



Eine Open-Source-Software für Industriemesssysteme



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Übersicht

Rahmenveranstaltung:

„Halbjährige Projektarbeit des Masterstudiengangs Geoinformatik und Vermessung“ (3 Studenten - je 540 Stunden Workload)

Angeregt und unterstützt durch die sigma3D GmbH

Gesamtziele:

„Eine leicht erweiterbare Softwarelösung für die 3D-Objekt Erfassung und Auswertung im Anwendungsbereich der Forschung, Lehre und Praxis“

„Studierenden Kenntnisse in den Bereichen Softwareengineering und Industrievermessung vermitteln“

Ziel der Projektarbeit:

Modellierung des „Grundkonzepts“ -> Entwicklung einer ersten Evolutionsstufe

Lizenz

GNU Lesser General Public License (LGPL)

Genutzte Open Source IDE: Qt/Qt Creator (C++ Framework)

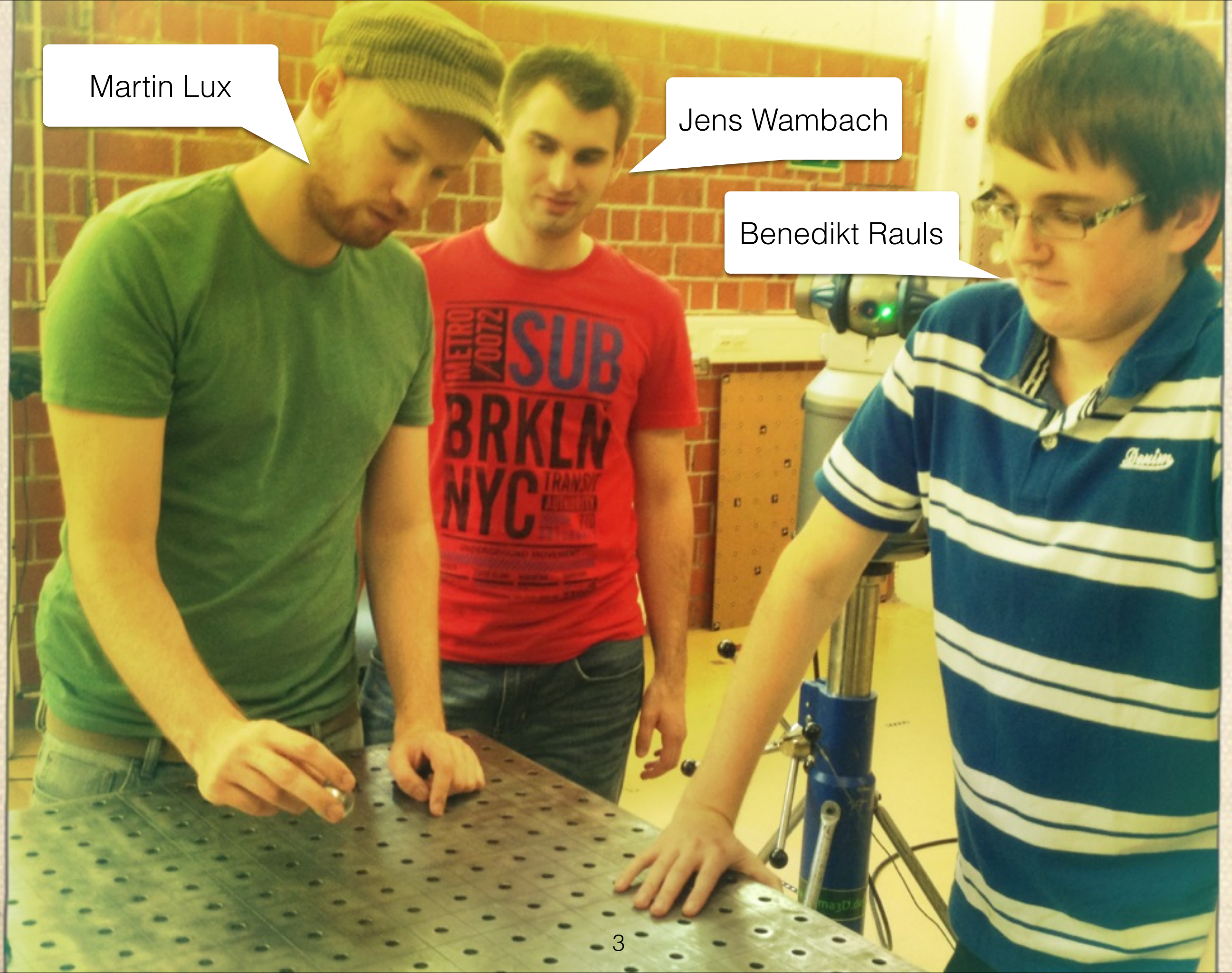
Social coding Plattform auf Github:

<https://github.com/OpenIndy>

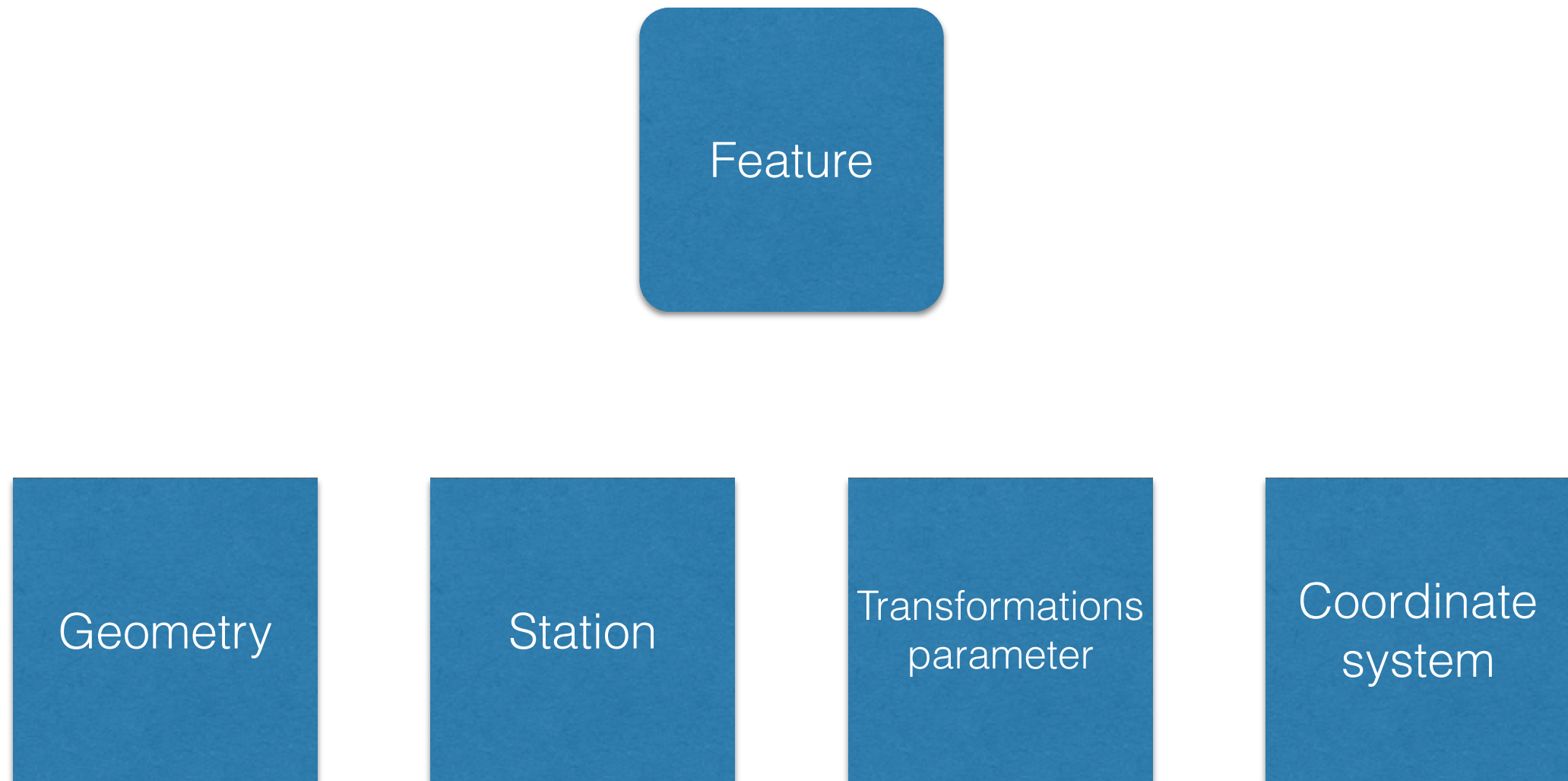
Martin Lux

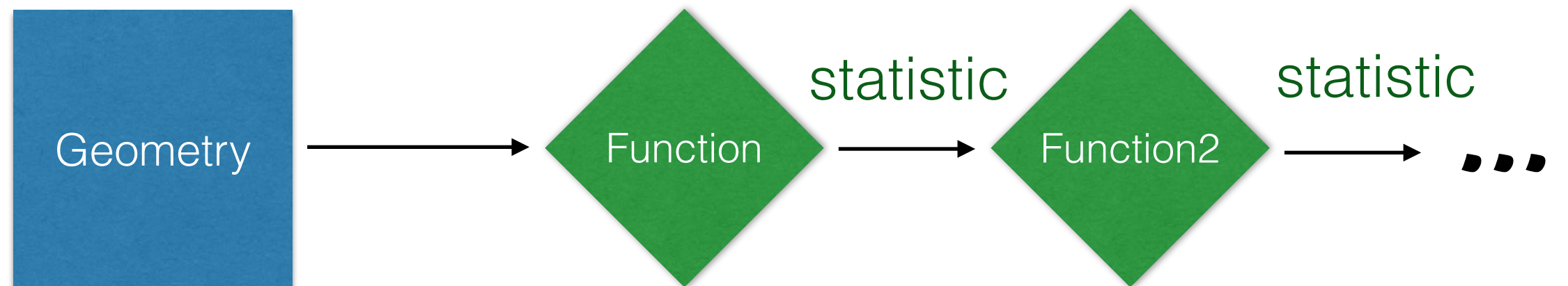
Jens Wambach

Benedikt Rauls



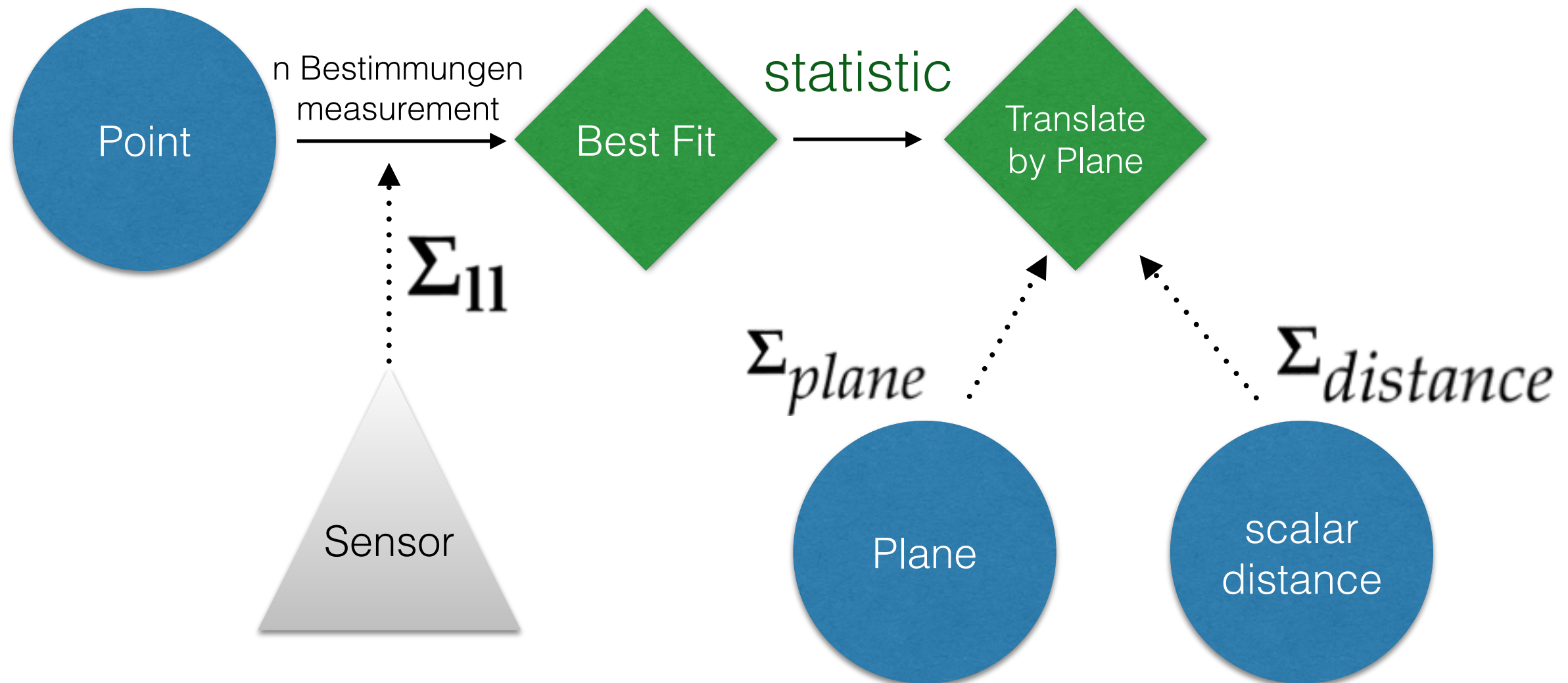
Konzept





$$\Sigma_{xx} = \mathbf{F}_{fit} \cdot \Sigma_{ll} \cdot \mathbf{F}_{fit}^T$$

$$\Sigma_{ff} = \mathbf{F}_{trans} \cdot \Sigma_{plane,distance,xx} \cdot \mathbf{F}_{trans}^T$$



Anwendungsbeispiel

Aufgabe:

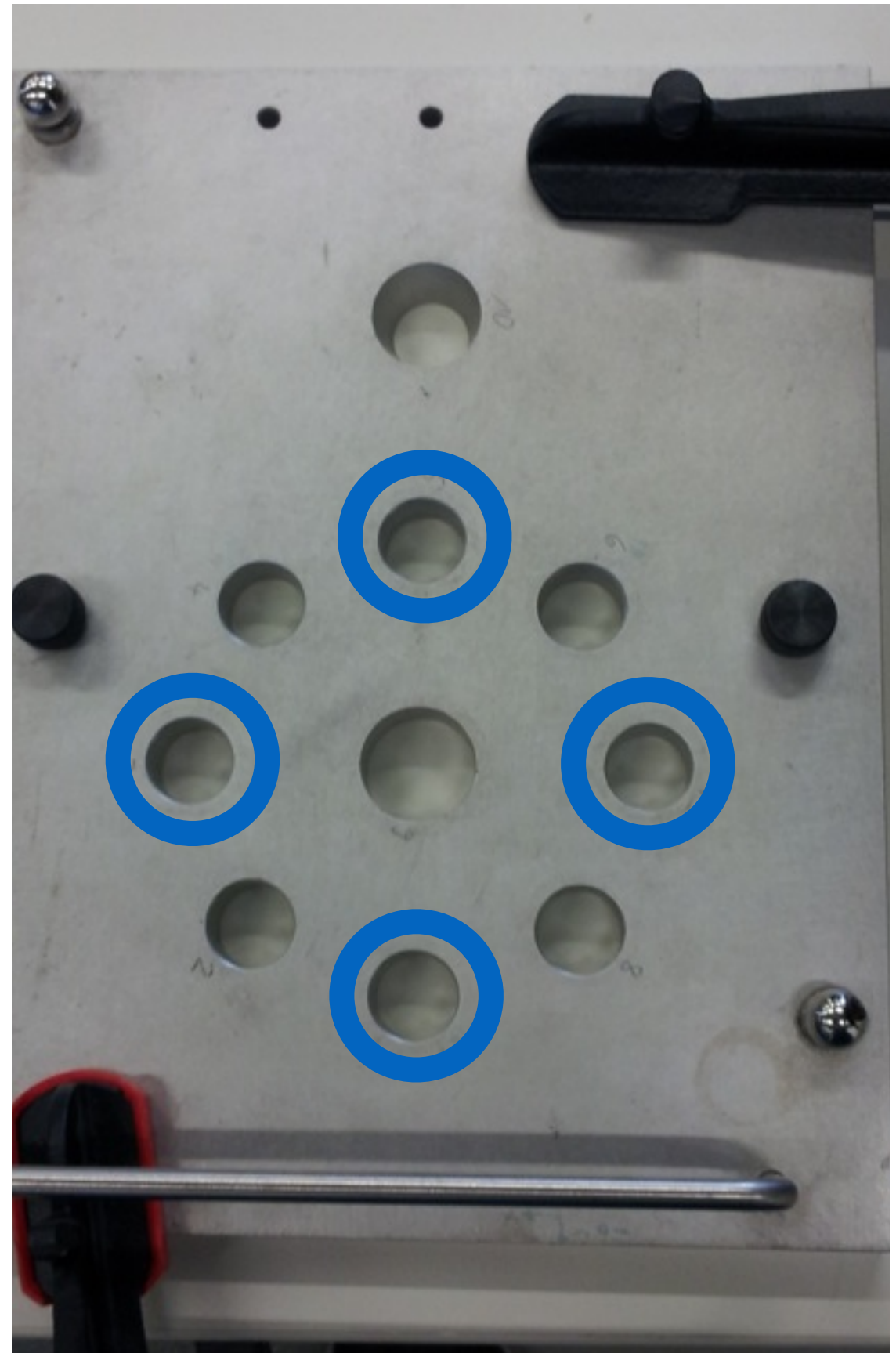
Mittelpunktsbestimmung der Bohrungen in Bezug auf „CAD-Solldaten“

Vorgehensweise:

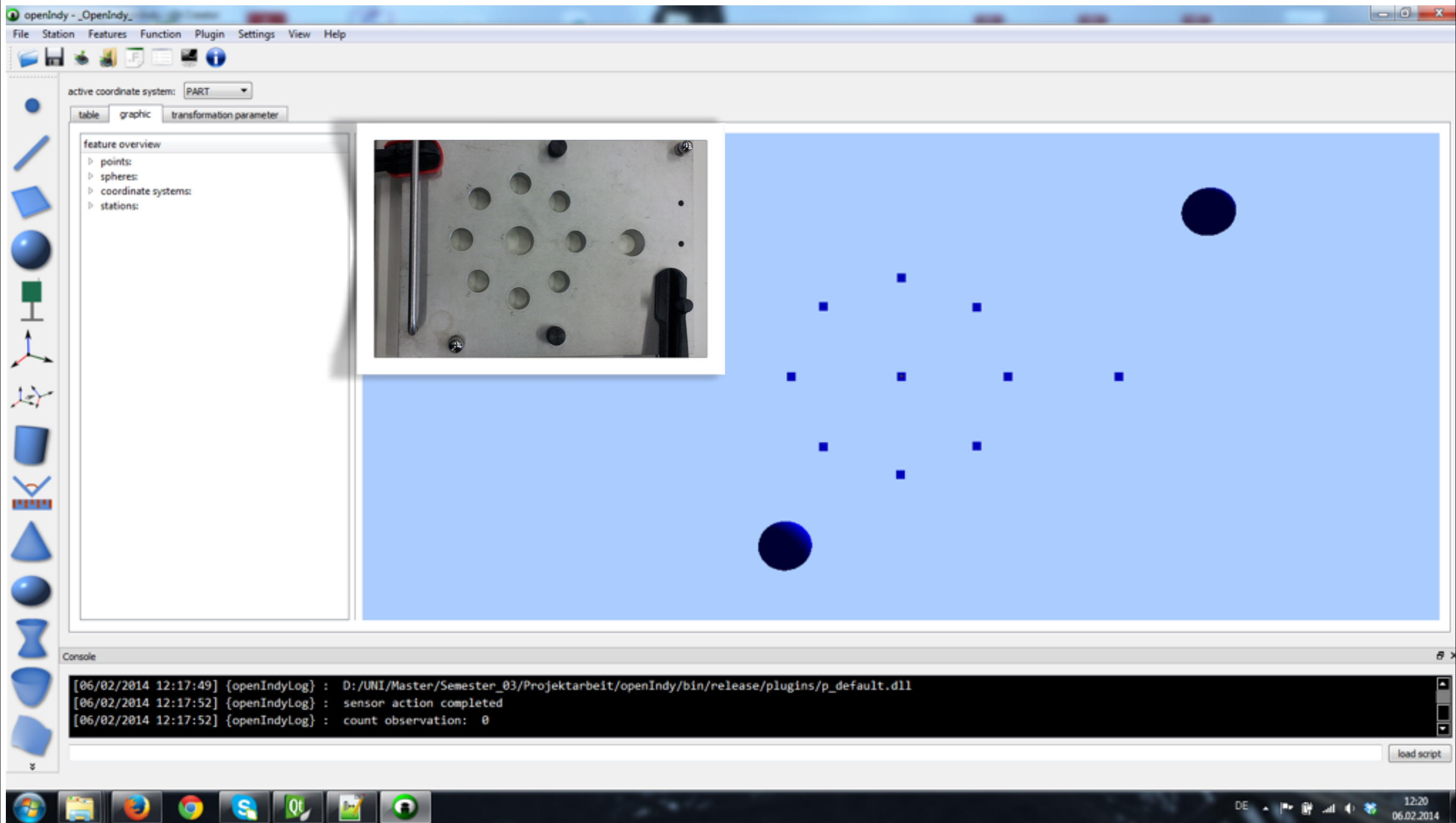
Sollkoordinaten einlesen

Punkte mit Hilfe eines Tachymeters und Kugelreflektor messen.

