
Impact of Absolute Antenna Phase Center Corrections on Global GPS Solutions

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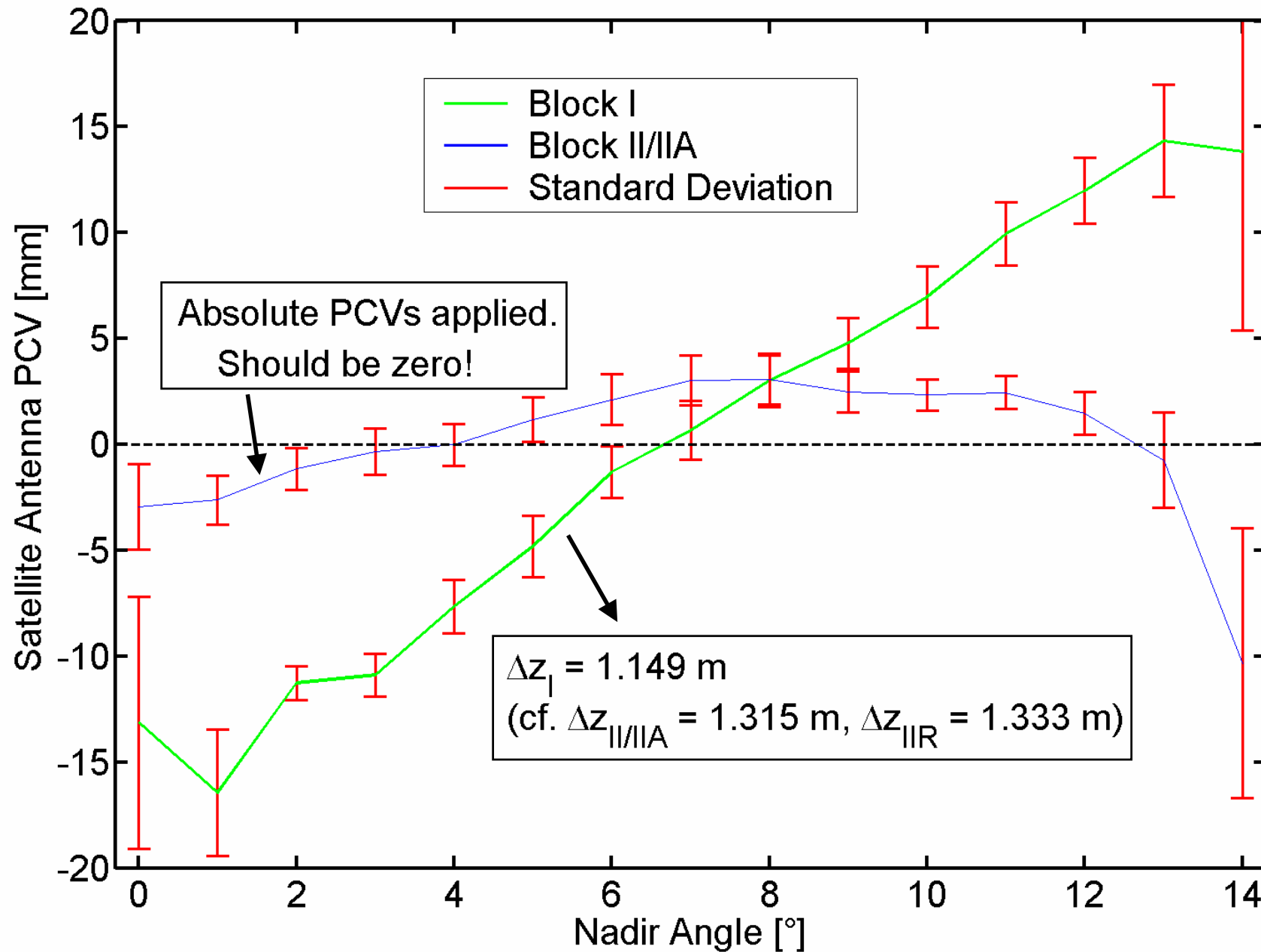
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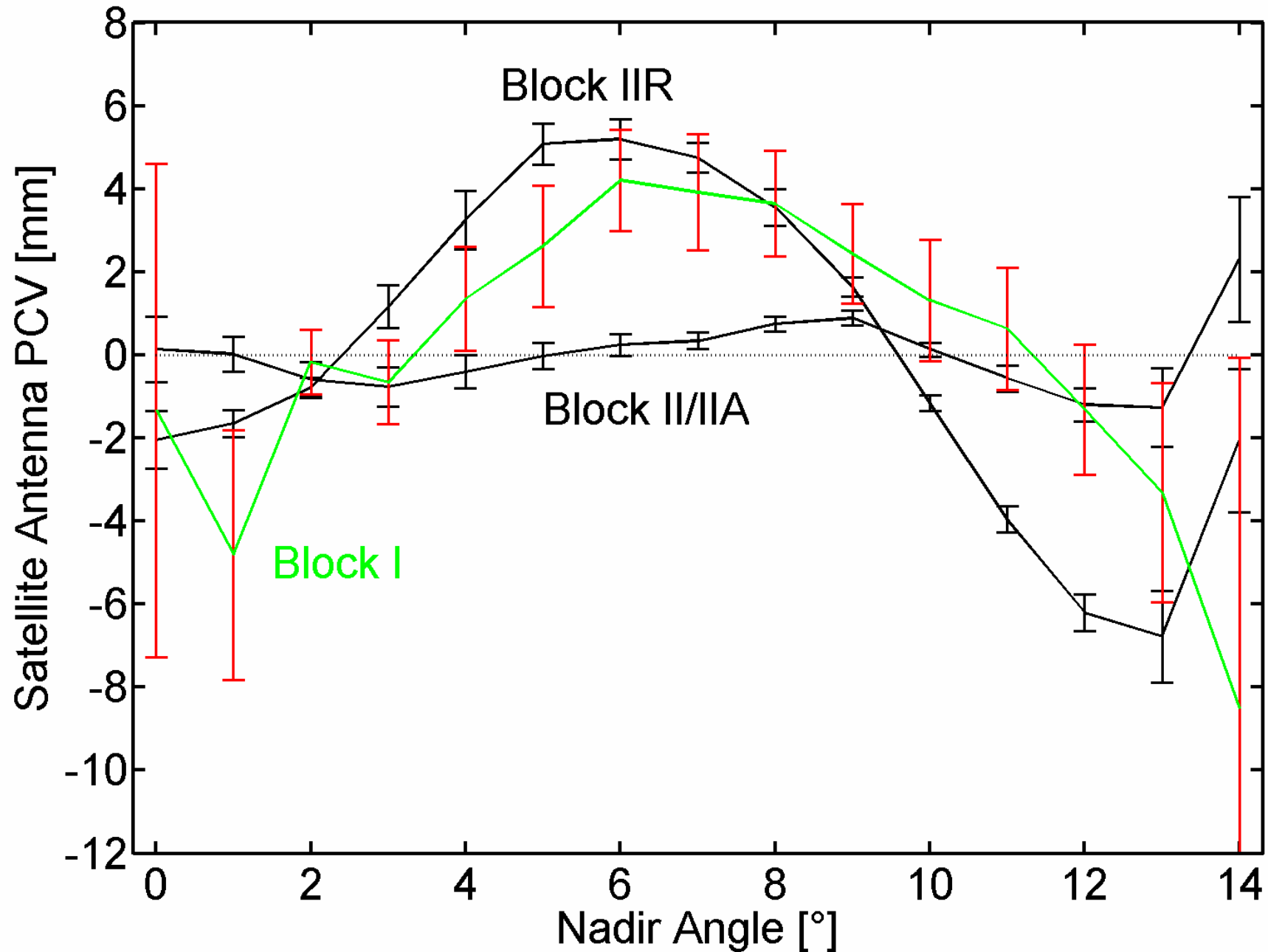
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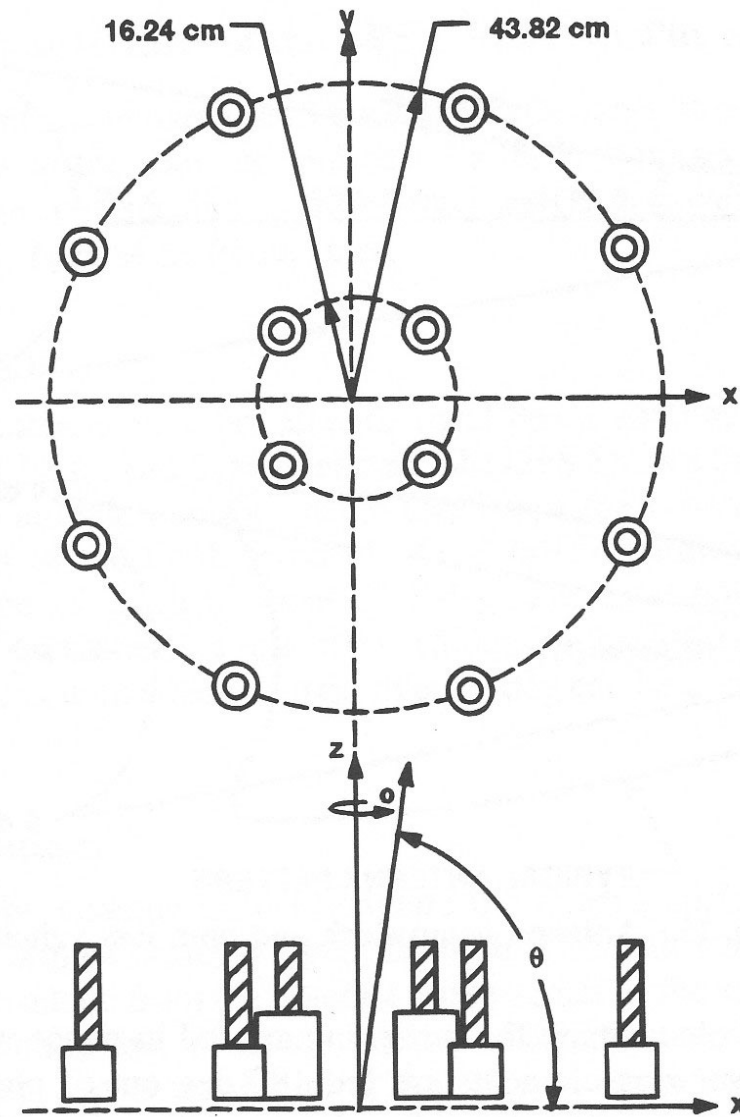
Mean LC Pattern (9 Days in 1994)



