HUN REN | Centre for Energy Research

HUN-REN Hungarian Research Network

RESEARCH AND INNOVATION SUPPORTING SAFETY, SECURITY AND SAFEGUARDS

FISA-EURADWASTE 2025 & SNETP Forum, Plenary IV.

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Research. Innovation. Impact.

Introduction

Akos Horvath holds a Master's Degree in Engineering physics (1995) and Phd in Chemistry(2003) at the University Roland Eötvös Faculty of Science, Budapest.

He began his professional career at the KFKI Atomic Energy Research Institute (from 2023 HUN-REN Centre for Energy Research). His studied corrosion and high temperature electrochemistry and radiation damage of structural materials.

He is the president of the V4G4 Centre for Excellence, promoting regional collaboration in nuclear energy among V4 countries.
He also serves on several national and international committees:

- Scientific Council of the Hungarian Safety Authority,
- Euratom Scientific and Technical Committee (STC) and Programme Committee (Fission),
- European Commission Strategic Energy Technology Plan Steering Committee

HUN-REN Centre for Energy is a public research institute aimed at research in nuclear safety, security, thermonuclear fusion, energy security and materials sciences. EK is a member of the Hungarian Research Network and located in Budapest, Hungary.

Safety of Big Boring and Smartly Marketed Reactors

- **Together with Renewables, Nuclear reactors are a key asset to reach Net Zero by 2050**
  - **Long Term Operation of existing Nuclear Power plant has to be strengthened in a safe and industrial way**
  - New Gen III reactors are to be built: the technology has to be commercial no later than 2030 in order to play a significant role in the Net Zero Objective
  - Introduction of the Accident Tolerant Fuel will further improve safety of existing reactors.
  - **➔ Light Water Reactor (LWR), both big plants and Small Modular Reactors (SMR) is today the unique solution to reach this objective**

- **Nuclear has to be sustainable on the long run**
  - Long Life wastes have to be reduced;
  - Uranium fuel has to be recycled
  - **➔ Advanced Modular Reactor , big and small plants (AMR), is the unique solution to reach this objective**

- **Continuity in policy is necessary between those two calendar steps:**
  - Nuclear industry is a long leading time industry (20 years from Lab to Industry)
  - Research development for LWR is beneficial to AMR
  - Huge synergies exist for Industrial supply chain and human competences between LWR and AMR

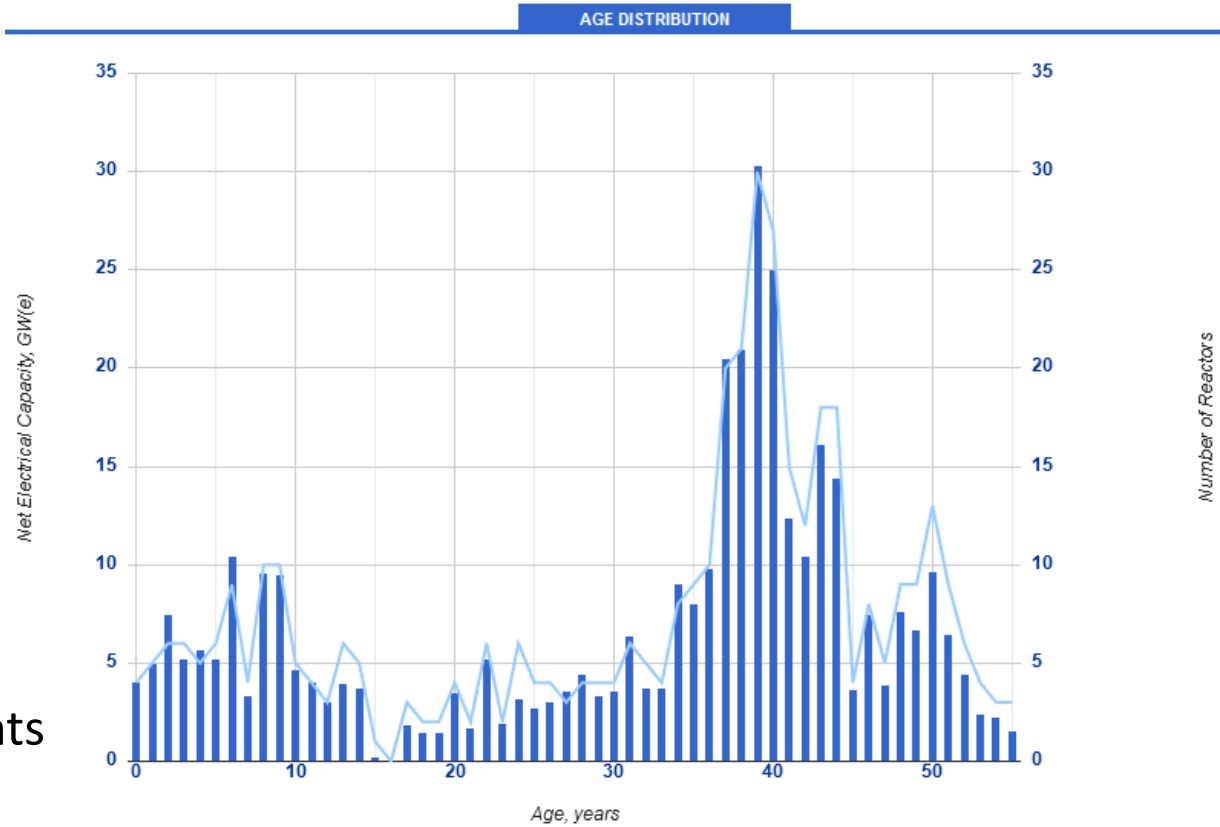
Strategic directions in the European nuclear research

