Thermal distortions II

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Summary of our present understanding.

We have now made a large number of tilt/temperature observations on antenna #4. These observations appear to lead to the following conclusions:

1. The elevation bearing housing, on top of the alidade structure, rotates as the temperature changes, at a rate of about 1.5 "/° C.

We believe that the effect is due to the fact that the base of the alidade structure is kept at a constant temperature while the rest of the structure approximately follows the ambient temperature. A simple thermal analysis of a pin-joint alidade predicts 1.5 "/ °C as observed.

2. There is an hysterisis in the rotation: different rotations are observed, at the same temperature, depending on whether the observation is in the morning (temperature increasing) or evening (temperature decreasing).

We believe that this effect is due to an additional rotation of the alidade structure which arises because of a differential temperature within the alidade structure, imposed by the air-flow: the structure nearest the air inlets is at a higher temperature than the structure by the outlet.

This hysterisis is reversed if the air-flow is stopped.

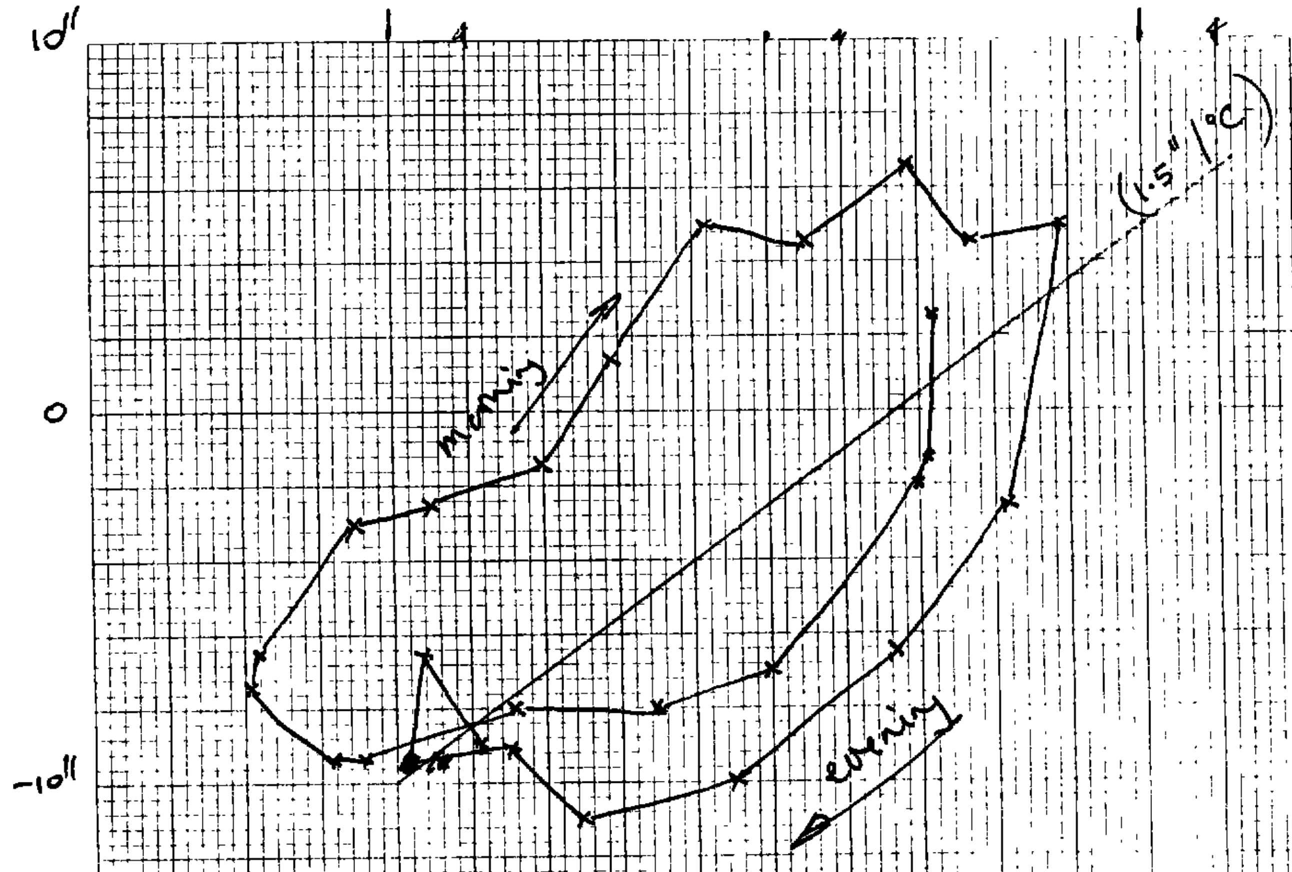
3. The plane of the alidade structure rotates inwards as the temperature rises. The rate is about 1 "/ °C; it may be that this is an hysterisis excursion).

