# Applications of Auto-Offset Location Technology

Optimal Ranging

**Jim Waite**
**President**


**2011 Damage Prevention Conference, Virginia Beach**

# Utility Geospatial Mapping – **Current Method**

- Utility location, followed by GPS position
  - **Locate the peak/null, then survey**
- Export depth values and lat/lon/altitude
- Assign attributes
- Convert to local job site coordinates
  - **Determine East, North, Up (elevation)**
- Update GIS database and CAD

Software can automate these tasks

Optimal Ranging

# Gas Pipeline Survey – **Typical Result**


Each point annotated with depth, current, and GNSS error

Optimal Ranging

Combined locating and mapping accuracy is typically sub-meter

- GPS system reports expected accuracy
- Locating system relies on the competence of the operator

# Desired Process Improvements

- Directly survey the utility from offset positions
- Improve overall accuracy to a decimeter (4”)
- Record locate result with expected “RMS” error
- Reduce the subjectivity of the locate
- Reduce occurrences of poor GNSS signals
- Reduce incidence of non-locatable lines

Optimal Ranging

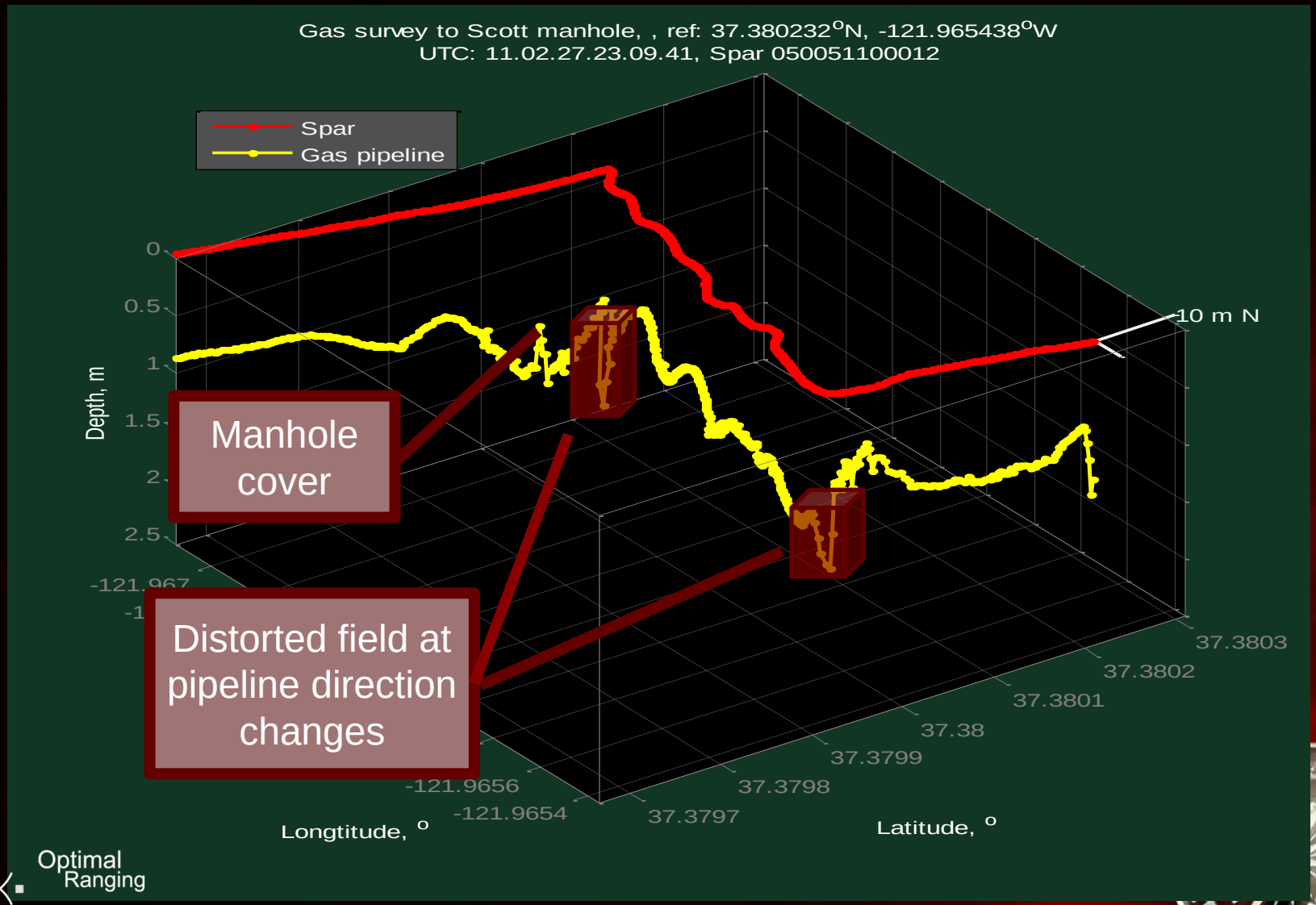
# Auto-Offset Data Collection


Walk path

Pipeline Survey

Optimal Ranging

# 3-D Geospatial Position



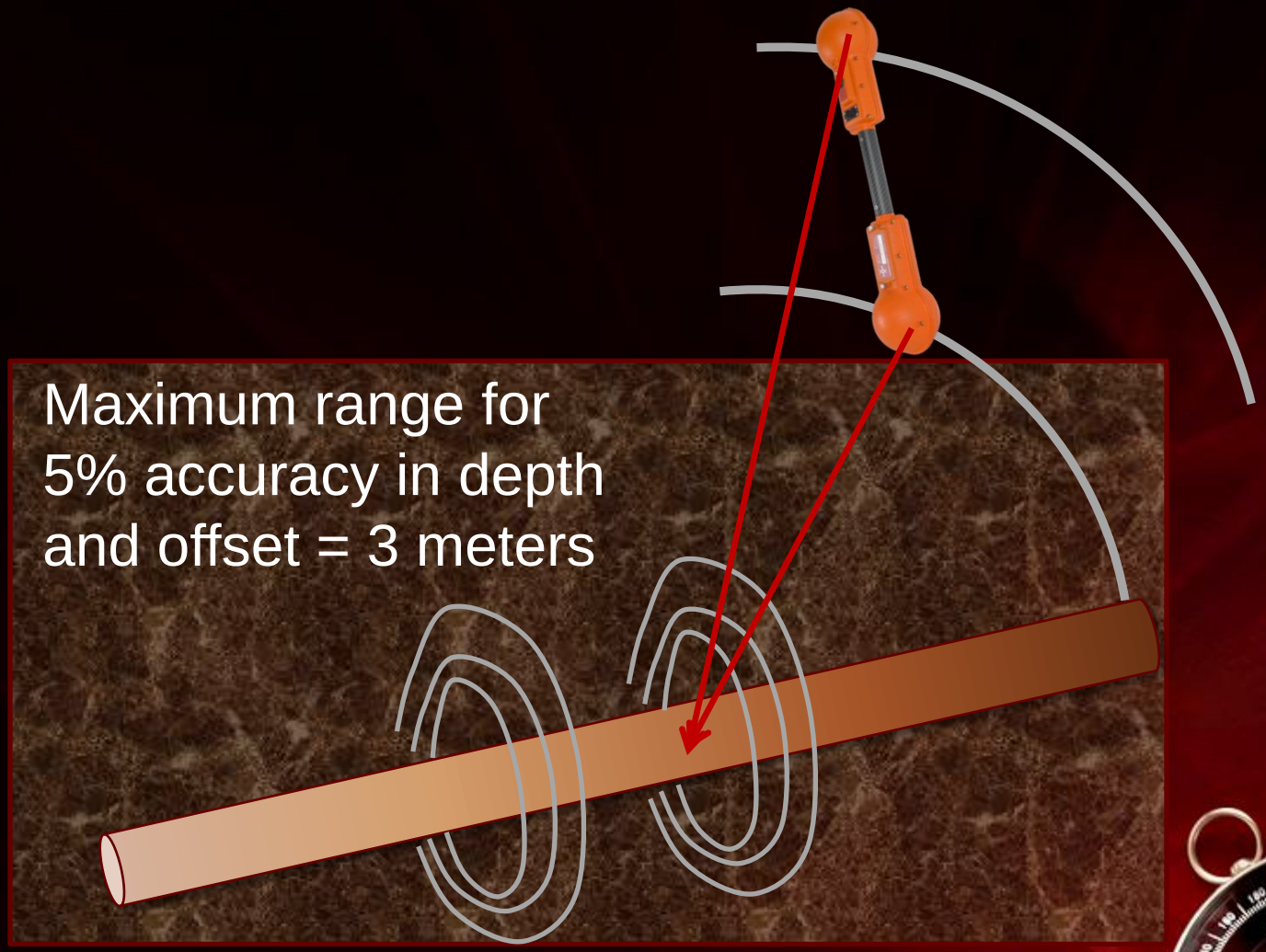

Optimal Ranging

# Auto-Offset Location

- Direct geospatial mapping of the utility to sub-decimeter accuracy
- Works from arbitrary perspectives, no need to be at the peak/null
- Applies measured centerline and depth offsets automatically
- Wireless networking used for accurate deep locates
- Uses job site coordinates, not lat/lon

