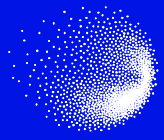


PSI Center for Scientific Computing, Theory and Data

# Life of a PhD student

Arnau Albà

Summer student programme, 07.08.2024

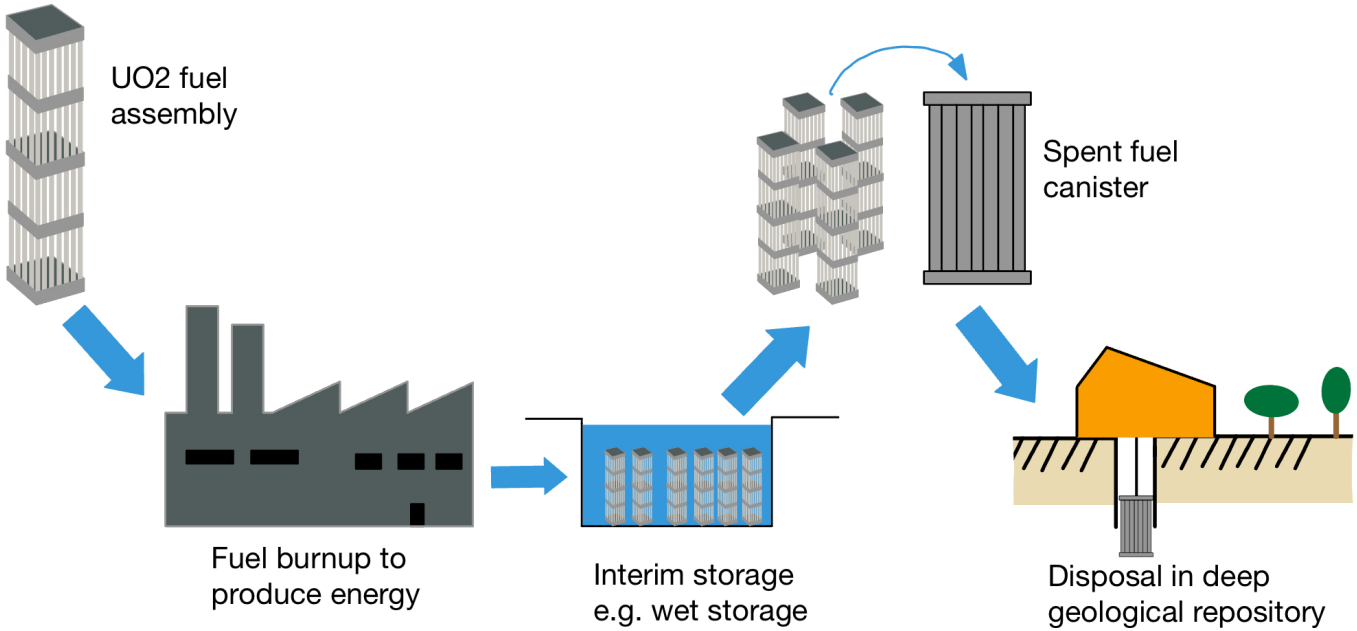
# About me

- BSc Physics at EPFL
- MSc Physics at ETH
  Thesis: Full 3D Modelling of Electron-Wiggler Interactions
- Currently: PhD in the 4th year
  Laboratory for Simulation and Modelling (LSM)
  Laboratory for Reactor Physics and Thermal-Hydraulics (LRT)
  *Novel Methods for Uncertainty Quantification of Spent Nuclear Fuel*

Interests:

- Computational electromagnetics
- Uncertainty quantification
- Numerical methods
- Neutronics simulations
- Particle accelerator modelling

