

Adventures with ANSYS



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Introduction

> all FEA studies so far were done with I-DEAS

- ,official' design CAD files are maintained by CERN
- import into I-DEAS via STEP files
- preparation of FE model from STEP file is rather work intensive
- complicated geometries often requires new I-DEAS parts and assembly
- workflow is not very efficient

> I-DEAS lacks a few features

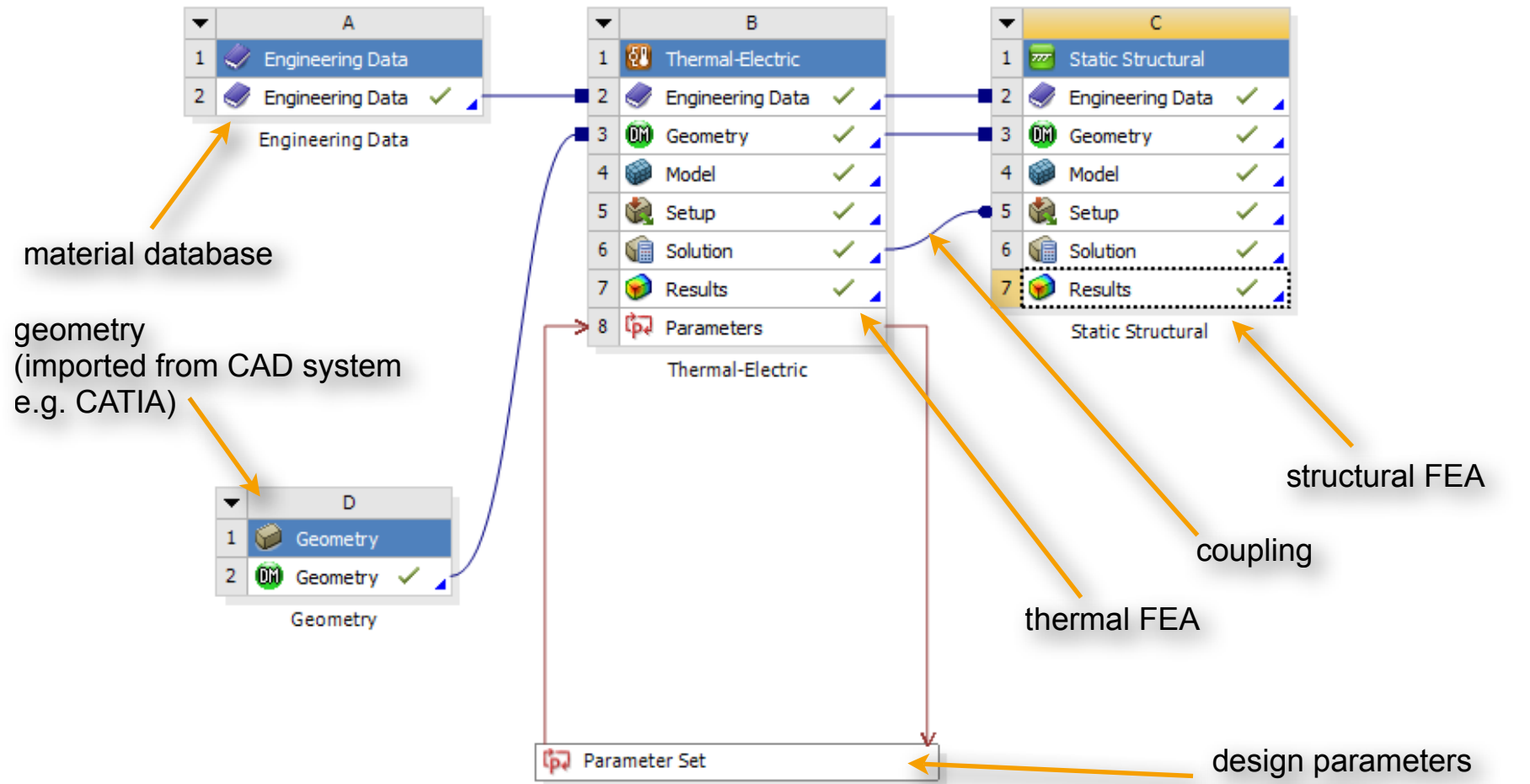
- thermo-mechanical optimization studies
 - coupling of a thermal and a structural analysis with variation of design parameters
 - in principle possible but requires a new FE model for each parameter step
- ,real' sensor power → temperature dependent thermal loads
 - needed for thermal runaway studies

> ANSYS is available at ZM1 (version 14.5)