Mean LC Pattern after Offset Correction



Azimuth-Dependent Satellite Antenna PCVs



Antennas of all existent satellite blocks consist of

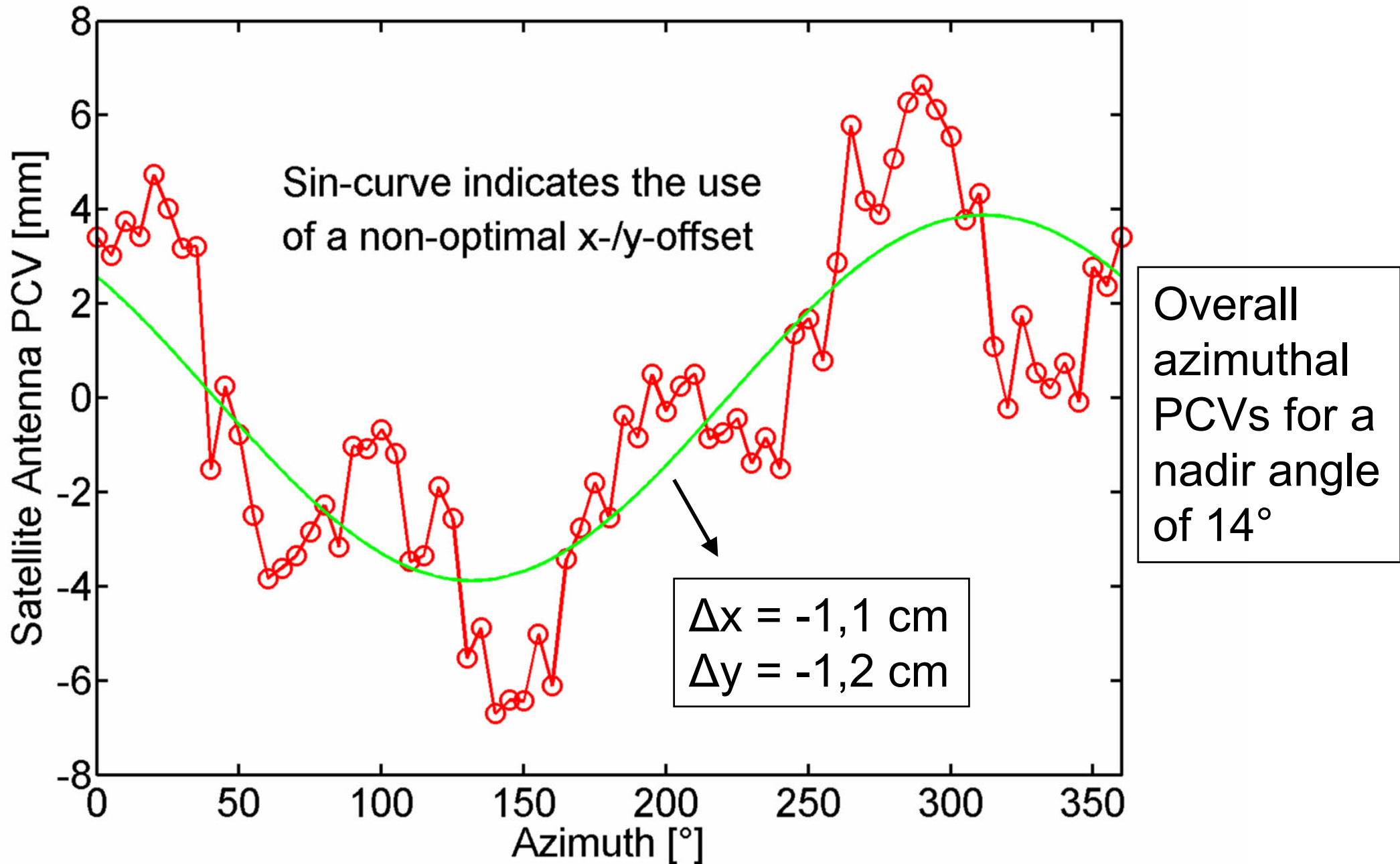
- 12 helical elements
- 2 concentric circles
- 4 elements forming the inner circle

Orientation with regard to the y-axis not always clear!

