assystem



SWITCH ON ENGINEERING & DIGITAL FOR ENERGY TRANSITION

PWR Conference – Prague – 20/10/2026

From Operational Experience to Digital Assets: Transforming Nuclear Knowledge.

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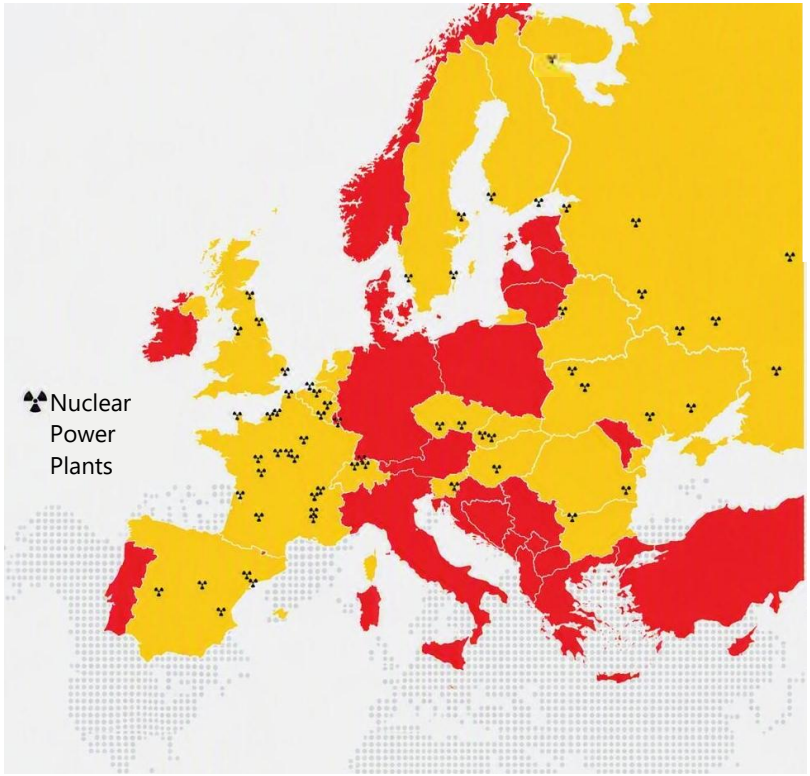
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With measurable results

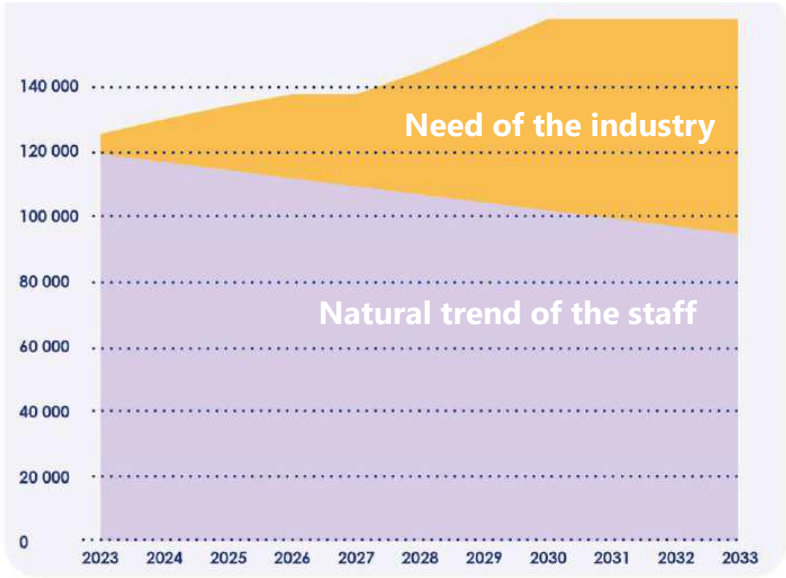
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European nuclear landscape at a glance : A few key challenges

