Tutorial for the Application of the Azimuth Diagram

Purpose: During the process of estimating a Line of Position with celestial methods the azimuth Az of the celestial object is an important parameter. The azimuth diagram is a graphical approach to determine the Az without the use of any electronics.

Remark: The math behind this azimuth diagram is identical to that of the **"Hanno Ix Graph",** which is mentioned by Greg Rudzinski. However it contains additional limit lines for altitudes. With the help of these limit lines the ambiguity of the resulting azimuth values can be eliminated, however a second sheet (the "Diamonds Scheme") has to be applied. - But it is straigthforward and easy to use.

Example: On May 23, 2017 at 10h 36' 25'' UT1 the DR position is **φ = +36° 29.5'** ("+" means "north"), **λ = -023° 58.3'** ("-" means "west"). The altitude h of the sun, the declination δ and the LHA at this position are estimated to be **h = 48° 37.6', δ = +20° 39.3**' and **LHA = 315° 56.8**' (Nautical Almanac needs to be used).

Knowing the values for δ, LHA and φ the Azimuth Az can be estimated using the "Azimuth Graph" together with the "Diamonds Scheme" (see separate tutorial).

The steps below have to be followed:

1. Locate LHA on the vertical axis. If LHA is beyond the range of 0° to 90°, use the table below the graph to find the entry value LHA'. In the example LHA is between 270° and 360°, so LHA' = 360 - LHA = 360° - 315°56.8' = **44° 03.2'**. So **LHA' = 44° 03.2'** is the entry value for the graph on the vertical axis.

2. On the horizontal axis locate the declination **δ = +20° 39.3'**. For this step it doesn't matter if the sign is positive (north) or negative (south). Just the absolute value is to be used as entry.

3. Find point **P1** as intersection of δ and LHA' in the diagram.

4. Check if point **P1** is on the lower left **(LL)** or on the upper right **(UR)** side of the limit line for the altidude φ of the DR position. For this step it also doesn't matter if the sign of φ is positive (north) or negative (south). In the example P1 is on the lower left side **(LL)** of the limit line for φ = 36° 29.5'.

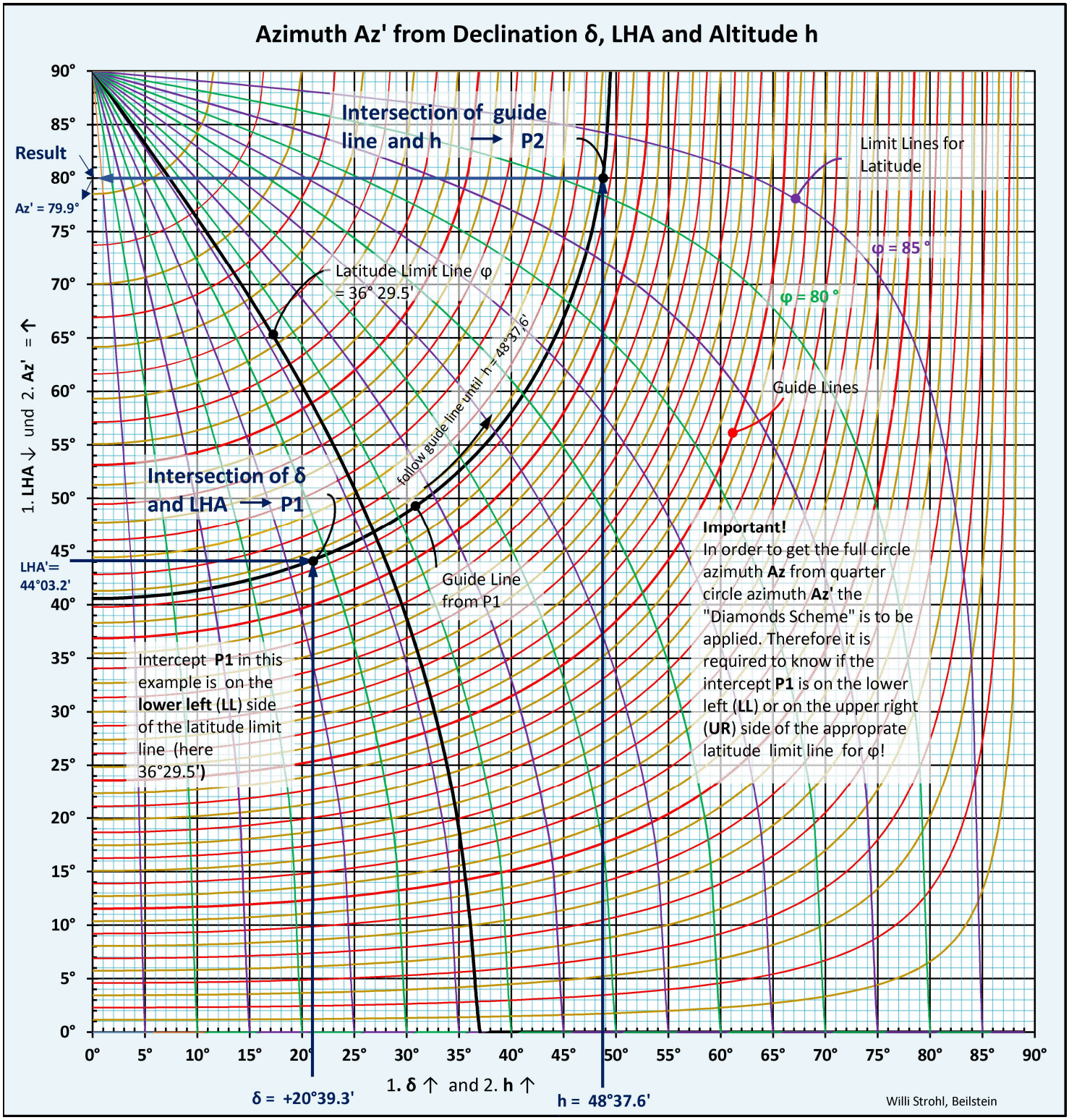
5. Point P1 also defines a "guide line". - Follow this guide line until it intersects with the line of constant altitude (here h = 48° 37.6') on the x-axis. The intercept is referred to as point P2.

6. Read the appropriate value of point P2 as the result for Az' on the y-axis. Here **Az' = 79.9°**. Az' is the "quarter circle azimuth". - (So far the procedure is very similar to Hanno Ix.)

7. To find the full circle azimuth Az, the "Diamonds Scheme" is to be applied. Now the signs of φ and δ as well as the location of P1 relative to the φ limit line are getting important. (See tutorial for Diamonds Scheme)

Summary: Entries: LHA = 315° 56.8' δ = +20° 39.3' h = 48° 37.6 φ = +36° 29.5'
Result: Az' = 79.9° (quarter circle azimuth, still an ambiguous value)

It is recommended to print out the Azimuth Diagram at least on an A-sized, better on a tabloid-sized sheet of paper.



The LHA of the DR-position possibly ranges from 0° to 360°. In the azimuth diagram above however LHA ranges only from 0° to 90°
The table below shows which values for LHA' have to be used as entry for the diagram if LHA is outside the range of 0° to 90°.

If LHA is between:	0 ° ↔ 90 °	90 ° ↔ 180 °	180 ° ↔ 270 °	270 ° ↔ 360 °
Diagram to be entered with LHA':	LHA	180-LHA	LHA-180	360-LHA