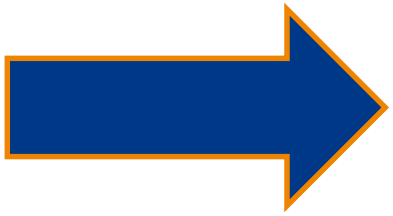
SOTERIA PROJECT

SPEAKER/COORDINATOR: C. ROBERTSON (CEA)

Objectives
Expected Results
Starting point, context & approach
Work plan structure
Consortium

Overall context

- The **nuclear energy safety issue** stands to the frontline of public debate



A priority for regulators and nuclear power providers to continue operating existing NPPs beyond the originally anticipated time frame by **extending their service life**

A need to guarantee a continuous safe long-term operation of existing power plants, it is a *sine qua non* to get an improved understanding of the role of **ageing phenomena** in reactor components

SOTERIA Starting point (I/II)

- ***Ageing management*** key aspects:
  - Identification of critical components subject to ageing (**internals and RPV steels**).
  - Understanding the **main ageing mechanisms** affecting each critical component (**IASCC** and **fracture toughness** evolution)
  - Use of operator's feedback towards improving the overall process

- **From LONGLIFE** (mainly experimental project) :
  - Microstructural and mechanical evolution data related to long-term irradiation exposure of RPV steels
  - Experimental observation of:
    - ***Flux effects*** on radiation-induced microstructural features → ion/neutron irradiation experiment transferability issue?
    - ***Data scattering*** in surveillance programs → origin of outliers on trend curve derivation?

→Understanding the observed phenomena: game-changing modelling developments

SOTERIA Starting point (II/II)

From PERFORM60 :

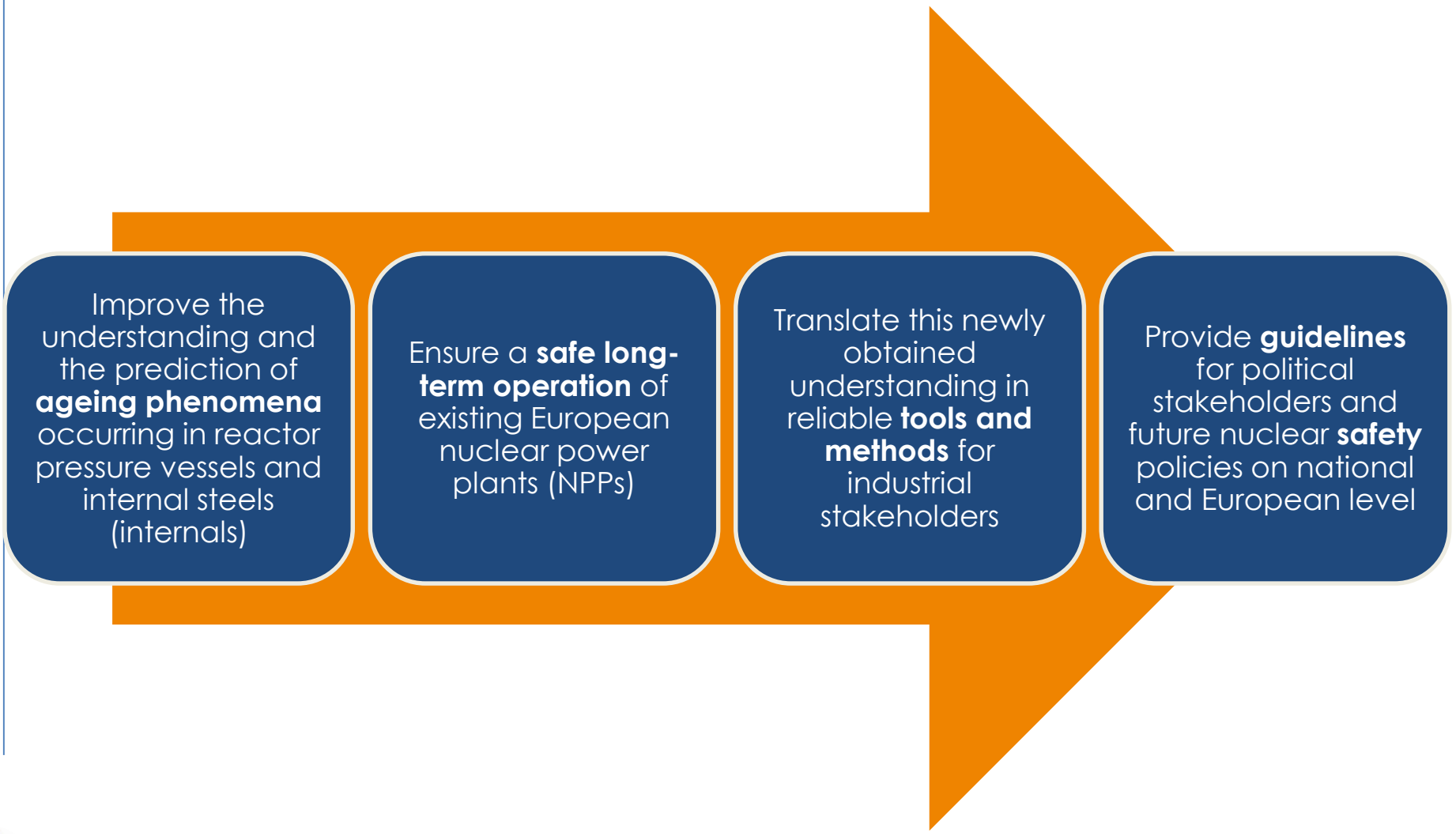
- Development of **multi-scale modelling tools** to predict RPV and internals radiation-induced evolution

