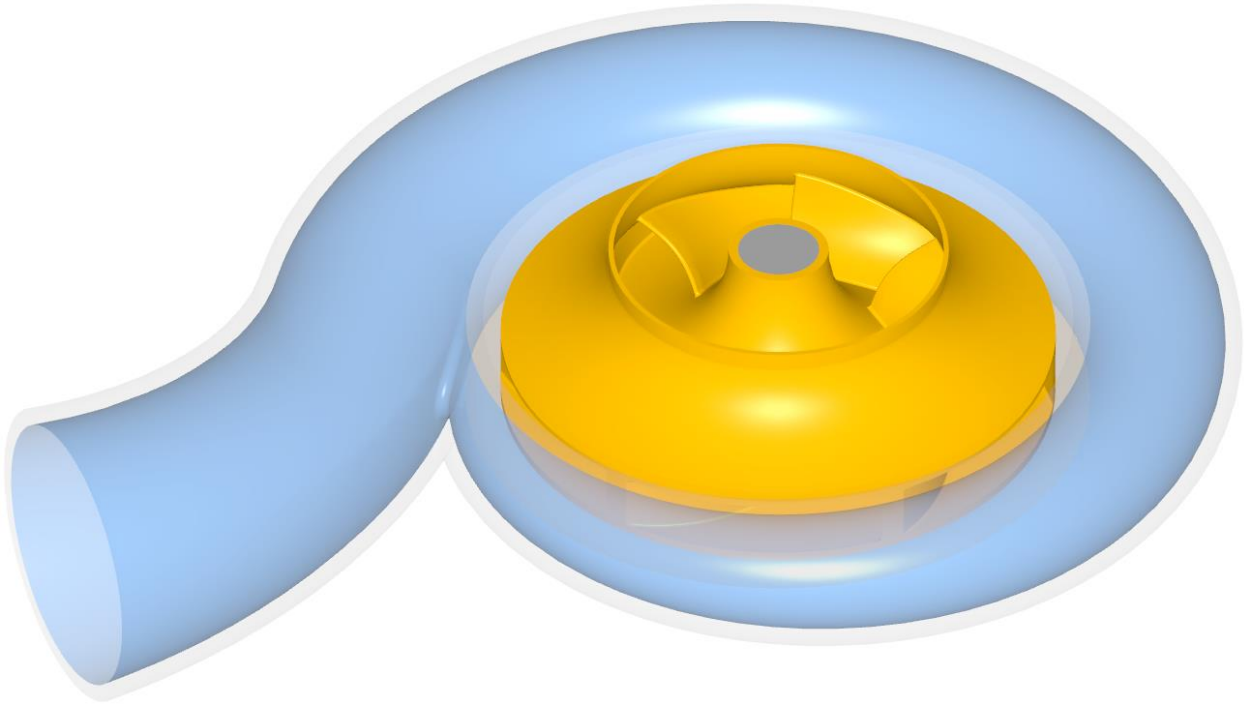
2024 series - Case Study #1

CFturbo BLADERUNNER

Centrifugal End-Suction Pump

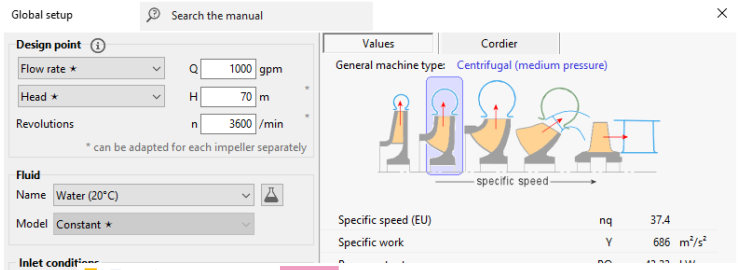


CFturbo 2024.R1 model geometry - Centrifugal End-Suction Pump

The CFturbo BLADERUNNER 2024 is a unique and innovative tool that will outperform the known capabilities of an **automated simulation process for Turbomachinery performance maps**. The new CFturbo BLADERUNNER controls the interaction of our conceptual Turbomachinery 3D-CAD system CFturbo with the 3D-CFD software CFturbo SMP (Simerics MP). This combination offers a user-friendly, robust, and affordable solution to predict Turbomachinery performance accurately, making it a tool of great interest to professionals and newcomers in the field.

The actual example will demonstrate the setup and the performance map simulation for a centrifugal end-suction pump model, including the leakage flow path.

