EICASLAB Rapid Control Prototyping in the FP6 European PiSA Project

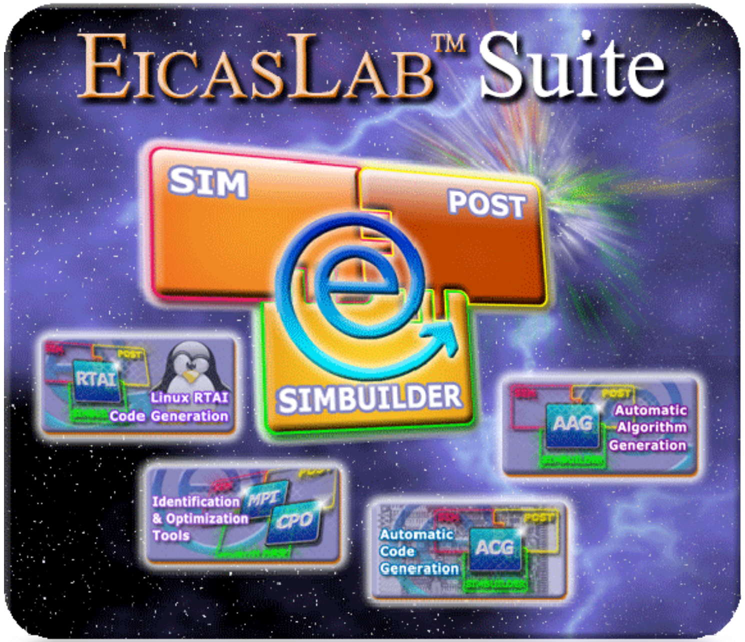

EicasLab™ Suite
SIM
POST
SIMBUILDER
RTAI
Linux RTAI Code Generation
AAG
Automatic Algorithm Generation
MPI
CPD
Identification & Optimization Tools
ACG
Automatic Code Generation

TABLE OF CONTENT

- *Introduction on PiSA European project and participants*
- *EICAS Goal and Safety requirements*
- *Subproject 2 – Time Sharing Robot*
- *Simulation and Rapid Control Prototyping*
- *User case example*
- *Test scenario*
- *User case movie*

PiSA **European Project -** NMP2-CT-2006-026697

An Integrated Project of the Sixth Framework Programme
"Next Generation of Flexible Assembly Technology and Processes"

Deals with Flexible Assembly Systems through Work-place Sharing and Time Sharing Human-Machine Cooperation

The overall goal of PISA is to keep human workers in the loop but to support them with powerful tools.

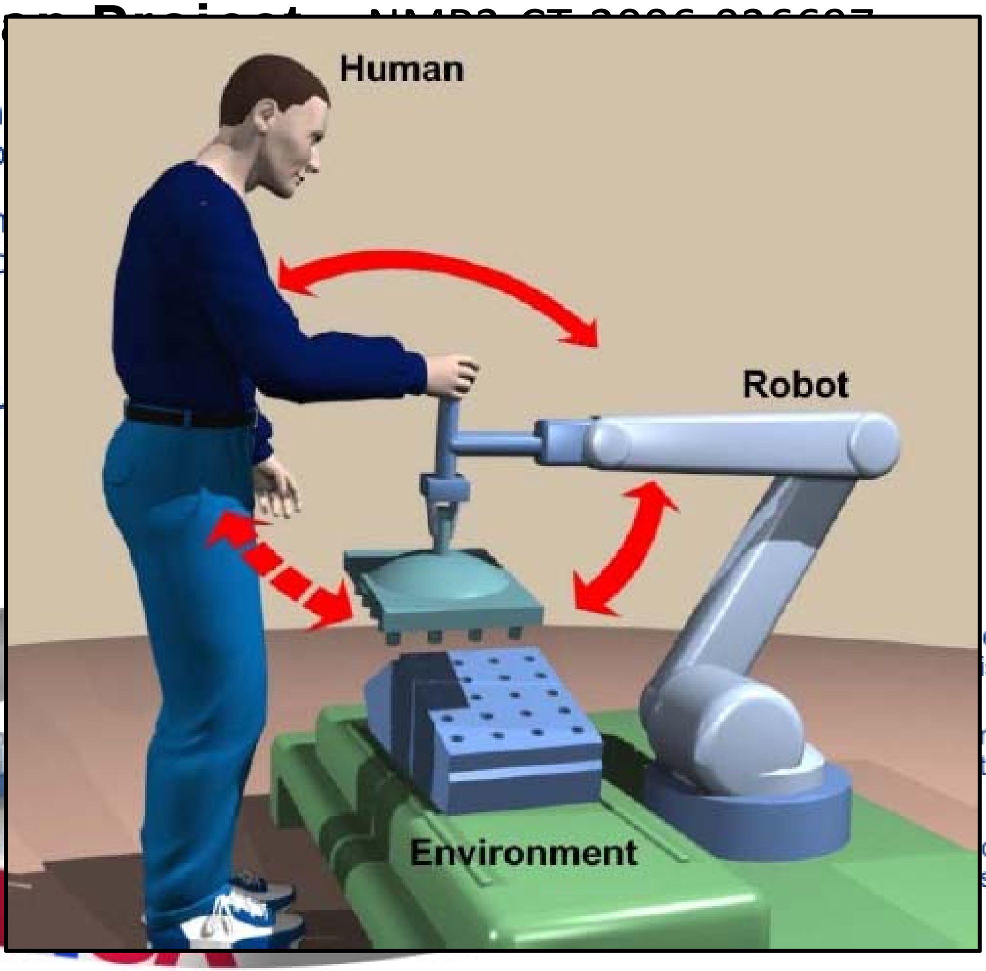
- Novel Intelligent Assist System IAS
- Planning Tools for their Integration
- Reconfigurability and Reusability of Assembly Equipment

PISA Europea

An Integrated Project of th
"Next Generation of Flexib

Deals with Flexible Assem
Time Sharing Human-Mac

The overall goal of PISA
but to suppor



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European Project - NMP2-CT-2006-026697

An Integrated Project of the Sixth Framework Programme
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Deals with Flexible Assembl
Time Sharing Human-Machi

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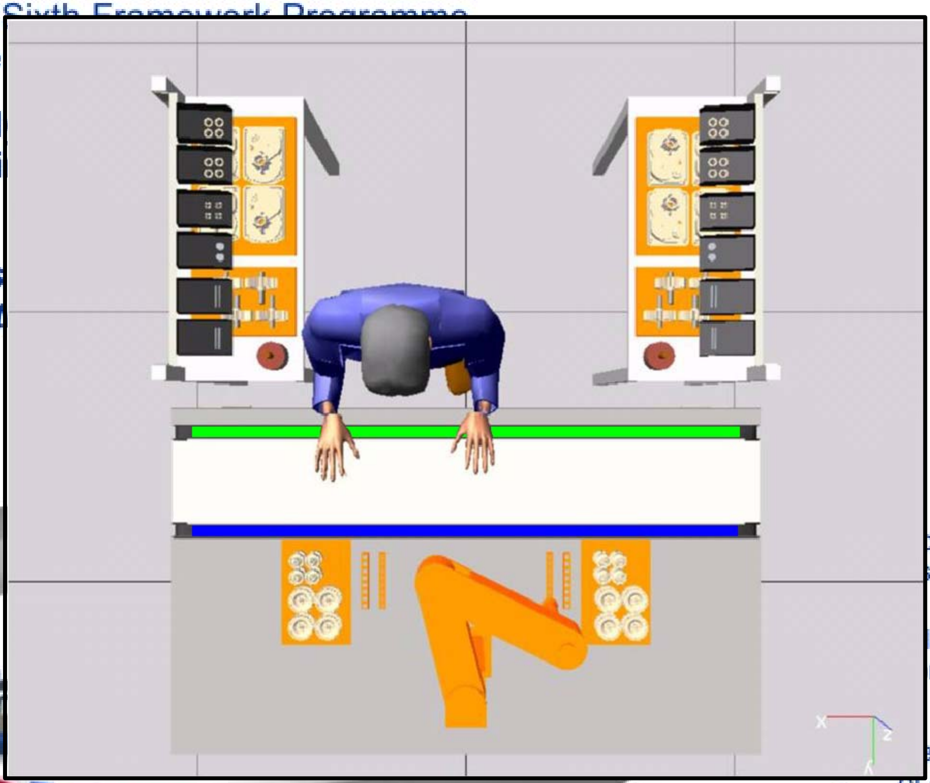

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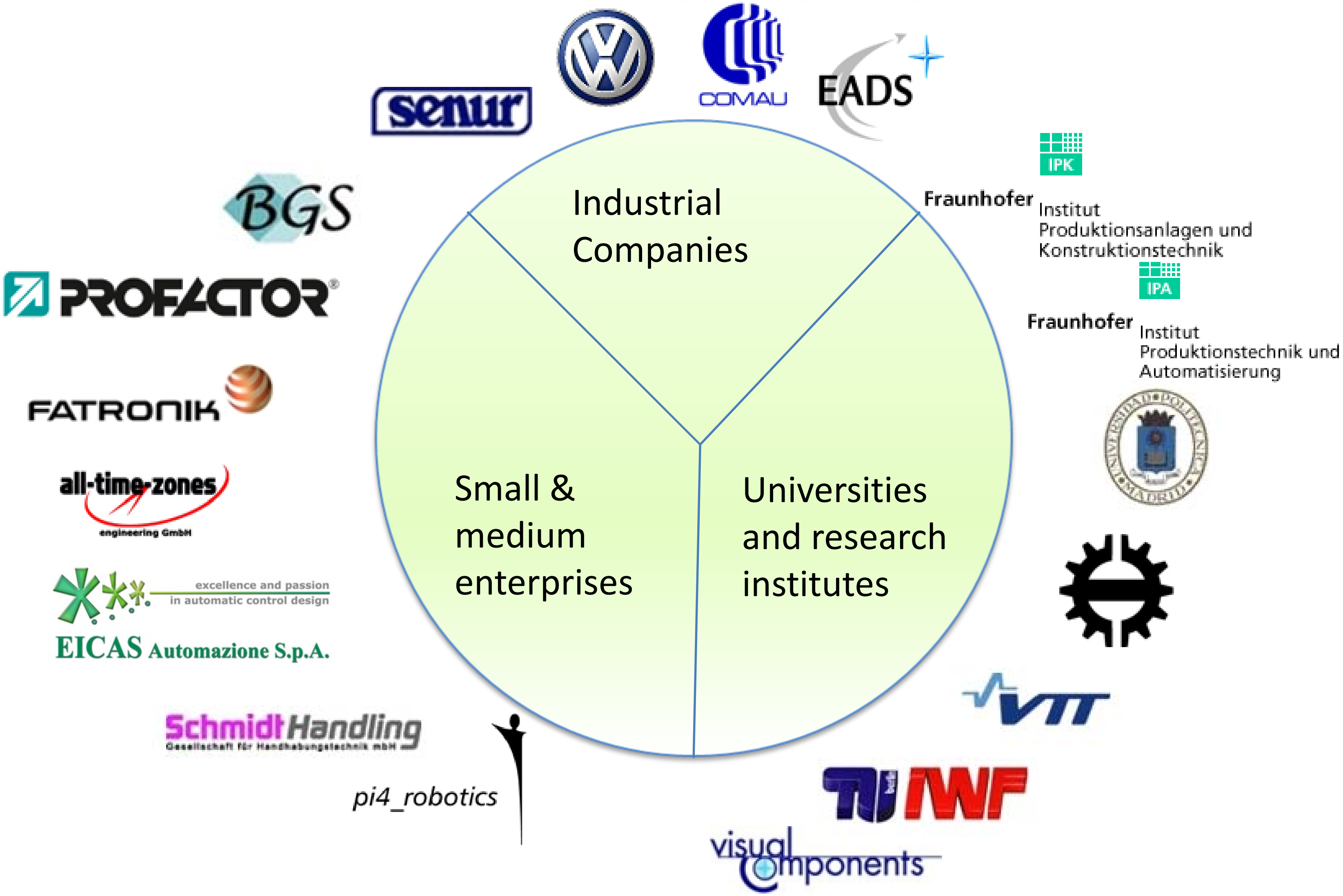

senur
COMAU
EADS
IPK
Fraunhofer Institut Produktionsanlagen und Konstruktionstechnik
IPA
Fraunhofer Institut Produktionstechnik und Automatisierung
BGS
PROFACTOR
FATRONIK
all-time-zones
engineering GmbH
excellence and passion in automatic control design
EICAS Automazione S.p.A.
SchmidtHandling
Gesellschaft für Handhabungstechnik mbH
pi4_robotics
VTT
TU IWF
visual components

Industrial Companies

Small & medium enterprises

Universities and research institutes

senur
COMAU
EADS

Industrial

SAFETY:
Supervising the human presence in the working environment in order to avoid dangerous and hazardous situations during Robots's operation.

