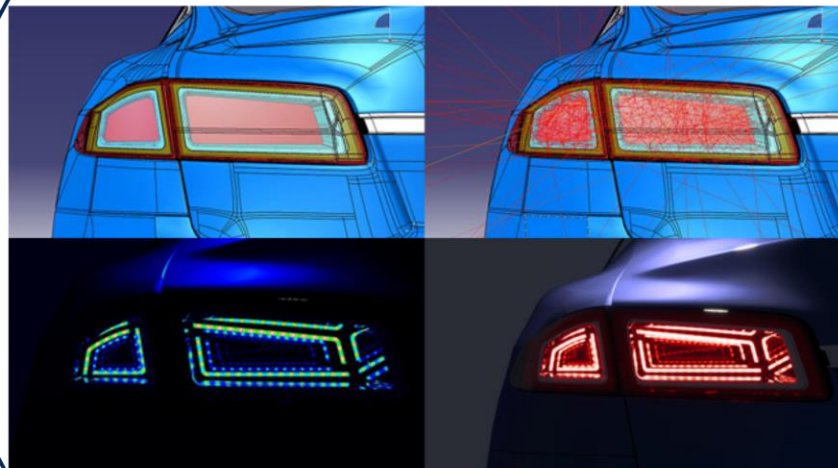
dynardo | presented at the 16th Weimar Optimization and Stochastic Days 2019 |
Source: www.dynardo.de/en/library

Optische Simulation unter thermo-mechanischen Einflüssen

Dr. Ervand Kandelaki
Business Development Manager
CADFEM GmbH

Weimar, 05.06.2019



Optische Simulation ist überall

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Optiksimulation – Virtual Prototyping

CADFEM

Was wird durch Virtual Prototyping ermöglicht?

- Fortschritt durch ERFAHRUNG
- Förderung der KREATIVITÄT
- Einfache KOMMUNIKATION
- Einsparung der KOSTEN
- Beitrag zur NACHHALTIGKEIT

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Optiksimulation: wie sieht das aus?

CADFEM

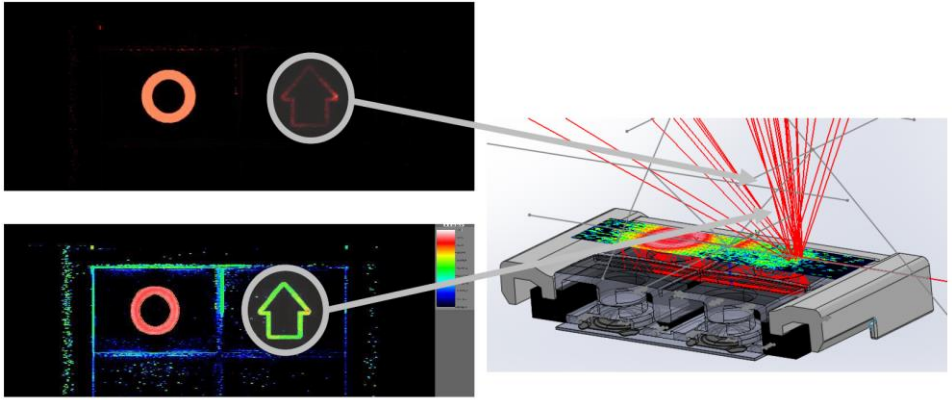
Menschliche Wahrnehmung

Bestrahlungsstärke
(irradiance)

Strahldichte
(radiance)

Beleuchtungsstärke
(illuminance)

Leuchtdichte
(luminance)



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Optiksimulation – getreu der Realität

Statische Optik	Echtzeitsimulation	Messgeräte
CAD-integriert (NX/Creo) oder Stand-alone (SCDM-basiert)	Driving Simulator, Sensors, Headlamp, Perceived Quality	Portabel oder Festinstalliert
Raytracing-Solver Monte-Carlo Algorithmen Sichtbares Licht + UV + IR	Dynamische Simulation Physik-basiert GPU-beschleunigt	Reflexionscharakteristik Daten für SPEOS/VRXPERIENCE Reale Materialien simulieren

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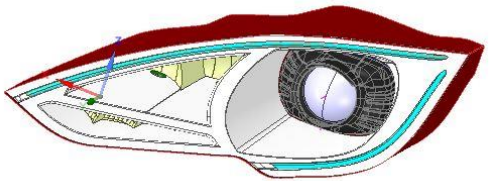
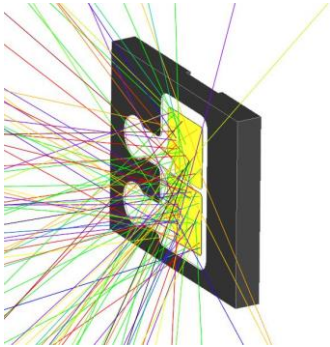
Aufbau der optischen Simulation

CADFEM

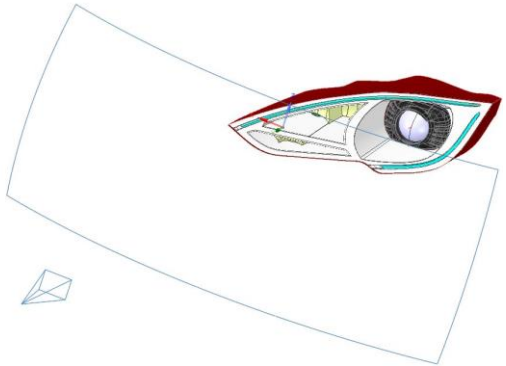
Geometrie



Quellen



Sensoren



Simulation

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OMD Messgeräte

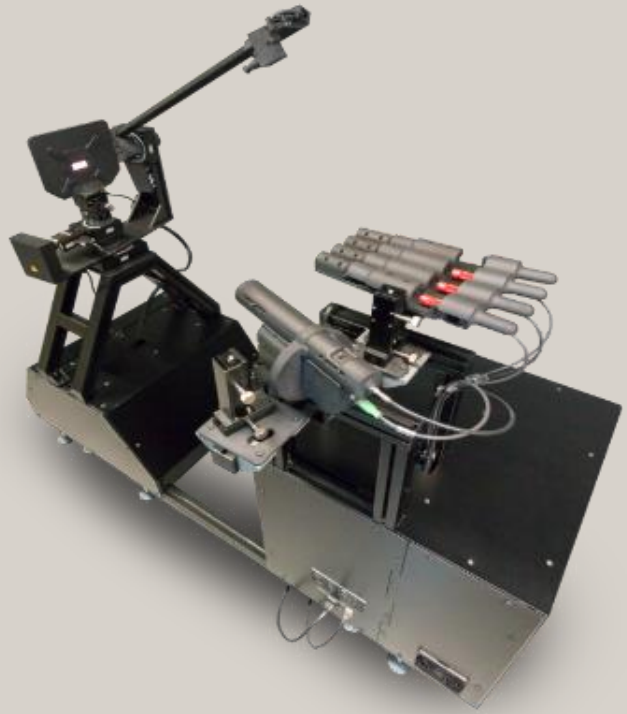
Materialien genau beschreiben

1| Portabel

Schnell, flexibel

2| Festinstalliert

Erweiterte, detaillierte Messung



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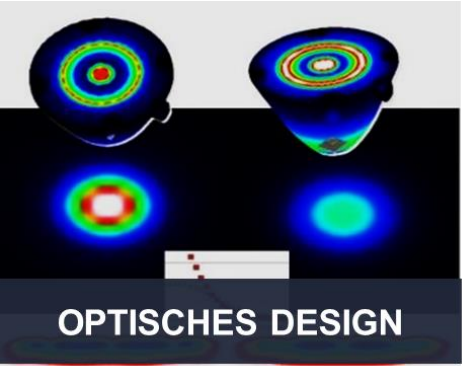
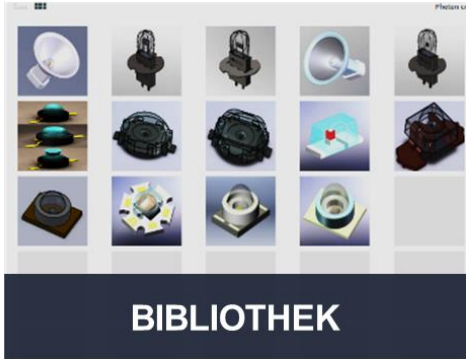
SPEOS – von Design zur Validierung





