

METAGEAR OR.4: ROBOTIC ASSEMBLY

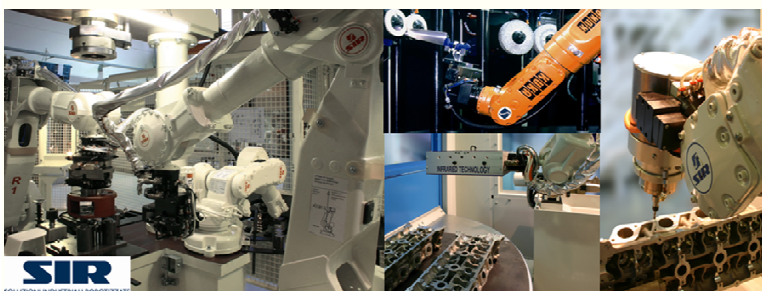
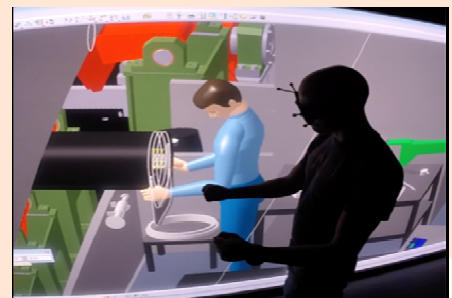
Prof. Marcello Pellicciari
InterMech MO.RE.
University of Modena and Reggio Emilia



INTERMECH MO.RE.

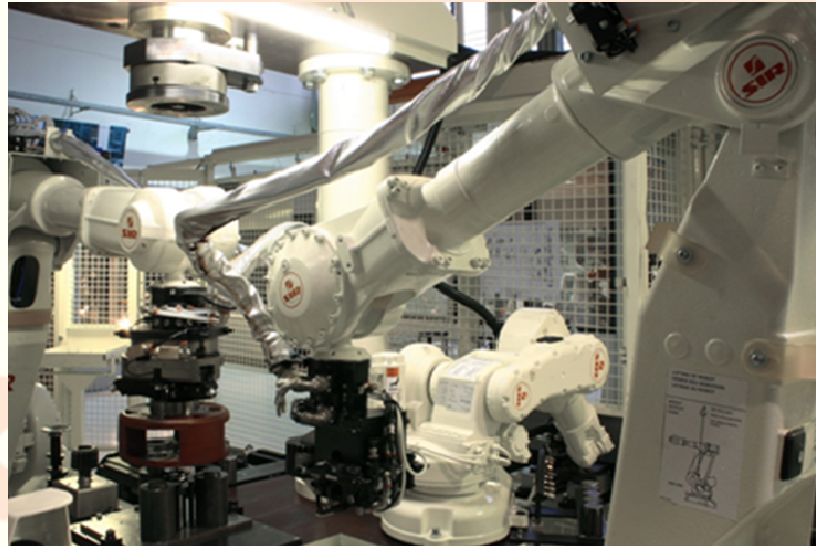


- Emilia Romagna High Technology Network
- University Industry Joint research lab on:
 - Digital Manufacturing
 - Industrial Robotics and automation
 - Industry 4.0