IPK
Fraunhofer Institut
Produktionsanlagen und
Konstruktionstechnik

IPA
Fraunhofer Institut
Produktionstechnik und
Automatisierung

BGS
PROFACTOR
FATRONIK
all-time-zones
engineering GmbH

excellence and passion
in automatic control design
EICAS Automazione S.p.A.

SchmidtHandling
Gesellschaft für Handhabungstechnik mbH

pi4_robotics

VTT
TU IWF
visual components

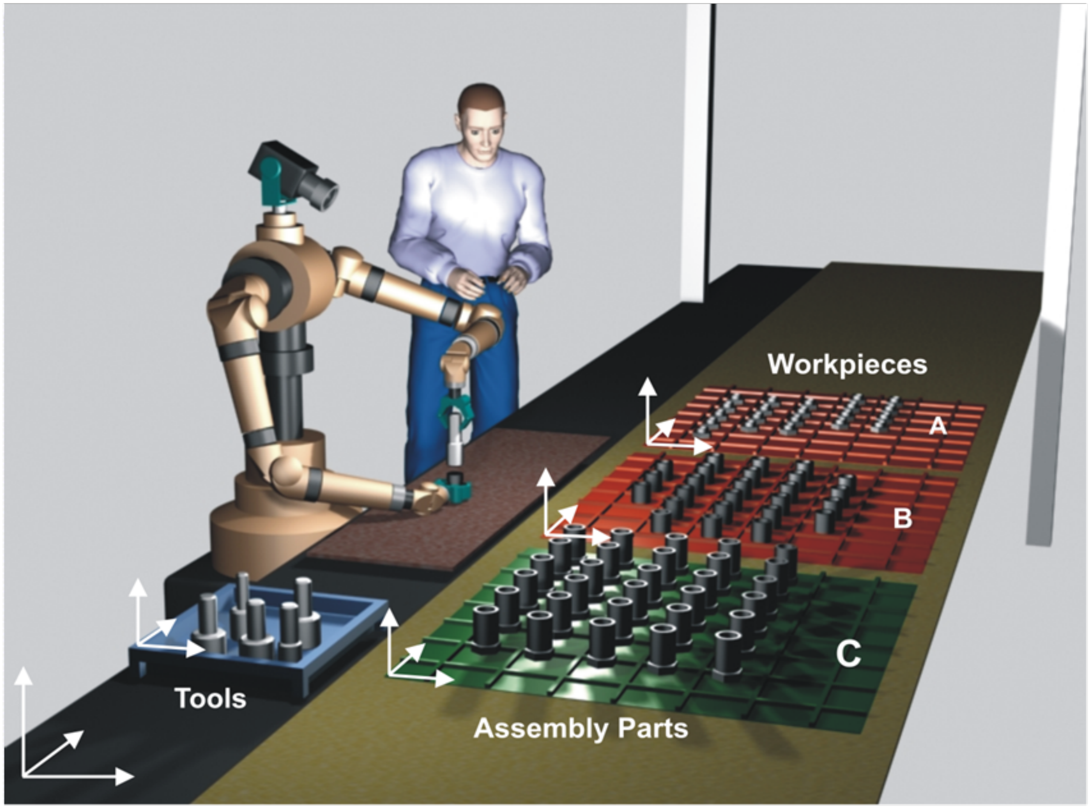
Safety functional requirements

- To supervise the area in the operating environment that the Robot covers during its tasks
- To allow the cooperation Human-Machine only when it is foreseen
- To signal hazardous situations to the robot controller for stopping the movement
- To give the possibility to change dynamically, during robot's movements, the shape of the supervised area
- To slow down the robot velocity, by means of an override factor, during the human-robot approaching

Time Sharing Robot – Subproject 2 (SP2)

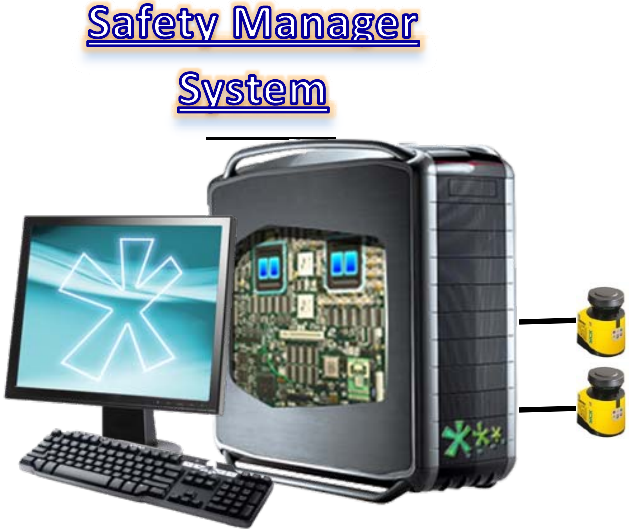
- *Dual Arms robot*
- *Studied for carrying out difficult Assembly tasks*
- *Cooperation with human workers in predefined areas*

Time Sharing Robot – Subproject 2 (SP2)

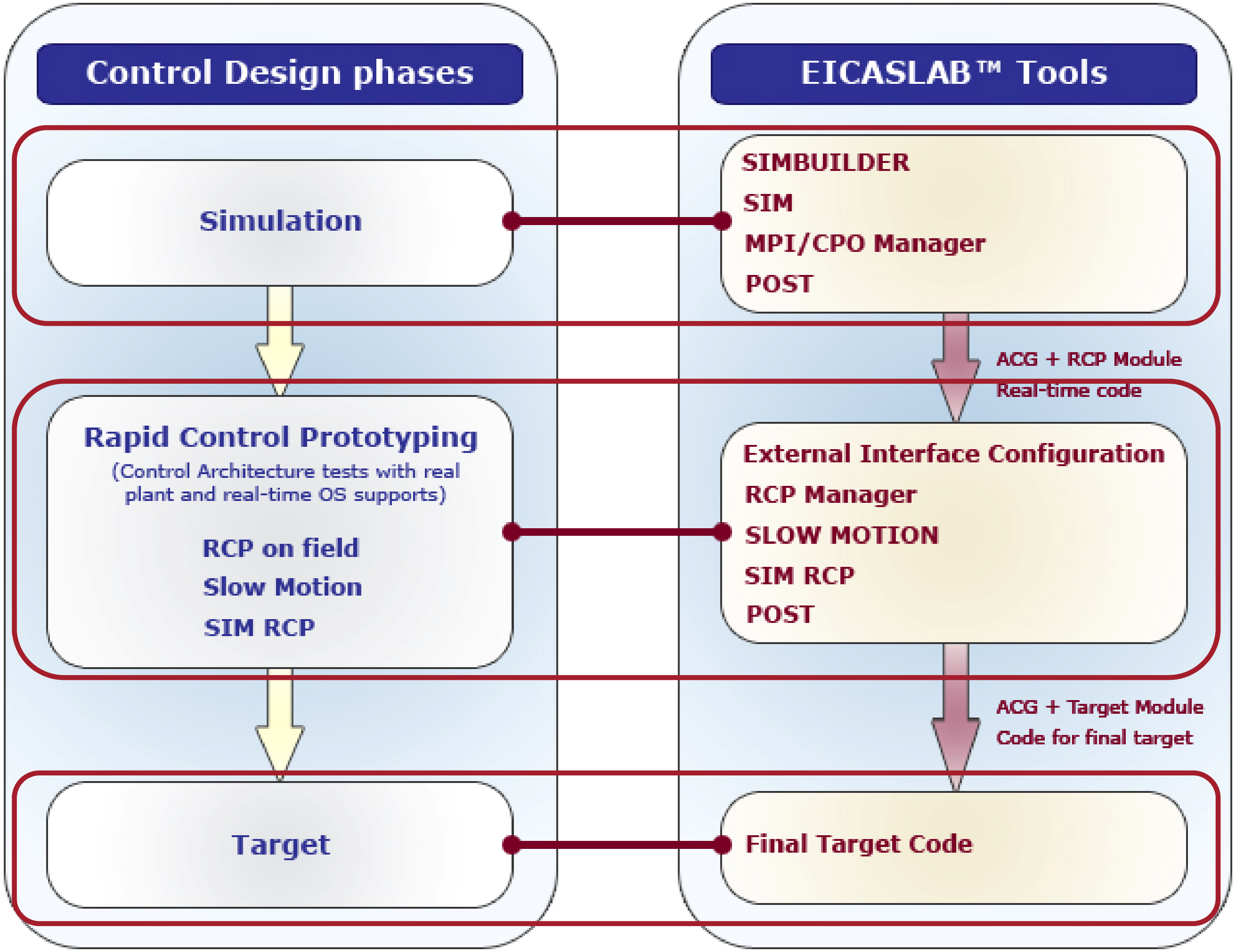

Workpieces
A
B
C
Tools
Assembly Parts

Time Sharing Robot – Subproject 2 (SP2)

- *Dual Arms robot*
- *Studied for carrying out difficult Assembly tasks*
- *Cooperation with human workers in predefined areas*



EICASLAB™ assists you in all the control design phases



Control Design phases

EICASLAB™ Tools

Simulation

SIMBUILDER
SIM
MPI/CPO Manager
POST

ACG + RCP Module
Real-time code

Rapid Control Prototyping
(Control Architecture tests with real plant and real-time OS supports)

