

Team RACKlette



About Us This is RACKlette

RACKlette (yes, like the cheese!) is a team of students from the Swiss Federal Institute of Technology (ETHZ) that share a passion for HPC. We are a permanent group that is active all year round and we represent the student body at ETHZ. Our team sports people from different departments, most notably Mathematics and Computer Science. Currently we have 12 active team members, but only six of them will be competing at SC22 here in Dallas.

The whole team



The current Roster



Niklas
 Hoi zäme, I'm Niklas and I'm now in my 5th semester of Computer Science. This is my second competition as I participated in the ISC22 Student Cluster Competition. My main interests are low level systems and hardware architectures.



Marcel
 Hello! My name is Marcel and I am a student of Computational Science at ETH. I'm currently in my 5th semester specializing in computational chemistry. This year I was part of the team that won second place at ISC22!



Piotr
 Hi, I'm Piotr. I'm a Computer Science student at ETH, currently in my 5th semester. My main areas of interest are parallel algorithms and systems programming. I have already participated in this year's ISC22 competition.



You
 Ni hao! My name is You and I am studying CSE with the specialisation field Geophysics. I am currently in my 5th semester and this will be my very first HPC competition. I am interested in numerical modelling and applied category theory.



Wendelin
 Hi there! My name is Wendelin and I study Computer Science (3rd semester) at ETH Zürich. I am fascinated by the use of HPC for solving real-world problems, especially in the domain of finance. This will be my first competition, so I am looking forward to getting to know y'all!



Christopher
 Hello! My name is Christopher and I am studying CSE. I am interested in many different fields such as neuroengineering, applied mathematics, AI, computational finance and of course HPC. This will be my first competition!

ETH Zurich Our University

This is the Swiss Federal Institute of Technology in Zurich. In German it is called the *Eidgenössische Technische Hochschule Zürich*: that's where the acronym **ETHZ** comes from!



ETHZ was founded in 1855 and since the beginning it has been a national center for education with international appeal. Over the years ETHZ has collected quite a long list of remarkable scientists, who have been students at the university: even Einstein studied at ETHZ! Today, ETHZ is still regarded as one of the best universities in the world and is consistently ranked in the top 10. If you are interested in learning more about the history of ETHZ, scan the QR code!



Our work is also closely related to **CSCS**, the Swiss Center for Scientific Computing (in Italian *Centro Svizzero di Calcolo Scientifico*) located in Lugano, canton of Ticino. CSCS is host to our cluster: they are responsible for the maintenance of our hardware and allow us to access the cluster throughout the year so that we can practice, test new ideas out and prepare for upcoming competitions. CSCS also offers us tutoring as we collaborate with experts in various fields of science to get the best performance out of our cluster. For more information about CSCS scan the QR code!



