

BigAnt* Engineering and Experimental Results

*Large Format Antenna for High Quality Geodetic Ground Stations



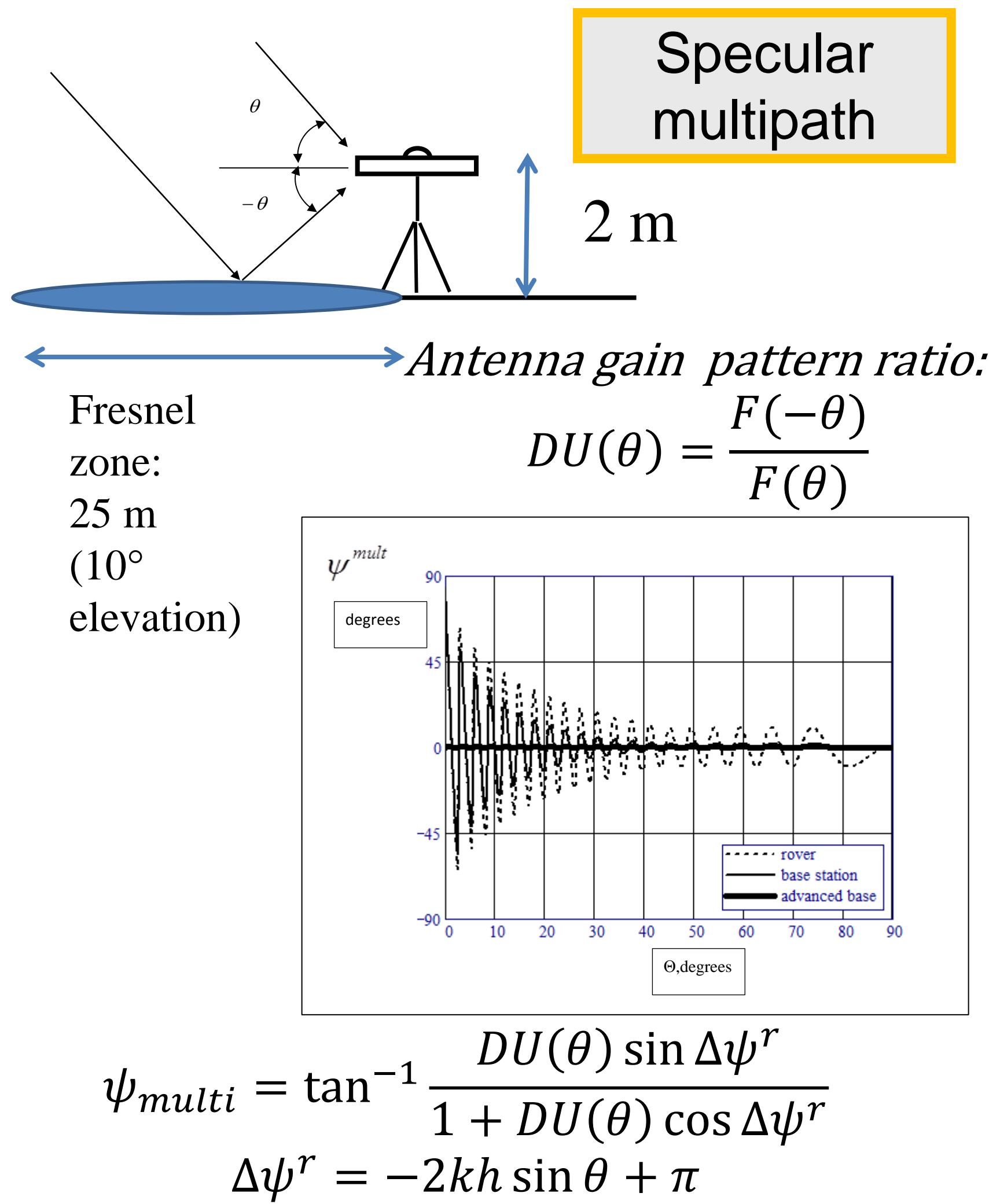
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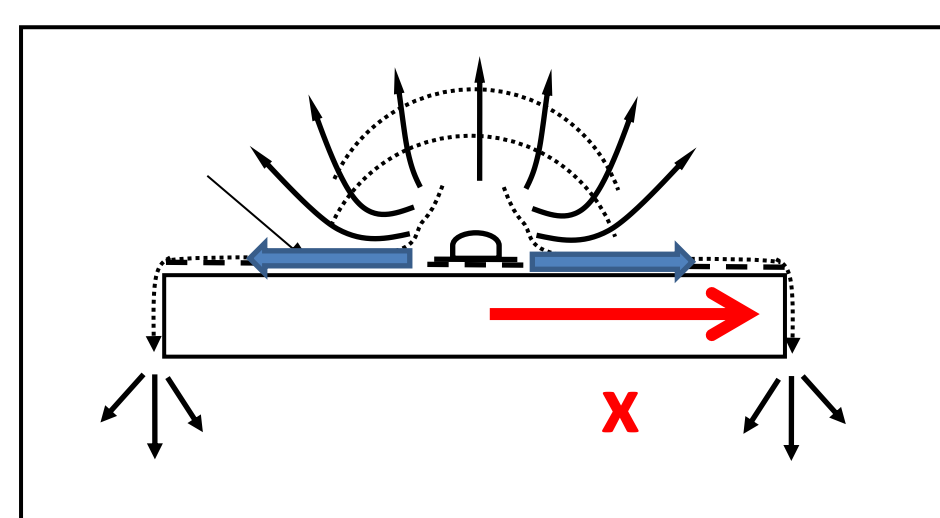
Conclusions

