

# Thermal analysis of a heat pipe nuclear reactor for space applications using CFD

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## BACKGROUND

- ❖ Remote mining sites in space are expected to have an energy demand in the order of MWs.
- ❖ Nuclear Energy appears to be an interesting candidate to deliver power to ISRU facilities.
- ❖ In particular, new designs of reactors such as the heat pipe nuclear reactors are very attractive features such as long term lifetime, no moving thermal parts, or inherent safety. The robust solid-state characteristics make it ideal for hazardous environmental conditions or potential damage during transportation.
- ❖ The study of this kind of reactors still needs some development as this technology, even though it was conceived in the 60s, still needs to mature.

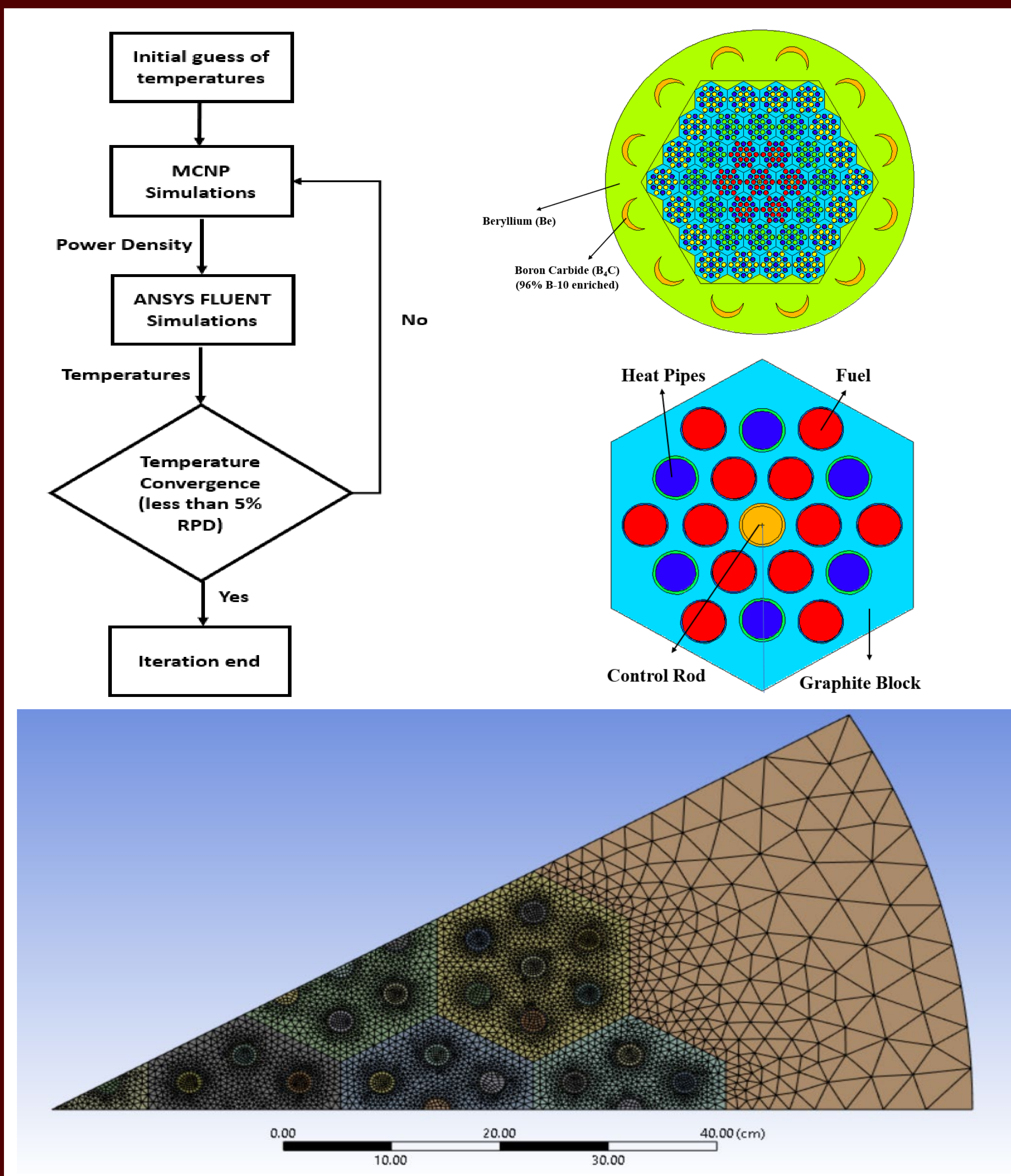
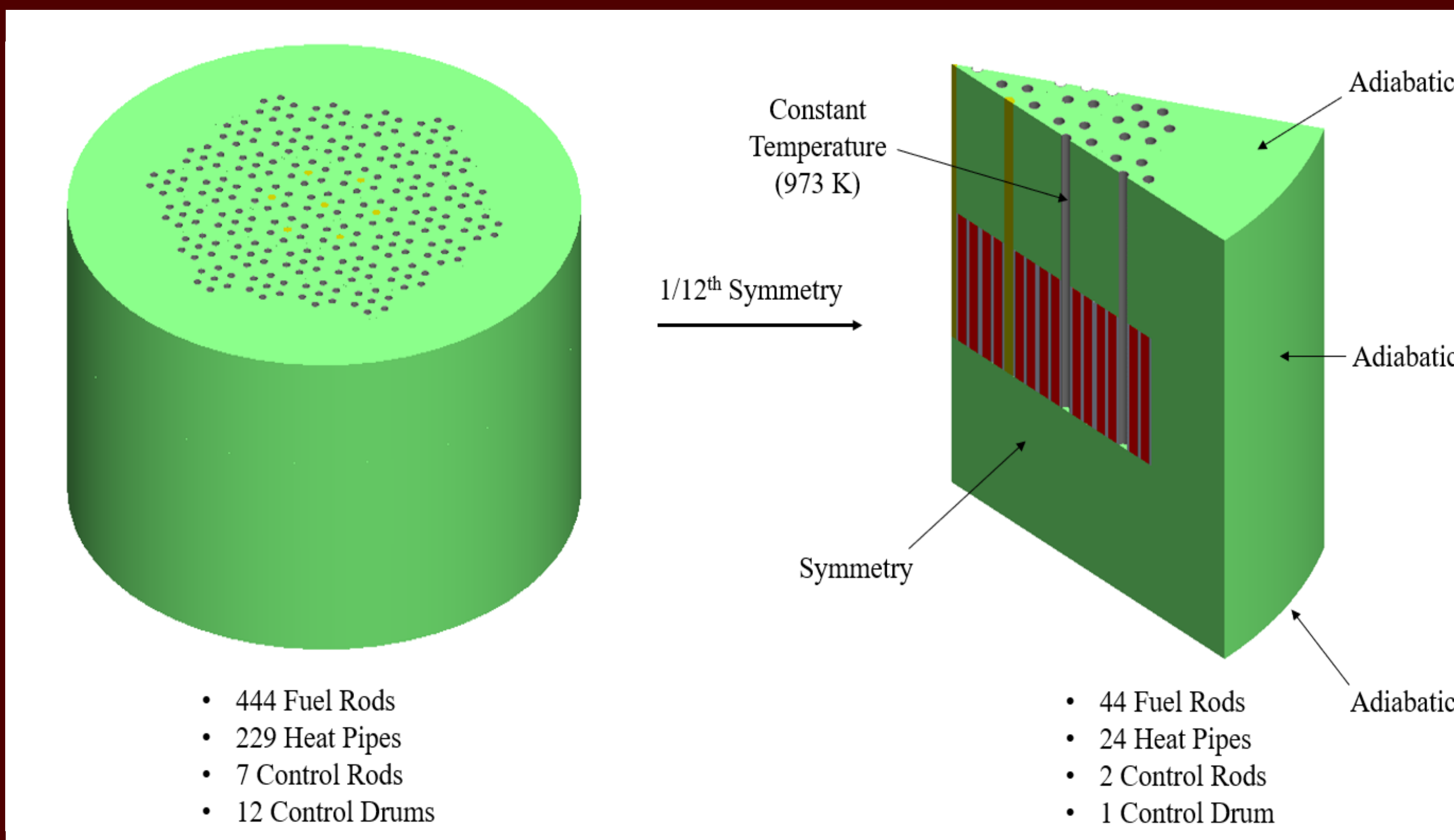
## OBJECTIVE