Optimal Ranging

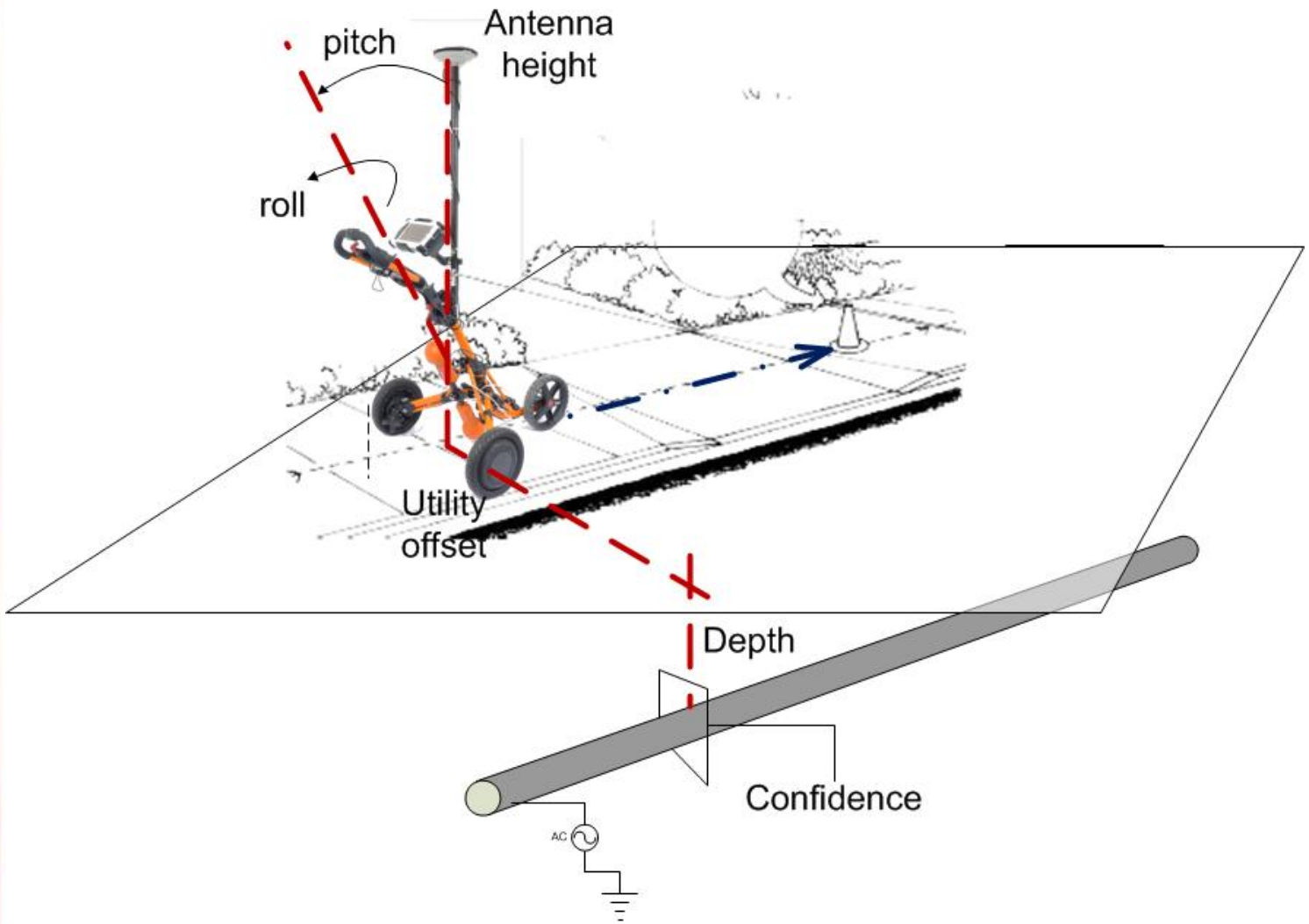
# Arbitrary Orientation and Perspective




Optimal Ranging

Optimal Ranging

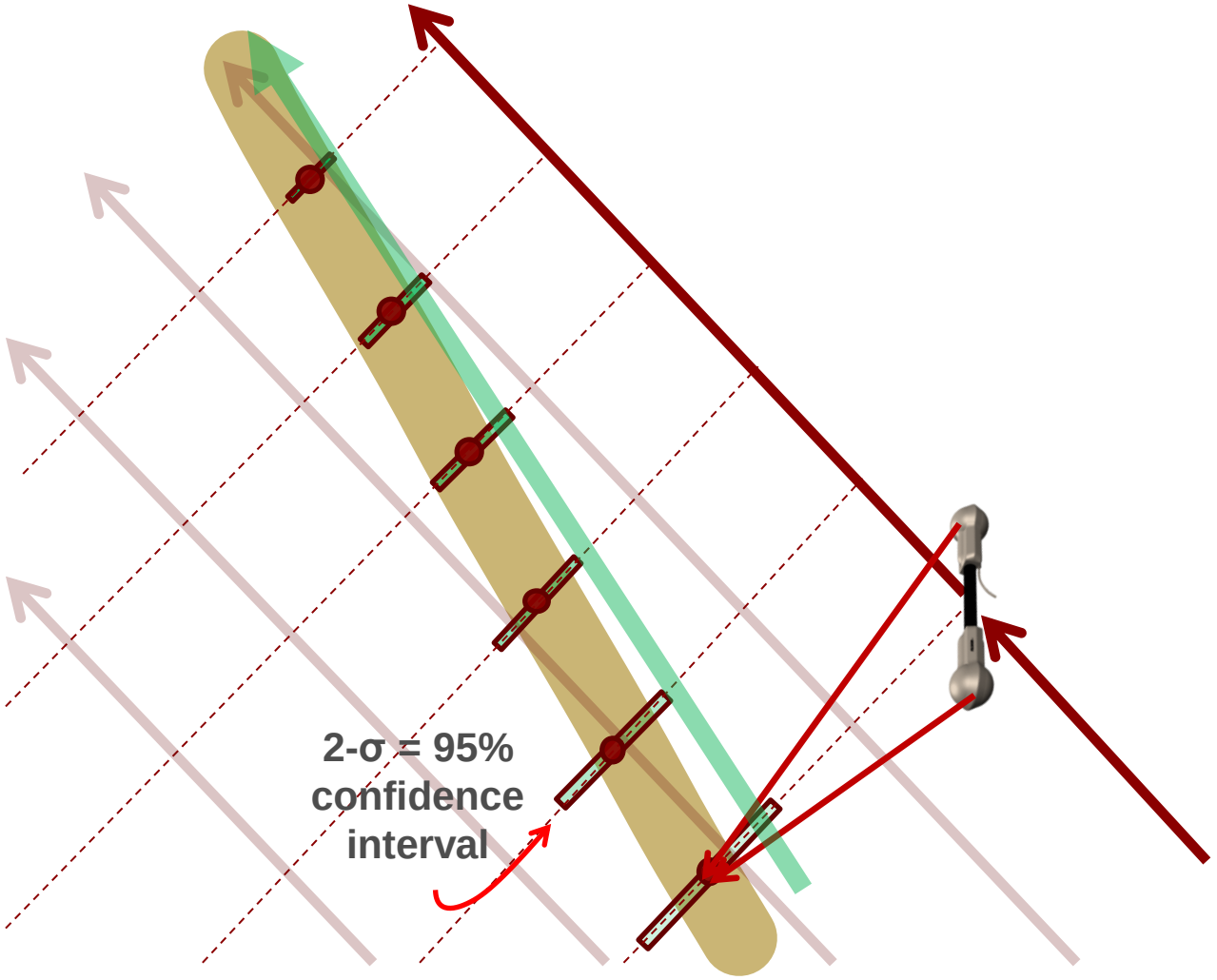
# Key Positioning Parameters




Utility offset and depth are merged with 3-D geospatial position. Expected RMS error is also combined.

