

# FloEFD Simulation Conference 2017

*Beating Moore's Law,  
with FloEFD in the cloud.*

*Koen Beyers – Voxdale*

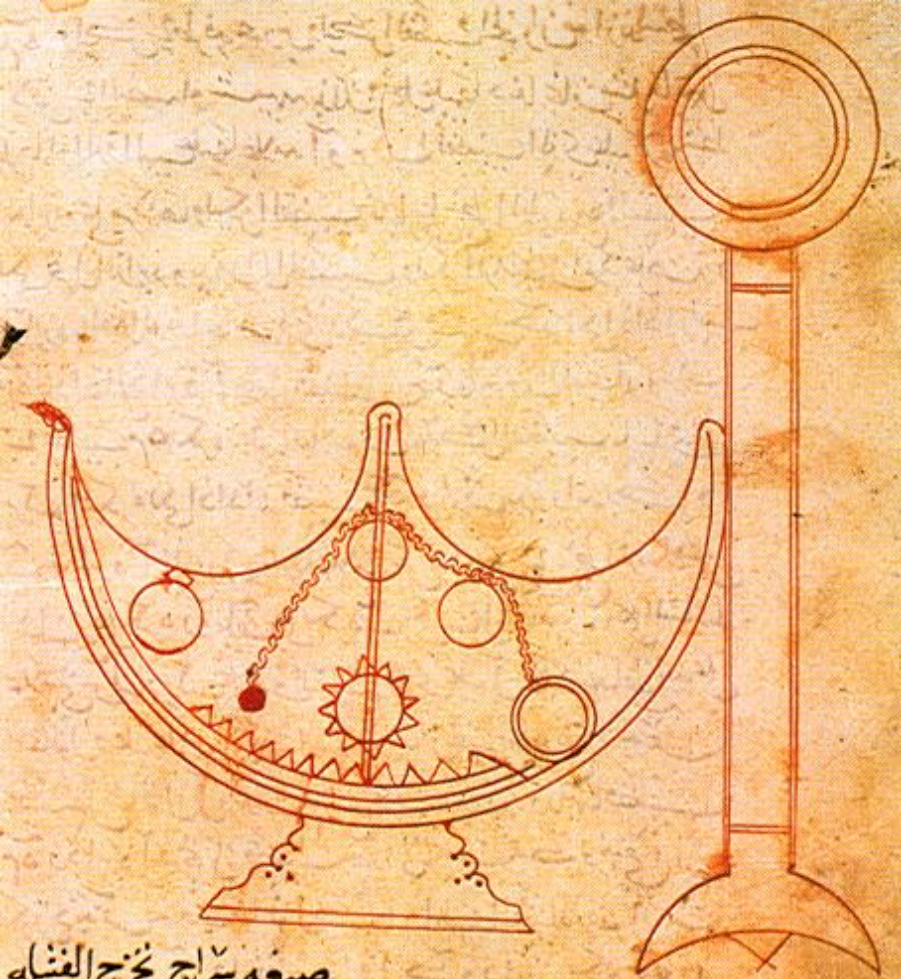
*November 29, 2017*







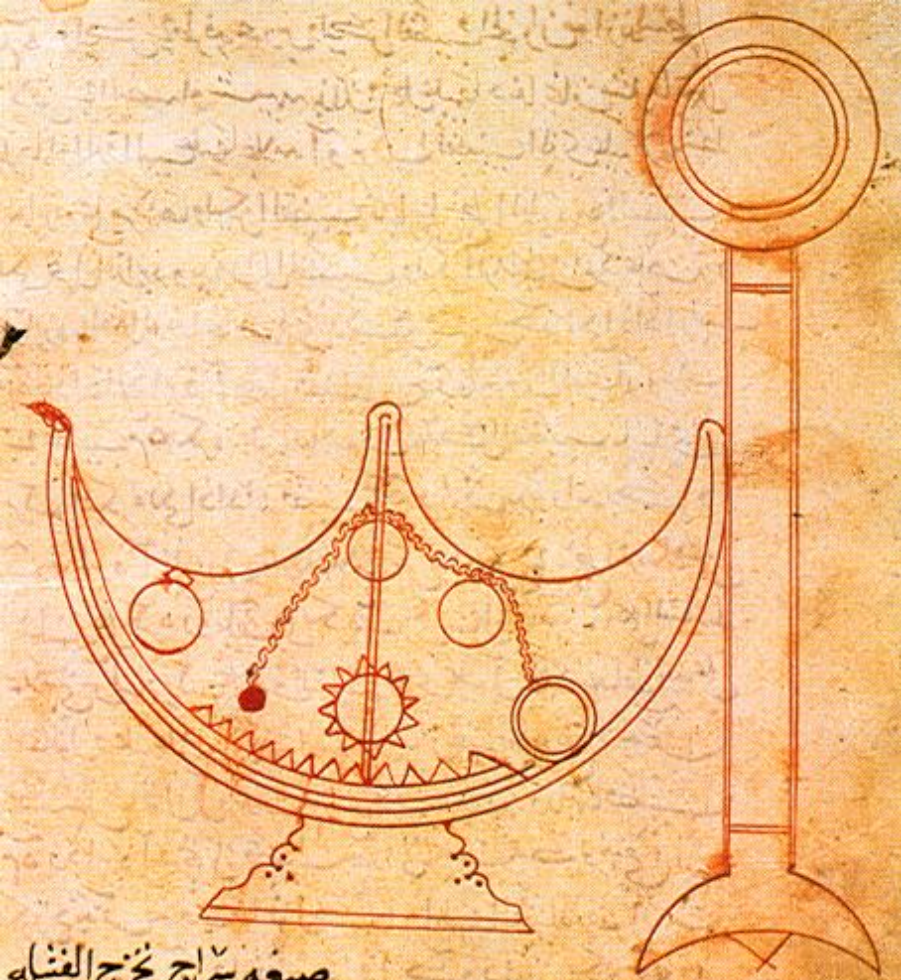




صَفْه سَرَّاج مَخْرَجُ الْغَيْثِ  
لِقَيْهِ وَهَيْبُ الزَّيْتِ لِقَيْهِ وَكُلُّ مَنْ يَرَاهُ يَنْظُرُ إِلَى النَّارِ لَا مَأْكُلَ

*Test setup for a self trimming lamp  
c. 850*





صَفْه سَرَّاج مَخْرَج الْفَيْتِيلِ  
لِقَسْبِهِ وَهَيِّبُ الرِّبِّ لِقَسْبِهِ وَكُلُّ مَنْ يَرَاهُ يَقُولُ إِنَّ النَّارَ لَا تَأْكُلُ

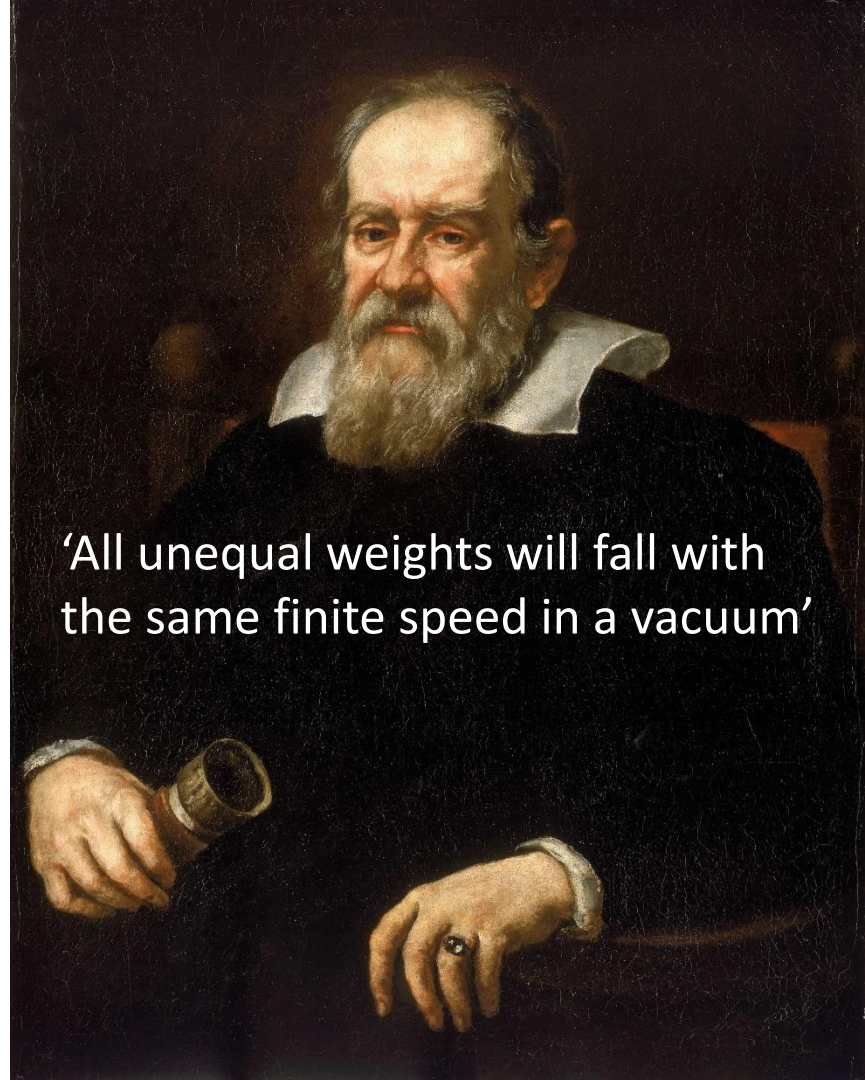


سَكْرُوحْنِ الْمَنْظَرِ الْبَلِيغِ الْمَبْكِلِ •  
فَرَطَ حَرَّ آدِي أَوْلَدُ عَجُونِ آوَرَا فِي •  
غَايَتِ قَوِي قَبِيلُوزِ جَوْدِي بَغِي •  
شَجَرْدُ زَصِيفِ وَشَتَادَه مَحْضَرِ أَوْلُودُ •  
وَجَّعَ اسْطَهْلَانَا فَعْدُزُ وَغَوْدِي •  
طَرْدُ أَبْدُرُ وَهَذَا مَثَلُنَا •

سُمَائِقُ طَاغَلَرْدَه بِزْ مَعْدَمِه قَوْتِ زَوِيَرْد • صَفَرِ آيِ إِذْ آلِهْ أَبْدُر • اخْتَقَانِ •  
أَوَّلُ شَنَةِ بَوَاصِرِي إِذَا آلِهْ أَبْدُرِ مَعَايِي بِآلِكَ أَبْدُرِ مَثَلُهُ • • •

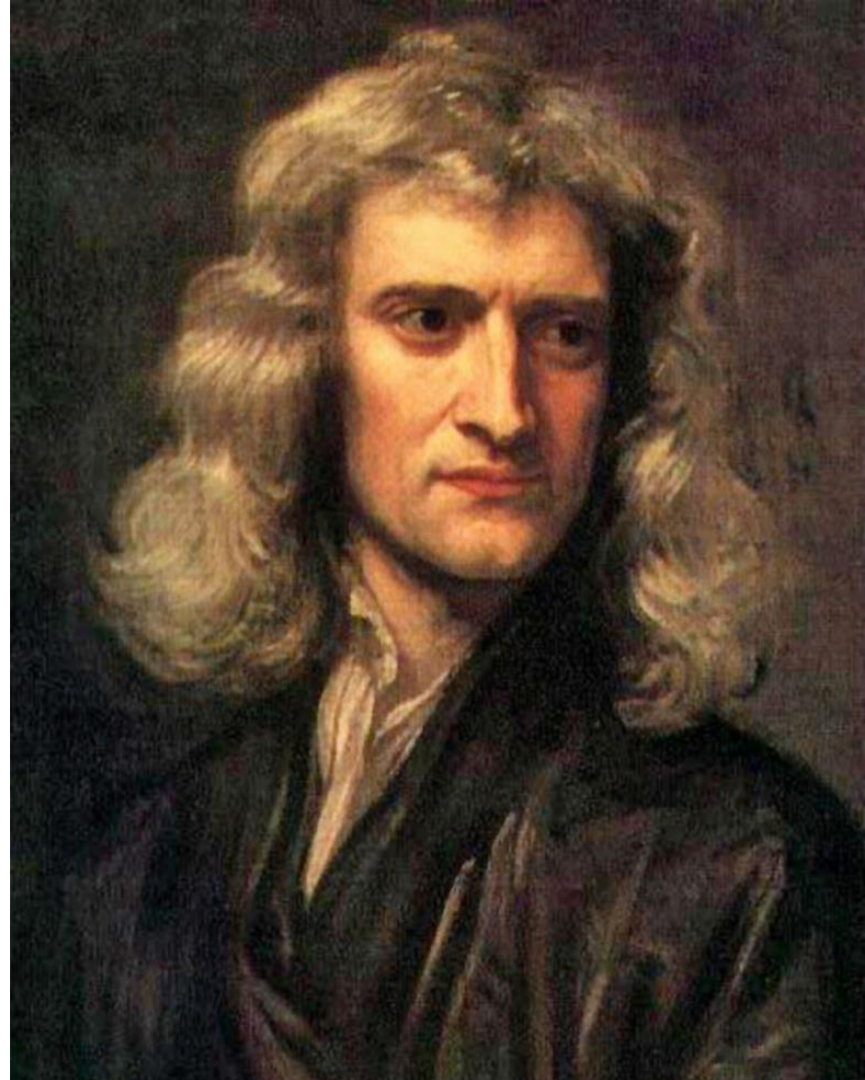
Cypress  
13th century





'All unequal weights will fall with  
the same finite speed in a vacuum'







*James Joule, Christian Doppler,  
Gregor Mendel, Charles Darwin,  
Nobel, Louis Pasteur, Heinrich Hertz  
Tesla, Thompson, ...*