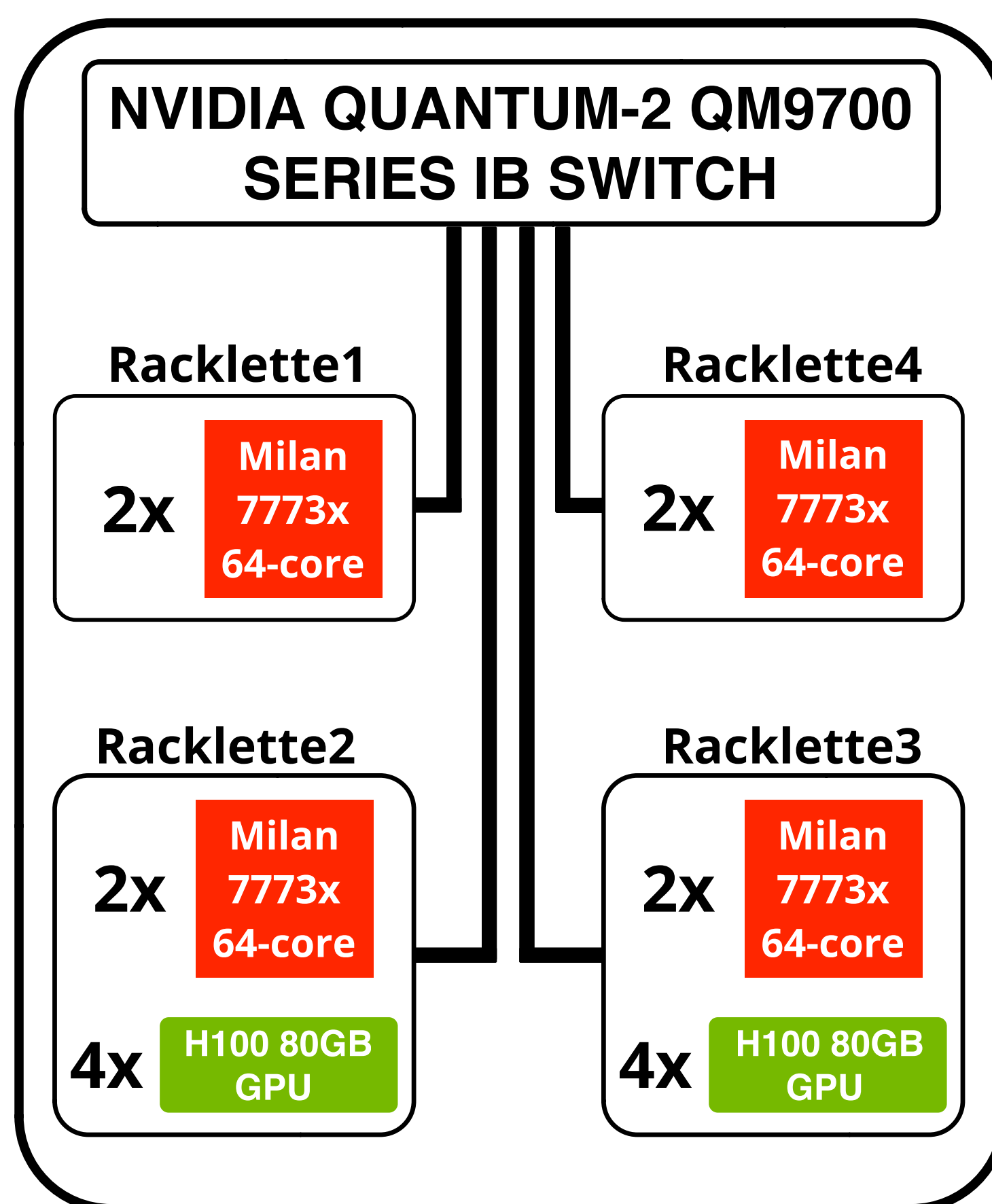
Our supervisor - Hussein

Hussein has been working in the field of HPC as an employee of CSCS for over 20 years. He is our main point of reference when it comes to seeking advice or when we are facing a serious obstacle.



