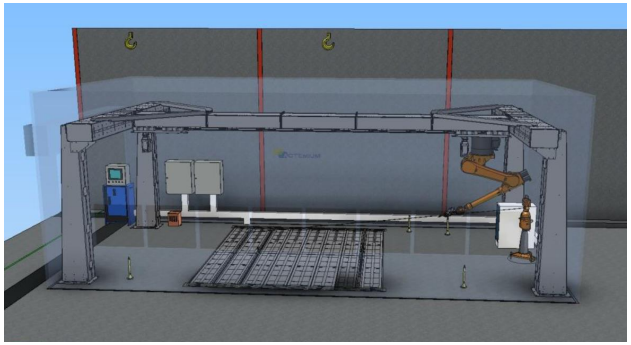
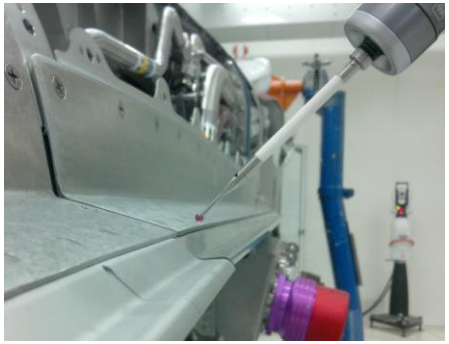
SM HPP BL AC FT

MEASURING SOLUTIONS argon

SA Automation

Automated tactile measurements – Airbus St. Eloi





SA User Conference on April 21-23, 2015
Williamsburg, USA

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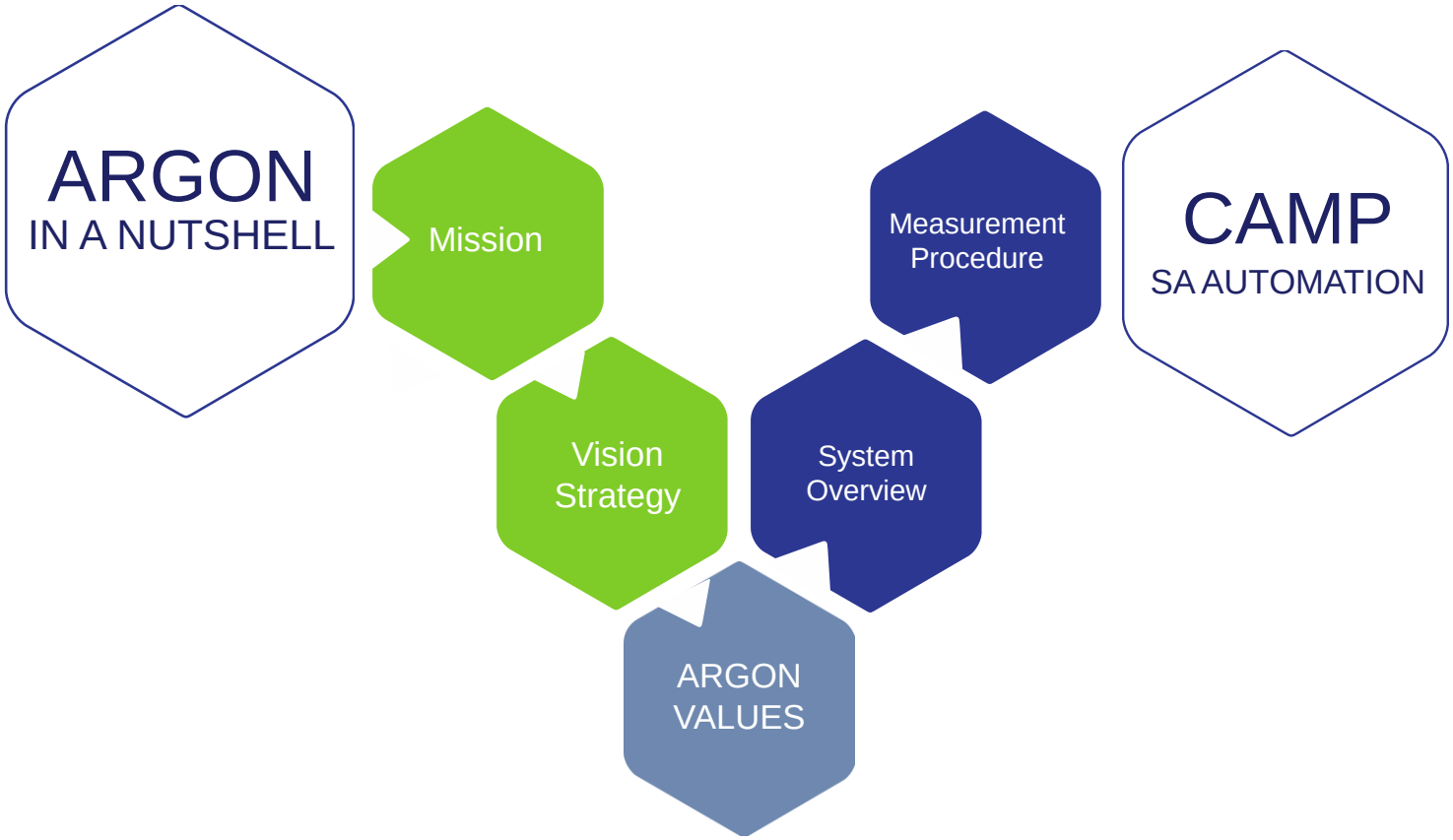
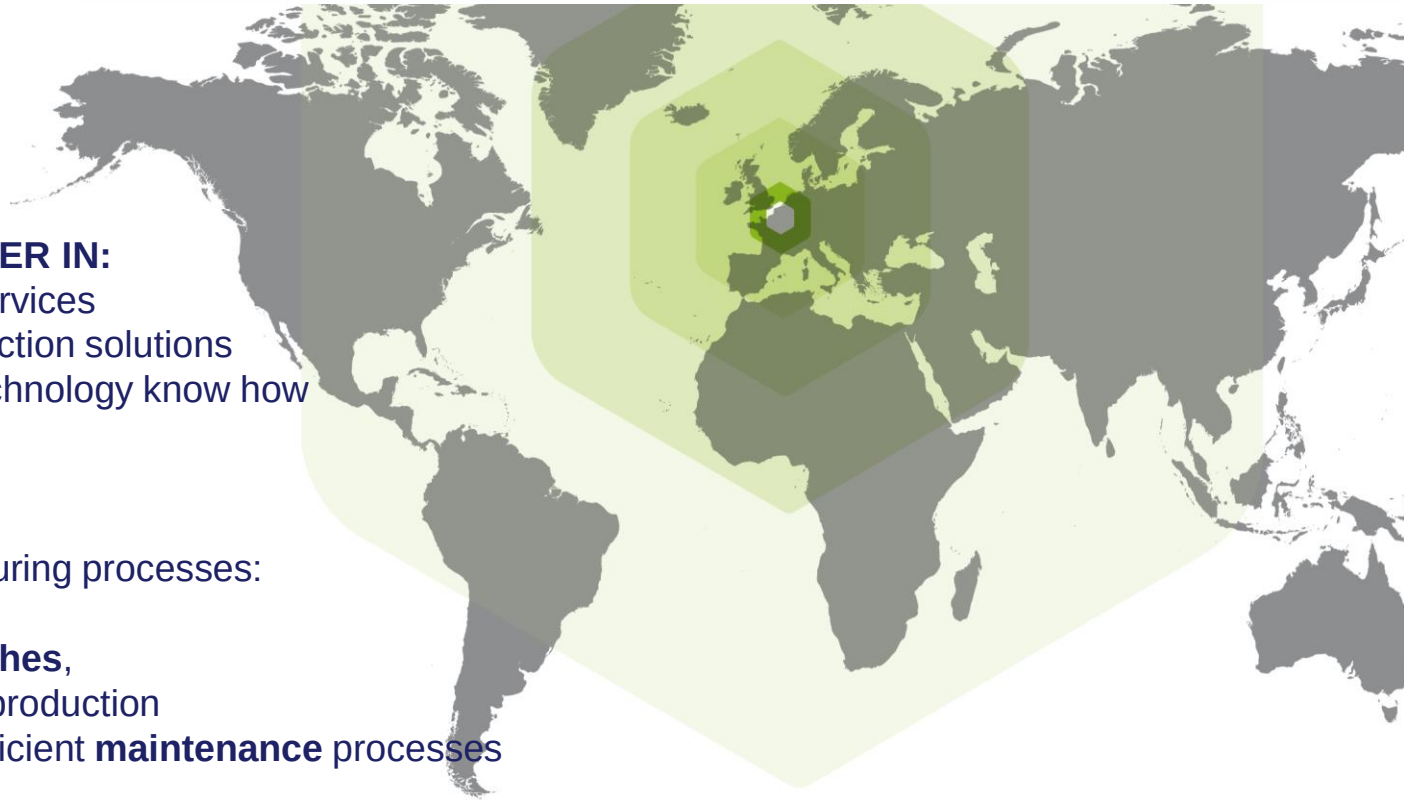
CONTENTS


