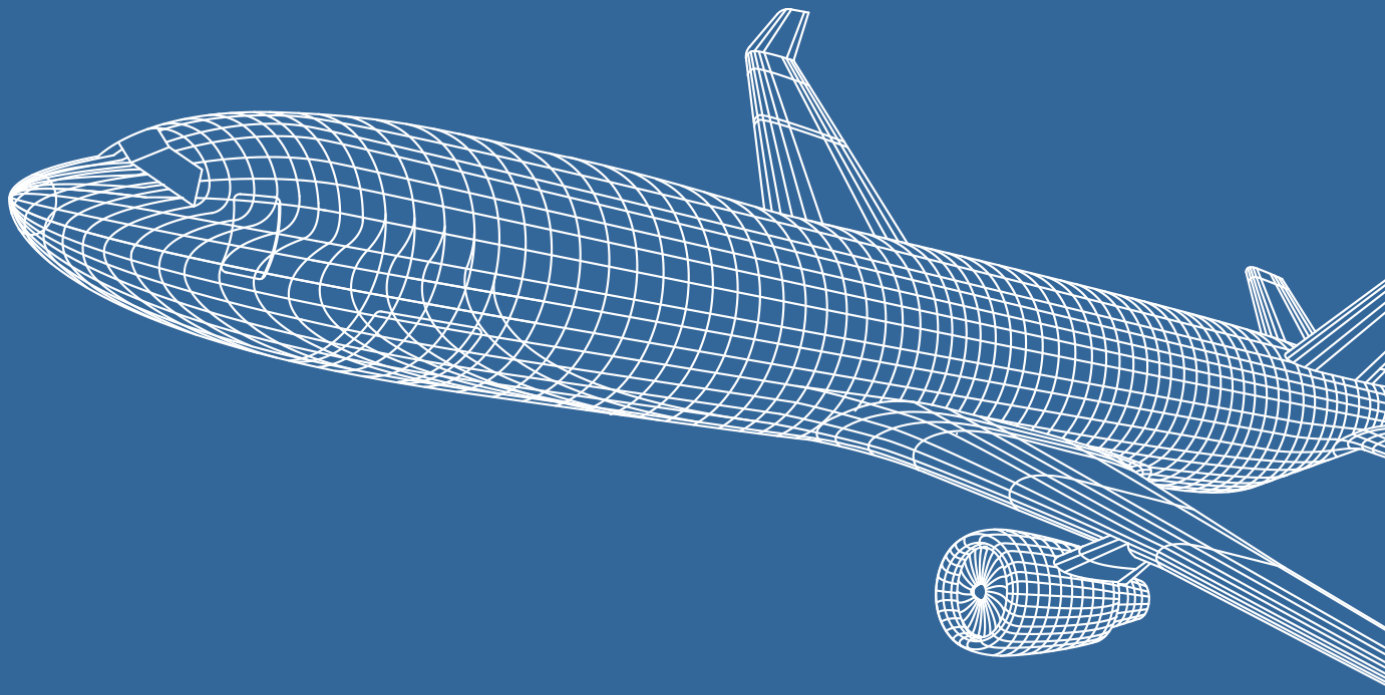

Systematic redesign of manufacturing systems for aerospace

Presented at Aerospace Technology Congress (FT2016)

Johan Vallhagen, 2016-10-12

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These results are part of an ongoing project

“ Methodology for Visual Production Development”

Dr. Johan Vallhagen, Project Lead

Erik Lindskog,Ph.D. student

Prof. Johan Stahre, Examiner

Prof. Björn Johansson, Supervisor

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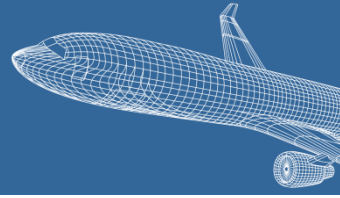
The support is gratefully acknowledged.
(NFFP - Nationella Flygtekniska Forskningsprogrammet)