-**European-wide program** supporting the continuous management of the operating nuclear power plants:

- Safety - no accident
- Fuel supply:
  - new fuels, including **Accident Tolerant Fuel**
  - Sovereignty: support to the VVER fleet
- Long time operation:
  - Further ageing, potential new challenges
  - Stabilization of the grid: more flexibility
  - Financial efficiency: Improved Inspection and Qualification methods
  - Extended use of the fleet: cogeneration

-**N**ew builds under construction, including 1000+ MWe plants and Small Modular Reactors (SMR)

-**D**ecommissioning

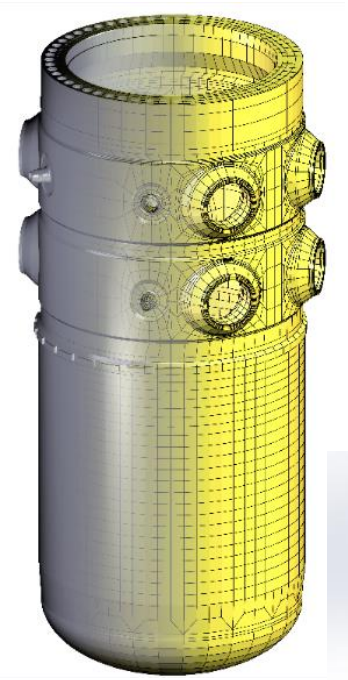


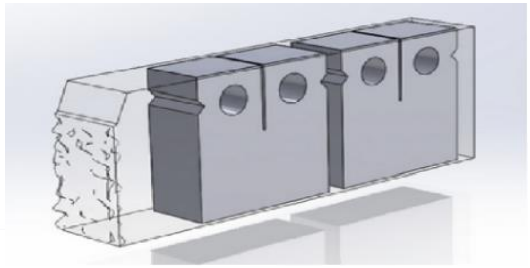
https://pris.iaea.org

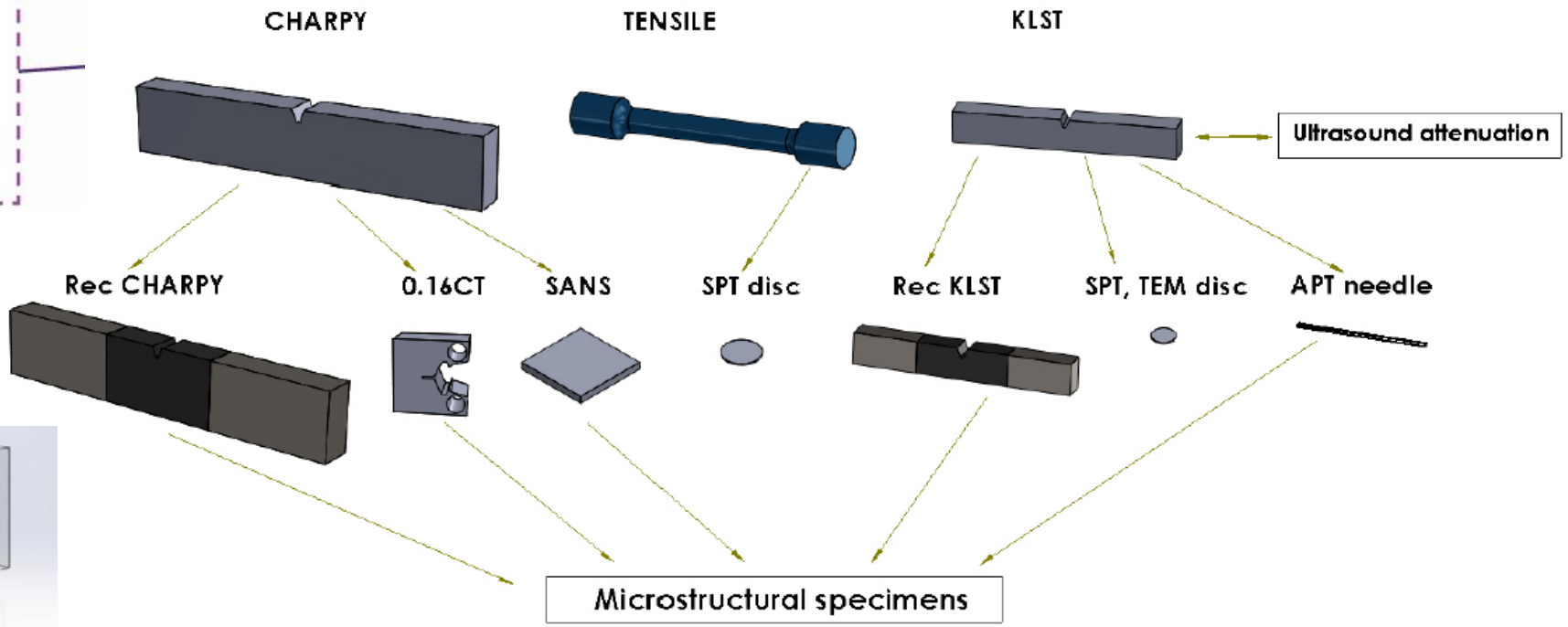
The research activities related to the present and near future needs are covered by the 8 technical areas of the NUGENIA expert network

Innovation in the structural analysis

Study of ageing of Reactor Pressure Vessel of PWR reactors by mechanical analysis

