LES OLYMPIADES FANUC

Team CentraleSupelec

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Summary:

1 – Problem description

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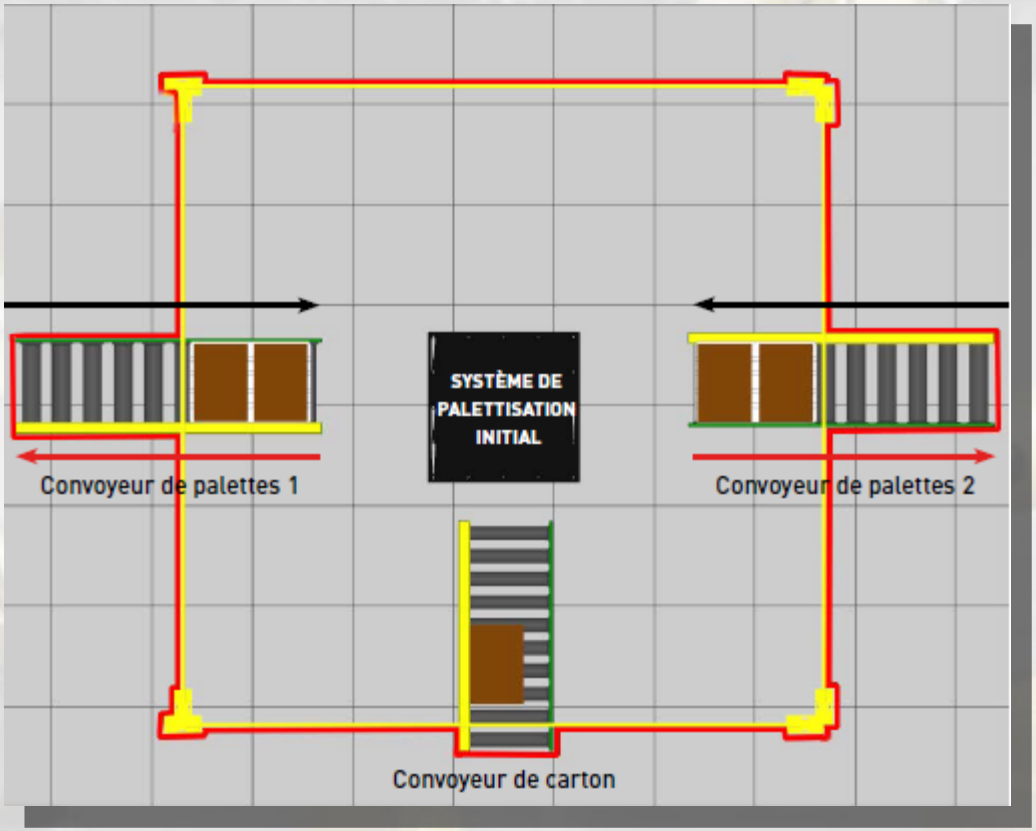
Project objective:

➢Optimize the palletizing system



Original Surface of 12.96 m²

1 – Problem description

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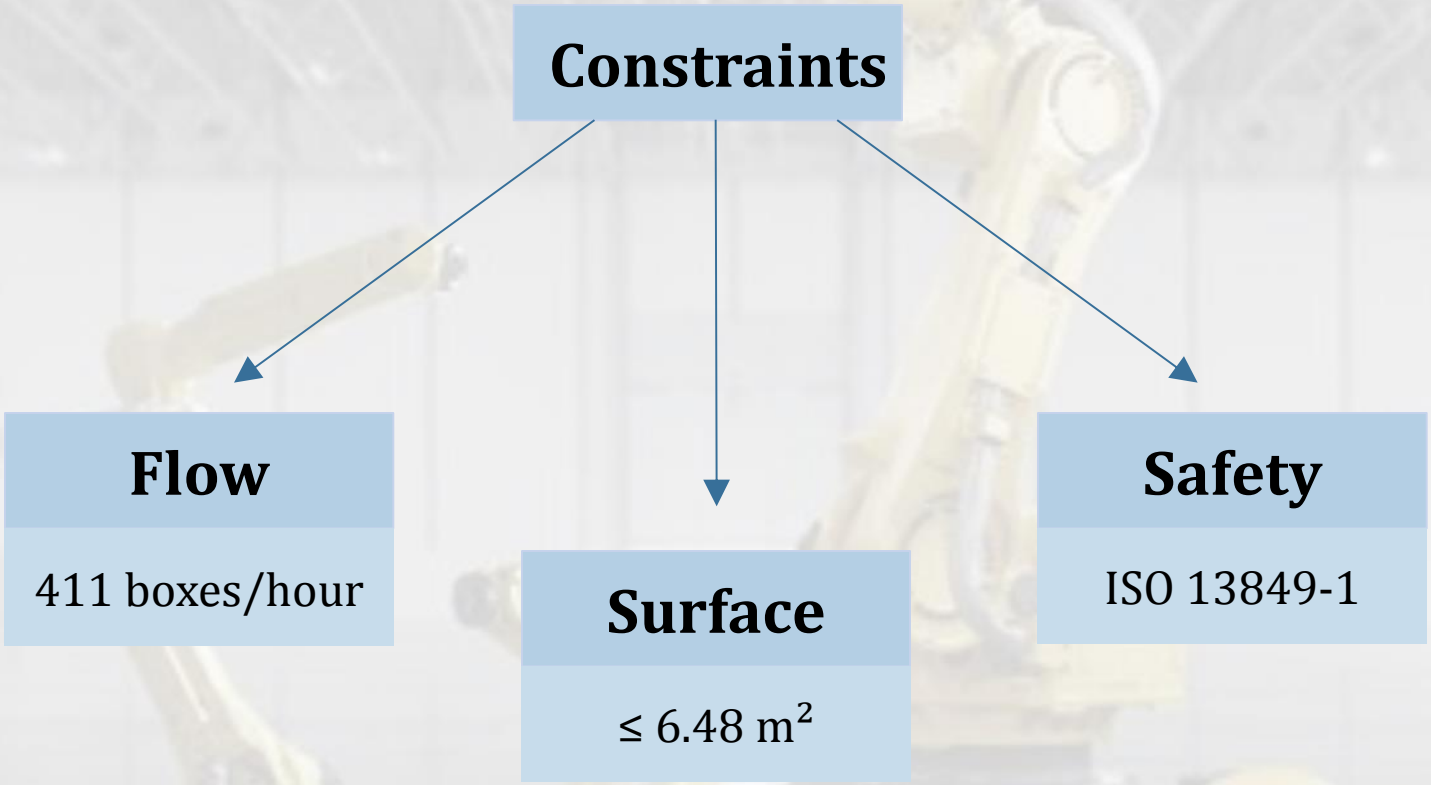

