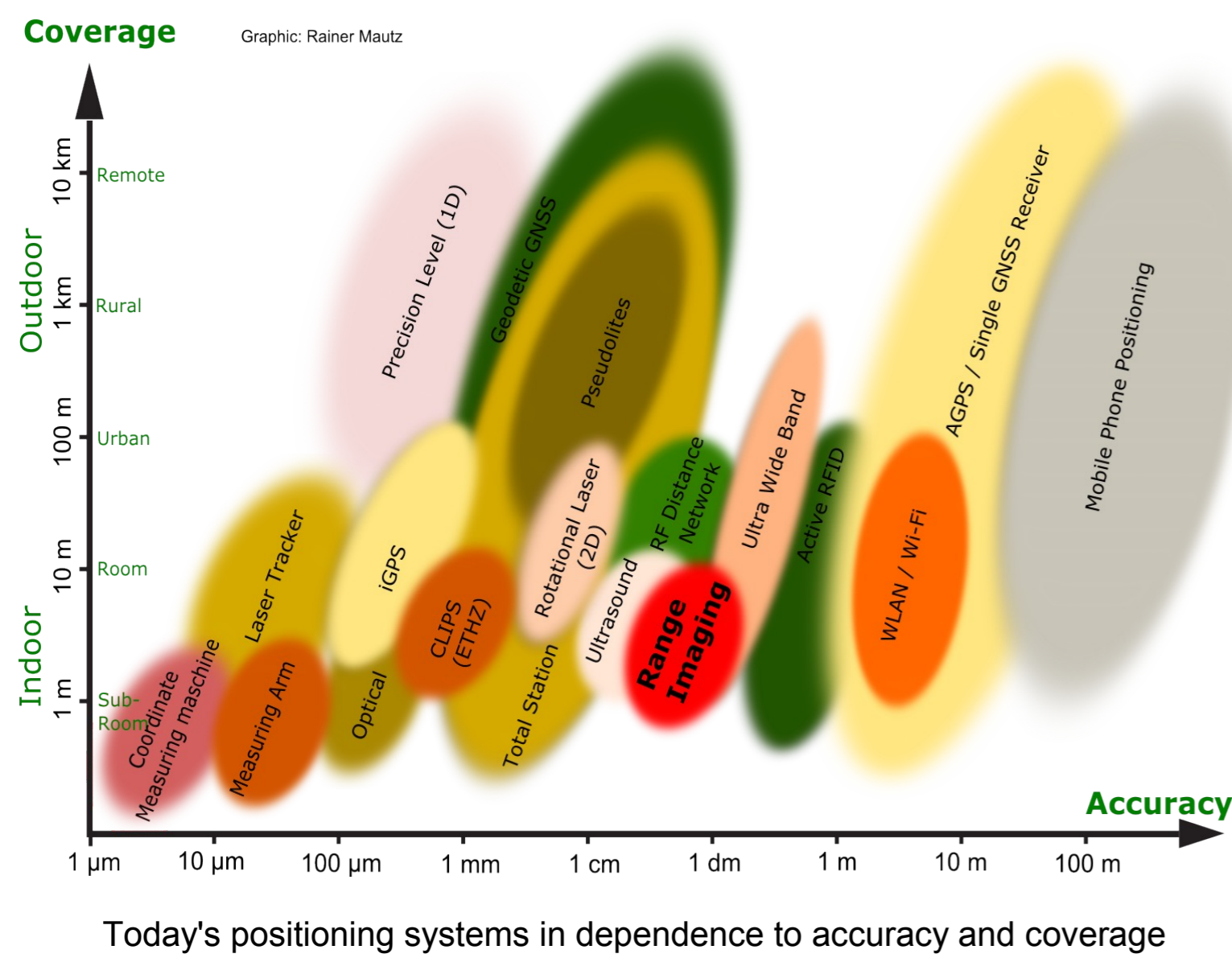


Real-time Indoor Positioning Using Range