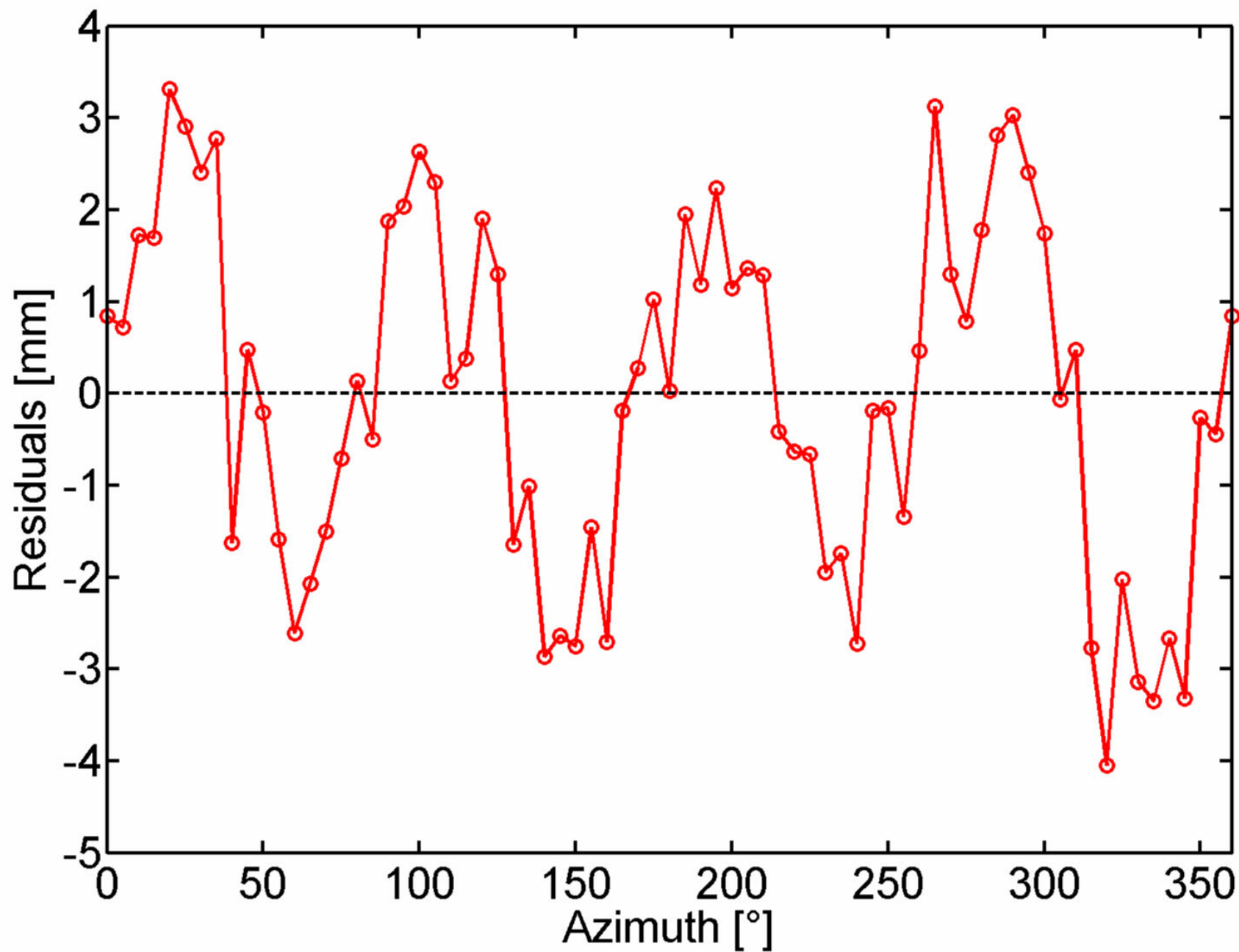
→ **Fourfold pattern** should show up in the PCVs

Block I antenna (Czopek et al., 1993)