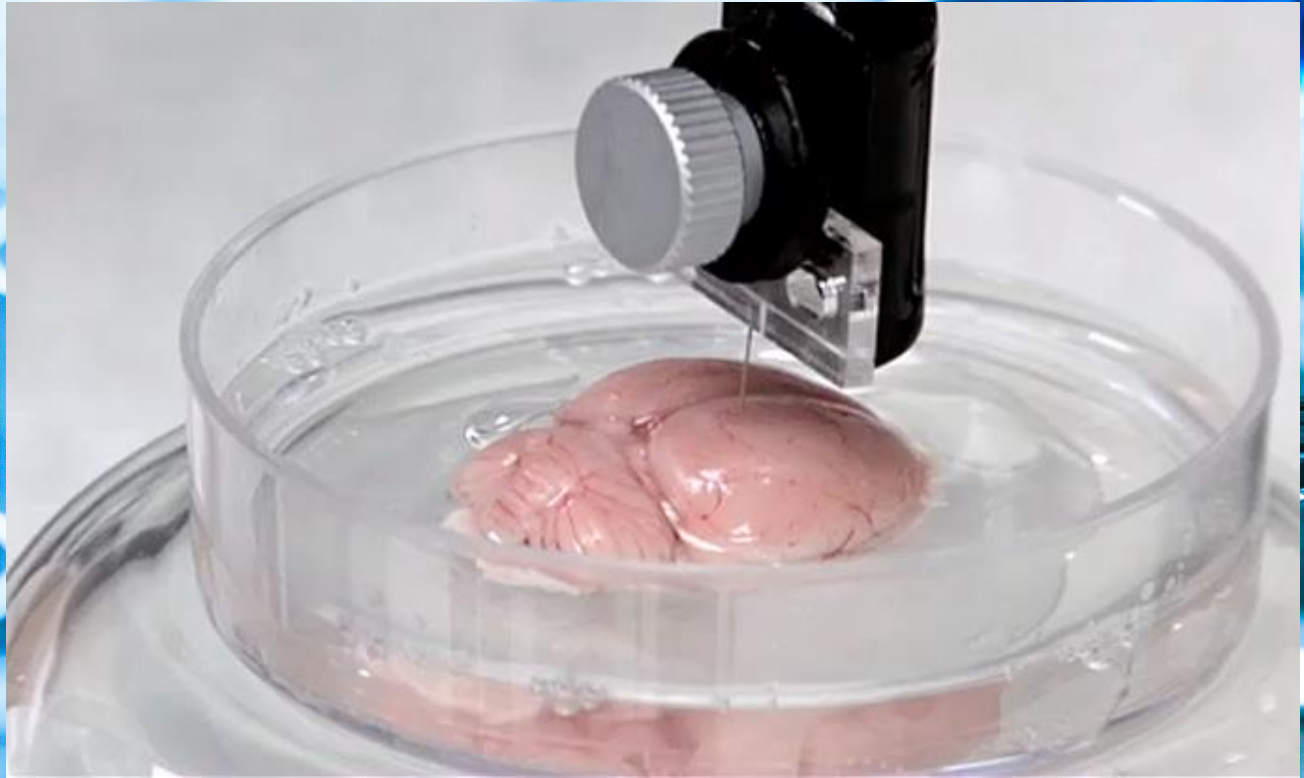
in vivo





in vivo

ex vivo



in vivo

ex vivo

in vitro





in vivo

ex vivo

in vitro

in situ



in vitro





in vitro



in situ





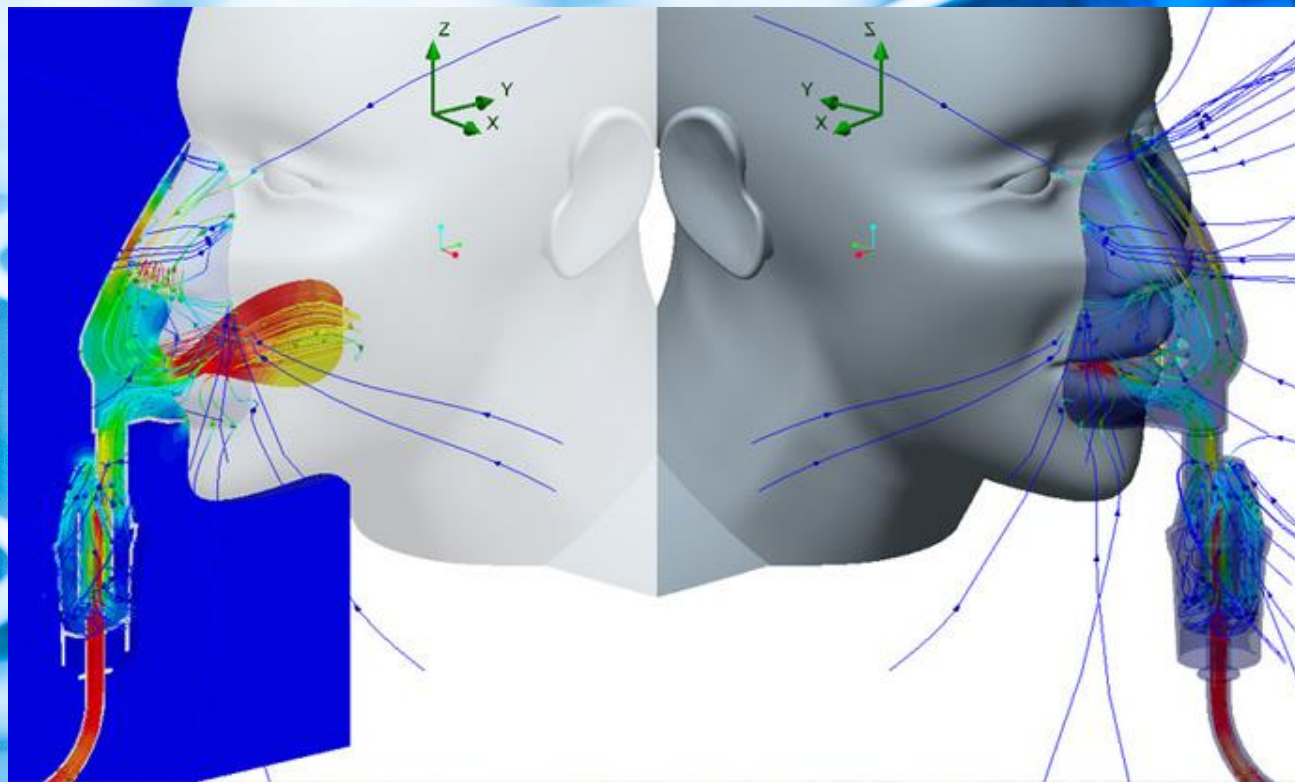
in vivo

ex vivo

in vitro

in situ

in silico



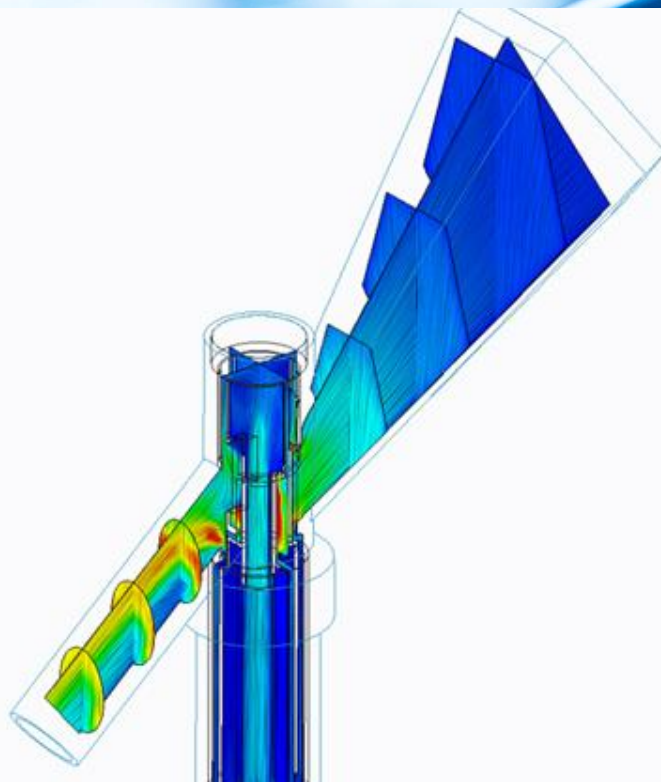
in vivo

ex vivo

in vitro

in situ

in silico





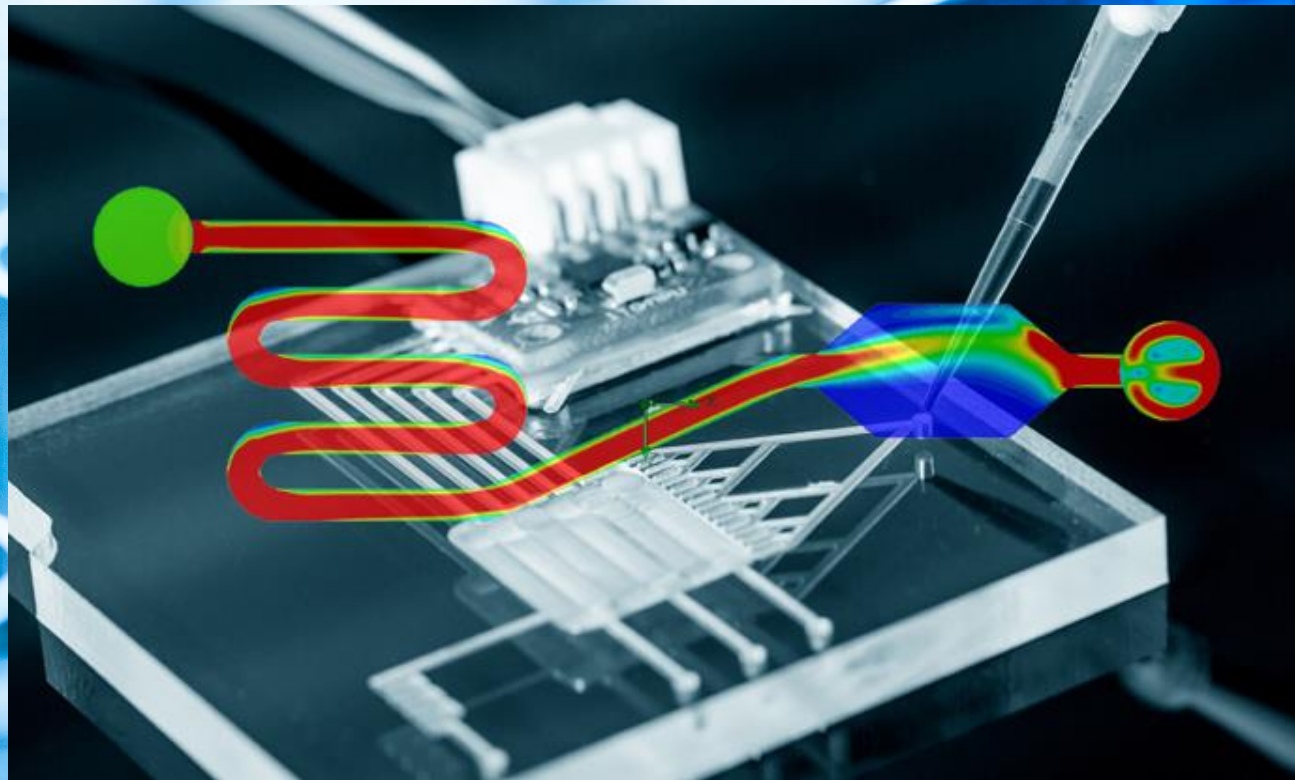
in vivo

ex vivo

in vitro

in situ

in silico





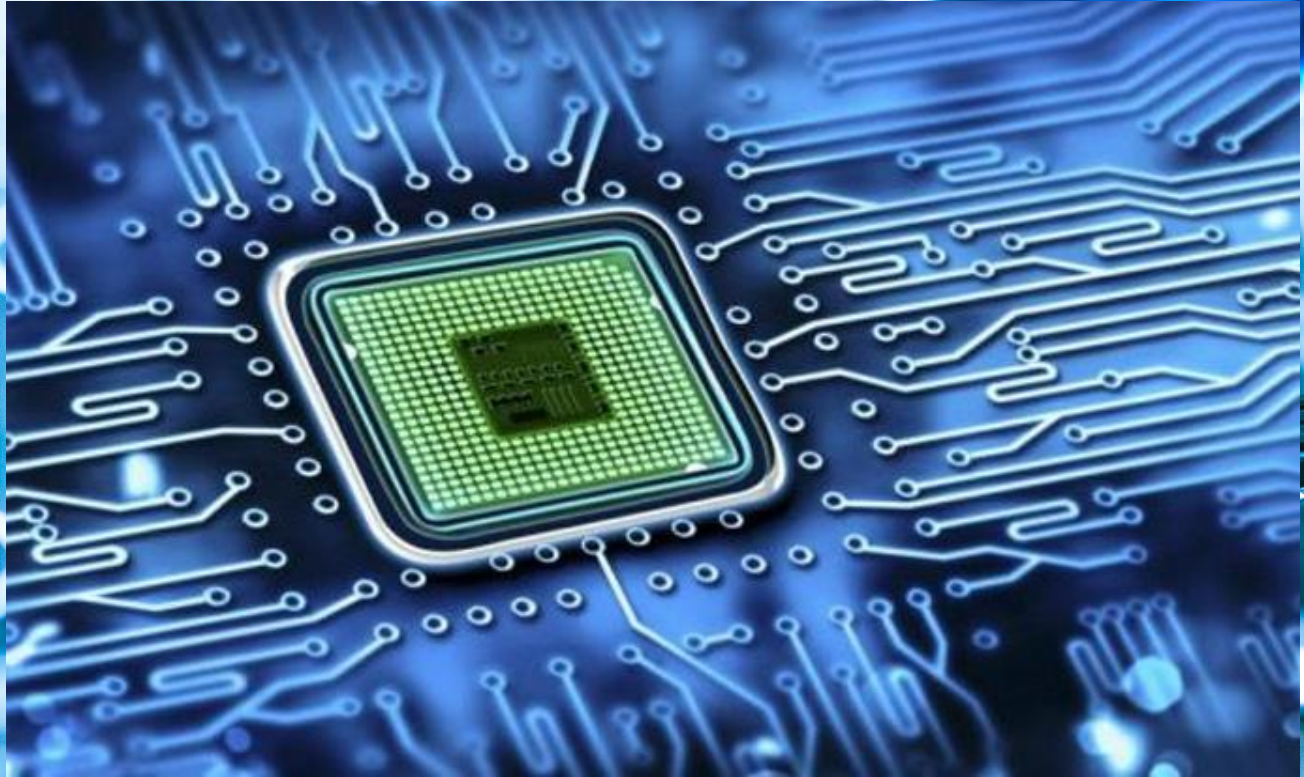
in vivo

ex vivo

in vitro

in situ

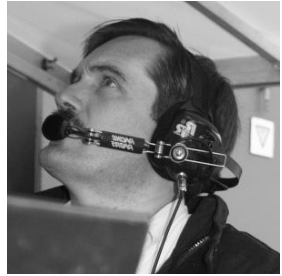
in silico



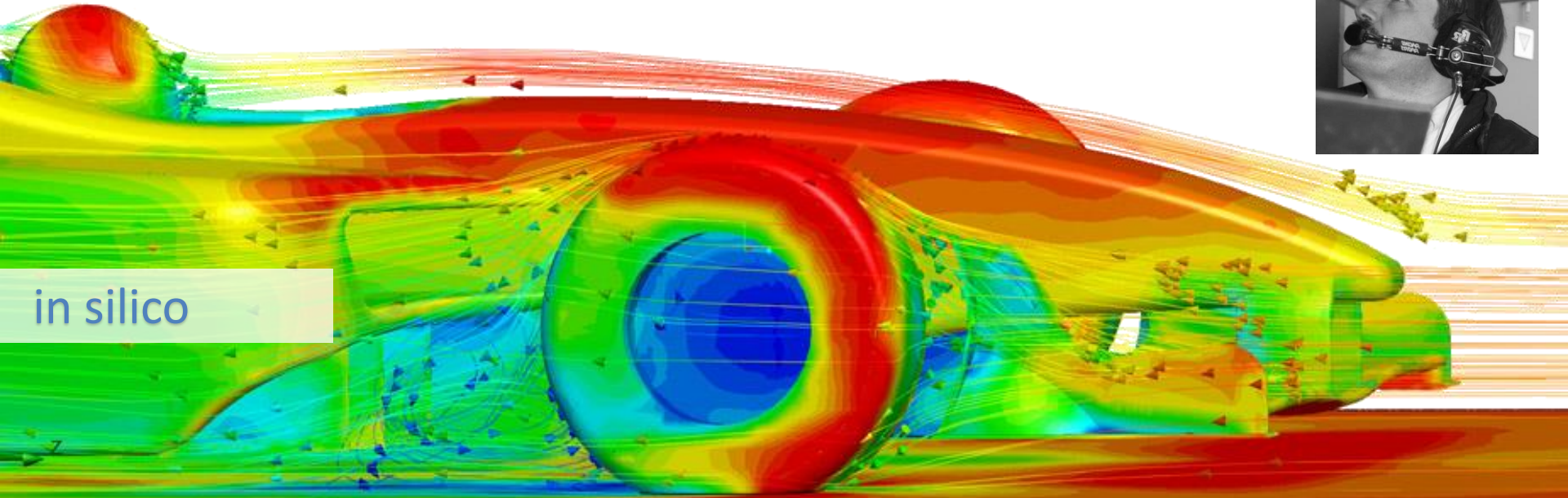


« Can we analyse and model  
our champcars? »

Don Bricker, Technical Director, Conquest



in silico





« Can we analyse and model  
our champcars? »

Don Bricker, Technical Director, Conquest

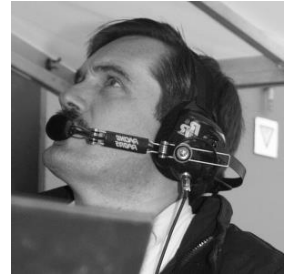
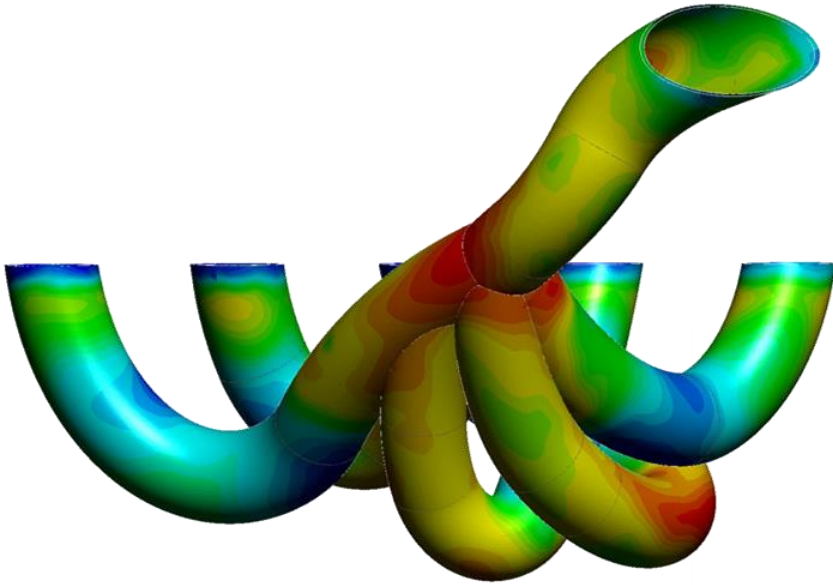


in silico

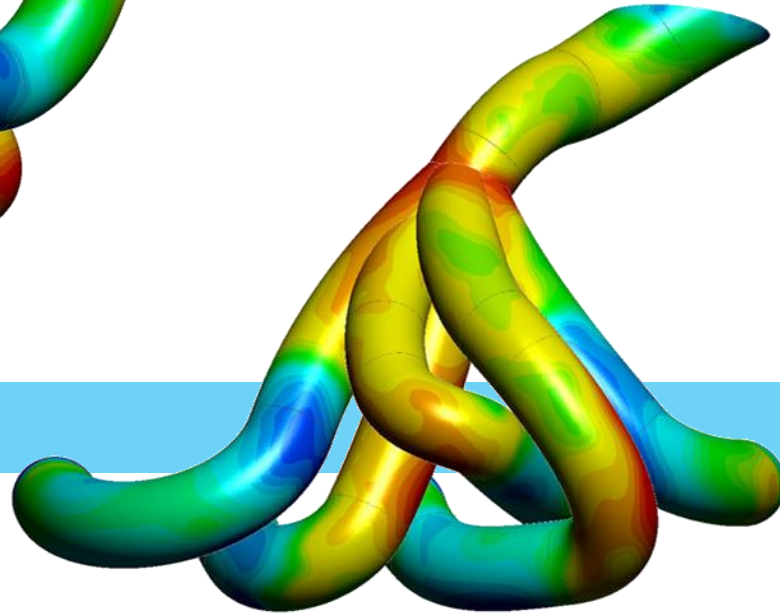


« Can we analyse and model  
our champcars? »

Don Bricker, Technical Director, Conquest



Thermal management



# 2,000,000

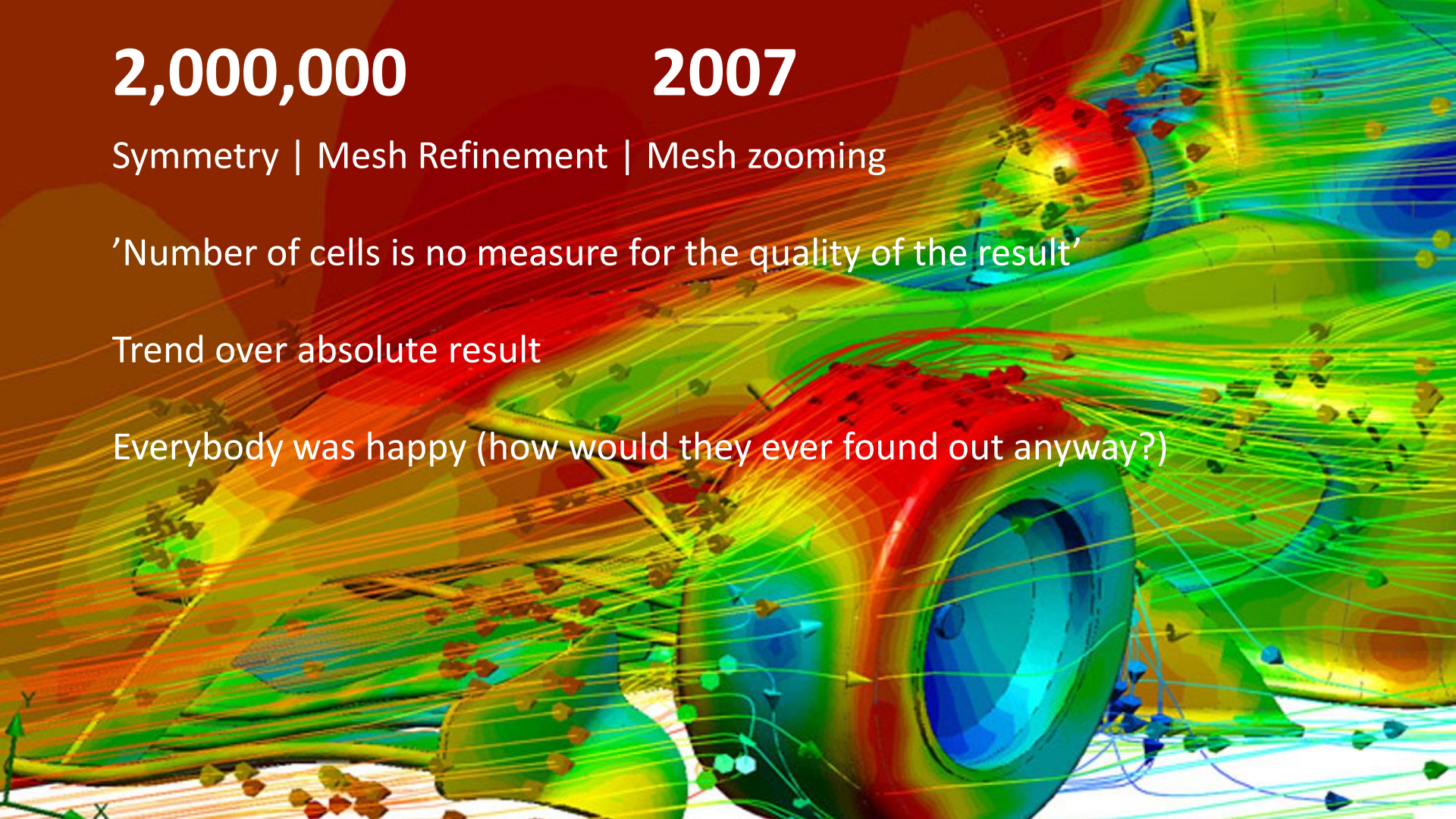
