



Australian Government

Geoscience Australia

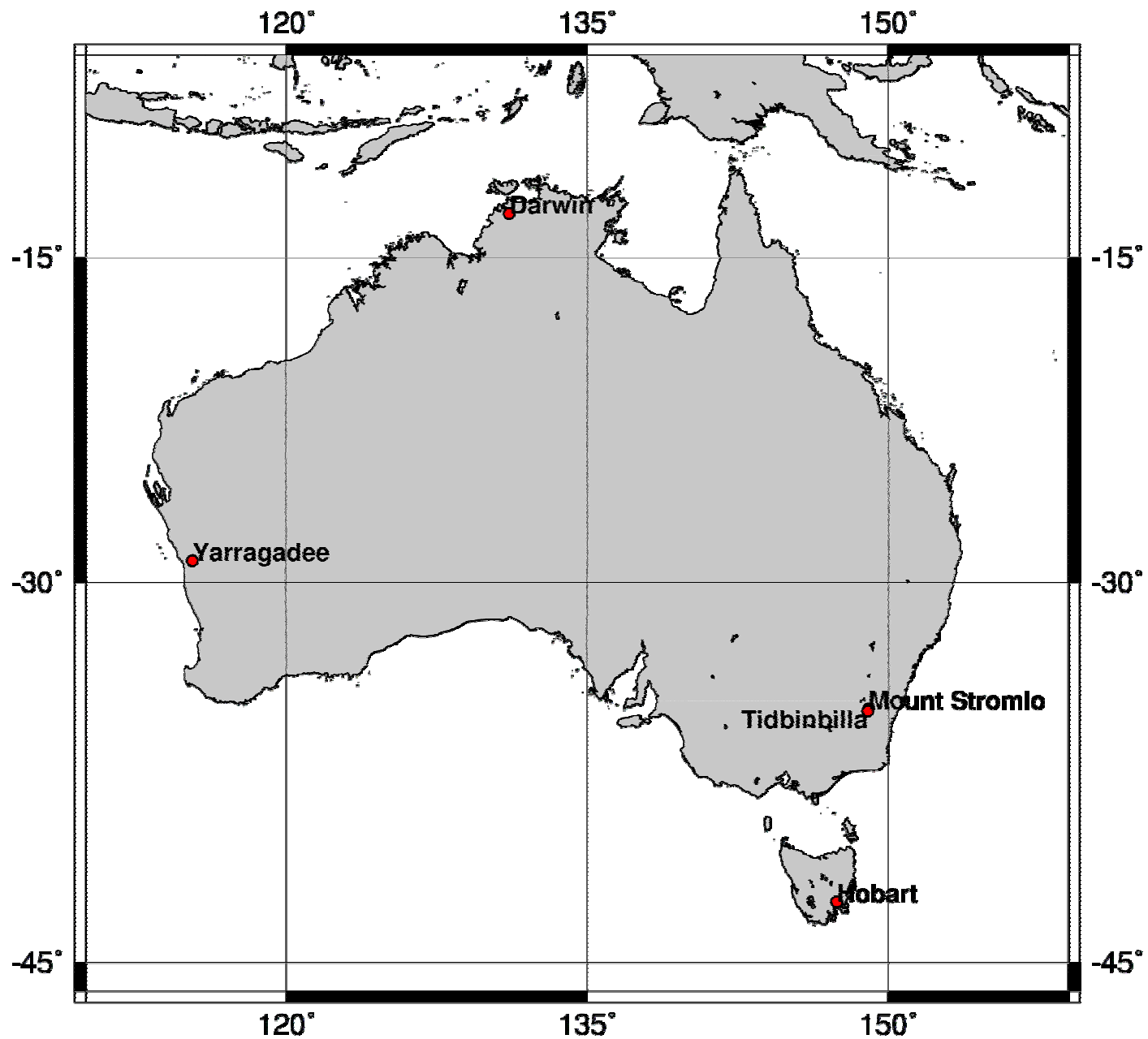
Precision Surveys at Australian Geodetic Observatories

Geoscience Earth Monitoring

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Overview

- Geodetic Observatories
- Planning and Strategies
- Equipment and Equipment calibration
- Monumentation and local control networks
- Reference point on space geodesy instruments
- Preliminary computations
- Limitations and developments



IERS Workshop on site co-location, Matera, Italy, Session 2 “Site Surveys”