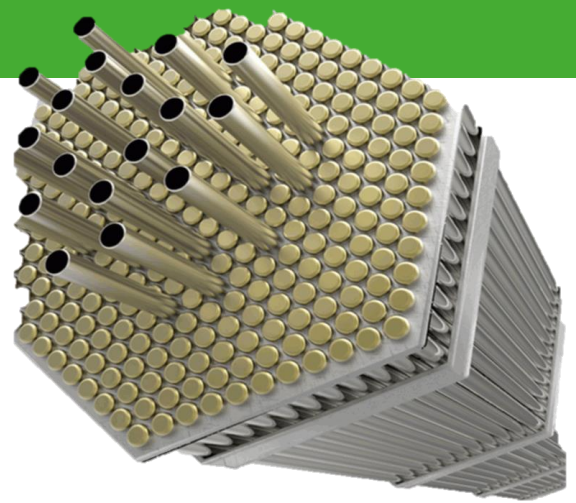






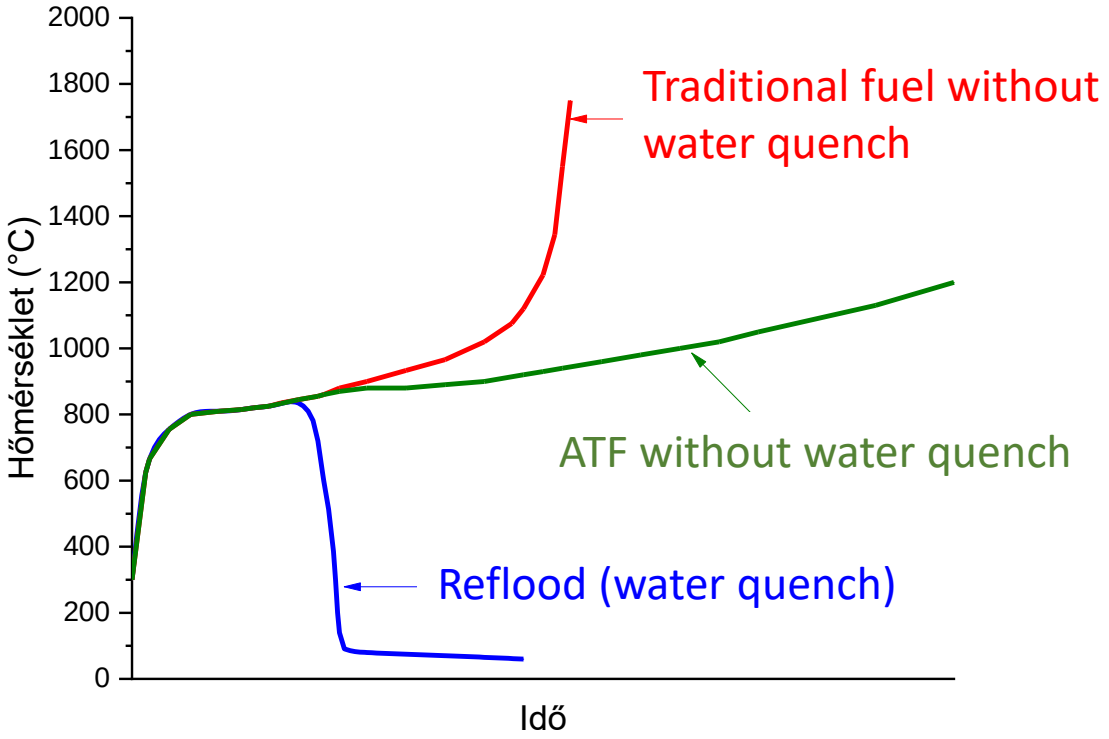
Smaller-sized specimens are developed and validated for mechanical analysis. The re-use of irradiated and fractured samples provides valuable insights into the radiation damage sustained by non-replaceable components, such as the reactor vessel, thereby supporting the extended operational lifetime of the nuclear power plant (NPP)

Accident Tolerant Fuel – ATF



Post-Fukushima developments:

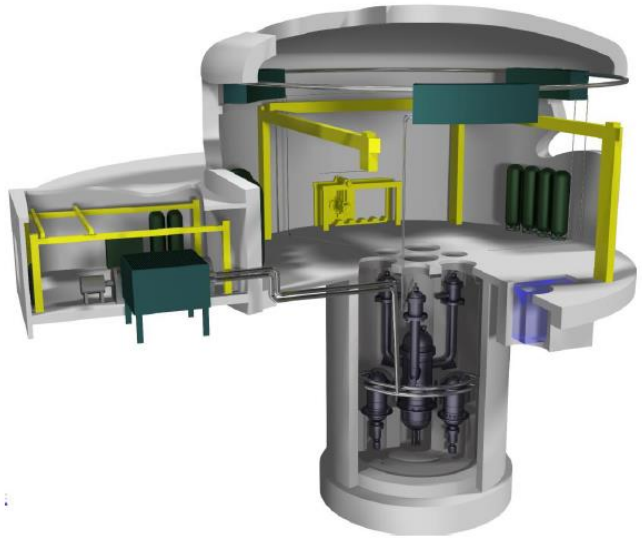
- Reduce the chemical reactions leading to increased heating in the core
- Minimize the amount of hydrogen produced
- Improve the mechanical properties of the cladding at high temperatures
- Improve the fuel pellet's ability to retain fission products



Hózer Z. Balesetálló atomerőművi fűtőelemek fejlesztése Fizikai Szemle 67 (2017)

ALLEGRO
Gas-cooled Fast Reactor Demonstrator

DESIGN
THERMODYNAMICS
CORE DESIGN



FP7 Projects
V4G4 CoE Research
National Research Projects
Other International Research

NFRP-6 Call

SafeG Concept

WP1 – Core Safety
WP2 - Materials and Technologies
WP3 –Decay Heat Removal
WP4 – Integration of Results
WP5 – Education and Training
WP6 – Dissemination of Results

Future R&D on GFR

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V4 Collaboration

BriVaTech Jacobs evalion The University Of Sheffield. UNIVERSITY OF CAMBRIDGE STU SLOVENSKÁ TECHNICKÁ UNIVERZITA V BRATISLAVE MŰEGYETEM 1782 ČVUT ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE KYOTO UNIVERSITY FOUNDED 1897