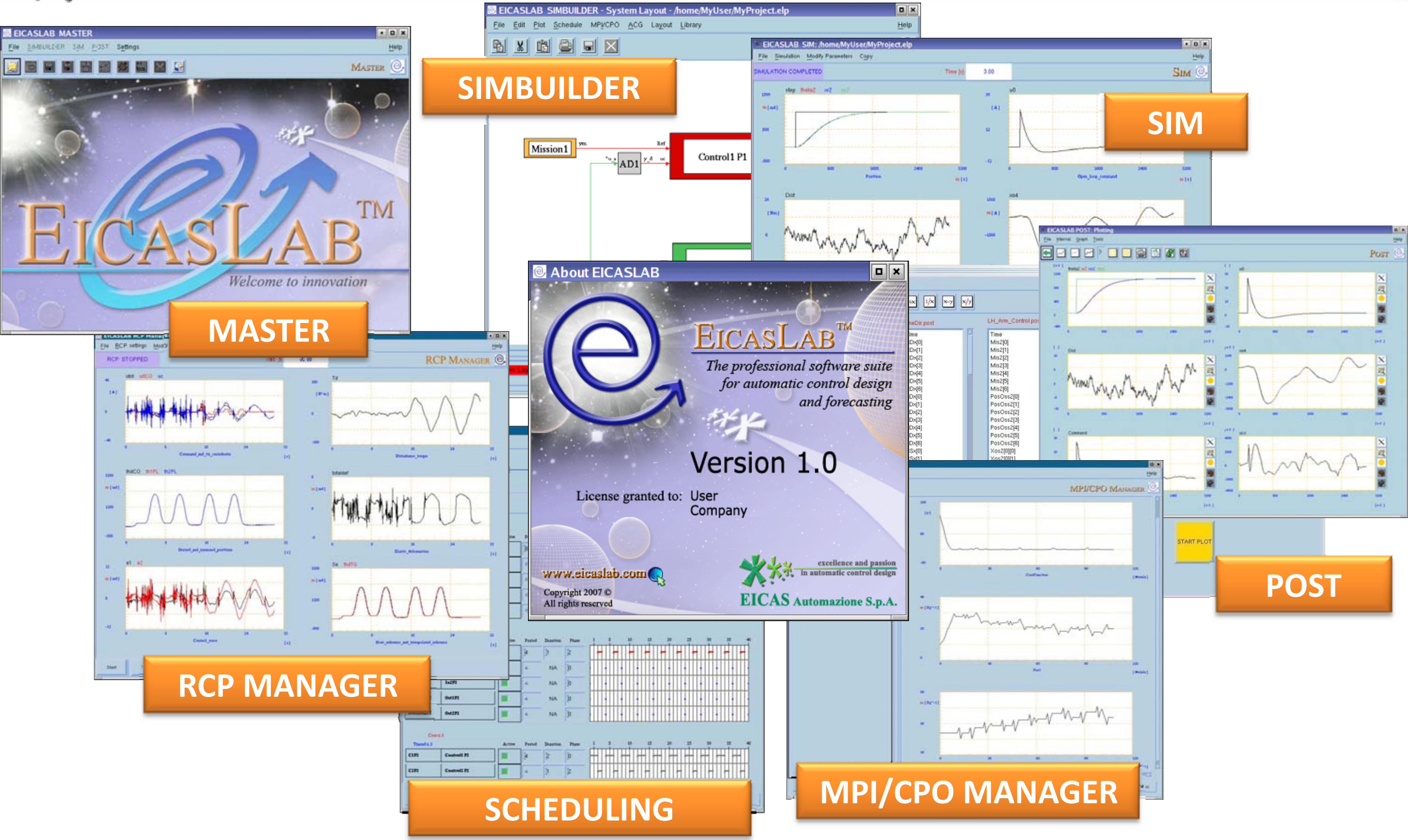
RCP on field
Slow Motion
SIM RCP

External Interface Configuration
RCP Manager
SLOW MOTION
SIM RCP
POST

ACG + Target Module
Code for final target

Target

Final Target Code


SIMBUILDER
SIM
MASTER
POST
RCP MANAGER
SCHEDULING
MPI/CPO MANAGER
EICASLAB MASTER
EICASLAB SIMBUILDER - System Layout - /home/MyUser/MyProject.elp
EICASLAB SIM: /home/MyUser/MyProject.elp
EICASLAB POST: Plotting
Mission1
AD1
Control1 P1
START PLOT
Welcome to innovation

About EICASLAB

EICASLAB™

The professional software suite for automatic control design and forecasting

Version 1.0

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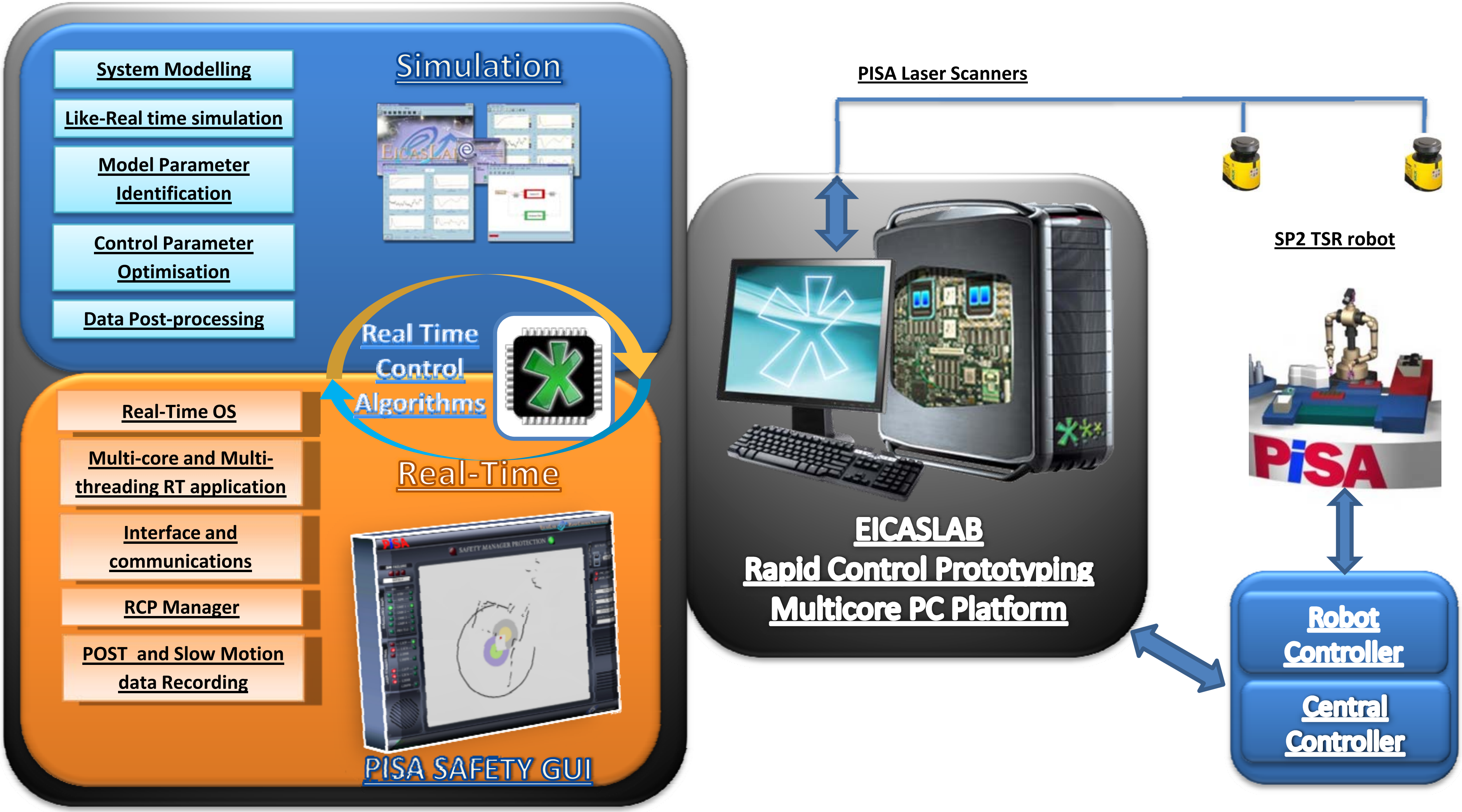
excellence and passion in automatic control design
EICAS Automazione S.p.A.

EICASLAB: from simulation to the Rapid Control Prototyping



Simulation

- System Modelling
- Like-Real time simulation
- Model Parameter Identification
- Control Parameter Optimisation
- Data Post-processing

Real Time Control Algorithms

Real-Time

- Real-Time OS
- Multi-core and Multi-threading RT application
- Interface and communications
- RCP Manager
- POST and Slow Motion data Recording

PISA SAFETY GUI

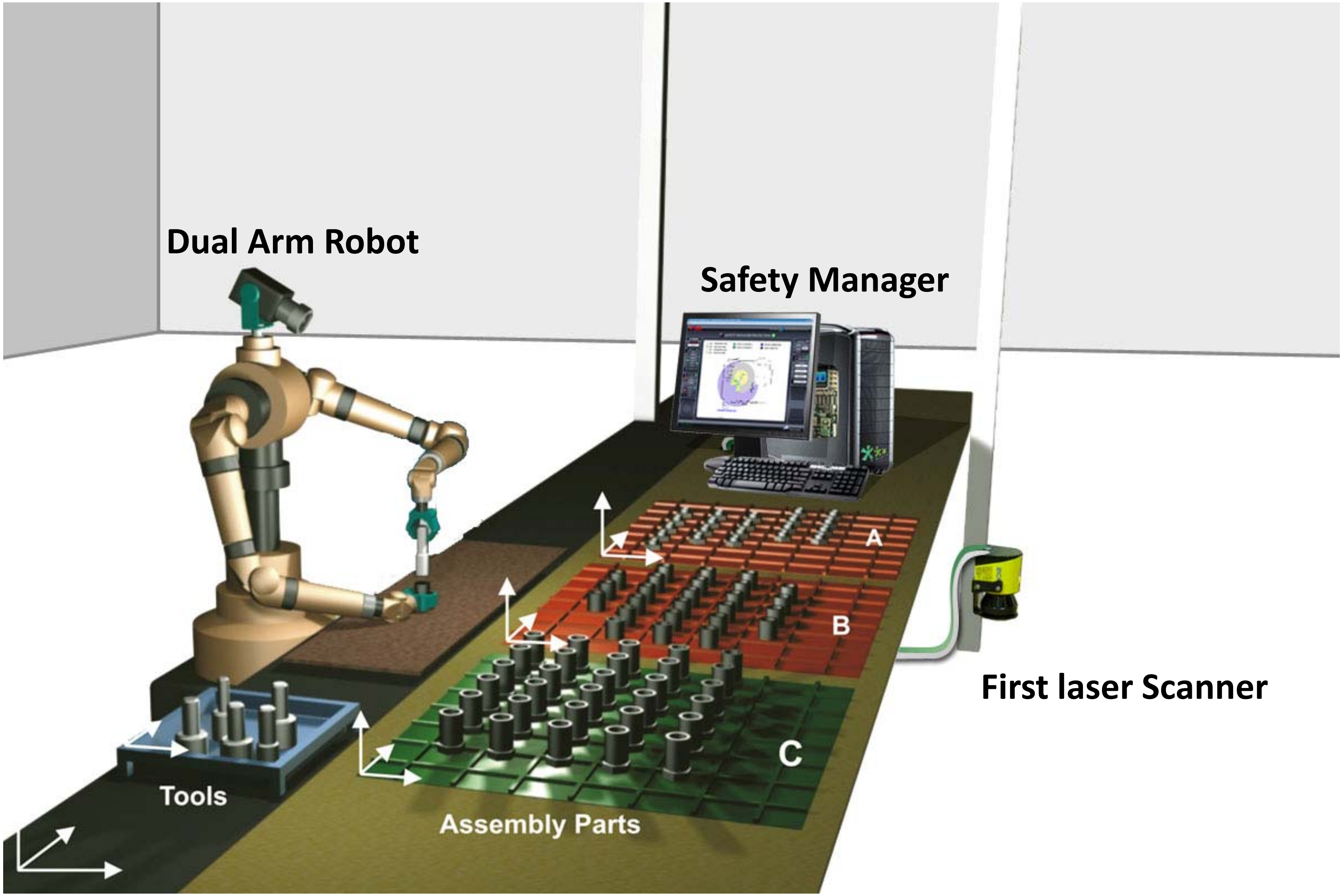
EICASLAB Rapid Control Prototyping Multicore PC Platform

