VOLKSWAGEN

AKTIENGESELLSCHAFT

Interaction Requirements for the Comparison of Target and Actual Components

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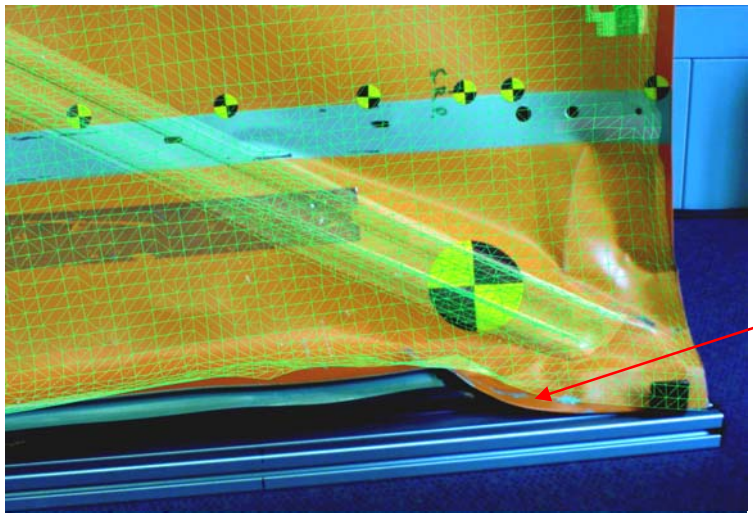
Method of comparing target and actual components

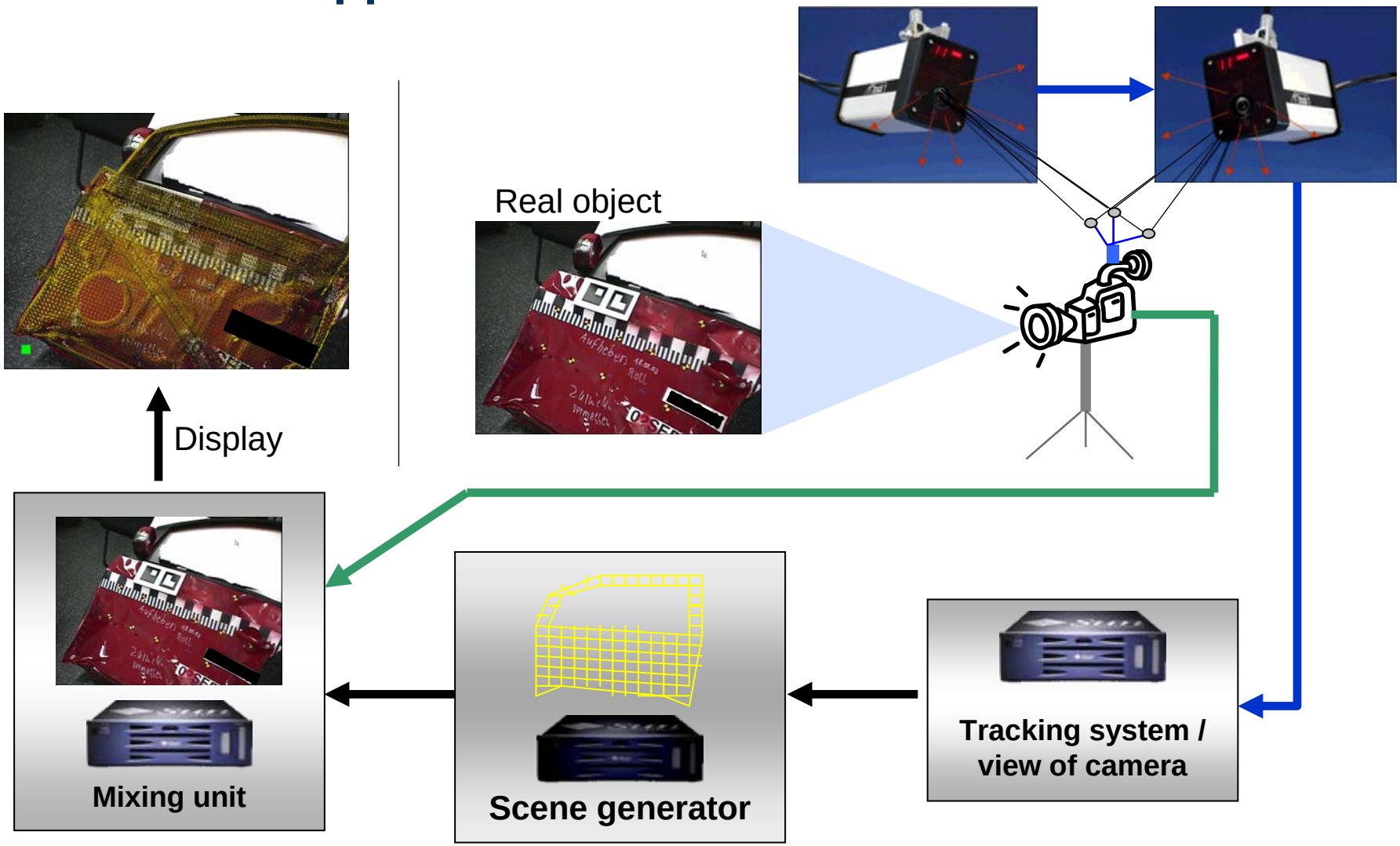
- **Idea:** superimposing virtual simulation data on the real part to compare aspects of fitting and quality



