ATLAS – An Open-Source TDOA-based Ultra-Wideband Localization System

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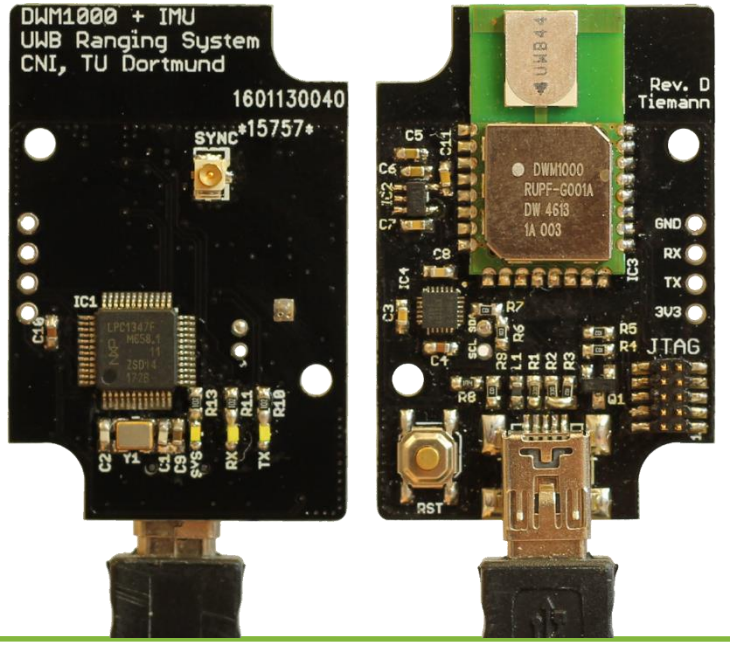
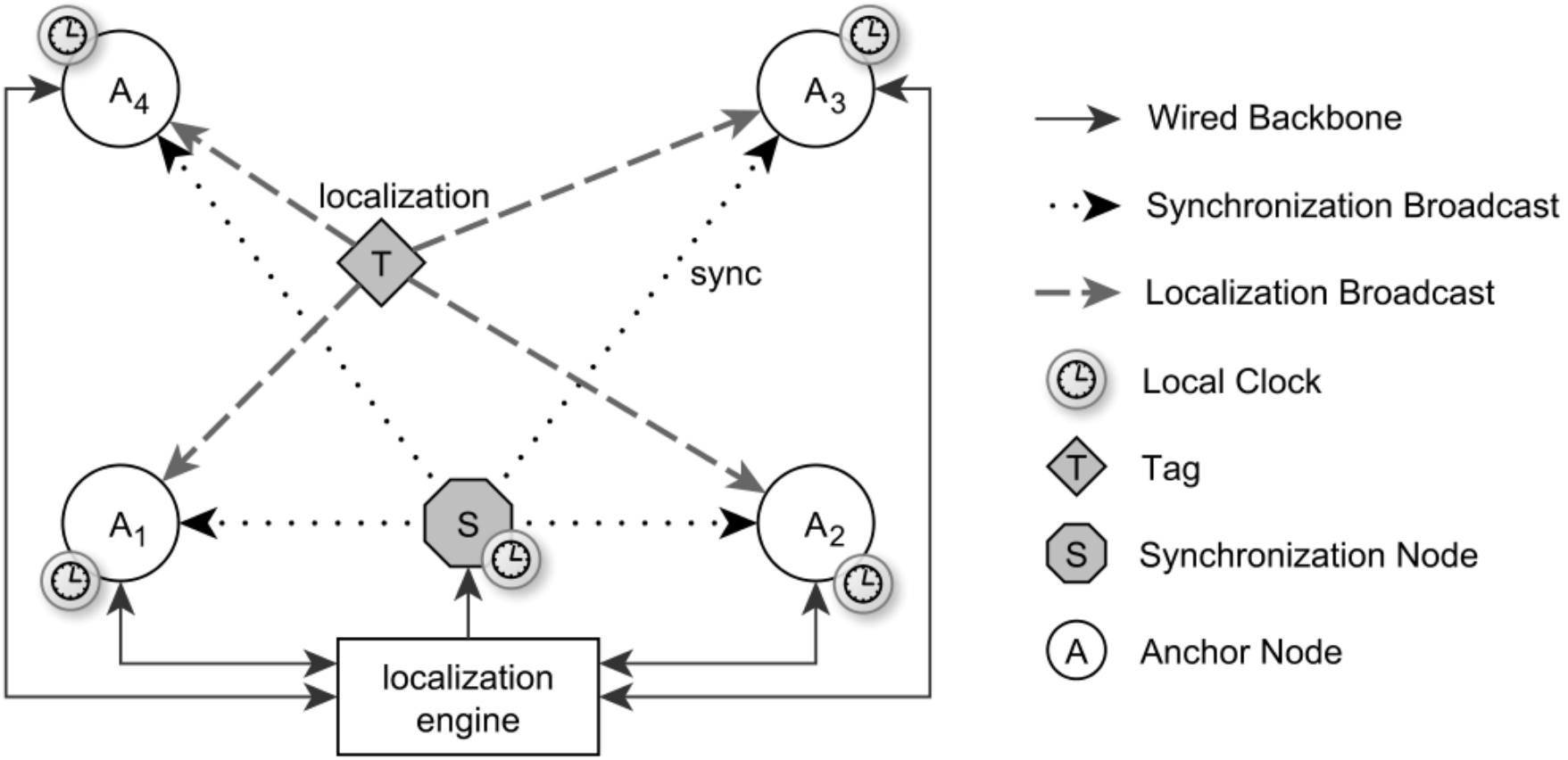
Hardware