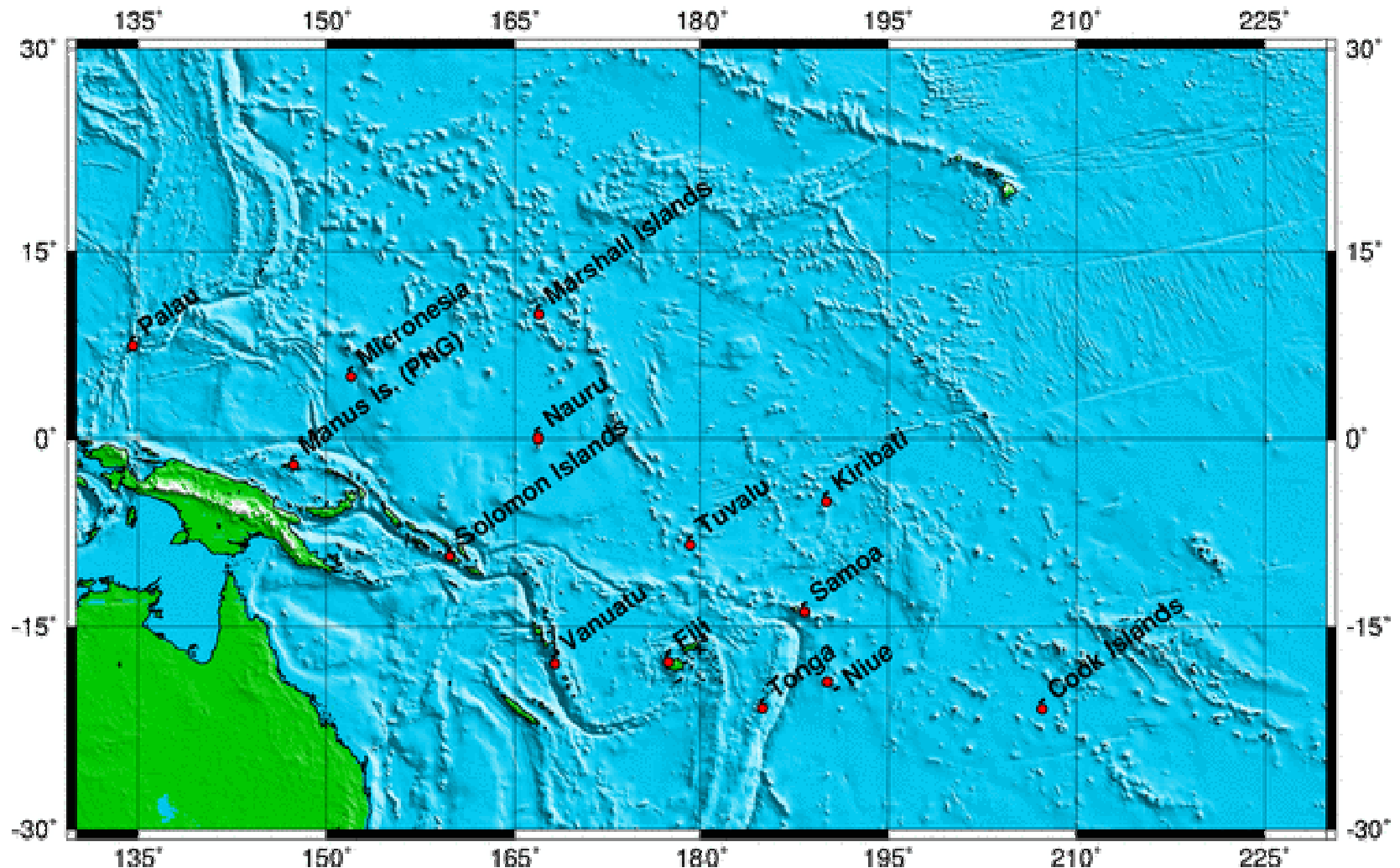
Australian geodetic co-location

Site	GPS	SLR	GLONASS	VLBI	DORIS	Absolute Gravity
Mount Stromlo	X	X	X	-	X	X
Tidbinbilla	X	-	-	X	-	X
Hobart	X	-	-	X	-	X
Yarragadee	X	X	X	-	X	X
Darwin	X	-	X	-	-	-

Other geodetic co-location

- GPS and tide gauge
 - Australia
 - Hillarys, Bernie
 - Antarctica
 - Mawson, Casey, Davis
 - South Pacific
 - Samoa, Cook Islands, Fiji, Tuvalu, Tonga, Manus Island, PNG, Kiribati, Vanuatu, Marshall Islands, Nauru, Micronesia
 - Palau, Niue, Solomon Islands

South Pacific Sea Level Monitoring



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GPS to Tide Gauge Benchmark Connection

- Multi-day GPS connection between ARGN site and TGBM
- Orthometric Levelling connection as well using Total Station Levelling (TSL)
- Connections typically completed biennially



Planning and Strategies

- Survey timing best when weather conditions are neutral ie. Optimum for survey observations
- Allow for several days down time on SLR or VLBI system
- Plan to avoid critical tracking campaigns
- Plan placement of marks on telescope to optimise design and computation approach (e.g. circle radii and arc length)
- Place instrument stand points so near orthogonal lines are observed into telescope

Yarragadee (SLR)



Mount Stromlo (SLR)