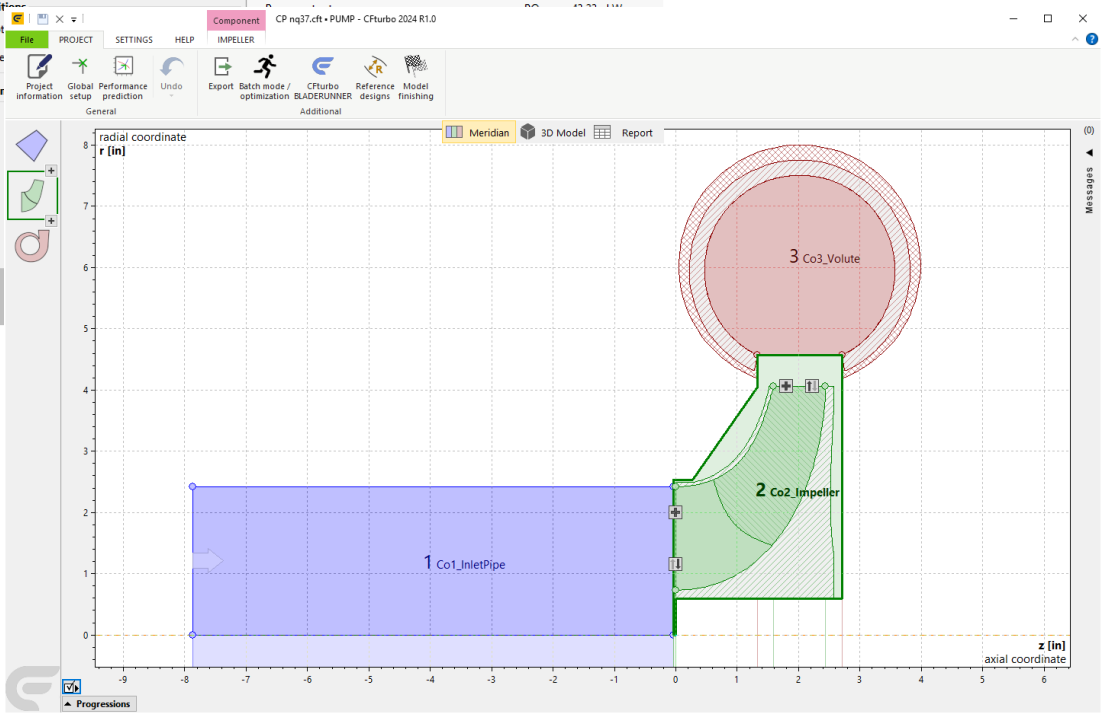
1. Define the duty point (Best Efficiency Point BEP) and create a conceptual pump design