This effect is somewhat at odds with expectations. We believe that it is due to the strut linking the elevation bearing to the top of the elevation motor mount structure. This strut may be expected to be at a lower temperature than the alidade structure which has the forced air circulation, and therefore the top of the alidade will be pulled inwards.

4. Tiltmeters mounted on the elevation shaft indicate that the angle between elevation and azimuth axes (departures from orthogonality) is constatnt to within ± 2.5"

This was measured on the elevation axis. The vertex room itself may show a different picture.

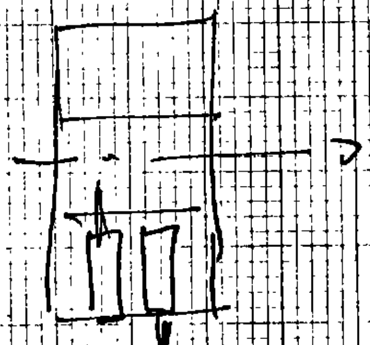
Talyvel tilt



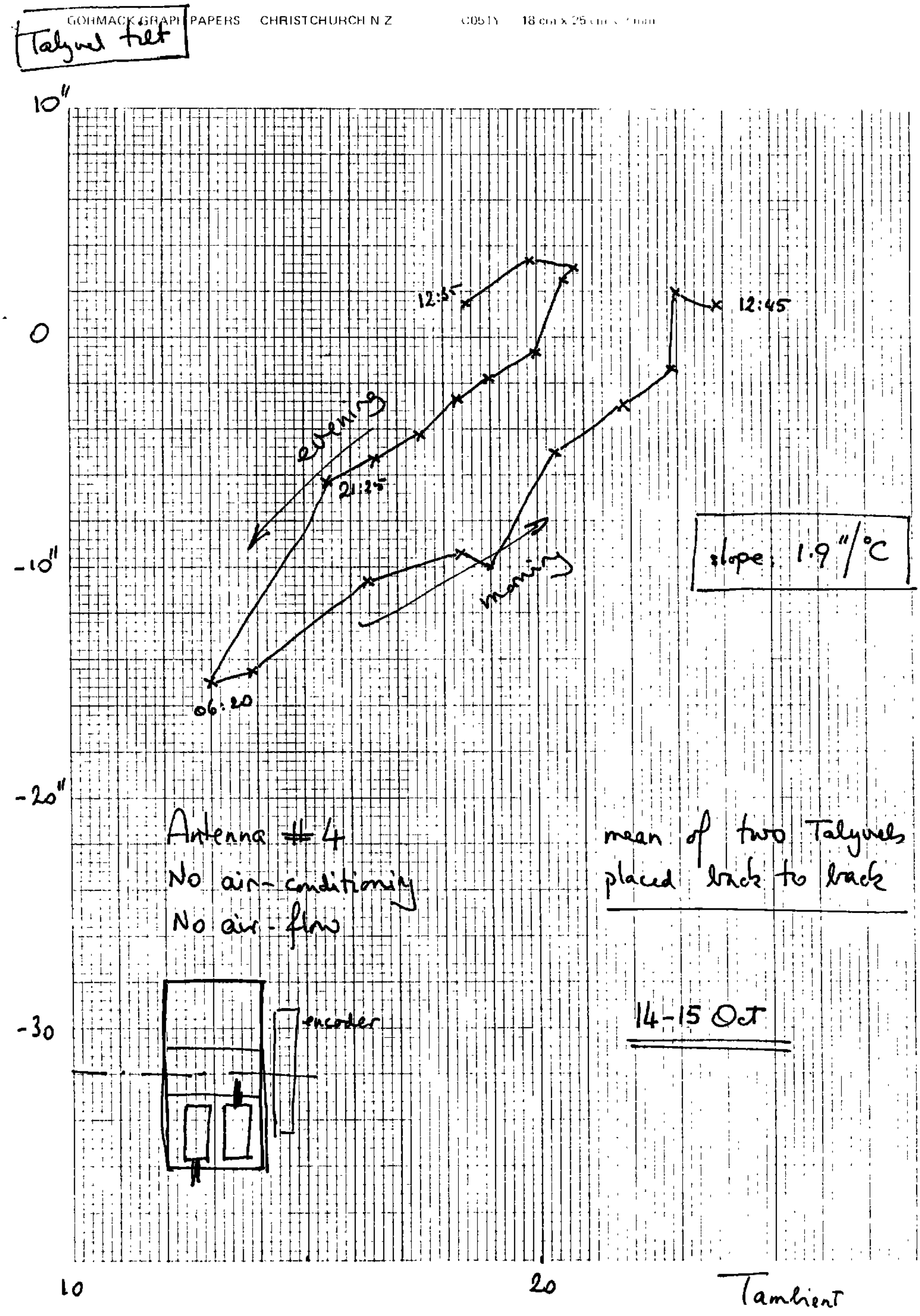
Antenna #4
18-19 Nov

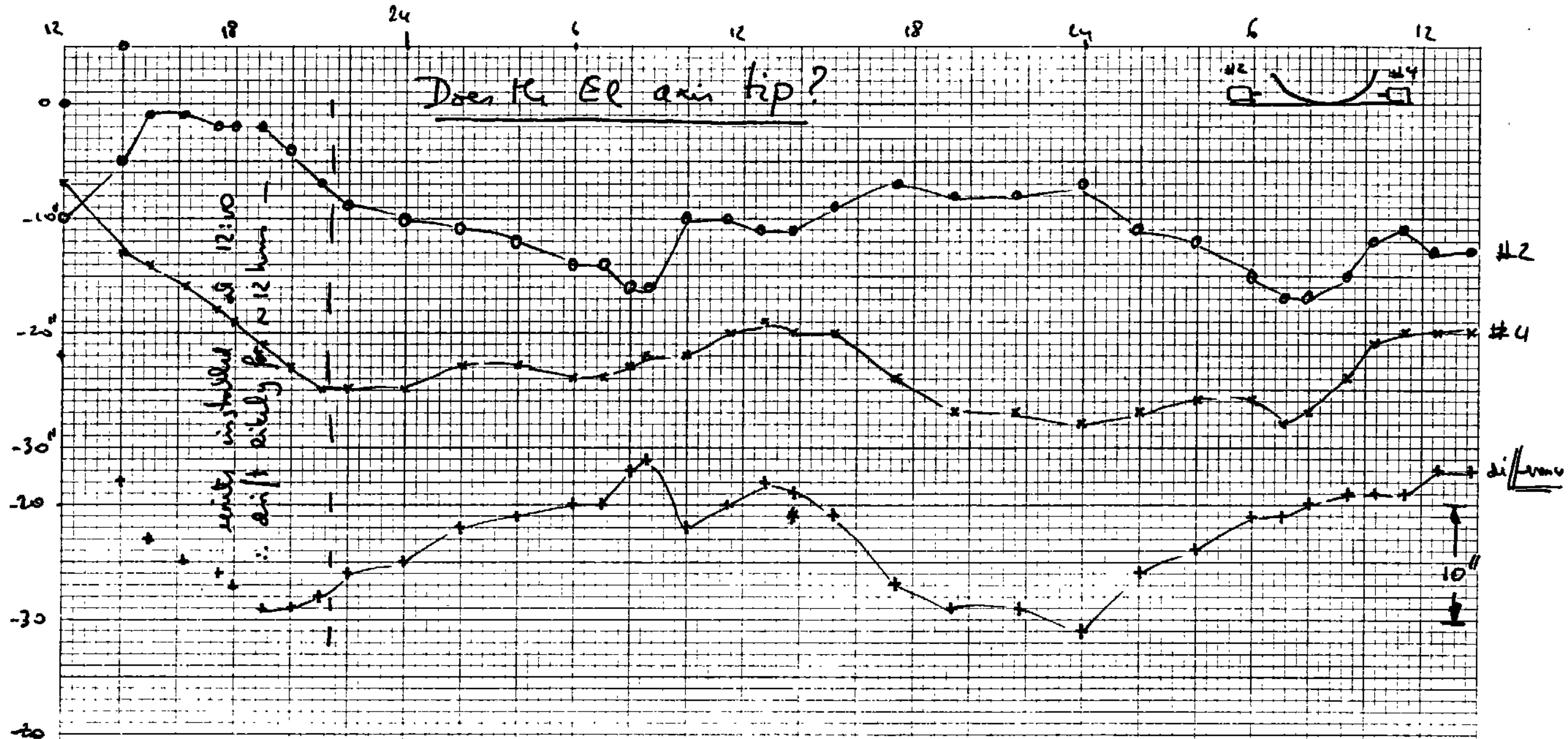
Mean of two Talyvels placed back-to-back.