- Based on decaWave DWM1000
- Using LPC1347 Microcontroller Unit (MCU)
- Integrated MPU-9250 Inertial Measurement Unit (IMU) Not used so far…
- USB for backbone communication and power supply



J. Tiemann, ATLAS node hardware design repository, http://dx.doi.org/10.5281/zenodo.61464, September 2016.

System Topology & Architecture



Distributed setup is possible through wireless clock synchronization

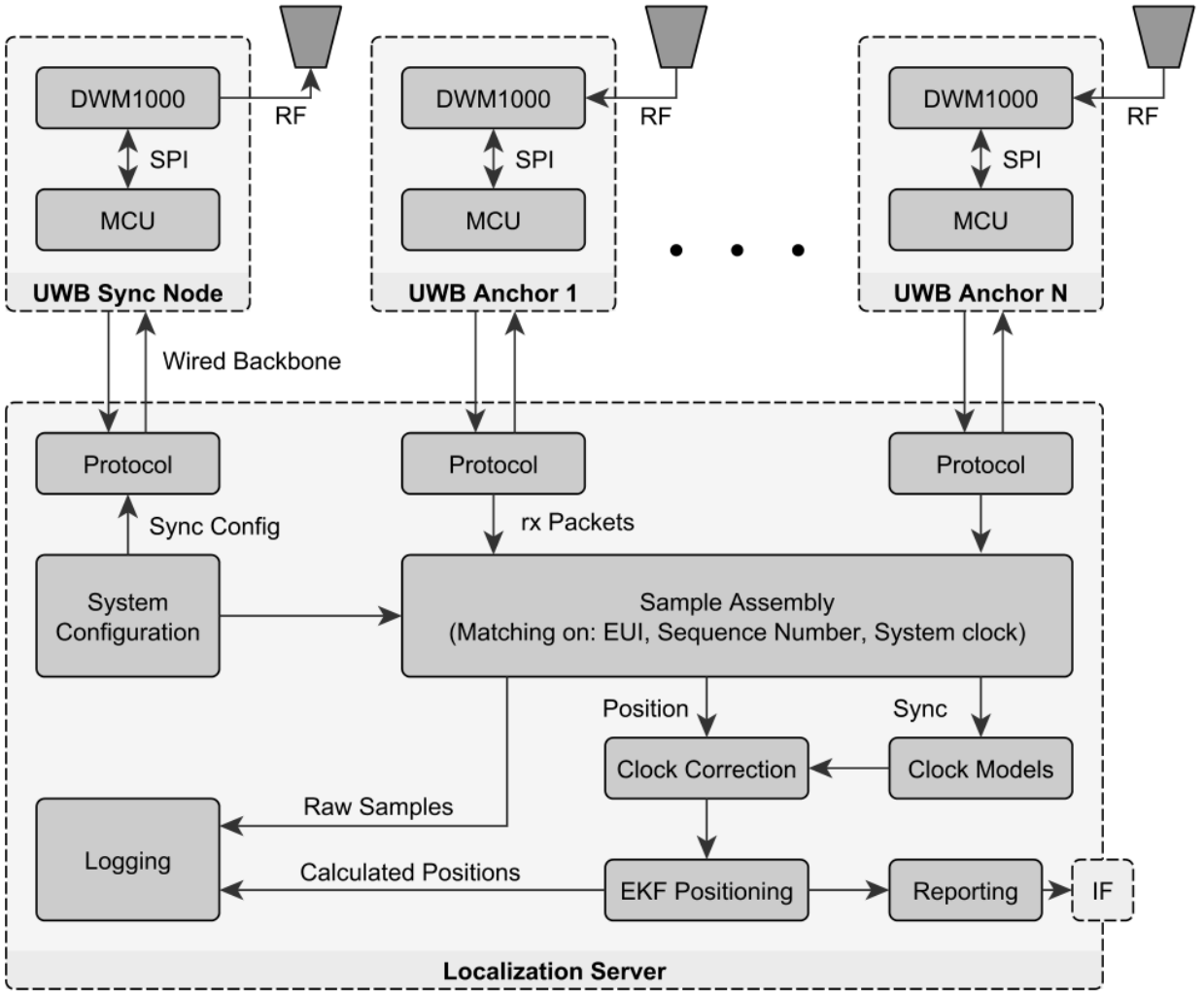
Wired backbone is replaceable through wireless/other backbone