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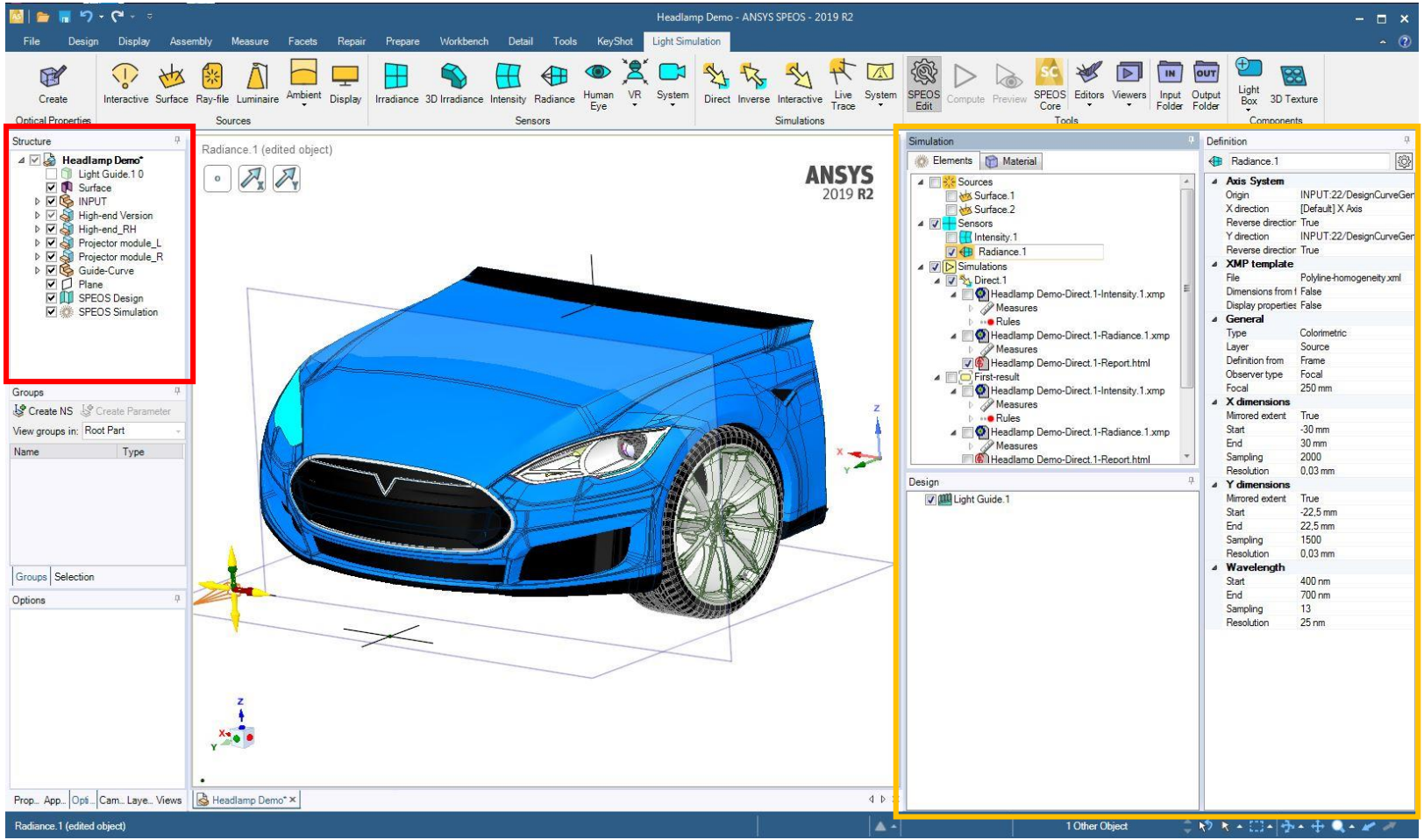
SPEOS – Oberfläche



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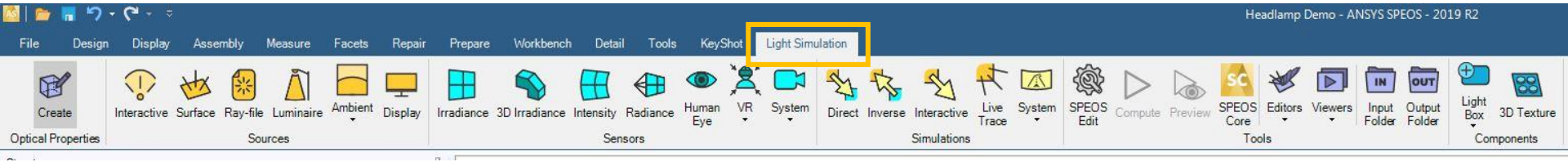
SPEOS – Funktionalität

SpaceClaim Direct Modeler + (SPEOS) Optical Part Design

Light Simulation – ANSYS SPEOS Funktionalität für optische Simulationen



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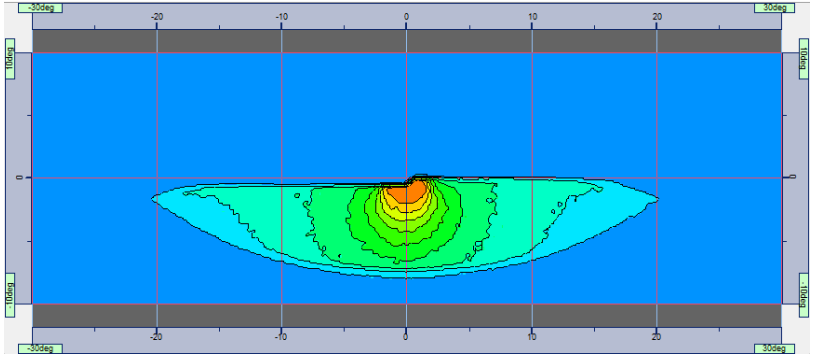
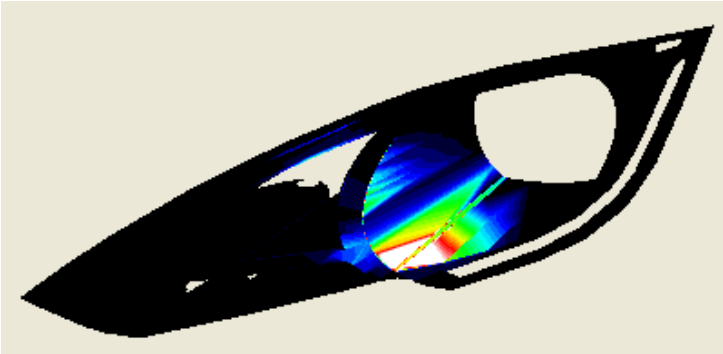
SPEOS – Optische Simulation