- GNSS receiving antenna with large impedance ground plane has been built;
- antenna has a cut-off pattern in elevation plane with down/up ratio of 20dB at 12 degrees elevation and 45dB at nadir;
- multipath error to positioning in real time falls below system noise level and is estimated to be +/-2mm in vertical coordinate
- certain improvement in data quality compared to traditional Choke Ring antenna is achieved

Error Sources



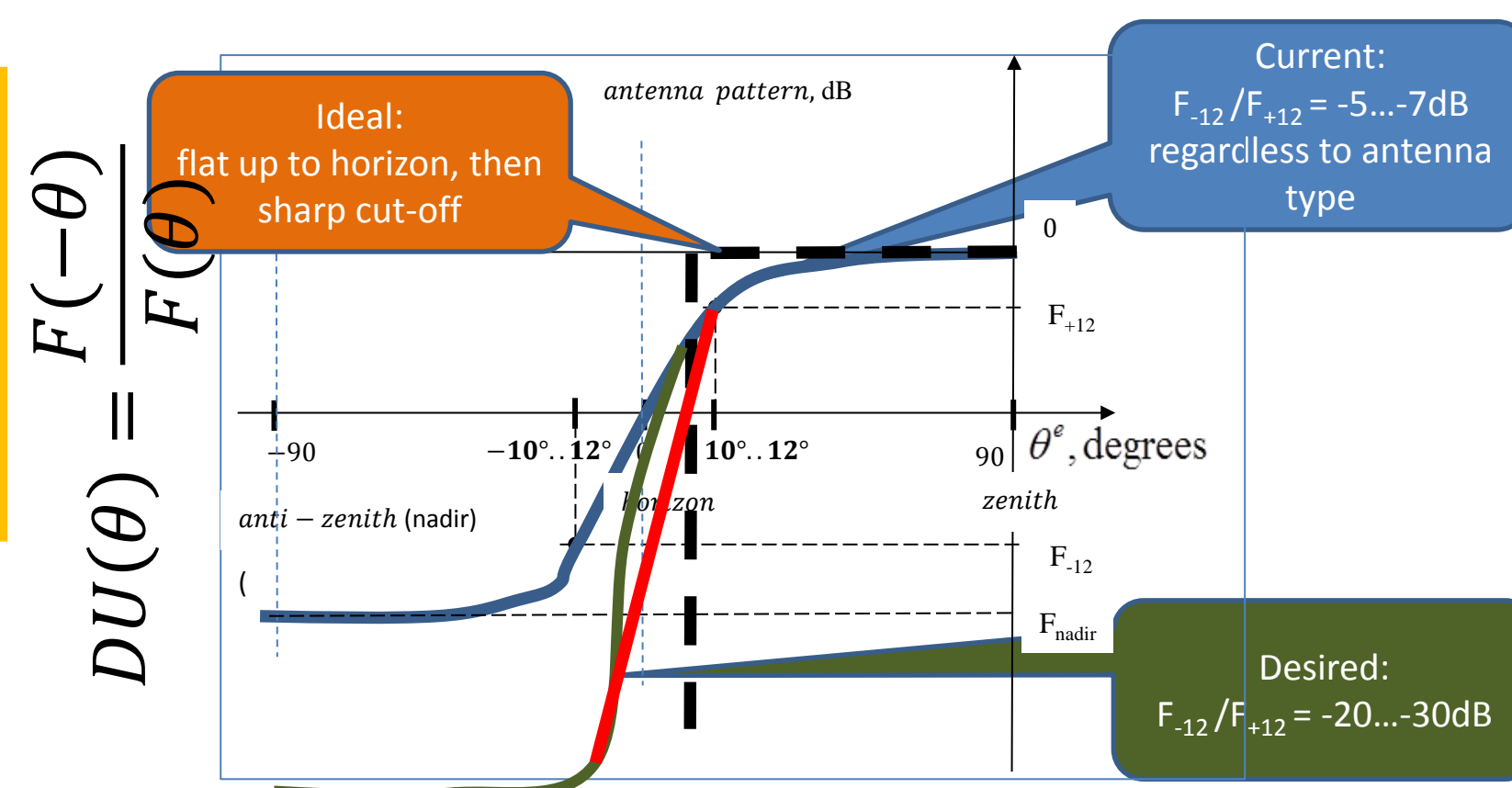
Diffraction over ground plane edges



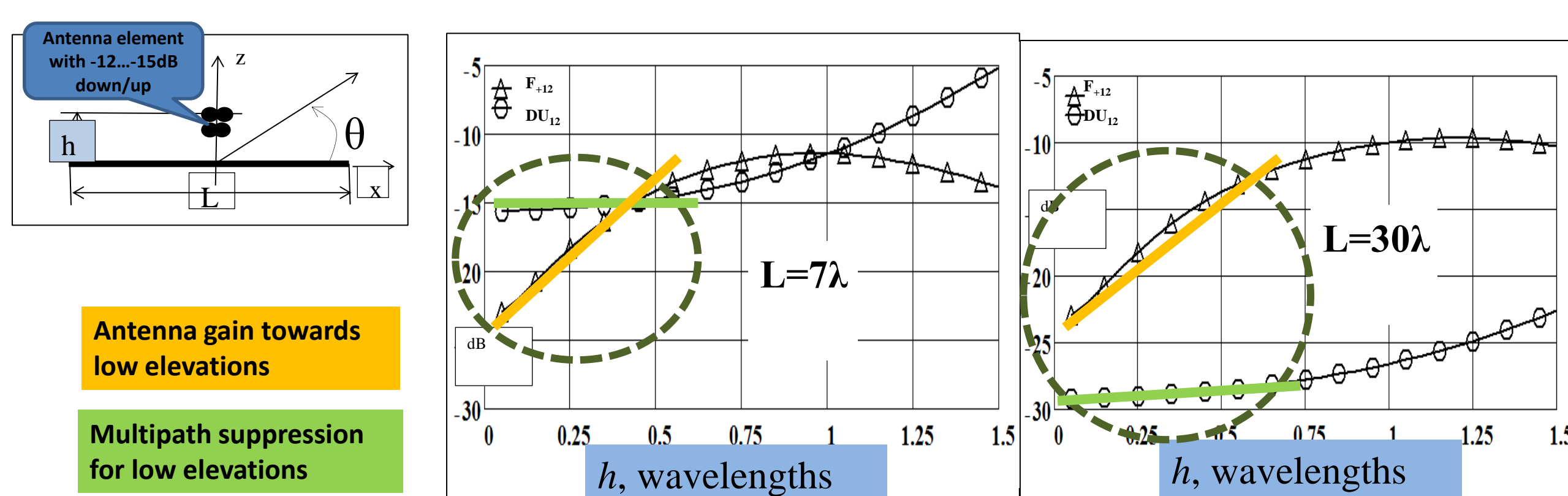
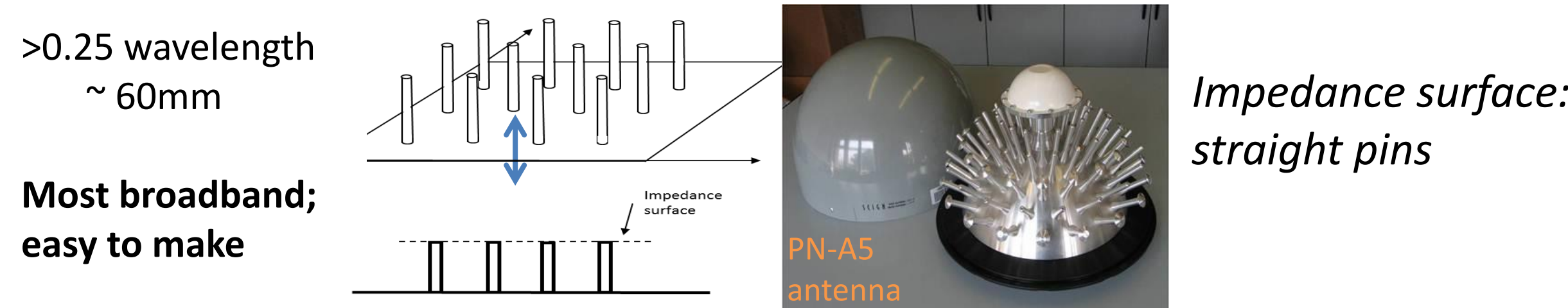
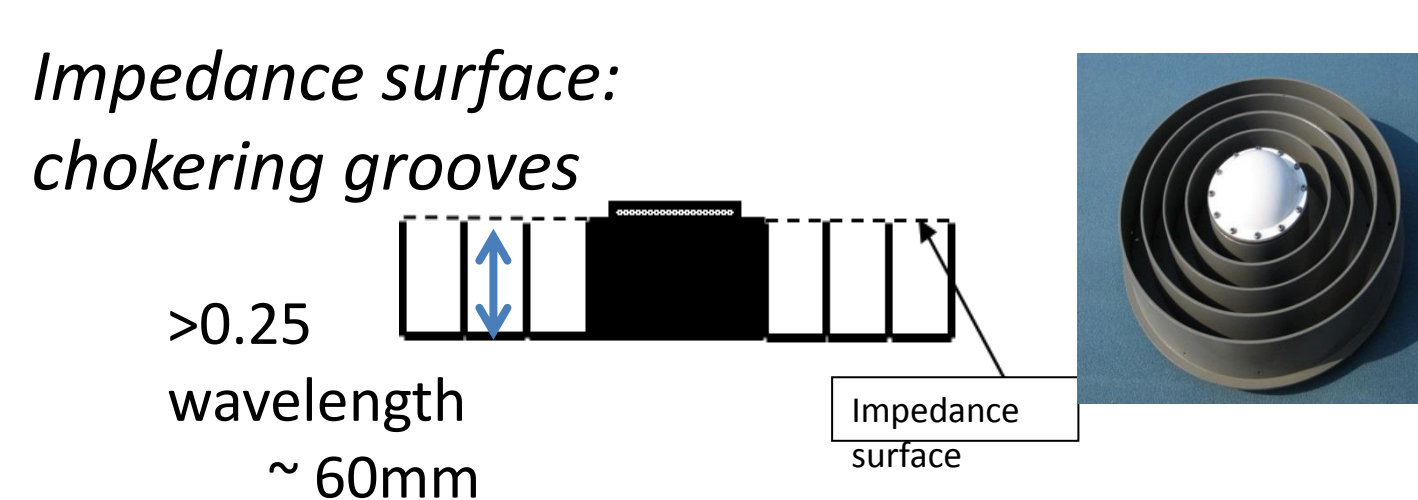
Flat metal ground plane: $A \sim 1/\sqrt{x}$
Impedance surface: $A \sim 1/x^{3/2}$

