Generation of igs05.atx – status quo

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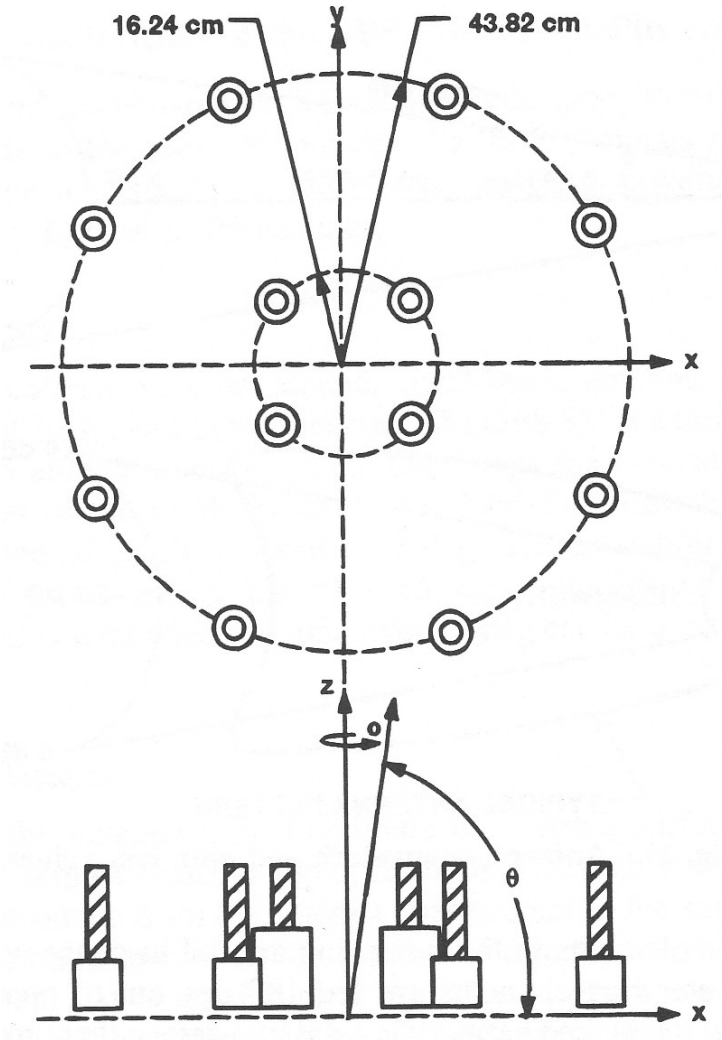
GPS satellite antenna types



Block I antenna (Czopek et al., 1993)

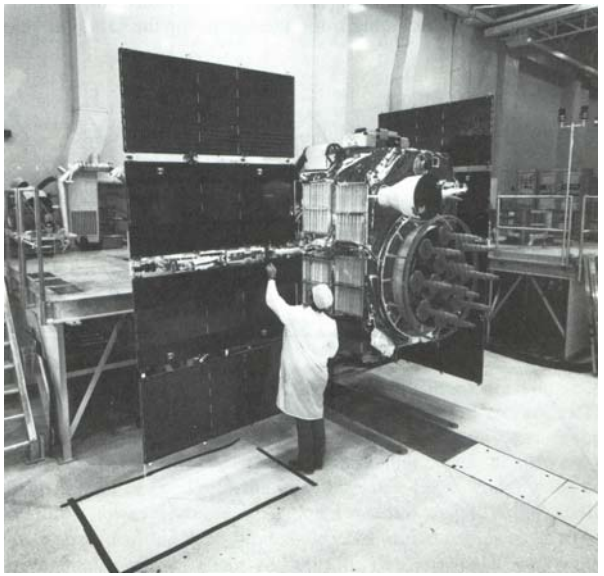


Photo: Rockwell International

4 different satellite antenna types:

- Block I
- Block II, Block IIA
- Block IIR-**A**
- Block IIR-**B**, Block IIR-M

Block IIR-A/B

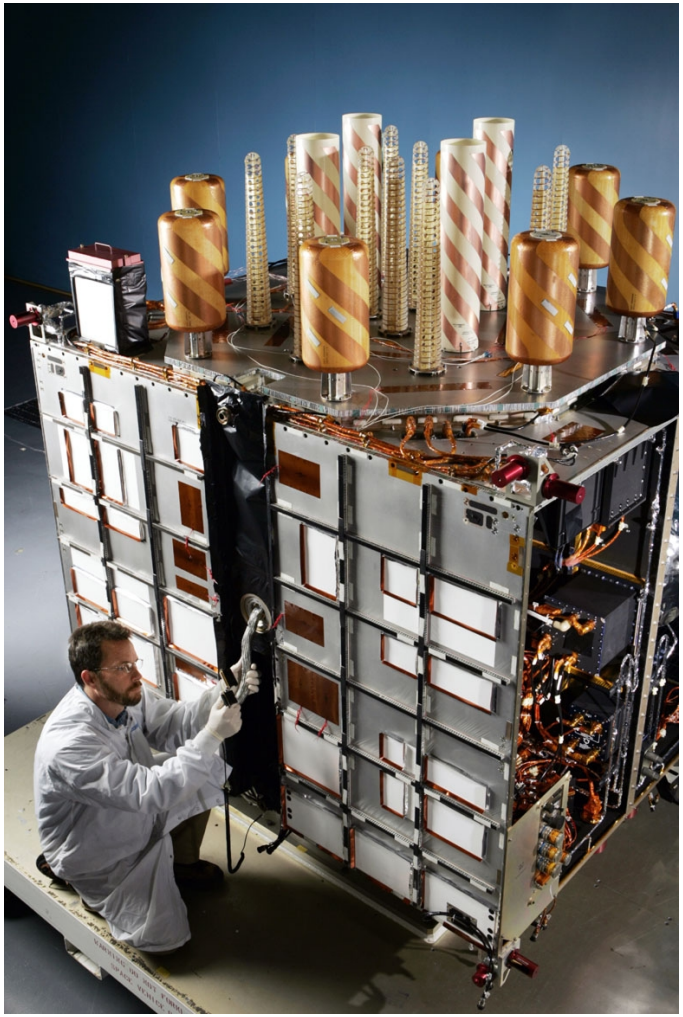
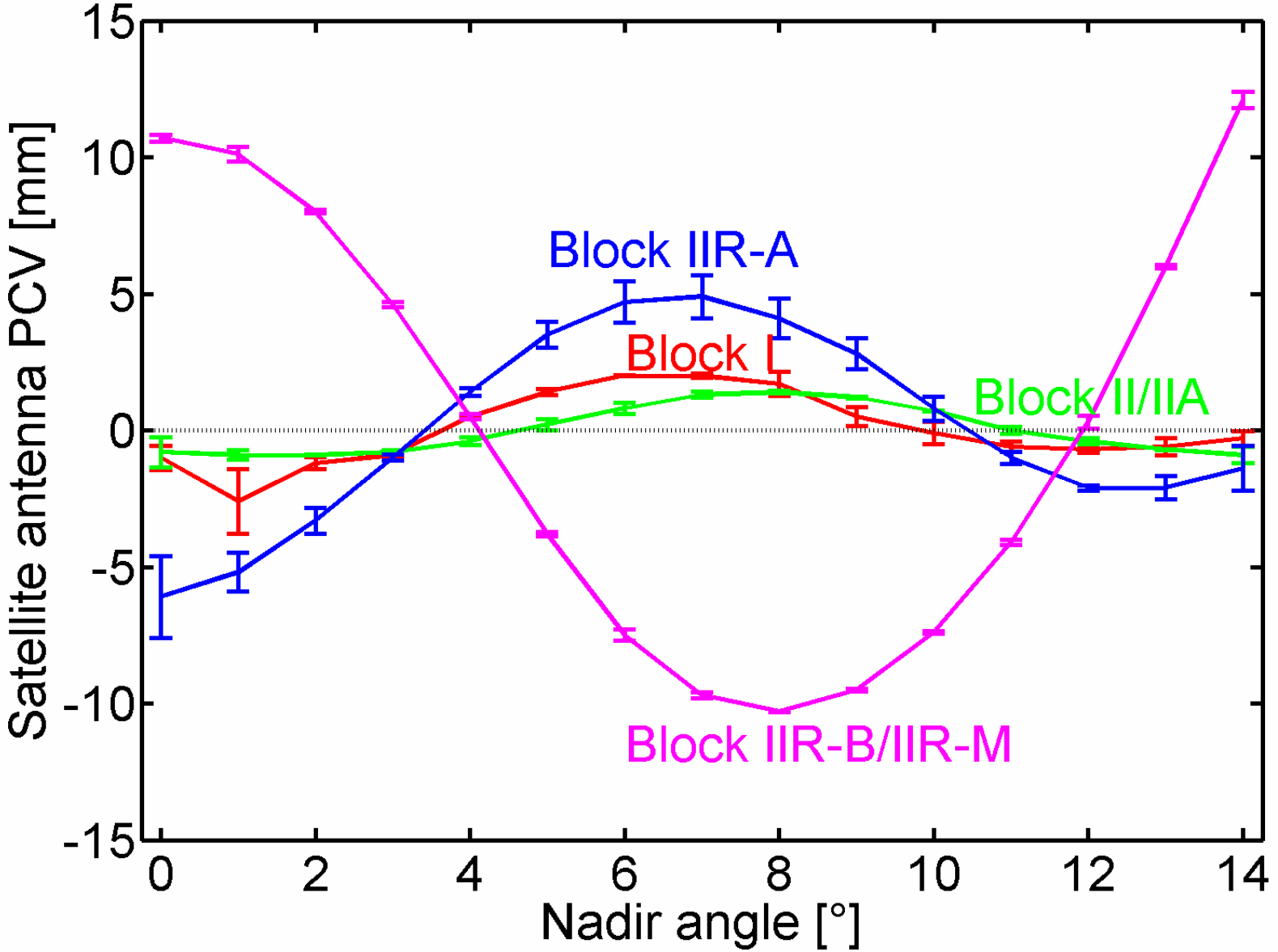