# 2007

Symmetry | Mesh Refinement | Mesh zooming

'Number of cells is no measure for the quality of the result'

Trend over absolute result

Everybody was happy (how would they ever found out anyway?)





# Moore's Law

Number of transistors in integrated circuits doubles every 2 years.



9 hrs > 5 hrs

1.333 > 1.600

3.4 > 4.7 GHz



# 50,000,000

# 2017

Not symmetric; oil left, water right

Aeromapping & windtunnel testing

Complex shapes, high detail

'This is the real stuff, this is not a toy', Dr. Moh Sabeur





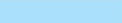
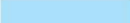


















**Mahindra**  
RACING  
FORMULA - E TEAM

**voxdale**® 

OFFICIAL DESIGN & TECHNOLOGY SUPPLIER



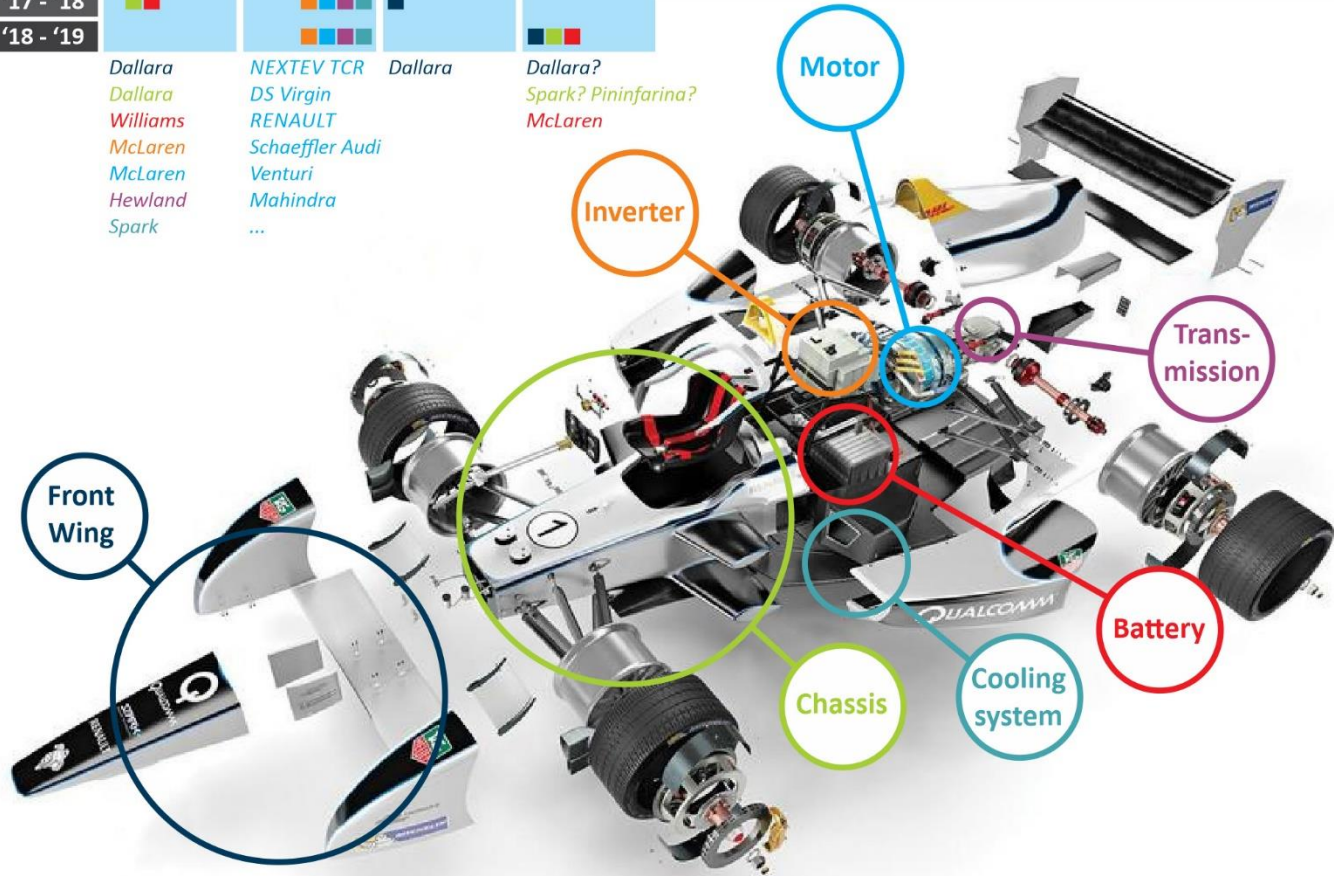
	Closed, Gen 1	Open	Closed, Gen 2	Closed, Gen 3
Season 1   '14 - '15				
Season 2   '15 - '16				
Season 3   '16 - '17				
Season 4   '17 - '18				
Season 5   '18 - '19				

Dallara  
Dallara  
Williams  
McLaren  
McLaren  
Hewland  
Spark

NEXTEV TCR  
DS Virgin  
RENAULT  
Schaeffler Audi  
Venturi  
Mahindra  
...