- guest PC available for test purposes



ANSYS Workbench



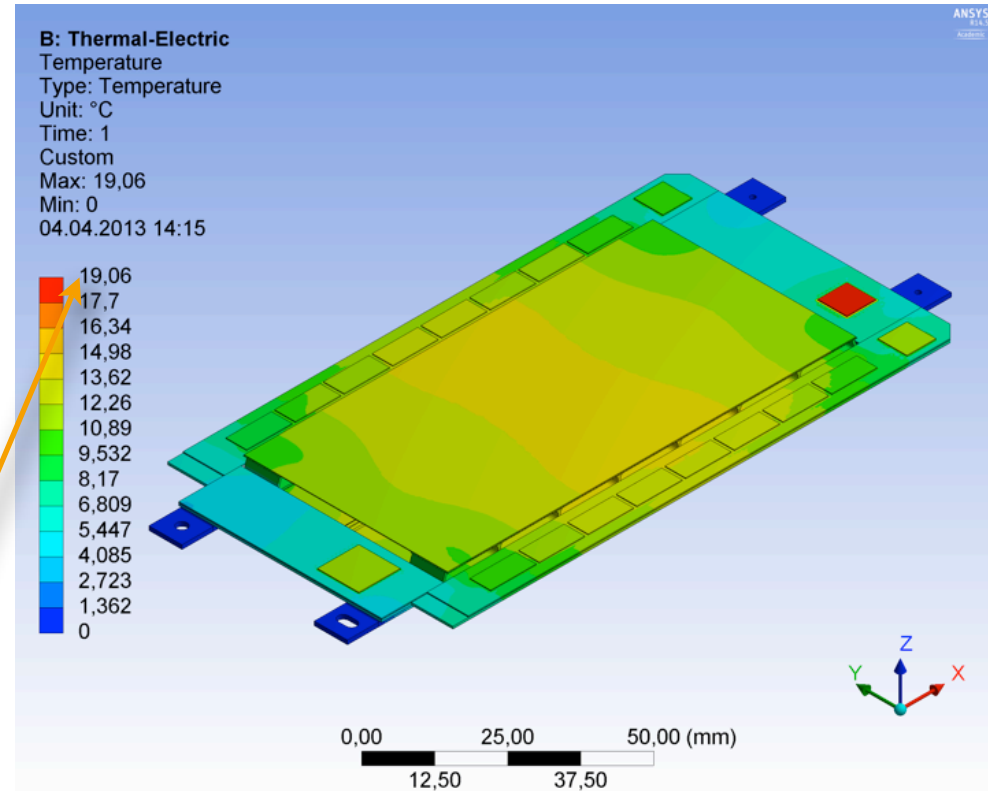
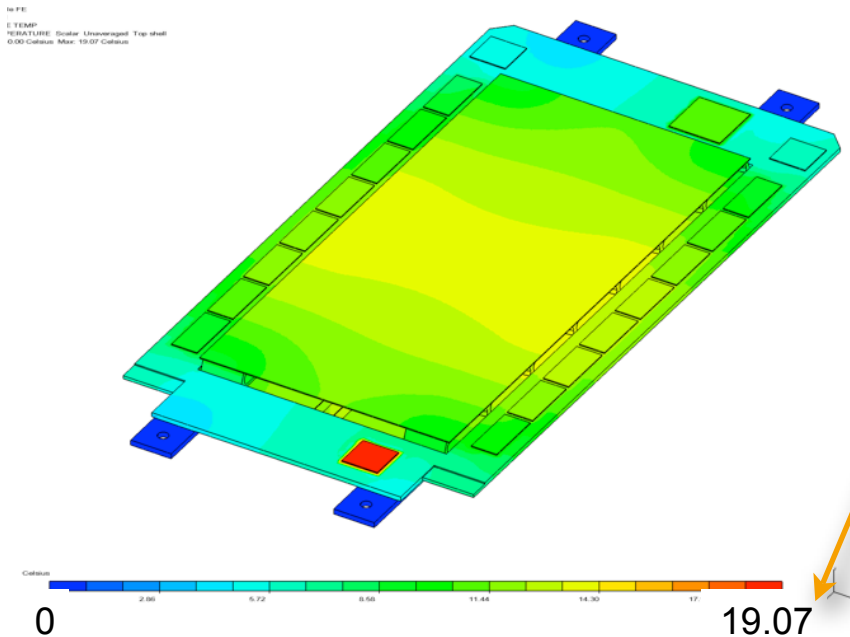
- graphical user interface as front-end
- generates APDL text file as input to solver