ARGON
IN A NUTSHELL
Mission
Vision
Strategy
ARGON
VALUES
System
Overview
Measurement
Procedure
CAMP
SA AUTOMATION

ABOUT ARGON

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

MEASURING SOLUTIONS argon



A WORLD WIDE LEADER IN:

- 3D measurement services
- automated 3D inspection solutions
- unique mix of 3D technology know how

TO ACHIEVE:

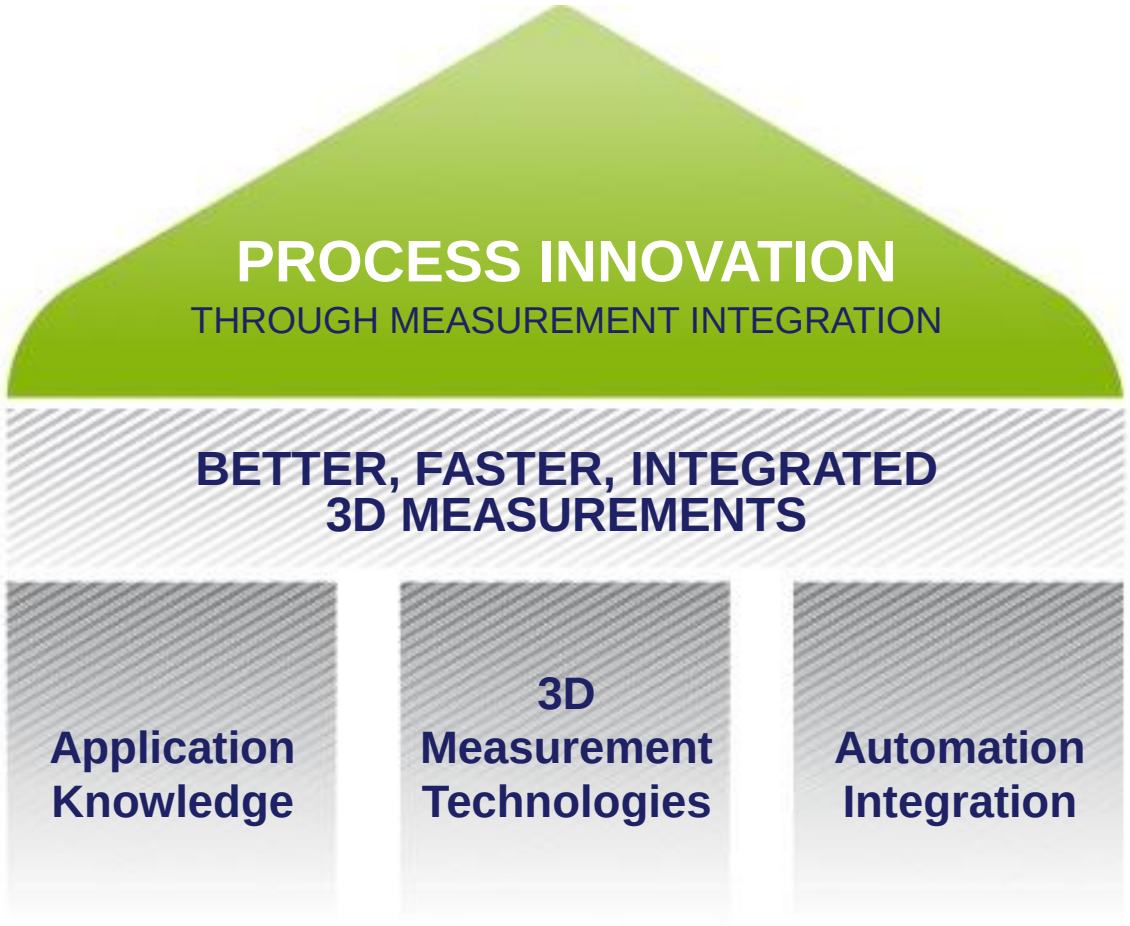
more efficient manufacturing processes:

- faster product **launches**,
- more stable **series** production
- shorter and more efficient **maintenance** processes

CURRENT FOOTPRINT:

- offices in Belgium, The Netherlands and Germany
- world wide network of partners

OUR MISSION

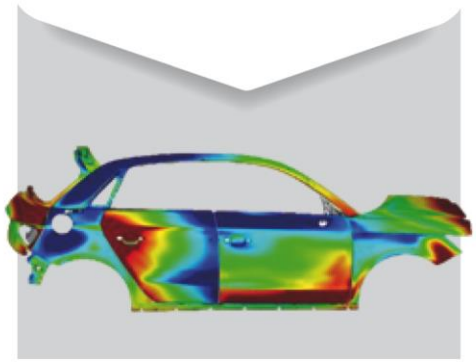

PROCESS INNOVATION
THROUGH MEASUREMENT INTEGRATION
BETTER, FASTER, INTEGRATED
3D MEASUREMENTS
Application Knowledge
3D Measurement Technologies
Automation Integration