# PhD: Characterisation of Spent Nuclear Fuel



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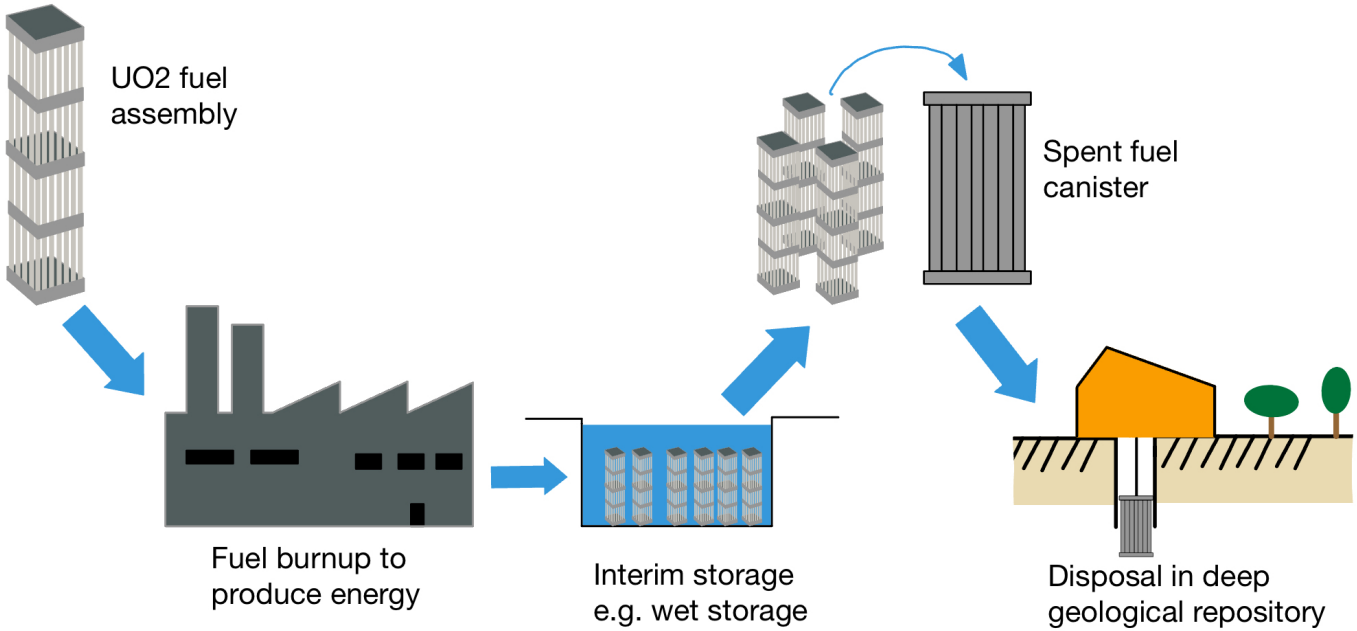


