

The transformation for the correction term  $\Delta H = H - H_2$  for  $1/\rho = 0$ :

$$\Delta H = -\sqrt{p^2 - (p_x - a_x)^2 - (p_y - a_y)^2} + p - \frac{(p_x - a_x)^2}{2p} - \frac{(p_y - a_y)^2}{2p} \quad (47)$$

$$= p - p_z - \frac{(p_x - a_x)^2}{2p} - \frac{(p_y - a_y)^2}{2p}, \quad (48)$$

$$a_x = -\frac{B_z}{2}y, \quad (49)$$

$$a_y = \frac{B_z}{2}x, \quad (50)$$

is written as

$$x = x_0 + \Delta x, \quad (51)$$

$$y = y_0 + \Delta y, \quad (52)$$

$$p_x = p_{x0} + \frac{B_z}{2}\Delta y, \quad (53)$$

$$p_y = p_{y0} - \frac{B_z}{2}\Delta x, \quad (54)$$

where

$$\Delta x = \left(p_{x0} + \frac{B_z}{2}y_0\right)\sin w\ell - \left(p_{y0} - \frac{B_z}{2}x_0\right)(\cos w\ell - 1), \quad (55)$$

$$\Delta y = \left(p_{x0} + \frac{B_z}{2}y_0\right)(\cos w\ell - 1) + \left(p_{y0} - \frac{B_z}{2}x_0\right)\sin w\ell, \quad (56)$$

$$w = \frac{B_z(p - p_z)}{pp_z}. \quad (57)$$

The longitudinal coordinate is transformed as:

$$z = z_0 + \left(\frac{3}{2} - \frac{p}{p_z} - \frac{p_z^2}{2p^2} + \Delta v\right)\ell. \quad (58)$$