- geometry
- material
- boundary conditions



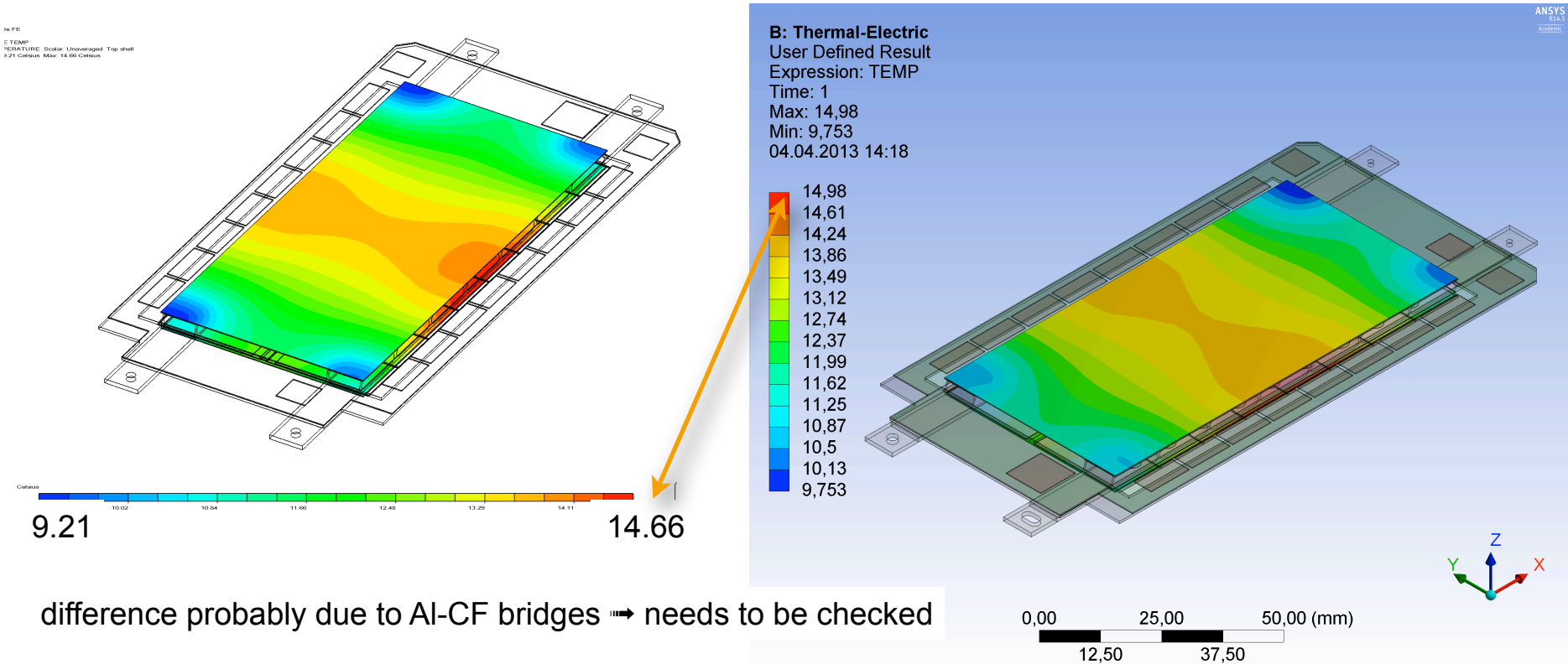
Preliminary I-DEAS vs. ANSYS Comparison

- > I-DEAS FE model based on a **copy** of CERN STEP file
 - a few details are different - e.g. bridges have been slightly simplified
 - swapped DCDC converter and LP-GBT
- > ANSYS FE model based on CERN STEP file