System Topology & Architecture

Central clock correction

Anchors are configured once

Timestamped frames are reported to the central localization engine



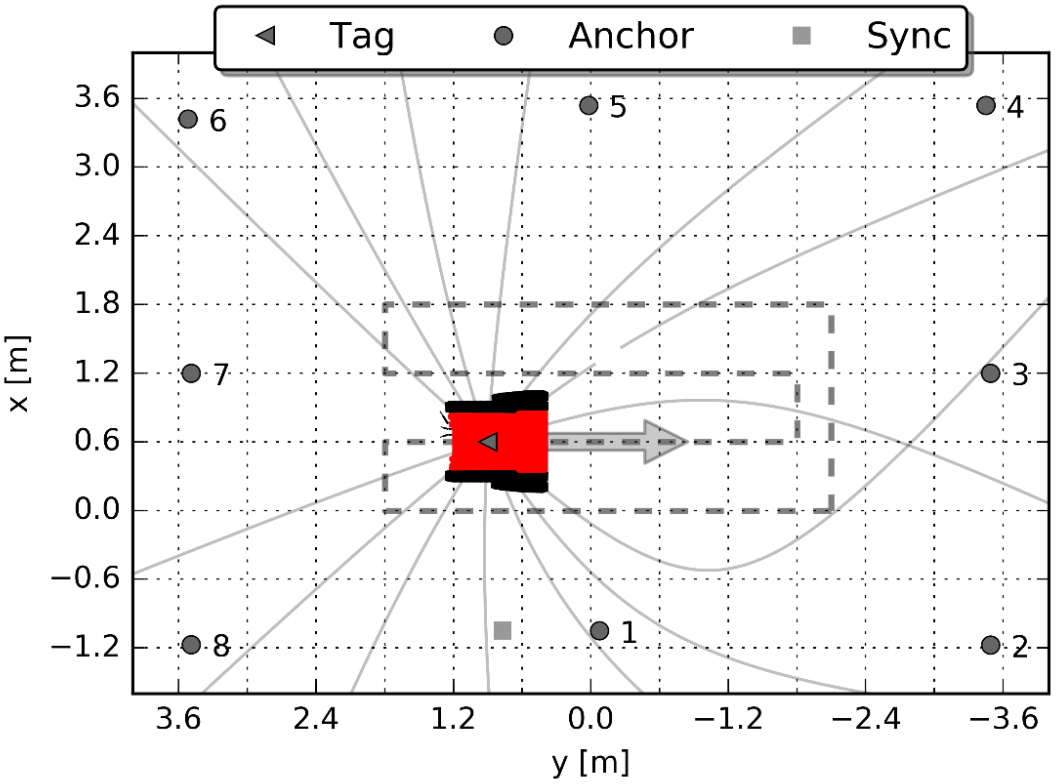
J. Tiemann, ATLAS Localization Server Source Code repository, http://dx.doi.org/10.5281/zenodo.61465, September 2016.

