

Estimation of Measurement Uncertainty of the RTLS Location System with UWB Technology

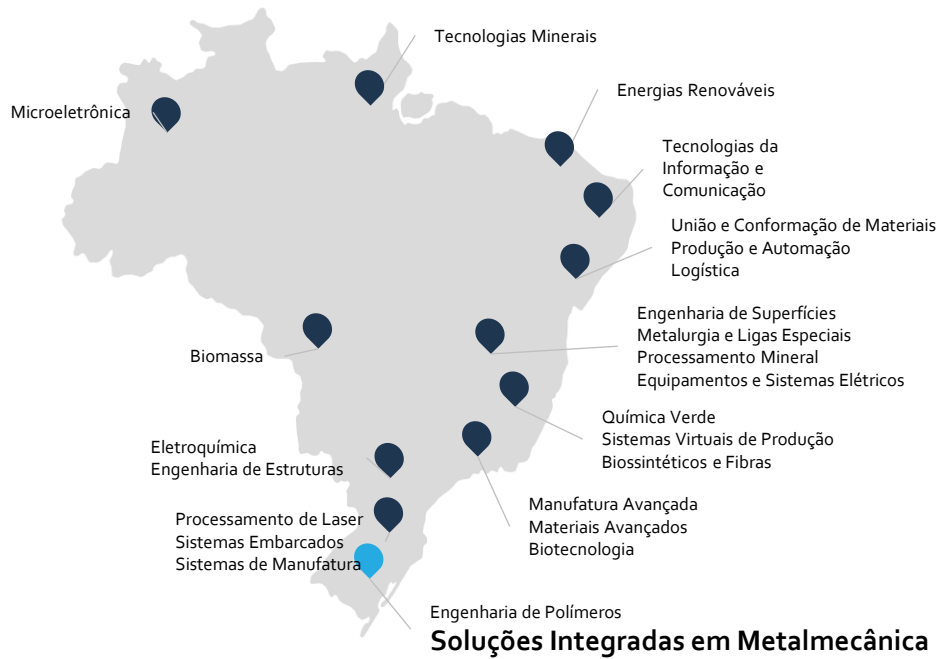
Alex Krummenauer

Victor Emmanuel de Oliveira Gomes

Vitor Camargo Nardelli

vitor.nardelli@senairs.org.br

SENAI Institute of Innovation for Integrated Solutions in Metal-mechanics



INSTITUTO SENAI
DE INOVAÇÃO METALMECÂNICA



More Than 40 Projects

delivered since 2017

Inaugurated in **April 2017**



21 Projects

in execution (in 2022)

with 20 companies



19 Ph.D.
31 MSc.

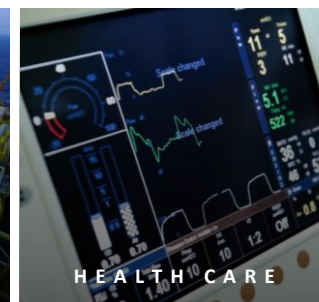
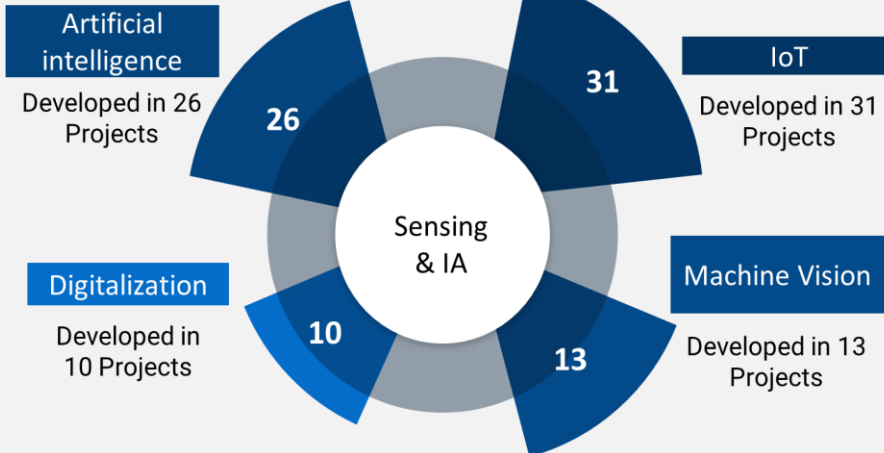
in our RD&I team



