Oklo Reactor Engineering and TPM

Technical Mini-Project

The purpose of the mini-project is to showcase your reactor engineering and technical project management skills and your creative thought process during the interview. We want to know more about

- how you think through reactor design process
- how you handle working with a limited set of information
- how you evaluate team dynamics, project management, and strategic decision-making
- your ability to research new topics
- your ability to conduct analysis to understand system behavior

The final deliverables should be (1) a presentation detailing your responses to the questions, the assumptions you made, and the analysis you conducted; and (2) code used for the analysis (please use Jupyter notebook). Once you're done with this mini-project, you'll be asked to present and discuss your responses with the Oklo team.

Have fun with this mini-project – we are very excited to learn more about you through your work!

Additional notes:

None of the mini-project questions require extensive analysis using tools beyond hand calculations (i.e., you should not need to create neutronics or CFD models); however, if you have access to these tools and you wish to use them, please feel free.

We expect that you should spend a **maximum of 8 hours** on the project. If you think you are going to take much longer than that, please reach out.

Use all resources available to you! If you are unfamiliar with a concept – Google it! This mini-project is open book, open internet.

Mini-Project Question 1 (Reactor Engineering)

Flow blockages can be challenging for fast reactors - for instance, Fermi 1 experienced a flow blockage caused by a piece of zirconium liner that had broken loose, creating a partial flow blockage that caused fuel damage. Partial flow blockage results in some localized undercooling, which can result in localized voiding. If voiding happens in the wrong place, this can result in a positive reactivity insertion.

1. For Argonne's Advanced Burner Reactor (ABR), which has a positive global void worth, how significant of a positive reactivity insertion could occur from localized flow blockages?
2. Based on this reactivity insertion and using a point kinetics assumption, how large of a temperature increase would occur from this reactivity insertion?
3. What can we do on the design side to prevent, detect, and mitigate this possible accident? What drawbacks are associated with these solutions?

Mini-Project Question 2 (Technical Project Management)

In the Oklo reactor product development side of the company, our product (reactors) has both software and mechanical design aspects. The reactor design is done within our software infrastructure, whereas most other aspects of the facility employ traditional mechanical engineering design. To track the most up to date version of the design (both the reactor and secondary side of the facility), we implement a versioning process via Jira. This versioning process has many steps and includes (1) having successful runs of our software infrastructure (successful means both runs we can trust and a design that we approve), (2) our multiple teams using the outputs of these successful runs to make adjustments to their software or mechanical components, and (3) finally documenting the results in Confluence to have an up to date version of the design; these runs include a comprehensive multiphysics analysis, numerous analytical tools, many stakeholders, version controls, and are on the order of 40 hours to run. The design and analysis relationships are complex, both between the software and mechanical side, as well as in the design dependencies between our facility's systems. Managing these complex relationships, team dynamics, and the quality of the work is challenging. Currently, our analysis pipeline is all hosted locally at Oklo's headquarters in California, whereas we use cloud services from the Atlassian suite.

1. At a high level (think: block diagrams), how would you design the versioning process? What are the key drivers to consider? Who are your stakeholders?
2. What kind of checks should be done before and after these comprehensive multiphysics analysis pipeline runs? Who should be doing the checks?
3. Would you recommend redundancy or a transition to cloud computing for the analysis pipeline? Why or why not? What would you evaluate to make this decision? How would you deploy a solution for cloud computing to build in redundancy for the local compute cluster?