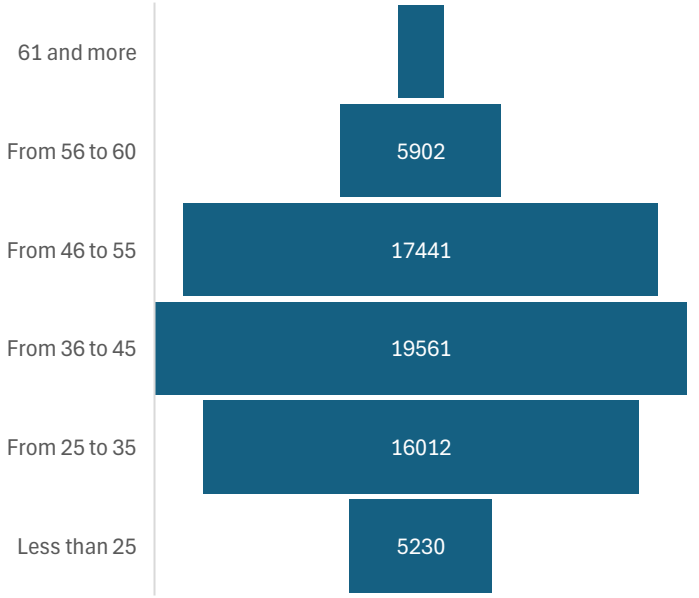
A fleet concentrated in few countries



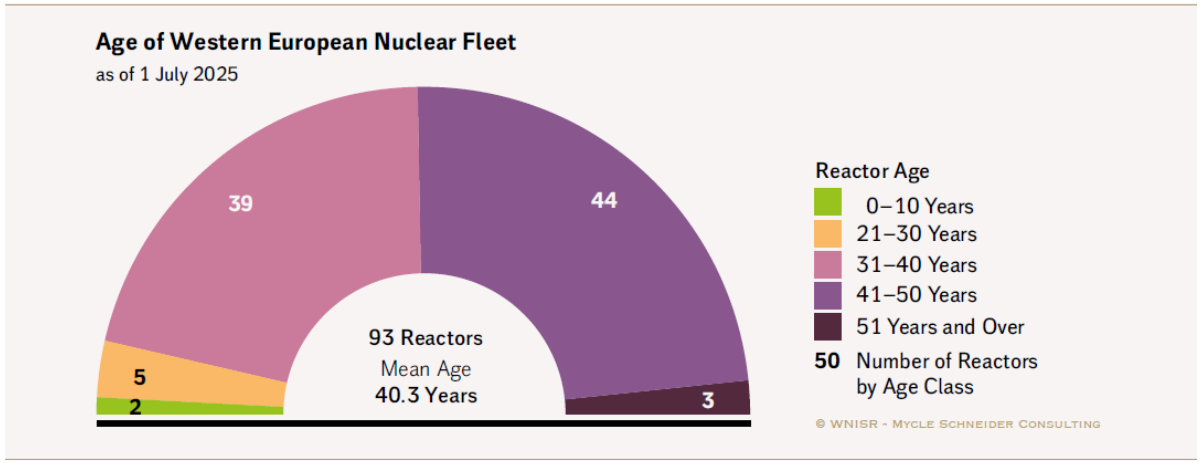
Significant recruitment needs



EDF SA Age Pyramid (2023 - in France)

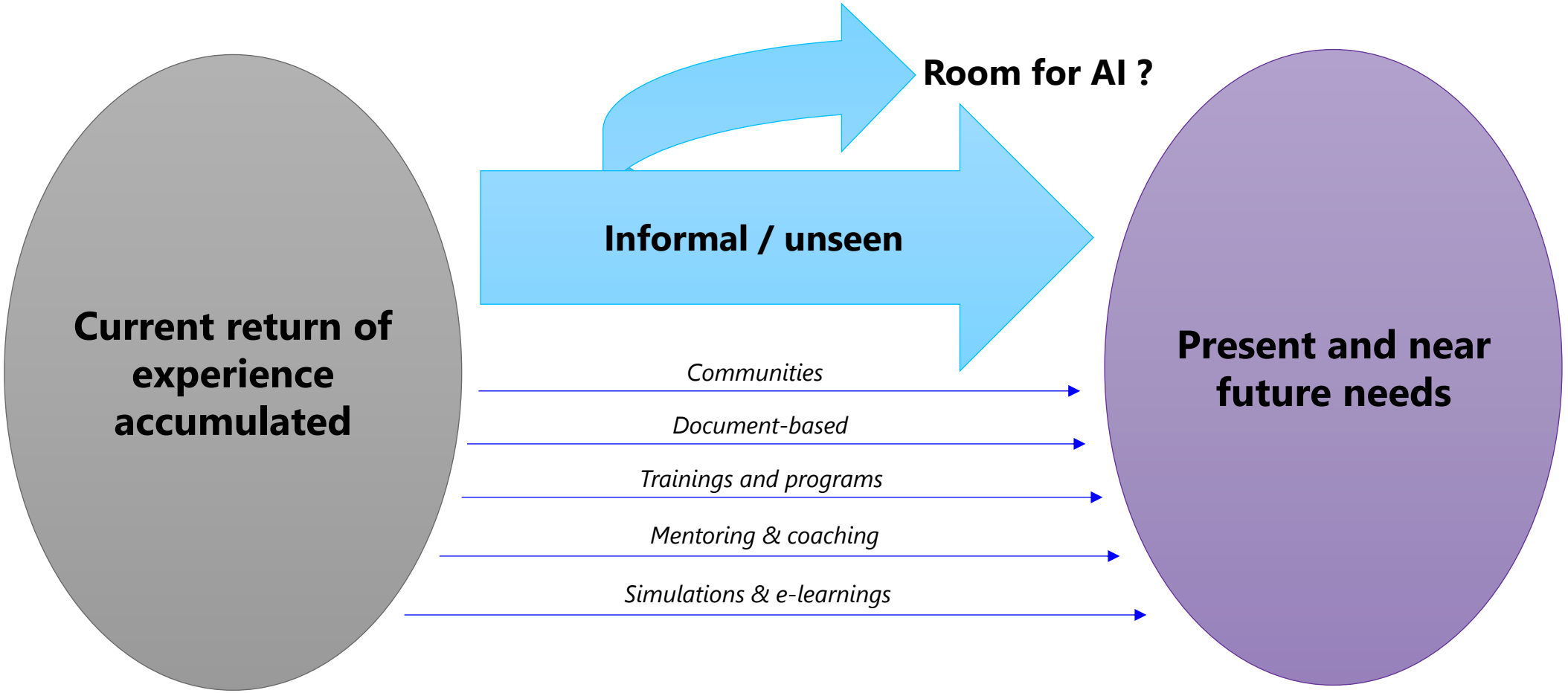


An ageing reactor fleet



Sources: WNISR with IAEA-PRIS, 2025

A huge room for improvement



The (maybe) new way.