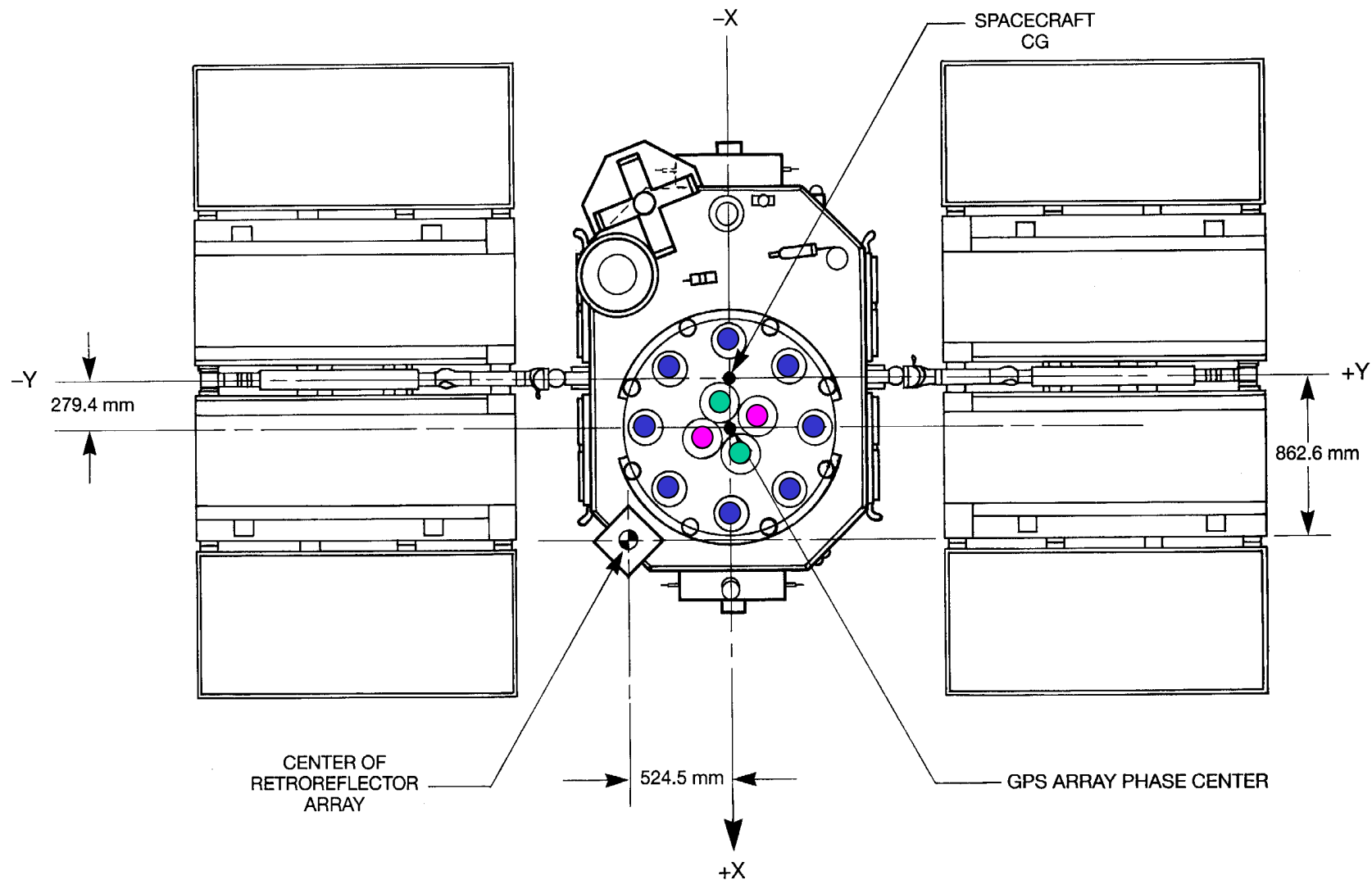
Block IIR, Overall PCVs



Block IR PCVs after Offset Correction

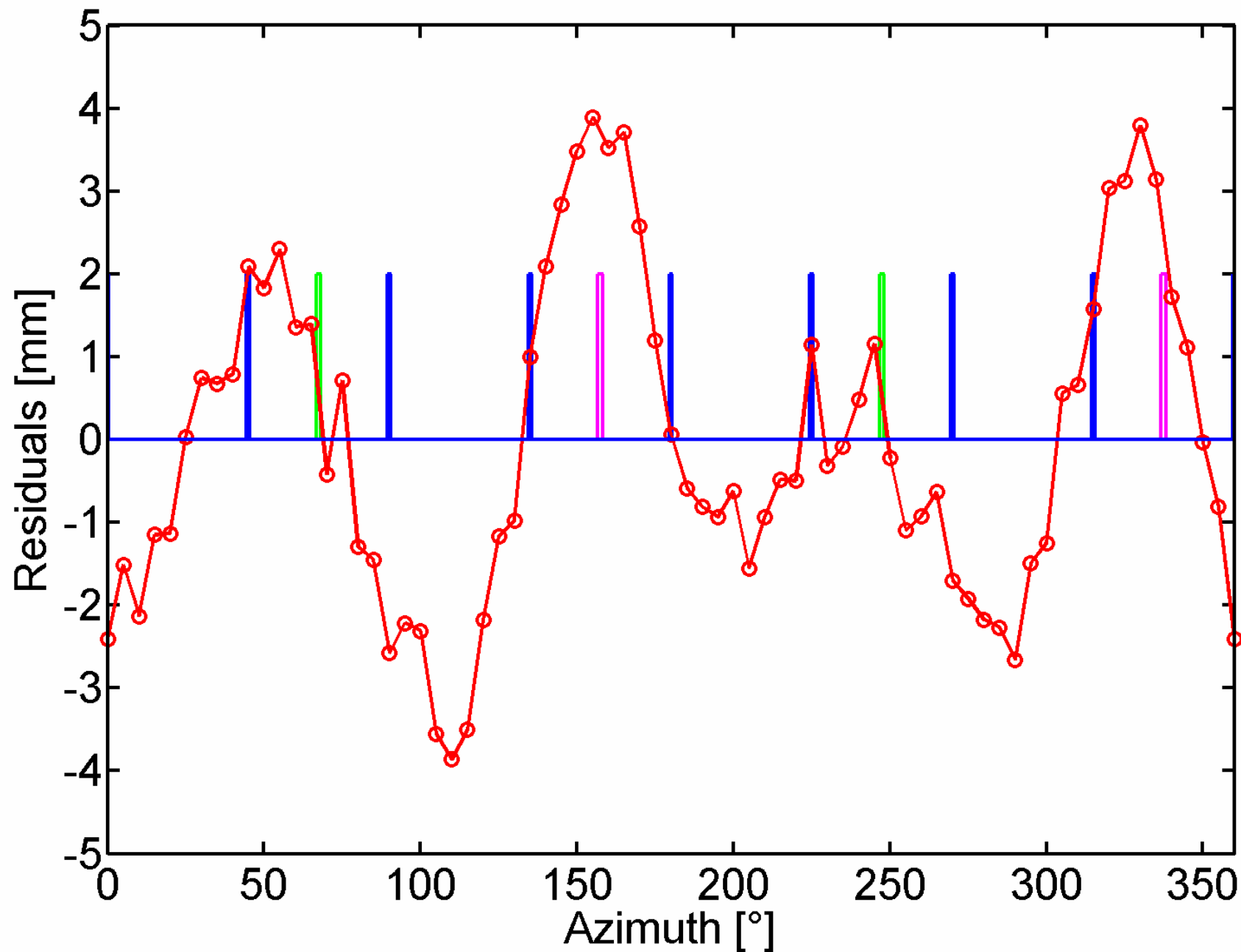


Azimuth-Dependent Satellite Antenna PCVs

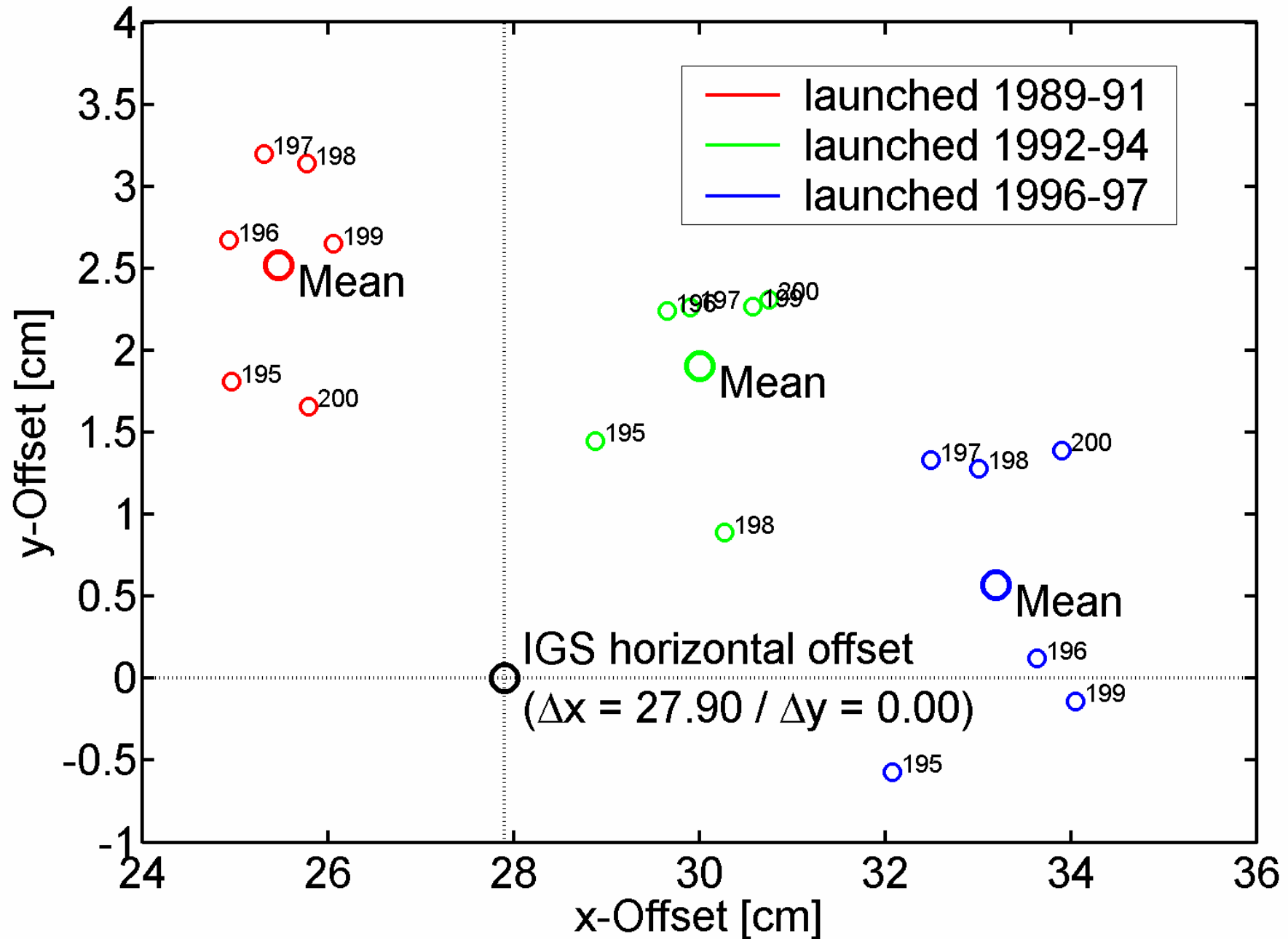


Inner circle of Block II/IIA: **elements unequally spaced?**

Block II/IIA PCVs after Offset Correction



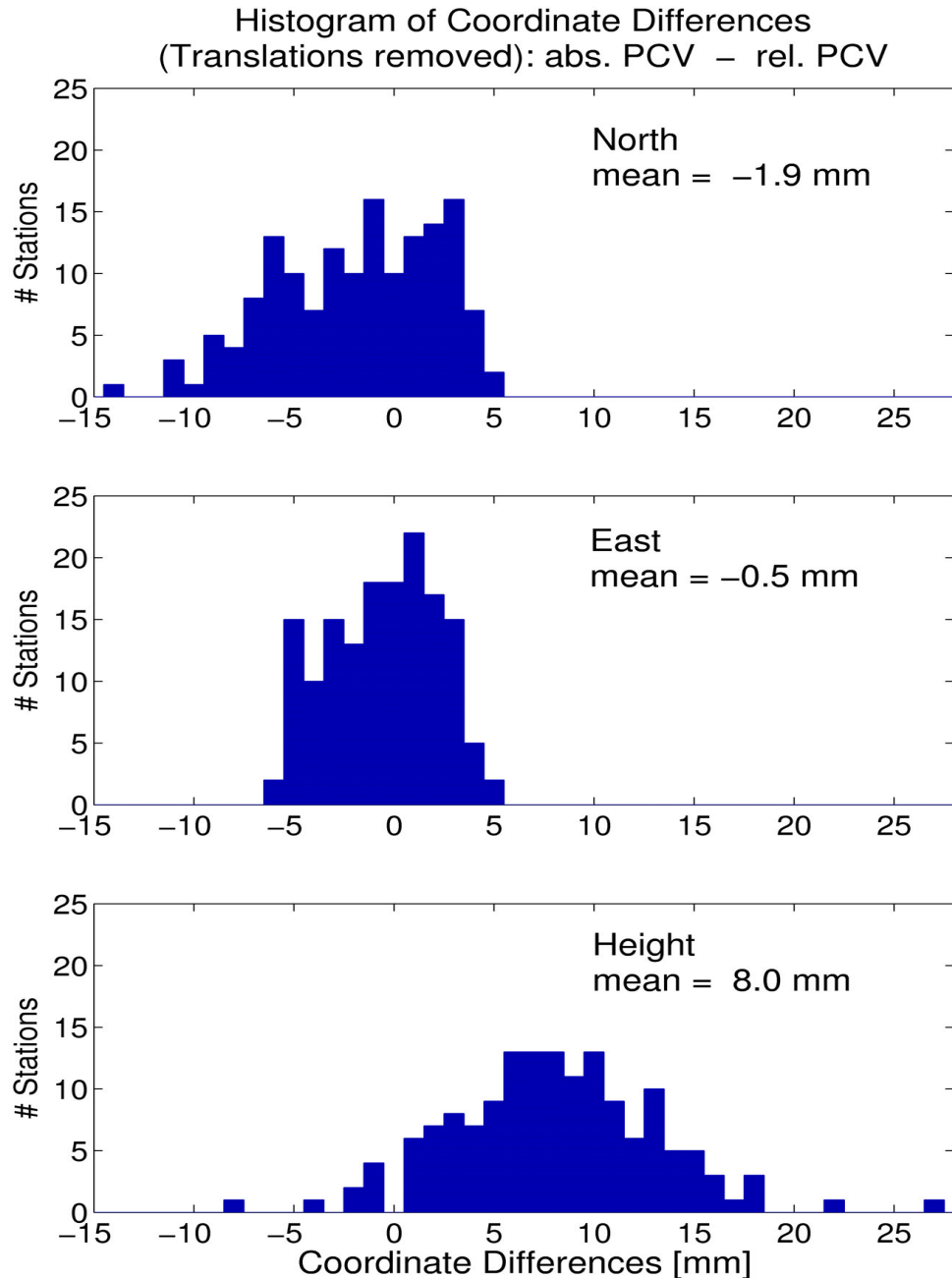
Block II/IIA, Horizontal Offsets



Comparison of Global Solutions

- IGS network (about 150 stations)
- Bernese GPS Software
- Daily solutions with estimation of all relevant global parameters (combined to two-week solutions for some of the tests)
- **PCVs applied:**
 - **relative:** official IGS set *igs_01.pcv* (receiver PCVs only!)
 - **absolute:** IGS test set *pcv_abs_proposed11.tst* (receiver and satellite PCVs)

