ptc

LIVEWORX

A NEW ERA IN PRODUCT LIFECYCLE INNOVATION

DAKTRONICS

SESSION ID: CA1465C

CREO FLOW ANALYSIS AND COMPUTATIONAL FLUID DYNAMICS: DAKTRONICS CASE STUDY

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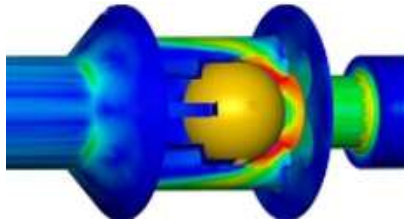
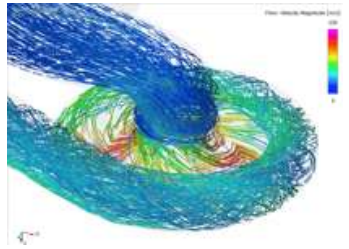
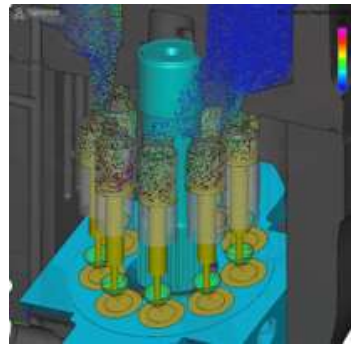
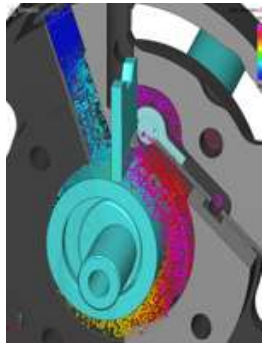
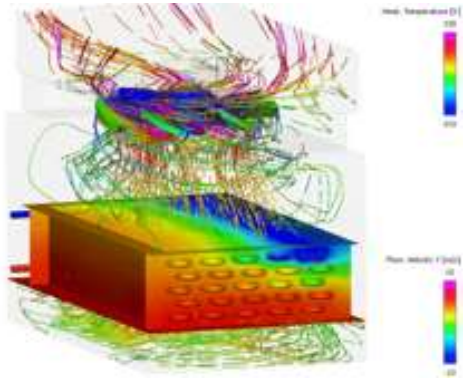
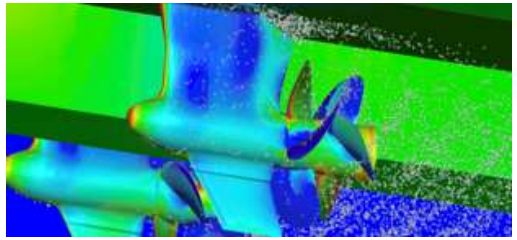
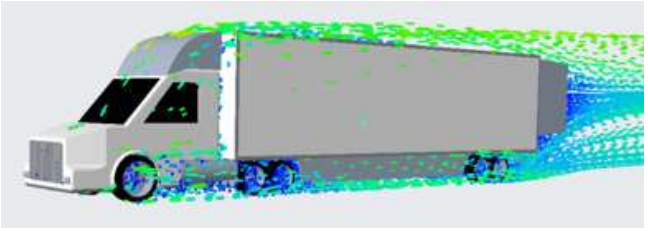
Wednesday, May 17, 2023

CREO FLOW ANALYSIS

Capabilities

- Three levels: Base, Advanced, and Premium
- Calculate internal/external flows, heat transfer and turbulence
- Particle simulation
- Radiation
- Multi-species and multi-phase simulation
- More

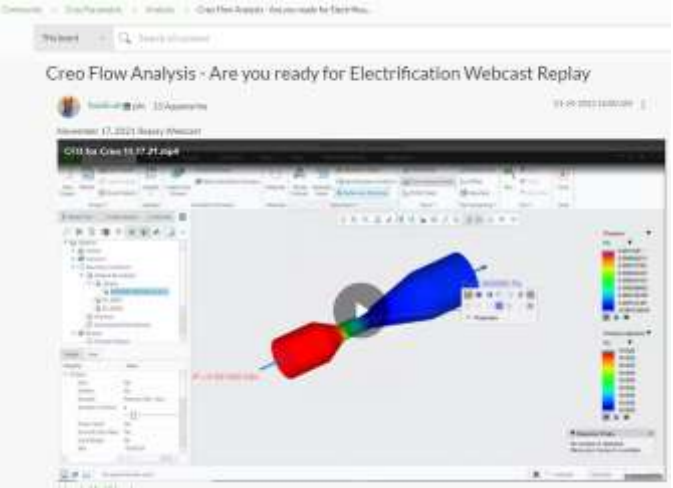
Analyst level functionality for Creo users

High performance solver

Creo 4.0 M040+ Digital fluids into your PTC Digital thread

Fully integrated in PTC Creo

CREO FLOW ANALYSIS



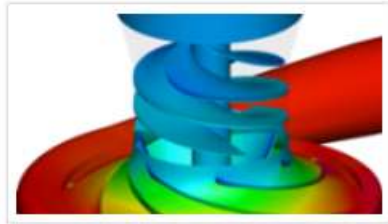
- Significant Development in Creo 9.0
  - Multi-project, usability, behavioral modeling, gyroids, post processing
- 400+ active unique customers with 1500+ active seats
- Webcasts – all in PTC Commununity

  - June 24, 2020 – CFD 101 Video Replay > CFD 101
  - August 19, 2020 – CFD 102 Video Replay > CFD 102
  - November 12, 2020 – CFD 201 Video Replay > CFD 201
  - Feb 17, 2021 – CFA – Evaluating Gyroids and Lattices Video Replay > CFA Gyroids-Lattices
  - May 19, 2021 – CFD for All Video Replay > CFD For All
  - November 17, 2021 – CFA – Are you ready for Electrification > Electrification
  - April 6, 2022 – CFA – Using CFD in Creo to Accelerate Prototypes > Prototypes
  - November 30, 2022 – Creo Flow Analysis (Creo 9.0) Tips and Techniques > Tips and Techniques
  - CFA How To Video Series > CFA Video Series