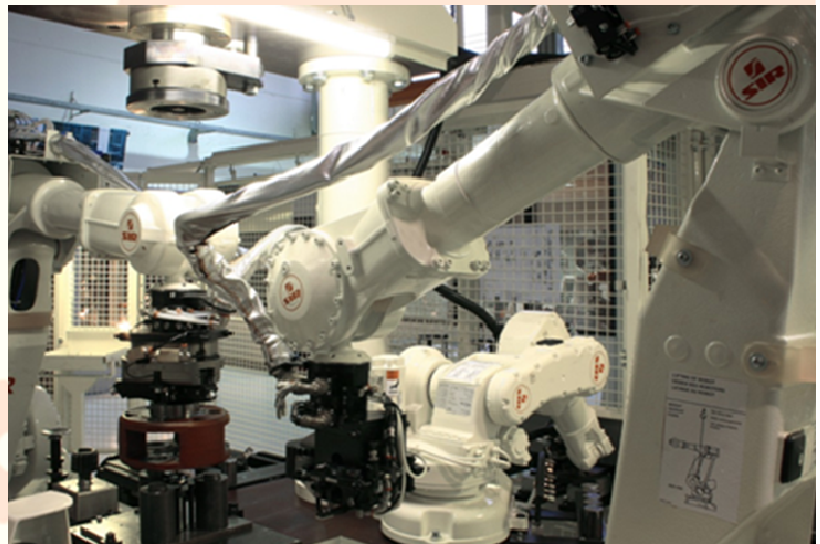
BACKGROUND AND MOTIVATIONS

- Increase the final **manufacturing quality** to better exploit the engineering design innovations
- Mass customized, Zero-Defect, **Industry 4.0 digitally connected production**
- Improve **sustainability** with energy-efficient robotic processes
- Reduce **costs** and **delivery time**



MAIN OBJECTIVES

- **Superior accuracy**, force feedback robotic assembly
- Singularly optimized, **one-piece-flow production**
- IoT-based **product quality tracking**
- Novel generation of **modular and reconfigurable robotic assembly cells**



DEMO-CELLS & CASE STUDY

- Application-driven research: experimental validation
- TRL-6 Demonstration on 2 demo cells