Design Considerations

Design goal:
Approach cut-off antenna pattern = antenna element



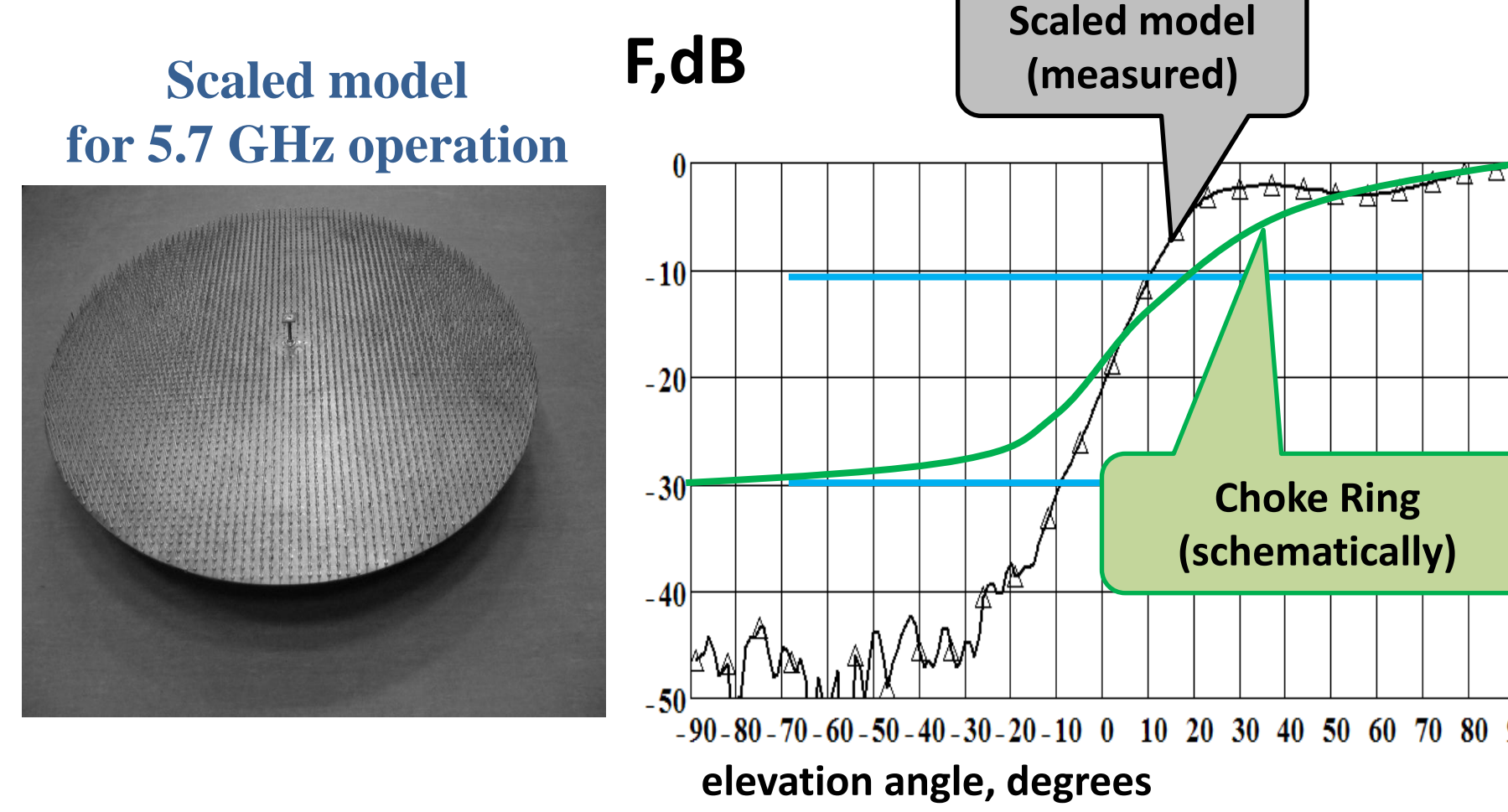
Design goal:
Minimize diffraction over ground plane edges = impedance surface



