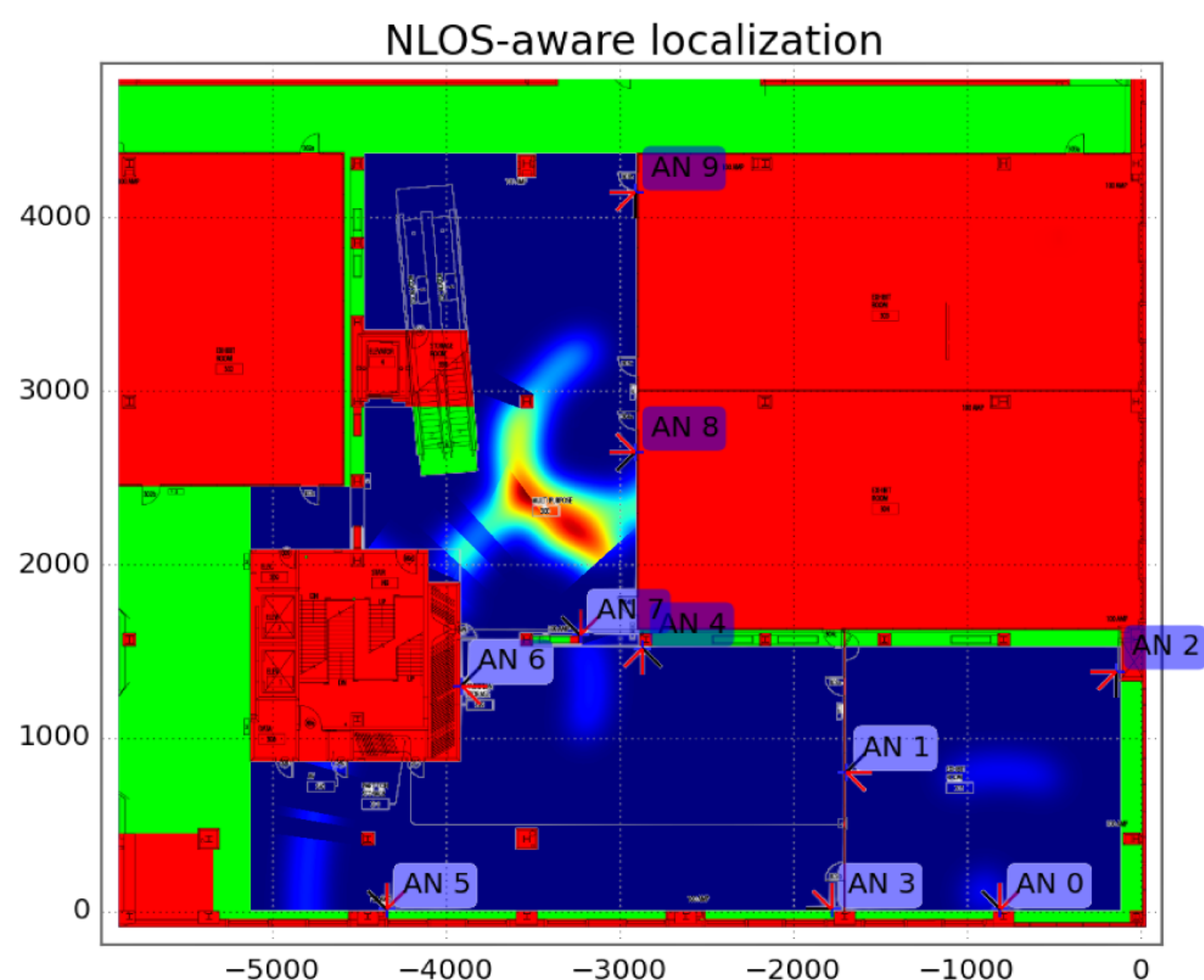


NLOS-aware Localization Based on Phase Shift Measurements

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