Applications:

- **Nuclear industry:** *ambient dosimetry & hot spot recurrent measurement.*
- **Homeland security:** *monitoring of major events and sensitive civil infrastructures.*

❖ Operational advantages of the innovation:

- *continuous dose rate measurement over long period (5 to 10 years on a single battery charge);*
- *wireless live monitoring of nuclear facilities & public events;*
- *spatial and temporal localization of the alert;*
- *simple and rapid deployment.*

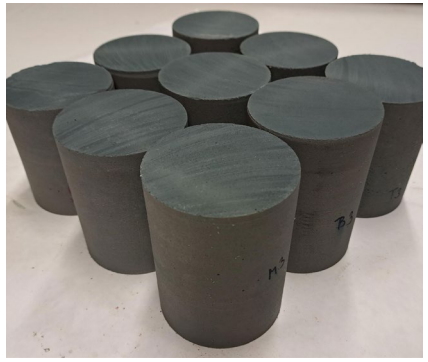
www.isymap.com
Charlotte CAMILLERI – CFO - camilleri@isymap.com
Aurelien BALLIER – CEO - ballier@isymap.com

My journey to the nuclear sector

- Background in the defence sector.
- Specialised in CBRN protection.
- Currently working in the Research Centre Řež, Czech Republic.

Direct immobilisation of RLOW surrogate in geopolymer matrix

- Research within the PREDIS project.



- Successfully scaled the process from lab to pilot level –100 L drum with 20 wt.% waste load and achieved TRL 6.

- Building on previous research within the EURAD-2.

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SNETP Forum

Day 2, 13.05.2025

Plenary Session I: Achieving Net Zero by 2050 in Europe (14:00 – 15:30)

Key takeaways:

2050, how to get there?

- EU policies and instruments based on neutral technology principle.
- State energy policies need to provide predictable stability for the investors and give guidance on the pathway. Governments need to support financing and bridge the funding gap by de-risking. (France, Poland, Czech)
- Business needs to get their and act together (delivering projects on time and on budget), Supply chain, European Business Alliance,..
- Regulators need to trim their rules and processes to help save on costs. Harmonizing European safety regulations (eg. Pre-licencing NUWARD, Czech for Rolls Royce SMR and BWRX-300 ,..)
- Waste management (learning from POSIVA for DGR, assessing new waste streams for SMRs/ AMRs,),
- Fuel manufacturing and supplies need to be diversified. Planning for production of fuels for SMRs/AMRs
- EU cooperation Platforms: IA SMR, SNETP, IGD-TP...
- Shared European research infrastructure from test equipment and computational platforms
- Central role of Euratom R&T programme
- International cooperation, IAEA, NEA, GIF,...
- Transparency and Public Acceptance, dialogue with local communities, tailored interaction with different

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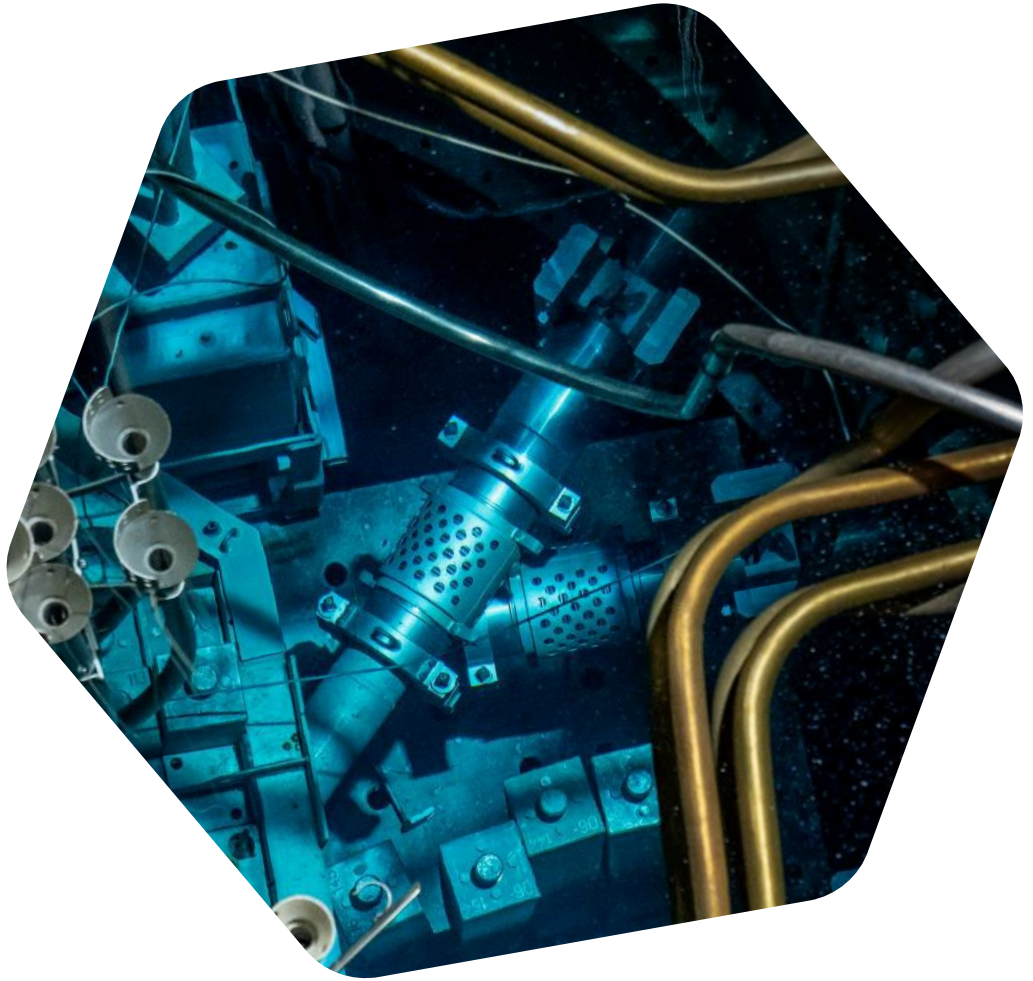