Imaging Sensors

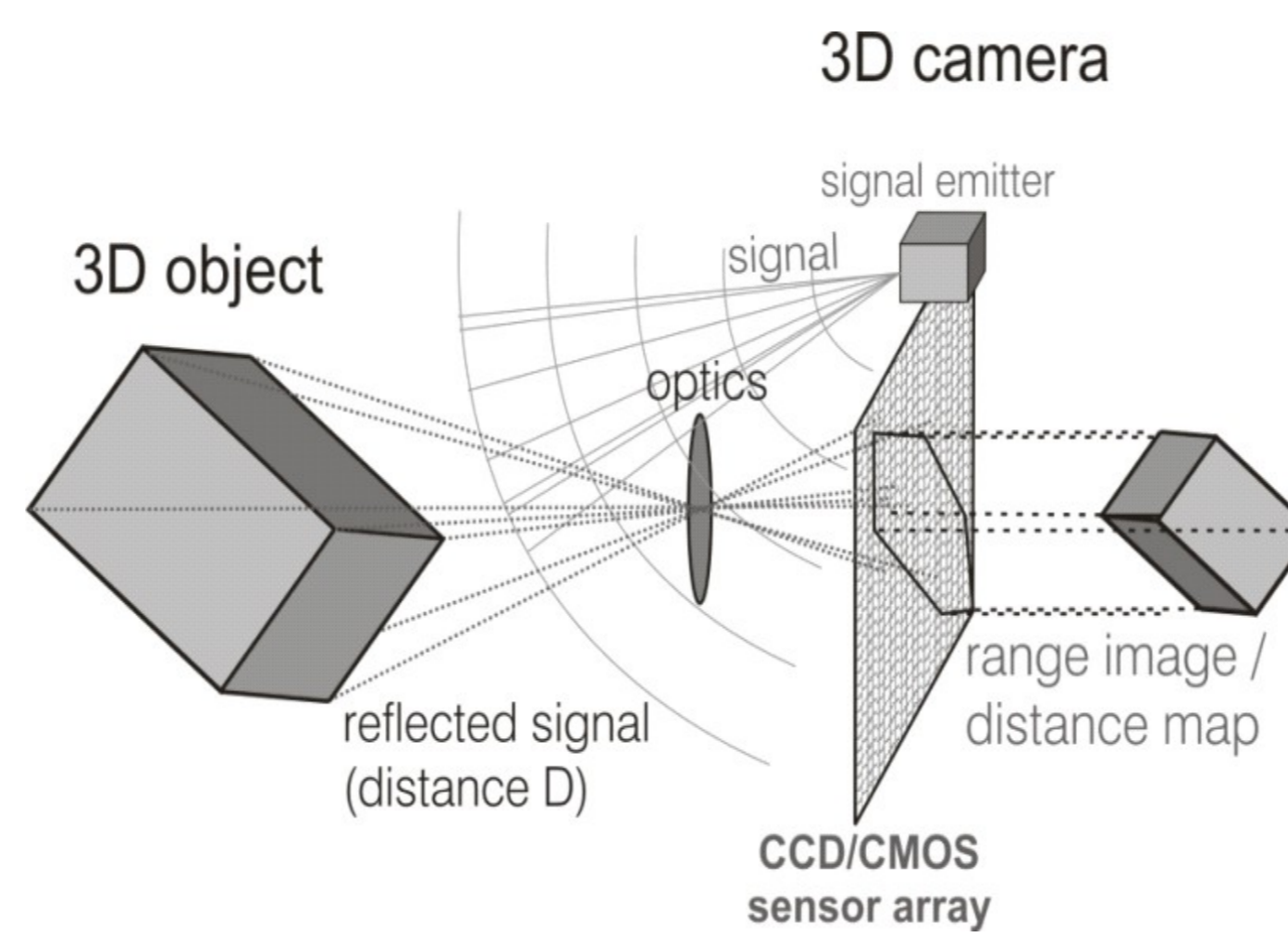
Why Indoor Positioning?

