

# Virtual Testing of Aeroelastic Configurations: ASDMAD Simulations and ETW Tests

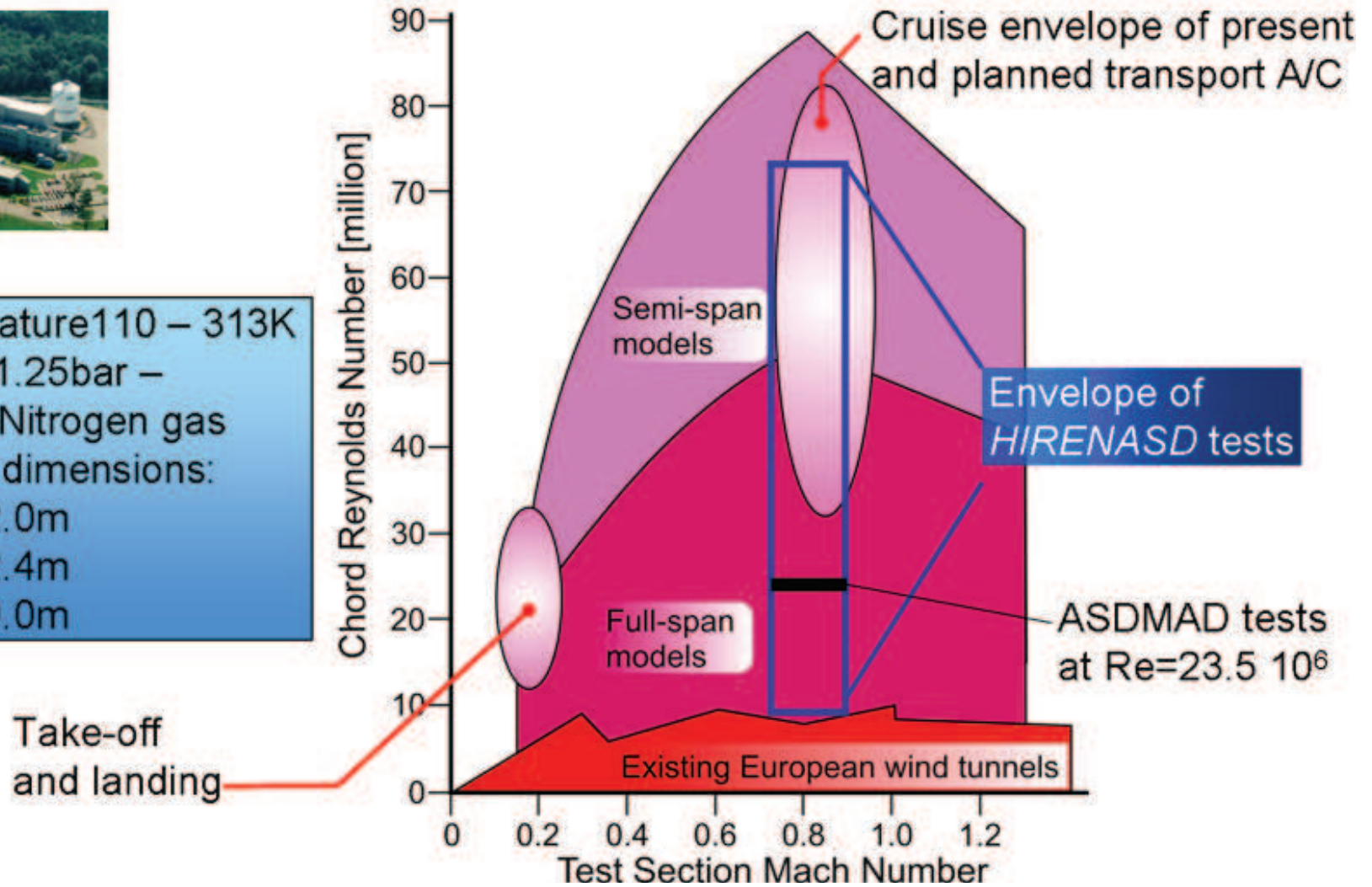
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AirTN-NextGen, Bonn  
September 25, 2014