Photo: www.lockheedmartin.com

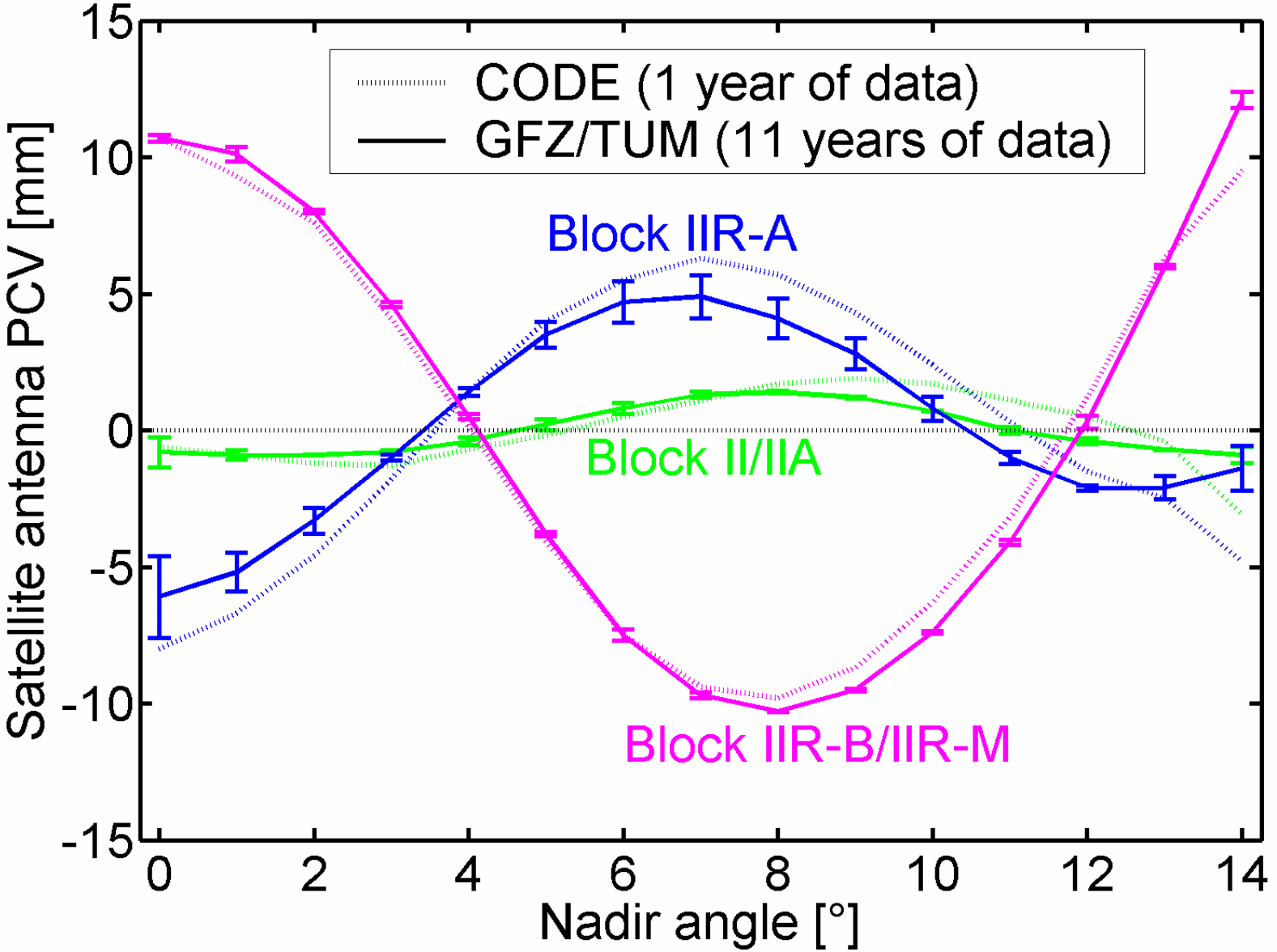
SVN	Legacy Antenna Panel	Improved Antenna Panel	IIR-M SV
41	x		
43	x		
44	x		
45	x		
46	x		
47		x	
48		x	x
49		x	x
50		x	x
51	x		
52		x	x
53		x	x
54	x		
55		x	x
56	x		
57		x	x
58		x	x
59		x	
60		x	
61		x	

Marquis & Reigh (2005)

