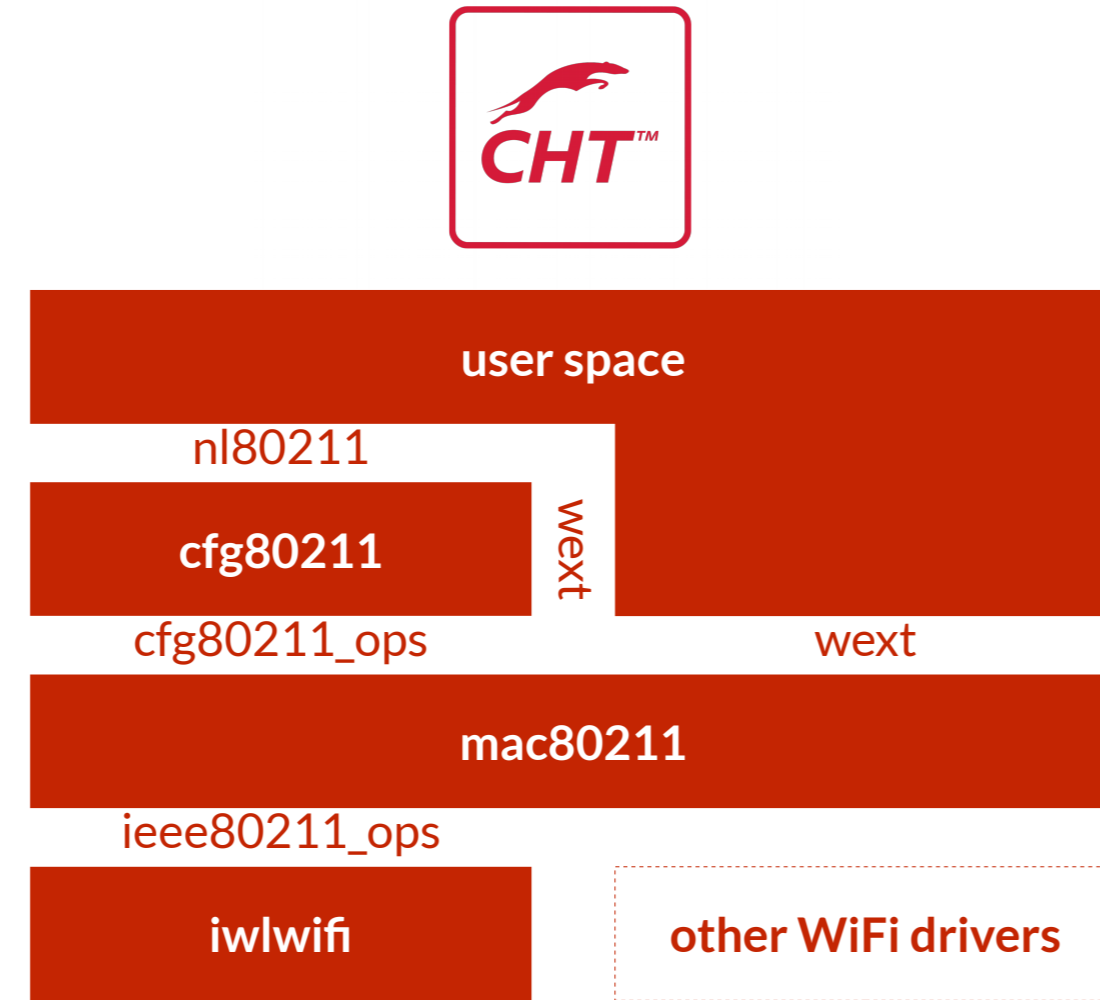


## CHALLENGE

### Develop multi-platform solutions

- that only use information available in the OS user space
  - SNIR, RSSI, MCS, number of transmitted packets...
- to address all the challenges of WiFi networks

