trinity

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www.trinityrobotics.eu

AGILE Consortium

- AGILE consortium is composed by two companies:

allbesmart

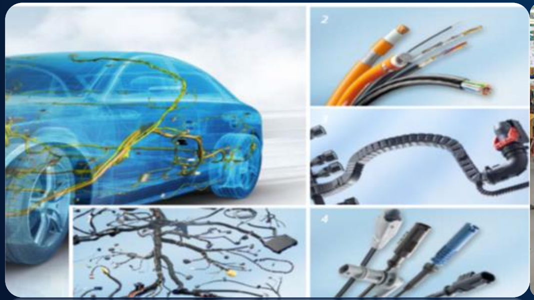
  - a Portuguese SME, established in 2015 that provides engineering services and technology expertise on IoT and Industry4.0

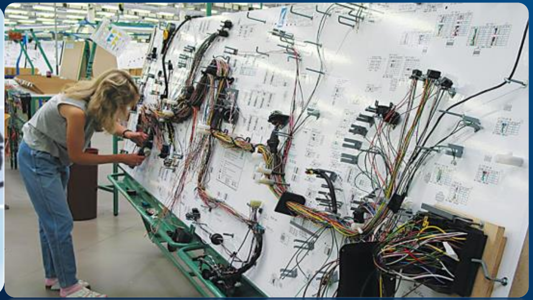
StoneShield ENGINEERING

  - a Portuguese SME, established in 2017 that manufactures industrial machines for the automotive cable assembly industry

AGILE Context

- Assembly of electric cables for the automotive industry:
  - is a process with significative manual work
  - most of the factories are located in cost-effective labour countries, mainly in north Africa, Mexico and India.





AGILE Context

- 90+ million vehicles are manufactured every year
- 60% of all electric cables manufactured are installed in cars
- Car manufacturers are using increasingly smaller components
- Miniaturization raises new challenges for manual labour
- Automation increases production, reduces costs, ensures quality
- Automation requires training/education and specialized maintenance operations

https://www.youtube.com/watch?v=4oI5R02uaKQ

AGILE Position in the Automotive Value Chain

Mentorship

- Collab. Robotics
- Augmented Reality
- AI Computer Vision
- Funding

Technology Provider

Robotic Integrator
Technology Adopter

Cable
Manufacturers

Automakers

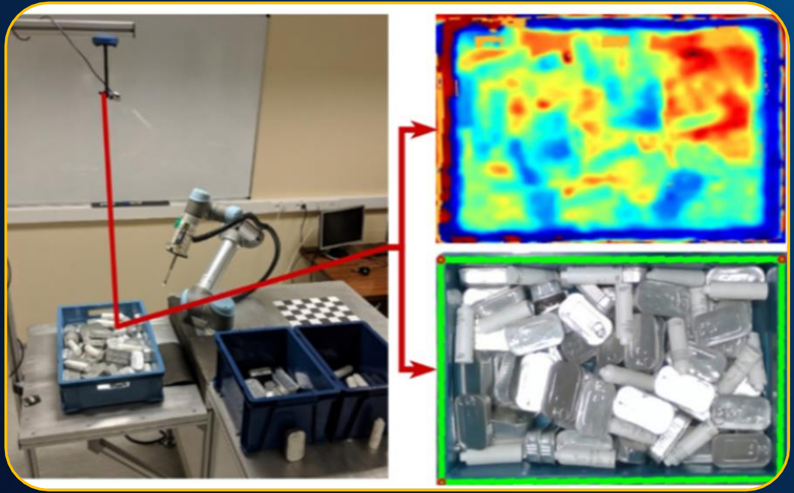
AGILE Demonstrators & TINITY Use Cases

TRINITY Use case 1

Collaborative assembly with vision-based safety system.

TRINITY Use case 10

HRI framework for operator support in human robot collaborative operations.