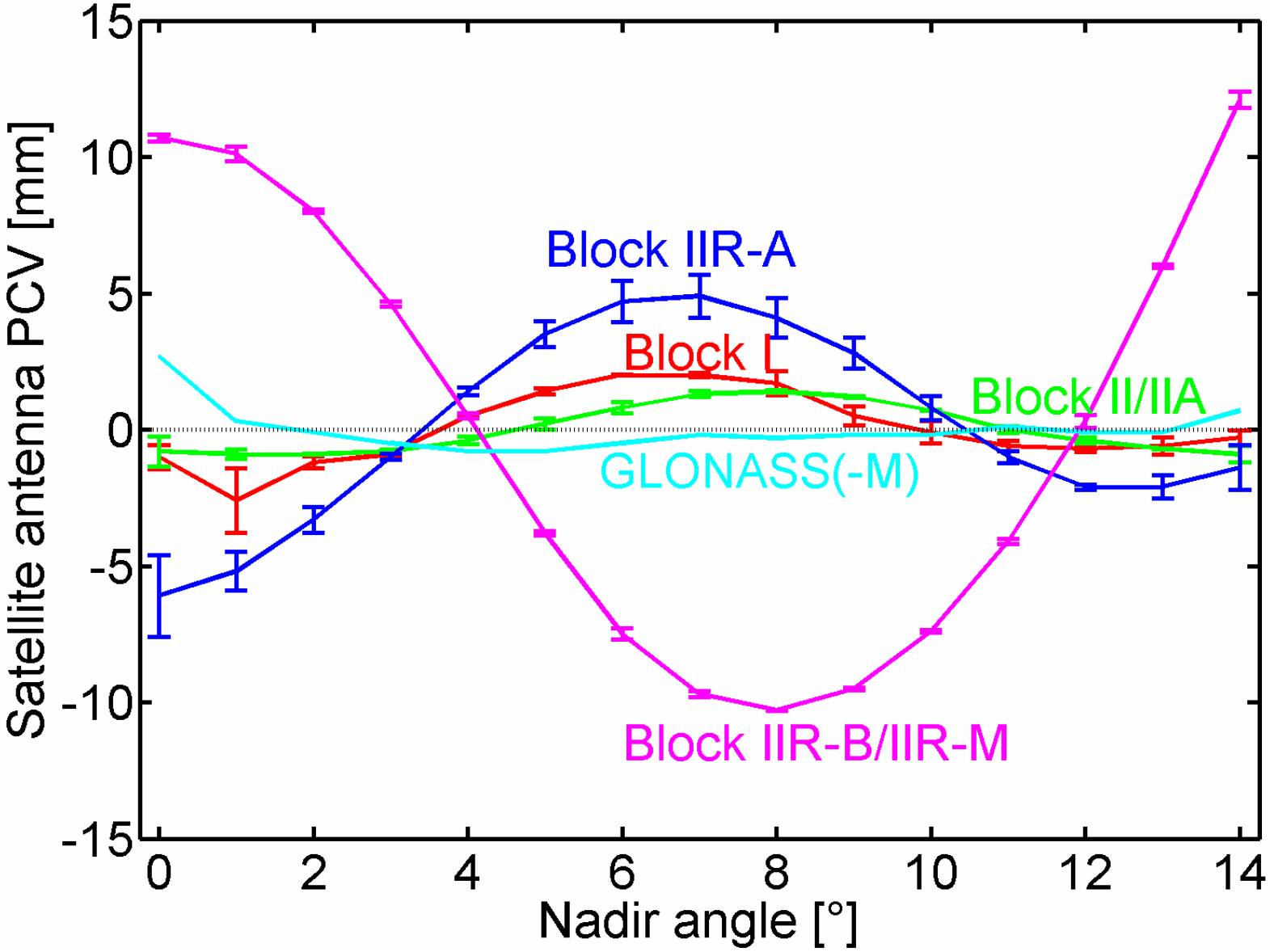
Mean PCVs from GFZ and TUM



Consistency check by CODE



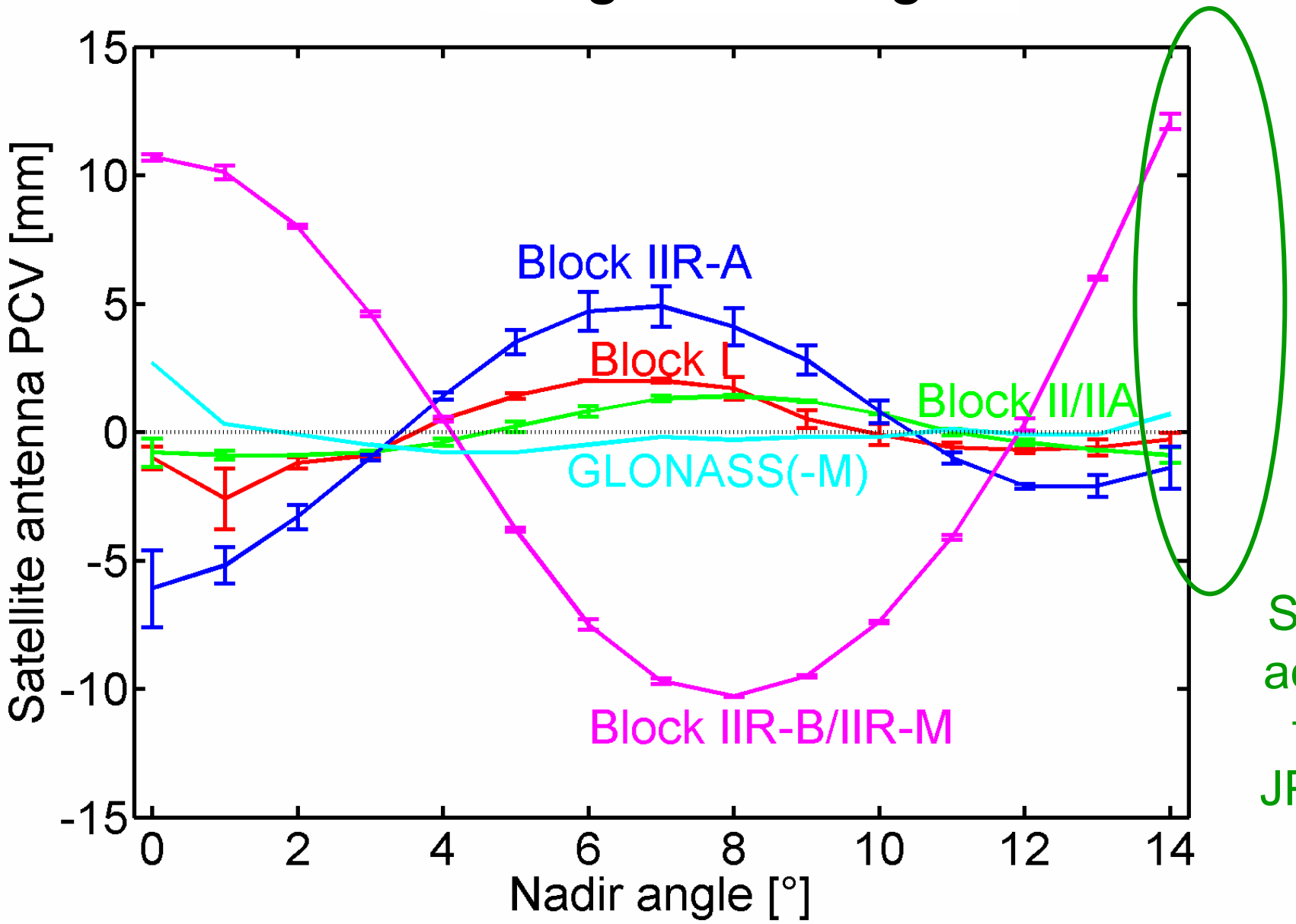
GLONASS PCVs from CODE



Based on GPS PCVs for the tracking antennas

Nadir-dep. only!

Large nadir angles

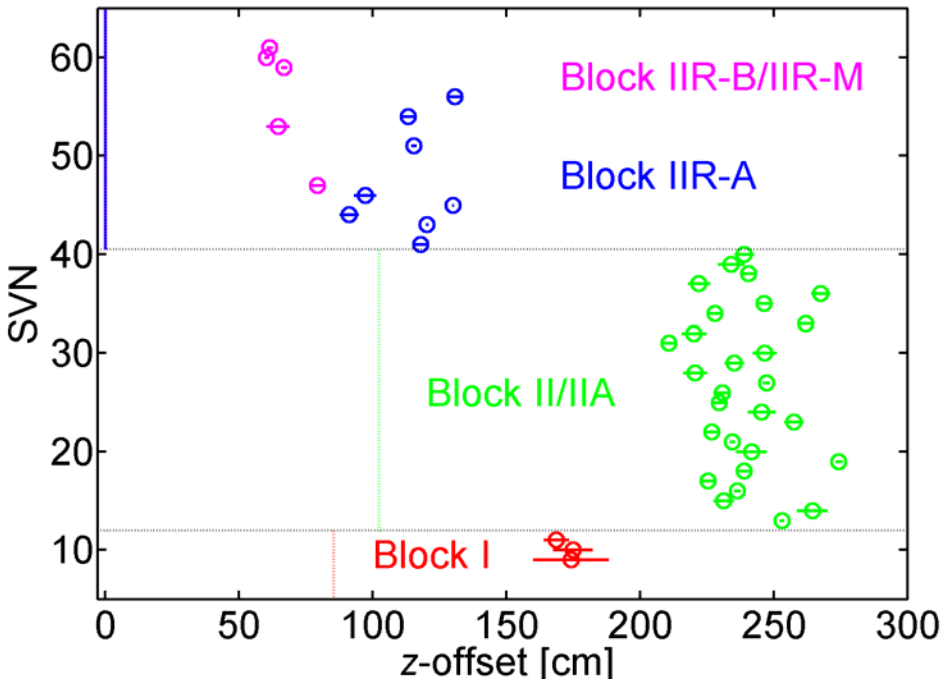


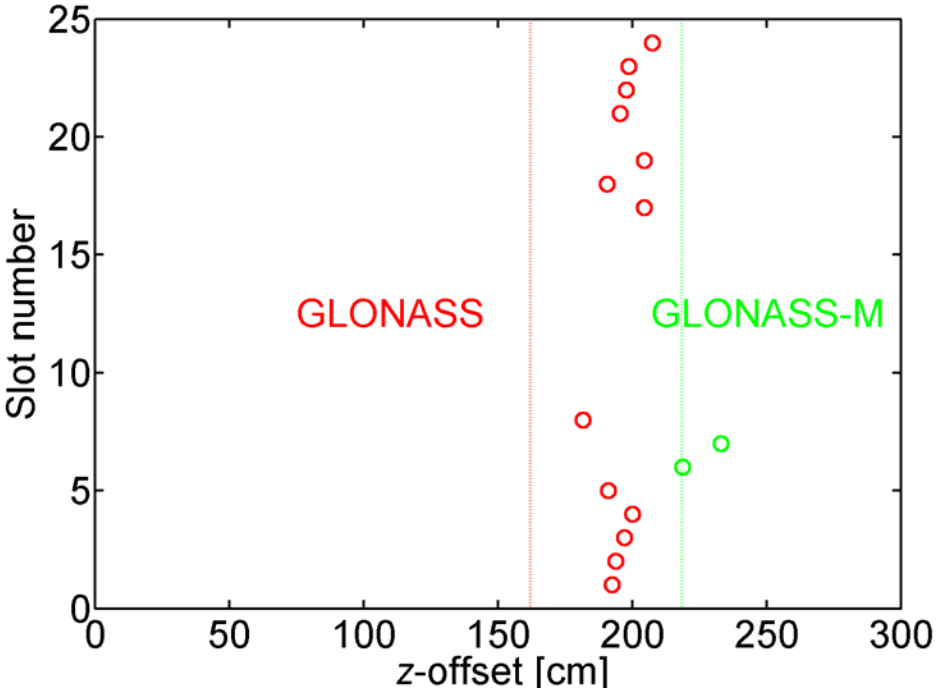
Should we add values from the JPL maps?