3 Global Projects

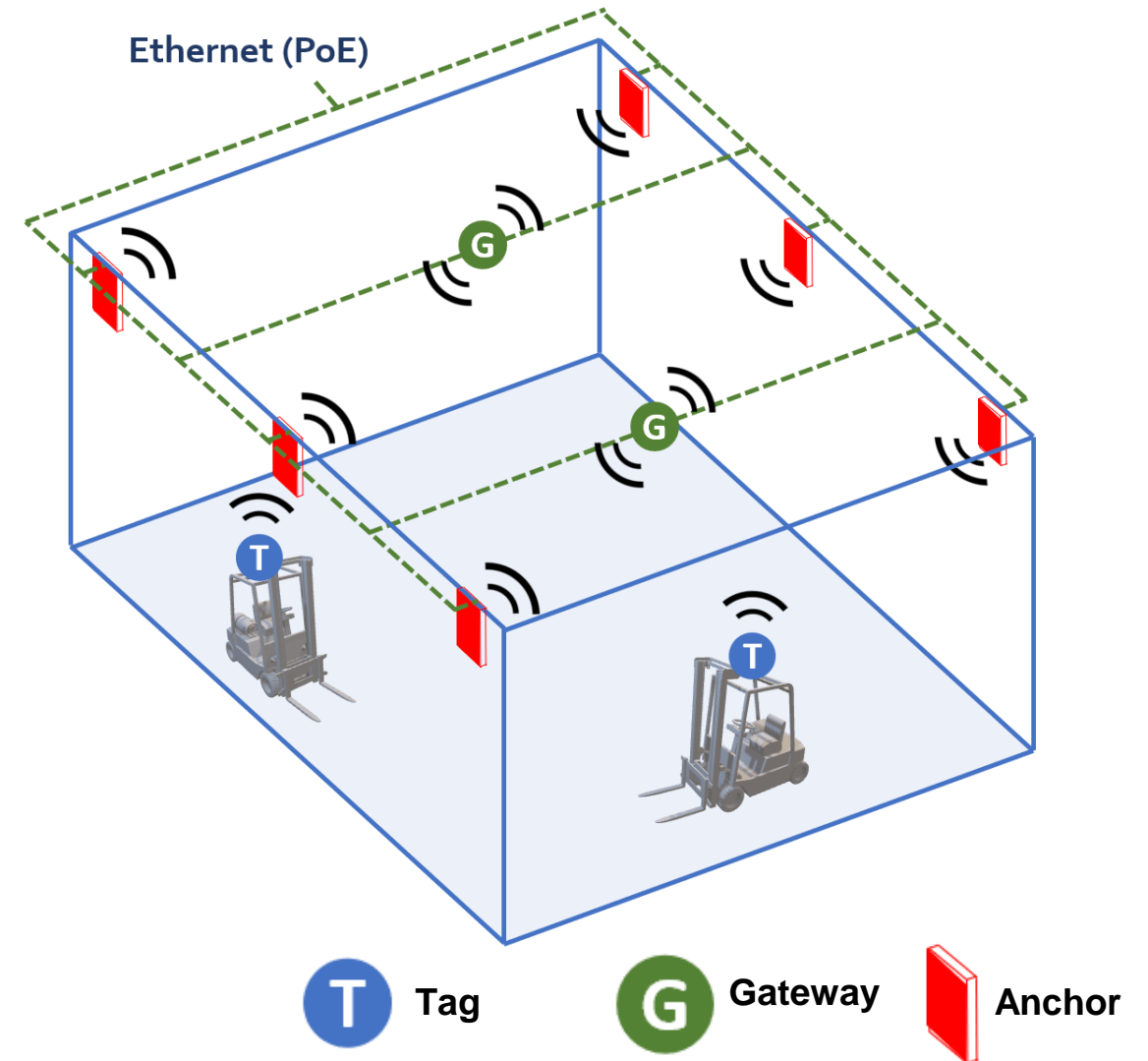
Switzerland, UK and USA