Transformation über **Passpunkte** in das CAD-System



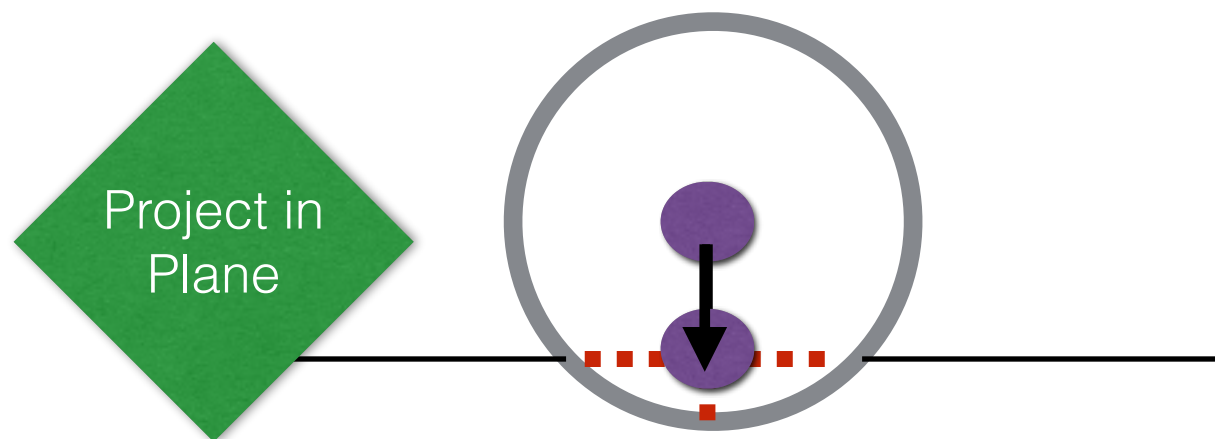
Sollkoordinaten einlesen



Punktmessung

Messung der Grundebene

Messung des Punktes mit
anschließender Projektion in
die Grundebene



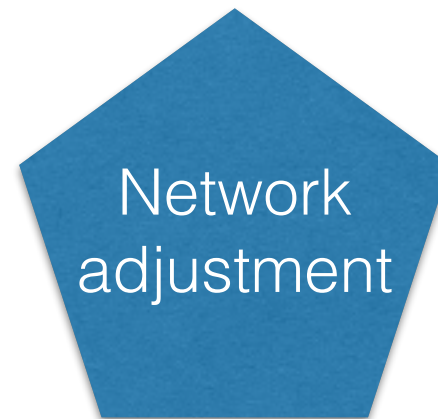
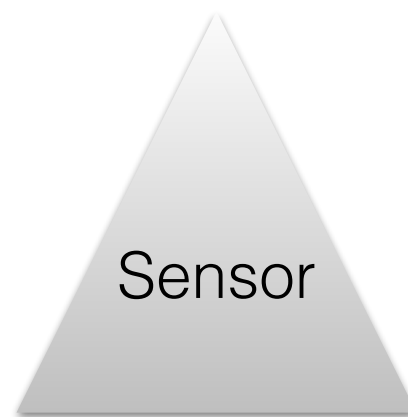
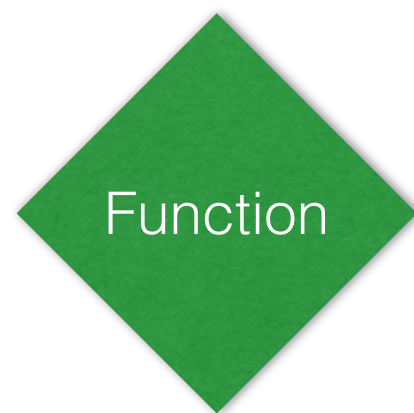
Transformation in das Objektkoordinatensystem



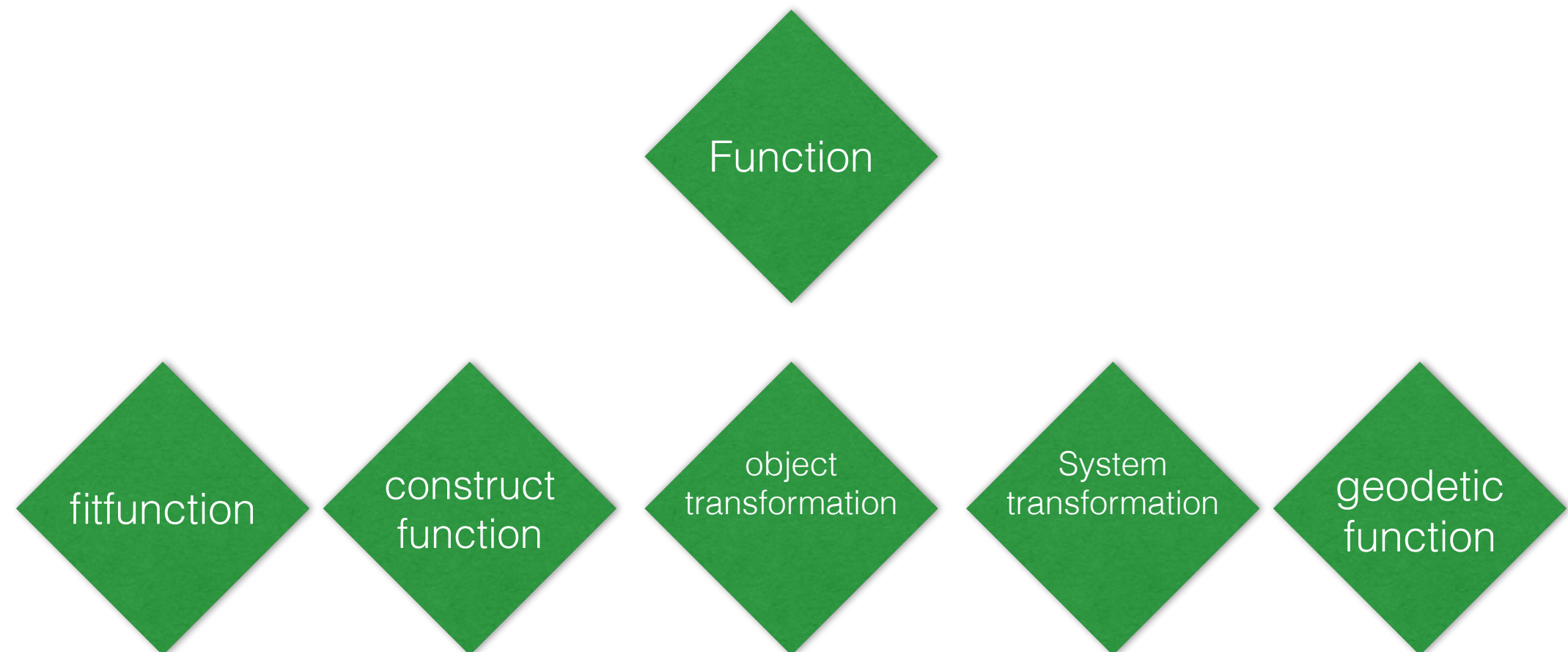


Feature name	X [mm]	Y [mm]	Z [mm]
p9 (actual)	-0.1188	0.1031	0.1953
p9 (nominal)	0.0000	0.0000	0.0000

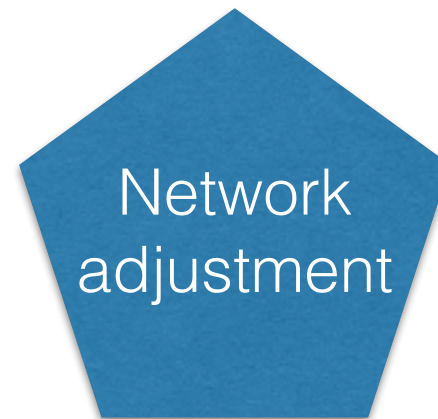
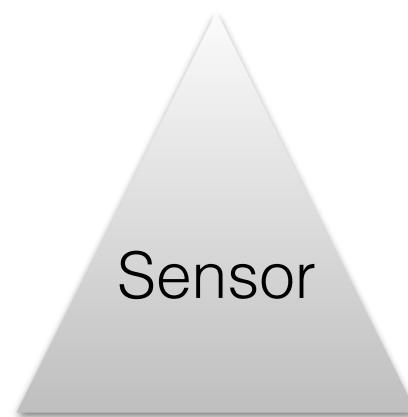
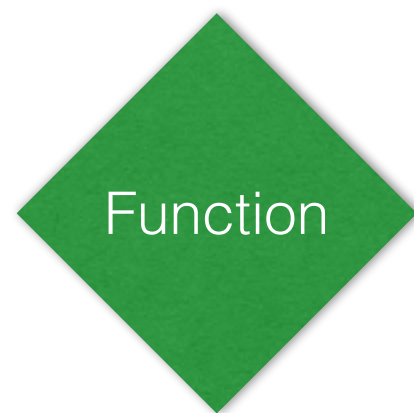
Plugins