GLONASS *z*-offsets from CODE

GPS: GFZ/TUM vs. IGS convention

GLONASS: CODE vs. nominal value





Latest model igs05_1365.atx

59 **satellite** antennas:

- 44 GPS
- 15 GLONASS (latest GLONASS-M missing: R714)

154 **receiver** antennas:

- 42 **robot** calibrations from Geo++ (az.+el.)
  - 32 without radome
  - 10 with radome
- 112 converted **field** calibrations from NGS (el. only)
  - 74 without radome
  - 38 with radome

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  - 38 w ome

Temporary solution!

Conversion of relative field calibrations

By adding the difference between the absolute and the relative values for the reference antenna AOAD/M_T.

Photo: National Geodetic Survey

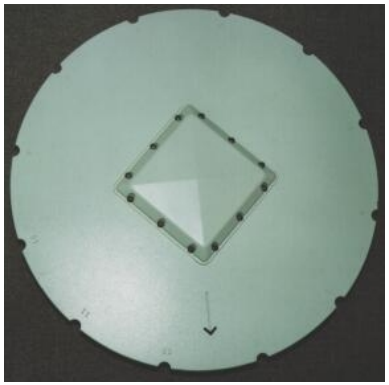
Phase center **offsets**:

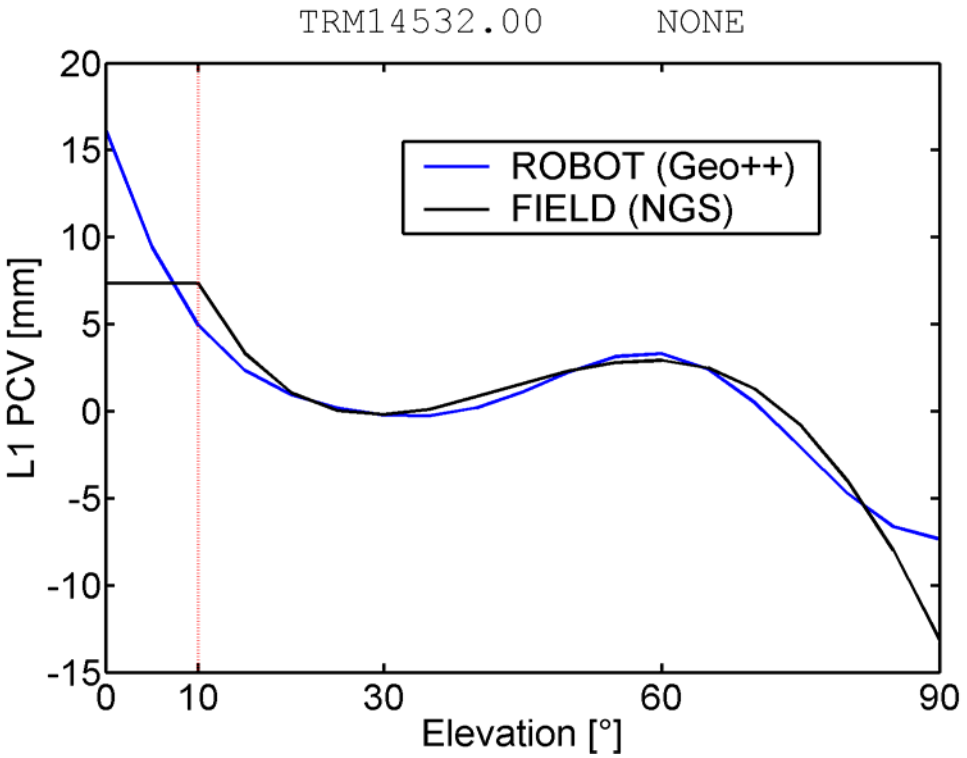
$$\mathrm{PCO}_{\mathrm{abs}} = \mathrm{PCO}_{\mathrm{rel}} + (\mathrm{PCO}_{\mathrm{abs}}(\mathtt{AOAD/M\_T}) - \mathrm{PCO}_{\mathrm{rel}}(\mathtt{AOAD/M\_T}))$$

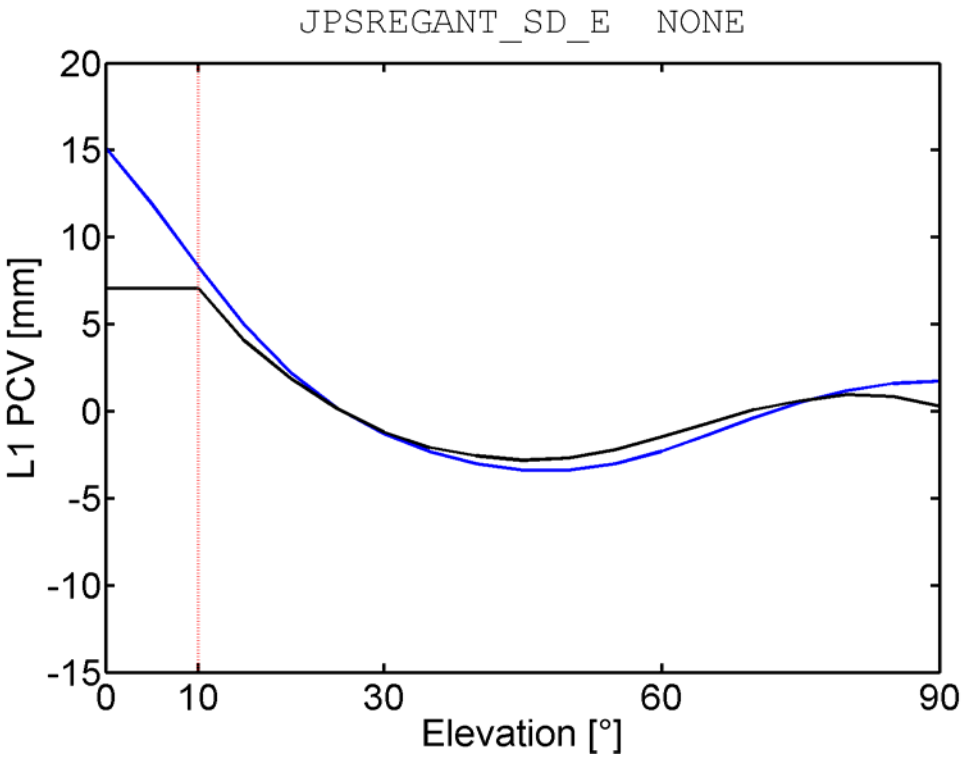
Phase center **variations**:

$$\mathrm{PCV}_{\mathrm{abs}} = \mathrm{PCV}_{\mathrm{rel}} + \mathrm{PCV}_{\mathrm{abs}}(\mathtt{AOAD/M\_T})$$

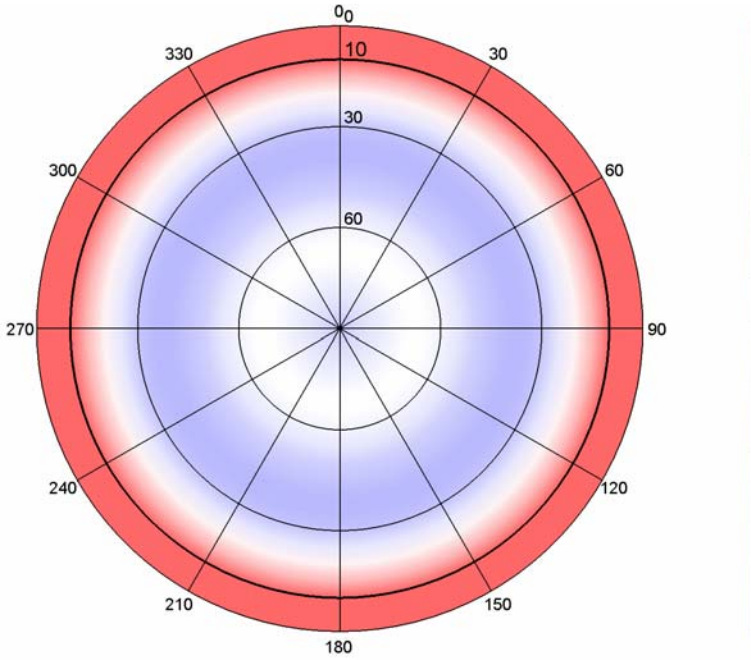
NGS calibrations – limited elevation range