Experimental Setup for Accuracy Analysis

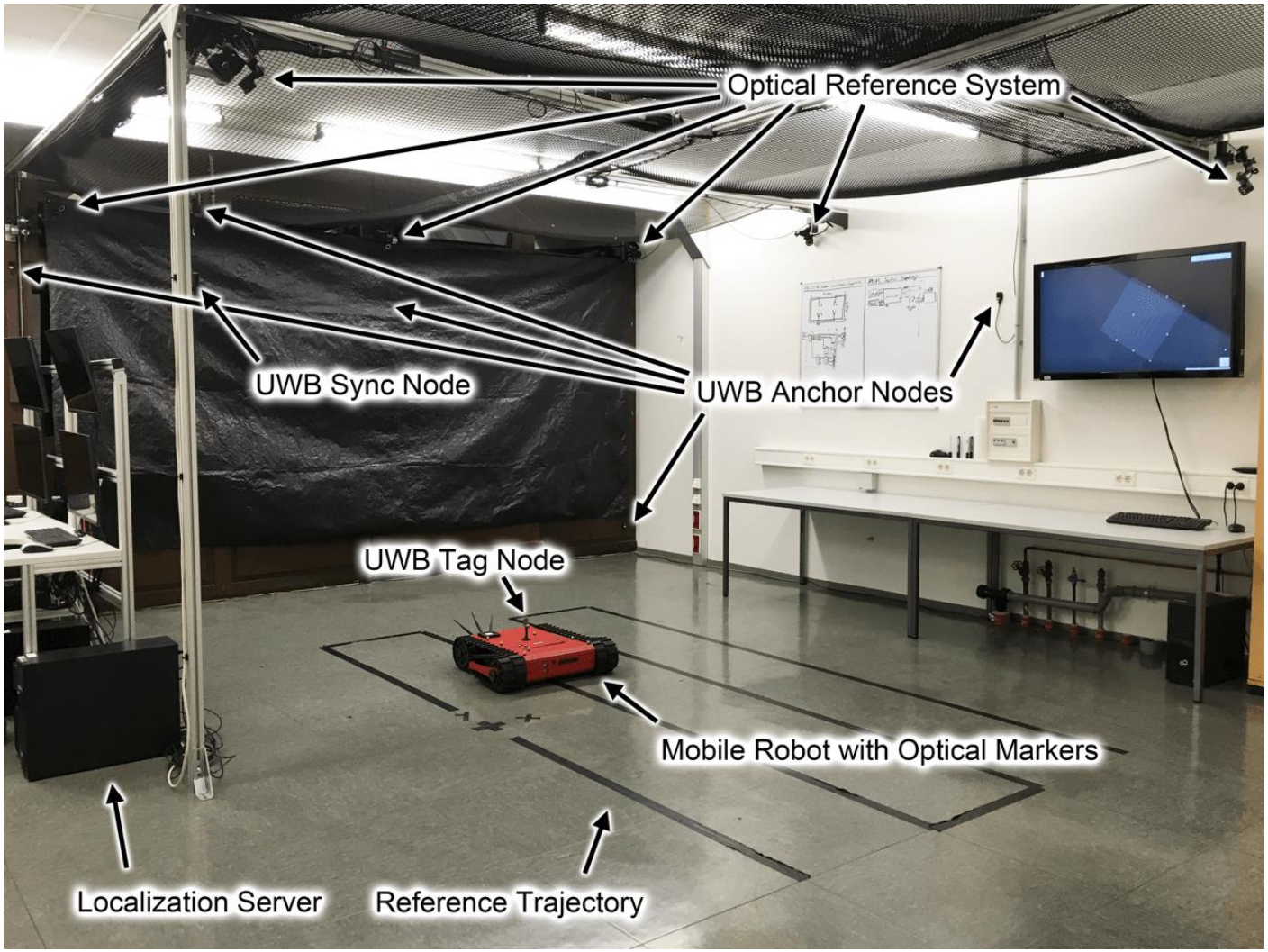
Repeated robotic movement over predefined track