Mount Stromlo (SLR) - after fire



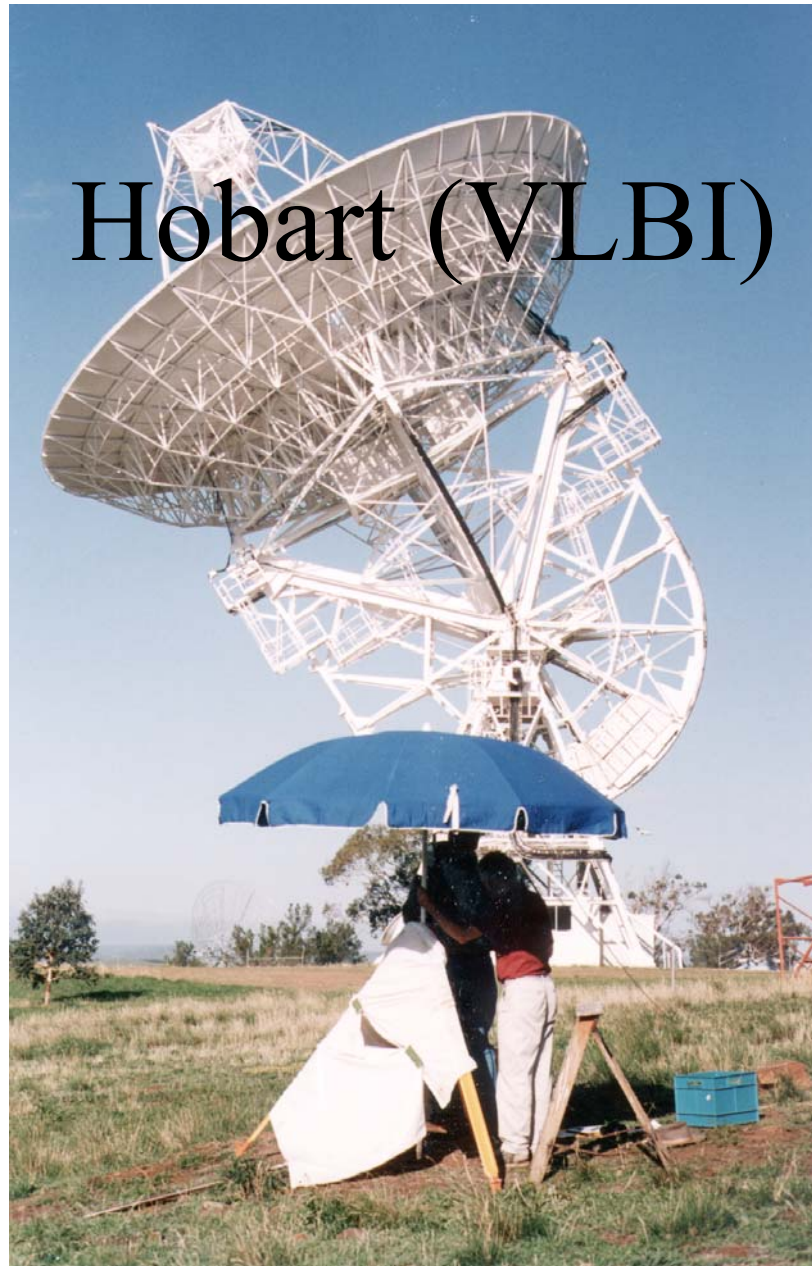
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Mount Stromlo (SLR) - today



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Hobart (VLBI)



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Tidbinbilla (VLBI)



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Equipment



Leica TCA2003

Specification

- Angular 1" H & V
- distance 1mm + 1ppm

Factory Calibration

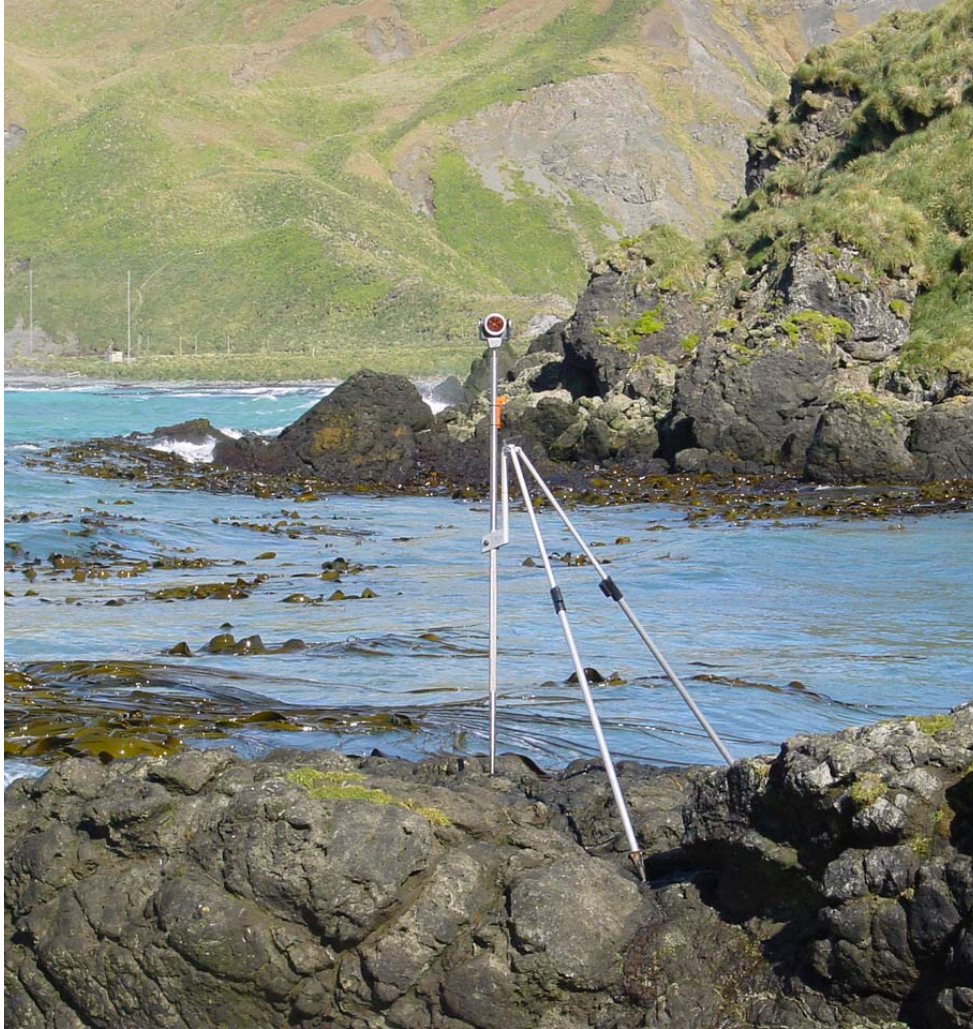
- Angular 0.6" H & V
- distance 0.5mm + 0.4ppm