- ❖ In this study, a design proposal for a 0.25 MWth heat pipe cooled, graphite moderated nuclear micro reactor. MCNP will be used for neutronics and FLUENT for thermal/analysis.
- ❖ The main driver of the design was to achieve enhanced safety characteristics while maintaining a long core lifetime, which would result in a design that is suitable for a variety of purposes

## CONCLUSION

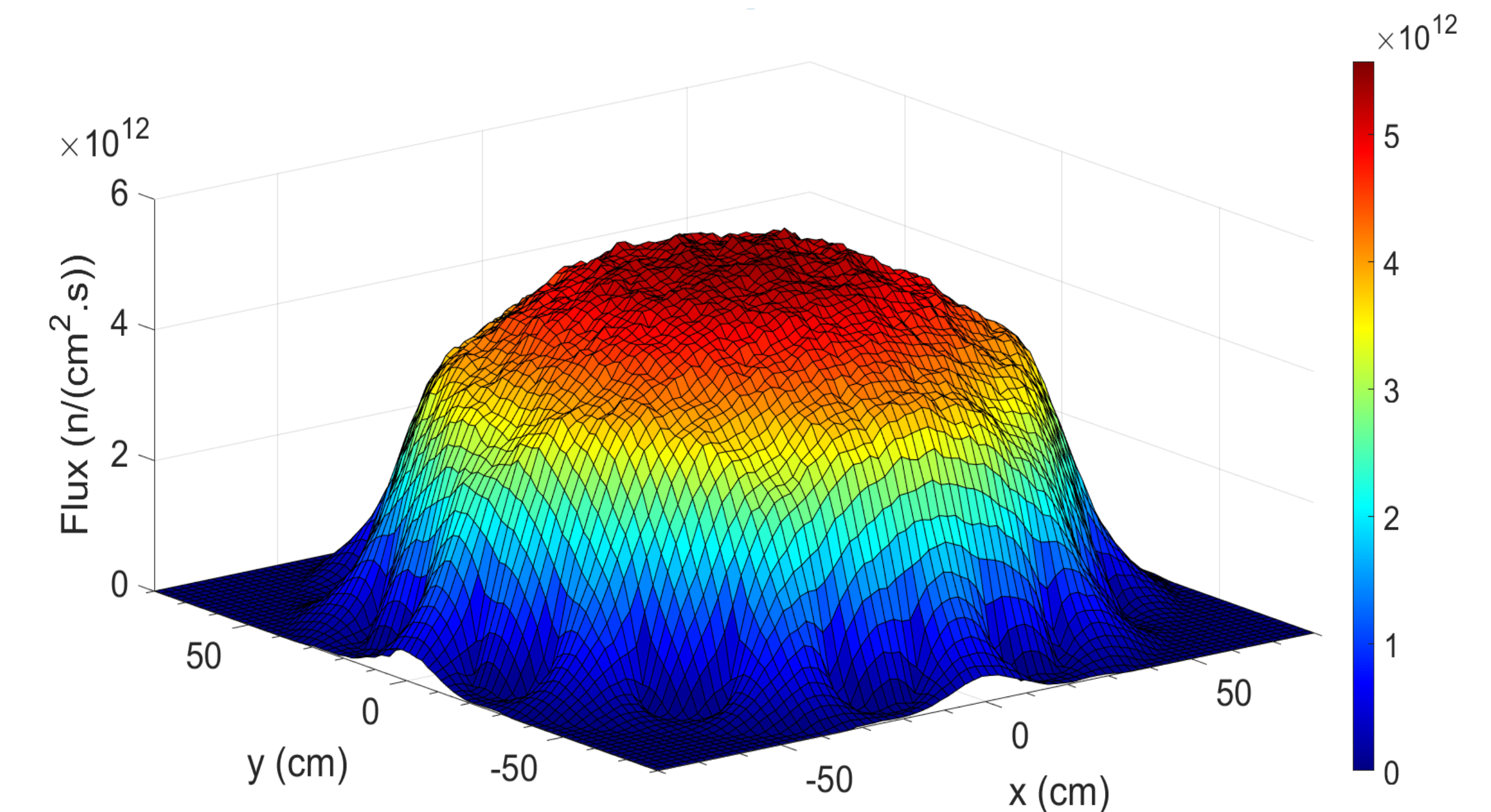
- ❖ The results showed that, for steady state normal operations, the highest achieved temperatures are well below the accepted limits for all the materials used in the design.
- ❖ An experimental facility is being developed at Texas A&M university which will be devoted to the study of heat pipes and will help in the validation and verification of future simulations.

