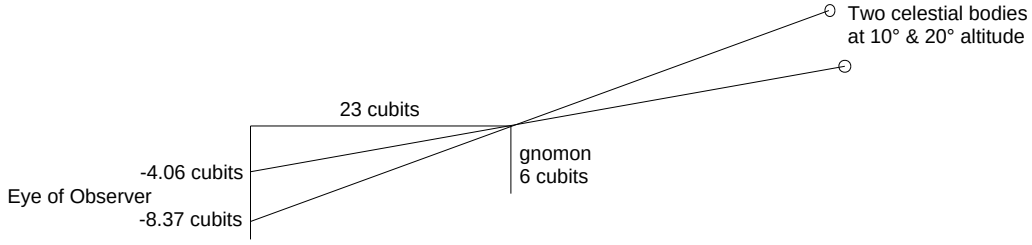
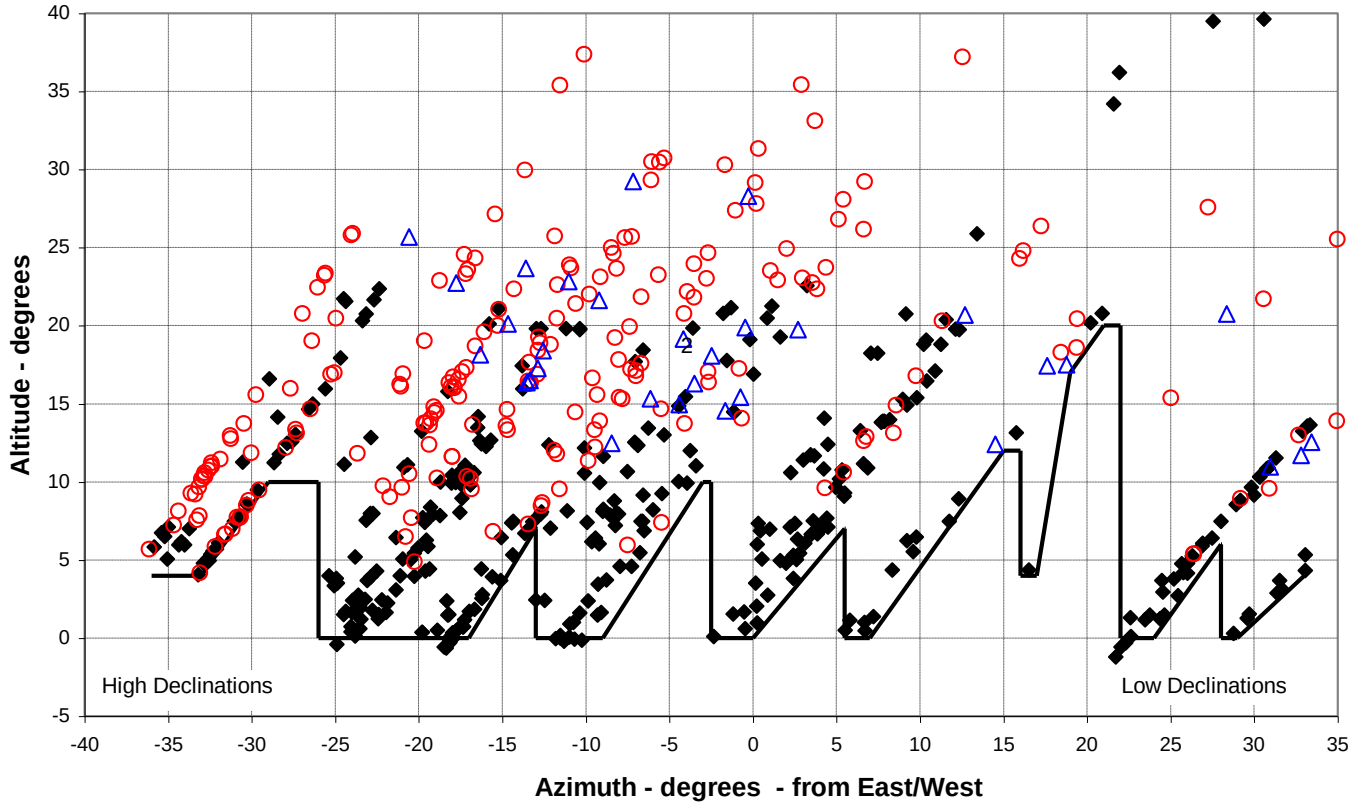
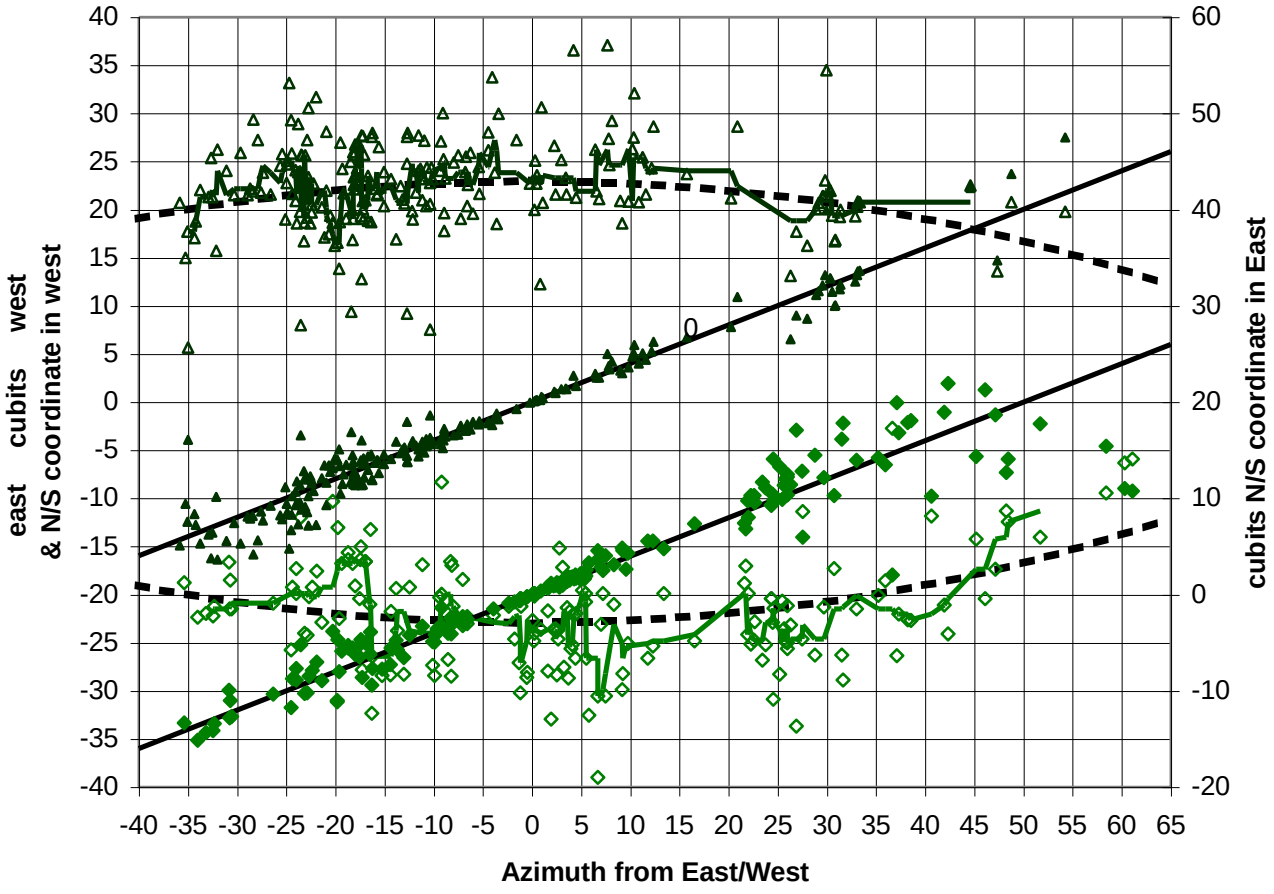
1. Cross-section of proposed device
with observer 23 cubits from gnomon
10° intervals measure, in vertical plane,
4.06 and 4.31 cubits