Developed Technologies

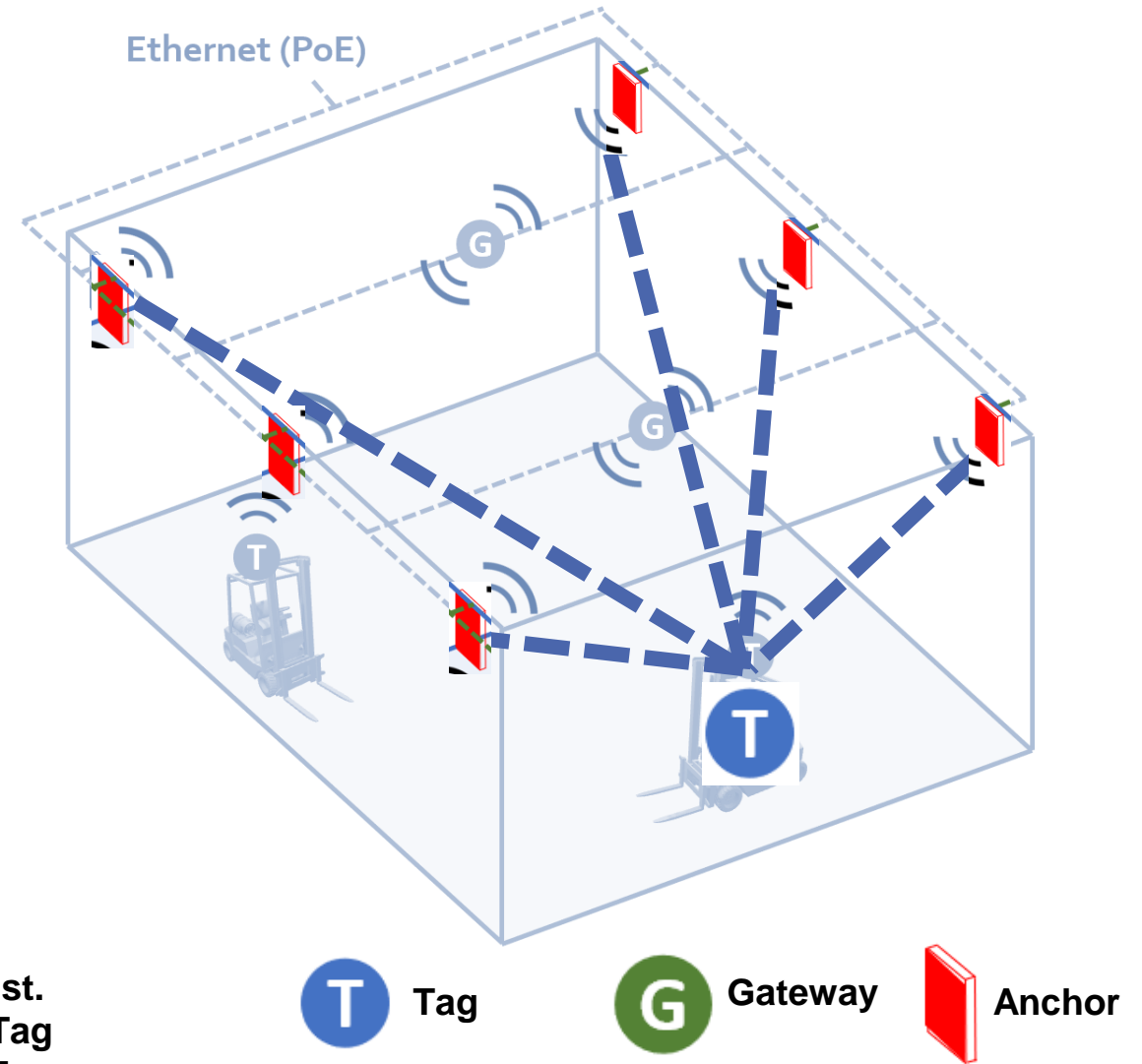
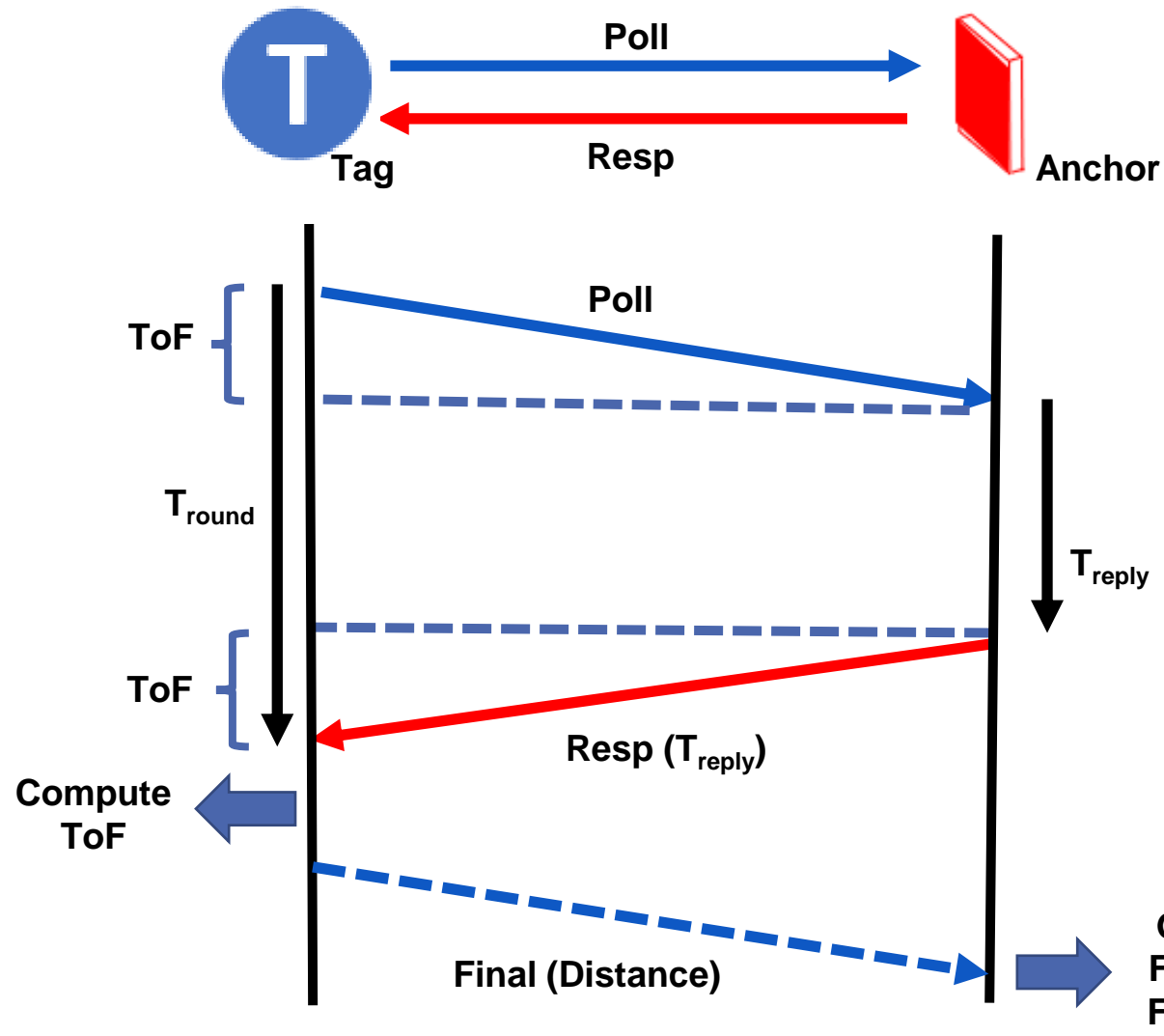