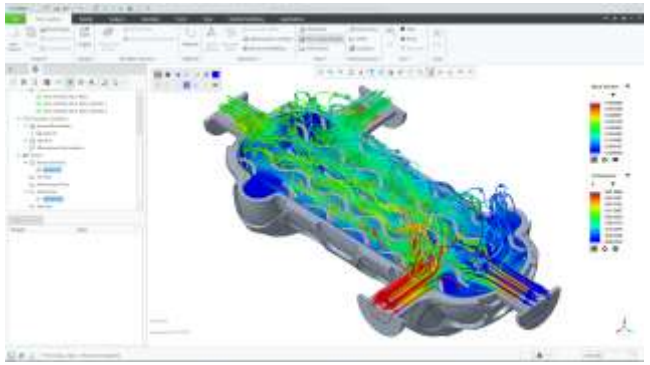
CREO FLOW ANALYSIS – PACKAGE OVERVIEW

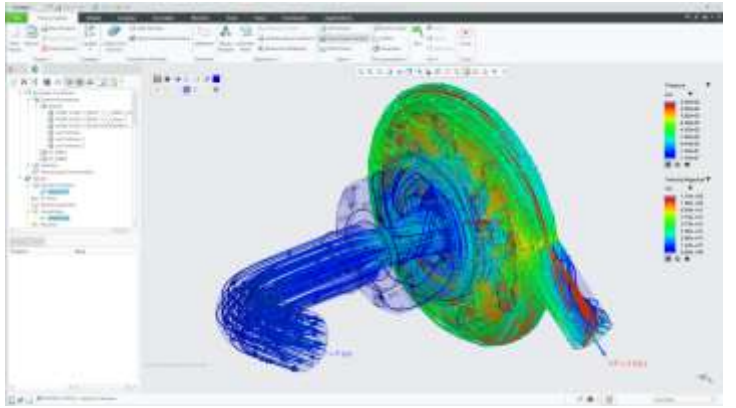
Capability	Creo Flow Analysis	Creo Flow Analysis Advanced	Creo Flow Analysis Premium
Calculate Internal and External Flows	✓	✓	✓
Animate Flow results in real-time	✓	✓	✓
Parallel Processing Simulation	✓	✓	✓
Analysis Types			
Simulate Flow	✓	✓	✓
Heat Transfer	✓	✓	✓
Turbulence	✓	✓	✓
Particle		✓	✓
Radiation		✓	✓
Species		✓	✓
Moving/Sliding Meshing		✓	✓
Cavitation			✓
Multiphase			✓
Multicomponent			✓
Dynamics			✓

- **Species Simulation -** Simulate mixing of **LIQUIDS** with similar density
- **Multiphase -** Used when simulating **Gas and Liquid** together
- **Multicomponent -** Another mixing capability used for multiple **Gases and density**
- **Dynamics -** Simulates **FLUIDS and SOLIDS** interaction
- **Cavitation -** Simulates **Vapor, Free Gas and Liquid (bubbles)** compressibility



TOP 5 CAPABILITIES OF CREO FLOW ANALYSIS





1. Fully Associative to Creo and integrated with PTC Digital Thread

2. Mesher Automatic and Body Fitted to Creo - even when fluid volumes rotate and slide!

3. Mesher applies Physics properly, automatic mesh separation and complete system calculations--Fluids, Heat/Thermal, Multiphase. It knows!

4. Fast solve time (due to efficient mesh and fewer solver iterations) and prototype accuracy (in all CFA cases up to 8 cores)

5. Paint in real time on Creo assembly/part/body--priceless!

WE ARE DAKTRONICS

WORLD LEADER

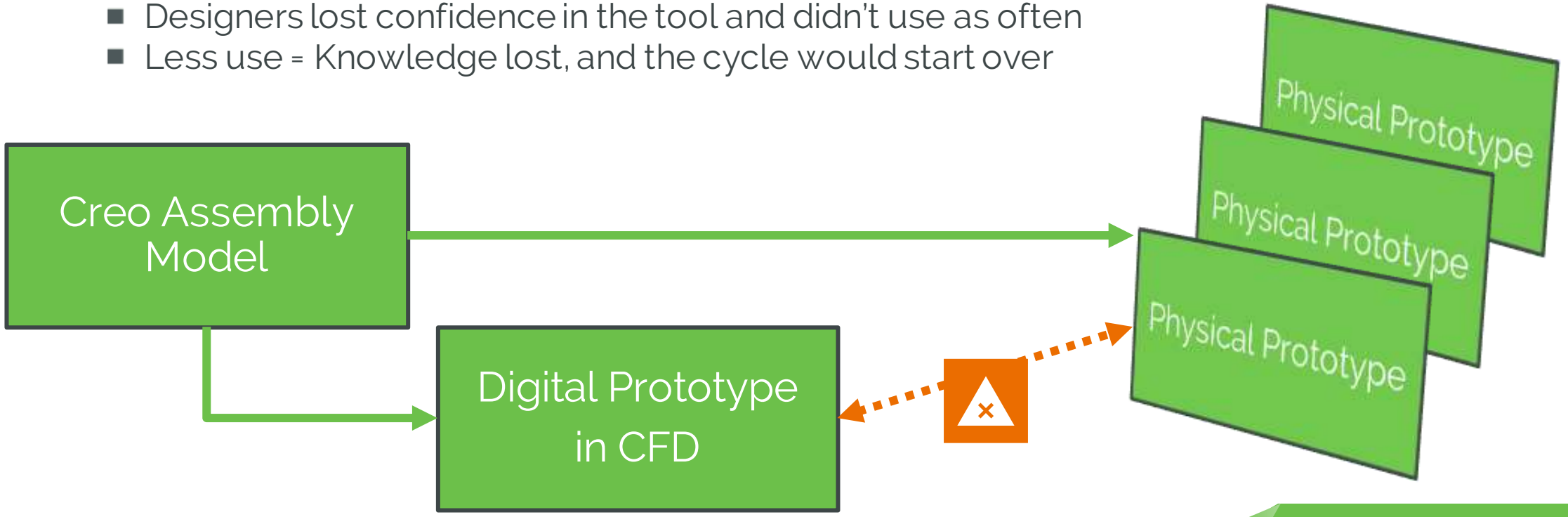
- No doubt you've seen our life's work!
  - Smallest of High Schools to the Largest of Stadiums
  - Convenient Stores to Large Outdoor Metropolitan Areas
  - Metro Stations to Digital Billboards