Optimal Ranging

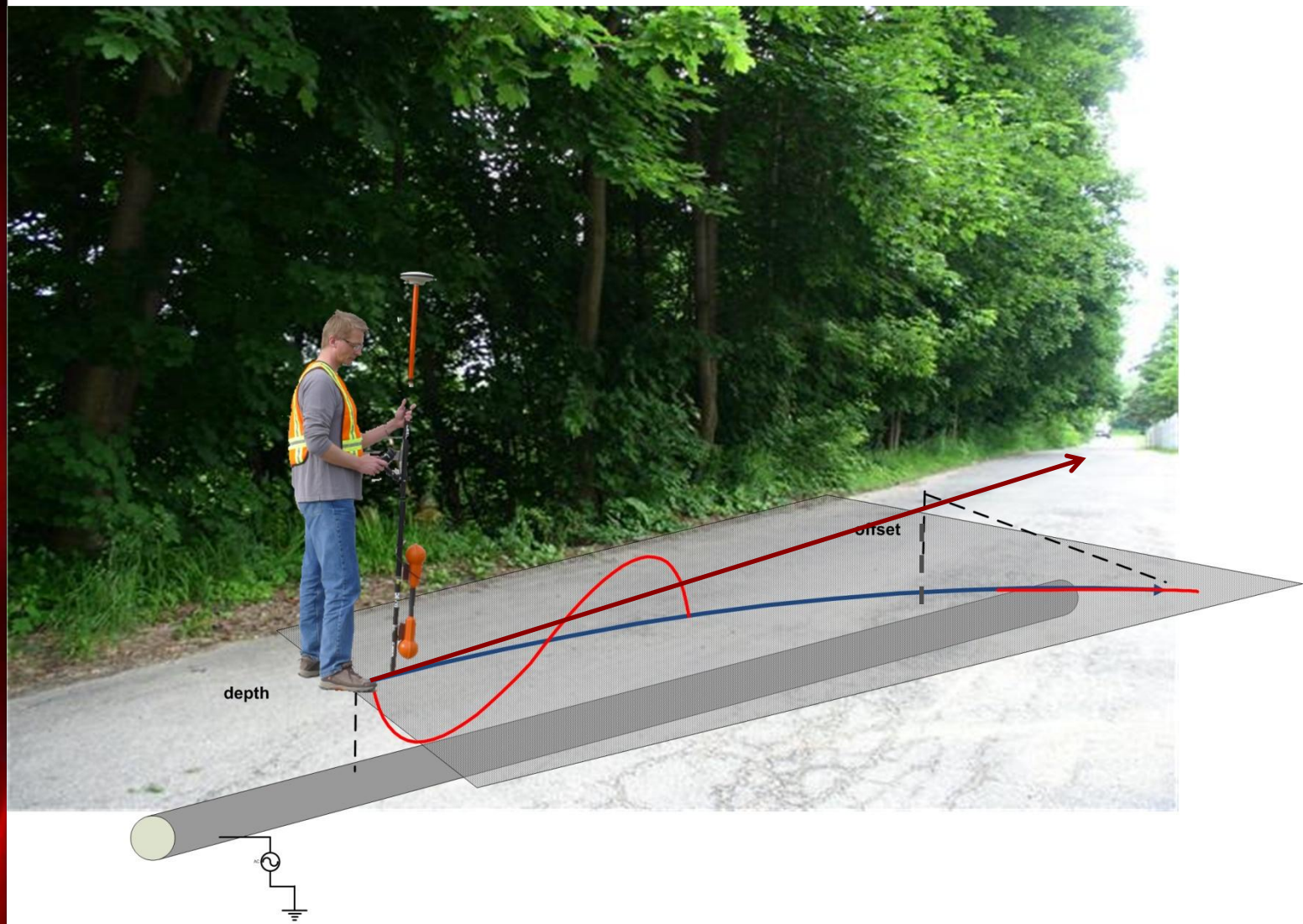
# 1-σ, 2-σ, or 3-σ Confidence




Accuracy is proportional to the radial distance from target

Optimal Ranging

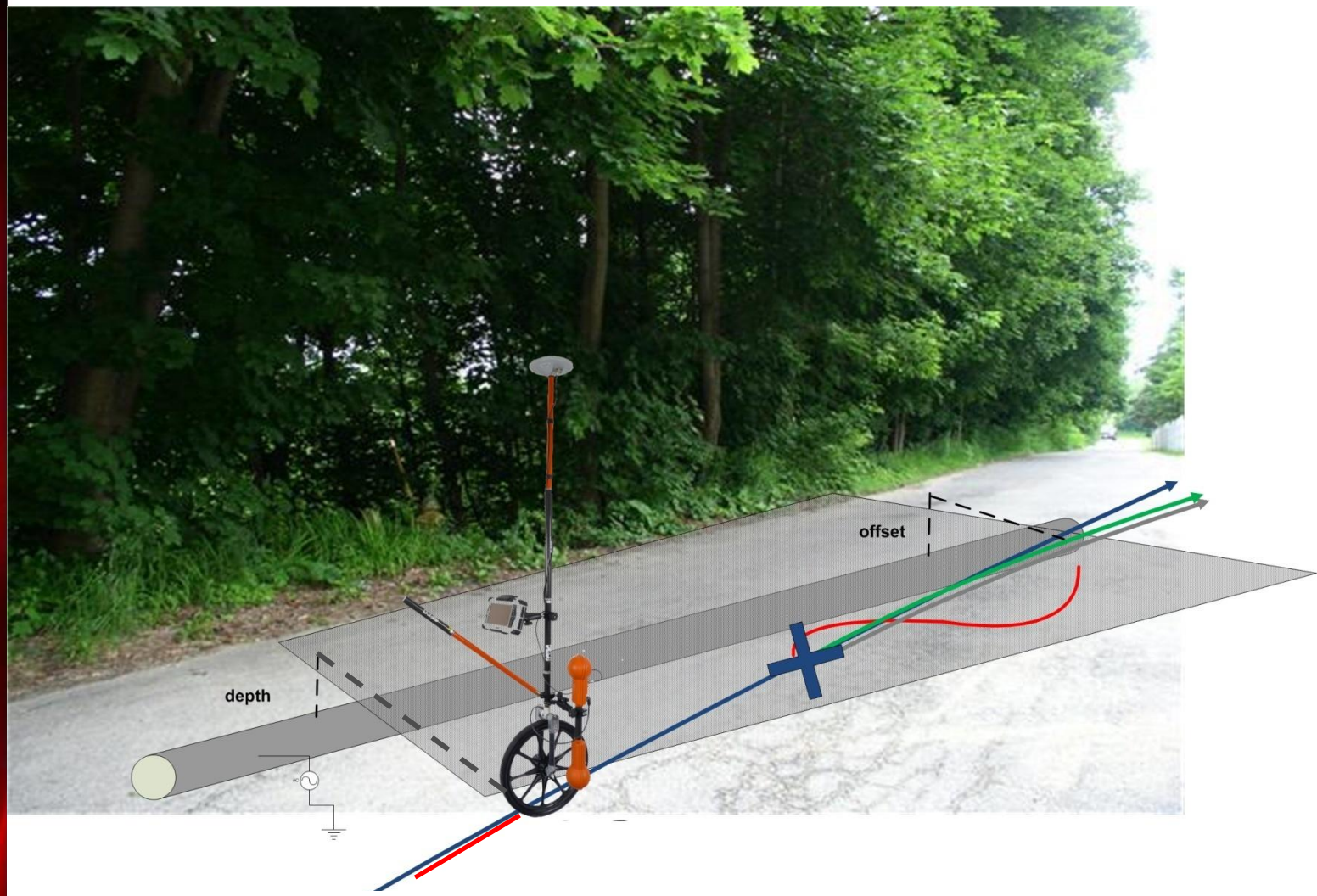
# Point Positioning Under Cover




GNSS signal is improved by moving off the line, using the measured offset for continued accurate target detection.