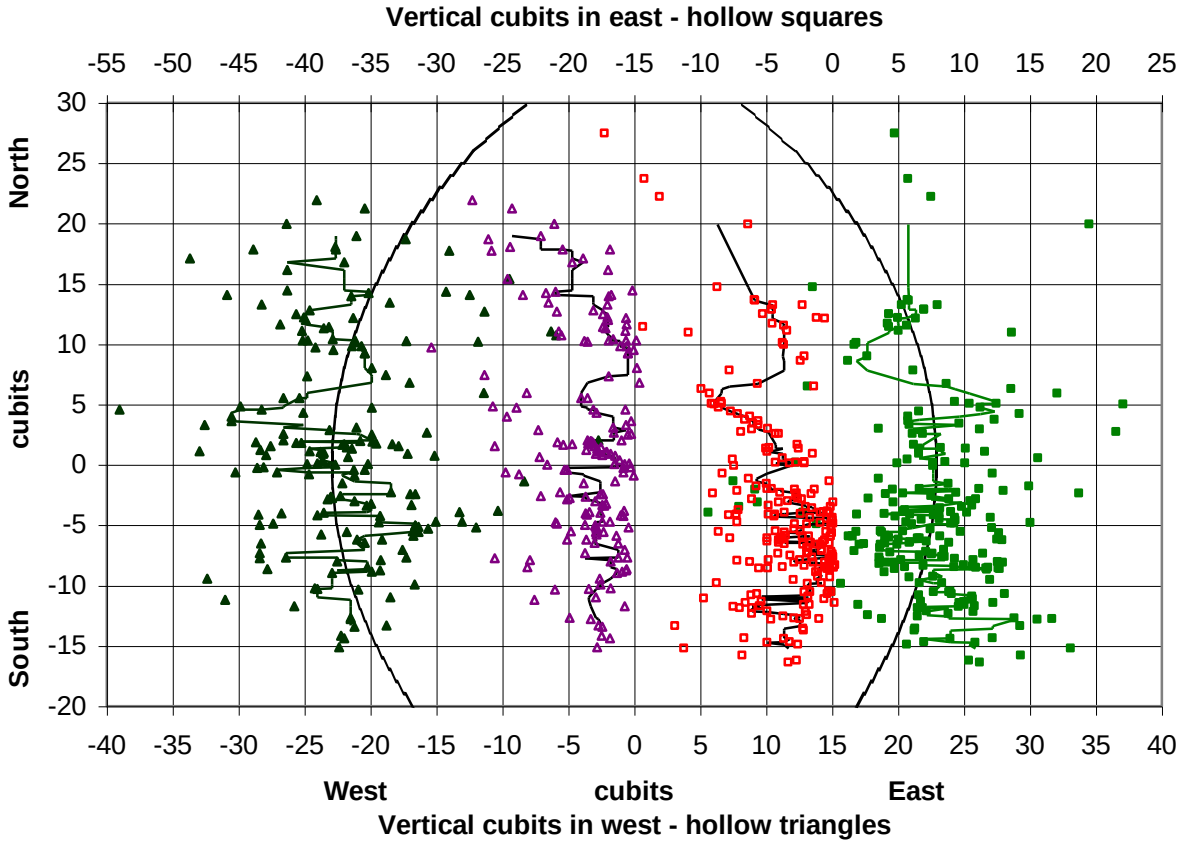
2. Positions Observer's Eye for Star
656 Passages - Calculated Distance Apart within 0.2% of Recorded Up/down Cubits
Best Alignment: Longitude - squares, R.A - circles, Azimuth - triangles
Continuous line marks lack of horizon observations (both E & W)

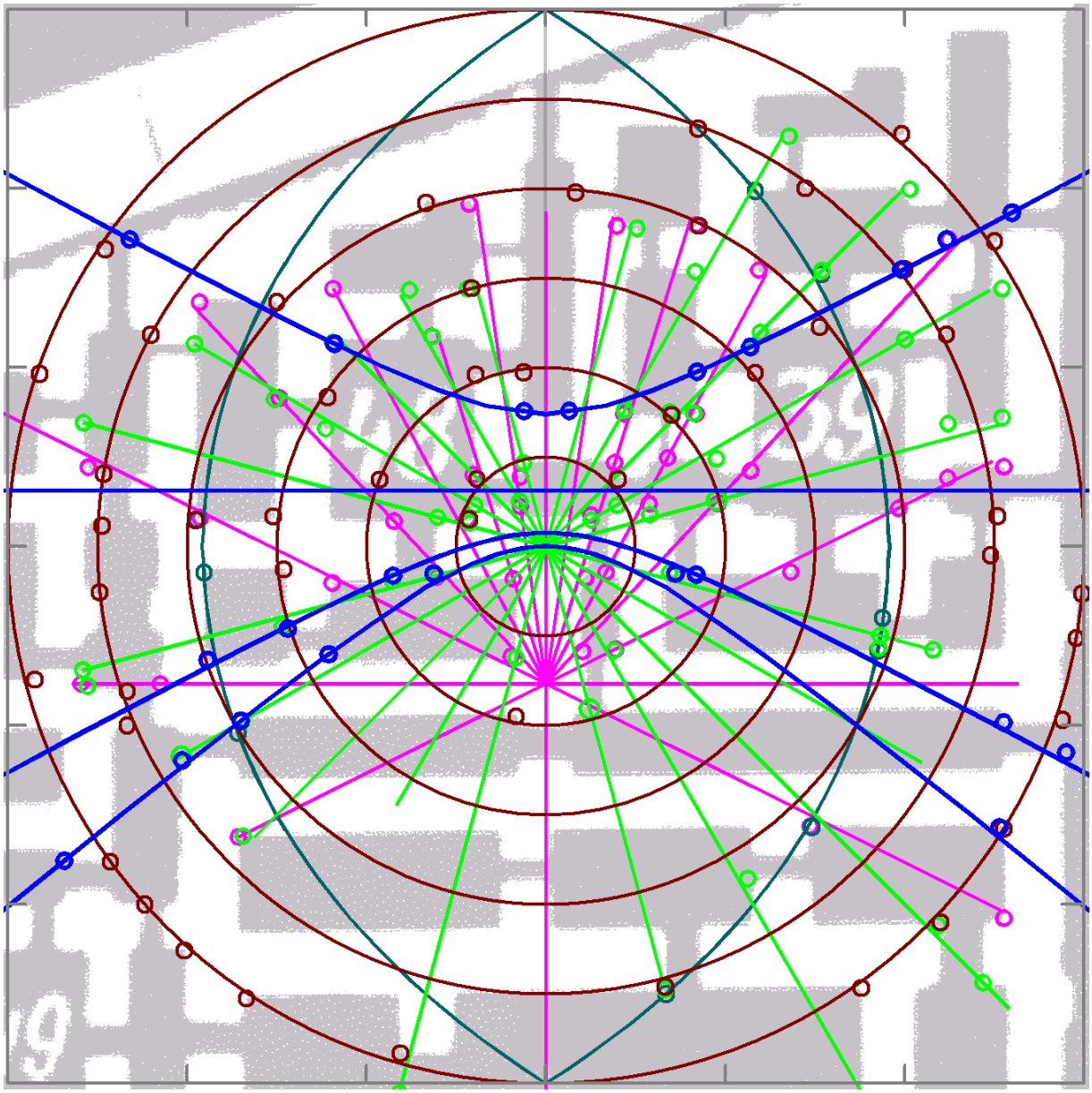


3. 386 Passages well-aligned Longitude
Positions Observer for star
Azimuth & separately W/E & N/S coordinates
diagonal lines 2.5° (azimuth) per N/S cubit
Continuous lines moving means (7 passages) of W/E coordinates
Dashed lines calculated values



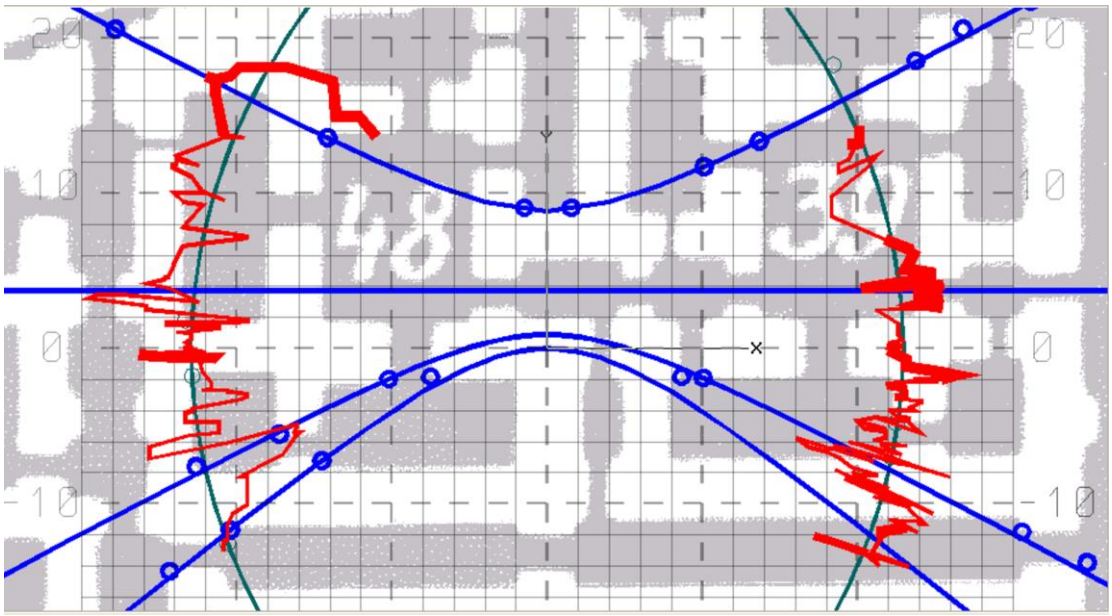
4. Passages best aligned in longitude
Observer's positions in plan & vertically
In East Observer's vertical position (top scale)
Continous lines - moving averages of 7
Dashed arcs - stepped curves
Significant anomaly ca. 5 cubits north of gnomon