## COMPUTATIONAL MODEL

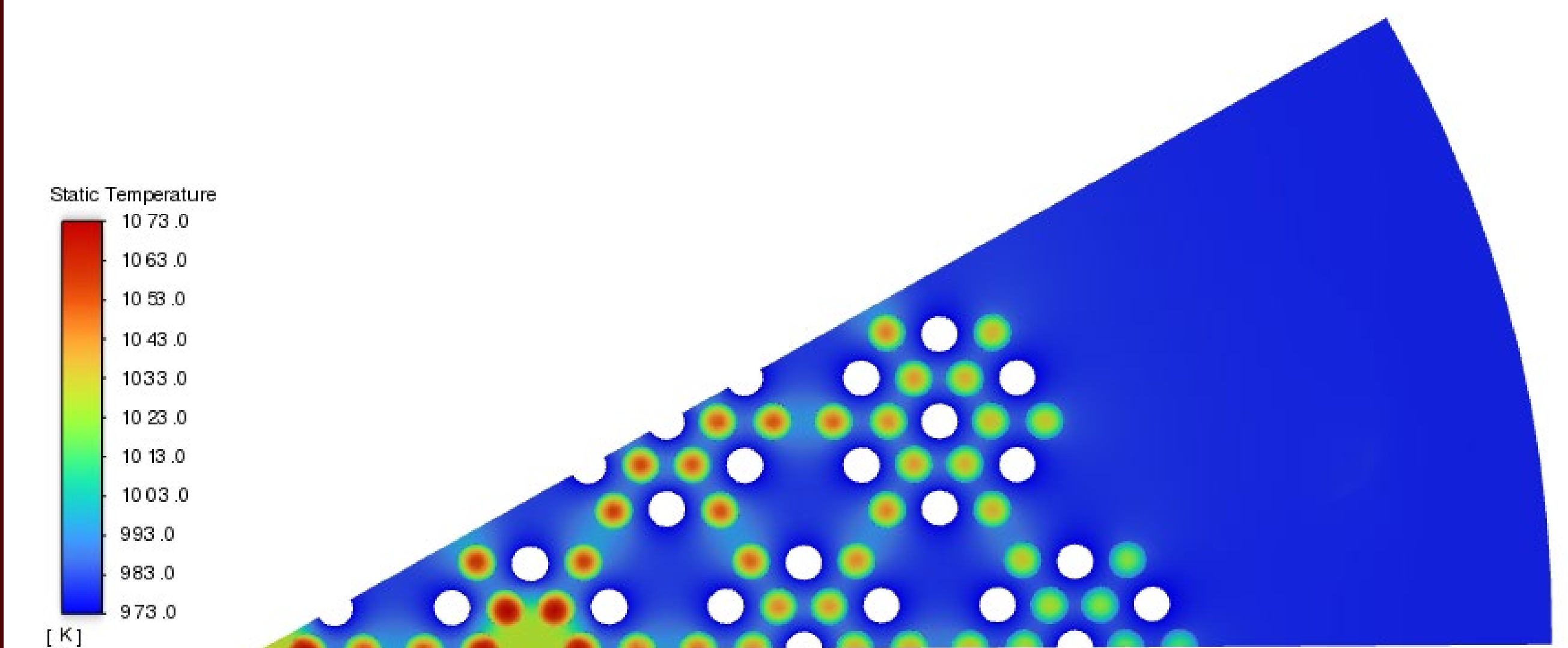


## RESULT

### Neturonic Analysis



### Thermal Analysis



### Safety and Lifetime Analysis