WHAT CAN AI DO?

Previous way is quite unefficient, and our belief is that AI might be one of the key to

- Simplify
- Centralise
- Trace
- Shorten
- Reduce the overall entropy

Of previous process, via some of its features.

Make sentences

'Understand' natural language

Extract only relevant data from a document

'Read' large amounts of documents

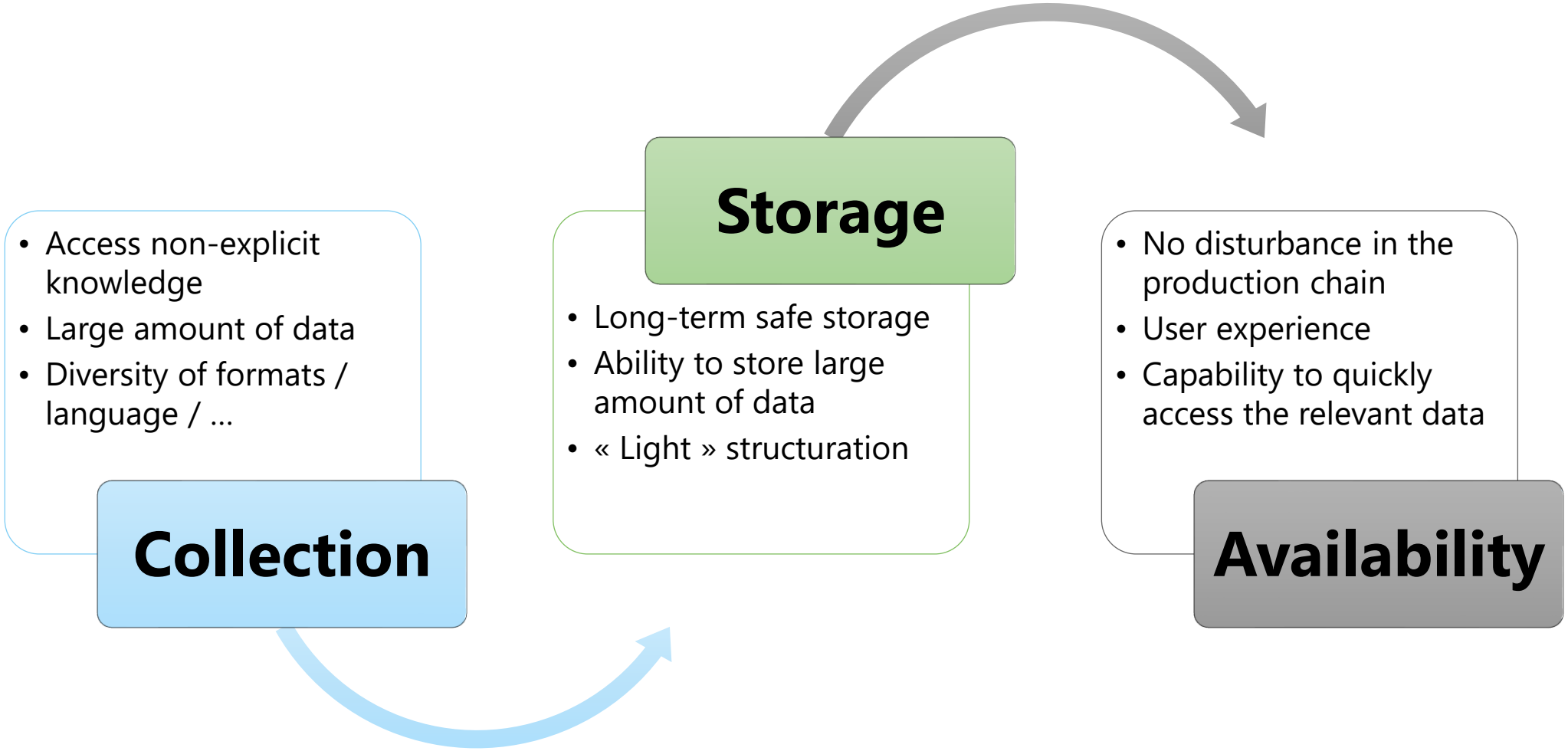
Identify accurate and 'almost' accurate matches with exhaustivity

Sort out large amounts of information



Form clusters of data related to specific topics from non explicit relations

The need to build a complete data-chain



While guaranteeing data safety, confidentiality and quality all along !