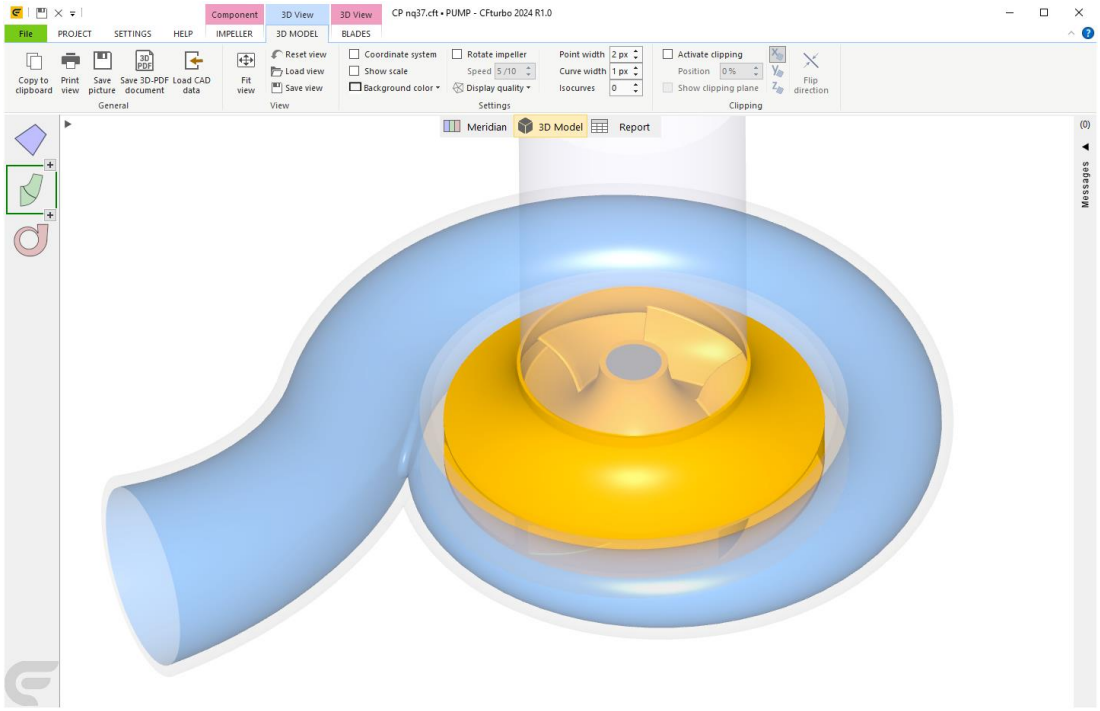


Specific speed numbers