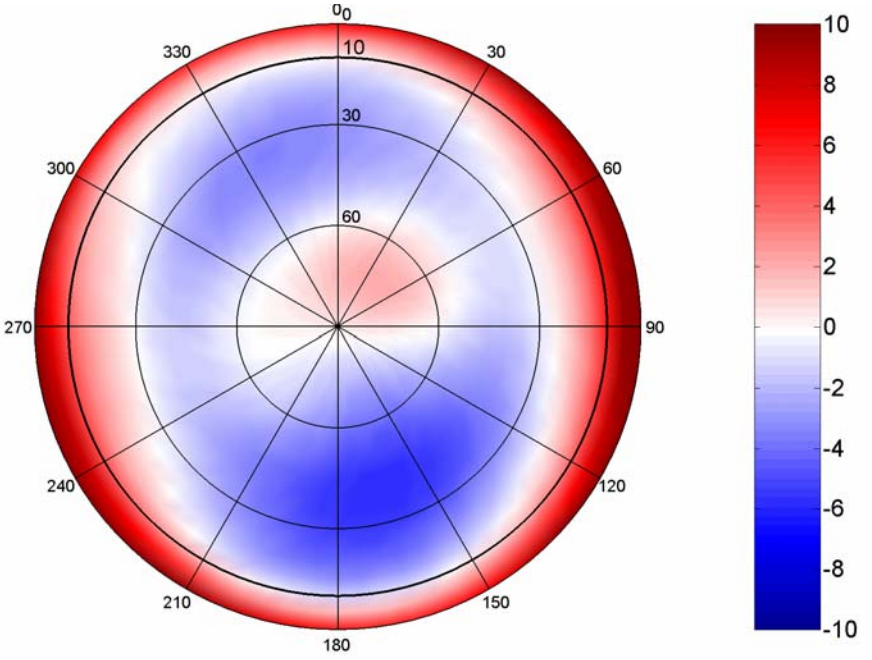




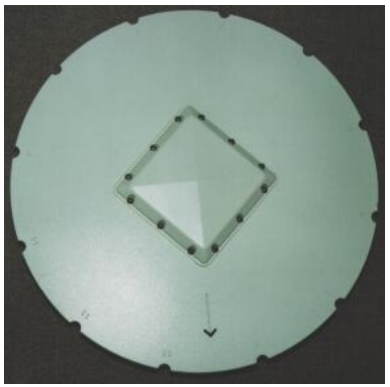
NGS calibrations – missing azimuth-dependence



L2 PCV FIELD [mm]

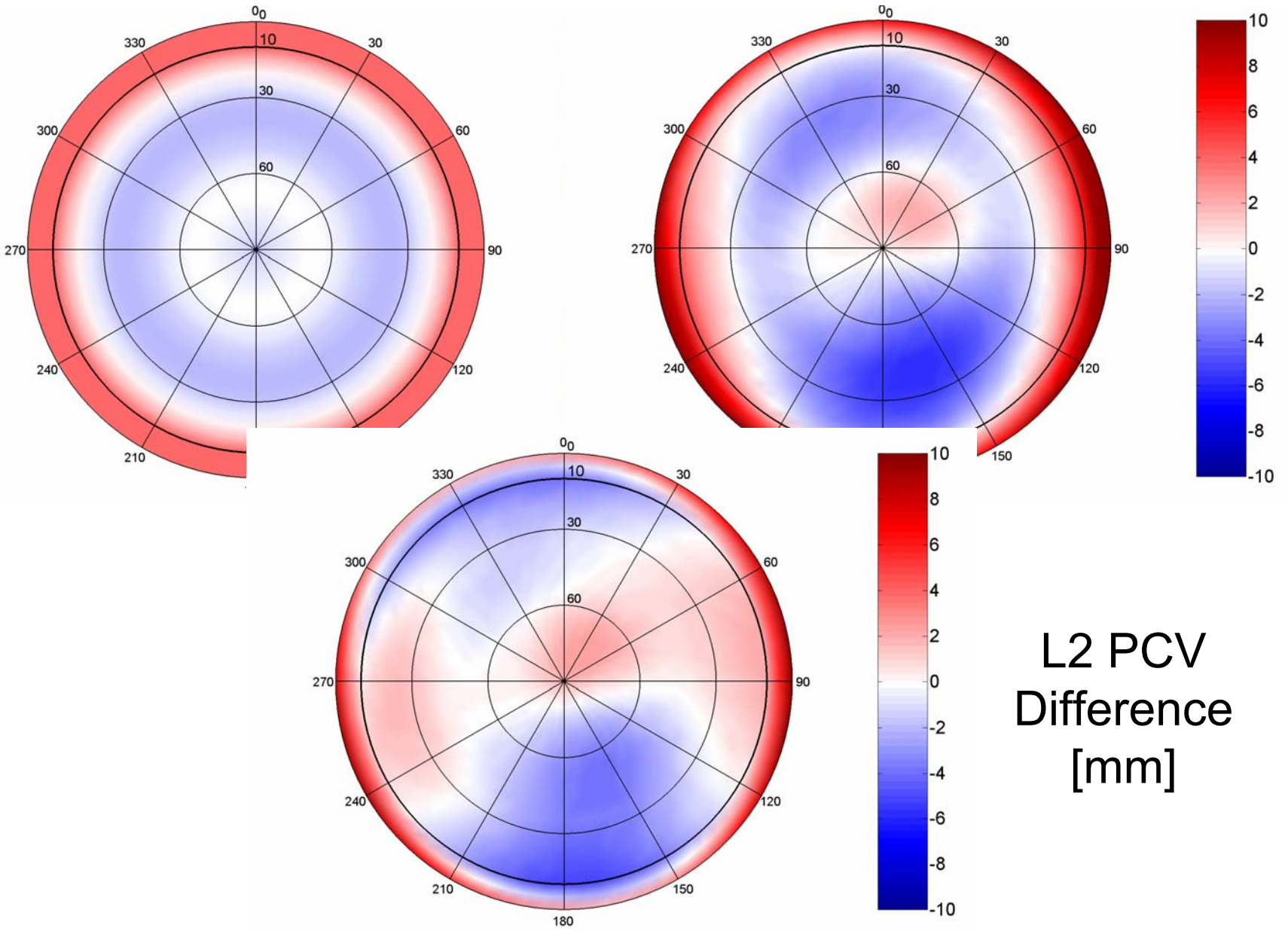


L2 PCV ROBOT [mm]



TRM14532.00 NONE

NGS calibrations – missing azimuth-dependence



L2 PCV Difference [mm]

Antennas in the IGS network

Data source: ftp://igscb.jpl.nasa.gov/igscb/station/general/**loghist.txt**

37 different antenna types (cf. igs05.atx: 106):

- 22 → robot calibration (60%)
- 15 → converted field calibration

81 antenna + radome combinations:

- 10 → robot calibration
- 15 → converted field calibration
- 42 → no calibration available
- 14 → not calibratable (DOME)

} 70%

When can field calibrations be replaced by robot calibrations?
When can new radome calibrations be added?