How can this gap be measured?

- **Necessary**: a kind of *measuring interaction* between real und virtual data

Function of the application



What do we need for distance measuring?

- We have to select a point on the virtual simulation data
  => Usually this will be done by picking in an editor for virtual data

- We have to select a point on the real part of the car
  => Usually this will be done by selecting a surface point with a measured tip

- How can this be done in an augmented reality environment?

Based on the above, we need:

1. A tracked device to select points on the real part
2. An interaction method for picking virtual points in the same application environment

Existing devices, first try

- Flystick from A.R.T.

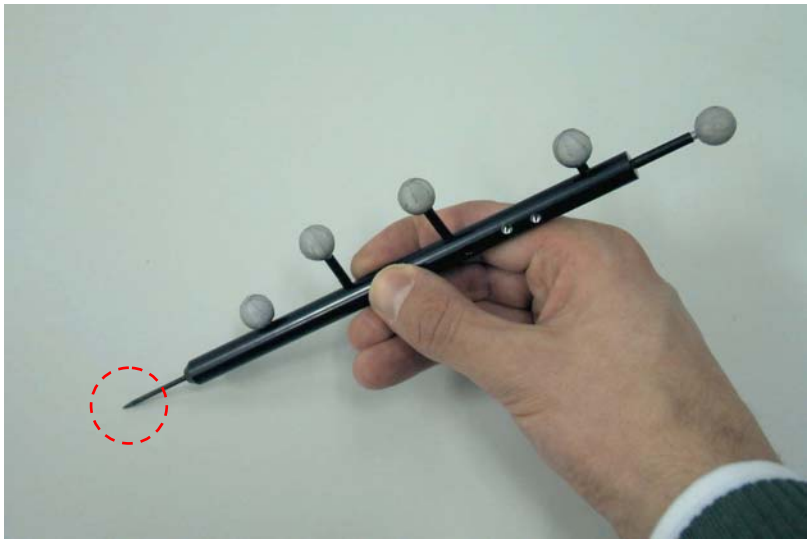
- The origin of the A.R.T. tracking sensor is calibrated to the middle of the front sphere
- Buttons of the Flystick can be used to control interactions

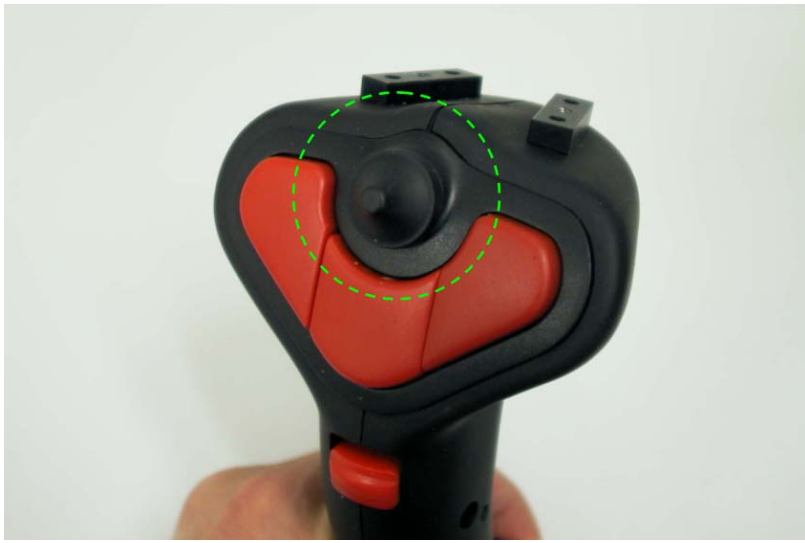
Disadvantage: 1. The Sphere is not suitable for exactly measuring surface points
2. It is not able to measure in/ between small gaps
3. Pushing the buttons can influence the position due to vibrations