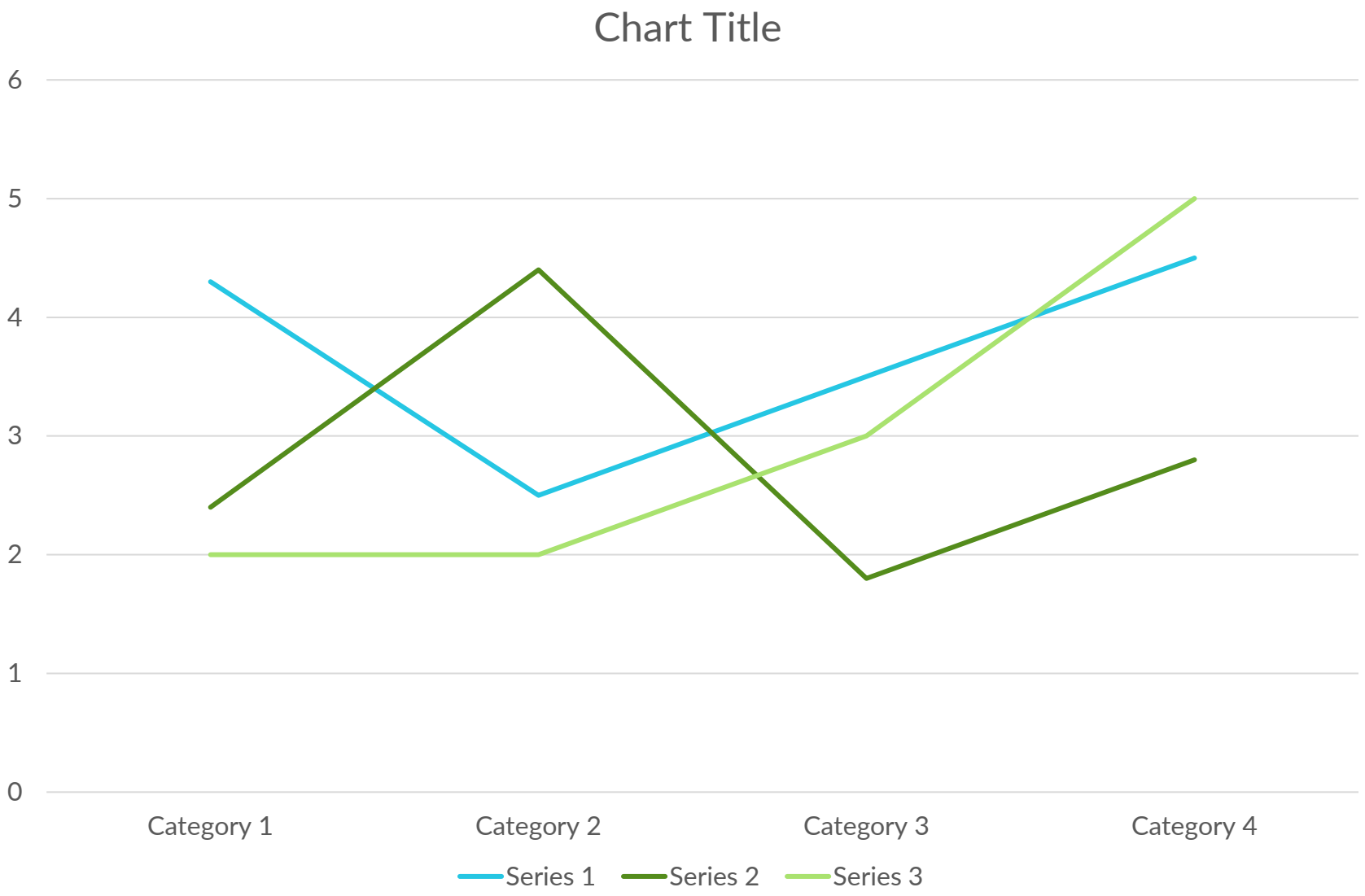
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Series 3