MORE THAN MEETS THE EYE

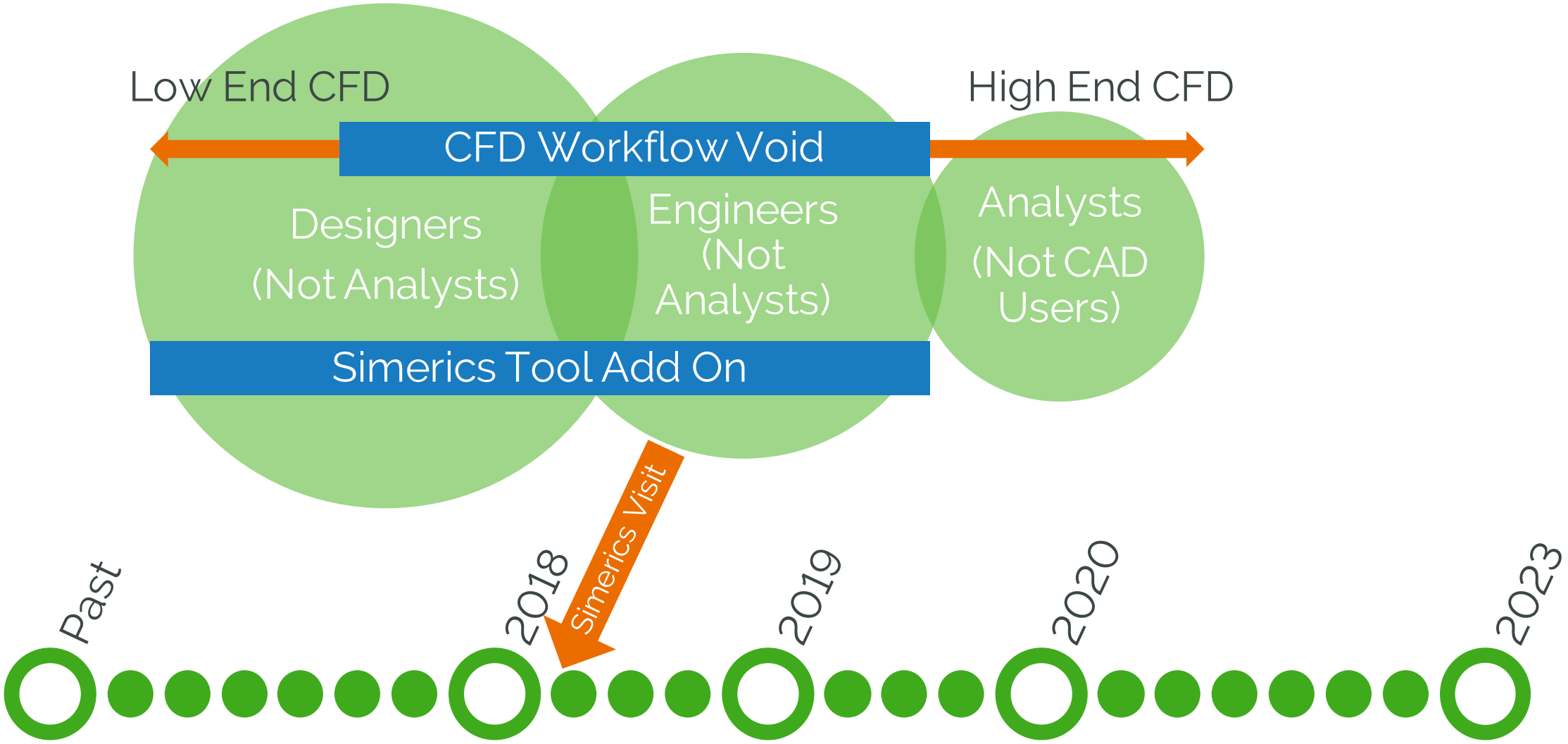
- Most people see the installation and digital content
- Many Design and Installation Considerations to factor in
  - Structural
  - Environmental
  - Power/Signal
  - Heat Management
  - Noise

HEAT MANAGEMENT

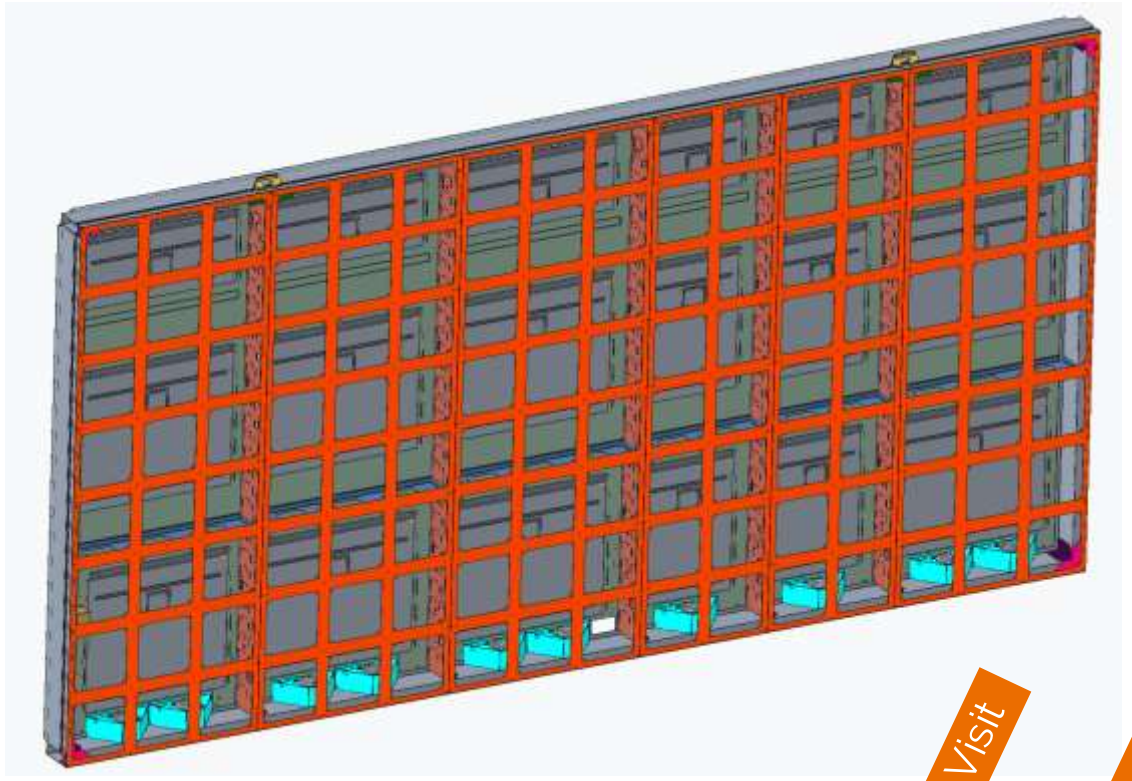
- Daktronics struggled to find a reliable CFD Analysis Software
- Lots of Prototyping and Testing
- Autodesk CFD
  - Tough learning curve
  - Results did not match our real-world testing.
  - Designers lost confidence in the tool and didn't use as often
  - Less use = Knowledge lost, and the cycle would start over

