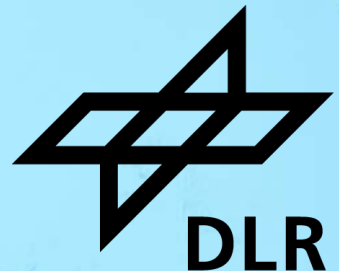


ELABORATION AND EVALUATION OF CONCEPTS FOR BATTERY MODULES IN ELECTRIFIED AIRCRAFT PROPULSION SYSTEMS

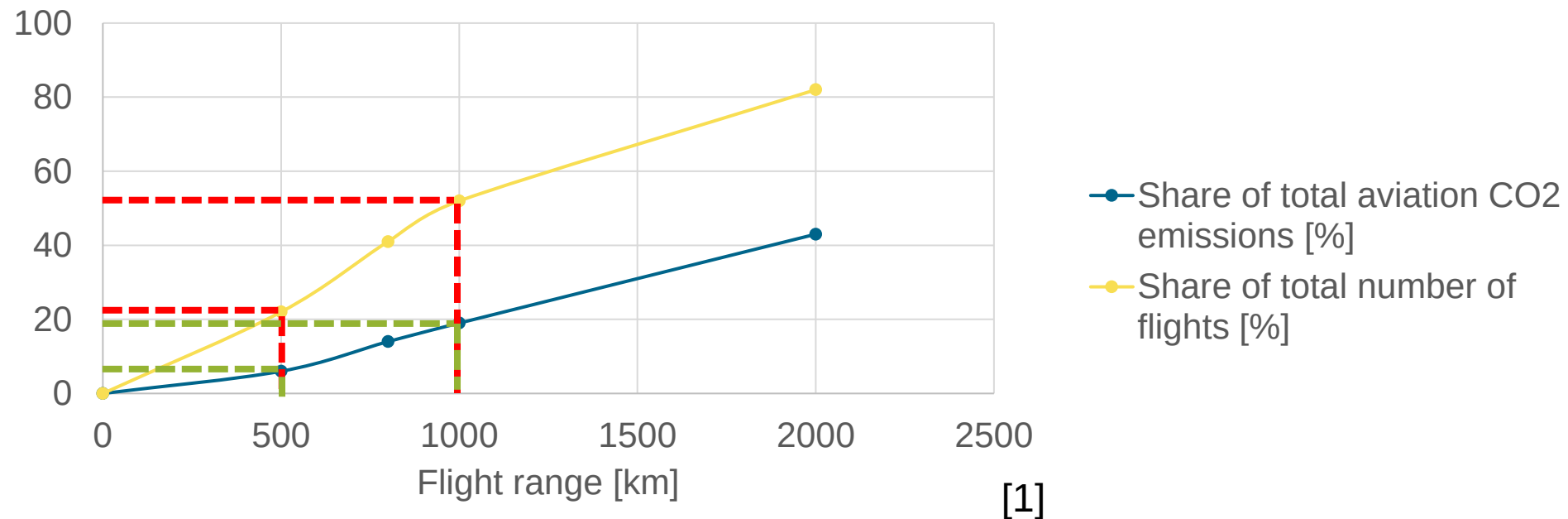
Alperen Oğuzhan Altun, Florian Franke, Stefan Kazula

German Aerospace Center (DLR) – Institute of Electrified Aero Engines



Motivation

Achieving the transition to an All Electric Aircraft (AEA) for a short-range (500-1000 km) passenger flight (~100 PAX) fully powered by batteries

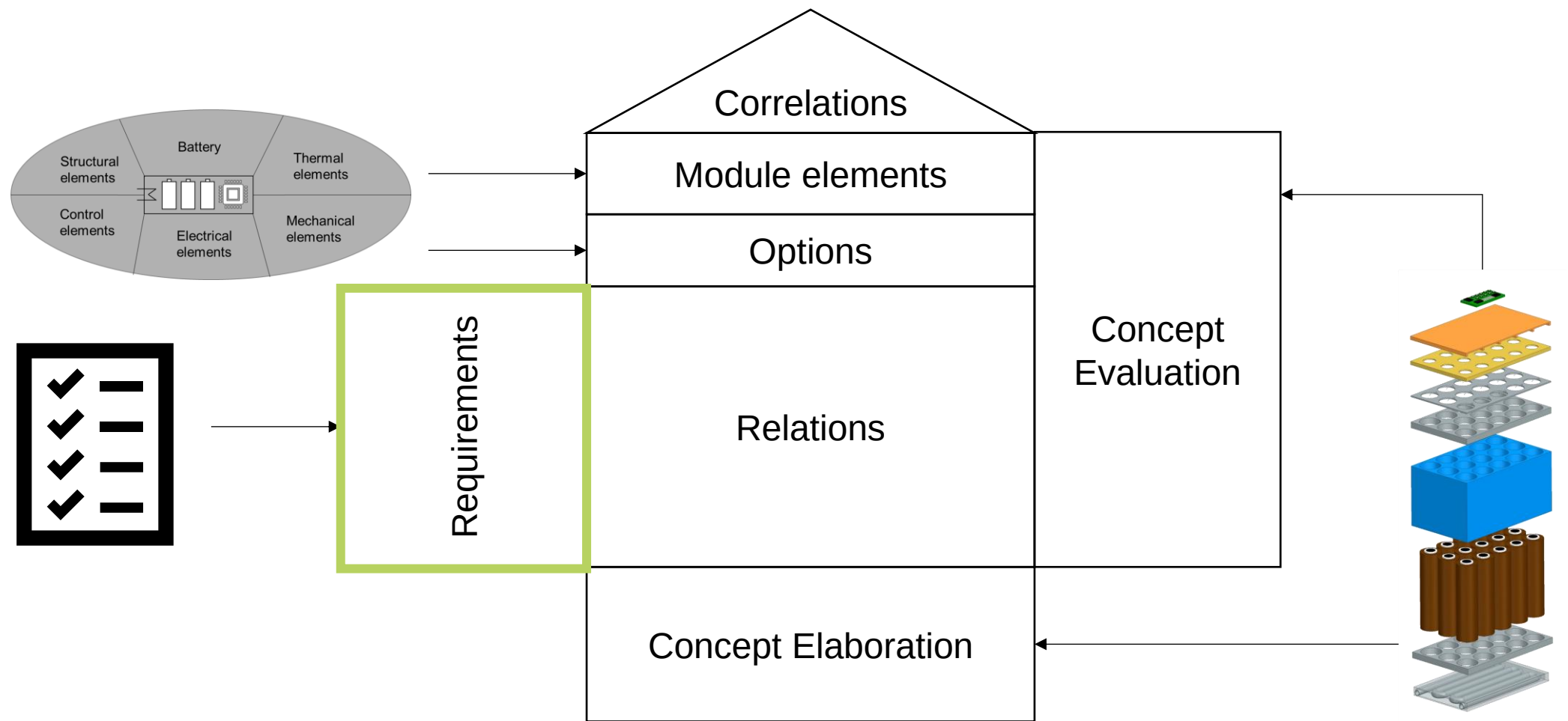


→What will the battery system of the future look like?

→How can the weight of the battery system be reduced while ensuring that safety requirements are met?