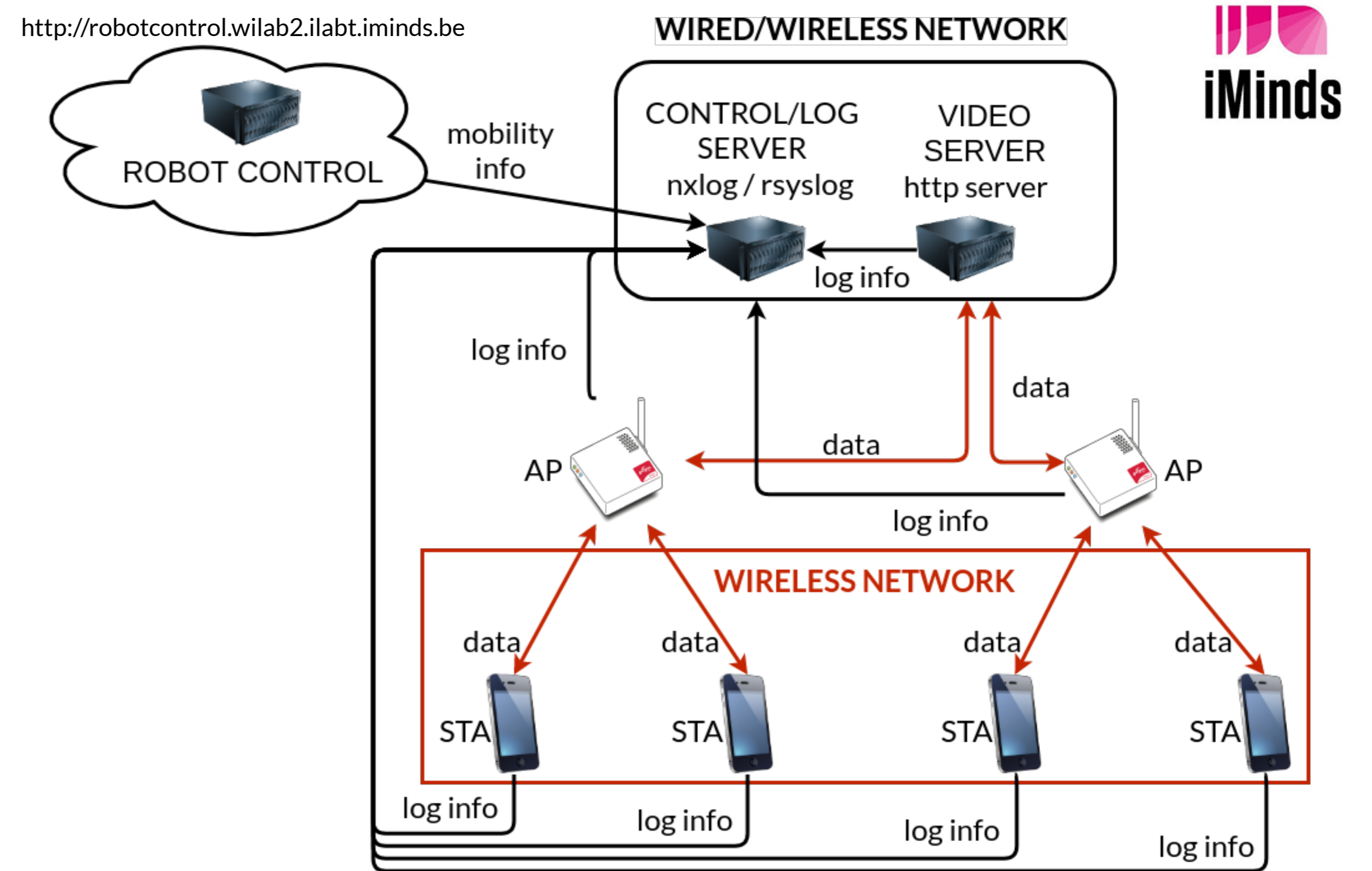


## GOALS

### Analysis of the behavior and performance of our multi-platform algorithms specifically designed to

- locate WiFi terminals (without additional hardware)
 
$$(x, y) = f(\text{RSSI}_{AP1}, \text{RSSI}_{AP2}, \dots, \text{RSSI}_{APn})$$
- control the AP transmission power in such a way that the user's QoS is guaranteed (user-oriented TPC)
  - $\min\{AP_{Ptx}\}$ , s.t. QoS =  $f(\text{SNIR})$  requirements