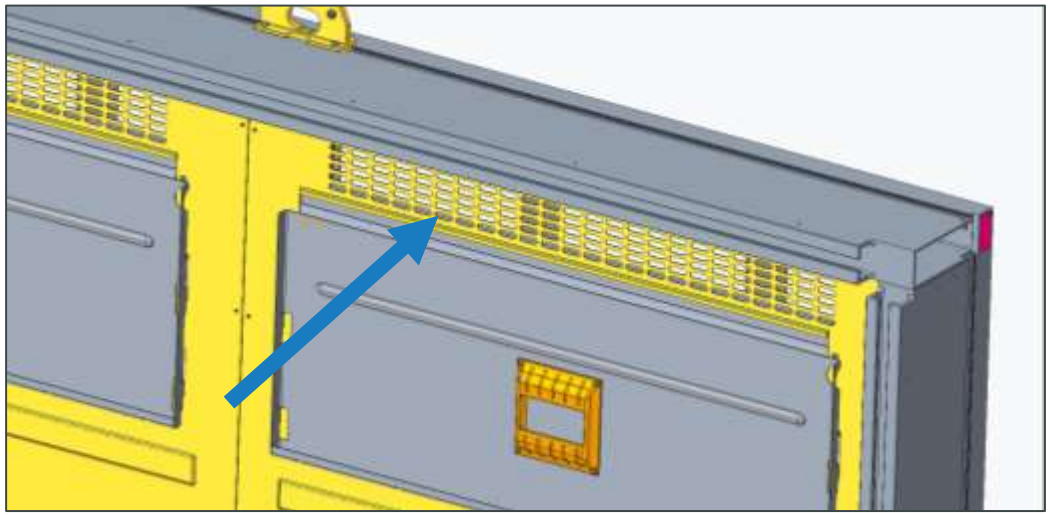


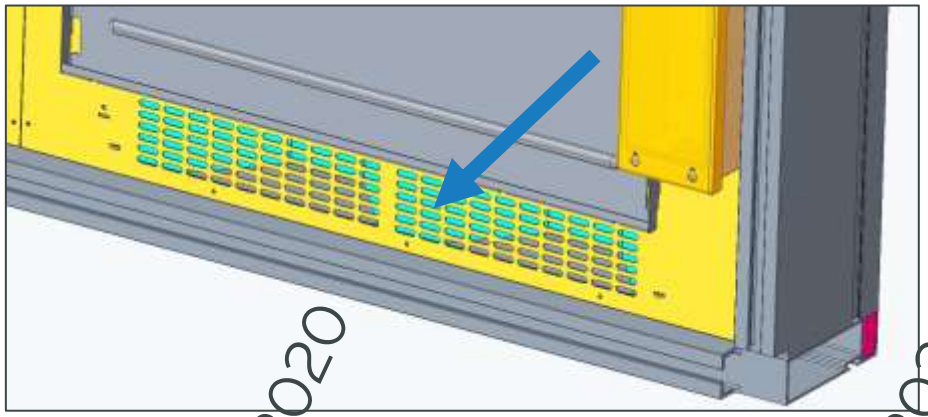
EARLY DISCUSSIONS WITH SIMERICS

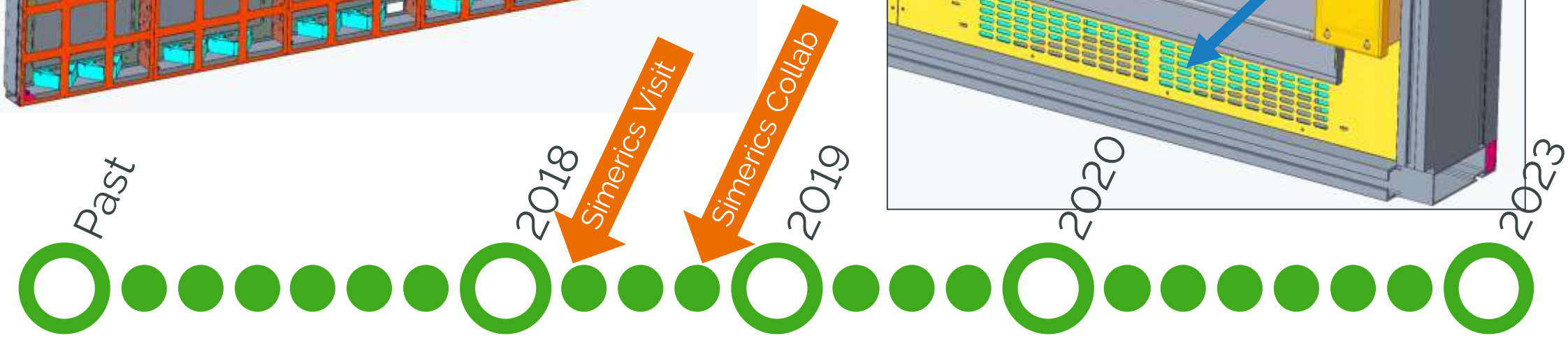


SIMERICS VISITS DAKTRONICS





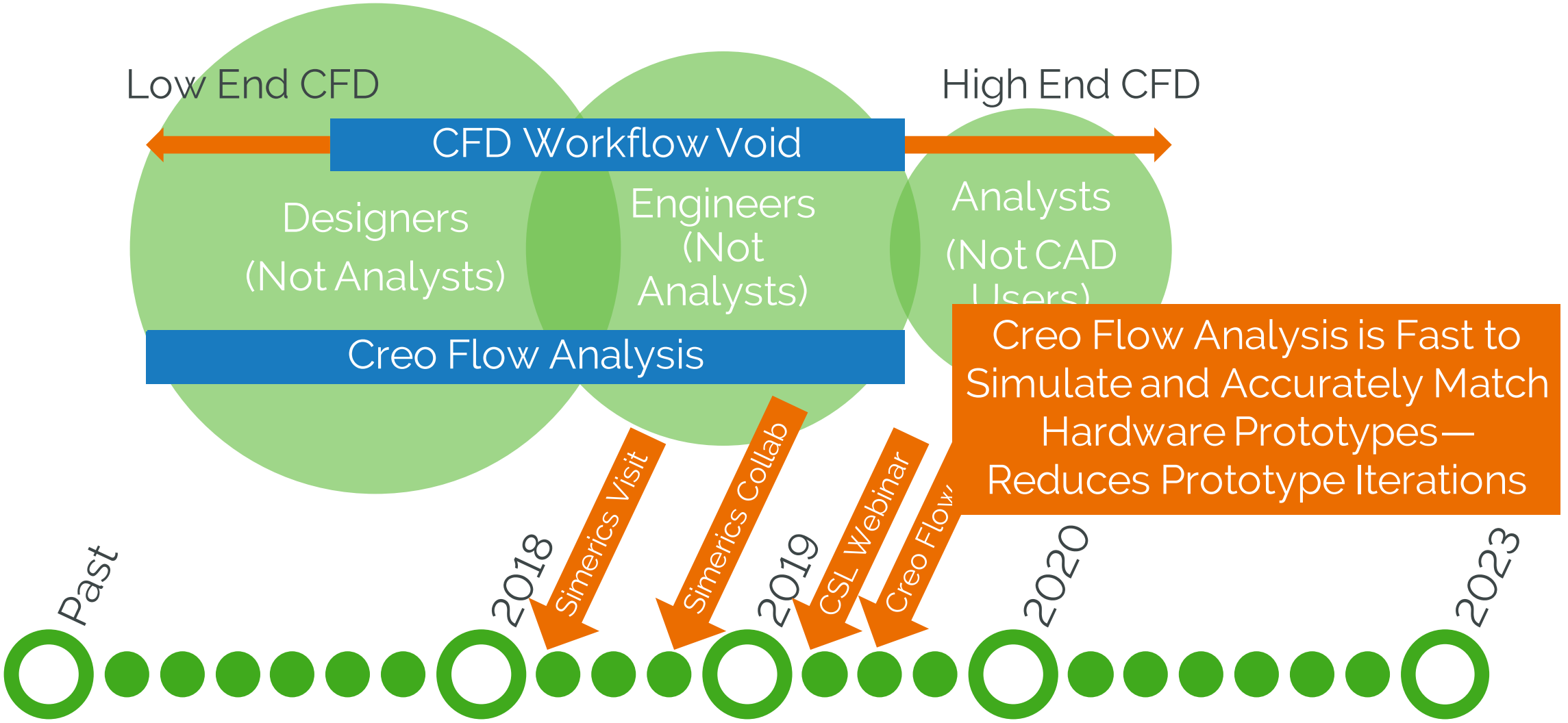




NEW SOFTWARE OPTIONS FROM PTC

- Invited to Participate in CSL Webinar at PTC Headquarters
  - Discussed our usage of the new tool
- While there, discovered two more in the works
  - ANSYS High-End Mechanical Analysis Solution (Creo ANSYS Simulation)
  - Simerics High-End CFD Analysis Solution (Creo Flow)

SIMERICS AND PTC PARTNERSHIP



BENEFITS FROM CREO FLOW

- Need Fewer Physical Prototypes
  - As we learned during COVID, this was a great tool to have
- Easy to Use
- Greater Confidence in the Tool
- Improved Painting
- Incredible Support

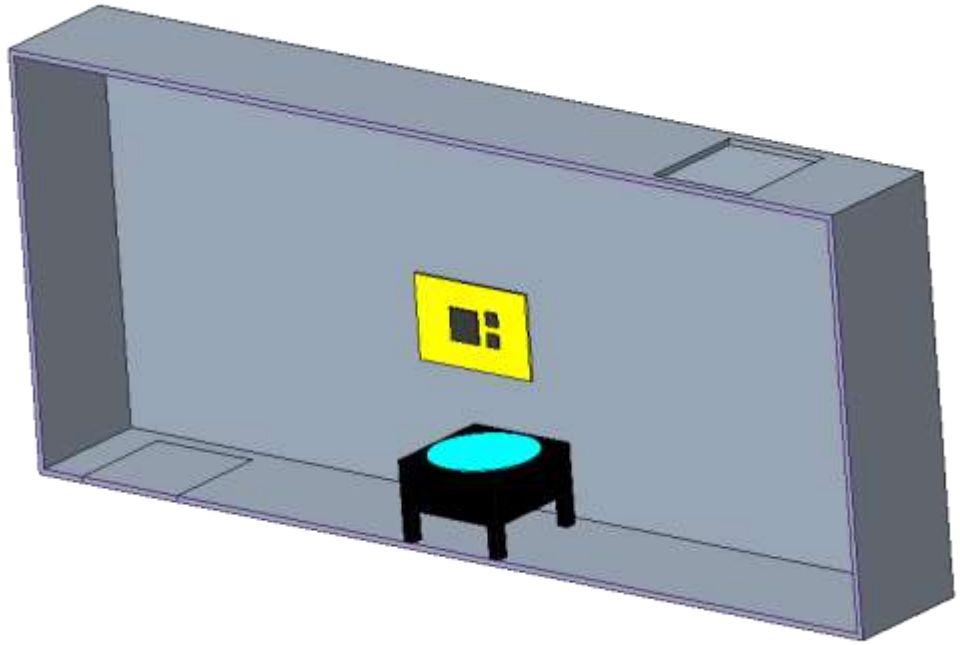
DAKTRONICS USE CASES