Radome problem – station FORT

8 April 2006: IGS station FORT decommissioned

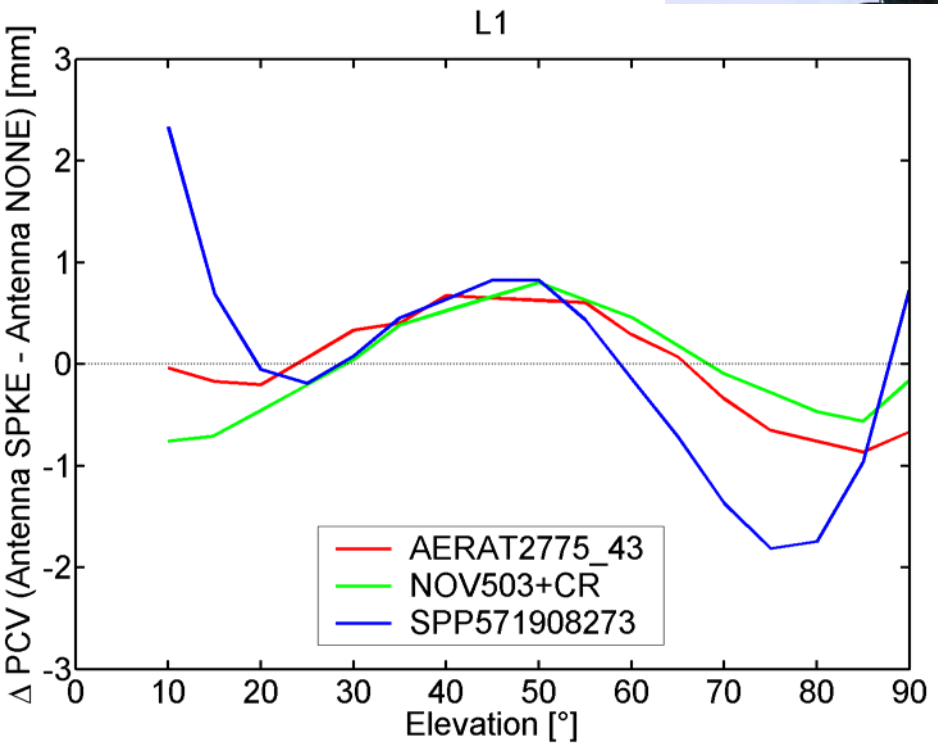
6 weeks before: radome (DOME) removed

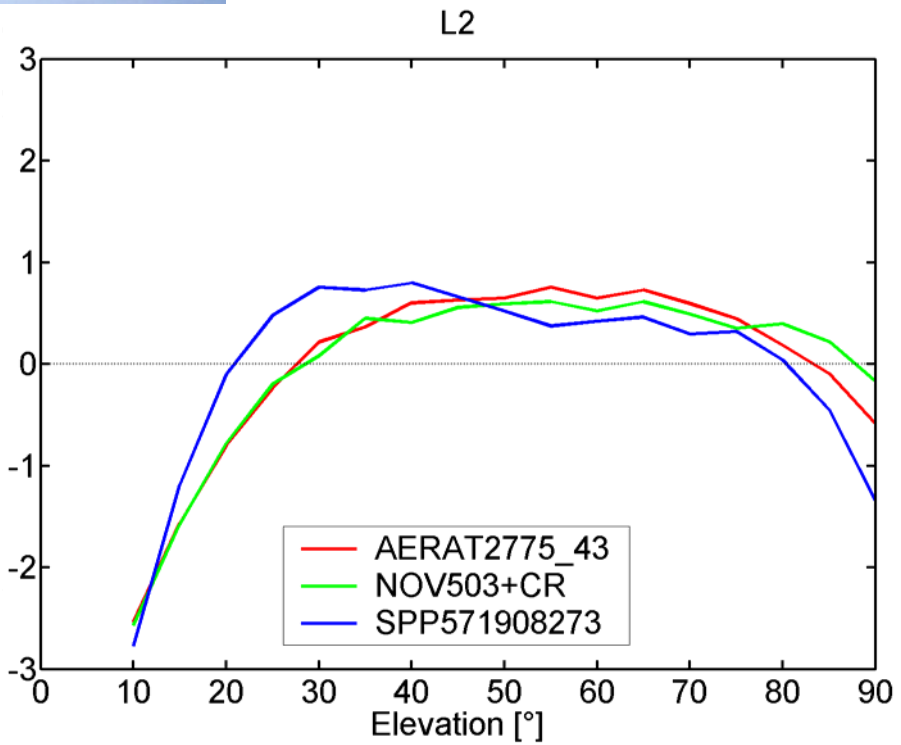
Photos: www.roen.inpe.br

Ray et al. (2006): The effect of the radome has been an apparent height bias of about 16 mm downward.

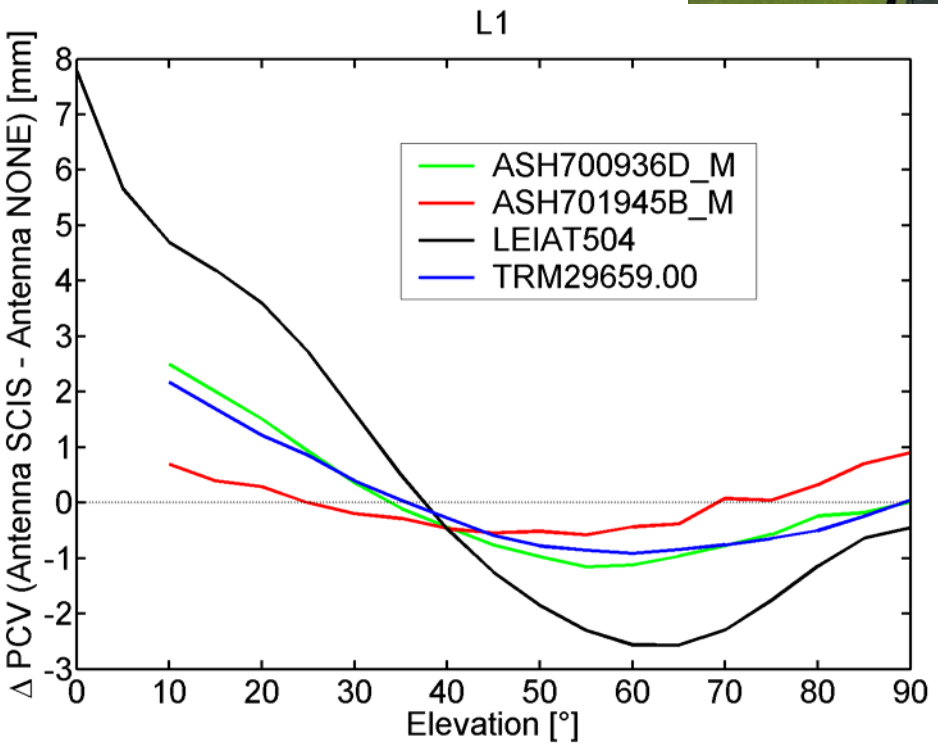
How to deal with stations with uncalibrated radomes?