Existing devices, second (successful) try

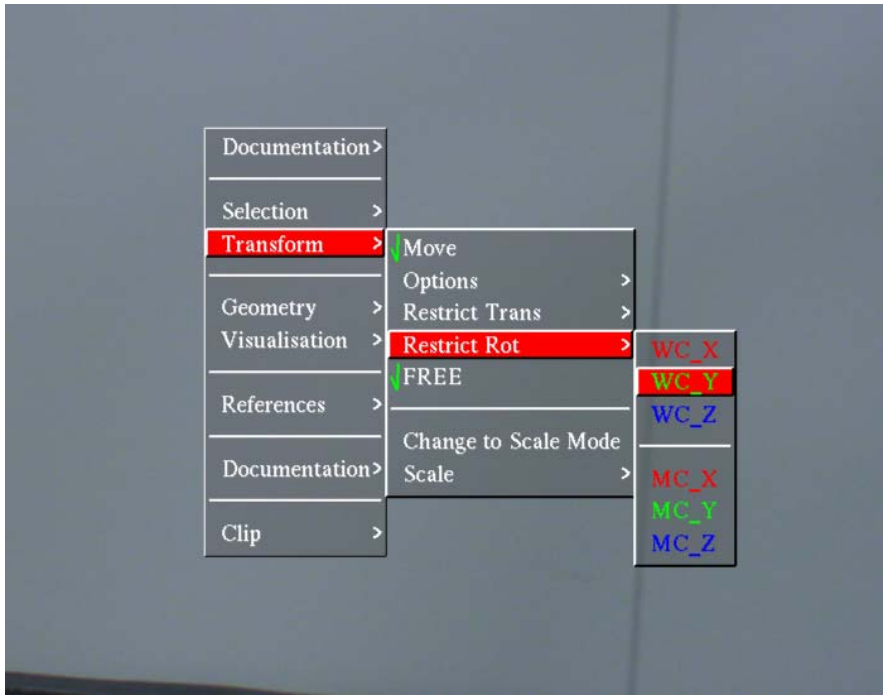
- Flystick from A.R.T. without tracking sensor
- Tracked feeler pin from A.R.T.

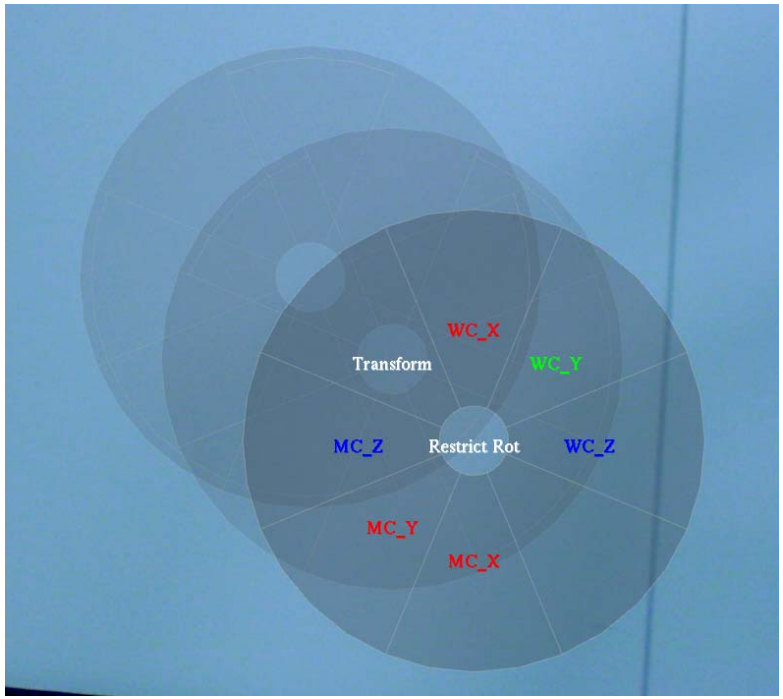
- The position of the feeler pin is calibrated to the tip
- Flystick is simply used to control interactions