UWB Technology

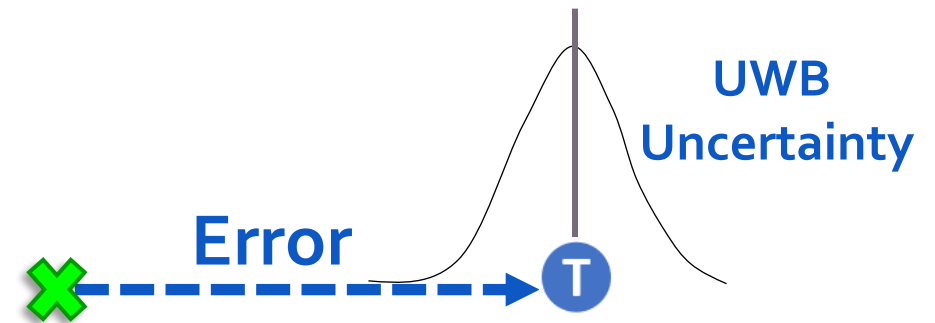
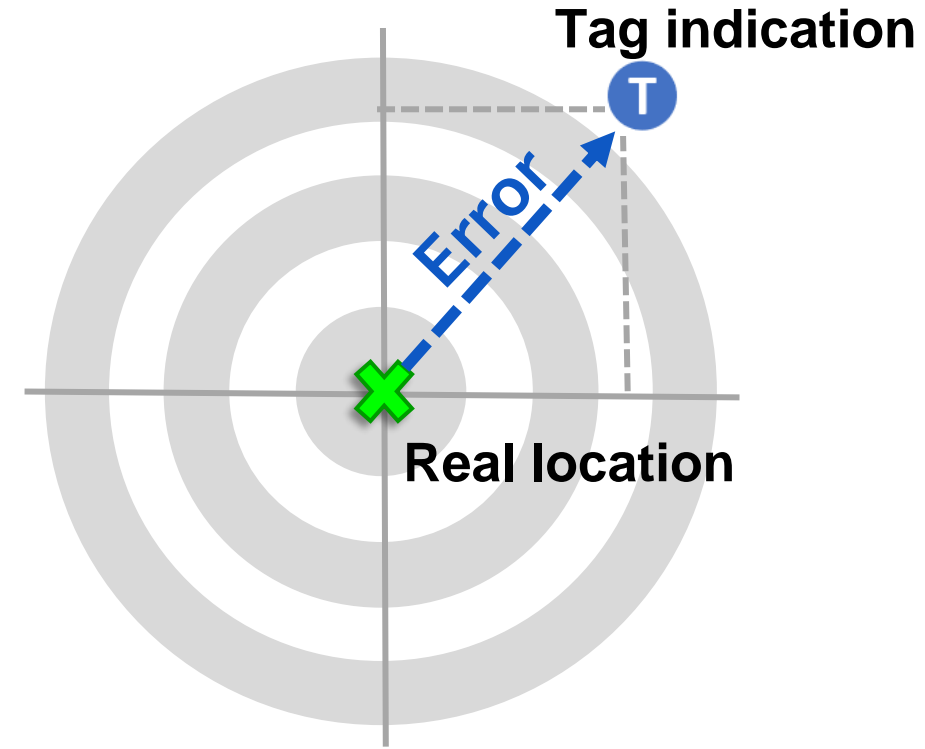
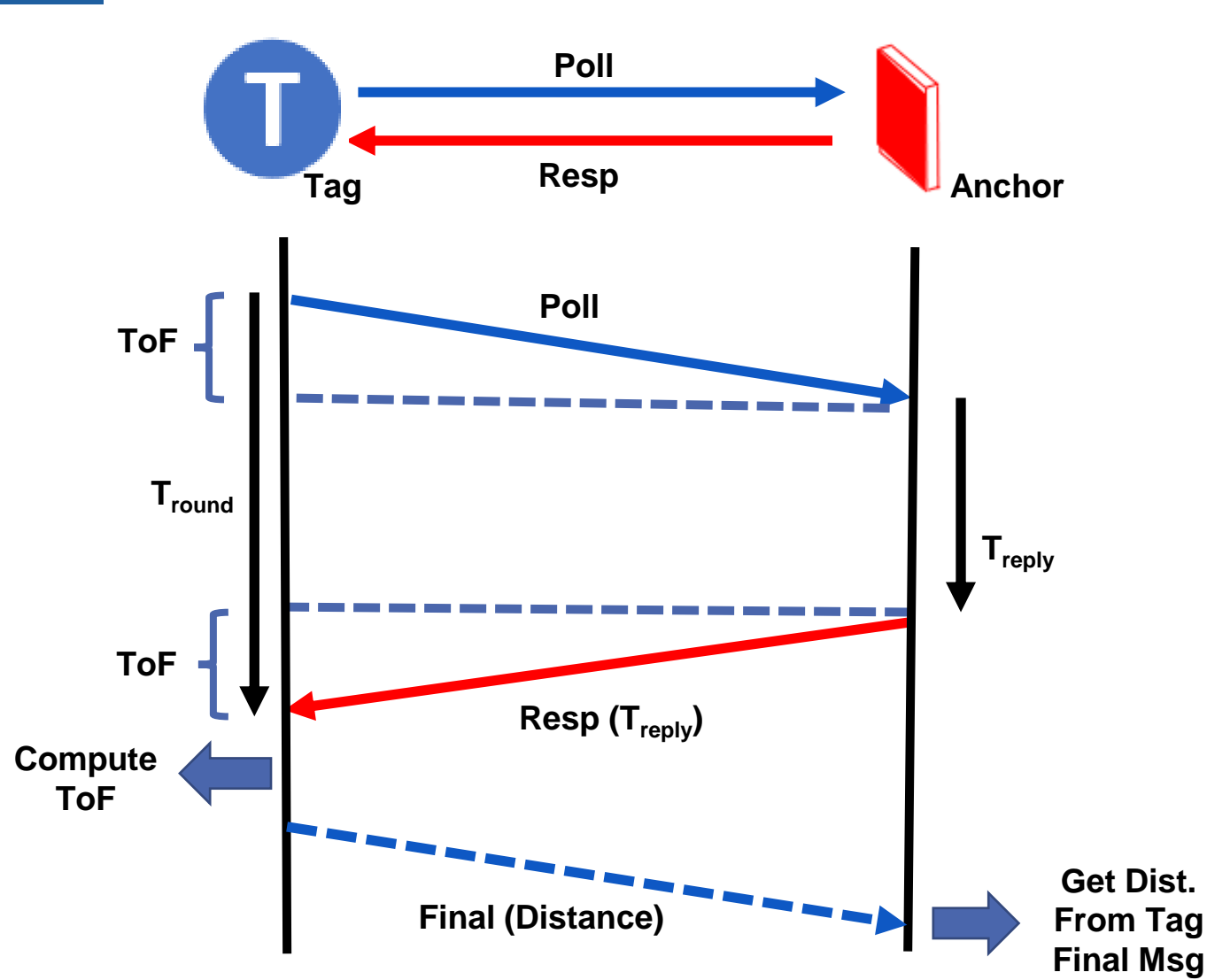
- Tags: mobile devices
- Anchors: Fixed devices
- Gateway: Device for communication between tags and application server
- Distance between a tag and an anchor is determined by the time it takes for UWB RF signals to pass back and forth between them (ToF)
- Low latency – 50 times faster than GPS
- Low Power, low cost, low processing
- High immunity to multipath and interference