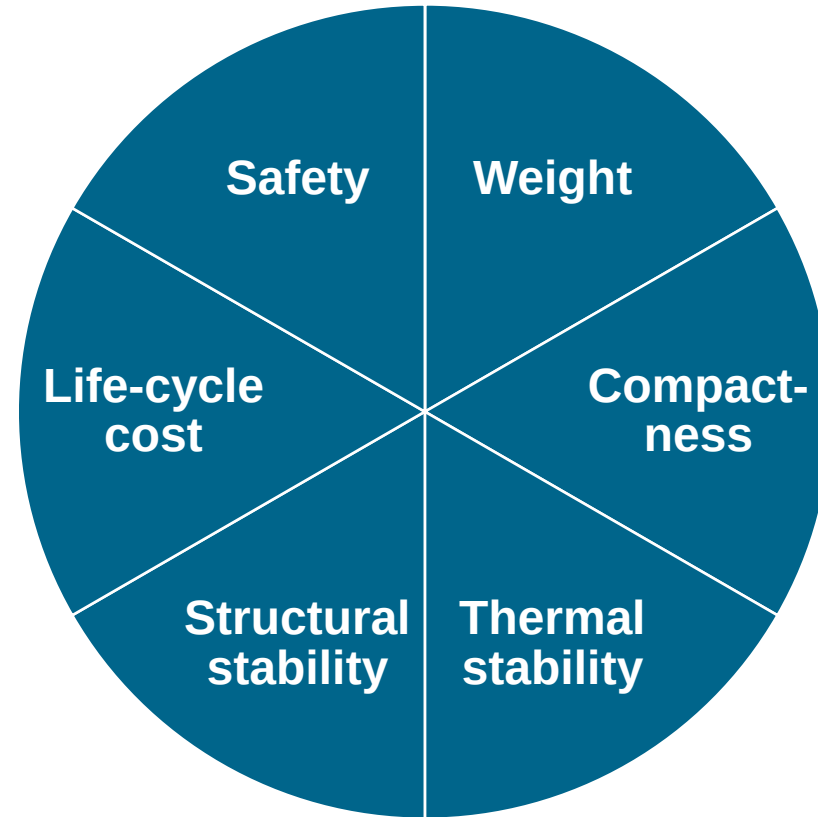
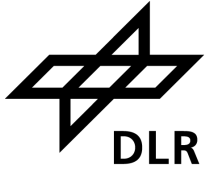
[1] de Vries, R.; Wolleswinkel, R.E.; Rosen Jacobsen, D.; Bonnema, G.M.; Thiede, S. Battery Performance Metrics for Large Electric Passenger Aircraft. In Proceedings of the 34th Congress of the International Council of Aeronautical Sciences, Florence, Italy, 9-13 September 2024.

Development of Concepts with the House of Quality (HoQ)

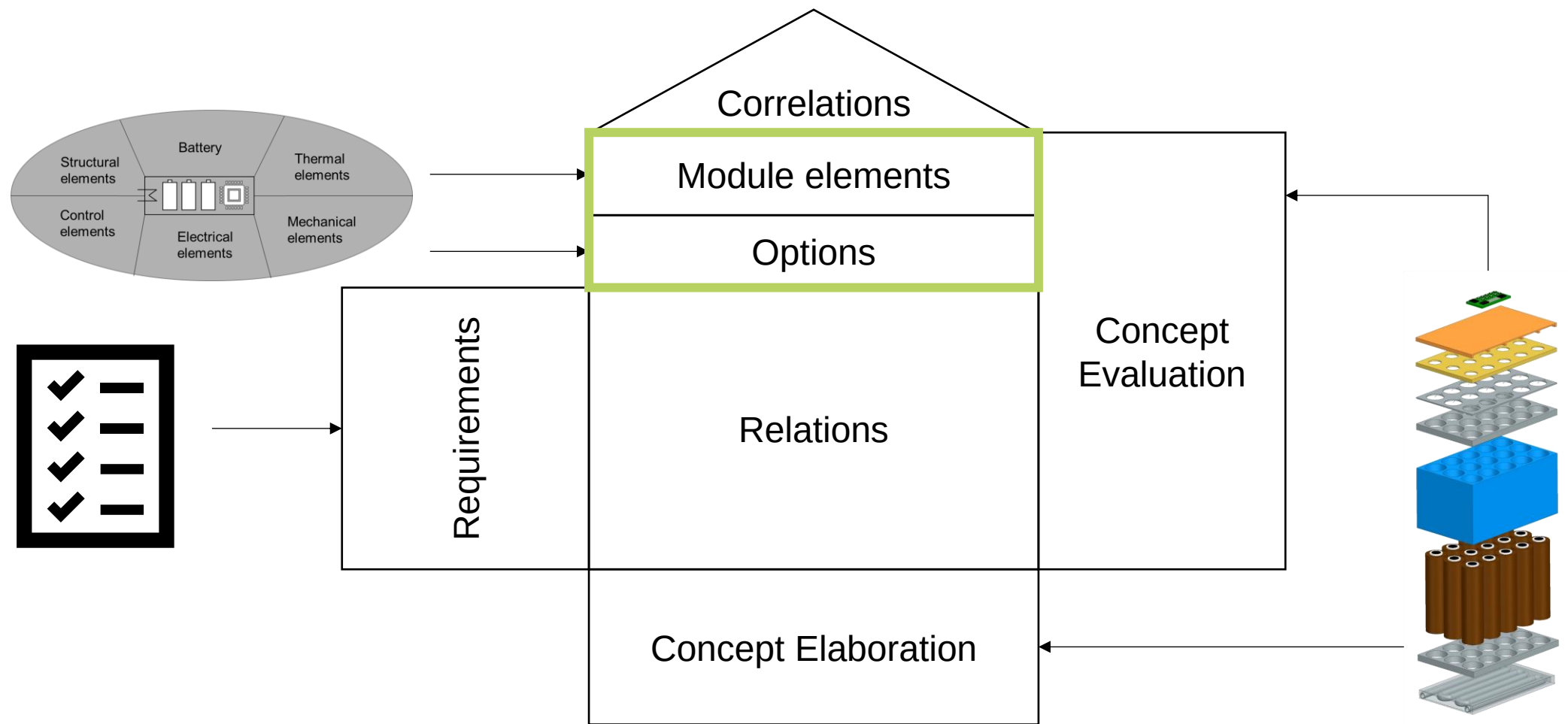


Hauser, J.; Clausing, D. The House of Quality. *Harvard Business Review* **1988**.