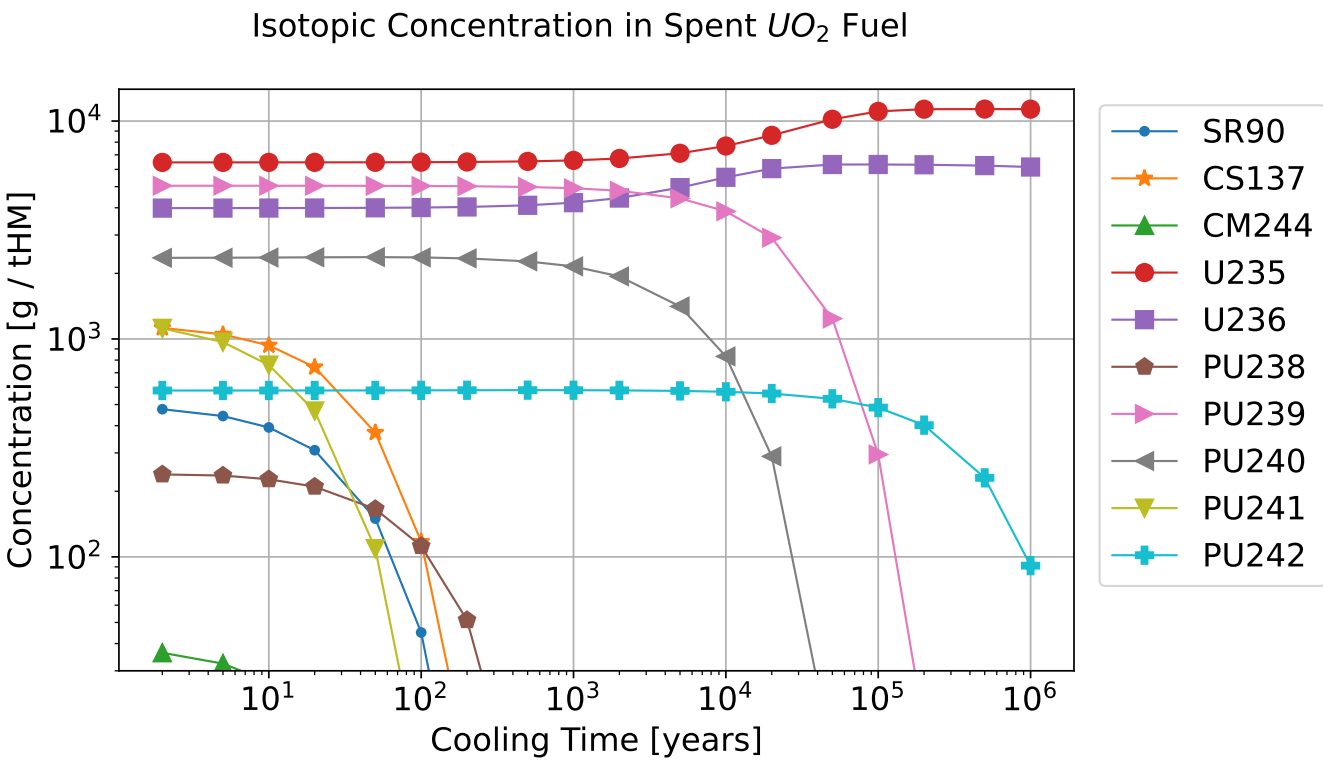

Challenges:

- How much shielding is needed for the spent fuel?
- How hot (*decay heat*) will it be?
- How to prevent criticality? (chain reaction)
- How many canisters?

**We have to predict these characteristics for the next 1 million years!**

Spent fuel keeps evolving for long time periods.

⇒ calculations must be accurate and robust for long time periods



- Nuclear codes make predictions about spent nuclear fuel (decay heat, radiation, etc…).

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- Predictions are used to make informed decisions to **reduce risks and costs** of fuel storage and disposal.
- Nuclear calculations **must include uncertainty quantification (UQ)**, to estimate the accuracy of the predictions.

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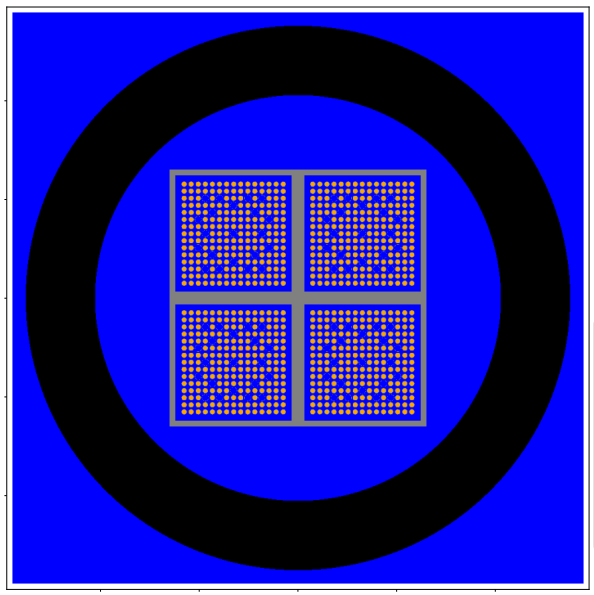

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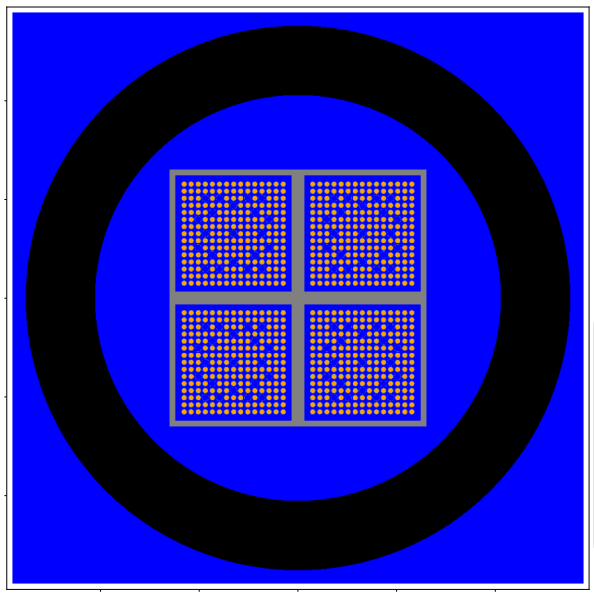