Dallara

Dallara?  
Spark? Pininfarina?  
McLaren





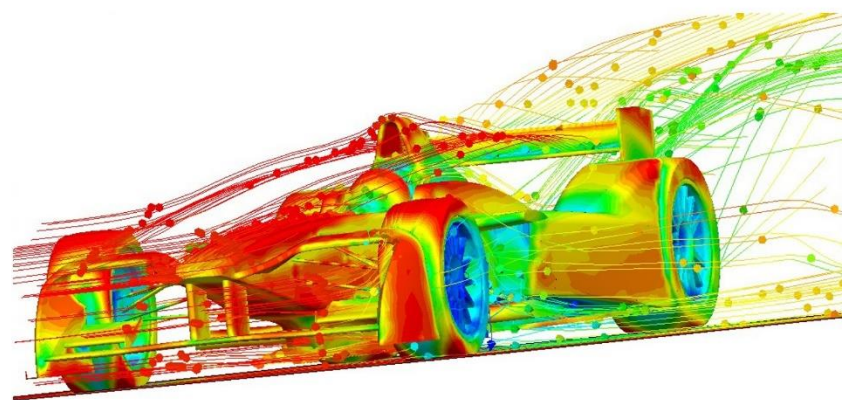
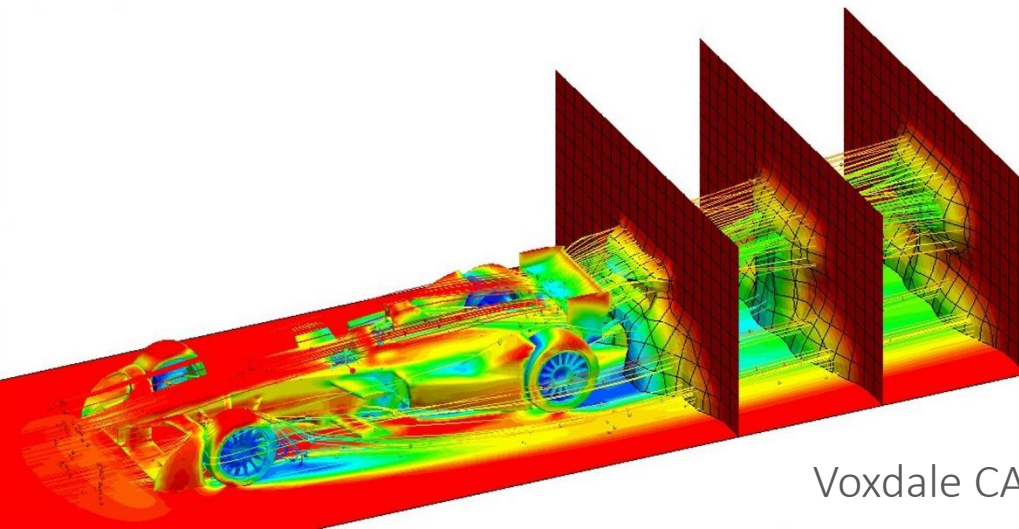
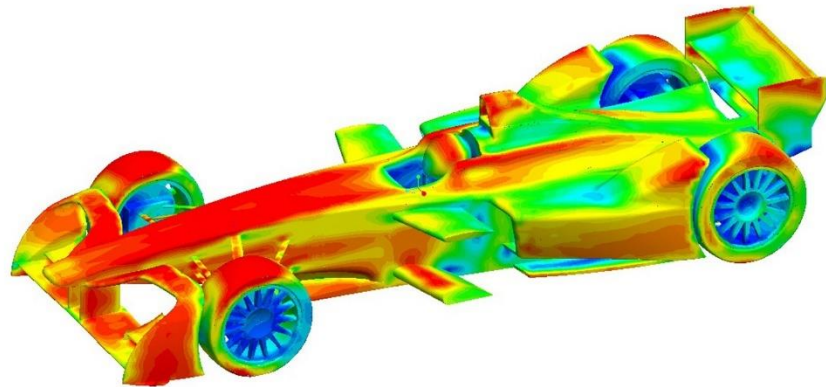
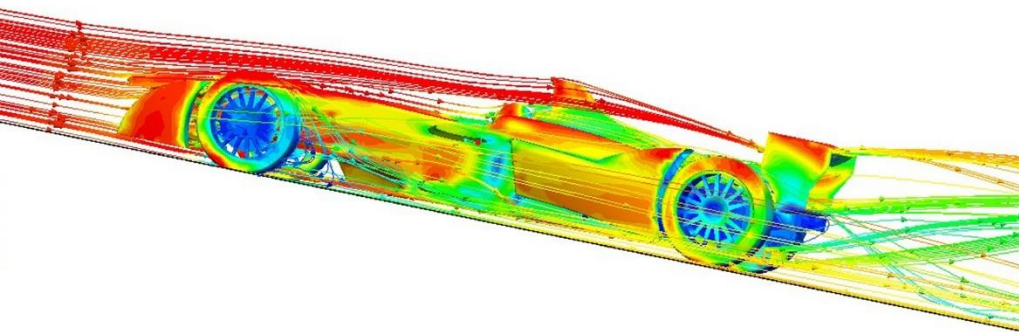
## CAD model of the S4 car

Brake cooling (heating)

Battery design & cooling

Aerodynamics & Aeromapping

Voxdale CAD, CFD & FEA simulation model for Season 4



Voxdale CAD, CFD & FEA simulation model for Season 4



## CAD model of the S5 car



Voxdale CAD, CFD & FEA simulation model for Season 5

## CAD model of the S5 car



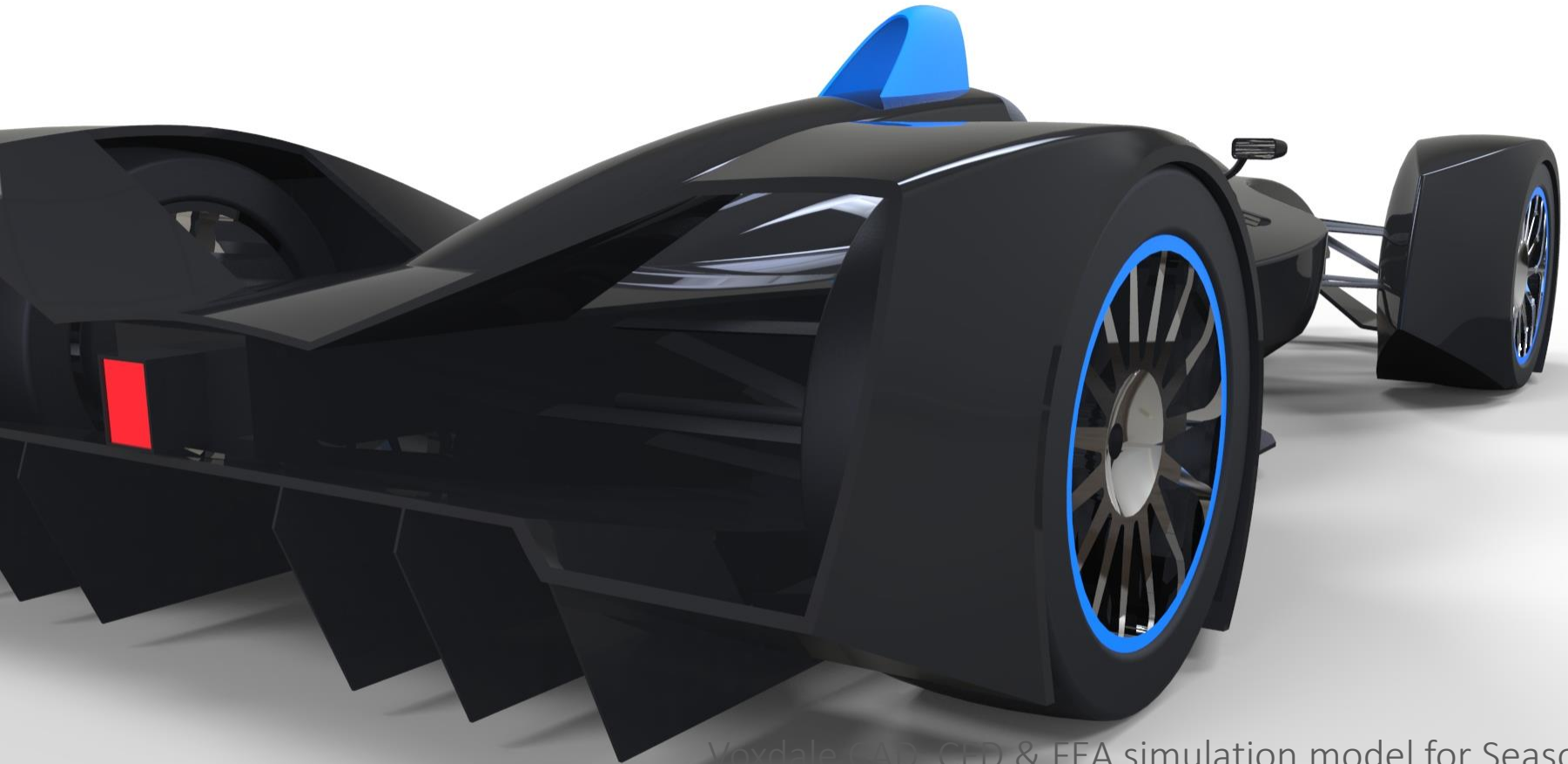
Current status:

Variety of models available with different front wing pillars and Halo's

Voxdale CAD, CFD & FEA simulation model for Season 5



## CAD model of the S5 car



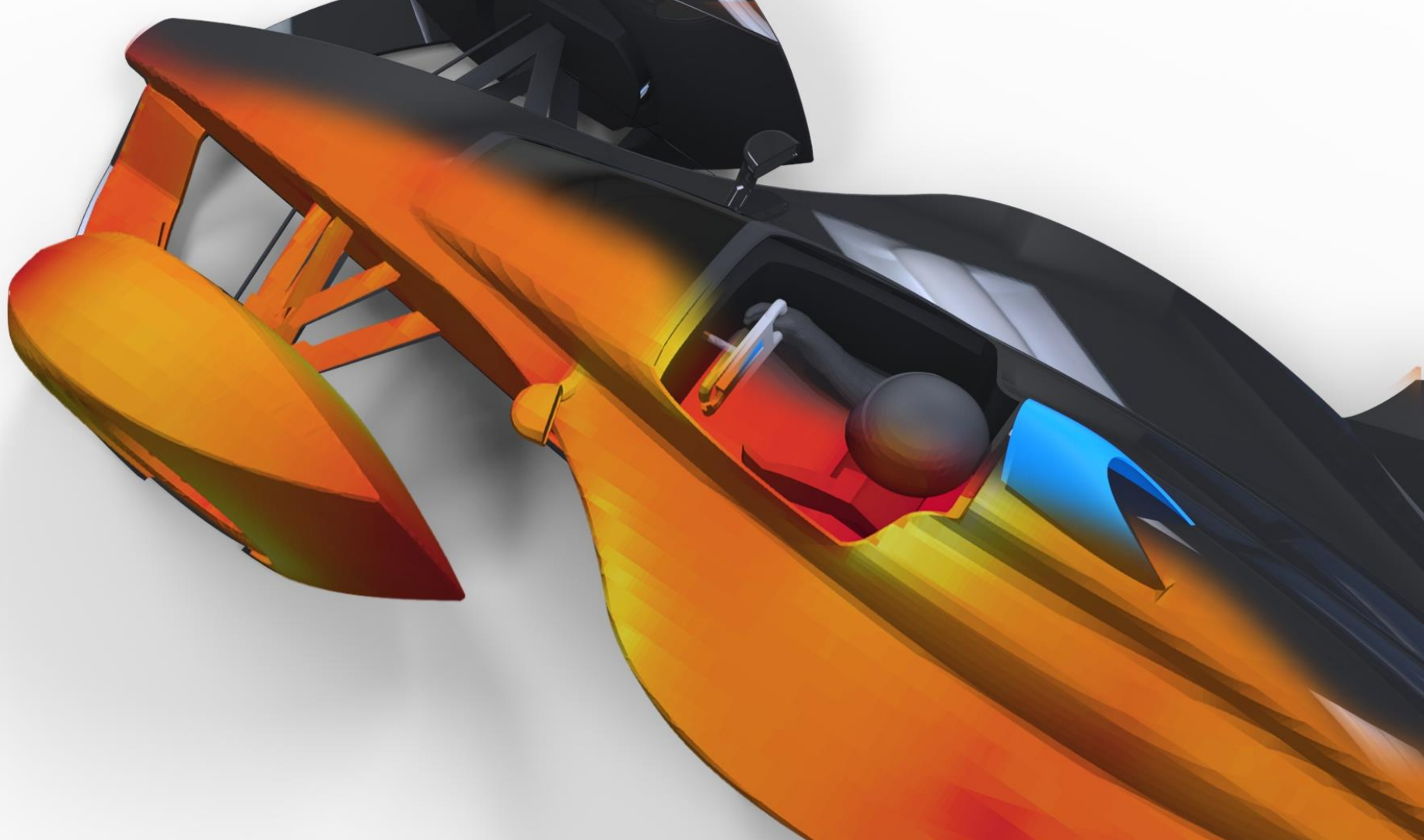
Voxdale CAD, CFD & FEA simulation model for Season 5