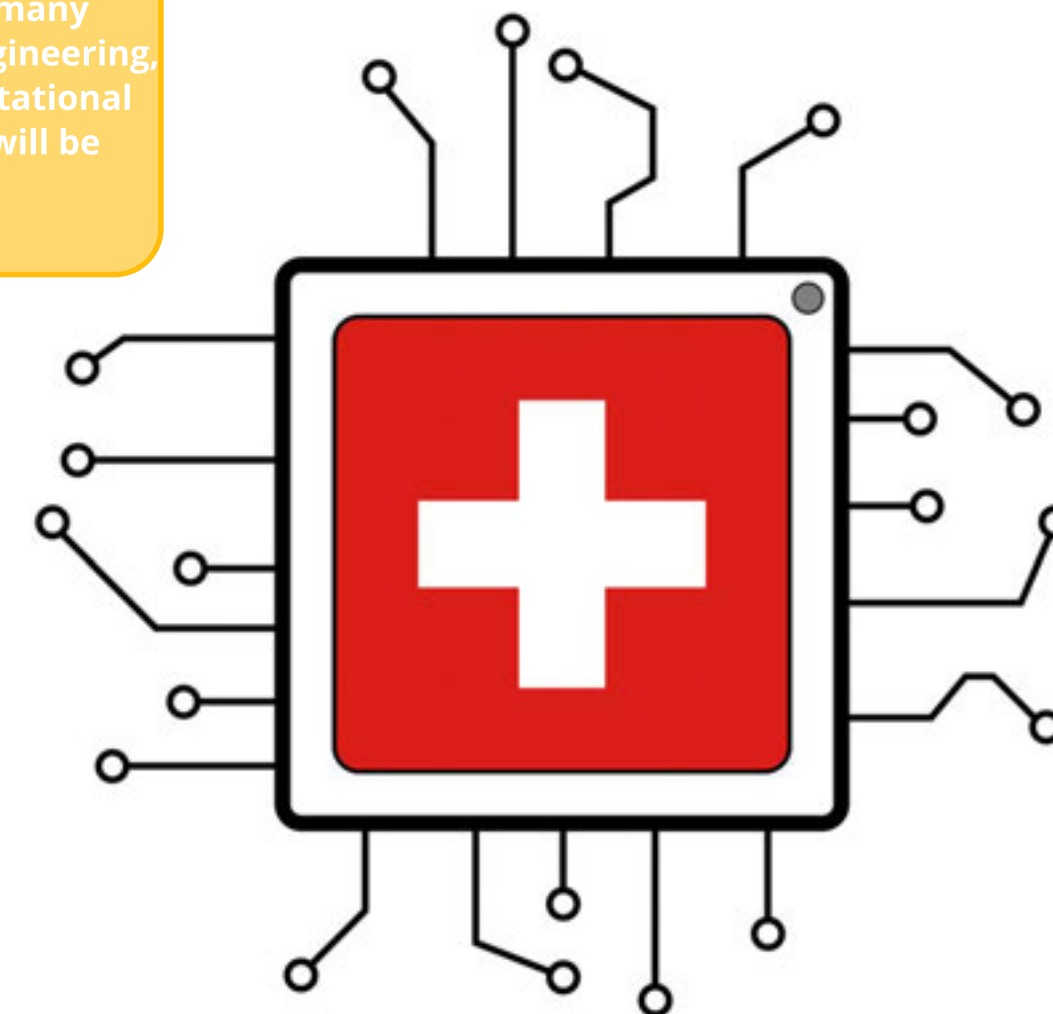
The cluster Hardware & Software

- Cluster setup:
- NVIDIA QUANTUM-2 QM9700 SERIES IB
 - 4 x SMC 4124GS-TNR (4U)
 - Dual socket AMD Milan 7773X; in total 8 CPUs in the cluster with 512 cores
 - 512GB of memory; in total 2048GB of system memory
 - On two nodes - per node 4 Nvidia H100 80GB GPU accelerators; in total 8 accelerators in the system / if not available A100 (probably)
 - On one node 1-4 2TB NVMe in a raid-0 config (benchmarked)