# European Transonic Wind Tunnel ETW



Fluid temperature 110 – 313K  
 Pressure: 1.25bar – 4.5bar  
 Fluid: Nitrogen gas  
 Test section dimensions:  
 Height: 2.0m  
 Width: 2.4m  
 Length: 9.0m



Independent control of  $Ma$ ,  $Re$  and model load  $q/E$  enables separation of aerodynamic and aeroelastic effects

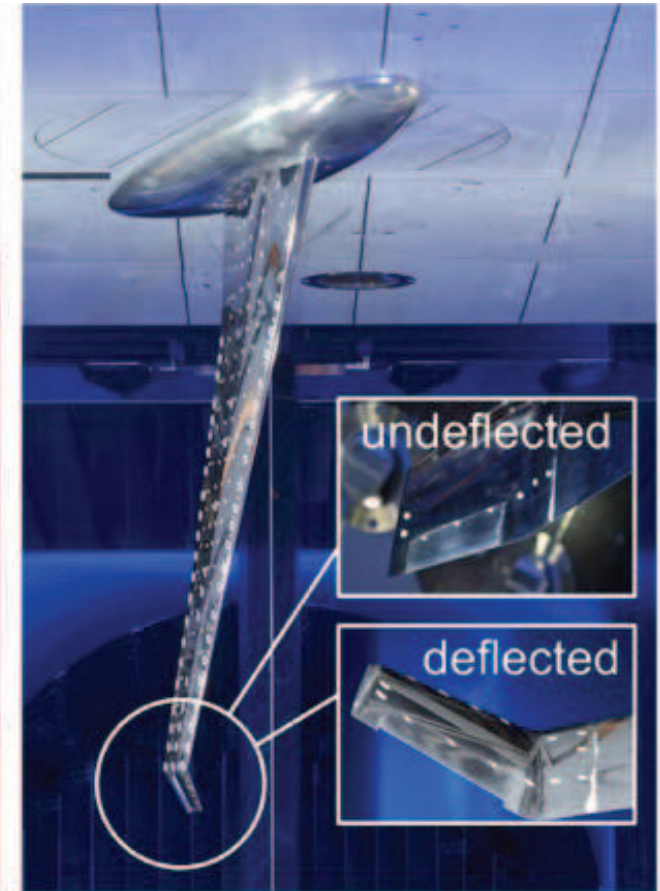
# Model Configurations in ETW



HIRENASD



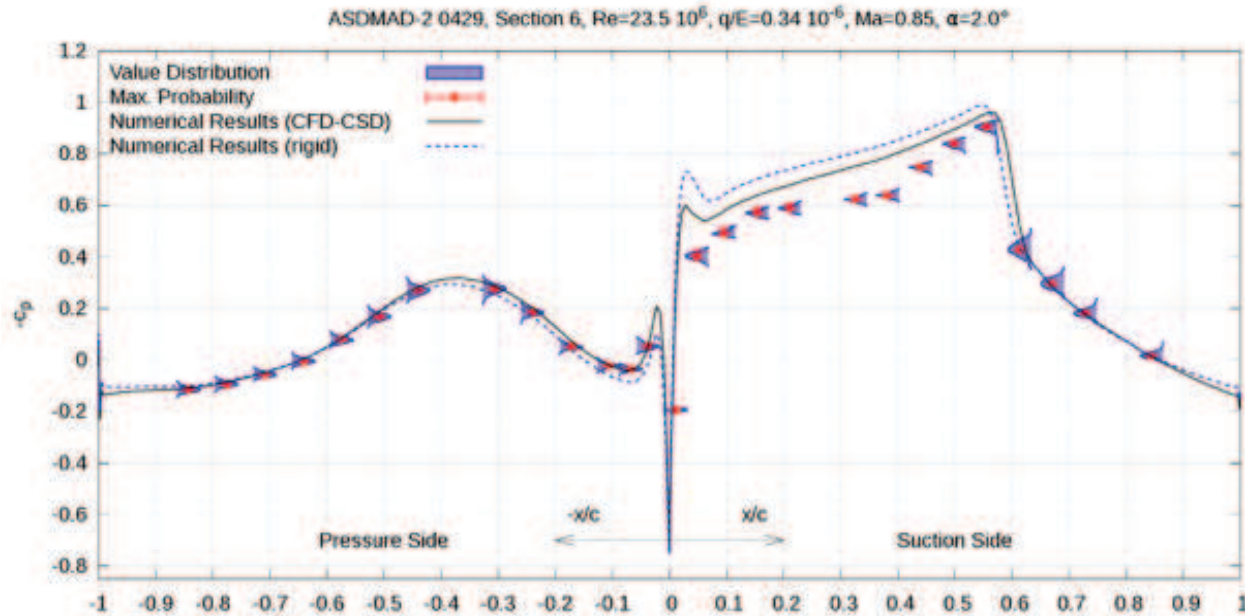