Photometrie





Kolorimetrie

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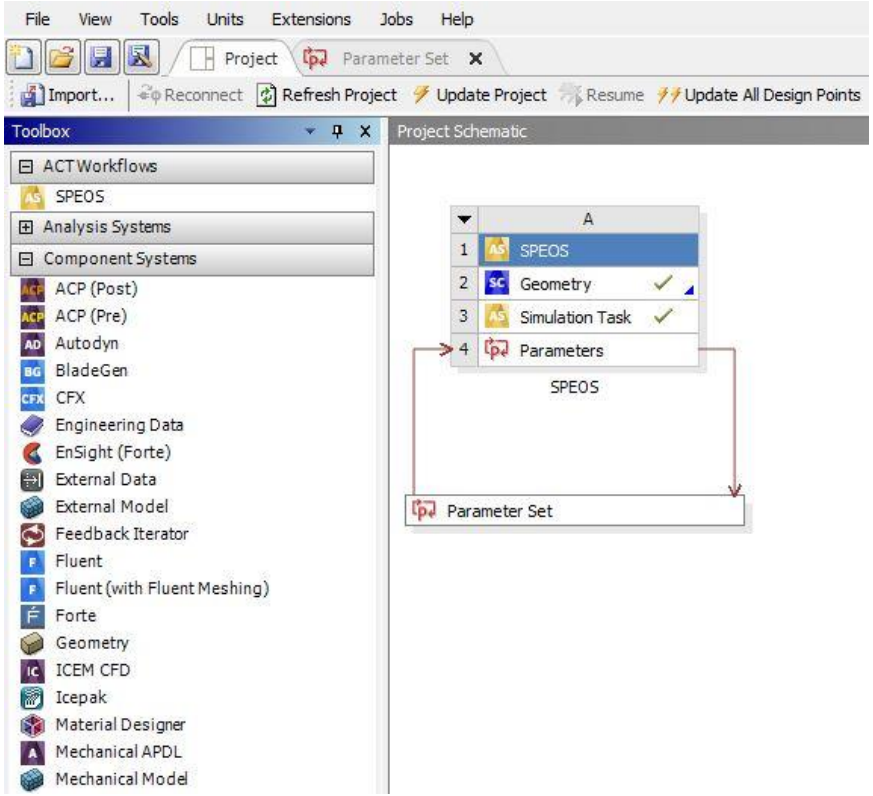
Workbench – Integration



Anbindung an andere Simulationstools

ANSYS Mechanical

ANSYS CFD

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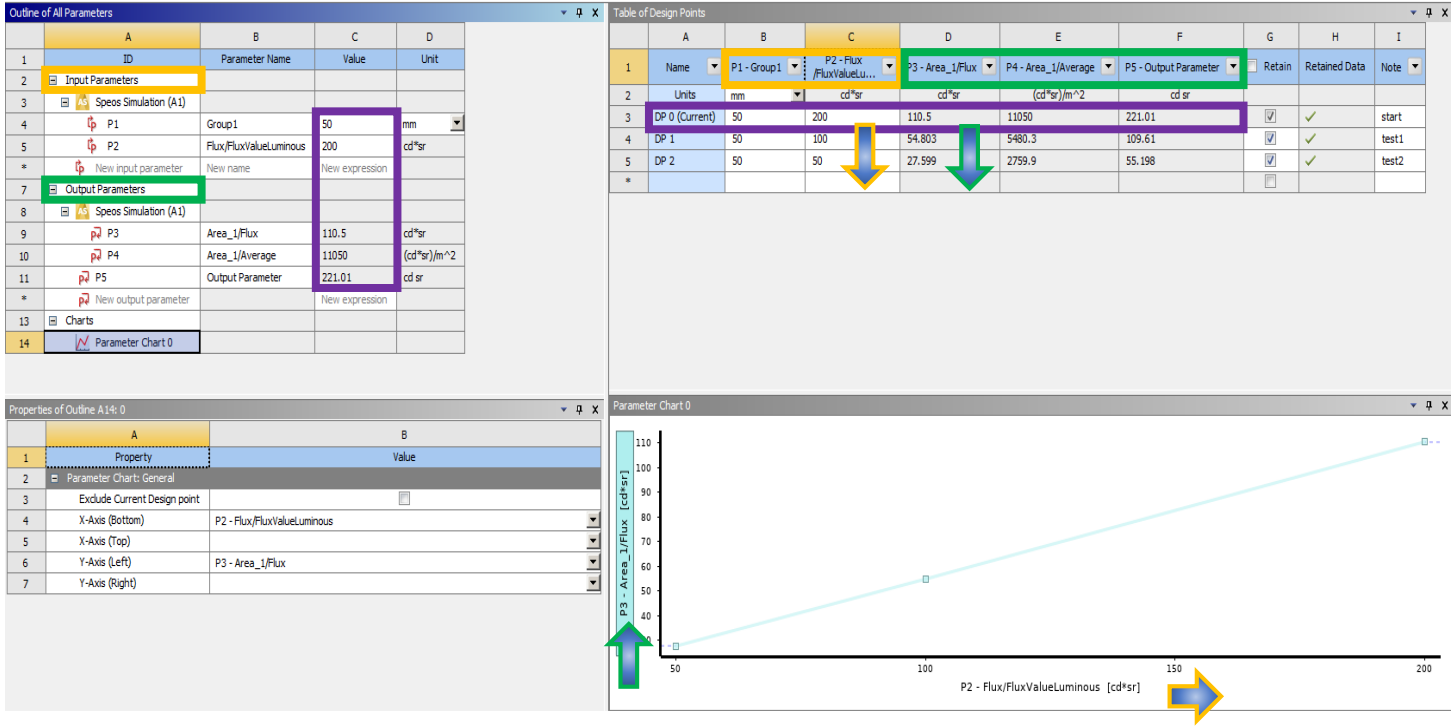
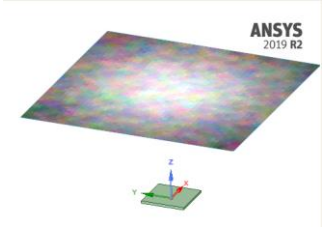
Workbench – Optimierung





Schnittstelle für Automatisierung → optiSLang

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Einflüsse durch Struktur-/Thermomechanik

- Strukturmechanische Verformung
  - Druck, Pressanpassungen
- Thermomechanische Verformung
  - Interne und externe Wärmequellen
- Veränderung von Materialeigenschaften
  - Brechungsindex abhängig von Temperatur

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Struktur- und Thermomechanik in optischen Systemen