Equipment



- Leica Precision prisms with Tribrach and carriers (including plate bubble)
- Zenith Nadir Plummet for centring tripods where required

Equipment



- Fixed height prism pole (pogo) for Total Station Levelling (TSL)
- Invar Staff for instrument heighting

Equipment



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Equipment



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Equipment Calibration

- Total Station
 - Factory calibration initially (when purchased)
 - Annual comparison with standard baseline (linked to national standard)
 - Internal angular calibrations at time of survey
 - Comparison with GPS
 - Calibration of prism / reflectors over a known baseline length

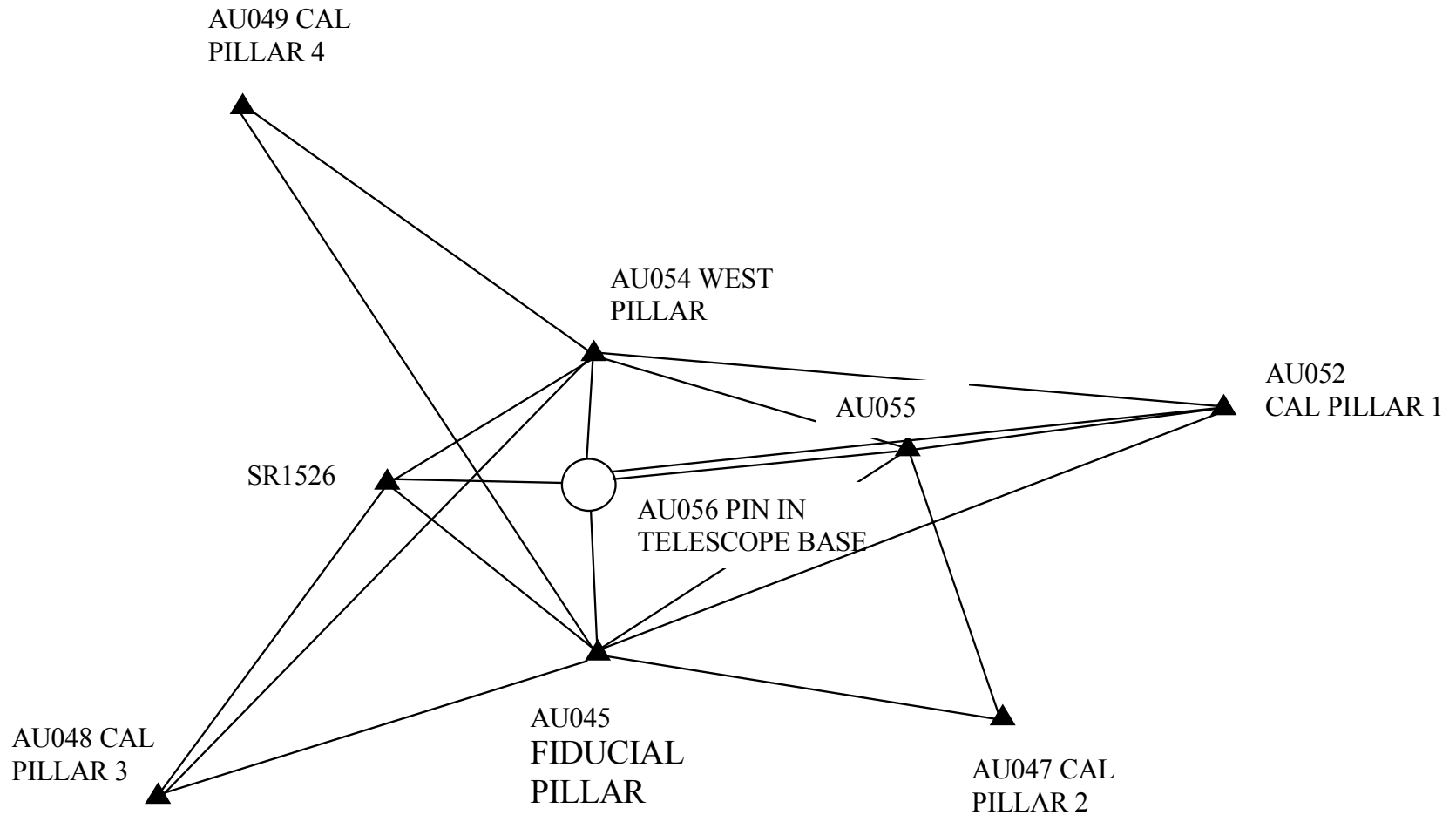
Equipment Calibration

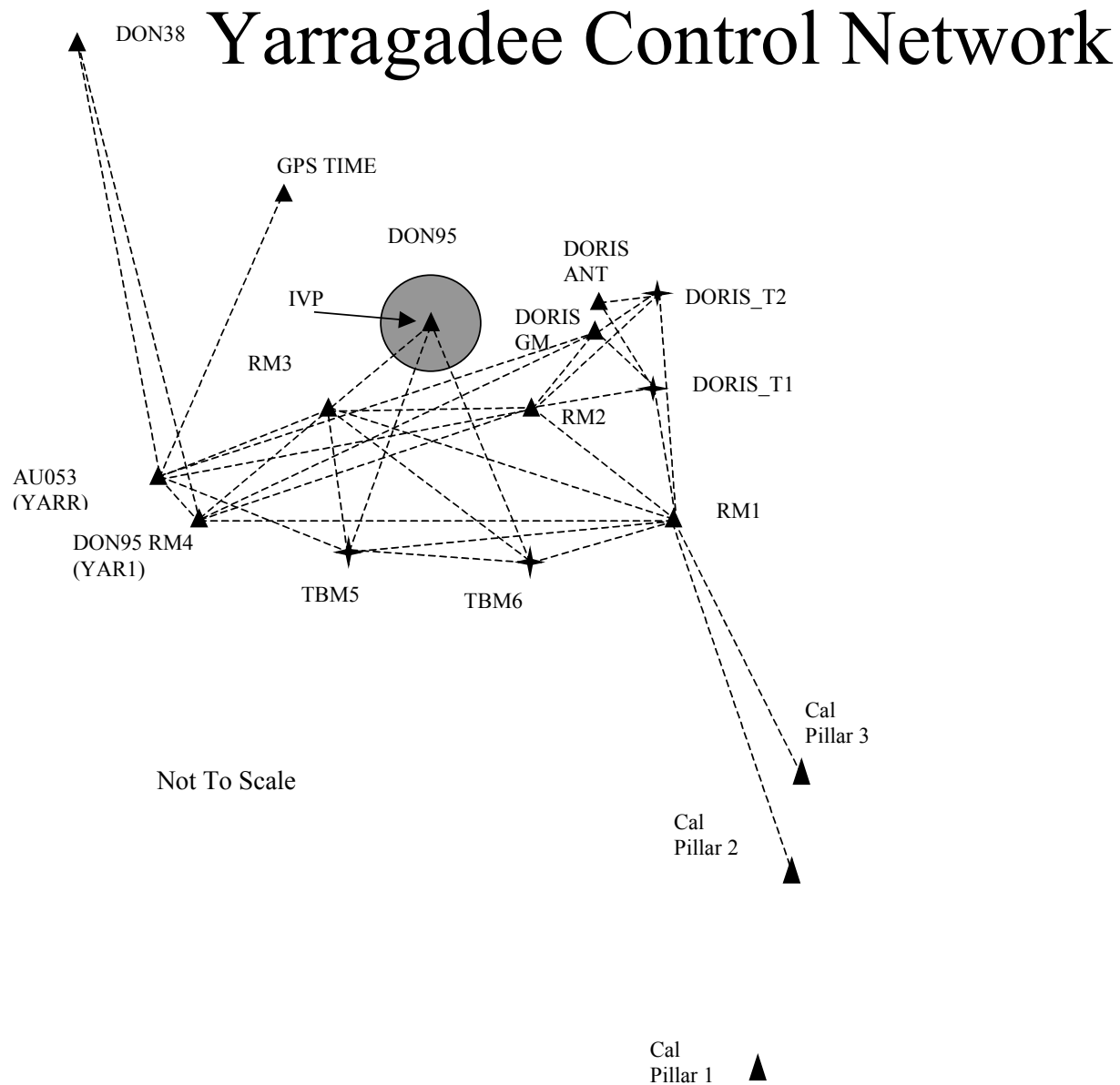
- Invar Staff
 - Factory calibration initially (when purchased)
 - Biennial calibration