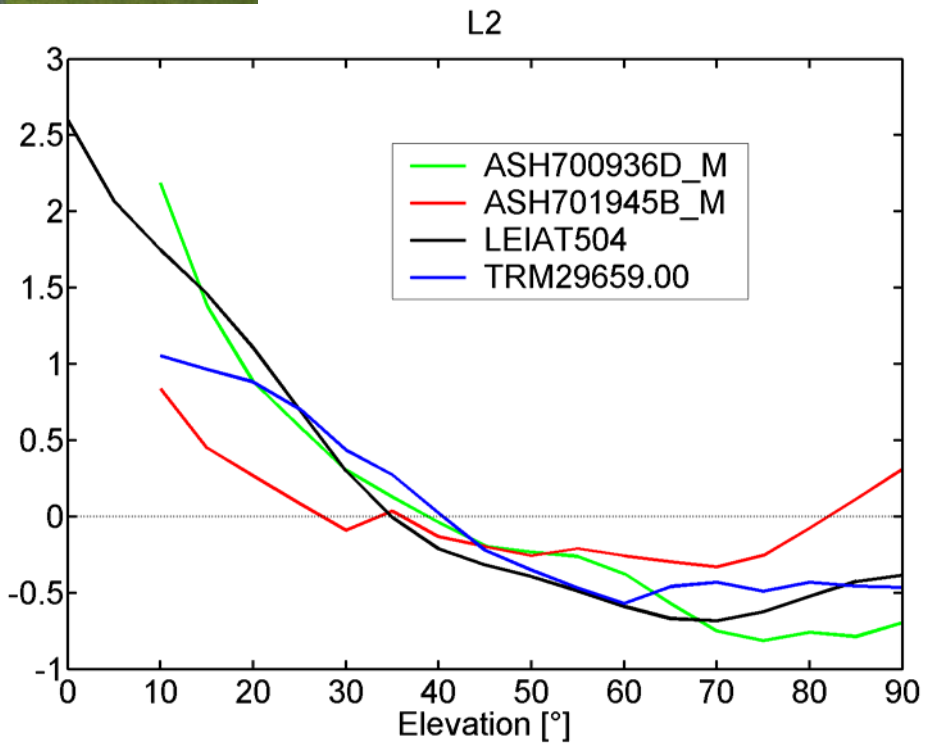
Radome effect – radome SPKE



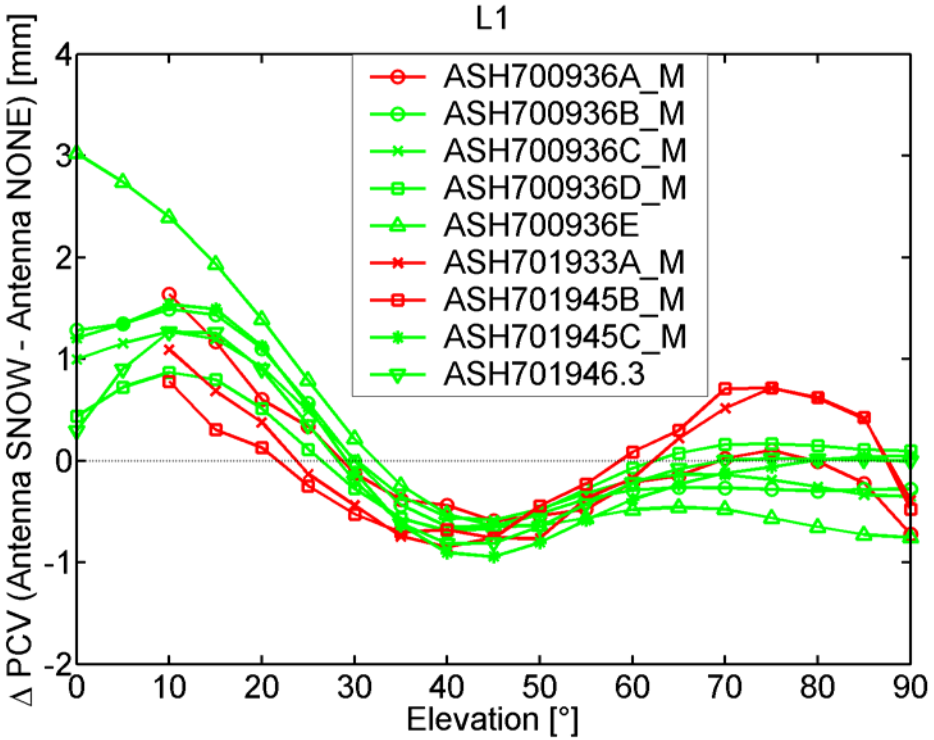


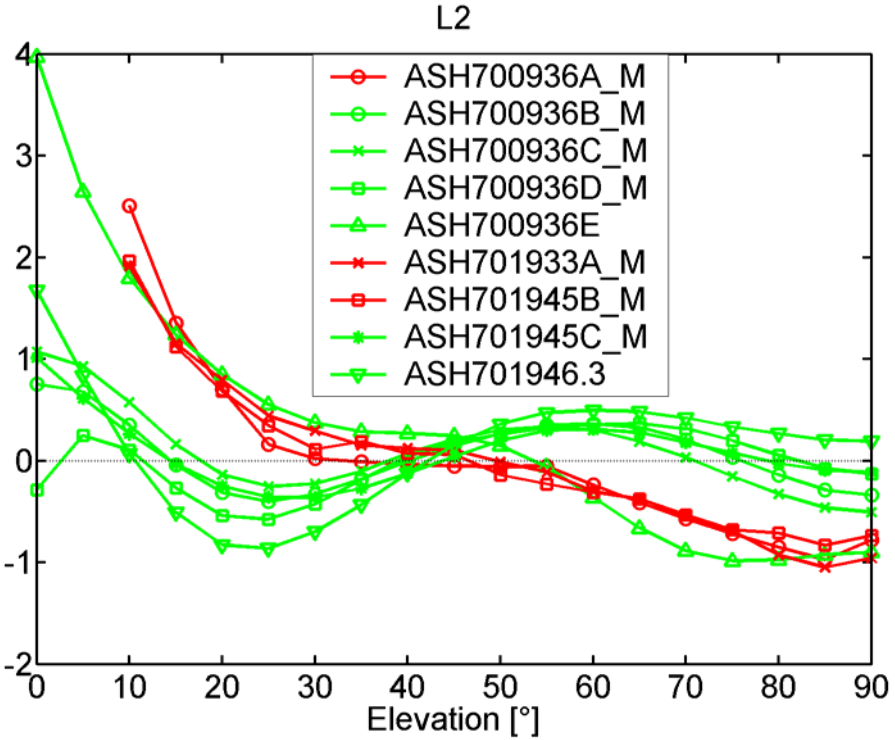
Radome effect – radome SCIS





Radome effect – radome SNOW





Propagation to other antennas

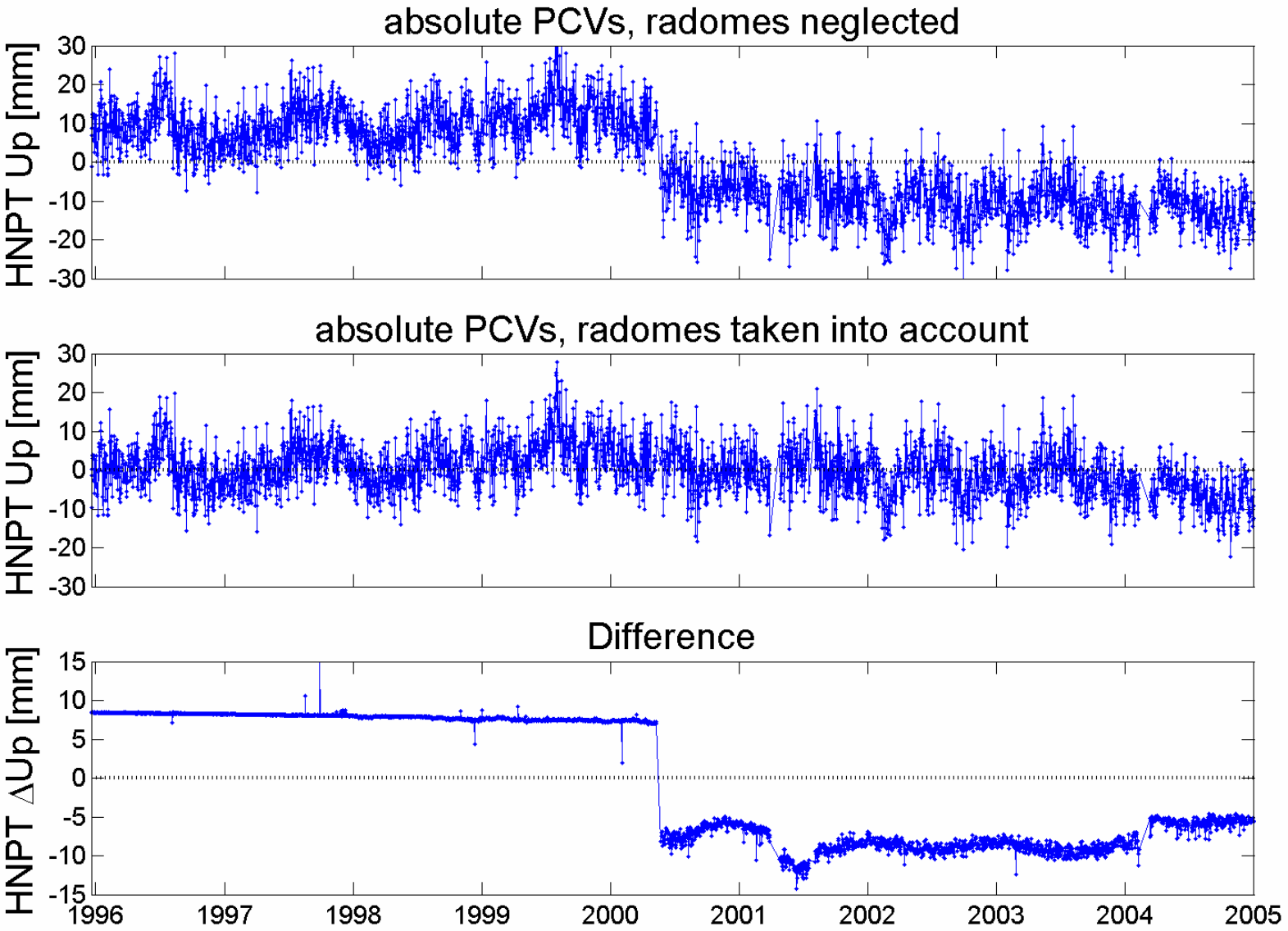
Pros:

- Better than ignoring the radome effect
- Smaller effort than needed for additional calibrations
- Surprisingly good agreement for some radomes/frequencies