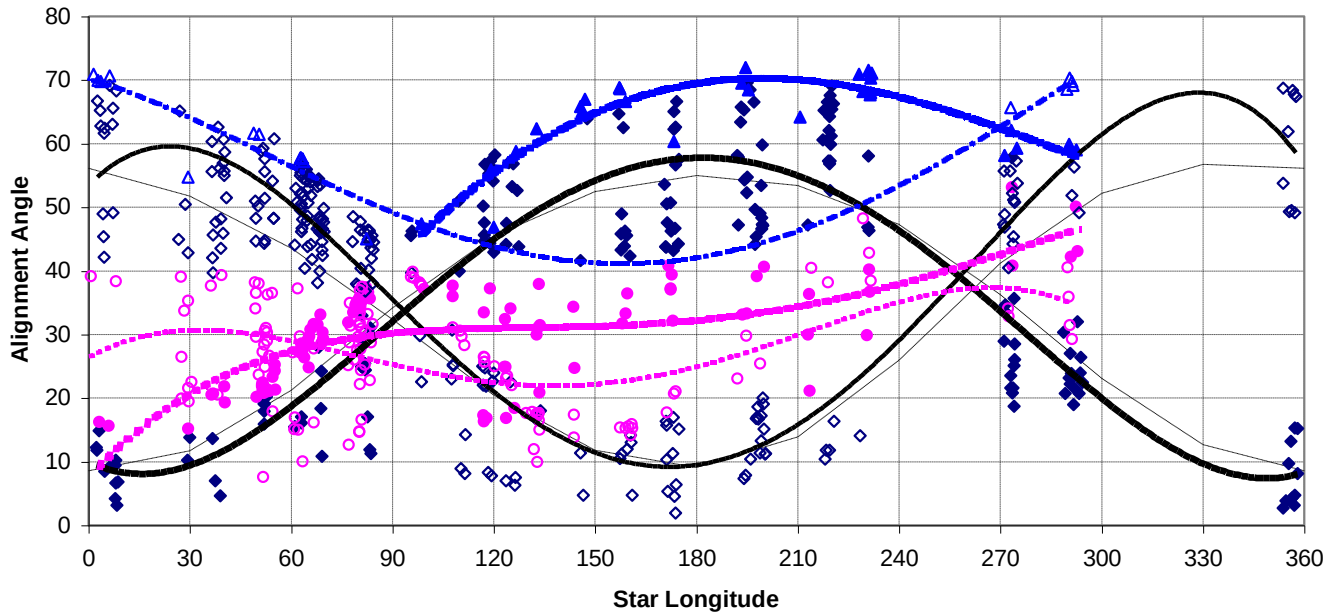


5. Plan of Babylon Palace North of Western Court,
assuming 6 cubit gnomon showing
outline square side 72 cubits – 37.4m
stepped curves for observer
concentric circles - radii from 6 to 36 cubits
lines radiating from gnomon at 15° intervals
lines radiating from pole at one hour intervals
small circles mark where lines meet wall junctions
in blue, paths of sun at equinoxes and solstices
with the equivalent path of stars that transit overhead

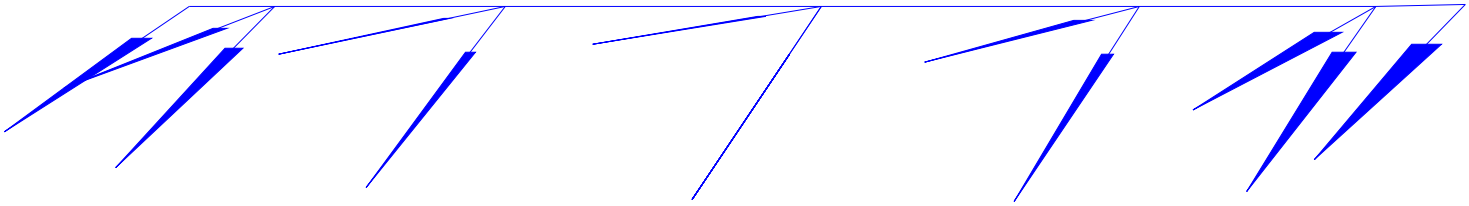
6. Enlargement of Figure 5, showing
calculated mean positions of observer in red
(thicker lines indicate greater depth)
square grid with sides of 2 cubits (ca. 1.04m)
in blue, paths of sun at equinoxes and solstices
with the equivalent path of stars that transit overhead



7. Positions Observer's Eye for Star
656 well-aligned Passages when in West or East
better aligned in Longitude (squares), R.A. (circles) or Azimuth (triangles)
dashed lines assume exact alignment in longitude near horizon



8. Schematic Cross-section of Device in East & West
showing 4 cubit rod at 30° intervals of longitude
lower body at 2° altitude



8B Comparison of frequencies of radiocarbon samples and placing of megaliths at Nabta Playa

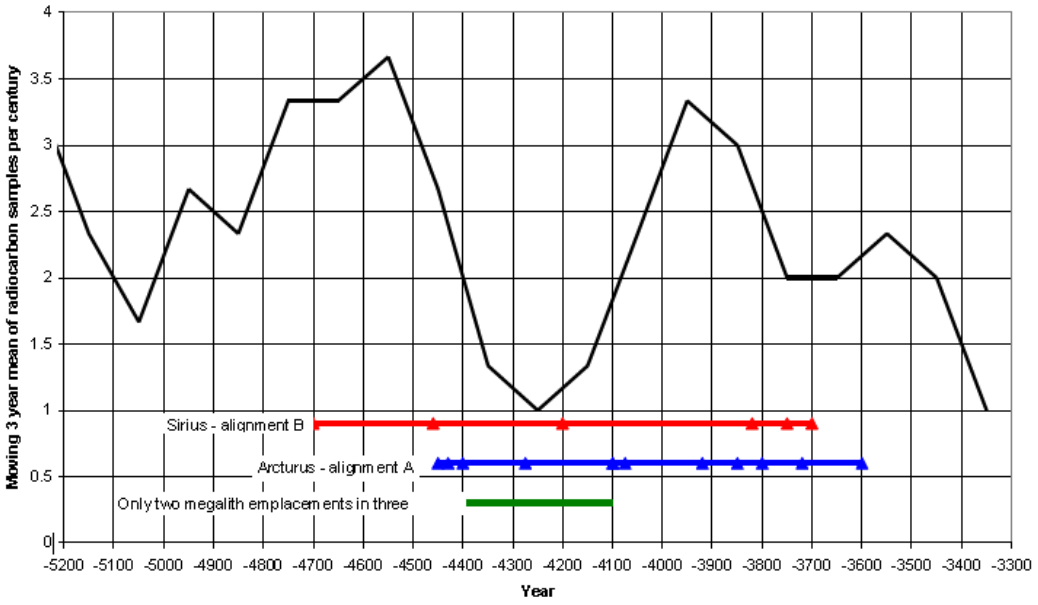


Fig 8c2. Hierakonpolis HK29B Three Possible Layouts
Red - Gnomon 4.0m - Declination -24.1°
Dashed Red - Gnomon 1.4m - Declination -29.6°
Green - Gnomon 5.5m - Declination -24.1°
Dashed Green - see text
Blue - Gnomon 4.78m - Principal line - Declination -35.7°
Dotted Blue lines radiate around blue cross

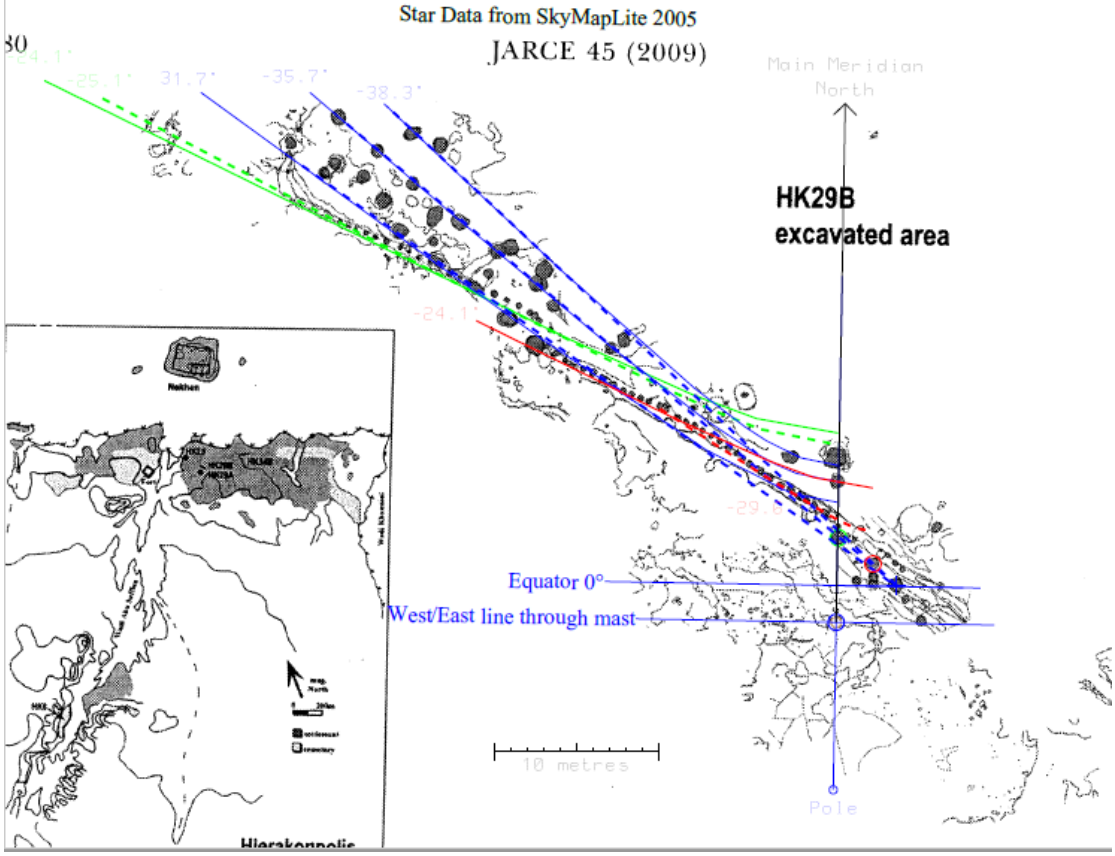


Fig.8d Hierakonpolis HK29A Phase 1 (-3500)
(For greater detail see Friedman 2009, Fig.8)
Dotted Black - lines at 45° to meridian, X & Y
Dashed Black - Unexcavated courtyard perimeter
Blue - lines of constant declination
Red - Hour-lines & degrees (Time) to Meridian
Brown - post holes south of courtyard