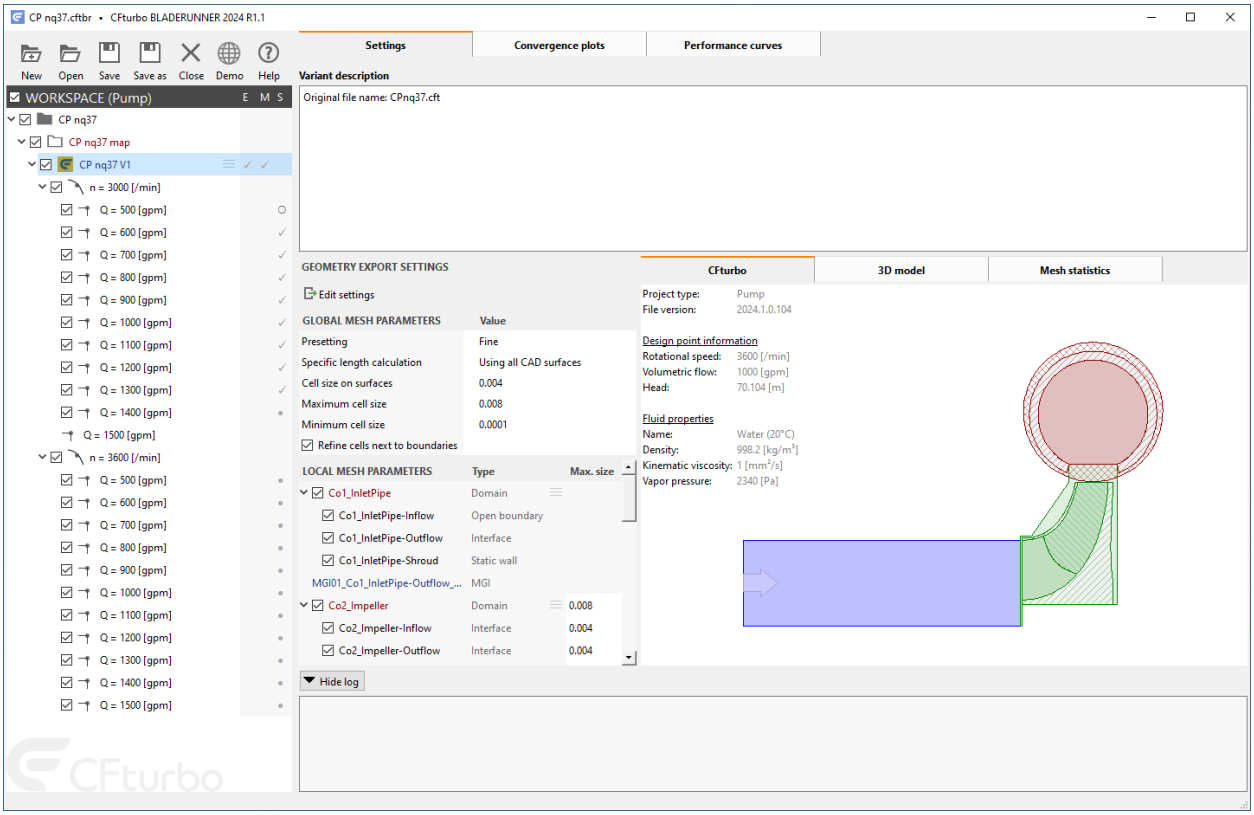
nq (EU) = 37

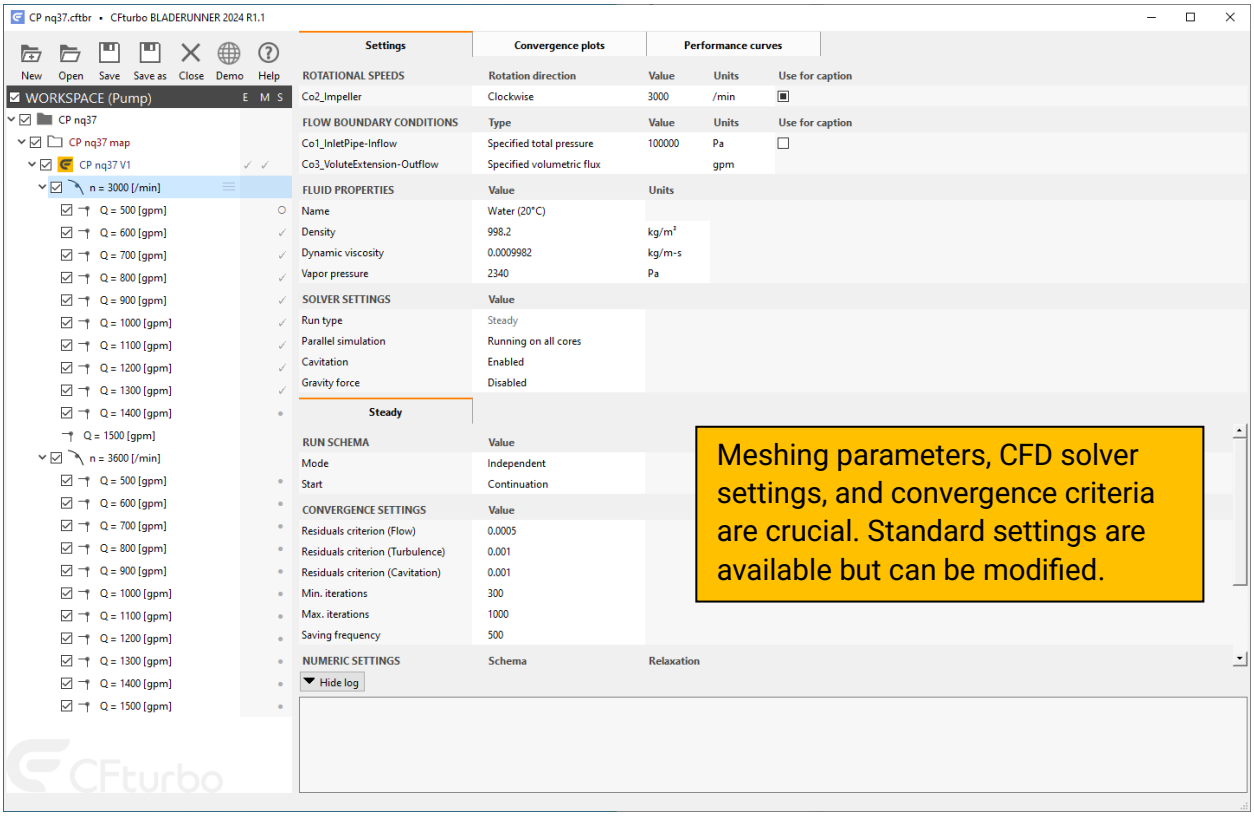
Ns (US) = 1930