Menu style





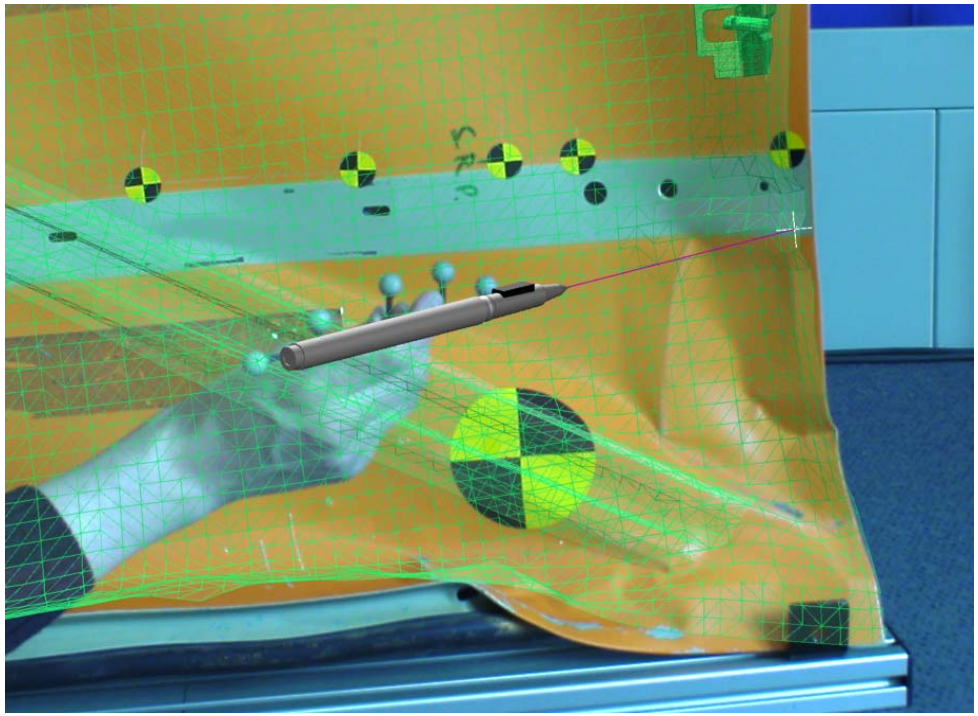
- With its four directions the small joystick of the A.R.T. Flystick is capable of navigating in a classic pop-up menu structure

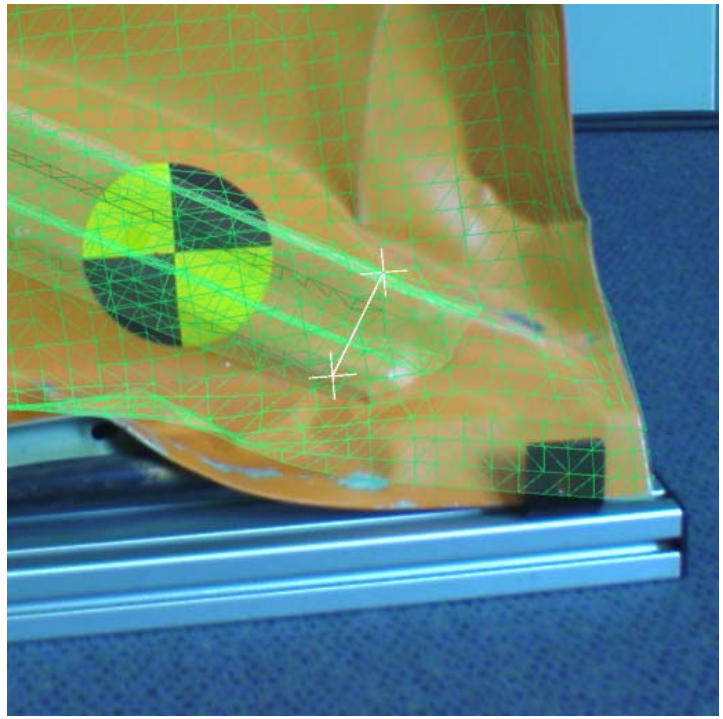
Measuring task (real points)

1. Moving the tip of the feeler pin to the surface point of the real part
2. Pushing the „measure“ button on the Flystick to confirm this position
3. The position of the tip, measured by the A.R.T. System, will be stored