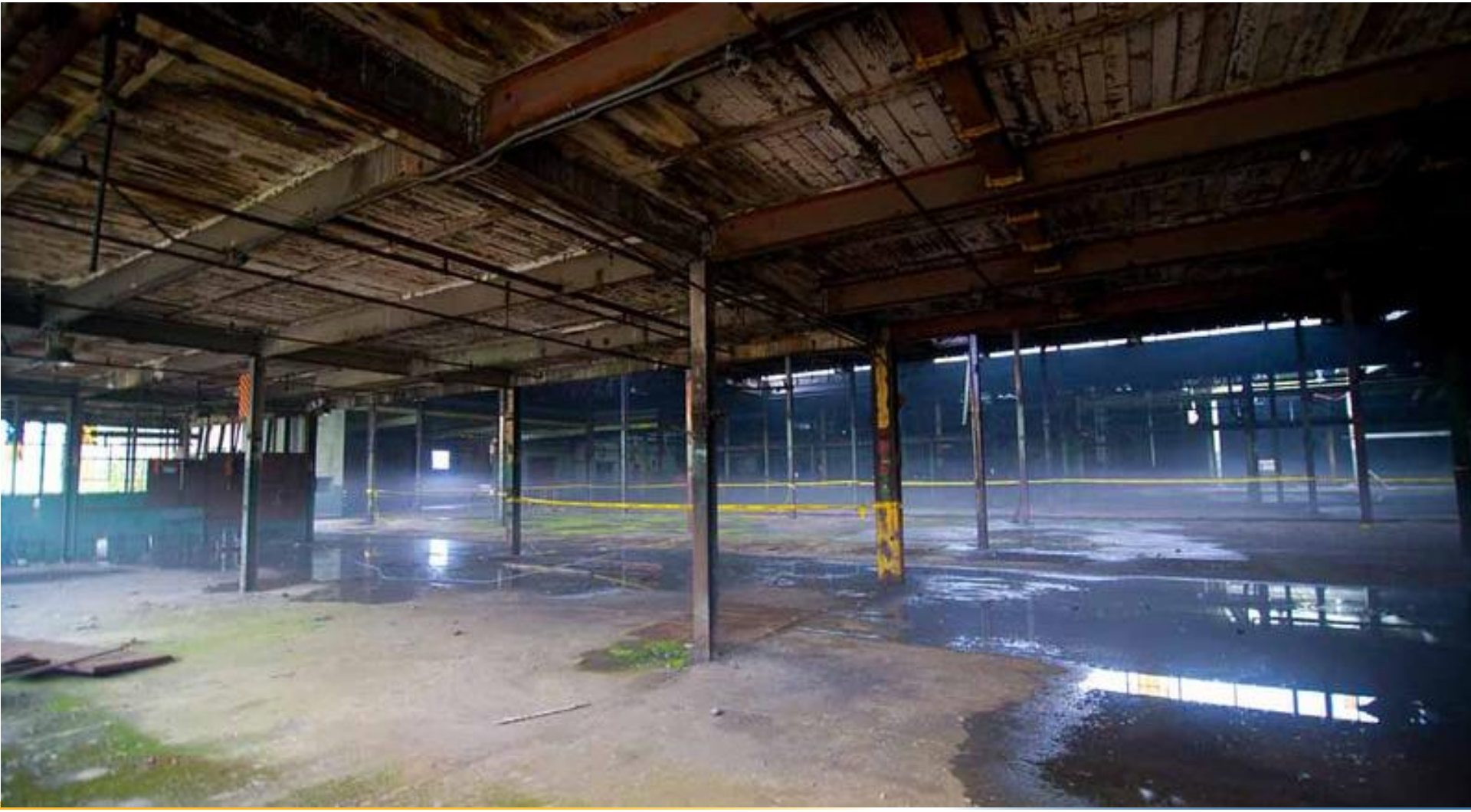
Agenda



1. Background and introduction to the research
2. Examples of case studies and learnings
3. A systematic method for using visualisation
4. Lessons Learned

”Greenfield” … (very few opportunities)

Brownfield … (more often)



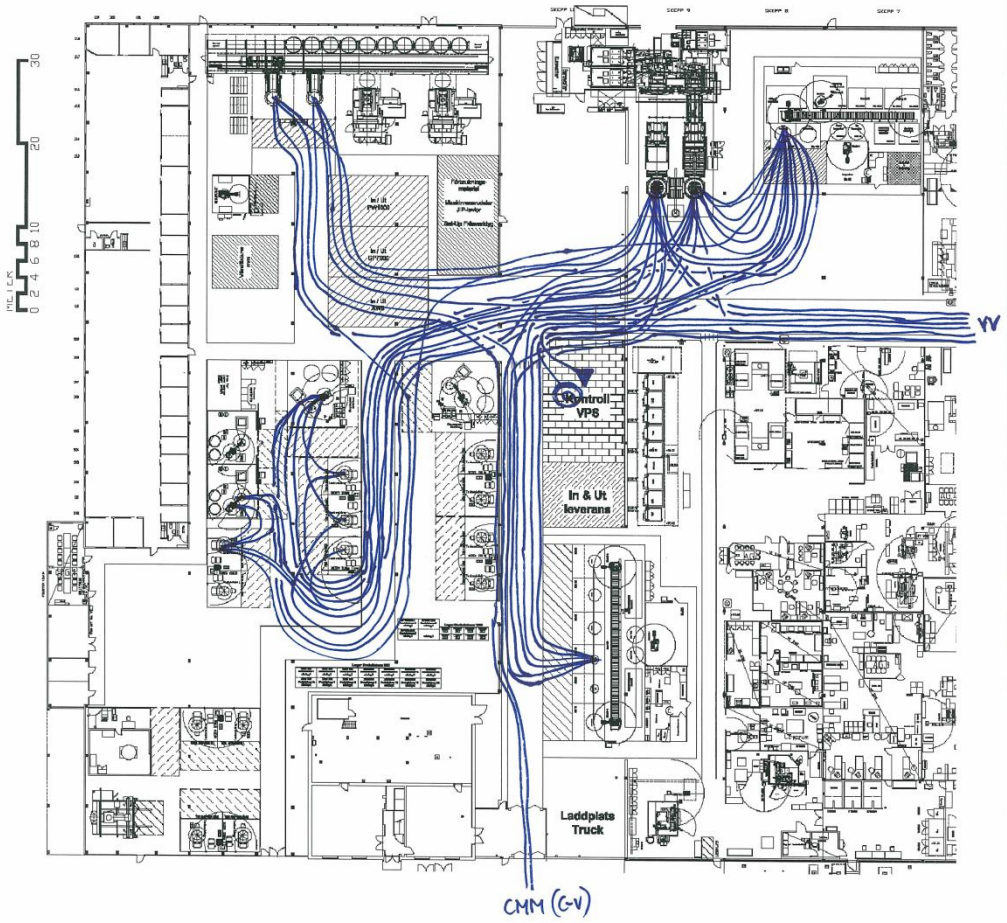
Production changes … (most common)

Update the production system:

- Replace old machines
- Introduce a new process
- Start up of a new product
- Add capasity

… or make improvements:

- Logistics & material handling
- Production planning & execution
- Quality …



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Idea and vision …

Tools easy to learn and use

- Games
- Google Earth

- Lean Production principles
  - ”Go to Gemba”

Develop a system that let us

”Go to the *future* Gemba”

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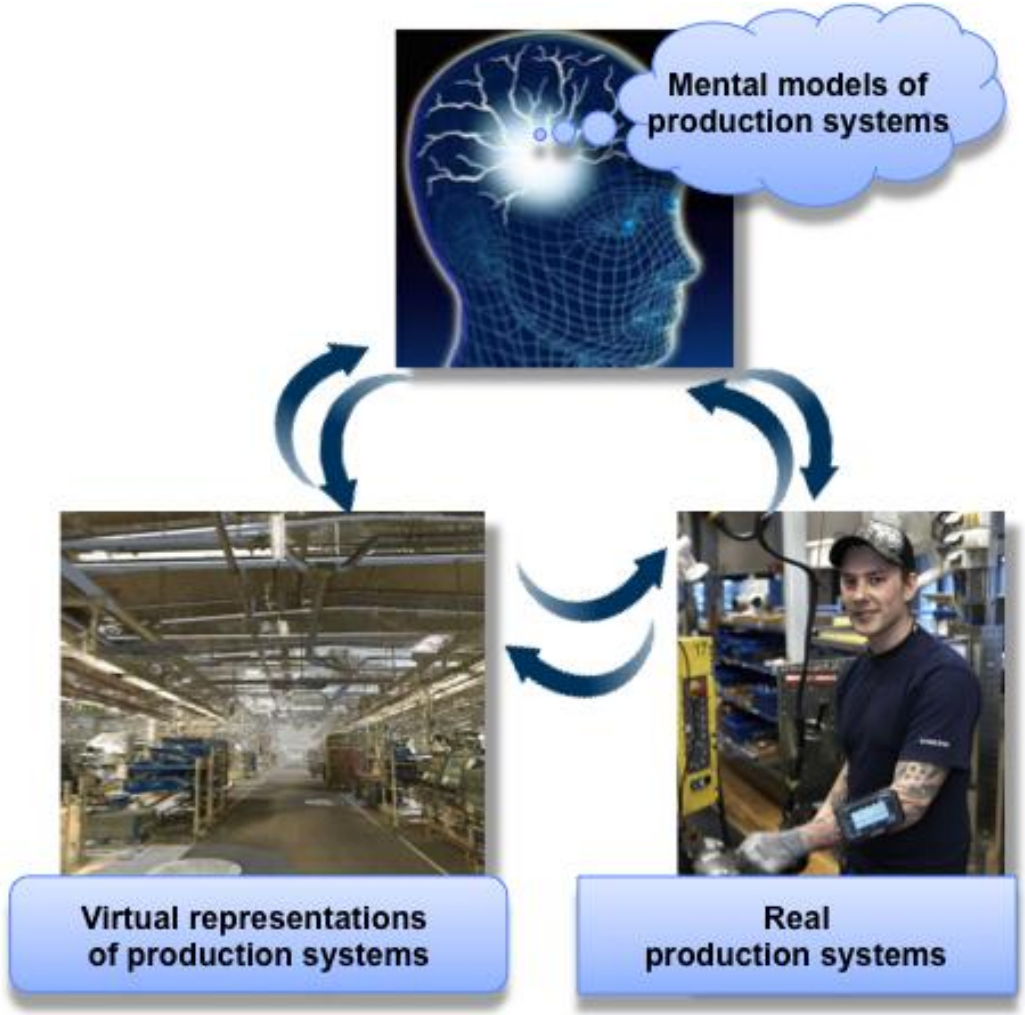
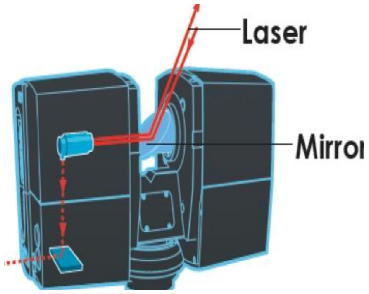
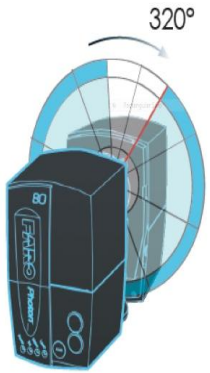
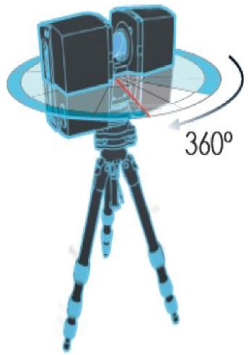
Scientific approach