Monumentation

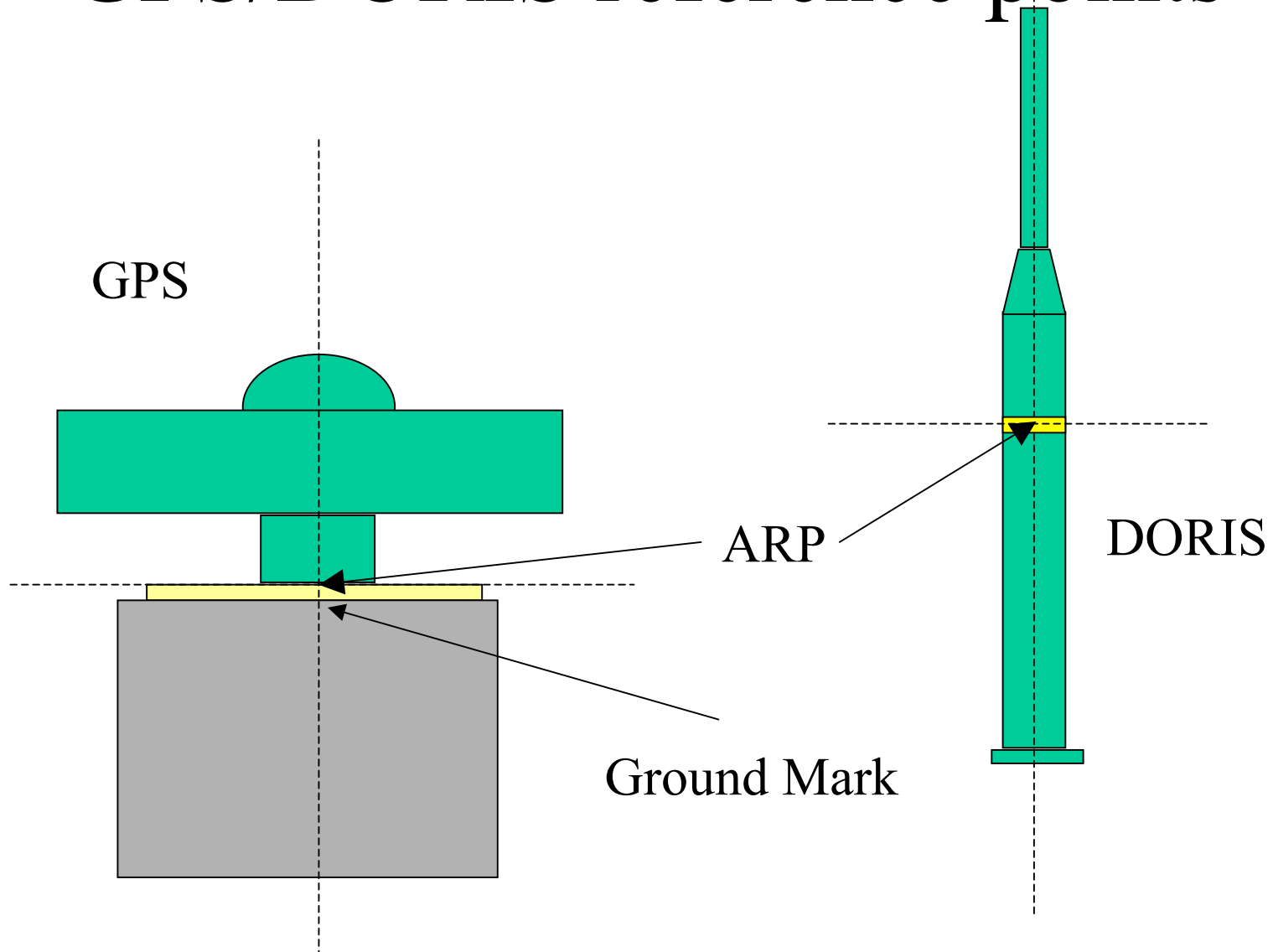
- Survey network linking instrumentation should be an over determined braced quadrilateral
- Ideally instrument standpoints are stable bedrock anchored pillars
- Pillars should have reference marks to monitor local deformation
- Survey marks should have an unambiguous reference point