- Set-up of an **integrated platform** whose preliminary version was assessed by **end-users** from nuclear industry field

- BUT remaining questions relative to LTO and in-service inspection issues:
  - ***Flux effects*** on radiation-induced evolutions not addressed
  - **Bridging** between models developed at different scales **not complete**
  - Limited **comparison** of mechanical models with **experiments**
  - **IASCC** issue not dealt with respect to operating conditions (**chemical environment**, load transients, GB influence…)

→To set smart experiments at appropriate scales to calibrate, support and validate the proposed models

SOTERIA Overall aim

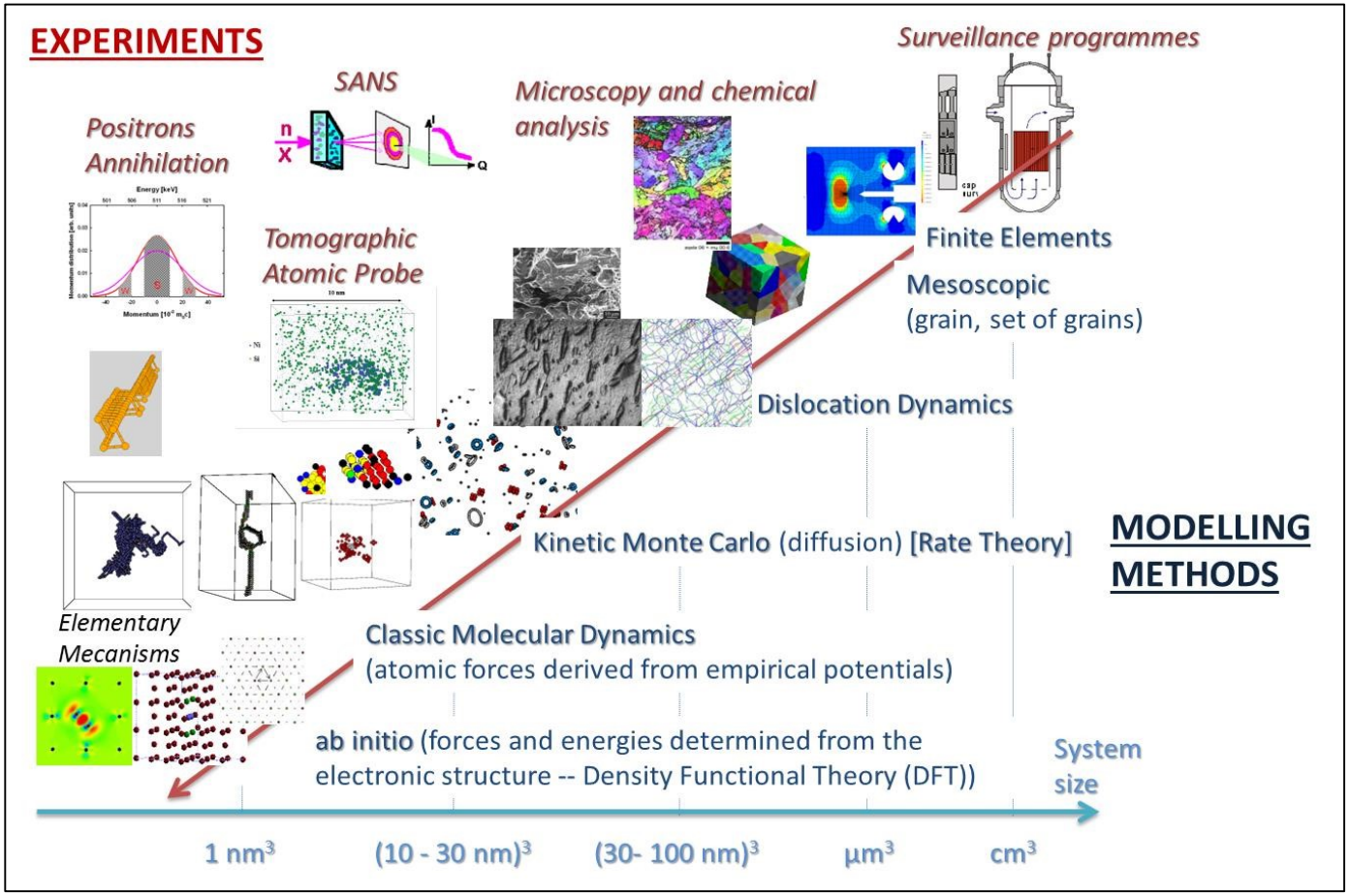


SOTERIA specific objectives