OptiTrack motion capture system for accuracy analysis

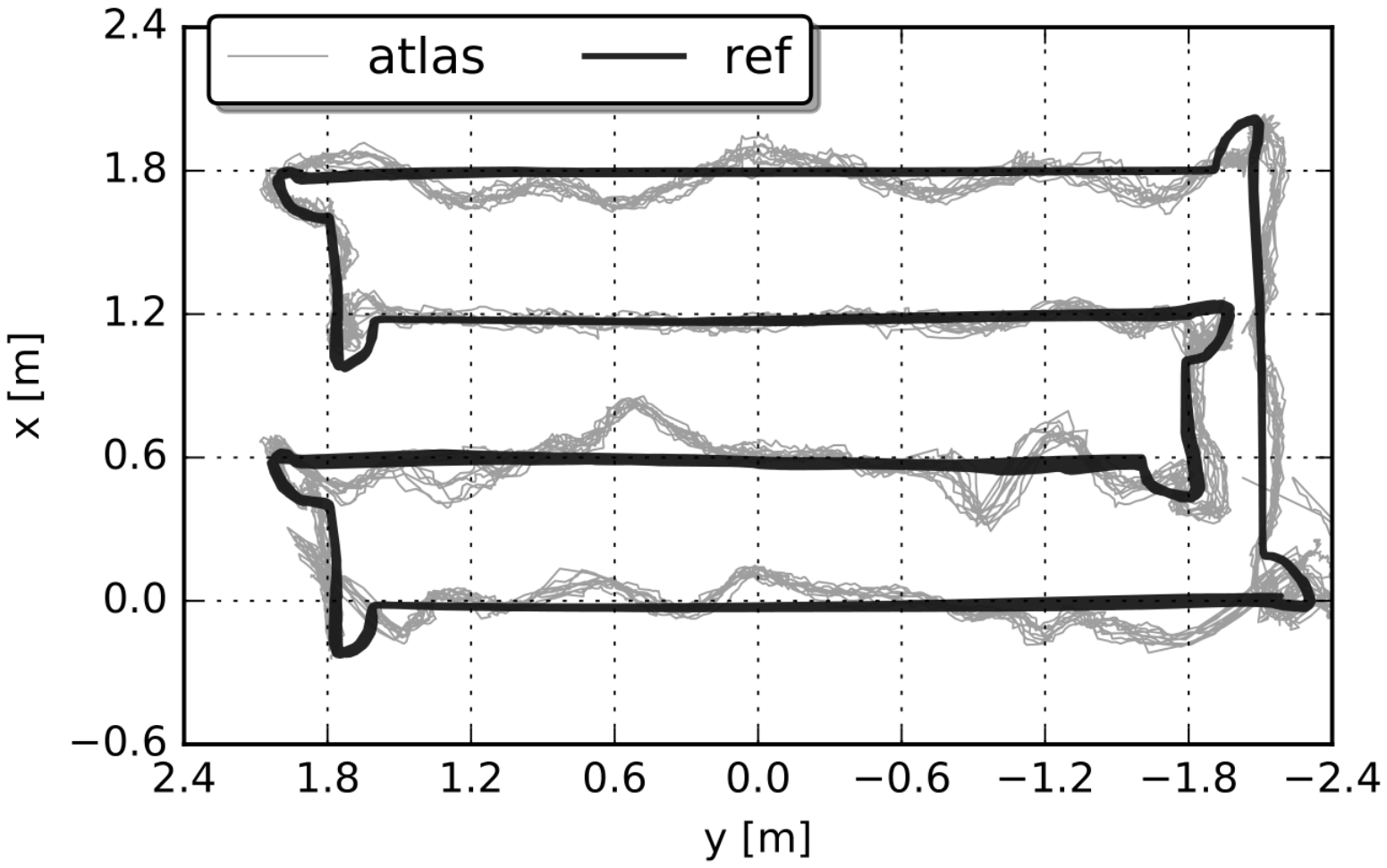
Robot controlled via motion capture system