Beispiel: Linsensystem

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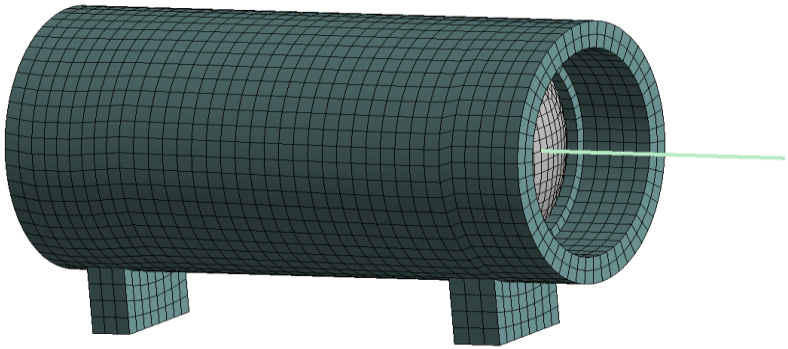
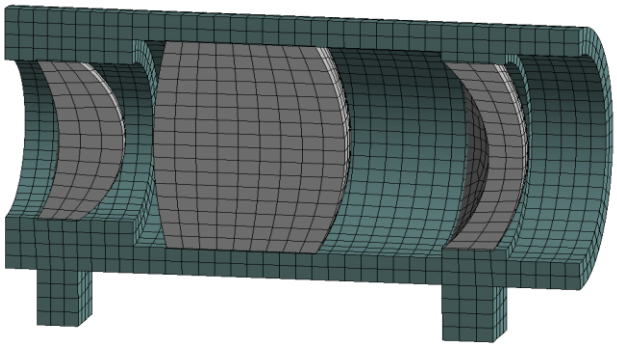
Modell



Finite-Elemente-Modell



Halbmodell

Quelle: CADFEM / LightTrans

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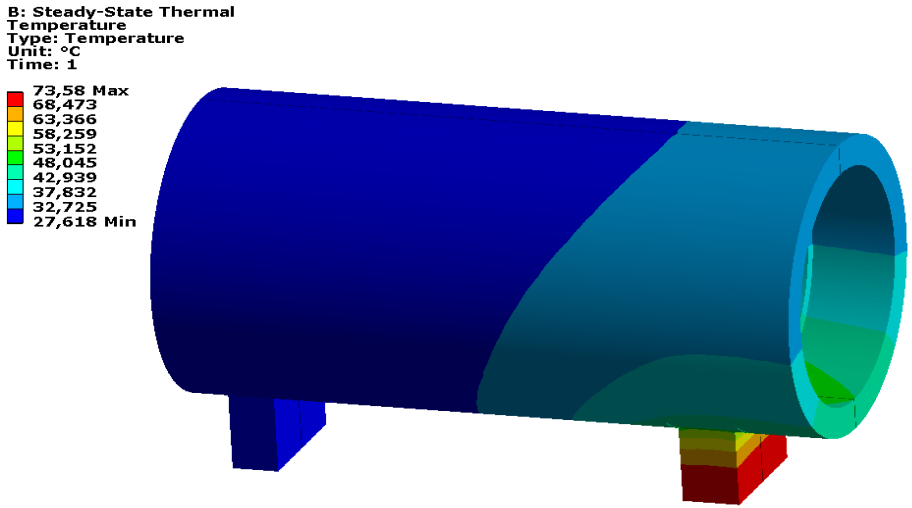
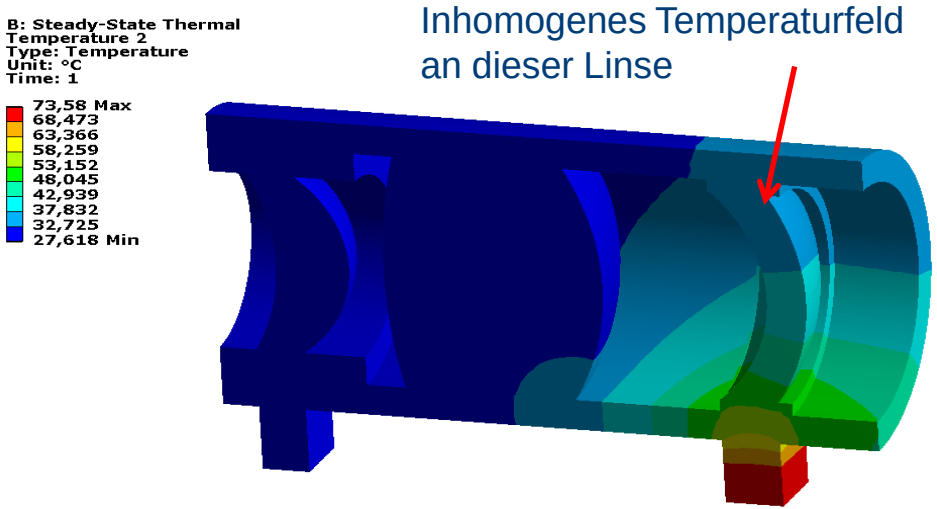
Temperaturfeld





Inhomogenes Temperaturfeld an dieser Linse

Quelle: CADFEM / LightTrans

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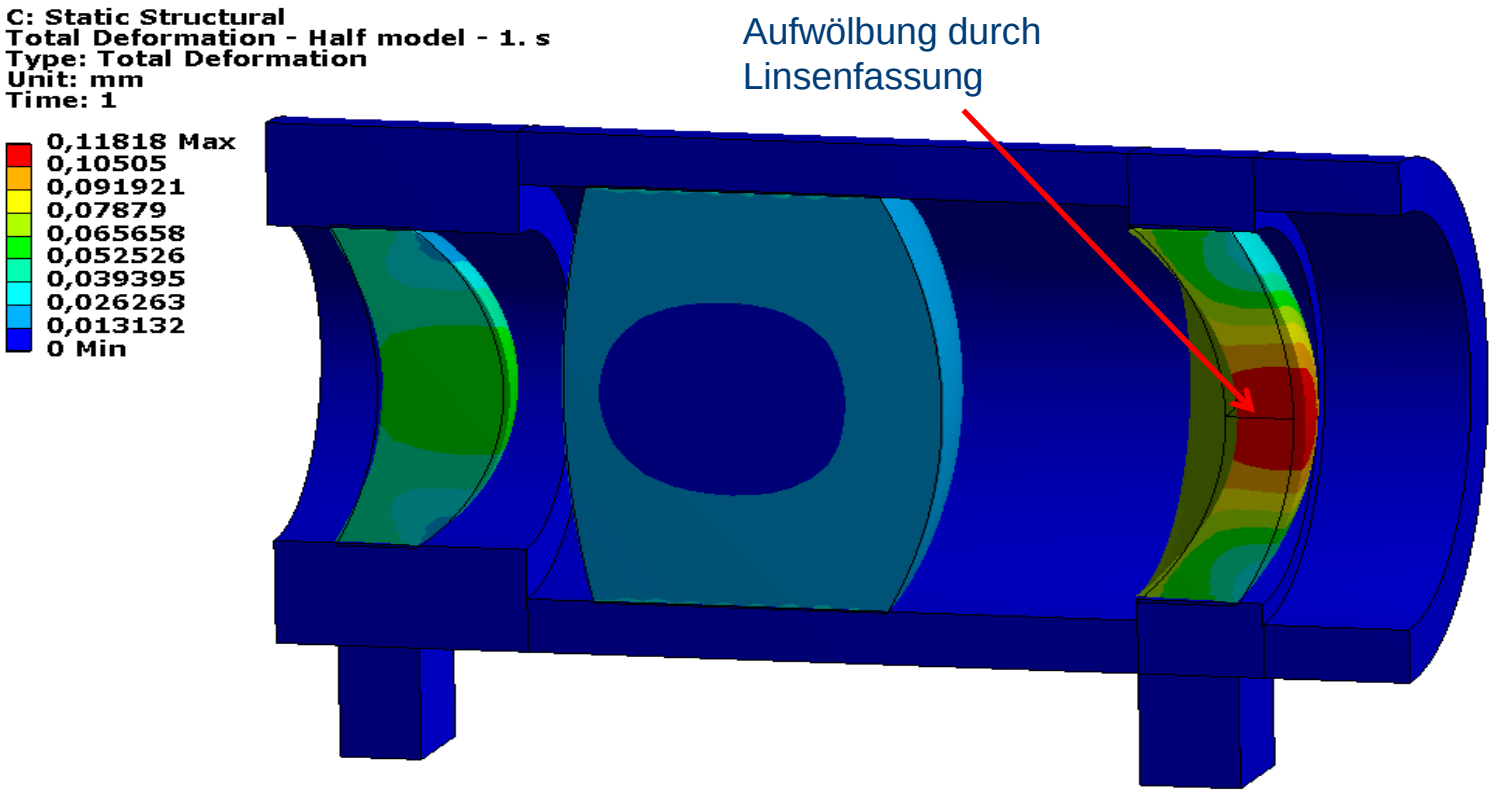
Verformung durch Presspassungen