1. Carry out experiments assessing neutron **flux and dose** effects on reactor pressure vessels and internal steels in pressurised water reactors
2. Evaluate the residual lifetime of reactor pressure vessels by taking into account **metallurgical heterogeneities**
3. Assess the effect of the **chemical environment** and dose on the integrity of internal structural components
4. Develop models for the assessment of ageing mechanisms in RPV and internals and set of an **integrated computer-based platform** including the new modelling tools
5. **communicate** on the project achievements towards the nuclear engineering and research community in order to improve and harmonise the knowledge of ageing phenomena in nuclear power plants

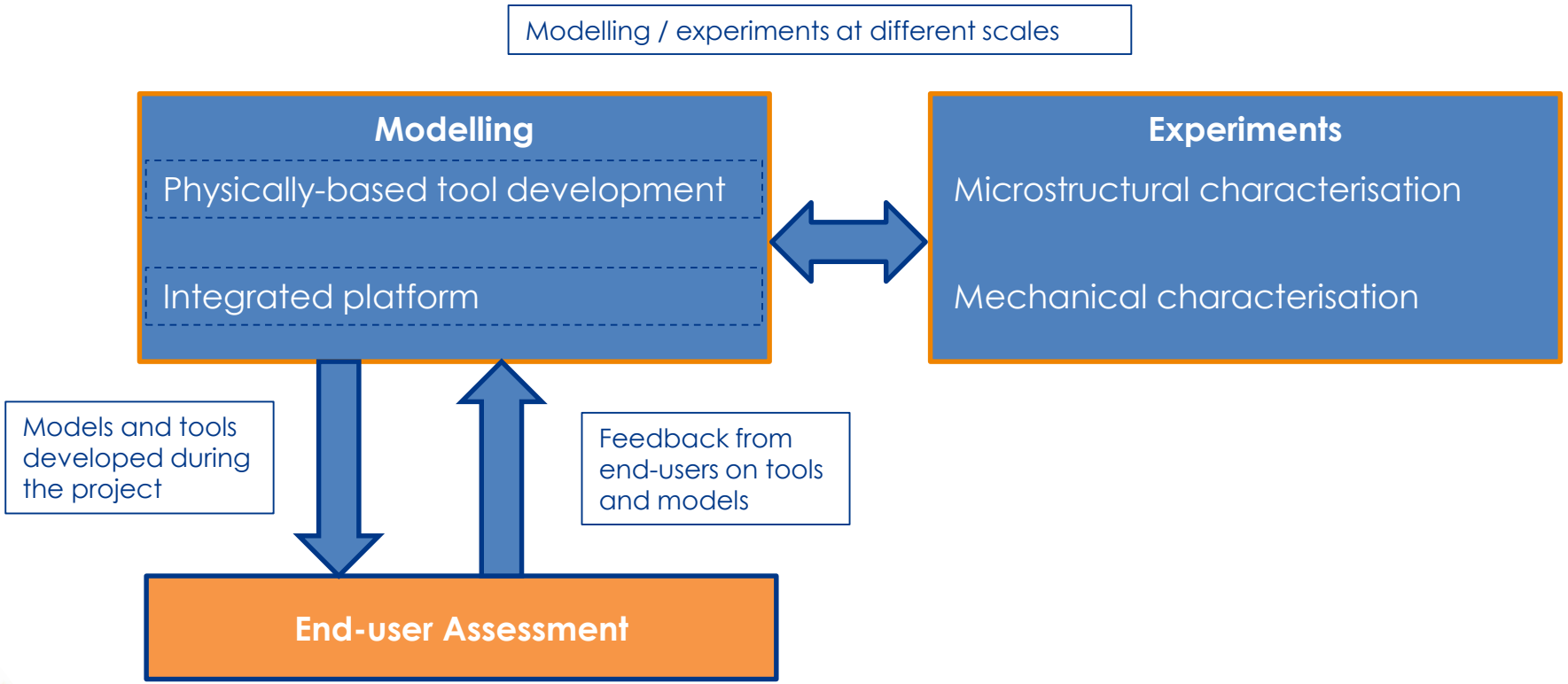
The SOTERIA approach (I/II)