PISA Laser Scanners

SP2 TSR robot

Robot Controller

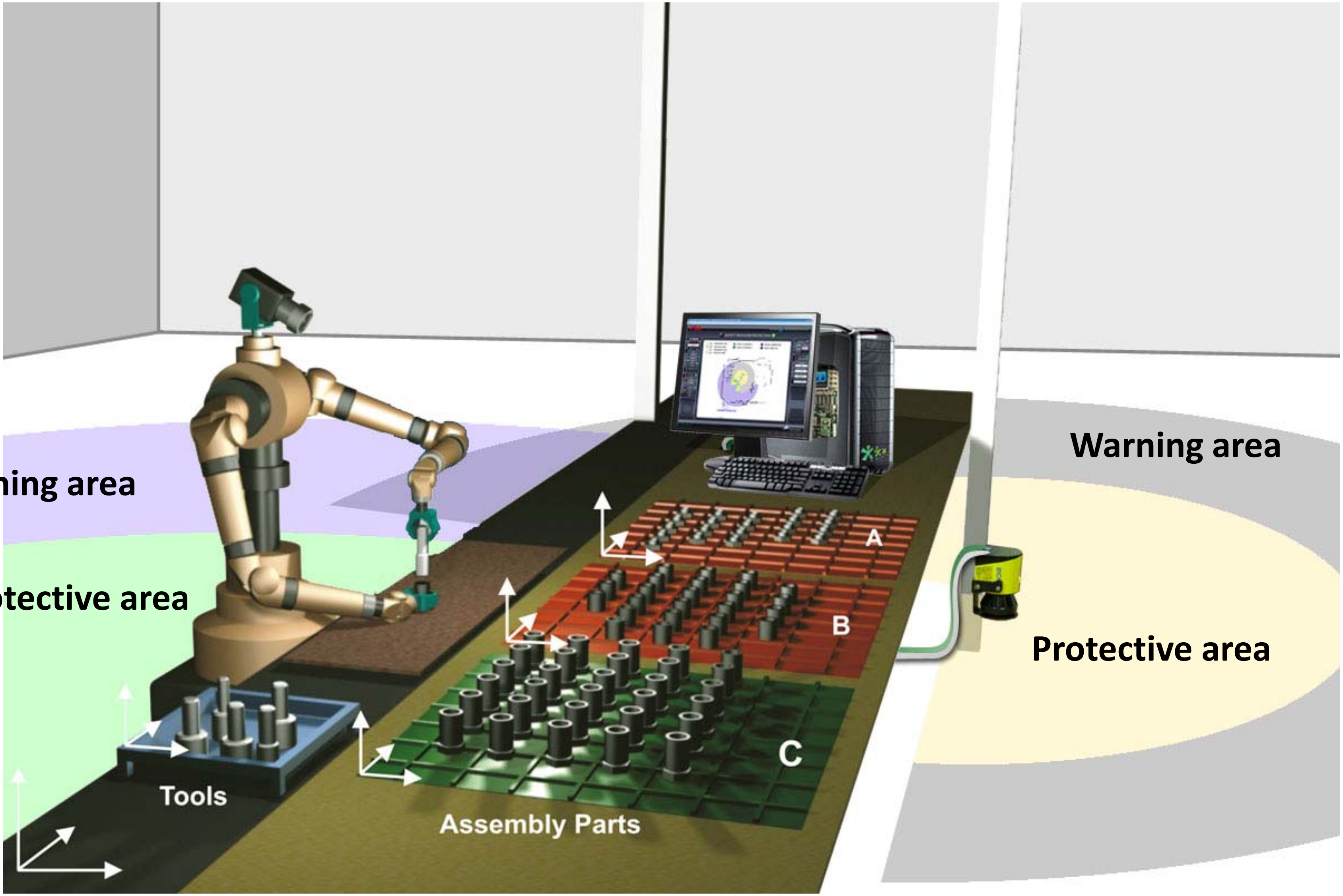
Central Controller



Dual Arm Robot

Safety Manager

First laser Scanner

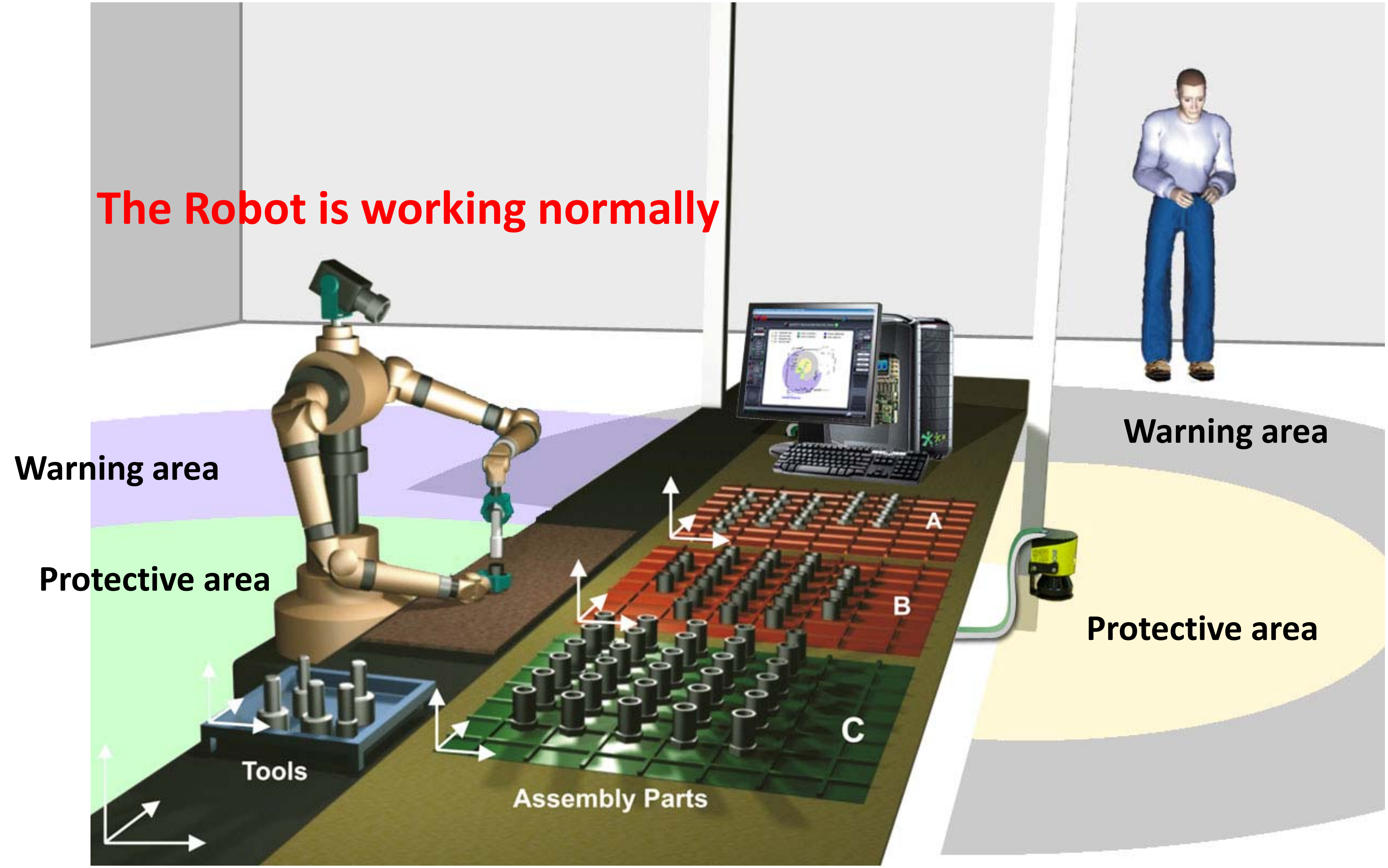


Warning area

Protective area

Warning area

Protective area



The Robot is working normally

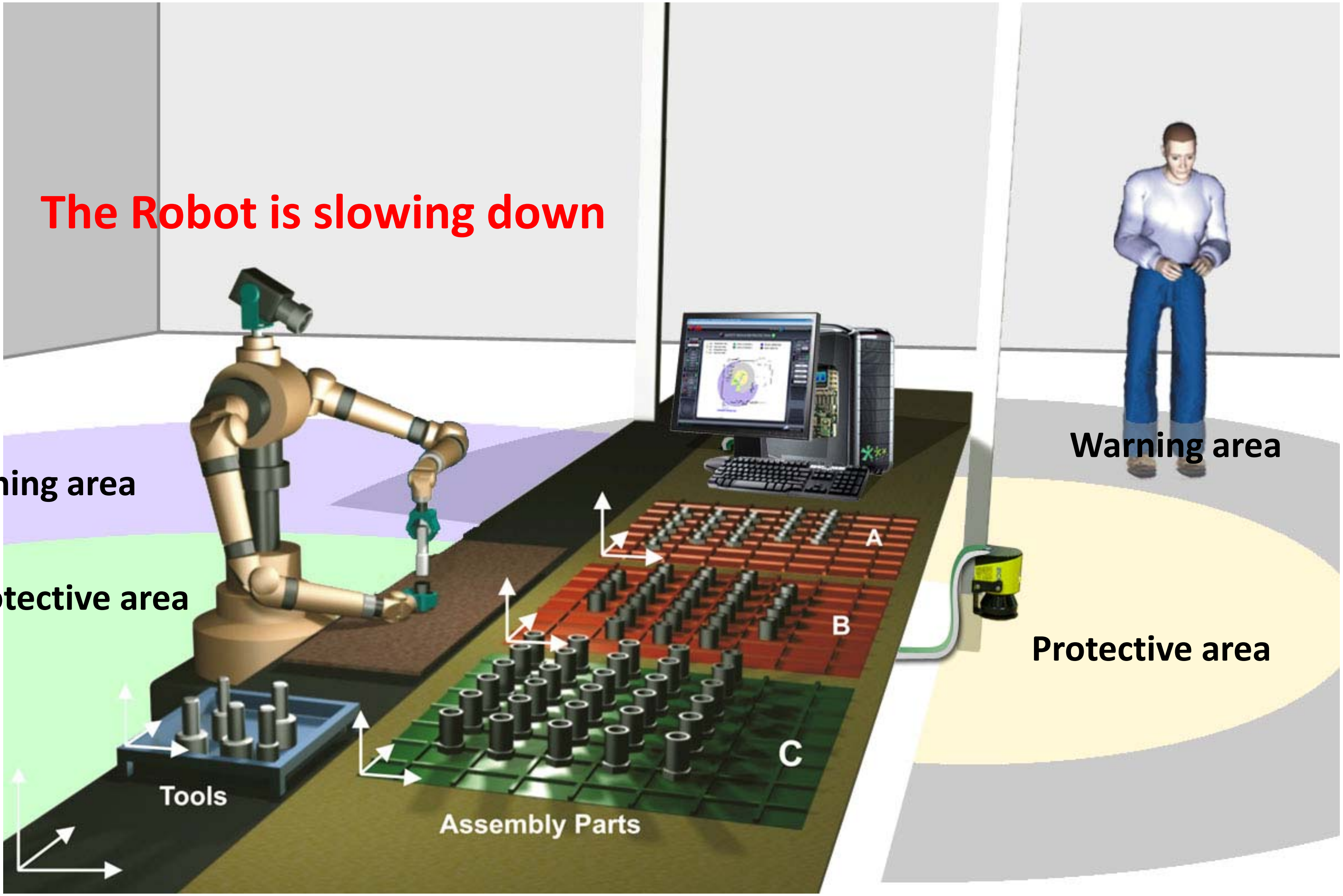