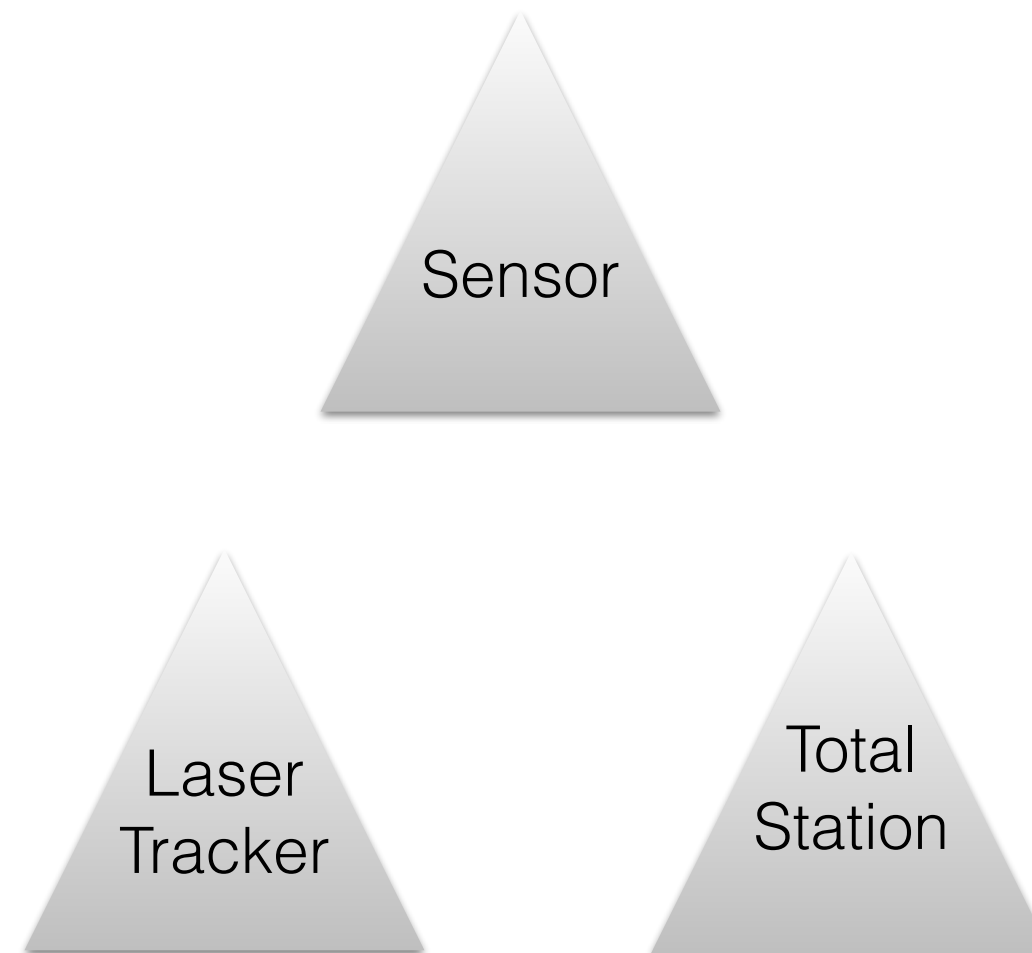
Zur Erweiterung der Auswertealgorithmen



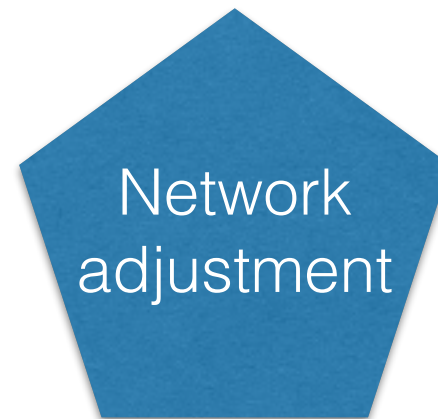
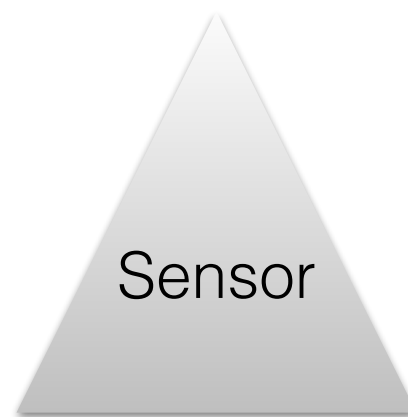
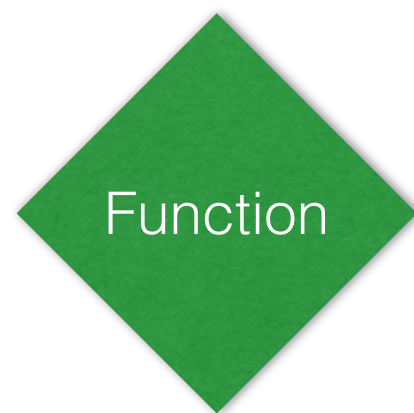
Plugins