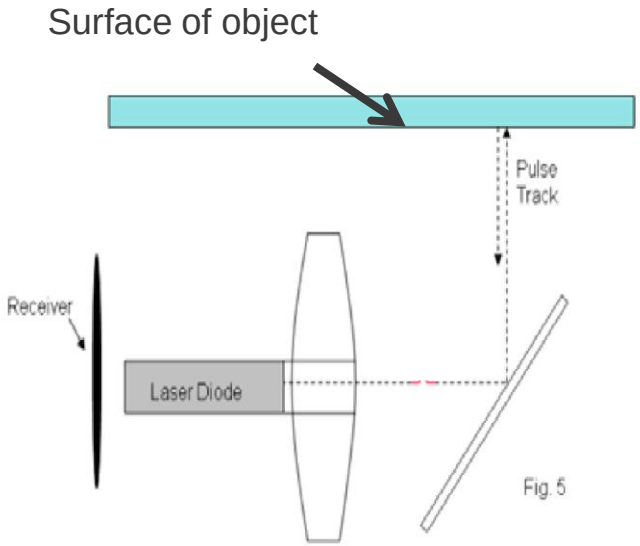


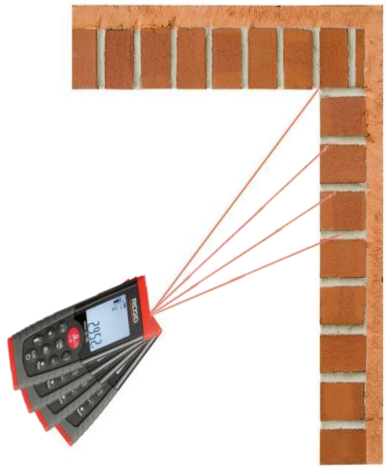
3D laser scanning – how does it work?

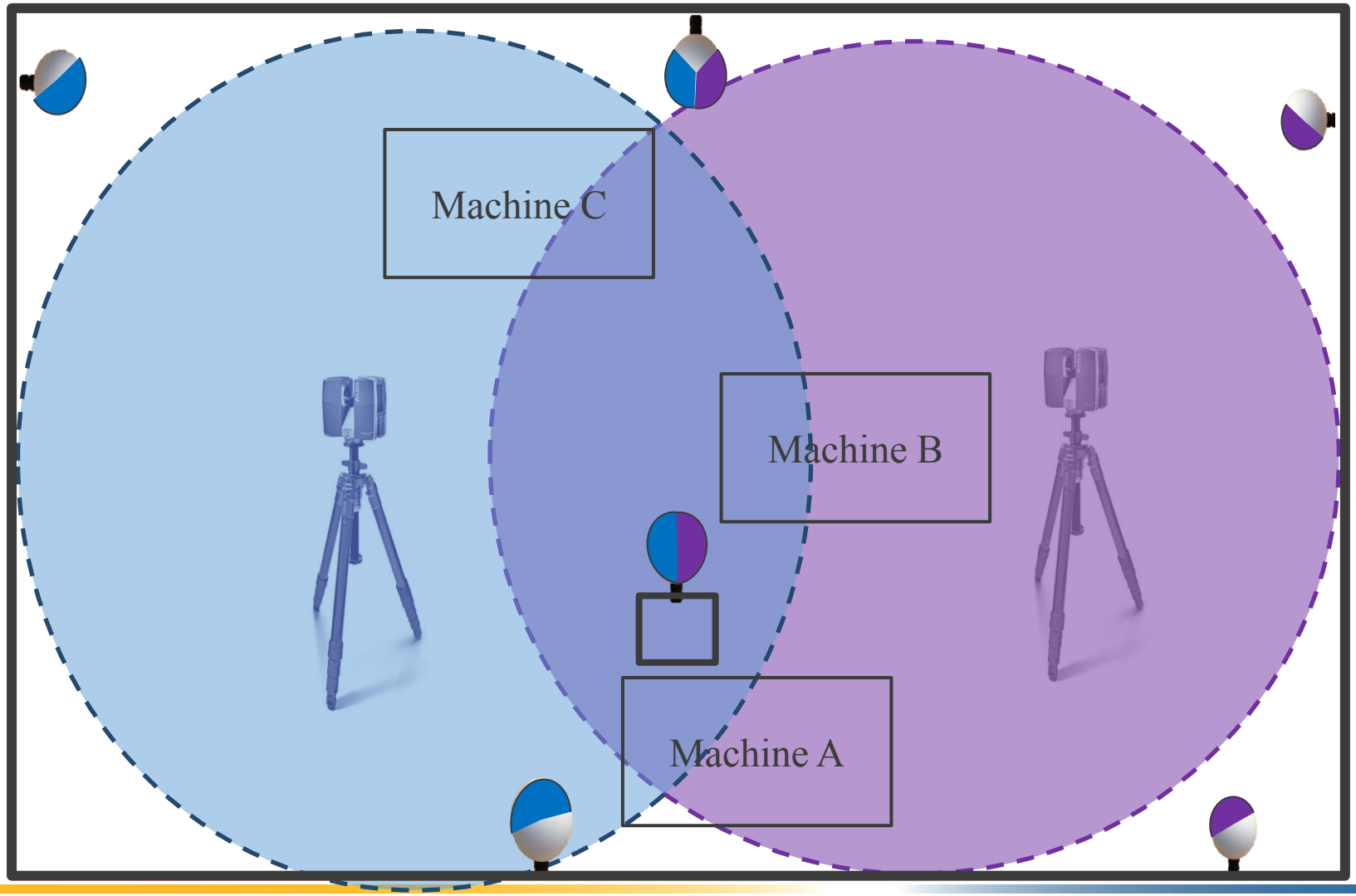






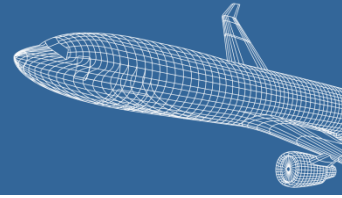






Scan data (point cloud)

Why 3D laser scanning and Point Clouds?