Quelle: CADFEM / LightTrans

(2fach überhöht dargestellt)

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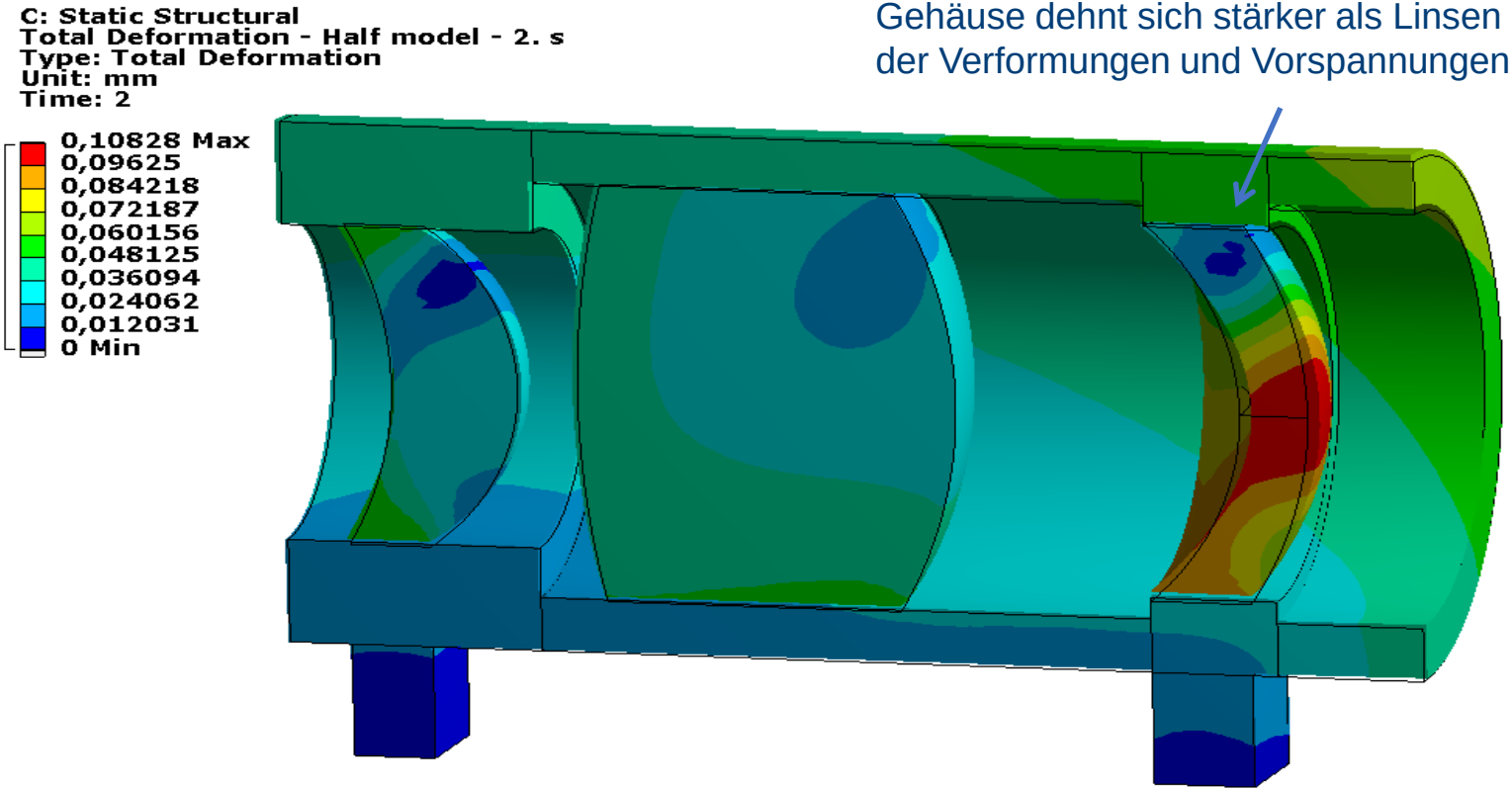
Verformung Presspassungen und Wärme

Gehäuse dehnt sich stärker als Linsen => Relaxation der Verformungen und Vorspannungen



Quelle: CADFEM / LightTrans

(2fach überhöht dargestellt)

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Kopplung von optischer und mechanischer Simulation
Beispiel: Lidar

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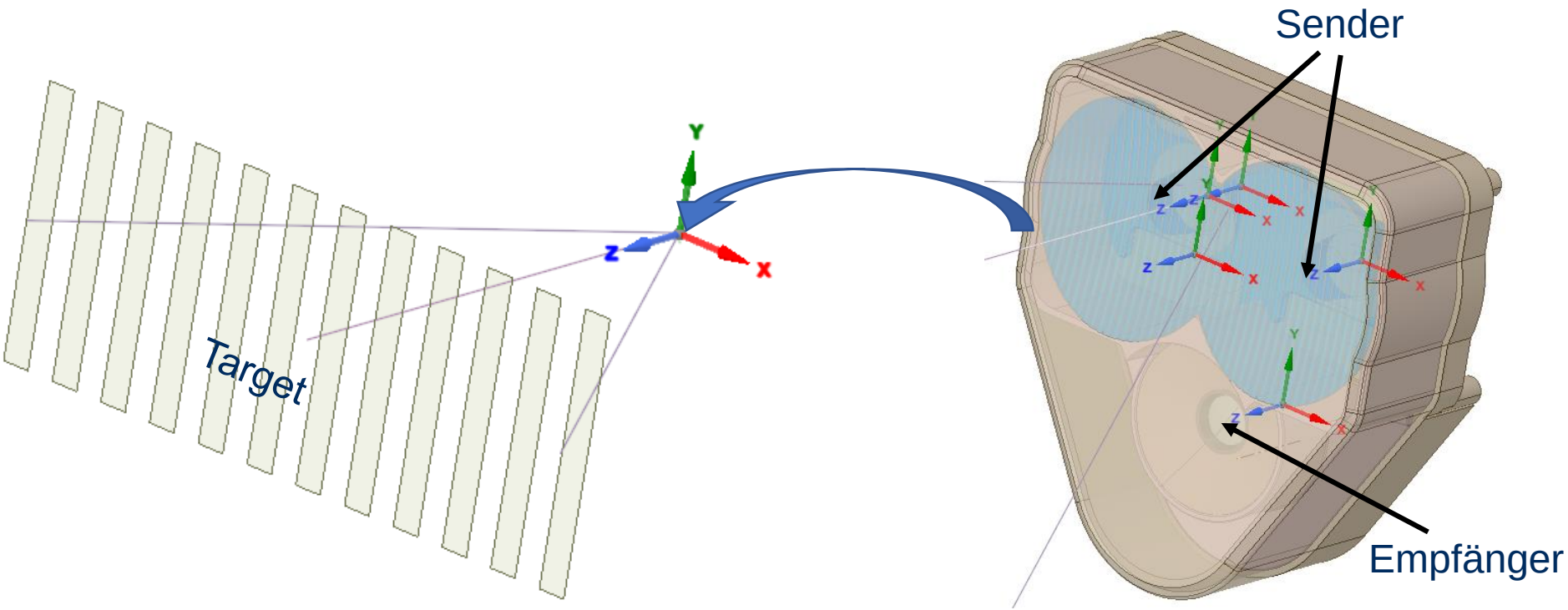
Modell