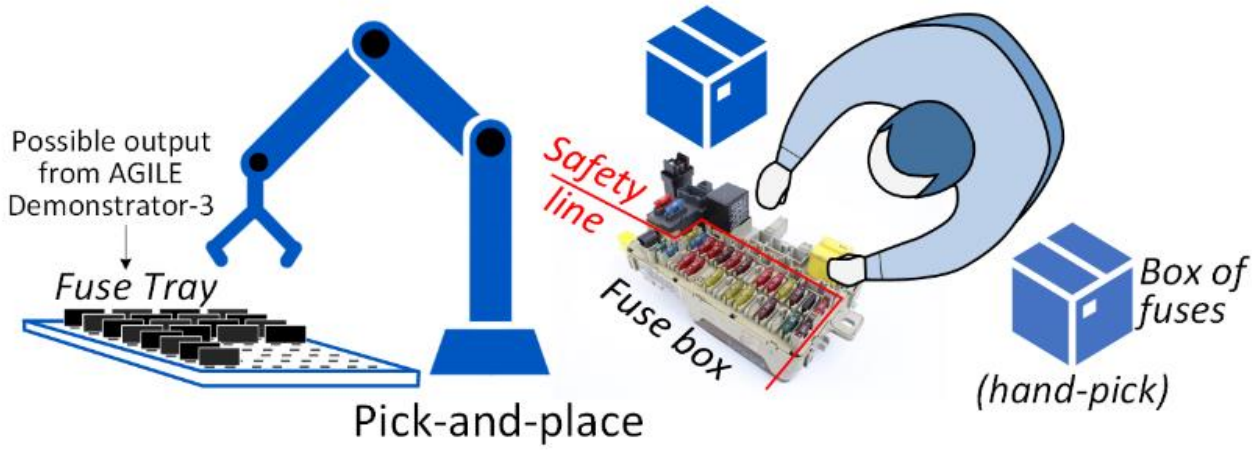
TRINITY Use case 17

Artificial Intelligence based stereo vision system for object detection, recognition, classification and pick-up by a robotic arm.

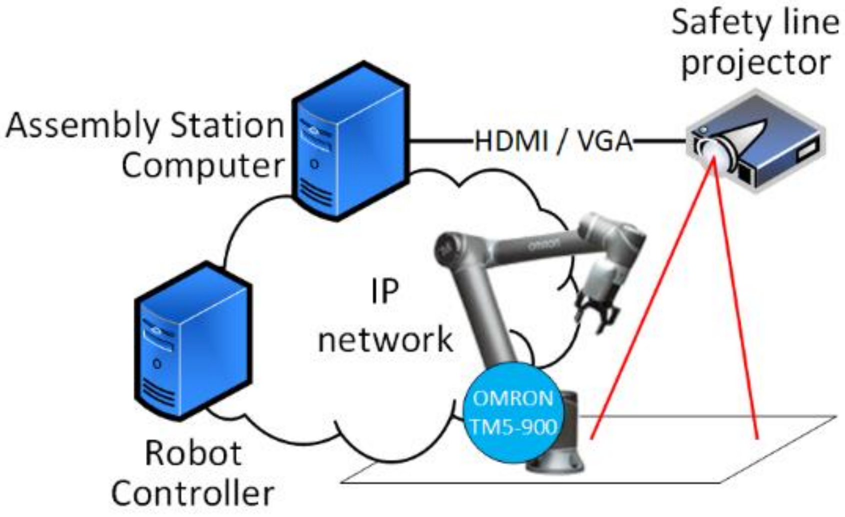
DIH: Tampere University (Finland)	DIH: LMS-University of Patras (Greece)	DIH: Institute of Electronics and Computer Science, Riga (Latvia)
AGILE Demonstrator 1	AGILE Demonstrator 2	AGILE Demonstrator 3
Mentor: Morteza Dianatfar	Mentor: Manto Zoga	Mentor: Janis Arents