Warning area

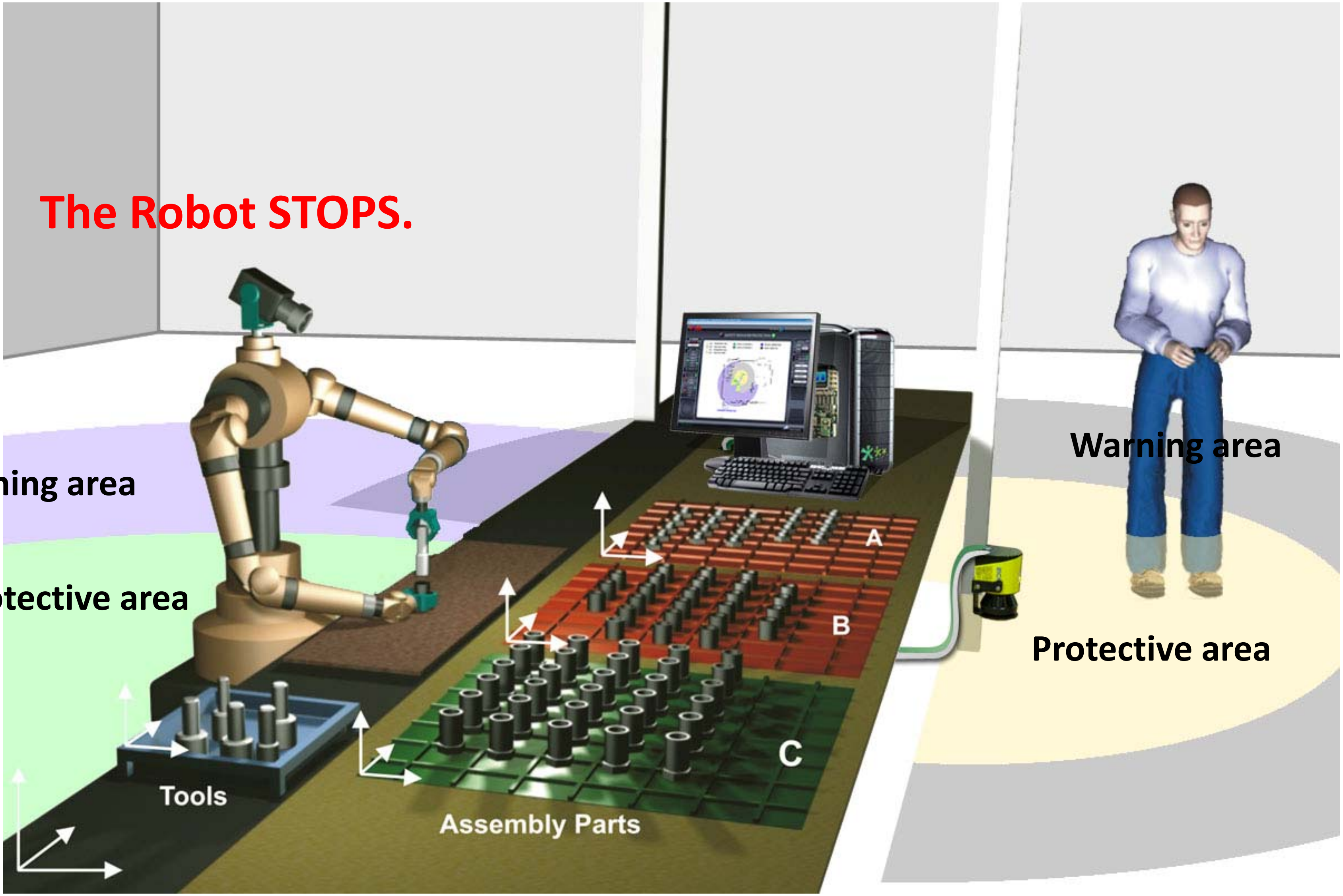
Protective area

Warning area

Protective area

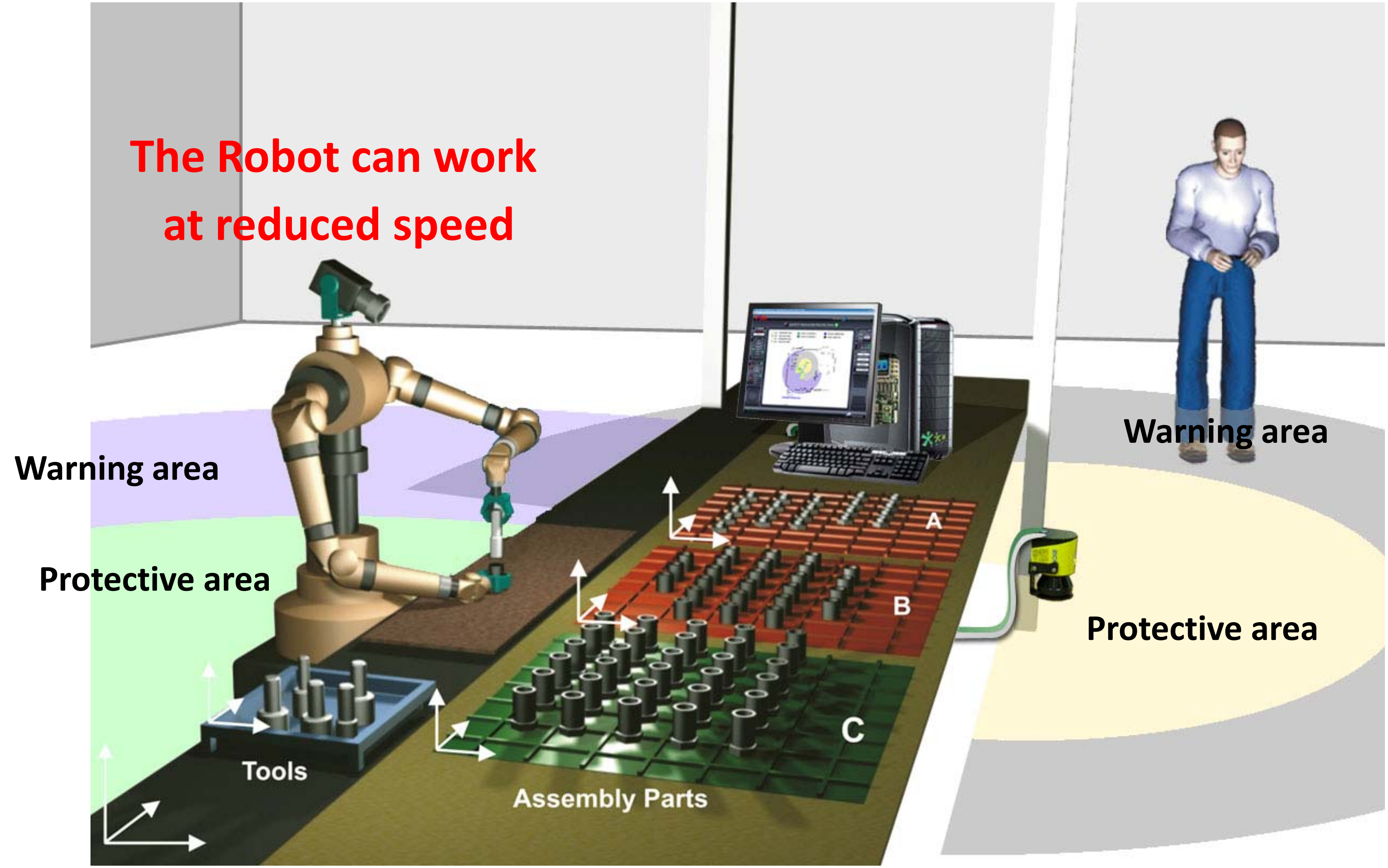
The Robot is slowing down


Warning area
Warning area
Protective area
Protective area
A
B
C
Tools
Assembly Parts

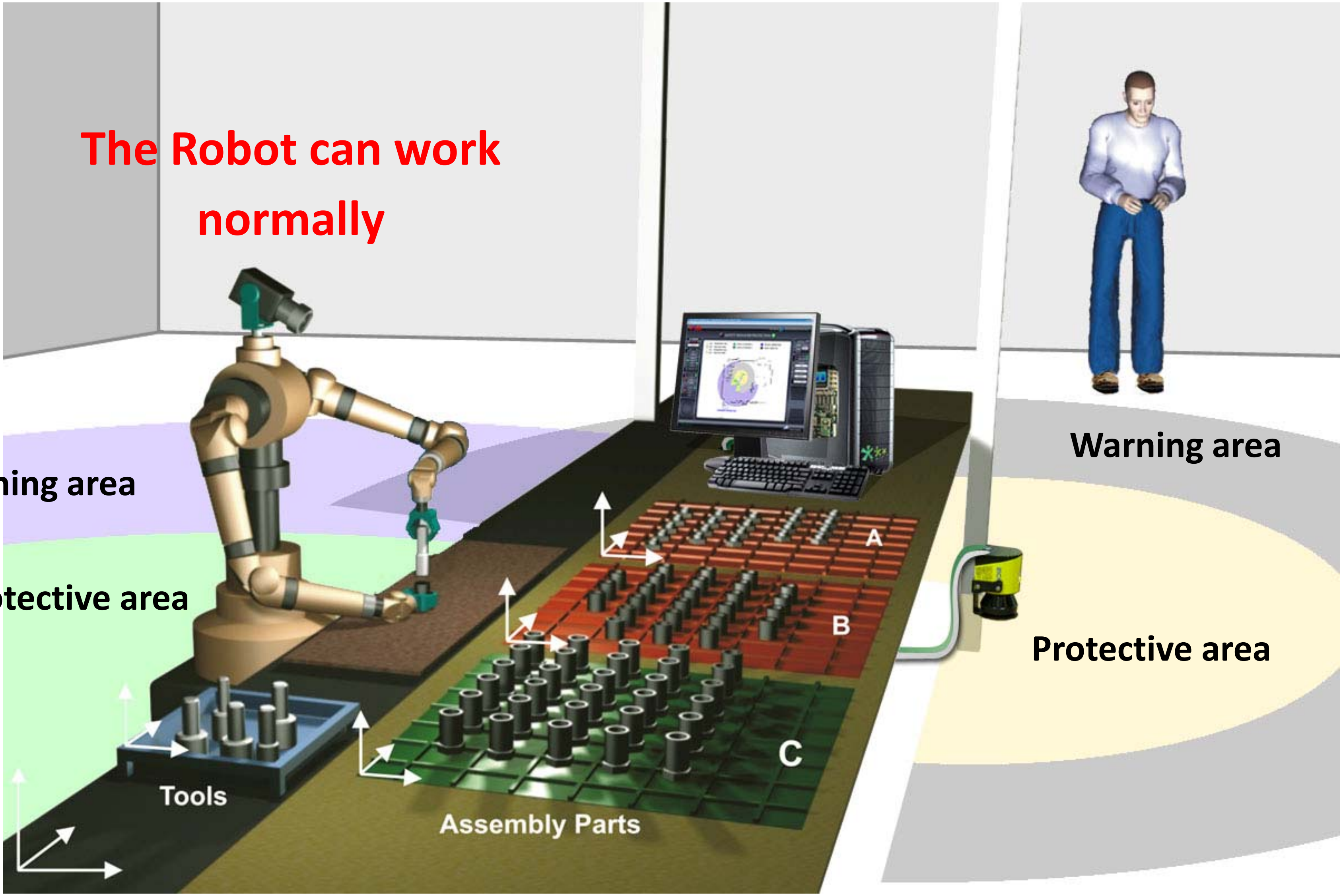


The Robot STOPS.