Need for virtual representation

- Accurate and realistic
- Can be created in short time

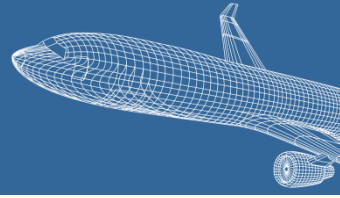
Inaccurate factory documentation

- Blueprints, CAD models etc. are often not updated
- Does not include production material

As-build factory representation

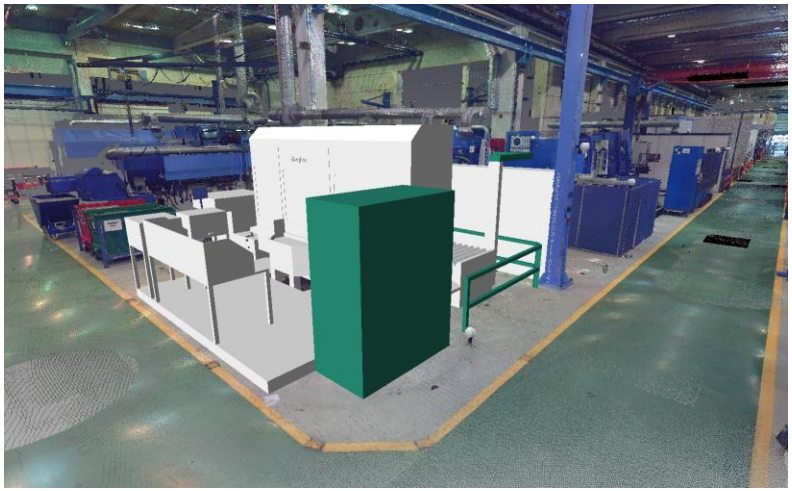
- Capture the current state in the factory
- It shows the actual production environemnt

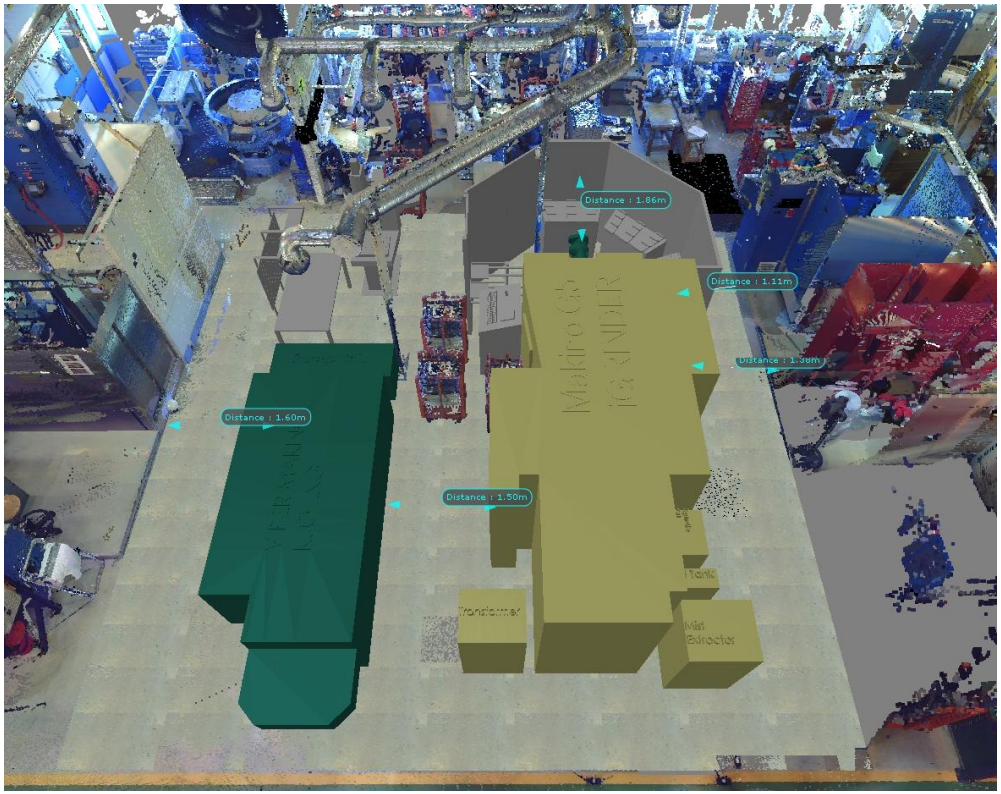
Examples from case studies



We have learned step by step

Moving old and installing new equipment





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Clooning a cell and modify the workshop