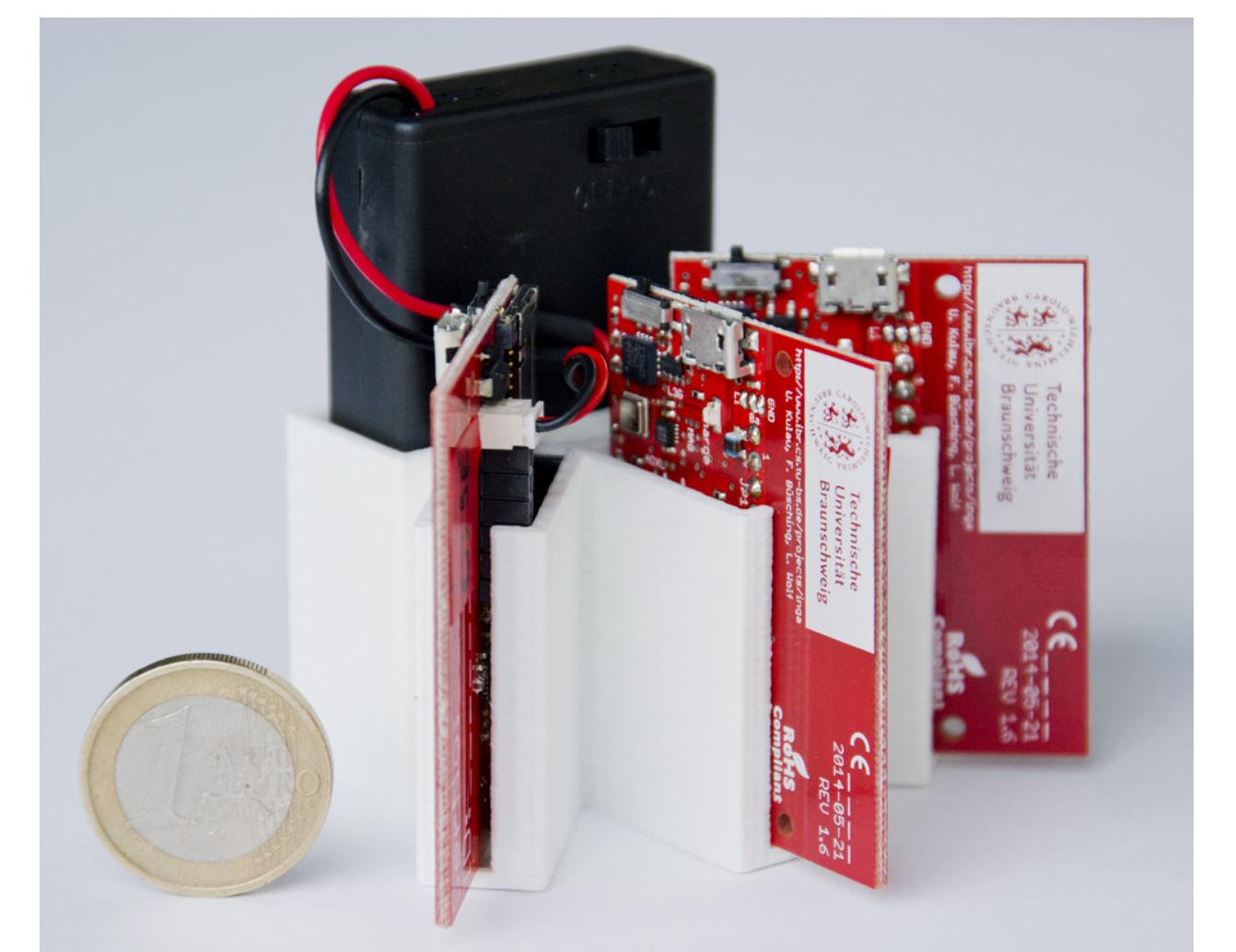
System Overview

Our system provides localization based on distance calculation from phase shift measurements between nodes.