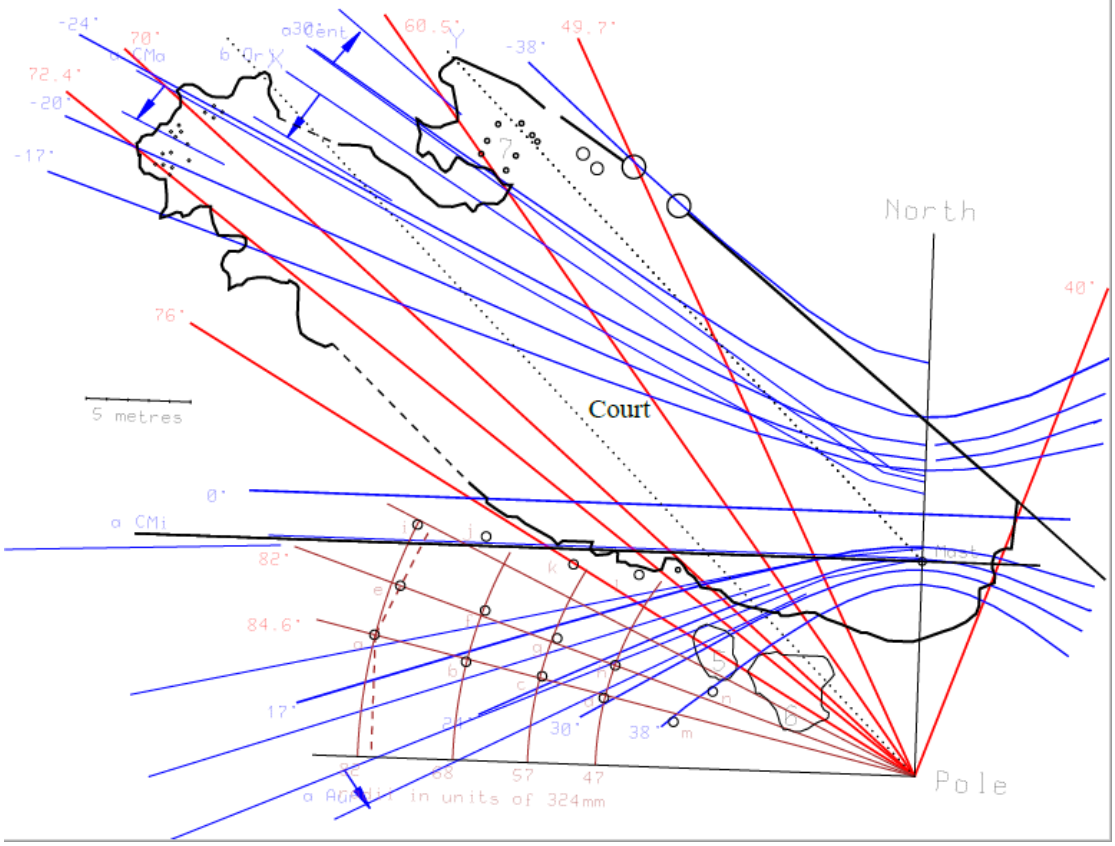
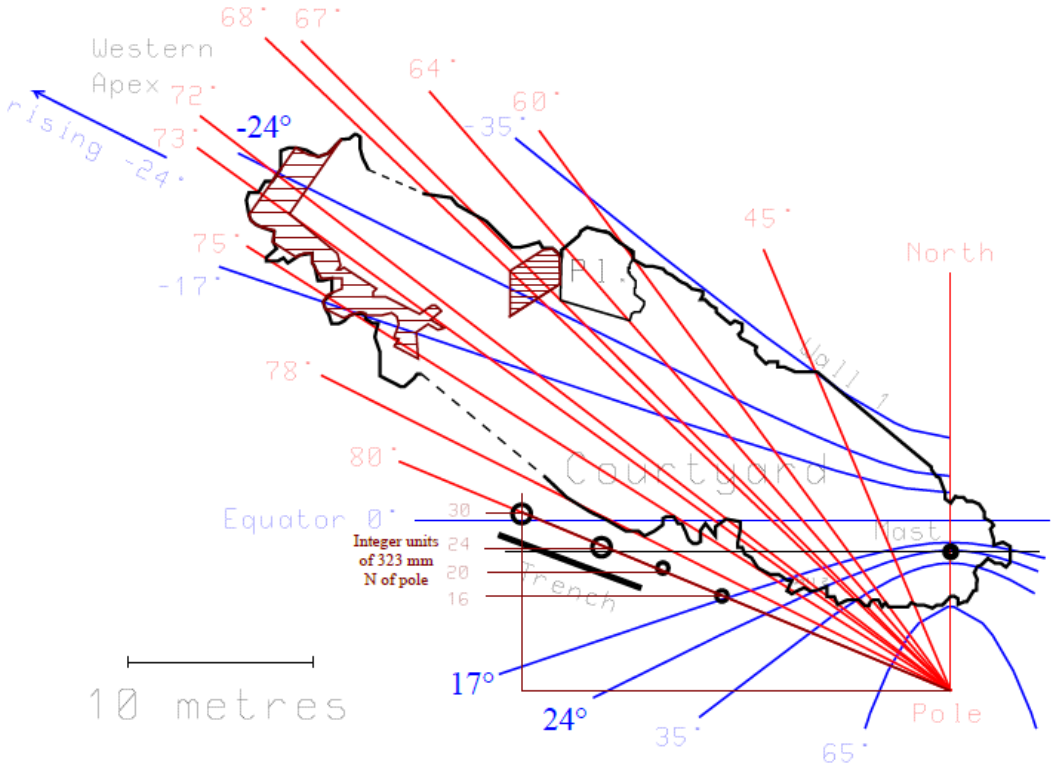
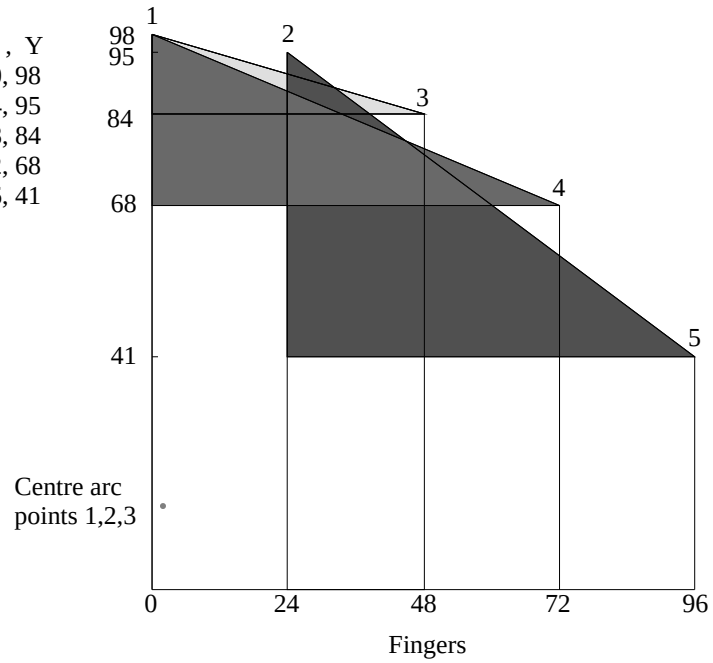


Fig.8e Hierakonpolis HK29A Phase 2 (-3300)
(For greater detail see Friedman Jarce 45 2009, Fig.9)
Dashed Black - Unexcavated courtyard perimeter
Blue - Lines of Constant Declination
Red - Hour-lines & degrees (time) to meridian
Brown - 4 post holes & 5,12,13 (x6) triangle
Brown hatched - Brickwork Western Apex



9. Saqqara Curve with Five Points

	X , Y
1	0, 98
2	24, 95
3	48, 84
4	72, 68
5	96, 41



Centres Arcs
points 3,4,5
points 1,3,5

9a Pepi II Pyramid Complex.Green Rectangular grid with 28.8 cubit squaresBlack Dotted grid & circles with 25 cubit squaresYellow Pythagorean TrianglesBlue Shadows of bodies with declination -12° &, in east, 0°, all at 10° intervals. in west equatorial shadow 35° from meridian, ignoring girdleRed Standard short hours of 40 minutes on declinations 0° (50/40°) & -12° (40/30°).