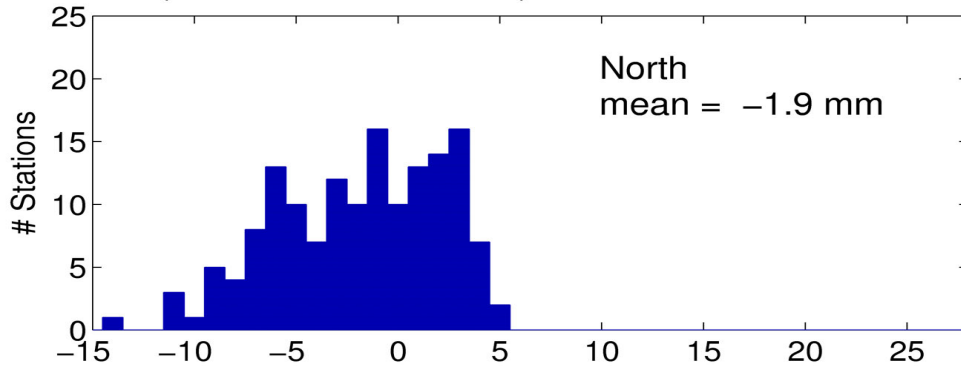
Coordinate jumps



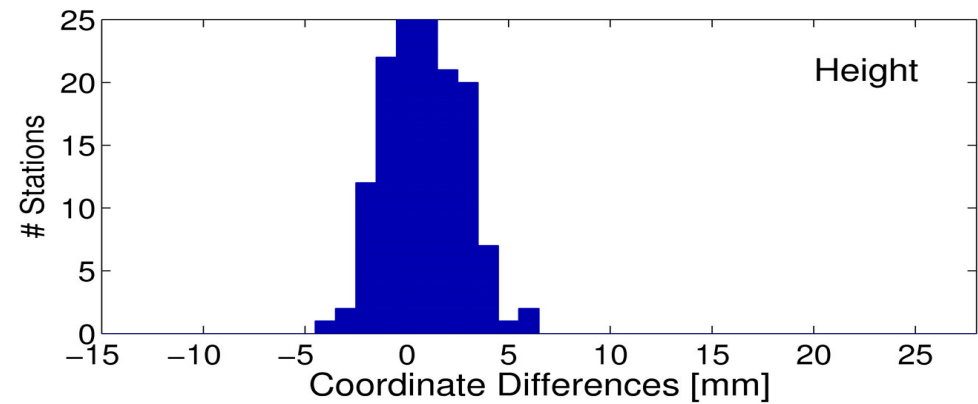
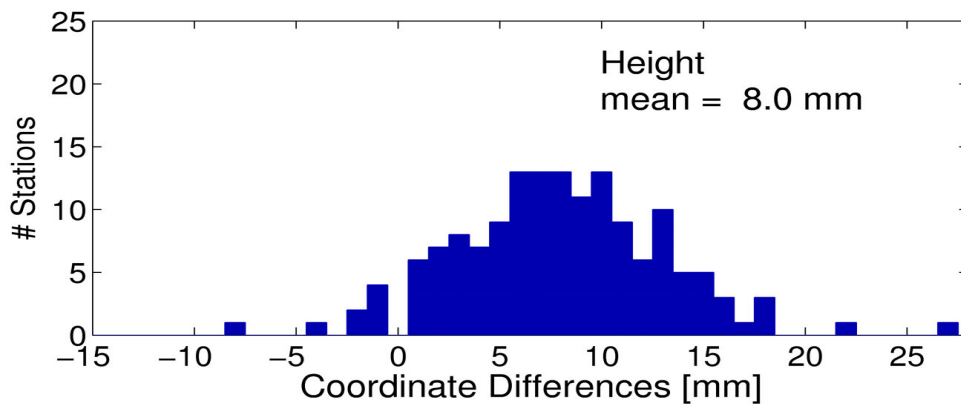
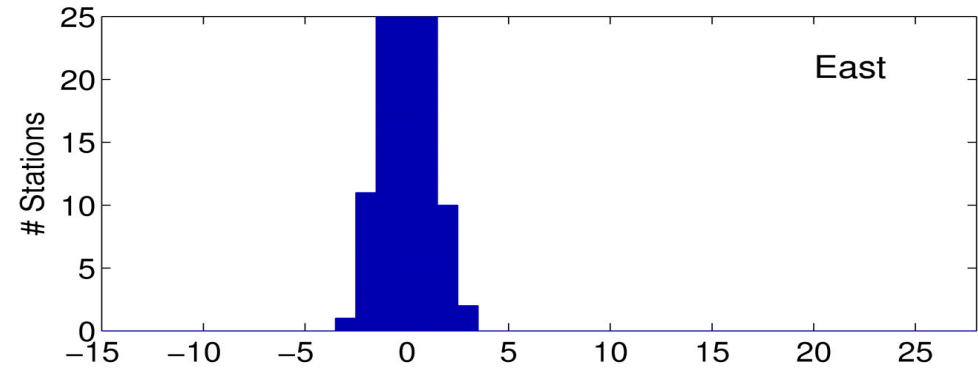
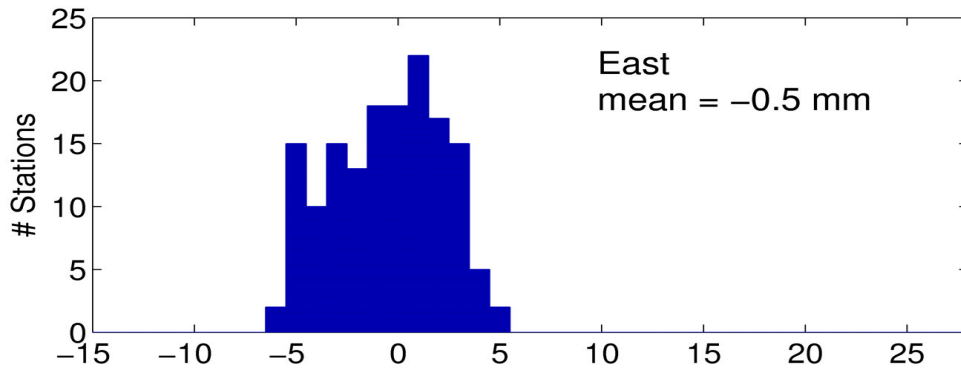
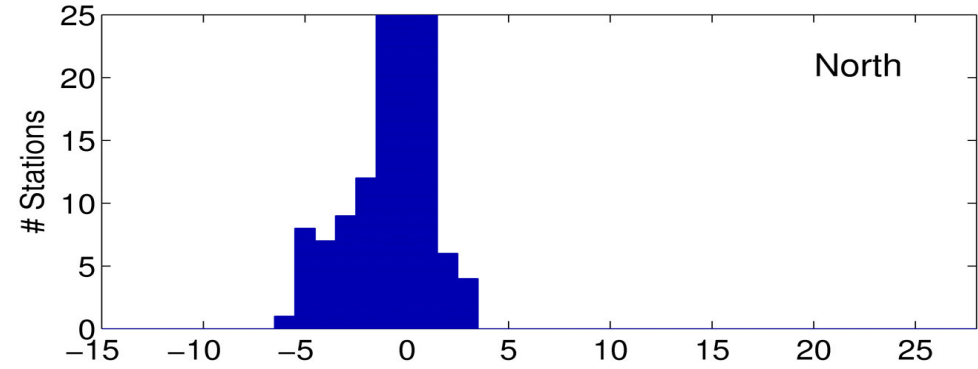
- Change in coordinates when switching from **relative** to **absolute PCVs** (two-week solution)
- Systematic effects due to different geocenter positions removed (several mm)
- Systematic change in height due to **change of scale to ITRF** (different for each AC)
- Absolute PCVs include **azimuth-dependent** receiver antenna corrections

Impact of Azimuth-Dependent PCVs

Histogram of Coordinate Differences
(Translations removed): abs. PCV - rel. PCV

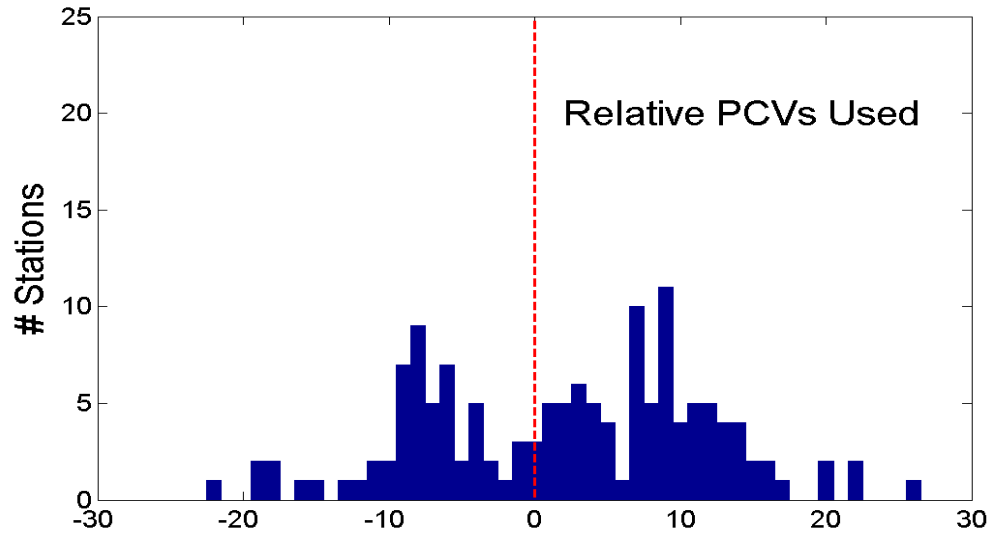


Histogram of Coordinate Differences:
Impact of azimuth-dependent receiver antenna PCVs