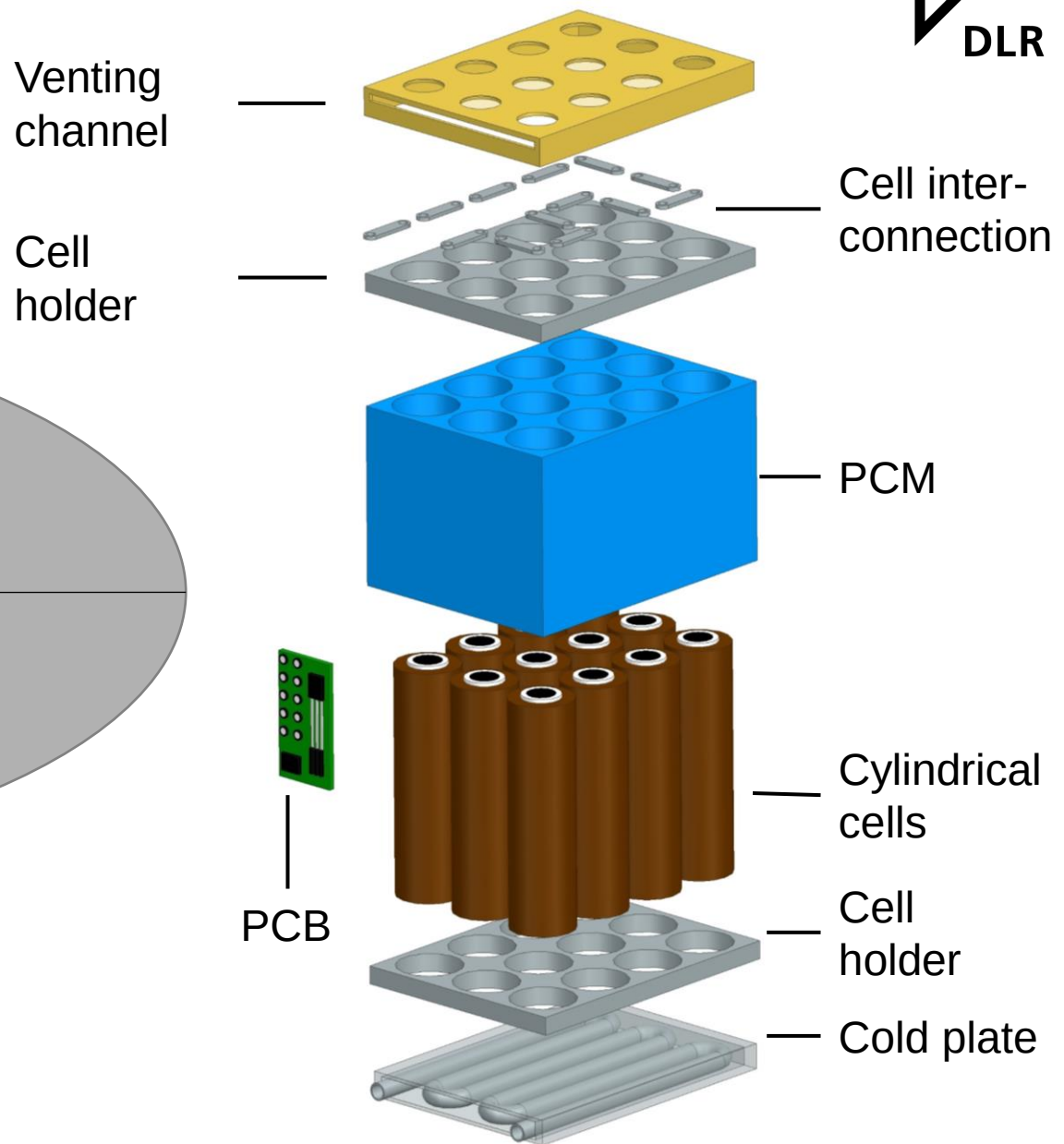
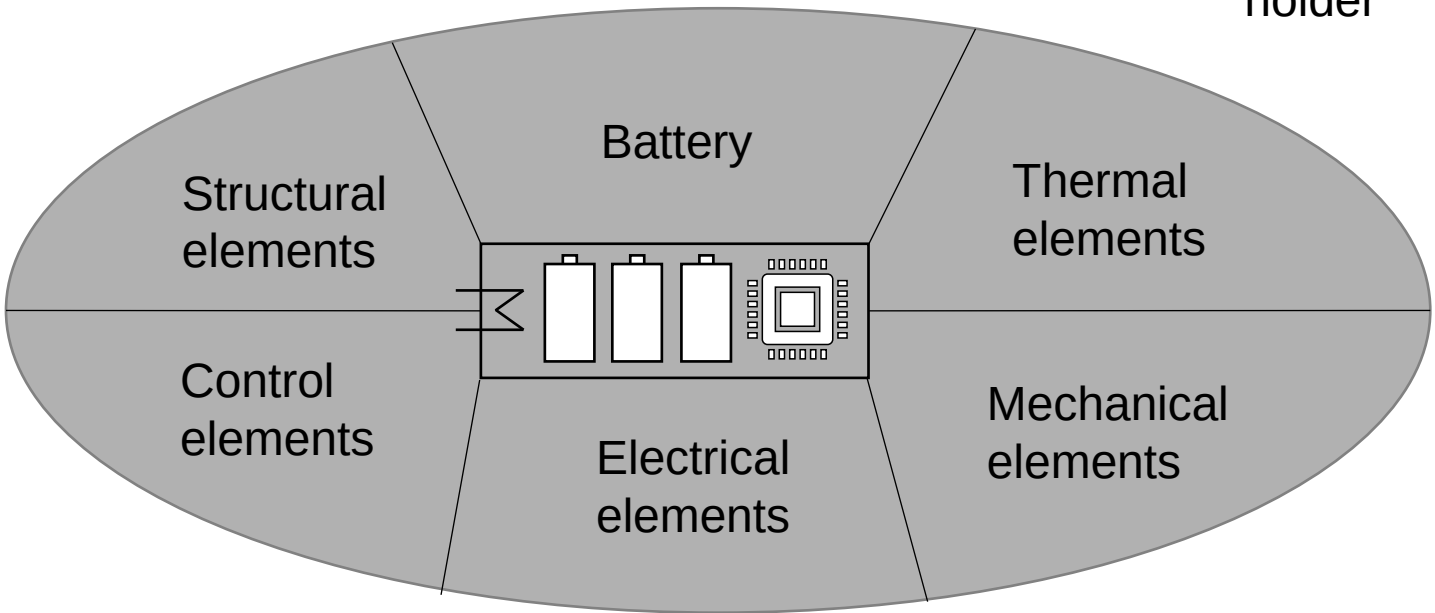
Requirements List (Excerpt)



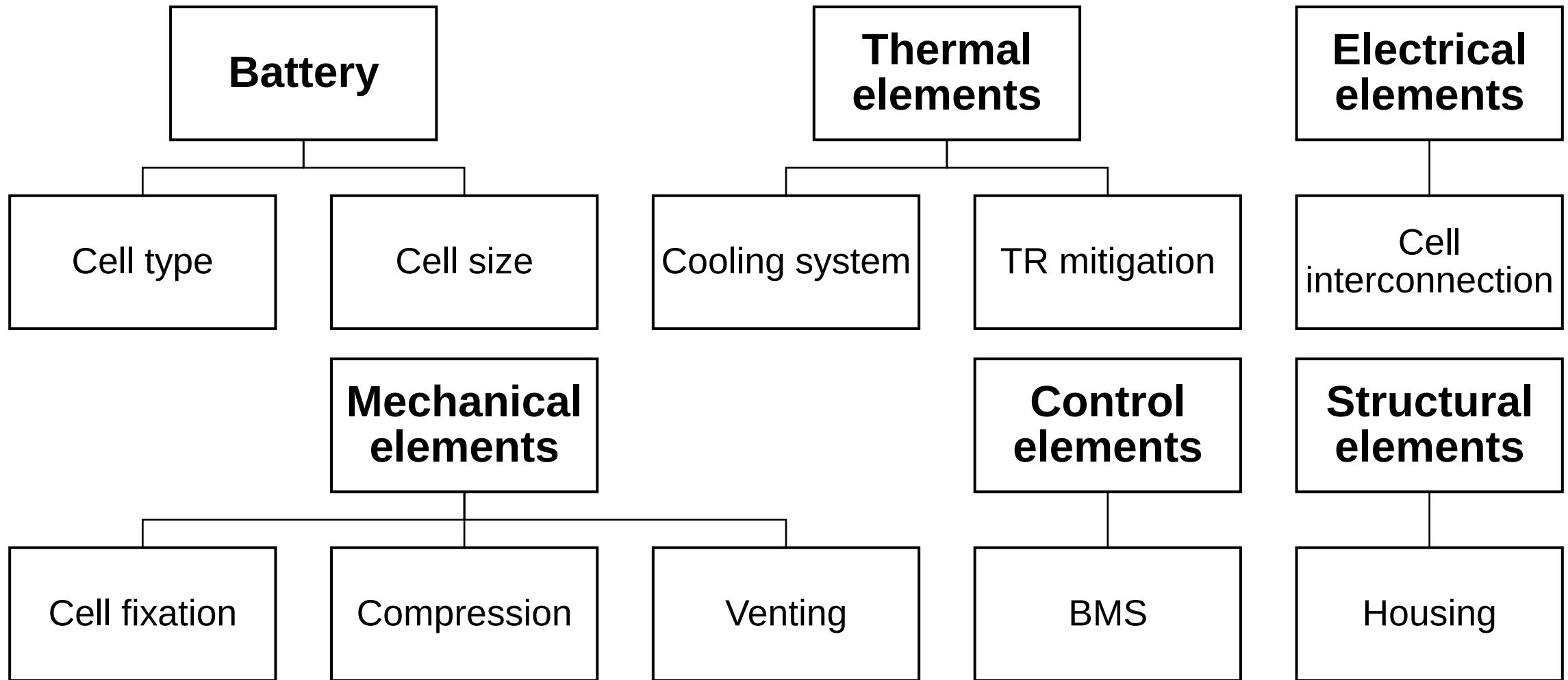
Development of Concepts with the House of Quality (HoQ)