The journey & the steps to build an AI tool

Identify use cases to be adressed

- Personas
- Safeguards
- Expectations & needs

Build a referential

- Open Source
- Explicit Knowledge
- Implicit Knowledge

Select a technology

- Maturity
- Maintenability
- Cost

Test & Build

- MVP Approach
- Perimeters to be selected

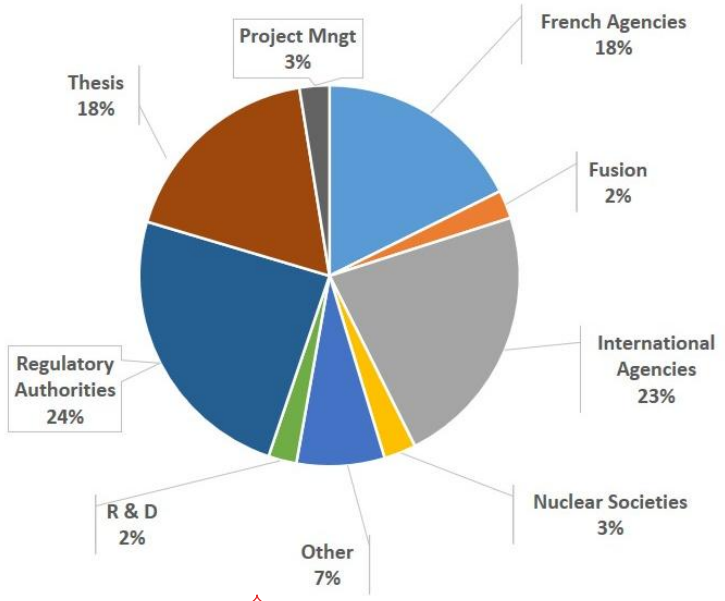
Monitor the use

- Identify KPIs
- Change Management
- Gradual deployment

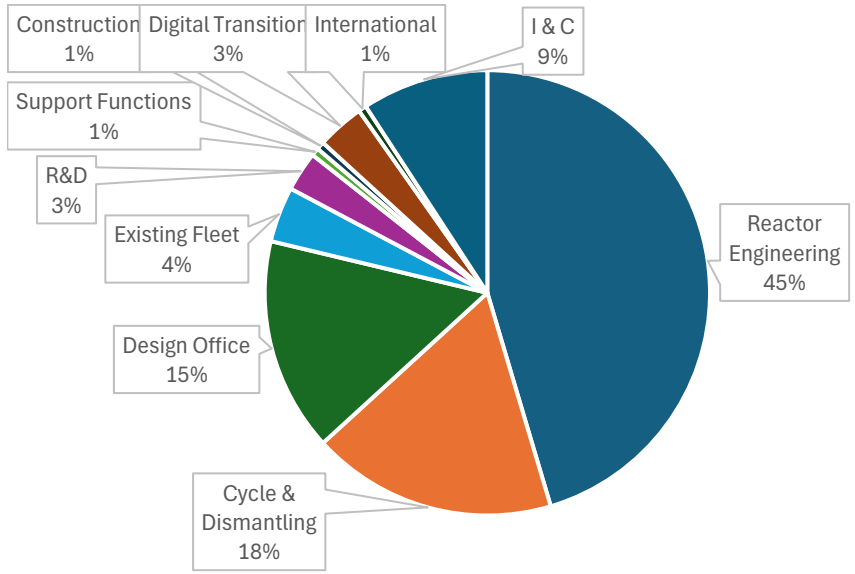
Aggregation of data sources

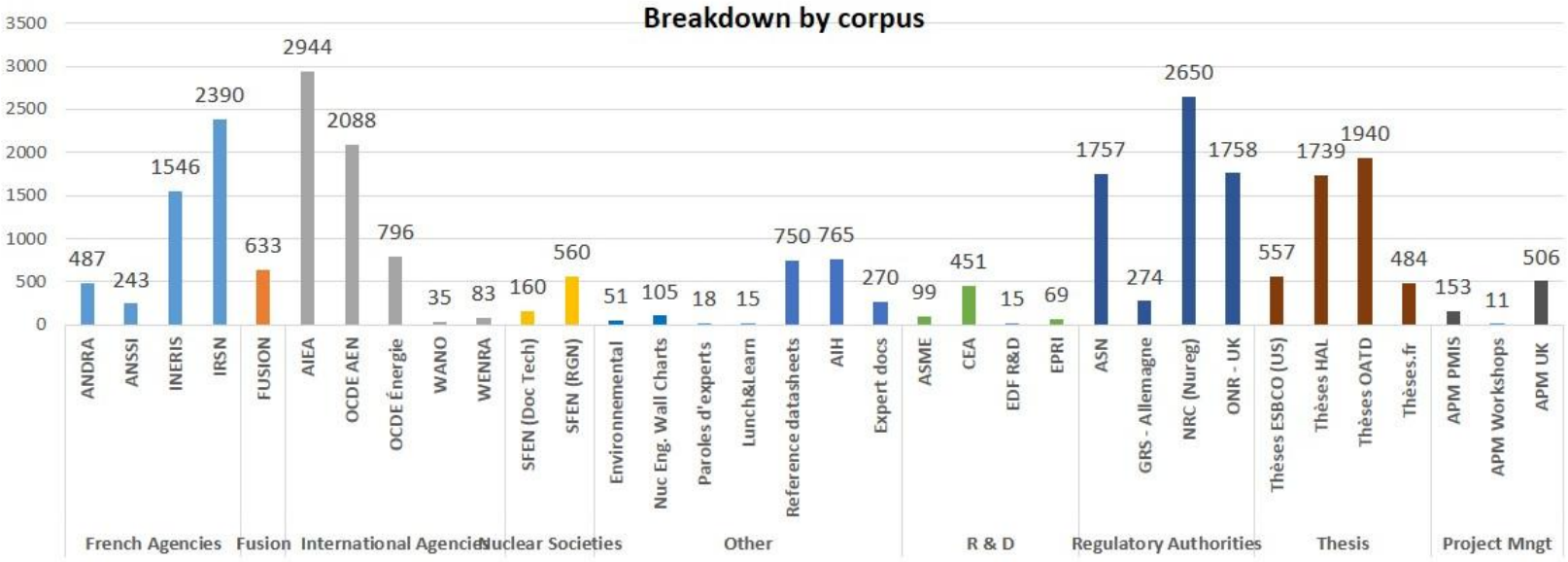
2 main sources :