- Top Creo Flow features that are valued here at Daktronics:
  - Native CAD Files
  - Conjugate Heat Transfer
    - Total Heat Source (W)
    - Solar Radiation (W/m2)
  - Flow Analysis
    - Porous Materials
    - Fan Curves
  - Live Results
    - Quick Solver
    - Easy to Update on the fly

NATIVE CAD

NATIVE CAD

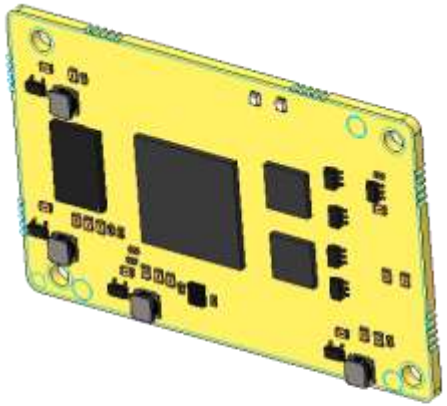
- Previously used Autodesk CFD Simulation
  - Creo file extensions could not be opened directly
    - Errors during exporting
      - Material properties would not carry
      - Accuracy & Unit miss-match
      - Collision/overlapping assemblies were not identified until meshing (usually after material assignments & boundary condition setup.
      - Mesh Failures without explanation
  - No Live Results once the simulation was started
    - Flow direction errors
    - Reversed gravity
    - Missed boundary conditions