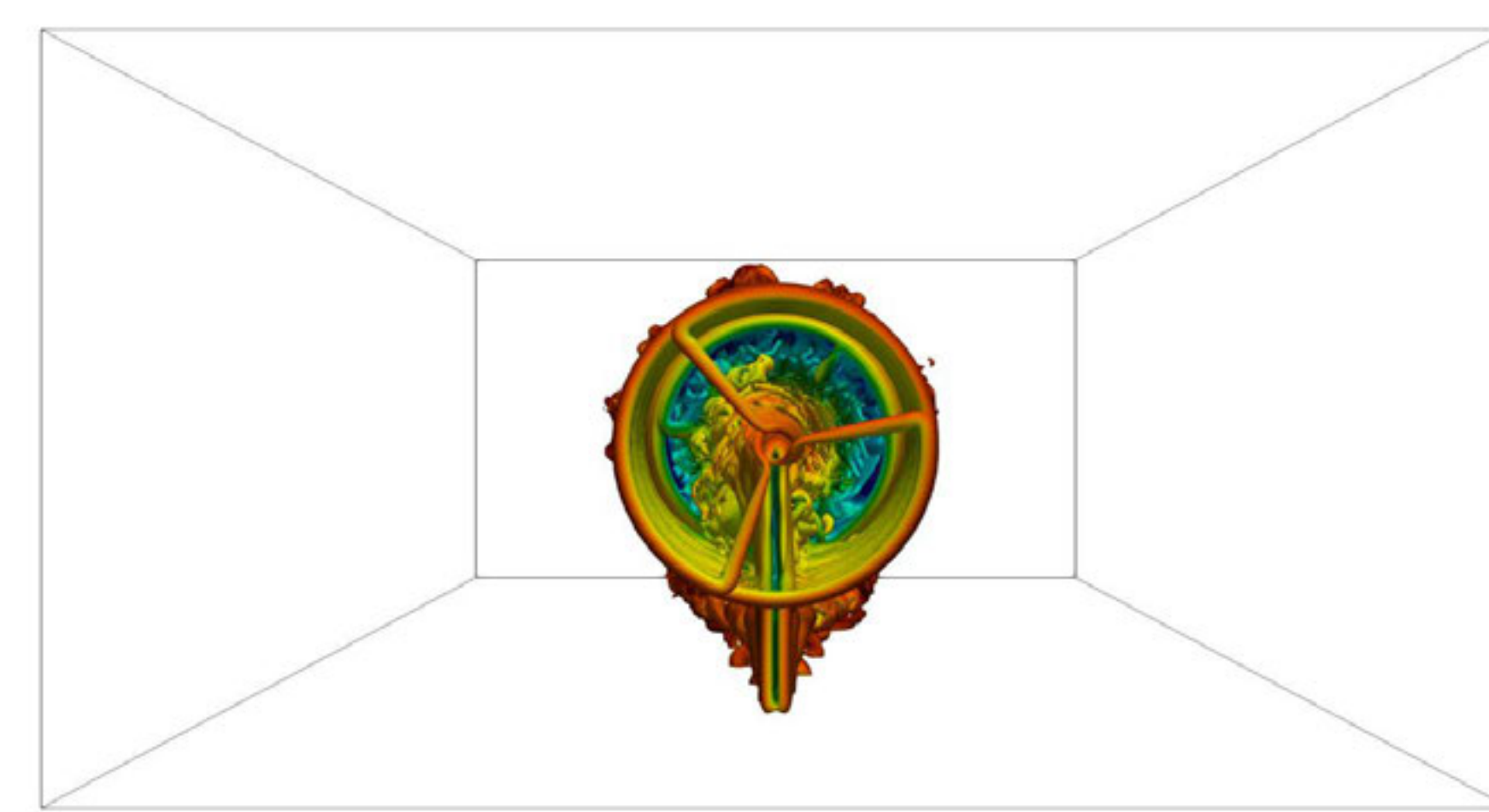
The system we brought to the Student Cluster Competition at Supercomputing 2022 in Dallas is an upgrade of our quite successful setup from ISC22's SCC in Frankfurt. We upgraded our CPUs from AMD Rome 7742 to the new AMD Milan 7773x to increase computing power and the 8 new Nvidia Tesla H100 accelerators allow us to further improve our performance on GPU optimised applications. We also replaced our previous IB with a QUANTUM-2 IB from Nvidia and configured it to run 400Gbit/s inter-node communication. Our system has been developed in close cooperation with our experienced advisors from the

Swiss National Supercomputing Centre (CSCS) and supported by our system component sponsors. We run rocky, a well established Linux distribution, for maximal compatibility with any HPC software. On top of our OS we run the Bright Cluster management with a single master node and three compute node configuration. The overhead has been measured to be negligible, however the gains in time and workflow are significant.

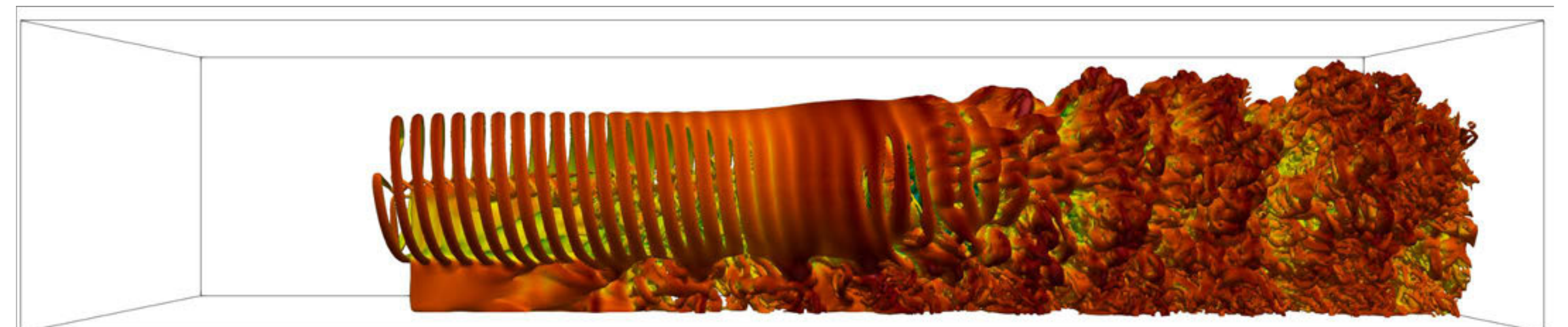


Our Work Strategy & Preparation

From past experience we have learned that organization is key when it comes to the competitive environment of HPC competitions, therefore when we prepare for such an event we always try to follow a set of guidelines to ensure everything gets done efficiently. The pictures show some of our work during past competitions.