- Use of open source referentials
- Interviews



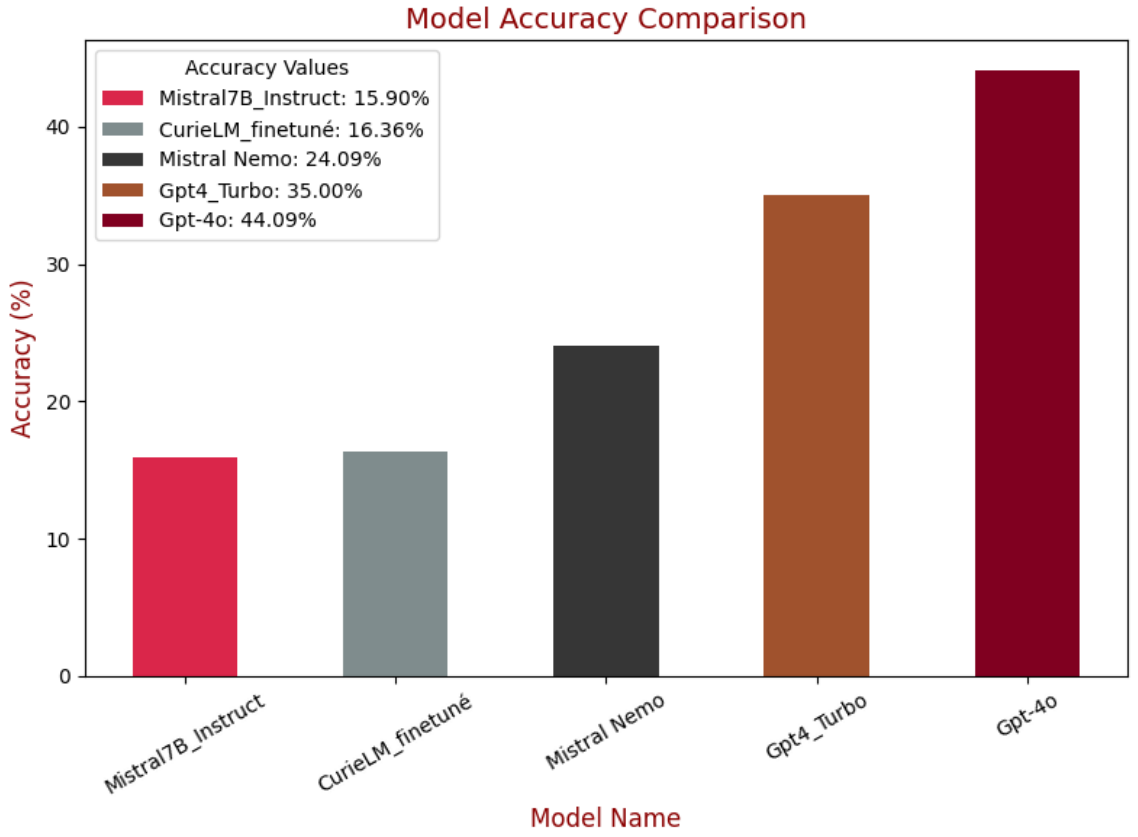
174 experts identified





Select a technology

- **Dataset:** 220 Questions & Answers two-times validated by experts from the nuclear domain during SMLP workshops.
- **Evaluated models:** Mistral 7B_Instruct_v3, CurieLM_finetuné, Mistral Nemo, Gpt-4o, GPT4_Turbo.
- **Evaluation method:** Automated method "**LLM as a judge**", which involved the use of a Large Language model to assess the quality of the generated answers. The **GPT-4 model** is used as a judge to perform this first round of evaluation.
- **Results analysis:**
  - Fast evolution of the **new general LLM** -> our fine-tuned models have become obsolete.
- **Studies in progress :**
  - Current activities are being carried out on the topic of RAG & distillation
- **Conclusions :**
  - High cost in time and ressources of the fine-tuning process -> focus on smaller and lighter approches : the integration of knowledge bases through RAG



Test & Build : Build

06/2023
- Gathering of initiatives to form DLFE
- Initial structuration & team identification incl. sponsors

11/2023
- Proof of Concept (PoC) available
- WNE 2023 : First Demo

01/2024
- Delivery of the first platform
- Minimum Viable Product (MVP)