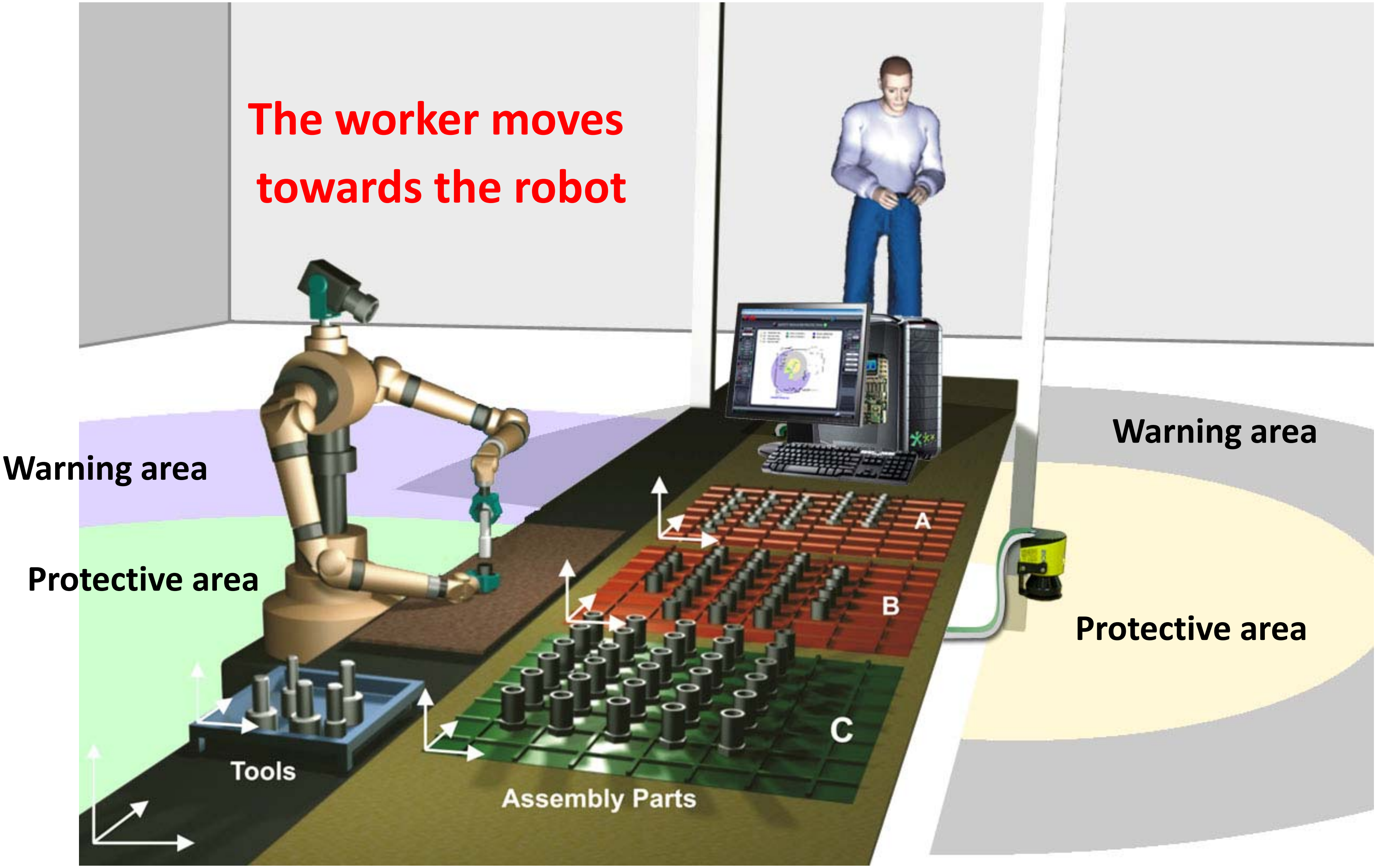
Warning area
Protective area
Warning area
Protective area
A
B
C
Tools
Assembly Parts

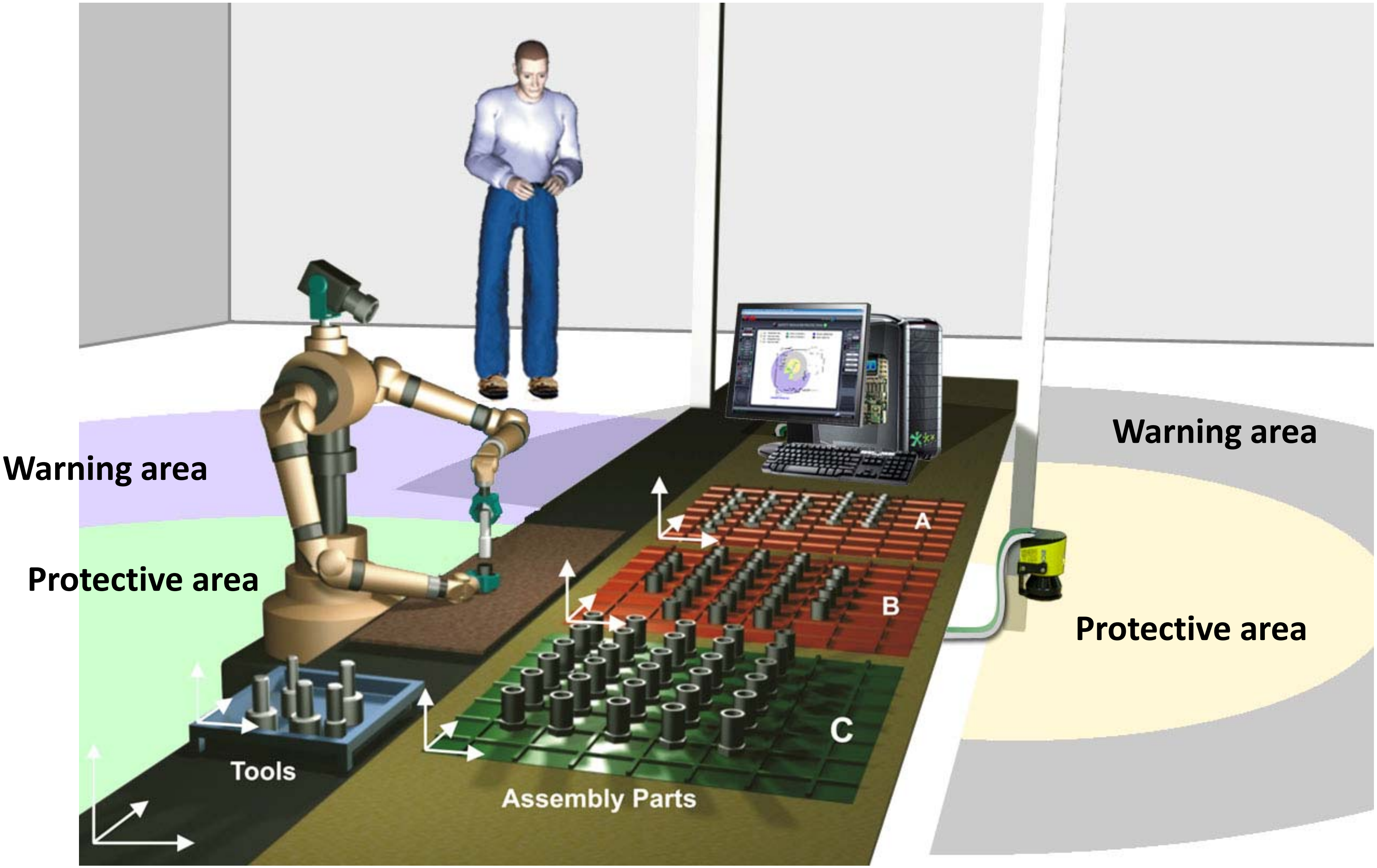

The Robot can work
at reduced speed
Warning area
Protective area
Warning area
Protective area
A
B
C
Tools
Assembly Parts