- Rescue missions in buildings with limited view
- Navigation in malls, conference buildings or museums
- Gaming industry for free hand interacting
- Controlling unmanned vehicles / robots inside buildings



Range Imaging

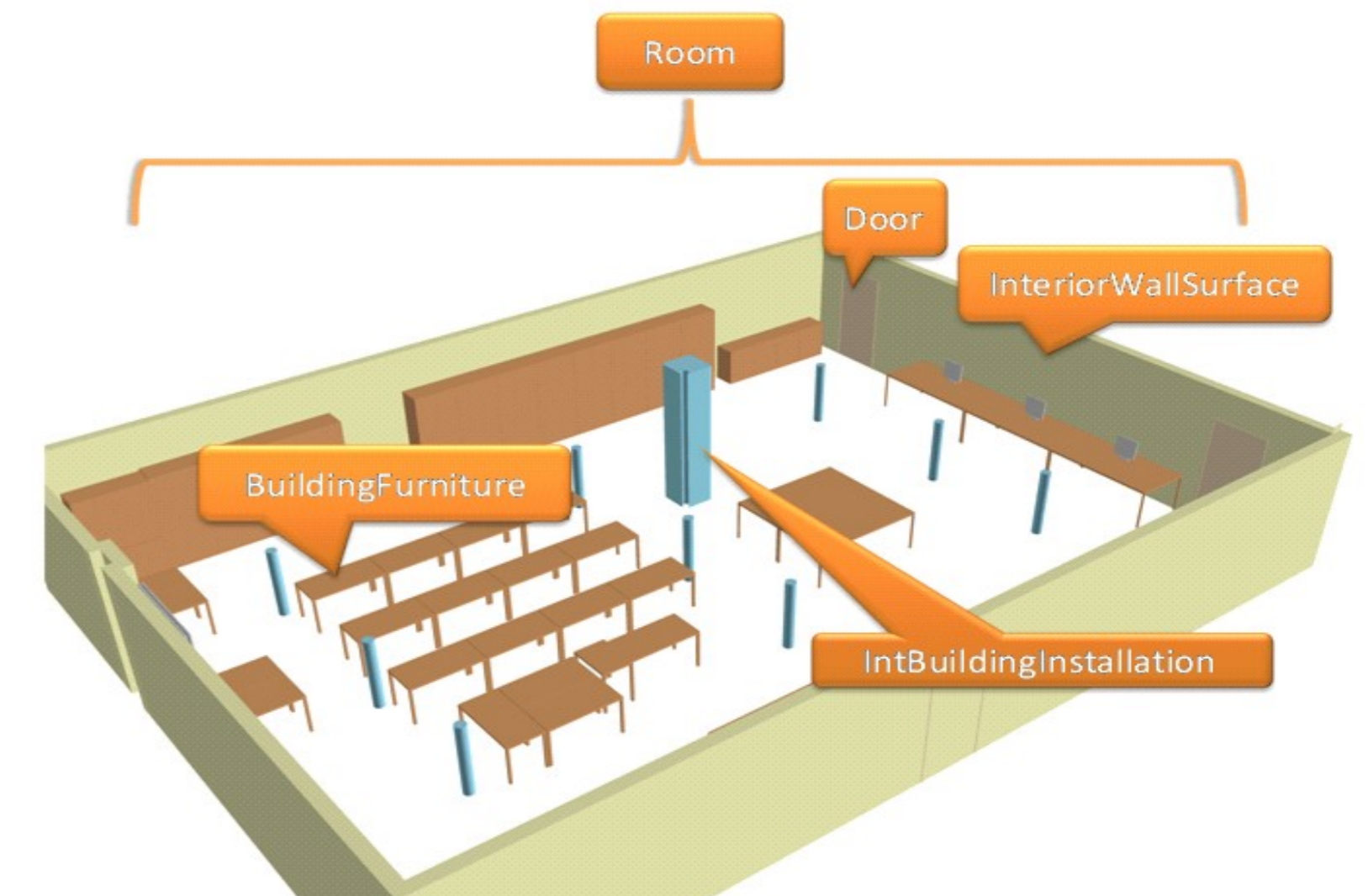
- Time-of-flight principle (phase shift detection)
- Real time distance observation up to 50 fps
- Accuracy level of centimetres
- Intensity and Range images