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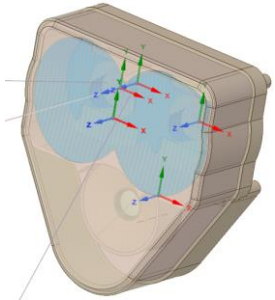
Workflow Optik + Mechanik

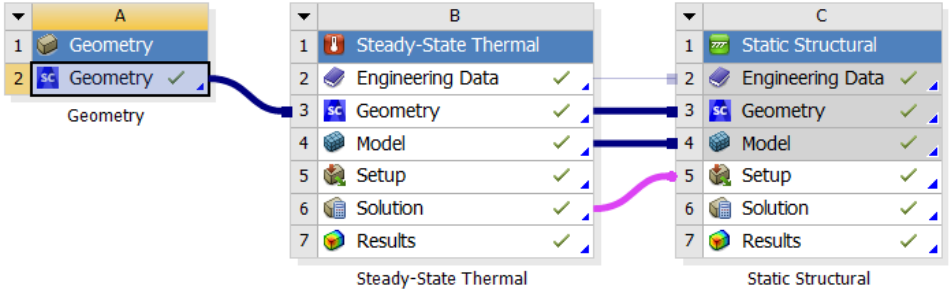
CADFEM

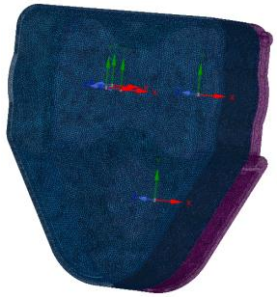
Optiksimulation
ANSYS SPEOS
ursprüngliches Design

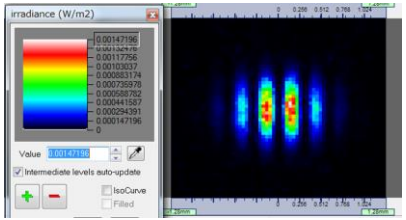
Thermo- & Strukturmechanik
ANSYS Workbench
ANSYS Mechanical

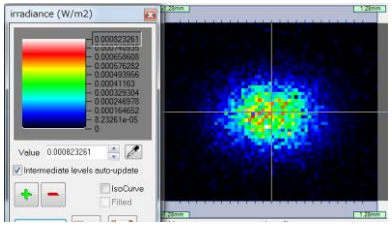
Optiksimulation
ANSYS SPEOS
verformtes Design











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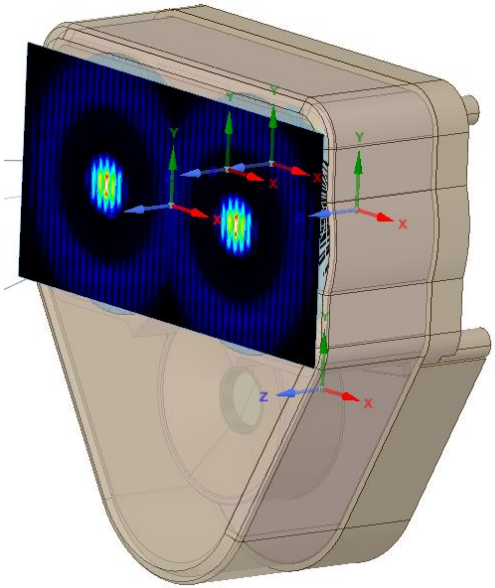
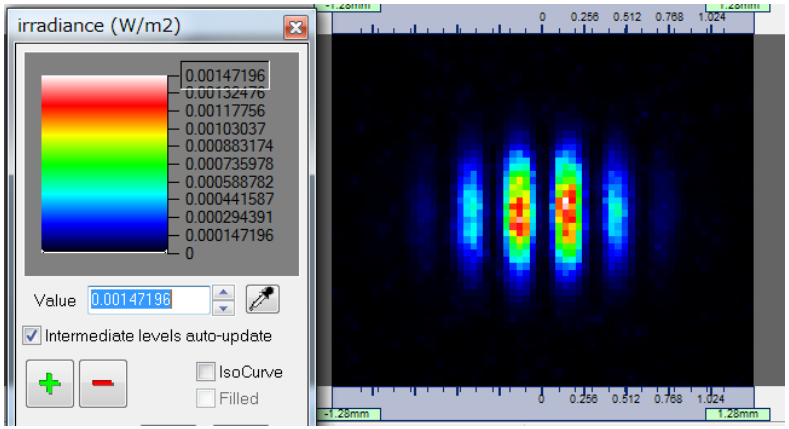
Optiksimulation Ursprüngliches Design





Simulationsergebnis:

Target auflösbar

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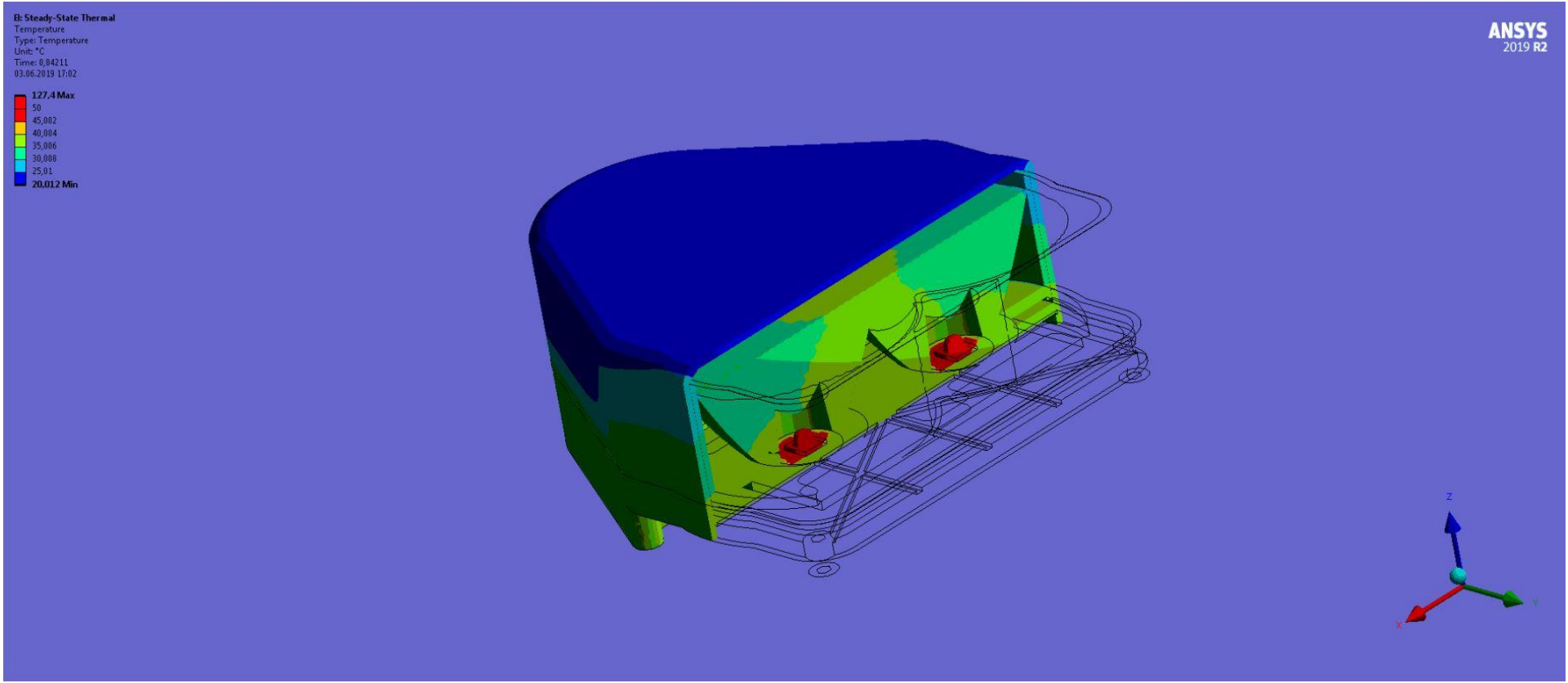
Temperaturfeld