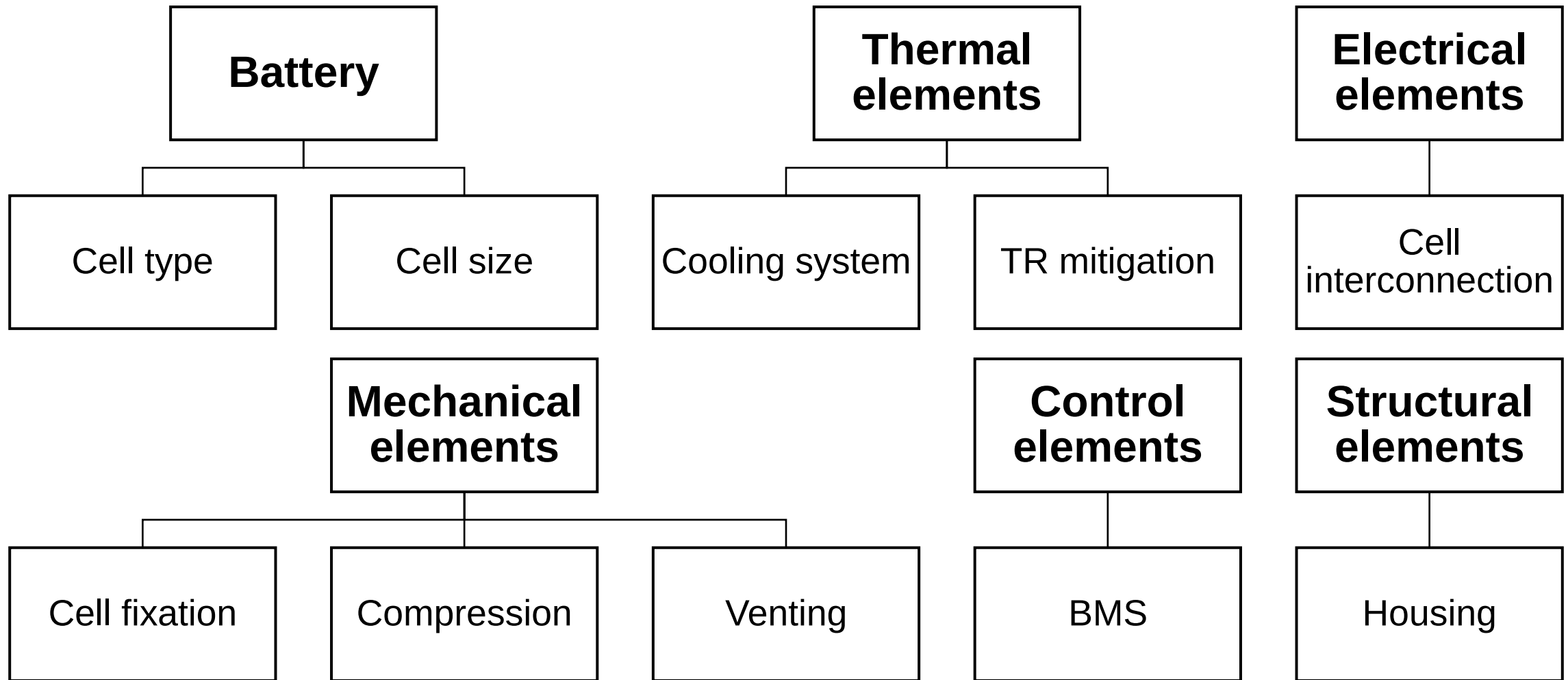
Overview of Module Elements



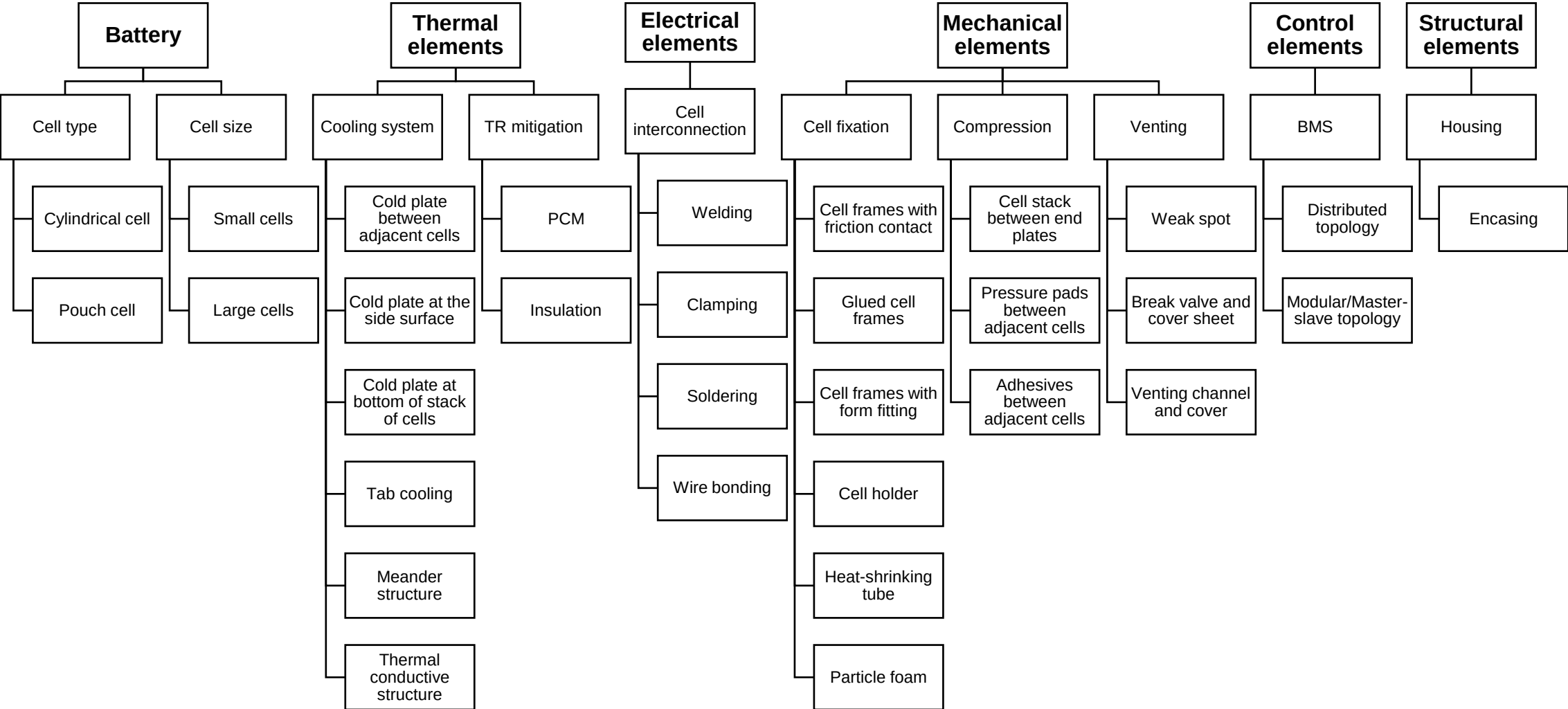
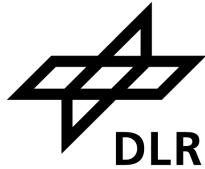
Overview of Module Elements