Hysteresis in Alidade tilt :- non-encoder end.



16 20 30 Temperature.


Talyvel tilt
10"
0
-10"
-20"
-30
10
20
Tambient
12:35
12:45
21:25
06:20
evening
morning
slope: 1.9"/°C
Antenna #4
No air-conditioning
No air-flow
encoder
mean of two Talyvels placed back to back
14-15 Oct



Because the two units are mounted in opposite orientations it is their difference which measures the mean tilt.

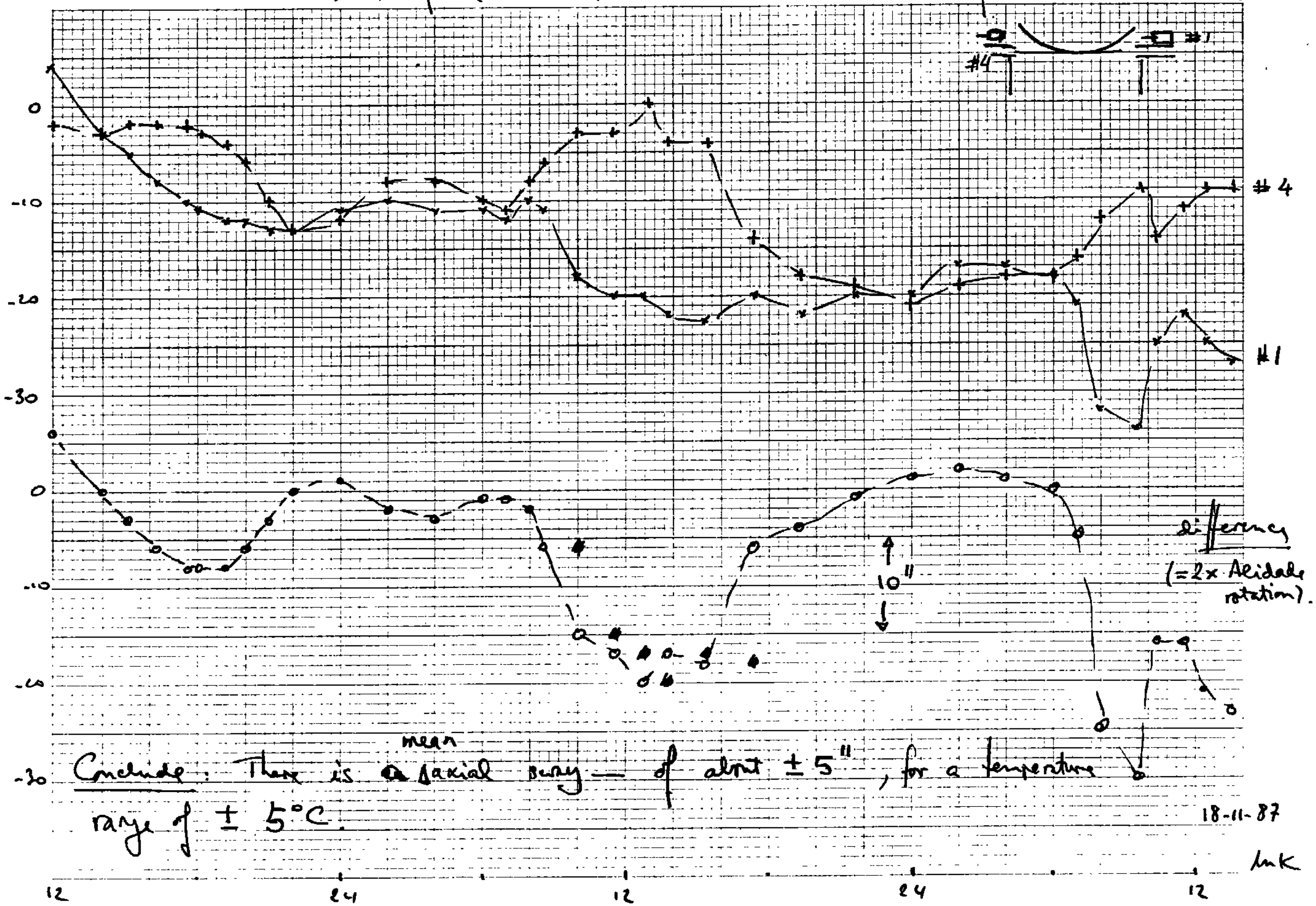
Thus mean tilt $\left(= \frac{\text{diff}}{2}\right)$ is within $\pm 2.5''$.