## DEMO SETUP

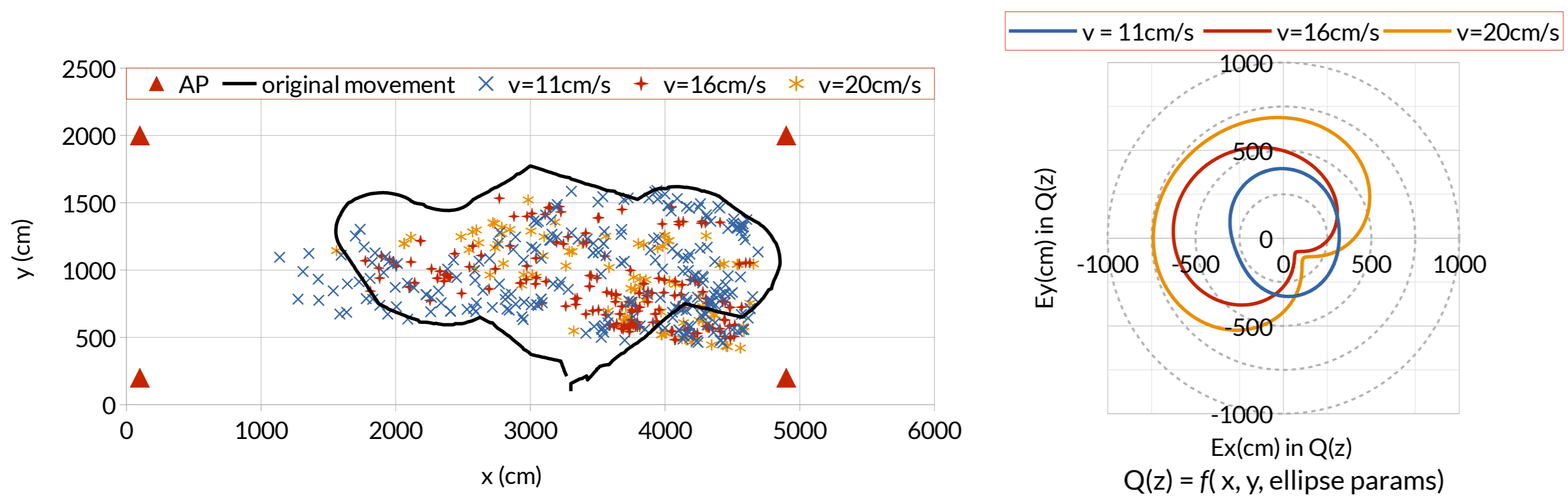


- Videostreaming tests (ON/OFF application)
- 5-10 minutes per test
- At least 10 tests per experiment
- Tests with both static and mobile WiFi terminals
- Log information is used to get KPIs
- Statistical methodology: Shapiro-Wilk test, Levene test, and ANOVA/Mann-Whitney U test to check the statistical significance of results