2.1 – Robot choice

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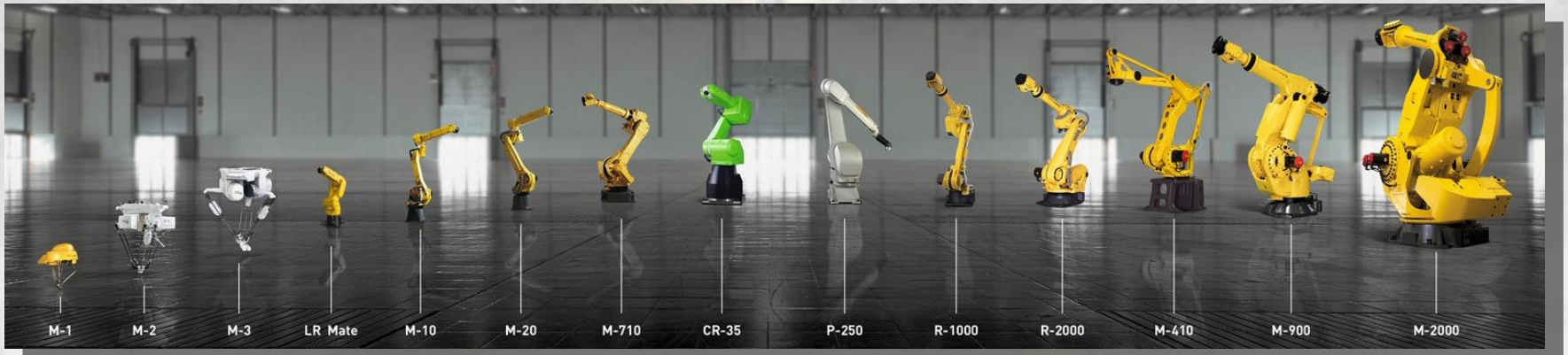

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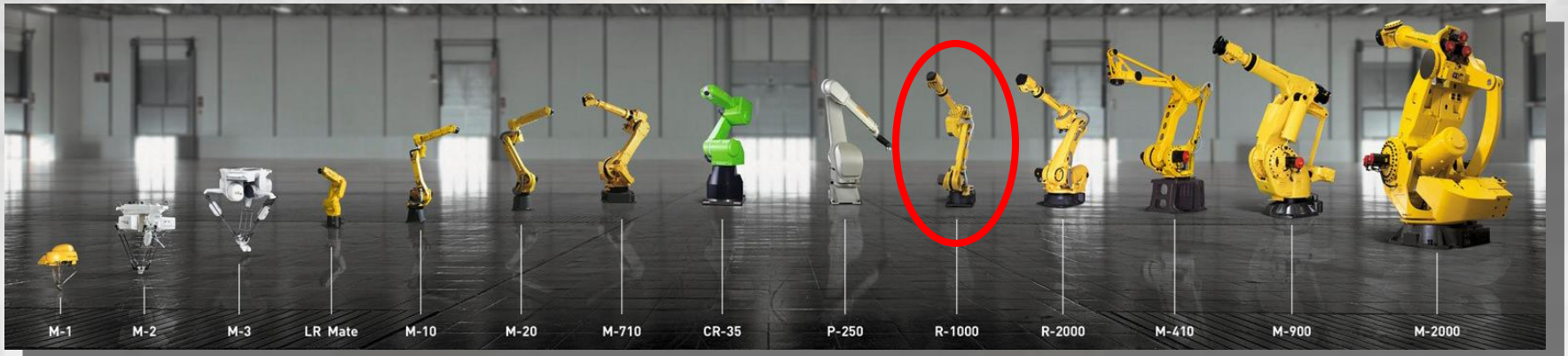

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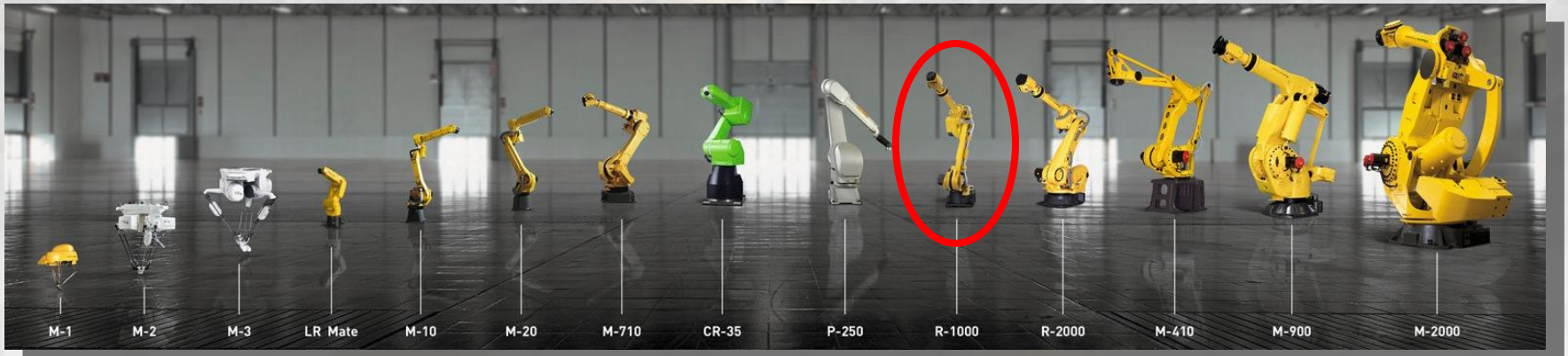

R-1000iA/80H

Number of axis	5
Reach	2230 mm
Load capacity	80 kg

- Application, payload, range of action.

2.2 – Robot and fixtures positioning

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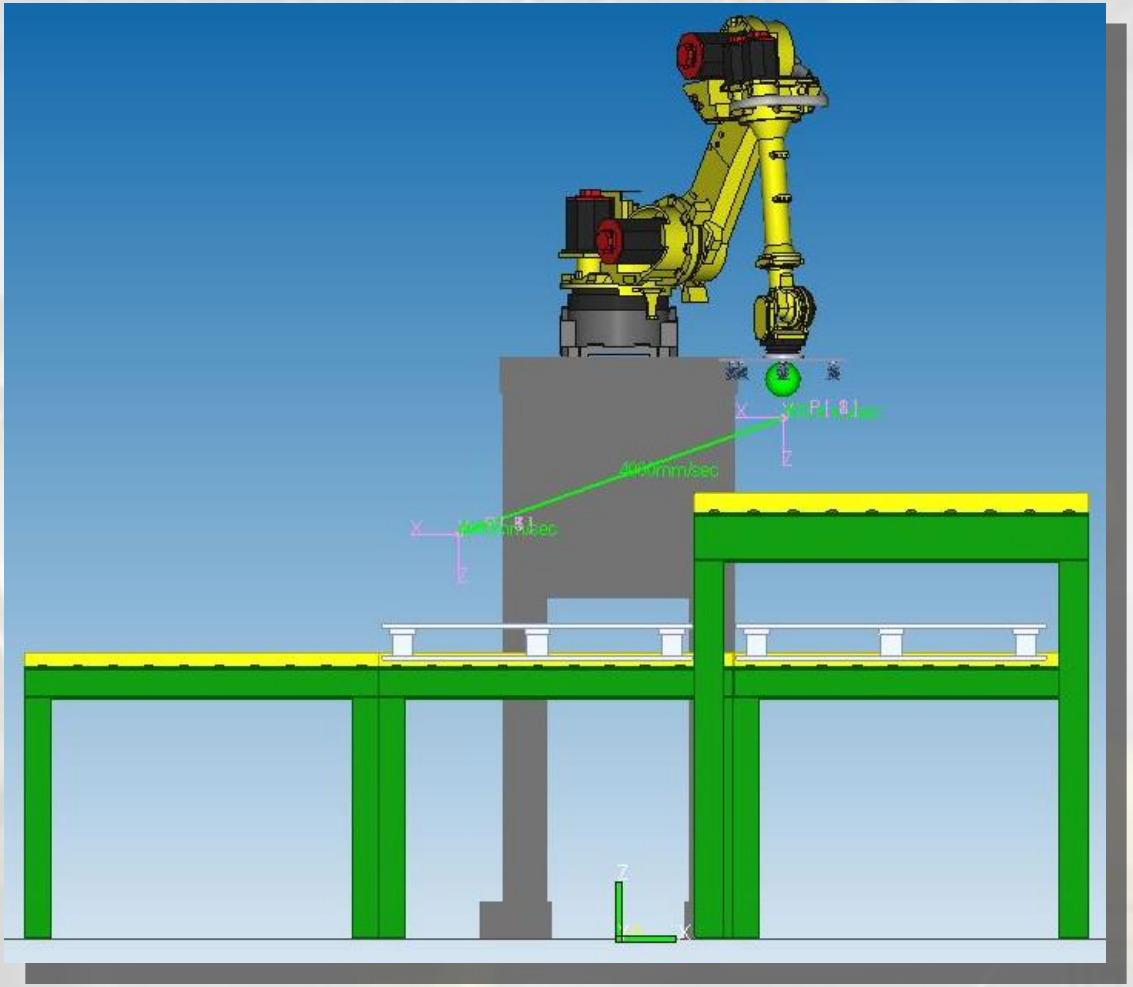
Reduce the area by **verticalizing** the operations