Demo-cell @ UNIMORE



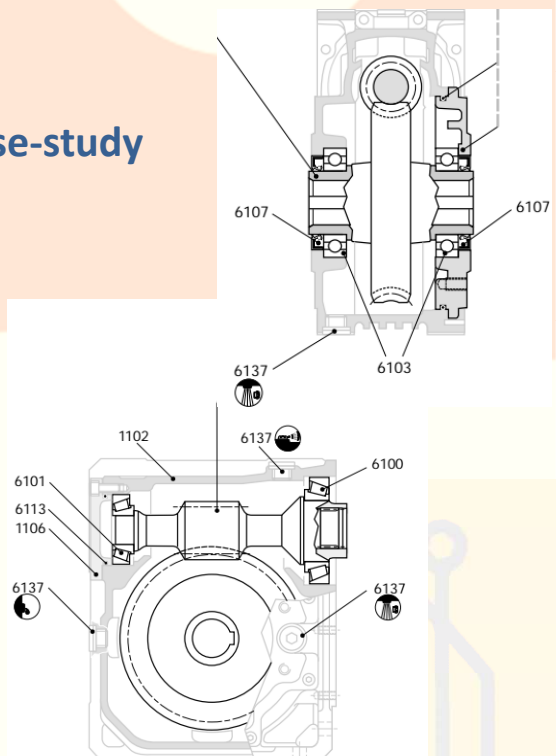
Demo-cell @ SIR



DEMO-CELLS & CASE STUDY

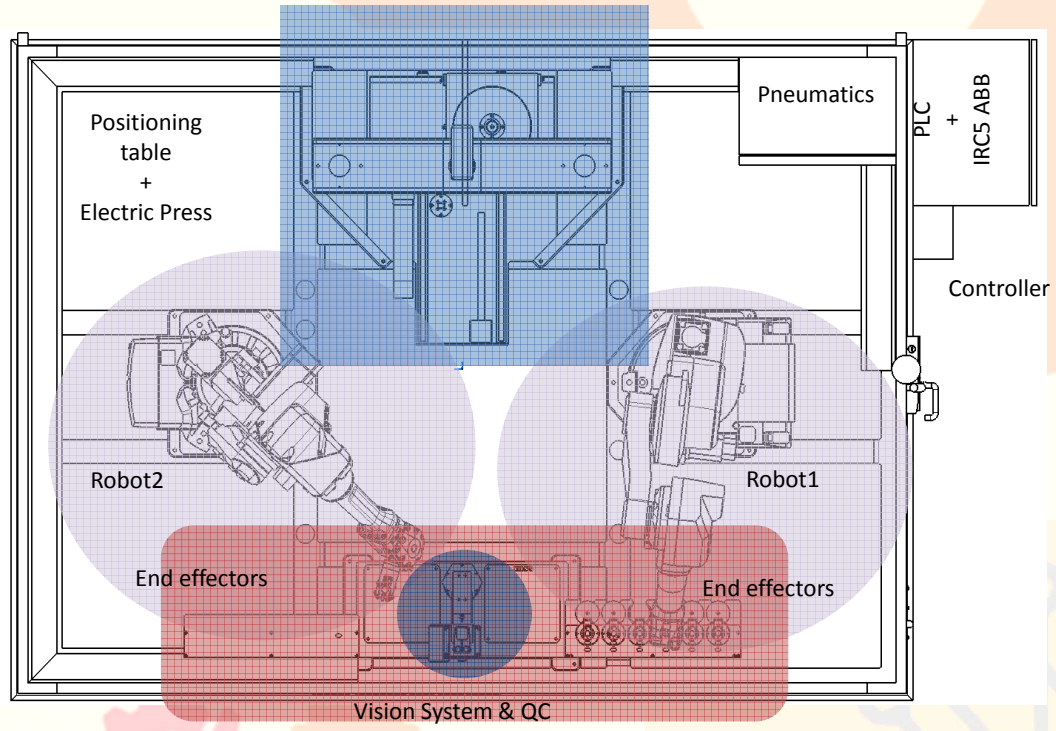
- Application-driven research: experimental validation
- TRL-6 Demonstration on 2 demo cells