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Prez_2
PK1-6
LSA
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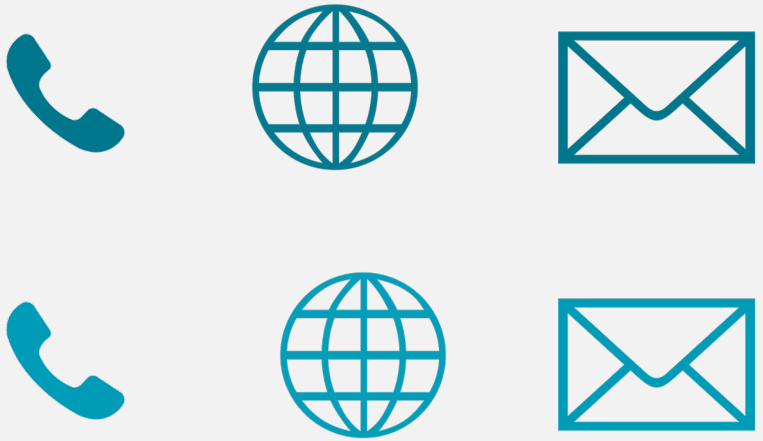
Useful pictograms



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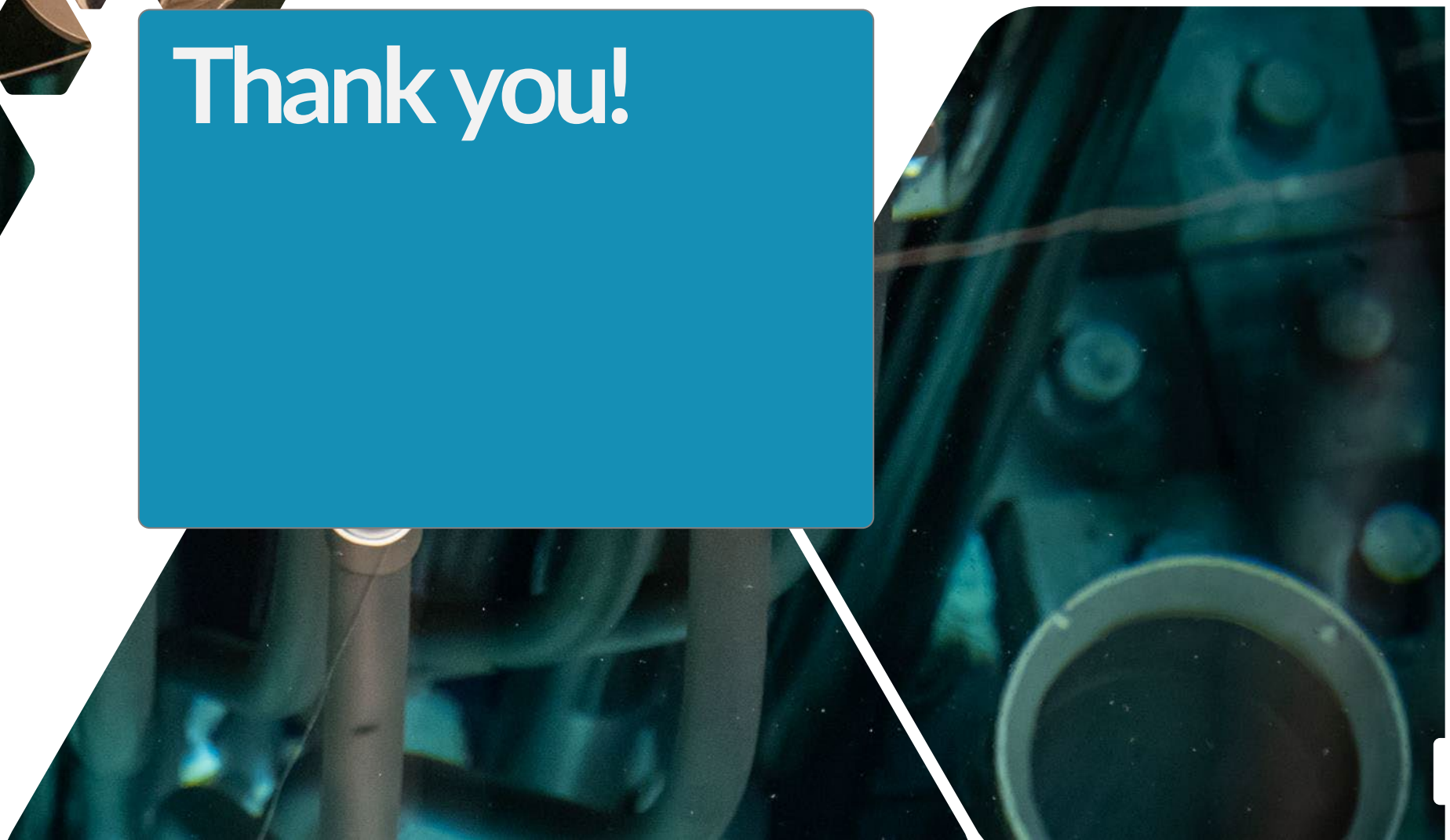
Thank you!



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