2.2 – Robot and fixtures positioning

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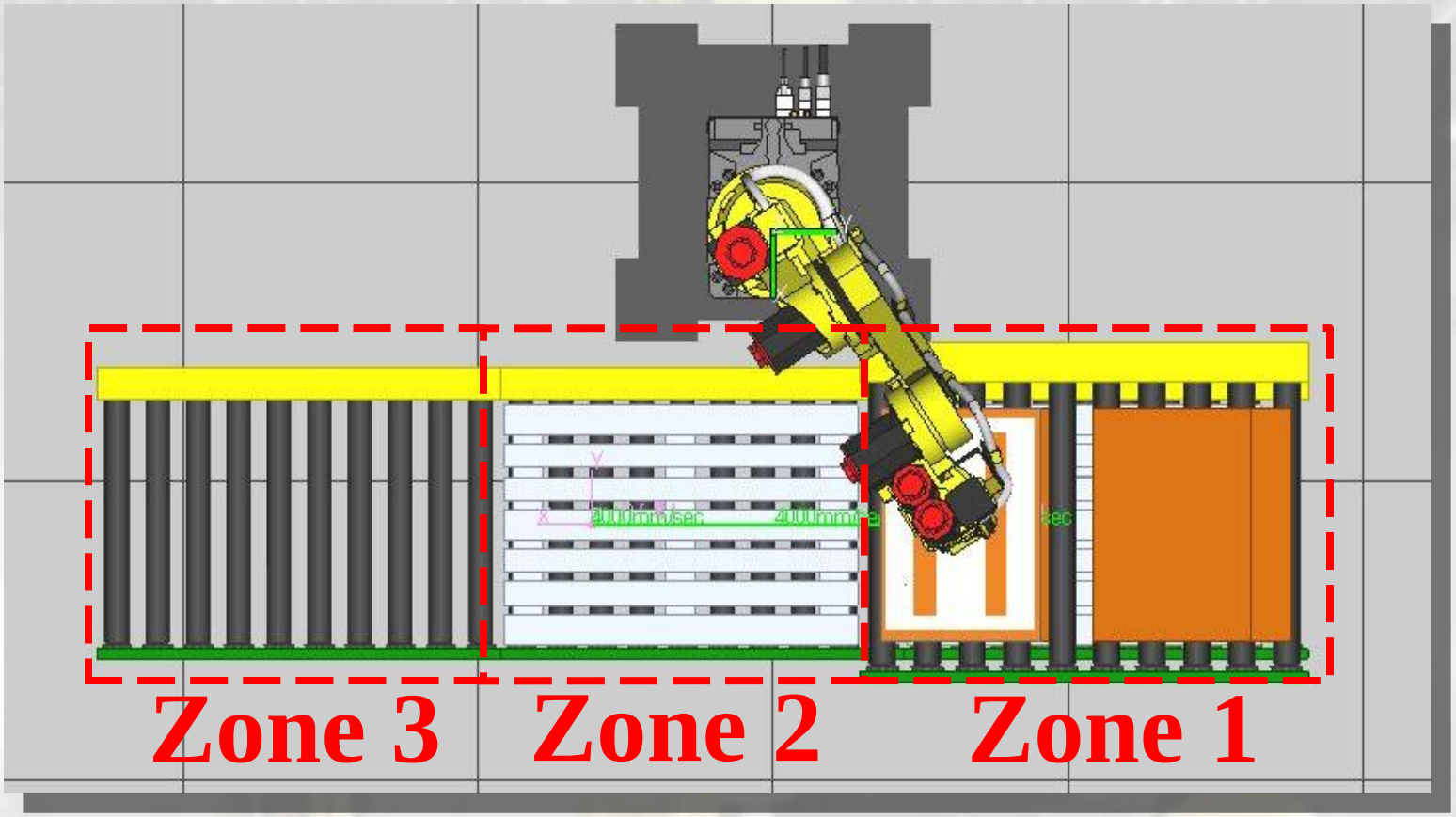

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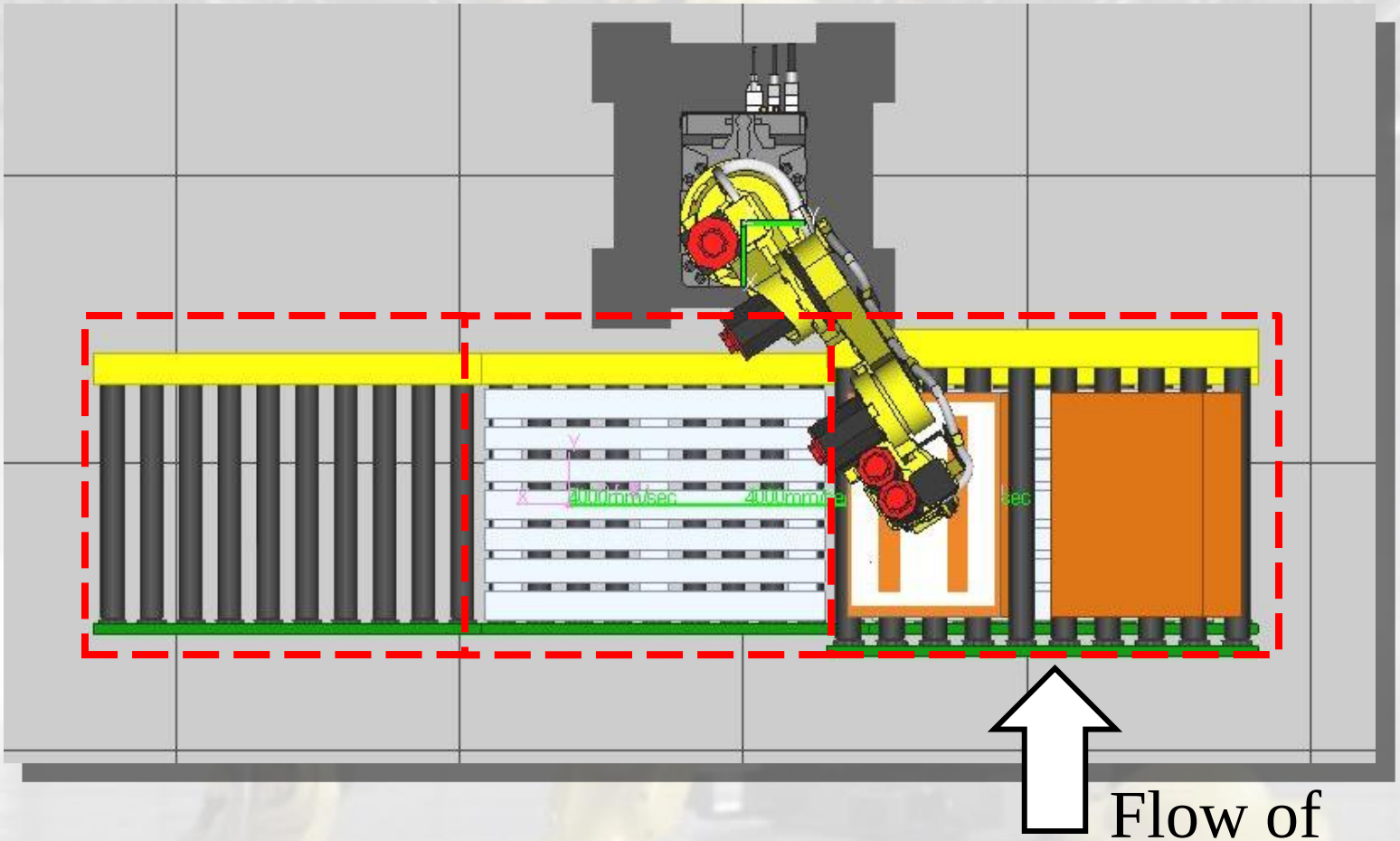