FILM

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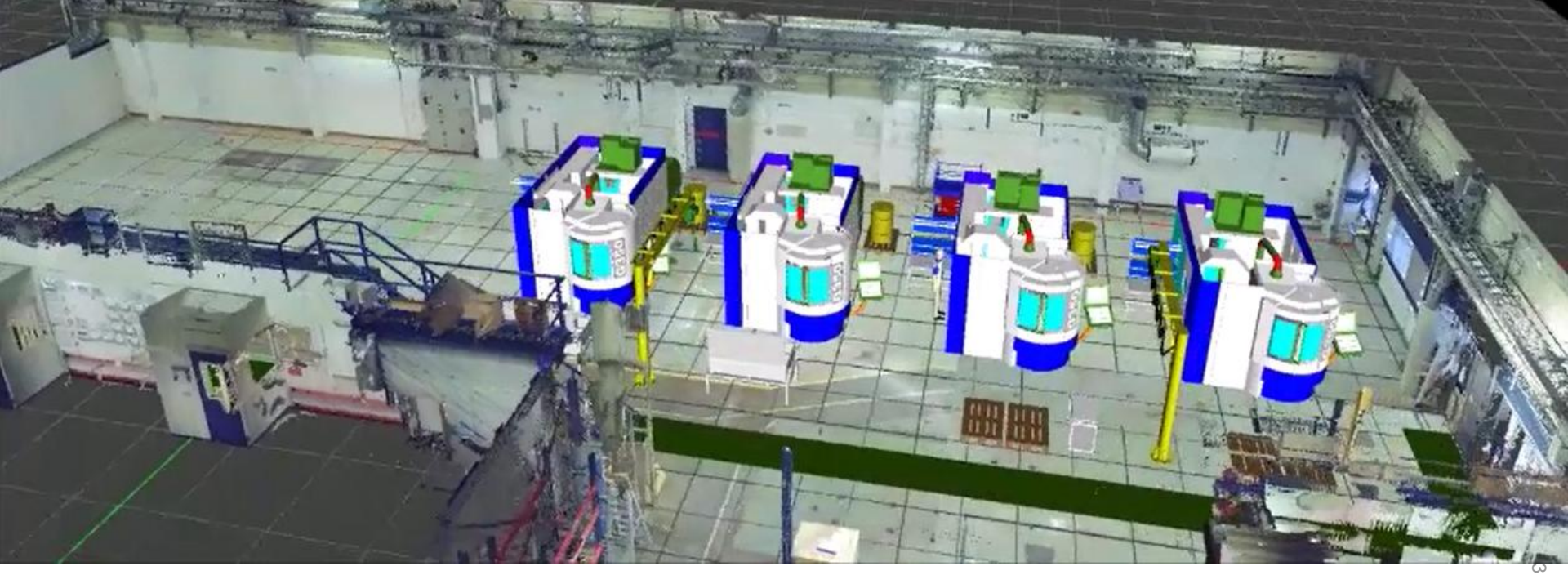
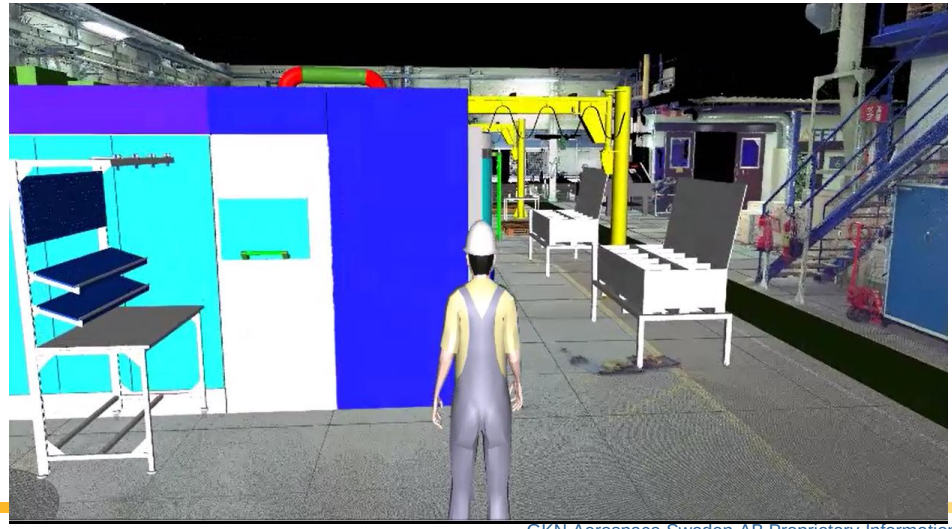
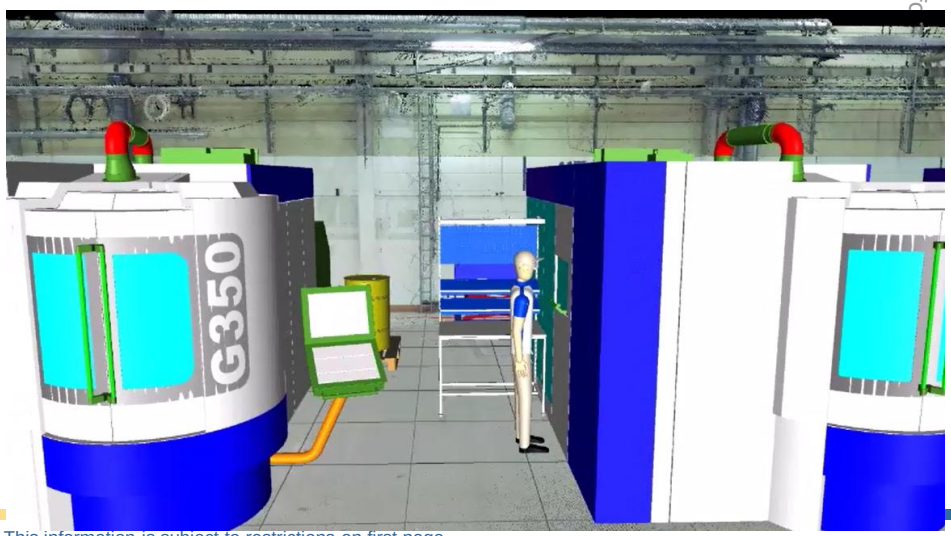
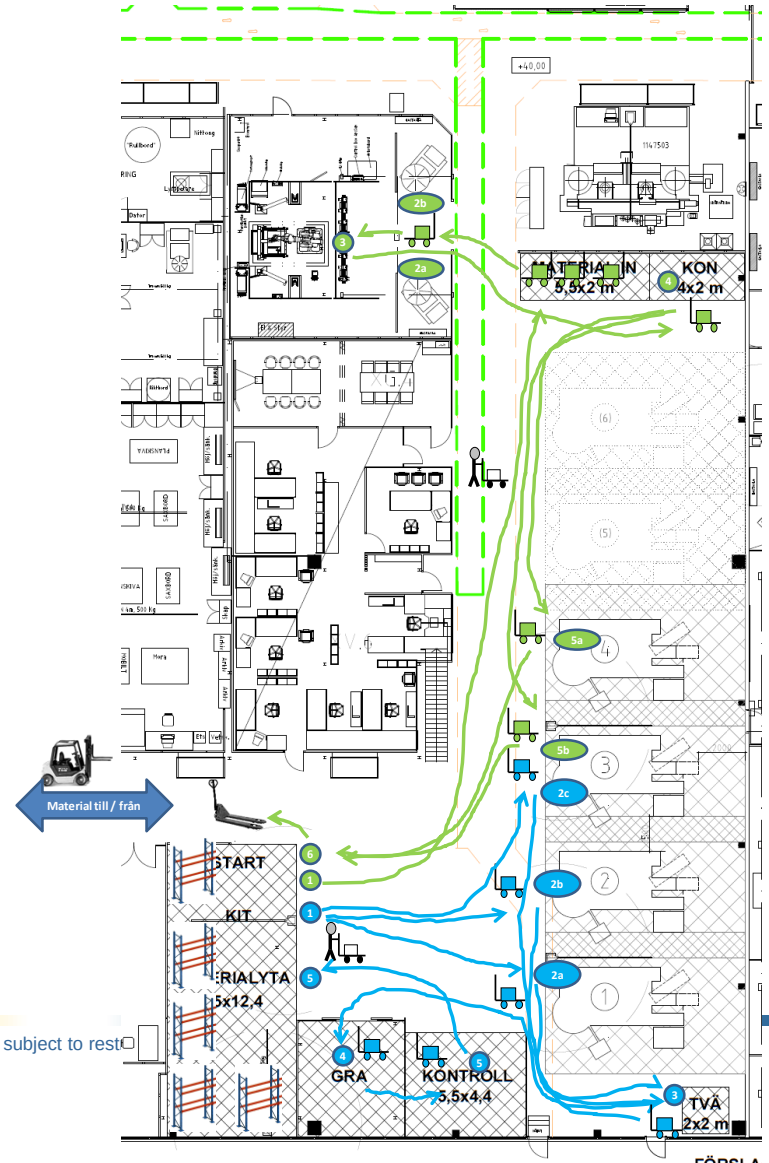