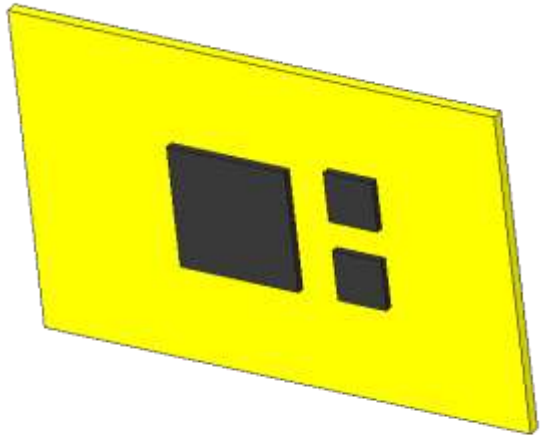


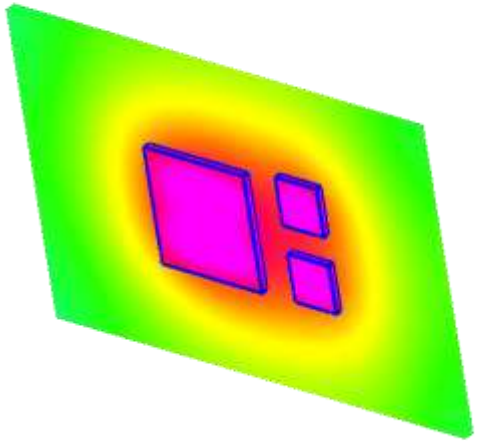
CONJUGATE HEAT TRANSFER

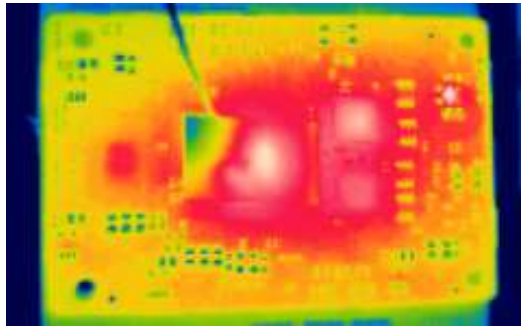
CONJUGATE HEAT TRANSFER

- 95% of Simulations include Conjugate Heat Transfer w/Air Flow Analysis
  - The heat management of electrical components is critical for image quality & reliability
  - Indoor and outdoor environment
    - Prefer natural convection cooling for indoor applications
    - Forced air cooling for outdoor applications
- Indoor Verification
  - Use Benchtop Testing for critical components to verify PCB Material Properties