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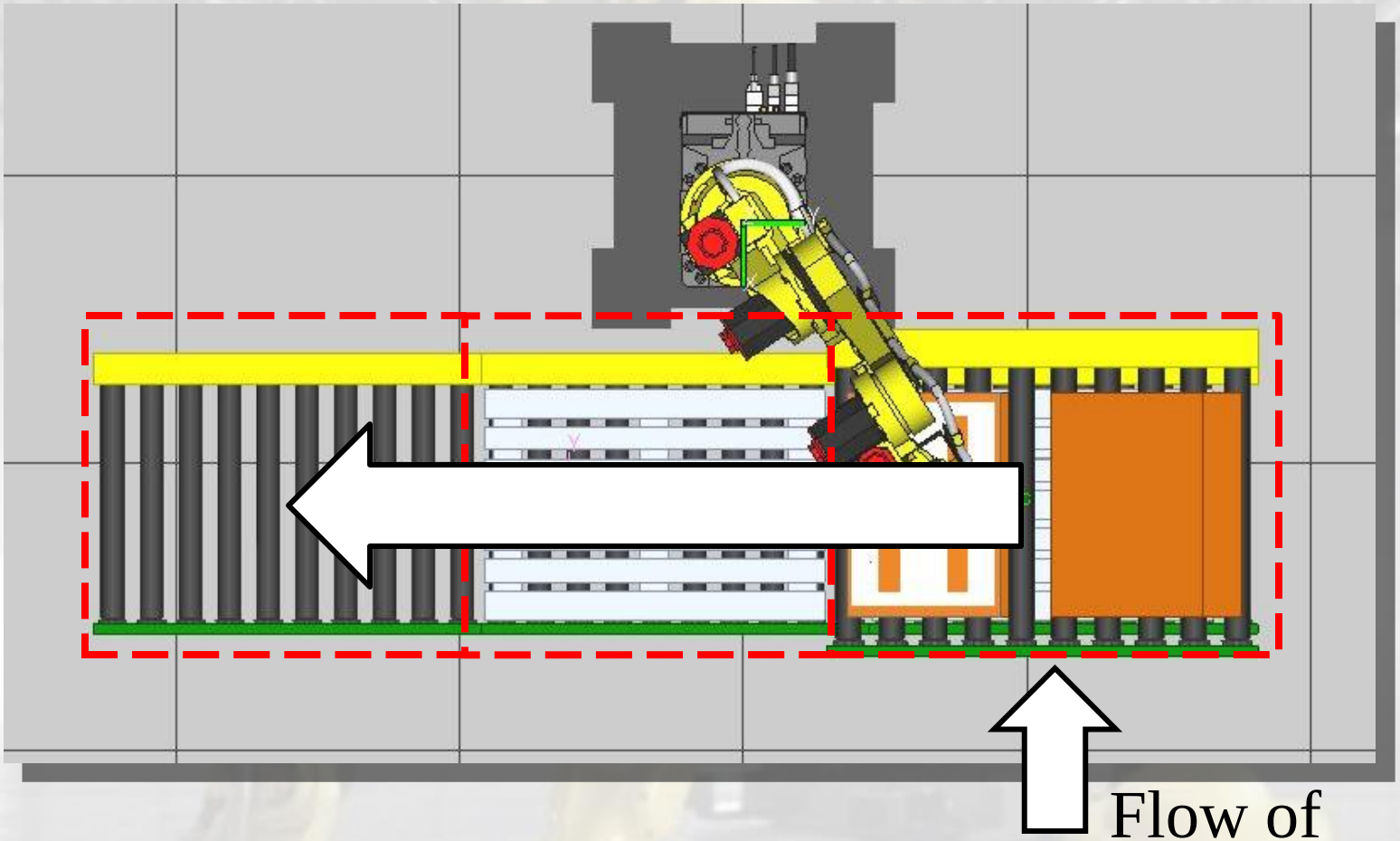

2.3 – Robot trajectory

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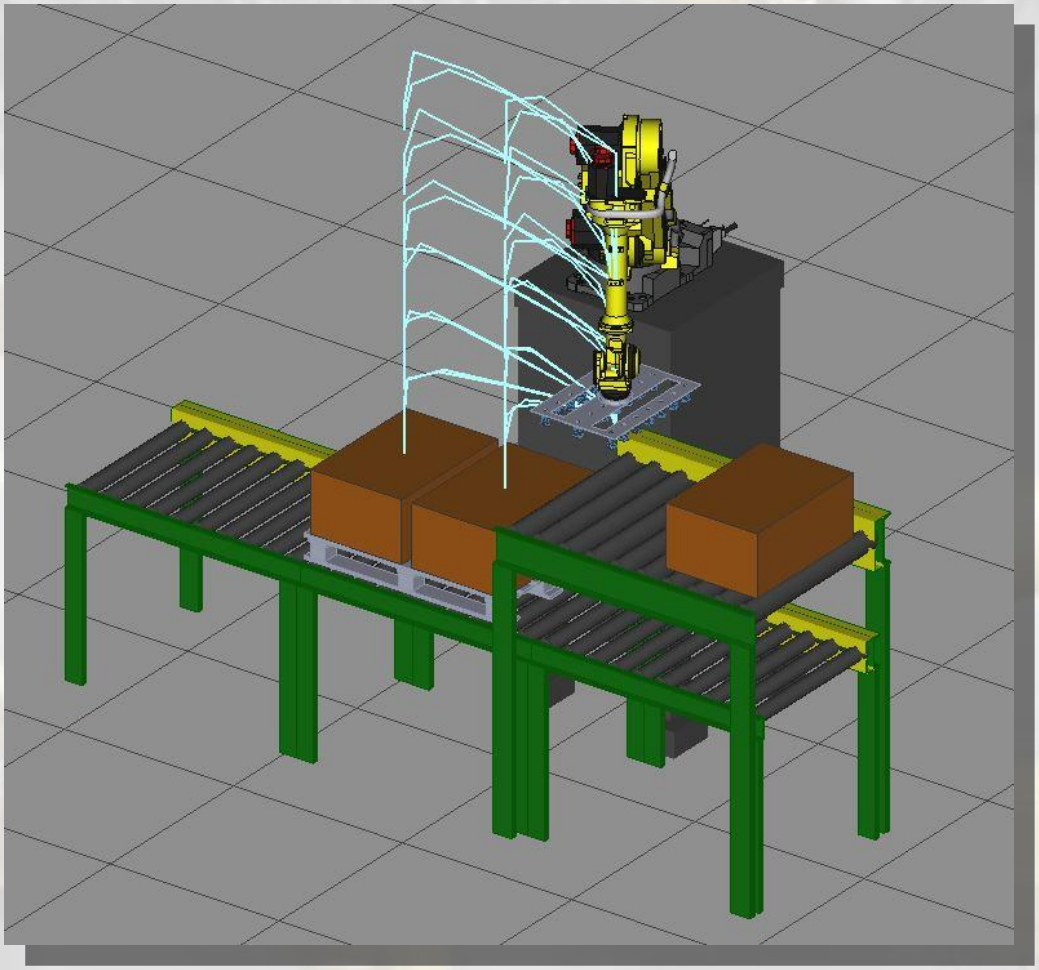
- Payload
- DCS