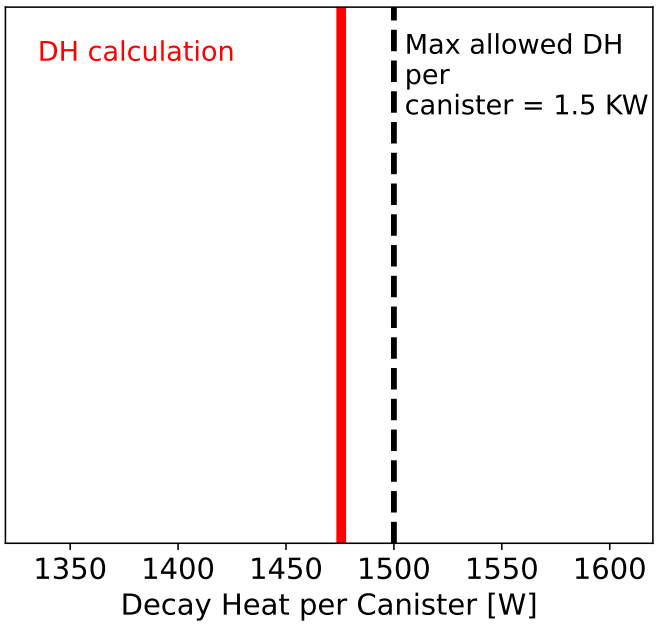

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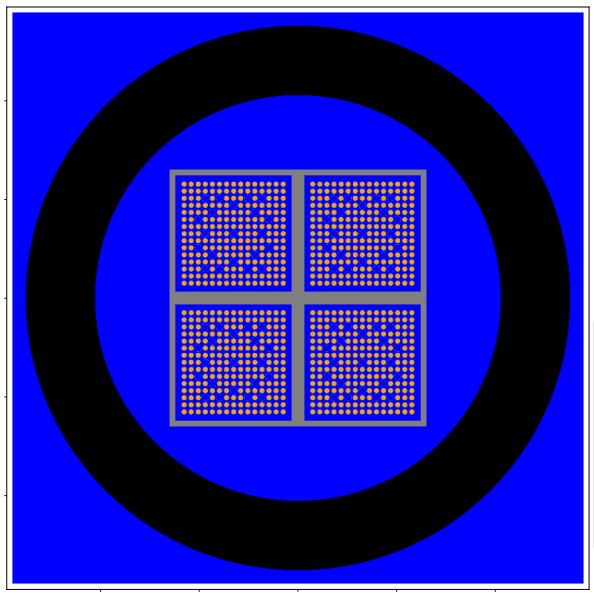
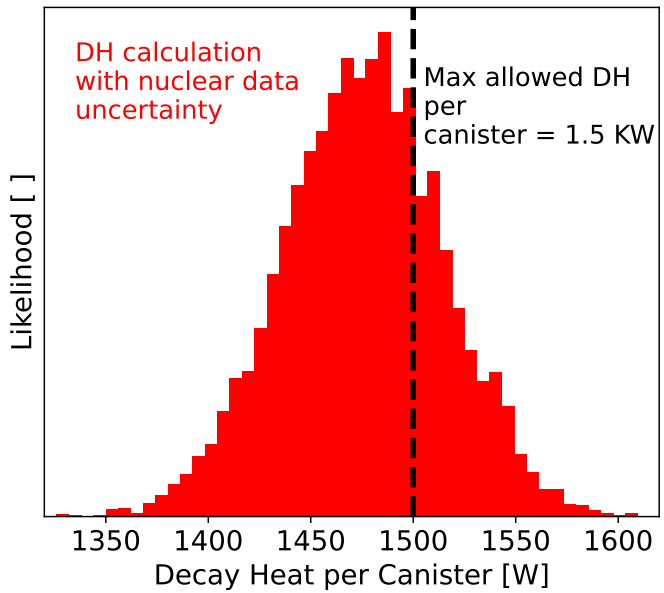
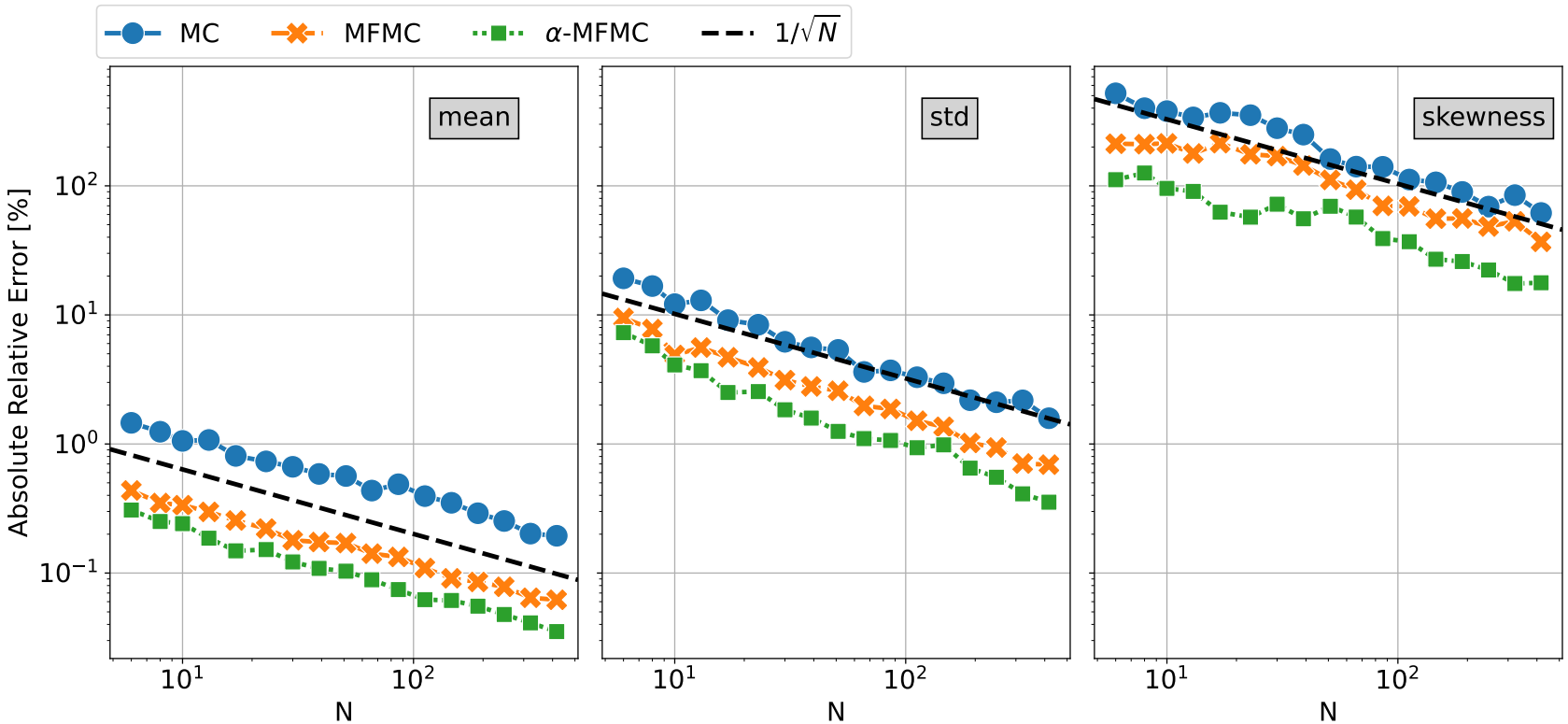