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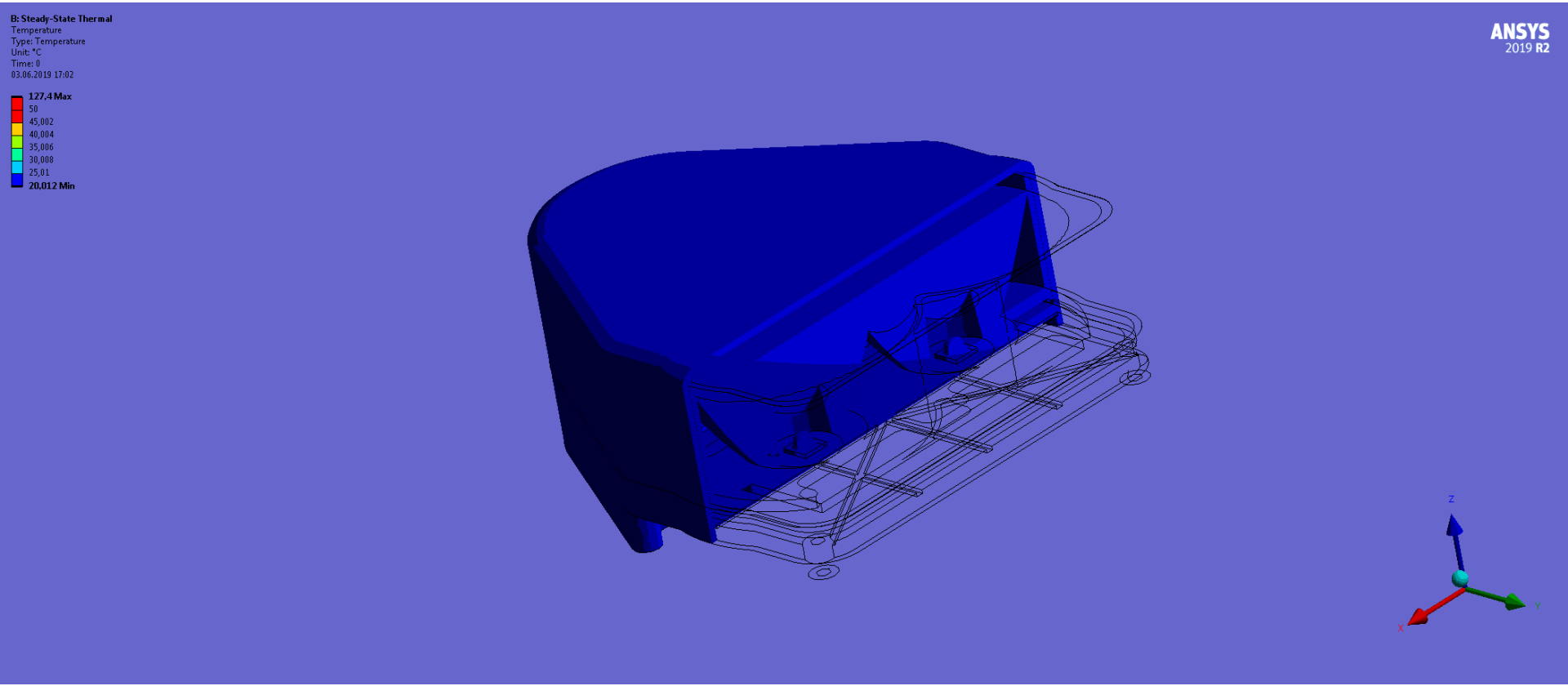
Temperaturfeld – Animation



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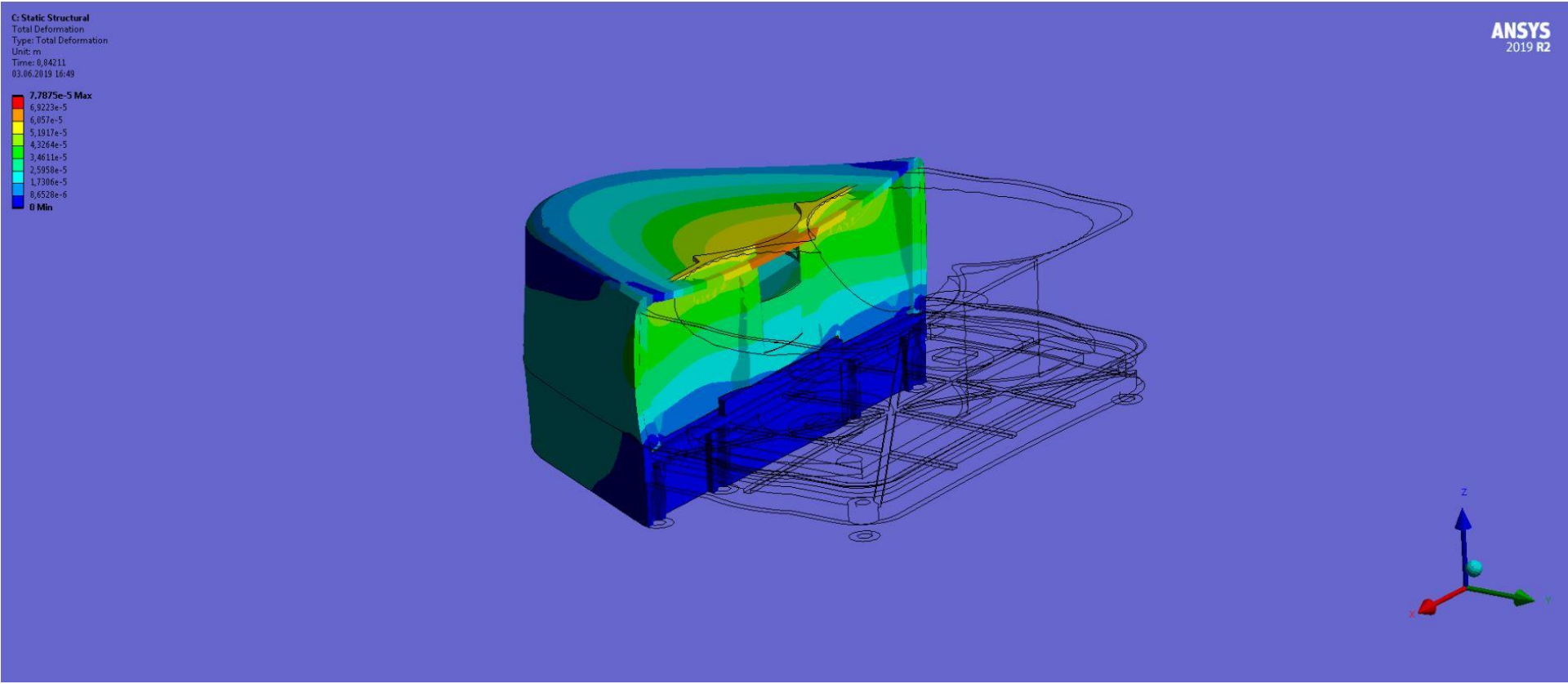
Verformung durch Wärme