Experimental Setup for Accuracy Analysis



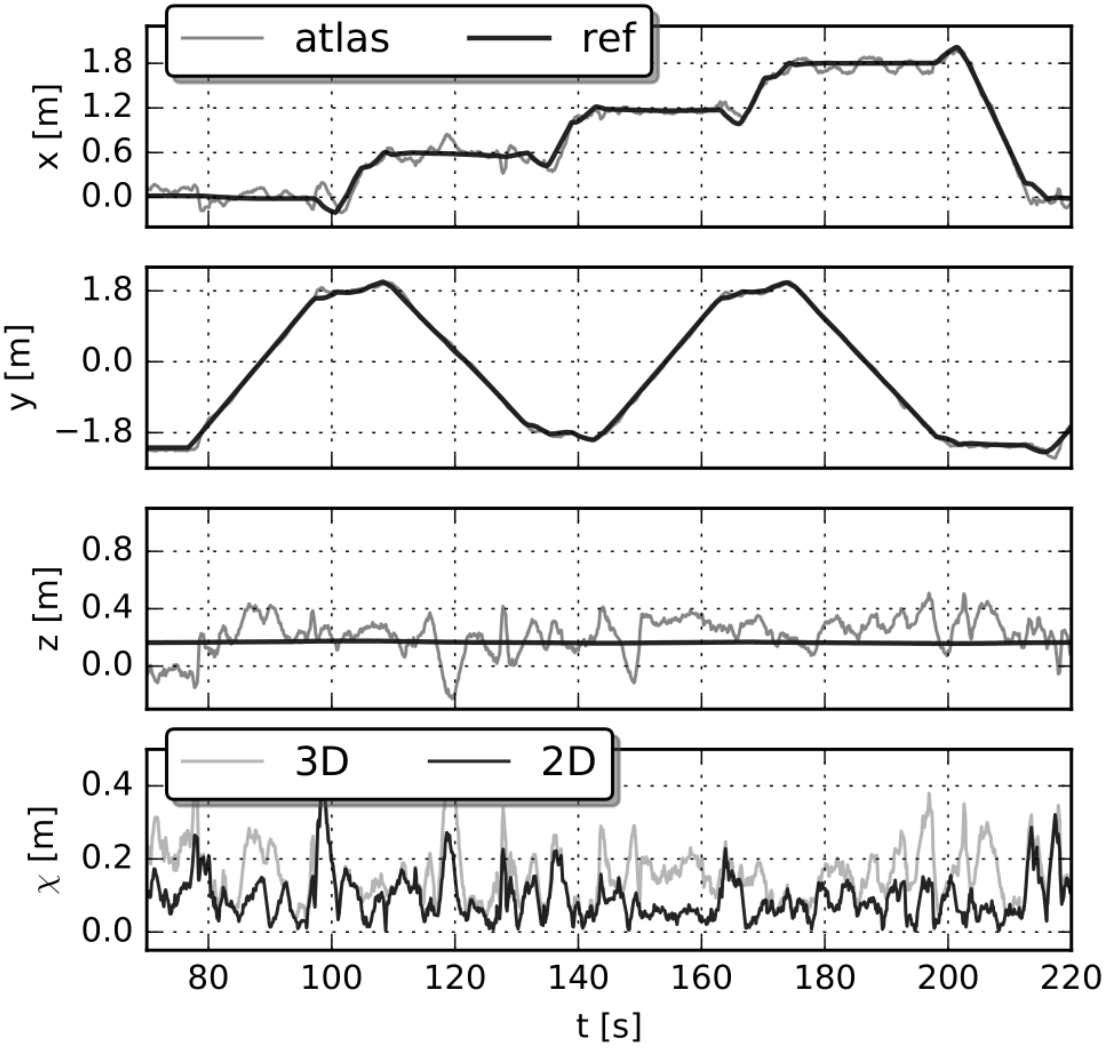
Experimental Results – Robot Trajectory



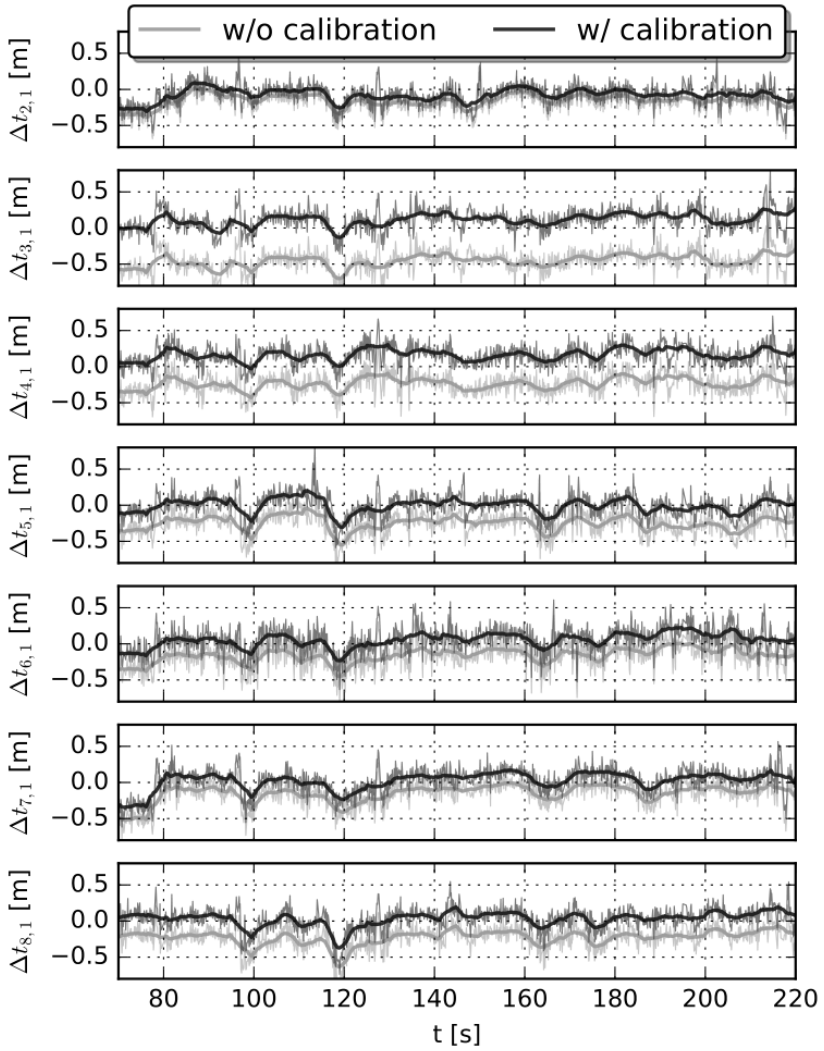
Experimental Results – Trajectory Error