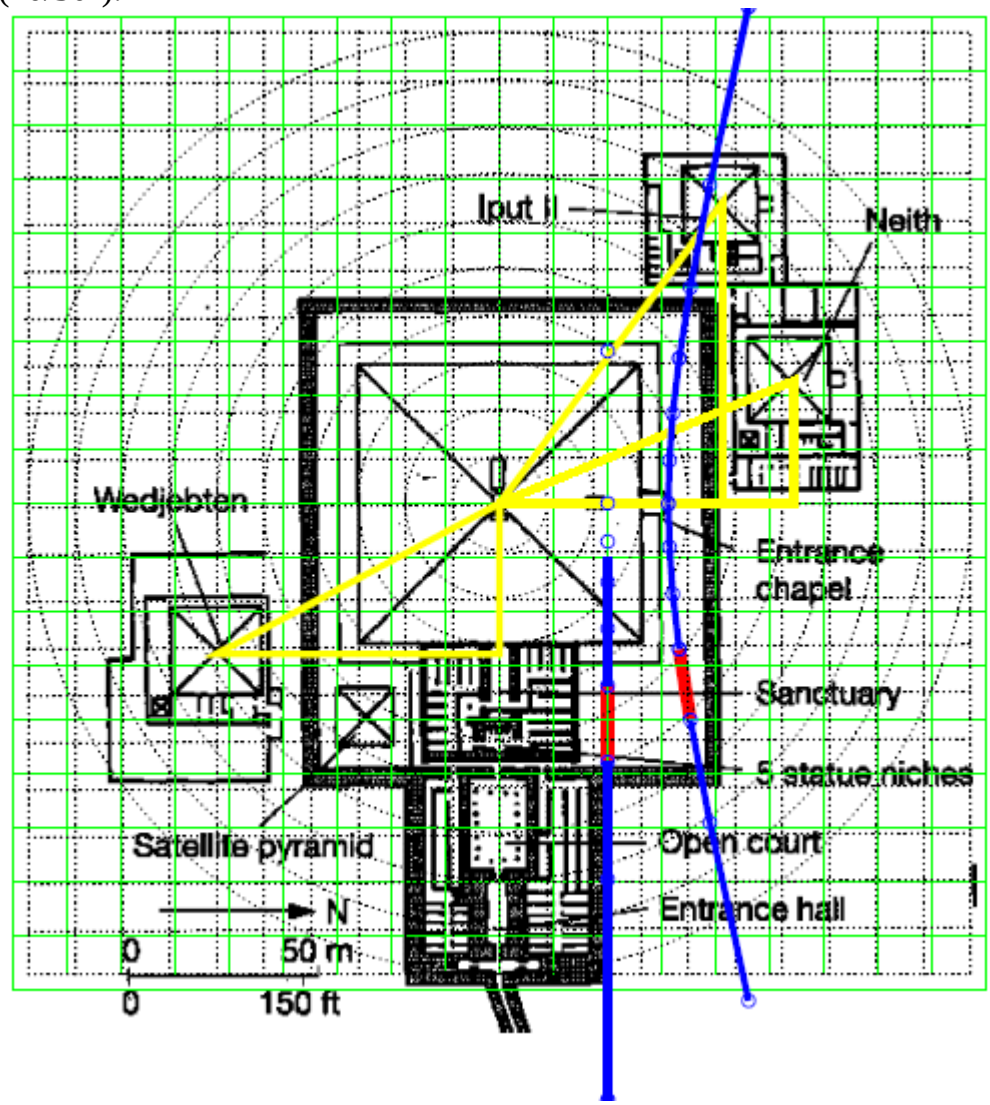


Fig.9b Horus Eye Fractions

Red	1/2	Green	1/16
Yellow	1/4	Black	1/32
Blue	1/8	Grey(2)	1/64

First Quadrant of Spiral

Total area 32 sq. units

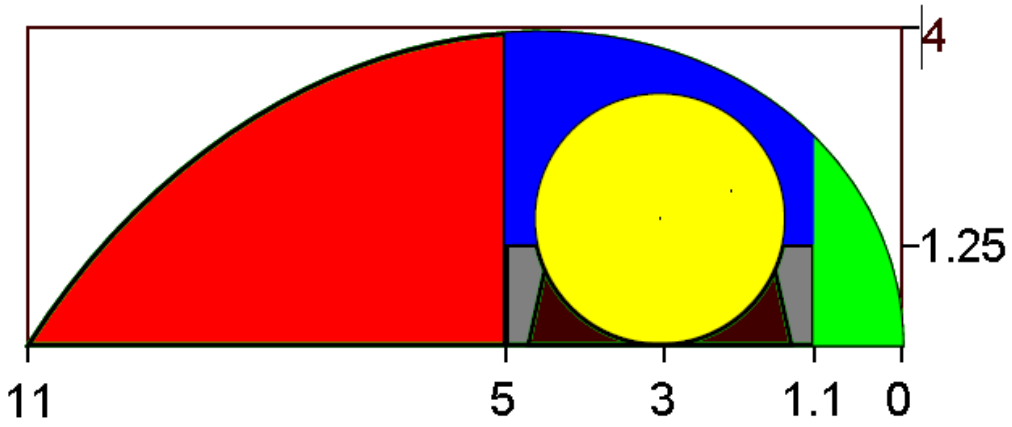


Fig. 9c Four 4th Dynasty Pyramids - Sneferu (3) & Khufu (1) -2610/-2580
Red - Hour-lines, around Pole, with Respective Times from Transit
Blue - Lines of Constant Declination
Scales Vary but Base Side/Height shown below Name
→ North

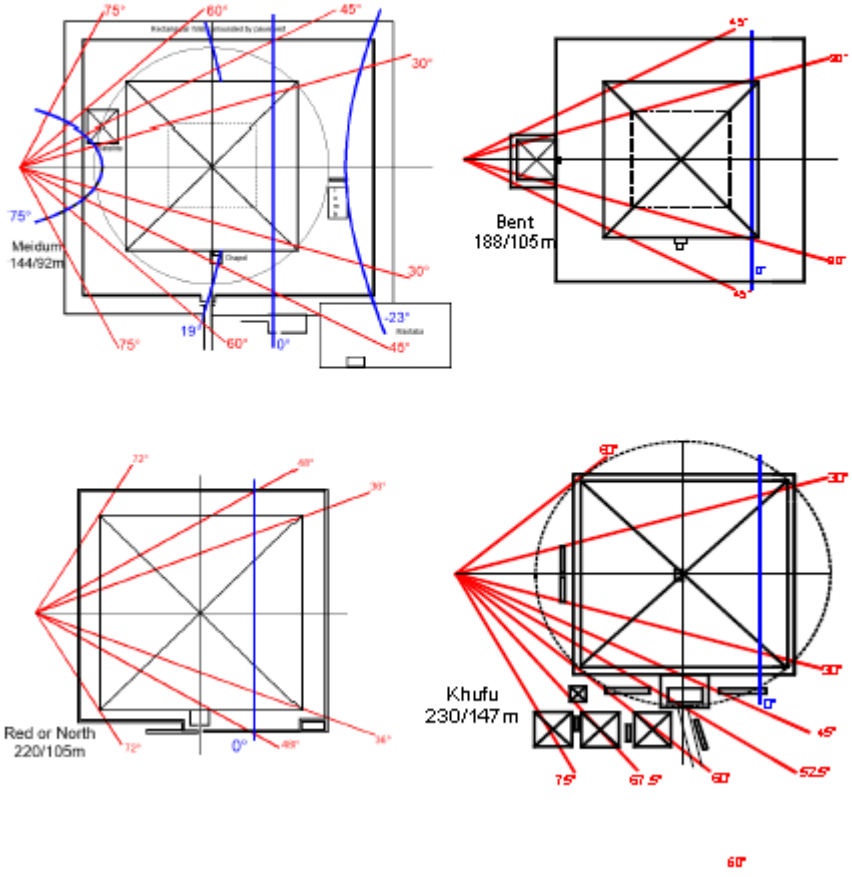


Fig 9d Four Pyramids - Kafre, Menkaure, Userkaf & Sahure -2540/-2480
Red - Hour-lines, around Pole, with Respective Times from Transit
Blue - Equator
Scales vary but Base Side/Height shown below Name
→ North