BEFI BETTER, FASTER, INTEGRATED 3D MEASUREMENTS

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

MEASURING SOLUTIONS argon

BETTER

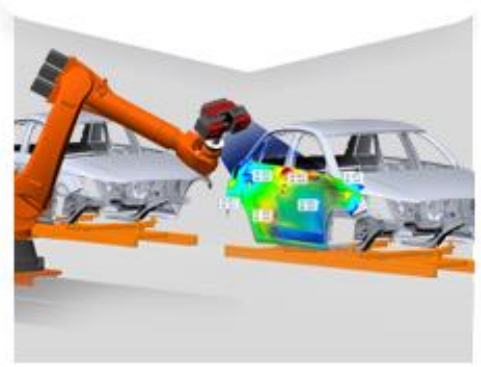


- Colour plots
- graphical vs numbers

FASTER

- 3D scanning
- Automated measurement
- Automated reporting

INTEGRATED

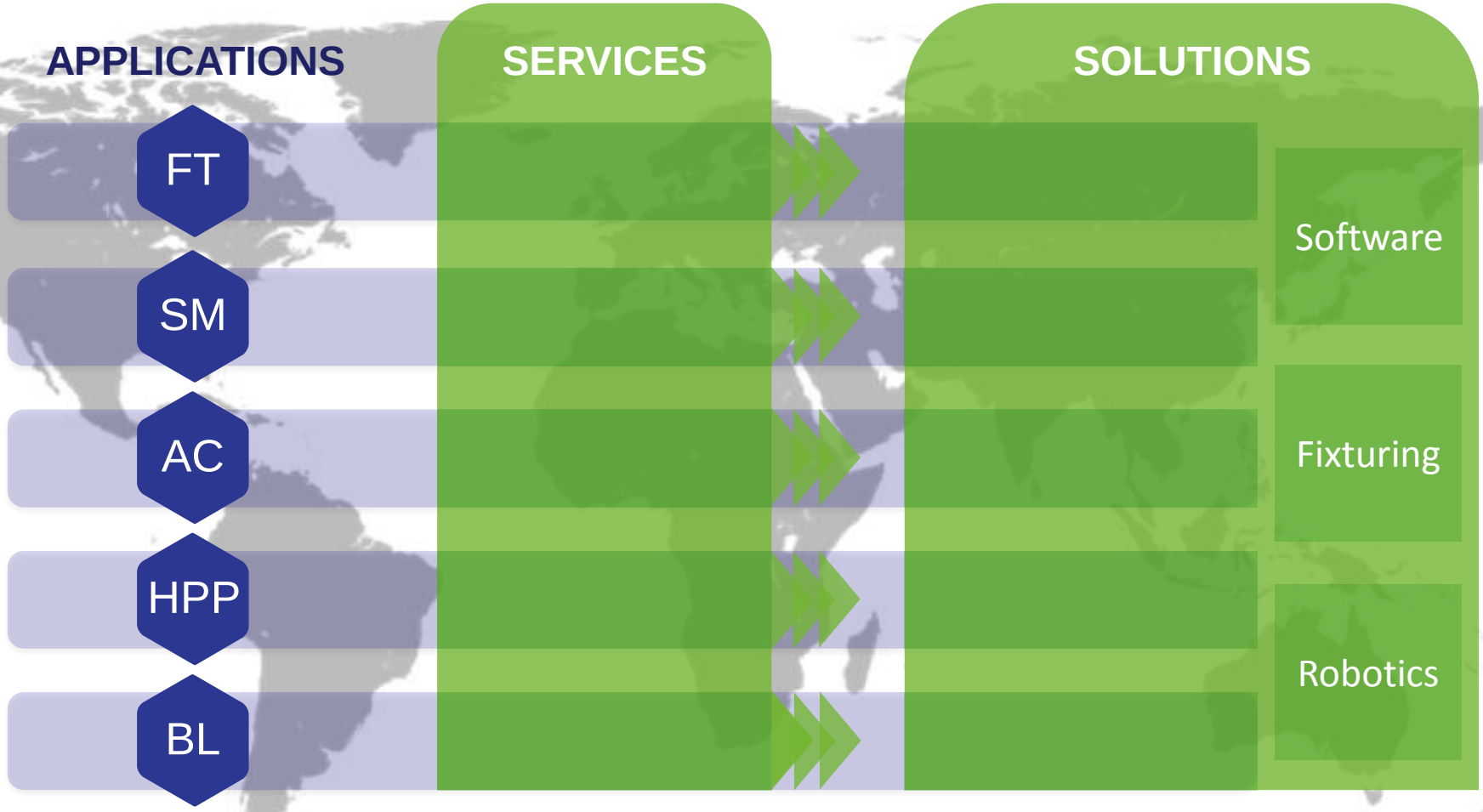


- Easy-to-operate
- Automated Handling
- Adaptive Manufacturing
- Integrated into PLM system

UNIQUE 3D BUSINESS MODEL

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

MEASURING SOLUTIONS argon



WHAT - HOW - WHERE

OUR VISION AND STRATEGY

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

MEASURING SOLUTIONS argon

GLOBAL PARTNER FOR GLOBAL COMPANIES

CONVINCE

- Through services
- Illustrate BEFI*

PENETRATE

- Roll out internationally
- Expand scope
- Continuous Improvement

INTEGRATE

- Automate
- Integrate

* *BEFI = BEtter, Faster, Integrated*

OUR VALUES

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

MEASURING SOLUTIONS argon

INNOVATION

- Value added
- Continuous improvement
- Technology Accelerators

EXCELLENCE

- Discipline – ROVAT*
- Drive to improve
- Technological frontier

PASSION

- About technology
- About clients
- About ARGON

TRUST

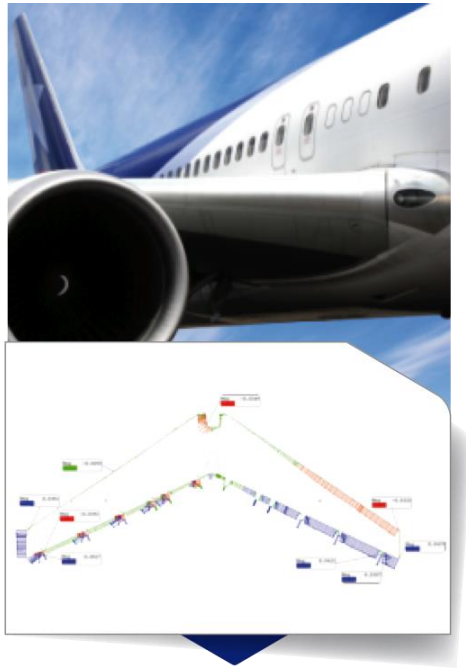
- Responsibility
- Respect
- Honesty

** ROVAT = ROyal Visit Any Time*

MAIN SECTORS

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

argon MEASURING SOLUTIONS



Audi
TI Automotive
KAUTEX A Textron Company
voestalpine
INERGY
TE connectivity
TOWER AUTOMOTIVE

