

# Berlin United - NaoTH

## Standard Platform League

### Humboldt-Universität zu Berlin

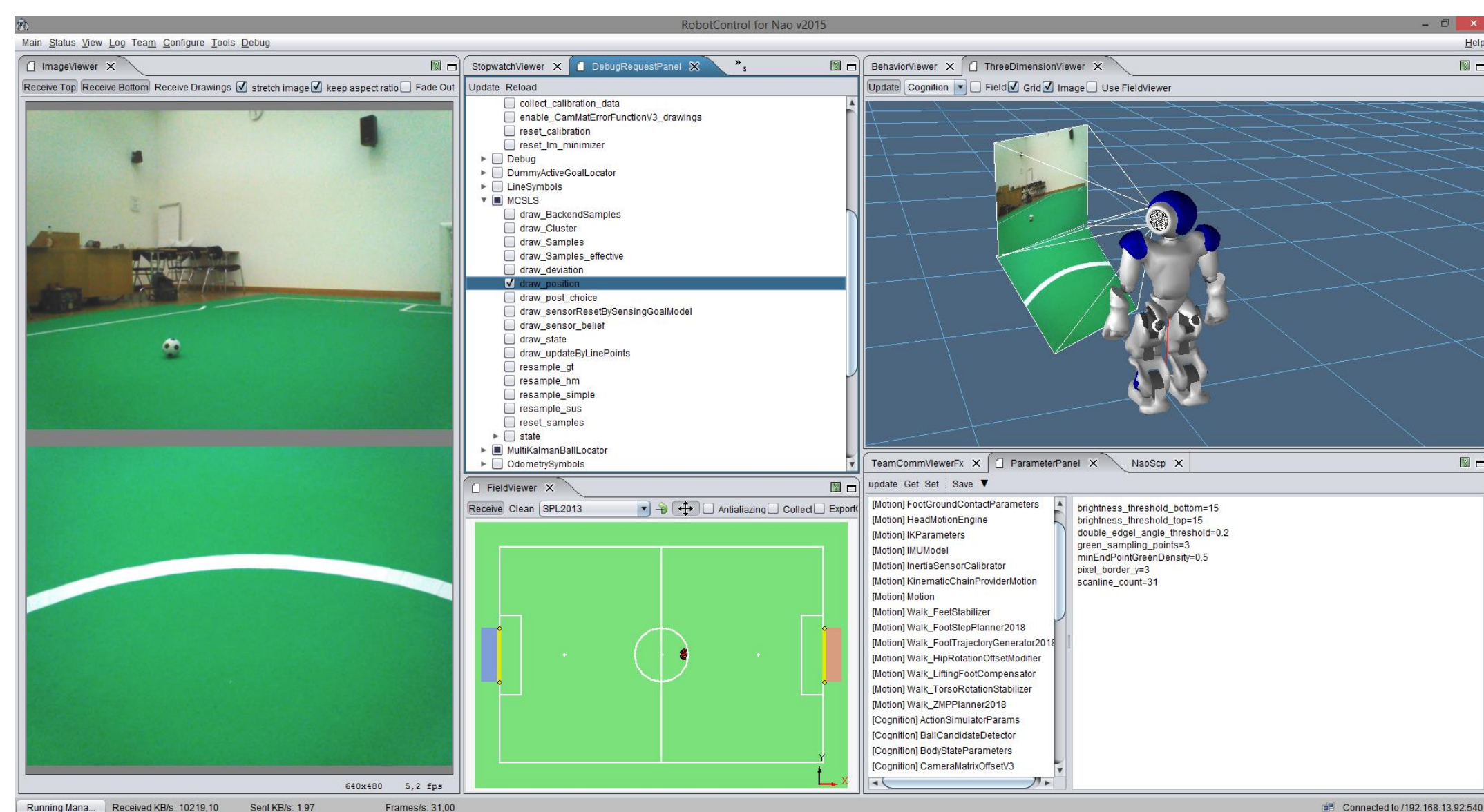


## >> Highlights of the Berlin United Code Base <<

### Software Architecture and Tools

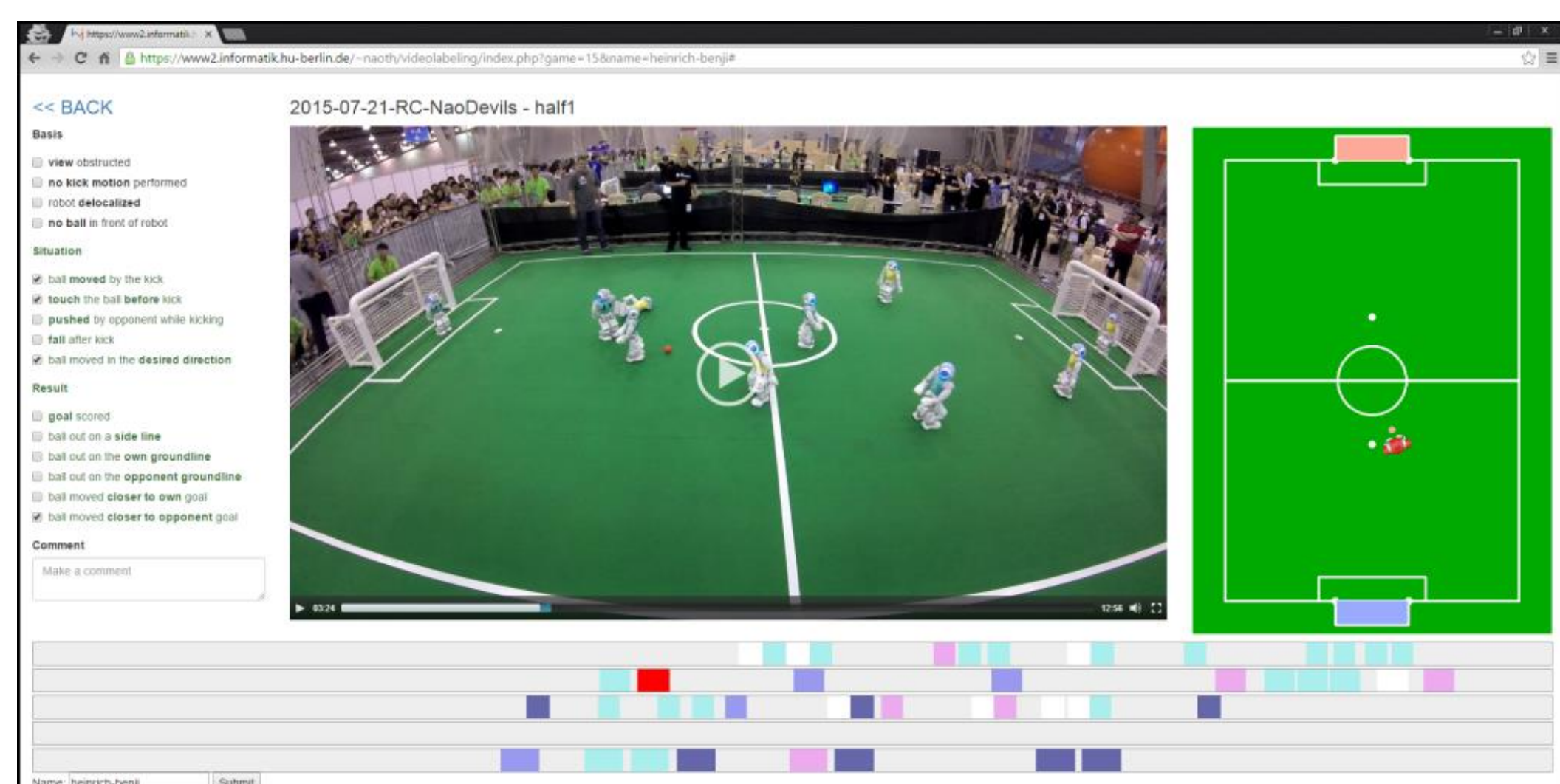
We designed a modular lightweight software architecture in C++ allowing for easy use of different platforms with the same code base, like different simulators and the real robot. It also enables easy testing and debugging, and allows for students of different levels to work together.

**RobotControl** (figure below) is a visual tool developed by our team for monitoring and debugging purposes. It offers a wide range of visualization dialogs. RobotControl is easily extensible by new dialogs through its plugin system.