Demo-cell @ SIR: wormgear case-study



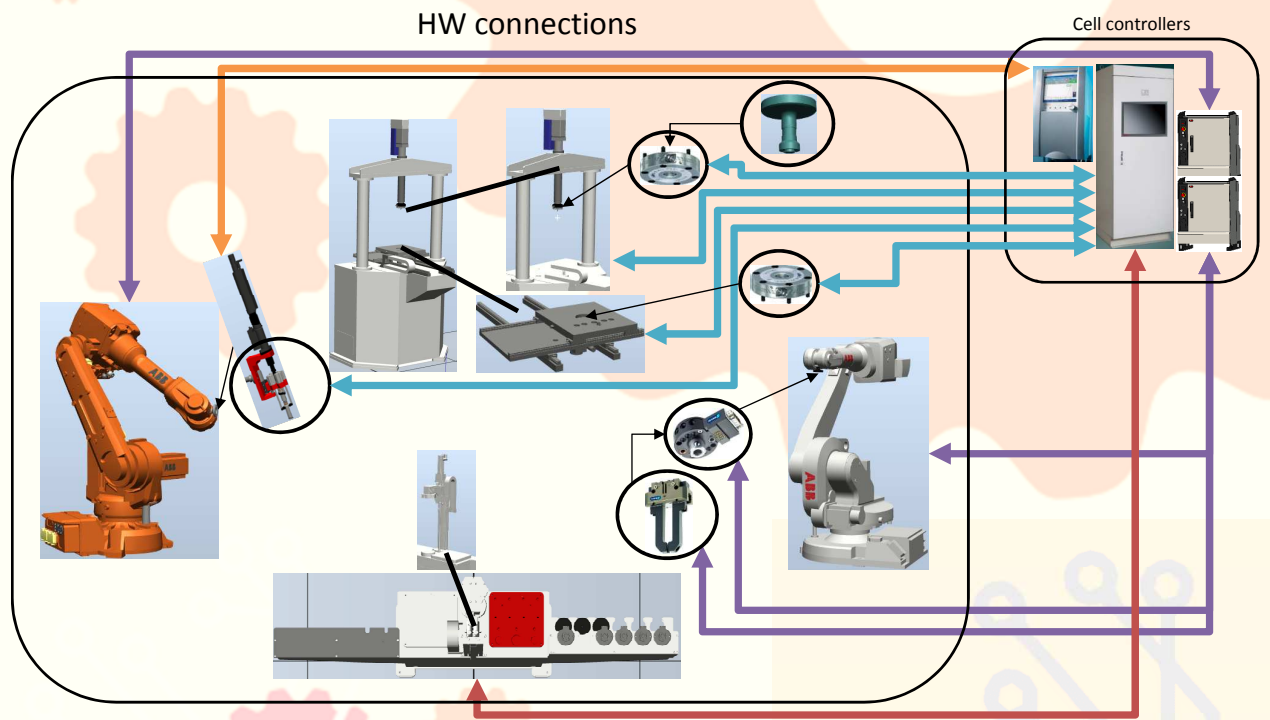
DEMO-CELL @ SIR

Layout



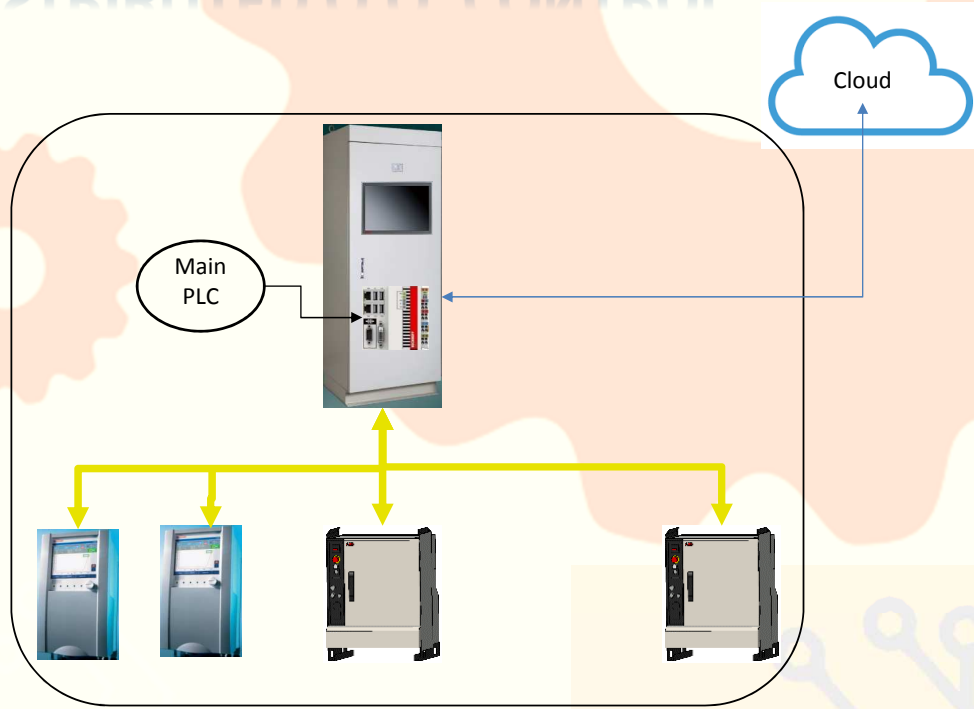
DEMO-CELL @ SIR

HW connections

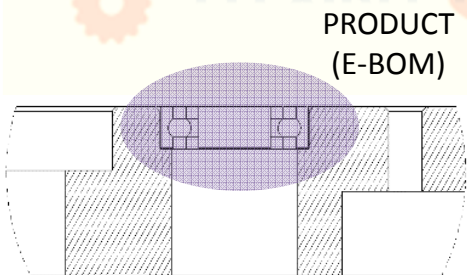


- 4+1 independent controllers
- 3 Field-Buses

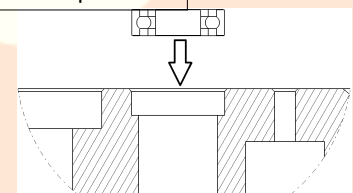
DISTRIBUTED O.O. CONTROL



FLEXIBLE PROCESS PLANNER

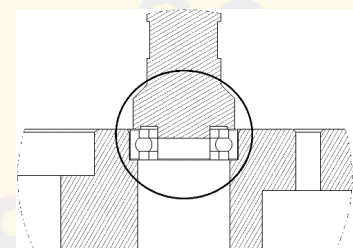
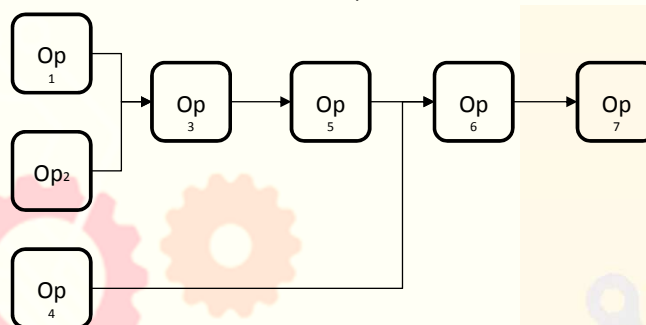
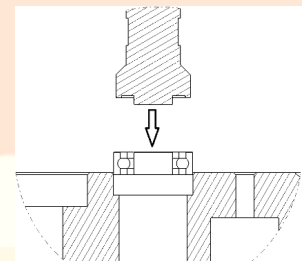


COMPONENTS	1 base
	1 cuscinetto piccolo