## RESULTS

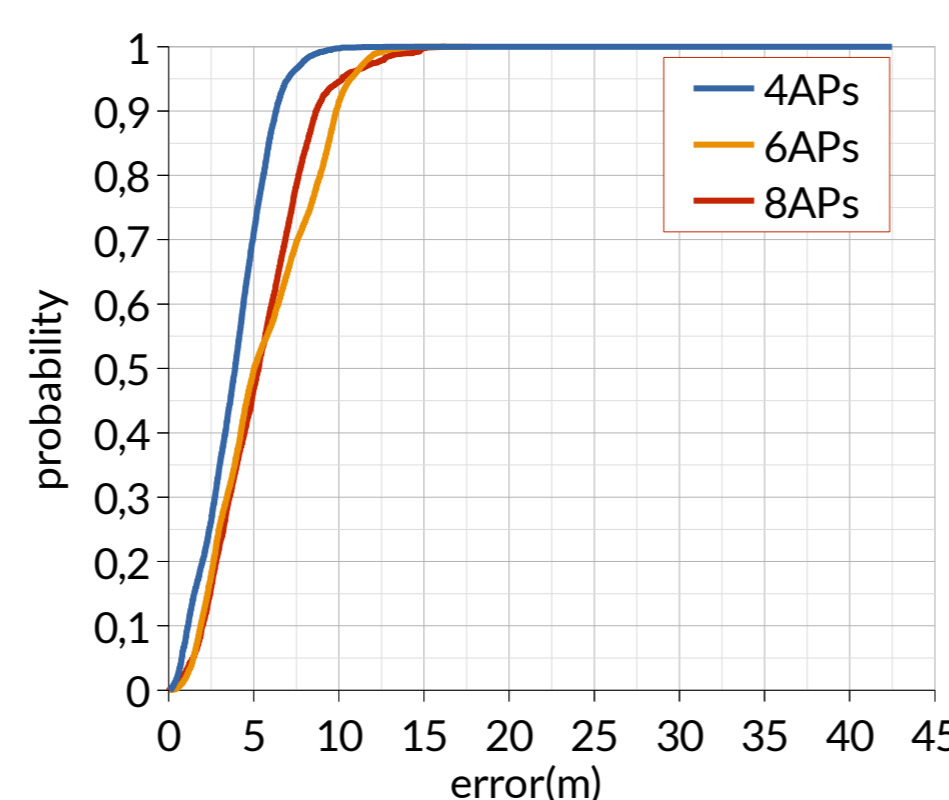
### Localization of WiFi terminals

#### Mobile STA with different velocities

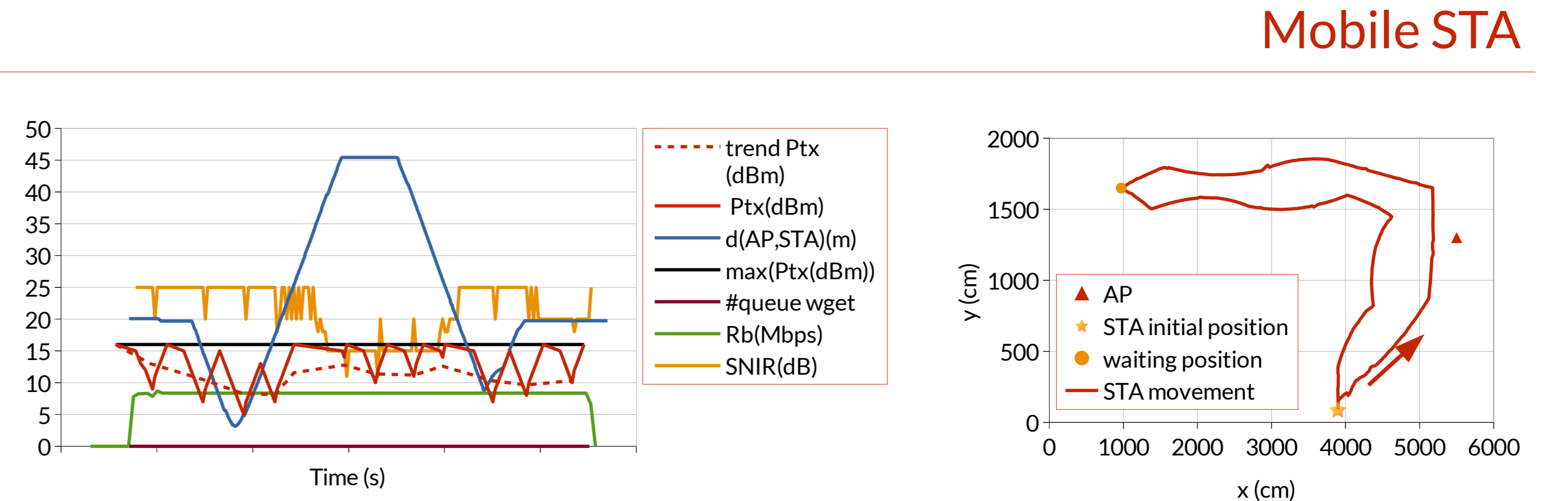


- Our algorithm only uses information gathered by APs
- Goal:
  - Achieve an error margin lower than 5m
- Results:
  - ✓ Location error below 5m with a probability of 70%
- Future improvements:
  - Include PCA to increase accuracy

#### Static STAs



### Transmission Power Control of WiFi APs



- Goal:
  - $\min\{AP_{Ptx}\}$  without QoS degradation (QoS =  $f(\text{SNIR})$ )
- Algorithm operation:
  - Progressive decrement of  $AP_{Ptx}$
  - Fast recovery upon detecting degradation of QoS
- Results:
  - ✓ 36% of power reduction without QoS degradation
- Future improvements:
  - Filter instant changes in the QoS due to fast fading, operation of the rate control algorithm...

## CONCLUSIONS

### Thanks to the experiments accomplished in this project

- We have been able to do experiments in a very useful laboratory (WiLab)
  - A controlled radioelectric environment
  - With a very versatile mobility testbed
  - With many WiFi devices
- We have been able to measure the behavior and the limit of our algorithms in a real environment
- We have been able to extract very useful information to define the improvement guidelines of our algorithms
- We have acquired new competencies related to the design and execution of experiments with mobile nodes
- The support from the WiLab technical team was also an important perceived value

## POST MORTEM

### Technical impact

- This project has speeded-up the testing of our algorithms
- Now, our laboratory scripts perform with mobile nodes
- Our algorithms will be improved taking into account the conclusions drawn in this project

### Business impact

- This project has speeded-up the time-to-market of our algorithms
- LOC: now, we can compete in public/private tenders wherein location of WiFi terminals is a requirement
- TPC: we have been able to fulfill our compromise with our most important customer