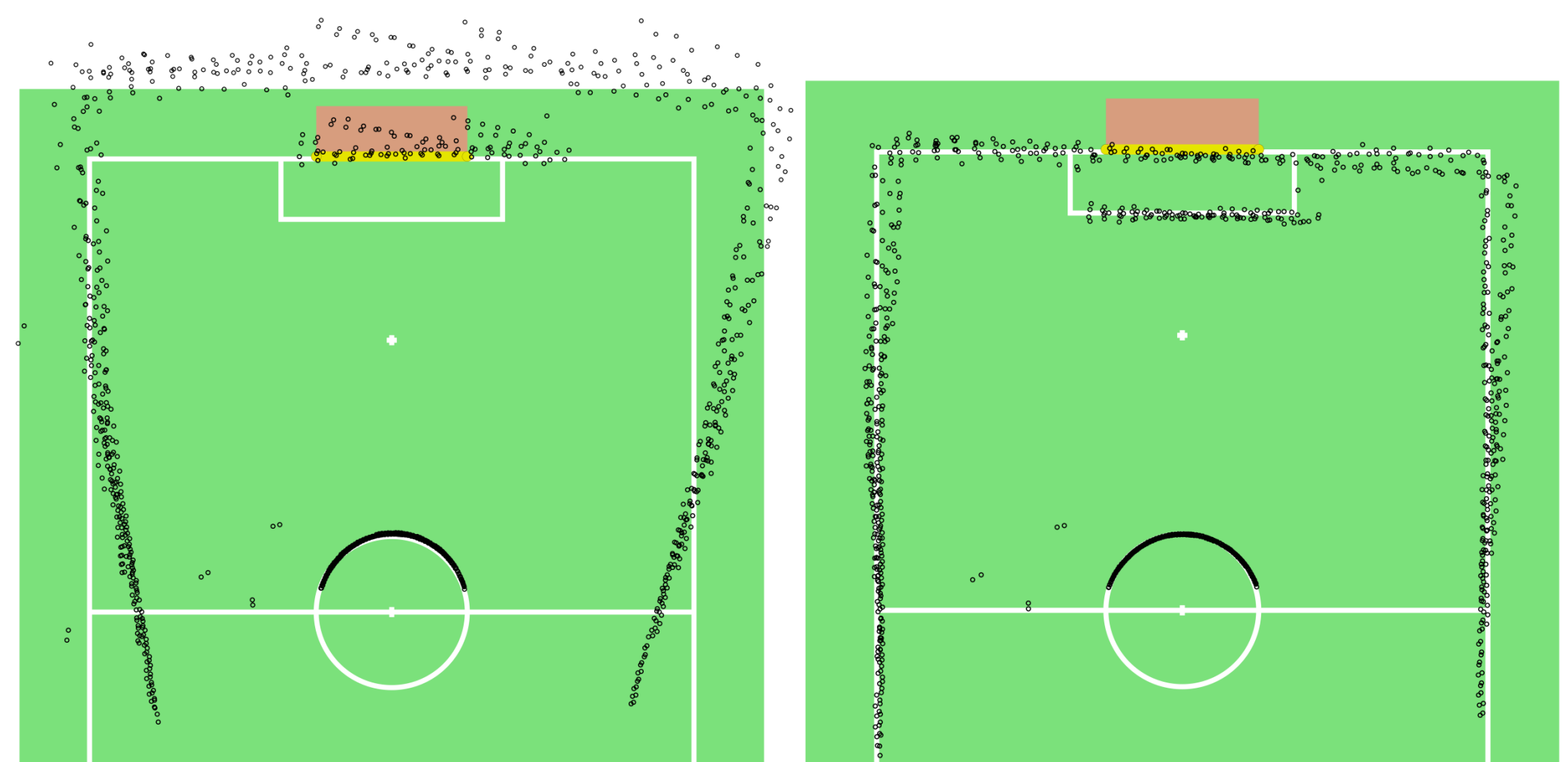
### Data Driven Evaluation and Development

We developed an extensible and flexible set of tools for the collection, systematization and analysis of the RoboCup specific data. Videos of games are collected automatically and synchronized with other log data like team communication and data recorded by the individual robots. The collected data can be used for debugging, development and machine learning purposes.