Time-series of single trajectory run

Constellation optimized for horizontal positioning



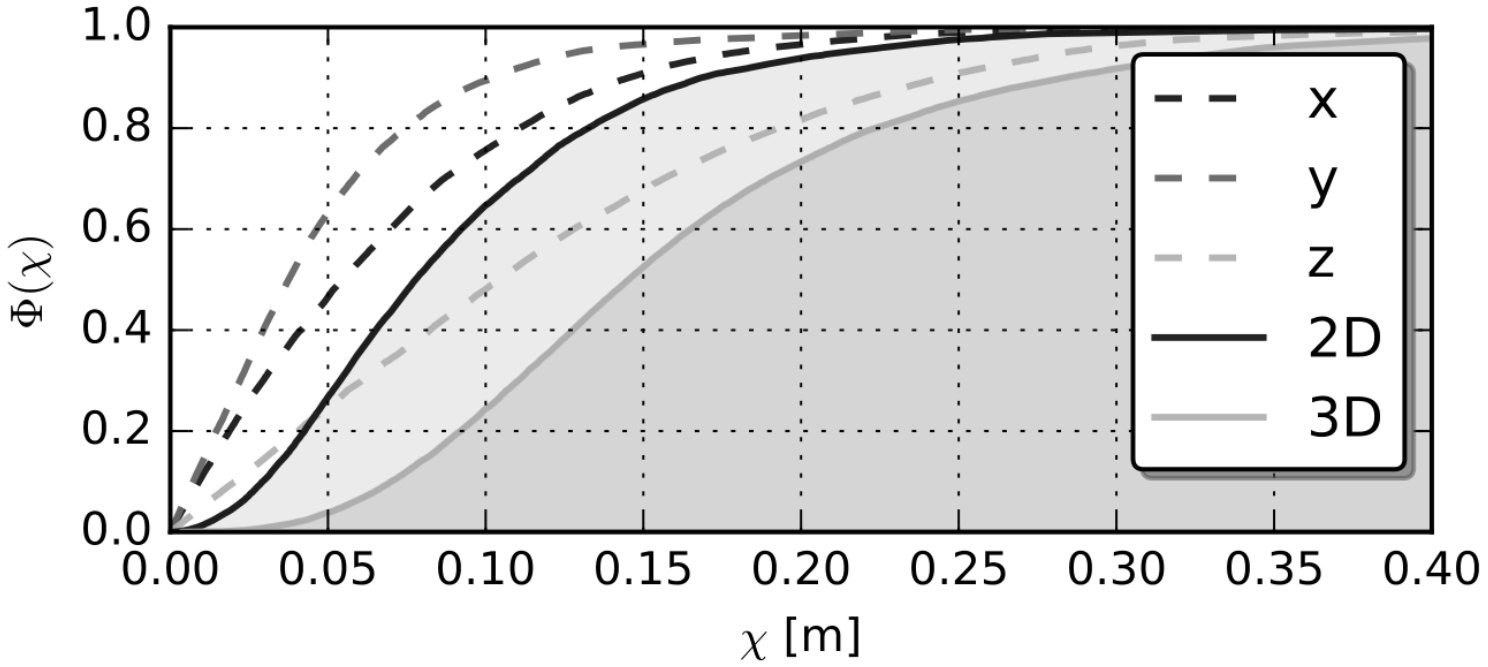
Experimental Results – Calibration Effect