Tolleranze cuscinetto
Tolleranze sede
Specifiche di forzamento

1. Fissare base a carrello
2. Portare carrello in posizione A
3. Posizionare cuscinetto
4. Montare punzone su pressa
5. Portare carrello in posizione B
6. Inserire cuscinetto
7. Verificare rispetto delle specifiche



FLEXIBLE PROCESS PLANNER

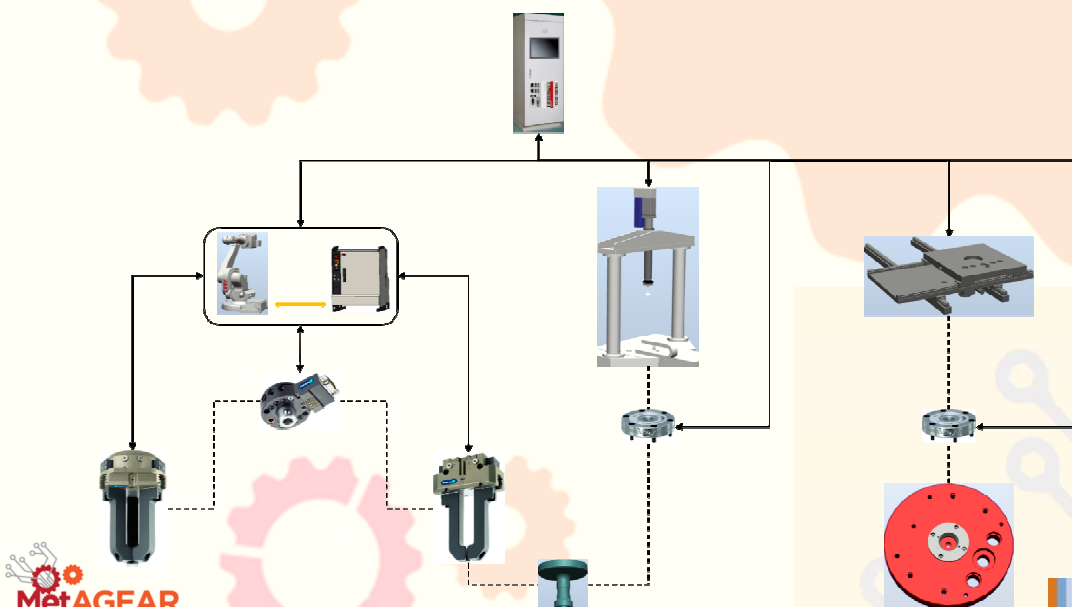
- Ontologies generate the process sequence from Product specifications and process constraints
- Resource availability driven optimized sequence generates specific control logics