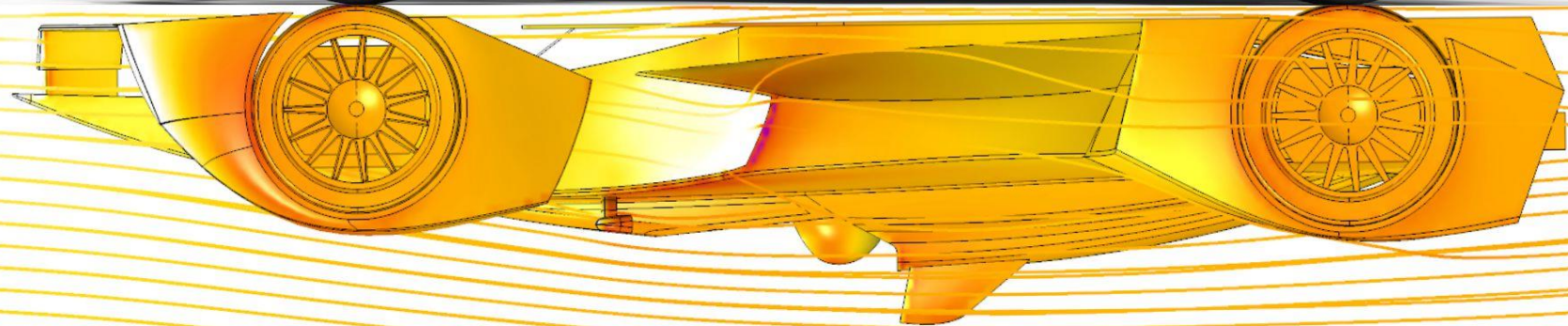
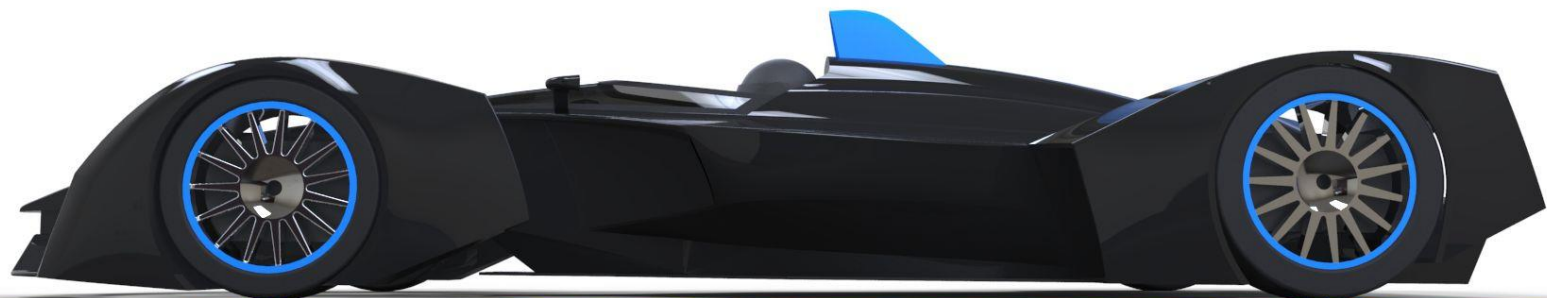


CAD model of the S5 car

Voxdale simulation model for Season 5

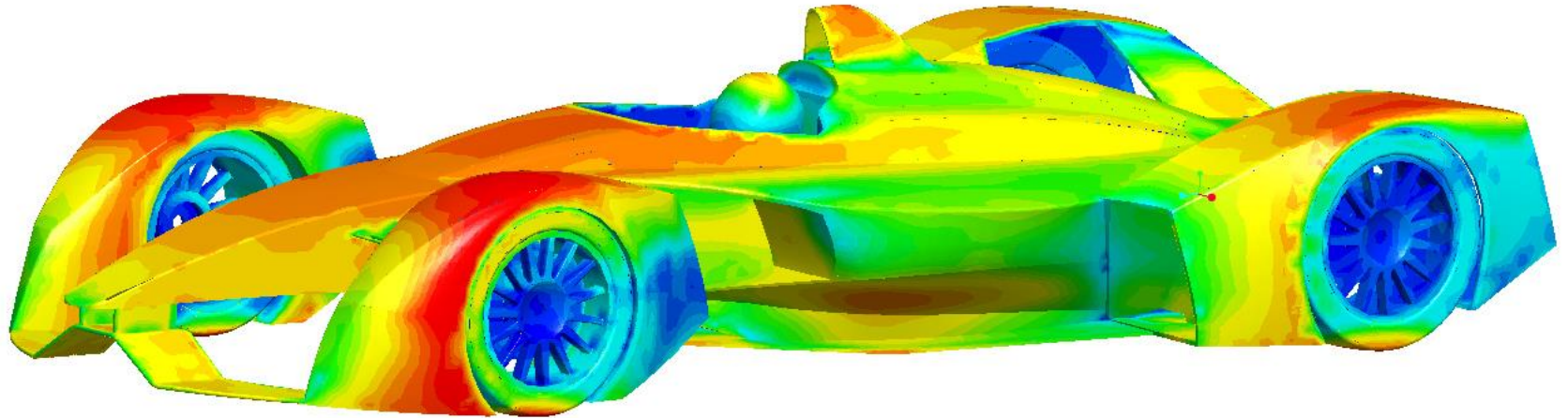




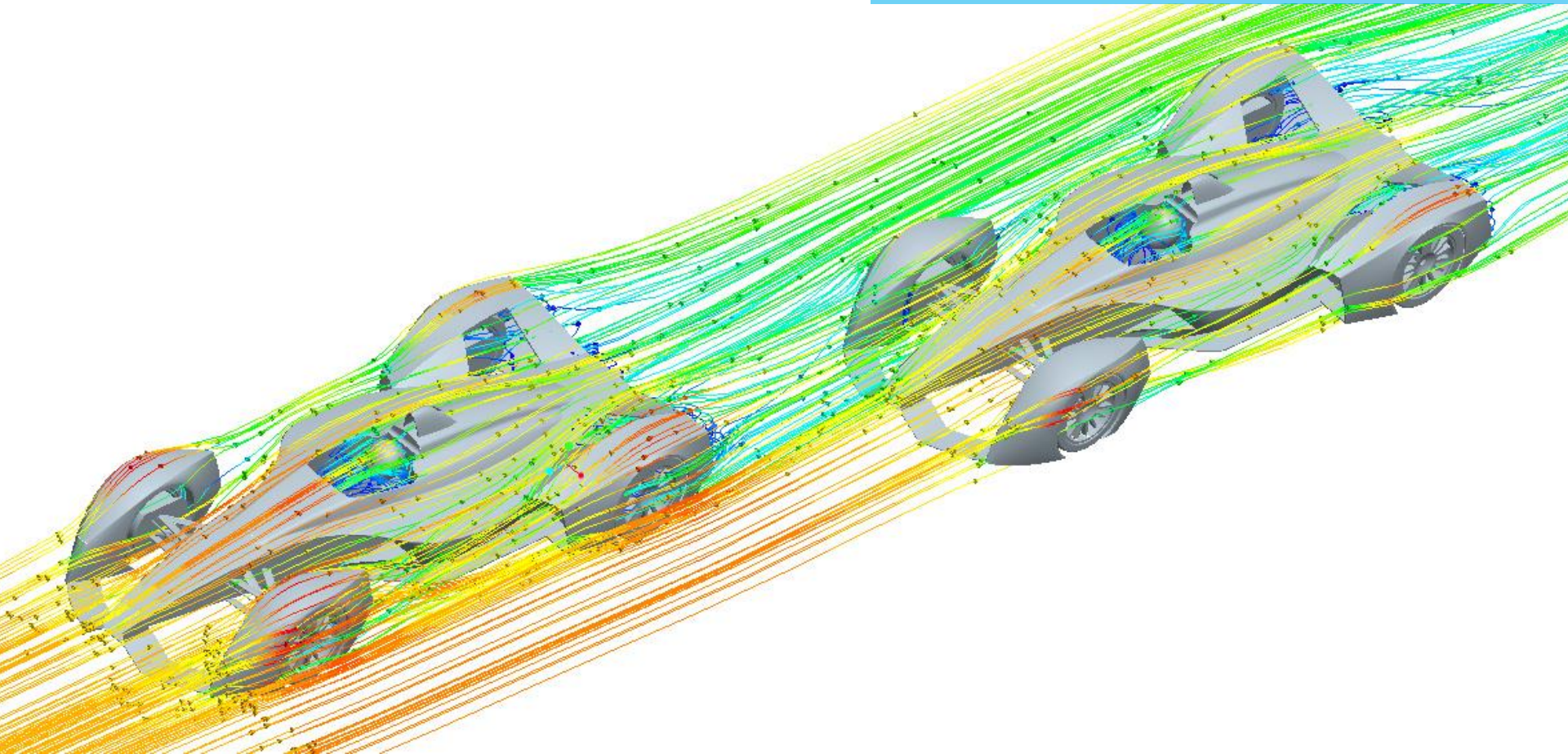




## Voxdale CFD model

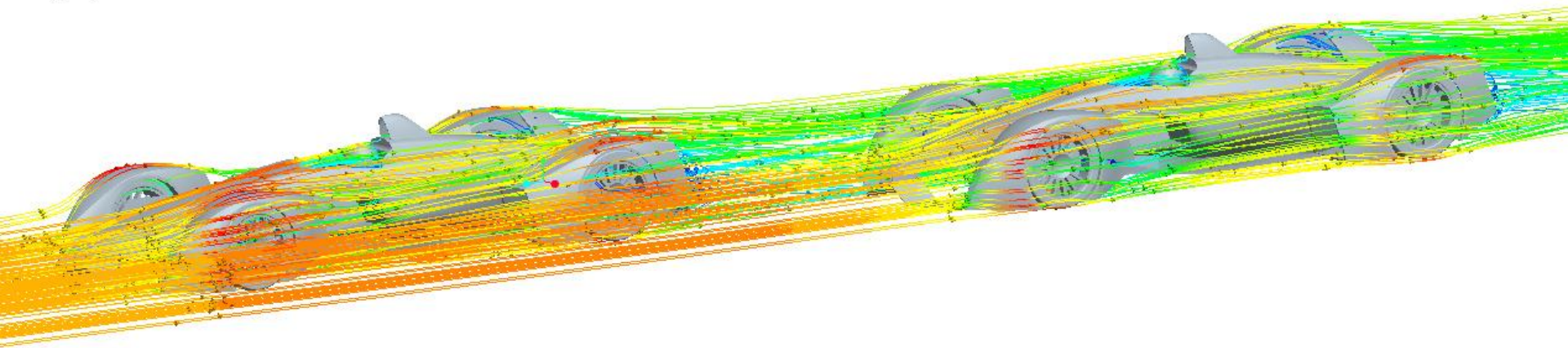


## Voxdale CFD model

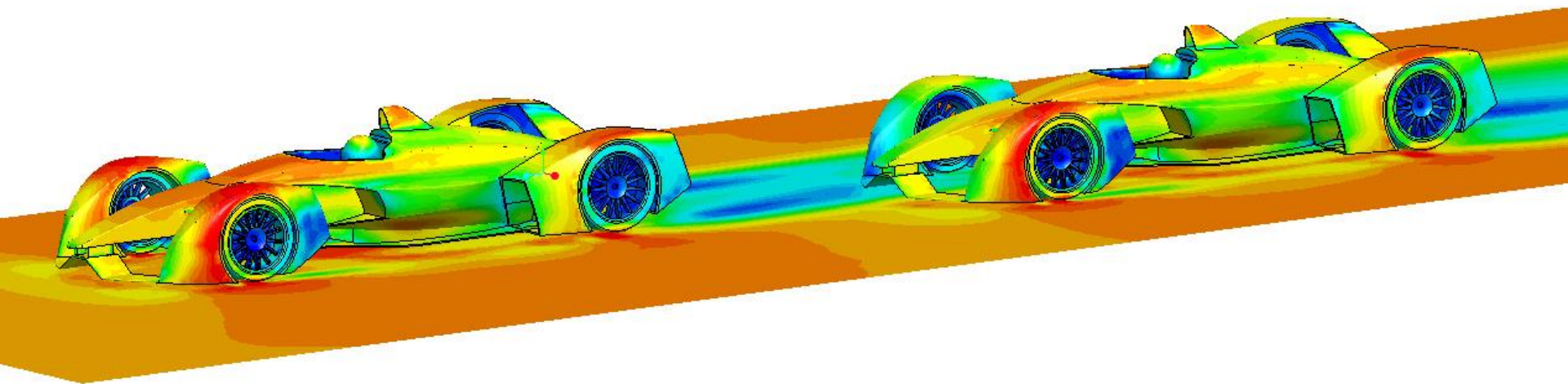




## Voxdale CFD model

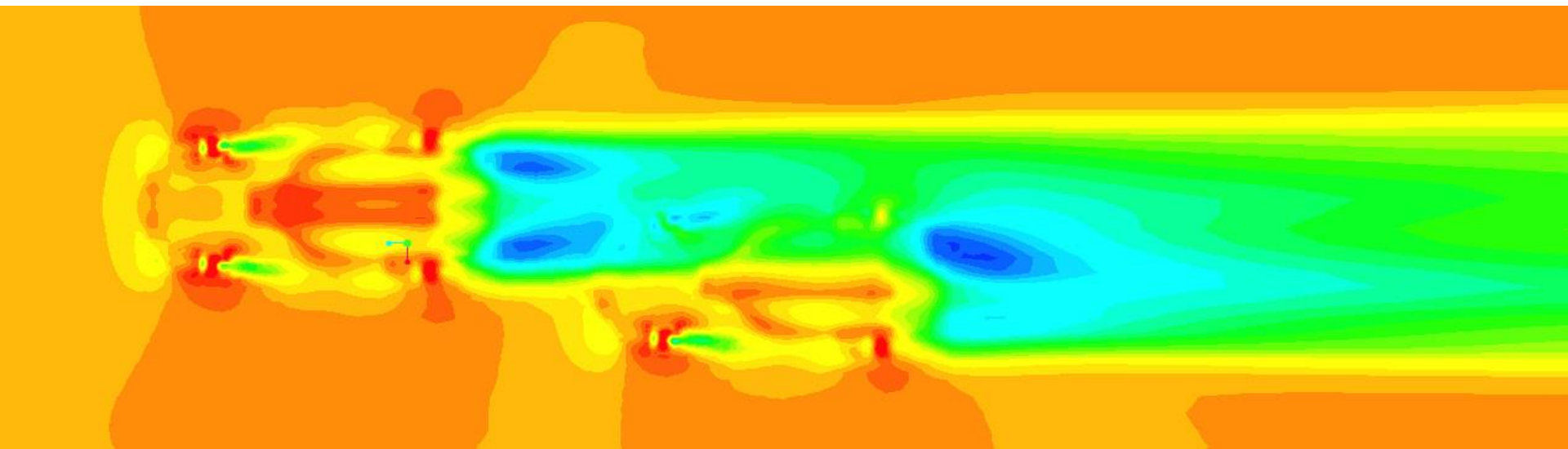


## Voxdale CFD model





## Voxdale CFD model



CFD road surface mapping of 2 trailing FE-S5 cars

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3.4 > 4.7 GHz



# Beating Moore's Law

Virtual machines in the cloud; creating the monster of monsters





# Beating Moore's Law

Virtual machines in the cloud; creating the monster of monsters

Servicestatus  
MIJN RESSOURCES



Licenses, security, ...