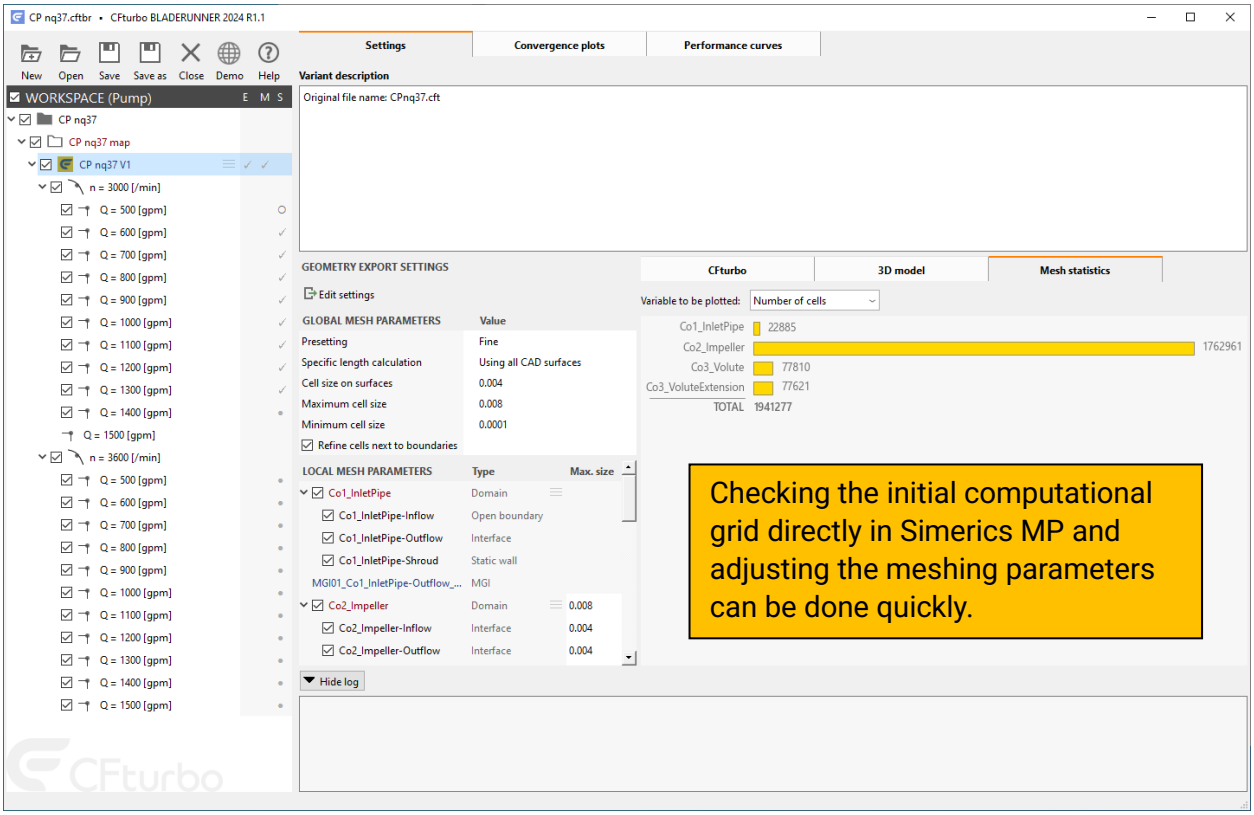


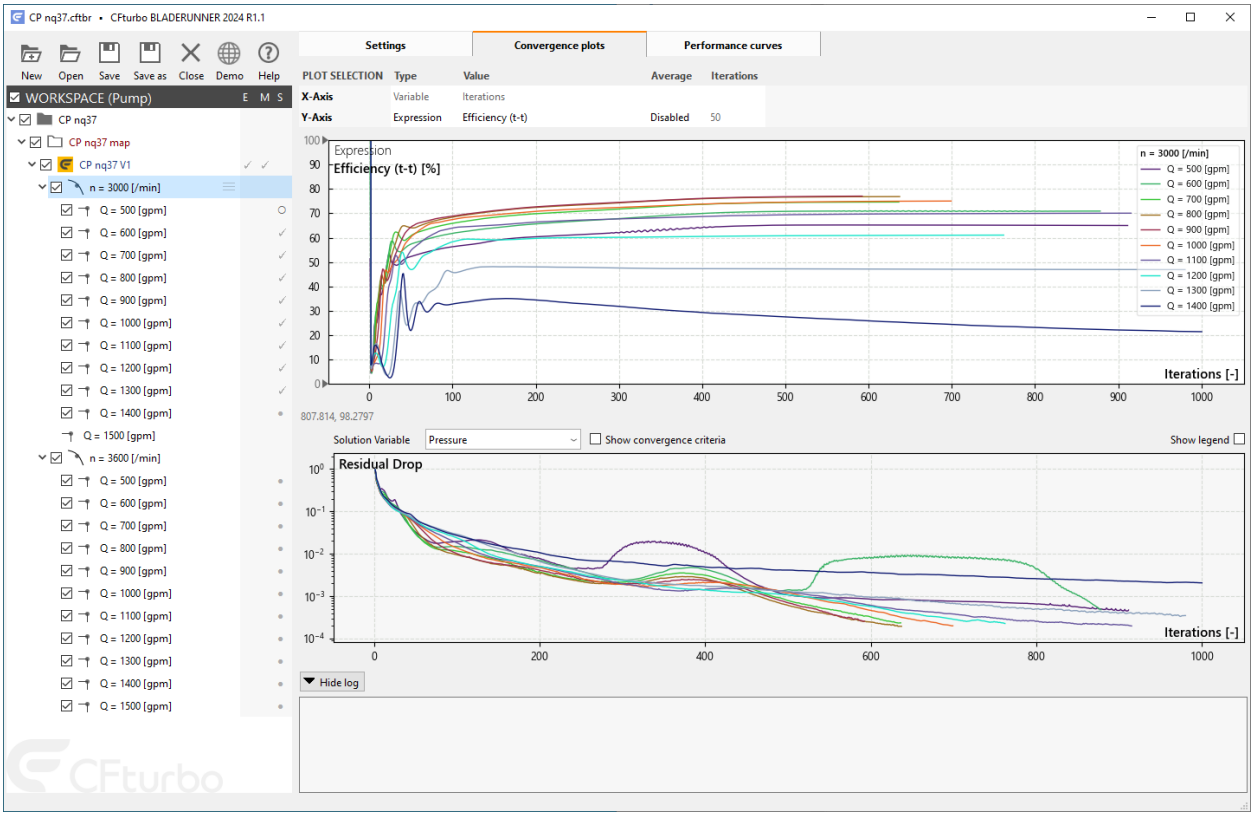
2. Start CFturbo BLADERUNNER - set up meshing parameters and CFD solver settings