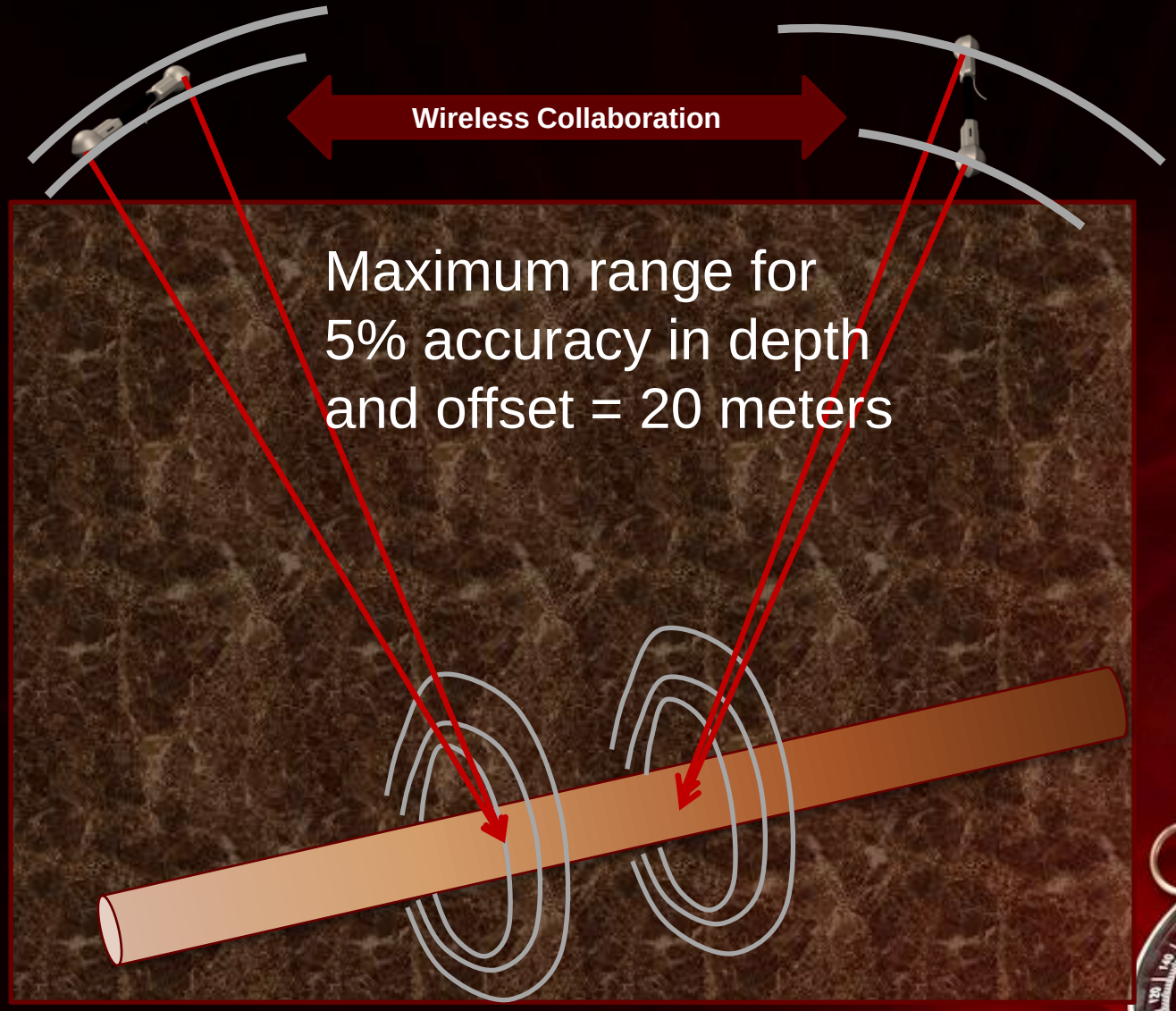
Optimal Ranging

# Continuous Positioning



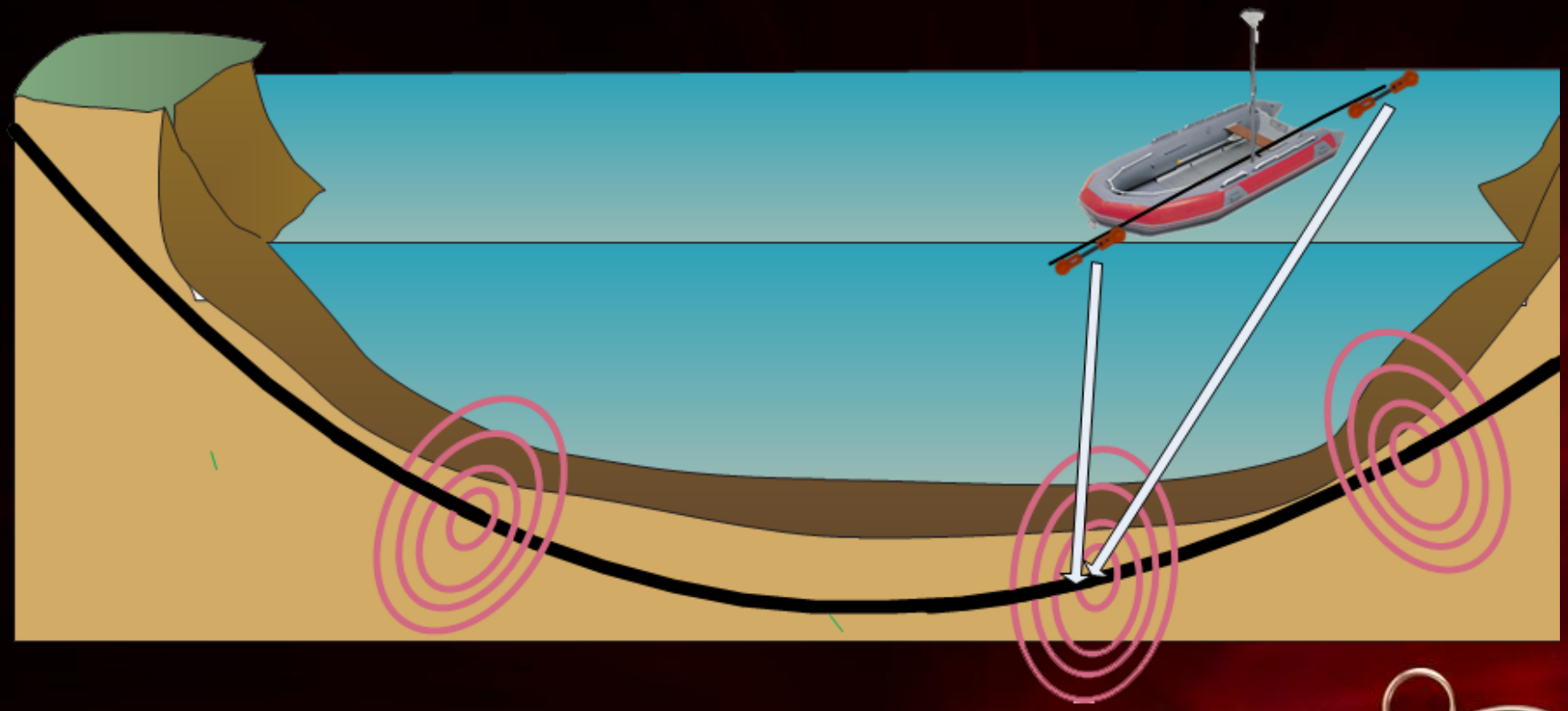

Maintain map accuracy with the use of complementary dead-reckoning components (compass, odometer)