ASDMAD-1



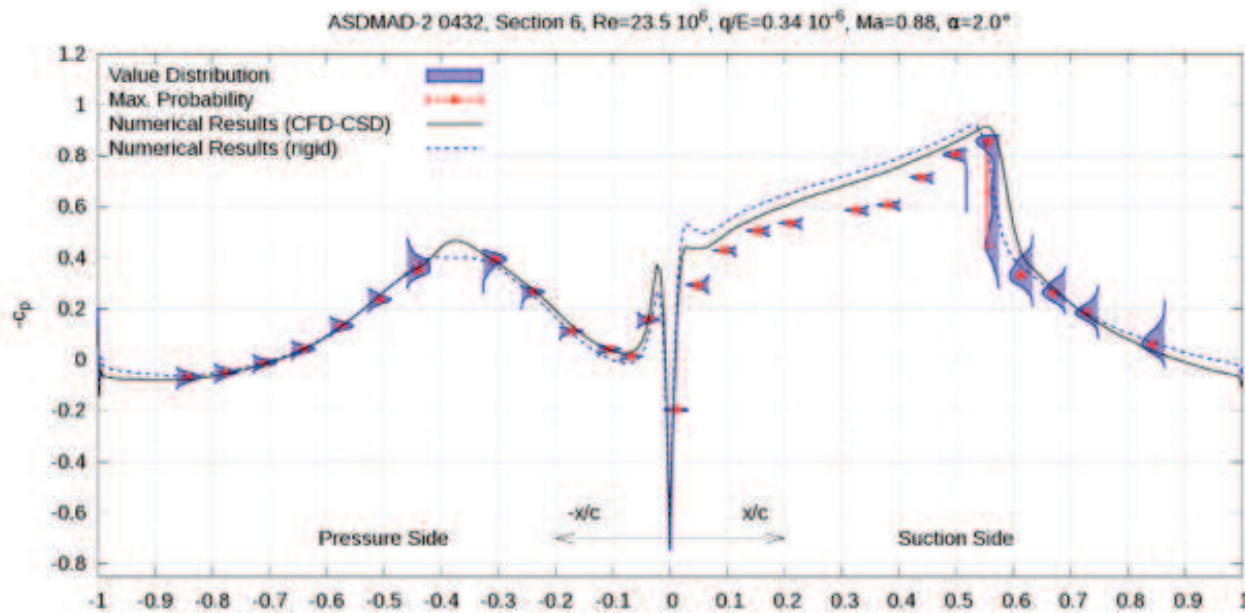
ASDMAD-2



# Pressure at Section 6 • Ma Varied



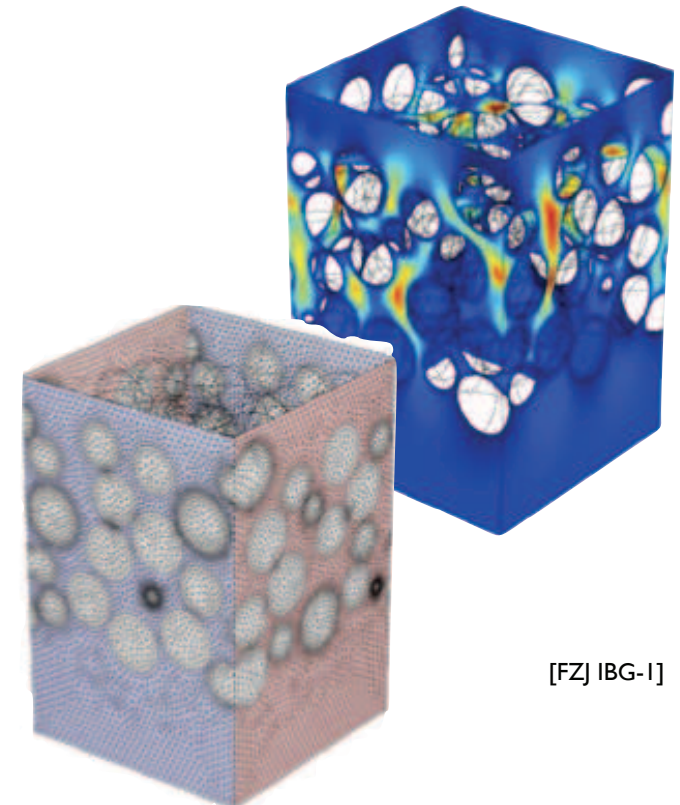
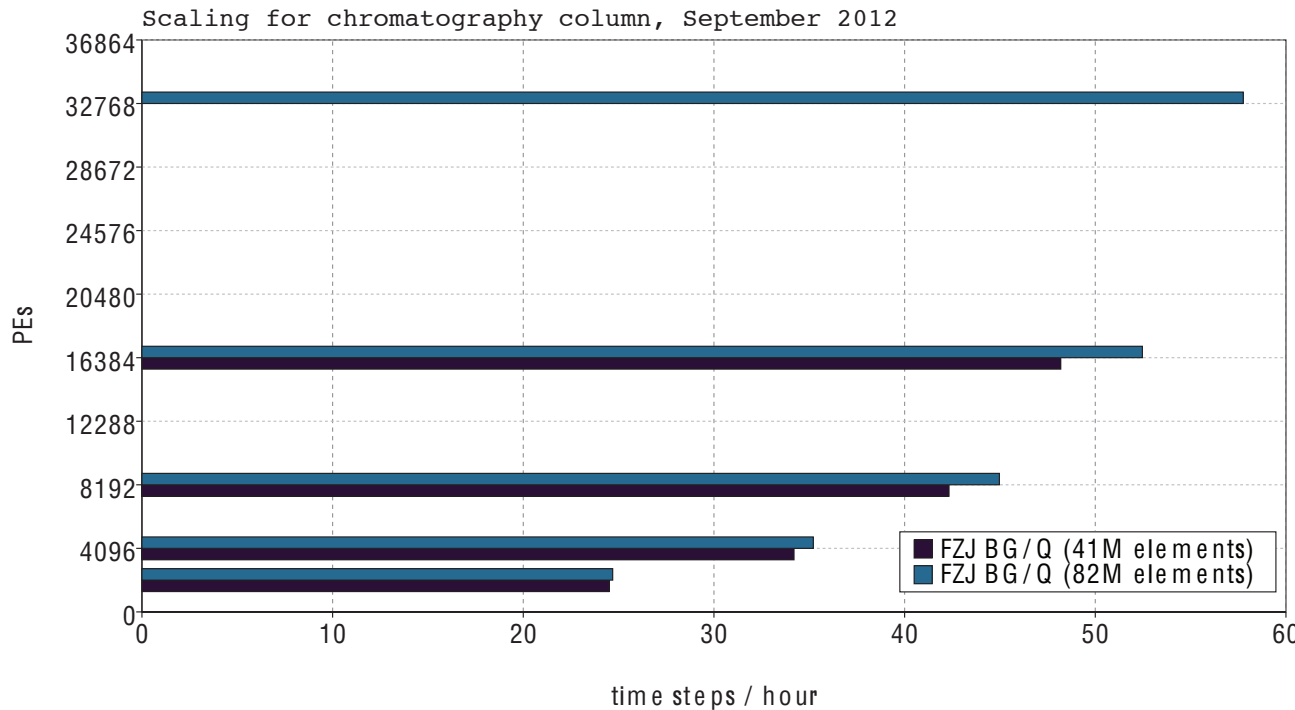
**Ma=0.85**