Mt Stromlo Control Network

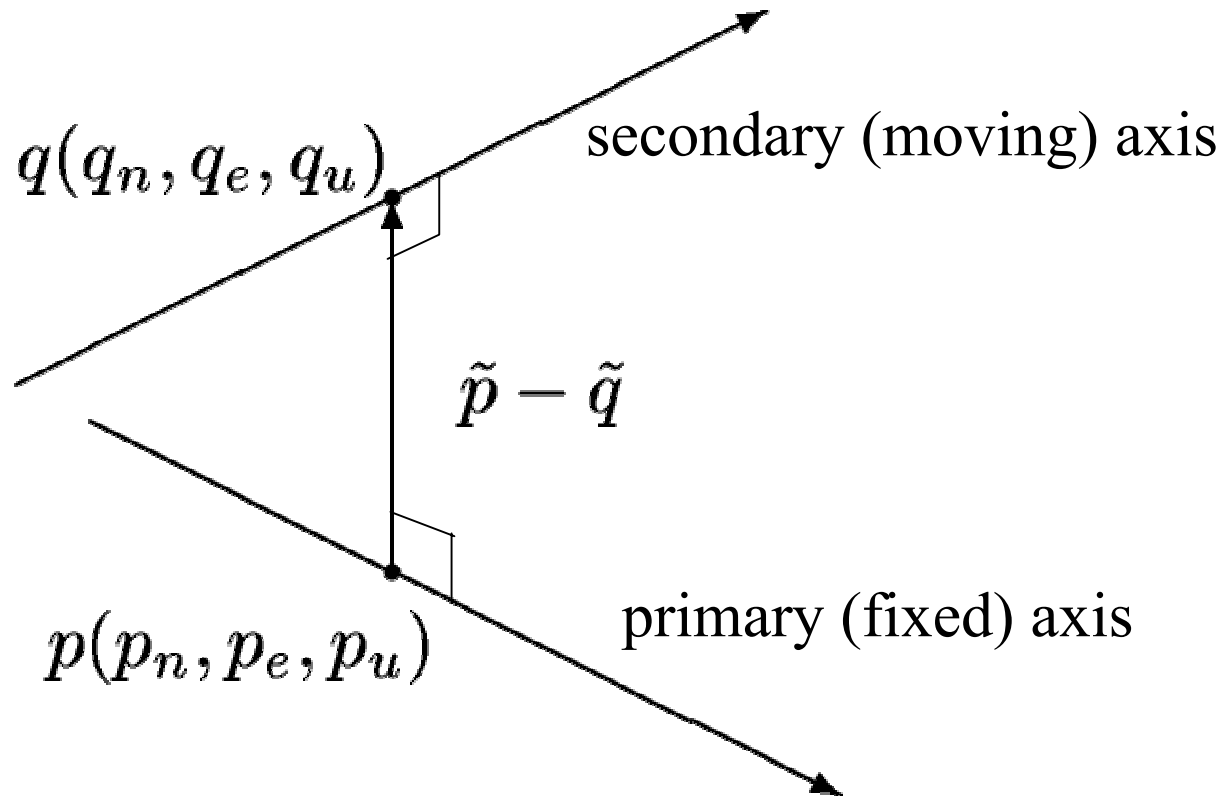




GPS/DORIS reference points



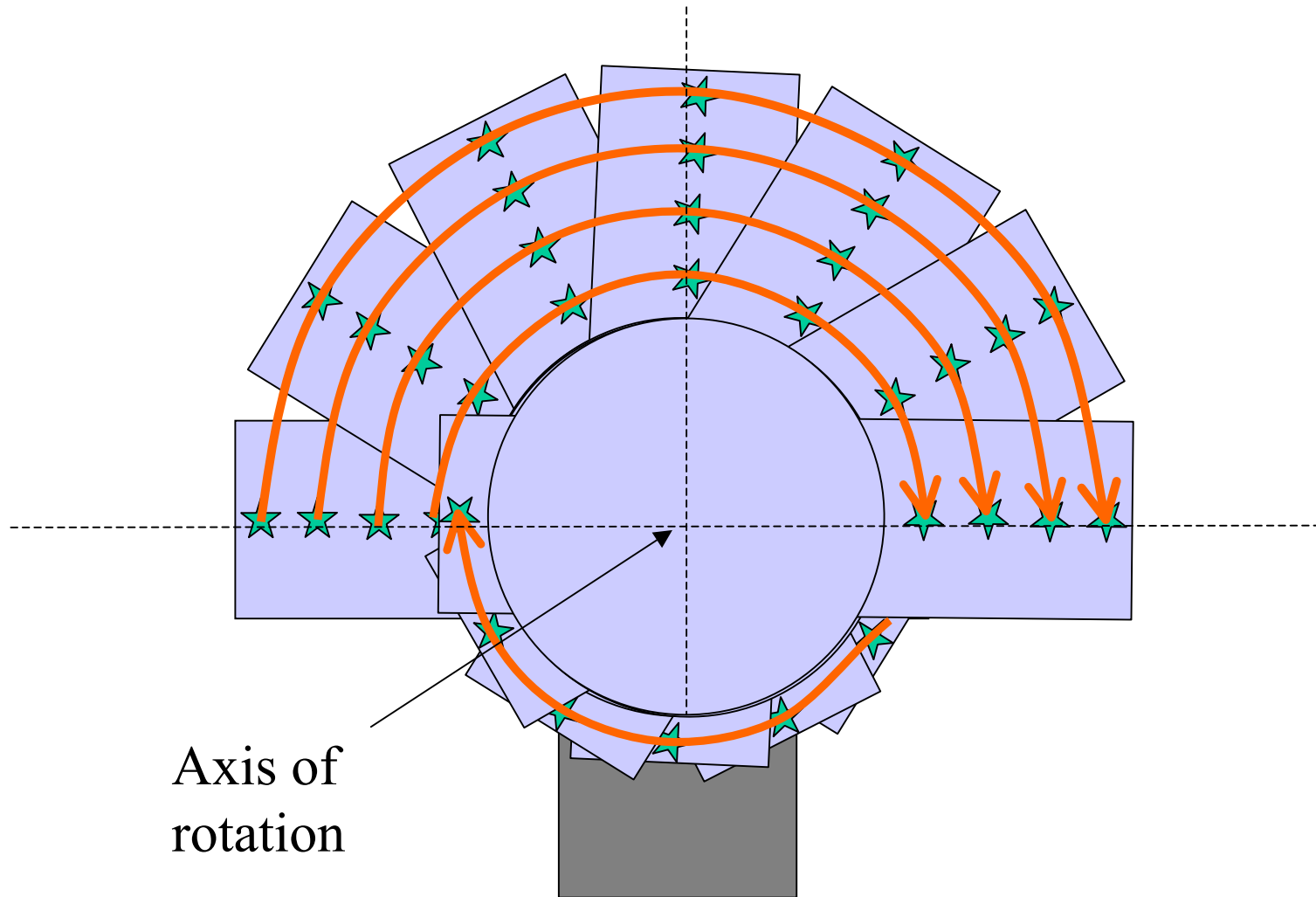
Reference Points



IVP Determination

- Survey targets placed on the telescope and observed through a rotational series
- Arcs scribed by target are centered around the axis of rotation