# Measurement Geometry Expansion




Optimal Ranging

# Underwater Utility Mapping



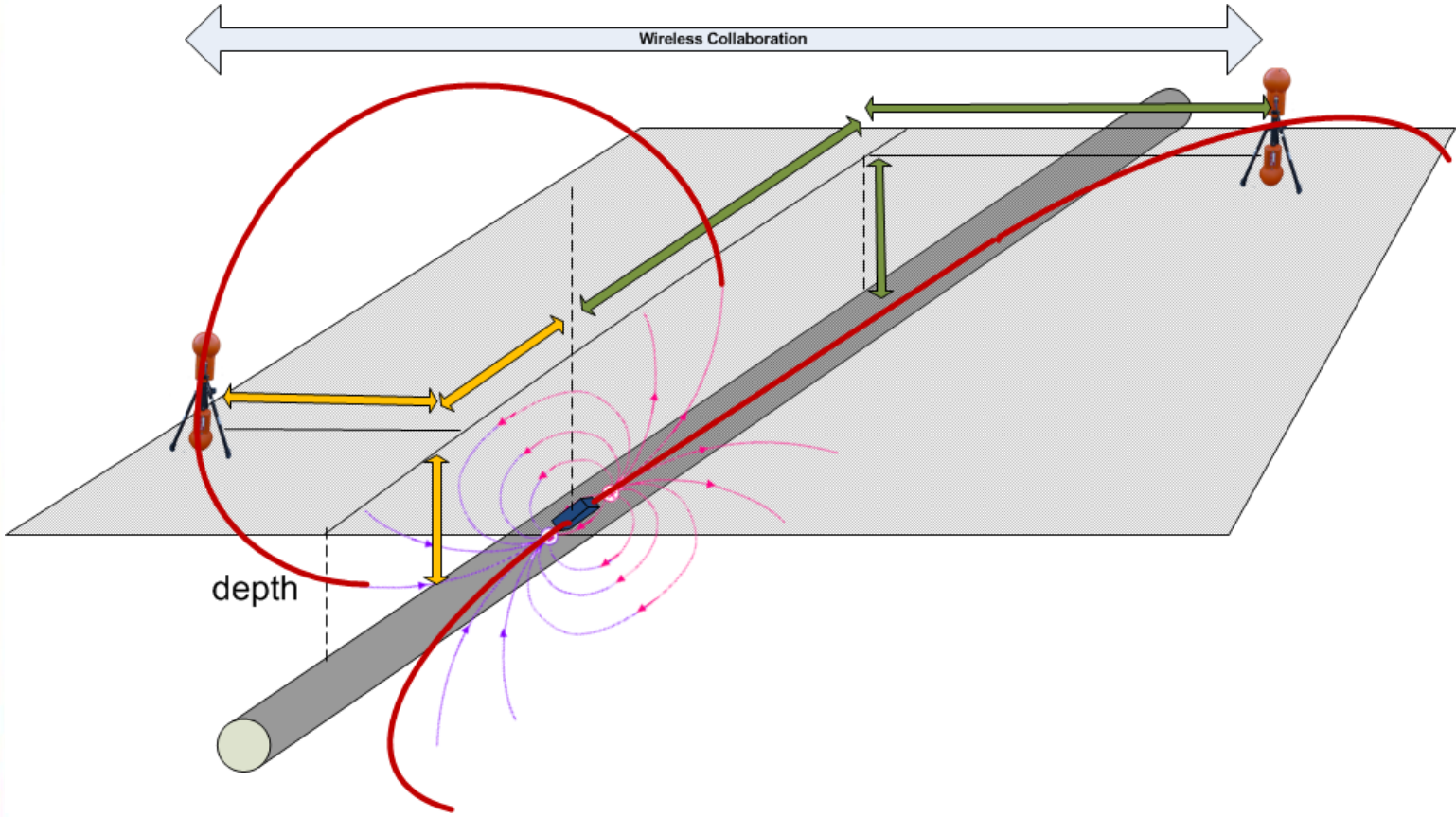
Above water, the dual-sensor positioning system is affixed to a non-ferrous