35.000.000 cells

140 Gb RAM

20 cores



# Beating Moore's Law

Virtual machines in the cloud; creating the monster of monsters

Servicestatus  
MIJN RESSOURCES



Voxdale domain

Oxford, Antwerp, ...

CPU versus Graphics

Remote Desktop

Microsoft Azure

# Beating Moore's Law

Virtual machines in the cloud; creating the monster of monsters

Servicestatus  
MIJN RESSOURCES



€2.5 per hour

Flexible & stand-by

One off configuration

Pay per use

€8,000 - €10,000

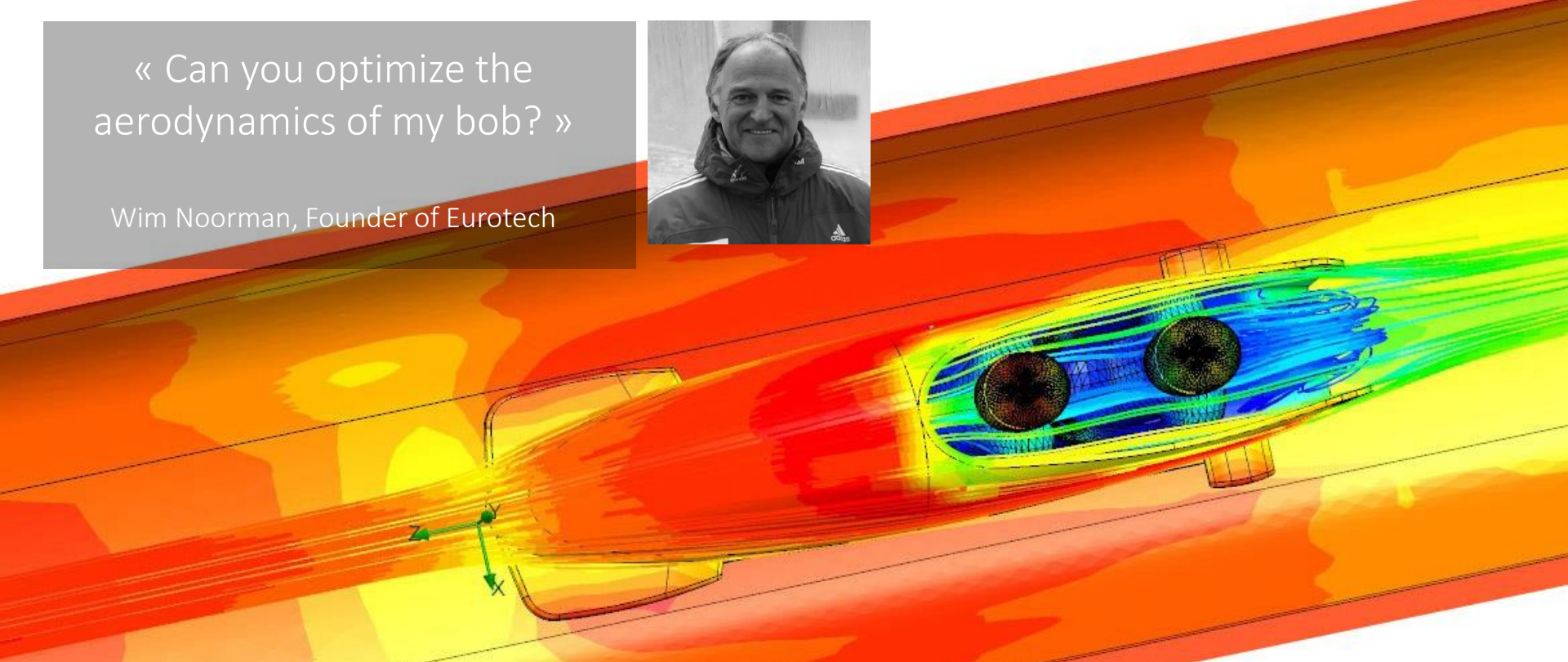
No storage issues





« Can you optimize the  
aerodynamics of my bob? »

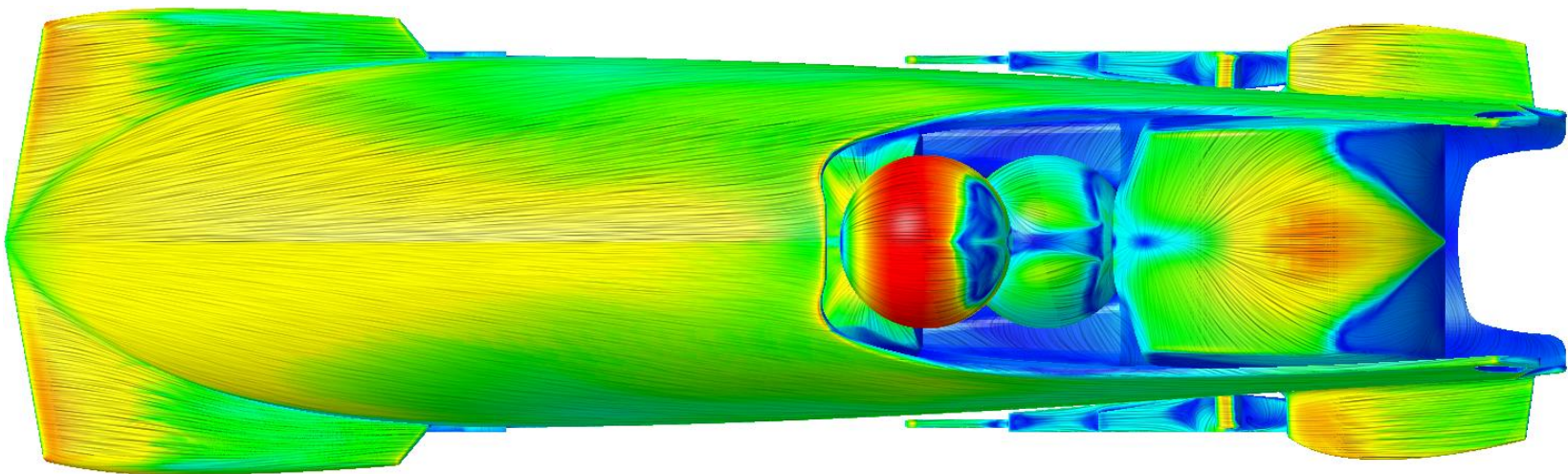
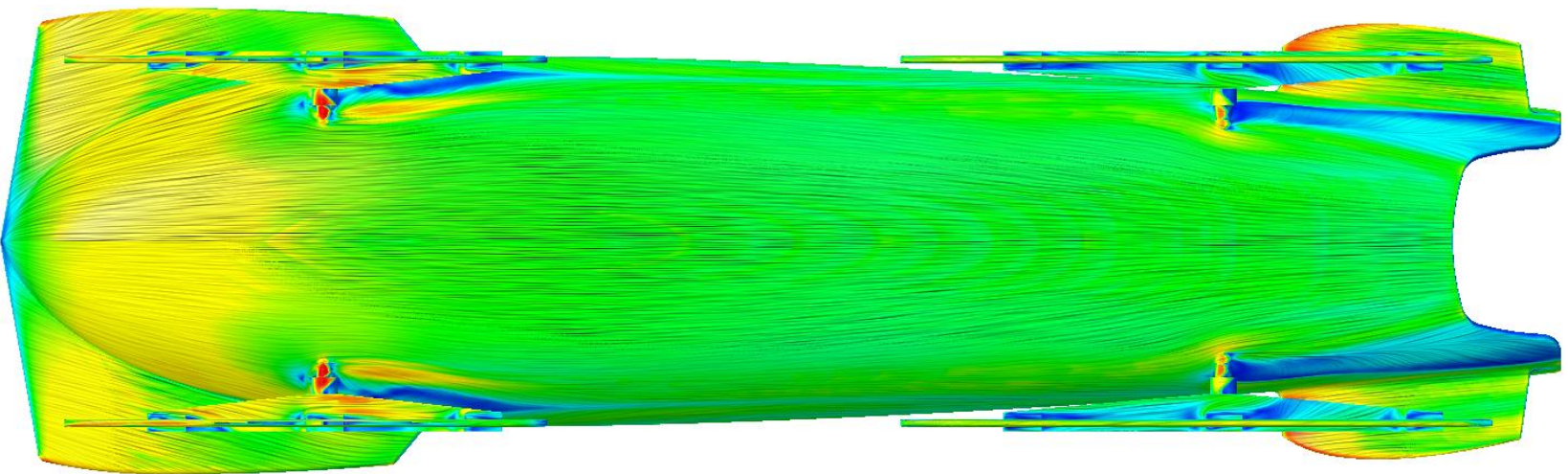
Wim Noorman, Founder of Eurotech



2x World Champion, 4x World Cup winner, 50+ World cup medals

Olympic Gold with Canada, Sochi 2014







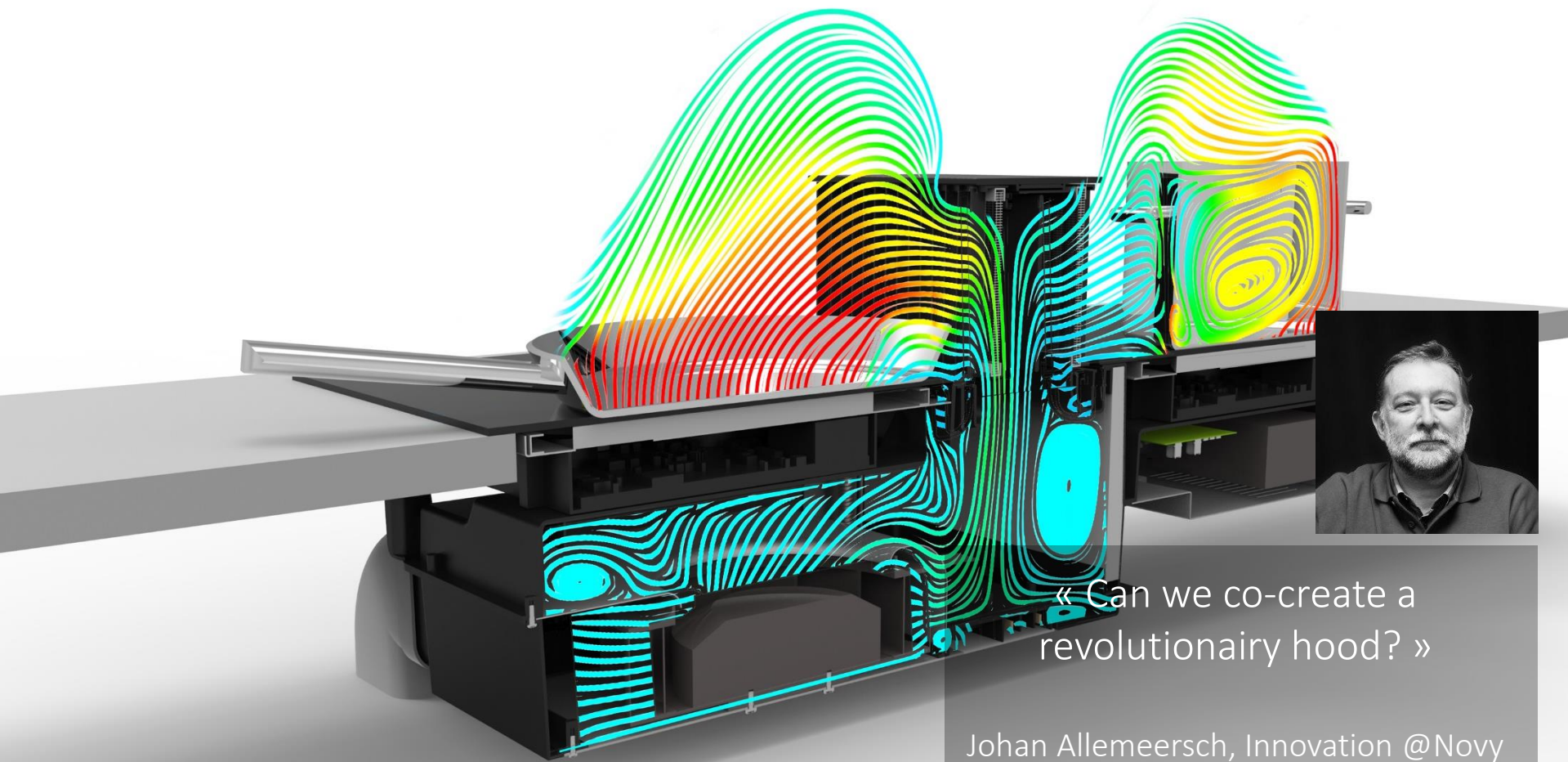
red**dot** award 2016  
winner



« Can you create a  
revolutionary hood? »