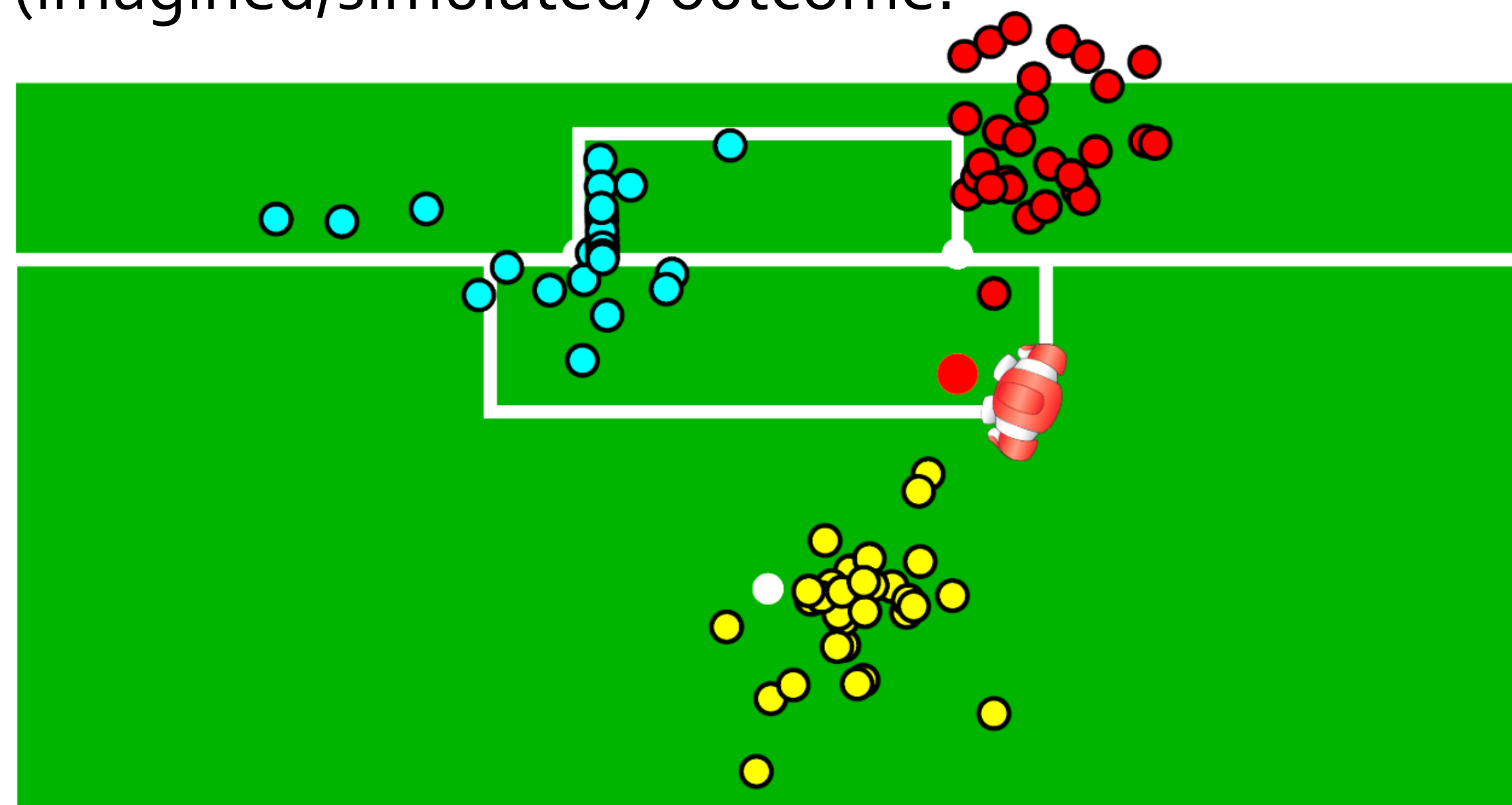
### Perception

Visual perception is based on fast heuristic algorithms for detection of lines and goals and neural networks for ball detection. Field detection is based on integral image. Spatial relations are established by a camera matrix which is calibrated with an automatic calibration routine (figure below).



### Simulation Based Decisions

Forward simulation is a versatile and extensible yet simple mechanism for inference of decisions. The intuition behind a simulation-based approach is to imagine (or simulate) what would happen as a result of the execution of a particular action and then choose the action with the optimal (imagined/simulated) outcome.



### Motion Control

A highlight of our original walking engine is its ability to perform precise step control, which is, for instance, used to realize dynamic kick steps. We also developed an extended body pose estimation (IMU) providing a precise odometry even after falling and rotating.

<https://robocup.tools>

<https://naoth.de>