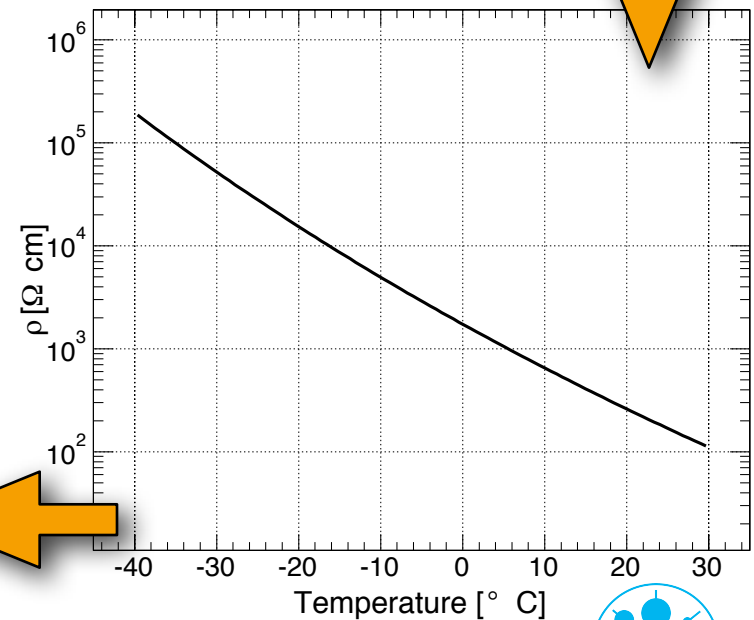
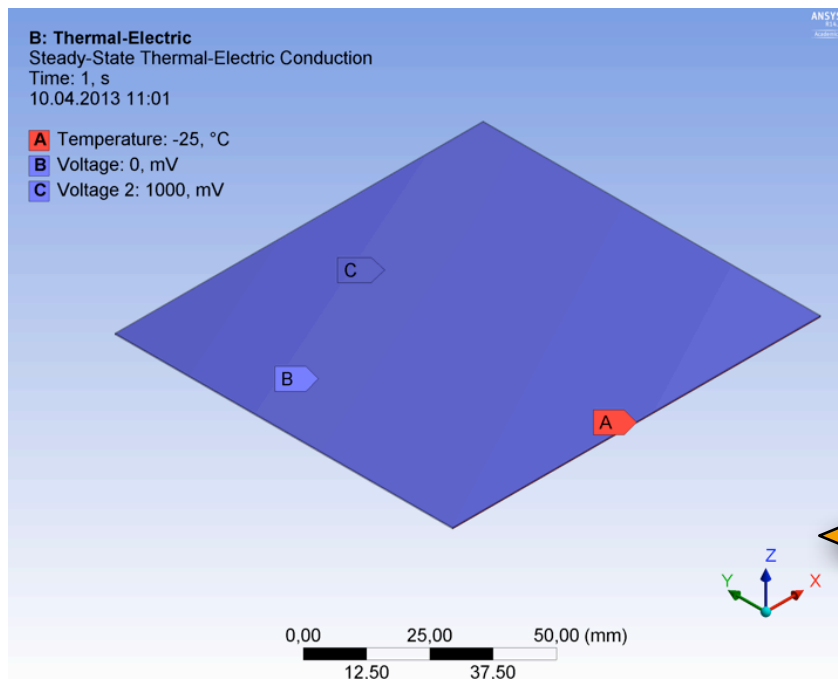
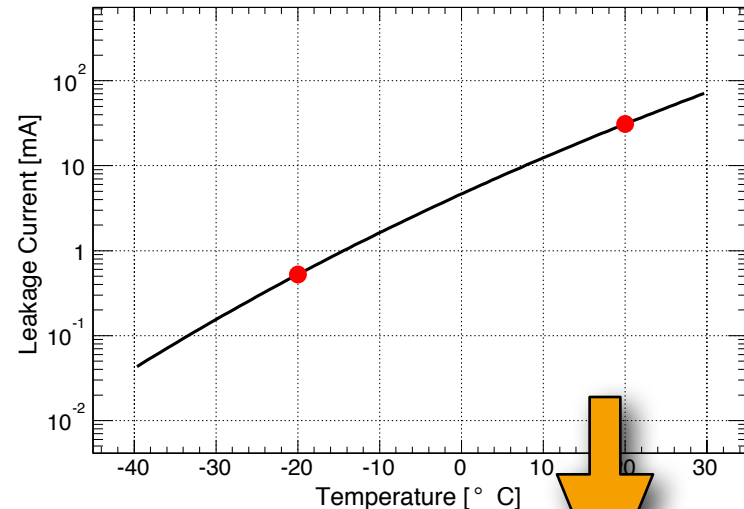
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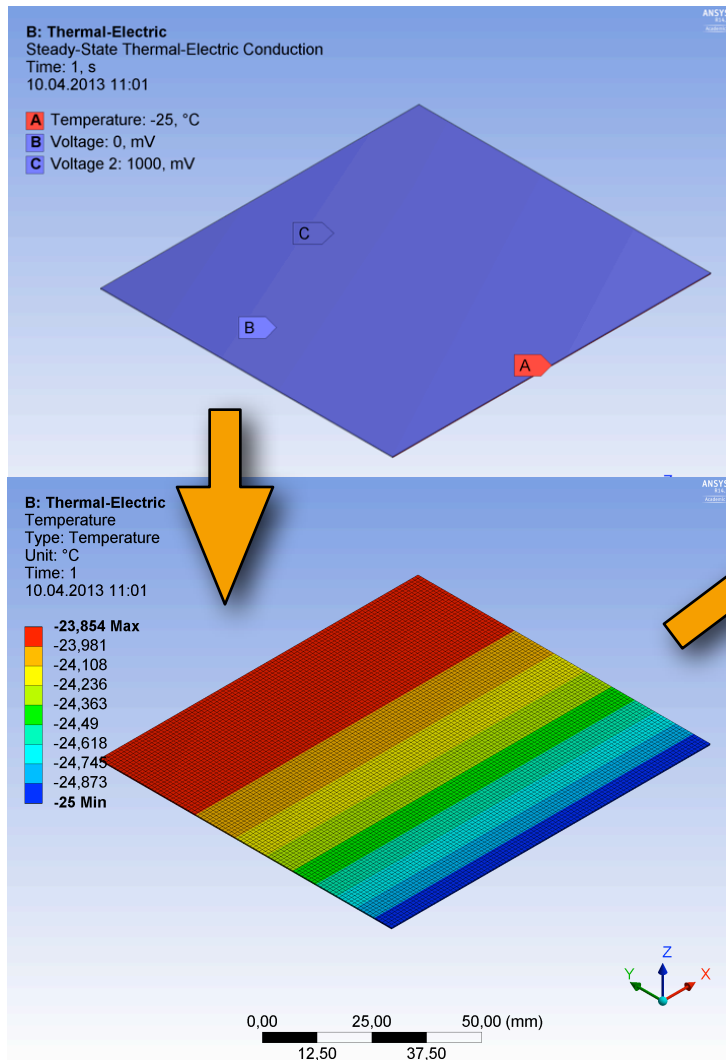
„Real“ Sensor Power Consumption