STORK Fokker
SAFRAN Techspace Aero
AIRBUS
Rolls-Royce
asco
S.A.B.C.A.
SONACA

SIEMENS
GDF SUEZ
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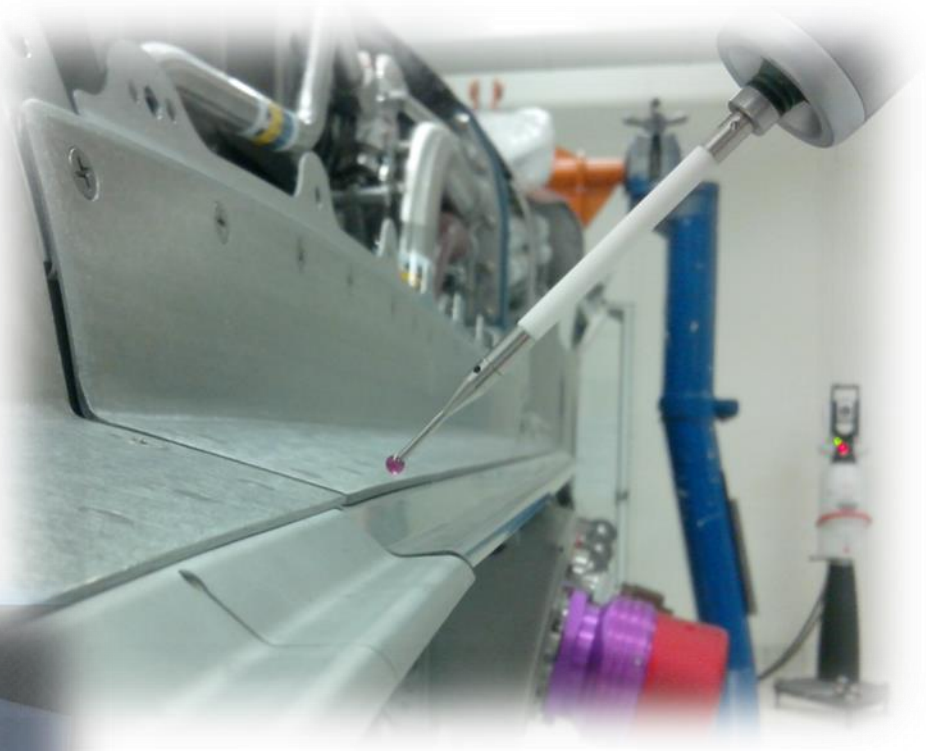
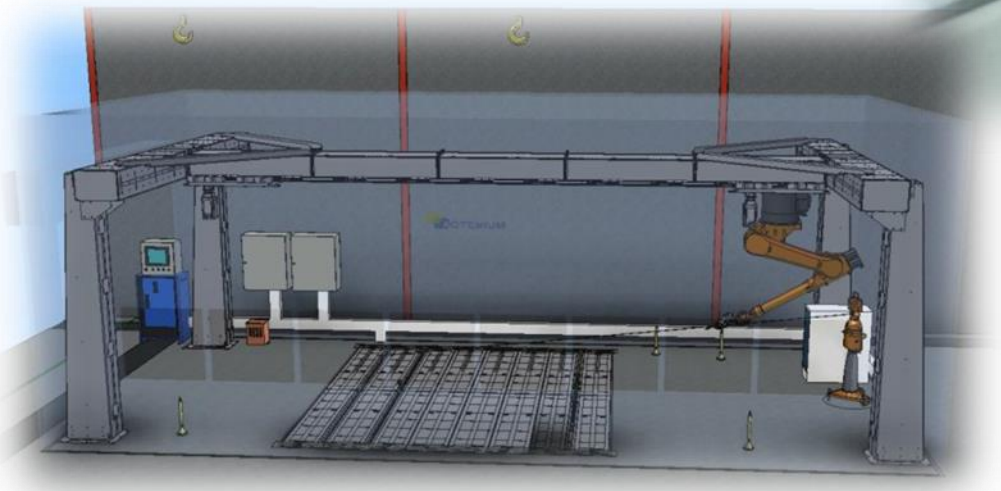
GE
MAN

CARscan

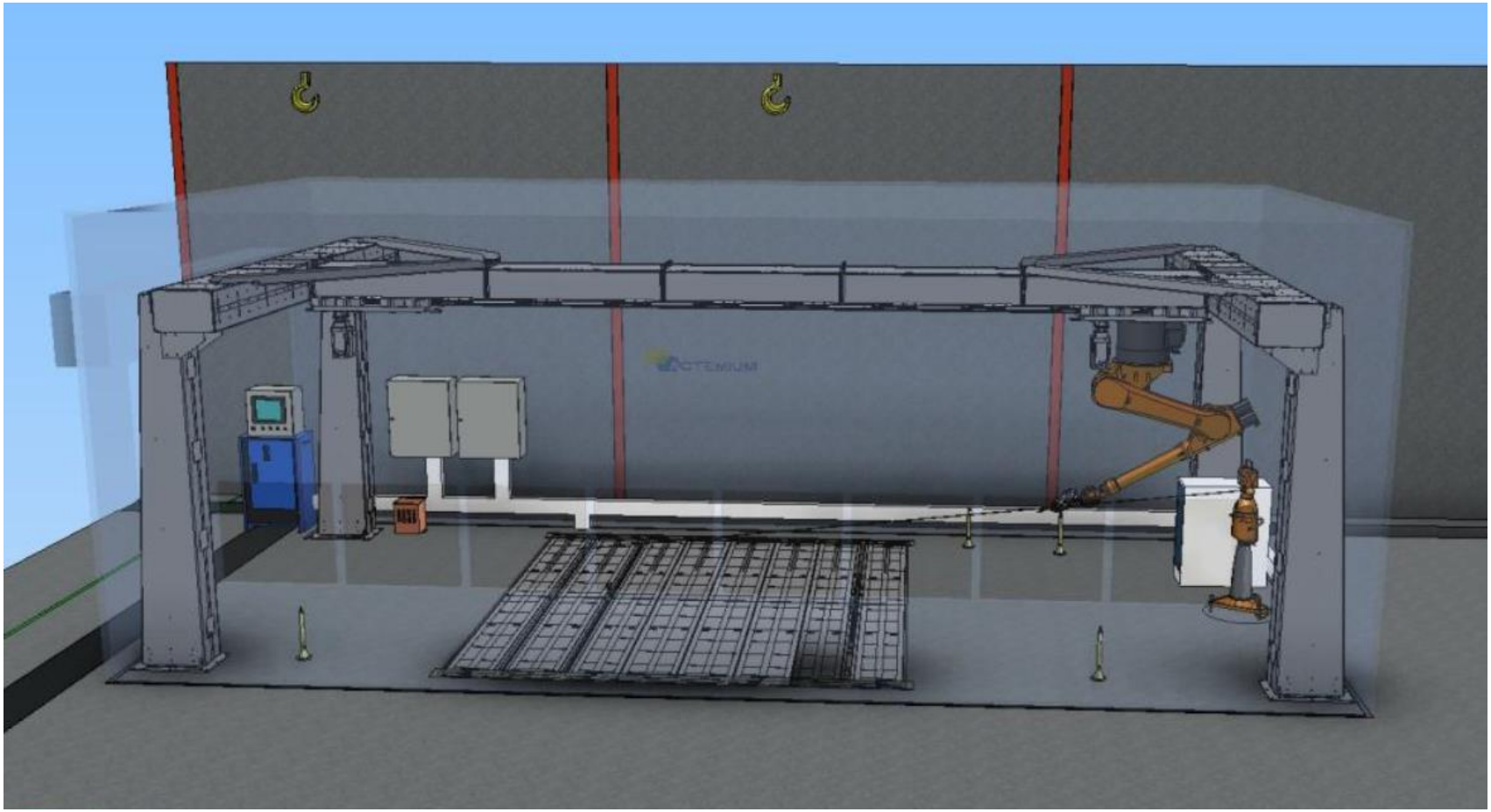

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION
argon
Audi
Vorsprung durch Technik
CARscan
in-line 3D Inspektion
für die Zukunft

CAMP – SA Automation (MP)