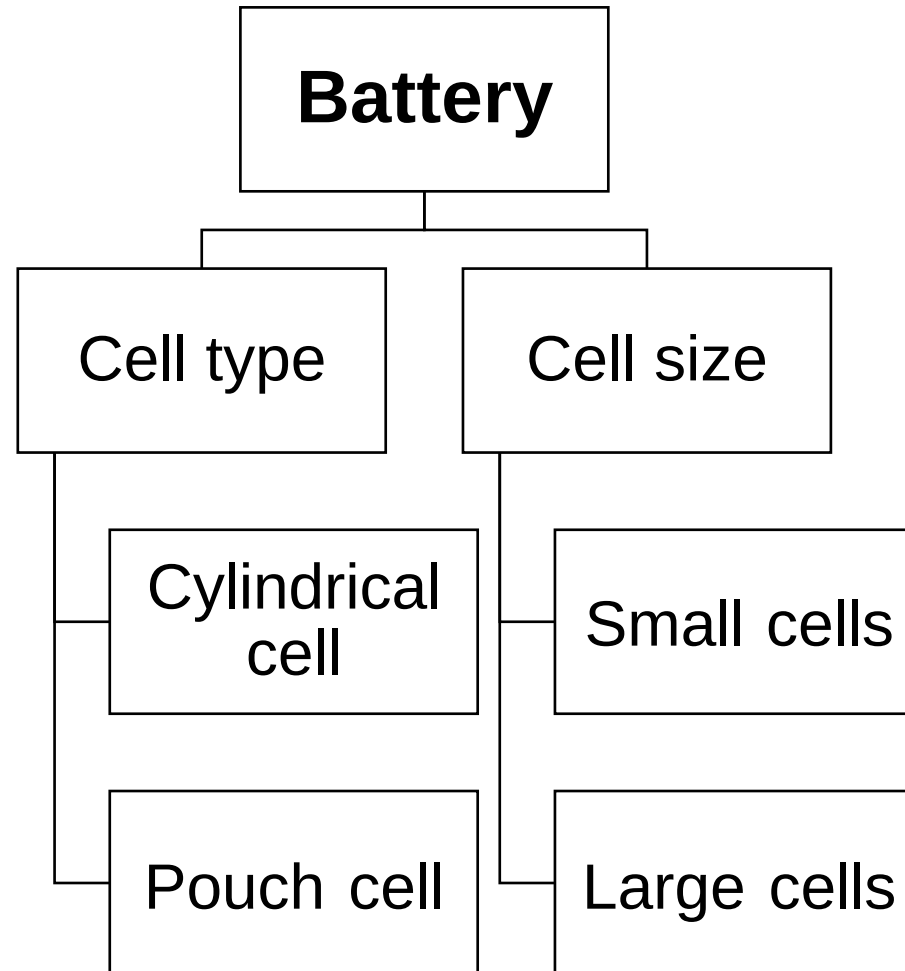
Overview of Module Elements



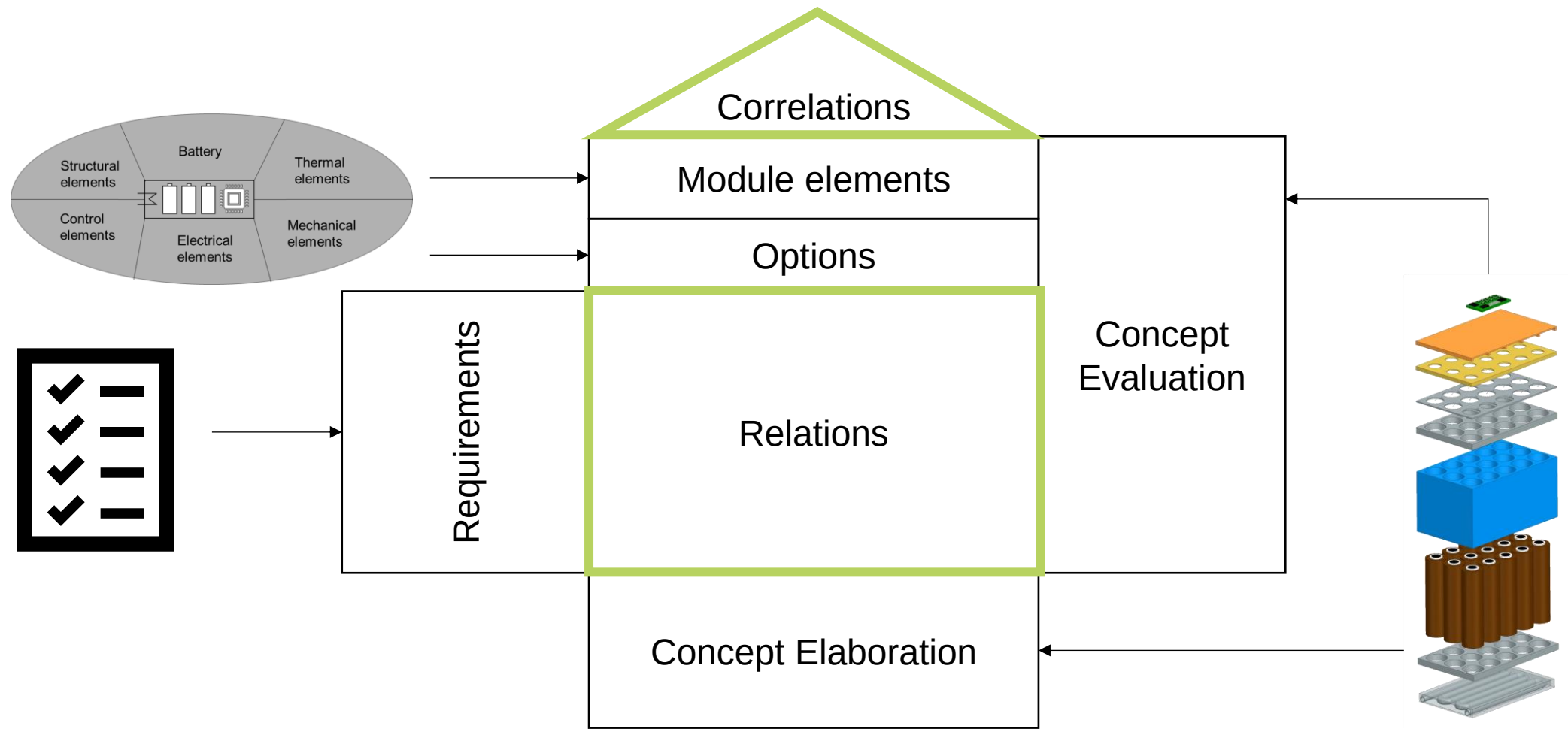
Overview of Module Elements



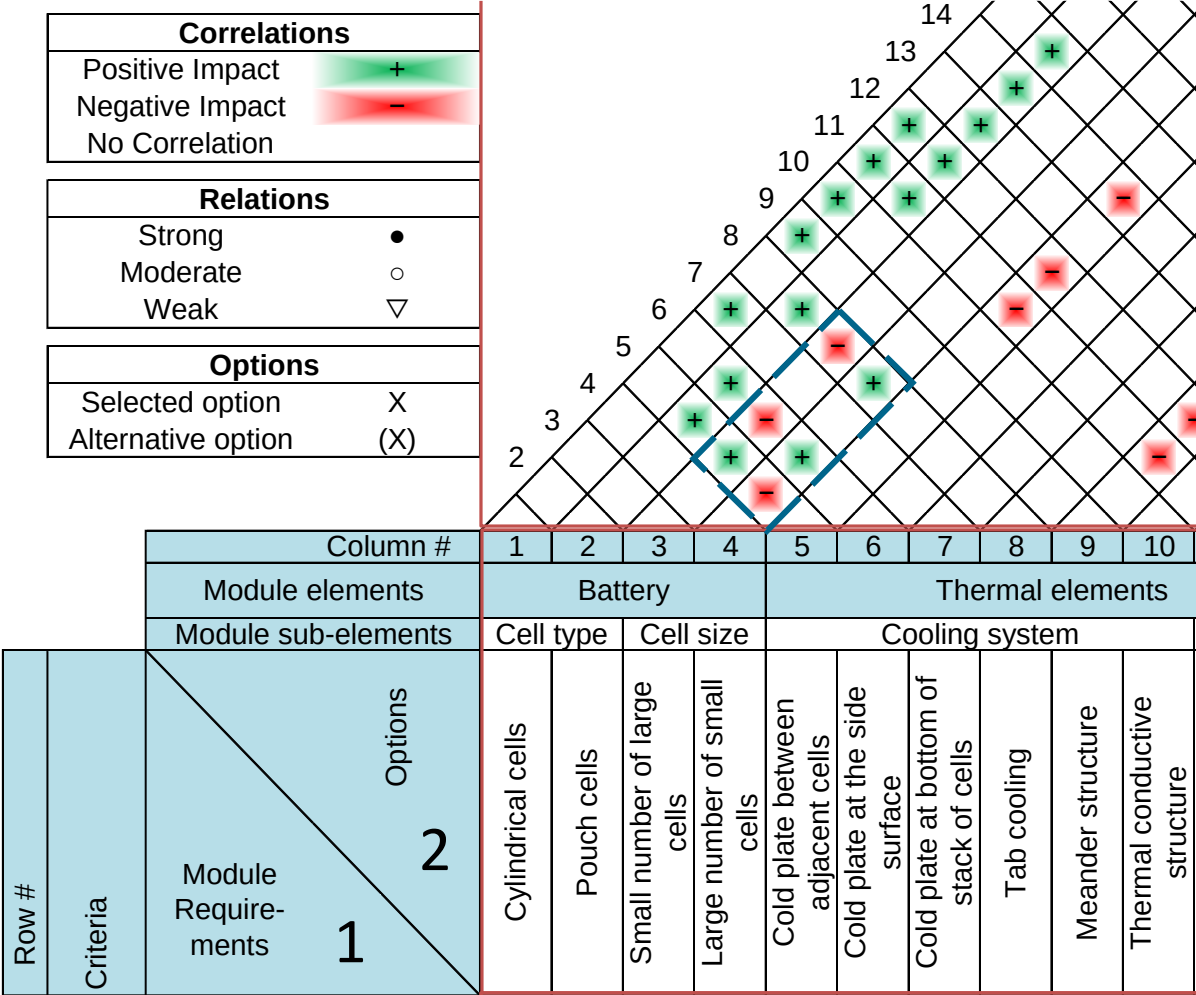
Overview of Module Elements



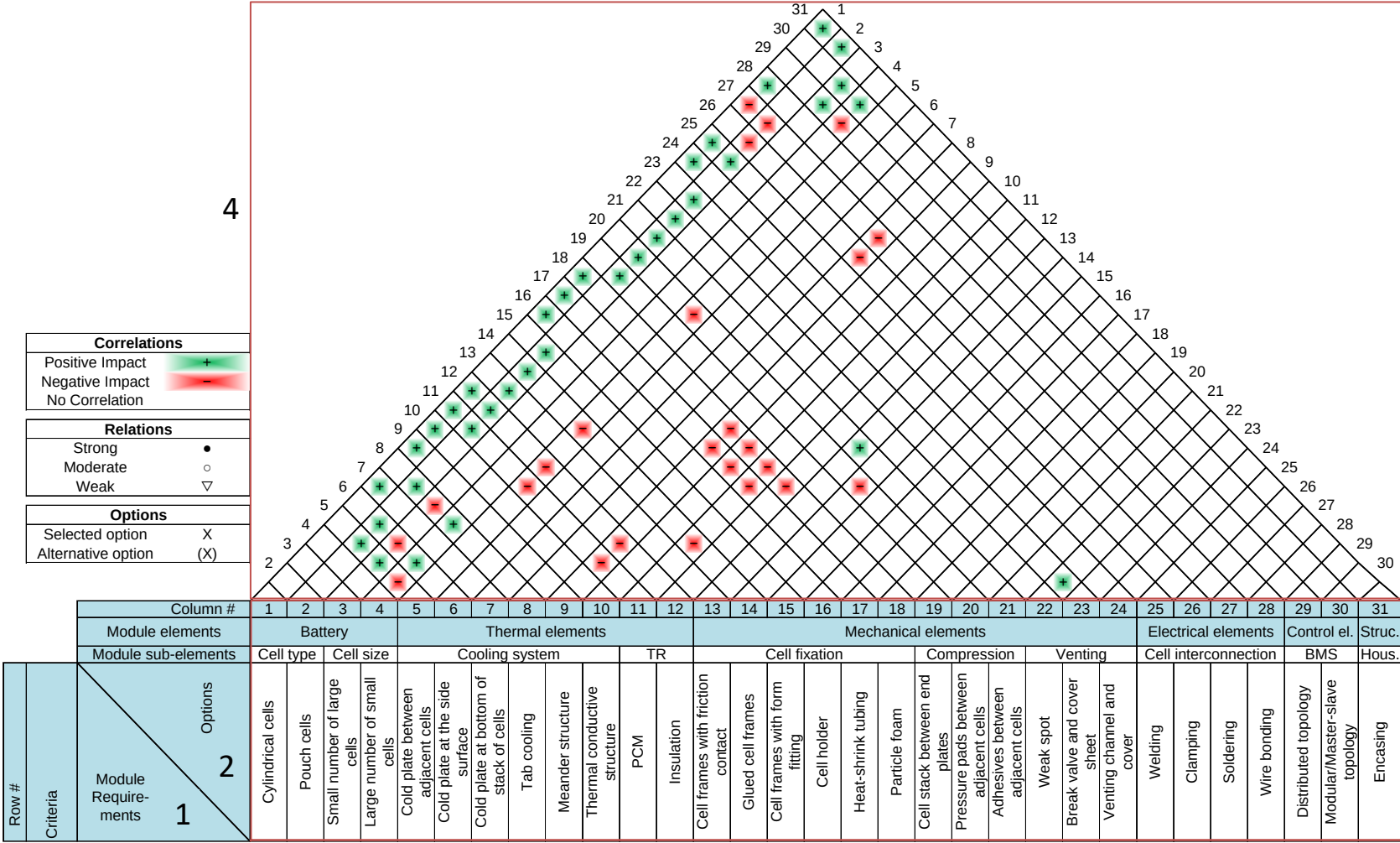
Development of Concepts with the House of Quality (HoQ)



Correlations between Module Element Options