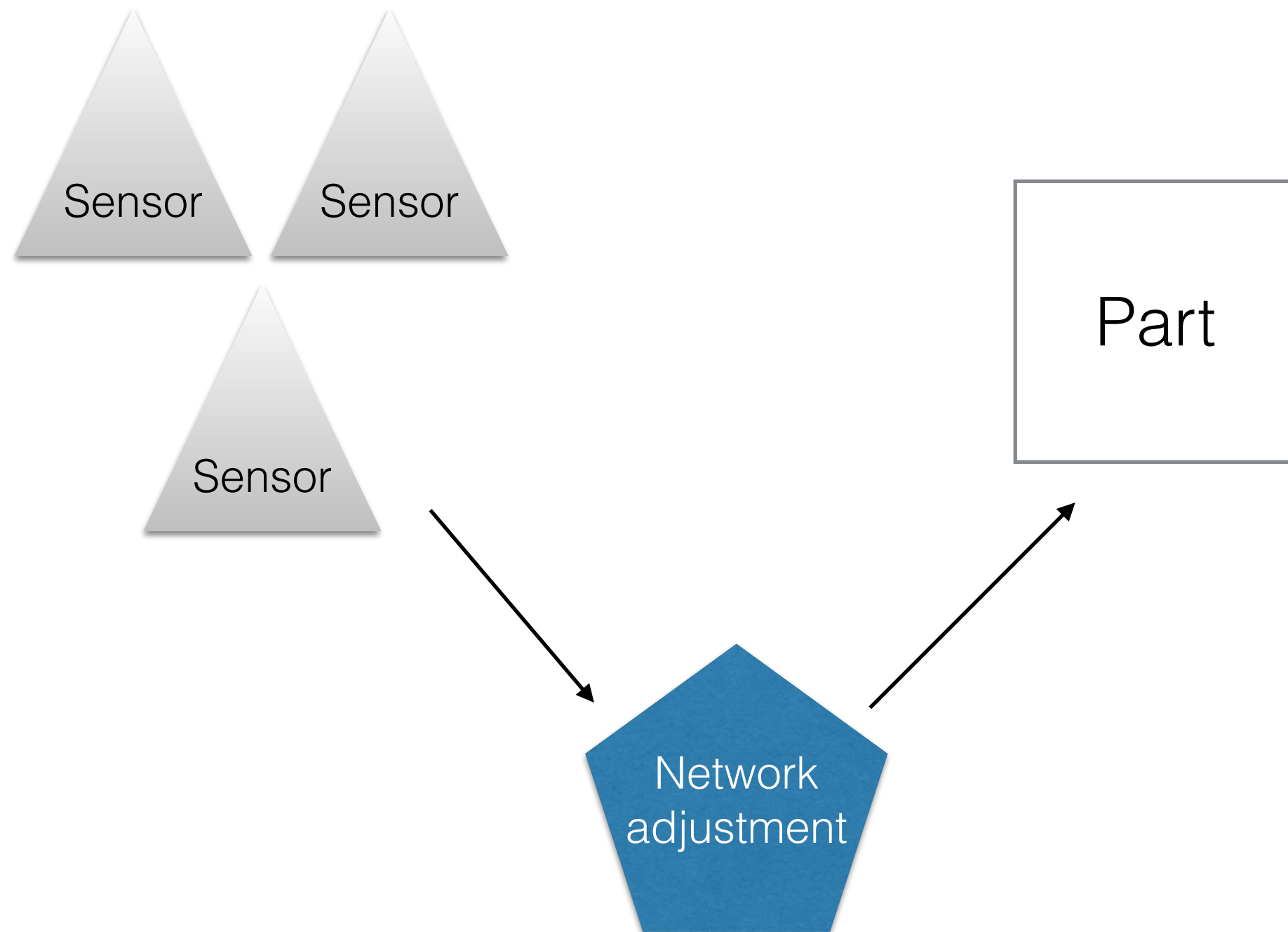


Für die Ansteuerung verschiedener Messinstrumente



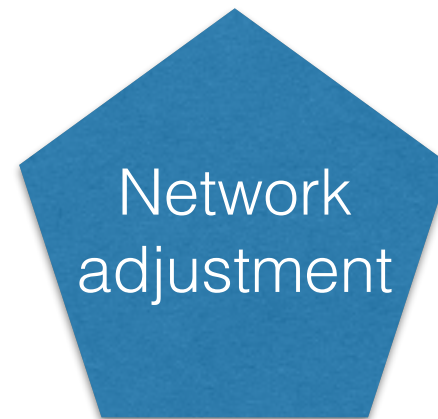
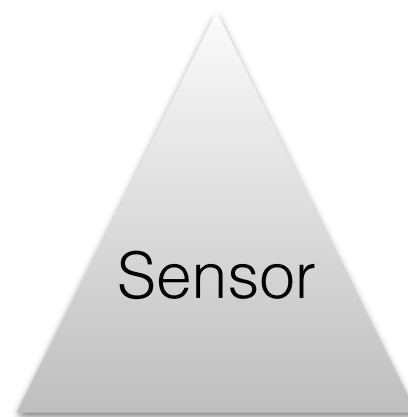
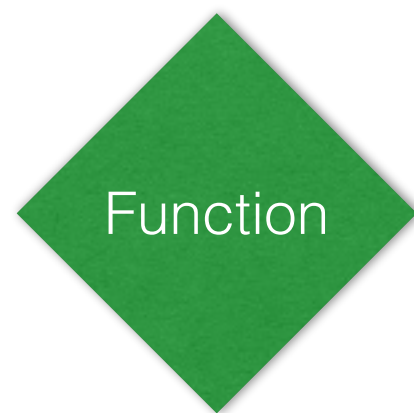
Plugins





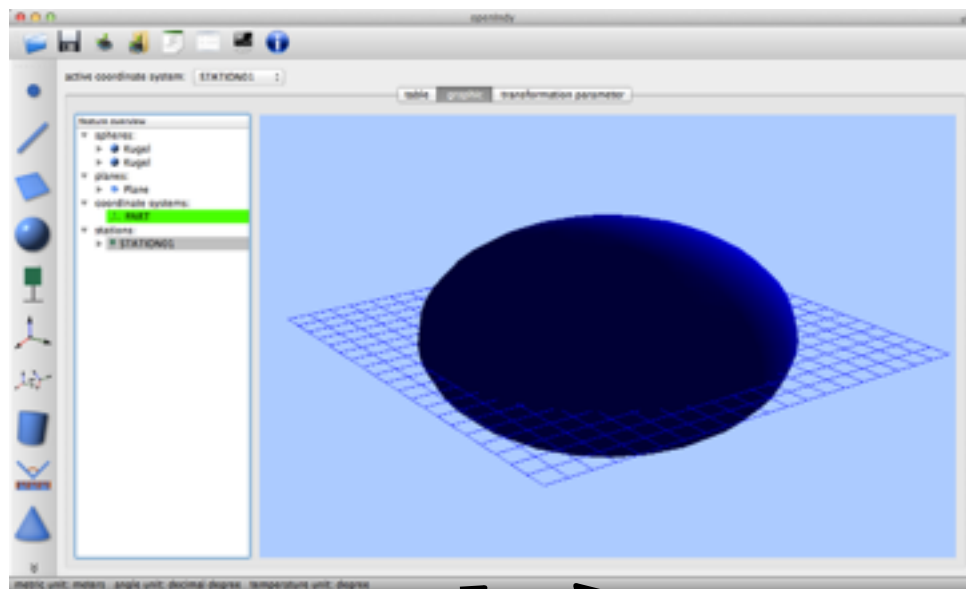
**Zum Ausführen einer anderen Art der Stationsbestimmung
(Bündelausgleichung)**

Plugins

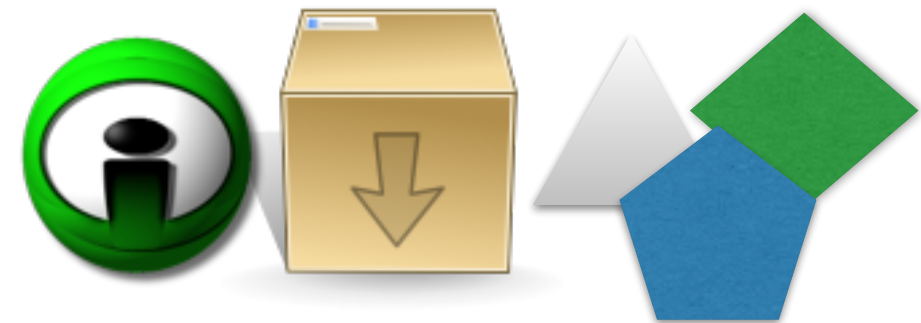


Architektur

OpenIndy



OpenIndy-Plugin



SystemDB (sqlite)