2.4 – Workcell surface

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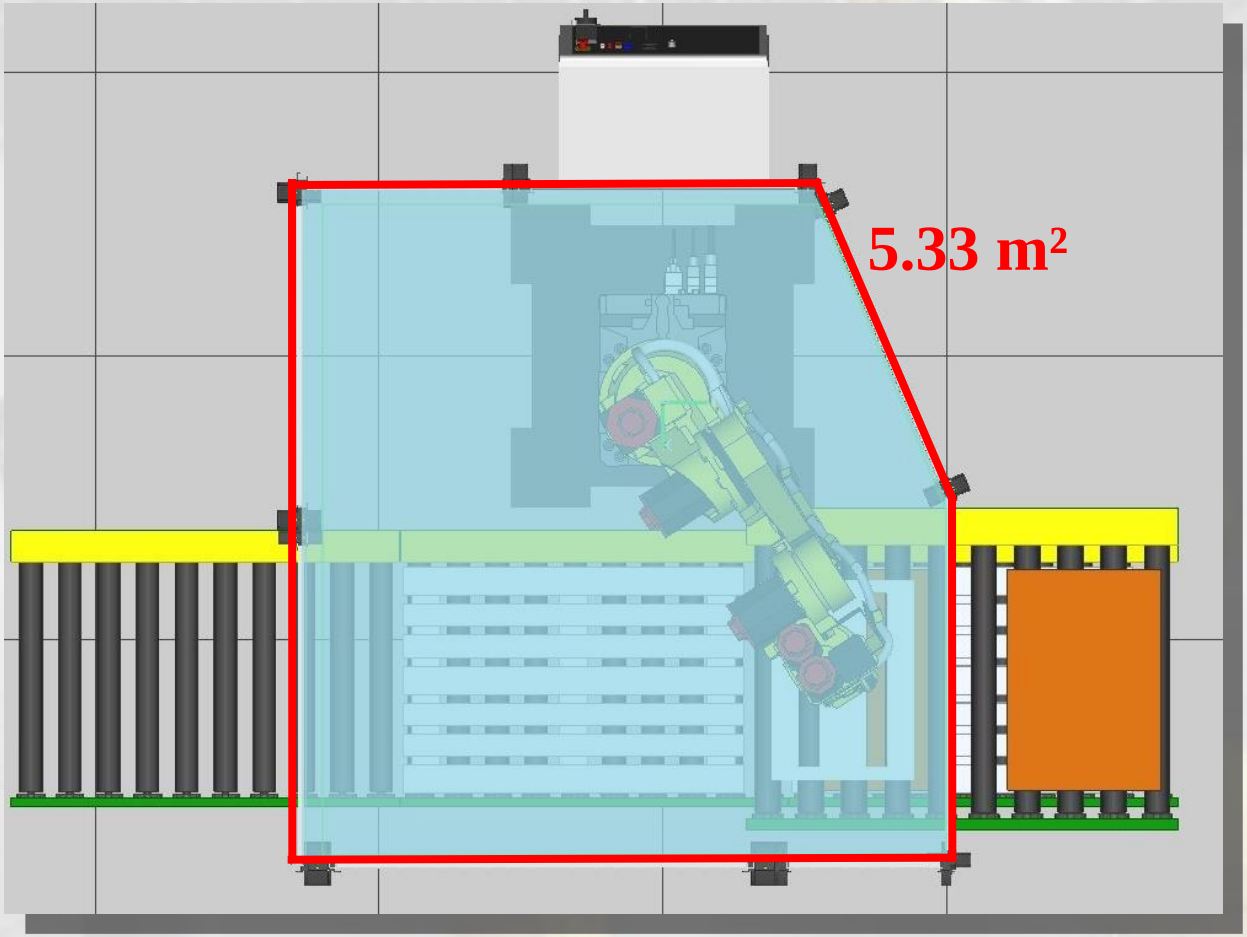
Equivalent to 41.14% of initial area



2.5 – Operational safety considerations

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Safety design standards:

- Machinery Directive 2006/42/EC
  General matters

- ISO 13849-1
  Safety Related Parts of a Control System

2.5 – Operational safety considerations

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Compliance with ISO 13849-1:

Assessed sources of Risks

↓

Evaluation of the risks posed by each one (PLr)

↓

Is the proposed solution adequate (PL ≥ PLr)?

2.5 – Operational safety considerations

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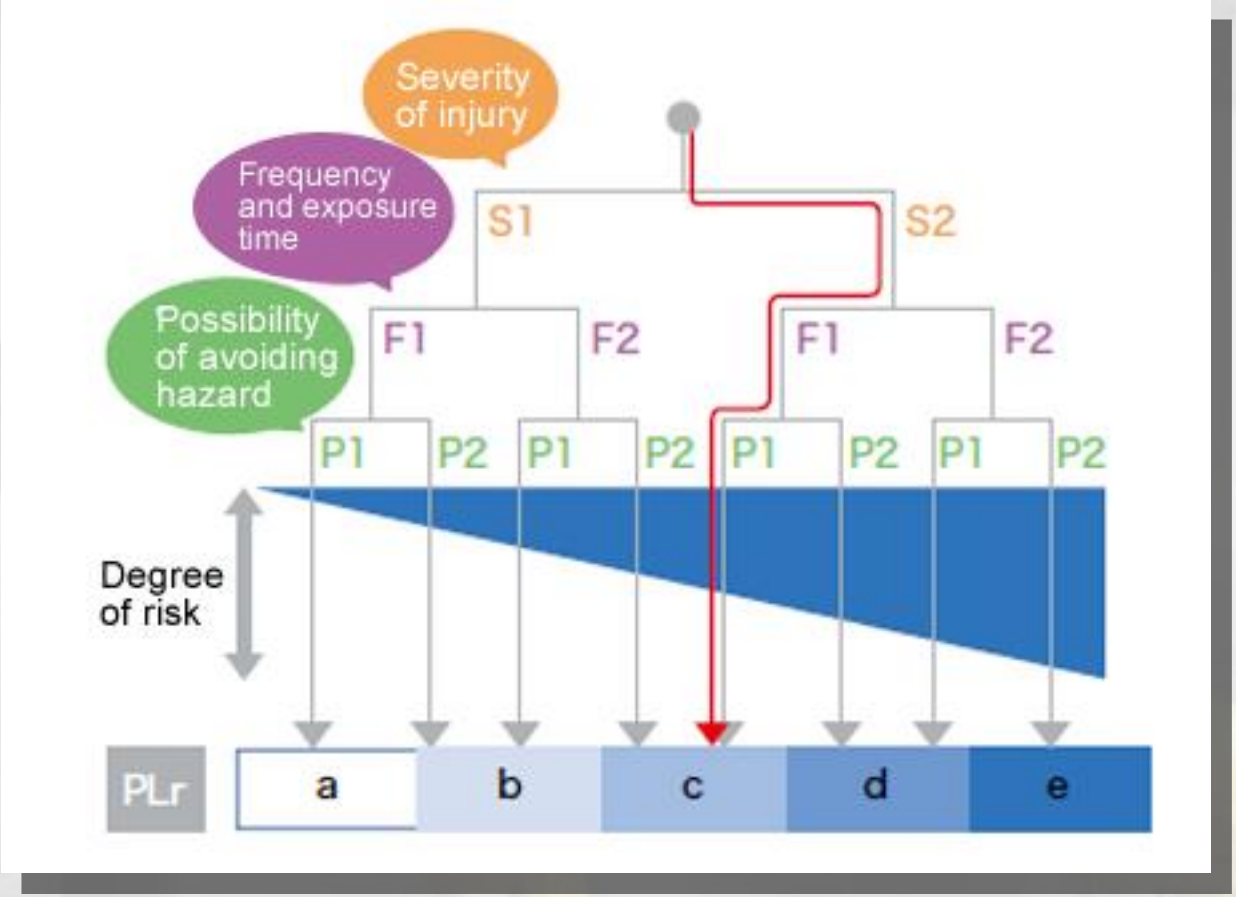
Compliance with ISO 13849-1:



2.5 – Operational safety considerations

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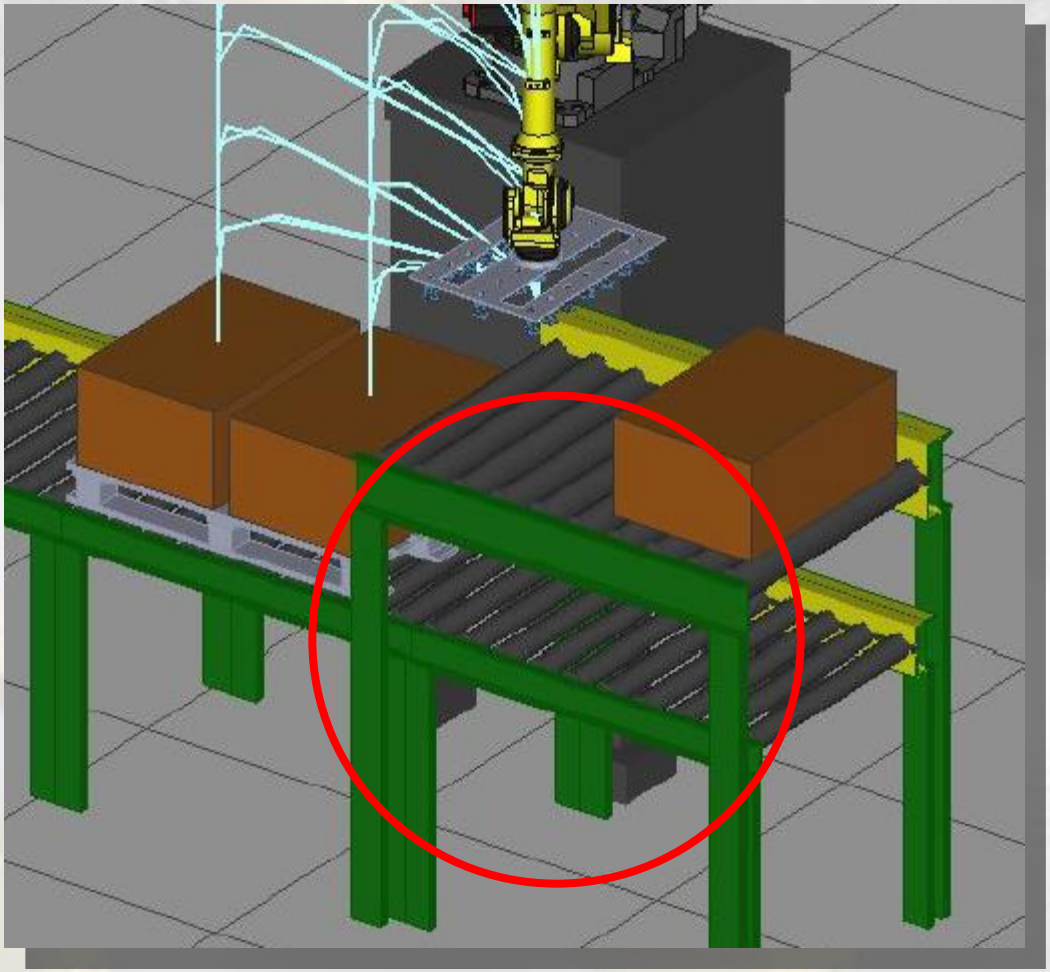
Risk assessment

- Access to the pallets
- Falling objects
- Maintenance



2.5 – Operational safety considerations

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2.5 – Operational safety considerations

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Risk assessment

- Access to the pallets
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2.5 – Operational safety considerations

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Compliance with ISO 13849-1:

Source of Risk	**S**	**F**	**P**	**PLr**
Access in Production	S2	F2	P1	PLd
Access in Maintenance	S2	F1	P1	PLb