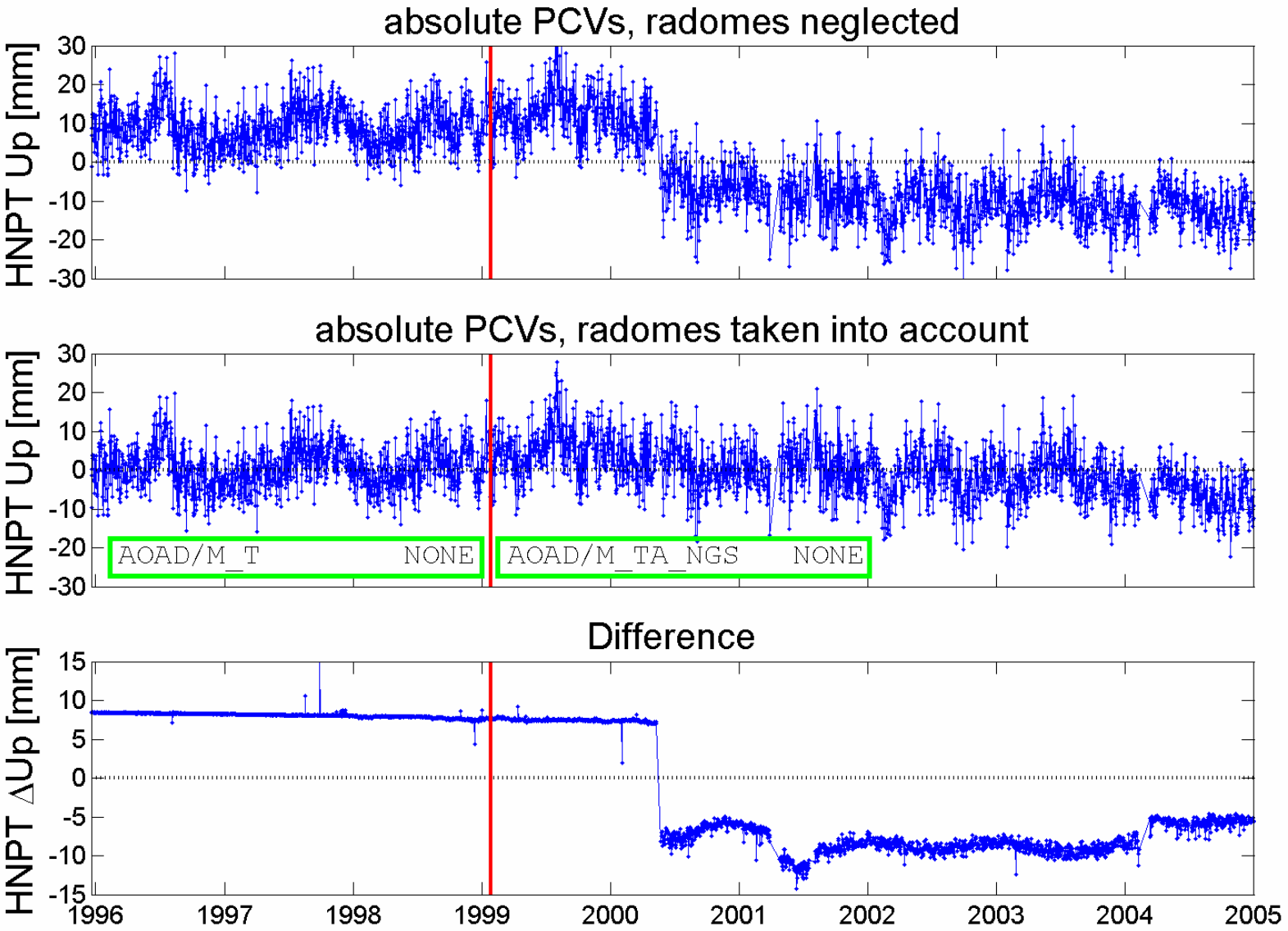
Cons:

- How to deal with discrepancies?
- Multiple calibrations only for very few radomes
- Azimuth-dependent (NONE) + elevation-dep. (radome) ?
- Generation of a "three-class society" in igs05_wwww.atx:
    1. robot calibrations
    2. converted field calibrations
    3. converted field calibrations + propagated radome effect

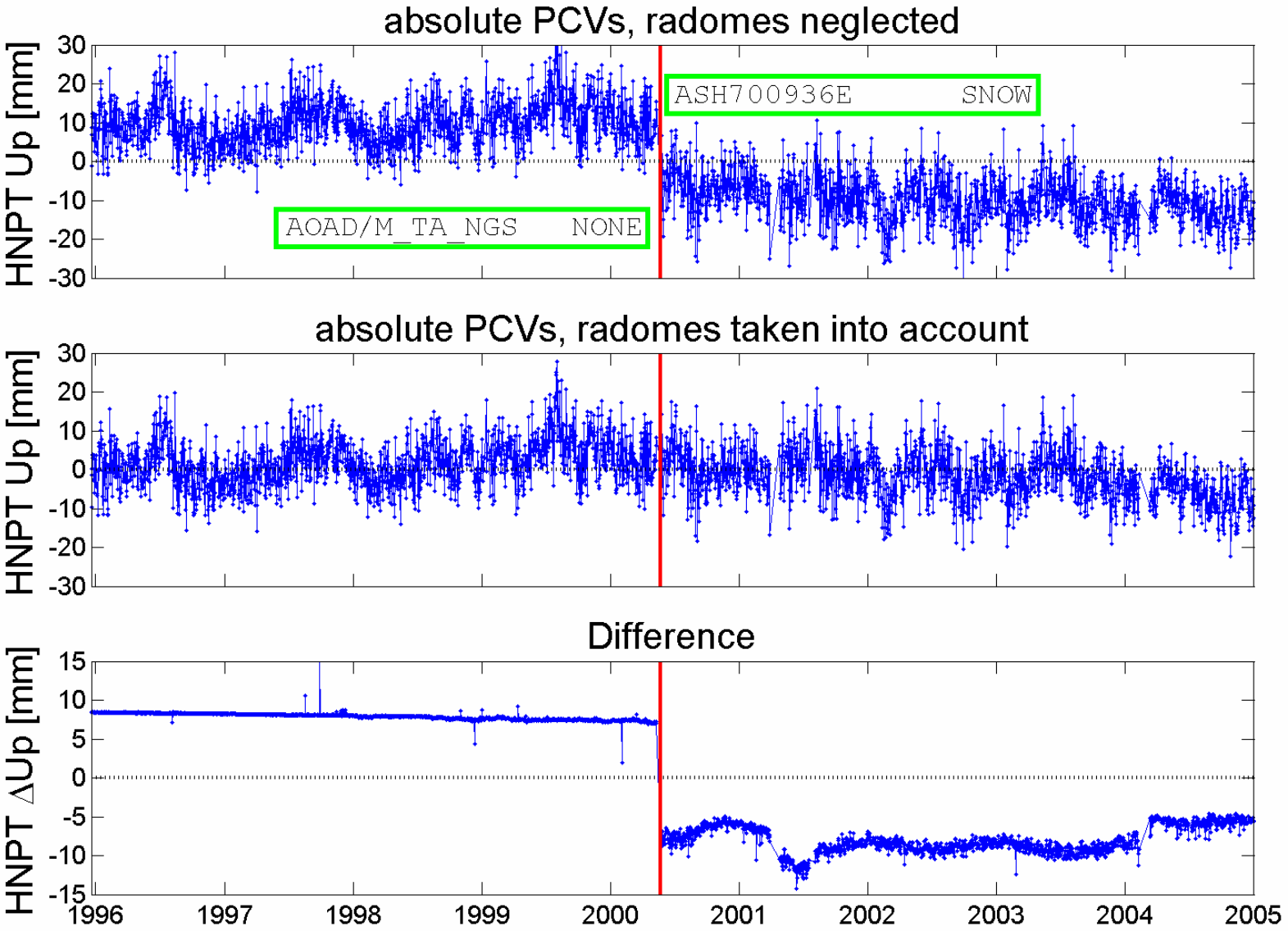
Benefit from radome calibrations



Benefit from radome calibrations



Benefit from radome calibrations



Conclusions

- Fully consistent antenna phase center model for all **GPS and GLONASS** satellites available (nadir-dependent only)
- **Converted field calibrations** should eventually be replaced by azimuthal PCVs down to 0° (How? When?)
- Big need for calibrations of **antenna + radome** combinations
- **Propagation** of the radome effect from one antenna to another is possible, but not trouble-free and of questionable accuracy
- Radome calibrations avoid **height biases of several cm**
- **Transition** to absolute PCVs is planned in parallel with the switch to ITRF2005 **in the coming months**


Thanks for
your attention!
Photo: Enrique Cabral, UNAM