vessel to benefit from the improved measurement geometry.

Optimal Ranging

Optimal Ranging

# Dual-sensor Mapping

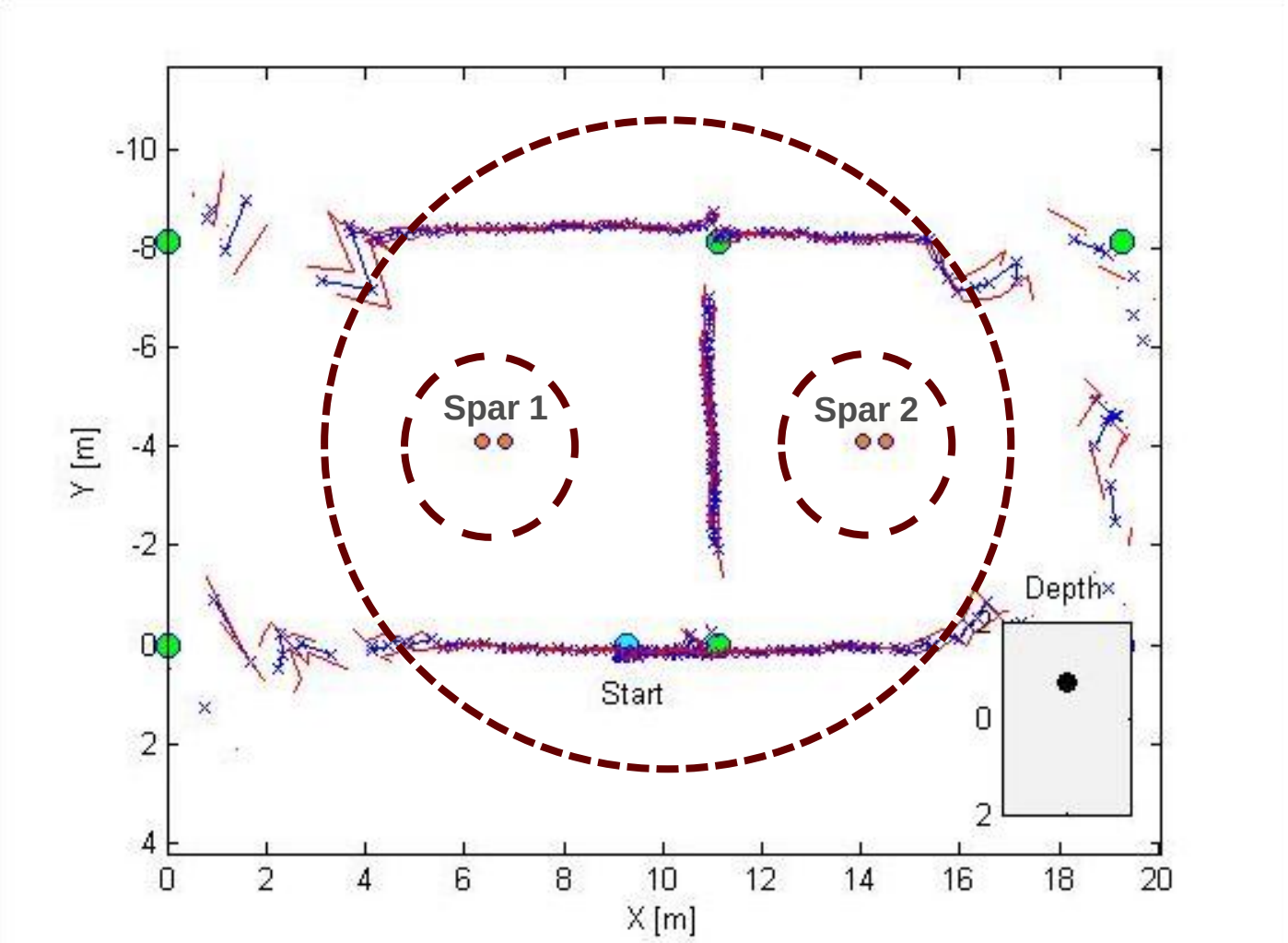
## (Duct, Tunnel, and Non-metallic Pipe)