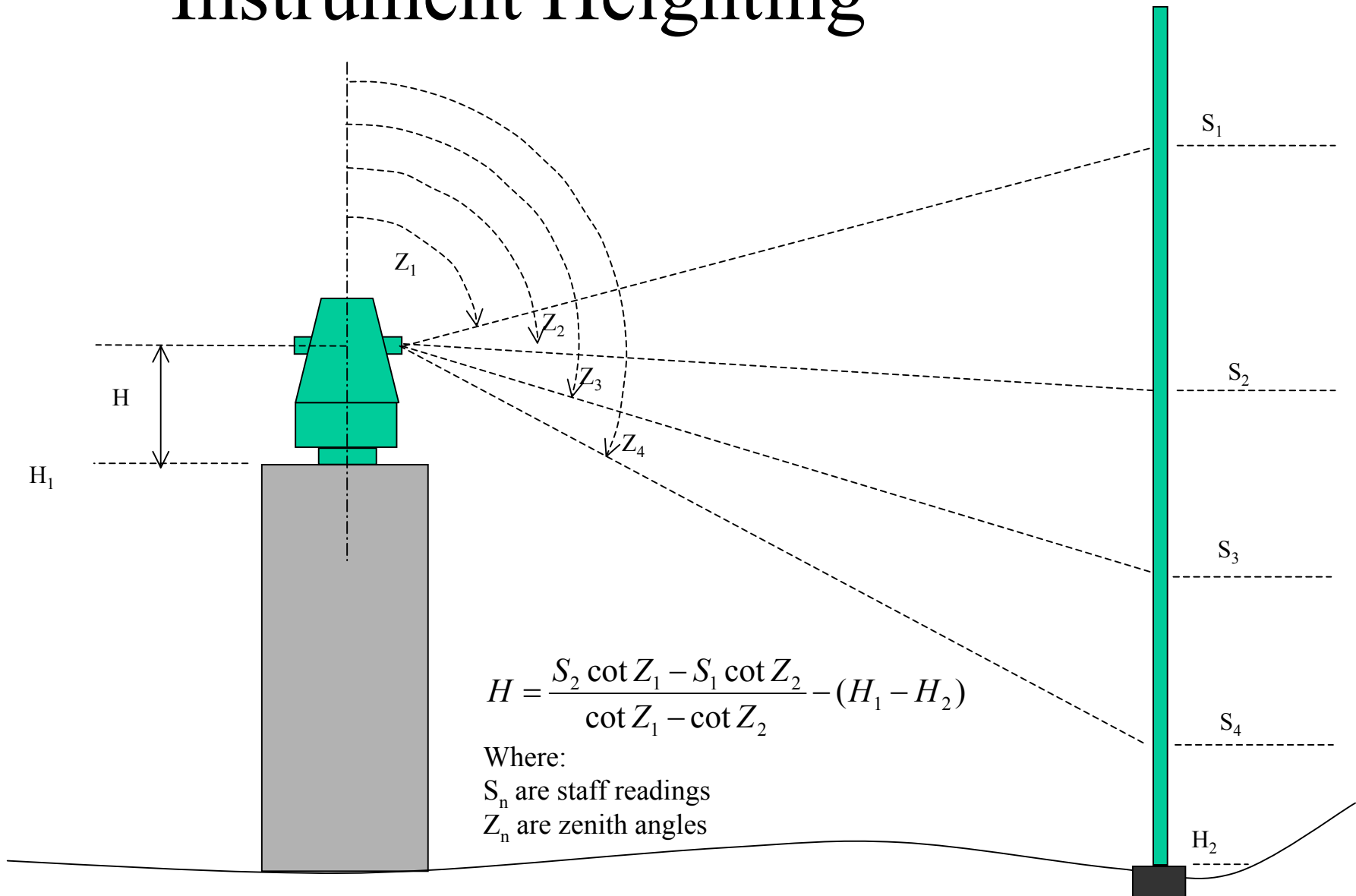
Principal



Limitations

- Measurement of instrument trunion axis height
- Transfer of ellipsoidal height (geoid model error)
- Impact of tape reflectors on distance and angular measurement
- Unknown effect of refraction on lines which have a temperature gradient

Instrument Heighting



Developments

- Use of Total Station Levelling (TSL) to reduce refraction and staff calibration issues
- Motorization and Automatic Target Recognition (ATR) in Total Stations reducing observer errors
- Possible use of laser scanning or terrestrial photogrammetry to determine VLBI antenna deformation