

Implementation of the measurements

VRS Networks: <ul style="list-style-type: none"> ✓ Tampere ✓ Geotrim Ltd. 	Test fields: <ul style="list-style-type: none"> ✓ Tampere region ✓ Southern Finland ✓ Sjäkulla photogrammetric test field ✓ Neighborhood of the FGI 	Criteria for test points: <ul style="list-style-type: none"> ✓ No obstructions above 20 degrees ✓ No reflecting surfaces and nearby electrical installations in the vicinity of the antenna ✓ Benchmark on bedrock or stable rocks or structures ✓ Benchmarks with known EUREF-FIN coordinates ✓ Distances to nearest reference station evenly at whole measurement area
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Pasi Häkklä: Practical Test on Accuracy and Usability of Virtual Reference Station Method in Finland
Finnish Geodetic Institute
P.O. Box 15, FI-02431 MASALA, Finland
FIG Working Week 2004, Athens, Greece, May 22-27, 2004
Pasi.Hakki@fgi.fi

Results in general

Results:

- ☐ Each test point measured 3-4 times under different satellite geometry
- ☐ Independent initialisations for all observations
- ☐ Accuracy and initialisation times on qualified benchmarks → capability of VRS system
- ☐ Failed initialisations: 1,8% (>10 minutes)
- ☐ 4 gross errors → proportional to chosen initialisation reliability (99,9%)

	Plane (mm)	Height (mm)	Initialisation time (s)
n = 2152			
RMS / average	27	35	29
95%	43	67	132
98%	66	100	396

Other tests:

- ☐ Baseline length
- ☐ Rover position
- ☐ Number of satellites, satellite geometry
- ☐ Number of epochs
- ☐ Surroundings (obstructions)
- ☐ Temporal variation of fixed solution
- ☐ Equipment
- ☐ Atmosphere

Number of network stations

<ul style="list-style-type: none"> ☐ Large network: 16 stations ☐ Small network: 4 stations 	<ul style="list-style-type: none"> ▪ Large network: practically no distance correlation ▪ Small network: No difference to large network in plane coordinates but for height and initialisation times clear correlation to distance visible
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Distances between network stations (density of network)

✓ 4 differently formed networks during four weeks, almost simultaneous observations from test and reference network

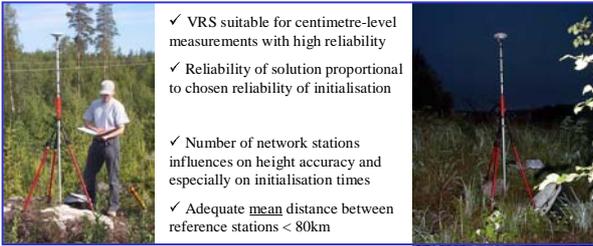
✓ Mean distances: 67km, 77km, 87km and 107km (reference: 61km)

Blue: Reference network
Red: Test network

- ✓ Each bar represents of 300 independent observations
- ✓ Difference of red and blue bars is the influence of spacing the network
- ✓ Mean distance below 80km safe

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Summary



- ✓ VRS suitable for centimetre-level measurements with high reliability
- ✓ Reliability of solution proportional to chosen reliability of initialisation
- ✓ Number of network stations influences on height accuracy and especially on initialisation times
- ✓ Adequate mean distance between reference stations < 80km

THANK YOU FOR YOUR ATTENTION



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