CAMP – SA Automation



CAMP – Measurement System

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

MEASURING SOLUTIONS argon

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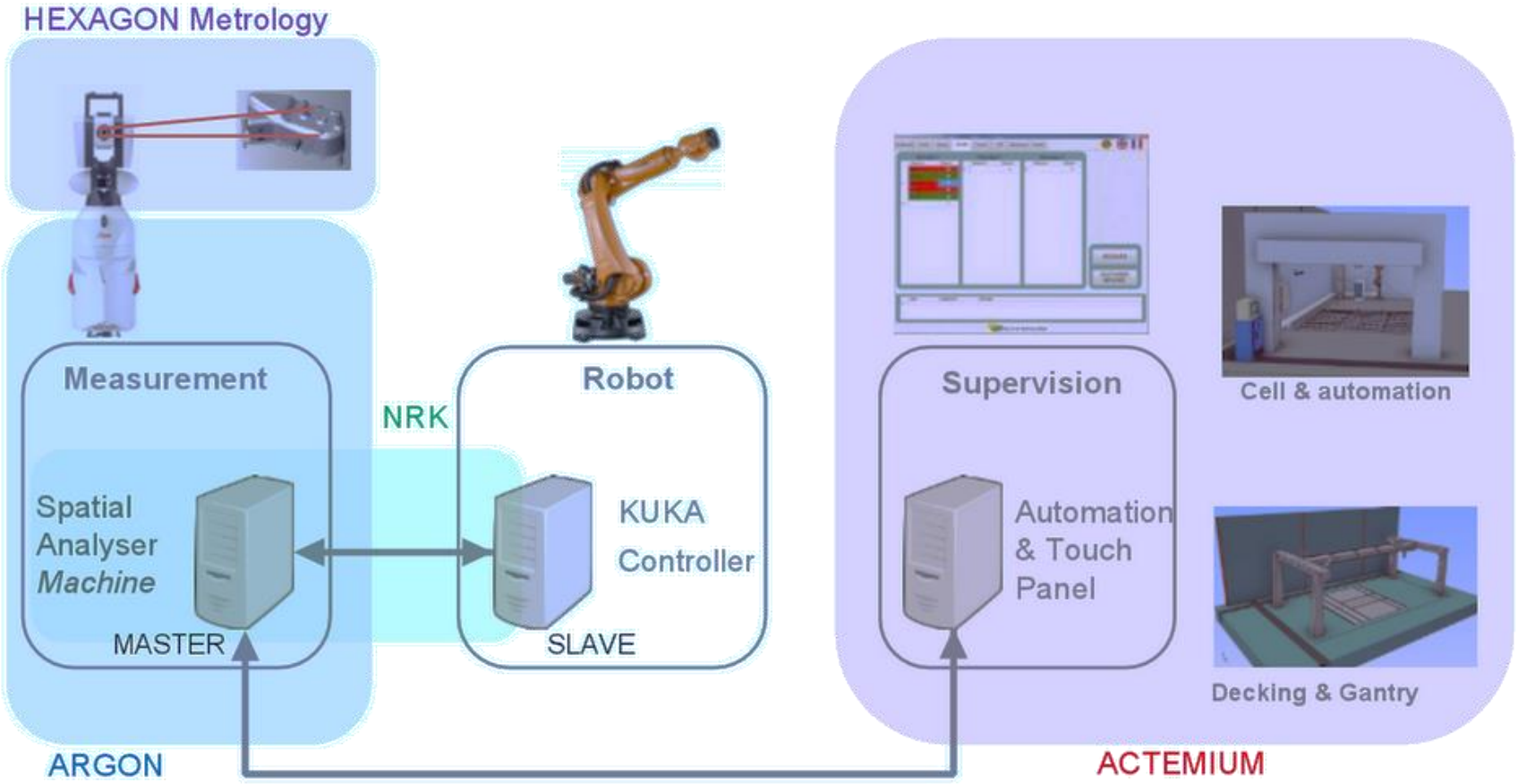
CAMP – System Overview



CAMP – SA Automation

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

argon MEASURING SOLUTIONS

	SA = Master	SA = Slave
Robot control	SA drives	Externally driven
Robot calibration of SA	Increased accuracy of robot positioning	Accuracy of default kinematic model
Measurement	Activated when needed	Waiting for triggers (unwanted triggers may occur)
Analysis + Export	V	V

CAMP – Measurement Procedure

Init.
- Prepare measurement cell for measurement
  - Initialize Laser Tracker, Robot
  - Measurement reference sphere → Check accuracy