Goal of PhD:

- Current UQ methods are computationally expensive (slow)
- Given the amount of nuclear fuel for disposal, we need faster methods
- Investigate new methods for faster UQ



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My example:

- After MSc I felt like an ”expert” in computational electromagnetics and particle accelerator modelling
- Applied for two PhDs: one on comp. EM in Zürich, one on nuclear fuel at PSI
- I chose PSI due to environment and people!
- At first, afraid of new topic where I knew nothing
- In hindsight, I have expertise in two very different fields! When applying for postdoc and industry both fields were viable for me.

# Life of a PhD at PSI

1st year:

- Reading, reading, and reading! (you will thank yourself later)
- Lots of impostor syndrome (never really goes away)
- Ask all the basic questions
- Listen to feedback and give presentations whenever you can
- Prepare research plan and aptitude colloquium (main task)
- Don’t expect much progress (no papers, might be frustrating, but you are still learning, your supervisor knows this too!)

# Life of a PhD at PSI

2nd year:

- Start to perform relevant work according to plan
- Sometimes feeling lost, or no progress $\Rightarrow$ follow research plan and discuss often with your supervisor
- Conferences:
  - Great for sharing work and getting honest feedback
  - Networking is crucial! ”you always meet twice” (future job, consulting other experts…)
  - First conference alone? many others in your situation, scientists are very friendly and forthcoming!
- Maybe first paper (be ready for rejection and major revision, it happens to everyone)

# Life of a PhD at PSI

3rd-4th year:

- This is the most productive time, you are more expert in the field than $99\%$ of people around you
- Most of your papers happen now. You know **what is lacking in the field** and you know **how to address these problems**
- Start writing thesis very early. Do not underestimate how long it takes to write $\sim 100$ pages!
- Write, write, and write!

# Some finishing thoughts

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- Enjoy your PhD!!
  - Learning all the time, on the cutting edge of research
  - Studying what you love
  - Lots of freedom to suggest new methods and crazy ideas
  - Enjoy time with colleagues, meet new people
  - Working hard is important, but weekends and rest are equally important
- There will be tough times: deadlines, rejected papers, brutally honest feedback
  **It will be okay** Learn from these situations, work hard when it's needed, discuss openly and often with your supervisor
- You might feel alone at times (you are expert in your niche topic, perhaps cannot discuss details) $\Rightarrow$ use conferences and networking to discuss with top world experts in your topic