UWB Technology



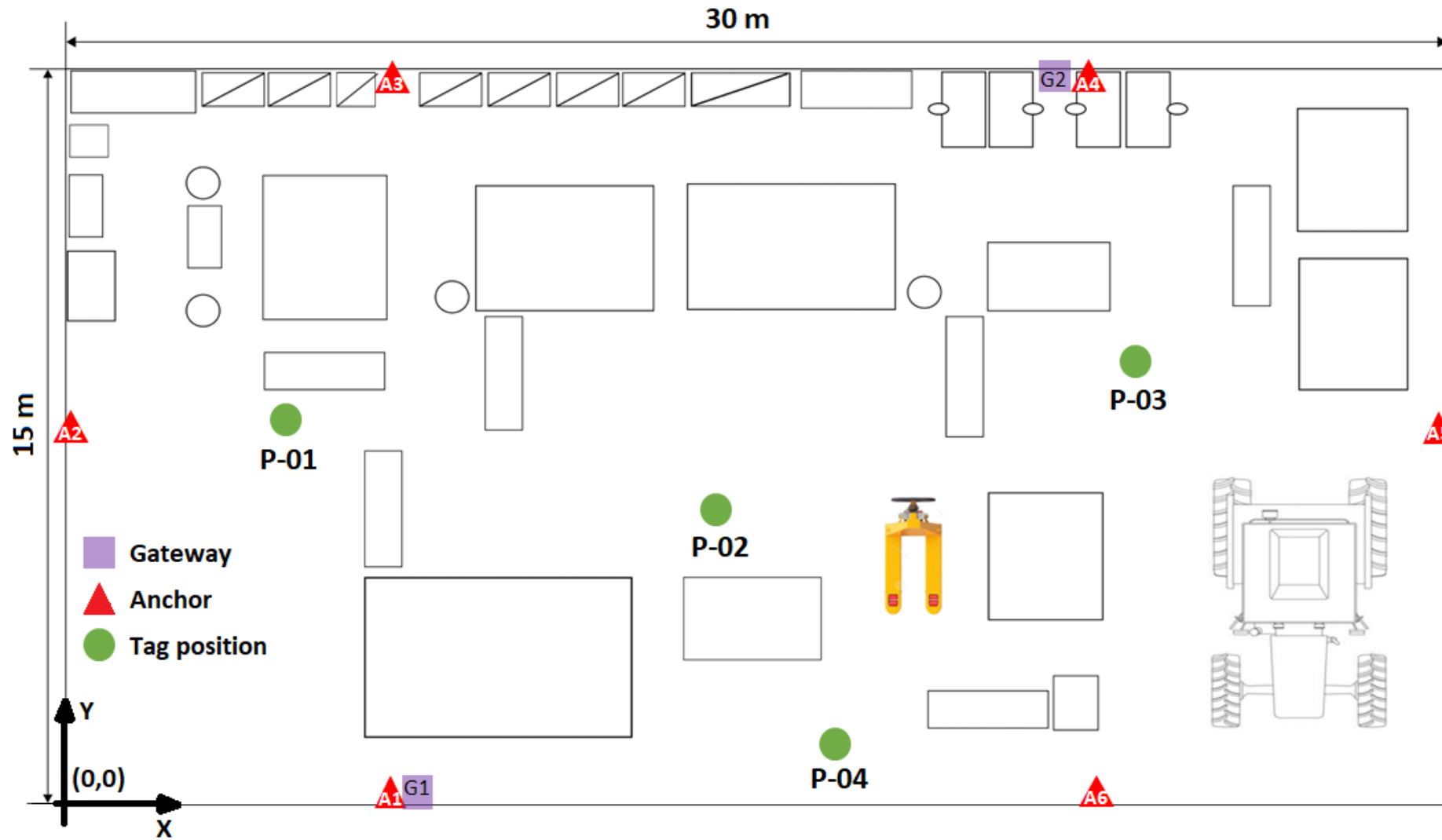
How accurate is the estimated distance?