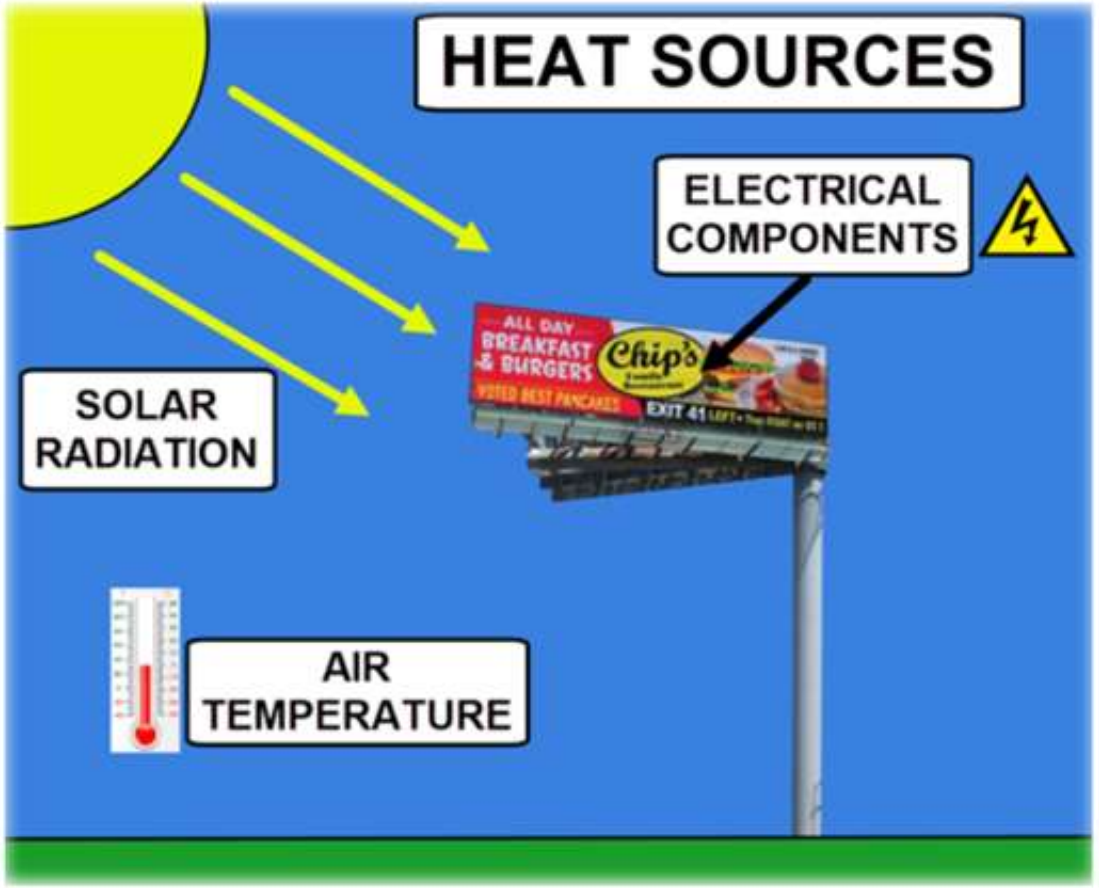


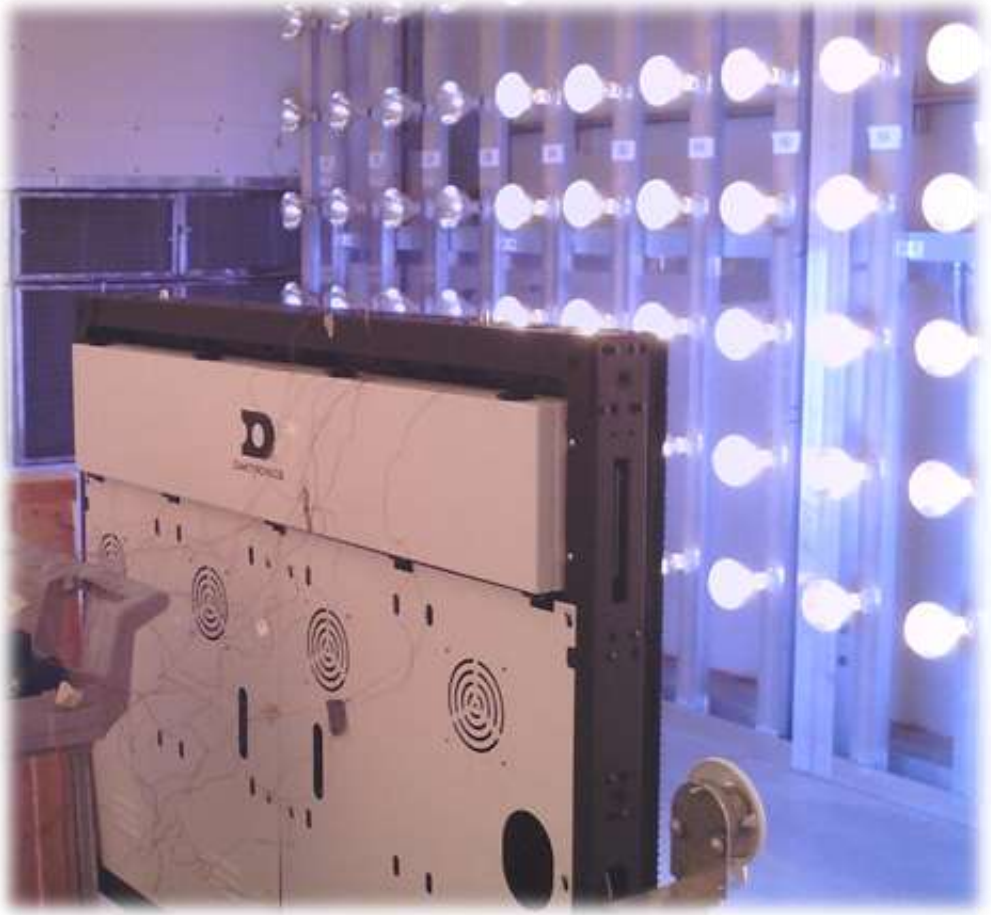




CONJUGATE HEAT TRANSFER

- Outdoor Verification
  - Verify solar radiation simulations using our in-house solar simulation chamber

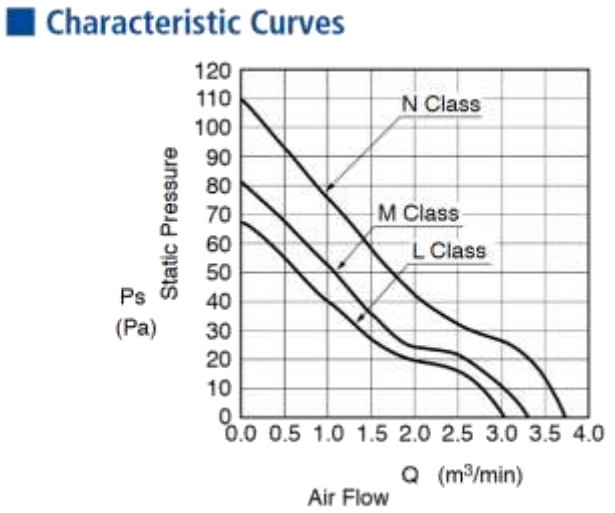


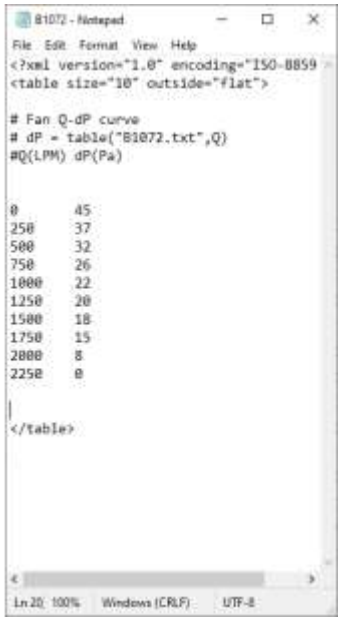


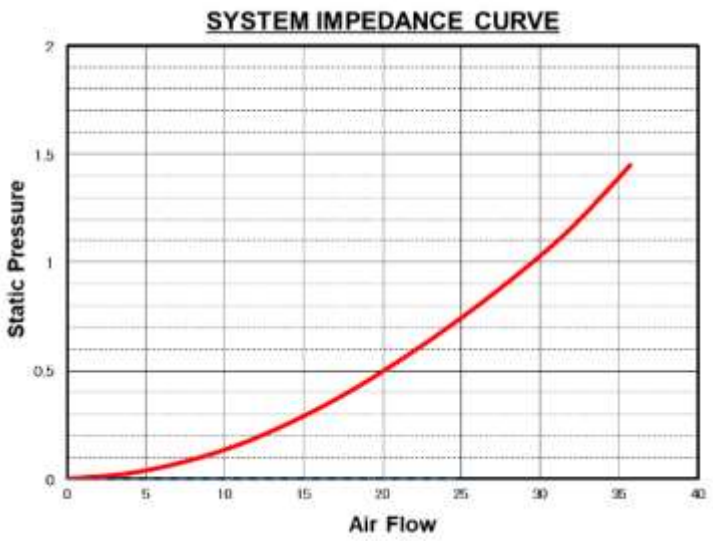
FLOW ANALYSIS

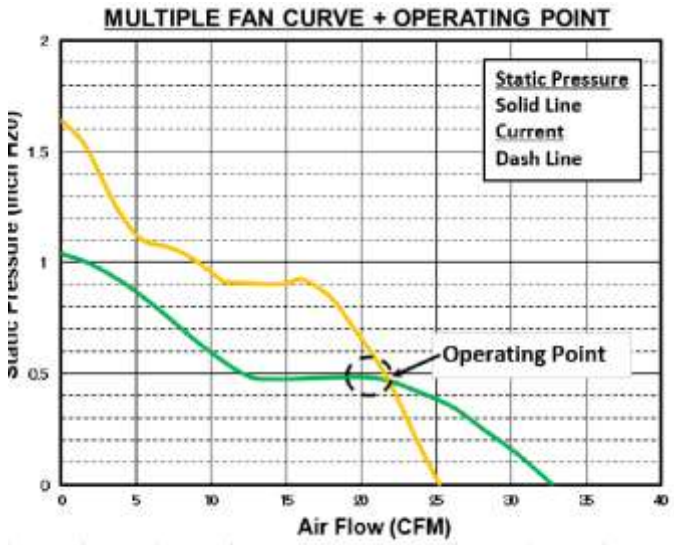
SYSTEM FLOW ANALYSIS

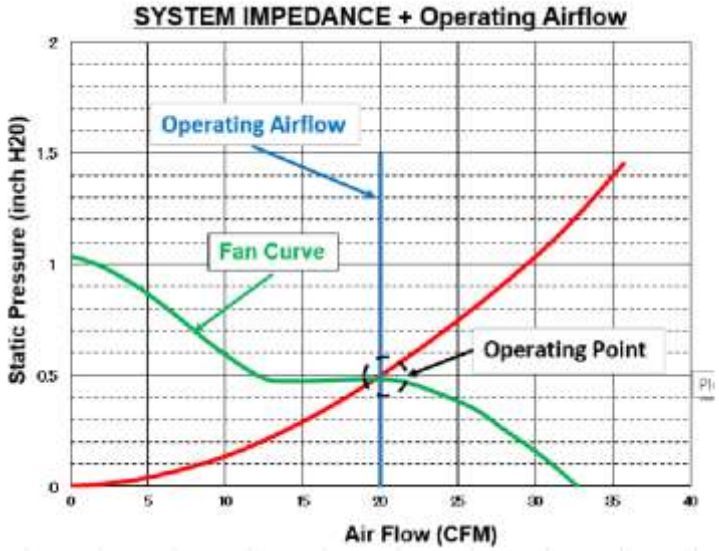
- Fan Curves
  - Provide airflow vs. pressure for a given fan
  - Text file located inside the working directory in Creo
- System Impedance Curve
  - Internal Pressure inside a system (enclosure) vs. air flow
- Goal is to establish best fan curve vs. system impedance to meet our operating point
  - Based on critical component temperature