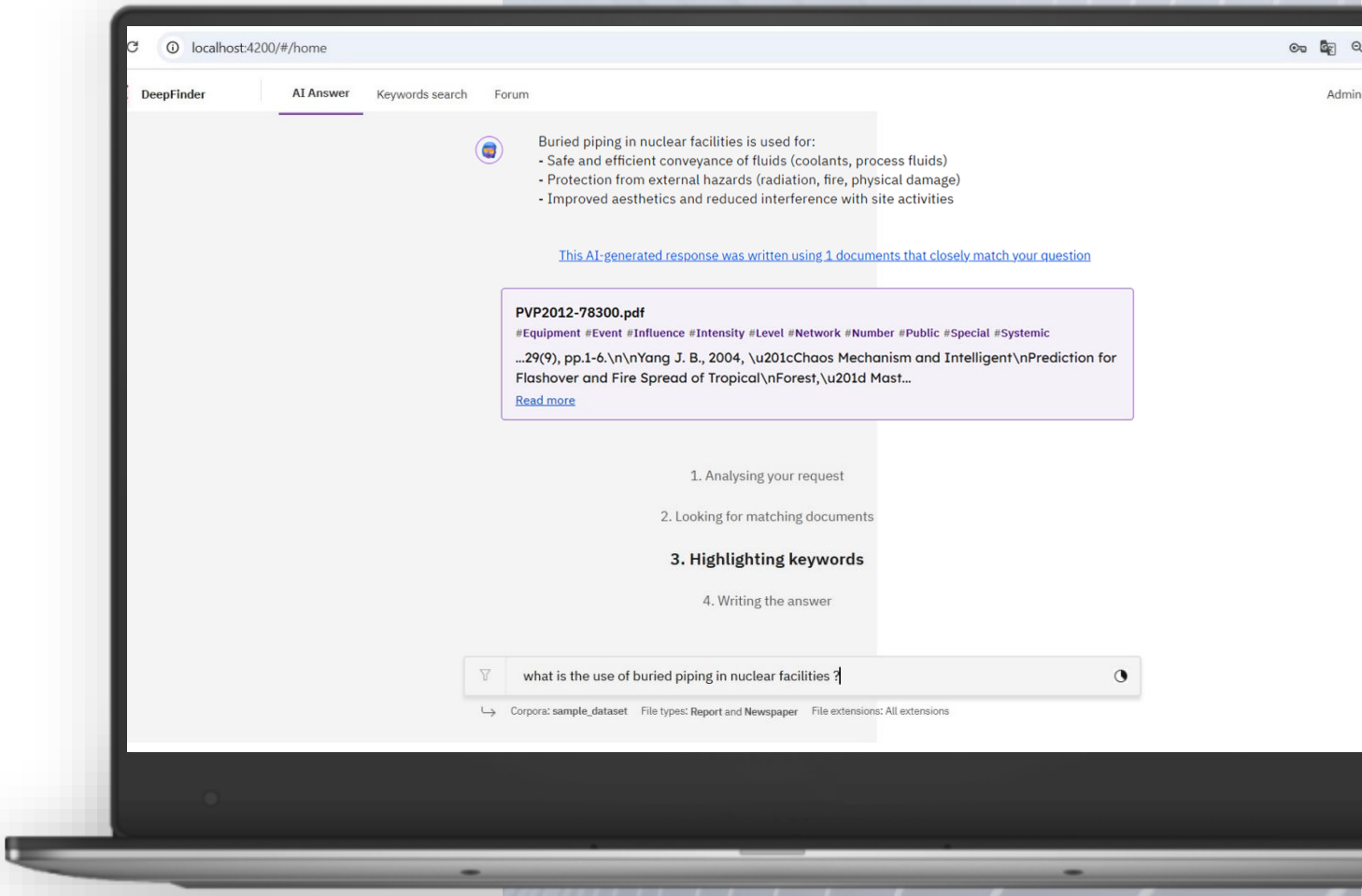
05/2024
- Launch of the work in UK (New AI User Journey ; Semantic Search Journey ; Forum and general styles)

11/2024
- LLM-ready v3
- Launch of the QA

03/2025
- LLM-ready version in production
- Integration of new corpora

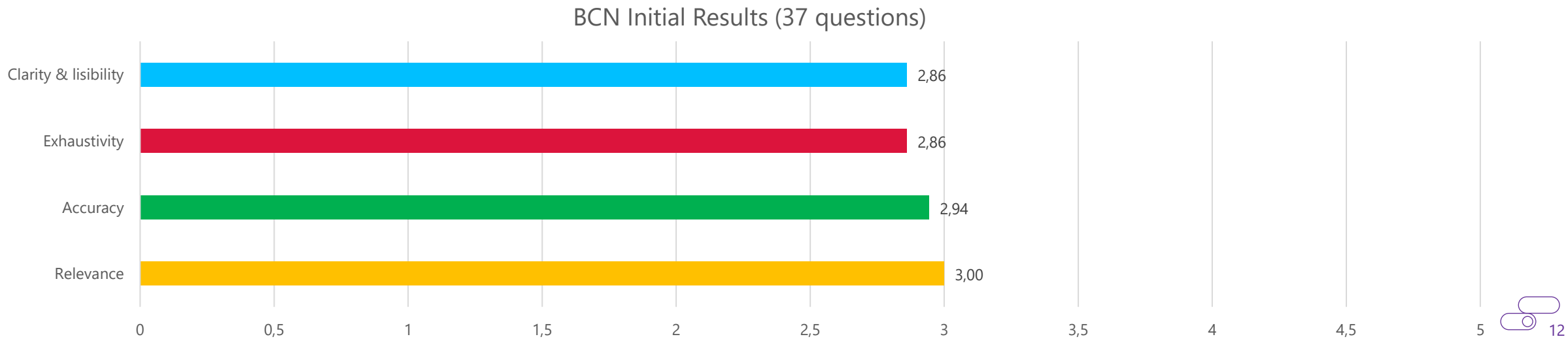
03/2026
- Upgrade to Ministral 3 8B
- Improved chat & RAG