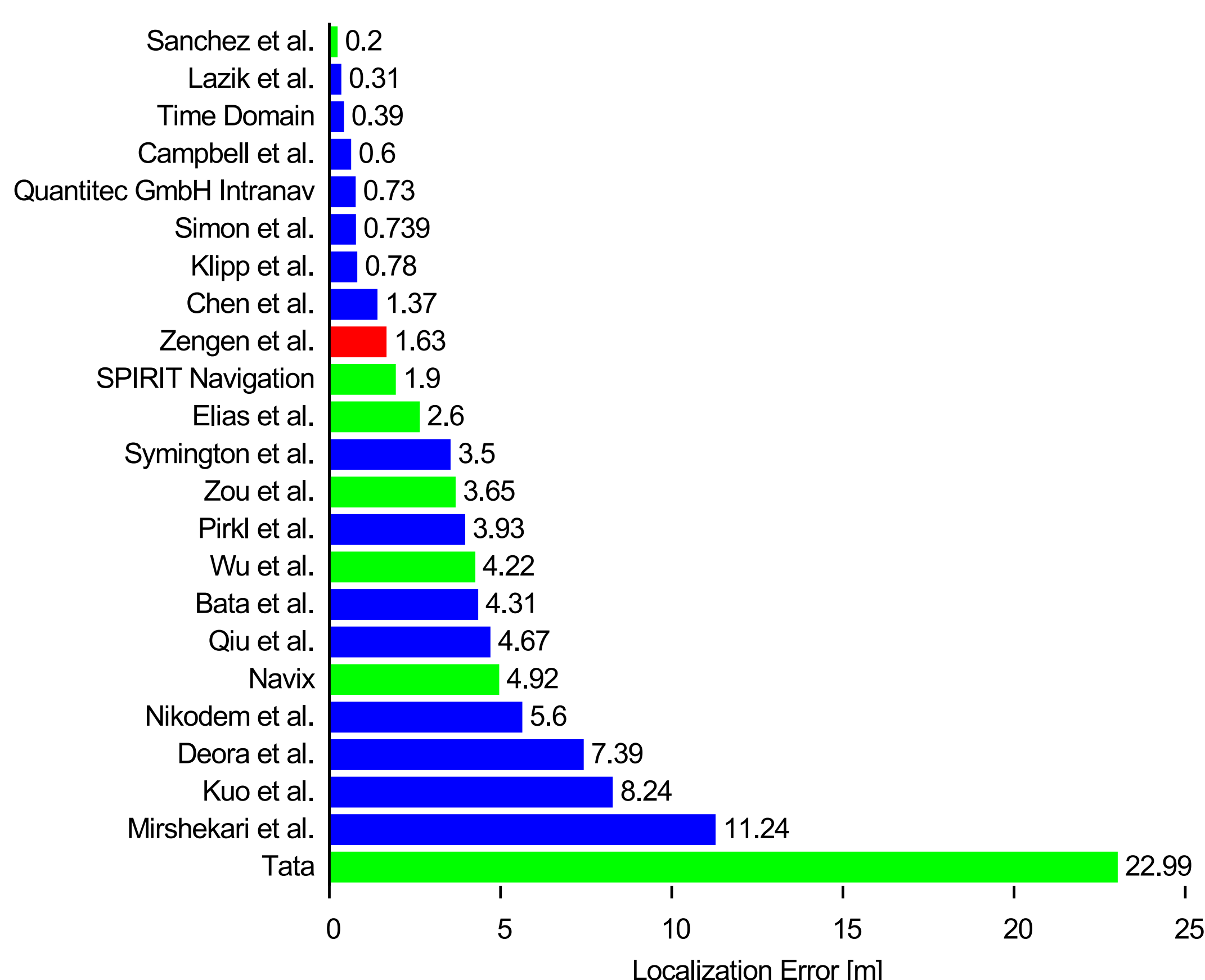
Phase shift measurements are prone to errors, because reflections and refractions will shift the phase of the signal resulting in large distance errors. We mitigate this problem by employing a 2D map of the deployment area. The map provides Non-Line-Of-Sight (NLOS) information for areas like walls and atriums. For each anchor node a shadow map is computed indicating NLOS conditions. Impossible tag locations are rejected based on shadow maps and the map of the deployment area.

Anchor Nodes

Each anchor node consists of three INGA wireless sensor nodes equipped with an AT86RF233 transceiver chip. This chip enables the system to determine the distance between the anchor and the tag. Three nodes are used to split the 180° opening angle into three sectors to achieve higher accuracy.