Calibration of static error of each TDOA through node with known position

Calibration adds static offset to the TDOA

Experimental Results – Quantitative Analysis

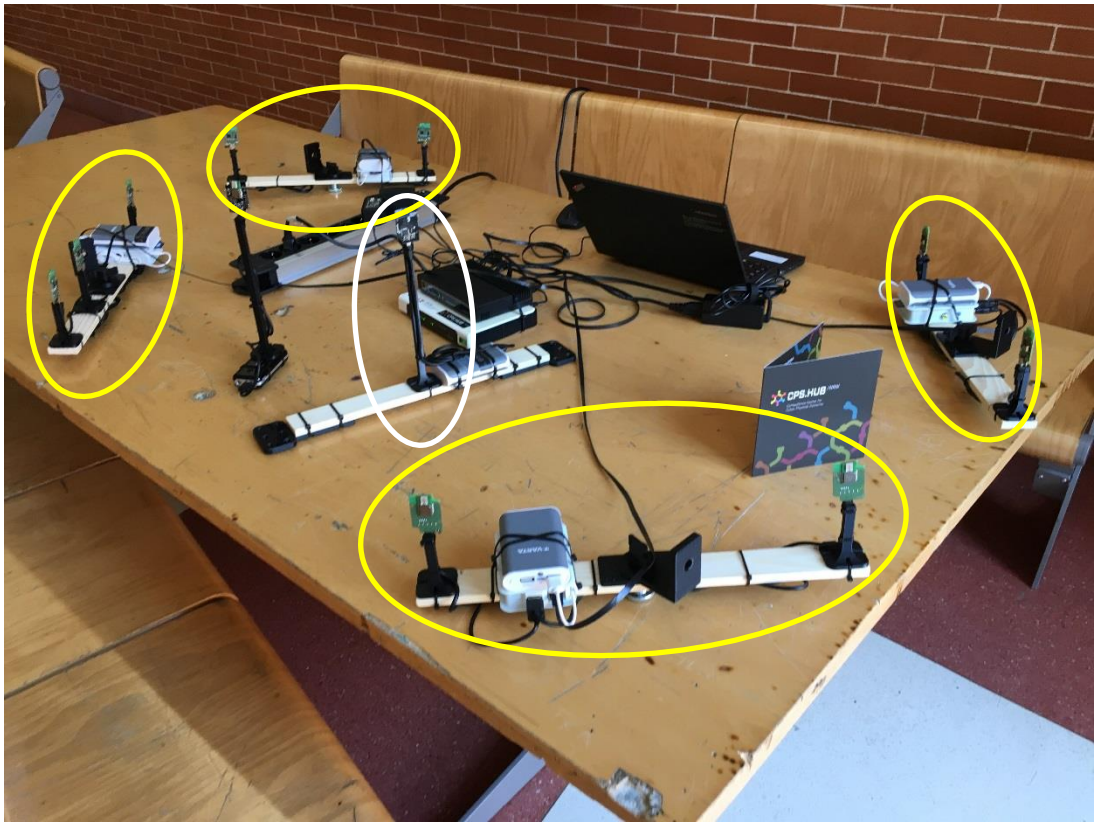


90% Quantile of the horizontal positioning error in the range of ~20cm

3D Positioning is worse due to constellation constraints

J. Tiemann, Raw Experimental localization, sample and tracking data, http://dx.doi.org/10.5281/zenodo.61335, September 2016.

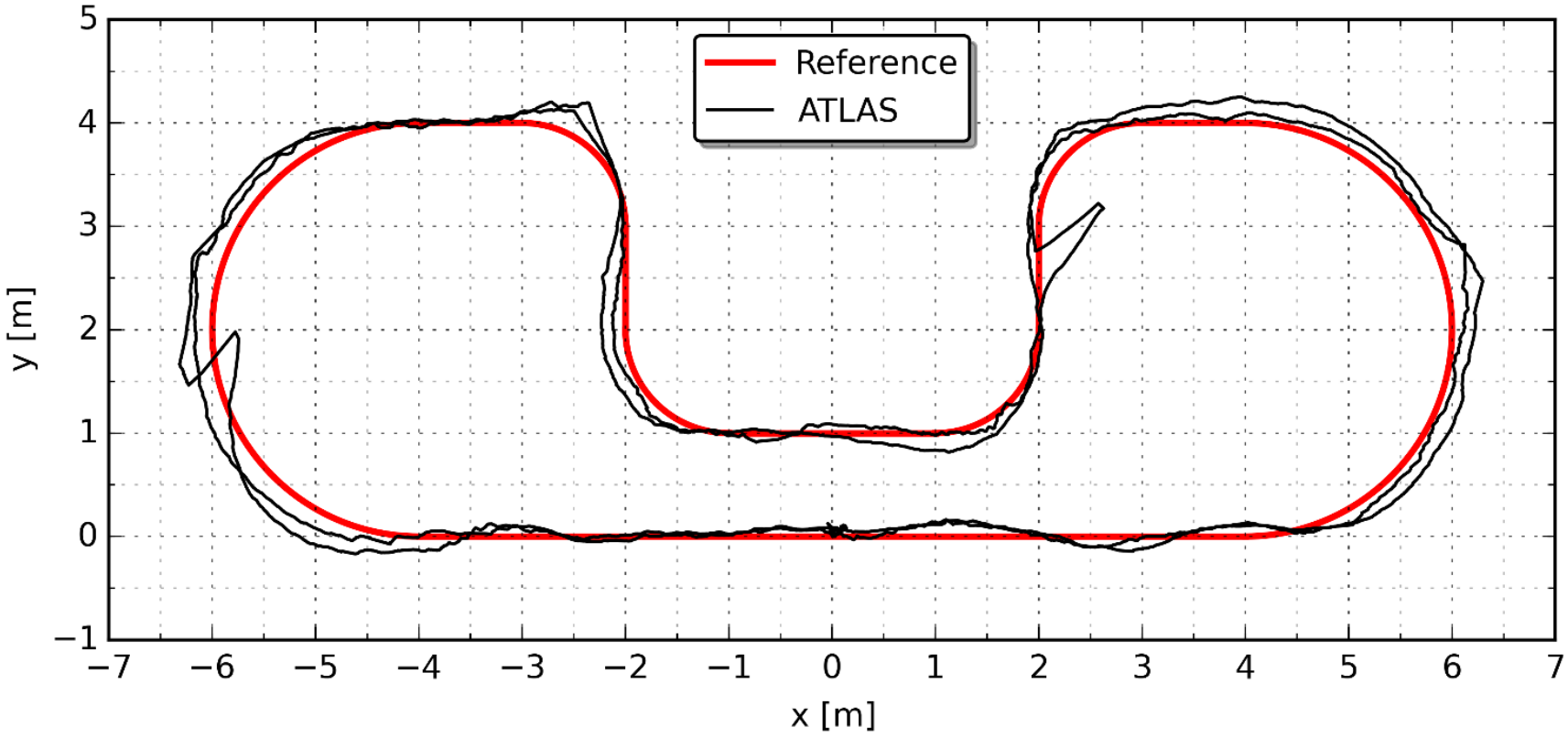
Competition System



Mounted in pairs of 2 to the 4 mounting posts, 1 mobile tag on the robot

Wired backbone through Ethernet, localization server on laptop

Competition Tracking Results



Quantified results will be presented tomorrow at the closing event
(we don't know them)

Thank you for your attention!
Questions?

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