Today
- New UX/UI being delivered
- User support & change management



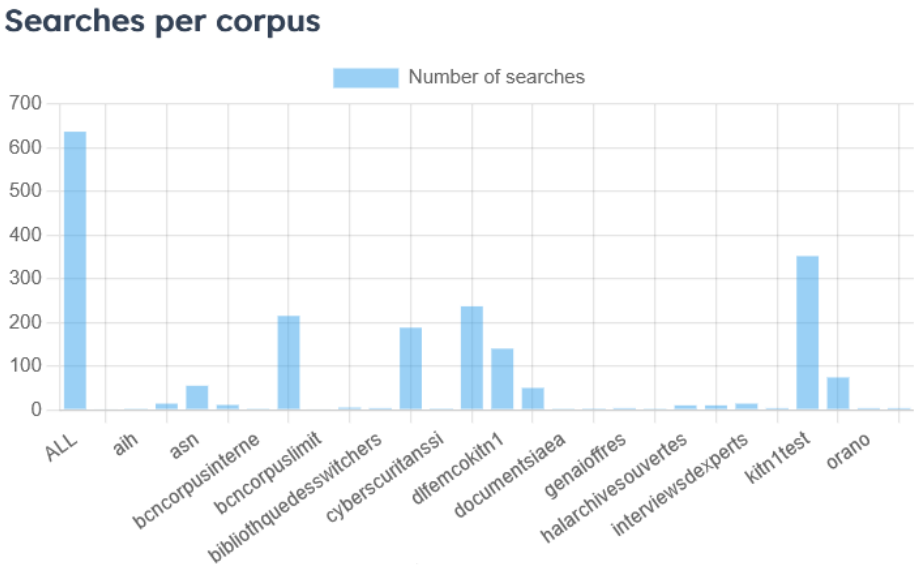
Test & Build : Test

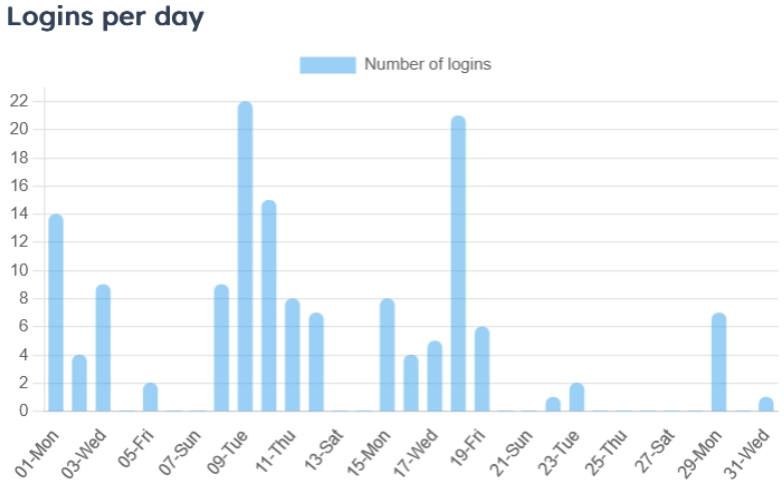
Simple	What are the fundamental safety functions ?	The fundamental safety functions are: a) Control of reactivity b) Fuel Heat Removal c) Confinement of Radioactive Material
Simple	What is REX?	REX stands for Retour d'Expérience, which translates to 'Return of Experience'.
Complex	What does 'critical' mean for a nuclear reactor?	Critical' in a nuclear reactor refers to the state where the rate of neutrons produced by fission equals the rate of neutrons absorbed or lost, allowing for a sustained chain reaction.
Border	What is the half-life of Cobalt-60?	5.27 years
Ambiguous	What is the difference between a proton and a proton?	A proton is a subatomic particle located in the nucleus of an atom, with a positive charge of +1 and a mass of approximately 938.272 MeV/c^2. A proton is not the same as a proton. Autre réponse "The difference between a proton and a proton is that one has a positive charge and the other does not."
Beyond scope	How many legs does a dog have?	A dog has four legs.
Document-specific	Can you find a document listing and explaining radioactive isotopes?	Réponse requête 1 :The document "Les-filières-d'évolution-chez-Assystem.pdf" might contain information about radioactive isotopes, as it is a general document about nuclear industry. However, I cannot confirm this without accessing the document. Réponse requête 2 : Yes, the document [5] "Indirect Methods for Assessing Intakes of Radionuclides Causing Occupational Exposure" from the International Atomic Energy Agency (IAEA) provides a list and explanation of many radioactive isotopes.