Basic principle of range imaging sensors

City GML indoor space model

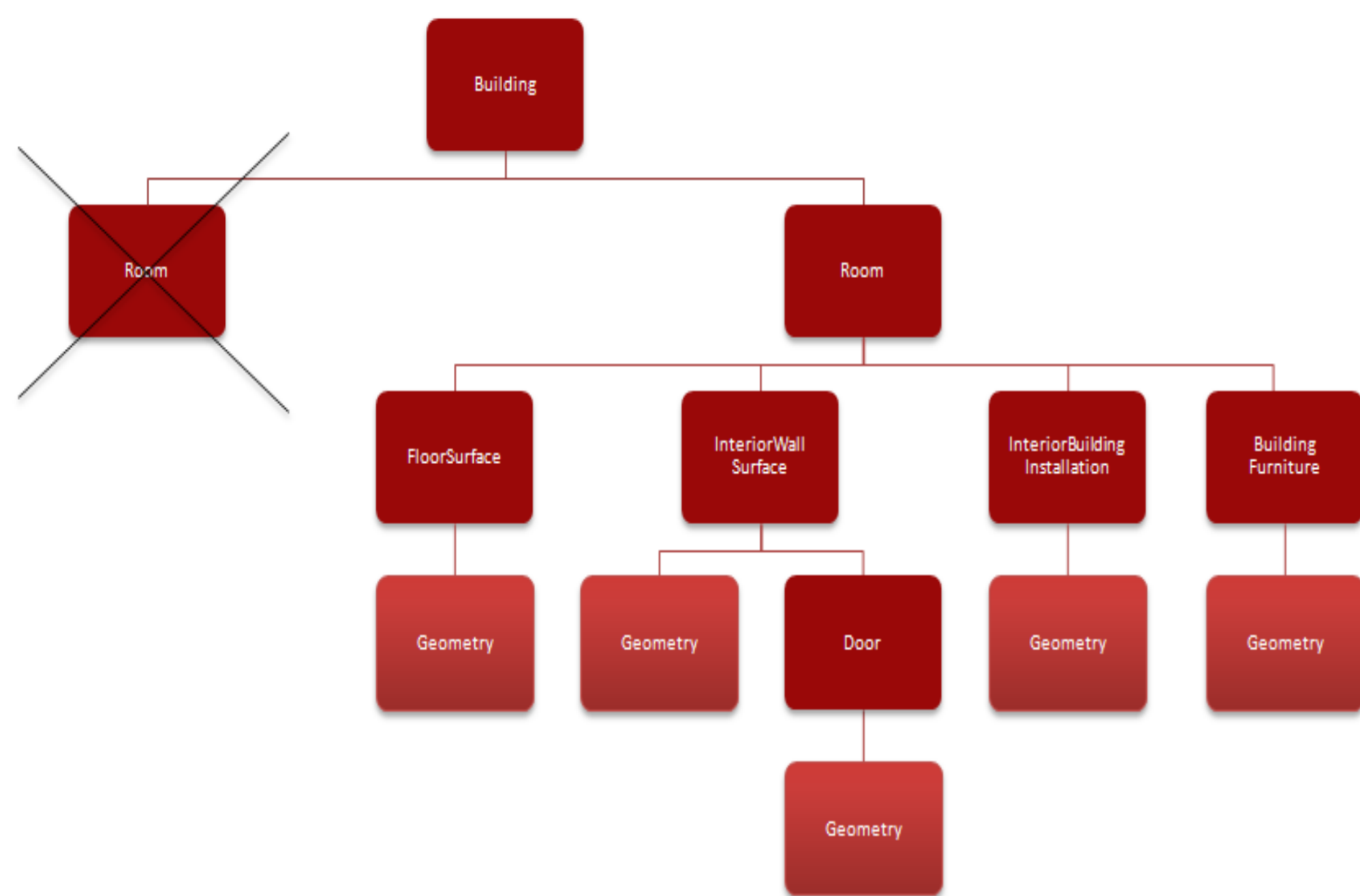
- City GML defines data model and XML data format for 3D city and topography models for GIS
- Level-of-Detail-concept (LoD) with LoD 4 for modelling the interior of buildings
- Geometric and semantic model of indoor environment



