

# Precise 3-D Object Positioning for Public Road Pole Cadasters Using TerraSAR-X & Geodetic SAR Processing

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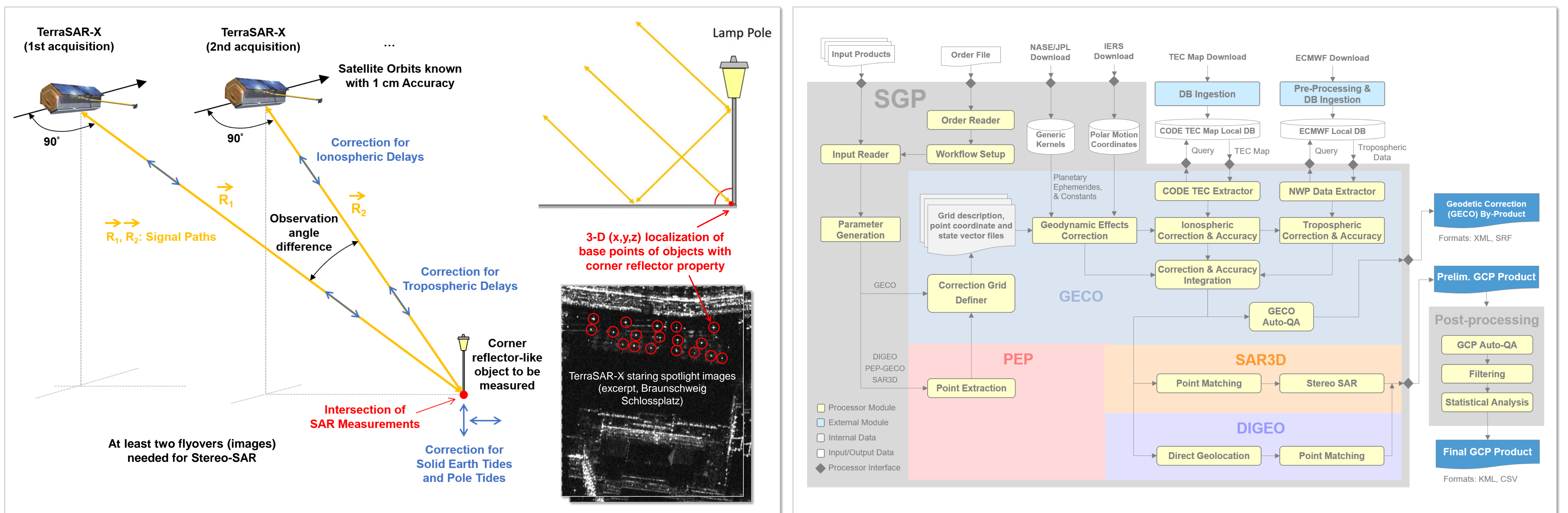


Fig. 1: Precise object localization with TerraSAR-X imaging geodesy (left) and SAR Geodesy Processor for geodetic correction and object extraction (right).

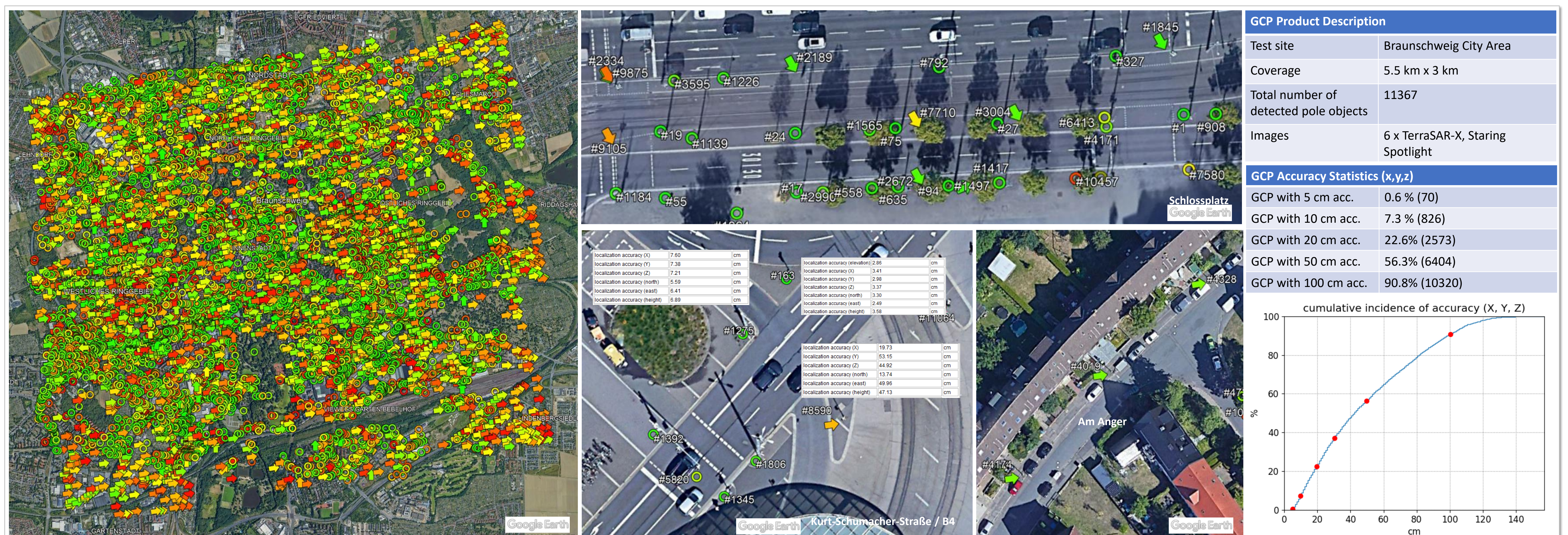


Fig. 2: Detected pole objects for test site „Braunschweig City“: complete product\*, sample objects\* and overall measurement accuracy statistics (left to right). \*overlaid on Google Earth images.

## Transport infrastructure object localization with geodetic SAR

Satellite SAR allows to detect and to precisely measure positions of objects in the periphery of roads. The base point coordinates of preferably pole-like objects can be determined down to cm-accuracy with geodetic SAR imaging and data processing, cf. Fig. 1 left and right. At least two SAR images, taken under different sensor viewing angles and with coordinates being corrected for various geodetic and for Radar signal delay effects, are needed for the stereoscopic approach of object localization. Large areas can be mapped this way, thereby collecting

sets of so called ground control point (GCP) coordinates. In the DLR project “Digitaler Atlas 2.0”, the technology is used to setup a pole object cadaster. Fig. 2 exemplary shows a visualization of a GCP data product. It includes the measured positions of pole-like objects for the „Braunschweig City“ test site (color-coded after accuracy), extracted from 6 TerraSAR-X spotlight images. Shown are the complete dataset (11367 GCP), selected measured objects thereof, some annotated with localization accuracy, and the statistics of the localization accuracy over all GCP of the dataset (left to right). Coordinates of almost 900 objects have an estimated accuracy of < 10 cm.

Beyond cadaster purposes, potential utilizations of the technique include

- Generation of digital maps of land marks for autonomous driving apps
- Improving aerial image georeference
- Highly-precise monitoring of the dynamics of infrastructure elements
- Tectonic shift measurements

The SAR geodetic processor software SGP and the GCP data product have technology readiness levels (TRL) that allow for licensing by third parties.

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[1] U. Balss et al., 3-D Landmarks Derived from TerraSAR-X Data as Ground Control Information for Optical Imagery, TerraSAR-X/TanDEM-X Science Team Meeting 2023, 18.-20. Okt. 2023, Oberpfaffenhofen, Germany.