projectfile
(openindyXML) ₁₈

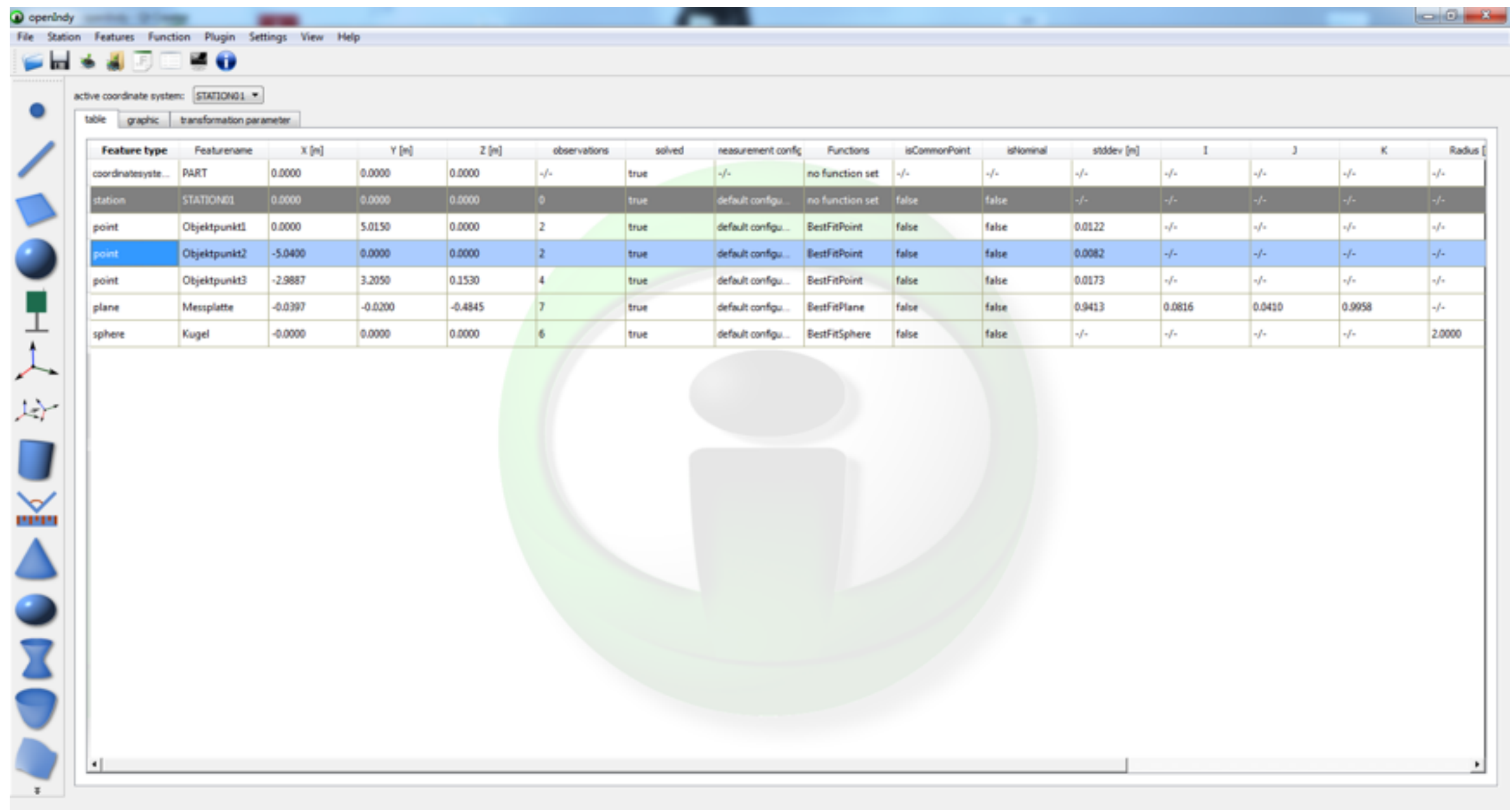
openindyXML (Austauschformat)

Persistente Speicherung im XML-Format

Beinhaltet Informationen:

- Beziehungen der Feature
- Geometrie
- Genauigkeit
- Funktionen
- Transformationen
- Sensor configuration
- Measurement configuration

```
<?xml version="1.0" encoding="UTF-8"?>
<oiProjectData name="oiProject.xml" date="2014-02-03T20:10:38" idcount=
  <member type="activeCoordinatesystem" ref="21"/>
  <station id="2" name="STATION01">
    <sensor name="PseudoTracker" plugin="OpenIndy Default Plugin"/>
    <member type="position" ref="3"/>
    <member type="coordinatesystem" ref="4"/>
  </station>
  <station id="19" name="station2">
    <sensor name="PseudoTracker" plugin="OpenIndy Default Plugin"/>
    <member type="position" ref="20"/>
    <member type="coordinatesystem" ref="21"/>
  </station>
  <coordinatesystem id="1" name="PART" solved="0"/>
  <coordinatesystem id="4" name="STATION01" solved="0">
    <member type="observation" ref="7"/>
    <member type="observation" ref="9"/>
    <member type="observation" ref="14"/>
    <member type="observation" ref="16"/>
    <member type="observation" ref="18"/>
    <member type="transformationParameter" ref="32"/>
  </coordinatesystem>
  <coordinatesystem id="21" name="station2" solved="0">
    <member type="observation" ref="23"/>
    <member type="observation" ref="25"/>
    <member type="observation" ref="27"/>
    <member type="observation" ref="29"/>
    <member type="observation" ref="31"/>
    <member type="transformationParameter" ref="32"/>
  </coordinatesystem>
  <transformationsparameter id="32" name="t1" solved="0" tx="69.9419">
    <from type="coordinatesystem" ref="4"/>
    <to type="coordinatesystem" ref="21"/>
    <member type="previouslyNeeded" ref="5"/>
    <member type="previouslyNeeded" ref="10"/>
    <member type="previouslyNeeded" ref="11"/>
    <member type="previouslyNeeded" ref="12"/>
    <function name="HelmertTransformation" plugin="OpenIndy Default">
      <inputElement index="0" type="1" ref="5"/>
      <inputElement index="0" type="1" ref="10"/>
      <inputElement index="0" type="1" ref="11"/>
      <inputElement index="0" type="1" ref="12"/>
    </function>
  </transformationsparameter>
  <transformationsparameter id="32" name="t1" solved="0" tx="69.9419">
    <from type="coordinatesystem" ref="4"/>
    <to type="coordinatesystem" ref="21"/>
    <member type="previouslyNeeded" ref="5"/>
    <member type="previouslyNeeded" ref="10"/>
    <member type="previouslyNeeded" ref="11"/>
    <member type="previouslyNeeded" ref="12"/>
    <function name="HelmertTransformation" plugin="OpenIndy Default">
      <inputElement index="0" type="1" ref="5"/>
      <inputElement index="0" type="1" ref="10"/>
      <inputElement index="0" type="1" ref="11"/>
      <inputElement index="0" type="1" ref="12"/>
    </function>
  </transformationsparameter>
```



GUI

„one model many views“

feature type	name	x	y	z	observations	solved	measurement configuration	function
point	Objektpunkt2	-5.0400	0.0000	0.0000	2	true	default configu...	BestFitPoint

measurement configuration - _OpenIndy_

load configuration

generally configuration

default configuration configuration name

1 number of measurements

polar type of Reading

☐ two face measurement

☐ distance dependent measurement

0 distance interval [m]

☐ time dependent measurement

0 time interval [sec]

save configuration ok cancel

function configuration new function

functions

- BestFitPoint
 - n observations
- ProjectInPlane
 - 1 plane

description:

Select observations to calculate the best fit point.