ETH Zurich lecture room HIL C71.3 in CityGML

Room identification

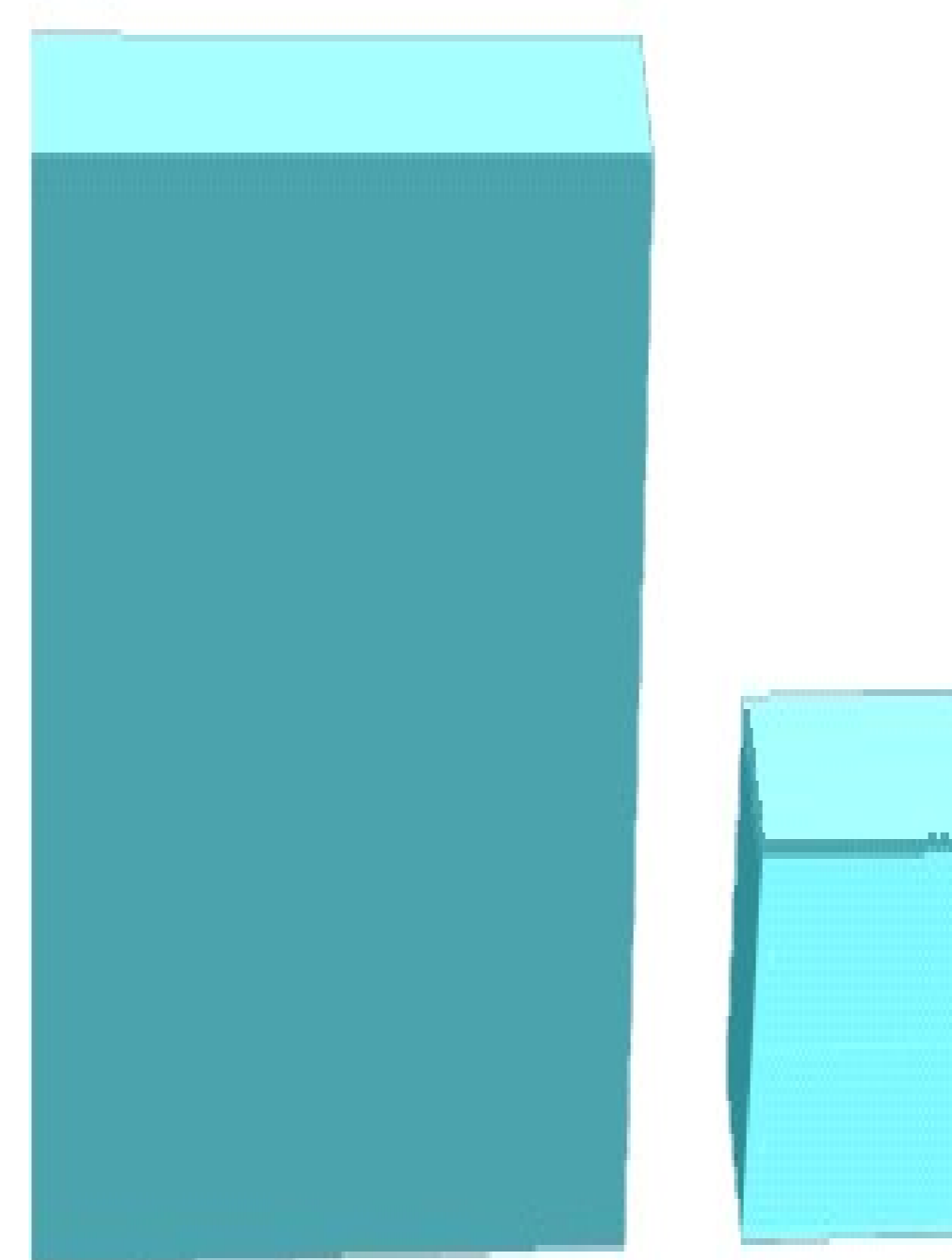
Use of amplitude and range images to acquire object properties like size, geometry and quantity to reduce the data base