Dual-sensor systems are also useful in sonde tracking applications. Receivers operate from fixed locations.

Optimal Ranging

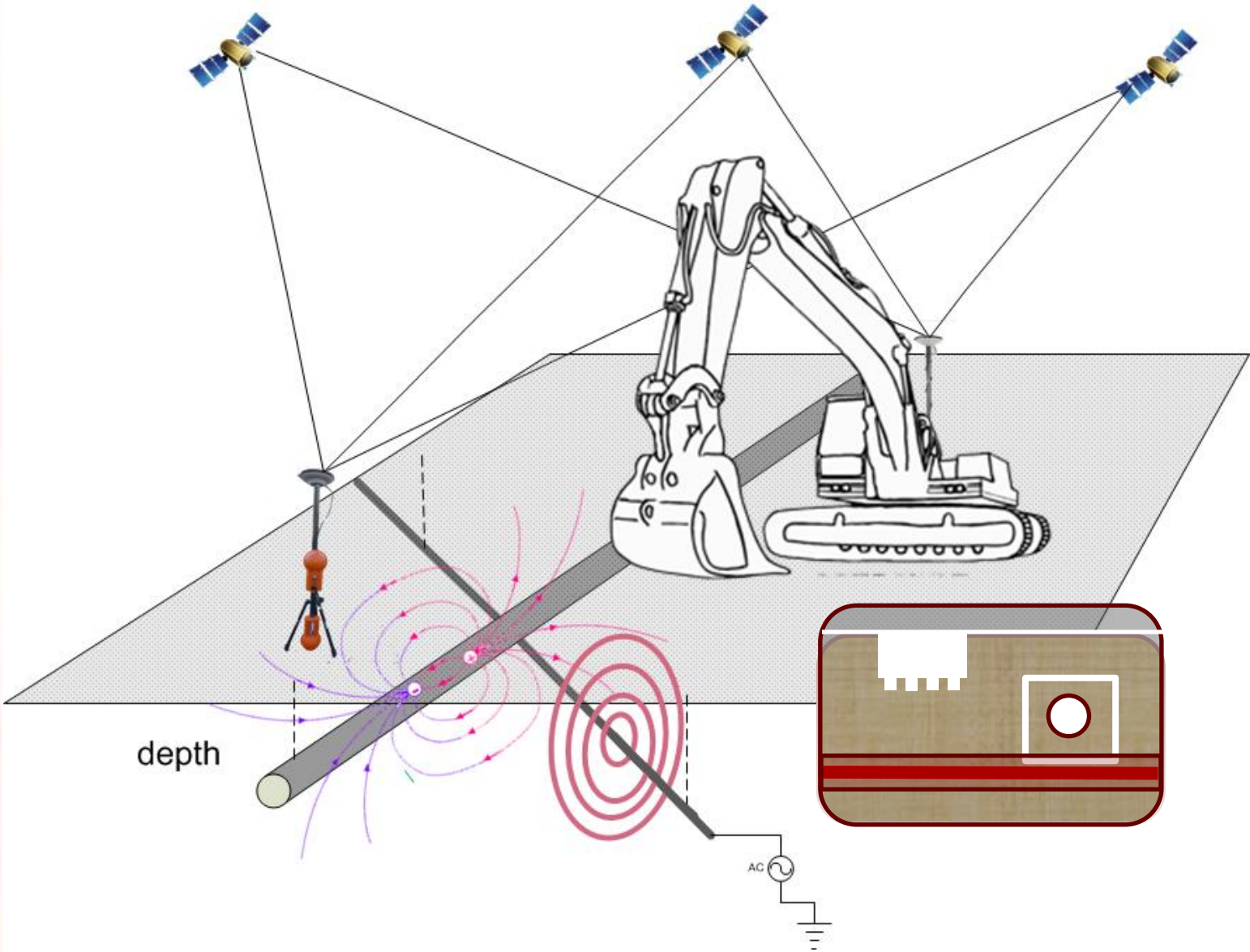
# Tracking Range for Single and Dual Receiver Systems




Sensor collaboration permits using the entire breadth of the emitted field without walkover locating.

Optimal Ranging

# Excavation Machine Control



# Auto-Offset Location Technology

www.optimalranging.com

Optimal Ranging