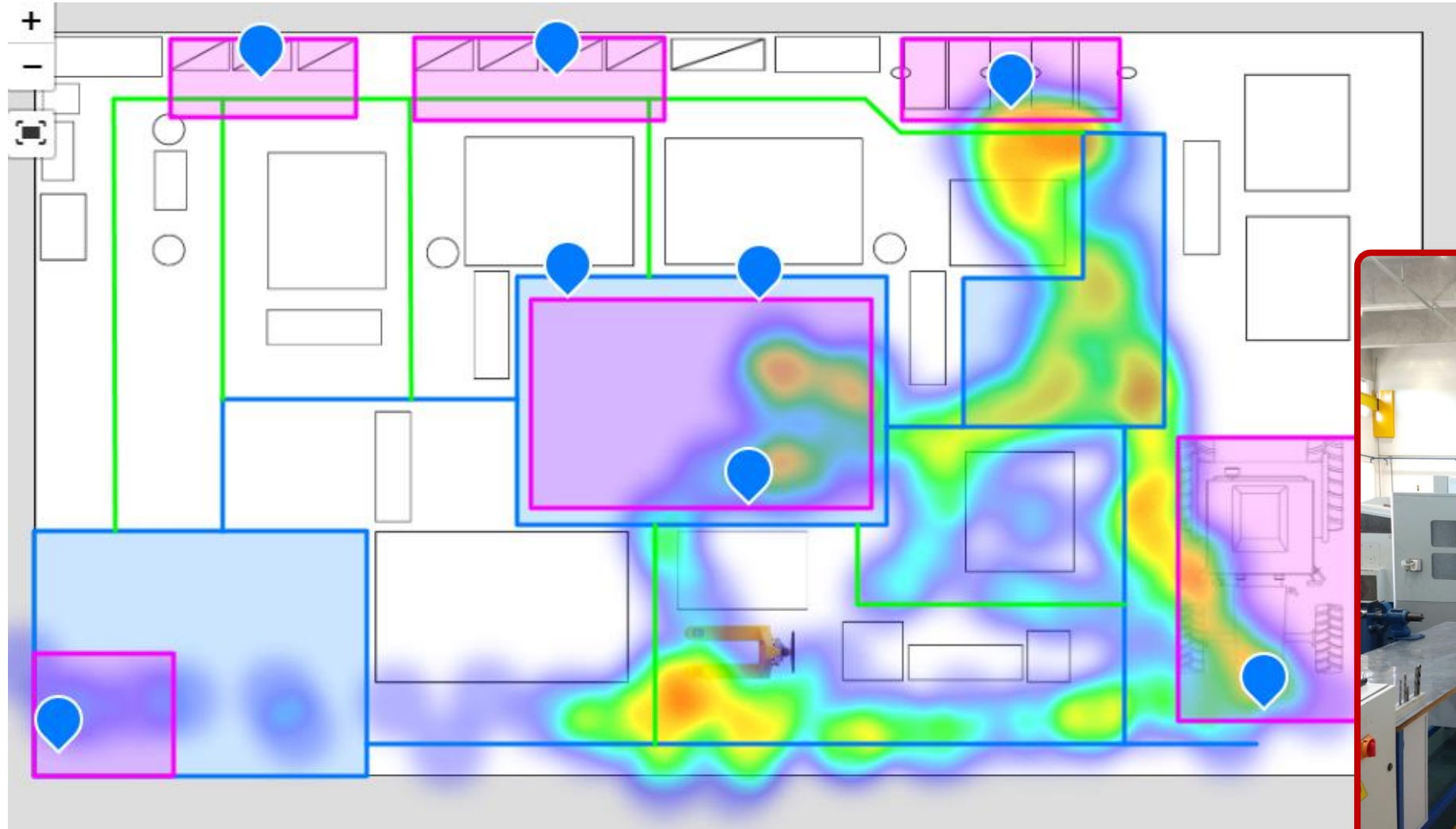
The experimental factory



The experimental factory



The experimental factory

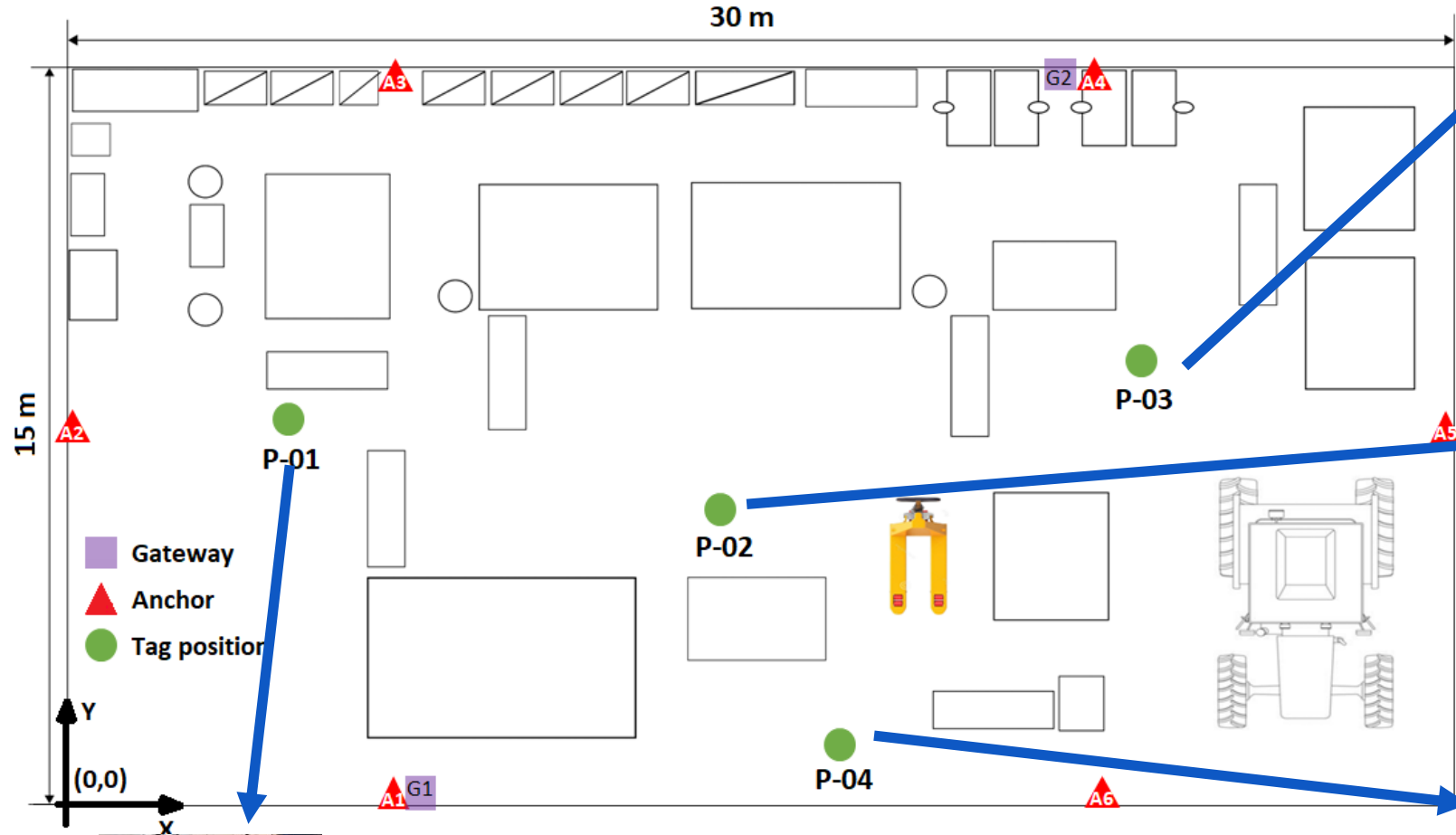


Reference measurements

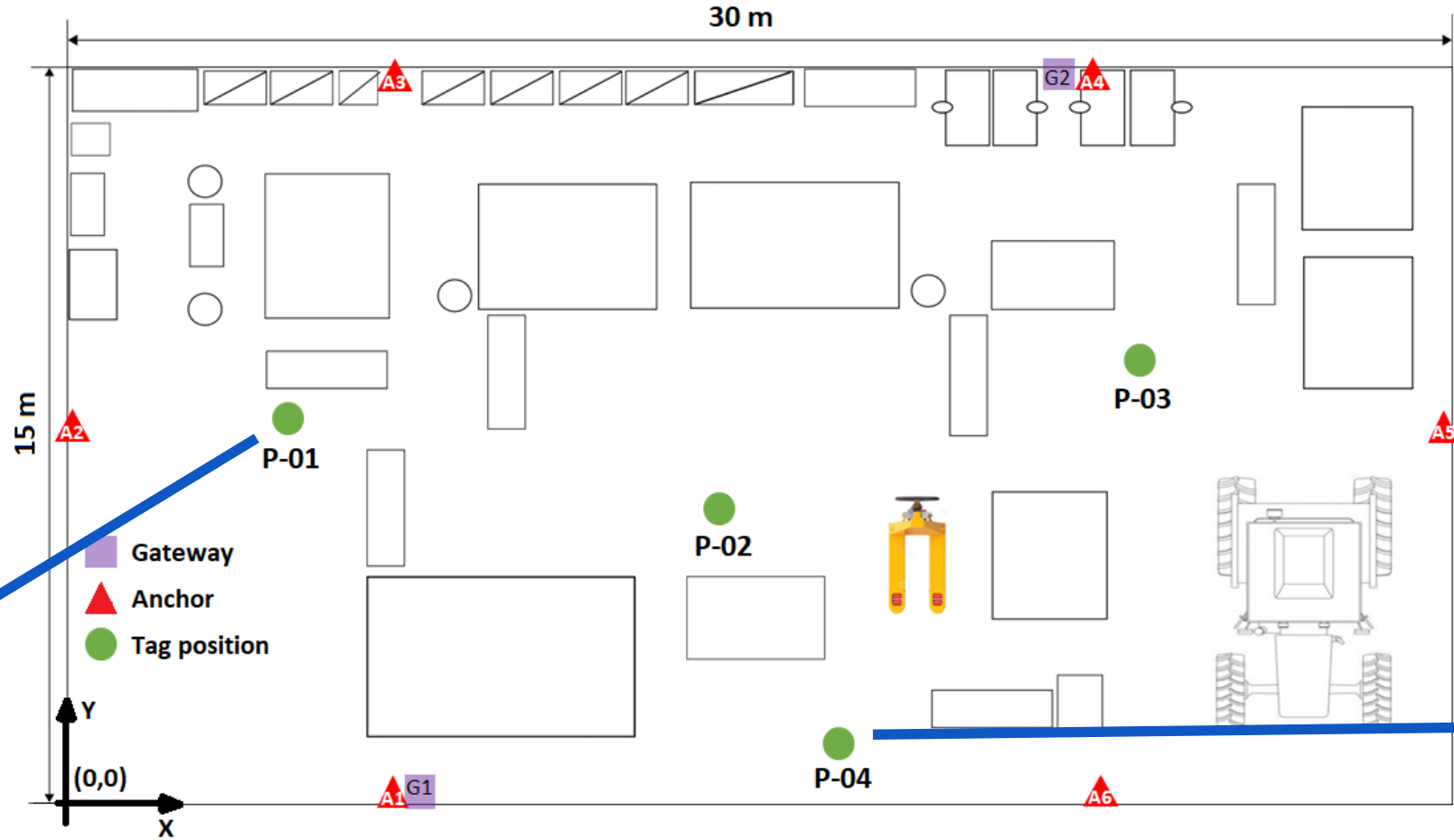
- **Total station:** Sokkia SET620K
 - Maximum angular error limit: $\pm 20''$
 - Maximum linear error: $\pm [4 \text{ mm} + 6 \text{ ppm} \times D]$ (mm)
where D is the distance measured in mm and ppm is part per million.
- **Steel scale:** Kawasa
- **Digital protractor:** Pantec
 - Resolution: 0.1°