DEVICES	Robot1 (ABB-IRB1600)
	Robot2 (ABB-IRB2600)
	Carrello
	Pressa
	Sistema di visione
	Schunk Grippers (1) (4)
	Schunk SWK-011
	Schunk NSE mini 90
	Avvitatore Rexroth
	Sistema aggancio/compensazione
Magazzini	
TOOLS	Punzoni (2)
	Inserti

FLEXIBLE PROCESS PLANNER

- Ontologies generate the process sequence from Product specifications and process constraints
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Control Logics tree

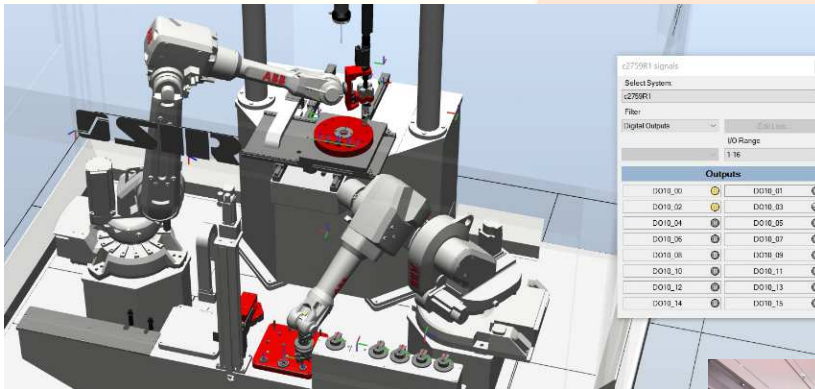


FLEXIBLE PROCESS PLANNER



UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

- Collision free trajectories verified on a Digital Twin



RETE ALTA TECNOLOGIA
EMILIA-ROMANA
HIGH TECHNOLOGY NETWORK



METAGEAR PROJECT

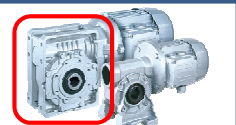


UNIMORE
UNIVERSITÀ DEGLI STUDI DI
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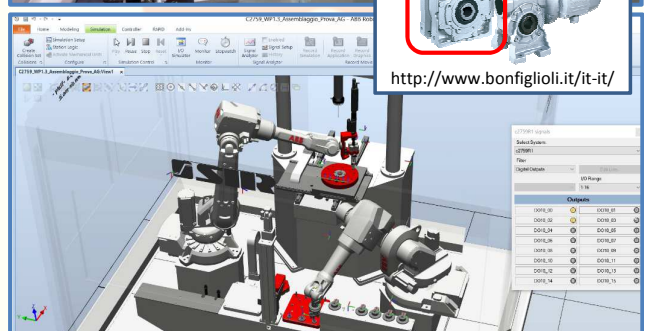
OR4 – High accuracy and reconfigurability robotic system

New architecture of reconfigurable robotic assembly cells:

- **Novel Industry 4.0 control architecture** to improve and re-adapt existing plants, and to develop high reconfigurable robotic cells
- **Superior accuracy** robotic assembly of gear reducers
- Operating modules and their behavioural models, product configuration, tests
- **Reconfigurable robotic cells** to achieve the highest manufacturing flexibility
- Zero-Defect



<http://www.bonfiglioli.it/it-it/>



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HIGH TECHNOLOGY NETWORK

THANK YOU! QUESTIONS?

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