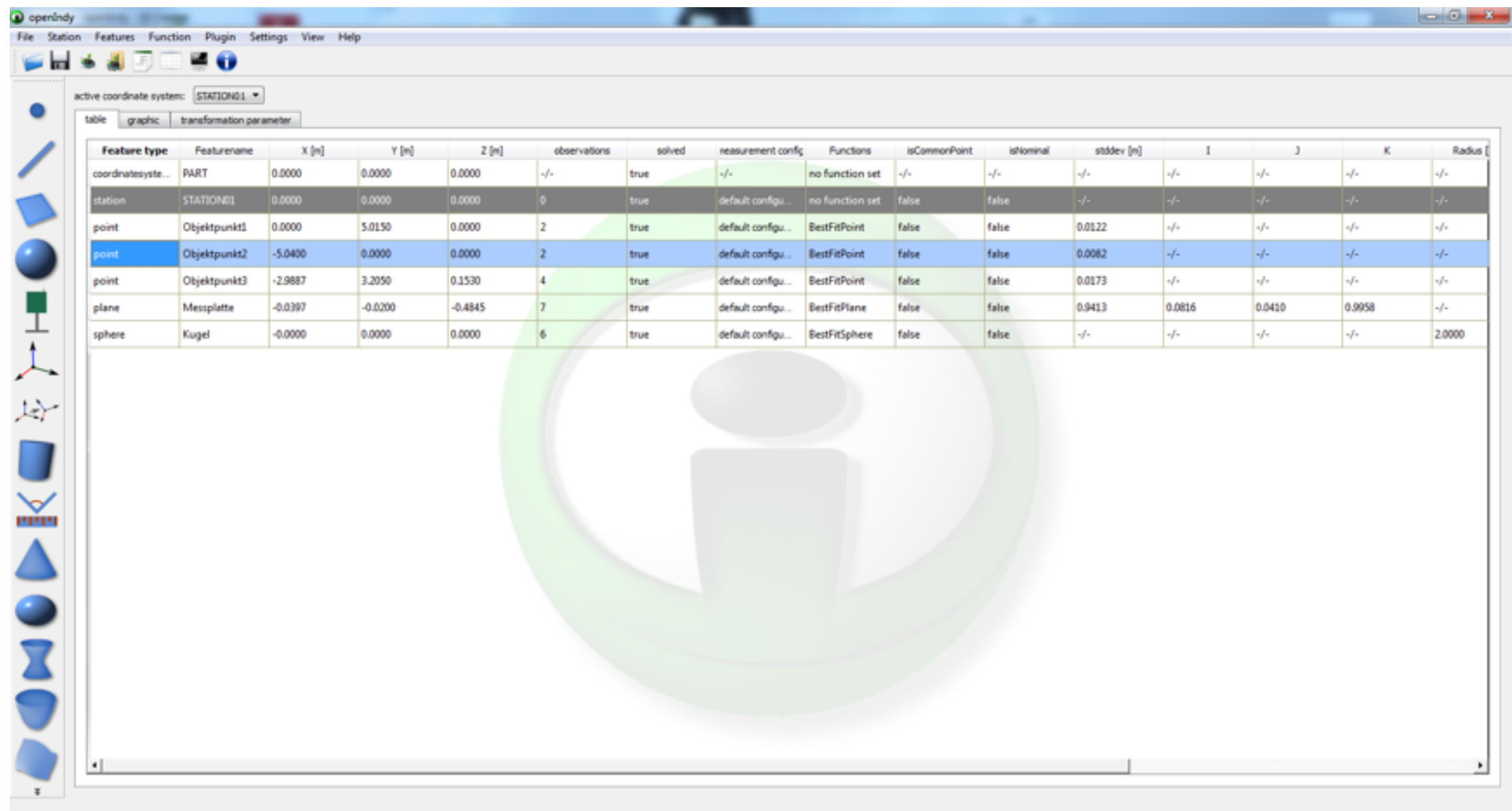
available elements

- points:
 - p1
 - p2
 - observations:
 - Do 6. Feb 15:51:12 2014
 - p3
 - p4
 - p5
 - p6
 - p7
 - p8
 - p9
 - p10
- planes:
 - Platte

used elements

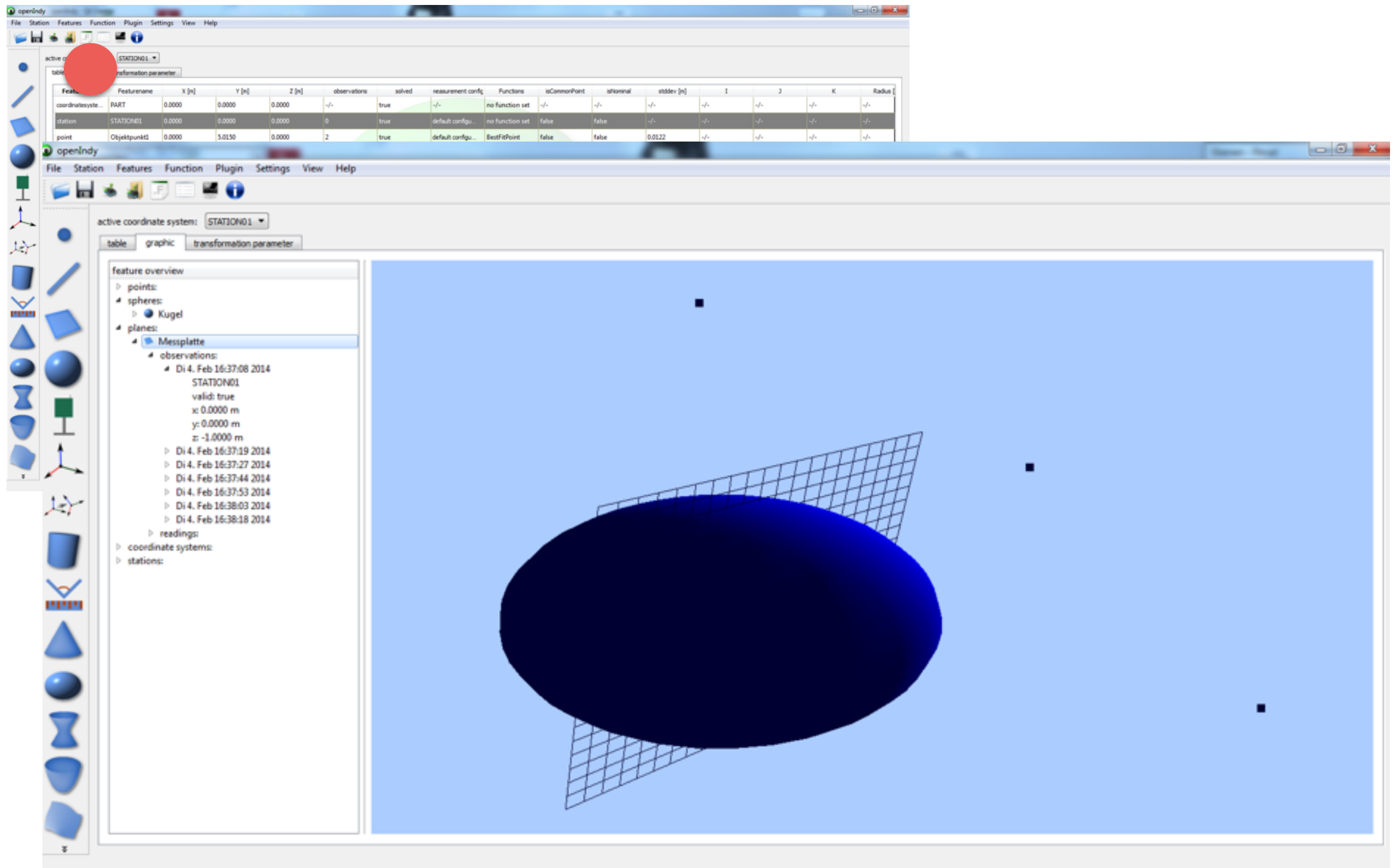
Do 6. Feb 16:26:01 2014

ok



GUI

„one model many views“



Besonderheiten von OpenIndy

- Plugins (Sensoren und Funktionen)
- konsequente Varianzfortpflanzung
- Open Source
- Multiplattform (Windows, Mac, Linux)
- XML-Austauschformat
- Tabellenansicht, Graphikansicht, Konsole

Ausblick

Weiterführung durch:

- **Masterarbeiten** (virtueller Laser Tracker, Geometrieerkennung, Temperaturkompensation, etc.)
- **hochschulinterne Module an der FH Mainz** (bspw. Prozessorientierte Programmierung SS2014)
- **sigma3D GmbH**
- **und...**



<https://github.com/OpenIndy>

WE WANT YOU!