trinity ENGAGE WITH AGILE MANUFACTURING

AGILE Demonstrator 1

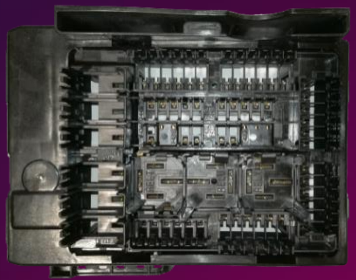


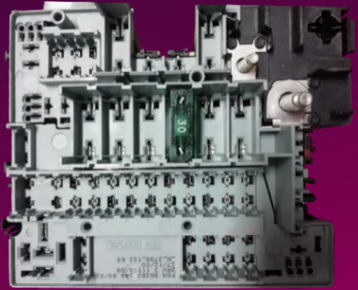
AGILE Demonstrator-1: concept

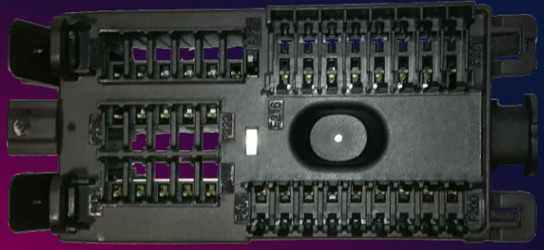


AGILE Demonstrator-1: high-level architecture

Fuse Boxes

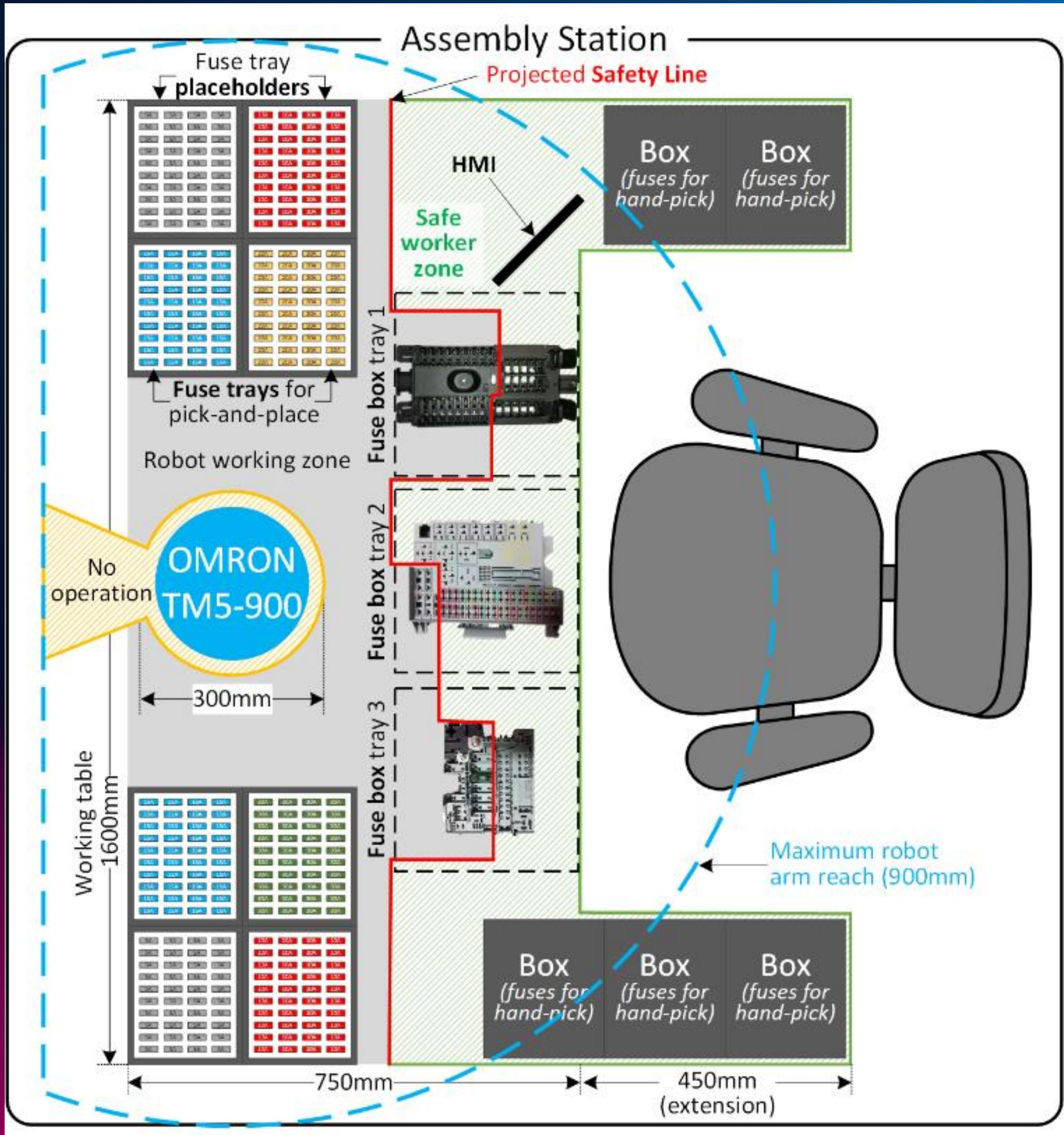






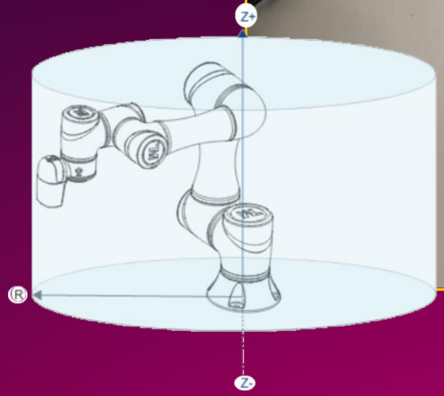
AGILE Demonstrator 1

- **Main KPI**: reach 30% decrease in the cycle time of a fuse box assembly process. Current average assembly time is 6 minutes.