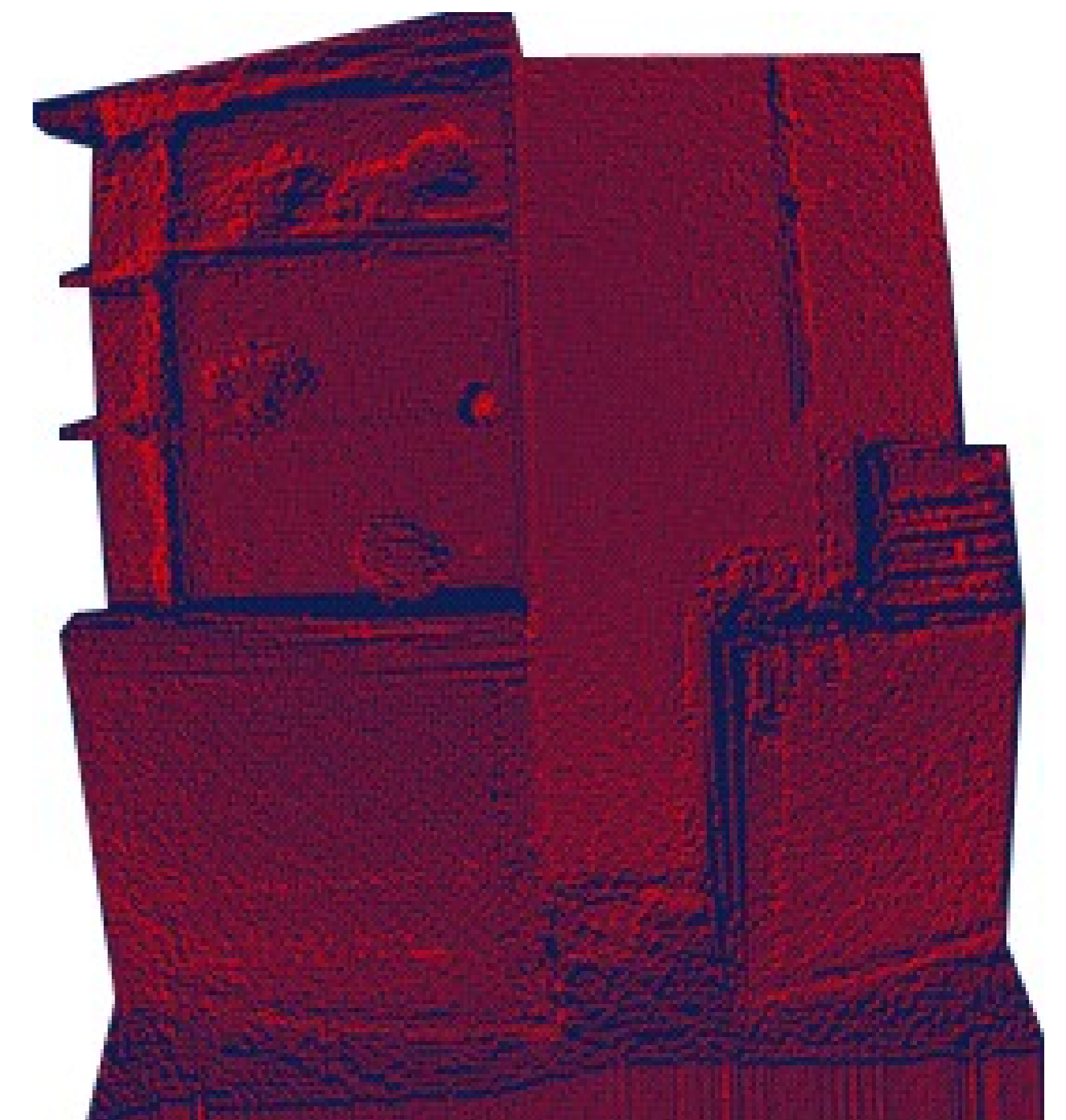
Decision tree for room identification

Accurate positioning

Comparison of the reference coordinates of the data base with the local coordinates measured by the range imaging camera



Storage rack model from CityGML database



Storage rack point-cloud from range imaging sensor

Opportunities

- Kinematic acquisition of 3D coordinates in real-time independent from surrounding light
- 1.5 cm accuracy of objects in distance of 2 m
- No physical reference structure required (e.g. WIFI hot spots)
- Coherent spatio-semantic model with high level of detail in CityGML
- Standardized web access interface for CityGML data access and filtering available (OGC Web Feature Service)
- Support of any geodetic reference system -> coupling of indoor and outdoor positioning methods

Limits

- Maximum distance range of 10 m -> ambiguity problem
- Mixed pixels on object edges
- Systematic optical influences need to be corrected
- Robust object recognition method required



PMD Tech CamCube



MESA Imaging SR 4000