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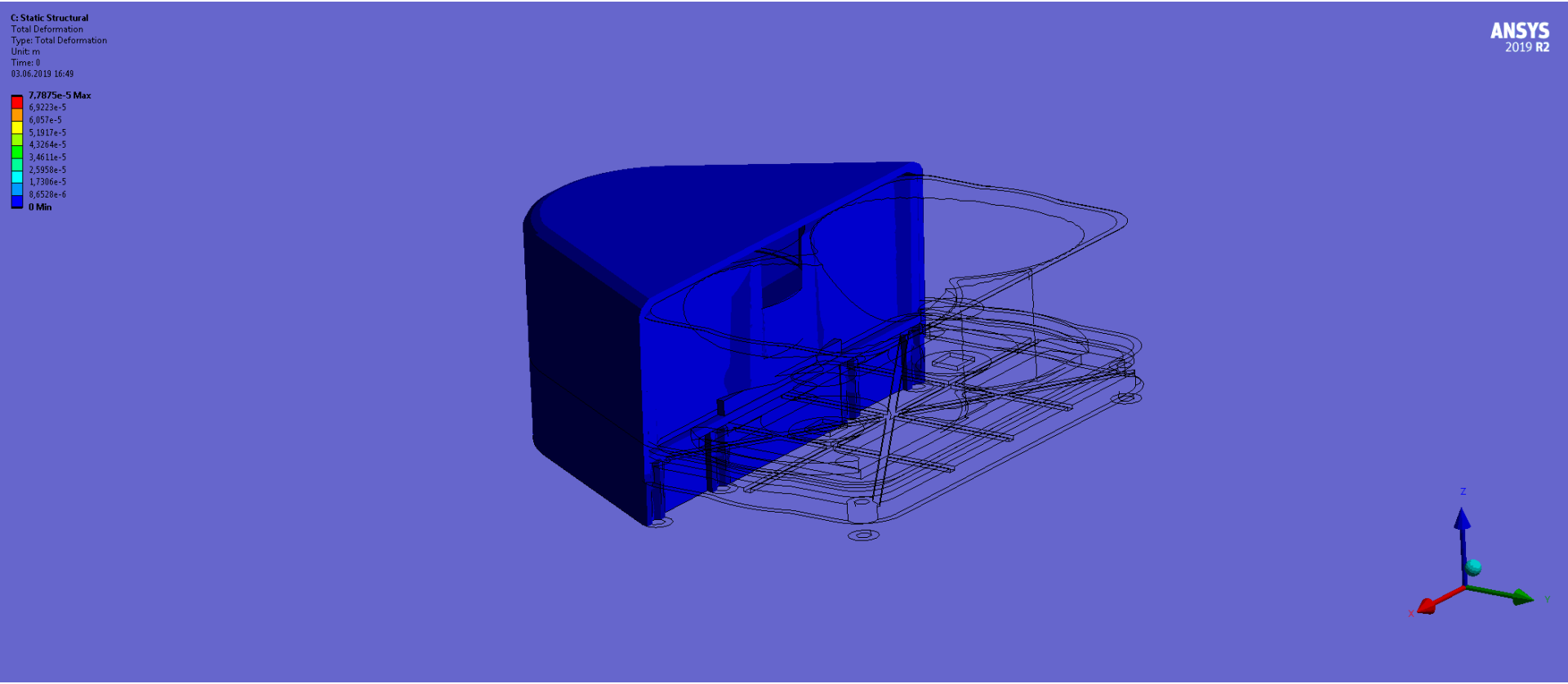
Verformung durch Wärme – Animation



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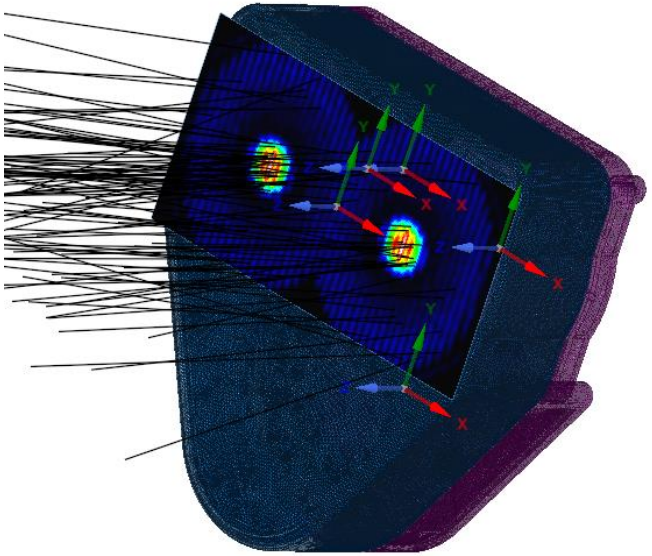
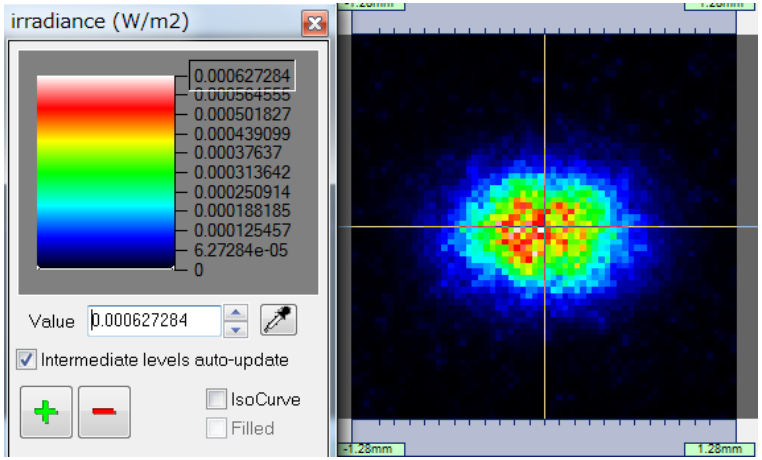
Optiksimulation Design mit Verformungen





Simulationsergebnis:

Target nicht mehr auflösbar

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Zusammenfassung

- Detaillierte Optiksimulation mit ANSYS SPEOS
- Effizienter Workflow dank ANSYS Workbench
- Anbindung an Struktur-,Thermomechanik, CFD, …
- Optimierung – auch mit optiSLang

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