- > power consumption is a function of temperature
- > what we want/need a load with temperature dependent power consumption per finite element
- > both I-DEAS and ANSYS don't have such a feature
- > In ANSYS one can treat the sensor like a resistor
 - temperature dependence of power consumption is modeled via temp. dependence of resistivity
 - one „silicon“ material definition per irradiation

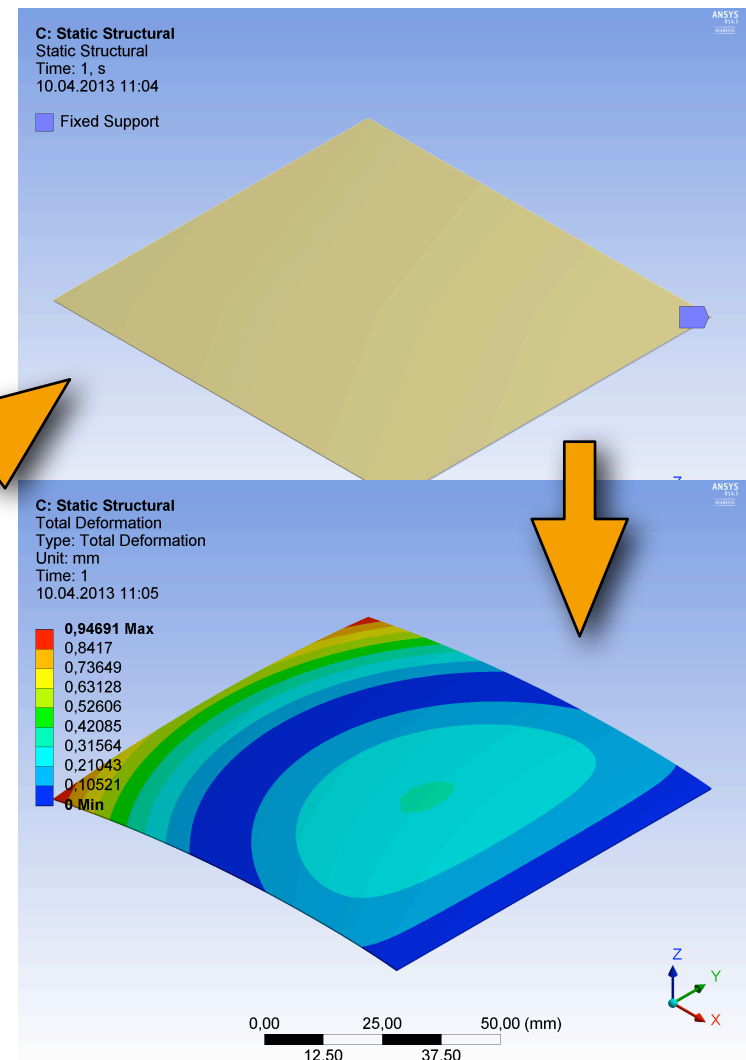


Coupling of Thermal and Structural FEA

Thermal

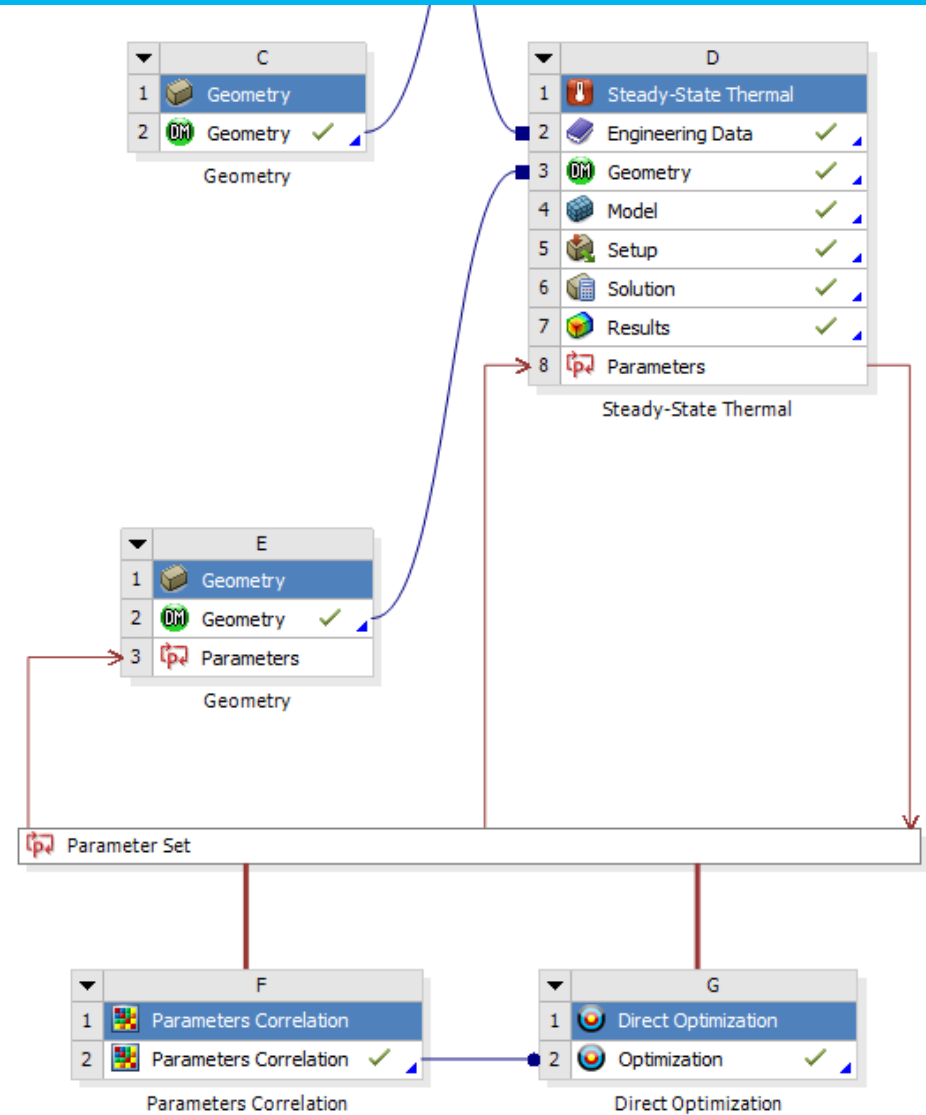
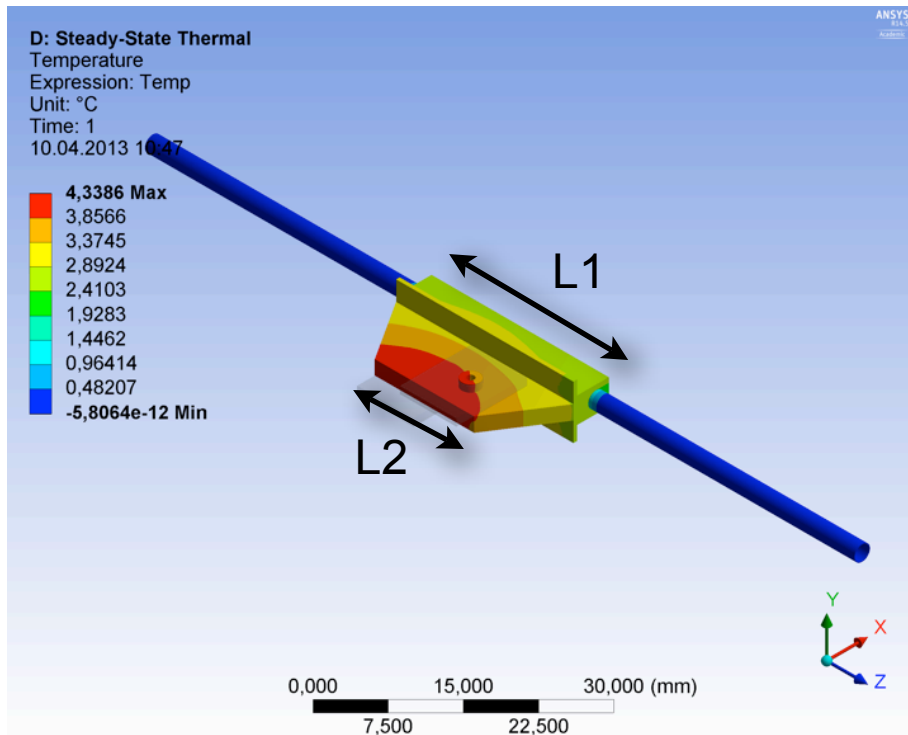