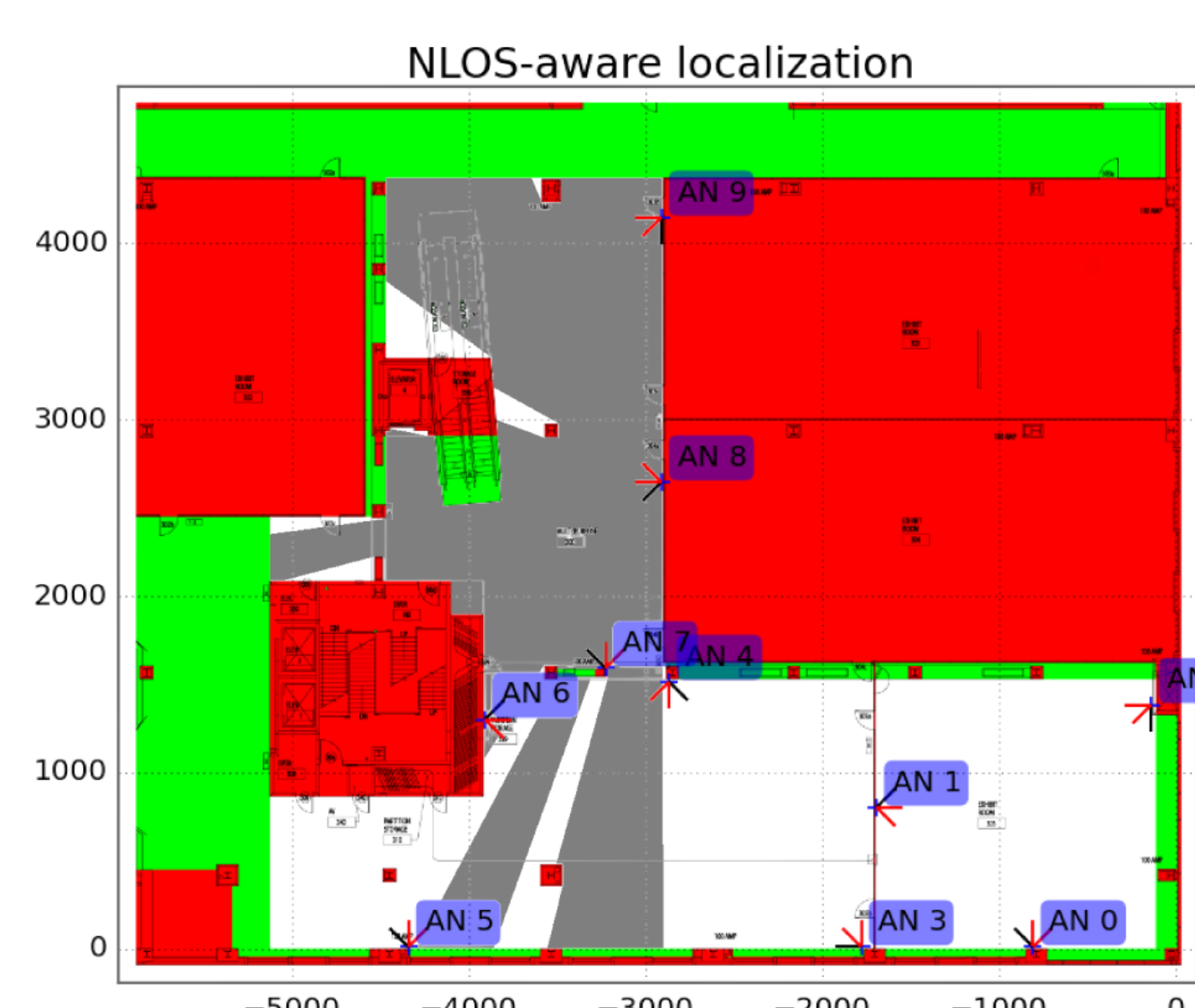
Competition Results



Competition

The system was tested in the Microsoft Indoor Localization Competition 2015. It was evaluated in a 2000 m² area consisting of a hallway with structural beams and a separate room.

To ensure a realistic environment attendees of the hosting conference walked through the evaluation area making it very dynamic. Several columns, escalators, and elevators lead to many NLOS connections in the network. An average position error of 1.63 m indicates that our algorithm is able to handle erroneous measurements from NLOS connections and calculate an accurate position in realistic environments.



Shadow Maps

Shadow maps are precomputed for anchor nodes (see left). The maps mark LOS conditions for anchors (gray area). They are generated from the 2D map of the deployment area which contains areas that are NLOS (red) and green areas that are LOS but are invalid as a tag's location. Raytracing is used to find the LOS area for each anchor node.

Output