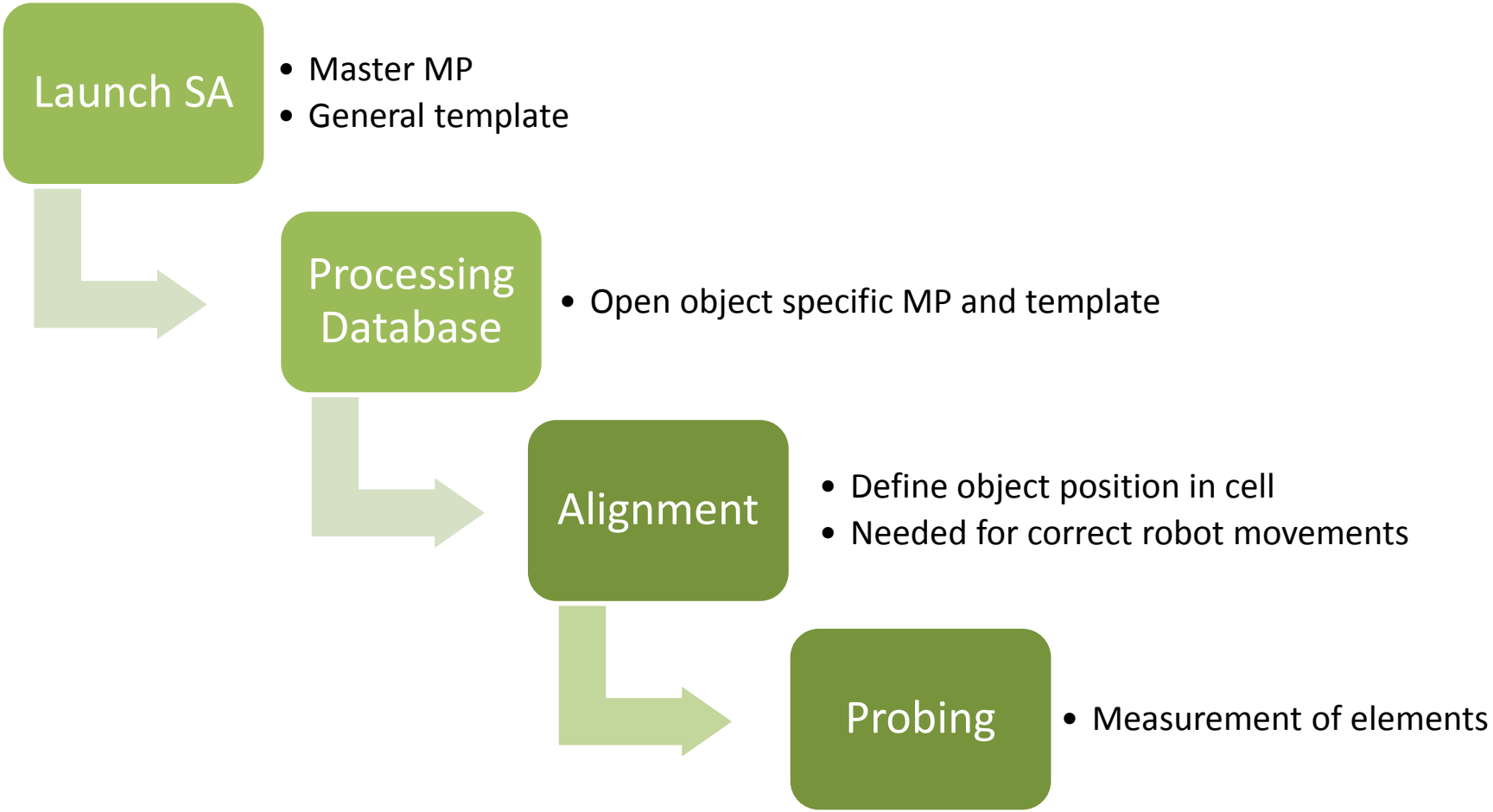
Input
- Serial number
- Object type

Meas.
- Processing Input
- Start object specific measurement plan

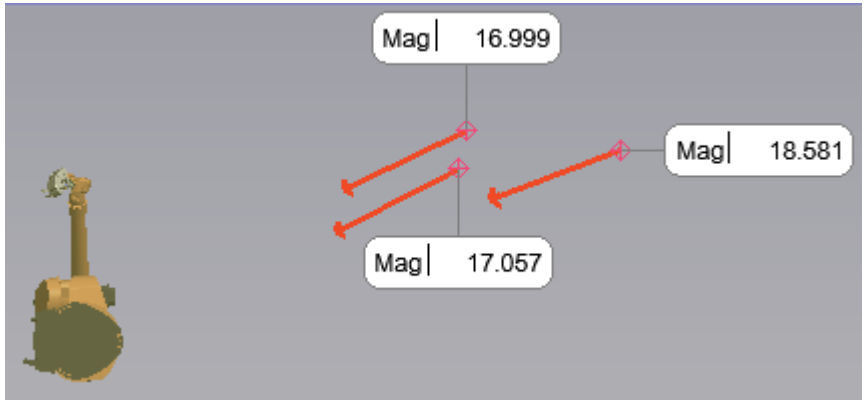
Output
- Excel / XML
- Verification

Decision
- Selective re-measurement
- End of measurement

CAMP – Measurement Procedure



CAMP – Object Alignment



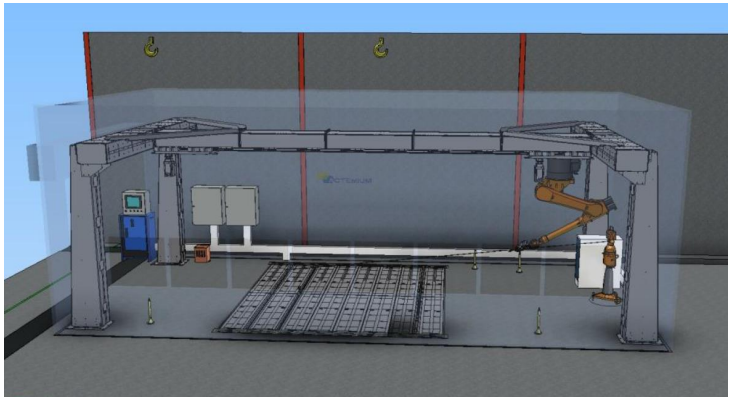
- Object ≠ Nominal
- Object variation
- Variation of fixture

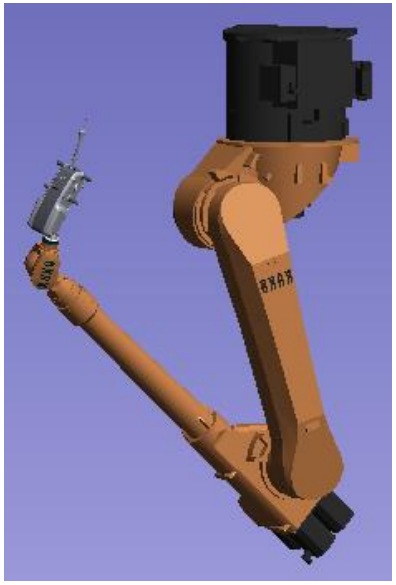
- Best Fit Alignment
  - Robot paths calculated for aligned object
  - Avoid collisions
  - Ensure triggers at expected locations
  - Include object check

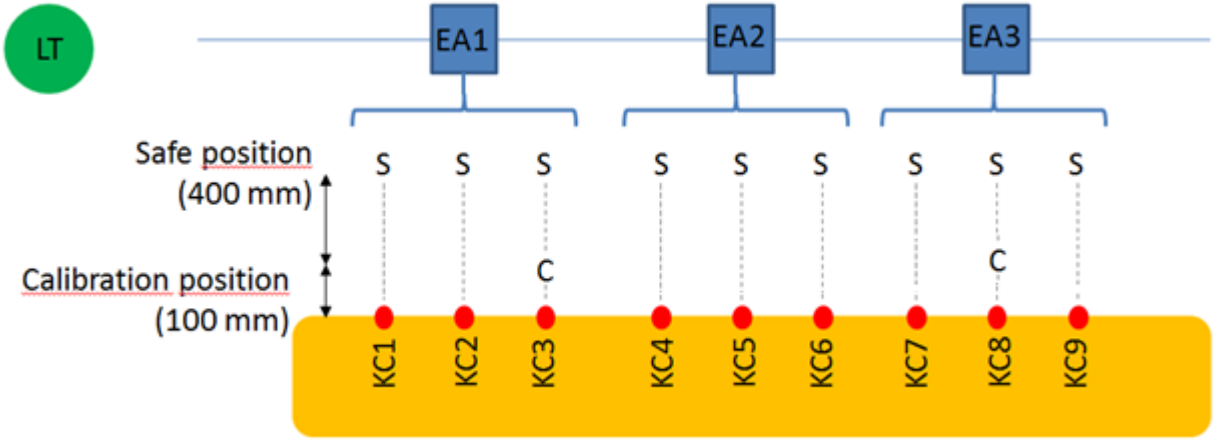
CAMP – Measurement Strategy

Element grouping in different external axis positions

- Fixed sequence
- Elements can be added/removed without influence on other EA positions
- Trigger only enabled when moving close to object

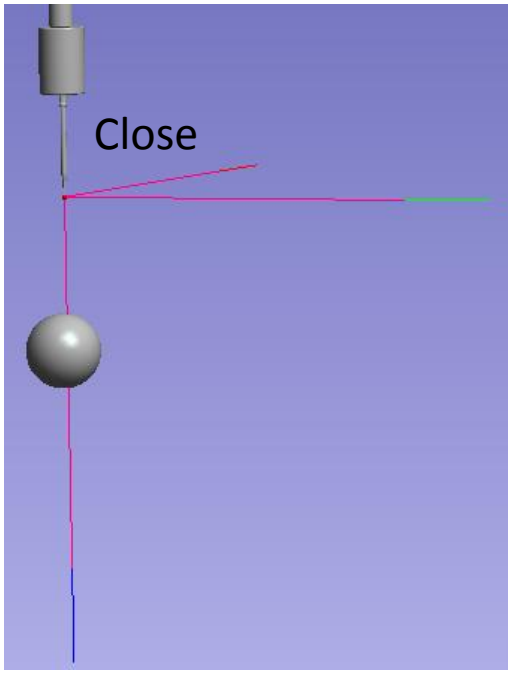


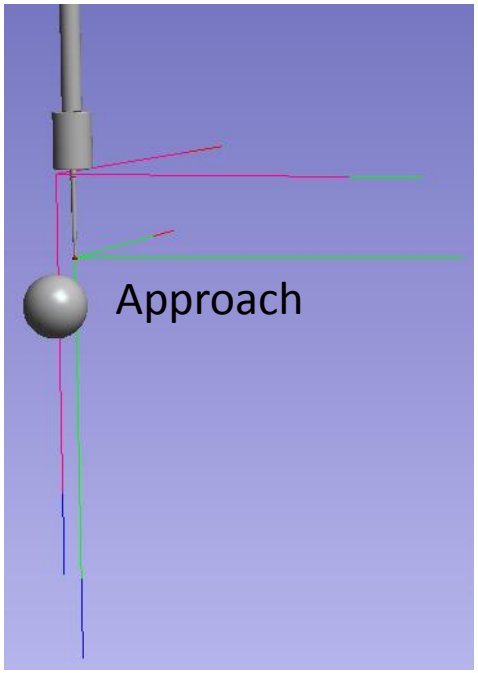




CAMP – Probing Strategy

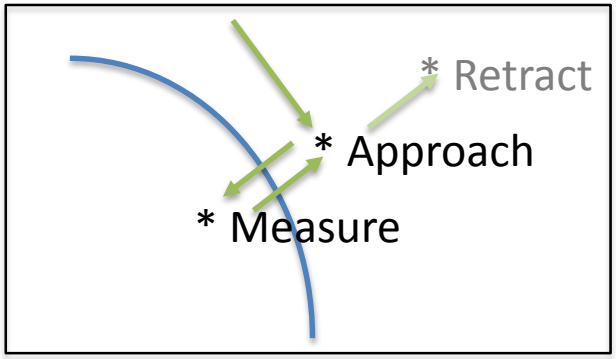
- Robot movement based on frames
  - End effector (Probe) moves towards commanded frame
  - SA sends XML-file to robot controller
    - Desired position
    - Velocity /acceleration
- Element measurement
  - Safe start position
  - Position close to element
  - Point measurements
    - Approach frame
    - Measurement frame
    - Retract frame
  - Return to safe position