Structural

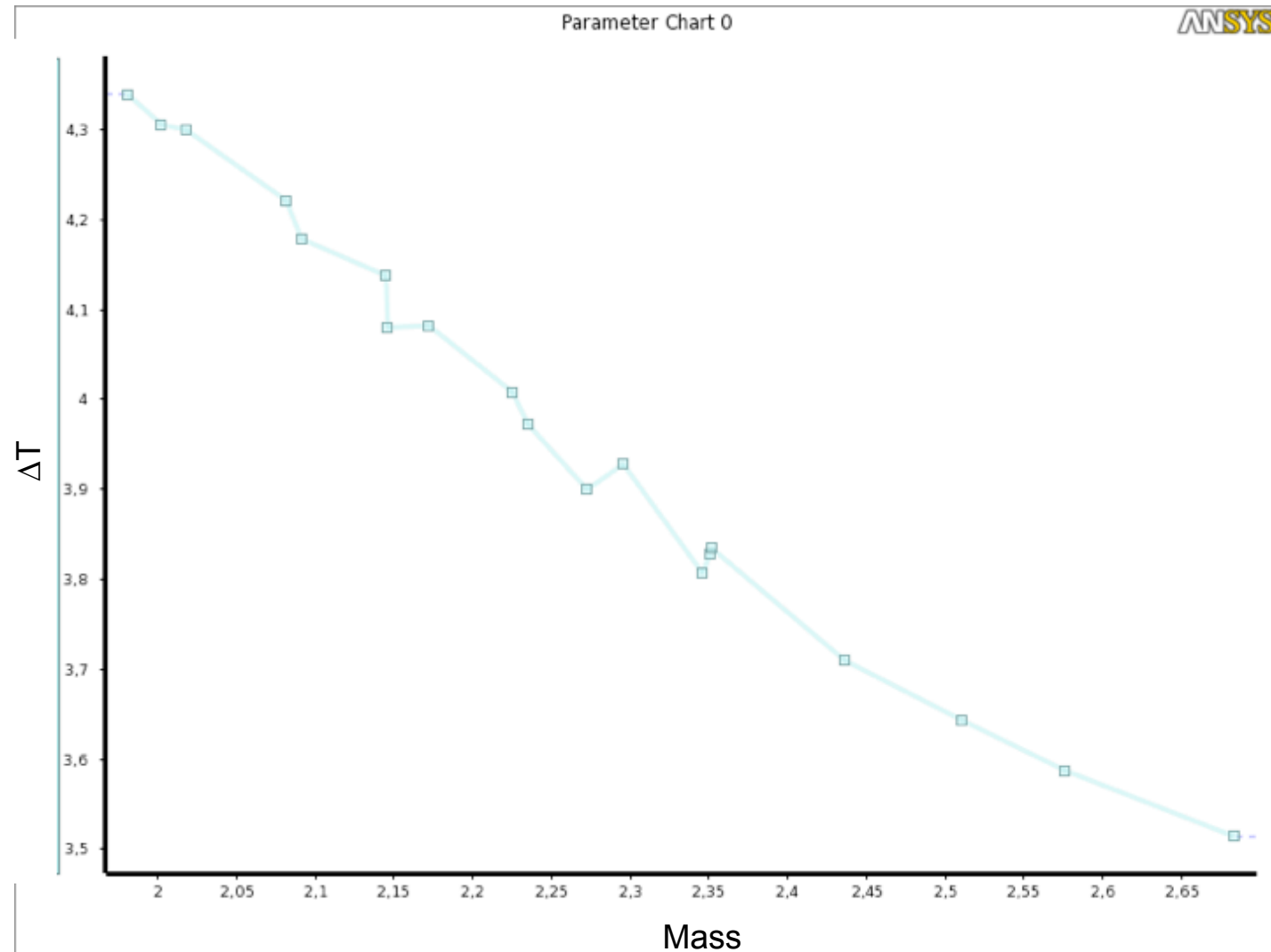


Design Optimization

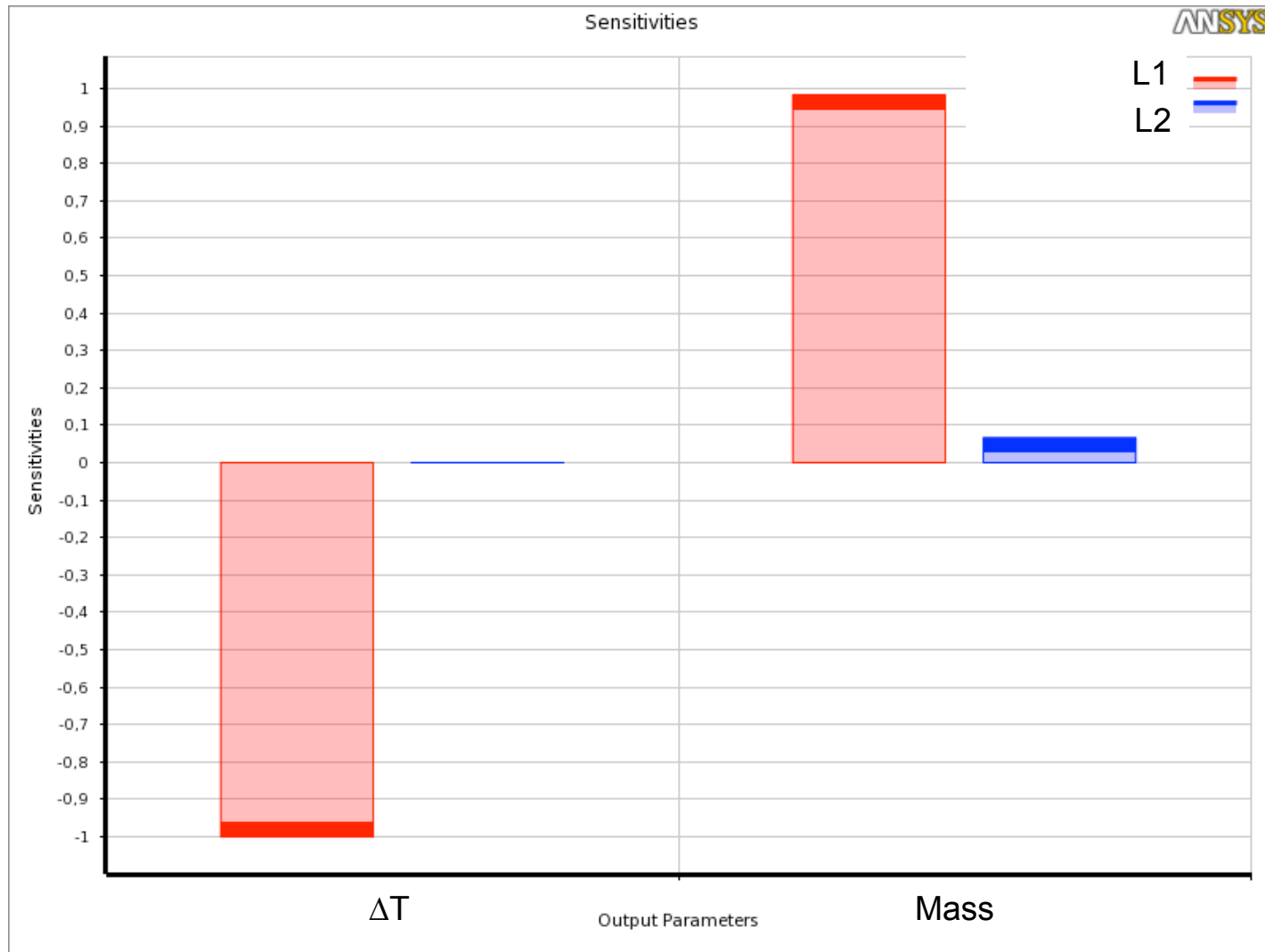
- optimization of support block on rod
 - variation of L1 and L2



Design Optimization - ΔT vs. Mass



Design Optimization - Sensitivity



Summary

- > ANSYS has quite a few advantages over I-DEAS
 - sensor power consumption can be modeled more realistically
 - allows for study of thermal runaway
 - better integration of CAD tools
 - faster turn-around
 - automated optimization options
 - workflows are typically more user friendly and more efficient

- > ZM1 is currently negotiating new license terms
 - three additional licenses requested by DESY groups