- SOTERIA combines **multi-scale** modelling approach with smart experimental characterisations at corresponding scales

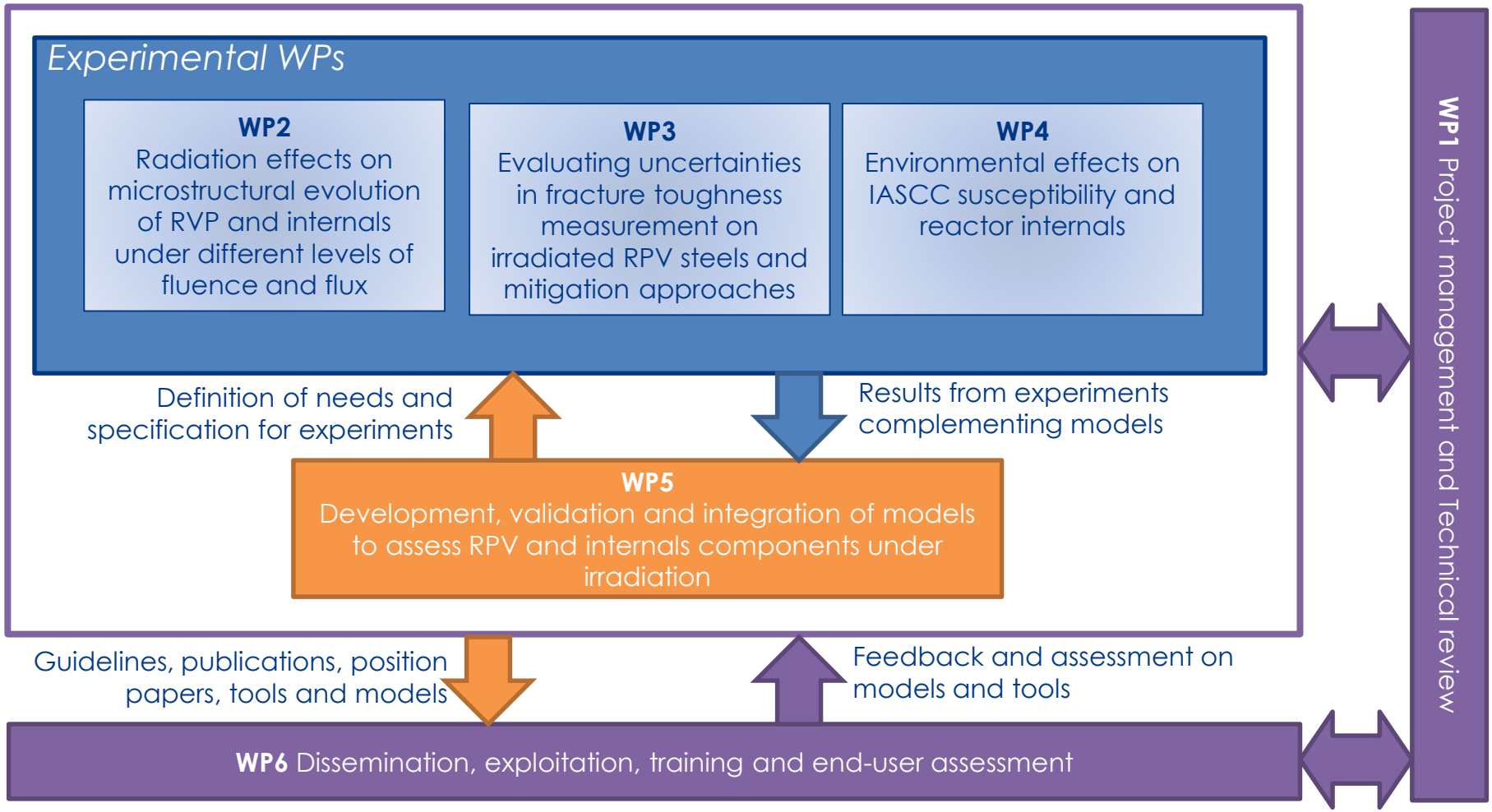


The SOTERIA approach (II/II)

- To start from an **end-user** perspective (end-user group has been arranged from the project start) to address operator-specific problems.
- Set up of **simulation-oriented experiments** aiming to validate models at different scales:



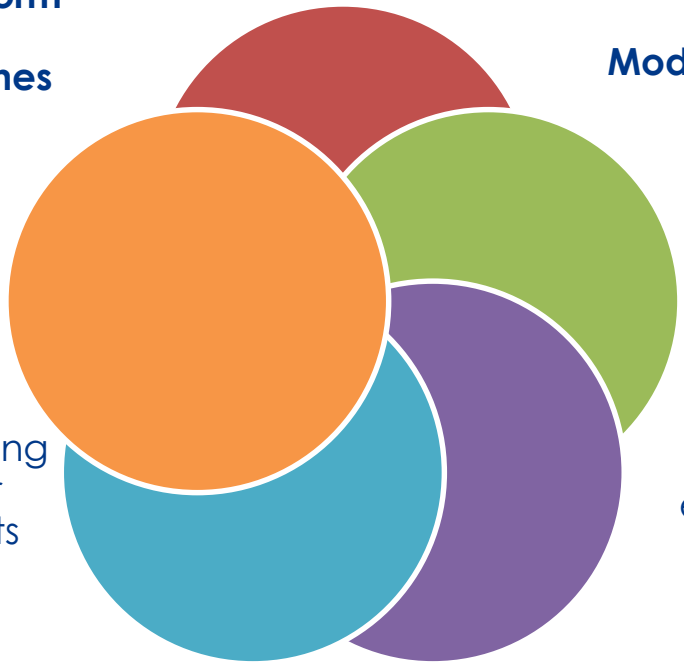
Workplan structure



Expected results

Understanding of initial microstructure heterogeneity effects on fracture

A specific **industry-adapted version of the modelling platform** fro reactor safety margins evaluation, including **guidelines** and user-friendly **interface**



Models accounting for flux effect in support of ion/neutron emulation experiments

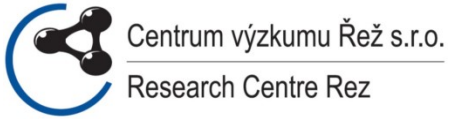
A modelling platform embedding **improved ageing models** for reactor structural components

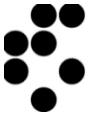
A **database** collecting the experiments carried out in the project

SOTERIA upcoming events

☞Final **User-Group** meeting
28th June, Tecnatom juline.vidal@edf.fr

☞Newsletter final issue.





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This project received funding under the Euratom research and training programme 2014-2018 under grant agreement N° 661913.

THANKS FOR YOUR ATTENTION