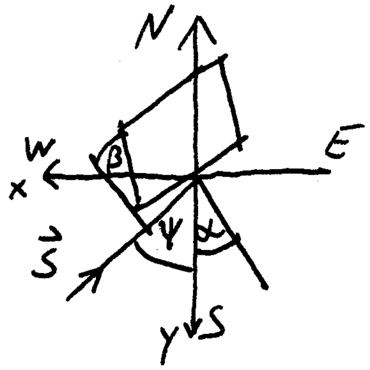
Variante B

Kafner 8.12.13

Vektor des Sonnenlichts $\vec{s} = \begin{pmatrix} 0 \\ \sin\theta \\ \cos\theta \end{pmatrix}$

$90°: \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \to \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$



$\Delta = \Psi - \alpha$

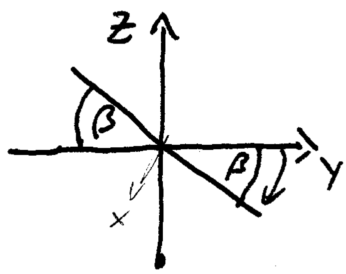
Drehung um $-\Delta$ um z-Achse

$$\vec{s}\,' = \begin{pmatrix} \cos\Delta & +\sin\Delta & 0 \\ -\sin\Delta & \cos\Delta & 0 \\ 0 & 0 & 1 \end{pmatrix} \cdot \vec{s}$$

$$= \begin{pmatrix} +\sin\theta\sin\Delta \\ \sin\theta\cos\Delta \\ \cos\theta \end{pmatrix}$$

Drehung um x-Achse um β

$90°: \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \to \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$

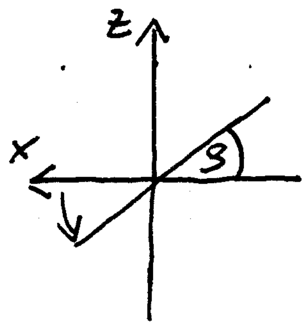


$$\vec{s}\,'' = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\beta & -\sin\beta \\ 0 & \sin\beta & \cos\beta \end{pmatrix} \vec{s}\,'$$

$$= \begin{pmatrix} +\sin\theta\sin\Delta \\ \cos\beta\sin\theta\cos\Delta - \sin\beta\cos\theta \\ \sin\beta\sin\theta\cos\Delta + \cos\beta\cos\theta \end{pmatrix}$$

Drehung um y-Achse um $-S$

$45°: \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix} \to \begin{pmatrix} -1 \\ 0 \\ 0 \end{pmatrix}$



$$\vec{s}\,''' = \begin{pmatrix} \cos S & 0 & \mp\sin S \\ 0 & 1 & 0 \\ +\sin S & 0 & \cos S \end{pmatrix} \cdot \vec{s}\,''$$

$$= \begin{pmatrix} +\cos S\sin\theta\sin\Delta \mp \sin S(\sin\beta\sin\theta\cos\Delta + \cos\beta\cos\theta) \\ \cos\beta\sin\theta\cos\Delta - \sin\beta\cos\theta \\ +\sin S\sin\theta\sin\Delta + \cos S(\sin\beta\sin\theta\cos\Delta + \cos\beta\cos\theta) \end{pmatrix}$$

Sonnenlicht ~~senk~~ auf z-Achse $\perp$ Kollektor $\theta_L = \measuredangle$ y-z Ebene $\theta_T = \measuredangle$ x-z Ebene

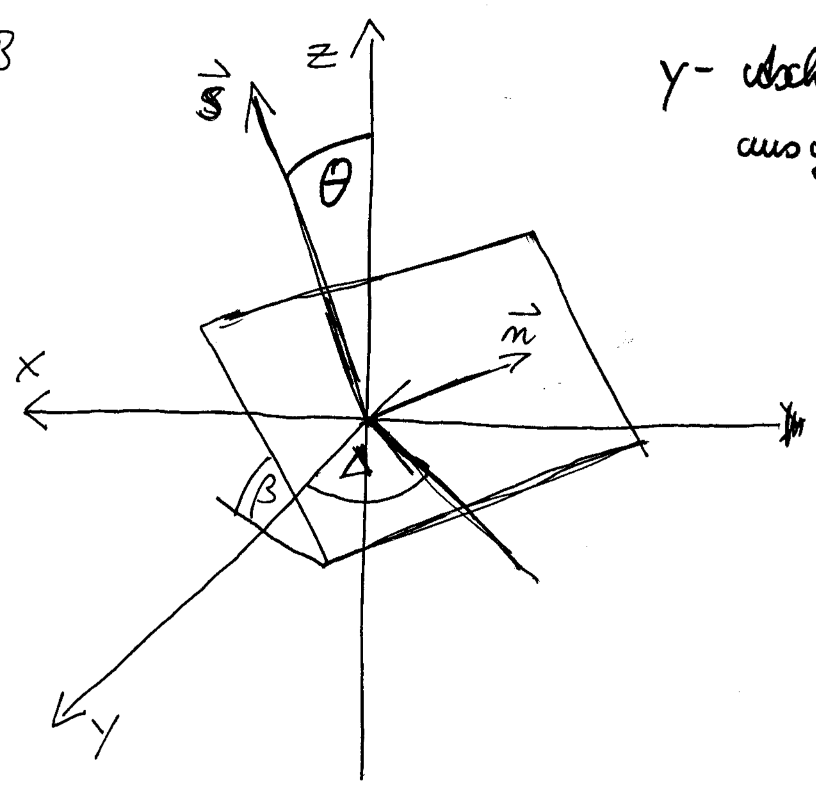
Variante B

$$\cos\Theta_L = \frac{\cos\delta\sin\beta\sin\theta\cos\Delta + \cos\delta\cos\beta\cos\theta + \sin\delta\sin\theta\sin\Delta}{\left[\left(\cos\beta\sin\theta\cos\Delta - \sin\beta\cos\theta\right)^2 + \underbrace{\left(+\sin\delta\sin\theta\sin\Delta + \cos\delta\sin\beta\sin\theta\cos\Delta + \cos\delta\cos\beta\cos\theta\right)}_{=\cos\Theta}^2\right]^{1/2}}$$

$$\cos\Theta_T = \frac{\cos\delta\sin\beta\sin\theta\cos\Delta + \cos\delta\cos\beta\cos\theta + \sin\delta\sin\theta\sin\Delta}{\left[\left(+\cos\delta\sin\theta\sin\Delta - \sin\delta\sin\beta\sin\theta\cos\Delta - \sin\delta\cos\beta\cos\theta\right)^2 + \underbrace{\left(+\sin\delta\sin\theta\sin\Delta + \cos\delta\sin\beta\sin\theta\cos\Delta + \cos\delta\cos\beta\cos\theta\right)}_{=\cos\Theta}^2\right]}$$

$$\cos\Theta = \sin\delta\sin\theta\sin\Delta + \cos\delta\left(\sin\beta\sin\theta\cos\Delta + \cos\beta\cos\theta\right)$$

Variante B



y- Achse auf Sonne ausgerichtet (= Azimut)

Kafner, 08.12.13