**Ma=0.88**

# Simulation Infrastructure • HPC

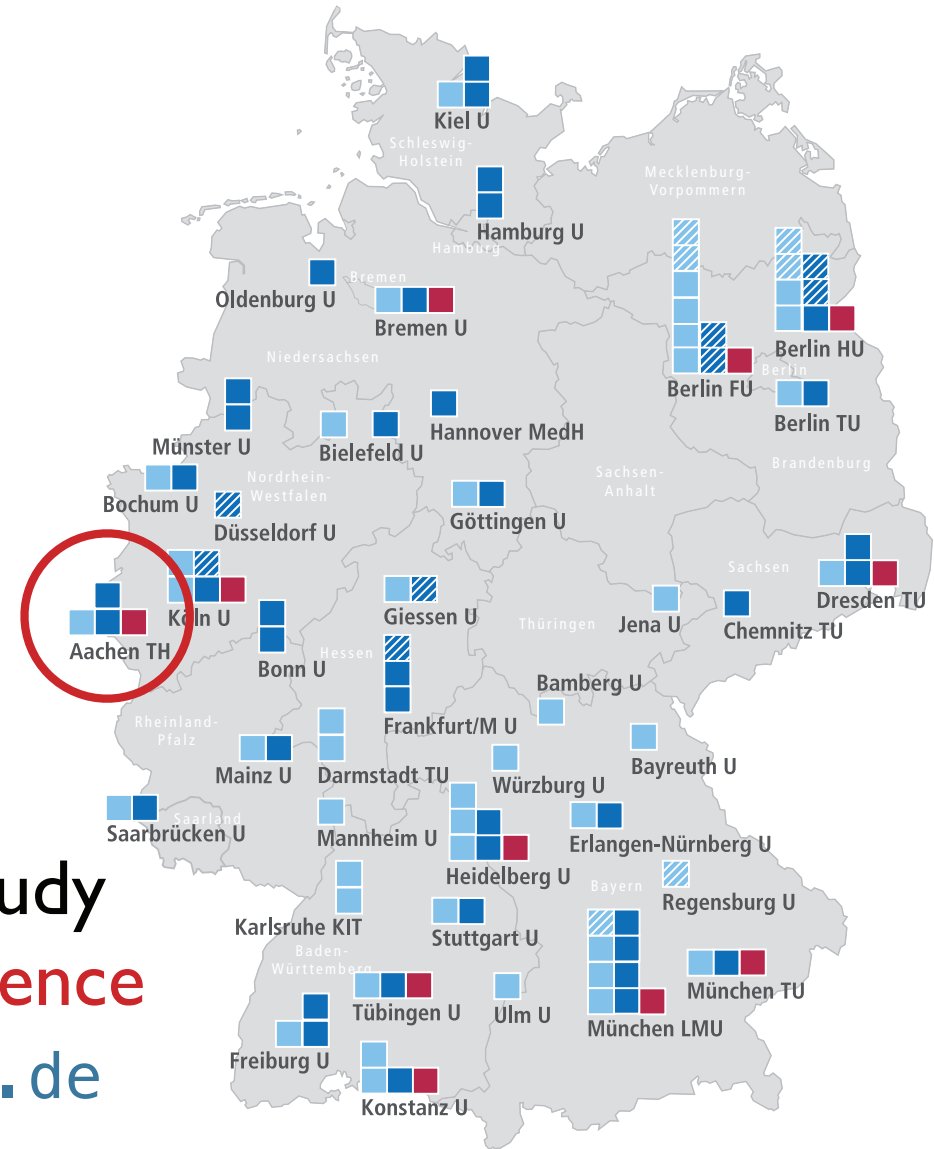
- Jülich-Aachen Research Alliance JARA-HPC:
  - Sun/Bull cluster; **26,304** × Intel Xeon X5570 @ 2.9 GHz
  - IBM Blue Gene/Q; **458,752** × PowerPC A2 @ 1.6 GHz (TOP 500 #8)
- Scaling for in-house solver in time steps per hour on BG/Q:



- Scaling issues as number of cores reach millions

# Simulation Infrastructure • **Methods**

- Validation and verification
- Multi-physics coupling
- Uncertainty quantification
- Model-order reduction



- Excellence Initiative 2006–2017
- Aachen Institute for Advanced Study in **Computational Engineering Science**  
<http://www.aices.rwth-aachen.de>