- **Secondary KPI**: Optimum trajectory planning, based on different robot configuration. The goal is to reach a linear as possible trajectory considering the assembly station layout.



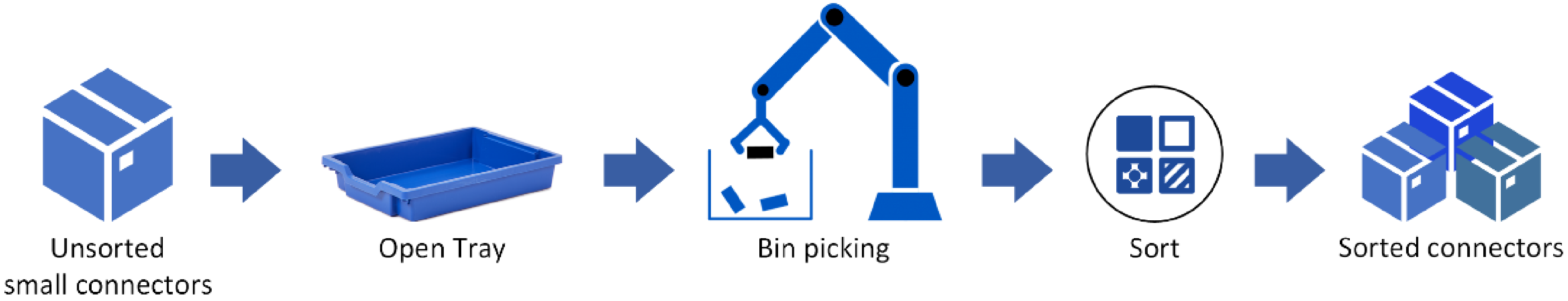
AGILE Demonstrator 1

- Next steps
  - A new gripper has been designed and manufactured for this Demonstrator (not used yet)
  - Safety line feature not yet integrated
  - Robot Arm safety zone not yet enforced



