Converting between
custom / northing (OpenCPN)
an unsere World-Coordinates   31. 1. 2024

① Lat z - World semimajor$\rightarrow$ k_0
   OpenCPN northing   (OpenCPN)

(I) $y = \sinh^{-1}(\tan(\text{Lat})) \cdot z$ Lat in Rad
    $\underbrace{\qquad\qquad\qquad}_{Q}$

   northing $y_n = y - y_{ref}$

   our World Coord (without shift)

(II) $y_w = (1 - Q/\pi) \cdot CV/2$ CV : Coord-Factor

$$= \frac{CV}{2} - \frac{Q \cdot CV}{2\pi} \qquad\qquad \Big| \text{ with I}$$

$$= \frac{CV}{2} - \frac{y \cdot CV}{z \cdot 2 \cdot \pi} \qquad\qquad \Big| \begin{array}{l} y = \text{northing} - y_{ref} \\ \overset{0}{N} \end{array}$$

III
$$\approx \frac{CV}{2} - \frac{N \cdot CV}{z \cdot 2 \cdot \pi} - \frac{y_{ref} \cdot CV}{z \cdot 2 \cdot \pi}$$

$$\Rightarrow y_{wref} = \frac{CV}{2} - \frac{y_{ref} \cdot CV}{z \cdot 2 \cdot \pi} \qquad\qquad \Big| N = 0 \ !$$

IV
$$\underbrace{\frac{y_{ref} \cdot CV}{z \cdot 2 \cdot \pi}}_{R} = \frac{CV}{2} - y_{wref}$$

IV→III
$$y_w = \frac{CV}{2} - \frac{N \cdot CV}{z \cdot 2 \cdot \pi} - R \qquad \Big(R' = \frac{y_{ref}}{z \cdot \pi} = 1 - \frac{2 y_{wr}}{CV}$$

$$y_w = \frac{CV}{2}\left(1 - \frac{N}{z \cdot \pi} - 1 + \frac{2 y_{wref}}{CV}\right)$$

$$\boxed{y_w = \frac{CV \cdot N}{2 \cdot z \cdot \pi} + y_{wref}}$$

our World
increase to south !