Film





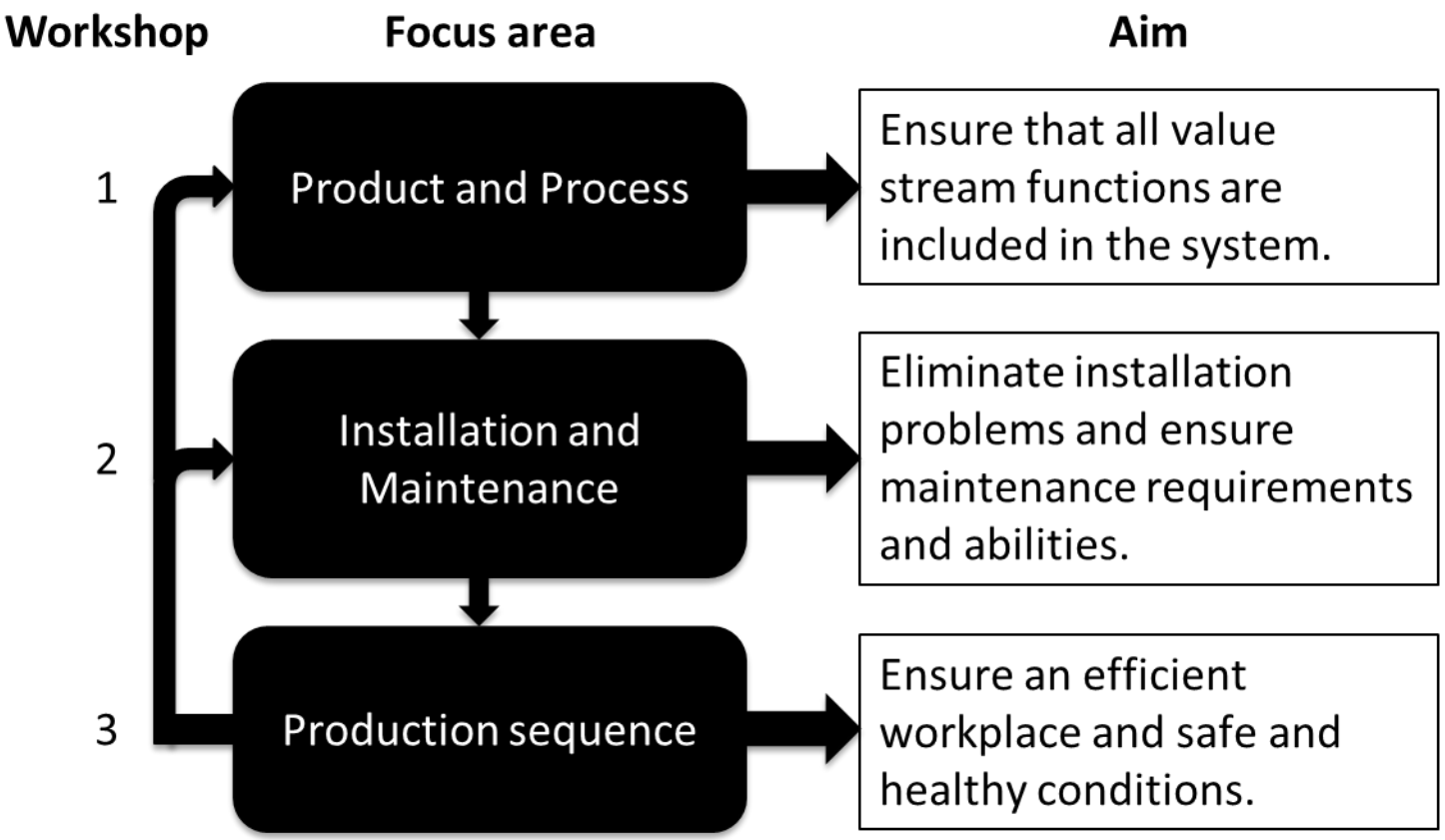
Concept for the production system design