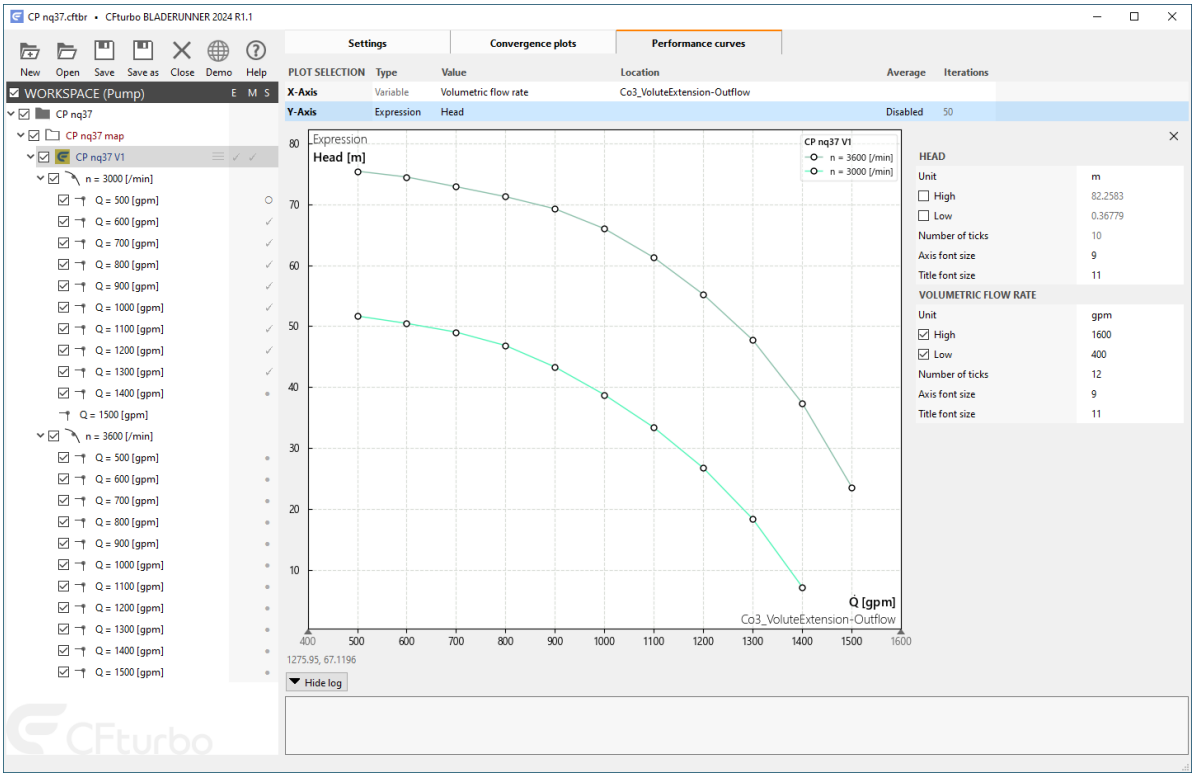


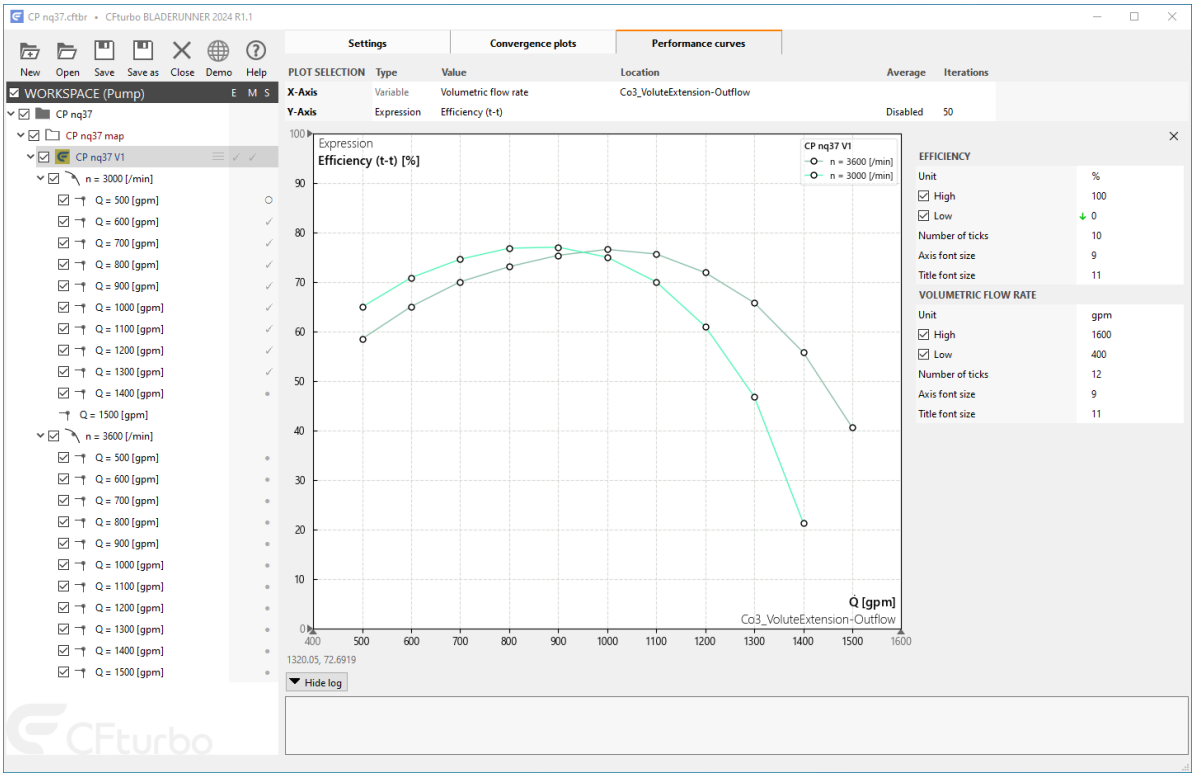
3. Review the computational grid, start CFD simulations, and check convergence