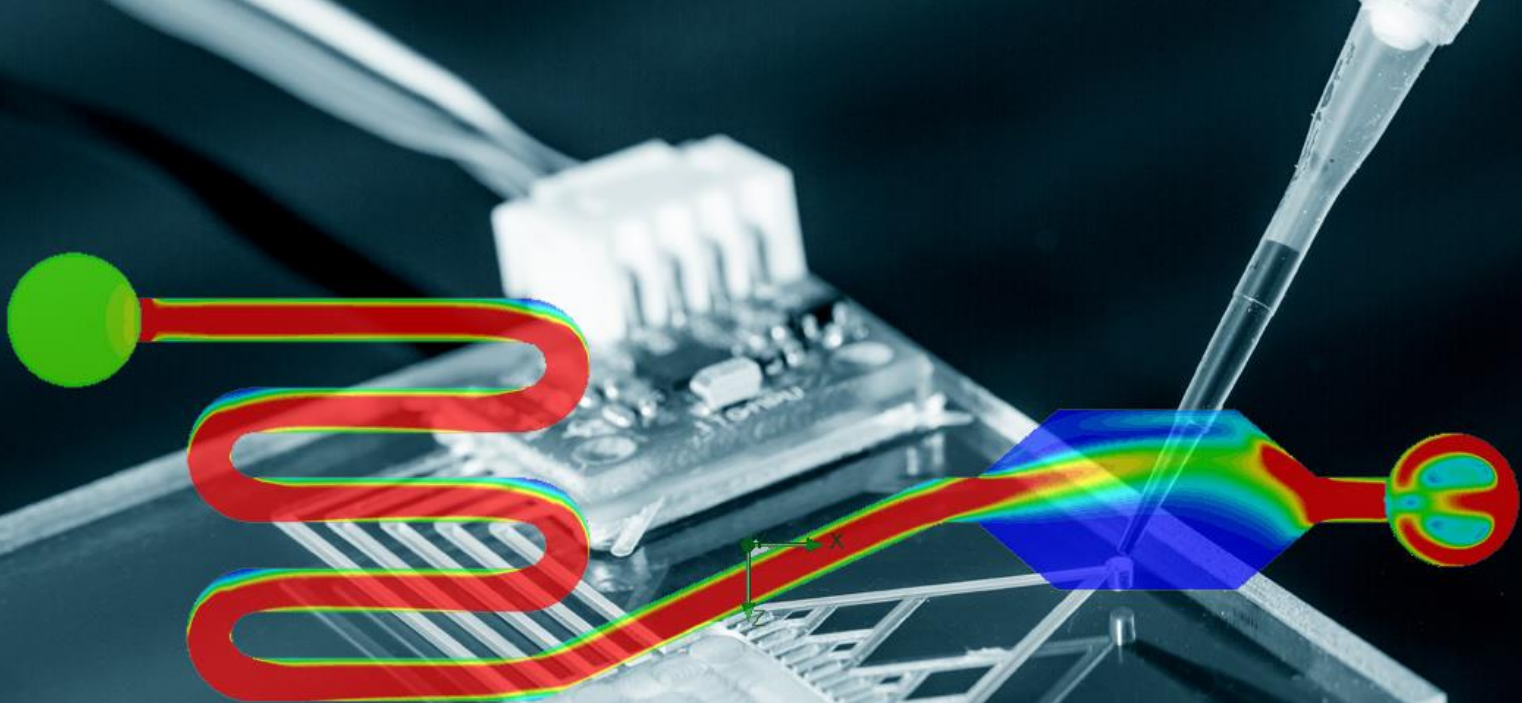
Johan Allemeersch, Innovation @Novy





« Can we co-create a  
revolutionary hood? »

Johan Allemeersch, Innovation @Novy



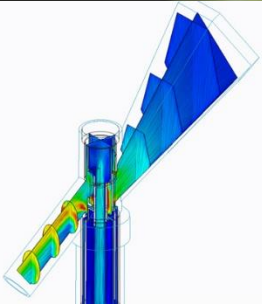
MicroFluidics and CFD (Computational Fluid Dynamics) for LoC (Lab on Chip) developments.





« Can we industrialize our IVD collection device for WHO screening programs? »

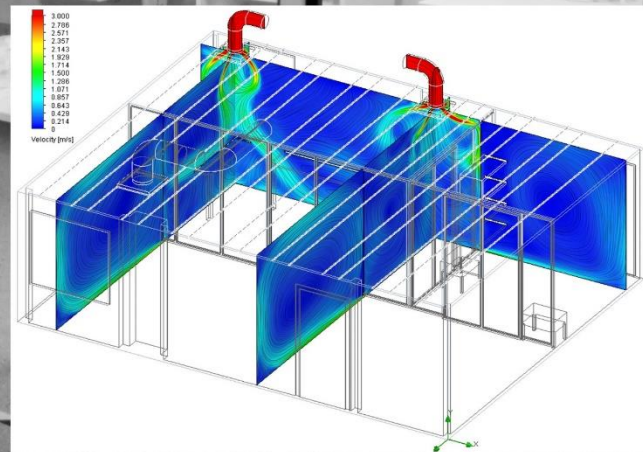
Dr. Alex Vorsters, Antwerp University



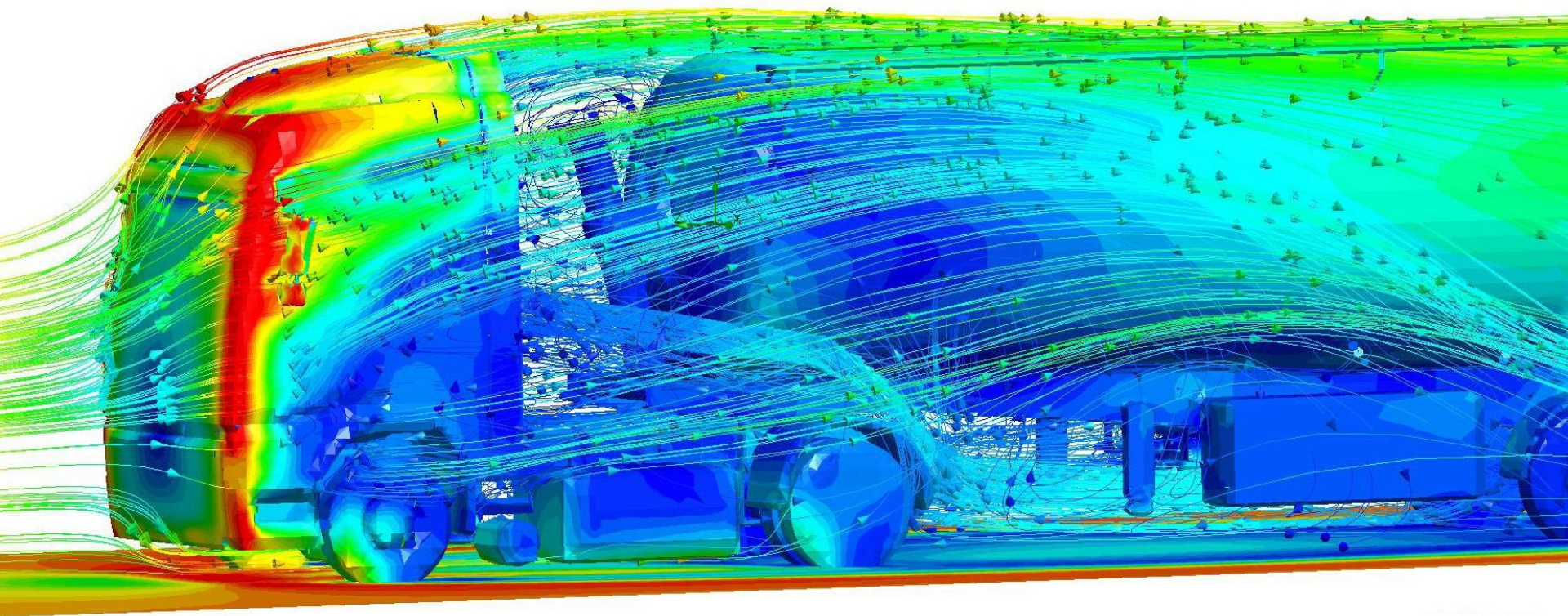


« Can we simulate and design  
our clean manufacturing area? »

Timothi Van Mulder, Quality Mgr at Novosanis







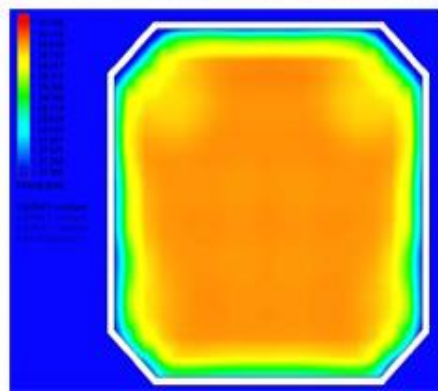
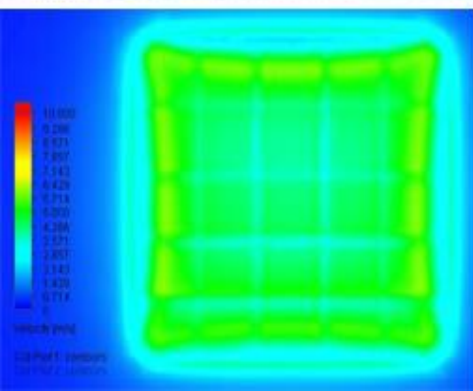
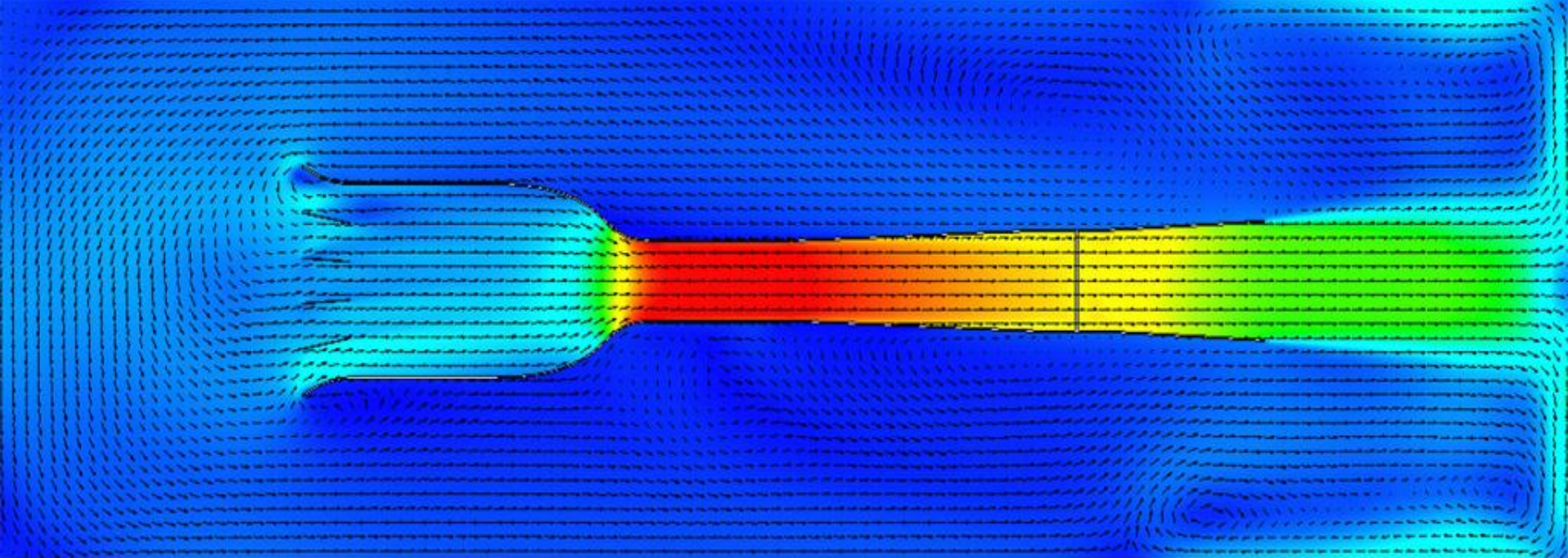




« Can you increase the speed  
and downforce of my Nascar? »

Anthony Kumpen, 2014 Nascar Champion

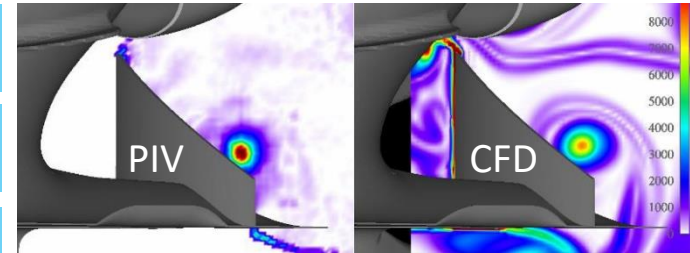




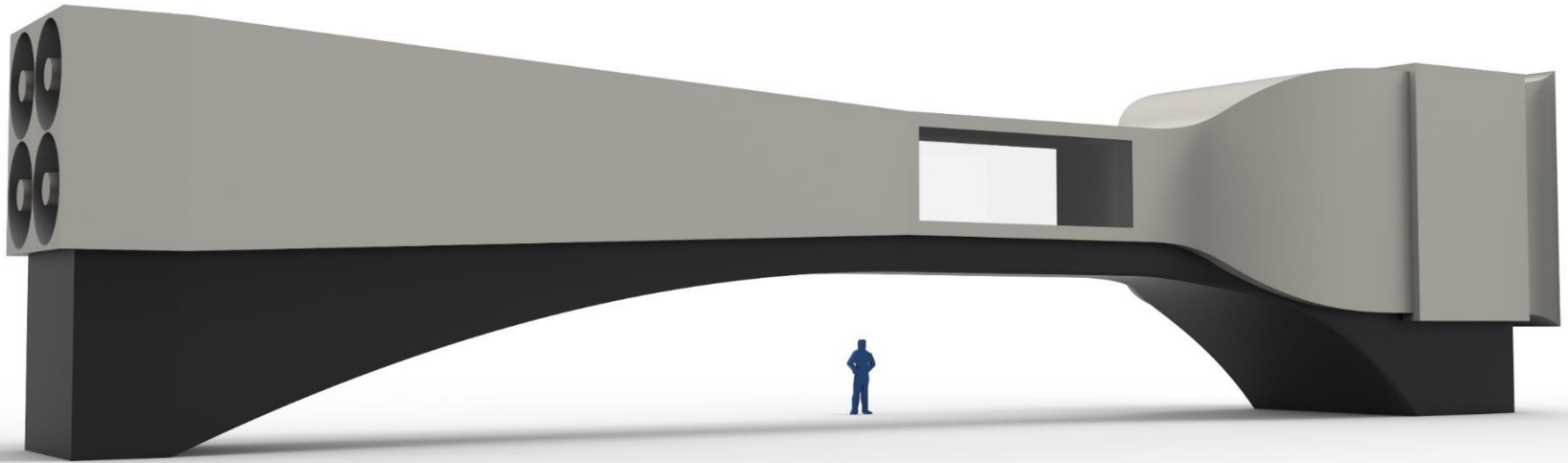
Founded by Voxdale, Ridley, Lazer, Bioracer