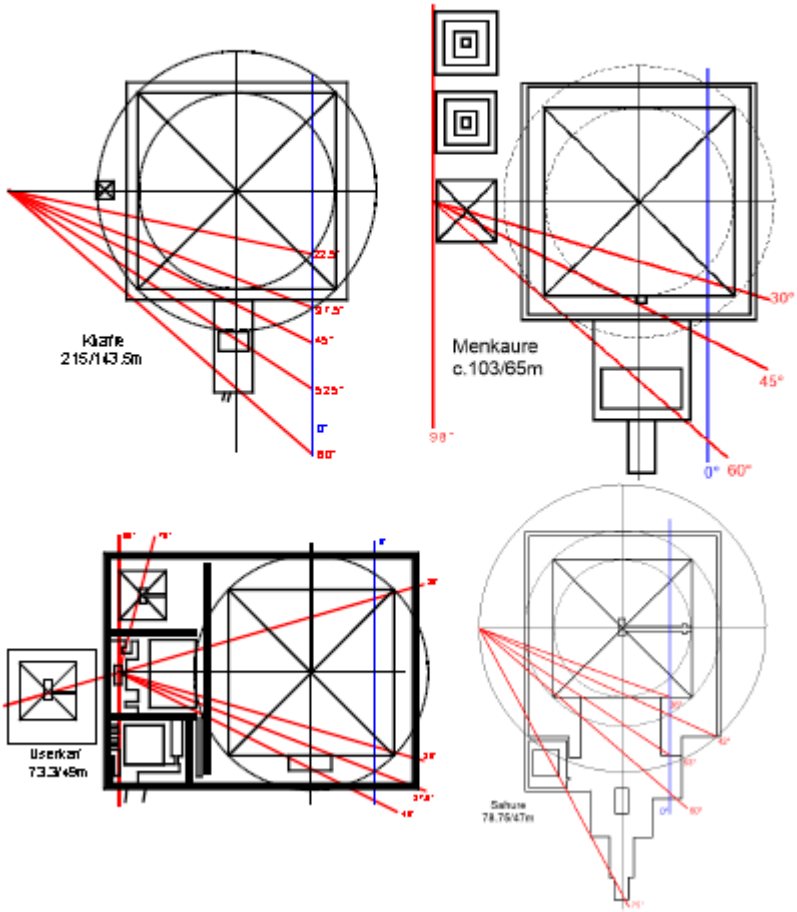
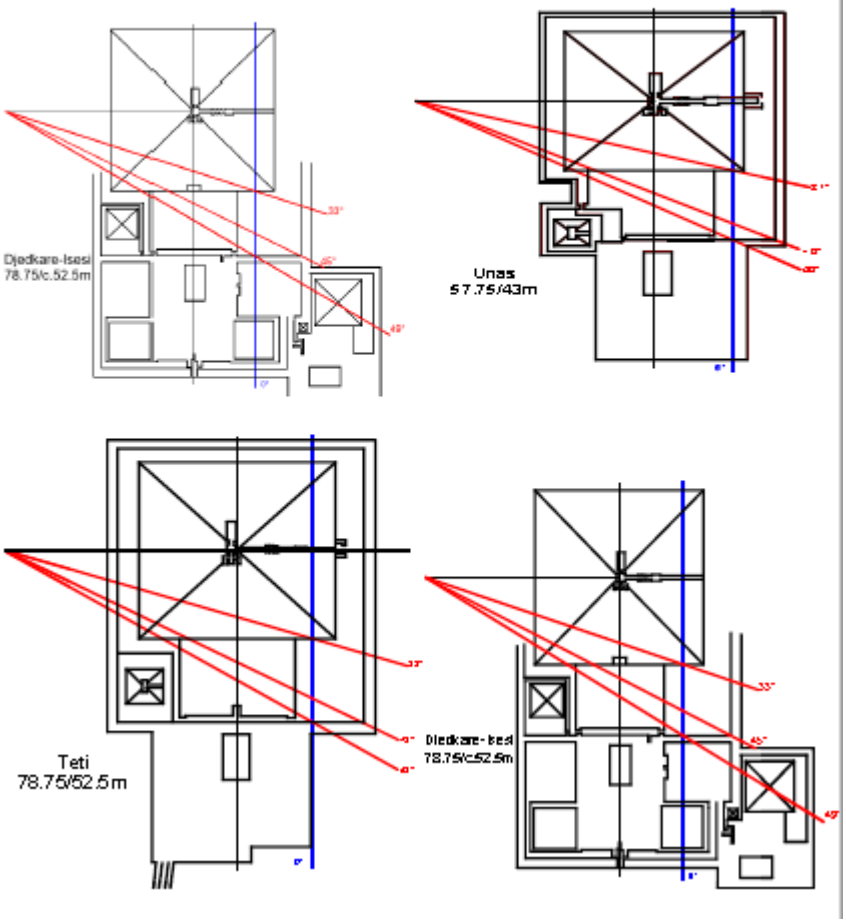
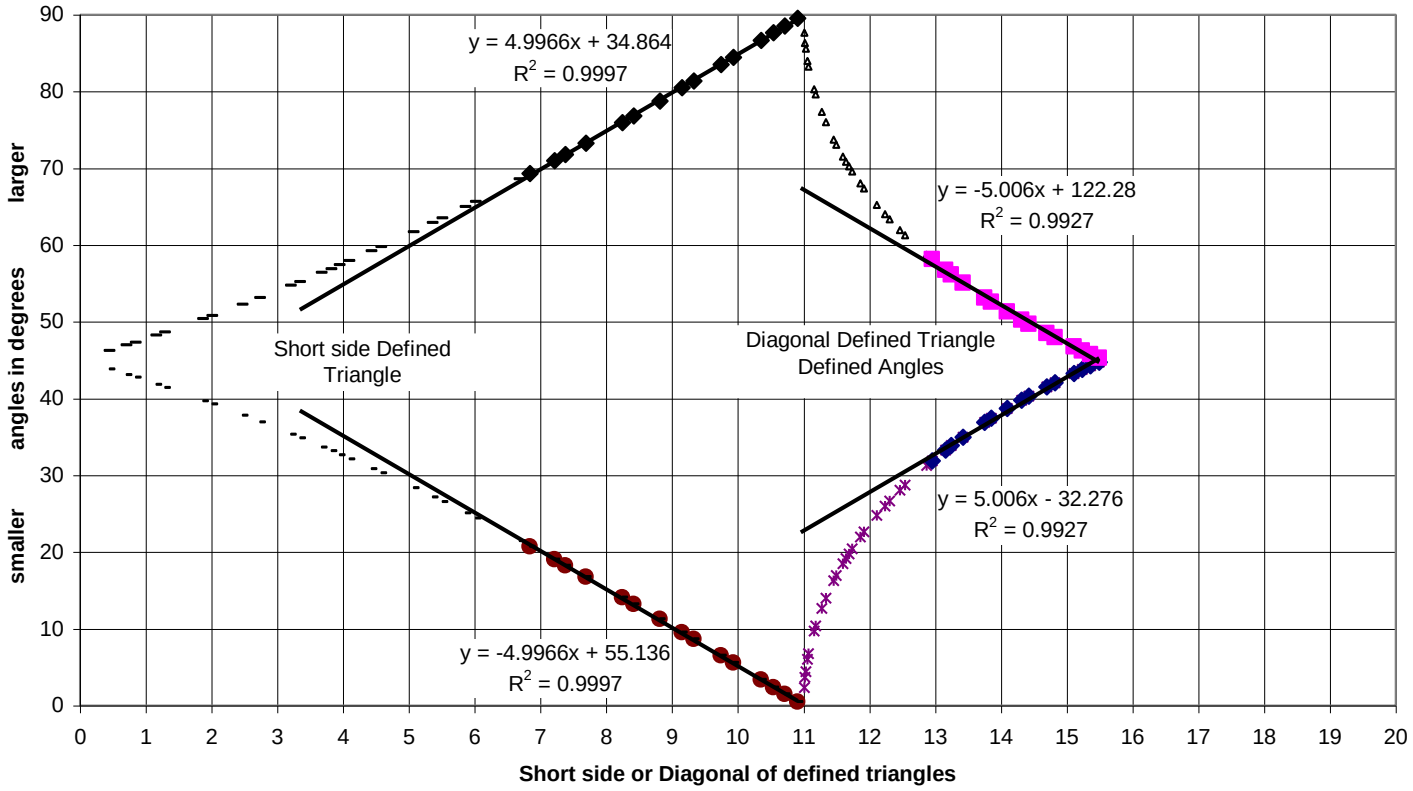