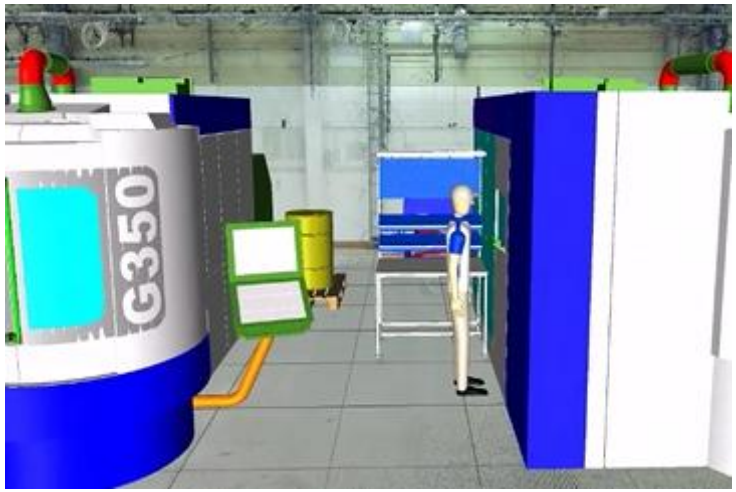
Value Stream Mapp, ”7-flows” of production and the block layout defines the Production System

First visualization of the system

Workshops with visualisation



Worskhop set-up



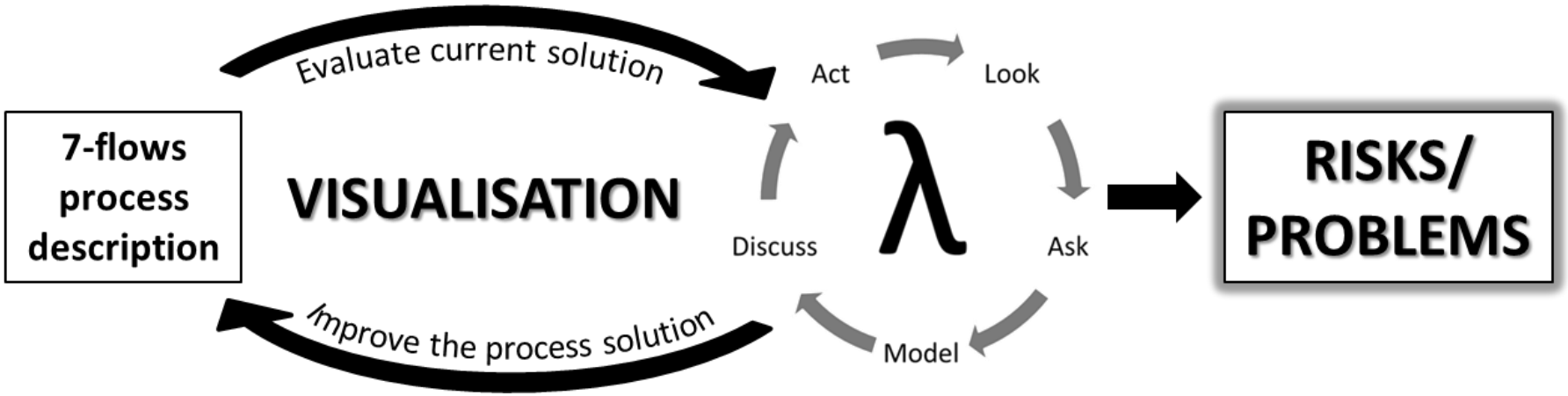
Documentation:

- 7-flows of production
- Specifications, drawings, etc.
- Document: risks, problems, etc
- …

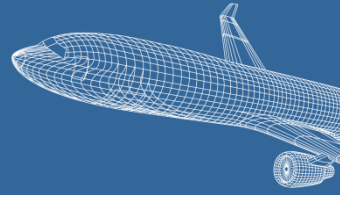
Identified problems and risks

7-flows category	Problems and risks
4, 5	The counter for tool changes is too high up on the machining center, a platform needs to be build.
1, 2, 4	The planned walkway is too narrow, equipment and material should not be placed too close to the walkway.
1, 2, 5	The cranes supporting each machining center where placed too close to a wall, causing problems with transporting materials in between.
2, 4, 5	The door entrance door was located too close to one of the machining centers, which can cause temperature problems in the machining center during winter season.
5, 6, 7	The comparison between the scan data and 2D CAD layout showed that walls and pillars in the building were positioned at the correct location. However, other parts were missing from the 2D CAD layout such as the ventilation system.

The resulting work method



Conclusions



- 3D laser scanning an important technology for supporting the redesign process of production systems
- Benefits drives from the accurate and realistic point clouds of the existing shop floors
- Verify the planned layouts before implement
- Reduce the necessary time for planning and discussions, and the risk for costly design errors
- 3D visualisations easier to understand
- A structured method of working with the technology during redesign projects is necessary