AGILE Demonstrator 3

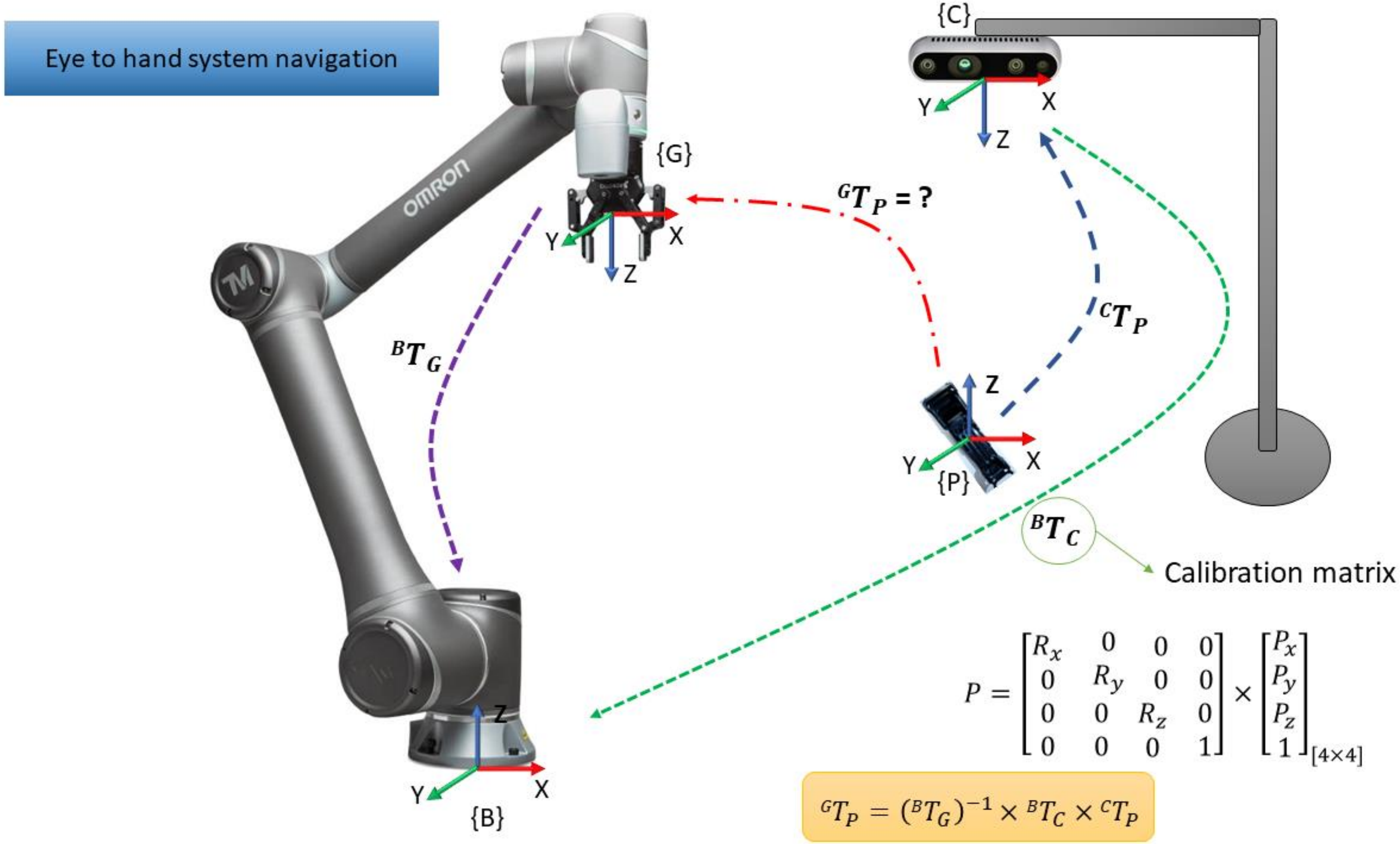
AGILE Demonstrator-3 concept



Main KPI: use AI to achieve an **average cycle time of 10 seconds** for a robotic arm to successfully pick-up small plastic cable connectors in unpredictable positions, sort them and place them in different boxes