Measuring task (virtual points in the application environment)

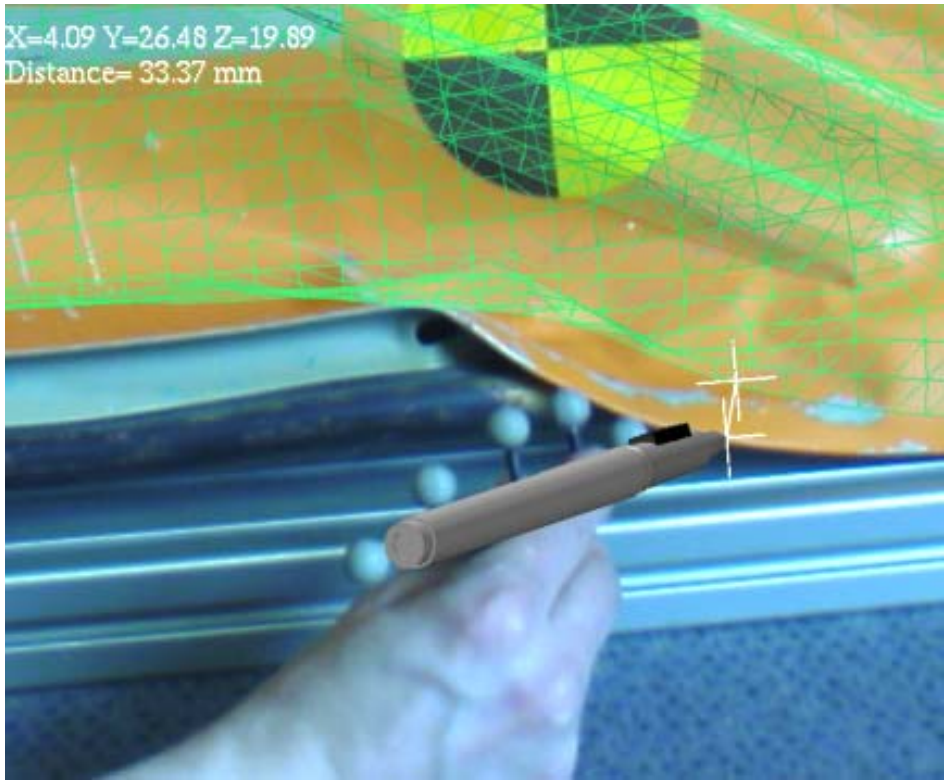
1. Using a **virtual ray** for picking
2. Virtual ray comes out of the tip of the feeler pin
3. The picking point will be selected by intersection of the ray and a virtual surface
4. Pushing the „measure“ button on the Flystick to confirm this position
5. The position of the intersection will be stored





Measuring task (distance between virtual and real points)

1. Idea: just mixing both methods in one interaction task
2. Using a virtual ray for picking a virtual surface point
3. Moving the tip of the feeler pin to the surface point of the real part
4. The distance between real part an virtual data can be estimated



Summary

- Combining an A.R.T. Flystick for controlling the application and
  an A.R.T. feeler pin for measuring

- The feeler pin is used to select virtual and real points in the same environment

- Pushing buttons on the Flystick do not influence the measured position
  caused by possible vibrations

- Measuring of distances between real and real points
  Measuring of distances between virtual and virtual points
  Measuring of distances between **real and virtual** points

- No special devices have to be developed

- User can learn interaction method within 1 hour

General requirements of Volkswagen on VT applications

- Virtual techniques are tools in the process of the product development process
- Important decisions can be based on the use of virtual techniques
- There will be a high rating of the potential of virtual techniques along the whole process chain like development, production and service
- **The reliability of decisions using virtual techniques needs to be optimized!**

General requirements of Volkswagen on AR applications

- Using HD input and output devices to increase resolution
  (Ethernet cameras, HDTV cameras, HD projection walls, etc.)
- Using more realistic lighting and shadowing for virtual objects
  (realtime ray tracing, modern shading methods, HDR techniques)
- Increasing the accuracy of tracking and overlaying
  (for example, a shift of about 5mm of a virtual rim superimposed by a real car is perceptible and will change the appearance of the whole car)
- Increasing the robustness of AR systems in terms of temperature, lighting, dirt, vibrations and wrong operations by the user
- Increasing the ergonomics of AR systems: Users do not want to change their behavior and operation process. Users want to use AR like MS Office!