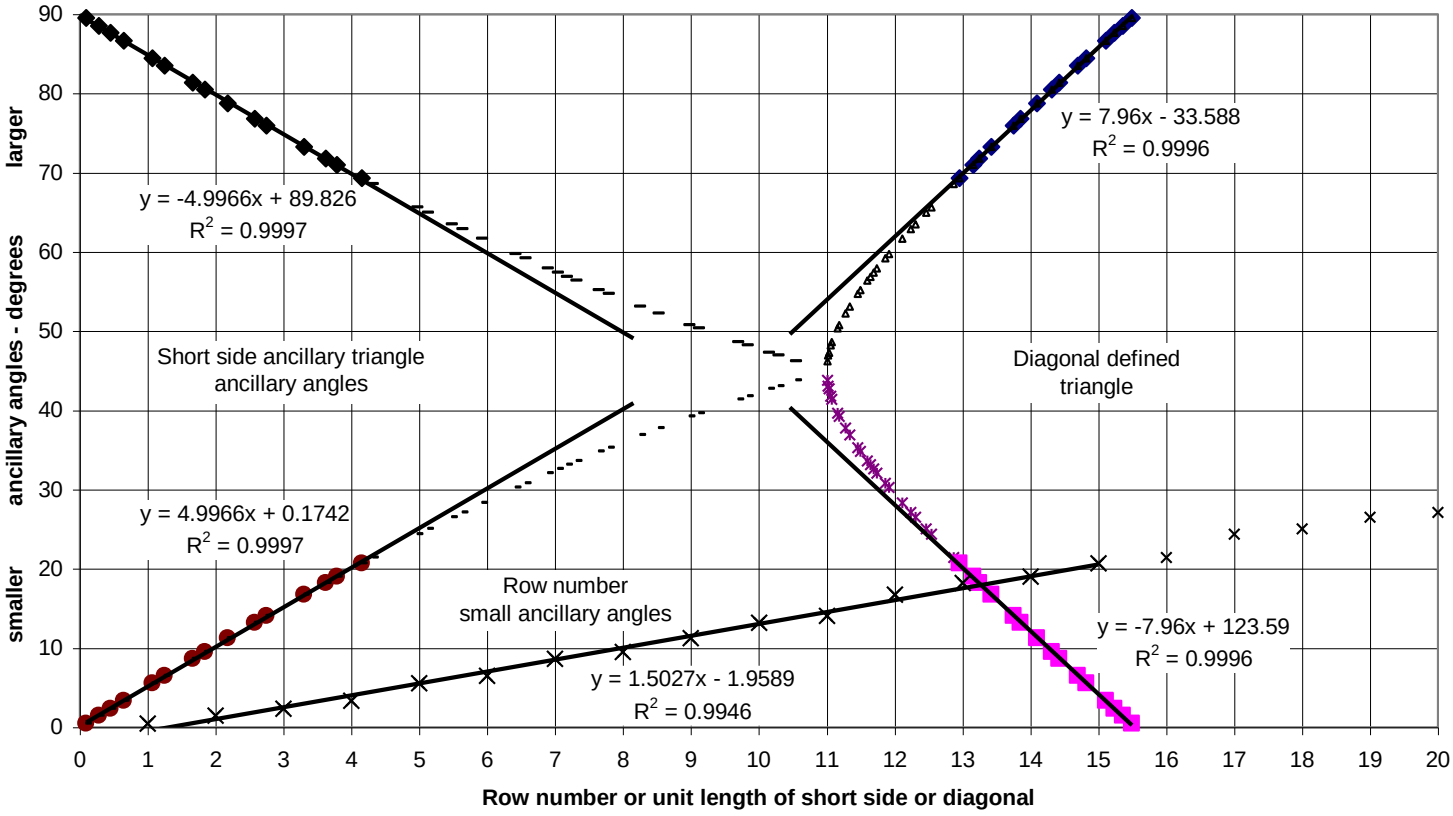
Fig.9e Four Pyramids Djedkare-Isesi, Unas, Teti & Pepi I -2400/-2300
Red - Hour-lines. around Pole, with respective Times from Transit
Blue - Equator
Scales Vary, but Base Side/Height shown below Name
→ North



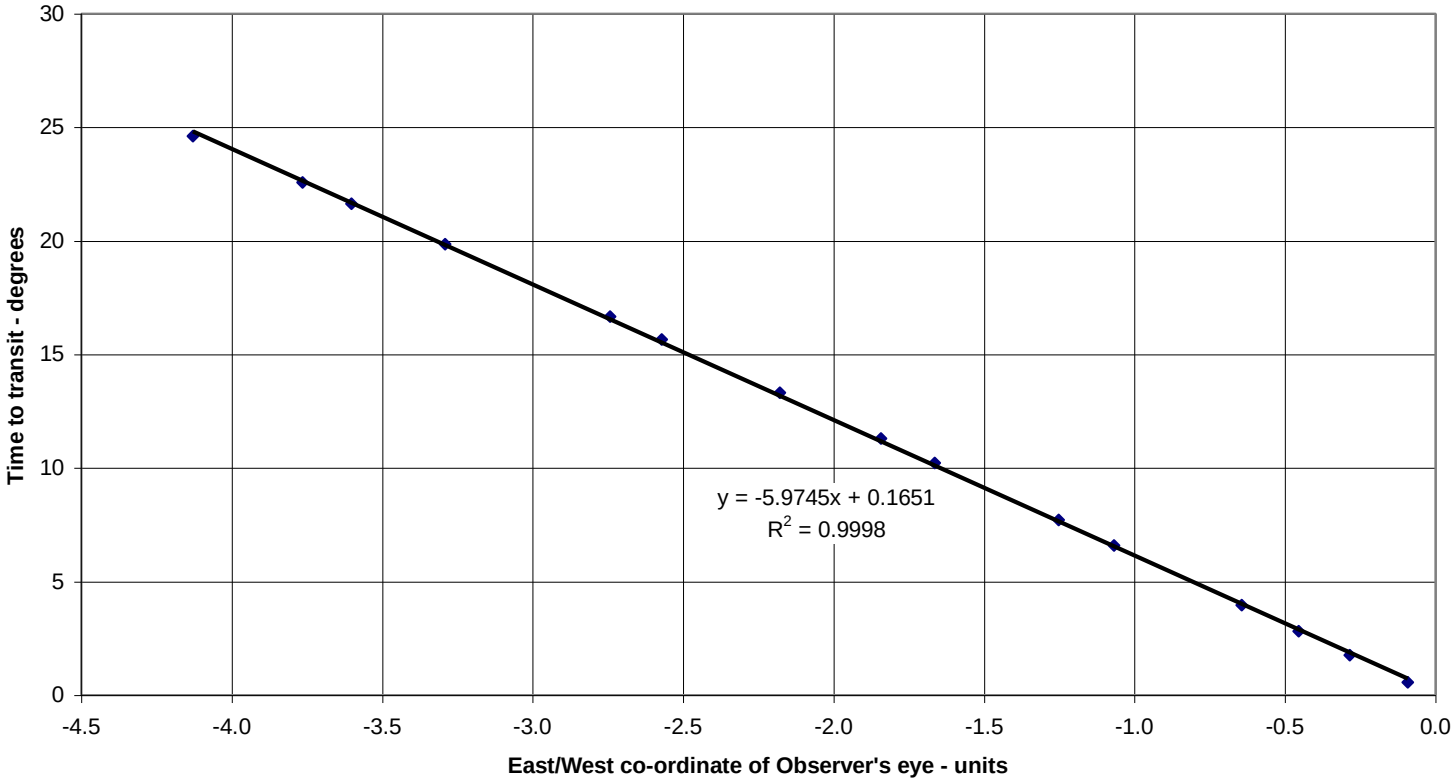
10. Plimpton 322 - Plot of short side or diagonal & angles of triangles with long side scaled to 11 units Enlarged markers & trendlines for 15 extant rows



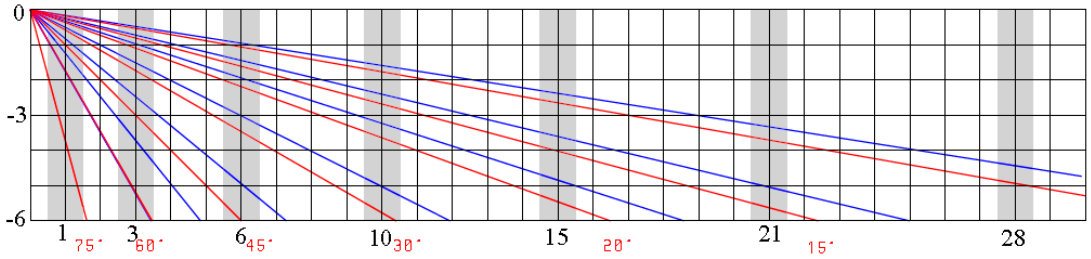
11. Plimton 322 - Plot of short side or diagonal & angles of ancillary triangles with long side scaled to 11 units plus row number & small ancillary angles Enlarged markers & trend lines for 15 extant rows



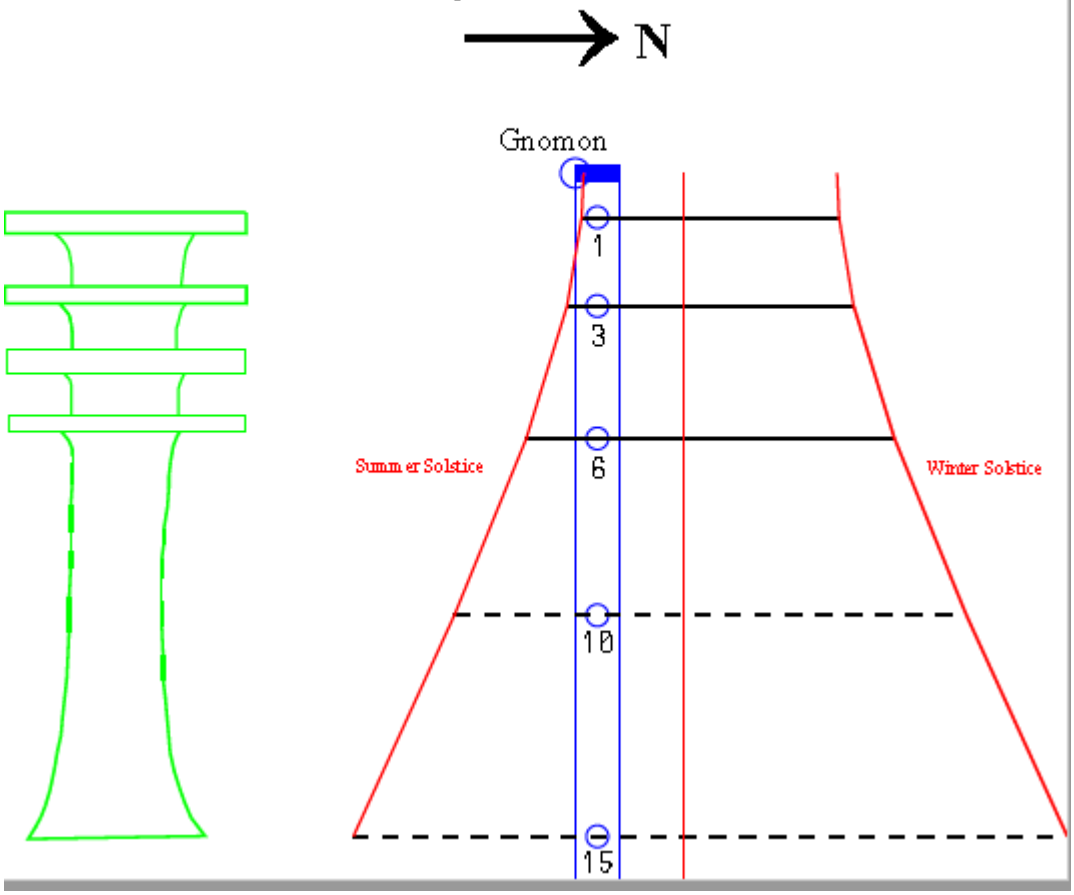
12.East/West Position of Observer's Eye
and time to transit with a gnomon of 11 units
Small Ancillary angle in Plimpton 322 assumed to correspond to
zenith distance of stars that transit overhead on a latitude of 32.5°