2.5 – Operational safety considerations

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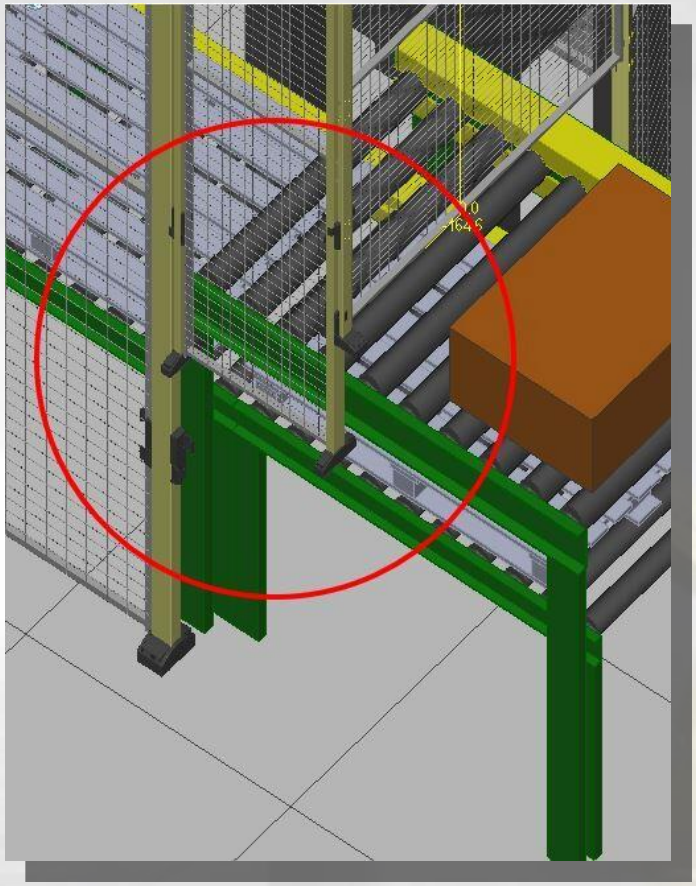
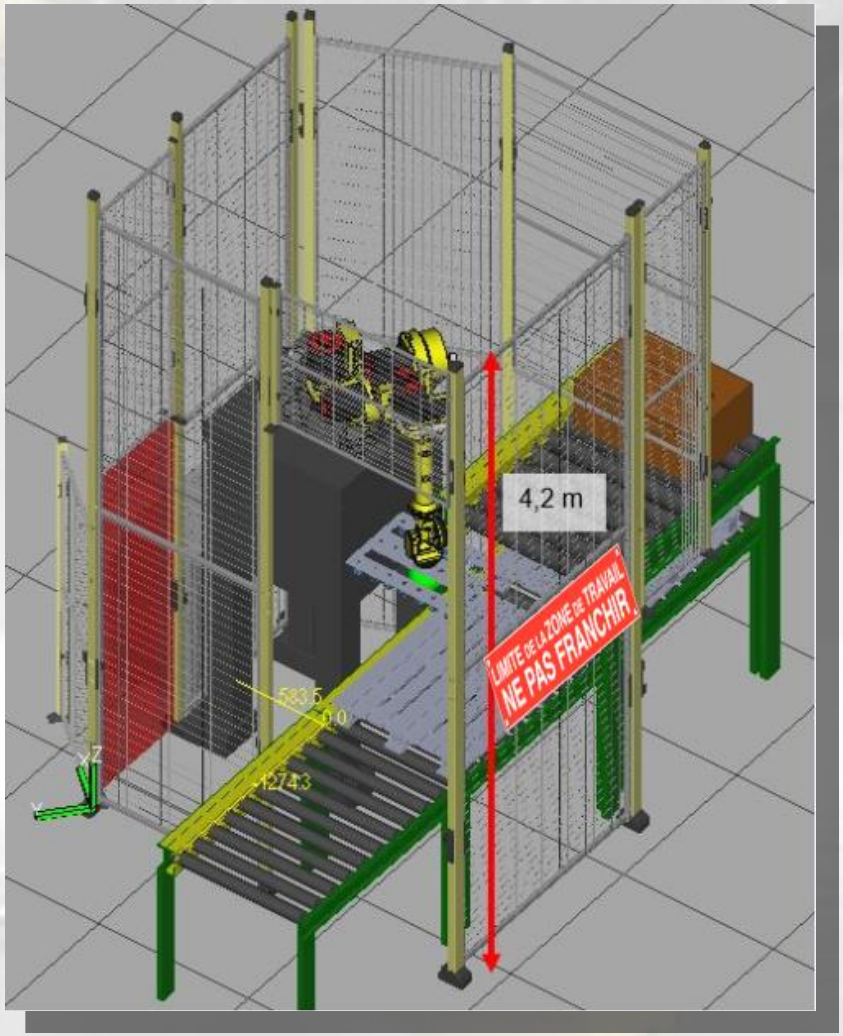
Isolation of Dangerous Zone





2.5 – Operational safety considerations

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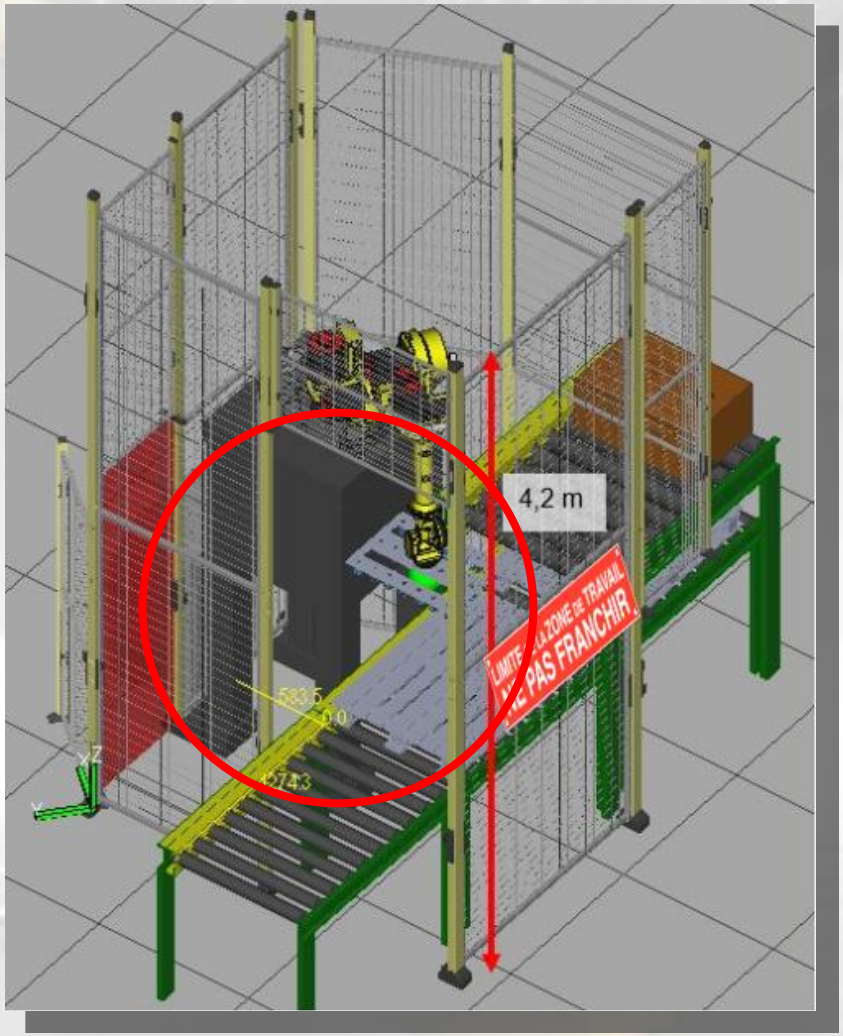
Problems:

- Lack of protection
- Fence area = Work Envelope



2.5 – Operational safety considerations

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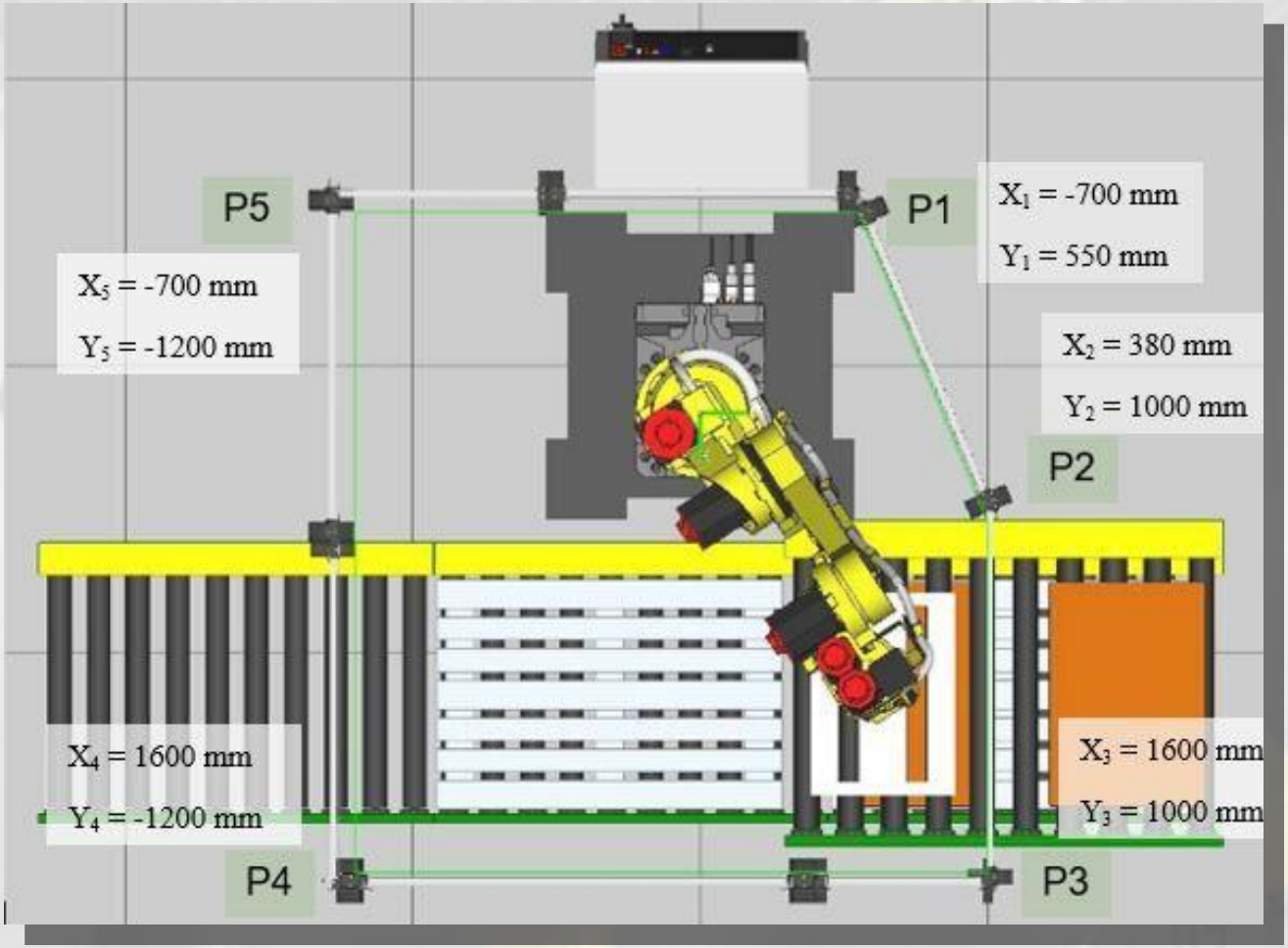
Solution: Dual Check Safety Cartesian Position Check



2.5 – Operational safety considerations

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Compliance with ISO 13849-1:

Function name	**Standard/Optional**	**ISO13849-1/IEC61508**
Joint Position Check Function	Option A05B-2600-J567	Category 3 PL d SIL 2

2.5 – Operational safety considerations

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Solution: Interlock Switch

2.6 – Robotic cell inputs and outputs

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Inputs

DI[1]	Box available
DI[3]	Empty pallet available
DI[4]	Pallet available to be charged
DI[5]	Charged pallet available to be removed

2.6 – Robotic cell inputs and outputs

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Outputs

DO[2]	Turn on/off the pallets conveyor zone 1 → 2
DO[3]	Turn on/off the pallets conveyor zone 2 → 3
DO[5]	Turn on/off the box conveyor
D0[6]	Turn on/off the gripper

2.7 – Budget

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Robot R-1000iA/80H + R-30iB Controller and DCS Module

About 45000 + 2000 €

2.7 – Budget

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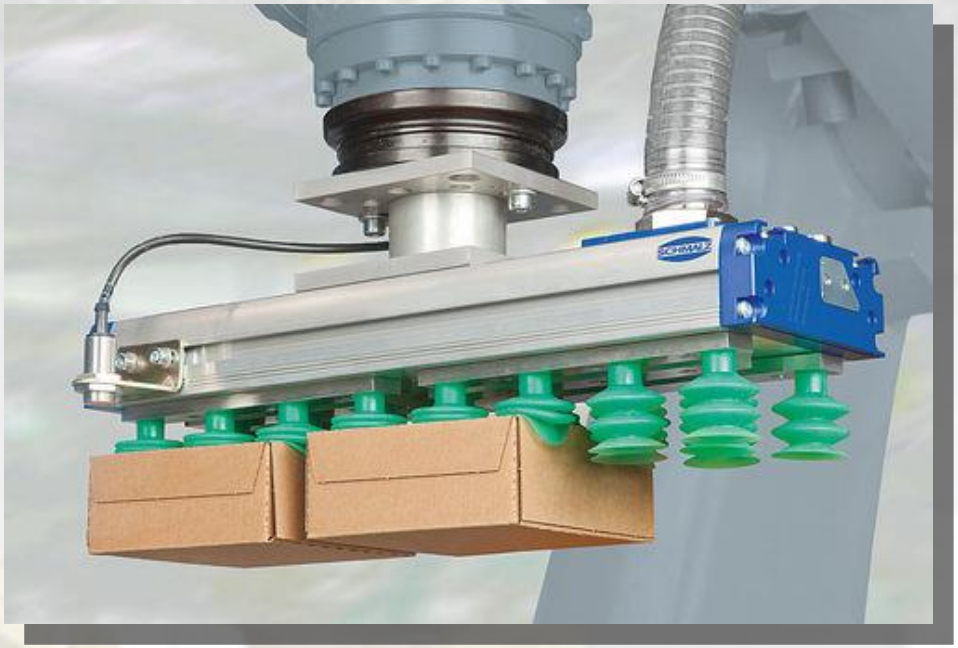
Suction Gripper

About 700 €



Merely illustrative

2.7 – Budget

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Elements	Price
Robot R-1000iA/80H	45000 €
DCS Module	2000 €
Suction Gripper	700 €
Total	47700 €

2.8 – Production Throughput

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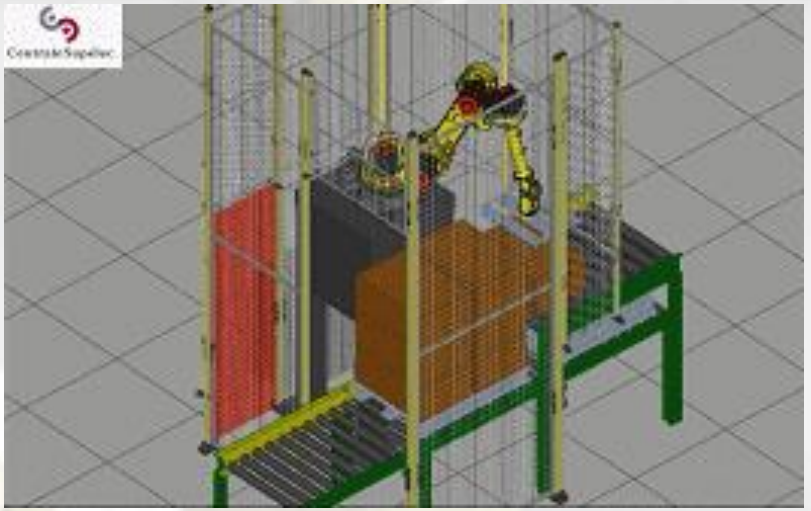
720 boxes / hour *

About 75% more than the original cell throughput



3 – Conclusion

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- Faster than expected
- Considerably cheap
- Software maintainability
- Less than 50% of initial surface

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Thank you for your attention!

Any questions?