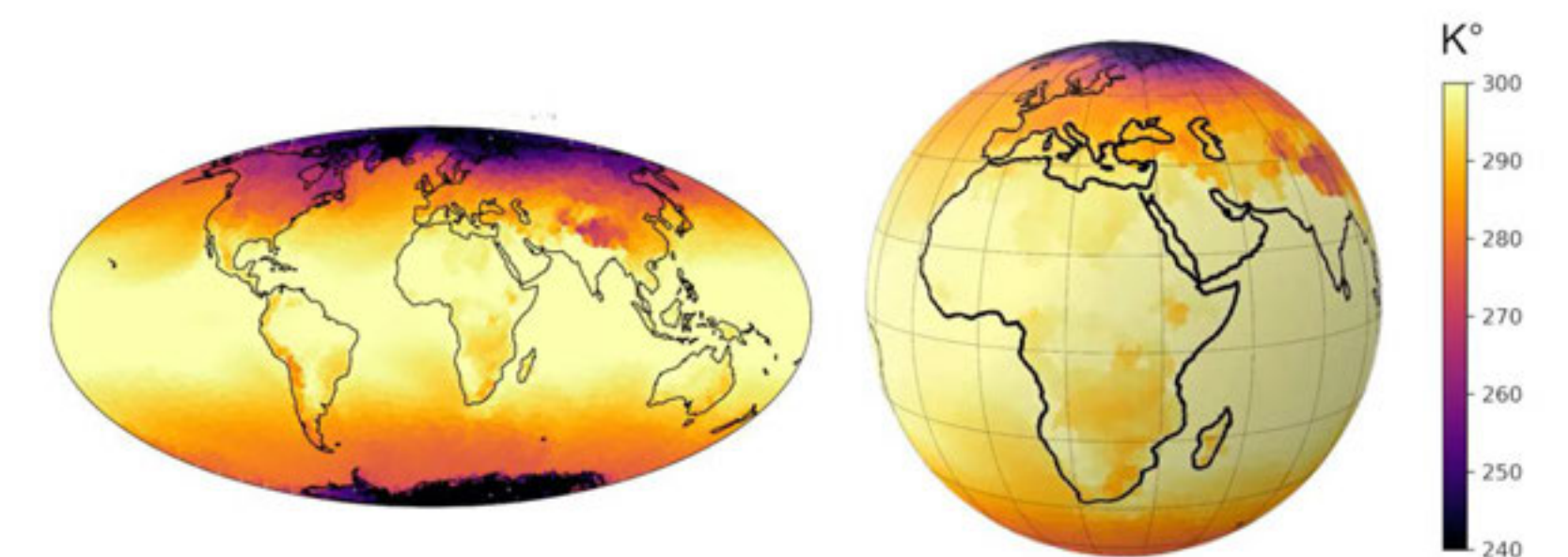
XCompact3D Wind Turbine CFD Simulations - Best performance by far at ISC22. Scan the QR code to view the full animation.



- Here are a few of the principles we try to follow:
- Assign two people per task: at least one computer scientist and one computational scientist working together to get the best of both worlds
 - Have weekly update meetings and when necessary further meetings for specific tasks
 - We are a big team: even if only six at a time will be working on the competition, we keep the rest of the group updated so that we are all able to learn
 - Attend workshops organised by CSCS
 - Have tutoring from experts at CSCS for each application
 - Examine our own written documentation, that we produced during past competition
 - Use project management tools to stay on track
 - Rely on performance profiling to figure out what can be improved
 - Always try different compilers, MPI implementations and process distributions

ISC22 Student Cluster Competition
Team RACKlette (ETH Zurich)
ICON Earth System Model

Average temperature



ICON Earth System Model simulation at ISC22. Scan the QR code to view the full animation.