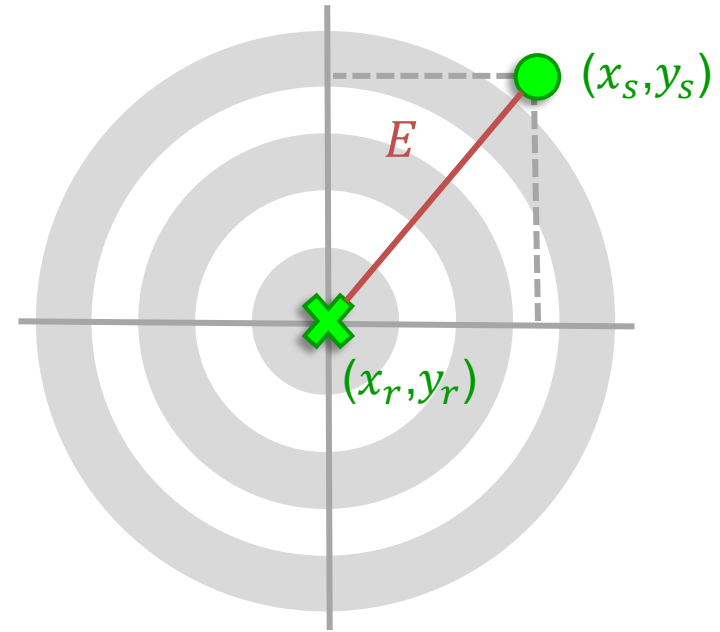
Experimental set up



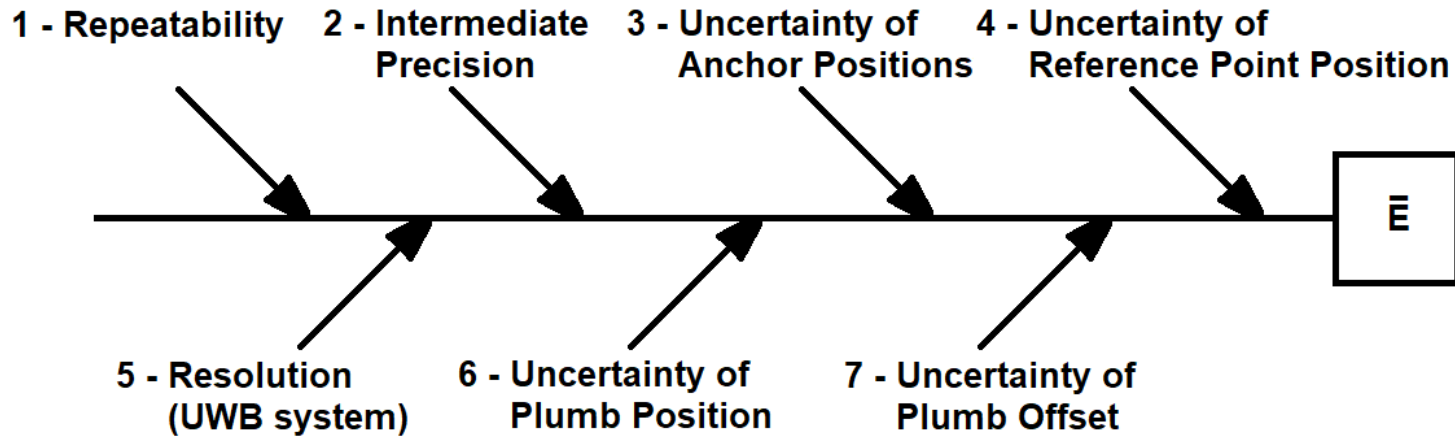
Experimental set up



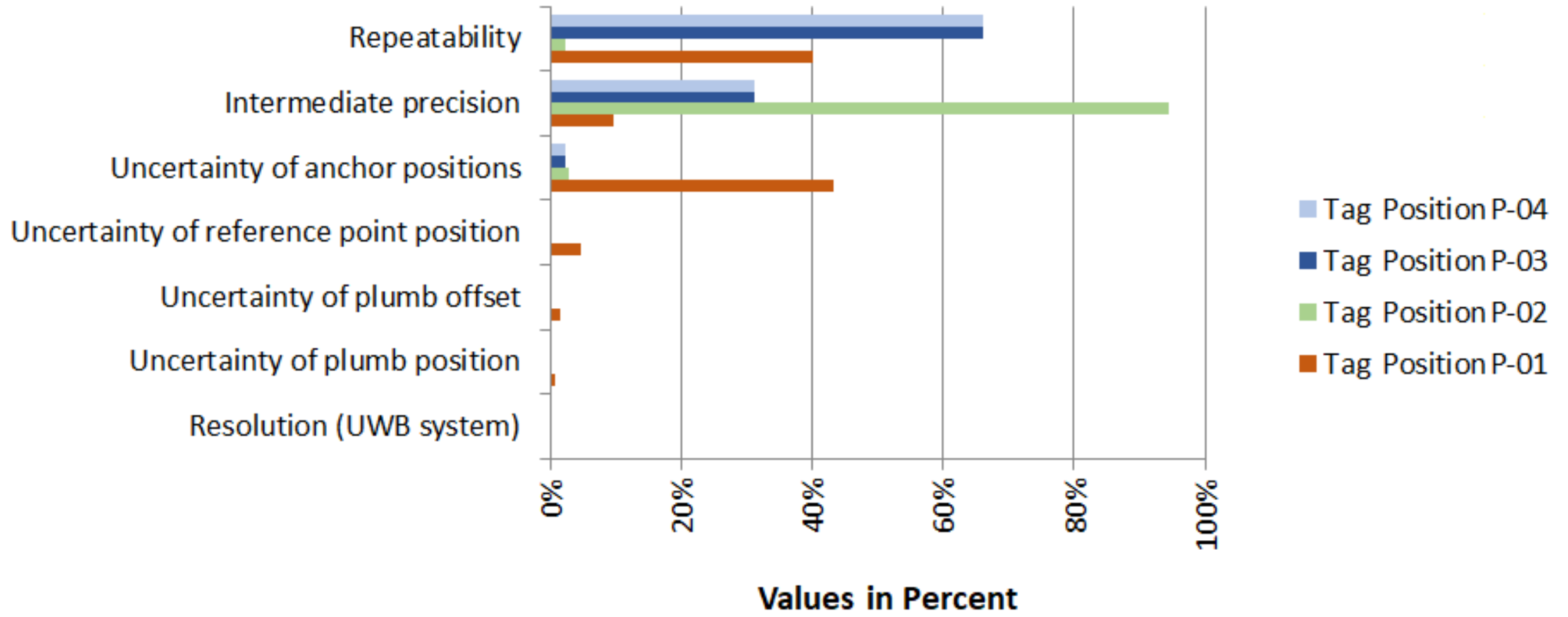
Results



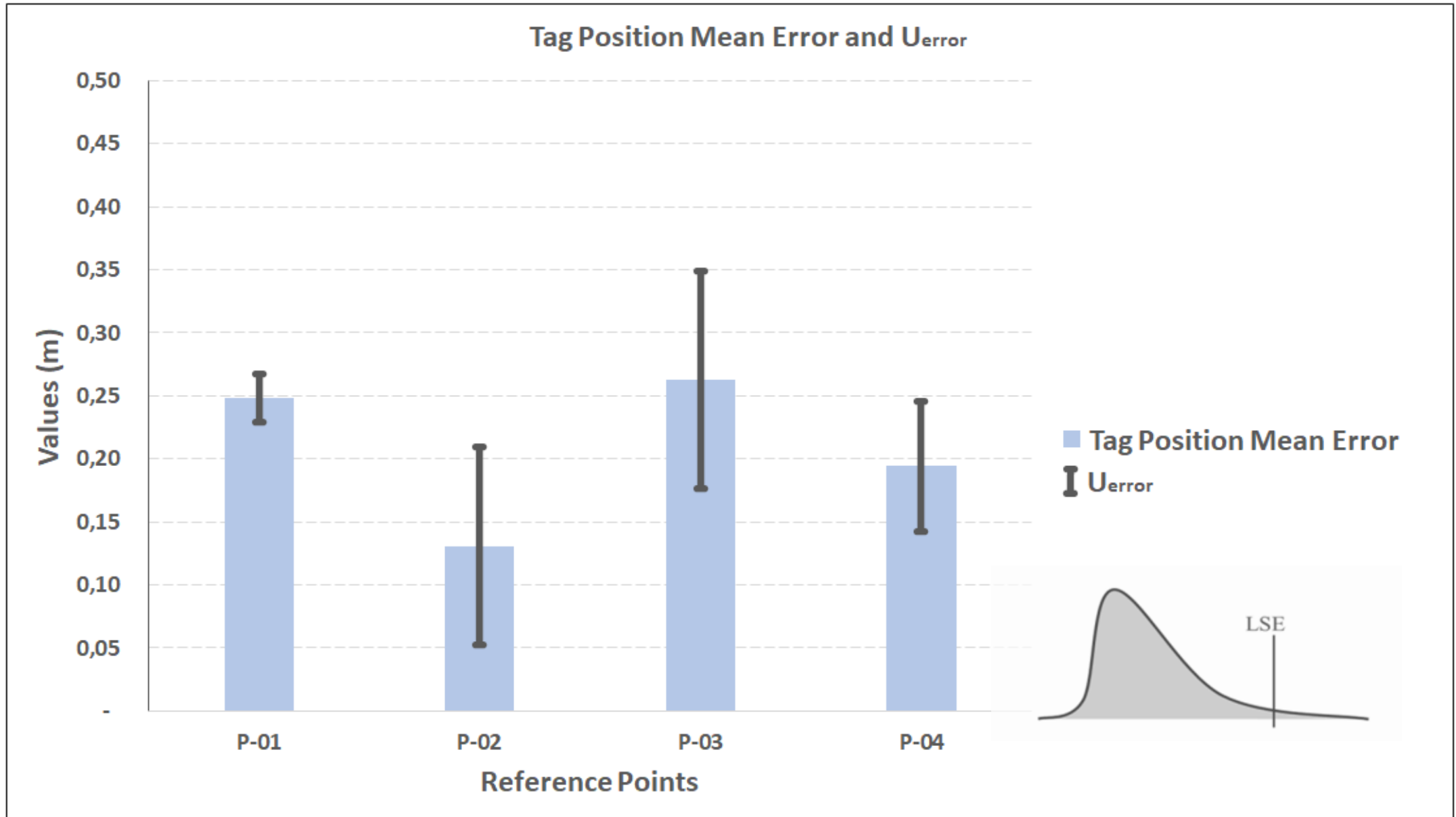
$$E = \sqrt{(x_s - x_r)^2 + (y_s - y_r)^2}$$



Contributions to Uncertainty



Results





INSTITUTO SENAI DE INOVAÇÃO EM SOLUÇÕES INTEGRADAS EM METALMECÂNICA

Unidade EMBRAPPII em Sistemas de Sensoriamento

Unidade credenciada no Programa BNDES IoT (Internet of Things)

Dr. Eng. Victor Gomes
victor.gomes@senairs.org.br