POROUS MATERIALS

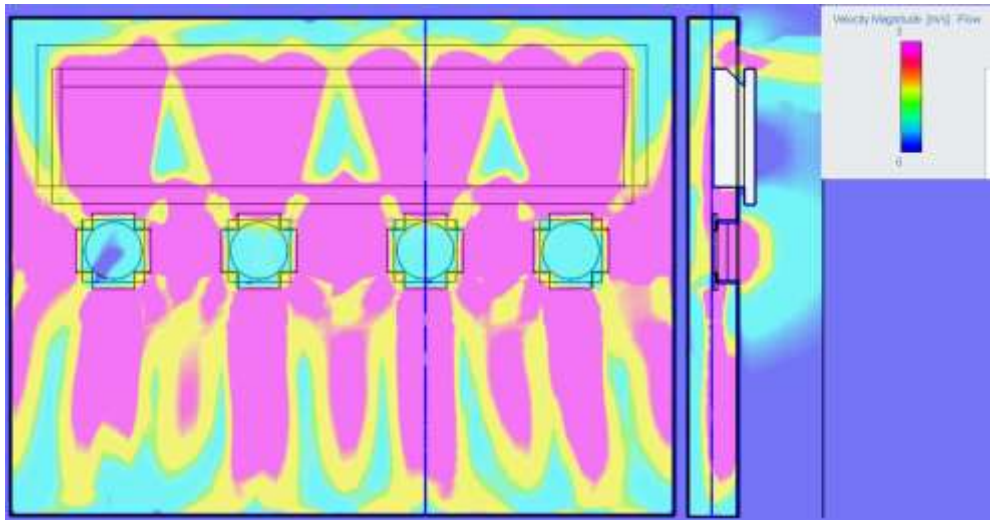
- System Impedance Curves are affected by blockages/restrictions in system
  - Filters
  - Perforated Air Intakes
- Porous material properties provide simplified method to simulate restriction

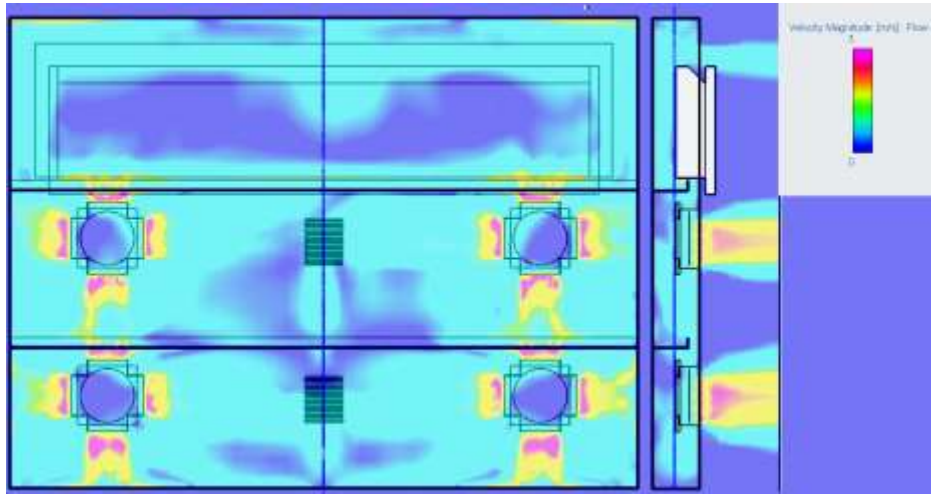
- Porosity % 0-1 Scale
  - 0 Fully Open – 1 Fully Closed

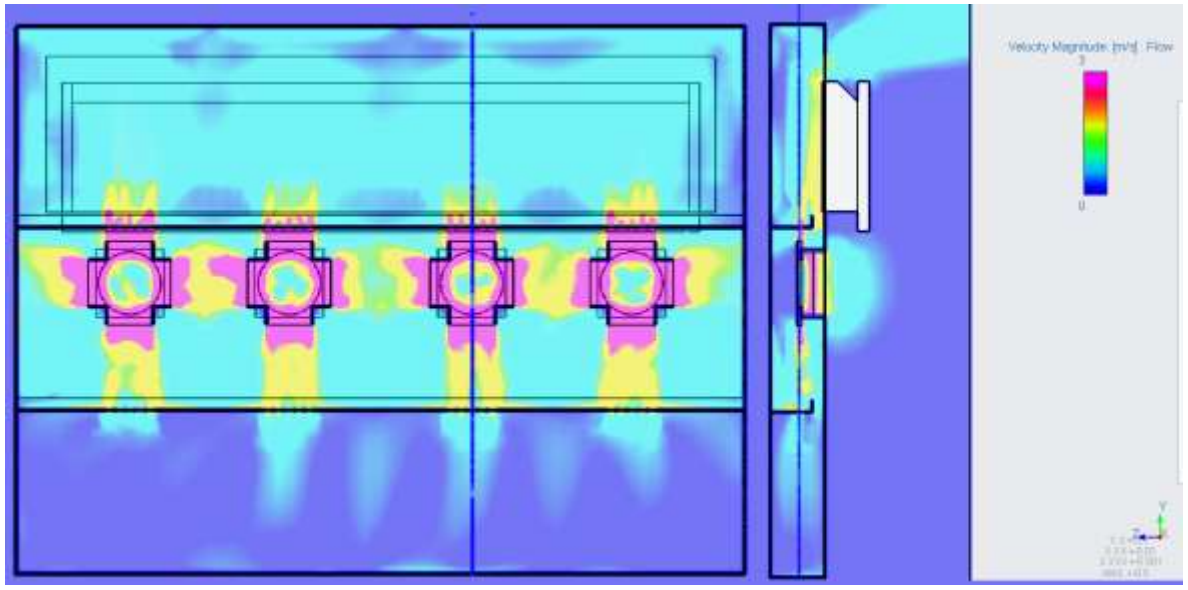
LIVE RESULTS

LIVE RESULTS

- Various design simulations are compared, and the best candidates are moved forward

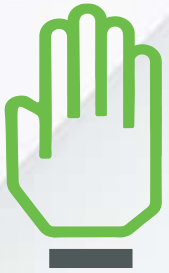






LIVE RESULTS

- Live Demo



QUESTIONS?

Thank you! You can find me at:

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Take your post-session survey(s) either in the event mobile app or via email post-event.

Your feedback provides us with valuable information on how to shape future content strategy for the event!

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