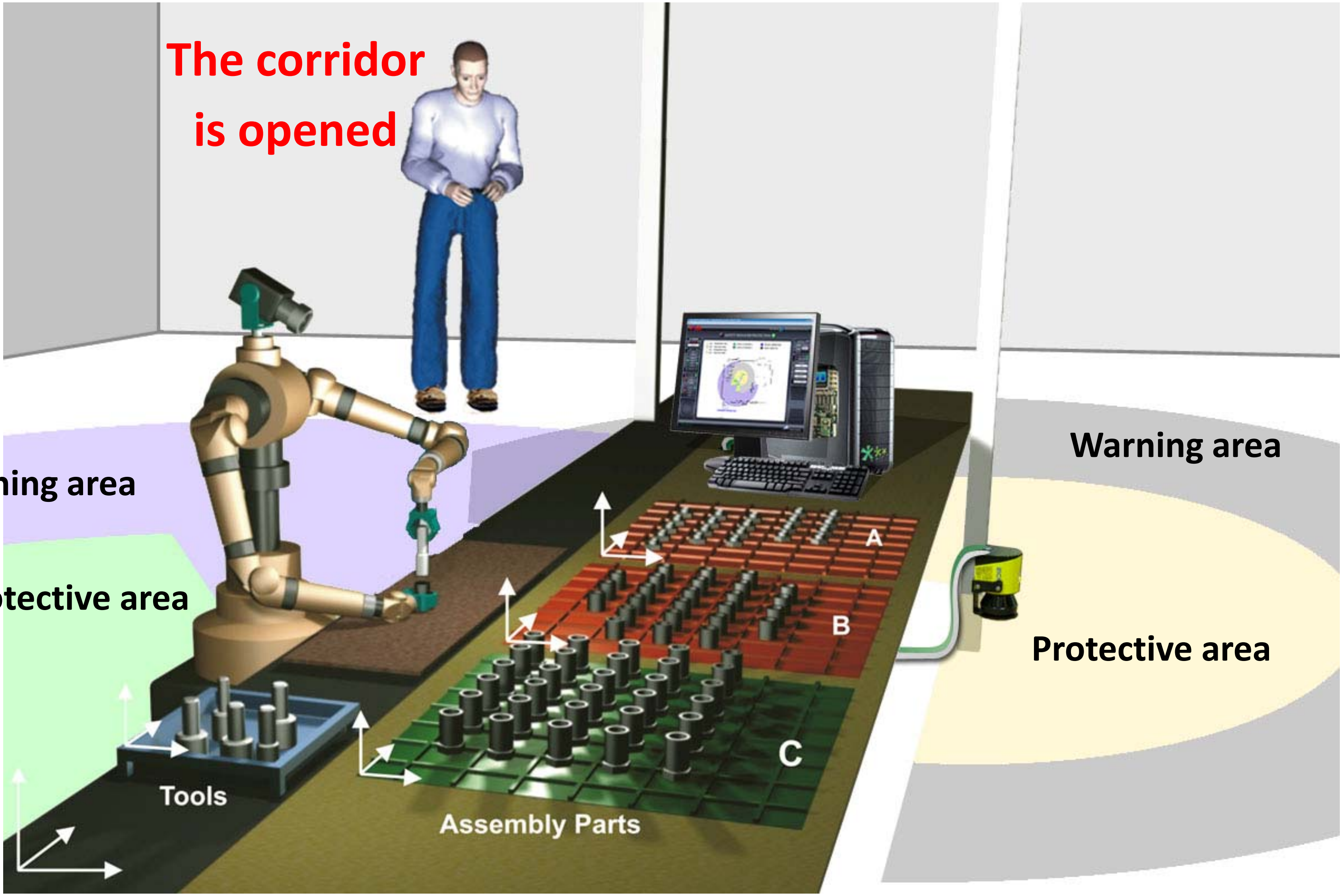
The Robot can work normally


Warning area
Protective area
Warning area
Protective area
A
B
C
Tools
Assembly Parts

The worker moves towards the robot


Warning area
Warning area
Protective area
Protective area
A
B
C
Tools
Assembly Parts


Warning area
Warning area
Protective area
Protective area
A
B
C
Tools
Assembly Parts



The corridor is opened

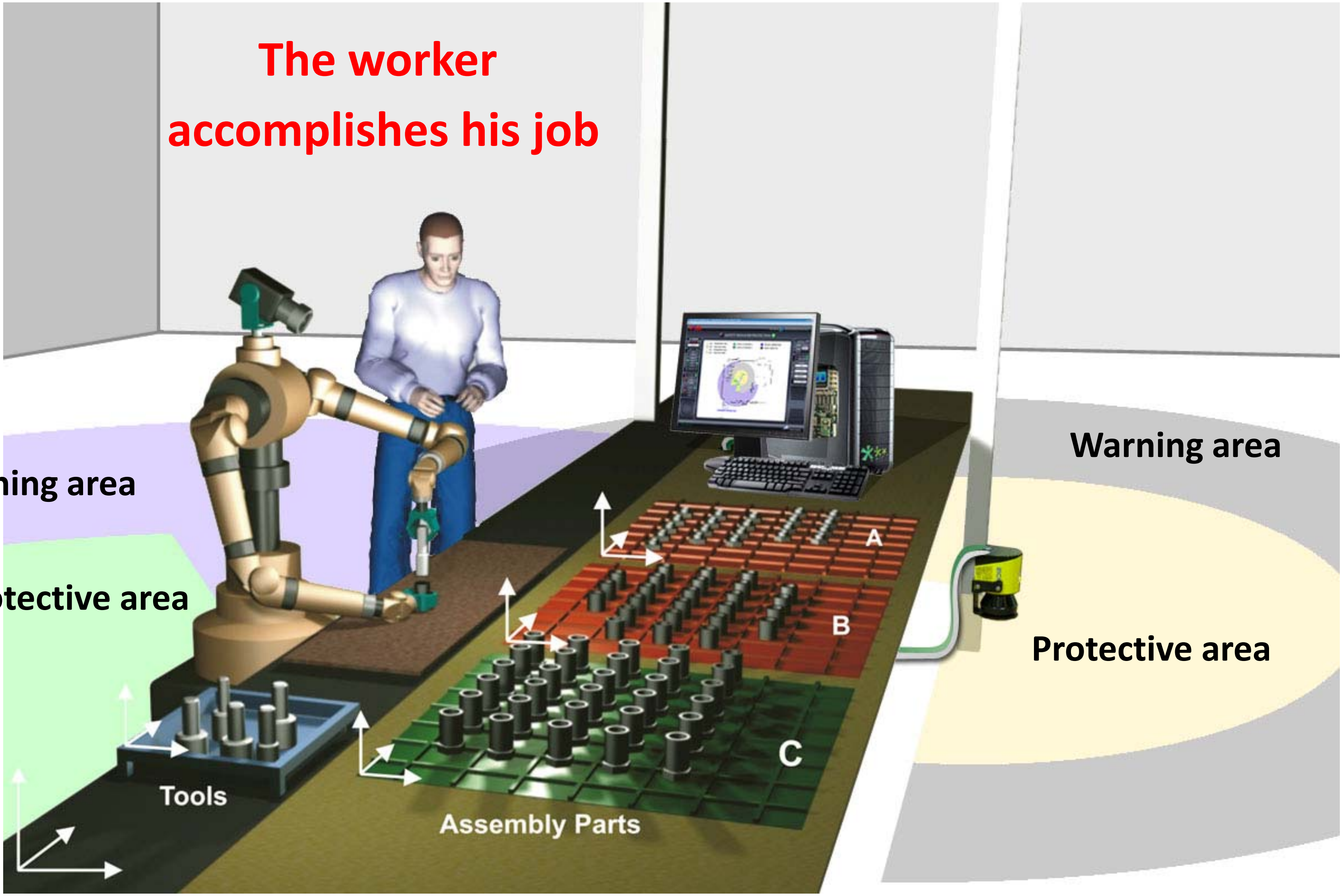
Warning area

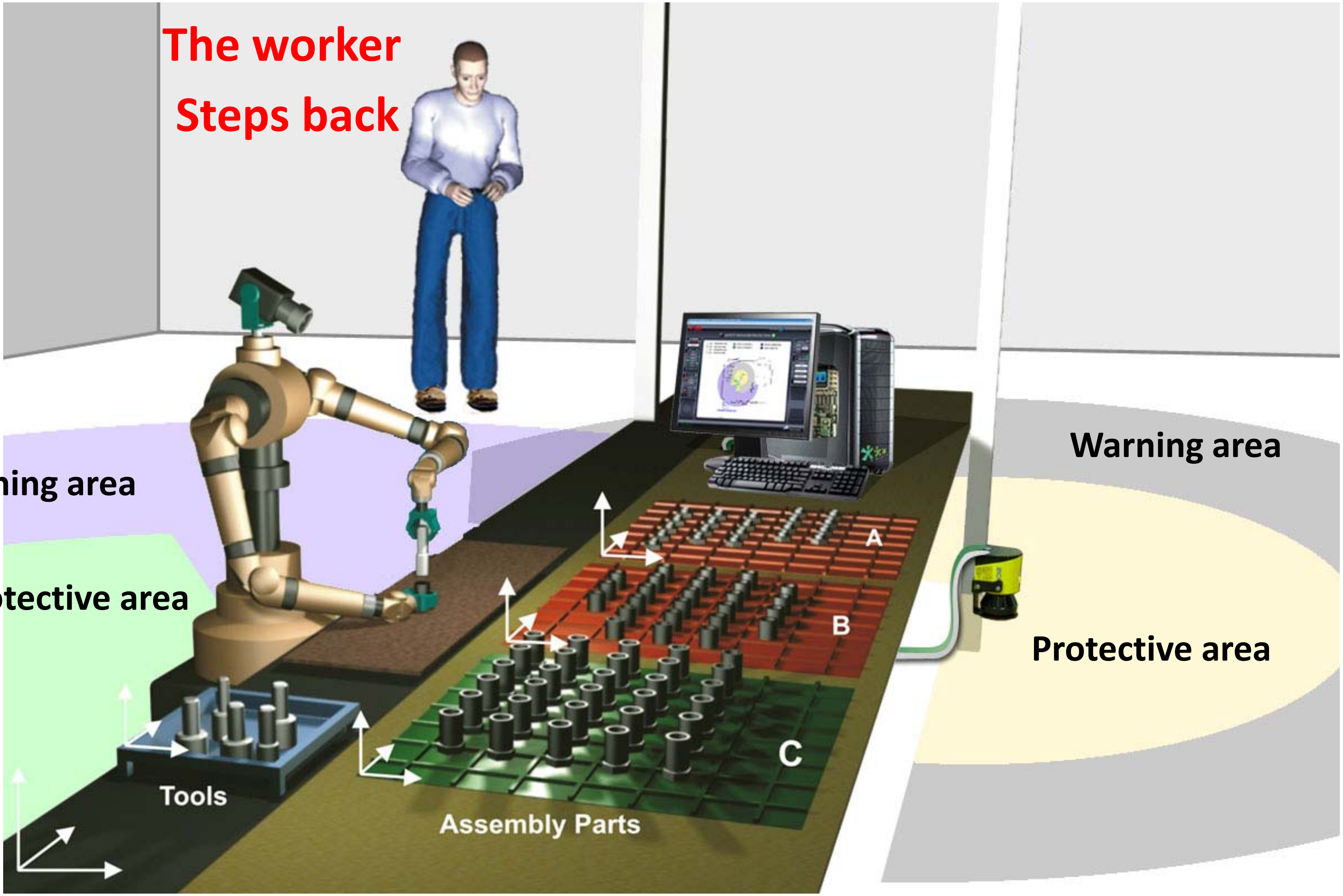
Protective area

Warning area

Protective area

The worker accomplishes his job


Warning area
Protective area
Warning area
Protective area
A
B
C
Tools
Assembly Parts