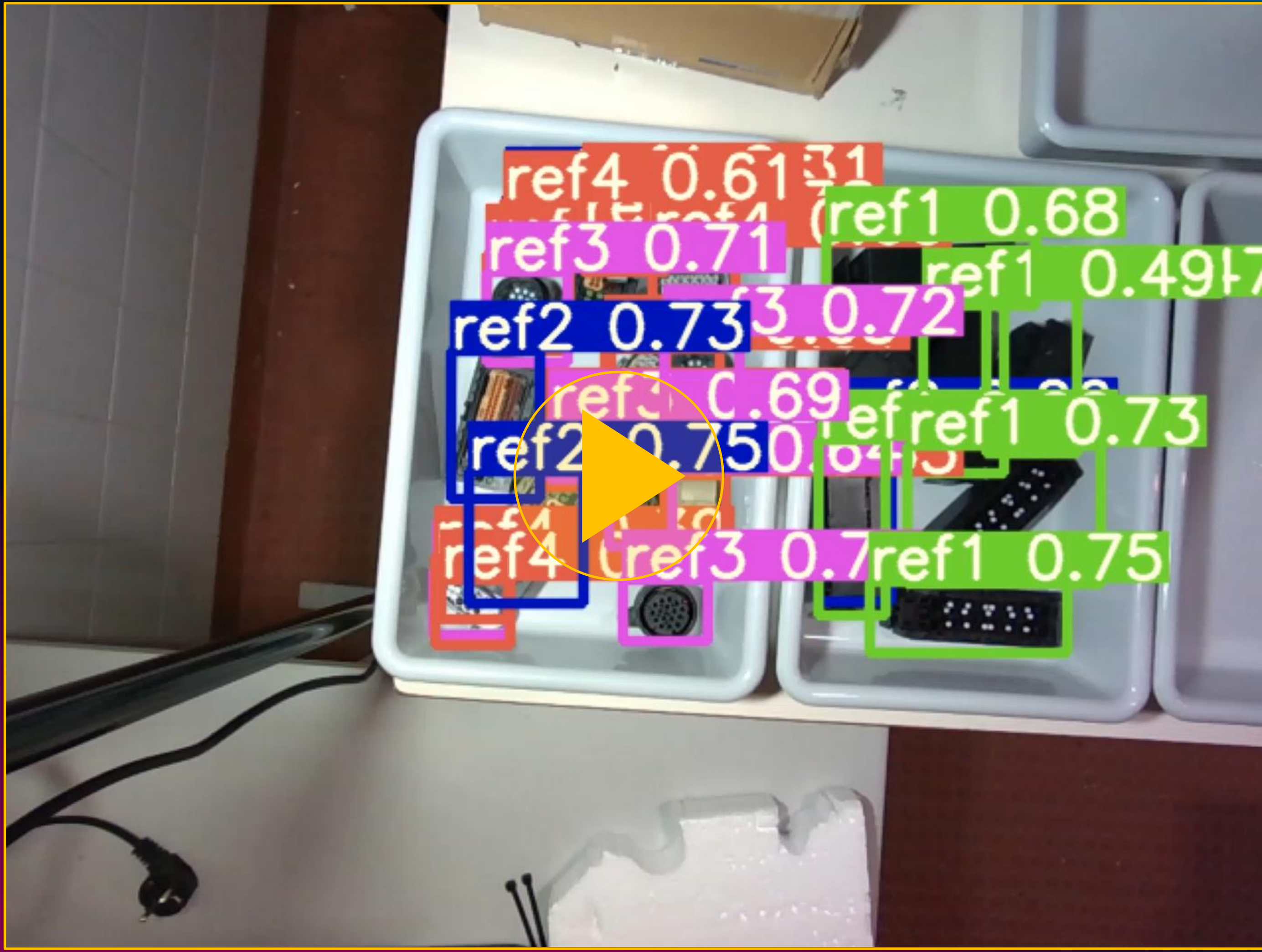
AGILE Demonstrator 3

- Synchronizing different system coordinates



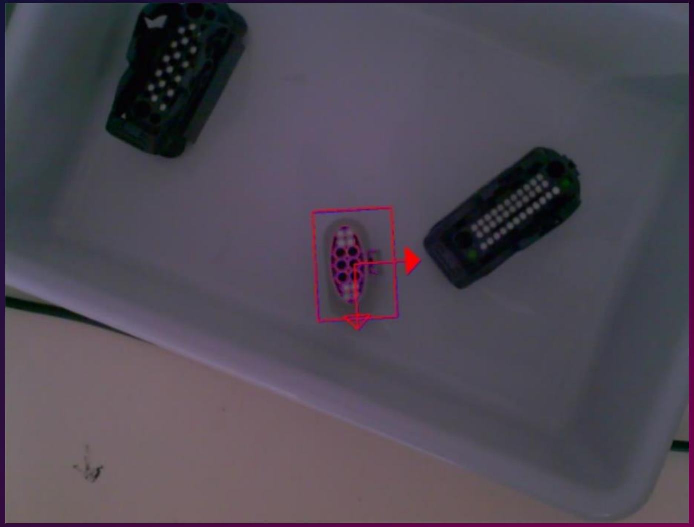
AGILE Demonstrator 2

- Object (connector) recognition and classification using:
  - Intel Real-Sense (3D vision / depth)
  - Robot arm camera (positioning)
  - YOLOv5 with Pytorch



AGILE Demonstrator 2

- Next steps
  - Improve the speed of the robot
  - Improve recognition of object orientation



Final Remarks

- TRINITY has provided us with expertise in different domains:
  - Inspiration for the Use cases
    - 3 Use Cases have direct match with our interests
    - These are very well documented and facilitate adoption
  - Valuable feedback in different technological areas
    - Collaborative assembly with vision-based safety system
    - Human-Robot Interaction guidelines
    - AI and ML for object detection, recognition, classification and pick-up by a robotic arm
  - Collaborative Publications (upcoming)