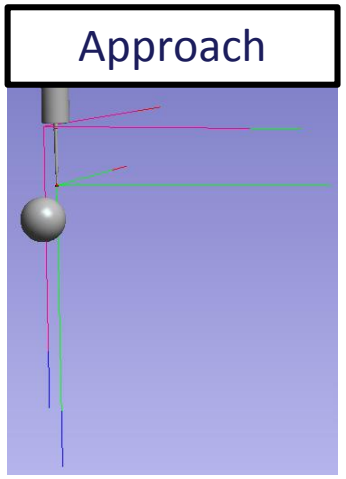


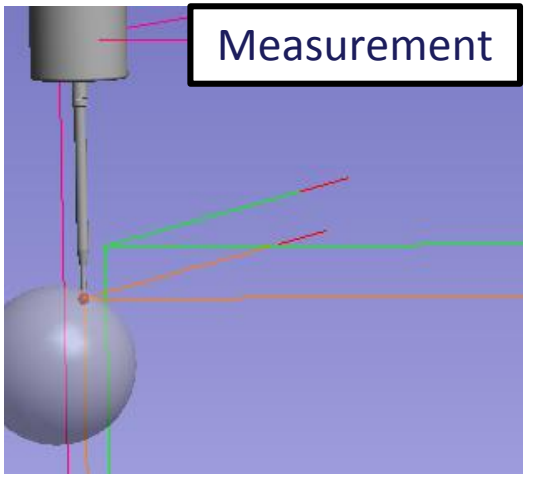


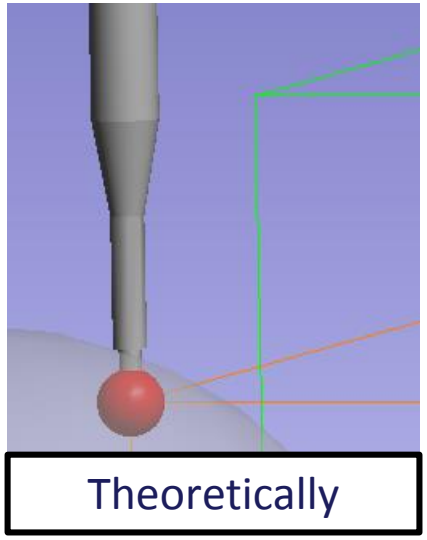
CAMP – Probing Strategy

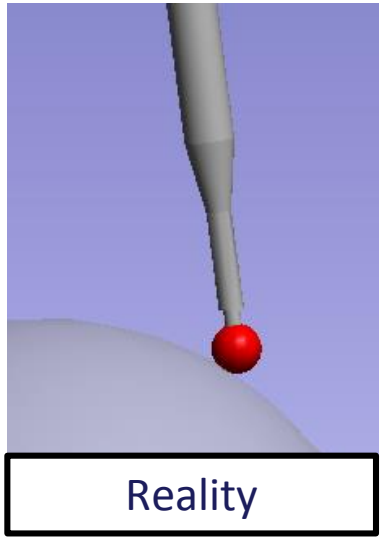
- Point measurements
  - Approach frame
  - Measurement frame
    - In surface to ensure trigger
    - Check if point is measured
    - Retract/Retry when needed
  - Retract frame
    - Automatic retract to approach
    - Declared retract frame











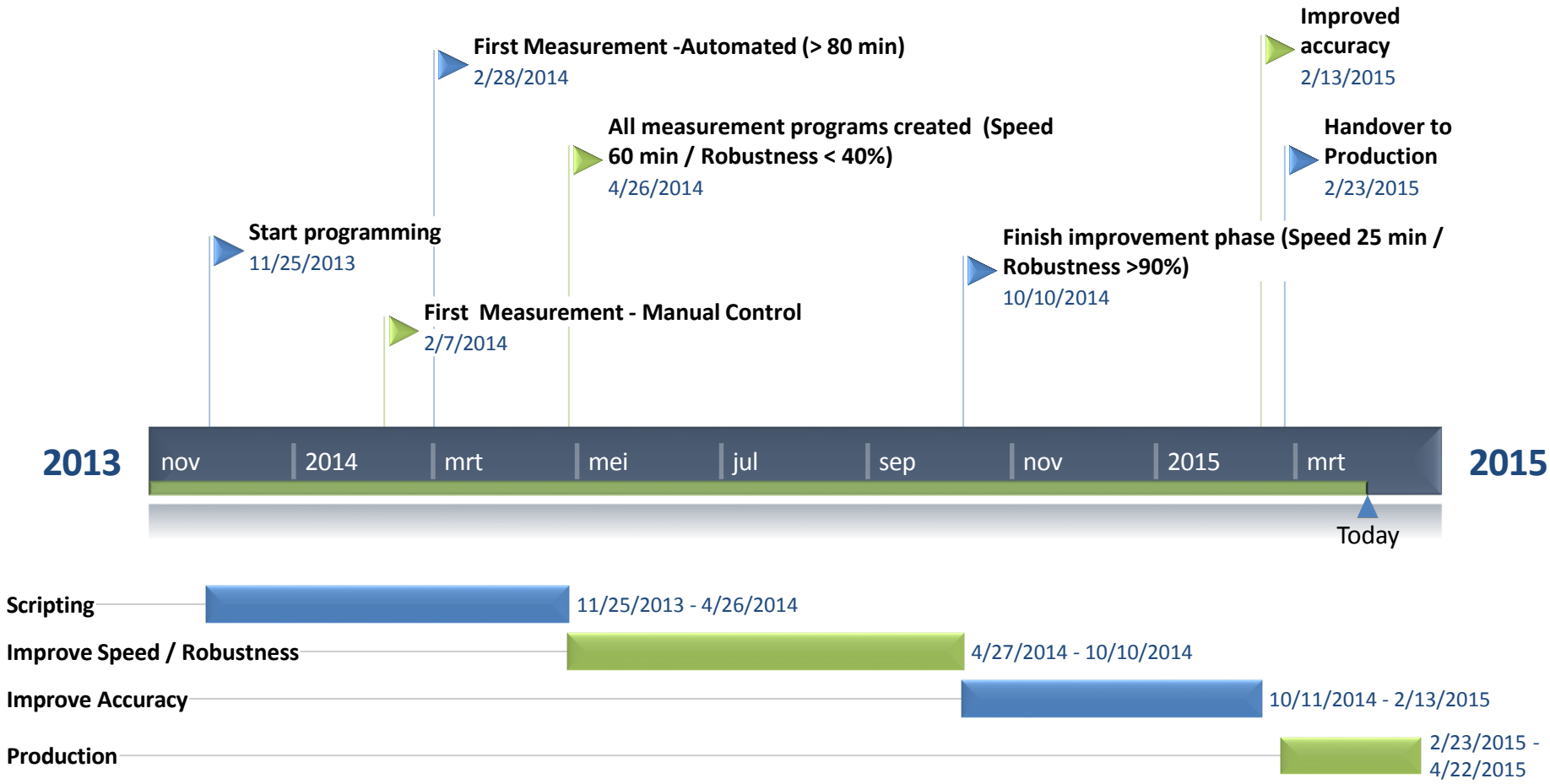
CAMP – Robot Calibration

T-Mac measurements to increase robot kinematic model

- Predefined calibration set
  - Set of measurements
    - 6-DOF measurement device
    - Different robot orientations
    - Kinematic model
  - Check/Update eg. Annually
  - Used for almost all elements
  - Different external axis positions