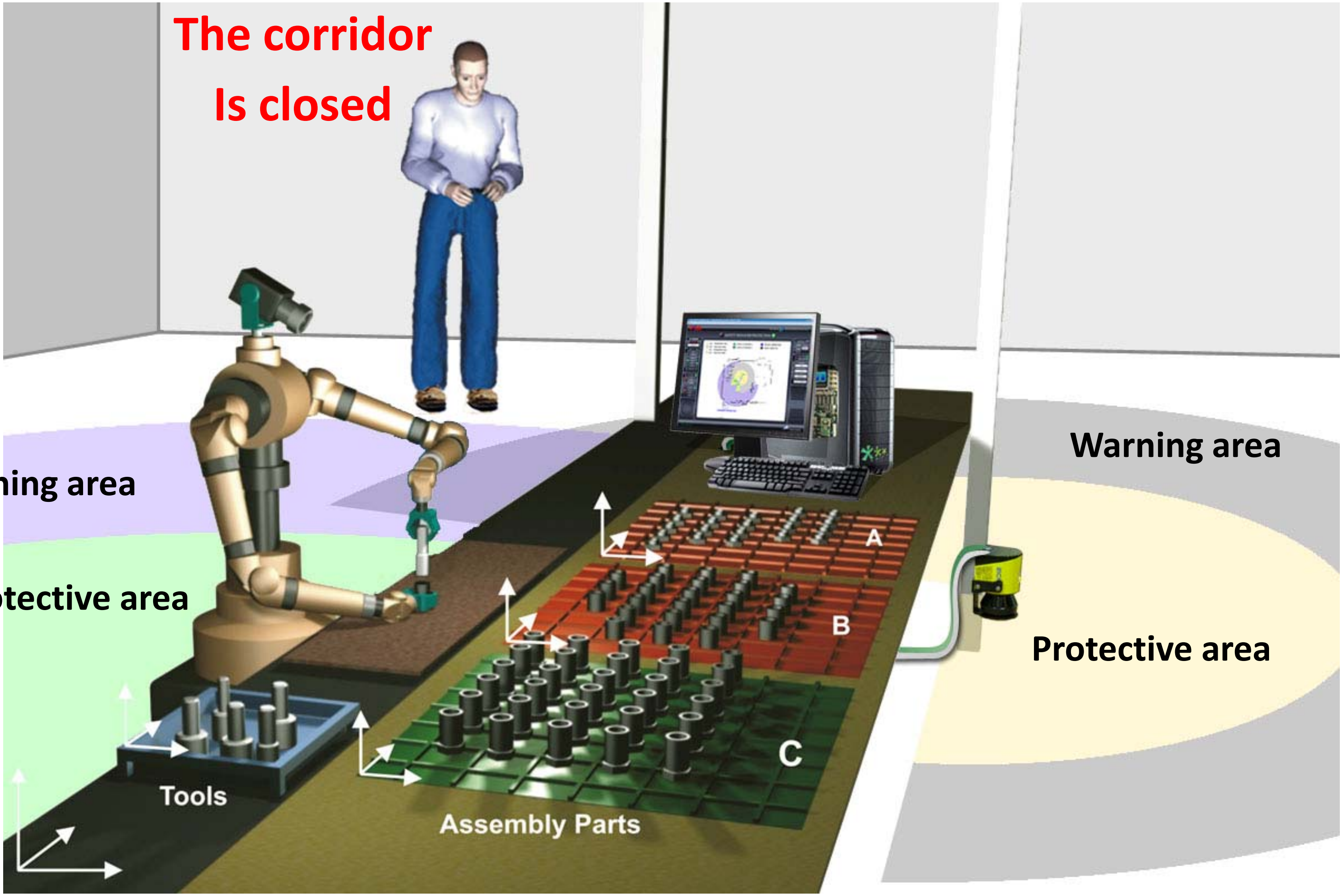
The worker
Steps back

Warning area

Protective area

Warning area

Protective area



The corridor
Is closed

Warning area

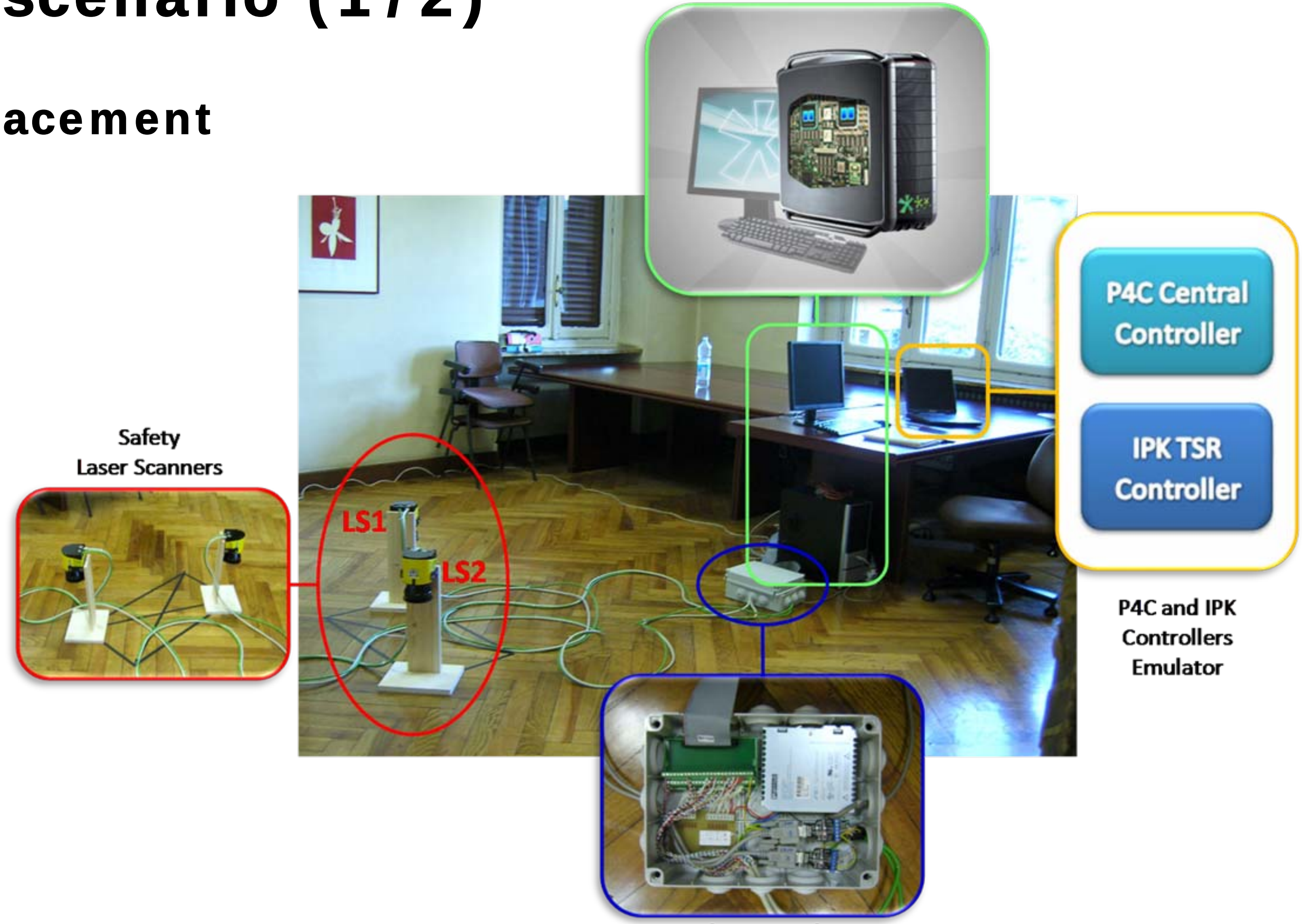
Protective area

Warning area

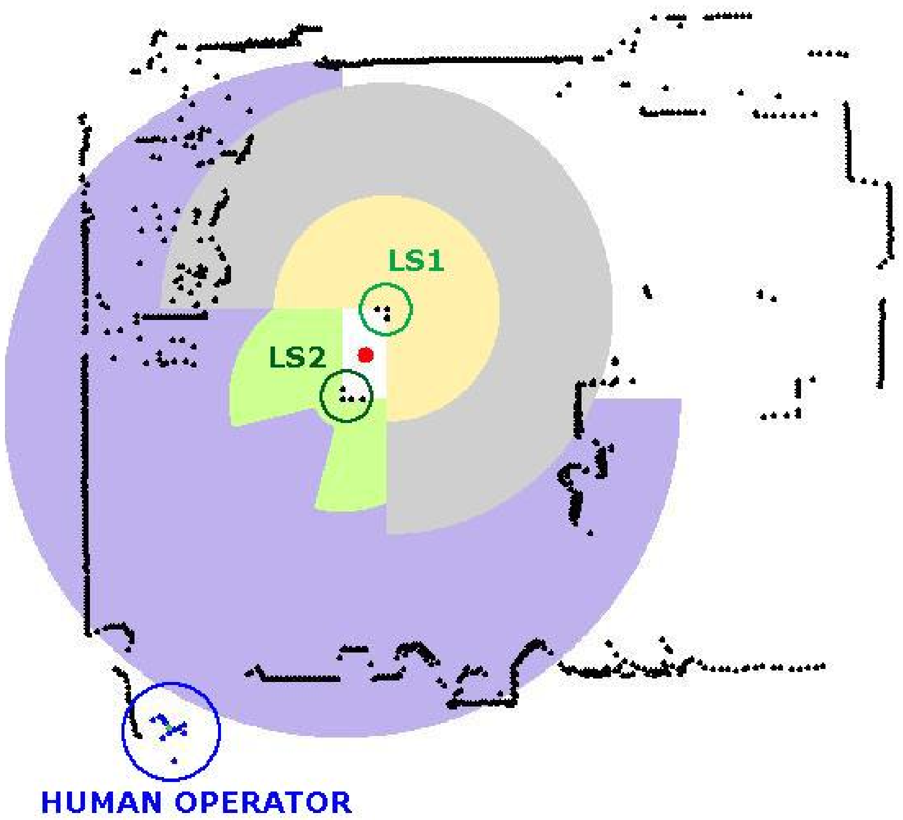
Protective area

TEST scenario (1 / 2)

Area displacement

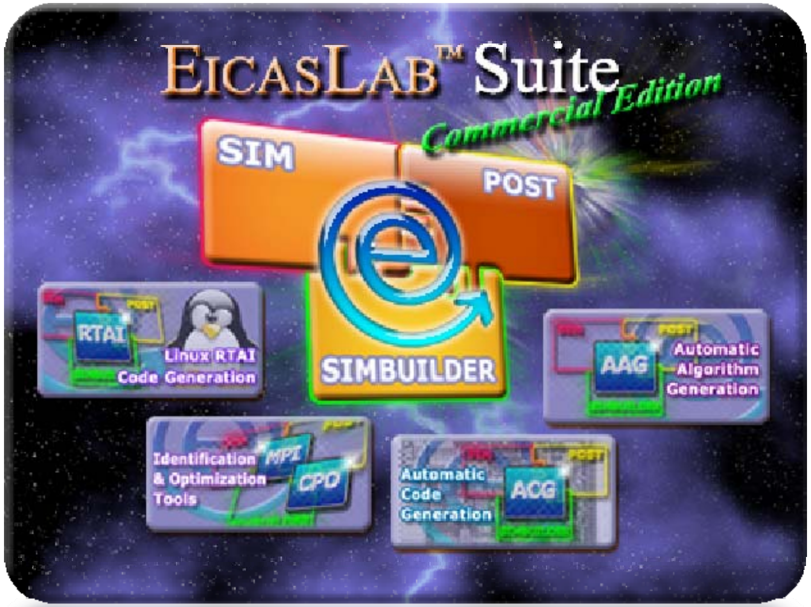

Safety
Laser Scanners
LS1
LS2
P4C Central Controller
IPK TSR Controller
P4C and IPK
Controllers
Emulator
Hardware test box

TEST scenario (1/2)



The procedure consists in:

- To reproduce a collaboration situation by opening a corridor towards the hypothetical robot (red spot)
- To verify the safety signal sent and the override factor for slowing down the robot
- To test the response for protective area overcomes
- To test the dynamic area change
- To test the failure detection by injection of faults on the communication channels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for Linux & for Windows

SIXTH FRAMEWORK PROGRAMME
INTEGRATED PROJECT

PiSA

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for Automatic Control Design
and Forecasting

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