



## Lab Work: Localization Using a Microphone Network

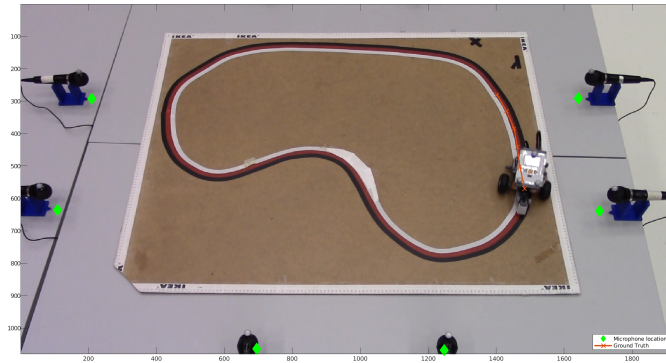
### Sensor Fusion

Fredrik Gustafsson  
fredrik.gustafsson@liu.se

**Gustaf Hendeby**  
gustaf.hendeby@liu.se

Linköping University

# Problem Formulation



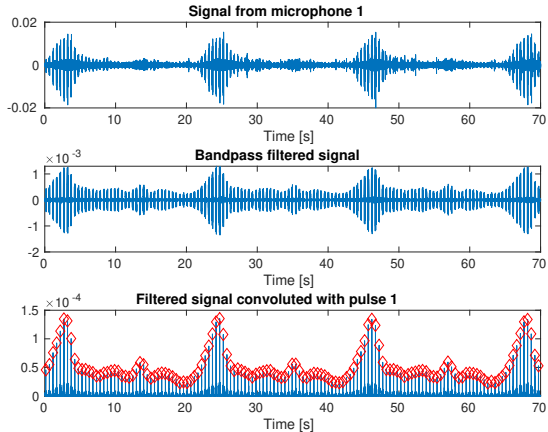
## Given:

- Lego robot that emits regular beeps.
- 8 microphones detecting the beeps.
- Exact time of pings unknown.

## Goal:

- Estimate the position of the Lego robot using the methods in the course.

# Measurements



- Record sound from several locations.
- Detect beeps using a matched filter.
- Ping times with unknown offset.

# Tasks

1. Sensor calibration
2. Signal modeling
3. Model code
4. Configuration analysis
5. (Snapshot) localization
6. Tracking
7. Sensitivity analysis

# Tasks

1. Sensor calibration
2. Signal modeling
3. Model code
4. Configuration analysis
5. (Snapshot) localization
6. Tracking
7. Sensitivity analysis

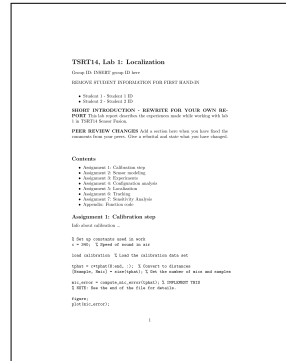
## Mapping to the lecture material

- Task 1–5: Lecture 1–3
- Task 6–7: Lecture 4–6  
(particle filters, if you choose to use them, in Lecture 7–8).

# Examination

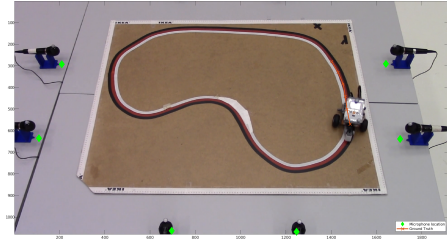
You work with the lab in groups of two throughout the course. Your work is examined in the following steps:

- Write a report on your results.  
*A report template is available in MATLAB Publish format.*
- Peer review another group's report (blind).
- Improve your report, and write rebuttal.



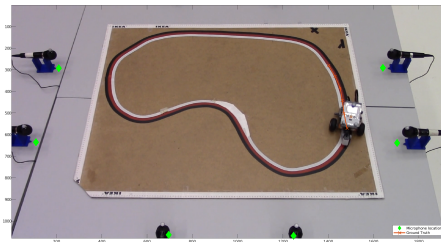
# Closing Remarks

- **Goal:** Localize a sounding object using time difference of arrival
- **Main objectives:**
  - Work with (imperfect) real data.
  - Gain hands on experience of taught methods.
  - Connect the different parts of the course.
- **Examination:** Peer reviewed report.
- **Time requirement:** approx. 64 h



# Closing Remarks

- **Goal:** Localize a sounding object using time difference of arrival
- **Main objectives:**
  - Work with (imperfect) real data.
  - Gain hands on experience of taught methods.
  - Connect the different parts of the course.
- **Examination:** Peer reviewed report.
- **Time requirement:** approx. 64 h



## Recommendation

Make sure to work continuously with the lab during the course to get the most out of it!