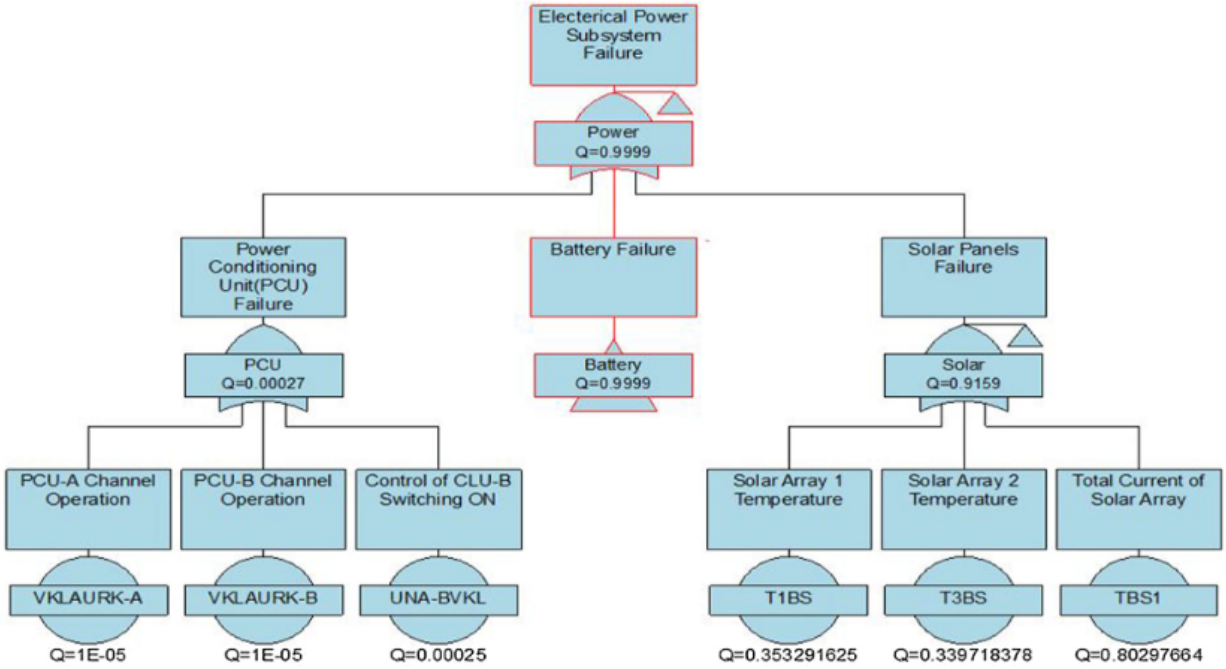
# Advancing Space Thermal Analysis through AI: Fault Diagnosis/Anomaly Detection, Model Correlation, Documentation Generation, Model reduction

**Abstract:**

Space missions and satellite operations demand precise thermal management to ensure the safety and functionality of spacecraft, and to guarantee the operational state of onboard instruments. Thermal analysis, including fault diagnosis, failure detection, and model correlation, is essential for maintaining temperature stability in the extreme conditions of space. Fault diagnosis involves the identification and analysis of anomalies or malfunctions in satellite systems. Model correlation refers to the process of aligning and validating computational models with real-world performance data. This correlation is vital for ensuring that predictive models accurately represent the behaviour of spacecraft and their components under the extreme conditions of space. This research project aims to harness the power of Artificial Intelligence (AI) to enhance thermal analysis capabilities, a well-documented state of the art review could be a great asset and some algorithms tested on real industrial data provided by Dorea (thermal results and satellite telemetries) would be a major contribution towards this research topic. AI-based solutions seem relevant to automate fault diagnosis, failure detection, improve model correlation as well as automatic generation of technical documentation and model reduction for more efficient and reliable space thermal management.




*Failure analysis from [1]*

The integration of AI into space missions' thermal management systems will enhance safety and efficiency while contributing to the success of future space endeavours.

References:

[1] https://www.sciencedirect.com/science/article/pii/S2090447919301029

[2]https://www.researchgate.net/publication/353165581_An_Automatic_Generation_of_Production_Documentation_from_MultiProLan_Models

[3] https://www.sciencedirect.com/science/article/abs/pii/S096599781630521X

[4] https://arc.aiaa.org/doi/abs/10.2514/1.9273?journalCode=jsr