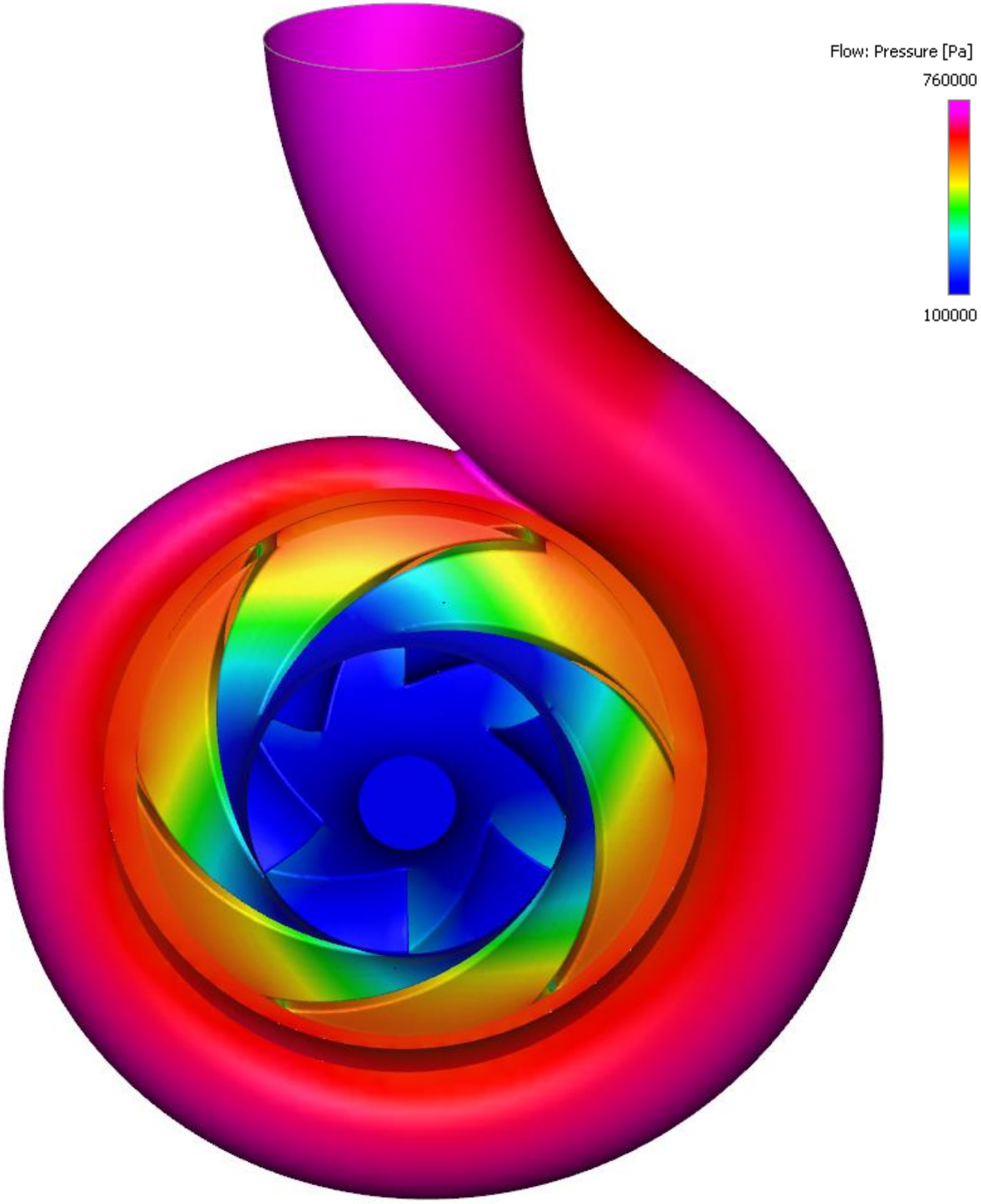
4. Plotting results - automatically during simulation runs





A user can switch and plot any available flow field variables or integral values, such as head, static, or total pressure differences, impeller or stage efficiency, shaft power, torque, etc.

5. Flow field post-processing in CFturbo SMP (Simerics MP)



6. Computational resources

- **Meshing** Simerics MP, hexahedral, binary tree mesh, **~ 2m nodes**
- **CFD code** Simerics MP, k-ε-turbulence model
- **Run time** 1 operating point, Steady-state (MFR) simulation **~ 6 … 9 minutes**
  1 operating point, Transient, 3 revolutions ~ 20 minutes*
- **Processor** Intel® Xeon® Gold 6438Y+, 2 GHz, 32 Cores, 32 Logical Processors

* Automated transient flow simulation and DoE/optimization technology are currently under development and will be integrated into the subsequent releases, CFturbo 2025.R1, and R2.

7. Summary

"An accurate pump performance curve over the lunch break …", anticipated for a long time, has become a reality! Predicting reliable Turbomachinery performance maps has always been a challenge, mainly when one must deal with limited resources. The all-new CFturbo BLADERUNNER, combining the conceptual 3D Turbomachinery design software CFturbo with the 3D fluid flow solver Simerics MP, delivers CFD results fast using a standard 32-core Windows workstation.

Compared to simplistic inviscid flow calculations or loss-model-based performance estimations, here we have a practical solution based on detailed Turbomachinery geometry components and 3D-CFD that provides fast and reliable performance data and will open an excellent path to affordable and accurate design exploration and optimization.

8. About CFturbo

CFturbo (est. 2008) is headquartered in Dresden, Germany, with a major office in Brooklyn, NY. CFturbo is dedicated to Turbomachinery design and engineering services in designing rotating machinery components and solving fluid flow and heat transfer problems. The company has gained worldwide respect within the Turbomachinery community.

Our conceptual design software, CFturbo, is the most user-friendly system available on the market. Through its unrivaled, intuitive, and user-friendly design process, CFturbo software empowers every user, regardless of experience. The software can be used to design various turbomachinery-related devices, including pumps, fans, blowers, compressors, turbines, stators, and volutes.

CFturbo, Inc. offers various Turbomachinery engineering services, including aerodynamic and hydraulic designs, CFD and FEA simulation, rotating machinery optimization, mechanical design, prototyping, and testing. For more information, visit cfturbo.com.