18-11-87

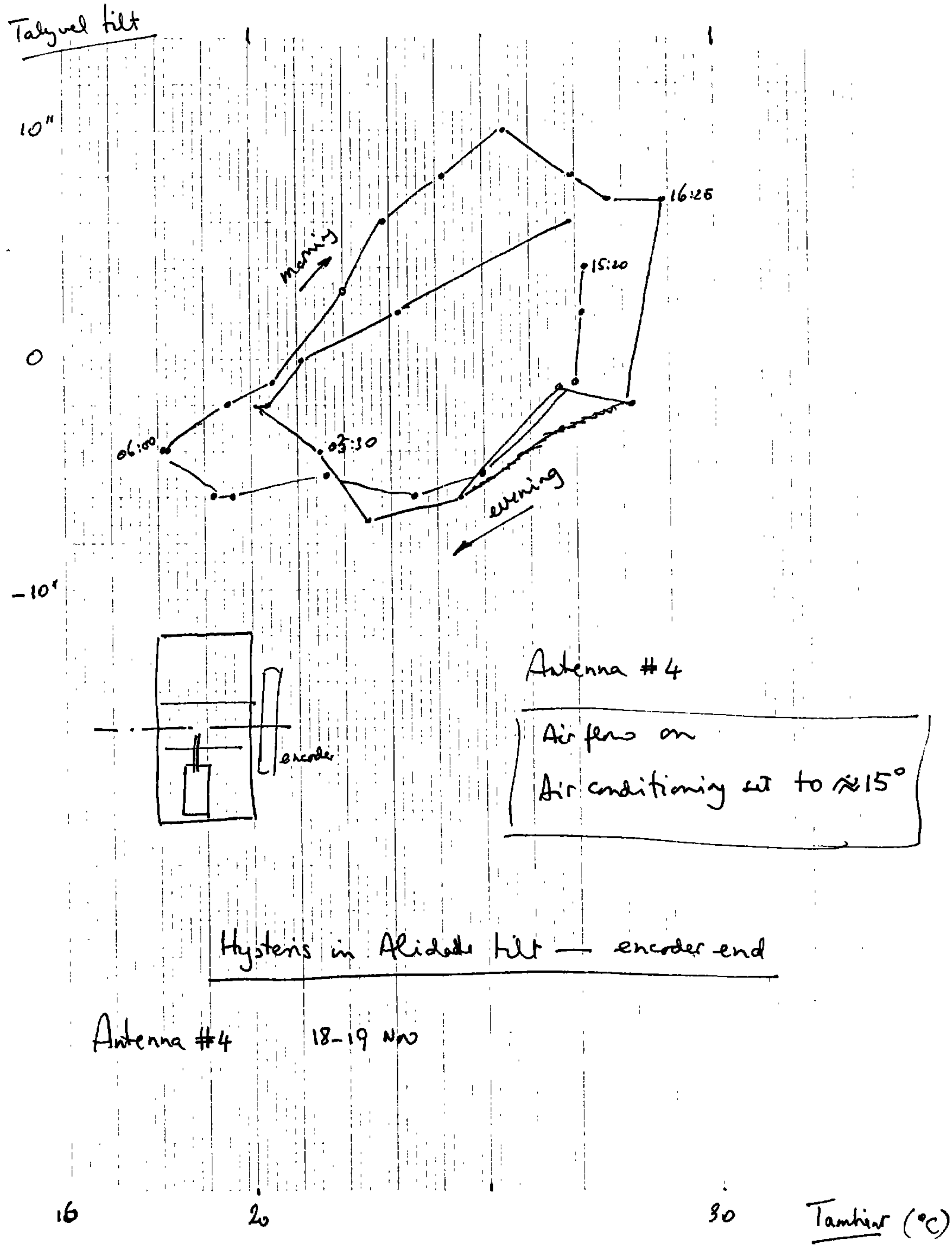
(Note: this does not necessarily relate to the Vertex room).

MK

Tilt of the Alidade structure in the direction of the Elevation Axis



Conclude: There is a mean axial bury — of about ± 5", for a temperature range of ± 5°C.


Talyvel tilt
10"
0
-10"
morning
evening
06:00
03:30
15:20
16:25
encoder
Antenna #4
Air fans on
Air conditioning set to ≈15°
Hysteresis in Alidade tilt — encoder end
Antenna #4 18-19 Nov
16
20
30
Tambient (°C)