50m | 600m<sup>2</sup> | 2.5 x 2.5 x 6.5m test section

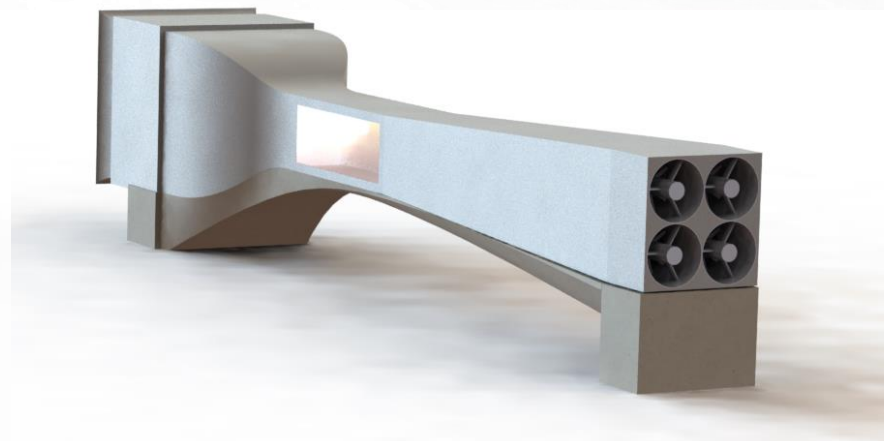
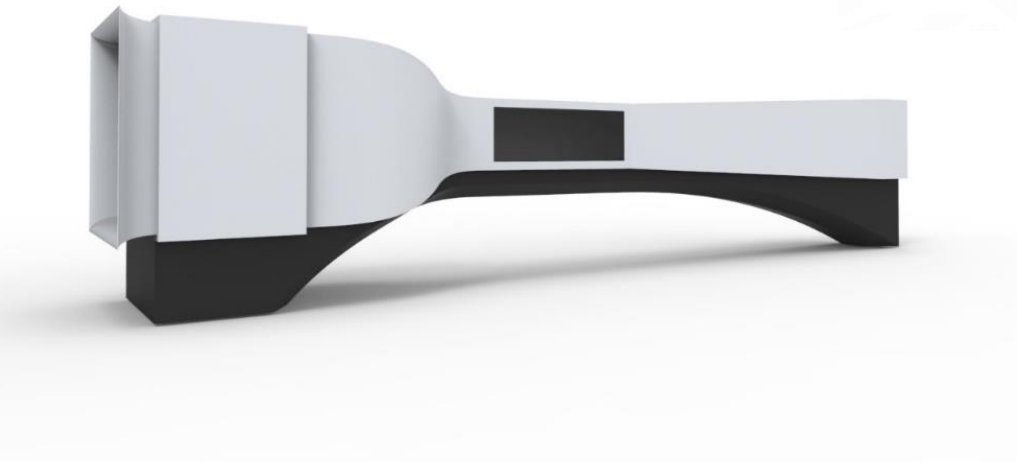
260HP | Load Cells | PIV visualization system



Wind tunnel PIV versus CFD













« Can we design high performance boats? »

Nico Bertels, Founder of Bernico



« Can we design high performance boats? »

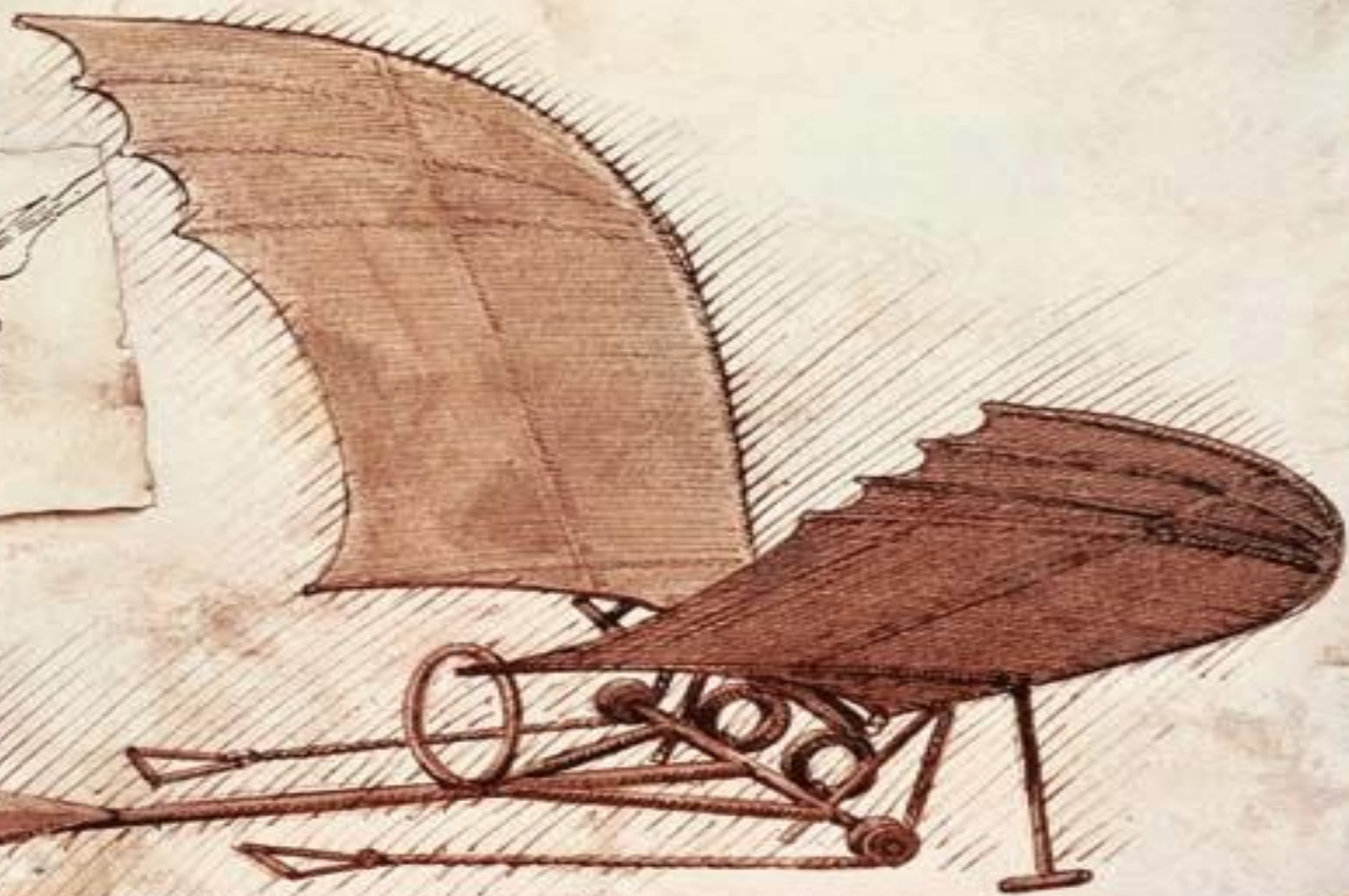
Nico Bertels, Founder of Bernico



in vivo

in situ

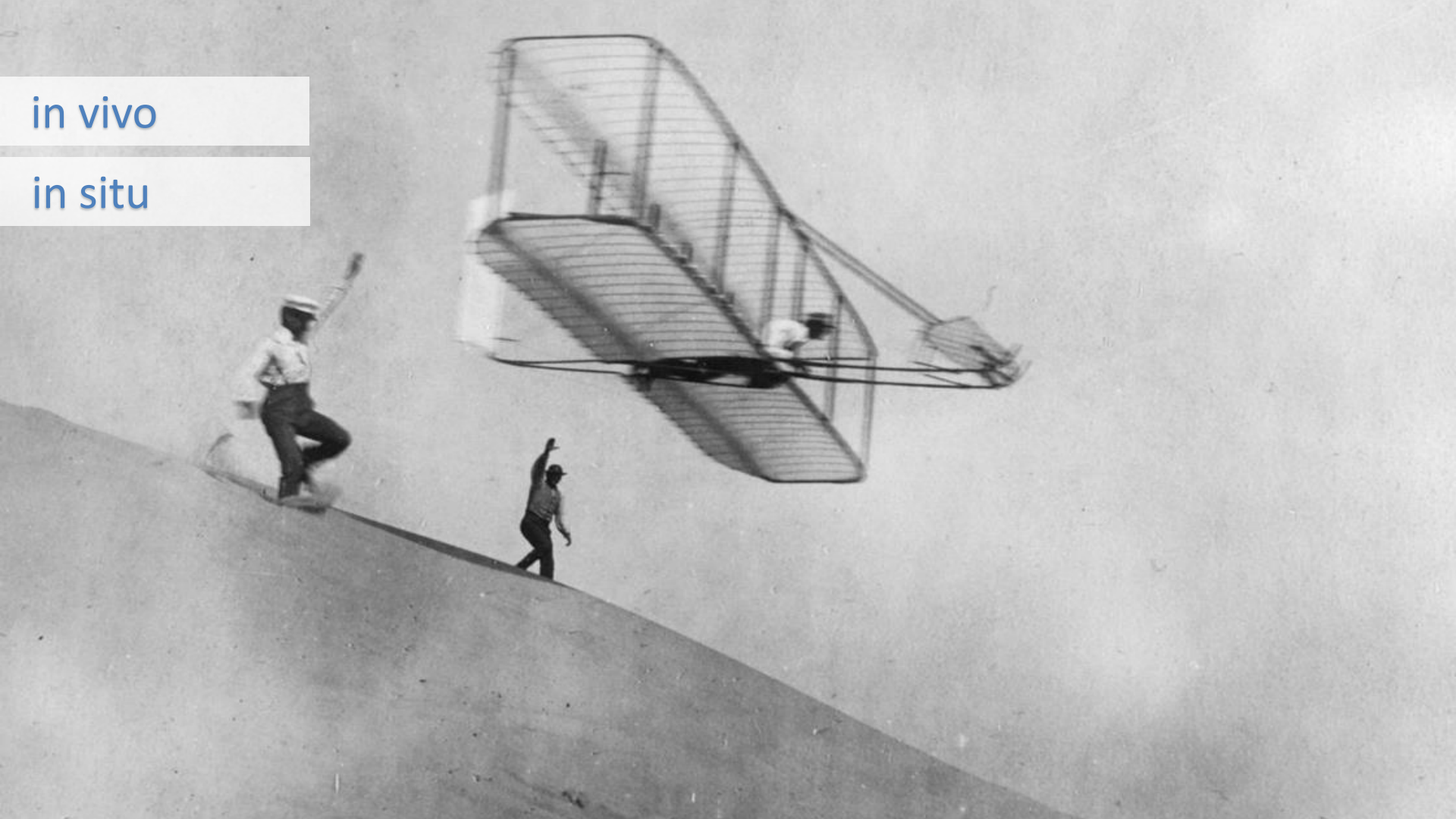






in vivo

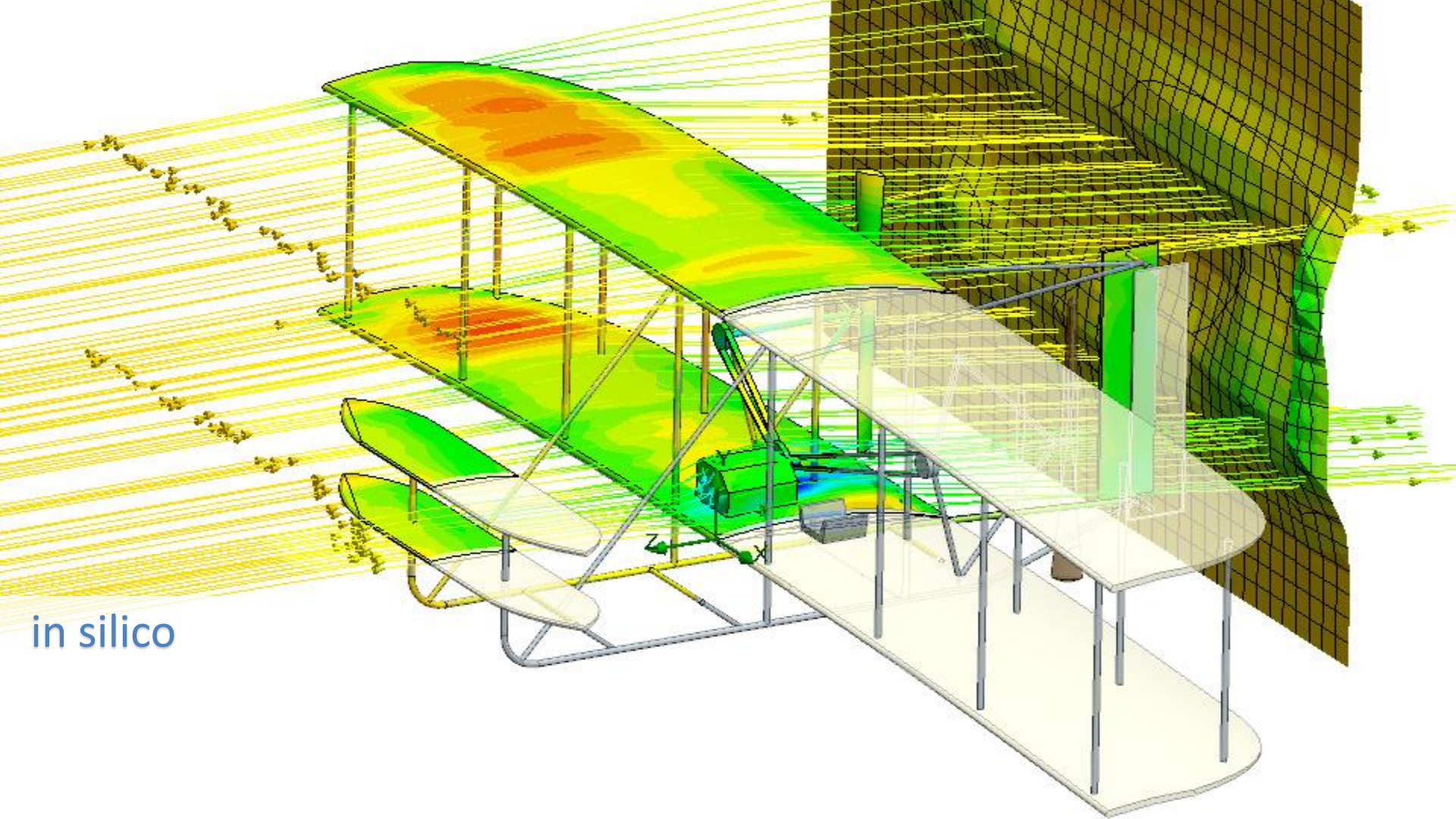
in situ



in silico



in silico



Thank you