Correlations between Module Element Options



Selected Design Recommendations



Welding and wire bonding high technological maturity



Distributed topology preferred for small number of cells in



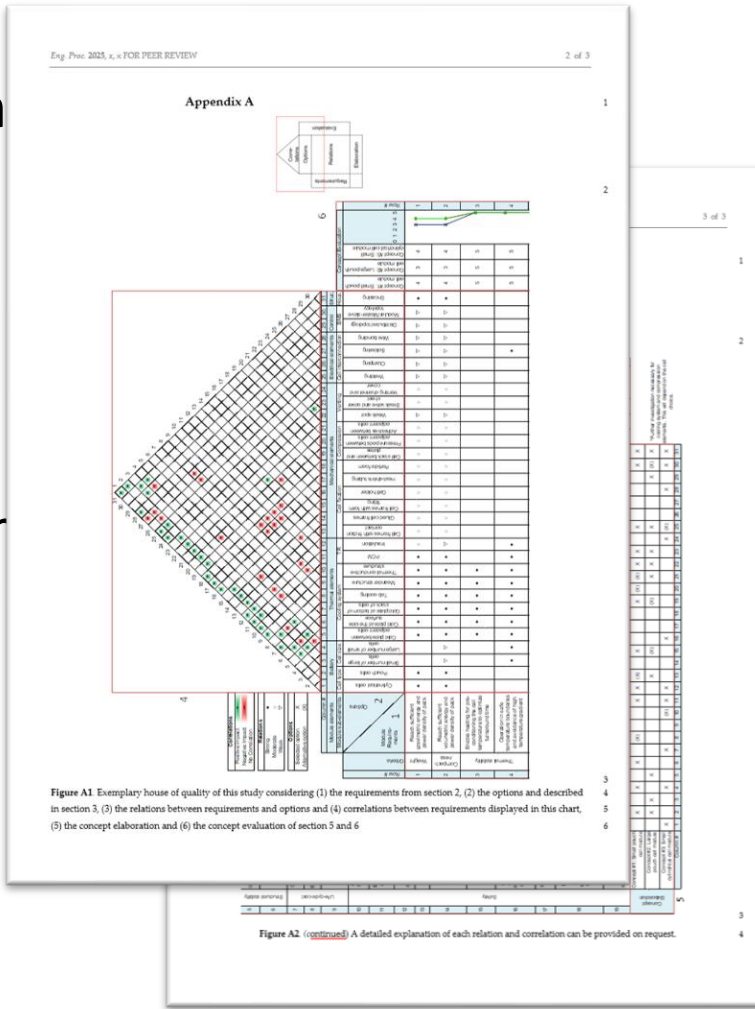
Cooling system dependent on cell size

- Surface cooling not viable for small cells
- Large cells aren't compatible with side or tab cooling