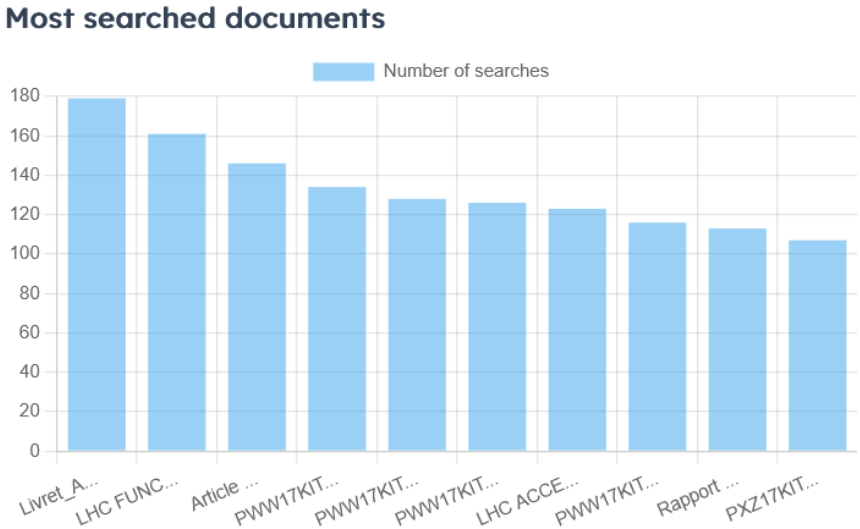


Monitor the use









Number of users : 451
Number of corpus : 33
Number of documents : 3506

What are the key remaining challenges ?

Safety, security & confidentiality

- Complete protection of the hosted data & exchanges
- Full compliance with requirements of nuclear sector

Specificity to nuclear

- Explanability of the reasoning & the answer provided in order to justify it
- Specific adjustment of the corpora to ensure relevance of provided answers

Resource-saving

- Ability to leverage and combine ‘small’ models that require less GPU
- Without compromises on the performance of the solution or quality of provided answers

Key Takeaways & conclusion

DLFE is much more than an AI chatbot. Its real value lies in transforming decades of tacit nuclear expertise into validated digital assets that can be preserved, shared and reused across generations.

KEY TAKEAWAYS

- More than **significant ramp-up is expected from nuclear industry in terms of workforce** in the coming years nd decade
- In order to ensure success of that ramp-up, **knowledge management & capitalization will be of utmost relevance**
- **Current KM approaches are clearly unsufficient**, the **key is to leverage** new use case from **AI**
- **Assystem has developped an AI-based KM solution,** relying on a RAG (DeepFinder) & a LLM (Ministral)
- This solution has been deployed to adress so far one use-case, **natural language question answering**
- Main roadblocks adressed include **change management, IP & confidentiality, information siloeage and probabilistic nature of AI**

CONCLUSION

How can this experience inform better policies ?

- Current regulatory and reglementary landscape is not adjusted and tailored as regards use of AI with respect to confidentiality, export control, …
- Change management is still a very burning issue, and efforts are to be made to leverage AI-culture & awareness among the workforce
- Probabilistic and explanation of AI is still a blocking point with respect to discussion with Safety Authorities, preventing large part of possible use-cases

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SWITCH ON

ENGINEERING & DIGITAL FOR ENERGY TRANSITION

THANK YOU.

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Abstract

- *The European Nuclear landscape is characterized by a few distinctive elements. First and foremost, Europe is still the most nuclearized continent, in number of reactors connected to the grid. Secondly, its reactors are ageing, in average between 35 to 40 years old, reaching the end of their initial lifetime, with more than 80% being older than 30. Last, even though they have been built by different manufacturers, they are still overall quite united in terms of technologies, most of them being Pressurized Water Reactors, either from Western (Westinghouse) or Eastern (VVER) designs.*

- *Subsequently, in order to ensure long term operation of such a fleet, almost 200 reactors representing around 25% of Europe's electricity, maintaining knowledge and understanding of the design and changes is highly critical. Especially given that the workforce which built those reactors or started their commercial operations have been retiring for years now. This return of experience of design, build, commissioning and decades of exploitation and maintenance constitutes a key asset in the journey of Europe's energy landscape. With still a large diversity, in terms of systems and components, disciplines, languages, etc…*

- *Assystem have been implementing within its teams and for its clients an approach called DLFE (Digital Learning From Experience), based on the CSV paradigm (Collect, Structure, Validate). The overall idea is to leverage new digital technologies, such as LLM and Generative AI to secure collection and valorization of existing operation knowledge. This hs been made possible thanks to extended work around 3 different dimension. First how to make this knowledge available to our engineers, using use cases such as Q/A, but also more advanced ones using agent-based process modeling. Secondly, knowledge and return of experience formalization and modeling, to ensure proper adequation between existing knowledge and usable lessons learnt. This work have been performed on the basis of extended ontology exploration. Last, collection of the elements. This aspect have been extensively investigated process-wise and tooling-wise, leveraging elements in a step-by-step journey :*

- *Open source and available documentation (such as IAEA, NEA, …)*

- *Our existing and legacy methodologies, sometimes decades old*

- *An extended campaign of interviews targeting at experts*

- *An auto-interview enabling us to capitalize 'on-the-flow' on the lesson leveraged daily*

- *A AI-Powered conversation-based self-interview, able to use also knowledge from the repository to ensure quality interaction with experts to address scientific issues*

- *In that journey, 3 challenges are key to ensure efficient knowledge transfer from one generation to another, and subsequently enable safe long-term operation of NPP. Efficiency of collection, to ensure that the implicit is collected, not just the explicit which is by many means the tip of the iceberg. Structuration of the repositories, to reach the best compromise between valorization and standardization. And technical validity and relevance, ensure by the 'human-in-the-loop' as quality of knowledge is the key to efficiency.*