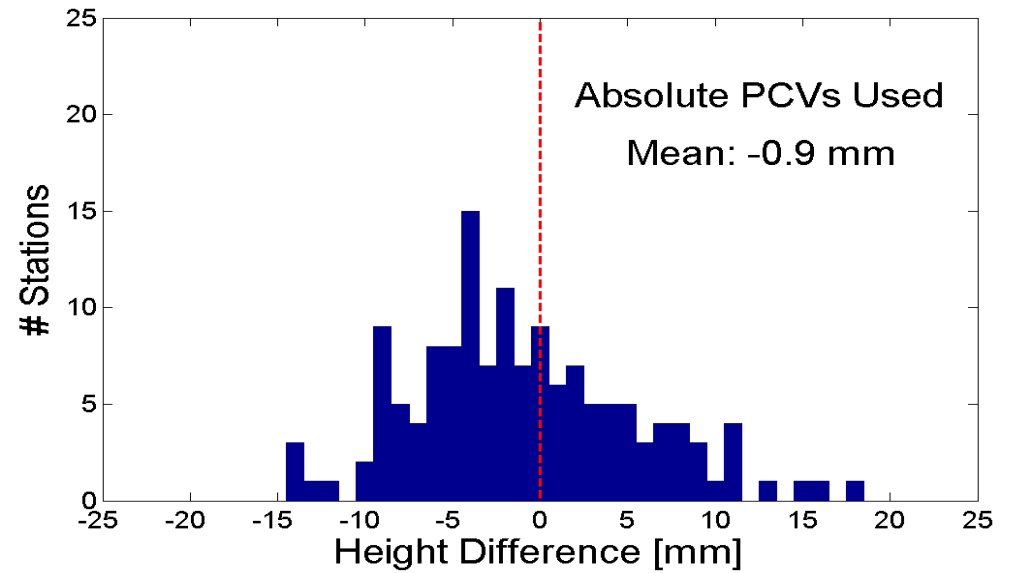
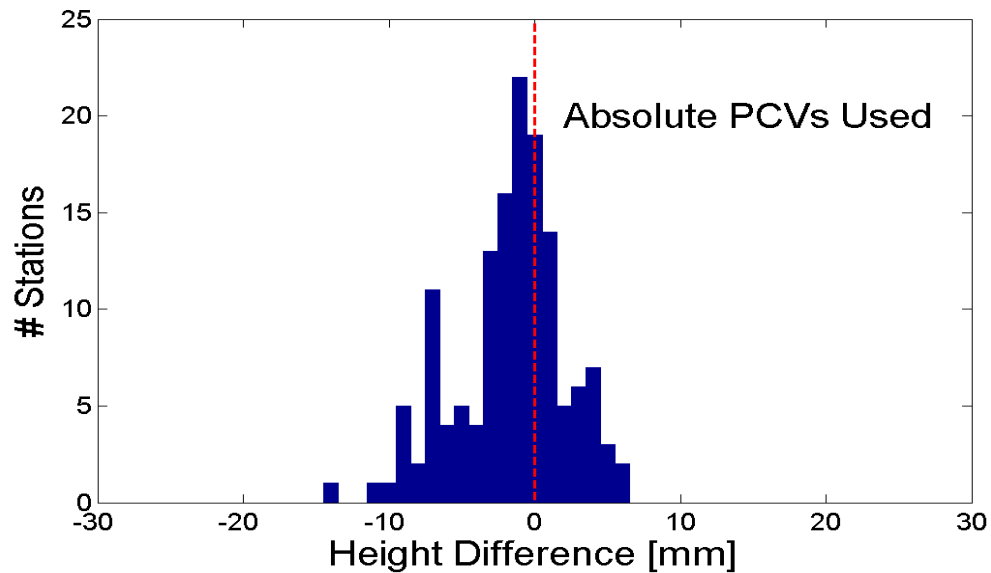
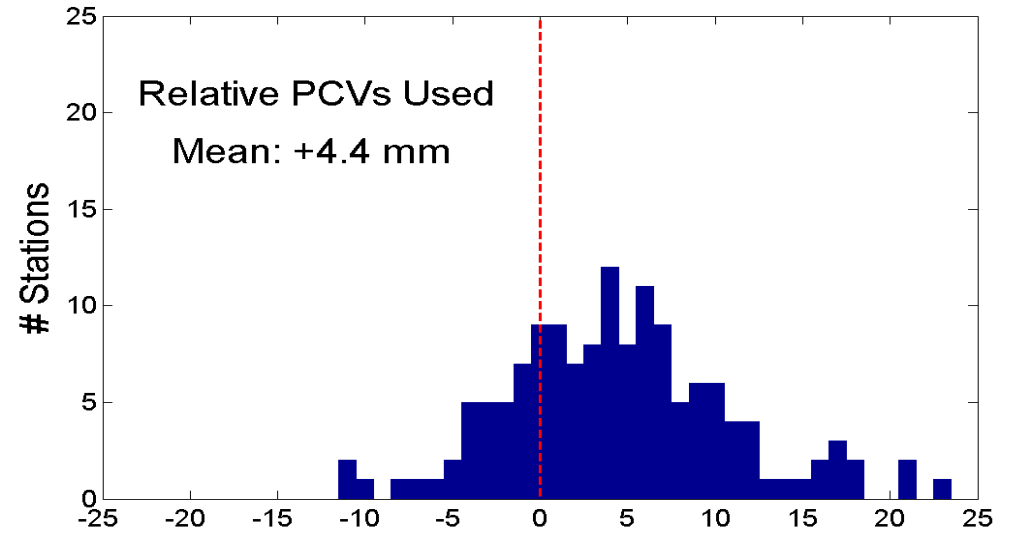