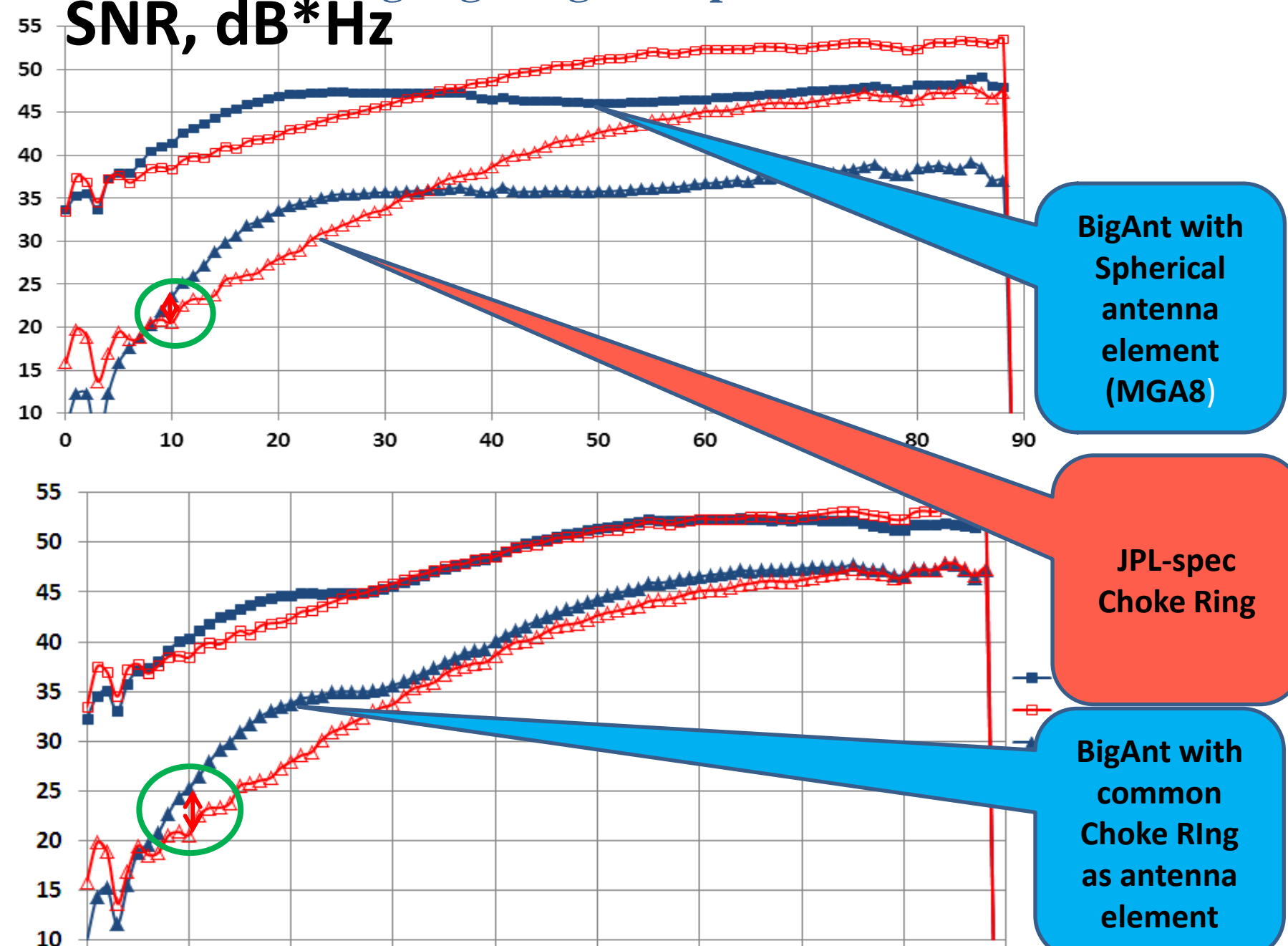
"BigAnt" Design

At GNSS frequencies, $h = 7-8$ cm (raise antenna above impedance surface)

Antenna element to have -12 to -15 dB gain, nadir vs zenith (most commercial GNSS antennas)