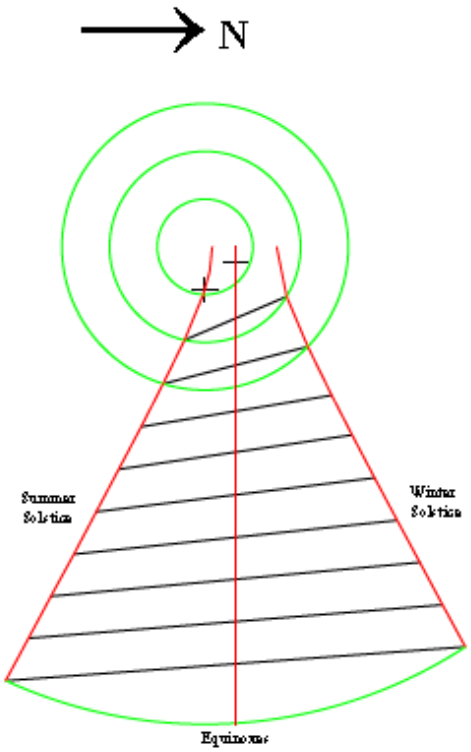
13 Cross-sections of L-shaped sundial aligned with sun
Black - 6 x 30 unit grid
Grey Bands - marks at 1, 3, 6, 10, 15, 21 & 28 +/- 1/2 units
Red - Altitudes to top of gnomon - 10°, 15°, 20°, 30°, 45°, 60° & 75°
Blue - Times from Rising - 10°, 15°, 20°, 30°, 45°, 60° & 75° at Equinoxes
Assumed Latitude 26° No allowance for refraction



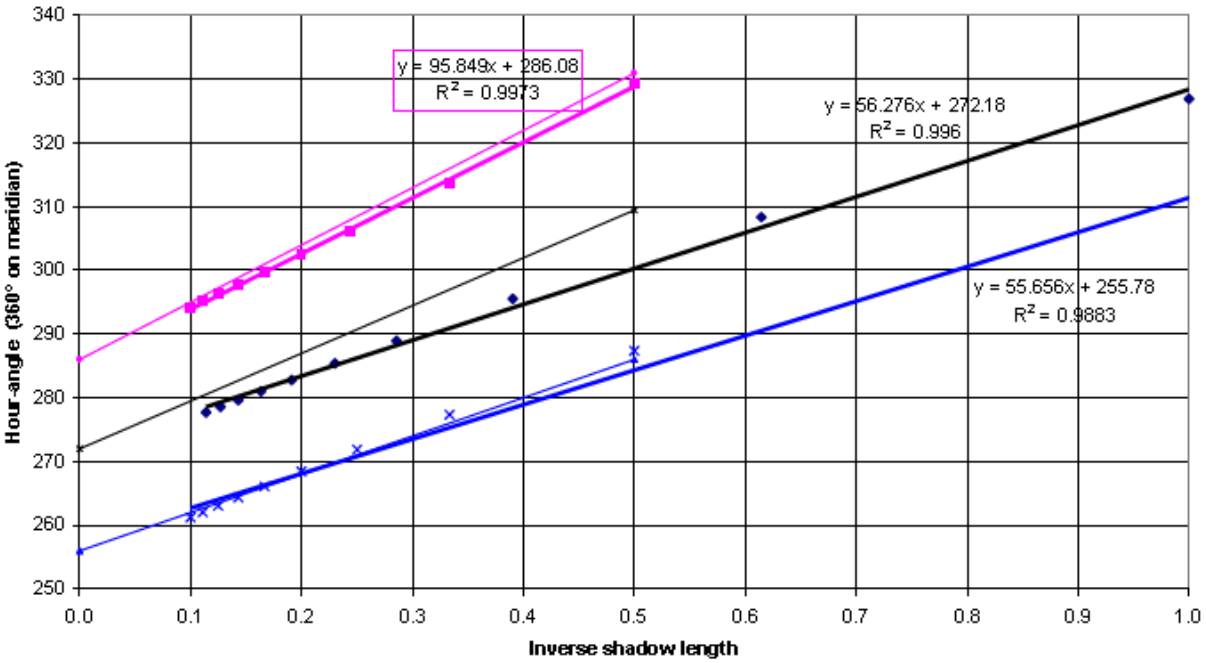
14 Plan Sun's Afternoon Shadows (red) Equinoxes and Solstices
cast by southern corner of flat topped gnomon (blue)
Gnomon Height & Width 5 & 1 units
Latitude 26°, Obliquity of Ecliptic 23.83°
Black Horizontal Lines: continuous - Seasonal time, dashed - equinoctial time
Djed Pillar at Left



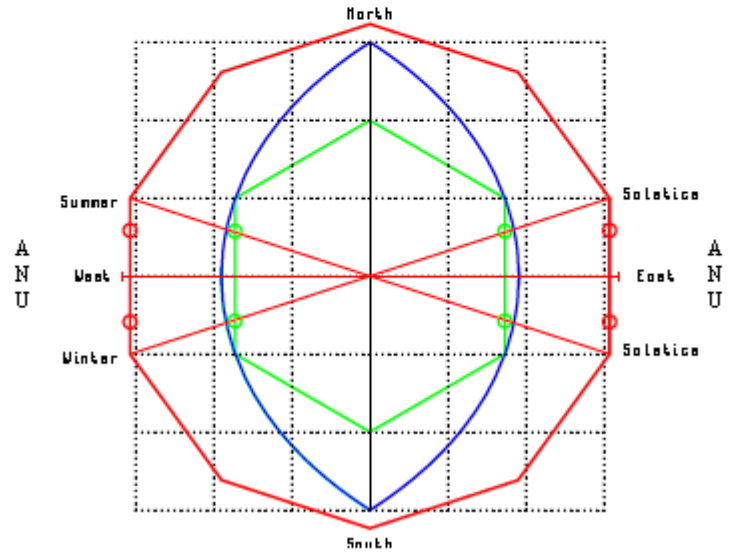
15. Mul-Apin Shadow Length Scheme -Latitude 32.5° - Obliquity 23.83°
Green - circles around gnomon - radii 1,2 & 3 and arc - 10 cubits.
Equinox Values (>3 radius) fixed by intersection of straight black lines joining solstice positions.
Crosses mark theoretical positions for 60° & 75° (time) for Summer Solstice & Equinoxes.
At Winter Solstice shadow does not reach a length of 1 cubit or 90° after rising.



16 Mul-Apin Shadow Length Scheme
Latitude 32.5°, No allowance for refraction
Dashed lines based on Constants/Rising H.A:
Summer Solstice 60/256°, Equinoxes 75/272° & Winter Solstice 90/286°
Winter Solstice shadow of 1 cubit ignored



17. At the horizon - Latitude 35°, Obliquity 23.9°, no allowance for refraction
Stepped curve (blue), each N/S cubit equals 2.5°azimuth
Hexagon (green) with sides 24 cubits (60° azimuth)
10-sided polygon (red) with sides 24 cubits (36° time)
grid squares 12 x 12 cubits
Small circles mark limits, 7 cubits north and south of due east/west ,
for the ANU band in Azimuth and Time



18. Modern Drawing of East-facing Vertical Sundial.

and below

Raising the Djed Pillar at Abydos c.-1300

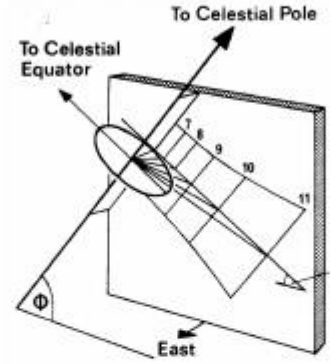


Fig.19 'Ready Reckoner' conversion rising degrees azimuth to time
Latitude 35°, Obliquity 23.8°, no allowance for refraction
Green - Long axis N/S - each cubit 2.5° azimuth or 3° (dotted)
Long axis E/W - each cubit 2° time
Dashed line - mirror image
Blue - for solstices 30° azimuth & 18° time from E/W
Red - Longitude (days) instead of cubits for E/W axis