- Current robot position calibration
  - Measurement during process
    - 6-DOF measurement device
    - 1 or more points
    - Update kinematic model
  - Almost real-time updates possible
    - Actual deviation is taken into account
  - Can be done iterative
  - Used when high accuracy is needed
    - Eg. Difficult accessibility

CAMP – Timeline



CAMP – Client benefits

- **Increased Productivity**
  - Sharp reduction in inspection time : 90 min ➔ 30 min
  - Throughput has increased but minimum factor 2

- **High Robustness** (towards 99%)
  - All possible error sources have been eliminated
  - Measurement capacity available 24/7/365d

- **Increased Accuracy**
  - Automated cell 20% more accurate than manual set up

- **Simplicity: Coffee machine** principle
  - System has a high user friendlyness: suitable shop floor operator

Living our values during the Project

PROCESS INNOVATION
THROUGH MEASUREMENT
INTEGRATION

MEASURING SOLUTIONS argon

INNOVATION

- Project executed at Technological Frontier
- Continouse Improvements together with NRK-Airbus on SA Machine

EXCELLENCE

- Project is a World Premiere
- Generic Scripting applied for Copy/Paste to new Programmes

PASSION

- Kept on going even under must difficult of conditions: 6 weeks became 56 weeks ...
- Coping Workload
- Fruitful Collaboration NRK - Airbus

TRUST

- ARGON took responsibility at all times
- Honest communication about status

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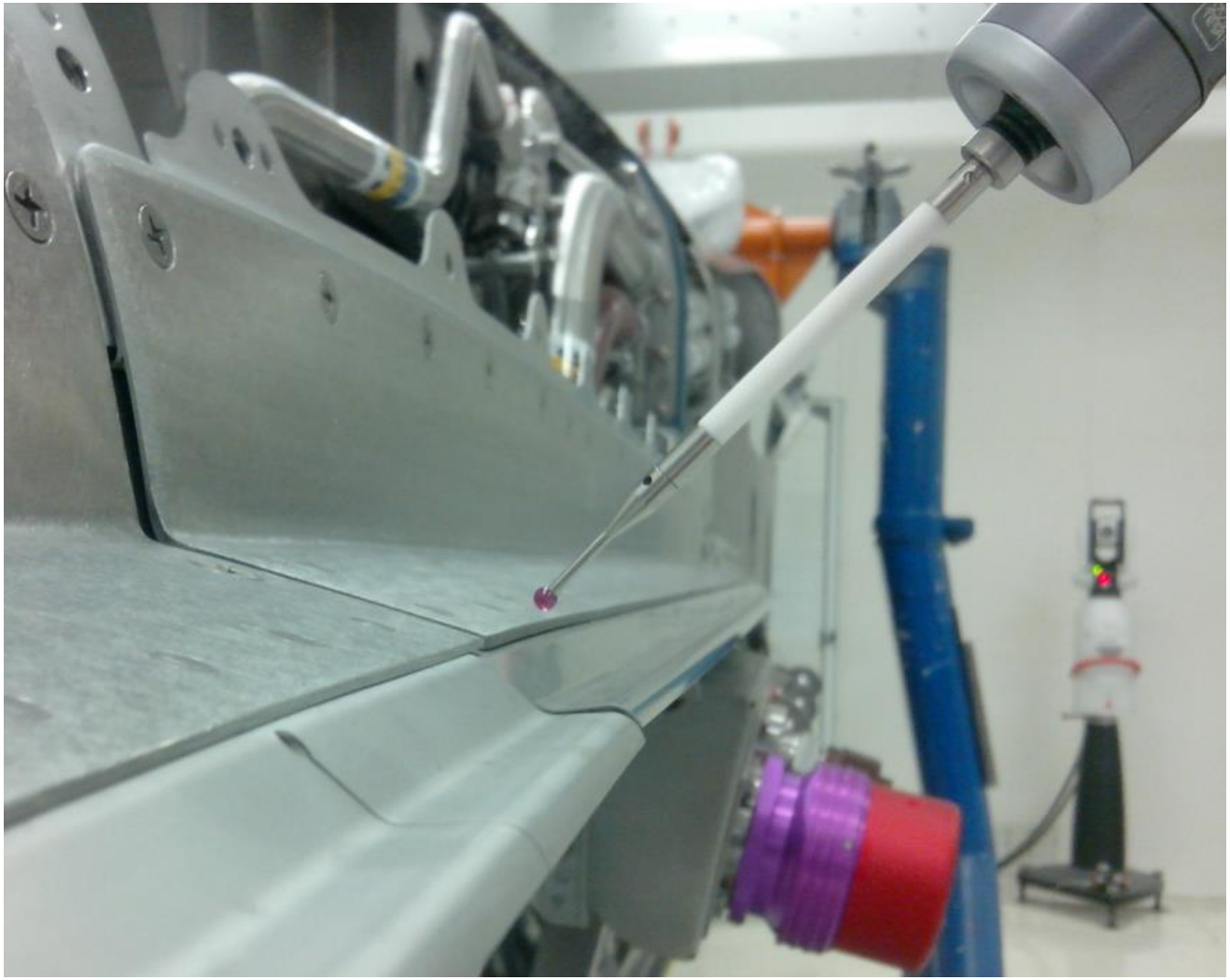
Impressions of the automated cell

CAMP – Questions?



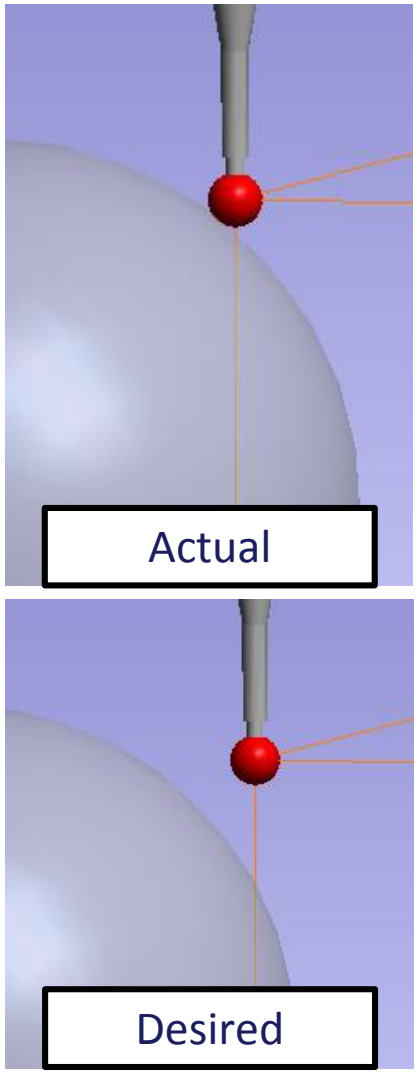
CAMP – Appedices

- Robot Calibration
- ARGON - BEFI

CAMP – Robot Calibration

- Robot = repeatable, not accurate
- SA robot calibration increases the accuracy of positioning

- Difference between desired position and real position
  - According to SA, robot always arrives in goalframe
  - Deviation to goalframe can be up to 5 mm (0,2 inch)
    - Depending on quality of kinematic model
  - Robot calibration → more accurate kinematic model
    - SA Machine tells the controller where the robot ought to go
    - Deviatons < 0,25 mm (0,01 inch) can be reached



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