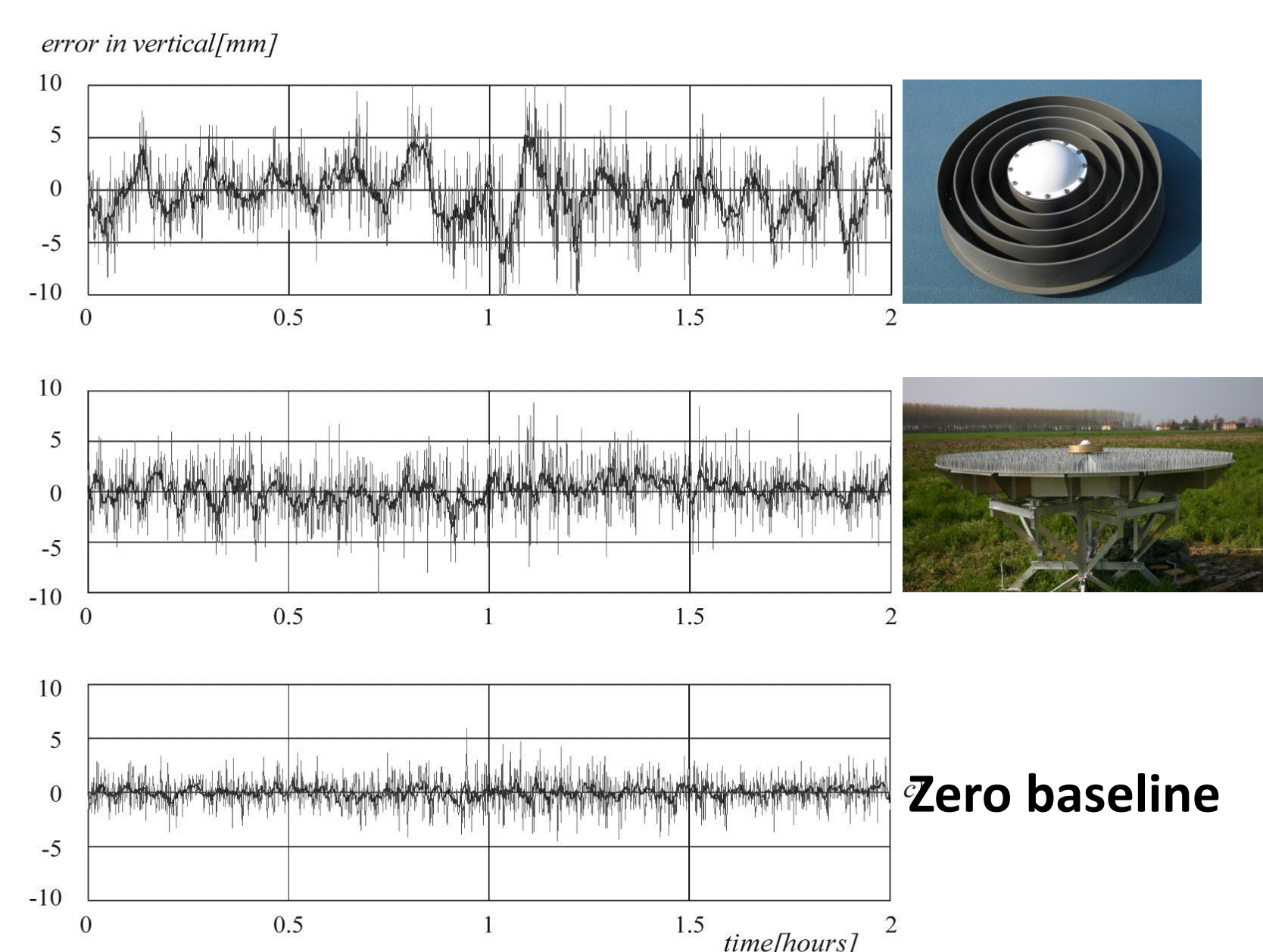


Field results using BigAnt groundplane with different antennas

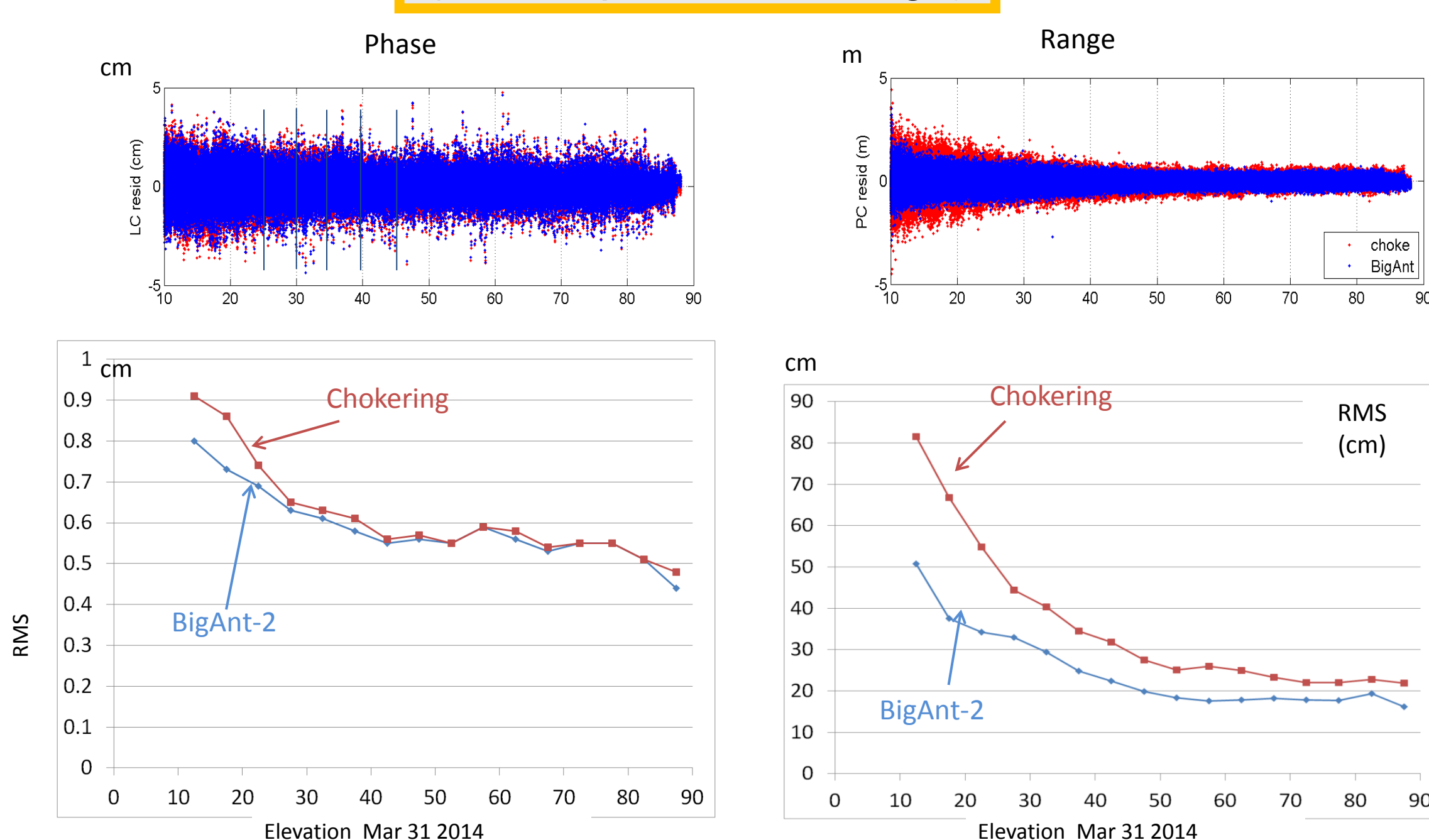