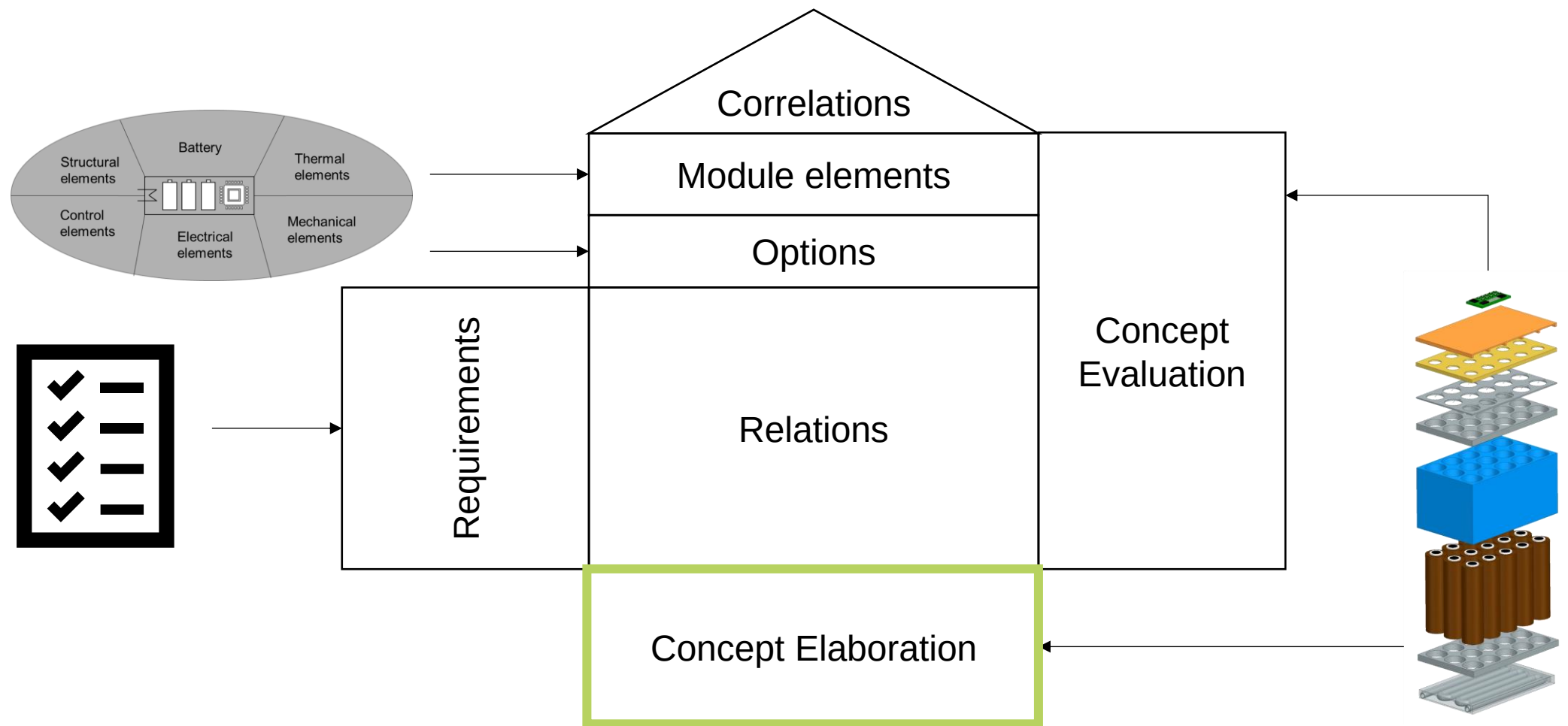


Particularly negative correlations between thermal element

→ Utilisation of a PCM prioritised

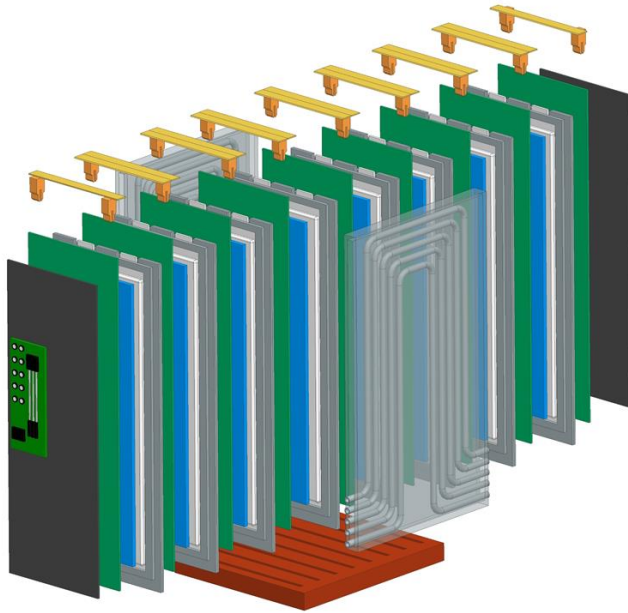


Development of Concepts with the House of Quality (HoQ)