Impact of Elevation Cut-Off Angle

Elevation Cut-Off: $10^\circ \rightarrow 3^\circ$



Elevation Cut-Off: $15^\circ \rightarrow 10^\circ$

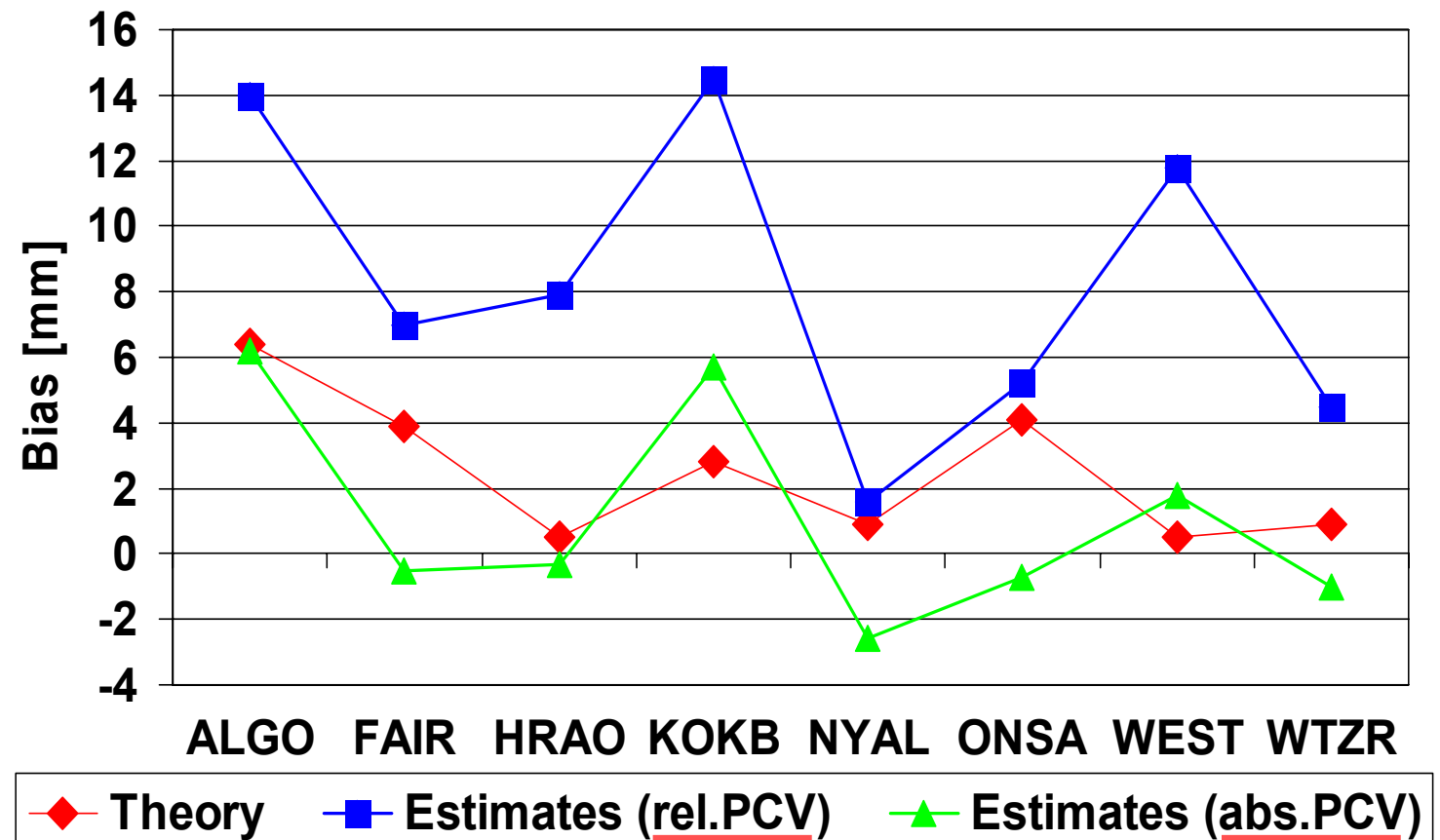


Comparison of GPS & VLBI Troposphere

Station	Δ Height (local tie) [m]
ALGO	23.11
FAIR	13.08
HRAO	1.54
KOKB	9.24
NYAL	3.07
ONSA	13.71
WEST	1.75
WTZR	3.10

VLBI: data of the continuous two-week campaign CONT'02 processed at DGFI

Mean Bias between GPS and VLBI

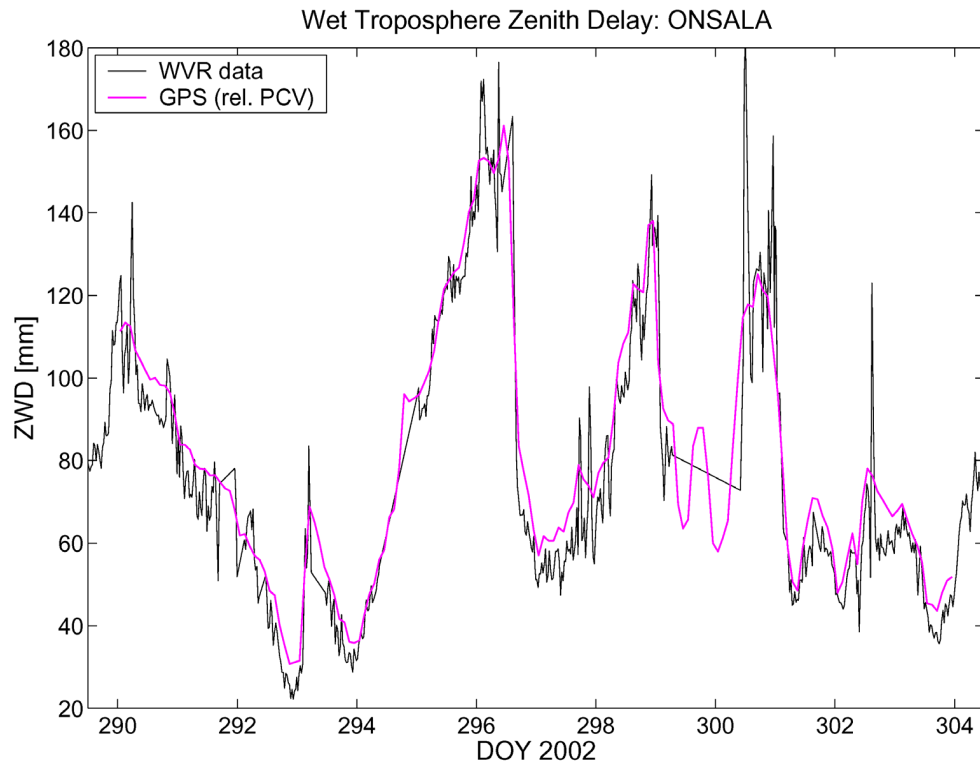


Theory: Δ Height = 10 m

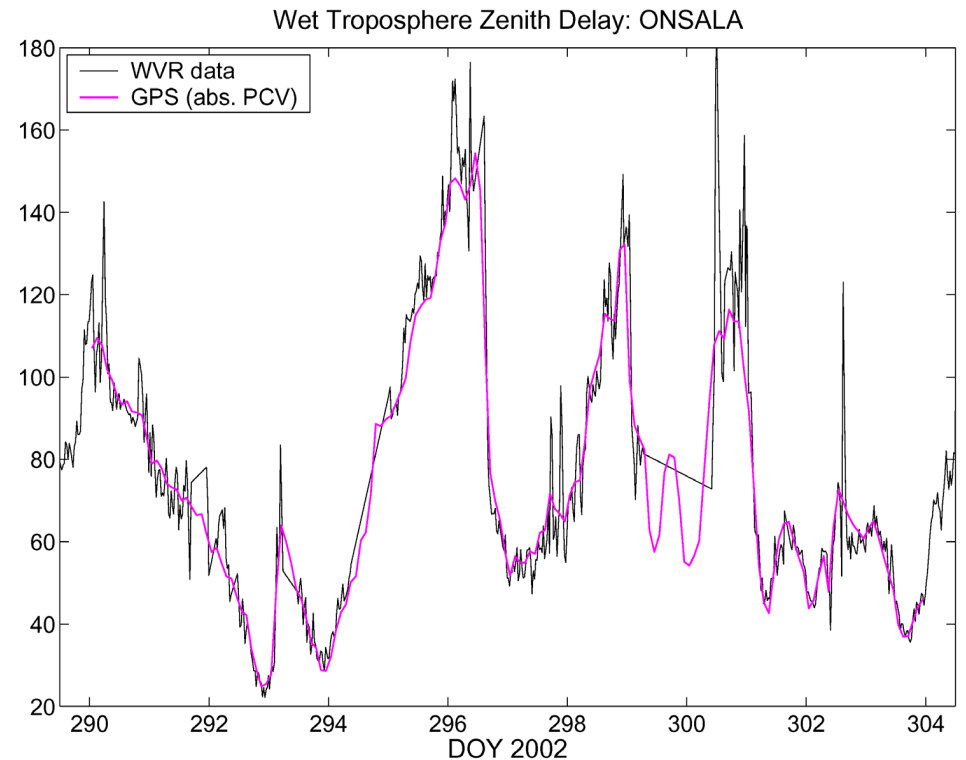
→ Δ ZD \approx 3 mm

Comparison of GPS & WVR Troposphere

WVR: preliminary data set from Onsala



**Bias using relative PCVs:
4.9 mm**



**Bias using absolute PCVs:
-0.9 mm**

Conclusions

Satellite antennas:

- Comparison of Block II pattern from 1994 and 2002: ± 3 mm
- Azimuth-dependent PCVs: ± 4 mm
- Significant differences in the horizontal offsets (center of mass variations due to maneuvers?)

Transition to absolute phase center corrections:

- Better agreement with tropospheric results from VLBI and WVR
- Coordinate jumps of up to 1 cm
- Results less dependent on the elevation cut-off angle
- A must when using data below 10° elevation!