Results: Data combinations and Positions

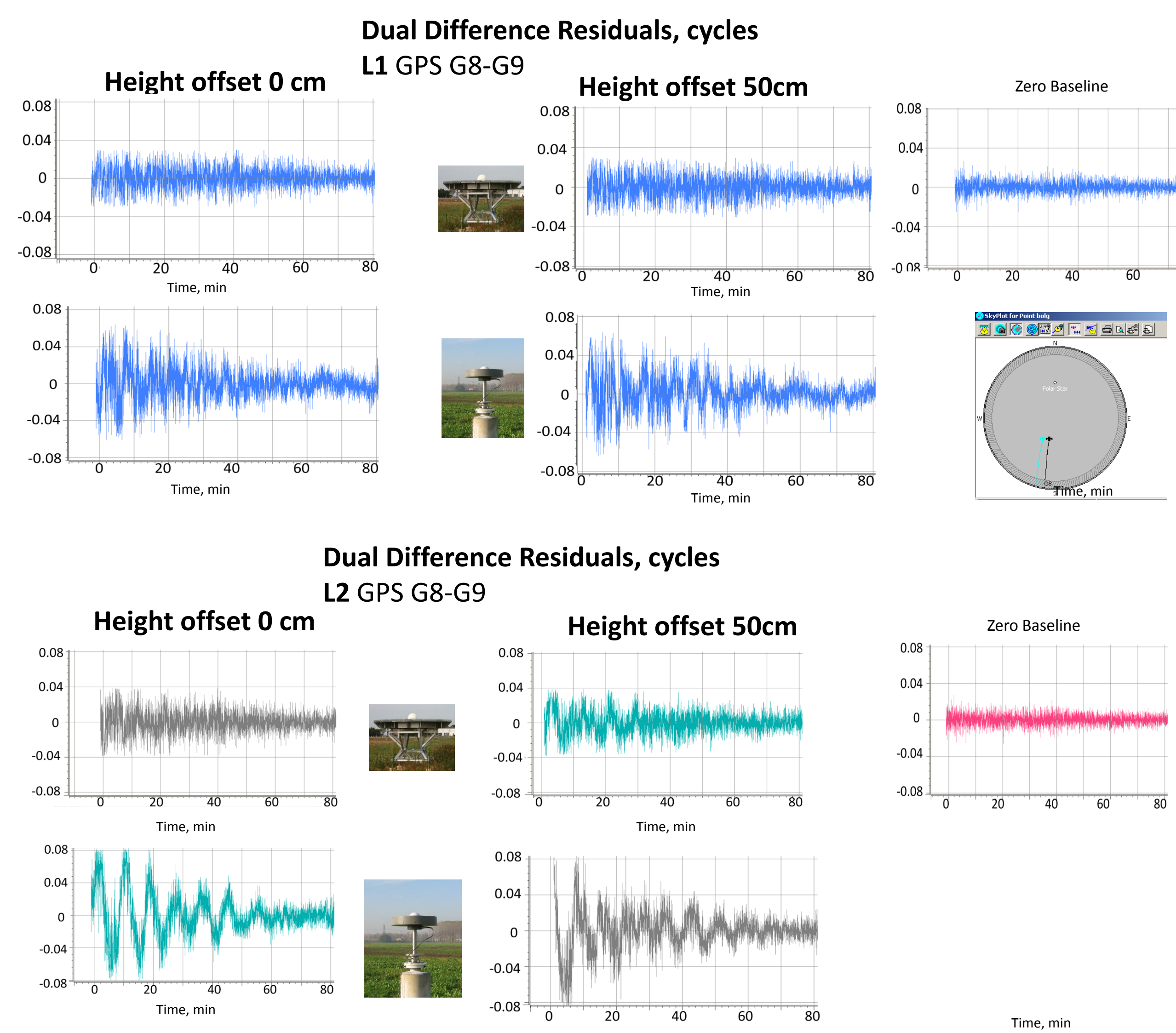
Kinematic positioning



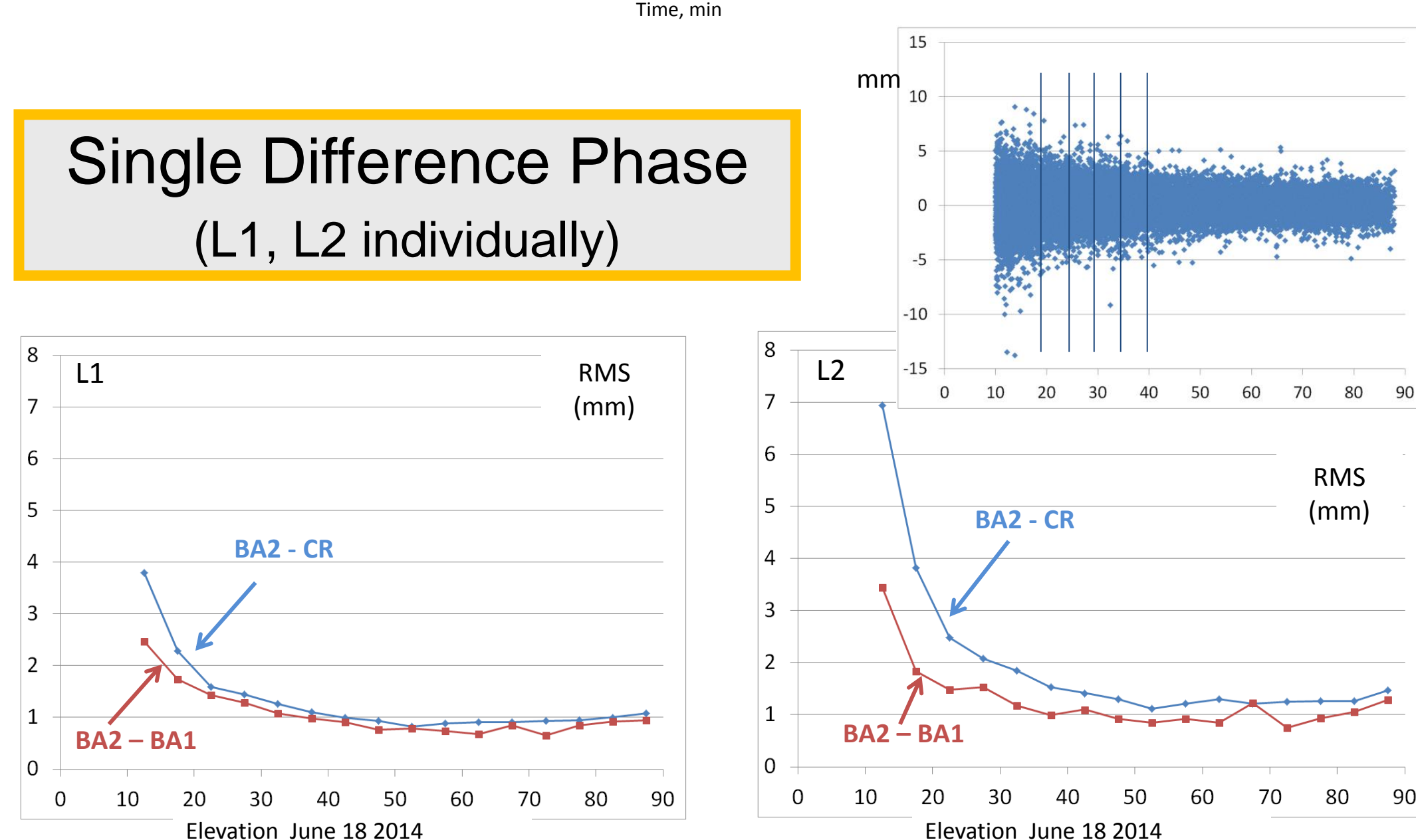
PPP residuals (L1+L2, phase and range)