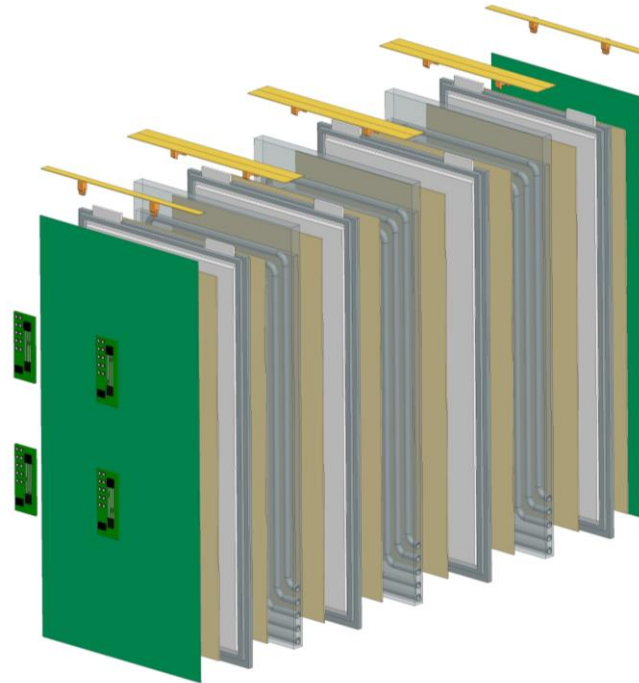


Resulting Concepts from the HoQ for Elaboration

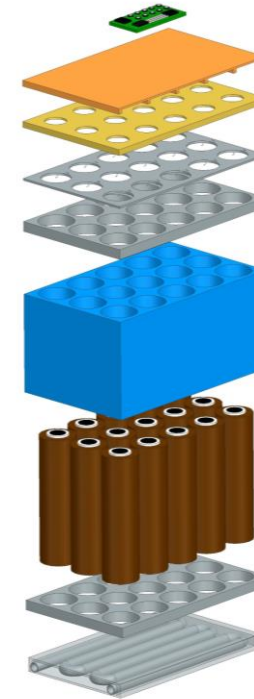
Small pouch cell module



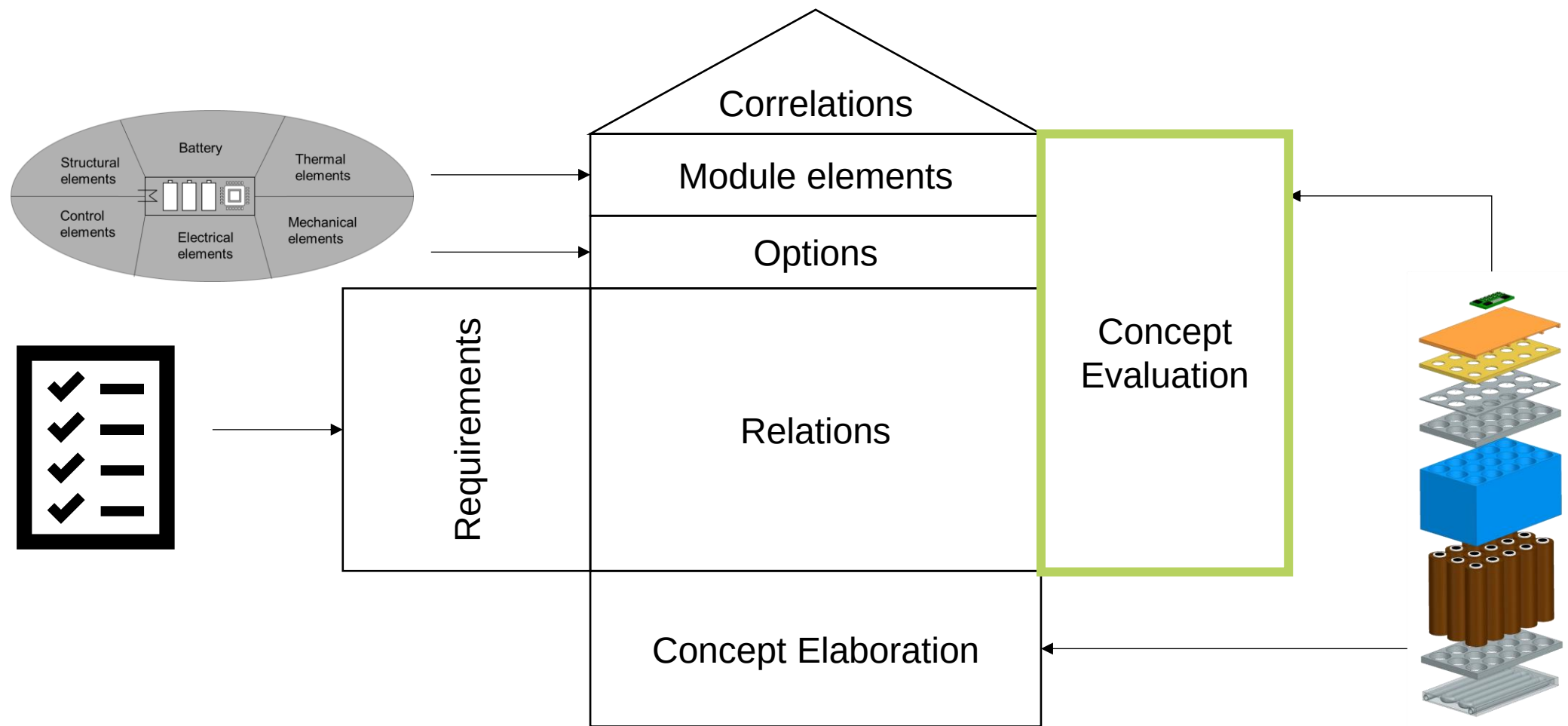
Elongated pouch cell module



Small cylindrical cell module

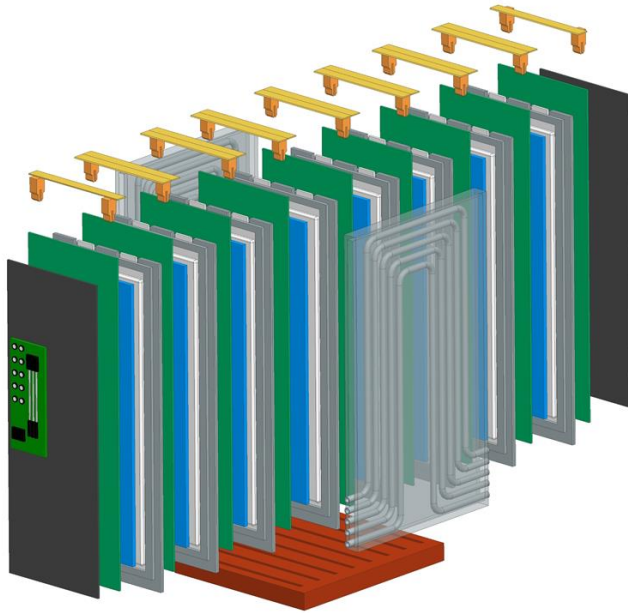


Development of Concepts with the House of Quality (HoQ)

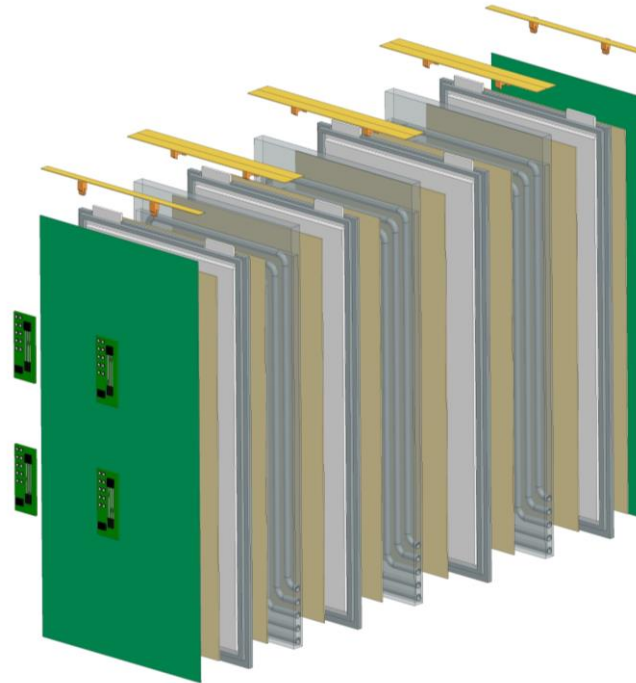


Resulting Concepts from the HoQ for Evaluation

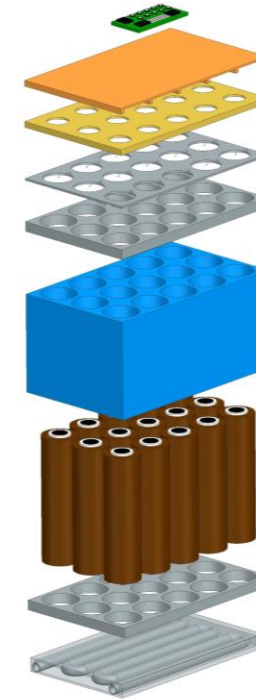
Small pouch cell module



Elongated pouch cell module



Small cylindrical cell module



- High uncertainties regarding the design of thermal and compression elements
- Small cylindrical cell module selected as preferred concept



Resulting HoQ of this work can be further expanded



Preferred choice is based on the applicability of a hybrid cooling system

→ More challenging for pouch cells due to the design complexities



Further analysis required for the cooling system.

→ The effectivity of a hybrid cooling system must be further investigated in a subsequent work.



Thank you for your attention!

Alperen Oğuzhan Altun

Alperen.altun@dlr.de