Pseudo rapidity

$$\eta = -\ln(\tan(\frac{\theta}{2})) \tag{1}$$

$$\begin{aligned}
\cos(\theta) &= 2\cos^2(\frac{\theta}{2}) - 1 && (2)\\
\sin(\theta) &= 2\cos(\frac{\theta}{2})\sin(\frac{\theta}{2}) && (3)\\
\tan(\frac{\theta}{2}) &= \frac{\sin(\frac{\theta}{2})}{\cos(\frac{\theta}{2})} = \frac{2\cos(\frac{\theta}{2})\sin(\frac{\theta}{2})}{2\cos^2(\frac{\theta}{2})} && (4)\\
&= \frac{\sin(\theta)}{1+\cos(\theta)} && (5)\\
&= \left(\frac{\sin^2(\theta)}{\{1+\cos(\theta)\}^2}\right)^{\frac{1}{2}} && (6)\\
&= \left(\frac{1-\cos^2(\theta)}{\{1+\cos(\theta)\}^2}\right)^{\frac{1}{2}} && (7)\\
&= \left(\frac{1-\cos(\theta)}{1+\cos(\theta)}\right)^{\frac{1}{2}} && (8)\\
&= \left(\frac{p-p_z}{p+p_z}\right)^{\frac{1}{2}} && (9)
\end{aligned}$$

Hence,

$$\eta = \frac{1}{2}\ln\left(\frac{p+p_z}{p-p_z}\right) \tag{10}$$

The rapidity is defined as

$$y = \frac{1}{2}\ln\left(\frac{E+p_z}{E-p_z}\right) \tag{11}$$

By the Lorentz boost along the z-direciton, it is shifted without changing the form. Therefore, if E is large and $E \sim p$, the same is true for the pseudo rapidity, η.