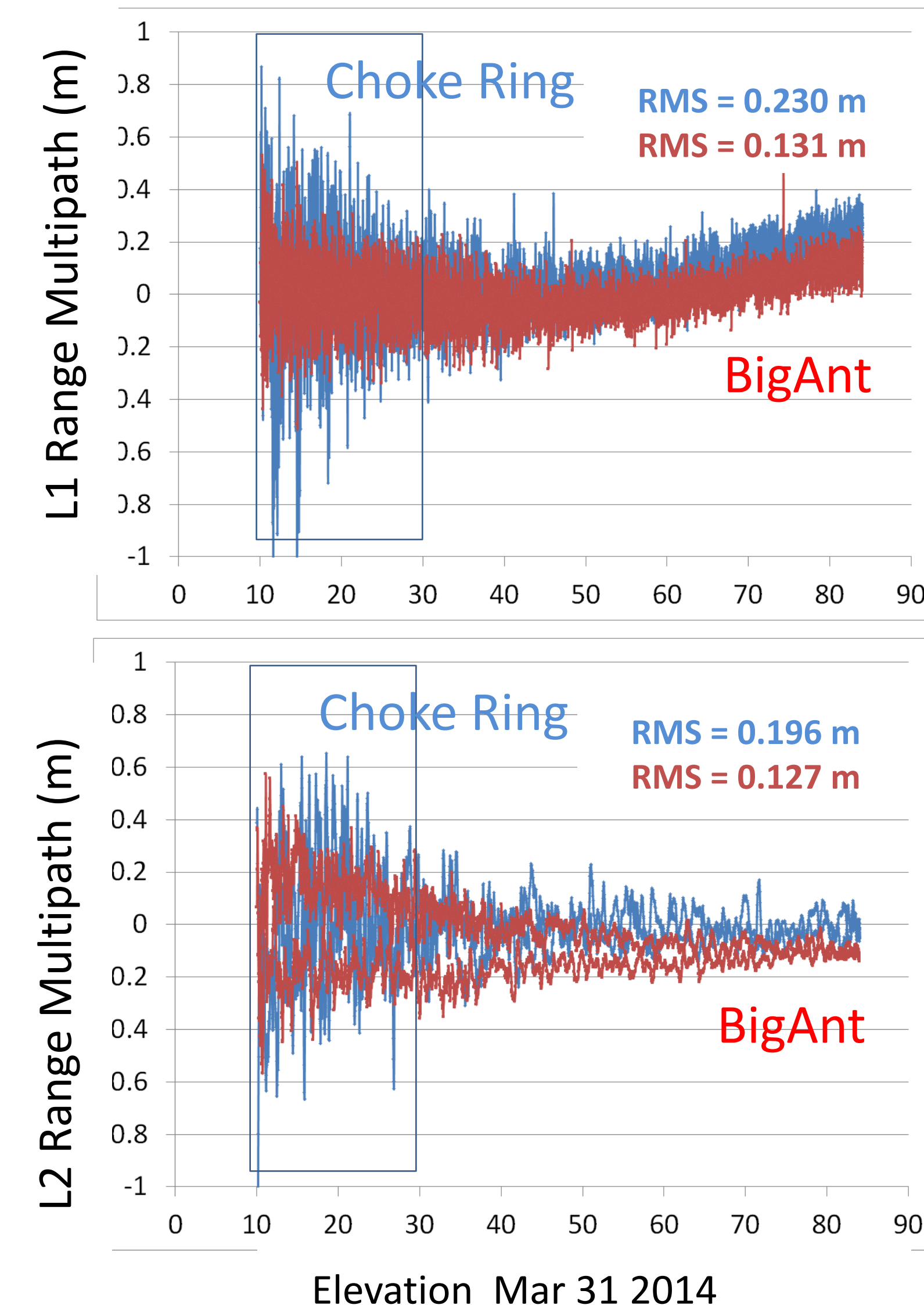
Double-difference phase



Single Difference Phase (L1, L2 individually)



Range multipath



- Relative to conventional chocking, BigAnt:
- (1) Suppresses phase multipath (even with height contrast), especially at low elevations
 - (2) Suppresses range multipath
 - (3) Lowers data noise (e.g. solution residual scatter, DD scatter, kinematic positions)